

**W220 2003 Update S500 LWB
Pneumatic System Equipment (PSE) Pump
Version 2
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1. Introduction

I would like to share my research on the Pneumatic System Equipment (PSE) Pump.

When I purchased my W220 2003 Update S500 LWB I did not think it had Soft/Self Close Doors. After I removed the door panels to have my windows tinted, I spotted the vacuum lines and the door actuators.

A bit of trawling on the BenzWorld Forum and a new thread titled “Does my S500 have soft/self closing doors?” suggested that this feature was standard on all S500’s.

My Boot/Trunk Self Closing Feature and Retracting Handle worked as did the Door Locks. The other PSE Pump related features were all a mystery to me. I then believed I had faulty Soft/Self Close Doors.

Turns out my S500 **does not have** Soft/Self Close Doors.

2. Version 1

I found a lot of the information on the PSE Pump on the various Forums but there was very little for the W220 S-Class. My way of unravelling the information was to list each piece as it was discovered, often by chance, in an orderly fashion, and to then condense it down to as many basic facts as possible.

Hence this document was formed.

I then performed a series of tests in an attempt to reverse engineer, ie discover by testing and analysis, what the various PSE Pump functions were.

I know that the information in this document is incomplete and there are bound to be many errors so please post any changes, additions and corrections etc and I will edit and repost. That way the document will hopefully evolve into a definitive one for the W220 S-Class Pneumatic System Equipment (PSE) Pump.

Note extra information is needed wherever there is:

TBD means 'To Be Determined'.

TBC means 'To Be Confirmed'.

?? means 'Don't Know'.

3. Version 2

After finding I did not have Soft/Self Close Doors, Version 1 was rewritten and edited slightly as Version 2 and may still be of use to other MB enthusiasts.

4. Acknowledgement

Brett Allison has written an excellent article on the W140 1997 S600 titled "Getting to know your Closing Assist Pump: Function, Tips, and Fixes".

Reference: http://v12uberalles.com/Closing_Assist_Pump.htm

Thanks also to : mjd, Skylaw, tower, praseto, EUROPEANSPORT1, renzo54, and Ralmeida.

5. Part Number

W220 2003 Update S500 OEM PSE Part Number:

>PP-TS20<

MB 220 800 10 48 [08]

BOSCH 0 132 006 381

(944)

0022 03190 10 0315 1 001 Made in France

One Post said:

220 800 02 48 is the oldest part number, then keeps going up to

220 800 03 48,

220 800 05 48,

220 800 10 48 etc....

but its all the same pump so they will all work...

I have seen a For Sale Site quoting 220 800 11 48.

Another Post said: "Only the newest pump will work for sure. The difference is in the electronics basically. Older pumps for example do not support the remote trunk closure option."

6. Description

The W220 PSE Pump is very clever, and similar to the W140 Close Assist Pump as described by Brett Allison in the Reference, in that it can **both** blow (create +ve pressure) and suck (create -ve pressure or vacuum).

Quote:

The pump does the closing of the doors and trunk with pressure. It pressurizes the lines causing the extension of pistons in actuators, which in turn move levers in the various latches, which pull the doors or trunk closed

and

Quote:

After pressurizing the line and doing the auto-closing, the pump then pulls a vacuum on the line, presumably to ensure retraction of the actuator piston.

The negative pressure (vacuum) pulled by the W220 PSE Pump may ensure retraction of various actuators TBD but it also performs function in it's own right, such as retracting the Boot/Trunk Handle.

My W220 2003 Update S500 LWB Pneumatic System Equipment (PSE) Pump performs the following functions:

- Locking/Unlocking of Doors,
- ~~Soft/Self Close Function for Doors,~~
- Inflation of Lumbar Support Bladders,
- Operation of Fuel Filler Flap Lock,
- Extension and retraction of the Boot/Trunk Handle,
- Releases the Child Safety Lock on Rear Doors in an emergency,
- Operation of the Boot/Trunk Catch for auto opening and closing, and
- Another function (KAF) ?? TBD (possibly a vent for the Pump or a means of providing vacuum to the vacuum reservoir when the car is not running).

7. Resetting Pneumatic System Equipment (PSE) Pump

It may also be necessary to reset the Pneumatic System Equipment (PSE) Pump every now and then. This can quite often restore functionality as the electronics has memory and will prohibit some functions if they do not work properly for some reason. Resetting is accomplished by either pulling the 20 amp fuse under the Rear Right Seat or disconnecting the main connector to the Pump for thirty seconds.

