Telematics


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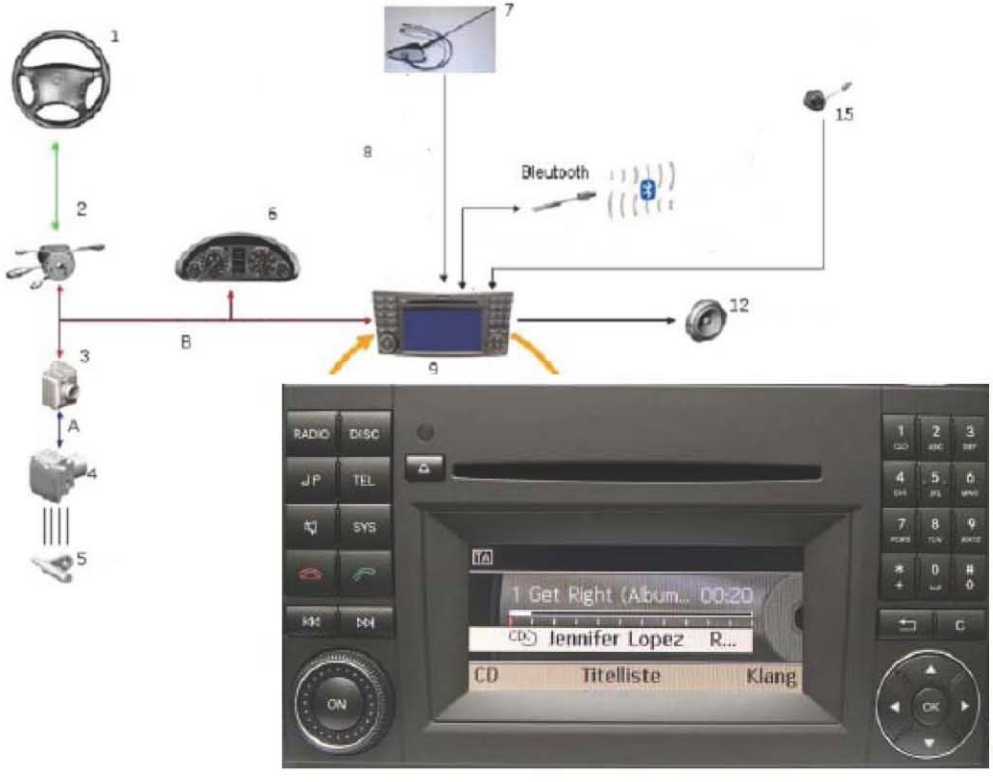
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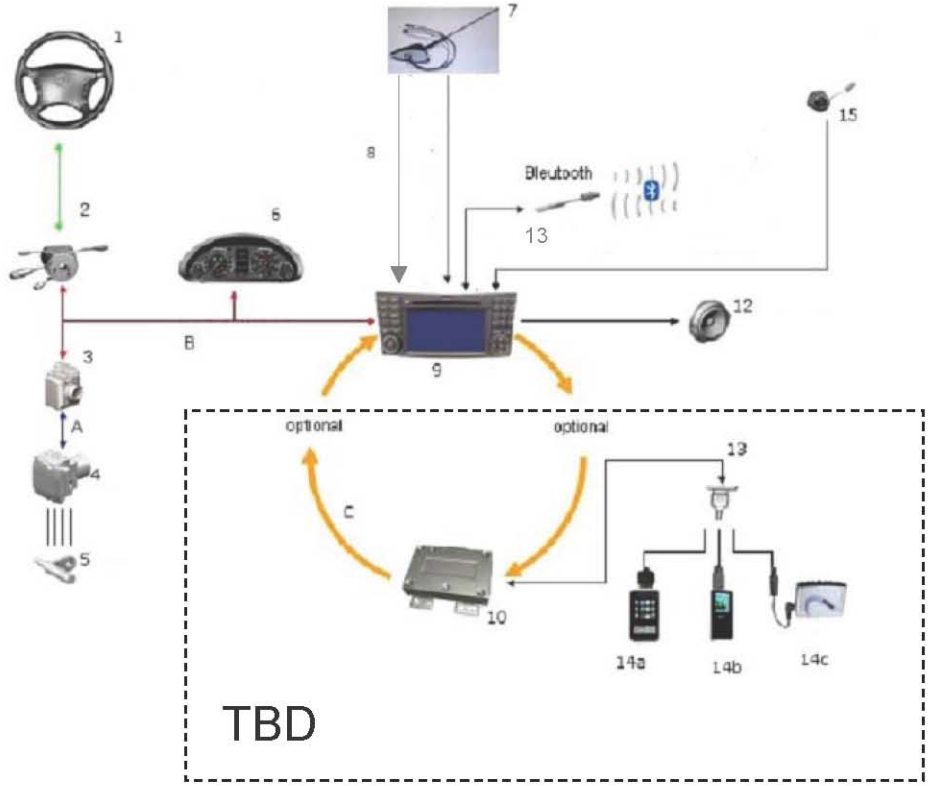
MY10 Telematics

1 Multifunction steering wheel
2 Steering column module
3 EIS
4 ESP
5 Wheel speed sensors
6 Instrument cluster
7 Antenna
8 AM/FM antenna leads
9 Head unit
10 Universal consumer interface (UCI)
12 Speakers
13 Bluetooth antenna (phone)
13 UCI connector
14a UCI terminal (iPod)
14b UCI terminal (USB)
14c UCI terminal (AUX jack)
15 Microphone

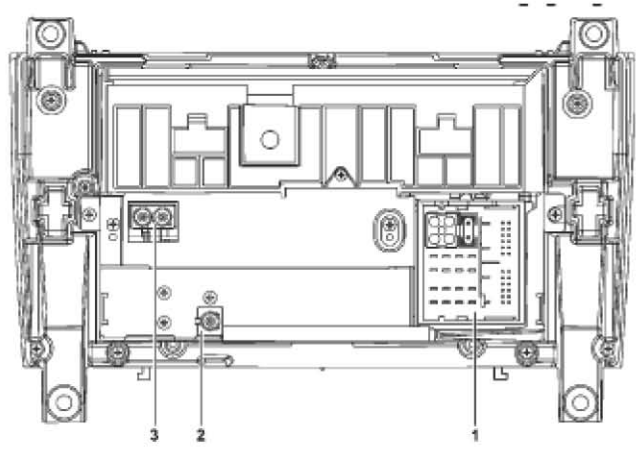


MY10 Telematics

- Sound 5 - AM/FM/CD
  - Monochrome LCD display
  - CD drive (MP3,WMA compatible)
  - AUX connection
  - Twin tuner / no diversity
  - Speed sensitive volume (from 20km/h)
  - 4 x 25 Watts output

MY10 Telematics

- Audio 20 NTG 2.5 AM/FM dual tuner/no diversity
  - CD drive (MP3, WMA compatible)
  - Bluetooth phone
  - 5” color TFT screen
  - AUX connection

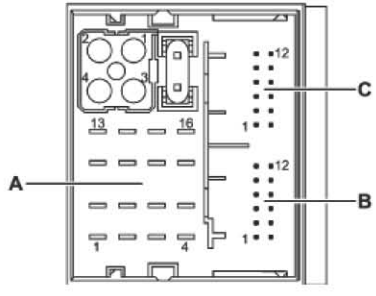


1 Combinations connector block 1 (MQS electrical terminals)
2 Bluetooth antenna connection
3 AM/FM antenna connection

MY10 Telematics

Combination connector, connector area 1, MQS 40 (electrical)

A Block A
B Block B
C Block C

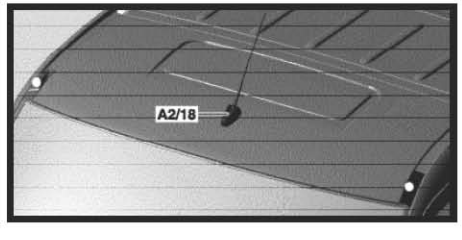


Connector	Pin	Assignment
Block A	1	RR+ (AF rear right +)
	2	FR+ (AF front right +)
	3	FL+ (AF front left +)
	4	RL+ (AF rear left +)
	5	RR- (AF rear right -)
	6	FR- (AF front right -)
	7	FL- (AF front left -)
	8	RL- (AF rear left -)
	9	Interior CAN, LOW
	10	Telephone mute
	11	Interior CAN, HIGH
	12	Ubat -
	13	NOT ASSIGNED
	14	Interior CAN-Shield
	15	Ubat + (terminal 30)
	16	MOST wake up

Connector	Pin	Assignment
Block B	1	Microphone_1_In+
	2	Microphone_2_In+
	3	Microphone_shield
	4	Microphone_out_+
	5 - 6	NOT ASSIGNED
	7	Cradle_Compensator
	8	NOT ASSIGNED
	9	Microphone_ground
	10	Microphone_out_-
	11 - 12	NOT ASSIGNED
Block C	1	Reserved
	2	Fan – (external fan)
	3	Aux1-S (Aux-AF-Shield)
	4	Aux1-L (Aux-AF-left)
	5 - 6	NOT ASSIGNED
	7	Diag-fan (DIAGNOSIS ext. fan)
	8	Fan – (external fan)
	9	Aux1-Gnd (AUX-AF-Ground)
	10	Aux1-R (Aux-AF-right)
	11 - 12	NOT ASSIGNED

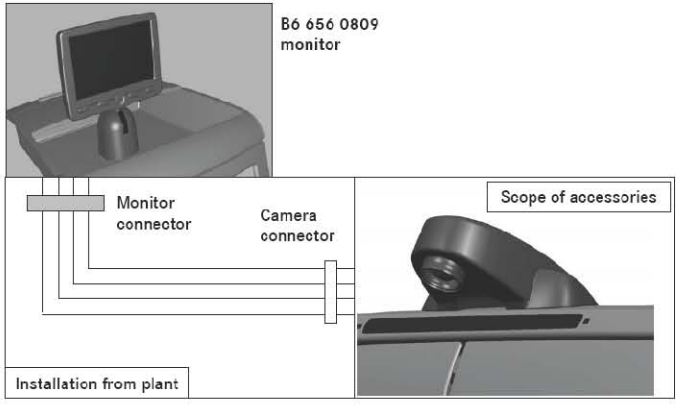
MY10 Telematics

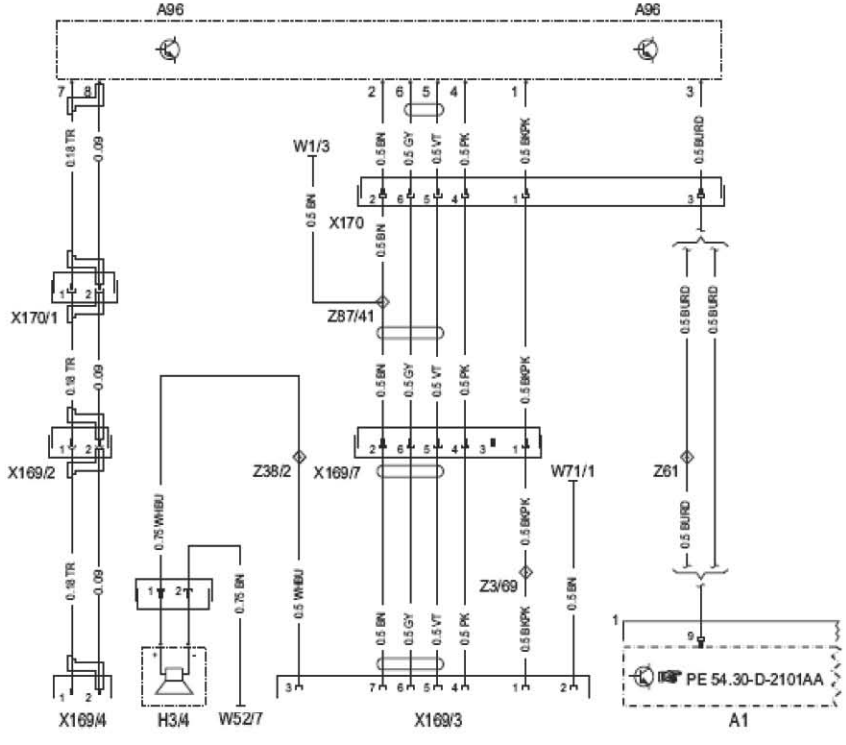
- AM/FM antennas are housed in antenna amplifier A2/18 and wired directly to head unit
  - Passive design, actively amplified
  - Audio 20 / Sound 5 only contains dual tuner – no diversity
- Bluetooth antenna for phone (Audio 20)
  - Installed behind head unit
  - 2400MHz frequency
- Microphone for phone installed in OCP



Rear View Camera

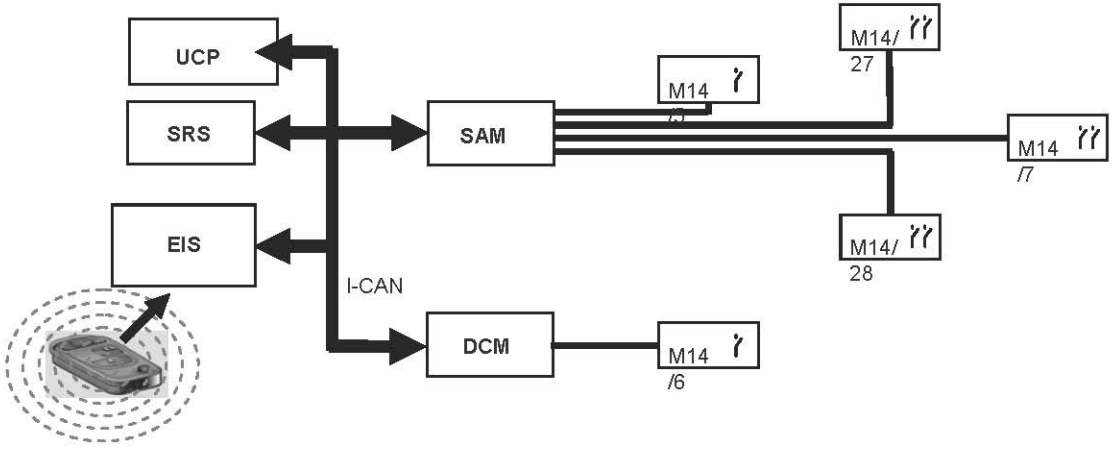
- High mount rear view camera option
  - FR7 wire pre-installation option
  - Adapter available for high roof





A1	Instrument Cluster
A96	Monitor back-up camera
H3/4	Horn for back-up warning
X169/3	Upfitter body builder connection 1
X169/4	Upfitter body builder connection 2
Z38/1	Spice for back-up lamp
Z61	Slice for speed signal

Central Locking



Central Locking

- **Central locking inside locking button**
  - In panel vans and passenger vans with integrated LED
  - 2 control circuits – cab/load compartment
  - LED indicates the status of the load compartment (locked)
  - No indication of the status of the overall vehicle
  - Upper rocker switch position for overall locking or unlocking
  - Lower rocker switch position for selective locking or unlocking (load compartment)
  - On models with driver cab/crew cab there is only one rocker switch position.

1 Overall vehicle button
2 Load compartment button

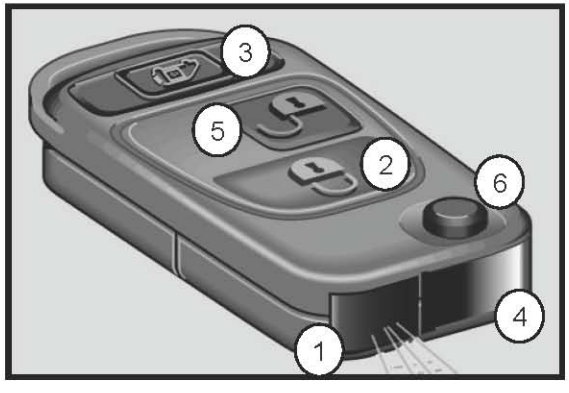
Central Locking

- You can activate and deactivate the global engine running-dependent locking feature by pressing and holding the top of the rocker switch for an extended period (approx. 5 s).
- You can activate and deactivate the engine running-dependent locking feature for the load compartment by pressing and holding the bottom of the rocker switch for an extended period (approx. 5 s).
- The ignition key must be in position 1 (terminal 15 R) and the vehicle speed must be 0 km/h.
- Feedback is given to confirm that the function parameter has been changed:
  - Global locking activated LED flashes 4 times
  - Global locking deactivated LED flashes 2 times
  - Selective locking activated LED flashes 4 times
  - Selective locking deactivated LED flashes 2 times

Central Locking

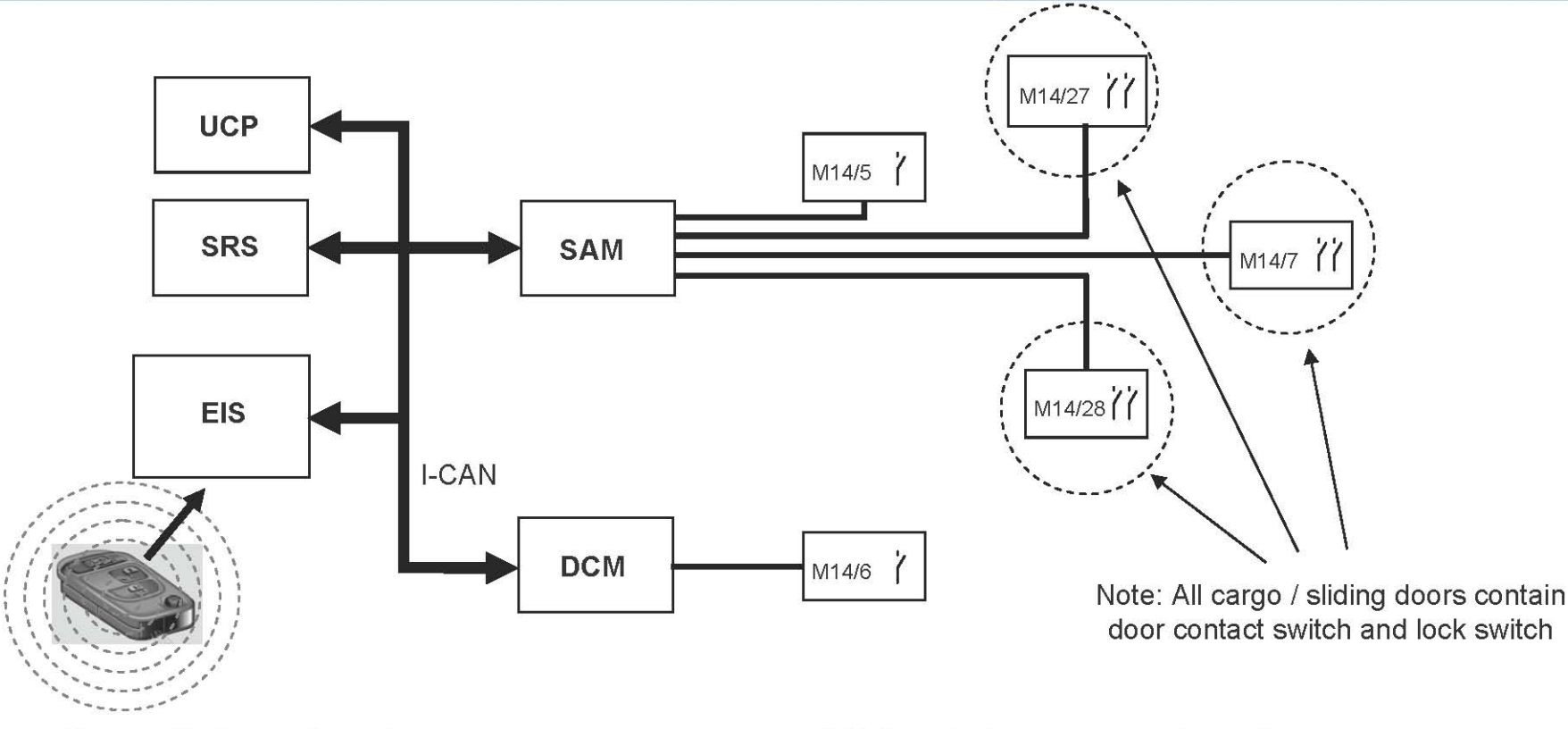
- Global unlocking:
  - Complete vehicle is unlocked
- Selective unlocking:
  - Drivers door is unlocked

- Programming of global/selective can only be done via Star Diagnosis.



1 Battery indicator lamp
2 Locking button
3 Button for unlocking rear-end and sliding doors
4 Mechanical emergency key
5 Unlocking button
6 Release button for mechanical

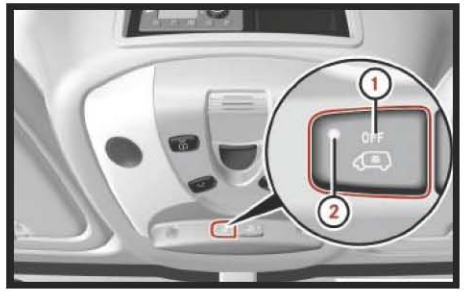
Central Locking



EIS	Electronic ignition switch
UCP	Upper control panel
SAM	Signal acquisition and actuation module
SRS	Airbag
DCM	Driver door control unit

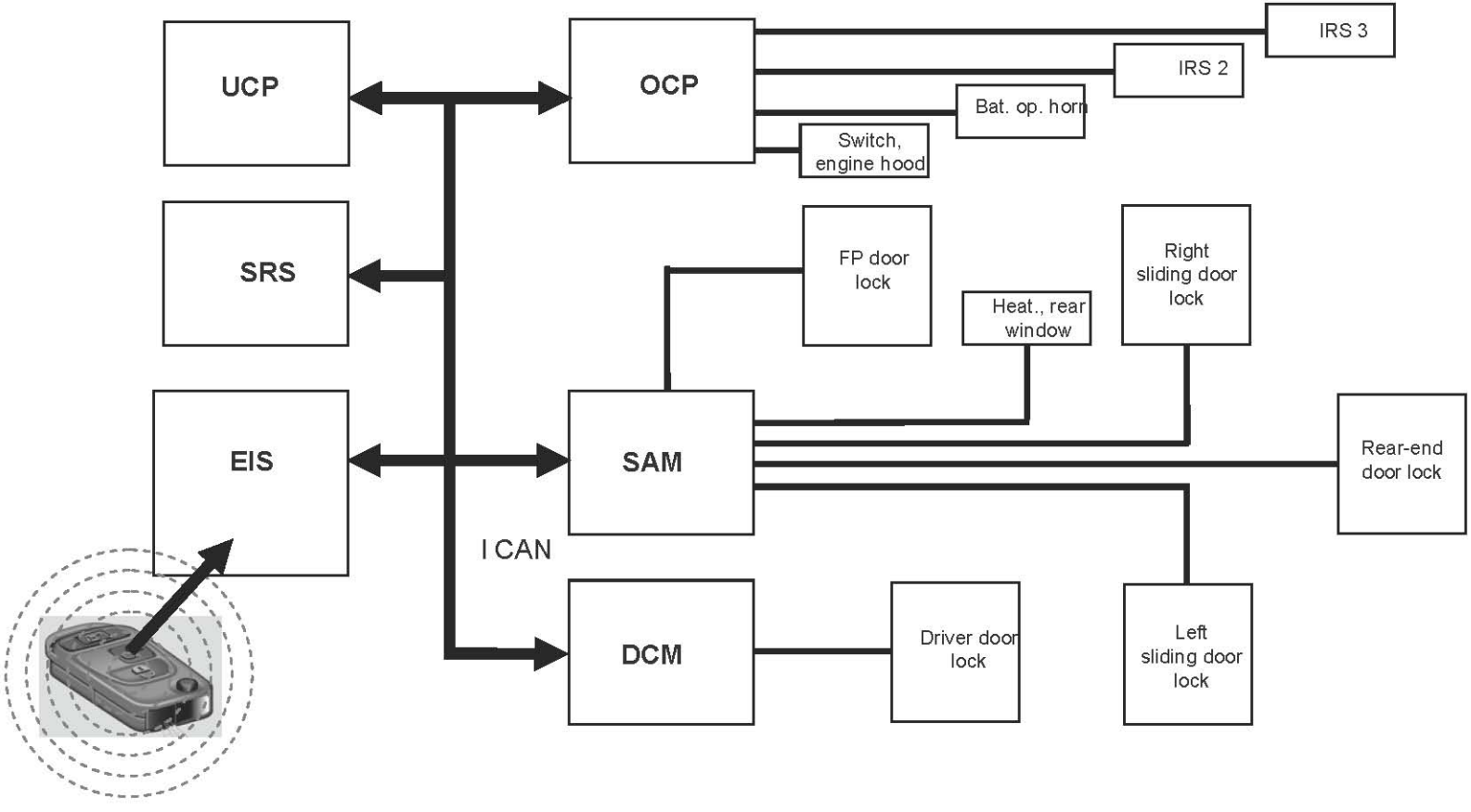
M14/5	Front passenger door central locking
M14/6	Driver door central locking
M14/7	Rear-end door central locking
M14/28	Left sliding door central locking
M14/27	Right sliding door central locking

