VALVE ADJUSTMENT FERRARI 365GTC/4

By Phil Auldridge, owner, s/n 15355

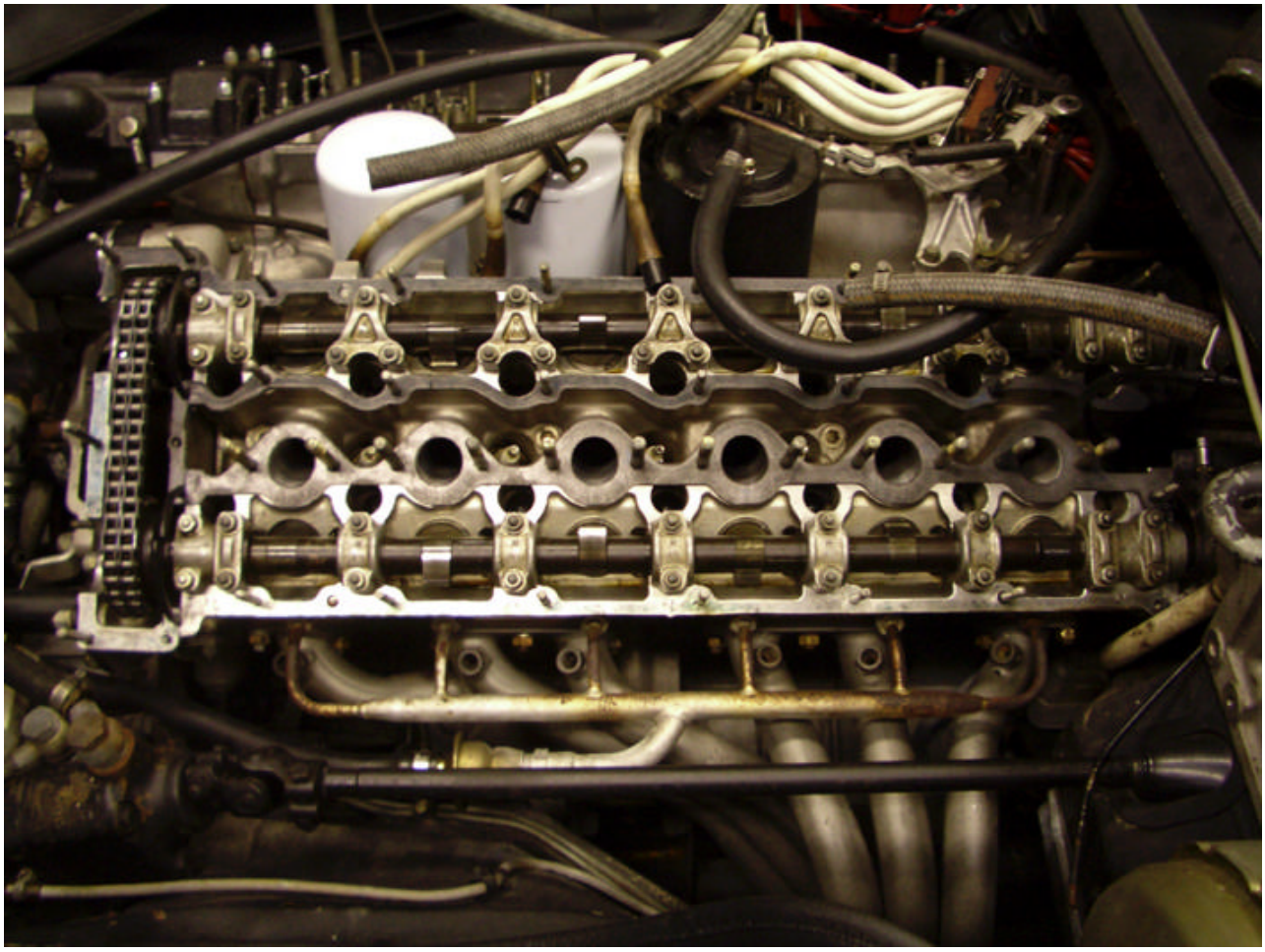
This is NOT difficult, just time consuming…

