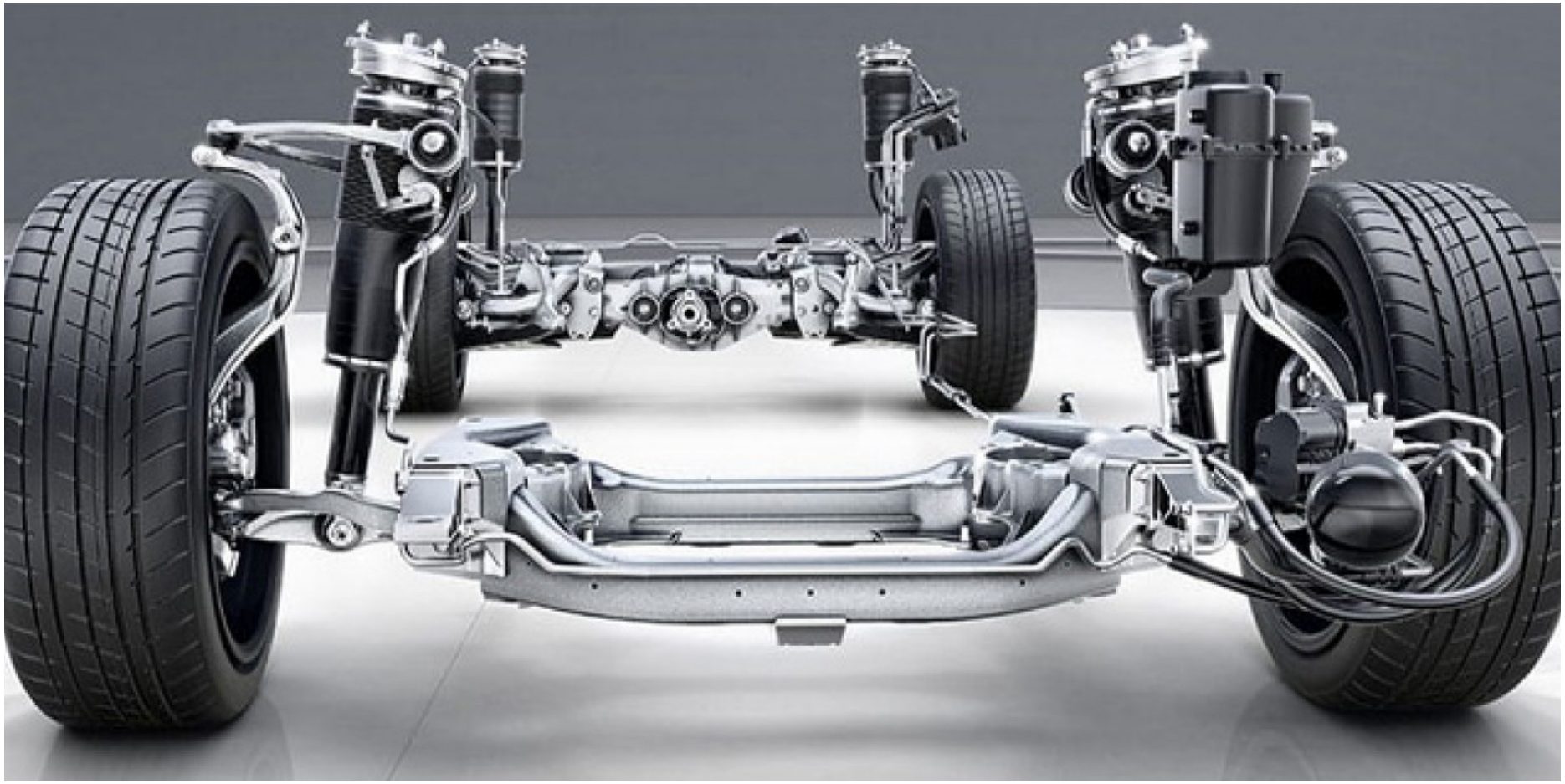

MERCEDES CHASSIS CONTROL SYSTEMS
AIRMATIC, ABC, & MAGIC BODY CONTROL
WITH ANDREW LIBERT & DENNIS WOLL
OPUS | IVS
NWACA
Northwest AUTO CARE ALLIANCE
SEATTLE ATE AUTOMOTIVE TRAINING EXPO
WTI
WORLDPAC Training Institute

What we will be covering today!

- AIRMatic
- Overview
- Functional Overview
- Components
- Service
- Diagnosis
- Test Plans By Symptom
- Test Plans by DTC
- Semi Active Air Suspension
- Partial Air Suspension

- Active Body Control (ABC)
- Overview
- Functional Overview
- Components
- Diagnosis
- Test Plans by Symptom
- Test Plans by DTC
- Magic Body Control
- E-Active Body Control

Airmatic Overview





















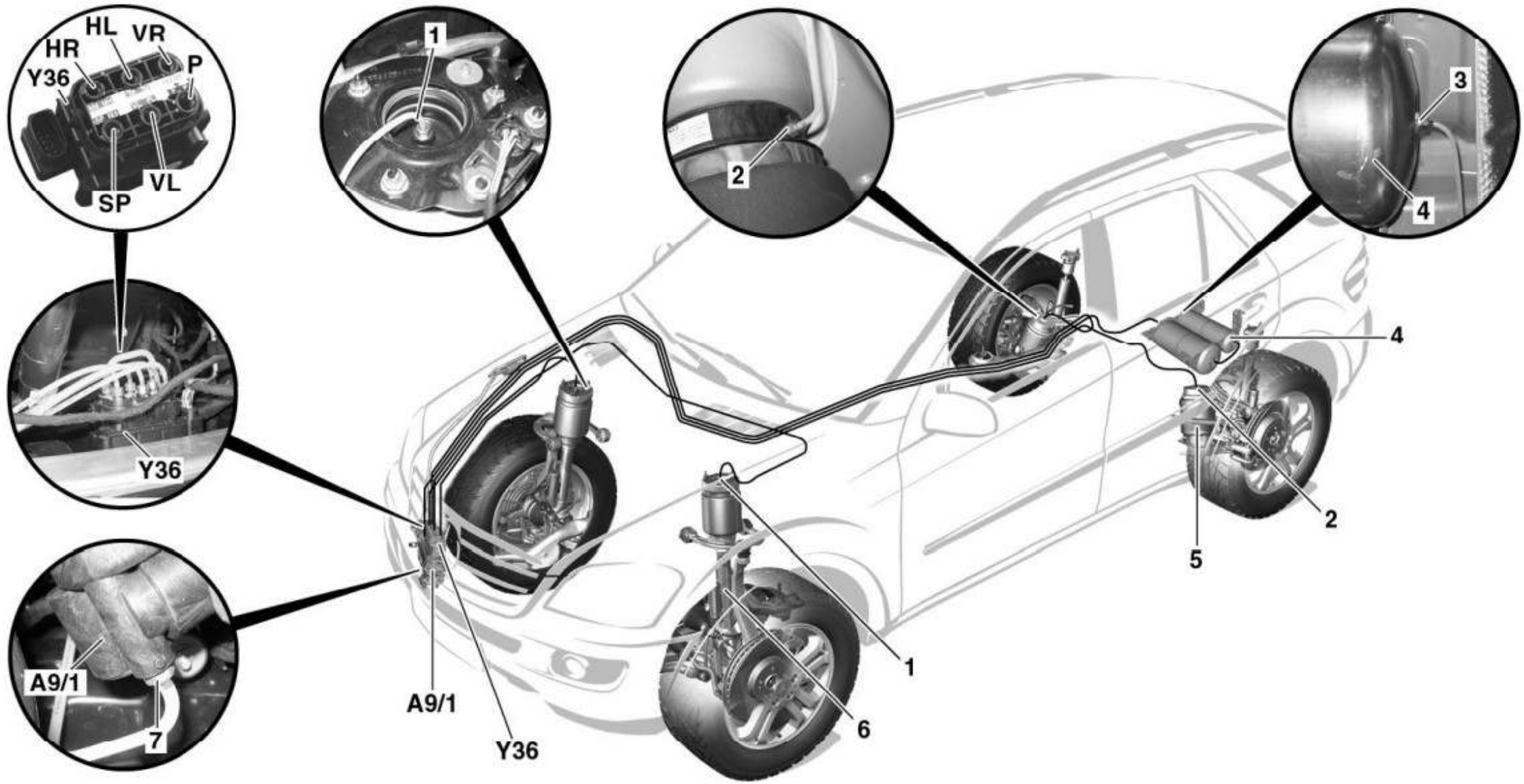




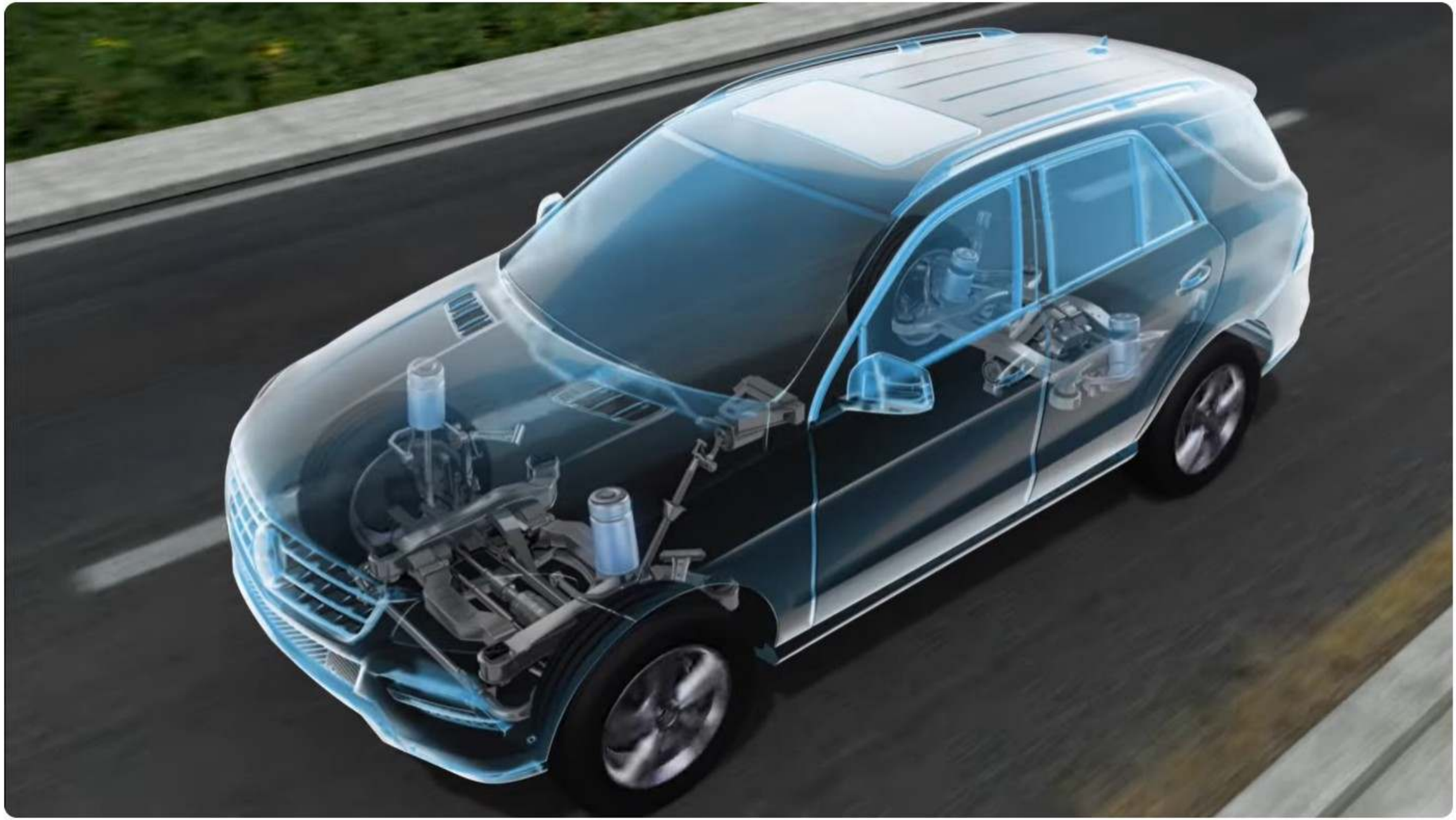
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AIRMATIC -- Air Suspension System Technology -- Mercedes-Benz

Mercedes-Benz USA

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Functional overview

Ride Level Control

- Level Measuring
  - Measure the ride level
  - Calculate vehicle height
- Level Maintenance
  - During inactive periods
  - When stationary
  - When driving
  - When lifted by jack or hoist
- Level Control
  - Speed dependent
  - Manual

Air Management

- Filter the air of dirt/moisture
- Charge the reservoir
- Raise the vehicle
- Lower the vehicle

Acceleration and Damping

- Measure ride quality
- Adjust suspension damping

Diagnostics

- Pressure sensor

Air Supply and Distribution

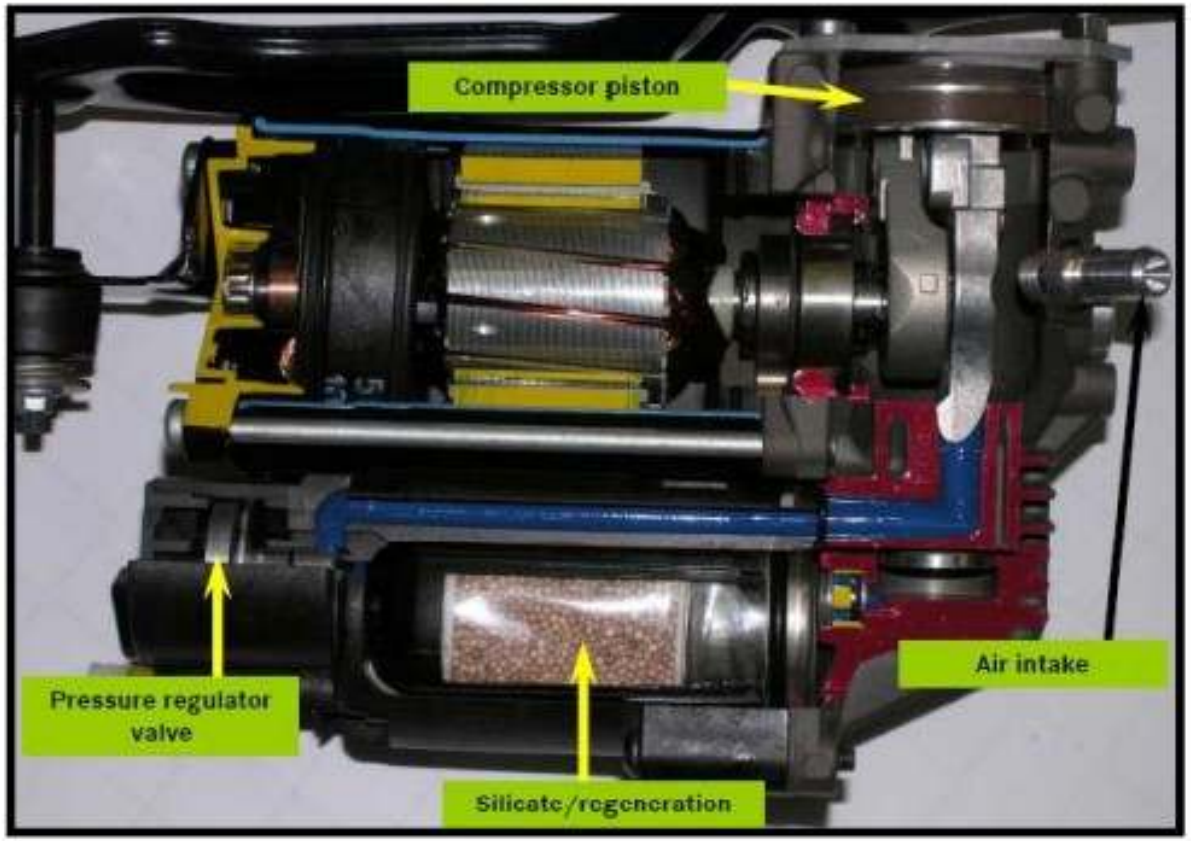
Compressor

Fuse, Relay, SAM

Inlet air line with filter

Piston with check valve

Relief valve









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Filtration



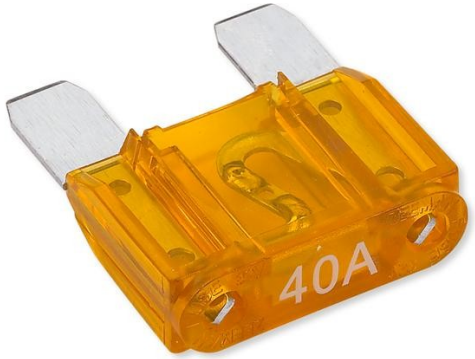




Compressor Electrical Actuation

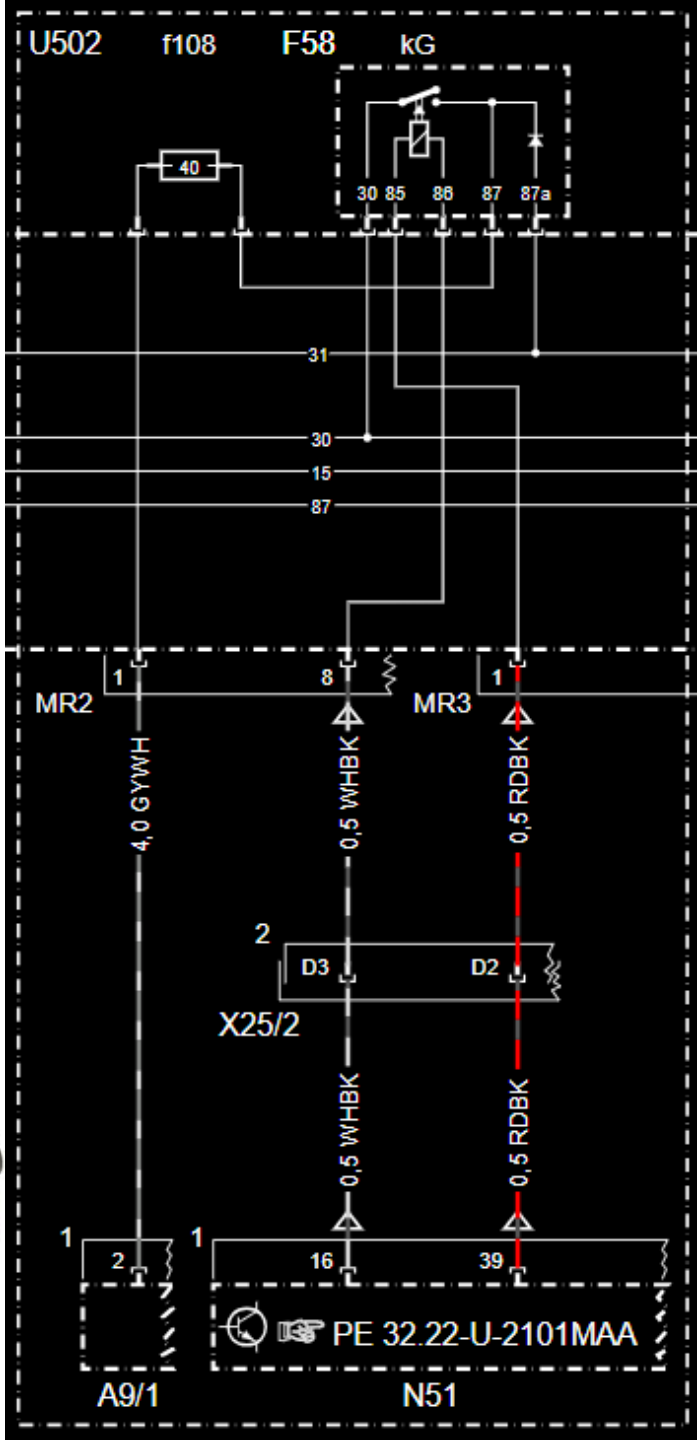








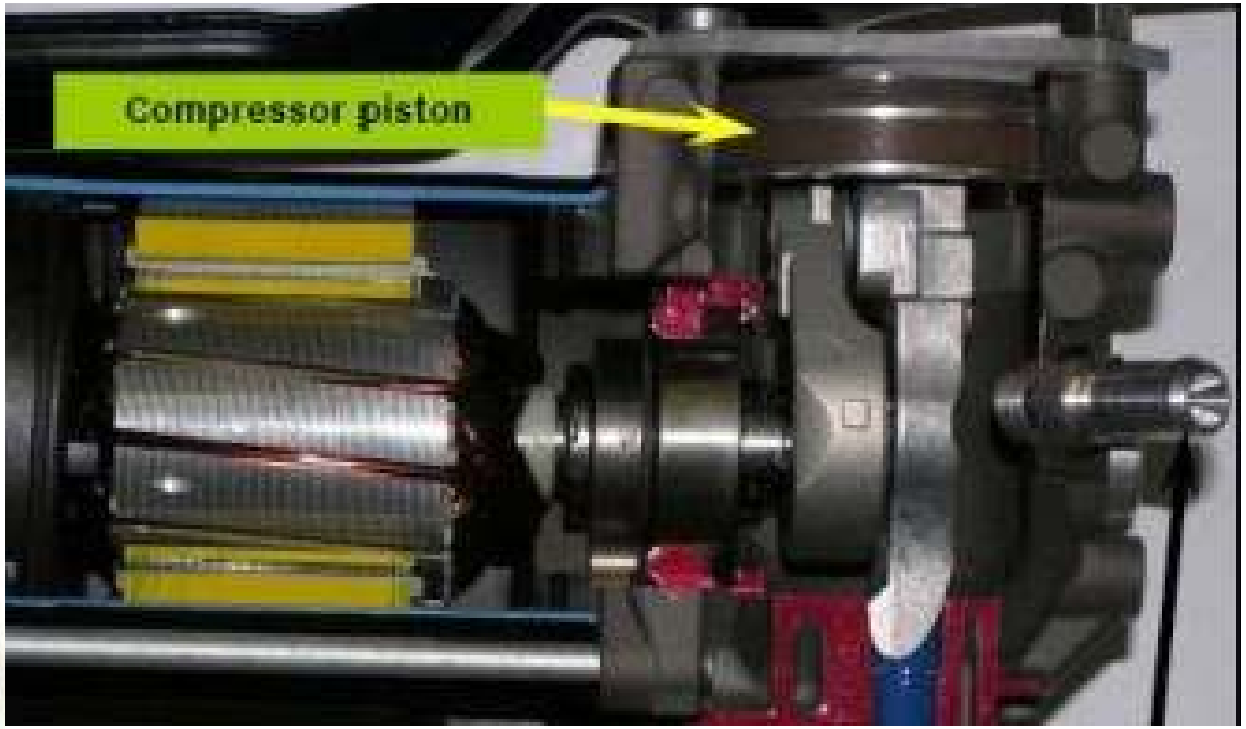


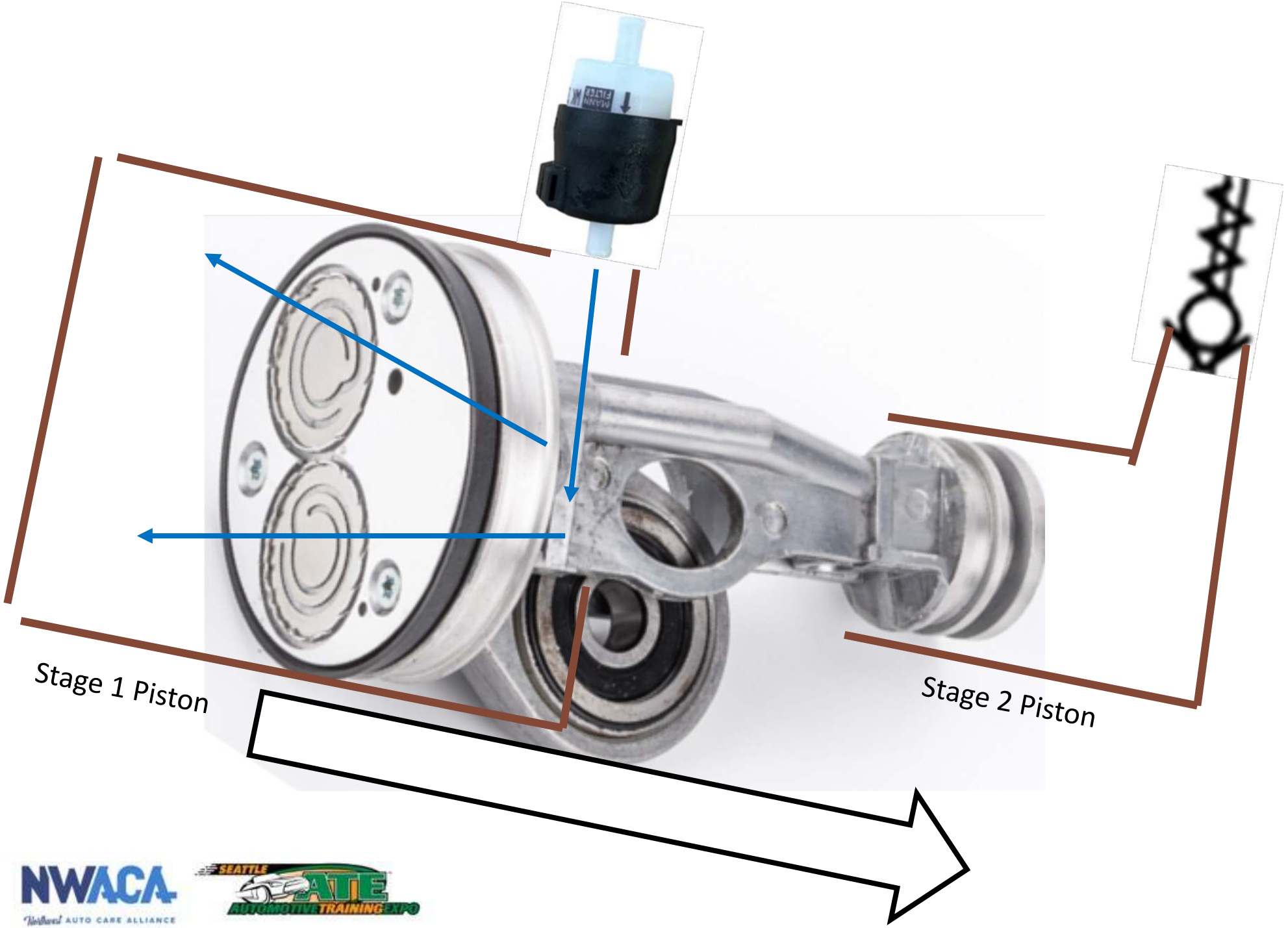


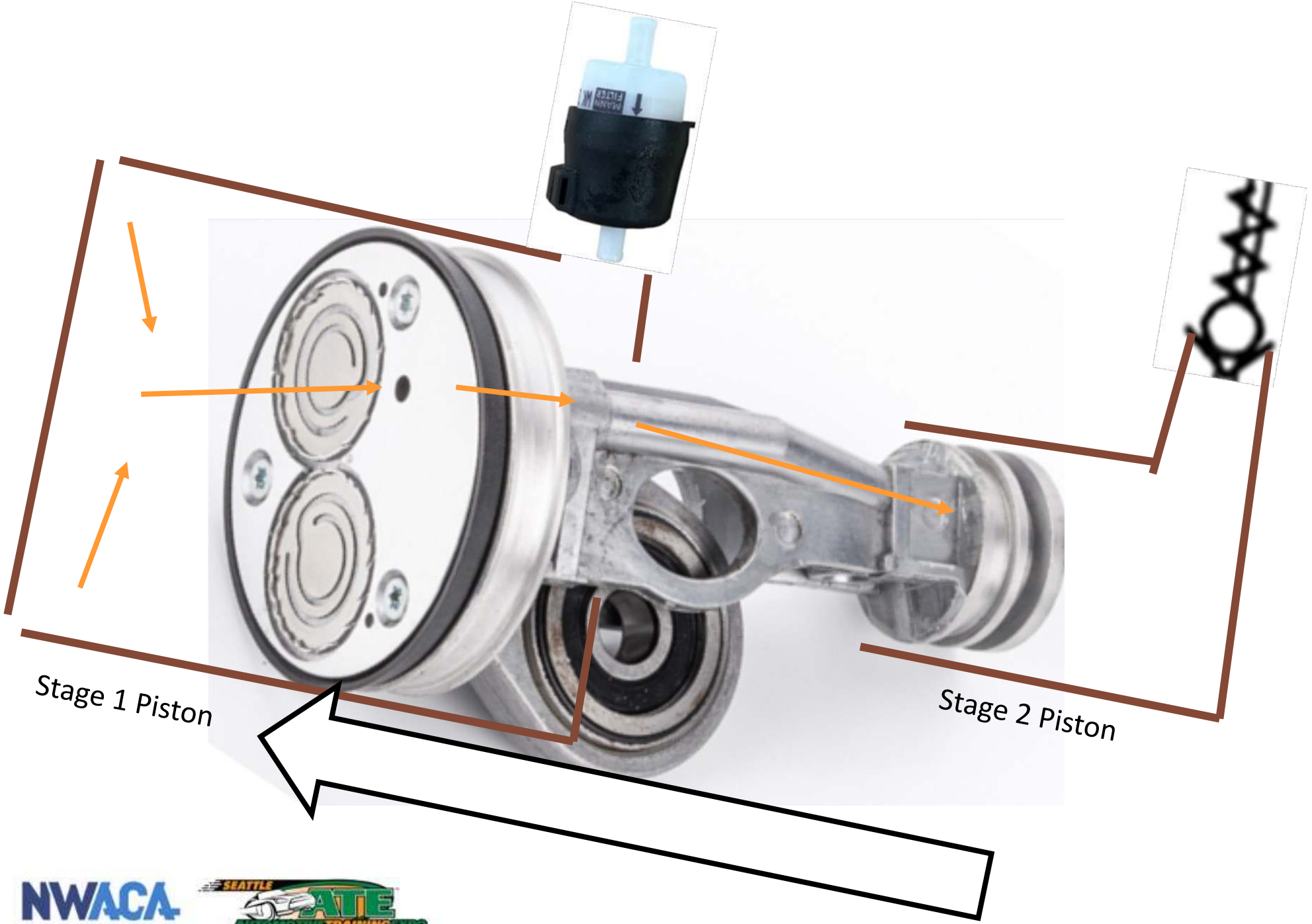
Compressor Pumping Mechanism

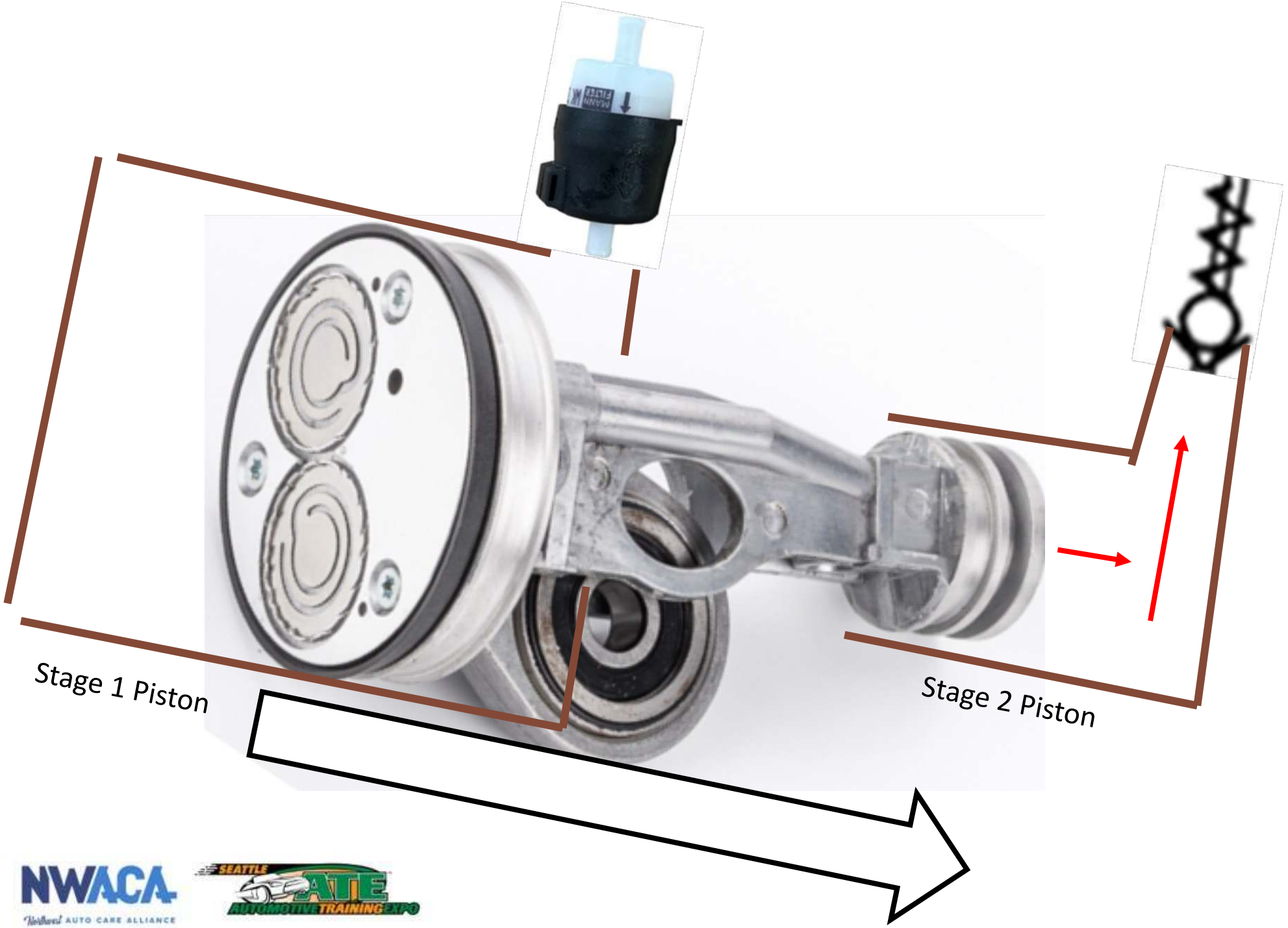




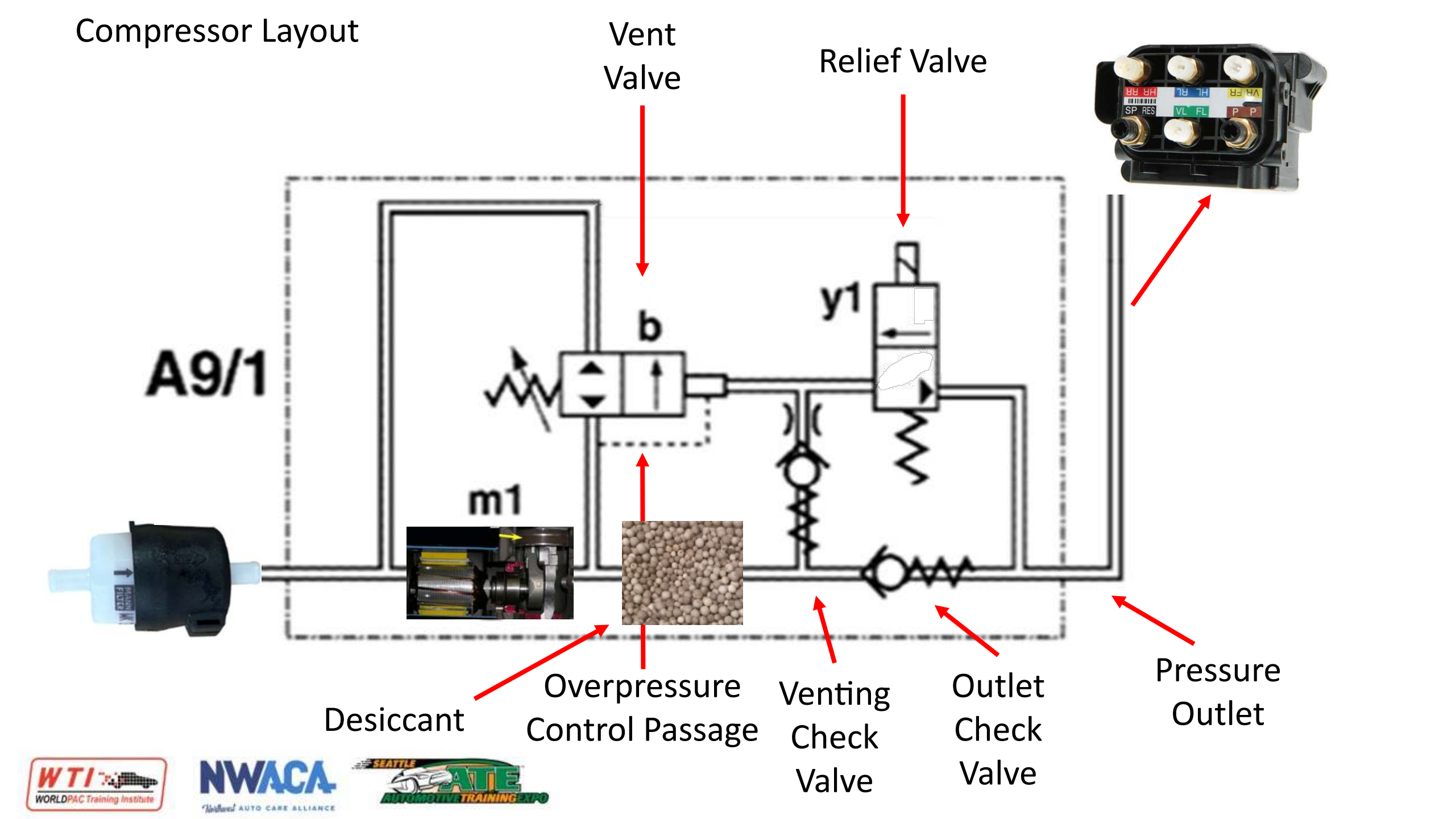



Stage 1 Piston
Stage 2 Piston

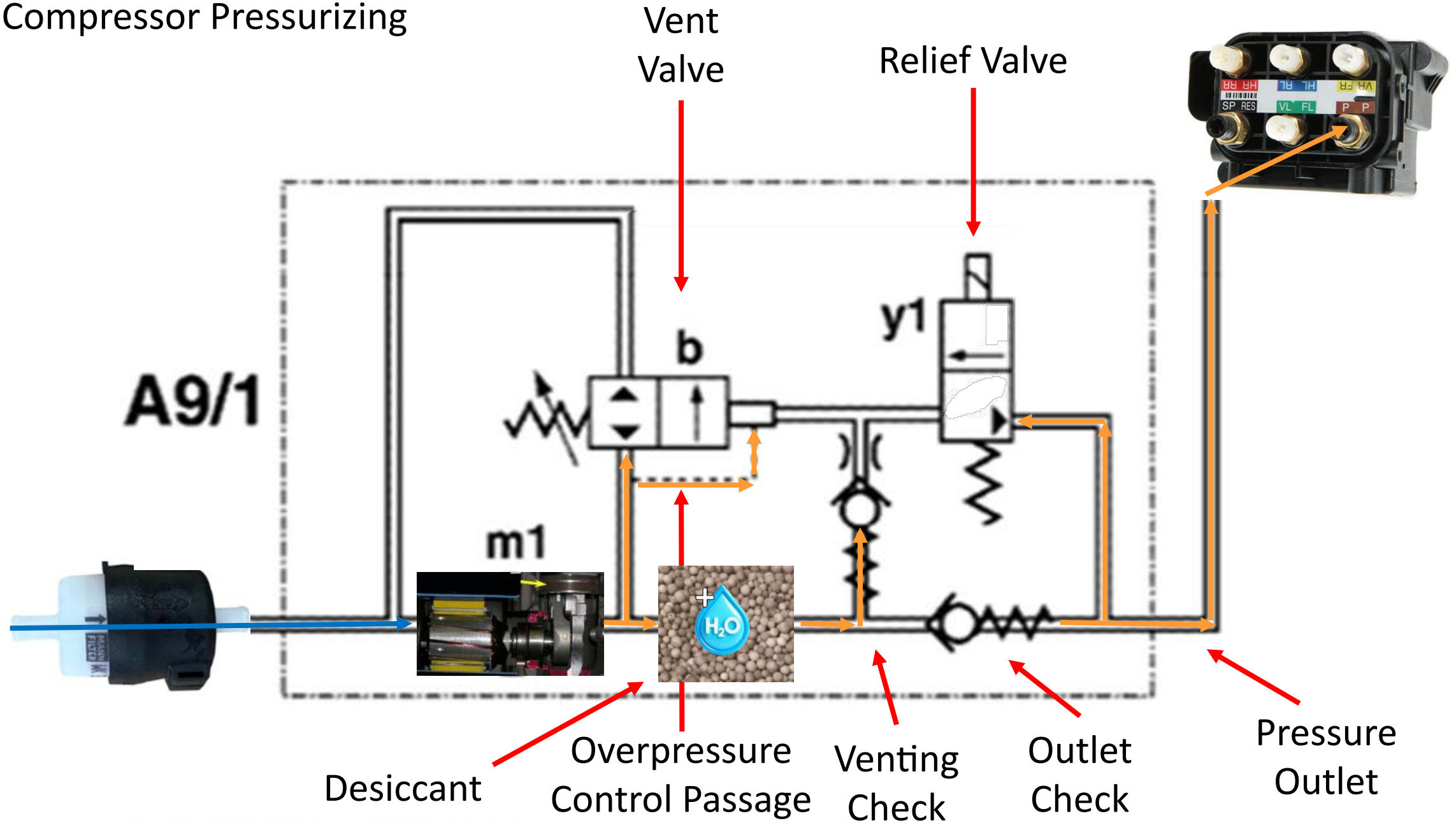

Stage 1 Piston
Stage 2 Piston


Stage 1 Piston
Stage 2 Piston

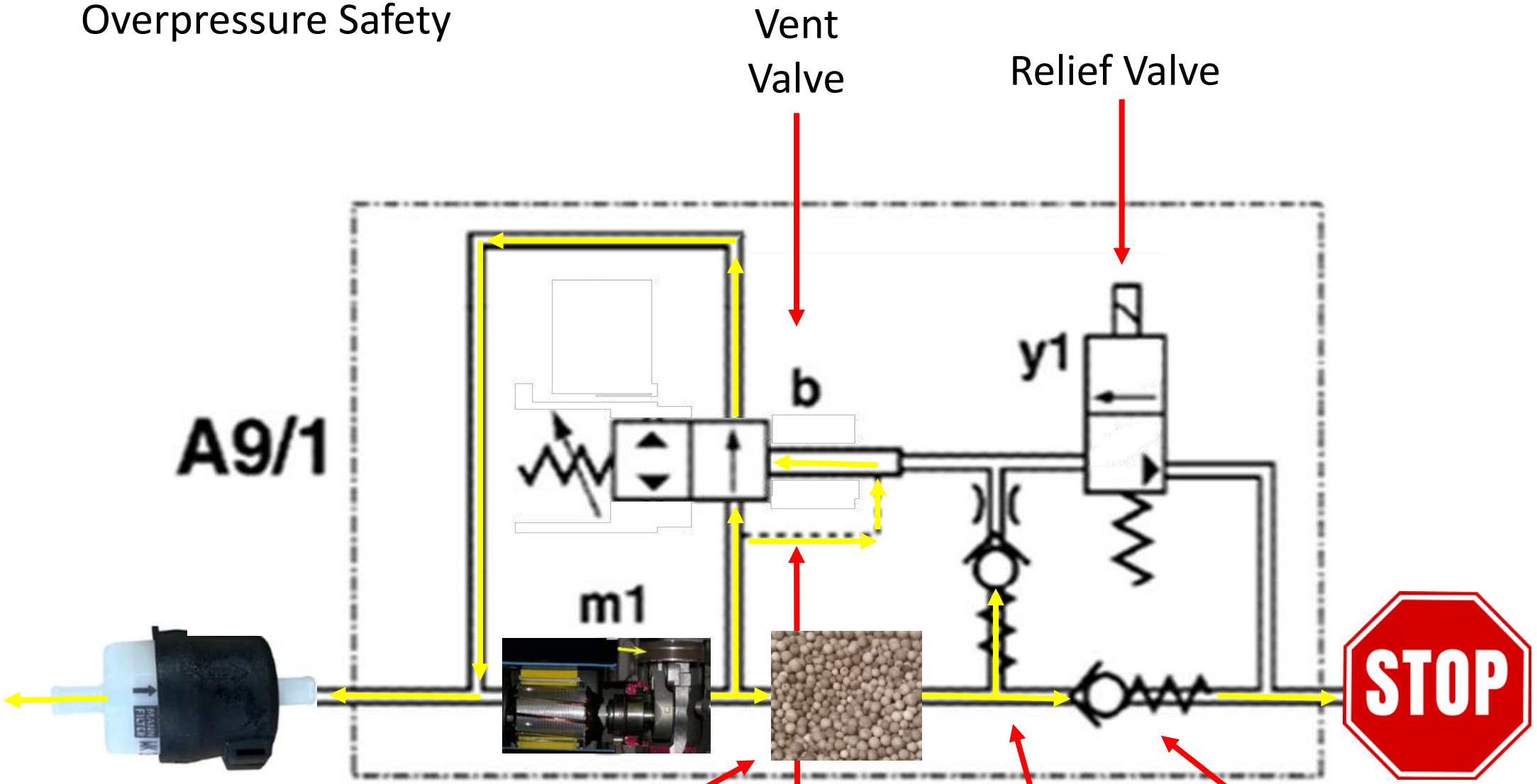
Compressor Layout



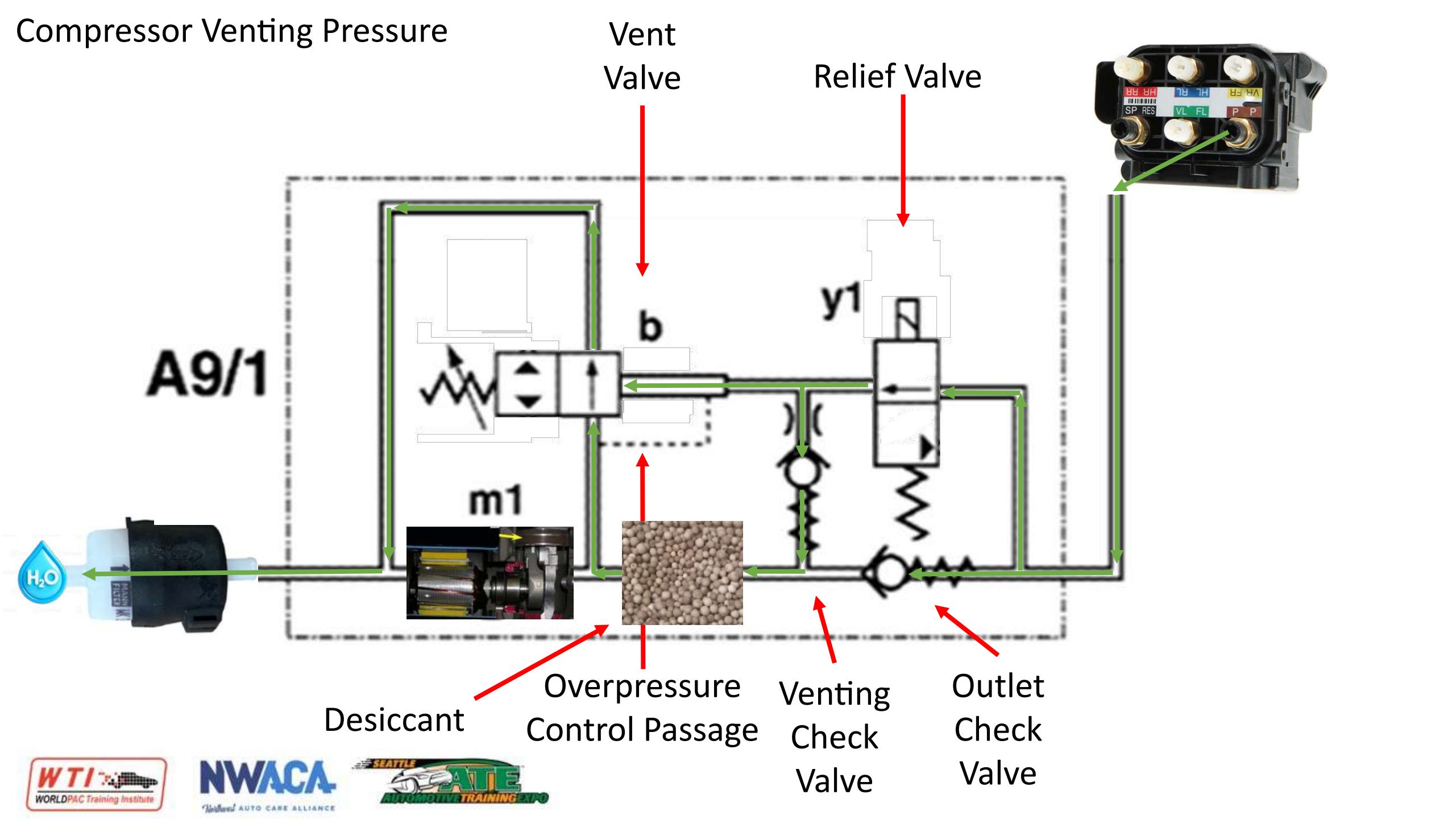
Compressor Pressurizing



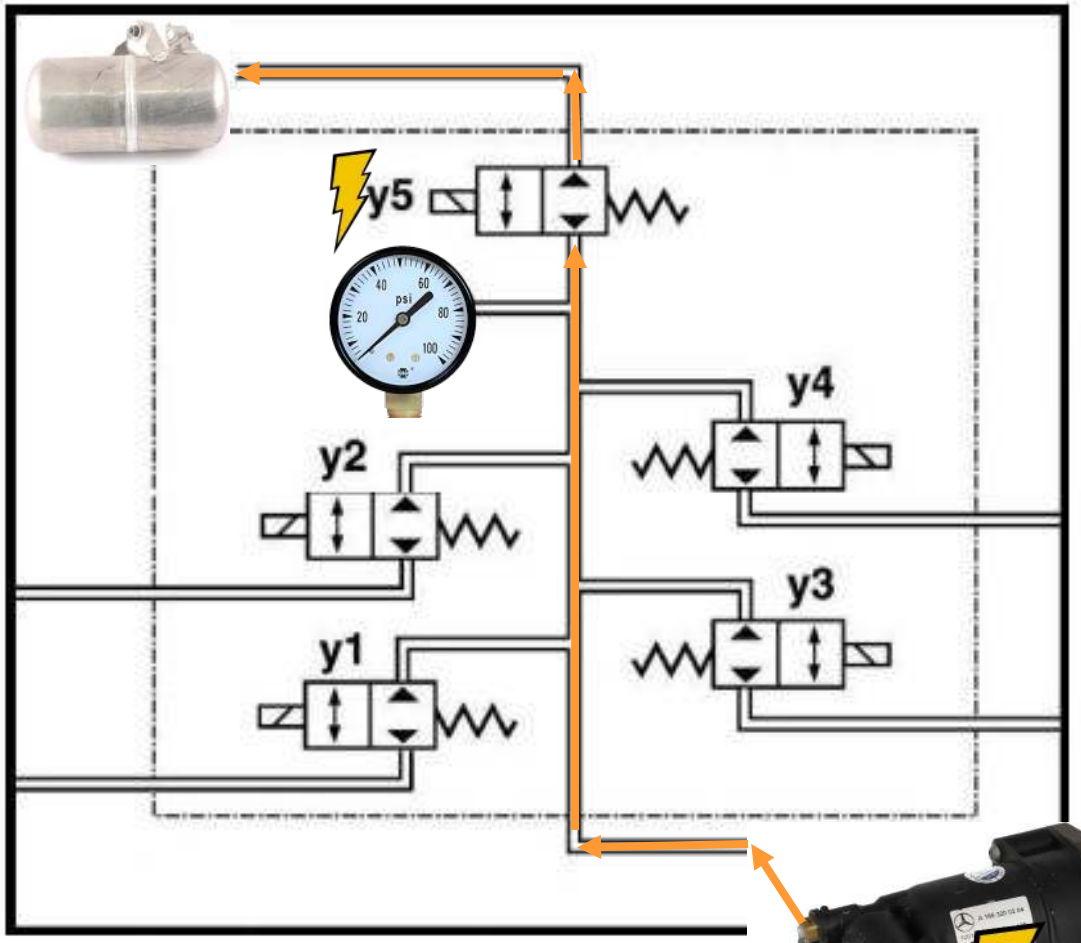
Overpressure Safety



Compressor Venting Pressure

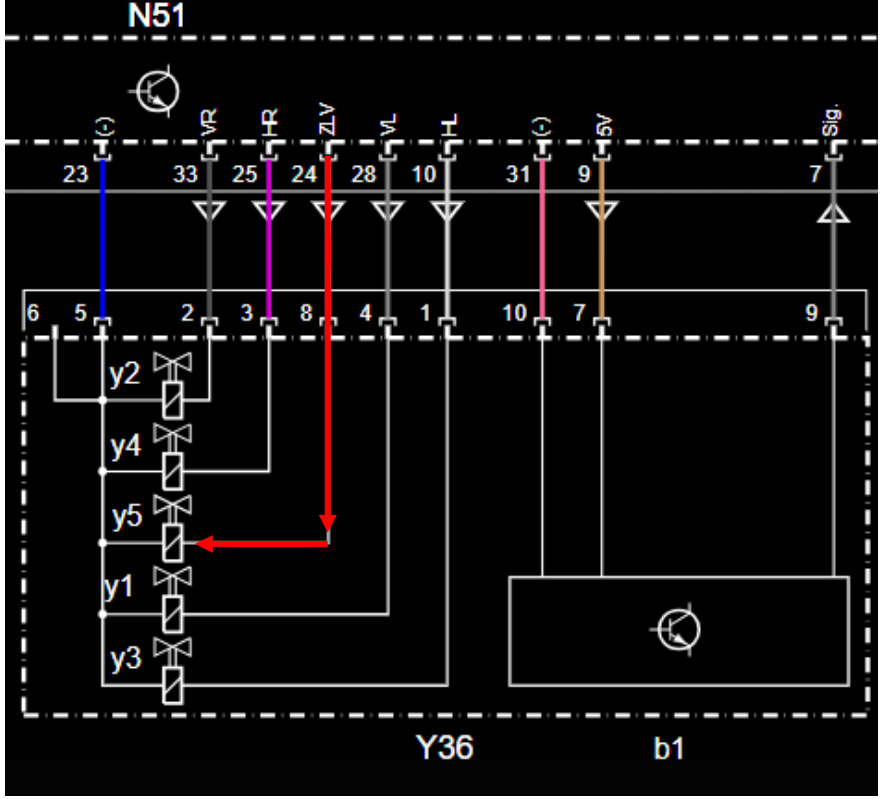


Charge the Reservoir





y1 left front strut
y2 right front strut
y3 left rear strut
y4 right rear strut
y5 central reservoir

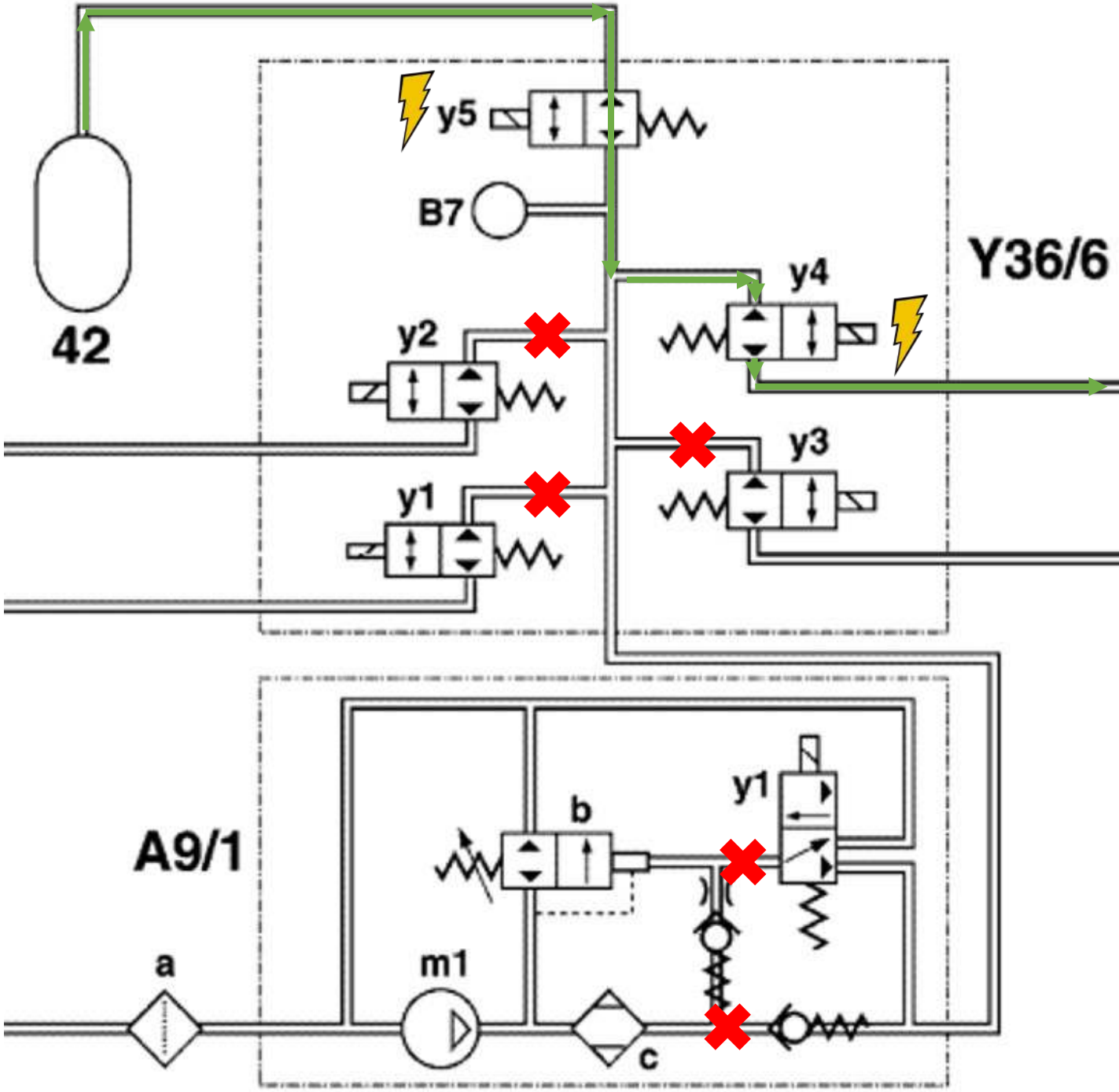




Raising with Reservoir (at least 11 bar)



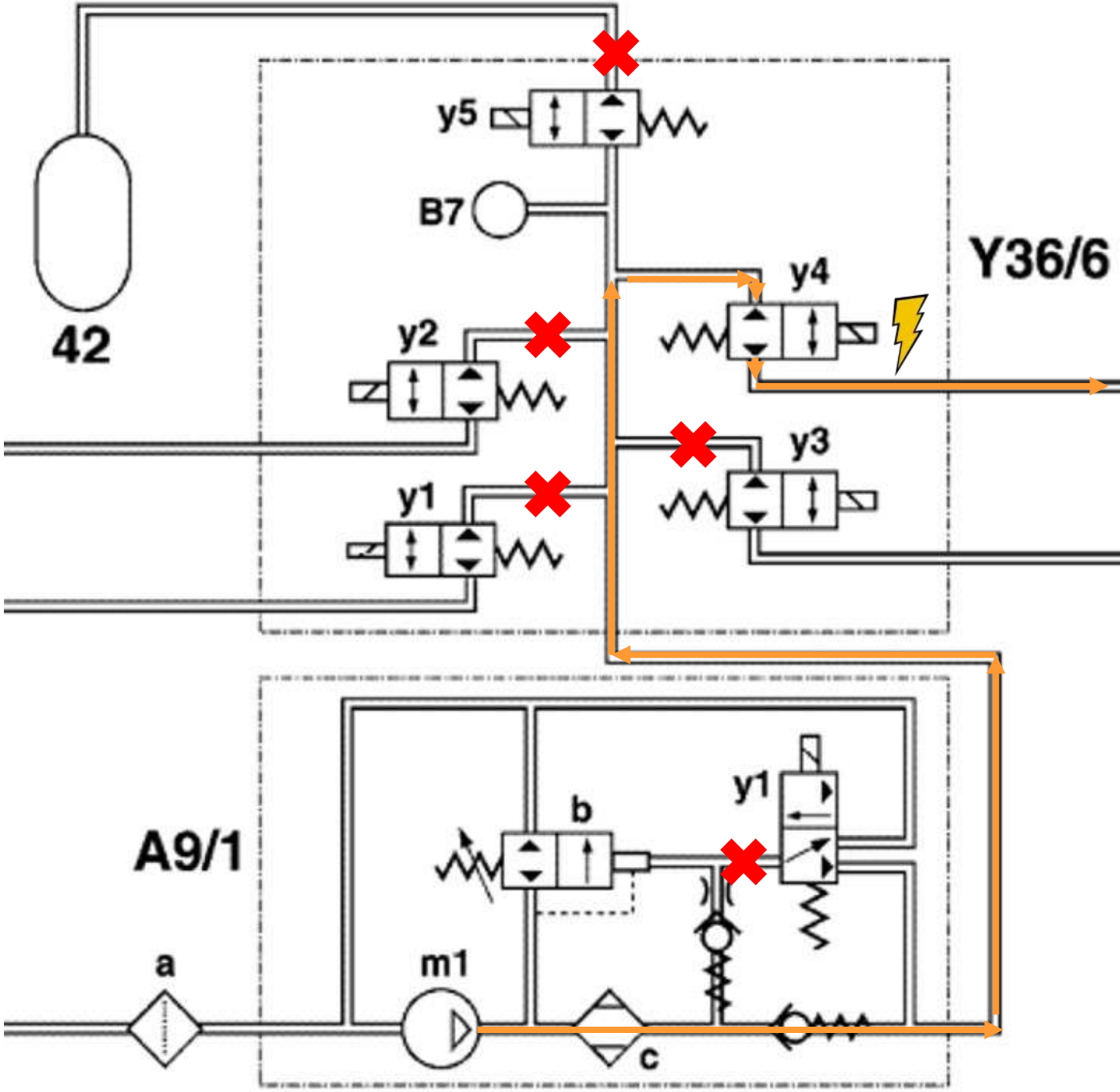




Raising with Compressor







Vehicle drops at one or more suspension struts.

Topic number	LI32.22-P-055731
Version	1
Design group	32.22 Air suspension
Date	02-28-2013
Validity	Model series 166 with SA code 489 (Air suspension)
Reason for change	

Complaint:

Vehicle occasionally drops at one or more suspension struts.

AIRMATIC symbol appears in multifunction display.

Stored fault codes:

FC: C155664 The compressed air sensor for system pressure has a malfunction. There is an implausible signal,

and additionally

FC: C157200 The correction time while filling is too long,

and additionally

FC: C156C00 The system 'Compressed air distribution' is leaking.

Cause:

Vent valve of compressor sticks sporadically.

Because of this, the compressed air escapes from the AIRMATIC system and the vehicle level drops at the suspension strut which is currently being actuated by the valve block.