Anti-theft Alarm (ATA)

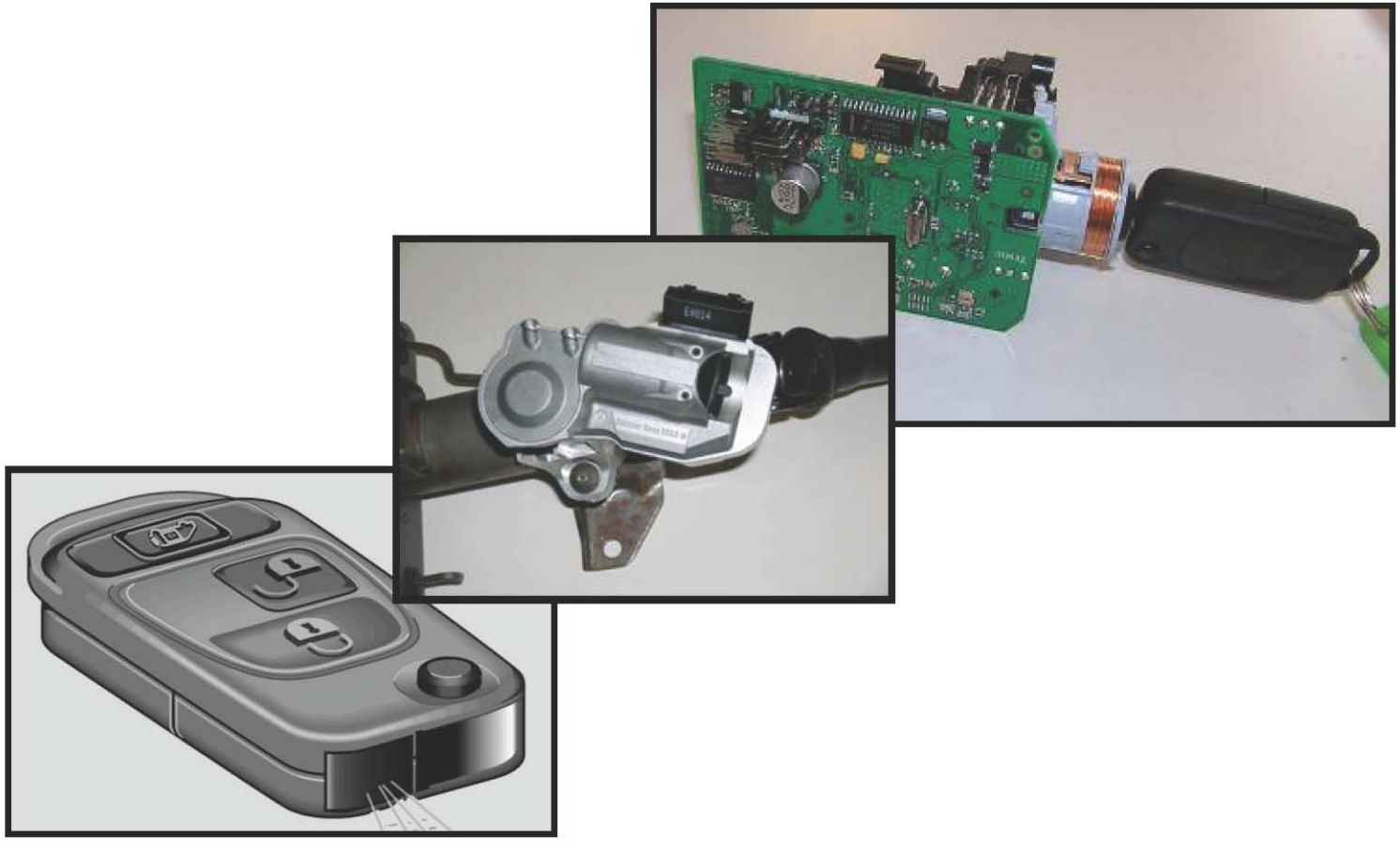


- ATA system includes:
  - interior ultrasound sensors (2 or 3)
  - inclination sensor
- Controlled by the OCP
- Armed automatically when the central locking system is operated.
  - approx. 30 seconds after the vehicle is locked by radio remote control.
  - indicated by three flashes of the turn signal lamps
- If persons or animals remain in the locked vehicle, the interior protection must be switched off to prevent false alarm
- Disarmed when the vehicle is unlocked using the remote control or the key is inserted in the EIS
- Battery-operated horn is not accessible from outside and is independent of the on-board electrical system. It will sound even if the main battery power supply is interrupted

Anti-theft Alarm (ATA)



Drive Authorization System



Drive Authorization System (DAS)

- The drive authorization system DAS is called FBS 2b
- Components of FBS 2b
  - Transmitter key with transponder
  - Electronic ignition/starter switch EIS (EZS)
  - Electric steering lock ESL (ELV)
  - Engine control module (CDI / ME)

Drive Authorization System (DAS)

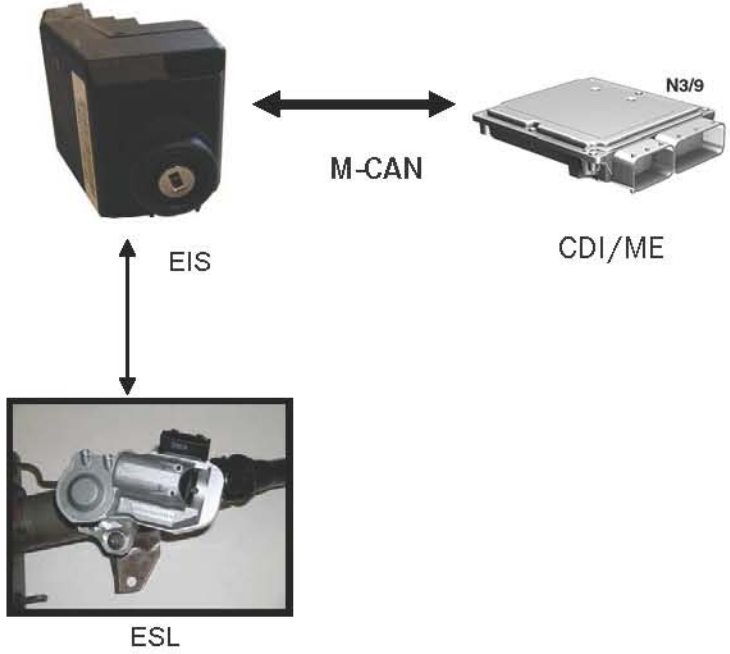
- Electronic ignition/starter switch (EIS) has many other tasks apart from the switch function "Ignition on" and "Start"
  - Master control unit for the drive authorization system
  - Master control unit for the central locking
  - Gateway between the interior bus, engine bus and diagnosis bus
  - Receiver of the radio remote control
  - Stores the variant coding for the entire vehicle
  - Connection to the electrical steering lock ESL

Drive Authorization System (DAS)

- After inserting the key in the EIS, a coil is energized which supplies the key inductively with voltage.
- The transponder is now able to send his code.
- EIS has 8 places to store a transponder code. So, it is possible to use 8 keys with one vehicle.
- Learning and erasing transponder codes is done by Star Diagnosis

Drive Authorization System (DAS)

- EIS receives the transponder code from the key. It is compared with an existing code list.
- Data transfer between EIS and ESL to unlock the steering. At the end ESL sends a message “unlocked” and the EIS releases the rotation lock.
- After switching on ignition, a special code is transmitted, via the engine bus (M-CAN), from the EIS to the engine control unit, where it is checked.
- Drive authorization is only issued once this process has been completed.



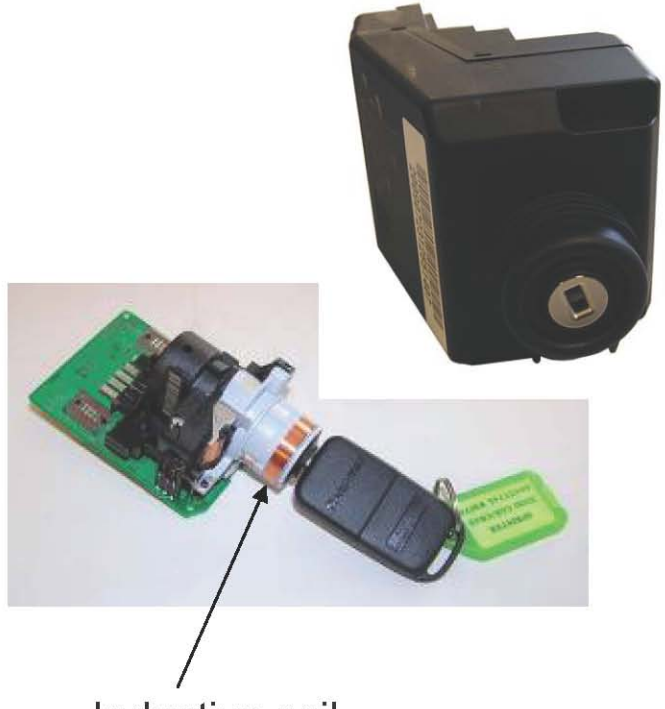
M-CAN	Engine bus (CAN C)
ESL	Electric steering lock (ELV)
EIS	Electronic ignition switch (EZS)
CDI/ME	Engine control unit

Replacing Theft Relevant Parts

- EIS
  - Order with VIN-number and electronic locking mechanism number
  - Enabling and programming with Star Diagnosis
  - Learning all keys with Star Diagnosis
- ESL
  - Order with VIN-number and electronic locking mechanism number
  - Enabling with Star Diagnosis
- Lost key
  - Disable the lost key by erasing the transponder code in EIS with Star Diagnosis
  - Order new key with VIN-number and electronic locking mechanism number
  - Enable new key with Star Diagnosis Synchronize radio remote by :
    - Pressing any button to send
    - insert the key in EIS
    - switch to pos. 1 (circuit. 15r)
    - switch off and pull key out

Drive Authorization System (DAS)

- Inductive coil used of power up key transponder once inserted into EIS
- EIS has 8 key tracks
- Each key track can be overwritten with a replacement key
- Total of 8 keys can be utilized per EIS at any given time
- EIS is replacable up to 8 times
- After 8 EIS replacements CDI control module will also have to be replaced



Acronyms

AAC	Automatic air conditioning control module
ATA	Anti Theft Alarm
CAN	Controller Area Network
CDI	Common Rail Diesel Injection
DAS	Drive Authorization System
DCM	LF door control module
EIS	Electronic ignition switch
ESM	Electronic Shifter Module
ESP	Electronic stability program
ETC	Electronic transmission control module
HRA	Headlamp Range Adjustment
IC	Instrument cluster
LIN	Local Interconnect Network
NTG	New Telematics Generation
OCP	Overhead control module
PSM	Paramiterizable Special Module
PTS	Parktronic
SAM	Signal Acquisition Module
SCM	Steering column module
SRS	Supplemental Restraint System
TPMS	Tire pressure monitoring control module
UCP	Upper control panel

OM642

OM642.898 Overview

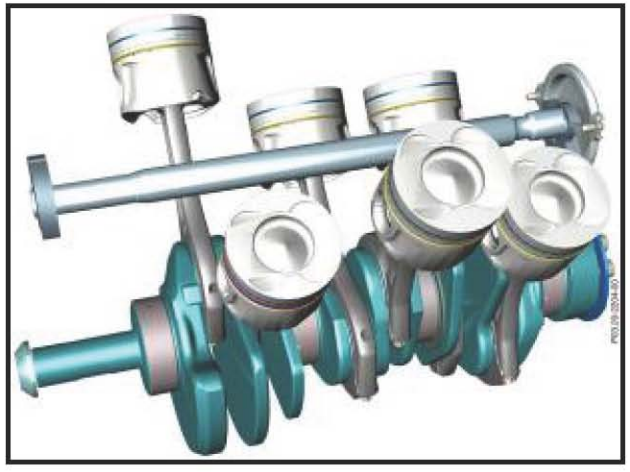
185 hp @ 3,800 rpm

325 lb-ft @ 1,400 – 2,400 rpm

Example of torque

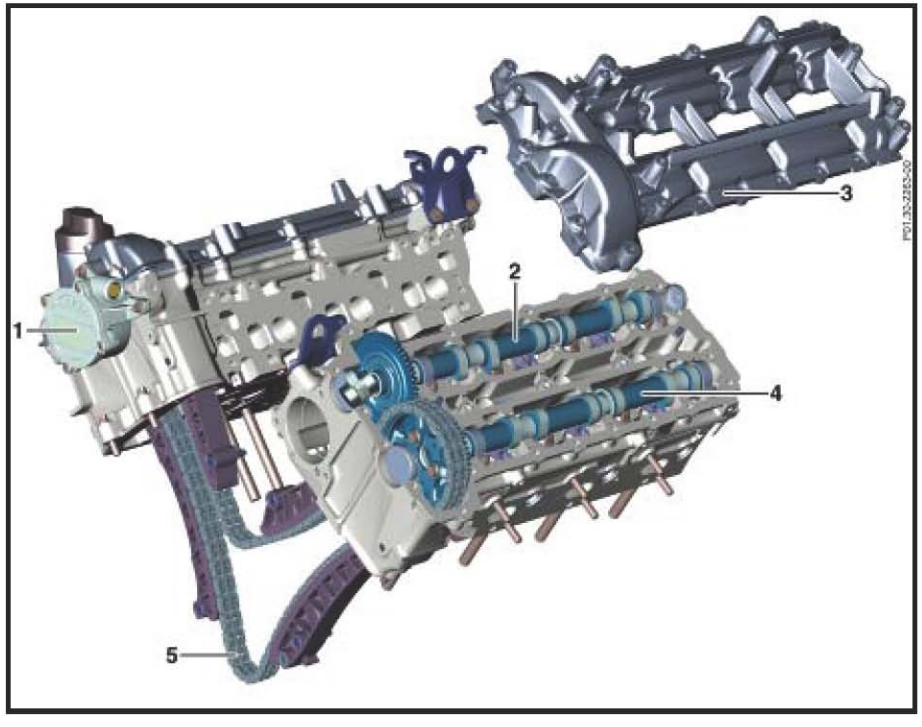
OM642.898 Overview

- Aluminum crankcase with cast in iron cylinder liners
- 72° crank angle
- Balance shaft
- VTG exhaust turbocharger with electrical adjuster and charge air cooling
- Electrically controlled exhaust recirculation valve for exhaust gas recirculation
- Electrically controlled intake air throttling
- Electrically controlled intake port shutoff (EKAS)



OM642 Overview

- 4 valves per cylinder with 2 camshafts per cylinder bank
- Common rail direct injection CDI 6 with up to 5 injections per cycle
- Instant start glow system (ISS)
- Maximum peak pressure in the combustion chamber up to 150 bar
- Crankcase ventilation with centrifugal oil separator



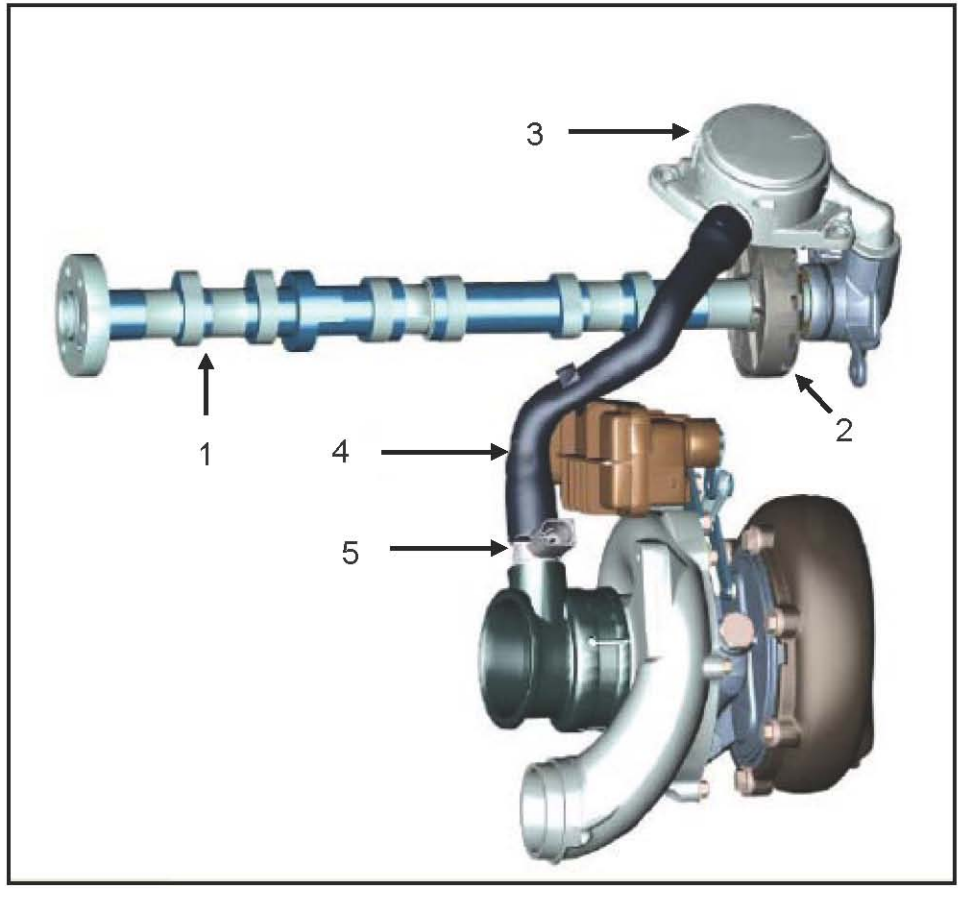
1 – Vacuum
2 – Intake camshaft
3 – Cylinder head cover with cam bearings
4 – Exhaust camshaft
5 – Timing chain

Crankcase Ventilation

Crankcase gases are fed to the intake manifold through the:

- Hollow intake cam (1)
- Oil separator (2)
- Pressure regulator (3)
- Vent line (4)
- Crankcase ventilation heating element (5)

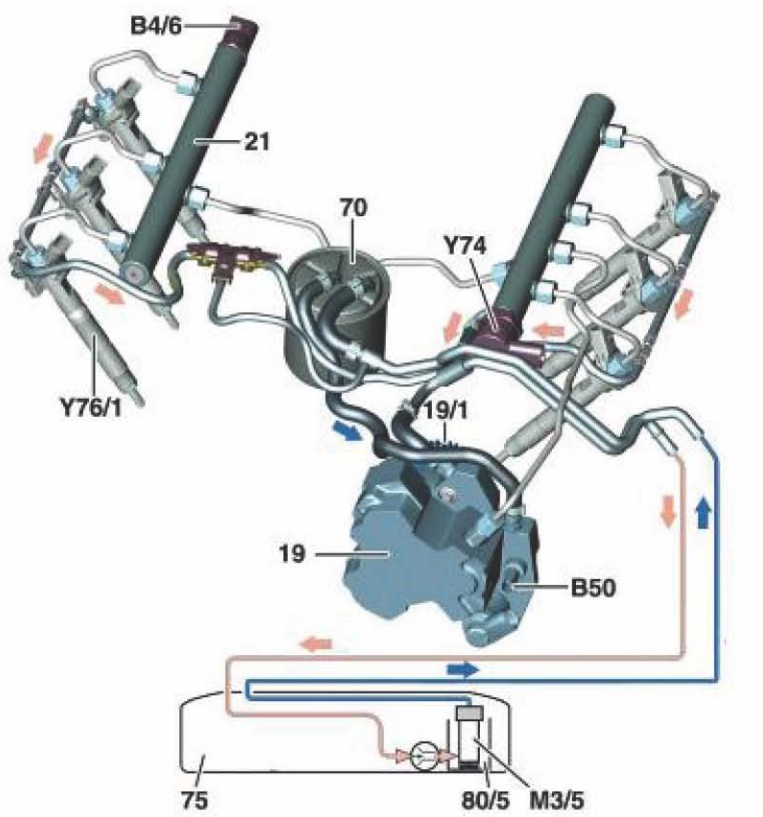
The vent line heater is controlled by the CDI control unit



Passenger car illustration, component shape may vary

Fuel System Overview

19	High pressure pump
19/1	High pressure pump drive
21	Rail
70	Fuel filter
80	Fuel tank
80/4	Suction jet pump
80/5	Swirl pot
80/11	Fuel strainer
B4/17	Rail pressure sensor
B50/6	Fuel temperature sensor
M3/5	Fuel pump
Y74/6	Pressure regulator valve
Y76	Fuel injector
Y94/4	Quantity control valve

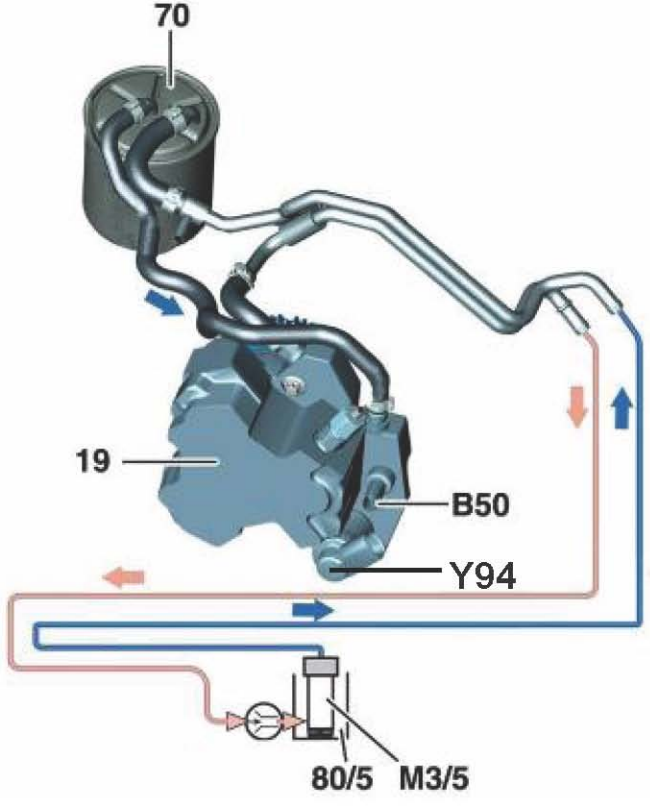


Warning – use of gasoline, kerosene, biodiesel (B6-100) and/or Low Sulfer diesel will cause damage not covered by warranty.

