

Chapter 1

Engine Fundamentals-Part B

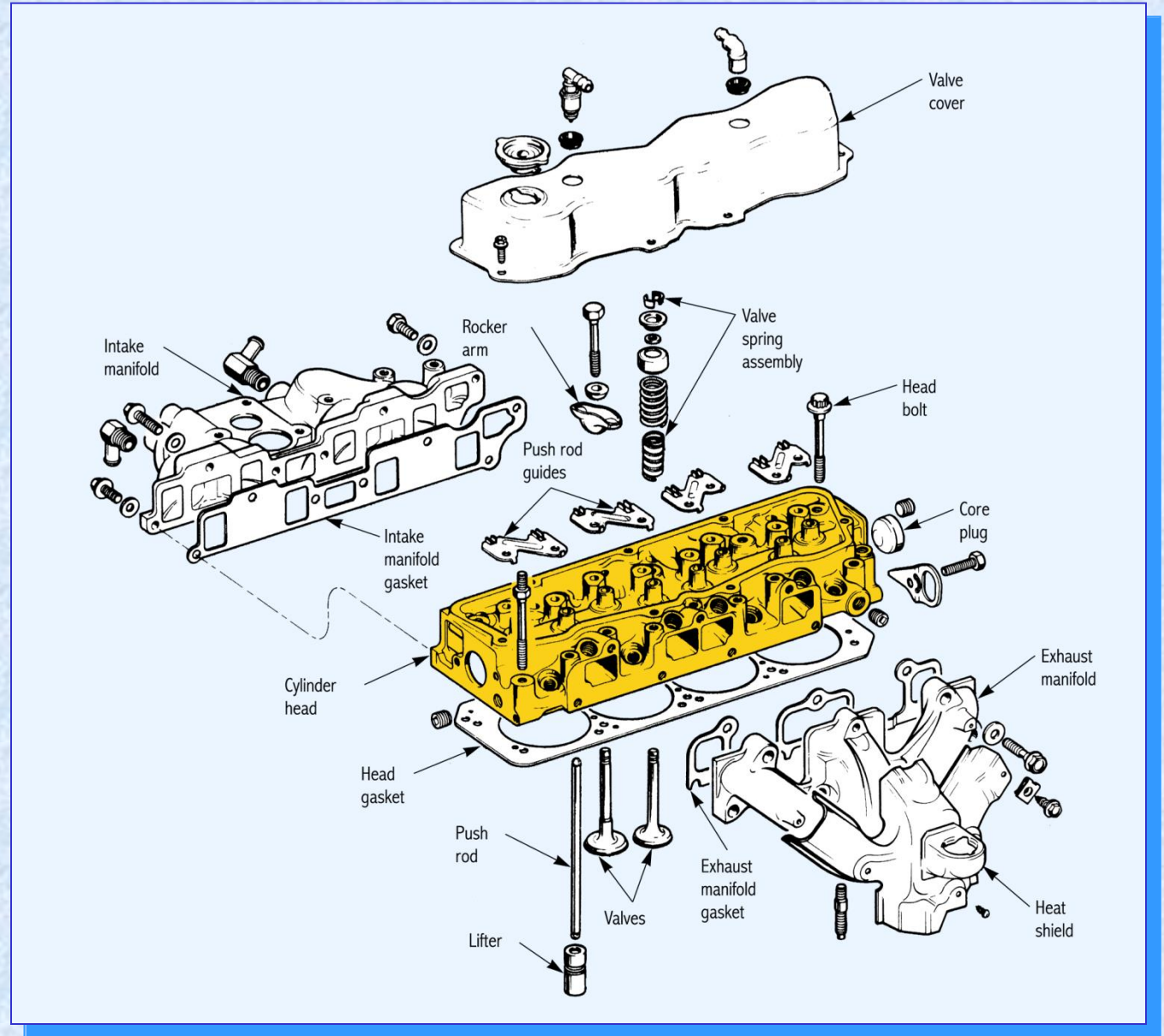
Contents

- Engine top end
- Engine front end

Engine Top End

- ❑ Refers to the cylinder heads, valves, camshaft, and other related components
- ❑ These parts work together to control the flow of air and fuel into the engine cylinders
- ❑ They also control the flow of exhaust out of the engine

