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# Table of Contents

## E70 Gasoline Engines

Subject	Page
Gasoline Engines for E70	5
N52B3001 Engine	5
Technical Data Comparison	6
N62B4801 Engine	7
Technical Data Comparison	8
N52B3001 Engine Features	10
Cylinder Head Cover	10
Oil Pan	10
Crankshaft	10
Torsional Vibration Damper	10
Belt Drive	10
Camshafts	11
Valves	11
Oil Supply	12
Intake Air Control	12
Hot-film Air Mass Meter (HFM)	13
Throttle Valve	13
Engine Electronics (N52KP)	13
Digital Motor Electronics	13
Generator	13
MSV80 Overview	14
N62B4801 Engine Features	16
Oil Pan	16
Belt Drive	16
Electronic Oil Level Measurement	17
Intake Air Control	17
Digital Motor Electronics	18
Generator	19
Exhaust System	20
N52B3001 Engine	20
N62B4801 Engine	20
Cooling System	21
Cooling Circuit N52B3001	22
Electric Coolant Pump	22
Cooling Circuit N62B4801	23
Fuel Supply System	24

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Subject	Page
Fuel Tank Volume .....	.24
Fuel Tank Ventilation .....	.24
Design .....	.24
Function .....	.26
Service Openings of the Fuel Tank .....	.26

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PAGE

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# Gasoline Engines

Model: E70

Production: From Start of Production

# OBJECTIVES

After completion of this module you will be able to:

- Describe the engines used in the E70
- Understand the engine changes

## Gasoline Engines for E70

The modern engines available at its launch are in line with the high standards the new X5 sets itself. At its market launch, the E70 available with the N52B30O1 and N62B48O1 gasoline engines, representing the best engines in their class.

The engines have been correspondingly adapted for use in the E70.

This Product Information only describes the new features and changes to the already familiar systems and components. Specifically they are the following:

- N52B30O1 Engine
- N62B48O1 Engine
- Cooling system
- Exhaust system
- Fuel supply system

### N52B30O1 Engine

The familiar 6-cylinder in-line engine N52B30O1 is the entry-level engine for the E70. The N52 was introduced for the first time in 2005 in the E90. At that time, the engine set new standards with its magnesium crankcase and VALVETRONIC II system.



The engine underwent minor modifications in September 2006 and is now designated N52K. With the introduction of the N52K, modifications were made in following areas:

- Cylinder head cover
- Camshafts
- Crankshaft
- Stem diameter of exhaust valves increased to 6 mm instead of 5 mm
- Torsional vibration damper
- Crankcase ventilation
- Hot-film air mass meter (HFM)
- Throttle valve
- Digital motor electronics

The following systems have been adapted on the N52K engine for the E70:

- Intake system
- Belt drive
- Oil pan

#### Technical Data Comparison

Specification	M54B30 (E53)	N52B30O1 (E70)
Engine type	inline 6	inline 6
Displacement (cm <sup>3</sup> )	2979	2996
Stroke/bore (mm)	89.6/84	88.0/85
Power output (kW/bhp) at engine speed (rpm)	170/231 5900	163/260 6600
Torque (Nm) at engine speed (rpm)	300 3500	305 2500
Compression ratio	10.2	10.7
Valves/cylinder	4	4
Fuel type (RON)	98	98
Firing order	1-5-3-6-2-4	1-5-3-6-2-4
Engine management (DME)	MS43	MSV80
Emission standard	LEV	ULEV II

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## N62B48O1 Engine

The high-end motorization at the launch of the E70 is the N62B48O1 engine. The N62 engine, which was introduced with the E65 in 2001, was already fitted in the predecessor X5 E53.

The reengineered version N62TU which was also introduced in the E65 in 2005 is now also fitted in the new X5.

Changes have been made to the following components for use in the E70:

- Intake system
- Belt drive
- Oil pan



## Technical Data Comparison

Specification	N62B44 (E53)	N62B48O1 (E70)
Engine type	V-8 90 degrees	V-8 90 degrees
Displacement (cm <sup>3</sup> )	4398	4799
Stroke/bore (mm)	82.7/92	88.3/93
Power output (kW/bhp) at engine speed (rpm)	235/320 6100	261/350 6300
Torque (Nm) at engine speed (rpm)	440 3600	475 3500
Compression ratio	10.0	10.5
Valves/cylinder	4	4
Fuel type (RON)	98	98
Firing order	1-5-4-8-6-3-7-2	1-5-4-8-6-3-7-2
Engine management (DME)	ME9.2 with VVT	ME9.2.3 with VVT
Emission standard	LEV	ULEV II



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PAGE

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## N52B30O1 Engine Features

The N52B30O1 engine was introduced in the E92 in September 2006. The engine has been adapted for use in the E70. The changes and modifications to the N52K compared to the N52 and the components specific to the E70 are described in the following.

### Cylinder Head Cover

The cylinder head cover on the N52K is made from plastic therefore steel bolts are used for the threaded connections. The ground connection of the ignition coils is made by means of two stud bolts that are connected to the cylinder head.

The crankcase ventilation is now integrated in the cylinder head cover together with the oil separator.

### Oil Pan

The geometry of the cast aluminum oil pan has been correspondingly adapted to suit the space conditions in the E70.

### Crankshaft

The crankshaft has a higher degree of balance (92 % instead of 83 %) in order to reduce the load on the engine-gearbox system.

### Torsional Vibration Damper

The design layout of the torsional vibration damper is adapted to the crankshaft. In view of the higher degree of crankshaft compensation, the first order vibrations are shifted into a higher frequency range. The frequency range in which the torsional vibration damper is effective has been correspondingly adapted.