1. REQUIRED EQUIPMENT:
    a. "valve adjusting gasket kit" from T. Rutlands. They will know what you need. About $150.
    b. 2-piece valve adjusting tools, also from T. Rutlands, about $75 (more about this later).
    c. Micrometer for measuring thickness of the valve shims
    d. Air hose with air blast gun (not absolutely essential, but will save you HOURS of time getting the shim or puck out of the bucket.
    e. Magnetic pick up tool. Yes! Just get it, you'll be glad you did

2. Remove the fuel supply manifolds on each side of the engine, and then remove all the carbs. I made a little diagram to show the original position of each carb on the engine, but probably not necessary. Be careful to catch the large round rubber o-ring which you will find on both sides of the thick fiber spacer/gaskets between carbs and intake manifold.

3. Now it is time to remove the valve covers… EACH valve cover has two horizontal bolts at the rear of each, which have to be removed. You do NOT have to remove the distributors or housings, however, for the LH intake cover, it is much facilitated to pop off the distributor cap on that side to get to the bolts, with a short, 10mm box-end wrench. (it will NOT be necessary to remove the RH distributor cap.) Additional notes in removing the covers:
    a. Do NOT remove the upper timing chain covers on either side. This will not be necessary at all.
    b. When removing the LH exhaust (lower) valve cover, you WILL have to remove the two bolts that secure the support bracket for the clutch cable. With that cable in the way, you will not be able to remove the cover all the way.
    c. When removing the RH exhaust valve cover, the oil dipstick housing has to be removed, otherwise the upper securing bracket interferes with the cover, making it impossible to remove. Unfortunately, it is not enough to just remove the retaining nut from the upper dipstick support. The whole affair is pretty rigid, and the large retaining nut at the lower end of the dipstick housing has to be removed. Unfortunately, not very accessible, unless you have a crow's foot wrench. I took the "easy" way out, and just filed a depression in the side of the upper retaining bracket, to allow clearance for the valve cover (there goes my originality).
    d. No need to remove the spark plug wires from their retaining grommets/brackets. Just remove each of the bracket retaining nuts, and move the entire wire assembly intact to the center section of the engine.

4. To remove the valve covers, just use a wood block and tap a few times in each direction. They should pop right off without a lot of resistance. Be careful when removing to keep the cover parallel to the head so the studs don't get damaged.



5. Now it is time to begin measuring valve clearances. Get a good sized half-inch ratchet, with about a 12" extension on it, and a 36mm socket. It can be tight to get in there from above. Another, perhaps easier solution is to make up a remote starter switch to turn over the engine (disconnect coil wire to each distributor).

6. Turn the engine clockwise only, as viewed from the front of the car. Print up a nice table to record your clearances, and to help keep track of which valves you have done (see sample at the end of this description). Turn the engine until the first cam lobe on either side (either exhaust or intake) is pointing straight up, away from the valve bucket. At this point, there will probably be at least 4 cam lobes on the entire engine which are in this position.

7. I prefer the following sequence for the entire process:
    a. Check valve clearance between cam and the valve "bucket" with a flat feeler gage.
    b. Go ahead and remove the first shim or puck from this valve, measure the thickness, and replace the shim back in the bucket (this is necessary to prevent the sharp edges of the shim "bucket" damaging the cam lobe when the engine is turned over for the next set of cams)
    c. Take note of the next cam lobe which is closest to pointing straight up away from the valve, and rotate the engine further until that cam is pointing straight up.

d. After all clearances and shim thicknesses have been recorded in this manner, go BACK, and REMEASURE EVERY valve clearance a second time. If there are any significant differences, between measurements, go back a third time to check those which show discrepancies.