Low Pressure Fuel System

Includes the following fuel system components:

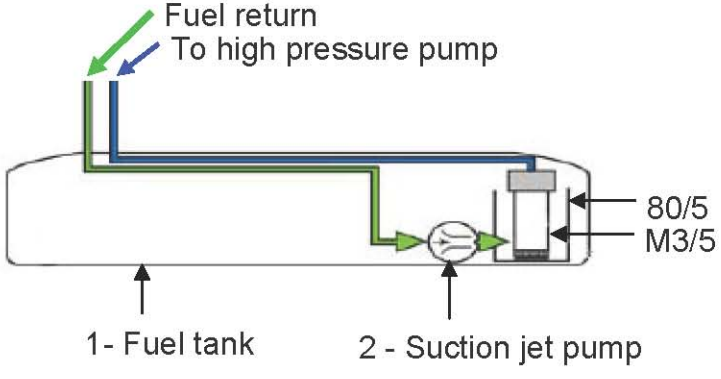
- 80/5 – Swirl pot
- M3/5 – Electric fuel pump
- 70 – Fuel filter
- 19 – High pressure pump with regulation valve
  (See next slide for details)
- B50/6 – Fuel temperature sensor
- Y94/4 – Quantity Control Valve
- Fuel lines (supply and return)



Fuel Tank and Pump

Includes the following fuel system components:

- 80/5 – Swirl pot
- M3/5 – Electric pump
- 25 Gal Fuel tank
- Suction jet pump



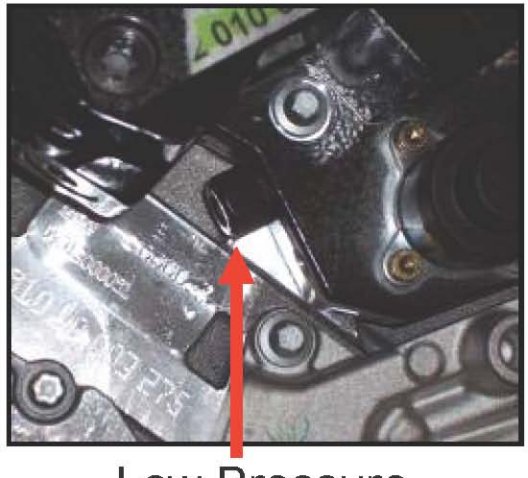
Located on left side of vehicle

Low Pressure Fuel System

Components located on the High Pressure Pump

Fuel temperature sensor
B50/6

Quantity control valve
Y94/4



Low Pressure
Regulating Valve

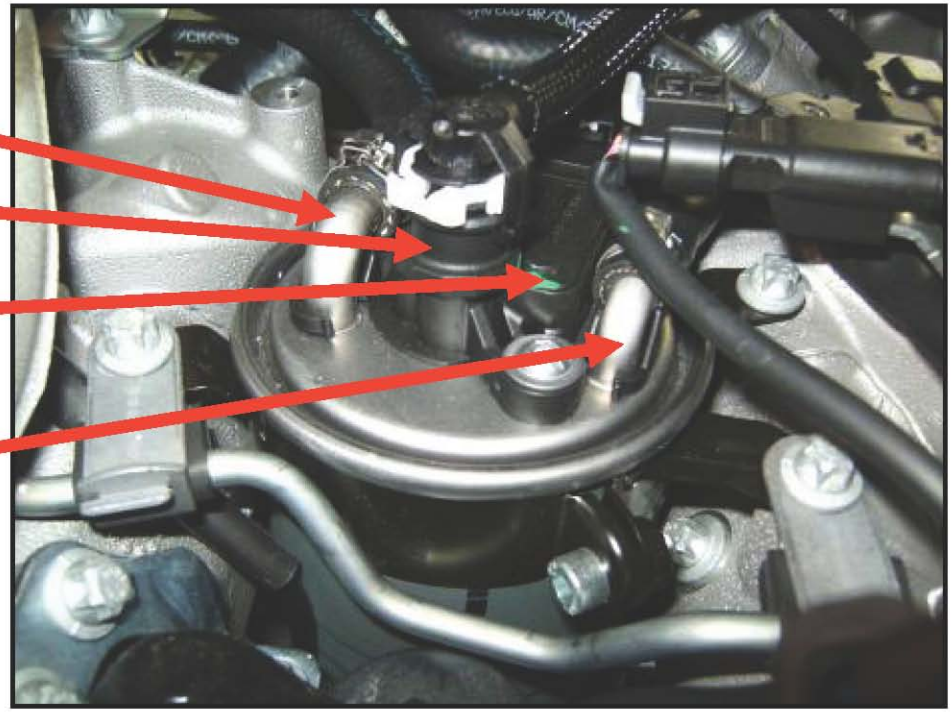
Fuel Filter

Fuel Inlet

Fuel drain line

Water Sensor/
Fuel Heater

Fuel outlet



Located in front of the turbocharger

Filter drain valve
Located near the dipstick
Right side of engine

Leak Oil Line

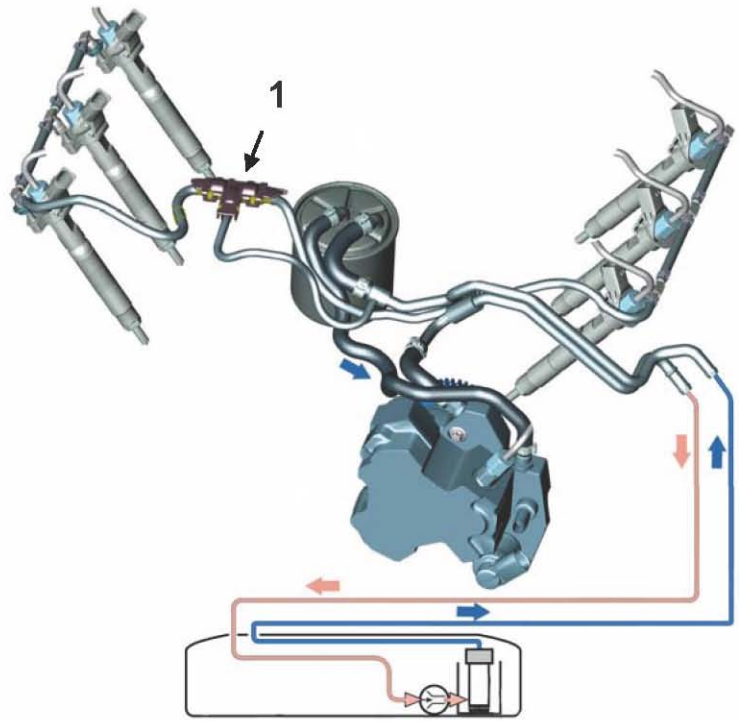
- Prior to the filter, fuel is supplied to injectors through a throttle and the leak oil lines

During Engine start:

- Leak oil line acts as supply line when fuel pump runs
- Supplies approx. 58 psi (4 bar) to the injector's coupling unit to ensure clearance between piezo unit and valve unit

Engine running:

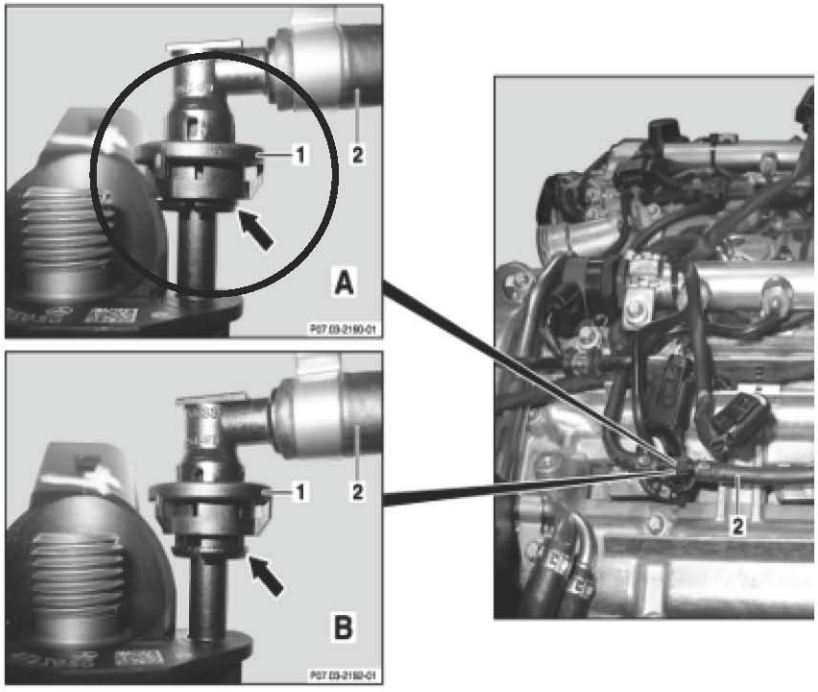
- High pressure supplied to the coupling unit
- Pressure in leak oil line from the injector is held by an orifice in the fuel T(1) between 5 bar at idle and 10 bar at full load
- Return quantity is with the piezo injector is ~0.026 gph



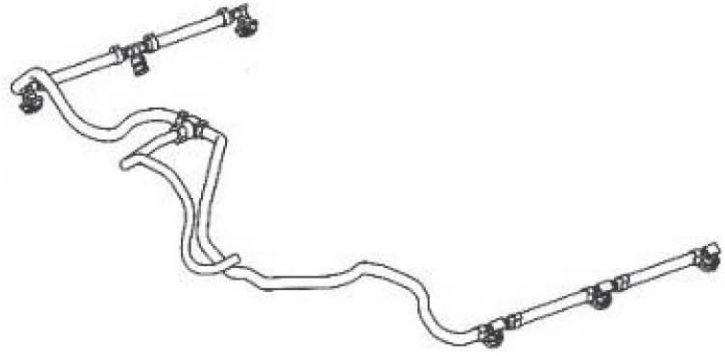
Leak Oil Line

Leak Oil Lines Repair Notes

Do not remove a leak oil line or **pinch** the line shut while the engine is running
(The back-flow pressure will raise up to 8 -10 bar)
To disconnect the leakage line (2) from the fuel injector pull the snap ring (1) bottom-up first (picture B).



The connection is locked correctly in picture A.
Note: To check the correct connection take a look from the top.
If there is a white ring still visible, the leakage line is not locked.

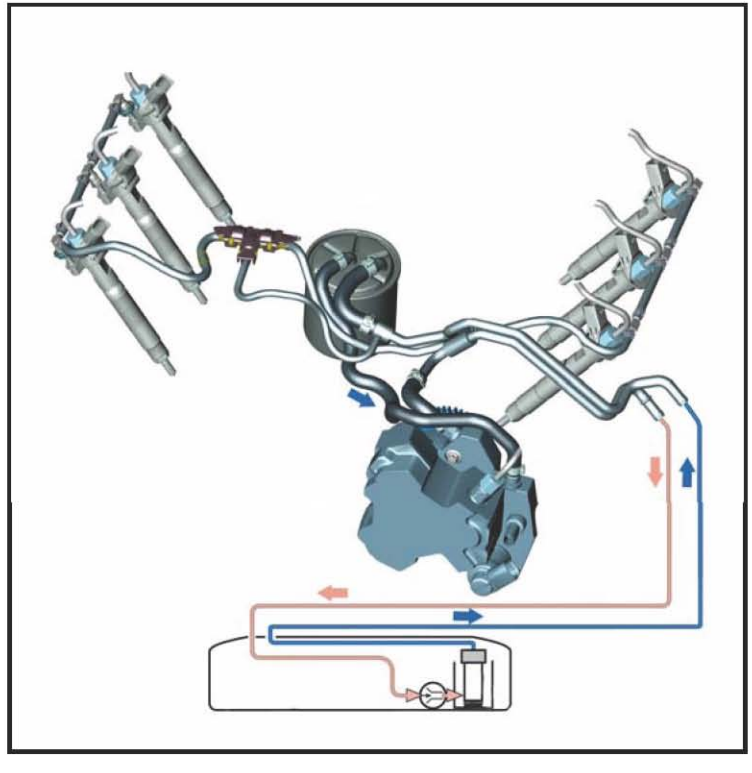


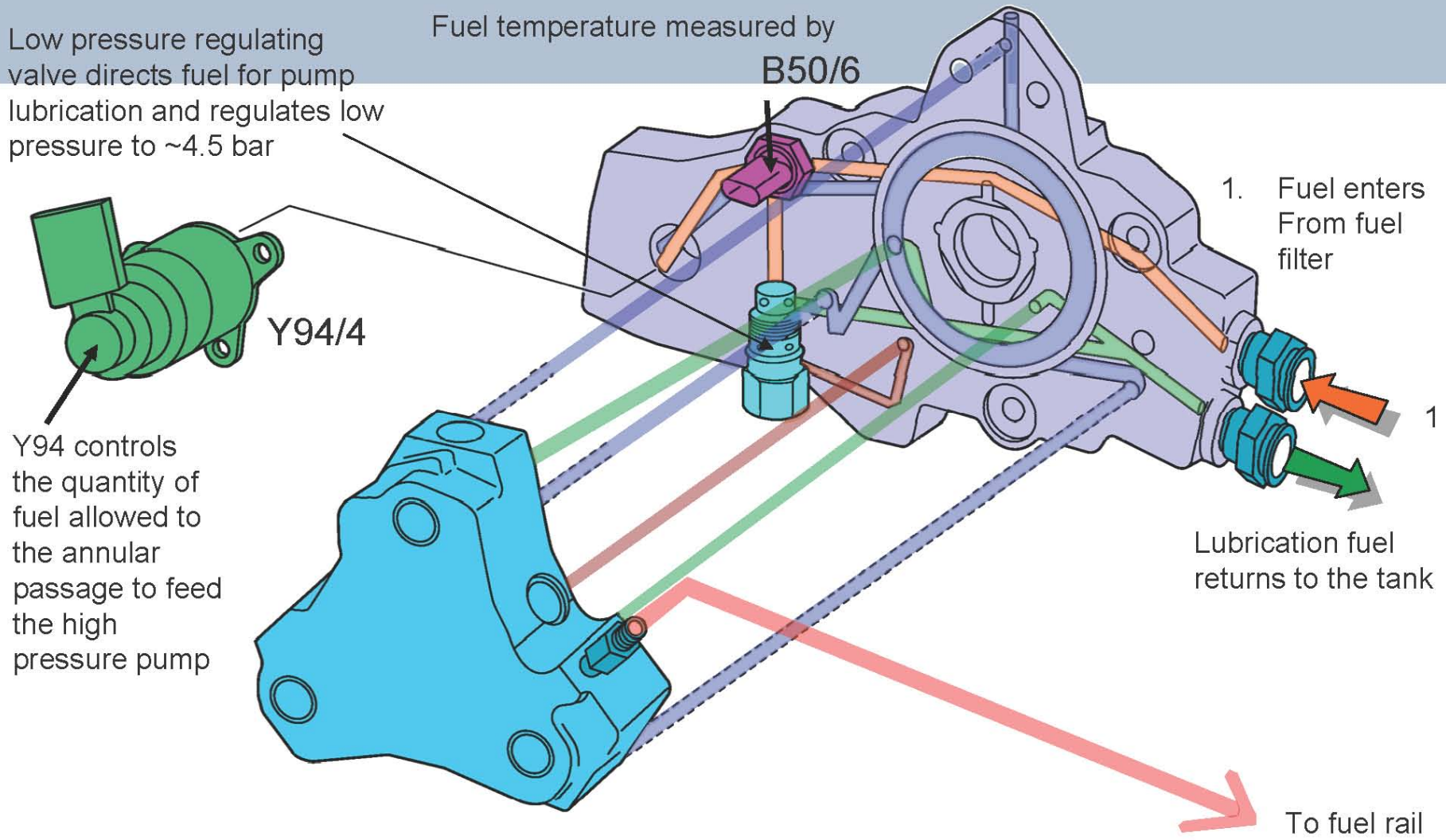
The leak oil line is available as one part only!

Service Note

Common Rail System Repair Work Note

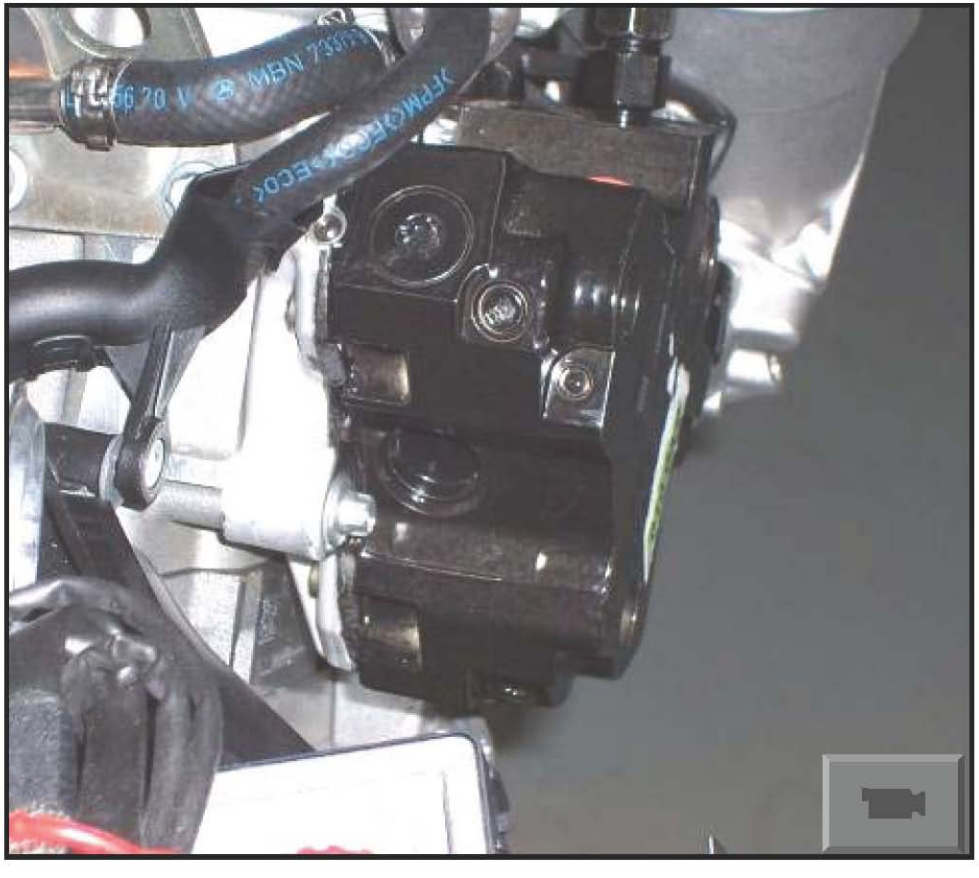
- There is a leakage test kit available for this system
- Never compress leakage lines, piezo actuator will damage immediately due to high back-flow pressure (35 - 40 bar)
- High pressure component faults are minimal if a fault is recorded, check low pressure system first, possible causes could be;
  - Diesel fuel quality/contamination
  - Fuel pump circuit
  - Fuel filter
  - Return flow pipe and/or fuel delivery module





Pump operation

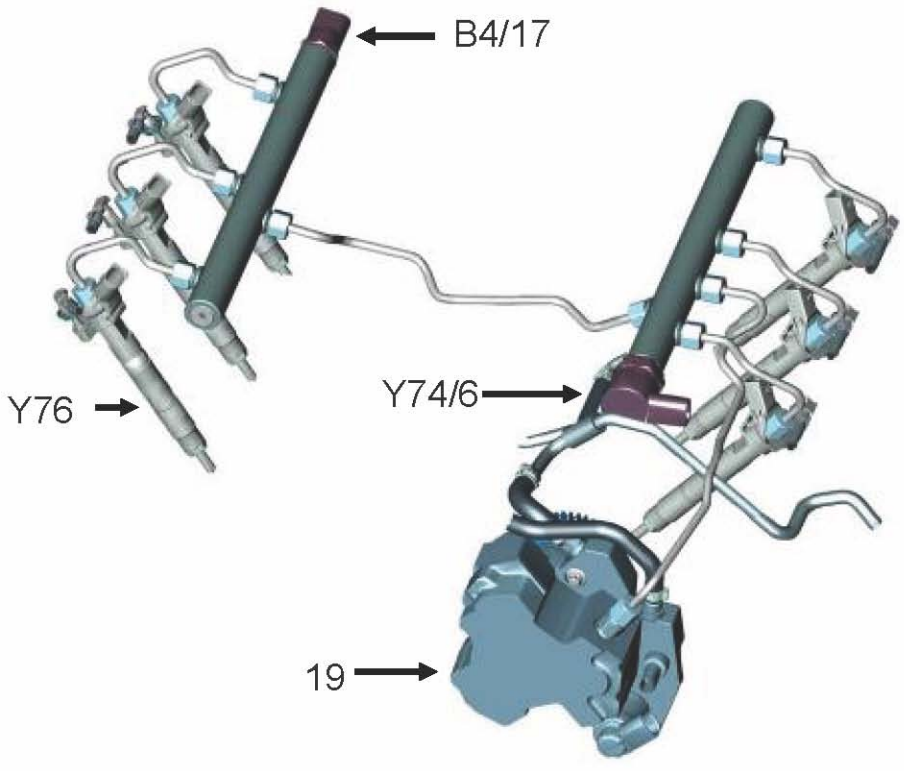
High Pressure Pump



High Pressure Fuel System

Includes the following fuel system components:

- High pressure pump (19)
- High pressure fuel lines
- Fuel rails (Left and Right)
- Pressure Regulating Valve (Y74/6)
- Piezo fuel injectors (Y76/18 - 23)
- Rail pressure sensor (B4/17)



Pressure Regulator Valve (Y74/6)

- Located in the fuel rail, the pressure regulator valve is spring loaded in the open position to allow for fuel expansion and retraction of the fuel at rest
- CDI control unit (N3/30) controls magnetic force which controls opening and the fuel pressure during operation
- In de-energized state the valve opens

Note: Pressure regulator valve cannot be replaced individually but only with the rail

Pressure regulator valve (Y74/6)

Quantity Control Valve (Y94/4)

- Located in the high pressure pump
- CDI control unit regulates the quantity of fuel fed to the high pressure pump via a PWM signal according to demand

Quantity control valve (Y94/4)

Fuel Rail Pressure Regulation

- Rail pressure regulation occurs via either the pressure regulator valve (Y74/6) or quantity control valve (Y94/4)

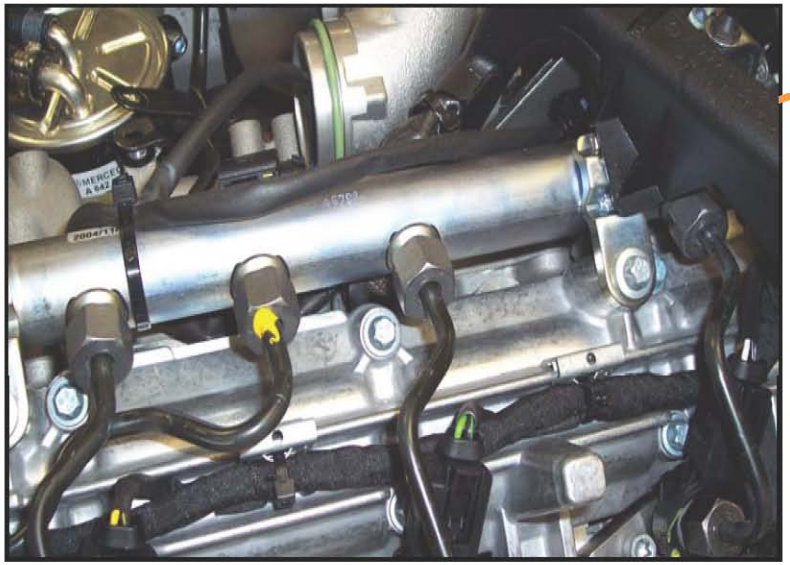
- Regulation with pressure regulator valve (Y74/6)
  - up to 30s after engine start
  - fuel temperature > 68°F (20°C)
  - idling (with exceptions)
  - decel mode

- Regulation with quantity control valve (Y94/4)
  - after 30s of engine running
  - fuel temperature > 68°F (20°C)
  - in “Normal” driving mode
  - > 1200 RPM or injection quantity > 15.5 mm^3 / intake stroke (hub)
  - not in decel mode

Pressure regulator valve (Y74/6)

Quantity control valve (Y94/4)

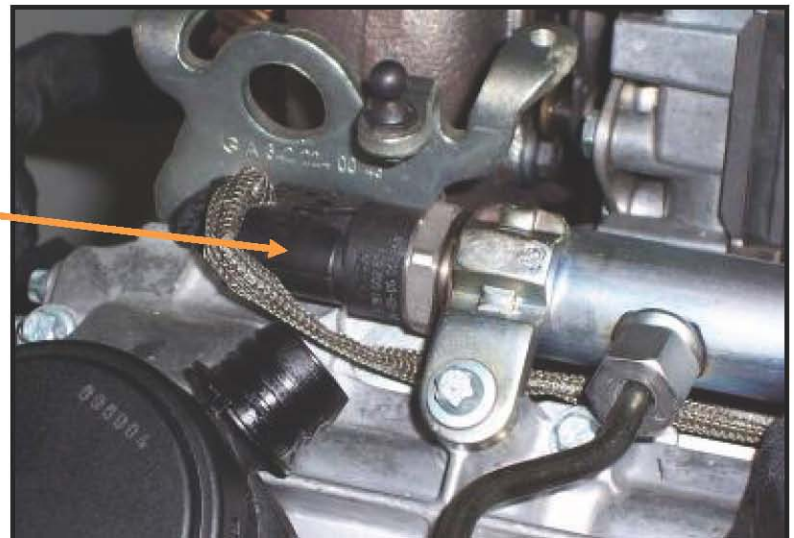
High Pressure Fuel System



Fuel Rails - both rails are equipped with throttles (0.8 mm) to reduce pressure waves. Only the drain on the left rail has no throttle (connection to the right rail).

