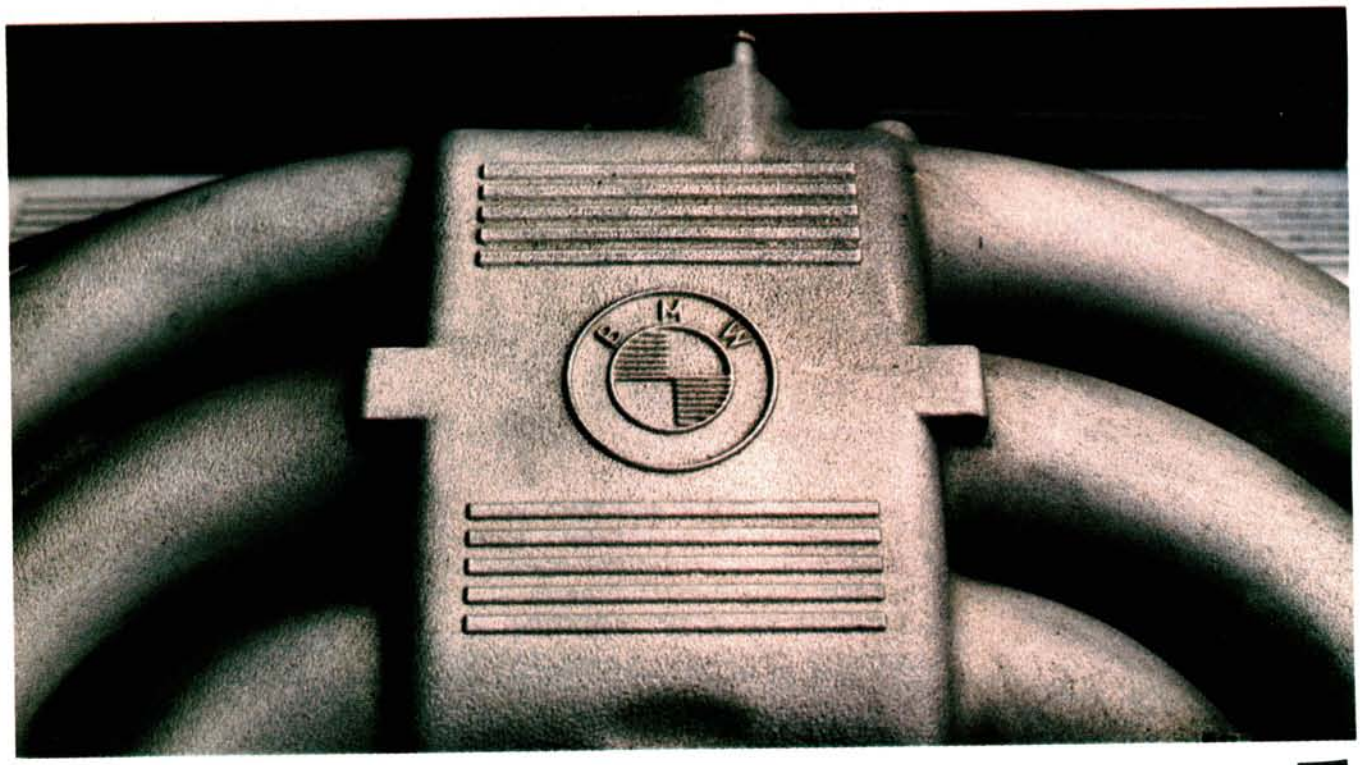
BMW



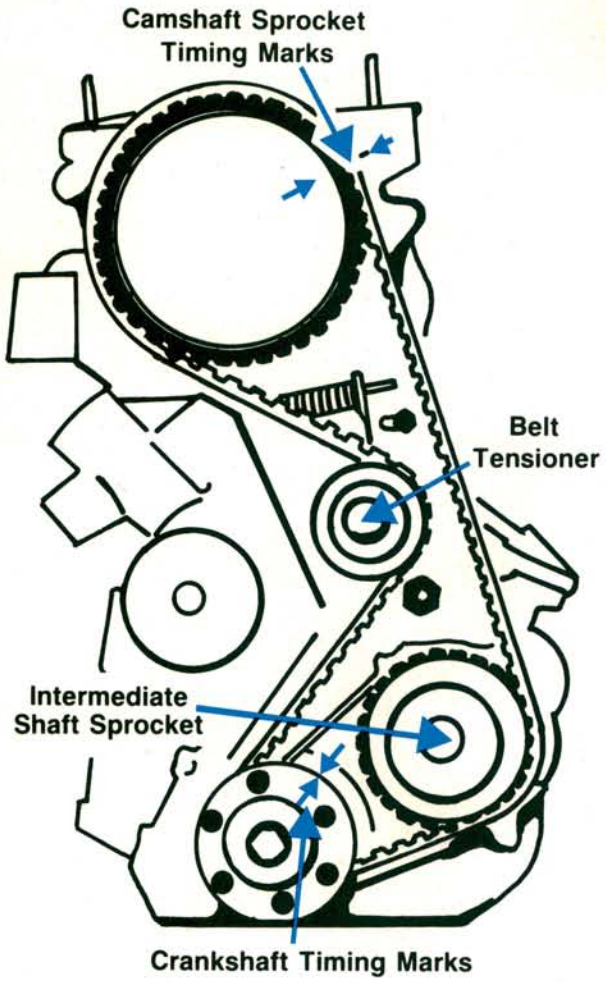
Cylinder Head Gasket R&R

BMW Head Gasket

The technician first noticed the oil leak from below the car. An oily residue had accumulated on the right side of the steering rack. He followed the oily path upward to its source and found that there was an oil leak at the cylinder head gasket in the area between the number 3 and number 4 cylinders on the exhaust manifold side of the head.

The car in question was a 1985 BMW 325. The M20B25 (2.5L engine) and the M20B27 (2.7L engine) are very similar. These are the "small" six-cylinder engines found in the 325 and larger 528 BMW models.

The customer was advised of the situation. And since this is a pretty big job, the shop owner wisely took the time to fully explain the problem. The owner of the car liked his BMW and decided to have it repaired. This made us very happy, since we needed to do an article.



Not So Scary

The 2.7L engine in the 325 is a pretty straightforward piece of equipment. Once you know a few tricks, the letters BMW get a little less frightening. If you pull the head with the manifolds attached as we did, you may find the job tougher on your back than it is on your brain.

Here are some things to keep in mind before we start:

• **Removing the hood makes things a lot easier**. Spray paint the hood hinge bolts before you remove them. A little extra paint *under* the hood is a lot better than chipped or missing paint on top when the hood and fenders don't realign properly.

