

SUSPENSION

Chassis and Suspension - Z4

E89 CHASSIS AND SUSPENSION

The handling and agility of the E89 are outstanding in this vehicle class. This is achieved by the rear wheel drive, an optimum steering response and outstanding traction in all load situations. It has been possible to optimally match the front axle kinematics and steering as no allowances had to be made for drive influences. An axle load distribution between 50:50 and 44:56 has been achieved in all load situations.

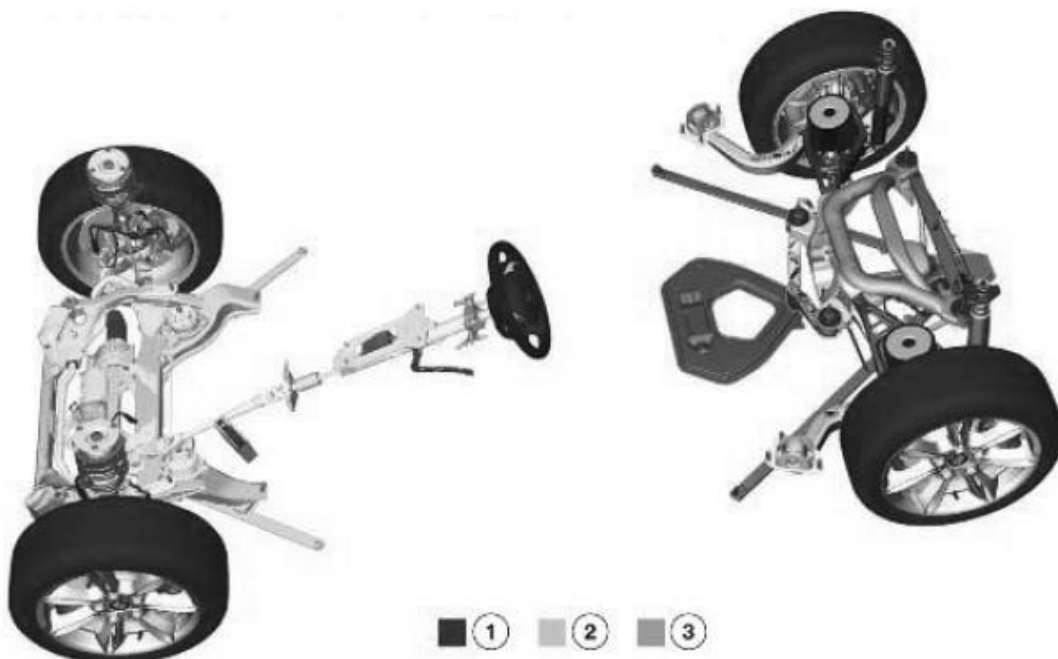


Fig. 1: Identifying E89 Chassis And Suspension
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	New components (newly developed)
2	Modified components (developed with minimum expenditure)
3	Common parts E87 and E90

DOUBLE-JOINT SPRING STRUT FRONT AXLE

A modified version of the double-joint spring strut front axle known from the E8x and E9x series vehicles is used in the E89. Adaptations were necessary due to the available space and the modified suspension geometry.

The graphic uses colors to show an overview of the common parts, modified components and new components

in the E89 compared to the E85 and compared to the E9x and E8x models for the front axle.

Some components have been fully adopted, others have been adapted and optimized to the changed conditions while other components are a complete new development. In the same way as the E8x and E9x models, the E89 is based on the well-known principle of the double-joint spring strut front axle. The well-proven principle of the central link rear axle from the E85 is retained for the rear axle.

Dynamic Driving Systems

Differentiation

The dynamic driving systems are differentiated in three directions of action and are assigned to the individual dynamic systems corresponding to their main direction of action:

- Longitudinal dynamics systems
 - Dynamic stability control (DSC)
 - Electromechanical parking brake (EMF)
- Transverse dynamics systems
 - Electromechanical power steering (electronic power steering EPS)
- Vertical dynamics systems
 - Adaptive M chassis and suspension

Changes and New Features

The parking brake on the E89 is designed as an electromechanical parking brake EMF. The EMF on the E89 differs from the known EMF systems in that it is integrated in the brake calliper. Competitors are already using this system in series production.

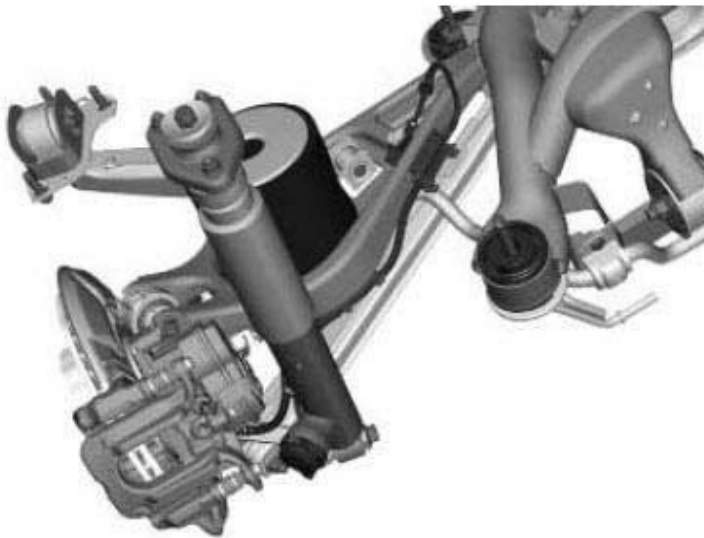


Fig. 2: Identifying E89 Brake Calliper With EMF Actuator
Courtesy of BMW OF NORTH AMERICA, INC.

E89 FRONT AXLE

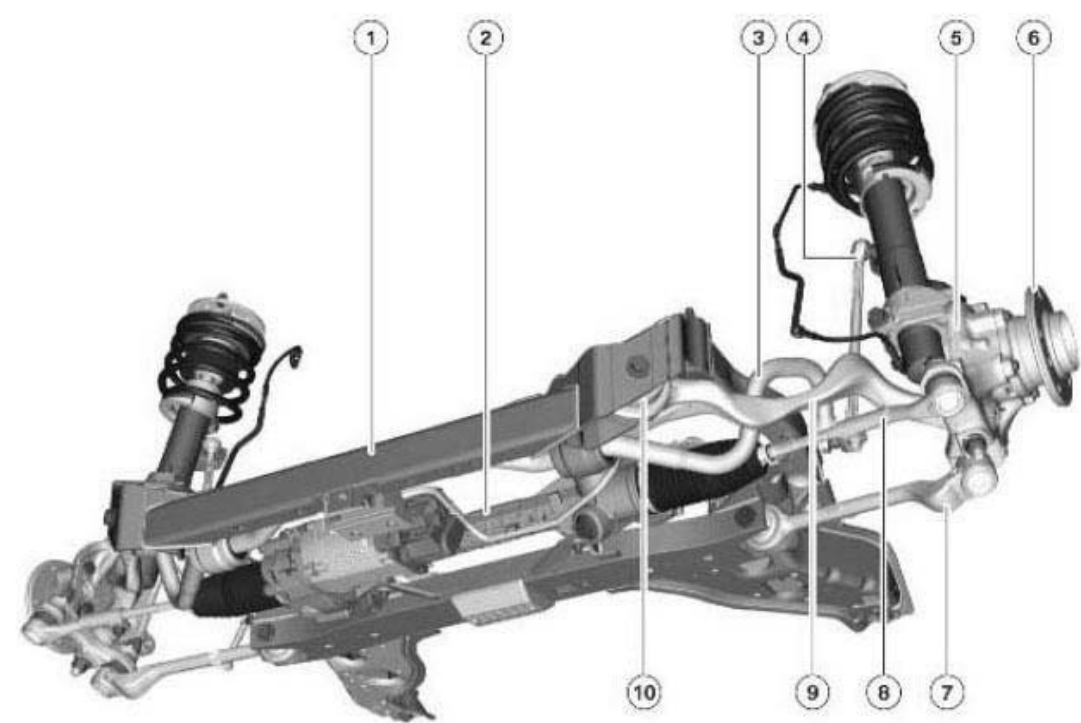


Fig. 3: Identifying E89 Front Axle Components
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Front axle carrier
2	Electromechanical power steering
3	Stabilizer bar
4	Stabilizer link
5	Spindle
6	Wheel hub
7	Control arm
8	Tie rod
9	Tension strut
10	Hydraulic mount/Bushing

The E85 was equipped with a single-joint spring strut front axle. To optimize the suspension properties, the E89 is equipped with a double-joint spring strut front axle. The reasons are explained in the following.

Kingpin Offset

The kingpin offset (scrub radius) of the E89 is greater compared to that of the E85. The reason for this is that

the front axle has been adopted from production line 2 (1 Series and 3 Series).

On the single-joint spring strut front axle of the E85 the position of the wheel control joint largely determines the size of the kingpin offset. Since the kingpin offset should be as small as possible, the wheel control joint must be located as far towards the outside as possible. This however results in problems concerning the package space for the brake disc and brake calliper. On the double-joint spring strut front axle the position of the control arm and tension strut with respect to each other determines the size of the kingpin offset.

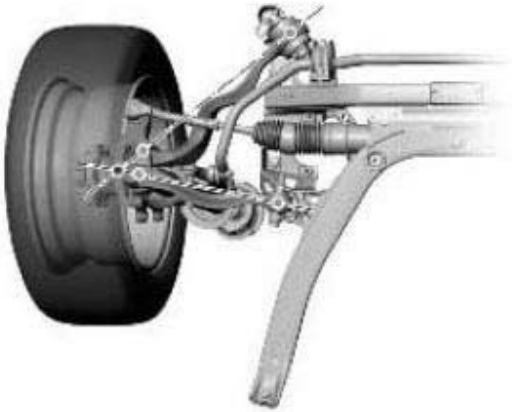


Fig. 4: Identifying Lower Pivot Point
Courtesy of BMW OF NORTH AMERICA, INC.

The pivot points of the control arm or wishbone and tension strut at the swivel bearing can therefore be selected such that no space problems are encountered for the brake system.

While these aspects still retain their validity, a larger kingpin offset than on the single-joint spring strut front axle is now used. The reason for this is that common parts from production line 2 are used as far as possible but the track width has increased compared to the 1 Series and 3 Series. Among other measures, this was achieved by changing the rim offset, thus, of course, also increasing the kingpin offset.

The effects of increased susceptibility to interference caused by a larger kingpin offset were eliminated by an optimized and modified elastokinematics system and tuned to such an extent that an improvement was achieved compared to the E85. As a result, the response of the E89 to steering movements is slightly more indirect at high speeds and very direct at speeds up to 100 km/h. The vehicle handling is very balanced up to the limit range and therefore has outstanding control properties.

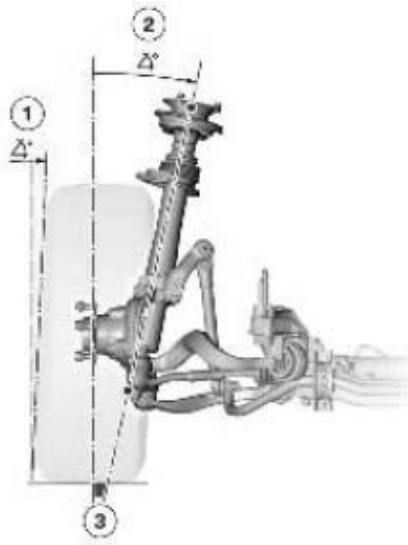


Fig. 5: Identifying Positive Kingpin Offset
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Camber
2	Kingpin inclination
3	Kingpin offset

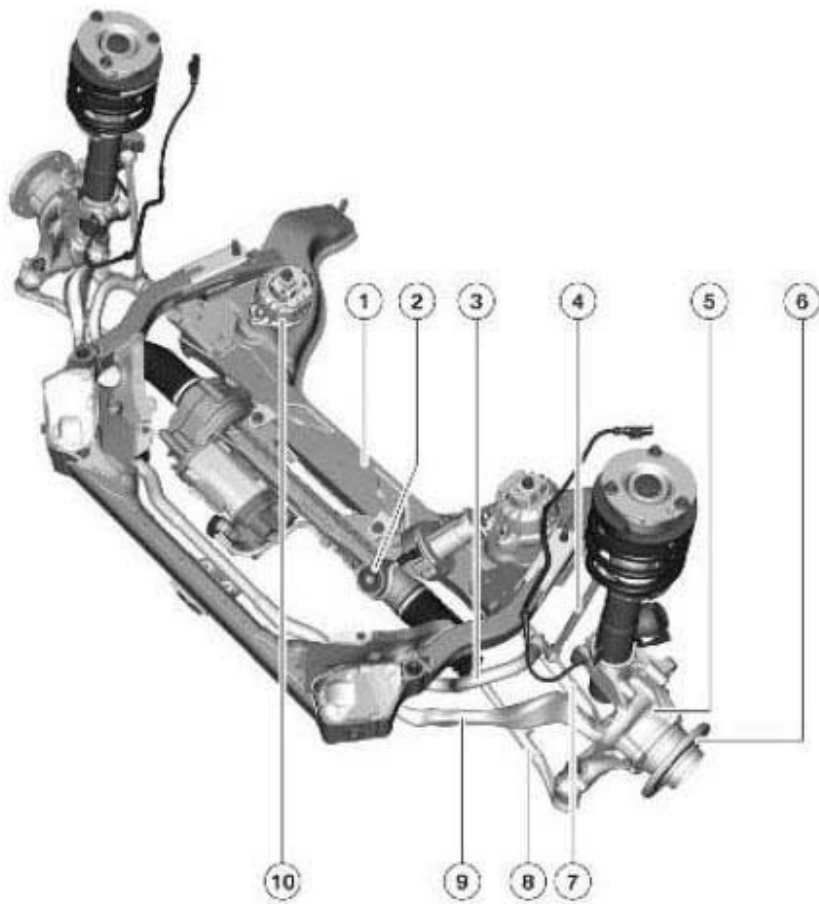


Fig. 6: Identifying E89 Front Axle Components
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Front axle carrier
2	Electromechanical power steering
3	Stabilizer bar
4	Stabilizer link
5	Swivel bearing
6	Wheel hub
7	Control arm
8	Track rod
9	Tension strut
10	Engine mount

Both tension struts are mounted with hydraulic bushings on the front axle carrier. In addition, the distance of the tension strut and control arm pivot points at the swivel bearing largely determines the vertical force lever arm. The further the joints of the tension strut and control arm are from each other at the swivel bearing, the greater

the recovery force initiated by the vehicle weight.

On the single-joint spring strut front axle, the distance is zero as the two joints of this axle have merged to form one. The resulting advantage of the double-joint spring strut front axle is improved directional stability in the high speed range and a lower tendency to steering instability in the lower speed range (less susceptible to torsional vibration in the steering wheel).

Compared to that of the control arm, the ball joint (guide joint) of the tension strut is raised at the swivel bearing, thus providing effective anti-dive control. A further advantage of this arrangement is that this tension strut mount on the axle carrier can be arranged at approximately the same level with respect to the mounting at the swivel bearing and does not have to be lowered. This is of particular benefit to a large overhang angle. In addition, it is possible to lower the control arm mount on the axle carrier side, thus enabling a lower roll center.

The single-joint axle features only one type of cross brace as the axle carrier. The double-joint spring strut front axle on the other hand features a frame which additionally provides significant stiffening of the front end.

TECHNICAL DATA

Description	E85	E89
Total toe-in	14.4'	14.0'
Track width	1473.3 mm	1511.1 mm
Camber	-34.8'	-23.3'
Kingpin inclination	15.7	14.3
Castor angle	5.9	7.2
Castor offset	17.7 mm	20.7 mm
Kingpin offset	4.7 mm	9.6 mm
Steering angle, inner	43.1	37.7
Steering angle, outer	35.3	31.2
Rim offset ET/IS	47 mm	29 mm
Tire size	225/50 R16	225/45 R17
	225/45 R17	225/40 R18
	225/40 R18	225/35 R19

Central-link Rear Axle

An adapted version of the rear axle known from the E85 with the development designation HA 3 is fitted in the E89.

The central link rear axle is an intricately constructed, weight and space saving, multi-link rear axle. The wheels are controlled by two control arms and one semi-trailing arm that is mounted at the central point on the body. The precise interaction between the semi-trailing arm and control arm ensures that the wheels remain in the best possible position with respect to the road surface, thus providing outstanding directional stability. The flexible link bearings ensure exceptional driving stability while cornering, providing the vehicle with excellent rolling and acoustic comfort.

The designation HA 3 does not refer to the three links but rather is a continuation of the development designation at BMW. The central link rear axle optimizes the following properties:

- Directional stability
- Alternating load response
- Self-steering response
- Lane change stability
- Transition response from cornering to straight ahead
- Rolling comfort.

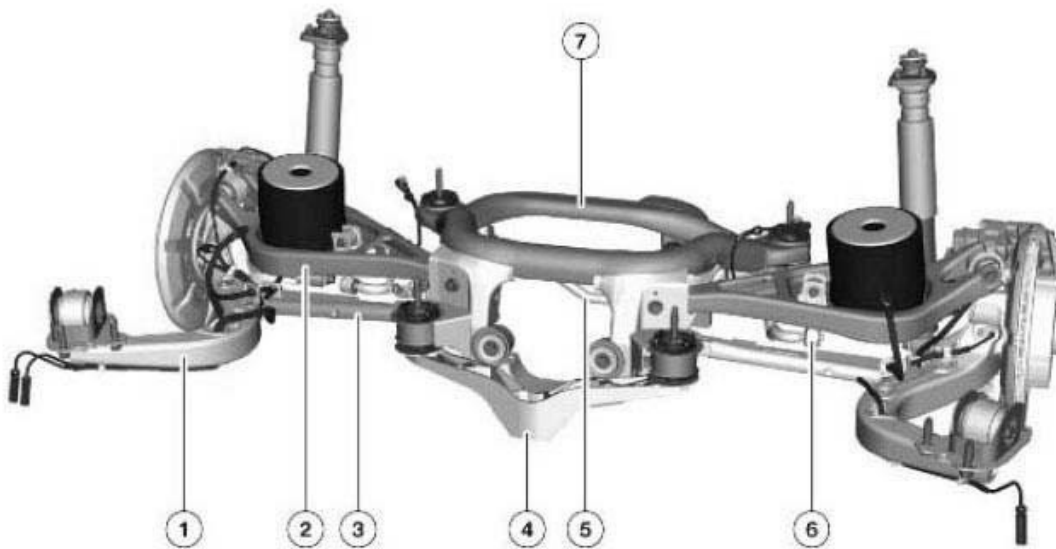


Fig. 7: Identifying E89 Central Link Rear Axle Components
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Semi-trailing arm
2	Transverse control arm, top
3	Transverse control arm, bottom
4	Thrust strut
5	Stabilizer bar
6	Stabilizer link
7	Rear axle carrier

TECHNICAL DATA

TECHNICAL DATA

Description	E85	E89
Total toe-in (angle)	22'	18'
Track width	1521 mm	1562 mm
Camber	-2 15'	-2 20'

Wheelbase	2495 mm	2496 mm
Rim offset ET/IS	47 mm (50 mm ⁽¹⁾)	29 mm (40 mm ⁽¹⁾)
Tire size	225/50 R16	225/45 R17
	225/45 R17	255/40 R17 ⁽¹⁾
	255/40 R17 ⁽¹⁾	255/35 R18 ⁽¹⁾
	255/35 R18 ⁽¹⁾	255/30 R19 ⁽¹⁾
(1) Mixed tires		

SUSPENSION REINFORCEMENT DEVICES

Support brackets are fitted on the front axle and rear axle as well as a thrust panel additionally on the rear axle to increase the body rigidity and to optimize the transfer of forces into the body. These components distribute the force input into the body over the largest possible area.

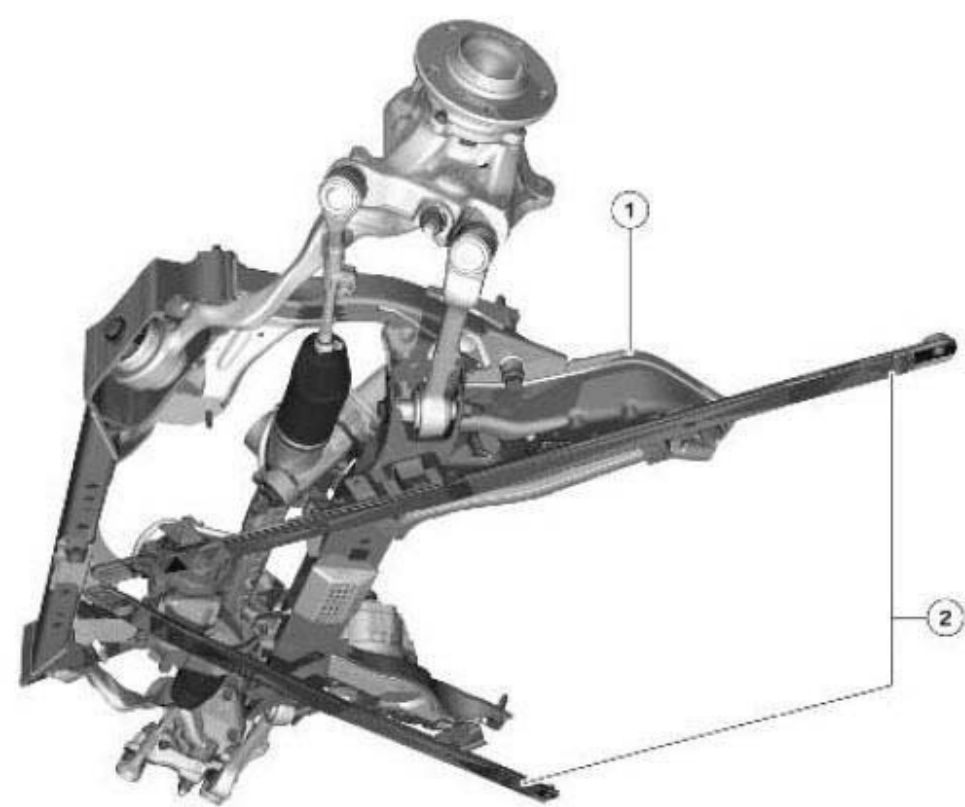


Fig. 8: Identifying Front Axle Carrier And Support Brackets
 Courtesy of BMW OF NORTH AMERICA, INC.

E89 Front axle carrier with struts

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
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1	Front axle carrier
2	Support brackets

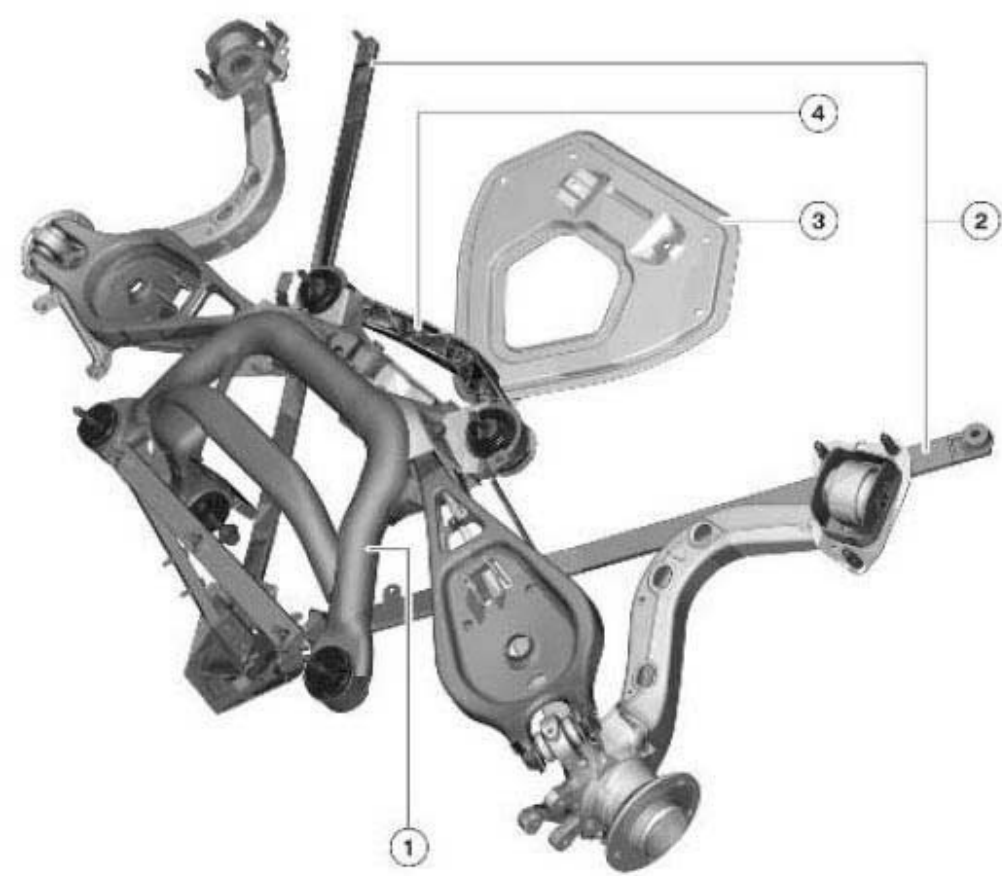


Fig. 9: Identifying Rear Axle Components
 Courtesy of BMW OF NORTH AMERICA, INC.

E89 Rear axle carrier with tension struts and thrust panel

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Rear axle carrier
2	Tension support brackets (struts)
3	Thrust panel
4	Thrust strut

BRAKES

The function and weight of the service brake have been improved. Aluminum floating calliper brakes and aluminum frame calliper brakes are fitted on the front axle. Lightweight brake discs are used on the front axle of both top models. Outstanding stability was achieved by the corresponding dimensioning. The brake pad control

principle as well as the brake callipers and brake discs secure the long-term properties in terms of surface protection, corrosion protection and unsusceptibility to soiling.

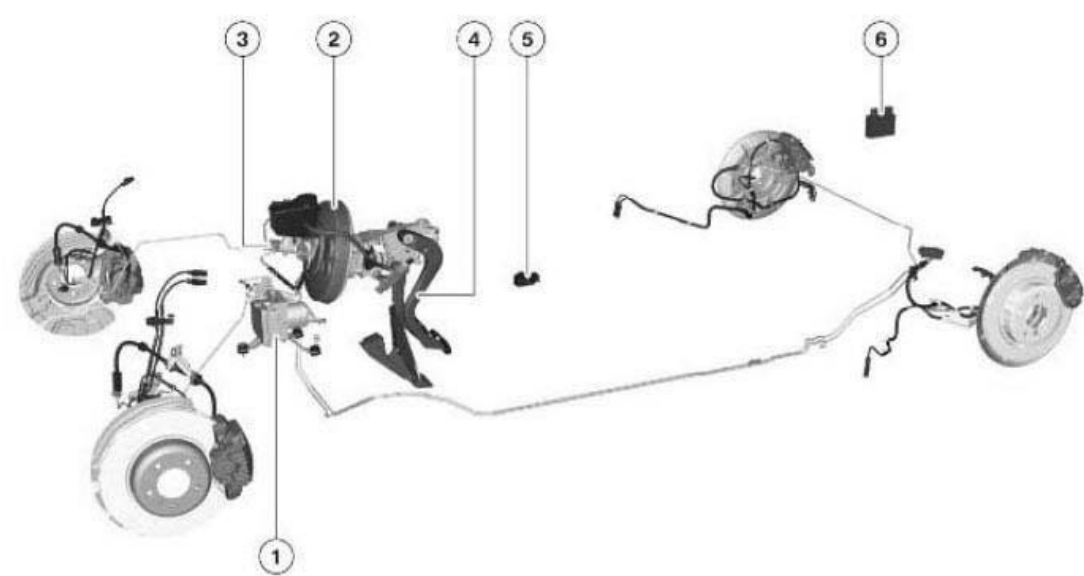


Fig. 10: Identifying E89 Service Brake Components
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	DSC unit
2	Brake booster
3	Master brake cylinder
4	Brake pedal
5	DSC sensor
6	EMF control unit

Technical Data

TECHNICAL DATA

Model	Type	Front brake disc in mm x thickness in mm	Rear brake disc in mm x thickness in mm
E85	Z4 2.5i	286 x 22 ⁽¹⁾	280 x 10
	Z4 3.0si	325 x 25 ⁽¹⁾	294 x 19 ⁽¹⁾
E89	Z4 sDrive30i	330 x 24 ⁽¹⁾	300 x 20 ⁽¹⁾
	Z4 sDrive35i	348 x 30 ⁽¹⁾	324 x 20 ⁽¹⁾
(1) Internally ventilated brake disc			

Parking Brake

For the first time at BMW, the E89 is equipped with an electromechanical parking brake integrated in the brake calliper. The use of the electromechanical parking brake offers the following advantages:

- Operation by means of a button ergonomically positioned in the center console
- Reliable application and release of the electromechanical parking brake (EMF) under all conditions
- Dynamic emergency braking function also at low friction ensured by the control systems (ABS)
- No parking brake lever means additional storage space in the area of the center console.

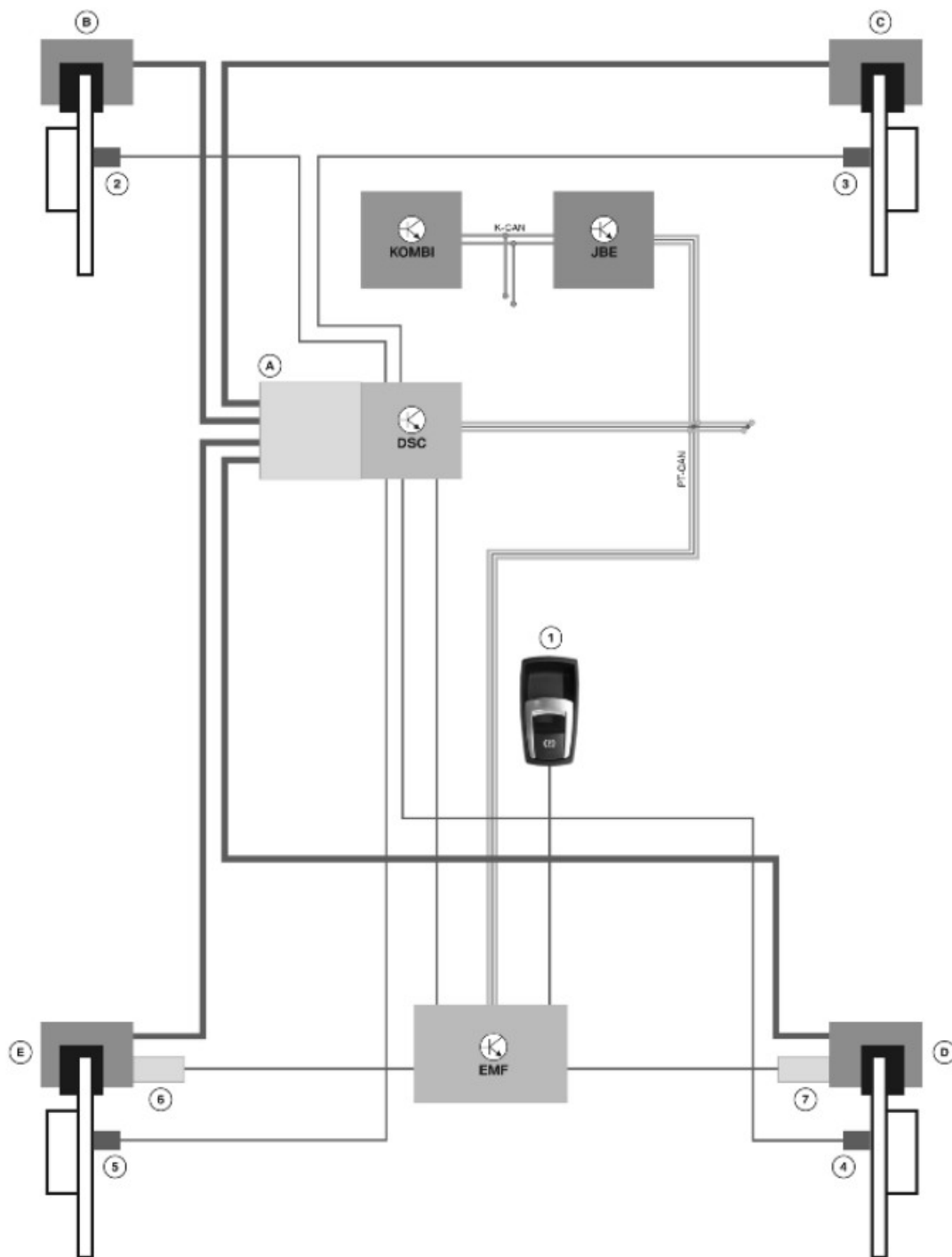


Fig. 11: System Overview - Electromechanical Parking Brake (EMF)
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
A	DSC unit

B	Brake calliper, front left
C	Brake calliper, front right
D	Brake calliper, rear right
E	Brake calliper, rear left
1	EMF button
2	Wheel speed sensor, front left (not used for EMF)
3	Wheel speed sensor, front right (not used for EMF)
4	Wheel speed sensor, rear right
5	Wheel speed sensor, rear left
6	EMF actuator, rear left
7	EMF actuator, rear right
EMF	Electromechanical parking brake
DSC	Dynamic stability control
JBE	Junction box electronics
KOMBI	Instrument cluster
PT-CAN	Powertrain-Controller Area Network

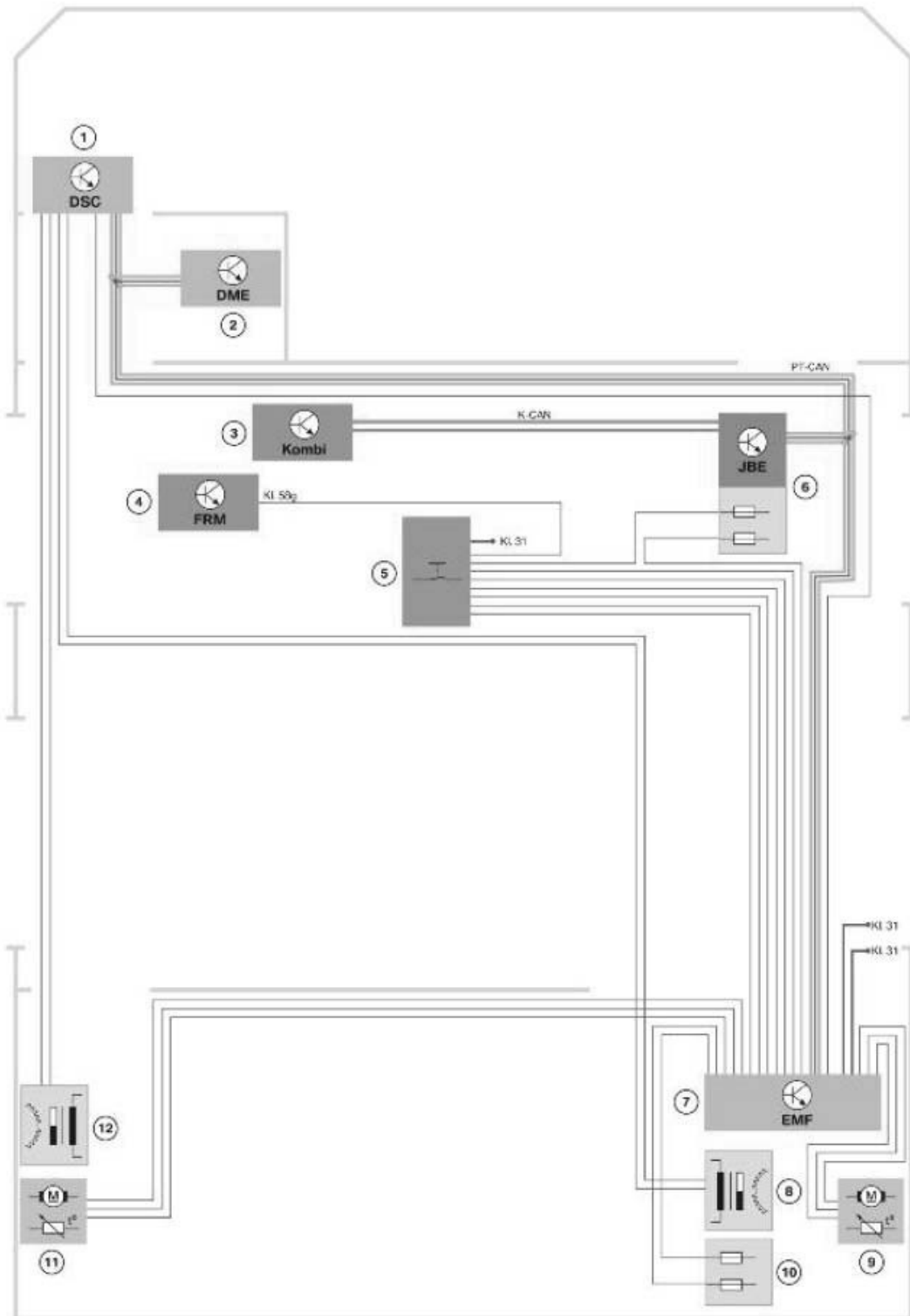


Fig. 12: System Circuit Diagram - Electromechanical Parking Brake (EMF)
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	DSC (Dynamic stability control)
2	DME (Digital motor electronics)
3	KOMBI (Instrument cluster)
4	FRM (Footwell module)
5	EMF button
6	JBE (Junction box electronics)
7	EMF (Electromechanical parking brake)
8	Wheel speed sensor, rear right
9	EMF actuator, rear right
10	Fuses
11	EMF actuator, rear left
12	Wheel speed sensor, rear left

PRINCIPLES OF OPERATION

The EMF control unit receives the driver's choice to apply the parking brake from the EMF button on the center console. The vehicle status is determined via the link to the electrical system and the bus systems and the control unit decides whether all conditions for applying the brake are met. If this is the case, the two EMF actuators on the rear brake callipers are actuated.

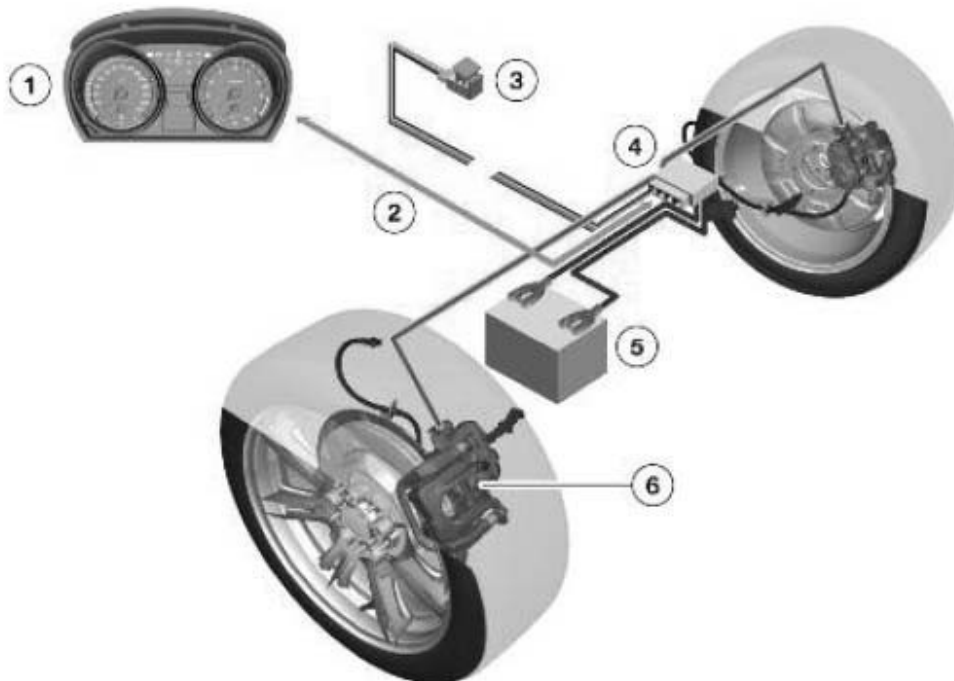


Fig. 13: E89 EMF System Overview
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Instrument cluster
2	Information flow
3	EMF button
4	EMF control unit
5	Battery
6	EMF actuator

Due to the self-locking characteristics of the spindle, the tension is retained even when no power is applied, thus firmly holding the vehicle. On reaching the required force, the applied brake status is indicated by a red indicator lamp in the instrument cluster and an additional red LED in the EMF button.

FUNCTION OF THE EMF ACTUATOR

The EMF actuator is mounted on the brake calliper and pushes directly on the back of the "normally" hydraulically operated brake piston.

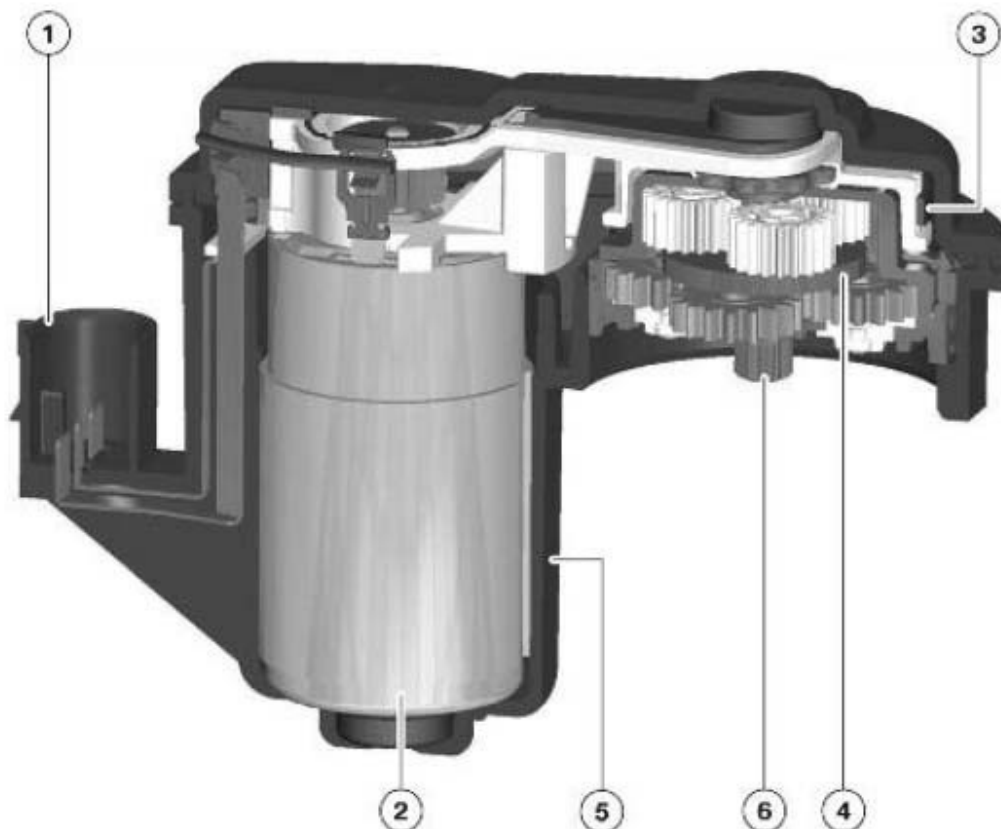


Fig. 14: Design Of EMF Actuator
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Plug connection
2	Electric motor
3	Drive belt
4	Planetary gear
5	Housing
6	Connection to spindle

The force is transmitted via electric motor (2) and drive belt (3) to a two-stage planetary gear train (4). Spindle (4) shown in the following graphic is driven by spindle connection (6). Spindle (4) in the spindle nut with anti-twist lock (2) in brake piston (3) provides the self-locking effect. The force is transmitted via the spindle and spindle nut with anti-twist lock to brake piston (3). As in hydraulically operated systems, the brake piston acts on the brake pads that are forced against the brake disc. Due to the self-locking effect of the spindle in the spindle nut with anti-twist lock, the tension is retained and the vehicle is held firmly even when no power is applied.

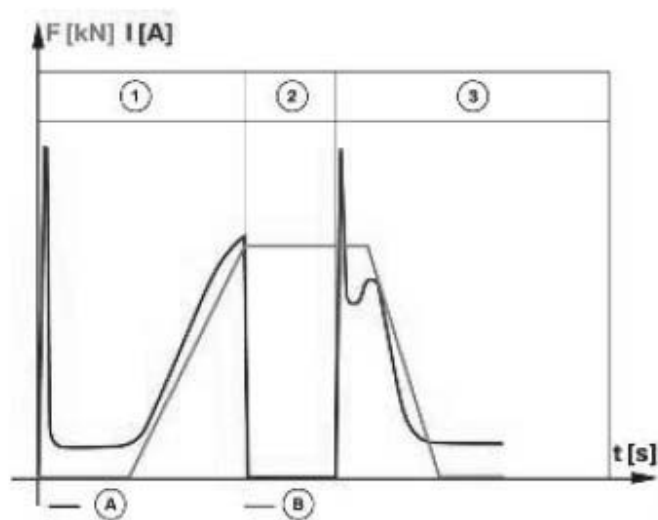


Fig. 15: E89 EMF Voltage And Force Curve
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
A	Force curve
B	Voltage curve
1	Applying EMF
2	EMF applied
3	Releasing EMF

BRAKE PISTON

The brake fluid can flow via grooves (1) past the spindle nut to ensure the brake system is completely bled. The screw-in travel is limited by spindle stop (5). This therefore prevents tightening and blocking when in open state.