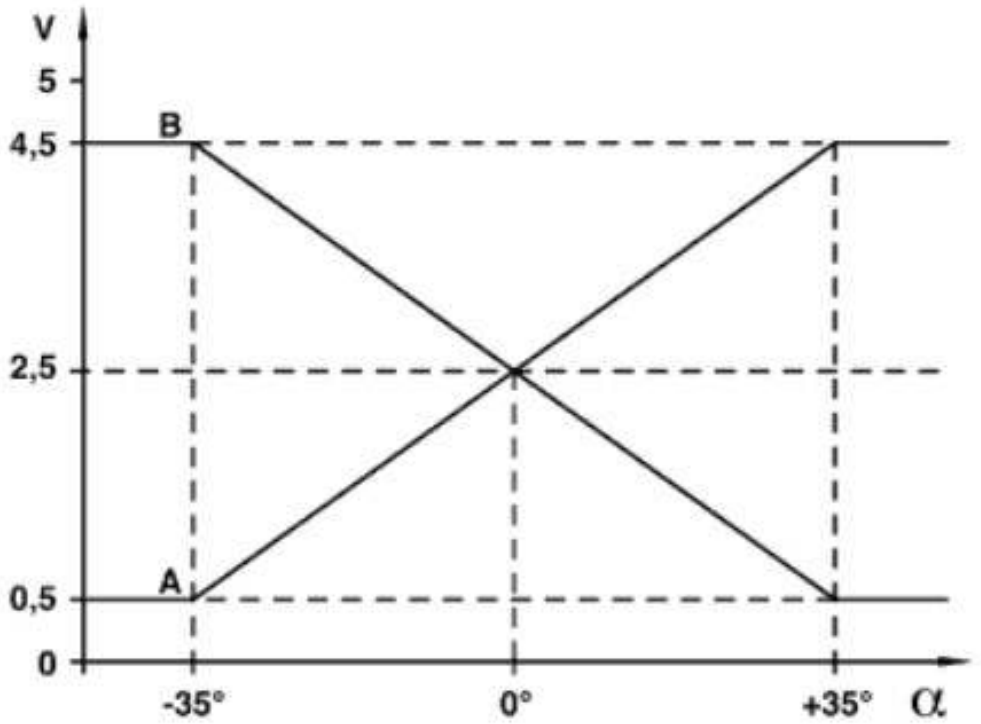
Remedy:

Compressor replacement

Leveling

- Measurement
  - Level sensors convert suspension travel into changing voltage
- Maintenance
  - Correction due to air loss or changes in vehicle load
- Control
  - Driver controlled or vehicle speed dependent

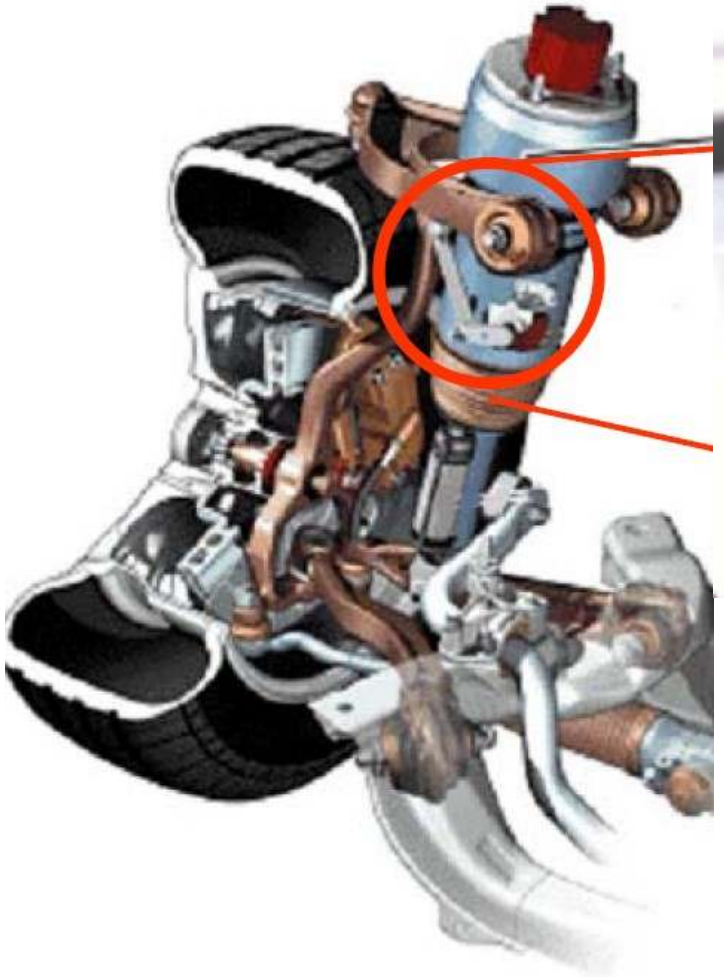
Level Sensors



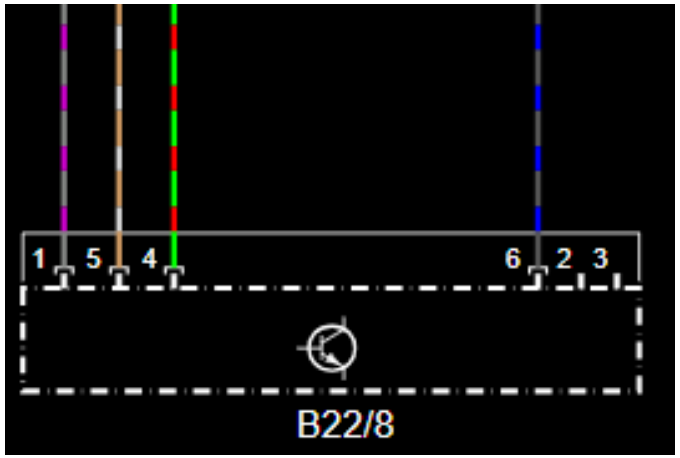


Front Level Sensors (B22/8, B22/9)

- 2 Hall effect sensors
- Redundant Signal
- Located at the upper control arm

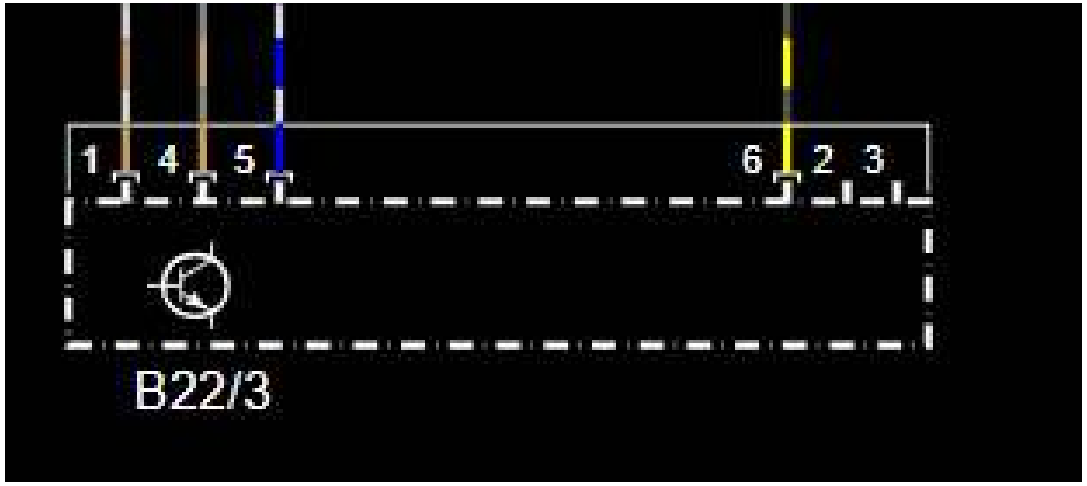


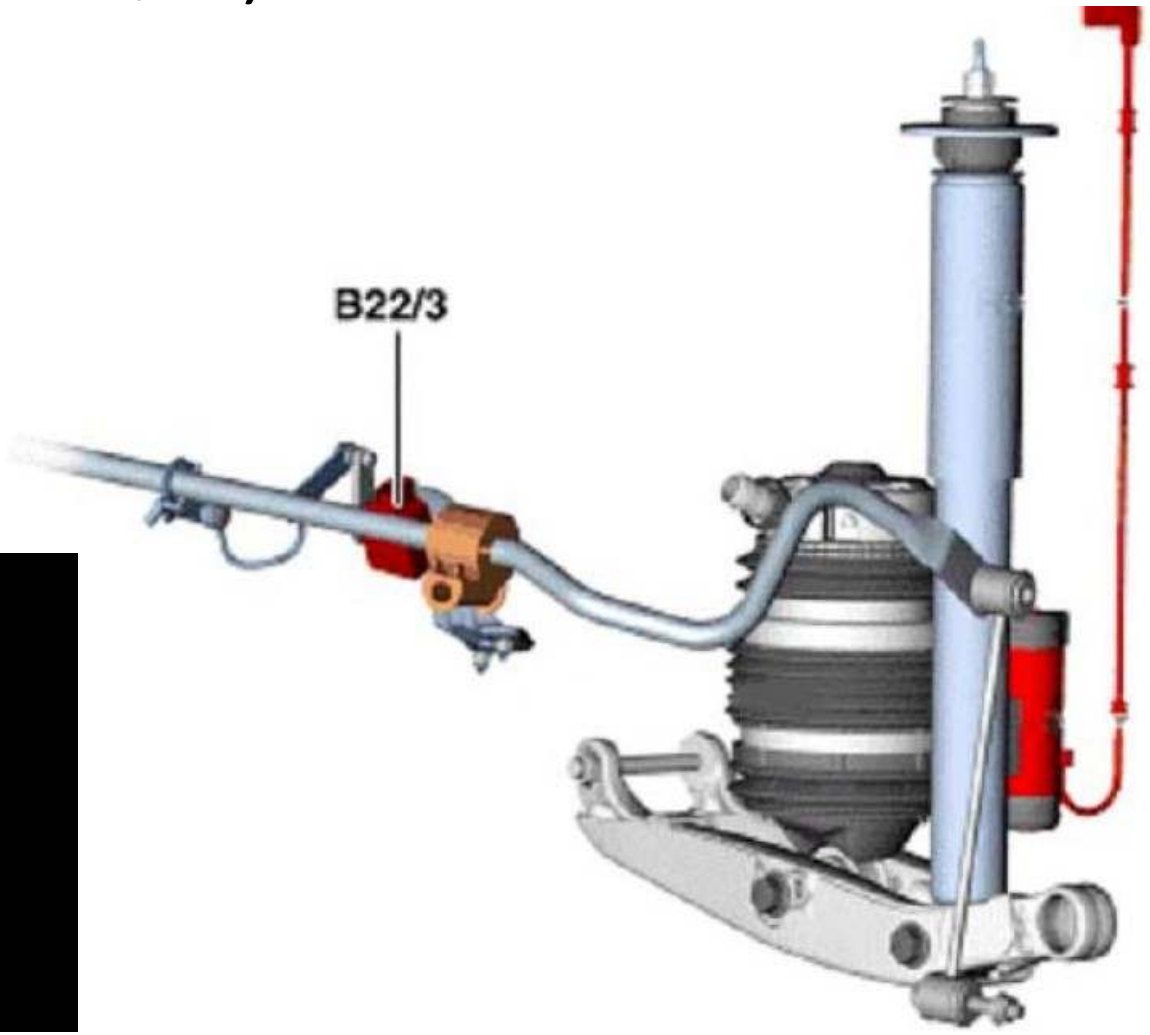




Rear Level Sensor (B22/3)

- Located at the rear sway bar
- Or rear control arms





Height Calculation

Name	Actual value
Signal voltage of component 'B22/7 (Left rear level sensor)'	2549mV
Signal voltage of component 'B22/10 (Right rear level sensor)'	2176mV
Signal voltage of component 'B22/8 (Left front level sensor)'	2235mV
Signal voltage of component 'B22/9 (Right front level sensor)'	2471mV

Name	Actual value
Left front vehicle level	27.00mm
Right front vehicle level	13.00mm
Left rear vehicle level	25.00mm
Right rear vehicle level	7.00mm
Level calibration completed	YES





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Level Maintenance

Vehicle Asleep or Suspension Inactive

All level valves are closed by spring pressure, there is no actuation by the Airmatic module

KOEO, Door Opened, or Vehicle Unlocked

> **-30mm** low, raised using reservoir
> **-65mm** low (can't steer), raised using compressor
> **+10mm** too high after unloading, lowered to normal

Engine running

Vehicle stationary, level > **±10mm**

The level is readjusted after a door, or the trunk lid is opened
May only be brought to a "provisional" level

Vehicle driving:

> **±20mm** The vehicle level is readjusted to within 10mm
Every 3 minutes: The vehicle level is adjusted to within 10mm

Locking Function

If vehicle is jacked or lifted the readings go very high,
provided the vehicle speed is zero, there is no adjustment

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Speed Dependent Level Control

216

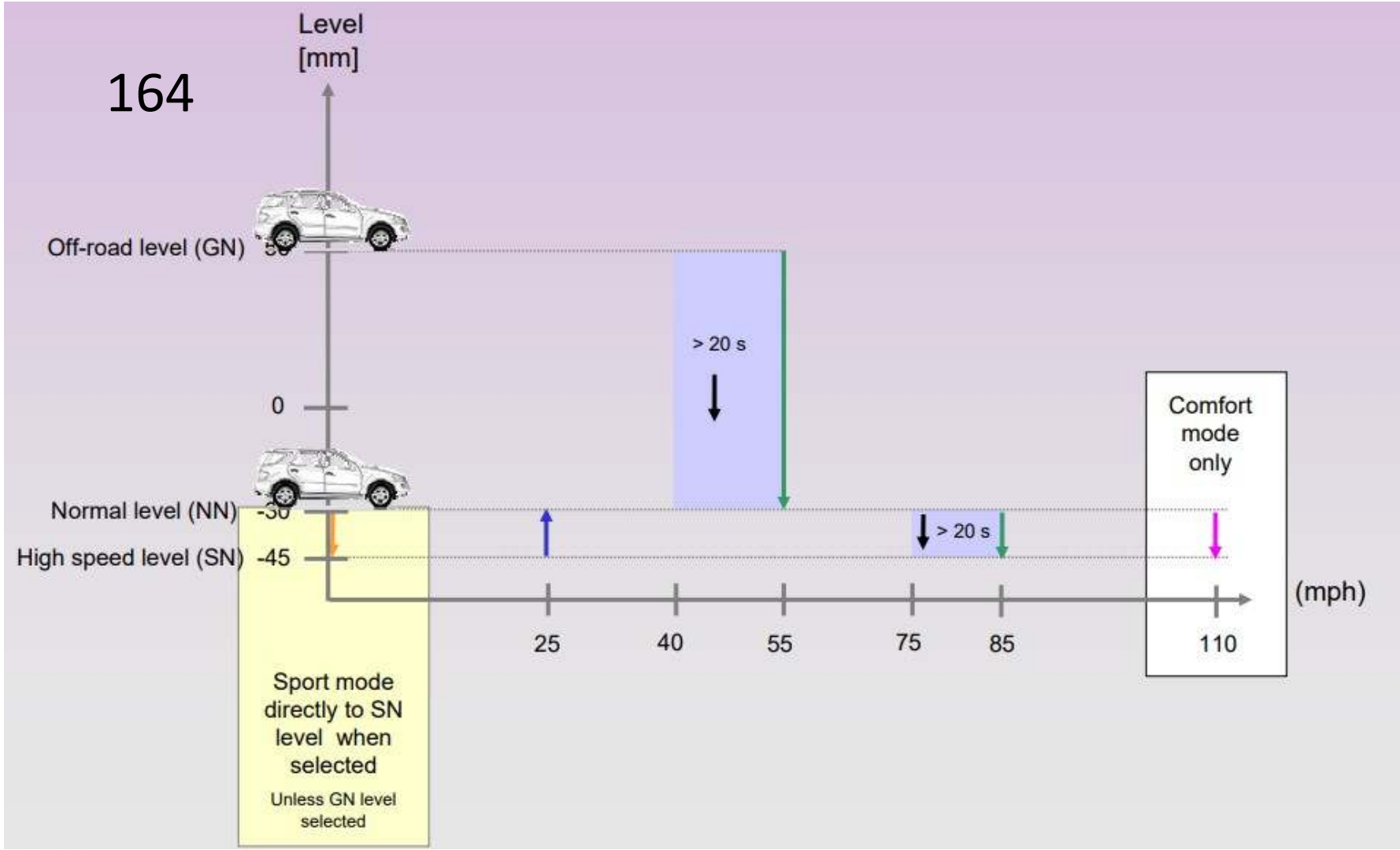
Level:
- Higher level
- Comfort performance map: 30 mm
- Sport performance map: 30 mm

- Normal level
- Comfort performance map: 0 mm
- Sport performance map: 0 mm

- Lowered level 1
- Comfort performance map: -10 mm
- Sport performance map: -20 mm

- Lowered level 2
- Comfort performance map: -20 mm
- Sport performance map: -20 mm

164



“Normal level” at -30.00mm

Move to calibrated vehicle level (automatically).

Status of associated actual values

	Name	Actual value	Specified value
	Left front vehicle level	-33.00mm	[-34 .. -26]
	Right front vehicle level	-27.00mm	[-34 .. -26]
	Right rear vehicle level	-34.00mm	[-34 .. -26]
	Left rear vehicle level	-35.00mm	[-34 .. -26]
	Normal level	-30.00mm	

Move to calibrated vehicle level (automatically).

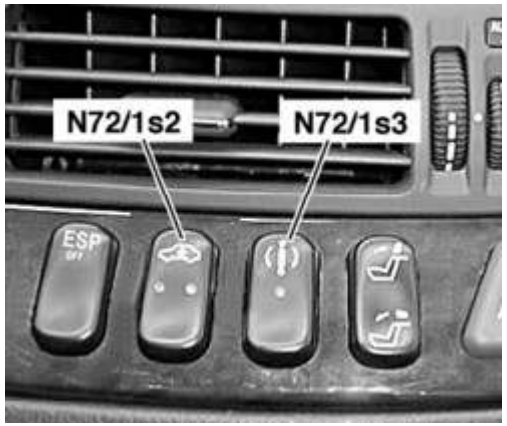
The actuation can be terminated when the actual values stop changing.

Manual Level Control



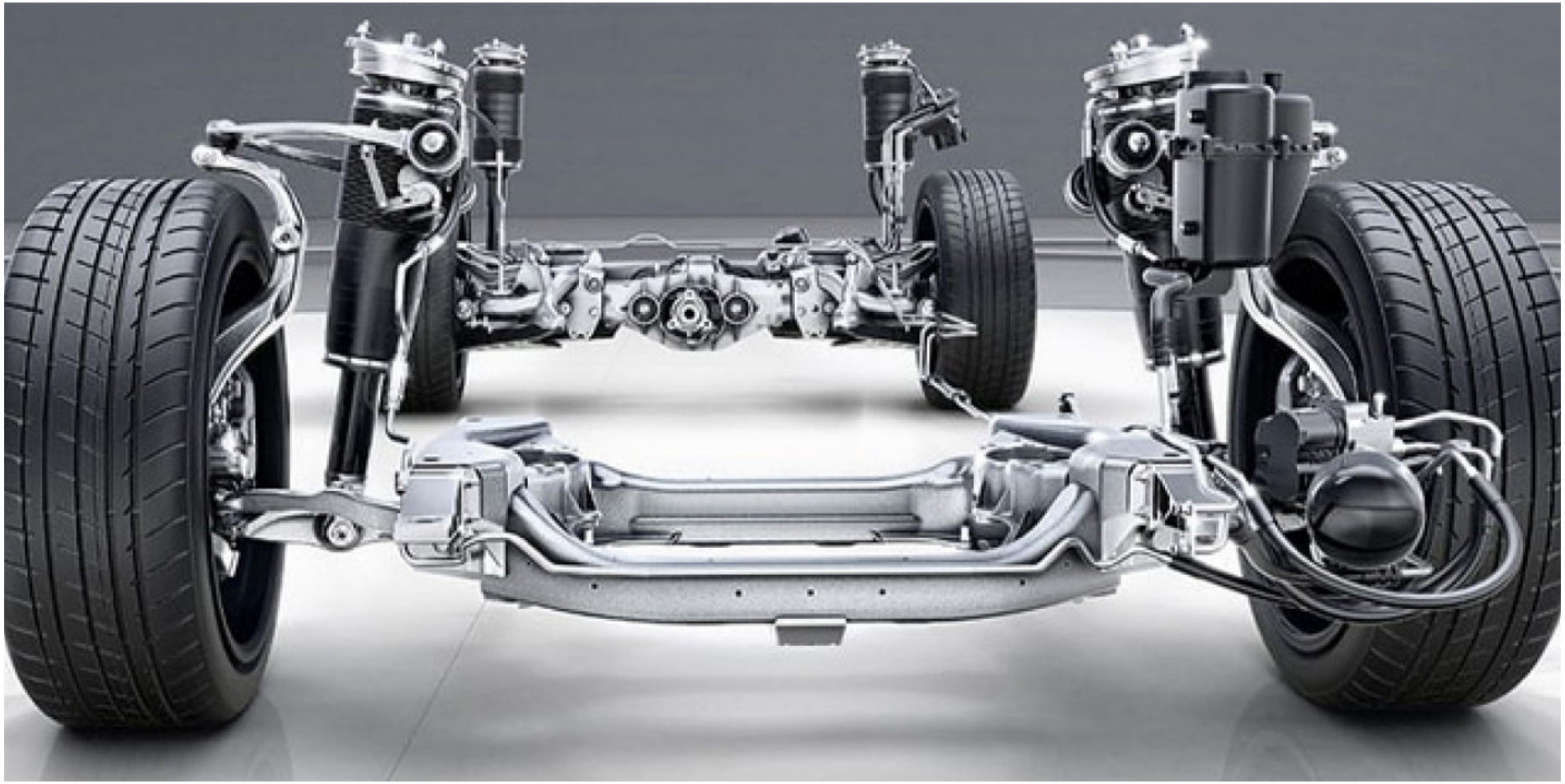








Components In Detail



Compressor

- The compressor should be replaced with the fuse, relay, and filter, when the fuse is serviceable – not all vehicles use a Maxi Fuse

- You should also consider replacing the valve block at the same time depending on age/mileage and budget as the components tend to wear out at the same rate

- On some vehicles the high amp draw of the compressor can cause the fuse to weld into the fuse box and when it blows the whole fuse box requires replacement. This is particularly a problem on the 164.

- Some models we have an automatic compressor test implemented, for others use fill/empty central reservoir.
- Compressor testing should be early in your diagnosis.
- Listen to your compressor, oftentimes worn-out failing compressors sound bad whereas those in good condition have a steady buzz

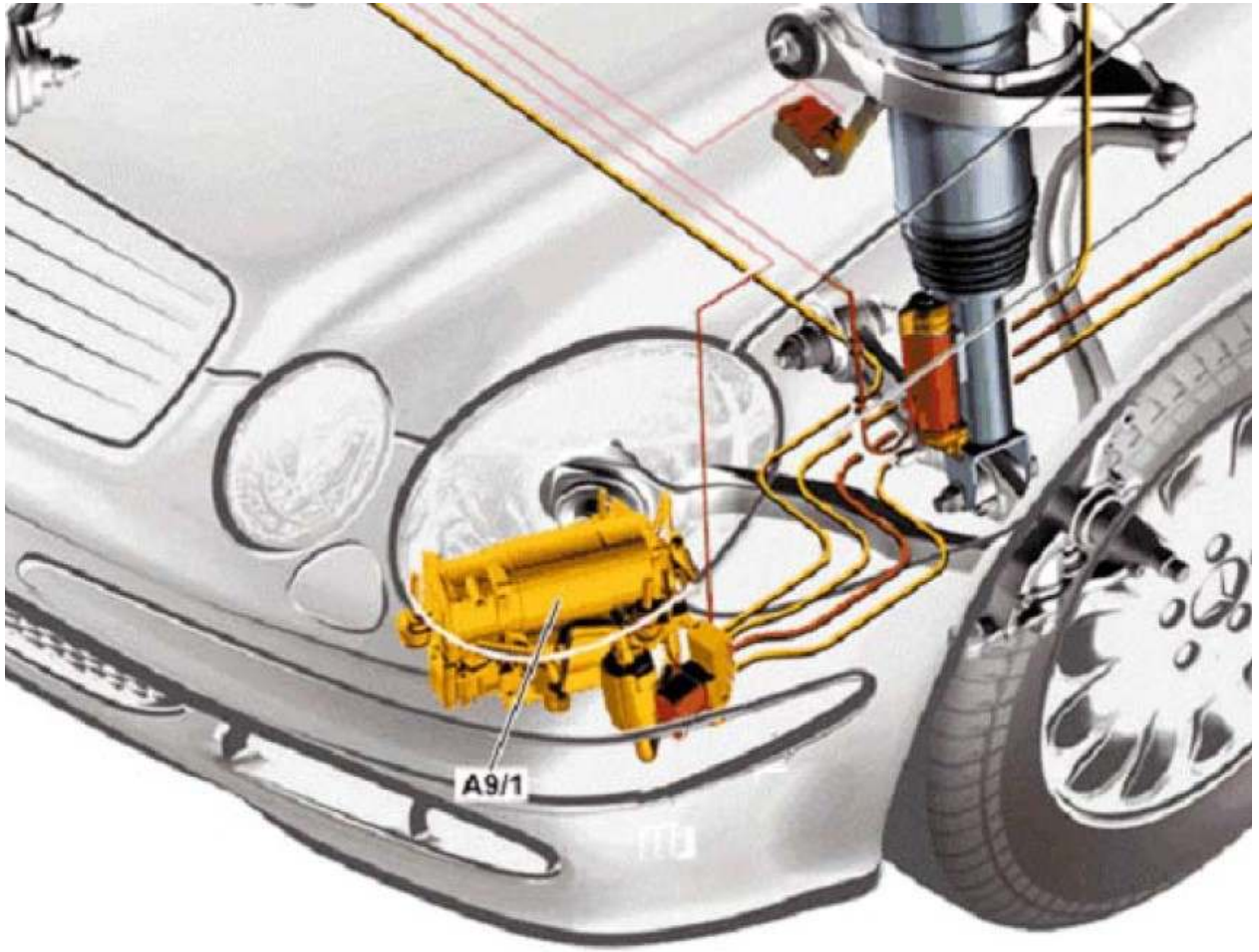
For some reason 166 chassis seems to have more compressor failures than all other chassis combined

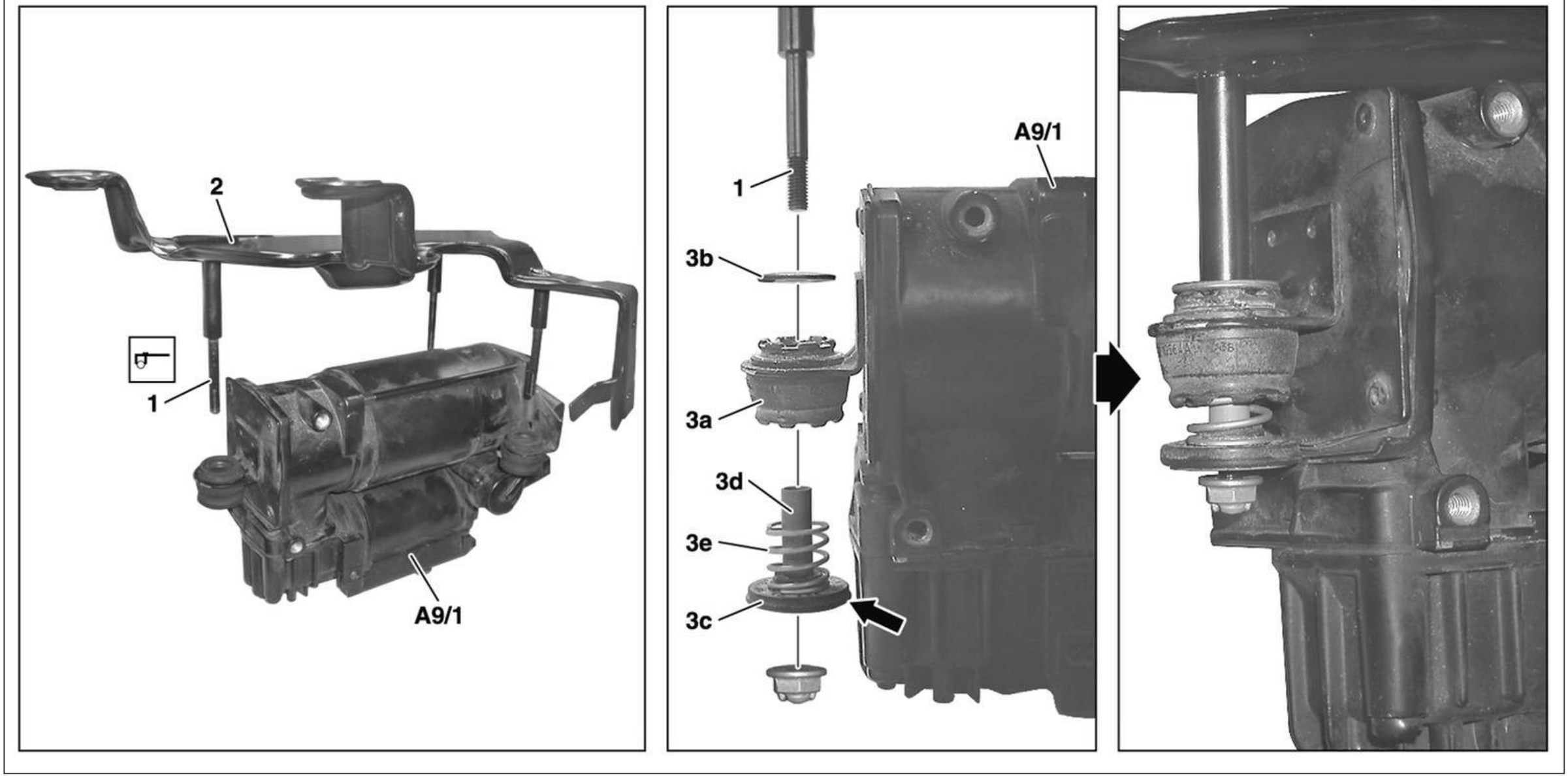




SAS Compressor Unit (A9/1) 211 / 219

- Located in the Left Front Wheel Housing
- Loves to rub against the fender liner!





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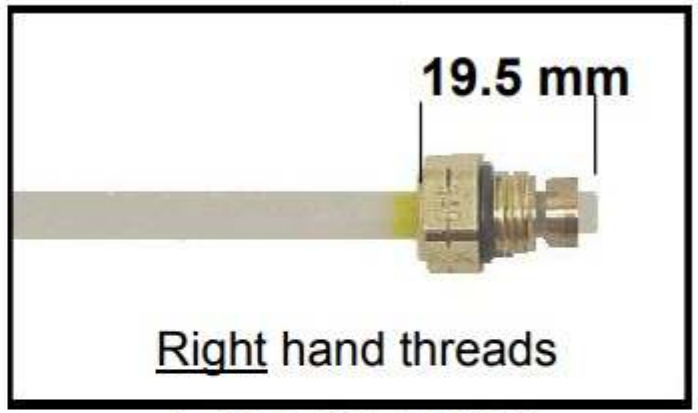
Air Line Repair

Inline repair kits



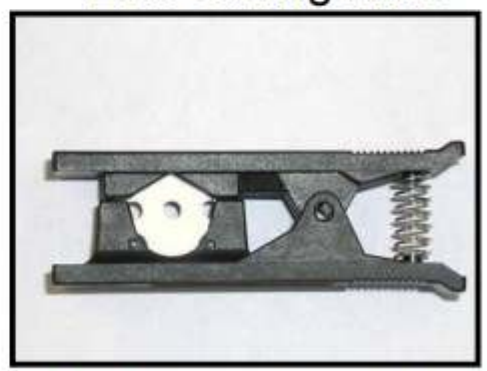
A 000 327 0169

Strut end repair kits



A 000 327 0069

Line cutting knife



W 000 589 12 2800

Note: Front lines are repairable.

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Valve Block

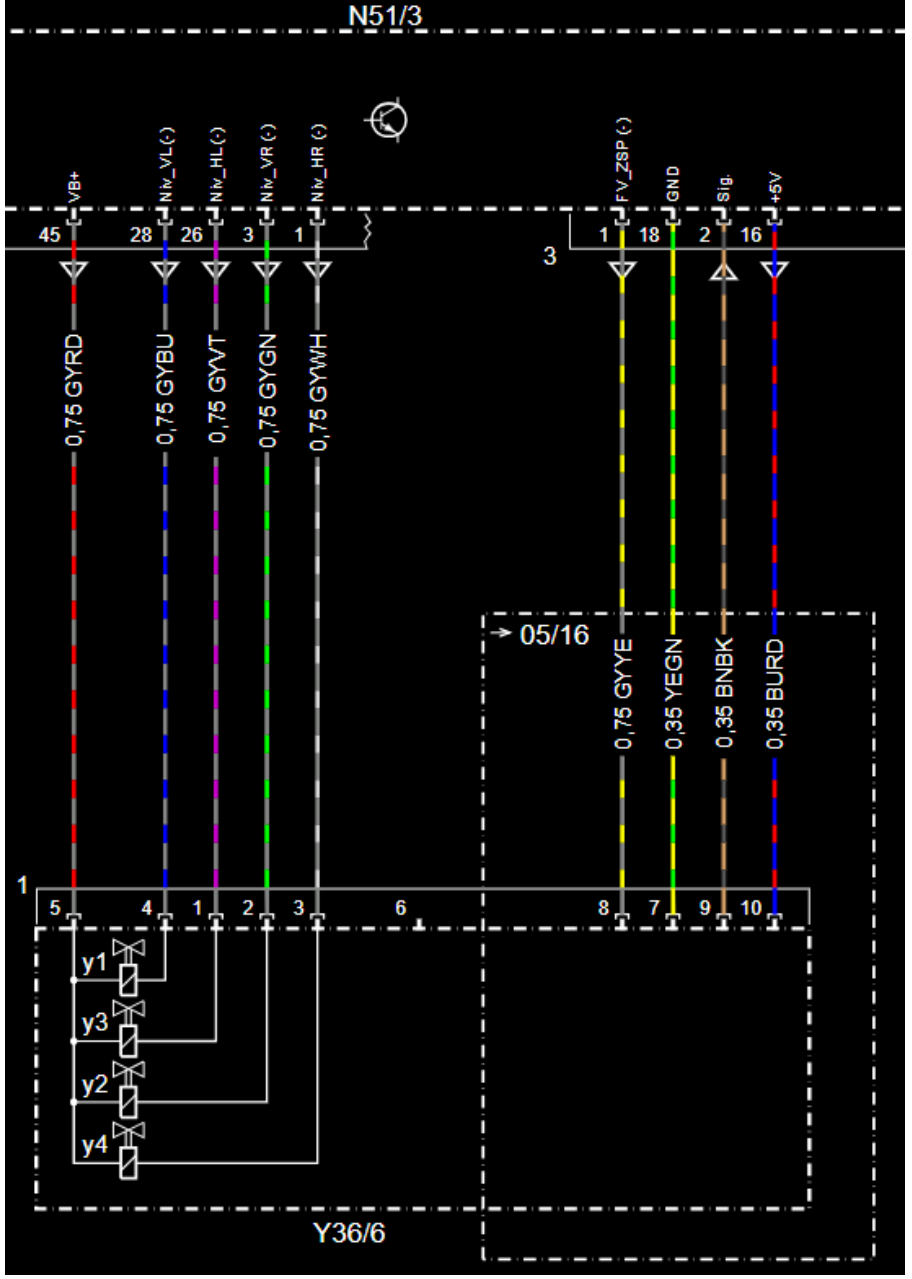


Pressure Sensor!



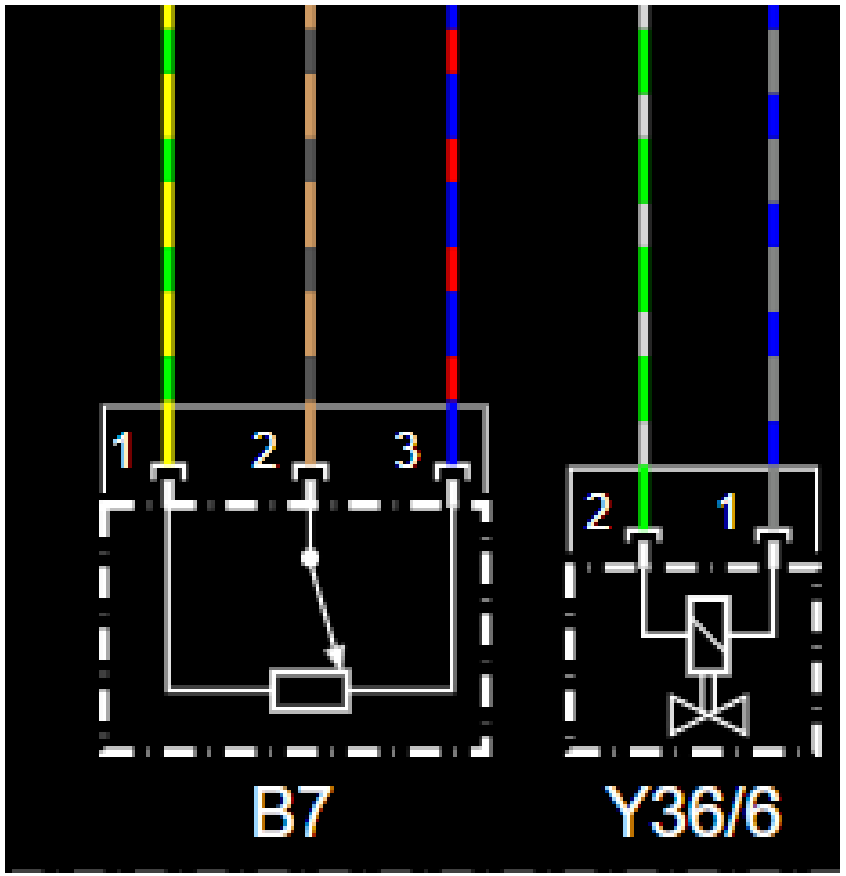
- Integrated into valve block
- Monitors reservoir fill level and triggers recharging when needed
- Used in diagnosing the compressor and level valves and leakage
- Helps adjust firmness (increase pressure) for heavier vehicle loading




N51/3
VB+
Niv_VL(-)
Niv_HL(+)
Niv_VR (-)
Niv_HR (-)
FV_ZSP (-)
GND
Sig.
+5V
45
28
26
3
1
3
1
18
2
16
0,75 GYRD
0,75 GYBU
0,75 GYVT
0,75 GYGN
0,75 GYWH
05/16
0,75 GYYE
0,35 YEGN
0,35 BNBK
0,35 BURD
1
5
4
1
2
3
6
8
7
9
10
y1
y3
y2
y4
Y36/6






1
2
3
2
1
B7
Y36/6

Partial air suspension

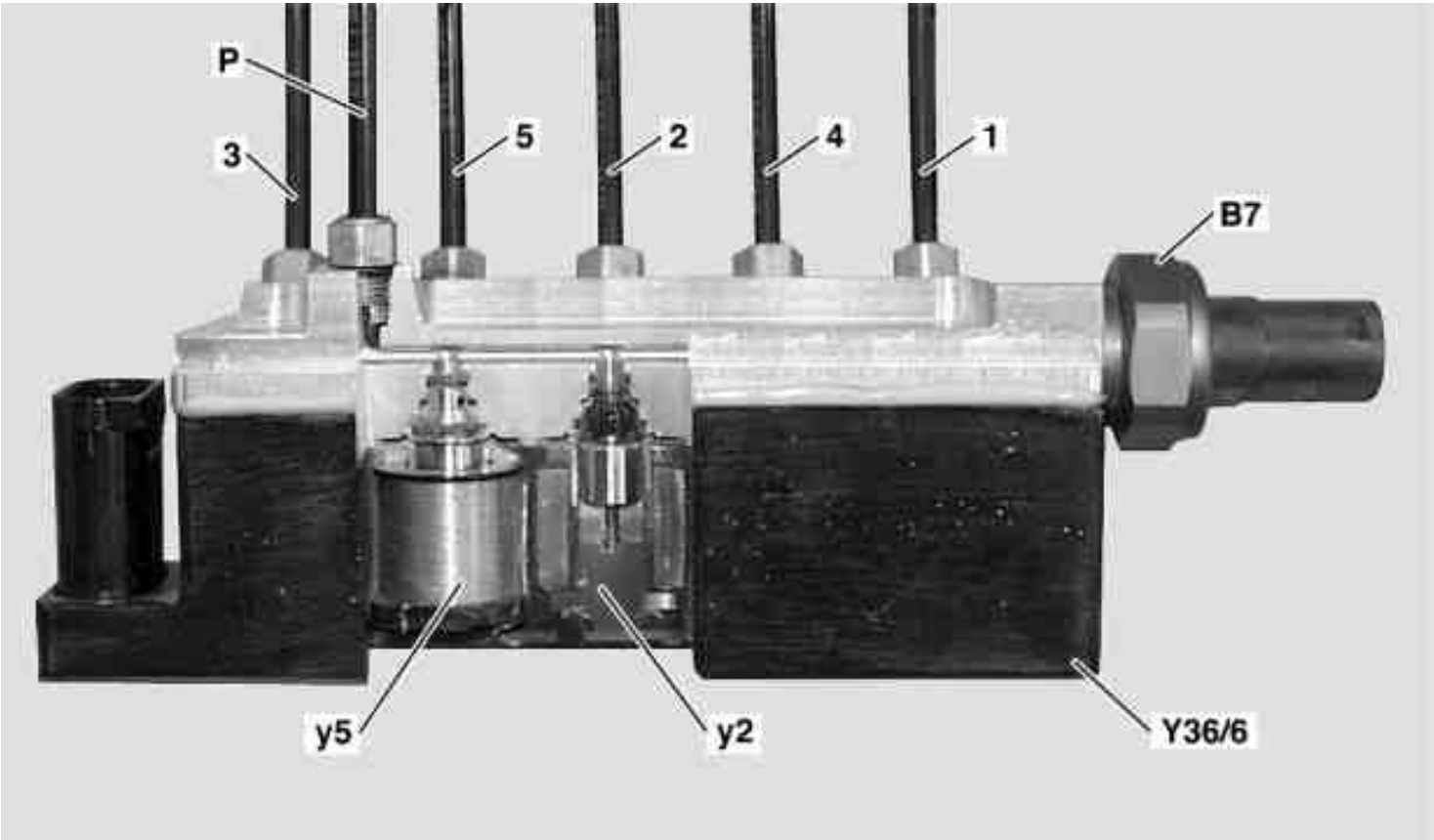
211 212 Wagon

251 R-Class

(Rear only)



Older version (220) showing valves



Level sensors



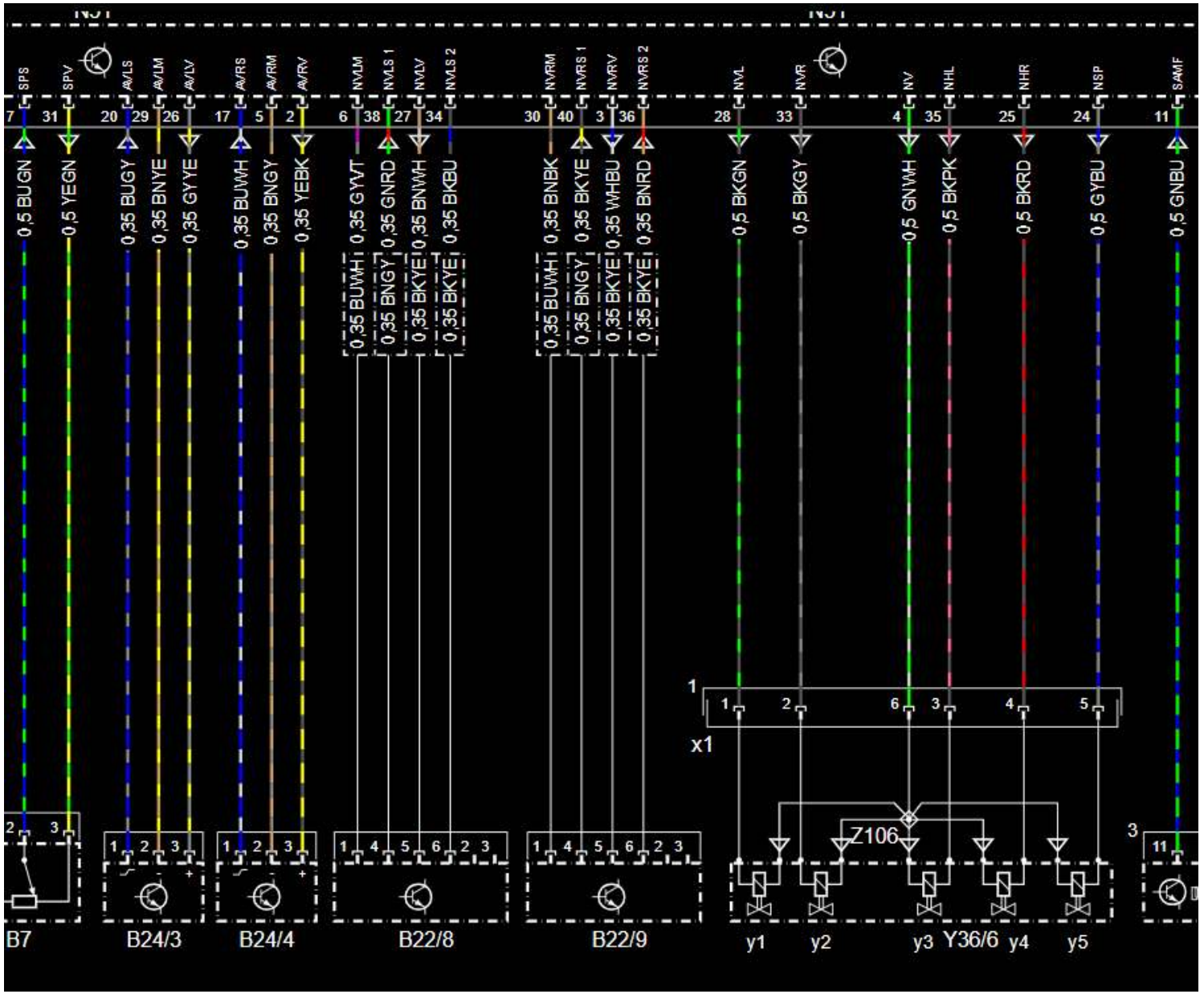




Linkages!






SPS
SPV
AVLS
AVLM
AVLV
AVRS
AVRM
AVRV
NVLM
NVLS 1
NVLV
NVLS 2
NVRM
NVRS 1
NVRV
NVRS 2
NVL
NVR
NV
NHL
NHR
NSP
SAMF
7
31
20
29
26
17
5
2
6
38
27
34
30
40
3
36
28
33
4
35
25
24
11
0,5 BUGN
0,5 YEGN
0,35 BUGY
0,35 BNYE
0,35 GYYE
0,35 BUWH
0,35 BNGY
0,35 YEBK
0,35 GYVT
0,35 GNRD
0,35 BNWH
0,35 BKBU
0,35 BNBK
0,35 BKYE
0,35 WHBU
0,35 BNRD
0,5 BKGN
0,5 BKGY
0,5 GNWH
0,5 BKPK
0,5 BKRD
0,5 GYBU
0,5 GNBU
1
x1
Z106
3
B7
B24/3
B24/4
B22/8
B22/9
y1
y2
y3
Y36/6
y4
y5

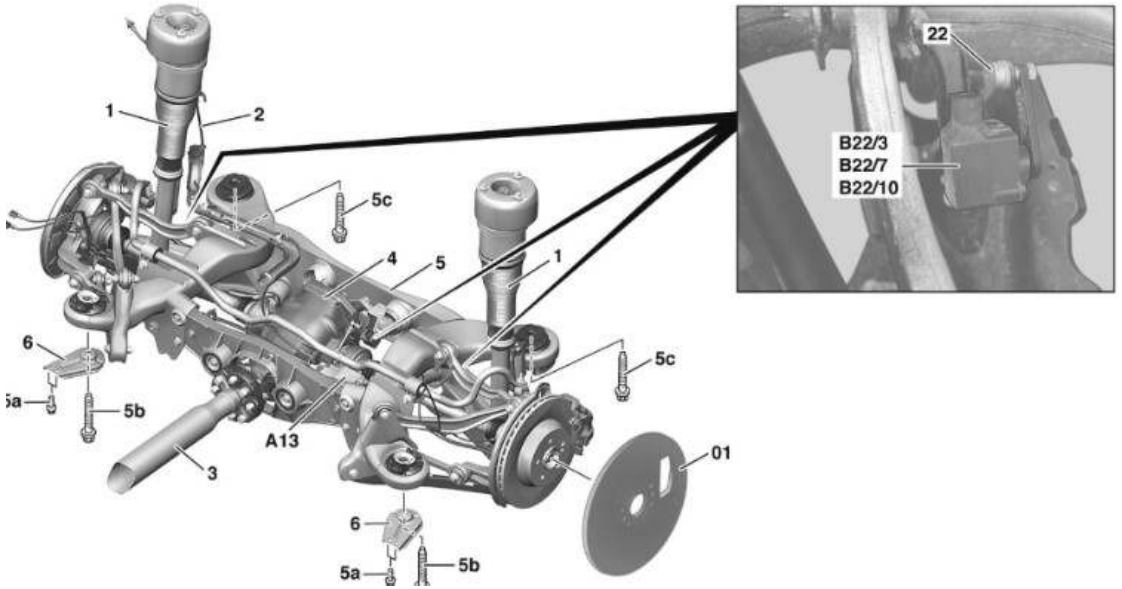
221 S-Class rear level sensor is broken

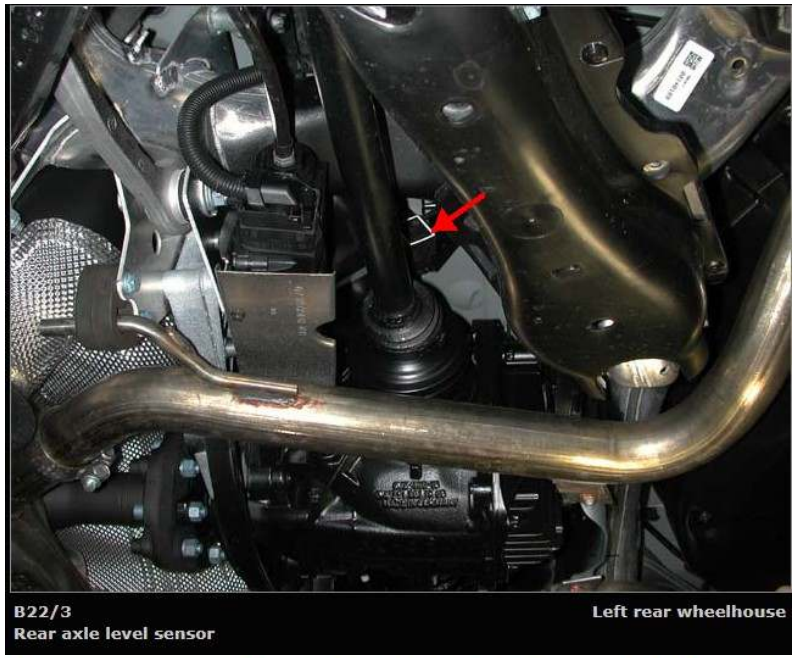


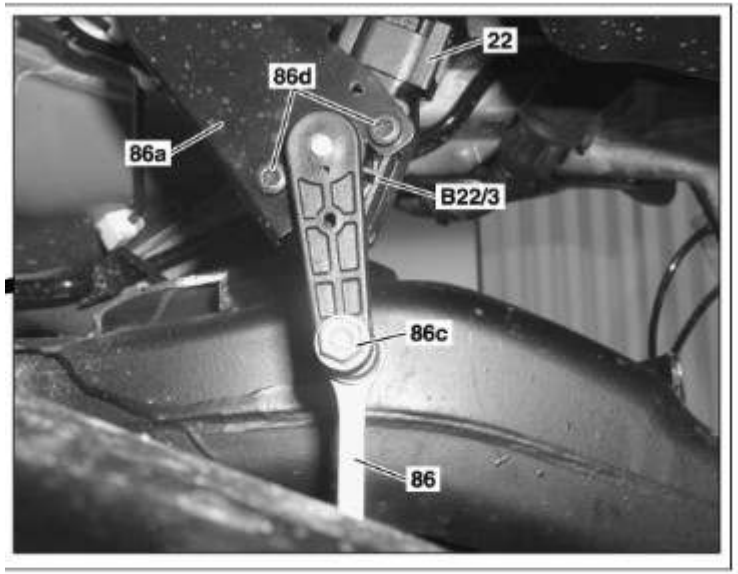
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221 Rear Sensor

B22/3



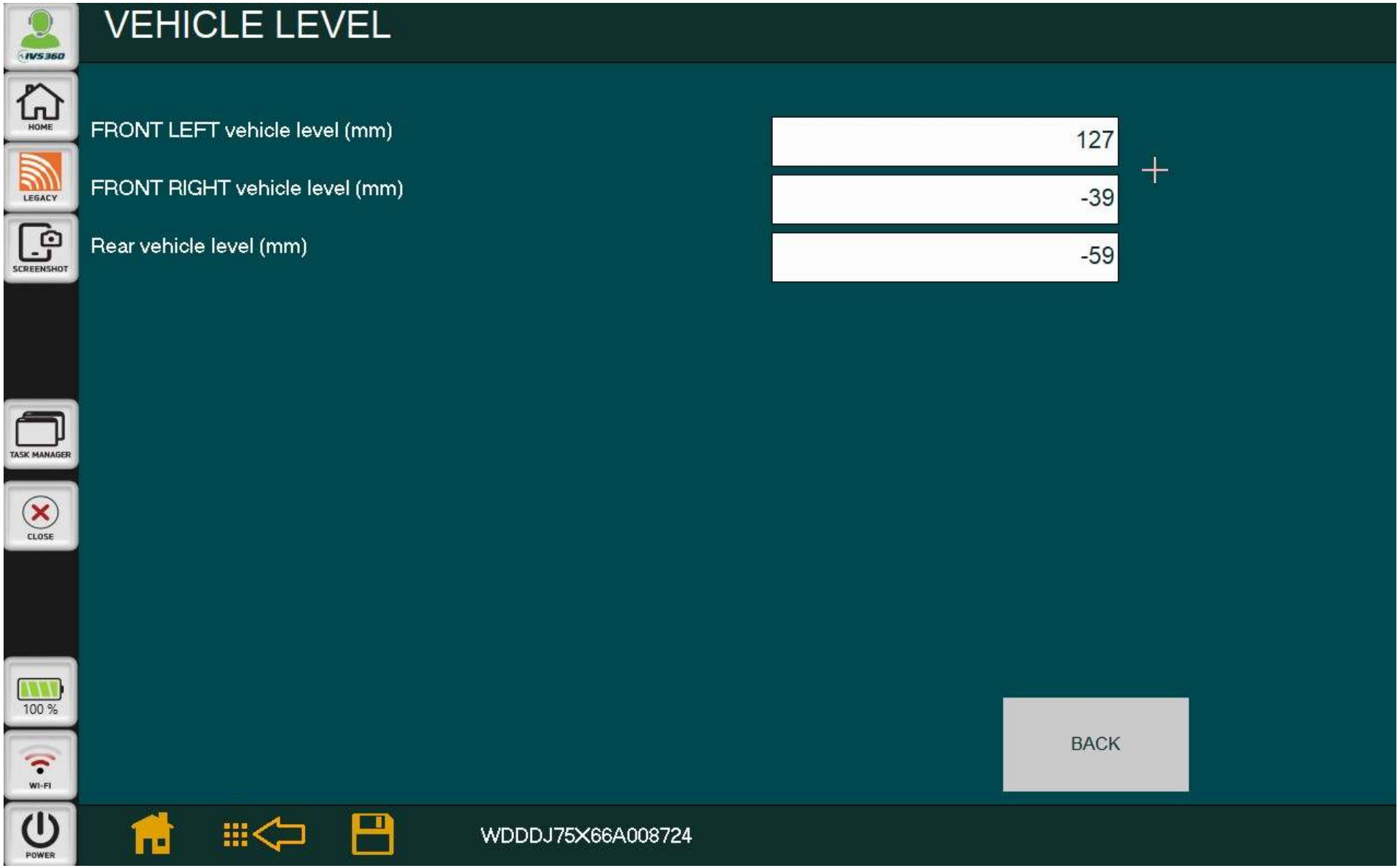




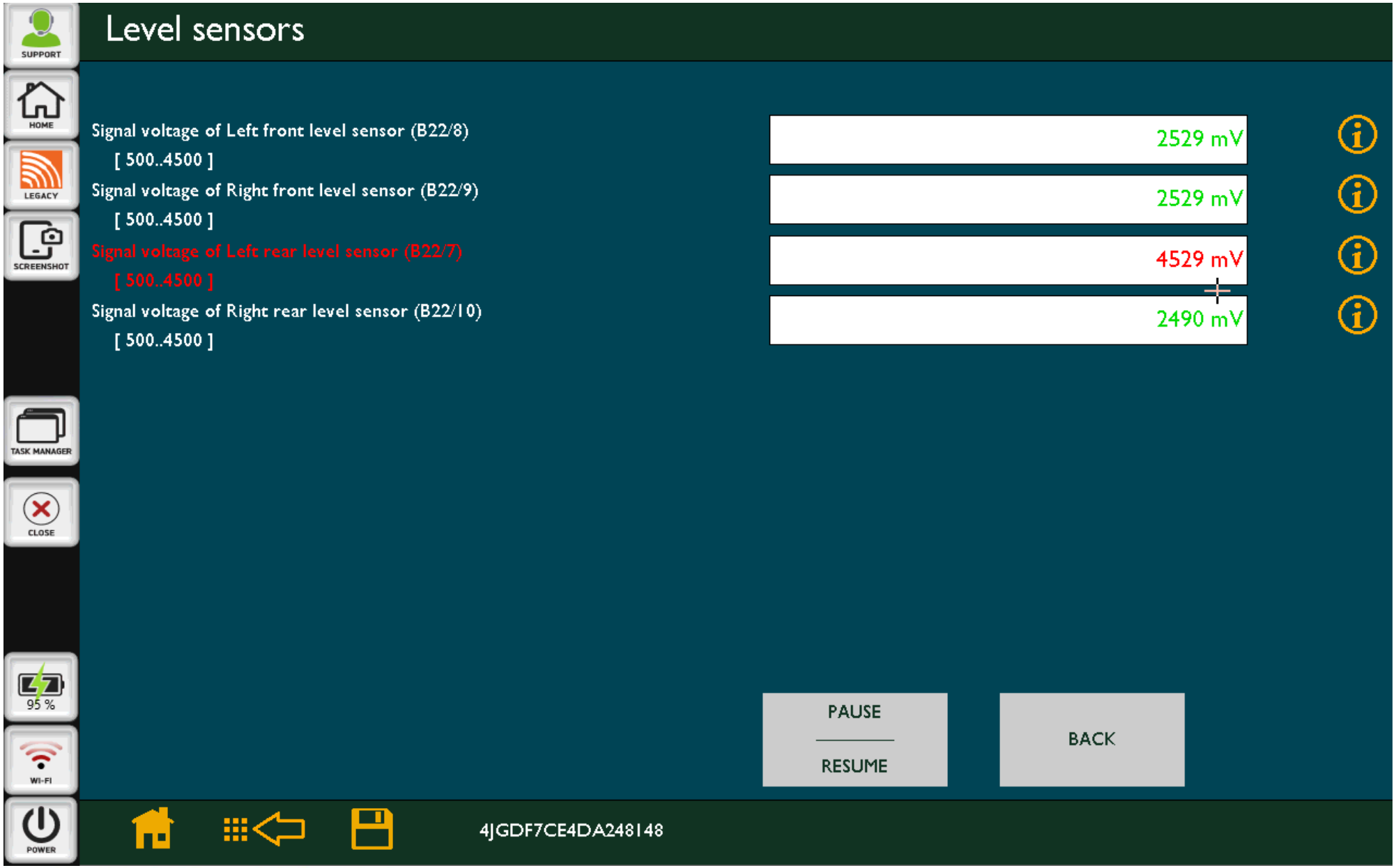


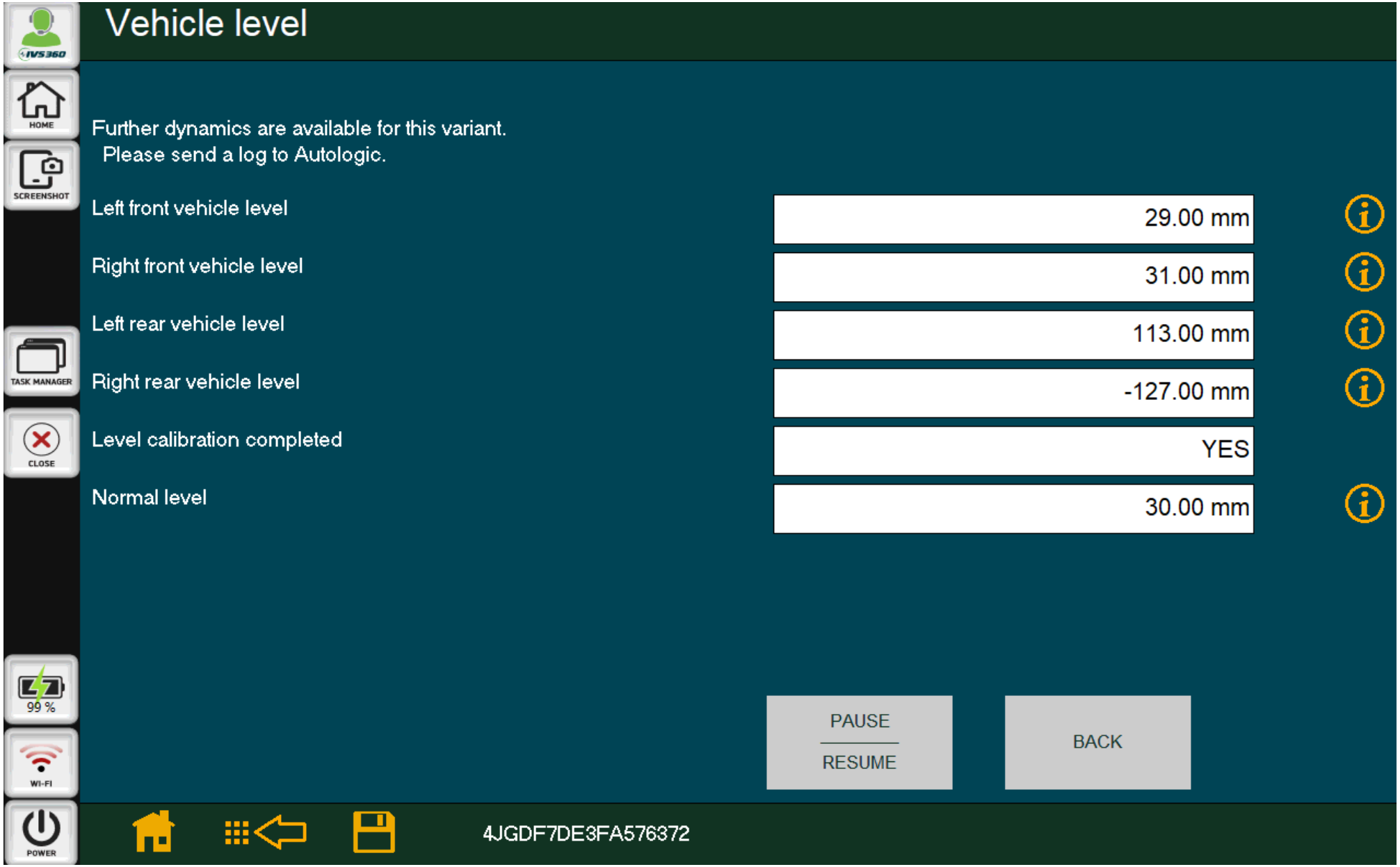
B22/3 Rear axle level sensor

Time to physically inspect the LF sensor

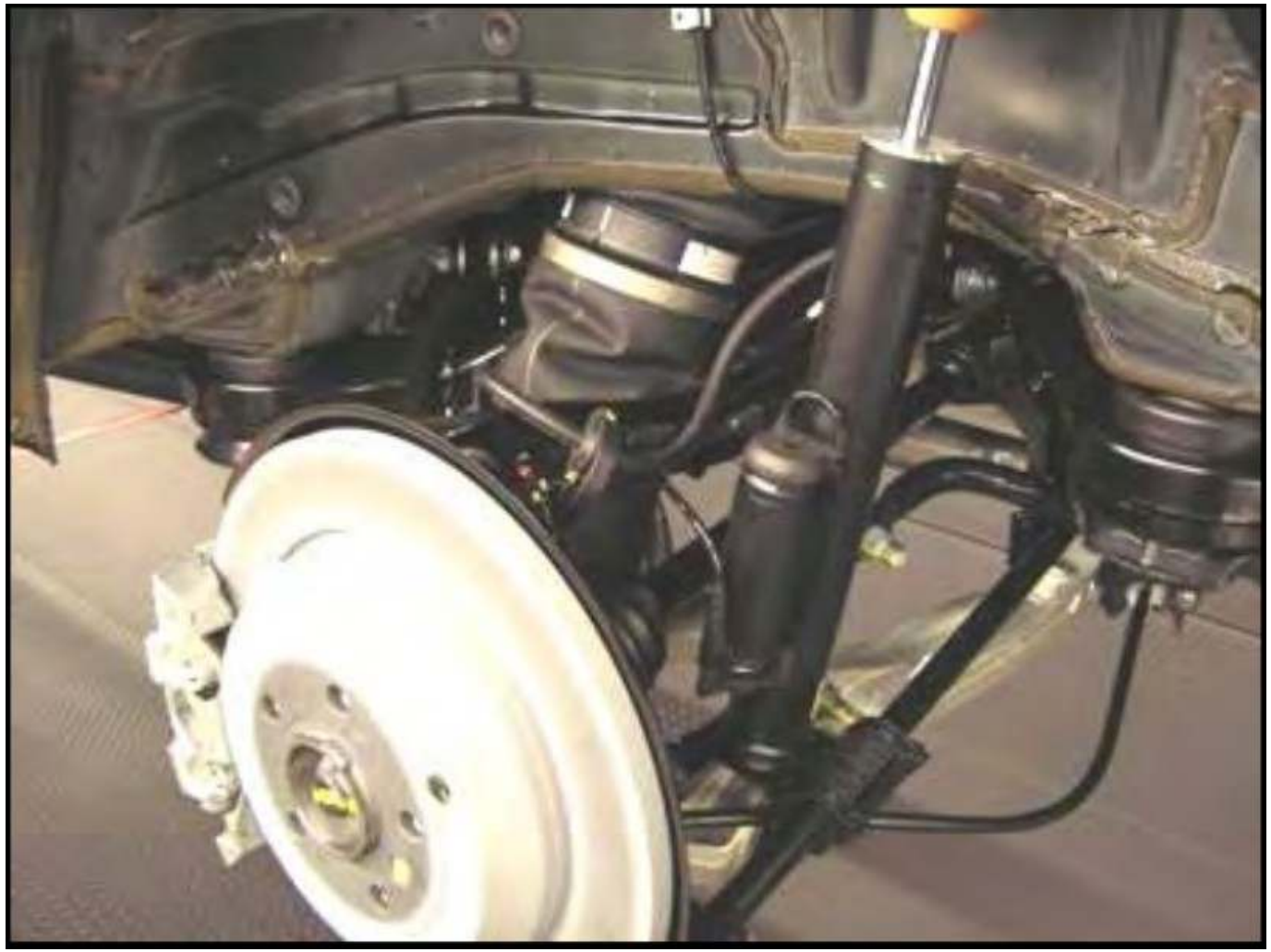


This one also needs physical inspection




Vehicle level
HOME
SCREENSHOT
TASK MANAGER
CLOSE
99 %
WI-FI
POWER
Further dynamics are available for this variant.
Please send a log to Autologic.
Left front vehicle level
29.00 mm
Right front vehicle level
31.00 mm
Left rear vehicle level
113.00 mm
Right rear vehicle level
-127.00 mm
Level calibration completed
YES
Normal level
30.00 mm
PAUSE
RESUME
BACK
4JGDF7DE3FA576372

Struts and Springs





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On 211/219 vehicles with Semi Active Suspension there are quality issues with aftermarket parts

Specifically the electrical components – valves sometimes do not pass the diagnostics of the airmatic module

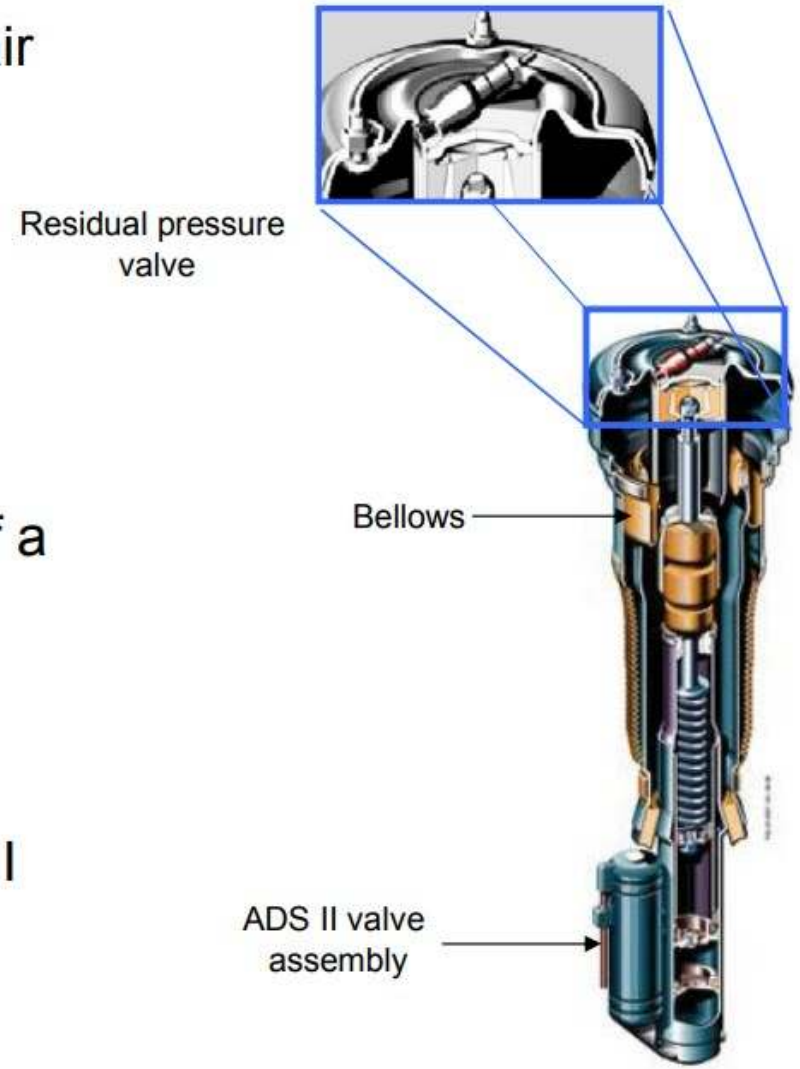
Pay attention to whether you have circuit faults eg Y51y1 or Y52y2 etc with the original parts on the vehicle

If new aftermarket parts start setting these codes, likely faulty



220 AIRmatic Spring Struts

- Weight of vehicle fully supported by air volume in bellows
- Ride height raised and lowered by adjusting air volume in bellows
- Residual pressure valve maintains approx. 4.5 bar in strut in the event of a line leak
  - Does not maintain ride height
  - Protects the bellows from damage
- Integrated shock absorber with ADS II at all 4 struts



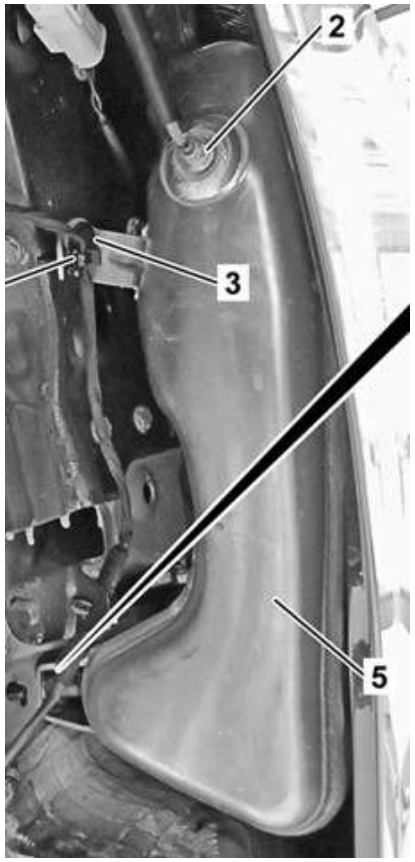
Reservoir

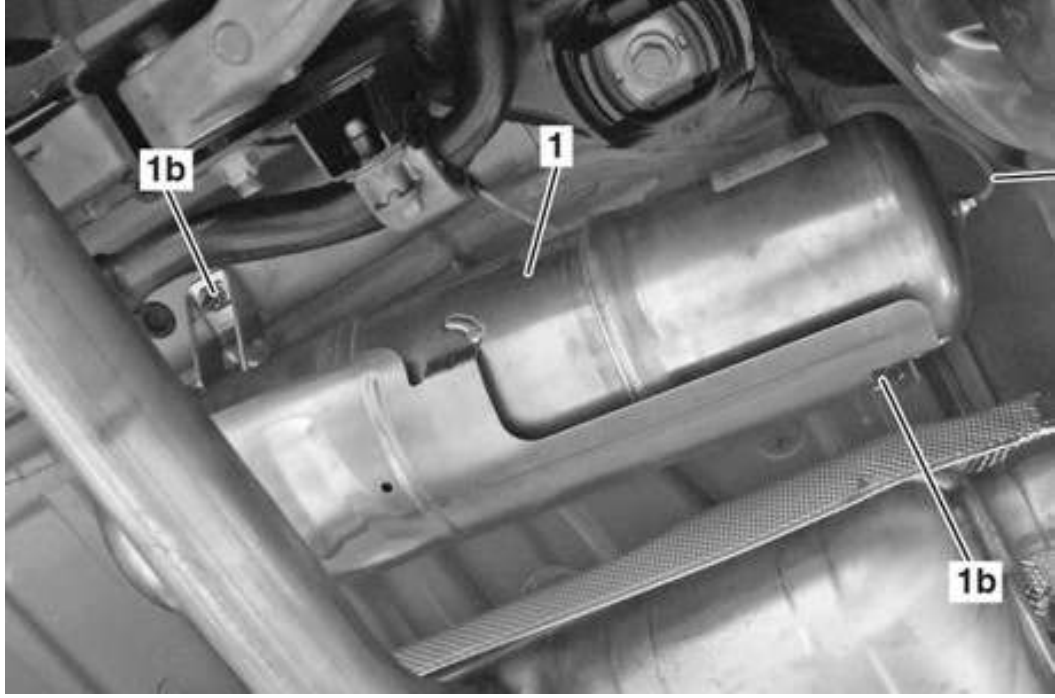
Used when we want to minimize noise or conserve power

Enables raising the vehicle more rapidly than compressor could

Similar to ABC accumulator, aids with peak demand









No reservoir used on the 205 chassis

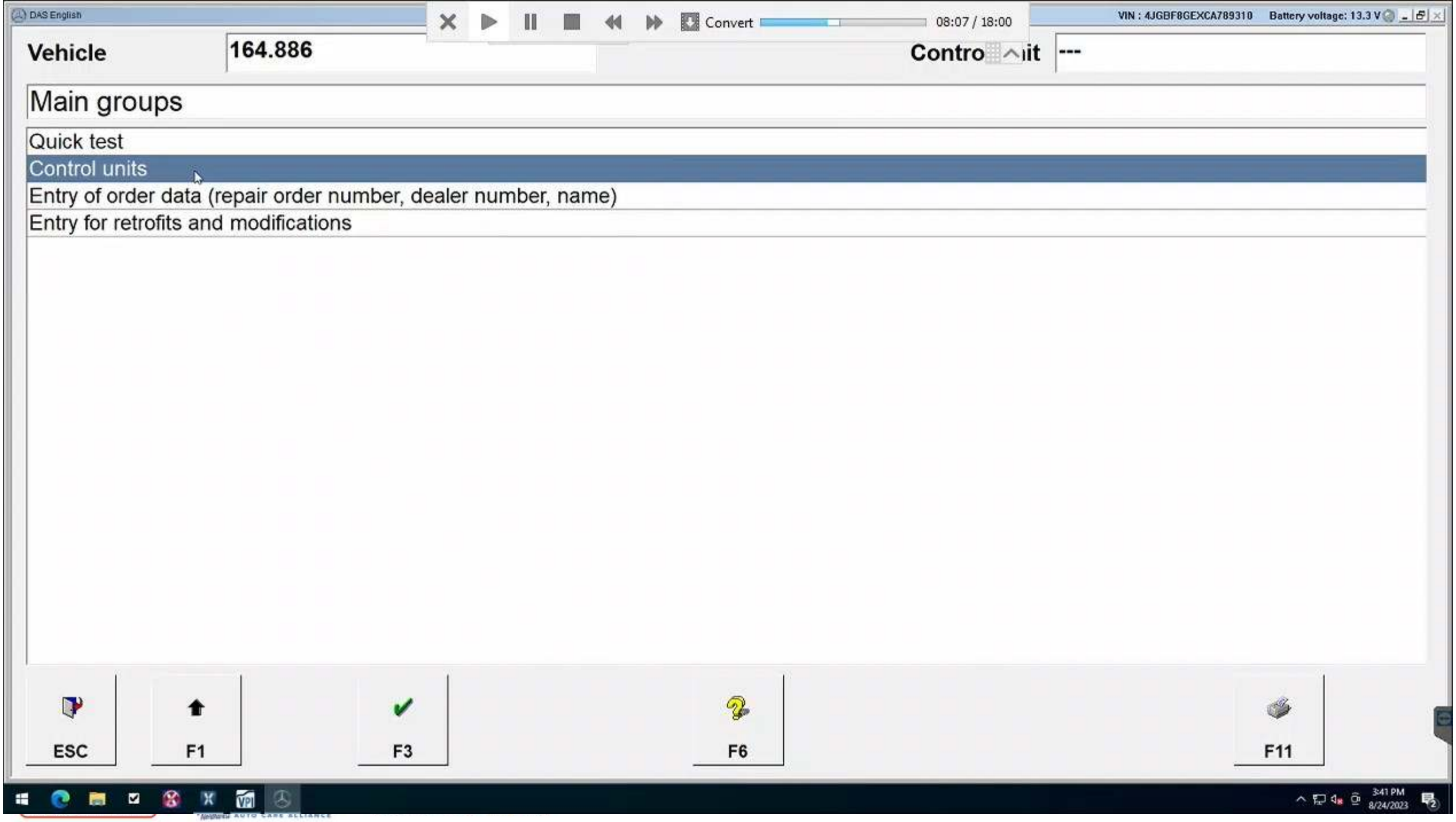


Vehicle 221.186 **Control unit** AIRmatic

Pneumatic test of component A9/1 (AIRmatic compressor unit)

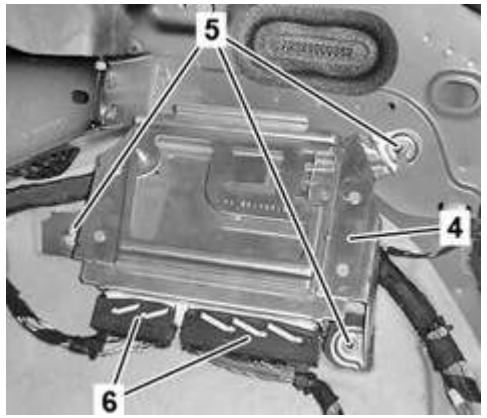
Preconditions :
- The air filter of component A9/1 (AIRmatic compressor unit) is not clogged.