• **BMW is specific about recommending metal reinforced valve cover gaskets**. A weak or inferior gasket can be sucked into the valve train area. Symptoms of a bad valve cover gasket include: a whistling noise, uneven idle speed, reduced engine power, and higher than normal oil and fuel consumption.

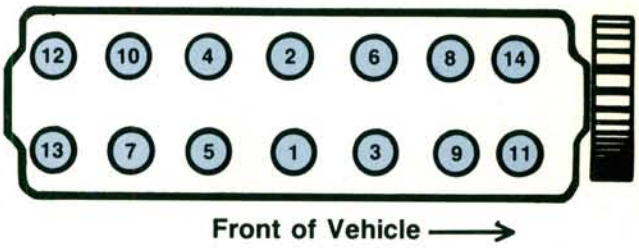
• **BMW recommends that you use no sealer of any kind on the M20 head gasket**. The only exception is on M10/M30 engines. On these engines, you'll need some Hylomar where the timing case cover meets the engine block.

• **BMW has supplied cylinder head gaskets in vacuum packaging since May of 1982**. The factory suggests that gaskets stored in the open air may harden and not seal well as a result.

• **BMW also emphasizes two points they feel are critical to proper cylinder head gasket sealing**. The first has to do with removal of the old gaskets. They suggest you use some spray gasket remover and a hardwood scraper. That way you won't be gouging critical engine sealing surfaces with hard metal scrapers. We also used a mild abrasive pad to finish the job.

• **Secondly, they suggest that you spend a little extra time cleaning the head bolts and head bolt holes**. You should be able to screw the bolts all the way into the holes using only your fingers. If you can't, there's either water and debris still in there, or the threads are damaged.

Cylinder Head Tightening Sequence



Three-Step Tightening

BMW prescribes a very definite tightening sequence for the head bolts. This is a three-step bolt tightening procedure that includes a two-step torque sequence, with an engine warm up in between, and then a final tightening with a torque angle gauge.