Note: Consider the throttles in the rails as potential places for blockage when diagnosing performance complaints

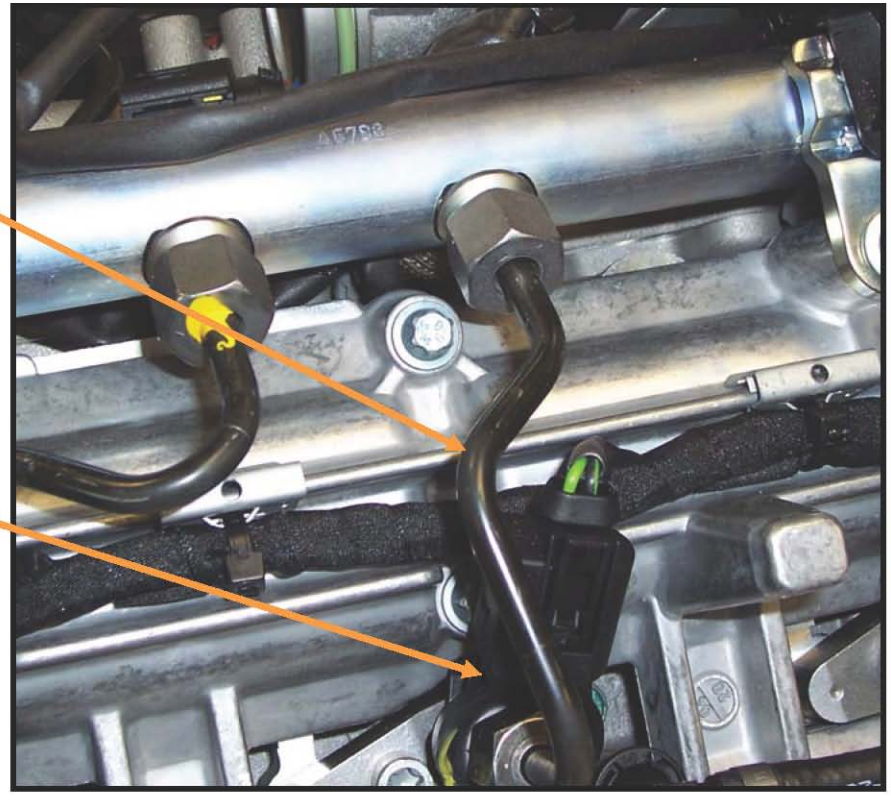
Rail pressure sensor



High Pressure Fuel System

High pressure fuel line

Piezo Injector

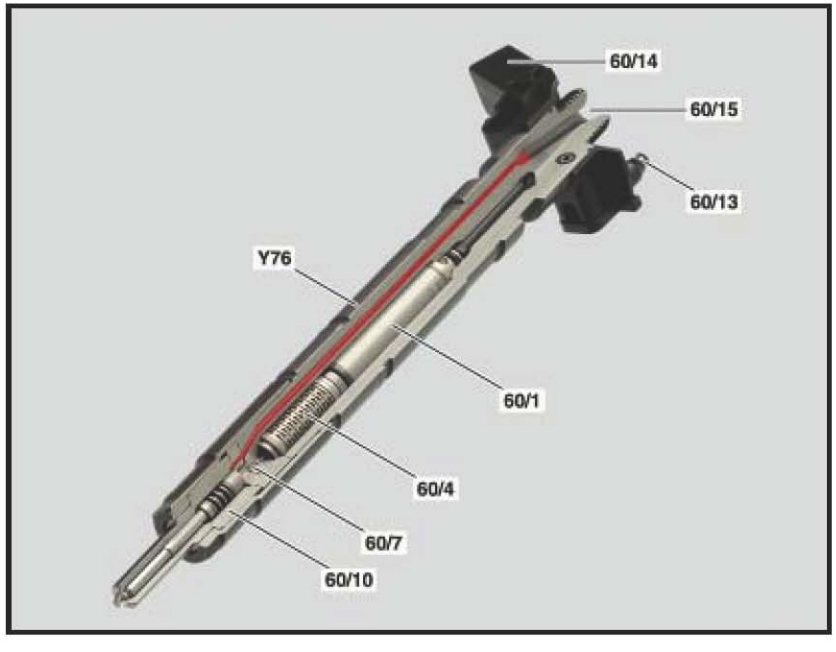


Piezo Fuel Injector (Y76)

Fuel injector (Y76)

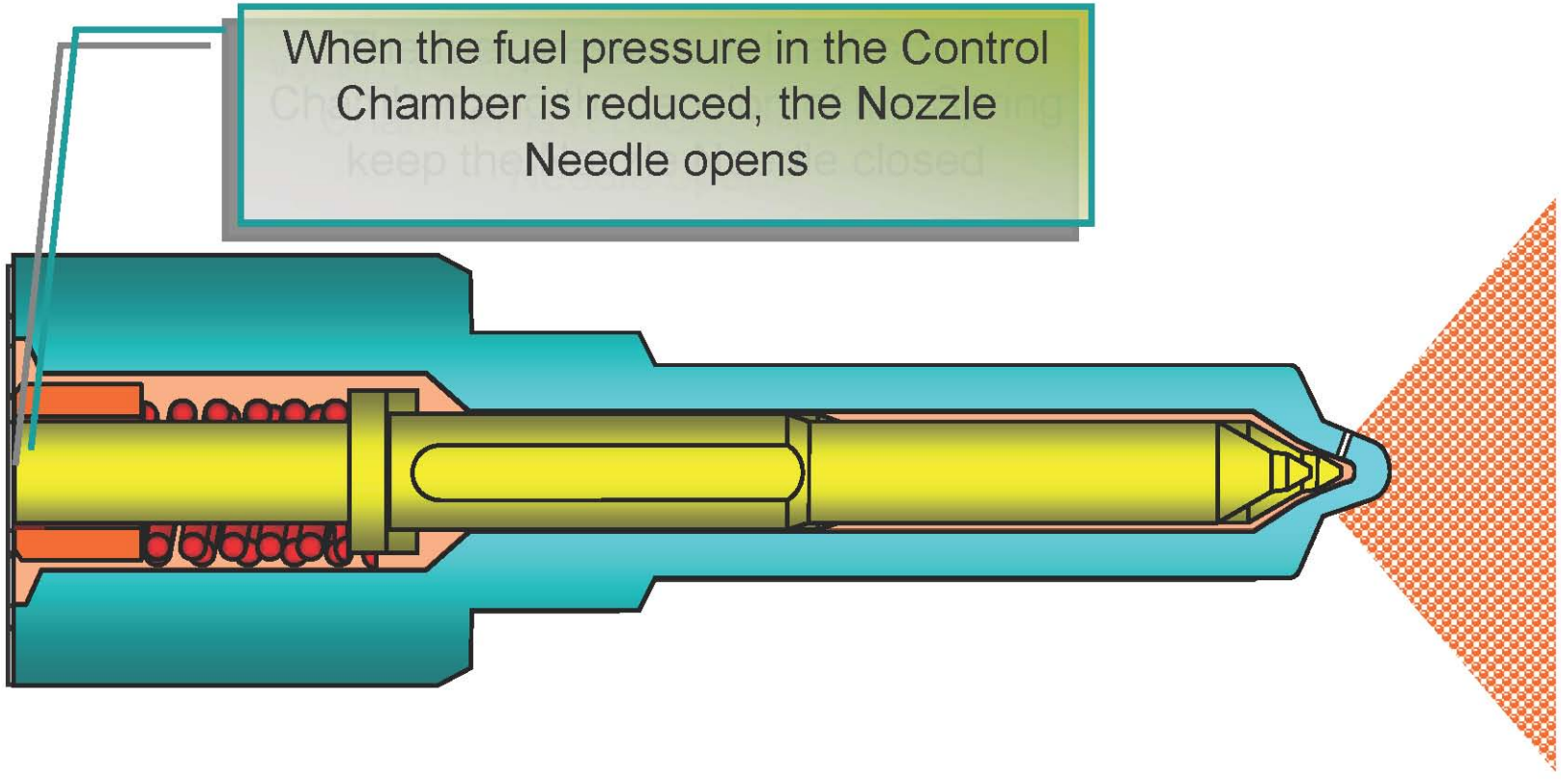
- Fast-switching piezo actuators
- Applying voltage opens nozzle needle
- Small fuel quantities achieved via very fast opening
  - – achieved with high voltage
- Technical details per injector:
  - – max. voltage: approx. 200 volts
  - – max. current: approx. 15 A
  - – internal resistance: approx. 180 K ohm
  - – 8 hole nozzle

Note:
Never disconnect injectors with “Ignition ON” due to high voltage!



60/1	Actuator module	60/14	Connector
60/4	Coupler module	60/15	High-pressure line connection
60/7	Valve group		
60/10	Nozzle module	Y76	Piezo fuel injector
60/13	Return		

Piezo Fuel Injector (Y76)



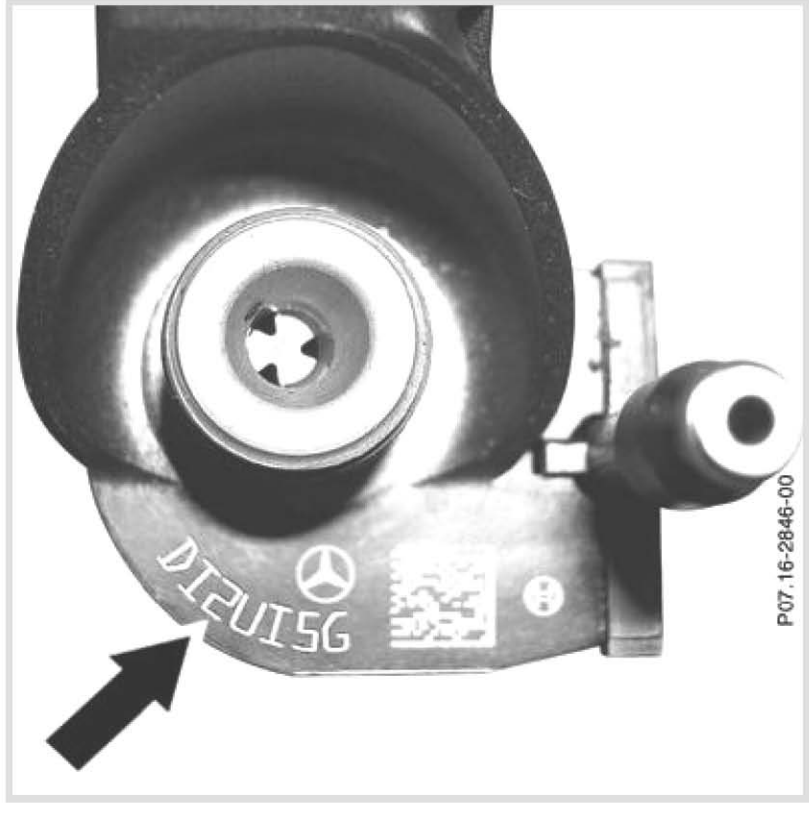
Injector 7 Digit Adjustment Value

To ensure proper injector calibration, two correction functions are contained within the 7-digit adjustment value:

- Correction of electrical units (ISA)
- Correction of mechanical units (IMA)

These correction factors allow for production tolerances and drift compensation

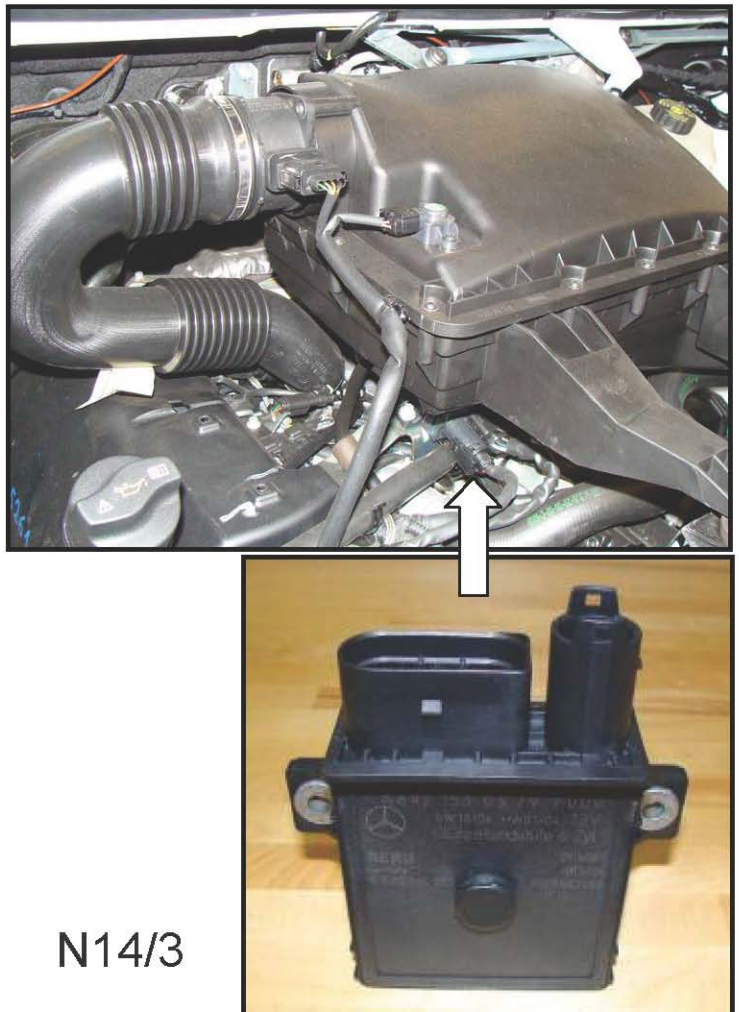
After replacing an injector, the coding number of the new injector must be entered in the CDI control unit. If the coding is not entered, the following complaints are possible: rough running, noisy injection and power loss



ISS Glow Plug System

ISS (Instant Start System) glow plug system is used to determine and control the following glow situations:

- Preglowing
- Ready-to-start glowing
- Start glowing
- Afterglowing
- Diesel particulate filter glowing
- Emergency glowing
- Diagnosis



N14/3

ISS Glow Plug System Processes

Preglowing - Heats the glow plugs as soon as circuit 87 is turned on. Full voltage

Ready-to-start glowing - After preglowing until engine start. Pulsed power

Start glowing - Glow during starting

Afterglowing - Improves running after cold start

Diesel particulate filter glowing - Glow plugs heated to 850°C to support DPF regeneration

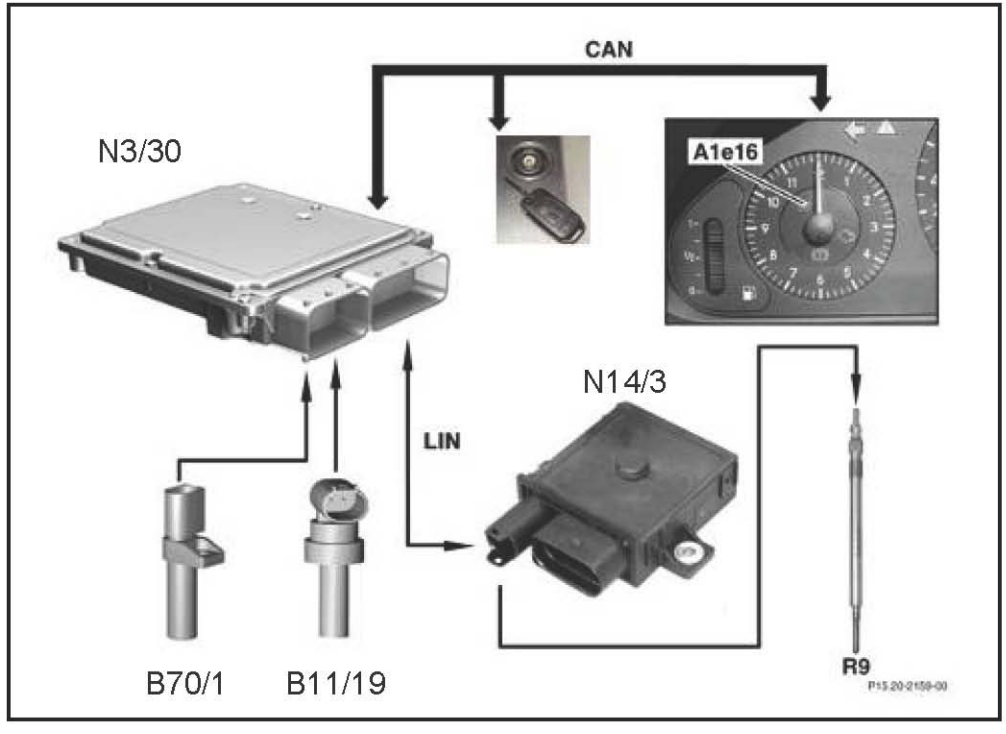
Emergency glowing - If a LIN bus error occurs, emergency function is triggered

Diagnosis – (DAS system diagnosis) Glow plugs energized at a low temperature using the SDS for diagnostic, independently of coolant temperature

Glow Plug System

The glow time output stage (N14/3) receives the following information over a LIN bus from the CDI (N3/30) control unit:

- RPM
- Engine load
- Coolant temperature



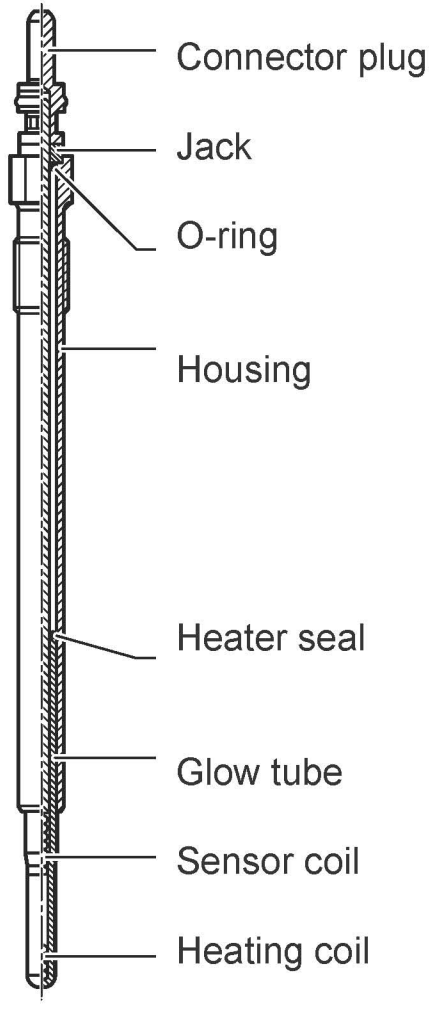
A1e36	Preglow indicator	N14/3	Glow time output stage
B11/19	Coolant temp sensor	R9	Glow plugs
B70/1	Crankshaft position sensor	LIN	Local-interconnet Network
N3/30	CDI control unit		

ISS Glow Plugs

ISS (Instant Start System) glow plugs (R9/1-6)

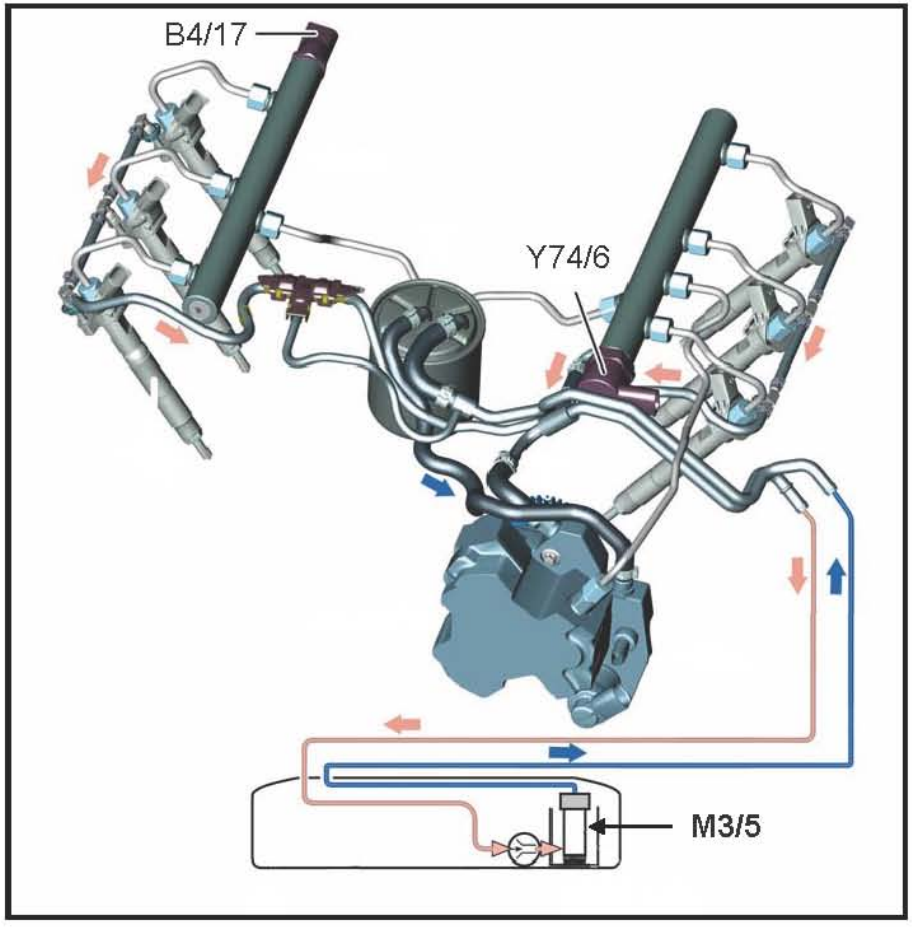
The rated voltage is 4.5 V, the switch-on current is < 35 A, the steady-state current is < 10A.

Note: The ISS glow plugs must only be operated via the control unit !



Fuel Control: Engine Start

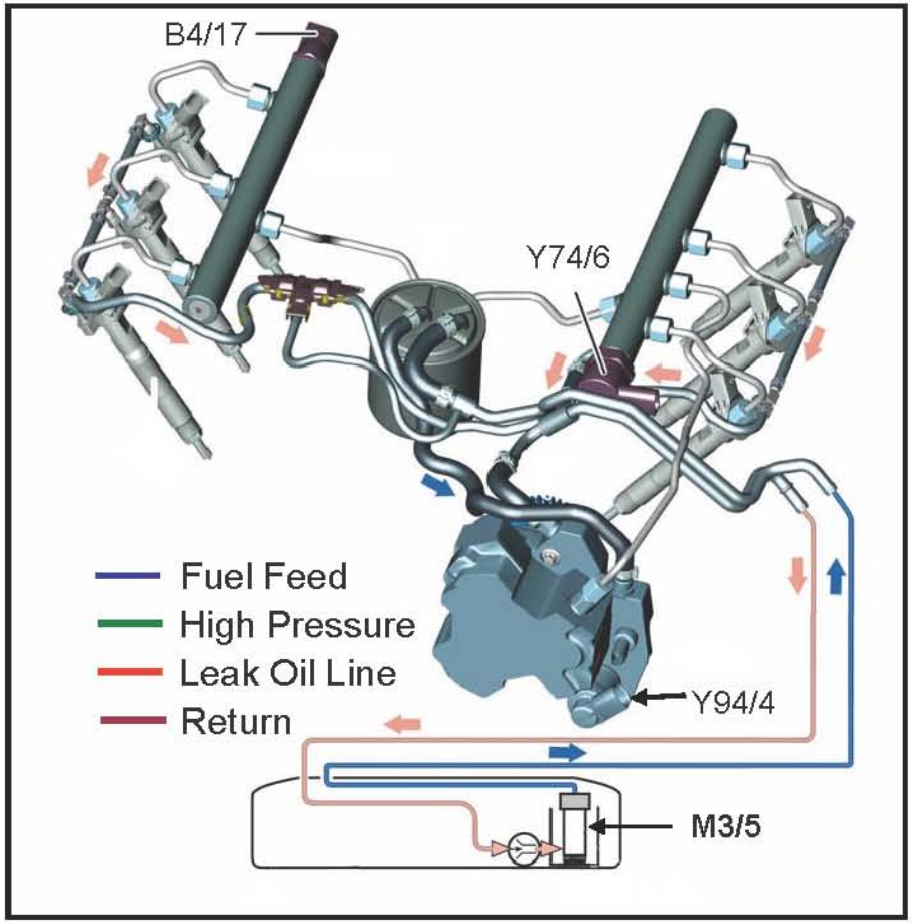
- Electric fuel pump (M3/5) supplies fuel through the fuel filter to the high pressure pump
- Pressure relief valve in the high pressure pump regulates fuel to maintain approx. 65 psi (4.5 bar)
- High pressure pump supplies fuel at approx. 4351 psi (300 bar) to fuel rails and inlet side of fuel injectors
- High pressure is regulated via Y74/6 and monitored via B4/17
- CDI control unit actuates injectors



Fuel Control: Engine Running

- High pressure fuel enters left rail which is connected to right rail via a high pressure line
- B4/17 monitors pressure
- Y74/6 (located on the left rail) regulates rail pressure
- Y94/4 allows full fuel flow to the high pressure pump
- Low pressure at return side of injectors becomes return fuel

Note:
Injector pipes must be fastened with the correct torque or you might narrow the orifices in the rails!



