

Variomatic vacuum – an explanation and fault finding tips

The vacuum system as it works in the DAF Variomatics can be equated to the nerve system of the car because apart from the ignition advance (and servo when fitted) it influences the whole performance of the transmission. It controls the change up, change down, kick down and low ratio hold.

How does it all work?

The principle is the same for all models from the DAF 31 to the Volvo 340, although there have been changes made over the years.

Change up

As the car accelerates, at a predetermined engine speed (2,850 rpm on air-cooled cars without load, 1,750 rpm on Volvo 340 fitted with tachometric relay) vacuum drawn through the engine manifold acts through a series of rubber and metal pipes on the outer chamber of the primary unit drum, and assists the action of the centrifugal weights to produce the change up effect, and then the overdrive effect.

This happens by the air being sucked out of the outer chamber and as the air is drawn out, the diaphragm is pulled towards the suction. But as the diaphragm is fixed onto the shaft and weight assembly, the effect is that the whole drum moves inwards towards the fixed disc. This forces the drive belt to the outer diameter of the primary discs.

As the length of the belts remains constant, the secondary unit sliding discs are moved apart and the belt slips into the inner diameter and thus the system is in high ratio.

Change down

When braking, the vacuum, through a second series of rubber and metal pipes, is redirected to act on the inner chamber of the primary unit, and as the air is drawn out, the diaphragm is now pulled towards the suction. Again the diaphragm is fixed and therefore the drum now moves outwards. This allows the sprung rear sliding discs to close, forcing the belt to the outer diameter of the secondary unit as the belt slips into inner diameter of the primary pulley. The system is now in low ratio.

Vacuum adjustment

To adjust the vacuum accurately a rev counter and vacuum gauge are essential. I will describe both the official way of using these instruments, and a simple practical way using no instruments, although it must be understood that this will only be an approximate setting.

Air-cooled DAFs

ENSURE THAT THE CAR IS IN NEUTRAL

Before attempting to adjust the vacuum, the ignition timing must be set. Also, the mixture must be set ensuring that when the brakes are applied, the engine revs do not increase by more than 50rpm.

Connect the vacuum gauge at the bottom hose of the rotary vacuum valve. Connect the rev counter. Start the engine. Slowly depress the accelerator and, at an indicated 2850rpm vacuum should register. If adjustment is necessary, disconnect the adjusting rod, loosen the lock nut(s) and screw ball joints in or out. Shorten the rod and the vacuum begins earlier. Lengthen the rod and vacuum is later.

If the rev counter and vacuum gauge are not available, an approximate setting can be achieved as follows:

Disconnect both the rubber hoses from the bottom two connections of the rotary valve. Connect a suitable piece of hose to one of these connections. With the engine switch OFF, pull the choke half way out and try to blow through the rubber hose while gently moving the accelerator. With very little movement you should be able to blow through. Adjust as above, if necessary, considering that if you can blow without moving the throttle vacuum is too early, and if a lot of movement is needed, vacuum is too late.

Water-cooled DAFs and early Volvo 66s/340s

ENSURE THAT THE CAR IS IN NEUTRAL

Before attempting to adjust the vacuum, ensure that the ignition timing is correctly set and also that the fuel mixture is adjusted correctly. Again there should be no increase of more than 50rpm when depressing the brake pedal.

Connect vacuum gauge to the bottom LH hose of the vacuum valve. Connect rev counter. Start the engine and gently depress the accelerator. At an indicated 2650rpm, vacuum should begin to register. To adjust, loosen the nut on the base of the micro switch base plate, loosen the nut on the set-screw, move the screw in or out as necessary ensuring that the plate is also moving. When adjusted correctly, retighten the nuts.

If the rev counter and vacuum gauge are not available, an approximate setting can be achieved as follows:

Pull the choke out half way. With the ignition on, but the engine OFF, move the accelerator gently listening to the electrical vacuum valve solenoid. With very little movement it should be heard to click. If incorrect, adjust as above.

Later Volvo 340 post 1978:

The system is fully electronic and is therefore not adjustable, but can be tested as above.

To check the micro switch, switch on the ignition and operate the throttle gently, listening for the electrical vacuum valve to click. If you cannot hear the valve operating, the use of a voltmeter or electrical circuit tester will be required to proceed with the test.

Trace the cable from the micro switch to the two spade-type connections about 18" from the micro switch and usually located under the air filter. Disconnect both spade connectors and, with the ignition switched on, test by connecting the voltmeter to the blue cable from the wiring harness and a suitable earth. If voltage is not indicated, the fault lies in the wiring. If voltage is indicated, switch off the ignition and connect the blue cable's spade connector to the micro switch leaving the green cable disconnected. Connect the voltmeter to the green

cable and switch on the ignition. Operate the throttle cable to activate the micro switch. If voltage is present, then the micro switch is OK. If voltage is not present, examine the connections to the micro switch and replace switch if necessary.

Check the mechanical rotary valve by blowing through, as for adjustment. If all seems to be working then start the engine, remove the bottom hose and block the valve pipe with your finger. Operate the throttle, feel for suction and listen for any leaks. If a vacuum gauge is available, connect and check for presence of vacuum.

Check the electrical valve by starting the engine, operating the throttle (IN NEUTRAL) and listening for the valve solenoid to operate. If it cannot be heard, use a voltmeter and check +ve and -ve connections for earth and voltage. If voltage is present then the valve is faulty. If the solenoid operates correctly, remove the bottom LH hose and block with a finger. Operate throttle and feel for suction, while listening for leaks. If a vacuum gauge is available, connect and check vacuum.

If the kick down switch is suspected on Volvo 66 or 340, connect voltmeter across valve connections, and with the ignition on, operate the throttle and check if voltage is present. If not, connect the voltmeter to the +ve and suitable earth. If voltage is now present, the kick down switch is suspect. It can be temporarily overcome by sacrificing kick down and connecting a separate earth.

To check vacuum pipe connections in the engine bay is easy. To check the connections under the car and the primary unit, proceed as follows:

Locate the two hoses going to the primary. On water cooled cars, the two bottom rubber hoses on the electrical vacuum valve can be traced going below the steering rack and joining two metal pipes before disappearing under the bulkhead. Disconnect at the electrical vacuum valve end. On air cooled cars, the rubber hoses to disconnect from the electrical brake valve, are the LH of the two at the bottom and the bottom hose of the mechanical rotary valve. Once disconnected blow hard into each hose in turn and observe the following:

- i. If you can blow freely down one hose without feeling air returning from the other hose, a loose connection can be expected.
- ii. If you cannot blow at all check for kinked hoses or blockages.
- iii. If you can blow and feel air continuously returning through the other hose, then a blown diaphragm or oil seal housing can be expected.
- iv. If you find resistance after blowing for a few seconds and when you stop you can feel air blowing back (like releasing air from a balloon) then the diaphragms are OK. Always repeat on both hoses.