

# Project GTV-6

*Part 8:*

*Valve adjustment  
and tune up*

by Paul Mitchell

DIAGRAMS COURTESY OF ALFA ROMEO CARS OF NORTH AMERICA



When one mentions Alfa Romeo to the uninitiated, the most likely response you'll receive will probably be centered on maintenance. It's unfortunate that many look upon these cars as requiring prohibitively high maintenance. Maintenance, or the public's perception of maintenance, has probably been one of the main causes of Alfas' flagging sales and recent withdrawal from the U.S. market.

Some inattentive owners, used to caring for American and Japanese automobiles, fail to properly maintain their Alfa per factory specifications, thus ensuring the car's premature demise. After the car self-destructs, they place the blame on the car and not on their own habits. The usual course of events results in two owners having been left with a bad taste in their mouths, as the first owner, the one who neglected the maintenance on this car, usually solves his or her problems by getting the car running well enough to sell it, thus passing on the problems to an unsuspecting new buyer—one dazzled by shiny paint and an unusually low price. All of this contributes directly to the public's perception that Alfa Romeos are unreliable and require fantastically high upkeep.

This scenario, though far too common, is quite removed from the enjoyment of owning a properly cared for Alfa Romeo.



This isn't to say that they require little or no maintenance; it's just that they require a small number of adjustments and fluid changes performed on a regular basis. I won't get into why one should change the oil every three thousand miles; that deceased equine has been flogged enough. What I do want to get on my soapbox about is following a regular schedule in your maintenance, and being thorough in caring for all systems and components of your car.

The main subject of this article is adjusting the valves of the GTV-6. They have a unique system of actuation, and are usually

left to a professional by most owners. This being so, the procedure requires leaving the car at least overnight, and is relatively costly. When faced with the expense and the prospect of being without their beloved cars for a few days, many owners simply choose to put off the valve adjustment for 'a more convenient time.' In the process of maintaining a GTV-6, few mistakes can be as costly as this one. Neglect to change the timing belt; certainly, failure to replace your failed drive shaft flex-couplings; expensive, but certainly not like a valve job on two Alfa heads, forgetting to change your oil for fifteen thousand miles;

you shouldn't own a car—get a monthly bus pass. Adjusting the valves on the GTV-6 is like going to confession for Catholics—do it regularly or face the consequences. It's that one time that you fail to that may cost you. After having completed the process, you may feel some form of redemption; but unlike confession, just adjusting your valves does not atone for any past sins in maintaining your car.

Failure to pay attention to valve adjustment usually results in burnt exhaust valves, preceded by poor performance. Due to the GTV-6, Milano, and 164s' unique actuation arrangement, the intakes will need to be adjusted less frequently than the exhaust valves. On average, one should adjust the clearances on the intakes every 20,000-30,000 miles and the exhausts every 10,000 miles. Remember, these figures are just averages, and consideration should be given to driving environment and engine condition.

The design of the valve actuation gear is thus: the cams are positioned above the intake valves and act upon them through cam followers, in traditional Alfa four-cylinder fashion. Between each cam follower and valve head is a shim used to set valve adjustment. The simplicity of the intake valve gear contributes positively to reliability and is the reason for the fewer adjustments required when compared to the exhaust side. Unfortunately, this arrangement also requires the removal of the cams to access the shims, but Alfa has conveniently arranged for the cam's removal without disturbing the timing belt and pulleys. Following the exhaust cam lobes are followers again, though this time

mounted in a horizontal plane above the inner head surface, midway between the intake and exhaust valves. The linear motion of the cam followers is translated through short rocker shafts to rocker arms, which in turn actuate the exhaust valves. Adjustment is through a threaded screw in each rocker arm secured with a lock nut. The rocker arms pivot on shafts and are lubricated internally through the shaft from the heads' oil galleys. The mechanical advantage of the rocker arms means that the exhaust lobes on each cam are substantially smaller than the intake lobes. The mechanical ratio for the exhaust rocker arms is 1.4 x1. Unfortunately, this design requires more frequent adjustments than the intake side and so often is neglected, usually resulting in burned valves.

Checking and adjusting the exhaust valve clearances every 10,000 miles is prudent maintenance, and at that time one should also check the intake clearances, though they may not yet need adjustment. With a small amount of skill and a basic understanding of the valve train design, the average owner should be able to perform his or her own valve adjustment on the single overhead cam V-6 Alfas. Required to adjust the intake valves are two special tools, the cam turning tool A.2.0361, the cam hub removal tool A.3.0521 and a set of adjustment shims. All the items needed can be found through a quality Alfa Romeo parts source, such as AR Ricambi. The shims can be bought individually, if one is willing to wait a few days for delivery, or as a complete set. Though not inexpensive, the set is still less than paying a mechanic to adjust your valves, and can last a lifetime. Items to also have on your bench at the time of this undertaking are a set quality feeler gauges, micrometer, cam cover

replace the plugs, distributor cap and rotor, set the timing, and replace all the filters. Also, verify that all vacuum hoses are in good condition and that all electrical wires and connectors are just that — connected.

