

**ELECTRONIC POWER STEERING****Overview - X3 (E83)****DESCRIPTION & OPERATION****RACK & PINION & SERVOTRONIC STEERING**

Conventional rack and pinion power steering is used in the X3 (E83) and Servotronic is available as an option. The design and functioning principle of the Servotronic option are nothing new but have been modified as described in this chapter. The servotronic steering system controls the amount of power assistance based on the current road speed. The hydraulic pressure is electronically adapted to the current road speed, with greater power assistance available at lower road speeds and less power assistance available at greater road speeds.

The E83 is equipped with hydraulic assisted rack and pinion steering. The total ratio of the steering is: 18.9:1. The total rack stroke is 81.0 mm (1.7 turns of the steering wheel). The hydraulic ports on the steering gear have quick release couplings. The hydraulic pump maximum pressure is limited to 127 bar. E83 vehicles are equipped with "W" shaped cooling loops (hoses) to assist in cooling. The hydraulic pump does not have a pump end shutdown feature. The hydraulic pump could be damaged after approximately 1 minute if the steering is kept on full lock (end stop) for a long period.

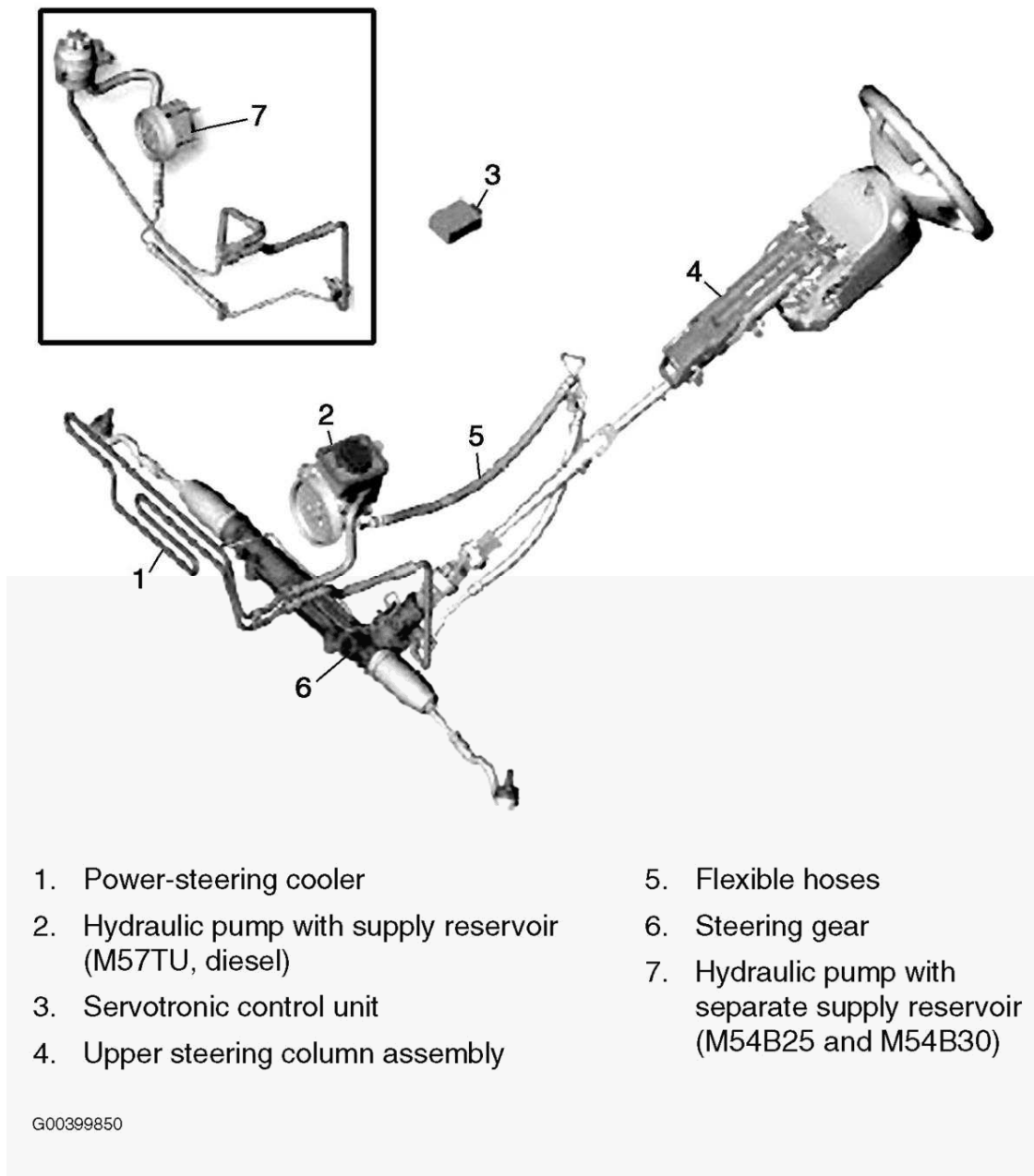


**Fig. 1: Overview Of Steering System**

Courtesy of BMW OF NORTH AMERICA, INC.

## SERVOTRONIC INTRODUCTION

Servotronic does not regulate the steering force support in a conventional way by using the engine speed, rather it is dependent upon the car's road speed. The Servotronic regulates the hydraulic pressure in the power-steering pump. Adaptation of the hydraulic pressure to the car's road speed has the effect of:

- High steering force support at low road speeds.
- Minimum steering force support at high road speeds.

This means that minimum force is required for steering force at slow road speeds. As the road speed increases the steering force support is continuously reduced. Contact to the road surface therefore becomes more direct and steering is more precise. Consequently, steering is very comfortable and maneuverability is maximized, for instance when parking and maneuvering at slow speeds.

## **COMPONENTS**

**NOTE:**        **The following actuators are involved in the Servotronic.**

### **Servotronic Control Unit (SVT)**

The SVT control unit specifies the nominal values for controlling the Servotronic valve (hydraulic pressure). The SVT control unit is connected to the PT-CAN (powertrain CAN) and K-Bus (body bus).

### **DSC Control Unit (Dynamic Stability Control)**

The DSC control unit delivers the car's road speed signal. The DSC control unit and SVT control unit are connected by the PT-CAN.

### **DME or DDE (Digital Engine Electronics or Digital Diesel Electronics DDE)**

The Servotronic receives the signal of whether the engine is running from the DME or DDE over the PT-CAN. The Servotronic only activates the Servotronic valve when the engine is running.

### **Instrument Cluster (KOMBI)**

The instrument cluster delivers the terminal status (e.g. terminal 15 ON) and the kilometer reading.

### **Servotronic Valve**

The Servotronic valve is an electro-hydraulic converter located in the power-assisted steering oil circuit. The Servotronic valve restricts the hydraulic current and consequently reduces the hydraulic pressure. The Servotronic valve is activated by a characteristic curve delivered by the SVT control unit.

## **SYSTEM FUNCTIONS**

The Servotronic is based upon the following system functions:

- Initialization of the Servotronic.
- Recording of the speed.
- Supplying the Servotronic valve with power.
- Undervoltage detection and overvoltage detection.

### **Initialization of the Servotronic**

The Servotronic is active from terminal 15 ON. A short initialization phase for the Servotronic (under 1 second) is necessary when the engine starts in order to reach the characteristic curve for a low road speed as fast as

possible. A plausibility check for supplying the Servotronic valve is performed during the initialization phase.

### **Recording of the Speed**

The road-speed signal is calculated by the DSC and supplied to the PT-CAN. The Servotronic specifies an acceleration value for plausibility of the road-speed signal. A road speed is calculated from the acceleration value. At a low acceleration the road-speed signal supplied by the DSC is used. At a higher acceleration the Servotronic control unit calculates the road speed internally. The road speed is stored in the Servotronic control unit.

### **Supplying the Servotronic Valve with Power**

The Servotronic valve is supplied with power in response to the car's road speed. The power-assisted steering characteristic is memorized in a characteristic curve. The characteristic curve specifies the power based on the car's road speed. The characteristic curve is written using 16 reference points. The Servotronic valve is no longer supplied with power when the engine is OFF (over the PT-CAN). Minimum steering force support is set (high road speed) when the Servotronic valve is no longer supplied with power. Equally, the Servotronic valve is also no longer supplied with power if there is a fault-memory entry.

### **Undervoltage detection and overvoltage detection**

The Servotronic valve is no longer supplied with power under the following conditions:

- Supply Voltage Less Than 9 Volts
- Supply Voltage Higher Than 17 Volts

Voltage dips during ignition faults are detected.

### **SWITCH-ON CONDITIONS**

Switch-on conditions for the Servotronic are:

- Terminal 15 ON
- Engine Must Be Running

The Servotronic only activates the Servotronic valve when the engine is running. When the engine has started and a road-speed signal is not supplied, the Servotronic sets the maximum steering force support. If a plausible road-speed signal is detected, the Servotronic valve is activated by the characteristic curve. If there is still not a (or not a plausible) road-speed signal 5 seconds after the engine has started, the minimum steering force support is set.

**STEERING****Steering - Operating Fluids****GEMMER STEERING**

The ZF Gemmer steering is permanently filled with oil. There is no drain plug.

**ZF RACK AND PINION STEERING WITHOUT POWER ASSIST**

The ZF rack and pinion steering is lubricated for its service life and therefore does not require servicing.

In case of repair, steering components on E21 vehicles are to be lubricated with a sodium-based grease, with a temperature range of -30°C to +75°C.

**BMW PART NUMBER SPECIFICATION**

Calypsol D 4024

BMW Part No. 32 11 1 116 929

**BALL AND NUT OR RACK AND PINION POWER STEERING**

Only reputable brand Automatic Transmission Fluid (ATF) of Dexron® III formulation may be used for the power steering and power steering pump.

In case of brief hydraulic noise after starting at low outside temperatures, we recommend replacing the red ATF with green CHF or LHM oil (see below).

**4.0 ZF Ball and Nut Power Steering with H31 System**

The approved oils for BMW models with power steering and the H31 brake booster system are identical with those oils approved for power steering without the H31 system except for the following:

E32 models with self-leveling rear suspension and mutual oil supply tank in the engine compartment.

Countries with very low outside temperatures (e.g. Canada) had their power steering systems filled at the factory with Pentosin CHF 7.1 since 9/87 through 9/91. This is also to be used on vehicles built before 9/87.

Since 9/91, vehicles now use Pentosin CHF 11S instead of CHF 7.1.

**BMW PART NUMBER SPECIFICATION**

Pentosin CHF 7.1

BMW Part No. 81 22 1 468 879

Pentosin CHF 11S

BMW Part No. 82 11 1 468 041

These cars are marked with a pertinent label located close to the oil tank.

LHM oils (green color) of the following manufacturers may also be used instead of Pentosin (CHF 7.1):

## 2007 BMW X3

### STEERING Steering - Operating Fluids

Shell LHM

Castrol LHM

Exxon LHM

**The mixing of CHF, LHM oils and ATF is not permitted.**

Pentosin CHF 4548 was used on vehicles built before 9/87 but is no longer available. However, mixing of Pentosin CHF 7.1 with residual quantities of Pentosin CHF 4548 are permitted in these earlier vehicles. Mixing of these two oils is not permitted for E32 / E38 vehicles.

The hydraulic system for power steering and power-assisted brakes must be drained as completely as possible when changing from one type of oil to the other.

All oil supply reservoirs are marked with the type of oil being used - ATF or CHF.

## OIL CHANGE FOR POWER STEERING

Regular oil changing is not necessary. However, it is recommended to replace the oil after completion of repairs (unit or line replacement). Use ATF of Dexron® III formulation.

## HORN SLIP RINGS

Approved grease is a copper paste (former BMW Part No. 81 22 9 400 794).

### BMW PART NUMBER SPECIFICATION

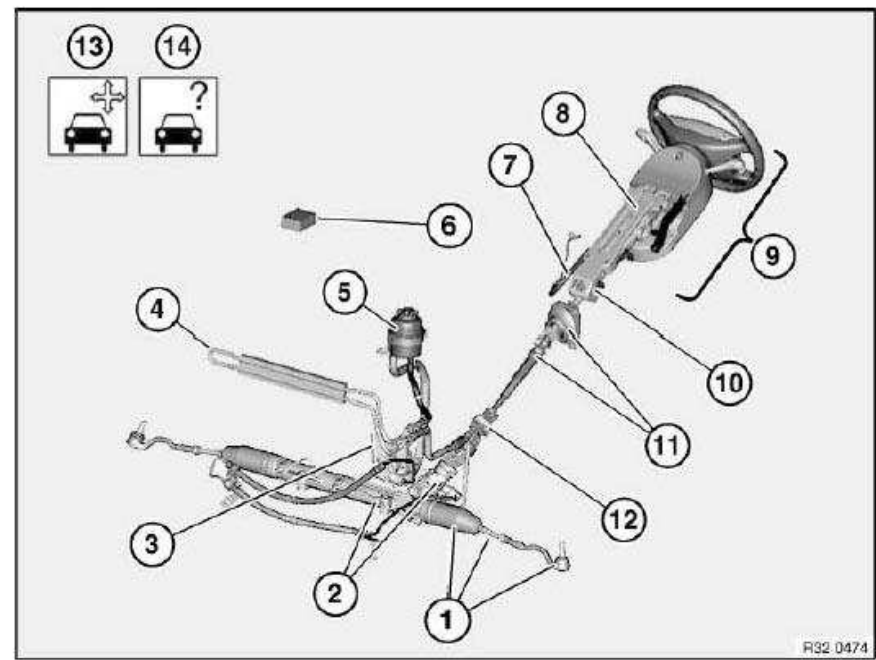
|     |                   |
|-----|-------------------|
| 3M  | Part No. 8945     |
| CRC | Part No. 3046 010 |

SUSPENSION

Steering & Wheel Alignment - Repair Instructions - X3

00 ELECTRONIC CHASSIS ALIGNMENT

32 ... OVERVIEW OF STEERING

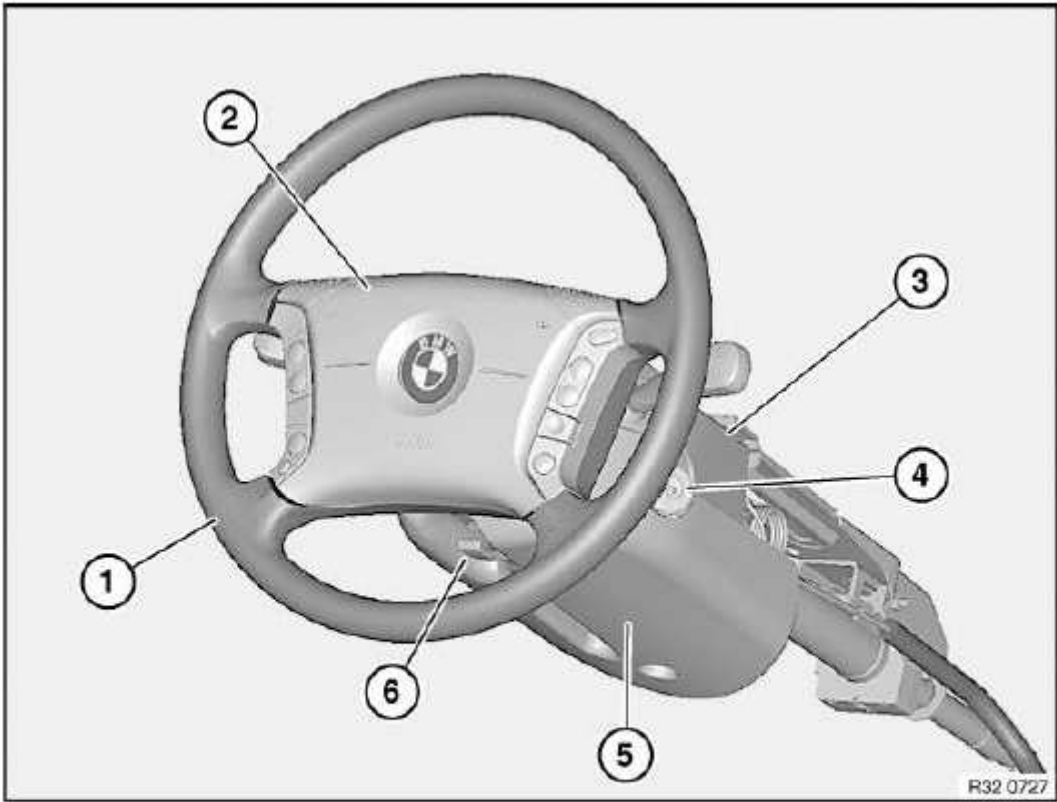


- |   |                                                    |    |
|---|----------------------------------------------------|----|
| 1 | <a href="#">Tie rod end / tie rod / gaiter</a>     | 8  |
| 2 | <a href="#">Power steering gear / EH converter</a> | 9  |
| 3 | <a href="#">Vane pump</a>                          | 10 |
| 4 | <a href="#">Cooling coil</a>                       | 11 |
| 5 | <a href="#">Fluid reservoir</a>                    | 12 |
| 6 | <a href="#">Servotronic control unit</a>           | 13 |
| 7 | <a href="#">Interlock cable</a>                    | 14 |

- [Steering column](#)
- [Overview of steering wheel/casing components](#)
- [Steering angle sensor](#)
- [Steering spindle lower section/sleeve](#)
- [Double joint](#)
- [Adjustment work](#)
- [Troubleshooting](#)

**Fig. 1: Overview Components Of Steering**  
Courtesy of BMW OF NORTH AMERICA, INC.

32 ... OVERVIEW OF STEERING WHEEL / CASING COMPONENTS / LOCK CYLINDER



- 1

[Steering wheel](#)
- 2

[Airbag unit](#)
- 3

[Upper steering column casing](#)
- 4

[Lock cylinder](#)
- 5

[Lower steering column casing](#)
- 6

[Control lever](#)

**Fig. 2: Overview Of Steering Wheel / Casing Components / Lock Cylinder**  
Courtesy of BMW OF NORTH AMERICA, INC.

**32 00 ... CHASSIS/WHEEL ALIGNMENT CHECK PROCEDURE**

**CHASSIS/WHEEL ALIGNMENT PROCEDURE CHART**

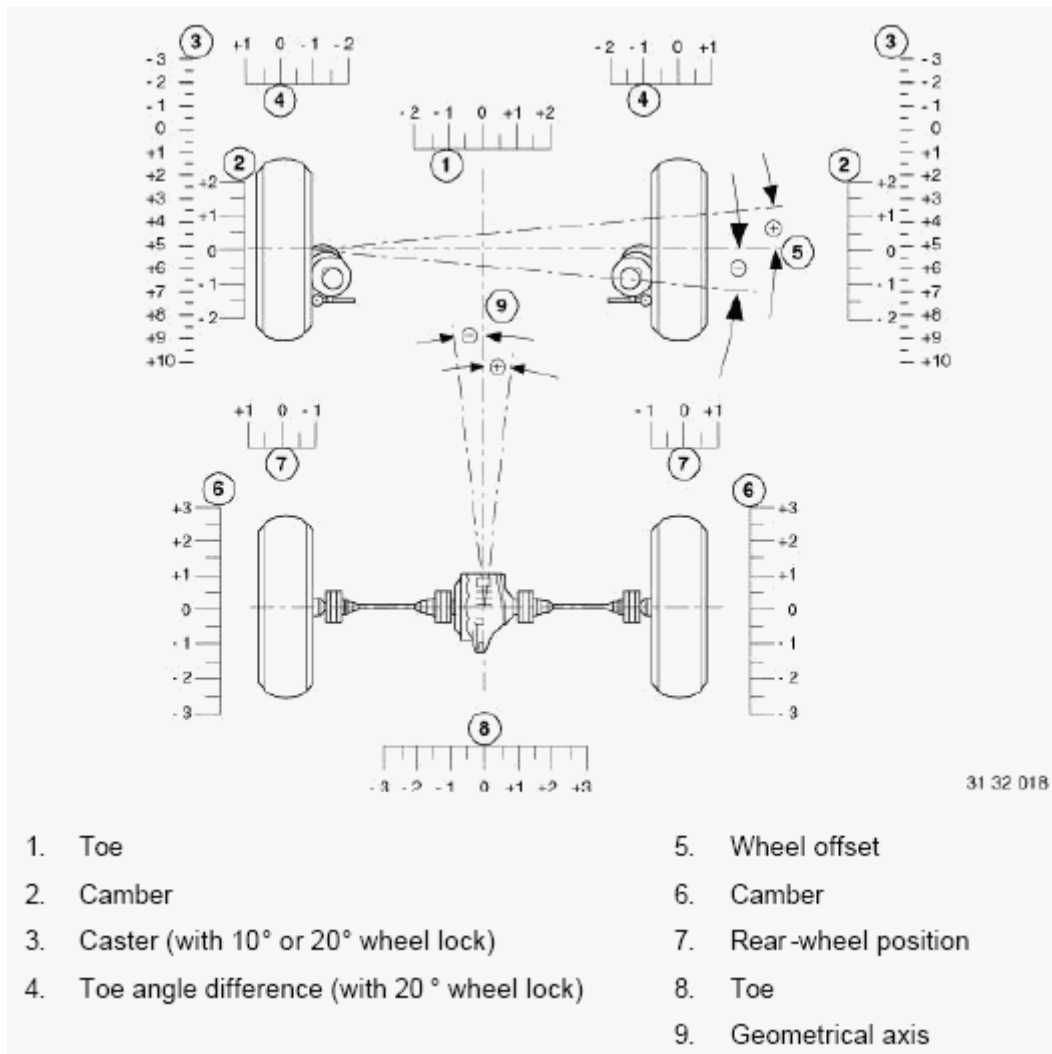
|                                                                                       |           |                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                       |           |                                                                                                                                                                                      |
| Check adherence to <b>32 00 ... Test conditions for chassis/wheel alignment check</b> |           |                                                                                                                                                                                      |
| I<br>V                                                                                |           |                                                                                                                                                                                      |
| Position vehicle on measuring stand                                                   |           |                                                                                                                                                                                      |
| I<br>V                                                                                |           |                                                                                                                                                                                      |
| Measure vehicle ride height                                                           | OK -<br>> | Carry out chassis/wheel alignment check with ride-height measurement without load, see <b>32 00 155 KDS chassis/wheel alignment check with ride-height measurement without load.</b> |
| Read off setpoint value in KDS                                                        |           |                                                                                                                                                                                      |

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### SUSPENSION Steering & Wheel Alignment - Repair Instructions - X3

|                                                                                                                                                                                   |               |                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------------------|
| Tolerance-20 / +40 mm per wheel permissible<br>Difference between left / right max. 10 mm permissible                                                                             |               |                                                  |
| Not OK / no data<br>I<br>V                                                                                                                                                        |               |                                                  |
| Move vehicle into normal position, see <b><u>32 00 ... Moving vehicle into normal position.</u></b>                                                                               |               |                                                  |
| Introduce load and measure ride heights                                                                                                                                           |               |                                                  |
| Read off setpoint value in KDS<br>Tolerance $\pm 10$ mm per wheel permissible<br>Difference between left / right max. 10 mm permissible                                           | Not OK -<br>> |                                                  |
| OK<br>I<br>V                                                                                                                                                                      |               | Check suspension for damage, repair if necessary |
| Move vehicle into design position, see <b><u>32 00 ... Moving vehicle into design position.</u></b>                                                                               | <-<br>Not OK  |                                                  |
| Add/distribute weights and measure ride heights                                                                                                                                   |               |                                                  |
| Read off setpoint value in KDS<br>Tolerance $\pm 2$ mm per wheel permissible<br>Difference between left / right max. 2 mm permissible                                             |               |                                                  |
| I<br>V                                                                                                                                                                            |               |                                                  |
| Carry out chassis/wheel alignment check with load up to design position, see <b><u>32 00 155 KDS chassis/wheel alignment check with ride-height measurement without load.</u></b> |               |                                                  |
|                                                                                                                                                                                   |               |                                                  |

### 32 00 ... GENERAL CHASSIS AND SUSPENSION DEFINITIONS

**Fig. 3: Chassis And Suspension Angle**

Courtesy of BMW OF NORTH AMERICA, INC.

