Engine Parts

There will be three questions on the ASE P2 test that deal with engine parts, mechanical parts and products.

Automatic Transmission
Braking System
Cooling System
Drivetrain
Electrical System
Emission Control System
Engine Parts
Gaskets and Seals
Exhaust System
Fuel System
HVAC
Ignition System
Manual Transmission/Transaxle
Steering & Suspension

Engine parts may be sold individually, in sets or in complete overhaul kits that include most of the parts that are commonly replaced when rebuilding an engine. Identifying the engine application is essential for looking up the correct replacement parts. In addition to the vehicle year, make and model, the engine displacement and sometimes the vehicle identification number (VIN) or engine code is needed to accurately identify the motor. Some engines that have the same displacement may have different compression ratios, camshafts, cylinder heads, valves or other parts.

Most engine blocks are cast iron, but a growing number are made of aluminum with or without iron cylinder liners. Cylinder heads that hold the valves and upper valve train components may be cast iron or aluminum. The cylinder heads on pushrod engines have two valves per combustion chamber (one intake and one exhaust). Heads on OHC engines may have two, three, four or even five valves per cylinder (one intake and one exhaust, two intakes and one exhaust, two of each, or various combinations thereof). More valves improve high-RPM breathing and power.

Valves in most cast iron heads close on seats that are machined into the head and ride up and down in "integral" guides in the head. But some (such as the big block Chevy) have replaceable press-fit valve guides. Aluminum is too soft for seats and guides, so all aluminum heads have hard alloy valve-seat inserts and replaceable press-fit cast iron, powder metal or bronze valve guides. Worn valve guides are a common problem in high-mileage engines and allow the engine to use oil. Excessive oil consumption can foul spark plugs and cause heavy carbon deposits on the intake valves and in combustion chambers. Worn guides can be replaced or repaired by installing bronze or cast iron guide liners to restore clearances, or reamed to oversize to accept new valves with oversize stems.

At the top of each valve guide is a seal to control lubrication. "Umbrella" seals act like a shield to deflect oil away from the guides while "positive" seals fit tightly around the stem to control lubrication. Most late-model engines have positive valve guide seals.

Valves are opened by eccentric lobes on the camshaft. Some older engines have "solid lifters" that require periodic valve lash adjustments, but most engines have "hydraulic lifters" that use oil pressure to main proper valve lash in the valvetrain. Lifters may be "flat-bottom tappets" that ride directly on the cam lobes or they may be "roller lifters" that ride on a small roller to reduce friction. In OHC engines, the cam lobes may push directly on the tops of the valve stems or use "followers" with or without hydraulic lash adjusters to open the valves.

Valves are closed by stiff springs mounted around the valve stems. A groove in the top of each valve stem accepts "keepers" that hold the spring "retainer" in place. Shims called "valve spring inserts" may be used under the springs to increase spring tension. Valve springs weaken with age, causing a loss in compression. Springs can also break. Weak or broken springs must be replaced.

Camshafts may need to be replaced if the lobes have become worn. Replacement cams may be new or reground with stock lobe profiles or performance profiles. Increasing valve lift with taller lobes (and valve duration) can add more horsepower. New lifters should be installed if the

camshaft is replaced. Aftermarket performance cam kits usually include new lifters and valve springs.

Camshaft timing gears wear with age and timing chains stretch. This can reduce engine performance and cause noise. Rubber timing belts maintain cam timing more accurately over the long haul, but must be replaced at 60,000 to 100,000 mile intervals to reduce the risk of breaking. A broken timing belt may bend valves in an "interference" engine that lacks enough valve-to-piston clearance.

Pistons may be cast aluminum, a special high-strength "hypereutectic" aluminum alloy or aluminum forgings. Some pistons have a moly coating on the "skirt" (side) to reduce scuffing and wear. Pistons that are cracked, burned or worn must be replaced. Replacement pistons should be the same type or better than the original for durability.

Three rings are used to seal the pistons with the cylinders: a top compression ring, a middle compression ring and a lower oil ring (usually a three-piece design). Worn or broken rings reduce compression, increase blowby into the crankcase and increase oil consumption. The pistons are joined to the crankshaft by "connecting rods." A "wrist pin" mates the small end of the rod to the piston. The large end of the rod has a removable cap that bolts around the crankshaft journal. Connecting rods are usually cast iron. New rods are needed if the old ones are cracked, twisted, bent or stretched.

Bearings support the crankshaft (and camshafts in pushrod engines). A thin film of oil between the bearings and shafts reduces friction and prevents wear. Bearings may be aluminum or steel with an aluminum or "tri-metal" overlay. Worn bearings produce noise and lower oil pressure. Bearing failure can occur if a bearing overheats and seizes, cracks or pounds out. Bearings can be damaged by dirt, lack of lubrication or oil breakdown. Wear can be accelerated by neglecting regular oil and filter changes. Bearings are usually replaced as complete sets and must be the correct size for the crankshaft journals. If the crankshaft has been reground to undersize, undersize bearings are required to maintain proper oil clearances. Some aftermarket replacement bearings are now available with a special friction-reducing surface coating to prevent dry starts and reduce the risk of bearing damage in the event of loss of oil pressure.

All engines have an oil pump to circulate oil from the oil pan to the bearings and to the rest of the engine. A spring-loaded valve controls the amount of oil pressure generated by the pump. The pump is driven off the crankshaft and may be located in the crankcase or under the front cover. A worn oil pump can lower oil pressure. Recommend a new oil pump if the bearings are being replaced or the engine is being overhauled. The oil pickup tube and screen should also be replaced. ◉