Test sequence :
- Pressure relief valve will be opened for 5 s.
- Pressure relief valve will be shut..
- Compressor will be switched on for 40 s maximum.
- All valve block valves are shut and the compressor must generate a pressure of more than 16 bar within 40 s.


DAS English
Convert
08:07 / 18:00
VIN : 4JGBF8GEXCA789310
Battery voltage: 13.3 V
Vehicle
164.886
Control unit

Main groups
Quick test
Control units
Entry of order data (repair order number, dealer number, name)
Entry for retrofits and modifications
ESC
F1
F3
F6
F11
3:41 PM
8/24/2023

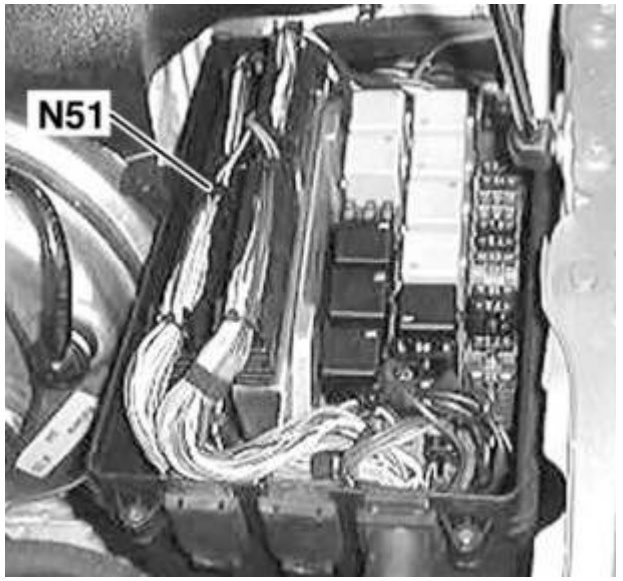
Airmatic Module

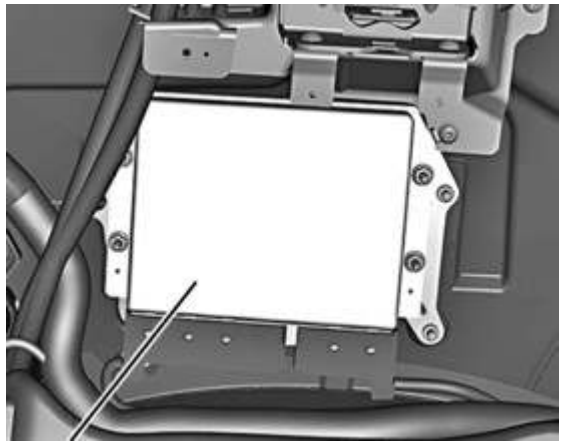












164



251



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AIRmatic Control Unit (N51/3)

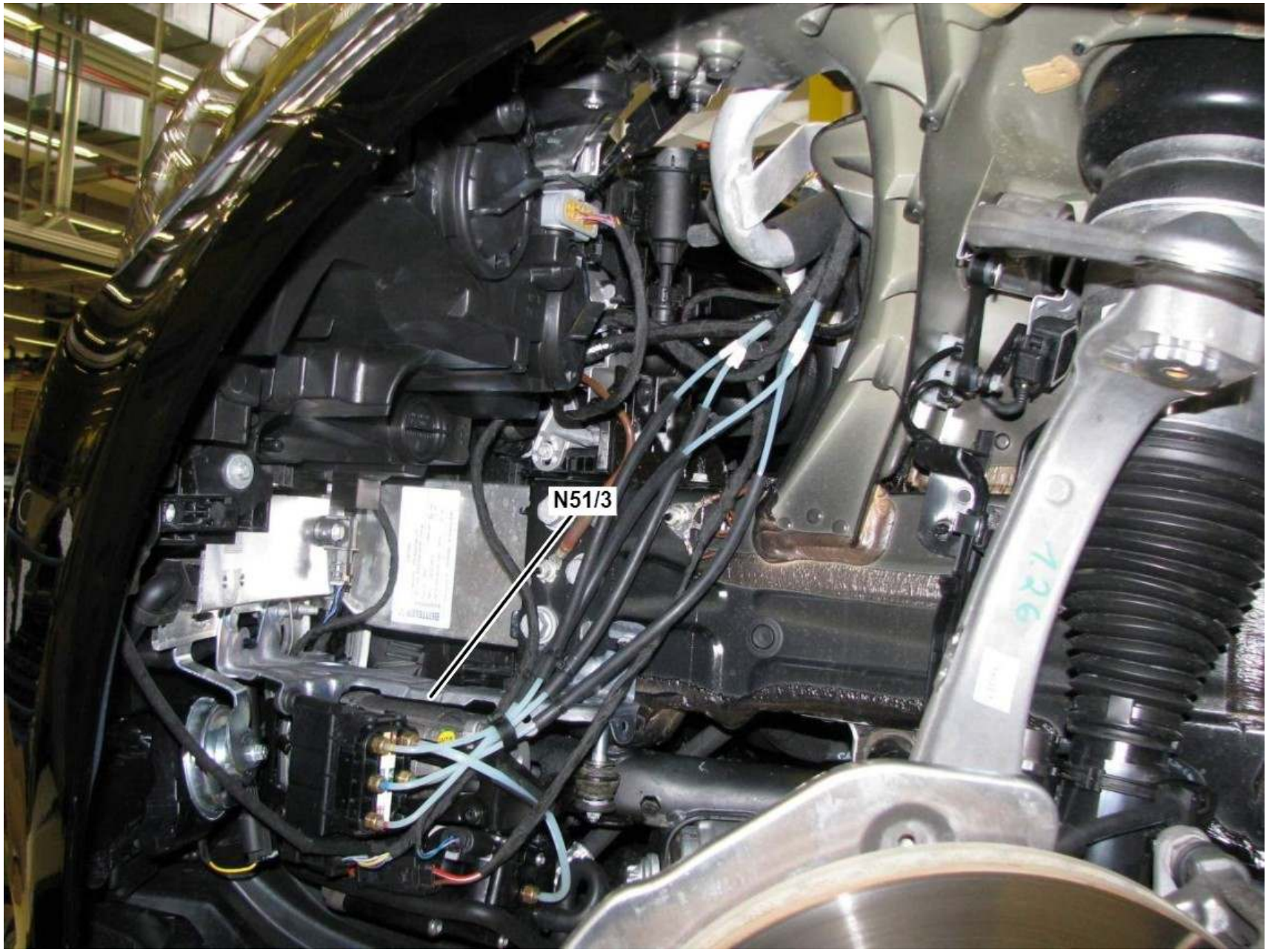
- Located under passenger floorboard
- Chassis CAN component (CAN E)
- CAN inputs:
  - ESP (wheel speed data)
  - ME (RPM, intake air temp, baro)
  - IC (ambient air temp)
  - SCM (steering angle)
  - Switch group (S77) (part of instrument panel LIN)
  - Wake-up
- Discrete inputs:
  - 3 body acceleration sensors
  - 4 level sensors
  - Pressure sensor in level regulating valve block (Y36/6)
  - Power (30G) & ground



- Outputs:
  - 4 level control valves
  - 1 central reservoir valve
  - Compressor relay
  - Pressure reduction valve
  - 4 damping valves
  - Status & warning messages (CAN)
  - Level sensor values (CAN)
    - Vehicles equipped with bi-xenon

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N51/3
AIRMATIC control unit

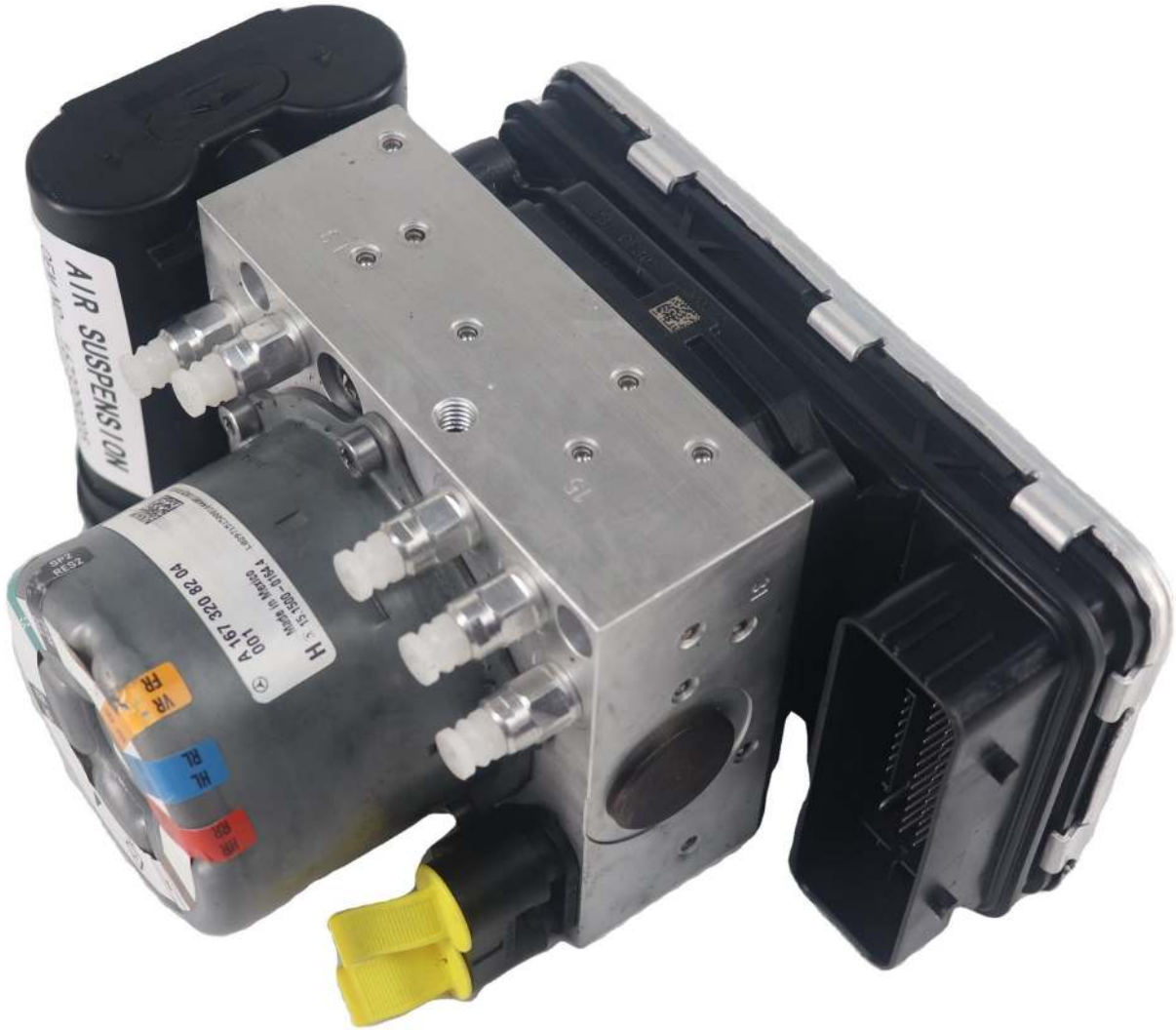


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167 Compressor, Valve Block, and Module

~$1800



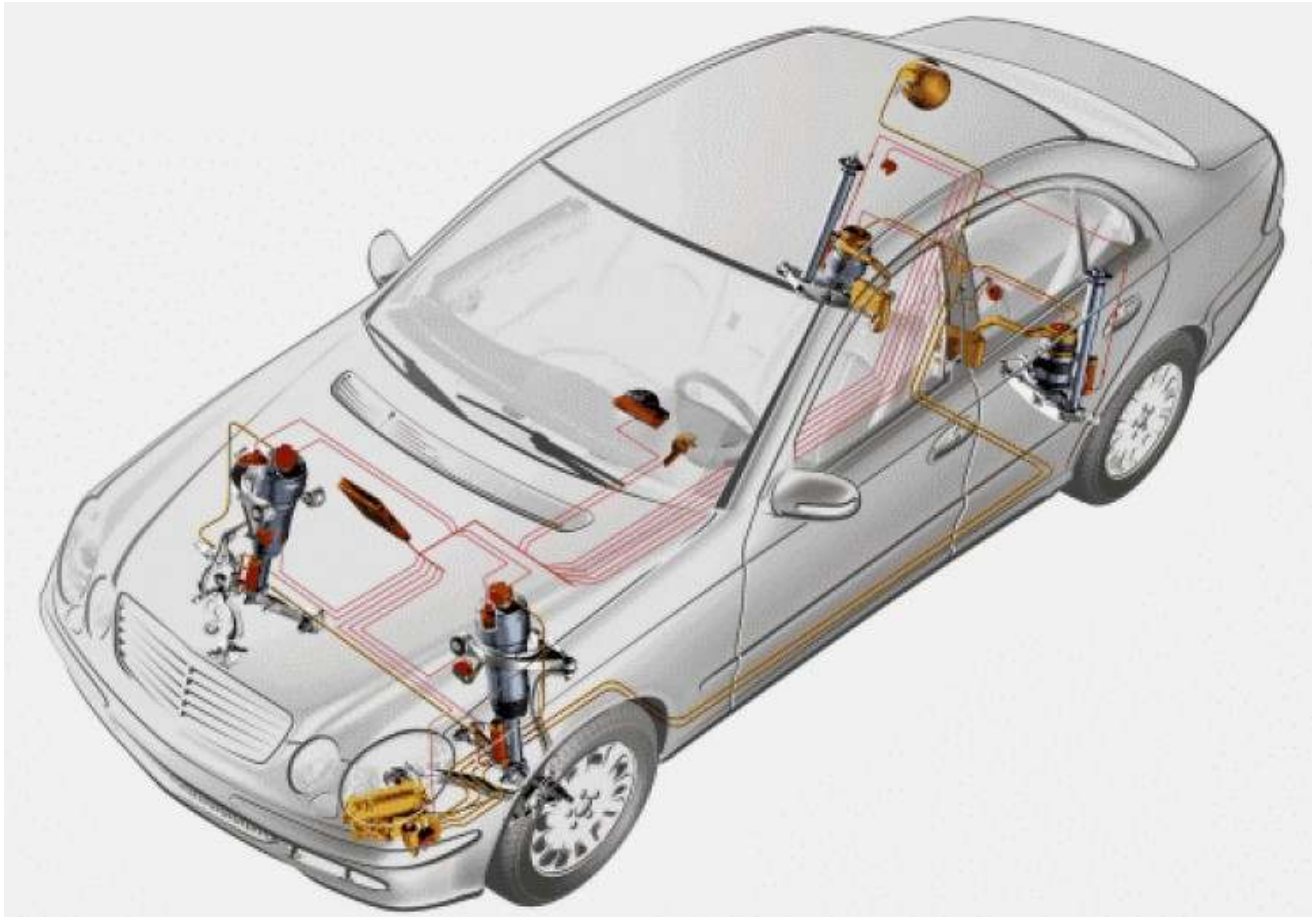


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Semi-Active Air Suspension (SAS)



SAS Function

- SAS Dual Control System
  - Air suspension leveling
  - Dual chambers are used
  - Used on 211/219 E and CLS



Front Air Strut

Y51/1 Left Front Strut Valve Unit

- y1 Additional Volume Valve
- y2 Level Valve

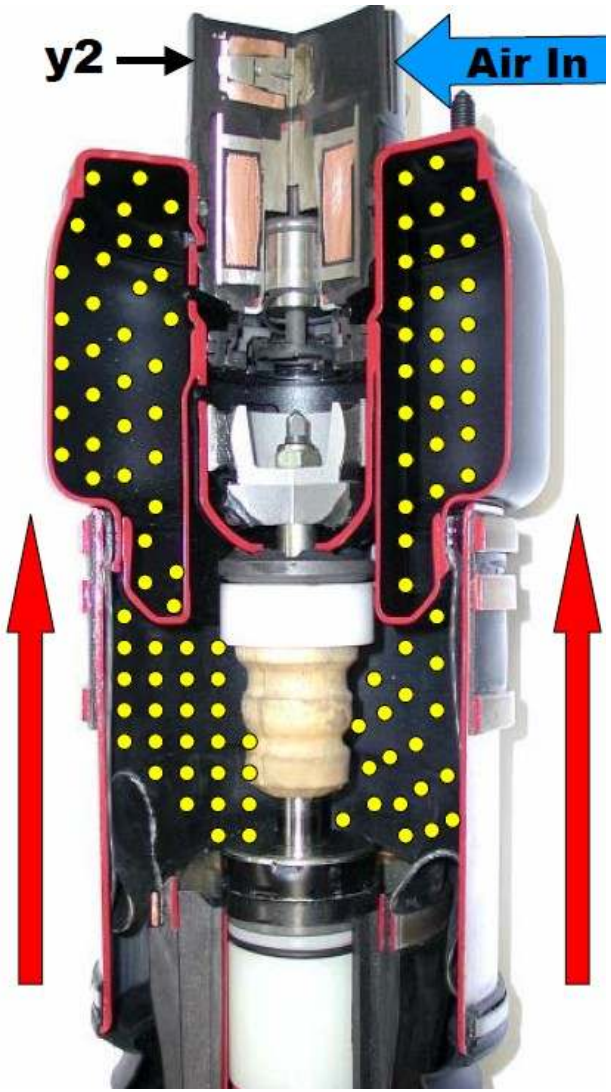
Y51 Left Front Axle Dampening Valve Unit

- y1 Solenoid Valve 1
- y2 Solenoid Valve 2



Y51/1y2 Blocking Valve





Additional Volume Valve (y1)

With the volume valve closed (energized), one air chamber is used.

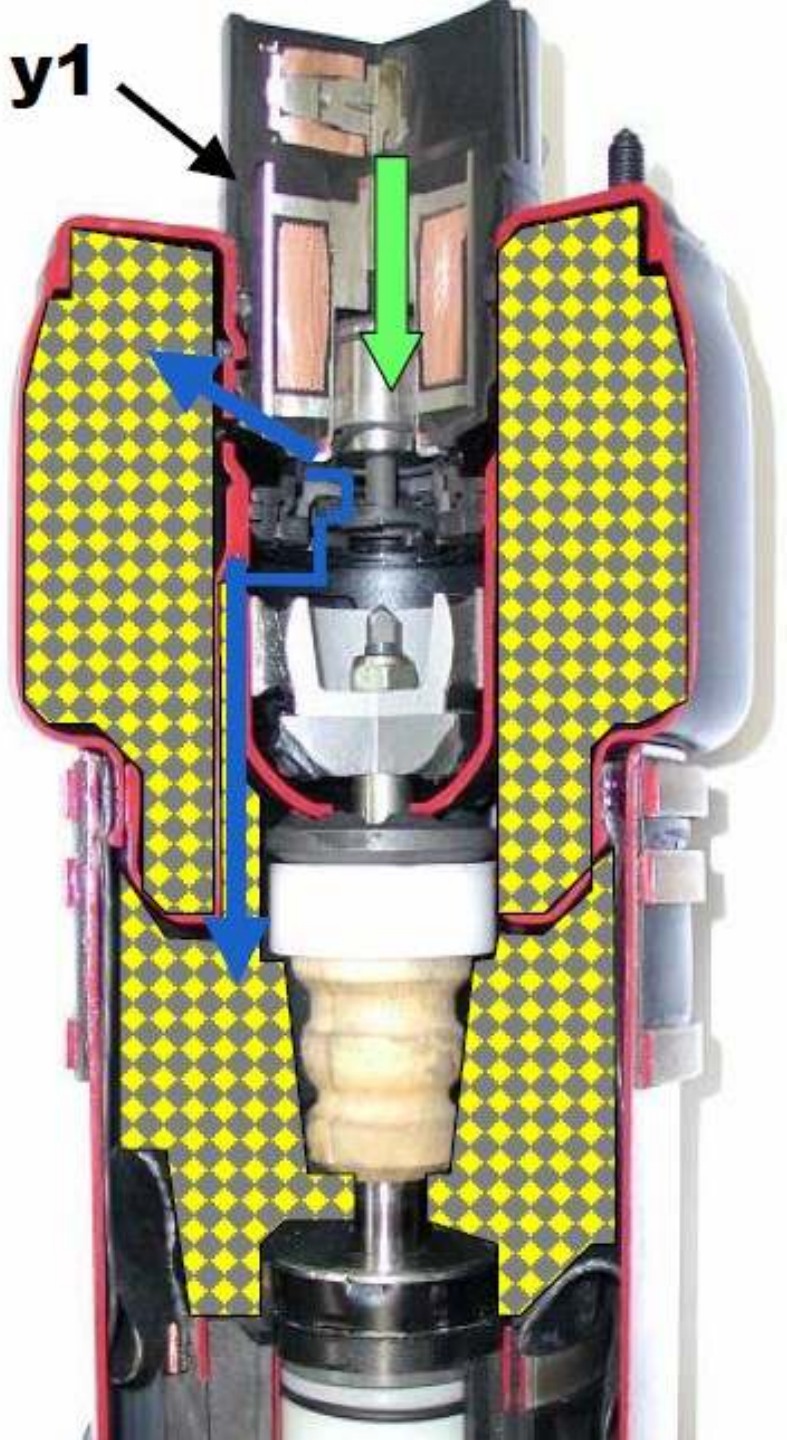
With less volume to compress there is a firmer ride



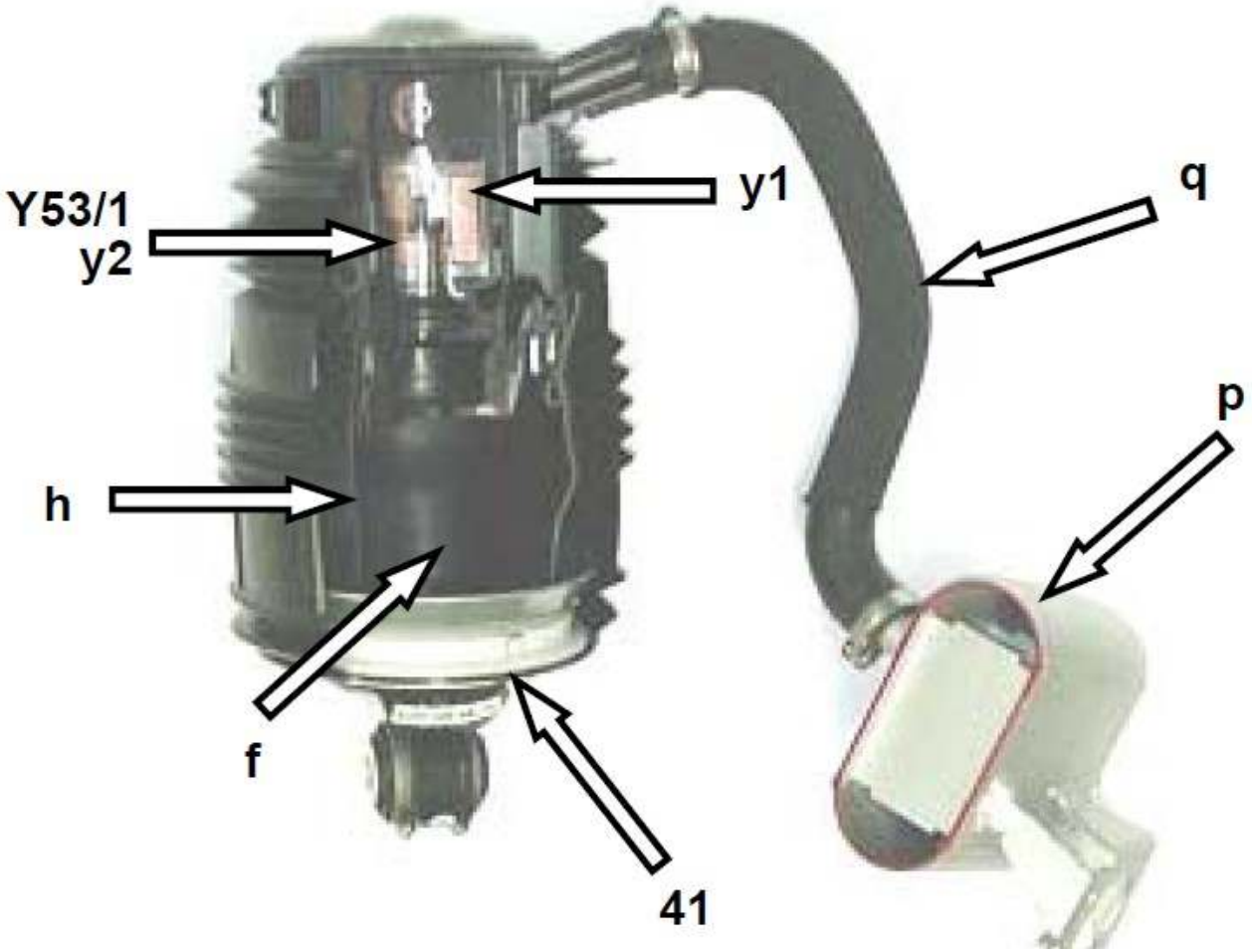
Air Spring Dampening

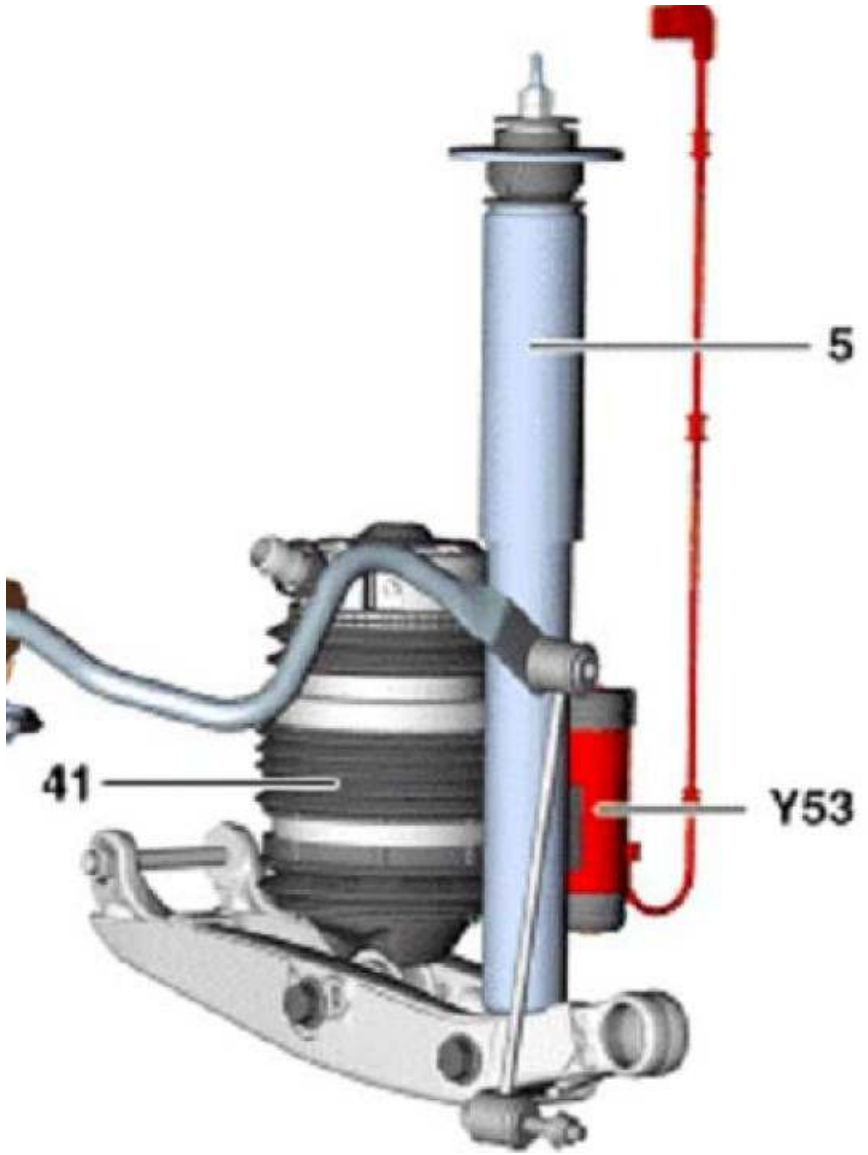
With the volume valve open (de-energized), both air chambers are used.

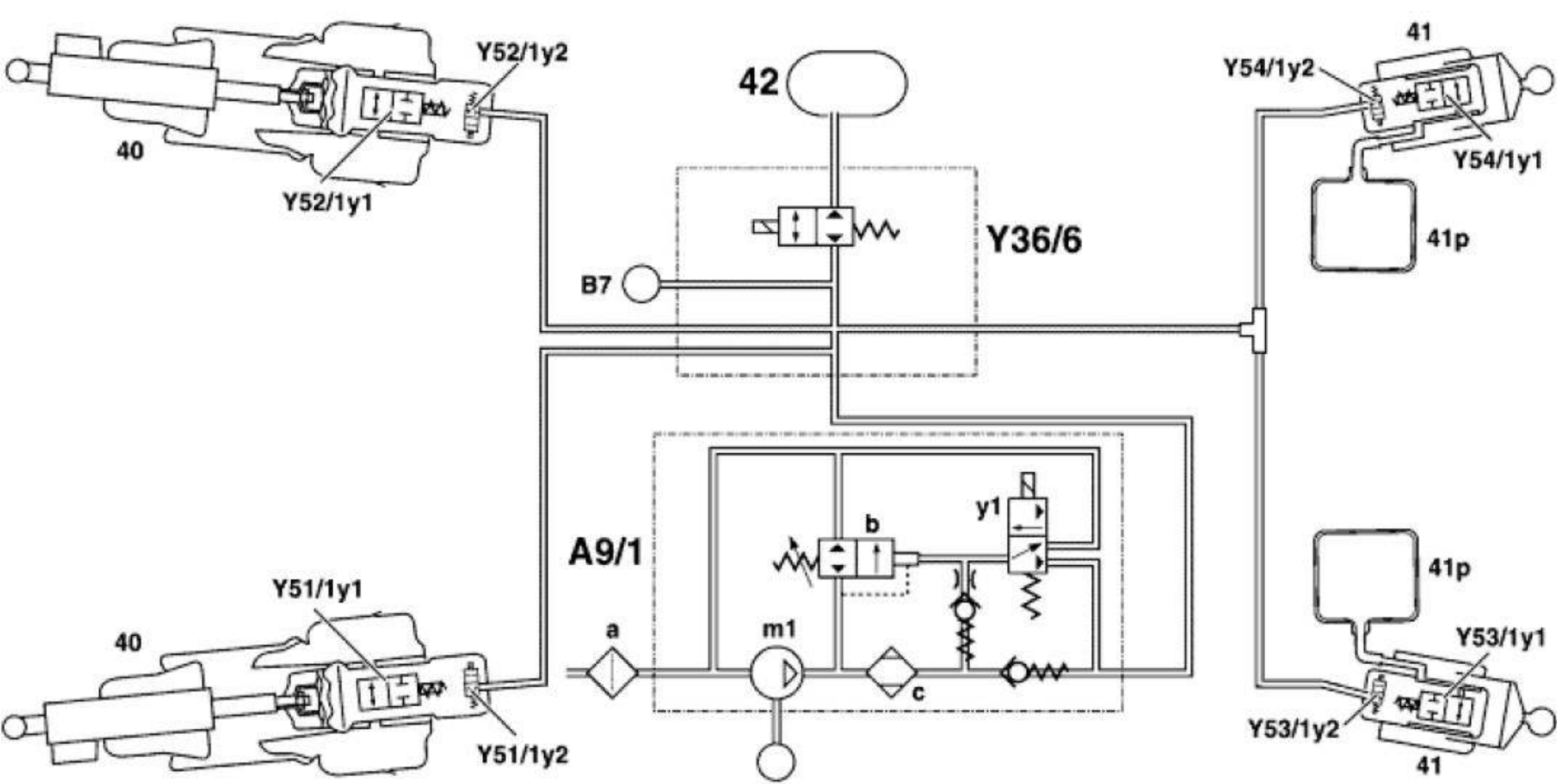
With more air volume to compress there is a softer ride



Rear Air Spring

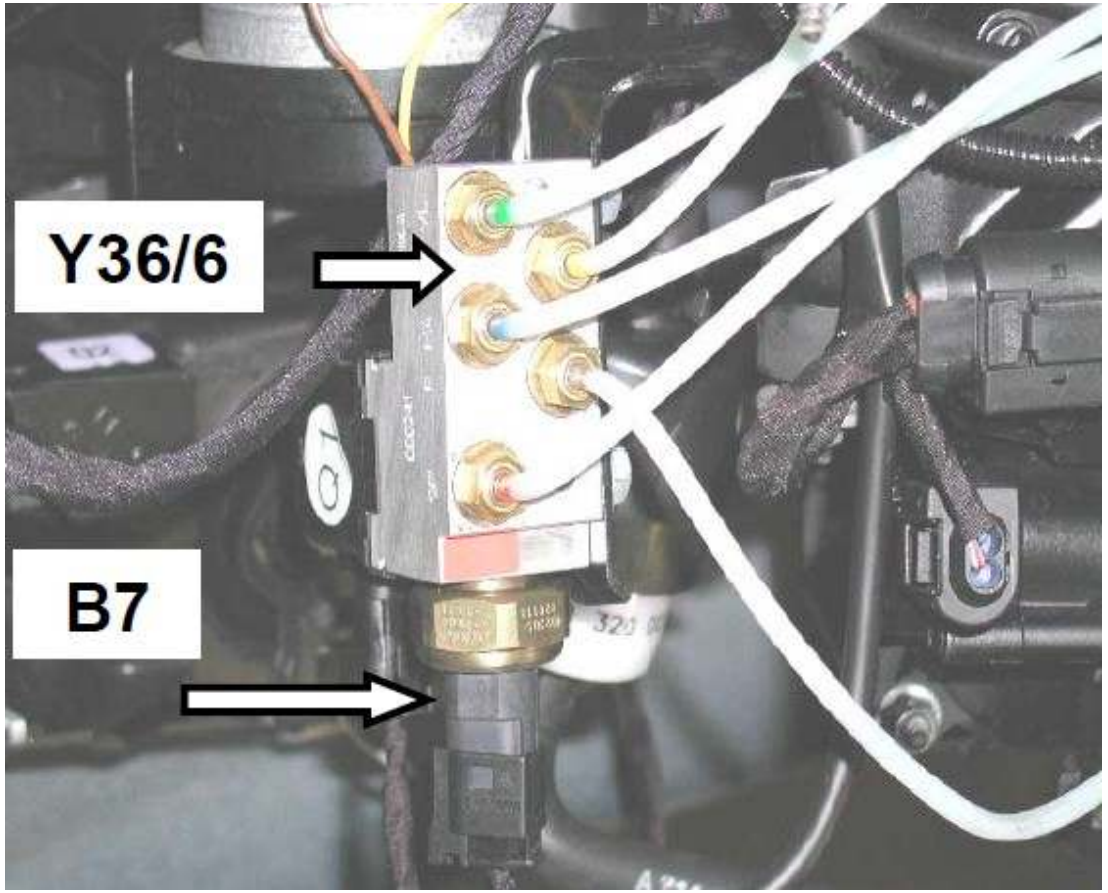





Y52/1y2
40
Y52/1y1
42
B7
Y36/6
41
Y54/1y2
Y54/1y1
41p
A9/1
b
y1
a
m1
c
Y51/1y1
40
Y51/1y2
41p
Y53/1y1
Y53/1y2
41

Central Reservoir Charge Valve (Y36/6)

- Y36/6 Central Reservoir Charge Valve
- B7 Central Pressure Sensor
- Located next to the compressor

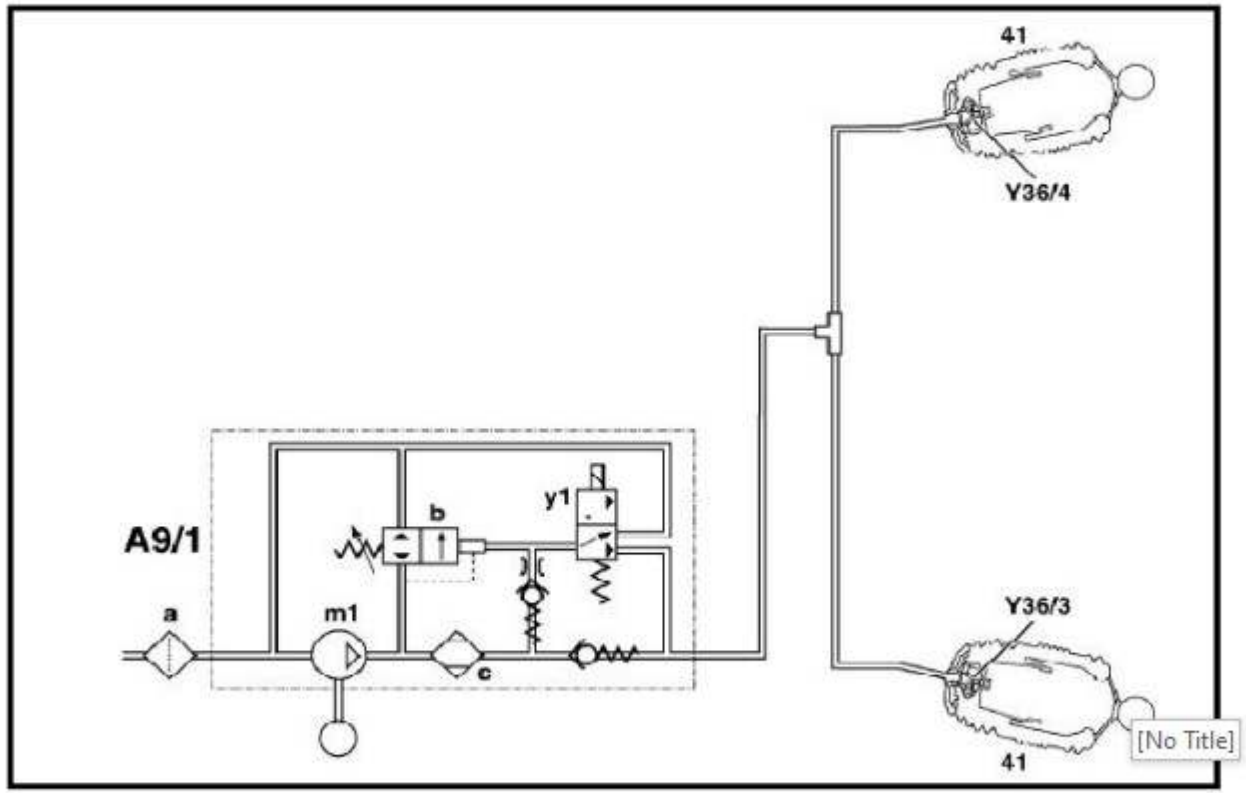


Partial Air Suspension (Rear Only)

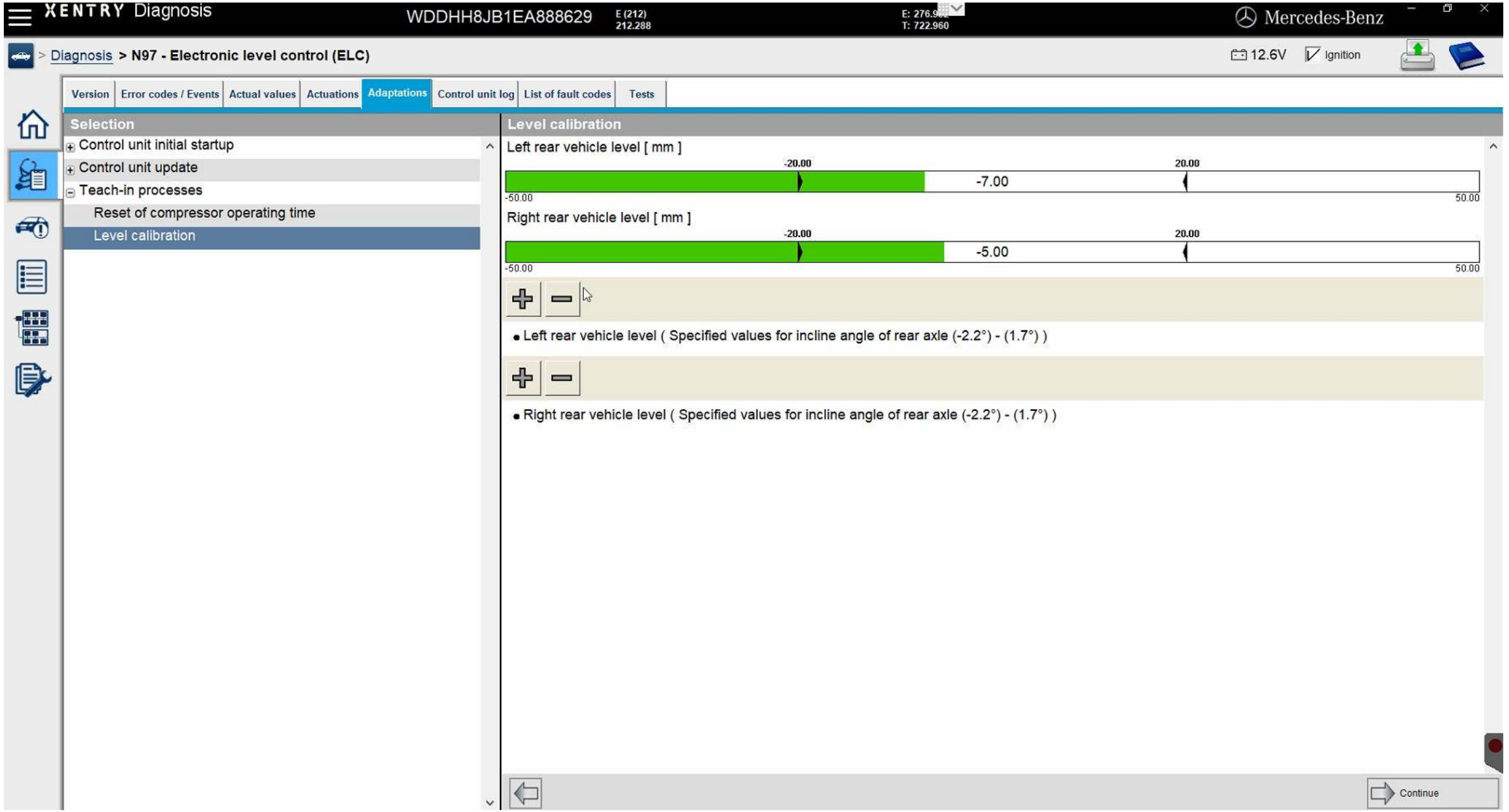
- Available on 211, 212, and 251
- No reservoir is used
- 251/212 Valve block has two valves for left/right
- 211 Valves in springs
- No adaptive damping
- No manual or automatic adjustment of ride level



Electronic Rear Axle Level Control (EHNR) S211 Version



41	Rear air spring	b	Pressure relief / residual pres. valve
A9/1	EHNR compressor	c	Silicate air drier
A9/1y1	Pressure relief	Y36/3	Left rear axle control valve
a	Air filter	Y36/4	Right rear axle control valve

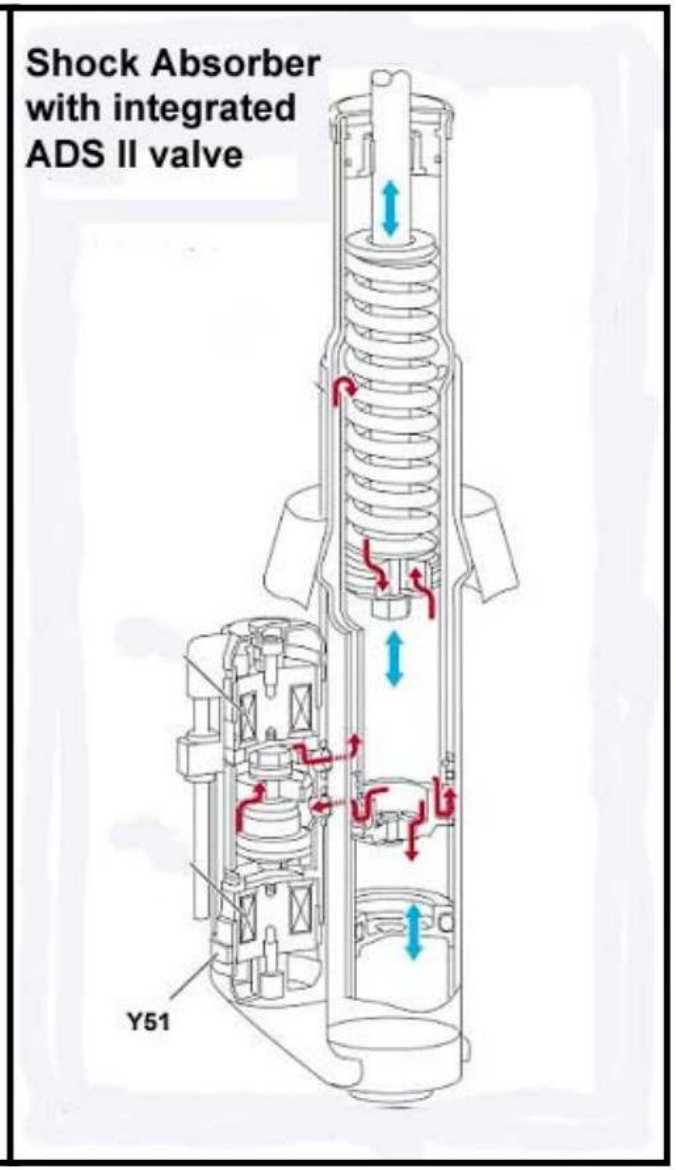

XENTRY Diagnosis
WDDHH8JB1EA888629
E (212)
212.288
E: 276.962
T: 722.960
Mercedes-Benz
> Diagnosis > N97 - Electronic level control (ELC)
12.6V
Ignition
Version
Error codes / Events
Actual values
Actuations
Adaptations
Control unit log
List of fault codes
Tests
Selection
Control unit initial startup
Control unit update
Teach-in processes
Reset of compressor operating time
Level calibration
Level calibration
Left rear vehicle level [mm]
-20.00
20.00
-7.00
-50.00
50.00
Right rear vehicle level [mm]
-20.00
20.00
-5.00
-50.00
50.00
Left rear vehicle level (Specified values for incline angle of rear axle (-2.2°) - (1.7°))
Right rear vehicle level (Specified values for incline angle of rear axle (-2.2°) - (1.7°))
Continue

Adaptive Damping

- Standard equipment on all AIRmatic equipped vehicles (except for X164, ADS II is within an option package or std depending on model year and model e.g 2009 Std on GL550, option on GL450)
- Older vehicles and AMG use acceleration sensors to monitor body.
- Vehicle speed, steering angle, braking information is sent over CAN
- The damping valves are the outputs. Older models have multiple levels of damping newer have continuously variable damping





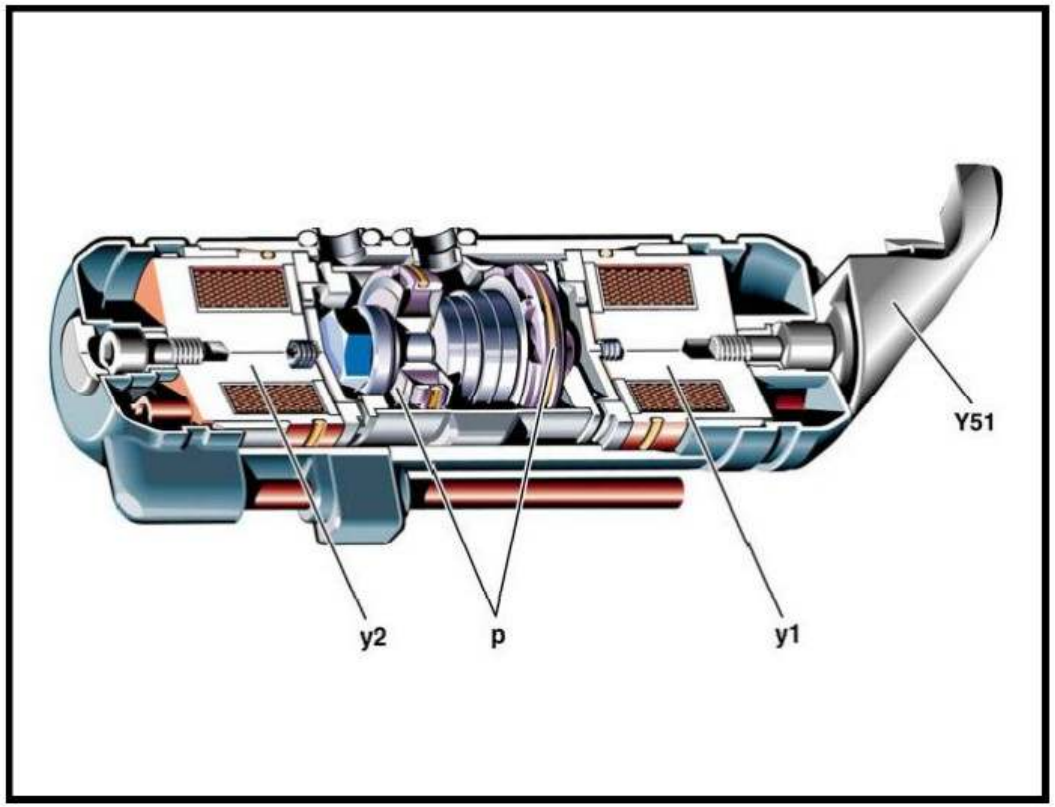


Movement Oil flow

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ADS II Damping Valve

- y1 and y2 solenoids are Pulse Width Modulated (PWM) controlled (<u>not</u> simply on/off)
- Operation (movement) of solenoid valves can be up to 5 hertz (cycles/second)
- Control of solenoids allows for extremely short adjustment times and adaptation to sudden changes
- If AIRmatic control module (N51) recognizes a fault in the system all solenoids are de-energized



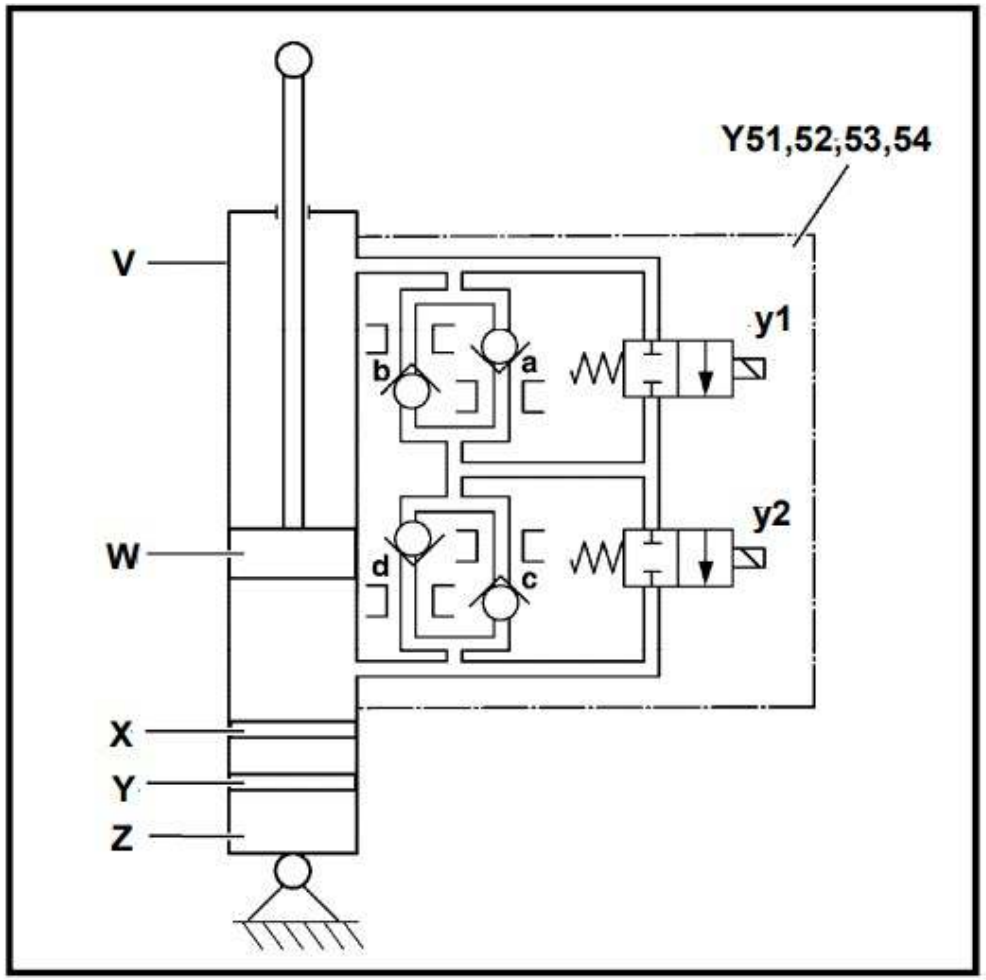
y1	Solenoid valve
y2	Solenoid valve
P	Piston reed valves
Y51	Left front damping valve

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ADS II Damping Valve

- 4 damping force levels can be obtained through actuation of individual damping valves
- Each damping valve consists of:
  - 2 solenoid valves
  - 4 bypass valves

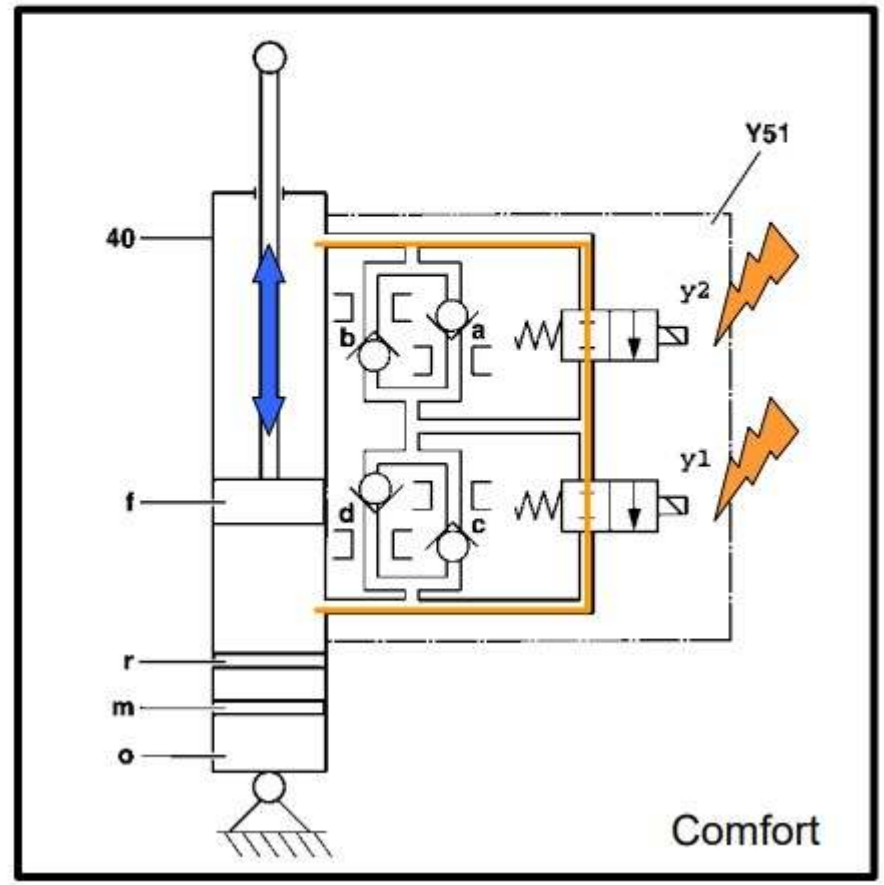
    (bypass valves are integrated into 2 reed valves)
- Each bypass valve acts as both a directional check valve and as a throttle valve (restrictor)
- Bypass valves ‘b’ and ‘d’ are less restrictive than bypass valves ’a’ and ‘c’



V	Strut / shock	y1	Solenoid valve 1
W	Operating piston	y2	Solenoid valve 2
X	Bottom valve	a	Bypass valve hard compression stage
Y	Dividing piston	b	Bypass valve soft rebound stage
Z	Gas pressure chamber	c	Bypass valve hard rebound stage
Y51- 54	Damping valve	d	Bypass valve soft compression stage

