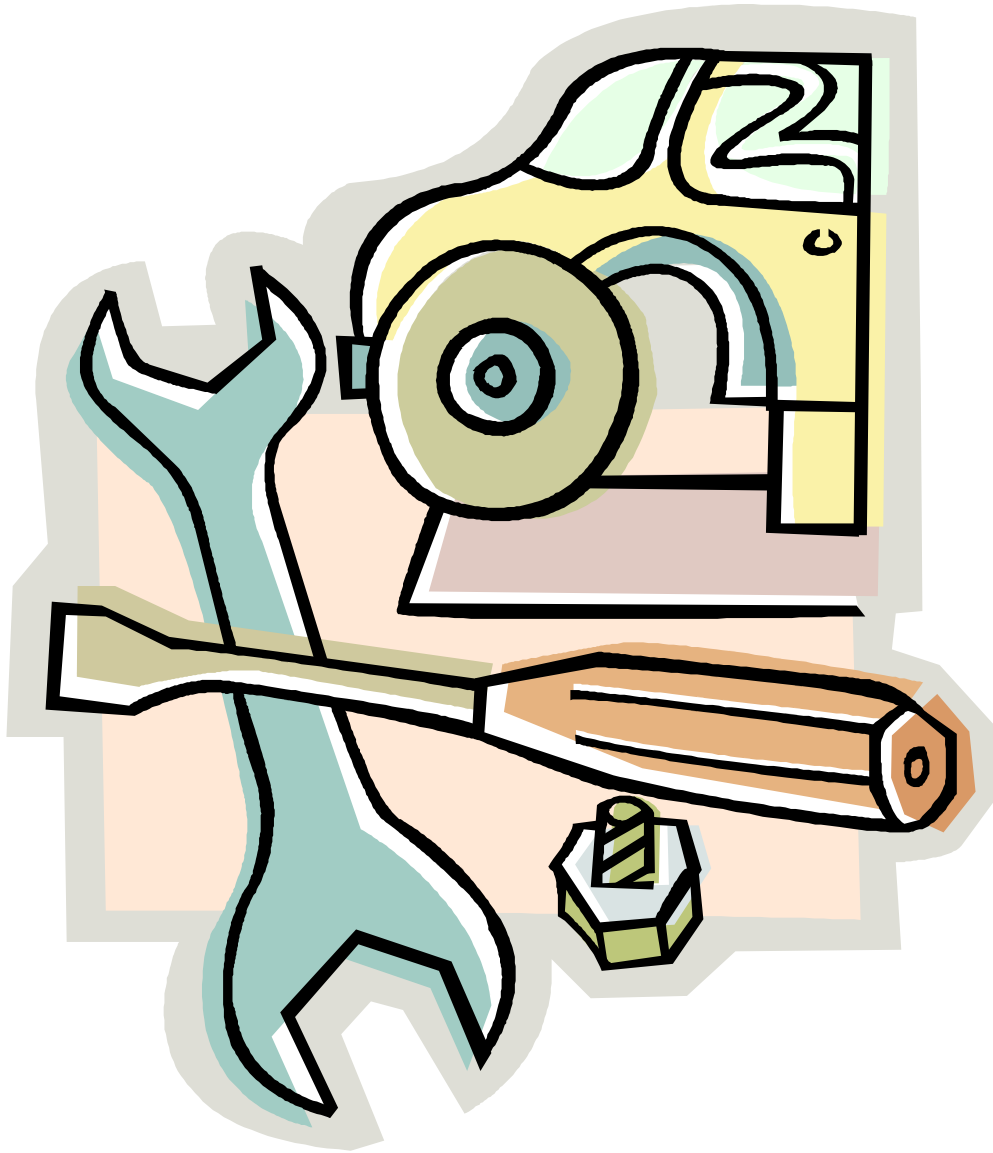


1981 – 1985 300SD 722.3 and 722.4 Transmission Adjustment Guide



Revision 03

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www.mercedesforum.nl/forum/])
Updated – January 2014

Revision: Adjustment Guide	Date:	Revision: Section	Reason for change:
Draft	11/2012		
01	11/2012	All	General clean-up and updating
02	12/2012	Page 23	Corrected Vacuum Modulator part number
03	01/2014	Update	Added update on latest adjustments (page 29)
04	10/2014	Update	Updated 'Latest Adjustments' section (page 29)

Disclaimer;

Although every effort has been made to ensure the accuracy of the information contained in this document, it is possible small errors will be found. A sincere apology if this is the case. I would ask that you take up contact with me and share what requires updating / correction.

IMPORTANT;

Some of the steps outlined in this document involve potential life threatening activities such as working under the car, making adjustments while the engine is running, etc. PLEASE exercise caution and common sense and take applicable safety precautions.

Special Thanks;

Without the Benzworld.org posts from the people listed below I would not have been able to prepare this document;

Hattenator

Gregs300CD

Govert70227

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1981 – 1985 300SD 722.3 and 722.4 Transmission

Background

Like some (many?) of you I had some challenges with smooth shifting in my '81 300SD. Having driven other manufacturer's automatics that shifted slightly earlier and much less noticeable I felt there must be a way to improve the situation.

Well, like some (many?) of you wading through all the articles and documentation can be bewildering to say the least and often you end up with more questions than answers.

I'm not going to stand on a soapbox and say this is the definitive article/solution to your problems but it should point many of you in the right direction. I'm not a transmission expert as some on this forum (that is meant as a compliment), but I do like to take a thorough approach to any project. Part of my day job is writing technical documentation so hopefully this will be helpful.

Caveat

I should also point out that this information is applicable to the 1981 through 1984 models of the 300SD. In 1985 MB made some major changes to the design that included, amongst others a Pressure Converter and Electronic Control Unit.

Type of Transmission

The first step is to identify the exact transmission you have. This will involve crawling under the **passenger side** of the car. You should be able to do this without the need to jack up the car. However, if a jack is required please take the proper safety precautions – use a safety stand that is rated to handle the weight of your car.

You will need a wire brush and a flashlight (torch for those of you in the UK). On the edge of the alloy casting just above the thick black oil pan gasket and close to the bell housing are the reference numbers. Give this area a good scrub with a wire brush and you should see a numbering sequence like this;

126 2700801 722.303 02 054545





Vehicle Type	Transmission Type	Vacuum Modulator Type	Serial Number
126 270 08 01	722.303	02	054545

722.0	3 speed
722.1	4 speed / 4 bolt pan
722.2	4 speed / 4 bolt pan
722.3	4 speed / 6 bolt pan / large case
722.4	4 speed / 6 bolt pan / small case
722.5	5 speed overdrive

The serial number can be a critical piece of information if you need to determine whether or not an improved component has been installed. Bear in mind that MB made running changes to this transmission.

The Vacuum Tutorial

The next step is to understand how Mercedes uses vacuum in its many forms. Please refer to the excellent article by Steve Brotherton (link below).

http://www.continentalimports.com/ser_ic20242.html

Before we go any further it is important to understand that the 3/2 valve assembly on top of the valve cover has NOTHING to do with the vacuum used but the transmission vacuum modulator. They are ONLY used for controlling the EGR valve. Having said that if you have a leak in any part of the EGR vacuum circuit it WILL affect the quality of your transmission gear changes. I would recommend disabling your EGR circuit before proceeding with any transmission adjustments. It will at least eliminate one possible problem. This is a good lead in to the next point.

Documents and Tools

Get your hands on the following documents and tools before proceeding;

1. Vacuum diagram applicable to your vehicle. Remember that there are differences between Federal and California and significant changes starting in 1985. See Service Manual section 14 – 050.

[300SD 14-050](#)

2. Procedure for adjusting the throttle linkage on your vehicle. See Service Manual section 30 – 300.

3. A good metal divider capable of measuring a distance of up to 20 cm (8"). You will need this to accurately measure each shaft in your linkage system.
4. Procedure for adjusting the valves on your vehicle. See Service Manual section 05 – 210, OR see link further down this page.
5. A good quality vacuum gauge.
6. A good quality vacuum pump (i.e. MityVac).
7. Two 14mm open end wrenches. The Mercedes ones are the best as they have the correct offset. Plan B would be to modify a set of wrenches. You'll need access to someone with welding equipment (Oxy Acetylene) to heat and bend. The MB part number 615 589 00 01 00 (not cheap at €23.67 each incl. 18.5% VAT tax [~\$30 US]) but saves time and skinned knuckles). See picture below to see the Mercedes items.



Step 1 – Adjusting the Valves (Service Manual 05 – 210)

I would recommend replacing the valve cover gasket when performing this task – you have it apart, why not. Since you will be disturbing the linkage on the top of the valve cover you may want to do this first before adjusting the throttle linkage. Your choice. An excellent procedure, with pictures, can be found via the link below. Please bear in mind a VERY IMPORTANT point, always turn the engine in the direction of running. With my car this is clockwise when facing the engine (standing in front of the radiator). You WILL damage the engine if you rotate it in the opposite direction.