**32 00 ... GENERAL INFORMATION AND DEFINITIONS**

Toe angle difference

a Toe angle difference

D Center point of operating circle

The toe angle difference is the angle adjustment of the inner cornering wheel relative to the outer cornering wheel when negotiating a curve. Steering is designed in such a way that angular position of wheels changes as steering lock progresses.

A correctly adjusted toe angle difference produces equal values for left and right lock with consideration of factory tolerances.

Toe angle difference provides information on corresponding operation of steering trapezoid for left or right steering lock from center position.

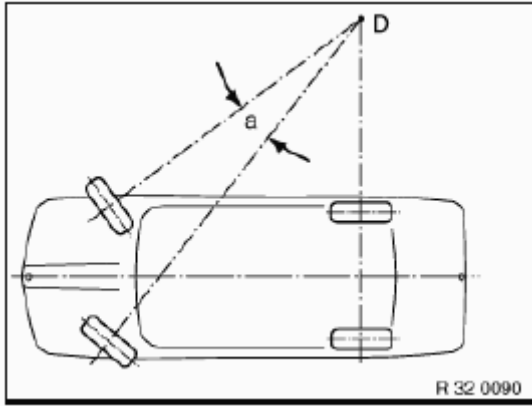


**Fig. 4: Toe Angle Difference**  
Courtesy of BMW OF NORTH AMERICA, INC.

Camber

Inclination of the wheel from the perpendicular.

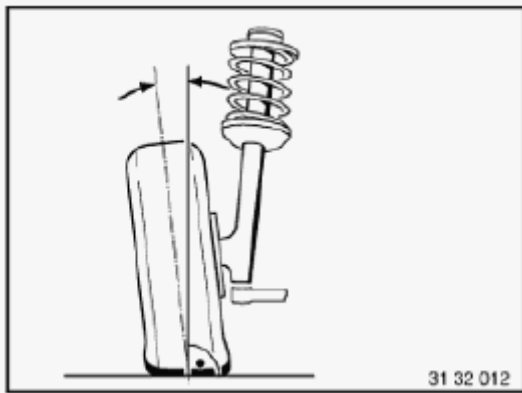


**Fig. 5: Camber Inclination Of Wheel From Perpendicular**  
Courtesy of BMW OF NORTH AMERICA, INC.

Toe

Reduction in distance of front of front wheels to rear of front wheels. The toe-in prevents the wheels from moving apart during driving and thus:

- the wheels from vibrating and grinding
- excessive tire wear
- excessive strain on the steering linkage and its links/joints
- heavy vehicle steering

Measurement is performed in "straight-ahead mode".

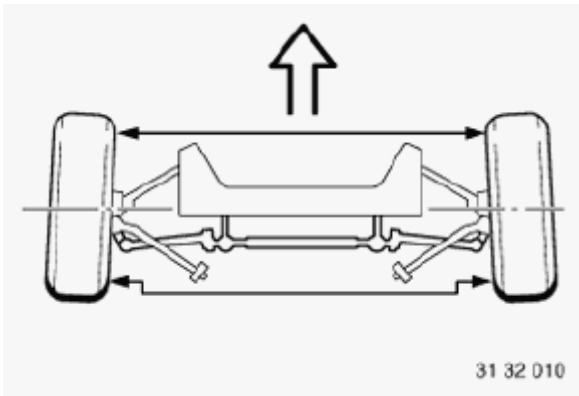


**Fig. 6: Toe Angle Difference**

Courtesy of BMW OF NORTH AMERICA, INC.

#### Caster

Is the inclination of the kingpin in the direction of travel viewed from the side. The line through the center point of the spring strut support bearing and the control arm ball joint corresponds to the "kingpin".

Thanks to caster, wheels are pulled and not pushed. In a similar manner to king pin inclination, when driving in curves or around corners, returning forces are reproduced to help return wheels to straight-ahead position.

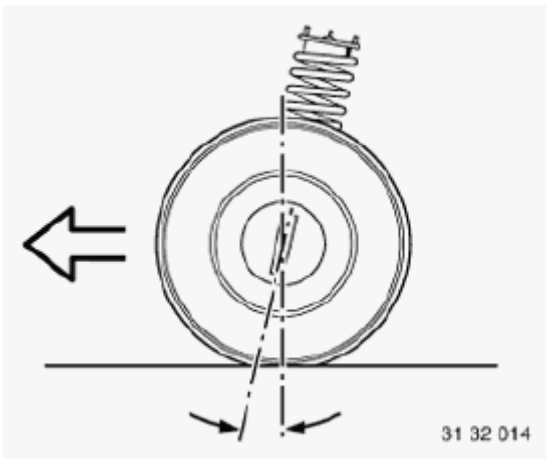


**Fig. 7: Caster Angle Difference**

Courtesy of BMW OF NORTH AMERICA, INC.

#### Geometrical axis 1

Is the angle bisector from the total rear-wheel toe.

Front-wheel measurements are taken in reference to this axis.

#### Symmetrical axis 2

Center line running through front and rear axles.

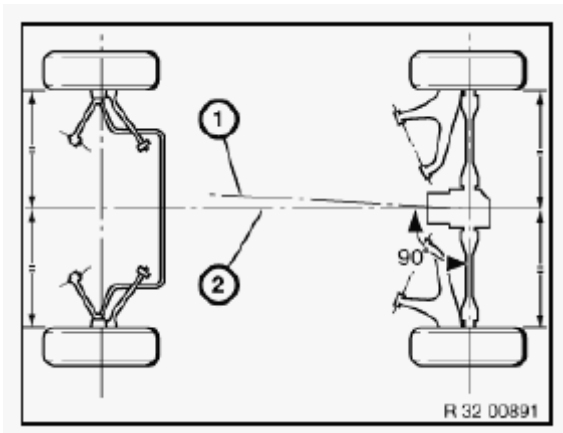


**Fig. 8: Geometrical Axis And Symmetrical Axis**  
Courtesy of BMW OF NORTH AMERICA, INC.

Wheel offset

Angle by which one front wheel is displaced more towards front or rear than the other front wheel. The wheel offset angle is positive when the right wheel is displaced towards the front and negative when it is displaced towards the rear.

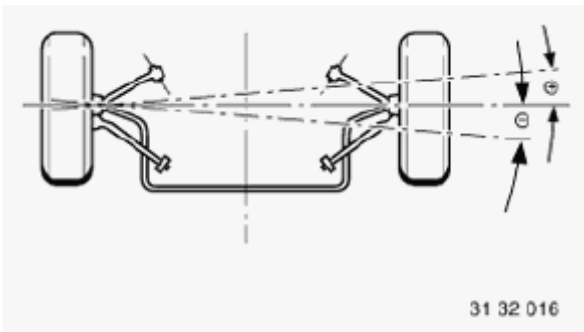


**Fig. 9: Wheel Offset Angle**  
Courtesy of BMW OF NORTH AMERICA, INC.

Kingpin offset/scrub radius

Is the distance from the center of the wheel contact face to the intersection point of the kingpin extension. The line through the center point of the spring strut support bearing and the control arm ball joint corresponds to the "kingpin".

The scrub radius is influenced by camber, kingpin angle and wheel offset of the wheel rim.

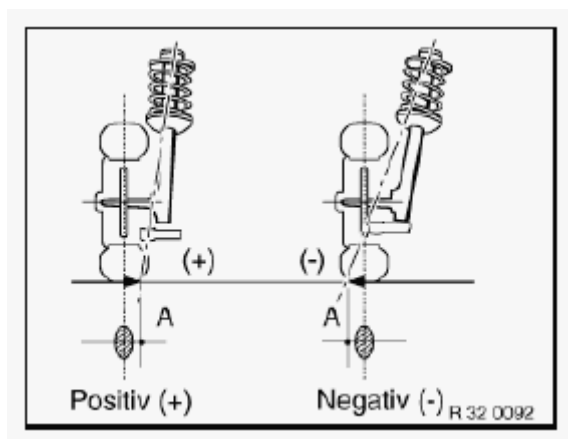


**Fig. 10: Kingpin Offset/Scrub Radius**

Courtesy of BMW OF NORTH AMERICA, INC.

### 32 00 ... IDENTIFICATION OF SUSPENSION WITHOUT LABEL

**NOTE:** If the front spring strut does not have a label for suspension identification, the type of suspension can be identified from the part number in the Electronic Parts Catalogue.

### 32 00 ... INFORMATION ON REPLACING STEERING GEAR AFTER ACCIDENT DAMAGE

#### Facts:

In the event of accidents or driving conditions similar to accidents, shocklike loads can cause different types of damage to steering gears. When a steering gear is externally undamaged, it is sometimes only possible to identify damage with great difficulty and with great effort. However, damage of this nature poses an unacceptable risk to the vehicle because it can result in failure of the steering system.

Because of the disproportionate amount of effort involved, it is generally not sensible to check thoroughly all the individual components of the steering gear and as an alternative it is necessary to take into account other components which can be checked more easily.

#### Procedure:

The steering gear must be replaced if one or more of the following points apply:

- A. Visible or noticeable damage to the steering gear
- B. Unacceptable torque increase and jamming when the steering gear is turned from lock to lock (without hydraulic assistance)
- C. Permissible tolerances exceeded during axle/wheel alignment check (if necessary, include alignment record with invoice / report)
- D. Fire damage
- E. Damage, permanent deformation or fractures to:

- Wheel rims in the event of a negative result from the wheel/axle alignment check
- Spring struts, steering knuckles, wheel carriers
- Control arms
- Compression or tension struts or stabilizer bars with this function
- Body-side screwing/bolting points for wheel guide/control components
- Front axle carrier
- Pitman arms
- Tie rods
- Steering gear fixtures
- Steering column

This guideline is binding for all accident repairs to BMW and MINI vehicles.

**NOTE:** If the steering gear replacement work which is required for safety reasons is refused by the customer or an insurance company for cost reasons, a memorandum to that effect must be drawn up and countersigned by the party bearing the costs of the accident repair.

**IMPORTANT:** The vehicle's type approval will be invalidated whenever the function of any of its safety components is compromised!

### **32 00 ... MOVING VEHICLE INTO DESIGN POSITION**

*Necessary preliminary tasks:*

- Move vehicle into normal position, see **32 00 ... Moving vehicle into normal position.**
- Version with air spring system:
  - Remove ignition key
  - Pull fuse for air supply unit control unit
- Add/distribute weights in area of spring struts until the vehicle ride height is within the tolerance (refer to **31 00 FRONT AXLE - RIDE HEIGHT E83** ).

Measure ride-level height of vehicle

### **32 00 ... MOVING VEHICLE INTO NORMAL POSITION**

*Necessary preliminary tasks:*

- Check compliance with test conditions, bring vehicle to a stop if necessary, see **32 00 ... Test conditions for chassis/wheel alignment check.**
- Version with air spring system: Carry out ride-height-calibration
- Check vehicle interior and luggage compartment (incl. luggage compartment recess) for load, unload

vehicle if necessary

- Introduce DIN load (refer to **32 00 CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E83**) into vehicle
- Determine vehicle ride height

**NOTE:** If the vehicle ride height is not inside the tolerance (refer to **31 00 FRONT AXLE - RIDE HEIGHT E83**), the vehicle must be repaired (coil spring/leakage).

### 32 00 ... PERFORMING RIM RUNOUT COMPENSATION

**NOTE:** Rim runout compensation involves electronically recording the lateral runout of the rim and the possible clamping error of the quick-clamping unit for one wheel rotation and compensating the toe and camber for measurement/alignment.

Raise body.

Perform rim runout compensation in accordance with equipment manufacturer's instructions.

Compress/deflect car.

### 32 00 ... TEST CONDITIONS FOR CHASSIS/WHEEL ALIGNMENT CHECK

Observe the following test conditions prior to the chassis/wheel alignment check:

1. Correct and identical rim and tyre sizes.
2. Correct tread depth. The tread depth for each axle may differ from left to right by max. 3-4 mm.
3. Correct tyre inflation pressure (see instruction plate on car).
4. Wheel bearing clearance OK
5. Steering backlash OK
6. Condition of suspension and shock absorbers OK
7. Cars with ride level control: Pull fuse of air supply unit so that there is no controlling down or up.

### 32 00 ... TROUBLESHOOTING AFTER WHEEL/CHASSIS ALIGNMENT CHECK ON FRONT AXLE

Substandard roadholding, atypical noises, tyres worn on one side and toe-in/camber values which deviate from the nominal value are all indicators of damage to the suspension caused by road traffic accidents or similar impacts.

To carry out proper repairs, you must follow the procedure set out in the troubleshooting table below depending on the condition of the vehicle in question.

You must also follow the rules and guidelines for accident-related repairs to the steering gear, see **32 00 ... Information on replacing steering gear after accident damage.**

**NOTE:** If after chassis/suspension components have been replaced adjustment of camber/track alignment is not possible, the vehicle must be placed on the straightening bench

**TROUBLESHOOTING CHART**

| <b>Fault</b>     | <b>Cause</b>                                               | <b>Remedy</b>                                                                                                                                                                                                                                  |
|------------------|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Toe deviation    | Tie rod end worn                                           | Replace tie rod end, see <b><u>32 21 151 Replacing left or right tie rod</u></b>                                                                                                                                                               |
|                  | Tie rod bent                                               | Replace tie rod, see <b><u>32 21 231 Replacing left or right tie rod</u></b>                                                                                                                                                                   |
|                  | Rubber mount or guide joint of tension strut faulty        | Replace rubber mount or guide joint, see <b><u>31 12 026 REMOVING AND INSTALLING/REPLACING GUIDE JOINT IN SWIVEL BEARING</u></b>                                                                                                               |
|                  | Rubber mount or ball joint of control arm faulty           | Replace rubber mount or control arm, see <b><u>31 12 000 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT CONTROL ARM</u></b>                                                                                                                   |
| Camber deviation | Rubber mount or ball joint of control arm faulty           | Replace rubber mount or control arm, see <b><u>31 12 000 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT CONTROL ARM</u></b>                                                                                                                   |
|                  | Control arm deformed                                       | Replace control arms <b><u>31 12 000 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT CONTROL ARM</u></b>                                                                                                                                       |
|                  | Rubber mount or guide joint of tension strut faulty        | Replace rubber mount or guide joint, see <b><u>31 12 026 REMOVING AND INSTALLING/REPLACING GUIDE JOINT IN SWIVEL BEARING</u></b>                                                                                                               |
|                  | Tension strut deformed                                     | Replace both tension struts, see <b><u>31 12 050 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT TENSION STRUT</u></b>                                                                                                                         |
|                  | Spring strut/piston rod of shock absorber deformed         | Replace front spring strut, see <b><u>31 31 031 REPLACING FRONT LEFT OR RIGHT SPRING STRUT SHOCK ABSORBER</u></b>                                                                                                                              |
|                  | Ride height between driver's and passenger sides different | Check load, correct if necessary, see <b><u>32 00 CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E83</u></b><br>Replace coil spring, see <b><u>31 33 100 REMOVING AND INSTALLING/REPLACING COIL SPRING FOR LEFT OR RIGHT FRONT SPRING STRUT</u></b> |
|                  | Front axle carrier deformed                                | Replace front axle carrier, see <b><u>31 11 001 REPLACING FRONT AXLE CARRIER (6-CYLINDER)</u></b>                                                                                                                                              |
|                  | Rubber mount or ball joint of control arm faulty           | Replace rubber mount or control arm, see <b><u>31 12 000 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT CONTROL ARM</u></b>                                                                                                                   |
|                  | Control arm deformed                                       | Replace control arms <b><u>31 12 000 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT CONTROL ARM</u></b>                                                                                                                                       |

## 2007 BMW X3

### SUSPENSION Steering & Wheel Alignment - Repair Instructions - X3

|                                                                                                   |                                                            |                                                                                                                                                          |
|---------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Caster deviation<br><br><b>NOTE:</b><br><b>Caster is defined by design and cannot be adjusted</b> | Rubber mount or guide joint of tension strut faulty        | Replace rubber mount or guide joint, see <b><u>31 12 026 REMOVING AND INSTALLING/REPLACING GUIDE JOINT IN SWIVEL BEARING</u></b>                         |
|                                                                                                   | Tension strut deformed                                     | Replace both tension struts, see <b><u>31 12 050 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT TENSION STRUT</u></b>                                   |
|                                                                                                   | Spring strut/piston rod of shock absorber deformed         | Replace front spring strut, see <b><u>31 31 031 REPLACING FRONT LEFT OR RIGHT SPRING STRUT SHOCK ABSORBER</u></b>                                        |
|                                                                                                   | Front axle carrier deformed                                | Replace front axle carrier, see <b><u>31 11 001 REPLACING FRONT AXLE CARRIER (6-CYLINDER)</u></b>                                                        |
|                                                                                                   | Ride height between driver's and passenger sides different | Check load, correct if necessary, see <b><u>32 00 CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E83</u></b>                                                  |
|                                                                                                   |                                                            | Air spring strut: Carry out ride-height-calibration                                                                                                      |
|                                                                                                   |                                                            | Check coil springs, replace if necessary, see <b><u>31 33 100 REMOVING AND INSTALLING/REPLACING COIL SPRING FOR LEFT OR RIGHT FRONT SPRING STRUT</u></b> |
| Toe-difference angle deviation<br>Prerequisite: camber and caster are correct                     | Tie rods not adjusted uniformly                            | Adjust toe on left and right sides to same value, see <b><u>32 00 150 KDS chassis/wheel alignment check with load up to design position</u></b>          |
| Wheel-offset deviation<br>Prerequisite: front wheels have equal single toe to geometrical axis    | Front axle carrier deformed                                | Replace front axle carrier, see <b><u>31 11 001 REPLACING FRONT AXLE CARRIER (6-CYLINDER)</u></b>                                                        |
|                                                                                                   | Control arm deformed                                       | Replace control arms <b><u>31 12 000 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT CONTROL ARM</u></b>                                                 |
|                                                                                                   | Tension strut deformed                                     | Replace both tension struts, see <b><u>31 12 050 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT TENSION STRUT</u></b>                                   |

### 32 00 ... TROUBLESHOOTING AFTER WHEEL/CHASSIS ALIGNMENT CHECK ON REAR AXLE

Substandard roadholding, atypical noises, tyres worn on one side and toe/camber values which deviate from the nominal value are all indicators of damage to the suspension caused by road traffic accidents or similar impacts.

To carry out proper repairs, you must follow the procedure set out in the troubleshooting table below depending on the condition of the vehicle in question.

**NOTE:** If after chassis/suspension components have been replaced adjustment of camber/track alignment is not possible, the vehicle must be placed on the straightening bench

### TROUBLESHOOTING CHART

|  |  |  |
|--|--|--|
|  |  |  |
|--|--|--|

## 2007 BMW X3

### SUSPENSION Steering & Wheel Alignment - Repair Instructions - X3

| <b>Fault</b>                  | <b>Cause</b>                                   | <b>Remedy</b>                                                                                                                 |
|-------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Camber deviation              | Rubber mount of upper control arm faulty       | Replace rubber mount, see <b><u>33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED)</u></b> . |
|                               | Upper control arm deformed                     | Replace upper control arm, see <b><u>33 32 071 REPLACING ONE UPPER CONTROL ARM</u></b>                                        |
|                               | Rubber mount of lower control arm faulty       | Replace rubber mount, see <b><u>33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED)</u></b> . |
|                               | Lower control arm deformed                     | Replace lower control arm, see <b><u>33 32 086 REMOVING AND INSTALLING/REPLACING BOTTOM LEFT CONTROL ARM</u></b>              |
|                               | Rubber mount/ball joint in trailing arm faulty | Replace rubber mount/ball joint, see <b><u>33 32 042 REPLACING A RUBBER MOUNT IN TRAILING ARM, FRONT</u></b> .                |
|                               | Rubber mount of rear axle carrier faulty       | Replace rubber mount, see <b><u>33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED)</u></b> . |
|                               | Rear axle carrier deformed                     | Replace rear axle carrier, see <b><u>33 31 011 REPLACING REAR AXLE CARRIER</u></b> .                                          |
| Toe deviation                 | Rubber mount of upper control arm faulty       | Replace rubber mount, see <b><u>33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED)</u></b> . |
|                               | Upper control arm deformed                     | Replace upper control arm, see <b><u>33 32 071 REPLACING ONE UPPER CONTROL ARM</u></b>                                        |
|                               | Rubber mount of lower control arm faulty       | Replace rubber mount, see <b><u>33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED)</u></b> . |
|                               | Lower control arm deformed                     | Replace lower control arm, see <b><u>33 32 086 REMOVING AND INSTALLING/REPLACING BOTTOM LEFT CONTROL ARM</u></b>              |
|                               | Rubber mount/ball joint in trailing arm faulty | Replace rubber mount/ball joint, see <b><u>33 32 042 REPLACING A RUBBER MOUNT IN TRAILING ARM, FRONT</u></b> .                |
|                               | Trailing arm deformed                          | Replace trailing arm, see <b><u>33 32 021 REPLACING LEFT OR RIGHT TRAILING ARM</u></b> .                                      |
|                               | Rubber mount of rear axle carrier faulty       | Replace rubber mount, see <b><u>33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED)</u></b> . |
|                               | Rear axle carrier deformed                     | Replace rear axle carrier, see <b><u>33 31 011 REPLACING REAR AXLE CARRIER</u></b> .                                          |
| Rear-wheel position incorrect | Rear axle carrier displaced laterally          | Replace rubber mount, see <b><u>33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED)</u></b> . |
| Deviation of                  | Rubber mount/ball                              | Replace rubber mount/ball joint, see <b><u>33 32 042 REPLACING</u></b>                                                        |

|                                                                                             |                                          |                                                                                                                               |
|---------------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| geometrical axis from symmetrical axis<br>Prerequisite: single wheel toe cannot be adjusted | joint in trailing arm faulty             | <b><u>A RUBBER MOUNT IN TRAILING ARM, FRONT .</u></b>                                                                         |
|                                                                                             | Rubber mount of rear axle carrier faulty | <b><u>Replace rubber mount, see 33 32 671 REPLACING ONE RUBBER MOUNT IN THE UPPER CONTROL ARM (CONTROL ARM REMOVED) .</u></b> |

## 32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION

Except M models:

**IMPORTANT:** Carry out chassis/wheel alignment with DIN load only:

- A. If the technical preconditions for alignment with ride height input are not in place
- B. If, in spite of repairs having been carried out, the car's ride height between the left and right sides is still outside the tolerance
- C. If the vehicles in question have been involved in an accident

**NOTE:**

- Read and comply with General information and definitions, see 32 00 ... General information and definitions.
- Read and comply with General chassis definition, see 32 00 ... General chassis and suspension definitions.

- If necessary, prepare lifting platform.
- Drive vehicle onto lifting platform.