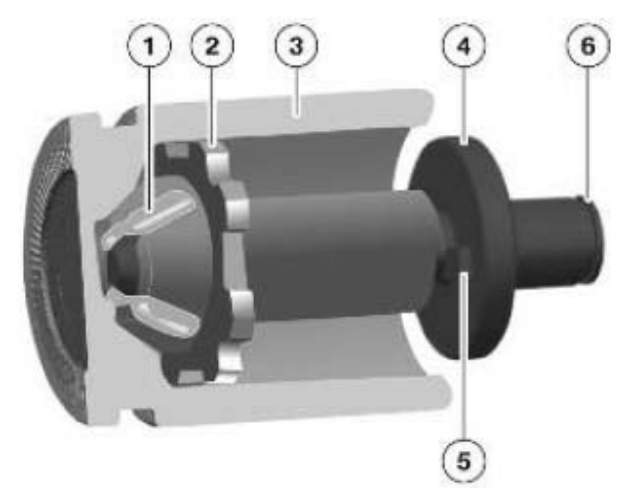


Fig. 16: Cutaway View Of Brake Piston
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Groove
2	Spindle nut with anti-twist lock
3	Brake piston
4	Spindle
5	Spindle stop
6	Connection to planetary gear

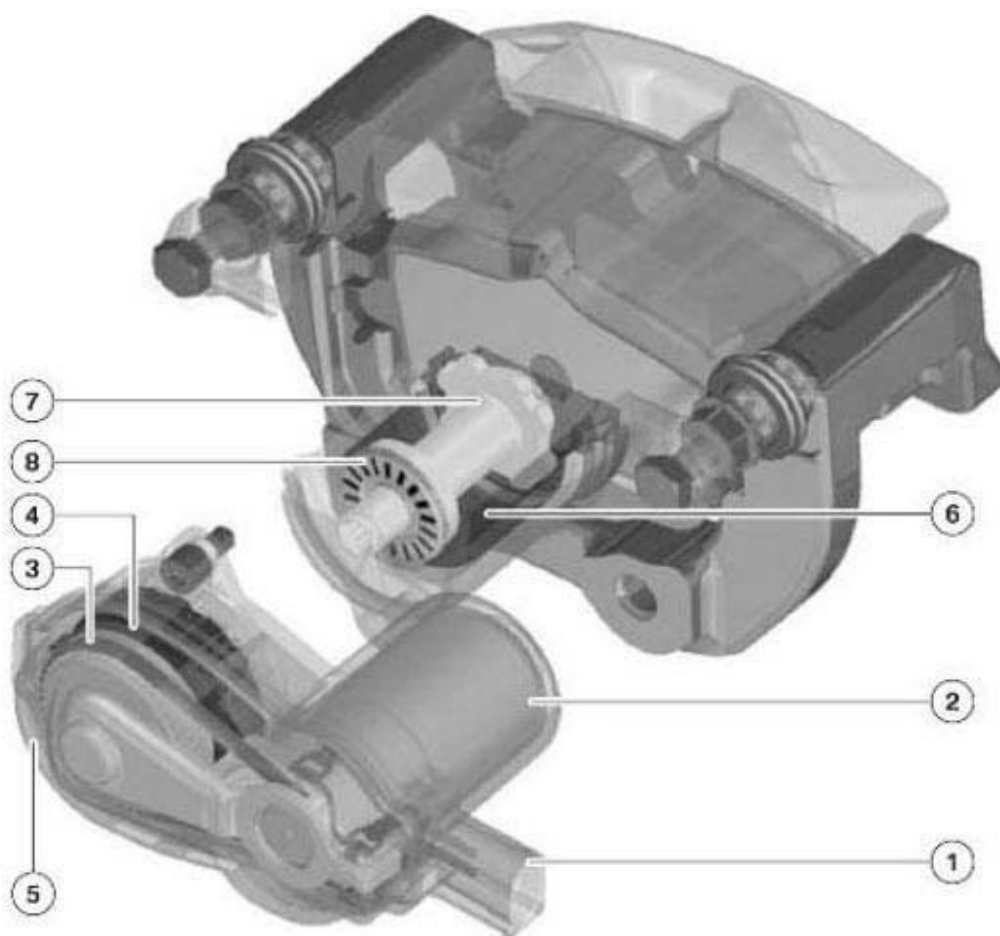


Fig. 17: Overview Of EMF Actuator With Brake Calliper
Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Plug connection
2	Electric motor
3	Drive belt
4	Planetary gear
5	Housing
6	Brake piston
7	Spindle with spindle nut
8	Roller bearing

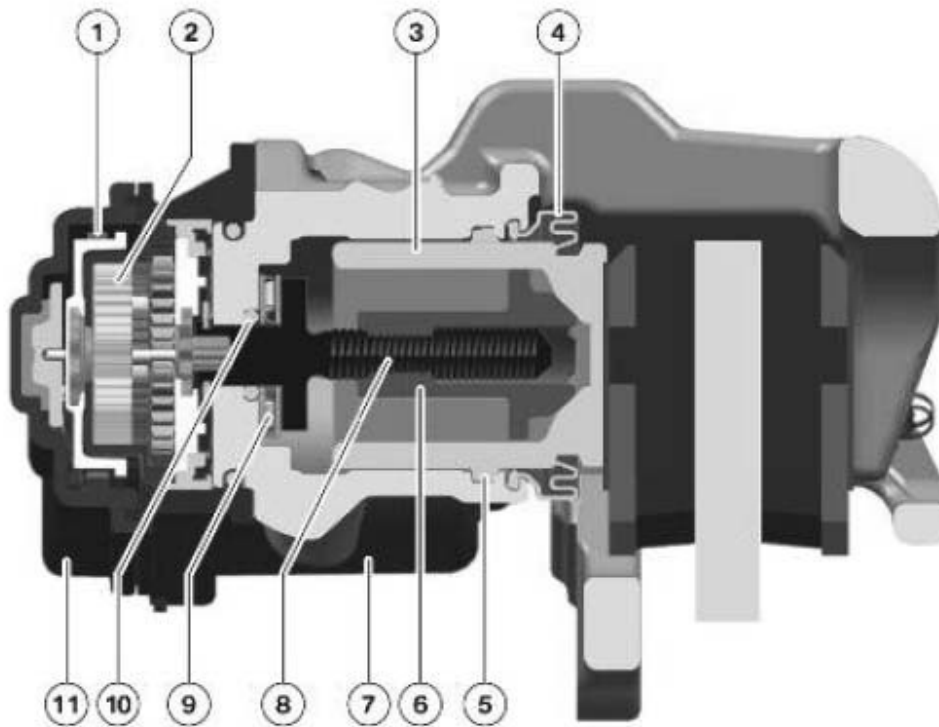


Fig. 18: Cutaway View Of E89 Parking Brake Applied With New Brake Pads
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Drive belt
2	Planetary gear
3	Brake piston
4	Dust sleeve
5	Seal
6	Spindle nut
7	Electric motor
8	Spindle
9	Roller bearing
10	Seal
11	Housing

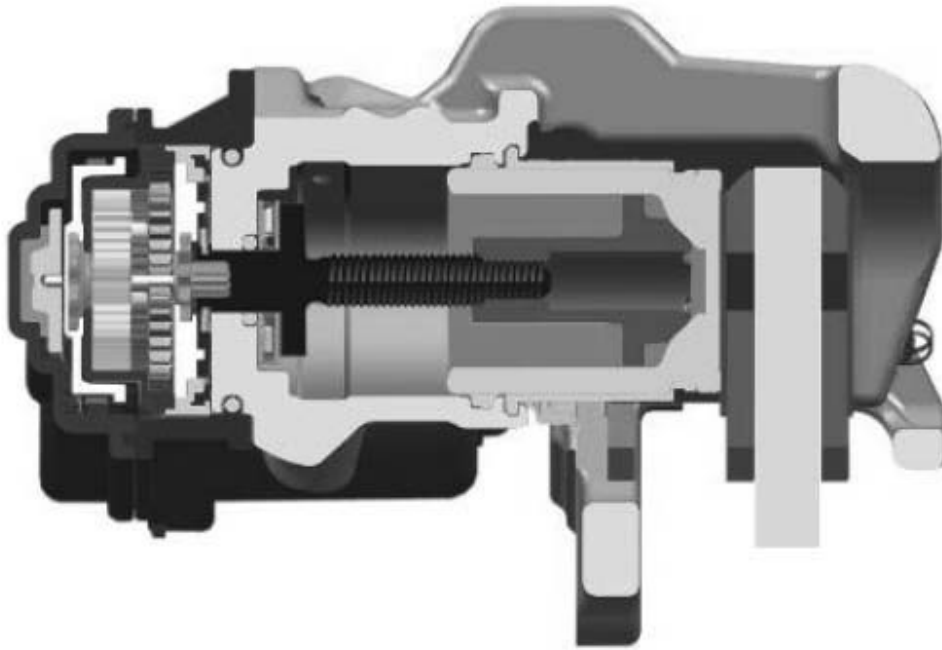


Fig. 19: Cutaway View Of E89 Parking Brake Applied With Worn Brake Pads
 Courtesy of BMW OF NORTH AMERICA, INC.

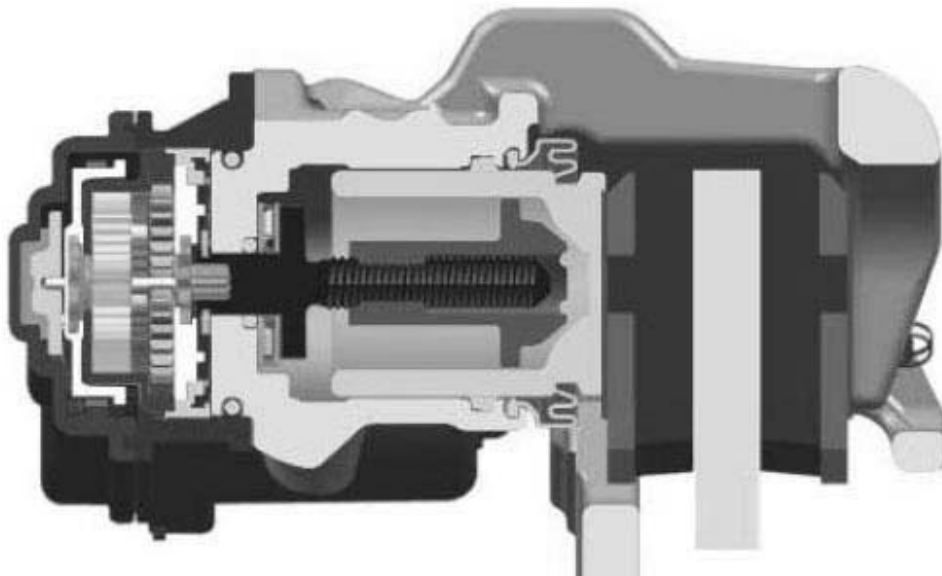


Fig. 20: Cutaway View Of E89 Parking Brake Released With New Brake Pads
 Courtesy of BMW OF NORTH AMERICA, INC.

Applying the Parking Brake

The driver can apply the parking brake by pulling the EMF button. The operating direction is the same as that of the mechanical handbrake lever.

The signal from the EMF button is read by the EMF control unit. The EMF control unit individually activates the EMF actuators at the wheel brake.

The parking brake can be applied in any logical terminal status. Applying the parking brake at terminal 0 is made possible by connecting terminal 30 to the EMF control unit. The EMF control unit is woken up when the driver operates the EMF button at terminal 0. In turn, the EMF control unit wakes the other control units in the vehicle. Only then does the EMF control unit receive the important information on the stationary status of the vehicle. In addition, the change status of the parking brake can be indicated after waking the control unit.

The parking brake applied status is indicated by a red LED in the EMF button and by the EMF indicator lamp in the instrument cluster. If the parking brake is already applied, pulling the EMF button again will have no effect.



Fig. 21: Identifying E89 Indicator Lamp, Parking Brake
Courtesy of BMW OF NORTH AMERICA, INC.

Rolling Monitor with Parking Brake Applied

This monitoring function is designed to prevent the vehicle from rolling with the parking brake applied. The rolling monitor is always activated when the status of the parking brake changes from released to applied and ends after a defined period of time after this status change.

The function ends:

- when a fault occurs that prevents mechanical retensioning
- when the vehicle assumes sleep mode, the control unit is switched off or reset.

The DSC uses a signal as the input variable for rolling detection. The tension at the EMF actuators is immediately increased as soon as this signal indicates that the vehicle is starting to roll during rolling monitoring. During the retensioning phase, the tensioning force is increased until the vehicle no longer rolls or a maximum tensioning force is reached.

Temperature Monitoring

The task of the temperature monitoring function is to compensate for the loss of force that occurs when the hot brake disc cools down. Temperature monitoring is activated when the temperature exceeds a defined value as the status of the parking brake changes from released to applied.

The DSC control unit calculates the brake disc temperature at the individual wheels and sends the corresponding value to the EMF control unit. During the status change, the higher temperature of the two brake discs is taken for the temperature monitoring function. A characteristic map contains the corresponding temperature ranges with the associated retensioning times.

The corresponding retensioning times in the characteristic map are activated depending on the temperature during the status change. The tension is increased once when the first retensioning time is reached. The tension is then increased again after the second retensioning time has elapsed and increased yet again after the third. The characteristic map may also contain the value 0 for one or several retensioning times. In these cases, the corresponding increase in tension does not take place. The function ends under following conditions:

- Occurrence of a fault that prevents retensioning
- The control unit is switched off or reset
- The last retensioning step has already been executed.

Releasing the Parking Brake

The EMF button is pushed down to release the parking brake. For the parking brake to actually release terminal 15 must additionally be on and at least one of the following conditions must apply:

- Brake pedal pressed or
- Parking lock of automatic gearbox engaged or clutch pedal pressed (only vehicle with manual gearbox).

This prevents the vehicle from inadvertently rolling if, for example, the EMF button is pressed by another occupant instead of the driver. The LED in the EMF button and the EMF indicator in the instrument cluster go out when the parking brake is released.

Activation of the EMF actuator causes the spindle to rotate. The rotation of the spindle causes the spindle nut to move a short defined distance from the brake piston.

Dynamic Emergency Braking

Two operating units for the brake are required by law. Besides the brake pedal, the second operating unit in the E89 is the EMF button in the center console. Pulling the EMF button while driving triggers dynamic emergency braking with a defined sequence via the DSC system. This function is intended for emergencies when the driver can no longer slow down the vehicle using the brake pedal. Other occupants can also stop the vehicle in this way should, for example, the driver suddenly become unconscious.

During dynamic emergency braking, hydraulic braking pressure is built up at all four wheel brakes. The DSC functions are fully active and the brake lights come on. This is an important advantage compared to a manual parking brake.

Dynamic emergency braking takes place only for as long as the driver is pulling the EMF button. The deceleration initiated by the DSC is increased in ramps. The EMF indicator lamp in the instrument cluster is activated during dynamic emergency braking. In addition, a check control message is given together with an acoustic signal in order to warn the driver of this adverse situation.

The DSC control unit prioritizes if the driver attempts to slow down the vehicle by simultaneously pressing the brake pedal and pulling the EMF button. The higher deceleration request is implemented. If dynamic emergency braking is continued until the vehicle comes to a stop, the parking brake will remain applied even after the EMF button is released. The EMF indicator lamp in the instrument cluster remains active. The driver can then release the parking brake (see **RELEASING THE PARKING BRAKE**).

Parking Brake Fault

The EMF indicator lamp in the instrument cluster lights yellow to indicate a fault in the parking brake. A check control message is also output.



Fig. 22: Identifying E89 Indicator Lamp, Parking Brake
Courtesy of BMW OF NORTH AMERICA, INC.

Emergency Release

No parking brake emergency release function is provided for the customer. The parking brake can be released using the BMW diagnosis system or the EMF actuators are removed and the spindle is turned back manually.

Changing Brake Pads

To change the brake pads, the EMF actuator must be in the fully opened position so that the brake piston can be pushed back. The BMW diagnosis system can be used to actuate the EMF actuators and assume the fully opened position. This position is necessary to change the brake pads. Installation mode is set automatically on reaching the installation position.

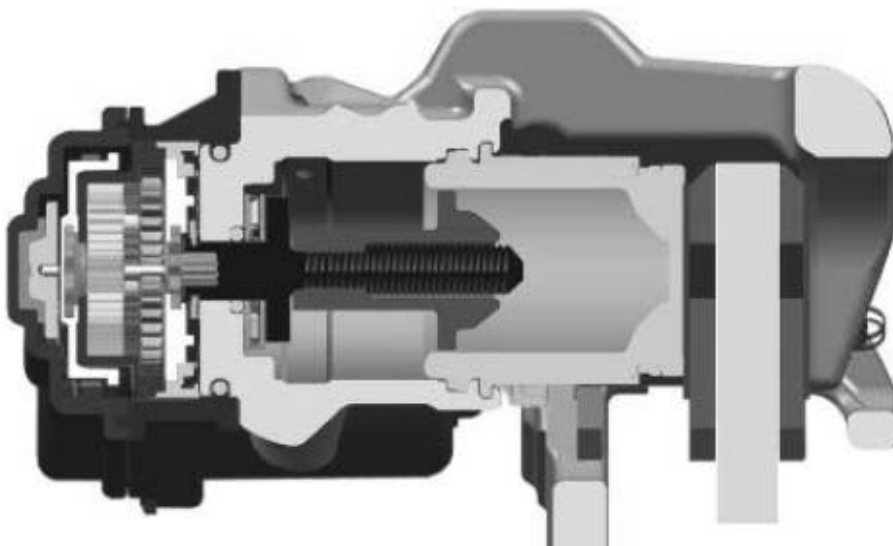


Fig. 23: Cutaway View Of E89 Parking Brake With Spindle Nut In Installation Position For Changing Brake Pads
Courtesy of BMW OF NORTH AMERICA, INC.

For safety reasons, the parking brake cannot be activated for as long as the EMF control unit is in

installation mode. If the EMF button is pulled, the EMF indicator lamp in the instrument cluster will flash yellow.

Installation mode can be cancelled in two ways:

- By carrying out the service function Reset Installation Mode with the aid of ISTA
- By driving the vehicle and exceeding a programmed minimum speed.

After being changed, the brake pads must be bedded-in. This is necessary to ensure the brake pad and brake disc pairing assumes the specified friction parameters. Only then will the required braking force be reached.

The exact procedure for bedding-in the service brakes is described in the Repair Instructions. The instructions must be followed exactly.

Brake Test Rig Recognition

The EMF control unit recognizes the brake test rig based on a plausibility check (wheel speed comparison) and assumes brake test rig mode. The following target positions are assumed in succession by pulling the EMF button several times:

- Brake pads applied
- Force 1 for brake test rig
- Force 2 for brake test rig
- Target force.

The EMF indicator lamp flashes slowly when brake test rig mode is activated and the EMF actuators are released.

The EMF indicator lamp begins to flash fast when brake test rig mode is activated and EMF actuators are partially applied.

The EMF indicator lamp lights permanently when brake test rig mode is activated and EMF actuators are fully applied.

The parking brake can be released on the brake test rig without pressing the brake pedal or clutch pedal.

Brake test rig mode is automatically cancelled on exiting the brake test rig. The mode is also deactivated by pressing the EMF button or if a fault occurs.

CHECK CONTROL MESSAGE REFERENCE CHART

Description	Check control message	Central information display	General brake indicator lamp	Parking brake indicator lamp	Check control symbol
For safety reasons,	Additionally press foot				

the parking brake can only be released with the service brake pedal depressed	brake Manual gearbox: Additionally press foot brake or clutch	-	-	-	
The driver must immediately be made aware of a fault in the EMF button	-	-	-		-
Parking brake applied mechanically	-	-	-		-
Redundant EMF button fault, workshop visit required as soon as possible	Parking brake fault!	Parking brake fault. Have checked by BMW Service dealer	-		
Mechanical application of parking brake no longer possible, dynamic emergency braking (emergency brake function) still available	Parking brake fault!	Parking brake fault. Not operative when vehicle stationary. Emergency braking function still possible. Have checked by nearest BMW Service dealer.	-		

CHECK CONTROL MESSAGE REFERENCE CHART

Description	Check control message	Central information display	General brake indicator lamp	Parking brake indicator lamp	Check control symbol
Dynamic emergency braking (emergency		Parking brake fault. No emergency braking function.			

brake function) no longer possible, mechanical brake application still possible	Parking brake fault!	Parking brake can be applied with vehicle stationary. Have checked by your BMW Service dealer.	-		
Parking brake completely failed, mechanical parking brake cannot be applied, no emergency braking function	Parking brake failed!	Parking brake failed. Secure vehicle to prevent it rolling away. Have checked by nearest BMW Service dealer.			
Warning when driving off - parking brake or dynamic emergency braking applied	Release parking brake	-	-		
Installation mode (only with EMF button operated)	-	-	-		-

Suspension and Damping

Basic Suspension Setup

The spring struts on the front axle are made of steel and are connected in a clamp arrangement to the aluminum wheel carrier. Two-tube gas-pressurized dampers are used.

The piston rods on the front axle are hollow. The piston in the shock absorbers are coated with PTFE (colloquially also known as Teflon).

The coil springs on the front and rear axle have been optimized in terms of their tension and weight. To ensure a constant ride height is achieved depending on the engine and vehicle equipment, as on all BMW vehicles, different springs are used that are adapted to the specific vehicle weight.

Stabilizer bars are used on the front and rear axles. For weight reasons, the stabilizer bar on the front axle is of a tubular/hollow design.

Adaptive M Chassis and Suspension

The adaptive M suspension setup is lower by 10 mm. Four continuously adjustable shock absorbers in the optional Adaptive M chassis and suspension achieve variable damping forces to suit the driving situation by means of coupled tension/compression stage adjustment (continuous electronic damper control EDC-K). The shock absorbers are automatically set harder (more dynamic/sporty) or softer (more comfortable) corresponding to the driving situation.

In contrast to the E70/E71 and F01/F02 a bus system is not used in the E89 for data transfer. The VDM control unit is responsible for controlling the vertical movements. On the E89, the EDC-K function is integrated in the VDM control unit. The E89 does not feature any other vertical dynamics systems.

The EDC-K system on the E70/E71 and F01/F02 is known as vertical dynamics control. The designation was changed because the actuator units for the dampers are controlled by satellites on the shock absorbers and data transmission from the VDM control unit to the satellites takes place via FlexRay.

Also on the E89, the damper control can be influenced by means of the dynamic driving control switch on the center console. Two characteristic curves are used, which, in addition to a comfortable characteristic (normal) additionally enable another distinctly sports-orientated characteristic (sport).

HISTORY OF ELECTRONIC DAMPING

HISTORY OF ELECTRONIC DAMPING REFERENCE

	EDC M3	EDCI	EDCII	EDCIII	EDC-K	VDCI	VDCII	EDC
Model	E30	E32, E34	E24	E31, E32, E34, M5, E38, E39	E65, E66	E70, E71	F01, F02	E89
Introduction	1987	1987	1989	1990	2001	2006	2008	2009
Operation	Rotary switch	Rocker switch	Pushbutton	Rocker switch	Controller	Dynamic driving switch	Dynamic driving switch	Dynamic driving switch
Damper levels	Comfort, Normal, Sport	Comfort, Sport	Comfort, Sport	Comfort, Sport	Continuous	Continuous	Continuous	Continuous
Selection via control	Comfort, Normal, Sport	Comfort, Sport	Comfort, Sport	Comfort, Sport	Comfort, Sport	COMFORT, Sport	COMFORT, NORMAL, SPORT, SPORT+	NORMAL, SPORT, SPORT+
Additional sensors	None	None	1x Vertical ⁽¹⁾ , Steering angle	2x Vertical ⁽¹⁾ , 1x Longitudinal ⁽¹⁾ , 1x Steering angle	3x Vertical ⁽¹⁾	4x EDC satellites, x Ride-height sensors	4x EDC satellites, 4x Ride-height sensors	3x Vertical ⁽¹⁾ 2x Ride height sensors
Gas								

pressurized shock absorber	Two-tube	Two-tube	Two-tube	Two-tube	Two-tube	Two-tube	Two-tube	Two-tube
Diagnostic capabilities	No	No	Yes	Yes	Yes	Yes	Yes	Yes
(1) Acceleration sensor								

NOTE: In order to simplify the description of the system, the continuous electronic damper control on the E89 is simply referred to as EDC.

Design

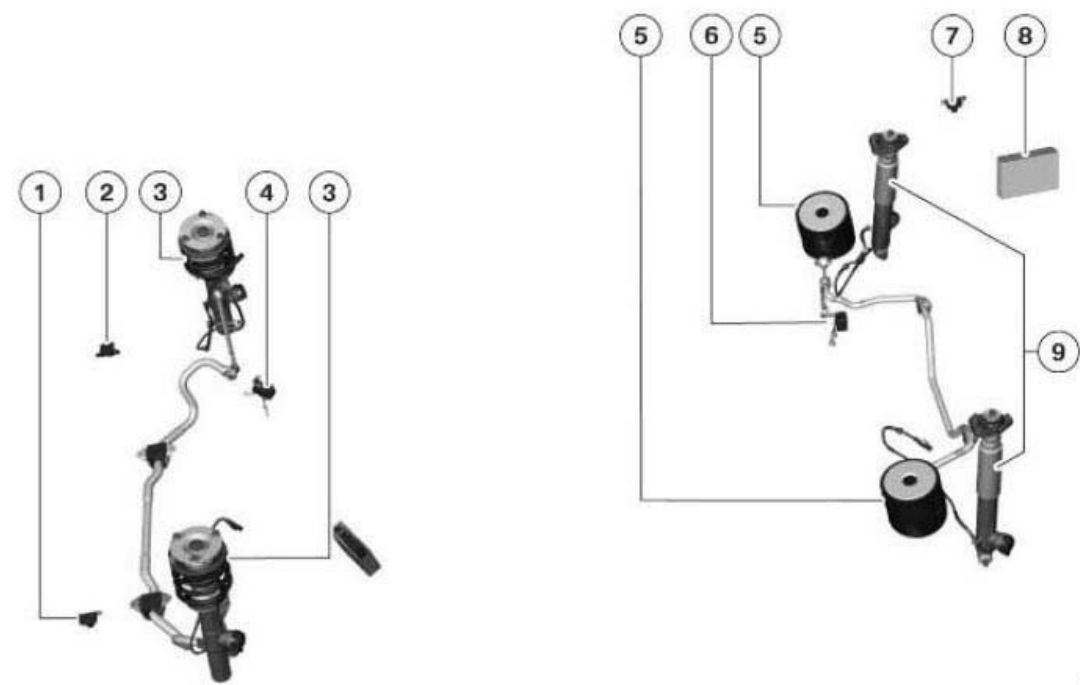


Fig. 24: Design Of E89 Adaptive M Chassis And Suspension
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	Acceleration sensor, front left
2	Acceleration sensor, front right
3	Spring strut, front
4	Ride-height sensor, front
5	Springs, rear
6	Ride-height sensor, rear
7	Acceleration sensor, rear right

8	VDM control unit
9	Shock absorber, rear

Function

The input parameters such as road condition, vehicle load and driving style are registered directly by the system and used to activate the corresponding characteristic map as required. This results in improved damping over a broad range with distinct comfort and safety advantages.

The aim of EDC is to clearly increase vibration comfort (vehicle movement) without compromising on driving characteristics (wheel-related movement) and safety. Three acceleration sensors register the driving dynamics of the vehicle and send the data each over a separate data line to the VDM control unit. Sensors register the following values:

- Vehicle speed
- Vertical acceleration
- Longitudinal acceleration and deceleration
- Steering angle
- Ride height.

The EDC valves are set to the hard position when no power is applied (failsafe position). The EDC valves are actuated by the VDM control unit and are set towards soft. The VDM control unit contains adaptive controllers with four output stages and converts the signals corresponding to a defined characteristic map. For this purpose, the four EDC valves on the shock absorbers are actuated independently (wheel-individual).

An EDC valve externally mounted on each shock absorber is responsible for controlling the oil flow in the tension and compression stages (damping). The shock absorbers are automatically set harder (increases dynamics) or softer (increased comfort) corresponding to the driving situation. In the event of the VDM control unit failing, the power supply to the EDC valves is disconnected and they are closed mechanically by springs, thus fixing the EDV valves in the hard position.

The dynamic driving switch makes it possible to additionally influence the control system.

Sensors

Additional sensors and information from existing systems are required to ensure the EDC operates correctly.

For instance, the EDC receives information on the vertical acceleration as the springs compress and recoil from the three additionally installed acceleration sensors. The acceleration sensors are fitted on the front left, front right and rear right. The acceleration sensors on the front and rear axles make it possible to register the movement of the vehicle body with respect to the road surface.

The steering column switch cluster makes available the rate of change in the steering angle in the form of a signal on the PT-CAN. The signal for the front left and front right wheel speed is also made available on the PT-CAN. The signal is provided by the DSC control unit.

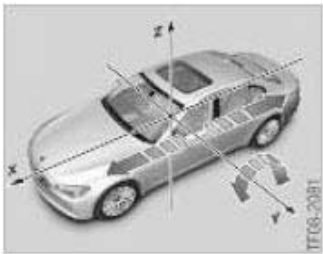
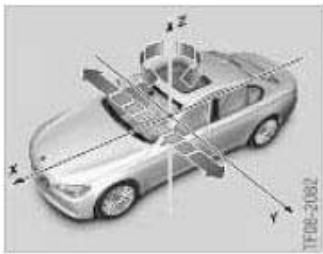
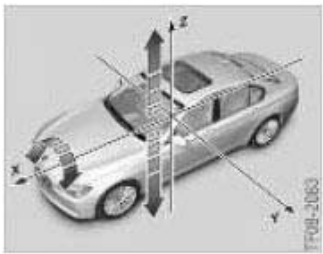
The DSC sensor makes available the longitudinal acceleration signal on the PT-CAN. The ride-height values are registered by a ride-height sensor on the front axle and on the rear axle and are also made available.

Dynamic Driving Systems

Overview

Fundamentally, the dynamic driving systems can be divided into three acceleration axes. The X-axis denotes the longitudinal dynamics, the Y-axis the transverse dynamics and the Z-axis the vertical dynamics. All dynamic driving systems act on one or several axes. The following overview shows the dynamic driving systems available for the E89 together with the effective axes.

DYNAMIC DRIVING SYSTEMS REFERENCE CHART

Effective direction			
DSC	sq. root	sq. root	
EPS		sq. root	
VDM			sq. root
DCC	sq. root		

Dynamic Stability Control DSC

The following table shows an overview of the subfunctions combined in the DSC.

DYNAMIC STABILITY CONTROL DSC FUNCTION CHART

Function	Subfunction	Description
ABS		Anti-lock brake system
	EBV	Electronic braking force distribution
	CBC	Cornering brake control (counteracts oversteer)
	DBC	Dynamic brake control
ASC		Automatic stability control
	MMR	Engine torque control
	MSR	Engine drag torque control
	BMR	Braking torque control
DSC		Dynamic stability control
	GMR	Yaw moment control
	SDR	Thrust differential control
	DTC	Dynamic traction control

Vertical Dynamics Management VDM

Electronic damper control EDC is used as the vertical dynamic system in the E89. The EDC function is integrated in the VDM control unit. The sales designation for the E89 is Adaptive M suspension.

Dynamic Cruise Control DCC

The option SA544 Cruise Control with Brake Function (also known as also known as Dynamic Cruise Control) is available for the E89.

Dynamic Driving Control in the E89

Compared to the E85/E86, the new dynamic control in the E89 has two new features:

- All dynamic driving systems available in the vehicle are influenced in full.
- Three levels are available. The status of the dynamic stability control is also taken into account thus making two further levels possible.

Dynamic Driving Switch

The E85/E86 was equipped with a SPORT button that influences several systems. The SPORT button switched the steering, automatic transmission and accelerator pedal between a standard mode and a sports mode. This made it possible to match these three systems more effectively in the two available modes. As a result, the customer experienced a vehicle trimmed to a sports driving style without compromise in sports mode.

Dynamic driving control is activated by a new dynamic driving switch and the DTC button arranged directly in front of it. Dynamic driving control combines the activation of many vehicle drive and dynamic driving functions.

The overall vehicle then assumes the characteristics that the driver expects in the selected drive range. With this bundling of functions, the vehicle characteristic can be set considerably more pronounced and less compromising. In response, the large number of, in part, unfeasible individual combinations is avoided (for example: sports steering and comfort-orientated damping).

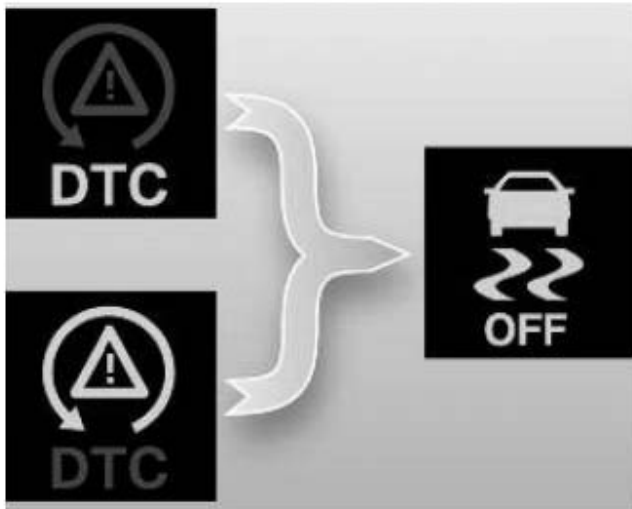


Fig. 25: Identifying DSC And DTC Symbols (With New Standardized Symbols)
 Courtesy of BMW OF NORTH AMERICA, INC.

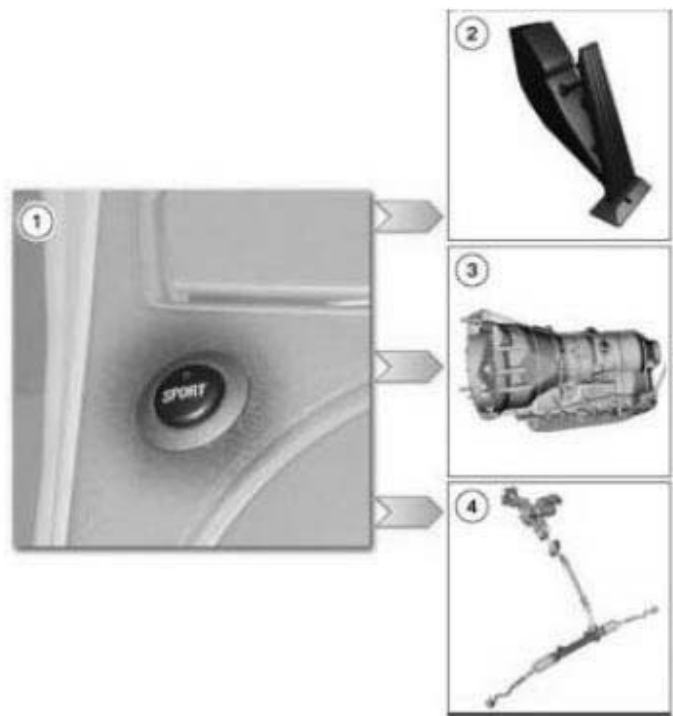


Fig. 26: Identifying SPORT Button In E85/E86
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	SPORT button
2	Accelerator pedal

3	Automatic gearbox
4	Steering



Fig. 27: Identifying DTC Button And Dynamic Driving Switch
 Courtesy of BMW OF NORTH AMERICA, INC.

INDEX EXPLANATION REFERENCE CHART

Index	Explanation
1	DTC button
2	Dynamic driving switch

Central Information Display CID

In addition to the indicator in the instrument cluster, an assistance window also appears in the CID when the DTC button or dynamic driving switch is pressed. The newly selected mode is shown here and explained by an additional text.

Modes and Their Effects

The entire vehicle has a coherent response due to the fact that the individual systems are switched jointly and in a co-ordinated manner. This configuration avoids unfeasible combinations. For instance, this configuration rules out a sports accelerator pedal characteristic together with an extremely comfort-orientated shift program of the automatic transmission. The following table shows the possible combinations and the five available modes.

DYNAMIC DRIVING SWITCH SPECIFICATION CHART

	Dynamic driving switch	DTC button

Mode	NORMAL			Sport			SPORT+			TRACTION			DSC OFF		
Vehicle setup	Comfort			Sport			Sport			Comfort			Comfort		
Drive systems															
Accelerator pedal characteristic	Comfort			Sport			Sport			Comfort			Comfort		
Mode, automatic gearbox	D	DS	M	D	DS	M	D	DS	M	D	DS	M	D	DS	M
Gearshift program, automatic gearbox ⁽¹⁾	XE	S	M	S	S	M	S	S	M	XE	S	M	XE	S	M
Gearshift speed, automatic gearbox ⁽²⁾	N	S	S	S	S	S+	S	S	S+	N	S	S	N	S	S
Vehicle Chassis, suspension and dynamic driving systems															
Power steering	Basic			Sport			Sport			Basic			Basic		
DSC	DSC ON			DSC ON			DTC			DTC			DSC OFF		
Vertical dynamics management	Basic			Sport			Sport			Basic			Basic		
(1) 1XE = Extremely economical gearshift program; S = Sports gearshift program; M = Manual gearshift program															
(2) 2N = Normal shift speed, S = Fast shift speed, S+ = Very fast shift speed															

The modes (D, DS, M) of the automatic gearbox are selected via the selector switch and shift paddles.

As before, DS mode is engaged by shifting the selector lever to the left. The selector lever locks in this position. The sports program can only be engaged from D. The manual gearshift program M is selected by shifting the selector lever forward or back in the sports program. The manual gearshift program M is also selected by pressing the shift paddles in D or DS mode.

GENERAL INFORMATION

Chassis Dynamics - Overview - All Models

INTRODUCTION TO CHASSIS DYNAMICS

Model: All

Production: All

INTRODUCTION TO CHASSIS DYNAMICS

One of the trademark characteristics of a BMW is its ability to handle like a sports car and still provide a pleasing driver experience. To keep ahead of the competition, BMW has continually raised the bar from a performance standpoint. BMW engines are usually "Best in Class" in the premium segment. However, to remain a leader it is not only the engine which must outperform the rest of the pack. The chassis must allow for optimal comfort and safety as well as superior handling and braking.

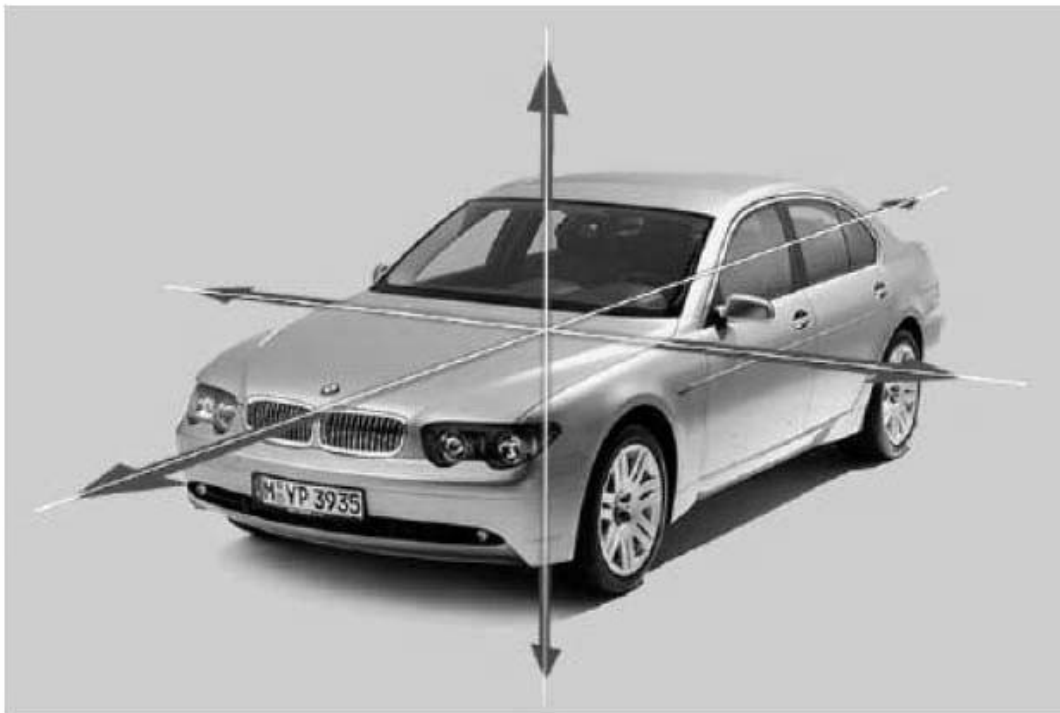


Fig. 1: Identifying Chassis Dynamics

Courtesy of BMW OF NORTH AMERICA, INC.

This training module will help the technician understand the basics of vehicle dynamics. Terminology, as it applies to BMW chassis systems, will also be explained in this section. A thorough understanding of current chassis technology is needed to diagnose and perform service procedures of these vehicles.

The information learned in this training module will provide fundamental knowledge needed to understand such

systems as Dynamic Stability Control, Active Steering and Active Roll Stabilization.

Vehicle Dynamics

A vehicle's cornering performance is also referred to as its self-steering properties. This handling performance is considerably influenced by the changing ratio of lateral force to wheel load on the front and rear axles. Lateral force increases as centrifugal force increases.

BMW vehicles are designed to have the best possible weight balance. A 50/50 weight ratio between the front and rear axles is always the intended design target.

The engineers at BMW always strive to achieve these goals during the design process. This effort can be seen by the use of lightweight components. New materials such as aluminum, magnesium and high-strength steel are used throughout various models. Even new materials, such as plastic, have been incorporated into the body.

For example, the E60 takes advantage of the lightweight front end technology (GRAV). On all modern BMW vehicles, the vehicle battery is installed in the rear of the vehicle for better weight balance.

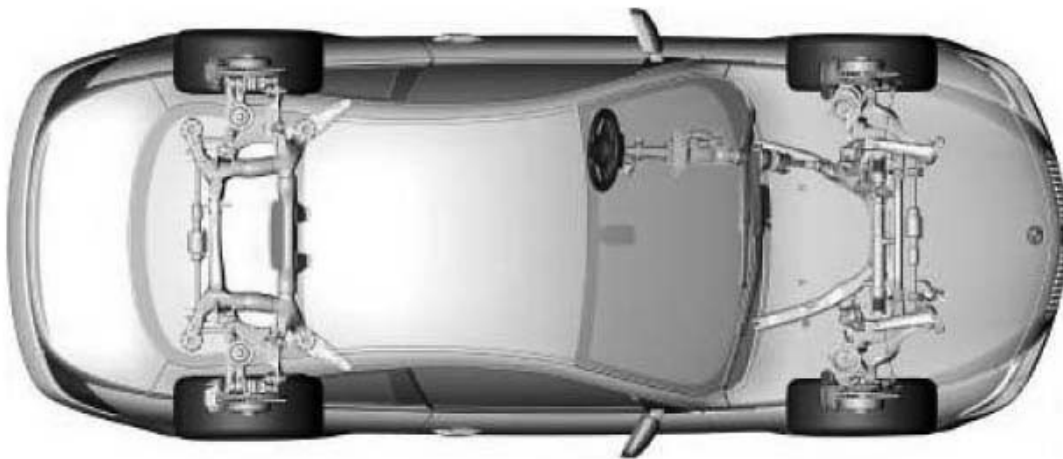


Fig. 2: BMW Vehicle Designed With Weight Balance
Courtesy of BMW OF NORTH AMERICA, INC.

Neutral Steer

The slip angles arising as a result of lateral force are the same on the front and rear axles. Neutral cornering facilitates the best use of lateral forces and thereby the highest limit cornering speeds. However, it also reduces the subjective feel for vehicle stability. In addition the breakaway cannot be calculated as it can occur via both the front and rear axles.

Understeer

The ratio of lateral force to wheel load is greater on the front axle than on the rear. The vehicle follows a larger cornering radius than that corresponding to the steering angle. It also slides to the outside of the turn via the front axle. When designing the chassis, this behavior is often the preferred option, because when the vehicle breaks away it can be returned to a straightline course which it is possible to calculate. Take, for example, a

vehicle which begins to break away via the front axle while being driven to the limits; if the steering angle is then reduced, the vehicle will recover to assume a straightline course.

BMW chassis are designed so that they have slight understeer characteristics.

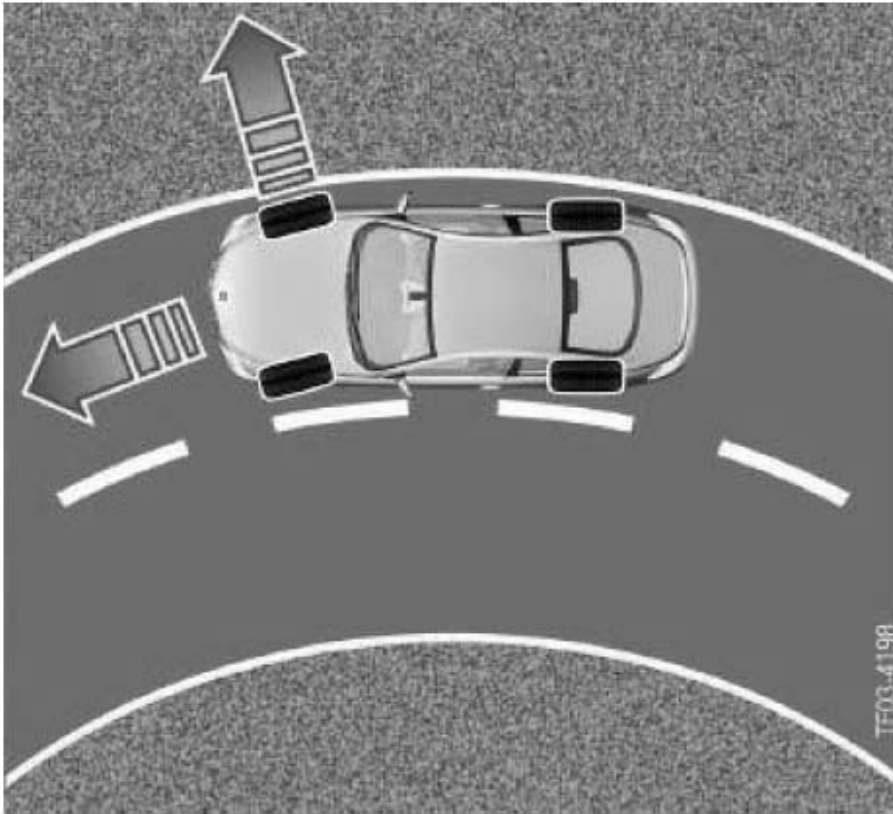


Fig. 3: Identifying Understeer
Courtesy of BMW OF NORTH AMERICA, INC.