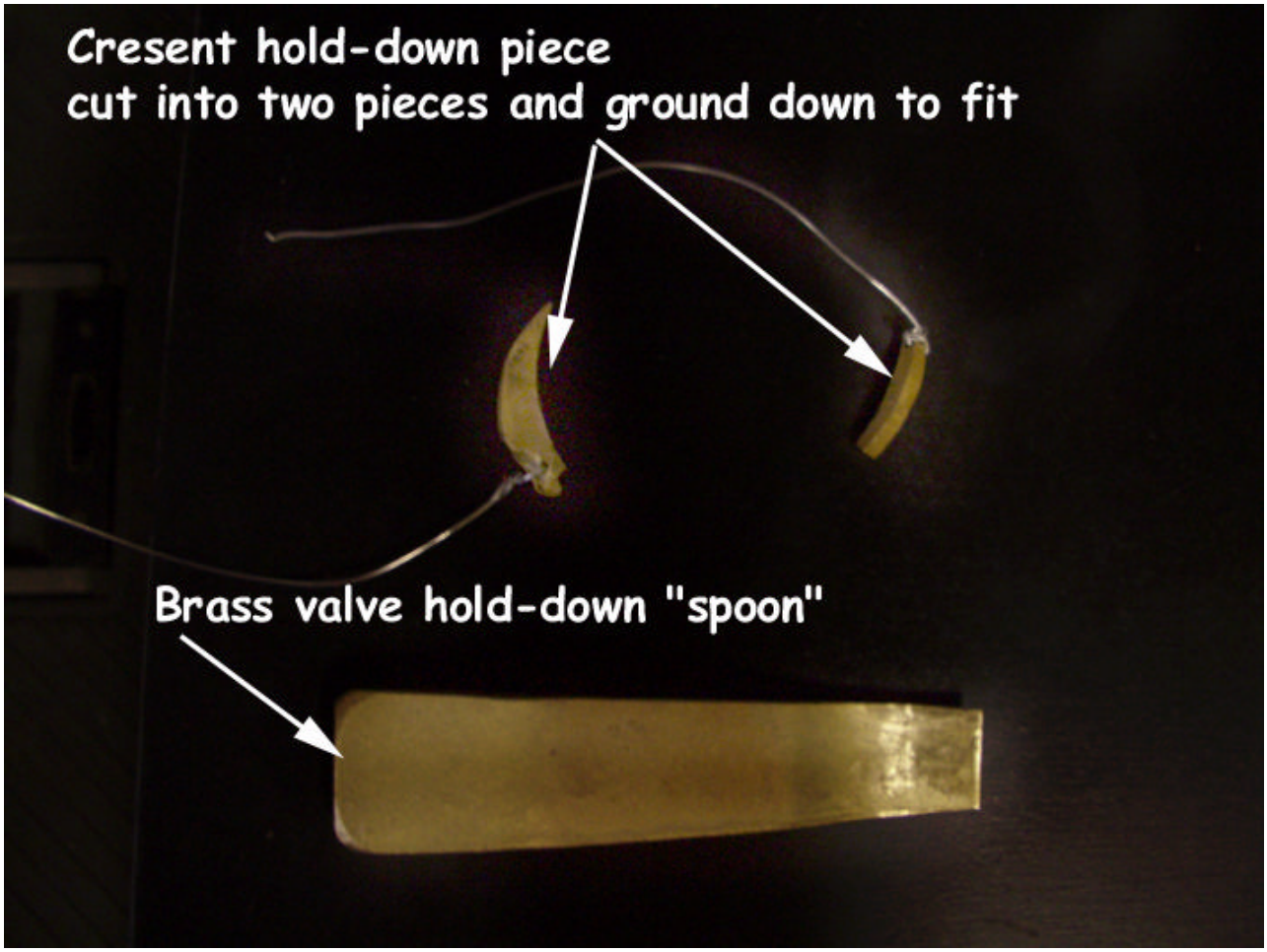
REMOVING AND MEASURING THE VALVE SHIMS

The valve adjusting tools from T. Rutlands consist of two pieces. A brass "spoon" which is wedged between the bottom of the cam and the shim bucket. I used a small rubber hammer to gently hammer it into place. Keep going until the shim bucket is fully depressed at or below the level of the surrounding casting material.