**NOTE:** The front and rear wheels must be positioned centrally on the rotary and sliding plates.

- Remove locking pins from both rotary and sliding plates, align pickup using bubble level and activate

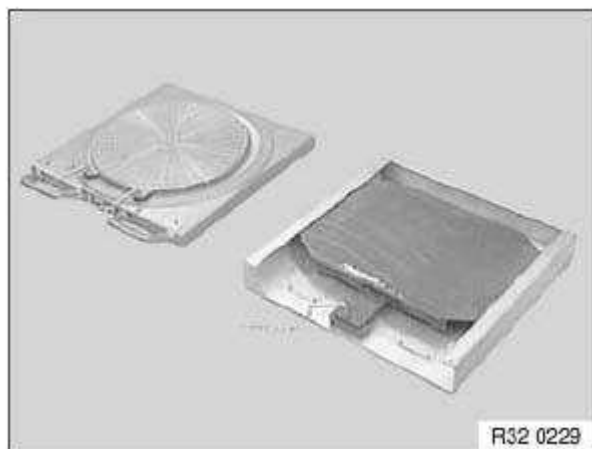


**Fig. 11: Lifting Platform**

Courtesy of BMW OF NORTH AMERICA, INC.

- Attach quick-clamping holder/quick-clamping unit to vehicle and remove clamping levers in area of front wheels
- Attach pickup to quick-clamping holder/quick-clamping unit, align using bubble level and connect to rotary plates

**NOTE:** When using quick-clamping units, perform rim runout compensation after installing the pickups, see 32 00 ... Performing rim runout compensation.

**Fig. 12: Attaching Quick-Clamping Holder/Quick-Clamping**

Courtesy of BMW OF NORTH AMERICA, INC.

- If necessary, attach spoiler adapter.

**Fig. 13: Spoiler Adapter**

Courtesy of BMW OF NORTH AMERICA, INC.

- If necessary, switch on chassis alignment system
- Enter customer and vehicle data

- Identify chassis version and select vehicle, see 32 00 ... Identification of suspension without label.
- Enter tyre pressure and tread depth
- Move vehicle into design position, see 32 00 ... Moving vehicle into design position.
- Install brake tensioner.

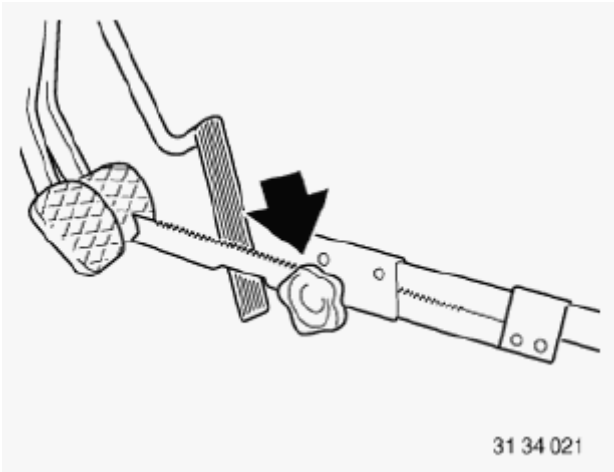


**Fig. 14: Locating Brake Tensioner**

Courtesy of BMW OF NORTH AMERICA, INC.

E87, E90, E91, E92:

**IMPORTANT: Risk of damage!**

In order to avoid damaging the front side panel during the "Max. steering lock" drive-in routine, make sure the pickups are removed from the quick-clamping holders/quick-clamping units during output and input alignment. In the process do not detach the connecting cable from the pickups or the rotary plates.

**NOTE:** After the drive-in routine, reconnect the pickups to the quick-clamping holders/quick-clamping units, align using the bubble levels and secure in place.

- Perform input measurement in accordance with equipment manufacturer's instructions.
- Compare specified values with actual values, see 32 00 CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E83 .

Only in event of customer complaint (e.g. poor driving performance):

**IMPORTANT: Do not remove screws/bolts (front axle carrier to engine carrier / body).**

Slacken all screws/bolts (front axle carrier to engine carrier / body) and then retighten to specified torque.

Refer to 31 11 506 LOWERING/RAISING FRONT AXLE CARRIER .

- If necessary, adjust front axle and rear axle, see 32 00 610 Adjusting toe-in and camber on front axle.

- Perform output measurement in accordance with equipment manufacturer's instructions.
- Save and print out test record.
- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment.**
- Insert locking pins into both rotary and sliding plates
- Remove chassis/wheel alignment system

### **32 00 155 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH RIDE-HEIGHT MEASUREMENT WITHOUT LOAD**

**IMPORTANT: Do not carry out chassis/wheel alignment without load:**

- A. if the technical requirements for alignment with ride height input are not in place
- B. if, in spite of repairs having been carried out, the car's ride height between the left and right sides is still outside the tolerance
- C. if the vehicles in question have been involved in an accident

**NOTE:**

- Read and comply with General information and definitions, see **32 00 ... General information and definitions.**
- Read and comply with General chassis definition, see **32 00 ... General chassis and suspension definitions.**
- Check compliance with test conditions, bring vehicle to a stop if necessary, see **32 00 ... Test conditions for chassis/wheel alignment check.**
- If necessary, prepare lifting platform.
- Drive vehicle onto lifting platform.

**NOTE: The front and rear wheels must be positioned centrally on the rotary and sliding plates.**

- Remove locking pins from both rotary and sliding plates, align pickup using bubble level and activate

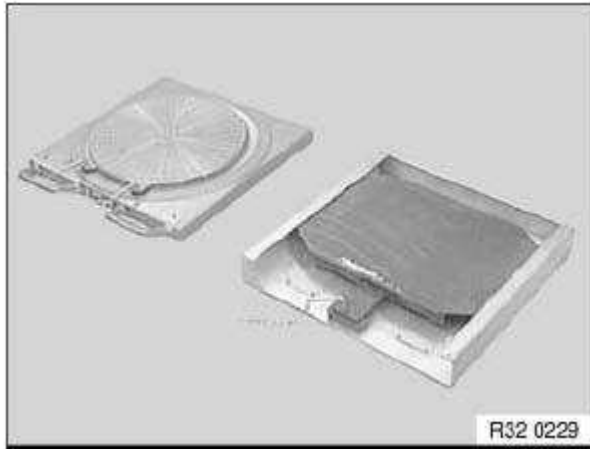


**Fig. 15: Lifting Platform**

**Courtesy of BMW OF NORTH AMERICA, INC.**

- If necessary, switch on chassis alignment system
- Enter customer and vehicle data
- Identify chassis version and select vehicle, see **32 00 ... Identification of suspension without label.**
- Enter tyre pressure and tread depth
- Measure and enter vehicle ride height
- Attach quick-clamping holder/quick-clamping unit to vehicle and remove clamping levers in area of front wheels
- Attach pickup to quick-clamping holder/quick-clamping unit, align using bubble level and connect to rotary plates

**NOTE:** When using quick-clamping units, perform rim runout compensation after installing the pickups, see **32 00 ... Performing rim runout compensation.**



**Fig. 16: Attaching Quick-Clamping Holder/Quick-Clamping**

**Courtesy of BMW OF NORTH AMERICA, INC.**

- If necessary, attach spoiler adapter.



R32 0241

**Fig. 17: Spoiler Adapter**

Courtesy of BMW OF NORTH AMERICA, INC.

- Install brake tensioner.

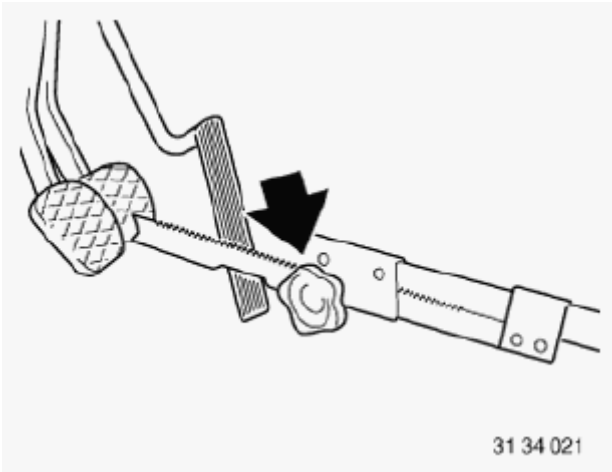


**Fig. 18: Locating Brake Tensioner**

Courtesy of BMW OF NORTH AMERICA, INC.

E87, E90, E91, E92:

**IMPORTANT: Risk of damage!**

In order to avoid damaging the front side panel during the "Max. steering lock" drive-in routine, make sure the pickups are removed from the quick-clamping holders/quick-clamping units during output and input alignment. In the process do not detach the connecting cable from the pickups or the rotary plates.

**NOTE:** After the drive-in routine, reconnect the pickups to the quickclamping holders/quick-clamping units, align using the bubble levels and secure in place.

- Perform input measurement in accordance with equipment manufacturer's instructions.
- Compare specified values with actual values, see **32 00 CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E83** .

Only in event of customer complaint (e.g. poor driving performance):

**IMPORTANT: Do not remove screws/bolts (front axle carrier to engine carrier / body).**

Slacken all screws/bolts (front axle carrier to engine carrier / body) and then retighten to specified torque.

Refer to **31 11 506 LOWERING/RAISING FRONT AXLE CARRIER** .

- If necessary, adjust front axle and rear axle, see **32 00 610 Adjusting toe-in and camber on front axle.**
- Perform output measurement in accordance with equipment manufacturer's instructions.
- Save and print out test record.
- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment.**
- Insert locking pins into both rotary and sliding plates
- Remove chassis/wheel alignment system
- Drive vehicle off lifting platform.

## **32 00 610 ADJUSTING TOE-IN AND CAMBER ON FRONT AXLE**

**Special tools required:**

- **32 3 140 SETTING TOOL**

**IMPORTANT: Changes in axle geometry caused by accidents must under no circumstances be rectified by camber adjustment!**

**NOTE:** Camber and toe-in influence each other. Adjust the toe-in first in order to simplify the adjustment procedure.  
The centering pin may only be driven or twisted out if the camber is outside the specified tolerance after toe adjustment.

**Adjust toe-in:**

If necessary, remove steering gear cover at side

Move steering into straight-ahead position by means of markings on cap (1) and steering gear (2).

Align steering wheel and secure with steering wheel arrester.

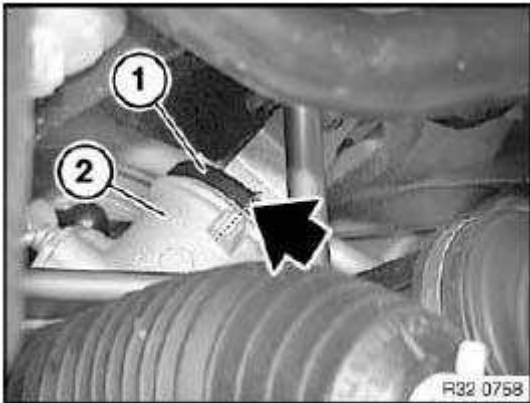


**Fig. 19: Locating Markings On Cap And Steering Gear**  
Courtesy of BMW OF NORTH AMERICA, INC.

Clean thread on tie rod.

Slacken clamping nut (2), gripping tie rod end (1) in the process.

Remove clamp (4).

Turn tie rod (3) to adjust toe-in to specified value.

Tighten down clamping nut (2).

Tightening torque: 32 21 5AZ, see **32 21 STEERING ARMS** .

Fit clamp (4).

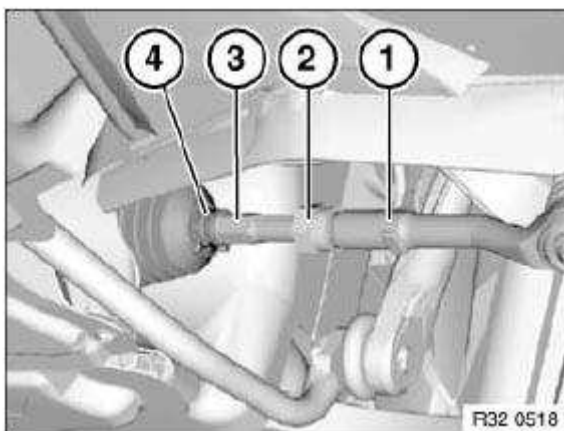


**Fig. 20: Clamping Nut, Tie Rod End And Clamp**  
Courtesy of BMW OF NORTH AMERICA, INC.

**Adjusting camber:**

Remove protective cap.

Knock out centering pin (1) in downwards direction.

Clean wheel arch from below in area of support bearing with compressed air.

Slacken nut (2) approx. 1 to 1.5 turns.

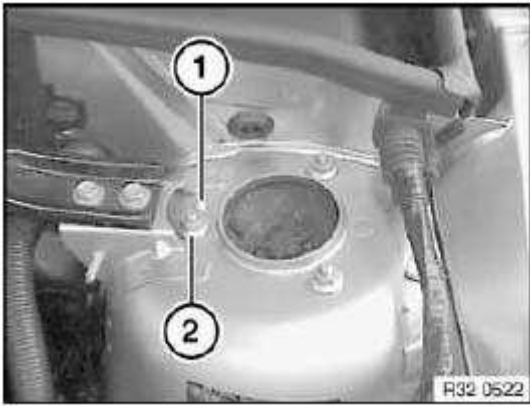


**Fig. 21: Centering Pin And Slacken Nut**  
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool 32 3 140 into wheel arch opening and over nut.

Replace nuts (1) and screw on but do not tighten down fully.

Turn nut in special tool 32 3 140 using open-end wrench (2) to adjust camber to specified value.

Tighten down nuts (1).

Tightening torque: 31 31 1AZ, see **31 31 SPRING STRUTS** .

Remove special tool 32 3 140.

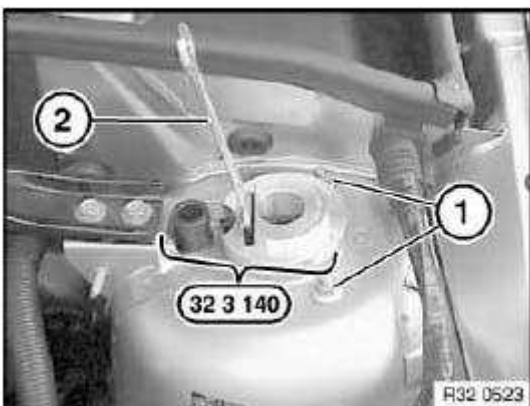


**Fig. 22: Nuts And Special Tool (32 3 140)****Courtesy of BMW OF NORTH AMERICA, INC.**

Replace nut (1) and tighten down.

Tightening torque: 31 31 1AZ, see **31 31 SPRING STRUTS** .

**Fig. 23: Nut****Courtesy of BMW OF NORTH AMERICA, INC.****After installation:**

- Check directional stability of vehicle; if necessary, repeat toe-in adjustment

**32 00 620 ADJUSTING REAR AXLE****Special tools required:**

- **32 3 030 SETTING TOOL**

**NOTE:**        **A camber change always means a toe change as well. The camber must therefore be adjusted first.**

**Adjusting camber:**

Replace nut (2) and tighten to 5 Nm.

Turn eccentric bolt (1) to adjust camber to setpoint value.

Tighten nut (2).

Tightening torque: 33 32 25AZ, see **33 32 CONTROL ARMS AND STRUTS** .

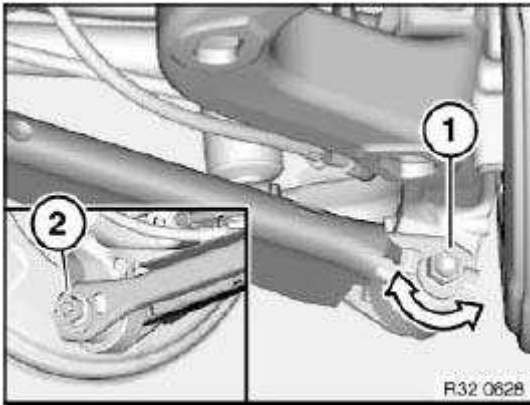


**Fig. 24: Turning Eccentric Bolt To Adjust Camber**  
Courtesy of BMW OF NORTH AMERICA, INC.

**Adjusting toe:**

Slacken bolts of bearing block by approx. 1 to 1.5 turns.

Attach special tool 32 3 030 to bolt head and pin (1).

Turn special tool 32 3 030 to adjust toe to specified value.

Tighten down bolts.

Tightening torque: 33 32 13AZ, see **33 32 CONTROL ARMS AND STRUTS** .

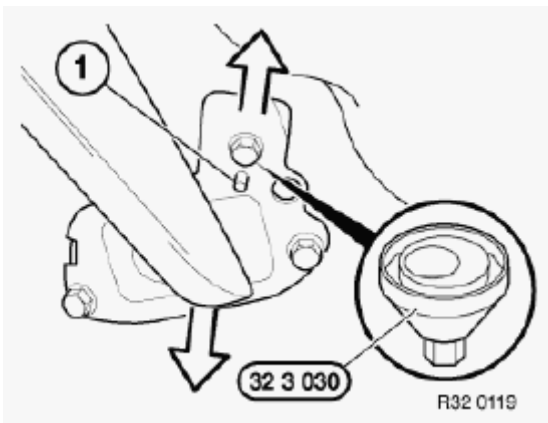


**Fig. 25: Special Tool (32 3 030) And Bolt Head And Pin**  
Courtesy of BMW OF NORTH AMERICA, INC.

**61 31 996 CARRY OUT STEERING ANGLE SENSOR ADJUSTMENT**

**IMPORTANT:** In vehicles with active front steering, steering angle sensor adjustment is integrated in the service function "Initial operation/adjustment for active front steering" and must not be carried out separately!

**NOTE:** Steering angle sensor adjustment must be carried out:

- after adjustment work on the front axle/steering
- after all mechanical work on the steering system
- after replacement / coding / programming of the following components:
  - Fixture for switches of steering column / switch cluster / steering angle sensor
  - Dynamic Stability Control (DSC) control unit
  - Control unit active anti-roll stabilization (ARS)

Connect vehicle to BMW diagnosis system or Software Service Station.

Select and carry out steering angle sensor adjustment under Service functions.

## 11 MECHANICAL STEERING GEAR

### 32 11 100 REPLACING GAITER FOR STEERING GEAR ON LEFT OR RIGHT

**IMPORTANT:** The power steering gear must be replaced if the polished surface of the rack is damaged (e.g. by corrosion).

*Necessary preliminary tasks:*

- Remove tie rod end, see 32 21 151 Replacing left or right tie rod
- Only at 4th cylinder: Remove reinforcement plate, see 31 10 010 REMOVING AND INSTALLING/REPLACING REINFORCEMENT PLATE .
- If necessary, remove steering gear cover at side

Clean tie rod.

Release band clamp (1) and ear clip (3), see 32 41 ... Instructions for removing and installing ear clips

Detach gaiter (2) from tie rod.

*Installation:*

Clean rack and check surface for damage (e.g. by corrosion).

Grease rack.

Clean tie rod and apply grease to taper.

**NOTE:** This ensures that the gaiter is not rotated when the tie rod is rotated.

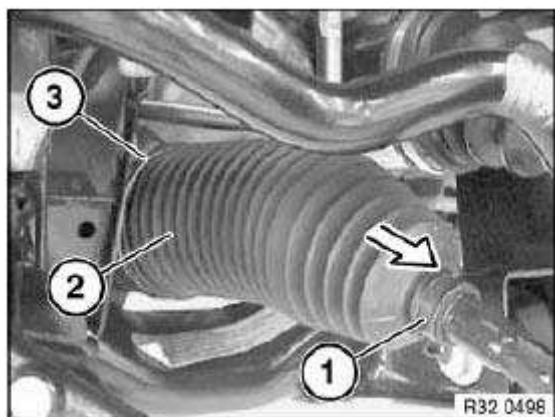


**Fig. 26: Clamp, Ear Clip And Gaiter**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Perform 32 00 150 KDS chassis/wheel alignment check with load up to design position.
- Carry out steering angle sensor adjustment, see 61 31 996 Carry out steering angle sensor adjustment.

## 13 STEERING GEAR WITH SERVO UNIT

### 32 13 ... FITTING REPAIR KIT FOR FCD COUPLING

**Special tools required:**

- 32 1 021 32 1 020 SET OF TOOLS
- 32 1 022 32 1 020 SET OF TOOLS
- 32 1 023 32 1 020 SET OF TOOLS

Remove FCD coupling.

Only following parts can be replaced on coupling head:

1. FCD dirt seal
2. Support ring
3. O-ring

**IMPORTANT:** Support ring and O-ring must not be mixed up! Always fit repair kit for FCD coupling completely.

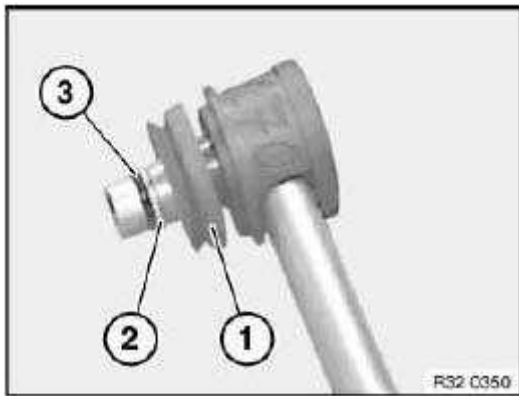


**Fig. 27: FCD Dirt Seal, Support Ring And O-Ring**  
Courtesy of BMW OF NORTH AMERICA, INC.

Press in special tool 32 1 023 as far as it will go in connecting piece on hydraulic steering gear. Then pull out again.

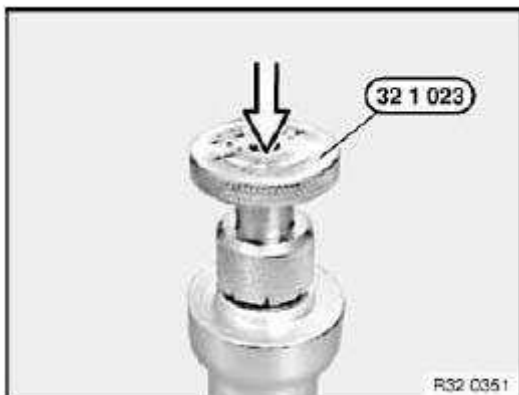


**Fig. 28: Pressing Special Tool (32 1 023)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove spring ring (1) from special tool 32 1 023.

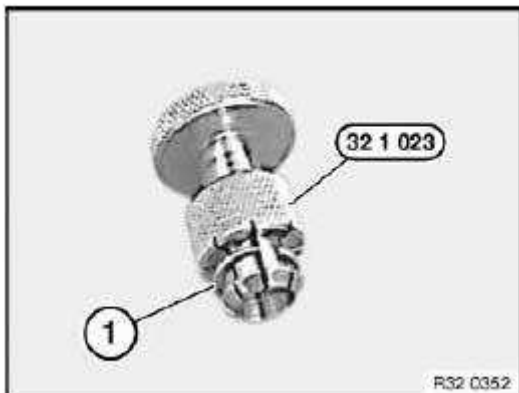


**Fig. 29: Spring Ring And Special Tool (32 1 023)**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

Lay new spring ring (1) in special tool 32 1 021.

Using special tool 32 1 022 , press spring ring (1) into connection. In so doing, press through special tool as far as it will go.

*Installation:*

Bore hole in special tool 32 1 021 is conical. Special tool must rest with stepped side securely on connection of hydraulic steering gear.

