A U T O T E C H

Installation Instructions *sport tuning*

Part Number: 10.109.418K
Description: Autotech 16V Sport Camshaft Set

Notes:

Ground on Autotech's own, custom manufactured, chill-hardened billets, our new Sport 16V camshafts achieve power levels higher than the benchmark Schrick 260°, yet provide far better low-end torque and drivability. Without question, they are the best street-legal* performance cams for your 16V.

* Exempt under C.A.R.B. Executive Order D-375-4. All timing settings and tune-up specifications are the same as original.

1) For a trouble-free installation, it is important to understand that there are two separate timing procedures that must be addressed when installing this (or any VW 16V) cam set:

First, there is cam-to-cam timing, which is set by the position of the chain connecting both cams.

Second, there is engine timing, set by the position of the timing belt connecting the crankshaft to the exhaust camshaft.

These timing procedures should be viewed as two, independent operations. Once seen this way, the installation is quite simple, and will go smoothly, even if it's your first time doing this sort of thing.

2) We strongly recommend changing the timing belt when it has seen 50,000 miles of use. If you're not sure how many miles your 16V's belt has, CHANGE IT! A new belt is cheap insurance against costly engine damage caused by a broken belt.

Procedure:

1. Remove the camshaft drive belt cover on the front (6 Nm/53 in. lb.) and side bolts (10 Nm/87 in. lb).
2. Rotate the crankshaft clockwise with a 19mm wrench until the No. 1 cylinder is at TDC (Top Dead Center), indicated by the marks on the camshaft sprocket and valve cover (see Fig 1)

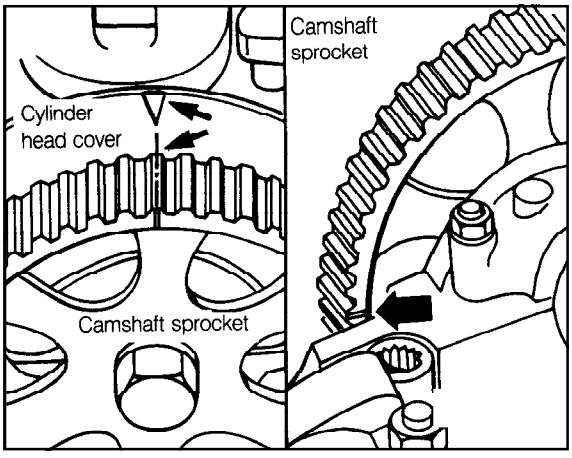

Fig 1

2. (cont)

Note: because the timing mark on the vibration damper and the "0" on the flywheel can indicate TDC for either cylinder No 1 or No 4, don't use these marks for double-checking here. Use the mark on the camshaft only.

3. Pull all four spark plug wires off the plugs. Keep the wires attached to the distributor cap, and remove the cap from the distributor.
4. Remove the upper intake manifold plenum. To do this, first remove the two rear support braces (20 Nm/15 ft lb)., all vacuum hoses, electrical connections, the throttle cable, and the intake boot from the throttle body. Then, using a 13mm wrench, remove the 5 nuts that hold the upper plenum to the lower (20 Nm/15 ft lb). Slide the upper plenum off of the lower half.
5. Cover the lower manifold to prevent any dirt or objects from falling into the engine.
6. Loosen the belt tensioner using a 15mm wrench. Slide the timing belt off of the cam sprocket.
7. Using a scribe or indelible pen, mark the position of the ignition distributor body relative to the cylinderhead. This will aid in re-installation and closer initial timing settings. Remove the two bolts that retain the ignition distributor to the head. Remove the distributor and set aside.
8. Remove the two center and six outer valve cover bolts. Remove the valve cover. If the rubber gasket has gotten hard or brittle, replace it. Otherwise, set the gasket aside for re-use.
9. With the engine still at TDC, use a clean rag to wipe the oil off of the two chainwheels and the top portion of the timing chain. Using a "paint pen" or marker, mark the position of the chain and chainwheels relative to one another (two places). This will aid in the proper timing of the new cams later (arrows, Fig 2).