Oversteer

The ratio of lateral force to wheel load is greater on the rear axle than on the front. The vehicle follows a smaller radius than that corresponding to the steering angle. The vehicle slides to the outside of the turn via the rear axle.

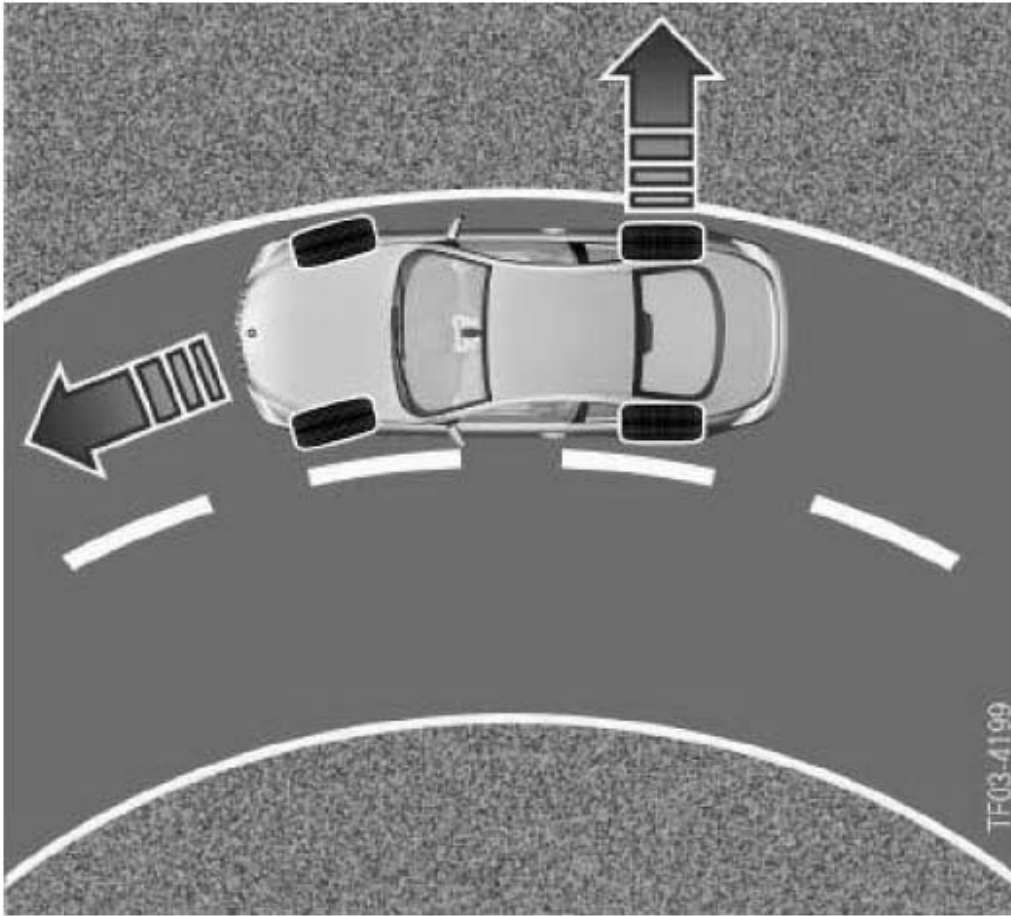


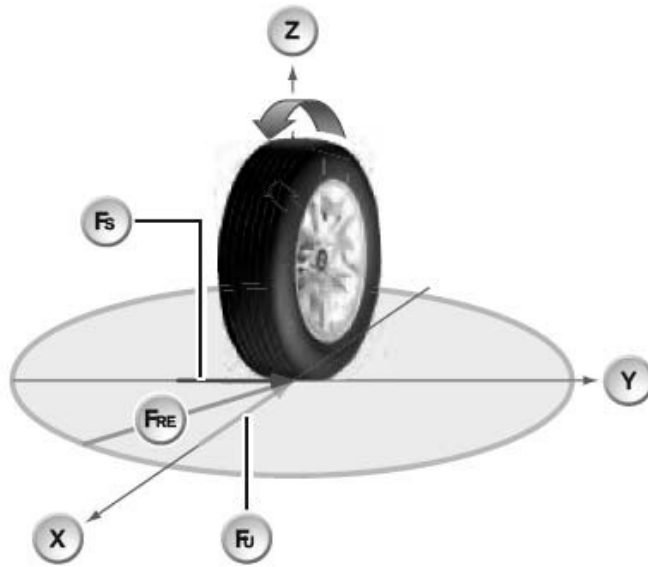
Fig. 4: Identifying Oversteer
Courtesy of BMW OF NORTH AMERICA, INC.

Chassis Forces

The chassis connects the vehicle with the road. Both force and drive torque are transferred to the road via the chassis. The chassis also has to absorb all cornering forces when the vehicle is cornering.

The chassis is therefore exposed to a huge number of forces and moments all of which act in different ways. It is essential that all these forces and moments can be transmitted in an optimum way via the tire contact areas.

As vehicles get more powerful and demands for ride comfort and driving safety rise, so the demands placed on the modern chassis increase considerably too.



Index	Explanation	Index	Explanation
Fv	Wheel contact force	Fre	Resulting force
Fu	Driving force	K	Maximum force
Fs	Cornering force	X,Y,Z	Coordinate axes

Fig. 5: Identifying Chassis Forces
Courtesy of BMW OF NORTH AMERICA, INC.

Kinematics

From a physics point of view, kinematics are the laws which give rise to sequences of movements.

Where chassis engineering is concerned, kinematics is the sequence of movements at the wheels and wheel-guiding components. Kinematics therefore have a direct effect on the position of the wheel for the respective load conditions.

Longitudinal Forces

Longitudinal forces act on the vehicle through the vehicle centerline. These forces are created by acceleration and braking. Also, any up or downhill movement will influence the longitudinal forces acting of the vehicle.



Fig. 6: Identifying Longitudinal Forces
Courtesy of BMW OF NORTH AMERICA, INC.

Lateral Forces

Lateral forces are also known as "transverse" forces. These forces are most prevalent during turns. Crosswinds also contribute to lateral force.



Fig. 7: Identifying Lateral Forces
Courtesy of BMW OF NORTH AMERICA, INC.

Rotational Forces

Rotational forces are more commonly known as "yaw". Yaw motion is the vehicle rotation around a vertical axis. These forces are also experienced during turns. The speed of this force indicates the degree of turning force.

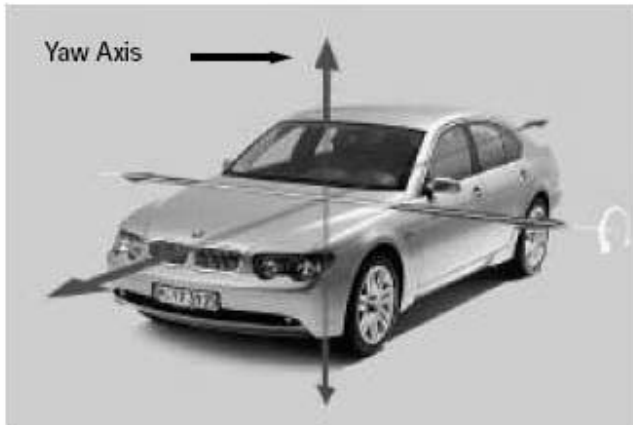


Fig. 8: Identifying Rotational Forces
 Courtesy of BMW OF NORTH AMERICA, INC.

Tire contact area

The tire contact area is the area which is covered by the wheel standing on the road.



Fig. 9: Identifying Tire Contact Area
 Courtesy of BMW OF NORTH AMERICA, INC.

Tire contact patch

The tire contact patch is the effective contact area of a tire in operation. It is therefore the tire contact area which is deformed by interfering forces (lateral forces, braking and acceleration forces) and by road surface quality.

The tire contact patch therefore describes the area of road which is touched by the tire when the vehicle is in operation.

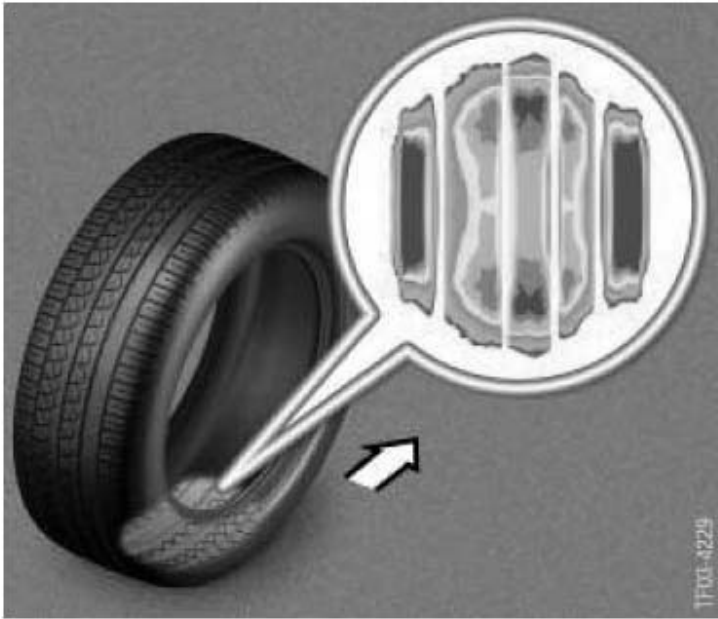


Fig. 10: Identifying Tire Contact Patch
Courtesy of BMW OF NORTH AMERICA, INC.

BMW suspension systems are designed to allow for the optimum contact patch when the vehicle is in operation. For example, the "double-pivot" suspension is designed to keep the outside front tire as close to a zero camber angle on turns.

SUSPENSION

Integrated Suspension Systems - Operating Fluids

1.0 GENERAL INFORMATION

LHM hydraulic fluid has a favorable viscosity range and permits problem-free operation of the self-leveling rear suspension at very low and very high temperatures. The solidification point is -78°F/-61°C.

2.0 APPROVED HYDRAULIC FLUIDS

E24, E28 produced prior to 9/87

Pentosin CHF 4548 was used for initial factory filling.

For filling up and replacement the following oil is to be used:

Pentosin CHF 7.1 BMW Part No. 81 22 1 468 879

Pentosin CHF 4548 and CHF 7.1 can be mixed in these cars.

For complete system oil replacement:

Reputable brand name LHM oils (green color) can also be used (Shell, Castrol, Exxon, etc.)

NOTE: Mixing of CHF and LHM oils is not permitted.

E24, E28 produced since 9/87

Pentosin CHF 7.1 is used for initial factory filling.

For filling up and replacement use only Pentosin CHF 7.1

BMW Part No. 81 22 1 468 879

For complete oil replacement:

Reputable brand name LHM oils (green color) can also be used.

NOTE: Mixing of CHF 7.1 and LHM oils is not permitted.

E32 produced prior to 9/91

Use only Pentosin CHF 7.1.

Mixing with other oils is not permitted.

E32, E34 produced since 9/91

Use only Pentosin CHF 11S

NOTE: All cars have a label indicating the respective type on the hydraulic fluid reservoir. Since both Pentosin CHF 11S and CHF 7.1 are green in color, the reservoir label must be carefully checked prior to adding fluid.

Mixing CHF 11S and CHF 7.1 is not permitted.

Pentosin CHF 11S BMW Part No. 82 11 1 468 041

E38 produced since 1/94

Use only Pentosin CHF 11S

NOTE: All cars have a label indicating the respective type on the hydraulic fluid reservoir. Since both Pentosin CHF 11S and CHF 7.1 are green in color, the reservoir label must be carefully checked prior to adding fluid.

Mixing CHF 11S and CHF 7.1 is not permitted.

Pentosin CHF 11S BMW Part No. 82 11 1 468 041

3.0 CHECKING HYDRAULIC FLUID LEVELS

The hydraulic fluid level must be checked on an unloaded car and at every Inspection I or, for cars without a Service Indicator, at 10,000 mi/15,000 km intervals.

NOTE: Not required as of 1993 model year vehicles.

Special checking instructions apply to the E32.

NOTE: Never fill above the "max" mark. There are no replacement intervals for hydraulic fluid.

SUSPENSION

Integrated Suspension Systems - Repair - Z4

3700 GENERAL

00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN

Danger of poisoning!

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

- Headaches
- Dizziness
- Stomach aches
- Vomiting
- Diarrhoea
- Cramps/fits
- Unconsciousness

Protective measures/rules of conduct

- Pour oil only into appropriately marked containers
- Do **not** pour oil into drinking vessels (drinks bottles, glasses, cups or mugs)
- Observe country-specific safety regulations

First aid measures

- Do not induce vomiting.

If the person affected is still conscious, he/she must rinse out their mouth with water, drink plenty of water and consult a doctor immediately.

If the person affected is unconscious, do not administer anything by mouth, place the person in the recovery position and seek immediate medical attention.

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If the person affected is unconscious, do not administer anything by mouth, place the person in the recovery position and seek immediate medical attention.

64 00 000 INFORMATION ON USING CLEANING AGENT/PAINTS (PERSONAL PROTECTION EQUIPMENT)

WARNING: Use of cleaning agents/paints not compliant with instructions can cause serious injuries or burns!
Handling cleaning agents/paints can trigger allergic skin and respiratory reactions!

IMPORTANT: Observe following instructions:

- Store cleaning agents/paints only in a secure cabinet.
- Keep cleaning agents/paints away from naked flames and other sources of ignition.
- Protect cleaning agents/paints from high temperatures and direct sunlight.
- Always keep an eye bath on hand, change the water regularly (once a month).

IMPORTANT: Observe following instructions before use:

- **Manufacturer's instructions (on container/packaging)**
- **Hazard warnings (on container/packaging)**
- **Manufacturer's instructions on package insert**
- **Material safety data sheet of manufacturer**
- **Product information in EPC**
- **National market regulations**

IMPORTANT: Observe following instructions during use:

- **Do not eat, drink or smoke while working with these products.**
- **Avoid direct contact with skin and eyes.**
- **Wear personal protective clothing/equipment.**
- **Ensure that all enclosed areas are well ventilated or extract fumes directly.**
- **Immediately change working clothes soiled with cleaning agent/paint.**
- **After finishing work, wash your hands and apply protective skin cream.**

IMPORTANT: Follow hazard warnings and wear personal protection equipment!

First Aid:

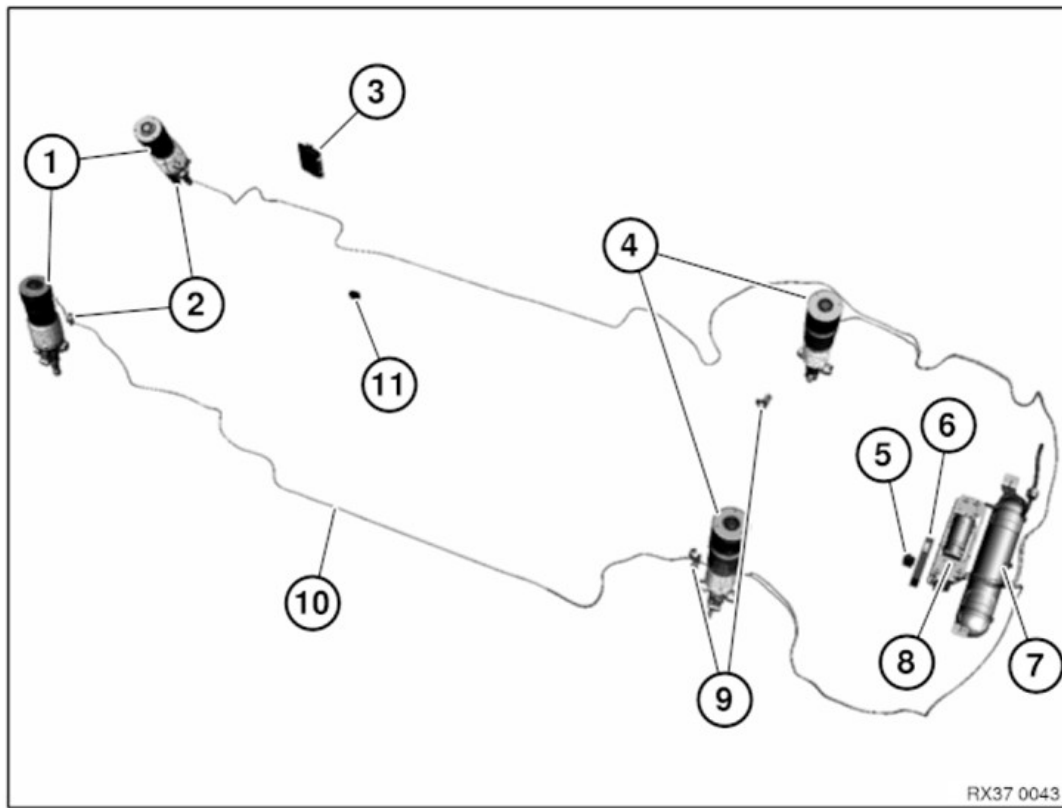
- If product comes in contact with eyes, immediately flush with running water for about 10 - 15 minutes. Seek the advice of eye specialist.
- In the event of skin contact and where applicable an allergic skin reaction, clean the affected areas immediately with soap and water and then apply silicone-free skin cream. Seek advice of physician.
- If an adhesive product is swallowed, rinse mouth/parts of mouth thoroughly with running water. Drink 1-2 glasses of water. Do not induce vomiting. Consult a doctor.
- After inhaling vapours ensure ample supply of fresh air. Keep calm, keep respiratory tracks clear and call doctor.

Recycling

Dispose of cleaning agents/paints in a professional manner!

Observe national/country-specific disposal regulations.

37 ... OVERVIEW OF 2- AXLE RIDE-HEIGHT CONTROL



- | | |
|---|--|
| 1 Air suspension strut, front left and right | 7 Pressure accumulator for air suspension |
| 2 Ride height sensor, front left and right | 8 Air supply system with solenoid valve manifold |
| 3 Vertical Dynamics Management (VDM) control unit | 9 Ride height sensor, rear left and right |
| 4 Air suspension strut, rear left and right | 10 Air lines |
| 5 Relay, air supply unit | 11 Ride-height control switch |
| 6 Electronic ride-height control | |

Fig. 1: Overview Of 2- Axle Ride-Height Control
Courtesy of BMW OF NORTH AMERICA, INC.

Safety instructions&general information Deactivate/activate air spring system

Bleed/fill pressure accumulator

Carry out ride height adjustment

- Air suspension strut, front left and right
- Ride height sensor, front left and right
- Vertical Dynamics Management (VDM) control unit

- Air suspension strut, rear left and right
- Relay, air supply unit
- Electronic ride-height control (EHC) control unit
- Pressure accumulator for air suspension
- Air supply system with solenoid valve manifold
- Ride height sensor, rear left and right
- Air lines
- Ride-height control switch

00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN

Danger of injury!

Contact with eyes or skin may result in injury!

Possible symptoms are:

- Impaired sight
- Irritation of the eyes
- Reddening of the skin
- Rough and cracked skin

Protective measures/rules of conduct

- Wear protective goggles
- Wear oil-resistant protective gloves
- Observe country-specific safety regulations

First aid measures

- **Eye contact:** Rinse eyes immediately with plenty of water for at least 15 minutes; if available, use an eye-rinsing bottle. If irritation of the eyes persists, consult a doctor.
- **Skin contact:** Wash off with soap and water immediately. If irritation persists, consult a doctor.

NOTE: Do not use solvents/thinners.

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NOTE: Do not use solvents/thinners.

00 SAFETY INFORMATION FOR WORKING ON VEHICLES WITH AUTOMATIC ENGINE START-STOP FUNCTION (MSA)

WARNING: If the engine hood/bonnet contact is pulled upwards (workshop mode), the information "switch closed" is output. The automatic engine start-stop function is active.
An automatic engine start is possible.

Observe safety precautions when working on MSA vehicles

Before carrying out practical work on the engine, always ensure that the MSA functionality is deactivated so as to prevent automatic engine starting while work is being carried out in the engine compartment.

MSA function is deactivated by

- Deactivate MSA by means of button (1) in passenger compartment
- Open seat belt buckle and driver's door

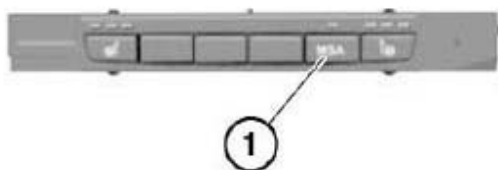


Fig. 2: Identifying Automatic Engine Start/Stop Button

Courtesy of BMW OF NORTH AMERICA, INC.

- Open engine bonnet/hood and ensure that engine hood/bonnet contact is not in workshop mode
 - Workshop mode

A = 10 mm

- Basic setting (engine hood/bonnet open)

B = 7 mm

To make sure that the engine hood/bonnet contact is at the basic setting, if necessary press the hood/bonnet contact up to the limit position before starting work and slowly release.

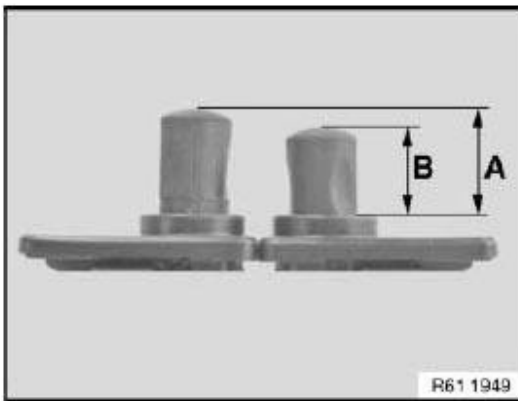


Fig. 3: Identifying Engine Hood/Bonnet Dimension

Courtesy of BMW OF NORTH AMERICA, INC.

When working with diagnosis tools

- Observe instructions in diagnosis tool

00 SAFETY INSTRUCTIONS FOR HANDLING OIL

WARNING: **DANGER OF POISONING** if oil is ingested/absorbed through the skin!
RISK OF INJURY if oil comes into contact with eyes and skin!

Recycling

Observe country-specific waste-disposal regulations.

Measures if oil is unintentionally released

- **Personal precautionary measures:** Danger of slipping! Keep non-involved persons away from the work

area. Wear personal protective clothing/equipment.

- **Environmental protection measures:** Prevent oil from draining into drain channels, sewerage systems, pits, cellars, water and the ground.
- **Limiting spread:** Use oil blocks to prevent the surface spread of oil.
- **Cleaning procedure:** Bind and dispose of escaped oil with nonflammable absorbents.

NOTE: Do not flush oil away with water or aqueous cleaning agents.

3711 FRONT CONTROL AND SUSPENSION ELEMENTS

37 11 030 REMOVING AND INSTALLING COMPLETE LEFT OR RIGHT SPRING STRUT SHOCK ABSORBER

IMPORTANT: If the centring pin is missing from the support bearing, the position of the studs to the wheel arch must be marked so that the original camber is approximately maintained.
Only one nut may ever be released for marking.

Necessary preliminary tasks

- Remove **FRONT WHEEL**
- Remove **STABILIZER LINK FROM SPRING STRUT**
- Disconnect plug connection and expose line up to holder on spring strut
- Unlock line from VDC damper in engine compartment and disconnect
- Remove front **PULSE GENERATOR** from swivel bearing
- Remove **FRONT BRAKE DISC**

Remove jointed rod of ride-height sensor from control arm.

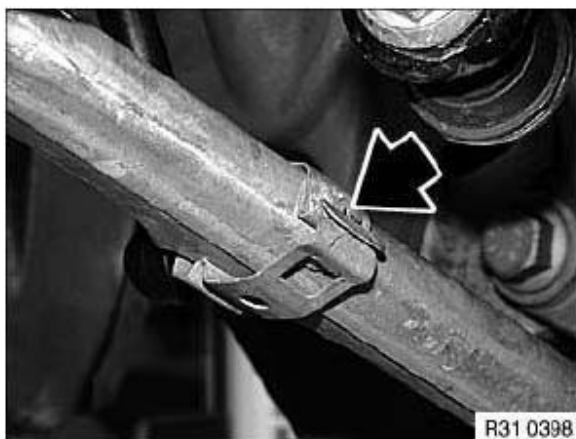


Fig. 4: Locating Jointed Rod Of Ride-Height Sensor
Courtesy of BMW OF NORTH AMERICA, INC.

Slacken **CONTROL ARM BOLT CONNECTION ON FRONT AXLE CARRIER** in order to prevent control arm rubber mount from being damaged.

Remove **CONTROL ARM FROM SWIVEL BEARING** .

Remove **TIE ROD END FROM SWIVEL BEARING** .

Remove **TENSION STRUT FROM SWIVEL BEARING**

WARNING: Risk of injury!
Secure spring strut against falling out.

Release nuts (1) and remove spring strut with swivel bearing towards bottom.

Installation:

Clean contact surface in spring strut dome.

Align spring strut using centring pin to bore in wheel arch or studs to wheel arch and push upwards.

Replace self-locking nuts.

Tightening torque **31 31 1AZ** .

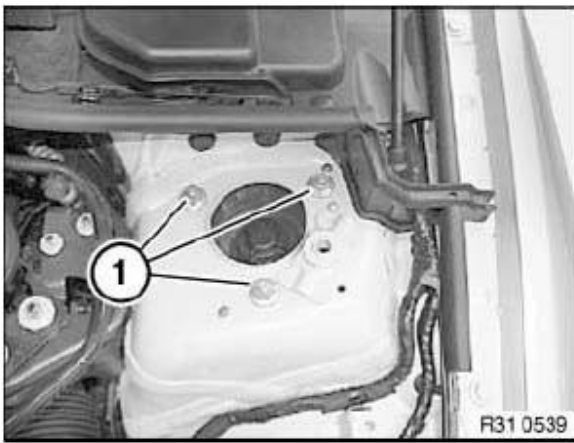


Fig. 5: Identifying Spring Strut Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Perform **CHASSIS ALIGNMENT CHECK**
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT**

3712 REAR CONTROL AND SUSPENSION ELEMENTS

37 12 001 CHECKING FUNCTION OF SELF-LEVELLING SUSPENSION SYSTEM

Carry out error search with BMW diagnosis system; if necessary, refer to Troubleshooting on self-levelling suspension system.

37 12 131 REPLACING LEFT OR RIGHT REAR SHOCK ABSORBER (ADAPTIVE M SUSPENSION)

NOTE: Read and comply with INFORMATION ON REPLACING SHOCK ABSORBERS .

Necessary preliminary tasks

- Remove REAR WHEEL
- Remove LUGGAGE COMPARTMENT WHEEL ARCH TRIM
- Unlock and disconnect plug connection of VDC damper and expose line to shock absorber

WARNING: Danger of injury!

Failure to comply with the following instructions may result in the vehicle slipping off the lifting platform and critically injuring other persons.

When supporting components, make sure that

- the vehicle can no longer be raised or lowered
- the vehicle does not lift off the locating plates on the lifting platform

Support trailing arm with a workshop jack (1).

Release screw.

Tightening torque 33 52 3AZ .

Installation:

Thrust washer (2) on rubber bearing must point to screw head.

Tighten bolt in NORMAL POSITION .

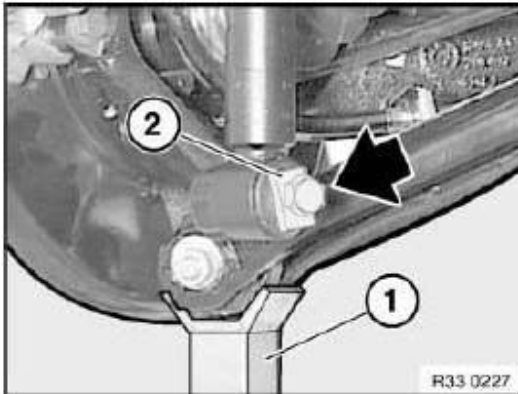


Fig. 6: Supporting Trailing Arm Using Workshop Jack
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

Remove shock absorber with support bearing towards bottom.

Installation:

Replace flat seal (between support bearing and body).

Replace self-locking nuts.

Tightening torque **33 52 2AZ** .

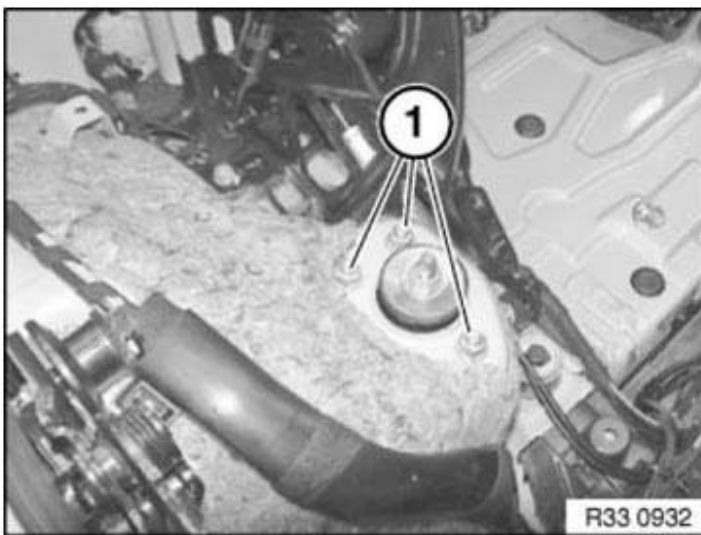


Fig. 7: Identifying Shock Absorbers Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

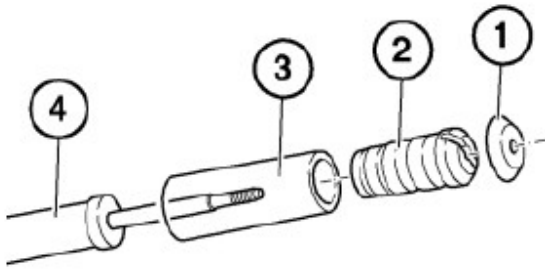
Replacement

Remove **SUPPORT BEARING** .

Remove or detach plate (1), spacer, auxiliary damper (2) and protective tube (3) from shock absorber (4).

Installation:

Check auxiliary damper (2) and protective tube (3) for damage, replace if necessary.



R33 0419

Fig. 8: Identifying Rear Shock Absorber, Auxiliary Damper And Protective Tube
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Check that output shaft is correctly seated in rear differential.

3714 ELECTRICAL COMPONENTS

37 14 027 REMOVING AND INSTALLING/REPLACING REAR MOUNTED ACCELERATION SENSOR

IMPORTANT: Read and comply with notes on PROTECTION AGAINST ELECTROSTATIC DISCHARGE (ESD PROTECTION) .

Necessary preliminary tasks

- Remove **RIGHT LUGGAGE COMPARTMENT TRIM PANEL**

Unfasten plug connection (1) and disconnect.

Release nuts (2) and remove mounted acceleration sensor (3).

Tightening torque **37 14 8AZ** .

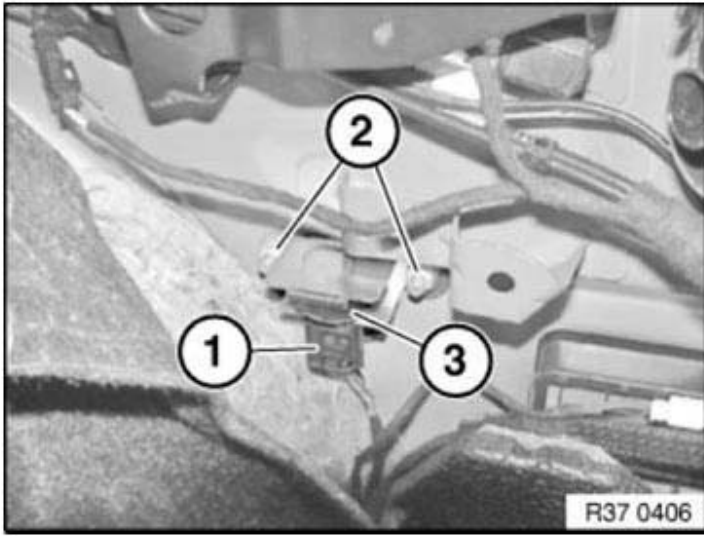


Fig. 9: Identifying Plug Connection And Acceleration Sensor With Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

37 14 017 REMOVING AND INSTALLING/REPLACING FRONT MOUNTED ACCELERATION SENSOR

IMPORTANT: Read and comply with notes on **PROTECTION AGAINST ELECTROSTATIC DAMAGE (ESD PROTECTION)** .

Necessary preliminary tasks

- Remove **FRONT WHEEL ARCH TRIM**

Unfasten plug connection (1) and disconnect.

Release screws (2) and remove mounted acceleration sensor (3).

Tightening torque **37 14 8AZ** .

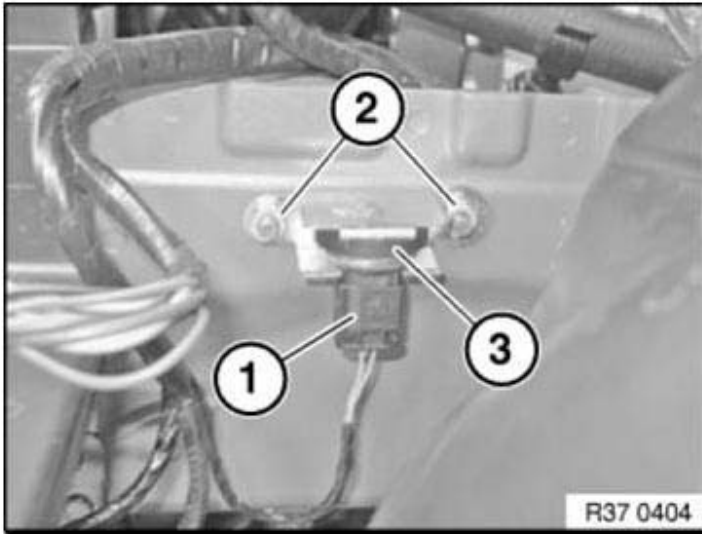


Fig. 10: Identifying Plug Connection And Acceleration Sensor With Nuts
 Courtesy of BMW OF NORTH AMERICA, INC.

37 14 511 REPLACING FRONT RIDE-HEIGHT SENSOR

IMPORTANT: Read and comply with notes on PROTECTION AGAINST ELECTROSTATIC DAMAGE (ESD PROTECTION) .

Unfasten plug connection (2) and disconnect.

Release nut (1) and disconnect jointed rod.

Tightening torque 37 14 7AZ .

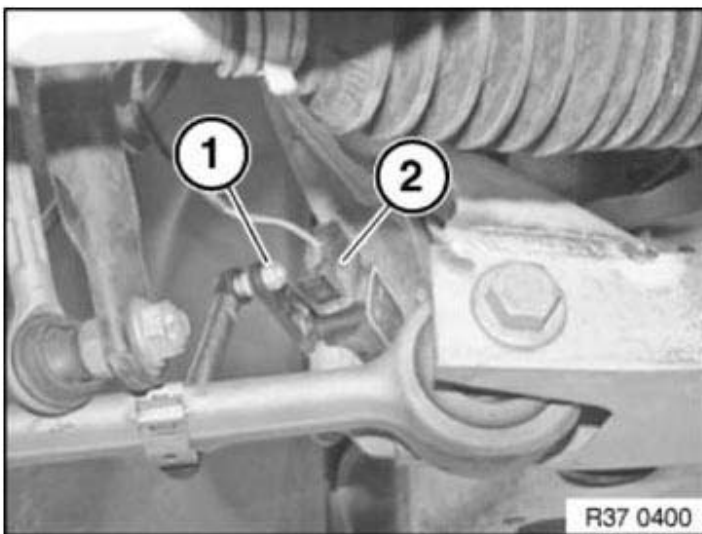


Fig. 11: Identifying Plug Connection And Jointed Rod Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) and remove ride-height sensor.

Tightening torque **37 14 5AZ** .

Installation:

Sensor lever must point to front from ride-height sensor.

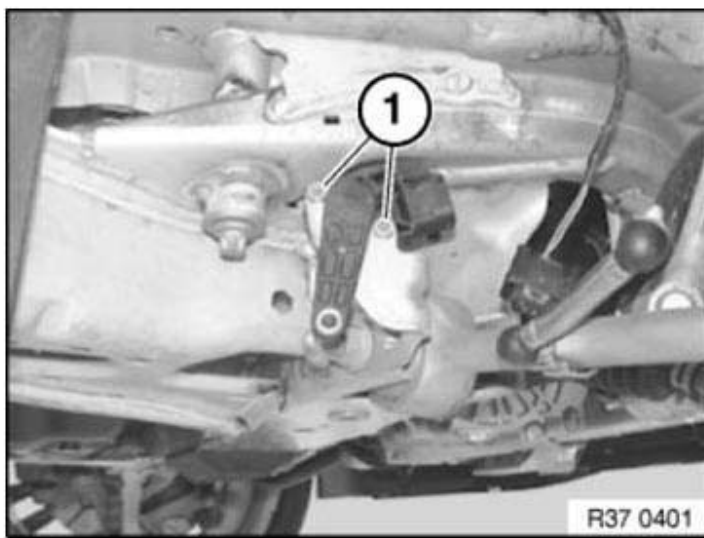


Fig. 12: Identifying Ride-Height Sensor Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

37 14 512 REPLACING REAR RIDE-HEIGHT SENSOR

IMPORTANT: Read and comply with notes on PROTECTION AGAINST ELECTROSTATIC DAMAGE (ESD PROTECTION) .

Release nut (1) and disengage jointed rod with lever extension (2).

Tightening torque **37 14 3AZ** .

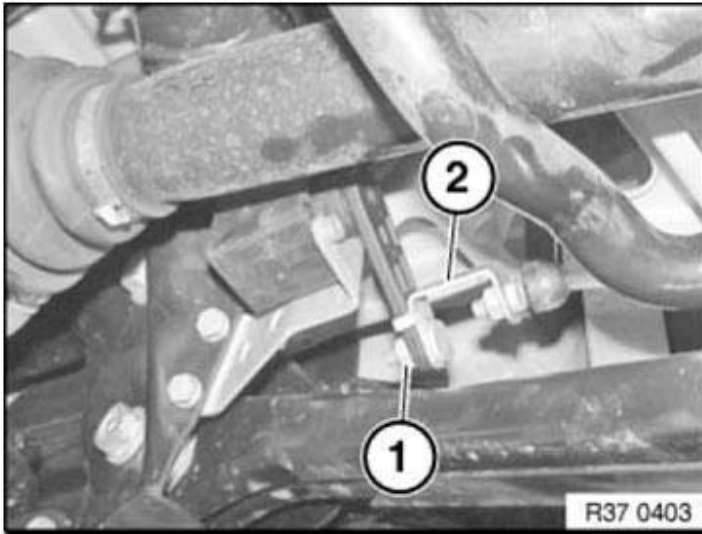


Fig. 13: Identifying Jointed Rod Nut With Lever Extension
 Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten plug connection (1) and disconnect.

Release screws (2) and remove ride-height sensor.

Tightening torque **37 14 1AZ** .

Installation:

Sensor lever (3) must point from ride-height sensor in direction opposite to direction of travel.

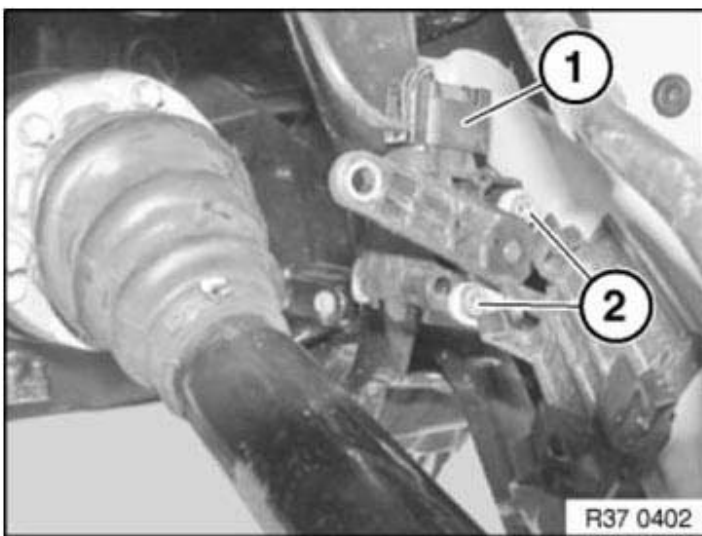


Fig. 14: Identifying Plug Connection And Ride-Height Sensor Screws
 Courtesy of BMW OF NORTH AMERICA, INC.

3715 ELECTRONIC DAMPING FORCE ADJUSTMENT

37 15 055 REMOVING AND INSTALLING/REPLACING EDC CONTROL UNIT

IMPORTANT: Read and comply with notes on PROTECTION AGAINST ELECTROSTATIC DAMAGE (ESD PROTECTION) .

Release screws (1).

Remove electronics box cover (2).

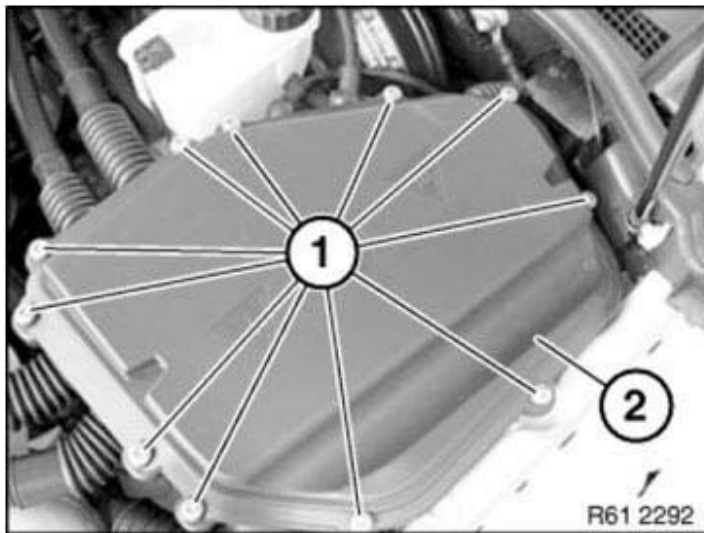


Fig. 15: Identifying Electronics Box Cover Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unlock plug connections (1) and disconnect.

Unlock control unit (2) and remove upwards from holder.

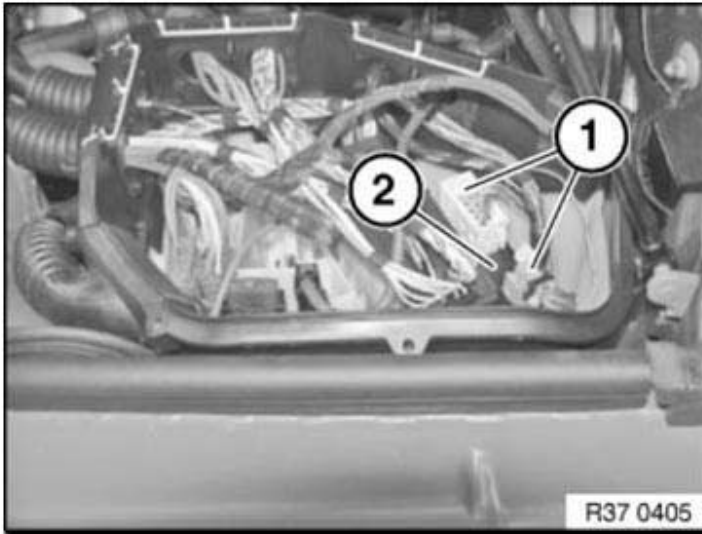


Fig. 16: Identifying Plug Connection And Control Unit Of Holder
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Carry out programming/coding.

SUSPENSION

Integrated Suspension Systems - Tightening Torques - Z4

ELECTRIC COMPONENTS

37 14 ELECTRIC COMPONENTS

TIGHTENING TORQUE SPECIFICATION - ELECTRIC COMPONENTS

		Type	Thread	Tightening specification	Measure
1AZ	Ride-height sensor, rear, to holder	E89	M5		5 Nm
2AZ	Bracket ride level sensor to rear axle carrier	E89	M6		8 Nm
3AZ	Lever extension to ride-height sensor, rear	E89	M6		8 Nm
4AZ	Jointed rod to lever extension or to control arm, rear	E89	M6	Replace nut	8 Nm
5AZ	Ride-height sensor, front, to holder	E89	M5	Replace nut	5 Nm
6AZ	Holder, ride-height sensor, front, to front axle carrier	E89	M6		8 Nm
7AZ	Jointed rod to ride-height sensor, front	E89	M6	Replace nuts	8 Nm
8AZ	Acceleration sensor to end plate, rear, or engine carrier, front	E89	M6		8 Nm

GENERAL INFORMATION

Undercar Technology - Overview - All Models

BASIC SUSPENSION GEOMETRY

Model: All

INTRODUCTION

The safety, stability, handling and performance of a vehicle depends on many factors. One of the most important aspects of these characteristics is the design of suspension and steering systems. BMW vehicles are known for their superior handling and road holding performance.