<http://www.dieselgiant.com/valveadjustment.htm>

Step 2 – Adjusting the Throttle Linkage (Service Manual section 30 – 300)

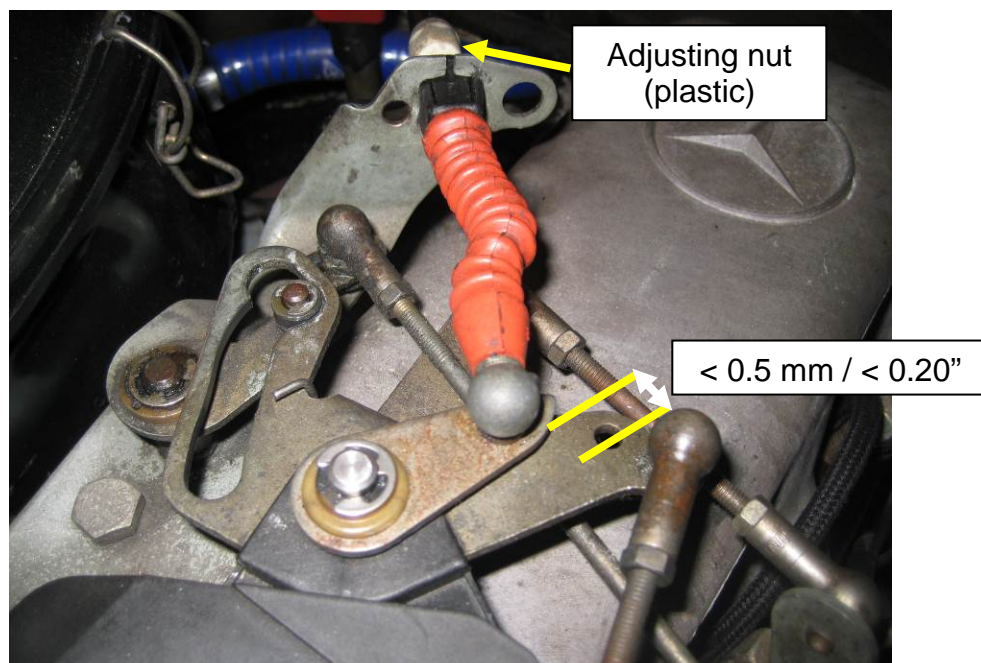
Adjust as per the specs for your vehicle there are huge variations depending on the model and year of manufacture. Double check everything and don't forget the shaft connecting the linkage to your Vacuum Control Valve (VCV).

When you are satisfied that the linkage is as it left the factory move to the Bowden cable to the transmission. This is the cable on top of the valve cover next to the air filter housing and has the rubber accordion bellows on it. This cable tells the transmission how far down you have pushed the accelerator. In other words, it will tell the gearbox to downshift under part or heavy throttle. Not to be confused with the kick down switch under the accelerator pedal – that one looks after full throttle downshifts.

This Bowden cable also has an influence on the downshift into first gear when slowing to a stop. If the cable is too loose the transmission assumes you are almost at a stop and downshift. This is often the cause of a harsh downshift into first.

The cable should have a slight amount to no free play (0.0 – 0.5 mm / 0.0 – 0.20"). This is difficult to feel so check and double check that you are feeling play in the cable and not pulling the cable or moving the throttle linkage.

(NOTE – see Update on page 29)



Step 3 – Changing the Transmission Fluid and Filter

Do yourself a favour and change the fluid and filter. Use a good quality transmission fluid and filter. As an added precaution, add a magnet to your oil pan, this will help to ensure that any small metal particles are captured and not circulated with the oil. This magnet is available from MB – part number 169 371 00 03 (see next page).

An excellent procedure with pictures can be found via the link below;

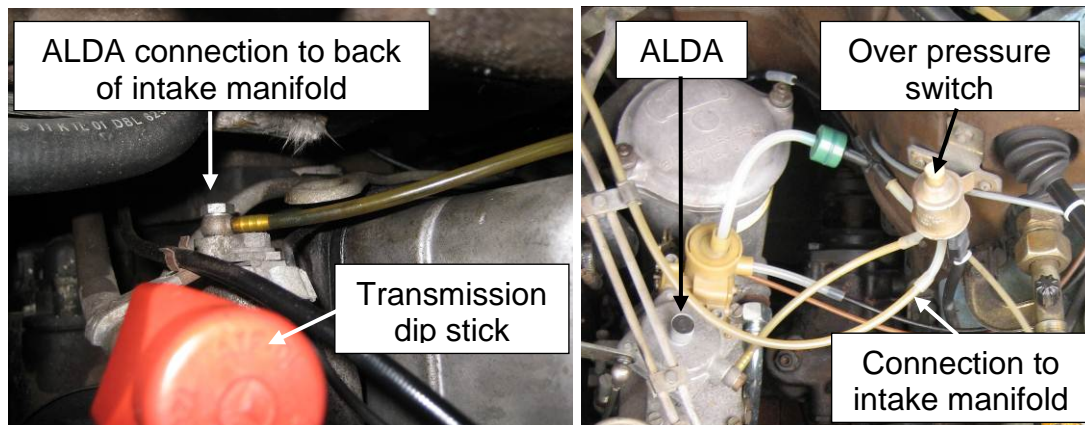
<http://www.diesलगiant.com/mercedestransmissionfluidchange.htm>



MB Magnet – P/N 169 371 00 03

Step 4 - Cleaning the ALDA Valve

Clean your ALDA (German acronym for Automatische Lade Druck Anreicherung) valve connection to the intake manifold. The ALDA valve ensures the correct fuel mixture during turbo boost. Basically a 'pressure sensor'.



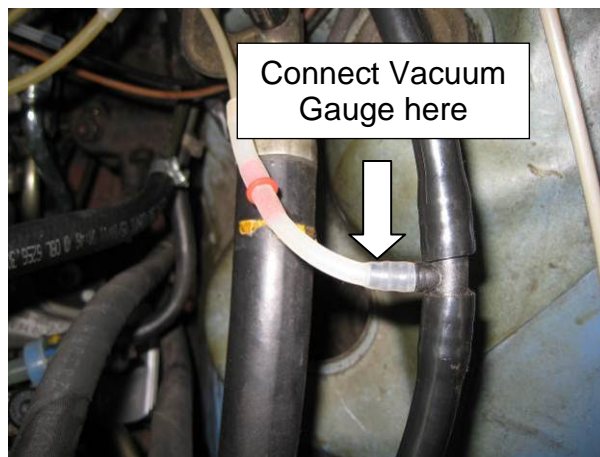
You will find an excellent article with pictures in the link below.

<http://www.diesलगiant.com/mercedesaldaboostsystemservi.htm>

You are probably wondering why all these other tasks before moving to the transmission. The purpose is to eliminate the other major contributors to poor shifting. If the engine is functioning at its best and you encounter shifting issues, you know where to focus your attention.

Step 5 – Vacuum Pump Output

Get out your vacuum gauge and connect this to the port on the hose running from your vacuum pump to your brake booster. This pipe is about 15mm (1/2") in diameter and close to where it goes through the heat/noise shield by the fuse panel you will see a plastic T connector. The smaller hose heading towards the engine is for the Vacuum Control Valve (VCV). Disconnect the small hose and connect the vacuum gauge. Start the engine and note the reading. You should see around 530 to 560 mmHg (21 to 23") of vacuum. If you do not, start checking the hose for leaks. Could be that your vacuum pump needs a rebuild. Do not proceed any further if you do not have a decent and relatively steady amount of vacuum – the needle will bounce for 10 or 15 seconds before giving you a steady reading. See picture below.



Step 6 – Vacuum Line Routing and Condition

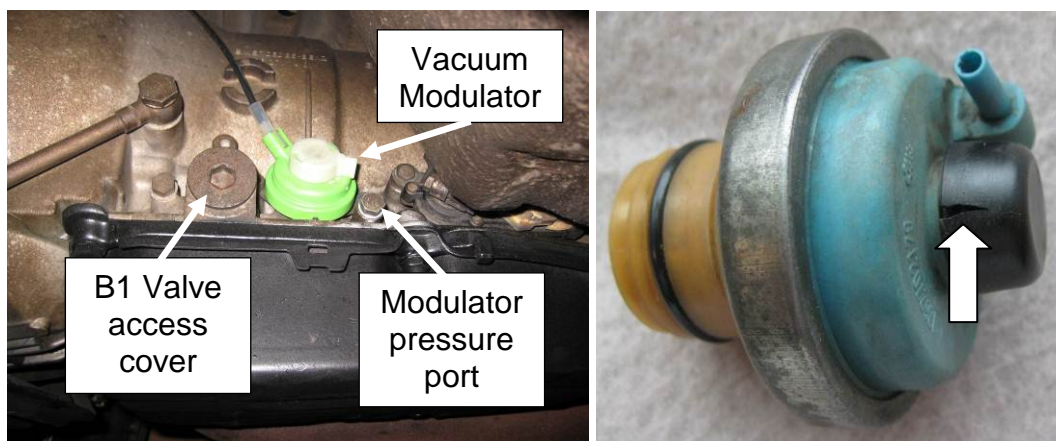
Check the routing of all vacuum lines – does it match the diagram for your vehicle (Service Manual section 14 – 050)? If not, connect up correctly. What is the condition of all vacuum lines? The plastic tubing is quite robust but can be damaged by rubbing on sharp edges or contacting a hot surface. This tubing is easily replaced either via your MB dealer or a local supplier that carries Festo products. Festo has a huge range of vacuum/pressure products including the plastic hose. Most of their 4 mm hose (2.9mm ID), will handle -30C to +80C although some has a higher rating. It generally comes in 50m rolls but you may luck out and they can sell you a short length. This assumes your MB dealer doesn't have any.