Oh, before inserting the spoon, take a small flat-bladed screwdriver and rotate the bucket so that one of the slots in the edge is accessible from the top or bottom (i.e., the slots should be perpendicular to the camshaft itself). These slots will be used when removing the shim. Don't worry, you'll forget a few times, and have to remove the hold-down tool just when you had everything perfect, to rotate the bucket to the proper position.

The second part of the tool consists of a crescent or moon shaped piece of brass, tapered on each end. Supposedly, the idea is to slip the pointy end of this crescent between the camshaft and the bucket, just catching the very edge of the bucket, but not the shim, so that when the hold-down spoon is removed, presumably the crescent tool will remain wedged between the bucket edge and the cam, holding it down far enough that the shim can be removed.

Unfortunately, after an hour of unsuccessful trials, and 3 separate phone calls to the knowledgeable techie at T. Rutlands, I came to accept that this part of the tool just WILL NOT work on the C4. From pics of other postings on other cars, it looks like the tool was designed to lay FLAT and just slide in and catch about ¼ of the circumference of the bucket edge. There is not enough clearance inside the camshaft cavity for this to happen on the C4. I finally took matters into my own hands, and cut the crescent piece into to pieces, then ground the outer edge down substantially so that the piece IS now small enough to slip underneath the cam and lay flat between the cam and the bucket edge. The thickness of this tool is just right… any thicker and it wouldn't fit under the cam, any thinner and it wouldn't hold the bucket down far enough to extract the shim. Pictures of the tool(s) with my modification, are on the next page.



Once the tool has been modified as described above, it is now small enough that it could easily fall down into one of the oil passages, creating a major tear-down disaster. To prevent this, I drilled a small hole in one edge of the “tool” (brass crescent), and put a piece of small-gauge stainless wire through the hole. It serves as a safety, and also helps to position the wedge in place.

Now… with the shim bucket depressed with the “spoon”, carefully position the circular wedge between the camshaft (you’ll now be on the raw “shaft” not the cam itself), and the very edge of the bucket, so that when you remove the brass spoon, the wedge holds just the bucket down, but leaves the shim free to be extracted. This will take some practice. I found that the shim should be easily rotatable with your finger while sitting in the bucket. If it doesn’t, then the crescent wedge is probably restraining it, and you need to reposition it.

Here’s where the air gun comes it… Place a rag over the shim bucket in question (to contain the residual oil which is going to be otherwise splattered all over your engine compartment). Position the air gun so that the air blast is pointing right at the little opening in the edge of the shim bucket, and give it a blast. One or two blasts should free the shim from its bucket. Be careful, because it is possible for the shim to be blown completely free of the engine, and wind up who knows where!

Once the shim is out, clean off the oil, and examine it. If not too worn, you should still see the width markings on the backside of the shim. There will be a single number above, and then 2 additional numbers printed below. This is the width in millimeters. For example, if the upper number is 3, and the two lower numbers are 85, your shim is a 3.85 millimeter thick shim.

. Don't take this as gospel, however, and go ahead and measure with your micrometer. Most likely your micrometer will be in inches. While you have the shim in your hand, go ahead and make the conversion from yhour measurement in inches, to millimeters, and compare with the value stamped on the shim, as a double-check. (multiple inch measurement by 25.4 to get equivalent millimeter).

After measurement, carefully replace the shim back in its bucket, making sure to keep the “business” end facing upward toward the cam (don’t get your fingers under the cam, in case the wedge gives way!). It will take a little jiggling to get it to seat properly, and you may have to tap it with a soft brass punch on alternate sides to get it to seat. It is properly in place when you can again rotate the shim in its bucket with your finger.

Re-insert the brass spoon to relieve pressure on your crescent wedge for removal, and you are done!