Another maintenance task worthy of performing at this time is to clean all the fuel injection and ignition electrical connections under the hood. Begin by carefully separating each connector individually and cleaning each side out by spraying electrical contact cleaner into each, and gently scrubbing with a brass bristle brush. Allow to dry and reconnect, some may choose to apply an electrical connection compound to the inside of each connector, though I personally don't.

When replacing the plugs, we have found NGK BT6ES gapped at 28 work particularly well in the Alfa V-6s. The factory Bosch cap and rotor are preferable, and we have found no substitute for the factory plug leads. The generic oxygen sensors readily available seem to work satisfactorily, and present no installation problems. The oil and air filter of choice are the UFI filters available through AR Ricambi (818) 956-7933, though we've had no problems with Fram, either. The main concern with the oil filter is its' outside diameter; if it is too large, it is almost impossible to remove or install in the tight space allowed. The best method for changing the oil filter requires the removal of the air box assembly from the firewall and doing the job from the top.

All valve tolerances must be measured with the engine cold, very cold. It must sit without running at least overnight. Our project GTV-6, having been fitted with the Sperry Valve Works performance cams as described in the first installment of the series (Jan. '95), requires a different set of clearances for valve adjustment, and so, I will provide both here.

#### Maintenance Schedule for the GTV-6, Milano and sohc 164

**Every 3000 miles**  
Change engine oil and filter

**Every 10,000 miles**  
Change air and fuel filters  
Replace spark plugs  
Adjust exhaust valves  
Replace brake fluid

**Every 30,000 miles**  
Replace timing belt  
Adjust intake valves  
Change transaxle oil  
Replace coolant  
Replace oxygen sensor

	Factory Tolerances	Sperry Cam Tolerances
Intake	.019-.020 in.	.014 in.
Exhaust	.009-.010 in.	.009 in.

gaskets, cam pulley O-rings, and a factory manual as a reference for those inevitable questions that seem to surface.

After the valve clearances are properly set, all that remains to complete what is commonly referred to as a major tune-up is to

For those who may not have seen the January 1995 issue with our GTV-6 engine article (it is still available as a back issue), the cams chosen to be installed in our freshly ported heads have a lift of 10mm, a duration of 232 at .050, and

# Project GTV-6

have provided remarkable performance.

Having completed all the above tasks, your car should now provide a surprisingly new level of performance, and continue to for quite some time. By following the maintenance schedule provided here, you'll ensure that the engine delivers all the performance available, and that reliability should never be in doubt.

## Valve Adjustment Procedures

The car must be cold before starting procedures.

### Required tools

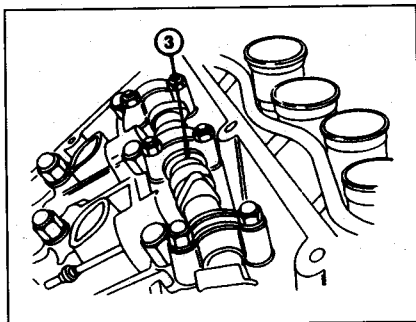
Set of standard metric hand tools  
Set of feeler gauges, 45deg. bend in last 1/4 of length  
Micrometer  
Cam turning tool  
Cam hub removal tool  
Syringe

### Required parts

Cam cover gaskets  
Cam pulley hub O-rings  
Adjustment shims, set or individual

•Disconnect the negative lead of the battery. Loosen the clamp securing the intake hose to the air flow meter and disconnect the electrical connection to the meter.

Free all vacuum hoses to the intake



Cam alignment indices on the right hand head. They must be aligned when engine is at Top Dead Center.

air hose and remove the hose. Remove the oil vapor separator from the left hand cam cover.

•Disconnect and remove the spark plug leads from the plugs. Remove the cam covers. Using the syringe, withdraw the oil from the wells around the valve train in the heads. Remove the spark plugs and place some cloth into the holes to prevent dirt from falling into the cylinders.

•With the feeler gauge, verify the clearance between the cams resting radius and the cam follower for each set of valves per cylinder.

