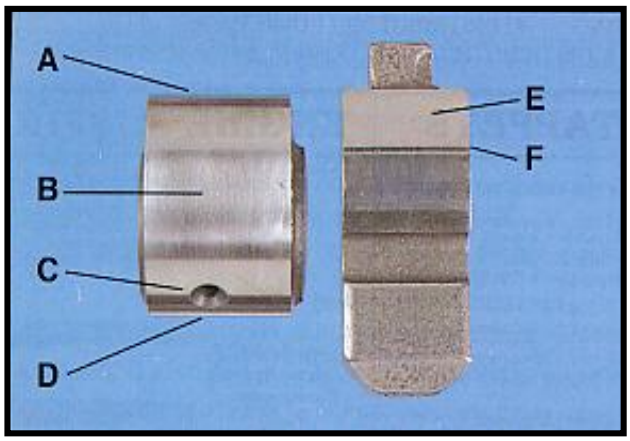
NORMAL APPEARANCE



FEATURES:

1) Components Clean!

2) Running surfaces will develop a polished surface.

3) Note "dwell" mark groove which develops as a standard feature on most finger & rocker arm followers. This is the point of maximum cam lift & loading & is not a "wear" problem!

TERMINOLOGY:

A = CAMSHAFT NOSE

B = RAMP

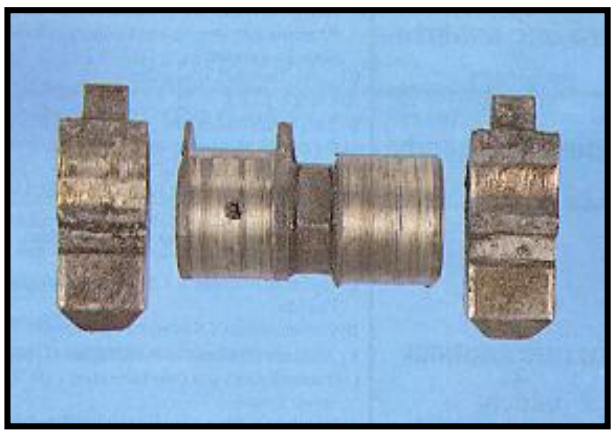
C = OIL FEED HOLE

D = BASE CIRCLE

E = FOLLOWER FACE

F = DWELL MARK

DIRTY OPERATING CONDITIONS



FEATURES:

1) Components layered with filthy carbonised oil crust.

2) Severe wear & metal loss with aggravated scoring.

3) Note oil hole on L/H cam lobe is blocked.

CAUSES:

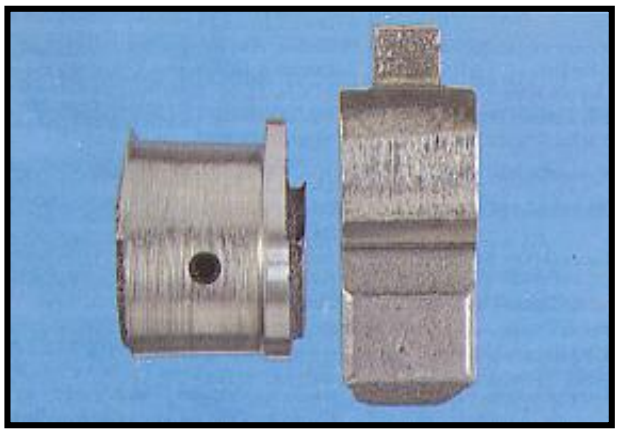
1) Dirty & fuel contaminated oil. Latent heat of engine on close down bakes the dirty oil & forms an ever thickening carbonised crust. Oil ways block & hydraulic columns seize.

2) Resulting lubrication failure promotes wear.

REMEDY:

1) Engine requires thorough cleaning which might involve total strip down. Ensure fuel emissions are within MOT requirements. Use top quality lubricant.

LUBRICATION CLEAN BUT INEFFICIENT



FEATURES:

1) Components Clean!

2) Severe cam wear & metal loss extending to base circle.

3) Severe follower face wear over total contact area.

CAUSES:

1) Pure lack of oil pressure/supply.

2) Thin oil due to fuel contamination.

3) Old hydraulic ball studs overloading due to inherent contamination.

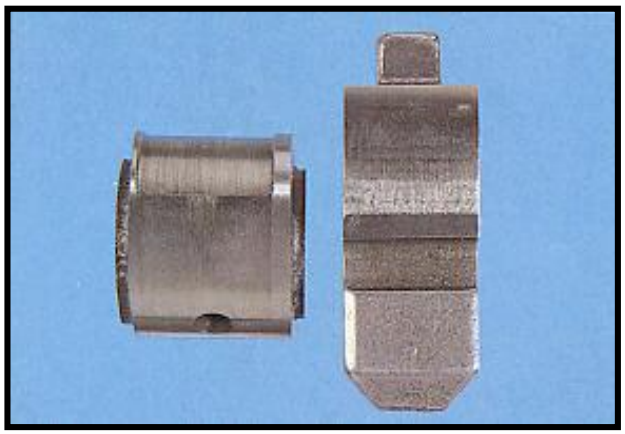
REMEDY:

1) Check oil pressure & supply if possible at cylinder head oil gallery plug.