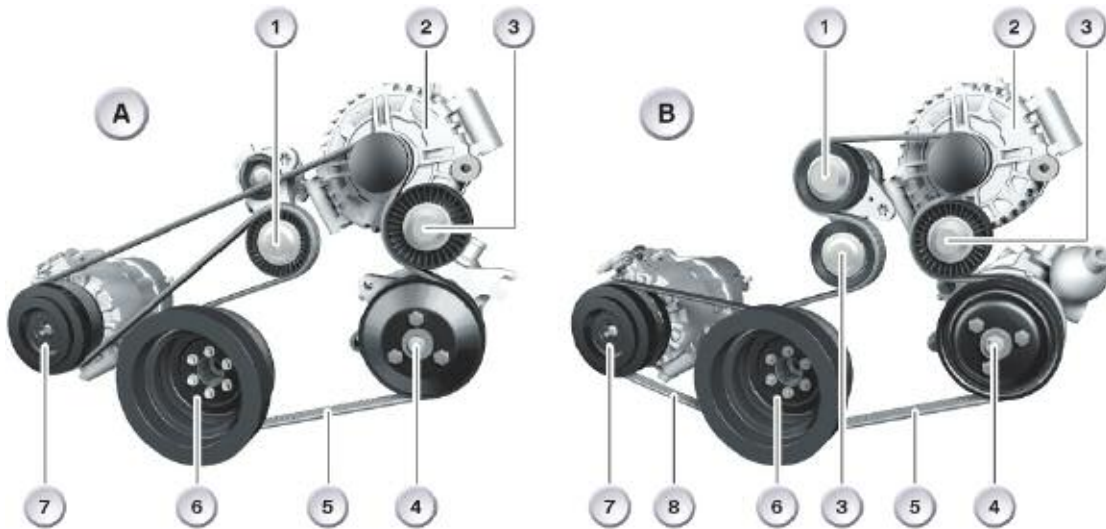
The torsional vibration damper is designed as a composite damper. This means the rubber layer that connects the masses is not vulcanized but rather takes the form of a rubber band.

New bolts are used for mounting the torsional vibration damper. The tightening instructions have been changed accordingly. Mixing up the bolts can result in damage to the belt drive.

### Belt Drive

The basic belt drive has been adopted from the N52B30O1 engine in the E92. This belt drive is a single belt system and consists of a ribbed V-belt with six V-ribs. Due to the higher load, the belt drive is designed as a double belt system if the E70 is equipped with at least one of the following options:

- Active steering system
- Adaptive drive
- 220 A generator



Index	Explanation	Index	Explanation
A	Basic belt drive	4	Power steering pump
B	Double belt drive	5	Ribbed V-belt
1	Tensioning pulley	6	Torsional vibration damper
2	Generator	7	A/C compressor
3	Deflection pulley	8	ELAST drive belt for A/C compressor

The main drive belt with seven V-ribs drives the power steering pump and generator. An ELAST drive belt with four V-ribs provides the secondary drive for the A/C compressor. In this case, the A/C compressor is correspondingly adapted to the modified belt drive.

Only fit the ELAST drive belt for the A/C compressor with the special tool specifically provided for this purpose. Otherwise there is a risk of damage to the belt and the belt pulley.

### Camshafts

In contrast to the N52, a lightweight construction intake camshaft produced in an internal high-pressure forming process is also fitted on the N52K. To date, this type of camshaft was used on the N52 only for the exhaust camshaft.

For production reasons, cast camshafts can also be installed at the production plant. For this reason, the engine can be fitted with any feasible combination of cast and lightweight construction camshafts.

### Valves

The stem diameter of the exhaust valves has been increased from 5 mm to 6 mm.

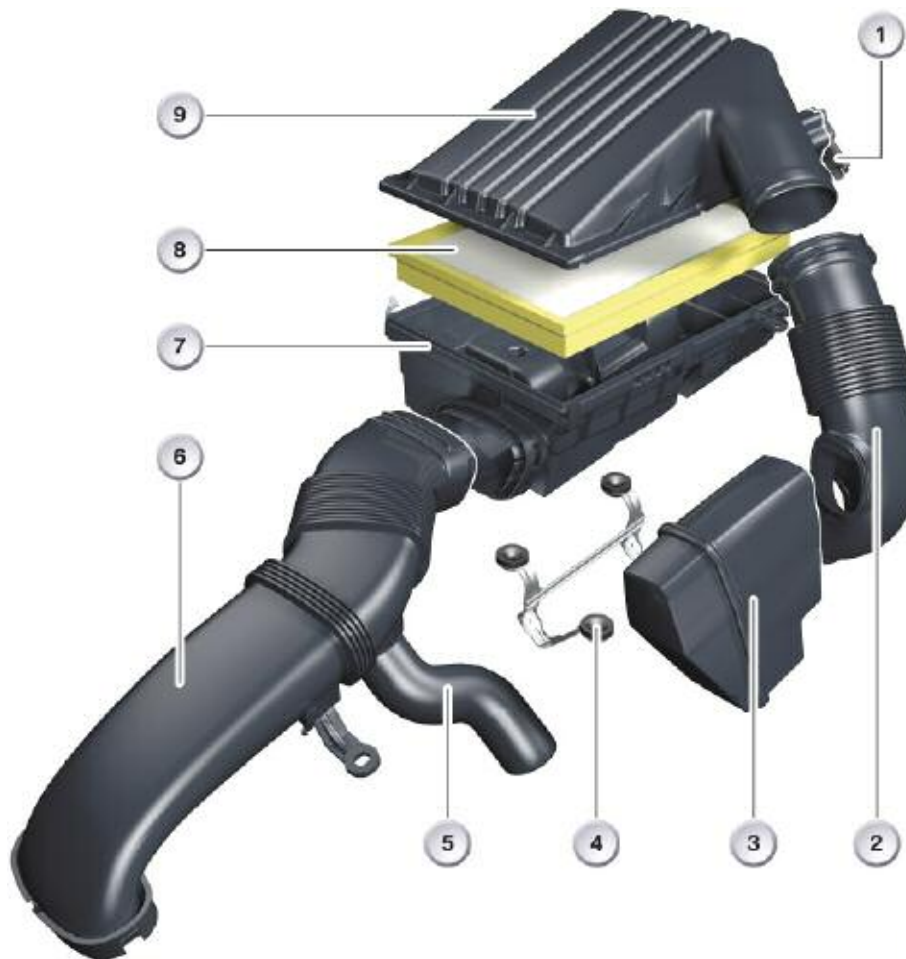
## Oil Supply

Electronic oil level measurement An oil quality-level-temperature sensor (QLT) is used for the purpose of measuring the oil level in the N52B30O1 in the E70.