Now check the Neoprene hose connections. These will be inline, 3 way and 4 way connectors (see picture next page). These tend to dry out and crack with age. Replace as required, your MB dealer still carries these. Plan B would be to replace the lines with good quality Neoprene vacuum hose or better yet Silicone hose (3 mm / 1/8" ID). This will allow you to use standard vacuum Ts

and connections as well as eliminating some connections (plastic tube to Neoprene to component fitting). NOTE – in the picture below I have modified the connections with Silicone hose plus the EGR valve is not connected.



Don't forget to check the vacuum connection to the Vacuum Modulator on the driver's side of the transmission, just above the oil pan and just behind the bell housing (see picture). You have plastic tubing to Neoprene hose to modulator fitting connection plus, and this is important, the little black plastic cap over the Vacuum Modulator adjuster. If this is split or damaged (see picture), it can cause a vacuum leak.



This is where your vacuum pump (MityVac or similar), comes into play. With the engine shut off you can connect the pump up to the line going to the Vacuum Modulator, pump a few strokes to ~250 mmHg (~10"), and see how long it maintains that level of vacuum. A leaky modulator will show up quickly. A good modulator will hold a vacuum for a while (I have not seen specs for the leak down). See picture on the next page.

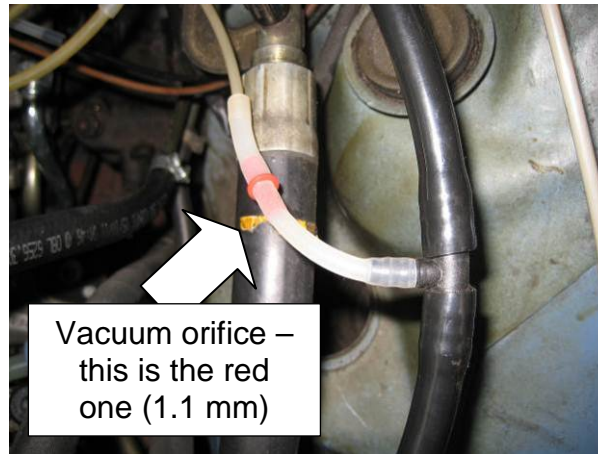


Step 7 – Vacuum to the Vacuum Control Valve (VCV)

With a T connection connect the Vacuum Gauge to the line heading towards the Vacuum Control Valve (VCV). Makes sure no other vacuum connections or devices are between the gauge and the VCV. You are going to measure the vacuum to the VCV. At idle this should approximately 250 mmHg (10"). When I say approximately it should be no more than +/- 12 mmHg (0.5") of this value. See picture below.



If it is not at this value then you need to check the condition of the restrictor in the connection to the T in the main line from the Vacuum Pump to the Power brake Boaster. See picture on the next page.



Mercedes has a whole series of restrictors (see chart below), some are very inexpensive others shockingly expensive. No idea as to why. The Yellow vacuum orifice at 2.0 mm is the 'fully open' one, in other words, unrestricted. If you have access to a pin drill and some very small drill bits you can make your own using standard in line vacuum tubing connectors and some Epoxy. Fill the connector with Epoxy, let it set and drill out accordingly.

Rule of thumb – each step in diameter change will affect the vacuum by ~25mm (1") at the Vacuum Modulator.

Vacuum Orifice		
Colour	Inside Diameter	Part Number
Yellow	2.0 mm	116 276 0929
Red	1.1 mm	116 276 1029
Blue	1.0 mm	116 276 1129
Brown	0.9 mm	116 276 1429
Green	0.7 mm	116 276 1329



In theory you could use these restrictors in combination but I don't really see the need.

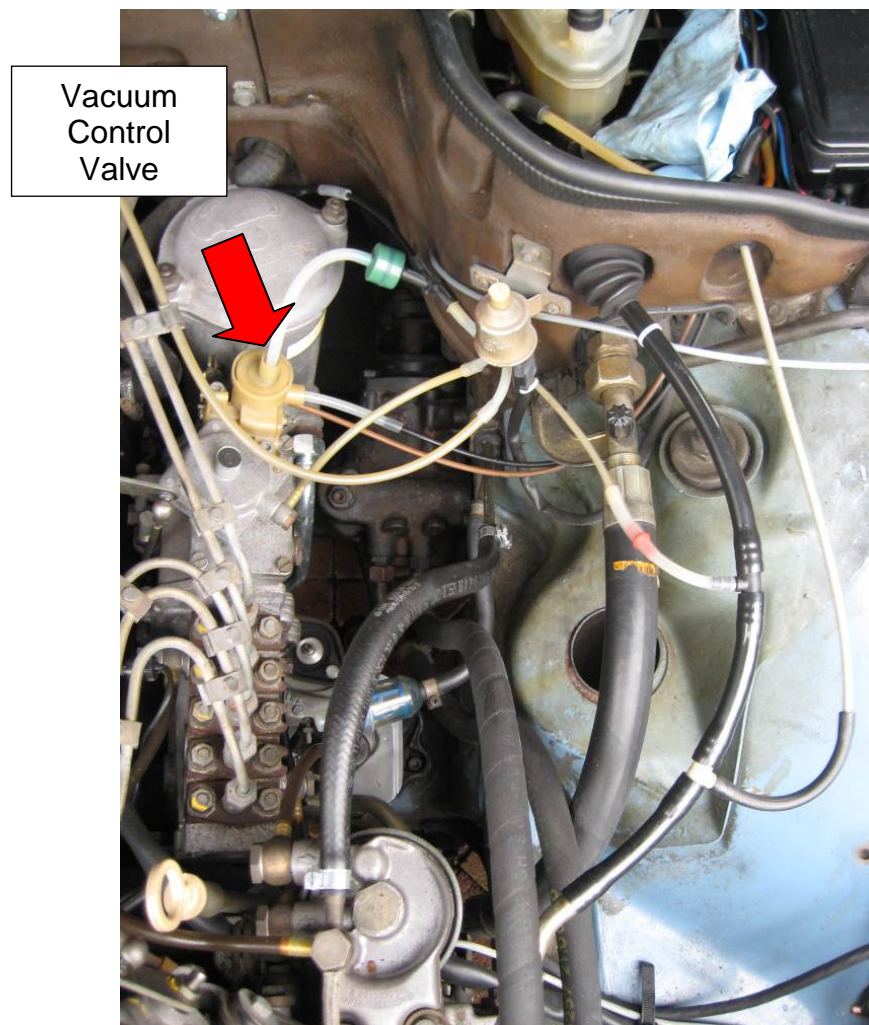
Hopefully you have obtained the target of ~250 mmHg (10") at idle.

Remove the Vacuum Gauge T connection and reconnect the vacuum line between the VCV and the main line from the Vacuum Pump to the Power brake Booster.

Step 8 – Vacuum to the Vacuum Modulator

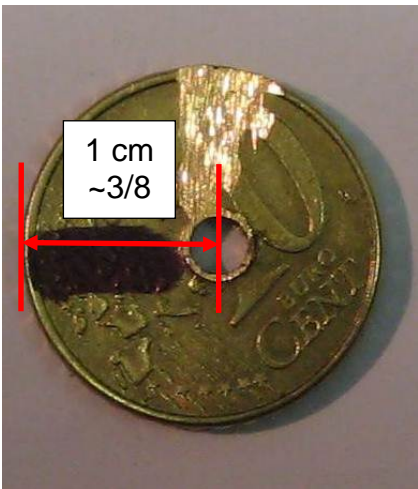
Vacuum to the Vacuum Modulator on the transmission is controlled by the Vacuum Control Valve or VCV (see picture below). Its sole purpose is the bleed vacuum at a controlled rate. It does this through a special diaphragm valve and a connection to the throttle linkage. When you open the throttle the diaphragm is opened and vacuum bled off. The further you open the throttle the less vacuum available to the Vacuum Modulator.

The best method is to do this testing under the hood – VCV removed from the Injection Pump and preferably laying on a flat surface. This will allow for easy and accurate adjustment.



MB does not publish a range specification linked to the throttle opening but does provide a specification for the VCV valve at a specific opening. This opening is obtained using, of course, a special MB tool. However, it is a piece of cake to make one as the special MB tool is simply a disc 2 cm (3/4"), in diameter. For those of you in the EU, grab a 10 cent Euro coin, in the UK a 1

Penny coin (1968 or latter), in Canada or the US, your 1 cent coin (it is 1.9 cm but close enough). Find the centre and drill a 3.1 mm or 1/8" hole. Don't worry if you are slightly offset from centre. All you need is one section that is 1 cm (~3/8 "), from the centre.



Despite my best efforts to centre punch the coin, drill exactly centre and have the benefit of a drill press (pillar drill for those of you in the UK), I was not successful. Notice the black felt tip mark – this happens to be the section that is 1 cm (~3/8 "), from the centre of the coin

For those of you that like to collect MB tools. They do produce a special one for the VCV adjustment – 916 589 00 21 00. I don't know what the cost is but if you have two friends you could reduce your out of pocket costs as the tool consists of three pieces of the disc.

Historic	916 589 00 21 00 Adjusting Rollers (3 pcs)	07 / A	MY1983
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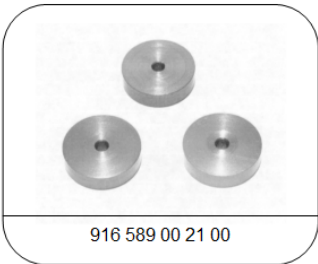
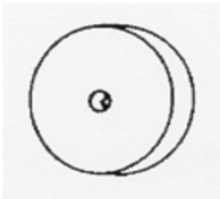
ENGINE 616, 617.91, 617.95

Use/specification:

Adjusting roller set for vacuum test on vacuum control valve.

