



Camshaft Timing

Matthew Whitten

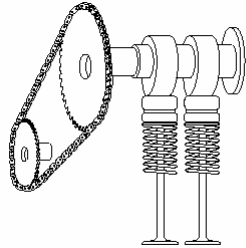


Objectives

- Identify the designs of Ford engines as they relate to camshaft timing
- Describe camshaft timing methods
- Describe timing procedures for engines with timing chains and reference links
- Describe timing procedures for engines with timing chains and no reference links
- Describe timing procedures for engines with timing belts



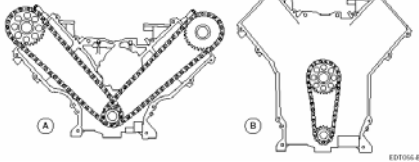
Cam Timing



- Camshaft timing is controlled by the relationship between the sprockets and chain/belt on the cam and crankshaft.
- Correct timing is critical to maintain



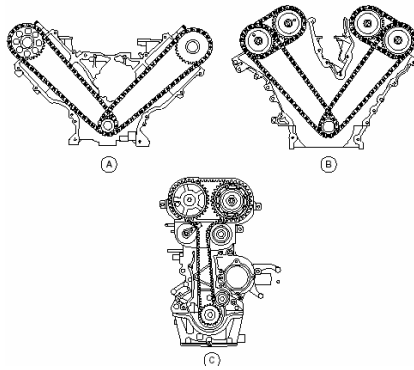
OHV and OHC



- Inline and “V” blocks can be either OHC or OHV
- OHC (a) blocks have the camshafts located above the cylinder heads.
- OHV (b) blocks have one camshaft located in the engine block



OHC



- Inline or “V” blocks can be either SOHC ((a)Single OverHead Cam) or ((a)Dual OverHead Cam)
- Camshafts can be driven by either a chain (a,b) or belt (c)

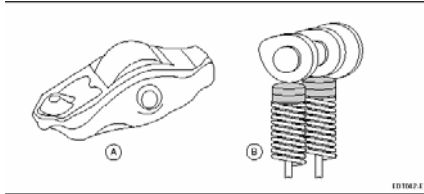


OHC Design

- OHC designs have benefits over the use of OHV engines:
 - Fewer moving components
 - More precise and direct valve operation
 - Reduced frictional losses in the valve train.
- SOHC:
 - Engine normally have two valves per cylinder
 - Will use RFF (roller finger followers) designed camshaft followers.
- DOHC:
 - Divides the job of valve opening between two camshafts (intake/exhaust)
 - DOHC engines normally use four valves per cylinder
 - Will use either RFF or DAMB/DAHB (Direct Acting Mechanical Buckets/ Direct Acting Hydraulic Buckets)



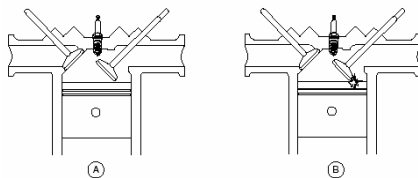
RFF, DAMB, and DAHB



- RFF:
 - Similar to rocker arms without a center pivot.
 - One end rests on the hydraulic lash adjuster and the other actuates the valve.
- DAMB/HB
 - Directly acts on valve
 - Prevents side loading of valve from camshaft.
 - DAMB do not automatically adjust for valve lash.
 - DAHB controls valve lash



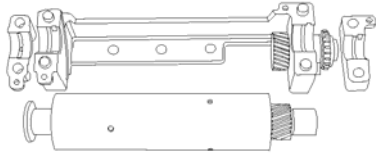
Interference



- Freewheeling (A) engine will not have valve to piston contact during incorrect valve timing
- Non-Freewheeling (B) engines will have piston to valve contact if valve timing is incorrect.



Balance Shaft



- Balance shafts are used in some engine applications to reduce characteristic engine vibrations.
- Balance shafts are turned at crankshaft speed.
- Applications:
 - 4.0: 4x4 explorer, mounted in oil pan.
 - 6.8: mounted on LH cylinder head.
 - 3.8 located in lifter valley



Servicing Camshaft Timing

- When to set camshaft timing:
 - Engine reassembly
 - Servicing valve train components (cylinder heads, camshafts, ect.)
 - When diagnosis of a symptom leads to camshaft timing as the cause.