Although the QLT is a new component, it has the same functions as the previous sensor. The QLT is longer to match the geometry of the oil pan in the E70.

## Intake Air Control

For the first time at BMW, the intake air silencer is a fixed part of the engine. The unfiltered air duct is crash-optimized. An unfiltered air resonator and a double-chamber filtered air resonator are used for the purpose of achieving the required sound quality.



Index	Explanation	Index	Explanation
1	Hot-film air mass meter	6	Unfiltered air pipe
2	Filtered air pipe	7	Intake silencer
3	Double chambered filtered air resonator	8	Air cleaner
4	Bracket	9	Intake silencer cover
5	Unfiltered air resonator		

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### Hot-film Air Mass Meter (HFM)

A digital hot-film air mass meter (HFM) is used in connection with the N52B30O1 engine in the E70. This HFM is accommodated in the cover of the intake silencer.

### Throttle Valve

The N52K is equipped with a new throttle valve. The throttle valve setting is now measured in a contactless system by means of two redundant magnetoresistive sensors.

These sensors exhibit an extremely high degree of measuring accuracy. The magnetoresistive sensor is already known as the eccentric shaft sensor in the VALVETRONIC system.

Compared to the potentiometers in the predecessor models, these sensors in the throttle valve permit 100 times the power level. This power ensures reliable signal transfer to the DME. The sensors are also non-wearing.

The signal is output in analog form by one sensor in the range from 0.3 to 4.6 V and inverted by the other sensor from 4.6 to 0.3 V. By forming the differential value, the DME evaluates the plausibility of the signal.

A new plug connector ensures the greatest possible contact quality. In this connector, the contact force that acts on the pins is decoupled from the plug-in force. In this way, it has been possible to increase the contact force by 10 times of that of a conventional plug connector.

Note: The connector for the throttle valve can be plugged on twisted over the first few millimeters. The connector may then be damaged if an attempt is made to plug it in with force.

## Engine Electronics (N52KP)

### Digital Motor Electronics

The engine management MSV80 is used in connection with the N52K. This system is a further development of the MSV70 and several details have been adapted accordingly.

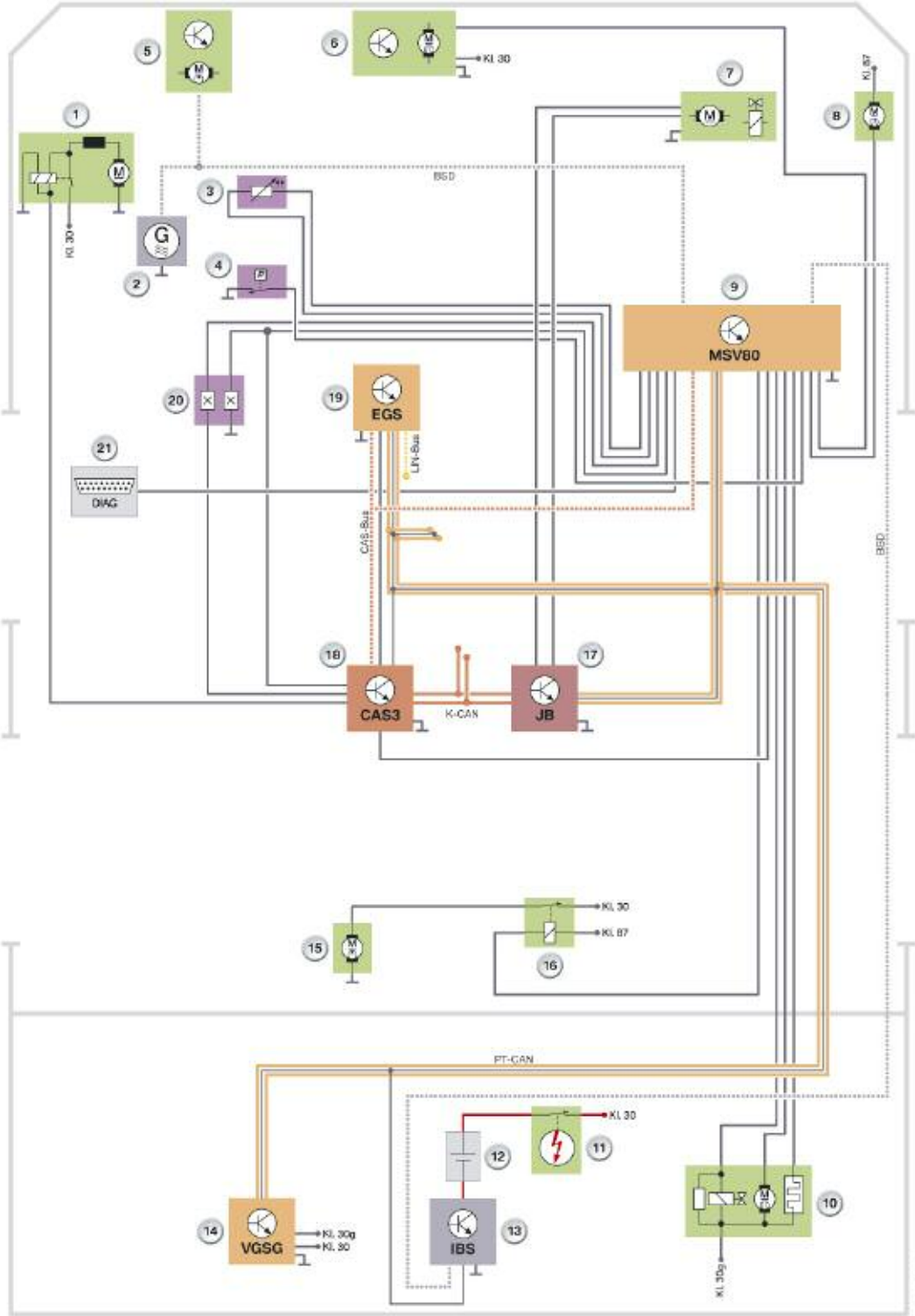
The MSV80 now has a modified connection for the digital HFM as it requires one less pin. The connection of the throttle valve sensors has a lower input resistance. This facilitates the higher current for the magnetoresistive resistors.

