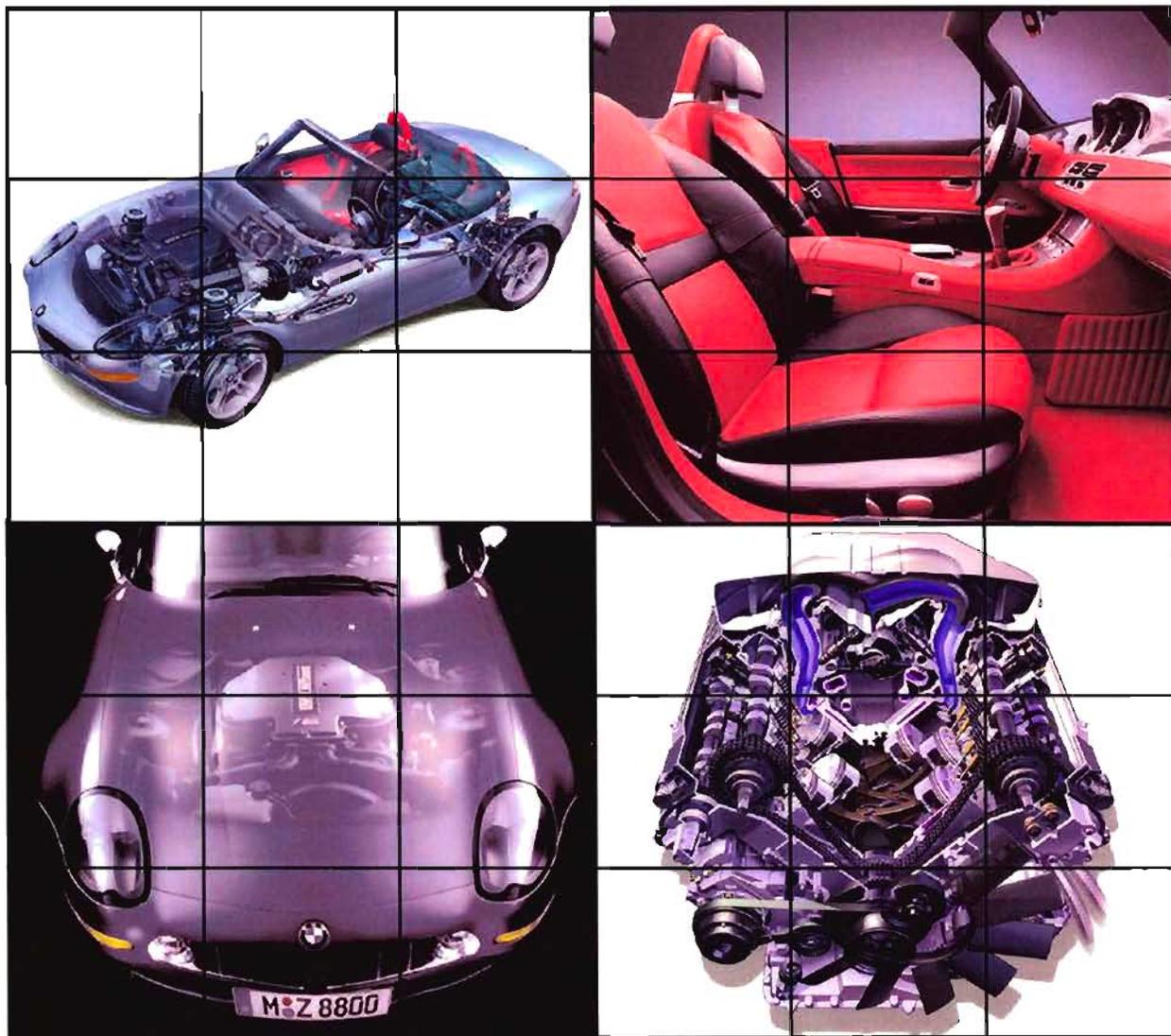




# BMW Technical Training

## Z8 Complete Vehicle



BMW of North America, LLC

**Technical Training**

**ST038**

5/1/03

Information Status: May 01, 2003

Course Code: ST038 Z8 Complete Vehicle

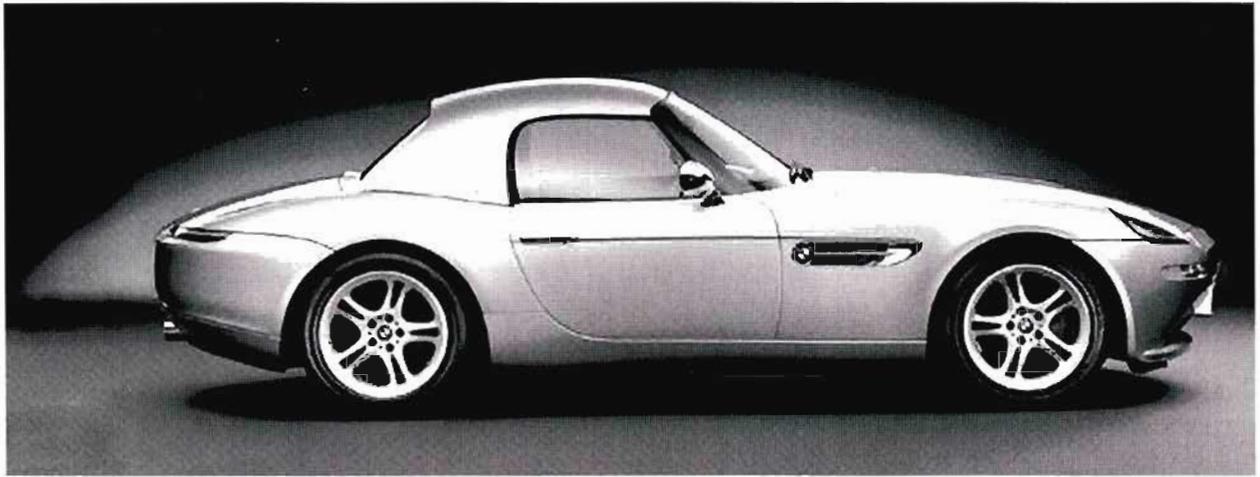
The information contained in the training course materials is solely intended for participants in this training course conducted by BMW Group Technical Training Centers, or BMW Group Contract Training Facilities.

This training manual or any attached publication is not intended to be a complete and all inclusive source for repair and maintenance data. It is only part of a training information system designed to assure that uniform procedures and information are presented to all participants.

For changes/additions to the technical data, repair procedures, please refer to the current information issued by BMW of North America, LLC, Technical Service Department.

This information is available by accessing TIS at [www.bmwcenternet.com](http://www.bmwcenternet.com).

# History and Introduction



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## History

### Z8 (E52) Complete Vehicle

The father of the Z8 is considered to be the legendary 507. Series 1 and Series 2 of the 507 were produced from November 1956 to March 1959. 43 Series 1 vehicles were produced and 209 Series 2 (shown below).

The vehicle was built on a box-section frame with frame side members and tubular cross members. The body was made of light alloy material.

The V8 engine boasted 3.2 litre displacement and 150 DIN bhp at 5000 rpm. Acceleration from 0 to 100 km/h was between 8 and 10 seconds depending on the axle transmission ratio. The specified top speed was 220 km/h. The 507 had a curb weight of 1220 kg.

The 507 was aimed at the sporty sections of elite society. In 1958 (Series 2) the vehicle cost was 29,950.00 DM.



## Introduction

The Z8 is a two-seater sports car following the tradition of the 507. The vehicle design is a combination of classic style elements and modern BMW technology.

The complete body of the Z8 is made of aluminum. The body is produced in the Dingolfing plant and the vehicle is then finished built as a limited production in Munich plant.

The Z8 is designed as a classic roadster featuring a long hood, short overhang, rear-wheel drive and a soft top. Clearly seen above and right, it also features design elements typical of BMW roadsters such as the standard grilles on the front fenders.

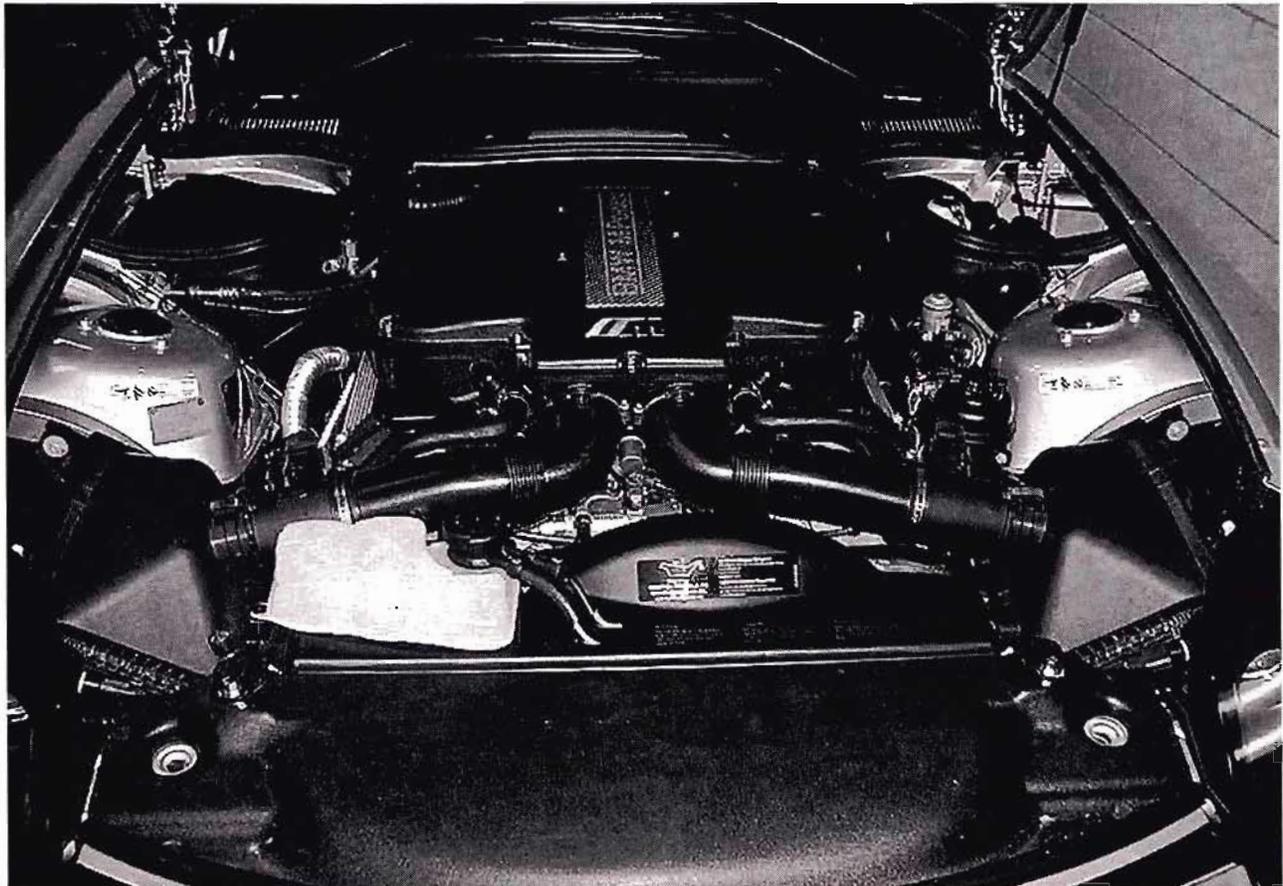
Typical for a roadster, the interior is both compact while at the same time setting new design standards.



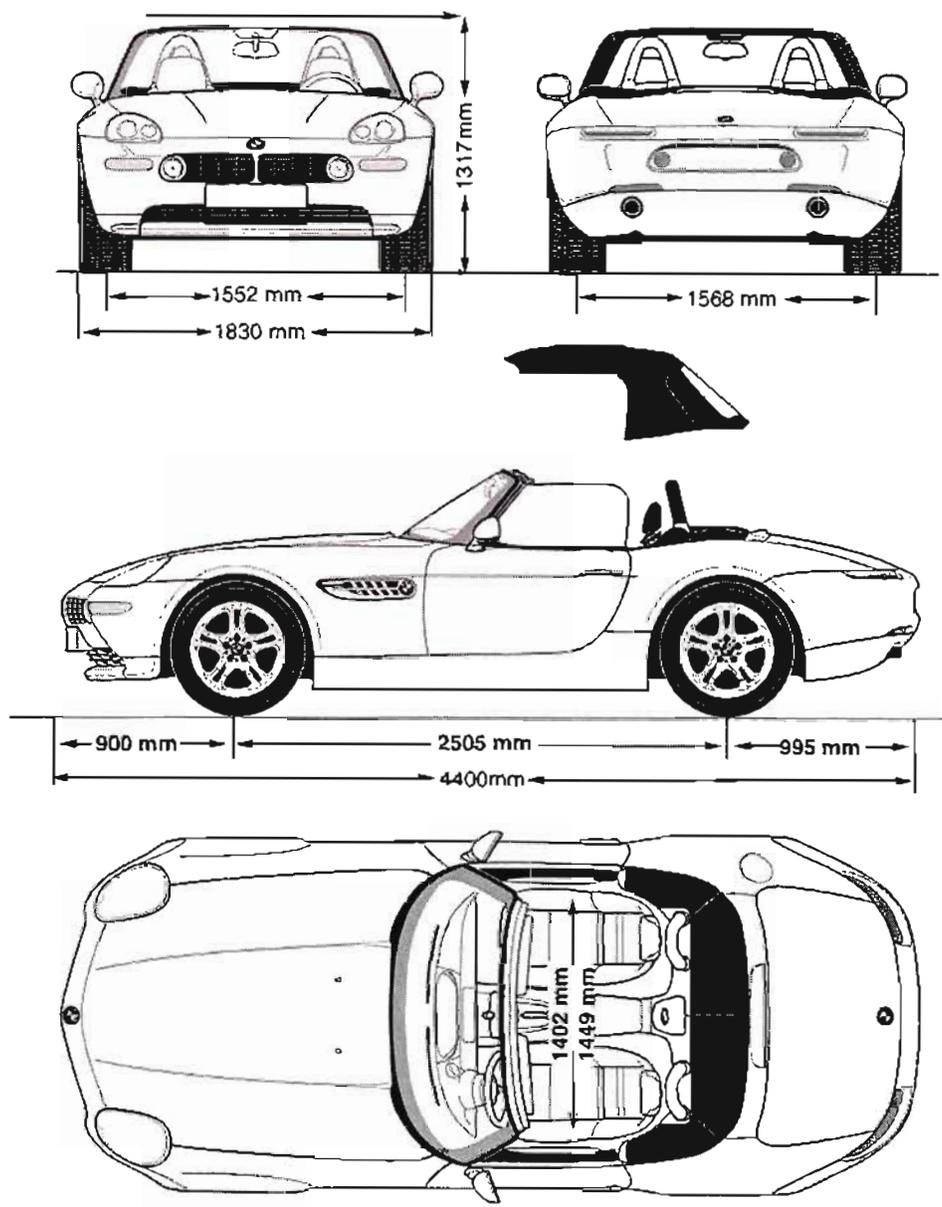
The instruments shown on the right are located in the center of the instrument panel. This allows the driver to fully concentrate on the road ahead.



The underhood view below reveals the cleanly laid out engine compartment. The Z8 is powered by the BMW 5 liter S62 V8 engine, developing 394 bhp and a maximum torque of 500 Nm. This engine is currently found in the M5 luxury sports car.



# Vehicle Dimensions



ST038-40

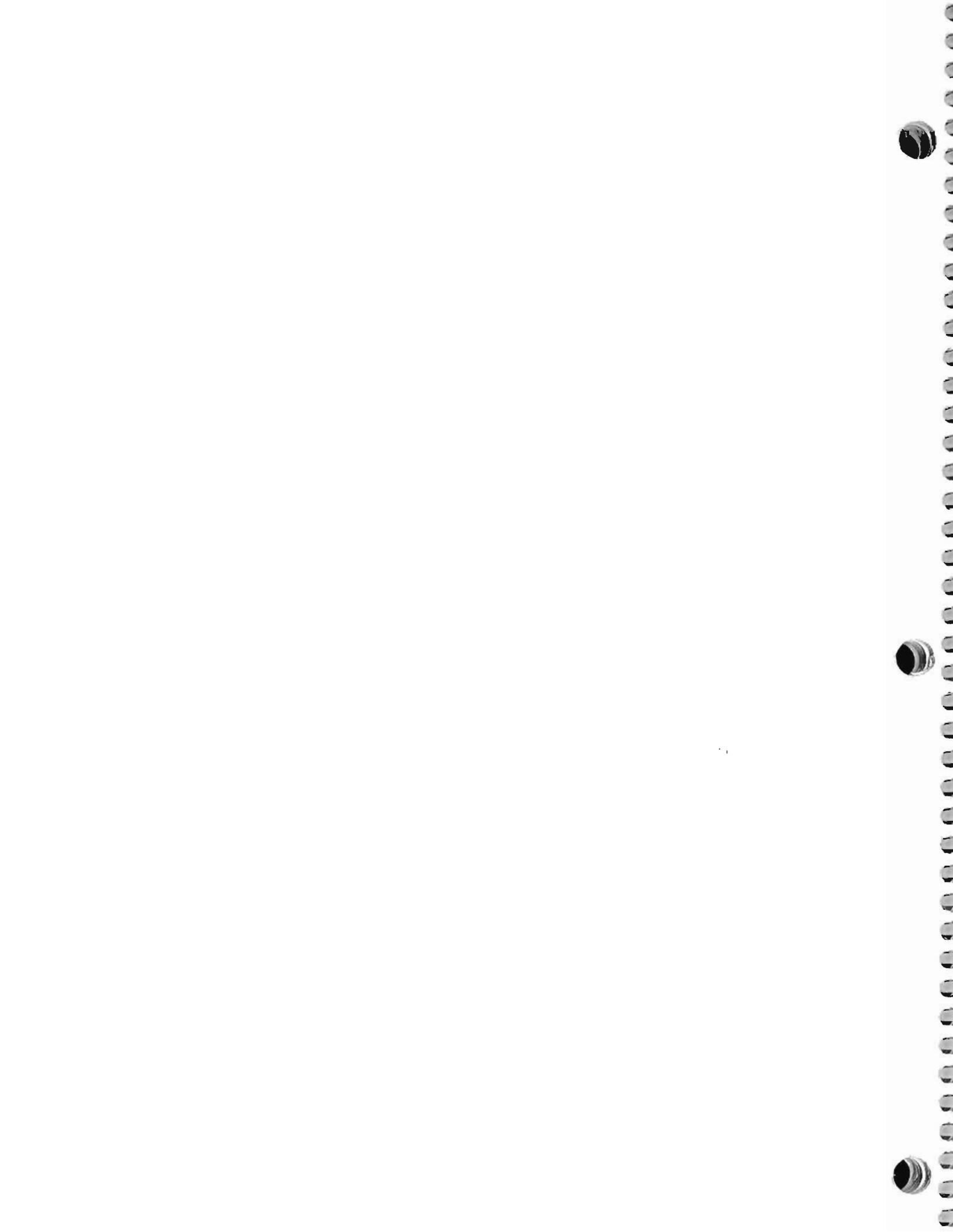
## Technical Data

General	
Length	4400mm
Width	1830mm
Height	1317mm
Wheelbase	2505mm
Drag Coefficient	0.43mm
Turning Circle	11.8mm
Track Width (Front)	1552mm
Track Rear (Rear)	1568mm
Curb Weight	1585kg (3500lb)
	1615kg (With Hardtop)
Gross Weight Rating	1930kg (4,255lb)
Axle load Distribution	50% / 50%
Fuel Tank Capacity	73 L
Engine	
Design	V8
Cylinder angle	90 Degrees
Valves per cylinder	4
Displacement	4941ccm
Bore / stroke	94mm / 89mm
Power	394bhp at 6600rpm
Max. torque	500Nm at 3800rpm
Compression ratio	11.1
Fuel	Premium Unleaded
Drive Train	
Transmission	6-Speed manual
Rear axle transmission ratio	3.15 US
Tire Dimensions	
Front	245/45R 18W
Rear	275/40R 18W

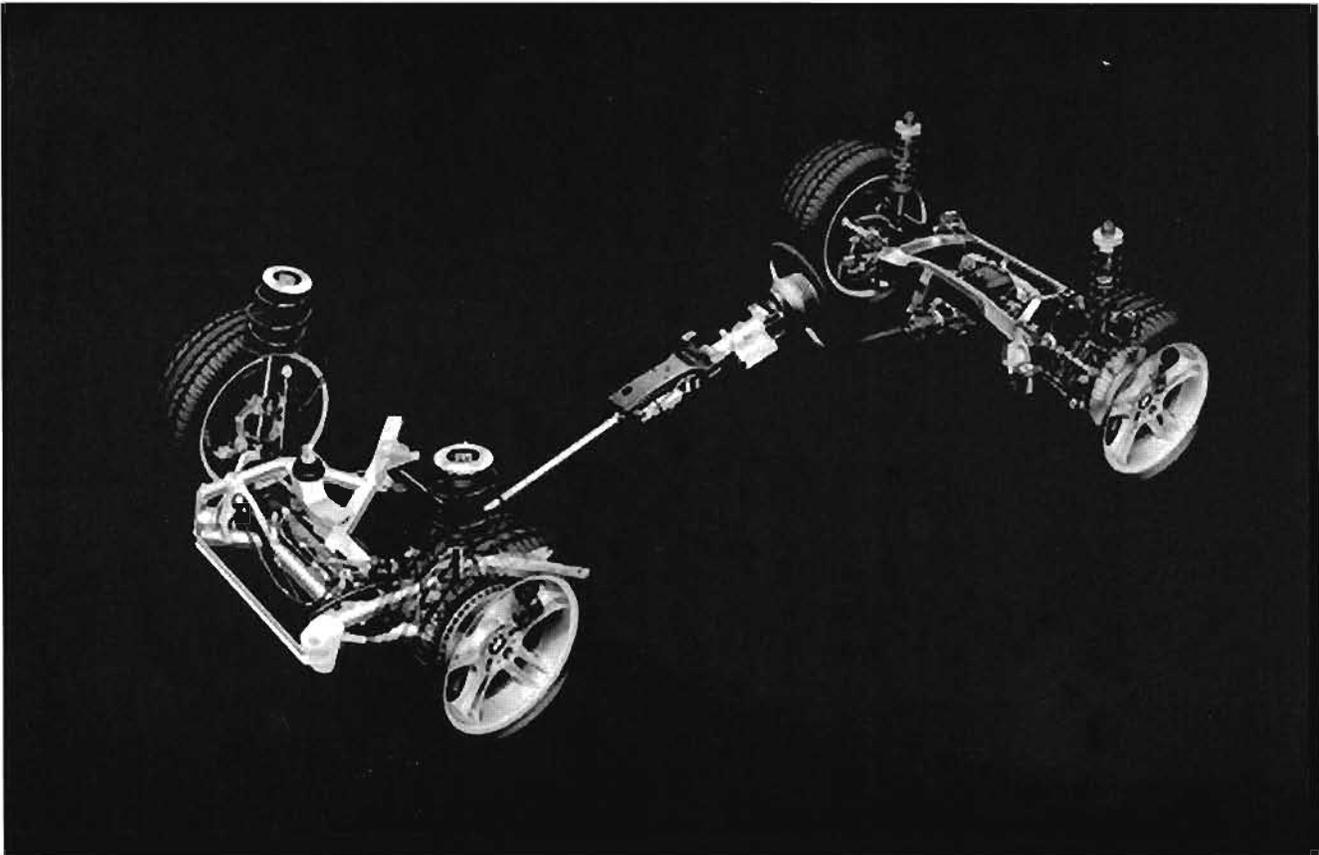
## Vehicles In Same Market Segment

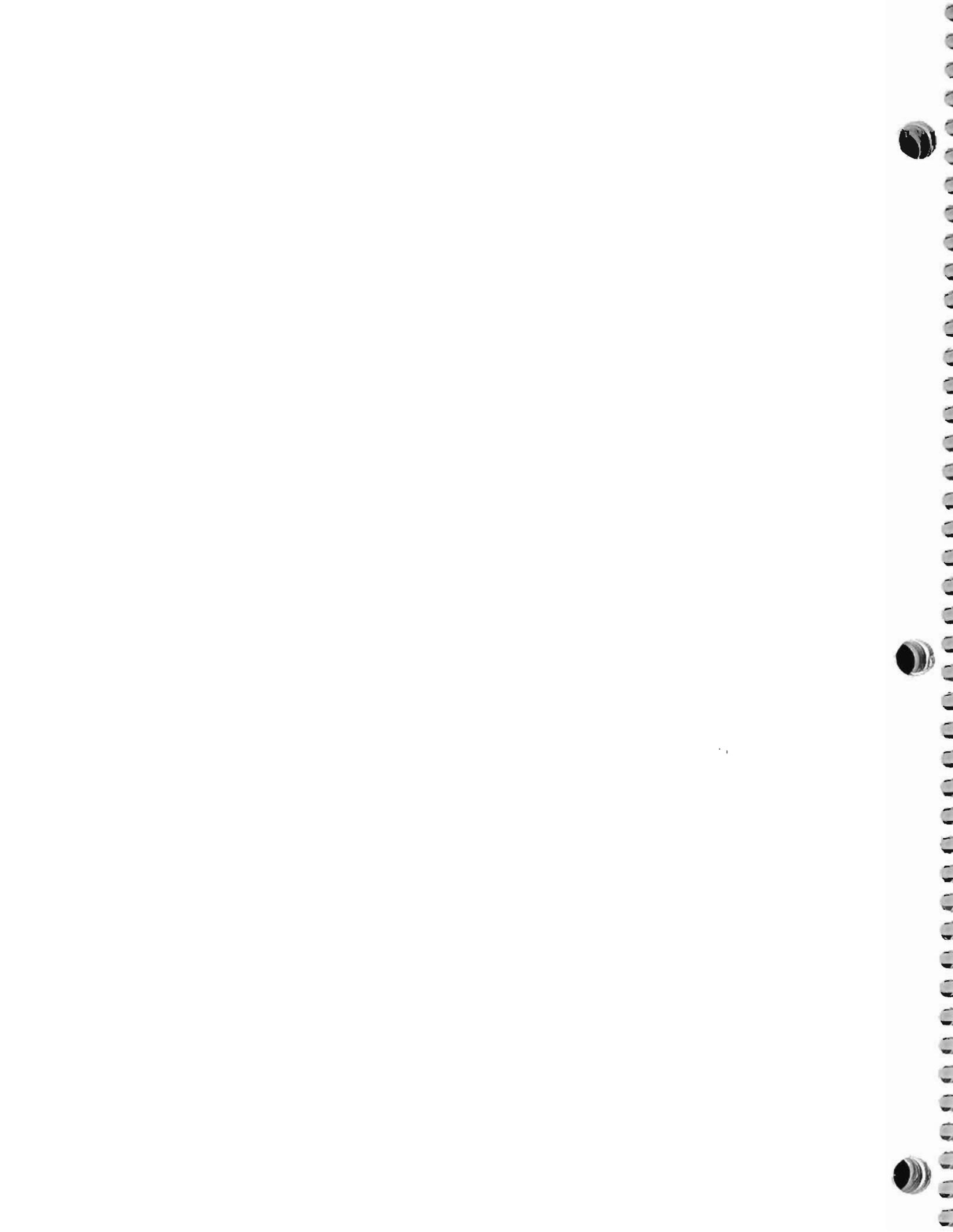
	BMW Z8	Mercedes SL 600	Porche 911 Cabriolet	Chevrolet Corvette Cabriolet	Ferrari F355 Spider	Ferrari 360 Modena (not yet on the market)	Jaguar XKR Cabriolet
<b>Dimensions</b>							
Length (mm)	4400	4499	4430	4560	4250	4477	4760
Width (mm)	1830	1809	1765	1869	1900	1922	1829
Height (mm)	1317	1300	1305	1214	1170	1214	1306
Wheelbase (mm)	2505	2515	2350	2656	2450	2600	1825
Curb Weight (kg)	1585	2050	1470	1538	1350	1390	2588
<b>Technical Data</b>							
Top Speed (km/h)	250 *)	250 *)	280	274	295	295	250 *)
Acceleration 0 -100 (km/h/s)	4.7	6.1	5.4	5.6	4.7	4.5	5.6
<b>Engine</b>							
Power (bhp) (kW)	394 (294)	396 (290)	300 (221)	344 (253)	380 (287)	400 (295)	376 (267)
Torque (Nm/rpm)	500/ 3800	570/ 3800	350/ 4600	483/ 4200	363/ 6000	375/ 5000	505/ 3600
Design	V8	V12	B6	V8	V8	V8	V8
Installation Location	front	front	rear	front	center	center	front
Ca. Price (DM)	235,000	230,000	160,000	115,000	230,000	230,000	170,000

\*) governed



# Running Gear





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# **BODY**

## **Bodyshell**

**Model:** E52  
**Production Date:** 03/00 To Present

### **Objectives of the Module**

After completing this module, you should be able to:

- Describe how the body shell is reinforced using aluminum components to achieve overall Torsional rigidity
- Describe the two main structure methods used to supply strength to support the chassis.
- Identify the different levels of body repair.
- Understand the Rollbar technology and the mounting fundamentals.

# Body Shell

## Purpose of the System

- The aim of BMW development was to achieve a high degree of rigidity in combination with low weight. This objective was achieved by using aluminum in a space frame design.
- The body of the Z8 roadster has been developed as a solid aluminum structure that combines an aluminum space frame with bolt on aluminum outer skin paneling. This design therefore renders necessary repair methods specific to aluminum.
- The aluminum outer skin panel consists of aluminum-magnesium-silicon alloy. The body framework is made up of extruded sections. The entire frame work has a weight of 225kg (496 lbs.).
- The bodyshell of the Z8 consists of a total of 287 parts, of which 87 parts are extruded sections.

*Factors of the outstanding rigidity of the Z8:*

The fastest way to a convertible: head off

coupe      roof off!      convertible

The best way to a convertible: use head

coupe      roof down!      convertible

Optimization of the tunnel frame structure means:

Straight-ahead driving:	good	good
Bumps:	good	good
Cornering:	poor	good
Torsion:	poor	good
Longitudinal rigity:	poor	good

The aluminum space frame structure of the Z8 was evolved from this

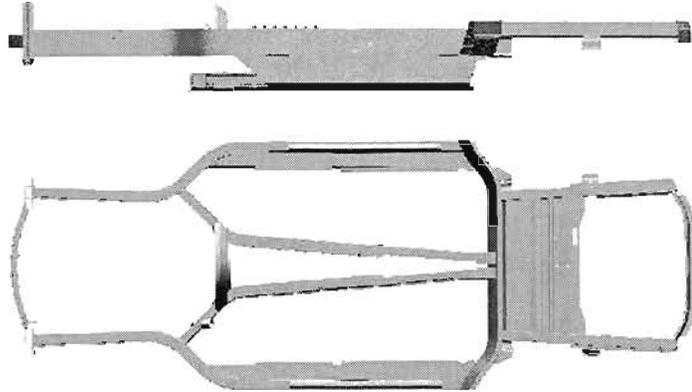
## Components

### Frame - Structural Views

The side and top view shown to the right reveals the formation of the frame "Y" structure.

The "Y" structure enhances strength in the Z8 application.

The depth of the side rail adds to the center strength, as well as accommodating the floor pan.

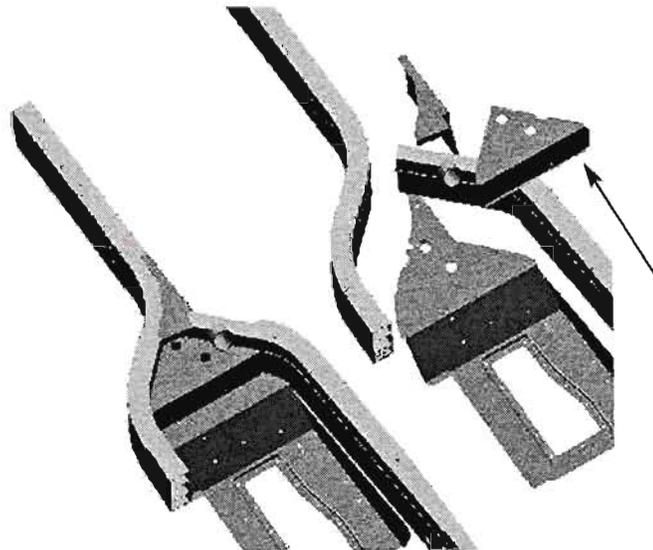


Using the "Y" structure provides the additional strength needed to compensate for the lack of a roof (open roadster).

The transmission tunnel is also a critical frame rail structure.

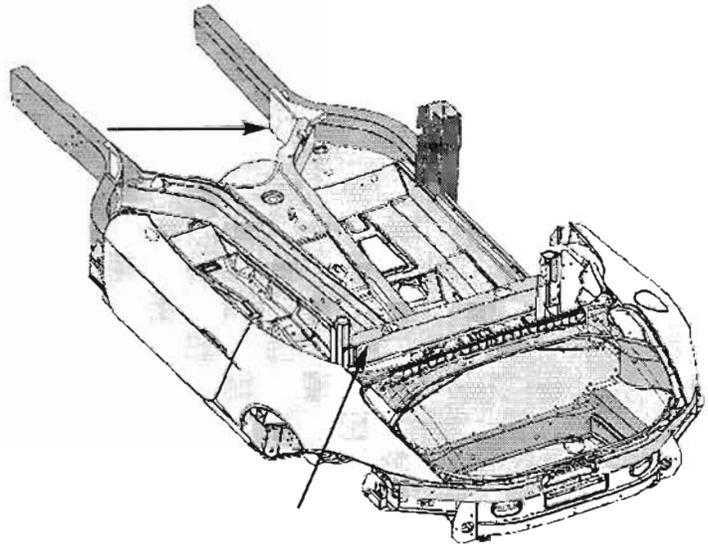
This method of construction provides two additional frame rails for center support which enhances structural rigidity.

The illustration on the right highlights the triangulation pieces that reinforce the "Y" structure.

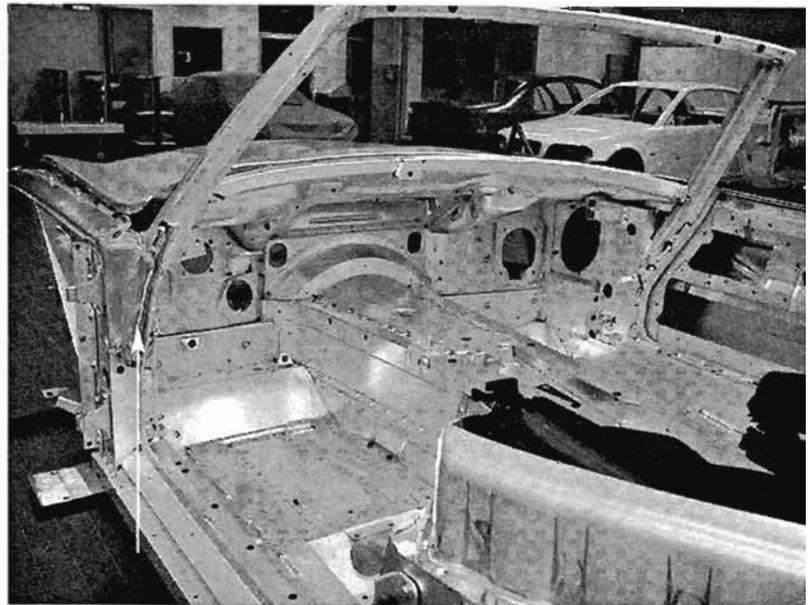


The frame and floor pan assembly illustration on the right shows additional triangulation reinforcement pieces.

The rear support beam provides additional floor pan support as well as torsional rigidity.



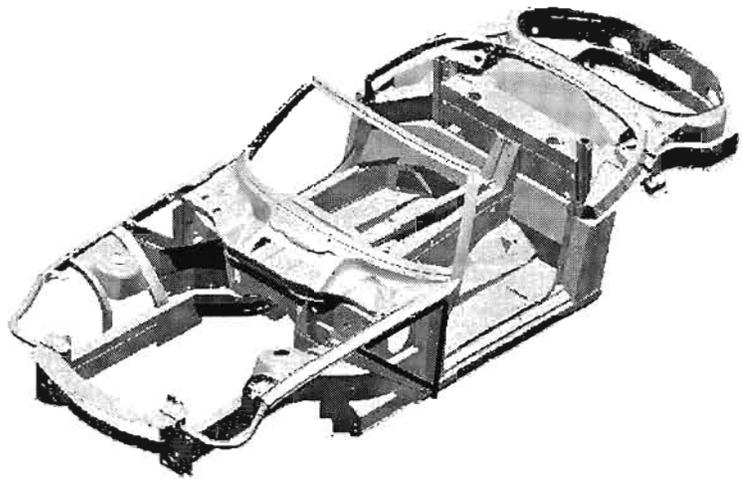
Shown on the right is the windshield frame structural mounting and engine compartment bulkhead assembly.



The aluminum "space frame" with joint connection is highlighted on the right.

To offer support for the front "clip" to the engine compartment bulkhead (preventing upward flex), the frame with a joint connection is used.

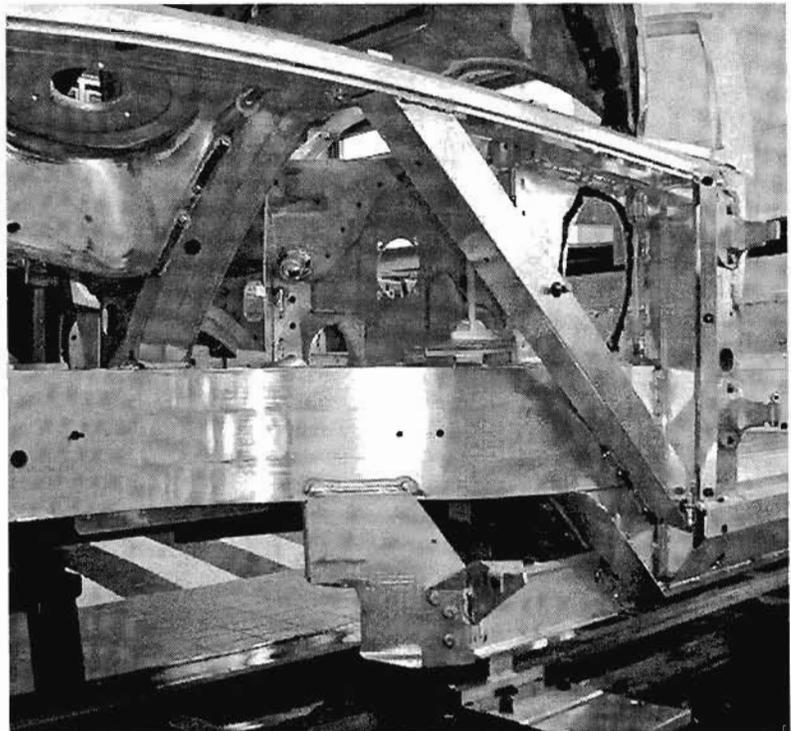
Critical in race car construction for strength and rigidity is the use of "triangulation".



The left front frame with joint connection (actual) is shown here on the right.

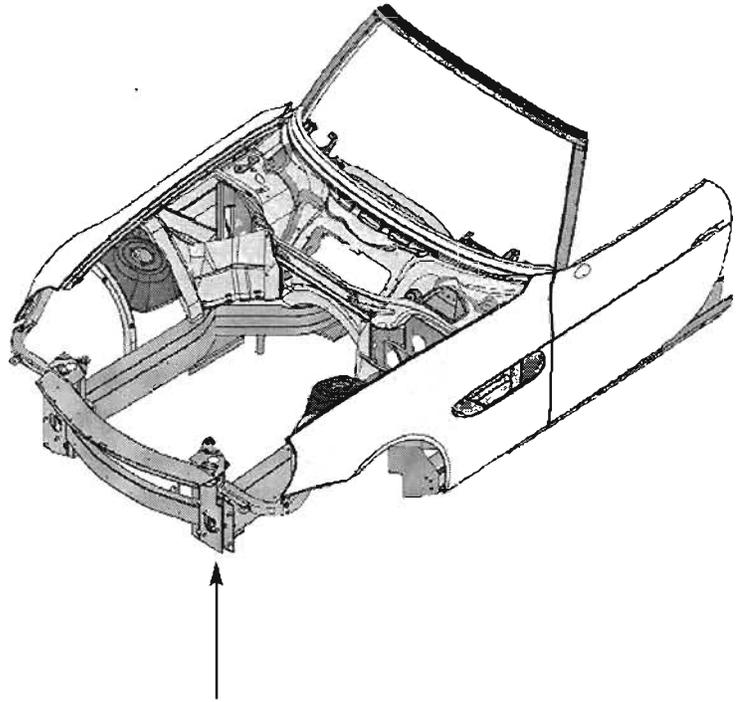
Triangulation can clearly be seen here to reinforce the upper front "clip" rails which support the strut towers.

This type of reinforcing provides excellent support for the aluminum frame.

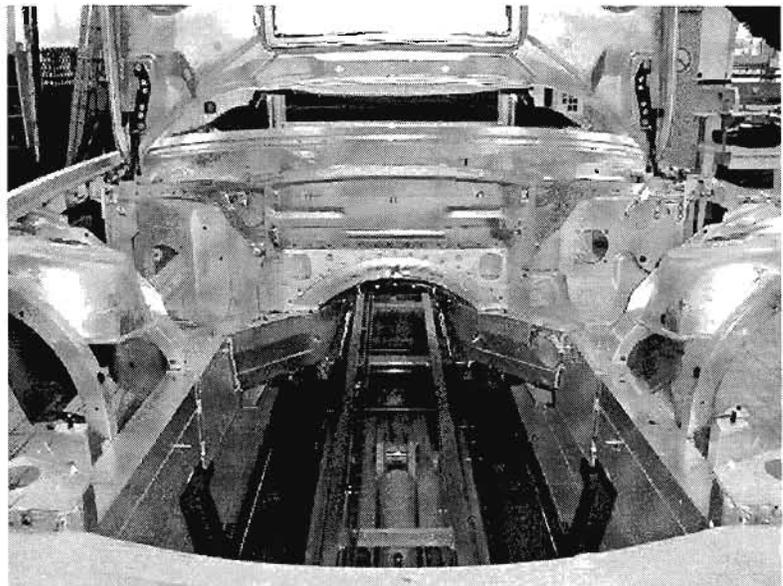


The front structure illustration on the right highlights the additional frame support behind the front bumper assembly.

The mounting points for the bumper impact absorbers can be seen here.



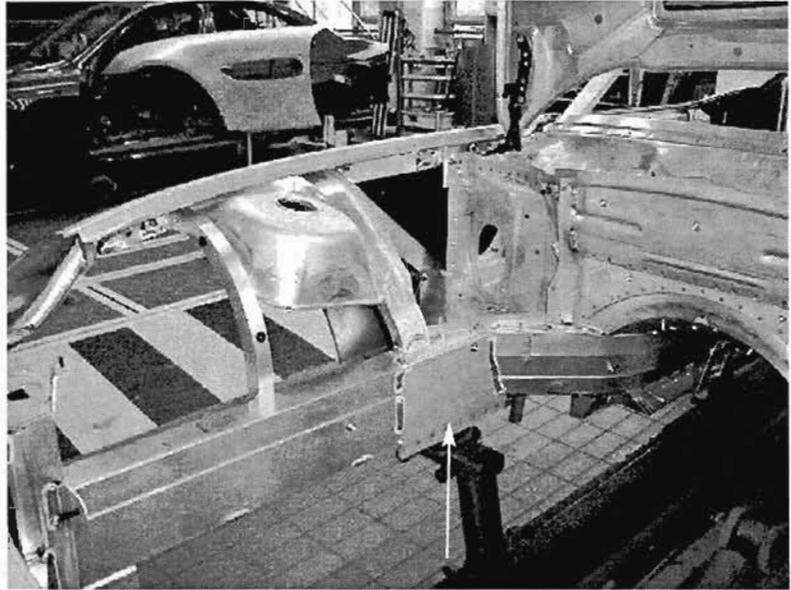
The engine compartment structure shown in this actual view reveals the massive frame rail size.



The aluminum strut tower structure can be seen here on the right which is supported by two channel braces that connect with the upper support rail.

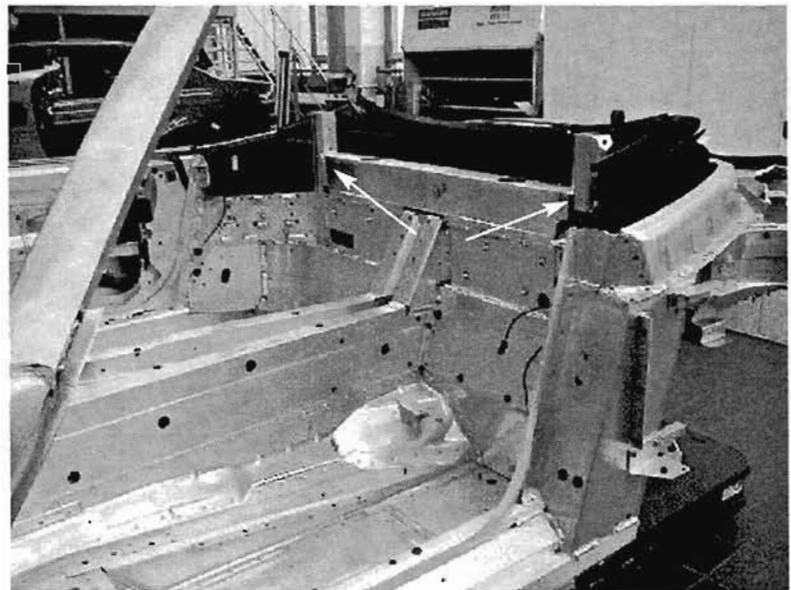
This method of construction reduces weight in the inner fender well area.

An additional strengthening plate for the frame rail is visible here.

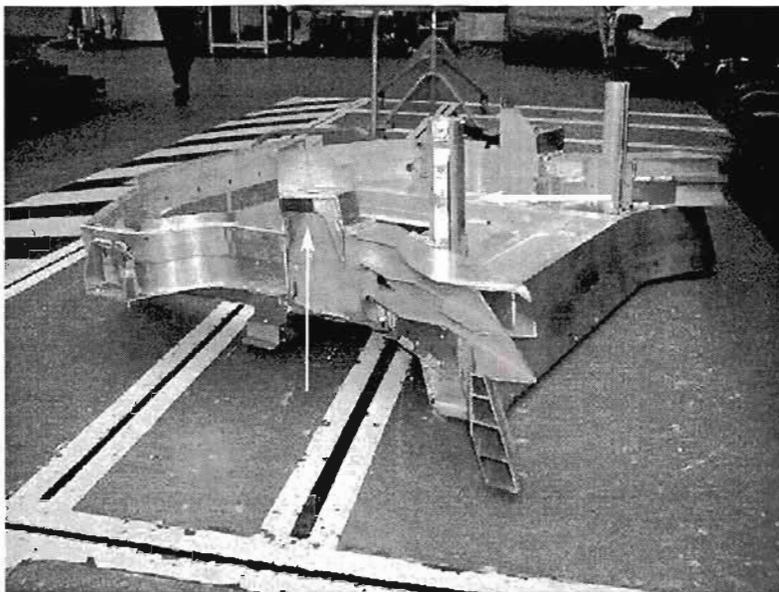


The left rear floor section shown here reveals the inner frame rail mounting to the rear support beam.

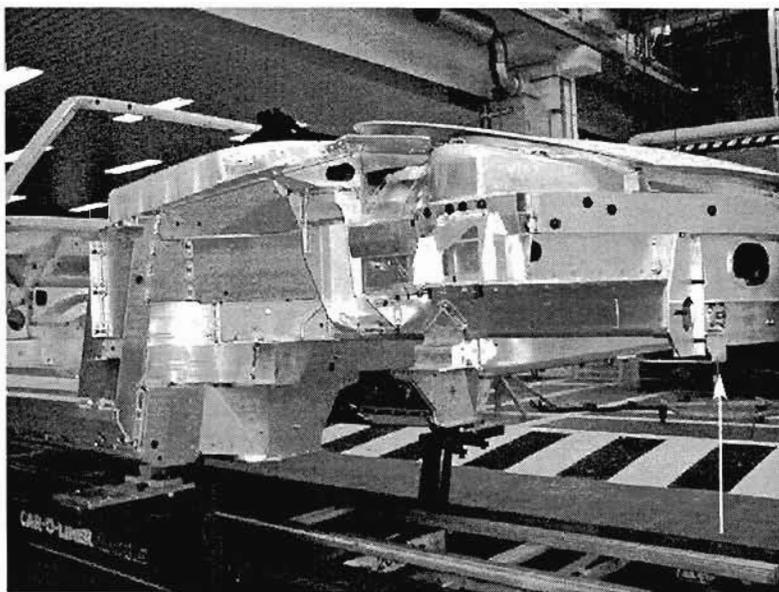
The roll bar supports are integral in the main structure.



The rear frame section (right side shown) points out the rear strut tower support and the integral roll bar mounting.



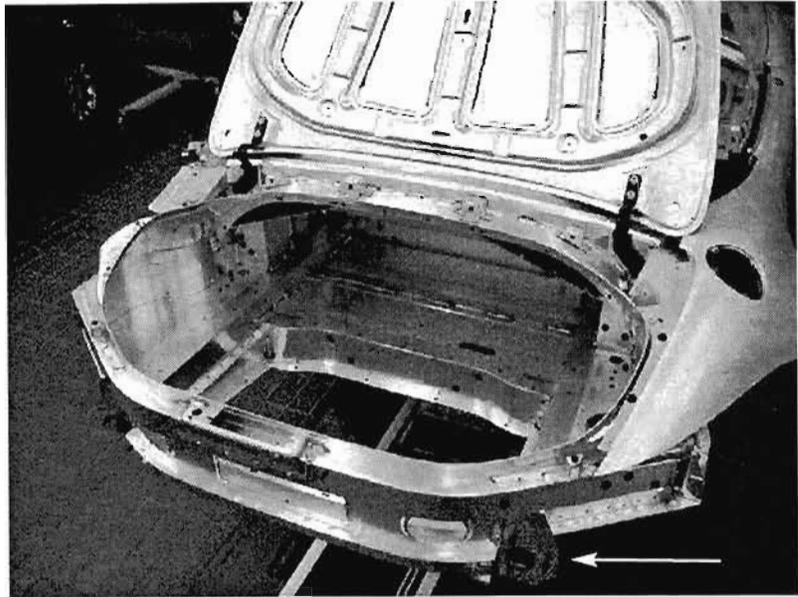
The left rear frame structure shown on the right highlights the upswept rear frame rail and the mounting point for the rear impact absorber.



The luggage compartment view on the right reveals the spacious trunk.

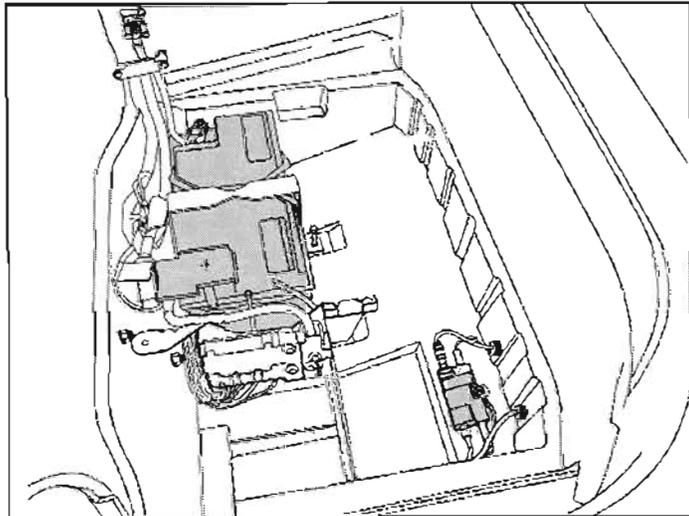
The fuel tank (73l) is forward mounted in this compartment.