CDI Control Unit (N3/30)

The CDI control unit's main functions are:

- Injection time and volume
- Injection pressure
- Delivery rate of high pressure pump
- Idle speed control
- Smooth running control
- RPM limitation
- Decel fuel shutoff
- Rail pressure control
- Air control
- Cruise control
- Diagnosis (OBD)
- DEF regulation
- Alternator LIN
- Glow plug
- EGR
- Fan Control

CDI Control Unit (N3/30)

The CDI Control Unit:

- has two internal sensors
  - Temperature sensor
  - Atmospheric pressure sensor (For altitude adjustment)

- communicates over the CAN with:
  - Instrument cluster (A1)
  - Electronic Shift Module
  - ESP control module
  - Electronic Ignition Switch
  - Steering column control module (N80)
  - Transmission control module

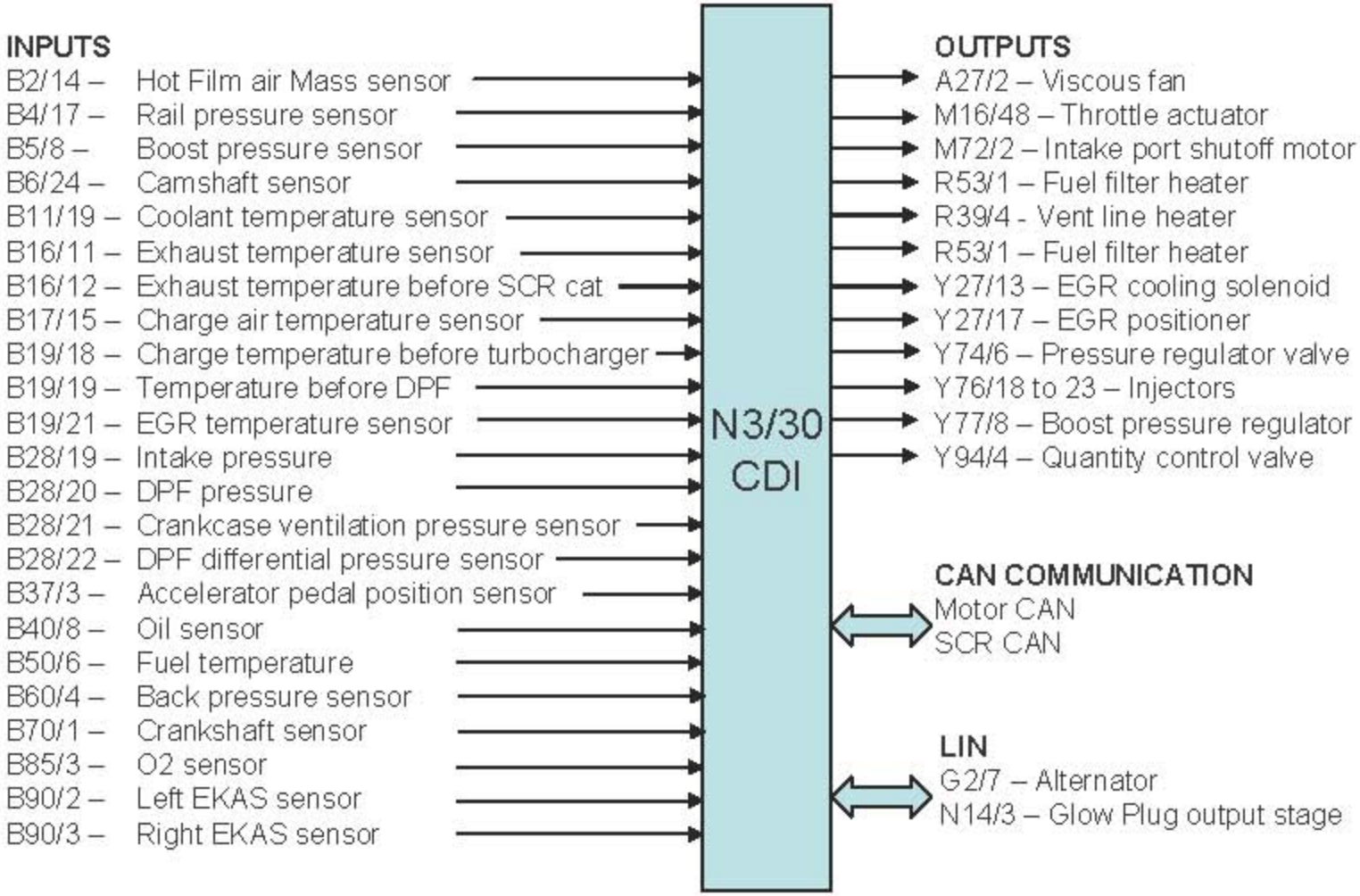
- communicates over the LIN network with
  - Alternator (G2/7)
  - Glow time output stage (N14/3)

Mixture Formation

Injection quantity calculated from the following variables:

- Engine load
- Engine speed
- Coolant temperature
- Boost air temperature
- Charge air pressure
- Rail pressure
- Fuel temperature
- Atmospheric pressure

N3/30 - Inputs/Outputs



Viscous Cooling Fan (A27/2)

The cooling fan is a viscous type that the CDI control unit (N3/30) monitors and can electronically influence based on:

- Coolant temperature
- Refrigerant pressure
- Oil temperature
- Boost air temperature
- Engine speed
- Fan speed
- Vehicle speed

Note: What appears to be a heavy gauge wire going to the manifold is a torque strap to prevent rotation of the clutch assembly.

Viscous Cooling Fan (A27/2)

The clutch is driven by the motor (1)

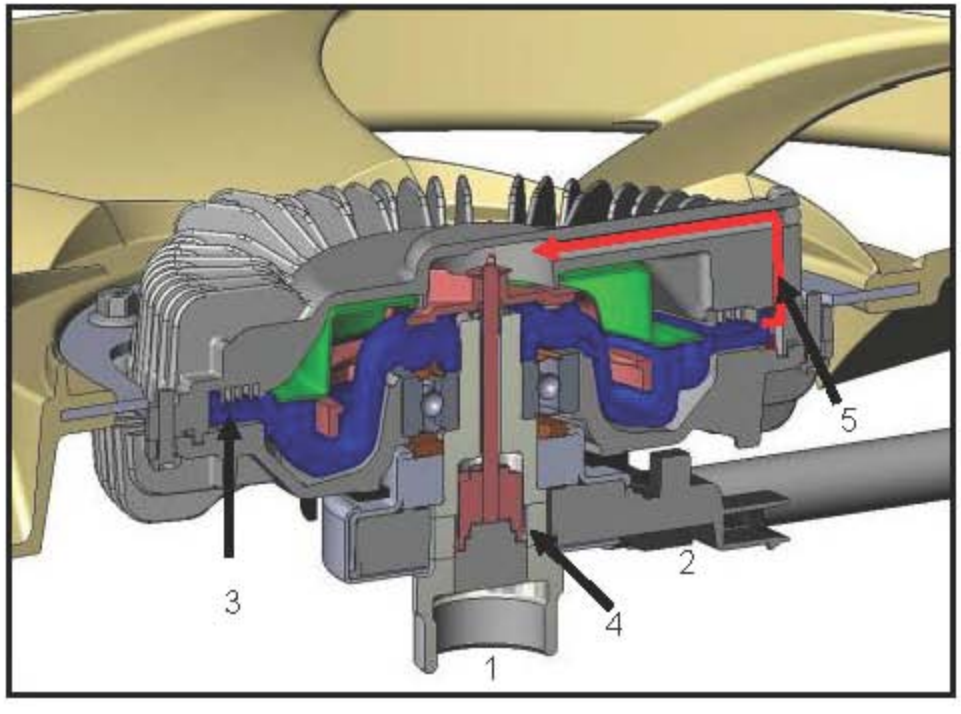
Speed monitored by sensor (2)

Friction connection created by oil quantity in the working area (3)

- More oil = higher fan speed
- Less oil = lower fan speed

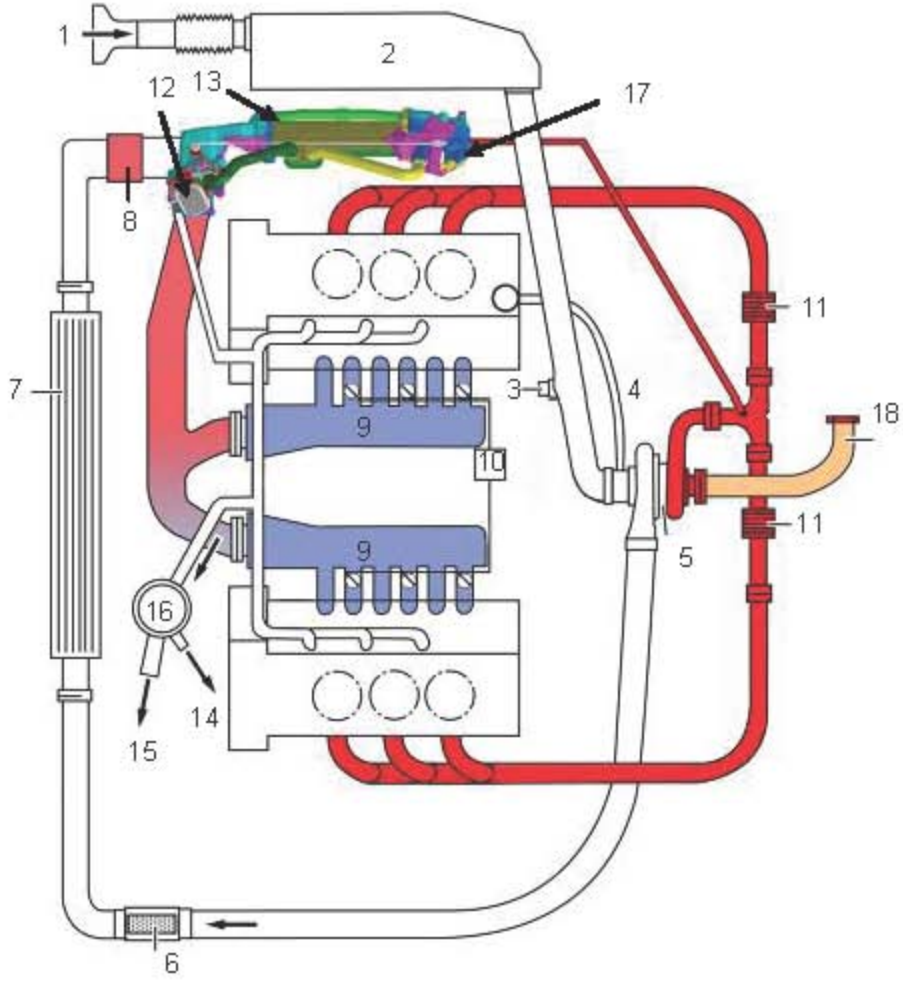
The CDI control unit (N3/30) controls the solenoid (4) via a PWM signal

The oil returns from the working area via the return ducts (5)



Intake System

1 Air intake
2 Air filter
3 Hot Film Air Mass sensor (B2/14)
4 Heated crankcase vent line
5 VTG Turbocharger
6 Pulsation damper
7 Charge air cooler
8 Throttle valve (M16/48)
9 Charge air distribution lines
10 Intake port shutoff
11 Expansion compensators
12 EGR valve with by-pass
13 EGR cooler
14 Vent line (Coolant)
15 Coolant to Radiator
16 Coolant thermostat
17 Coolant line from heater core
18 Exhaust



Pressure Sensor (B28/19)

Pressure sensor (B28/19) downstream of the air filter detects the absolute pressure in the intake duct and transmits the signal to the CDI control unit (N3/30) to:

- Protect turbocharger from over revving
- Monitor condition of air filter

B28/19 - Pressure sensor downstream of air filter

Hot Film Air Mass Sensor (B2/14)

Hot film MAF sensor

- MAF sensor monitors intake air volume
- Integrated temperature sensor monitors intake air temperature
- The signal from the MAF sensors are used by the CDI control unit for:
  - Inlet port shutoff
  - Exhaust gas recirculation
  - Fuel mixture

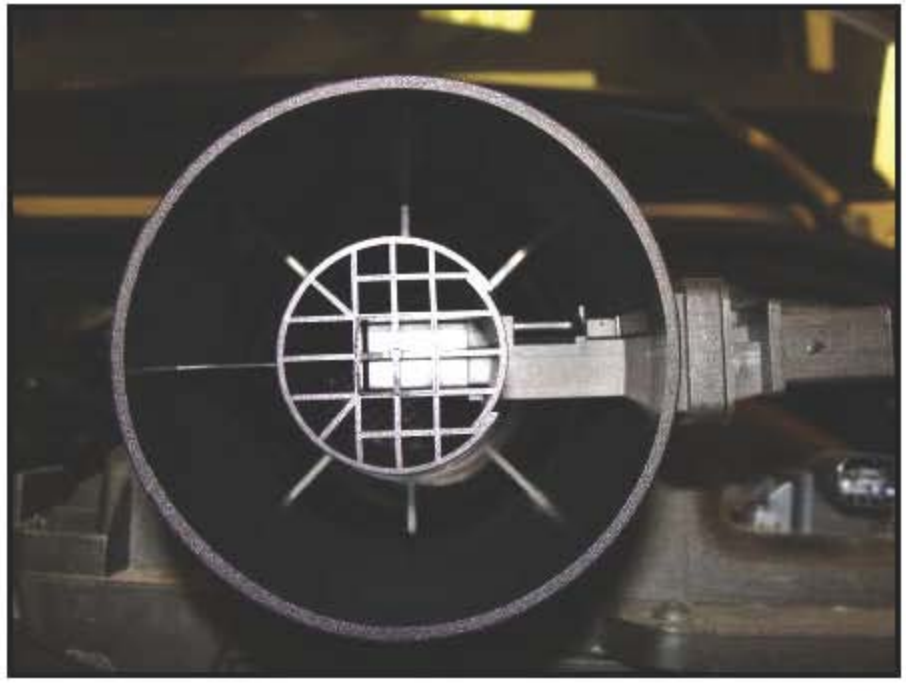
B2/14 – Hot film air mass sensor

Hot Film Air Mass Sensor (B2/14)

The Hot Film Air Mass sensor measures Oxygen and intake air temperature

This information is primarily used for:

- Intake port shutoff
- Exhaust gas recirculation
- Quantity mean value adaptation

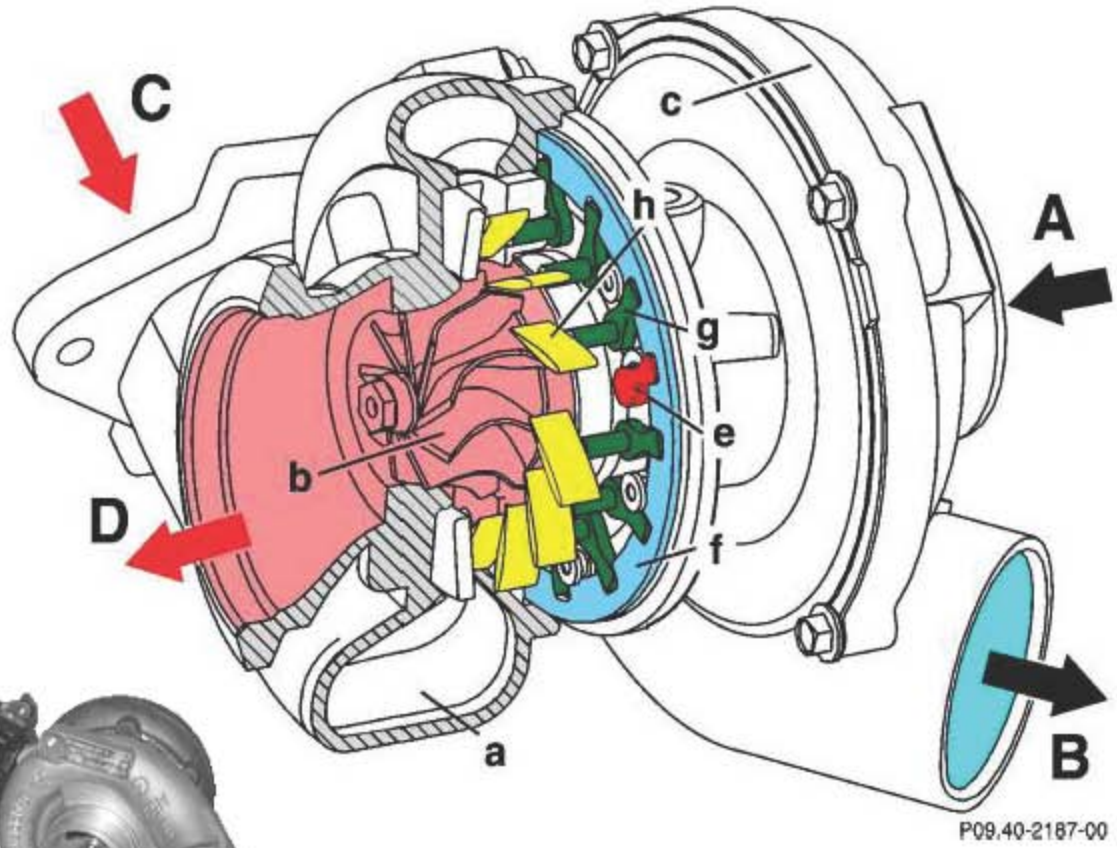


Turbocharger

VTG Turbocharger

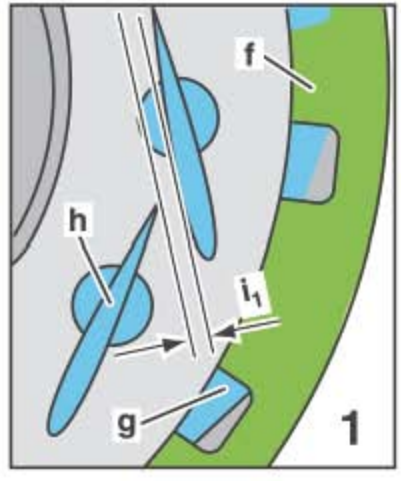
A Compressor entrance
B Compressor exit
C Exhaust to turbine wheel
D Exhaust exit

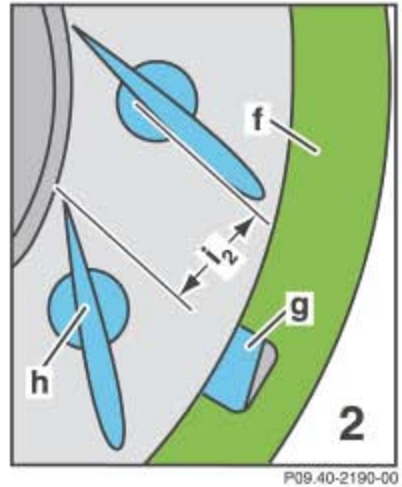
a Turbine housing
b Turbine wheel
c Compressor housing
e Pilot stud, control rods
f Adjusting ring
g Pilot stud, guide vanes
h Guide vanes



VTG Turbocharger

Using the boost pressure, boost air temperature and load requirements, CDI control unit use the boost pressure regulator (Y77/8) to rotate the adjusting ring which alters the cross section of the guide vanes to control boost pressure





P09.40-2190-00

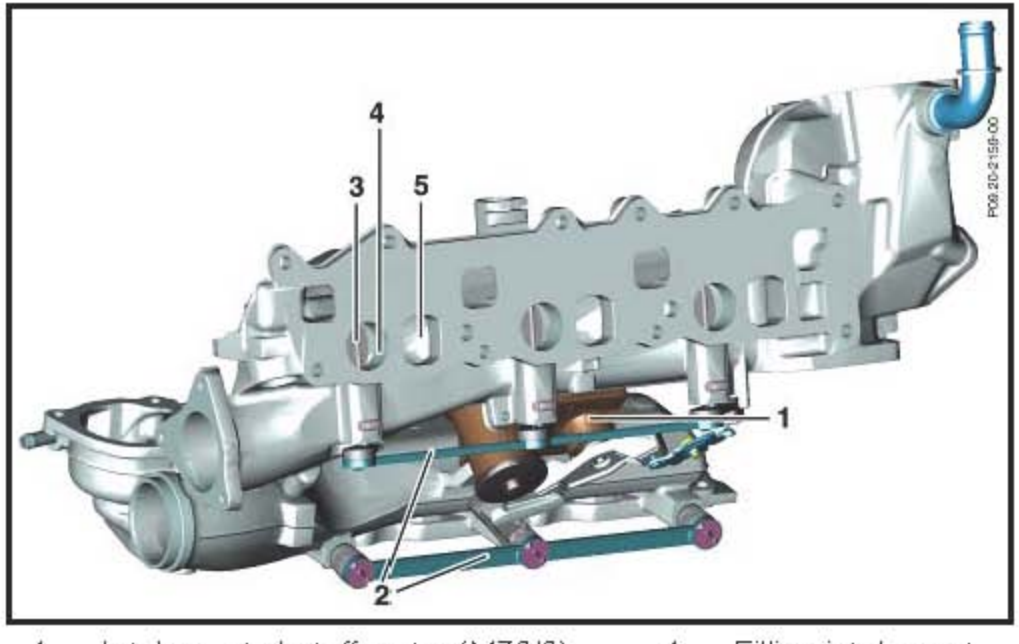
1	Guide vanes closed (High boost)
2	Guide vanes open (Low boost)
f	Adjusting ring
g	Guide vane pilot stud
h	Guide vane
i_1	Flow cross section with closed vanes
i_2	Flow cross section with open vanes

Charge Air Distribution

The Charge air distribution manifold swirl ports are PWM controlled from the CDI control unit to improve premixing of the air and fuel

The ports are:

- spring loaded open
- closed at low rpm and load
- opened as load and rpm increase



1	Intake port shutoff motor (M72/2)	4	Filling intake port
2	Linkage	5	Swirl intake port
3	Flap		

Back Pressure Sensor (B60/4)

- The exhaust back pressure sensor (B60/4) determines the back pressure upstream of the turbocharger

The CDI (N3/30) control unit monitors the diesel particulate filter fill level for protection of the turbocharger and engine

B60/4 – At rear of EGR cooler

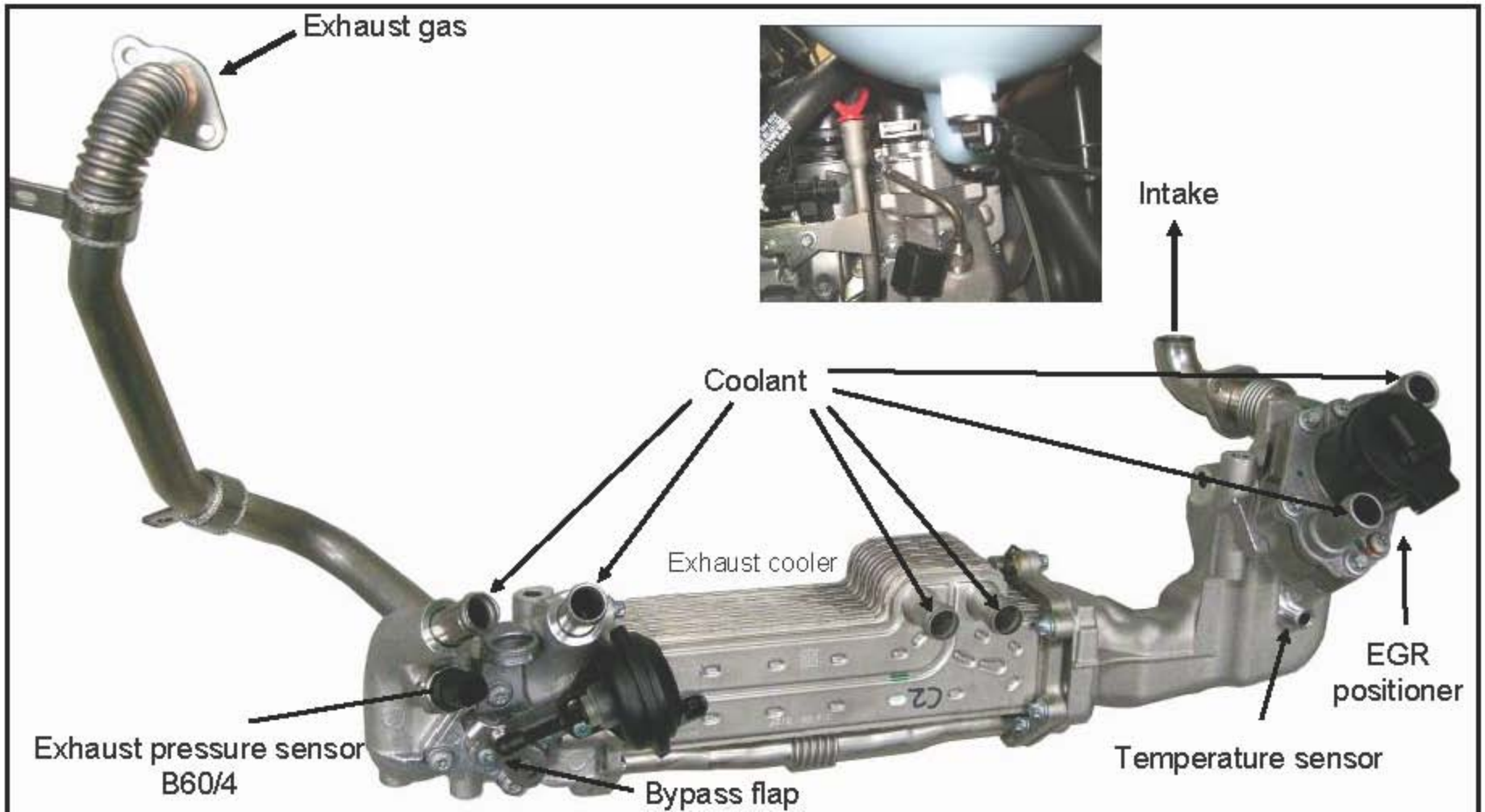
Exhaust Gas Recirculation

- Exhaust gas volume is regulated by the CDI (N3/30) control unit via the EGR positioner (Y27/17)
- The EGR valve controls the flow of exhaust gas via the EGR water cooled heat exchanger intercooler to the charge air manifold