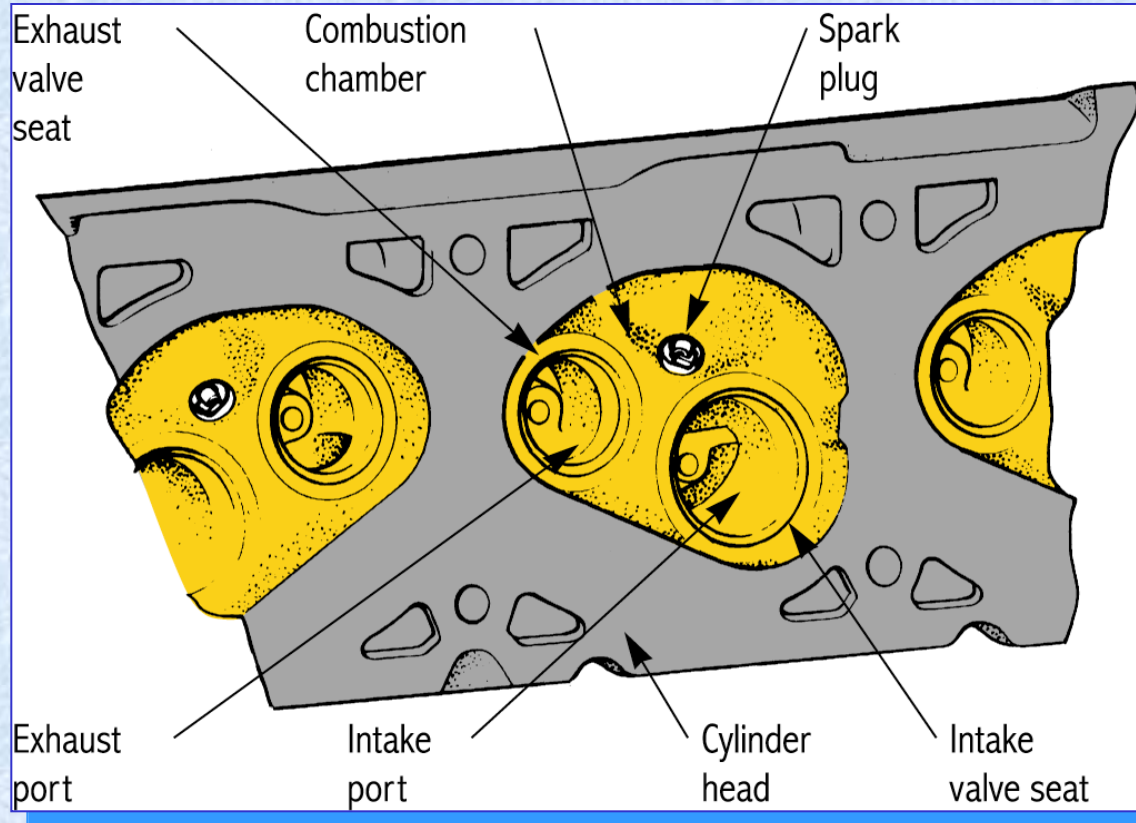
ENGINE PORTS AND PIPES



Cylinder Head

- ❑ Bolts to the deck of the cylinder block
- ❑ Covers and encloses the top of the cylinders
- ❑ Combustion chambers are small pockets formed in the cylinder head
 - combustion occurs in these small pockets

Cylinder Head



Combustion chambers contain the spark plug tip and valve seats

Cylinder Head Parts

□ Intake ports

- route air (diesel engine) or air and fuel (gasoline engine) into the combustion chamber

□ Exhaust ports

- route burned gases out of the combustion chamber

Cylinder Head Parts

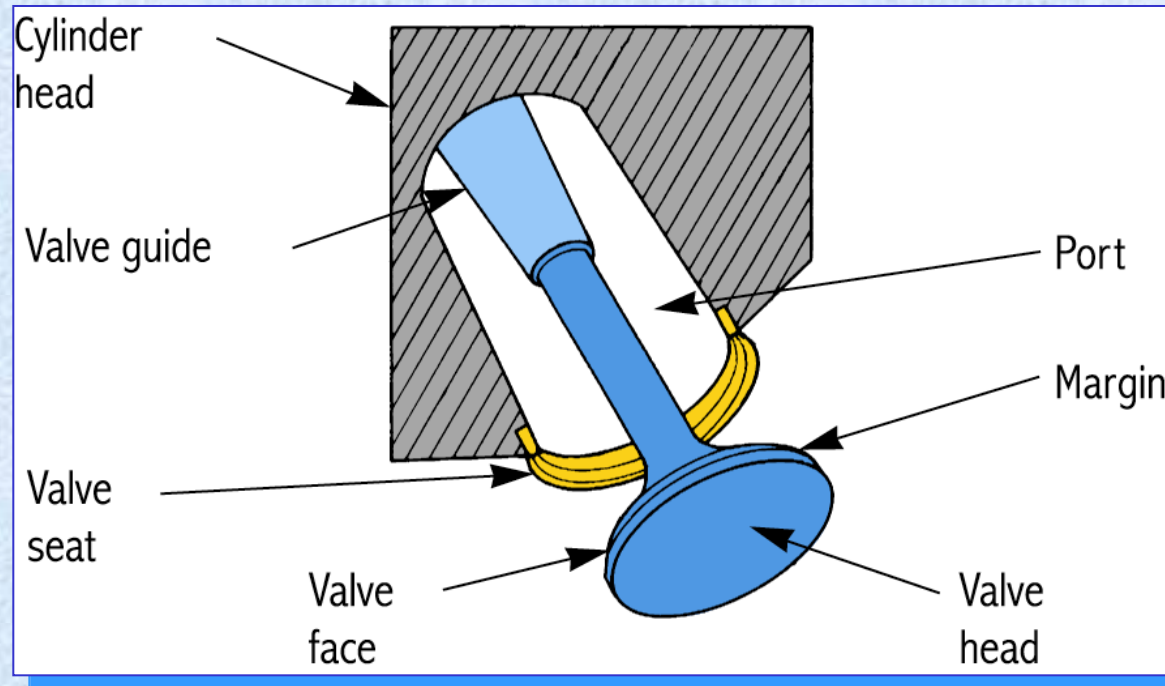
☐ Valve guides

- small holes machined through the cylinder head for the valves
- valves slide in these guides

☐ Valve seats

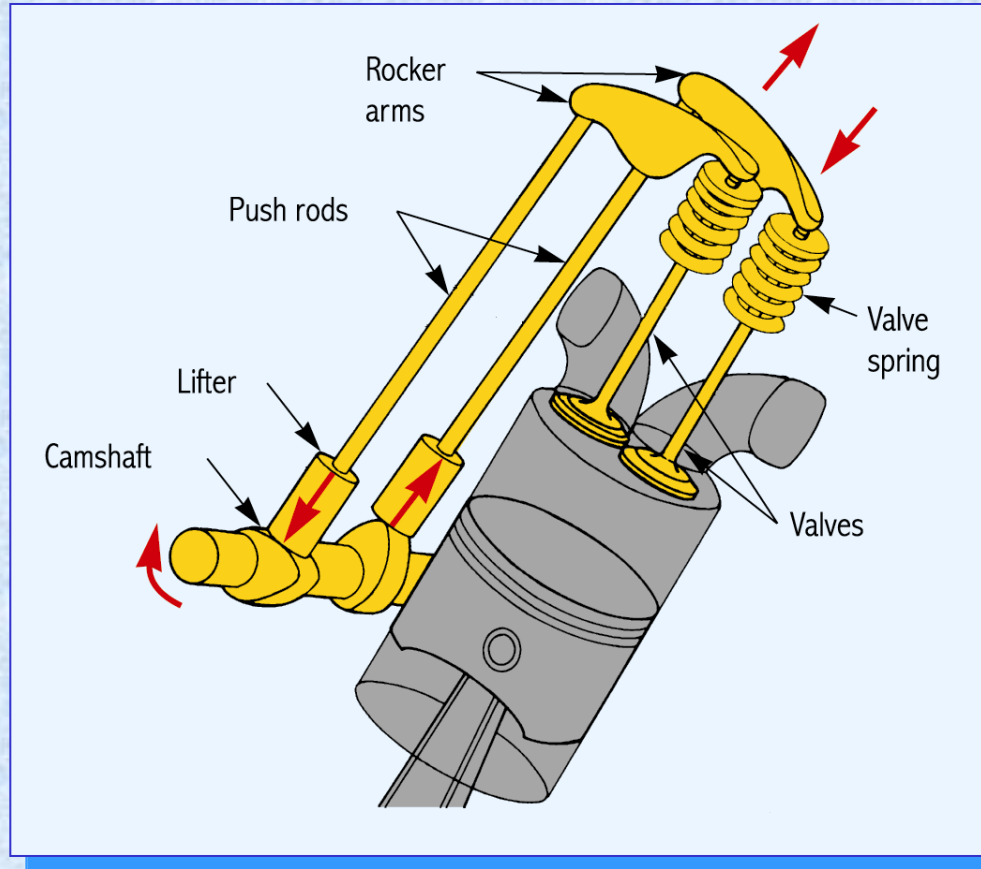
- machined surfaces in the combustion chamber port openings