Also shown is the massive rear support structure and mounting for the bumper impact absorbers.



The luggage compartment floor insert is a bolt in plastic tray that holds the battery, tool kit, and antenna amplifier.

The view on the right also shows the BST cable and high amp fuses.

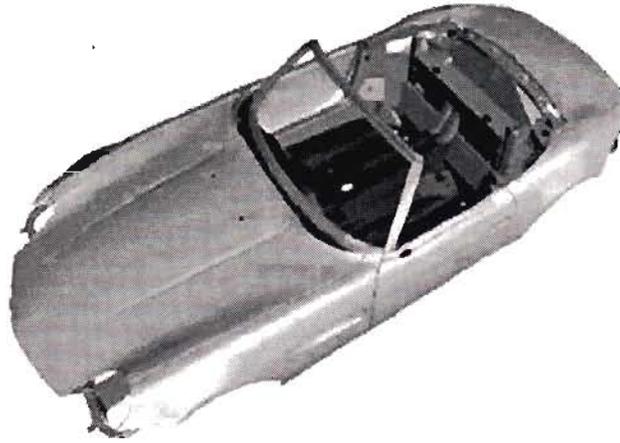


# Components

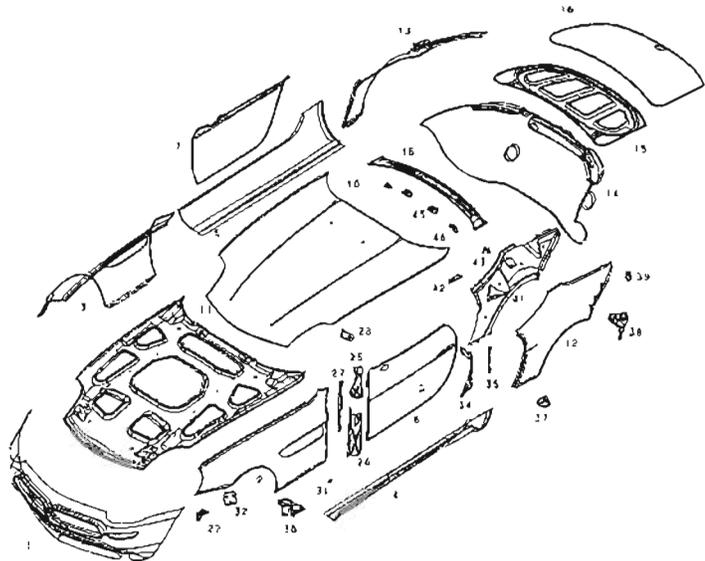
## Body - Panel Views

The outer "skin" body panels are all bolt on, minimizing repair time and cost.

The picture on the right represents the entire body shell and frame structure assembly.

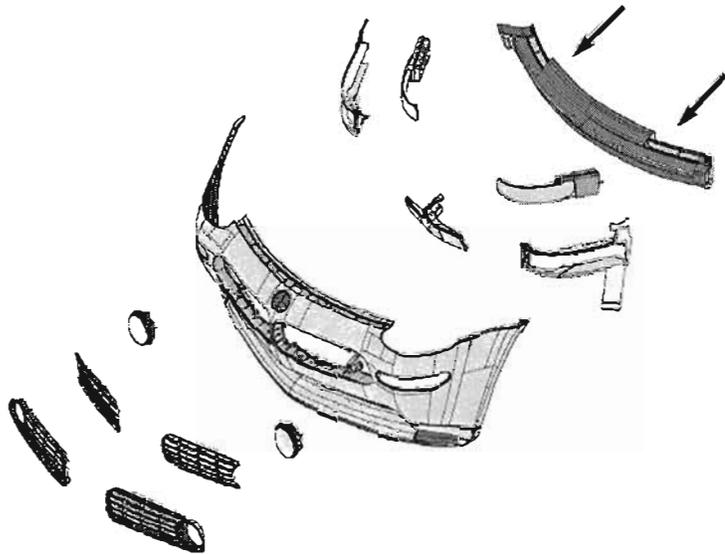


In addition to the bolt on panels shown in this illustration, compound outer panels such as door, hood, and trunk skins are bonded to their support frames.



The illustration on the right is the integrated flexible front bumper assembly.

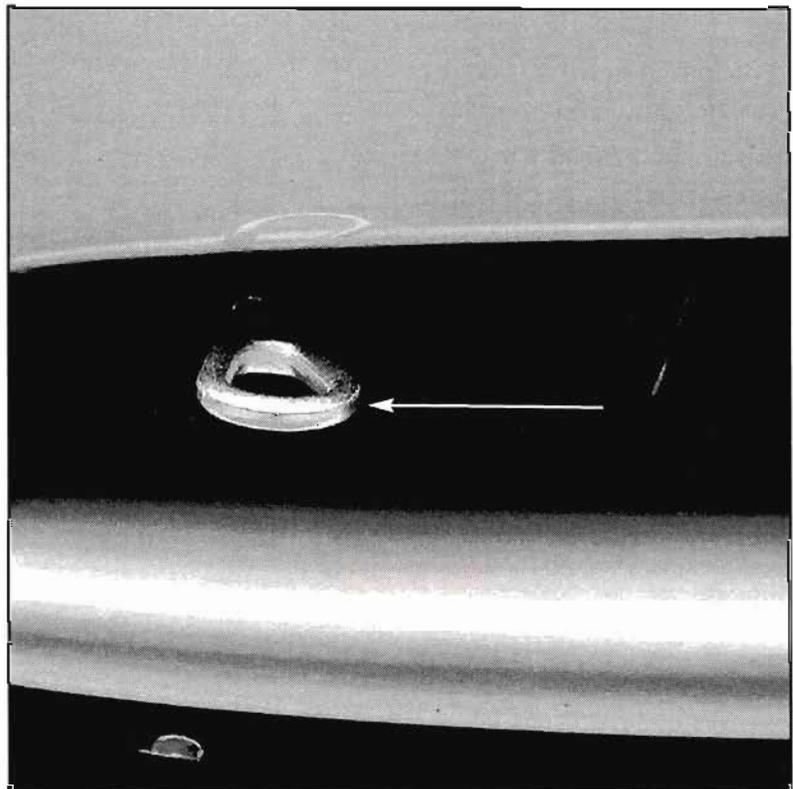
Notice the impact absorbers are not shown, but they mount to the structural support and into the frame rails.



Pull out (unsnap) the grille panel to access the tow hook mounting point.

The threaded tow hook is stored in the tool kit.

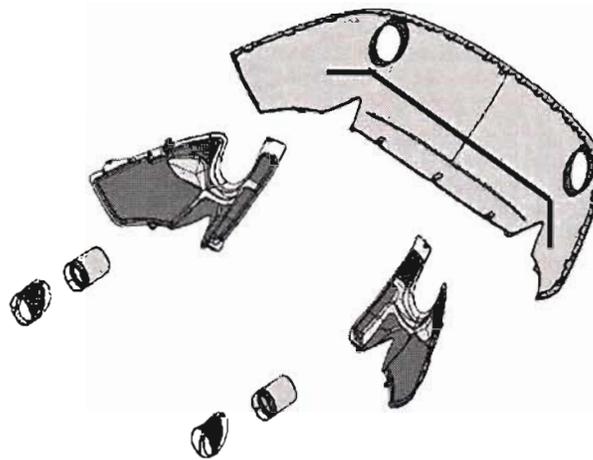
Shown on the right is the installation position.



The rear bumper assembly with heat insulators is shown to the right. The AM/FM/ Telephone antenna is located across the flexible panel.

Notice the impact absorbers are not shown, but they mount the rear bumper assembly to the rear frame rails.

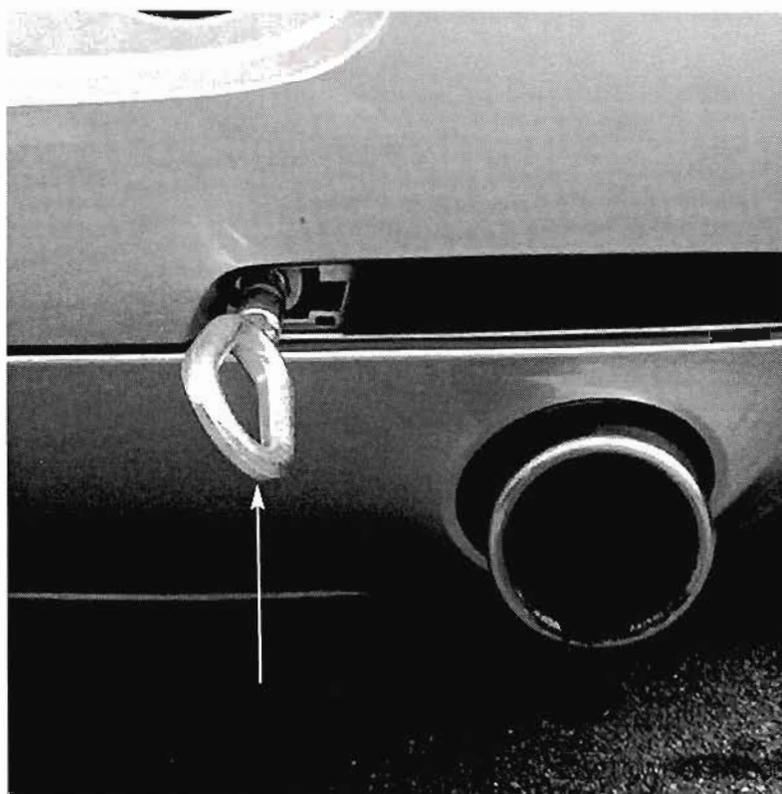
The exhaust tips are attached to the rear bumper assembly.



To access the rear tow hook mounting, push on release tab of the split reflective lens as indicated in this picture.

The threaded tow hook is located in the tool kit.

The exhaust tip can also be seen here which is attached to the bumper assembly.



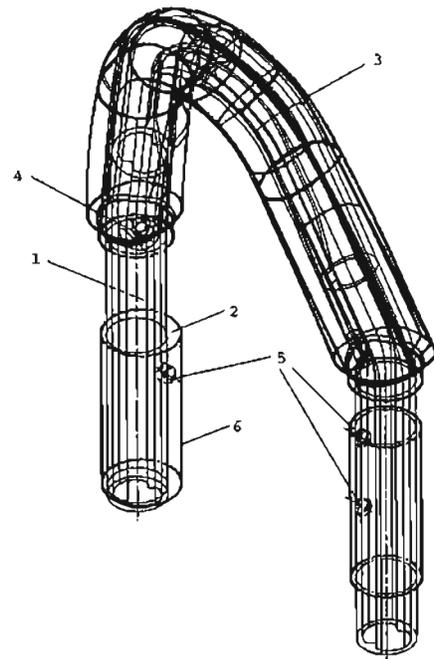
## Rollbar

The fixed rollbars are made of high strength extruded aluminum sections. The rollbar is fitted in a sleeve, to which it is insulated by a cushion of vulcanized material.

This vulcanized material can deform under heavy load allowing the rollbar to move within a predetermined range. Therefore; the rollbar can reduce forces to the head in the event of a rear end collision.

To ensure the body mounts are not damaged by the very firm rollbar under extreme load, the rollbar features defined deformation points at which it can kink without sheering.

1. High strength aluminum extruded section
2. Vulcanized material
3. Foam jacketing material with leather cover
4. Defined deformation point
5. Mounting points
6. Sleeve



The rollbar is connected to the body mount by a sleeve.

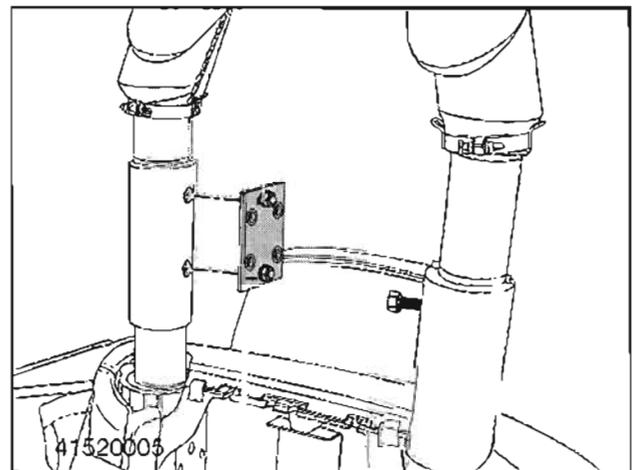
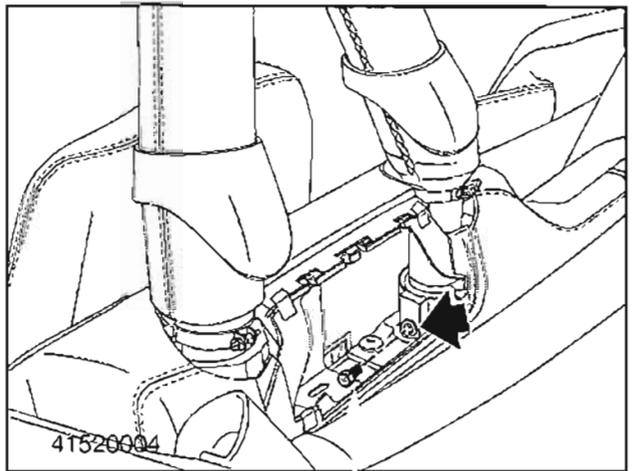
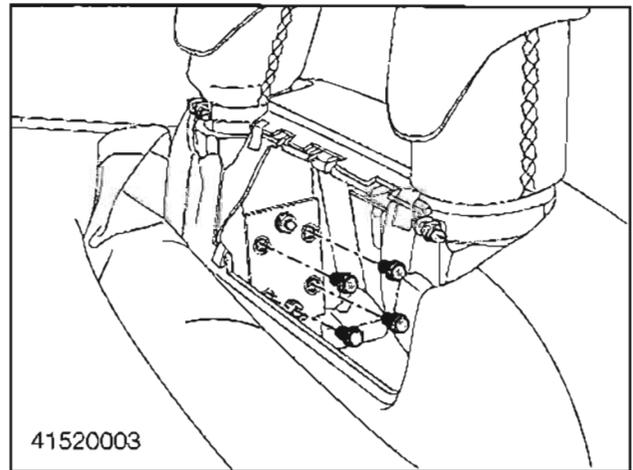
## Rollbar Mounting

To remove the roll bars, gently slide the chrome base covers up as shown on the right. Unsnap the cover panel from the top and fold down to remove.

Remove the mounting bolts, four 10 mm on the outside (shown on the right), and one 13 mm on the inside (shown below), of the roll bars.

The roll bar has been removed from the mounting sleeves to allow visibility of the single mounting bolt on the right, and the four bolt locating plate on the left.

**Note:** The mounting bolts exert a certain force (determined by the tightening torque) on the extruded section of the roll-bar. Be sure to engage the pins on the locating plate in the roll bar before tightening.



## Repair Concept

- The Z8 requires special attention when body repair is needed due to the all aluminum construction. It is important to note that body repair methods on aluminum widely differ from those methods used on steel.
- Please, review the following information on Repair Concept and share the information with other BMW Center personnel. This information reflects engineering and design, repair work in general, and our recommendation for implementation.
- With consideration for engineering, repair equipment availability, quality requirements, know how, investment outlay, *three levels* of repair are outlined:

### Level 1 - "light duty" repair:

scratches  
dents  
bolt on panel replacement  
paint work

### Level 2 - "medium duty" repair:

frame rail sectioning  
the use of epoxy bonding and riveting  
repairs requiring frame/body fixtures  
repairs requiring dimensioning tools

### Level 3 - "heavy duty" repair:

frame rail replacement  
structural panel/support replacement  
repairs requiring welding  
repairs requiring the use of frame/body fixture tools

\*level 2 and 3 require specific tools, equipment, and training

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## Implementation

*Level 1* is straight forward and can be performed by a competent BMW body repair facility, or BMW approved sublet partner repair facility.

Due to the complexity, skill, tools and equipment required for *Level 2* and *3* repairs it is **HIGHLY RECOMMENDED** to have the vehicle repaired at one of the BMW authorized repair centers:

BMW of North America, Inc.  
Montvale, NJ

BMW Performance Center  
Greer, SC

BMW of North America, Inc.  
Oxnard, CA

Quality repairs are need to maintain sound structural integrity and value preservation of the Z8 as well as all other BMWs.

The locations listed above are recommended as they have the specialized equipment required and factory collision repair technicians, possessing the skill need to perform proper Z8 repairs.

Please, refer to any Aftersales announcements such as the Service Information Bulletins for outlined specific details.

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## Review Questions

1. What is the most important point about replacing the rollbar?

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2. Where are the recommended repair facilities for a level 2 or 3 body repair?

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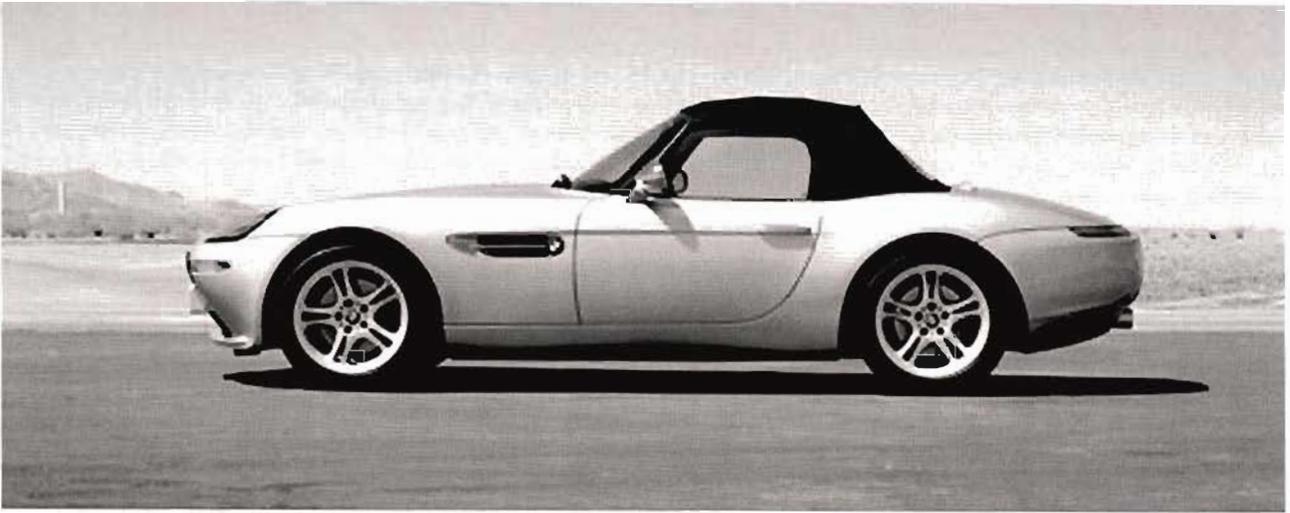
3. What are the two major frame structures that add to the rigidity of the Z8?

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# Convertible Top



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# **BODY**

## **Convertible Top**

**Model:** E52

**Production Date:** 03/00 To Present

### **Objectives of the Module**

After completing this module, you will be able to:

- Describe the lowering and raising sequence of the convertible soft top in detail.
- Name the functions and locations of the convertible top sensors.
- Identify and describe the hydraulic components used in the convertible top.
- Describe the windshield frame latching assembly.
- Describe and perform the convertible top emergency operation.

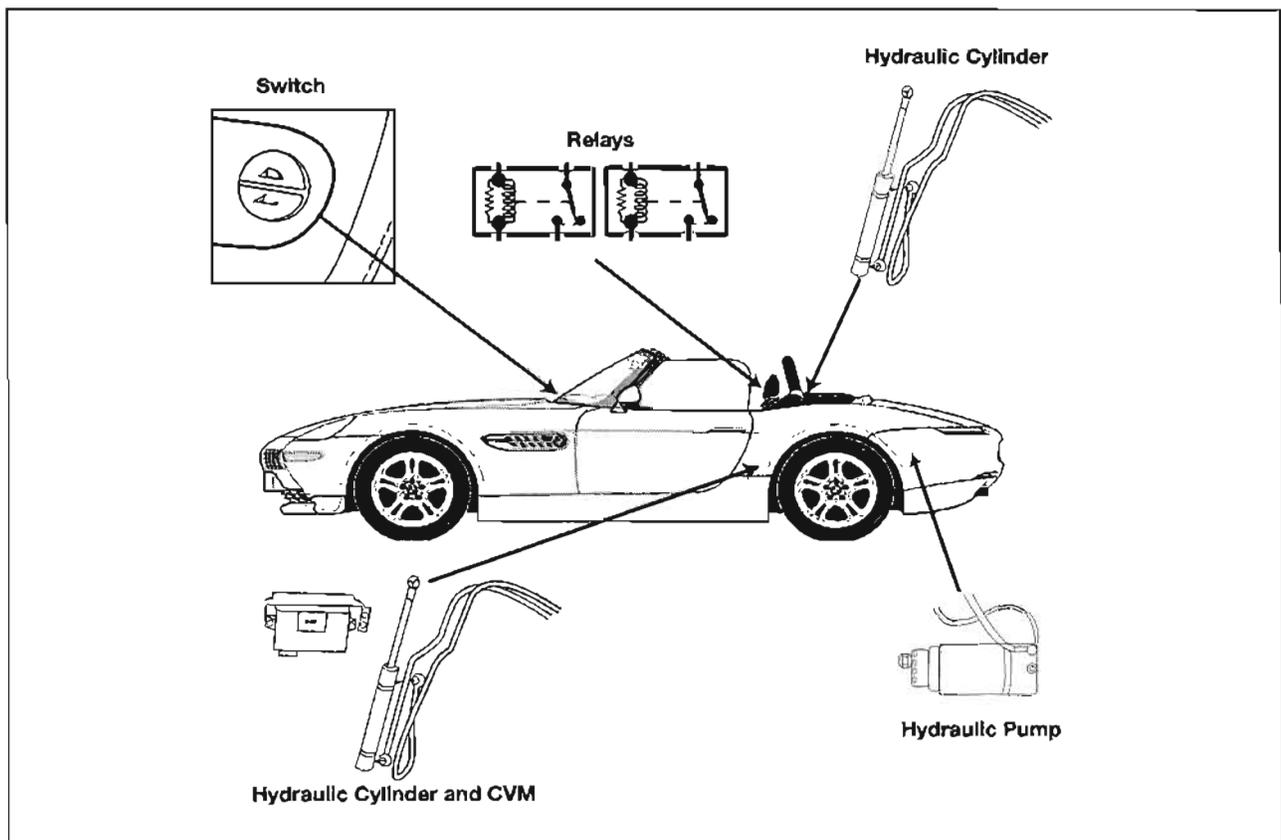
## Convertible Top

### Purpose of The System

The Z8 Convertible top is a semi-automatic electro-hydraulic system that opens and closes the soft top using hydraulic cylinders and an electric motor. It consists of the convertible module (CVM) which monitors and controls the complete operation of the soft top system. The CVM interacts with the General Module which controls the window operation when lowering or raising the soft top. A hard top is standard equipment.

### Convertible Top Features

- Electro/Hydraulic Operation
- Servo Assisted Electric Lock
- Flexible, Easy to Replace Rear Window (Zip Out)
- Inner Headliner
- Emergency Operation



## Top Construction

### Top and Frame

The convertible top consists of *three layers*:

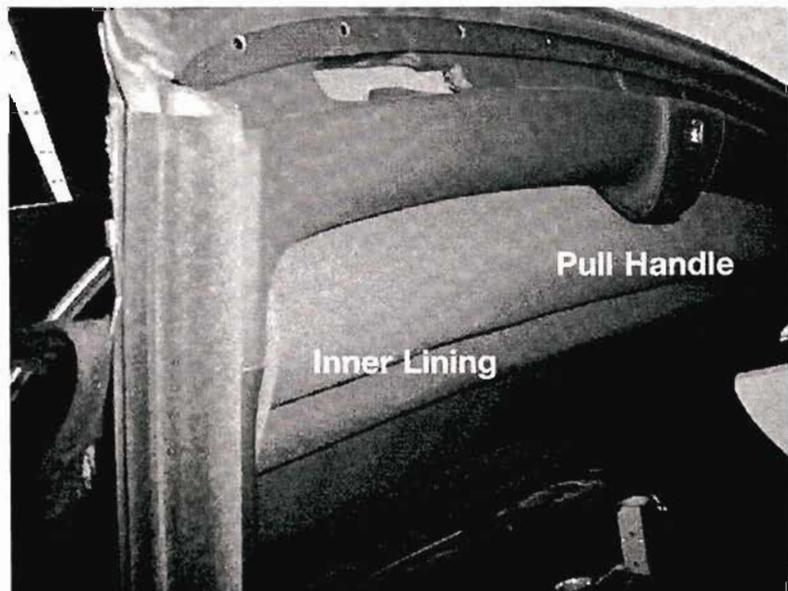
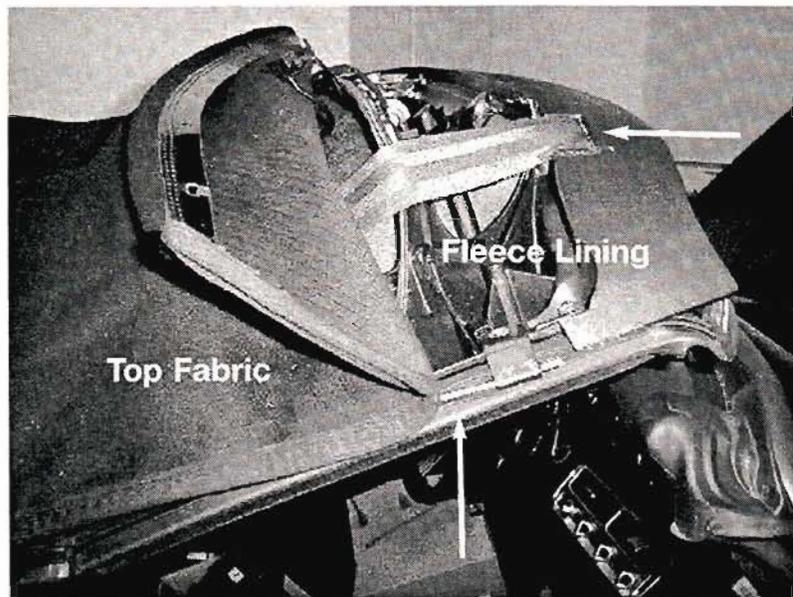
The **outer layer** is fabric with a replaceable (zip-out) rear window.

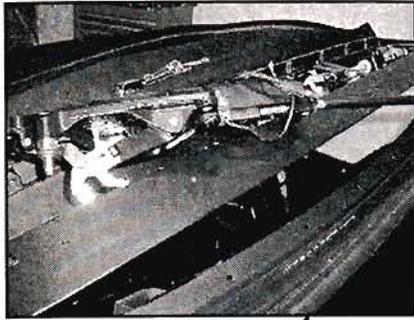
A **middle fleece liner** is installed between the fabric and inner liner for sound and weather insulating purposes.

To assist the frame in tensioning when the top is closed, the top has tensioning straps and cables for additional support, which is indicated by the arrows on the right.

The **inner liner** is similar to the E46iC and is attached to the top frame so that it stretches tight when the top is closed.

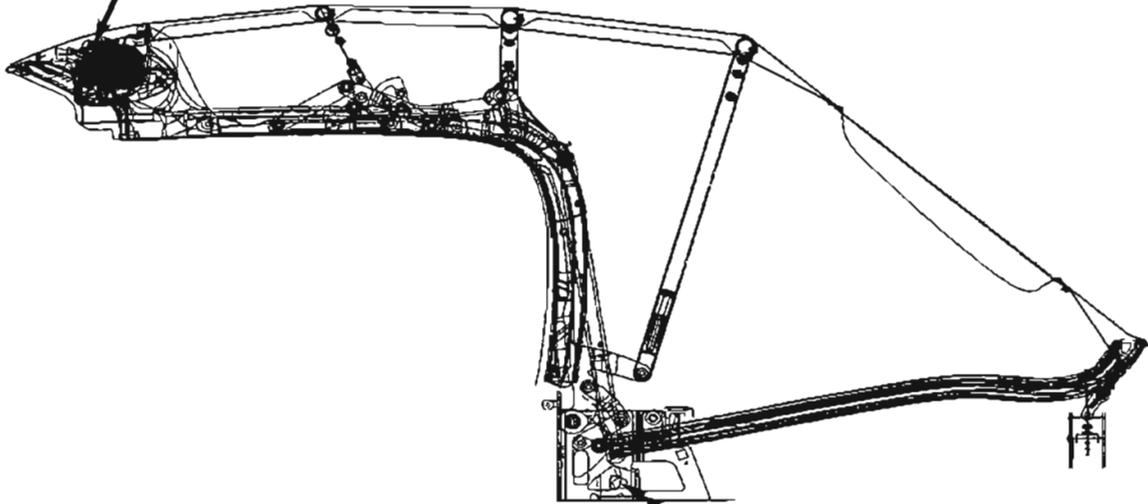
The pull handle with integral Hall sensor which is (required for the final closing procedure) is also shown on the right.



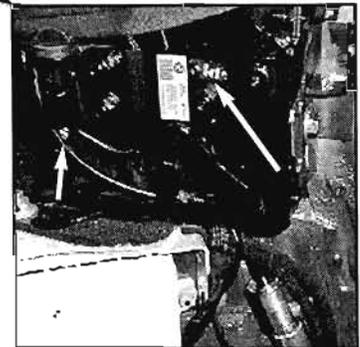


Latching Assembly

Underneath the fabric, the front bow houses the latching assembly. This assembly consists of a drive motor, closing handle (hall sensor) and two mechanical latches. The right hand latch consist of three hall sensors.



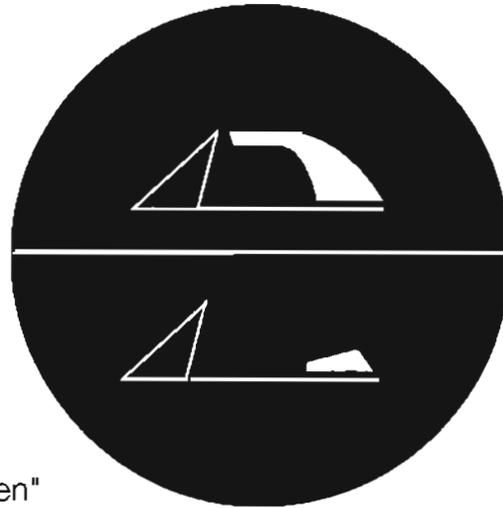
The left rear hinge assembly contains two hall sensors for top up/down recognition.



Hall Sensors

## Pre-Conditions for Soft Top Operation

- Ignition switched on
- Vehicle stationary (0 road speed)
- Switch must be continually pressed



## Procedure To Open The Top

- Press and hold convertible top switch to "open"
- Windshield latch is released automatically
- The side windows are lowered (via K-bus to GM V)
- The convertible top is lowered into the convertible top compartment
- Sound system is automatically equalized (road noise compensation)
- Windows will raise if the switch is continually pressed after the top is stored

## Procedure To Close The Top

- Press and hold convertible top button to "close"
- The side windows are lowered (via K-bus to GM V)
- The convertible top is raised out of the convertible top compartment
- Release "close" convertible top button
- Squeeze/pull the recessed handle (windshield latches lock the bow)
- Windows will raise if the squeeze/pull handle is continually pressed after the top is raised

## Hydraulic Unit

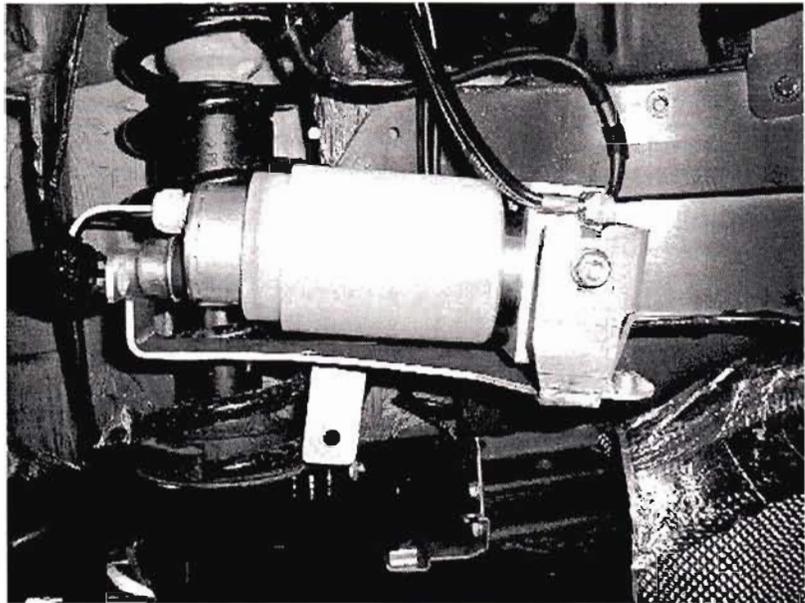
The hydraulic unit is a self contained unit with a sealed reservoir that is sleeved around the pump assembly.

The end of the hydraulic unit contains a distribution block where the hydraulic lines are fitted.

The hydraulic unit is located in the left rear fender well.

The pump motor is controlled by the CVM III.

The CVM III simply reverses the polarity (through the relays) to reverse the pump motor operation.

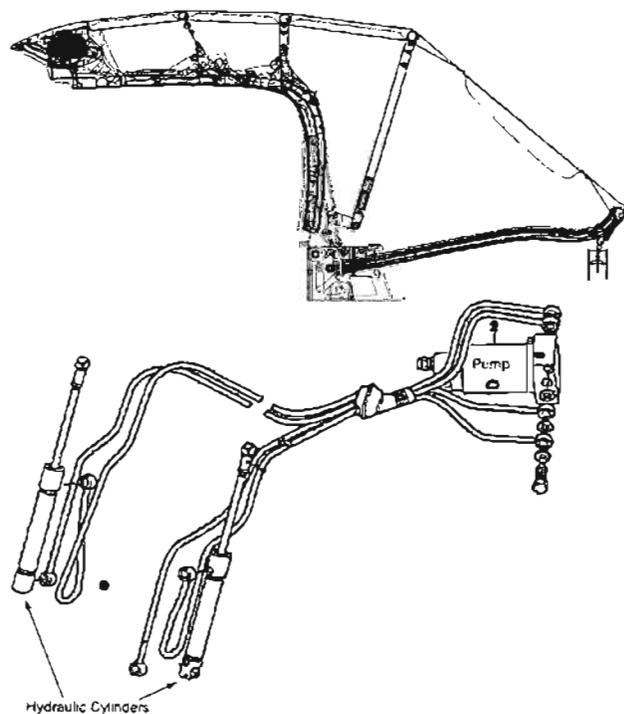


## Hydraulic Cylinders

The convertible top is operated by two hydraulic cylinders (which reduces stress from the top frame).

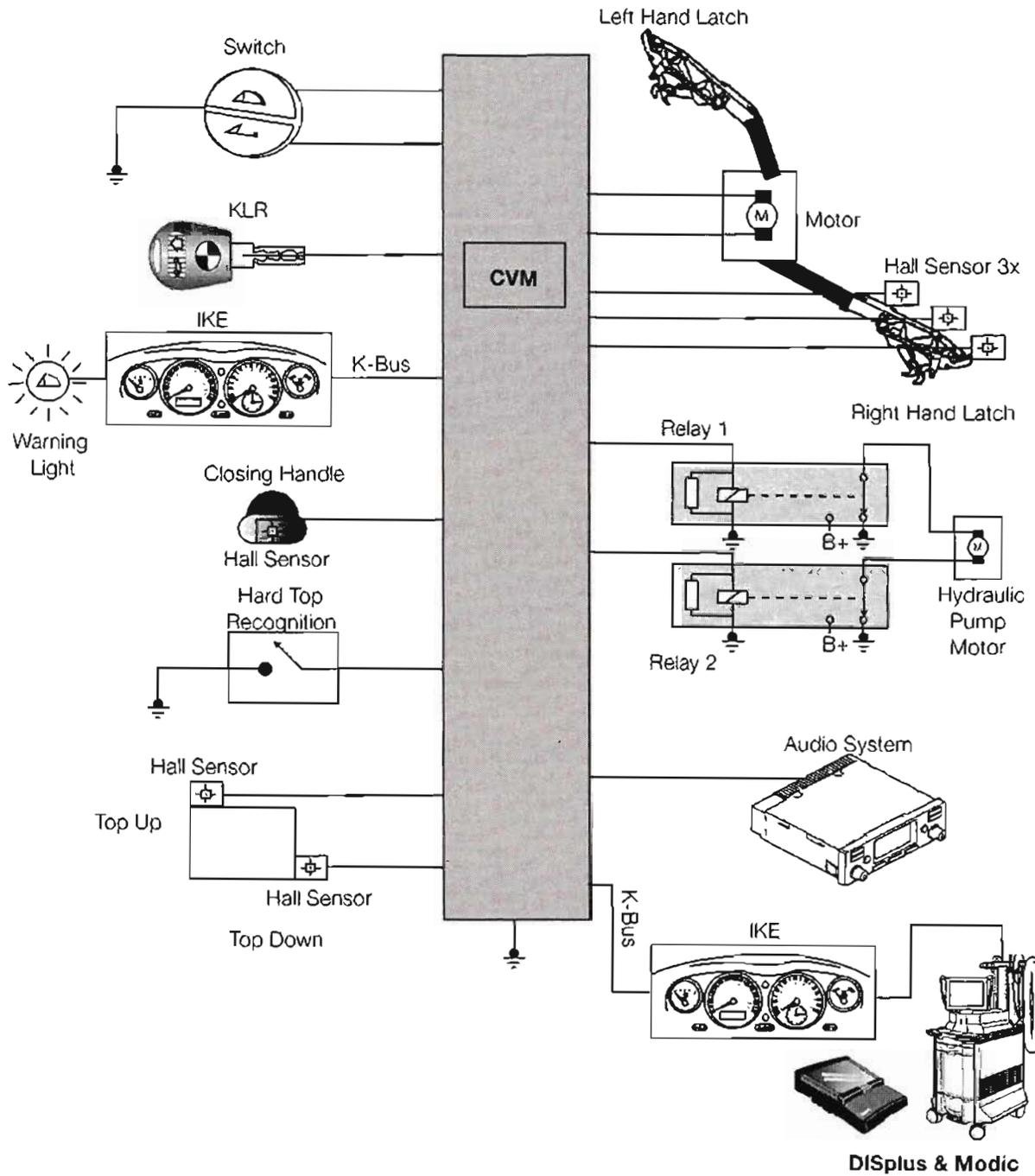
They are located behind each seat under the rear interior trim panels.

The hydraulic lines are routed into the body behind the driver's seat.



# System Operation

## Electrical Operation



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## Electrical Operation

### Top Operation

The convertible top operation is controlled by the Convertible Top Module (CVM III). The control switch is located in the center console, next to the shift handle. During operation the convertible top warning light will be "on". If the top is stopped in mid operation, or if a fault occurs, the warning light will "flash". The top will not operate if there is road speed present.

### Top Lowering Sequence

#### *Top Switch Pressed "Open"*

- The CVM activates the latching drive motor, which releases and open the latches.
- The latch hall sensor confirms the release of the latches by sending a signal to the CVM.
- The CVM signals the GM to lower the windows (if closed) for approx. 1.5 sec.
- The CVM activates the pump motor relay (1) and the hydraulic pump pressurizes the hydraulic cylinders to pull the soft top open.
- The soft top will then be folded into the storage compartment.
- When the soft top is in the storage compartment, the Top-down hall sensor signals the CVM to deactivate the hydraulic pump.
- The CVM will then activate the latching drive motor to "fold in" the latches.

### Top Raising Sequence

#### *Top Switch Pressed "Closed"*

- The CVM activates the latching drive motor, which releases and opens the latches.
- The latch hall sensor confirms the release of the latches by sending a signal to the CVM.
- The CVM activates the pump motor relay (2) and the hydraulic pump runs in the reverse direction, pressurizing the hydraulic cylinders to raise the soft top frame.
- The soft top is raised to the point that the Top-up hall sensor signals the CVM to stop the pump motor.
- At this point the soft top is slightly open, the driver must reach into the recessed handle and squeeze and pull down at the same time.
- The pull handle hall sensor will trigger the CVM to activate the latching drive motor to lock the top frame/bow to the windshield frame.

## Emergency Closing Operation

- In the event of an electric/hydraulic malfunction, the top can be raised manually
- To raise the top, the bow latches must be released
- Remove the access cover from the inner bow cover, and using the tool from the tool kit, manually crank the bow latches open.



- Once the latches have been fully released, the top can be manually raised (the latches will then need to be manually latched) - a slight bleed off time is required
- The convertible top can not be manually lowered
- This system does not require an initialization after the emergency procedure has been performed

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## Review Questions

1. In the event of a malfunction, how is the convertible top manually raised?

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2. What hydraulic components are used for the convertible top operation?

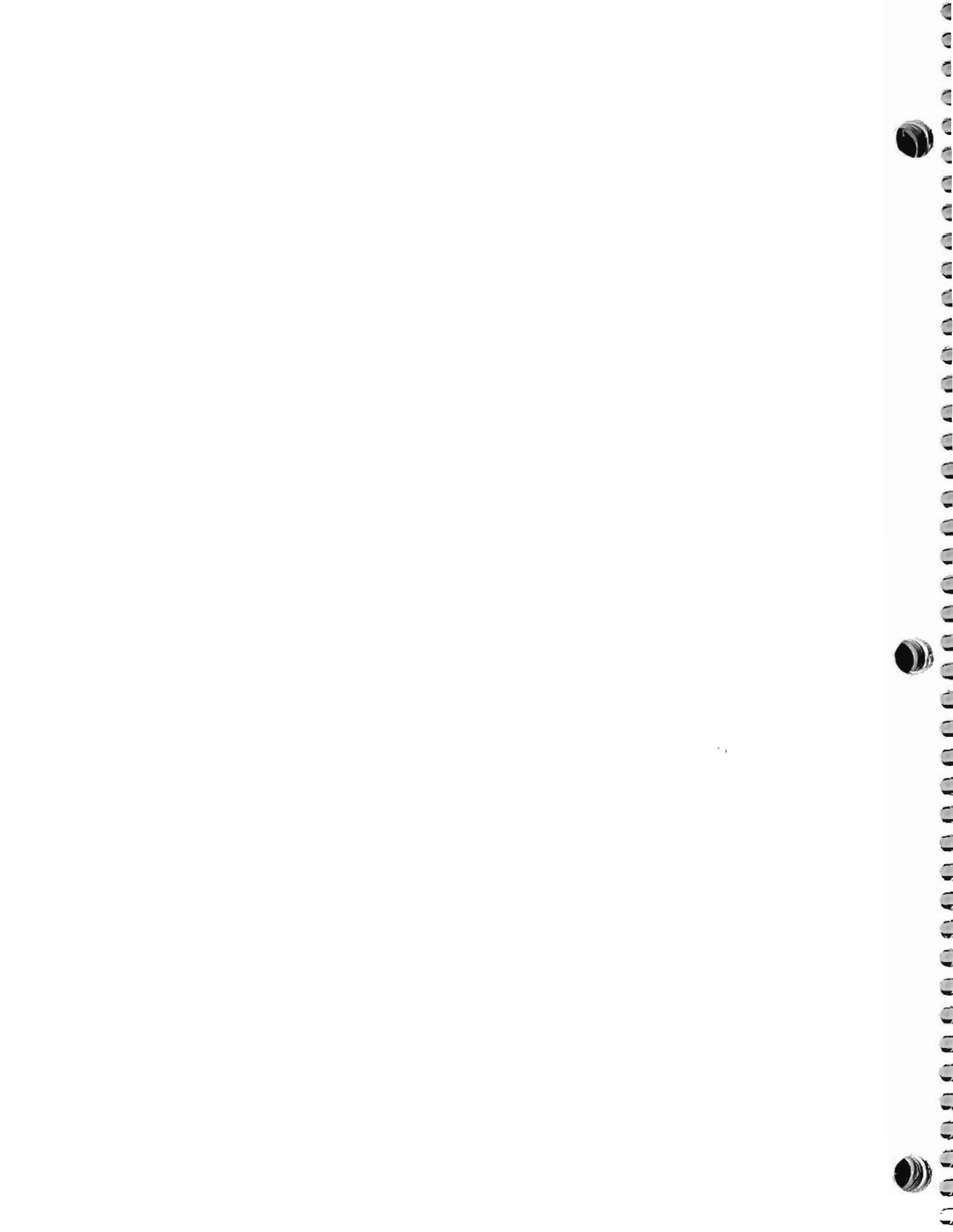
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3. What other systems interact with the CVM and why?

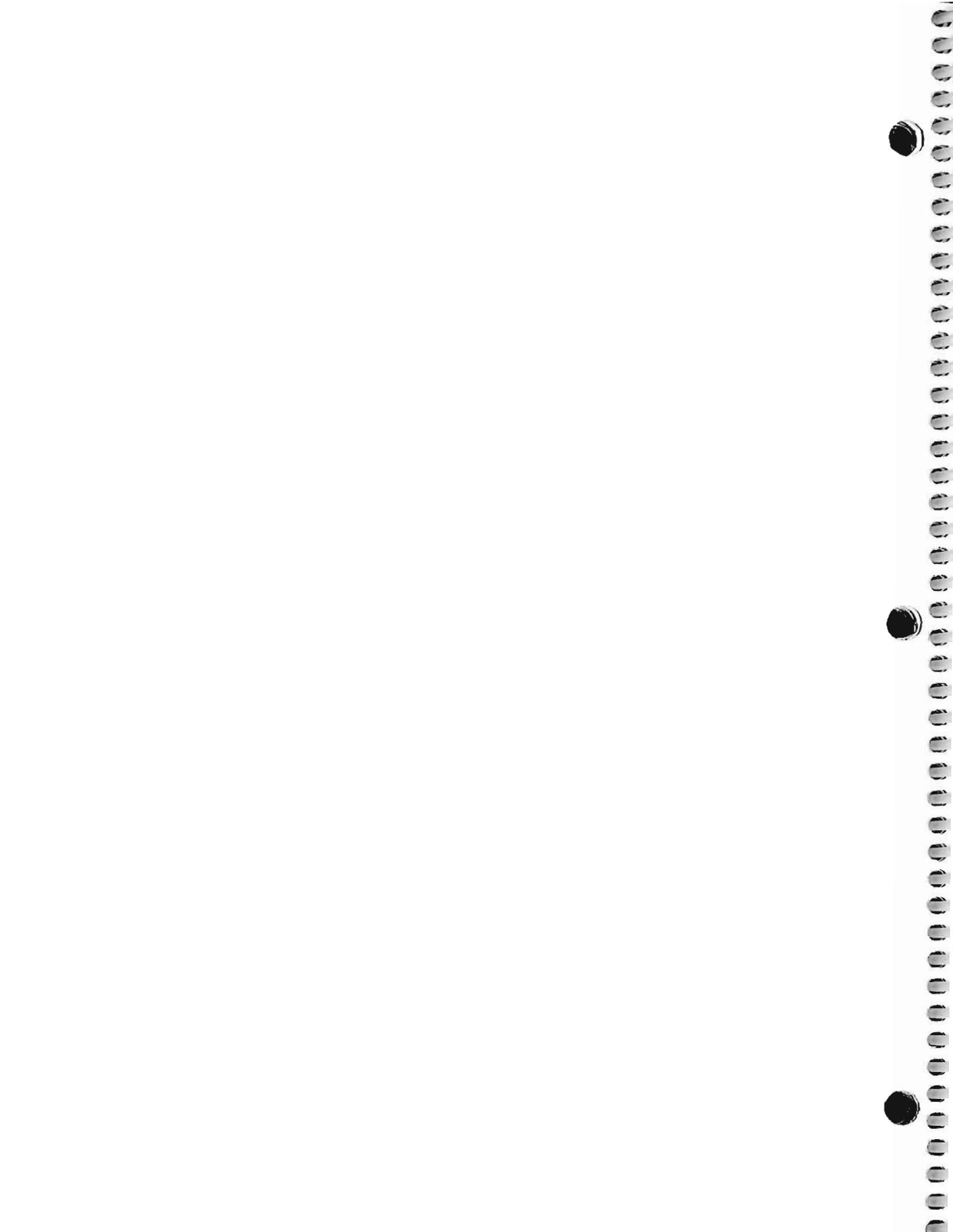
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## Interior Features





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## Interior Features

**Model:** E52

**Production Date:** 03/00 To Present

### Objectives of the Module

After completing this module, you will be able to:

- Perform proper removal of a door panel.
- Describe the Instrument Cluster and IKE functionality.
- Understand gauge functions.
- Perform instrument cluster self test.
- Understand the IHKS control panel operation.
- Describe the differences of the Z8 IHKS compared to previous IHKS systems.

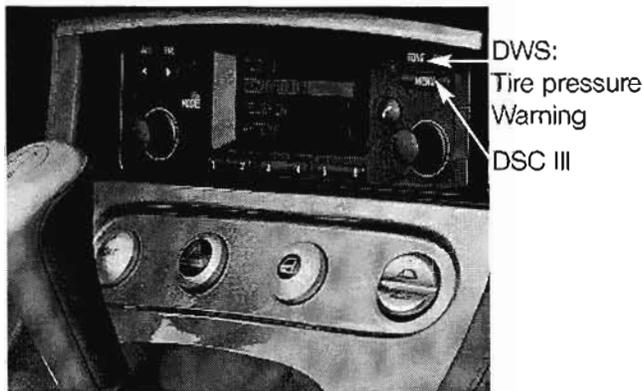
## Center Console

### Purpose of the System

The center console provides layout for various control switches. It can be accessed by removing the parking brake lever cover boot and carefully prying up on the console.

### System Components

- **SPORT SWITCH** - When pressed, the indicator light is on and signals the ECM for a sport throttle operation mode (same as M5). If not selected, a comfort throttle mode will be in operation (reset back to this position each time the ignition switch is cycled).
- **HAZARD SWITCH** - Activates the hazard lights, also used to reset the hazards after an impact.
- **CENTRAL LOCK** - When the doors are closed, pressing the button activates the door locks (single lock). Pressing the button again, or pulling the interior door handle twice will open the door(s).
- **CONVERTIBLE TOP SWITCH** - Lowers and raises the soft top.

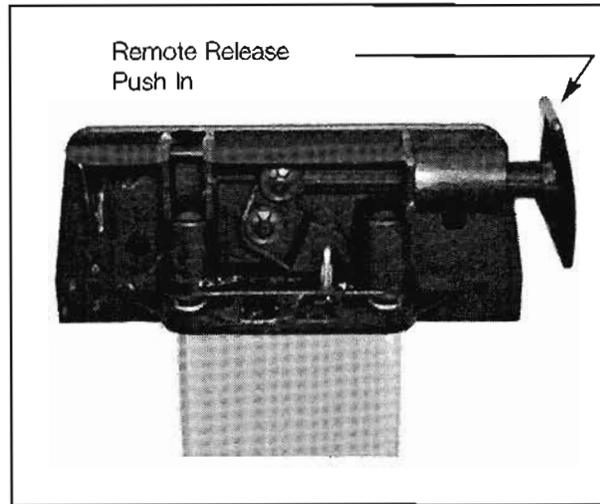
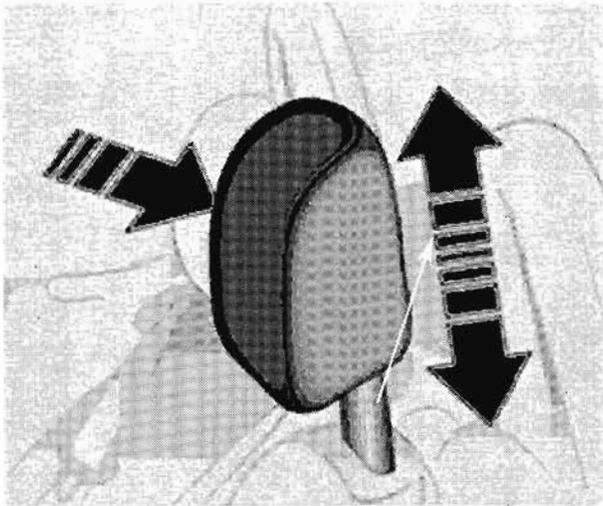
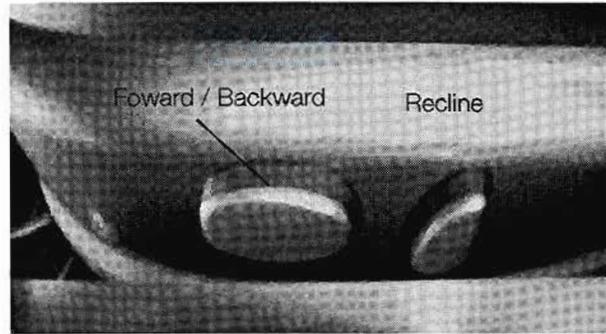


The two position Seat Heater Switches are located on the left and right sides of the center console as shown above.