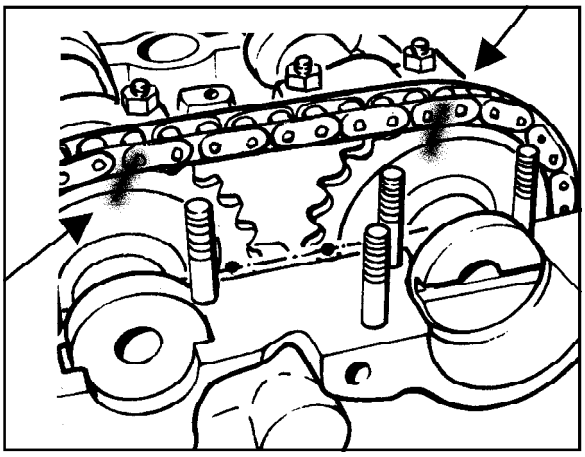

Fig 2

10. Removing the cam bearing caps - Use an 11mm wrench to:
    - remove bearing caps 5 and 7 (each cap is marked) from the *INTAKE* camshaft.
    - Next, remove the end cap on the *INTAKE* cam closest to the chainwheel.
    - Remove caps 1 and 3 on the *EXHAUST* cam, then remove the two end caps as well.
    - Now gradually and evenly loosen the nuts on the remaining caps a little at a time, so the tension in the valve springs and cam chain are released evenly.

    NOTE THE DIRECTION AND NUMERICAL SEQUENCE OF THE BEARING CAPS ON THE ENGINE! IF THESE CAPS ARE INSTALLED INCORRECTLY, IT CAN PREVENT THE CAMSHAFTS FROM TURNING AND WILL CAUSE UNREPAIRABLE CAMSHAFT AND BEARING WEAR!
11. Lift the camshafts from the head TOGETHER, then remove the drive chain. Make sure you have marked the chain and chainwheels, as in Figure 2, before separating them!

(cont)

12. Now use a 17mm wrench to remove the bolt that holds the timing belt sprocket to the exhaust cam (65 Nm/48 ft lb). We recommend holding the cam in a vise *using soft jaws* to do this easily. Gently tap the sprocket to remove from the camshaft. Be careful not to damage the keyway integral on the sprocket!
13. Removing the chainwheels for transfer to the new cams.
    BEFORE REMOVING, NOTE WHICH WAY THE CHAINWHEELS ARE FACING. THEY MUST BE PLACED THE SAME WAY ON THE NEW CAMS, OR YOU WILL NOT BE ABLE TO PROPERLY TIME THEM! The chainwheels have a front and back, distinguished by the chamfer or radius of the wheel's face near the center hole (Fig 3)

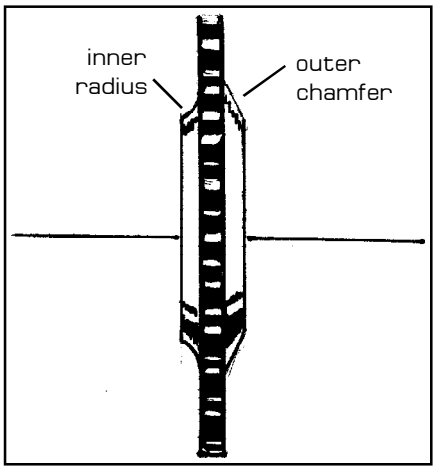

Fig 3

The chainwheels must be locally heated to be removed or installed. *It is best to have them pressed on or off the cams using a hydraulic press with steady force after heating.* If this is not possible, you will have to heat, then gently drive the chainwheels off or on with a soft faced mallet. This is best accomplished by driving the cam off of or onto the chainwheel, while supporting the chainwheel on at least two places over an open vise. Make sure to keep the woodruff keys for re-use.

Install the chainwheels on the new cams facing the same direction as on the originals.