Cylinder Head Parts



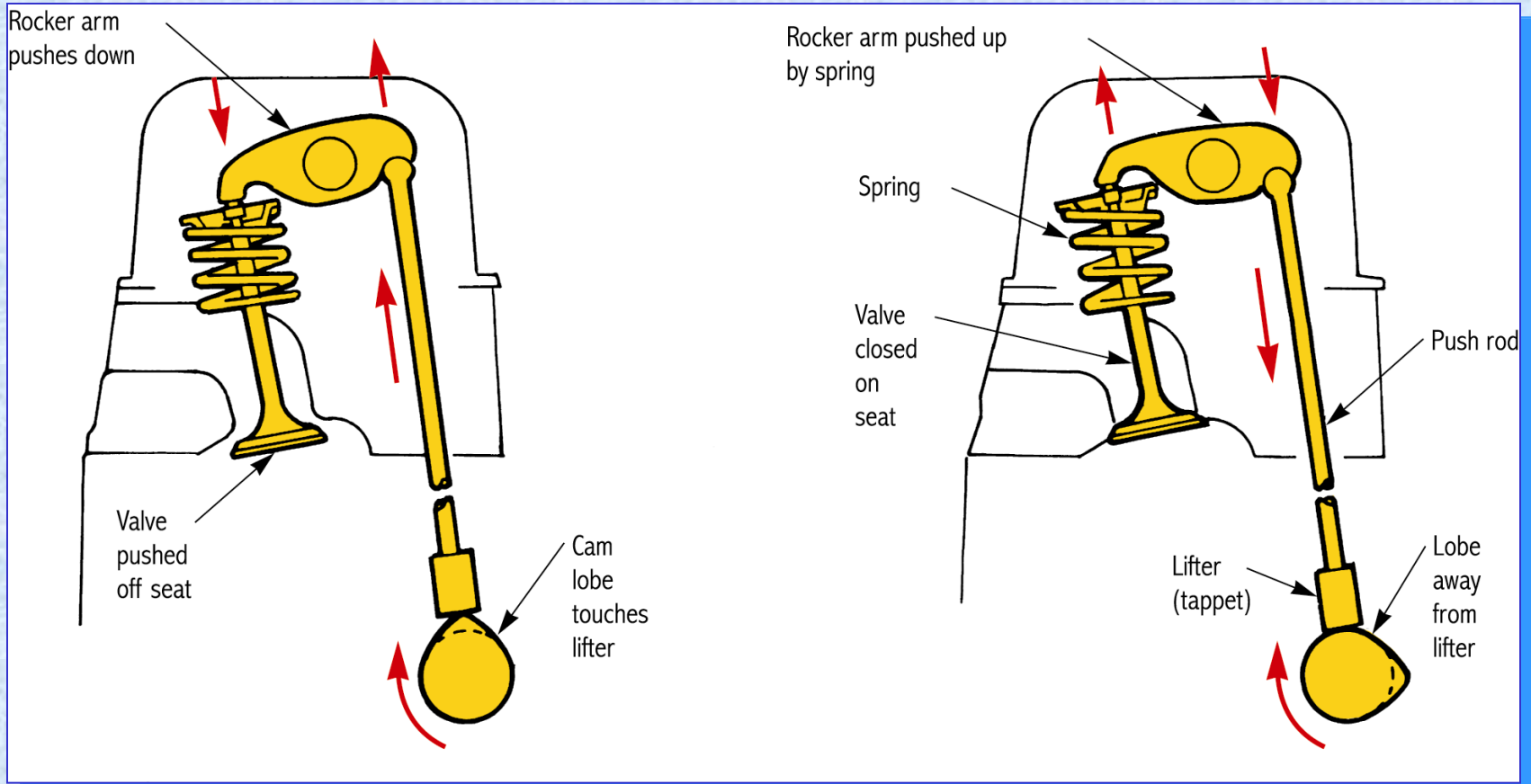
When the valve is closed, it seals against the valve seat