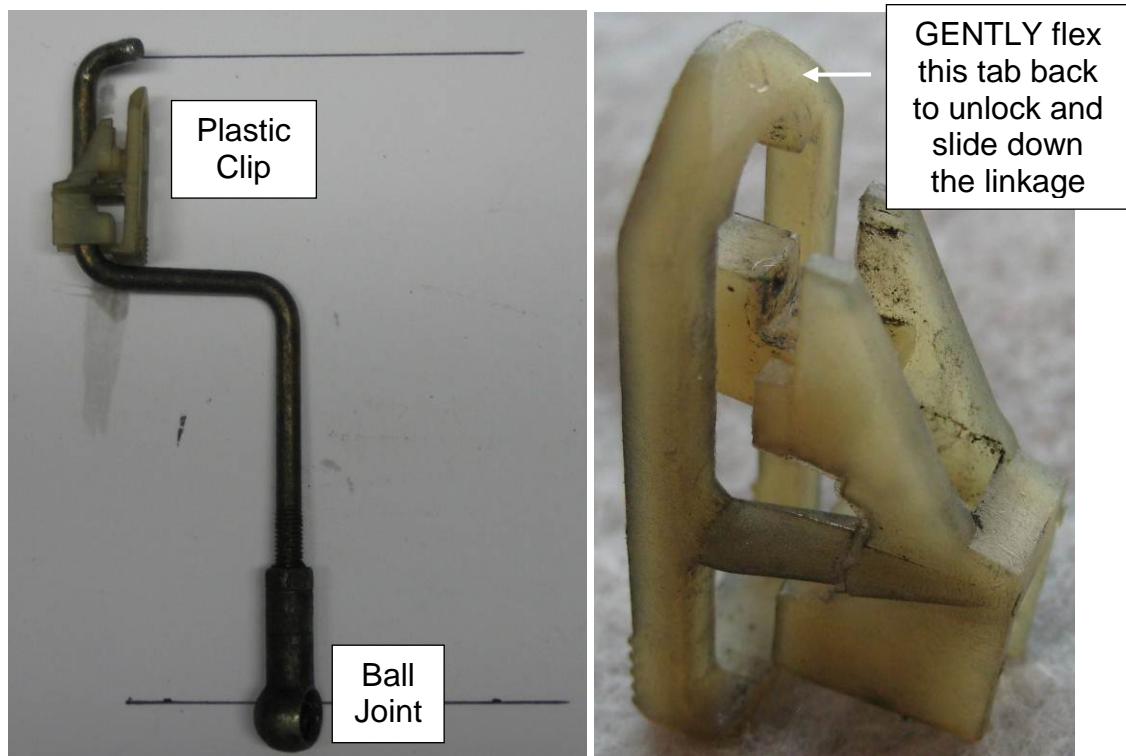
(Set = 3 rollers).

(Ref: AST)



You will find it best to work with the VCV valve removed from the Injection Pump. In this manner you can make adjustments with the engine running and providing vacuum without the need of raising the engine rpm above idle.

With a large blade slot screwdriver gently pop the ball joint end of the VCV linkage from the Injection Pump linkage. Some of you may prefer to do this using the plastic clip on the linkage arm next to the VCV. However, this clip is very fragile and easily broken – the design is not the best.

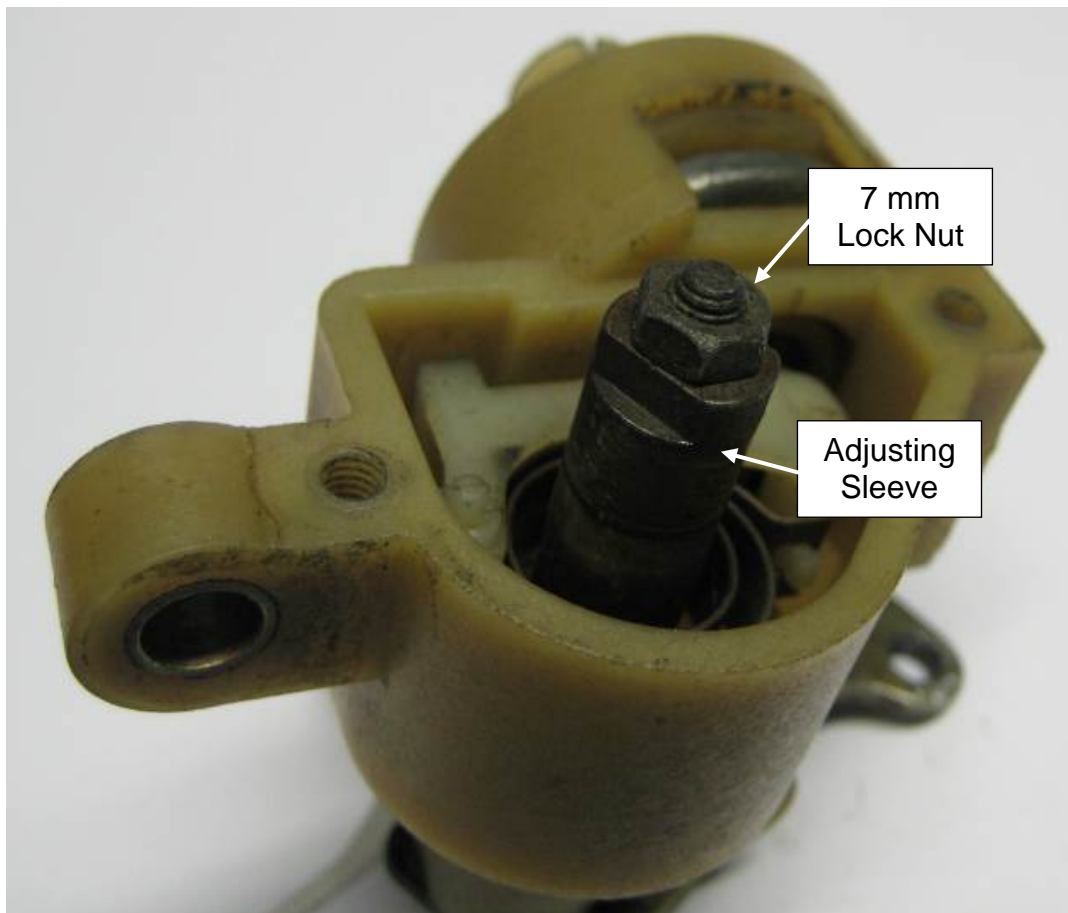
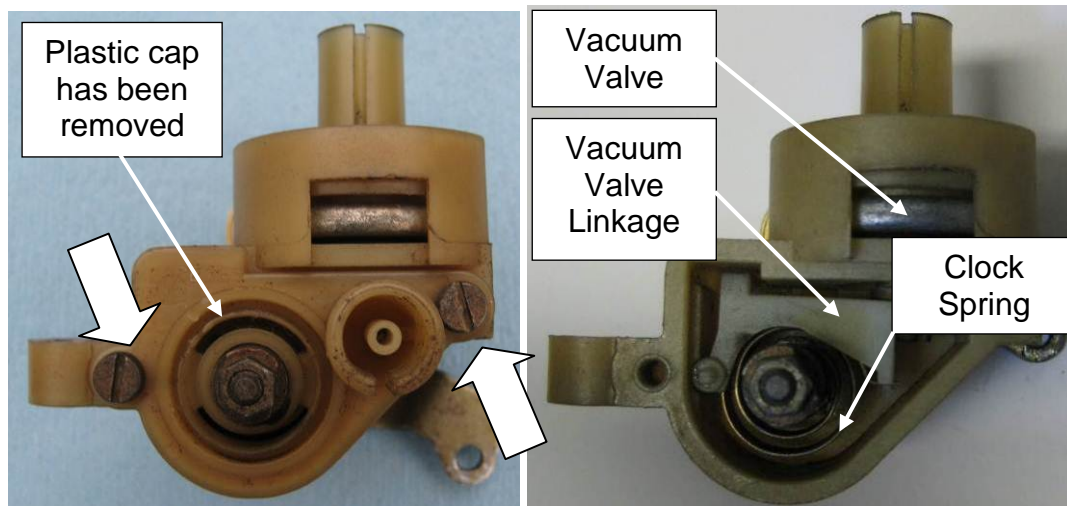


Remove the hose connection from the top of the VCV to the Vacuum Damper (green cylinder shaped object in the line). The other hose going to the side of the VCV is the air intake from the passenger compartment.

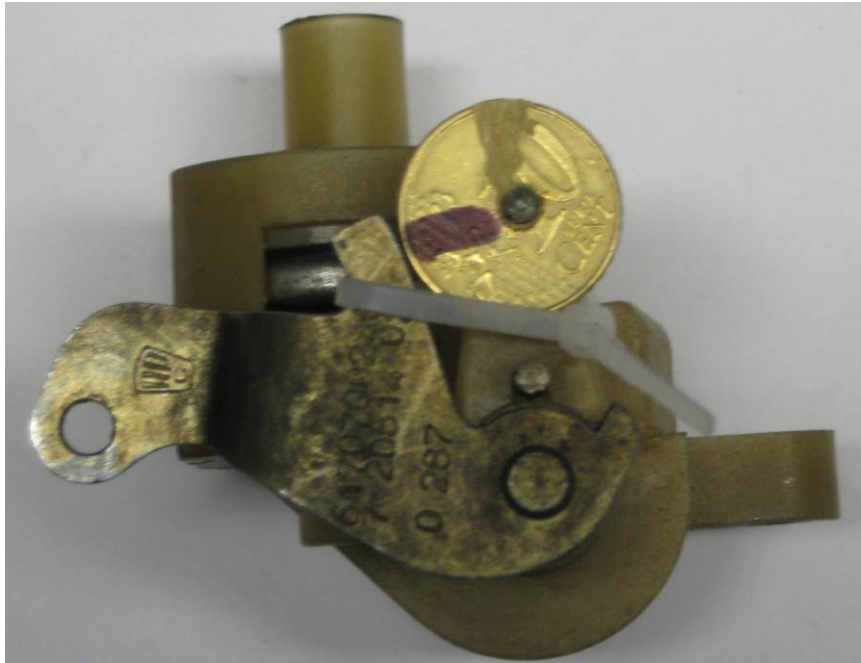
Now take a 5 mm Allen socket or wrench and undo the two screws used to attach the VCV to the Injection Pump. Note the two small flat washers under these two screws.