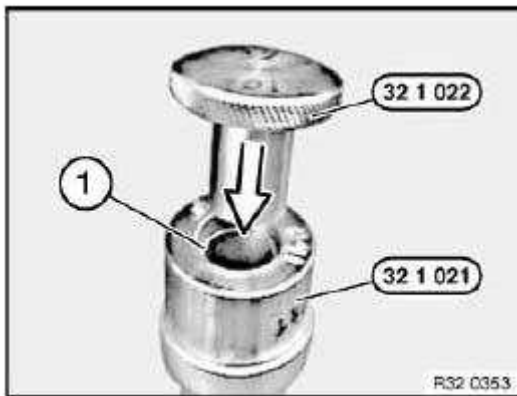


**Fig. 30: Pressing Spring Ring Into Connection Using Special Tool (32 1 022)**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

### 32 13 ... NOTES ON REMOVING/INSTALLING FCD CLUTCHES

**Special tools required:**

- **32 1 030 LEVER**
- **32 1 300 FORK**

There are 2 different types of FCD clutches:

1. FCD clutches with plastic caps
2. Metal FCD clutches (N73 only!)

FCD clutches without plastic caps must be replaced with a suitable special tool!

**FCD coupling with plastic caps:**

**Removal**

To release quick-release coupling, turn cap from position (A) - closed - to position (B) - open.

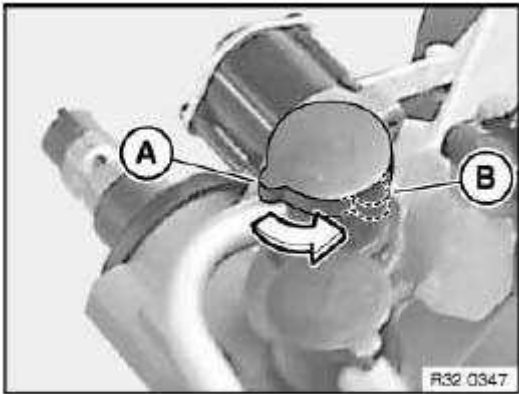


**Fig. 31: Turning Cap From Position (A)**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

Unlock quick-release coupling by pressing on cap (1).

Detach line while pressing cap.

In event of removal while installed, use special tool 32 1 030.

Position special tool close to locking head.

If necessary, fit repair kit for FCD coupling.

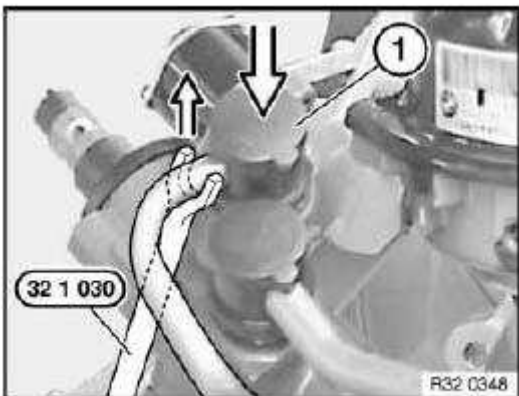


**Fig. 32: Cap And Special Tool (32 1 030)**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

### **Installation**

Coat seal pack (O-ring (1), support ring (2)) with hydraulic fluid before sliding in.

Slide quick-release coupling into housing by pressing on coupling cover.

Quick-release coupling must snap into place with an audible "click".

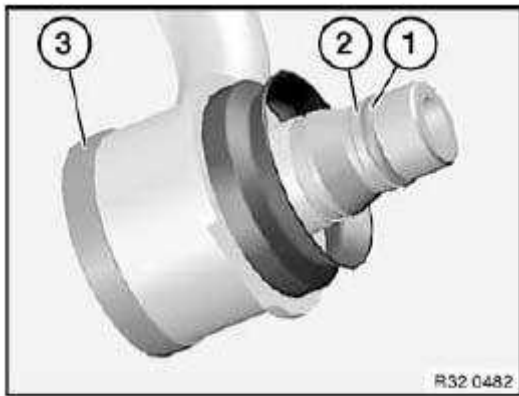


**Fig. 33: Seal Pack (O-Ring And Support Ring)**  
Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, lock coupling by turning cap from position (B) to position (A).

Lug of coupling must be over line outlet - position (A).

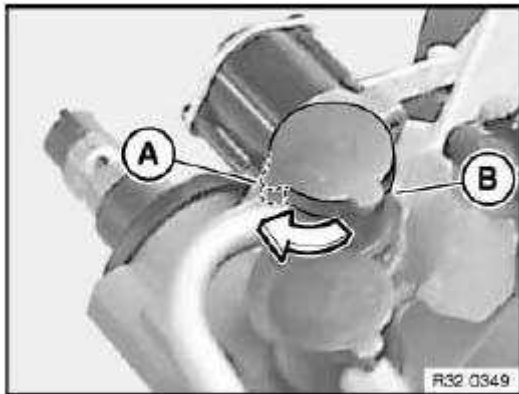


**Fig. 34: Turning Cap From Position (B) To Position (A)**  
Courtesy of BMW OF NORTH AMERICA, INC.

**Metal FCD clutches:**

### **Removal**

Metal quick-release couplings can only be opened with special tool 32 1 300.

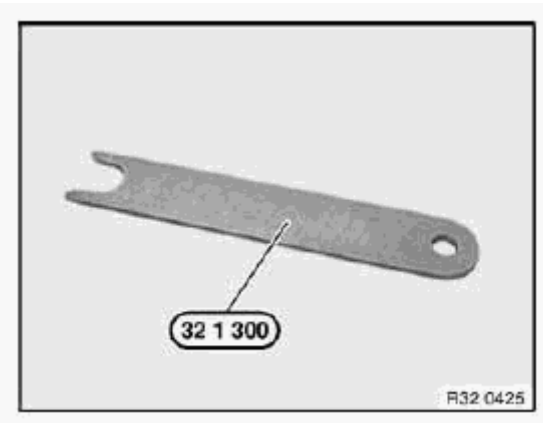


**Fig. 35: Special Tool (32 1 300)**

Courtesy of BMW OF NORTH AMERICA, INC.

Slide special tool 32 1 300 between metal head (1) and rubber lip (2) of quick-release coupling.

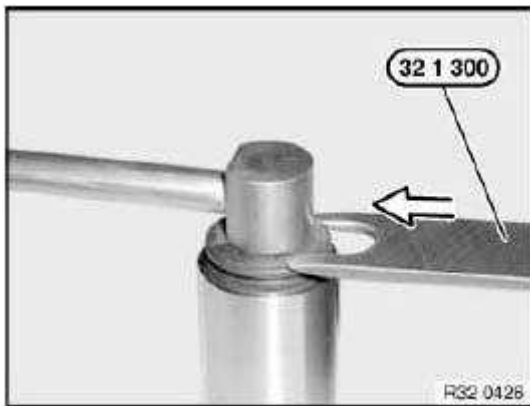


**Fig. 36: Sliding Special Tool (32 1 300) Between Metal Head And Rubber Lip Of Quick-Release Coupling**  
Courtesy of BMW OF NORTH AMERICA, INC.

Slide in special tool 32 1 300 as far as it will go. Quick-release coupling unlocks with a light click.

Then pull off coupling and tool towards top.

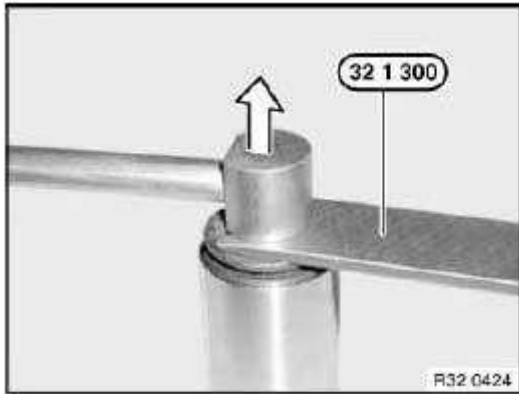


**Fig. 37: Pulling Off Coupling**

Courtesy of BMW OF NORTH AMERICA, INC.

### Installation

Remove tool.

Press quick-release coupling into steering gear.

Quick-release coupling must snap into place with an audible click.

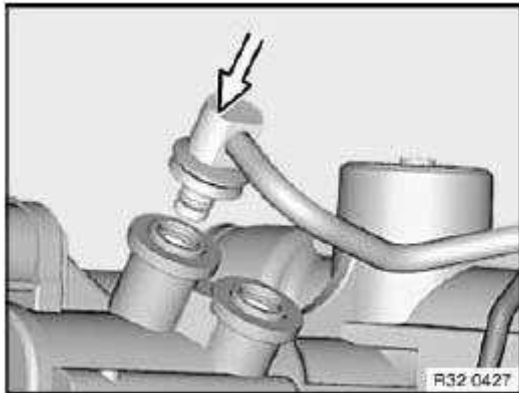


**Fig. 38: Pressing Quick-Release Coupling Into Steering Gear**

Courtesy of BMW OF NORTH AMERICA, INC.

### 32 13 006 BLEEDING POWER STEERING UNIT

**WARNING:** Danger of poisoning if oil is ingested/absorbed through the skin! See 00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN .

Risk of injury if oil comes into contact with eyes and skin! See 00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN .

**IMPORTANT:** Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.

Using contaminated equipment to add fluid may introduce dirt particles into the fluid reservoir and significantly reduce the service life of the power steering system. Do not use any filler funnels or similar!

The fill level may only be checked or adjusted when the engine is stopped! The fluid temperature should be approx. 20°C here.

Ensure that the cap is fully screwed in prior to the fill level check.

**NOTE:** To avoid mix-ups when filling with hydraulic fluid, mark the fluid reservoirs or their caps with identification marks.

ATF Automatic transmission fluid

CHF Pentosin CHF11S

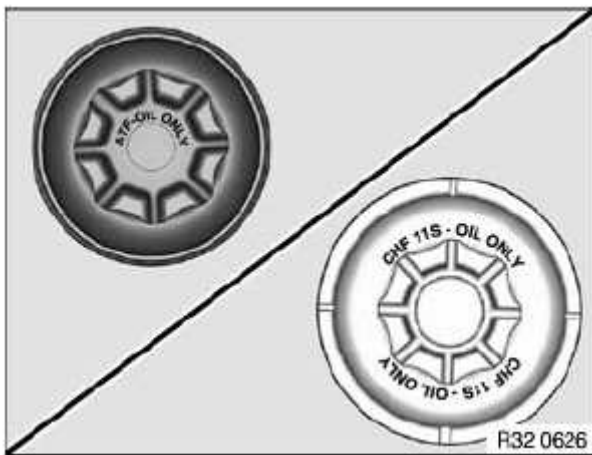


**Fig. 39: Reservoirs Wire Caps**

Courtesy of BMW OF NORTH AMERICA, INC.

1. Thoroughly clean fluid reservoir and its immediate surroundings
2. Check and correct fill level

**NOTE:** The fill level can come to rest above the "MAX" mark when the engine is at normal operating temperature. This is dictated by the design in that the marking on the dipstick is referred to a fluid temperature of 20°C. With the engine at normal operating temperature (approx. 50-60°C fluid temperature) adjust a fill height 10 mm above the "MAX" mark. Do not under any circumstances draw off the fluid to the "MAX" mark when the engine is at normal operating temperature.

3. Start engine
4. Turn steering wheel left and right twice in each case up to full lock; if necessary, top up hydraulic fluid (e.g. if hydraulic system is completely drained)
5. Move steering wheel to straight-ahead position and turn off engine
6. Check and correct fill level with engine stopped
7. Check hydraulic system for leaks

### **32 13 060 REMOVING AND INSTALLING/REPLACING POWER STEERING GEAR**

**IMPORTANT: Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.  
Seal off pipe connections with plugs.**

*Necessary preliminary tasks:*

- Draw off and dispose off hydraulic fluid from fluid reservoir
- If necessary, remove assembly underside protection, see **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION** .
- Remove reinforcement plate, see **31 10 010 REMOVING AND INSTALLING/REPLACING REINFORCEMENT PLATE** .
- If necessary, remove steering gear cover on both sides
- Remove double joint from power steering gear, see **32 31 219 Removing and installing/replacing double joint with flexible disk**.
- Remove tie rod end from swivel bearing, see **32 21 151 Replacing left or right tie rod**.
- Replacement only:
  - Remove tie rod end at both ends of tie rod, see **32 21 151 Replacing left or right tie rod**.
- Remove stabilizer link on both sides from stabilizer, see **31 35 005 REMOVING AND INSTALLING/REPLACING PUSH ROD (STABILIZER LINK) FOR LEFT/RIGHT STABILIZER** .

If necessary, remove heat shield from power steering gear. Release FCD couplings, see **32 13 ... Notes on removing/installing FCD clutches** , disconnect hydraulic lines and lay to one side.

Disconnect plug connection on EH converter

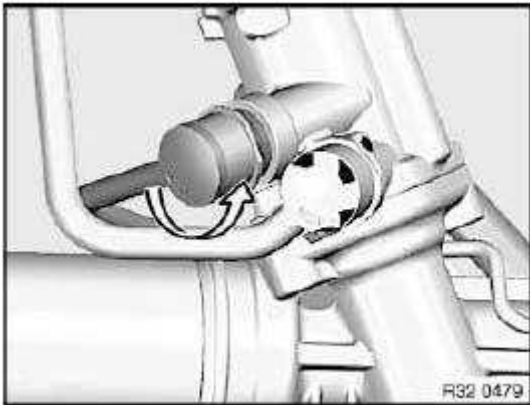


**Fig. 40: Disconnecting Plug Connection On EH Converter**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Turn left swivel bearing to left.

If necessary, detach pressure line from front axle carrier.

Turn power steering gear and remove through left wheel arch.

*Installation:*

Replace screws and self-locking nuts.

Tightening torque: 32 00 1AZ, see **32 00 STEERING** .

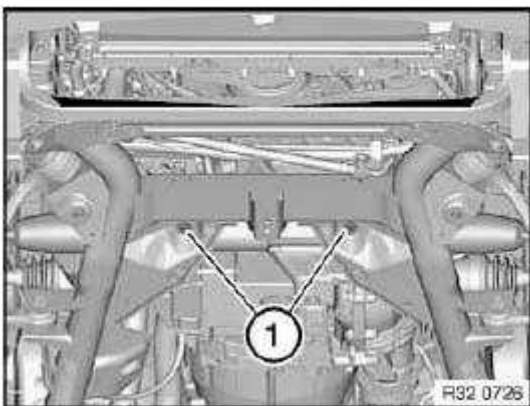


**Fig. 41: Screws**  
Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**

- Check pipe connections for leaks
- Perform **32 00 150 KDS chassis/wheel alignment check with load up to design position.**
- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment.**

### 32 13 650 REMOVING AND INSTALLING/REPLACING EH CONVERTER FOR SERVOTRONIC

**IMPORTANT: Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.**

*Necessary preliminary tasks:*

- If necessary, remove steering gear cover at side

Disconnect plug connection (1).

Unfasten screws (2).

Remove EH converter (3).

*Installation:*

Clean side return orifice with compressed air.

Align EH converter (3) to opening in power steering gear, press by hand into power steering gear up to stop, insert screws (2) and tighten down.

Tightening torque: 32 13 12AZ, see **32 13 POWER STEERING GEAR** .

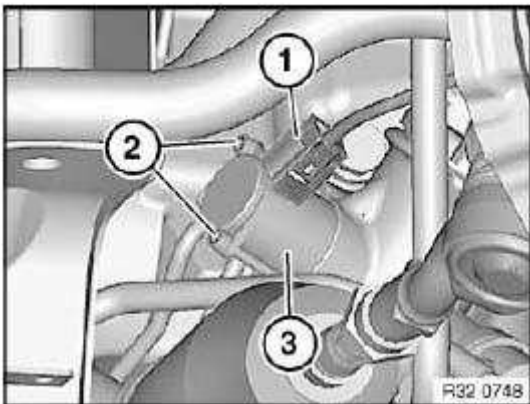


**Fig. 42: Plug Connection, Screws And EH Converter**  
Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**

## 21 STEERING ARMS, TIE RODS, STEERING DAMPER

### 32 21 151 REPLACING LEFT OR RIGHT TIE ROD

#### Special tools required:

- **31 2 300 EXTRACTOR**

#### Necessary preliminary tasks:

- Remove front wheel, see **36 10 300 REMOVING OR INSTALLING FRONT OR REAR WHEEL** .

#### After installation:

- Perform **32 00 150 KDS chassis/wheel alignment check with load up to design position**.
- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment**.

Release nut; if necessary, grip brace at Torx socket.

Force tie rod end off swivel bearing with special tool 31 2 300.

#### Installation:

Keep journal on tie rod end and bore hole in swivel bearing clean and free from grease.

Replace self-locking nut.

Tightening torque: 32 21 3AZ, see **32 21 STEERING ARMS** .

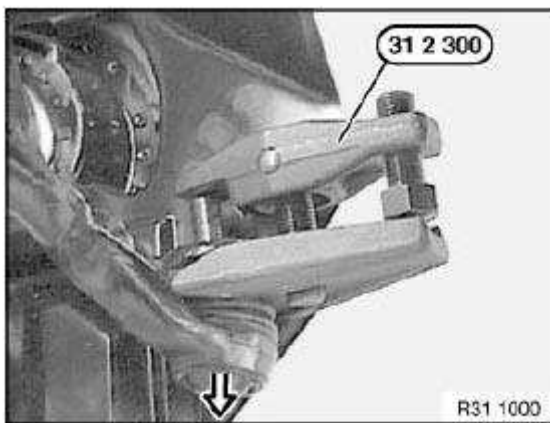


**Fig. 43: Special Tool (31 1 300)**

Courtesy of BMW OF NORTH AMERICA, INC.

Determine measurement (A) to simplify following adjustment of front axle.

Release clamping nut.

Screw off tie rod end; if necessary, grip tie rod with open-end wrench.

*Installation:*

Check gaiter , replace if necessary.

Mount clamping ring (1).

Screw in tie rod end to measurement (A).

Tightening torque: 32 21 5AZ, see **32 21 STEERING ARMS** .

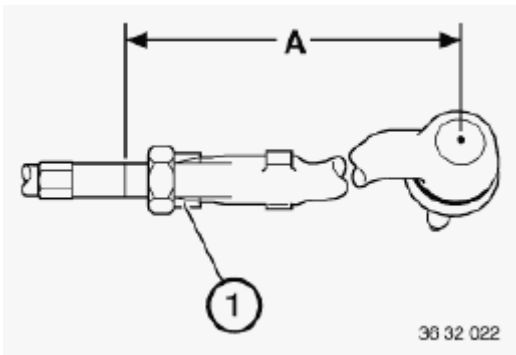


**Fig. 44: Measurement (A) Of Front Axle**  
Courtesy of BMW OF NORTH AMERICA, INC.

### **32 21 231 REPLACING LEFT OR RIGHT TIE ROD**

*Necessary preliminary tasks:*

- Remove tie rod end from swivel bearing, see **32 21 151 Replacing left or right tie rod.**
- Remove gaiter from power steering gear and slide back, see **32 11 100 Replacing gaiter for steering gear on left or right.**

**IMPORTANT:** To avoid damage to rack and to suspension mounting, move rack in as far as possible.

Screw tie rod off rack of power steering gear.

*Installation:*

Clean rack and check surface for damage (e.g. by corrosion).

Replace O-ring.

Grease rack and O-ring.

Tightening torque: 32 21 2AZ, see **32 21 STEERING ARMS** .

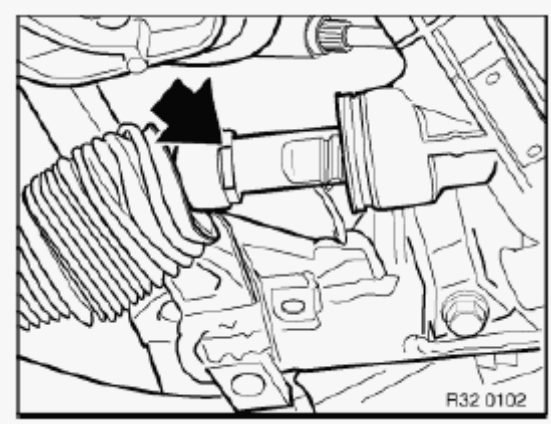


**Fig. 45: Locating Rack**

Courtesy of BMW OF NORTH AMERICA, INC.

**Assembling new component with gaiter:**

Release clamping nut (2).

Screw off tie rod end; if necessary, grip tie rod with open-end wrench.

Remove clamping ring (1) and screw off clamping nut (2).

Slide gaiter (4) and band clamp (3) onto tie rod.

Screw clamping nut (2) onto tie rod.

Slide clamping ring (1) onto tie rod.

Determine measurement (A) on old part to simplify following adjustment of front axle.

Screw tie rod end onto tie rod to measurement (A).

Tighten down clamping nut (2).

Tightening torque: 32 21 5AZ, see **32 21 STEERING ARMS** .

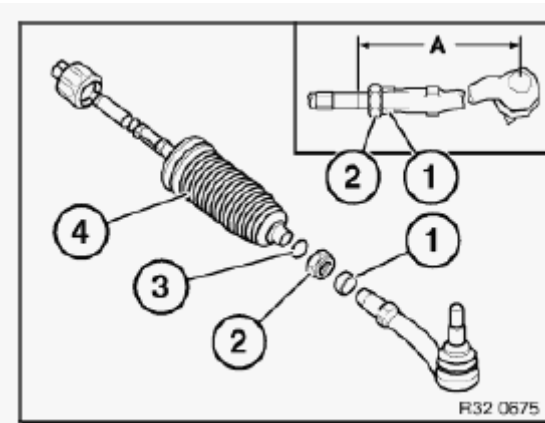


**Fig. 46: Clamping Ring, Clamping Nut, Clamp And Gaiter**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Perform **32 00 150 KDS chassis/wheel alignment check with load up to design position.**
- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment.**

## **31 STEERING COLUMN**

### **32 31 003 REPLACING UPPER SECTION OF STEERING COLUMN TRIM**

*Necessary preliminary tasks:*

Remove lower section of steering column trim, see **32 31 020 Removing and installing / replacing lower section of steering column trim.**

Move steering column in "bottom" and "extended" position.

Release expander rivet.

*Installation:*

If necessary, replace expansion rivet.

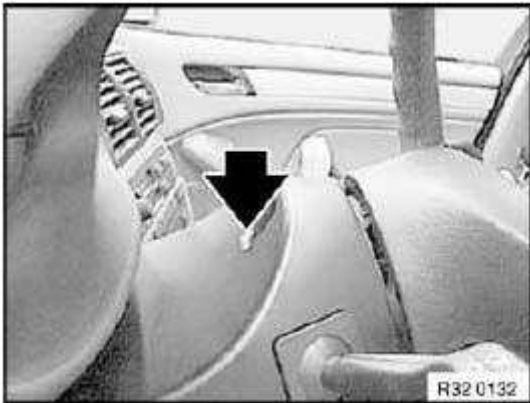


**Fig. 47: Locating Expander Rivet**

Courtesy of BMW OF NORTH AMERICA, INC.

Tilt steering column trim forwards.

Unclip steering column gap cover from steering column trim.

Remove steering column trim.

*Installation:*

Make sure steering column gap cover is in correct installation position.

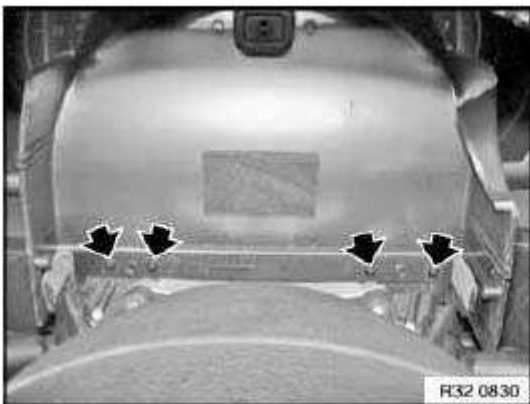


**Fig. 48: Locating Steering Column Trim**

Courtesy of BMW OF NORTH AMERICA, INC.