Valve Train



Consists of the valves and the parts that operate them

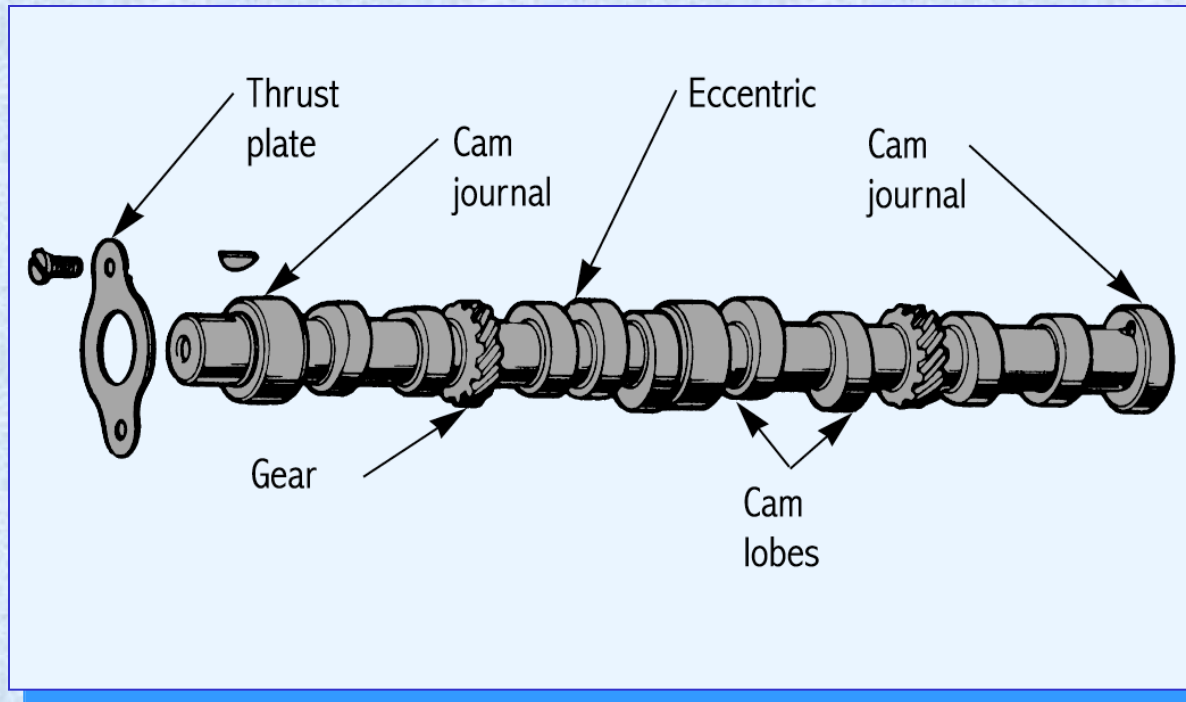
Valve Train Operation



The camshaft lobe turns into the lifter and the valve is pushed **open**

The lobe rotates away from the lifter and the valve spring pushes the valve **closed**

Camshaft



Located in the engine block or in the cylinder head

Camshaft Parts

□ Cam lobes

- egg-shaped protrusions machined on the camshaft
- one lobe is provided for each engine valve

□ Eccentric

- may be machined on the camshaft for a mechanical fuel pump

□ Camshaft journals

- machined surfaces for the cam bearings

Valve Lifters

- ❑ Usually rides on the cam lobes and transfers motion to the rest of the valve train
- ❑ Located in the engine block or cylinder head
- ❑ Fit into lifter bores, which are machined holes in the block or head

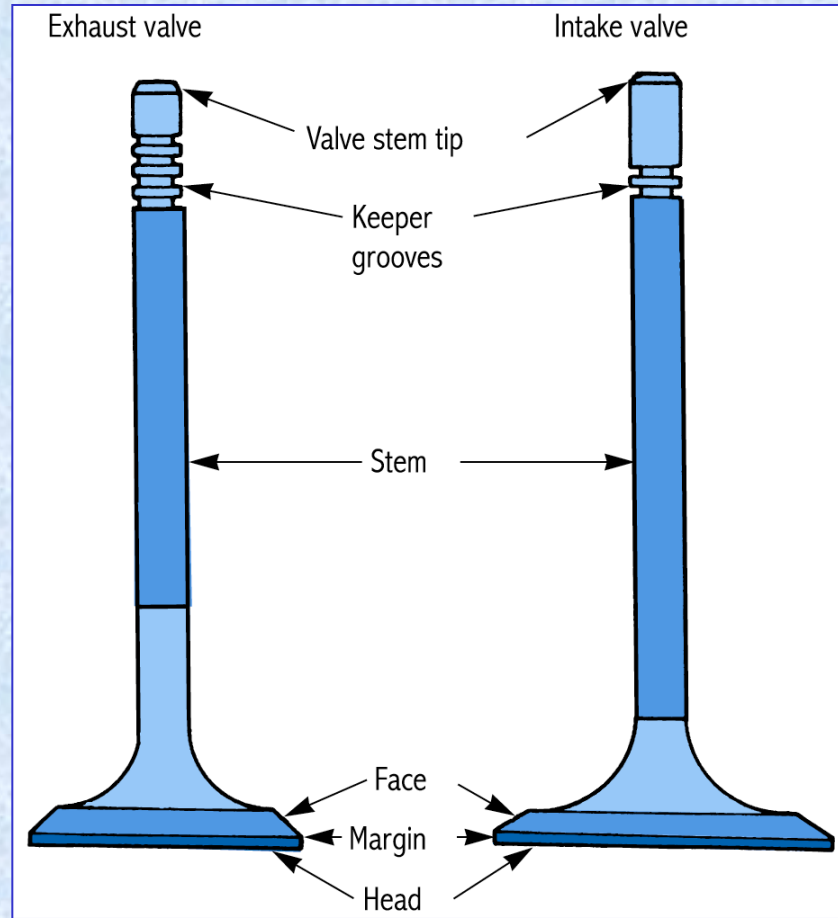
Push Rods

- ❑ Transfer motion between the lifters and the rocker arms
- ❑ Needed when the camshaft is located in the cylinder block
- ❑ Made from a hollow metal tube with a ball or socket formed on each end
- ❑ One end fits into the lifter, while the other end fits against the rocker arm

Rocker Arms

- ❑ Used to transfer motion to the valves
- ❑ Mount on top of the cylinder head
- ❑ Rocker arm movement allows the camshaft lobe to force the valve open
- ❑ Valve spring force closes the valve and keeps the rocker arm in contact with the push rod