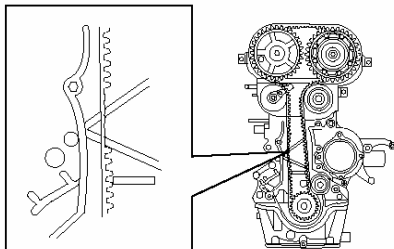


Cam Timing Symptoms

- Some symptoms caused by incorrect cam timing:
 - Backfire
 - Intermittent miss-fire
 - Hard start/No start
 - No power/Low power
 - Rough idle
 - Black smoke
- Improper installation of cam timing components can cause premature failure of:
 - Valves and pistons
 - Timing belt/chains



Belt/Chain Inspection



- Belt:
 - Damaged tensioner
 - Belt cogs
 - Contaminated belt
 - Stretched
- Chain:
 - Chain tensioner
 - Guides

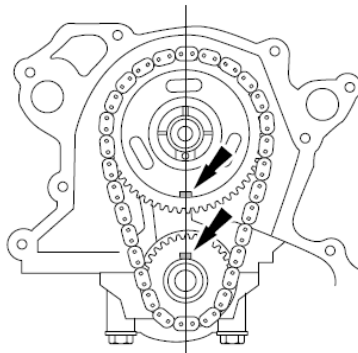


Camshaft Timing Methods

- Sprocket to sprocket alignment, dots on camshaft and crankshaft sprockets
- Sprocket to block alignment, dot on sprocket aligned with area on engine
- Chain system with reference links on the sprockets and chain.
- Belt/Chain systems with no reference links on either sprockets, chains, or block. Requires special tools.



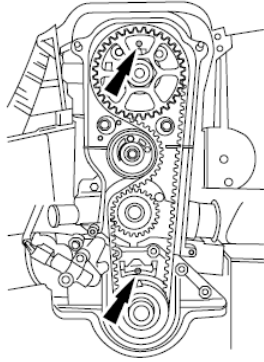
Sprocket-to-Sprocket



- OHV engines
- Alignment of keyways, dots, or lines on each of the sprockets with each other.



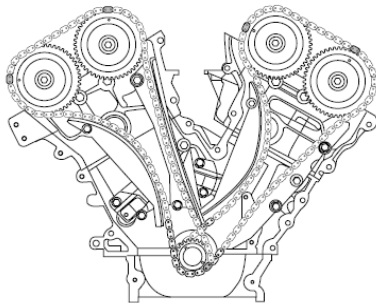
Sprocket to Block



- SOHC 2.0 SPI engine
- Uses pointer on cam sprocket that lines with dot on cylinder head and pointer on crank sprocket that lines up with marker on oil pump.



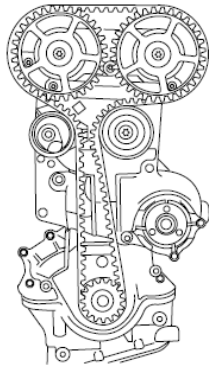
Chains w/ Reference Links



- 2.5, 3.0 4V, 3.0, 4.6 2/4V, 5.4 2/4V, and 6.8.
- Usually employs colored timing chain links (copper).
- Uses markings on cam and crank sprockets.



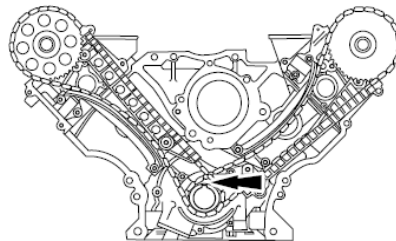
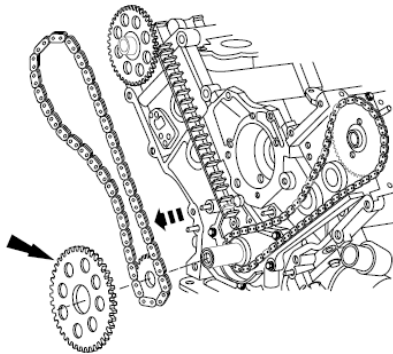
No Timing Marks



- 3.9 4v, 2.0 Zetec and 4.0 SOHC.
- Requires the use of specialized tools to align cam and crankshafts.

