Alfa Tune-up Day Instructions

AROO TUNE UP CLINIC
SPICA TUNEUP SECTION

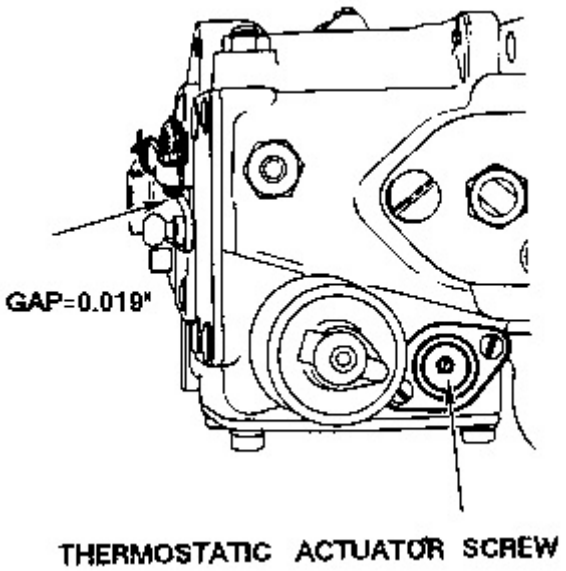
ALFA ROMEO FUEL INJECTION SYSTEM (1970 -1980)

IMPORTANT:

The following procedure is designed to allow you to tune your Alfa Fuel Injection system **without the use of special tools**. Each adjustment is dependent upon the setting of the previous adjustments, so to avoid problems, follow the indicated sequence.

Tuning your car so that it runs the best with the parts that are on it, is the point of this tune-up.

1) Adjust the **THERMOSTATIC ACTUATOR SCREW** in the Fl pump.



Prerequisites: HOT engine

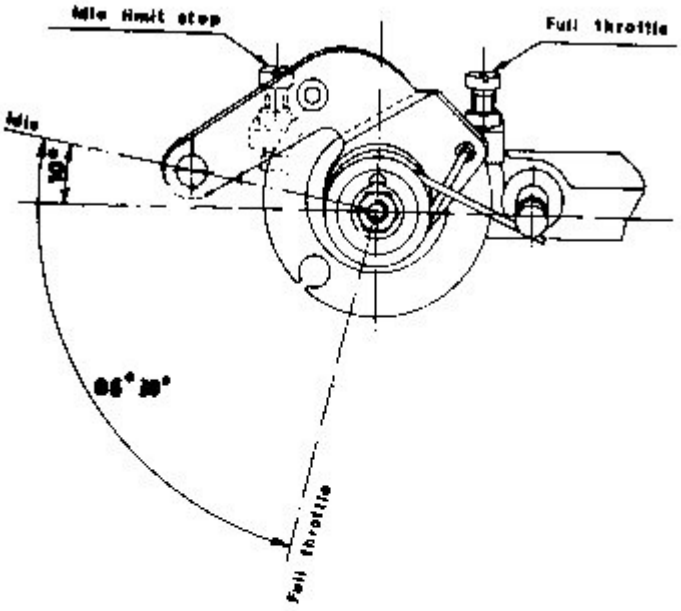
The thermostatic actuator is Alfa's version of a choke and a fast idle cam. The plunger in the thermostatic actuator pushes on an adjustable screw in the Fl pump. When the engine is at operating temperature, the actuator plunger should fully extend and move the lever at the back of the Fl pump to zero to 0.019 inch from the reference screw. The farther the control arm is from the reference screw at any given temperature, the richer the mixture.