After all shims have been measured and recorded on the sheet, do the math looking at the difference between recorded valve clearances and the desired clearance., and add that difference to the shim thickness for that valve, to determine the new shim size you need.

Ferrari specifies .10-.15mm clearance for intake valves, .25-.30mm for exhaust. This is a good bit tighter than for other models, so I shoot for the halfway mark as a target: .13 for intake, .28 for exhaust.

Some people say never re-use shims, others say it is not a problem if there is no visible sign of wear. I’ve decided to apply a rather unscientific approach: if the thickness printing on the back of the shim is still visible, and the wear surface looks good, I reuse it. If the size is no longer visible, then I consider it time to replace the shim.

Supposedly Volvo uses the same diameter shims, and they may be more accessible from your local dealer than ordering. Otherwise, T. Rutlands carries the full range, in .05mm increments, so round up or down. It is generally advisable to err on the side of a larger clearance, other than a smaller one.

Once you receive your replacement shims, you know the drill… turn the engine over until the cam is pointing skyward, remove the old shim, replace with the new one, then, of course, measure the clearance to confirm. It may take some adjustment to get everything right.

REFINISHING CAM COVERS

Almost certainly it will have been some time since your cam covers have been off, and may very well be in need of refinishing. I bead blasted mine (take it from me, don’t even TRY to keep blasting media out of the throttle linkage bearings on the intake cam covers. I wound up replacing all my bearings. It is pretty simple to remove the bearings for bead blasting and painting… just remove the staked indents that hold them in, and carefully drive them out of their housings by supporting the support towers on a block of wood, and using an appropriately-sized socket as a bearing removal tool, along with a soft rubber hammer. If your bearings need replacing, they can be found at reasonable price at any decent bearing supply company.

I was unwilling to go to all this work and then spray the cheap $4.00 can of “wrinkle paint” from Home Depot. on these parts. After much research, I finally found one source of in-the-can wrinkle paint that you can spray from your own gun. It goes on incredibly easy, can be baked in the oven to harden it, and has an extremely durable and consistent finish. This stuff came from a Maserati supply house on the west coast :
MIE corp 1620 Industry Dr SW ste F
Auburn, WA 98001 253-833-2598. See the finished result below:

REASSEMBLY

It is best to use assembly lube, or just plain oil on all moving surfaces prior to closing up the valve covers. Remember, you have used air to blow much of the lubricant away from the mating surfaces, and the engine has most likely been sitting for a bit longer than normal.