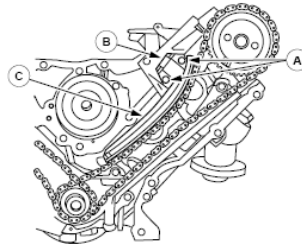
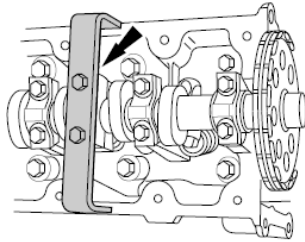


5.4

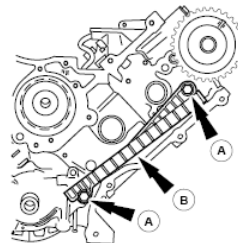
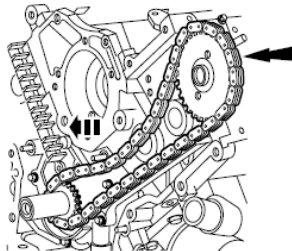




Camshaft Timing

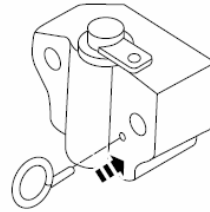
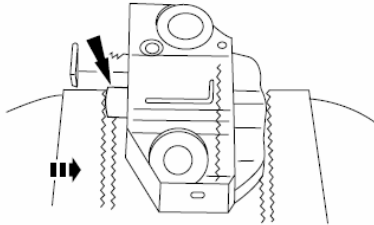


Camshaft Timing

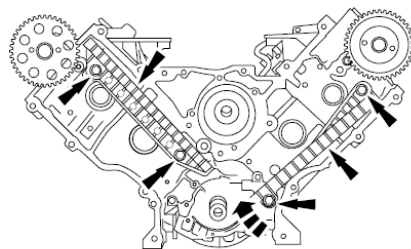
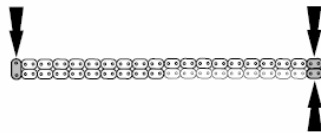




Camshaft Timing

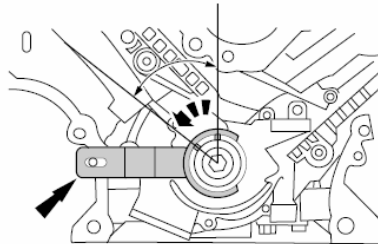
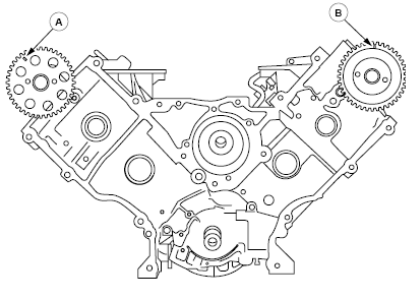


Camshaft Timing

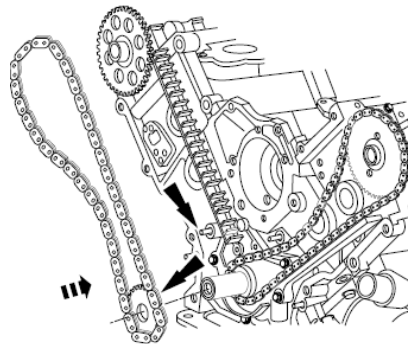
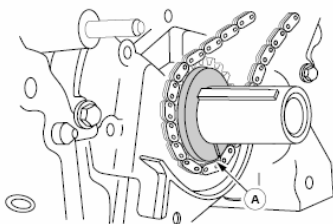




Camshaft Timing

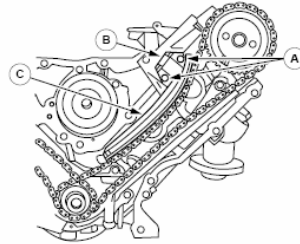
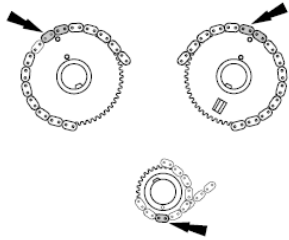