### **32 31 020 REMOVING AND INSTALLING / REPLACING LOWER SECTION OF STEERING COLUMN TRIM**

*Necessary preliminary tasks:*

- Unclip panel for pedals in area of steering column trim, see **51 45 185 REMOVING AND INSTALLING/REPLACING TRIM FOR PEDAL ASSEMBLY** .

Move steering column in "top" and "extended" position.

Remove expander rivets (1).

**NOTE:** Press pin approx. 5 mm into expander rivet (1).

**Installation:**

Expander rivet can be reused. Insert rivet and push in pin until flush.

Release adjusting lever (2) for steering column.

Reach into opening underneath and pull off lower section of steering column trim (3) towards bottom.

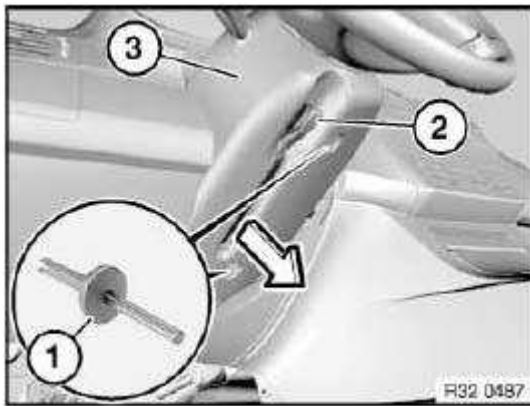


**Fig. 49: Expander Rivets And Adjusting Lever**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

*Installation:*

Catch (1), guide (2), pin (3) and lock (4) must not be damaged.

Insert pin (3) at both ends into bore until lower section of steering column trim can be heard to engage with upper section via lock (4).

Press lower section of steering column trim against steering column until catch (1) locks.

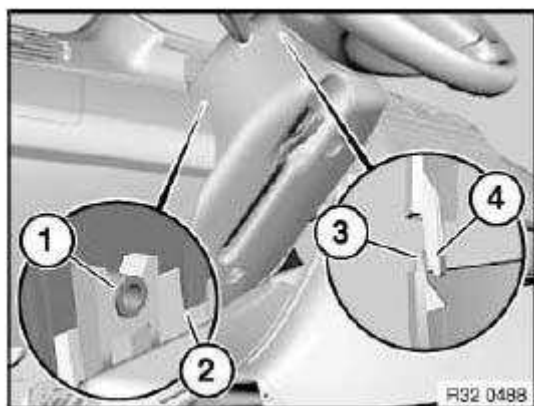


**Fig. 50: Catch, Guide, Pin And Lock**

Courtesy of BMW OF NORTH AMERICA, INC.

### **32 31 070 REMOVING AND INSTALLING / REPLACING LOWER SECTION OF STEERING SPINDLE**

**IMPORTANT:** If the lower section of the steering spindle is separated from the power steering gear/steering column, this can result in damage to the steering column switch cluster when the steering wheel is turned!

Release clamping screw.

Move steering wheel to straight-ahead position and remove ignition key.

Detach lower steering spindle from steering column and remove with double joint towards bottom.

*Installation:*

Recut thread.

Replace clamping screw.

Clamping screw must rest in groove of steering column.

Tightening torque: 32 31 1AZ, see **32 31 STEERING COLUMN** .

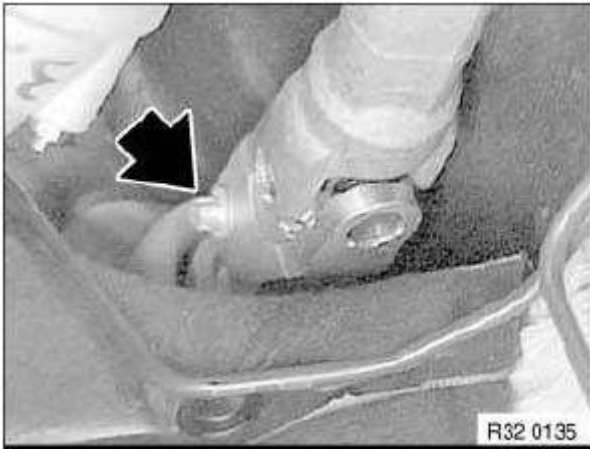


**Fig. 51: Locating Clamping Screw**

Courtesy of BMW OF NORTH AMERICA, INC.

**Replacement:**

Release clamping screw.

Pull lower section of steering spindle (1) out of double joint with flexible disk.

*Installation:*

Recut thread.

Replace clamping screw.

Clamping screw must rest in groove of lower steering spindle (1).

Tightening torque: 32 31 13AZ, see **32 31 STEERING COLUMN** .

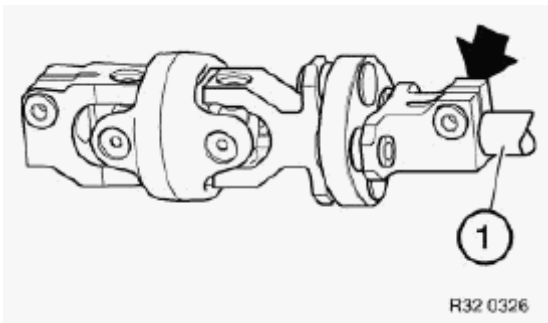


**Fig. 52: Lower Section Of Steering Spindle**

Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Carry out steering angle sensor adjustment, see 61 31 996 Carry out steering angle sensor adjustment.
- Turn steering wheel in both directions to full lock

**NOTE:** The airbag warning lamp must not light up in the process.

- Check directional stability of vehicle

### 32 31 082 REMOVING AND INSTALLING/REPLACING STEERING ANGLE SENSOR

*Necessary preliminary tasks:*

- Slide upper steering spindle into steering column (see 32 31 102 Replacing steering spindle sleeve)

After installation:

- Replacement only: Carry out programming/coding using appropriate BMW service tool.
- Carry out steering angle sensor adjustment, see 61 31 996 Carry out steering angle sensor adjustment.

Release screw (1).

**NOTE:** For the following work step, the plug connection does not have to be disconnected nor does the brake pedal return spring have to be disengaged.

Remove holder (3) with brake light switch from pedal assembly bearing block (2).

*Installation:*

Insert holder (3) with guide (4) into opening in pedal assembly bearing block (2).

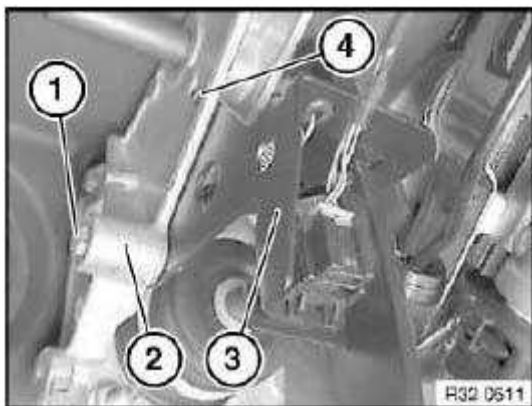


**Fig. 53: Screw, Bearing, Holder And Guide**  
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nut (1).

Tightening torque: 32 31 16AZ, see **32 31 STEERING COLUMN** .

Press brake pedal forwards.

Press out screw (2) with a suitable tool.

Remove plug connection for steering angle sensor (4) from holder, unlock and disconnect.

Expose cable up to steering angle sensor (4).

*Installation:*

Align guide bushes (3) to bores in mounting plate (5).

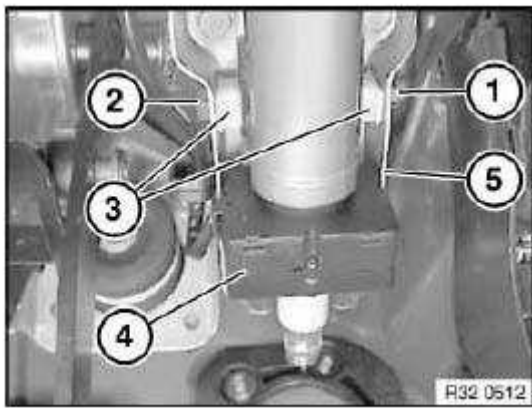


**Fig. 54: Nut, Screw, Steering Angle Sensor, Guide Bushes And Mounting Plate**  
Courtesy of BMW OF NORTH AMERICA, INC.

Pull steering column (3) downwards a little.

Insert a spacer (2) with a height of 4 to 5 cm between mounting plate (1) and steering column (3).

Detach sleeve (5) from upper steering spindle.

Press both hooks inwards and detach steering angle sensor (4) towards bottom.

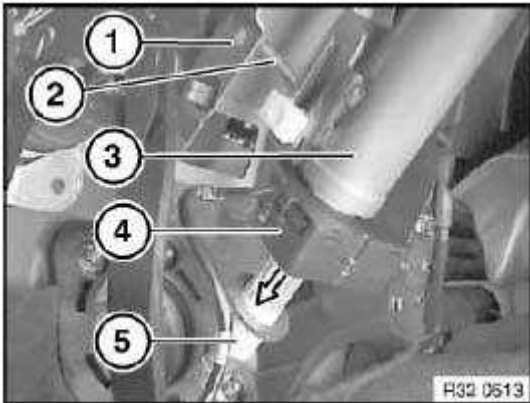


**Fig. 55: Mounting Plate, Spacer, Steering Column, Steering Angle Sensor And Sleeve**  
Courtesy of BMW OF NORTH AMERICA, INC.

### 32 31 090 REMOVING AND INSTALLING/REPLACING STEERING COLUMN

*Necessary preliminary tasks:*

- Slide upper section of steering spindle into steering column (see **REPLACING STEERING SPINDLE SLEEVE**)
- Remove fixture for steering column stalks

Disconnect plug connections (1, 2).

If necessary, remove interlock cable from steering column, see **32 32 170 Removing and installing/replacing interlock cable**.

Expose wiring harness and remove from cable duct (3).

Turn holder (5) approx. 45° downwards and remove.

Remove plug connection (4) from holder (5) and disconnect.

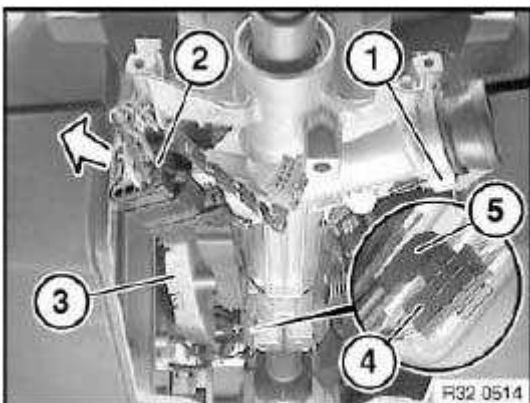
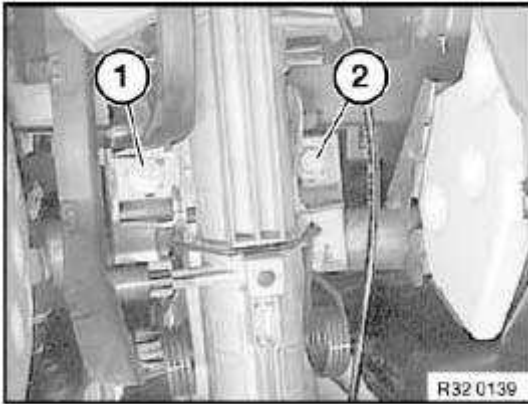


**Fig. 56: Plug Connections And Holder**

Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1, 2).

Tightening torque: 32 31 6AZ, see 32 31 STEERING COLUMN .

**Fig. 57: Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

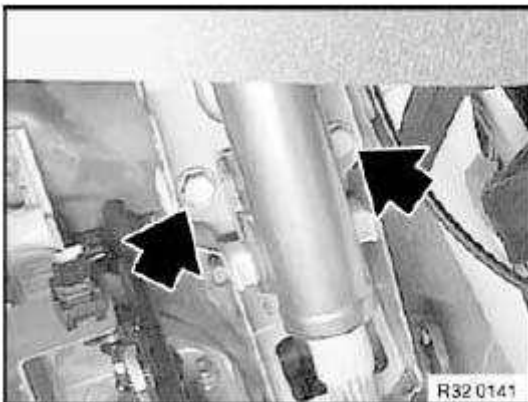
Unscrew nuts.

Remove steering column towards rear through instrument panel.

*Installation:*

Replace self-locking nuts.

Tightening torque: 32 31 15AZ, see 32 31 STEERING COLUMN .

**Fig. 58: Locating Nuts**

Courtesy of BMW OF NORTH AMERICA, INC.

**Replacement:**

- Modify cable duct
- Modify lock cylinder, see **32 32 050 Removing and installing/replacing steering lock cylinder.**
- Modify steering angle sensor, see **32 31 082 Removing and installing/replacing steering angle sensor.**

**After installation:**

- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment.**
- Perform function check:
  - I. Check for ease of movement in overall adjustment range of steering column to adjoining components/wires
  - II. Turn steering wheel in both directions to full lock. The airbag warning lamp must not light up in the process.
    - Check directional stability of vehicle

**32 31 102 REPLACING STEERING SPINDLE SLEEVE***Necessary preliminary tasks:*

- Remove lower section of steering spindle, see **32 31 070 Removing and installing / replacing lower section of steering spindle.**
- Remove trim for pedal assembly, see **51 45 185 REMOVING AND INSTALLING/REPLACING TRIM FOR PEDAL ASSEMBLY .**

Press crash disk (2) off crash sleeve (1).

Open crash sleeve (1) slightly and remove from upper steering spindle (3).

Slide upper steering spindle (3) into steering column.

Remove crash disk (2).

*Installation:*

Replace crash sleeve (1).

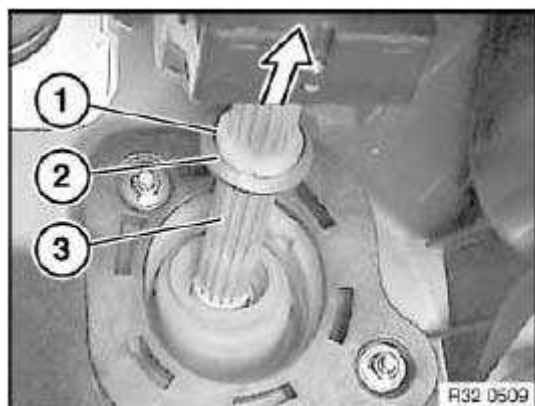


**Fig. 59: Crash Sleeve, Crash Disk And Upper Steering Spindle**  
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

Remove sleeve bracket (2).

*Installation:*

Replace self-locking nuts.

Tightening torque: 32 31 10AZ, see **32 31 STEERING COLUMN** .

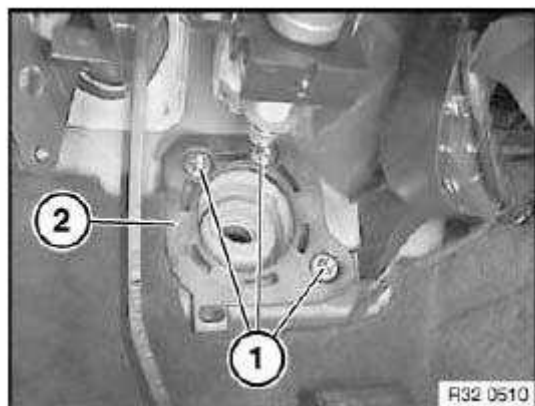


**Fig. 60: Nuts And Sleeve Bracket**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove sleeve from bulkhead.

*Installation:*

Make sure sleeve is correctly seated in relation to opening in bulkhead.

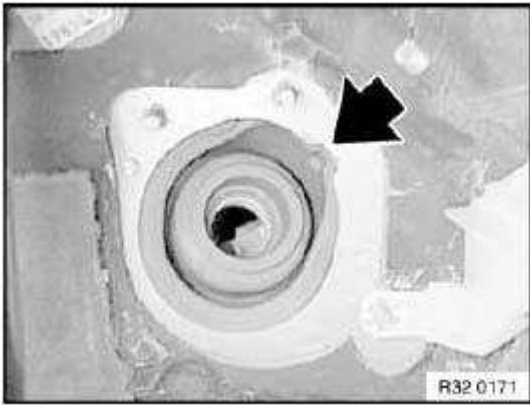


**Fig. 61: Locating Sleeve**

Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment.**

### **32 31 219 REMOVING AND INSTALLING/REPLACING DOUBLE JOINT WITH FLEXIBLE DISK**

*Necessary preliminary tasks:*

- If necessary, remove steering gear cover at side

Release clamping screw, turn power steering if necessary.

Move steering wheel to straight-ahead position and remove ignition key.

Detach double joint with flexible disk from power steering gear.

*Installation:*

If necessary, move power steering gear to straight-ahead position - markings on cap and housing must match up.

Replace clamping screw.

Tightening torque: 32 31 1AZ, see **32 31 STEERING COLUMN** .

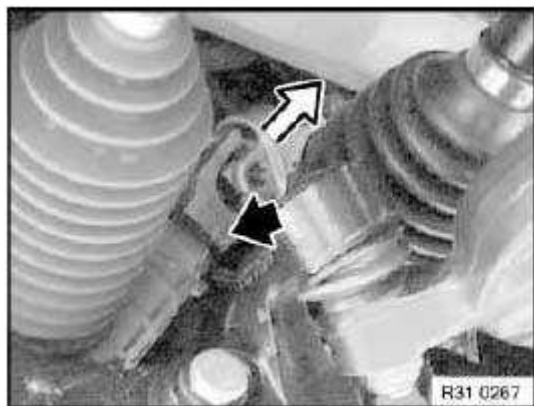


**Fig. 62: Detaching Double Joint With Flexible Disk From Power Steering Gear**  
 Courtesy of BMW OF NORTH AMERICA, INC.

Release clamping screw.

Detach double joint with flexible disk from lower steering spindle (1).

*Installation:*

Clamping screw must rest in groove of lower steering spindle (1).

Replace clamping screw.

Tightening torque: 32 31 13AZ, see **32 31 STEERING COLUMN** .

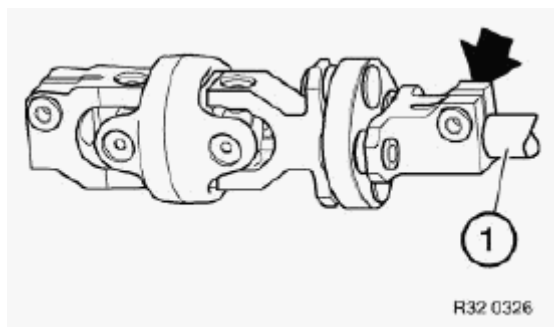


**Fig. 63: Lower Section Of Steering Spindle**  
 Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Carry out steering angle sensor adjustment, see **61 31 996 Carry out steering angle sensor adjustment**.

**32 31 241 REPLACING ADJUSTING LEVER FOR STEERING COLUMN**

*Necessary preliminary tasks:*

- Remove lower section of trim, see **32 31 020 Removing and installing / replacing lower section of steering column trim.**

Disconnect plug connections (1).

Remove wiring harness (2) from cable guide (3).

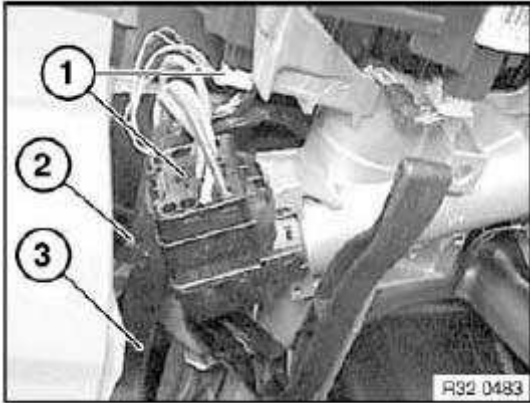


**Fig. 64: Plug Connections, Wiring Harness And Cable Guide**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1), remove cable guide (2).

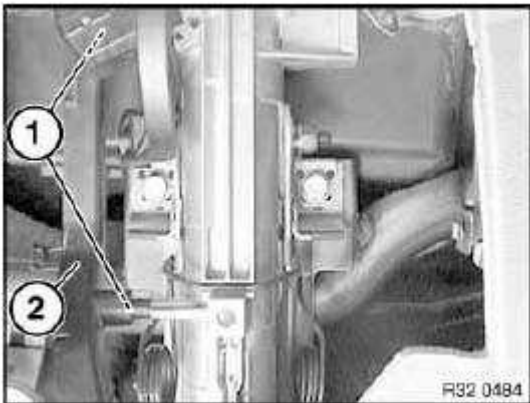


**Fig. 65: Screws And Cable Guide**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** Clamping bearing must be held down until secured.

Securing clamping bearing:

- Pull retaining tab (1) in direction of steering column.
- Turn clamping bearing head (3) so that pin (2) on clamping bearing is held by retaining tab (1).

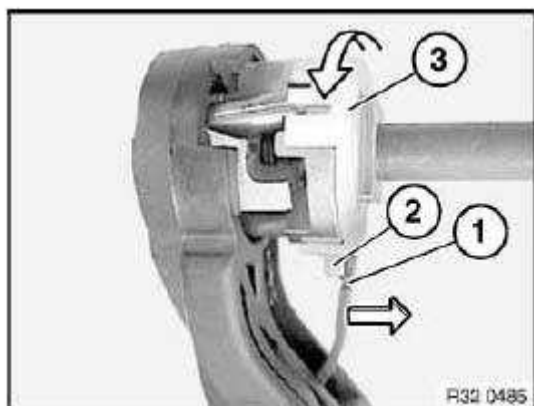


**Fig. 66: Pulling Retaining Tab**

Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT:** The secure fitting must not be released when the adjusting

Unscrew nut (1).

Remove needle bearing (2) and washer.

Pull out adjusting lever (3).

*Installation:*

- Replace nut (1).
- Move adjusting lever (3) into locked position.
- Fit washer and needle bearing (2) and screw on nut (1) until it contacts needle bearing (2).

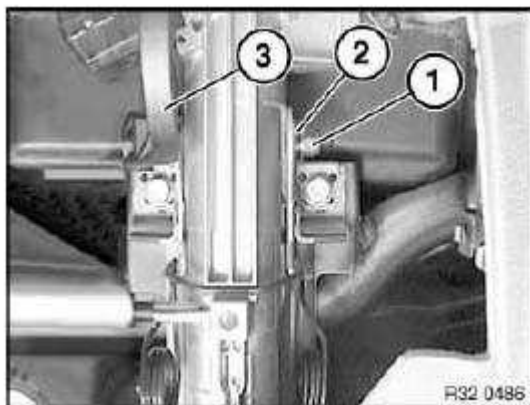


**Fig. 67: Nut, Needle Bearing And Adjusting Lever**

Courtesy of BMW OF NORTH AMERICA, INC.

- Open and close adjusting lever (3).
- Tighten nut (1) to torque value 1.

Tightening torque: 32 31 3AZ, see **32 31 STEERING COLUMN** .

- Open and close adjusting lever (3) again.
- Tighten nut (1) to torque value 2.

Tightening torque: 32 31 3AZ, see **32 31 STEERING COLUMN** .

- Open and close adjusting lever (3) again.
- Tighten nut (1) again to torque value 2.