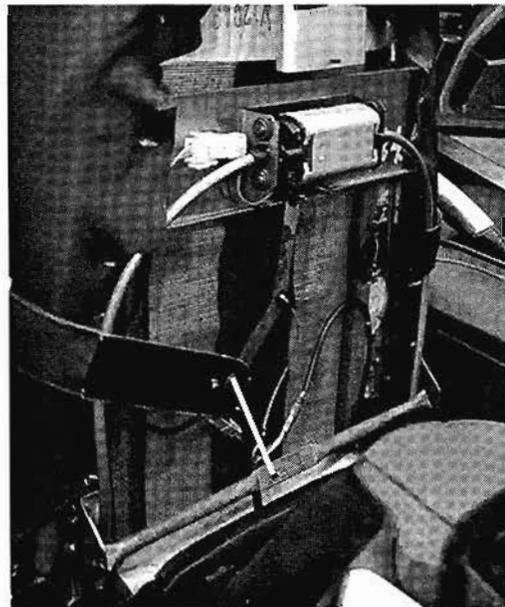
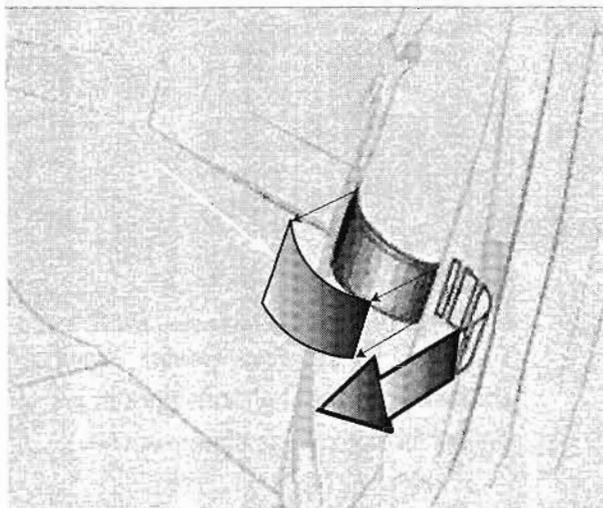
## Seats

The seats are power operated (driver and passenger) for base raising, forward/backward, and recline positions. The Z8 seats do not have "seat memory".

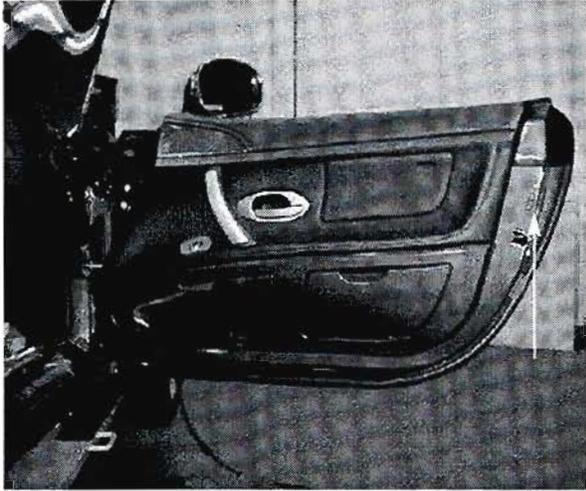
The headrest can be manually raised, but there is a remote release (rightside headrest cushion) to lower the headrest.



To access the navigation cd or compact disc changer compartments, pull the release strap to fold the seat forward.



## Doors



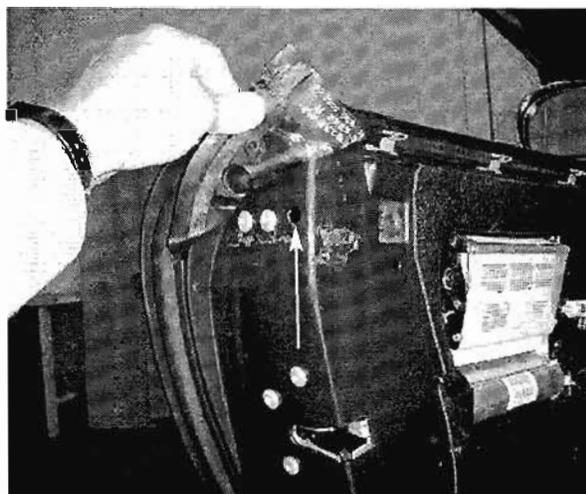
The doors panels are fitted with storage "pockets"

The passenger door is fitted with a manual locking knob (indicated on the left) which can lock the door if the vehicle battery were to fail.

Simply slide the knob downward and close the door. It can not be opened from the outside.

In this position, the door can be opened from the inside by pulling the inside door handle twice.

The driver's door can then be locked with the key .



To remove the door panels, an additional torx screw at the rear of each panel (arrow in the left diagram) needs to be removed in addition to the traditional fasteners.

## Secure Storage

Secure lockable storage compartments are provided behind each seat.

These compartments are manually locked with a master key (indicated by arrows on the right and lower right).

Shown to the right is the Navigation cd unit with fuse box and manual trunklid release.



Shown to the right is the sound system CD Changer with the flash light and charging socket which is located behind the driver's seat.

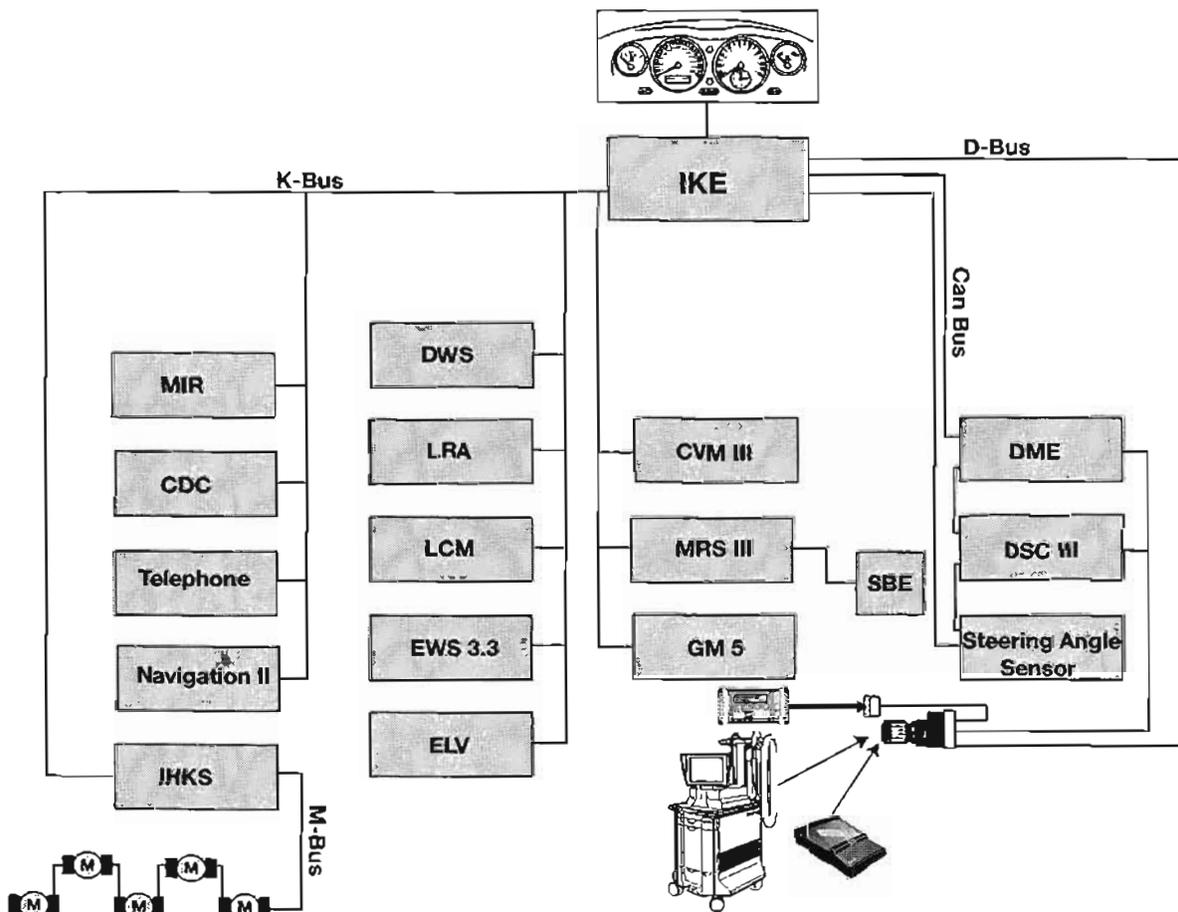


## Instrument Cluster

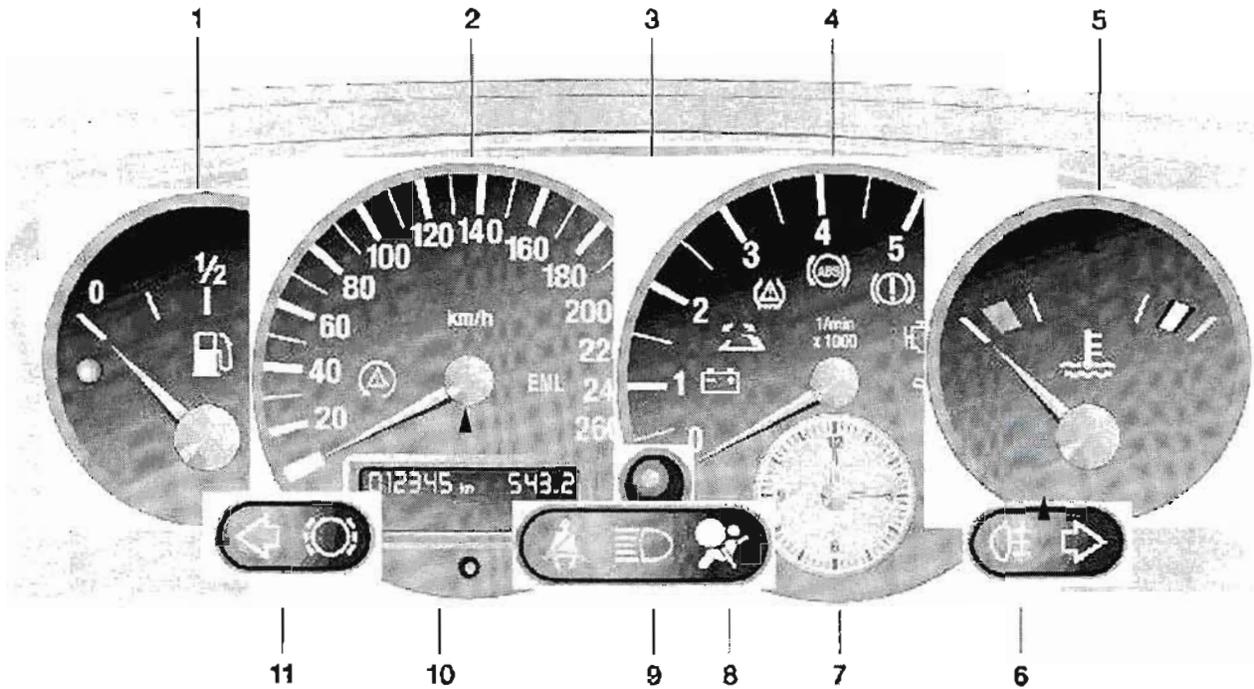
### Purpose of the System

The instrument cluster displays status information about different operating systems in the vehicle. The information is received using Dial gauges, LCD display, Warning LEDs and Gong tones.

- Z8 instrument cluster is based on the E39 technology (base version). Due to the limited space available in the Z8, the indicator instruments have been separated from the electronics. The resulting indicator modules are connected with the electronic control (instrument cluster module) through a separate wiring harness.
- The instrument cluster consists of 7 modules, 4 modules with pointer instruments (stepper motor driven) and 3 modules with displays and control. The instrument cluster control module (IKE) contains the necessary electronics to control the modules.
- The IKE is connected to the vehicle wiring harness and contains the three bus interfaces - Diagnosis bus, K-bus, and Can-bus.



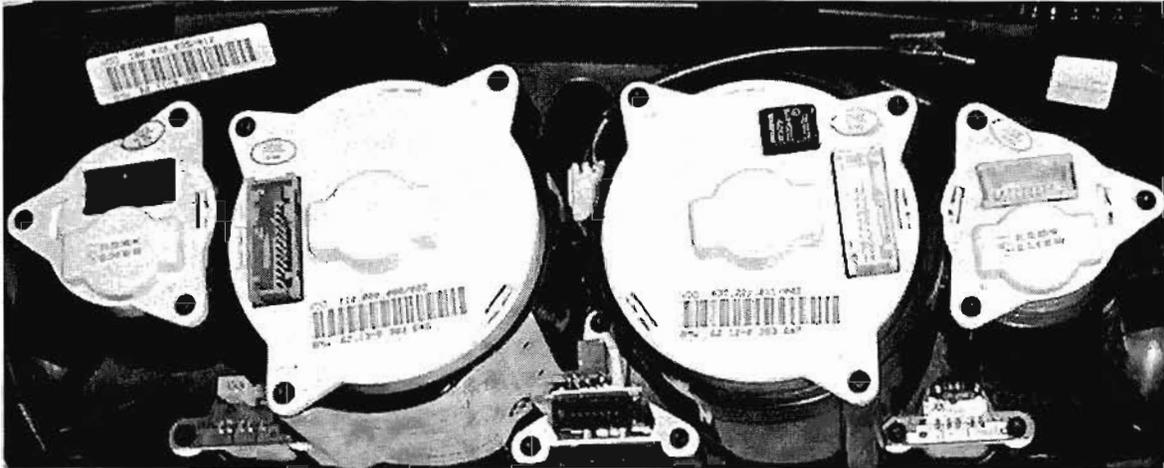
## System Components



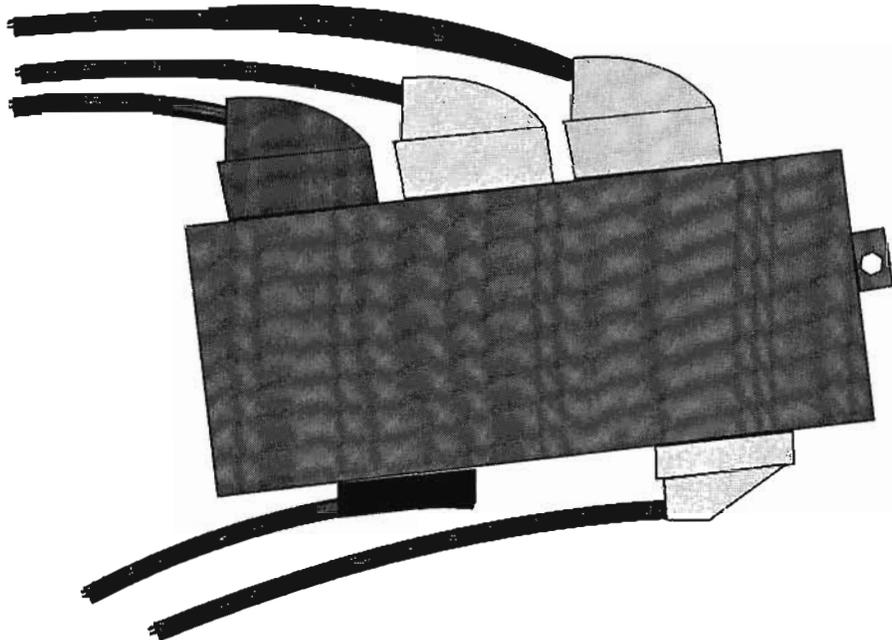
1. Fuel gauge with reserve light
2. Speedometer with indicator and EML/DSC warning lights
3. Dimmer control for instrument cluster lighting
4. Tachometer with indicator and warning lights: charging system, convertible top, DWS, ABS, handbrake/brake fluid/CBC, service engine soon, engine oil pressure and level
5. Coolant temperature gauge with over heat light
6. Direction and rear fog light indicator
7. Analog clock
8. Clock and trip odometer reset knob
9. Seat belt, high beam, and SRS warning lights
10. Odometer, trip odometer, and Service Interval digital display
11. Directional and brake lining indicators

The instrument cluster is divided into module components, shown below is the rear view of the instruments.

- To remove the instrument cluster: carefully pry out the dash side panels (driver's and passenger's), and remove the four corner screws.



- The instrument cluster assembly is hard wired to the IKE module which is located behind the glove box.



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## **Instruments, Indicators and Displays**

### **Speedometer**

The speedometer module is equipped with different indicators corresponding to the country-specific variant. The distance pulse for indicating the road speed comes from the DSC control module. The input to the DSC III originates from the rear left wheel speed sensor.

### **Tachometer**

The tachometer is controlled by the IKE (rpm signal supplied by the ECM). The engine speed information is made available to the other control units via the K-bus.

### **Clock**

The time is indicated by a classic looking analog clock (refer to control knob for setting).

### **Fuel Gauge**

The level in the fuel tank is measured with a lever-type sensor that is connected to the IKE using a dedicated ground terminal and sensor circuit. The level sensor does contain a reserve contact. The fuel reserve warning light is activated by the IKE based on the low level of the sensor. The "fuel reserve" signal is additionally output as information for the engine management. The level sensor is designed for the shape of the tank by the resistance characteristic curve and IKE coding data.

### **Coolant Temperature Gauge**

The coolant temperature is measured in the Engine Control Module (ECM) and is sent via the CAN-bus to the IKE for the instrument modules. The coolant temperature information is also provided to other systems on the K-bus. The IKE also determines the coolant temperature with a separate NTC sensor. This temperature is indicated in the coolant temperature gauge during the initialization phase of the CAN-bus. To prevent "heat surge" from affecting the gauge after a hot engine restart, the IKE buffers this circuit. If the IKE detects a higher temperature on restart compared to when the engine was switched off, the value stored at "engine off" is indicated. The current value will be displayed approximately 20 seconds after restart.

### **Coolant Overheat Warning**

The IKE activates on the coolant overheat warning light for 2 seconds when the ignition is switched on (pre-drive check). It is then controlled by the engine control module via the CAN-bus. If the coolant overheat warning light is activated by the engine control module, this CAN message is made available to other modules on the K-bus. The IKE receives the value via the CAN-bus and if the maximum value is reached, the gauge needle is moved in the center of the red warning zone.

---

## **Service Interval Display (SIA4)**

The Service Interval Display (SIA4) is a consumption-dependent distance-based inspection display with the ability to indicate remaining distance. It serves the driver and the workshop as an indication showing when an engine oil service or distance based inspection is due. The current Service Interval status is indicated as from ignition "terminal 15 ON" for up to 10 seconds after reaching a minimum engine speed of 400 rpm. The SIA4 data is also stored in the light check module (LCM). The SIA4 can be reset like current BMW models. Each reset can be carried out independent of each other, oil service or distance inspection reset.

## **Total Distance and Trip Odometer**

The current trip odometer reading is shown in the display from ignition terminal R "ON". When terminal R is switched "OFF" the odometer reading (total mileage) can be displayed for approx. 25 seconds by pressing the trip odometer reset button and then releasing it. The total distance is made available on the K-bus which is stored in the IKE and in the LCM.

## **Ambient Temperature**

The IKE determines the current outside temperature based on the outside temperature sensor (NTC resistor). The outside temperature sensor has a dedicated ground and sensor circuit to the IKE. The "outside temperature" information is transferred from the instrument cluster on the bus and is displayed by the multifunction radio (MIR). When the ignition is switched off, the outside temperature sensor is read in timed minute intervals by the IKE. For this purpose, the IKE is activated for a short time, it makes available the "outside temperature" information and then switches off again (sleep mode).

## **Instrument Light Dimming**

The instrument lights and the digital display lighting are dimmed in different ways. The pulse width modulated signal (58g) from the LCM is used for instrument light dimming. With the lights switched off, the brightness information from the phototransistor (integrated in the speedometer) is used for the purpose of controlling and adapting the lighting of the digital display to the ambient conditions. With the lights switched on, the lighting intensity can be additionally varied with the dimmer within a limited range. In this case, the ambient light information provided by the phototransistors has priority in controlling the intensity of the lights.

---

## Warning and Indicator Lights

*General information:* light emitting diodes (LEDs) are used to backlight all warning light symbols. Two-colored LEDs are used for symbols that can light up red or yellow.

### General Brake Warning Light

Illuminated red when:

- Parking brake applied with ignition switched on.
- Brake fluid low level warning via bus signal from the LCM.
- Malfunction signal on CAN-bus from DSC to the IKE.
- Electronic brake pressure distribution (EBV) failure warning from DSC control unit.

Illuminated yellow when:

- Malfunction warning on CAN-bus brake assistant from DSC control unit.

During the pre-drive check, the warning light is illuminated red and yellow for 1 second provided the function for the brake assistant is coded, otherwise the warning light will be illuminated only in red for 2 seconds. If the parking brake is applied, only the red warning light will be illuminated.

The warning light can light up yellow only when there is no warning for red. The DSC switches on the yellow warning light via the CAN-bus if the DSC detects a malfunction in the brake assist.

### Seat Belt Indicator Light

The seat belt indicator light is activated when ignition terminal 15 is switched "ON". The LCM sends a K-bus signal until the seat belt is latched (contact is opened).

### Indicator Lights

Direction indicator, high beam, and the rear fog light indicator lights are switched by means of a corresponding bus message from the LCM to the IKE.

### Charge Indicator Light

The warning light is activated by the compact alternator when there is no charging output to the IKE.

---

## **Oil Light**

The red warning light is activated by the oil pressure switch.

The yellow warning light is activated by a K-bus message from the LCM to the IKE. The engine control module (ECM) evaluates the signal from the oil level sensor in the engine and sends a CAN message to the IKE.

The IKE converts the message and passes it on to the LCM via the K-bus. The LCM compares the signal to coded data and sends a K-bus message to the IKE. The IKE activates the oil level warning with priority given to the oil pressure warning.

The oil indicator light is illuminated yellow under following conditions:

*Oil level sensor defective:* The oil level sensor is monitored by the ECM, and if a defect is detected, a message is sent to the LCM that is stored in fault memory. The LCM switches on the oil indicator light (yellow for oil level warning) for 30 seconds via the K-bus. This fault is set with ignition "ON", engine speed and oil pressure must have been detected.

*Low oil level detected:* Low oil level is detected by the ECM only when the engine is running and a message is sent to the LCM. This information is stored in the LCM and activates the yellow oil level indicator light for approximately 30 seconds after the ignition has been switched off.

*Oil loss recognized:* Oil loss is detected by the ECM only when the engine is running. Consequently, the LCM immediately switches on the yellow oil level indicator light.

## **ABS Indicator Light**

The warning light is activated by the ABS/DSC system. The warning light must also be activated if a signal line is interrupted.

The circuit logic is:

- Low signal (ground) = warning light off.
- High signal (system voltage) = warning light on.
- High signal (high resistance, break) = warning lamp on, recognizes a break or interruption in the signal line.

## **SRS Indicator Light**

The SRS warning light is activated by a ground signal from the SRS control module for pre-drive check as well as system faults.

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### **Service Engine Soon Light**

The "Service Engine Soon" warning light is activated by the ECM via the CAN bus. The light is illuminated for pre-drive checks as well as emission related faults.

### **Warning Light for Automatic Stability Control (DSC)**

The "ASC" warning light is switched by the DSC system via the CAN-bus. As a function check after switching on the ignition, the DSC switches on the warning light for a limited period of time (pre-drive check).

### **Warning Light for Tire Pressure Warning (DWS)**

The tire failure warning light is switched by a corresponding bus message from the tire pressure warning system (DWS) to the IKE. As a function check, the warning light is activated for 2 seconds (pre-drive check).

The "EML" warning light is activated by the ECM via the CAN bus. If EML message is not received on the CAN-bus from the ECM to the IKE, the warning light is switched on for 1.5 seconds after switching on the ignition (emergency running value).

### **Brake Lining Warning Light (BBV)**

The brake lining warning light is located in the left direction indicator and is activated by the IKE. As a function check, the warning light is switched on for approx. 2 seconds after the ignition is switched on (pre-drive check). The sensors consist of a circuit loop in the rear right and front left brake pads (connected in series). When the brake pad is worn, the circuit loop is interrupted (recognized by the IKE) and the warning light is activated. The warning is cancelled if the interruption is not detected for 30 seconds after ignition "ON" with the engine not running.

### **Convertible Top Warning Light**

The convertible top warning light is activated by the Convertible Top Module (CVM III) via a circuit line. The warning light illuminates when the convertible top is operated, and flashes if the convertible top is not locked in either end position.

### **Lights On Warning**

The audible warning for the lights "ON" and the indicator clock is installed in the speedometer module. The "lights ON" warning sounds for 8 cycles (one cycle = 500 ms "ON" / 500 ms "OFF") when the ignition is switched off, the driver's door is opened for the first time and the instrument lights are switched on. The message to trigger the "lights ON" warning is read via the K-bus and is controlled by the IKE.

---

## Ignition Key Warning

The "ignition key warning" function is activated by the IKE. Based on a K-bus message, the LCM triggers the audible warning. The ignition key warning is triggered when the ignition is switched off and the driver's door is opened. The warning is immediately cancelled if the IKE receives a message from the LCM.

## Acoustic Cycle for Direction Indicators

The acoustic generator for the direction indicators and the lights "ON" warning is installed in the speedometer module. The IKE activates the acoustic relay synchronously with the left and right direction indicator lights as well as the direction indicators. The "direction indicator" information comes from the LCM via the K-bus that also controls the synchronization. If a bulb failure is detected in a direction indicator, the IKE is informed by a K-bus message. Both indicator lamps are activated at twice the normal cycle frequency.

## Gong

The IKE controls the tone 3 (T3) in the gong. An acoustic warning is output for the seat belt warning, ignition key warning, hand brake warning, tire pressure warning and speed warning. Depending on the type of warning, a short tone 3 (T3) is output repeatedly or only once.

*Acoustic seat belt warning:* an acoustic seat belt warning is possible only in conjunction with a driver's seat belt buckle contact. The warning is activated by the LCM via the K-bus. When the belt contact is opened, the IKE activates the gong tone 3 (T3) intermittently for a maximum of 6 seconds after switching on the ignition. The gong is deactivated if the seat belt is buckled before this period of time has elapsed.

*Acoustic ignition lock warning:* the ignition key warning is triggered for a maximum of 60 seconds if the driver's door is opened with the ignition switched off.

*Acoustic speed warning:* a speed warning is triggered by the IKE. If the speed threshold is exceeded, a short tone 3 (T3) sounds in the gong. If the speed drops below this threshold by more than 5 km/h, the tone will be triggered again upon exceeding the threshold.

*Acoustic parking brake warning:* a parking brake warning is triggered at the gong as soon as the handbrake is applied and a road speed of more than 3 km/h is detected. The intermittent tone sounds for as long as the warning condition is applied or maximum 20 seconds.

*Acoustic tire pressure warning:* the tire failure warning light is activated via the K-bus from the tire pressure warning system to the IKE. An acoustic warning in the form of the single tone 3 gong is triggered provided the ignition is switched on.

## System Operation

### Test Functions

To access the test functions, the key must be in the accessory position. After the ignition switch is placed in the accessory position (terminal R), the odometer reset button must be pressed within 5 seconds and held in until the test functions appear.

Test No.	Function
1.	Identification of control unit for instrument modules (sub tests 1.1-1.7)
2.	System test (2 sweeps)
3.	SIA data
4.	Current consumption values in 1/100 km and l/h
5.	Not used
6.	Fuel tank contents value
7.	Coolant temperature, outside temperature, current engine speed, current road speed.
8.	ADC values (system voltage, lever-type sensor voltage, left and right, phototransistor voltage and BVA, voltage terminal 30 in Volt.
9.	System voltage terminal 30 in Volt.
10.	Read out country code.
11.	Read out units (AM / PM or mm.dd/dd.mm) etc.
12.	Not used
13.	Trigger acoustic signals
14.	Read out error bytes (self-diagnosis)
15.	Display of I/O port statuses
16.	Dimmer value (lights on)
17.	Internal clock
18.	Not Used
19.	Lock and release test functions
20.	Not Used
21.	Reset instrument cluster (software reset)
0.	End of test, test mode can be exited via this function

---

## Workshop Hints

### Replacing the IKE

The four examples described in the following section outline the procedure, conditions, and measures to ensure trouble-free repair of the instrument cluster.

*Example 1:* the IKE is defective and the LCM is OK.

- Replace the IKE (new part).
- The manipulation dot is set with the ignition switched on.
- The manipulation dot is set as the vehicle identification number in the LCM differs from the vehicle identification number in the IKE.
- Re-encode the IKE.
- Encode the IKE in accordance with the central encoding code.
- Encode the vehicle identification number in the IKE. If the vehicle identification number is not encoded in the IKE, the total distance will not be recorded either in the IKE or in the LCM.
- Switch the ignition off and on again. The manipulation point goes out, the IKE adopts the total mileage and the SIA4 data from the LCM. The information exchange between the IKE and the LCM for joint data storage (SIA data, total mileage, vehicle identification number) is taken over.

*Example 2:* the IKE is OK and the LCM is defective.

- Replace the LCM (new part).
- The manipulation dot is set with the ignition switched on.
- The manipulation dot is set if the vehicle identification number in the LCM differs from the vehicle identification number in the IKE.
- Re-encode the LCM in accordance with the central encoding code.
- Encode the vehicle identification number in the LCM, the total distance will not be recorded in the LCM as long as the vehicle identification number is not encoded in the LCM.
- Switch ignition off and on again. The manipulation dot goes out, the LCM adopts the total mileage and the SIA4 data from the IKE. The information exchange between the IKE and the LCM for joint data storage (SIA data, total mileage, vehicle identification number) is taken over.

---

*Example 3: the IKE and the LCM need to be replaced.*

*Note: Replace both control modules at the same time only when necessary (total mileage recording will be irretrievably lost).*

- Replace the IKE and LCM with the battery disconnected (new parts).
- When the ignition is switched on, the manipulation dot is set and the total mileage is set to zero. The previous total mileage is irretrievably lost.
- Encode the IKE and LCM in accordance with the central encoding code.
- Encode the vehicle identification number in the IKE and in the LCM.
- Switch ignition off and on again. The manipulation dot goes out, the LCM adopts the total mileage and the SIA4 data from the IKE. The information exchange between the IKE and the LCM for joint data storage (SIA4 data, total mileage, vehicle identification number) is taken over.

*Example 4: the IKE or the LCM is to be replaced as a "diagnostic test".*

*Note: Although, in principle, replacing one of the two control units as a test is possible, it should be avoided.*

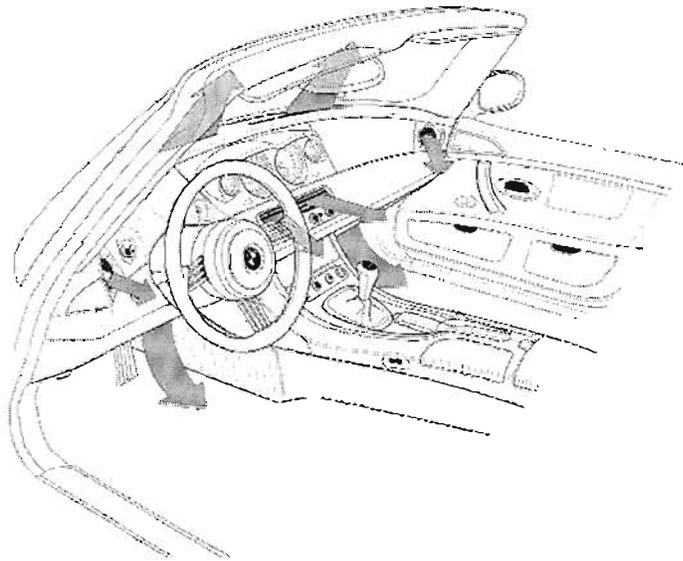
- The IKE or the LCM from another vehicle is installed for testing purposes.
- When the ignition is switched on, the manipulation dot is set and the IKE continues to record the total mileage. The total mileage is only recorded in the IKE as long as the vehicle identification number differs. There is no total mileage transfer to the LCM.

---

## IHKS - Heating and Air Conditioning

### Purpose of the System

An integrated heating/air conditioning control system (IHKS) is used in the Z8 to provide the driver and passenger a comfortable atmosphere regardless of conditions outside the vehicle. The heater/air conditioner is designed as an air-based control. 6 actuators are used to distribute the air and control the temperature.



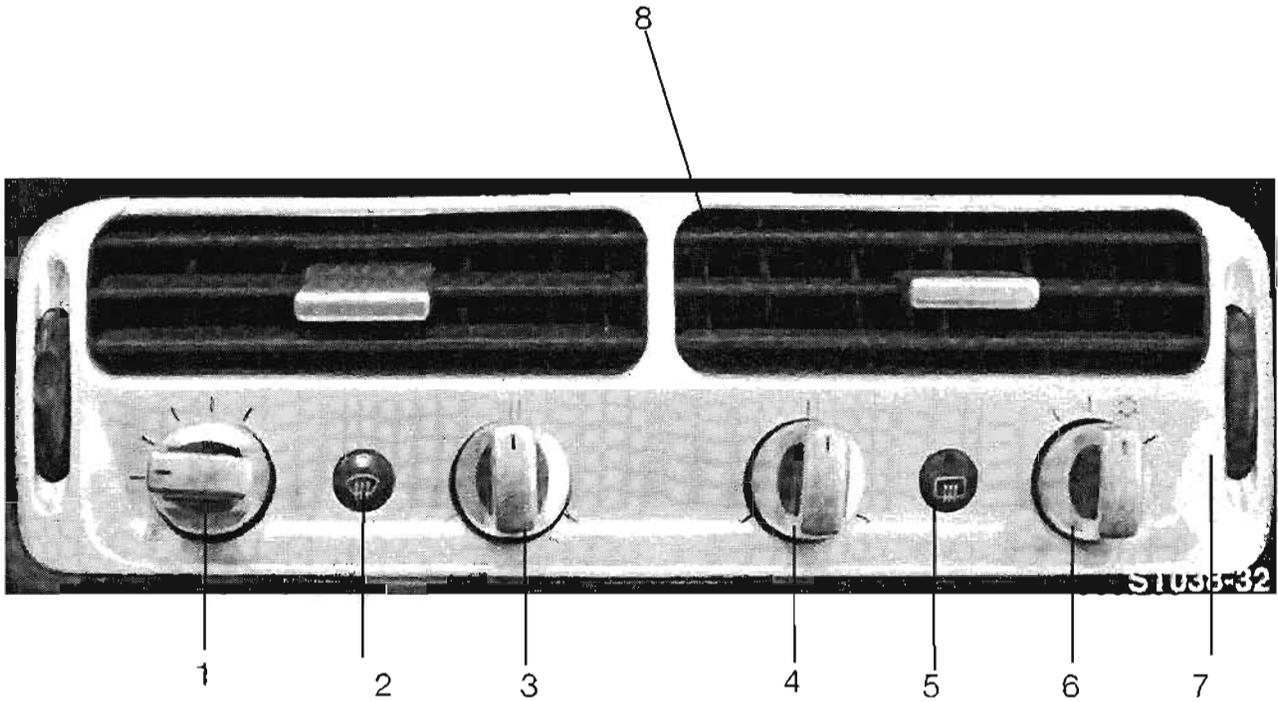
### System Components

The IHKS consists of the following main components:

- Electronic Control panel/module with integrated fresh air grille
- Heater/air conditioner unit
- Five actuator (bus stepper motors) for controlling the recirculated air, temperature mixing, defroster, face vent and foot-well flaps
- One actuator (high speed stepper motor) for controlling the fresh air flap
- Electric shut-off water valve
- Electric auxiliary water pump
- Refrigerant pressure sensor
- Evaporator temperature sensor
- Rear window defogger relay
- Series resistors for blower motor

## IHKS Control Panel

The interior temperature, fan speed, and air distribution are set with classic rotary knobs and push buttons. The setting request are processed by the integrated electronics.

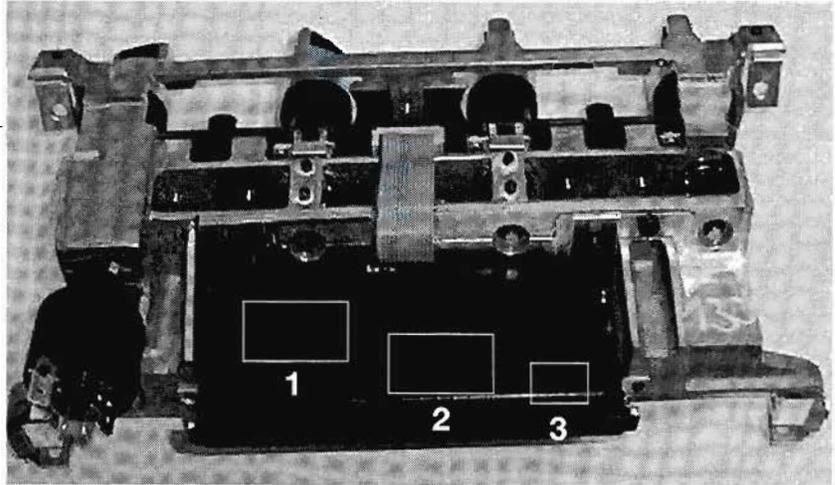


Number	Description
1.	Blower setting (5-stage rotary switch, including off)
2.	Defrost button
3.	Temperature setting (potentiometer)
4.	Air Distributor (potentiometer)
5.	Rear window defroger button (if hardtop fitted)
6.	A/C Program selector switch (potentiometer)
7.	Air flow control
8.	Fresh air grille

## Control Panel - Connections

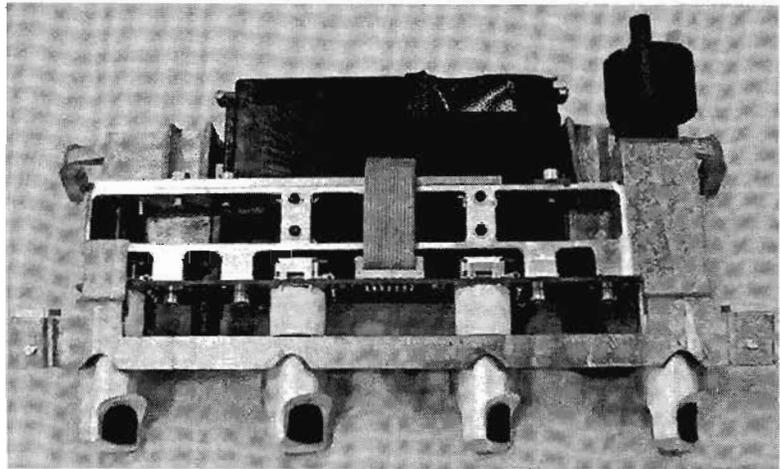
A total of 3 plug connections are integrated in the IHKS control module.

The fourth is a separate connection to the blower switch.



The IHKS control module is located on the back of the control panel.

The Z8 IHKS can be coded and diagnosed via the DIS/MoDIC.



## Blower Setting

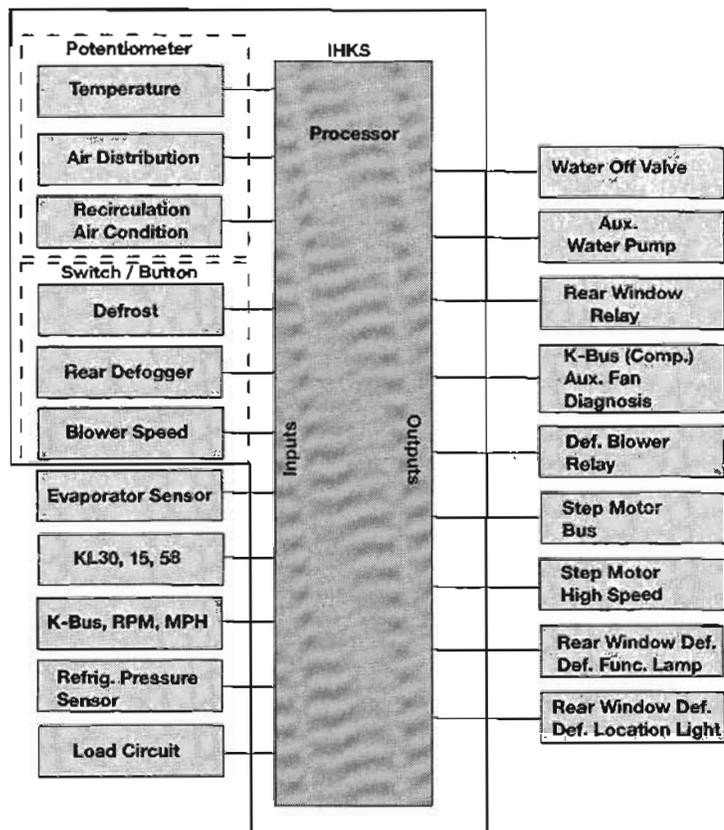
The blower control is designed as a 5-stage switch (including off). When the blower switch is set to the zero position all flaps are closed and the refrigerant circuit is switched off automatically.

The IHKS features "ram" air compensation in which the fresh air flap is increasingly closed as the vehicle speed increases thus making it dependent on the type of top used (hardtop or soft top). The fresh air flap is operated by a high speed stepper motor. The IHKS receives information (via the K-bus) as to whether the soft top is open or closed.

## System Operation

Functions:

- Blower control
- Temperature control
- Recirculated air/fresh air mode
- Air conditioner mode
- Defroster function
- Air distribution
- Rear window defogger

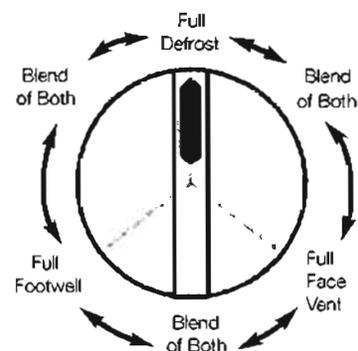


*Note: If the IHKS control module is replaced, it must be recoded.*

## Air Distribution

The air flow is adjusted by a 360° potentiometer. The flaps are controlled by 3 stepper motors (bus) that operate the defroster, face vent and footwell flaps. Flap control is dependent on the position of the air distribution knob as well as the position of the temperature knob.

Different characteristic curves are used for the maximum warm setting and the maximum cold setting. If the temperature control knob is anywhere between these two settings, the new flap position is set.



---

## Flap setting

The stepper motors for flap operation execute a position run after ignition terminal 15 has been switched off. The fresh air and defroster flaps are completely opened, and all other flaps are closed.

The temperature setting flap is the only flap that remains unchanged. This procedure lasts approximately 15 seconds.

The IHKS performs a calibration run after every 20th time the ignition is switched off or after an interruption in memory power. The flap end positions serve as reference points.

A total of five (200 Hz) stepper motors with M-bus activation and one (500 Hz) high speed fresh air motor are used.

	IHKS Off (KL 15 on)	Defroster function	IHKS OFF (KL 15 off)
Fresh air	Closed	Open	Open
Recirculation	Closed	Closed	Closed
Defrosting	Closed	Open	Open
Ventilation	Closed	Closed	Closed
Footwell	Closed	Closed	Closed
Temperature	Unchanged	Maximum	Unchanged

## Auxiliary Water Pump

An auxiliary water pump is installed to ensure the necessary water flow rate at low engine rpm.

The auxiliary water pump is switched on when the following conditions are fulfilled:

- Water valve is opened (de-energized)
- Engine rpm < 2000 rpm
- Engine temperature > 32 °F
- Start procedure completed (terminal 50)

The auxiliary water pump is switched off when, apart from the engine speed that must exceed 2500 rpm, at least one of the above conditions is not fulfilled.

---

## Temperature Control

The rotary knob locks in both end positions. The temperature is set by means of a mixing flap that is operated by a stepper motor (bus). The temperature control potentiometer can be turned through an angle of 240°.

The water valve is closed when the control knob is set in the minimum position. From the 10 o'clock position (potentiometer value) on, the water valve is opened and the auxiliary water pump switched on.

## Air Conditioning

The air conditioning is requested by a combination switch. The IHKS activates the A/C compressor magnetic clutch, and cool air flows from the evaporator. With the aid of a temperature mixing flap, this air is blended with warm air from the heater core.

To prevent the evaporator surface from icing up, the evaporator temperature sensor signals the IHKS to deactivate the compressor clutch. The switching threshold is set at approximately 1 °C (34 degrees F).

## Idle Speed Compensation

The Engine Control Module (ECM) compensates the idle speed to ensure smooth operation of the engine at idle.

The IHKS will signal the ECM for idle speed compensation when at least one of the following conditions occurs:

- Rear window defogger switched on (hardtop fitted)
- Blower set to max. position
- Air conditioning switched on

## Filling Station Effect

The filling station effect corresponds to the heater core “hot soak”, because the water valve is sprung open with out power. In order to avoid this effect, after ignition terminal 15 is switched off, power is still applied to the water valve for 5 minutes.

---

## **Characteristic Map Cooling**

Characteristic map cooling is not used in the Z8 with the S62 B50 engine.

## **Defroster Function**

The defroster function has priority over other functions. It has the task of defrosting the windshield as fast as possible.

The following functions are activated for this purpose:

- The temperature is set to maximum warm.
- The blower speed is set to the highest stage.
- Defroster flaps fully open.
- All other air distribution flaps are closed.
- The fresh air flap is fully opened (recirculated air closed).
- The water valve is opened.
- The auxiliary water pump is switched on.

## **Rear Window Defogger**

This function is active only in conjunction with the hardtop. During the defrost phase the heating is fully powered for 17 minutes.

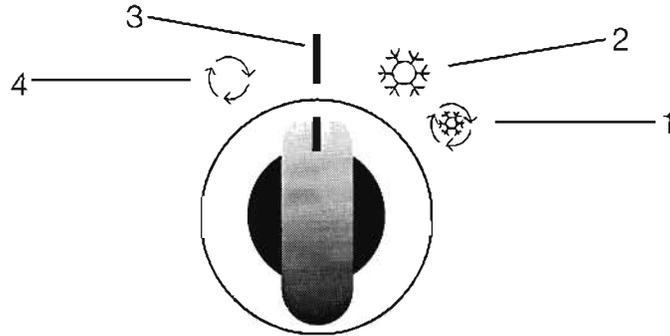
If the defrost phase is not sufficient to completely defrost the rear window the heating can be activated for a further 5 minutes by pressing the rear window defogger button again.

If the heating is switched off for any reason the timer is stopped so that defrosting can continue from exactly this point when switched on again.

The rear window defogger is completely deactivated when the unloader function is active (starting the vehicle).

## Program Selector Switch for Recirculated Air, Outside Air, A/C Functions

The functions are selected by a rotary knob with 4 settings. Each setting corresponds to a program.



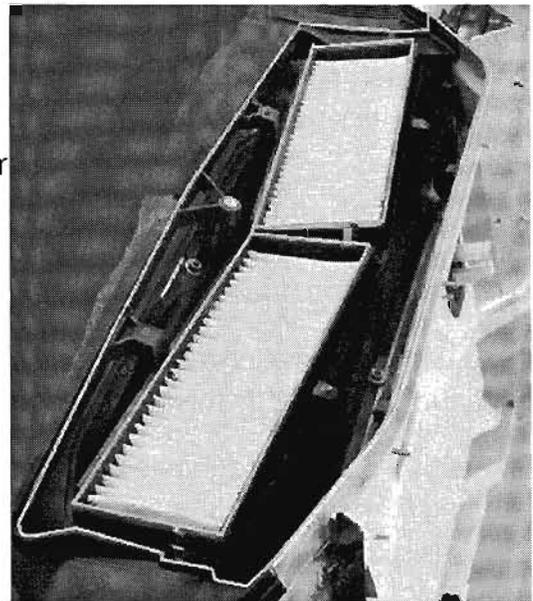
Setting	Function
1	Recirculating air with air conditioning
2	Outside air with air conditioning
3	Outside air
4	Recirculating air

The recirculation air control flap is operated by a stepper motor (bus).

## Filters

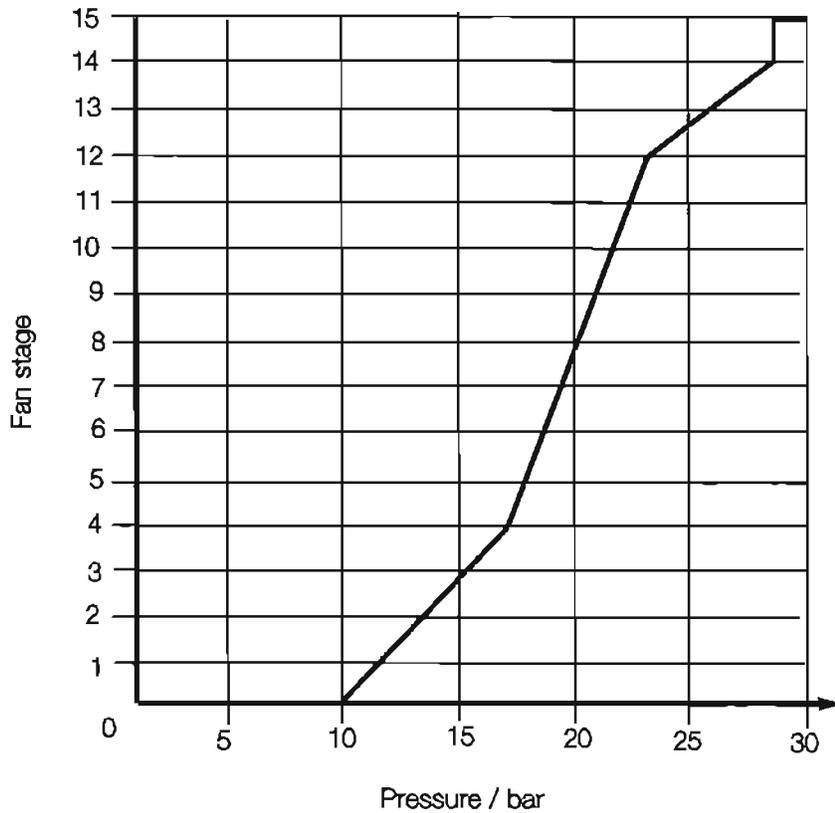
The micro-filters are located under the hood.

To service the micro-filters, simply remove the four torx screws and remove the cover panel.



## Auxiliary Fan

The auxiliary fan stage (speed) is determined from the refrigerant pressure sensor signal. The IHKS signals the ECM via the K-bus, and the ECM will activate the auxiliary fan. The fan stage (speed) is generally set to 0 at vehicle speeds above 50 mph (ram air).