8. Location

The Pneumatic System Equipment (PSE) Pump is located in the Boot/Trunk in a foam lined compartment in the left rear fender well, above the GPS Navigation Unit and is hidden from view by the Boot/Trunk Liner.

9. Accessing

Remove the plastic panel at the rear most edge of the Boot/Trunk opening.

Remove the left Boot/Trunk liner.

It is not necessary to touch either the GPS Navigation or the CD Player.

It helps to remove the Boot/Trunk Lining under the back window after also removing the Battery Cover and the right Boot/Trunk liner but it is not absolutely necessary.

Figure 1 shows the Pneumatic System Equipment (PSE) Pump once it is removed from it's sound proof housing and sitting on the Boot/Trunk floor with the air lines still attached. The Air Lines are connected to the pump by snap-on connectors.

Warning: DO NOT remove any of the Air Lines before ANNOTATING them.
The PSE Pump Ports are marked but the Air Lines are not.



Figure 1 MB OEM Pneumatic System Equipment (PSE) Pump in Boot/Trunk

10. Summary of Designations and Functions

The W220 S-Class Pneumatic System Equipment (PSE) Pump has each Port designated with Capital Letters:

SK, KAF, HECK, TD, Blank
 FoR, FoL, BFT, FT and MKL.

See Figure 2 PSE Pump Air Line Port Designations.



Figure 2 PSE Pump Air Line Port Designations

The following Table shows the Connector Colour, Air Line Colour, Designation and Function for each PSE Pump Port for a W220 2003 Update S500L

Pneumatic System Equipment (PSE) Pump Port Connector and Air Line Colour	Designation	Function in W220 2003 Update S500L
Black connector/large yellow air line	SK	Rear Seat Head Restraints
Grey connector /white air line	KAF	Unknown ?? TBD (possibly a vent for the

Pneumatic System Equipment (PSE) Pump Port Connector and Air Line Colour	Designation	Function in W220 2003 Update S500L
		Pump or a means of providing vacuum to the vacuum reservoir when the car is not running).
Grey connector /yellow air line	HECK	Boot/Trunk Catch Actuator and Handle Retractor
Grey connector /yellow air line	TD	Fuel Filler Flap Lock
Not Used		
Grey connector /yellow air line	FoR	Rear Right Door Lock, Child Safety Door Lock Release and Soft/Self Close
Grey connector /yellow air line	FoL	Rear Left Door Lock , Child Safety Door Lock Release and Soft/Self Close
Grey connector /yellow air line	BFT	Front Left Door Lock and Soft/Self Close
Grey connector /yellow air line	FT	Front Right Door Lock and Soft/Self Close
Grey connector /grey air line	MKL	Multi Contour Backrest (Lumbar Support Bladder all four seats)

11. Baseline Pressure Tests

In order to establish a base line performance the following pressure tests were conducted and the results recorded as each feature was run through it's full range of operation.

The pressure readings were obtained with a home made dual gauge set, comprising a Vacuum Gauge and a Pressure Gauge teed together, and then this dual gauge teed into each air line in turn.

The appropriate function was then operated as per normal whilst observing the dual gauges. By necessity each air line had to be disconnected and then reconnected with the tee piece in line for each test. This may have some impact on the results as the Pump is very aware that the line has been disconnected. According to Brett Allison in the reference, the W140 Close Assist Pump will cease to control a particular air line if it detects a fault several times in a row. This condition is corrected by unplugging the large connector on the PSE Pump, waiting a minute or so and reconnecting, which apparently resets the electronics.

PSE Pump Port Designation	Function in W220 2003 Update S500 LWB	Pressure Tests (Note Non-Existent Soft Close Function on All Doors)
SK	Rear Seat Head Restraints	Switch Head Restraints up, get -ve pressure (4" Hg vacuum), the head restraints go up, then returns to atmospheric pressure. Switch Head Restraints down, no change in pressure (atmospheric), Head Restraints go down.
KAF	Unknown ??	Unknown ??
HECK	Boot/Trunk Catch Actuator and Handle Retractor	Close Boot/Trunk with Key Remote, get +ve pressure (110KPa or 16psi), Boot/Trunk Catch Actuator pulls boot closed, then -ve pressure (19" Hg vacuum), which retracts Handle, then returns to atmospheric pressure. Open Boot/Trunk with Key Remote, get +ve pressure (110KPa or 16psi), which extends Handle, and unlocks Boot/Trunk, releasing lid which fully opens, then returns to atmospheric pressure.
TD	Fuel Filler Flap Lock	Lock car using Remote Key, get +ve pressure (28Kpa or 4psi), which moves pin out to lock Fuel Filler Flap, then returns to atmospheric pressure. Unlock car using Remote Key, get -ve pressure (8" Hg vacuum), which retracts pin to unlock Fuel Filler Flap, then returns to atmospheric pressure.

