Short Block Service

Brookhaven College

Block Construction

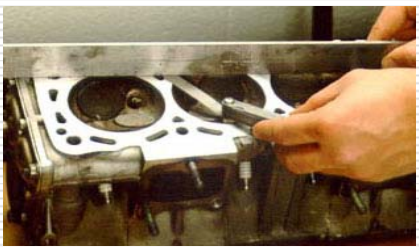
- Cast Iron
  - nickel is often added to improve durability and strength
- Aluminum
  - iron cylinder liners
  - light weight
  - heat dissipation

Crack Detection

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

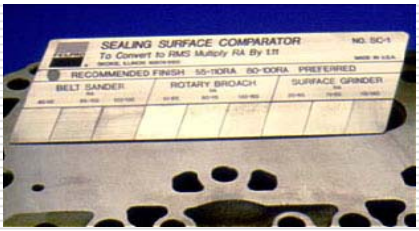
Cylinder Block Warpage

- Straight Edge and Feeler Gauge
- Inspect Deck Flatness
  - head gasket failure may be due to block warpage
  - aluminum blocks may have greater warpage limits than cast iron blocks of similar designs
- Check Main Bearing Bore Alignment
  - .0015”



Checking Surface Finish

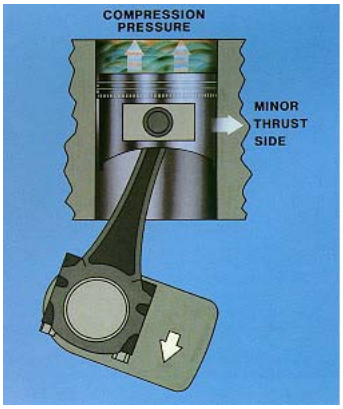
- Surface finish systems of measurement
  - RMS - Root Mean Square
  - RA - Roughness Average
- When the surface is rougher than 125 RMS, there are too many peaks and valleys on the metal's surface to seal properly.
- If the surface is smoother than 60 RMS, it may create sealing problems.

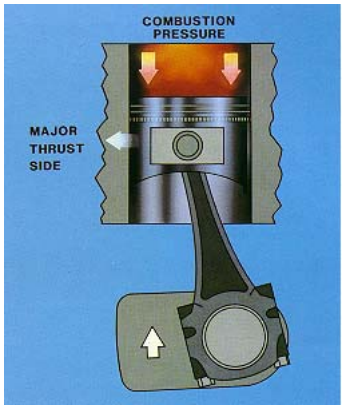


Cylinder Wear

- Use a bright light to conduct a thorough visual inspection before measuring
- Inspect and measure the worst cylinder first
- Measuring Cylinders
  - Inside Micrometers
  - Outside Micrometers
  - Telescoping Gauges
  - Dial Vernier Calipers
  - Bore Gauges

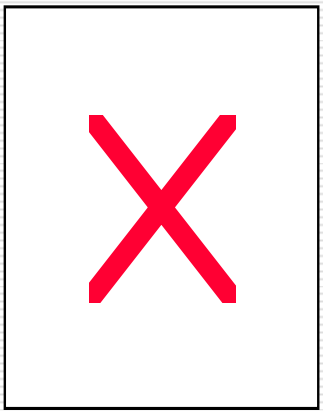
Cylinder Thrust Surfaces





Cylinder Repair

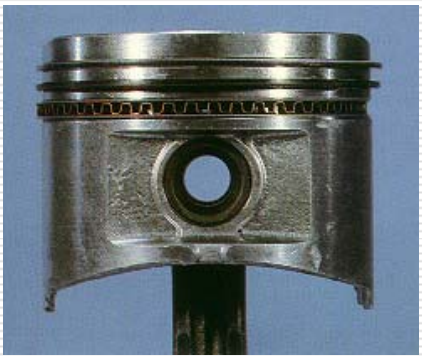
- Cylinder Deglazing
  - crosshatch pattern holds oil
  - promotes ring seating during break-in
- Cylinder Honing
  - honing is used to correct damage up to .010”
- Cylinder Boring
  - performed by machine shops