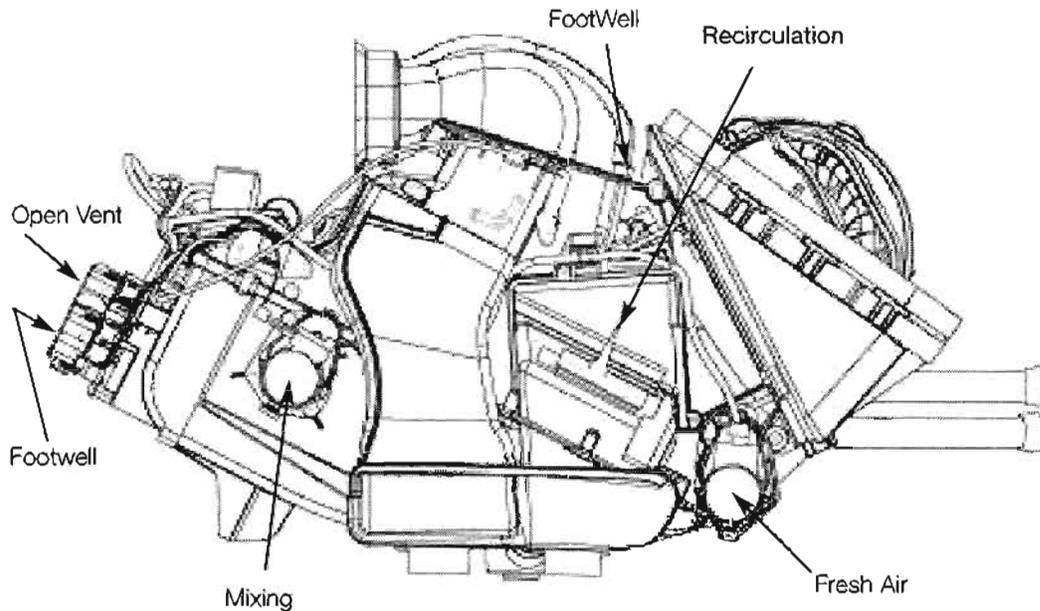
## K-bus Interface

This interface transmits data such as the vehicle speed, engine speed and diagnosis between the IHKS control unit and the IKE.

The K-bus is also used to transmit compressor load values as well as auxiliary fan request from the IHKS through the IKE then over the can line to the ECM.

## Heater/Air Conditioner Housing

The heater/air conditioner housing design is based on the E36/7. To compliment the lightweight and compact design, stepper motors are used to operate the flaps.



## Diagnosis

All inputs and outputs are monitored by the IHKS control module. Faults are stored in the EEPROM after terminal 15 has been switched off. Faults that occur sporadically can be deleted by the IHKS control module after successful self-repair. However, the entry "sporadic fault" is retained.

Unlike previous IHKS systems, the Z8 version is diagnoseable via DIS/MoDIC.

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## Review Questions

1. How do you lower the head rests?

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2. Are the Navigation and CD storage compartments electrically or manually locked?

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3. What module is used for instrument cluster (IKE) data back up storage?

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4. What is unique about the Z8 IHKS system as compared to previous IHKS system?

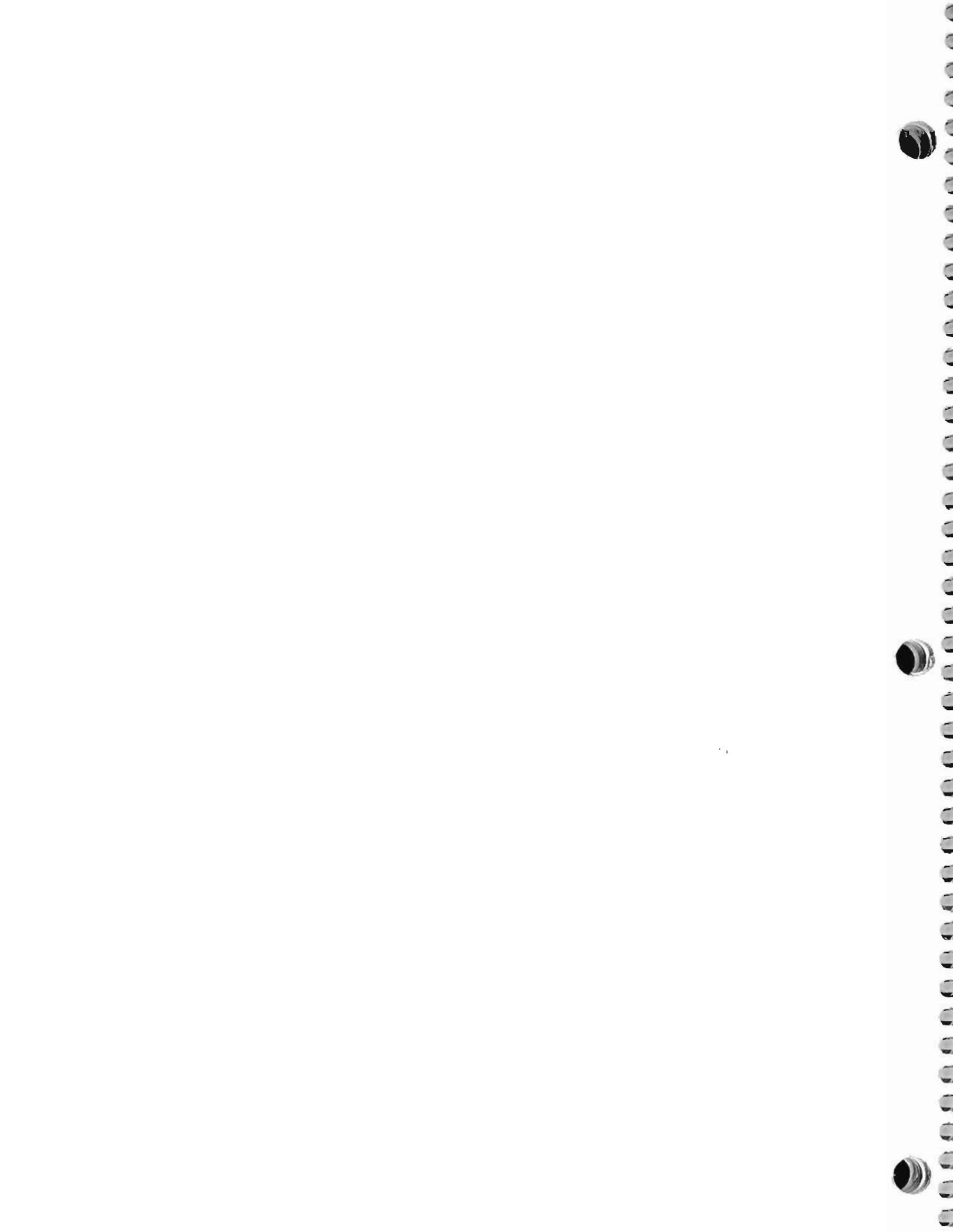
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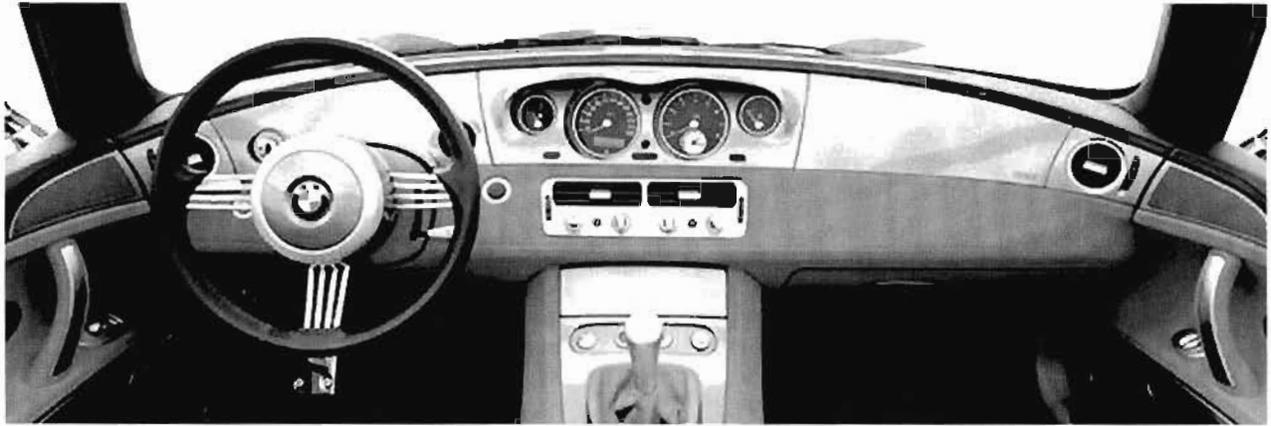
5. What test step allows unlocking the IKE to perform all of the cluster self diagnostics?

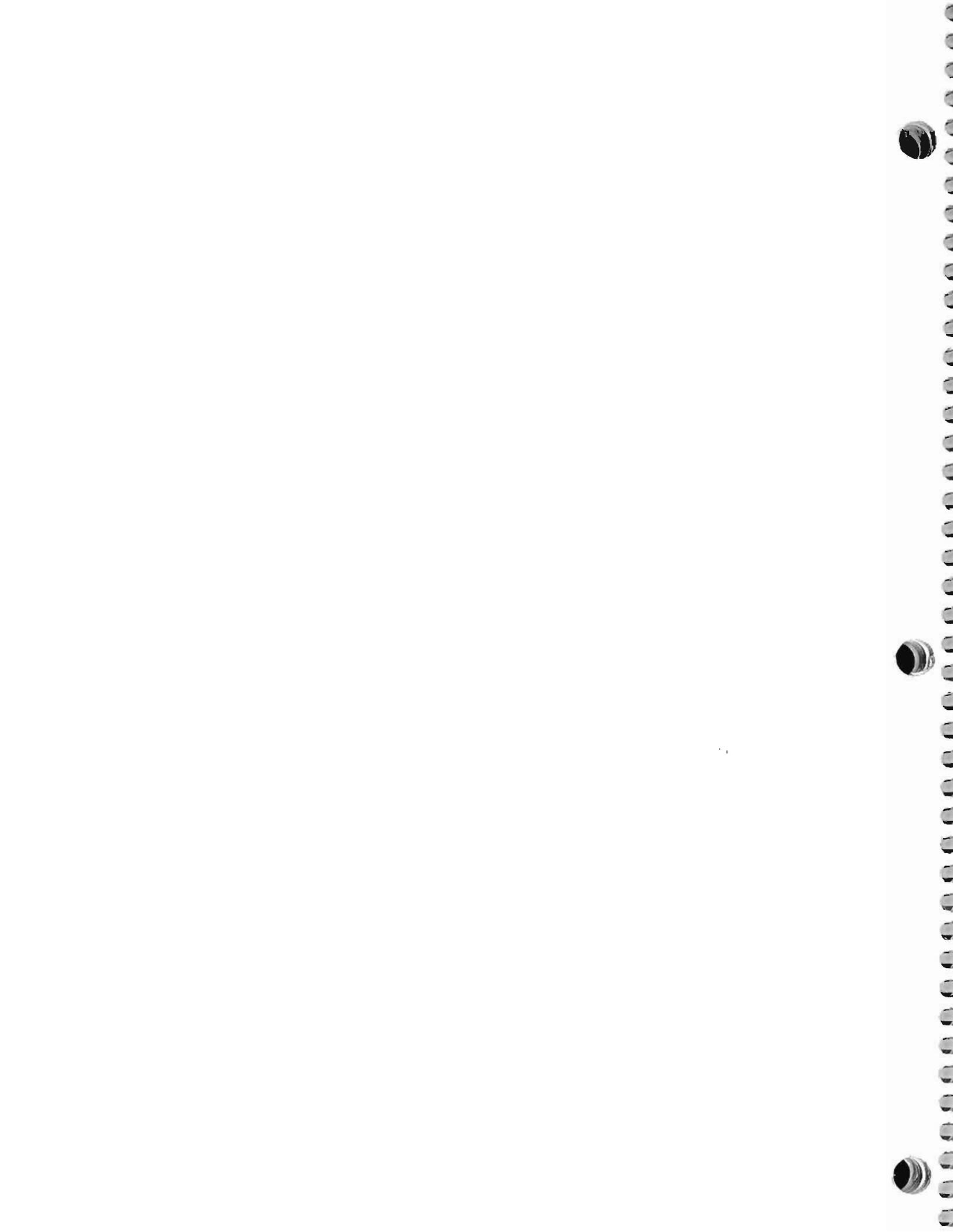
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# Central Body Electronics





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# CENTRAL BODY ELECTRONICS

**Model:** E52

**Production Date:** 03/00 to Present

## Objectives of the Module

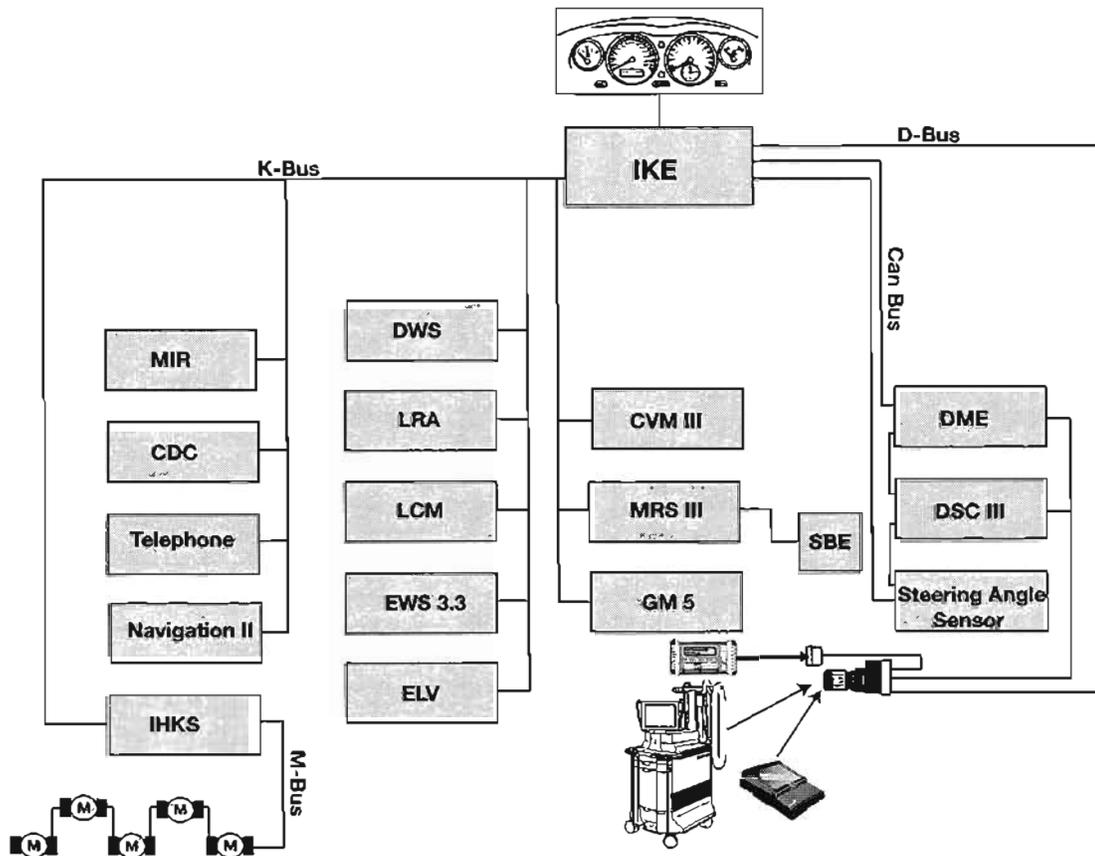
After completing this module, you will be able to:

- Describe the functions of the ZKE sub systems.
- Locate the various fuse boxes.
- Name the bus systems used on the Z8.
- Identify the locations of the control modules.
- Describe 3 ways to open the trunk.
- Describe SDR operation.
- Understand Neon Lights Technology.
- Identify the ELV components and their locations

# Vehicle Electrical System

## Purpose of the System

The state of the art Z8 electrical system satisfies all of today's demanding requirements. The Z8 electrical system is developed from the E46 concept.

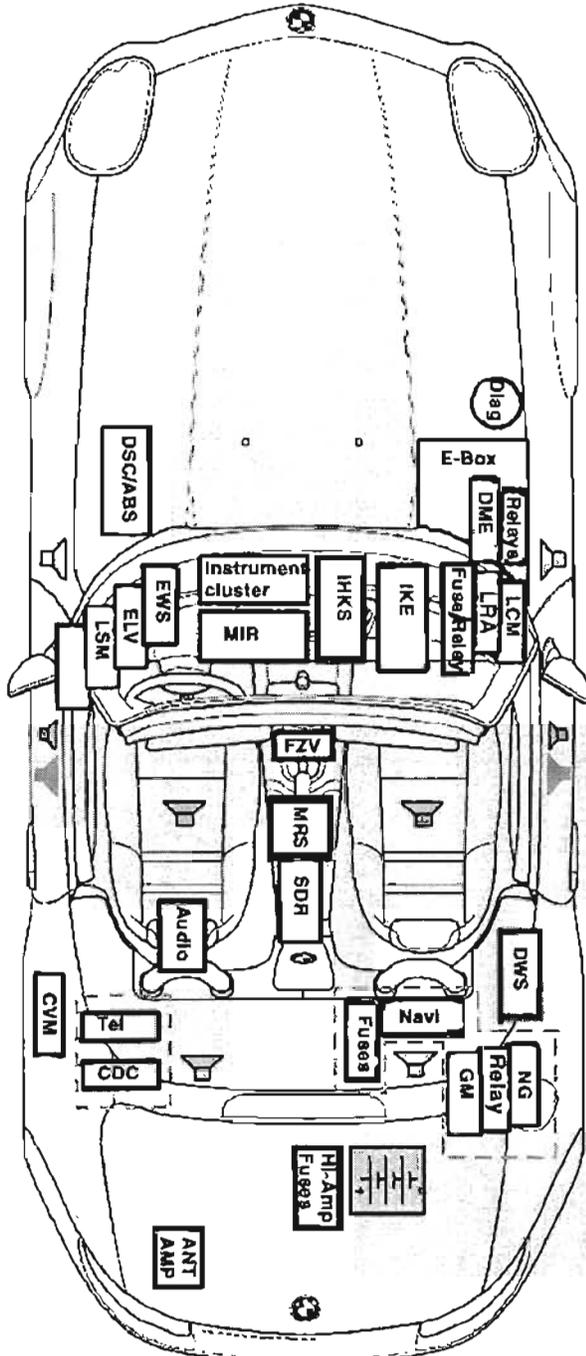


The Z8 electrical system concept with its stringent power and weight requirements that BMW places on all sports cars was considered in wiring harness production.

The wiring harness is divided into *three sections*:  
(Telephone provisions can be provided optionally)

1. Main wiring harness (repair kits for left front, right front and right rear)
2. Audio/navigation (left rear, no repair kit)

## Control Unit Locations



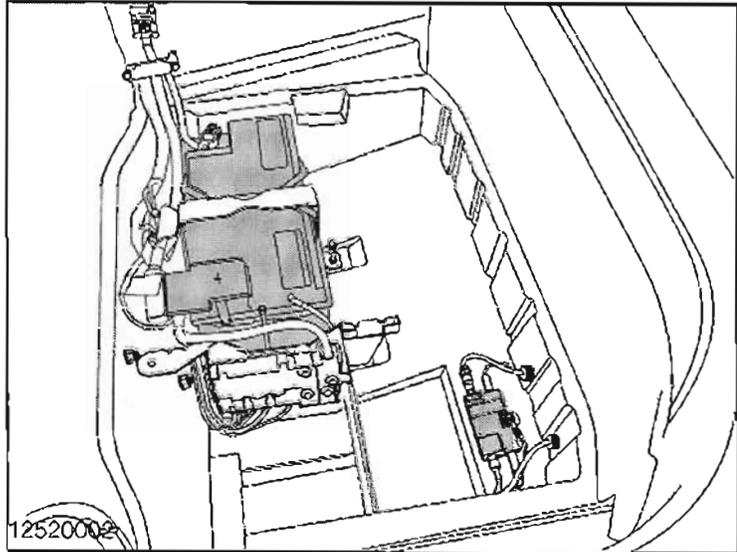
Abbrev.	Description
EWS	Electronic Vehicle Immobilization
ELV	Electronic Steering Lock
E-Box	E-Box
CVM	Convertible Top Module
DSC	Dynamic Stability Control
DME	Digital Motor Electronics
Diag.	Diagnosis Connector
CVM	Convertible Top Module
CDC	CD Changer
ELV	Electronic Steering Lock
Audio	Audio Amplifier
ANT	Antenna Amplifier
FZV	Radio Central Locking
GM	General Module
Hi Amp	Main Fuses
IHKS	Air Conditioning
IKE	Instrument Cluster Module
Instrument Cluster	Instrument Cluster Display
LCM	Light Check Module
LSM	Steering Column Module
LRA	Headlight Vertical Arm Control
MRS	Airbag Control Unit
Navi	Navigation Computer
NG	Tilt Sensor
MIR	Multi-Information Radio
Tel.	Telephone

## Power and Fuse Layouts

The vehicle battery is located in the trunk floor along with the tool kit.

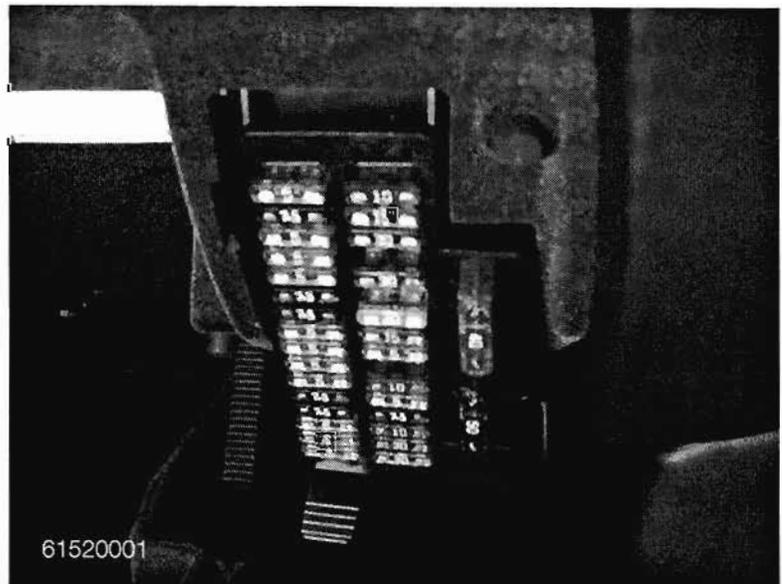
The B+ cable is equipped with the familiar BST (see 1997 New Model Update Handout for additional information).

The "high amp" fuses are located next to the vehicle battery (shown to the right).



The glove box mounted fuse panel is located behind an access panel cover in the glovebox.

The fuse ID is also located on this cover (shown opened on the right).





There are additional vehicle fuses located in the Navigation cd storage compartment.



The E box is shown above containing the traditional engine fuses.

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## ZKE V

### Purpose of the System

The **ZKE V** system is a new variant Central Body Electronics system unique to the Z8. Many of its features and functions operate similarly to previous BMW ZKE systems with minor changes, added features, and refinements.

The following functions **are directly** controlled by the General Module V (GM V):

- Windshield wiping/washing and headlight washing
- Central locking with power trunk/fuel filler door release
- FZV Keyless Entry
- Power window control
- Anti-theft warning (DWA)

The following functions are included as body electrical systems but are **not directly** controlled by the GM V:

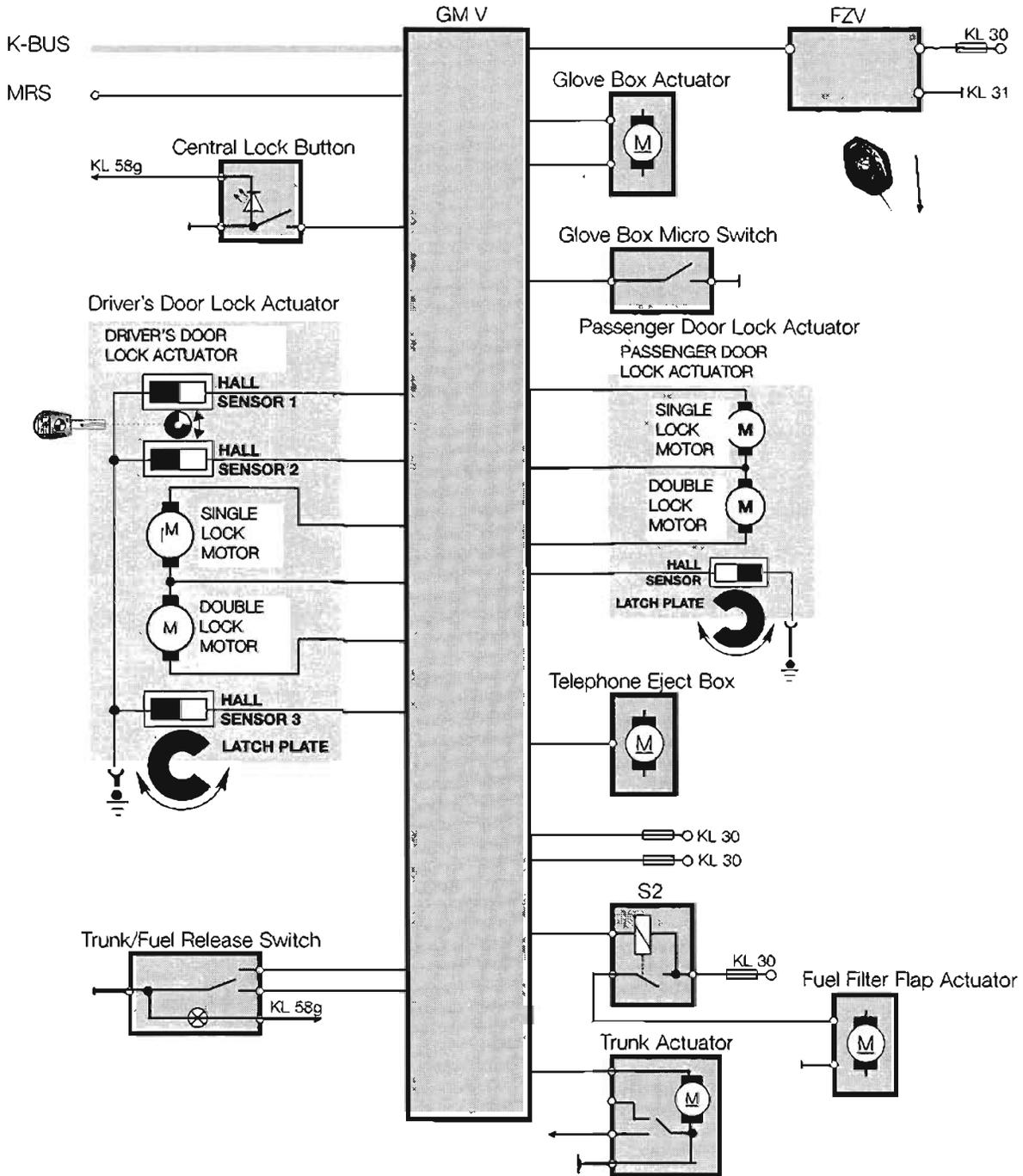
- Driver and Passenger seat electrical adjustment (no control module - switch controlled)
- Side Mirror - adjustment/heating (also includes windshield washer jet heating)
- Electrochromic rearview mirror
- MRS III

ZKE V introduces the following changes and new features:

- Similar to the E46 GM V, the Z8 GM V controls its respective peripheral components directly (no P-Bus). It communicates with other pertinent control modules via the K-bus as does the E38/E39 GM V.
- The GM V is responsible for the Car/Key Memory feature. Key memory provides the added convenience of identifying users of the vehicle. Whenever the vehicle is locked or unlocked via the FZV keyless entry system, a unique key identification signal (key number) is transmitted to the General Module.

# System Diagram

## Central Locking System



The Central Locking system of ZKE V controls the door lock, trunk lock, fuel filler flap, glove box, telephone storage compartment, and DWA.

The familiar single/double locking strategy is maintained from previous systems with the introduction of a new style door lock mechanism combined with dual actuator motors (similar to E46).

The new style actuators are sealed, self contained units with no replaceable parts.

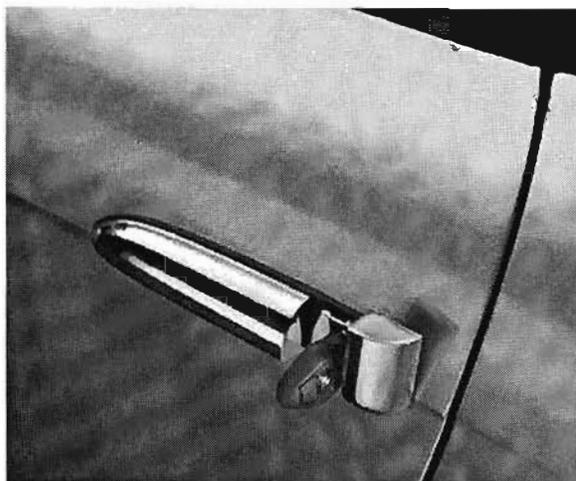
The door lock actuator use hall effect sensors in place of pin contacts and microswitches to provide:

- Door lock key position (driver's door only),
- Door open/closed status (replaces door jamb switch).

The passenger door is fitted with a manual locking knob which can lock the door if the vehicle battery were to fail. Simply slide the knob downward and close the door. It can not be opened from the outside. In this position, the door can be opened from the inside by pulling the inside door handle (2x).

The Driver's door lock location is the only point outside of the vehicle where the key can mechanically control all of the central locking system functions.

Shown to the right is the lock cylinder is protected by a spring loaded cover.

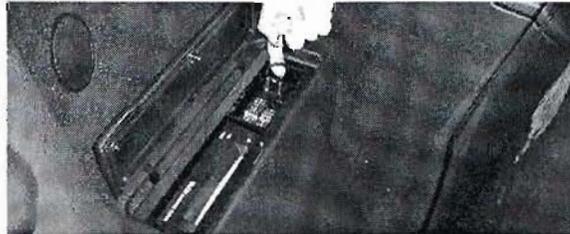


The central locking switch is located in the center console.

Locking the vehicle from the central switch (indicated by the arrow on the right) "single locks" the vehicle except for the fuel filler flap, glove box, and telephone storage compartment.



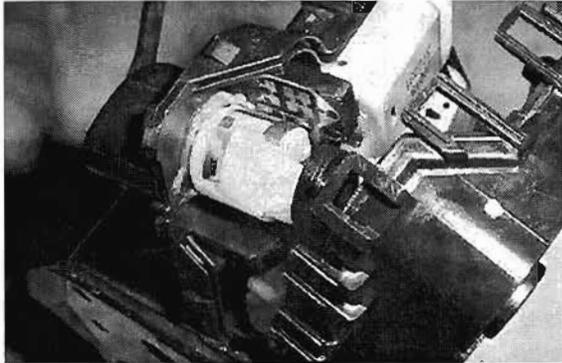
- 
- The Z8 can be locked with the top down. When the vehicle is locked with the exterior mechanical key or FZV, the doors, glove box and telephone storage compartment are locked. Locking the glovebox with a "master Key" will also lock out the trunk and telephone storage compartment. The Navigation and cd changer storage compartments can be mechanically locked with a "master key".



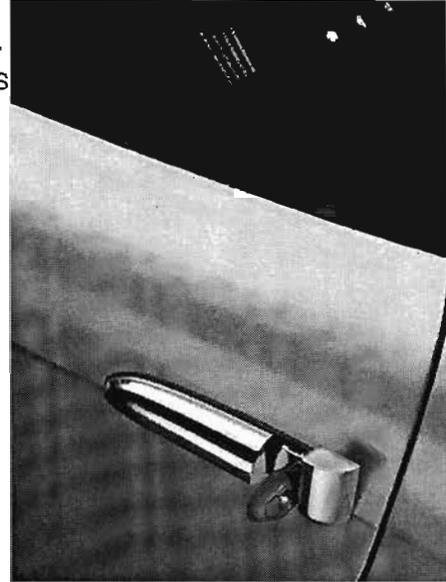
- The trunk can be unlocked remotely with the key (FZV) but does not lock/unlock the entire vehicle. The trunk can be opened by depressing the trunk button in the left kick panel. The mechanical release is located in the Navigation storage compartment.
- GM V and EWS 3.3 interface via the K bus to monitor double lock status and to initiate double lock override. This feature allows the doors to be opened from the inside if an accepted EWS key is switched on in the ignition when double locked.
- The selective unlocking feature of the E38/E39 is maintained on the ZKE V. A single unlock request from the driver's door with the key or via the remote transmitter unlocks the driver's door only. A second unlock request unlocks the passenger door.
- Car/Key memory coding allows the "single" locking to be activated after the vehicle is driven off.
- The Multiple Restraint System (MRS III) control module provides a switched signal to the GM in the event of an accident. The signal is an output function of the MRS control module and becomes active when MRS determines a crash has occurred. When active, the GM unlocks the door lock actuator, switches on the interior lights and signals the LCM via the K bus to activate the hazard warning flasher. Once the crash signal is active, the GM will not respond to lock requests from the system until the ignition switch is cycled or a front door is opened.
- Continuous locking/unlocking will initiate a timed arrest of the locking system. The GM counts each time the locks are actuated. After approximately 12 cycles, the timed arrest is active. The timed arrest is deactivated one actuator cycle for every 8 seconds until the counter is reset to 0. The timed arrest is overridden if a crash signal is received from the MRS III.

The driver's door lock provides the following familiar signals to the General Module:

- Lock / Unlock
- DWA arm/disarm
- Convenience closing and opening signals
- Provides a mechanical link to manually lock/unlock the actuator in the event of a failure.
- The GM monitors these key positions over two wires. The signals are generated by two hall effect sensors (Hall Sensor 1 & 2) located in the actuator.



Hall sensor 1 & 2 is not included in the passenger door actuator.



When the key is turned, a plastic cylinder in the lock actuator is simultaneously rotated by the lock tumbler extension rod. An asymmetrical shaped magnet is incorporated in the plastic cylinder, which when rotated changes the magnetic influence on the hall sensors. The presence of a magnet in close proximity to the sensing surface of either hall sensor creates a coded input over the two wires that the GM uses to determine the key position.

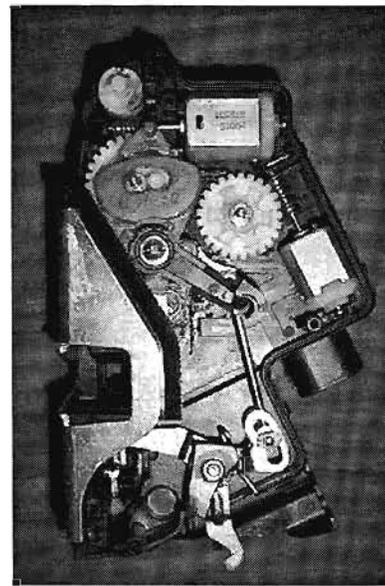
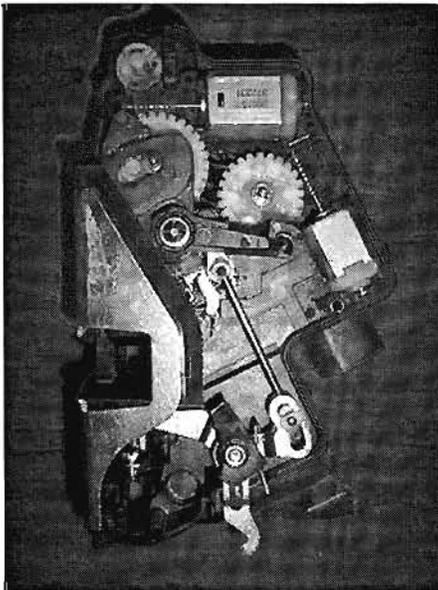
- Magnet in front of sensor, current flow through the sensor is  $<5$  mA (**0**).
- Magnet rotated away from sensor, current flow through the sensor is  $>12$  mA (**1**).

Hall effect sensors improve the actuator reliability since they are impervious to moisture and there are no wear contacts.

- Key in the neutral position, both sensors are simultaneously influenced by the magnet - **0/0**.
- Key turned to the unlock position from neutral, hall sensor #1 magnet segment moves away from hall sensor - **1/0**.
- Key turned to lock position from neutral, hall sensor #2 magnet segment moves away from hall sensor - **0/1**.

There are two motors incorporated in each actuator that provide two separate functions:

- **Single lock/unlock function.** Also known as central lock, this motor controls the mechanical lock mechanism when the central lock button is pressed to single lock the vehicle. The lock mechanism is fully locked at this point but can still be opened from the interior by pulling an interior door handle **twice** or by pressing the central lock button again. When single lock function is activated, the fuel filler flap actuator, glove box, and telephone storage compartment is not locked.
- **Double lock/unlock function.** Also known as central arrest, this motor is activated only when the vehicle is locked from the outside at the driver's door lock with a key or when the GM receives a lock request from the FZV system. In this case the double lock motor is activated simultaneously with the single lock motor. The function of the double lock motor is to mechanically offset an internal rod disabling it from unlocking the vehicle from the interior. This prevents the doors from being unlocked by any means except from an unlock request at the driver's door or via the FZV/remote key.



Note: This component has been disassembled to provide functional understanding. This component does not contain any replaceable parts and will void its warranty if disassembled.

## Door Contact Hall Sensor

Also included in the drivers door actuator is a third hall effect sensor. This sensor signals the door open/closed status to the GM. This sensor replaces the door jamb mechanical switch of previous systems. The rotary latch plate position activates the door contact hall sensor.

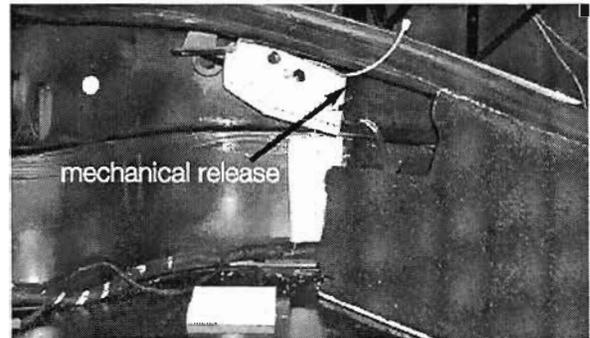
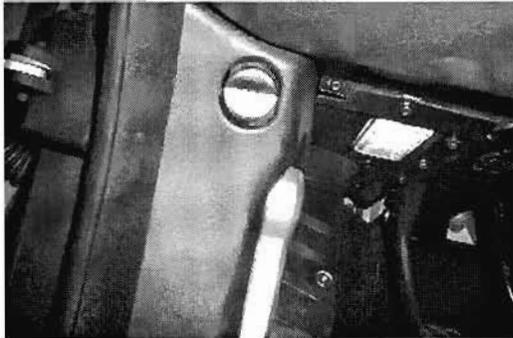
- When the door latch is closed, current flow through the sensor is  $<5$  mA **(0)**.
- When the door is open, current flow through the sensor is  $>12$  mA **(1)**.

The passenger side door actuator only includes this hall effect sensor (hall sensor 3). Hall sensors 1 & 2 are not required.

## Fuel Filler Flap Remote Unlock

The fuel filler flap can be opened from inside the vehicle by pressing the remote button (combined with the trunk button) when the vehicle is unlocked or single locked from the central lock button.

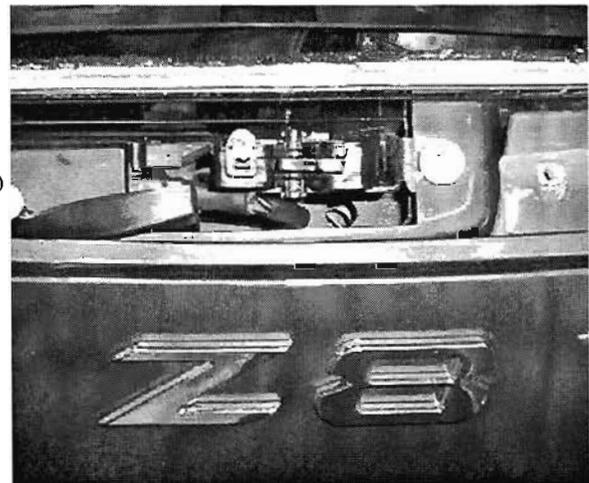
The remote fuel filler flap button is locked out when the GM detects a vehicle speed signal  $> 4$  MPH via the K-bus.



## Trunk Remote Unlock

The trunk can be opened from inside the vehicle by pressing the remote trunk button when the vehicle is unlocked or single locked from the central lock button. The trunk can also be opened from the remote key (FZV).

The remote trunk button is locked out when the glove box is locked in the hotel setting and/or when the GM detects a vehicle speed signal  $> 4$  MPH via the K-bus.



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## Windshield Wiping/Washing System

**Model:** E52  
**Production Date:** 03/00 to Present

### Purpose of the System

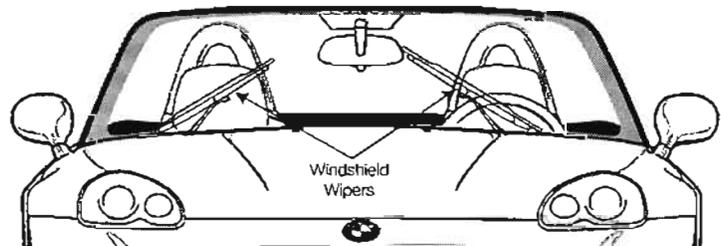
The Z8 windshield wiping/washing system is very traditional in operation, however an aggressive sport "look" has been given to the wiper arm mounting and articulation. The wiper arm mounting posts are positioned outboard on the windshield cowling.

The windshield wiping/washing system is similar to the E38/E39 system.

All wiping/washing functions are controlled by the GM V.

Output control of the wiper motor is through a windshield wiper double contact relay, which is located under the carpet below the glove-box.

The system has four wiping stages with interval wiping. The wiping stage inputs are coded signals through a two wire link with a combination of high/low inputs as on previous systems.



## The wiping stages include

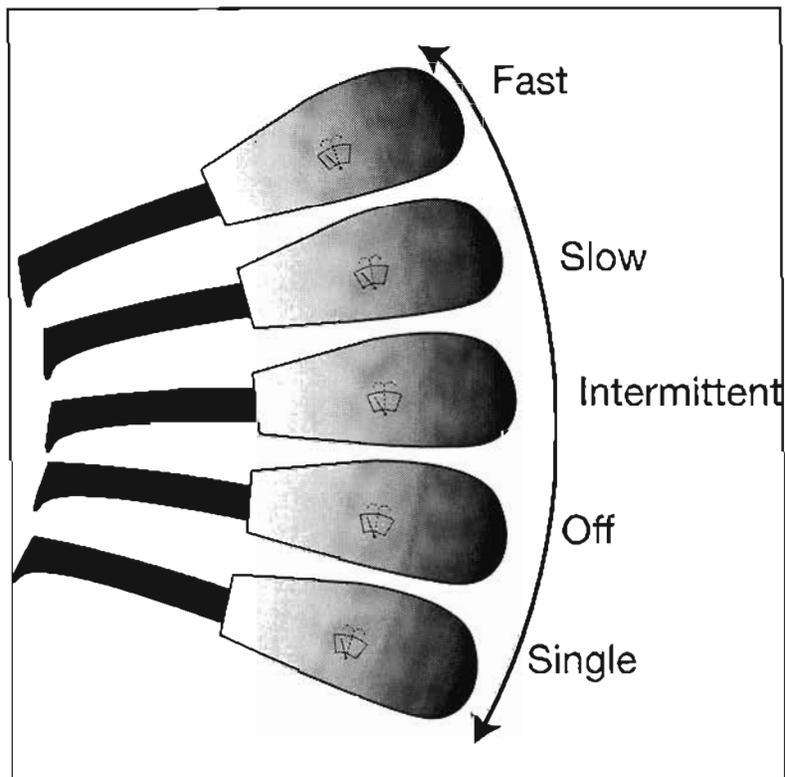
**Single:** Holding the wiper switch down in the single position provides a ground signal to activate the slow speed circuit providing wiper operation until the switch is released.

**Intermittent:** The intermittent wiping is activated by placing the switch in the first “up” position. Switching off the ignition in this position raises the wipers to the “service position”.

- The intermittent wiping intervals are dependent on the road speed.
- As road speed increases, the wiping interval delay is decreased.

**Slow (I) and Fast (II):** The stage I and stage II wiping speeds are also affected by road speed. The factory encoded settings are the same as previous systems:

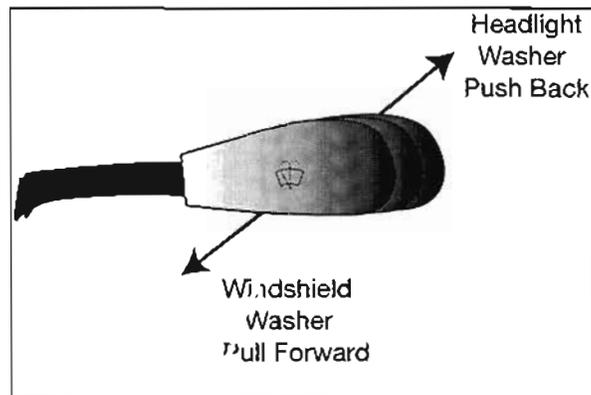
- Stage I automatically switches to intermittent when the vehicle is stopped, and resumes stage I when vehicle speed is present.
- Stage II automatically switches to stage I when the vehicle is stopped, and resumes stage II when vehicle speed is present.



## Windshield/Headlight Washing

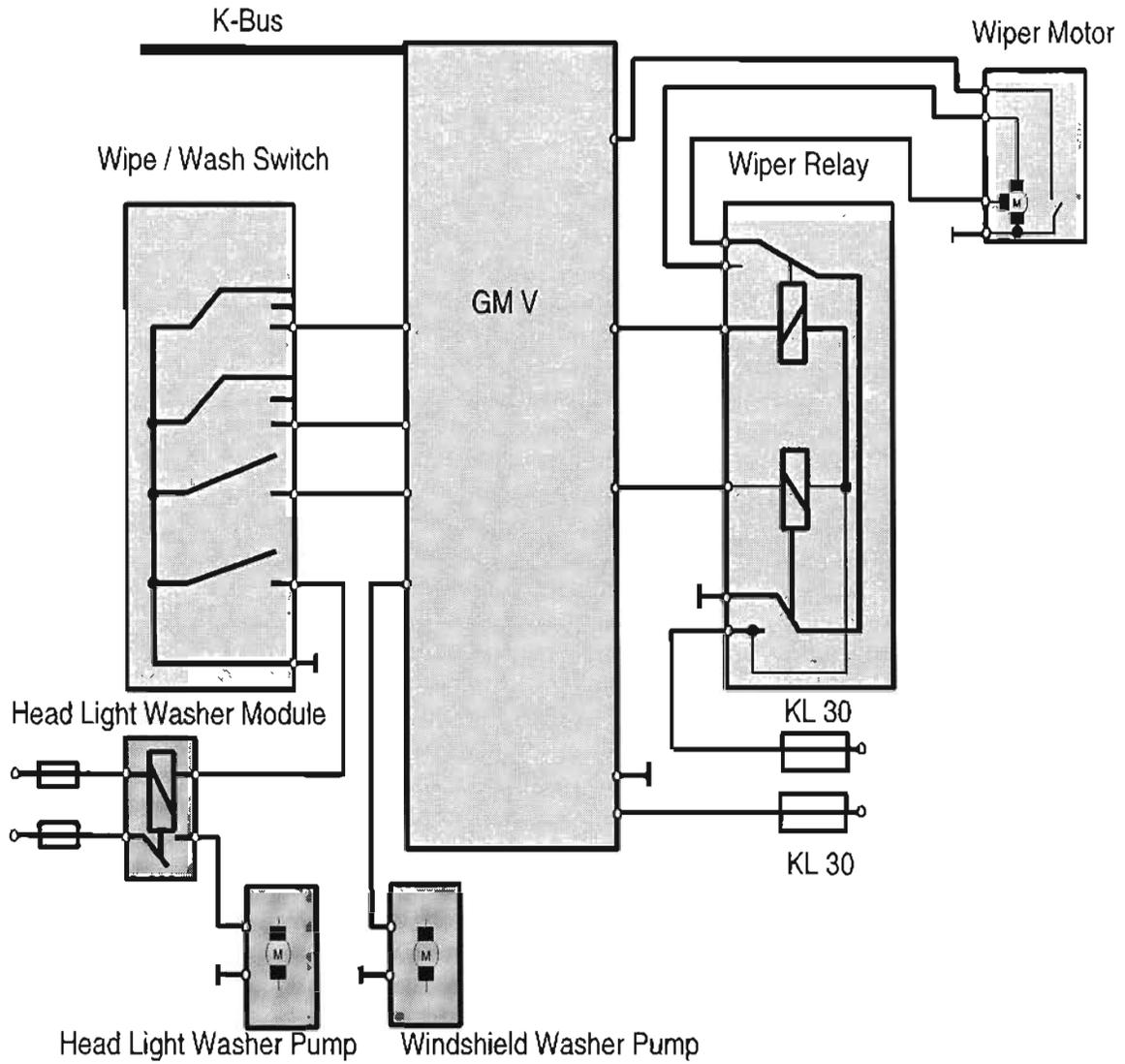
Windshield Washing: Pulling the Windshield Wiper Switch rearward closes the "windshield wash" contacts and provides a switched ground input to the GM. The GM activates the windshield washer pump directly via a power output final stage transistor. The wiper motor is also activated to wipe the glass clean.

Windshield/Headlight Washing: Pushing the windshield wiper switch forward requests windshield/headlight washing, regardless of the headlights being switched on or off. The signal activates the headlight washer relay which powers the headlight washer pump (nozzles are pressure opened) for 2 cycles. A time "arrest" (3 min.) will prevent unnecessary washing (which can be overridden by cycling the ignition). This system uses a common reservoir, located in the rear of the right front fender (5.3 L).



# System Diagram

## Wipe/Wash



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# Antitheft Warning System

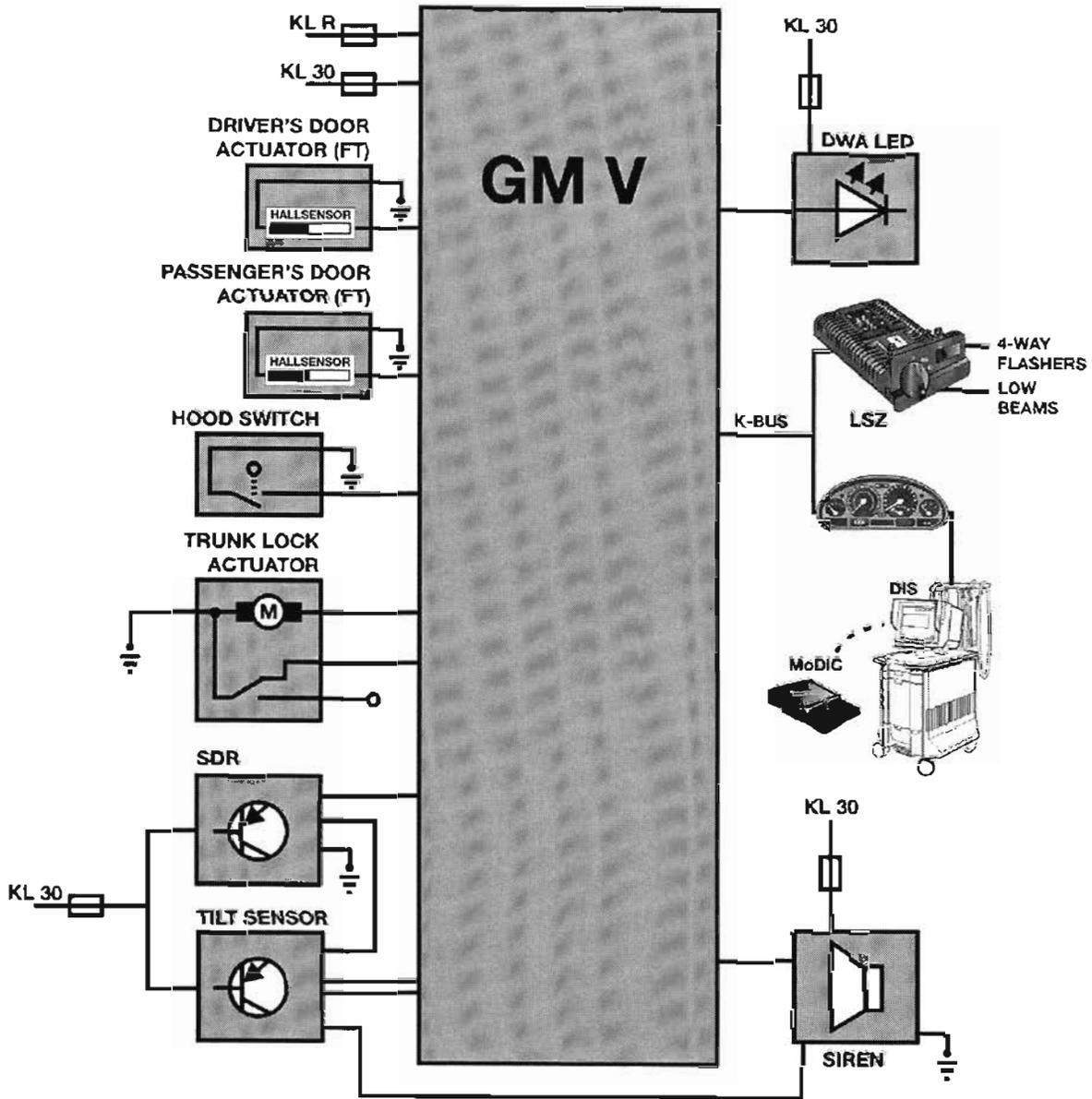
## Purpose of the System

The Z8 is equipped with the familiar DWA that has traditionally protected BMWs with Antitheft Warning. In addition, DWA offers a superior protection package because the system uses pre-existing ZKE components.