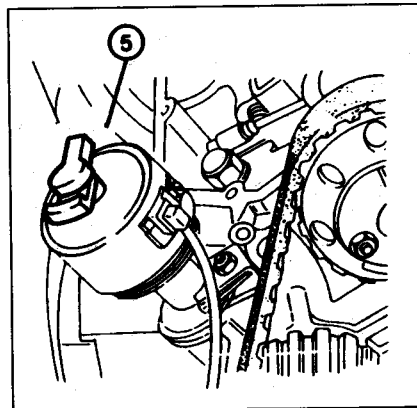
Note the measurement in the following manner. Draw your own version of this diagram and note each measurement within it to keep track of all the measurements before calculating the shim required to bring the tolerance within specification.

## Intake Valve Adjustment

When verifying tolerance on each valve, check the cam lobes for wear by running your fingernail over the end of the cam lobe; any roughness or scoring felt indicates wear, and should be replaced. Perform this on all cam followers also.

•Should it be necessary to adjust the intake valves, put the car into 5th gear and roll the vehicle forward to bring the P index on the crankshaft pulley to align with the reference pin on the front cover. The indices on the camshafts will then be aligned with the reference indices on the camshaft caps.

•Remove the circular covers from the timing belt cover, and using the cam turning tool A.2.0361, keep the

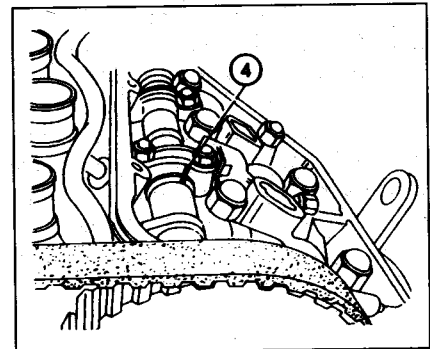


Distributor with the cap removed but rotor in place. When at TDC., the rotor should align with index in distributor body.

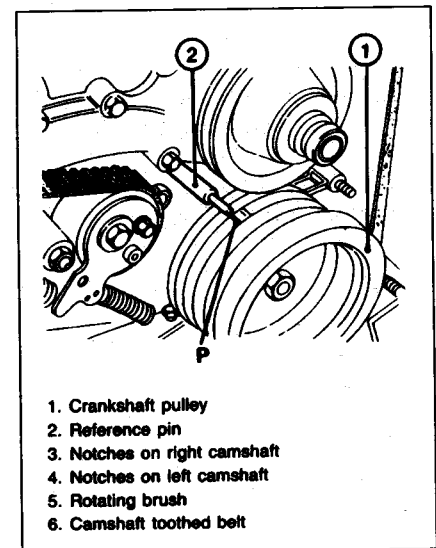
camshaft still while loosening the nut securing the camshaft pulley and remove the nut. Next, loosen and remove the three bolts securing the cam hub. Attach hub removal tool A.3.0521 to the hub and withdraw the hub from the pulley.

•Remove the camshaft caps, noting the placement and orientation of each, and lift the camshaft out to the rear. Remove each intake cam follower individually, note the thickness of its shim using the micrometer, and mark this measurement in the appropriate place on the diagram.

•Replace each follower and shim, lubricating them with oil. Place the camshaft into its journals and replace the caps, noting their position and orientation, note: Right cam cap arrow points towards the rear, Left cam cap arrow points towards the front. Tighten the cam



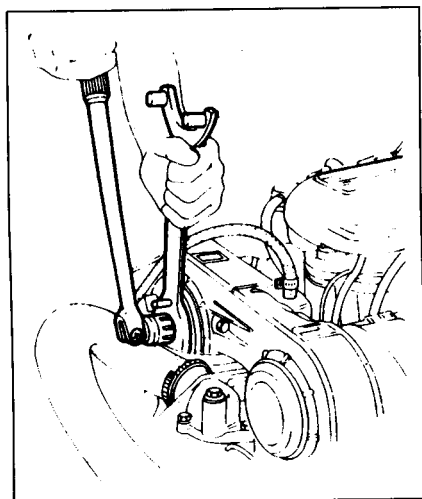
Left head showing cam indices in proper alignment for TDC.



1. Crankshaft pulley
2. Reference pin
3. Notches on right camshaft
4. Notches on left camshaft
5. Rotating brush
6. Camshaft toothed belt

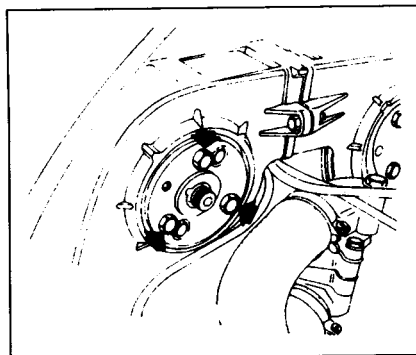
Reference pin on front cover must be in alignment with P index on front pulley at Top Dead Center.