Valves



Open and close the ports in
the cylinder head

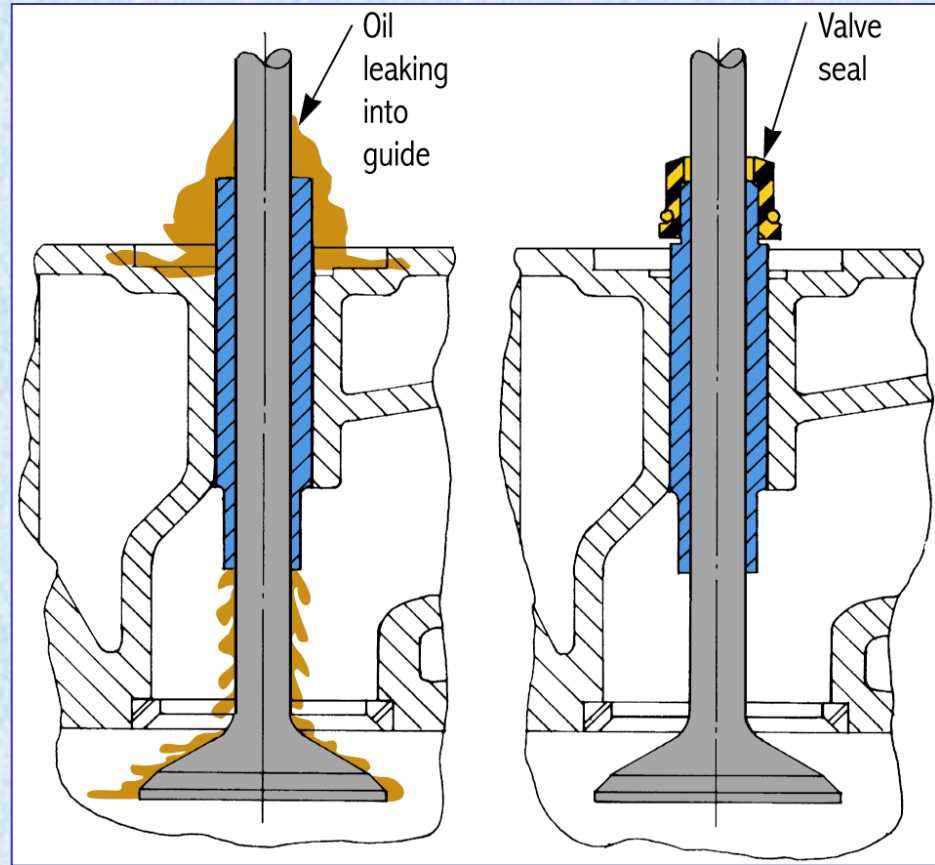
Intake Valve

- ❑ Larger than the exhaust valve
- ❑ Controls the flow of the air-fuel mixture (gasoline engine) or air (diesel) into the combustion chamber
- ❑ Fits into the port leading from the intake manifold

Exhaust Valve

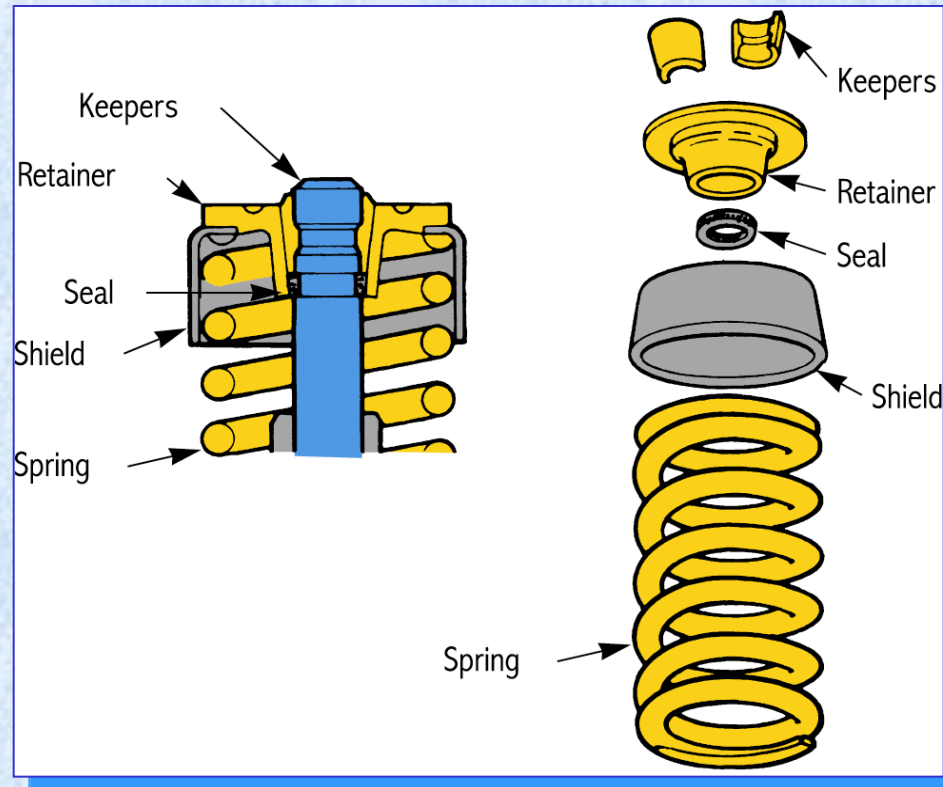
- ❑ Controls the flow of exhaust gases out of the cylinder
- ❑ Smaller than the intake valve
- ❑ Fits into the port leading to the exhaust manifold