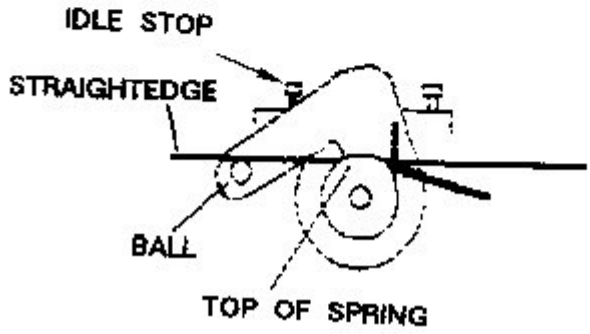
A) With the engine (and thermostatic actuator) at operating temperature, disconnect the Long Rod from the bellcrank. Measure the gap between the lever at the back of the pump and the Reference Screw. If the gap is zero to 0.019 inch, the thermostatic actuator screw is adjusted correctly (unless you are dissatisfied with the engine performance during warm-up). Go to Step 2.

B) if the gap is more than 0.019 inch. Remove the two screws that hold the thermostatic actuator to the Fl pump. Carefully pull the actuator from the bore of the Fl pump. **DO NOT KINK** the tubing. Push and hold the control arm against the Reference screw and measure the distance with calipers from the top of the adjuster screw to top of the bore. The distances should be:

- 27 mm for 1971 to 1974 Alfas
- 27.8 mm for 1975 and 1976 Alfas
- 29 mm for 1977 and 1978 Alfas.

C) Use a screwdriver to turn the adjuster screw so that the measurement is correct. To change the mixture for the warm-up period, turn the screw CLOCKWISE TO WIDEN (to enrich) or COUNTER CLOCKWISE TO NARROW the gap at the Reference screw. Reinstall the thermostatic actuator. Make sure that the gap is 0.019" or less when the engine is hot.





2) Adjust the position of the **BELLCRANK STOP SCREWS.**

Prerequisites: Adjust pedal stop and throttle cable

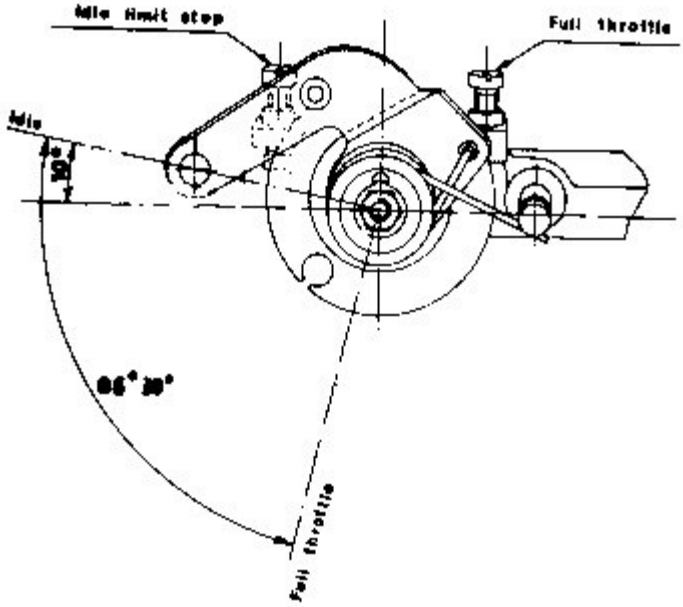
This adjustment is to make sure that the bellcrank will allow full throttle opening and be at the correct position so that the arcs of the linkages will correspond for the correct fuel mixture curve throughout the load and rpm range.

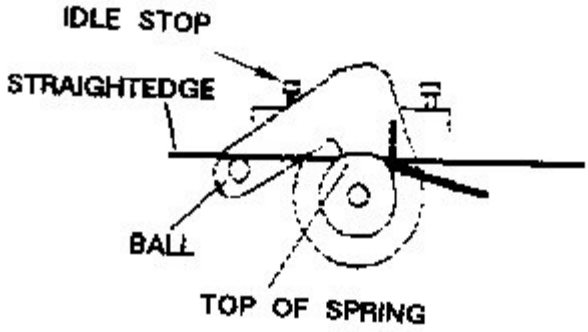
A) If the paint is untouched on the bellcrank stop screws then you needn't worry about this setting. Go on to Step 3.