PSE Pump Port Designation	Function in W220 2003 Update S500 LWB	Pressure Tests (Note Non-Existent Soft Close Function on All Doors)
Not Used		
FoR	Rear Right Door	Lock car using Remote Key, get +ve pressure (14Kpa or 2psi), which pulls Rear Right Door Lock Button down, then returns to atmospheric pressure. Unlock car using Remote Key, get -ve pressure (9”Hg vacuum), which moves Rear Right Door Lock Button up, then returns to atmospheric pressure. Soft Close Feature (Where Fitted TBD)
FoL	Rear Left Door	Lock car using Remote Key, get +ve pressure (24Kpa or 3.5psi), which pulls Rear Left Door Lock Button down, then returns to atmospheric pressure. Unlock car using Remote Key, get -ve pressure (9”Hg vacuum) which moves Rear Left Door Lock Button up, then returns to atmospheric pressure. Soft Close Feature (Where Fitted TBD)
BFT	Front Left Door	Lock car using Remote Key, get +ve pressure (24Kpa or 3.5psi), which pulls Front Left Door Lock Button down, then returns to atmospheric pressure. Unlock car using Remote Key, get -ve pressure (9”Hg vacuum), which moves Front Left Door Lock Button up, then returns to atmospheric pressure. Soft Close Feature (Where Fitted TBD)
FT	Front Right Door	Lock car using Remote Key, get +ve pressure (21Kpa or 3psi), which pulls Front Right Door Lock Button down, then returns to atmospheric pressure. Unlock car using Remote Key, get -ve pressure (9”Hg vacuum), which moves Front Right Door Lock Button up, then returns to atmospheric pressure. Soft Close Feature (Where Fitted TBD)
MKL	Multi Contour Backrest (Lumbar Support Bladder all seats)	When the MKL Air Line is connected it always has +ve pressure (55Kpa or 8psi). If the MKL Air Line is disconnected each Lumbar Support Bladder remains inflated until it’s Adjustment Control on the edge of the seat is returned to ‘0’. You can hear the air escaping from the Adjustment Control.

12. Further Pressure Tests on FoL

An attempt was made to establish why the Soft/Self Close Feature will not work on all four doors on my car even though other features (HECK Boot/Trunk Catch Actuator and Handle Retractor and TD Fuel Filler Flap Lock) requiring high vacuum and pressure work fine. (Later note for Version 2; My S500 does not have the Soft/Self Close Feature.)

12.1. Test 1.

During my Base Line Pressure Tests in the table above the PSE Pump on Port FoR, when locking the car using Remote Key, produced +ve pressure (14KPa or 2psi) which pulls Rear Right Door Lock Button down, then returns to atmospheric pressure.

12.2. Test 2.

I then tried plugging the FoR Air Line with my dual Vacuum and Pressure Gauge teed in (thus isolating any leaks in the line itself or the actuator mechanism in the door) and locking the car using Remote Key. I

observed the same +ve pressure (14Kpa or 2psi) which implies to me that there are no significant leaks in the PSE Pump.

12.3. Test 3.

I then tried applying 69Kpa or 10psi to the FoL Air Line using my Work Shop Air Compressor with it's Pressure Regulator appropriately set and with the Rear Right Door closed on the first latch. This did not make the Soft Close Feature operate and there was no significant air leaking anywhere that I could hear. The Rear Right Door Lock Button was pulled down as before.

12.4. Test 4.

I repeated Test 3 but with 138Kpa or 20psi and got exactly the same result.

12.5. Version 1 Conclusion

The results of these tests on the FoL Port and Air Line makes me think that the 14Kpa or 2psi as delivered by the PSE Pump is very low considering that it easily delivered 110KPa or 16psi for the SK Port Boot/Trunk Actuator. I will thus dismantle the pump and see if the pump head or other parts are contaminated with the fine black powder as reported by other Posters such as GotBenz.