Camshaft Timing

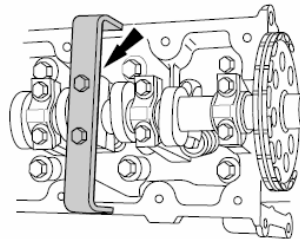
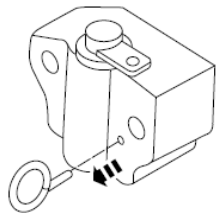




Camshaft Timing

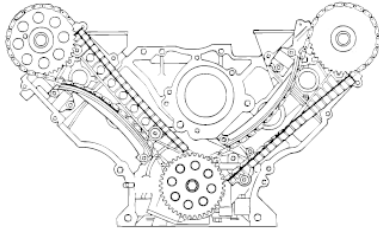


Camshaft Timing



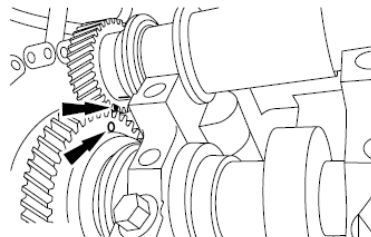


Camshaft Timing



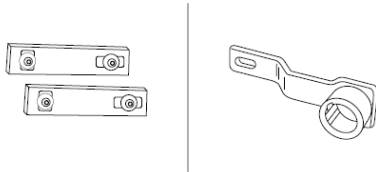
Camshaft Timing

4.6 and 6.8

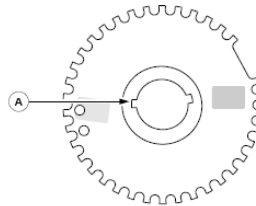
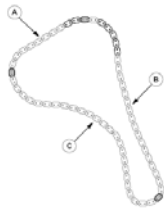




4.6 DOHC



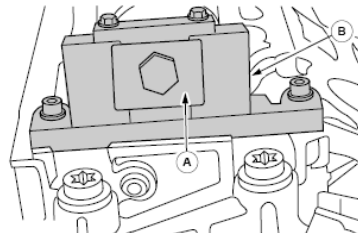
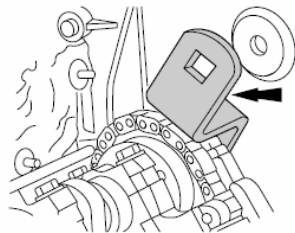
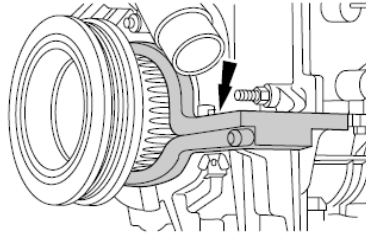
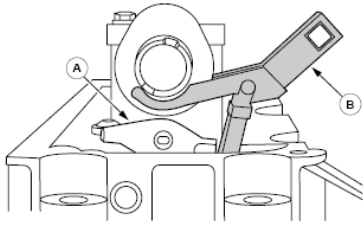
2.5 3.0 DOHC



- Three identifying links on the chain.
- The crankshaft excitor wheel has two keyways:
 - Orange- Taurus
 - Blue- Cougar Contour Escape, and Mystique

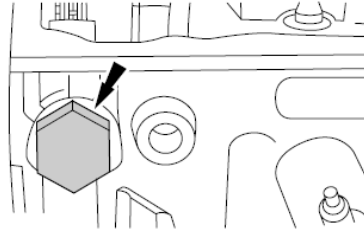
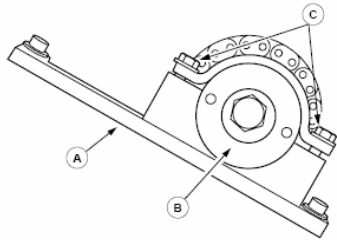


4.0 SOHC

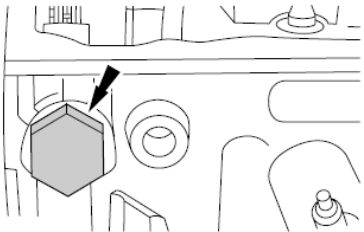
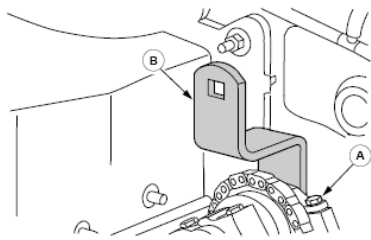