Crankshaft Inspection

- Seal Scoring
- Crack Detection
  - Magnaglo - a fluorescent paste containing iron particles is mixed with oil and sprayed on the component
- Journal Inspection
  - obvious scoring or damage
  - taper
  - out of round

Piston Inspection

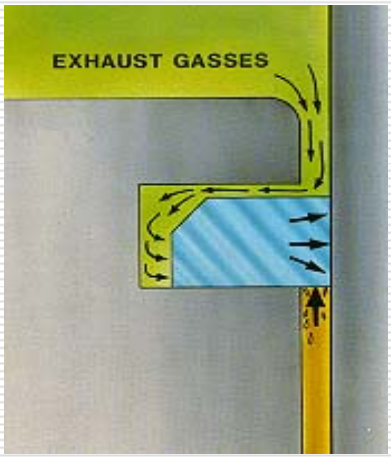


- cracks
- ring groove condition
- piston pin noise
  - a sharp double knock that increases under load
- piston slap
  - most noticeable when the engine is cold, at part throttle and under light acceleration

Piston Fit

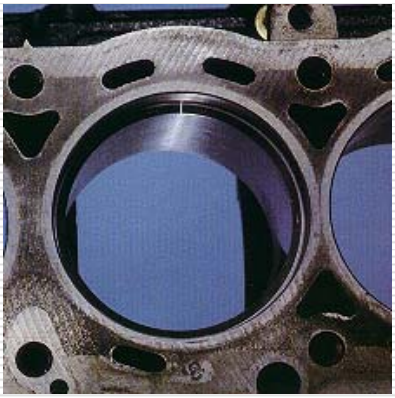
- pistons are not round
  - the top is smaller in diameter than the skirt
  - piston diameter is measured on the skirt at 90 degrees from the piston pin
- pistons are available in different sizes to allow for selective fit to the bore

Piston Rings



- seals compression
- prevents blow-by
- prevents excess oil from entering the combustion chamber
- top compression ring
  - barrel shaped
  - chrome or moly coating
- second compression ring
- oil control ring

Piston Ring Installation

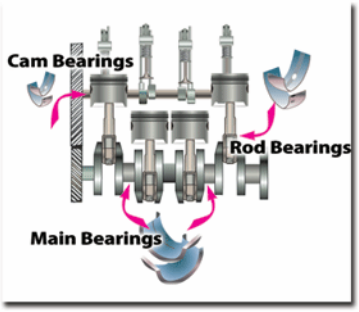


- end gap
  - excessive end gap allows compression to escape
  - insufficient end gap can cause ring too break
  - ring end end gaps should not be in a line
  - ring end gaps should not be installed on cylinder thrust surfaces
- side clearance
- follow piston ring manufacturer instructions carefully

Connecting Rods

- milled cap design
- cracked rod design
- oil squirt holes
- number rods before disassembly
- inspect for scratches and knicks
- twist tolerances are usually less than .001”
- crank journal end tolerances usually within .0003”
- rod noise - light metallic knock that is most audible on acceleration/deceleration

Insert Bearings



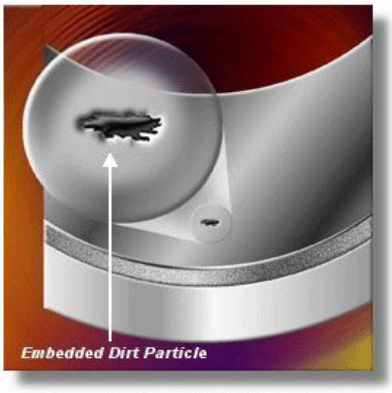
- replaceable
  - soft surface material allows foreign particles to be embedded in the bearing surface
- bearing construction
  - steel backing
  - copper/lead lining
  - babbitt surface
- solid aluminum

Bearing Purpose

- Bearings ultimate purpose are as a replaceable bearing surface.
- Keep particles from damaging expensive shafts.