14. Once the chainwheels are installed on the new cams, apply a small amount of cam lube or oil to the inside of a new camshaft oil seal (OE no 068.103.085A) and place it on the exhaust cam. On a table or flat surface, place the drive chain onto the new cams, and make sure the marks you made (in Step 9) on the chainwheels and chain align. Now place the cams in the head TOGETHER, making sure that the chain does not skip or move a tooth while doing so.
15. Install bearing caps 2, 4, 6, and 8, tightening them down gradually and evenly. Make sure the caps are on the correct journals and that the caps' beveled corners face the intake (forward) side of the engine. Now install caps 1, 3, 5, and 7 in the same manner. Lastly, put the four end caps on. Double check to make sure ALL caps are facing the right direction and are in the proper position! Finally, torque the nuts (15 Nm/11 ft. lb.).
16. Place the timing belt sprocket on the exhaust cam and bolt it on (65 Nm/48 ft lb).
17. CAM-TO-CAM TIMING

    Rotate the timing belt sprocket to check the cam-to-cam timing as shown in figure 4. Remember that *cam-to-cam* timing and *engine* timing are to be treated as separate procedures. It is in reality, quite simple to get *cam-to-cam* wrong! Pay close attention that the dots are truly in-line with the edge of the head when they face each other. **Cam-to-cam timing must be perfect or serious engine damage could occur!**

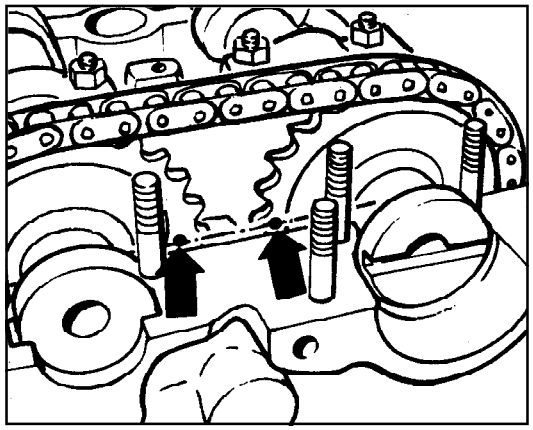

Fig 4-cam to cam timing

18. ENGINE TIMING

Once cam-to-cam timing is set properly, you can now set the engine timing (cam-to-crank). Install the valve cover and gasket on the head with its eight bolts (10 Nm/7.2 ft lb). Rotate the camshaft timing sprocket until the TDC mark aligns with the mark on the valve cover (Fig 1). The crankshaft should not have been moved, but you should double check that the crank is still at TDC. Note that the 16V engine is an "interference engine," meaning that the valves will hit the tops of the pistons if the engine goes out of time. Therefore, you cannot rotate the cams beyond the point where the valves hit the top of the piston on any one cylinder.

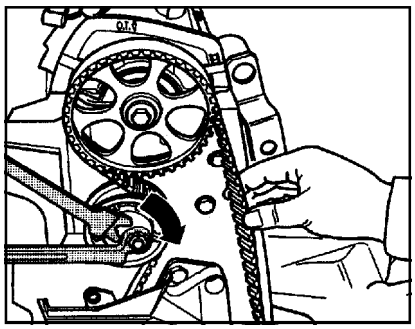

Fig 5

Once TDC on both cams and crank are confirmed, place the timing belt on the camshaft timing sprocket and set the belt tension using the special tool (AST 10.012.86400). Tighten the belt tension (Fig 5) until you can rotate the belt **no more than 45°** (this is different than 8-valve engines). Torque the tensioner nut to spec (45 Nm/33 ft lb).

19. Install the ignition distributor using the marks you made earlier to locate the body position. You will still need to set your ignition timing, once the engine is back together; but it should be close using these marks.
20. Re-assemble all remaining components on the engine in the reverse of removal. The braces on the back of the intake plenum should be tightened last (20 Nm/15 ft lb).
21. Rotate the engine by hand (19mm wrench on the crank bolt) at least two full rotations, and re-check your timing marks before attempting to start the engine.
22. **WAIT AT LEAST 30 MINUTES BEFORE STARTING ENGINE!**

The hydraulic lifters will need at least that time to bleed down to normal level. If you start the engine, and the lifters have not yet bled down, you could possibly damage the engine due to valve-to-piston interference. When you're ready to start the car; be ready to shut it down if the engine runs rough. If it does not start or runs rough, DON'T PANIC! Wait 30 minutes more before trying to start it again. The lifters may still be pumped up and are keeping the valves open. Be patient. Some lifters take longer than others to bleed down.

23. Once the engine is started, run the engine at a high idle (1500-2000 rpm) for 20 minutes to assure good oil pressure on the new camshafts. Set your ignition timing to factory specs (adjusting value: 6° BTDC ±1°).