The General Module utilizes existing components and/or circuits as part of the DWA system:

- Door Lock Hall Effect Sensor Contacts (door open/closed).
- Trunk Actuator Switch Contact (monitored for closed trunk).
- Trunk Open Request (FZV key) this signal prevents DWA from activating if armed when the trunk is opened with the key.
- Hood Switch.
- DWA Status LED (part of rear view mirror).
- Tilt Sensor.
- DWA Siren.

# Anti-Theft Warning System



## Door Contacts

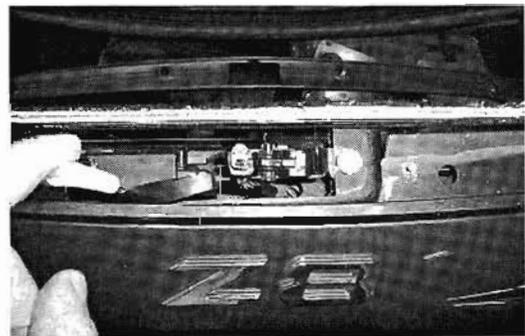
As mentioned in the Central Locking Section, the door lock contact hall effect sensors provide status of door open/closed.

- When the door latch is closed, current flow through the sensor is <math><5\text{ mA}</math> (0).
- When the door is open, current flow through the sensor is >12 mA (1).

The GM will activate the siren if a door open signal becomes active when the DWA is armed.

## Trunk Actuator Switch Contacts

The trunk switch contact is located in the trunk lock actuator assembly. When closed, the trunk contact provides a ground signal to the GM signifying a "closed trunk". The GM will activate the siren if the trunk switch contact ground signal opens when the DWA is armed (except when using FZV).



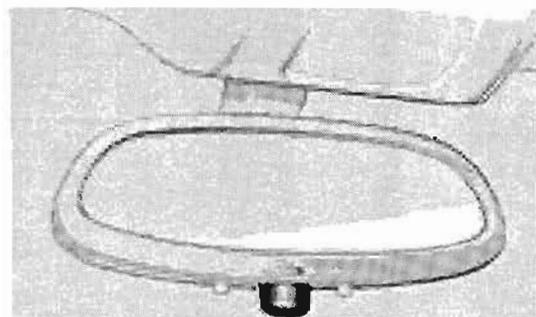
## Hood Contact Switch

Located on the left side engine compartment, the hood contact switch provides a ground signal to the GM signifying an open hood.

The plunger of this switch can be pulled up past a detente causing the switch contact to open (service position). This feature can be used to simulate a closed hood with the hood open when diagnosing the DWA system.

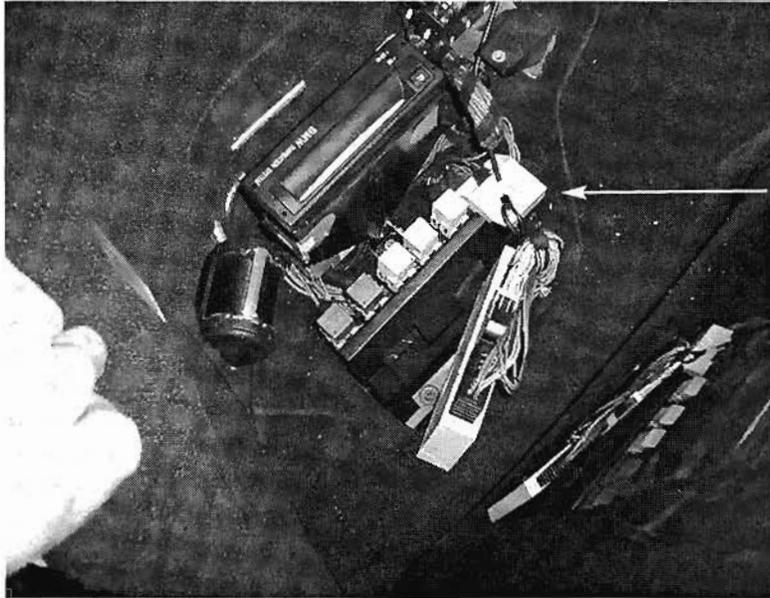
## DWA LED

As on other BMWs, the DWA indicator is located in the rear view mirror. The LED is provided with constant battery voltage (KL 30). The GM provides a switched ground signal providing the various blinking signals used to convey DWA status to the vehicle operator (covered further on).



## Tilt Sensor

Located in the Navigation storage compartment, the tilt sensor is an electronic sensing device with the sole purpose of monitoring the vehicle's parked angle when DWA is armed. This sensor is a new, one third smaller, solid state version (E46 similar).



The sensor requires three signal wires to perform its function:

- KL 30 - Constant battery voltage
- Signal "STDWA"; switched ground input signal provided by the GM indicating DWA armed/disarmed status. The tilt sensor is used as a splice location for the STDWA signal to the Siren and FIS interior protection sensor.
- Signal "NG"; switched ground output signal provided to the GM.

The signal is used for **two purposes**:

1. As a momentary acknowledgment that the tilt sensor received STDWA and is currently monitoring the vehicle angle.
2. If the tilt sensor detects a change in the vehicle's angle when DWA is armed, signal NG is switched to inform the GM to activate the siren.

When the tilt sensor receives the STDWA signal from the GM it memorizes the vehicle's parked angle. The angle of the vehicle is monitored by the solid state electronics. Once armed, if the angle changes, the tilt sensor provides a switched ground signal to the GM to activate DWA.

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## Alarm Siren

- The DWA siren is installed in the vehicle cowl under the micro-filters. This location provides a secure position with loud acoustic output.
- The siren contains electronic circuitry for producing the warning tone when the alarm is triggered. The siren also contains a rechargeable battery that is used to power the siren when the alarm is triggered.
- The rechargeable battery will allow the siren to sound if it or the vehicle's battery is disconnected. The siren battery is recharged, from the vehicle's battery when DWA is not in the armed state.
- The siren has four wires connecting it to the system; *KL 30*, *KL 31*, *Signal STDWA* (arm/disarm signal from GM), and *Signal NG* (activate siren output signal to the GM)
- The arm/disarm output signal from the GM (*STDWA*) is provided to the Tilt sensor, SDR module and the siren simultaneously. The arm/disarm signal is a switched ground that signals the components of *DWA* armed/disarmed status.
- The activate siren signal (*NG* is high whether *DWA* is armed or disarmed). If a monitored input activates the alarm, the high signal to the siren is switched to a 50% duty cycle at the GM. The control circuitry in the siren activates the siren driver. If the *DWA* is armed and the battery is disconnected the siren recognizes the normally high "*NG*" signal as suddenly going low, the siren is also activated.

## DWA Arming/Disarming

- The *DWA* is armed every time the vehicle is locked from the outside with the door lock cylinder or *FZV* key.
- The *LED* in the rear view mirror flashes as an acknowledgment along with the exterior lights and a momentary chirp from the siren.
- The GM monitors all required input signals for closed status (door closed, trunk closed, etc.) The inputs must be in a closed status for a minimum of 3 seconds for the GM to include them as an activation component. Change of status re-monitors the inputs.  
*Example:* Hood being left open, then closed after the alarm has been set on.
- If the *DWA* is armed a second time within 10 seconds, the tilt sensor and interior protection (SDR) are also excluded as alarm activation components. This function is useful if the vehicle is transported on a train or flat bed truck to prevent false alarm activations.

---

While armed the trunk can be opened with out the alarm being triggered as follows:

- If opened with the trunk remote button via the *FZV*, the *GM* prevents the alarm from activating. When the trunk is returned to the closed position, it is no longer considered as an activation signal.

**Panic Mode Operation:** When the trunk button is pressed and held, the *GM* is signaled to activate the siren for the Panic Mode. The panic mode is function with either an armed or disarmed *DWA* system.

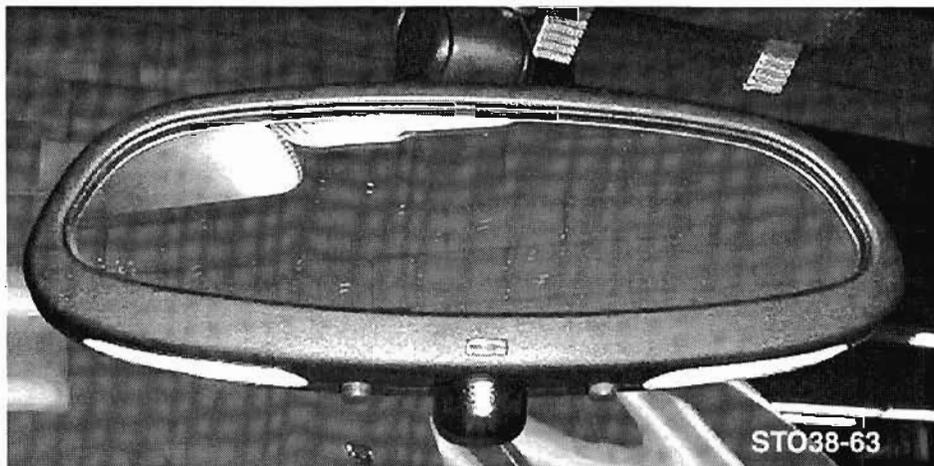
### **Emergency Disarming**

Emergency disarming occurs automatically if a key is used to turn the ignition switch on and the *EWS III* accepts it. The *EWS III* signals the *GM* to unlock the doors and deactivate the *DWA*.

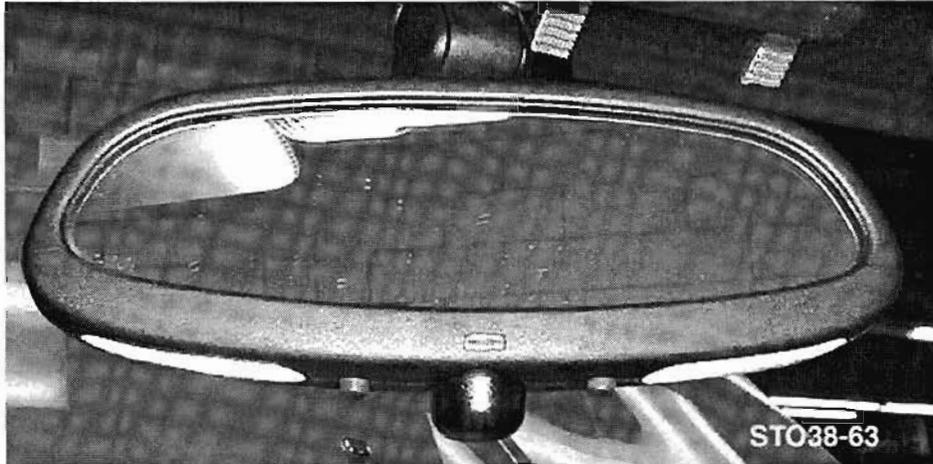
### **Alarm Indication**

When the alarm is triggered, the siren will sound for 30 seconds. At the same time the parking and high beam lights will flash for 5 minutes. The *GM* signals the the *LCM* via the *K bus* to flash the lights.

Following an alarm trigger, the system will reset and trigger again if further tampering is done to the vehicle.



## DWA LED Status



DWA STATUS	DWA LED CONDITION
Disarmed	Off
Armed	Continual slow flash
Armed with one or more monitored inputs not in closed position (ie: trunk not fully closed, etc.)	Rapid flash for 10 seconds, then continual slow flash.
Alarm activated	Rapid flash for 5 minutes then continual slow flash.
Rearmed in less then 10 seconds.	On for 1 second
Disarmed after activated alarm	Rapid flash for 10 seconds, then OFF.

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## Interior Lights

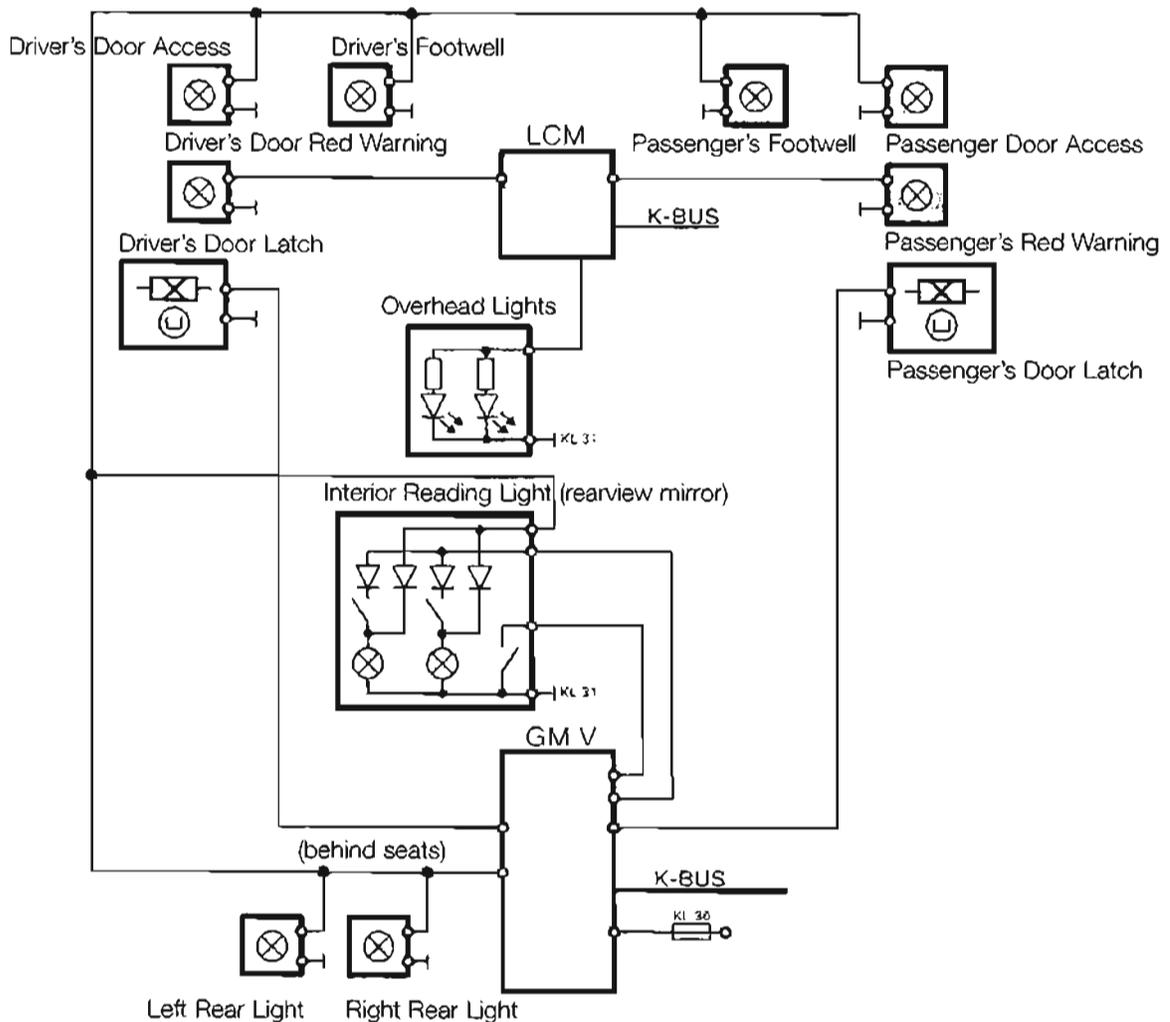
### Purpose of the System

The GM controls the interior lighting automatically with the status change of several monitored inputs. The lighting can also be manually controlled using the interior light switch.

# System Components

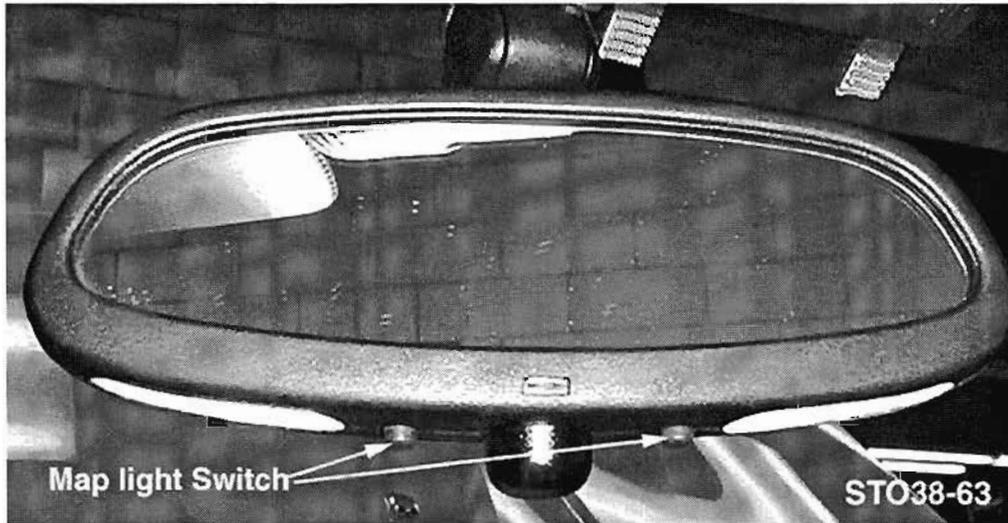
## Door Contacts

As mentioned in the *Central Locking Section*, the door lock actuator contain a hall effect sensor for the purpose of monitoring door open/closed status (hall sensor 3 in the driver's door actuator). The hall effect sensor is located directly behind the rotary latch plate encased in the actuator. The sensor is activated by the rotary latch plate's position. A change in current flow informs the General module when a door is opened or closed.



## Interior/Map Light Unit

The overhead interior/map lights are contained in the rear view mirror, consisting of 2 lights. The lights are controlled by the GM automatically or by momentarily "twisting" the interior light switch (DWA indicator) located on the rear view mirror.



The switch provides a momentary ground signal that the GM recognizes as a request to either turn the lights on (if off) or turn the lights off (if on).

If the switch (DWA indicator) is held for more than 3 seconds, the GM interprets the continuous ground signal as a request to turn the interior light circuit off (workshop mode) as on previous systems.

The workshop mode is stored in memory and will not come back on even if the GM is removed from its power supply and reconnected. The switch must be activated to turn the lights back on.

The lights can be used individually as reading/map lights. Each light is mechanically controlled by depressing its corresponding on/off switch.

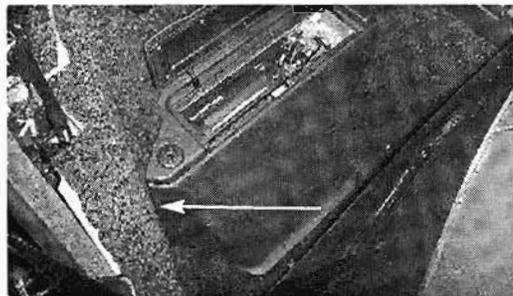
The power supply for the map lights is supplied by the GM through the Consumer Cut Off circuit.

## Front Footwell Lights

In each front footwell, there is also a courtesy light. These lights are only operated when the GM provides power to the interior lighting circuit.

## Rear Compartment Lights

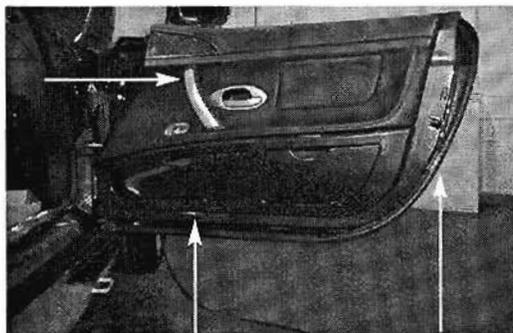
Lights are installed behind the seats to allow visibility for the Navigation/cd changer compartments.



## Door Lighting

The doors are equipped with exit access lighting, as well as "red" safety lights when the doors are opened.

The inside door handles are back lit with an led.



## Night Lights

The night lights are located above the rear view mirror on the windshield frame. They provide a subtle illumination of the center console when the headlights are switched on.

## Load Cutout Lights

The remaining lights can be switched on regardless of the ignition position:

- Reading lights
- Glovebox light
- Engine compartment lights
- Luggage compartment lights

The B+ power supply is provided by the GM V. To ensure against battery draw if the lights are left on, the GM V will deactivate the circuit 16 minutes after the ignition terminal "R" is switched off. The lights will be switched on again when ignition terminal "R" or "15" is switched on in addition to an input to the GM V - opening a door, hood, unlocking the door.

---

## Automatic Control Function

The GM provides 12 volts (linear application providing soft on feature) to the interior lighting circuit when the one of the following input signal statuses change:

- Interior light switch
- Door contact hall sensor active (door opened)
- An Unlock request from the driver's door key lock hall sensors are received. This only occurs if the ignition switch is off.
- An Unlock request from the FZV keyless entry system is received via the K bus. This only occurs if the ignition switch is off as well.
- The ignition switch is switched off (within 32 seconds) and the vehicle exterior lights (LCM) have been on for a minimum of 2 minutes prior. This information is provided to the GM via the K bus.
- Active crash signal from the MRS III control module.
- Lock button of FZV key is pressed with the vehicle is already locked (interior search function).

The GM gradually reduces the full 12 volt power supply (linear reduction providing soft off) until the lights are off when the following input signal statuses change:

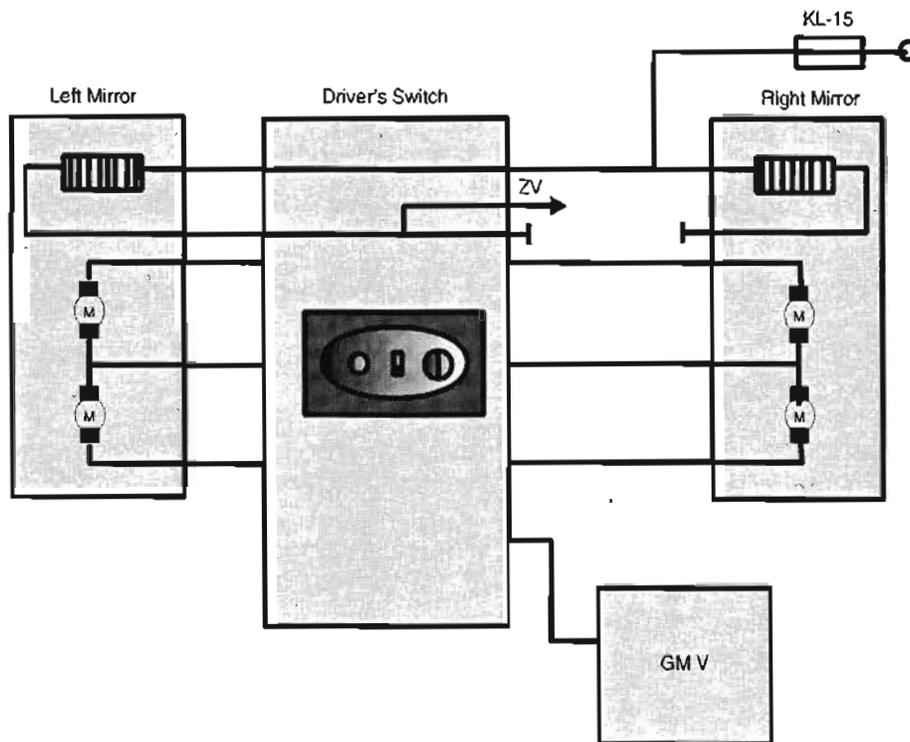
- Interior light switch
- Immediately after the ignition switch is turned to KL R with the driver's door hall sensor door contact closed.
- When the vehicle is locked (single or double) with the door contacts closed.
- When the vehicle door contacts are closed. The lights remain on for 20 seconds and then go to soft off.
- After the interior search function is activated, the lights will automatically turn off (soft off) after 8 seconds.
- After 16 minutes with a door contact active (open door) and the key off, the lights are switched off (consumer cutoff function).

# Outside Mirror Adjustments

## Purpose of the System

The outside mirrors can be electrically adjusted to a desired position. The Mirror adjust/window combination switch allows the driver to adjust the mirrors (up/down - left/right). This switch contains a slide switch that will "toggle" control from the left to right mirror.

The mirrors contain 2 motors and traditional heating elements . The Z8 does not have mirror memory, and the reverse gear input has no affect on the right mirror.



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# CENTRAL BODY ELECTRONICS

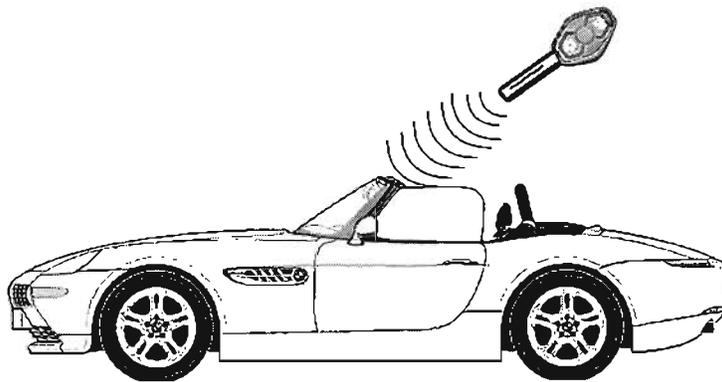
## Remote RF (Keyless) Entry

**Model:** E52  
**Production Date:** 03/00

### Purpose of the System

The Z8 keyless entry system's operation is carried over from the E38/E39. A minor change occurred with the location of the FZV receiver module location.

- The receiver is located in the interior rear view mirror.
- The receiver produces a digital signal based on the transmitter command and sends it to the GM for processing.
- The GM then carries out all remote lock features, window convenience opening feature and DWA arming/disarming functions.
- The frequency at which the key transmits the radio signal to the receiver is 315 MHz.
- The system is also used to convey the key being used to lock/unlock the vehicle.



## System Components

### FZV Key

- New appearance with blue and white BMW roundel.
- New button arrangement (larger buttons) with sequential operation (enhanced operating convenience)
- Rechargeable battery replaces replaceable batteries. Charged by EWS ring antenna.
- The key housing is encapsulated and can not be opened.
- The LED has been omitted.
- Key is used in Z8, E46, E38 and E39 vehicles.

### Features of the keyless entry system include:

#### 1. ARROW

##### Press once

- unlock driver's door
- DWA disarmed
- interior lights on

##### Press twice

- total unlocking

##### Hold

- convenience opening

#### 2. ROUNDEL

##### Press once

- locking
- DWA arming
- interior lights on when vehicle locked

##### Press twice

- within 10s
- deactivate SDR and tilt monitoring

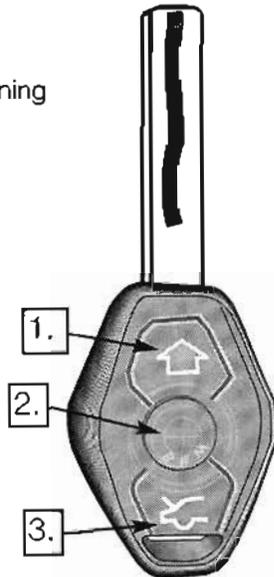
#### 3. TRUNK

##### Momentarily press

- trunk lid opens

##### Press and hold

- panic mode alarm



- Up to 4 radio-control keys can be operated in conjunction with one vehicle.
- Locking/unlocking of doors, trunk, fuel filler lid.
- Selective unlocking of driver's door (as with key in lock).
- Arming/dis-arming of DWA alarm system.
- Remote unlocking of the trunk only.
- Comfort opening of windows
- Interior lighting activation (search mode).
- Panic mode alarm activation.
- Automatic correction for up to 1000 erroneous activation signals.
- Low transmitter battery fault code storage in the GM.
- An EEPROM is used to store the key data. The data is no longer lost when the battery is replaced and initialization is not required.
- Keys delivered with a four color label sheet containing four different colored labels for each of the four possible FZV keys.

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## FZV Key Rechargeable Battery

From KL R, the battery inside the key head is charged inductively by the EWS ring antenna via a coil antenna integrated in the key. The charging process is controlled by electronic circuitry integrated in the key.

- The service life of a radio-control key used under normal conditions corresponds to the vehicle lifespan.
- If the FZV keys are not used (ie: stored in a drawer), the battery will be discharged after approx. 1.5 years.
- The time required to fully charge a discharged battery is approx. 30 hours.
- The remote control can be operated about 15 times after a charging period of approx. 30 minutes (driving time).

The key data is stored in a transponder chip. The transponder chip is a wireless read and write EEPROM. It is powered via the ring coil at the steering lock. Power is applied electromagnetically when the key is in the ignition switch from KL R.

The power supply is used both for data transfer as well as for charging the battery. This has been made possible by new development of the transponder chip.

As with previous systems, every press of an FZV key also provides the battery charge condition. When the FZV electronics receives a low power condition message three successive times, the GM sets a fault indicating a low battery within a specific key. The LCM is also informed via the bus system and alerts the driver via an instrument cluster matrix message.

If the battery is recharged (used operate car), the fault will be automatically deleted when five successive messages are received indicating a charged battery condition. The new battery has no affect on the EWS III communication function!

## Remote Key Initialization

The initialization of the FZV keys is required to establish the Lock/Unlock signal synchronization with the GM. The initialization procedure provides the GM with a key identification number and a "rolling code" for each key. If the initialization is not performed, the GM will not respond to the key signals.

Up to 4 remote keys can be initialized. They must be initialized at the same time. Key initialization is only possible with the vehicle unlocked.

### Procedure:



1. Close all doors and have all keys available.
2. Using key number 1, turn the ignition switch to KLR, then switch off within 5 seconds and remove the first key.
3. Within 30 seconds of turning the ignition switch to "off" press and hold the arrow button.
4. While holding the arrow button, press and release ("tap") the round button three times within 10 seconds.
5. Release both buttons. The GM will immediately lock and unlock the doors signaling a successful initialization.
6. If additional keys need to be initialized repeat steps 3 - 5 within 30 seconds.
7. Switching the ignition to KL R completes the initialization.

### SERVICE NOTE:

The key memory function of the GM responds to the key identification number of each key. If the keys are not initialized in the same order prior to initialization, the key memory functions activated by the keys will not be assigned correctly. Always initialize the keys in the same order.

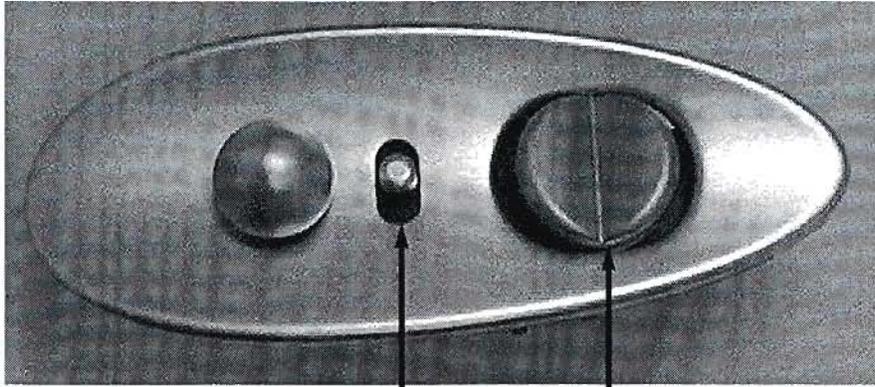
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## Power Windows

### Purpose of the System

The Z8 power window is very unique. Features of the system operation includes:

- Control of the window motors is carried out directly by the GM.
- One-touch window operation in both directions (passenger side down only).
- Window lowering/raising when the doors are opened and closed.
- Cable type window regulators.
- Driver's side combination window/power mirror switch
- Convenience closing/opening of the windows from the driver's lock cylinder or convenience opening only from the FZV remote key
- Window operation with the ignition switched off until a door is opened or 16 minutes has elapsed after the key is switched off
- Window load switching is through relays integral of the GM. The GM V monitors the current draw for end limit position. The maximum run time for the window motors is limited to 8 seconds. This allows the motors to be switched off if the end limit load sensing fails.



Slide Switch      Window Switch

### **New Style Window Switches**

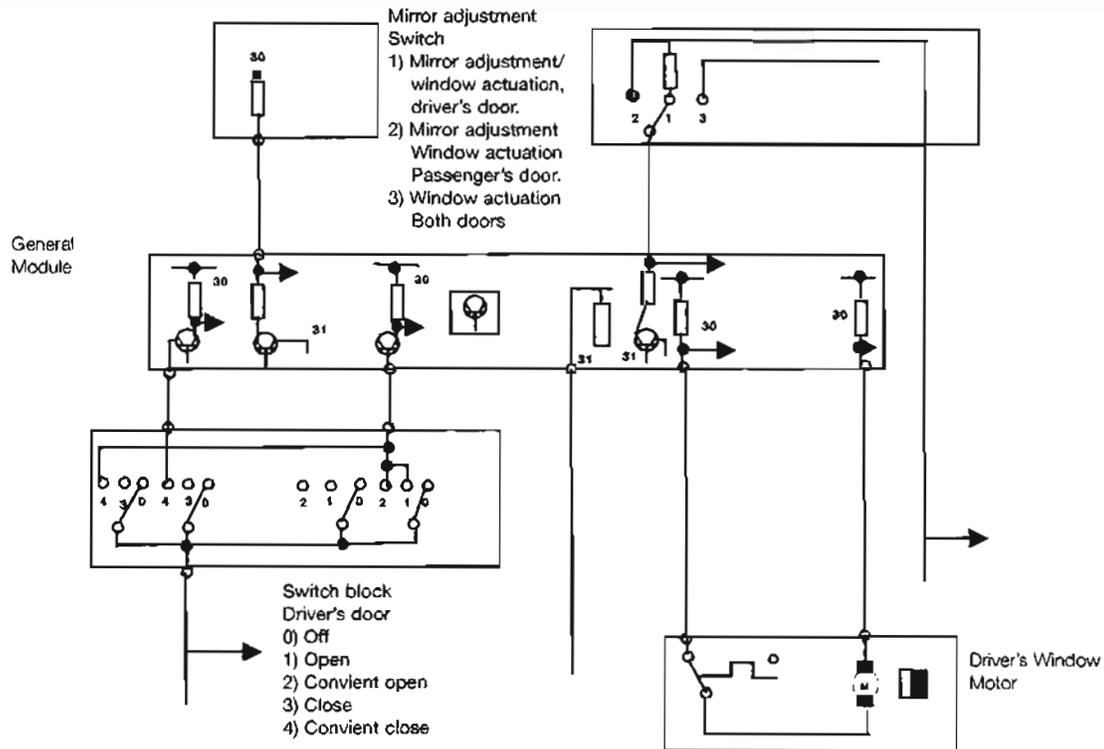
The Z8 power window switch design is a new rocker type switch. The switch provides the GM V with the familiar coded ground signaling strategy as previous two wire switches.

Pushing a switch to the first detent and holding provides a single ground signal on one wire requesting the GM to operate the window motor in the down direction. When released, the ground signal is removed and the window motor stops.

Momentarily pushing the switch to the second detent and releasing provides an additional ground signal on the second wire requesting the “one touch mode”, operating the window motor automatically. The motor runs the window down until it reaches it's end stop.

The switch functions in the same manner for the upward run of the window motor (driver side only)but the ground signal sequencing is reversed.

The drivers side switch block contains a slide switch for the mirrors, this also affects the windows. If the slide switch is set to the left, the left window will be controlled. If the slide switch is set to the right, the right window will be controlled. If the slide switch is set to the middle position, both windows will be controlled from the driver's window switch.



## Power Window Motors

The window motors are mounted on the cable regulators. The window motor control circuit consists of two wires for operating the motor in both directions.

The motors are activated by relays in the GM. The relays provide either power or ground depending on the direction of window travel.

The GM controls the polarity of the based on a request to run the window (window switch, Convenience Opening/Closing).

The windows are run to their limit stops which is detected by an amperage increase in the control circuit. Additionally, the window run cycle is limited to an 8 second duration if in case the amperage increase is not detected or there is a malfunction with the regulator.

## Window Motor Limit Stop Function

If the repetitive window activation (up/down) exceeds one minute, the GM deactivates the internal relays and disregards any further input requests. The GM provides motor activation after a short duration but not for the full one minute monitoring cycle.

Over time, the GM slowly reverses the stored count of activation until the stored number equals 0.

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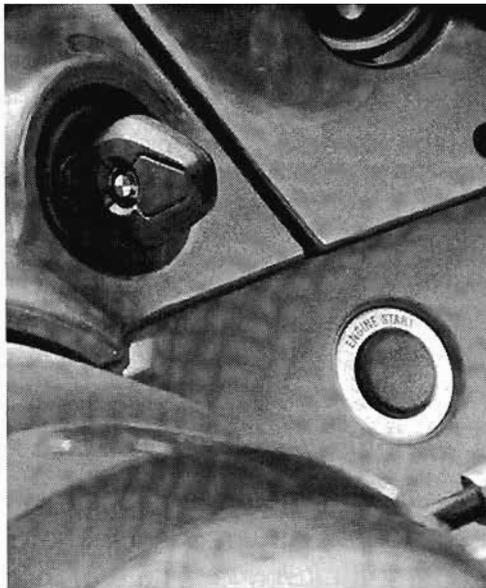
## Electronic Steering Lock (ELV)

### Purpose of the System

On historical cars and race cars the starter has a remote button separate from the ignition switch.

In the Z8, this operating concept has been enhanced by the latest technology in the form of the electronic steering lock system (ELV).

The advantages of this system are that the steering lock and ignition switch can be relocated in a safe location (security), the starter button is located in an ergonomically optimum position for the driver, and the steering column lock is released by EWS recognition.

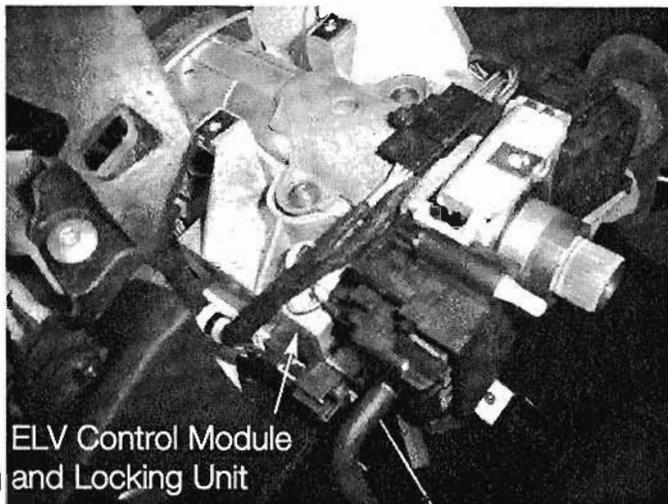


## System Components

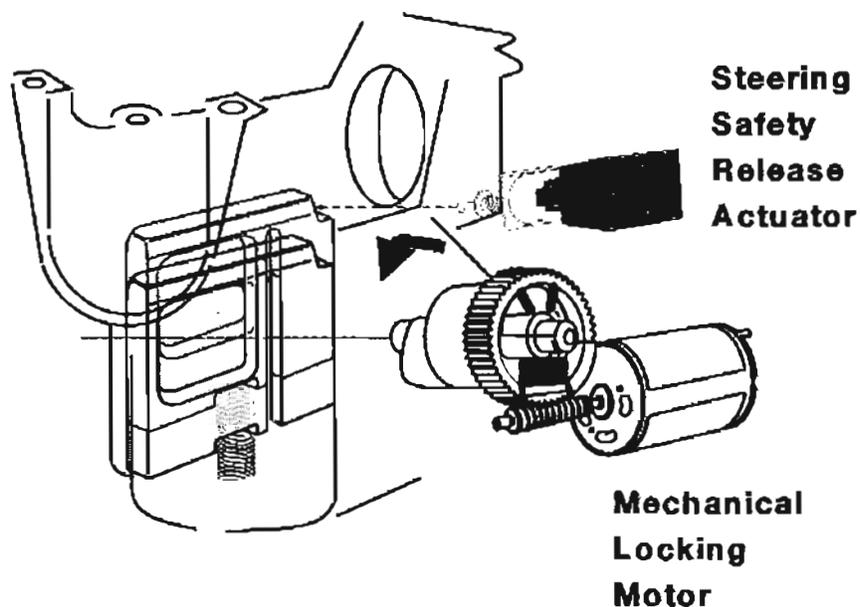
The ELV unit is mounted on the steering column as shown to the right. It is secured with sheer bolts, and is not serviceable. The ELV must be replaced as a unit

The ELV assembly contains the control module and steering lock mechanism.

The steering lock consist of the mechanical locking motor to engage or release the locking plate, and the safety release actuator (solenoid) to maintain the locking plate position in the event of power loss during operation.



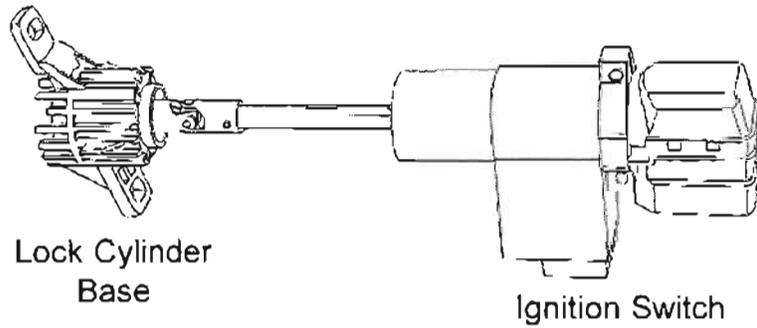
ELV Control Module and Locking Unit



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## System Components

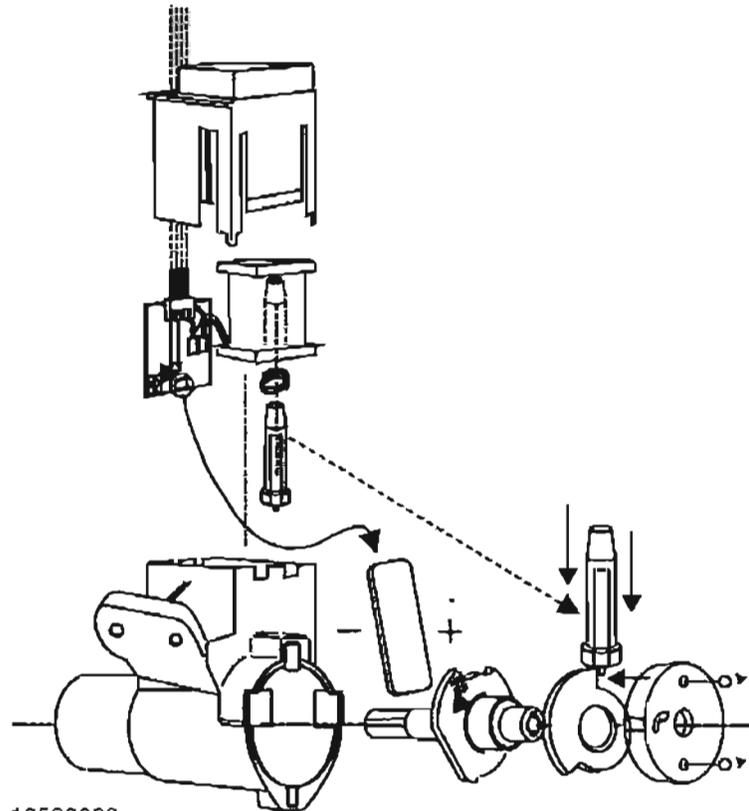
The ignition switch assembly shown on the right allows for "remote" mounting of the switch which is a further deterrent for tampering.



12520005

The ignition switch consist of a "turn catch" actuator (solenoid) which prevents turning of the ignition switch unless EWS recognition has taken place.

The rotating plate in the switch is monitored by a Hall sensor (rotation recognition). This input is used by the ELV for a plausibility check in conjunction with KL R and KL 15.



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## System Operation

To unlock/start:

- Key check conducted by EWS via K-bus
- Steering release aided by an actuator (key near antenna ring)
- Mechanical locking (locking motor)
- Rotary lock released (in ignition switch)
- Start enable signal to EWS

To lock:

- Terminal 15, R, and ignition switch rotation recognition check
- Speed signal check (from left rear wheel - must not be present)
- Interrupt relay is deactivated

Special functions:

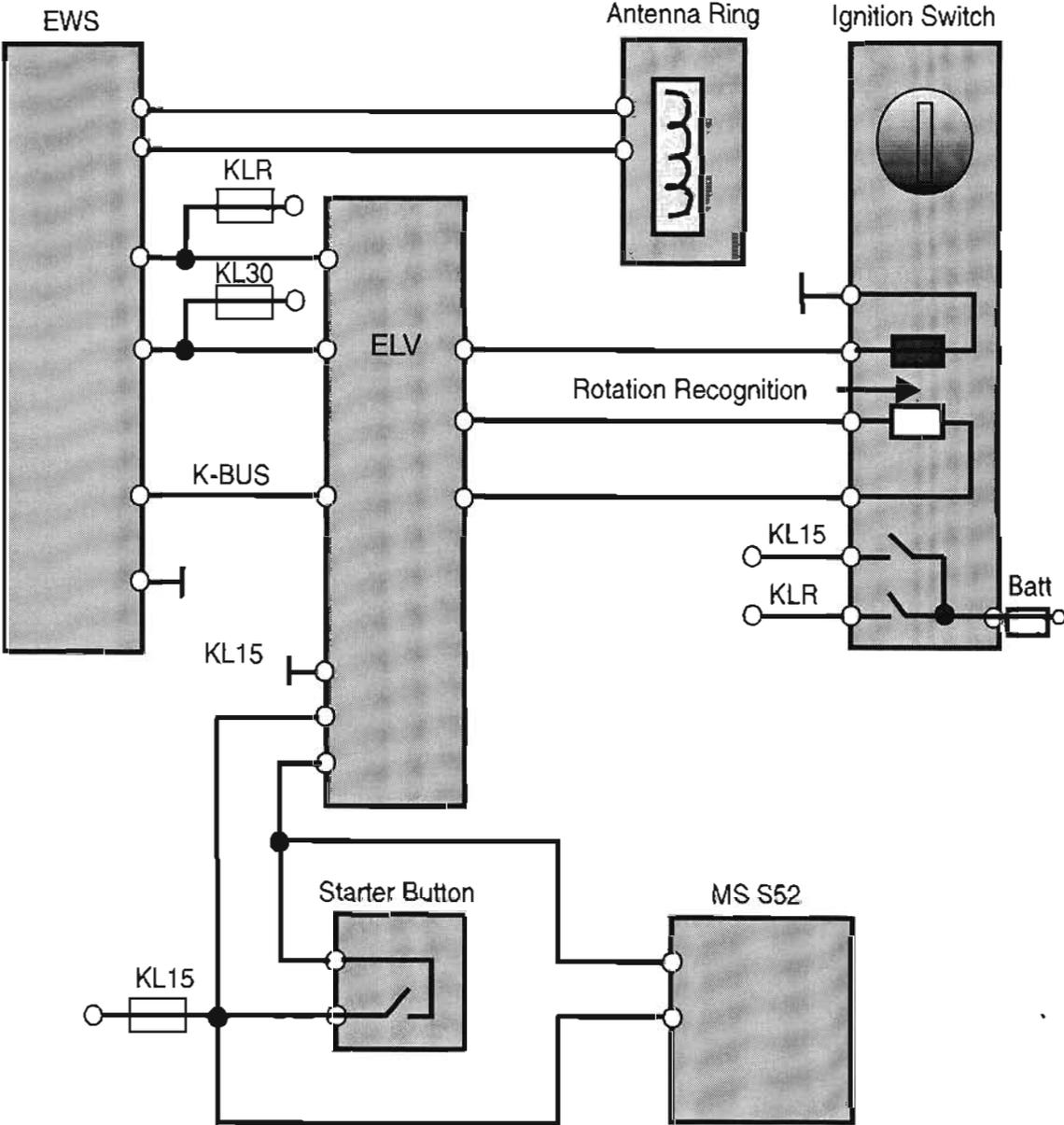
- Emergency functions in the event of K-bus defect
- Overload cutout for actuator
- Sleep mode
- Crash mode (lock released)

Diagnosis/encoding:

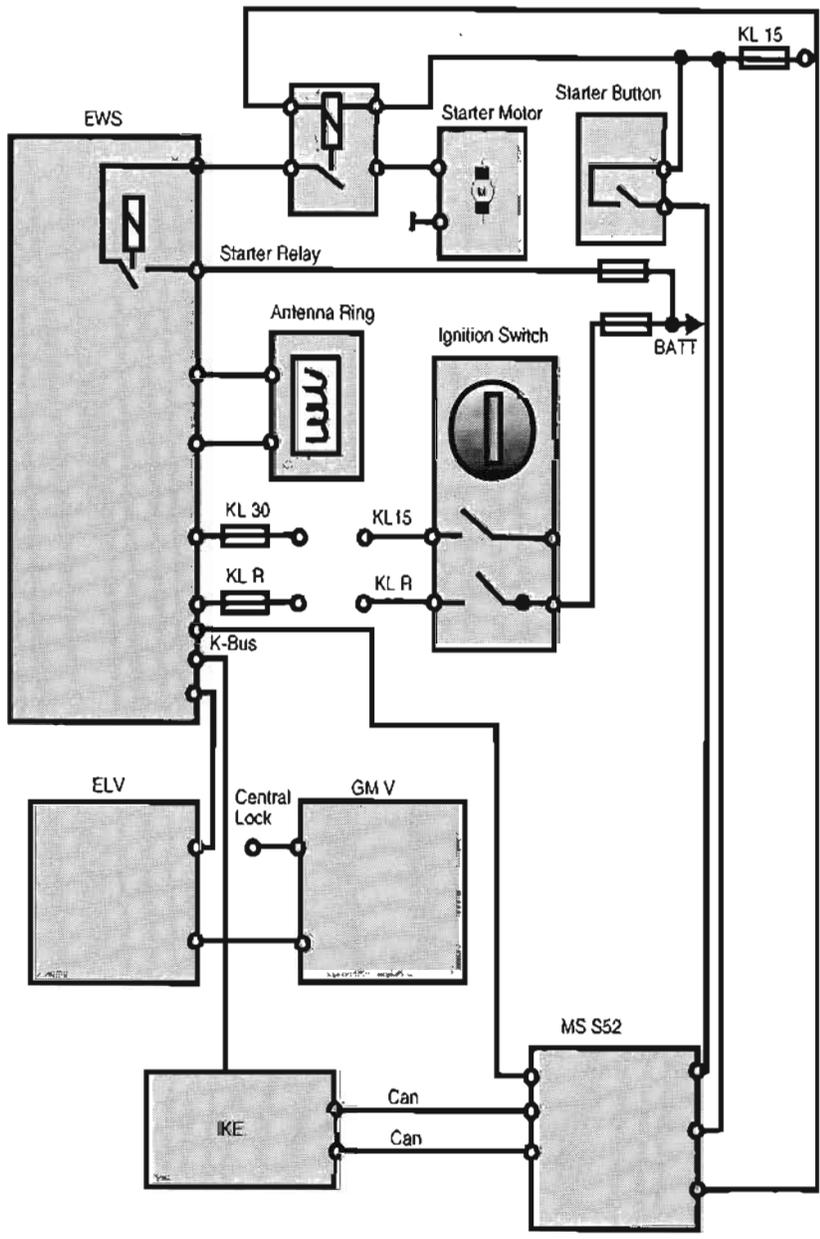
- Coding function after replacement of ELV unit
- Fault code memory
- Status check of all outputs and inputs
- Diagnosis

# System Diagram

## ELV Block Diagram



# ELV Link Diagram



The Z8 EWS 3.3 is similar to previous BMW models. All of the familiar EWS 3.3 features carry over to the Z8.