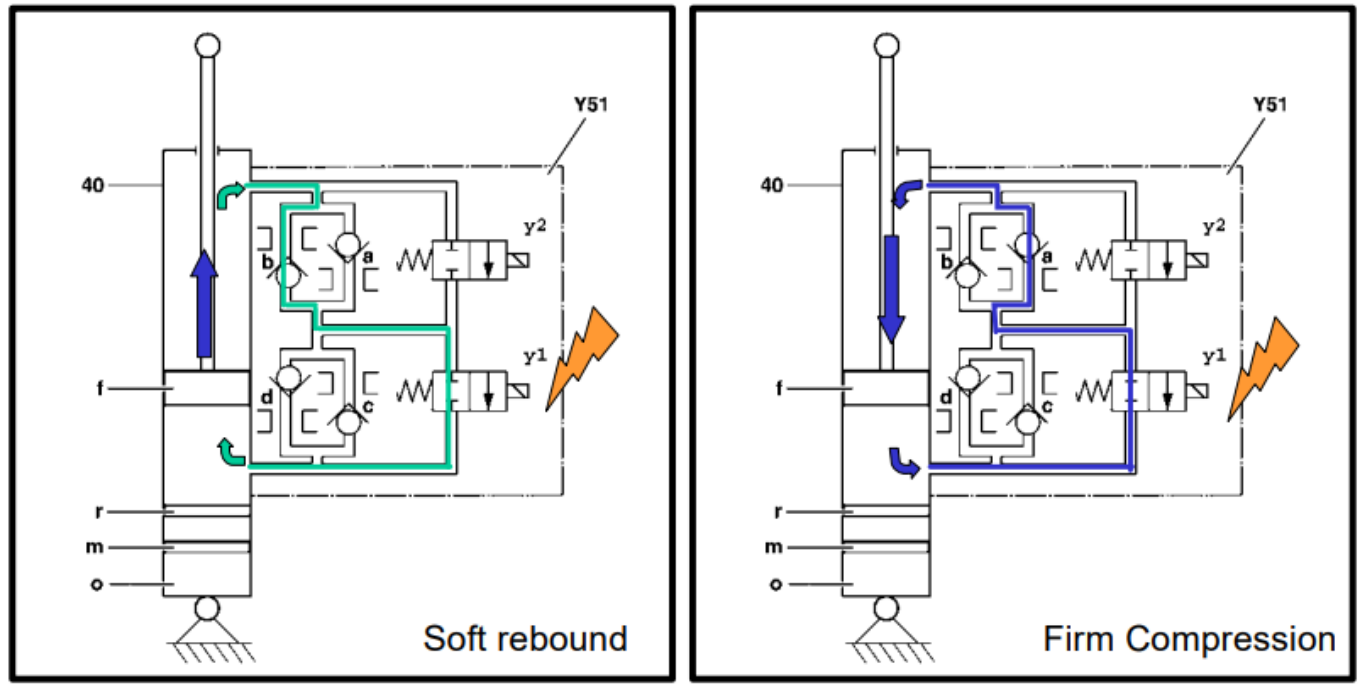
ADS II Damping Stage 1

40	Front axle strut
Y51	Damping valve
Y1	Solenoid valve 1
Y2	Solenoid valve 2
a	Check valve (hard push stage)
b	Check valve (soft pull stage)
c	Check valve (hard pull stage)
d	Check valve (soft push stage)
f	Operating piston
m	Dividing piston
o	Gas pressure chamber
t	Floor valve



- Solenoids y1 and y2 energized
- Soft compression *(shown above)*
- Soft rebound *(shown above)*

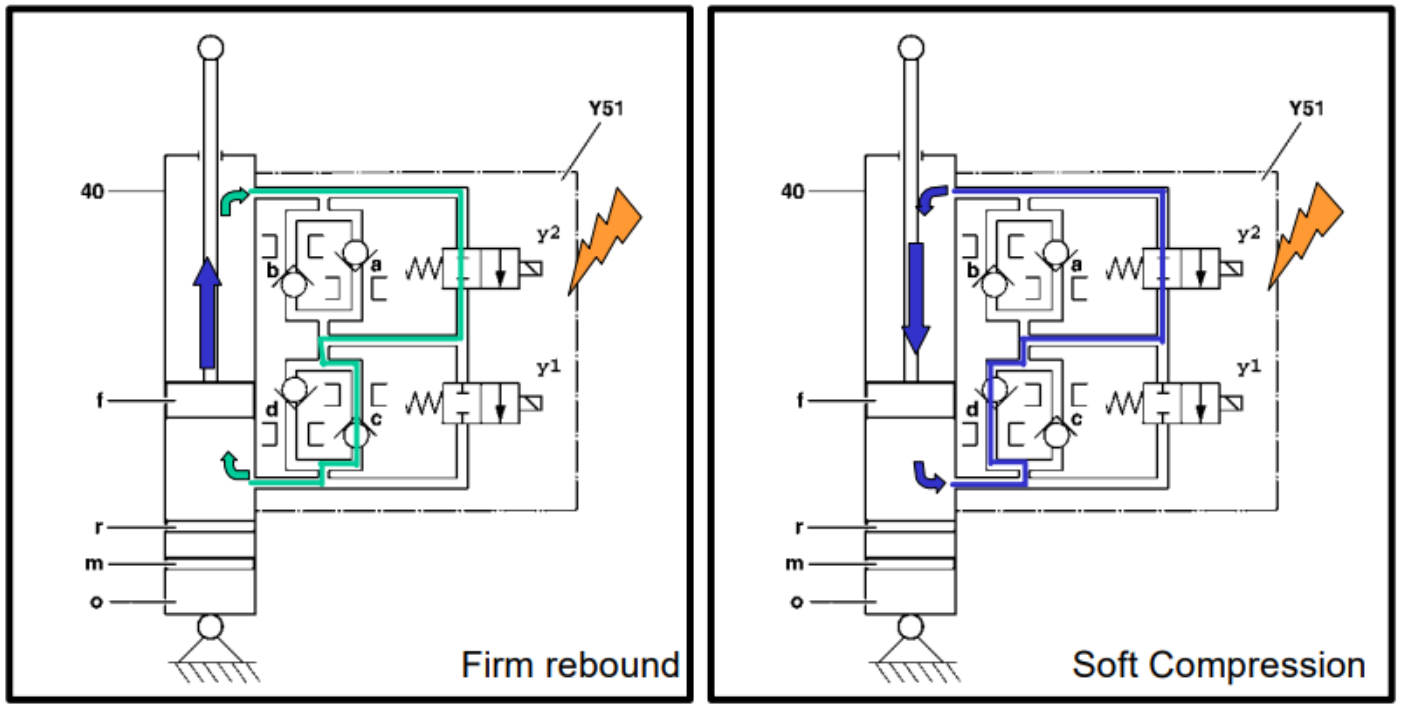
ADS II Damping Stage 2



a – more restriction b – less restriction c – more restriction d – less restriction

- Solenoid y1 (energized)
- Soft compression
- Hard rebound *(shown above)*

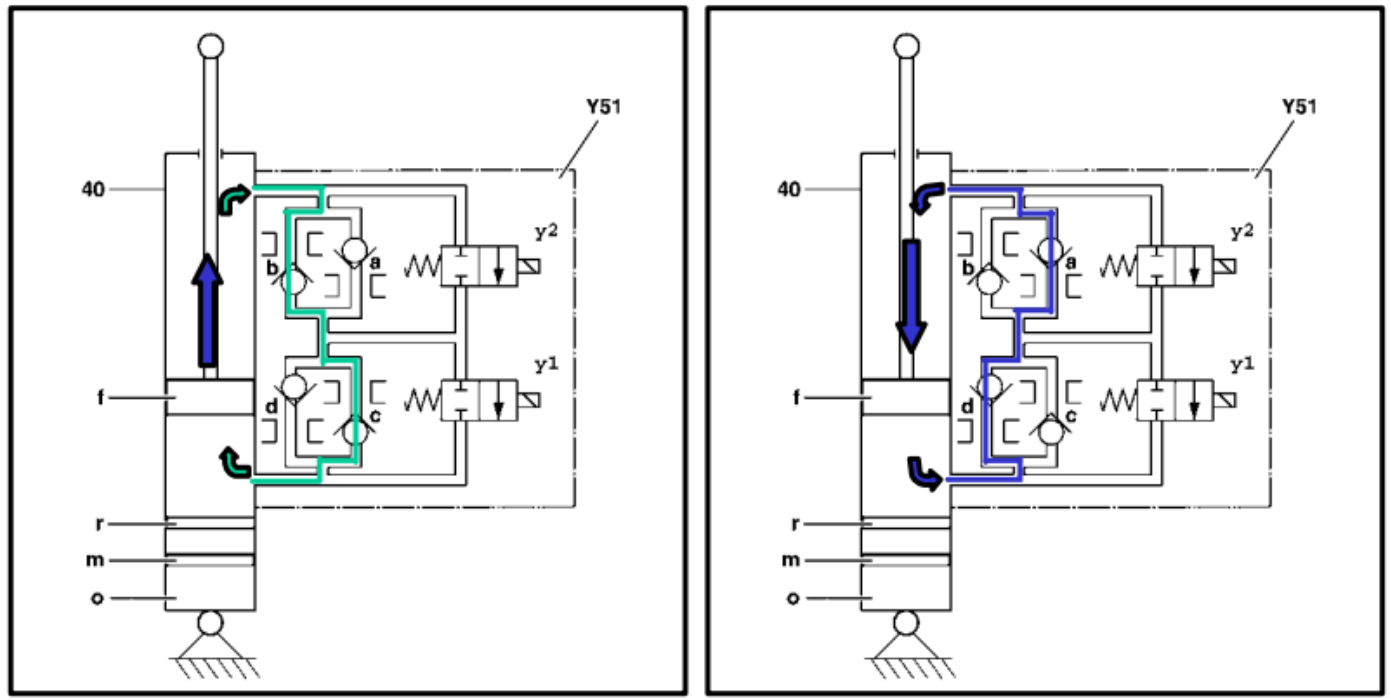
ADS II Damping Stage 3



a – more restriction b – less restriction c – more restriction d – less restriction

- Solenoid y2 energized
- Hard compression *(shown above)*
- Soft rebound

ADS II Damping Stage 4

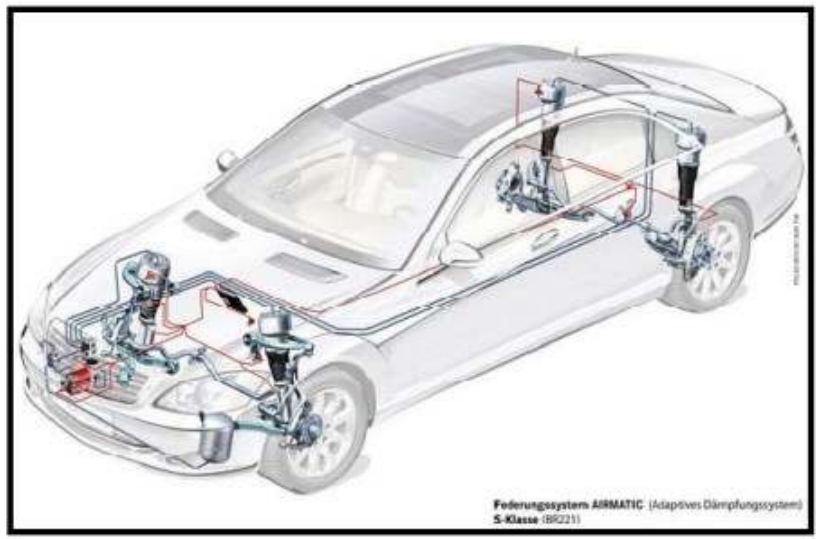


a – more restriction b – less restriction c – more restriction d – less restriction

- Solenoids y1 and y2 de-energized
- Hard compression *(shown above)*
- Hard rebound *(shown above)*

ADS II System Control Logic

- Control logic based around three types of shock absorption depending upon body movement
  - Soft shock absorption (both valves energized)
  - Skyhook operation (valves controlled individually)
  - Hard shock absorption
- Skyhook operation
  - Upward body motion = hard rebound / soft compression
  - Downward body motion = soft rebound / hard compression
- Skyhook operation will also help to reduce body roll and pitch



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Driver Control

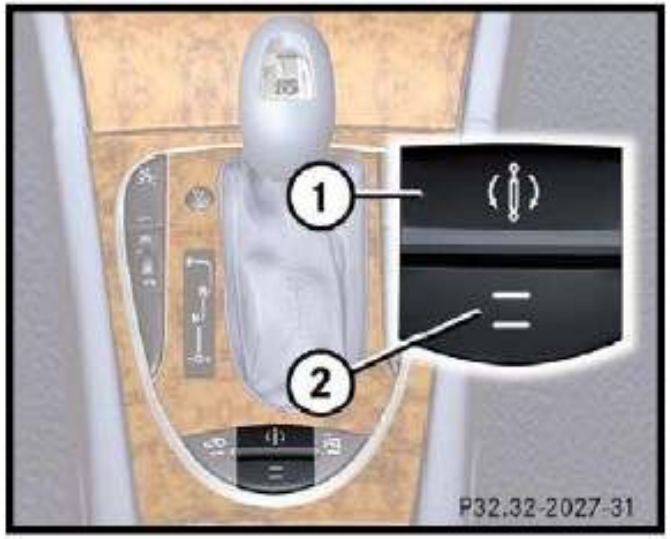
Driver can influence suspension firmness using

- ADS II switch
- Transmission S/C (sport/comfort) mode switch

Comfort = softer suspension adjustments

Sport = firmer suspension adjustments

Selection is stored in instrument cluster so same performance map is retained on next engine restart



Example 211



221 (as of 06/09)



Example 221 (up to 05/09)

ADS II Comfort/ Sport Switch (N72s25)

- LEDs off, comfort setting

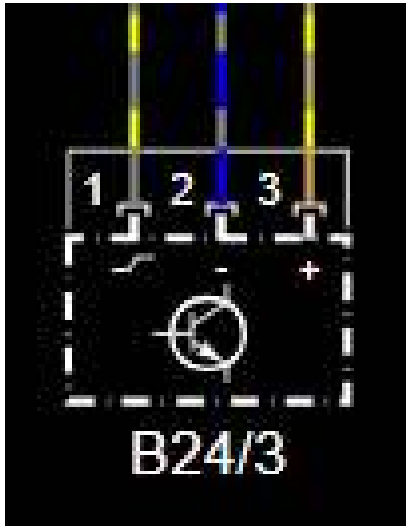
- Sport setting #1
  - 1 LED illuminated
  - - SAS reduced air dampening volume (firmer)
  - - ADS II dampening controlled automatically

- Sport setting #2
  - - 2 LEDs illuminated
  - - SAS reduced air dampening volume (firmer)
  - - ADS II, stage 3 or 4 dampening, as required



Body Acceleration Sensors (B24/3,4,6)

- Measures vertical oscillations of the chassis
- Translates mechanical movements into voltage signals
- Influences ADS II dampening functions
- Eliminated in later years







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Acceleration sensors

No.	Name	Specified value	Actual values	Unit
027	B24/12 (ABC lateral acceleration sensor)	[2.25...2.75]	2.51	V
028	B24/3 (Left front body acceleration sensor)	[2.25...2.75]	2.53	V
029	B24/4 (right front body acceleration sensor)	[2.25...2.75]	2.53	V
030	B24/6 (right rear body acceleration sensor)	[2.25...2.75]	2.51	V

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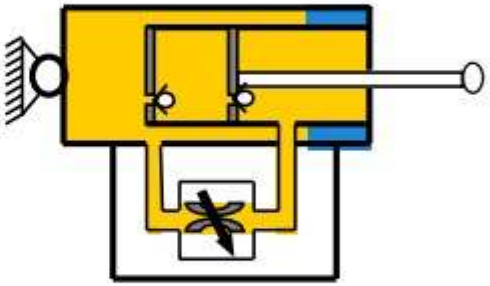
Continuous Damping

- Permanently affixed to front strut assemblies and rear shocks (not serviceable)

- Continuously adjustable between soft and firm for compression and rebound
  - Not like ADS II with four stages of damping

- Contain only one solenoid valve
- Pulse width modulated by N51/3 (two wires)
- System failure will result in semi-firm damping (de-energized)

- Units
  - Y51 – left front
  - Y52 – right front
  - Y53 – left rear
  - Y54 – right rear

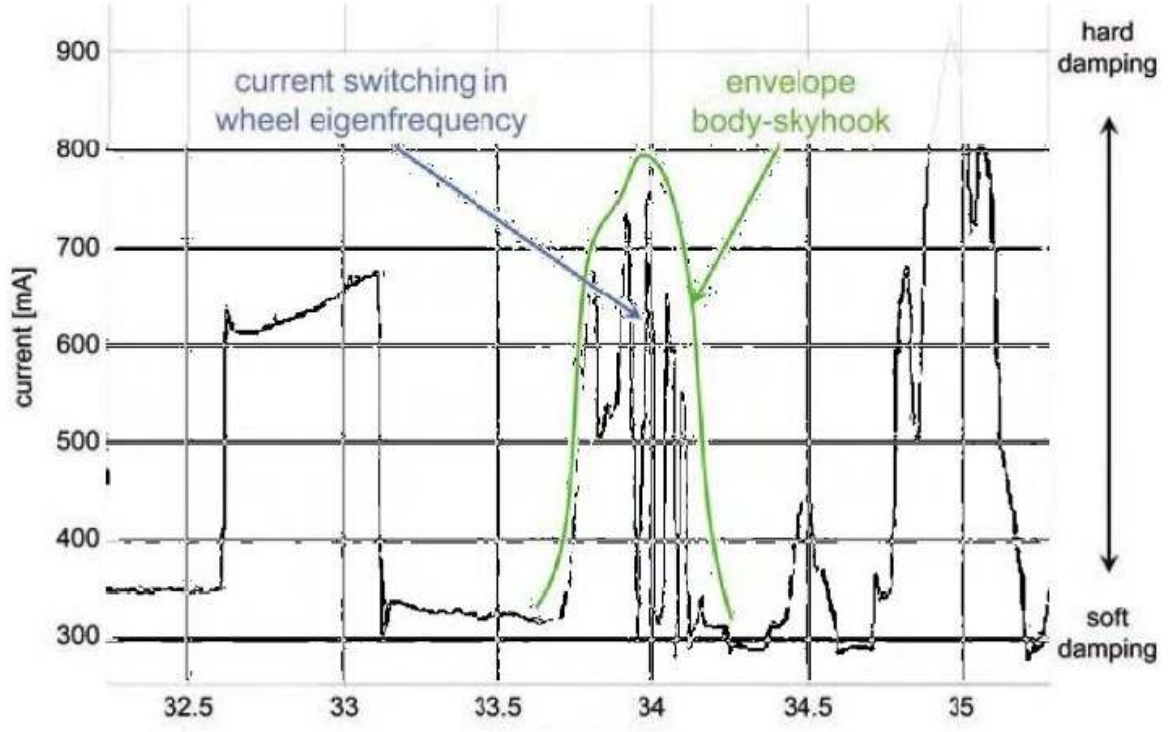


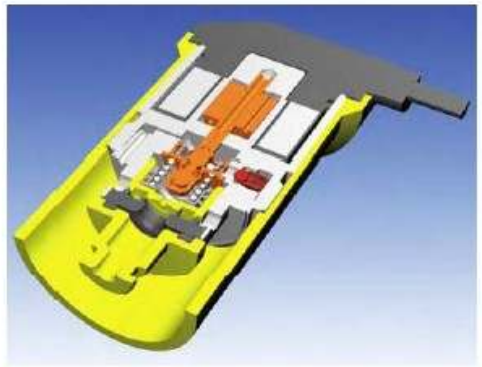


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Damping Algorithm

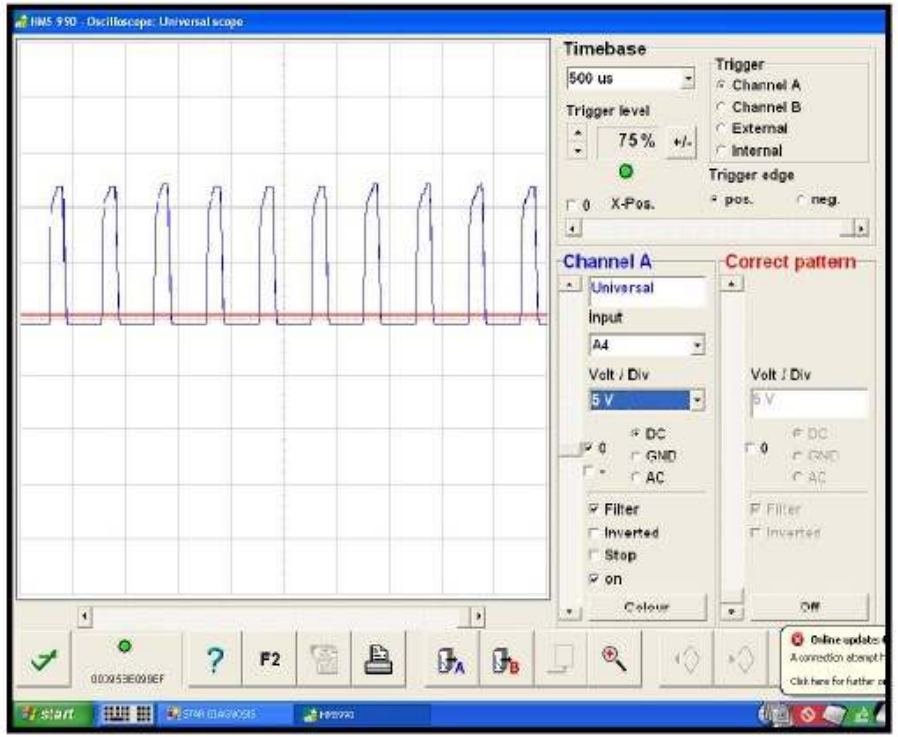
- Damping valve changes compression & rebound phases at 12Hz
  - Driving style influences damping characteristic
  - Vehicle level sensors influence damping above/below design position

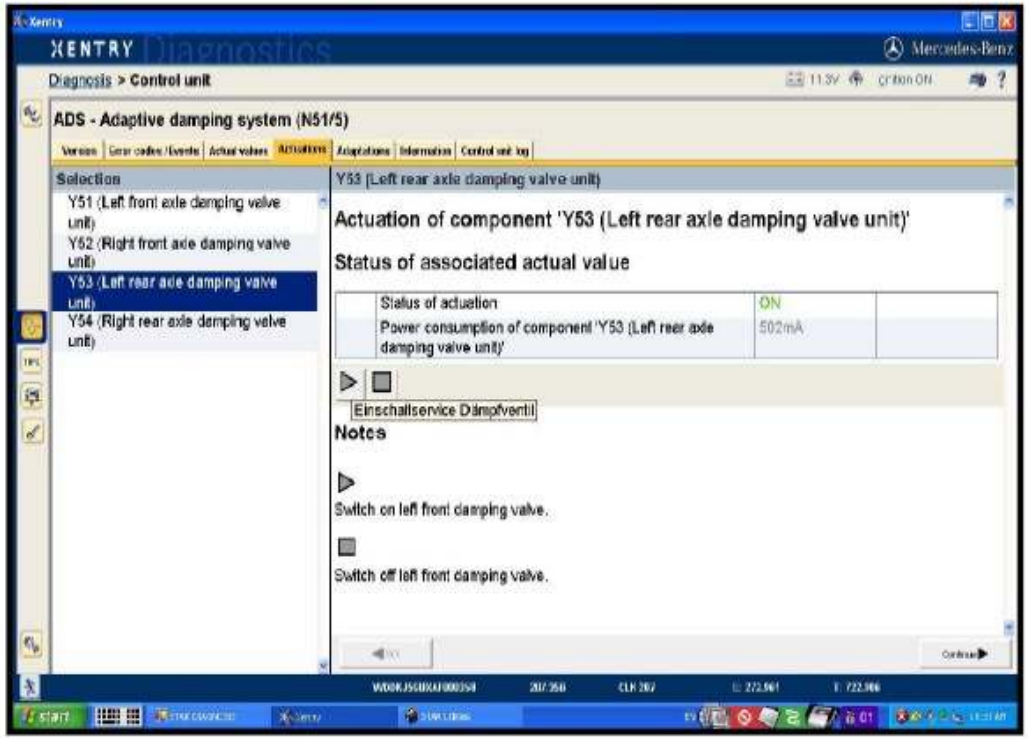




Damping Valves (Y51-Y54)

- Test of damping valves via Xentry “Actuations”
- Scope pattern shows PWM cycle 0 volts to 12 volts when actuated
- Xentry actual value shows approx. 500mA





Diagnosis



Preliminaries

- Visually inspect suspension
- Check cluster messages
- Check battery/start engine
- Listen for compressor, air leaks
- Check for faults, irrational live data
- Test drive the vehicle when applicable
- Look over vehicle ride level / attitude



Scan tool usage

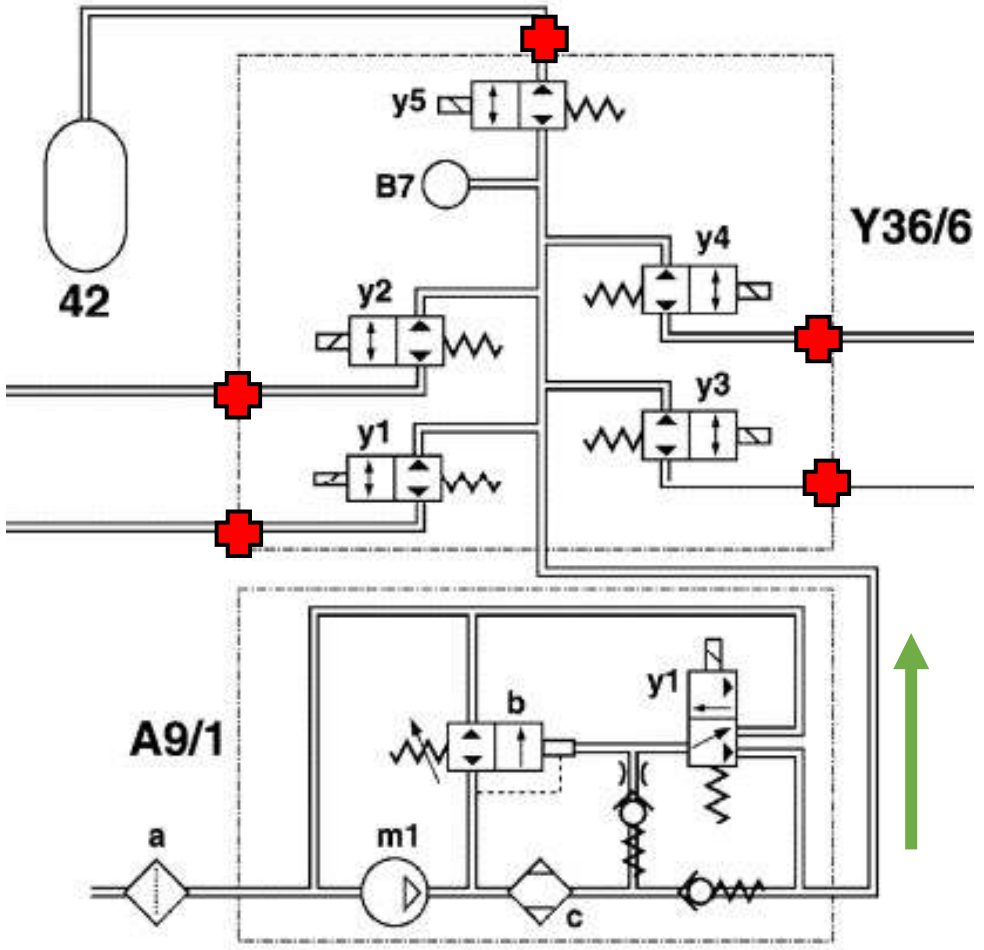
- Actual values
  - Level in mm
  - Level sensor voltage
  - System pressure
  - Compressor status

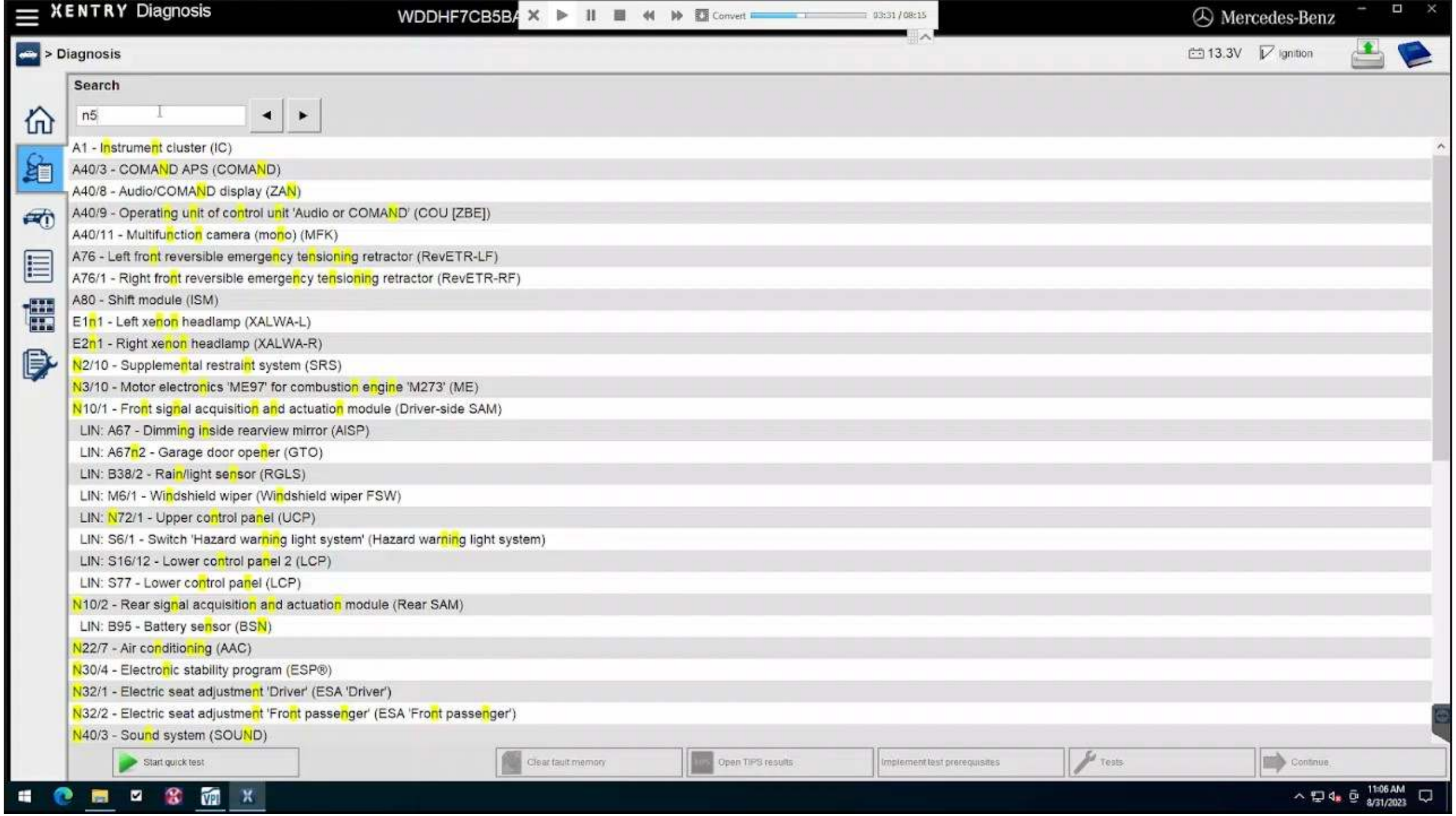
- Actuations
  - Move to calibrated level
  - Fill suspension strut
  - Fill central reservoir

- Adaptations
  - Level calibration
  - Compressor reset

Compressor Testing

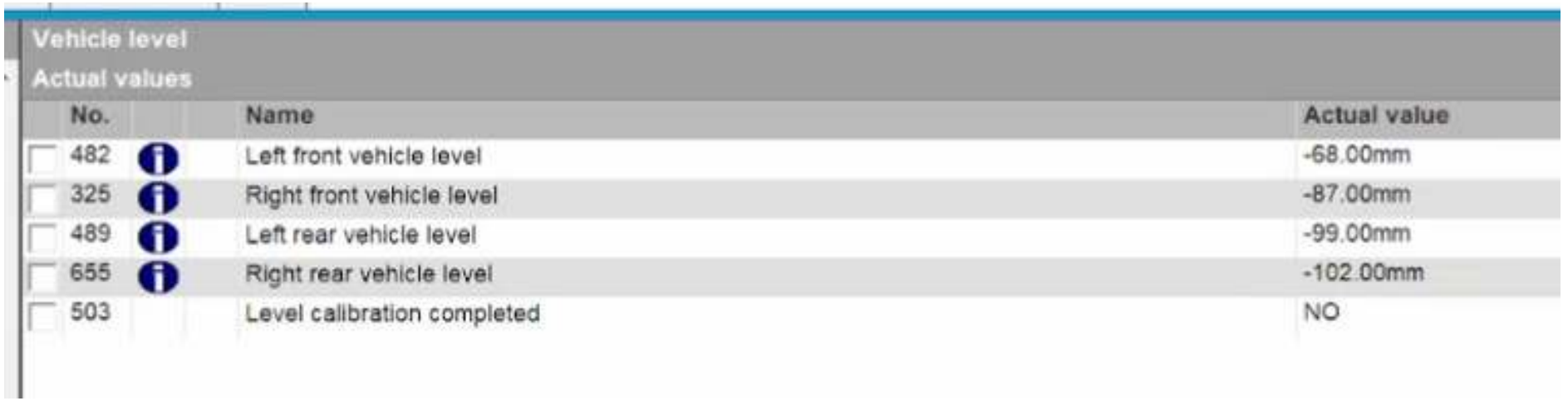
- Generally, there is an automated test which pressurizes the valve block and tries to build 14 bar+ in 40 seconds
- Some newer vehicles lower and raise the suspension and measure the time it takes
- You can also try to fill the reservoir in some and see how well the pump performs, though this is a lot harder than pressurizing the valve block





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Before running compressor test

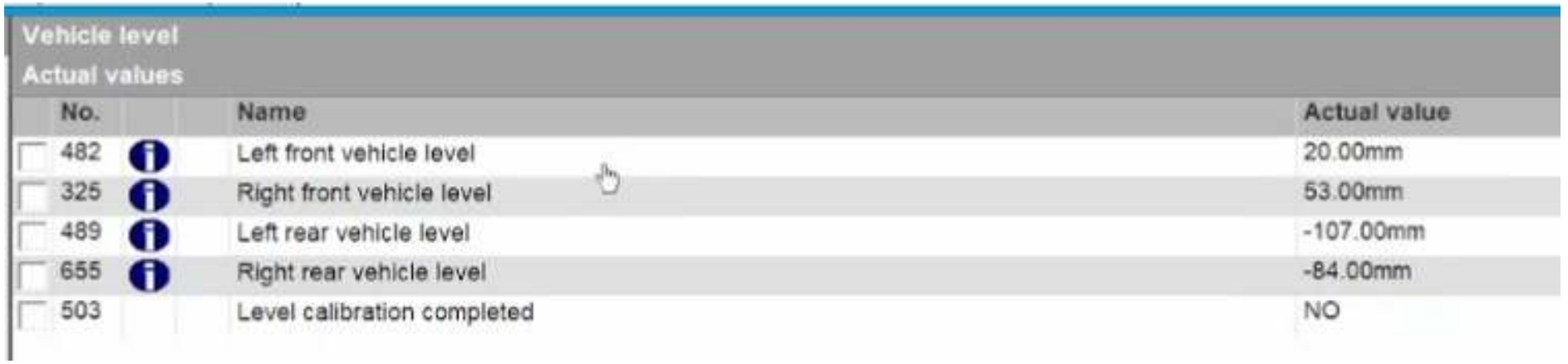


Vehicle level

Actual values

No.	Name	Actual value
482	Left front vehicle level	-68.00mm
325	Right front vehicle level	-87.00mm
489	Left rear vehicle level	-99.00mm
655	Right rear vehicle level	-102.00mm
503	Level calibration completed	NO

After running compressor test



Vehicle level

Actual values

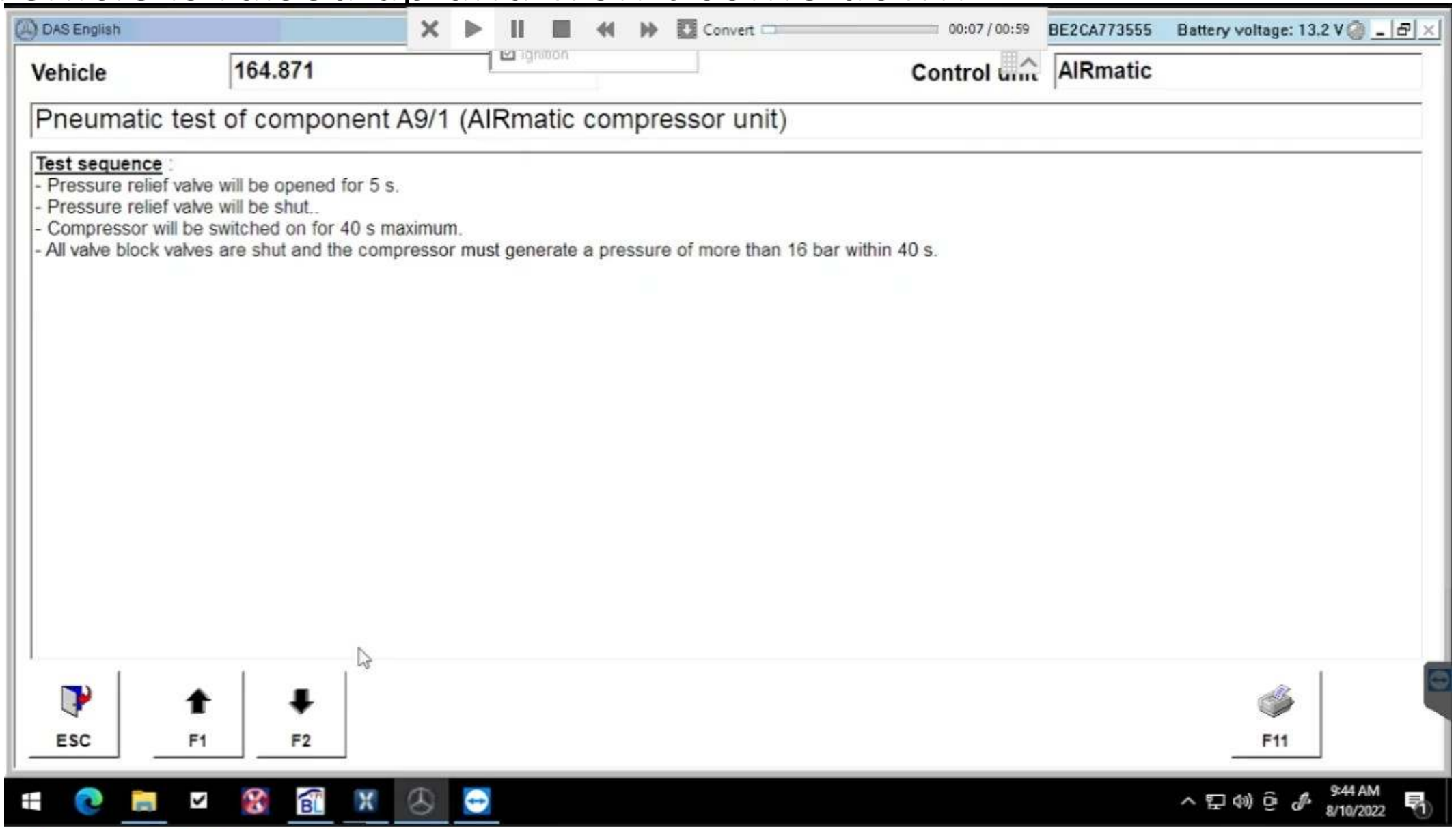
No.	Name	Actual value
482	Left front vehicle level	20.00mm
325	Right front vehicle level	53.00mm
489	Left rear vehicle level	-107.00mm
655	Right rear vehicle level	-84.00mm
503	Level calibration completed	NO

Test plans by symptom





Vehicle is raised up and won't come down



Entire vehicle on the ground and won't raise

- Few things can cause total collapse of the vehicle
- Mostly trying to operate the suspension with a leaking compressor
- Start by checking the compressor operation and its fuse

One or more corners drops down overnight

- Can be caused by a leaking valve block or strut
- Check for leaks with soapy bubble solution
- Swap lines at the valve block and fill the struts back up, where does it collapse now?
- Can also test with vacuum gauge on pressure line

Portion of vehicle will not raise or level out

Can have various causes

Drive it and recheck, some vehicles won't fine tune while stationary

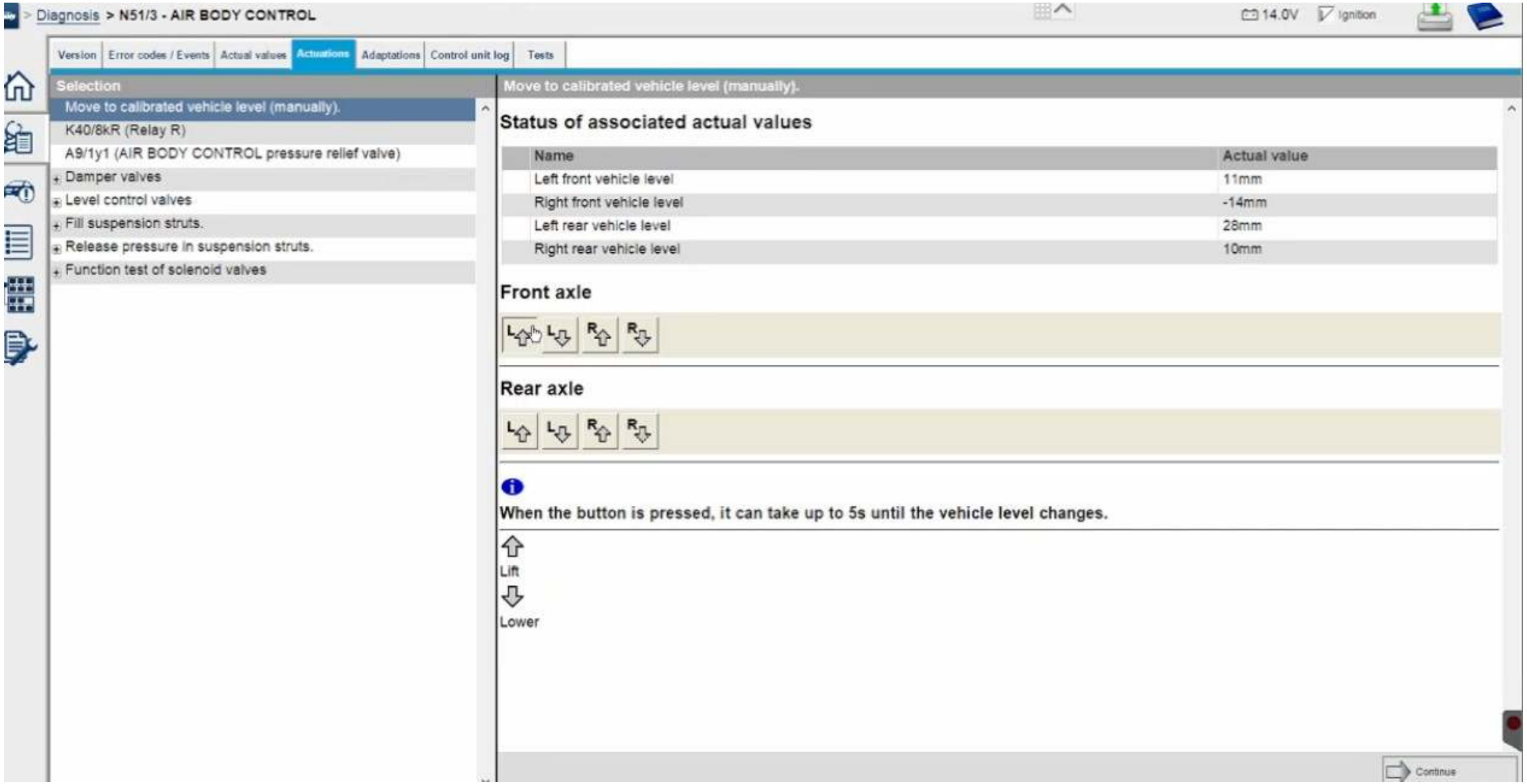
Check the level sensor data see if the vehicle thinks it is level

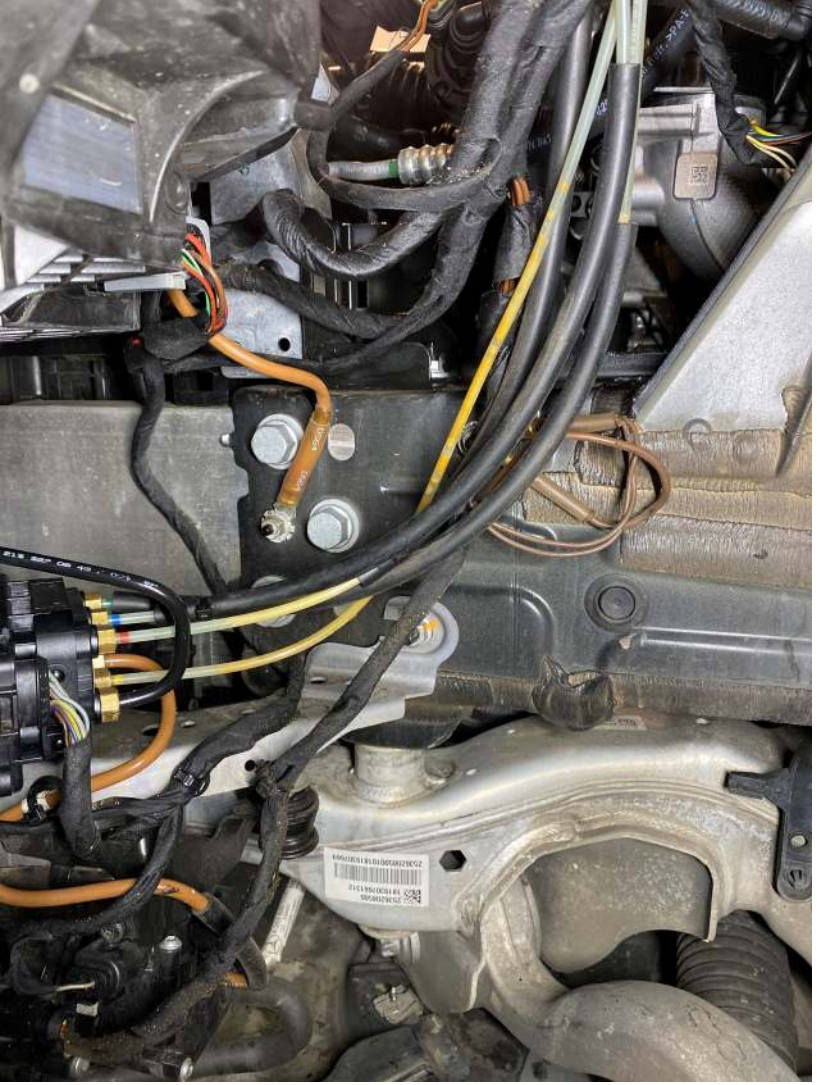
- If so, check level sensor linkage and operation
- If level sensor is good, possible miscalibration issue

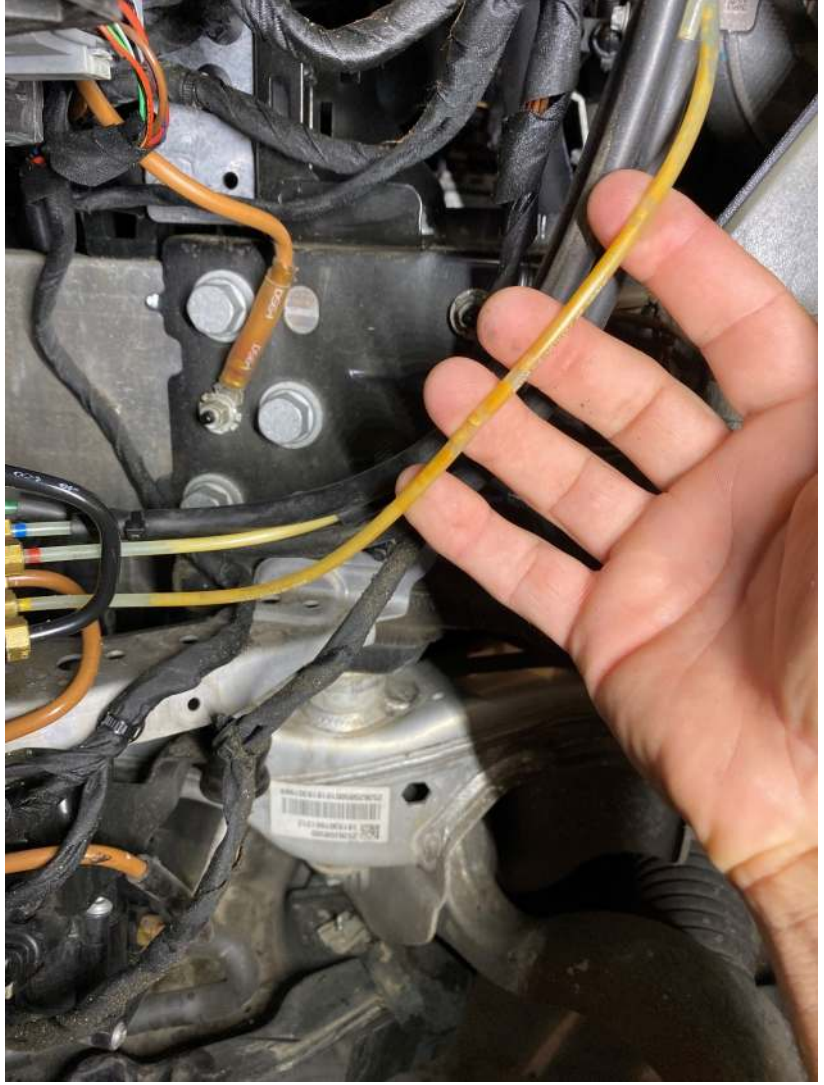
Try to raise it manually with actuations

- If not, possible valve block issue

08 Airmatic 253 Cracked line raising suspension Xentry Video (Front lines swapped!)



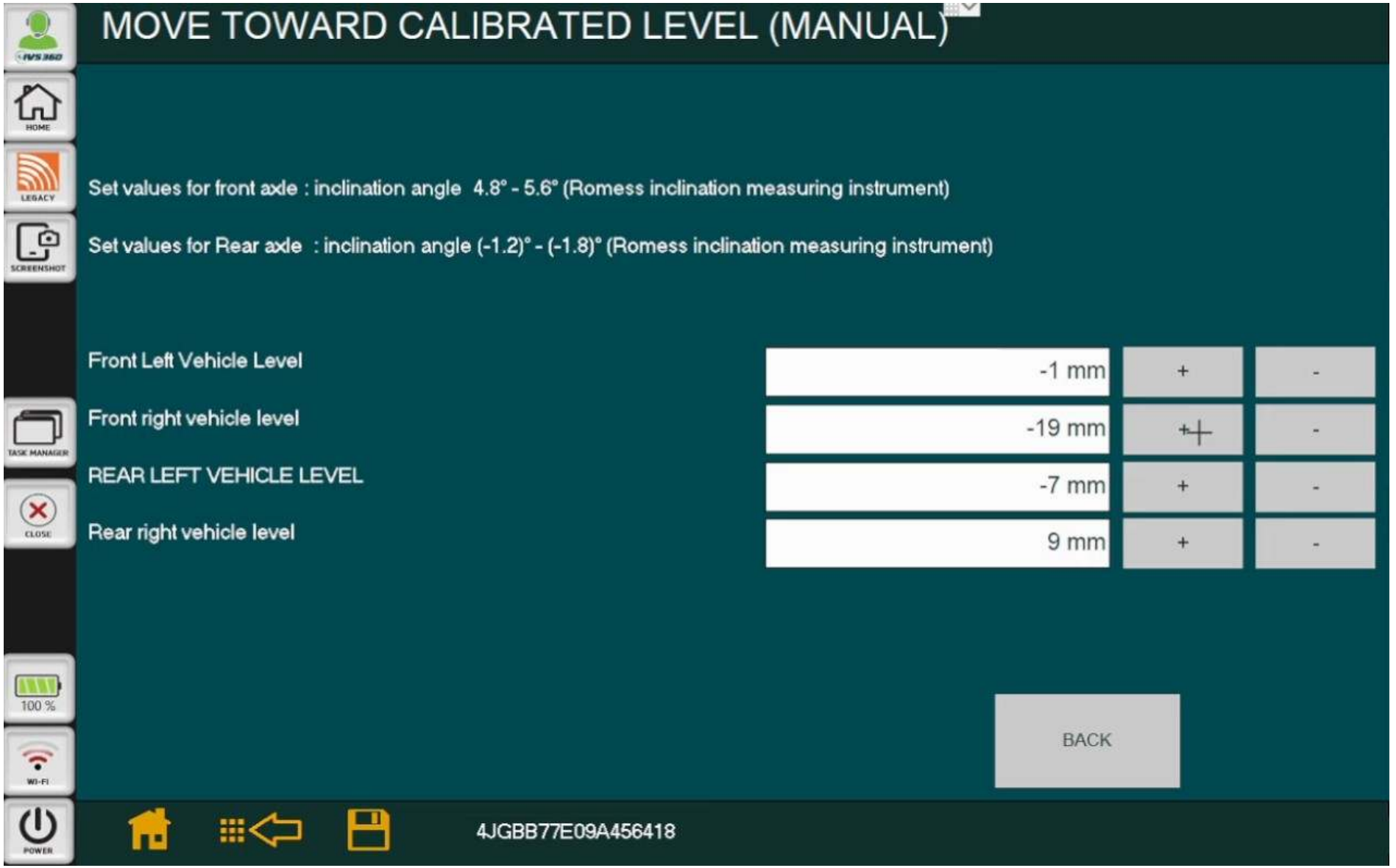






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09 Airmatic 164 threshold leak fast forward Drive Video



Hissing sound from air compressor area

- Can be caused by broken or leaking compressor, air lines
  - Visually inspect for leaks
- Can be caused by a bad air filter when the system exhausts air
- Can also be caused by the system exhausting air due to level corrections when the vehicle is unlocked, root cause could be a corner leaking down

Does not maintain level while driving

- Can be caused by binding or bent level sensors / linkages, inspect closely
- Can be caused by a failing five-volt reference for the level sensors, possibly a failing control unit, but this is very rare
- As the vehicle sinks linkages and sensor orientation can distort

The compressor relay does not activate

- Check actual values for pressure and vehicle level make sure nothing irrational there that might inhibit compressor operation including vehicle electrical system load
- Try to activate the compressor with fill central reservoir
- Try another compressor relay
- Check wiring from airmatic control unit to relay
- Note the airmatic relay doesn’t use conventional power and ground on the control side and may not try to operate the relay if it is removed, control voltages vary

Replaced strut and now will not level

- Sometimes when a corner runs low the level sensor can be damaged
  - Inspect the level sensor
  - They may have driven on it with a partially collapsed strut

Strut will not collapse with air line removed

- For 211 and 219 vehicles which have Semi Active Air Suspension this is normal as the valves are integrated into the strut

- Release the pressure with scan tool actuations

Strut will not collapse with air line removed (Continued)

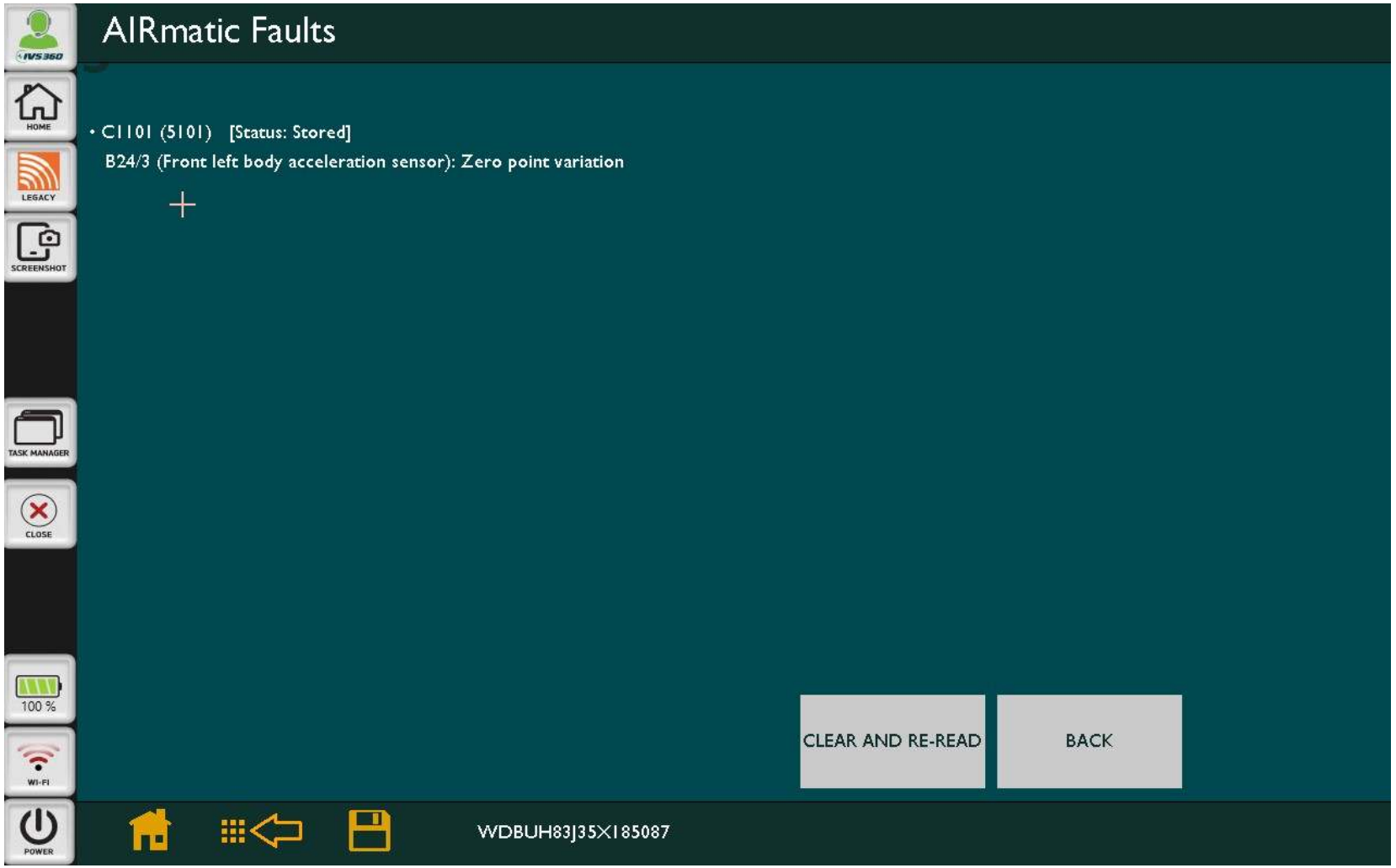
- This is a problem on the older 220 S-Class
- It had residual pressure valves designed to prevent the strut from collapsing if the air line ruptured
- These valves corroded and can cause the strut to lock up
- The strut should be replaced

Test plans by DTC

5100 B24/3 (Left front body acceleration sensor) : Signal failure
5101 B24/3 (Left front body acceleration sensor) : Zero point variation
5110 B24/4 (right front body acceleration sensor) : Signal failure
5111 B24/4 (right front body acceleration sensor) : Zero point variation
5120 B24/6 (right rear body acceleration sensor) : Signal failure
5121 B24/6 (right rear body acceleration sensor) : Zero point variation
5130 B22/8 (Left front level sensor) : Failure of both signals
5131 B22/8 (Left front level sensor) : Signal implausible
5132 B22/8 (Left front level sensor) : Signal failure
5140 B22/9 (Right front level sensor) : Failure of both signals
5141 B22/9 (Right front level sensor) : Signal implausible
5142 B22/9 (Right front level sensor) : Signal failure
5150 B22/3 (Rear axle level sensor) : Failure of both signals
5151 B22/3 (Rear axle level sensor) : Signal implausible
5152 B22/3 (Rear axle level sensor) : Signal failure
5170 B7 (AIRmatic pressure sensor) : Signal failure
5171 B7 (AIRmatic pressure sensor) : Signal implausible
5190 Power supply Valves : Short circuit to positive
5191 Power supply Valves : Short circuit to ground
5192 Power supply Sensors : Short circuit to positive
5193 Power supply Sensors : Short circuit to ground
5194 Power supply Valves : Short circuit to ground
5200 Y51 (left front axle damping valve unit) Y51y1 (Left front solenoid valve 1) : Open circuit
5203 Y51 (left front axle damping valve unit) Y51y1 (Left front solenoid valve 1) : Ground cable Short circuit to GND
5204 Y51 (left front axle damping valve unit) Y51y1 (Left front solenoid valve 1) : Ground cable Short circuit to POS

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Acceleration sensor zero point variation





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Compressed air supply is leaky

- This is a generic fault that doesn’t tell us a whole lot
- First and foremost, we need to test the compressor
- Also verify the pressure sensor is reading rationally

The pressure line system leaks

- Check the line from the compressor to the valve block

Recovery time filling central reservoir too long

- Most commonly caused by a failing compressor
- Can also be caused by leaks, damaged air lines, or in some rare cases a leaking reservoir

Ride level calibration not performed

Level Calibration

- Does NOT calibrate the ride height!
- It is a LEVEL SENSOR Calibration
- Teaches N51 installation tolerances of level sensors, linkages, control arms

Measuring Ride Height Using the Romess Inclinometer for Mercedes

When certain Mercedes-Benz vehicles specifications are selected ride height should be measured using a Romess inclinometer.

The M-B Romess tool CM-09606 is used to measure ride height which is required to obtain caster and camber specifications.