The design of the BMW suspension systems is a key factor in achieving these goals. Suspension geometry is defined as: "The angular relationship between the suspension, the steering linkage and the wheels - relative to the road surface."

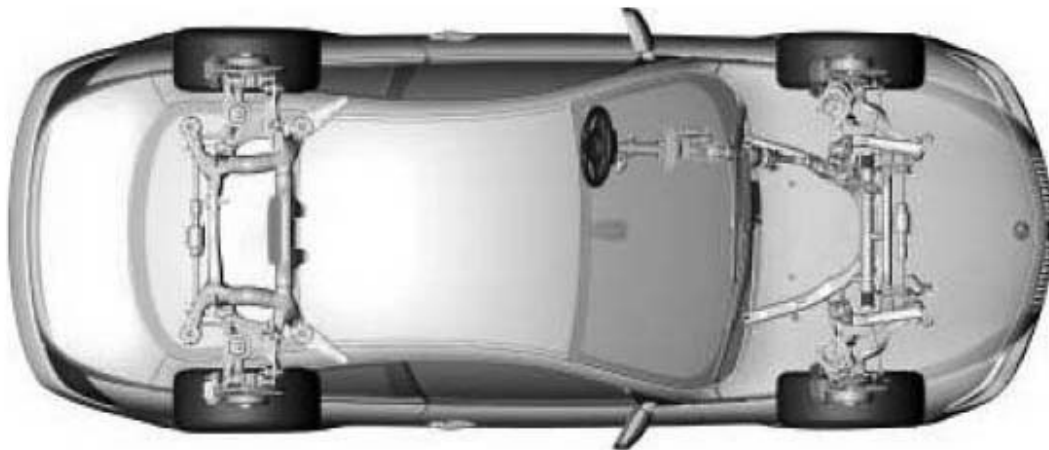


Fig. 1: Identifying Design Of BMW Suspension Systems
Courtesy of BMW OF NORTH AMERICA, INC.

There are several alignment geometry angles which relate to the suspension components and steering linkages including:

- Caster
- Camber
- Toe-In/Toe-Out
- Steering Roll Radius (steering offset)
- Steering Axis Inclination (SAI) and Included Angle (IA)
- Toe Out on Turns
- Thrust Line and Thrust Angle

All of these angles influence:

- The ease with which the vehicle can be steered
- The overall vehicle stability (handling, tracking and safety)
- Tire wear

The suspension geometry for any given vehicle is a result of the design engineers development of the vehicle and the design criteria for that particular vehicle.

ALIGNMENT ANGLES

Caster

Caster is the forward or rearward tilt of the steering axis centerline, as viewed from the side of the vehicle, and is measured in degrees. When the steering axis centerline is exactly perpendicular to the road surface, the Caster is considered to be at zero degrees.

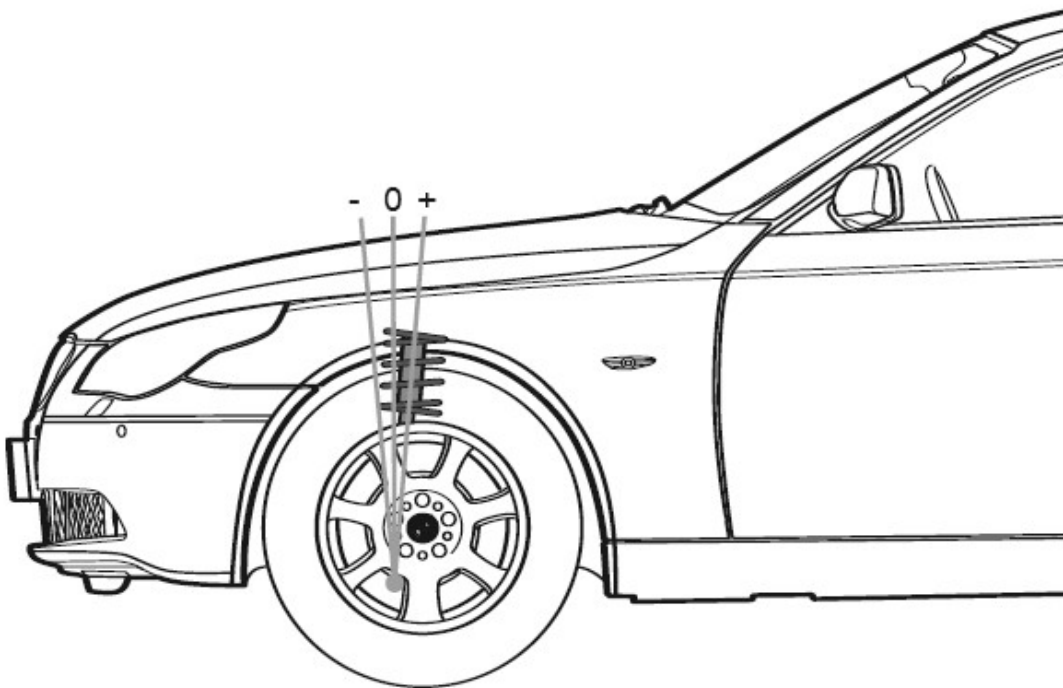


Fig. 2: Identifying Caster Angle
Courtesy of BMW OF NORTH AMERICA, INC.

When the top of the steering axis centerline is tilted rearward (toward the bulkhead), the caster is considered to be "positive". When the top of the steering axis centerline is tilted forwards, the caster is considered to be negative.

Most vehicles have a caster angle from zero degrees to a positive angle. Negative caster is not very desirable because it reduces the vehicle stability especially at high speeds. BMW vehicles always have a positive caster

angle. Positive caster promotes high speed stability and provides feedback to the driver.

Positive caster also promotes "steering return" which increases driver comfort and safety. Caster angles which are more negative (or not very positive) can increase the effect of wheel "shimmy", create sensitivity to high winds and creates poor steering return.

When the caster angle differs greatly from side to side, the vehicle may "pull" to the side which has the "least positive" caster.

One of the main characteristics of positive caster is the positive effect on high speed steering stability. However, low speed steering effort is increased. This characteristic is counteracted by the power steering system and in particular the Servotronic system. Servotronic will be discussed in later training modules.

Caster is not a directly measured angle. It can only be measured by sweeping the steering through an angle of 20 degrees in both directions. This is important to know during the alignment procedure.

On BMW vehicles, caster can only be measured, there is no adjustment. However, caster measurement can be used to detect and diagnose alignment concerns. Caster which is out of specification could indicate damaged or worn components.

Caster Offset

Caster offset is the distance between the centerline of the wheel contact point and the intersection point of the extended pivot axis. The greater the offset, the more effort required to turn a moving wheel. The negative effects of more increased offset are counter-acted by the BMW double pivot suspension system and the Servotronic steering system (if equipped).

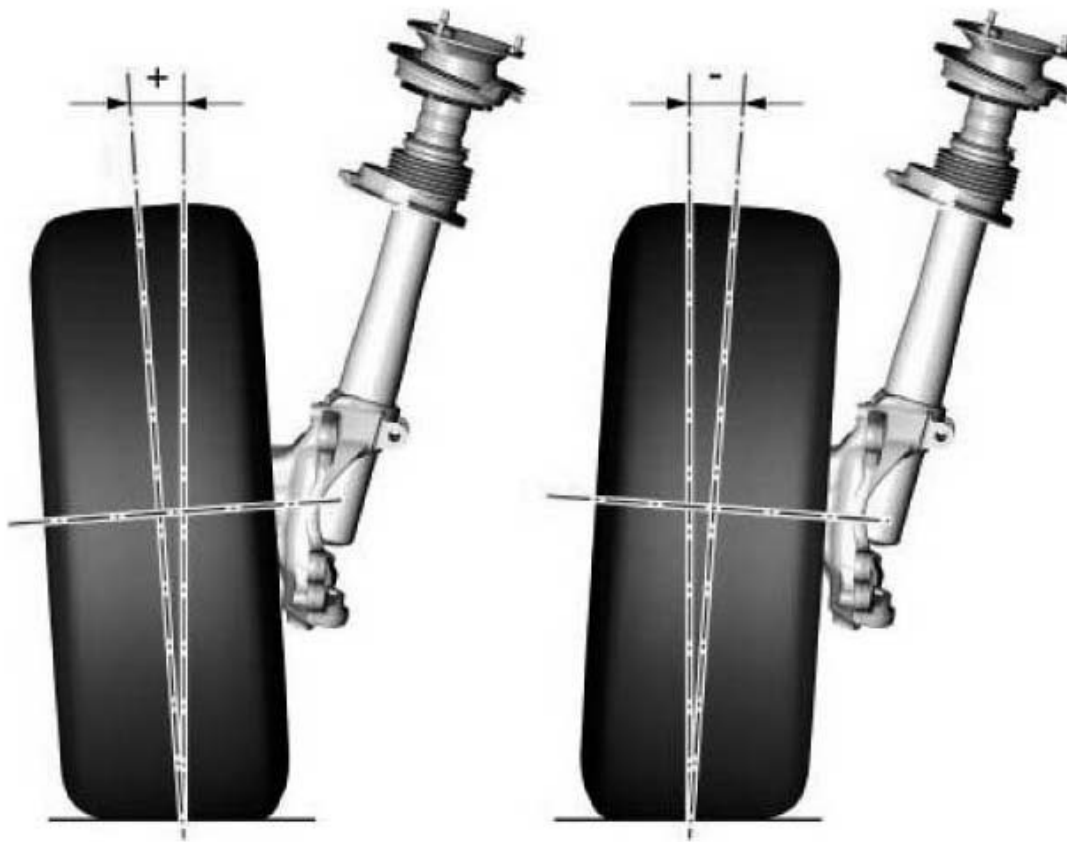


Fig. 4: Identifying Camber Angle

Courtesy of BMW OF NORTH AMERICA, INC.

Wheels running at a camber want to follow a circular path, like an overturned cone. Therefore, vehicles which have excessive camber angles will tend to pull to one side. As a general rule, the vehicle will tend to pull to the side of the vehicle which has the most positive camber.

Front camber angle on most current BMW vehicles is set at a slightly negative value. This promotes good straight line stability. This is due to the fact that slight negative camber causes the wheels to "track inward". As long as the side-to-side camber is roughly equal, the vehicle will track in a straight line.

Camber angle also has an effect on component wear. For instance, the wheel bearings will perform well and last longer as long as the camber is within specification. Camber which is out of specification will cause undue load on the wheel bearings. Excessive camber angle also causes wear on the outer edges of the tire. The outside of the tire will wear if the camber is too positive and the reverse is true with excessive negative camber. The same holds true for the rear camber angle.

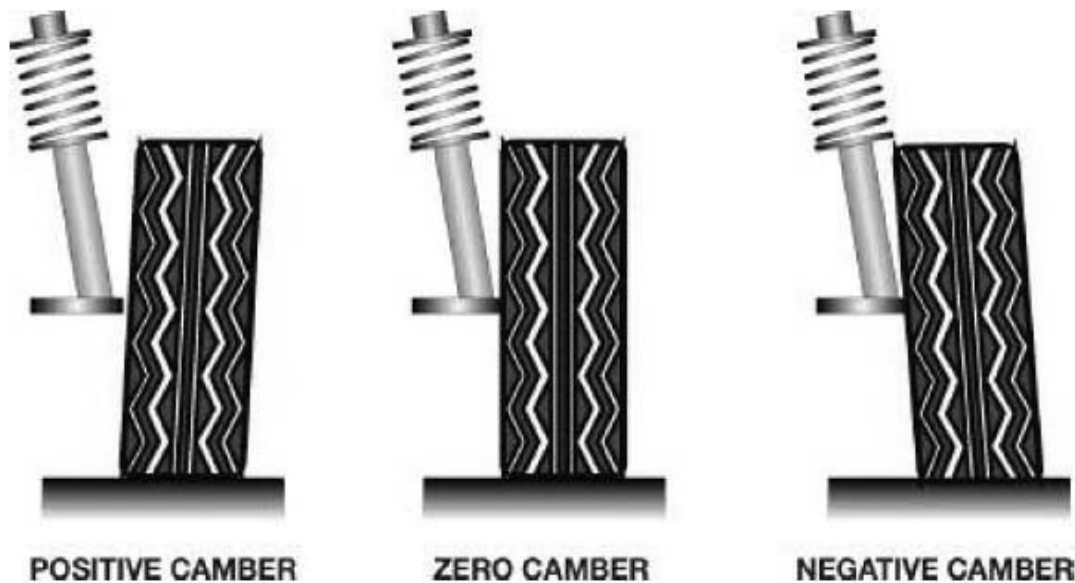


Fig. 5: Identifying Positive Camber, Zero Camber And Negative Camber
Courtesy of BMW OF NORTH AMERICA, INC.

Positive Camber

Older vehicles often had a positive camber on the front axle. The design made this necessary, as the tapered roller bearings would not withstand any other type of load. In a steering maneuver, the front axle wheel on the outside of the turn is shifted to the negative camber range by the caster angle and the spread. The desired cornering stability is achieved in this way. When cornering, no positive camber should arise at the outer wheel of the steered axle.

Negative Camber

On modern BMW chassis, it is possible to set a negative camber for the straight-ahead position on the front axle as well. This has been made possible by using two rows of ball bearings. The rear wheels on BMW vehicles have always had a negative camber.

This is a compromise. The wheels on the rear axle cannot be shifted to the negative camber range by steering movements. To improve cornering stability, a negative camber has to be pre-set.

Toe

The total toe of an axle is the difference in the distance between the front of the wheels and the rear of the wheels on the same axle.

Toe is measured at the center of the wheels from one wheel rim to the other. When the distance is greater at the rear of the wheels, it is called toe-in. When the distance is greater at the front of the wheels, it is called toe-out.

Rear wheel drive vehicles generally will have a small amount of toe-in at the front wheels. This will allow the wheels to toe out when rolling to achieve a zero running toe.

Toe is measured in Degrees when using BMW specifications. Front toe is adjustable on all BMW vehicles. Rear toe is only adjustable on some models.

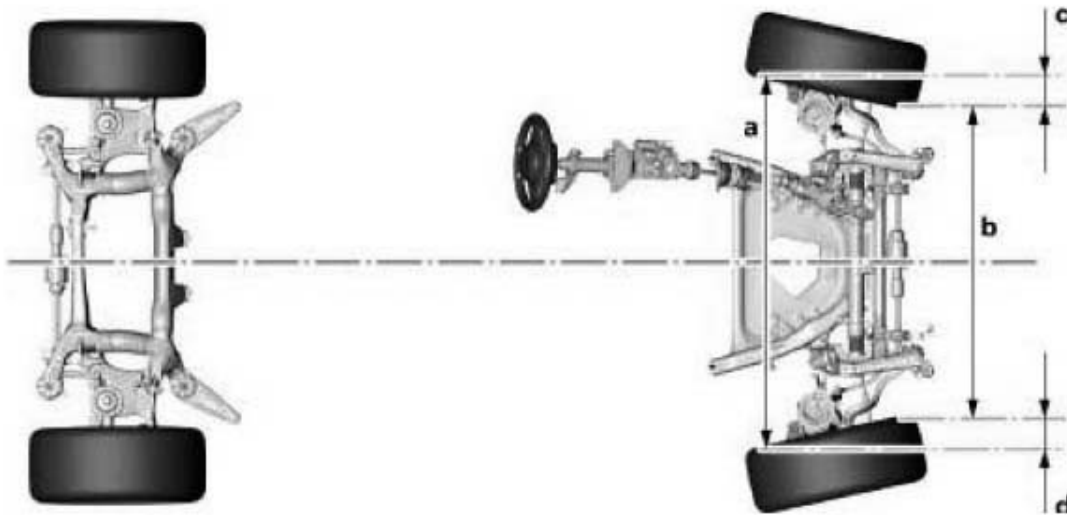


Fig. 6: Identifying Toe-In Angle
Courtesy of BMW OF NORTH AMERICA, INC.

Toe has a major influence on vehicle handling, straight line stability and the position of the steering wheel. An incorrect toe setting will have a negative effect on tire wear. A toe angle which is out of specification will cause the tires to wear in a relatively short time.

Toe Out on Turns

Also referred to as "Turning Angle" or "Toe differential angle". Toe out on turns results from the different angles (arcs) taken by the front wheels when driving through a corner. When turning a corner, the outside wheel must travel a greater distance than the inside wheel. The additional toe angle is determined by the steering arm design.

Deviations from the specified value could indicate possible bent steering linkage. A typical complaint that would be associated with this condition would be excessive tire squeal or "scrubbing" on turns. When looking for this specification in TIS, look for the "Track Differential Angle" specification.

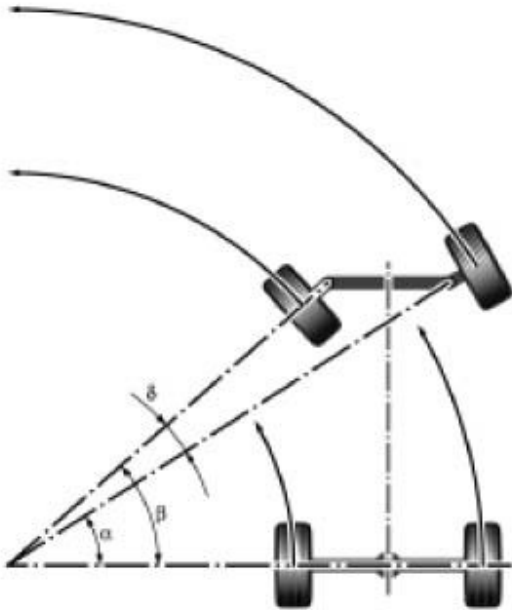


Fig. 7: Identifying Toe-In Angle And Turning Angle
 Courtesy of BMW OF NORTH AMERICA, INC.

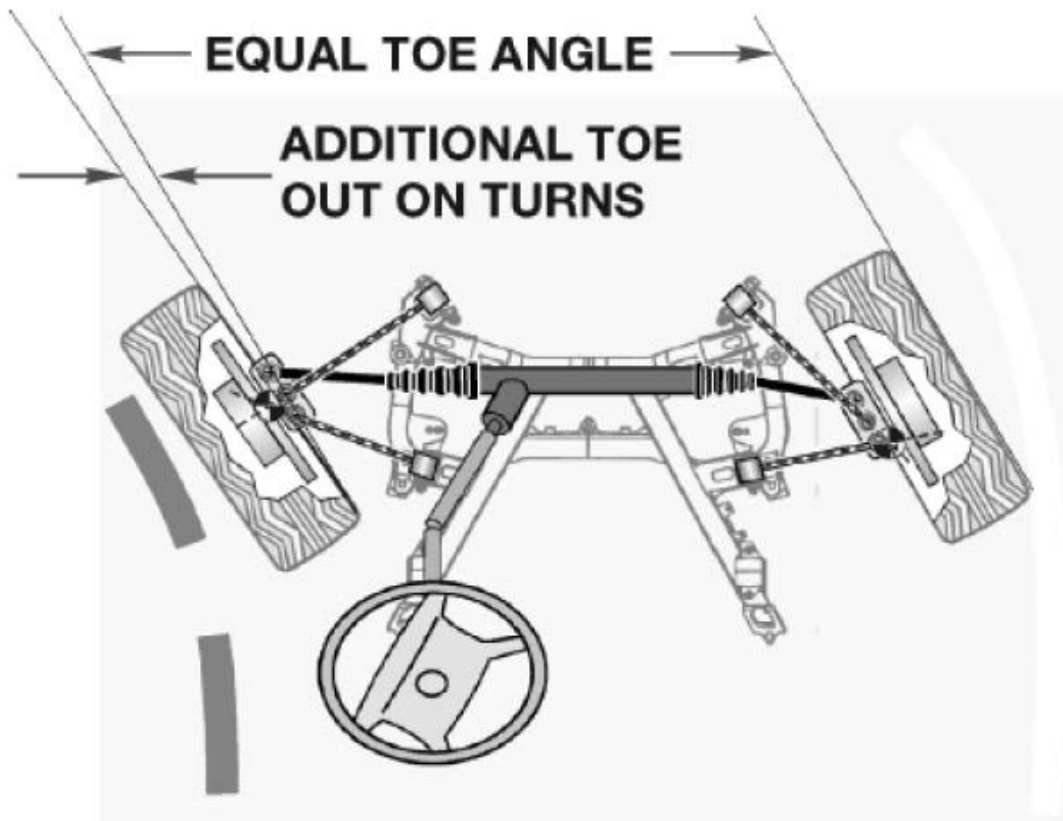


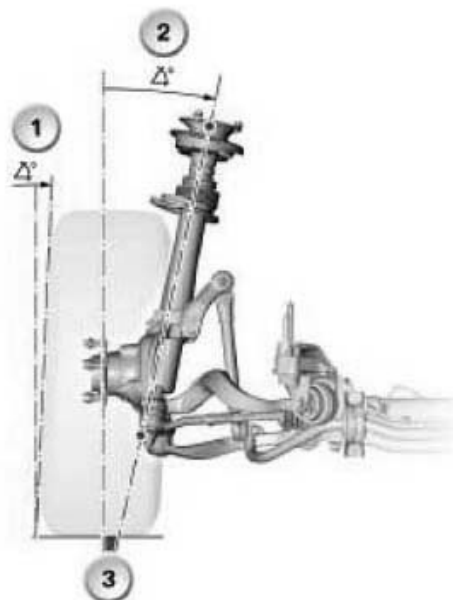
Fig. 8: Identifying Toe-Out Angle
 Courtesy of BMW OF NORTH AMERICA, INC.

Steering Roll Radius (Steering Offset)

The steering roll radius is the distance between the point of contact of the projected line drawn through the steering axis to the road surface and the center point of the tire contact area (foot print). The roll radius is the distance between these two lines.

The roll radius can be positive or negative:

- A positive roll radius exists when the steering axis line is inside the center line of the tire (in other words, the imaginary intersection of these two lines is below the road surface).
- A negative roll radius exists when the steering axis line is outside of the tire center line (in other words, the imaginary intersection of these two lines is above the road surface).



Index	Explanation	Index	Explanation
1	Camber	3	Steering Roll Radius
2	Steering Axis Inclination		

Fig. 9: Identifying Steering Axis Inclination
Courtesy of BMW OF NORTH AMERICA, INC.

The steering roll radius influences the steering by means of a "torque effect". During braking, uneven brake forces will influence the steering towards the side with the most braking force. This becomes more evident when the roll radius is excessively positive. A positive roll radius also provides more feedback to the driver regarding road surface conditions.

A steering roll radius which is excessively positive, reduces vehicle stability during braking. However, when roll radius is excessively negative, the directional stability is reduced (when not braking) and there is reduced feedback to the driver through the steering wheel. This is why BMW vehicles are designed with a steering roll radius which is slightly positive. This gives the driver a better "road feel" without compromising braking

stability.

Steering Roll Radius is not adjustable, but can be influenced by camber, SAI and rim offset. This can become evident by installing improper tire and wheel combinations. Wheels with incorrect offsets can compromise handling characteristics.

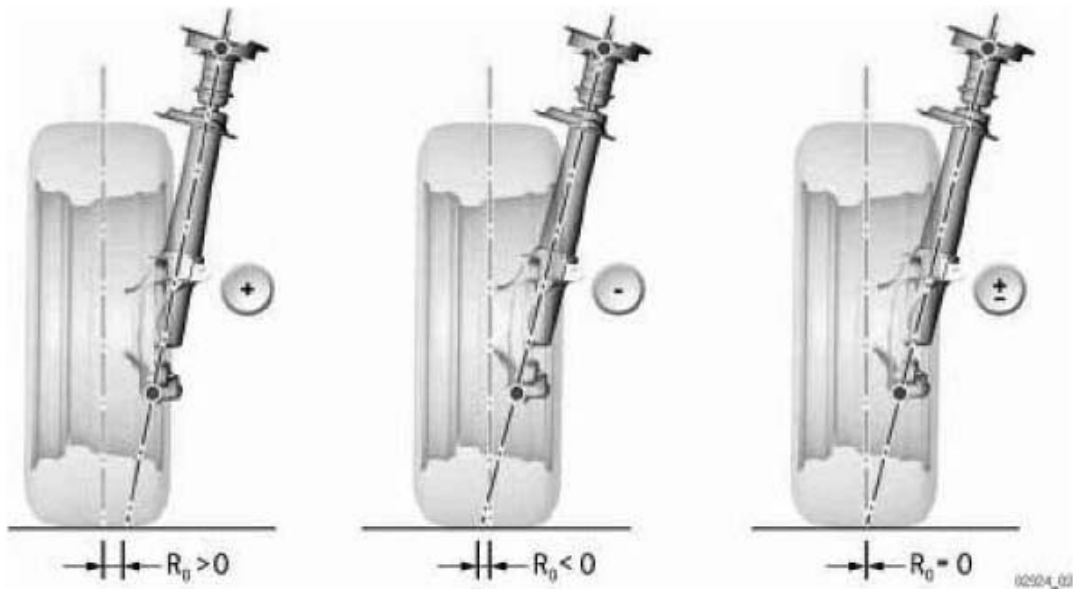


Fig. 10: Identifying Steering Roll Radius
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: The term "Steering Roll Radius" is also known as Scrub Radius, Steering Offset or King Pin Offset.

Steering Axis Inclination (SAI)

Steering Axis Inclination is the inward tilt (angle) of the strut assembly with respect to a vertical line to the road surface. SAI raises the vehicle when the steering wheel is turned, which results in the self-correcting forces that cause the front wheels and steering wheel to return to a straight ahead position after cornering.

SAI is not adjustable, but is affected by damaged suspension components.

Most current alignment equipment can measure SAI and can aid in the diagnosis of damaged parts. Bent strut or spindle assemblies are common causes of incorrect SAI readings.

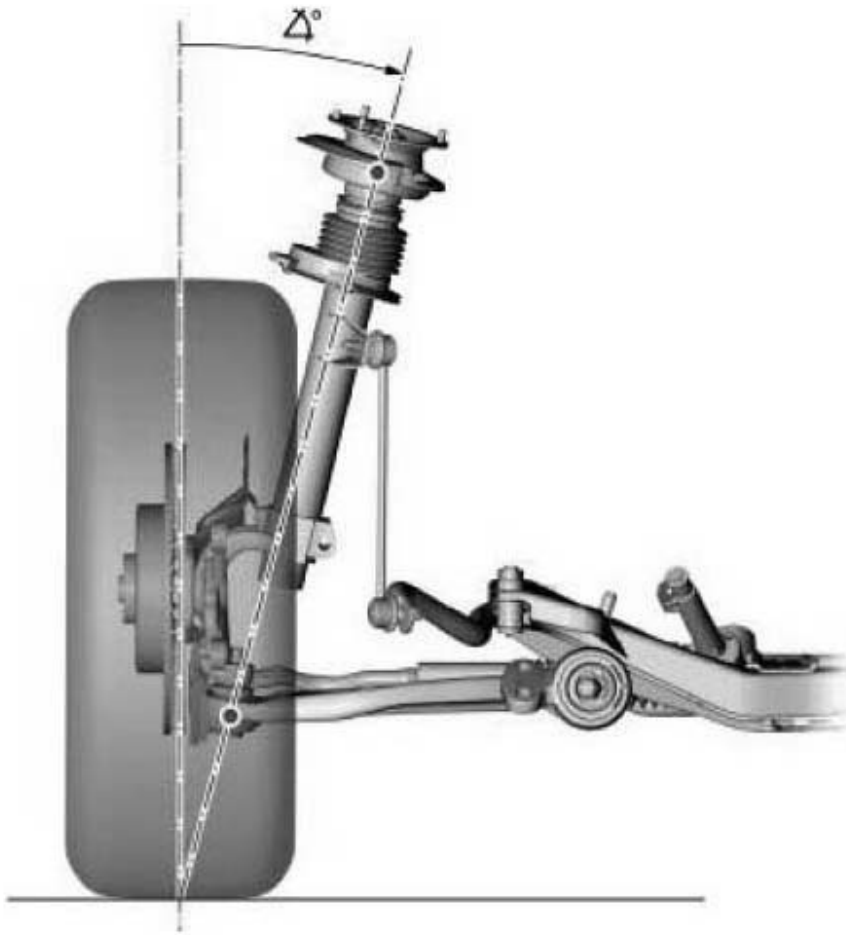


Fig. 11: Identifying Steering Axis Inclination (SAI)
Courtesy of BMW OF NORTH AMERICA, INC.

Included Angle (IA)

Included angle is the Camber angle and SAI combined. IA is also helpful when trying to diagnose bent suspension components. Knowing the IA and SAI is helpful when adjusting Camber. If the desired Camber angle cannot be achieved, then looking at SAI and IA could help determine the cause.

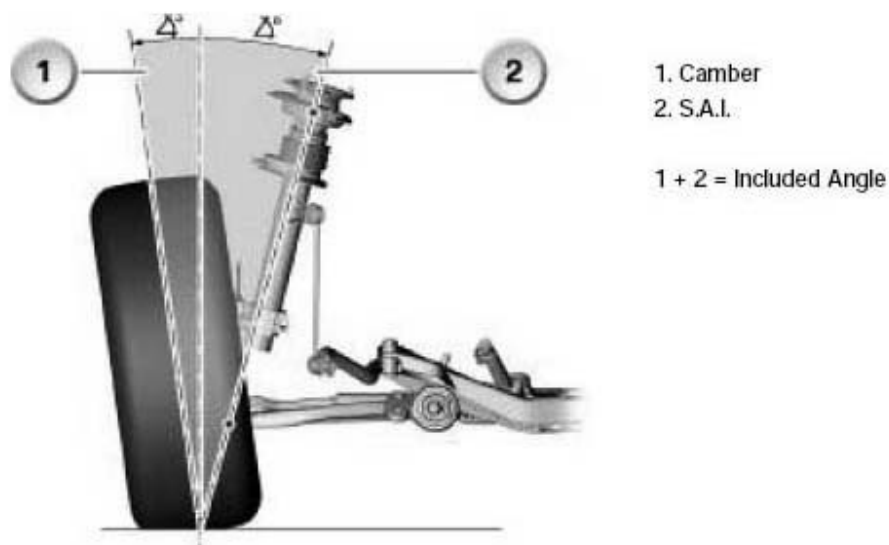


Fig. 12: Identifying Included Angle (IA)
Courtesy of BMW OF NORTH AMERICA, INC.

Depending on the type of alignment equipment used, S.A.I. and I.A. can be measured by raising the vehicle. Look for any excessive deviations from side to side. This could indicate possible chassis (frame) damage or bent components (strut/spindle).

Geometric Axis

The Geometric Axis (Centerline) is an imaginary line that is drawn between the midpoints of both front and rear wheels. The Axis is perpendicular to the axis of the front and rear axles at 90 degrees. This is an imaginary angle that is not adjustable.

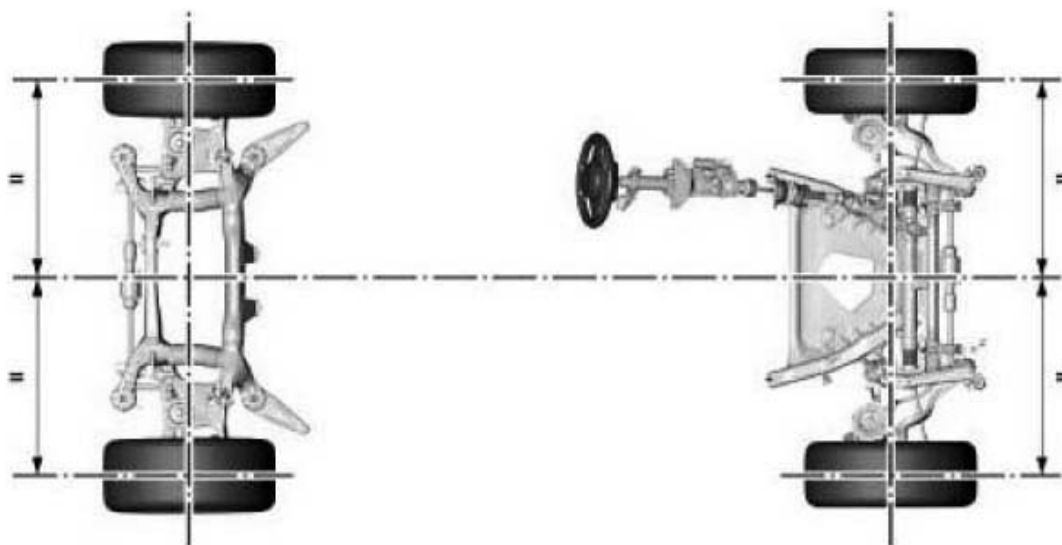


Fig. 13: Identifying Geometric Axis
Courtesy of BMW OF NORTH AMERICA, INC.

Thrust Line/Thrust Angle

The Thrust Line is represented by an imaginary line that bisects the rear toe angle. This angle represents the overall "direction" in which the rear wheels are pointing. The thrust angle is the difference between the Geometric Axis and the Thrust Line. The optimum Thrust Angle is Zero Degrees, any deviation from this will affect the position of the steering wheel.

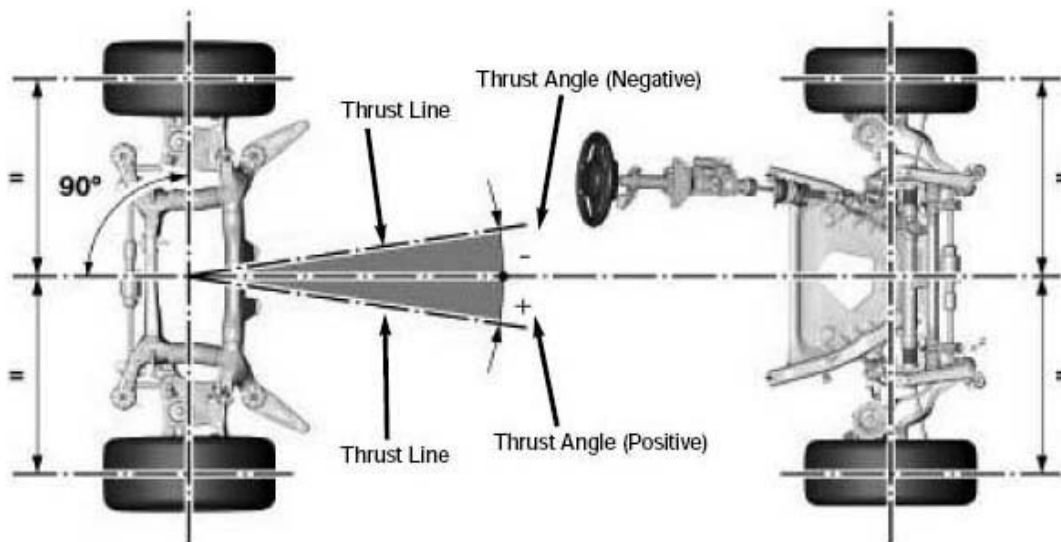


Fig. 14: Identifying Thrust Line/Thrust Angle
Courtesy of BMW OF NORTH AMERICA, INC.

Positive Thrust Angle

A positive thrust angle is formed when the thrust line is to the right of the Geometric Axis (Centerline). When this situation occurs, the steering wheel position will be off to the right as well. The rear of the vehicle will tend to move to the right which will cause the front of the vehicle to steer left, the driver will move the steering wheel to the right to compensate.

Negative Thrust Angle

A negative thrust angle is formed when the thrust line is to the left of the Geometric Axis (Centerline). When this situation occurs, the steering wheel position will be off to the left as well. The rear of the vehicle will tend to move to the left which will cause the front of the vehicle to steer right, the driver will steer the vehicle by moving the steering wheel to the left to compensate.

|| Alignment Procedures

When performing a wheel alignment, make sure that the thrust angle is as close to zero as possible. Failure to do so can result in a steering wheel that is not centered.

Wheelbase

Wheelbase (1) is the distance between the centerline of the two wheels on the same side of the vehicle. This is a

static measurement which will change when the suspension travels on a moving vehicle.

A vehicle with a long wheelbase is of course larger and more spacious. The ride comfort is improved due to less "pitching" motion. In contrast, a vehicle with a shorter wheelbase is capable of tighter "cornering".

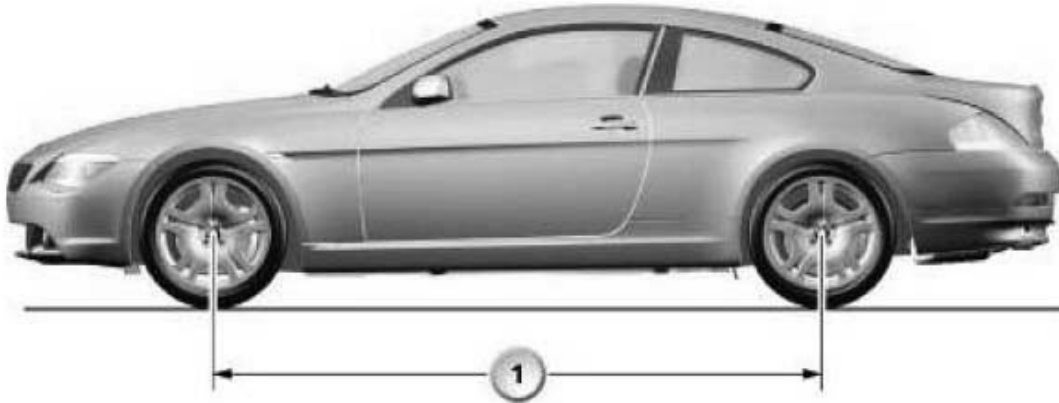


Fig. 15: Identifying Wheelbase
Courtesy of BMW OF NORTH AMERICA, INC.

Track Width

Track Width (1) is the distance between the centerline (wheel contact point) of two wheels on the same axle. This is also a static measurement which will change during vehicle movement.

A vehicle with an increased "track width" can corner at higher speeds.



Fig. 16: Identifying Track Width
Courtesy of BMW OF NORTH AMERICA, INC.

SUSPENSION

Wheel and Tires - Repair - Z4

3610 WHEELS

36 00 ... CHECKING TIRE INFLATION PRESSURE

NOTE: Through natural air diffusion, a tire loses approx. 0.05 bar per month, which is about 0.03 bar inflation pressure after 6 months.
Driving with low pressure negatively impacts fuel consumption and tire wear, particularly the tendency of run-flat tires to wear unevenly and experience increased abrasion.
In addition, extremely low inflation pressure can adversely affect driving stability or cause tire damage and thus accidents.
Checking inflation pressure (at least twice a month and prior to long trips) as well as adjusting it to the load status of the vehicle is necessary.

Checking tire inflation pressure

The pressure information for the approved tire sizes are located on the driver's door post.

If the tires speed rating letter is not listed, the inflation pressure for the particular size, such as 255/45, applies.

When towing a trailer, the higher load inflation pressure listed in the pressure information applies.

The pressure information applies to tire sizes approved and makes recommended by BMW.

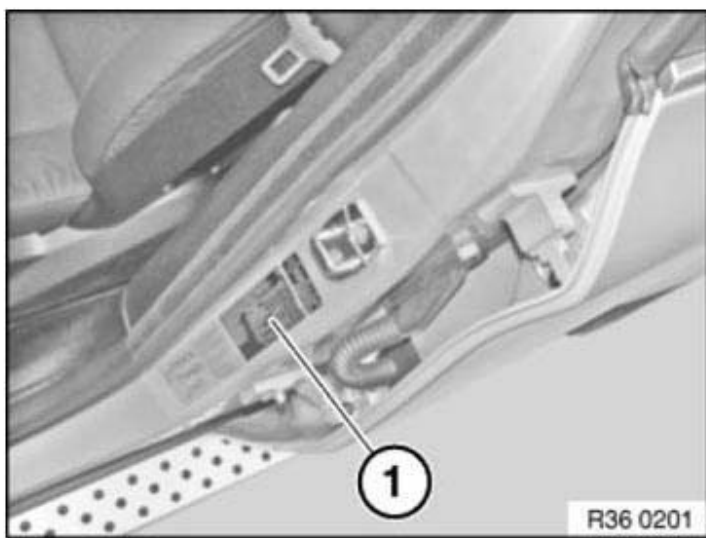


Fig. 1: Identifying Tyre Inflation Pressure Label
Courtesy of BMW OF NORTH AMERICA, INC.

For vehicles with a Run Flat Indicator, the indicator must be initialized after completing repair work.

36 10 300 REMOVING OR INSTALLING FRONT OR REAR WHEEL

IMPORTANT: Wheel was balanced electronically.

Observe the following in order to avoid positioning errors and imbalance:

- Loosen wheel bolts.
- Wheel positioned with valve facing down.
- If several wheels are simultaneously removed, mark installation location of wheels on tires (e.g. with a piece of chalk).
- Mark out wheel to wheel hub.
- Mark out lockable wheel bolt in relation to wheel.
- Release wheel bolts and remove wheel.

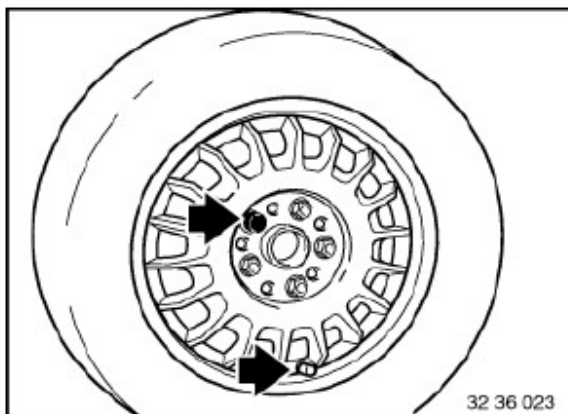


Fig. 2: Identifying Wheel Bolts

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: contact surfaces between brake disc and disc wheel and between brake disc and wheel hub must be free of grease.
Follow instructions on initializing Run Flat Indicator (RPA).
When fitting all four wheels (e.g. when changing from summer to winter wheels), check the tire inflation pressure.
To avoid tire damage, advise the customer to check the tire inflation pressures on a regular basis (see Owner's Handbook).

Remove dirt, grease residues and corrosion from contact surface (1) with a drill and special tool 36 1 250.

IMPORTANT: Do not operate special tool 36 1 250 with an impact screwdriver!

NOTE: Degrease contact face with universal cleaner, refer to BMW Parts Department.

NOTE: If there are grease residues in the area of the wheel bolt bore, the brake disc must be removed See 3411220 REMOVING AND INSTALLING/REPLACING BOTH FRONT BRAKE DISCS or 3421320 REMOVING AND INSTALLING OR REPLACING BOTH REAR BRAKE DISCS and cleaned.

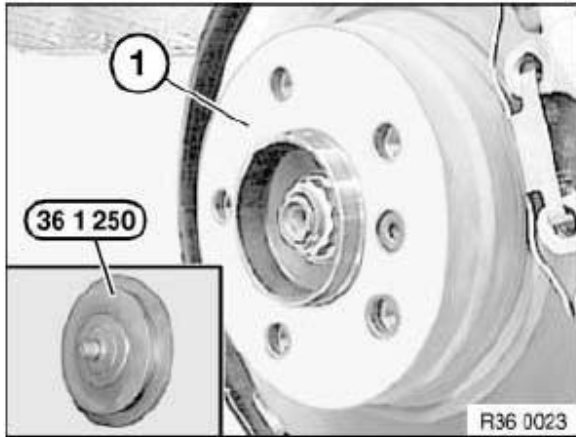


Fig. 3: Identifying Brake Disc And Disc Wheel Contact Surface With Special Tool (36 1 250)
Courtesy of BMW OF NORTH AMERICA, INC.

Remove dirt, grease residues and corrosion from contact surface (1) with a drill and special tool 36 1 250.

IMPORTANT: Do not operate special tool 36 1 250 with an impact screwdriver!

NOTE: Degrease contact face with universal cleaner, refer to BMW Parts Department.

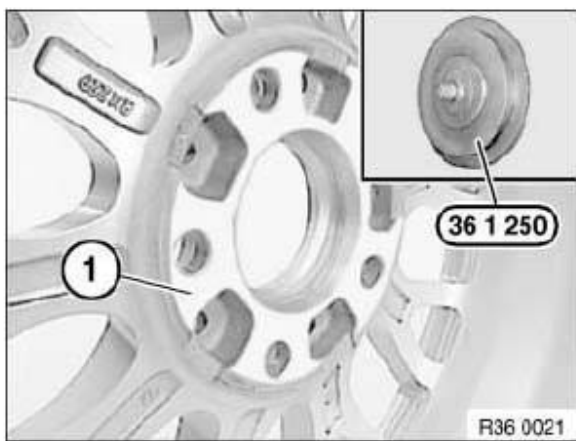


Fig. 4: Identifying Contact Surface With Special Tool 36 1 250
Courtesy of BMW OF NORTH AMERICA, INC.

Check brake disc retaining bolt (1) for secure seating.

IMPORTANT: Brake disc retaining bolt must under no circumstances protrude over contact surface (2) between brake disc and disc wheel.
Tightening torque, brake disc retaining screw,
Front axle, 34 11 1AZ .
Rear axle 34 21 1AZ .

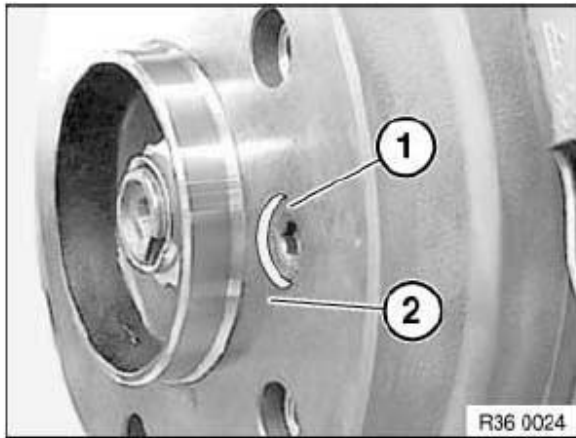


Fig. 5: Identifying Brake Disc Mounting Bolt Position With Brake Disc And Disc Wheel Contact Surface
Courtesy of BMW OF NORTH AMERICA, INC.