Find a piece of wood or a cutting board to set on the radiator support or firewall housing around the fuse box. This is to serve as a small work surface.

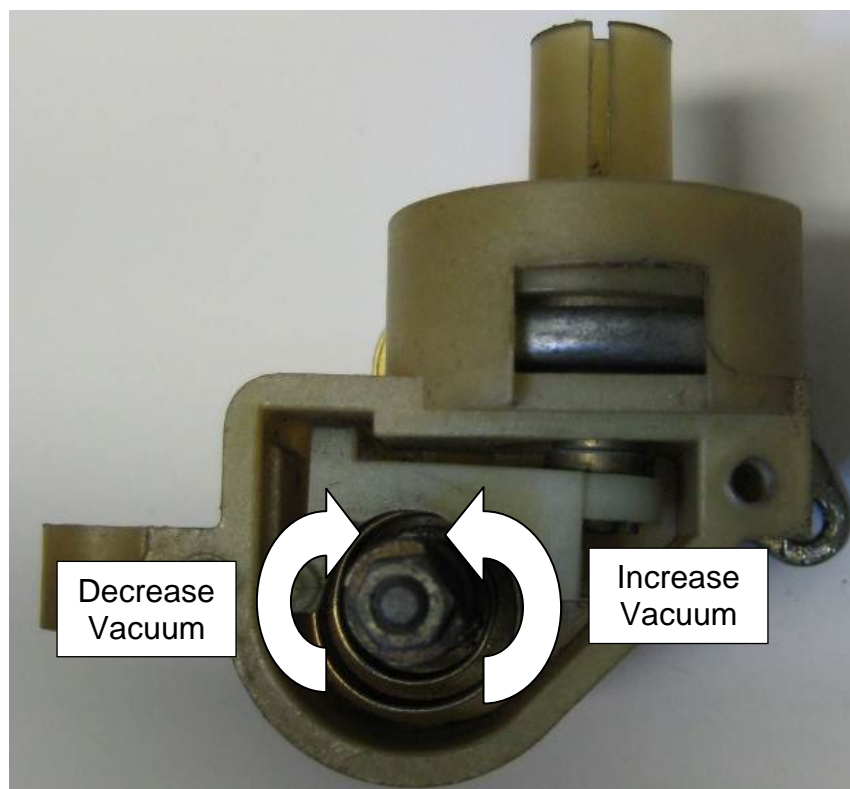
Remove the two slot head screws on the one side of the VCV. This will gain you access to the adjustment mechanism. Grab a 7 mm open end or box end wrench as well as a small Vise Grip or other type of locking pliers. The locking pliers are required to GENTLY turn the adjusting sleeve to obtain the correct vacuum reading. This adjusting sleeve does not act directly on the vacuum valve linkage but does so through the clock spring as seen in the picture below. Note, the plastic cap over the adjustment nut/sleeve has been removed.



Now attach the coin to the roll pin and with a tie wrap or piece of wire lock the linkage against the coin. You can now proceed with adjusting the vacuum.



Take the locking pliers and clamp these firmly but not too hard onto the adjusting sleeve. Slightly loosen the 7 mm lock nut. You want just enough friction to prevent the clock spring from moving the adjusting sleeve during your adjustments. **Clockwise decreases** the amount of vacuum, **counter clockwise increases** vacuum.



Because of the historical issues related to the VCV and the quality of the gear changes, MB issued a Service Information bulletin in 1986 – MBNA 27/1. It contained the following;

=====
This Service Information supercedes MBNA 27/1, Jan. 1981, (modification of valve body MY 1980), MBNA 27/3, Nov. 1981, and “Testing of Vacuum Control Valve”(Group 27, page 33 of 1983 Introduction Manual).

Since the beginning of the model year 1981, a modified vacuum control valve was installed in production. Poor shift quality at partial throttle can be improved by adjusting this modified vacuum control valve.

If the test value is found to be out of tolerance, start the test by adjusting valve (*meaning* VCV) to an initial value of 145 mbar or 4.3 inches (Engines 617.91, 617.95), 200 mbar or 6.0 inches (Engine 616.91).

If the VCV value has been adjusted to the specification indicated above and you experience;

Hard Shifts – **adjust the VCV vacuum to the upper limit.**

Slipping Shifts – **adjust the VCV vacuum to the lower limit.**

Vacuum Test Values

Engine	Vacuum Control Valve		EGR Valve	
	mbar	inches	mbar	inches
616.91	155 – 215	4.5 – 6.5	200 – 240	6.0 – 7.0
617.91	110 – 160	3.3 – 4.7	150 – 190	4.4 – 5.6
617.95	110 – 160	3.3 – 4.7	150 – 190	4.4 – 5.6
617.95 *	110 – 160	3.3 – 4.7	390 – 440	11.5 – 12.9
			320 – 350	9.5 – 10.3

* California version, 1990 model year.

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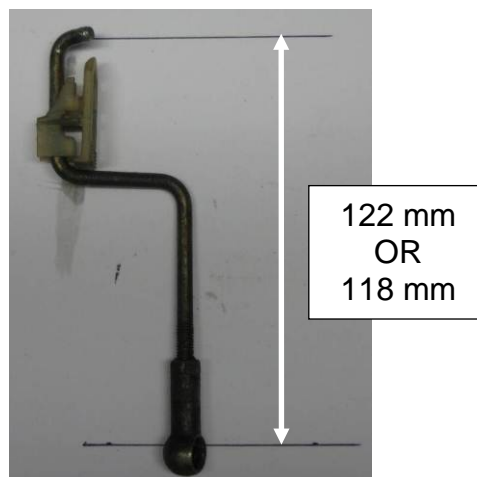
Connect the vacuum lines to/from the VCV in the way it would be if installed in the vehicle. Ensure the vacuum damper (if fitted), is installed and connect your vacuum gauge to the connection normally reserved for the line to the Vacuum Modulator. You want to measure the vacuum as it would be delivered to the Vacuum Modulator under normal driving conditions.

In my case I initially set the vacuum at 125 mbar (5“) but found the shifts too firm. So I took the MB recommended specification of 145 mbar (4.7“) as indicated above MB. If you are curious, the piece of test equipment I’m using

in these pictures is from my place of work. It is a reference device I'm evaluating to test blood pressure monitors. It's not inexpensive; ~\$767 (US).



When you are satisfied with the adjustment – double check it again. Before installing the VCV check the linkage. Centre to centre distance must be 122 mm. MB document (AT-01.01) indicates 118 mm for transmission 722.303 / 722.315 and 722.416).



Put the cover back on the VCV, remove the coin and the tie wrap or locking wire, install the linkage (add a dab of grease to the ball joint). Be careful with the plastic locking tab on the linkage. Tighten the two 5 mm Allen screws that connect the VCV to the Injection Pump. Double check your work and all vacuum connections. Do not connect the hose for the Vacuum Modulator – the next adjustment requires this to be disconnected.

There is one other important factor linked to this – the Vacuum Modulator adjustment.

Step 9 – Vacuum Modulator Adjustment (Modulator Pressure)

The Vacuum Modulator has a provision for adjusting the oil pressure used in the transmission. Yes, MB has defined pressure specifications for each transmission type. For example mine is a 722.303 which should have 2.9 bar (42 psi). Some people play with the pressure to adjust the shift quality, doing this with vacuum is better. At best you can get these transmissions to shift

quickly, softly but never un-noticeable. I do not believe it is possible to adjust these transmissions to shift like one might be used to with older and newer American cars and newer European and Japanese cars.

I have found two different tables with pressure information. If anyone can clarify which one is correct it would be appreciated? My assumption is the table with the model years is probably the better one as MB would have been experimenting with Vacuum Modulators and modulator pressure to improve shift quality.