Intake air is mixed with the cooled exhaust gas to reduce NO_x values

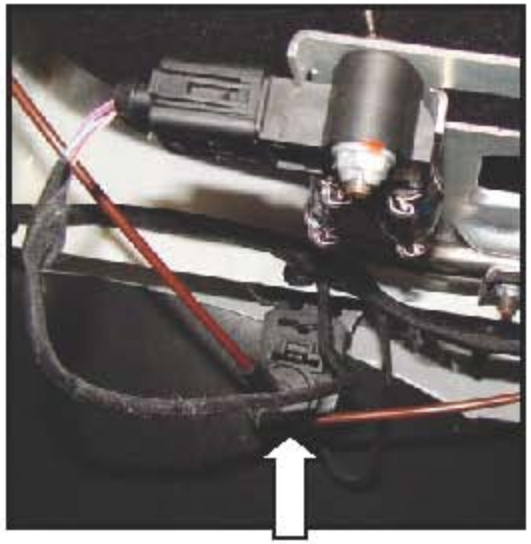
EGR positioner (Y27/17)

Exhaust Gas Recirculation Cooler

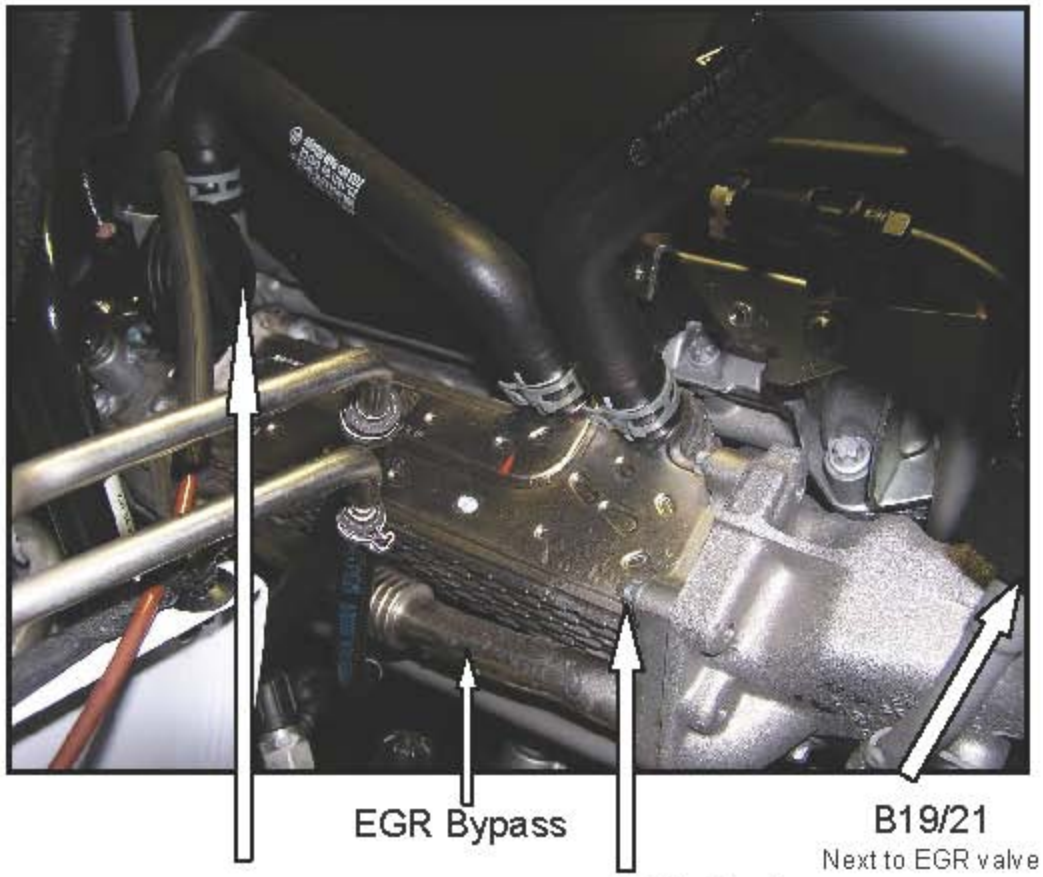


Exhaust Gas Recirculation Cooler

The CDI control unit (N3/30) monitors the EGR cooler temperature sensor (B19/21) and regulates a pneumatic bypass flap via a solenoid valve (Y27/13)



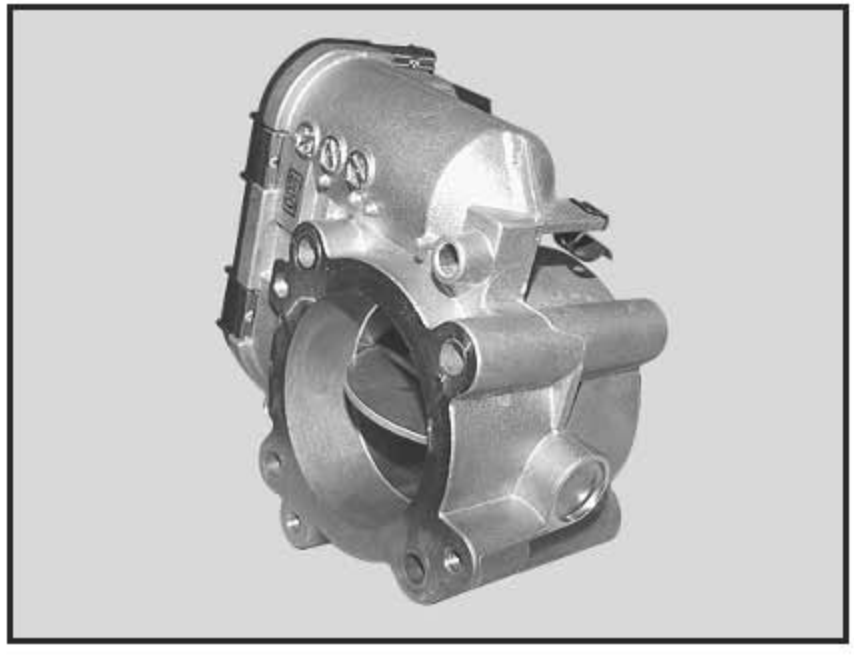
Y27/13 behind right headlamp



Throttle Valve Actuator (M16/48)

- The CDI control unit uses a PWM signal to regulate the throttle valve
- By throttling the intake air, the exhaust gas recirculation rate can be increased to reduce NO_x

During the DPF burn cycle, the flap is actuated to increase combustion temperature



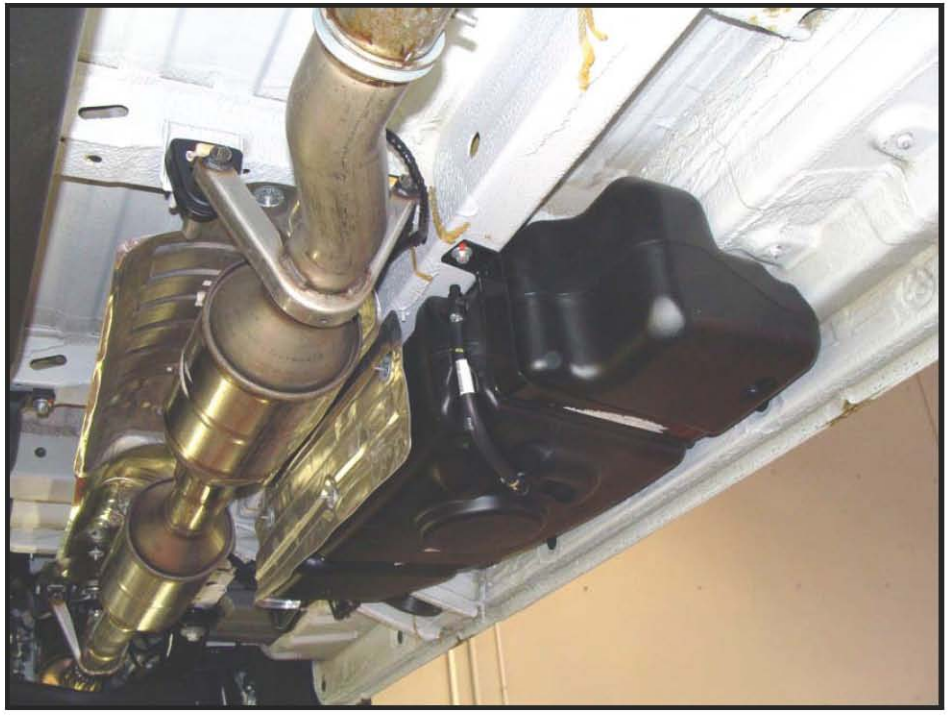
Throttle Valve Actuator (M16/48)

Exhaust Aftertreatment

2010 Sprinters will meet 50 state emission guidelines with the help of a SCR (Selective Catalytic Reduction) system that includes:

- DEF (Diesel Exhaust Fluid)
- SCR catalyst
- Electronic controllers
- Sensors
- Heating elements
- Dosing valve
- DEF tank

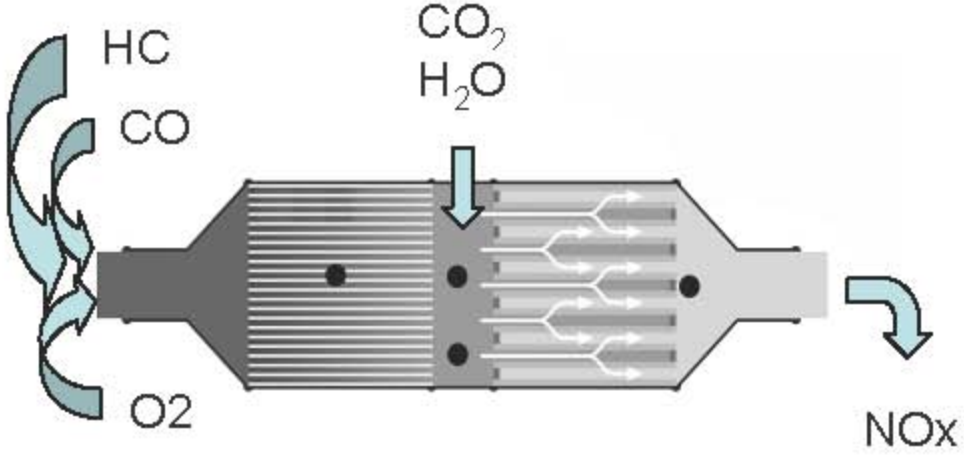
This system reduces NOx (Nitrogen Oxide) emissions by over 80%



Exhaust Aftertreatment

The engine controls have minimized:

- CO
- HC
- NOx levels



However, they still need to be reduced -

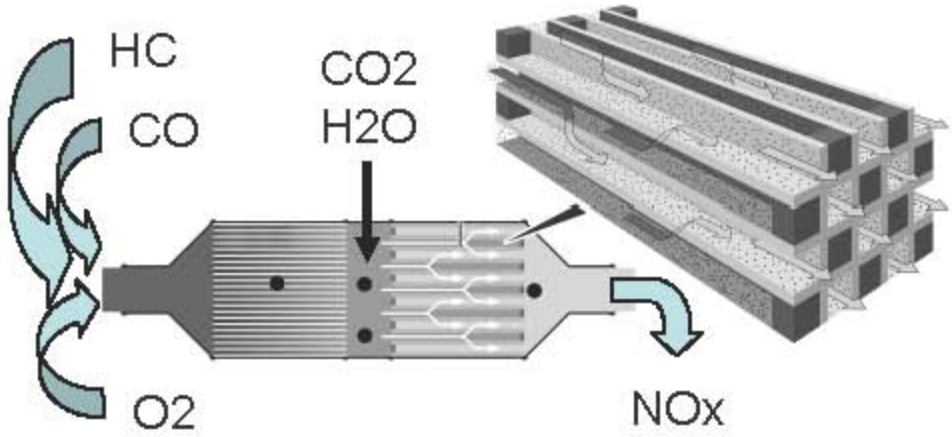
Exhaust Description

First exhaust component is the Oxidation Catalytic Converter which converts carbon monoxide and hydrocarbons to carbon dioxide and water

The Diesel Particulate Filter (DPF) in the same housing traps soot particles and are burned off using additional fuel injections

This action creates NO (Nitric Oxide) which combines with O2 to create NO2 (nitrogen dioxide)

The NOx will be reduced in the SCR catalyst



DEF (Diesel Exhaust Fluid)

DEF (Diesel Exhaust Fluid) is a mixture of ~33% Urea and ~67% water

DEF has a shelf life that is influenced by ambient temperature and humidity

Storage tank located on right side of vehicle, behind the B-pillar

DEF

DEF crystallizes, as seen in the upper picture and is also corrosive

Care must be taken when handling, if spilled near electrical connections it could cause electrical issues

Clean up with plenty of warm water if spilled

DEF freezes (as seen in the lower picture) at 12° F

All components that come into contact with DEF are heated

DEF Safety Notes

SAFETY NOTE:

- Wash hands and any body parts that come into contact with DEF
- Flush eyes immediately if they come in contact with DEF and seek immediate medical attention.
- Drink plenty of water if DEF is swallowed and seek immediate medical attention

DEF Consumption

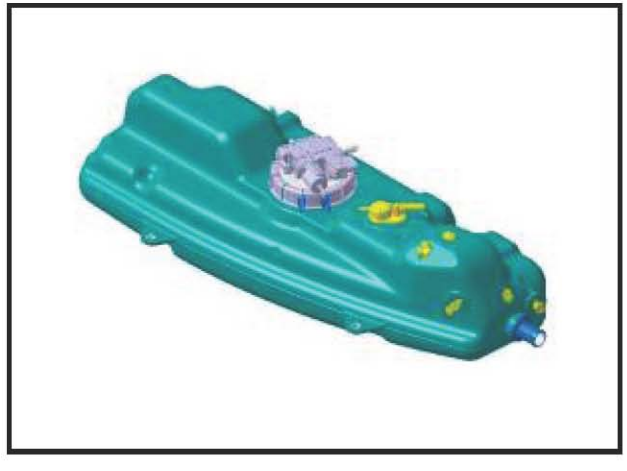
Extreme driving conditions can lead to higher DEF consumption:

- Engine operating conditions with high EGR rate
- Engine operating conditions with small injecting rate
- Cold outside temperatures
- Driving profile with low speed (city-drive)

DEF Tank

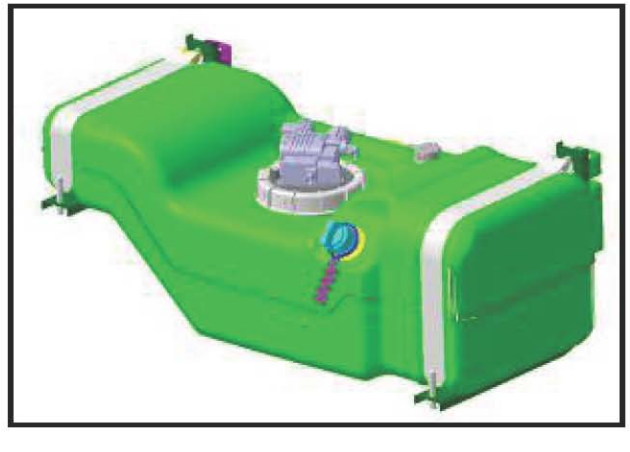
The DEF tank on cargo and passenger vans consists of:

- 5.07gal. (19.2L)
- SCR pump
- Temperature sensor
- Heating elements
- Level sensors
- Drain valve



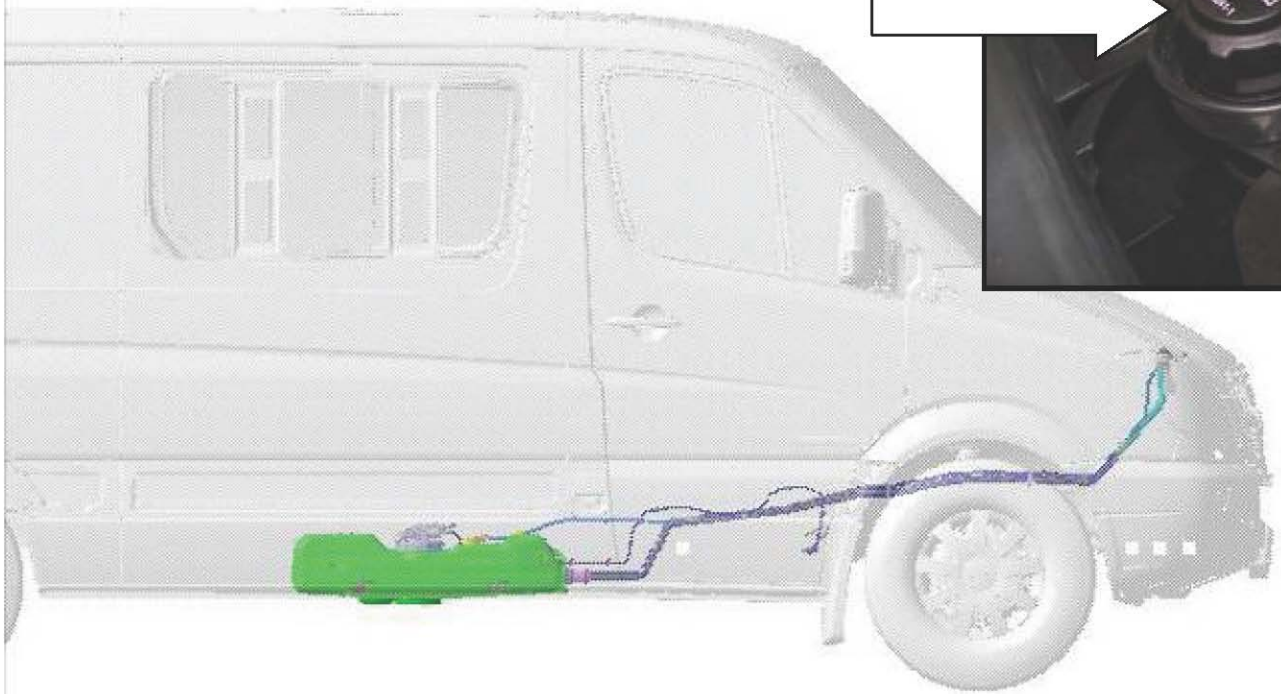
The chassis cab version differs:

- 5.86gal. (22.2L) tank
- SCR pump
- Temperature sensor
- Heating elements
- Level sensors
- No drain valve



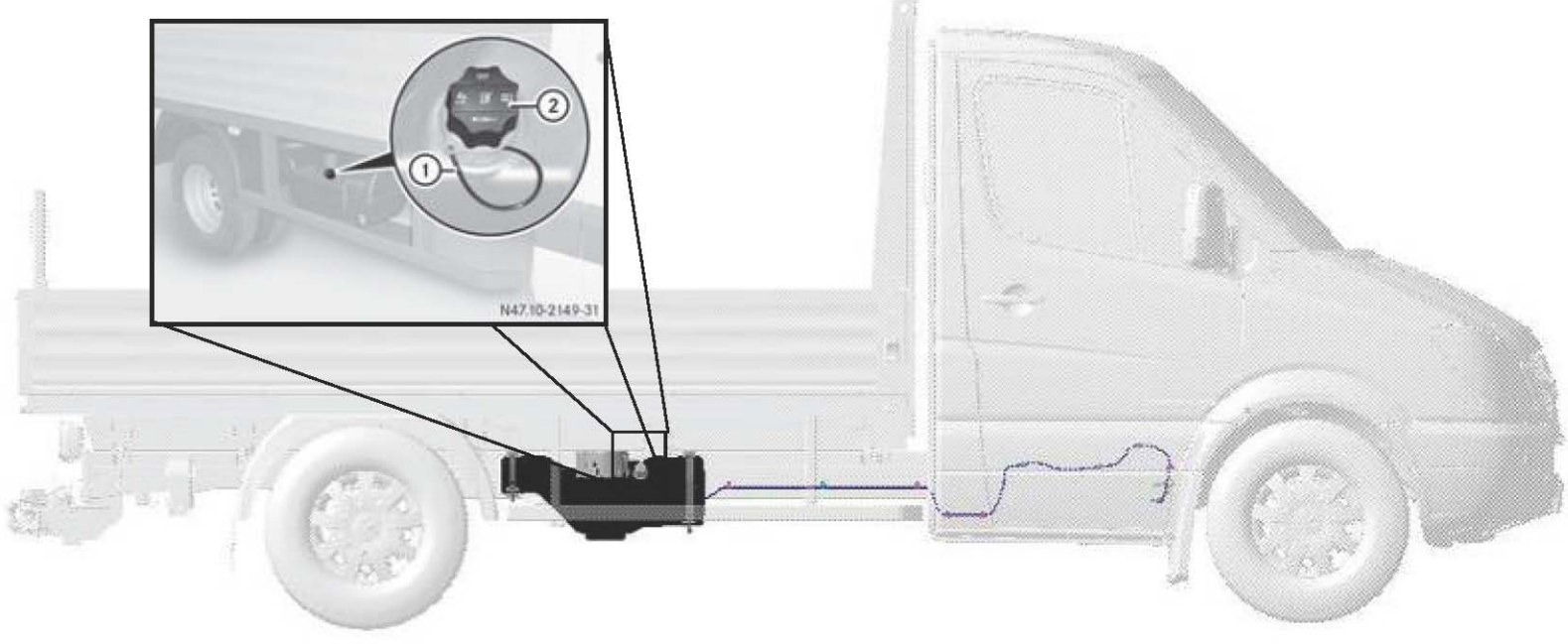
DEF Tank Filling

The DEF tank on cargo and passenger vehicles is filled from under the hood near coolant reservoir



DEF Tank Filling

The DEF tank on Chassis-Cab is filled on the right side of the vehicle
Special tool to open the cap is located in the jack area of the cab



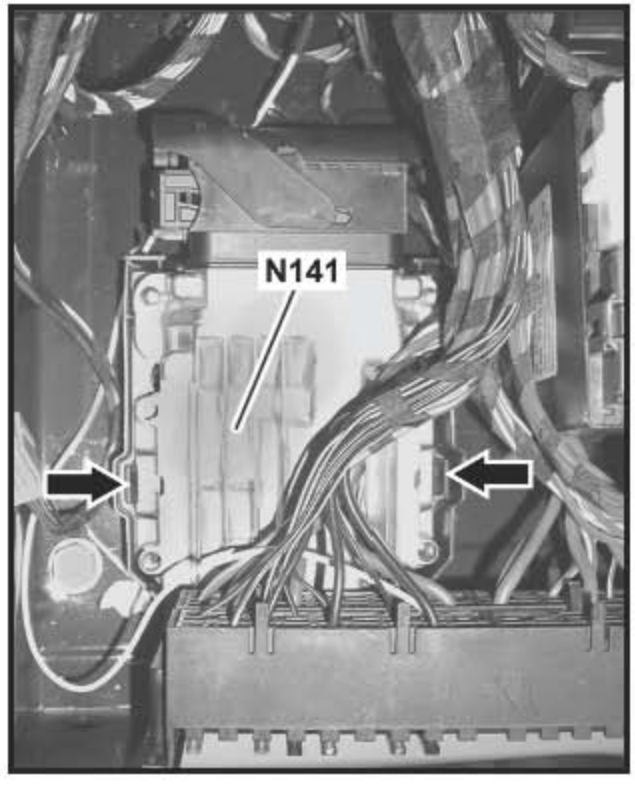
SCR Control Unit (N141)

The SCR Control Unit (N141) communicates with:

- The Pump Module
  - temperatures & pressure
- CDI control unit (N3/30) via the SCR CAN.