The head bolt tightening procedure for M20 engines is as follows:

Torque the head bolts in the proper sequence to an initial torque of 40 Nm (29 ft-lb). Now wait 15 minutes for the head gasket to settle. While you're waiting, you can replace the timing belt and start connecting hoses, cables, and wiring.

Using the same torque sequence, tighten the head bolts to 65 Nm (47 ft-lb), then run the engine at operating temperature [coolant temperature of 85-95 degrees C (185-203 degrees F)] for 25 minutes.

Shut the engine off, and using a torque angle gauge, tighten the head bolts in the same sequence an additional 20-30 degrees. This final step can be done with the engine hot, regardless of engine temperature. You don't need to readjust the valves after the final torque angle tightening.

—By Dré Brungardt

BMW Part Numbers

Self locking nuts/exhaust flanges
P/N 11 62 1 259 559

Sealing rings (2) for oil by-pass tube
P/N 11 15 1 714 390

Valve cover gasket P/N 11 12 1 265 108

Head gasket P/N 11 12 1 708 891 (standard)

Head gasket P/N 11 12 1 713 493 (+ 0.3 mm for machined cylinder heads)

Timing Belt P/N 11 31 1 713 361

Belt tensioner P/N 11 31 1 711 153

Rocker shaft seals (4) P/N 11 33 1 264 519

Front camshaft seal P/N 11 14 1 274 346

Valve Adjustment Specifications for M20 engines:

Intake and exhaust 0.25 mm with coolant temperature below 35 degrees C (95 degrees F).

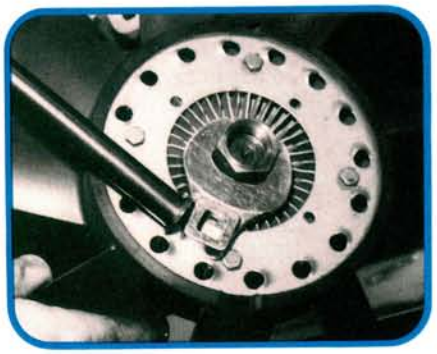
Intake and exhaust valves 0.35 mm for a warm engine with coolant temperature 85-95 degrees C (185-203 degrees F).

1

Start by removing the hood. Disconnect the windshield washer fluid hose and plug it. Spray paint the bolts in the hood hinges before you remove them. That way, you can use the paint marks as bolt locators when you reinstall the hood, and be right on the money the first time.

2

Trigger the cold start injector several times to relieve any residual pressure in the fuel loop. Remove the inlet and return lines from the fuel rail and plug them. Then remove the cold start valve/idle compensator assembly and lay it aside as shown. Remove the wire harness supports and the valve cover.



3

The cooling fan screws onto the threaded water pump shaft with a LEFT-HAND thread. Take a 32 mm or 1¼ inch crows foot, and strike the head of the wrench with long bar to break the fan free. Unscrew and remove the fan. Radiator removal is not necessary, but you'll need to drain the coolant.

4

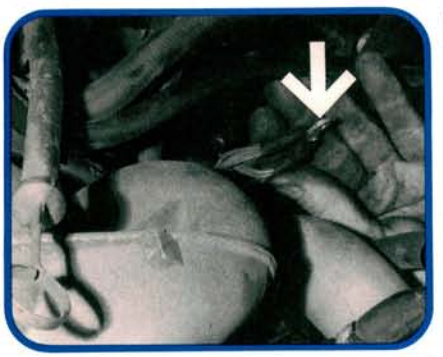
Remove the distributor cap and rotor. The allen-head bolts holding the rotor to the camshaft are tight. Make sure your socket isn't all rounded off from wear. Once the bolt heads strip, you'll be struggling with locking pliers. Remove the distributor cover to expose the cam sprocket and belt.

5

Slit the rubber boot on the oil pressure sensor wire. Disconnect the wire and slide the spade terminal through the boot. This will let you pull the wire to the top of the engine compartment without cutting it. While you're down there, unbolt the exhaust down pipes. Throw the old locknuts away, they're not to be reused.