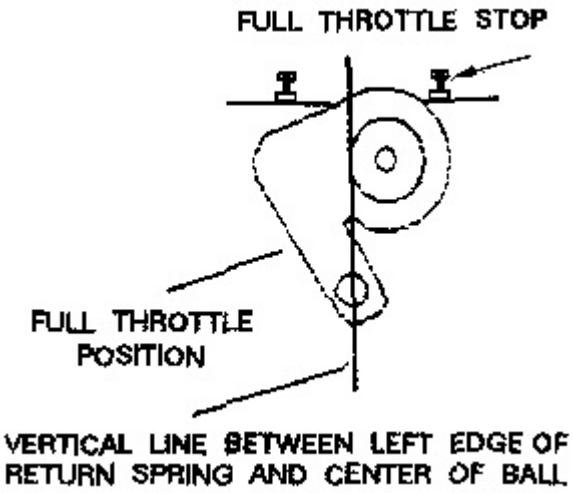
B) If these screws have been turned since the factory adjustment, you can come close enough to the factory setting using the following procedure.

IDLE STOP SCREW ADJUSTMENT

C) Lay a straightedge across the top of the bellcrank return spring coils and the top of the ball for the Long Rod. Loosen the lock nut and adjust the Idle Stop Screw so that the straightedge is level (parallel to the top of the camshaft cover). Make sure that there is slack in the throttle cable and that the both rods are disconnected when adjusted the Idle Stop Screw. Tighten the lock nut when the Idle Stop Screw is in the correct position.







FULL THROTTLE STOP SCREW ADJUSTMENT

D) After the Idle Stop Screw is adjusted to the correct position, move the bellcrank to the full throttle position. This position must be slightly less than 90 degrees (86 and a half) from the idle position. Adjust the Full Throttle Stop Screw so that the center of the ball is directly- below the left edge of the return spring coils.

(3) Check the **THROTTLE CABLE** condition and adjustment.

Prerequisites: Adjust Pedal stop and Idle Stop Screw

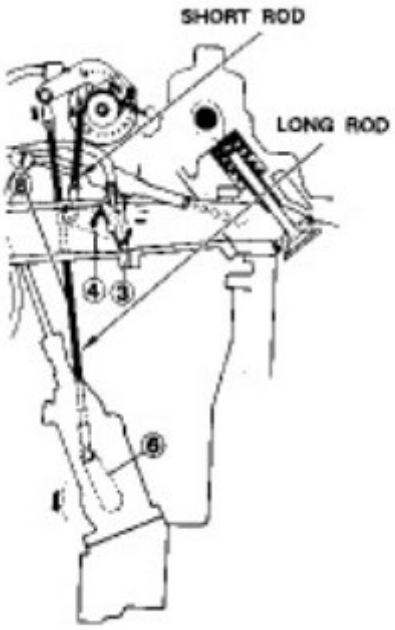
Examine the throttle cable for fraying and make **RETURN SPRING AND CENTER OF BALL** sure that there is a slight amount of slack in the cable when the bell crank is on the idle stop screw.

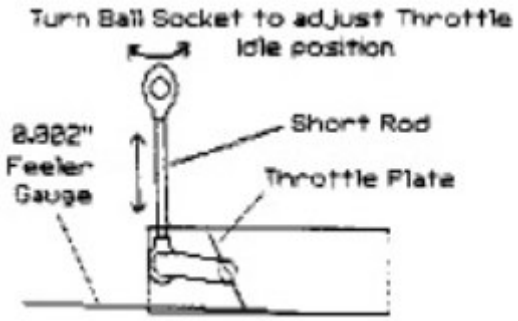
4) SYNCHRONIZE the throttle plates.