The additional features in the Z8 are the remote starter button and the *ELV steering lock*.

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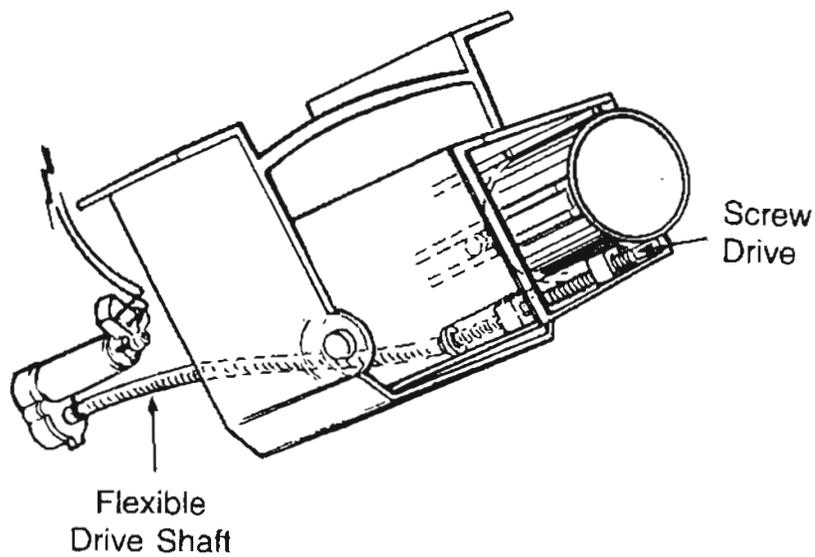
## Electrically Adjustable Steering Column

The steering column can be adjusted for telescopic (inward/outward) position.

This is accomplished electrically as previously seen on other BMW models.

The electric column in the Z8 does not have a memory feature.

The telescopic column rocker switch is located on the underside of the steering column.



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# Multiple Restrain System - MRS III

## Purpose of the System

The Z8 is equipped with the Multiple Restraint System (MRS III) which employs the use of "SMART" technology. Smart technology refers to the control module's programming which allows for the deployment of the airbags, in stages, depending on the severity of the impact. Two stage airbags are used for both the driver and passenger which allows for a softer cushioning effect when the bags are triggered at lighter impacts.

MRS III control modules are manufactured by either Bosch or Temic. While the functional operation of both modules are the same. The control modules are not interchangeable from a replacement standpoint. Always refer to the EPC parts system to ensure that the proper module is installed in the vehicle.

In addition to the use of two stage airbags for the driver and passenger, the following features are also included in the MRS III system:

- The MRS III control module is linked to the K-Bus for coding and diagnosis.
- The MRS III includes a fuel pump cut off feature in the event of an airbag deployment.
- Inert gas generators are now used for all air bags and seat belt tensioners.
- The inert gas is a mixture of hydrogen (13.5%) and oxygen (86.5%).

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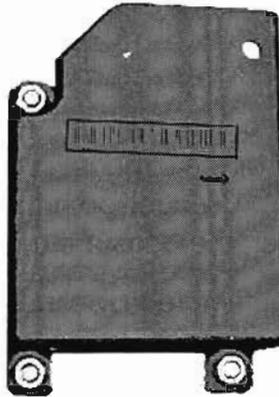
## System Component

### MRS III Control Module

The control module is mounted in the center console area on the driveshaft tunnel.

The control module contains the processing electronics (Smart Technology) for triggering of all air bags and pyrotechnic devices installed in the vehicle.

Two electronic deceleration sensors are installed in the module for crash or impact detection.



### Satellite Sensors

The satellite sensors are mounted behind the driver's and passenger's seats underneath the Navigation and cd storage compartments. The function of the sensors is to detect the severity of side impacts and signal the MRS III control module, through a pulse modulated signal, in the event of a crash. The control module uses this input signal along with its internal impact sensor signal to determine the deployment of the side/head airbags.

As with the control modules, the satellite sensors are manufacturer specific. The Temic sensors have a three wire connector which will not interchange with the Bosch sensors. Only two of the wires are used for the satellite sensor's operation. The signal for deployment of the bags is carried over the power wire of the sensor.



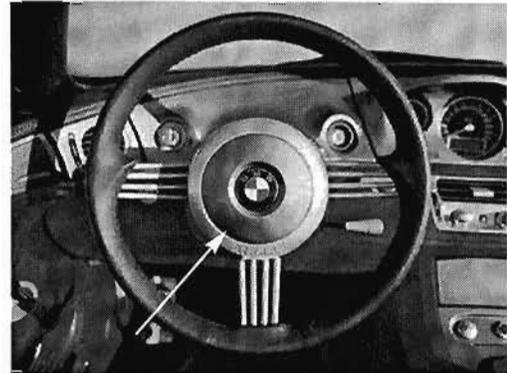
## Driver's Front Air Bag

With the MRS III system, the driver's front airbag becomes a two stage bag similar to the passenger's front side bag, introduced on the 1999 model E38/E39s. The complete assembly is mounted beneath the cover in the center of the steering wheel as with previous airbags. The assembly now contains the inert gas generator chamber and two ignition stages (ignitors).

The airbag consists of:

- Accumulator/gas generator
- Two ignition capsules
- Propellant gas - 13.5% hydrogen  
86.5% oxygen

*To remove the airbag - compress the spring latches through the two access holes (at the bag base, next to the steering wheel spokes).*

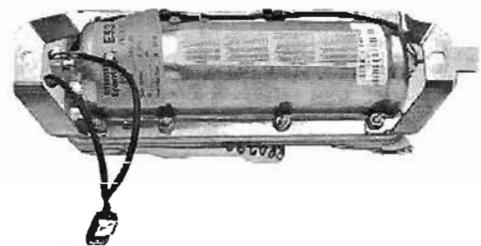


## Passenger's Front Air Bag

The passenger's front airbag is the same unit as installed on E38/E39 vehicles as of 9/98 production.

The passenger's airbag consists of:

- Pressure accumulator/gas generator
- Two ignition capsules - for two stage activation
- Propellant gas of - 13.5% hydrogen  
86.5% oxygen



## Side Air Bags (Thorax)

The side airbags continue to be mounted in the door panels on the doors. Deployment of the side airbags is dependent on the triggering thresholds programmed in the MRS III control module, based on the inputs from the satellite sensors and internal crash sensor. The side airbags use the same cold gas inflation method as the driver's and passenger's front bags.



## System Operation

As with previous systems, the triggering thresholds are programmed in the MRS III control module. These thresholds are determined by BMW through crash and vehicle testing during the design and development of the vehicle. These thresholds will vary depending on the vehicle size and design.

There are several different thresholds for airbag and safety restraint deployment including:

- Belt pre-tensioner threshold for activation of the seat belt tensioners.
- *Airbag threshold #1* - the first level of activation for the two stage front airbags, always deployed first when the front triggering threshold is reached.
- *Airbag threshold #2* - the second level of the two stage front airbags, can be deployed simultaneously or after a time delay, depending on the severity of the impact.
- *Rear crash threshold* - for activation of the seatbelt tensioners with a rear impact.
- *Battery safety terminal threshold* - for activation of the BST with airbag deployment.
- *Side airbag threshold* - for deployment of the side (thorax) airbags.

### Triggering Thresholds - Two Stage Air Bags

The programming of the MRS III includes four triggering thresholds for the two stage front airbags. The triggering of the front airbags is also dependent on whether the seat belts are connected and if the front passenger seat is occupied.

Threshold	No Seat Belt	Belted
1	Ignition Stage 1	No Activation
2	Ignition Stage 1&2	Ignition Stage 1
3	Ignition Stage 1&2	Ignition Stage 1&2
4	Ignition Stage 1&2 Simultaneously	Ignition Stage 1&2 Simultaneously

- 
- If the signal from the SBE is defective on triggering, the MRS III will deploy as if the seat is occupied.
  - If the signal from the seat belt contacts are defective, the MRS III will deploy as if the belts were not buckled.

### **Triggering Threshold - Side Air Bags**

The triggering thresholds for the side airbags is dependent on the signals from the satellite sensors and the crash sensor in the MRS III control module. The triggering thresholds are independent of the belt tensioners.

### **Triggering Threshold - Belt Tensioner**

The triggering of the belt tensioners is dependent on the signal from the seat belt contact and the severity of the impact as detected by the control module.

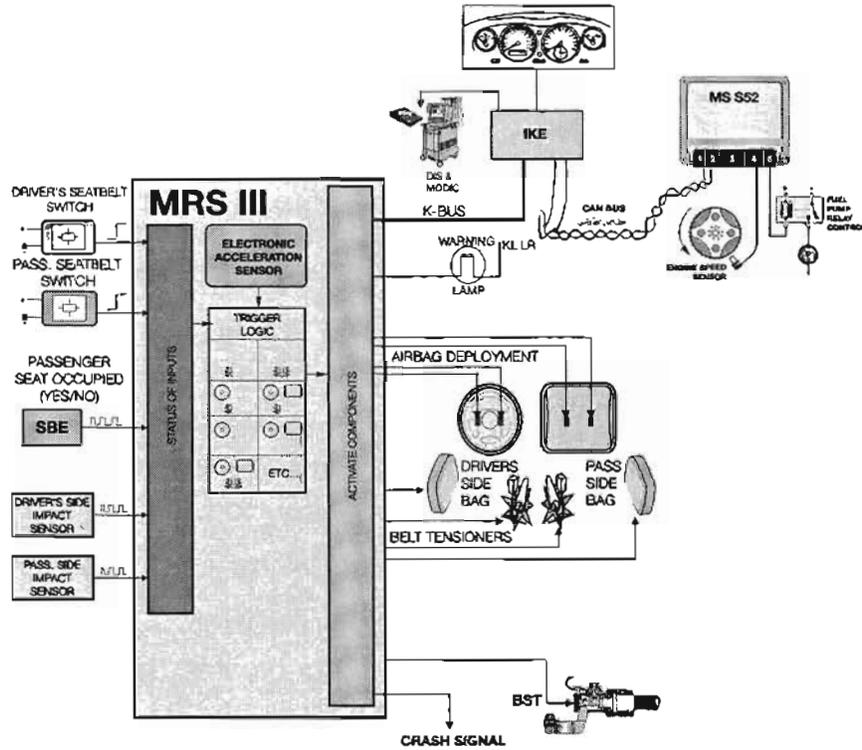
### **Triggering Threshold - Battery Safety Terminal**

The BST will deploy in a frontal impact at threshold 2 or greater. The threshold for BST activation with a side impact is programmed separately in the side deployment criteria. The BST will also be deployed when the rear impact threshold is exceeded.

### **Triggering Threshold - Fuel Pump Shut Down**

New to the MRS III system is the link via the K-Bus/CAN Bus to the Engine Control Module for deactivation of the fuel pump. The MRS III will signal the DME over the K-Bus through the IKE and CAN Bus to shut off the fuel pump in the event that any crash threshold is exceeded.

## System Diagram



## Diagnosis

Diagnosis and troubleshooting of the MRS III system is fault driven and can be accessed using the DIS Tester or MoDiC. The control module performs a self test of the system every time the ignition is switched on ( this includes the satellite sensors and seat occupancy sensor). Any faults with the system will cause the warning lamp in the instrument cluster to remain illuminated after the engine is started.

Installation of a new or replacement control module requires ZCS coding also using the DIS or MoDiC.

When servicing or replacing any MRS III components, always follow precautionary measures outlined in the repair manual of TIS. this includes disconnecting the battery prior to any repair or maintenance work being performed.

All airbag components are part number specific by model and require verification in the EPC to ensure the correct component is being installed.

# Light Technology

## Purpose of The System

As a technical innovation in addition to the classic appearance, neon light technology is used in the Z8 for the external light systems. Neon light technology is used for the direction indicator, brake light and reversing light functions.

Neon tubes are used in the tail lights and direction indicator lights instead of light bulbs. The neon tubes are activated by means of special ignition control units controlled by the LCM.

Fiber optic technology is used for the side indicator lamps (same principle as E38 entrance area lighting).

The remaining vehicle light systems in the Z8 use the xenon light for the low beam headlight and halogen light for the high beam headlight.

As on other new BMW models, all light functions are controlled by a central light control unit (LCM). Car memory allows Day time and "follow me home" lighting (pull the high beam stalk back briefly).

## Operating Data

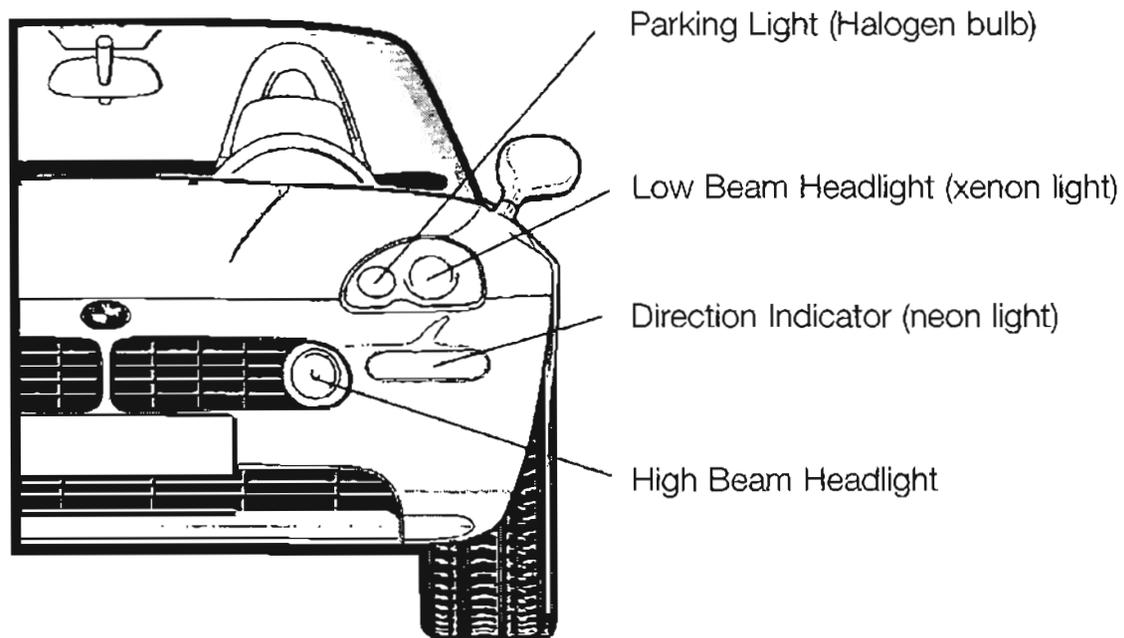
TYPE	POWER	VOLTAGE	CURRENT	FREQUENCY	IGNITION
Front Direction Indicator	45W	1000V	50mA	14.5kHz	10,000 V
Rear Direction Indicator	25W	1000V	50 mA	14.5kHz	10,000V
Central Brake Light	8W	620V	12 mA	22.0kHz	1,800V
Brake Light	20W	750V	24 mA	33.0 kHz	6,000V
Backup Light	2W (power-reduced brake light)				

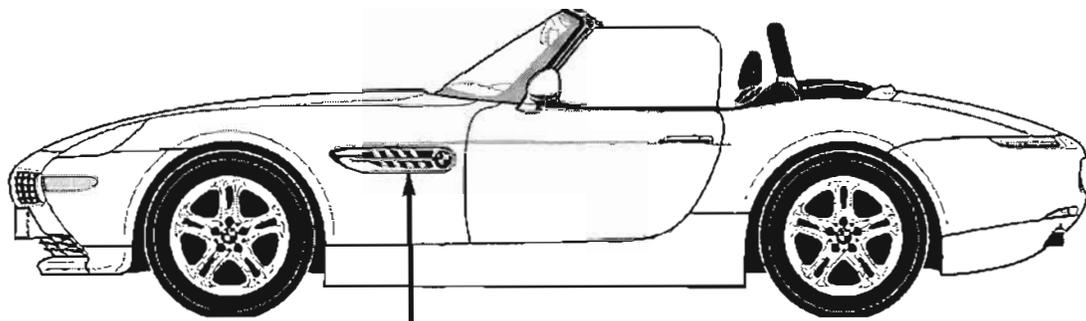
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## System Components

### Front Direction Indicator Lights

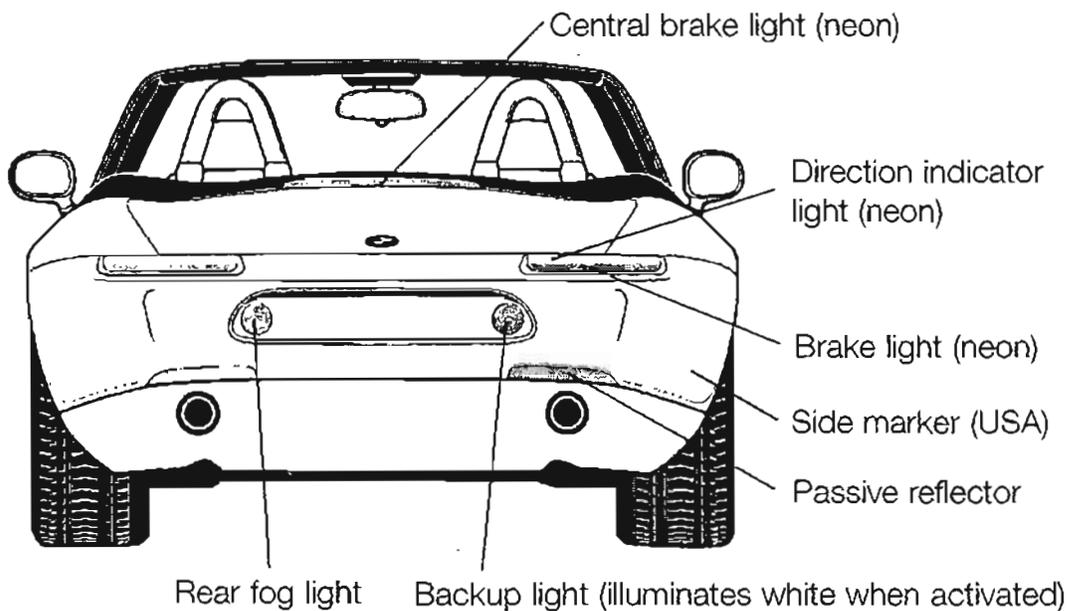
Used as side markers, the direction indicator lights are continuously operated with 5 W (watts) when the lights are switched on (including parking light). When active, the direction indicator lights are alternately powered 5 W and 45 W.





STO38-60

Side direction indicator light (fiber optics technology)



### Rear Direction Indicators

These lights are red. They have the dual function of direction indicators and stop lights. The outer brake lights also have the dual function of direction indicators and stop lights.

The dual function is used when braking with the direction indicators active.

- Direction indicator and hazard lights have priority over brake lights.
- The light monitoring (LCM) has been extended to incorporate the outer brake lights.

Note: Neon light fault codes can be read out from the LCM via the DIS/MoDIC.

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## Neon Technology

### Background

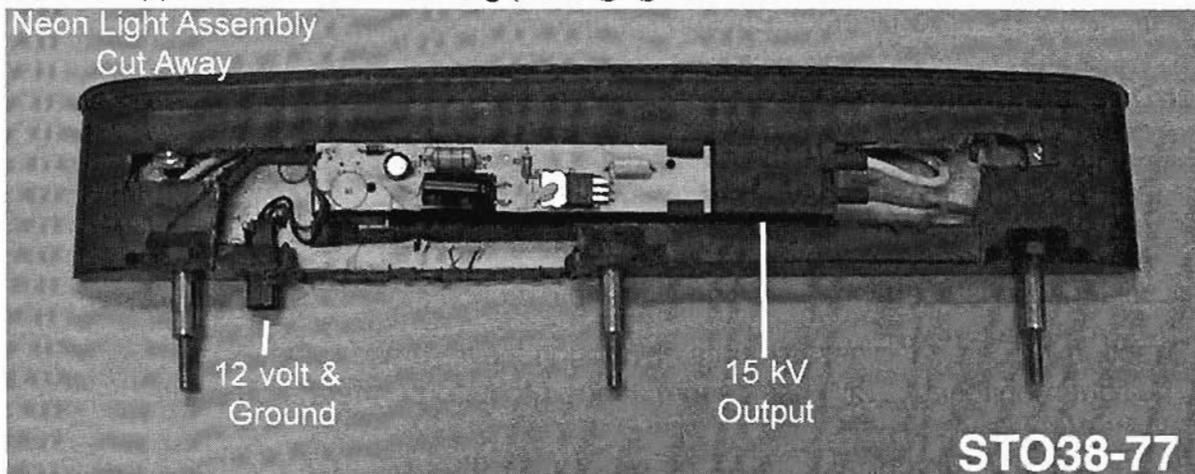
Neon (symbol Ne) produces a glow in a vacuum electric-discharge tube and is used extensively in the familiar advertising displays.

A neon light is a glass bulb or tube containing neon (gaseous element) at low pressure, and two metallic electrodes. To make a neon light, the tube is bent while warmed, to the desired shape and sealed at both ends. During the sealing process, electrodes are added at each end. An access port is left near one end and a vacuum is applied to the interior of the tube. After the air and humidity has been removed, the neon gas is added under low pressure and the tube is sealed.

The light produces a reddish-orange glow when an electric current (applied across the electrodes) is raised in voltage to the point at which it ionizes the gas in the tube. The voltage at which the light glows varies with the design of the tube. When the glass tube is ionized, the voltage drop across the tube is constant, regardless of the amount of current flowing through the tube. The neon glows with an even intensity throughout the length of the tube.

A variant of this is the glass tube containing ionized neon at very low pressure. The tube shines with a brilliant red glow if a high-voltage alternating current is applied to the electrodes sealed in the ends of the tube.

With chemistry and electrical changes, neon lights can produce an amber color. This allows the application for front turning/parking lights.

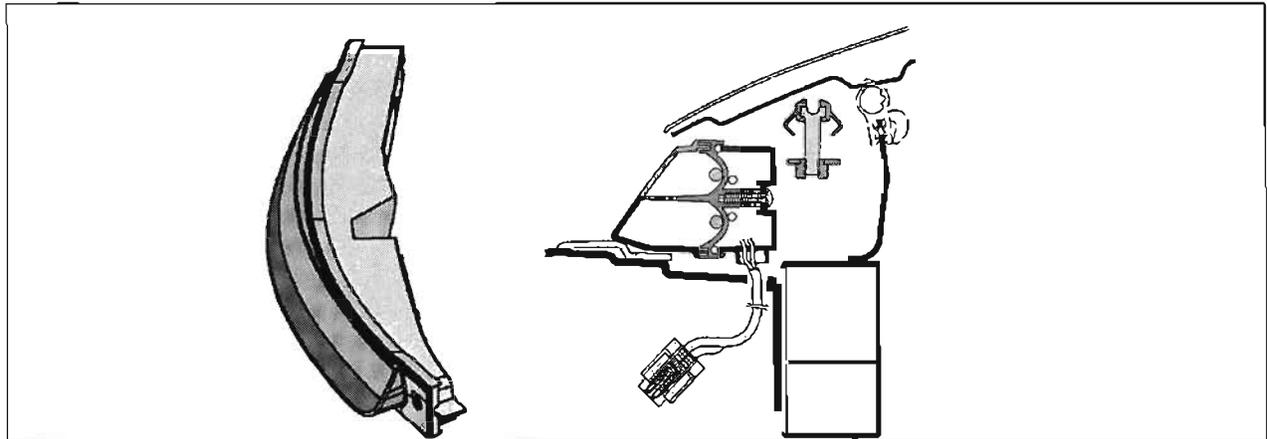


## Neon Technology

### Neon Benefits

The use of neon lighting provides several advantages to automobile manufacturers and consumers:

- \* Light failures caused by shock and vibration are minimized, because neon operates without a filament.
- \* The average life of the light is considerably higher as compared to incandescent bulbs.
- \* Styling of the light includes a more uniform distribution of light across the lense, and neon tubes can be bent to conform to the contour of the vehicle.
- \* Amber neon allows the use of a clear lense (for vehicle color schemes).
- \* Neon enhances safety because of the extremely fast ignition time of the light (instantaneous braking signal), allowing other drivers more time to react.



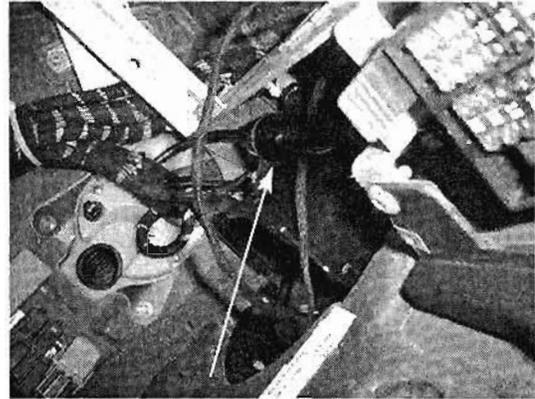
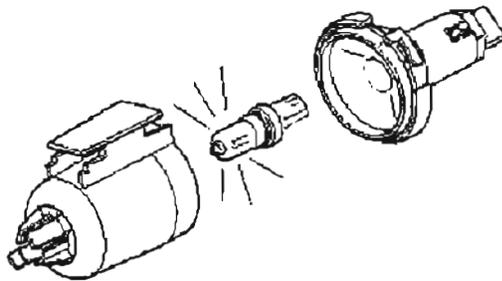
The neon lights are activated directly by the LCM. The neon tubes have ignition control units on each housing.

Note: Due to extremely high internal voltage, internal testing is not permitted. Please refer to the repair information before testing or servicing.

## Side Direction Indicator - Fiber Optics

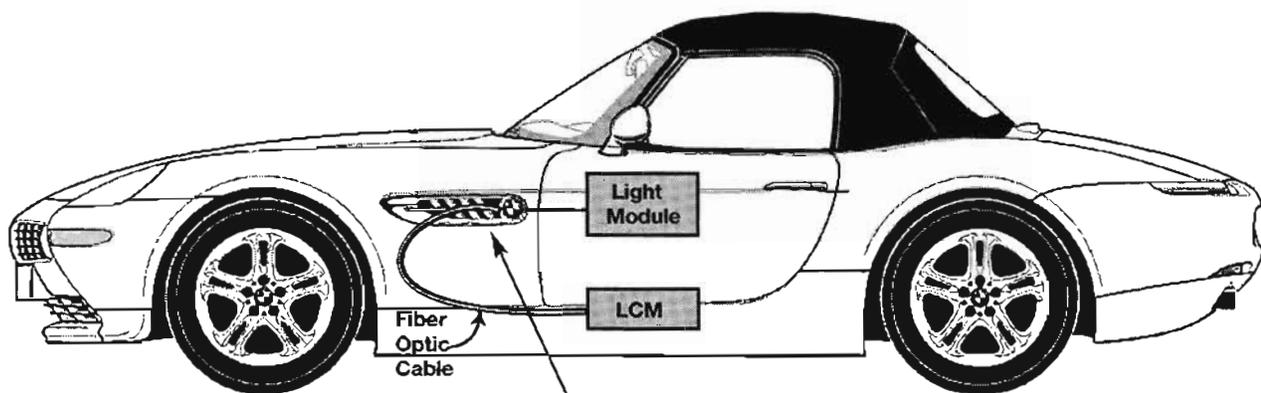
The side directional indicator lighting is provided by halogen bulb light sources in each base of the "A" pillars, and fiber optic tubing. The light sources are controlled directly by the LCM, when the directional signal is activated.

**Light Source Modules:** Mounted in each "A" pillar base, behind the lower dash trim, are the light source modules. The light source modules are made up of the housing, halogen bulb and reflector.



The reflector holds the bulb and focus the bulbs light into the housing. The bulbs are available for individual replacement (P/N 63 31 8 371 610).

**Fiber Optic Light Conductor Cable:** The fiber optic cables carry the light to their respective light housing in each front fender (through the engine compartment bulkhead).



Side Direction Indicator Light (Fiber Optic Technology)

Installation note: the bending radius of the fiber optic cable should be less than 20mm when installing.

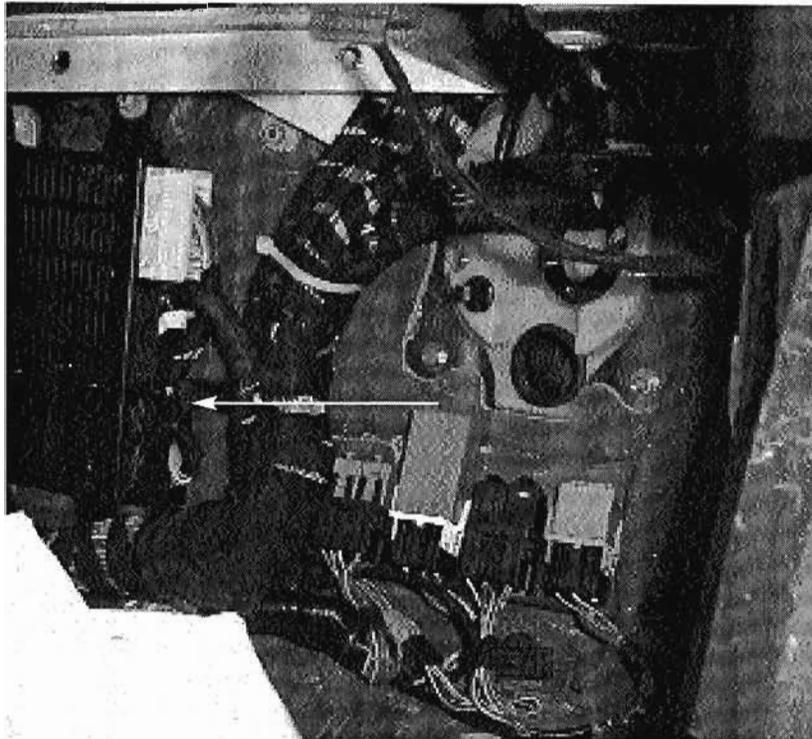
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## Light Control Module - LCM

The neon and fiber optic lights are directly activated by the LCM.

The LCM is located behind the carpet and protection plate on the passenger's side, below the glovebox.

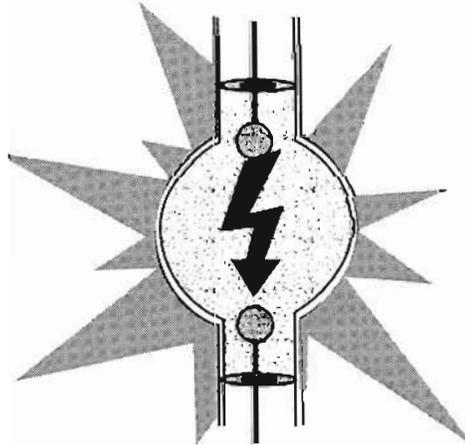
The LCM is diagnoseable via DIS/MoDIC, and requires coding when replaced (refer to IKE section).



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## Xenon Lights

- The automotive industry/press often identify xenon lighting systems as HID (high intensity discharge) systems. Xenon headlight technology was first introduced to the US market exclusively on the E32 750iL in 1993. BMW xenon headlight systems have evolved and their availability as optional equipment has spread through out the model lineup.
- Blue/White in color and using ellipsoidal technology Xenon headlights provide improved night time visibility in all driving conditions compared with traditional Halogen bulb headlights.



### Xenon High Intensity Discharge Bulbs

- Xenon bulbs are identified as D2S(D=Discharge). Xenon bulbs illuminate when an arc of electrical current is established between two electrodes in the bulb.
- The xenon gas sealed in the bulb reacts to the electrical excitation and heat generated by the current flow. The distinct bluish/white brilliant light is the result of the xenon gas reacting to the controlled current flow.

## Phases of Bulb Operation

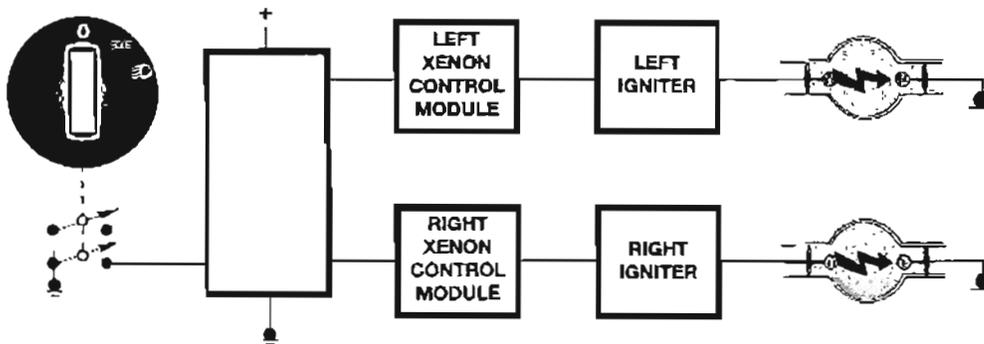
**Starting Phase:** The bulb requires an initial high voltage starting pulse of 18-25kV to establish the arc.

**Warm Up Phase:** Once the arc is established the power supply to the bulb is regulated to 2.6A generating a lamp output of 75 watts. This is the period of operation where the xenon gas begins to brightly illuminate. The warm up phase stabilizes the environment in the bulb ensuring continual current flow across the electrodes.

**Continuous Phase:** Once the warm up phase is completed, the system switches to a continuous mode of operation. The supply voltage for the bulb is reduced and the operating power required for continual bulb illumination is reduced to 35 watts which is less than a conventional halogen bulb.

## Functional Description

- To regulate the power supply to the bulbs, additional components are required. The xenon control modules (1 per light) receive operating power from the lighting control module (LCM) when the headlights are switched on. The xenon control modules provide the regulated power supply to illuminate the bulbs through their phases of operation.
- The igniters establish the electric arcs. Integral coils generate the initial high voltage starting pulses from the control module provided starting voltage. Thereafter they provide a closed circuit for the regulated power output from the control modules.



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## Xenon Bulb Monitoring

- Xenon bulb function is monitored by the Lighting Control Module (LCM). The bulbs are only "hot" monitored. Cold monitoring is not possible since the lighting control module is not in direct control of the xenon bulb. For this reason cold monitoring for low beam headlights is encoded off in the lighting control module for Xenon headlight equipped vehicle.
- The lighting control module detects xenon bulb failure via a reduction in current flow to the xenon control module. When a bulb fails, the xenon control module's current consumption drops to 60mA indicating unsuccessful xenon bulb illumination. The lighting control module then posts the appropriate display message.

## Diagnosis

- Xenon control modules are not connected to the diagnostic link. However, the vehicle specific Lighting Control Module (LCM) does incorporate xenon headlight specific diagnosis up to the xenon control module.

## Xenon Headlight Testing

*Warning: Xenon headlight control systems generate high output voltage. Prior to headlight removal or testing observe the vehicle warning labels and be cautious by following safeguards to prevent accidental injury.*

Refer to SI 04 33 96 for detailed adapter introductory information.

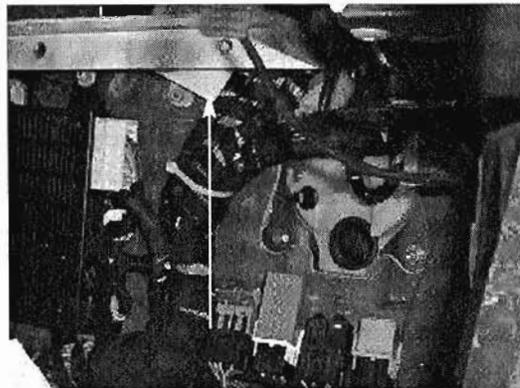
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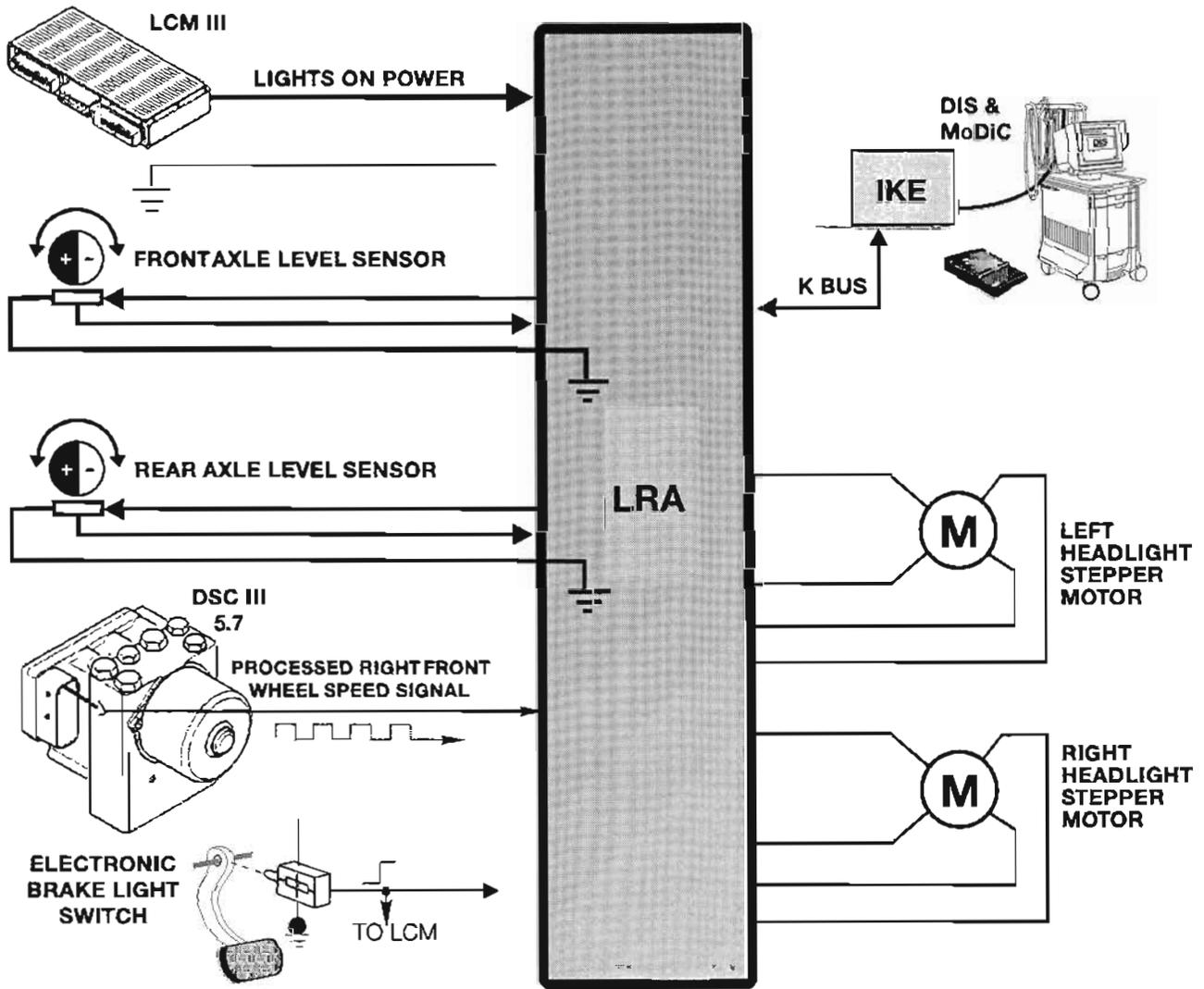
## Headlight Beam Throw Control - LRA

- LRA automatically adjusts the vertical positioning of the headlights to maintain optimum headlight beam positioning for maximum driving visibility and to prevent undue glare for oncoming motorists. The system compensates for vehicle load angle changes (ie: diminishing reserve of gasoline in fuel tank during a long journey, over loaded cargo weight, etc.)
- LRA has been available on BMW vehicles (referred to as LWR) in other markets for quite some time. Starting with the 1999 model year all US market vehicles with Xenon Lights incorporate LWR as standard equipment, now included in the new Z8 (refer to 1999 Model Update for specifics).
- LRA monitors the vehicle's loaded angle via two hall effect sensors mounted to the front and rear suspension members. When an adjustment is necessary, LRA simultaneously activates two stepper motors (one in each headlight assembly).
- The stepper motors drive a threaded rod that moves the lower edge of the headlight carrier plate forward and backward (depending on driven direction). The upper edge of the headlight carrier plate is fixed on a pivot. The pivoting movement adjusts the vertical position of the headlight beam.

### Control Module

The LRA control module is located behind the glovebox. The control module connects to a single, harness connector. The control module has diagnostic capabilities and communicates with the DIS/MoDiC via the K bus - IKE gateway to the D bus.





## Multi-Information Radio System (MIR)

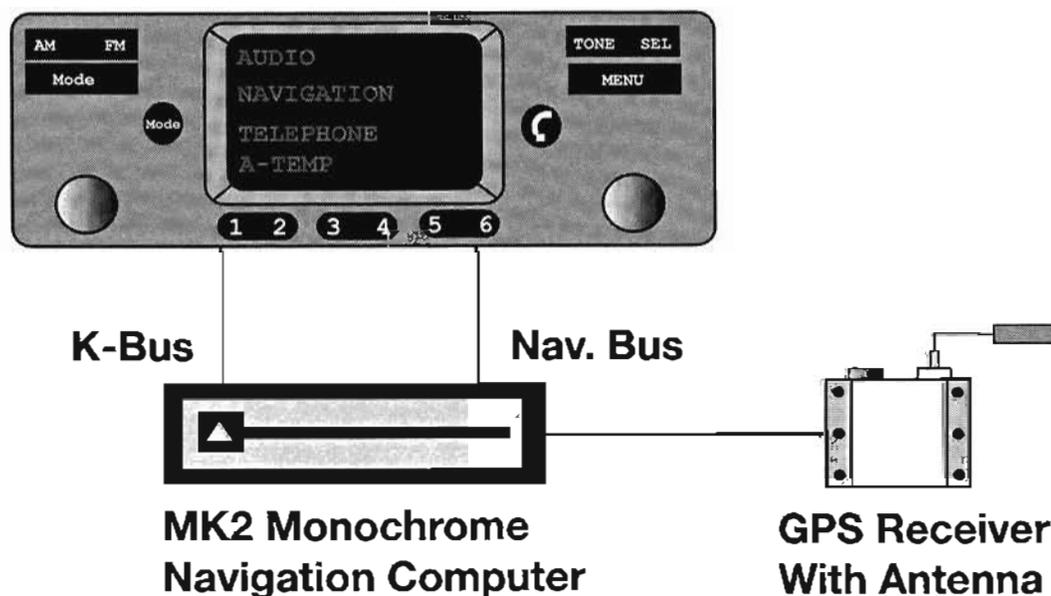
**Model:** E52  
**Production Date:** 03/00 to Present

### Purpose of the System

This audio set is the first of the New Generation Radio family. The multi-information radio will be installed for the first time in the Z8. The standard equipment includes a CD changer together with a Harman Kardon HiFi system. The MIR in the Z8 does not have cassette player.

Audio mixing makes it possible to simultaneously listen to music and obtain navigation information.

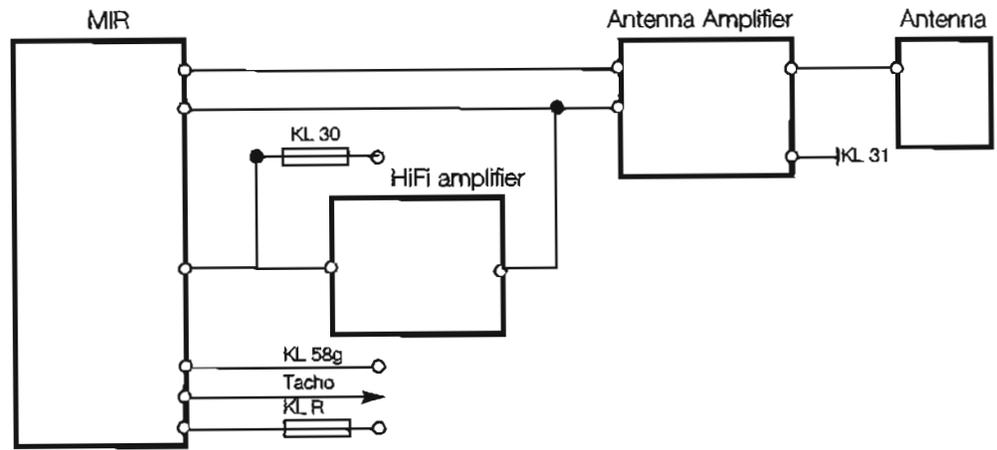
The outside temperature display (warning) is the only BC function that can be called up in the MIR of the Z8. Country-specific variants are set by coding. Please review aftersales publications for details and operation.



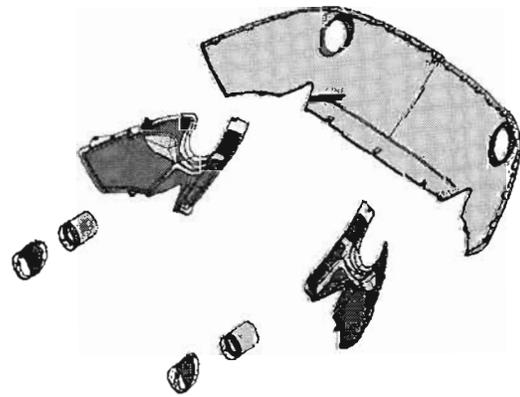
MIR as radio navigation system

## System Components

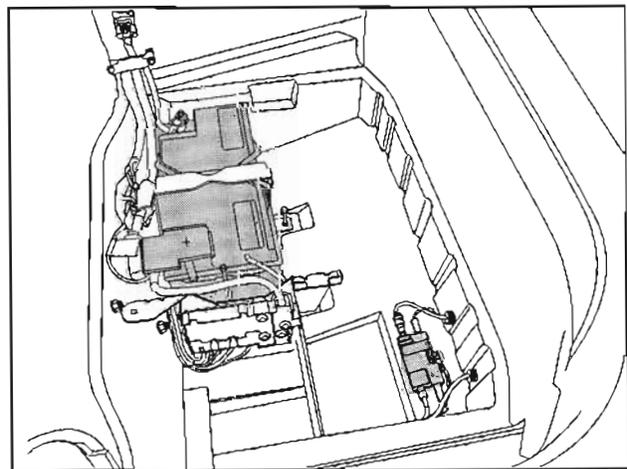
Block diagram of **rear bumper antenna**



The **AM/FM antenna** located in the rear bum



The **antenna amplifier** located on the trunk floor



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## Review Questions

1. What features of the power windows can the FZV operate?

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2. The IKE shares "backup" information with what other module?

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3. Can you name the different buses in the Z8?

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4. If the battery is dead, how can the trunk be opened?

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5. Where does the "door closed" signal come from?

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6. What controls the "red" doorlights and when do they illuminate?

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7. If the hazard lights are activated what light illuminates when the brakes are applied?

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8. What control module is the diagnostic gateway to the ZKE?

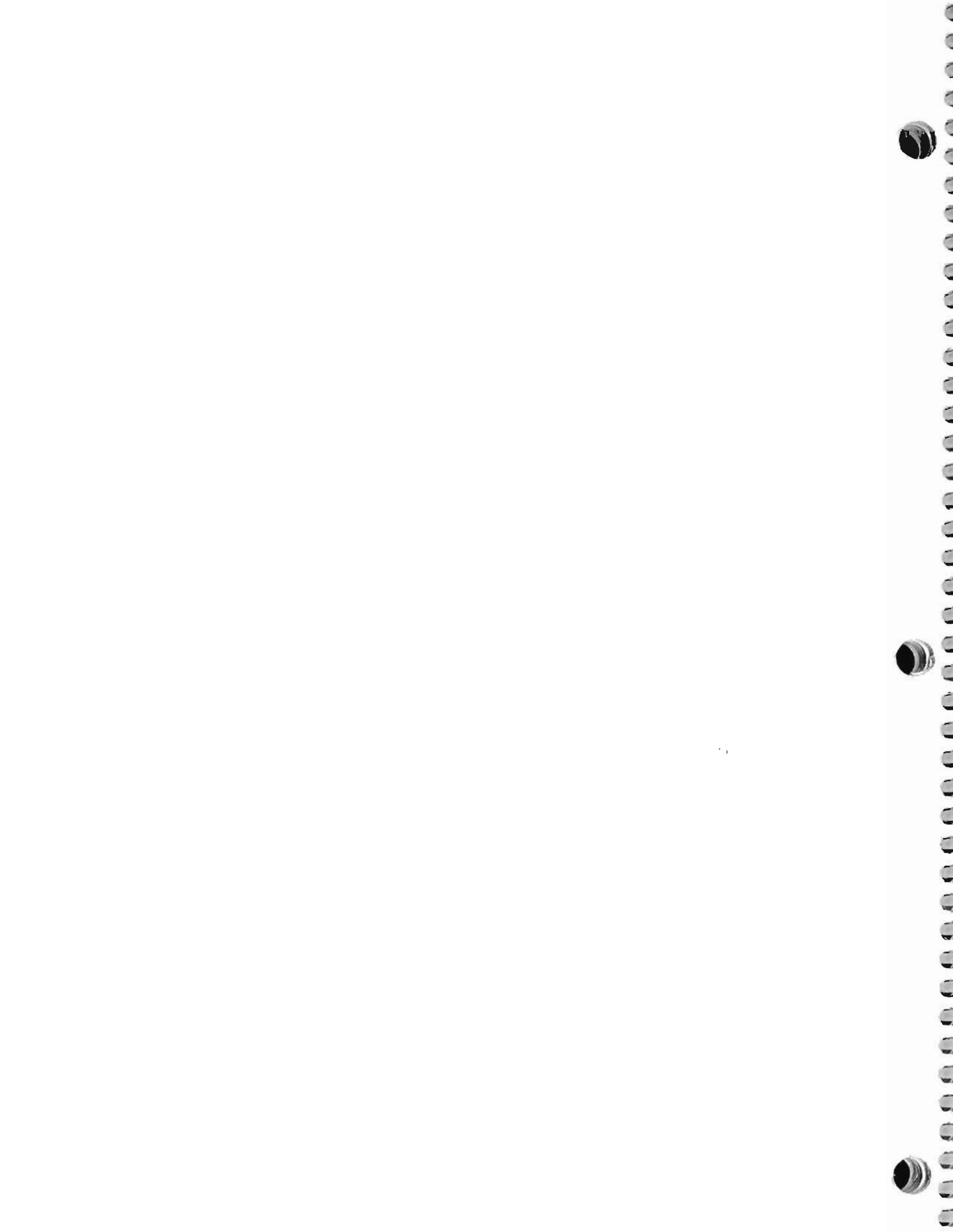
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9. Identify the ELV's components and their locations.