2) Ensure fuel emissions are within MOT requirements.

3) Renew hydraulic ball studs.

BIASED BALL STUD LOADING



FEATURES:

1) Components clean.

2) Camshaft nose peak worn. Base circle & ramps in maiden condition.

3) Follower faces scored at hydraulic ball stud end.

CAUSES:

1) Overloading of followers due to inefficient hydraulic ball stud.

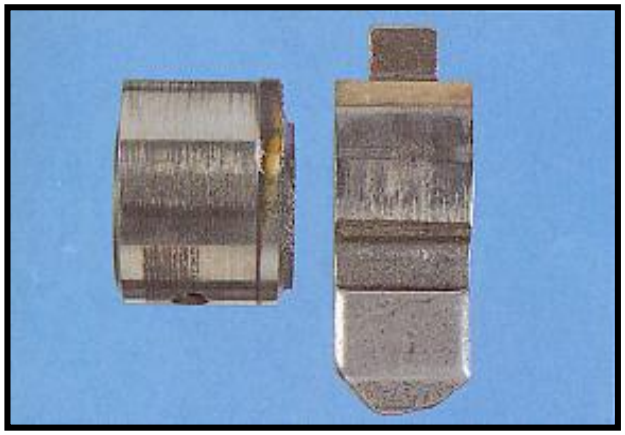
2) Accelerating damage caused by insufficient lubrication at start up.

REMEDY:

1) Renew hydraulic ball studs.

2) When fitting cam kit, always obtain oil pressure with spark or glow plugs removed.

EXCESSIVE HEAT GENERATION



FEATURES:

1) Camshaft nose peak scored. Yellow to blue tempering colouration on unused edge of cam.

2) Follower face beginning to score. Yellow to blue colouration of face ends & sides.

CAUSES:

1) Poor quality oil or insufficient supply.

2) Thin oil due to fuel contamination.

3) General overheating due to coolant or ignition problems.

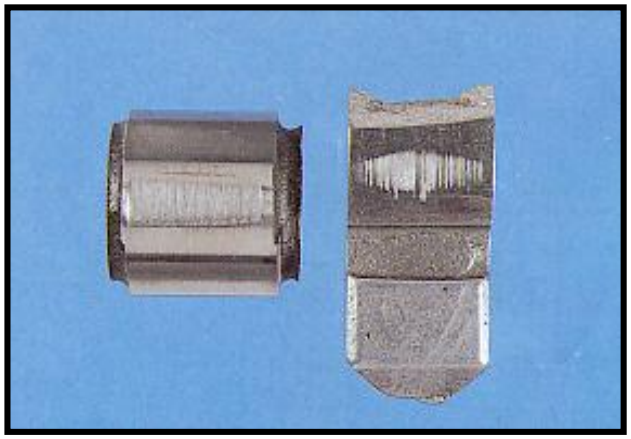
REMEDY:

1) Check oil pressure & supply, if possible at cylinder head oil gallery.

2) Ensure fuel emissions are within MOT requirements.

3) Address general overheating causes.

PISTON / VALVE IMPACT



FEATURES:

1) Cam nose has wear "flat" on its peak.

2) Follower has snapped central about face.

3) Break is vertical in valve open position.

CAUSES:

1) Valve & piston collision due to incorrect valve timing or ingress of foreign object into combustion chamber.

2) Incorrect diesel cylinder head gasket i.e. too thin.

3) Valve spring seating cup assembled upside down causing spring coil binding.

REMEDY:

1) Correct all above assembly faults.

LUBRICANT PARTICLE CONTAMINATION

FEATURES:

1) L/H failed follower has severe body scratches and top button has collapsed.

2) R/H normal follower has polished body. Top button is proud.

CAUSES:

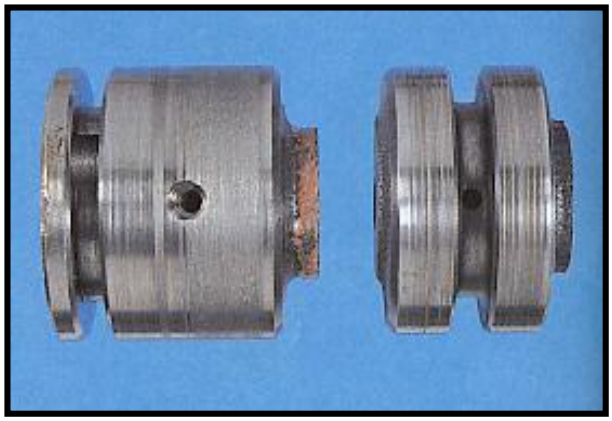
1) Lubricant contaminated with tiny metal particles, inherent in oil from previous failure.

2) Internal parts of follower become scored, seize & collapse.

REMEDY:

1) Engine requires thorough cleaning which might involve total strip down.

LUBRICANT DEFICIENCY & CONTAMINATION



FEATURES:

1) L/H main journal has raised metal adhesions.

2) Severe wear & metal loss with aggravated scoring.