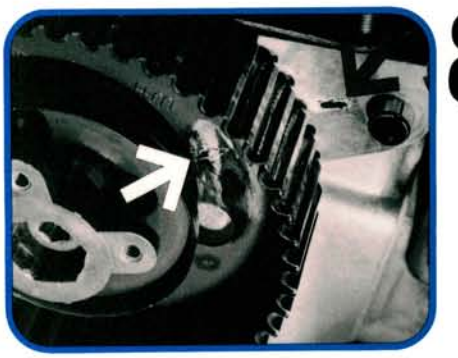
6

Unplug the remainder of the wiring harness from the right side of the engine. Feed it under and through the intake manifold. Be careful not to break any electrical connectors. Don't lose those wire locking clips and the rectangular seals that keep water out of the connections, either.



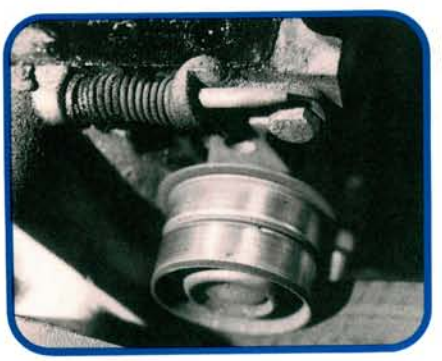
7

Locate and remove the bolt below the intake manifold that secures the heater hose bracket. (It's the hose that runs to the thermostat housing). This bolt holds three things in place: the hose bracket, the clamp holding the wiring harness, and this central harness ground eyelet.



8

You might as well set the engine to TDC on number one before going any further. That way you can remove and reinstall the timing belt with the cam and crank timed. Turn the engine until the crankshaft timing mark aligns with "OT" on the crankshaft pulley and the valves lap on number six.



9

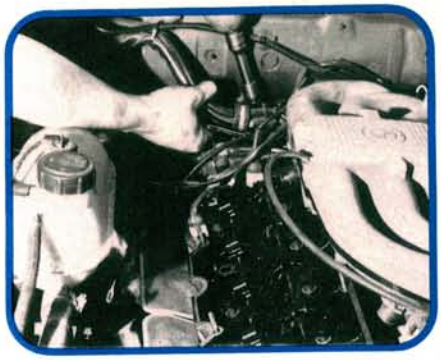
Now release the tension on the timing belt. You'll need a 12 mm wrench to loosen the bolts on the tensioner. With the bolts loose, pry the tensioner away from the belt and snug the bolts to hold the tensioner away from the belt. Remove the timing belt from the camshaft sprocket.

10

The heater hoses are connected at the firewall right next to the master cylinder brake booster. Disconnect only the hose that's connected to the intake manifold. It may fight coming off, but resist the temptation to start prying with a large bar or you may damage something.

11

This photo will give you a better view of some of the things you can only find by feel while the head is still in place. The spring-tensioned oil by-pass breather hose is attached to the head (white arrow). The heater hose we removed at the firewall is still attached to the manifold (black arrow).



12

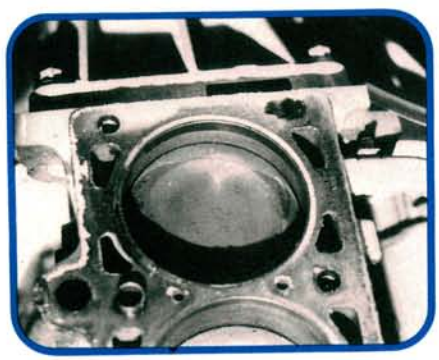
Remove the head bolts. Start from the center and move outward in a spiral pattern. There are 16 bolts in all. Make sure the engine is completely cold when you remove the head bolts. Never remove the head bolts while the engine is still hot.

13

Finish disconnecting the cables and hoses from the intake manifold. Have an assistant give you a hand lifting the cylinder head assembly from the engine. As we said before, there's no need to remove the manifolds if you're just removing the head.

14

With the head removed, clean away the old gasket. This mild abrasive disc is a time saver and won't damage the sealing surface of the deck. No metal scrapers, please. Spend some time cleaning the head bolt holes. Clean the cylinder head bolts with a wire brush and lightly lube them with a few drops of oil.