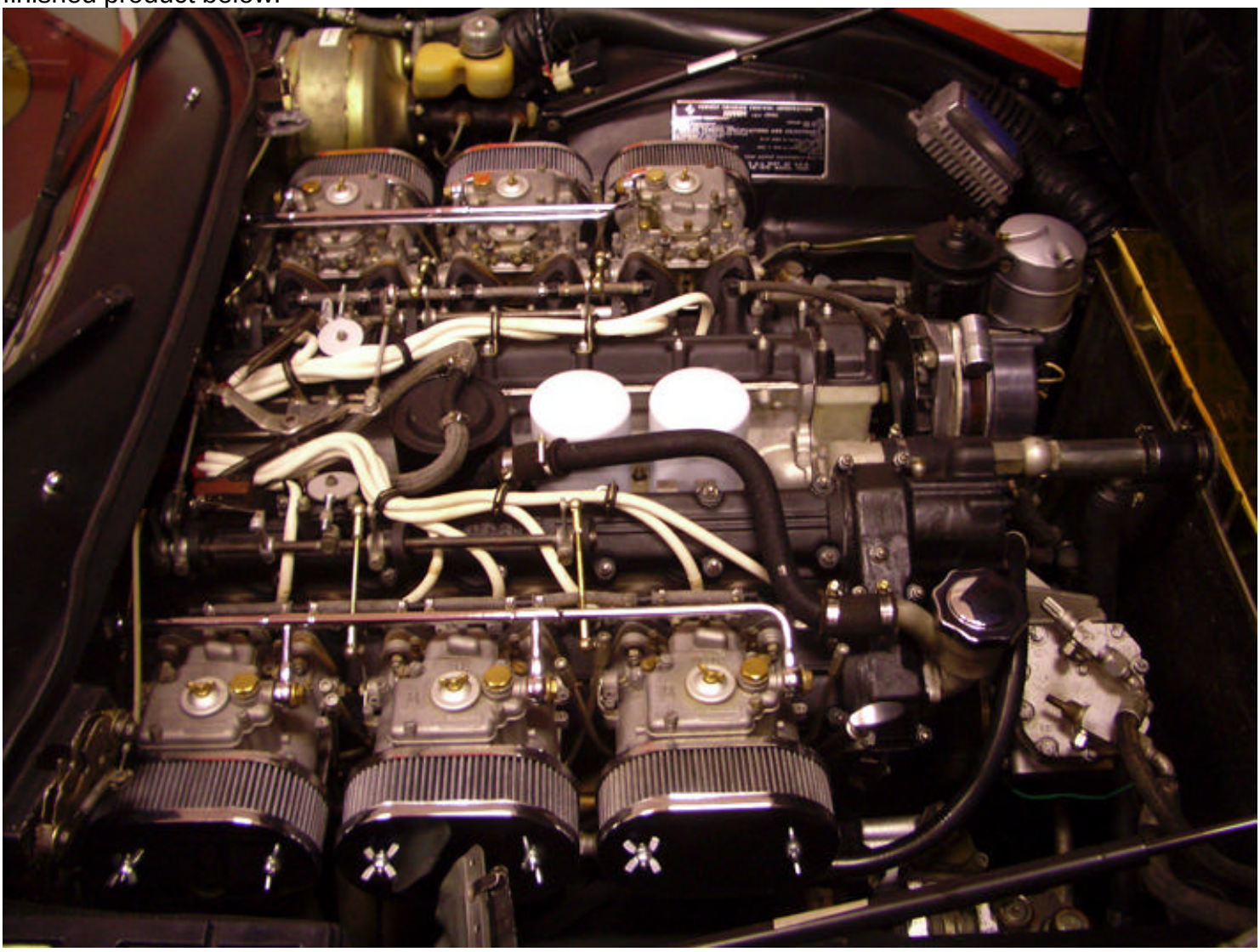
Use a small amount of lithium grease on both surfaces (valve cover, and head mating surface) to both hold the gasket in place, and to insure that it comes clean from the head with the next job. You will have to trim the edge of the gasket, which comes as a single piece to include the timing chain covers.

Put a small amount of silicone sealant around the horizontal mating pieces at each end of the valve cover, especially at the lower corner of each end, since this is a typical place for potential leaks.

Cut an aluminum soda can flat, grease it up with spray silicone or other lubricant, and place next to the circular o-rings at each end before fitting the valve cover back on, to keep the o-rings in place while installing, then slip the aluminum out.

Torque the valve cover to just 6-7 foot lbs, don't overdo it! Obviously, the larger acorn nuts securing the actual intake passages can use a bit more torque, but I am unable to find a value in any of the Ferrari literature.

That does it! You have just saved yourself about $3,000 by doing this job yourself. Picture of the finished product below:



Ferrari 365GTC/4
Valve Clearance Recording Form

Desired Clearances: Exhaust: .25-.30mm Intake .10-.15mm Target values: .28 Exhaust .13 Intake
Turn Engine Clockwise from front torque valve covers 6-7 ft lbs

RightHand (Passenger's Side)

INTAKE	6	5	4	3	2	1
Original mm Clearance						
Shim Size in. mm						
New Shim						

EXHAUST	6	5	4	3	2	1
Original mm Clearance						
Shim Size in. mm						
New Shim						

LEFTHAND (Driver's Side)

INTAKE	7	8	9	10	11	12
Original Clearance						
Shim Size in. mm						
New Shim						

EXHAUST	7	8	9	10	11	12
Original Clearance						
Shim Size in. mm						
New Shim						