Apply a thin coat of grease to wheel centering (1) in disc wheel.

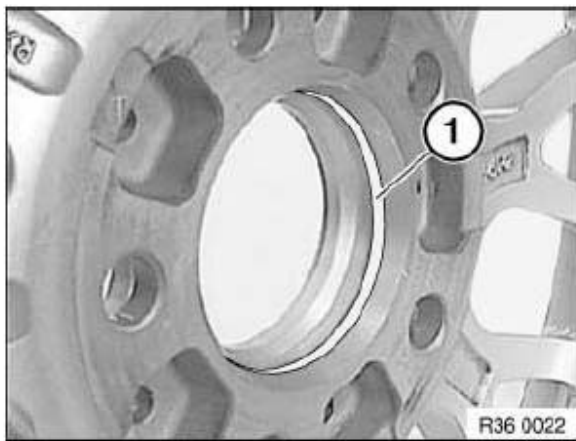


Fig. 6: Identifying Wheel Centering On Disc Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Wheel bolts with taper:

- a. Wheel bolt - galvanized
- b. Wheel bolt - black chrome plated
- c. Wheel bolt - black chrome plated and lockable

d. Lockable wheel bolt with adapter, black chrome-plated

NOTE: To release and tighten down lockable wheel bolt, use a matching adapter from special tool 36 1 300 (wheel bolt adapter set).

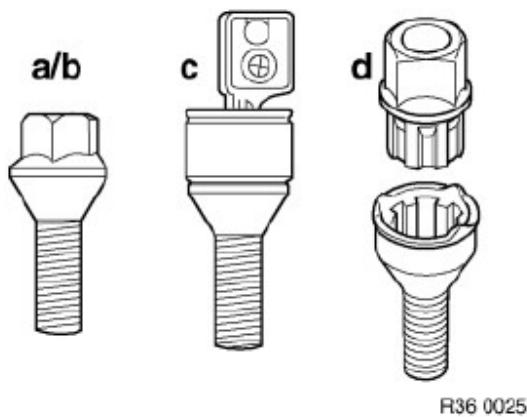


Fig. 7: Identifying Wheel Bolts With Taper
Courtesy of BMW OF NORTH AMERICA, INC.

Clean wheel bolts and check threads for damage, replace, if necessary.

Replace rusty wheel bolts.

IMPORTANT: Do not apply oil to wheel bolts.

IMPORTANT: Under no circumstances use pneumatic or power screwdrivers to install and tighten the wheel bolts.

IMPORTANT: Disc wheel must rest uniformly against brake disc.

In the case of non-original BMW wheel bolts/rims it may be necessary to retighten the wheel bolts on account of settling properties (refer to manufacturer's documents).

Screw in wheel bolts and, to center disc wheel, tighten down by hand diagonally and evenly.

Using torque wrench, firmly tighten wheel bolts in diagonal and even sequence.

Tightening torque **36 10 1AZ** .

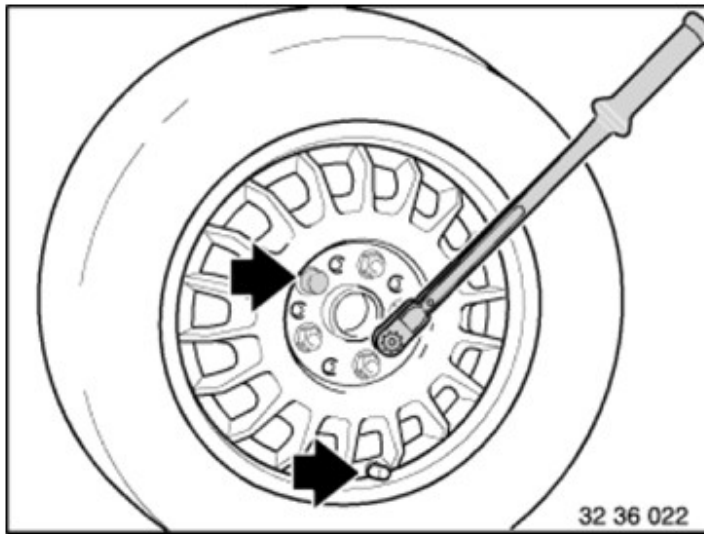


Fig. 8: Tightening Wheel Bolts Using Torque Wrench
 Courtesy of BMW OF NORTH AMERICA, INC.

3611 DISC WHEELS (RIMS)

36 11 000 INITIALIZING RUN FLAT INDICATOR (RPA)

NOTE: Checking the tire pressure is based on monitoring the speeds of the wheels in relation to each other. A tire puncture is detected and signalled by way of a deviation in specific speed ratios.
 The four tires mounted on the vehicle are monitored while the vehicle is moving.
 Initialization must be carried out in each case immediately after tire pressures have been corrected, after tires/wheels have been replaced and after repairs to the air spring system.

IMPORTANT: The Run Flat Indicator does not function when the vehicle is driven with the compact spare wheel.

Version with iDrive:

- Press controller to call up **i** menu
- Select **Settings** and press controller
- Select **Car/Tires** and press controller
- If necessary, switch to the top field. Turn controller until Tires: RPA is selected and press controller
- Start engine but do not drive off
- Select **Confirm tire** pressure and press controller



Fig. 9: Control Display - CBS Menu

Courtesy of BMW OF NORTH AMERICA, INC.

- Drive off. Initialization is completed during the journey

Version without iDrive:

- Start engine but do not drive off
- Touch direction indicator lever up or down until the corresponding symbol and **RESET** appear
- Press PC button to confirm selection of Run Flat Indicator
- Press PC button for approx. 5 seconds until a check/tick appears after RESET
- Drive off. Initialization is completed during the journey

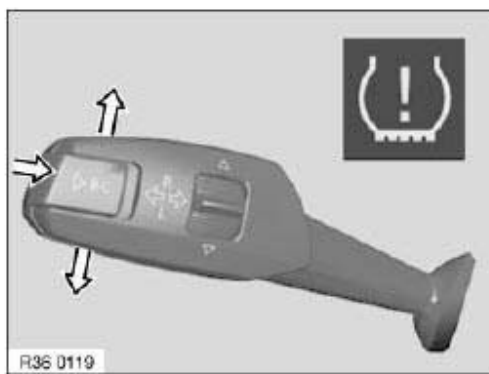


Fig. 10: Identifying RDC Menu (Without iDrive)

Courtesy of BMW OF NORTH AMERICA, INC.

36 11 105 REMOVING AND INSTALLING RDC (TYRE PRESSURE CONTROL) CONTROL UNIT (LOW COST)

IMPORTANT: Read and comply with notes on protection against electrostatic damage (ESD protection).

Loosen the lower part of the bumper panel (1) and raise slightly.

Disconnect plug connection (2).

Push the retaining tabs (3) apart.

Pull the RDC control unit out.

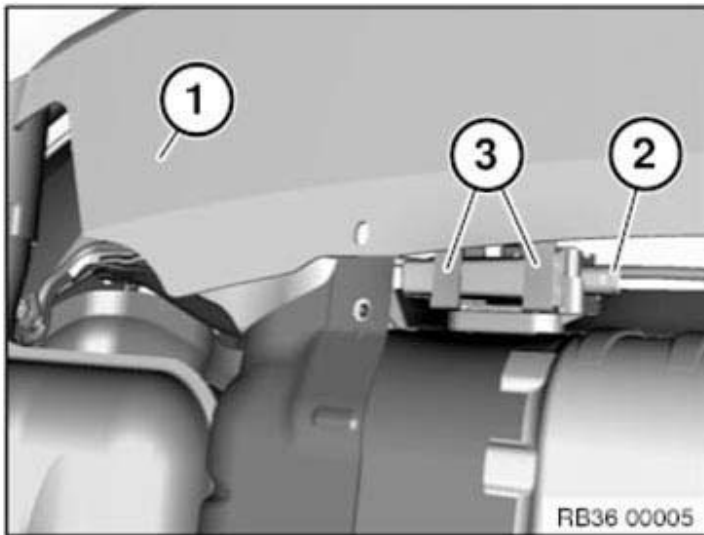


Fig. 11: Identifying Plug Connection, Retaining Tabs And RDC Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Replacement

- Carry out programming/encoding

36 11 105 REMOVING AND INSTALLING/REPLACING RDC (TYRE PRESSURE CONTROL) CONTROL UNIT

Necessary preliminary tasks

- Remove right luggage compartment **WHEEL ARCH PANEL**

Swing out RDC control unit (1).

Disconnect plug connection and remove RDC control unit.

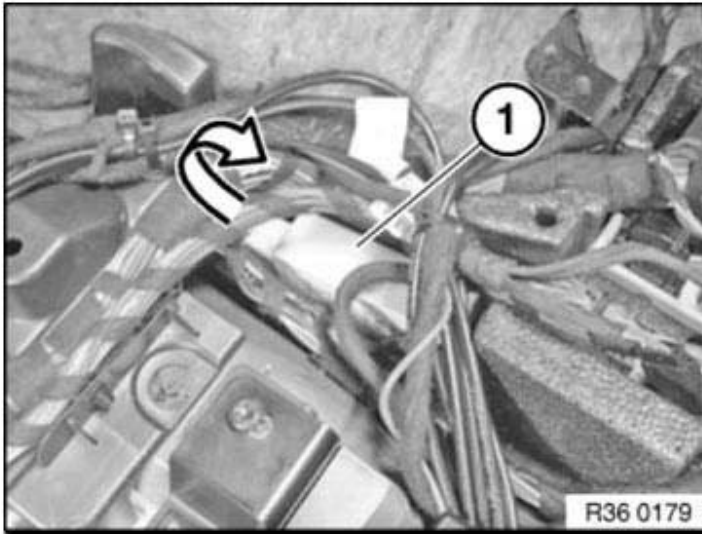


Fig. 12: Swinging RDC Control Unit
 Courtesy of BMW OF NORTH AMERICA, INC.

36 11 115 REMOVING AND INSTALLING/REPLACING RDC RECEIVING AERIAL

Necessary preliminary tasks

- Remove front left underbody panelling

Disconnect plug connection (1).

Gently press retaining tabs apart in direction of arrow and remove RDC aerial (2).

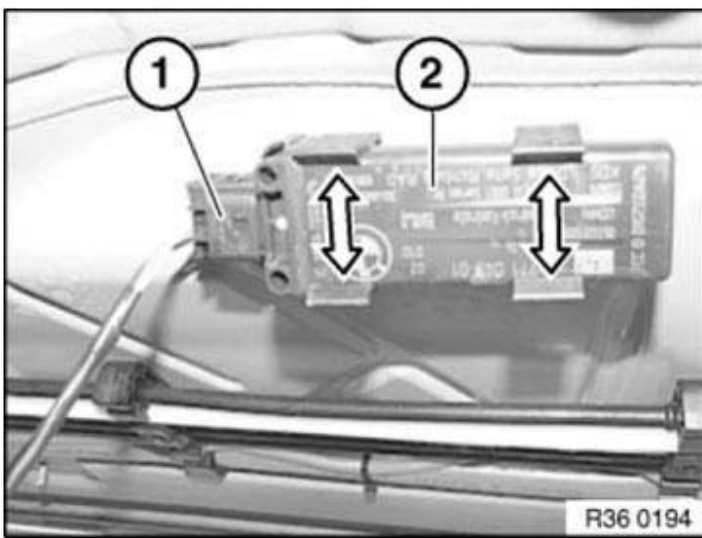


Fig. 13: Removing RDC Aerial
 Courtesy of BMW OF NORTH AMERICA, INC.

36 11 123 REMOVING AND INSTALLING/REPLACING AN RDC TRIGGER TRANSMITTER (REAR)

Necessary preliminary tasks

- Release rear WHEEL ARCH PANEL

Disconnect plug connection (1).

Press catch (2) together and swing out RDC transmitter (3).

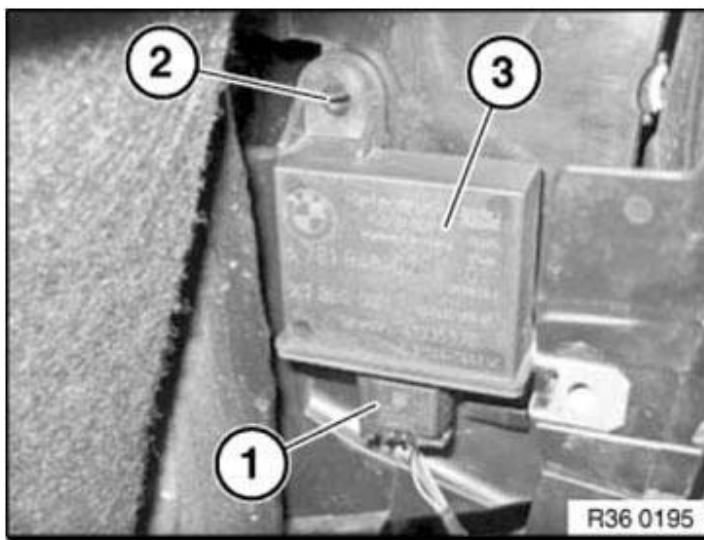


Fig. 14: Identifying Plug Connection, Catch And RDC Transmitter
Courtesy of BMW OF NORTH AMERICA, INC.

36 11 130 REMOVING AND INSTALLING/REPLACING FRONT LEFT RDC TRIGGER TRANSMITTER

Necessary preliminary tasks

- Remove front left WHEEL ARCH PANEL .

Unclip RDC transmitter (1).

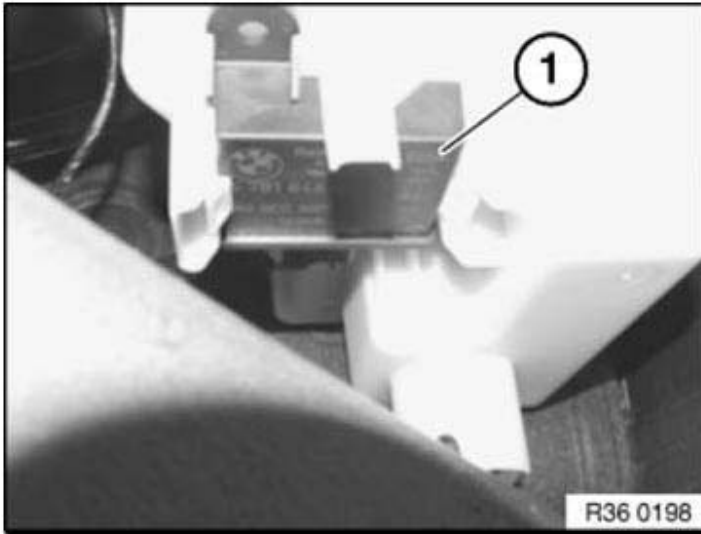


Fig. 15: Identifying RDC Transmitter
 Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1).

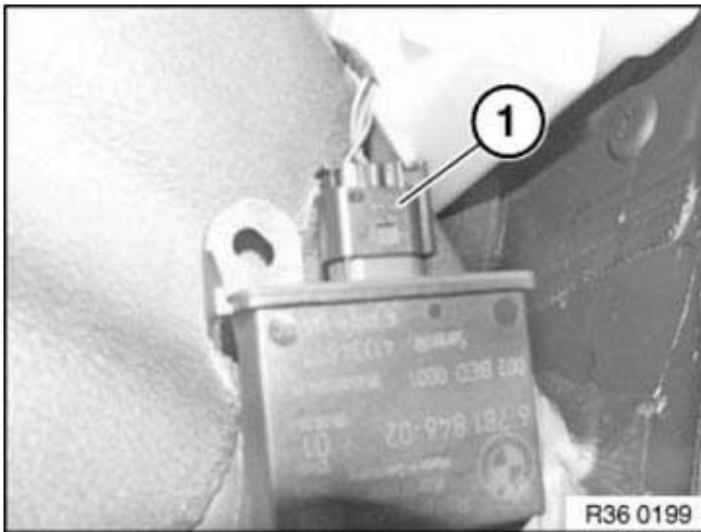


Fig. 16: Identifying Plug Connection
 Courtesy of BMW OF NORTH AMERICA, INC.

36 11 131 REMOVING AND INSTALLING/REPLACING FRONT RIGHT RDC TRIGGER TRANSMITTER

Unclip line (1) from washer fluid reservoir (2).

Unlock washer fluid reservoir (2) (3) and swing out.

Disconnect plug connection of RDC transmitter.

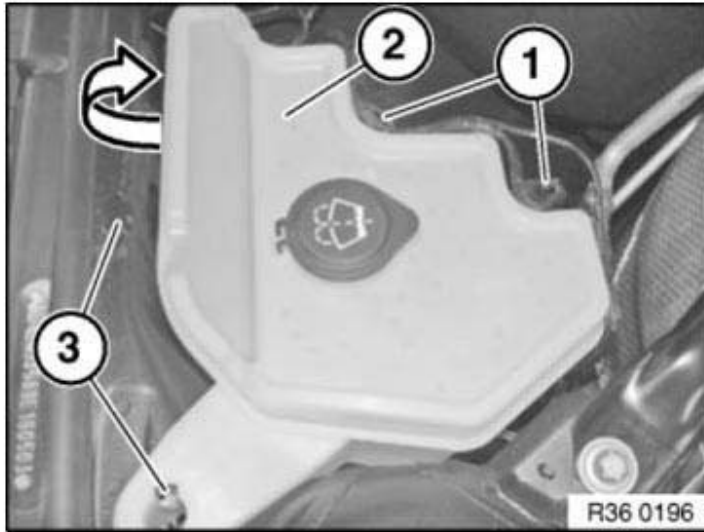


Fig. 17: Removing Line From Washer Fluid Reservoir
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Installation:

Tightening torque **36 11 3AZ** .

Remove RDC transmitter (2).

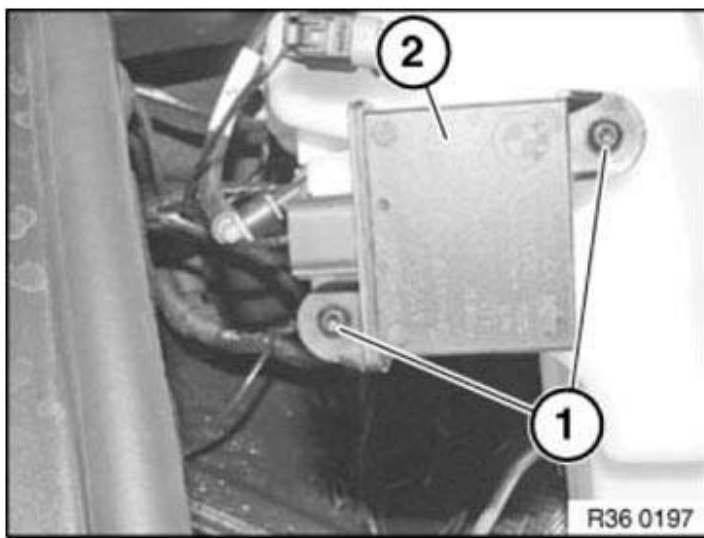


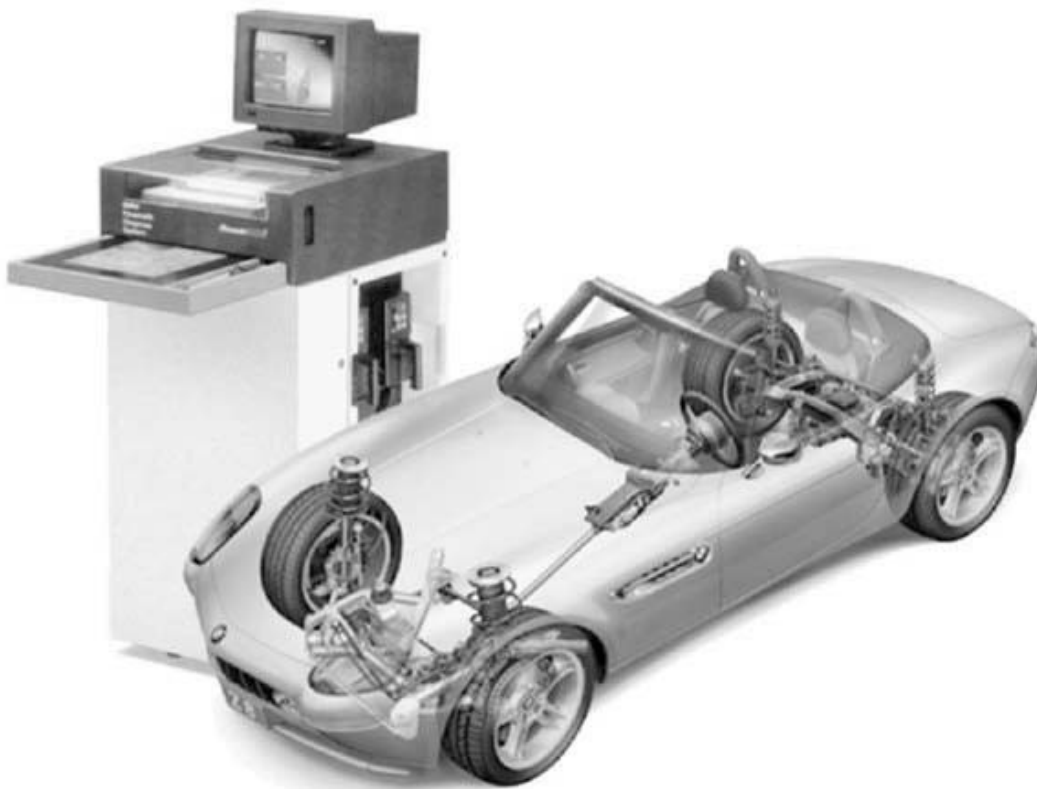
Fig. 18: Identifying RDC Transmitter With Screws
Courtesy of BMW OF NORTH AMERICA, INC.

SUSPENSION

Wheel And Tires - SI Techniques - All Models

KINEMATIC DIAGNOSIS SYSTEM AND ENVIRONMENT

BMW KDS (Beissbarth)



G03179502

Fig. 1: Identifying Kinematic Diagnosis System And Environment
Courtesy of BMW OF NORTH AMERICA, INC.

1. FOREWORD

1.1 Objectives

Wheel alignment has become an increasingly complex subject. The aim of this BMW Service Technology bulletin, therefore, is to achieve several objectives:

- Creation of guidelines for working with the BMW Kinematic Diagnosis System (KDS).
- Familiarization with wheel alignment technology for current vehicles and clarifying any questions which

arise in this connection.

- Transparency and clarification of different terms.
- Clarification of the causes of errors in the past, such that they can be avoided after reading this document.
- Creation of conditions for dealing safely with the BMW KDS.

1.2 Further development of the BMW Kinematic Diagnosis System

- The BMW Kinematic Diagnosis System is an integrated part of automotive system concepts. It ensures that work is carried out in a particularly rational manner which is appropriate for BMW requirements, such that you can also be certain of being prepared for future technological developments. As far as precision and performance in wheel alignment and tuning is concerned, BMW, together with leading manufacturers, has made the best of what is technically feasible: the BMW Kinematic Diagnosis System.
- The BMW Kinematic Diagnosis System manufactured by Beissbarth is more than just the further development of conventional wheel alignment equipment. It sets new standards in precision, performance, speed and handling. It is a guarantor for the perfection which BMW service customers rely on.
- Ride comfort, road safety and tyre wear depend to a large extent on the perfect interplay of the vehicle's kinematic functions. BMW is constantly launching new generations of chassis which are even better than their predecessors. This is why there are fewer kinematics system adjusting points and narrower tolerances when measuring and tuning the chassis.
- With the use of the multi-link rear suspension and the E36, the electronic wheel alignment devices are no longer suitable for BMW wheel alignment purposes. This applies to both the measuring procedure and measuring precision. The generation of equipment which was approved with the E36 series still fulfils all the requirements placed on a modern wheel alignment device, including the use of the latest computer technology.
- Only BMW Kinematic Diagnosis Systems manufactured by Beissarth and Bosch may be used for wheel alignment.

1.3 Technical Data



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Fig. 2: Technical Data Display

Courtesy of BMW OF NORTH AMERICA, INC.

BMW KINEMATIC DIAGNOSIS SYSTEM - TECHNICAL DATA SPECIFICATIONS

1)	Display	- 17" graphic screen with high-resolution graphics (640x480 pixels with 256 colours)
2)	On-screen text	- In the appropriate national language
3)	Wheel dimensions	- 12"...20"
4)	Vehicle memory locations	- Unlimited
5)	Rotating plates	- Load bearing capacity 1000 kg, angle of rotation +/- 360°, 450 x 450 x 50 mm (L x W x H), sliding range +/- 50 mm, weight 18 kg
6)	Sliding plates	- Loadbearing capacity 1000 kg, angle of rotation +/- 10°, 450x450 x 50mm (L x W x H)
7)	Electrical connection	- 100...115 V/220...240V 50/60 Hz, 0.5 kW (other connections on request)

1.4 Scope Of Delivery

1 - PC display device with graphic screen, graphical tablet, small or large equipment cabinet including automatic charging station, DIN A4 dot matrix printer

4 - Measuring sensors with CCD camera technology and infrared data transmission with built-in power supply

1 - Cable set (comprising 4 cables)

1 - Brake clamping device

1 - Steering lock device

2 - Electronic precision rotating plates with integrated sensor without access ramps

2 - Sliding plates without access ramps

4 - BMW quick-clamping units, comprising a P8-68 locating bell and P267 01 quick-acting clamp including coated holding claws

1 - Operating instructions for BMW KDS (8 languages)

1 BMW software and the BMW vehicle set-point data with setting screens as well as text for the measurement preparations

1.5 Accessories Required

2 Locating rods for positioning the vehicle

1 Set of sand bags for the prescribed loading

1.6 Accessories recommended

4 - Quick-clamping units

2 - Sets of access ramps

1 - Remote control display

1 - Trolley (for ballast bags, rotating and sliding plates and 4 quick-acting clamps)

2. MEASURING OPTIONS USING THE BMW KINEMATIC DIAGNOSIS SYSTEM

2.1 Front Axle

- Toe-in (single and total toe-in in relation to the geometrical drive axis)
- Camber (with steering wheel pointing straight ahead)
- Wheel displacement (in relation to the left-hand front wheel)
- Castor, kingpin inclination and toe-differential angle

2.2 Rear Axle

- Toe-in (single and total toe-in in relation to the longitudinal centre plane of the vehicle -> previously called symmetrical axis)
- Geometrical drive axis
- Camber

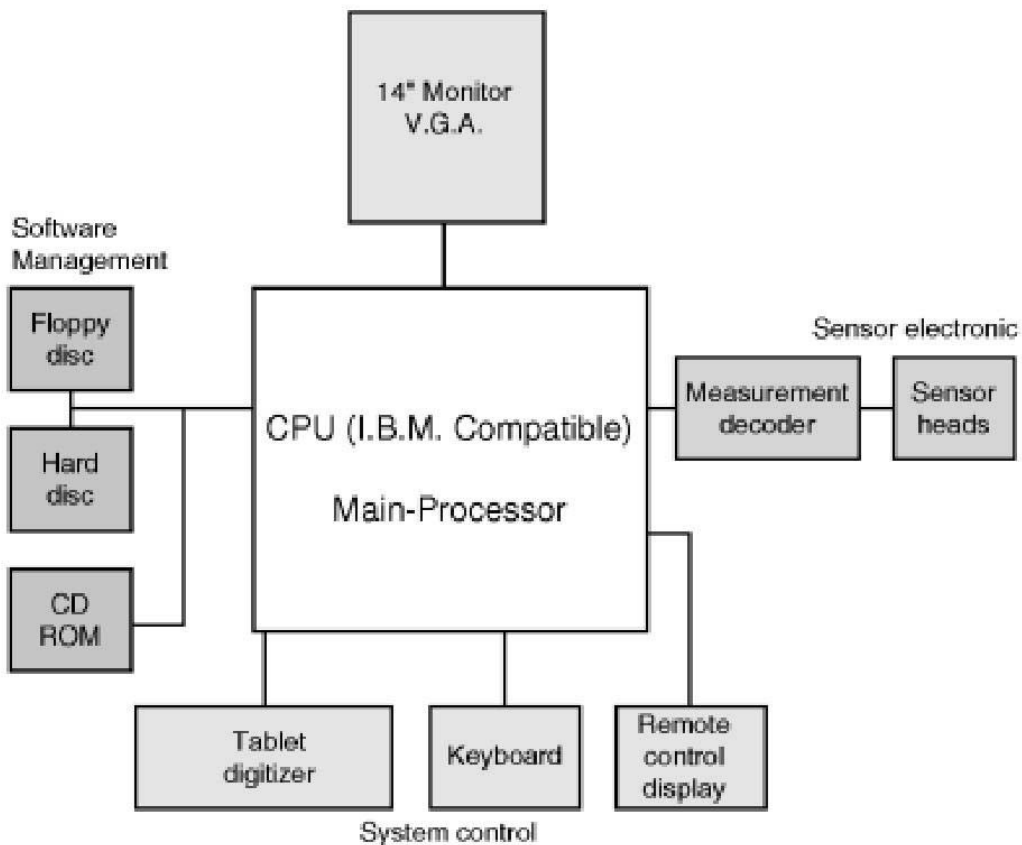
2.3 Other Measuring Options

- Rear Wheel Displacement
- Wheelbase Difference
- Lateral Displacement On Right
- Lateral Displacement On Left
- Track Difference
- Axial Displacement

3. SYSTEM DESCRIPTION

3.1 BMW Kinematic Diagnosis System 1, Based On The Beissbarth ML4000

microline 4000 system concept



G03179504

Fig. 3: BMW Kinematic Diagnosis System Concept Chart
Courtesy of BMW OF NORTH AMERICA, INC.

The KDS 1 is available in two different designs at no extra charge:

1. Mobile Workstation



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Fig. 4: Identifying Mobile Workstation
Courtesy of BMW OF NORTH AMERICA, INC.

2. Mobile Compact Cabinet



G03179506

Fig. 5: Identifying Mobile Compact Cabinet
Courtesy of BMW OF NORTH AMERICA, INC.

The larger workstation offers a small storage area for accessories, whilst the compact cabinet is mobile and ideal for restricted working areas. Both variants can be supplied as a cableless measuring system (infrared). From the point of view of measuring technology, there is only a difference in the handling and equipping of the system. For both designs, the four measuring sensors are stored in integrated inserts with rechargeable battery charging points. When automatically charged over night, the measuring sensor batteries provide enough power for 10 hours of continuous use.

3.2 Computer

The KDS 1 system comprises tested and reliable industrial components. The computer is an IBM-compatible, 32-bit Intel processor with CD ROM drive to the industry standard.

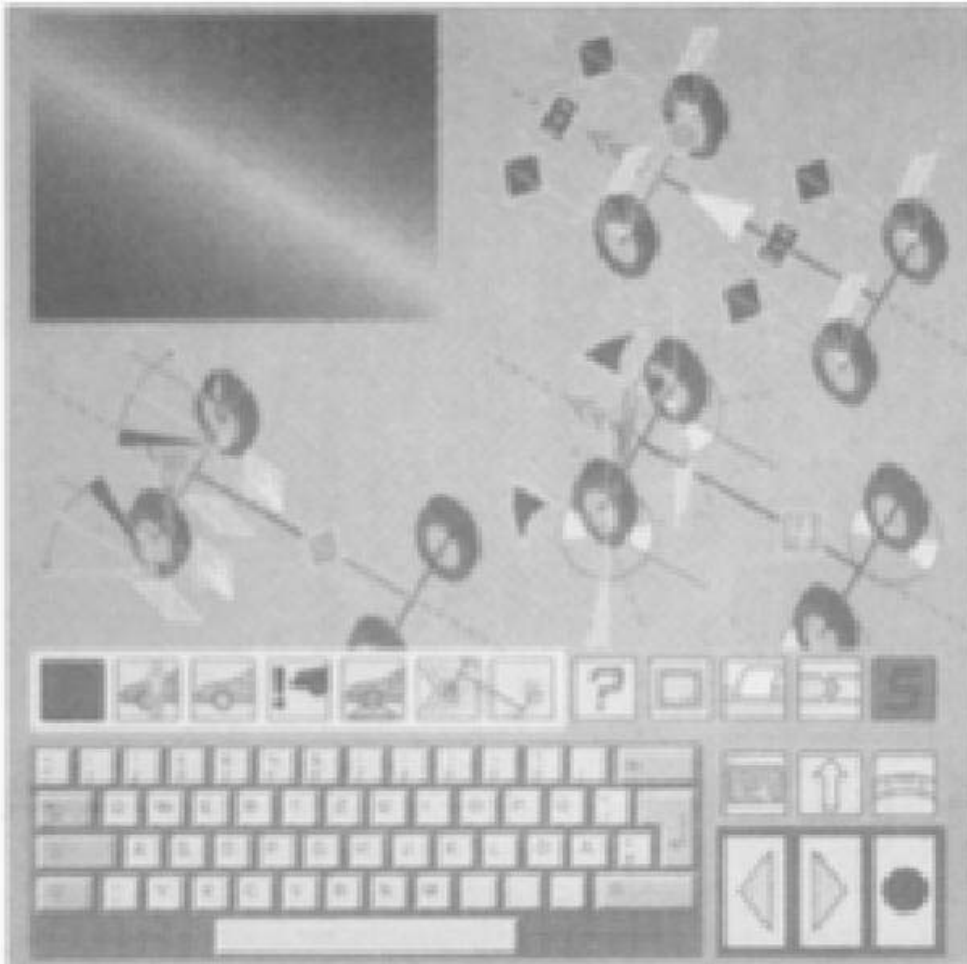


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Fig. 6: Identifying System Comprises Tested And Reliable Industrial Components
Courtesy of BMW OF NORTH AMERICA, INC.

3.3 Graphical Tablet

All functions are shown in graphical form on a "pictogram" panel. The panel is protected by a plexiglass cover. It can easily be replaced if more extensive design modifications are necessary. The operator interface has no membrane and is thus protected against damage. The main functions are activated by clicking the icon with the digital pen.

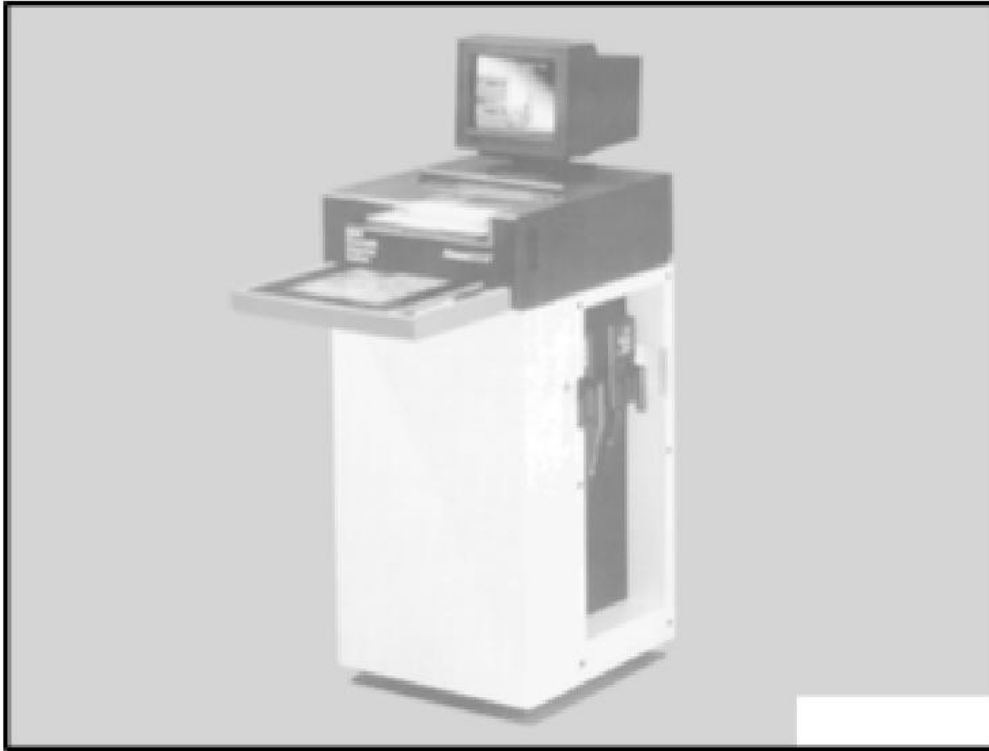


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Fig. 7: Identifying Graphical Tablet
Courtesy of BMW OF NORTH AMERICA, INC.

3.4 Equipment Cabinet

The PC with graphic monitor and removable operating panel, supports for the measuring sensors, the remote control and the A4 printer are integrated into the workstation. The charging station is located in the cabinet and can also be connected to the measuring sensors and the remote control using the plug-in cables (operating while simultaneously charging the batteries).



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Fig. 8: Identifying Equipment Cabinet
Courtesy of BMW OF NORTH AMERICA, INC.

3.5 Remote Display

A cableless remote display can be supplied on request. The remote control keys are only active during measuring and adjustment (not for customer data input, or if selecting a vehicle or editing the setpoint data etc.). The following displays are supported by the remote control:

- Measured value with setpoint/actual comparison and tolerance bar
- Steering graphics for steering routines
- Live overview of the track/camber values with a setpoint/actual comparison
- Rim run-out compensation



G03179510

Fig. 9: Identifying Remote Display
Courtesy of BMW OF NORTH AMERICA, INC.

3.6 Measuring Sensors With CCD Camera

The measuring sensors are each equipped for automatic measurement with two CCD cameras and their own processor for the cableless infrared transmission of data with integrated batteries. Benefits:

- No temperature deviation
- Very high measuring resolution (the track
- Single track range of more than ± 9 degrees for the constant display of toe-in when changing the tie-rod ends
- Exact system accuracy, i.e. when carrying out measurements at the vehicle following rim run-out compensation, the toe-in and camber measurements are accurate to 2 angular minutes



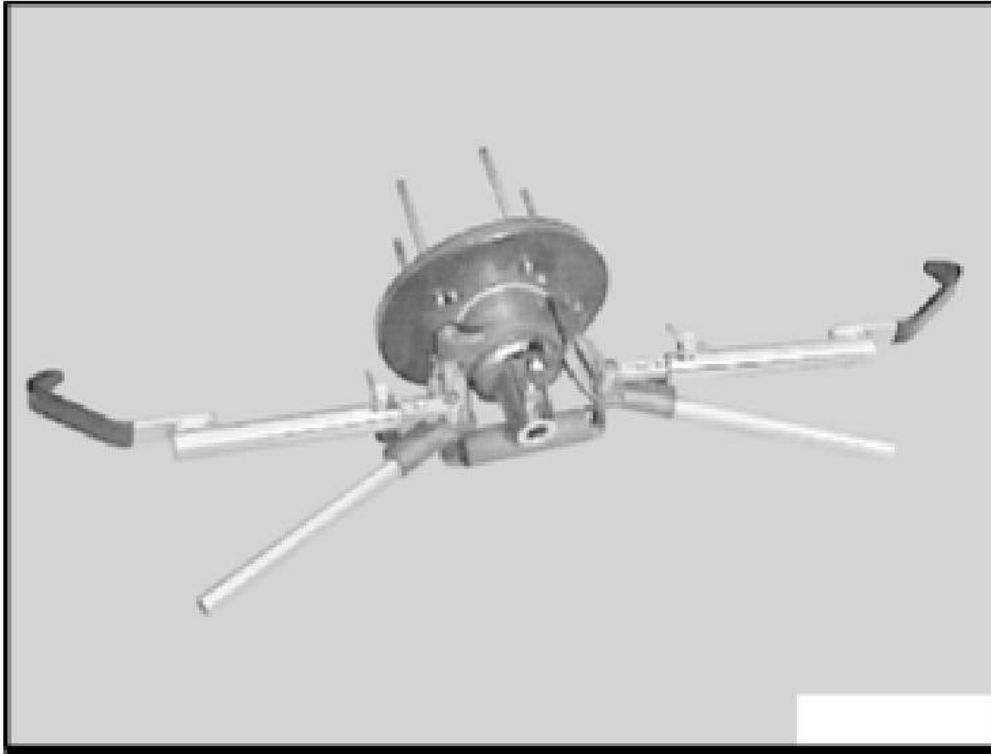
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Fig. 10: Measuring Sensors With CCD Camera
Courtesy of BMW OF NORTH AMERICA, INC.

3.7 BMW Quick-Acting Clamp

BMW quick-acting clamp for holding the measuring sensors precisely in position and measuring without rim run-out compensation.

NOTE: **Any existing quick-acting clamps, e.g. from older F1600s or ML-3000s, must not be used on the BMW KDS.**

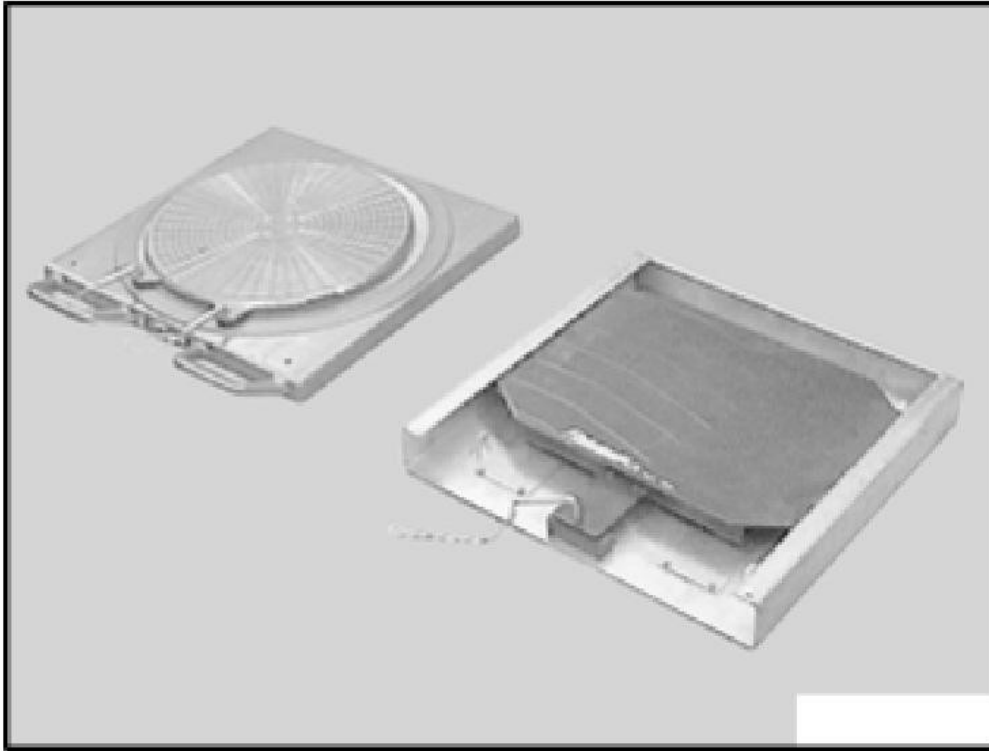


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Fig. 11: Measuring BMW Quick-Acting Clamp For Holding
Courtesy of BMW OF NORTH AMERICA, INC.

3.8 Rotating/Sliding Plates

- Electronic precision rotating plates for the front wheels with integrated sensor (360 degree measuring range)
- Stable sliding plates for the rear wheels with a swivelling/rotating top plate
- Accessories: Cover hood for aluminum rotating plates

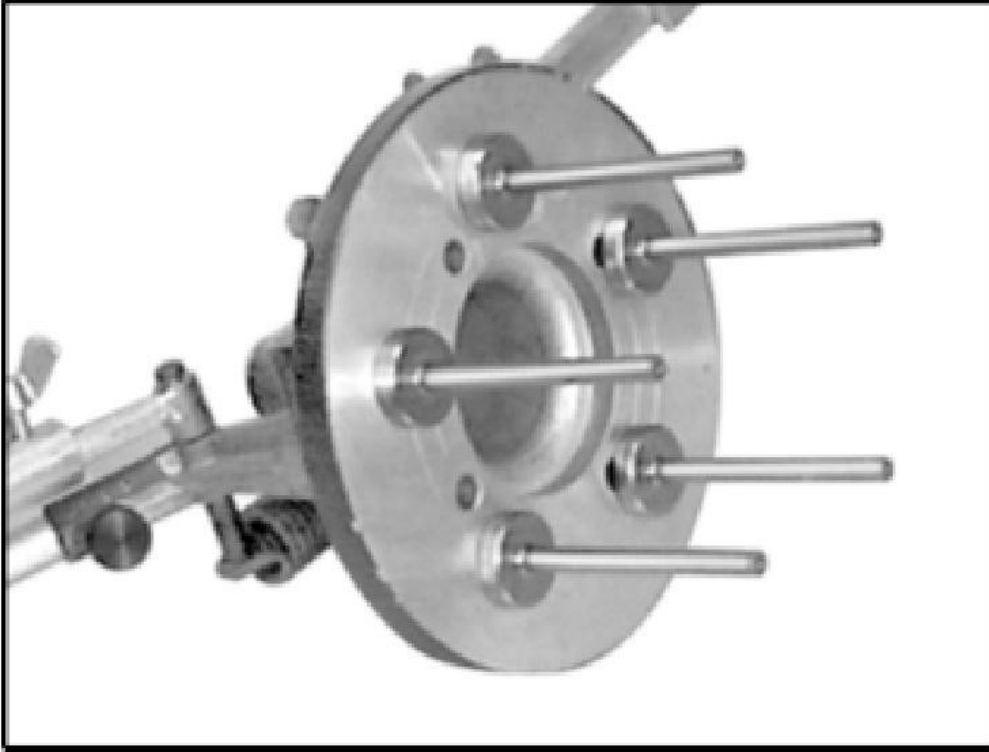


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Fig. 12: Identifying Rotating/Sliding Plates
Courtesy of BMW OF NORTH AMERICA, INC.