Prerequisites: None

This step is critical for smooth idling. If the positions of the dual throttle shafts are NOT exactly aligned, one set of throttles will be open farther, causing those two cylinders to carry the bulk of the engine load at the idle. The two "open throttle" cylinders will also run leaner because they receive the same amount of fuel at idle as do the two "closed throttle"

A) Disconnect the Long Rod from the bellcrank and use the bellcrank to open the throttles. Insert a very thin (0.002 inch or so) feeler gauge (or a piece of paper) into the throat of cylinder #1 or #2. Close the throttles on the feeler gauge and pull the feeler gauge from the throttle. Repeat this for the #3 or #4 throttle. If it is harder to pull the feeler gauge from one throat than from the other, then the throttle synchronizer screw must be adjusted. If the feeler gauge is too difficult to pull out, temporarily lengthen the Short Rod by one half or one turn and try again. Remember to reset the rod after this measurement.





B.) Use a screwdriver to slightly turn the synchronizer screw between the two throttle shafts. Check the throttle openings with feeler gauges after each adjustment. The tension on both feeler gauges can change as the synchronizer screw is turned, so make sure that you check both throttles after each turning of the screw. When the throttle plates are correctly synchronized, the same tension is needed to pull a feeler gauge from any of the throttles.

5) Adjust the **THROTTLE PLATE IDLE OPENING** (Adjusting the Short Rod).

Prerequisites: Synchronize throttles; Adjust Idle Stop

This adjustment affects the idle air flow by setting the position of the throttle plates in relation to the bellcrank. The Short Rod must be set so that there is a slight clearance between the closed throttle plates and the bores. This clearance prevents the throttle plates from the digging into the inlet runners when the throttle is snapped shut.

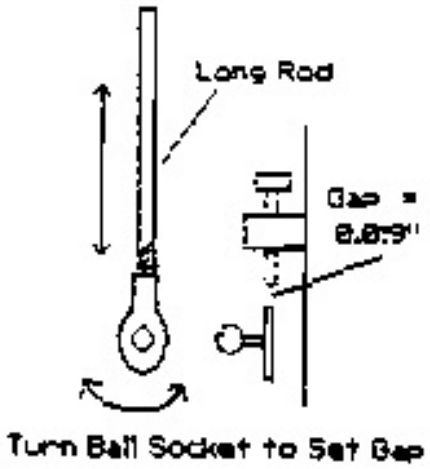
Make sure that the Long Rod is disconnected before adjusting the Short Rod. Disconnect the Short Rod from the bellcrank and push the ball socket toward the ball on the lever. If the ball socket is exactly centered on the ball, turn the top ball socket one half turn counter- clockwise to lengthen the rod. Reconnect the Short Rod and retest. Wiggle the throttles slightly when the bellcrank is on the Idle Stop Screw to make sure that there is some clearance.

NOTE: The idle speed can be changed, if necessary, by slightly adjusting the idle stop and/or the Short Rod by half a turn as long as the throttle plates have some clearance.

6) Adjust the Long Rod to adjust air flow/fuel flow relationship.

Prerequisites: Hot engine. Short Rod correctly adjusted.

This adjustment sets the relationship between the throttles (air flow) and the Fl pump (fuel flow).



When you step on the accelerator pedal, the Long Rod tells the Fl pump to supply more fuel. Also, the Long Rod opens the throttles when the engine is cold for a faster idle. The thermostatic actuator moves the Long Rod when the engine is cold and the Long Rod then pulls the bellcrank to open the throttles. With the engine at operating temperature (and the control lever at the back of the Fl pump is zero to 0.019 inch from the Reference Screw). Adjust the length of the Long Rod so that the gap at the reference screw *remains* at 0.019 inch when the bellcrank is on the Idle Stop Screw. One half turn of the ball socket on the rod will change the length by 0.019 inch. Snap the ball socket of the long rod onto the ball and measure the gap. Note that the gap increases as the engine cools.