Process

- Put vehicle on alignment rack, raise and lower the suspension
- Check suspension angles with Romess gauge
- Adjust until vehicle is within prescribed range and side to side are similar
- Write angle measurements to N51



Alignment is Based on Proper Ride Height

Ride Height Angles = Camber Specs

Example: 163 Chassis Front Camber Table

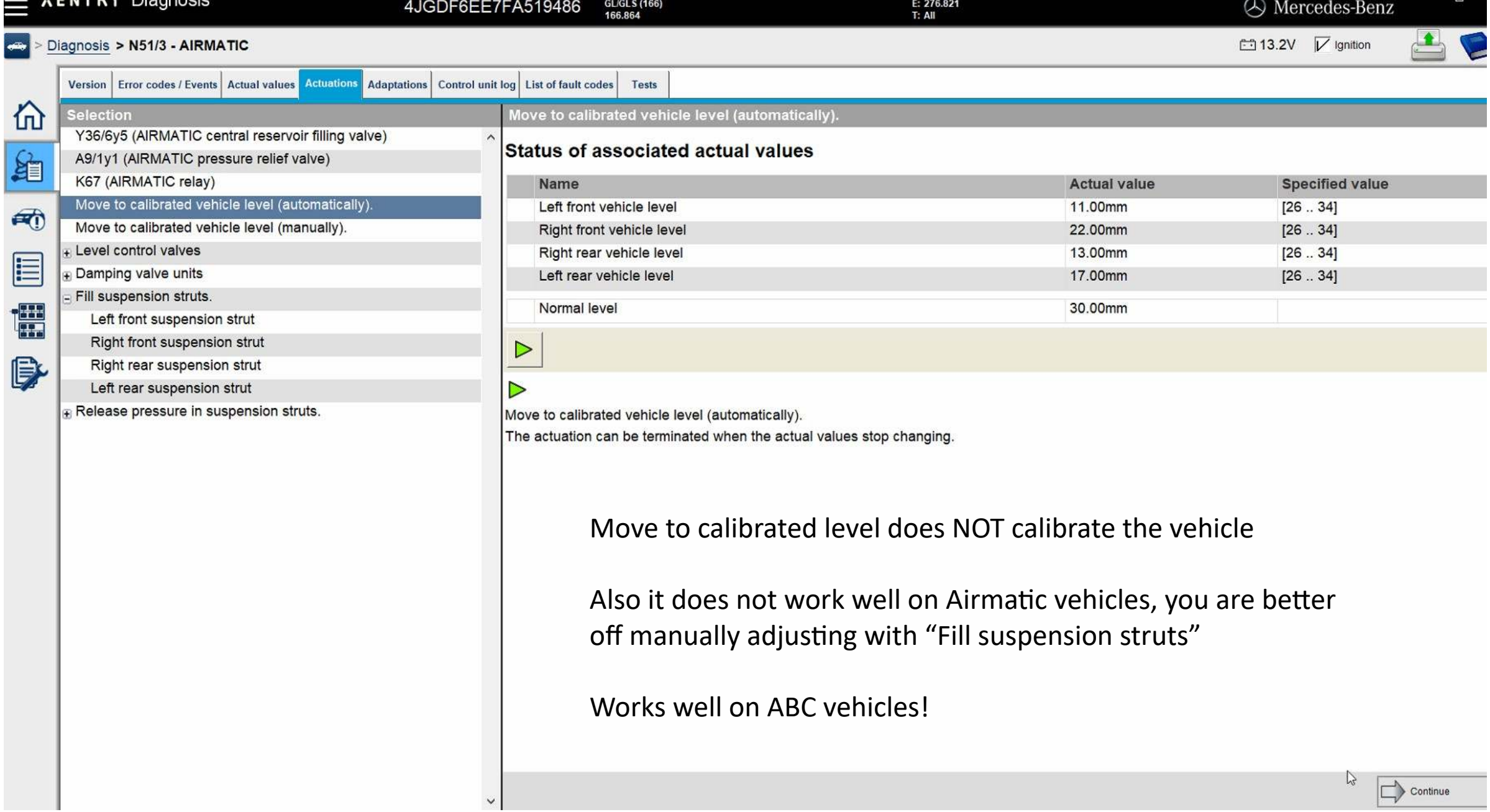
VA

∠°	Grad° Min'
-2,6	-0° 20'
-1,9	-0° 20'
-1,2	-0° 20'
-0,5	-0° 20'
-0,2	-0° 20'
0,9	-0° 21'
1,6	-0° 22'
2,2	-0° 24'
2,9	-0° 25'
3,6	-0° 27'
4,3	-0° 29'
5,0	-0° 32'
5,7	-0° 35'
6,4	-0° 38'
7,0	-0° 42'
7,7	-0° 46'
8,4	-0° 50'
9,1	-0° 54'
9,8	-0° 59'
10,5	-1° 04'
11,2	-1° 09'

P40.20-0366-03

Front Camber Spec = -0° 25'

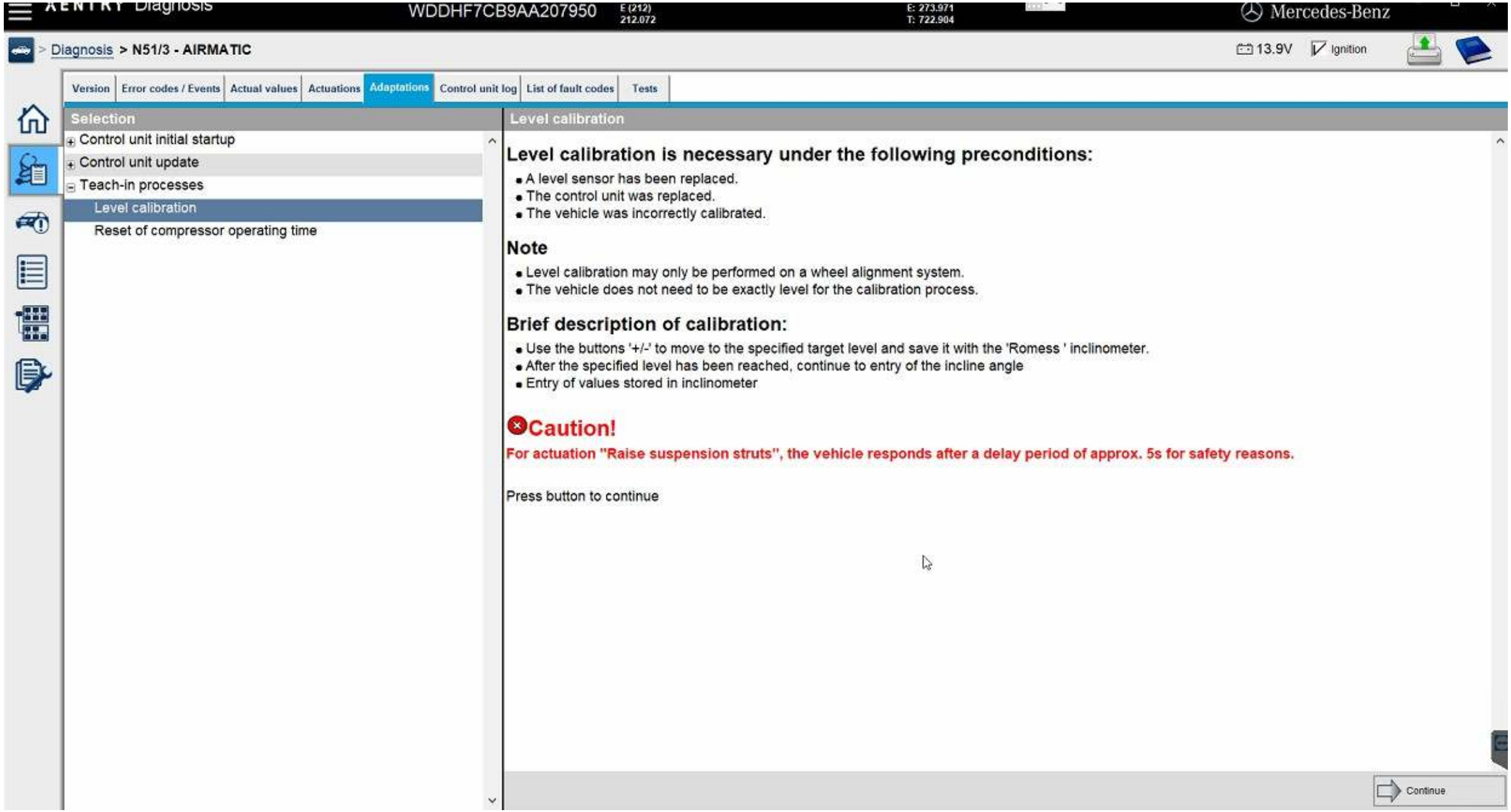
VA = Front Axle (left or right)



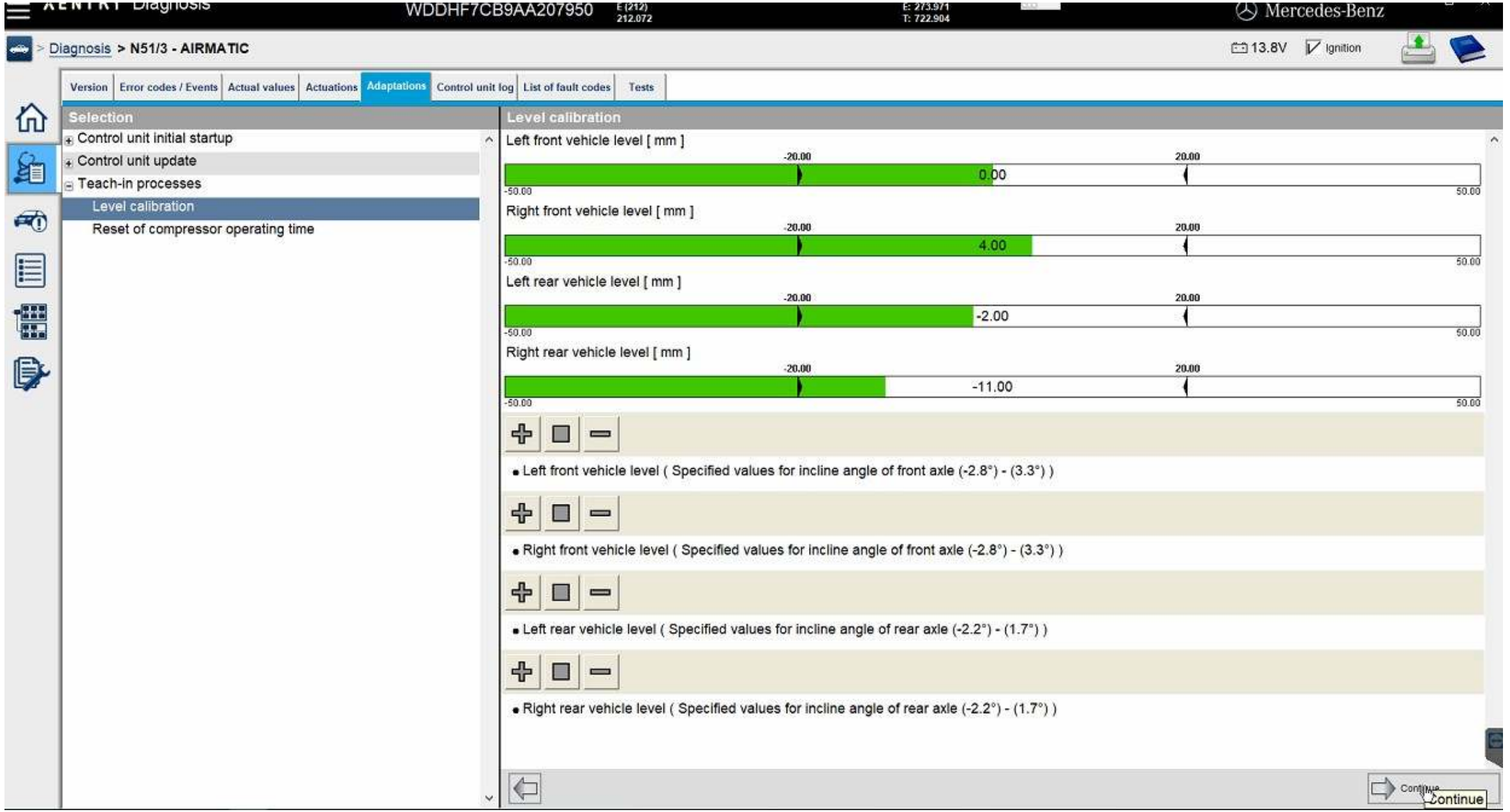
Move to calibrated level does NOT calibrate the vehicle

Also it does not work well on Airmatic vehicles, you are better off manually adjusting with “Fill suspension struts”

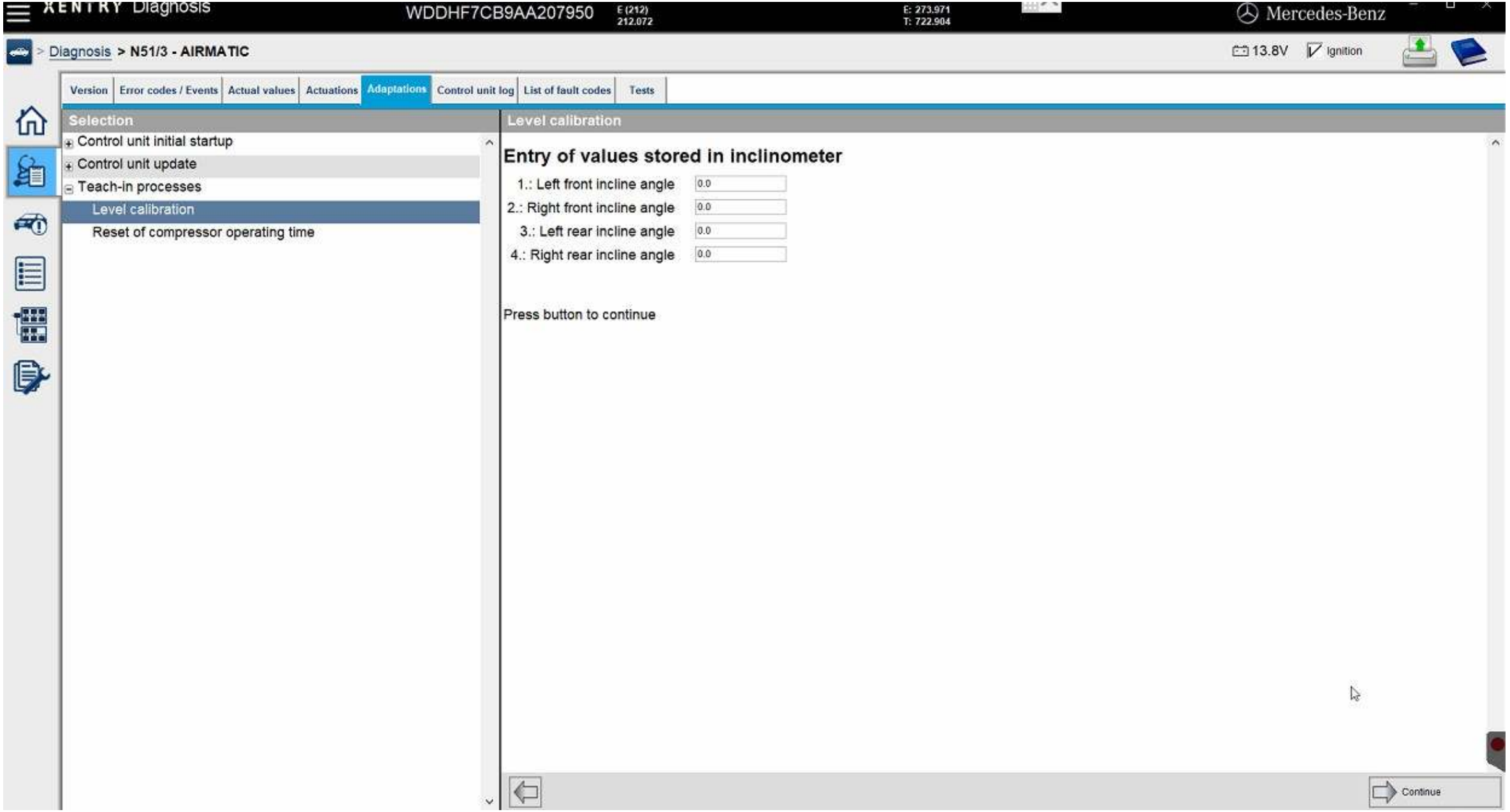
Works well on ABC vehicles!



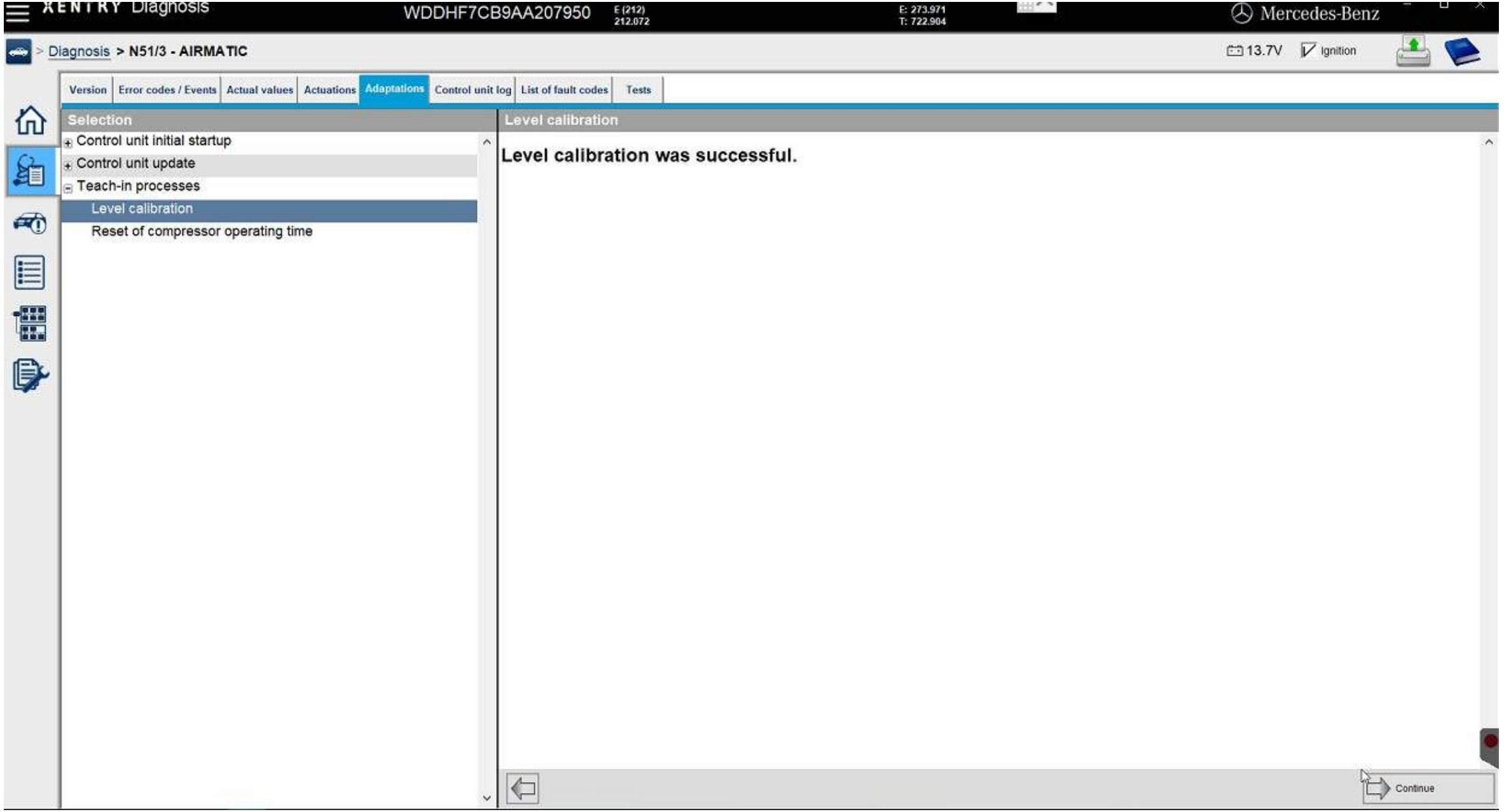
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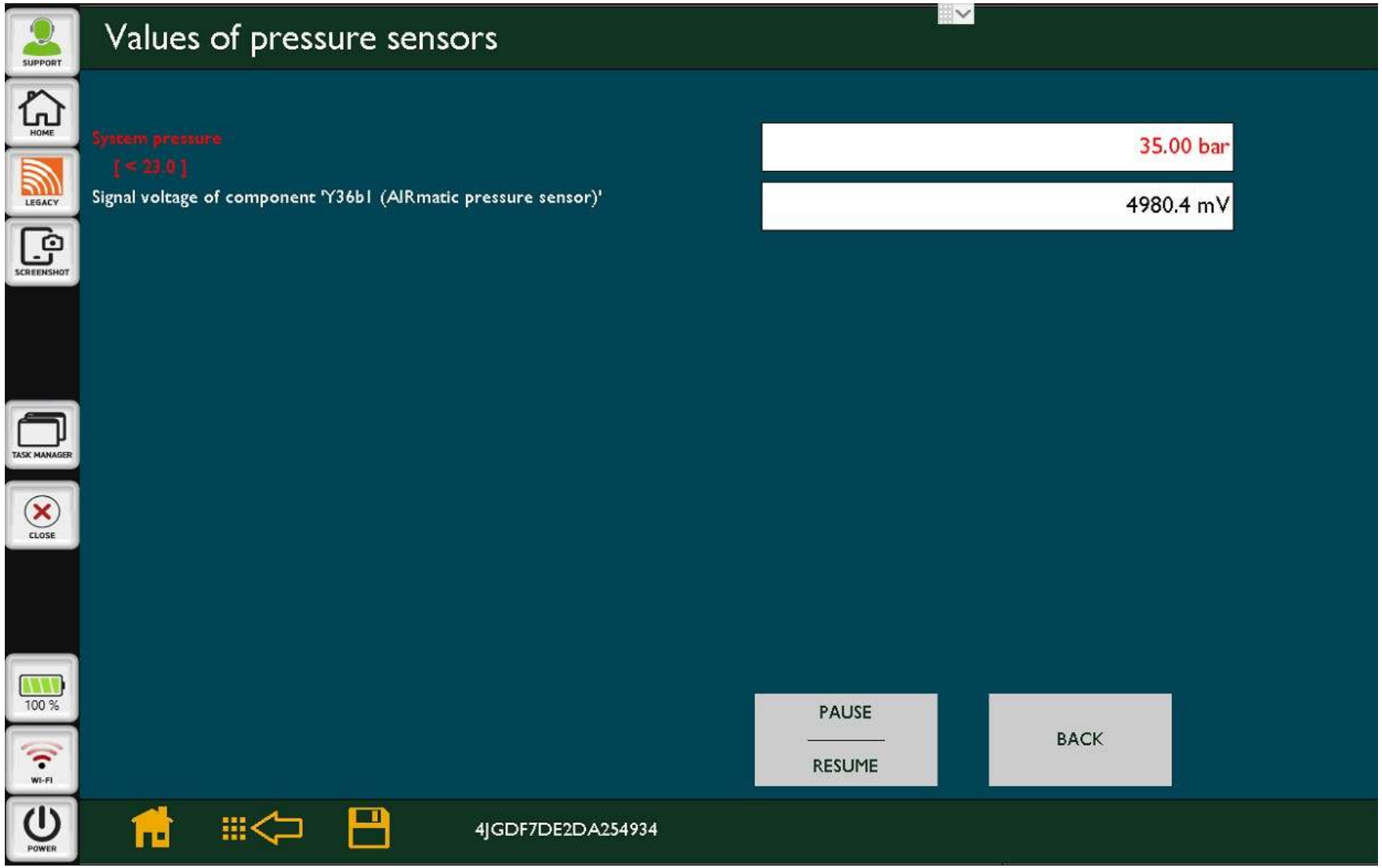


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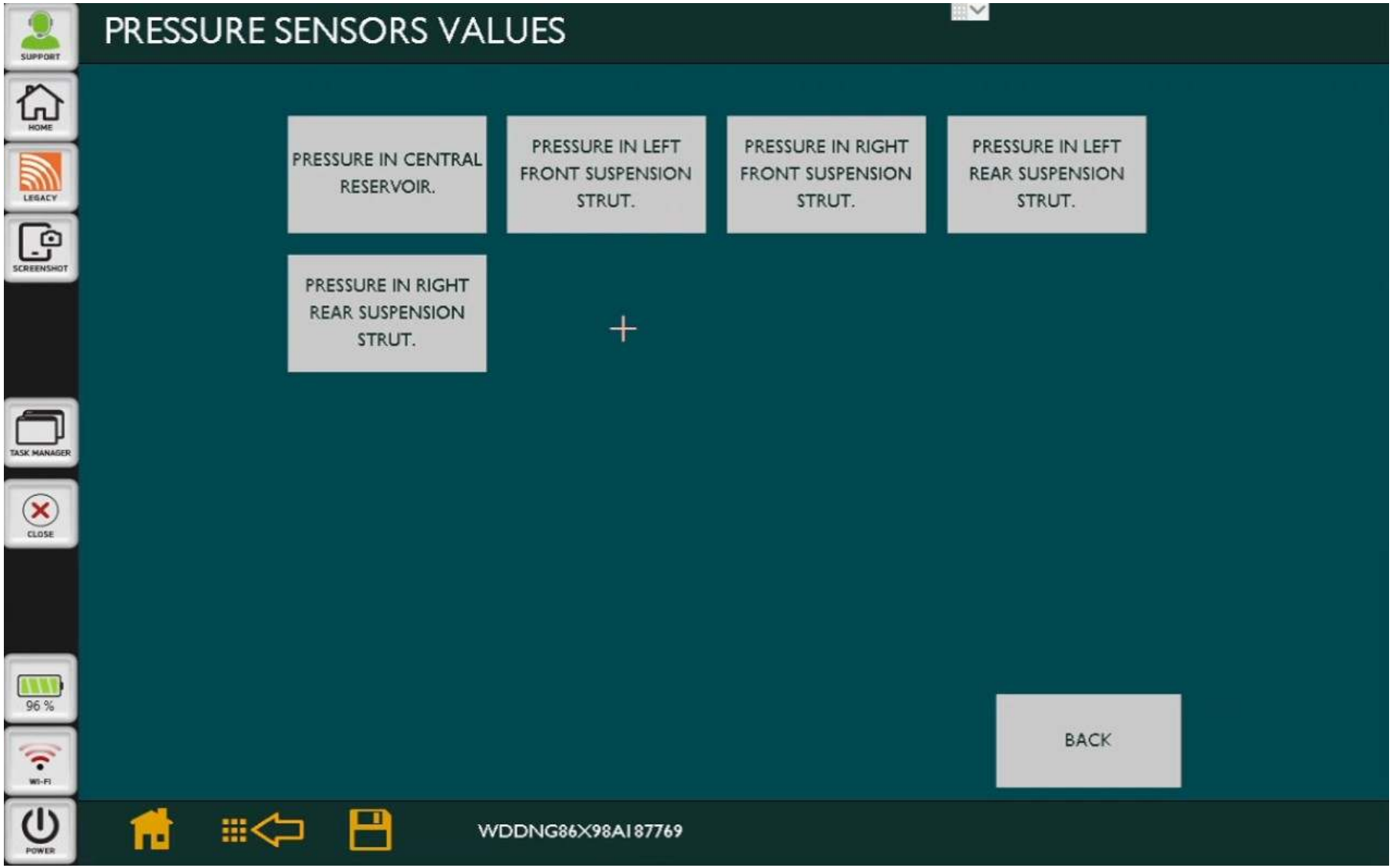


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Pressure measurement plausibility



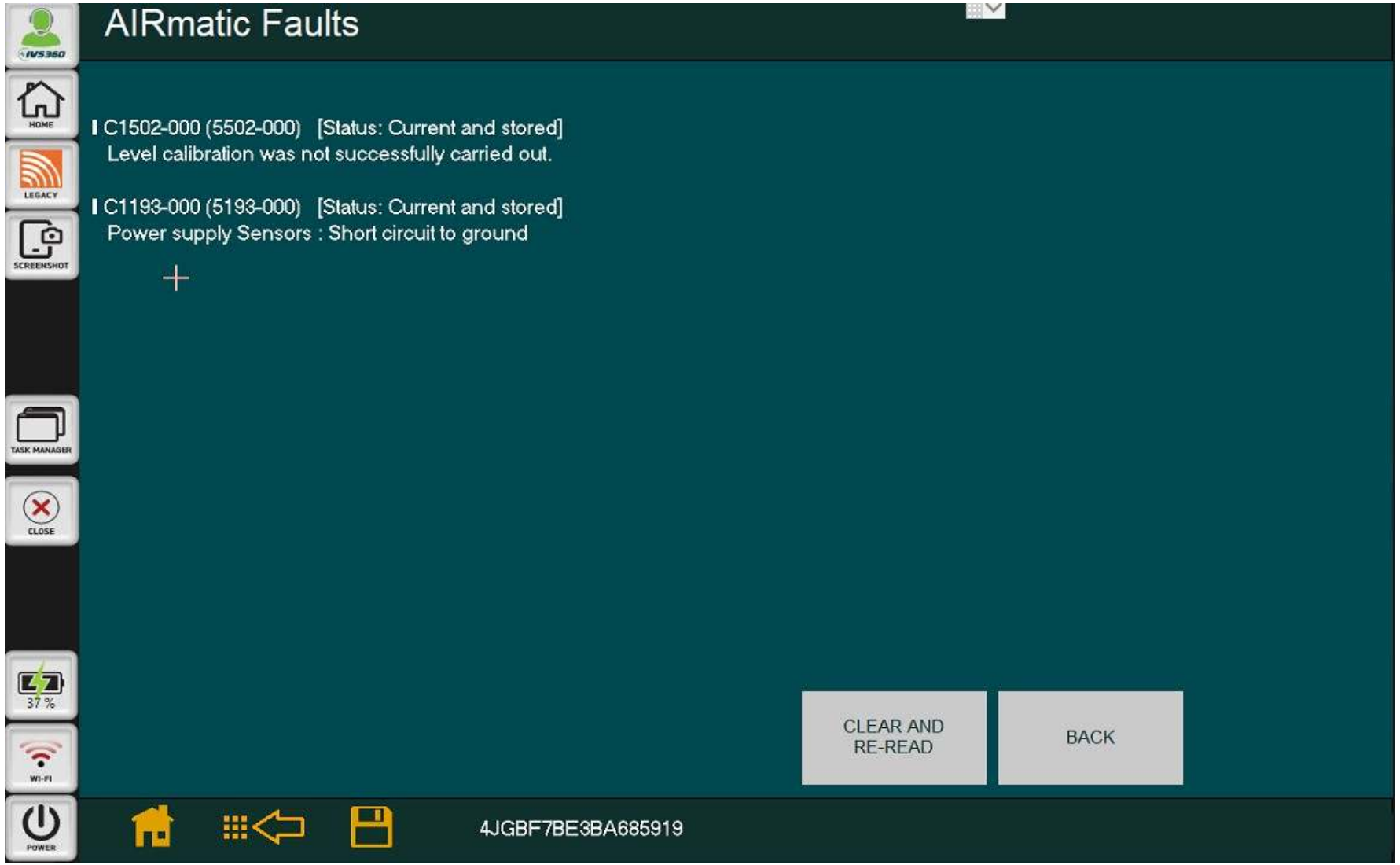
10 Airmatic 221 Pressure Sensor 35 bar Video



Damping solenoid issue

- Check the solenoid resistance and compare to the other side
- Startek loose spec is 10-16 ohms commonly
- Voltage can vary 7-10 volts while driving

Power supply Sensors



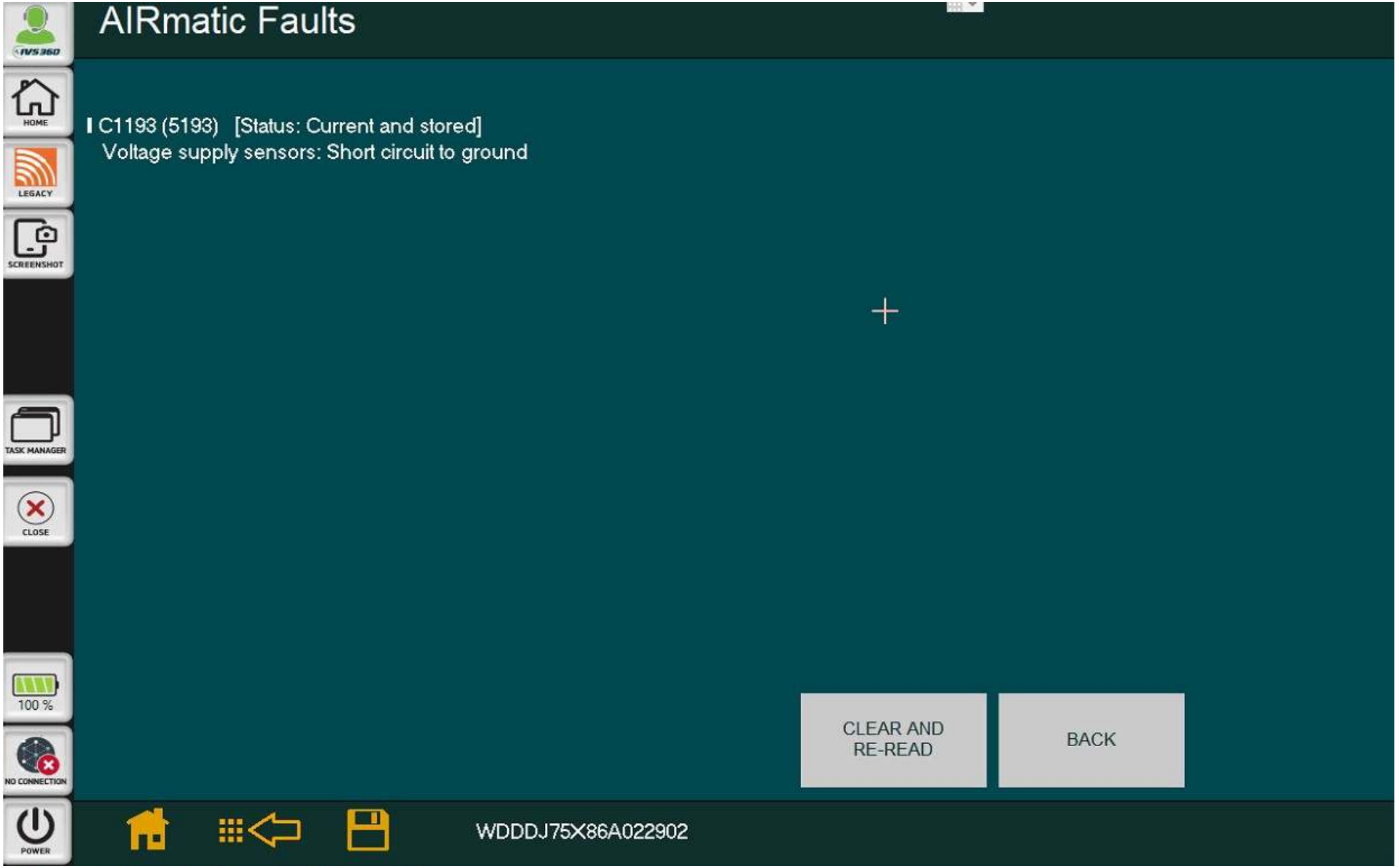


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CLS Level sensor failure



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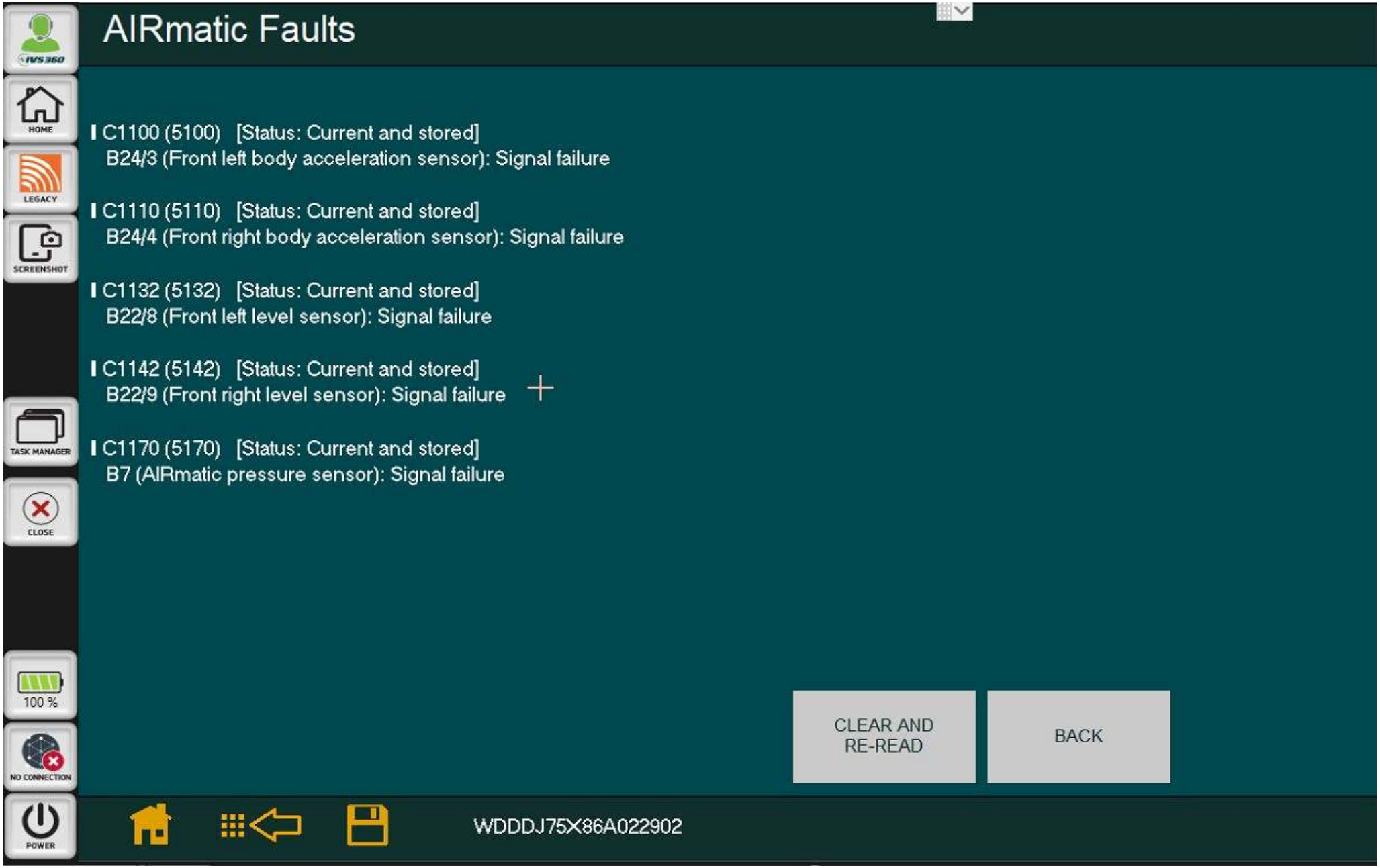
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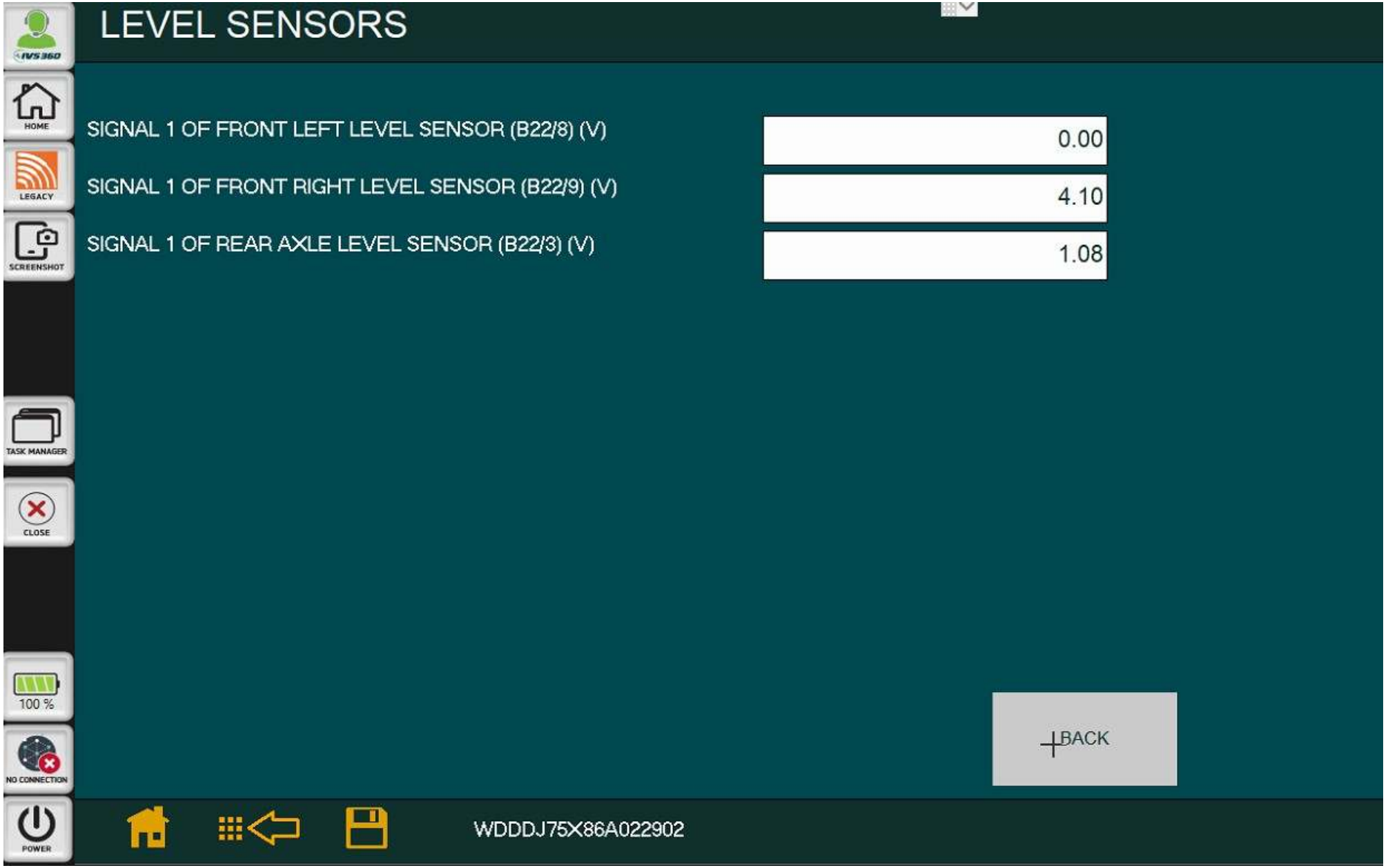


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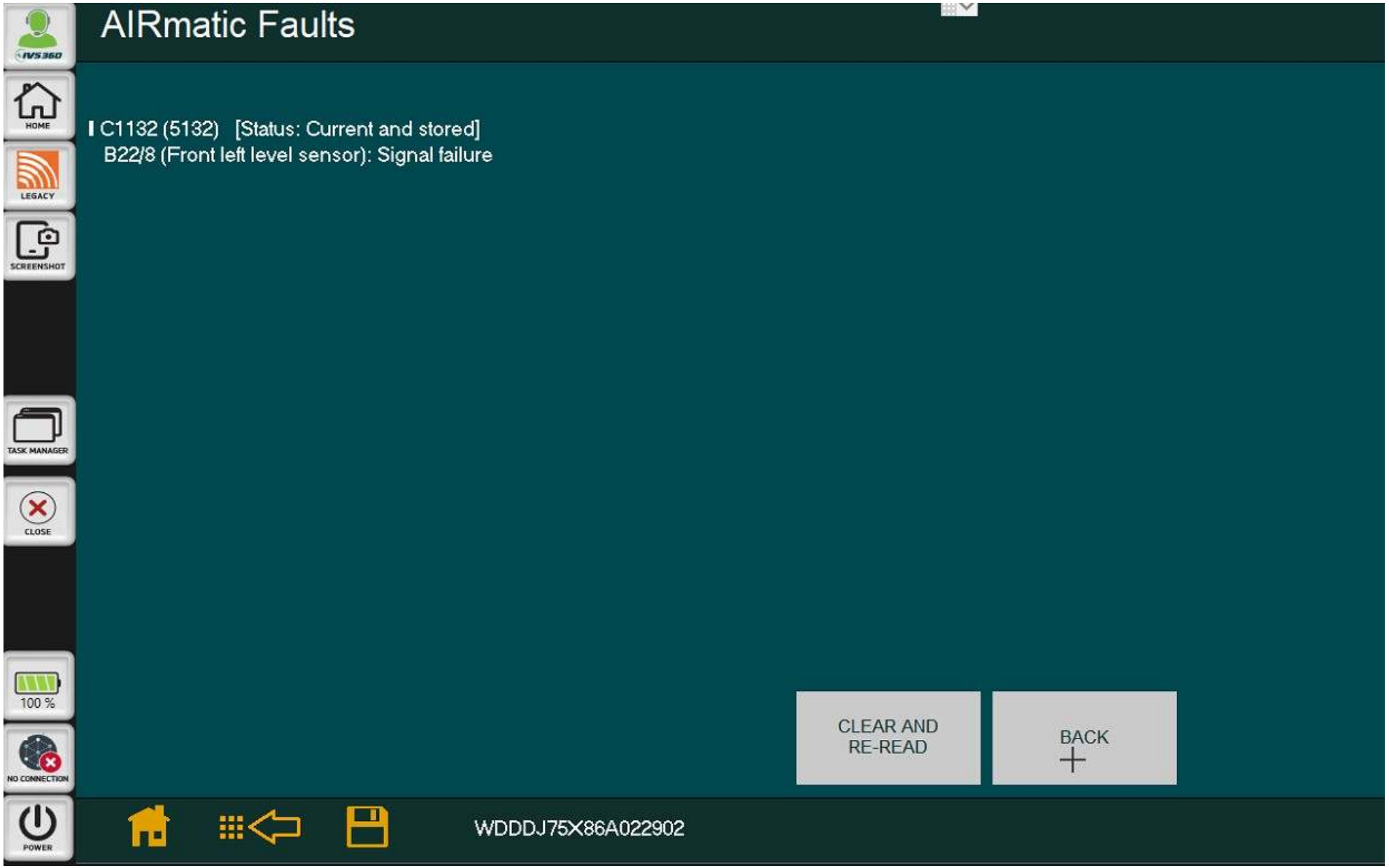

AIRmatic Faults
HOME
LEGACY
SCREENSHOT
TASK MANAGER
CLOSE
100 %
NO CONNECTION
POWER
C1100 (5100) [Status: Current and stored]
B24/3 (Front left body acceleration sensor): Signal failure
C1110 (5110) [Status: Current and stored]
B24/4 (Front right body acceleration sensor): Signal failure
C1132 (5132) [Status: Current and stored]
B22/8 (Front left level sensor): Signal failure
C1142 (5142) [Status: Current and stored]
B22/9 (Front right level sensor): Signal failure
C1170 (5170) [Status: Current and stored]
B7 (AIRmatic pressure sensor): Signal failure
CLEAR AND RE-READ
BACK
WDDDJ75X86A022902



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PRESSURE IN FRONT RIGHT SUSPENSION STRUT
AIRMATIC PRESSURE SENSOR (B7) (bar)
5.90
HOME
LEGACY
SCREENSHOT
TASK MANAGER
CLOSE
100 %
NO CONNECTION
POWER
BACK
WDDDJ75X86A022902

Only the left front level sensor code remains because it is disconnected



Level sensor plausibility



Tooling



CTA 5171

CTA Tools 5171 Air Suspension Pressure Tester









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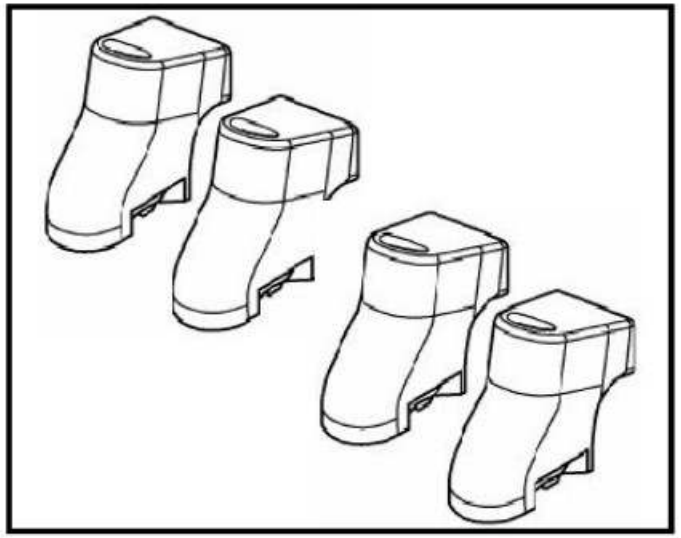
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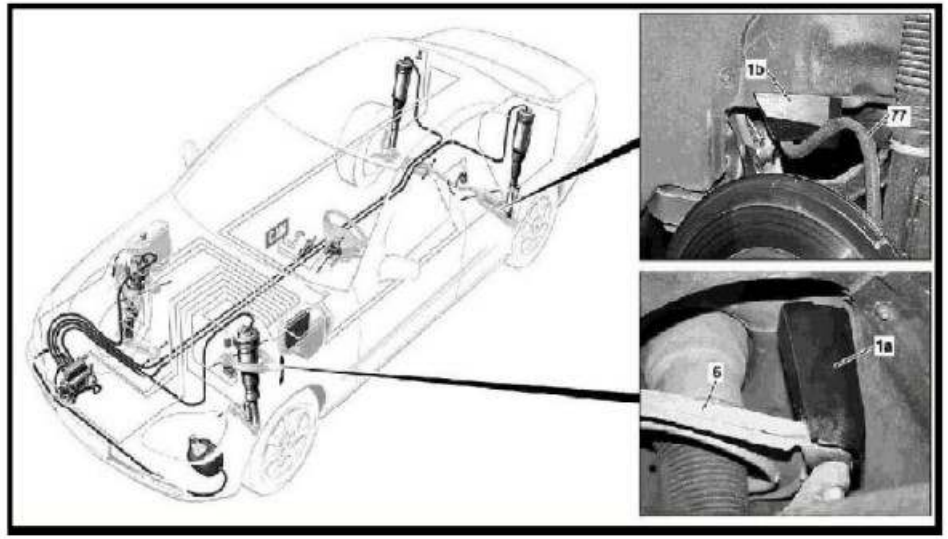

ROMESS
electronic
OFF
ON
SAVE
STEP
MEMORY
ROMESS ROGG GmbH & Co
ATTENTION
■ Operating instructions are placed in the lid of the case behind the foam plastics
■ Hint:
Ref.: Operating instructions, page 6 Quality report
(last paragraph-Data transfer)
Measurement only possible withinstalled data transmission and charging station, Order No. CM09630-10/,-11/ or -20.
(+) Pol.
Attention :
Take care of Polarity

Towing Blocks



221 / 216

All corners - 221 589 00 31 00
(placed between upper control arm and strut tower on front and sliding in on the camber strut on rear)



220 / 215 / 211

Front P/N - 220 327 12 30
Rear P/N - 220 328 08 39

Warning: May only be used for maneuvering, NOT for driving





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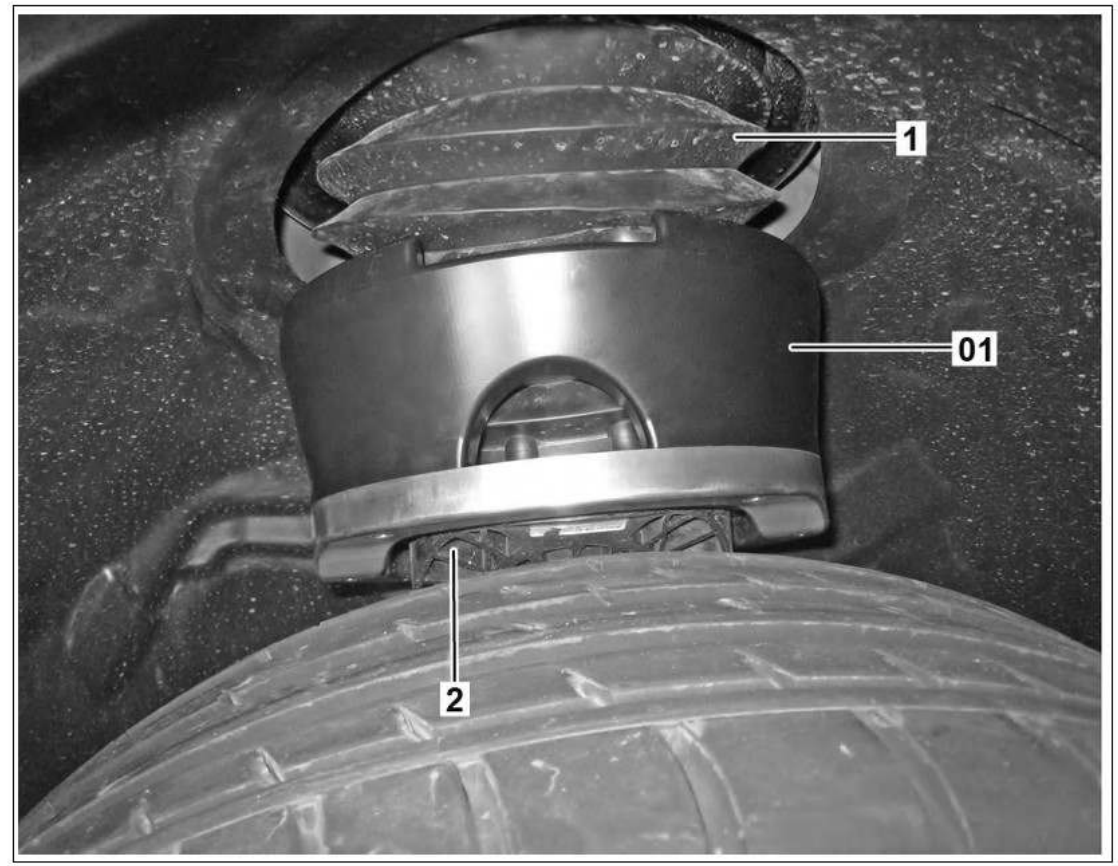
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AR32.00-P-1000EW	Install/remove emergency buffer	27.10.10

MODEL 212
with CODE (489) AIRmatic (air suspension with continuous damper adjustment)
with CODE (488) Steel/air suspension
MODEL 218
with CODE (489) AIRmatic (air suspension with continuous damper adjustment)
with CODE (488) Steel/air suspension

Front axle

01 ☒ *Emergency buffer (front)*
1 *Boot*
2 *Bottom spring retainer*



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Rear axle

02 *Emergency buffer (rear)*
3 *Protective tube*
4 *Support bushing*

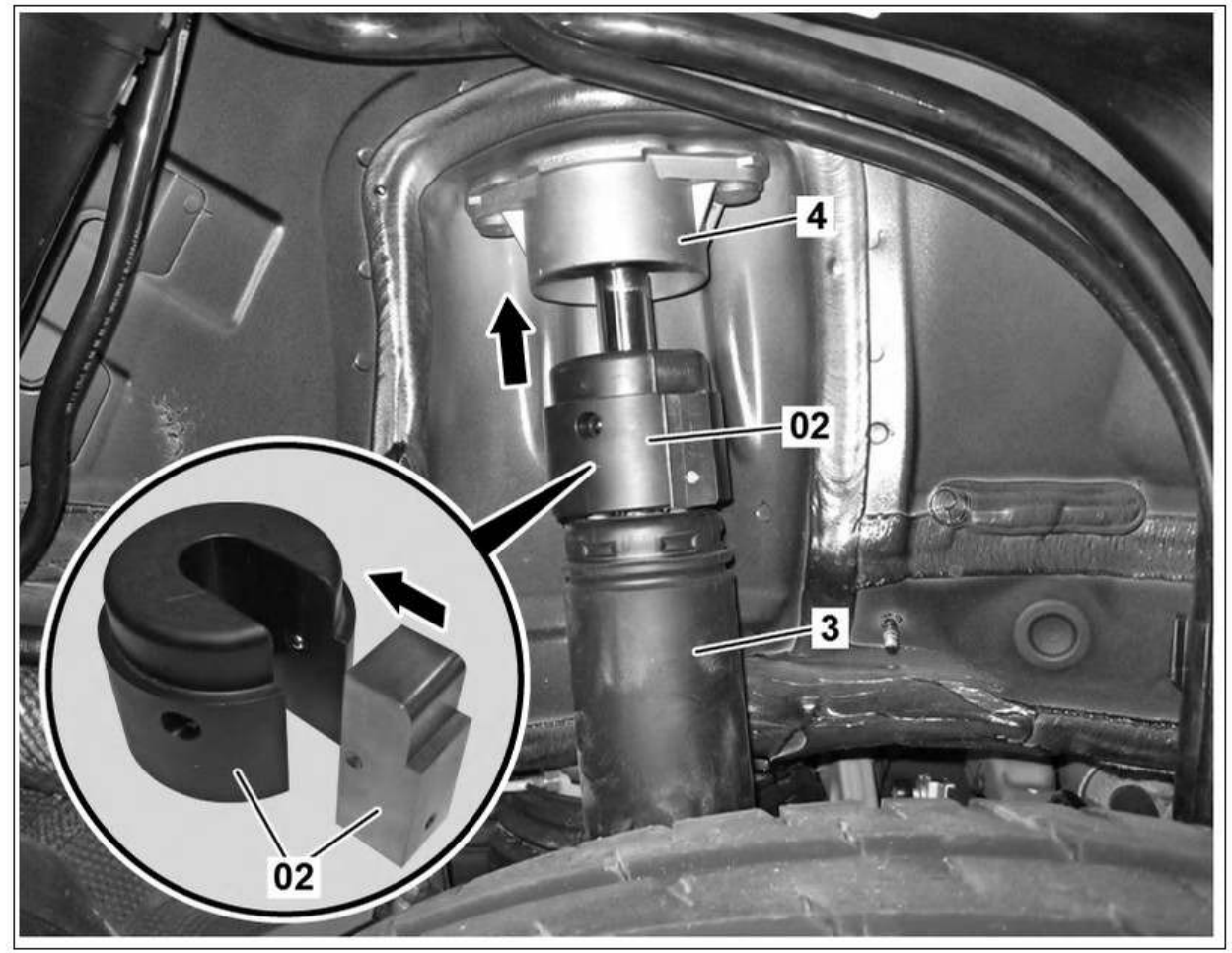
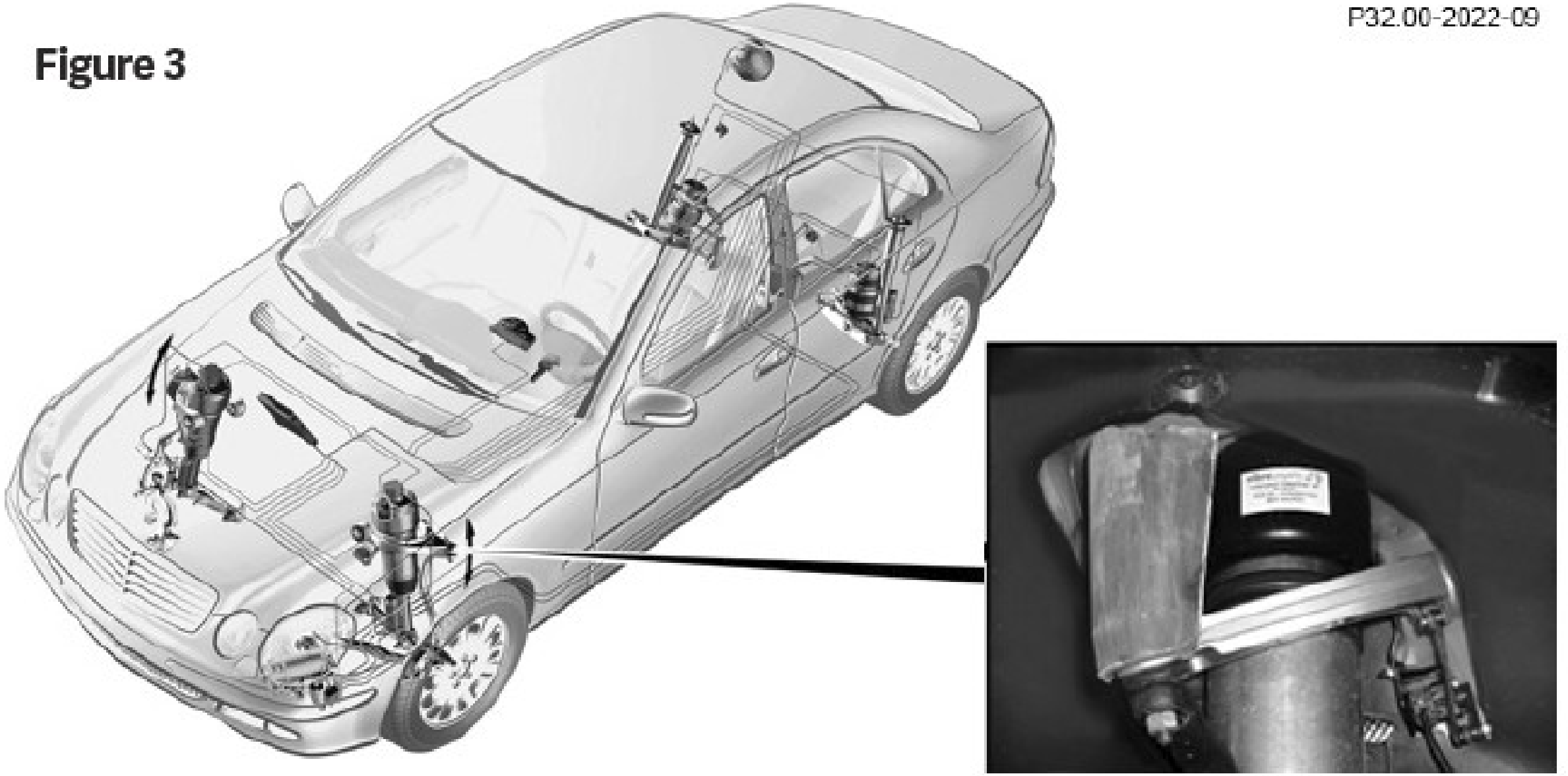


Figure 3





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Service



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Airmatic Variations



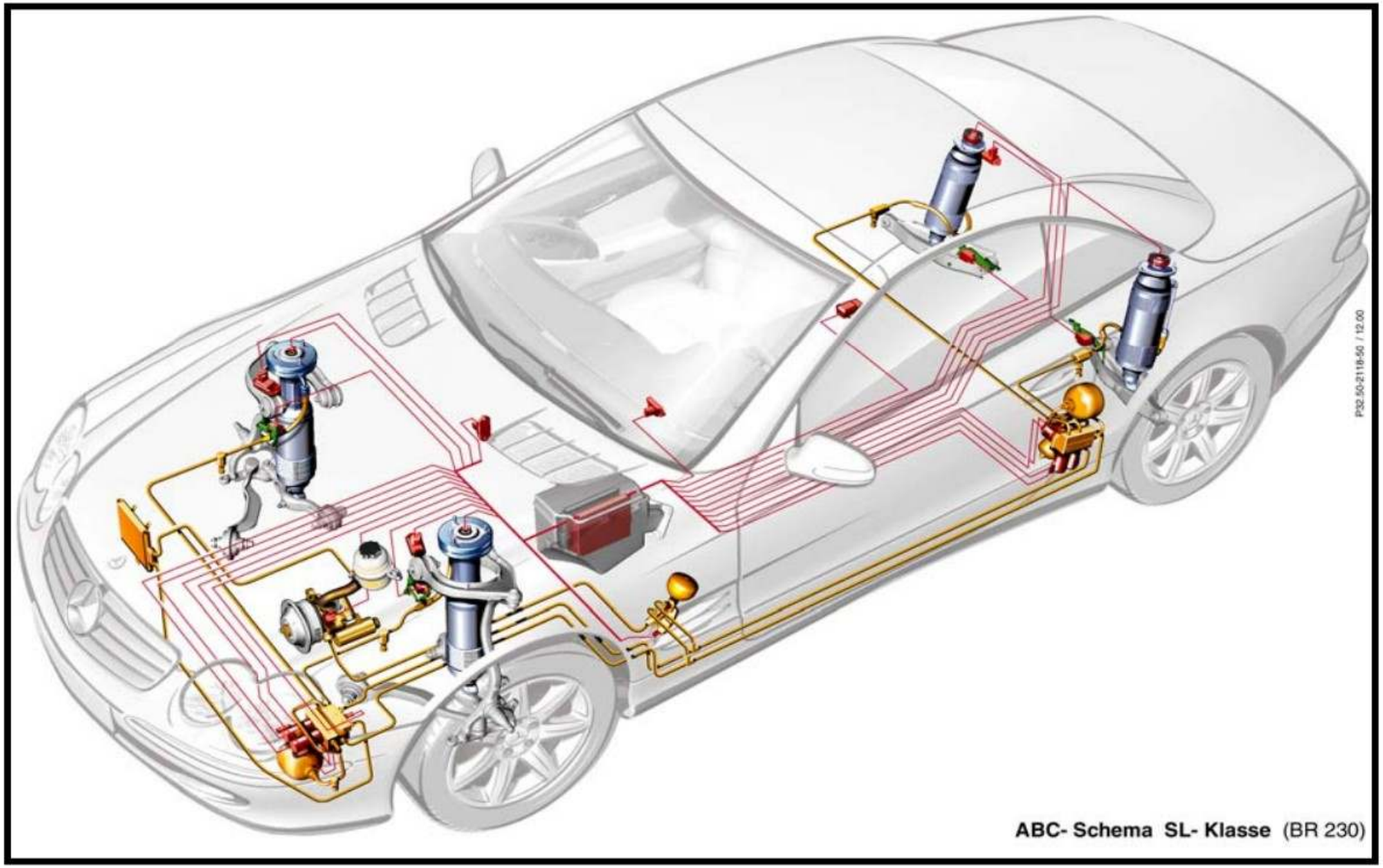


Driver Inputs

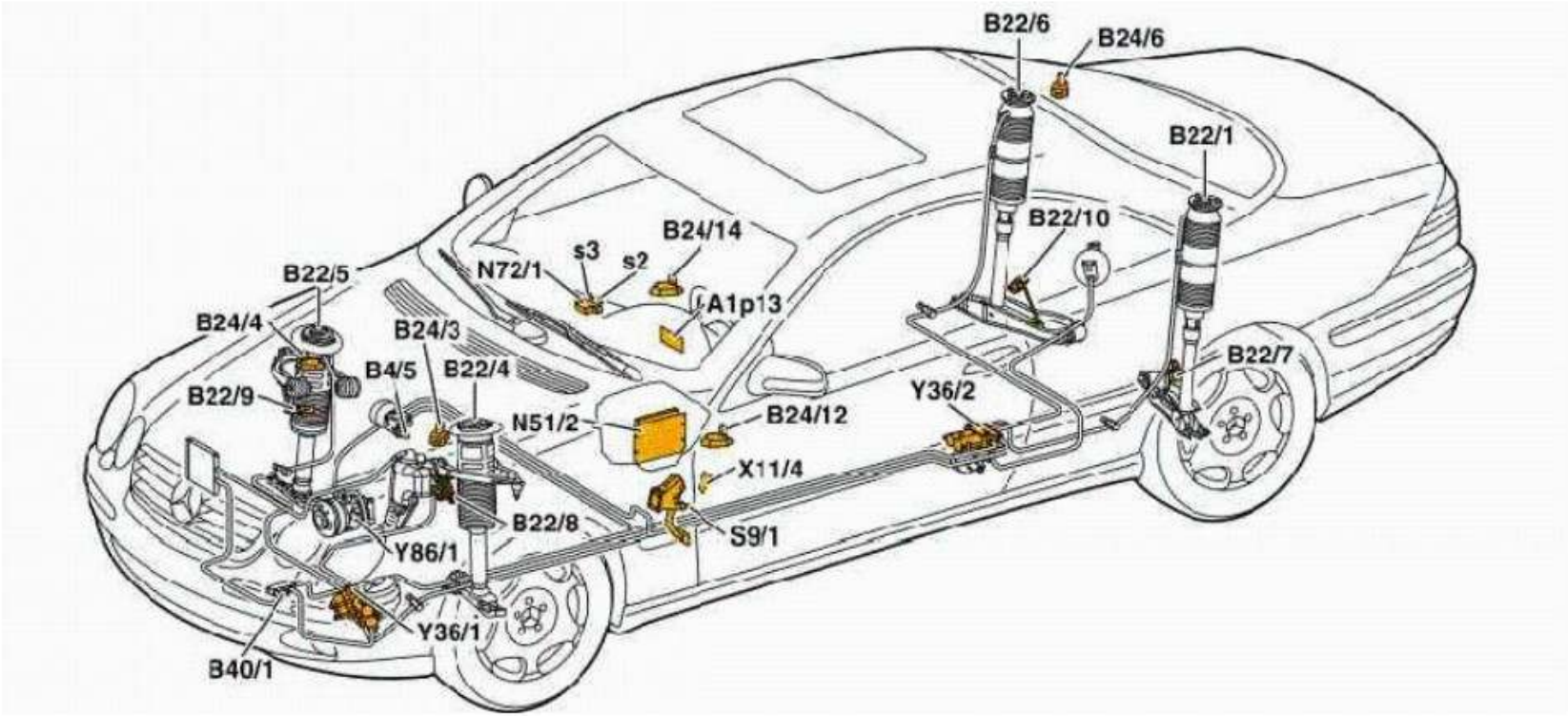
- Driver can select between 3 ride heights using switch (N72/1s2)
  - Normal (no LED's)
  - Raise approx. 14 mm (1 LED)
  - Raised approx. 24 mm (2 LED's)
- At speed vehicle,s ride height will be lowered to high speed level (driver selection to increase ride height will be cancelled)
- Sport switch (N72/1s3) reduces allowable body roll



ABC Active Body Control



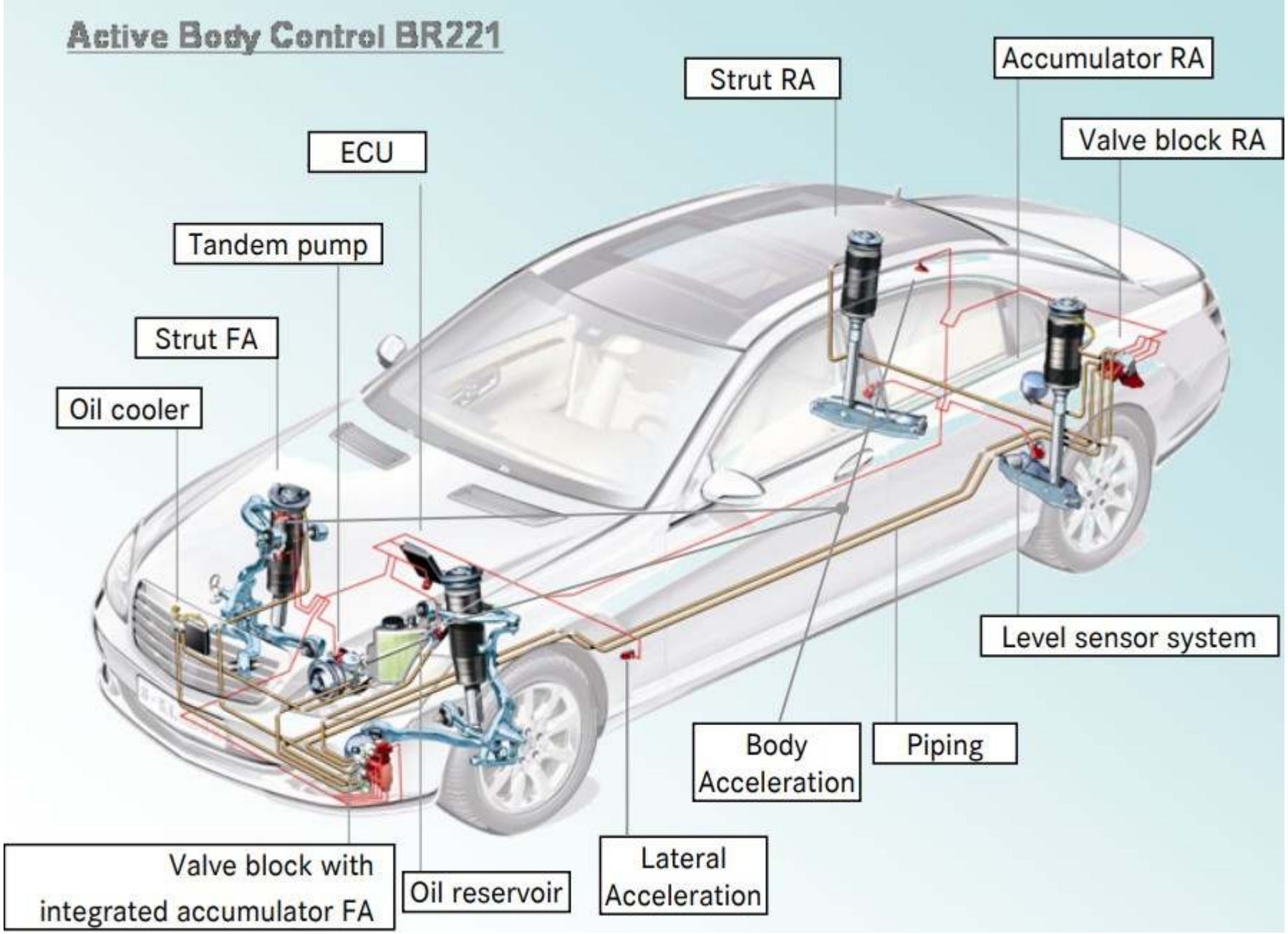
Components of ABC



A1p13	Multifunction display
B4/5	ABC pressure sensor
B22/1	Left rear plunger travel sensor
B22/4	Left front plunger travel sensor
B22/5	Right front plunger travel sensor
B22/6	Right rear plunger travel sensor
B22/7	Left rear level sensor
B22/8	Left front level sensor
B22/9	Right front level sensor
B22/10	Right rear level sensor
B24/3	Front left body acceleration sensor
B24/4	Front right body acceleration sensor
B24/6	Rear right body acceleration sensor
B24/12	ABC lateral acceleration sensor
B24/14	ABC longitudinal acceleration sensor
B40/1	ABC oil temperature sensor
N51/2	ABC control module
N72/1s2	Level adjustment switch
N72/1s3	Comfort and SPORT switch
S9/1	Stop lamp switch (4-pin)
X11/4	Diagnostic data link connector
Y36/1	ABC front axle valve unit
Y36/2	ABC rear axle valve unit
Y86/1	ABC suction restrictor valve