3.9 Sensor Pins

- A new BMW light alloy wheel (styling no. 18) has been available as optional equipment from April 1993. When measurements are being made on vehicles with these wheels, new sensor pins are required for the quick-acting clamps of the recommended wheel alignment equipment.
- The new sensor pins are included in the scope of supply for new deliveries of KDS 1 (order number: BS 90 19 11).



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Fig. 13: Identifying Sensor Pins

Courtesy of BMW OF NORTH AMERICA, INC.

3.10 Spoiler Adapter

- In the case of vehicles with very low spoilers, the sensor beam may be broken by the spoiler between the measuring sensors. This primarily occurs in front of the front axle.
- The spoiler adapter is used here as a connecting element between the measuring equipment clamp and the measuring sensor. Thanks to the adapter, the sensors are placed 50 mm lower, thus allowing the sensor beam to move freely below the spoiler.

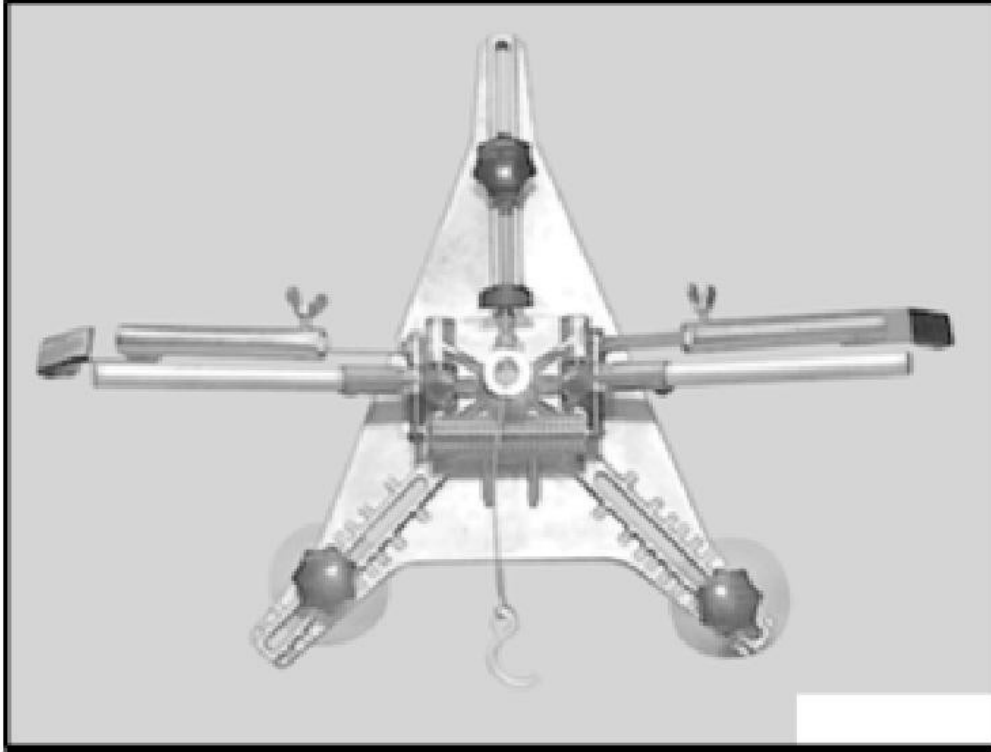


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Fig. 14: Identifying Spoiler Adapter
Courtesy of BMW OF NORTH AMERICA, INC.

3.11 Quick-Clamping Units

- Quick-clamping units for wheel alignment on non-BMW vehicles with rim run-out compensation.
- Rims without sensors boreholes (rims for BMW vehicles from other manufacturers)

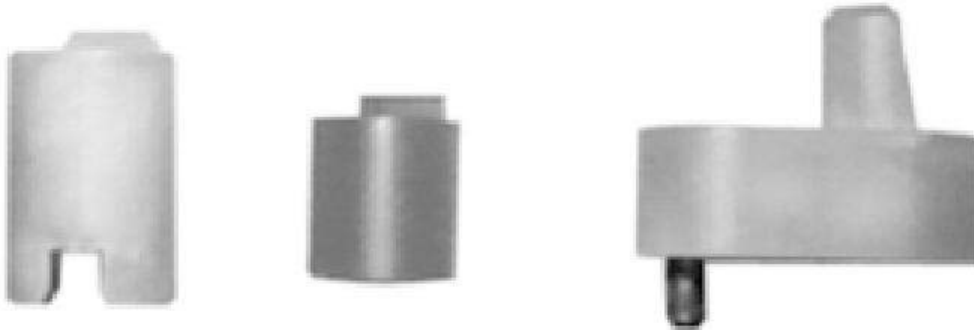


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Fig. 15: Identifying Quick-Clamping Units For Wheel Alignment Non-BMW
Courtesy of BMW OF NORTH AMERICA, INC.

3.12 Retainers

- The most varied clamping options for the measuring equipment are possible thanks to the versatile retainers and the rubber-coated thrust pieces, even on exotic light-alloy rims.



G03179517

Fig. 16: Identifying Retainers

Courtesy of BMW OF NORTH AMERICA, INC.

4. WORKSTATION

4.1 Environment

All lifting platforms currently recommended by BMW (see Workshop Equipment Planning documentation, Issue 11) for wheel alignment meet the requirements for the BMW KDS.

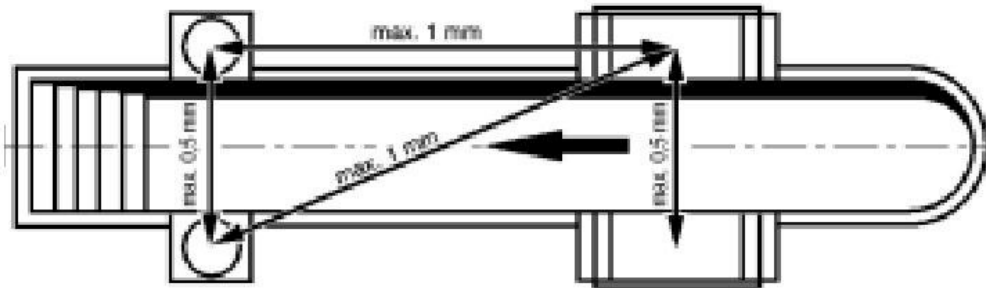
No particular requirements have to be met in respect of the location at which the BMW KDS is used. The measuring device can be installed over working pits or on lifting platforms.

Requirements:

- Wheel alignment pits
- Pillar-type lifts with set-down device
- 2 plunger-type lifting platforms with set-down device
- Repair stands with set-down device
- One measuring area (approx. 4.5 m x 7.0 m).
- The rotating plates must be pinned to the platform

The support surfaces for the rotating and sliding plates may only display the following maximum height difference:

- from left to right +/- 0.5 mm
- from front to back +/- 1.0 mm
- diagonally +/- 1.0 mm.



G03179518

Fig. 17: Cutaway View Of For Rotating And Sliding Plates
 Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: A difference in the height of the rotary plates of ± 2 mm from left to right results in a measuring error of 4.8° in the camber.
 As a comparison: The camber tolerance on the E36 is $\pm 10'$. The tyre tread difference or varying tyre pressure cause measuring errors of the same magnitude.

4.2 Preconditions For Alignment

When carrying out the wheel alignment, the front and rear wheels must be centred on the rotating and sliding plates in order that all wheel suspensions remain free of tension during the steering routine and adjustment work. As a result, the rotating and sliding plates for the relevant wheel bases and track widths of the vehicle to be aligned must be moved.

4.3 Measuring Tolerance

All measuring tolerances are system tolerances. This means that the sum of all individual tolerances gives the value shown in the example. Example of camber: Quick-acting clamp + measuring sensor + computer = $1'$ at a measuring range of $\pm 3^\circ$ (all BMW vehicles are within this measuring range).

4.4 Levelling The Measuring Station

The manufacturers of the BMW KDS (Beissbarth/Bosch) are able to measure the measuring area to the required accuracy using levelling devices. Any "normal" water level is not suitable for this. Lifting platforms must be levelled under load so that the uneven deflection in the travel rails is taken into account.

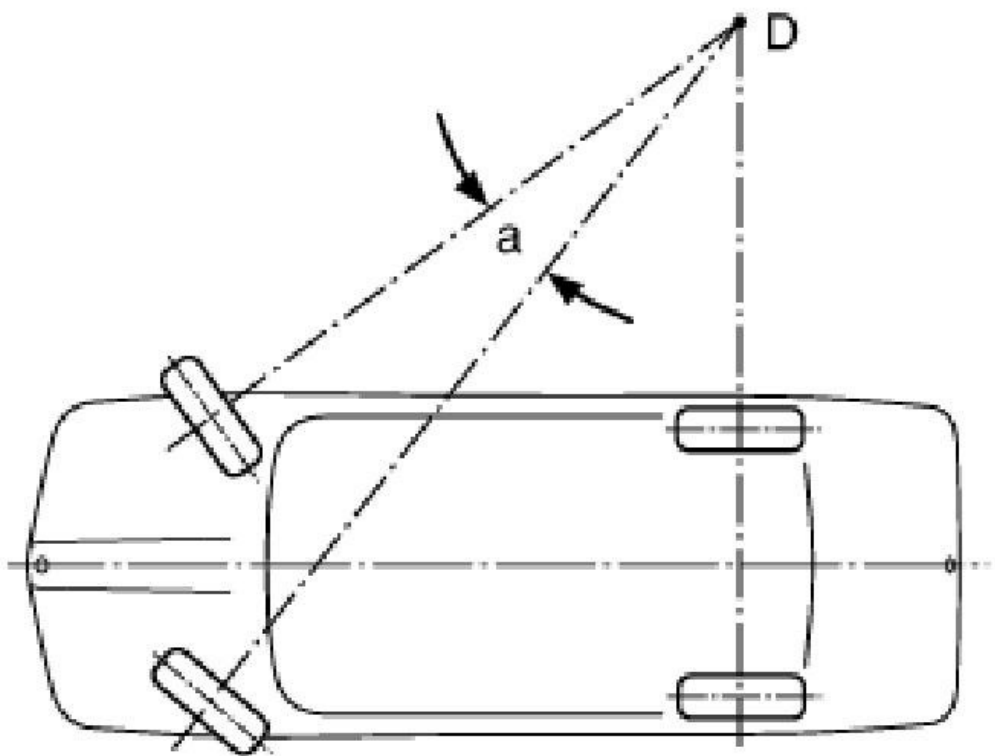
IMPORTANT: Adjustment work for the lifting platform concerned must be executed by a specialist (manufacturer's after-sales service).

5. CHASSIS-RELATED TERMS

5.1 Toe-Differential Angle

Description:

- The toe-differential angle (a) is the angular position of the internal wheel on the curve in relation to the external wheel on the curve when driving round bends. The steering is designed such that the angular position of the wheels in relation to each other changes as the steering angle increases.
- In ideal cases, the wheel axes meet at point D in any steering position (except for straight ahead).

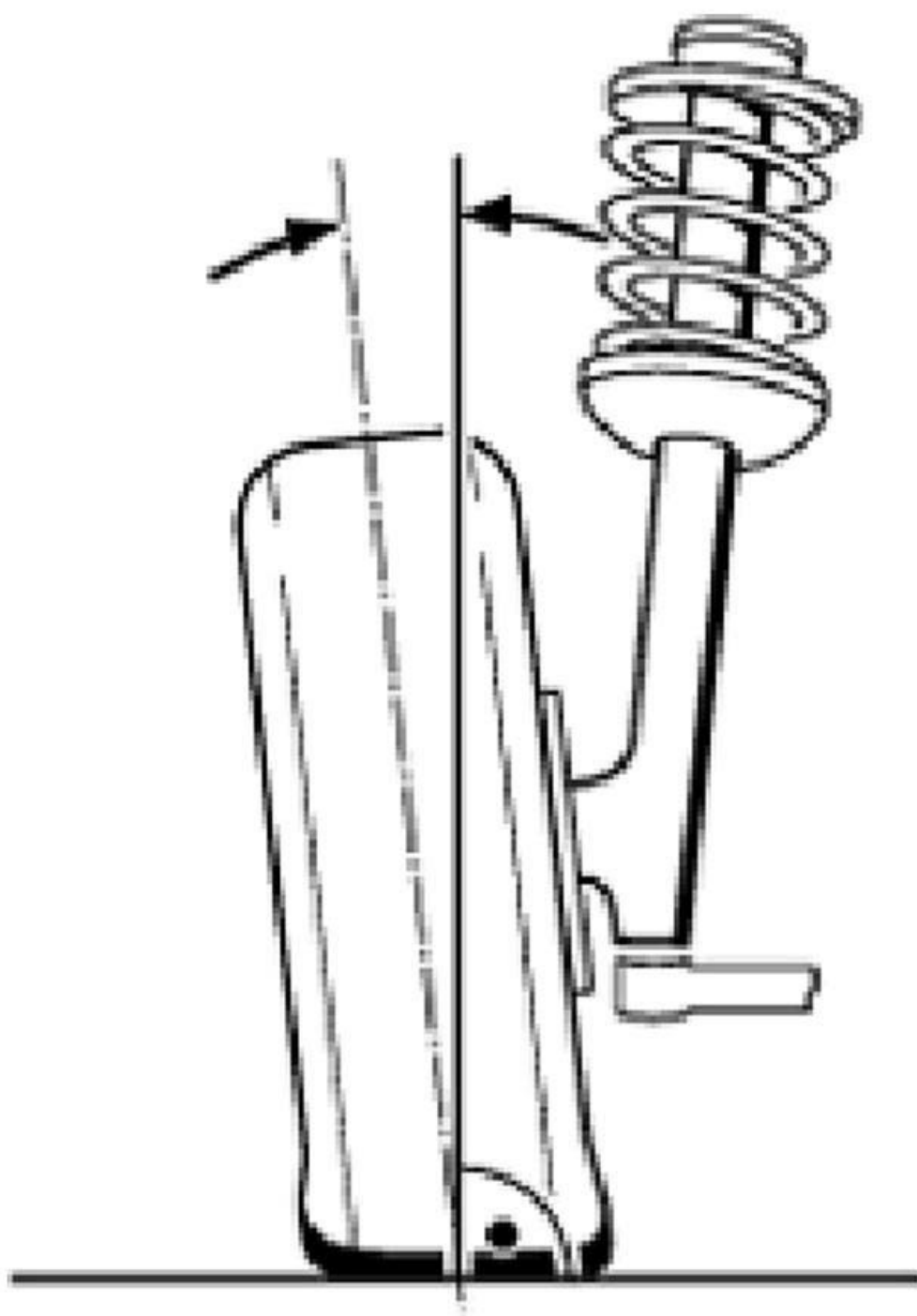


G03179519

Fig. 18: Identifying Toe-Differential Angle
Courtesy of BMW OF NORTH AMERICA, INC.

5.2 Camber

- The camber is the angle of inclination of the wheel in relation to the vertical.



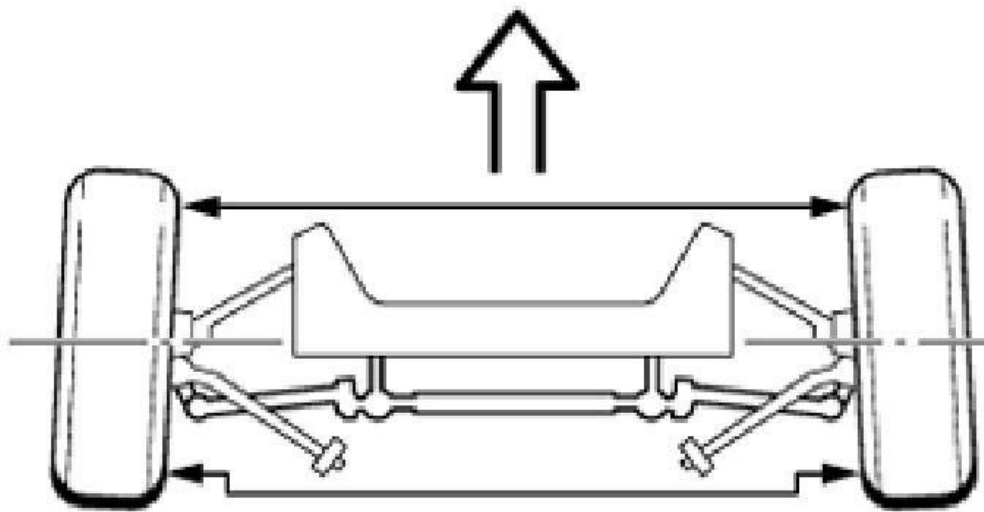
G03179520

Fig. 19: Identifying Camber Angle

Courtesy of BMW OF NORTH AMERICA, INC.

5.3 Toe-In

- The toe-in is the reduction in the distance between the front of the wheels and the rear. The toe-in prevents the wheels from moving apart whilst driving (wobbling and grinding).



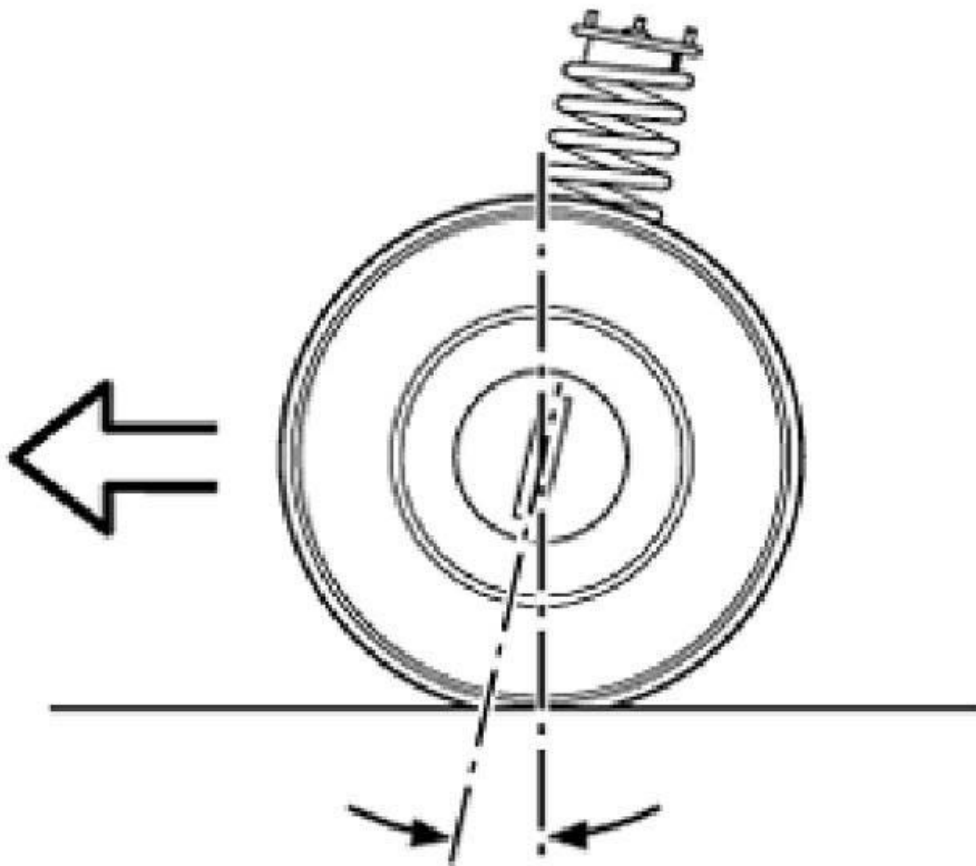
G03179521

Fig. 20: Identifying Toe-In Angle

Courtesy of BMW OF NORTH AMERICA, INC.

5.4 Caster

- The caster is the kingpin angle seen from the side in the opposite direction of travel. The line through the centre of the spring strut mount and control arm ball joint corresponds to the kingpin.

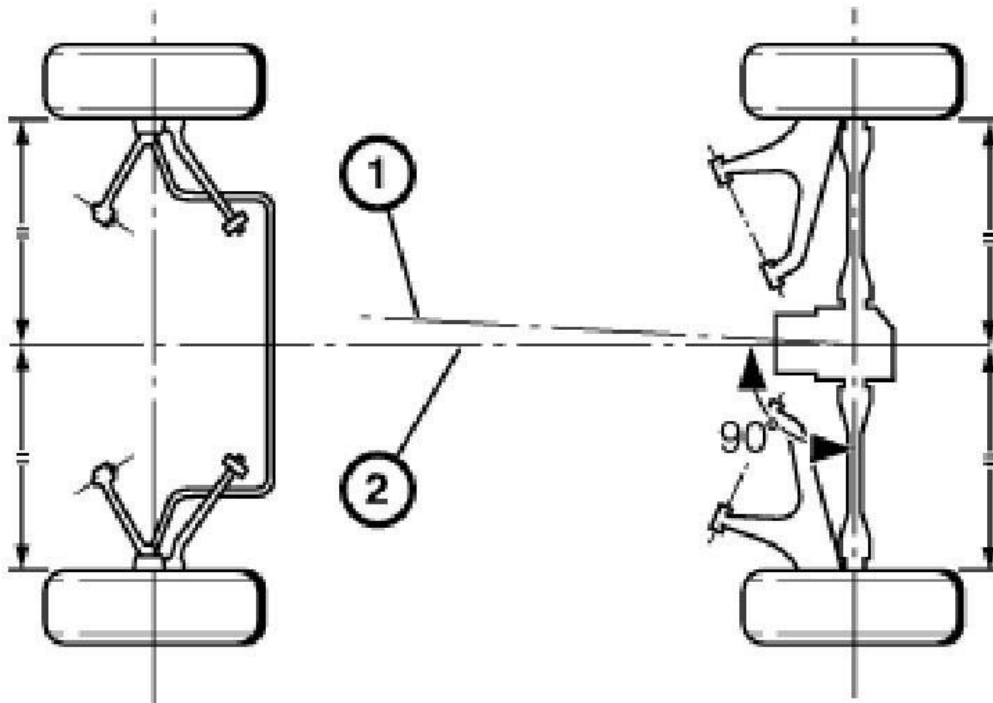


G03179522

Fig. 21: Identifying Castor Angle
Courtesy of BMW OF NORTH AMERICA, INC.

5.5 Geometrical Drive Axis/Symmetrical Axis

- (1) The geometrical drive axis is the line bisecting the angle of the overall rear wheel toe. The measurements of the front wheels relate to this axis.
- (2) The symmetrical axis represents the centre line through the front and rear axes.

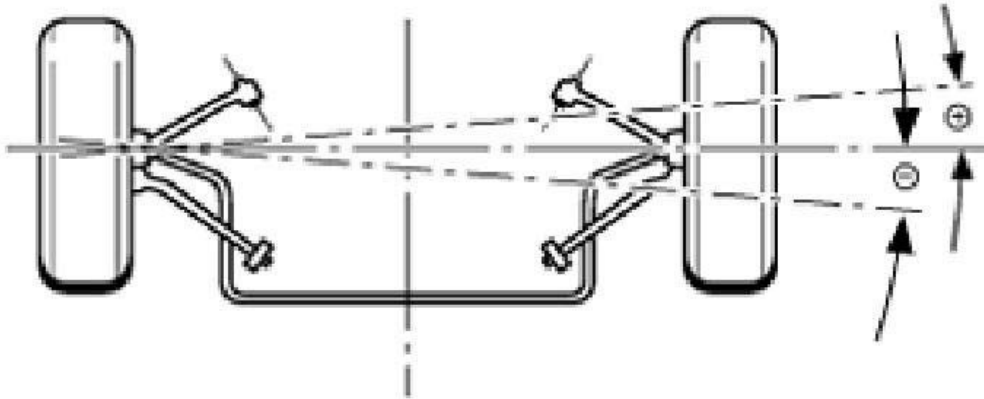


G03179523

Fig. 22: Identifying Geometrical Drive Axis Angle
 Courtesy of BMW OF NORTH AMERICA, INC.

5.6 Wheel Displacement Angle

- The wheel displacement angle is the angular deviation of the connecting line of the wheel contact points in relation to a line running at 90° to the geometrical drive axis. The wheel displacement angle is positive if the right-hand wheel is displaced to the front, and is negative if it is displaced to the rear.

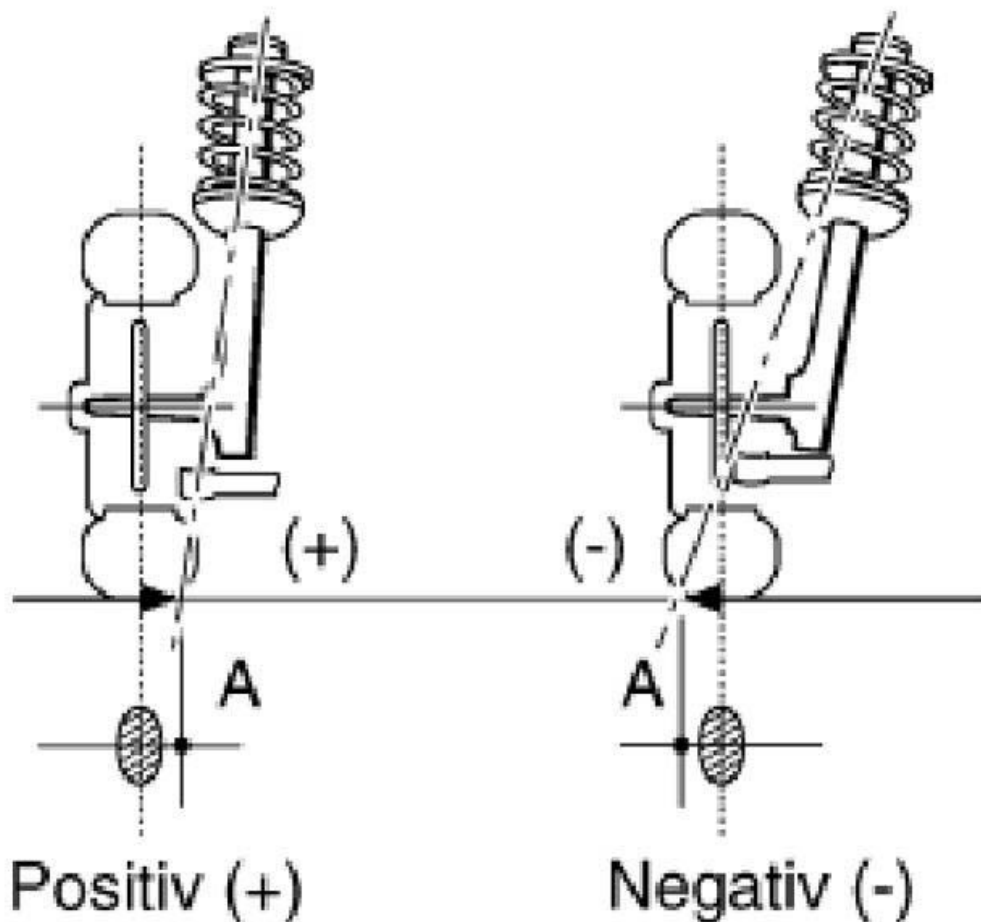


G03179524

Fig. 23: Identifying Wheel Displacement Angle
 Courtesy of BMW OF NORTH AMERICA, INC.

5.7 Kingpin Offset

- The kingpin offset is the distance from the centre of the wheel contact point to the contact point of the kingpin extrapolation.



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Fig. 24: Identifying Kingpin Offset Angle
 Courtesy of BMW OF NORTH AMERICA, INC.

6. WHEEL SUSPENSION

Those parts which connect the wheel to the mostly load-bearing floor elements of the bodywork and guide it in the required direction belong to the wheel suspension. They are connected by axles or other comparable structures and guided by the arms. The wheel suspension plays a decisive role in the handling characteristics of a vehicle. Two main groups have to be distinguished: 1. Rigid axle suspension and 2. Independent wheel suspension.

6.1 Rigid Axle Suspension

RIGID AXLE SUSPENSION SPECIFICATIONS

Description	Advantages	Disadvantages
The rigid axle suspension has a rigid connection between both wheels or wheel pairs. Any change in one wheel is more or less transferred to the other. It is now only fitted as a rear axle, if at all. However it is frequently used for lorries or busses.	In the event of deflection taking place, there are no changes to the camber or wheel toe. This means: less tyre wear and good track stability.	Non-driven rear axles may also acquire negative camber as well as increasing tyre lateral guidance, thus increasing tyre wear.

6.2 Independent Wheel Suspension

INDEPENDENT WHEEL SUSPENSION DESCRIPTION

Description	Advantages	Disadvantages
State-of-the-art individual wheel suspension is available on BMW vehicles on the front and rear axles. This development has its cause in mass inertia, as a reduction in the non-suspended mass improves wheel and ground contact, and the wheel stays better on the road. Control arms and trailing arms, which have to absorb high longitudinal and lateral forces to some extent, are required for guiding independently suspended wheels.	Wheels suspended independently from each other have no mutual influence on each other.	Depending on the type, changes may occur in the camber, wheel toe, track width, castor and wheelbase.

7. WHEEL ALIGNMENT PROCEDURE

7.1 Measuring Options

An overview of all measuring options and values (VA = front axle, HA = rear axle) is shown below.

MEASURING OPTIONS SPECIFICATIONS

Measuring options	Measuring accuracy	In measuring range	Total measuring range
Total wheel toe (VA + HA)	+/- 2'	+/-2°	+/-18°
Single wheel toe (VA + HA)	+/-2'	+/-2°	+/-9°
Camber (VA + HA)	+/-1'	+/-3°	+/-10°
Wheel displacement (VA)	+/-2'	+/-2°	+/-9°
Geometrical drive axis	+/-2'	+/-2°	+/-9°

Castor	$\pm 4'$	$\pm 18^\circ$	$\pm 22^\circ$
Kingpin inclination	$\pm 4'$	$\pm 18^\circ$	$\pm 22^\circ$
Toe-differential angle	$\pm 4'$	$\pm 20^\circ$	$\pm 20^\circ$
Maximum steering angle (VA)	$\pm 4'$	$\pm 60^\circ$	$\pm 300^\circ$
Maximum steering angle (HA)	$\pm 4'$	$\pm 9^\circ$	$\pm 9^\circ$
Castor correction range	$\pm 4'$	$\pm 7^\circ$	$\pm 10^\circ$

NOTE: The measuring accuracy details only apply when using the precision rotating and sliding plates as well as the BMW quick-acting clamps.

7.2 Preparatory Work

Before commencing the measurement, preparatory work must be carried out at the measuring area and on the vehicle (see BMW KDS operating instructions). Preparatory work includes:

- Easy-running rotating and sliding plates
- Aligning the rotating and sliding plates in relation to the track width and wheelbase
- Centering the vehicle on the plates
- Applying the parking brake
- Removing the lock pins on the plates to prevent tension in the chassis under loading
- Checking the rim and tyre size, tread depth, tyre pressure, steering wheel play, wheel bearings and condition of suspension and shock absorbers
- Fastening the measuring equipment to the wheels
- Loading the vehicle according to BMW KDS specifications
- Rock the vehicle firmly with the brakes released to ensure a stable centre position
- Lock the service brake using the brake clamping device

7.3 Initial/Final Measurement

This measurement can be carried out as a program-guided measurement in the same way as any subsequent adjusting work and the final measurement. The sequence of the chassis measuring points to be called up is specified and controlled by the system software. The individual steps comprise:

- Driving straight ahead to correctly record the wheel toe and camber values for the rear axle
- Steering routine for recording the castor, kingpin inclination and toe-differential angle
- Recording the wheel toe and camber of the front axle (adjust the steering centre point in advance)
- Steering routine for measuring the maximum steering angle on the left/right
- Checking the overview of measured values with the setpoint and actual comparison of all measured values

7.4 Printing Out The Data

BMW iSDS Kinematik Diagnostic System									
Kunden Nr.:					Fahrg. Nr.:				
Lenkstil:					Tachometerstand:				
Kunde:					Reiseabrechnung:				
Anw. Kunde:					Datum: 01.12.1994/11:21				
Unternehmen:									
Fahrzeug: * BMW * Typ: 318i * 3750 * Serie: 177849									
Richtwert: Lenkst. Softwert:					Richtwert:				
425 mm ± 12 mm - 12 mm					144 mm ± 12 mm - 12 mm				
Richtwert: Lenkst. Softwert:					Richtwert:				
425 mm ± 12 mm - 12 mm					144 mm ± 12 mm - 12 mm				
Richtwert: Lenkst. Softwert:					Richtwert:				
425 mm ± 12 mm - 12 mm					144 mm ± 12 mm - 12 mm				

			Richtwert		Softwert		Richtwert		Softwert	
			max. Differenz		min.		max.		min.	
Vorne:	Lenkst.	links	-1°13'	-1°30'	-0°20'	-0°20'	-1°14'	-1°14'	-0°20'	-0°20'
		rechts	+0°30'	+0°30'	-0°20'	-0°20'	+0°30'	+0°30'	-0°20'	-0°20'
		links	+0°12'	+0°12'	-0°20'	-0°20'	+0°12'	+0°12'	-0°20'	-0°20'
		rechts	+0°12'	+0°12'	-0°20'	-0°20'	+0°12'	+0°12'	-0°20'	-0°20'
	Fahrbahneinst.		+0°12'		+0°12'		+0°12'		+0°12'	
	Hinten:	Nachlauf	links	+1°44'	+1°44'	-0°30'	-0°30'	+1°44'	+1°44'	-0°30'
rechts			+1°24'	+1°24'	-0°30'	-0°30'	+1°24'	+1°24'	-0°30'	-0°30'
Spurweite		links	-1°54'	-1°54'	-0°30'	-0°30'	-1°54'	-1°54'	-0°30'	-0°30'
		rechts	-1°45'	-1°45'	-0°30'	-0°30'	-1°45'	-1°45'	-0°30'	-0°30'
Steuer		links	+0°04'	+0°13'	+0°30'	+0°30'	+0°04'	+0°04'	+0°13'	+0°13'
		rechts	+0°13'	+0°13'	+0°30'	+0°30'	+0°13'	+0°13'	+0°30'	+0°30'
Spur		links	+0°04'	+0°04'	+0°30'	+0°30'	+0°11'	+0°11'	+0°30'	+0°30'
		rechts	+0°11'	+0°11'	+0°30'	+0°30'	+0°11'	+0°11'	+0°30'	+0°30'
gerade		+0°20'		+0°14'		+0°14'		+0°20'		
Radverr.		-0°04'		+0°04'		-0°13'		-0°13'		
Maximaler Längswinkel mit Lenkst.	links	0	0	+0°30'	+0°30'	0	0	0	0	
	rechts	0	0	+0°30'	+0°30'	0	0	0	0	

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Fig. 25: Specification Data
Courtesy of BMW OF NORTH AMERICA, INC.

The report printout from the integrated DIN A4 printer is subdivided into three sections:

- Header lines with customer and vehicle identification data --> the customer data entered before beginning the measurement as well as vehicle data are printed out here.
- Centre section with vehicle data -> this includes the make, type, model and vehicle model year defined when the setpoint data record was selected. The values previously measured for height level, tyre pressure and tread depth are also printed in this section.
- The end section with all vehicle alignment values comprises the 3 columns initial measurement, setpoint values and output measurement. The measured values are recorded separately in these three columns.

8. SPECIAL FEATURES

8.1 Free Wheel Alignment

With free wheel alignment the selection and sequence of the measuring points is freely selectable. The following points must be observed for attaining the correct measurement results:

- Carry out all work in the same way as with the program-guided measurement.
- Before measuring the wheel toe and camber values for the rear axle, the steering must be in the "straight ahead" position to ensure that it is perfectly aligned in relation to the longitudinal centre plane of the vehicle.
- Before measuring the single wheel toe values on the front axle, the centre of steering must be established to ensure the correct position of the steering wheel.

8.2 System Settings

The following settings must only be entered or set once: language, display format, date/time, advertising text, remote control with display, rotating plate selection and printer settings. They remain stored.

9. BMW KINEMATIC DIAGNOSIS SYSTEM COMPARISON (BOSCH - BEISSBARTH)

BMW KINEMATIC DIAGNOSIS SYSTEM SPECIFICATIONS

Bosch		Beissbarth
Measured value recording	Infrared	CCD camera
Data transmission	Cable	Infrared / cable
Measuring sensor power supply	Cable	Battery/ cable
Remote control	Infrared	Infrared
Remote control with measured value display	Cable	Infrared
Setpoint data memory	Floppy disk	Hard disk
Measured value memory	Always the last vehicle measured	Unlimited vehicle memory
Operating system	--	MS-DOS
Languages	English and one language on request	EN, DE, NI, SV, IT, FR, SP (further languages can be called up)
Update	3.5" floppy disk	3.5" floppy disk using TIS/DIS
Monitor	20"	17"
Computer	--	Pentium
Disk drives	2 x floppy disk	1 x floppy, 1 x CD ROM

10. CONTROL MODIFICATION (MENU)

10.1 Remote Control With Display

The following steps show how the remote control with display is activated:

1. Call up the "Service" menu in special functions ("S" key)
2. Call up the "Remote control" sub-menu in the "Service" menu.
3. Select the "Remote control with display" item in the "Remote control" sub-menu - this configuration is retained.

IMPORTANT: In the case of equipment without remote control, this must be configured to "No remote control".

10.2 Brief Operating Instructions

1. Activate the remote control with the "ON" button (it may also be switched on during alignment). The title page will appear on the LCD.
2. Select "Straight ahead" of the "Initial measurement", "Adjustment work" or "Final measurement" at the measuring equipment cabinet. The steering graphics for "Straight ahead" will appear on the LCD.
3. Use the "Forward arrow" to change to the next measurement image. Display blocks will appear on the LCD with the designation of the measured value and tolerance bar with the measured value. If the measured value is within the tolerance range, it is shown in dark figures against a light background. If the measured value is outside the tolerance range, it will be shown in inverse video (light figures against a dark background).
4. By pressing the "F" key shortly, you can move alternately between the designation of the measured value and the setpoint value with the tolerance inside the display blocks.
5. You can scroll through the measured values using the "Forward arrow", "Backward arrow" and "Cancel" (red dot) keys. The function of these keys is identical to that of the keys on the graphics panel.
6. Even with "Free alignment", it is possible to scroll through the measured values in the same way as with "Program-guided alignment".
7. During measurement, the report print-out can be initiated using the "Printer" key. The remote control keys are only active during measurement and adjustment (not during customer data input, vehicle selection etc.).

10.3 Display Support

- Measured values with a setpoint/actual comparison and tolerance bar (setpoint figures can be displayed with the "F" key).
- Steering graphics for steering routines.
- Overview of measured values with current setpoint/actual comparison
- Rim run-out compensation.
- With all other functions (e.g. customer input), the title illustration appears on the LCD display.

If the data transmission from the remote control to the computer is interrupted, the remote control icon in the bottom right-hand corner of the screen changes colour from green to red and the illustration on the LCD display is shown inversely - black turns to white, white to black. This change does not take place in the title illustration. Once the line-of-sight connection has been re-established, the remote control continues to operate from the point of interruption in the program. A continuous visual connection during alignment is therefore not necessary.

- The "Hour glass" icon in the LCD display means: "Please wait".
- The "Battery" icon in the top right-hand corner of the LCD display means that the battery reserve has been reached.
- To switch off the remote control: press the "F" key for 5 seconds, then return it to its charging unit or

connect it to a charge cable. The title illustration will again appear as a charging check.

- If, during the measurement, the remote control has been placed back in the charging unit, it must be switched on again using the "ON" button.

11. UPDATING THE SOFTWARE/SETPOINT DATA

Floppy disks will no longer be sent to BMW partners who have acquired a "BMW KDS (Beissbarth/Bosch)". For cost-related reasons, you can create these disks yourself on the "DIS-tester" or on the "TIS/EPC server". The data for this is regularly updated on the TIS CD.

11.1 Requirements

- BMW KDS (Beissbarth/Bosch)
- TIS CD program status (Beissbarth): from CD 12/95
- EPC program status: from 12/95
- TIS CD program status (Bosch): from CD 08/97
- DIS program status: from V6.0
- 3.5" diskettes, 1.44 MB (Beissbarth 5 diskettes/Bosch 1 diskette)

11.2 Procedure (Beissbarth)

1. Go to the "Administration" screen
2. Select the KDS button
3. Select Beissbarth
4. Insert "Diskette 1" on request and confirm with "OK" (program diskette 1 of 2 is created, label it)
5. Insert "Diskette 2" on request and confirm with "OK" (program diskette 2 of 2 is created, label it)
6. Insert "Diskette 3" on request and confirm with "OK" (setpoint data diskette 1 of 3 is created, label it)
7. Insert "Diskette 4" on request and confirm with "OK" (setpoint data diskette 2 of 3 is created, label it)
8. Insert "Diskette 5" on request and confirm with "OK" (setpoint data diskette 3 of 3 is created, label it)
9. Perform update and/or setpoint data on the KDS in the usual manner with the diskettes which have just been created.

11.3 Procedure (Bosch)

1. Go to the "Administration" screen
2. Select the KDS button
3. Select Bosch
4. Label "Diskette 3.1", insert it into the drive on request and confirm with "OK" (2x) --> Setpoint data is copied to the diskettes.
5. Insert setpoint data diskette 3.1 into the 3.1 floppy disk drive, insert operating system diskette 3.0 into the 3.0 drive.
6. Switch on the machine in the usual manner.

IMPORTANT: When creating the KDS diskettes, all data on the diskettes used is overwritten.

NOTE: In the event of an error, a corresponding message is shown and the program is cancelled completely. The procedure must be run from the beginning again and all data on the diskette will be deleted. A new diskette may have to be used.

12. CREATING, COPYING AND EDITING SETPOINT DATA

12.1 Copying

- Press the "C" button and select the vehicle to be copied.
- Select the **"Edit setpoint data"** menu item from the special functions. Create a new vehicle in the usual manner. The setpoint values for the last vehicle selected will appear in the data input screen. Enter the data and save the data record.

12.2 Creating

- Press the "C" button and select the **"Edit setpoint data"** menu item from the special functions. Create a new vehicle in the usual manner. An empty data input screen will appear. Enter the data and save the data record.

12.3 Editing

- Factory-programmed setpoint data can neither be deleted nor modified. If this data does need to be modified, a new vehicle with modified setpoint data must be created. New vehicles created by the user are identified by a "+" in the selection menu. These vehicles can be deleted by the user using the "-" key or modified using the "<>" key. These keys only appear if vehicles have been entered by the user.

13. SPECIAL FUNCTIONS

13.1 Customer-Specific Printer Report Header

The sub-item **"Customer-specific text"** must be called up in the **"Special functions"** menu. An input screen will appear on the monitor. This input screen must be filled out with the name and address and stored with the "S" screen key. The text entered is inserted into the report header.

13.2 Adjusting Options

- Call up the **"Service"** menu in the special functions ("S" key).
- Select the **"Wheel toe adjustment"** item or the **"Camber adjustment"** item from the **"Adjustment"** sub-menu. The toe and camber adjustment program will guide the user step by step through the adjustment using text and images. The measuring deviation for each measuring sensor will be shown on the screen when the adjustment has been completed.
- You can store the adjustment values in the measuring sensor using the **"Store"** key or you can quit the program with the **"Red dot key"** without saving them (check). The adjustment values can be printed out.

13.3 Rotating Plate Test

- Call up the **"Service"** menu in the special functions (**"S"** key).
- Call up the **"Rotating plate"** item in the **"Service"** menu. Turn the left-hand and right-hand rotating plate and check the display on the screen. Important: The measuring range is +/- 306 degrees.

13.4 Viewing And Deleting Customer Entries From Database

- Call up the menu item **"Delete"** in the **"Database"** menu in the special functions. The data input screen will appear. Fill in the search fields with the data to be deleted.
- Use the **"-"** button to delete this data record. A new data record can then be highlighted and deleted with the digital pen.
- You can scroll through the entire database with the **"Arrow up"** and **"Arrow down"** keys.

14. MODIFICATIONS WITHIN PROGRAM

Further modifications were carried out within the program which only slightly change the program sequence but which optimise the alignment in respect of comfort and speed. This is described below:

- Optimisation of the rim run-out compensation in respect of speed.
- Optimisation of the steering routines: Highlighted values within the gate can still be corrected. The message **"Rotating plates not connected"** no longer causes the steering routine to be cancelled. Further measurements can be carried out after the rotating plates have been connected.
- Standardisation of screen colours with the colours on the tablet.
- Addition of texts in several foreign languages.
- Elimination of program-related and cosmetic faults.
- Electronic water level.
- Omission of kingpin inclination measurement.