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# Driveline



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# M ENGINES

**Model: E39 M5, E52 Z8**

**Engine: S62B50**

**Production Date: 2000 MY (Starting with M5) to Present**

## Objectives of The Module

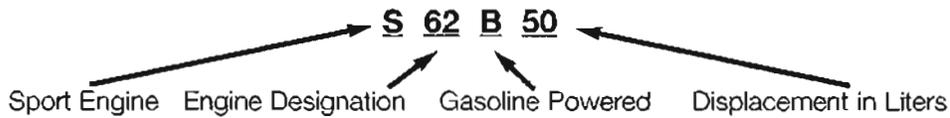
After Completing this module, you will be able to:

- Identify camshaft markings and correct "timing".
- Explain the VANOS operation.
- Identify piston markings for correct installation.
- Explain the VANOS oil flow circuit.
- Understand the VANOS oil pump operation.
- Identify the intake air system components.
- List the function of the Scavenge Oil Pumps and how they affect oil pan removal.
- Identify the special tools used to perform the VANOS function test.
- Describe where the fuel pressure is tested on the E39 M5 and what the nominal pressure is.
- List what the flywheel mounted incremental wheel is monitored for.

# S62B50 Engine

## Purpose of The System

The S62B50 engine is an eight cylinder "90° V arrangement" powerplant. This 4941 ccm displacement engine is used worldwide. The engine designation is:



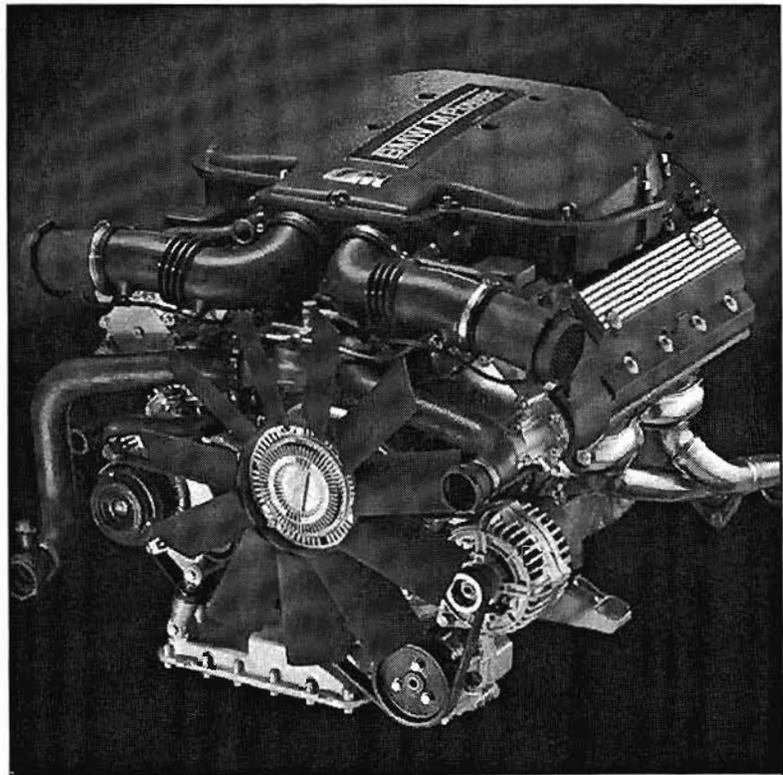
The S62 engine design provides:

1. <b>Everyday Driveability</b>	5. <b>Economic Operation</b>
2. <b>Reduction in Weight of Engine Components</b>	6. <b>Increased Output (to previous M5)</b>
3. <b>Enviromental Compatability</b>	7. <b>High Performance</b>
4. <b>Greater Speed Range</b>	8. <b>EDR (Electronic Throttle)</b>

The S62B50 is a 4-valve per cylinder dual VANOS naturally aspirated engine with high torque and high-rev concepts. High torque is developed by a large volume engine at low engine rpm and a long total gear ratio. High-rev is achieved with a small displacement "lightweight" (internal components) engine and short total gear ratio. This powertrain provides the best of both worlds by using a 5 Liter 32 valve V8 configuration coupled to a 6 speed manual transmission.

## Power Output for the S62:

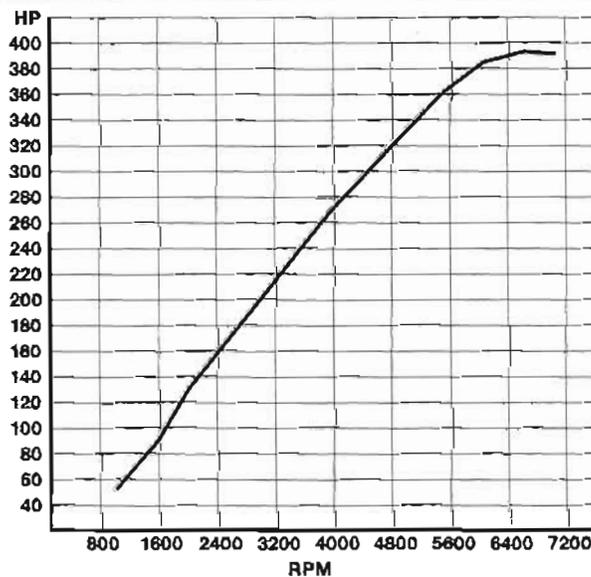
1. 394 hp at 6600 rpm
2. 500 Nm of Torque at 3800 rpm



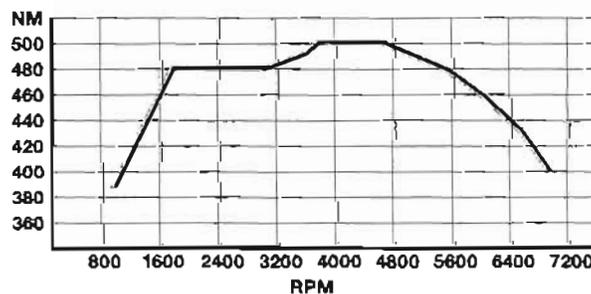
## Technical Data

Engine Management	MS S52
Effective Displacement (CCM) Design / Valve Per Cylinder	4941 90° V8 / 4
Bore / Stroke (mm)	94 / 89
Maximum Engine RPM	7000
Power Output (hp)	394 hp
Weight-to-Power Ratio (kg per hp)	4.23 / 4.5
US Torque (Nm per rpm)	500 @ 3800
Compression Ratio	11.0 : 1
Fuel	Premium Unleaded
Valve Diameter	
Intake / Exhaust (mm)	35 / 30.5
Stem - Intake / Exhaust (mm)*	6.0 / 6.0
Valve Lift	
Intake / Exhaust (mm)	10.3 / 10.2
Valve Clearance	
Automatic Hydraulic Compensation	
Camshaft Spread Angle	
Intake (degrees)	74 - 134
Exhaust (degrees)	76 - 136
US Emission Compliance	TLEV

S62 power



S62 torque



## System Components

### Engine Block

The S62 engine block is manufactured from Alusil as aluminum alloy pressure die-casting. *The cylinder walls are finished by an etching process only.*

The water cooling passageways of the block incorporate a connection in the "V" of the block for an oil/water heat exchanger.

The bore of the block is 94 mm. This along with a stroke of 89 mm gives the S62 engine a displacement of 5 liters. There is 3 mm between the cylinder bores of the engine. The "bare" block weighs approximately 71lbs. (32 kg.)

**Crankshaft and Bearings:** The crankshaft is forged steel with five main bearing journals (70 mm diameter) and the thrust bearing on number five journal.

The S62 bearings are identified by the "triple classification" system. The bearing shell thickness is marked by "notches" in the crankcase and paint markings on the counterweights of the crankshaft (refer to the Repair Instructions for details).

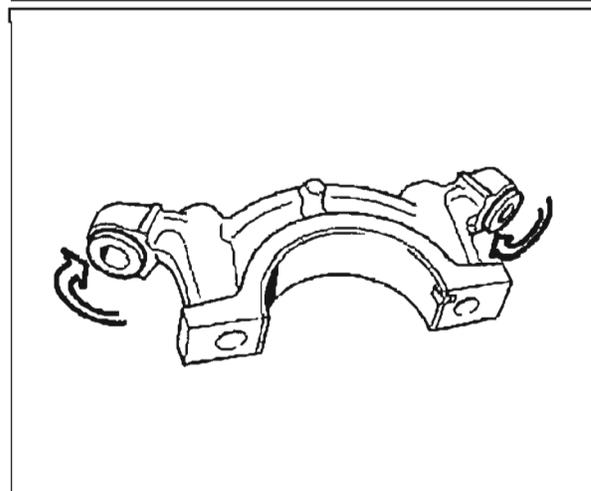
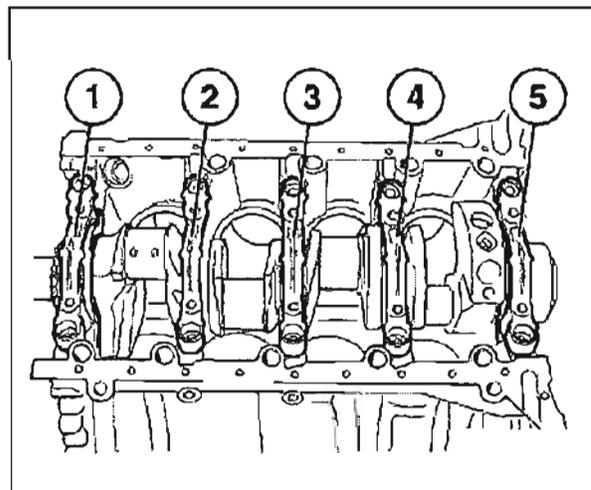
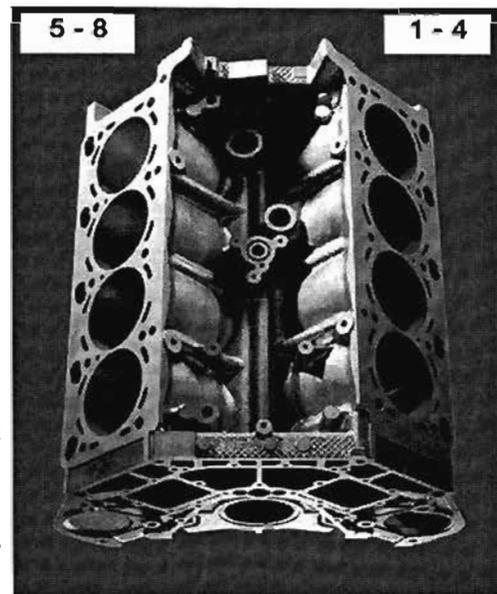
#### Bearing Clearance:

- |                                       |
|---------------------------------------|
| 1. Main 0.025 - 0.050 mm              |
| 2. Thrust (end play) 0.085 - 0.257 mm |

The main bearing caps are secured by four bolts each. The outer bolts are "splayed" (angled) out to the block adding greater strength and support.

The adjustable hex head must be threaded in for installation and then "preloaded" to the block (refer to the Repair Instructions for details).

Cylinder Bank Numbering  
From Engine Front



The thrust bearing (#5) is constructed of two radial shells and four shims (example shown on the right).

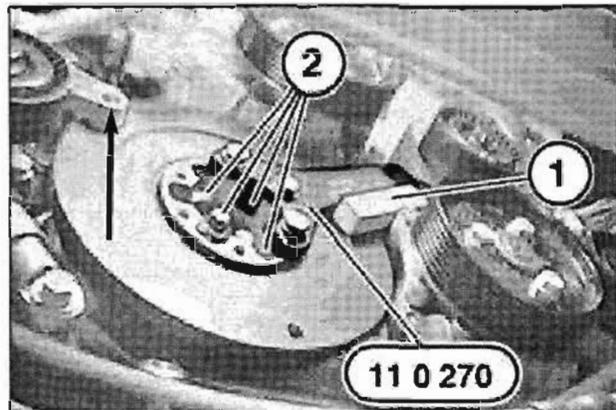
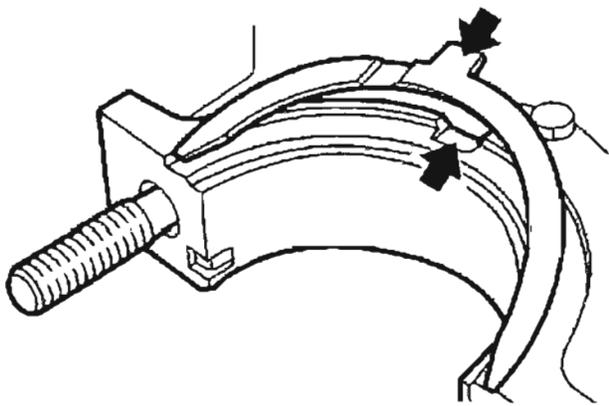
The shim tab must align with the notch in the bearing cap.

Refer to the Repair Instructions for details on installing the shims in the engine block.

The torsional vibration damper is specifically designed for the higher engine rpm.

The damper is secured by 4 "stretch" bolts (#2 in the diagram, one time use only) which must be angle torqued (refer to Repair Instructions and Technical Data).

Note the installation location for the crankshaft position locating special tool (arrow).



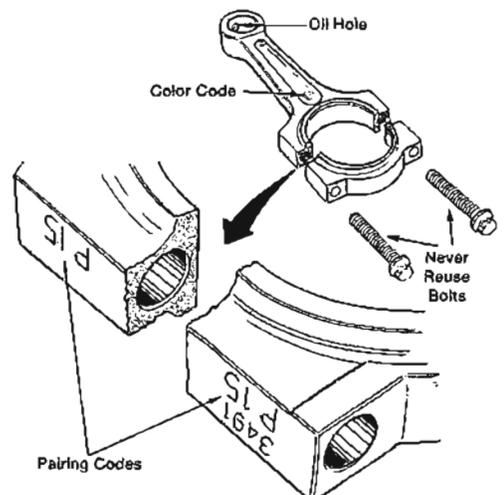
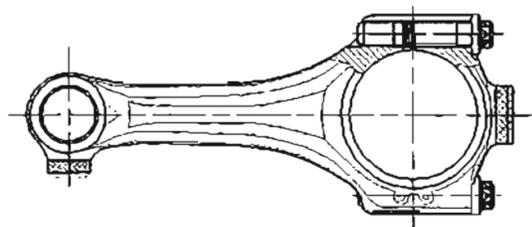
**Connecting Rods and Bearings:** The S62 uses reinforced forged steel "cracked" connecting rods with a 53 mm journal diameter.

The "cracked" connecting rod refers to the cap which is split off leaving rough surfaces on both the cap and the rod.

Centering of the cap on the rod is carried out through the structure of the split which eliminates the alignment sleeves. Pairing codes are stamped into the rod to ensure proper installation of the cap.

The S62 connecting rods are weight-optimized (+/- 4 grams). Only one set of connecting rods (the same weight class) is available to maintain balance.

The connecting rod bolts are "stretch" type (one time use only) which must be angle torqued (refer to Repair Instructions and Technical Data).



**Pistons and Piston Rings:** The S62 uses short skirt design pistons that are coated with a Ferrostan/tin plating for use with the Alusil block. The piston diameter is 94mm.

The pistons are cooled with oil spray jets, mounted in the crankcase. The compression ratio is 11.0 : 1 and requires premium unleaded fuel for optimum performance.

The pistons for cylinder bank 1-4 are different from cylinder bank 5-8 due to the wrist pin off set. The relevant cylinder bank number is engraved into the piston crown using laser technology.

Piston Rings:

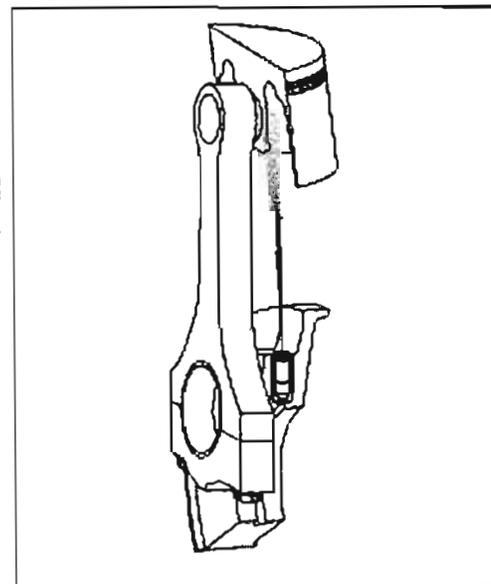
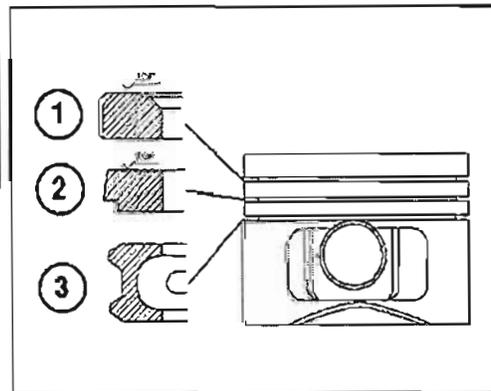
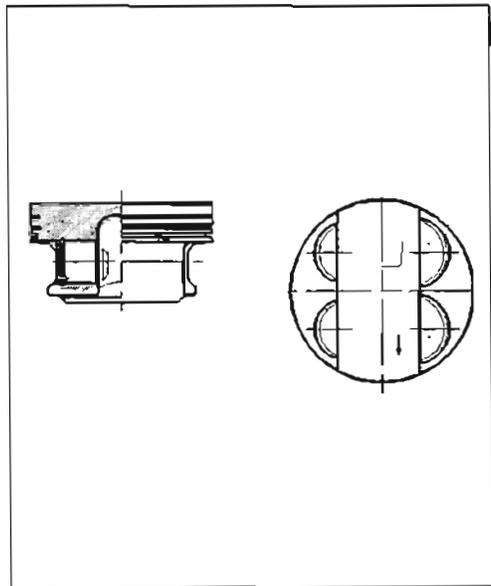
<b>1. Compression Ring 1 = 1.2 mm Height</b>
<b>2. Compression Ring 2 = Taper Face 1.5 mm Height</b>
<b>3. Oil Control Ring = Bevelled, Spring Loaded 2 mm Height</b>

A Special Tool (ring compressor) is required to install the pistons.

The pistons are cooled by oil spray nozzles that are bolted into the crankcase.

The nozzles are "tapped" into the main oil gallery and delivers a constant oil spray to the underside of the pistons.

Notes: \_\_\_\_\_  
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## Engine Oil System

The oil supply system of the S62B50 engine is specifically designed for the M5 and Z8. Due to the sport nature and the ability for high speed cornering (transverse acceleration) of up to 1.2g, the engine oil could be forced (and trapped) into the outer edge of the cylinder head and the rear area of the oil sump.

The main oil pump function is to supply the engine with the required volume of oil for all of the lubrication needs.

To prevent oil starvation from occurring during these driving situations, two additional scavenging oil pumps are installed within the main oil pump housing (integral unit).

The two additional pumps only supply the oil sump with the scavenged oil.

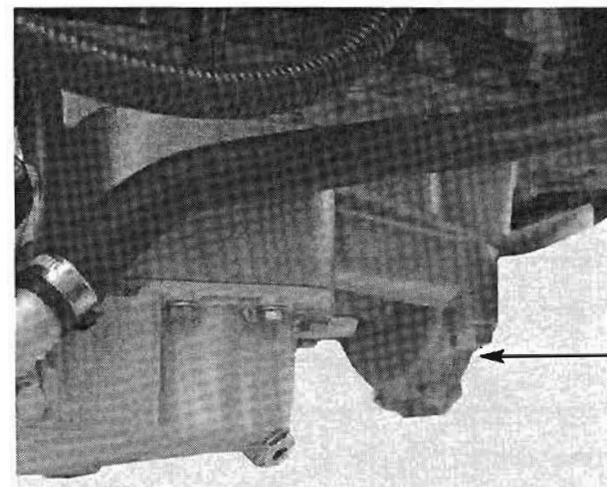
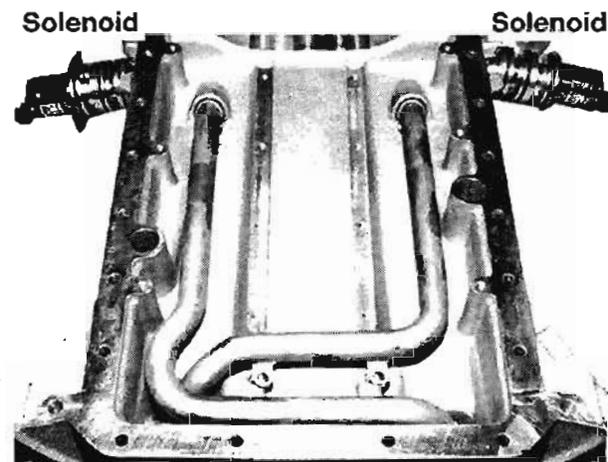
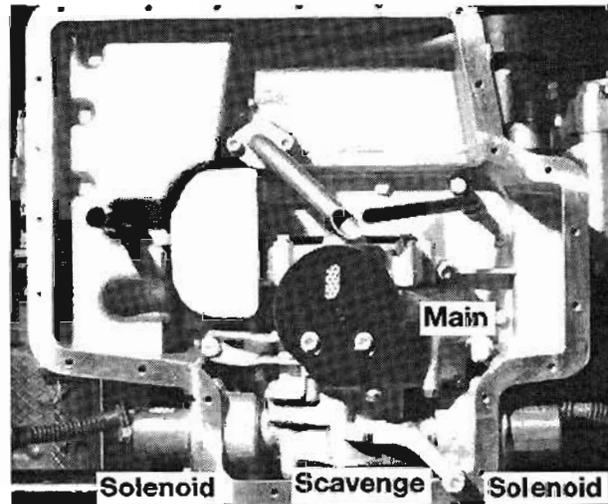
Each additional oil pump incorporates a *solenoid changeover valve* that is connected to two scavenging tubes routed to the rear section of the oil pan and the outer edge of the cylinder head.

The scavenging tubes in the oil pan crossover so that the right side pump draws from the rear left side of the pan and the left pump from the right side of the pan.

The solenoid changeover valves must be removed before attempting to remove the oil pan. The valves insert directly into the scavenge pump housing through the oil pan.

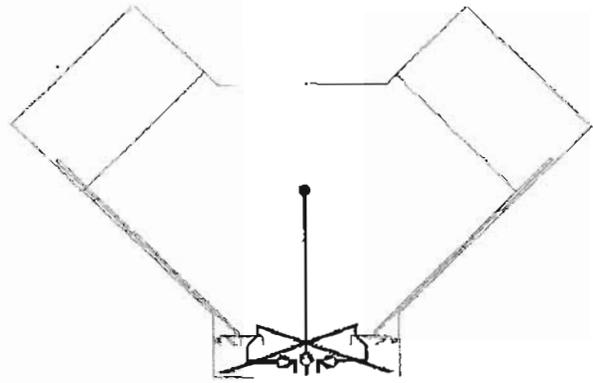
*The upper oil pan for the Z8 is been modified* due to the engine and crossmember "clearance" relationship.

The upper oil pan is contoured around the oil pump drive at the front of the engine (arrow).



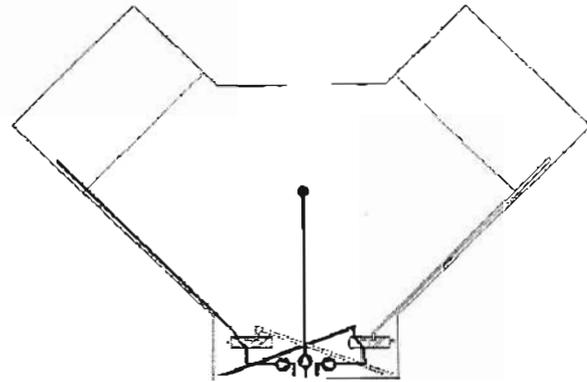
**Scavenge Oil Pump(s) Operation:** While driving straight ahead, the two oil pumps draw oil from the rear of the oil pan to supply the main oil pump pick up.

The solenoids are de-activated in this situation.



When cornering at forces  $> 0.9g$ , one solenoid will be activated by the ECM to draw oil from the cylinder head while the second solenoid will continue to draw oil from the rear of the pan.

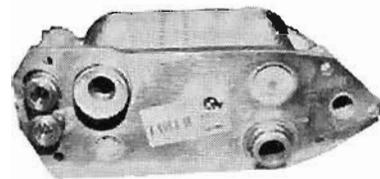
The ECM receives the signal from the DSC Control Module (based on cornering G-force) over the CAN Bus line.



**Oil Cooling:** The S62 engine is equipped with an oil-to-coolant heat exchanger. It is mounted in the "V" of the block and serves to heat the oil during engine warm up and cool the oil during normal driving. Oil and coolant passageways are cast into the block. Formed "O" rings are used to seal the the heat exchanger. The coolant return is through external pipes back to the thermostat housing.



A differential pressure control valve is integrated into the heat exchanger on the oil side. The valve opens an oil bypass in the event that the exchanger should become clogged or at very low start temperatures. This ensures that the engine will receive sufficient lubrication under all driving conditions.



## Crankcase Ventilation

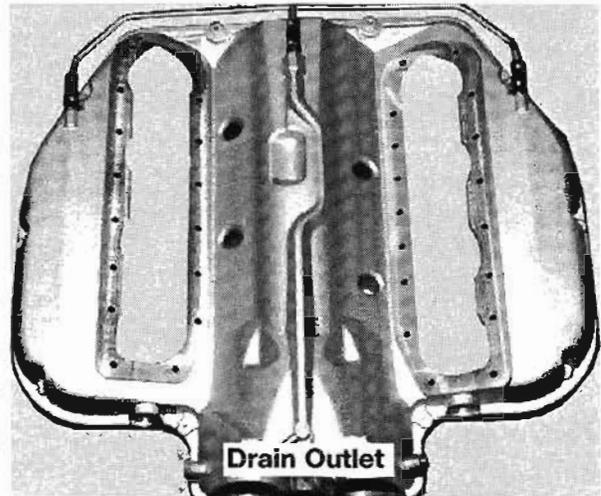
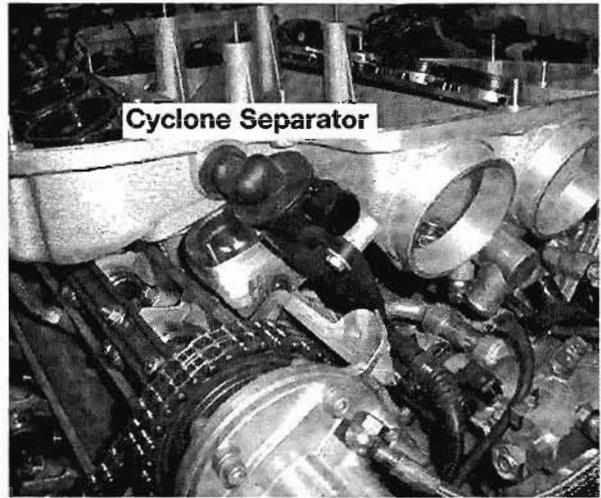
The crankcase blow-by vapors are “purged” by intake manifold vacuum. The blow-by vapors flow into the intake through two cyclone separators.

The separators are mounted at the left and right sides of the intake manifold. The oil condensates are separated and flow directly back to the oil sump through feed/return hoses into the front timing case covers.

The crankcase ventilation system is completely sealed. *Care must be taken when reinstalling the cyclone separators in the intake manifold to ensure that the radial seal is fully seated.*

If oil collects in the intake manifold, drainage is provided from two points at the back of the intake manifold lower plenum.

The drainage points “tee” into an integral return passage cast in the intake manifold base as shown. An outlet fitting at the front of the manifold connects to a drain hose that allows the oil to drain back to the crankcase.

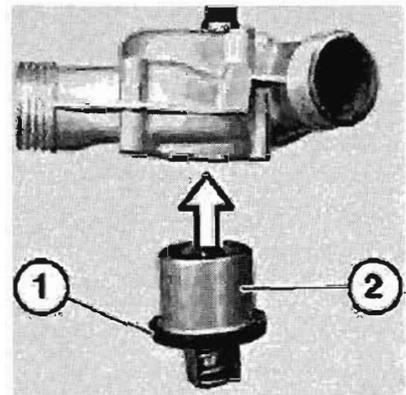


## Engine Cooling

The S62 coolant flows from the water pump into the block. From here it passes through the heat exchanger and cylinder heads. The coolant cross flows through the cylinder heads.

The coolant returns from the heat exchanger and two return pipes from the cylinder heads back into the thermostat housing. Vehicle heating is also taken from the coolant return pipes in the “V” of the block and returns back into the water pump housing.

The S62 engine uses a conventionally heated thermostat (2) that opens at 79 ° C and is mounted on top of the waterpump housing.

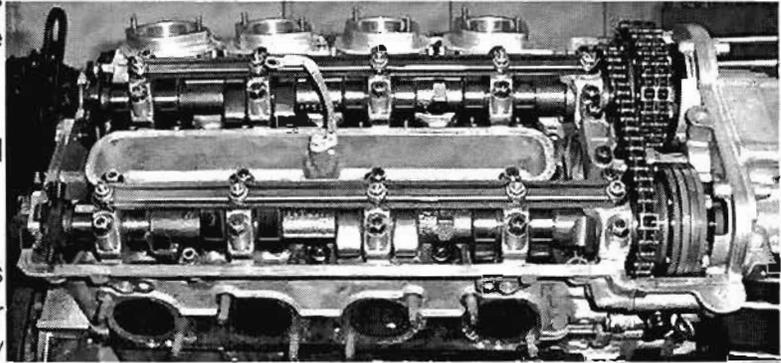


## Cylinder Heads

The S62 features aluminum cross-flow cylinder heads designed as single components that house the camshafts and valve train.

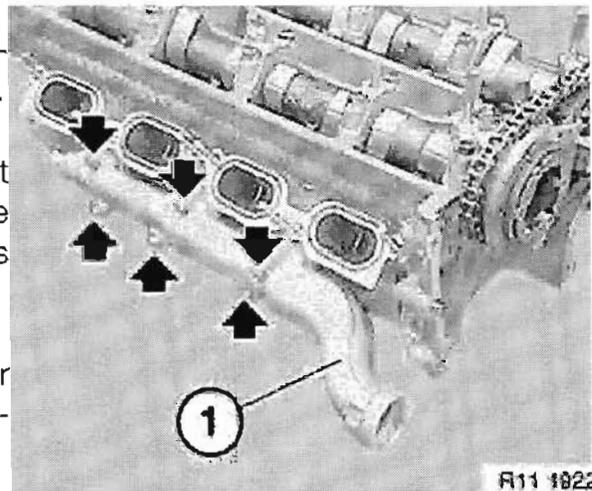
The four valve (per-cylinder) head is a single piece construction.

The camshaft bearing journal caps are machined with the cylinder head and are marked intake/exhaust and numbered for location.



HVA (hydraulic compensators) are used to actuate the valves. *Valve adjustment is not required.*

The cylinder head uses a cross flow coolant design. The coolant enters from the block on the exhaust side and exits through three openings between the cylinders on the intake side.



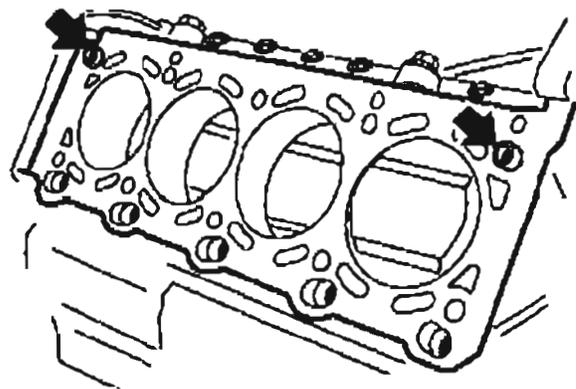
The coolant returns through an external water manifold (1) on each cylinder head to the thermostat housing.

The spark plugs are centrally located in the combustion area for the most effective power and reduced emission outputs.

Refer to the Repair Instructions using the Special Tools for cylinder head pressure testing.

The cylinder head gasket is a steel version.

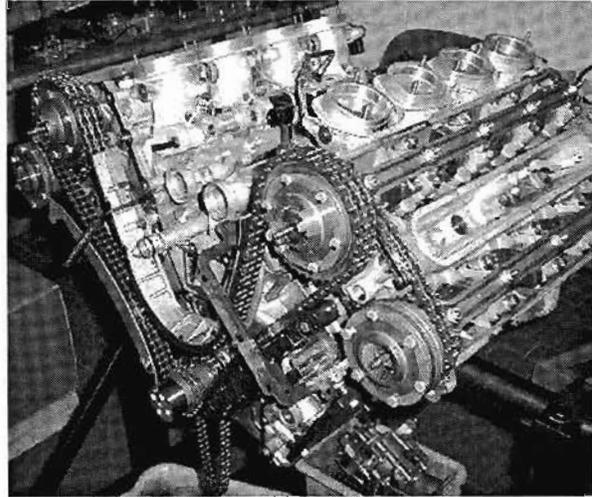
*Note: Cylinder head machining is not permitted.*



## Valve Train

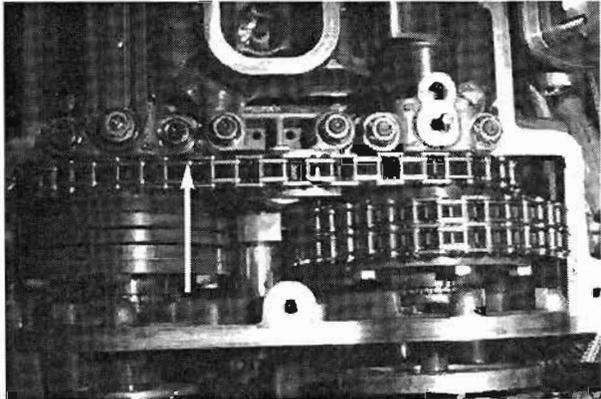
**Camshaft Primary Drive:** Primary drive is provided by a double-roller chain from the crankshaft to the intake camshafts on both banks.

The chain is guided by a centrally positioned V-shape deflection rail. Additionally, a straight rail is used on cylinder bank 5-8 and a curved chain tensioner rail with a hydraulic "self adjusting" tensioner on cylinder bank 1-4.



**Camshaft Secondary Drive:** Secondary drive is from the intake camshaft to the exhaust camshaft by a single roller chain (arrow). The chain is tensioned by a hydro-mechanical "self adjusting" tensioner (between the sprockets).

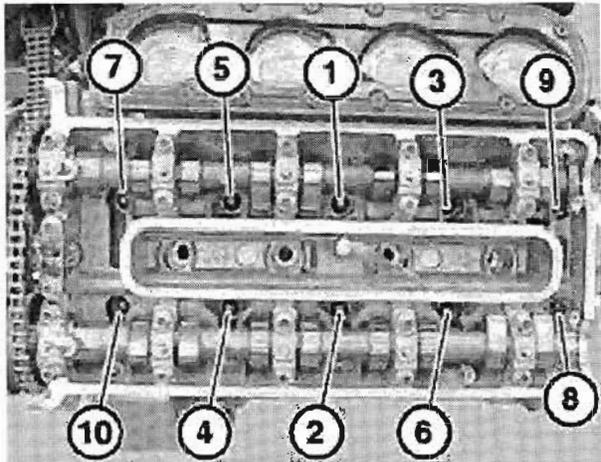
The oil supply for the chain tensioner also supplies the VANOS hydraulic units through a pressure control valve.



**Camshafts:** The four S62 cast iron overhead camshafts are hollow and are strengthened by heat treating the journals and cam lobes.

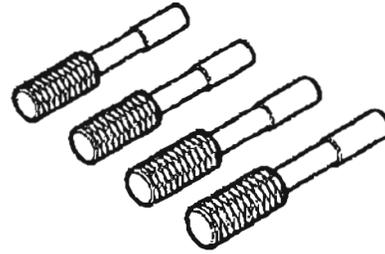
Each camshaft is supported by five bearings that are marked intake/exhaust and numbered for location.

The camshafts feature recesses that allow the cylinder head bolts to be removed without removing the shafts (head bolts 1 through 10 shown on the right).



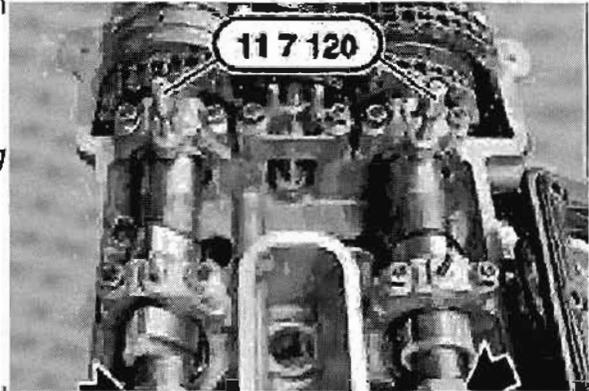
The camshafts are not interchangeable, therefore they should be marked before disassembly.

For installation and timing procedures, the camshafts are held in position by locking pins (Special Tools) that are inserted into the front camshaft bearing caps on both cylinder heads (as shown on the right).

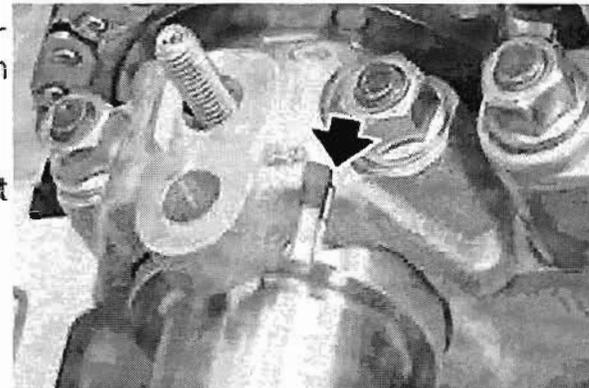


Using an open end wrench to turn camshafts will allow the locking pins to be inserted with ease. Refer to the Repair Instructions for details on camshaft removal, installation and timing.

*Caution: Remove locking pins before rotating camshafts!*

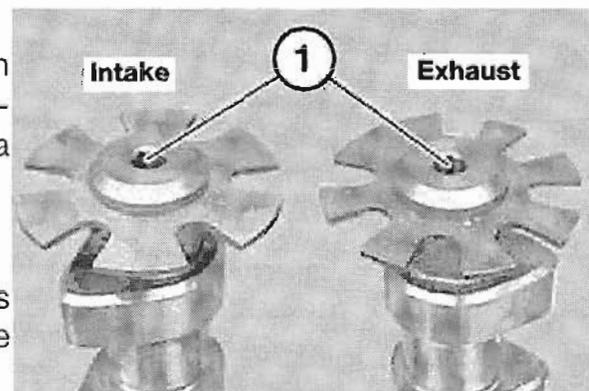


When performing camshaft timing, a visual "sight" is provided on the front cam journal support cap and in the camshaft journal (for both intake and exhaust).



The two grooves should line up to verify correct timing.

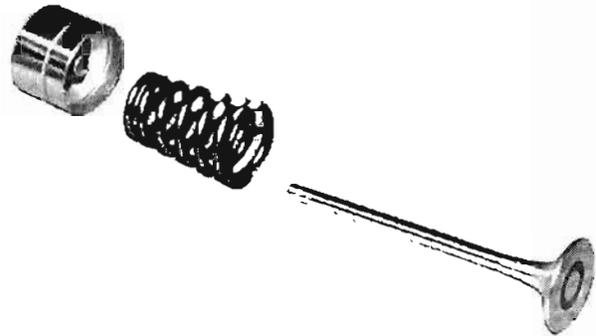
An impulse wheel is mounted on the end of each camshaft for position detection (VANOS operation). The impulse wheels are secured by a removeable bolt (1).



The intake camshaft impulse wheels have 6 lugs and the exhaust camshaft impulse wheels have 7 lugs (including one large lug).

**Valves and Valve Springs:** The intake and exhaust valves are lightweight in design to reduce reciprocating mass. The valve diameter is:

1.	Intake 35 mm
2.	Exhaust 30.5 mm
3.	Stem-Intake / Exhaust 6.0 mm



The S62 valves use single conical (tapered) valve springs and HVAs (hydraulic compensators) to actuate the valves. *Valve adjustment is not required.*

The springs are marked for correct installation due to the "cone" shape (*paint stripes facing down towards cylinder head*).

Notes: \_\_\_\_\_

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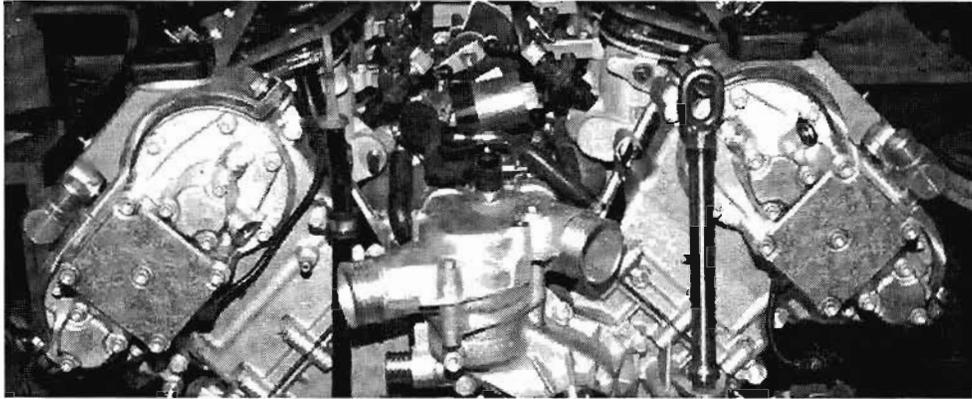
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## VANOS

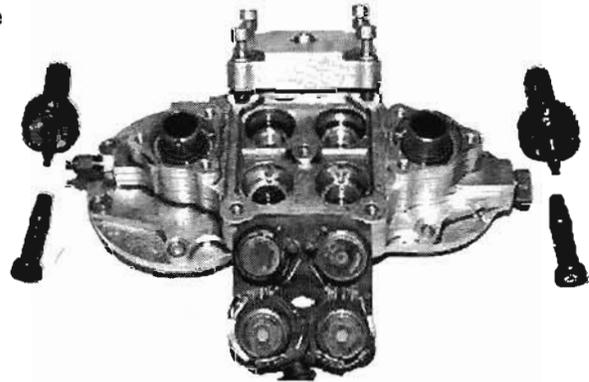
Performance, torque, idle characteristics and exhaust emissions reduction are improved by variable camshaft timing (VANOS). The S62 engine uses a double VANOS system for valve timing on both the intake and exhaust camshafts.



The S62 uses a high pressure (100 Bar) control system that ensures quick and reliable adjustments of the camshafts to meet the high performance requirements of the M Engines. The VANOS units are mounted directly on the front of the cylinder heads.

Each VANOS unit contains:

- High pressure radial oil pump (driven by the intake Camshaft)
- Two inlet solenoids
- Two outlet solenoids
- Two adjustment pistons
- Two hydraulically actuated adjustment shafts

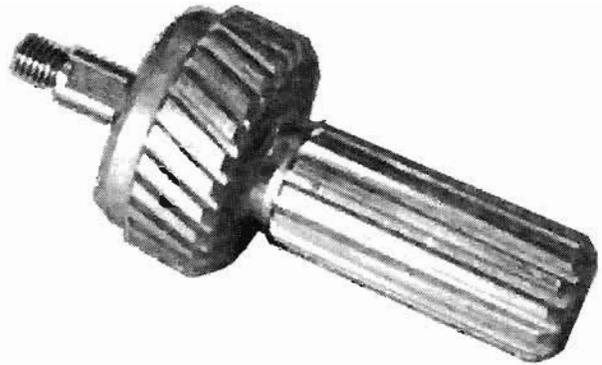


Two solenoids are required for each adjusting piston circuit, one for advancing and one for retarding the camshaft timing. The solenoids are controlled by the ECM.

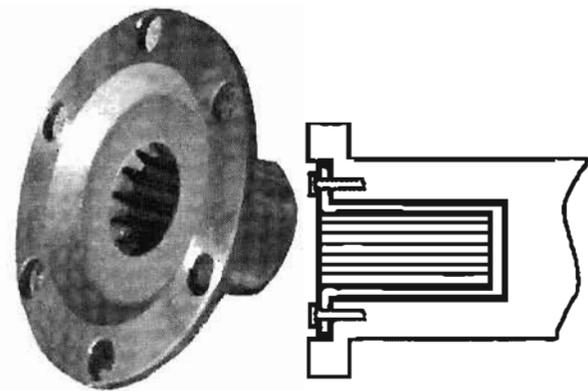
The adjustment shafts contain two sets of splines that engage with:

- |    |  |
|----|--|
| 1. | <b>Camshaft Sleeves (Straight Splines)</b>     |
| 2. | <b>Chain Driven Sprocket (Helical Splines)</b> |

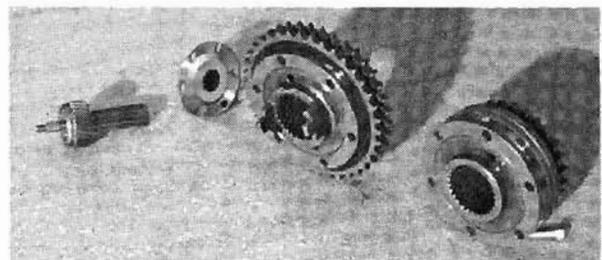
The adjustment shafts have a total stroke of 25 mm.



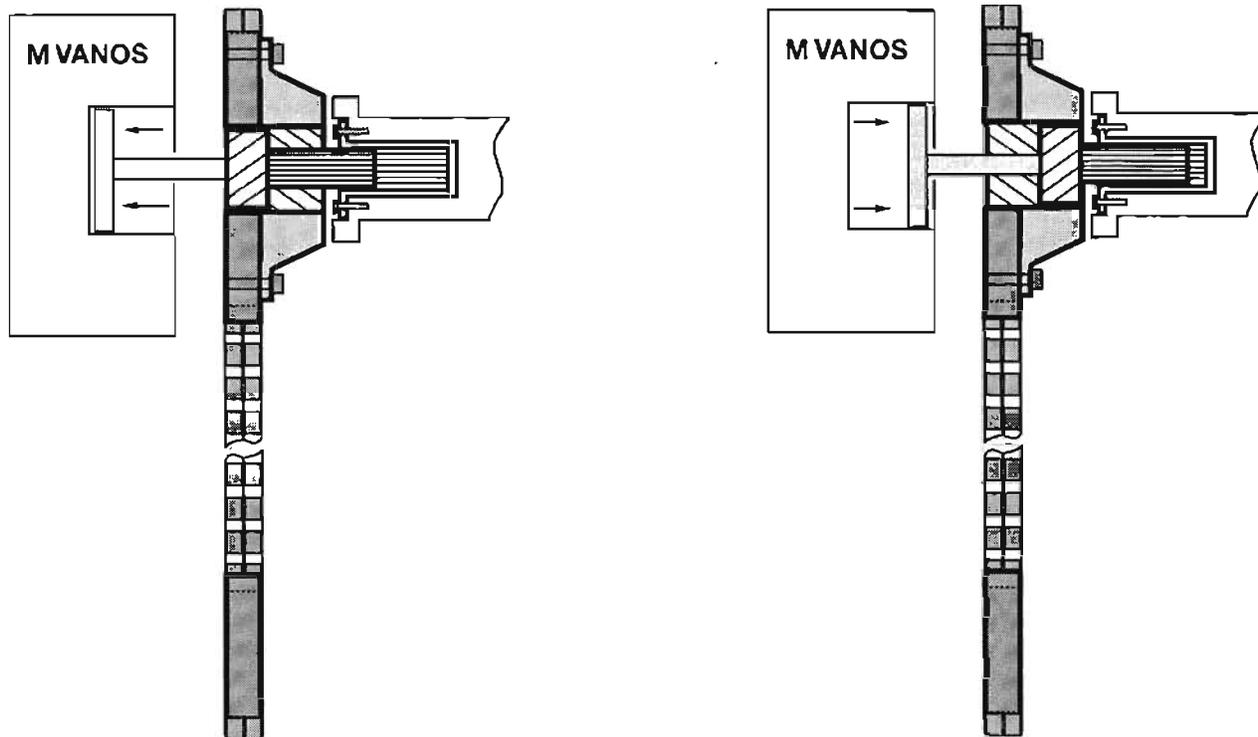
The camshaft sleeves are bolted to the end of the camshafts and engage with the straight spline of the adjustment shaft shown above.



The chain driven sprocket and spacer sleeve assembly is shown to the right (one assembly per camshaft). The sprocket engages with the helical splines of the adjustment shaft shown above.



The intake camshaft sprocket assembly has two drive "lugs" that must be aligned with the radial piston oil pump during installation.



VANOS mechanical operation is dependent on oil pressure applied to position the control pistons. The double VANOS camshafts are infinitely adjustable within the mechanical travel limits of the drive gears.

When oil pressure is applied to the control piston, the piston moves causing the splined adjustment shaft to move. The straight splines slide within the camshaft sleeve. The helical splines rotate the camshaft drive sprocket changing the position in relation to the camshaft position which advances/retards the camshaft timing.

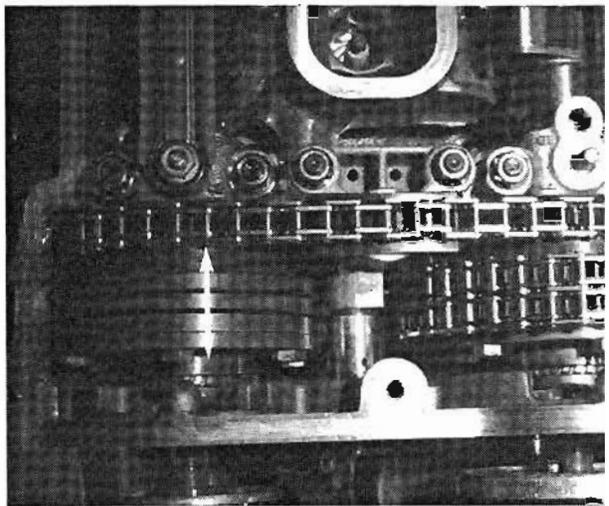
**The total adjustment range of the camshafts is 60° (as referenced to the crankshaft).**

The “default” mechanical stop position without VANOS influence is:

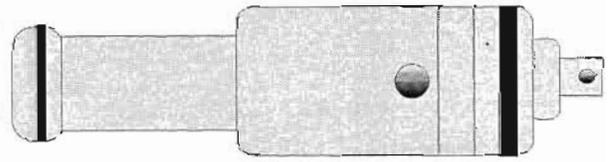
**Intake Camshaft = Retarded**  
**Exhaust Camshaft = Advance**

Oil is supplied from the main gallery through the front of cylinder head (arrow) to the inlet pressure reducing valve.

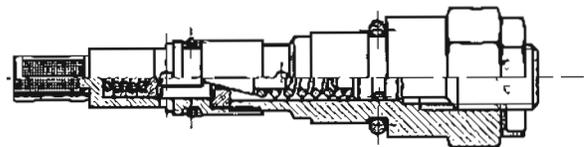
**Pressure Reducing Valve:** The pressure reducing valve supplies oil to the radial piston high pressure oil pump. It is located between the cylinder head and the VANOS unit.



The valve ensures the oil pressure supply to the VANOS pump is 0.5 Bar regardless of the varying pressure from the main oil pressure gallery. The pressure reducing valve is pressed into the VANOS unit and secured by an "o-ring".



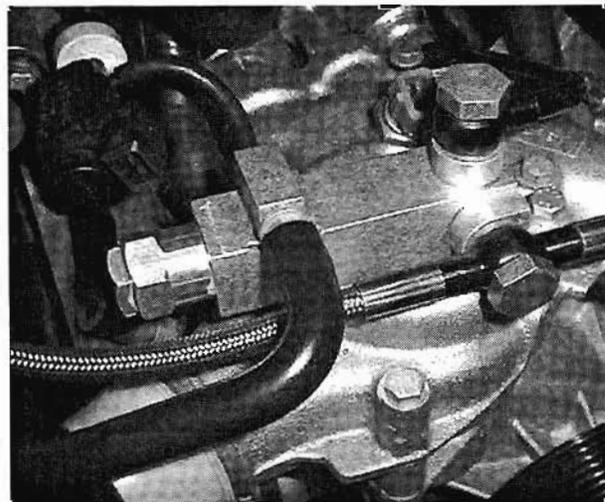
**100 Bar Pressure Regulating Valve:** The 100 Bar pressure regulating valve regulates the pressure produced by the radial piston high pressure oil pumps.