The relay for the power supply to the fuel injectors is no longer required on the N52B30O1 in the E70. The power is now supplied via terminal 87.

### Generator

The basic generator for the M52B30O1 engine is the Bosch M2.5 with a rating of 180 A. The Valeo TG23 at 220 A is used for equipment variants that have a higher power consumption.

# MSV80 Overview



Legend for MSV80 Overview

Index	Explanation	Index	Explanation
1	Starter	12	Battery
2	Generator	13	Intelligent Battery Sensor
3	Coolant temperature sensor at radiator outlet	14	Transfer Case control unit
4	Oil pressure switch	15	Electric fuel pump
5	Electric coolant pump	16	EKP relay
6	Electric fan (engine cooling)	17	Junction box control unit
7	Magnetic clutch, A/C compressor	18	CAS control unit
8	E-box fan	19	EGS control unit
9	ECM (DME- MSV80)	20	Brake light switch
10	DM-TL	21	Diagnosis connection
11	Safety battery terminal		

## N62B48O1 Engine Features

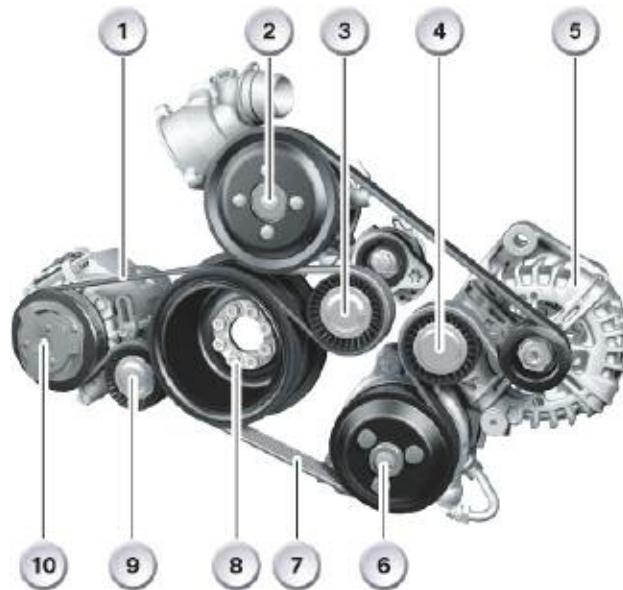
### Oil Pan

The geometry of the aluminum oil pan has been correspondingly adapted due to the position of the front axle gearbox.

### Belt Drive

The belt drive of the N62B48O1 engine has been modified for use on the E70. The generator and power steering pump has been repositioned for space reasons. The belt drive has been correspondingly adapted.

The belt drive is a double system as standard. The main drive for the power steering pump, generator and coolant pump consists of a ribbed V-belt with seven grooves.



Index	Explanation	Index	Explanation
1	ELAST drive belt for A/C compressor	6	Power steering pump
2	Coolant pump	7	Ribbed V-belt
3	Tensioning pulley	8	Torsional vibration damper
4	Deflection pulley	9	Linear tensioner
5	Generator	10	A/C compressor

The A/C compressor is driven by an ELAST drive belt. A new feature of this system is that the ELAST drive belt is tensioned to the required value by a linear tensioner. This makes fitting of the ELAST-belt easier as no special tools are required for tightening.

It is important that the procedure for fitting the ELAST drive belt for the A/C compressor is followed precisely as described in the repair instructions otherwise the linear tensioner may be damaged.



The exact position of the generator and of the A/C compressor is ensured by a threaded insert. It is important to precisely follow the procedure described in the repair instructions when installing the generator or the A/C compressor. Otherwise, the belt drive may squeak and result in damage to the ribbed V-belt.

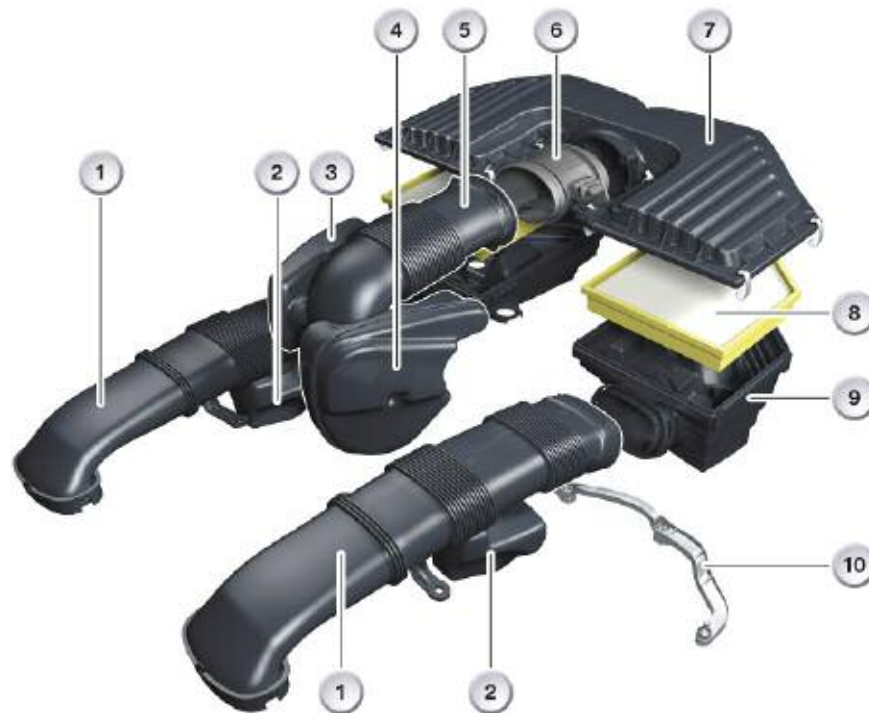
### Electronic Oil Level Measurement

The oil quality-level-temperature sensor (QLT) is also used on the N62B48O1 engine for measuring the oil level in the E70.