SCR outputs:

- Dosing valve (Y130) – PWM signal
  - Amount determined by CDI
- DEF system heating elements
- Reversing valve
- DEF pump



Located under the drive's seat

Dosing Valve (Y130)

The dosing valve is responsible for injecting the DEF into the exhaust prior to the SCR Catalytic converter

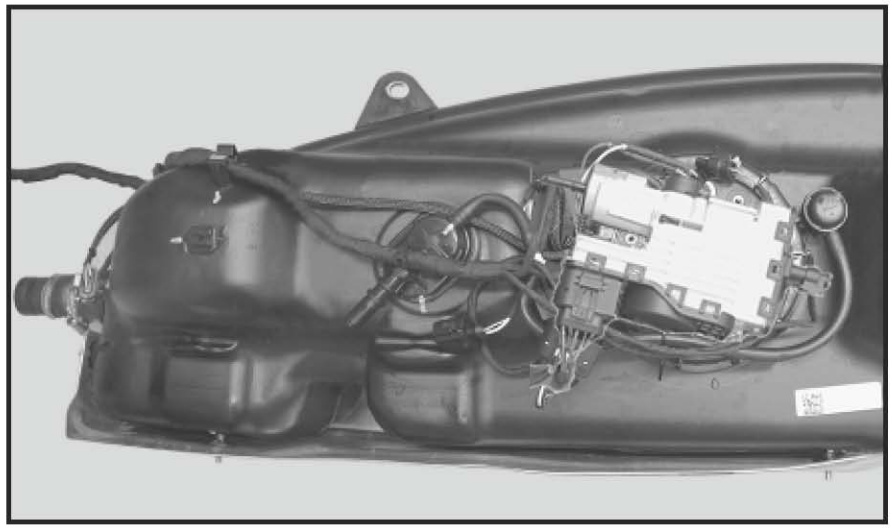
- Up to 5 bar pressure supplied via the DEF pump
- SCR control unit activates dosing valve via a PWM signal
- Valve is also opened when engine is shut down to purge the valve and pressure line of DEF
- PWM controlled from SCR control module N141

Y130 – DEF Dosing Valve

DEF Pump Module (A103)

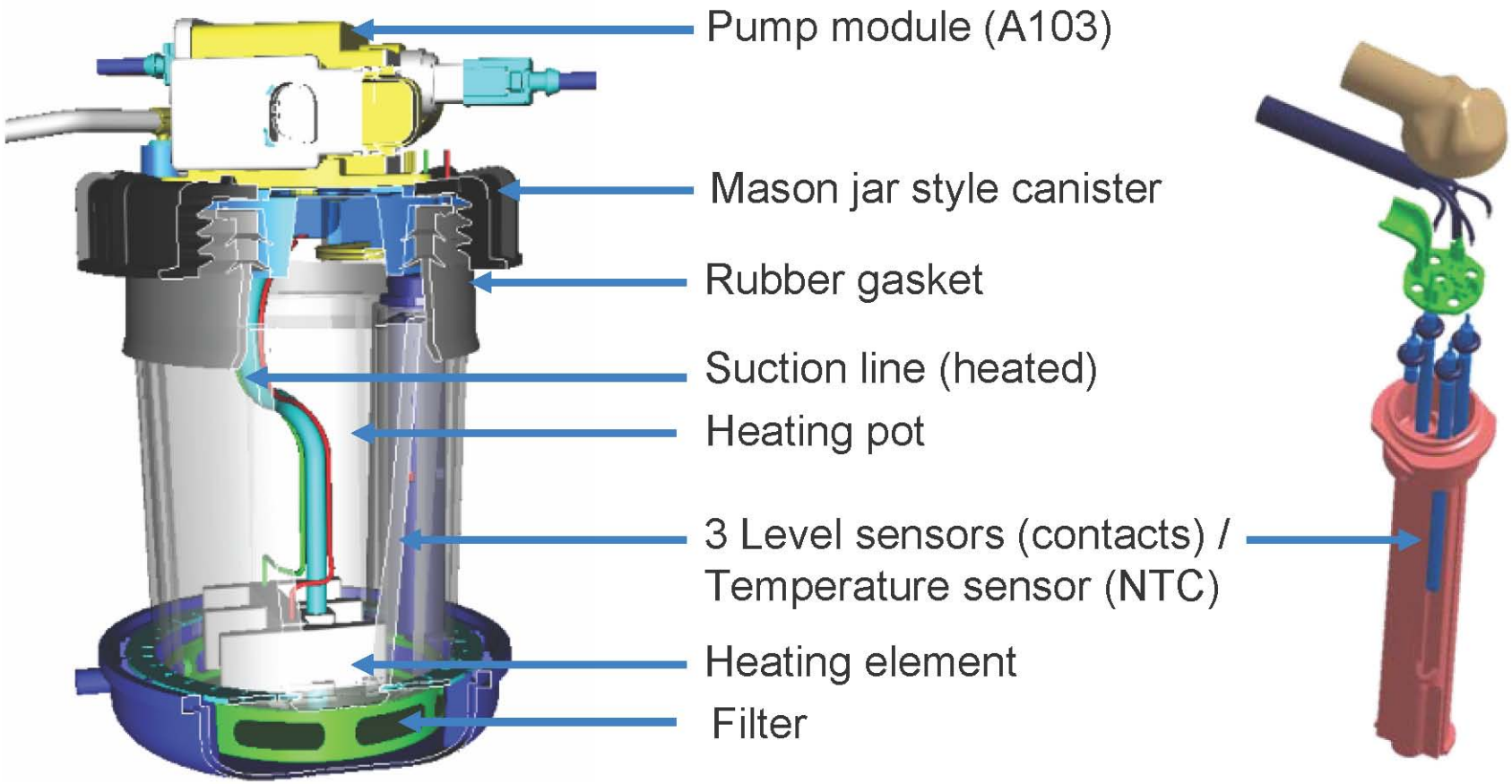
The Pump Module is controlled by the SCR Control Unit (N141) and consist of:

- DEF pump (M89) (Capable of 5 bar pressure)
- Tank level sensor (B152)
- Pressure sensor (B151)
- Temperature sensor
- Heating elements (R51)
- Reversing valve (Y129)
- Filter



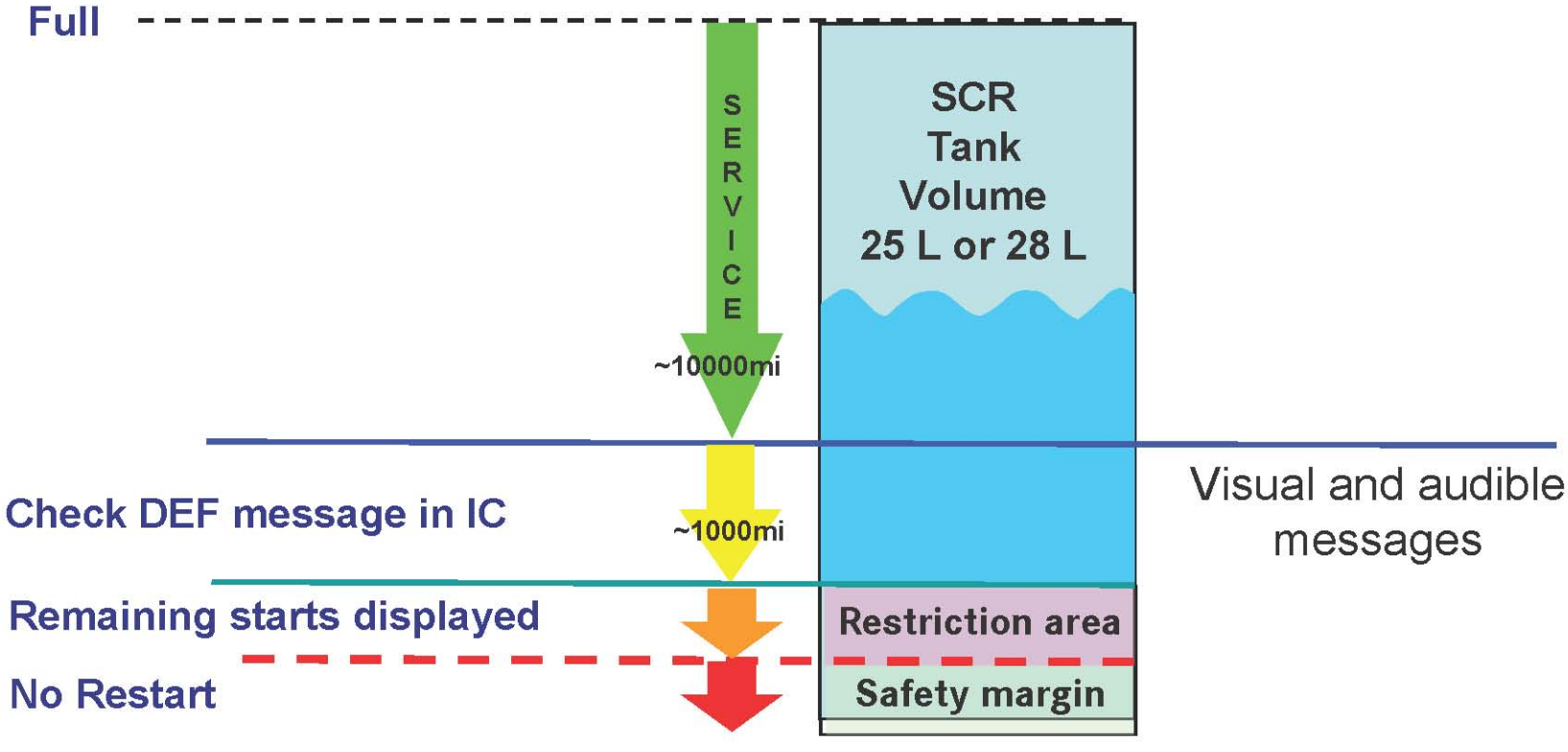
The Pump Module is located on the tank above the heating pot

DEF Tank Heating Pot



There are no moving parts inside the DEF tank

DEF Level Warnings



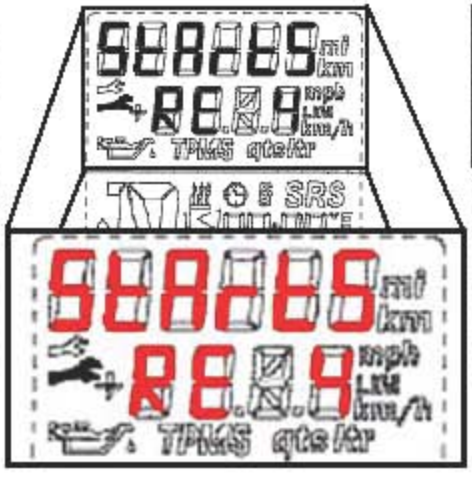
DEF Warnings – Lowline Cluster

When DEF level is in the Warning level range

gong

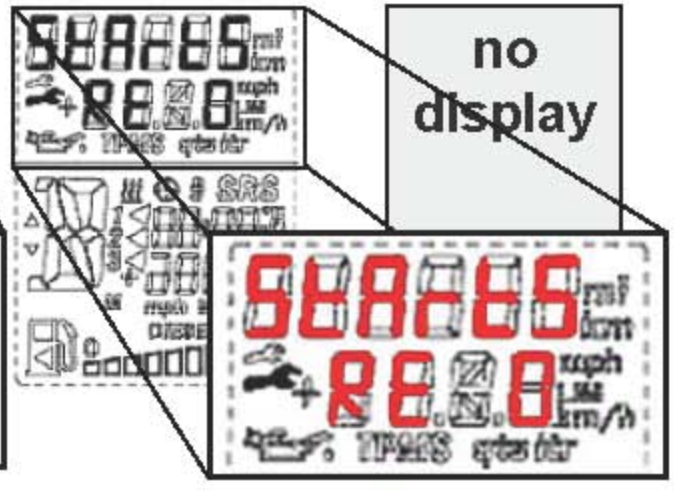
Limited Starts remaining

triple buzzer



No starts remaining

triple buzzer

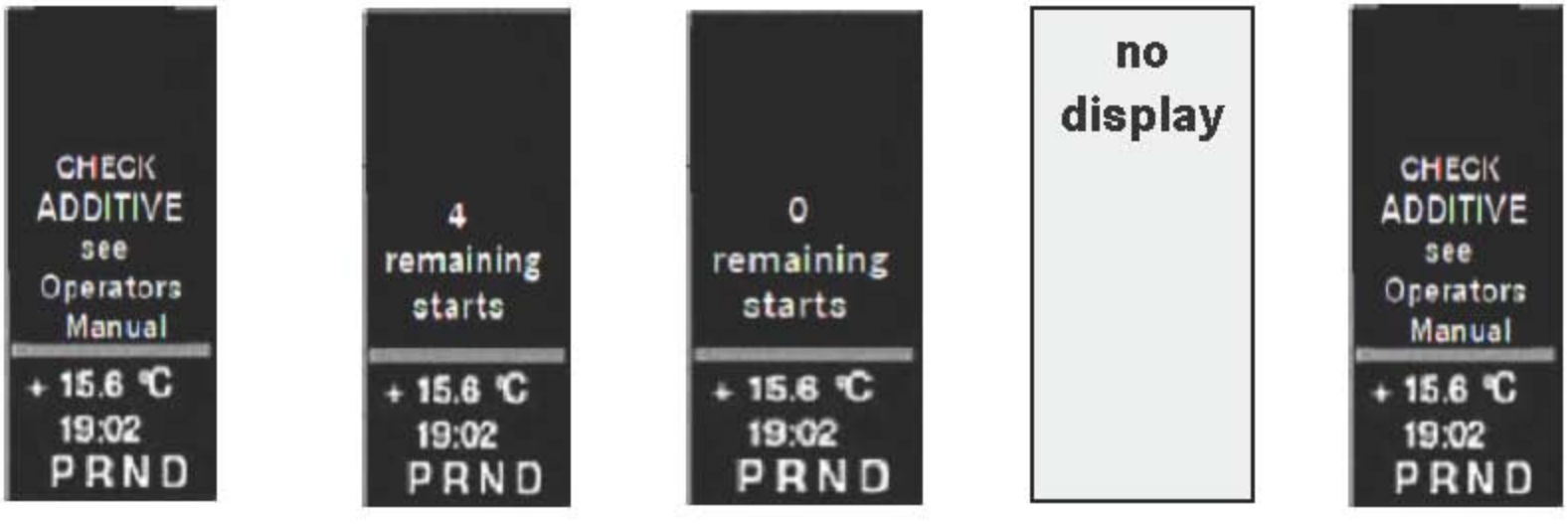


Failure of NOx-Sensor system

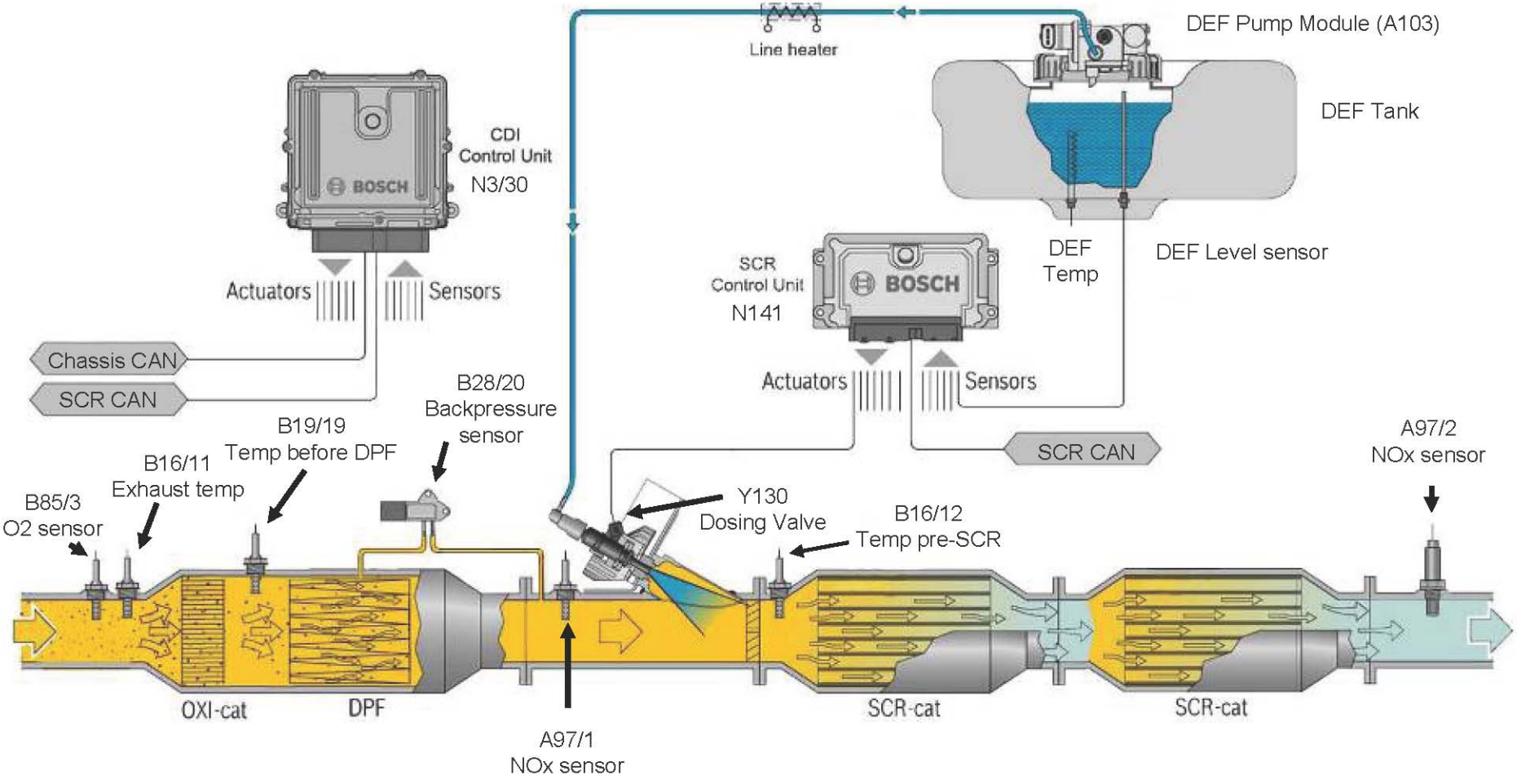
Wrong reducing agent

gong

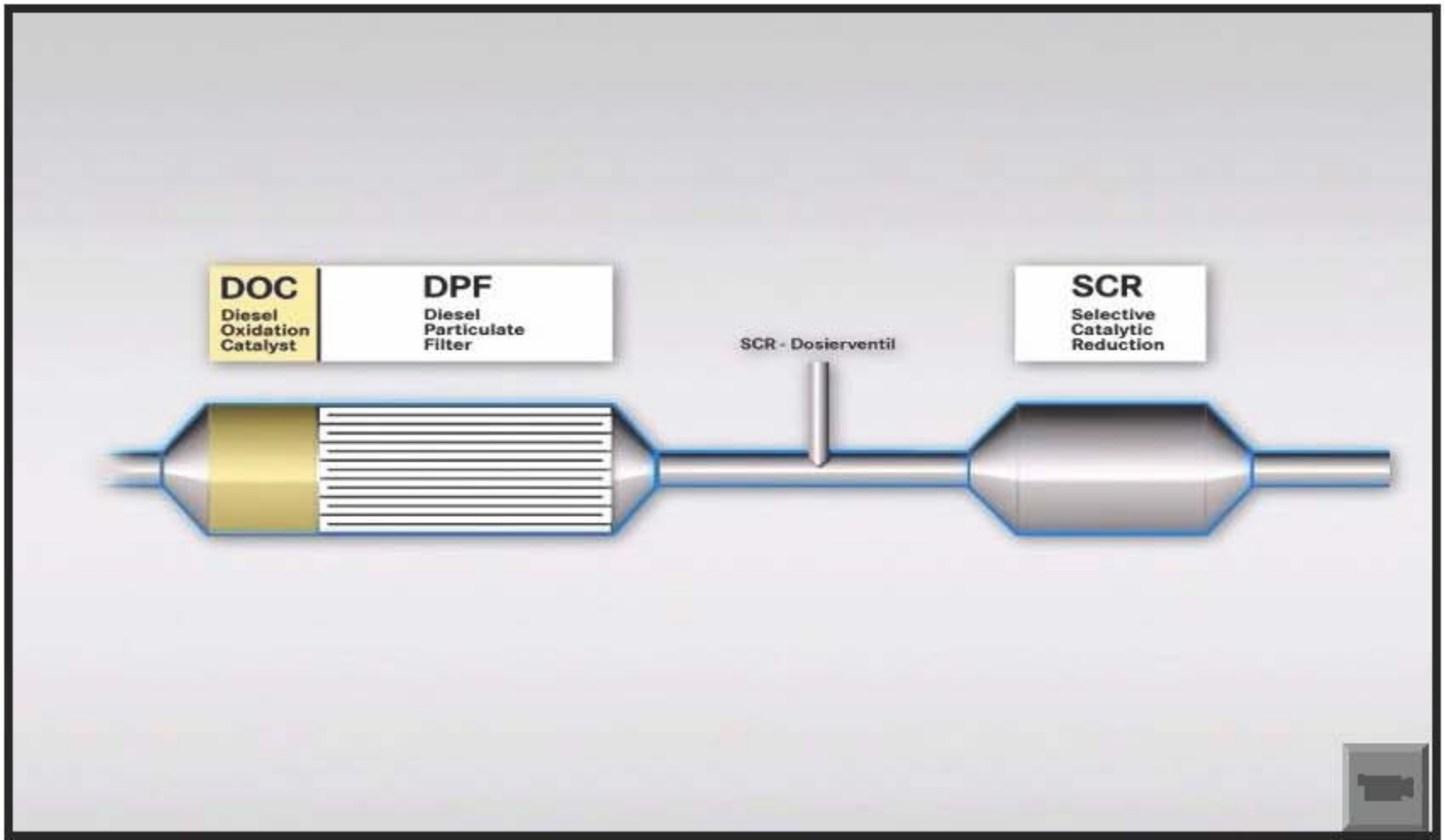
DEF Warnings – Highline Cluster

When DEF level is in the Warning level range	Limited Starts remaining	No starts remaining	Failure of NOx-Sensor system	Wrong reducing agent
gong	triple buzzer	triple buzzer	none	gong
				

Exhaust Concept

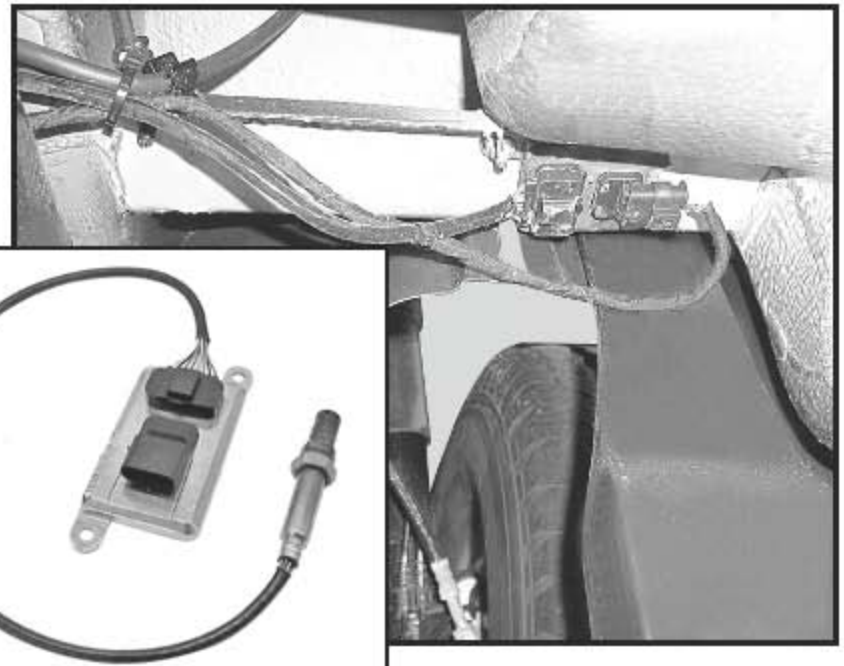


Operational Overview



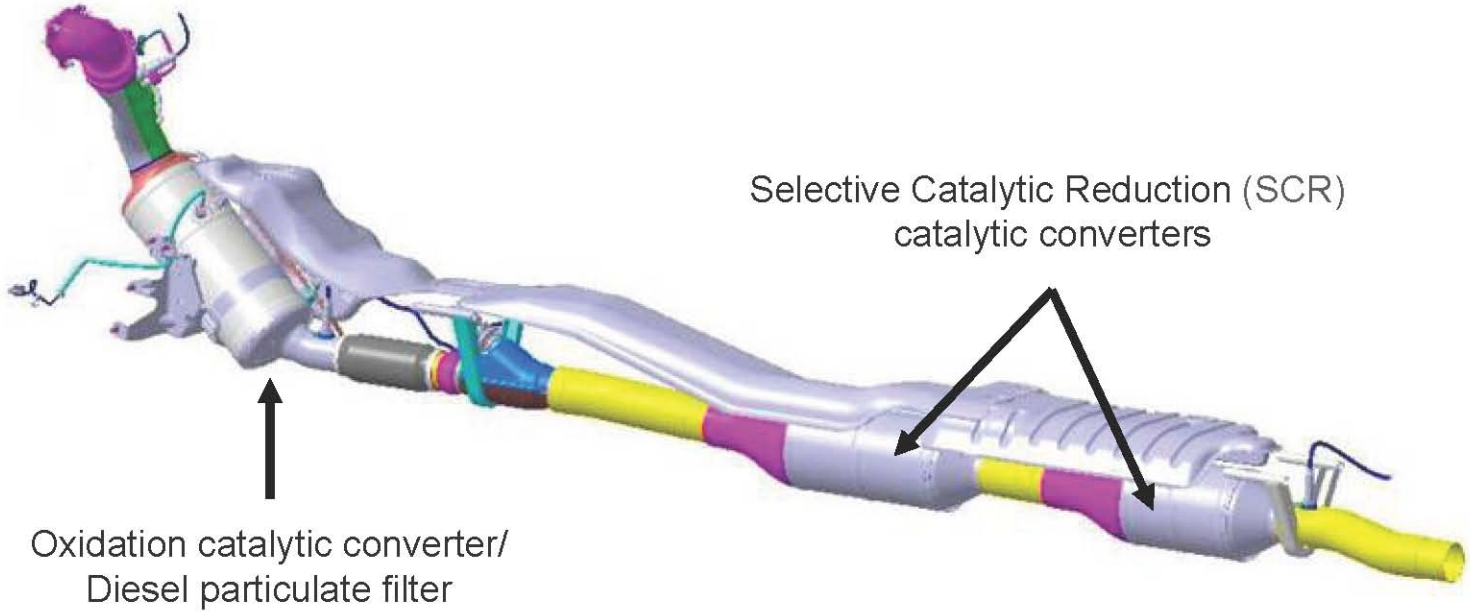
NOx Sensors (A97/1 & 2)