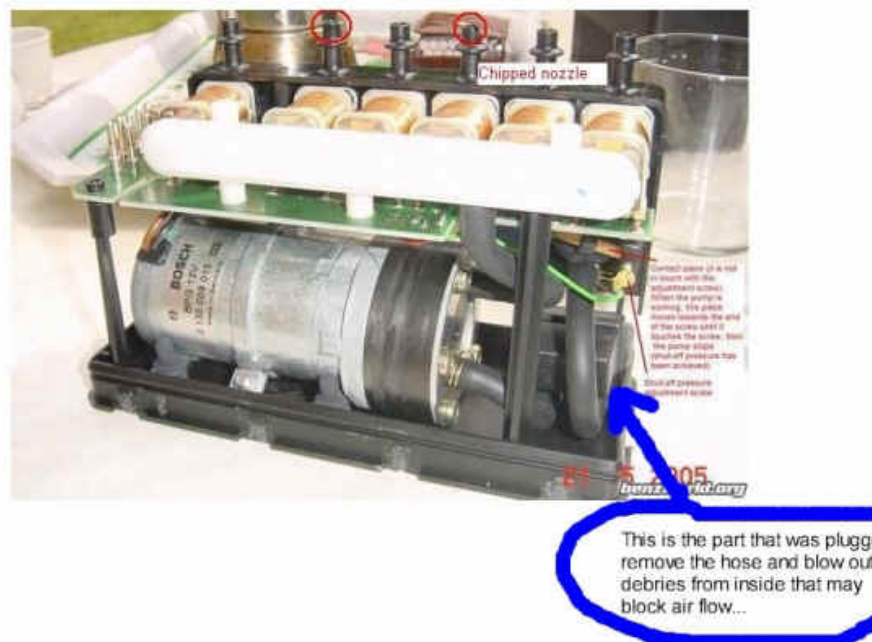


Figure 3 PSE Pump Part That Gets Blocked (Reference GotBenz)

Alternatively, because the door Soft/Self Close Actuators did not operate when I applied 138Kpa or 20psi I suspect they may be seized or broken and will have to pull them as well. According to Brett Allison in Reference the W140 Closing Assist Pump has micro switches in the actuators which initiate the pump closing sequence.

13. Details for Version 2

I am now a very disappointed MB owner as my version of the W220 (2003 Update S500 LWB) as delivered in Australia, **does not have** the Soft/Self Close Doors.

It does have the soft/close Trunk/Boot, pneumatically operated Door Lock Buttons, Fuel Filler Flap Lock, plus Lumbar Support in the backs of all seats, plus a safety feature re the Child Lock on the Rear Doors.

This is what made me think that I did have Soft/Self Close Doors.



Figure 4 View of My Actuator in Rear Left Door

From the outside the Actuators all look the same. (The actuator in the next Photo on the left is actually from a Rear Right Door copied from a BenzWorld post by Skylaw, but has been reversed for comparison purposes.)



Figure 5 Actuator on Left has Soft/Self Close Feature, Actuator on Right Doesn't

13.1. Removal of Actuator

Other Posters have explained how to remove the Door Panel, Door Handle and the Actuator, so I will just add my experience with the difficult areas.

13.1.1. Remove Door Handle and Interior Mechanism



Figure 6 Remove this Plug to gain Access to the Rear Door Handle Screw

You will need a torch/flashlight to be able to see the screw.



Figure 7 View of Rear Door Handle Screw

Even though the screw is a Torx type I used a long Allen key to undo. The next Photograph shows a close-up of the screw with the Door Handle Mechanism out of the vehicle.



Figure 8 Close-up of Rear Door Handle Screw

The Rear Door Handle was easily removed in two parts.



Figure 9 First Part of Rear Door Handle Removed



Figure 10 Second Part of Rear Door Handle Removed

Undo the two Torx screws to release the interior part of the Rear Door Handle Mechanism.



Figure 11 Two Torx Screws Removed.

Reach inside and release the white plastic clip holding the lever which goes between the Door Handle and the Actuator. It just requires a firm push towards the outside of the vehicle using your thumb.

This is what the clip looks like.