The 100 Bar pressure regulating valve is mounted in the center of the cylinder block "V" on the thermostat housing.

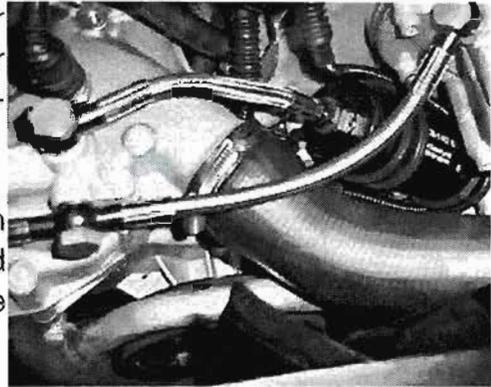
The valve ensures that the oil pressure for VANOS operation is maintained at 100 bar. One pressure regulator is used for both cylinder banks.

*Note: The 100 Bar pressure regulating valve is not adjustable.*



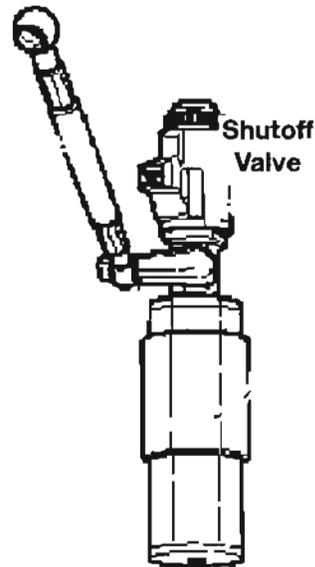
**VANOS Accumulator:** The VANOS accumulator ensures that there is a sufficient volume of oil under pressure to adjust the camshafts under all engine operating conditions.

The accumulator is Nitrogen charged and is located on the front of the 5 - 8 bank of the engine. It is connected to the VANOS oil pressure circuit by a high pressure line.



**VANOS Accumulator with Electrical Shutoff Valve:** The VANOS accumulator with an electrical shutoff valve was phased into production on 2001 MY S62 engines.

This production change addresses the customer complaint of a rattling noise (from the VANOS units) in the first few seconds after starting the engine. The VANOS hydraulics can cause rattling noises after the engine start due to the varying torque of the camshaft before sufficient VANOS oil pressure has built up.



When the engine is stopped, the oil runs out of the high-pressure chamber in the adjustment cylinder. This can cause the VANOS adjustment piston to move freely against the housing during startup.

The shutoff valve prevents this because it will close (without electrical power) to reserve a volume of oil under pressure in the accumulator when the ignition is switched off. Upon the next engine start, the valve will be opened by the ECM allowing the stored accumulator release to "prime" the VANOS assemblies with pressurized oil.

*This noise has no effect on the engine's power output or durability.*

*The affected vehicles are:*

- E39 (M5), E52 (Z8)

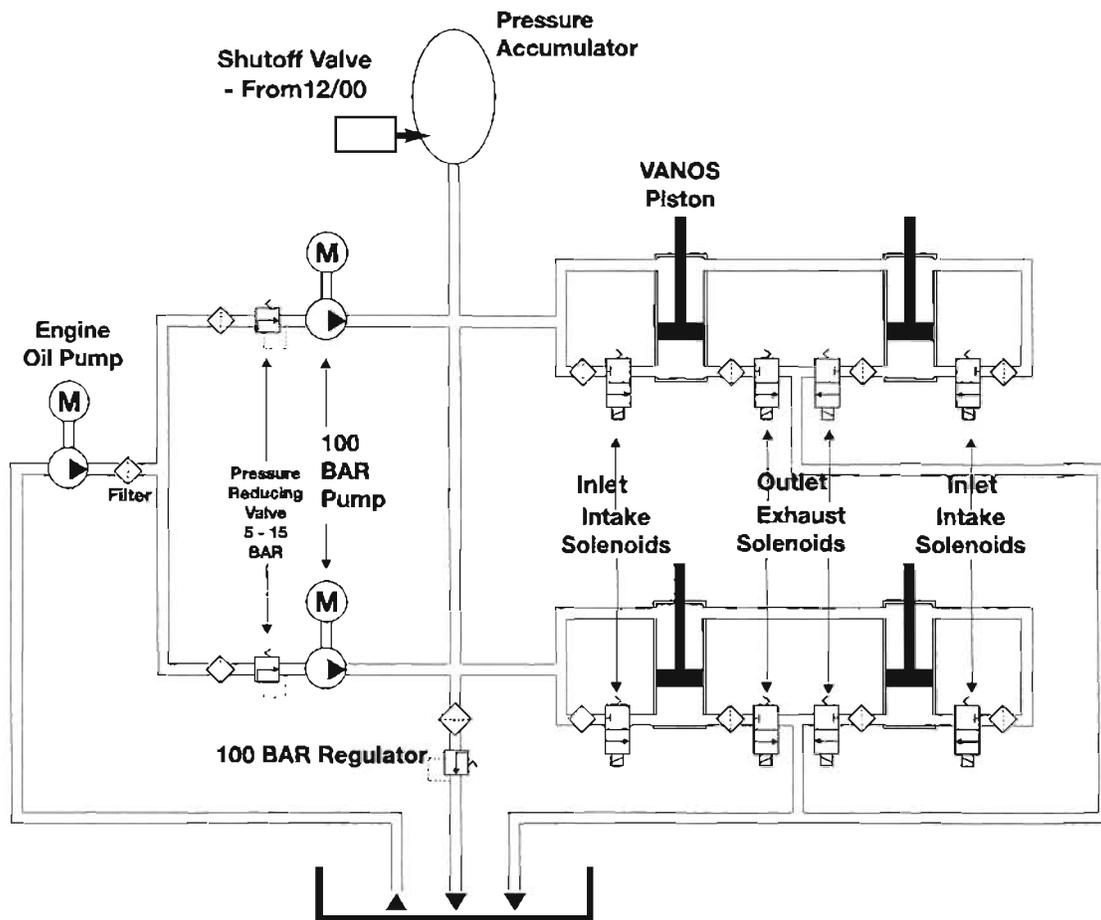
*Manufacturing period:*

- From the start of series production up to November 2000

*In case of customer complaint on vehicles produced before 12/2000, Refer to the Service Information Bulletin. A shutoff valve may be retrofitted to the VANOS accumulator.*

*Note: There are two different retrofit kits depending on the vehicle production date.*

- Retrofitting on vehicles from start of series production until August 2000.
- Retrofitting on vehicles from September 2000 until November 2000.



### **VANOS system hydraulic operation:**

- When the engine starts, oil from the main engine oil pump is fed under pressure to the pressure reducing valves.
- The oil pressure is dropped to approximately 0.5 Bar and fed to the radial piston high pressure oil pumps.
- The pumps are driven by the intake camshafts and the 100 bar pressure is built up by the pressure regulating valve. The volume of pressurized oil is stored in the accumulator supplying both adjustment pistons. Both pistons are held in the default position by the high pressure oil.
- At the same time the high pressure oil is available at the inlet solenoids of both adjustment pistons.

- VANOS adjustment is carried out by the ECM pulsing the inlet and outlet solenoids to allow pressurized oil to the back side of the adjustment pistons. The surface area on this side of the piston is larger so that the oil pressure is greater and the adjustment piston will move causing the valve timing to change.
- The piston is connected to the adjustment shaft. As the piston moves, the shaft turns the helical splines varying the camshaft sprocket position in relation to the camshafts.

#### *From 12/00 Production Date*

- When the ignition is switched "off" the shutoff valve will close (without electrical power) to reserve a volume of oil under pressure in the accumulator. Upon the next engine start, the valve will be opened by the ECM allowing the stored accumulator release to "prime" the VANOS assemblies with pressurized oil.

#### **CAUTION!**

- *The VANOS system is under high pressure (100 Bar).*
- *The VANOS accumulator stores pressurized oil, do not energize the Shutoff Valve when the oil circuit (lines) is open!*
- *Consult the Repair Instructions before performing any repairs.*

#### **Workshop Hints**

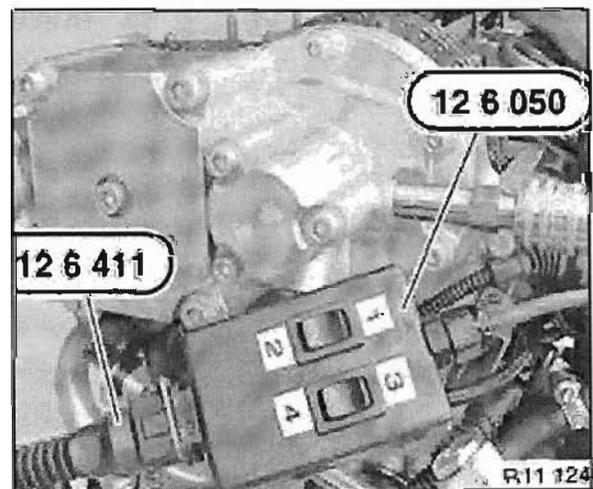
The VANOS function test can be performed by using Special Tools:

#90 88 6 126 411

#90 88 6 126 050

*Regulated Compressed Air (2-8 bar)*

Refer to the Repair Instructions for the VANOS function test procedures.

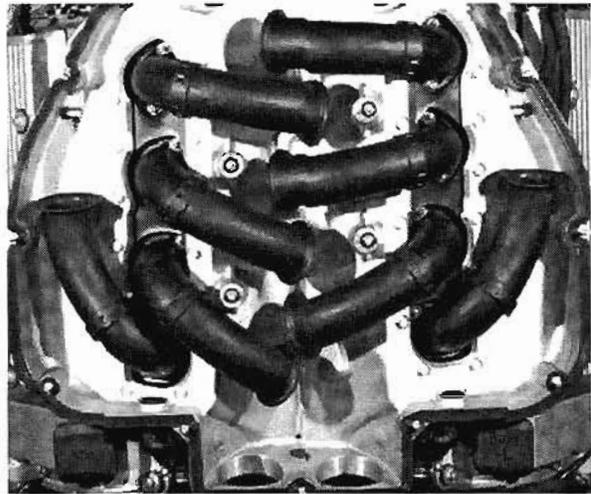


**Intake Air Plenum:** The large intake air plenum is designed for the maximum volume required for the S62 engine. Inside the intake plenum, each throttle valve has its own air funnel which is bolted to the individual throttle housing.

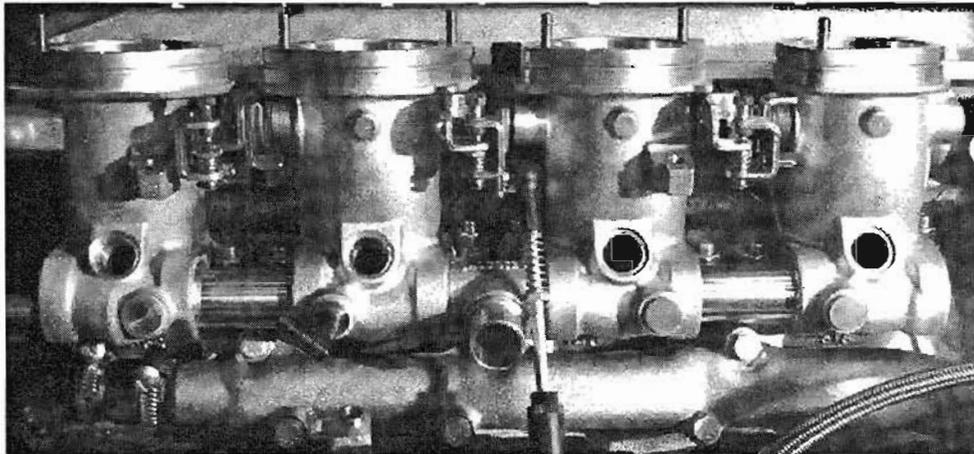
The air funnel positions are defined by the shape of the plenum. The funnels for cylinders 1 and 5 face rearward and the remaining funnels face inward.

The lower plenum is sealed to the upper cover by a perimeter gasket and four "o-rings" on the center support towers.

*Caution: Remove attaching nuts and store away from intake plenum before lifting funnels from the throttle housings so they do not fall into the throttle housings!*



**Intake Air System:** The S62 engine uses eight individual throttle housings that are bolted directly to the cylinder heads. To ensure smooth and stable engine operation all eight throttles must be synchronized for an even distribution of the intake air.



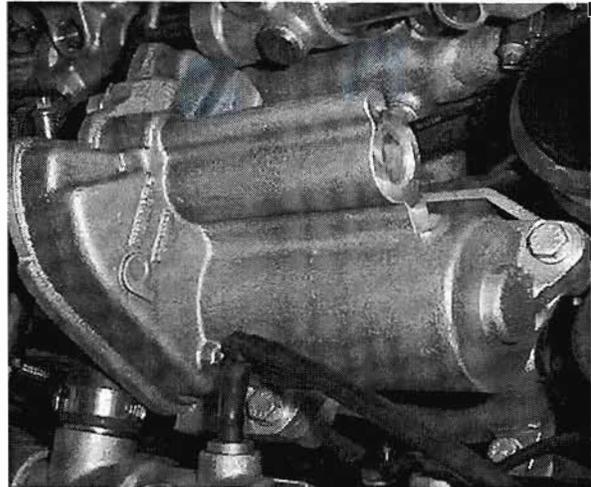
*One bank of four shown*

*Refer to the Repair Instructions for the procedure to adjust and synchronize the throttle housings.*

**Electronic Throttle Motor (EDR):** All eight throttles are activated by one electric throttle motor (EDR).

The EDR motor is mounted in the “V” of the block and controls the throttles through two linkages. The ECM controls the EDR to open and close the throttle valves.

The throttle valves are fitted with mechanical return springs to close them when the EDR is not energized.



**Idle Speed Actuator:** A separate idle speed actuator (ZWD 5) is used to supply the idle air to all cylinders. The actuator supplies air to the base of the throttle housings which bypasses the throttle valves (plates) to maintain engine idle speed.

The idle speed actuator is mounted in the “V” of the block and is connected to the throttle valves through large air pipes linked between each throttle housing.



**Fuel Supply:** The fuel is supplied through a Non Return Fuel Rail System. This system is used on the S62 for TLEV compliancy. The fuel supply pressure is controlled by the 5 Bar fuel pressure regulator integrated in the fuel filter assembly (pressure test fitting at this point). The E39 M5 fuel filter assembly is located under the left front floor area (next to the frame rail).

The fuel exits the fuel pressure regulator supplying even fuel distribution to all fuel injectors due to a “T” connection feeding both fuel rails.

The fuel return line is located on the filter/regulator assembly which directs the unused fuel back to the fuel tank. The fuel tank hydrocarbons are reduced by returning the fuel from this point instead of from the fuel rail.



The Non Return Fuel Rails are secured to the throttle housings by two bolts (for each shown to the right #1).

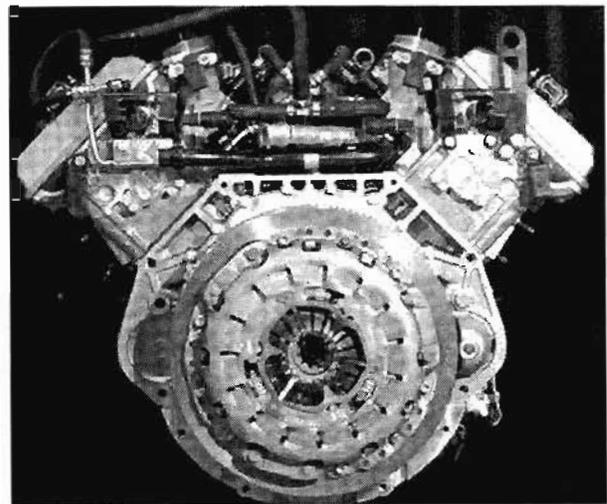
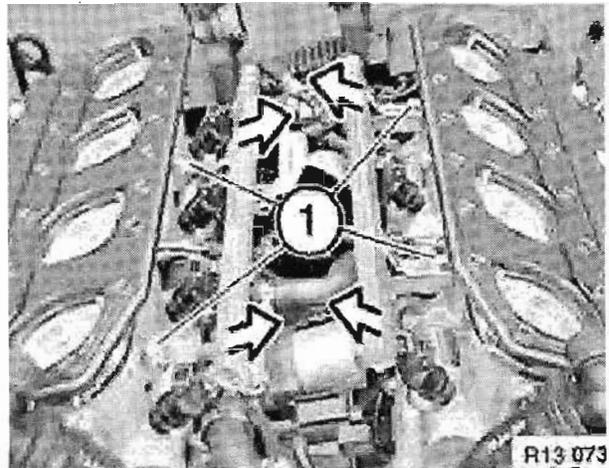
The fuel rails provide even distribution and a volume of fuel for the injectors.

**Clutch Assembly:** The S62 clutch assembly is specially designed to transfer the high torque to the driveline and dampen vibrations throughout the rpm range.

The clutch assembly consists of:

<b>Weight Optimized Dampened Dual-Mass Flywheel</b>
<b>Diaphragm Type Self Adjusting Pressure Plate and Drive Disk</b>

The incremental wheel is mounted to the flywheel for the engine speed, reference and Mis-fire Detection. The self adjusting clutch (SAC) has lower release forces for easier clutch operation (less pedal effort required).

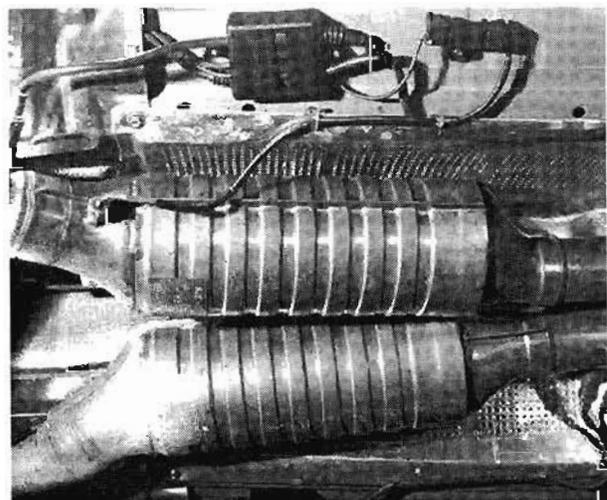


*Procedures for checking and replacing the self adjustment clutch including the Special Tools are found in the Repair Instructions.*

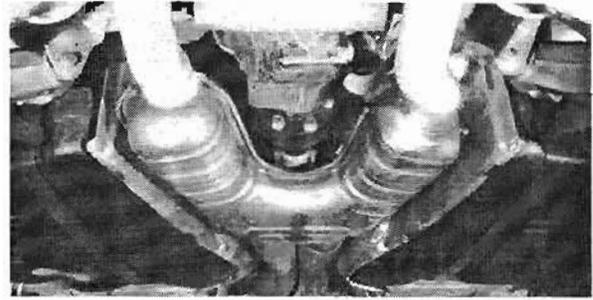
**Exhaust System:** The exhaust manifolds are stainless steel with an air gap insulation that allows the converters to warm up rapidly and reach their operating temperature.

Two metal monolith catalytic converters are used with pre and post catalyst oxygen sensors for OBD II compliance.

The left side catalyst contains an Exhaust Gas Temperature Sensor on vehicles produced up to 9/2000. Vehicles produced >9/2000 do not have this sensor. *Refer to the Service Information Bulletin on modifying early production-vehicles.*

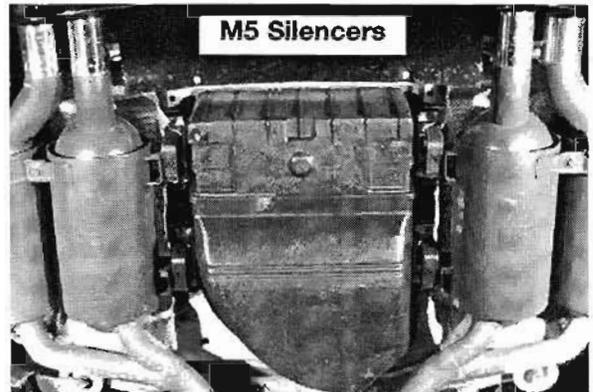


The exhaust is combined in the one piece central silencer with two outlet openings at the rear which lead to the two main silencers.



**Main Silencers:** Four main silencers with individual outlets are used on the M5 to comply with international noise emission regulations.

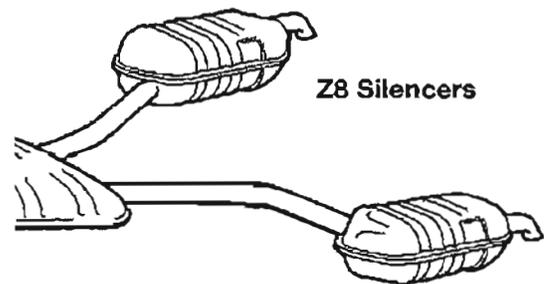
Due to the positioning and space requirements for the silencers, the floor pan of the luggage compartment is redesigned and the spare wheel has been eliminated.



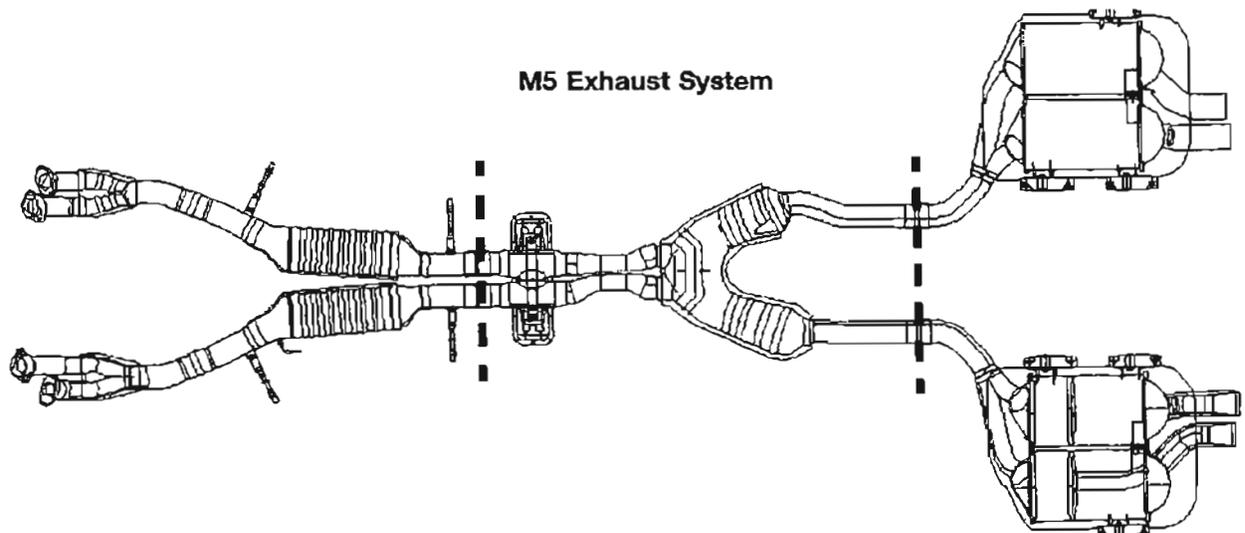
The battery is mounted in the luggage compartment floor between the rear silencers as shown on the right.

The Z8 uses two rear silencers with individual outlets

For production purposes, the stainless steel exhaust system is a one piece component after the exhaust manifolds.



*For repair purposes, the system is separated and sleeved in sections at specific points.*

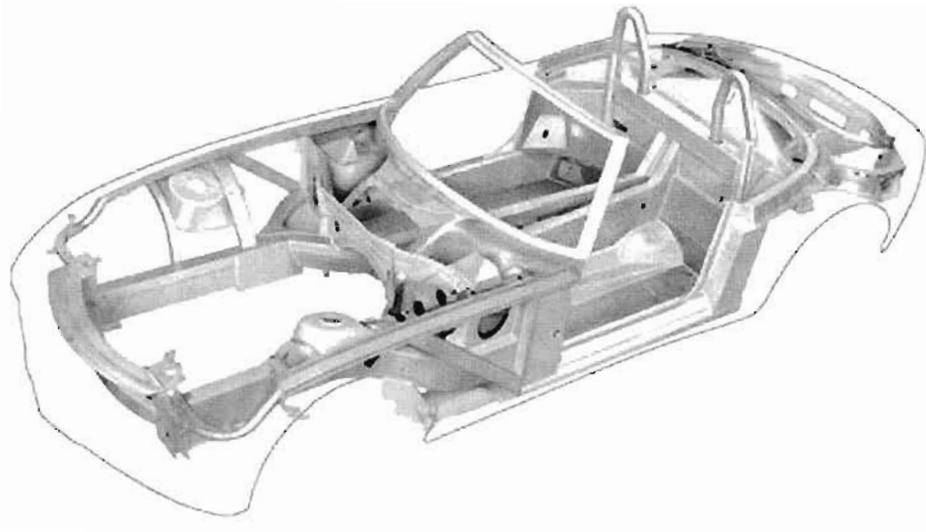


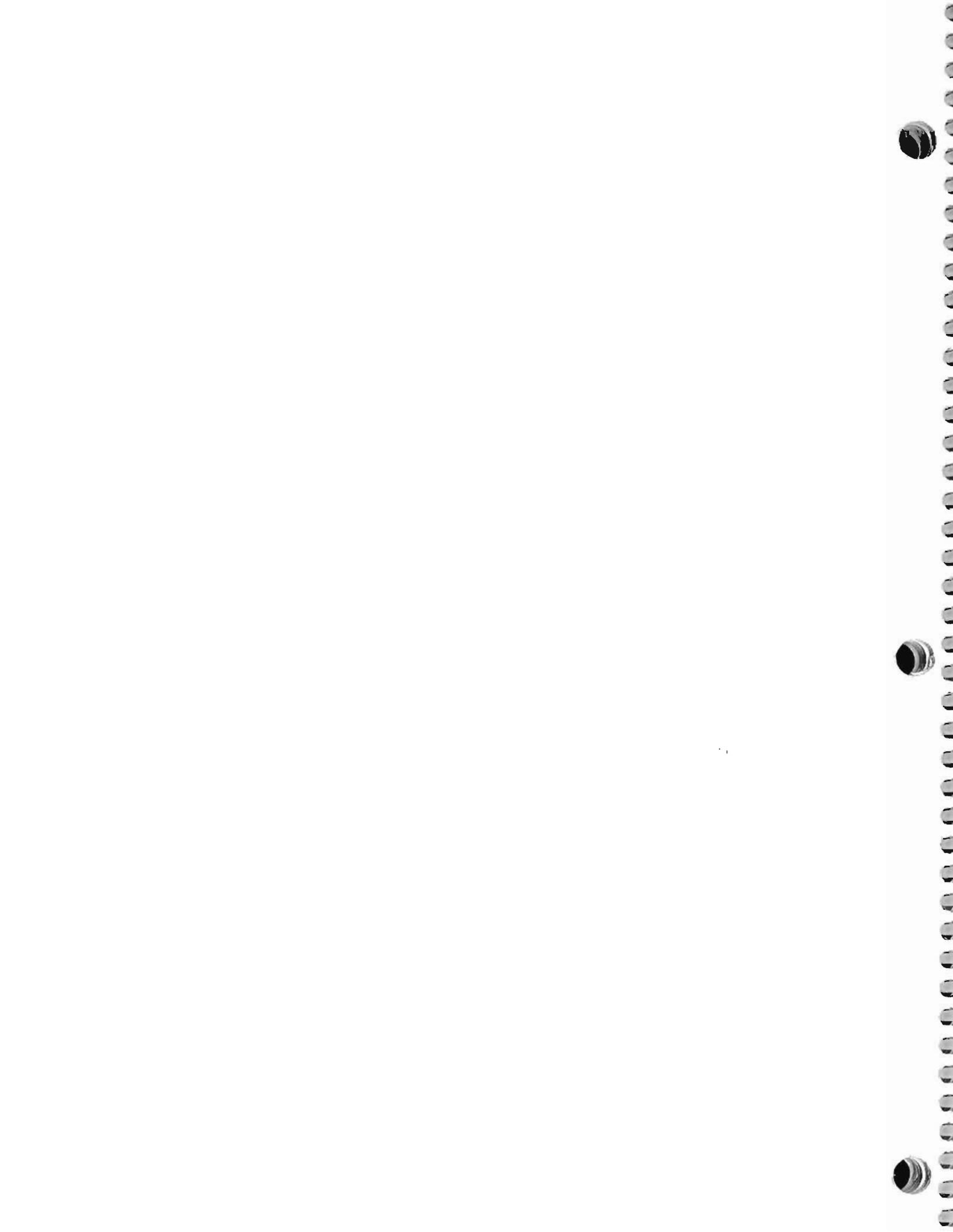
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## Review Questions

1. Why does the valve clearance not have to be adjusted on the S62? \_\_\_\_\_  
\_\_\_\_\_
2. The flywheel mounted incremental wheel on the S62 provides:  
\_\_\_\_\_
3. What does the term "cracked" connecting rod mean?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. What is the function of the Scavenge Oil Pumps on the S62 and how do they affect oil pan removal? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. What special tools are used to perform the VANOS function test?  
# \_\_\_\_\_ # \_\_\_\_\_
6. When installing the camshafts, the journal caps should be installed based on what markings?  
\_\_\_\_\_
7. What is the purpose of the VANOS Accumulator with an Electrical Shutoff Valve?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
8. What must be "aligned" with the radial piston high pressure oil pumps when installing the VANOS units? \_\_\_\_\_
9. Where is the fuel pressure tested on the E39 M5 and what is the nominal pressure?  
\_\_\_\_\_ Bar
10. What sensor was deleted from S62 equipped vehicles produced after 9/2000?  
\_\_\_\_\_

# Body Shell





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# RUNNING GEAR

**Model:** E52  
**Production Date:** 03/00

## Objectives of the Module

After completing this module, you should be able to:

- To identify which suspension components are aluminum on the Z8.
- To list the spring and sway specification increases for handling.
- To describe the braking system enhancements.

## Front Axle

The Z8 front suspension is designed as a double pivot with spring over strut.

The axle principle of the E39 and E38 models has been re-engineered in order to achieve the desired sports and roadster-specific characteristics.

The front axle carrier is a welded aluminum structure consisting of extruded sections and reinforcement panels.

The front axle carrier is connected to the body by 6 bolted points.

The tension struts are also forged aluminum.

Hydraulic rubber mounts have been installed (tension rod bushings) in order to reduce axle vibration.

The struts are clamped to the spindle hub unit.

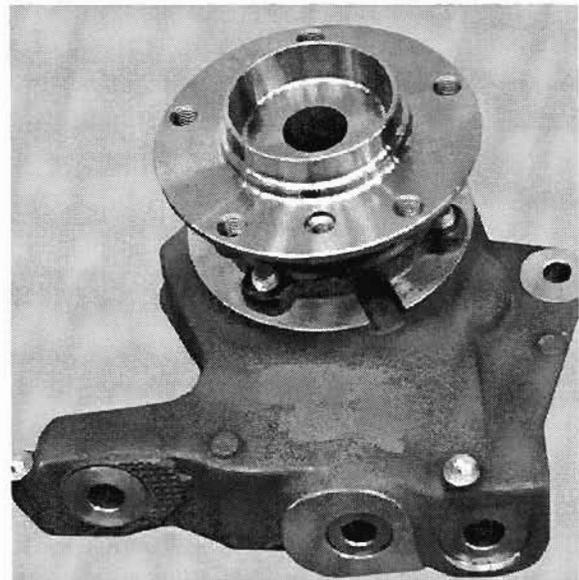
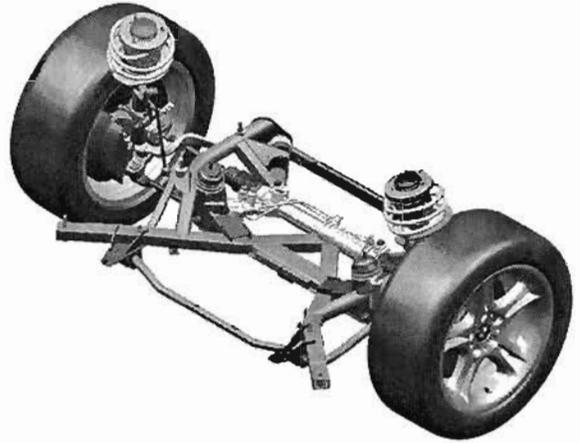
The upper pivot bearings (plates) are made of aluminum.

### Suspension

The front struts are equipped with gas pressure shock absorbers.

The spring tuning is approx. 18% stiffer than on sedans. Due to the harder spring tuning, the spring compression range is 70 mm.

The anti-sway bar is 27 mm in diameter. This suspension design allows a low hood line to be achieved.



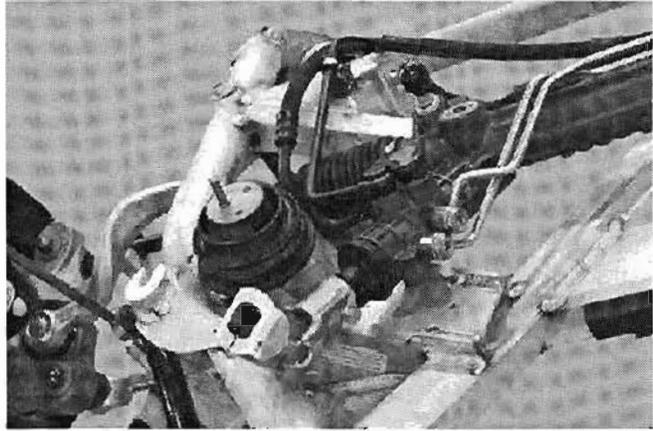
## Steering

The Z8 is equipped with power assisted rack and pinion steering.

The steering gear is located in front of the wheel center and subframe cross member. This combination ensures correct steering characteristics and steering line accuracy.

The variable ratio of the steering gear provides a responsive feel under all driving conditions.

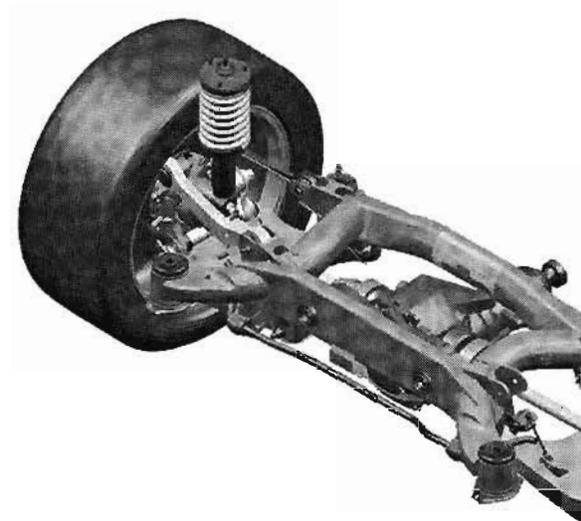
The Z8 is not equipped with Servotronic.



## Rear Axle

The concept of the Z8 rear axle is known from the E38. The rear axle carrier is made of steel, similar to the carrier installed in the E38.

The rear axle is connected to the body by large-volume rubber mounts. Ball bearings are used in the lower control arm pivots, allowing for the hard longitudinal and transverse acceleration forces.



## Suspension

Struts with centrally positioned springs are fitted on the rear axle.

The spring tuning is approx. 25% harder than on the E38 sedan. The spring compression range is 80 mm.

A 14 mm diameter anti-sway bar is standard.

## Brakes

- The Z8 features a 2-circuit vacuum boosted brake system with a front/back split arrangement. The brake system has been adopted and modified from the E38 security vehicle.
- The front brakes are designed as a dual-piston floating calipers, and the rear brakes are single-piston floating calipers.
- The rotors feature a special coating (Geomet), improving corrosion resistance.

Brake Disc	Diameter	Thickness
Front	334 mm	32 mm
Rear	328 mm	20 mm

Note: Brake discs and pads are not directional.

## Wheels/Tires

The following types of light alloy wheels are standard on the Z8:

Summer Tires (mixed tires)	
Front Rims	8 J x 18 LM
Rear Rims	9 J x 18 LM
Front Tires	245/45 ZR 18 96 Y
Rear Tires	275/40 ZR 18 99 Y
Winter Tires	
Rims	8 J x 18 LM
Tires	245/45 R 18 96Q/T/H M+S



- Only run flat tires are used with emergency running characteristics (refer to after sales publications for details).
- The Z8 is not equipped with a spare tire or M-mobility kit.

The DWS tire pressure warning system is standard. This system has a new acronym on the Z8, but is based on the RDW from the E39 M5. For specific details refer to the ST037 M5 handout.

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## Review Questions

1. List the aluminum suspension components.

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2. What is unique about the Z8 steering gear?

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3. What type of brake circuit (hydraulics) is used on the Z8?

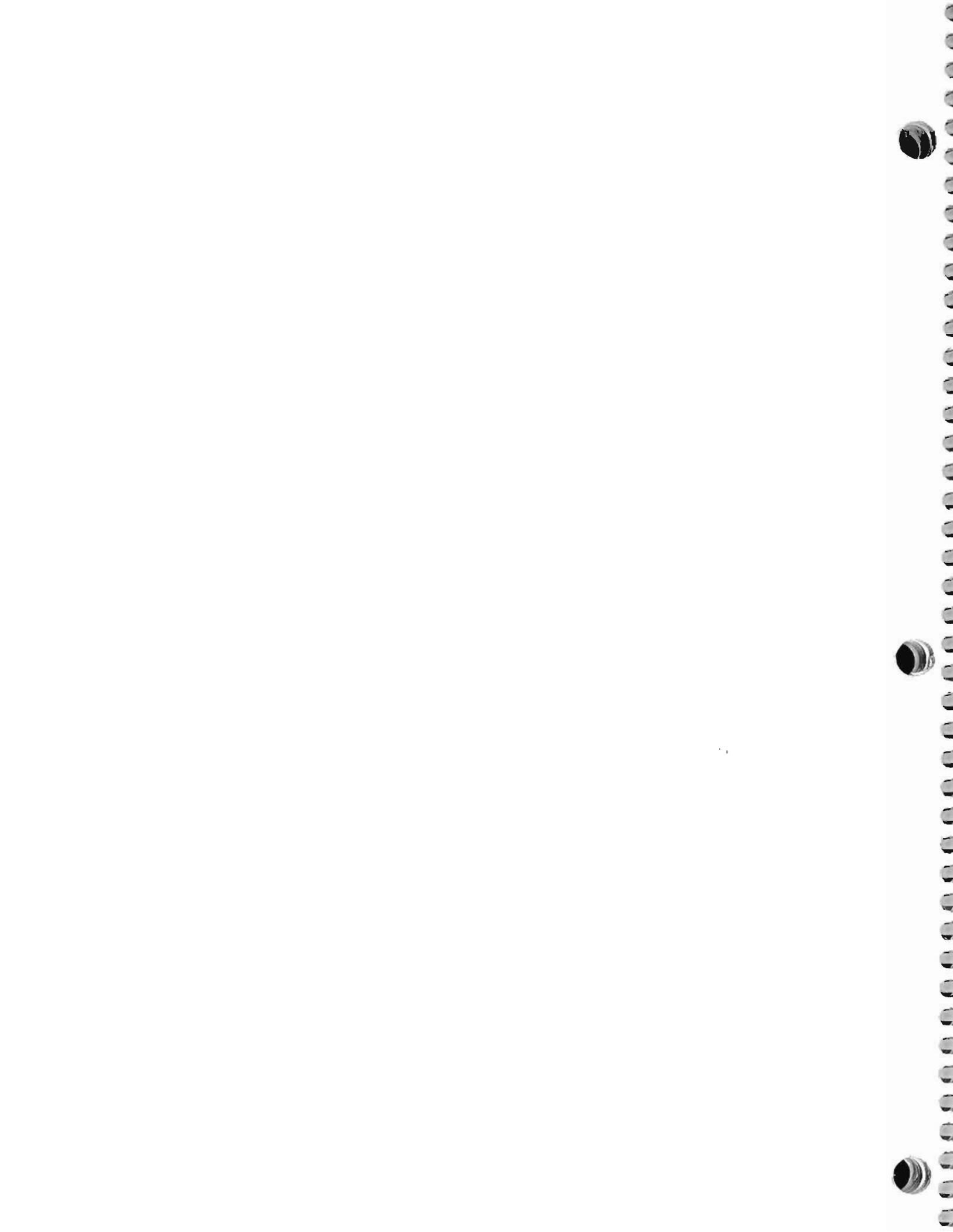
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# BMW Alpina Roadster V8





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# BMW ALPINA ROADSTER V8

**Model: E52**

**Production Date: MY 2003**

## **Objectives:**

After completion of this module you will be able to:

- Identify the visual differences of the BMW ALPINA ROADSTER V8.
- Describe the driveline differences of the BMW ALPINA ROADSTER V8.

## BMW ALPINA ROADSTER V8

This new Z8 is not only from BMW, but also from ALPINA. Located in the Upper Bavarian town of Buchloe, ALPINA was established in 1964 as an official and approved "ennobler" of BMW automobiles - and with that word, we unabashedly translate directly from the German word Veredler, which tells us that ALPINA is not concerned merely with making BMWs go faster and look racier.

Instead, ALPINA's tradition is to take production BMWs and make them even more appealing to connoisseurs of automotive finery. Performance finery, we must add, as ALPINA's treatments include not merely cosmetic modifications but also a palette of powertrain and chassis refinements that consistently enhance BMW models' already formidable road capabilities within a context of thorough engineering and mature character.

With this latest creation, which amounts to an exclusive and unique ALPINA re-interpretation of the Z8 roadster, the team of automotive ennoblers has added its unique touch to an already classic creation, and has done so with the skill and maturity of the seasoned automotive gourmet. The BMW ALPINA ROADSTER V8 incorporates change not just for the sake of change and exclusivity - although of course it offers exclusivity in great measure - but rather as a specific, targeted refinement in the direction of greater comfort.



## What ALPINA has created - and how

ALPINA has transformed the Z8 in a thoroughly logical way, consistent with its own long-standing principles and the tastes preferences.

Toward an understanding of the ALPINA transformation of the Z8, it is helpful to look at the ways in which the ALPINA roadster differs from the original Z8 - whose limited production concludes today with a total of approximately 5,000 units having been largely handbuilt.

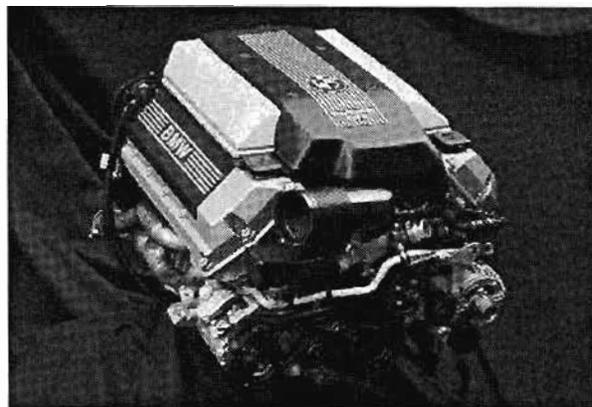


## Engine

Most dramatically, the BMW ALPINA ROADSTER V8 replaces the Z8's BMW M engine (5.0 liters, 394 horsepower, elaborate individual throttles for each of the eight cylinders and many other racecar-like engineering characteristics) with a performance-developed version of BMW's "regular" V-8 engine.

Remarkably, the 4.8-liter ALPINA engine comes to within 19 hp of the BMW M unit (375 hp, vs. 394), does so at lower rpm levels, and (this is key) is thus suited to teaming with an automatic transmission.

Its power peak comes at 5800 rpm, vs. 6600; its torque peak occurs at the same 3800 rpm but is actually higher: 383 lb-ft. (vs. 368 lb-ft). The ALPINA engine delivers at least 368 lb-ft. all the way from 3100 to 5000 rpm.



The cast-aluminum cylinder heads' intake and exhaust ports are polished, the entire hand assembled engine, differs from the existing M62 V-8 engine variations as follows:

- The cylinder block, as cast by BMW in Alusil (aluminum-silicon alloy), has 93.0-mm cylinder bores. This is 1.0 mm greater than those of the 4.4i engine, and shared with the X5 4.6is engine.
- The crankshaft, with 89.0-mm stroke, is almost identical to that of the M5/Z8 engine; this stroke is 6.3 mm greater than that of the 4.4 engine, and 4.0 mm greater than that of the 4.6. The combination of 93.0-mm bore and 89.0-mm stroke produces a

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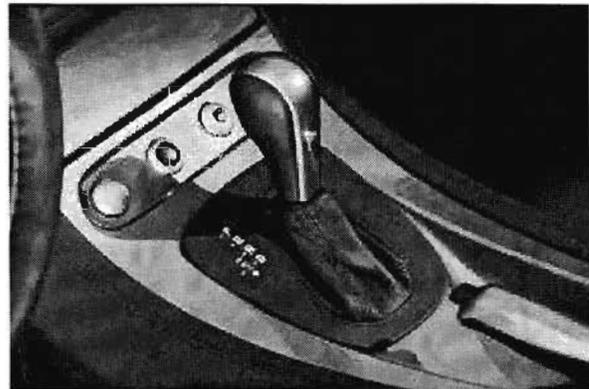
displacement of 4837 cc, vs. the 4.4's 4396 and the 4.6's 4619.

- ALPINA-specific lightweight aluminum pistons from Mahle, the famous German producer of pistons and other internal engine components.
- ALPINA-specific connecting rods, camshafts and valves.
- ALPINA-specific intake manifold, with increased volume and more sensitive air-mass sensors.

### Transmission

In another significant departure from the original Z8, and in harmony with the new engine, the 6-speed manual transmission is replaced by a special BMW ALPINA automatic transmission.

Based on the 5-speed ZF unit employed in V8-powered 5 and X5 Series models, the ALPINA version differs in several major aspects:



- In addition to up and downshifting by "tipping" the shift lever rearward or forward, the driver can also shift by pressing "+" and "-" buttons near the steering-wheel rim.
- 1st and 2nd gears are strengthened to handle the engine's higher torque. (Up to now, the largest, highest-torque V-8 teamed with this transmission has been that of the X5 4.6is.)
- Directly in front of the driver, a transmission display instrument indicates the range (P, R, N, D), mode (Automatic or Manual) and the gear currently engaged.
- Transmission software is unique to this unit.
- Under wide-open throttle in its Automatic mode (D), the unit upshifts at 5800 rpm, the engine's power peak. In its Manual mode (M), shifting is under the driver's control but it will upshift at 6500 rpm to prevent engine overspeed.

### Wheels and Tires

Also dramatic: special BMW ALPINA 20-inch wheels, with five clusters of four spokes each. With 9.0-in. width at the front and 10.0 at the rear, these wheels are an inch wider at the front and carry Y-rated performance tires of dimensions 255/35R-20 at the front and 285/30R-20 at the rear. Z8 wheels and tires are 18-inchers, the tires being 245/45 at the front and 275/40 at the rear.

Y-rated performance tires are a departure from Z8 practice too. The Z8 wears W-rated run-flat (also performance) tires; the ALPINA's tires balance their lower profile (which implies firm sidewalls) against Z8's higher-profile, but still relatively stiff run-flat sidewalls. (20-in. run-flat tires would have been unacceptably harsh-riding.) At the bottom line, sensitive drivers will find the BMW ALPINA ROADSTER V8 to deliver increased riding comfort with at least comparable handling.

For the eventuality of a flat tire, the ALPINA model employs the BMW Mobility System, familiar from BMW M models. BMW Mobility consists of a container of rapid sealant, an integrated micro-compressor, and a hose to connect the compressor to the damaged tire. All this is carried in a trunk recess near the right rear wheel, designed into the Z8 right from the start. The system can seal punctures up to approximately 1/4 in. across.

## Interior

Retaining the Z8's power telescopic adjustment, the BMW ALPINA ROADSTER V8 adopts a different steering wheel, with three leather-and-metal-finished spokes in place of the Z8's "banjo" spokes. An ALPINA logo replaces the BMW emblem on the steering wheel's center hub.

The cockpit is upholstered in Soft Nappa (distinctive from the Z8's Nappa), with special piping and ALPINA logos in the upper seatback. Three color schemes are offered: Black/Black, Black/Crema and Black/Sport Red.



As its name implies, the ALPINA interior's Soft Nappa leather is somewhat more pliant than the Z8's already luxurious Nappa leather. The three color combinations correspond to three of the Z8's four; special piping, the ALPINA steering wheel and the ALPINA logos in the seat upholstery add further distinction.

So does the plaque between the seats, which documents each vehicle's production number. And at night, in place of the Z8's soft red lighting emanating from the instrument centers, it's blue - blue being a traditional ALPINA identifier. (The dials themselves are ALPINA too, and have red pointers.)

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## 2003 BMW ALPINA Roadster V8 - Specifications

### General

Curb weight, lb.:

Without hardtop 3571

With hardtop 3630

Weight distribution, front/rear, % 49.9/50.1

Wheelbase, in. 98.6

Track, front/rear, in. 61.1/61.7

Length x width x height, in. 173.2 x 72.0 x 51.9

### Body

Type Aluminum space frame, aluminum body panels

Aerodynamic drag coefficient:

With raised softtop 0.43

With hardtop installed 0.39

EPA size classification 2-Seater

### Accommodations

Seating capacity, persons 2

Shoulder room, in. 55.2

Head room, in. (raised softtop) 37.2

Leg room, in. 42.8

EPA interior volume, cu ft. 51.1

EPA cargo volume, cu ft. 5.1

### Engine & Electrical

Engine type DOHC 32-valve (4-cam) V-8, VANOS variable intake-valve timing

Bore x stroke, mm/in. 93.0 x 89.0 / 3.66 x 3.50

Displacement, cu in./cc 4837/295

Compression ratio 10.5:1

Power @ rpm, hp SAE net 375 @ 5800

Torque @ rpm, lb.-ft. 383 @ 3800

Engine-management system BOSCH Motronic ME 7.2

Fuel requirement Premium unleaded

Fuel capacity, U.S. gal. 19.3

Battery capacity, amp-hr. 90

Alternator output, amp./W 120/1680

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## Drivetrain

Drive system Front engine/rear drive

Automatic transmission ZF 5HP24EH, 5-speed SWITCHTRONIC  
with Adaptive Transmission Control & selectable Manual mode

Ratios: 1st 3.57:1

2nd 2.20:1

3rd 1.51:1

4th 1.00:1

5th 0.83:1

Reverse 4.10:1

Final drive ratio 3.38:1

## Chassis

Front suspension Sport suspension in aluminum; struts, double-pivot lower arms  
with low-friction balljoints at pivot points, coil springs, twin-tube  
gas-pressure shock absorbers, anti-roll bar

Rear suspension Sport suspension; 4-link Integral system with low-friction balljoints  
at pivots of upper lateral arms & lower lateral arm, twin-tube gas-  
pressure shock absorbers, anti-roll bar

Steering type Variable-ratio rack & pinion, engine-speed-sensitive power assist

Overall ratio Variable; mean ratio 17.0:1

Turns lock-to-lock 3.0

Turning circle, ft. 38.7

4-wheel ventilated disc brakes:

Diameter, front, mm/in. 332/13.1

Diameter, rear, mm/in. 328/12.9

Assist Vacuum

Wheels Cast alloy;

20 x 8.5H2 front / 20 x 9.0H2 rear

Tires Performance radials,

255/35R-20 Y -rated front /

285/30R-20 Y -rated rear

Stability-enhancement system Dynamic Stability Control (DSC), including all-speed traction  
control, electronic brake proportioning, antilock braking (ABS), Dynamic Brake  
Control & cornering/avoidance-stability enhancement

## Performance Data

Acceleration, 0-60 mph, sec. 5.0

Top speed, mph 161

Fuel economy, EPA est. MPG,  
city/highway 14/21