### Intake Air Control

For the first time at BMW, the air intake system is fixed to the engine in the E70. Flow conditions have been optimized for the high air throughput rates. The intake air control is designed as a dual-flow system in order to minimize pressure losses on the intake side.

Two unfiltered air resonators, one single chamber filtered air resonator and one double chamber filtered air resonator are used for achieving the required acoustic qualities.

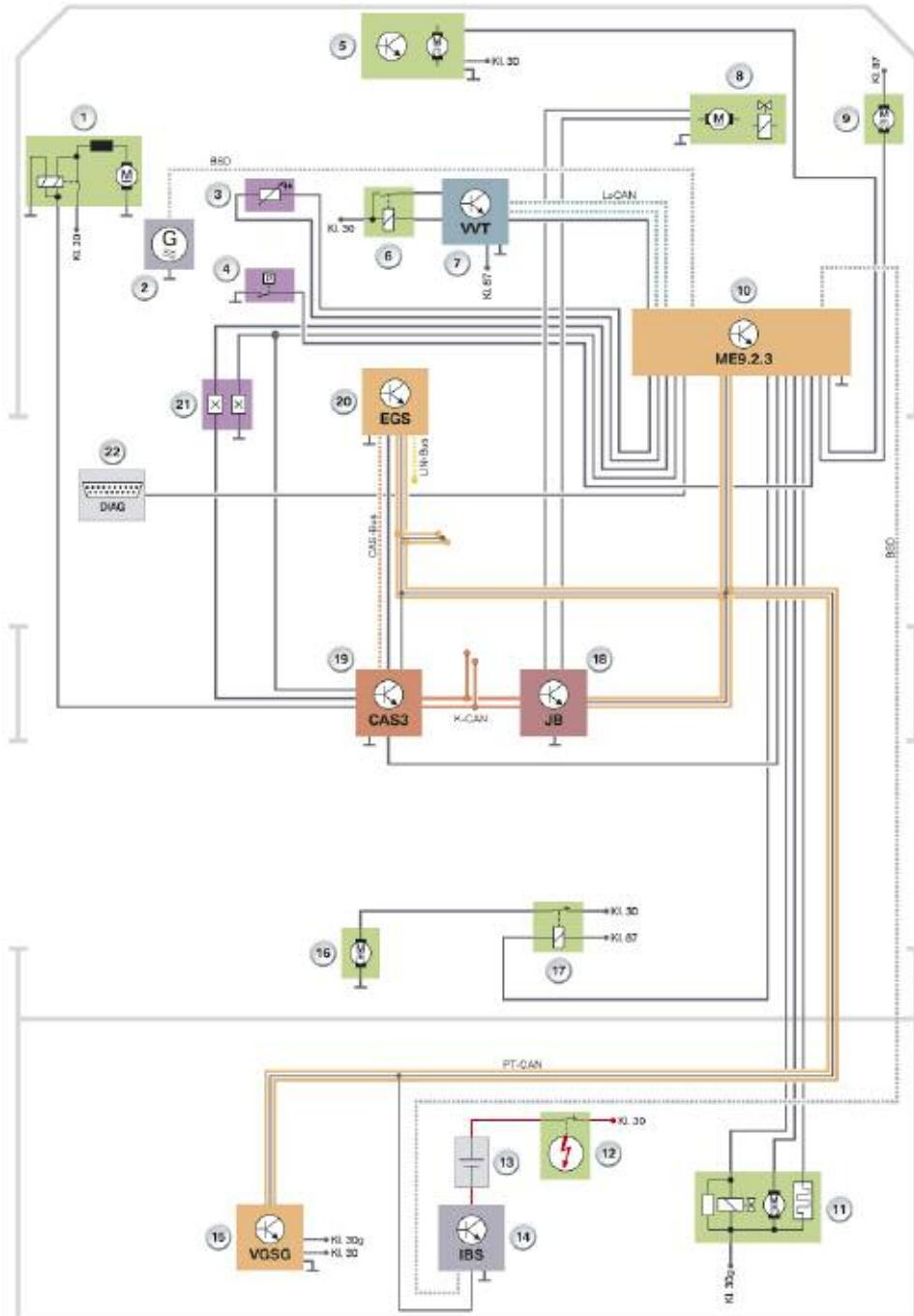


Index	Explanation	Index	Explanation
1	Unfiltered air pipe	6	HFM
2	Unfiltered air resonator	7	Intake silencer cover
3	Filtered air resonator	8	Air cleaner
4	Double chamber filtered air resonator	9	Intake silencer
5	Filtered air pipe	10	Bracket

## Digital Motor Electronics

The ME9.2.3 is a further development of the ME9.2.2. This system is equipped with a faster processor (66 MHz instead of 56 MHz) in order to cope with the increased scope of functions and diagnostic procedures such as OBD on CAN, wheel torque interface for xDrive. The ME9.2.3 also offers potential for the introduction of further functions in the future.

### ME9.2.3 Overview



### Legend for ME9.2.3 Overview

Index	Explanation	Index	Explanation
1	Starter	12	Safety battery terminal
2	Generator	13	Battery
3	Coolant temperature sensor at radiator outlet	14	Intelligent Battery Sensor
4	Oil pressure switch	15	Transfer Case control unit
5	Electric fan (engine cooling)	16	Electric fuel pump
6	Valvetronic relay	17	EKP relay
7	Valvetronic control unit	18	Junction box control unit
8	Magnetic clutch, A/C compressor	19	CAS control unit
9	E-box fan	20	EGS control unit
10	ECM (DME- ME9.2.3 )	21	Brake light switch
11	DM-TL	22	Diagnosis connection

### Generator

The basic generator is the Valeo TG17 with a rated current of 180 A. The Valeo TG23 at 220 A is used to cover the power requirements of higher equipment variants.