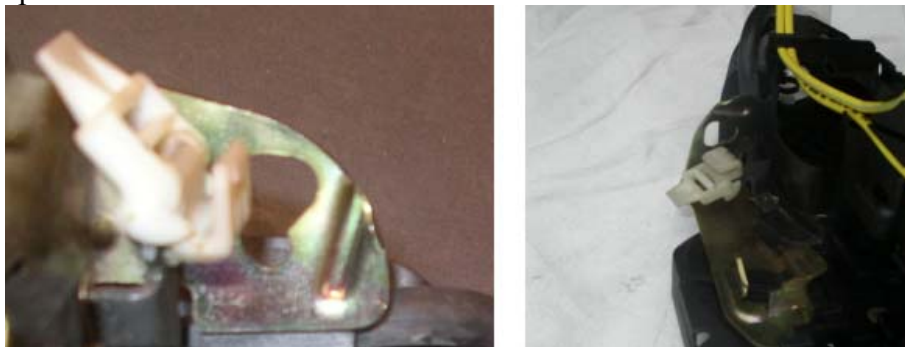


Figure 12 Clip for Door Handle to Actuator Lever

Another tricky bracket was this white plastic one which goes between the Rear Door Handle Mechanism and the Door Inside Panel.



Figure 13 White 'Y' Plastic Bracket

The black screw goes through the small hole in the centre of the next photograph.



Figure 14 Mounting Hole for White 'Y' Bracket

This is another view of the white bracket and where it goes on the Door Handle Mechanism. When I took this out I didn't take much notice of where it went and couldn't figure out how it went back together so had to dismantle the other side door to find out.



Figure 15 White 'Y' Bracket Mounted on the Door Handle Mechanism

The Door Handle Mechanism can now be jiggled out through the large hole in the door panel. I found it was necessary to remove the Door Handle Mechanism before removing the Door Actuator.



Figure 16 Rear Left Door Handle Mechanism

13.1.2. Remove Door Actuator

Undo three Torx screws and the Door Actuator is almost ready to come out. I decided to cut the yellow vacuum line rather than try to remove it from the barbed connectors. It was easily joined again at the end using a bit of rubber hose held in place with plastic ties.



Figure 17 Cut Yellow Vacuum Line

The Rear Door Actuator can now be jiggled out through the large hole in the door panel.



Figure 18 Rear Left Door Actuator

13.2. Tests on Door Actuator and Vacuum Line

I plugged the cut vacuum line at the actuator end.



Figure 19 Plugged Vacuum Line

Then using a MityVac hand operated vacuum pump at the PSE Pump end I was easily able to pull an excellent vacuum of 27”Hg which held with no leaks at all.

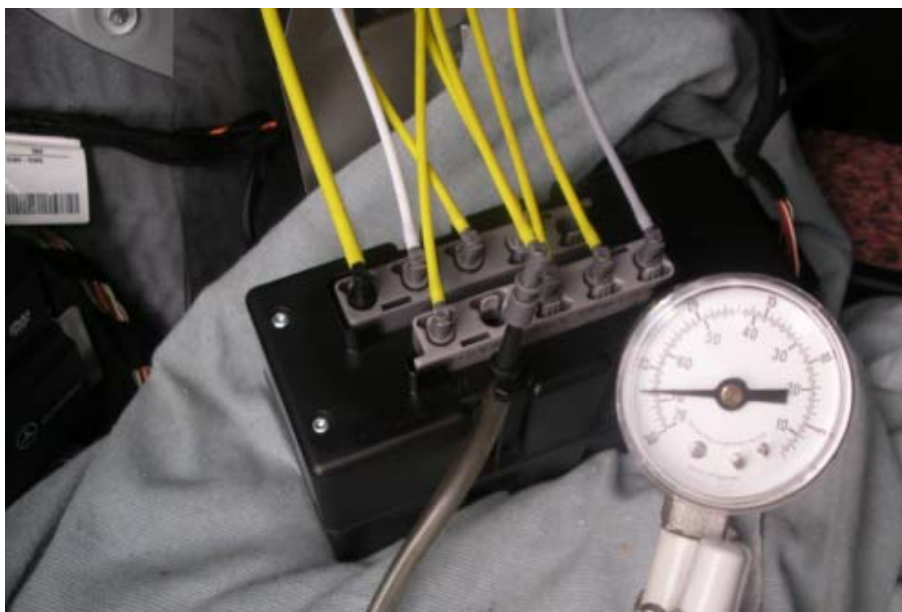


Figure 20 MityVac Hand Operated Vacuum Pump at the PSE Pump End

It was when I tested the Actuator on the Bench that I discovered there was no mechanism for pulling the doors closed.

Obviously the Soft/Self Close Diaphragm is the largest one as it would generate the most force due to its large diameter piston/diaphragm, and in my car has only very basic internals (it is basically just a tee piece). In the next Photograph on the right, you can see the white housing is basically empty.