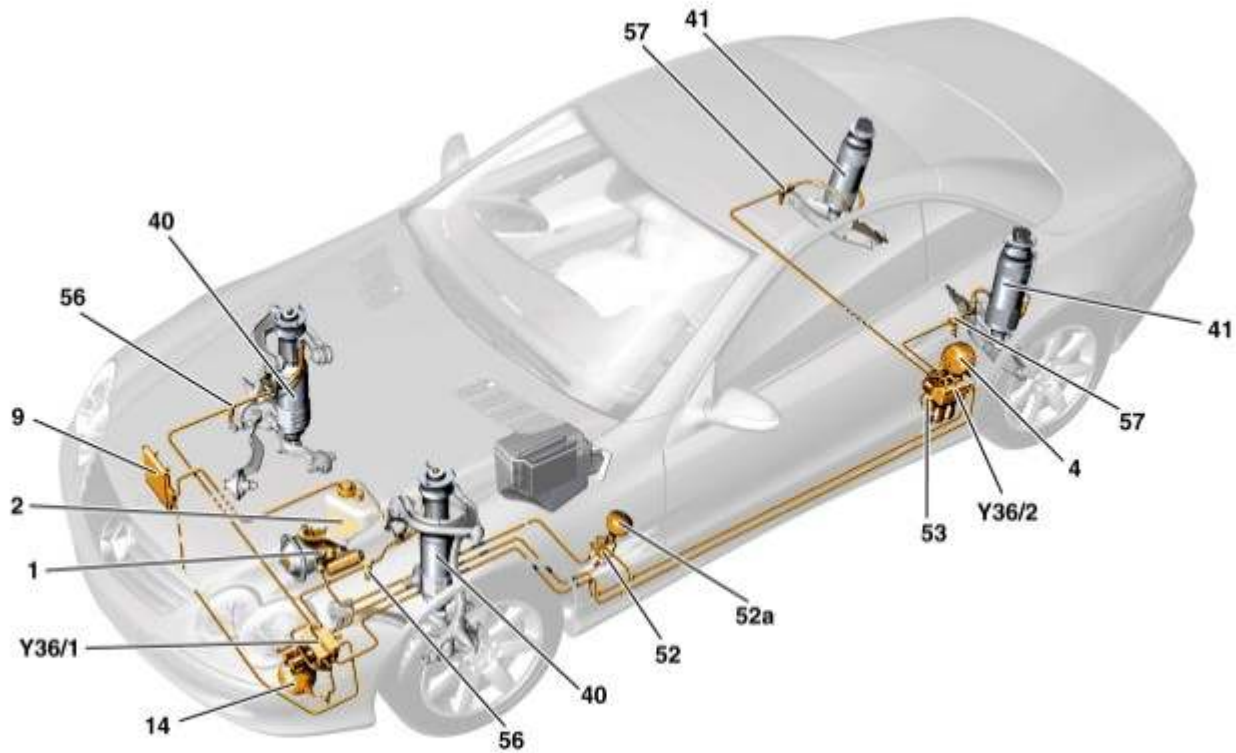
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Active Body Control BR221



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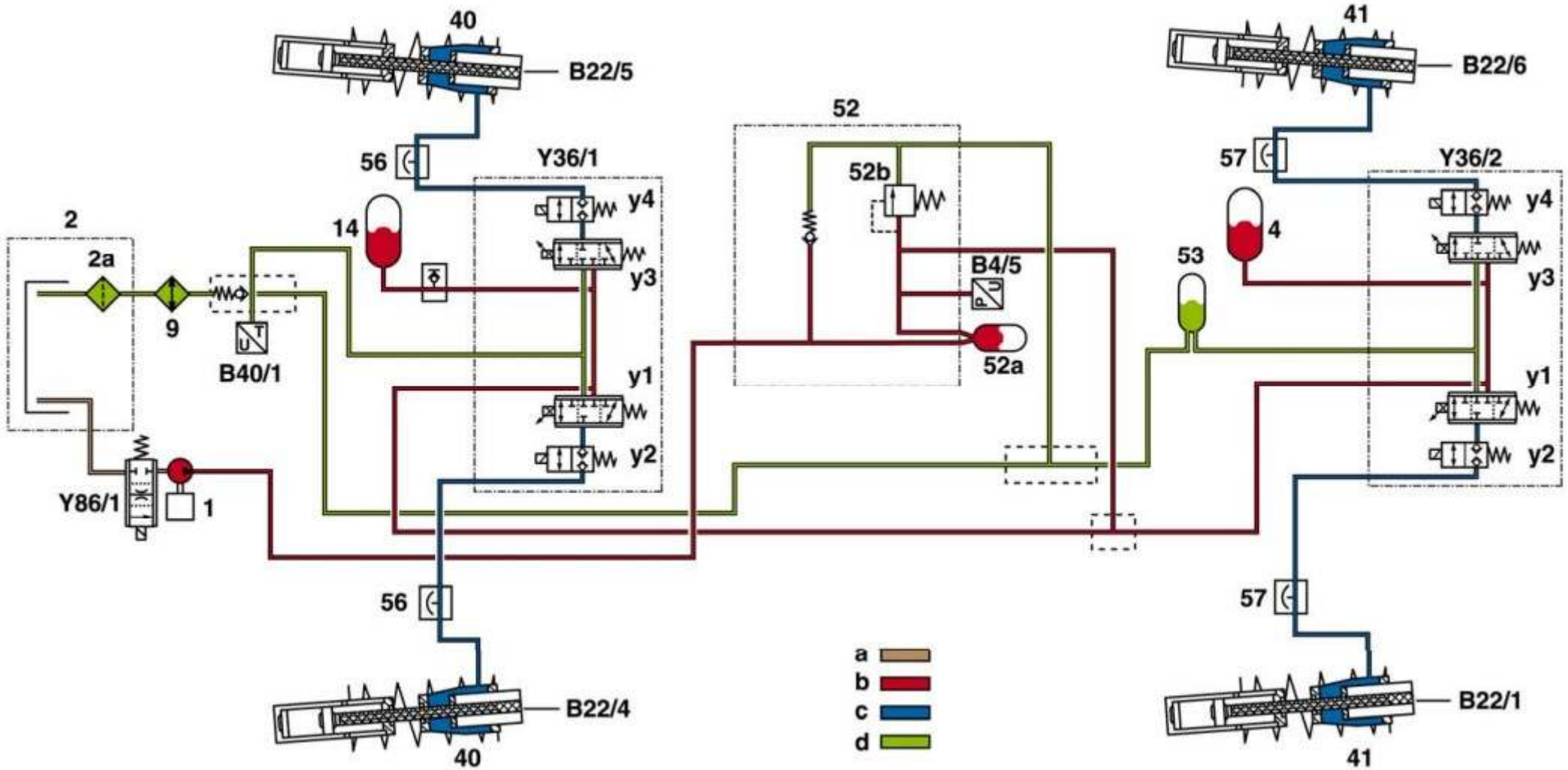
GF32.50-P-0001-06SL	Active body control (ABC) location of hydraulic components	Model 230	GF



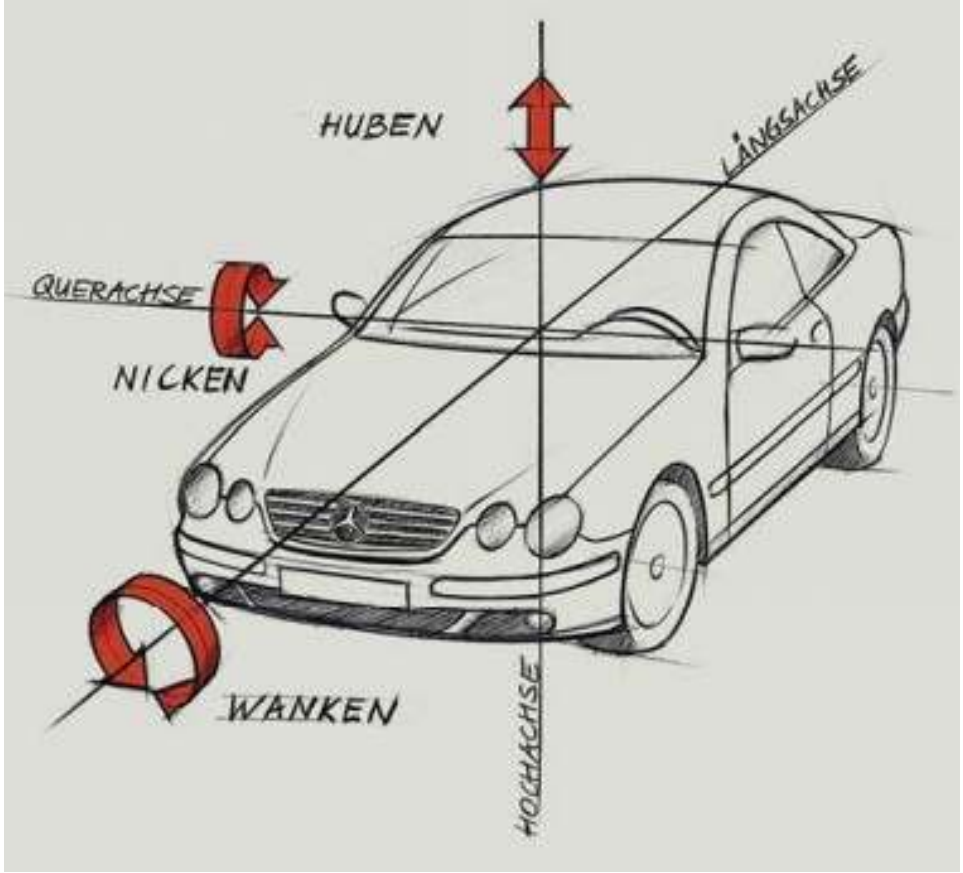
P32.50-2126-79

1 Radial piston pump
2 Oil reservoir
4 Rear axle pressure reservoir
9 Oil cooler
14 Front axle pressure reservoir
40 Front suspension strut
41 Rear suspension strut
52 Pressure supply valve unit
52a Pulsation damper
53 Return flow pressure reservoir
56 Front bleeder screw
57 Rear bleeder screw
Y36/1 Front axle valve unit
Y36/2 Rear axle valve unit

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40
B22/5
56
Y36/1
y4
y3
y1
y2
14
2
2a
9
B40/1
Y86/1
1
56
B22/4
40
52
52b
B4/5
52a
41
B22/6
57
Y36/2
y4
y3
y1
y2
4
53
57
B22/1
41
a
b
c
d

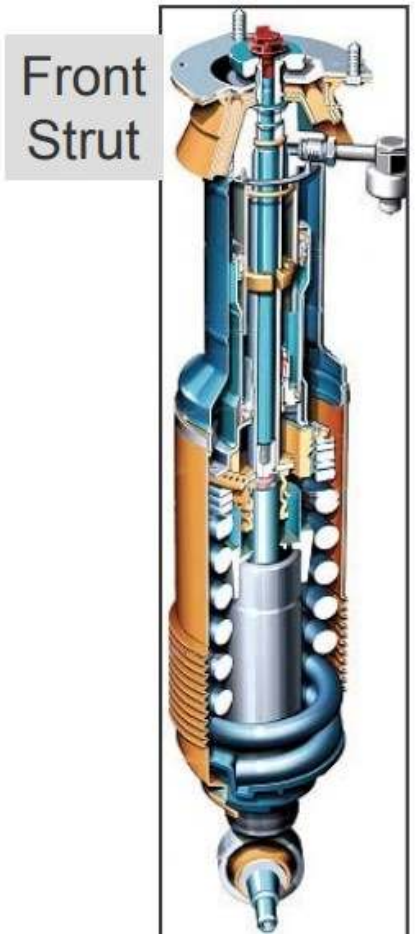
Functional overview



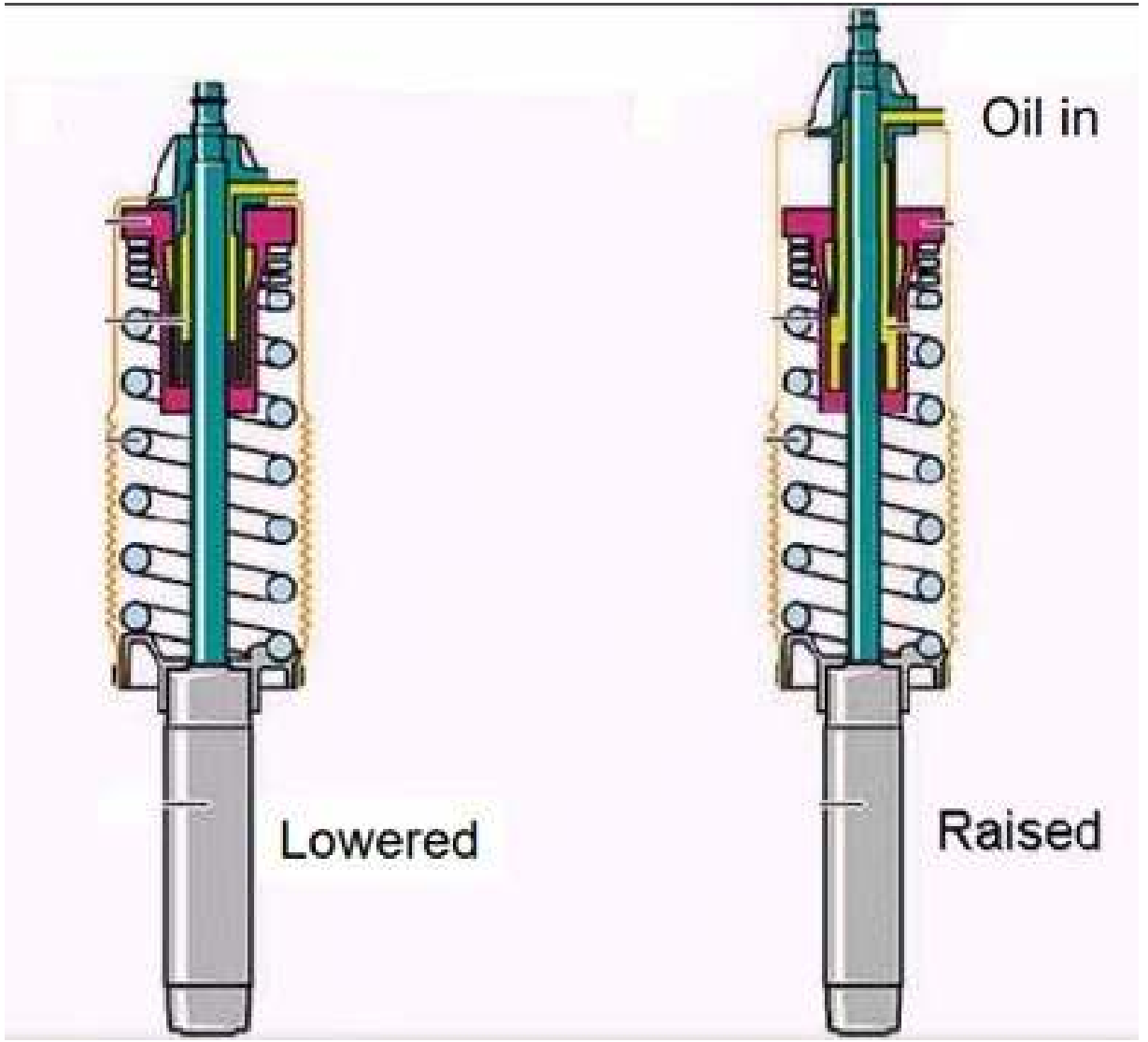
- Support and Maintain the vehicle level
- Sense and monitor the ride level
- Build hydraulic pressure supply
- Store surplus hydraulic fluid
- Adjust the suspension height
- Maintain suspension at standstill, when driving, or lifting vehicle
- Provide vehicle level information to Headlamp range/aim system
- Adapt suspension damping to driving conditions

Vehicle support

The suspension is supported by a combination of springs and hydraulic fluid under pressure







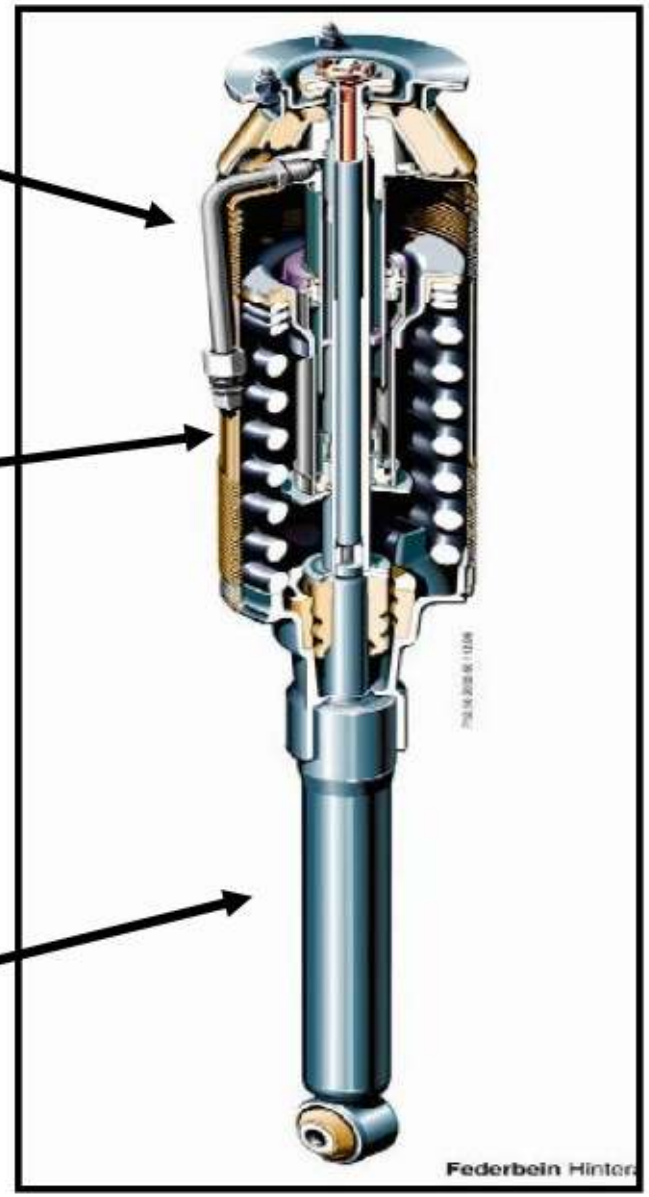
- Hydraulic fluid under pressure (approx. 200 bar) enters strut on top of spring

Always follow safety measures such as Personal Protective Equipment (PPE) when dealing with high pressure systems. Safety glasses, protective gloves, etc…

- Fluid compresses spring, changing effective spring rate

- Combination of hydraulic pressure and spring dampen vibrations up to 5 hertz

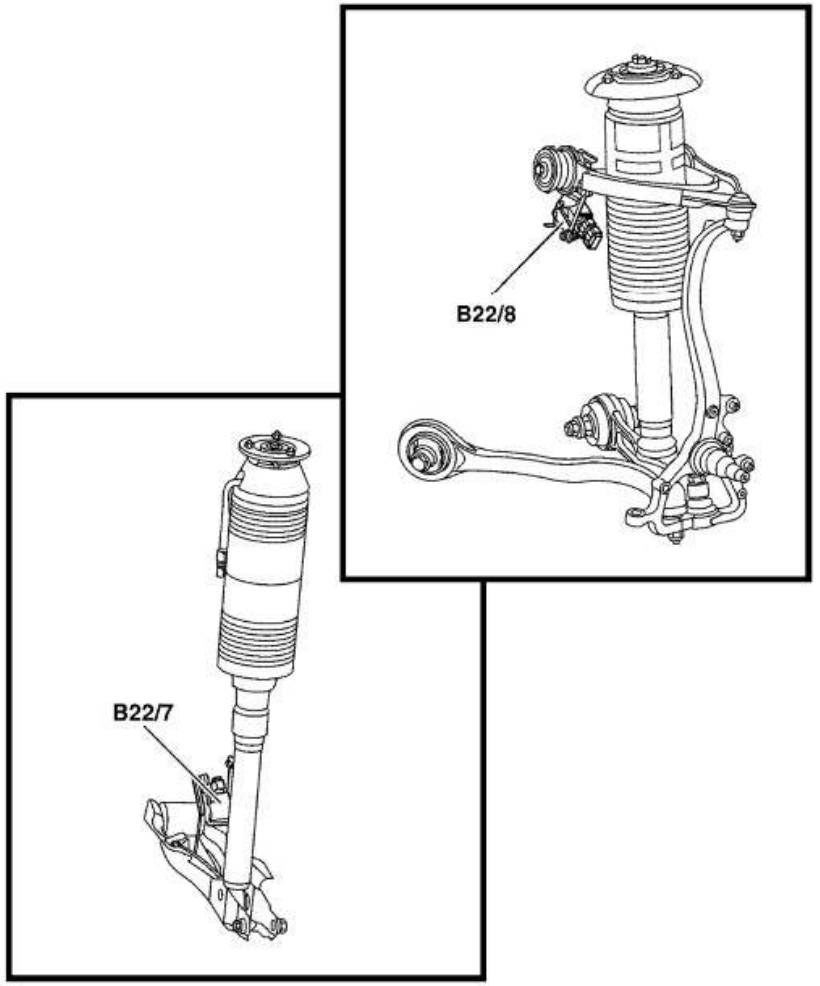
- Gas charged shock and spring dampen vibrations above 5 hertz



Leveling

Level Sensors (B22/7 – B22/10)

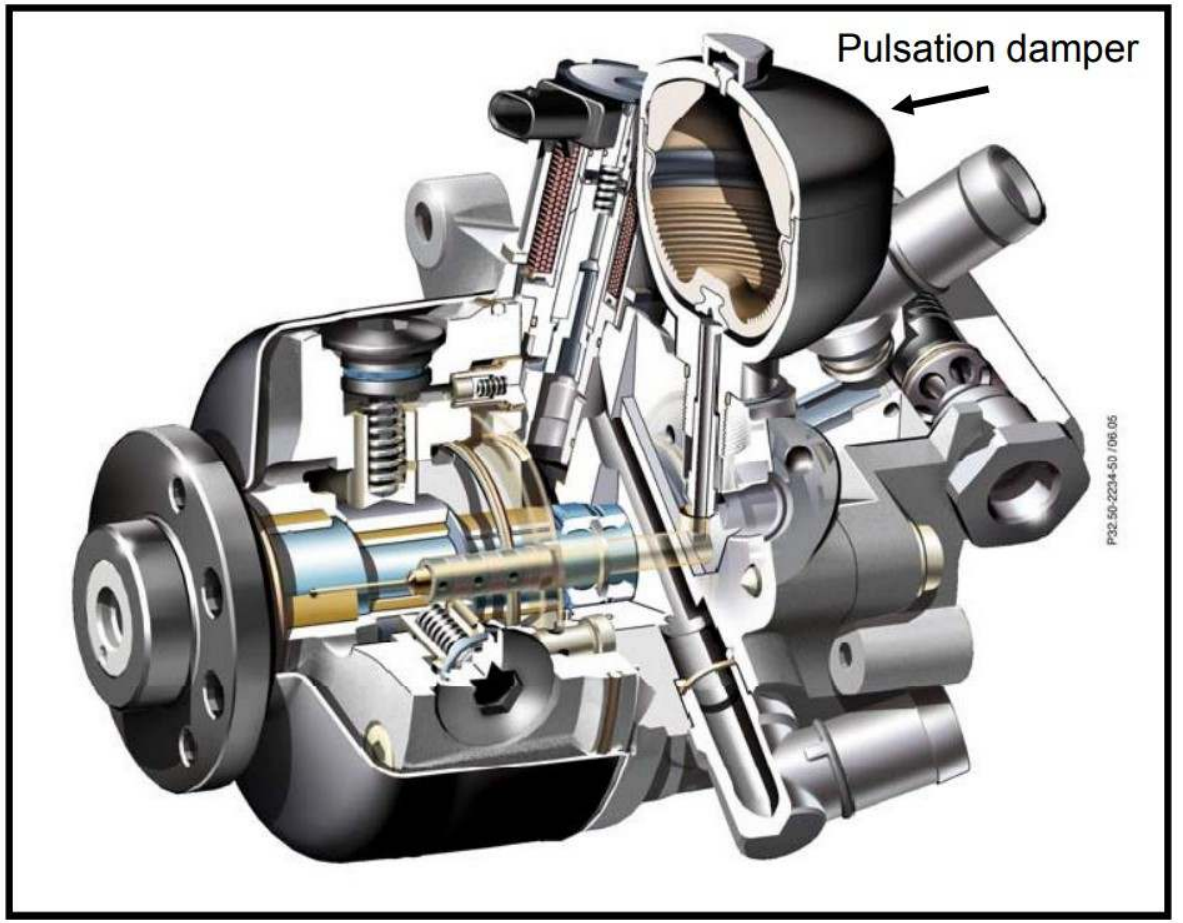
- 4 level sensors used
  - LF (B22/8)
  - RF (B22/9)
  - LR (B22/7)
  - RR (B22/10)
- Each contains 2 hall effect sensors
  - Transmits opposing / redundant signals
- Level must be recalibrated if any level sensor is replaced



Build hydraulic pressure supply

- The ABC pump provides pressurized fluid for the suspension and one half of it acts as a power steering pump although they are separate hydraulically

- Newer (ABC+) have a damper on the pump

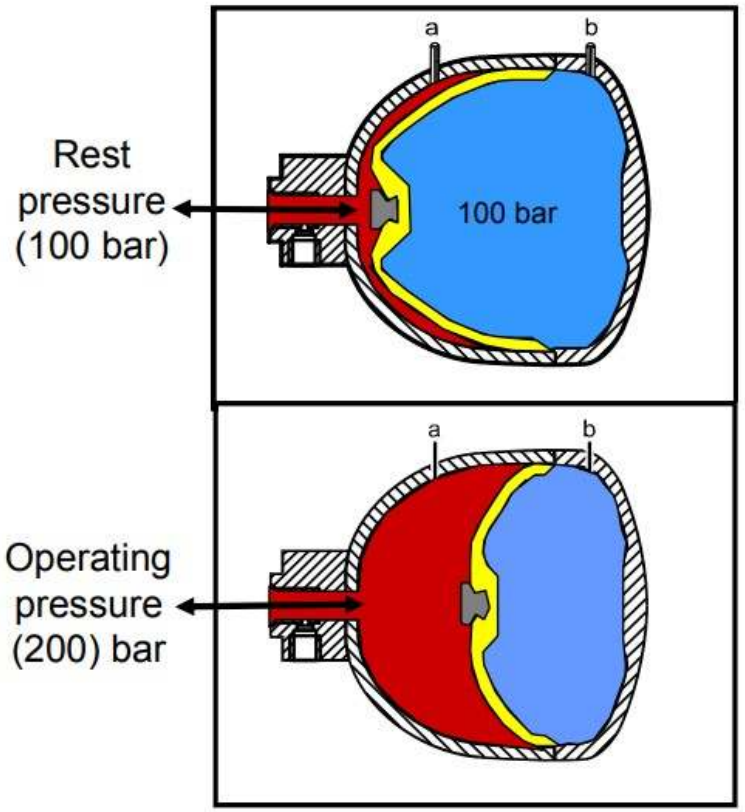


Store surplus hydraulic fluid

Accumulators

NOTE: May have 3 or 4 depending on the vehicle and model year

- Provides for high pressure fluid storage
- Primarily consist of 3 parts
  - Spherical steel container with oil chamber (a)
  - Gas chamber filled with 100 bar of nitrogen (b)
  - Separation membrane
- Even though reservoirs are positioned with axle valve units, their placement is before the regulator valves (volume stored is available to both axle valves)



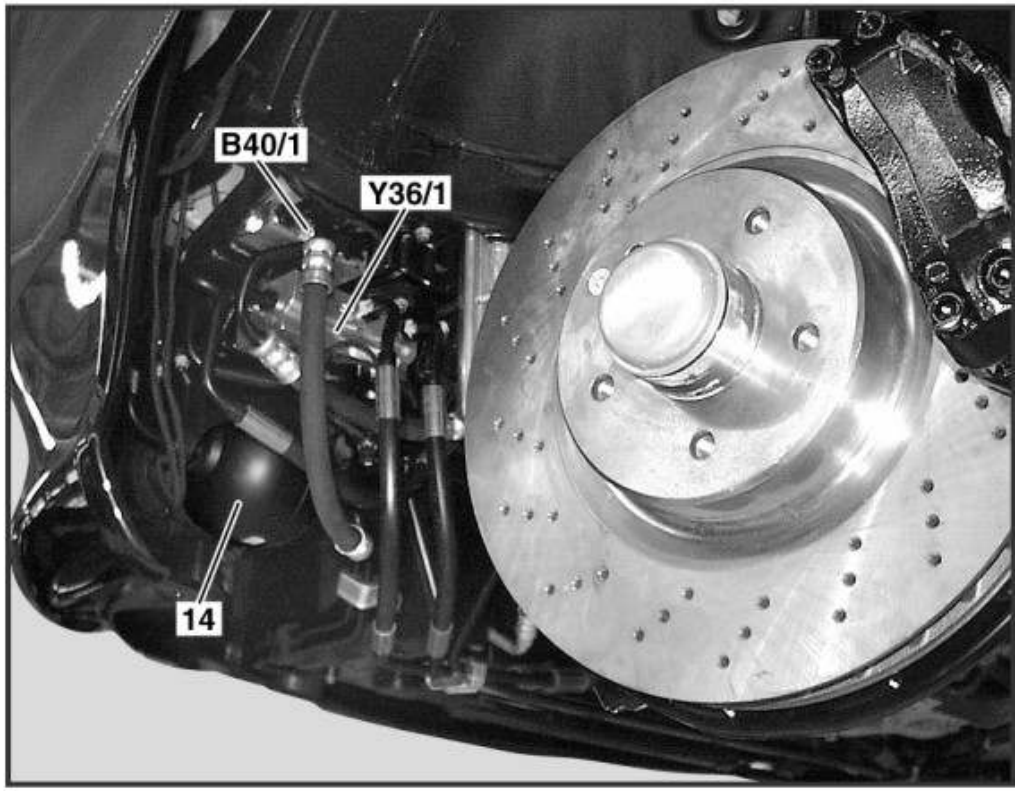
Level Control

Front Axle Valve Unit (Y36/1)

Remove paneling under left bumper cover to access

B40/1 temperature sensor

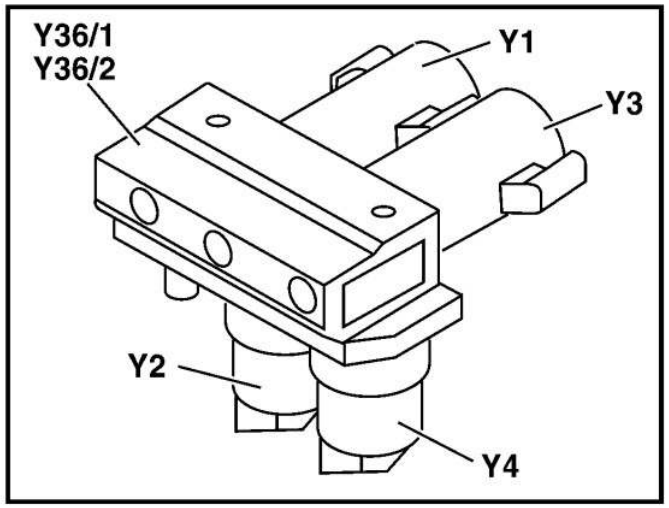
14 pressure reservoir



Level Control

Front (Y36/1) & Rear (Y36/2) Axle Valve Units

- Regulating valves (y1 and y3) are 3 position valves
  - Center position: closed
  - One direction: allows oil into strut
  - Opposite direction: allows oil to exit strut
  - Controlled by a PWM signal
- Shut off valves (y2 and y4) are normally closed
  - Energized to allow oil into or out of strut
  - Prevents oil from leaking out of strut in the event of regulating valve leakage





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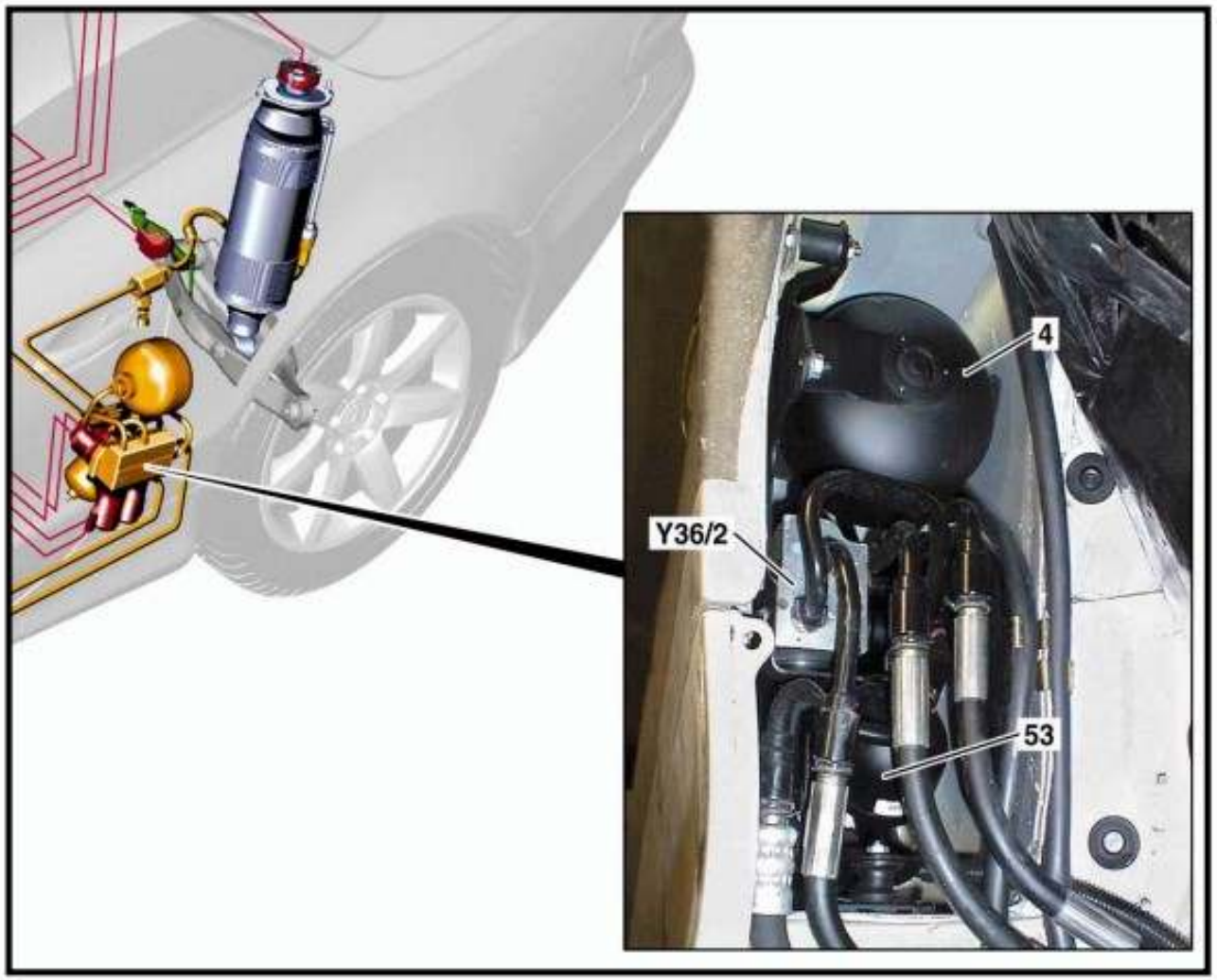
Level Control

Rear Axle Valve Unit Y36/2

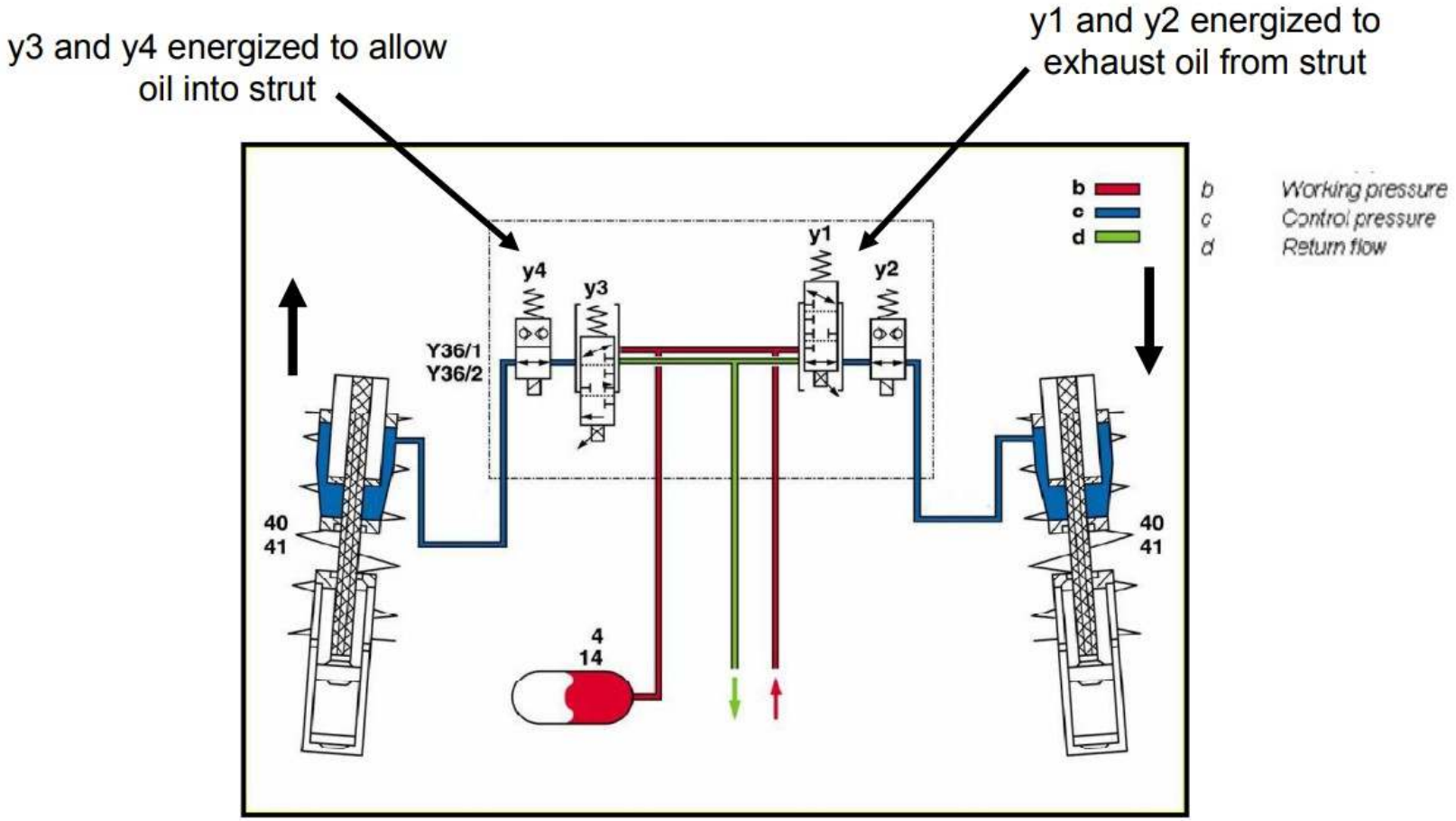
Remove wheel well lining to access

4 - supply pressure reservoir

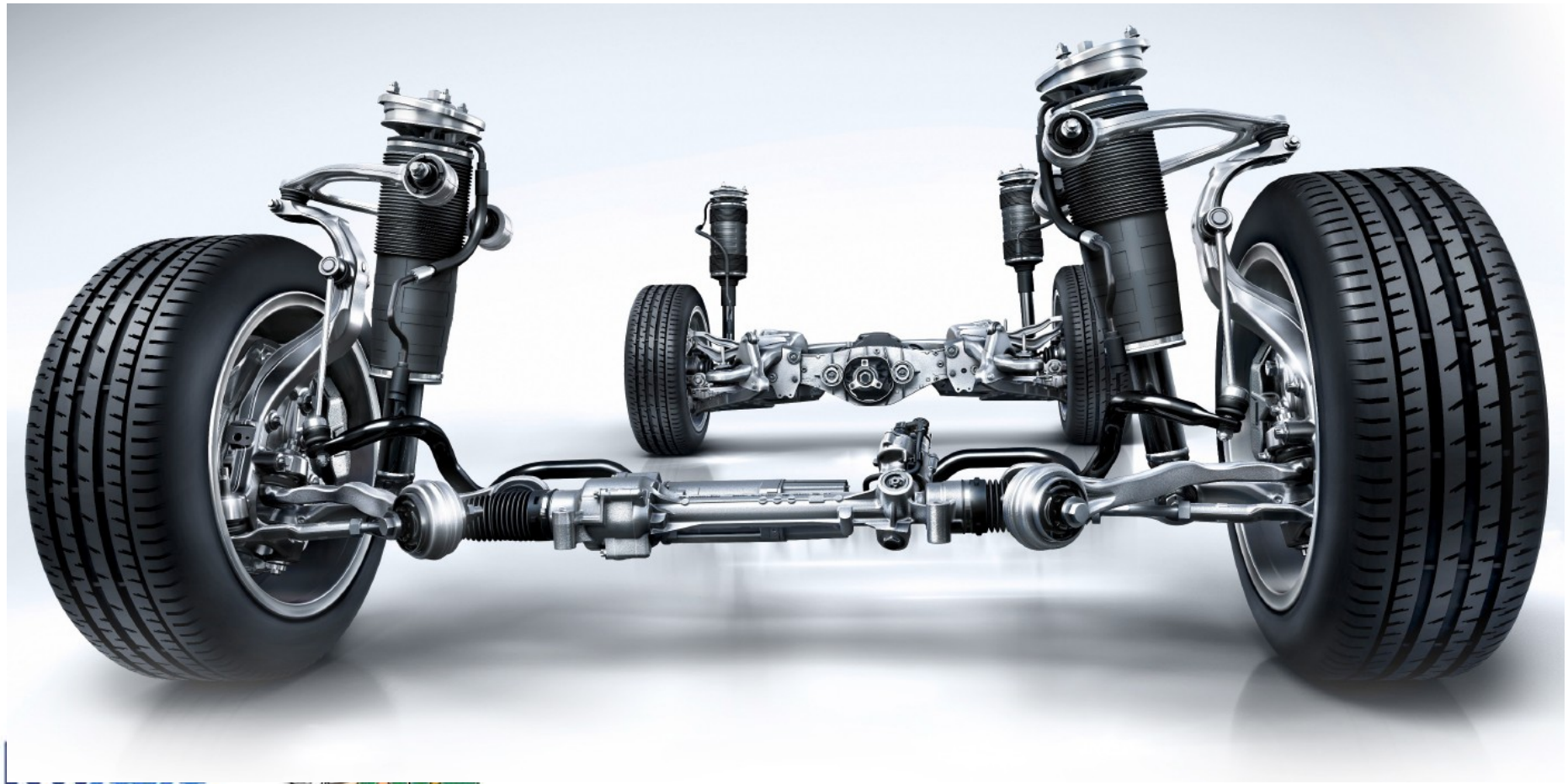
53 - return pressure reservoir



Level Control

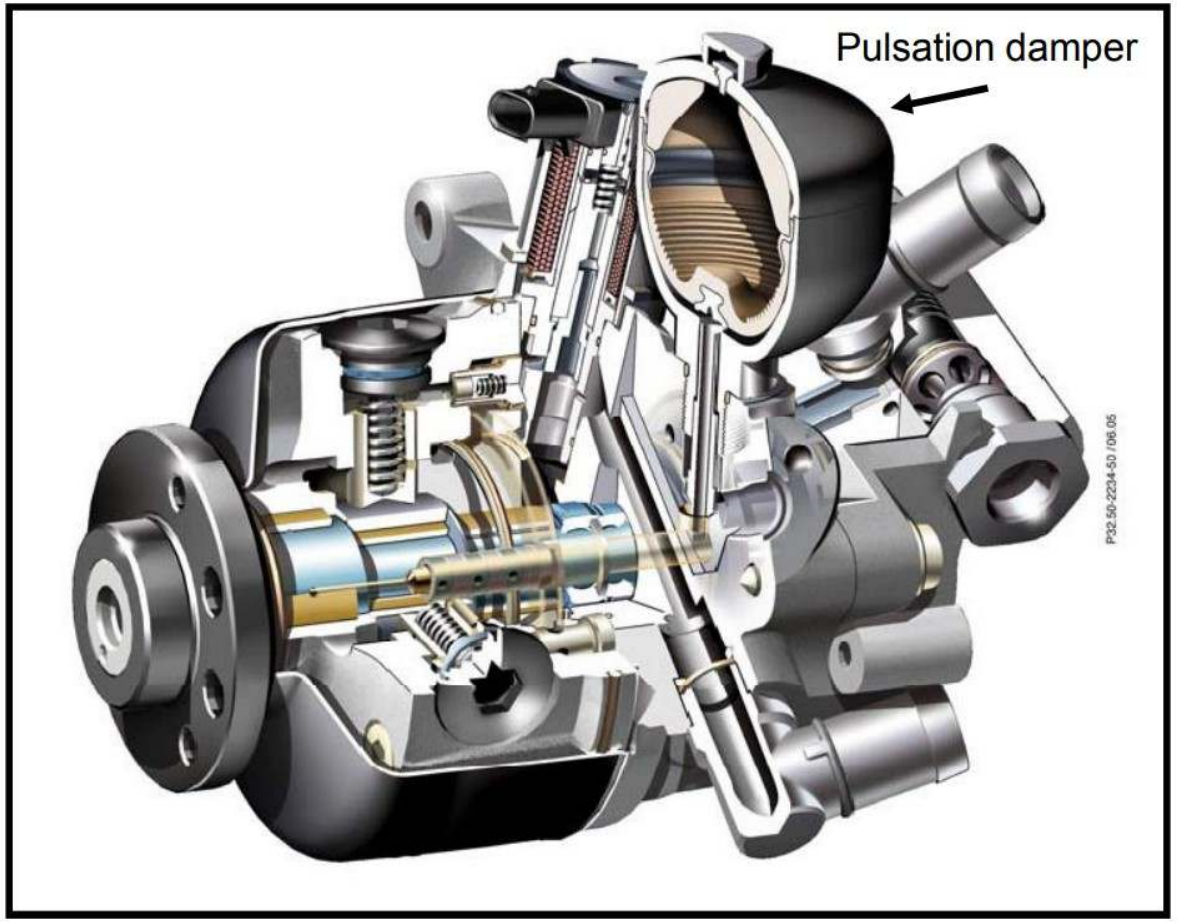


Components



ABC Pump

- Needs to be pressurized when replaced!
- Some have a damper some don’t









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Safety

High Pressure Hydraulics Safety

Never open a hydraulic system when the engine is running.

-Wear Safety glasses, gloves.
-Do not search for leaks with your hands. Shut the engine off, wait, and visually inspect.
-Injection injuries extremely rare but can destroy tissue, **require amputation.**



Injection injuries: seemingly minor injuries with major consequences

HZ Dailiana, D Kotsaki, S Varitimidis, S Moka, M Bakarozi, K Oikonomou, and NK Malizos

Author information ► Copyright and License information ►

CAUTION

The fuel system contains high pressure fuel up to 23,500 PSI. Do Not use your fingers to find leaks! High pressure fuel entering your bloodstream may result in amputation or loss of life.

Abstract

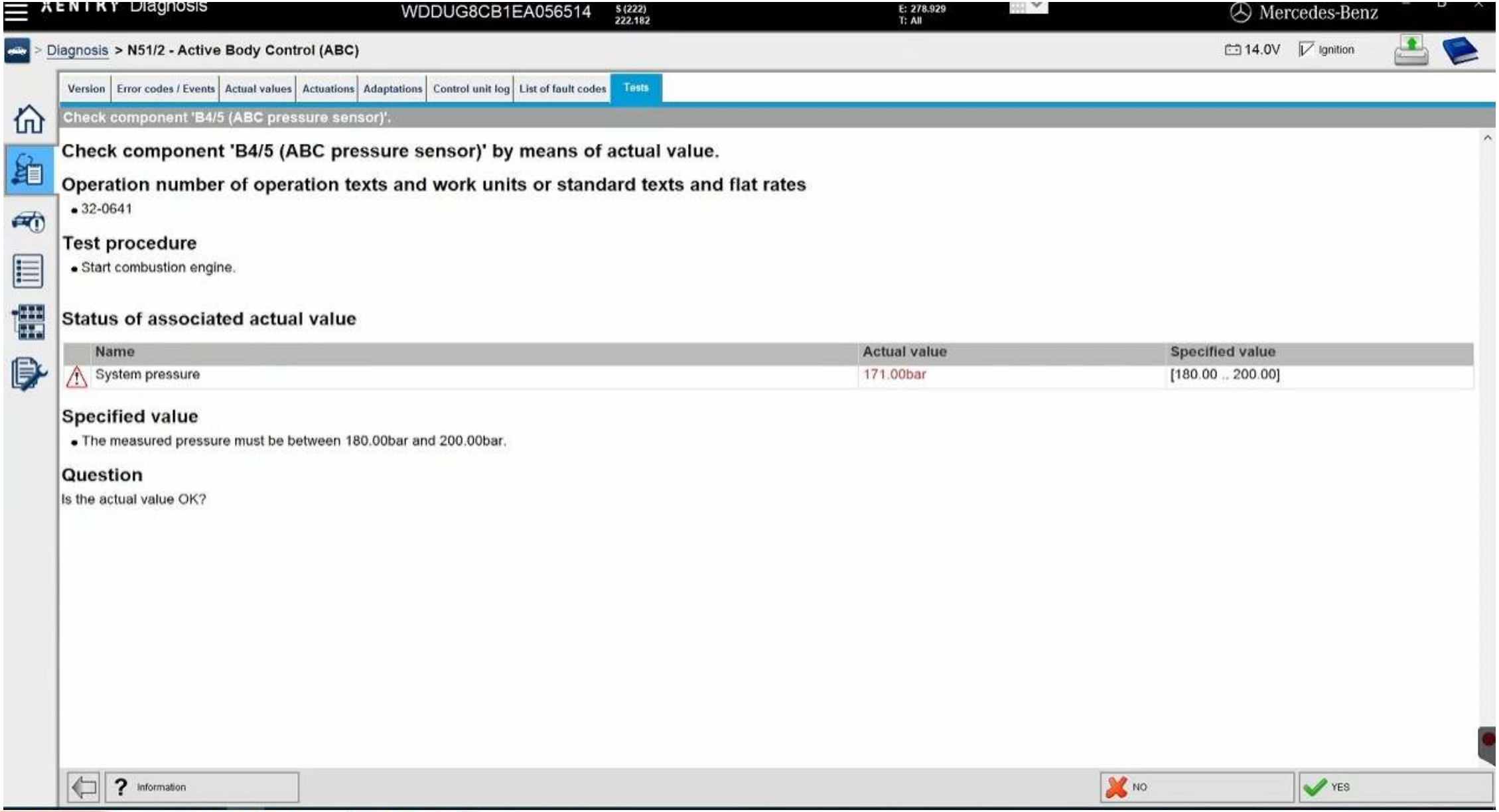
Background: High-pressure injection injuries are rare injuries, characterized by a small puncture wound that is often underestimated by physicians and patients. The injected substance leads to extensive tissue damage and sometimes to loss of the limb. **Aim:** To underline the severity of these injuries and to alert physicians to recognize them and treat them appropriately.

Suction Throttling Valve Y86/1

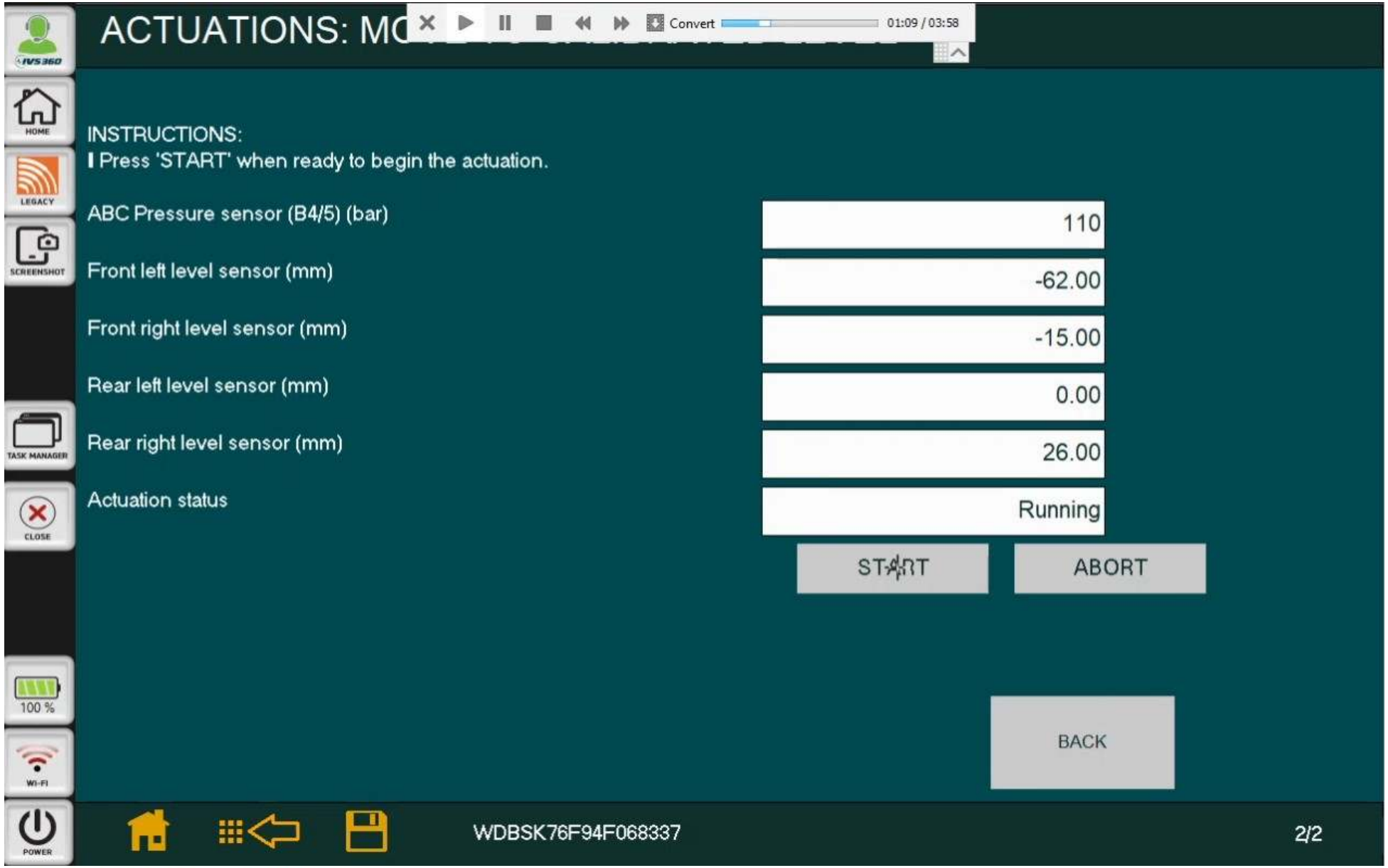


- Suction restrictor valve (Y86/1) attached to pump
  - Adjust intake volume of pump to demand
  - Acts as a proportioning valve
  - Normally closed valve, however due to its proportioning function does not completely close

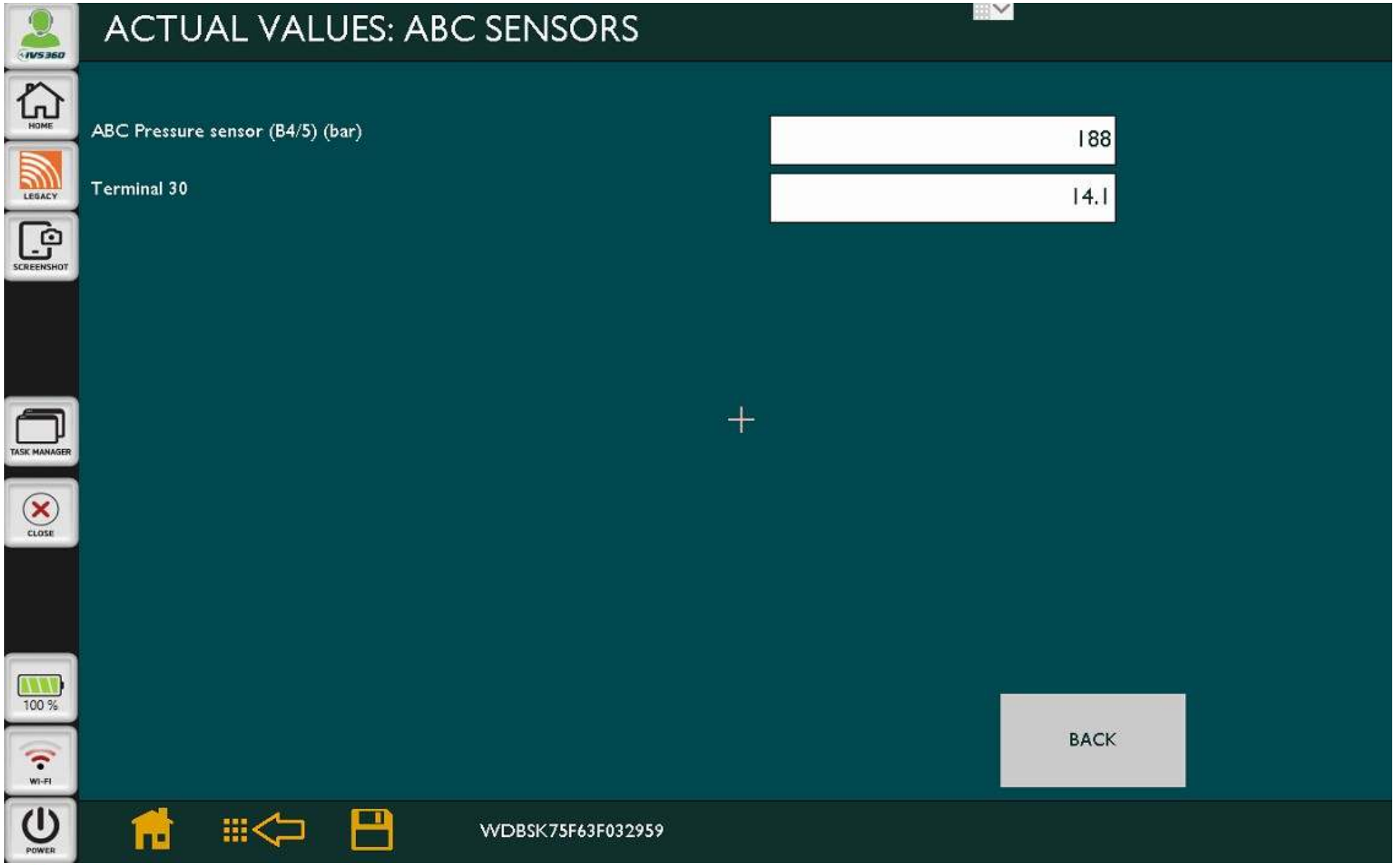
15 ABC 222 Erratic Pump Pressure Video



16 ABC Lazy Pump Video

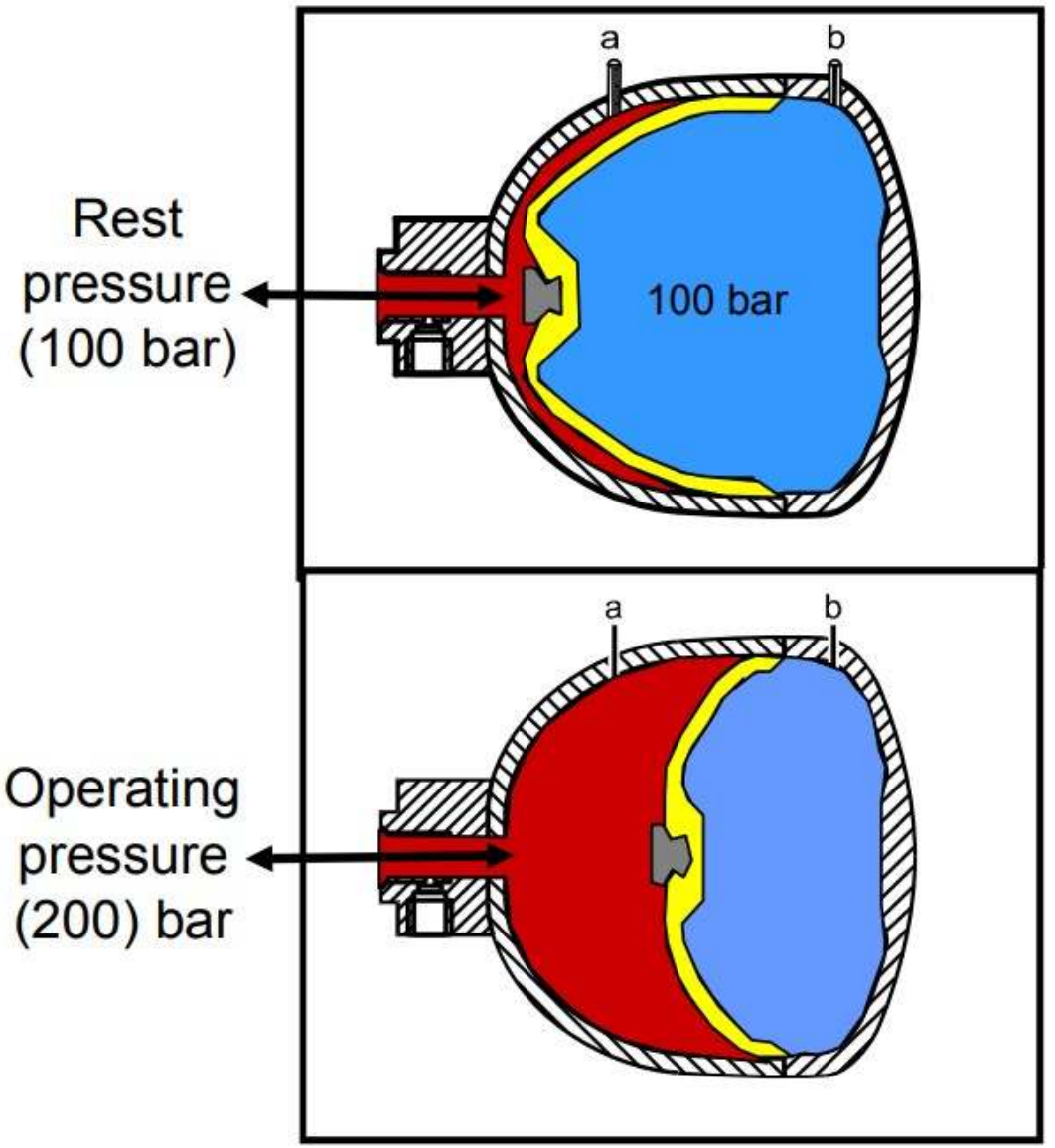


17 Proper ABC Pump Video



Accumulators





Accumulators

- Accumulators have a nitrogen charge and store hydraulic fluid under pressure in large quantities so when the system demand is high and the pump can't keep up they can pick up the slack.
- The nitrogen charge leaks out over time and causes the ABC light to flash going over bumps. It can also cause the plunger travel calibration to fail.
- Also they act as shock absorbers for the system protecting the other components like hoses.
- They're usually positioned on or near the valve blocks