722.112 - 3.8 bar 55.0 psi
 722.117 - 3.0 43.5
 722.118 - 3.0 43.5
 722.120 - 2.8 40.5
 722.122 - 3.8 55.0

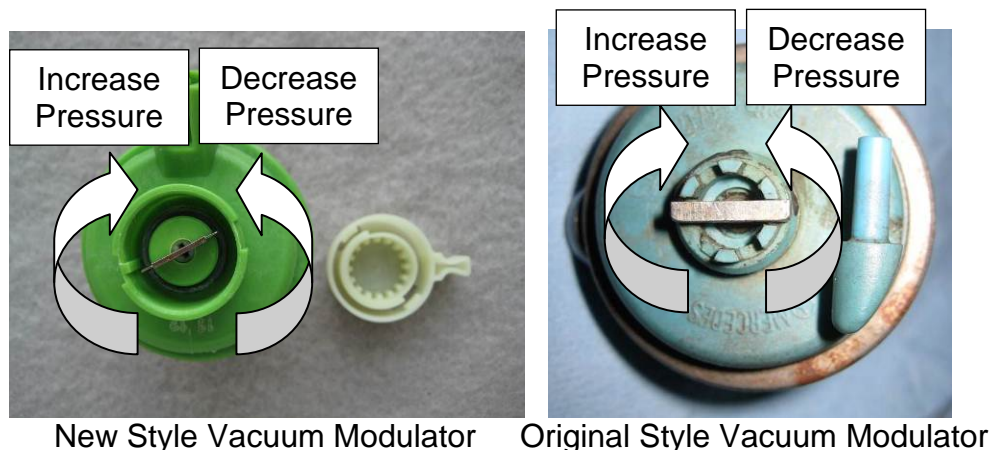
1981 -
 722.300 - 2.4 bar 35.0 psi
 722.301 - 3.5 51.0
 722.303 - 2.9 42.0
 722.304 - 3.5 51.0

1982 -
 722.300 - 2.8 bar 40.5 psi
 722.303 - 2.9 42.0
 722.309 - 2.8 40.5
 722.310 - 3.7 54.0
 722.312 - 3.7 54.0
 722.315 - 2.9 42.0

1983 -
(does anyone have this info for this year as well as 1984 and 1985 ??)

Vacuum Modulator Pressure Specifications								
722.3 Models Versions	Vacuum Modulator Colour	Set @ 50 kph / 30 mph		722.4 Models Versions	Vacuum Modulator Colour	Set @ 50 kph / 30 mph		Note
		Bar	PSI			Bar	PSI	
.301	Green	3.5	51	.400	Green	3.1	46	
.303	Green	2.9	42	.403	Green	3.0	44	
.304	Red	3.5	51	.408	Green	3.9	57	
.309	Red	2.8	41	.409	Red	3.3	48	
.310	Red	3.9	57	.410	Green	3.5	51	
.311	White	3.3	48	.413	Red	3.2	47	
.312	Red	3.7	54	.414	Brown	2.8	41	
.313	Red	4.0	58	.416	Black	3.0	44	
.315	Green	2.9	42	.418	Red	3.2	47	To serial # 813648
.317	Black	3.1	46		Black	3.2	47	From serial # 813649
.320	Black	3.9	57					
.321	Black	3.1	46					
.323	Red	4.0	58					
.324	Green	3.6	52					
.342	Black	4.0	58					
.350	Black	3.8	55					
.351	Black	4.0	58					
.352	Red	3.8	55					
.353	Black	4.1	59					
.355	Black	3.8	55					
.358	Black	4.0	58					
.359	Red	3.8	55					
.361	Red	3.8	55					

In the picture below you will see that once the plastic or Neoprene cap is removed a small silver bar is visible. This is actually T shaped and the horizontal portion of the T can be pulled out slightly and turned **clockwise to increase pressure** or **counter clockwise to decrease**. Using a pair of needle nose pliers you can VERY GENTLY pull on the silver bar just enough to pull it clear of the housing surface. Then either use the T handle to adjust or a small slot head screwdriver (the T handle can be removed to use a screwdriver). Think of the adjustment as a fine screw thread, you may have to make more than one full turn in either direction. In the new style Vacuum Modulator the cap in the right of the picture acts as the lock for the T handle. In the old style the T handle is pushed down to lock it between the notches. The black Neoprene cap keeps everything in place.



To adjust modulator pressure the engine and transmission must be at operating temperature. After it has warmed up, shut the engine off and slide under the driver's side of the car. Just behind the Vacuum Modulator you will see a 12 mm bolt. This is the modulator pressure test port. In the picture below the cover and T handle have been removed from the Vacuum Modulator and I have connected a pressure gauge to the pressure port. Note this fitting is 8 x 1.0 mm thread which is an uncommon fine thread (usually it is 1.25 or 1.5mm pitch). If you have access to a recycling yard with a 300SD, grab the banjo fitting and bolt from the ALDA – this is an 8 x 1.0 mm fitting and is ideal for the oil pressure gauge connection. For those of you with access to Harbor Freight Tools, they have an oil pressure test kit that includes an 8 x 1.0 mm fitting.

<http://www.harborfreight.com/engine-oil-pressure-test-kit-98949.html>



Start the car and quickly check for leaks at the fitting to the transmission (picture previous page) and at the pressure gauge.

NOTE – engine must be running and the vacuum line to the Vacuum Modulator disconnected.

As mentioned, use the T handle or a small slot screw driver to adjust the modulator pressure. Adjust the pressure to the specification for your transmission. In my case this is 2.9 bar or 42 psi. (The picture on the left shows 2908 mbar = 2.9 bar).



With the vacuum in the correct range adjusting the Vacuum Modulator allows you to fine tune the 1 – 2 shift and to a certain extent, the 2 – 3 shift.

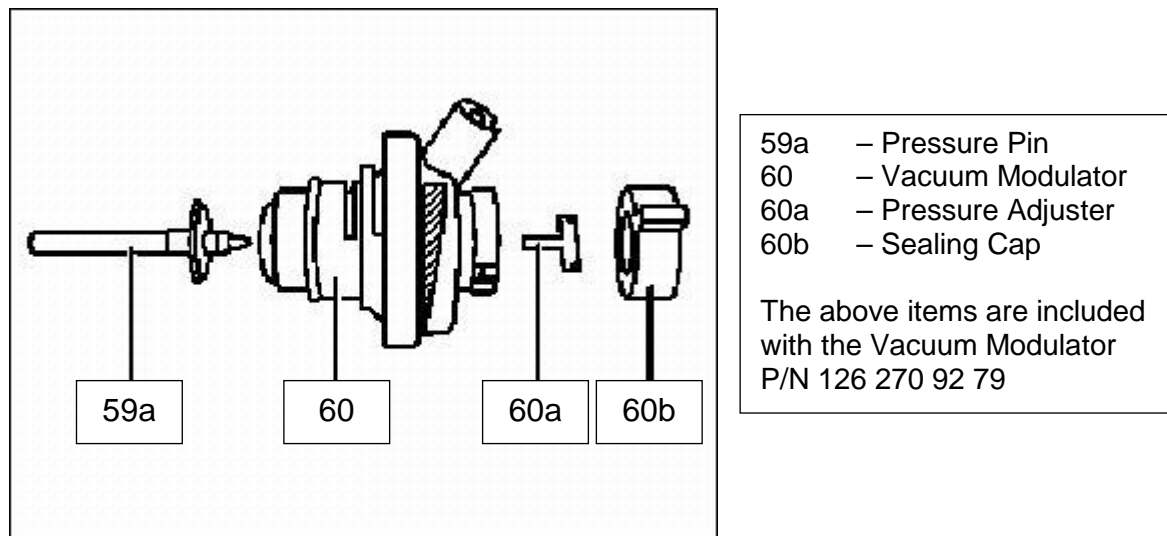
IMPORTANT – MB states that this pressure adjustment must be done at 50 kph (30 mph). I have run tests at idle and at 50 kph and there is NO difference in pressure. My recommendation is to adjust at idle in the comfort of your garage or driveway. Also, doing this at 50 kph is inconvenient and hard on the transmission – downshifts to second and first when coming to a stop are hard (almost painful), due to the disconnected vacuum to the modulator.

Step 10 – Fine Tuning

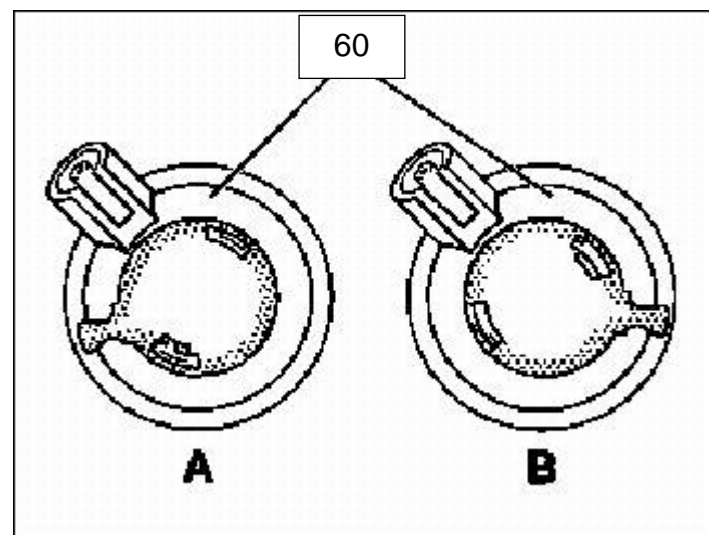
In my case I had adjusted the VCV vacuum to 145 mbar (4.3”), and the modulator pressure to 2.9 bar (42 psi). However, the shifting was still a little firmer than I would have liked. Increasing the VCV vacuum to 160 mbar (4.7”) (upper limit recommended by MB), brought some improvement. Then I discovered the bulletin regarding the VCV linkage adjustment specific to my transmission (118mm – see page 19). This made a significant difference and the shifting is now much smoother. If you have installed the new style Vacuum Modulator it allows a slight lowering of the pressure if you need to soften the shifting further. (See next page)

New Style Vacuum Modulator Installation

As of 08/92 all 722.3 and 722.5 transmissions have been manufactured with an upgraded Vacuum Modulator.