Valve Seals



Prevent oil from entering the combustion chambers through the valve guides

Valve Spring Assembly



Used to close the valve

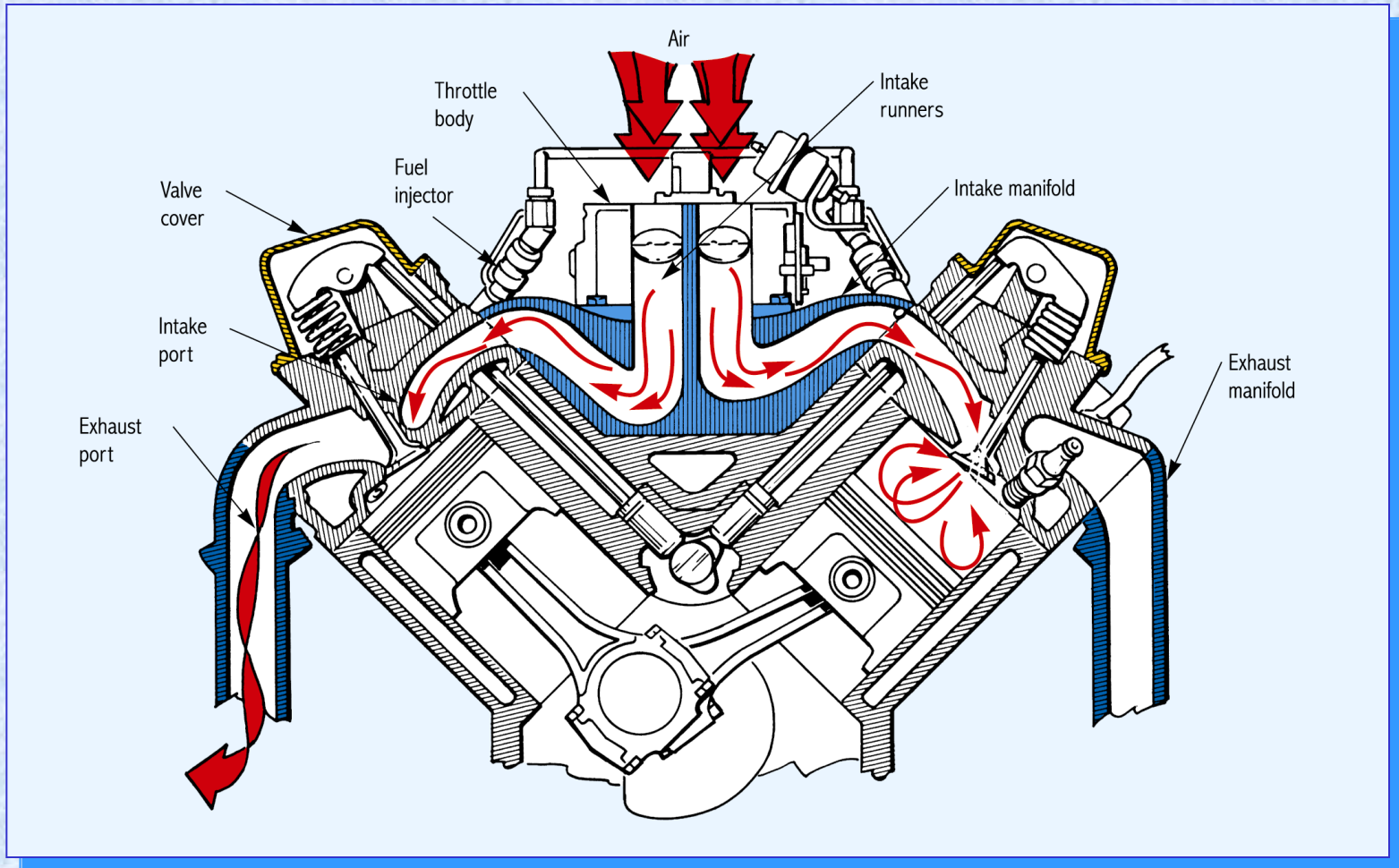
Intake Manifold

- ❑ Bolts to the side of the cylinder head
- ❑ Contains runners going to each cylinder head port
- ❑ Air and fuel (gasoline engine) are routed through these runners

Exhaust Manifold

- ❑ Bolts to the cylinder head
- ❑ Fastens over the exhaust ports to carry burned gases to the exhaust system
- ❑ Made of cast iron, lightweight aluminum, or stainless steel tubing

Engine Manifolds



Valve (Rocker) Cover

- ❑ Thin metal or plastic cover over the top of the cylinder head
- ❑ Keeps valve train oil spray from leaking out of the engine