# Project GTV-6



After removing cam pulley cover on timing belt cover, employ tool A.2.0361 to prevent cam pulley from turning while loosening bolt securing cam to the hub.

caps to 12 to 13.5 ft-lb wet (16 to 18 Nm) Rotate the camshaft so that its index lines up with the reference



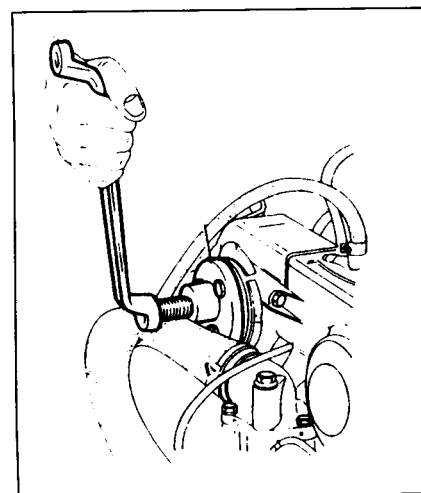
The three bolts securing the pulley to the hub must be removed before the hub may be extracted.

index on the camshaft cap.

- Install the hub complete with a new O-ring, and secure the three bolts, but do not tighten them. Thread on the nut that secures the cam to the pulley, and using the cam shaft turning tool to prevent the camshaft from turning, torque to 70 to 85 ft-lb (97 to 117 Nm) and then tighten the three bolts securing the hub to the pulley. Verify alignment of all indices.

## Exhaust Valve Adjustment

When verifying tolerance on each



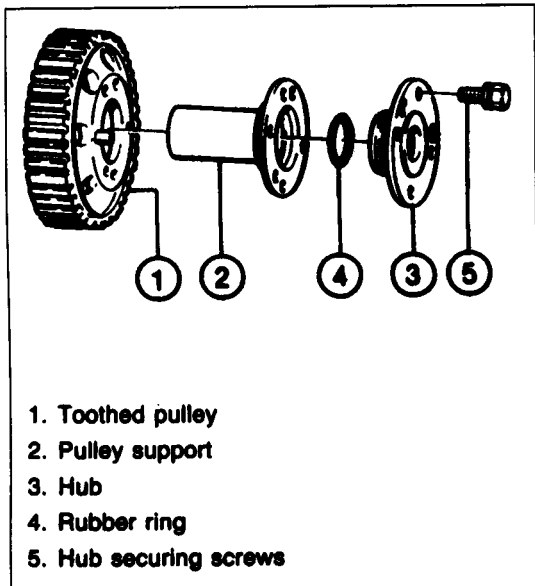
Employing tool A.3.0521 and an appropriate wrench, withdraw the hub from the cam pulley. Repeat procedure on other head.

valve, check the cam lobes for wear by running your fingernail over the end of the cam lobe; any roughness or scoring felt indicates wear, and should be replaced. Perform this on all cam followers also.

- Using the closed end of a box open wrench, loosen the locknut securing the adjustment screw at the rocker arm. There is a special tool

# Project GTV-6

for this procedure, A.5.0220, but a box open and a flat blade screwdriver work as well. Rotate the adjusting screw until the proper clearance is reached, verifying with the feeler gauge between the resting radius of the cam and the follower. When proper clearance is achieved, tighten the lock nut down and reverify the tolerance. Repeat for each exhaust valve, rotating the engine as necessary to bring the cams into correct position to measure the tolerance. ❏



*Exploded view of cam pulley and hub assembly. When extracting hub to perform valve adjustment, the pulley will remain in the head, so as to not disturb cam drive belt and distributor.*

**Sperry Valve Works**  
2829 Gundry Ave.  
Signal Hill, CA 90806  
(310) 988-5960

**AR Ricambi**  
6644 San Fernando Rd.  
Glendale CA 91201  
(818) 956-7933  
(800) 225-2532

## Previous Articles

Jan. '95 Part 1: Project GTV-6,  
Engine performance and  
reliability upgrades

March '95 Part 2: Project GTV-6,  
Suspension upgrades

April '95 Part 3: Project GTV-6,  
Wheels and Tires

May '95 Part 4: Project GTV-6,  
Brake upgrades

June '95 Part 5: Project GTV-6,  
Headlight upgrade

July '95 Part 6: Project GTV-6,  
Headlight upgrade

Aug. '95 Part 7: Project  
GTV-6,  
Camber mods; notes on  
alignment