CAUSES:

1) L/H main journal has picked up in its housing due to oil pressure not being attained before initial start-up.

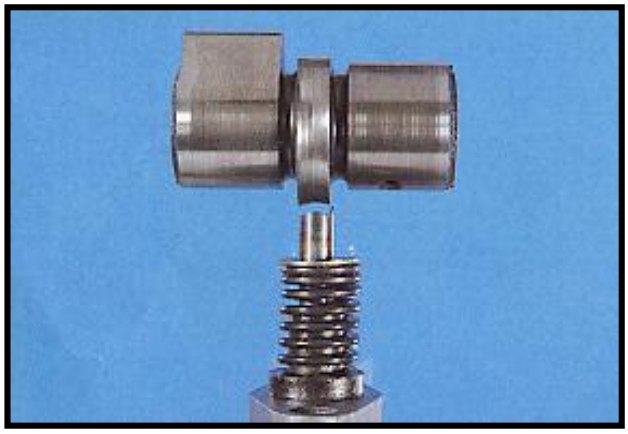
2) R/H main journal is scored due to inherent particle contamination in lubricant.

REMEDY:

1) Attain oil pressure before initial start-up.

2) Engine requires thorough cleaning which might involve total strip down.

FUEL / VACUUM PUMP ROD WEAR



FEATURES:

1) Fuel or vacuum pump push rod face is worn. Camshaft pump eccentrics worn to same degree.

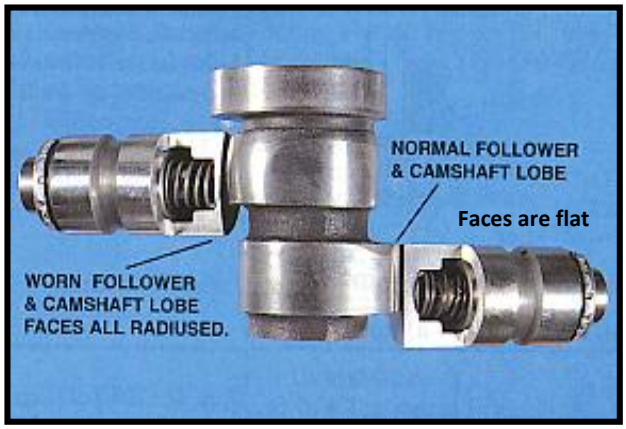
CAUSES:

1) Worn fuel or vacuum pump push rod assembled onto new camshaft.

REMEDY:

1) Renew parts as required.

BARREL FOLLOWER WEAR



FEATURES

1) L/H couple shows typical radiused face wear compared with normal R/H assembly which is flat. Note dishing in of L/H follower & reduced face thickness.

CAUSES

1) Insufficient or inefficient oil supply.

2) Particle contamination of lubricant.

3) Damage resultant of incorrect start up procedure.

4) Incorrect oil filter without anti drain off valve.

REMEDY

1) Check oil pressure & supply.

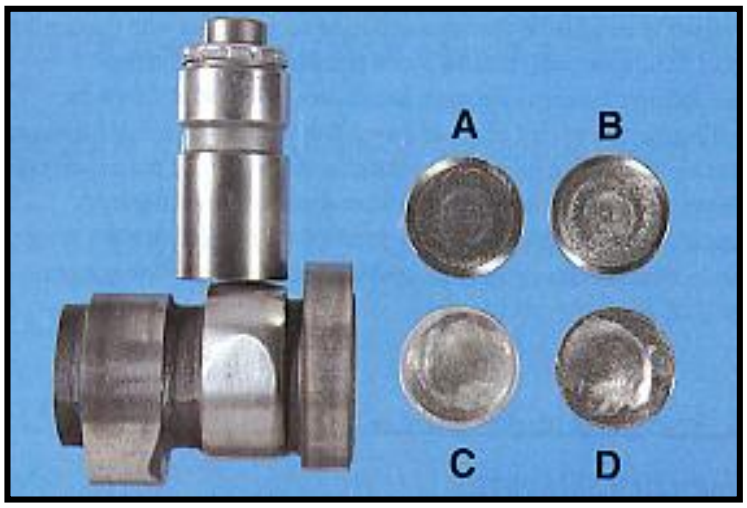
2) Check fuel emissions are within MOT requirements.

3) Ensure cleanliness of engine & oil ways.

4) Follow start up procedures of fitting leaflets.

5) Fit O/E or top quality oil filters.

NEW FOLLOWERS FITTED to WORN CAM



FEATURES:

1) Note point loading of worn cam to face of new follower.

SEQUENCE:

Follower (A) is still rotating but face contact is constrained to the centre causing a massive point contact overload. Follower (B) is still rotating but fatigue pitting & metal loss is developing. Visual dishing of follower face. Follower (C) has stopped spinning & friction & loading has now doubled. Cam lobe & follower face further deteriorate with the wear now extending outwards. Follower (D) will wear cam lobe further aggravated by metal particle contamination. Dishing extends right to the follower edge & fretting develops.

REMEDY:

Never fit new followers to existing cams (or vice-versa), particularly if the original faces shows signs of dishing. (As per photograph sequence above).