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## Exhaust System

In line with the available engines on the E70, exhaust systems have been developed that comply with the more demanding requirements of this vehicle with regard to emissions, and acoustics etc.

### N52B30O1 Engine

EU4 and ULEV 2 are standard on the E70 with N52B30O1 engine. A catalytic converter with 900 cells is connected to each of the two 3-in-1 exhaust manifolds. The pipes of the dualflow exhaust system run adjacent to each other up to the intermediate silencer. The pipes have the same diameter of 55 mm. For ULEV 2, an underfloor catalytic converter is connected upstream of the intermediate silencer. The wrap-construction intermediate silencer has a volume of 5 liters. A front silencer is not fitted. The intermediate silencer is followed by the crossover point designed as a pipe junction (1 x 75 mm). The transverse wrap-construction rear silencer has a volume of 30 liters. The right and left tail pipes pass through the bumper panel.

### N62B48O1 Engine

The E70 with the N62B48O1 engine conforms to the ULEV 2 standard. The engine is fitted on both sides with a new air gap-insulated exhaust manifold with 4-into-1 pipe arrangement, to which the close-coupled catalytic converters with 600 and 400 cells are connected.

The dual-flow pipes of the exhaust system are separated on either side up to the intermediate silencer. The pipes are asymmetric with different length for sound engineering reasons. No front silencers are fitted. Each wrap-construction intermediate silencer has a volume of 4 liters.

The transverse wrap-construction rear silencer has a volume of 36 liters. The left and right tail pipes pass through the bumper panel. Reliable compliance with the specified limit values is ensured by the engine application and the optimized monolith load which also render a secondary air system unnecessary.

## Cooling System

The cooling system of the E70 is based on a modular design. The following illustration shows the components of the cooling module. The components that make up the cooling module are dependent on the installed engine and the equipment configuration.

The following components in the cooling module may differ:

- Electric fan (400 W/600 W)
- Radiator
- Engine oil cooler in side panel module (either fitted or not)



Index	Explanation	Index	Explanation
1	Engine oil cooler (oil to air)	5	Radiator
2	Power steering cooler	6	Electric fan
3	COoling module frame	7	Transmission oil cooler
4	Air conditioning condenser		

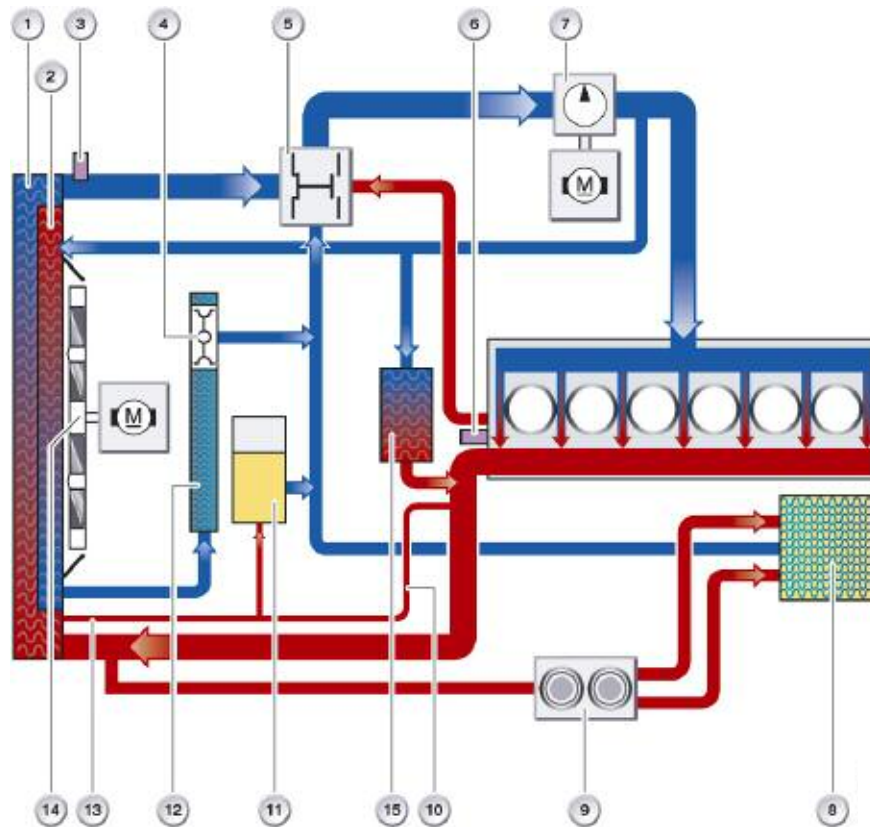
This means there are four different variants of the cooling module available for the E70 with gasoline engines. The all-aluminum radiator operates in accordance with the familiar cross-flow principle.

The engine oil cooler is mounted separate and is located in the side panel module on the left. The oil lines have a separating point with quick-release couplings to the side panel module.

The gearbox oil-to-coolant heat exchanger is based on a new design with improved efficiency.

Do not grasp into the fan ring when carrying the electric fan as it is easily breakable.