15. FAULTS

15.1 Tyre Faults

TYRE FAULTS SPECIFICATIONS

Fault	Effect
1) Wheel toe, camber, toe-differential angle and castor not correct	1) Severe tyre squeaking even at relatively low speeds
2) Excessive toe-in and excessive positive camber	2) Tyres are worn down on one outside edge in the longitudinal direction
3) Excessive negative camber	3) Tyre wear on inside edge
4) Worn front-axle suspension on front-wheel-drive vehicles	4) Increased noise / Vehicle pulls on one side when accelerating
5) Incorrect wheel alignment	5) Wheels scrubbing / Tyre surface shows feathering in the tread

6) Play in the suspension due to mechanical parts (suspension, steering)	6) Washout / Wobbling of front wheels
7) Tyre pressure too low	7) Outside tyre surface wear

15.2 Front Axle Faults

FRONT AXLE FAULTS SPECIFICATIONS

Fault	Cause	Remedy
1. Toe deviation	a. Vehicle not in normal position b. Tie rod(s) bent c. Tie rod ball joints worn d. Rubber mount in control arm defective	a. Correct height level b. Replace tie rod(s) c. Replace tie rod(s) d. Replace control arm
2. Camber deviation: The camber is fixed during the design stage and cannot be adjusted.	a. Rubber mount in control arm defective b. Control arm deformed c. Spring strut deformed d. Traction strut worn e. Spring deflection too great f. Front axle carrier deformed g. Spring strut mount deformed h. Distortion in the floor assembly (engine bracket)	a. Replace control arm b. Replace control arm c. Replace spring strut d. Replace control arm e. Replace coil spring, height level f. Replace front axle carrier g. Repair forward structure h. Repair body
3. Castor deviation: The castor is fixed during the design stage and cannot be adjusted.	a. Rubber mount for tension / traction strut defective b. Tension / traction strut deformed c. Control arm deformed d. Spring strut deformed e. Wheelhouse deformed (spring strut mount) f. Distortion in the floor assembly (engine bracket)	a. Replace rubber mount b. Replace tension / traction strut c. Replace control arm d. Replace spring strut e. Repair forward structure f. Repair body
4. Toe-differential angle deviation	Requirement: camber and castor are correct a. Tie rods unevenly adjusted	a. Set wheel toe on left and right to identical values
5. Wheel displacement deviation	Requirement: Front wheels have same single toe in relation to the	a. Replace front axle carrier

	geometrical axis a. Front axle carrier deformed b. Engine bracket deformed c. Control arm deformed d. Tension / traction strut deformed	b. Repair body c. Replace control arm d. Replace tension / traction strut
--	---	---

15.3 Rear Axle Faults

REAR AXLE FAULTS SPECIFICATIONS

Fault	Cause	Remedy
1. Camber deviation	a. Vehicle not in normal position: spring deflection too great b. Rubber mount on rear axle c. Rear axle carrier deformed d. Control arm deformed e. Traction strut deformed f. Distortion in the floor assembly g. Swinging arm deformed	a. Correct height level b. Replace rubber mount c. Check rear axle carrier and replace, if necessary d. Check control arm and replace, if necessary e. Check traction strut and replace, if necessary f. Repair body g. Replace swinging arm
2. Rear wheel position is not correct	a. Rear axle carrier has been shifted laterally b. Distortion in the floor assembly	a. Check the rubber mounts on the rear axle carrier and replace, if necessary b. Repair body
3. Toe deviation	a. Vehicle not in normal position, i.e. spring deflection too great b. Rubber mount in rear axle carrier defective c. Control arm deformed d. Rubber mount and swinging arm defective e. Rear axle carrier deformed f. Traction strut deformed	a. Correct height level b. Replace rubber mount c. Replace control arm d. Replace swinging arm e. Check rear axle carrier and replace, if necessary f. Check traction strut and replace, if necessary
4. Deviation from the geometrical drive axis	Requirement: Total wheel toe is correct a. Distortion in the floor assembly	a. Repair body

Further details on the "Kinematic Diagnosis System" can be found in the operating instructions for the BMW KDS (Beissbarth/Bosch).

Functional and system descriptions are not subject to change. Parts availability and immediate ordering availability cannot be derived from this information. The specialist departments will be providing further details at the relevant time.

RUNFLAT INDICATOR

All models



Fig. 26: Identifying Runflat Indicator
Courtesy of BMW OF NORTH AMERICA, INC.

INTRODUCTION

The Run Flat Indicator (RPA) monitors the tyre pressure throughout the journey.

The entire vehicle weight is carried by the air pressure in the tyres. If the pressure in one of the tyres should drop, the tyre will gradually "cave in". The resulting flexing means that the defective tyre will quickly receive additional damage. The tyre could burst.

Some 80 % of all flat tyres are caused by small holes (e.g. caused by nails). The holes result in a gradual loss of pressure in the affected tyre. Many "tyre blowouts" can be traced back to preliminary damage caused by a gradual loss of pressure.

A gradual loss of pressure in one tyre may remain unnoticed for a long time. The lack of pressure only makes itself clearly felt when driving when the tyre is almost completely empty.

As tyre pressure drops, the radius of the wheel and with it the tyre's rolling circumference will also decrease. The upshot is that the wheel speed of the affected tyre is increased.

The RPA records the wheel speeds using the wheel-speed sensors of the Dynamic Stability Control (DSC). The RPA compares the speeds of the individual wheels and computes an average speed. In this way the RPA is able to detect a loss of tyre pressure.

The RPA detects a drop in pressure below about 30 % +/- 10 % of the initial value. The RPA indicator and warning light indicates a drop in tyre pressure. The RPA will indicate this after just a short distance, as a rule after a few minutes, from a certain minimum speed (e.g. 25 km/h) up to the permissible top speed.

IMPORTANT: Responsibility resides with the driver at all times.

Check tyre pressures regularly, at least twice a month and before embarking on lengthy journeys.

During initialisation, the set tyre pressure is taken as the initial value for the current set of tyres.

If all 4 tyres lose pressure at the same rate, the wheel speeds will also change at the same rate. The RPA is unable to detect a uniform drop in pressure in all tyres (e.g. due to diffusion = natural loss of air from all 4 tyres)

IMPORTANT: Correct function of the Run Flat Indicator is not guaranteed when the emergency wheel is fitted.

As the emergency wheel has a much smaller diameter, the correct operation of the RPA can no longer be guaranteed.

BRIEF DESCRIPTION OF COMPONENTS

The SMG system comprises the following key components:

4 Wheel Speed Sensors The wheel-speed sensors of the Dynamic Stability Control (DSC) measure the wheel speeds of the individual wheels.

RPA button (E46, E53, E83, E85) The RPA button is only needed for initializing the PRA.

(RPA initialisation means "teaching the system the tyre pressures".

CID: Central Information Display Vehicles that are equipped with CID are initialized using the CID.

On-board computer button and rocker switch on turn-signal/main-beam switch (E87, E90, E91) Initialisation is performed on the LCD display, using the BC button and the rocker switch on the turn-signal/main-beam switch. The on-board computer functions are selected with the rocker switch.

The RPA software is in the following control units, depending on model series:

- **RPA Control Unit** (E46 all-wheel drive)

The E46 All-wheel drive has a separate RPA control unit.

The 4 wheel-speed sensors measure the wheel speeds. The DSC control unit sends the signals through 4 direct wires to the RPA control unit.

Alternatively

- **DSC control unit with additional software for Run Flat Indicator** (E46, E53, E60, E61, E63, E64, E83, E85, E87, E90, E91)

With DSC Mk60 and DSC 8, the RPA is integrated into the DSC control unit through additional software.

Alternatively

- **CIM: Chassis integration module** (E65, E66)

The CIM controls:

- Servotronic
- Steering column adjustment
- Run Flat Indicator (RPA)

The following control units are involved in the functions of the Run Flat Indicator:

- **CAS: Car Access System** E60, E61, E63, E64, E65, E66, E87, E90, E91

The CAS control unit provides input signals relating to terminal status (e.g. terminal 15 ON).

- **GM: Basic Module** E46, E53, E83, E85

The general module provides input signals relating to terminal status (e.g. terminal 15 ON).

- **JBE: Junction Box Electronics** E87, E90, E91

The JBE is the data interface (= gateway) between the K-CAN and the PT-CAN. (K-CAN stands for "Body Controller Area Network"; PT-CAN stands for "Powertrain Controller Area Network") The junction box consists of the junction-box electronics and the electrical distribution centre.

- **KGM: Body-Gateway Module** E60, E61, E63, E64 from 09/2005

The body-gateway module replaces the safety and gateway module (SGM). The KGM forms the data interface (= gateway) between the K-CAN and the PT-CAN.

- **M-ASK/CCC: Multi-Audio System Controller/Car Communication Computer** The M-ASK/CCC will emit an acoustic warning through the loudspeakers if tyre pressure drops. (On vehicles without M-ASK or CCC, the instrument cluster will emit the warning.)

- **SGM: Safety and gateway module** E60, E61, E63, E64 up to 09/2005 E65, E66 from 03/2004

The SGM is the data interface (= gateway) between the K-CAN, byteflight and the PT-CAN.

- **SZL: Steering Column Switch Cluster** E87, E90, E91

The signals from the on-board computer button and from the rocker switch are recorded and processed in the SZL. The data are transmitted to the instrument cluster through a direct wire (on-board computer).

- **ZGM: Central Gateway Module** E65, E66 until 03/2004

The ZGM forms the data interface (= gateway) between the K-CAN and the PT-CAN.

- **KOMBI and CID: Instrument Cluster and Central Information Display** A fault in the RPA or drop in tyre pressure will be indicated by the RPA indicator and warning light in instrument cluster. At the same time, the symbol will light up in the LC display.

Faults registered by the RPA are indicated as follows by the RPA indicator and warning light (for variations, please refer to national version):

- The RPA indicator and warning light lights up:
 - **Red (with acoustic signal):** Drop in tyre pressure more than approx. 30 % +/- 10 %. Driving safety is no longer guaranteed.
 - **Yellow:** RPA failed

Information about the Check-Control message can be called up in the CID (CID is fitted depending on the vehicle's equipment).

RPA Indicator And Warning Lights And Central Information Display

Installation Location

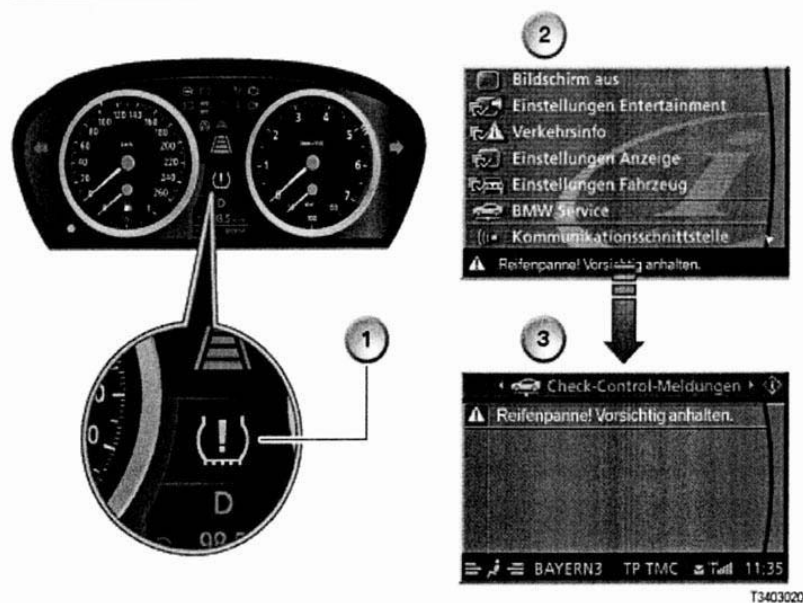
The Run Flat Indicator (RPA) has the following displays in the instrument cluster:

- RPA Indicator And Warning Light
- Symbol In LC Display



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Fig. 27: Identifying Runflat Indicator (E83 Shown)
Courtesy of BMW OF NORTH AMERICA, INC.



Item	Description	Item	Description
1	Symbol for check control message (yellow or red) on E60	2	"BMW Service" menu in the Central Information Display (CID)
3	Check control message in the Central Information Display (CID)		

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Fig. 28: Identifying RPA Warning In Central Information Display
Courtesy of BMW OF NORTH AMERICA, INC.

How It Works RPA fault is displayed as follows:

- Via the RPA indicator and warning light The RPA indicator and warning light lights up:
 - **Red (with acoustic signal):** Drop in tyre pressure more than approx. 30 % +/- 10 %. Driving safety is no longer guaranteed.
 - **Yellow:** The RPA has developed a fault.
- Indicator or symbol in LC display (yellow or red).
- Check control message in Central Information Display (CID) with additional information text.

If the RPA should fail, the following Check-Control messages are possible (for example):

RPA FAILURE MESSAGES & EXPLANATIONS

Check Control Message In CID Status Bar	Further Information
Flat tyre!	Flat tyre Stop the vehicle carefully.

	Please refer to the Owner's Handbook for how to change a wheel. Tyres with emergency-running characteristics (RSC): The journey can be continued for a limited distance at speeds up to max. 80 km/h, please refer to the Owner's Handbook. Have the tyres checked by the nearest BMW Service
Run Flat Indicator failure!	Run Flat Indicator Run Flat Indicator failed Flat tyres cannot be detected. Have the problem checked by BMW Service as soon as possible.

SYSTEM FUNCTIONS

The Run Flat Indicator (RPA) comprises the following functions:

- Self-test
- Initialisation
- Detects drop in tyre pressure
- Visual and acoustic warning

Self-Test

The RPA performs a self-test when terminal 15 is switched ON. A fault in the RPA is indicated by the RPA indicator and warning light and by a symbol in the LCD display.

Initialisation

Initialisation is started manually (e.g. by pressing the RPA button). Then (after the journey has started), initialisation will run as a fully automatic calibration sequence. In other words, the circumference of individual tyres are recorded and evaluated.

To allow a drop in tyre pressure to be detected, the system considers different speed ranges and driving situations. Taking account of the driving situation means that the system has to be primed for each speed range individually.

From 09/2004 (starting with E87), these speed ranges and driving situations have been combined into 3 calibration ranges. This means greater clarity for output via the BMW diagnosis systems Group Tester One (GT1) and DISplus.

The initialisation phase lasts approx. 5 to 15 minutes for the individual speed ranges. The end of the initialisation phase is not indicated.

Detects Drop In Tyre Pressure

The RPA records the wheel speeds using the wheel-speed sensors from the DSC. The RPA compares the speeds of the individual wheels and computes an average speed. In this way the RPA is able to detect a loss of tyre pressure. (In the event of a tyre losing pressure, the tyre rolling circumference of the affected tyre is also reduced.)

Visual And Acoustic Warning

A drop in pressure in one tyre of approx. 30 % +/- 10 % from the initial value is indicated by the RPA indicator and warning light. In addition, an acoustic signal sounds.

Signal output: Depending on the model concerned, either via the instrument cluster or the multi-audio system controller (M-ASK)/Car Communication Computer (CCC).

NOTE: ***DSC malfunction***

The sensors used by the RPA are all monitored by the DSC. If DSC detect a fault, the RPA will also register a malfunction.

SPECIAL CONDITIONS FOR SYSTEM FUNCTION

The following operating conditions may cause a delay in the warning being given in the event of a drop in tyre pressure:

- Heavy braking
- Rapid acceleration
- High rate of lateral acceleration
- Cornering (in a tight corner)
- Vehicle speed dropping below a minimum speed (the RPA only responds when a certain minimum speed has been reached)
- Large difference in slip (between axles or between wheel on one side of vehicle)
- Initialisation not being completed in current speed range (see "Controls")
- Winter conditions

The following operating conditions may cause a delay in the warning being given in the event of a drop in tyre pressure:

- Driving with snow chains fitted

Driving with snow chains may impair the correct function of the RPA.

The system will work as normal again after the snow chains have been removed and the vehicle is driven for a few minutes. (Repeat initialisation not necessary.)

NOTE: **Do not perform initialisation when snow chains are fitted.**

Initialisation and snow chains will cause incorrect adaptation values.

- Trailer towing

Initialisation should be performed when a trailer with a weight greater than approx. 300 kg is being towed.

Repeat the initialisation process after detaching or unloading the trailer.

- Old/new tyres

NOTE: Only fit tyres with the same tread depth!

Avoid fitting tyres with greatly different tread depth (from approx. 2 millimetres) on one axle. The different diameters mean that the correct operation of the RPA is no longer guaranteed.

In the following cases, the system will **not emit a warning despite a drop in tyre pressure being detected** :

- The same amount of pressure is lost in 2 or more tyres.
- Drops in tyre pressures caused by diffusion and affecting all 4 tyres equally
- If a tyre is damaged with a sudden loss of all pressure (tyre blowout, warning is given too late)

OPERATION

The Run Flat Indicator (RPA) is initialized using the following control elements:

- RPA button
- On-board computer button on turn-signal/main-beam switch
- With iDrive in the Central Information Display (CID) with the controller

IMPORTANT: Always perform initialisation immediately after correcting the tyre pressure, especially if a tyre is changed or the wheels are interchanged. Only check tyre pressures when the tyres are cold.

Set the tyres to the correct pressure before performing initialisation. During initialisation, the set tyre pressure is taken as the initial value for the current set of wheels.

Correct the tyre pressures when the tyres are cold to prevent the data recorded from being affected by temperature.

IMPORTANT: Responsibility resides with the driver at all times.

Check tyre pressures regularly, at least twice a month and before embarking on lengthy journeys. During initialisation, the set tyre pressure is taken as the initial value for the current set of tyres.

Initialise the RPA in the following situations:

- If tyre pressure is changed
(tyre pressure is corrected or reset)
- If the position of the tyres is changed (change of axles, wheels), even if the tyre pressure is not changed
- If a tyre is changed or the wheels are interchanged
(e.g. old tyres for new tyres, summer tyres for winter tyres, etc.)

Start initialisation as follows:

- Terminal 15 ON
(engine OFF or ON, do not pull away)
- Vehicles **with** RPA button
 - Press and hold the RPA button until the RPA indicator and warning light lights up yellow for a few seconds
- Vehicles **with** BC button (on-board computer function)
 - In the on-board computer function select "RPA" and "INIT" (LCD display) with the rocker switch on the turn-signal/main-beam switch. Press the BC button to confirm.
 - Press and hold the BC button for approx. 5 seconds, until a box with a tick appears behind the "INIT" display.
- Vehicles with Central Information Display

Initialisation is performed via the Central Information Display (CID) and controller.

- Select "RPA" in the "Settings" menu and confirm.
 - Select "Set" and confirm.
- Drive off

The end of the initialisation phase is not indicated.

Preconditions For Activation

The Run Flat Indicator (RPA) is automatically activated when terminal 15 is switched ON. The RPA cannot be switched off manually.

NOTES FOR SERVICE STAFF

Service staff should note the following points:

General information:

General information for Service staff on the Run Flat Indicator The following general information on the Run Flat Indicator (RPA) is given for Service staff:

- Wheel-Speed Sensor Failure
- Read Off Status Of Initialisation Phase

Wheel-Speed Sensor Failure If no signal is received from one of the wheel-speed sensors, the RPA will switch to "inactive" mode after approx. 2 minutes. The RPA indicator and warning light lights up yellow. The fault is indicated with a check control message. A fault is recorded in the fault memory of the RPA control unit.

If the RPA is integrated into the DSC, a fault will be recorded in the DSC control unit. If the signal returns after a signal failure, the RPA will be active again after driving for approx. 30 minutes. The fault will remain stored in the fault memory.

Read off status of initialisation phase The status of the initialisation phase can be displayed in the service functions for the control unit concerned (e.g. DSC control unit).

Diagnosis:

Encoding/Programming The Run Flat Indicator

- **Encoding** At the factory, the Run Flat Indicator (RPA) software is adapted to the model series concerned (encoding data). The RPA is encoded with the encoding data. Here, different parameters specific to the various vehicle models are written into the control unit.
- **Programming** The RPA is automatically programmed with the software for the Dynamic Stability Control (DSC).

US NATIONAL VERSION

A flat tyre is indicated as follows:

- E53, E83, E85

Yellow RPA indicator and warning light **without** acoustic signal

- E60, E61, E63, E64, E65, E66, E90, E91

Yellow RPA indicator and warning light **with** acoustic signal

An RPA failure is indicated as follows:

- Yellow RPA indicator and warning light **without** acoustic signal

Subject to alteration due to misprints, errors and technical modifications.

TYRES WITH EMERGENCY RUNNING CHARACTERISTICS AND TYRE

PRESSURE WARNING SYSTEMS

All models

GENERAL INFORMATION

Warning Systems

BMW AG offers two different systems to warn the driver of a drop in tyre pressure.

WARNING SYSTEMS SPECIFICATIONS

System	Description	Measuring principle
RDC	Tyre pressure control	Tyre pressure/temperature
RDW	Tyre pressure warning	Comparison of wheel speeds

Emergency Running Systems

In addition to the warning systems, two emergency running systems are also employed to prevent a depressurised tyre from caving in:

Components of emergency running system with self-supporting tyres:

EMERGENCY RUNNING SYSTEM COMPONENTS (WITH SELF-SUPPORTING TYRES)

RDW (standard equipment)	Tyre pressure warning
RDC (available as option from 03/2000)	Tyre pressure control
SST	Self Supporting Tyre
EH2 disc wheel	Disc wheel with Extended Hump 2

Components of emergency running system with integrated support ring:

EMERGENCY RUNNING SYSTEM COMPONENTS (WITH INTEGRATED SUPPORT RING)

Support ring	NOTE: In the future, only for heavy safety vehicles (E38/3)
RDC (optional)	Tyre pressure control
H2 disc wheel	Standard disc wheel with Hump 2

TYRE PRESSURE CONTROL (RDC)

RDC System Description

RDC permanently monitors the tyre pressure and the temperature in the tyres, both while the vehicle is being driven and when it is stationary. Data is transmitted via data telegram by the wheel electronic units to the antennas installed in the wheel housing and on to the RDC control unit. There, the data received is compared with the stored limit values.

After correcting the air pressure with the engine off and the ignition on, press the Set button and hold (approx. 6 seconds) until the words "Set tyre pressure" appear in the instrument cluster (instrument cluster high) or the yellow LED lights up (basic instrument cluster).

If the limit values are exceeded, the driver will be warned via the instrument cluster in two stages, as follows:

RDC WARNING SYSTEM (LOSS OF TIRE PRESSURE)

Loss of tyre pressure	Warning
Drop in tyre pressure of 0.2 to 0.4 bar	Yellow LED on basic instrument cluster, or Text: "Check tyre pressure" on instrument cluster high Gong: no
Drop in tyre pressure of more than 0.4 bar	Red LED on basic instrument cluster, or Text: "Tyre failure" on instrument cluster high Gong: yes

Advantages of RDC

ADVANTAGES OF RDC

1) Safety	○ early warning in the event of rapid loss of pressure ○ warning of loss of tyre pressure through normal diffusion
2) Comfort	○ unchanging ride comfort ○ instruction to check tyre pressure as necessary
3) Service life, economy	○ minimisation of tyre wear ○ minimisation of fuel consumption
4) New developments	○ allow tyres with emergency running characteristics to be fitted ○ no spare wheel if tyres with emergency running characteristics are fitted (saves weight)

RDC System Layout

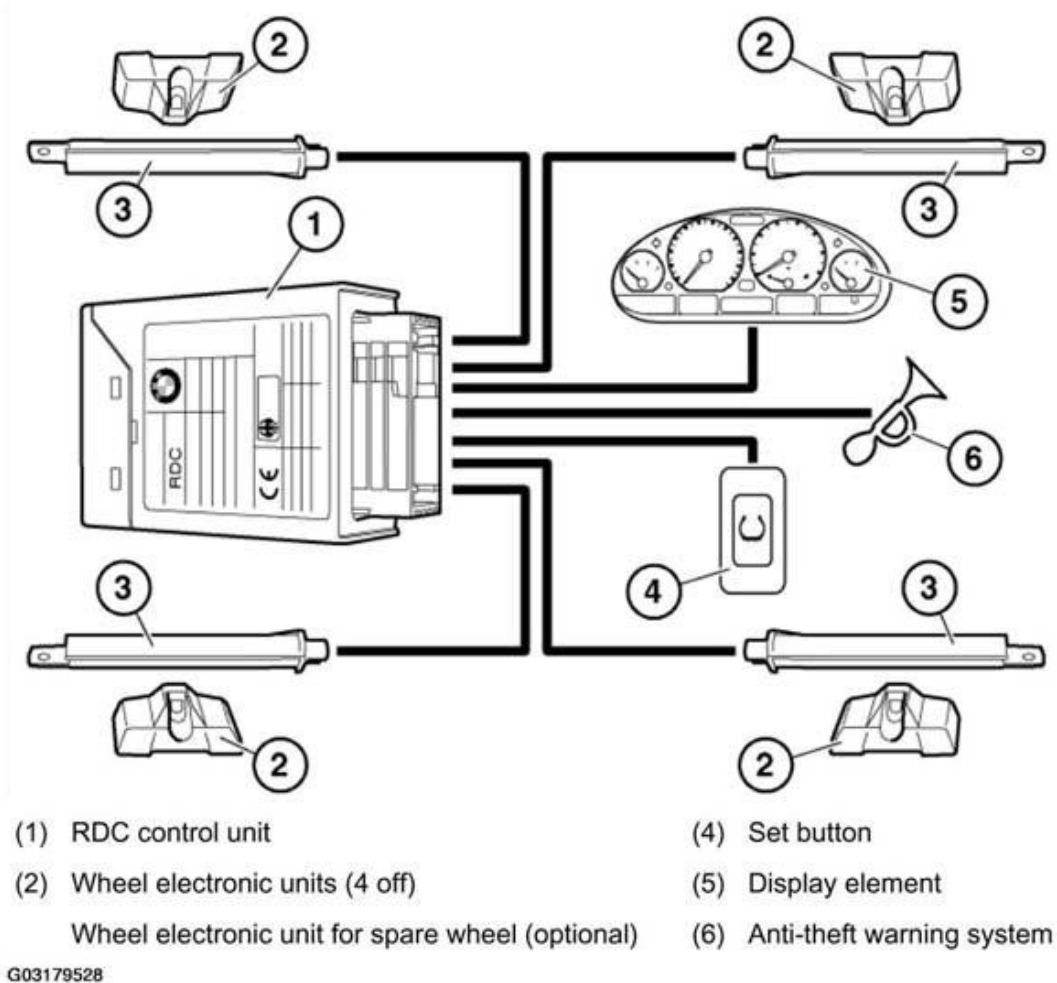


Fig. 29: RDC System Layout
 Courtesy of BMW OF NORTH AMERICA, INC.

Component Description

RDC Control Unit

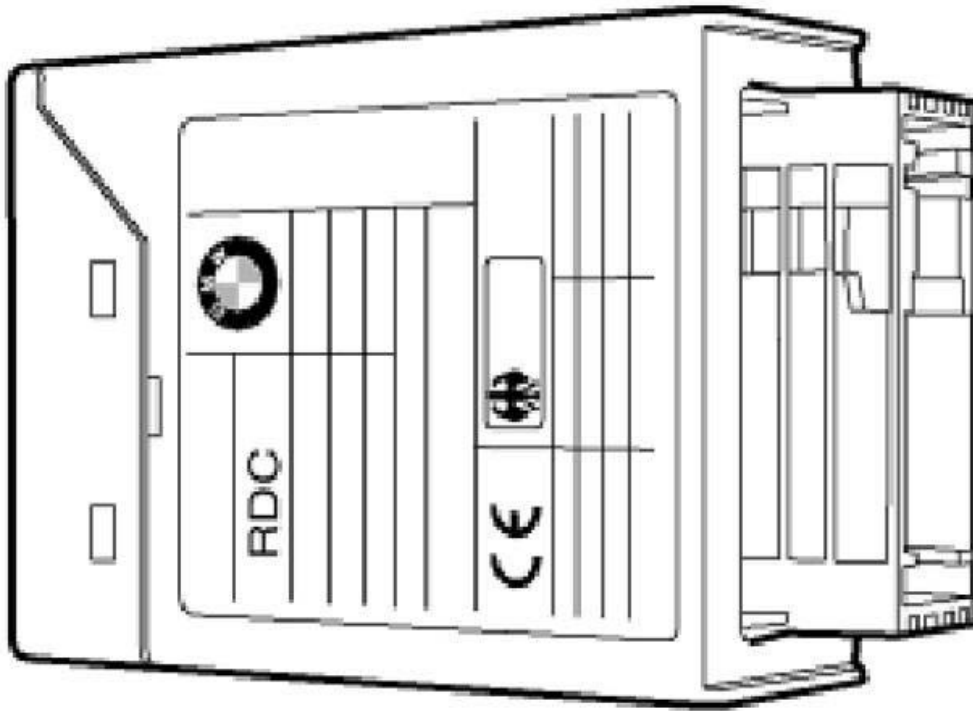
Fully diagnosis-compatible

Task:

Evaluates the following telegrams from the wheel electronic units:

- Tyre Pressure
- Tyre Air Temperature
- Identification Number Of Wheel Electronic Unit

- Remaining Service Life Of Wheel Electronic Unit Battery



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Fig. 30: Identifying RDC Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

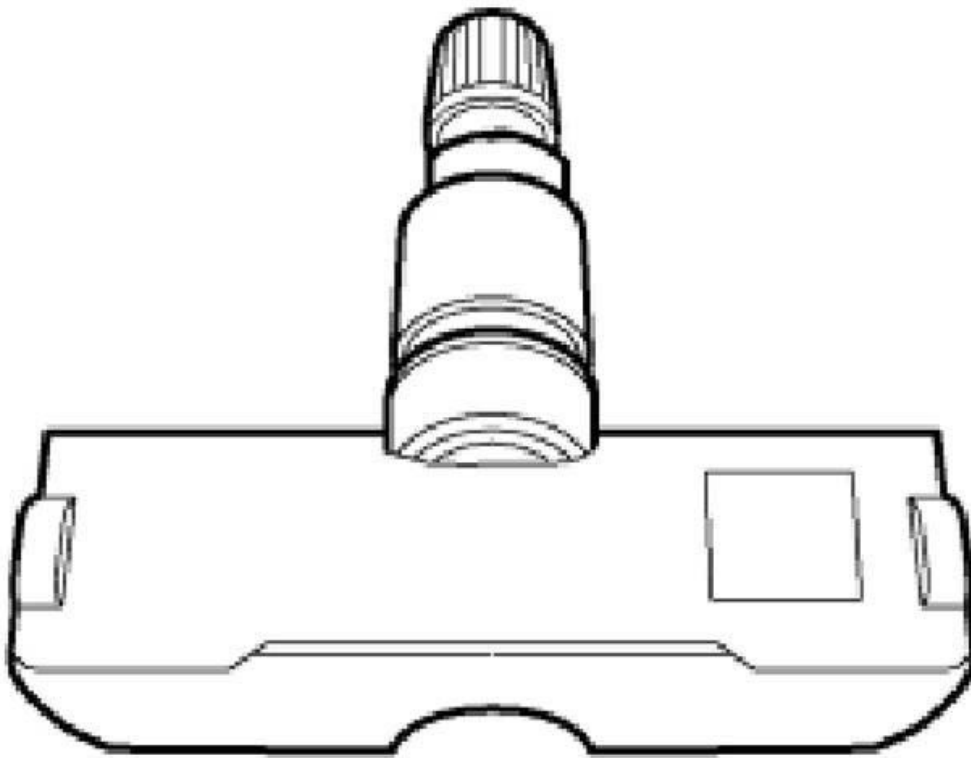
If required, information or a warning is transmitted.

Wheel Electronic Unit With Valve

Components:

- Pressure Sensor
- Temperature Sensor
- Transmitter
 - Frequencies According To Country
- Power Supply

- Service Life: Approx. 7 Years
- Not Exchangeable



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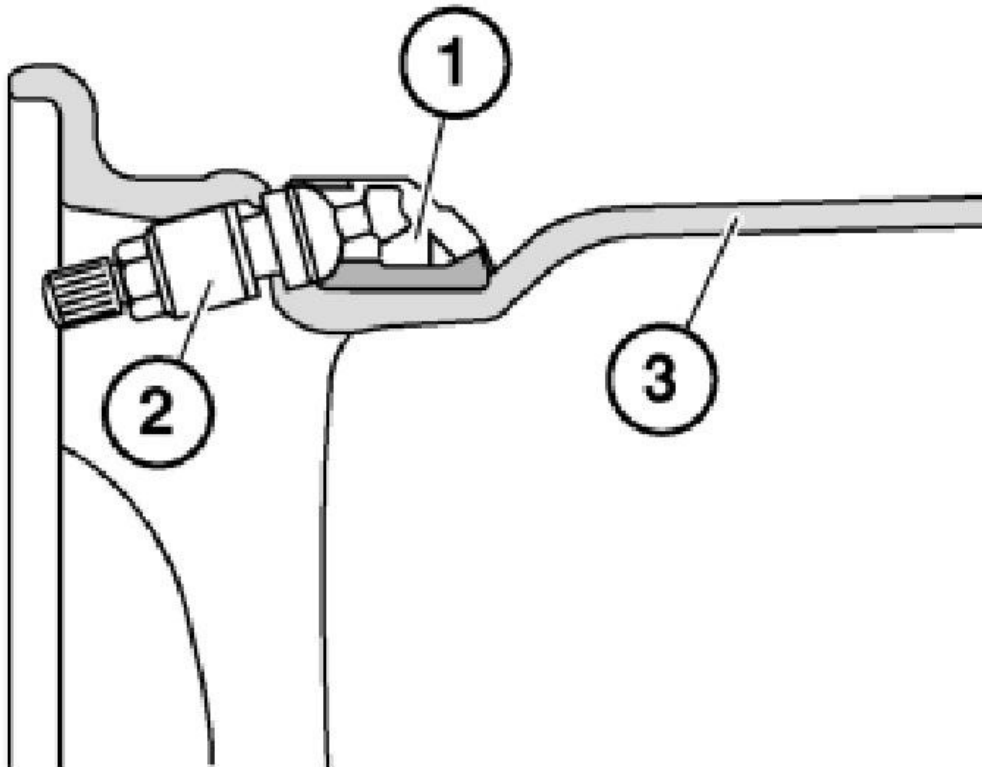
Fig. 31: Identifying Wheel Electronic Unit With Valve
Courtesy of BMW OF NORTH AMERICA, INC.

Installation Location Of Wheel Electronic Unit In Disc Wheel

The wheel electronic unit (1) is screwed to the valve (2) on the disc wheel (3)

Identifying feature: Metal Tyre Valves

NOTE: Different valves have to be used to allow for the different disc wheel sizes. The valves are colour-coded. The correct coding can be taken from the spare parts catalogue.



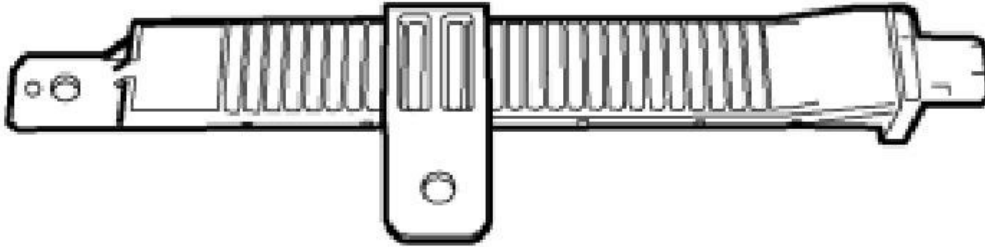
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Fig. 32: Identifying Installed Position Of Wheel Electronic Unit In Disc Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

Antenna

There is an antenna in each wheel housing.

Task: Receives telegrams and forwards these to the RDC control unit.



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Fig. 33: Identifying RDC Antenna
Courtesy of BMW OF NORTH AMERICA, INC.

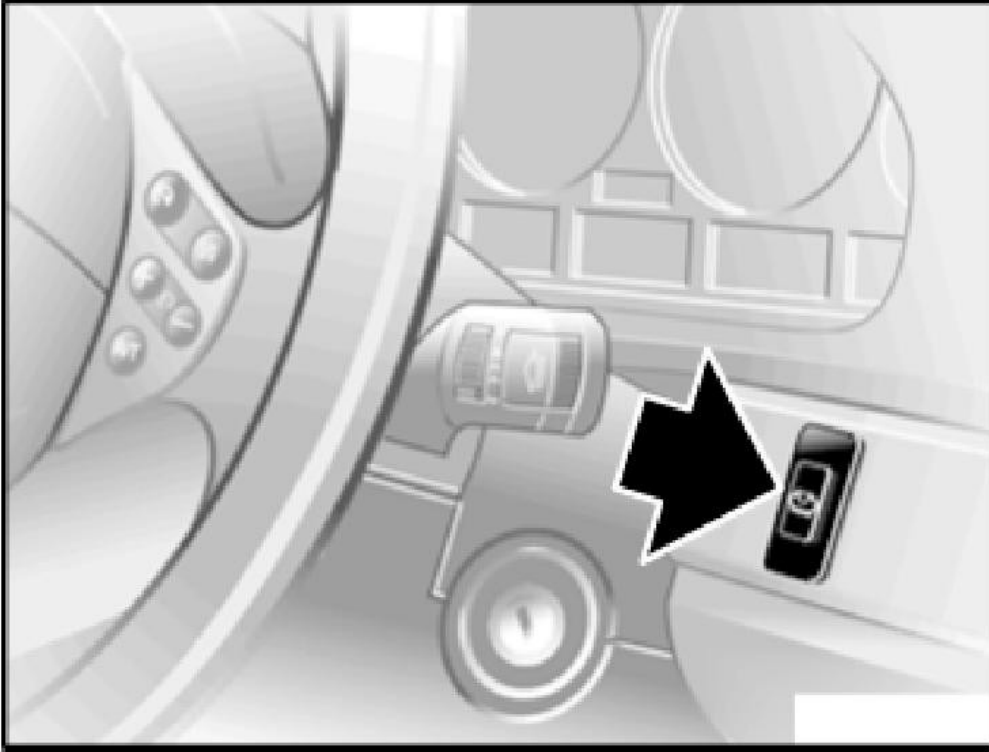
Component Description

Set Button

Installed in the instrument panel to the right of the steering wheel. (E46: in the centre console)

Symbol: tyre cross-section

Task: initialisation after resetting cold tyre pressure or after changing tyre or wheel location.



G03179533

Fig. 34: Identifying RDC Set Button
Courtesy of BMW OF NORTH AMERICA, INC.

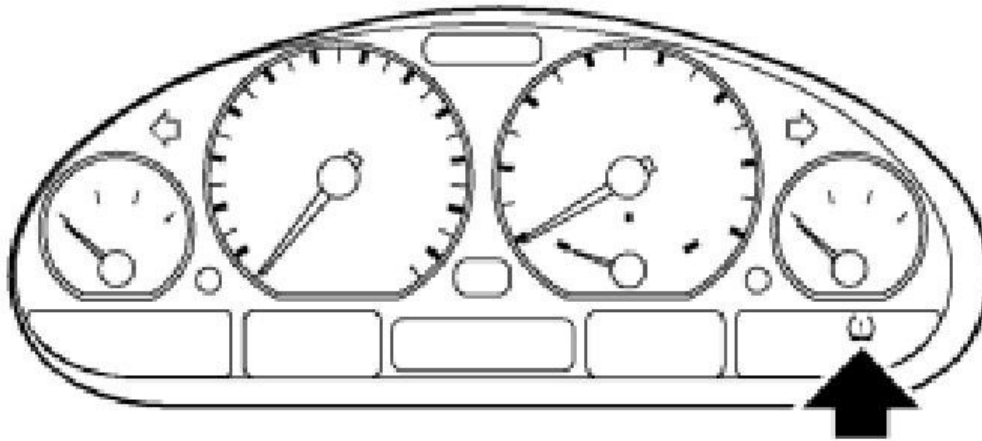
Display Element In Instrument Cluster

Indicator lamp lights up yellow:

- drop in tyre pressure of 0.2 to 0.4 bar

Indicator lamp lights up red:

- drop in tyre pressure of greater than 0.4 bar



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Fig. 35: Identifying RDC Indicator In Instrument Cluster Display
 Courtesy of BMW OF NORTH AMERICA, INC.

TYRE PRESSURE WARNING RDW

RDW System Description

RDW measures the wheel speeds on all four wheels, using the wheel speed sensors of the ABS/ASC or ABS/DSC system. It compares the wheel speeds of the diagonally opposite wheels and of the average speed.

In the event of a drop in tyre pressure, the dynamic diameter of a wheel will change, leading to a changed wheel speed.

A drop in tyre pressure of 30 +/- 10 % can be detected on all wheels from about 15 km/h (10 mph) up to the vehicle's top speed.

If this value is exceeded, the driver will be warned via the instrument cluster as follows:

RDW SYSTEM DESCRIPTION

Loss of tyre pressure	Warning
Loss of tyre pressure of 30 +/- 10 %	Red LED Text: "Tyre failure" Gong: yes The vehicle is not to be driven faster than 80 km/h (50 mph).

NOTE: A cautious driving style with moderate forward and transverse acceleration will help to prolong the service life of the defective tyre.

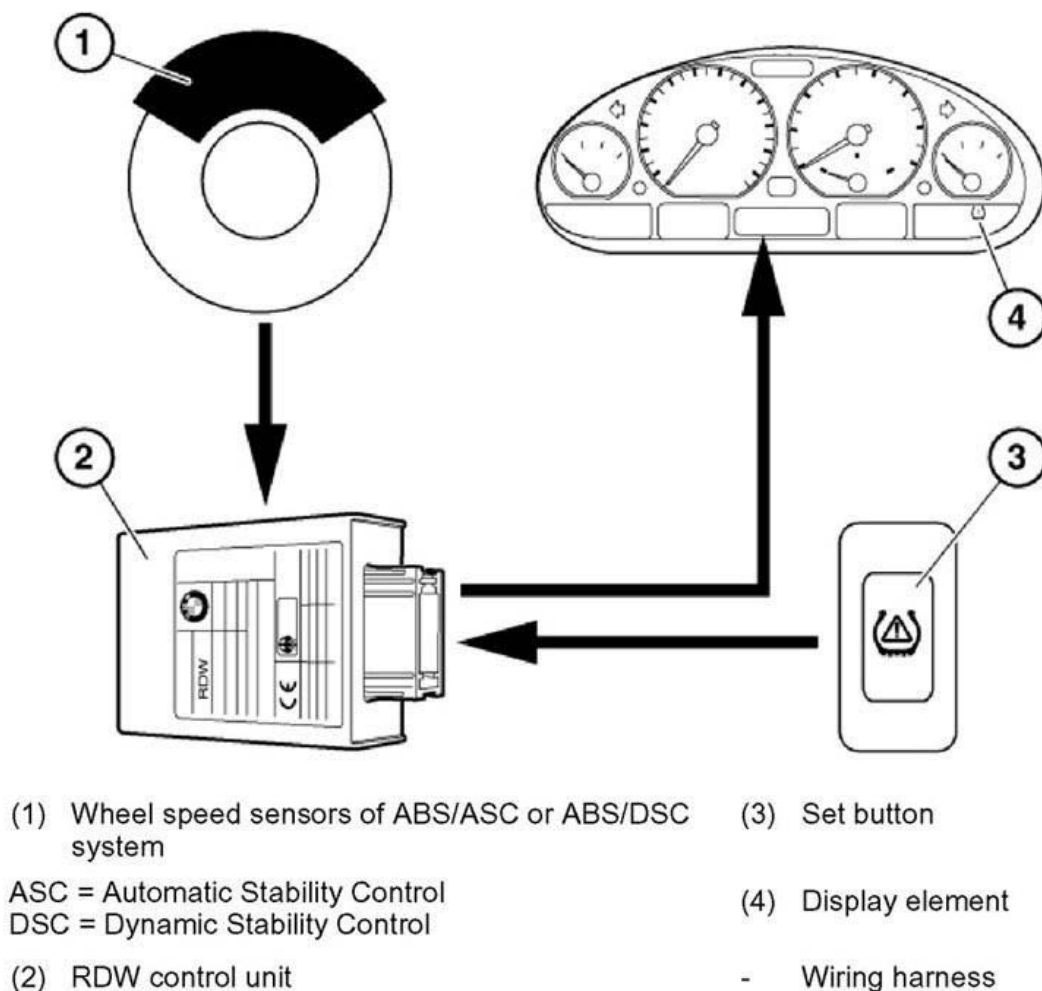
Advantages of RDW

With two exceptions, the advantages of RDC also apply to RDW.

Exceptions:

- no warning of loss of tyre pressure through normal diffusion
- tyre pressure still have to be checked regularly, every 14 days

RDW System Layout



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Fig. 36: RDW System Layout

Courtesy of BMW OF NORTH AMERICA, INC.

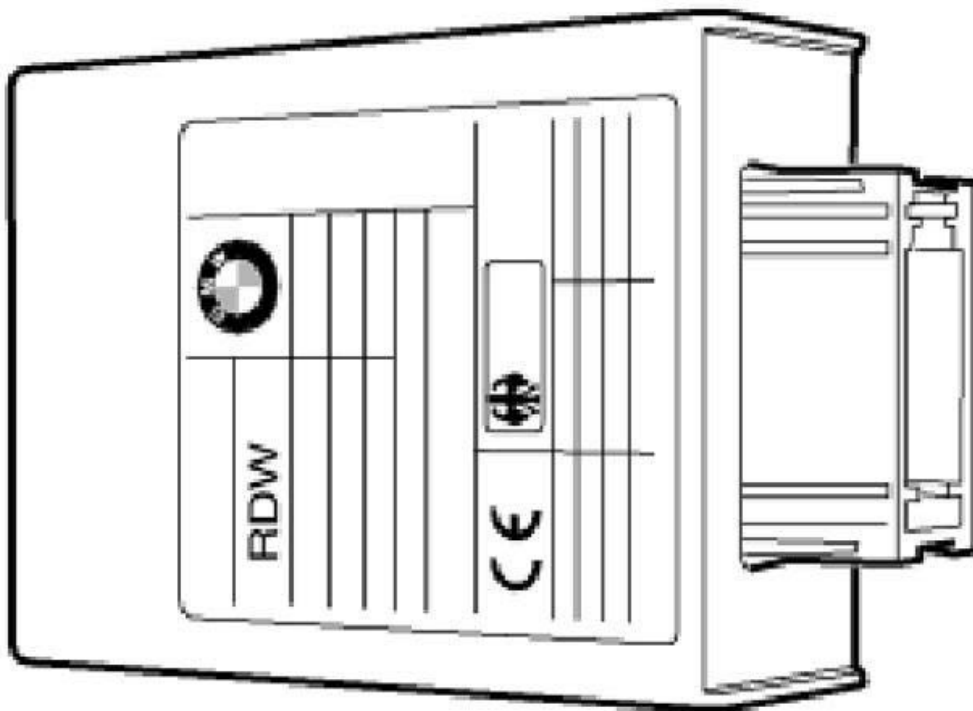
Component Description

RDW Control Unit

Fully diagnosis-compatible

Task:

- evaluates wheel speeds.
- a warning is transmitted as required.