- NOx sensor assemblies are installed under the vehicle
- One is located before the SCR Catalytic Converters and the other one after (Each unit has a different part number)
- NOx sensors measure:
  - NOx in the exhaust gas
  - Oxygen (O2) concentration
- The information is sent over the SCR CAN

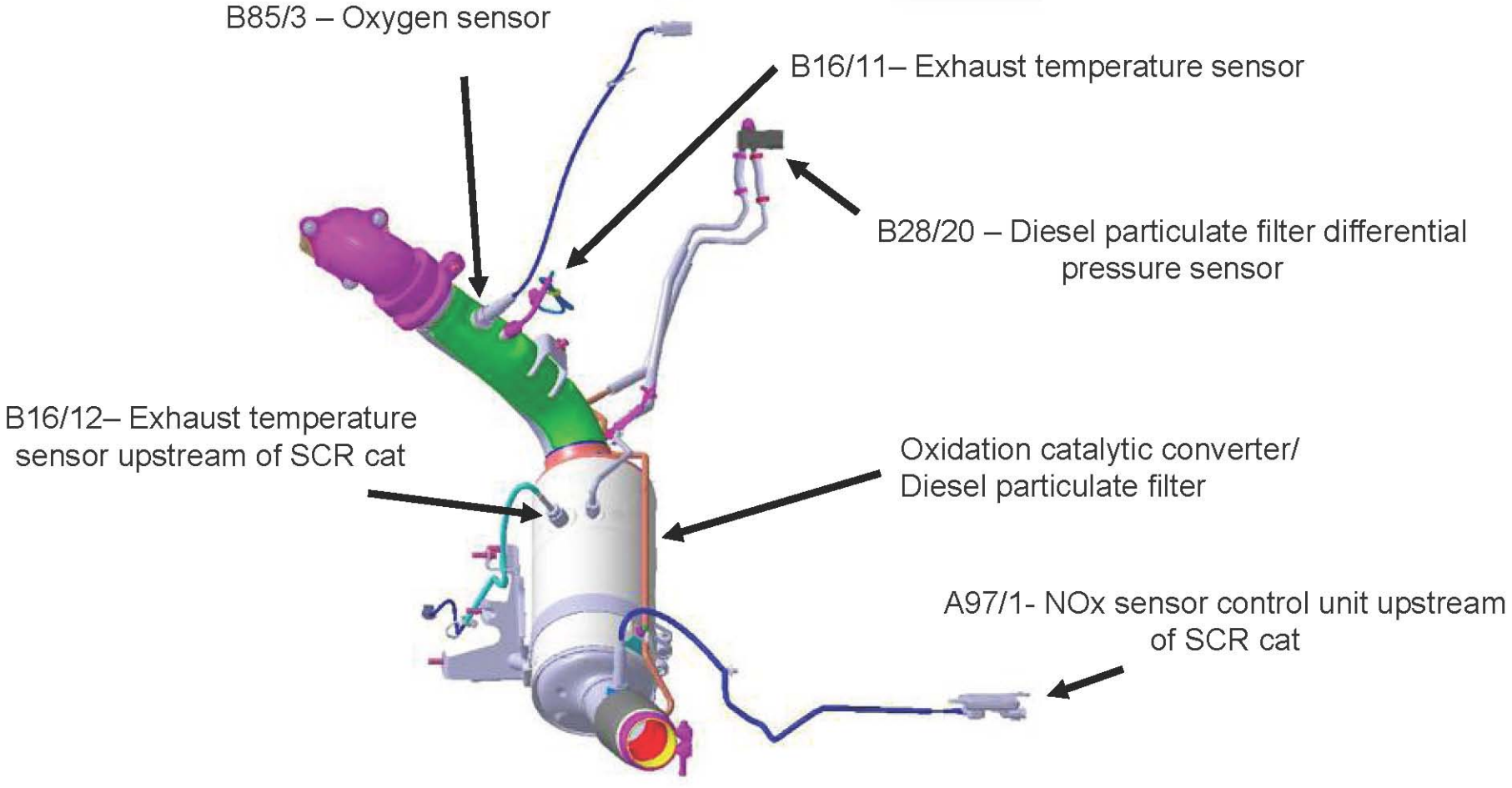


- The CDI (N3/30)control unit uses this information to determine the amount of DEF required

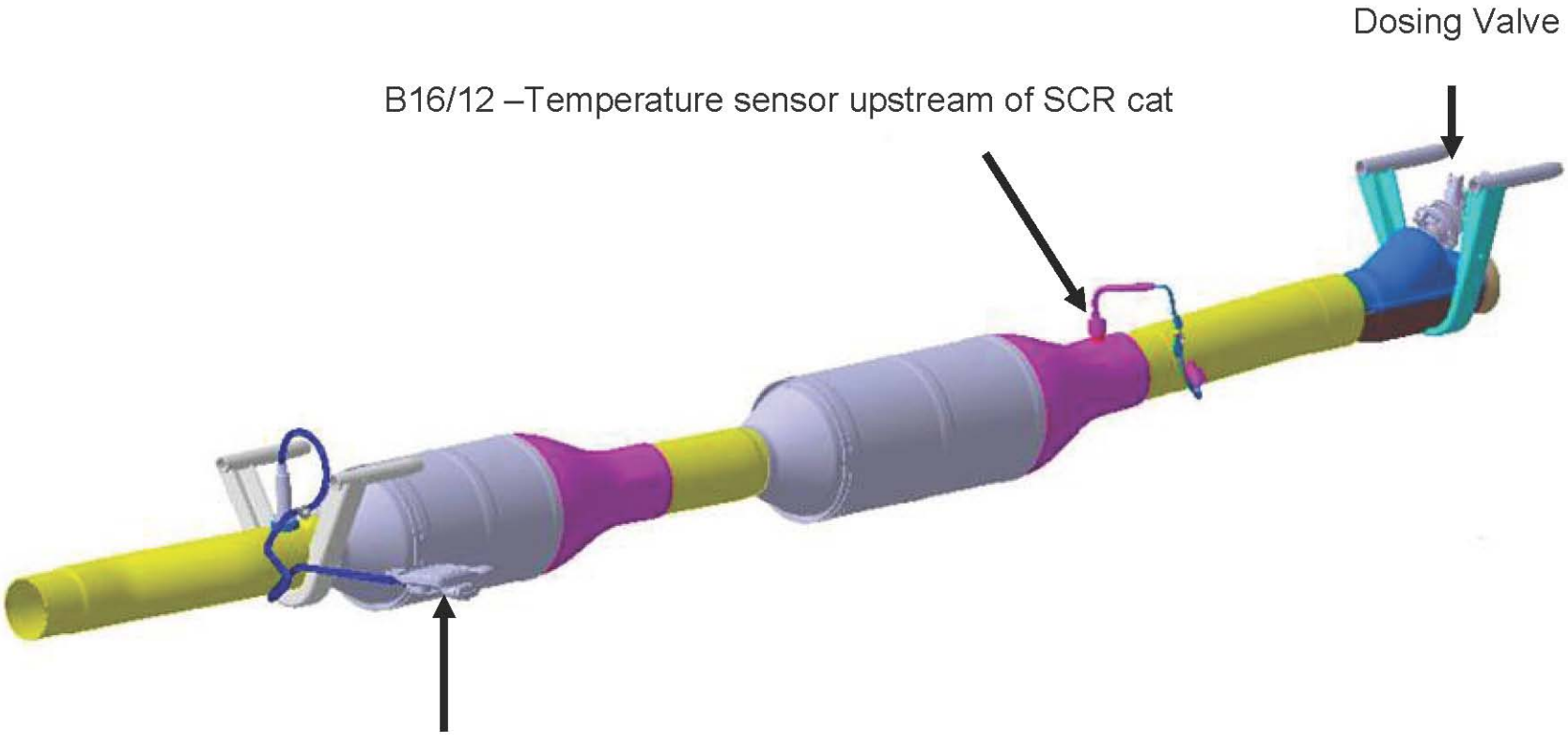
Exhaust Components



Exhaust Details



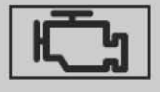
Exhaust Details



On Board Diagnosis

The following systems and functions are monitored:

- Exhaust gas recirculation
- Smooth running
- Fuel system
- Glow system
- Intake and charge air system



Engine diagnostic indicator lamp

Exhaust gas aftertreatment malfunction

Freeze frame data stored with fault

- Vehicle speed
- Engine RPM
- Coolant Temperature
- Boost pressure
- Engine load

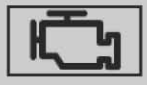
Note: Freeze frame data is not deleted when the battery (G1) is disconnected

On Board Diagnosis Terminology

Readiness code – used to recognize that test procedures have been processed for fault detection.

Readiness code is set when two driving cycles, including the cold start have run without fault.

Driving cycle consist of
- Engine start
- 35 sec idling
- Engine stop
- Processor run-on of at least 10 seconds (Wait for cooling fan run-on)



Engine diagnostic indicator lamp

Exhaust gas aftertreatment malfunction

Warm-up cycle some systems are only checked after a warm-up cycle has been run.
A warm-up cycle consists of:
- Engine start
- Temperature increase > 4.5 C
- Final temperature > 60 C
- Engine stop
- Run-on of at least 10 s (wait for cooling fan run-on)

Service Refill / Workshop Equipment

Suction pump for DEF

- This pump is used to empty the tank, which is necessary to remove old DEF, as it has a life span of approximately two years

BlueTEC testing and measurement kit

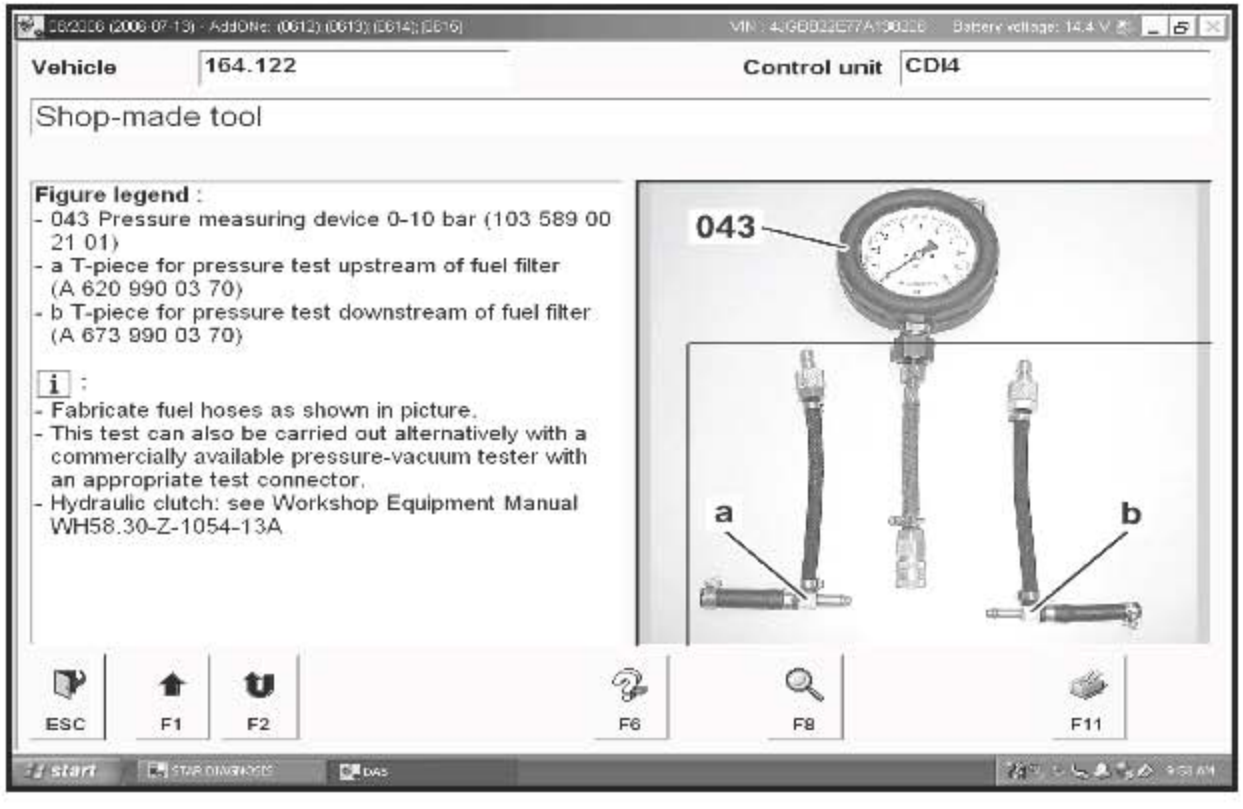
- Test kit for measurement and quantification of the urea content in DEF, kit contains;
  - Refractometer for measuring DEF Quality
  - Measuring cylinders for measuring DEF output
  - Hoses for testing connection

Special Notes / Diagnosis

- High pressure fuel system performs “logic” test for system pressure, and there is currently no mechanical test for high pressure system.
- Faults for insufficient high pressure may occur due to loss of low pressure system function.
- Because of high pressure pump limitations on testing, proper low pressure system testing must be performed prior to testing high pressure system.
- Read through SDS test instructions before performing test to ensure directions follow logical order.
- CDI control module may install substitute values for failed sensors.

Special Notes / Diagnosis

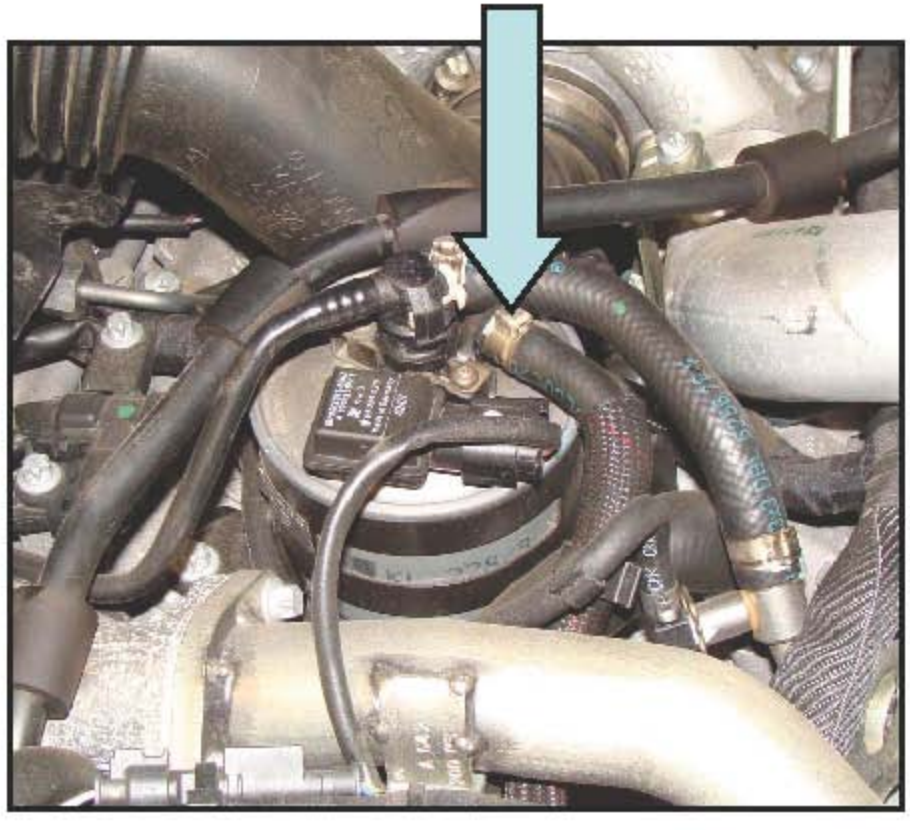
Proper low side pressure is essential in order for the high side to function properly.



Special Notes / Diagnosis

Checking the low side fuel pressure circuit <u>after</u> the fuel filter

- Remove fuel hose after fuel filter.
- Connect fuel pressure gauge
- Start engine
- Fuel pressure should be 3.8 to 4.5 bar.

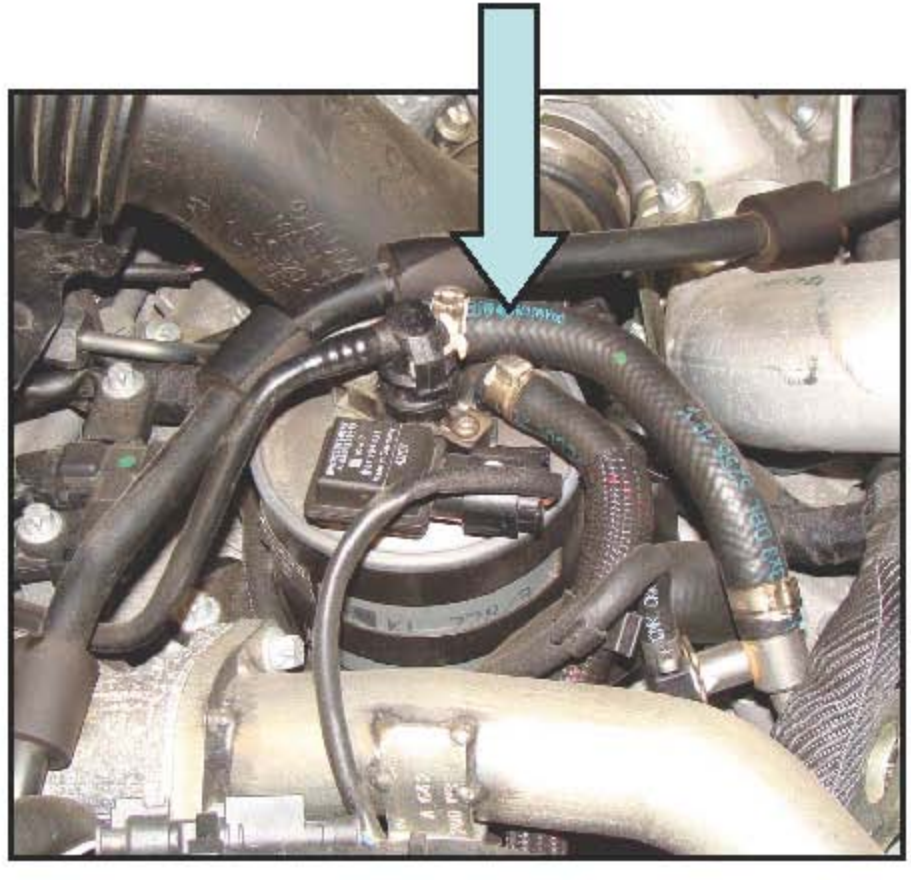


Special Notes / Diagnosis

Checking low fuel pressure circuit
before fuel filter

- Remove fuel hose before fuel filter.
- Connect fuel pressure gauge
- Start engine
- Fuel pressure should be 3.8 to 4.5 bar.

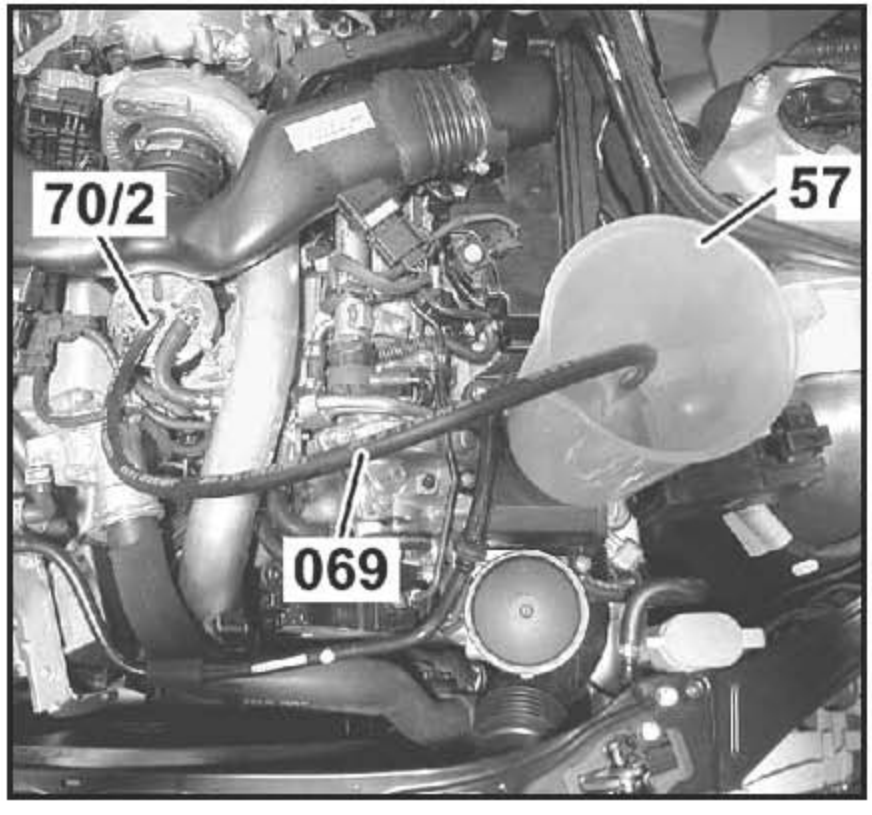
Note: If the fuel pressure is higher than the previous test, the fuel filter is restricted.



Special Notes / Diagnosis

Perform low pressure system supply volume test at High Pressure Pump inlet or fuel filter exit connections.

Test is performed using SDS under lists of guided test or as part of testing for specific fault code.



Special Notes / Diagnosis

Low Pressure Circuit Test Values

- Normal fuel pressure;
  Before filter 3.8 to 4.5 Bar
  After filter 3.8 to 4.5 Bar

- Rest pressure falls to 0 Bar 3-5 seconds after ignition off

- Normal fuel volume as tested at high pressure inlet;
  More than 0.5 liters in 9 seconds

- Normal electric fuel pump current as tested at fuse;
  4 to 9 amps during pump cycle

Special Notes / Diagnosis

High pressure system testing notes

- Inadequate high system pressure can occur due to mechanical or electrical failures of :
  - Y74/6 (Rail Pressure Control Valve)
  - Y94/4 (Quantity Control Valve)

- After low pressure system test ensures correct delivery of fuel to high pressure pump, SDS guided test can be performed to validate high pressure control function.

- There is no mechanical test for the high side pressure

- Piezo injectors use high voltage and should not be disconnected with engine running.

Acronym List

CAN - Control Area Network
CDI – Common rail Direct Injection
CO – Carbon Monoxide
DAS – Diagnostic Assistance System
DEF – Diesel Exhaust Fluid (AdBlue)
DOC – Diesel Oxidation Catalyst
DPF – Diesel Particulate Filter
ECU – Electronic Control Module
EKAS - Electrically controlled intake port shutoff
EGR – Exhaust Gas Recirculation
FSCM – Fuel System Control Module
FSCU – Fuel System Control Unit
HC – Hydrocarbon
ISA – Injector compensation
IMA – Injector compensation
ISS – Instant Start glow plug System
LIN – Local Interconnect Network
MAF – Mass Air Flow sensor
MAP – Manifold Absolute pressure
NO2 – Nitrogen Dioxide
NOx – Nitrogen Oxide
NTC – Negative Temperature Coefficient
O2 – Oxygen
OBD – On Board Diagnosis
OM – Oil Motor (OM642)
PWM – Pulse Width Modulation
SCR – Selective Catalytic Reduction
SDS – Star Diagnostic System
VTG - Variable Turbocharger Geometry