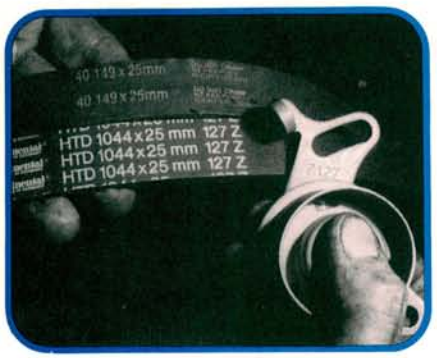


15

Check the top of the number six piston for excess oil residue. On some of these cars, overtightening of the bell housing bolts caused just enough distortion of the cylinder bore to allow blow-by. In some cases, the situation has been corrected by temporarily loosening the bell housing bolts until the head was reinstalled and fully torqued.

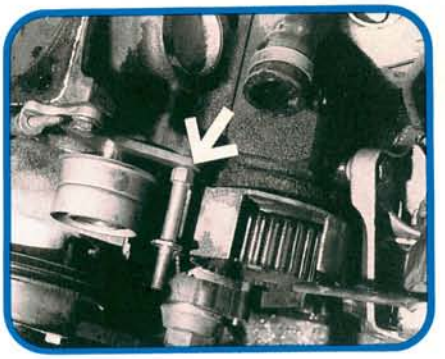
16

Remove these six 13 mm bolts, the vibration damper, and the front pulley. Swing the alternator out of the way. This will let you remove the lower timing belt cover so you can get at the crankshaft sprocket and remove the timing belt. Make sure you haven't moved the crankshaft from top dead center.



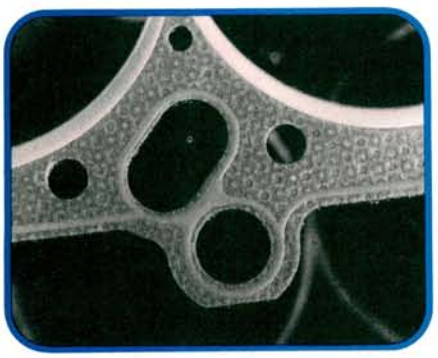
17

The replacement timing belt is shorter, wider, and stronger than the original. As a result, you'll need to remove the old belt tensioner and install a new one when you install a new belt. This photo shows the difference in belt sizes marked on the backs of the belts. The new belt is at the bottom.



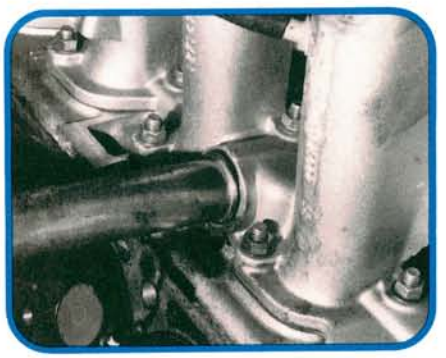
18

This photo gives you a better view of the tensioner as it is installed on the block. The lower bolt is also a support for the front cover and alternator bracket. Use a 12 mm hex head to loosen or tighten the bolt. With the belt installed, you'll have to get at the bolt head from the backside of the belt.



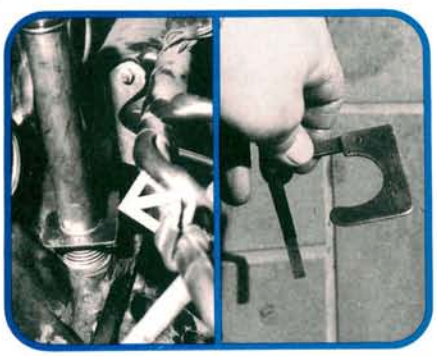
19

This new head gasket comes with a printed seal around the oil passages (and every other passage, for that matter). This printed seal should eliminate future oil leak problems, assuming you follow the head-bolt tightening sequence outlined in our introduction.



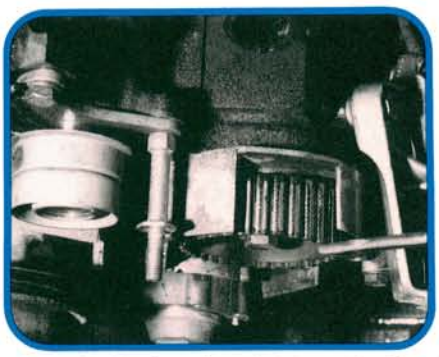
20

Remember the oil by-pass tube shown in photo 11? The tube is sealed by o-rings, top and bottom. Remove the old seals and clean the bores in the intake manifold and the engine block with some carb cleaner and a tail light socket brush. Install new seals and lightly lube them to ease reinstallation.