The plastic Sealing Cap (60b), for this Vacuum Modulator (60), is a change from the previous Neoprene cap. The T shaped Pressure Adjuster (60a) design is the same as previous however with the Sealing Cap (60b) installed the adjustment range is now limited to a pressure reduction of 0.2 bar (~2.9 psi).



A – Initial modulator pressure setting.

B – Modulator pressure reduced by ~0.2 bar (~2.9 psi).

The revised Pressure Pin (59a) **MUST** be used with this Vacuum Modulator.

On my 'to do list' is to replace the B1 and B2 piston assemblies with the new version. I have already replaced the B1 and K1 valve assemblies – ran out of time to do the pistons as these require additional work. A simple homemade tool for the B1 piston, removal of the first section of the exhaust pipe and lowering of the transmission (to gain extra clearance). I hope to get at this within the next few months. I will update this document when I have completed the work.

Still not happy with the quality of the shifting? That means you may have to move on to components in the transmission itself. The table below highlights which component is responsible for what action. These are all known weak points in the MB 722.3 and 722.4 transmissions.

Mercedes 722.3 and 722.4 Gearbox Gear / Component Relationship						
Gear	Component					Gear Reduction
	B1	B2	B3	K1	K2	
1		X			(X)	3.68
2	X	X				2.41
3		X		X		1.44
4				X	X	1.00
R			X		(X)	5.14
(X) = K2 bridges the one-way clutch during deceleration (coasting)						

Mercedes Service Information 1985 Models – Vacuum Adjustment Procedure

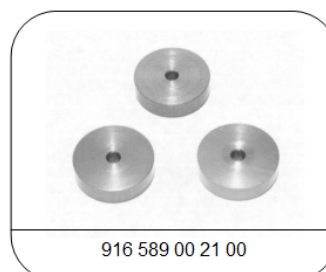
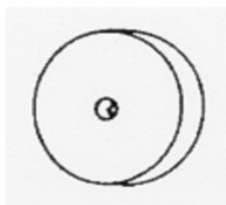
Historic	916 589 00 21 00 Adjusting Rollers (3 pcs)	07 / A	MY1983
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ENGINE 616, 617.91, 617.95

Use/specification:

Adjusting roller set for vacuum test on vacuum control valve.

(Set = 3 rollers).



(Ref: AST)

AT-01.01

Vacuum Control Valve Test

B. Models 126.1 and 123.1, Model Year 1985

722.303

722.315

722.416

Test Values

Transmission	Engine	Vacuum mbar (in Hg.)
722.303		
722.315	617.95	120–160 (3.5–4.7)
722.416		

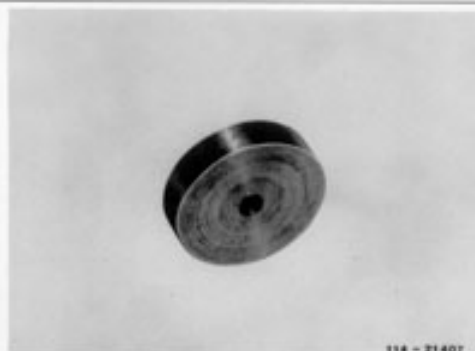
Special Tools

Vacuum/pressure tester
0–1000 mbar (0–29.5 in. Hg.)



201 589 13 21 00

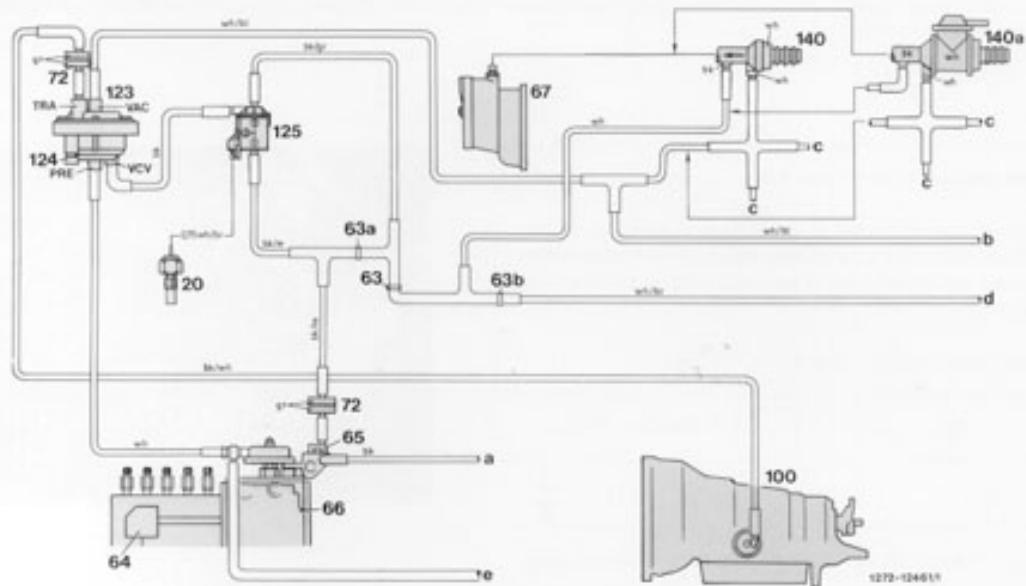
Adjusting roller for checking
vacuum on the vacuum
control valve



916 589 00 21 00

114 - 21407

Functional diagram of vacuum line routing



- 20 Temperature switch, 50°C (122°F)
- 63 Orifice 0.6 mm (natural)
- 63a Orifice 0.6 mm (natural)
- 63b Orifice 0.5 mm
- 64 Fuel rack position sensor
- 65 Vacuum control valve
- 66 Injection pump
- 67 Vacuum pump
- 72 Vacuum damper
- 100 Automatic transmission
- 123 Vacuum amplifier
- 124 Adjusting screw
- 125 Switchover valve, vacuum amplifier
- 140 Check valve, model 123
- 140a Check valve, model 126
- a Vent line to passenger compartment
- b Switchover valve, vacuum converter
- c Remaining consumers
- d Vacuum converter
- e Switchover valve, boost pressure aneroid

Color Code

- bk = black
- bl = blue
- br = brown
- gr = green
- re = red
- wh = white

- PRE = Boost pressure
- TRA = Transmission
- VAC = Vacuum
- VCV = Vacuum control valve

Test conditions:

Engine at idle and operating temperature. Test vacuum lines according to function diagram. Check orifices 63 and 63a for blockage. Modulating pressure correct.

Test**Testing vacuum control valve (65)**

Disconnect connecting rod (5) at ball head. Connect tester with Y-distributor behind vacuum damper. Place adjusting roller (arrow) on vacuum control valve. Move level so it rests against the roller (arrow).

Nominal value: 140 ± 20 mbar (3.5–4.7 in. Hg.)

OK

Not OK

Adjust vacuum control valve, replace if necessary.

Testing temperature switch, 50°C (122°F) (20)

At coolant temperatures above 50°C (122°F) the ground connection for the switchover valve (125) must be disconnected by the temperature switch.

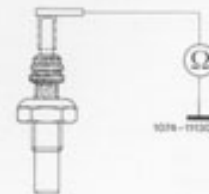
Connect ohmmeter to temperature switch and ground.

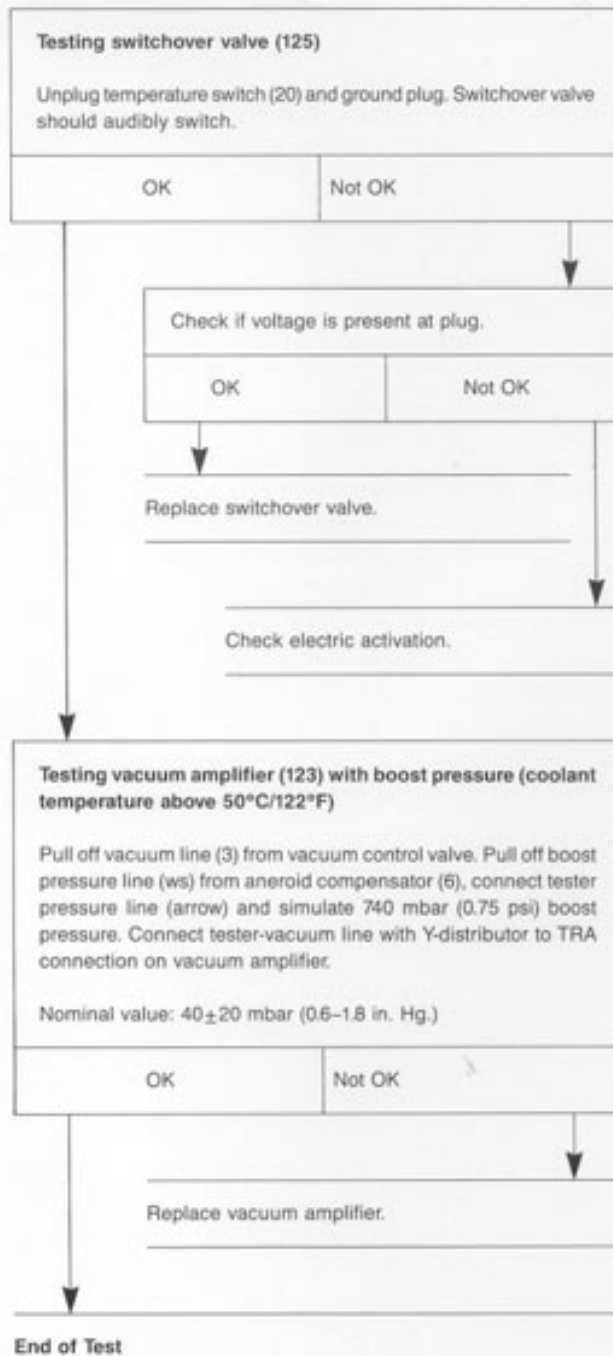
Nominal value: ∞ ohm

OK

Not OK

Replace temperature switch.