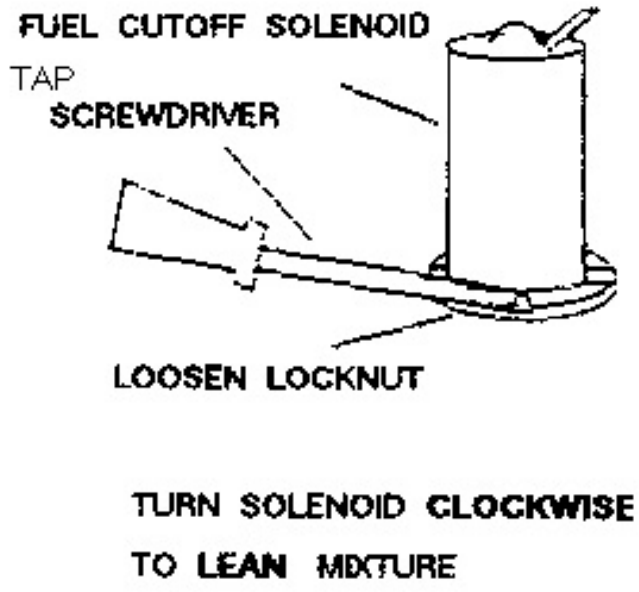
7) Adjust the fuel mixture (Adjusting the Fuel Cutoff Solenoid)

Prerequisites: Ignition tune-up: Adjust Long Rod; Warm, running engine

This adjustment changes the fuel mixture for all throttle positions and engine speeds. The position of the Fuel Cutoff Solenoid affects the mixture ratio of the Fl pump even when the Fuel Cutoff Solenoid is not energized. When the microswitch closes, the Fuel Cutoff Solenoid energizes to prevent backfiring in the exhaust. The Fuel Cut-off Solenoid energizes and stops the fuel flow when the engine is decelerating (bellcrank on the Idle Stop Screw and the engine speed above 1300rpm). If installed calibration is new or obviously very far off, reset and start with 10 turns out from full down. Make adjustment with the baro/temp selector on top of pump (if your particular pump has it) in "N" (normal), vs. "C" (cold) or "F" (freezing). This control only affects mixture at high RPMs. By referencing your initial mixture setting at "N," you can slightly adjust the high speed mixture later by going to C (to richen) or F (to richen even more).

A) Check the operation of the Fuel Cutoff Solenoid and the microswitch by revving the engine to 3000 rpm and releasing the bellcrank. Disconnect the wire and use a voltmeter to see if the microswitch is working. A 12 volt reading should be indicated when the throttle is released until the rpm drops to 1300. You can feel a slight electric shock if you touch the terminal (with the wire connected) when the Fuel Cutoff Solenoid first energizes or de-energizes.

B.) Loosen the lock nut on the Fuel Cutoff Solenoid by using an old screwdriver and a hammer. You an also take an old wrench and grind it down to required thickness. Disconnect the wire from the solenoid terminal. Start the engine and wedge a screwdriver between the throttle cable and the pedal stop capscrew on the firewall so that the engine runs at approximately 2500 rpm.



C) Slowly turn the Fuel Cutoff Solenoid clockwise to lean the mixture until the engine begins to miss. Wait 5-10 seconds for the results of each mixture change to vary the engine speed. The solenoid position at which the engine first starts to miss is the lean reference point.

D) Turn the Fuel Cutoff Solenoid counter clockwise (out) to richen the mixture in one eighth turn increments until the engine speed does not increase with further rotation of the solenoid. This point is the "rich" reference position of the solenoid. Adjust the pedal stop capscrew after each adjustment so that the engine speed stays at 2500 rpm. The range between the "lean" and the "rich position is about one turn.

E) Repeat Steps c) and d) until you are sure of the solenoid position for the "rich" setting. This is tricky, but very important.

F) Turn the solenoid CLOCKWISE one quarter turn from the "rich" position. This position is a good starting point for the fine adjustment of the mixture. Tightening the locknut causes the solenoid to slightly richen the mixture, so turn the solenoid a few degrees clockwise before tightening the lock nut. Test the mixture setting with an exhaust gas analyzer.