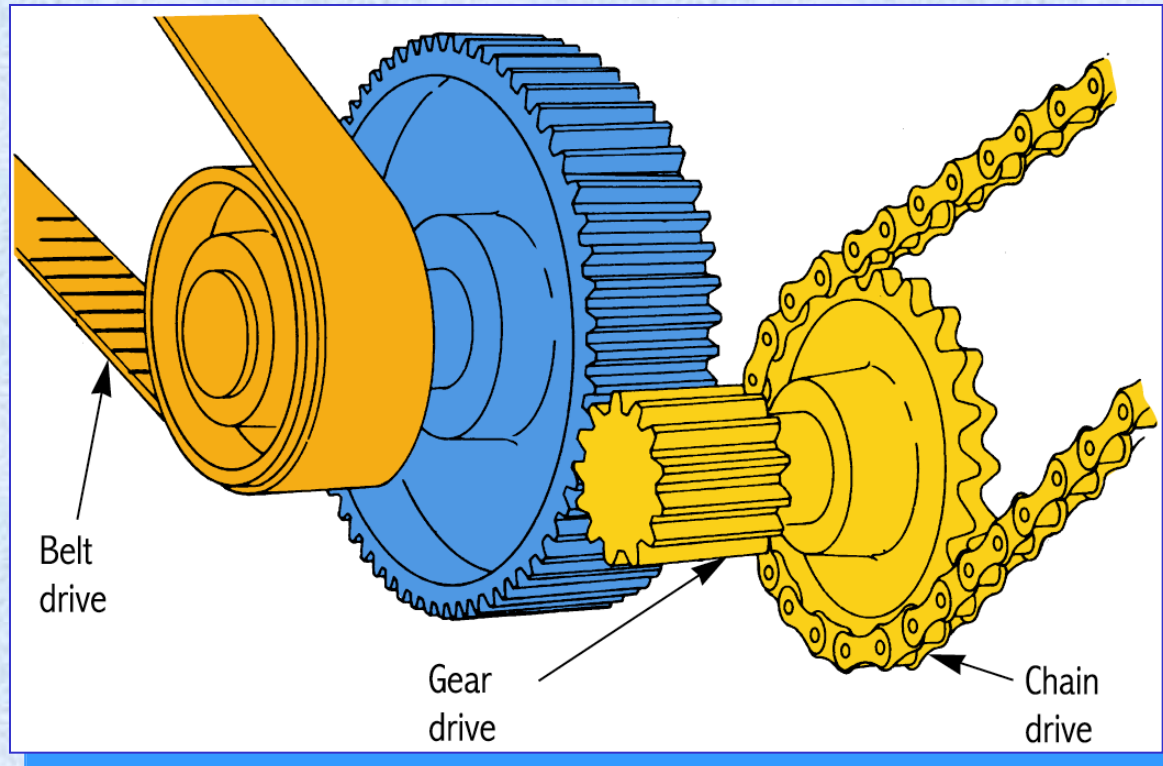
Engine Front End

- ❑ Operates the engine camshaft and sometimes the oil pump, distributor, engine sensors, and diesel injection pump
- ❑ Consists of a drive mechanism, a front cover, an oil seal, and a crankshaft damper

Camshaft Drive

- ❑ Needed to turn the camshaft at one-half engine speed
- ❑ Often called the timing belt, timing chain, or timing gears because they time the camshaft with the crankshaft