21

You'll need a tool like BMW number 11-1-290 to temporarily hold the by-pass tube in the block. The tool holds the tube against the spring so it doesn't pop upward as you reinstall the head. When lowering the head onto the deck, align the top of the tube with the bore in the intake manifold. Don't forget to remove the tool when you're done.

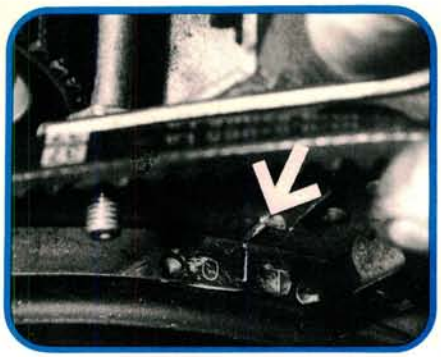


22

Reinstall the head and torque the head bolts to the first tightening stage. If you took the time to set the engine at TDC on number one, and didn't move anything, reinstalling the belt should be easy. Install the new tensioner and compress it against the tensioner spring. Snug the pivot and adjustment bolts.

23

Double check your timing marks. Install the new belt. If the belt teeth don't fall right into the notches on the camshaft sprocket, bump the cam to the nearest tooth that fits. Make sure the belt teeth are sitting square in the crank sprocket. Keep the side of the belt away from the tensioner pulled tight.

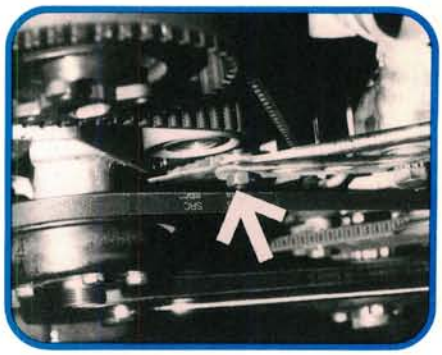


24

With the tensioner still compressed against its spring, turn the engine over by hand, two full turns in the direction of normal engine rotation. Recheck the timing marks. Don't turn the engine backward or you'll loosen the crankshaft center bolt. Recheck your timing marks.

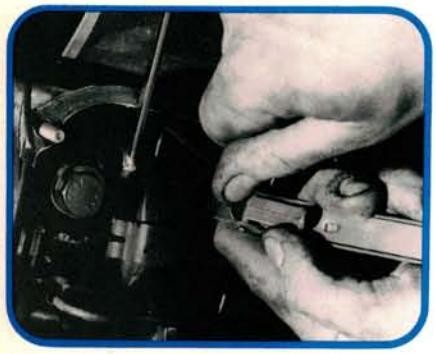
25

If the timing marks align properly, loosen the pivot and adjustment bolts on the tensioner until the spring pulls the tensioner against the belt. Snug the bolts. Turn the engine over two more full turns so the tensioner can settle into its new home. Loosen and finally tighten the tensioner bolts one more time.



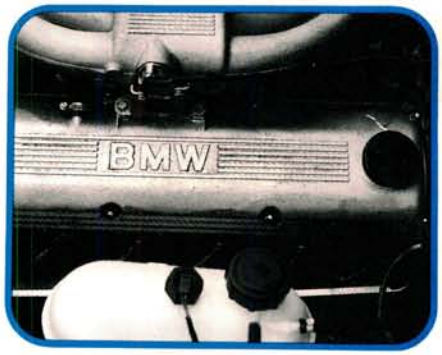
26

When you reinstall the lower timing belt cover and alternator bracket on the stud end of the tensioner pivot bolt, put things back in the right order. If you replace the lower timing belt cover and the bracket in the wrong order, the cover will interfere with the timing belt and make a racket.



27

Reassemble the rest of the engine. Change the engine oil and filter. Fill the cooling system and check for leaks. Replace the belts and the cooling fan. Adjust the valves. Install the valve cover using the old gasket. Run the engine for 25 minutes to get it warm.



28

Remove the valve cover and install a new gasket. Grab your torque angle gauge and tighten the head bolts in sequence an additional 25 degrees. Replace the valve cover, test drive the car, and check for any oil or coolant leaks.