G) With the engine at operating temperature, a quick blip of the throttle will produce a slight hesitation when the mixture is correctly set. A nice, instant, carburetor-like acceleration means that the setting is too rich.

8) Adjust the idle air flow.

Prerequisites: Ignition tune-up: Throttle Idle Opening: warm, running engine

This adjustment sets the idle speed and has an effect on the smoothness of the idle.

When the engine is at operating temperature and all the other Fl adjustments (except the Cold Start Solenoid) are correct, use a coin to turn the inlet tube on the idle air manifold. Turn the tube clockwise to compress the rubber O-ring and decrease the idle speed. If this has no effect, the O-ring is probably either damaged or missing. Increase the idle speed by turning the tube counter clockwise. Slight adjustment of the Idle Stop Screw is permitted to obtain the correct idle speed if the Long Rod is readjusted after the Idle Stop Screw is reset.

9) Adjust the Cold Start Solenoid.

Prerequisites: Ignition tune-up: Throttle Idle Opening: warm, running engine

This adjustment controls the amount of "extra" gas that is injected while the starter motor is operating. This adjustment affects how easily your Alfa starts.

A) With the engine at operating temperature and all other Fl adjustments completed, allow the engine to idle. Disconnect the wire to the Cold Start solenoid and connect one end of a jumper wire to the positive battery cable at the starter solenoid. Temporarily, connect the other end of the jumper wire to the Cold Start Solenoid. If the Cold Start Solenoid is adjusted correctly, the engine will continue to idle, but at a speed 100 to 200 rpm slower than before.

B) If the engine immediately dies when the Cold Start Solenoid is jumped, the solenoid is allowing too much gas to be injected. Use a punch and hammer to loosen the lock nut at the base of the Cold Start

Solenoid. Turn the solenoid clockwise one eighth turn and retest. Continue until the engine idle speed drops a couple hundred rpm when the solenoid is jumped. Tighten the lock nut when the adjustment is correct.

C) If there is no change in idle speed when the solenoid is jumped, the solenoid is not allowing enough gas to be injected (or is not operating). Turn the solenoid one-eighth turn counter-clockwise to increase the fuel flow. Retest. Repeat this step until the idle speed drops approximately 150 rpm when the Cold Start Solenoid is jumped. Tighten the lock nut.

(End of SPICA Section of Tune Up)

The Thermostatic Actuator

The function of the thermostatic actuator is fairly simple. The Spica fuel injection is a mechanical system which uses a series of levers to vary mixture according to temperature. The thermostatic actuator is the temperature sensor.

The temperature sensor we are all familiar with is a thermometer. As temperature goes up, mercury in the glass bulb expands and is forced up the tube. The higher the temperature, the higher the mercury. Temperature falls, mercury contracts and falls. Simple, really. The thermostatic actuator works the same way.

The actuator reservoir located in the intake manifold serves the same purpose as the thermometer bulb. As the motor warms up, the fluid in the reservoir expands. Instead of pushing liquid up a glass tube, it pushes through the metal tube against the piston at the other end of the actuator. By operating on the levers inside the Spica pump, the actuator varies the mixture to suit engine temperature.

While the Spica system must be properly adjusted following procedures in the Fuel-Injection Manuals, the actuator must also be working properly. Over time, the sealing surface of the actuator piston may become corroded (frequent changing of the oil filter in the fuel-injection pump can help prevent this). The actuator may become erratic in operation or lose fluid, thus reading lower than actual temperatures and causing a rich mixture.

To check the actuator, remove it from the car. At room temperature or 70 degrees, the piston to mounting flange depth should be 23+/- 1mm. With the other end of the actuator held in hot water at 175 degrees, the piston should protrude to 29+/- 1mm. Check for consistency of these readings by repeating the measurements. Let the actuator cool back to room temperature for at least 15 minutes each time. Usually, a bad actuator will fail these tests dramatically. If the measurements are all consistent but a little high, the actuator can be shimmed out from the pump to compensate.