Bearing Embedability

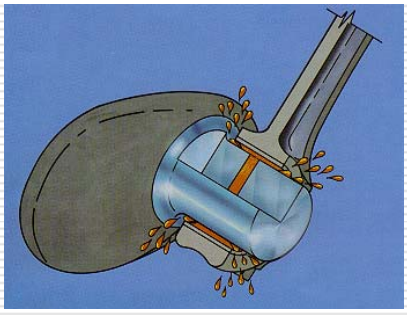
- Particles of metal, carbon, or dirt can be embeded in the soft material of the bearing to prevent shaft damage.
- The soft material also allows for a custom installation of the bearing around the shaft. The



Bearing Lubrication

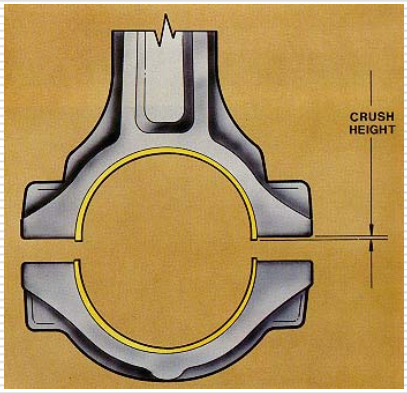
- oil is fed from the low load side of bearing
- a cross drilled crankshaft or bearing groove distributes oil
- hydrodynamic lubrication efficiency decreases rapidly with increased bearing clearances
  - a minimum lubrication film of .000040" is required to prevent damage

Bearing Clearance



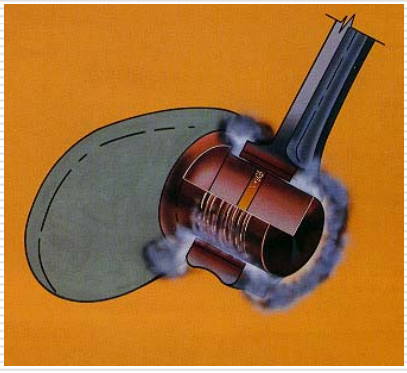
- doubling bearing clearance increases oil leakage at the bearing by a factor of five
- excessive clearance can cause
  - low oil pressure
  - oil consumption
  - knocking

Bearing Crush



- the bearing shell extends beyond the parting surfaces by approximately .001”
- prevents bearing from spinning
- assure good heat dissipation

Bearing Failure



- dirt
- misassembly
- misalignment
- insufficient lubrication
- overloading or stress
- corrosion

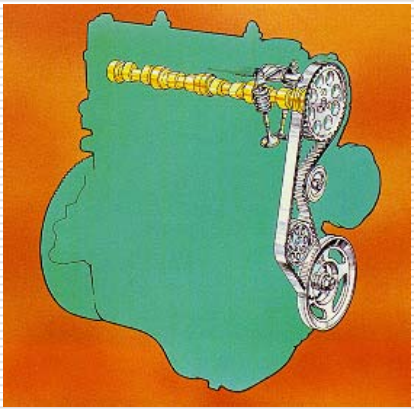
Bearing Damage

- material behind bearing
- surface fatigue
- bearing cap shift
- bent or twisted connecting rod
- out of round bearing bore
- misshaped journal
- misaligned rod, crankshaft or main bore
- excessive journal fillets
- improper bearing crush
- insufficient lubrication
- excessive heat cavitation

Timing Chain and Gears

- Timing Chain/Gears
  - deflection - no more than 1/2”
- Timing Gears
  - backlash is checked with a dial indicator
  - gear whine - decreases as engine speed increases

Timing Belt



- timing belts do not stretch like chains
- timing belts usually have replacement intervals of 50,000 to 60,000 miles
- timing belt whine or warble is centered near the front of the engine and varies with engine speed