Tightening torque: 32 31 3AZ, see **32 31 STEERING COLUMN** .

**IMPORTANT: Observe tightening torques without fail!**

The clamping force is adjusted by means of the tightening torque.

## 32 STEERING LOCK

### 32 32 050 REMOVING AND INSTALLING/REPLACING STEERING LOCK CYLINDER

**Special tools required:**

- **32 3 110 RELEASING TOOL**

*Necessary preliminary tasks:*

- Remove ring antenna

If necessary, unlock interlock through bore (1).

With ignition lock key, turn lock cylinder to required position "R" = radio, windscreen wipers, etc.

Press special tool 32 3 110 into locking cylinder hole and remove locking cylinder.

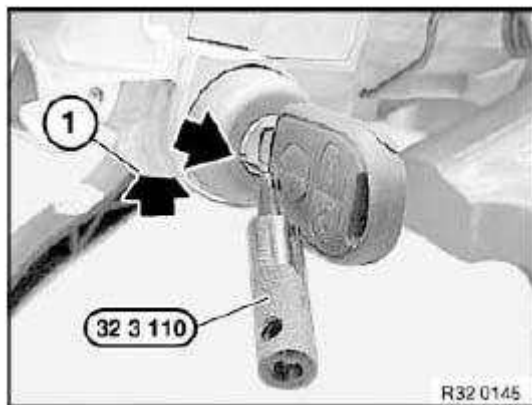
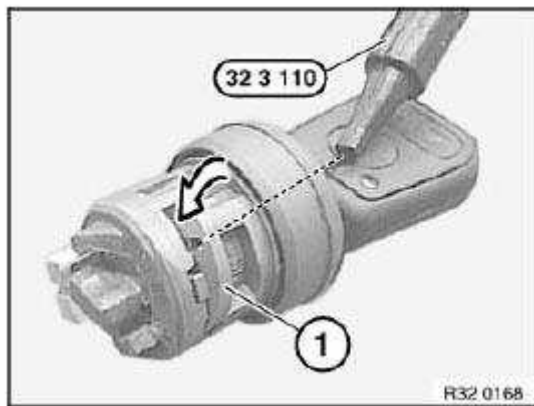


**Fig. 68: Bore And Special Tool (32 3 110)**

Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** Use special tool 32 3 110 to disengage lock (1). If necessary, special tool 32 3 110 must be turned in bore.

**Fig. 69: Disengaging Lock**

Courtesy of BMW OF NORTH AMERICA, INC.

**32 32 170 REMOVING AND INSTALLING/REPLACING INTERLOCK CABLE**

*Necessary preliminary tasks:*

- Remove function carrier on trim for instrument panel, see **51 45 106 REMOVING AND INSTALLING/REPLACING FUNCTION CARRIER ON INSTRUMENT PANEL TRIM**
- Remove lower section of steering column trim, see **32 31 020 Removing and installing / replacing lower section of steering column trim.**

After installation:

- Check function of interlock cable, see **25 16 175 ADJUSTING INTERLOCK CABLE** .
- Adjust interlock cable, see **25 16 175 ADJUSTING INTERLOCK CABLE** .

Release screw (1).

Take off holder (2).

Press interlock cable (3) in area of switch block to driver's side and remove towards front.

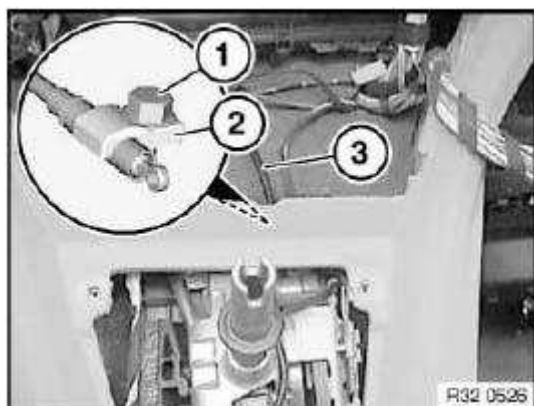


**Fig. 70: Screw, Holder And Interlock Cable**  
Courtesy of BMW OF NORTH AMERICA, INC.

Turn guide sleeve (1) through approx. 45°.

Pull interlock cable (2) out of steering column.

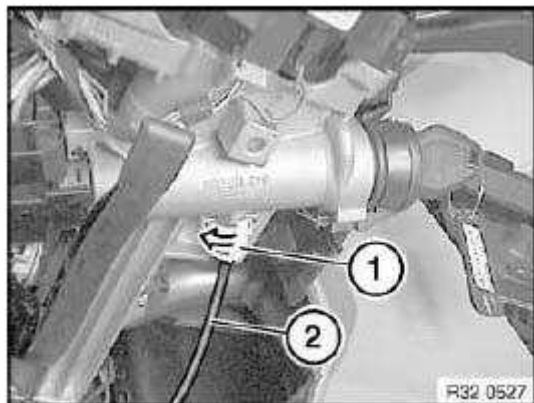


**Fig. 71: Guide Sleeve And Interlock Cable**  
Courtesy of BMW OF NORTH AMERICA, INC.

Tie wire or cord to end of interlock cable (1) in area of switch block.

Pull out interlock cable (1) in direction of steering column.

**IMPORTANT: Do not kink interlock cable (1).**

If necessary, remove wire or cord from interlock cable (1).

*Installation:*

Check installation position of interlock cable (1) in area of footwell heating duct (2), correct if necessary.

L = steering column, S = switch block

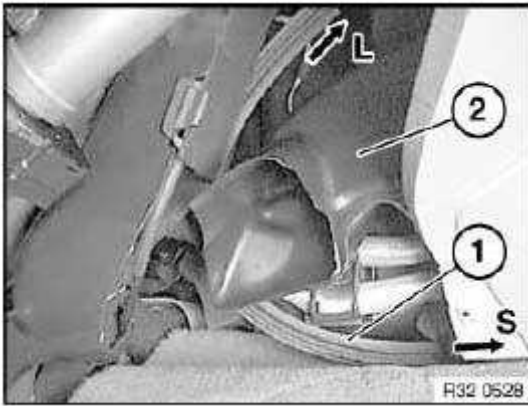


**Fig. 72: Interlock Cable And Heating Duct**  
Courtesy of BMW OF NORTH AMERICA, INC.

Pull through interlock cable (1) in direction of switch block.

Replacement only:

Tie wire of cord to end of new interlock cable.

### 33 STEERING WHEEL

#### 32 33 ... REPLACING LEFT OR RIGHT COVER FOR STEERING WHEEL (FROM 09/2006)

*Necessary preliminary tasks:*

- Remove airbag unit, see 32 34 020 Removing and installing/replacing airbag unit (from 09/2006).

**NOTE:** For simplification purposes, the illustration shows how to release the screws on the removed steering wheel.

Release screws (1) with Torx screwdriver (T10).



**Fig. 73: Screws**

Courtesy of BMW OF NORTH AMERICA, INC.

Unclip cover (1).



**Fig. 74: Cover**

Courtesy of BMW OF NORTH AMERICA, INC.

### 32 33 000 REMOVING AND INSTALLING/REPLACING STEERING WHEEL (FROM 09/2006)

*Necessary preliminary tasks:*

- Remove airbag unit, see **32 34 020 Removing and installing/replacing airbag unit (from 09/2006).**

Move wheels/steering wheel into straight-ahead position.

Release screw (1).

Tightening torque: 32 33 1AZ, see **32 33 STEERING WHEEL** .

Remove steering wheel (2).



**Fig. 75: Screw And Steering Wheel**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Align steering wheel by way of marking (1) to steering column marking (2) and attach.

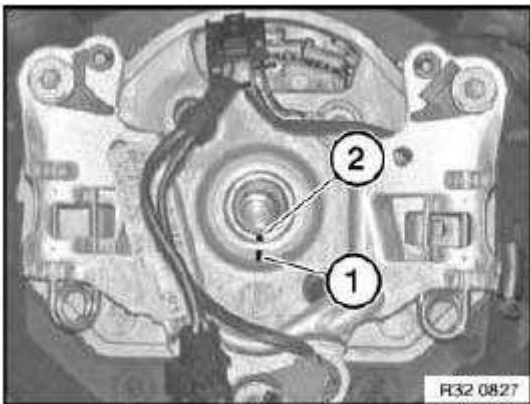


**Fig. 76: Aligning Steering Wheel By Way Of Marking To Steering Column Marking**

Courtesy of BMW OF NORTH AMERICA, INC.

**Replacement:**

Modify multifunction steering wheel covers/switches, see **32 33 ... Replacing left or right cover for steering wheel (from 09/2006)**.

### **32 33 010 REMOVING AND INSTALLING SPORTS STEERING WHEEL**

*Necessary preliminary tasks:*

- Remove airbag unit, see **32 34 020 Removing and installing/replacing airbag unit (from 09/2006)**.
- Move steering wheel/wheels to straight-ahead position

Unscrew bolt (1).

Tightening torque: 32 33 1AZ, see **32 33 STEERING WHEEL** .

Unlock plug connections (2) and disconnect.

Remove sports steering wheel.

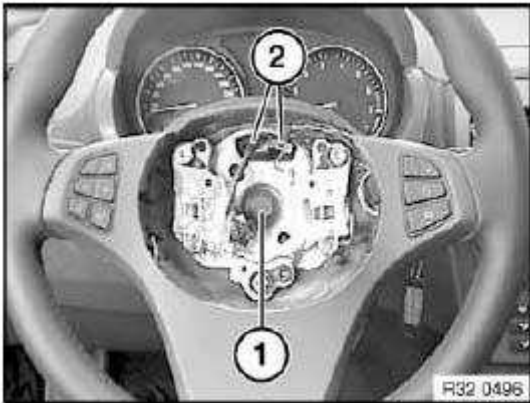


**Fig. 77: Bolt And Plug Connections**

Courtesy of BMW OF NORTH AMERICA, INC.

*Installation:*

Move wheels to straight-ahead position.

Attach sports steering wheel. Markings (1) on sports steering wheel and steering spindle must match up. The retaining pins (2) must also appear in the openings in the sports steering wheel.

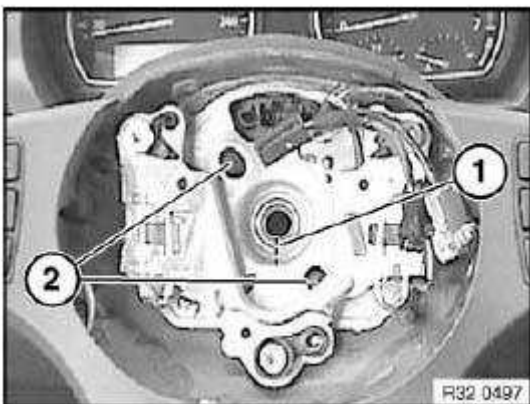


**Fig. 78: Marking On Sports Steering Wheel And Steering Spindle**

Courtesy of BMW OF NORTH AMERICA, INC.

**32 33 015 REPLACING SPORTS STEERING WHEEL**

*Necessary preliminary tasks:*

- Remove sports steering wheel, see 32 33 010 Removing and installing sports steering wheel.

Remove cover (1).

If necessary, remove switch (2) for multifunction unit.

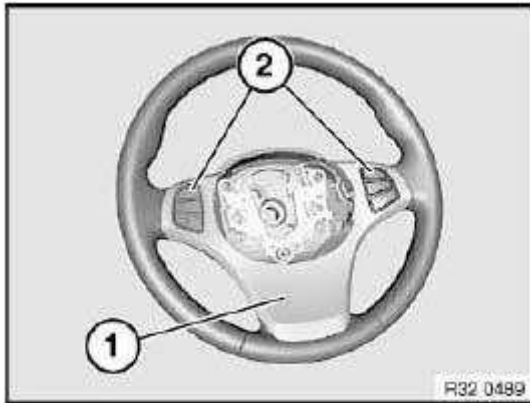


**Fig. 79: Cover**

Courtesy of BMW OF NORTH AMERICA, INC.

## 34 STEERING WHEEL FOR AIRBAG

### 32 34 020 REMOVING AND INSTALLING/REPLACING AIRBAG UNIT (FROM 09/2006)

**WARNING:** Observe the following instructions to avoid any risk of injury by the airbag unit.

- Comply with 72 00 ... SAFETY REGULATIONS FOR HANDLING COMPONENTS WITH GAS GENERATORS .
- Do not exert any force on the airbag unit.
- Use only specified tools for releasing the airbag unit.

**NOTE:** Incorrect handling may result in triggering of the airbag unit and thereby cause serious injury.

**IMPORTANT:** Steering wheel must be replaced if airbag unit has been triggered! See 32 33 000 Removing and installing/replacing steering wheel (from 09/2006).

**Follow 72 12 ... PROCEDURE AFTER AIRBAG TRIGGERING AS RESULT OF AN ACCIDENT .**

*Necessary preliminary tasks:*

- Disconnect battery negative lead

Insert Torx screwdriver T30 (1) horizontally into opening on reverse side of steering wheel until a spring resistance is felt (approx. 4 cm).

Press spring leg (2) with Torx screwdriver (1) up to stop and pull airbag unit away from steering wheel.

Repeat procedure on other side.

*Installation:*

Make sure electrical leads are correctly positioned.

Snap airbag unit with uniform pressing force plane-parallel in direction of steering column shaft into steering wheel.

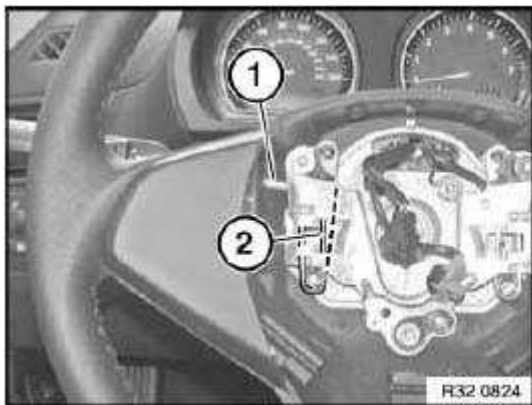


**Fig. 80: Torx Screwdriver T30 And Spring Leg**  
Courtesy of BMW OF NORTH AMERICA, INC.

**WARNING: Danger of injury!**

Airbag unit may only be set down with the airbag itself facing upwards.

Tilt airbag unit (1) towards rear.

Disconnect plug connections (2) and remove airbag unit (1), see **72 12 ... UNLOCKING/LOCKING AIRBAG PLUG CONNECTIONS** .

*Installation:*

Connect plugs to connections of same colour on airbag unit.

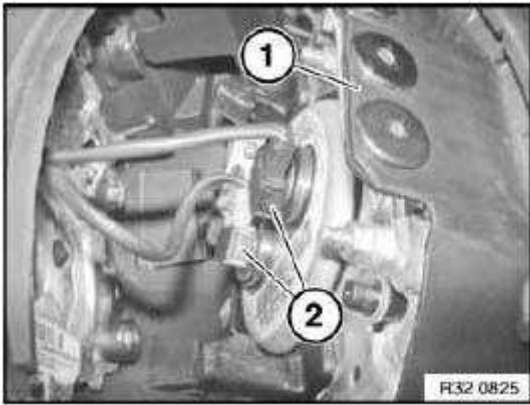


**Fig. 81: Airbag Unit And Plug Connections**

Courtesy of BMW OF NORTH AMERICA, INC.

### **32 34 030 REMOVING AND INSTALLING / REPLACING AIRBAG UNIT (SPORT STEERING WHEEL)**

**WARNING:** Observe the following instructions to avoid any risk of injury by the airbag unit.

- Comply with 72 00 ... SAFETY REGULATIONS FOR HANDLING COMPONENTS WITH GAS GENERATORS .
- Do not exert any force on the airbag unit.
- Use only specified tools for releasing the airbag unit.

**NOTE:** Incorrect handling may result in triggering of the airbag unit and thereby cause serious injury.

**IMPORTANT:** Steering wheel must be replaced if airbag unit has been triggered! See 32 33 000 Removing and installing/replacing steering wheel (from 09/2006).

**Follow 72 12 ... PROCEDURE AFTER AIRBAG TRIGGERING AS RESULT OF AN ACCIDENT .**

*Necessary preliminary tasks:*

- Disconnect battery negative lead

Insert Torx screwdriver (T30) horizontally into opening on reverse side of steering wheel up to stop (approx. 4.5 cm).



**Fig. 82: Inserting Torx Screwdriver (T30) Horizontally Into Opening On Reverse Side Of Steering Wheel**  
Courtesy of BMW OF NORTH AMERICA, INC.

Increase pressure with Torx screwdriver T30 (1) on spring leg (2) until airbag unit is unlocked.

Repeat procedure on other side.

*Installation:*

Make sure electrical leads are correctly positioned.

Snap airbag unit with uniform pressing force plane-parallel in direction of steering column shaft into steering wheel.

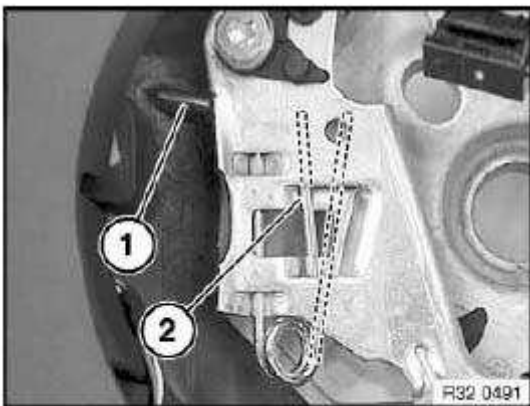


**Fig. 83: Torx Screwdriver T30 And Spring Leg**  
Courtesy of BMW OF NORTH AMERICA, INC.

**WARNING: Danger of injury!**

**Airbag unit may only be set down with the airbag itself facing upwards.**

Tilt airbag unit (1) slightly to one side.

Slide screwdriver (2) from front into both plug connections (3) until cover lifts off.

Disconnect plug connections (3).

Remove airbag unit (1).

*Installation:*

Connect plugs to connections of same colour on airbag unit.

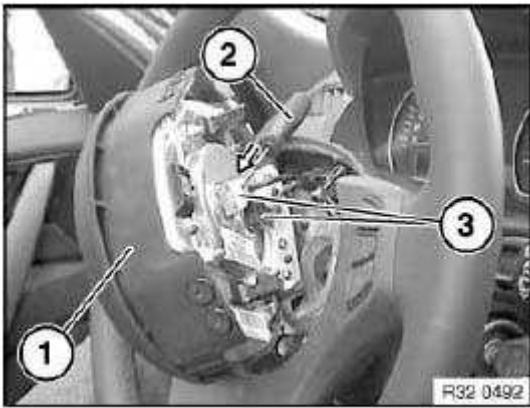


**Fig. 84: Airbag Unit, Screwdriver And Plug Connections**  
Courtesy of BMW OF NORTH AMERICA, INC.

## **41 PUMP AND OIL SUPPLY**

### **32 41 ... INSTRUCTIONS FOR REMOVING AND INSTALLING EAR CLIPS**

**Special tools required:**

- **32 1 260 PLIERS**

**NOTE:** The work steps are show on assorted components. Ear clip must always be replaced.

To remove an ear clip, place special tool 32 1 260 at right angles to ear and cut ear open.

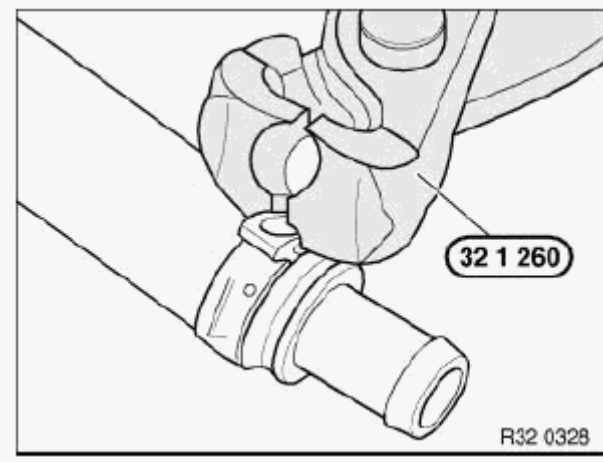


**Fig. 85: Special Tool (32 1 260)**

Courtesy of BMW OF NORTH AMERICA, INC.

The ear clip can be fitted not only axially but also radially after the hook fastener has been opened.

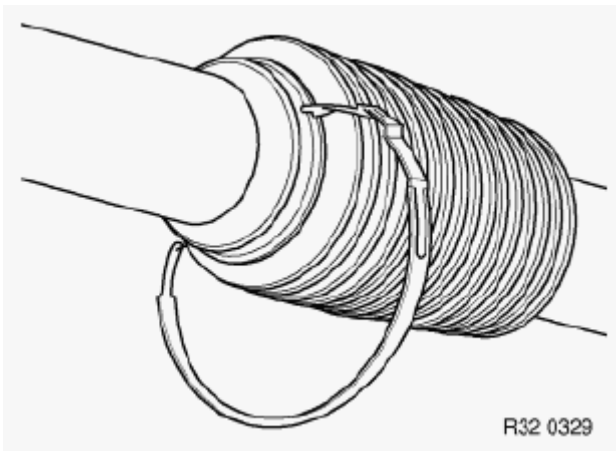


**Fig. 86: Ear Clip**

Courtesy of BMW OF NORTH AMERICA, INC.

Attach hook fastener and press ear together with special tool 32 1 260.

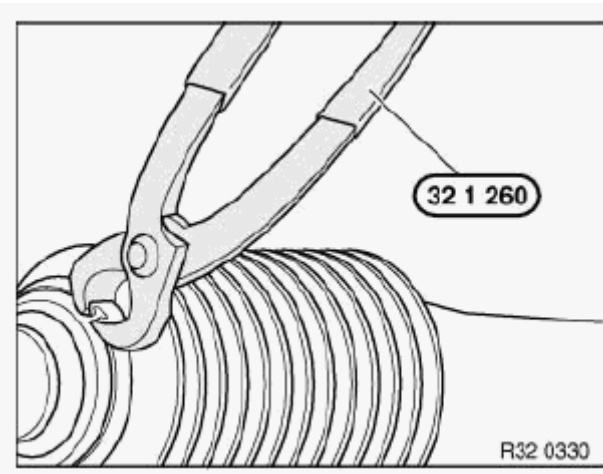


**Fig. 87: Special Tool (32 1 260)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Side cutter of special tool 32 1 260 can be used in areas which are difficult to access.

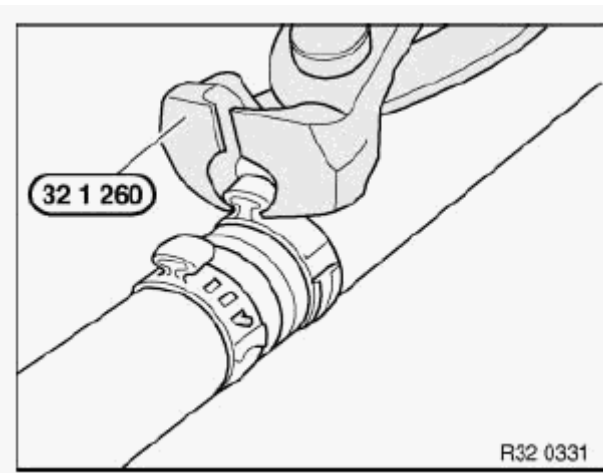


**Fig. 88: Special Tool (32 1 260)**  
Courtesy of BMW OF NORTH AMERICA, INC.

**IMPORTANT: Gap (A) max. 1 mm!**

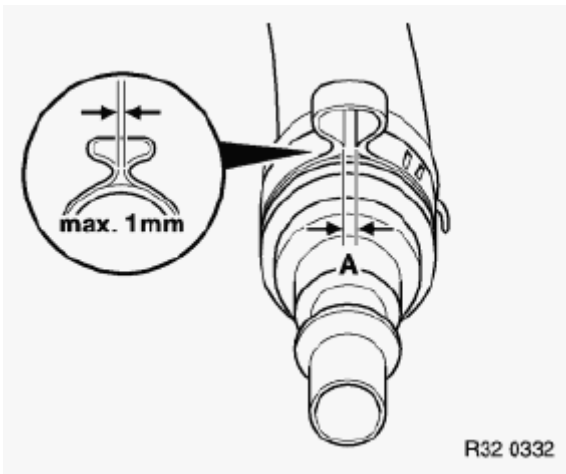


**Fig. 89: Gap (A)**

Courtesy of BMW OF NORTH AMERICA, INC.