Camshaft Timing

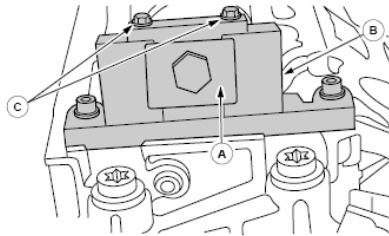
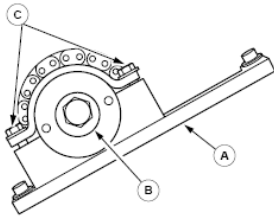


Camshaft Timing

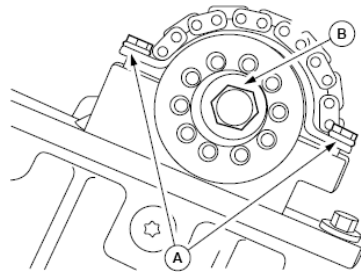
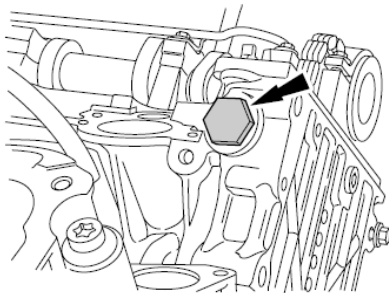




Camshaft Timing

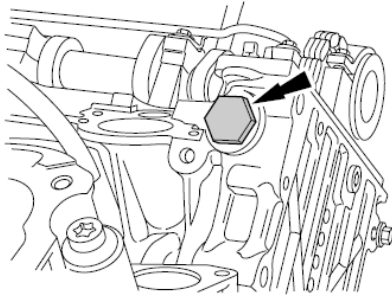


Camshaft Timing



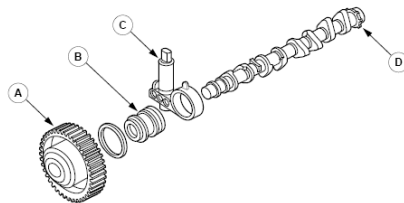
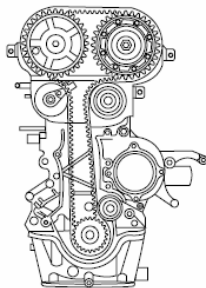


Camshaft Timing



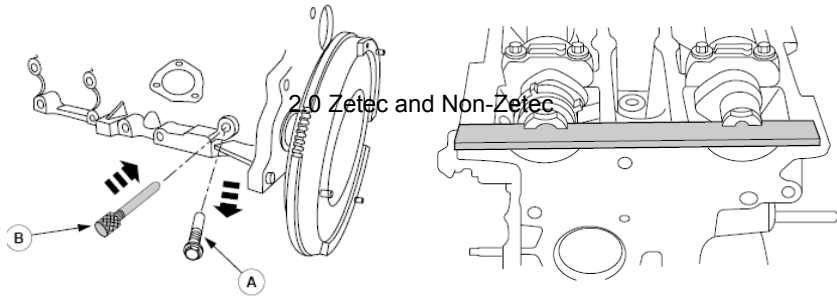
Camshaft Timing

2.0 Zetec and Non-Zetec

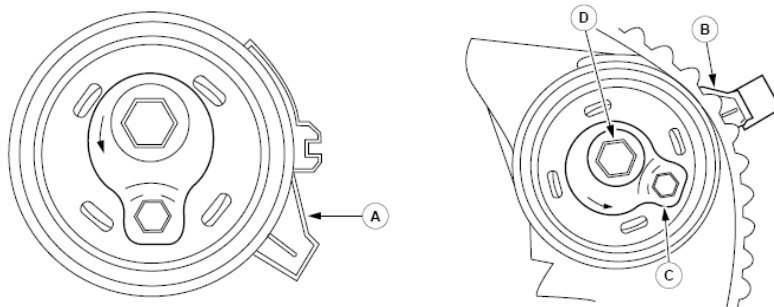




2.0 Zetec and Non-Zetec



2.0 Zetec and Non-Zetec





2.0 Zetec and Non-Zetec