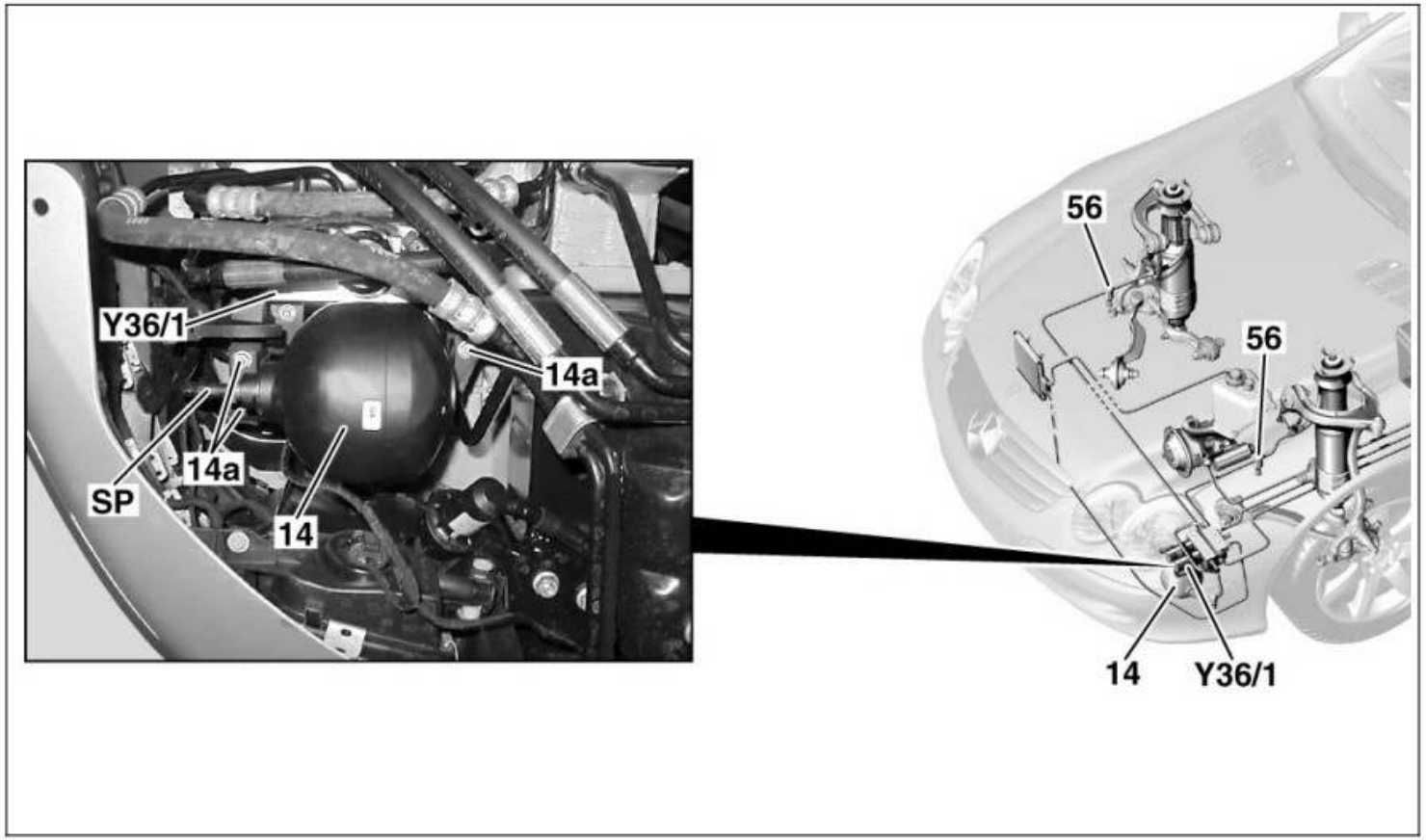


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230 accumulators

Remove/install front suspension pressure reservoir

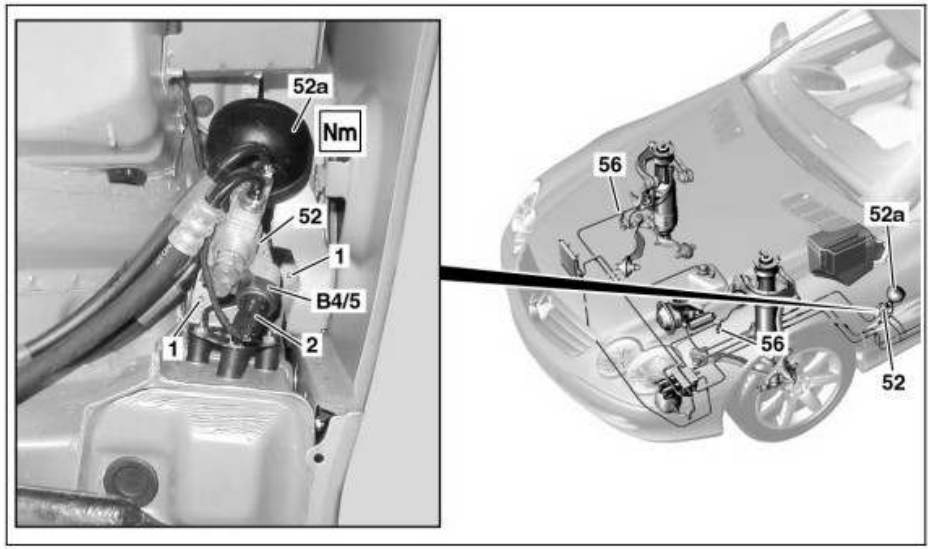
14	*Front axle pressure reservoir*
14a	*Nuts*
SP	*Pressure reservoir pressure line*
Y36/1	*ABC front axle valve unit*



Remove/install pulsation damper

1 *Nuts*
2 *Connector*
52 *Pressure supply valve unit*
52a *Pulsation damper*

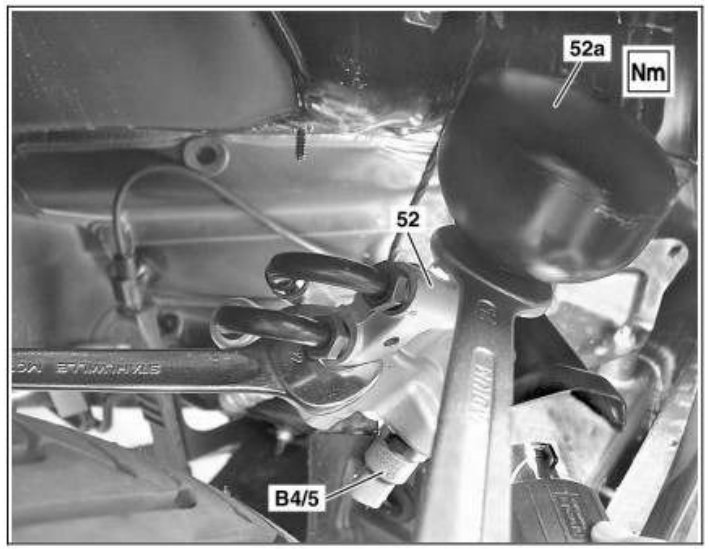
B4/5 *ABC pressure sensor*



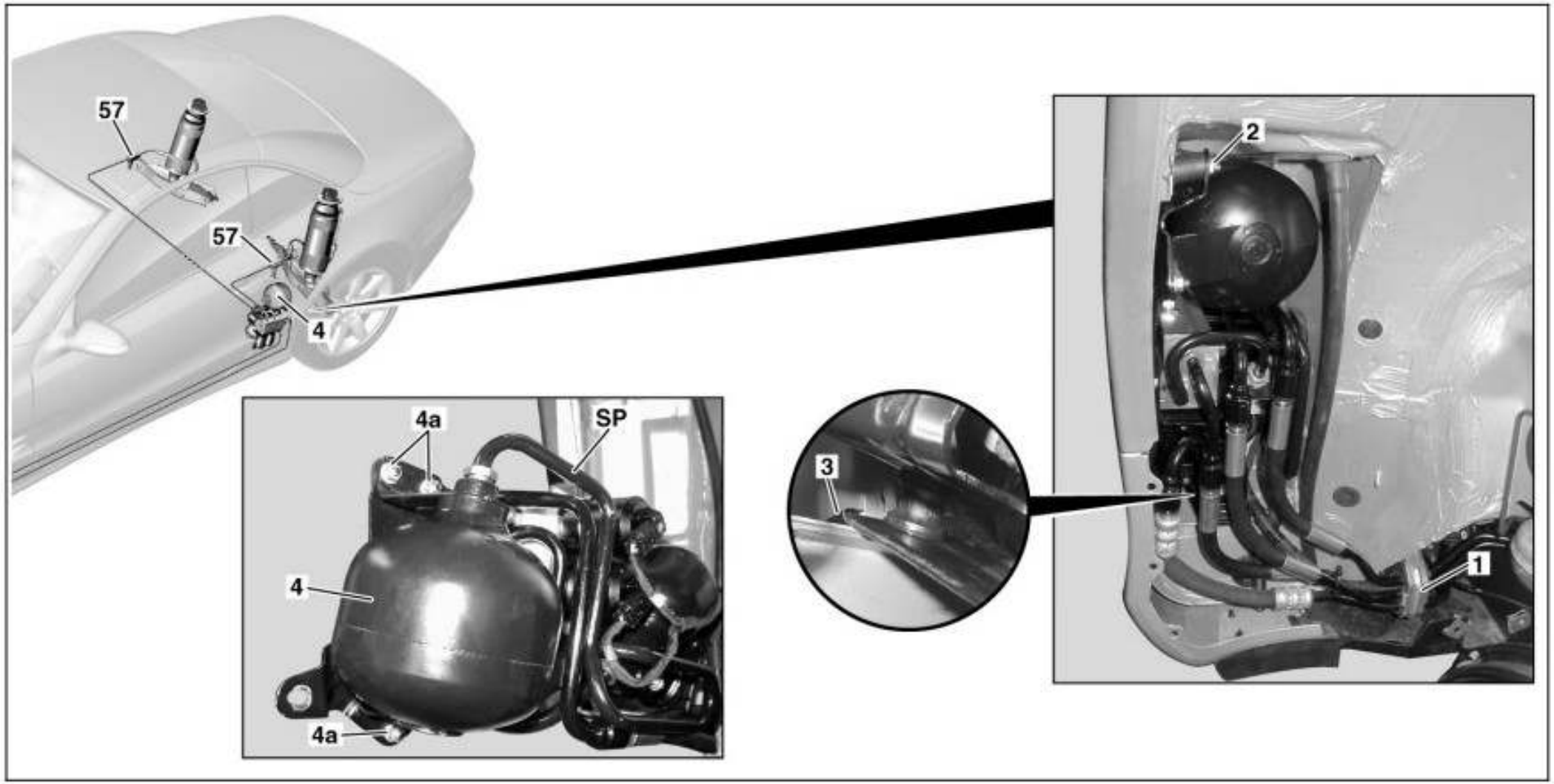
P32.50-2150-05

52 *Pressure supply valve unit*
52a *Pulsation damper*

B4/5 *ABC pressure sensor*



Remove/install rear axle pressure reservoir

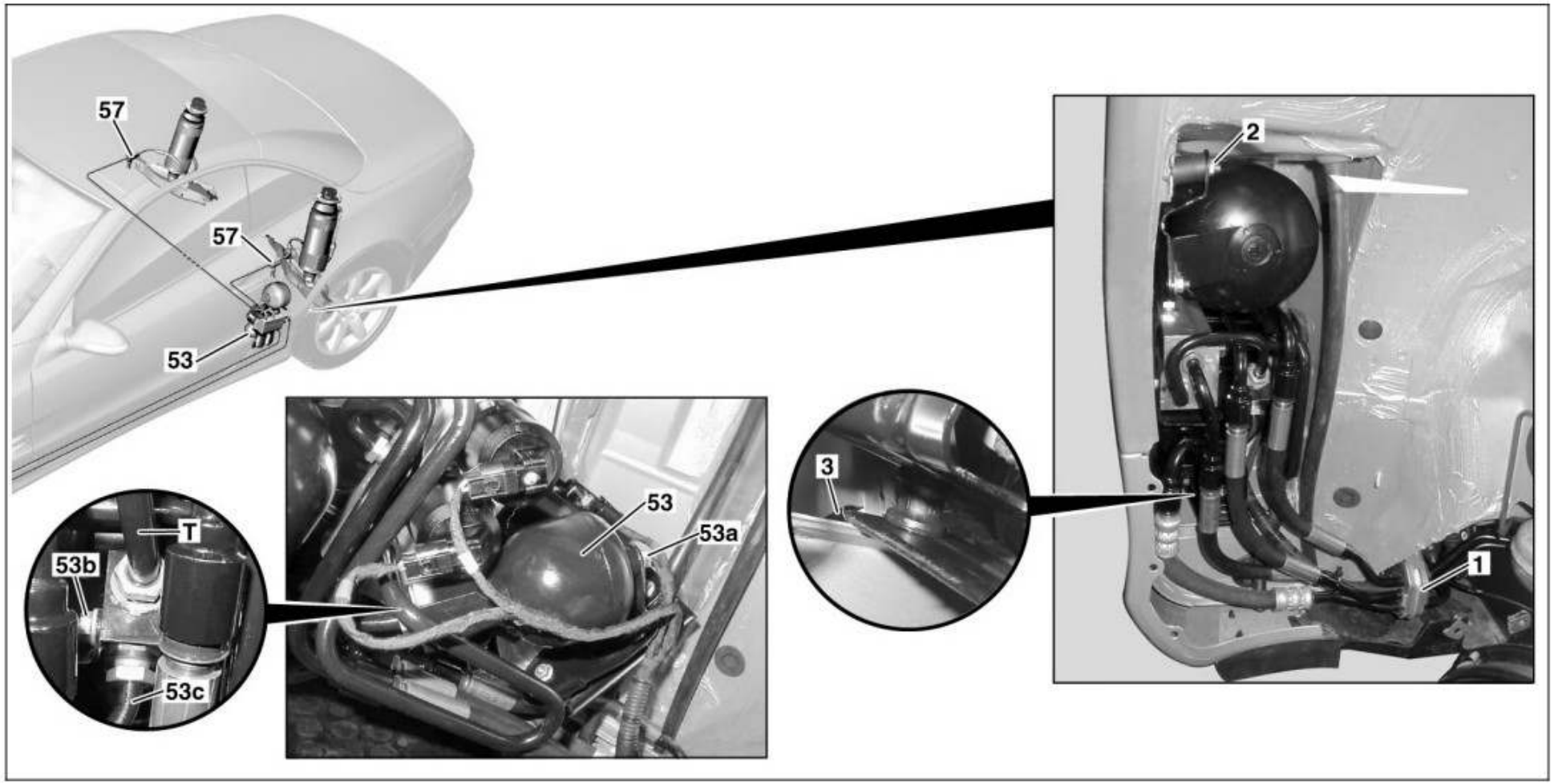


P32.50-2142-09

1	Retaining clip	3	Guide	4a	Nuts
2	Nut	4	Rear axle pressure reservoir	SP	Pressure reservoir pressure line

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Remove/install return pressure reservoir



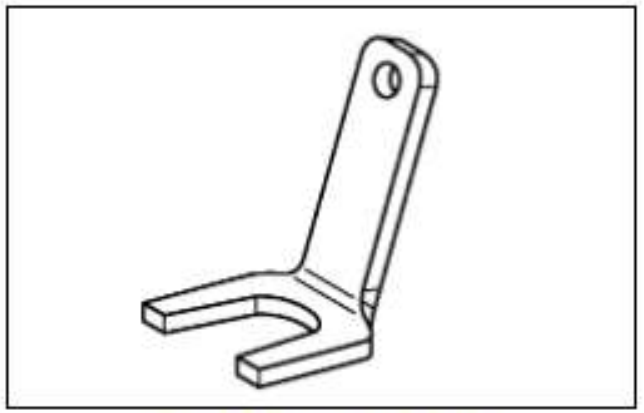
P32.50-2144-09

1	Retaining clip	53	Return flow pressure reservoir	53 C	High pressure line
2	Nut	53a	Nut		
3	Guide	53b	Screw	T	Pressure line to expansion reservoir

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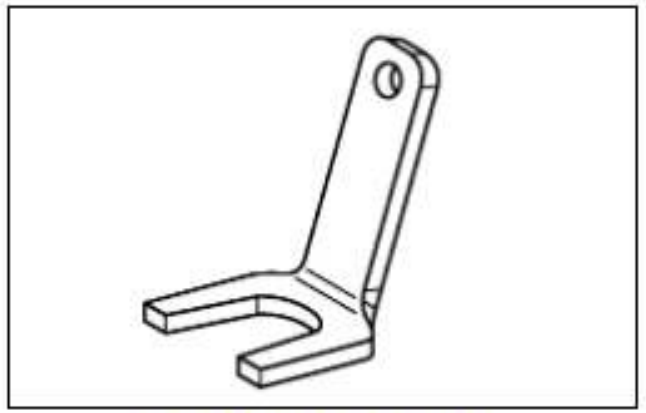
Detaching Tools

Note: You can use water pump pliers as well, or 14mm wrench on some.



221 589 01 33 00

Detaching tool



230 589 01 33 00

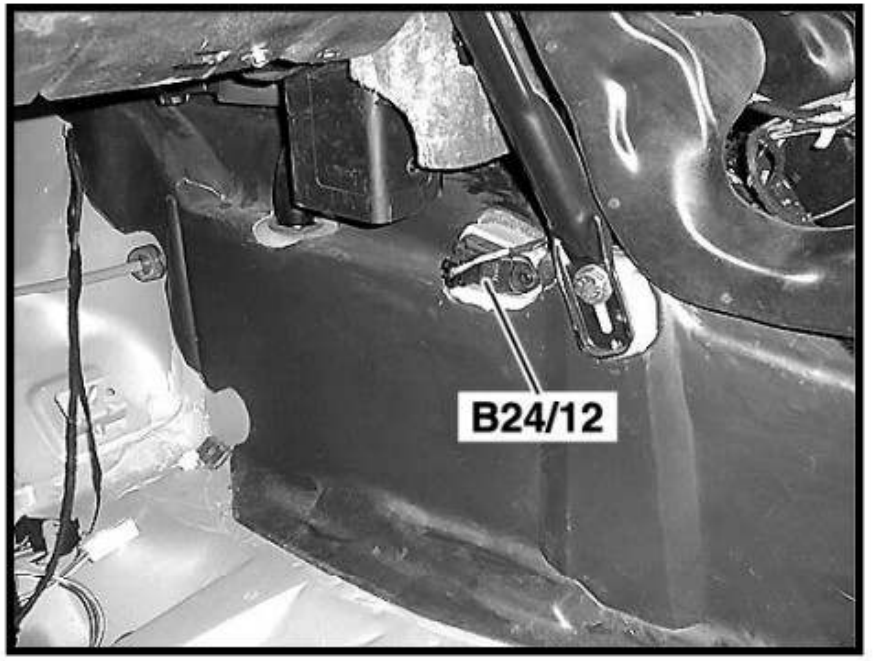
Detaching tool



Acceleration Sensors

- Lateral acceleration sensor (B24/12) used to determine side to side movement of body
  - Separate from ESP combination sensor
  - Located left side of transmission tunnel

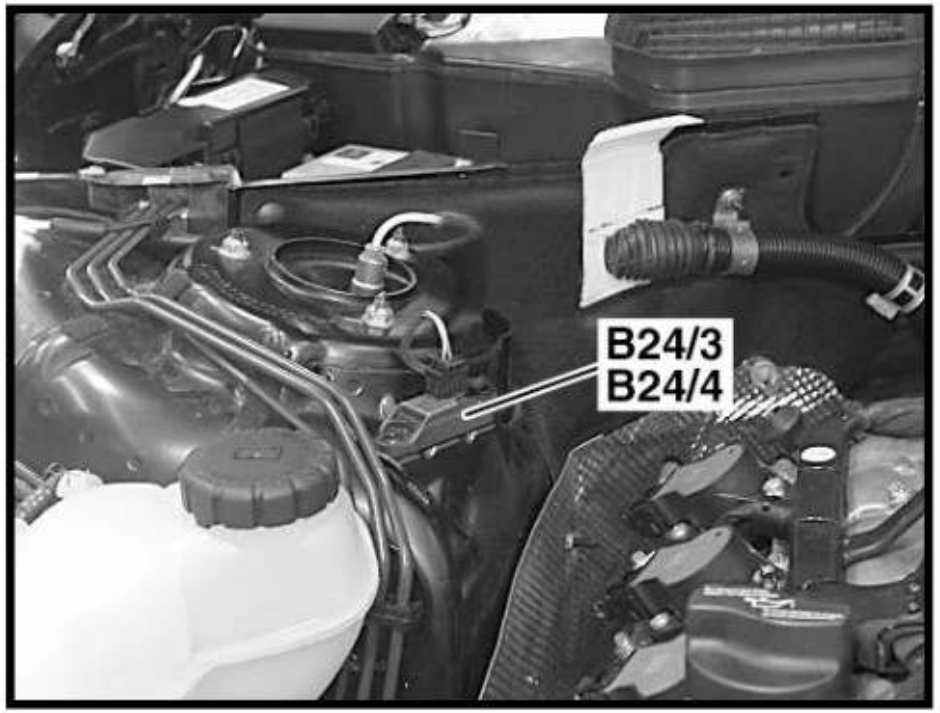
- Longitudinal acceleration sensor (B24/14) used to determine fore and aft movement of body
  - Separate from ESP combination sensor
  - Located under right front seat

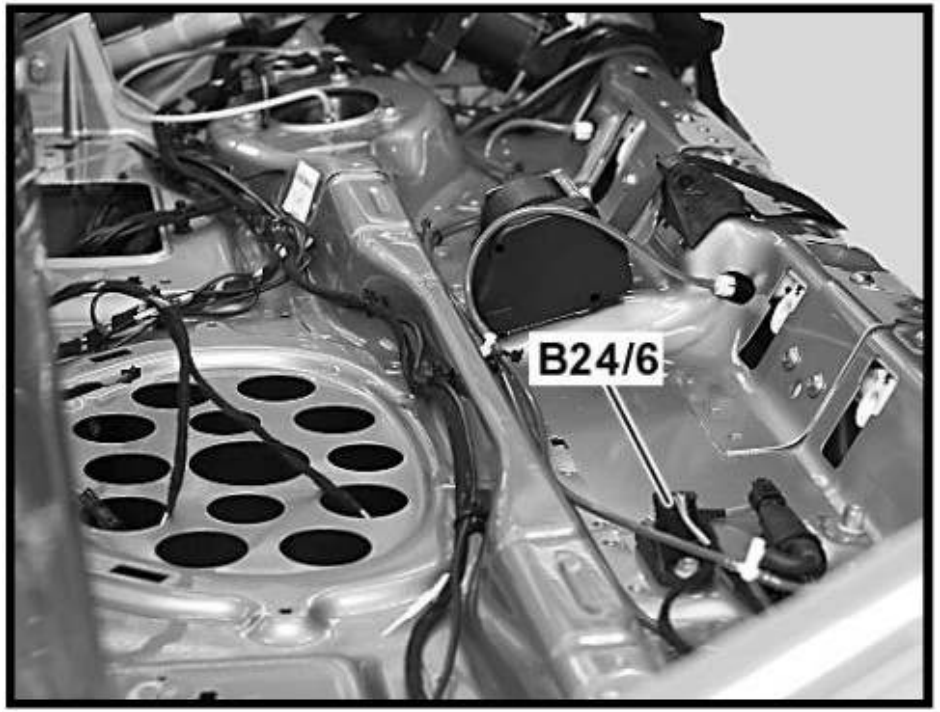




Acceleration Sensors

- Acceleration sensors provide real time feedback to the ABC module which it uses to fine tune the suspension as fast as every 125 milliseconds.
- They operate off a typical 5-volt reference with a nominal 2.5-volt signal output
- Location varies by vehicle but usually close to struts





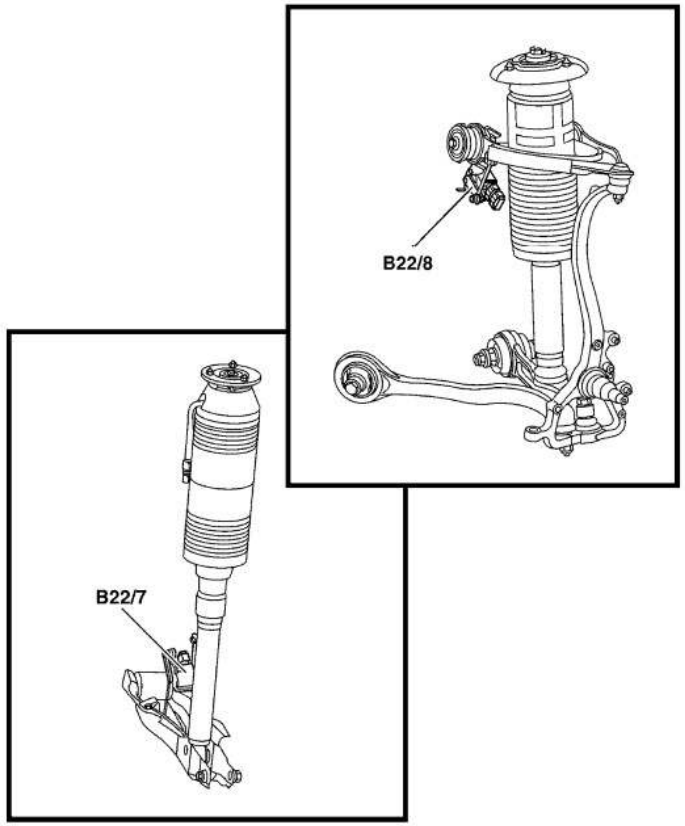
Typical / known good readings from acceleration sensors



Level sensors

NOTE: The level sensors should add up to 5 volts from side to side (adds up just like CAN)

- 4 level sensors used
  - LF (B22/8)
  - RF (B22/9)
  - LR (B22/7)
  - RR (B22/10)
- Each contains 2 hall effect sensors
  - Transmits opposing / redundant signals
- Level must be recalibrated if any level sensor is replaced

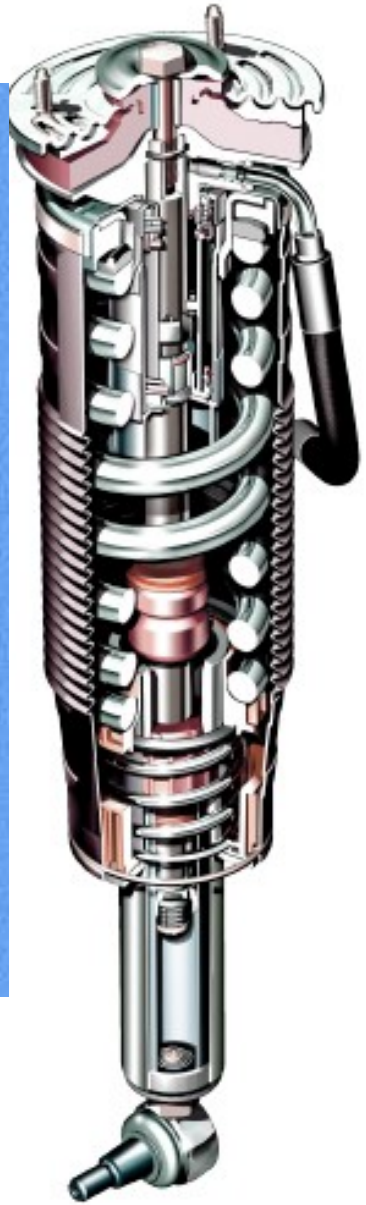


ABC Struts

- ABC struts are fairly reliable but do sometimes eventually leak and require replacement

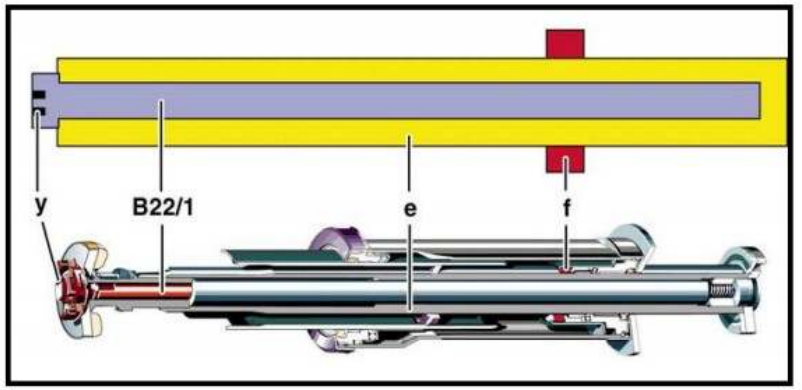
- Before releasing the hydraulic line with a suitable tool, crack the bleeder screws to ensure there is no pressure in the lines. This should be done even after “depressurizing” the system with a scan tool.



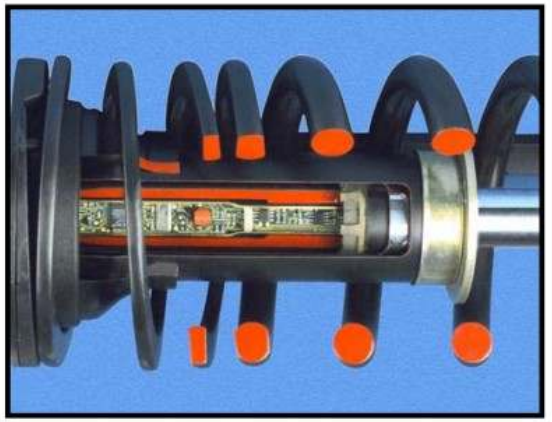


Plunger Travel Sensors

- Magnetostrictive sensor
  - Integrated in strut
  - Can not be replaced separately
- Strut rods made of “austentenitic high grade steel” which can not be magnetized
- As strut rod passes through center of fixed magnet it alters length and width of the magnetic field creating small current pulses
- Changes in magnet field and current pulses used to determine position of strut rod



f magnet
e strut rod
y electrical connector



Overview Notes

- During the Plunger travel Sensor Calibration, the sensors should all reach 0mm, and the vehicle should look like it is going to jump off the shop floor

- Accumulators should all be replaced at the same time, together

- When the sensors fail, they typically fail as an open circuit. This can be represented as a 255mm Value in a scan tool

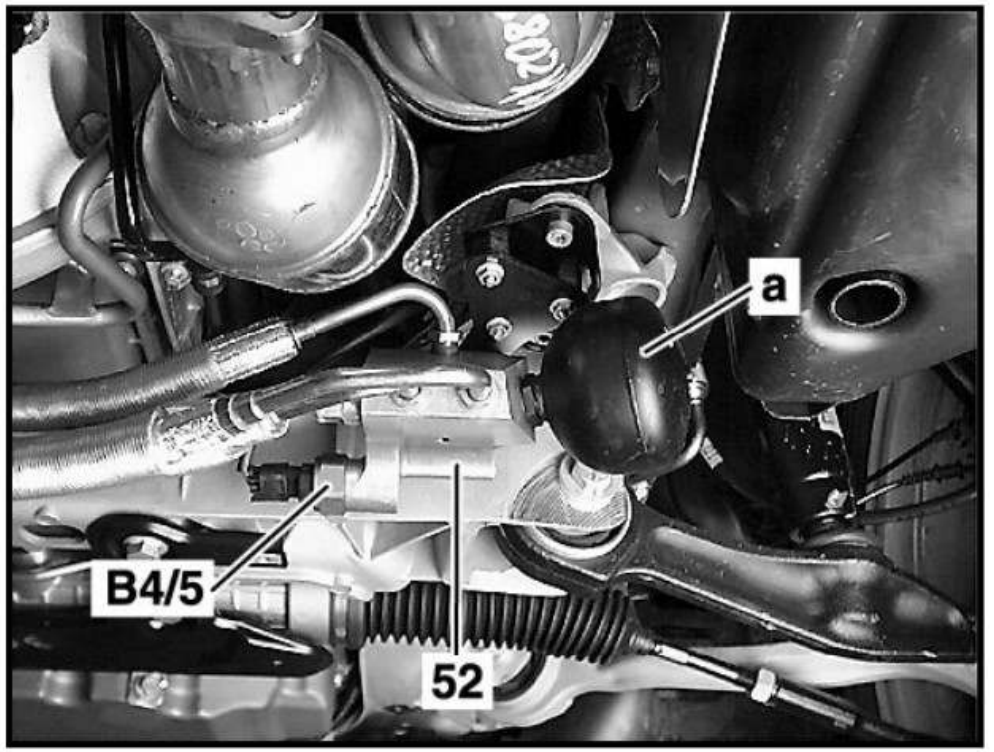
Valve Blocks

- Valve blocks are very expensive and one of the more common failures of the ABC system.
- Typically, the vehicle will sink gradually on one or more corners when parked.
- You can try flushing system to clear debris from the valves, but this rarely works
- There are rebuild kits available



Pressure Supply Valve Unit

- Oil from pump is first routed to pressure supply valve unit
- Located behind right front wheel
- Components include:
  - Pressure sensor (B4/5), used to measure system supply pressure
  - Pulsation damper (a)
  - 2 pressure limiting valves
    - First @ 200 bar
    - Second @ 230 bar



52 Pressure supply valve unit

ABC Pressure Sensor

- Installed on the pressure supply valve unit
- Typically very reliable
- Sometimes fluid blows through sensor
- Pressurize the reservoir, see if value changes

ABC Hydraulic Fluid

- System Takes MANY liters of CHF 11S
- 10-15 liters for a flush
- All waste is to go into a drain
- All filters must be changed



Reservoir and filter

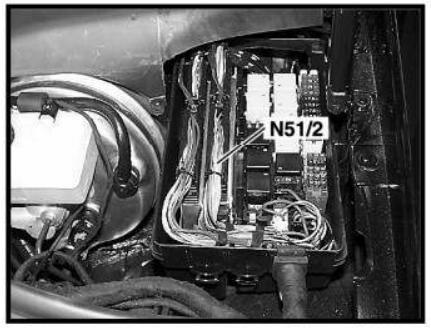
Should be changed at 40K



ABC Control Module

ABC Control Module (N51/2)

- Located next to LF SAM
- CAN C component
- Discrete wake up line from LF SAM
- Discrete inputs
  - 4 level sensors (2 opposing redundant signals from each sensor)
  - 3 body acceleration sensors
  - 4 plunger travel sensors
  - ABC pressure and temp. sensors
  - ABC lateral and longitudinal sensors
- Discrete outputs
  - ABC suction restrictor valve
  - ABC front and rear axle valve units



- CAN inputs
  - UCP (level, sport switches)
  - CGW
  - ME (RPM)
  - ETC (D/R, shift points)
  - IC (ambient temp, malfunction)
  - ESP (VS, braking)

ABC Calibration

- The stored level calibration data teaches the ABC module what voltages correspond to what suspension angles

Diagnostics



Testing Preliminaries

- Visually inspect suspension
- Check cluster messages
- Check battery/start engine
- Inspect the reservoir for fluid overflow
- Check the fluid level
- Hook up tool check for faults, irrational live data
- Check for leaks
- Road test over varied terrain, include bumpy roads

Checking the fluid level



- With the engine OFF, check the dipstick on the side that reads “ENGINE OFF UNLADEN”. The level has to be between the MIN and MAX marks.

- Start the engine and press the Ride Level adjustment button to cycle through all three suspension heights. The button shows no LEDs, 1 LED, or 2 LEDs to indicate the various levels. Perform three full cycles for a normal fluid check.

- Shut the engine off and wait 10 minutes for the fluid to settle in the suspension, then check the dipstick. Adjust fluid level between the MIN and MAX marks on the ENGINE OFF UNLADEN side.

•**Note:**

- Dipstick markings may be in the original German, in which case they will read *MOTOR AUS* for Engine Off, *MOTOR AN* for Engine Running, and *UNBELADEN* for Vehicle empty, no heavy cargo etc.

Scan tool usage

- ***Do not initiate level calibration!***

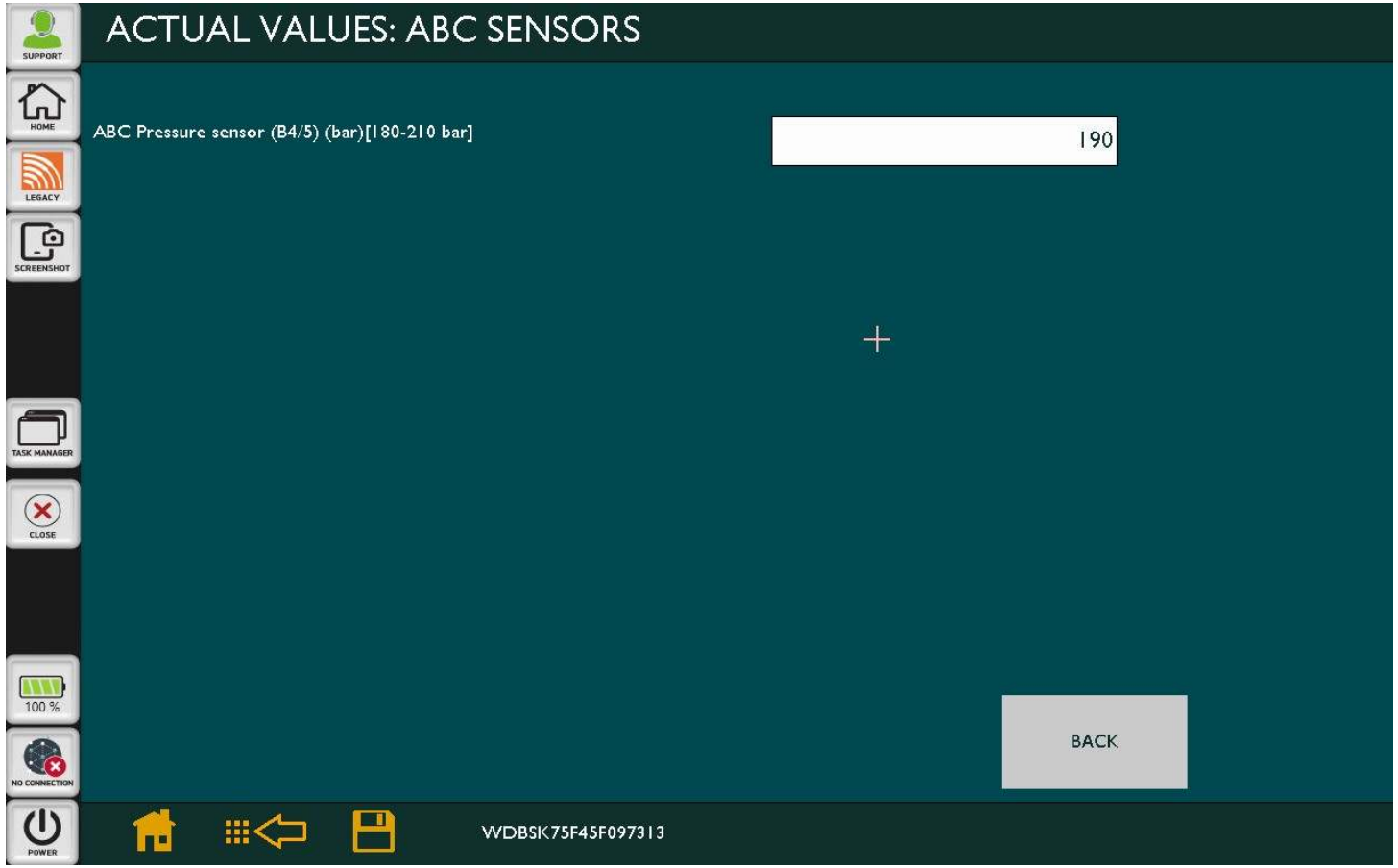
- Check ABC pressure

- Check for faults

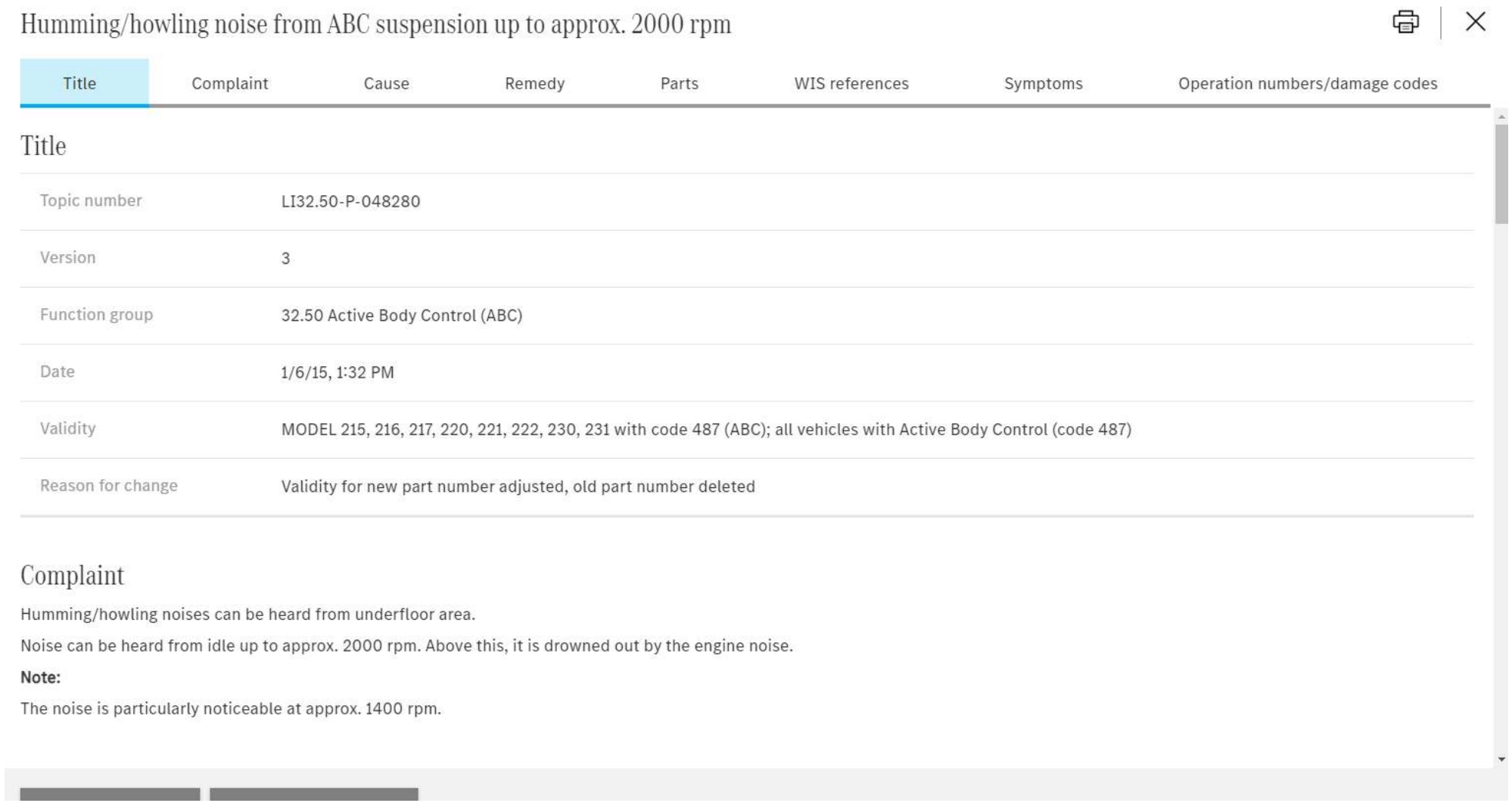


Typical/known good measurements & data

- ABC Pressure should be 190-192 bar, 180 minimum



Noteworthy Bulletins



Humming/howling noise from ABC suspension up to approx. 2000 rpm

Title | Complaint | Cause | Remedy | Parts | WIS references | Symptoms | Operation numbers/damage codes

Title

Topic number	LI32.50-P-048280
Version	3
Function group	32.50 Active Body Control (ABC)
Date	1/6/15, 1:32 PM
Validity	MODEL 215, 216, 217, 220, 221, 222, 230, 231 with code 487 (ABC); all vehicles with Active Body Control (code 487)
Reason for change	Validity for new part number adjusted, old part number deleted

Complaint

Humming/howling noises can be heard from underfloor area.

Noise can be heard from idle up to approx. 2000 rpm. Above this, it is drowned out by the engine noise.

Note:

The noise is particularly noticeable at approx. 1400 rpm.

Cause

As mileage increases, the gas pressure in the pulsation damper ("pressure reservoir" / "damper") of the ABC system can decline, meaning that the full damping effect may no longer be available.

Note:

Noises may also be caused by touching / stressed ABC lines. Please check this before replacing any parts, and correct if necessary.

Aids:

Use clamp kit for noise diagnosis (STEELMAN ChassisEAR) as per WIS document (AR32.00-P-2000A).

Remedy

If ABC lines are not touching / stressed,

replace damper at pressure supply valve block (ABC I) or pulsation damper at tandem pump (ABC-PLUS).

Note:

Pulsation damper can be replaced separately, sealing ring is included.

Note:

Replacement of the entire pressure supply valve unit or ABC tandem pump is not required.

Note:

With the introduction of ABC-PLUS (as of model year 2006), the pulsation damper is located on the tandem pump.

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Random Vehicle Level (P-B-32.50/35c, October 29, 2008)

Title | Complaint | Cause | Remedy | Parts | WIS references | Symptoms | Operation numbers/damage codes

Date	1/27/09, 10:46 AM
Validity	Model 215.373/374/375/376/378/379 Model 220.067/083/170/173/174/175/176/178/179/183/184, Equipped with Code 487 (Active Body Control) Model 230.471/472/474/475/476/477/479, Up to VIN F118817
Reason for change	

Complaint

Suspension level randomly lowering while driving and/or rapid sporadic level changes shortly after stopping the vehicle

Cause

N/A

Remedy

Replace the body acceleration sensors (reference WIS document GF32.31-P-4100A), with a manufacturing date greater than 02 W 01 (Year 2002, week 01) (Figure 1).

[i] Note: Do not replace any other ABC suspension components.

In both of the above scenarios, vehicle level changes typically occur intermittently and predominately after driving for extended periods. The vehicle's level adjusts without obvious cause, and

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Level Adjustment Without Obvious Cause

Title	Complaint	Cause	Remedy	Parts	Symptoms	Operation numbers/damage codes	Control unit/fault code

Validity	Model 215.373/374/375/376/378, VIN Range A018130 to VIN A023610 Model 220.170/173/174/175/176/178, VIN Range A227562 to A265219, Equipped with ABC Suspension (code 487a) Model 230.474/475/476, VIN Range F000300 to F004810
Reason for change	

Complaint

Level Adjustment Without Obvious Cause

Cause

Level adjustment without obvious cause may be the result of a jammed control valve in the front or rear axle valve block, which in newer vehicles can occur after the vehicle has been idling for a prolonged period of time (>10 minutes). In isolated cases, this condition can also occur on older vehicles as a result of dirt in the valve block.

Remedy

If you receive customer reports in the above model vehicles of erratic level adjustment without obvious cause after the vehicle has been idling for a prolonged period of time (greater than 10 minutes), replace the Active Body Control (ABC) control module with a revised part.
The vehicle may raise or lower erratically at one wheel or at one axle. In isolated cases, a warning message appears in the display of the instrument cluster and one or multiple of the following fault codes (listed below) may be stored in the ABC control module.
[i] Note: The revised ABC control module software contains a control algorithm which prevents the control valves from jamming. The revised algorithm causes the control valves to move back and forth slightly while the vehicle is idling.

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Symptoms


ACTIVE BODY CONTROL
ABC
VISIT WORKSHOP
km/h
0
20
40
60
80
100
160
180
200
220
300
320

ABC Light flashes when going over bumps

- Most commonly caused by failed accumulators
- The accumulators act as a “shock absorber” for the entire system



Vehicle will not sit level

- Level Sensor Logic
- Locking/Blocking Solenoids
- Internal Module Issue/ (Software issue addressed with Hardware)
- Scored Valve Blocks
- Body Acceleration Sensors

Entire vehicle on the ground and won't raise



- Check the ABC pressure, this is usually a pump that has lost it's prime or failed completely
- Try and prime the system to see if it will build pressure and raise
- Depending on the condition and severity the pump is usually too far gone
- Is there hydraulic oil on the reservoir and subframe?

One or more corners drops down overnight

- Typically caused by an internal leak in a valve block
- Verify there are no external fluid leaks
- Leave the vehicle on level ground and measure the ride level over time to be sure you identify exactly which corner is leaking down

Leaking hydraulic hose

- Sometimes the hoses just wear out and leak
- May indicate accumulators are due for replacement



Fluid coming out of the reservoir

- Nitrogen gas from the accumulators escapes and pulls hydraulic fluid with it as it exits the reservoir
- Accumulators should be changed as a set
- Quantity/location varies by vehicle, check parts diagrams



Test plans by DTCs



Critical vehicle level

C1525 (001) Critical vehicle level front left
C1525 (002) Critical vehicle level front right
C1525 (004) Critical vehicle level rear left
C1525 (008) Critical vehicle level rear right

Often caused by scored valve blocks allowing the vehicle to leak down



System pressure

C1525 (064) System pressure too low

- Check the ABC pressure if it is low or struggling it is likely a pump failure
- Also very commonly caused by failed accumulators
- Inspect the B4/5 for oil in the sensor

The level calibration has not been carried out



EQUIPMENT CATALOG

Wheel Alignment

- Alignment Instrumentation 9
- Alignment Instrumentation Misc 43
- Alignment Rack - Scissor Type 2
- Alignment Rack Acc/Misc 10
- Alignment Racks - 4 Post 2
- Inspection 2

Romess Electronic Level Gauge



USD $8,201.00

Login for special pricing 521-900 589 012100

RAE

1 Add to cart

Click to see additional Options / Models / Accessories Available

Accessories

Request a call

NOTE: For assistance with ROMESS products, please contact Reliable Automotive Equipment via email @ bill@rae1.com . In email, please include picture of the unit, with issue, along with serial number and concern. To verify receipt of email, please contact 732-495-7900.

ROMESS®

The electronic level gauge consists of an easy-to-operate measuring instrument with graphic-display for the clear

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Select the DTC and hit enter to proceed to level calibration

Vehicle 230.475 **Control unit** ABC

Fault codes

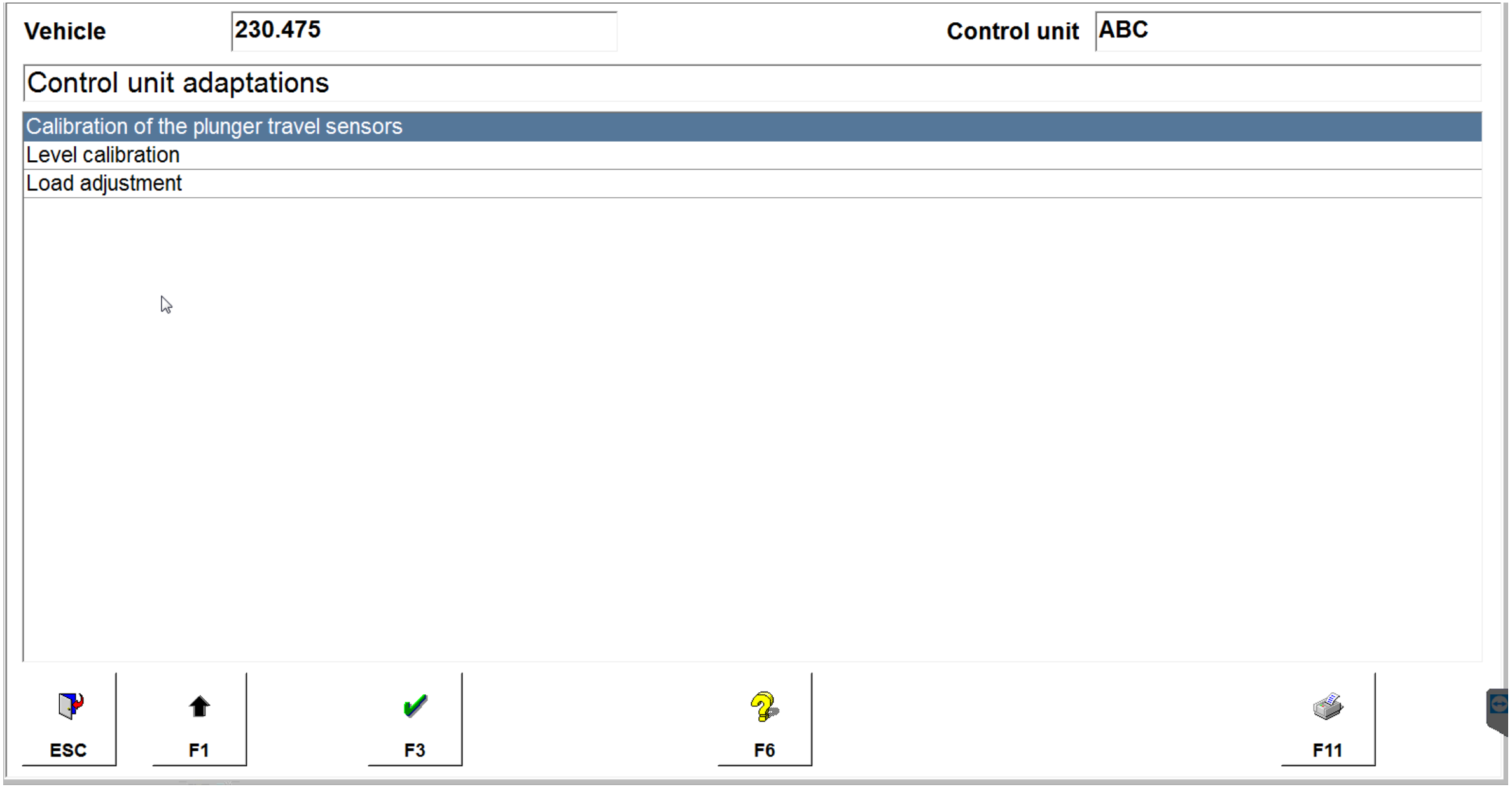
Code	Text	No.	Status
C1525-016	Level calibration was not successfully carried out.	0	Current and stored
C1526-064	Load adjustment not successfully performed	0	Current and stored

DTC: The level calibration has n...

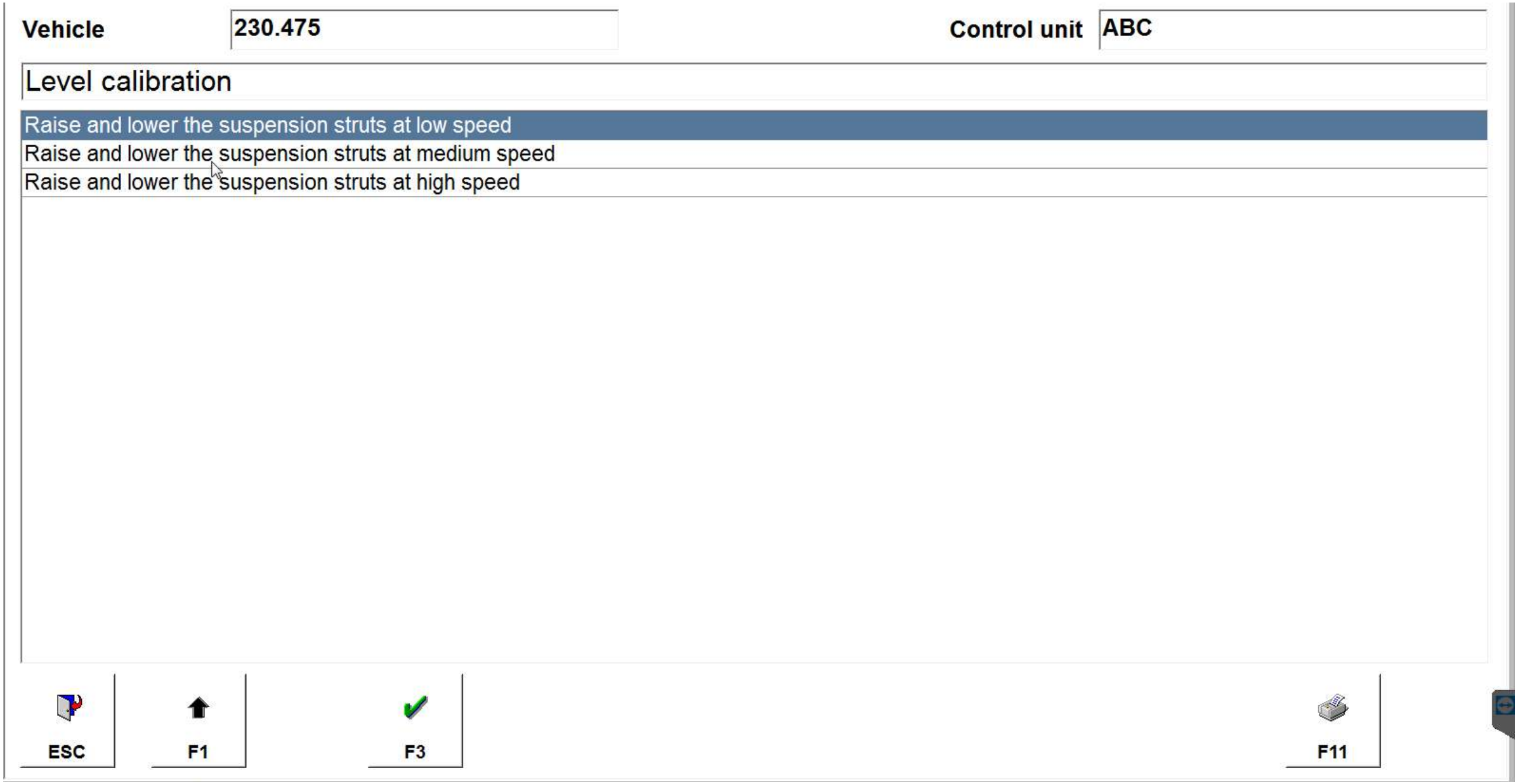
ESC F1 F3 F5 F6 F9 F11

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Or go to control unit adaptations and select “Level calibration”



You can choose different speeds for adjusting the suspension



Again, level calibration is only indicated if a level sensor has been replaced and even then in our experience it is not necessary

Vehicle 230.475 **Control unit** ABC

Raise and lower the suspension struts at low speed

Level calibration is necessary under the following conditions: :
- A level sensor has been replaced.
- Control module N51/2 (ABC control module) has been replaced.
- The vehicles have been incorrectly calibrated.

General notes :
- Level calibration must only be carried out on a chassis alignment system.

Brief description of calibration :
- Start engine.
- Continue with key F2 in order to actuate the level valves.
- After all the specified levels have been reached, continue with key F2 for entering the angle.
- Entry of values stored in the inclination measuring instrument

ESC F1 F2 F6 F11

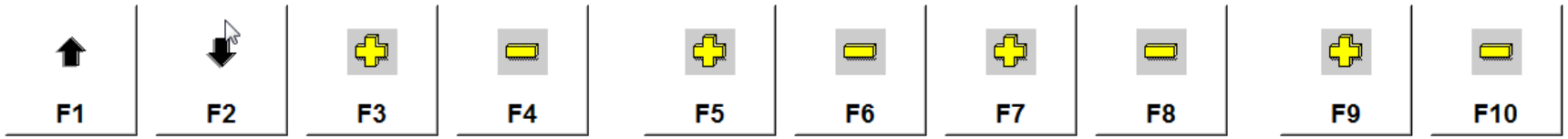
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The level sensors will read close to 2.6/2.4 when the vehicle is level

Vehicle	230.475	Control unit	ABC

Actuation of level valves

B22/8 (Left front level sensor)	2.63 V
B22/9 (Right front level sensor)	2.41 V
B22/7 (Left rear level sensor)	2.59 V
B22/10 (Right rear level sensor)	2.43 V
B4/5 (ABC pressure sensor)	198 bar
Set values for front axle: inclination angle (-8.3)° - (-7.2)° (Romess inclination measuring instrument) Set values for rear axle: inclination angle (-2.4)° - (-1.4)° (Romess inclination measuring instrument)	
F3: Lift front left.	
F4: Lower front left.	
F5: Lift front right.	
F6: Lower front right.	
F7: Lift rear left.	
F8: Lower rear left.	
F9: Lift rear right.	
F10: Lower rear right.	



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You will be prompted to enter the angles measured by the Romess gauge

Vehicle 230.475 **Control unit** ABC

Entry of values stored in the inclination measuring instrument

Left front inclination angle

A dot has to be used as a decimal separation character (e.g. 5.1).

Right front inclination angle

A dot has to be used as a decimal separation character (e.g. 5.1).

Left rear inclination angle

A dot has to be used as a decimal separation character (e.g. 5.1).

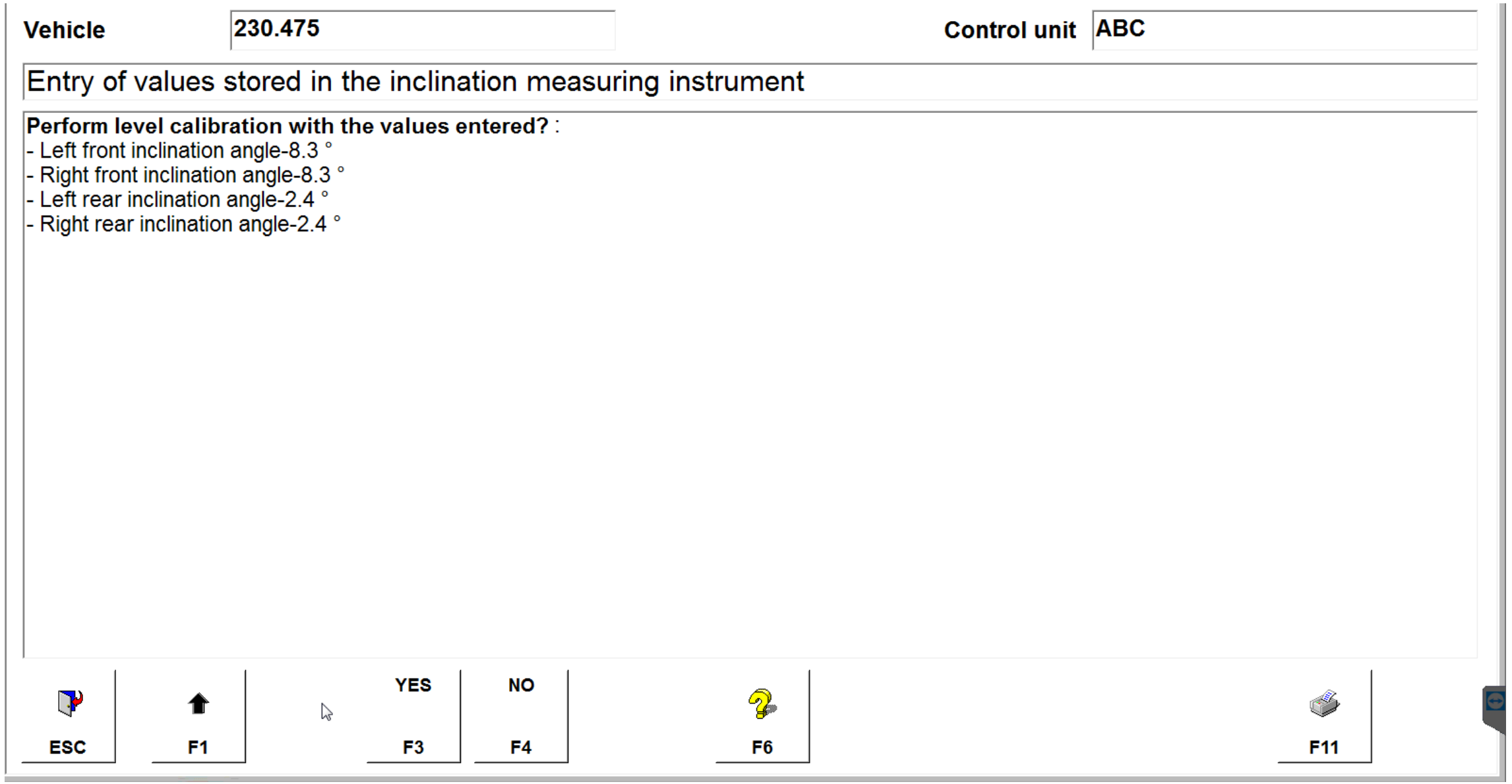
Right rear inclination angle

A dot has to be used as a decimal separation character (e.g. 5.1).