#### 32 41 ... INSTRUCTIONS FOR USING SPECIAL TOOL 32 4 000

##### Special tools required:

- 32 4 000 FIXTURE
- 32 4 004 32 4 000 FIXTURE
- 32 4 005 32 4 000 FIXTURE
- 32 4 006 32 4 000 FIXTURE
- 32 4 011 32 4 000 FIXTURE
- 32 4 012 32 4 000 FIXTURE

Depending on the pressure hose connection on the pump, the special tool 32 4 000 must be assembled.

1 = Connection, pump

2 = Connection, steering gear

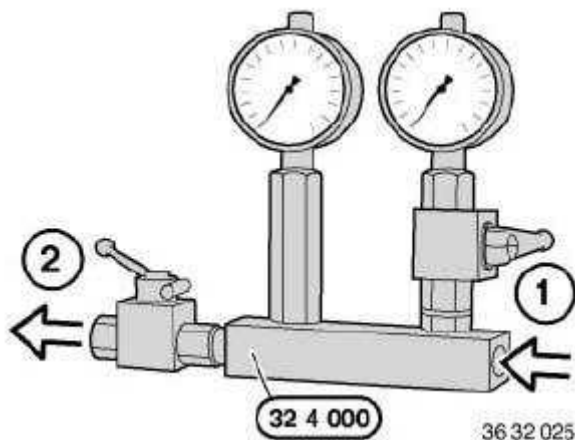


**Fig. 90: Special Tool (32 4 000) And Connections**  
Courtesy of BMW OF NORTH AMERICA, INC.

Pressure hose connection to pump with M14 x 1.5 banjo bolt:

Screw special tool 32 4 004 with M14 x 1.5 banjo bolt (1) and 2 sealing rings to special tool 32 4 000.

Screw special tool 32 4 011 onto pump and connect special tool 32 4 004.

Screw special tools 32 4 006 / 32 4 012 onto special tool 32 4 000 and connect pressure hose with M14 x 1.5 banjo bolts and 2 sealing rings.

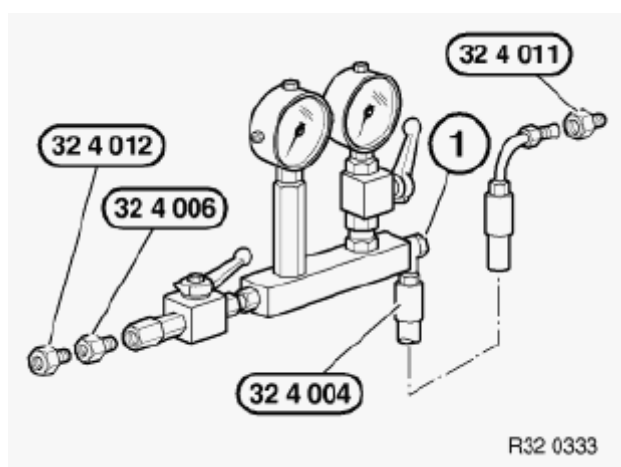


**Fig. 91: Special Tools (32 1 030)**  
Courtesy of BMW OF NORTH AMERICA, INC.

Pressure hose connection to pump with M16 x 1.5 banjo bolt:

Screw special tool 32 4 004 with M14 x 1.5 banjo bolt (1) and 2 sealing rings to special tool 32 4 000.

Screw special tool 32 4 005 onto pump and connect special tool 32 4 004.

Screw special tool 32 4 006 onto special tool 32 4 000 and connect pressure hose with M16 x 1.5 banjo bolt and 2 sealing rings.

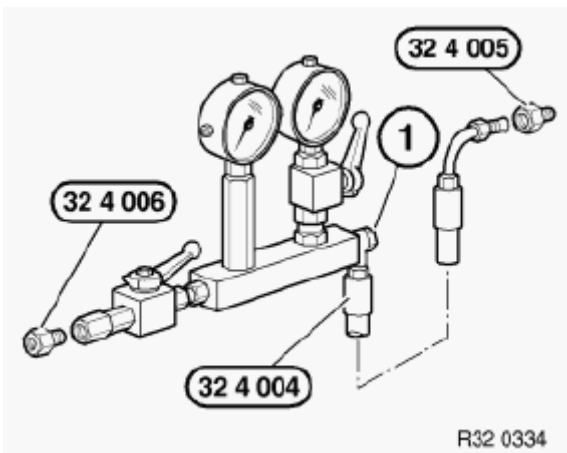


**Fig. 92: Special Tools (32 4 006), (32 4 004) And (32 4 005)**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

Pressure hose connection to pump with M16 x 1.5 union screw: Screw special tool 32 4 004 with M14 x 1.5 banjo bolt (1) and 2 sealing rings to special tool 32 4 000.

Connect special tool 32 4 004 to pump.

Screw special tools 32 4 006 / 32 4 005 onto special tool 32 4 000 and connect pressure hose.

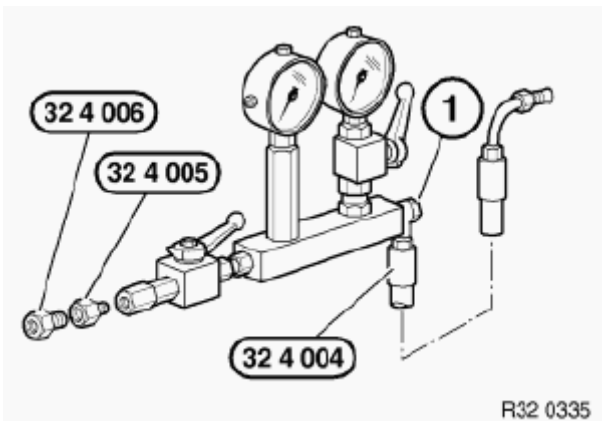


**Fig. 93: Special Tools (32 4 006), (32 4 004) And (32 4 005)**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

### 32 41 ... NOTES ON HYDRAULIC LINE WITH QUICK-CONNECT COUPLING

1. Quick-connect coupling with ID marking

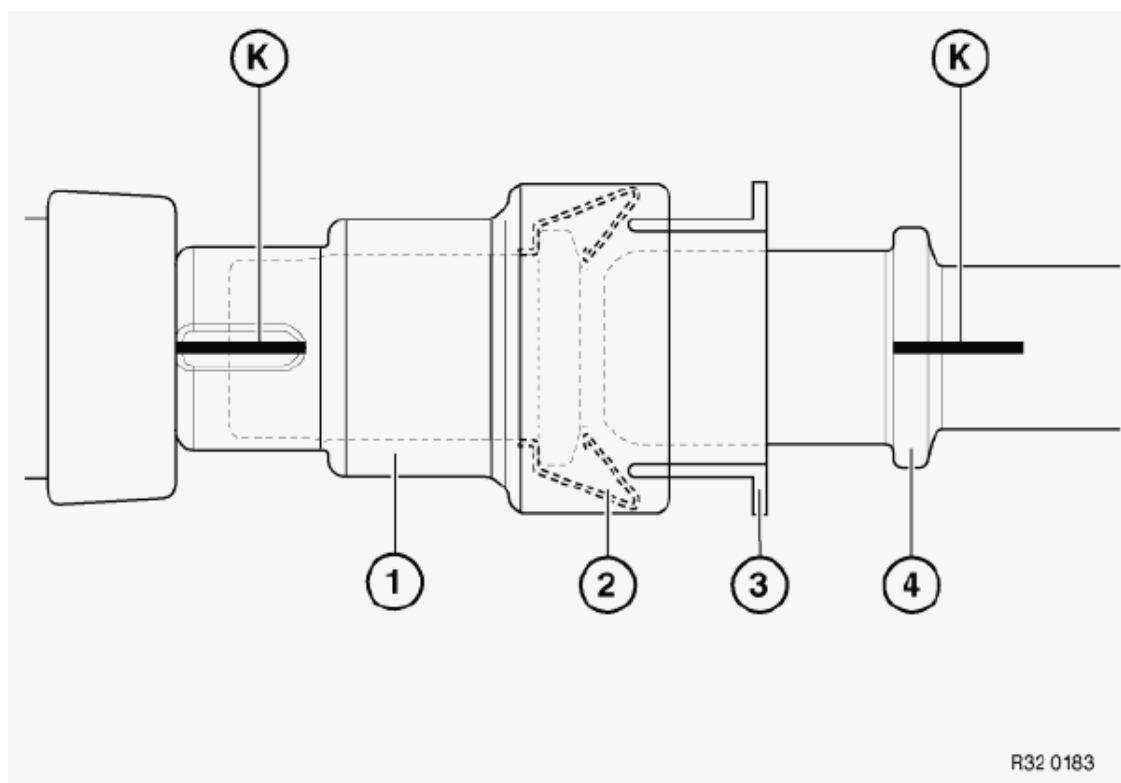


**Fig. 94: Quick-Connect Coupling Component With ID Marking**  
Courtesy of BMW OF NORTH AMERICA, INC.

#### **Removing:**

Push quick-connect coupling (1) against pipe (4) (thereby relieving strain on spring (2)).

Press plastic ring (3) into quick-connect coupling (1) and remove coupling (1).

#### **Assembly:**

Markings (K) on coupling (1) and pipe (4) must be flush.

Push quick-connect coupling (1) onto pipe (4) until a "click" can clearly be heard.

To check that quick-connect coupling (1) has been installed correctly, pull it back forcefully.

#### **2. Quick-connect coupling with indication pins**

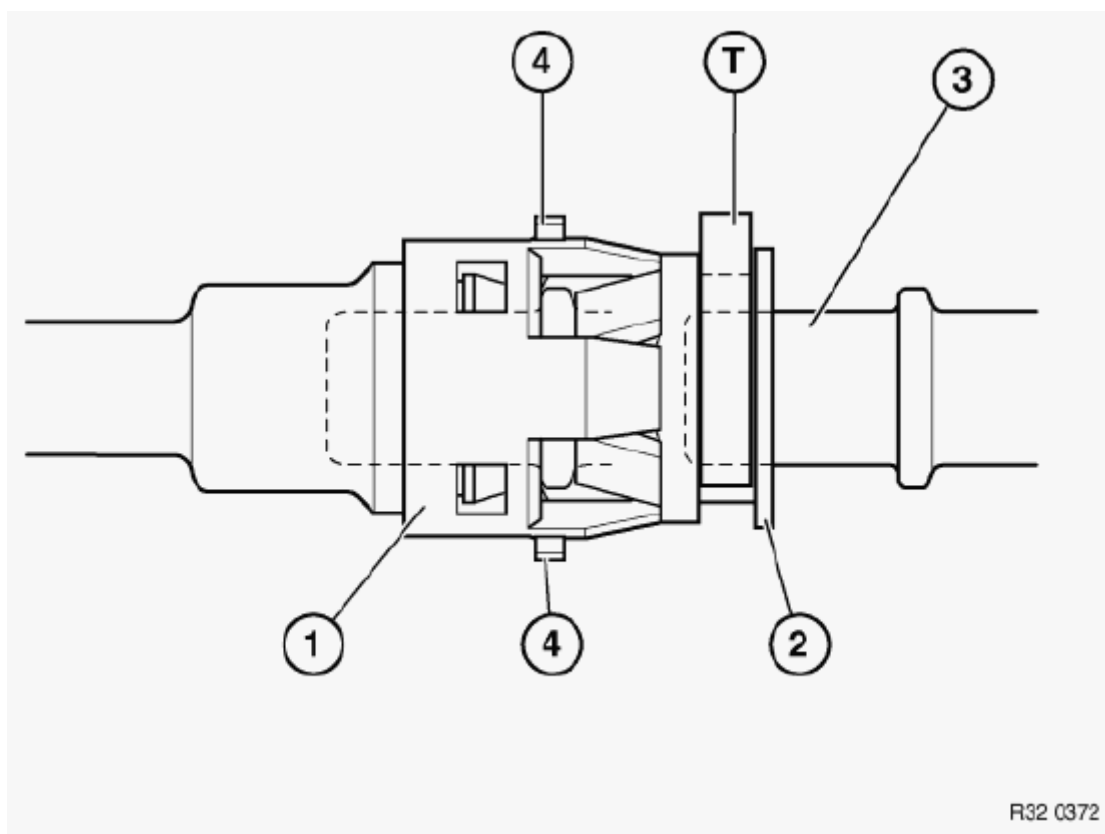


**Fig. 95: Quick-Connect Coupling Component With Indication Pins**  
 Courtesy of BMW OF NORTH AMERICA, INC.

#### Removing:

Press plastic ring (2) into quick-connect coupling (1) and remove coupling (1).

#### Assembly:

When replacing hydraulic line: remove transportation lock (T).

Push quick-connect coupling (1) onto pipe (3) until both indication pins (4) can be seen and felt to point outwards at outside diameter of housing.

To check that quick-connect coupling (1) has been correctly fitted, feel indication pins (4) at outside diameter of housing. When correctly seated, indication pins (4) cannot be pressed into housing.

**IMPORTANT: Coupling is not correctly engaged if both indication pins (4) fail to protrude from housing. Leakage is thus unavoidable.**

#### 32 41 001 SERVOTRONIC TROUBLESHOOTING

Refer to the following two Service Information bulletins for all the necessary information.

- Diagnostic aid for power steering
- Diagnosis of power steering systems

### 32 41 009 CHECKING FUNCTION OF POWER STEERING VANE PUMP

#### Special tools required:

- **32 4 000 FIXTURE**

**IMPORTANT:** Prior to this check, first check all hose connections, the vane pump and the power steering gear for leaks.  
**Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.**

#### *Necessary preliminary tasks:*

- Draw off and dispose off hydraulic fluid from fluid reservoir
- If necessary, remove front assembly underside protection, see **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION** .
- Disconnect pressure line from vane pump, see **32 41 060 Removing and installing/replacing power steering vane pump (N52)**.

#### Connecting special tool:

Connect special tool 32 4 000 (refer to **32 41 ... Instructions for using special tool 32 4 000**) with new sealing rings to vane pump and pressure line.

1. Connection, vane pump
2. Connection, power steering gear

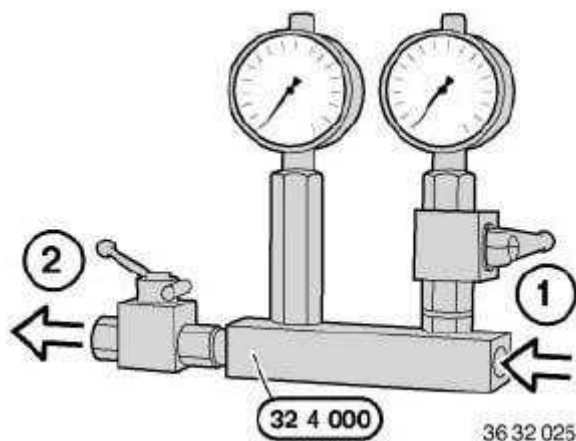


**Fig. 96: Special Tool (32 4 000) And Connections**  
Courtesy of BMW OF NORTH AMERICA, INC.

Checking pump pressure:

1. Close valve (A).
2. Open valve (B).
3. Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**
4. Start engine.
5. Heat hydraulic fluid to approx. 50°C by moving steering wheel at increased engine speed.
6. Close valve (B) for max. 10 secs. and read off pressure.
7. Compare measured pressure with specified nominal pressure.

Replace vane pump if the nominal pressure is exceeded by more than 10 %, see **32 41 060 Removing and installing/replacing power steering vane pump (N52)**

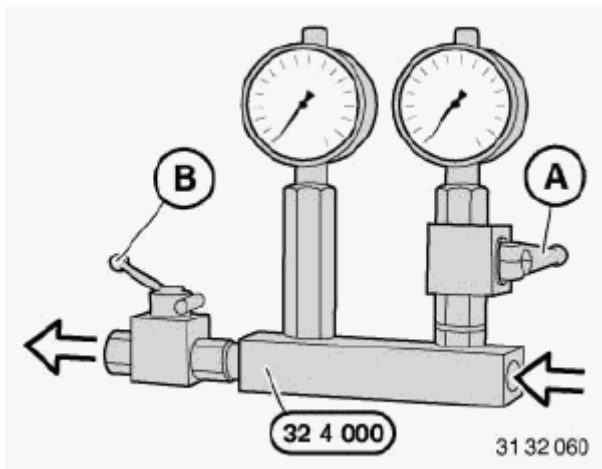


**Fig. 97: Special Tool (32 4 000) And Valve**  
Courtesy of BMW OF NORTH AMERICA, INC.

Check belt tension if the nominal pressure is undershot by more than 10 %. Replace vane pump if belt tension is OK, see **32 41 060 Removing and installing/replacing power steering vane pump (N52)**

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**
- Check pipe connections for leaks

### **32 41 060 REMOVING AND INSTALLING/REPLACING POWER STEERING VANE PUMP (N52)**

**IMPORTANT: Aluminium-magnesium materials.**

**No steel screws/bolts may be used due to the threat of electrochemical corrosion.**

**A magnesium crankcase requires aluminium screws/bolts exclusively.**

**Aluminium screws/bolts must be replaced each time they are released.**

**The end faces of aluminium screws/bolts are painted blue for the purposes of**

reliable identification.

Jointing torque and angle of rotation must be observed without fail (risk of damage).

**IMPORTANT:** Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.  
Close off pipe connections with plugs.

*Necessary preliminary tasks:*

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove intake filter housing, see **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N52K)** .
- Remove belt pulley, see **32 41 100 Removing and installing/replacing belt pulley on vane pump for power steering**.

Release hose clamp (1) and detach suction line (2) from vane pump.

*Installation:*

Align suction line by way of marking to connection on vane pump.

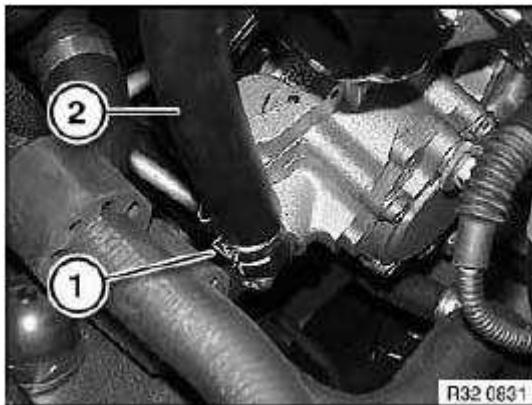


**Fig. 98: Hose Clamp And Suction Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1).

*Installation:*

**Replace aluminium screws.**

Observe screwing sequence.

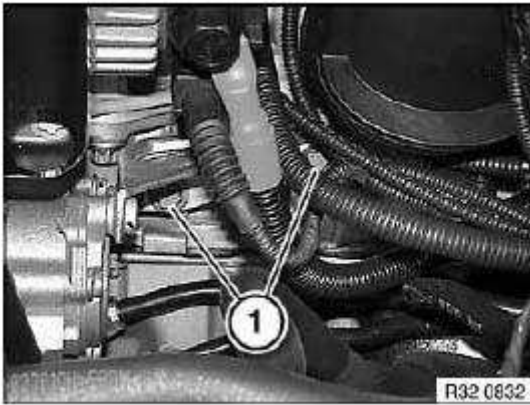


**Fig. 99: Bolts**

Courtesy of BMW OF NORTH AMERICA, INC.

Remove front underbody protection, see **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION** .

Release banjo bolt (1) and disconnect pressure line.

*Installation:*

Replace sealing ring.

Make sure pressure line is laid without tension and with sufficient spacing to adjoining components.

Tightening torque: 32 41 3AZ, see **32 41 PUMP AND OIL SUPPLY** .

Release screws (2) and remove vane pump towards top.

*Installation:*

**Replace aluminium screws.**

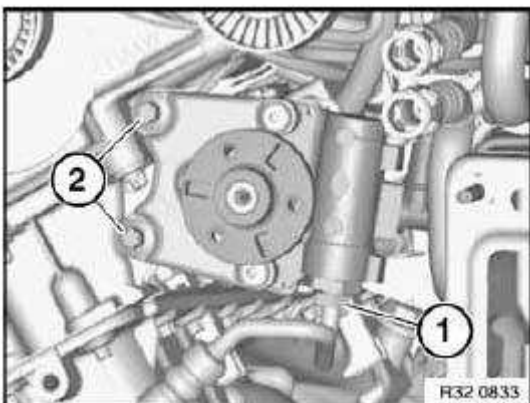


**Fig. 100: Banjo Bolt And Screws**

**Courtesy of BMW OF NORTH AMERICA, INC.**

Observe screwing sequence.

**Screw-fastening sequence:**

1. Secure vane pump with screws
2. Tighten side screws to 2 Nm
3. Tighten front screws to 2 Nm
4. Tighten down front screws to jointing torque and angle of rotation

Tightening torque: 32 41 1AZ, see **32 41 PUMP AND OIL SUPPLY** .

5. Release screws at side and check screw fastening points for gap freedom
6. Tighten down side screws to jointing torque and angle of rotation

Tightening torque: 32 41 1AZ, see **32 41 PUMP AND OIL SUPPLY** .

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit**.
- Check pipe connections for leaks

**32 41 100 REMOVING AND INSTALLING/REPLACING BELT PULLEY ON VANE PUMP FOR POWER STEERING**

**NOTE:** Carry out preliminary work as described in the document "Replacing drive belt".

Slacken screws (1)

Relieve tension on drive belt and remove from belt pulley (2).

Unscrew bolts (1) and remove belt pulley (2).

**Installation:**

Lettering on belt pulley (2) must point forwards.

Tightening torque: 32 41 14AZ, see **32 41 PUMP AND OIL SUPPLY** .

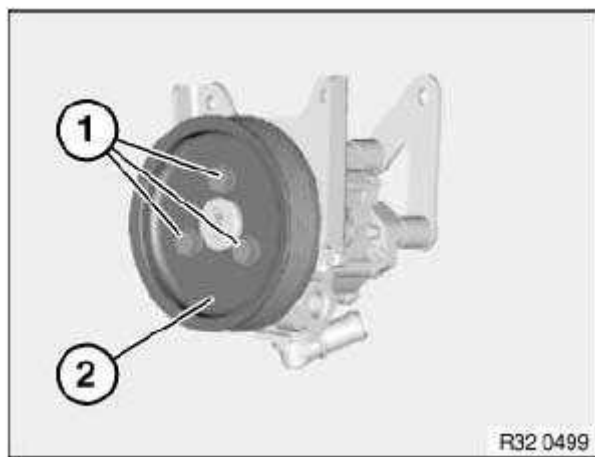


**Fig. 101: Screws And Belt Pulley**

Courtesy of BMW OF NORTH AMERICA, INC.