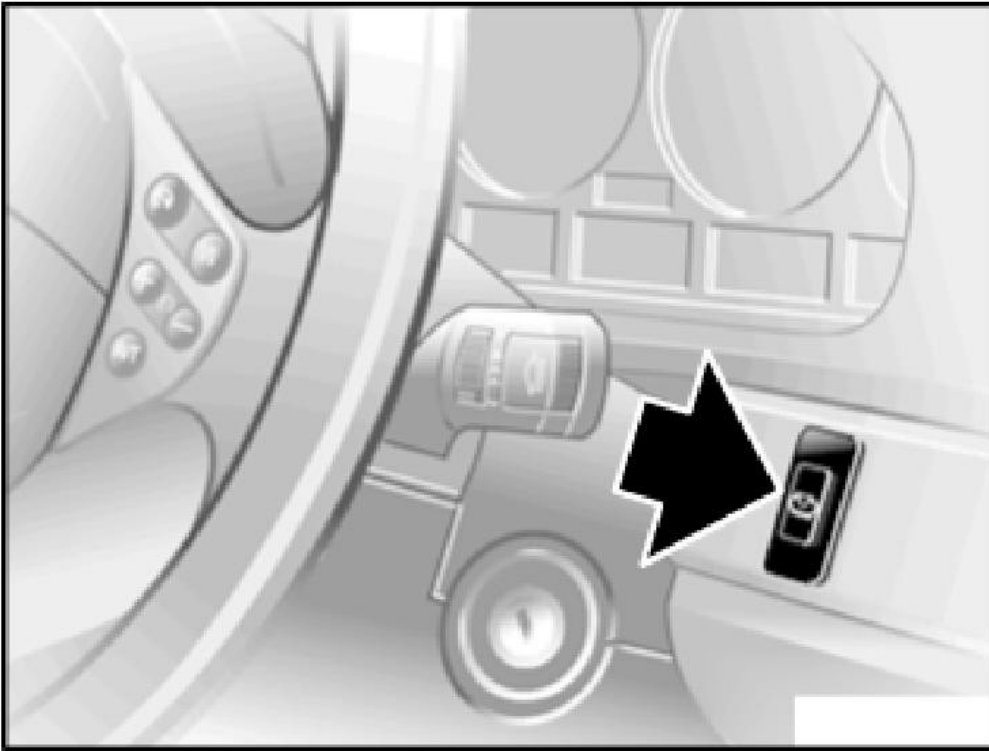
G03179536

Fig. 37: Identifying RDW Control Unit
Courtesy of BMW OF NORTH AMERICA, INC.

Set Button

Installed in the dashboard to the right of the steering wheel. Symbol: tyre cross-section with warning triangle.

Task: initialisation after resetting cold tyre pressure or after changing tyre or wheel location.



G03179537

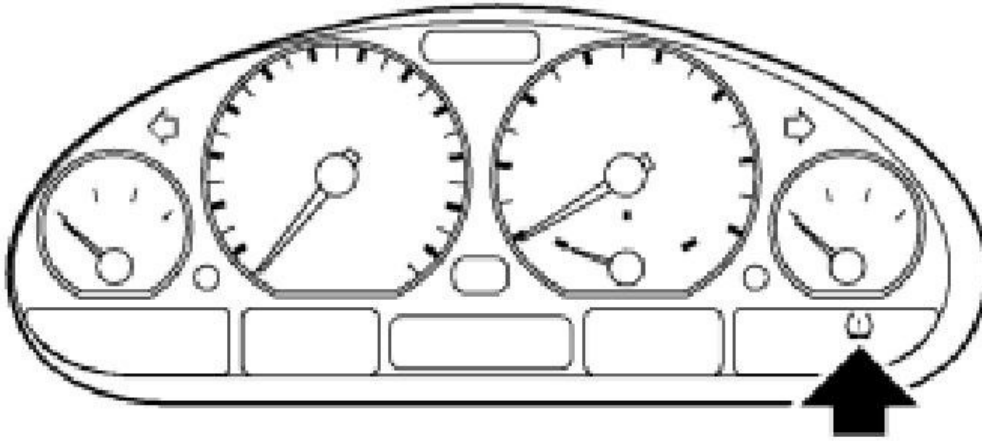
Fig. 38: Identifying Set Button

Courtesy of BMW OF NORTH AMERICA, INC.

Display Element In Instrument Cluster

Indicator lamp lights up red:

- drop in tyre pressure 30 +/- 10 %



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Fig. 39: Identifying RDW Indicator Lamp
 Courtesy of BMW OF NORTH AMERICA, INC.

EMERGENCY RUNNING SYSTEMS

Introduction

Tyres with emergency running characteristics can still be used for a certain distance even if they suffer a complete loss of pressure. There are two different systems which meet these requirements:

- emergency running system with self-supporting tyres
- emergency running system with integrated support ring

Emergency Running Systems Setup

Emergency Running System With Self-Supporting Tyres

The side walls of the self-supporting tyre are reinforced. In conjunction with a special disc wheel, the tyre can still be used for a certain distance even if it suffers a complete loss of pressure.

Mobility is retained for the following distances up to a speed of 80 km/h (50 mph) and with a cautious, suitably adapted driving style:

EMERGENCY RUNNING SYSTEM DESCRIPTION

Unloaded vehicle	max. 500 km (300 miles)
Unloaded roadster	less than 250 km (150 miles)

Fully loaded vehicle

max. 50 km (30 miles)

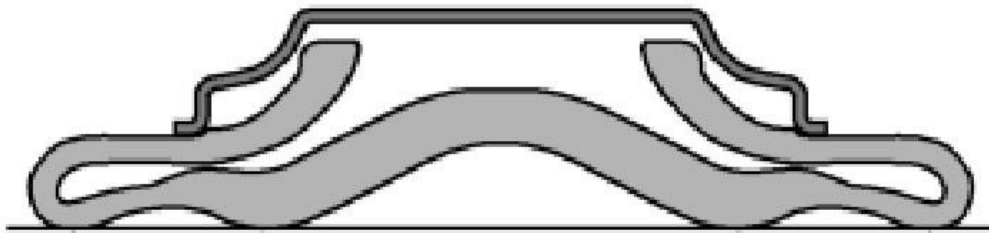
Self-supporting tyres demand permanent monitoring of the tyre pressure to ensure that the driver is given adequate warning if pressure is lost during a journey. For this reason, these tyres are only available in conjunction with the warning system RDW and from 03/2000 also with RDC.

To prevent the self-supporting tyres from becoming detached from the disc wheel in the event of a complete loss of tyre pressure, they must be fitted to newly developed wheels with modified disc wheel humps, but with unchanged tyre seating (= standard disc wheel).

However, the new wheels can also be used for standard tyres of the same size.

Comparison Standard Tyres/Self-Supporting Tyres

Standard Tyres, Unpressurised

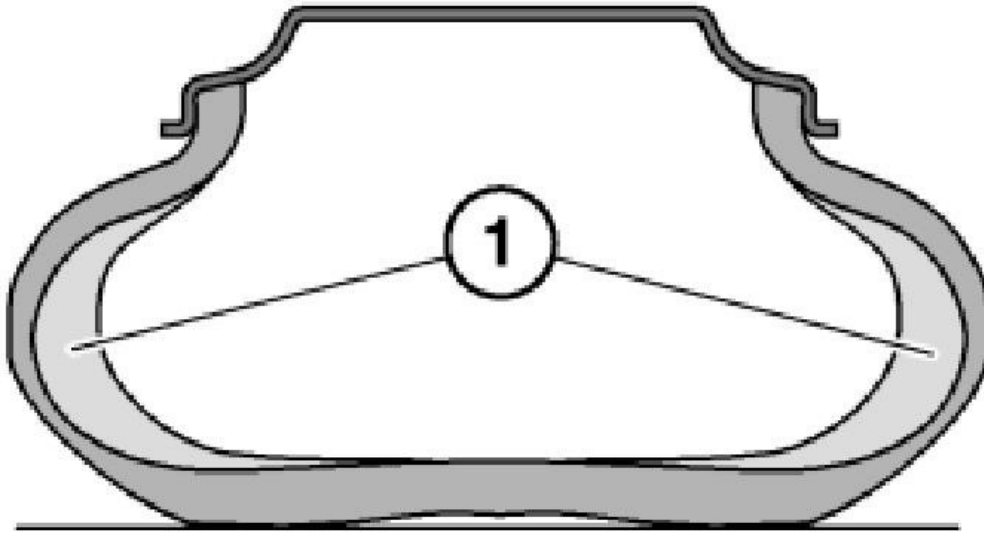


G03179539

Fig. 40: Identifying Unpressurised, Standard Tyres
Courtesy of BMW OF NORTH AMERICA, INC.

Self-supporting tyres, unpressurised

Envulcanised reinforcement (1) made of a temperature-resistant rubber compound.



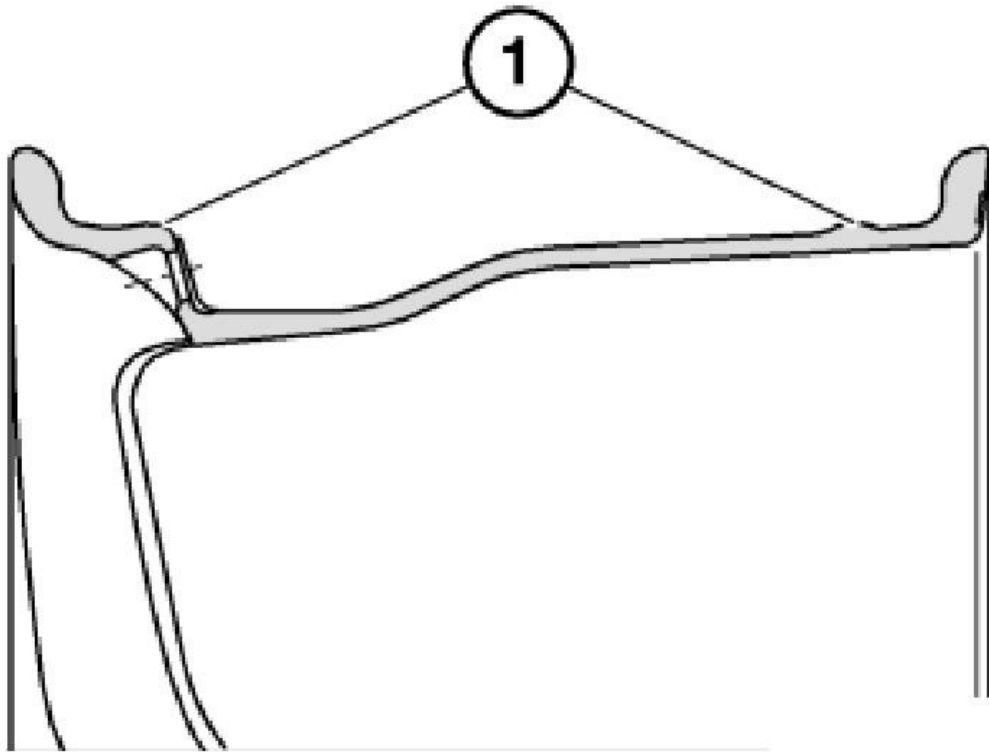
G03179540

Fig. 41: Identifying Unpressurised, Self-Supporting Tyres
Courtesy of BMW OF NORTH AMERICA, INC.

Disc Wheels

H2 Disc Wheel (Standard Disc Wheel) For Emergency Running System With Integrated Support Ring

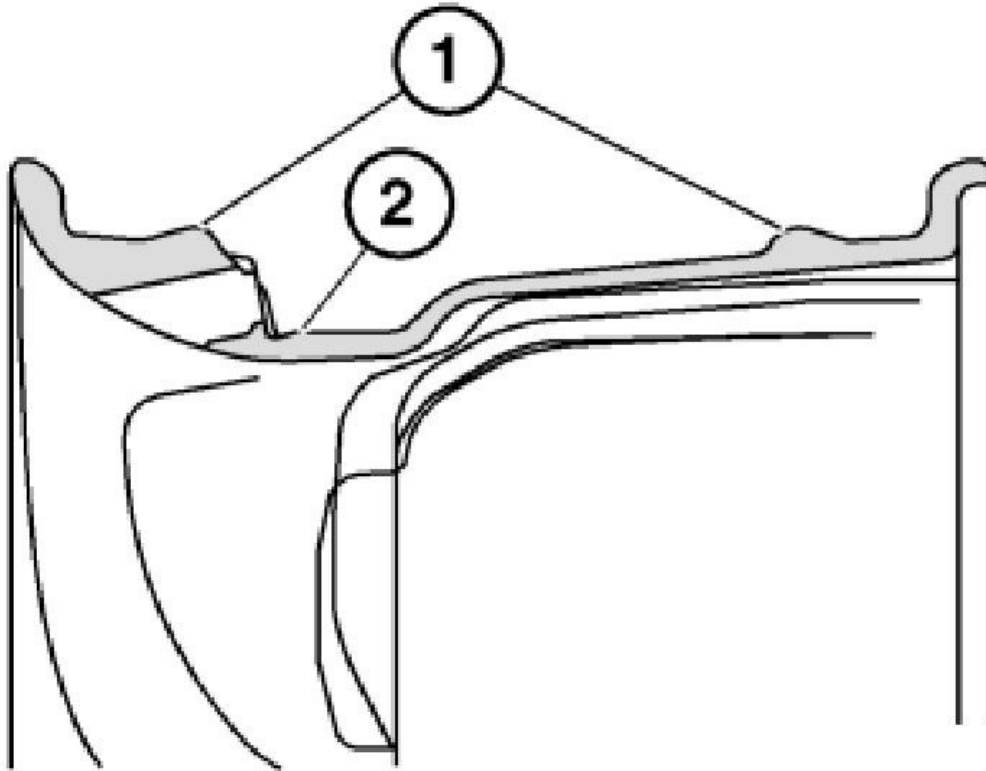
(1) Hump 2 of standard disc wheel



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Fig. 42: Identifying H2 Disc Wheel
Courtesy of BMW OF NORTH AMERICA, INC.

EH2 Disc Wheel For Emergency Running System With Self-Supporting Tyre



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Fig. 43: Identifying EH2 Disc Wheel
 Courtesy of BMW OF NORTH AMERICA, INC.

1. Extended Hump 2 of disc wheel
2. Drop centre relocated a few millimetres to the centre (precentring on outside)

NOTE: The new EH2 disc wheels (extended Hump 2 inner and outer) will be used more frequently on BMW vehicles in the future as they can also help to delay standard tyres from being lost in the event of a drop in tyre pressure.
Example: from current 1.1 bar to 0.6 bar (X5 or Landrover disc wheel)

Emergency Running System With Integrated Support Ring

(In the future, primarily on heavy safety vehicles)

The support ring is made of a high-strength resilient plastic and is fitted on the disc wheel inside the tyre. The support ring can only be removed using special tools which have been specially approved by BMW. It can only

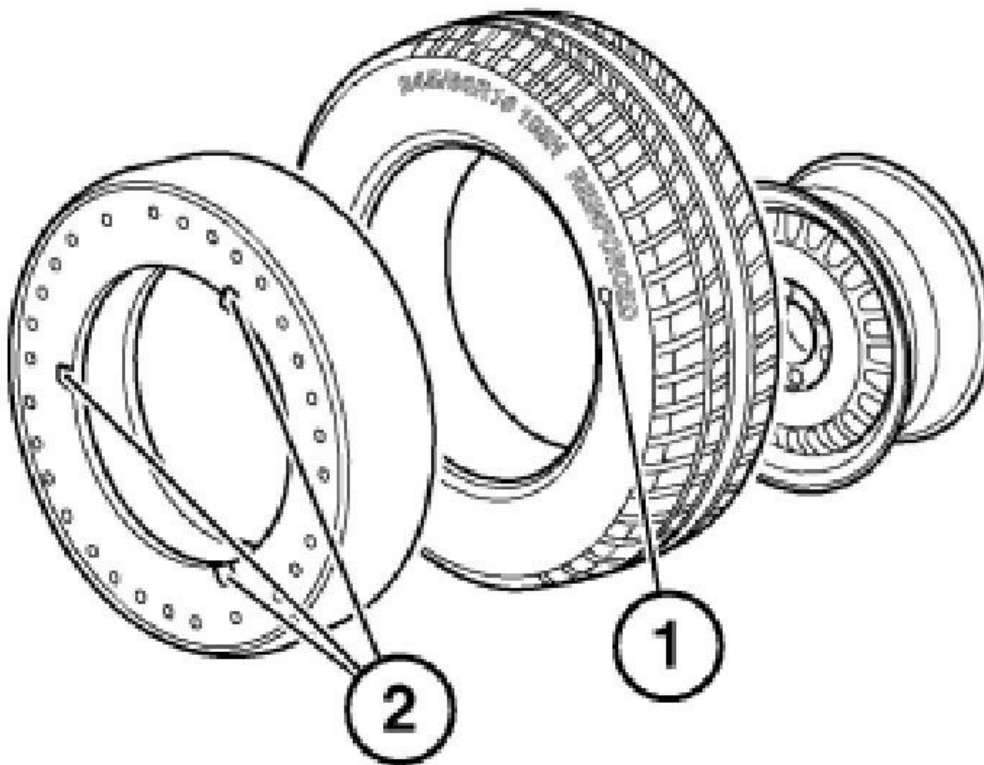
be removed after destroying the tyre.

Emergency running systems with integrated support ring are used in particular on heavy safety vehicles. They allow the vehicle to be driven away from a potential danger without dropping speed even if the tyres have suffered a complete loss of pressure (flight situation).

It is possible as an option to have the tyre pressure monitored by an RDC system. The RDC is installed by pressing the components into the support ring before it is fitted.

Wheel Structure With Integrated Support Ring

Emergency Running System With Integrated Support Ring



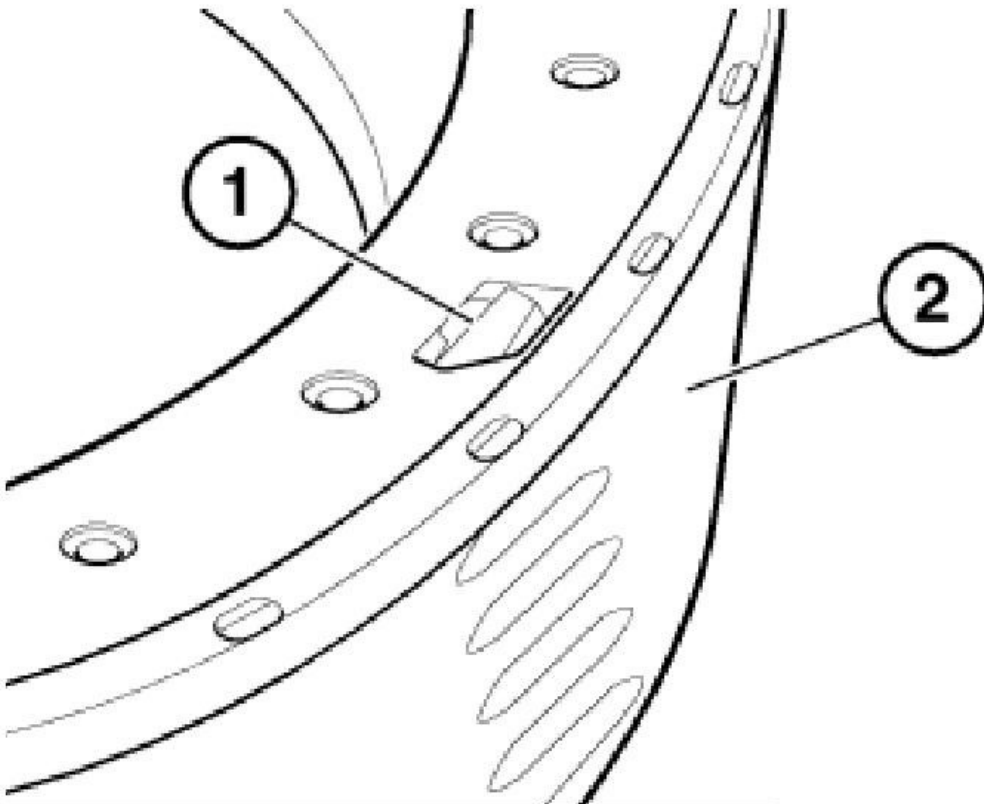
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Fig. 44: Identifying Support Ring And Tyre
Courtesy of BMW OF NORTH AMERICA, INC.

1. Tyre

2. Support ring

Installation Location Of RDC Wheel Electronic Unit



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Fig. 45: Identifying Wheel Electronic Unit And Support Ring
Courtesy of BMW OF NORTH AMERICA, INC.

1. Wheel electronic unit
2. Support ring

For further information on the subject of "Tyre pressure warning systems and tyres with emergency running characteristics", please refer to the vehicle Owner's Handbook.

A Parts Information bulletin will be published with information on how to order parts.

Functional and system descriptions are not subject to change. Parts availability and immediate ordering

availability cannot be derived from this information. The specialised departments will inform the markets with further details at the appropriate time.

STORING WHEELS AND TYRES

All Models

WHEELS/TYRES - GENERAL NOTES

The service of storing a customer's wheels is one which is now almost taken for granted. For this reason, we have published this BMW Technical Service bulletin to provide a uniform storage concept, which will prevent damage being caused due to incorrect storage.

The tyre's rubber will age under the influence of sunlight, heat, humidity, movements in the air and ozone, and will thus lose some of its stability and elasticity. For this reason, tyres should never be stored in the open-air. If open-air storage cannot be avoided, the wheels/tyres must be stored in a clean and dry condition and covered with waterproof material. It is essential that wheels/tyres are protected against rain, snow and sunlight, but due to the risk of corrosion they must not be stored in tyre sacks. For more information on protective covers for wheels and tyres, see SI 36 01 88 (864).

Wheels/tyres with tyre pressure control (RDC) must not be cleaned with high-pressure cleaning equipment. For general information on RDC, **TYRES WITH EMERGENCY RUNNING CHARACTERISTICS AND TYRE PRESSURE WARNING SYSTEMS**.

Storage Requirements

The following requirements apply in general to storage in enclosed rooms:

STORING WHEELS AND TYRES SPECIFICATIONS

cool	15...25 °C / sources of heat screened, or 1 m minimum distance from source of heat
dry	Prevent water and condensation Avoid contact with mineral lubrication products
dark	Protect from direct sunlight and high-UV artificial light
moderate ventilation	Avoid a supply of oxygen and ozone

In short, the storage room should be cool and dry. It is not necessary to heat the room during the winter. In the summer, the doors and windows should be kept closed to ensure that no air can circulate. In addition, the windows can also be coated with sun protection paint.

The storage room should not contain any working electric machinery, welding equipment, distribution boxes etc. as electrical sparks generate ozone which can have a serious impact on the surface of the tyre (ozone cracks).

Tyres should not be allowed to come into contact with oil, petrol, or other mineral lubricants as these dissolve rubber, making the tyre porous.

Preparing Wheels/Tyres

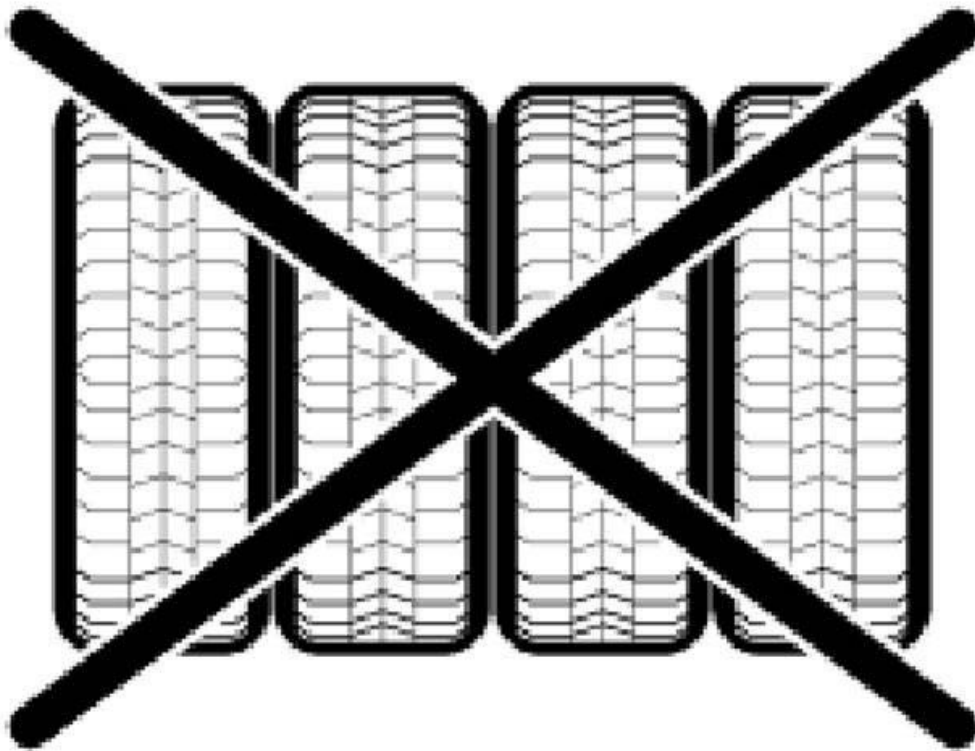
1. Before removing a wheel, mark its position on the vehicle.
2. Whenever possible, keep the tyre on its wheel (complete wheels).
3. Correct the inflation pressure and recheck every 2 months.
4. Ensure that tyres are stored at a sufficient distance above the ground. Wheels/tyres should never be stored on the ground.
5. Complete the storage forms. These should contain the following data:
 - Type and size of tyre
 - Condition and tread depth
 - Customer's address
 - Date and signature of customer

Wheel/Tyre Storage Requirements

A. Tyre fitted to wheel

Do not store upright, ...

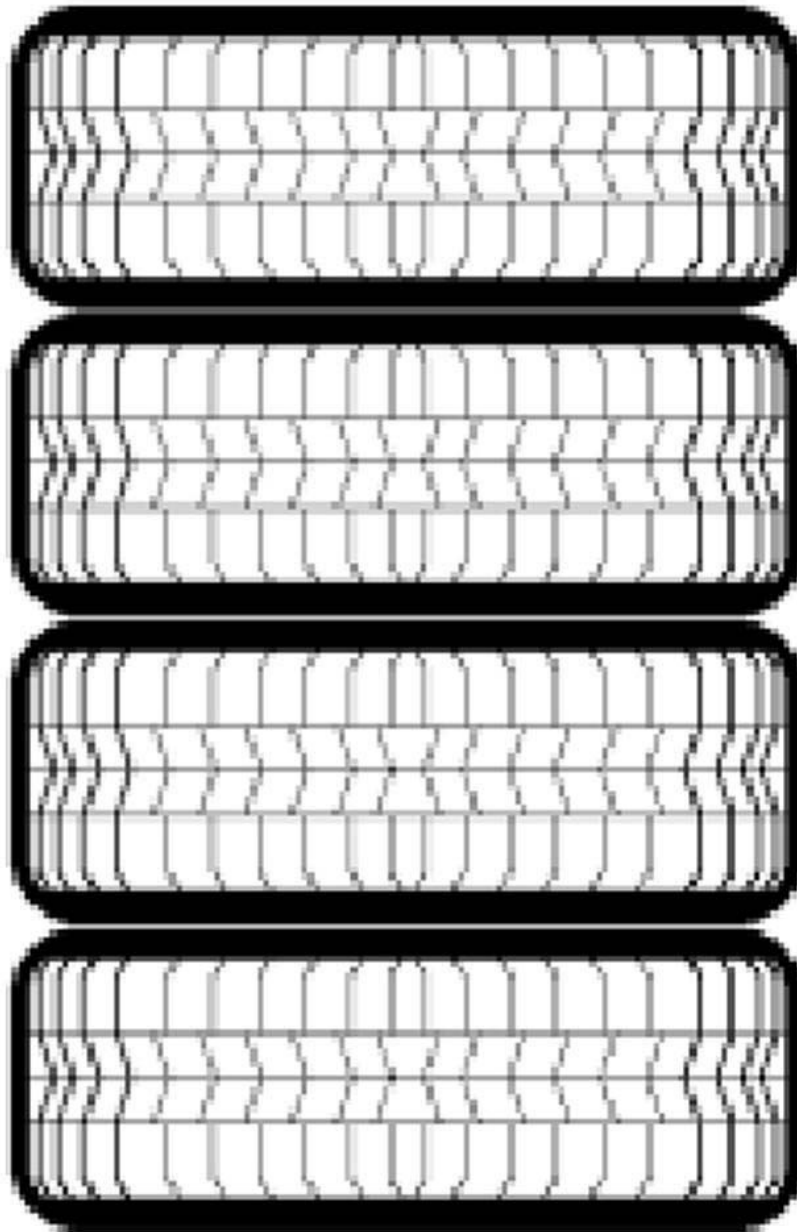
NOTE: **If storing the wheels upright cannot be avoided, the inflation pressure must be increased to 3.5 bar.**



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Fig. 46: Use Care When Storing Wheel/Tyre Storage In Upright Position (Tyre Fitted To Wheel)
Courtesy of BMW OF NORTH AMERICA, INC.

... but rather hang ...

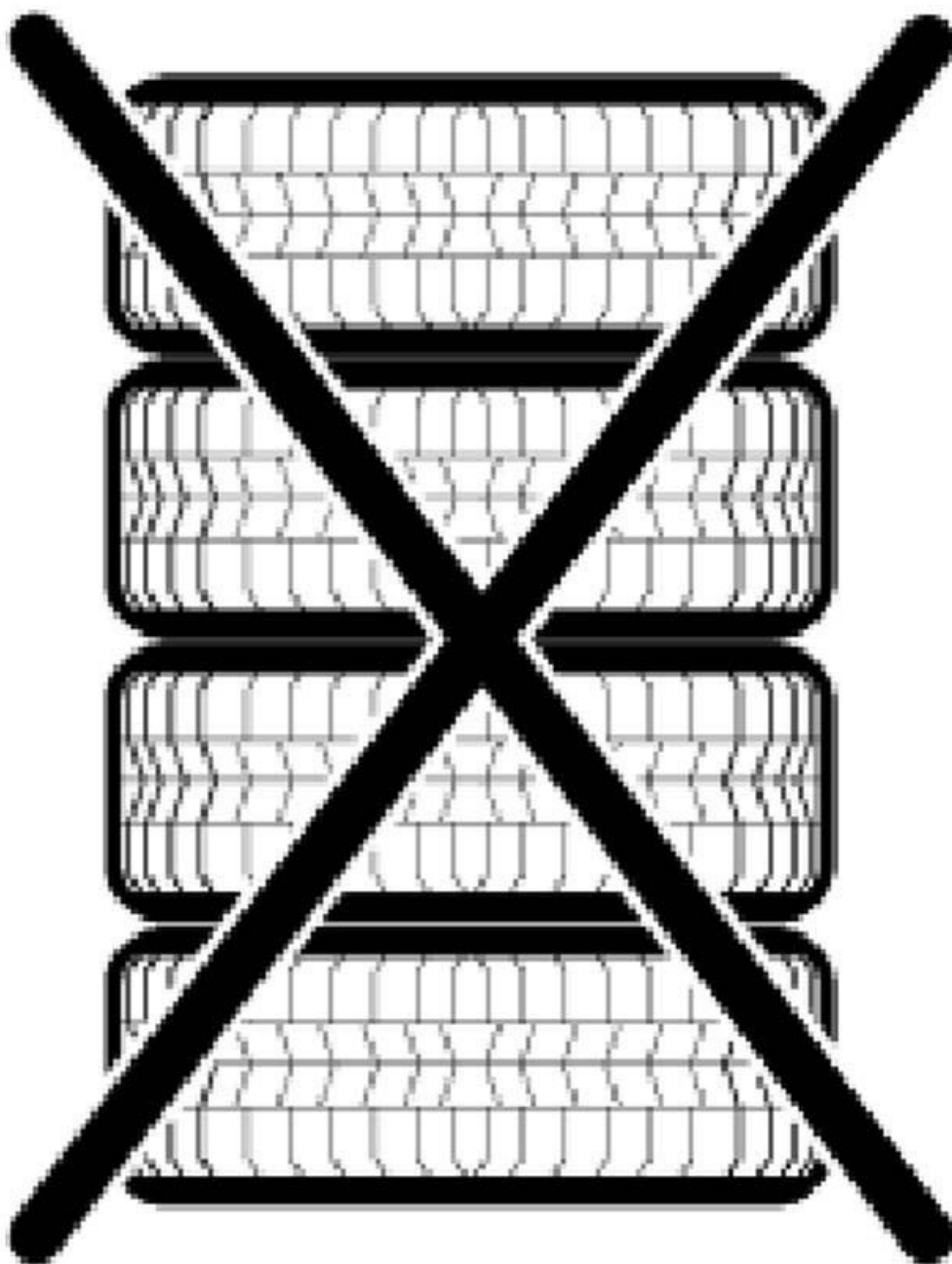


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Fig. 48: Storing Tyres In Stacked Position (Tyre Fitted To Wheel)
Courtesy of BMW OF NORTH AMERICA, INC.

B. Tyres Not Fitted

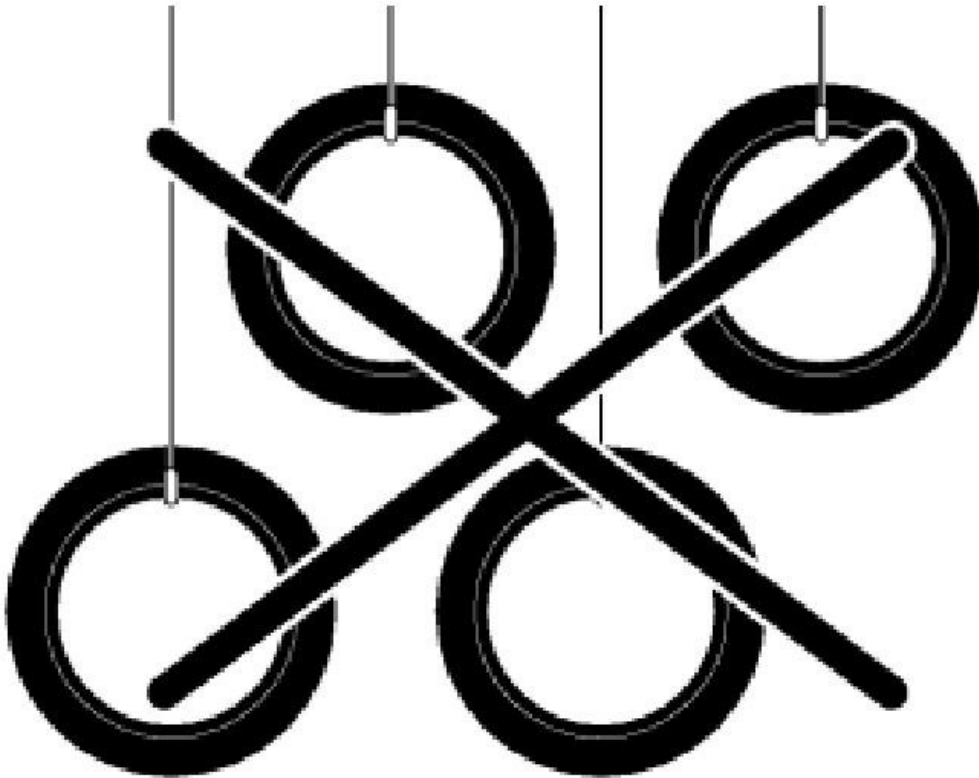
Do not stack, ...



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Fig. 49: DO NOT Store Wheel/Tyre In Staked Position (Tyres Not Fitted)
Courtesy of BMW OF NORTH AMERICA, INC.

... do not hang, ...

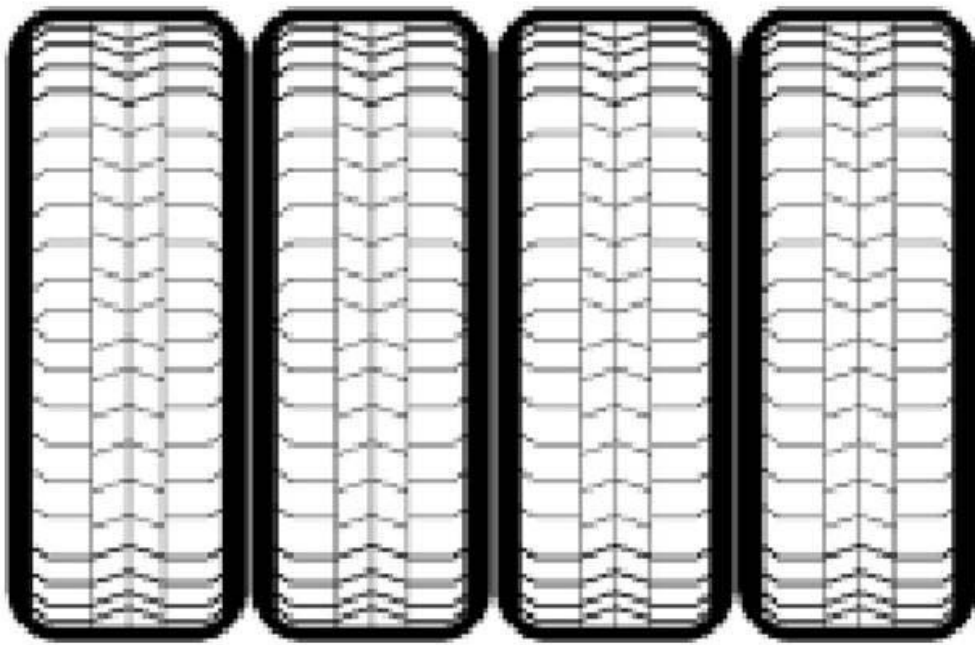


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Fig. 50: DO NOT Store Wheel/Tyre In Hanging Position (Tyres Not Fitted)
Courtesy of BMW OF NORTH AMERICA, INC.

... but rather store them upright and turn them every 4 weeks.

NOTE: **Never store tyres on the ground.**
 Use commercially available shelves.



G03179550

Fig. 51: Preferred: Store Tyres In Staked Position (Tyres Not Fitted)
Courtesy of BMW OF NORTH AMERICA, INC.

SUSPENSION

Wheel and Tires - Special Tools - Z4

36 WHEELS WITH TIRES

36-1339 CASE WITH INLAY

36 1 339 Case with inlay

NOTE: incl. connection diagram sticker



Fig. 1: Identifying Case With Inlay (361339)
Courtesy of BMW OF NORTH AMERICA, INC.

36-1336 CONNECTION DIAGRAM STICKER

36 1 336 Connection diagram sticker



Fig. 2: Identifying Connection Diagram Sticker (361336)
Courtesy of BMW OF NORTH AMERICA, INC.

36-1335 SUPPLEMENTARY SET FOR WHEEL BOLT ADAPTER KIT 36 1 300

36 1 335 Supplementary set for wheel bolt adapter kit 36 1 300

NOTE: Consisting of: 36 1 323 Code 30 36 1 324 Code 31 36 1 325 Code 32 36 1 326 Code 33 36 1 327 Code 34 36 1 328 Code 35 36 1 329 Code 36 36 1 331 Code 37 36 1 332 Code 38 36 1 333 Code 40 36 1 336 Connection diagram sticker

SI number

1 27 04 (167)



Fig. 3: Identifying Supplementary Set For Wheel Bolt Adapter Kit 36 1 300 (361335)
Courtesy of BMW OF NORTH AMERICA, INC.

36-1030 TESTER

0493829 361030 Tester MW

NOTE: For measuring vertical and lateral runout of road wheels

SI number

01 11 00 (594)

Consisting of:

1 = 0493904 Holder

NOTE: (Holder) Discontinuation and replaced by 36 1 030.(0 493 829)

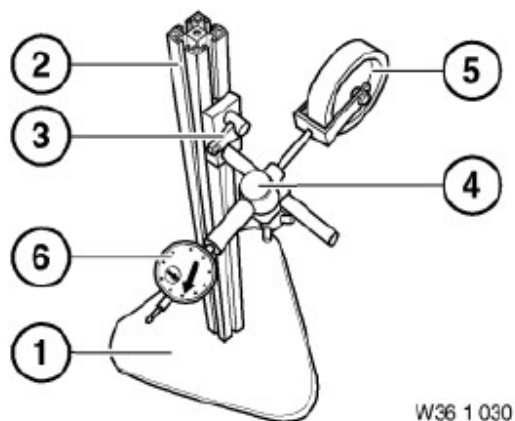


Fig. 4: Identifying Tester (361030)

Courtesy of BMW OF NORTH AMERICA, INC.

2 = 0493905 Profile strip

NOTE: (Profile strip)

3 = 0493906 Adapter

NOTE: (Adapter) Replaced by 00 9 120 (0 490 504)

4 = 0493907 Terminal

NOTE: (Terminal)

5 = 0493908 Roller

NOTE: (Measuring roller)

6 = 0493909 Dial gauge

SUSPENSION

Wheel and Tires - Technical Data - Z4

WHEELS ONE-PART ALLOY WHEELS

36 10 WHEELS ONE-PART ALLOY WHEELS

WHEELS ONE-PART ALLOY WHEELS SPECIFICATION

Max. radial runout of tire Rim with tire	max. mm	1.1
Max. axial runout of tire Rim with tire	max. mm	1.3
Max. radial runout out rim	max. mm	0.3
Max. axial runout of rim	max. mm	0.3
Max. imbalance for each side (before balancing)	max. g	90 for clamp weights 120 for stick-on weights
Permissible residual imbalance for each side (after balancing)	max. g	4
Elimination of imbalance: Up to 60 g with one weight or more than 60 g with two weights		

STEEL AND ALUMINIUM STRIP WHEELS

36 10 STEEL AND ALUMINIUM STRIP WHEELS

WHEELS STEEL AND ALUMINIUM STRIP WHEELS SPECIFICATION

Max. radial runout of tire Rim with tire	max. mm	1.6
Max. axial runout of tire Rim with tire	max. mm	1.8
Max. radial runout out rim	max. mm	0.8
Max. axial runout of rim	max. mm	0.8
Max. imbalance for each side (before balancing)	max. g	90 for clamp weights 120 for stick-on weights
Permissible residual imbalance for each side (after balancing)	max. g	4
Elimination of imbalance: Up to 60 g with one weight or more than 60 g with two weights		

TWO-PART ALLOY WHEELS

36 10 WHEELS TWO-PART ALLOY WHEELS

WHEELS TWO-PART ALLOY WHEELS SPECIFICATION

Max. radial runout of tire Rim with tire	max. mm	1.3
Max. axial runout or tire Rim with tire	max. mm	1.5
Max. radial runout out rim	max. mm	0.5
Max. axial runout of rim	max. mm	0.5
Max. imbalance for each side (before balancing)	max. g	90 for clamp weights 120 for stick-on weights
Permissible residual imbalance for each side (after balancing)	max. g	4
Elimination of imbalance: Up to 60 g with one weight or more than 60 g with two weights		

SUSPENSION

Wheel and Tires - Tightening Torques - Z4

WHEEL RIMS

36 11 WHEEL RIMS

TIGHTENING TORQUE SPECIFICATION - WHEEL RIMS

	Type	Thread	Tightening specification	Measure
1AZ Valve on disc wheel (RDC)	E89			3.5 Nm
2AZ Wheel electronics (RDC) on valve	E89			3.5 Nm
3AZ RDC transmitter to washer fluid reservoir	E89			1.5 Nm

WHEELS

36 10 WHEELS

TIGHTENING TORQUE SPECIFICATION - WHEELS

	Type	Thread	Tightening specification	Measure
1AZ Wheel bolt	E89	M12		120 Nm

SUSPENSION

Wheels And Tires - Operating Fluids

1.0 TIRE MOUNTING PASTE

Use only a lubricant specifically designed for this purpose (former BMW Part No. 81 22 9 407 288).

Würth Tire Mounting Paste Part No. 892800

Silicone sprays are not acceptable, as they are extremely slippery and don't dry. If applied to the tire bead, it is likely that the tire moves on the rim, causing an imbalance.

2.0 WHEEL CLEANERS

Liquids for cleaning the alloy wheels must be strong enough to lift brake dust, road dirt, etc. off the painted wheel surface with minimum manual agitation, yet not attack the wheel material. The following cleaner has been thoroughly tested for optimum cleaning action and long-term compatibility with the wheel's surfaces:

Wheel Cleaner Spray BMW Part No. 82 14 1 467 045

3.0 WHEEL HUB COVERS

Covers may be affixed to the alloy rim by using Loctite 638 (former BMW Part No. 07 58 9 056 030). Covers may only be used once.

WHEEL HUB COVERS SPECIFICATION

Loctite 638	-	Würth Part No. 8936010
	-	Loctite Part No. 21447

The cooling-turbine wheel covers of the M5 (E34) produced from March 1990 to October 1990 may be secured to the wheel by applying Loctite 242 to the attaching screw threads. First clean screw threads with Loctite Cleaning Solvent 755.

4.0 ANTI-CORROSION PASTE

Apply small amounts of Plastilube paste evenly around the centering cone of the alloy wheel rim and onto the contact areas of the brake hub.

Plastilube BMW Part No. 81 22 9 407 103.