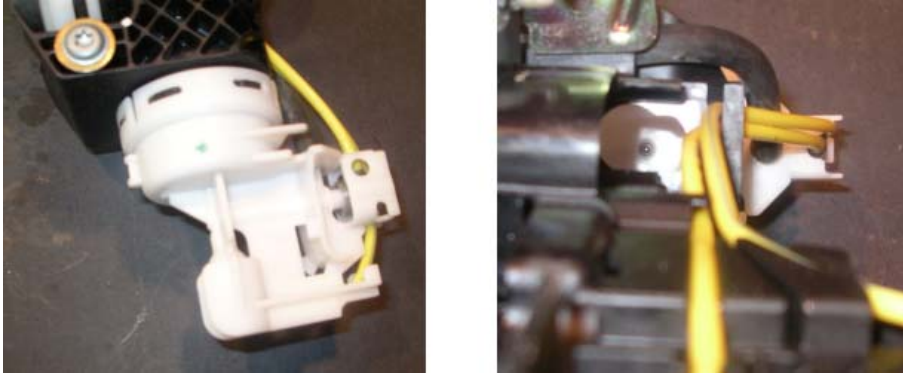


Figure 21 Were the Soft/Self Close Diaphragm Should Be

14. Function of Pistons/Diaphragms

What I was able to do was to deduce the function of each of the three Piston/Diaphragms in the Rear Door Actuator Mechanism.

14.1. Door Lock Button Piston/Diaphragm

The following Photograph shows the Rear Door Lock Button Piston/Diaphragm Housing.



Figure 22 Rear Left Door Lock Button Piston/Diaphragm Housing

The Door Lock Button Diaphragm works with both positive and negative pressure from the PSE Pump. When you lock the car using Remote Key etc, the PSE Pump applies +ve pressure to the Door Lock Button Piston/Diaphragm, which pulls the Door Lock Button down, then returns to atmospheric pressure.

When you unlock car using Remote Key etc, the PSE Pump applies -ve pressure or vacuum, which moves the Door Lock Button up and then returns to atmospheric pressure.

14.2. Soft/Self Close Piston/Diaphragm

The largest of the Actuator Piston/Diaphragms is obviously the one which operates the Soft/Self Close Feature. (The larger the diameter of the diaphragm the more force obtained and it obviously takes a lot of force to pull the doors closed.)



Figure 23 Soft/Self Close Piston/Diaphragm Housing

14.3. Safety Child Lock Diaphragm

The next Photograph shows the smallest Piston/Diaphragm at the top of the Rear Door Actuator. It releases the Child Safety Switch when -ve pressure is continuously applied to the Actuator. As noted above negative pressure unlocks the Door and raises the Door Lock Button. If the Child Safety Lock Switch is in the position which prevents rear seat passengers from opening the door, this Piston/Diaphragm overrides this function. I suspect that this is a safety feature, which would be applied in the event of an emergency, thus allowing the door to be opened from the outside and the inside. Very clever!

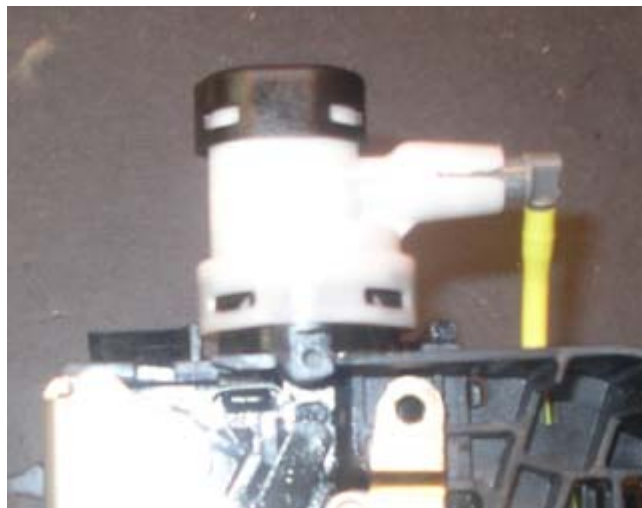


Figure 24 Child Safety Lock Piston/Diaphragm Housing

15. Interesting Question.

Now that I know for certain that my car does not have the Soft/Self Close Feature, I was wondering whether I could fit it just by replacing the for door actuators. Probably won't bother as it is a lot of work.