Camshaft Drive

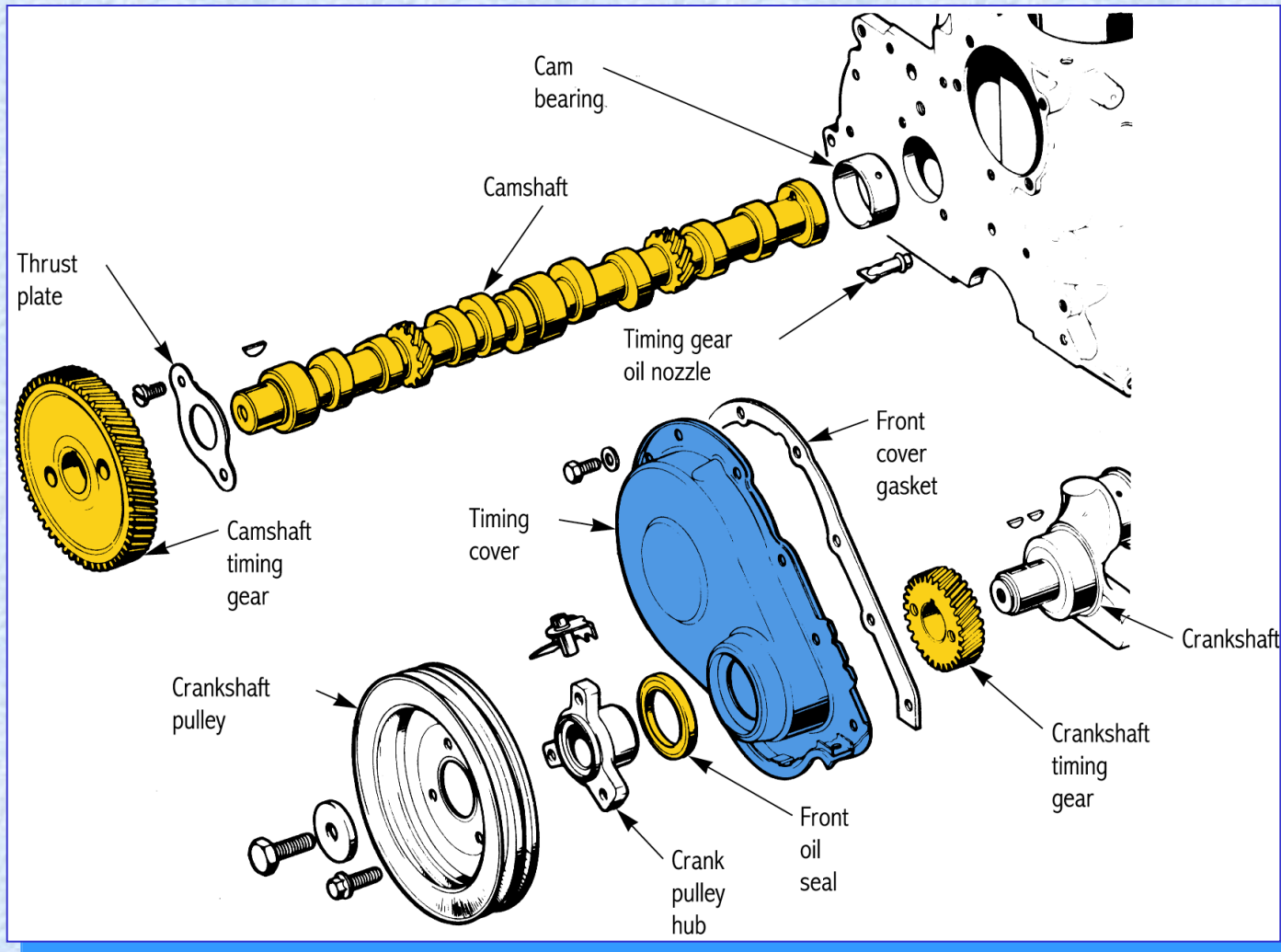


A belt-drive, chain-drive, or gear-drive may be used to turn the camshaft

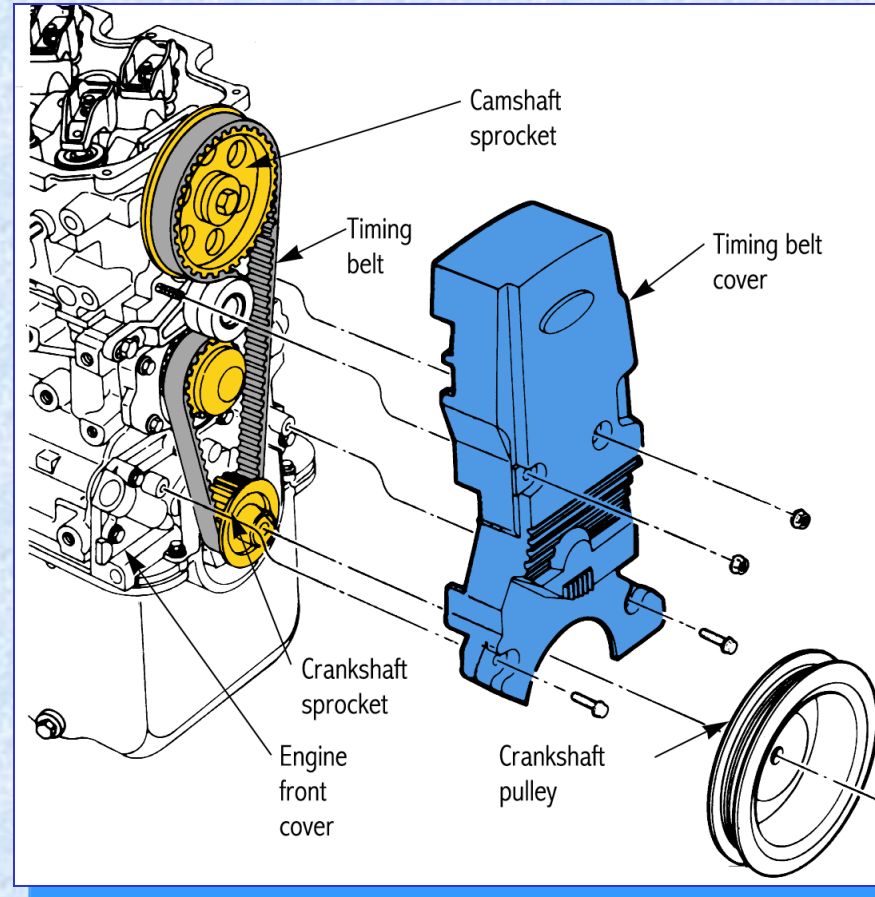
Front Cover

- ❑ Bolts over the crankshaft snout
- ❑ Holds an oil seal that seals the front of the crankshaft
- ❑ When the engine uses a gear- or chain-type camshaft drive, the front cover may be called the timing cover

Engine Front End



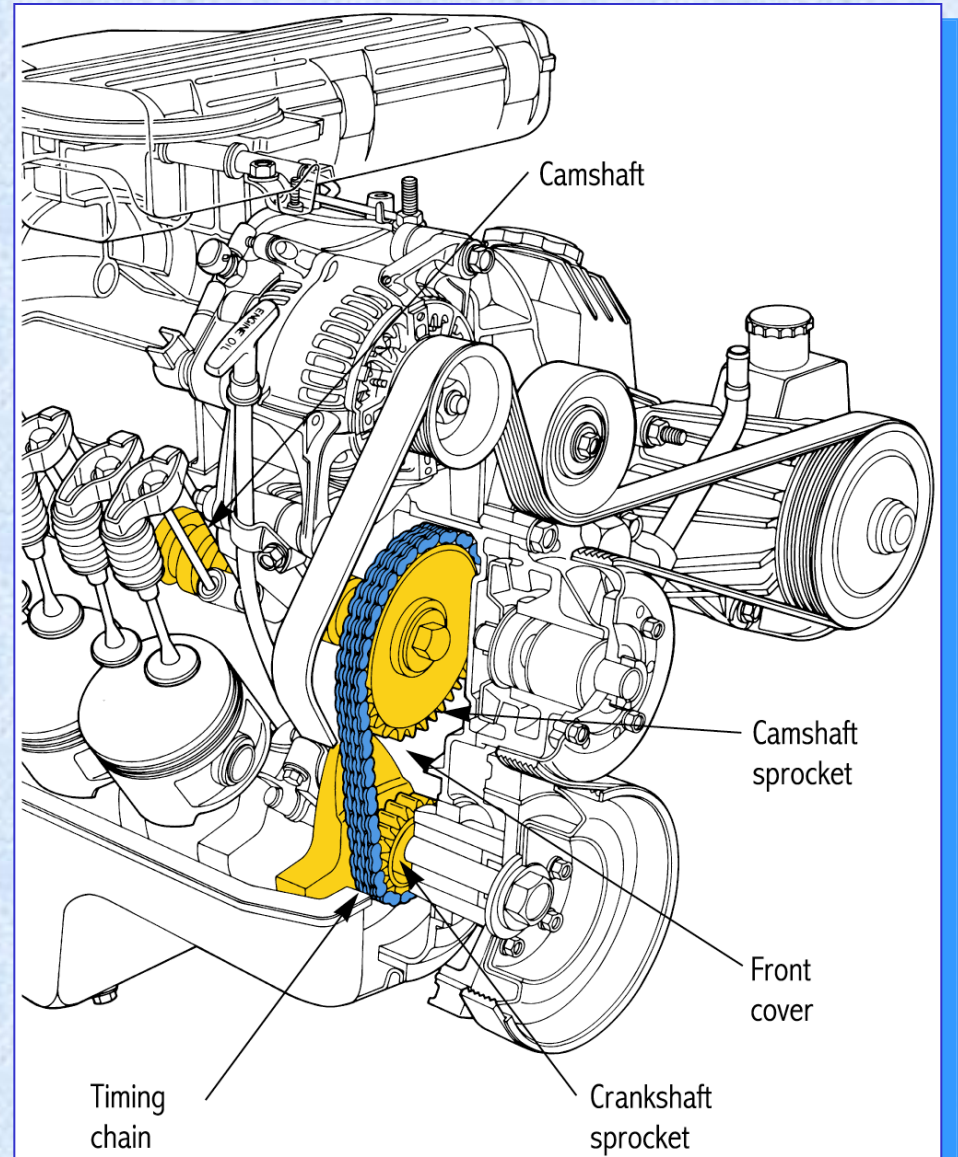
Timing Belt



The front cover houses the front oil seal.
The timing cover fits over the belt.

Timing Chain

Timing chain and sprockets operate the camshaft in this engine



Crank Damper

- ❑ Heavy wheel on the crankshaft snout
- ❑ Mounted in rubber
- ❑ Helps prevent crankshaft vibration and damage
- ❑ Also called the harmonic balancer or vibration damper