## Cooling Circuit N52B30O1



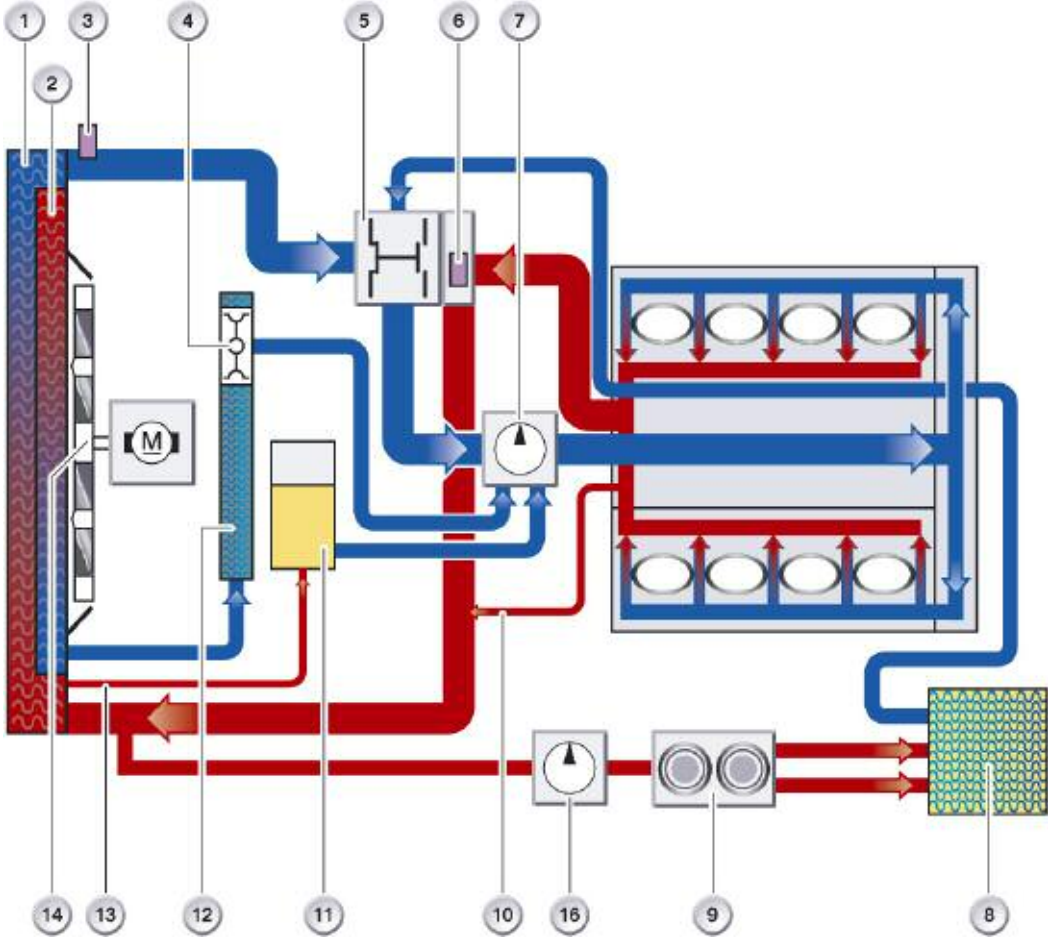
Index	Explanation	Index	Explanation
1	Radiator	9	Water valve
2	Transmission oil cooler	10	Ventilation line
3	Temperature sensor at radiator outlet	11	Expansion tank
4	Thermostat, transmission oil cooler	12	Transmission cooler
5	Map-controlled thermostat	13	Ventilation line
6	Temperature sensor at engine outlet	14	Electric fan
7	Electric coolant pump (200W - Pierburg)	15	Engine oil cooler (oil to coolant)
8	Heat exchanger (for climate control)		

The gear oil cooler (2) is in a separate circuit in the low-temperature area of the radiator.

### ■ Electric Coolant Pump

The electric coolant pump for the N52B30O1 engine in the E70 is a version of the Siemens coolant pump modified to 200 W and as known from the N54 engine. The reason for the modification is not the required cooling capacity but rather the restricted space conditions. For this reason, the 200 W Pierburg pump is not used as is standard on the N52K engine.

Cooling Circuit N62B48O1



Index	Explanation	Index	Explanation
1	Radiator	9	Water valve
2	Transmission oil cooler	10	Ventilation line
3	Temperature sensor at radiator outlet	11	Expansion tank
4	Thermostat, transmission oil cooler	12	Transmission cooler
5	Map-controlled thermostat	13	Ventilation line
6	Temperature sensor at engine outlet	14	Electric fan
7	Coolant pump (belt driven)	15	Auxiliary coolant pump
8	Heat exchanger (for climate control)		

The transmission oil cooler (2) is designed as a low temperature area of the radiator. It is not separated from the engine cooling circuit on the N62B48O1.

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## Fuel Supply System

### Fuel Tank Volume

The E70 is equipped with a plastic fuel tank with two chambers providing a tank volume of 85 liters.

### Fuel Tank Ventilation

The carbon canister is larger on US models as the vapors that occur while refuelling the tank are not extracted by the fuel-pump nozzle.

The vapors are cleaned by the carbon canister and given off via a dust filter into the atmosphere. There is also a diagnostic module (DMTL).

### Design

The fuel supply system has two delivery units that are accommodated in the right and left fuel tank halves.

The fuel pump (13) with prefilter (10) and fuel filter (7) are part of the right-hand delivery unit. The swirl pot including a suction jet pump (9) with non-return valve (12) and initial filling valve (11) as well as a fuel level sensor (8) complete this delivery unit. The fuel pump and filter can only be replaced together. The fuel filter is designed as a lifetime filter.

The pressure regulator (21), a suction jet pump (17), fuel level sensor (19) and two non-return valves (18 + 20) belong to the left-hand delivery unit.