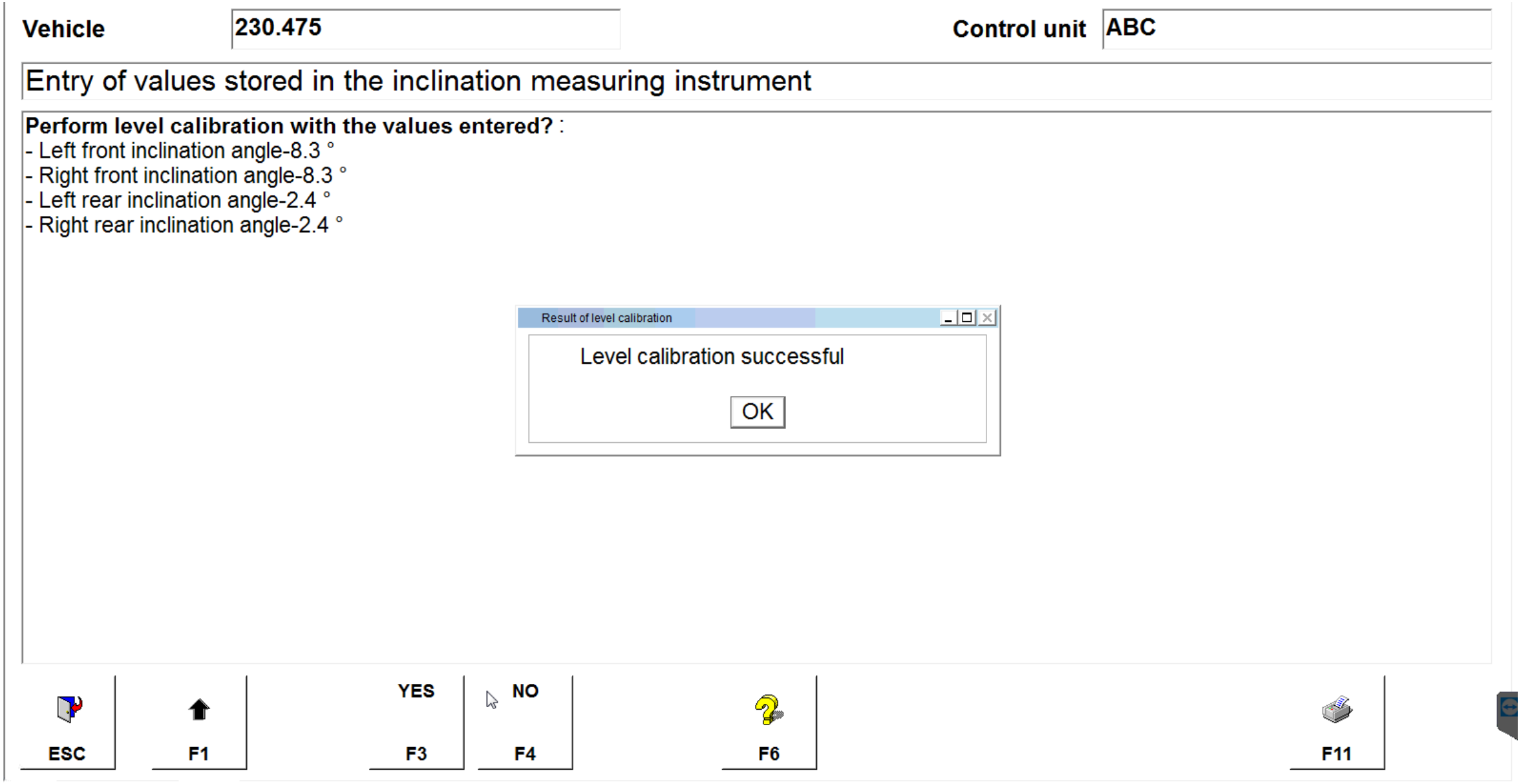
ESC F1 F6 F11

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In this example we’re using the low end of the range

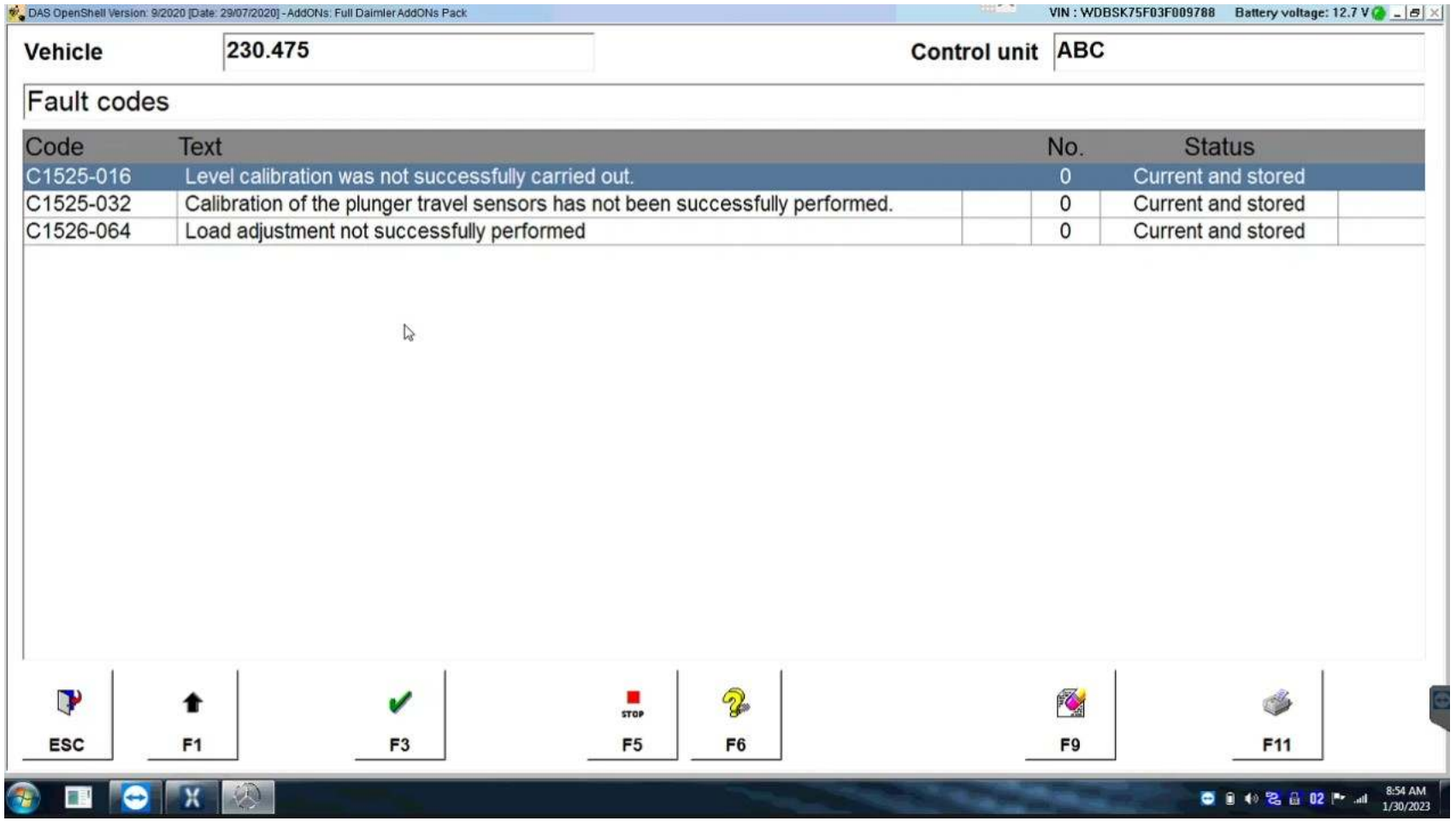


This is the message you will get if you are able to calibrate it successfully



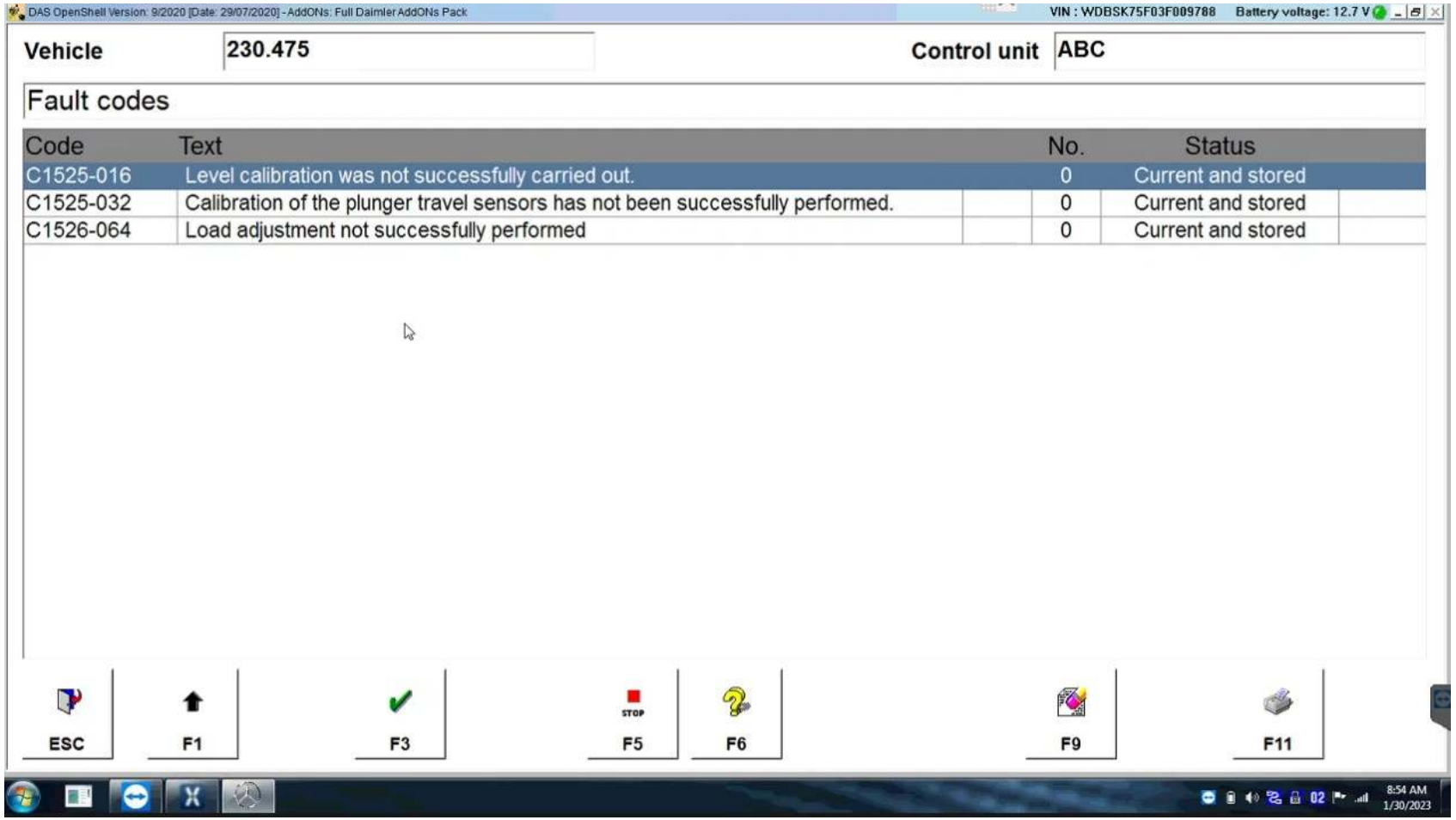
The load adjustment needs to be performed

13 ABC Load adjustment calibration Video



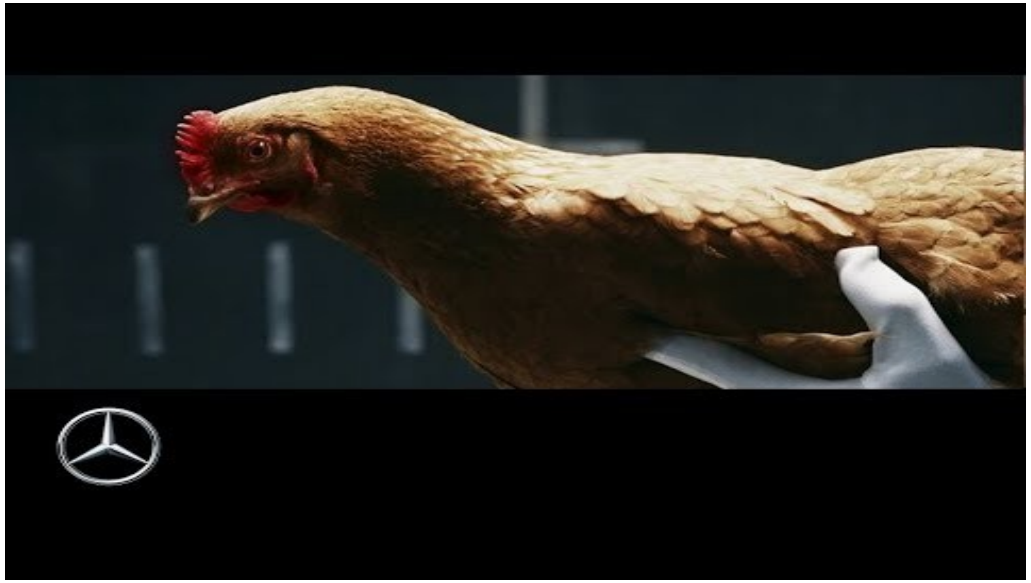
The plunger travel calibration needs to be performed

14 ABC Plunger travel sensor calibration Video

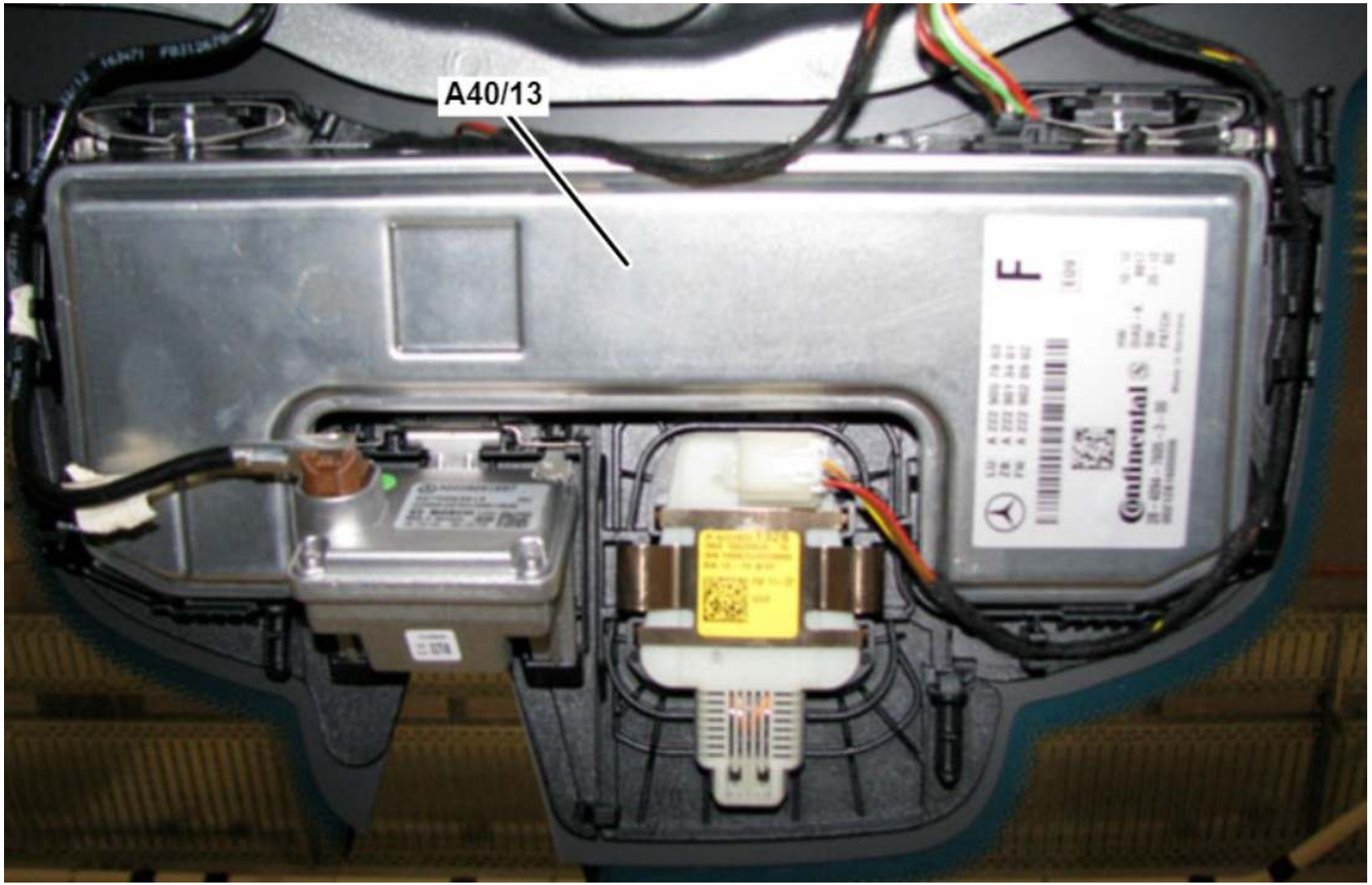


Magic Body Control

- Magic Body Control is based on the ABC suspension
- Magic Body Control can adjust the forces at each wheel with the aid of ABC

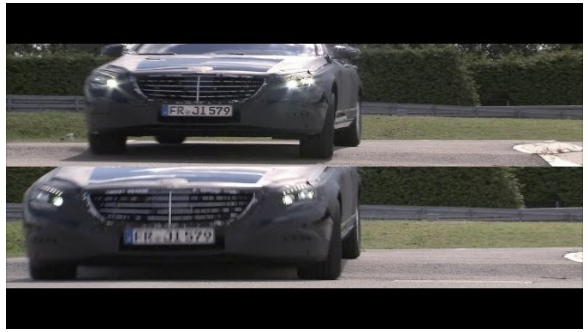


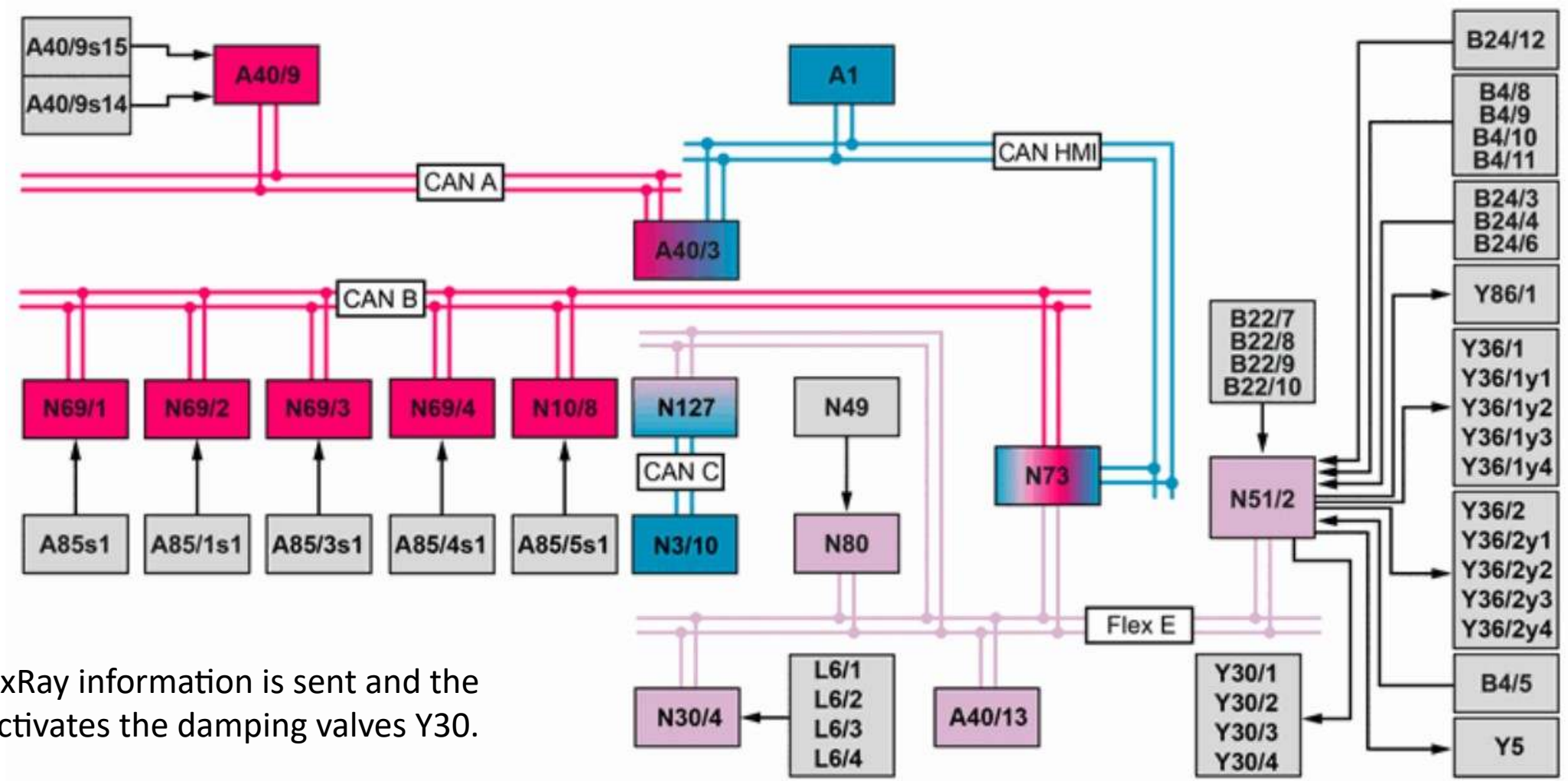
Stereo Multifunction Camera



Stereo Multifunction Camera

- Scans the road in real time up to 15 meters in front of the vehicle
- Measures the height of obstacles of 3mm and better
- Can measure up to 130km/h, 81 mph
- Passes the information to the Magic Body Control
- Magic Body Control will then with the aid of ABC can adjust each corner to feel as less of the rough terrain as possible.





Over FlexRay information is sent and the N51/2 activates the damping valves Y30.

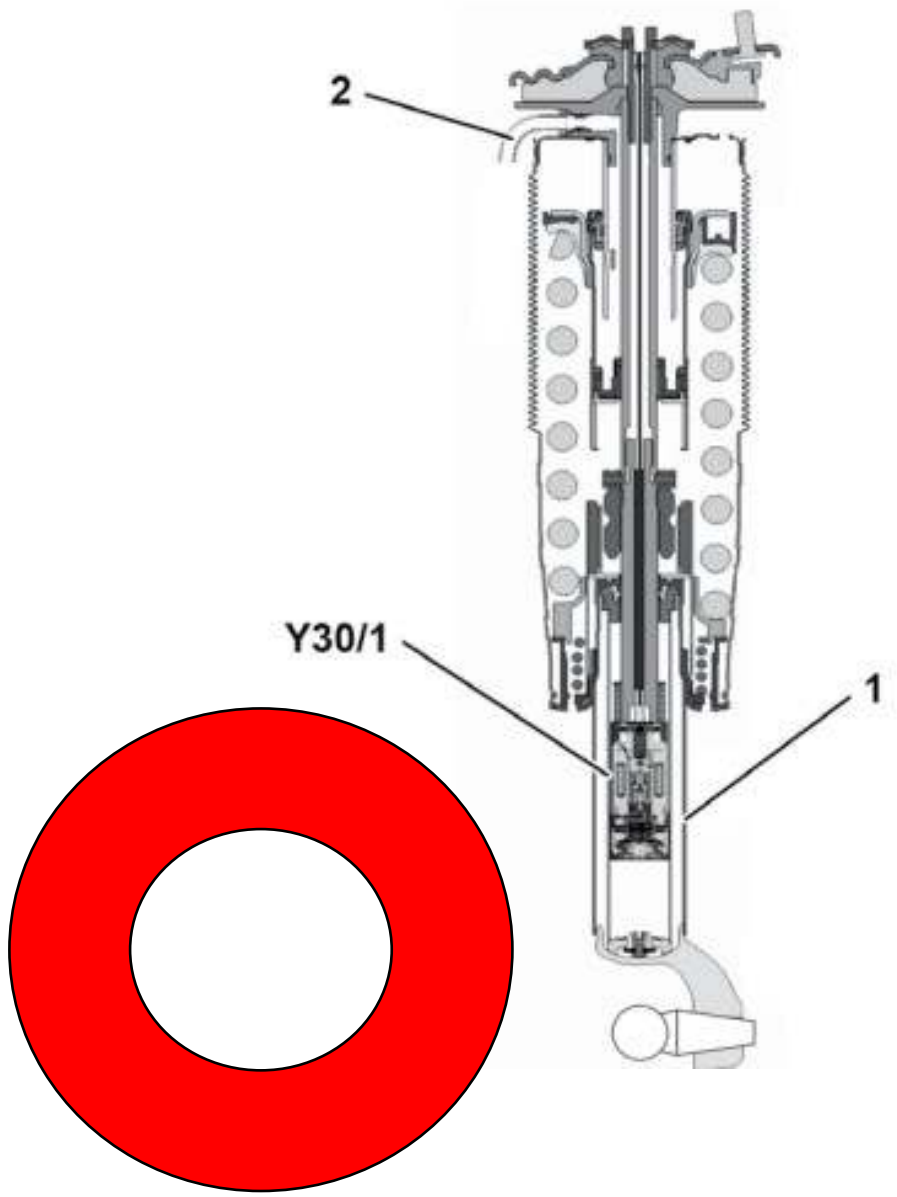
The oil Flow is controlled into the strut to compensate for the road ahead.

Body Movement

Y30/1

Wheel

Road



Impaired Function

NOTE: YOU WILL FEEL SPEED BUMPS!

- The road surface is insufficiently lit
- There is poor visibility, e.g. snow, rain, fog or spray
- There is glare, e.g. from the sun or from oncoming traffic
- The windshield is dirty, fogged up or covered, for instance by a sticker, in the vicinity of the camera
- The road surface has no texture or is reflective, e.g. in the case of newly laid asphalt, concrete slabs or puddles
- The distance to the vehicle in front is too short
- Sections of the route have a very small radius of curvature
- If you accelerate hard or brake sharply

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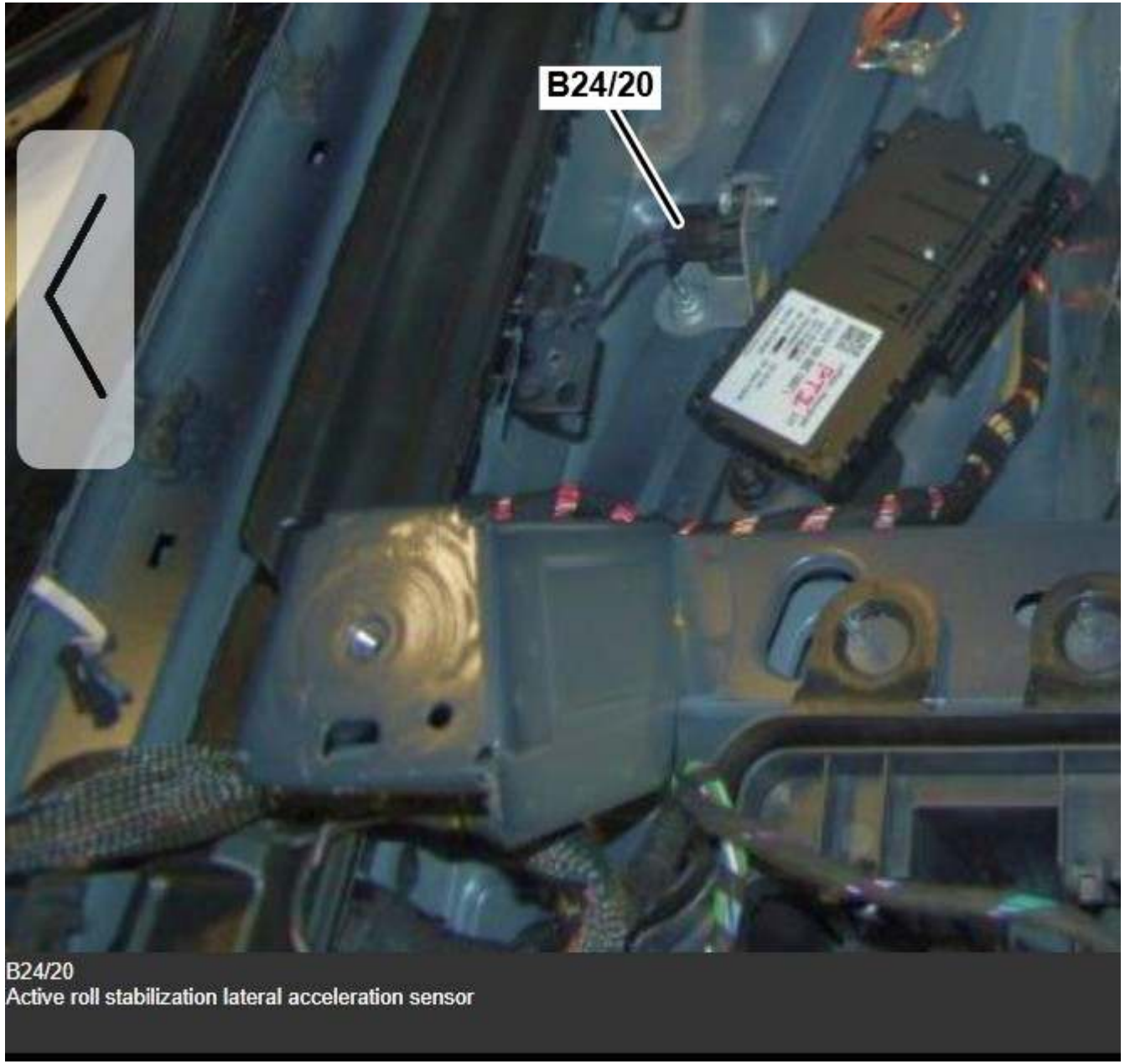
166 Active Roll Stabilization





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Figure 2



B24/20
Active roll stabilization lateral acceleration sensor

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Version | Error codes / Events | Actual values | Actuations | Adaptations | Control unit log | List of fault codes | Tests

Selection

- Directional control valves
- Pressure control valves
- Y86/2 (Active Roll Stabilization throttle valve)
- Y86/3 (Active roll stabilization safety valve)
- Bleeding of hydraulic system
- High-pressure test
- VA_Pruefung
- HA-Pruefung

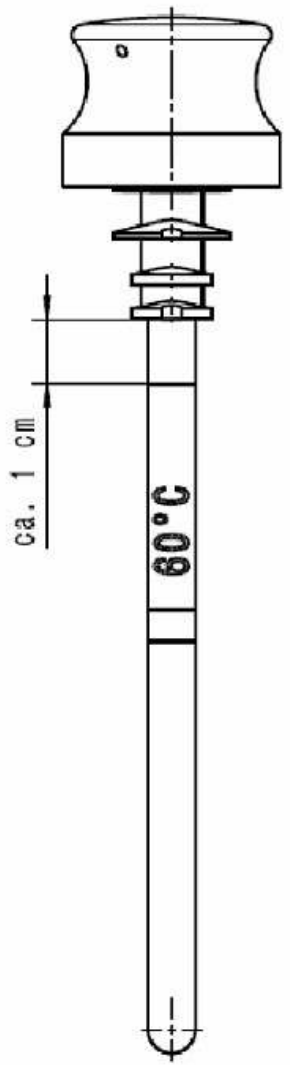
Bleeding of hydraulic system

Bleeding of hydraulic system

Requirement

- There must be no error codes present in control unit 'N51/3 (AIRMATIC control unit)'.
- The vehicle must be standing horizontally on a level surface.
- The combustion engine is at idle.
- The fluid level in the hydraulic fluid reservoir must be filled up to one centimeter below the lowermost disk on the oil dipstick.

After bleeding, process 'High-pressure test' is carried out automatically.
This process lasts approx. 6 minutes.
Start test with button 'Continue'.

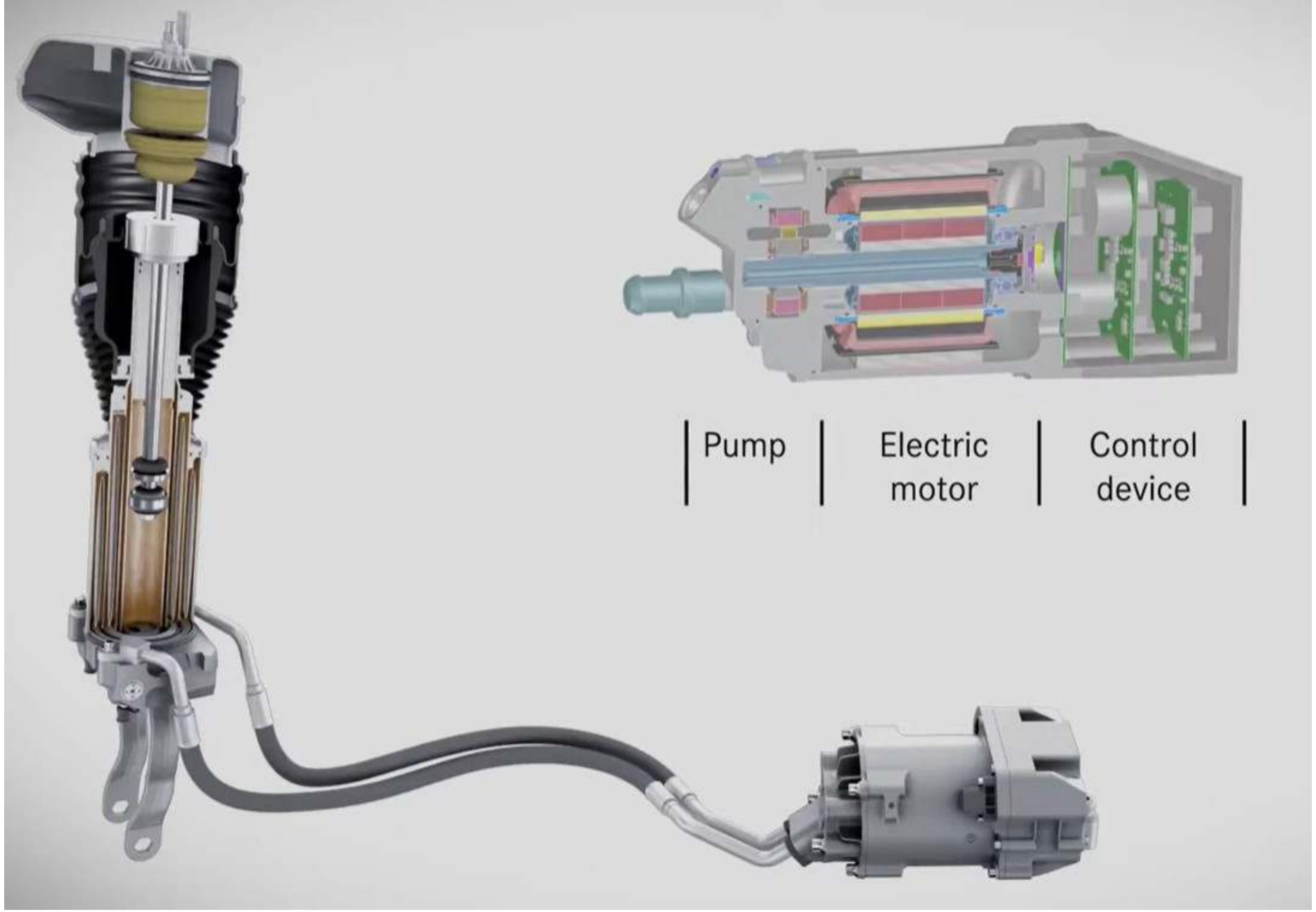


Change view.

Continue

167 E Active Body Control





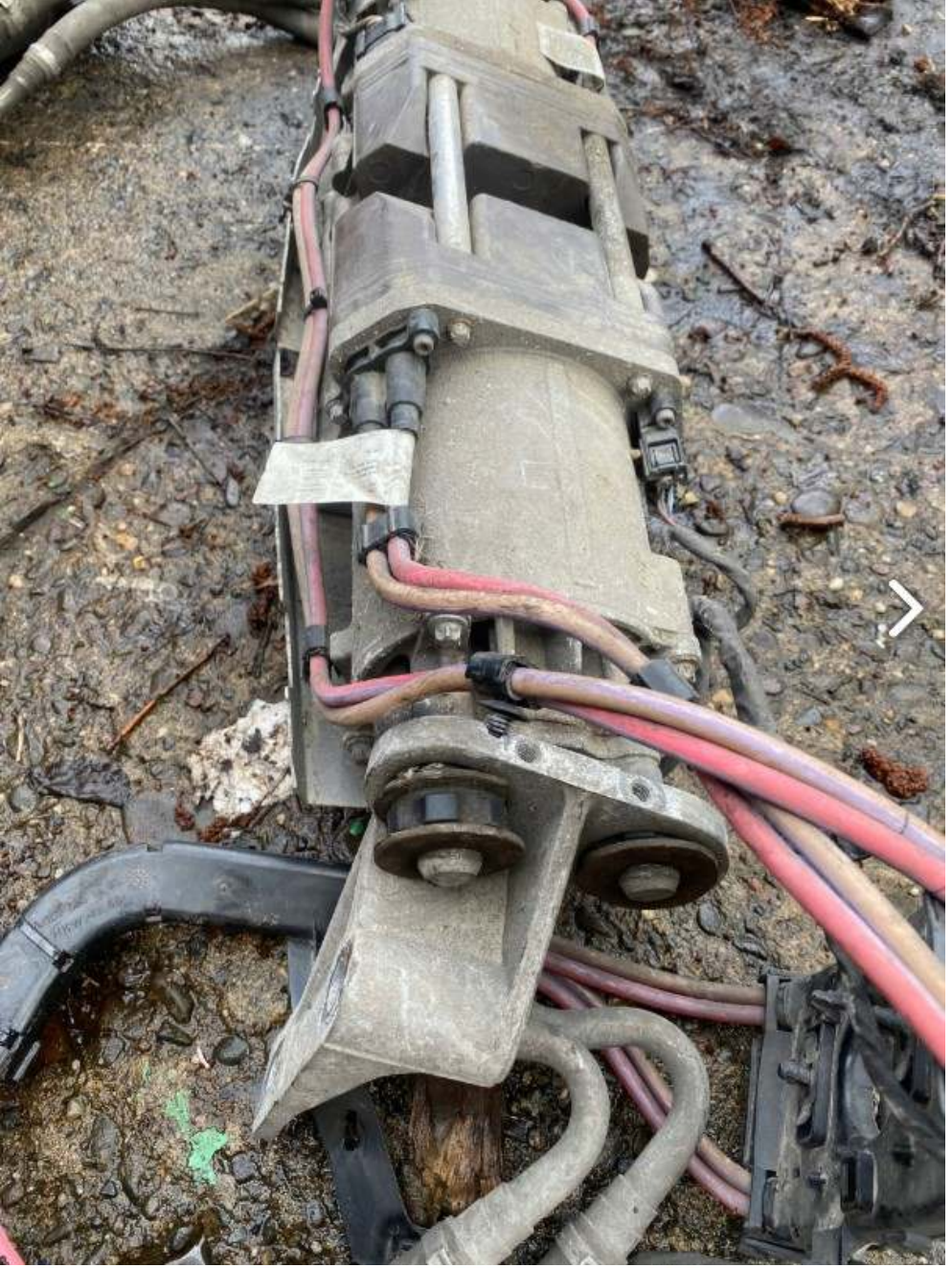
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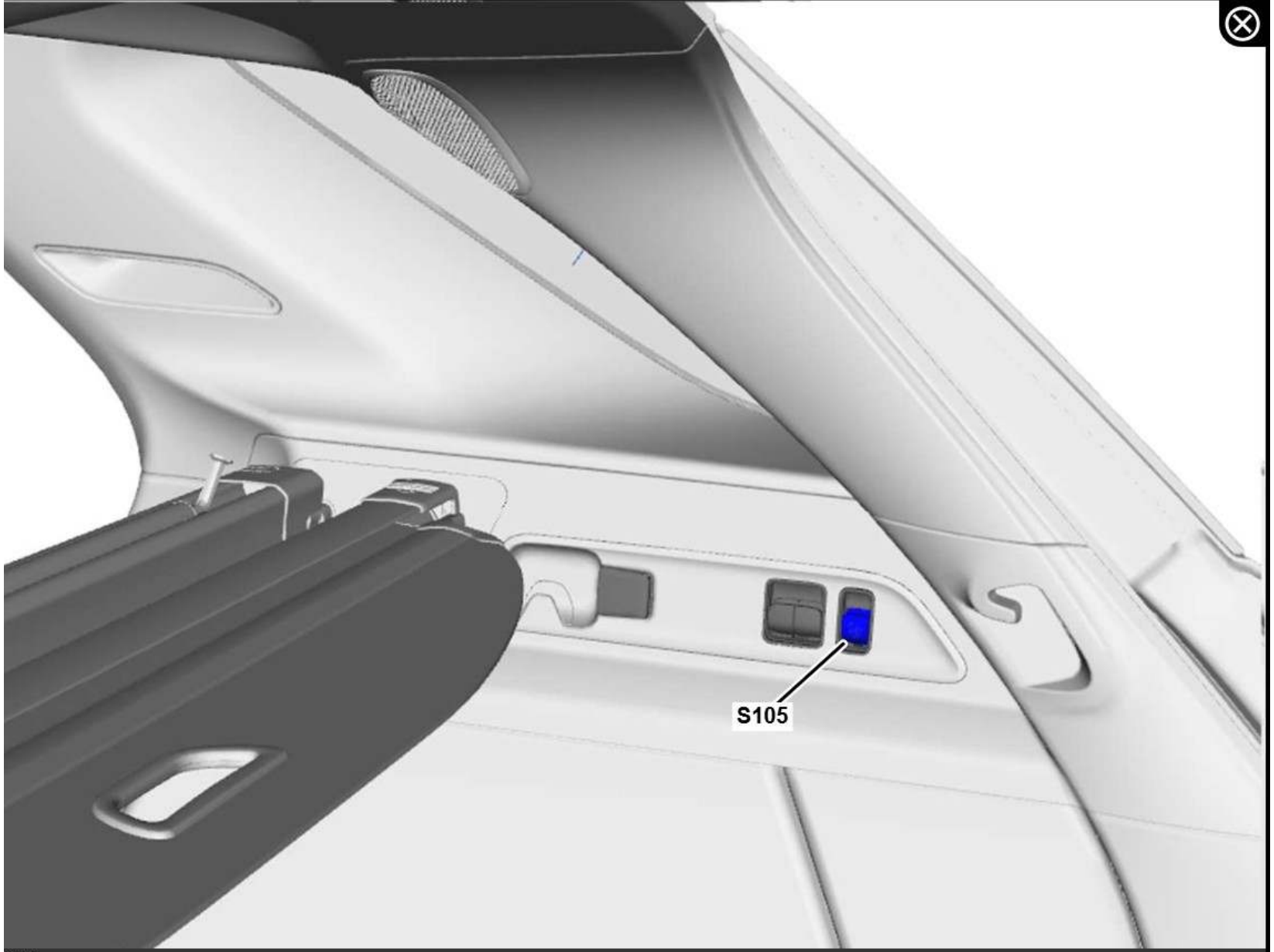


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S105
Rear-end lowering switch

Interior, right D-pillar

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Plausibility check of minimum pressure

Test prerequisites

- The ignition is switched on.
- The vehicle must be on a level surface.
- Perform test at room temperature.

Test procedure

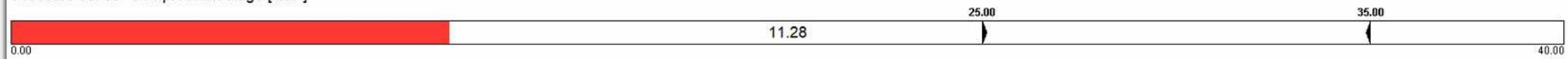
- A pressure of 29.00bar must be built up.

Specified value

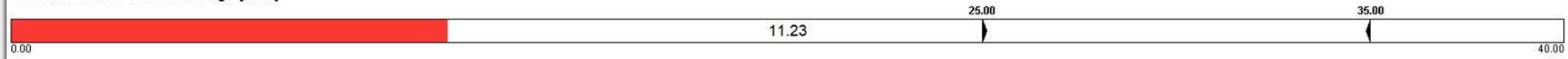
- Specified value: 29.00bar [25.00bar...35.00bar]
- All actual values must be approximately equal.

Electrohydraulic controller unit LEFT FRONT

Pressure sensor Compression stage [bar]

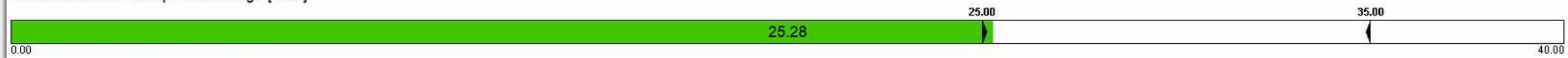


Pressure sensor Rebound stage [bar]

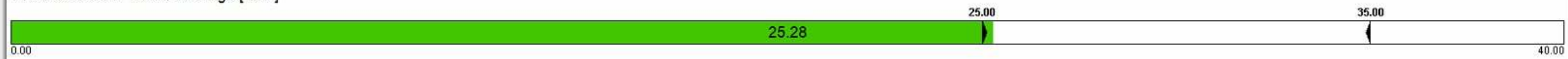


Electrohydraulic controller unit RIGHT FRONT

Pressure sensor Compression stage [bar]



Pressure sensor Rebound stage [bar]



Electrohydraulic controller unit LEFT REAR

Pressure sensor Compression stage [bar]

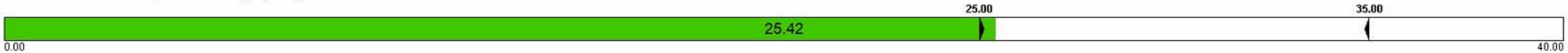


Pressure sensor Rebound stage [bar]

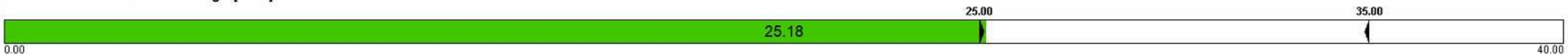


Electrohydraulic controller unit RIGHT REAR

Pressure sensor Compression stage [bar]



Pressure sensor Rebound stage [bar]



Question

- Are the actual values OK?

? Information

NO

YES

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Plausibility check of minimum pressure

Component 'Shock-absorber strut' is defective.

Possible causes and remedies

- A leak may have led to destruction of the respective shock-absorber strut.
- Perform repair work as per document 'AR32.25-P-1017ME'.

Has component 'Shock-absorber strut' already been replaced as part of the current test procedure?

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Selection

- Function test of component 'EHSE'
- Hydraulic unit'EHSE' EVACUATION
- Hydraulic unit'EHSE' FILLING

Hydraulic unit'EHSE' EVACUATION

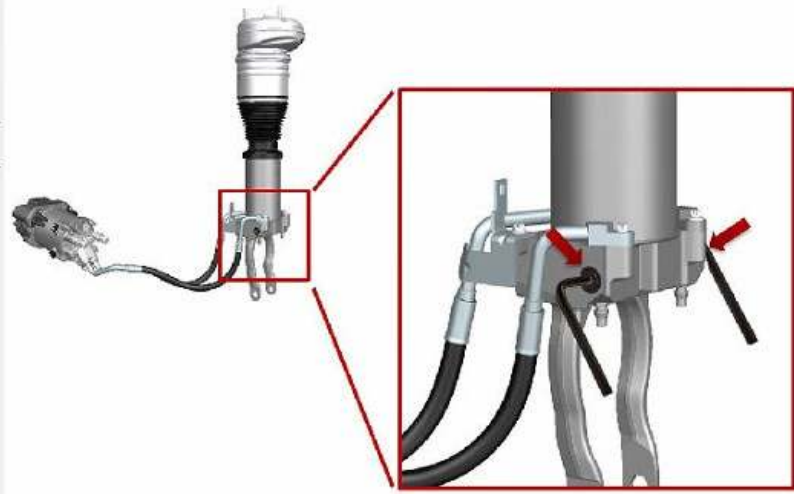
Hydraulic unit'EHSE' EVACUATION

Both shutoff valves must be closed.

- Please refer to WIS document 'Hydraulic unitEHSE FILLING / EVACUATION'.
- See Figure Electrohydraulic suspension

⚠Warning

If the hydraulic line of the filler/bleeder unit is connected to the respective shock-absorber strut before all the valves on it are closed, the depressurization will cause irreparable damage to the shock-absorber strut.



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EHSE

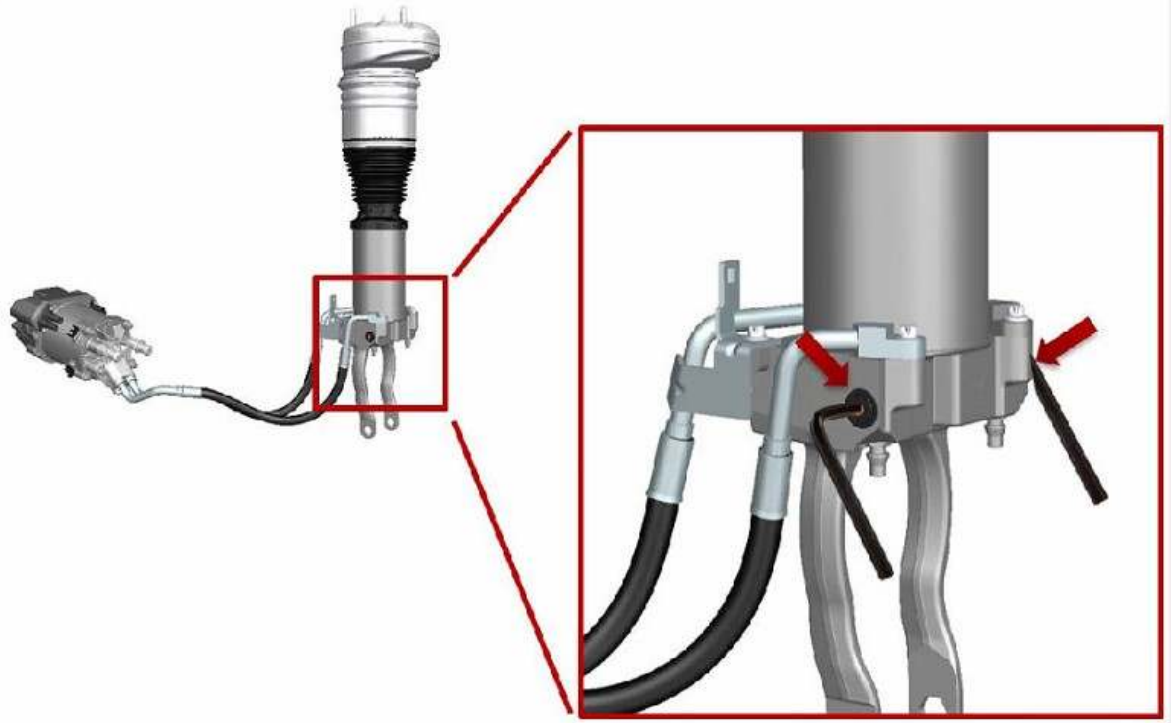
Warning

If the hydraulic line of the filler/bleeder unit is connected to the respective shock-absorber strut before all the valves on it are closed, the depressurization will cause irreparable damage to the shock-absorber strut.

Safety instructions/precautions

- Both shutoff valves must be closed.
- Please refer to WIS document 'Hydraulic unitEHSE FILLING / EVACUATION'.

I hereby confirm that the above-mentioned procedure was complied with and carried out.



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Version | Error codes / Events | Actual values | Actuations | Adaptations | Control unit log | List of fault codes | Tests

EHSE

Danger

- Risk of injury caused by moving parts that can pinch, crush or in extreme cases even sever limbs!

Safety instructions/precautions

- Make sure that nobody is within the hazard area.
- There must be no objects under the vehicle.
- The vehicle moves.



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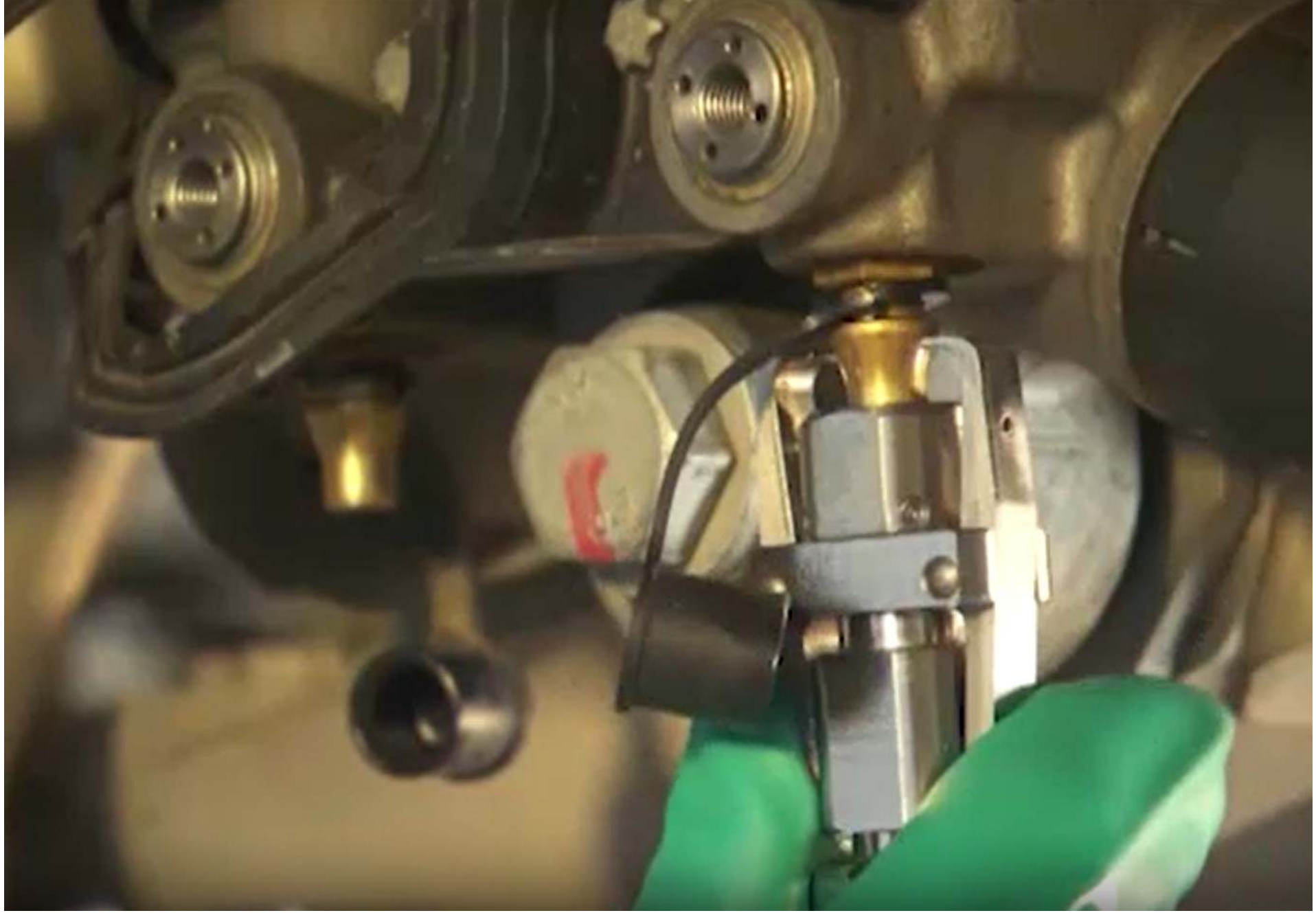
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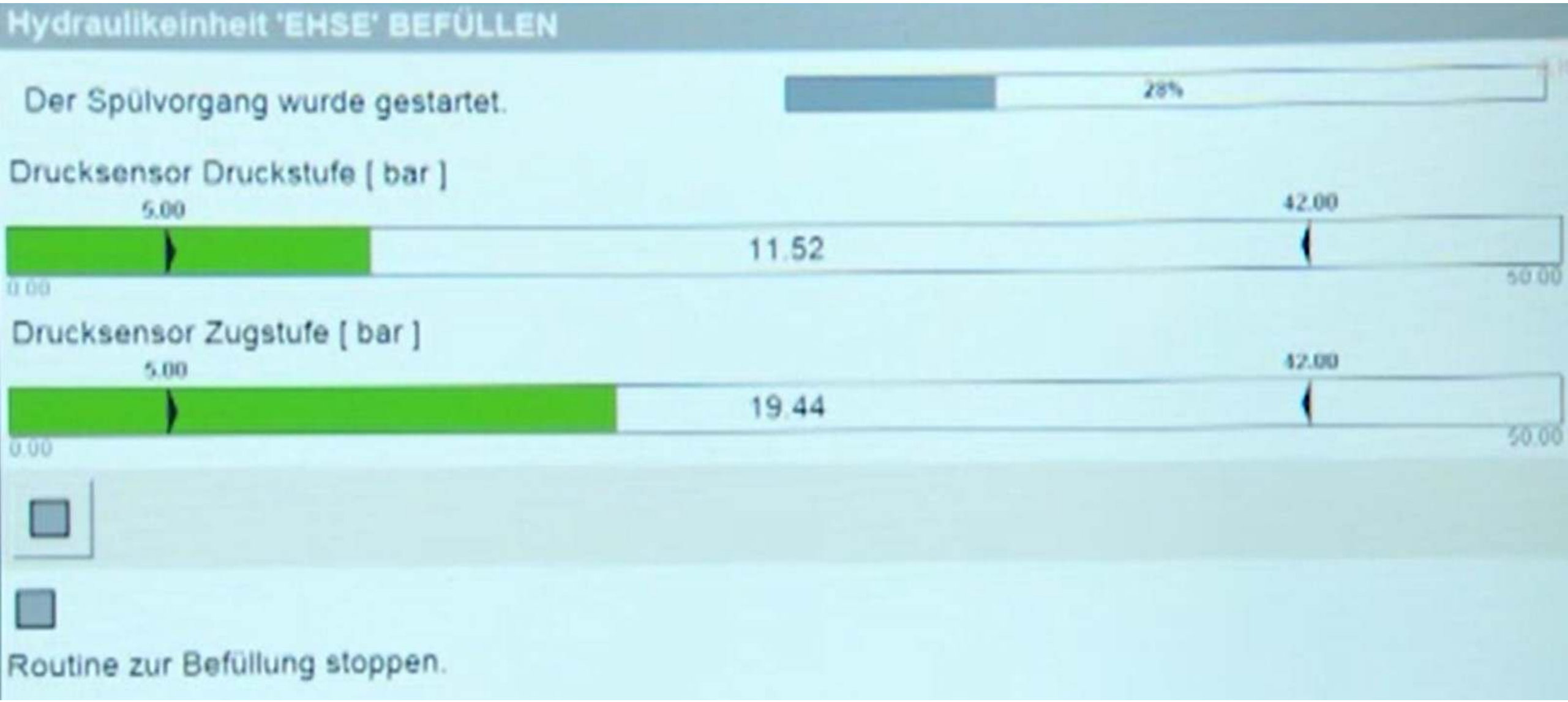
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Hydraulikeinheit 'EHSE' BEFÜLLEN
Der Spülvorgang wurde gestartet.
28%
Drucksensor Druckstufe [bar]
5.00
42.00
11.52
0.00
50.00
Drucksensor Zugstufe [bar]
5.00
42.00
19.44
0.00
50.00
Routine zur Befüllung stoppen.

DRUCKAUFBAU

1 Das Befüll- und Entlüftungsgerät muss eingeschaltet bleiben.

2 Der Rücklaufschlauch muss abgezogen werden.

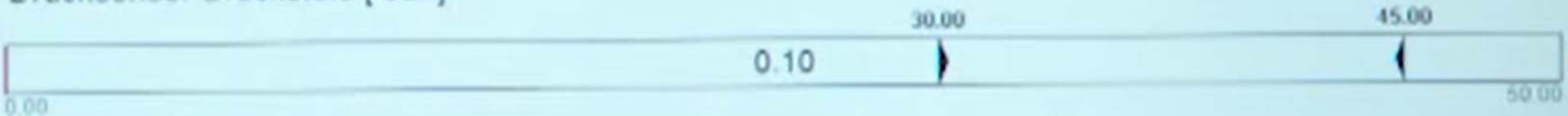
3 Das Befüll- und Entlüftungsgerät muss eingeschaltet bleiben.

4 Der Zulaufschlauch muss abgezogen werden.

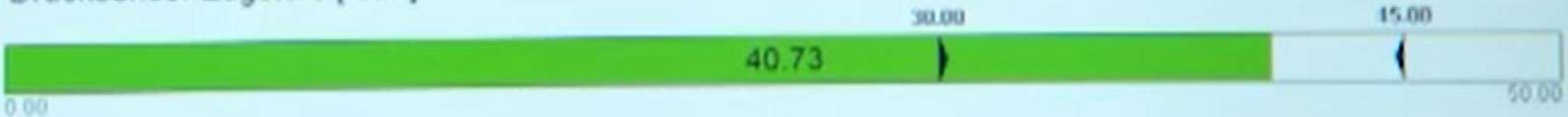
5 Befüll- und Entlüftungsgerät deaktivieren.

6 Nach dem Abziehen des Zu- und Rücklaufschlauchs muss sich ein Druck von ca. 40.00bar einstellen.

Drucksensor Druckstufe [bar]



Drucksensor Zugstufe [bar]



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FILL HYDRAULIC UNIT 'EHSE'

PRESSURE BUILDUP

1. The filling and venting device must remain switched on.
2. The return hose must be disconnected.
3. The filling and venting device must remain switched on.
4. The supply hose must be disconnected.
5. Deactivate the filling and venting device.
6. After disconnecting the supply and return hose, a pressure of approx. 40.00 bar must be set.

Pressure sensor pressure stage [bar]



Pressure sensor pulling stage [bar]





DRUCKAUFBAU

1 Das Befüll- und Entlüftungsgerät muss eingeschaltet bleiben.

2 Der Rücklaufschlauch muss abgezogen werden.

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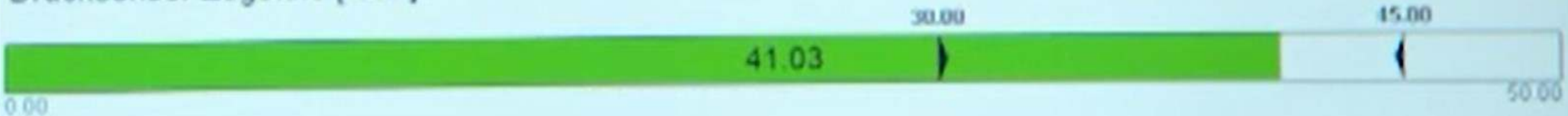
5 Befüll- und Entlüftungsgerät deaktivieren.

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Drucksensor Druckstufe [bar]



Drucksensor Zugstufe [bar]



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Display Message Suspension - eABC (eSuspension)

Topic number	LI32.50-P-074278
Version	1
Function group	32.50 - Active Body Control (ABC)
Date	1/27/22
Validity	Model series 223 with SA code 490/eABC. Except AMG model designations.
Reason for change	

Complaint

Warning display message for eSuspension.

Cause

Various causes are possible.

Remedy

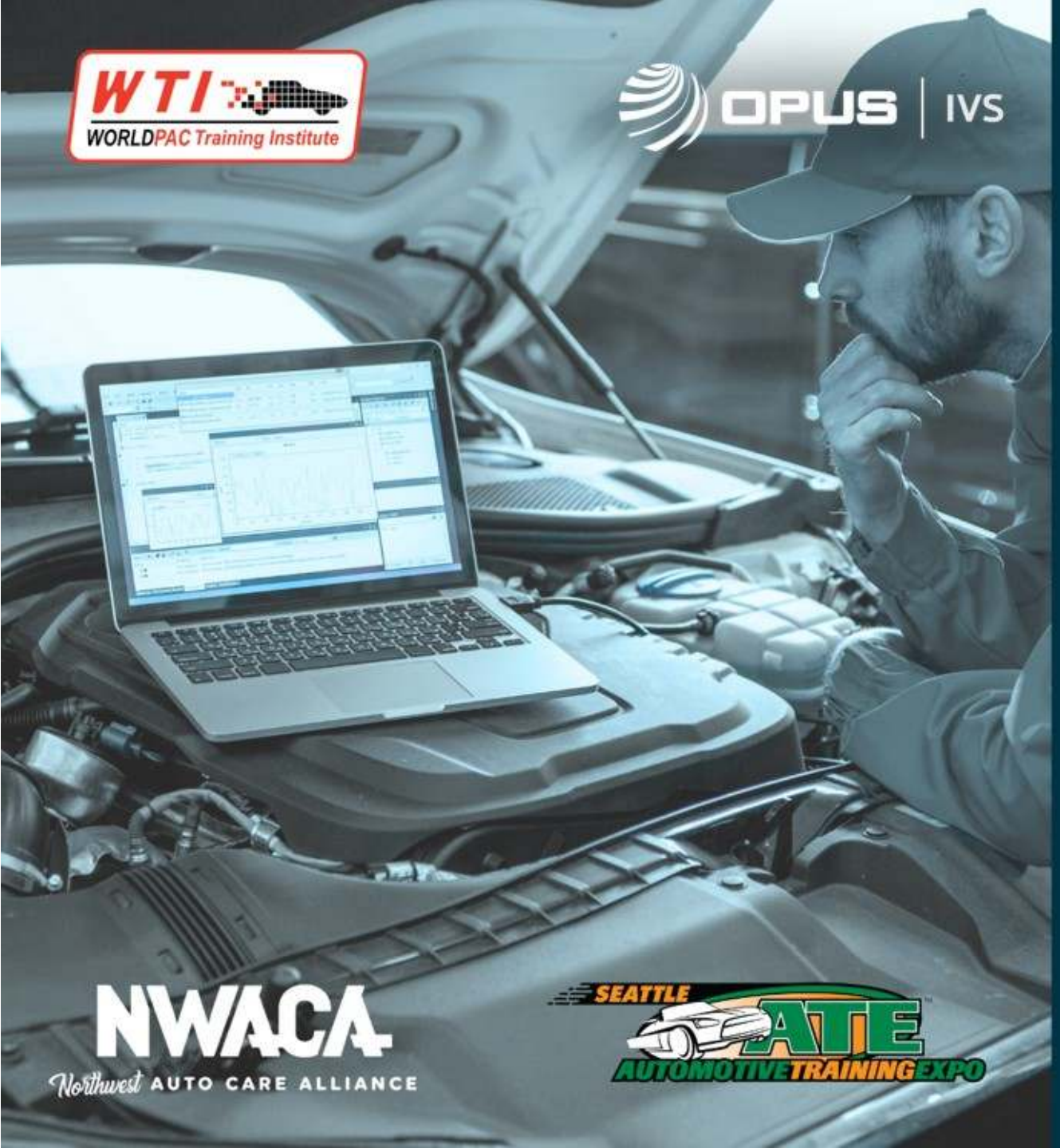
A general replacement of eABC components - MPE/EHSE (motor pump unit/electrohydraulic high-pressure pump) or suspension struts is not useful.

First check and update AFW control unit N51/8 and the four EHSE pump units M67, M67/1, M67/2 and M67/3 with new software.

If this does not resolve the issue, then create a PTSS case and attach the following:

- Logs for control units N51/8, M67, M67/1, M67/2 and M67/3 with fault freeze frame data.
- Actual values for the pressures of the four hydraulic high-pressure pumps at standstill at room temperature.

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THANK YOU FOR ATTENDING

Be sure to complete the survey that follows this presentation

QUESTIONS?

EMAIL US ANYTIME AT WTI@WORLDPAC.COM

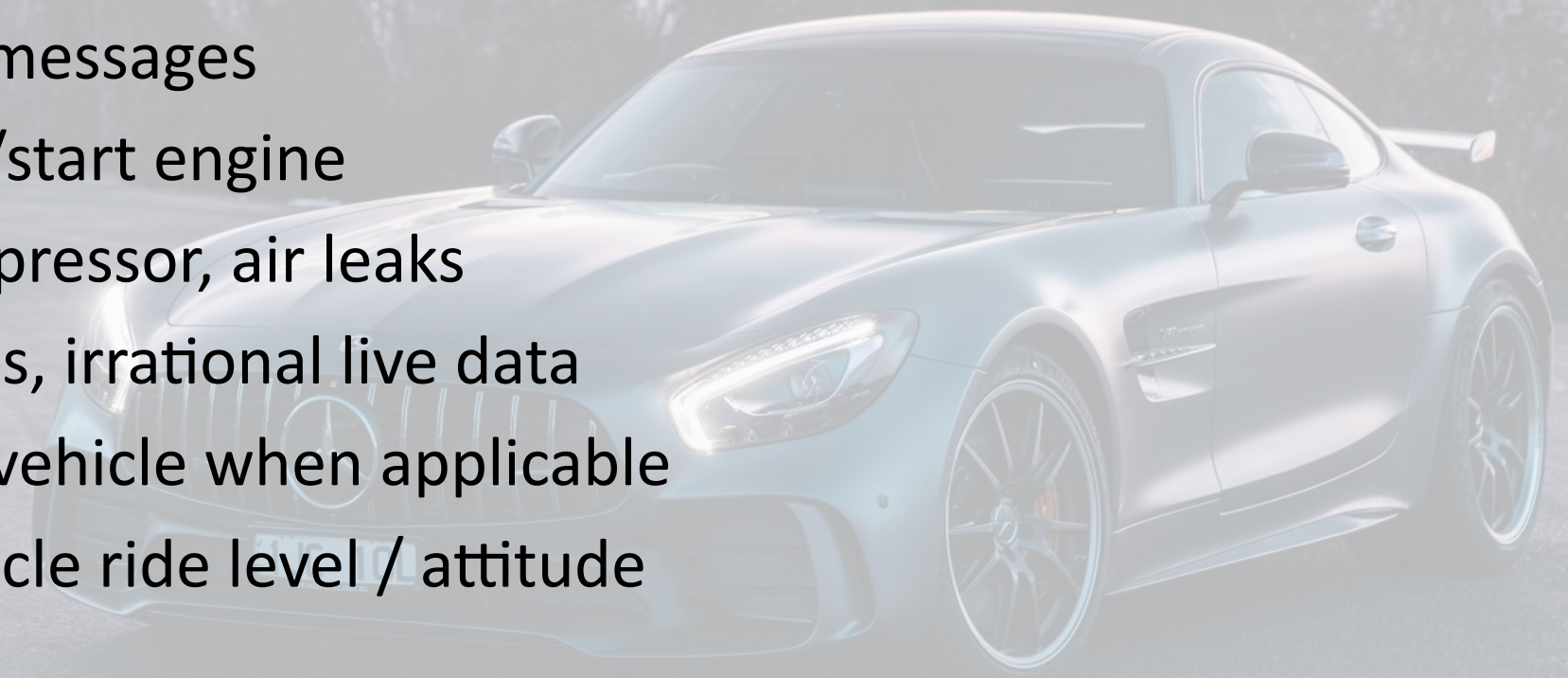
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Preliminaries

- Visually inspect suspension
- Check cluster messages
- Check battery/start engine
- Listen for compressor, air leaks
- Check for faults, irrational live data
- Test drive the vehicle when applicable
- Look over vehicle ride level / attitude



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