Update (January 2014)

I can't believe it has been just over a year since I performed the initial work on the gearbox. Although I don't drive the car much (~5,000km/3,000m per year), the shifting has improved but not to the level I would like it.

Over the past few months I've adjusted the valve clearances, checked all the throttle linkage dimensions, replaced the injector nozzles, adjusted the opening pressure and set the injection pump timing. None of this made any noticeable difference in the shift quality – at the very least it eliminated these as potential influence factors.

As mentioned on page 24, I had already replaced the B1 and K1 valve assemblies but the B1 and B2 Servos were still on the 'to do list'. Due to a medical challenge and the lack of access to a hoist I arranged for an independent MB garage to do the work. It was a difficult decision as I never let anyone touch my car but it worked out well. The work was done very professionally and for less money than I expected. Part of the work included replacing the transmission oil cooler flex lines (at the radiator), and the kick down solenoid (new style). These last two items were replaced as precautionary and not due to wear or potential failure.

I must say I was disappointed when I picked the car up. I probably expected a big change sadly it wasn't to be. So I went back through all my notes and bold text found on page 18 jumped out at me;

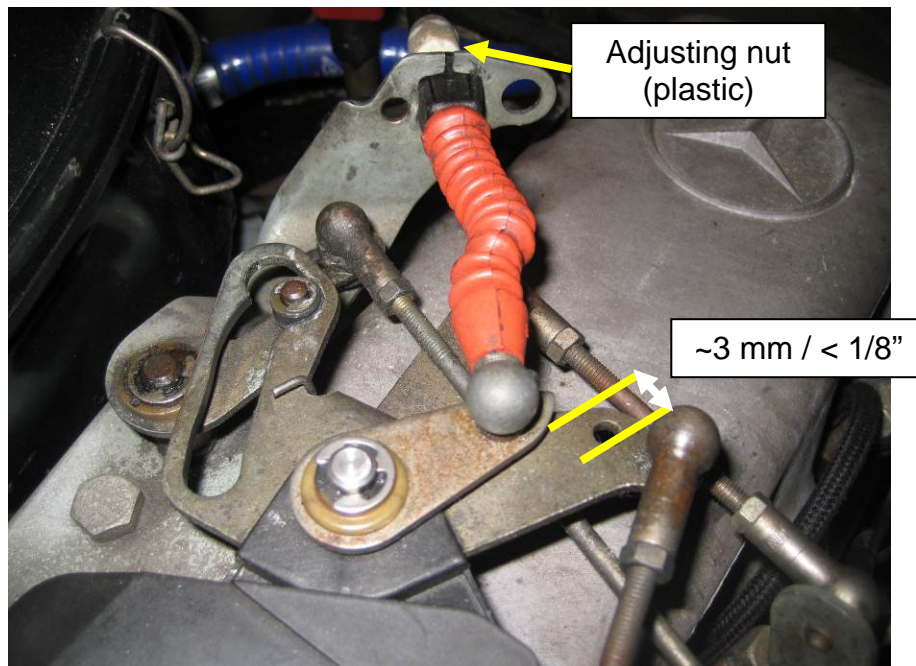
Hard Shifts – adjust the VCV vacuum to the upper limit.

Slipping Shifts – adjust the VCV vacuum to the lower limit.

Rather than disturb all my adjustments (see pages 16, 17 and 18) I decided to see what could be accomplished by increasing the vacuum to the Vacuum Control Valve. All my adjustments were based on the Red vacuum restrictor (1.1 mm – see page 12).

Before I tried the modified vacuum restrictors I decided to change the shift points. The Bowden cable between the throttle linkage and the transmission is typically adjusted with almost no play ~0.5 mm (0.20"), so I increased this to ~3 mm (slightly less than 1/8"). This causes the gearbox to shift earlier which works well as the engine has more than enough torque to overcome this.

NOTE – adjusting this Bowden cable can be touchy. Make sure you are adjusting the slack in the cable. The tension of the internal gearbox linkage is very light so it is easy to misadjust the linkage. Double and triple check the play.

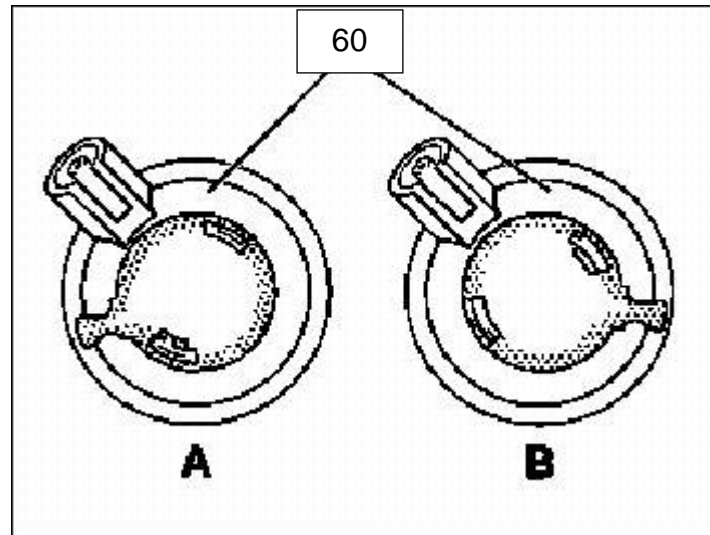


Surprisingly the car shifted smoother as a result of the slightly earlier shift points. Acceleration felt smoother – Diesel torque is a wonderful thing. :-)

So I experimented with moving from the Red restrictor (1.1 mm) to the Blue restrictor (1.0 mm). Shifts became harsher so I tried the Yellow one (2.0 mm). This had the opposite effect, shifts were very soft, in fact the 3-4 shift was like someone slipping the clutch during a gear change. So I knew I was going in the right direction, unfortunately I had no restrictors between 1.1 and 2.0 mm. So I found a couple 2.0 mm ones, filled them with Epoxy and then drilled one out to 1.2 mm and the other to 1.3 mm.

Inserting the 1.2 mm resulted in noticeably smoother shifts. I've been test driving the car a lot to ensure I'm not imagining things. Next step is to try the 1.3 mm restrictor.

If you find the shifts a touch to firm or soft there is a minor adjustment that can be done via the Vacuum Modulator. The new style allows one to adjust the pressure by 0.2 bar / 2.9 psi.



A – Initial modulator pressure setting.

B – Modulator pressure reduced by ~0.2 bar (~2.9 psi).

Update (October 2014)

As mentioned in the previous update the transmission now has had the following changes;

1. B1 Servo (self-adjusting type with new style servo guide)
2. B1 Valve Assembly
3. B2 Servo
4. B2 Valve Assembly
5. K1 Valve Assembly
6. Kick Down Solenoid
7. Vacuum Modulator
8. Filter and MB transmission fluid.

The results of all these changes were a noticeable improvement in shift quality but still not meeting my expectations. Of course, how do you define 'one's expectations'? In general terms the 1 – 2 shift is acceptable (soft but noticeable), 2 – 3 is a little too firm and 3 – 4 is ideal (almost unnoticeable). Under full throttle acceleration there is slight flaring on the most of the gear changes but this is due to the slight decrease in modulator pressure I've set the vacuum modulator at. I set the adjuster to the middle of the range so ~2.8 bar / 40.5 psi instead of the specification of 2.9 bar / 42 psi. Returning the pressure to factory spec would reduce/eliminate the flare but would create firmer shifts which I did not want. Hence the compromise setting.

One other challenge is downshifting when coming to a stop. If you are not aware these transmissions do a 4 – 3 downshift as you are coming to a stop (almost unnoticeable), followed quite quickly by a 3 – 2 shift just before you come to a stop. On mine this 3 – 2 shift is quite noticeable and accompanied by a slight mechanical clunk from the rear axle. The car will now be idling in second gear and will downshift to first as soon as you move the throttle pedal. This 2 – 1 downshift accounts for what appears to be a split second hesitation in throttle response when moving away from a stop.

Since my 2 – 3 shift is a little too firm and the 3 – 2 is much too firm I am now focusing my attention in this area.

I found a dramatic improvement in the 3 – 2 downshift quality when I correctly adjusted the idle speed. I had decided to replace the electrolytic capacitors in the tachometer (along with the speedometer and clock). The tachometer immediately started to read ~200 RPM lower which, after a highway run confirmed my previous suspicions about accuracy. What the tach displayed at highway speeds never matched my mathematical calculations as to what it should show (it was always reading 200 to 300 RPM too high).

Previously I had been setting idle speed by feel/ear as I did not trust the tach. I discovered that it was set too high so I adjusted it to spec (600 – 700 RPM). This resulted in a noticeable improvement (much softer), 3 – 2 downshift.

At the moment I'm trying to decide how to approach the situation. The car is currently off the road due to the Dutch road tax situation – based on weight with no consideration for 'old timer' classification or usage (less than 5K km/year). I take issue with paying 0.35 Euro per kilometer for a hobby vehicle! So I have the luxury of taking my time to find a solution.

I have a Superior Shift Kit for this transmission but it is designed to address flaring and soft shifts but not firm shifts. :-(

So I need to find a really knowledgeable 722 series transmission expert to discuss this with. The hunt is on.