When working smoothly, properly installed and adjusted, the Spica injection with the thermostatic actuator will start immediately and give the best mixture for any given engine temperature. The disadvantage of the less expensive manual "actuator" is that it offers no intermediate settings, being either too rich or too lean until the car is thoroughly warmed up.

Altitude Compensator Tension Spring

A broken ACT spring is the most common internal failure of the Spica fuel-injection pump. Symptoms appear immediately rather than by gradual deterioration. The engine will suddenly begin to run rich and foul plugs but

will still give strong performance at full throttle and higher RPM. The way to check for this failure is to remove the triangular plate, along with the barometric capsule, on top of the injection pump. On pre-1974 Alfas, there is a seasonal adjustment lever on this plate. The N is for "normal" temperatures, C for "cold" (32 degrees to 59 degrees), and F for temperatures below freezing. Adjusting this lever richens the mixture for colder temperatures. Directly forward of the opening in the top of the pump, positioned vertically between a retaining screw on the top and a rack on the bottom, is, or should be, the tension spring. It can be easily inspected either visually or manually without removing the pump from the engine. Do not push down on the rack that the barometric capsule normally interacts with. The most common cause of spring failure is corrosion caused by moisture trapped in the rear section of the pump or the top retaining screw being backed off. If the spring has come off of the retaining screw or has broken just underneath the screw, it may be possible to reattach the spring by grabbing it through the triangular plate opening, pulling it up, and rethreading it onto the screw. This will take patience. If the spring is badly corroded or has become disconnected from the lower attachment point, it will be necessary to remove the injection pump from the car to replace it. Part number for this spring is FI473.

Cold Start System for Spica Fuel Injection

The function of the cold start solenoid is to get the car running. It is only activated while the key is in the "start" position and the starter motor is engaged. It also has a dashpot unit operating in an oil-filled cylinder to allow the cold start action to slowly release over a few seconds after the ignition key is returned to "run" from "start". The thermostatic actuator then takes over to keep the car running. The cold start solenoid is governed by the thermostatic actuator to provide less fuel on hot starts so that the car is not flooded. There is always some action by the cold start solenoid even on a hot start. Because of this, it is possible to occasionally flood the engine on a "sloppy" start or if the car starts and then stalls shortly thereafter. A way to get around this flooding is to disconnect the wire coming from the starter solenoid going to the cold start solenoid. Be sure to reconnect it before your next cold start. This flooding could also be an indication of the cold start solenoid being set too rich. If your Alfa does not want to start, but once it is started runs fine, that is an indication that the cold start solenoid is either not functioning or set too lean. If your Alfa starts fine but does not keep running, you should inspect the thermostatic actuator. To test that the solenoid is working, disconnect the wire connecting it to the starter solenoid and run 12 volts to it from another source. The solenoid should produce an audible and palpable click. Do not leave 12 volts connected to it for more than a few seconds as the solenoid will overheat and burn out. If the solenoid works, then it's time to adjust it. The official procedure requires removing the fuel- injection pump from the car and adjusting the linkage per the procedure outlined in the fuel-injection manual. However, there is a seat of the pants procedure that does the job just fine. You will need a 24mm crowfoot wrench that is thin enough to slide between the solenoid and the body of the injection pump. Some grinding on the wrench may be required. Loosen the lock nut securing the solenoid. Screwing the solenoid out (up) will richen the cold start mixture, screwing it in leans the mixture. To check the mixture, start the engine and then disconnect the wire going to the cold start solenoid. If you do not disconnect the solenoid, the next step will engage the starter motor while the engine is running. When the engine is warm, run 12 volts to the cold start solenoid. If the solenoid is properly adjusted, the engine will bog down with a rich mixture but will not stall immediately. It should stall in about 5 seconds. If the engine stalls immediately, the solenoid is set too rich. If there is no change in the way the engine runs (assuming the solenoid is functioning), the solenoid is set too lean. Usually one turn either way will be the most it needs to be adjusted.