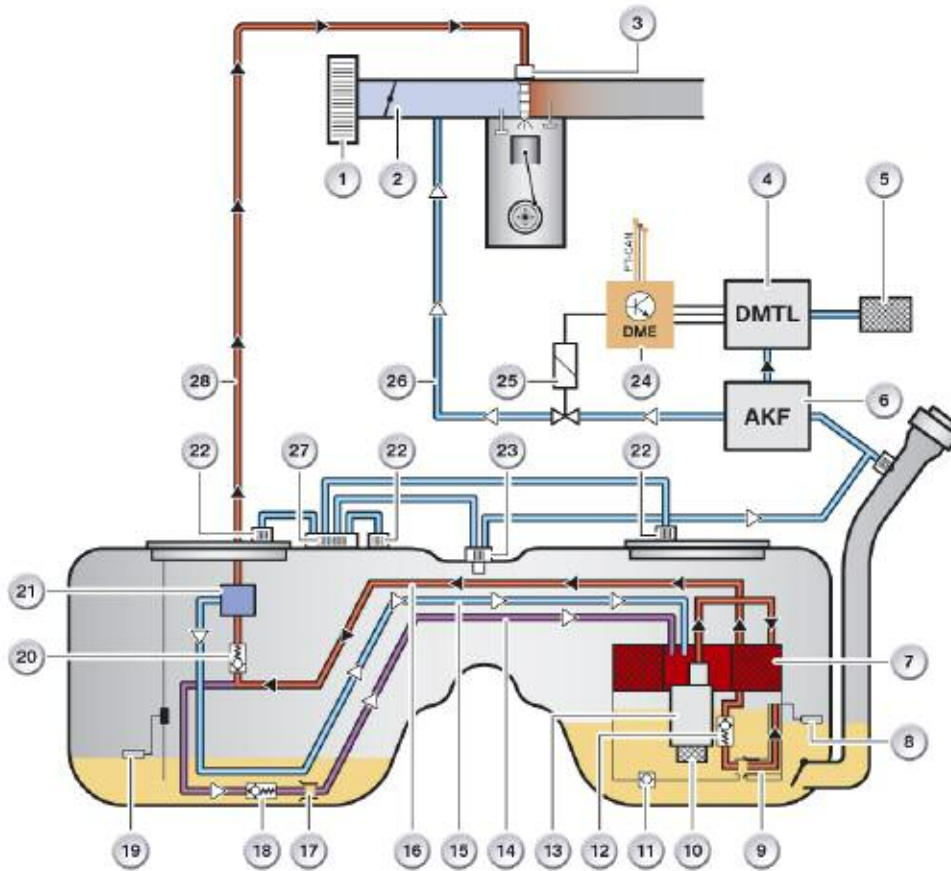
The lines of the three operational vent valves (22) are combined in the central constant pressure valve (Z-DHV) (27) to form one line which then leads to the refuelling vent valve (23). From here, the line leads to the fuel filler neck.

From the fuel filler neck, a branch leads to the carbon canister (AKF). On the one hand, this branch is connected to the fuel tank leakage diagnostic module (DMTL) (6) and on the other hand via the purge air line (26) and the fuel tank vent valve (TEV) (25) to the engine intake system.

The lock for the service openings is new. A clip with a break-away nut ensures the correct forces are maintained in the sensitive system. The advantage is that it provides an outstanding seal.



## E70 Fuel Supply System



Index	Explanation	Index	Explanation
1	Engine air cleaner	15	Return line
2	intake manifold	16	Feed line
3	Fuel injectors	17	Suction jet pump
4	DM-TL	18	Non-return valve
5	Dust filter	19	Fuel level sensor
6	Purge canister	20	Non-return valve
7	Fuel filter	21	Pressure regulator
8	Fuel level sensor	22	Breather valve
9	Suction jet pump	23	Refuelling vent valve
10	Intake mesh filter	24	ECM (DME)
11	Initial filling valve	25	Fuel tank vent valve (purge valve)
12	Non-return valve	26	Purge air line
13	Electric fuel pump	27	Central constant pressure valve (Z-DHV)
14	Compensating line	28	Feed line to engine

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## Function

The fuel pump (13) with intake filter (10) delivers the fuel directly into the fuel filter (7). The fuel then flows via the feed line (16) and a non-return valve (20) to the pressure regulator (21). The task of this non-return valve is to ensure that the feed line to the engine (27) does not run empty when the engine is turned off and thus secures the pressure in the feed line to the engine.

The pressure regulator (21) ensures a constant pressure in the feed line to the engine and therefore also at the fuel injectors (3). Surplus fuel is conveyed by the pressure regulator along a return line (15) back into the swirl pot.

A line branches from the feed line (16) for the purpose of feeding the suction jet pump (17) in the left-hand tank half. This pump conveys fuel from the left-hand tank half via the compensation line (14) into the swirl pot. A non-return valve (18) from the suction jet pump (17) prevents the right-hand fuel tank emptying via the feed line (16) when the vehicle is parked on a slope.

A line from the fuel filter leads directly to the suction jet pump (9) that fills the swirl pot. A non-return valve (12) upstream of this suction jet pump ensures that the swirl pot and the fuel filter are not emptied via the suction jet pump when the vehicle is parked on a slope.

In the event of the swirl pot being completely empty, the initial filling valve (11) ensures fuel enters the swirl pot while refuelling. Ventilation of the fuel tank is ensured by three operational vent valves (22), the central constant pressure valve (Z-DHV) (27) and the refuelling vent valve (23). The three lines lead from the operational vent valves (22) to a manifold, i.e. the central constant pressure valve (27) and from here one line leads to the central refuelling vent valve (23).

The central constant pressure valve also assumes the function of preventing overfilling. The refuelling vent valve ensures ventilation while refuelling. The fuel vapors are routed up to the filler pipe where they join the vapors that occur in the filler pipe while refuelling and then directed to the carbon canister (AKF) (6).

Here, the air is separated from the fuel constituents. The air is given off via the fuel tank leakage diagnostic module (4) and a dust filter (5) into the atmosphere. The fuel constituents are fed via the fuel tank vent valve (25) to the engine intake system (2).

### ■ Service Openings of the Fuel Tank

The service openings feature a new lock system. The reason for introducing this system is to provide an improved seal to conform to stringent US emission laws. The service opening is closed off with a tensioning clip that must be tightened to a defined torque. This is achieved in the production plant by using a special tightening tool. As it is difficult to access, the tensioning clip has a break-away nut for service purposes.

The tensioning clips and seals of the service openings must be replaced every time the system is opened.

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PAGE