### 32 41 250 REMOVING AND INSTALLING/REPLACING FLUID RESERVOIR FOR POWER STEERING (M54, N46, N52)

#### Special tools required:

- **32 1 260 PLIERS**

**IMPORTANT:** Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.  
Seal off pipe connections with plugs.

#### *Necessary preliminary tasks:*

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove intake filter housing, see **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N52K)** .
- N46: Remove intake duct

N52:

**IMPORTANT:** Cover alternator with a suitable covering to prevent ingress of hydraulic fluid.

Release screw (1).

Tightening torque: 32 41 9AZ, see **32 41 PUMP AND OIL SUPPLY** .

Remove hose clamps if necessary with special tool 32 1 260.

**NOTE:** If necessary, raise and/or turn fluid reservoir in order to gain better access to

**hose clamps.**

Disconnect suction line and radiator return line from fluid reservoir.

Lift out fluid reservoir.

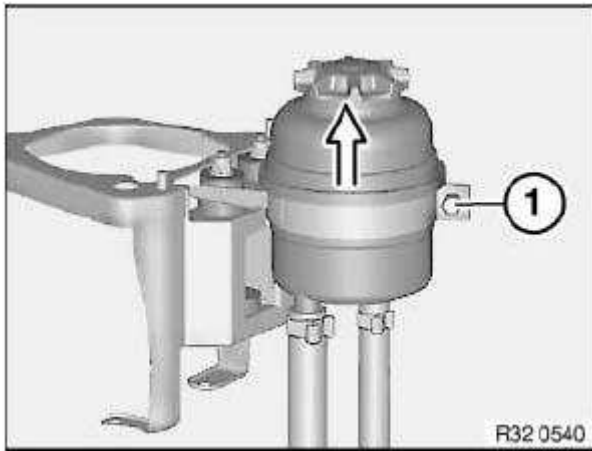


**Fig. 102: Lifting Out Fluid Reservoir**

Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**
- Check pipe connections for leaks

**32 41 311 REPLACING SUCTION LINE FOR POWER STEERING (N52)**

**IMPORTANT: Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.**

**Seal off hydraulic lines with plugs.**

***Necessary preliminary tasks:***

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove front underbody protection, see **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION .**
- Remove intake filter housing, see **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N52K) .**

Remove fluid reservoir from mounting bracket/body.

Release hose clamp (1) and detach suction line (2) from fluid reservoir.

*Installation:*

Make sure hydraulic line is laid without tension and with sufficient spacing to adjoining components.

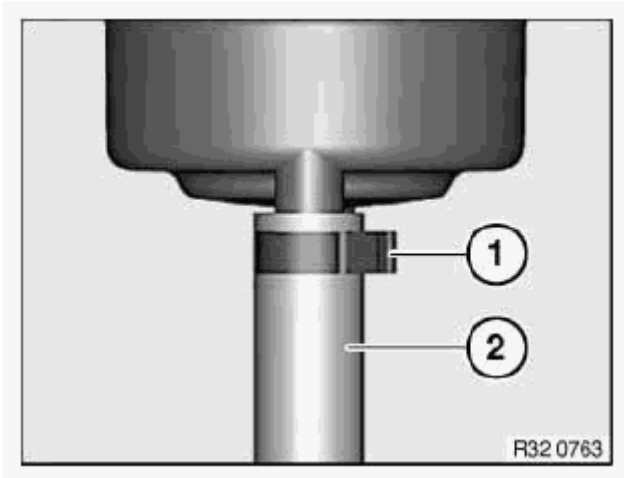


**Fig. 103: Hose Clamp And Suction Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

Expose suction line up to connection on vane pump.

Release hose clamp (1) and detach suction line (2) from vane pump.

*Installation:*

Markings (3) on suction line and vane pump must match up.

If a marking is missing, it is important to ensure when installing the hydraulic line that it is laid without tension and with sufficient spacing to adjoining components.

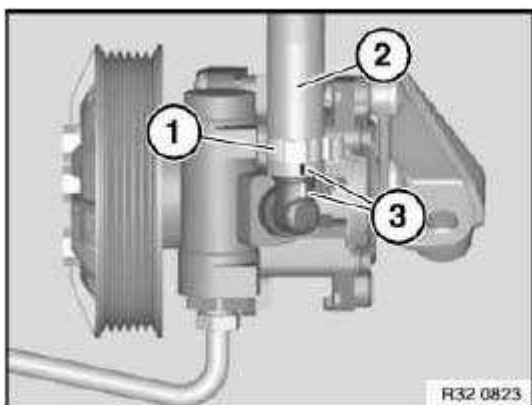


**Fig. 104: Hose Clamp And Suction Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**
- Check pipe connections for leaks

**32 41 331 REPLACING PRESSURE LINE FOR POWER STEERING (N52)**

**IMPORTANT: Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.  
Seal off hydraulic lines with plugs.**

*Recycling:*

Catch and dispose of hydraulic fluid in a suitable container.

*Necessary preliminary tasks:*

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove front underbody protection, see **51 47 490 REMOVING AND INSTALLING / REPLACING FRONT UNDERBODY PROTECTION** .

Release union screw (1) and detach pressure line (2) from vane pump.

*Installation:*

Replace sealing ring.

Make sure hydraulic line is laid without tension and with sufficient spacing to adjoining components.

Tightening torque: 32 41 3AZ, see **32 41 PUMP AND OIL SUPPLY** .

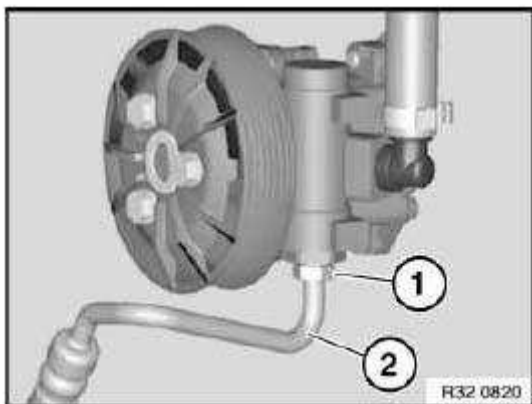


**Fig. 105: Union Screw And Pressure Line**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

Expose pressure line up to connection on power steering gear.

Release FCD coupling and disconnect pressure line.

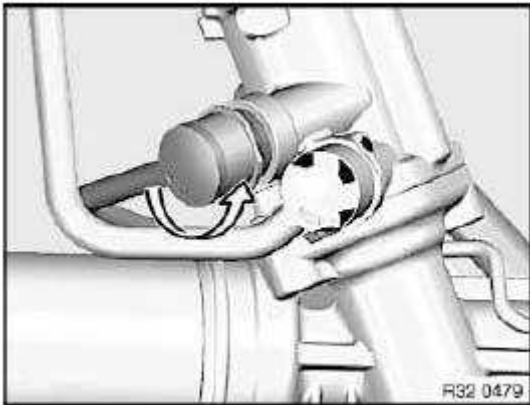


**Fig. 106: Disconnecting Plug Connection On EH Converter**  
Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**
- Check pipe connections for leaks

**32 41 341 REPLACING COOLER RETURN LINE FOR POWER STEERING (M54, N46, N52)**

**IMPORTANT: Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.  
Seal off hydraulic lines with plugs.**

**Recycling:**

Catch and dispose of hydraulic fluid in a suitable container.

**Necessary preliminary tasks:**

- Draw off and dispose of hydraulic fluid from fluid reservoir
- N46: Remove intake duct
- Remove intake filter housing, see **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N52K) .**

Remove fluid reservoir from mounting bracket/body.

Release hose clamp (1) and detach cooler return line (2) from fluid reservoir.

**Installation:**

Make sure hydraulic line is laid without tension and with sufficient spacing to adjoining components.

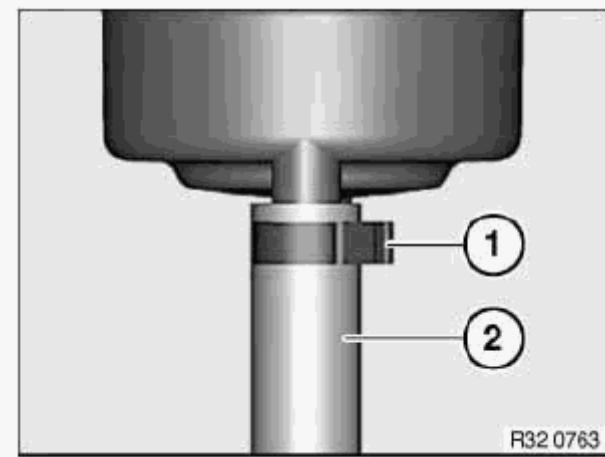


**Fig. 107: Hose Clamp And Suction Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

Expose cooler return line up to connection on power steering coil.

Release quick-connect coupling and seal power steering coil connection with a suitable plug, see **32 41 ... Notes on hydraulic line with quick-connect coupling.**

*Installation:*

Make sure hydraulic line is laid without tension and with sufficient spacing to adjoining components.

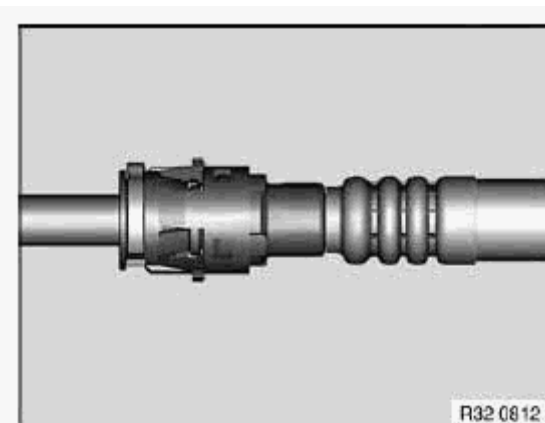


**Fig. 108: Quick-Connect Coupling And Seal Power Steering Coil**  
Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**
- Check pipe connections for leaks

**32 41 351 REPLACING RETURN LINE FOR POWER STEERING**

**IMPORTANT:** Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.  
Seal off hydraulic lines with plugs.

*Recycling:*

Catch and dispose of hydraulic fluid in a suitable container.

*Necessary preliminary tasks:*

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove intake filter housing, see **13 71 000 REMOVING AND INSTALLING/REPLACING INTAKE FILTER HOUSING (N52K)** .

Release quick-connect coupling and seal power steering coil connection with a suitable plug, see **32 41 ... Notes on hydraulic line with quick-connect coupling**.

*Installation:*

Make sure hydraulic line is laid without tension and with sufficient spacing to adjoining components.

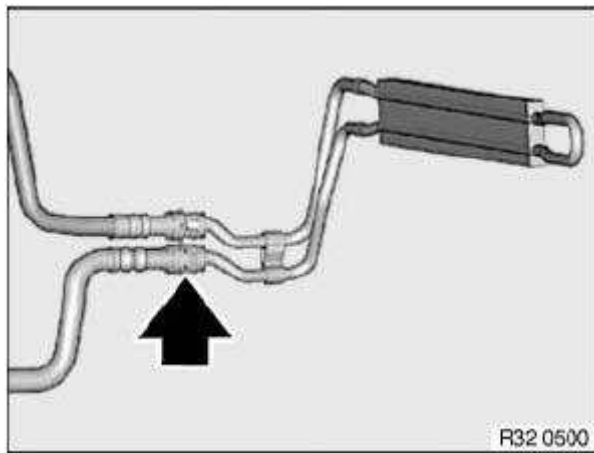


**Fig. 109: Locating Quick-Connect Coupling**  
Courtesy of BMW OF NORTH AMERICA, INC.

Remove reinforcement plate, see **31 10 010 REMOVING AND INSTALLING/REPLACING REINFORCEMENT PLATE** .

Diesel engines: Partially detach steering gear cover.

Expose return line up to connection on power steering gear.

Release FCD coupling and disconnect return line.

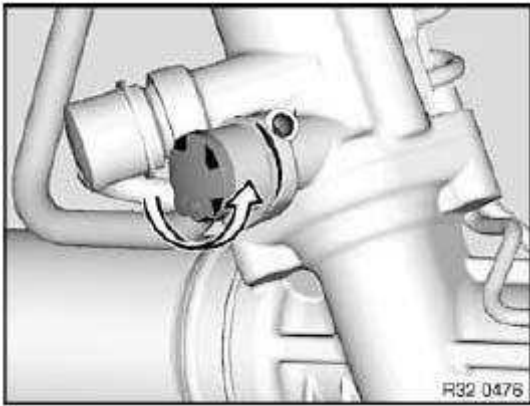


**Fig. 110: Disconnecting Return Line**  
Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Fill and bleed hydraulic system, see **32 13 006 Bleeding power steering unit.**
- Check pipe connections for leaks

## **43 ELECTRONIC POWER STEERING**

### **32 43 521 REPLACING SERVOTRONIC CONTROL UNIT**

**IMPORTANT: Read and comply with 61 35 ... NOTES ON ESD PROTECTION (ELECTRO STATIC DISCHARGE)**

*Necessary preliminary tasks:*

- Remove ignition key
- Disconnect battery negative lead
- Remove glovebox, see **51 16 360 REMOVING AND INSTALLING RIGHT GLOVEBOX .**

Disconnect plug connection (1).

Unlock catch (2) and remove control unit (3).

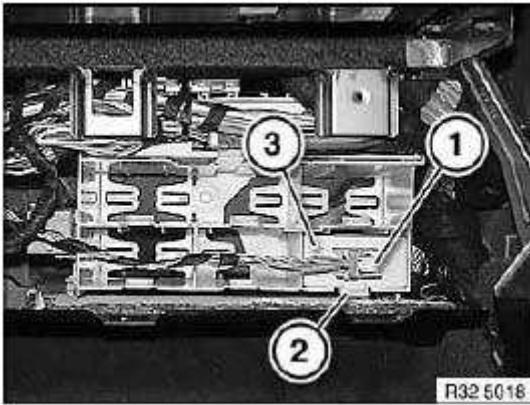


**Fig. 111: Plug Connection, Catch And Control Unit**  
Courtesy of BMW OF NORTH AMERICA, INC.

**After installation:**

- Replacement only: Carry out programming/coding using appropriate BMW service tool.

## 90 TROUBLESHOOTING

### 32 90 ... TROUBLESHOOTING ON STEERING

Observe troubleshooting on front axle and diagnosis help for steering (SI), see **31 90 ... FRONT AXLE TROUBLESHOOTING** .

#### FRONT AXLE TROUBLESHOOTING CHART

| Fault                                              | Cause                                                                                                                   | Remedy                                                                                                                                           |
|----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Excessive steering wheel play/steering wheel shake | Screws at lower section of steering spindle to steering gear/steering column loose                                      | Replace screws and tighten down (refer to <b><u>32 31 070 Removing and installing / replacing lower section of steering spindle</u></b> )        |
|                                                    | Bolt connection, universal joint/double joint, to lower section of steering spindle/steering gear/steering column loose | Replace and tighten down bolts (refer to <b><u>32 31 219 Removing and installing/replacing double joint with flexible disk</u></b> )             |
|                                                    | Journal of tie rod end deformed                                                                                         | Replace steering gear and tie rod ends, see <b><u>32 13 060 Removing and installing/replacing power steering gear</u></b>                        |
|                                                    | Tie rod end worn                                                                                                        | Check steering gear rack; if necessary, replace steering gear, see <b><u>32 13 060 Removing and installing/replacing power steering gear</u></b> |
|                                                    |                                                                                                                         | Check tie rods, replace if necessary, see <b><u>32 21 231 Replacing left or right tie rod</u></b>                                                |
|                                                    |                                                                                                                         | Replace tie rod end, see <b><u>32 21 151 Replacing left or right tie rod</u></b>                                                                 |

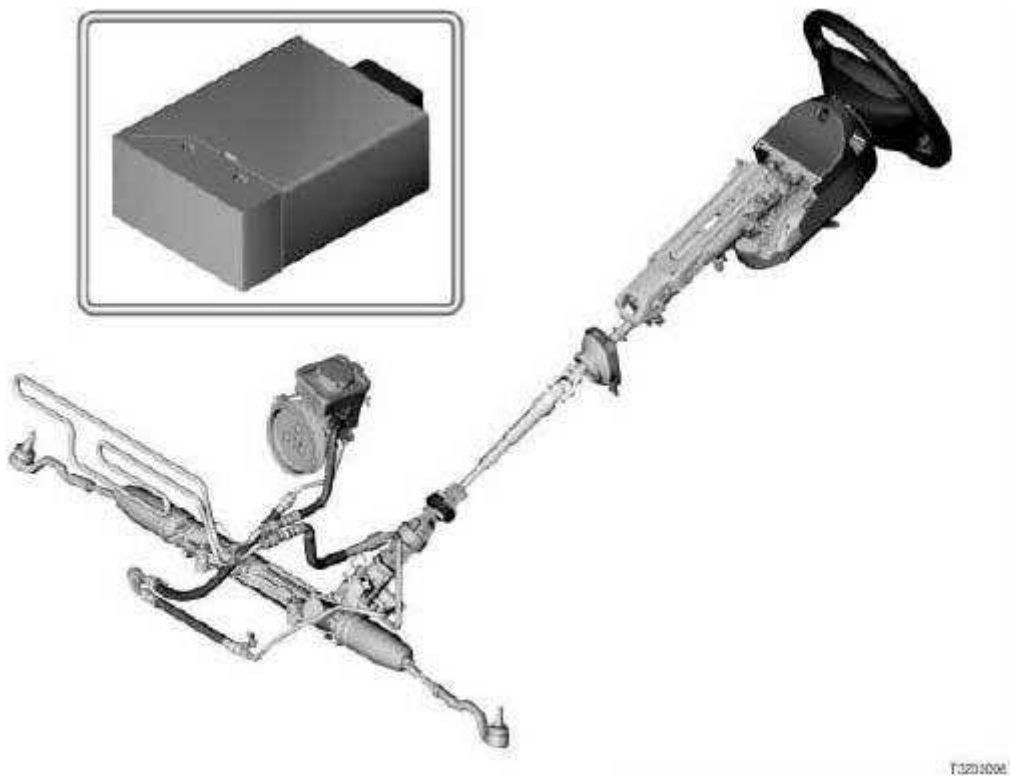
## 2007 BMW X3

### SUSPENSION Steering & Wheel Alignment - Repair Instructions - X3

|                                                             |                                                             |                                                                                                                                             |
|-------------------------------------------------------------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Steering wheel inclination                                  | Steering gear rack damaged                                  | Replace steering gear, see <b><u>32 13 060 Removing and installing/replacing power steering gear</u></b>                                    |
|                                                             | Refer to <b><u>31 90 ... FRONT AXLE TROUBLESHOOTING</u></b> |                                                                                                                                             |
|                                                             | Tie rod end worn                                            | Replace tie rod end, see <b><u>32 21 151 Replacing left or right tie rod</u></b>                                                            |
|                                                             | Front axle alignment incorrectly adjusted                   | Carry out chassis/wheel alignment check, adjust toe/track if necessary, see <b><u>32 00 ... Chassis/wheel alignment check procedure</u></b> |
| Refer to <b><u>31 90 ... FRONT AXLE TROUBLESHOOTING</u></b> |                                                             |                                                                                                                                             |

**STEERING****Steering and Wheel Alignment - SI Techniques - X3****32 STEERING AND WHEEL ALIGNMENT****SERVOTRONIC**

E83

**Fig. 1: Servotronic****Courtesy of BMW OF NORTH AMERICA, INC.****INTRODUCTION**

The Servotronic does not regulate the steering force support in a conventional way by using the engine speed, rather it is dependent upon the car's road speed. The Servotronic regulates the hydraulic pressure in the power-steering pump. Adaptation of the hydraulic pressure to the car's road speed has the effect of:

- High steering force support at low road speeds
- Minimum steering force support at high road speeds

This means that minimum force is required for steering force at slow road speeds. As the road speed increases the steering force support is continuously reduced. Contact to the road surface therefore becomes more direct

and steering is more precise. Consequently, steering is very comfortable and maneuverability is maximized, for instance when parking and maneuvering at slow speeds.

**New:** In E83 the Servotronic is integrated in its own control unit.

The Servotronic is available as special equipment (option 216).

## **BRIEF DESCRIPTION OF COMPONENTS**

The following control units are involved in the Servotronic:

- **Servotronic control unit (SVT)**

The SVT control unit specifies the nominal values for controlling the Servotronic valve (hydraulic pressure). The SVT control unit is connected to the PT-CAN (powertrain CAN) and K-Bus (body bus).

- **DSC control unit (Dynamic Stability Control)**

The DSC control unit delivers the car's road speed signal. The DSC control unit and SVT control unit are connected by the PT-CAN.

- **DME or DDE (Digital Engine Electronics or Digital Diesel Electronics DDE)**

The Servotronic receives the signal of whether the engine is running from the DME or DDE over the PT-CAN. The Servotronic only activates the Servotronic valve when the engine is running.

- **Instrument cluster (KOMBI)**

The instrument cluster delivers the terminal status (e.g. terminal 15 ON) and the kilometer reading.

The following actuators are controlled by the Servotronic:

- **Servotronic valve**

The Servotronic valve is an electro-hydraulic converter located in the power-assisted steering oil circuit. The Servotronic valve restricts the hydraulic current and consequently reduces the hydraulic pressure.

The Servotronic valve is activated by a characteristic curve delivered by the SVT control unit.

## **System functions**

The Servotronic is based upon the following system functions:

- Initialisation of the Servotronic
- Recording of the speed
- Supplying the Servotronic valve with power
- Undervoltage detection and overvoltage detection

**Initialisation of the Servotronic**

The Servotronic is active from terminal 15 ON.

A short initialization phase for the Servotronic (under 1 second) is necessary when the engine starts in order to reach the characteristic curve for a low road speed as fast as possible.

A plausibility check for supplying the Servotronic valve is performed during the initialization phase.

**Recording of the speed**

The road-speed signal is calculated by the DSC and supplied to the PT-CAN. The Servotronic specifies an acceleration value for plausibility of the road-speed signal. A road speed is calculated from the acceleration value.

At a low acceleration the road-speed signal supplied by the DSC is used.

At a higher acceleration the Servotronic control unit calculates the road speed internally. The road speed is stored in the Servotronic control unit.

**Supplying the Servotronic valve with power**

The Servotronic valve is supplied with power in response to the car's road speed. The power-assisted steering characteristic is memorized in a characteristic curve. The characteristic curve specifies the power based on the car's road speed.

The characteristic curve is written using 16 reference points.

The Servotronic valve is no longer supplied with power when the engine is OFF (over the PT-CAN). Minimum steering force support is set (high road speed) when the Servotronic valve is no longer supplied with power.

Equally, the Servotronic valve is also no longer supplied with power if there is a fault-memory entry.

**Undervoltage detection and overvoltage detection**

The Servotronic valve is no longer supplied with power under the following conditions:

- Supply voltage less than 9 volts
- Supply voltage higher than 17 volts

Voltage dips during ignition faults are detected.

**SWITCH-ON CONDITIONS**

Switch-on conditions for the Servotronic are:

- Terminal 15 ON

- The engine must be running

The Servotronic only activates the Servotronic valve when the engine is running.

When the engine has started and there a road-speed signal is not supplied the Servotronic sets the maximum steering force support.

If a plausible road-speed signal is detected the Servotronic valve is activated by the characteristic curve.

If there is still not a (or not a plausible) road-speed signal 5 seconds after the engine has started the minimum steering force support is set.

## KINEMATIC DIAGNOSIS SYSTEM AND ENVIRONMENT

BMW KDS (Beissbarth)

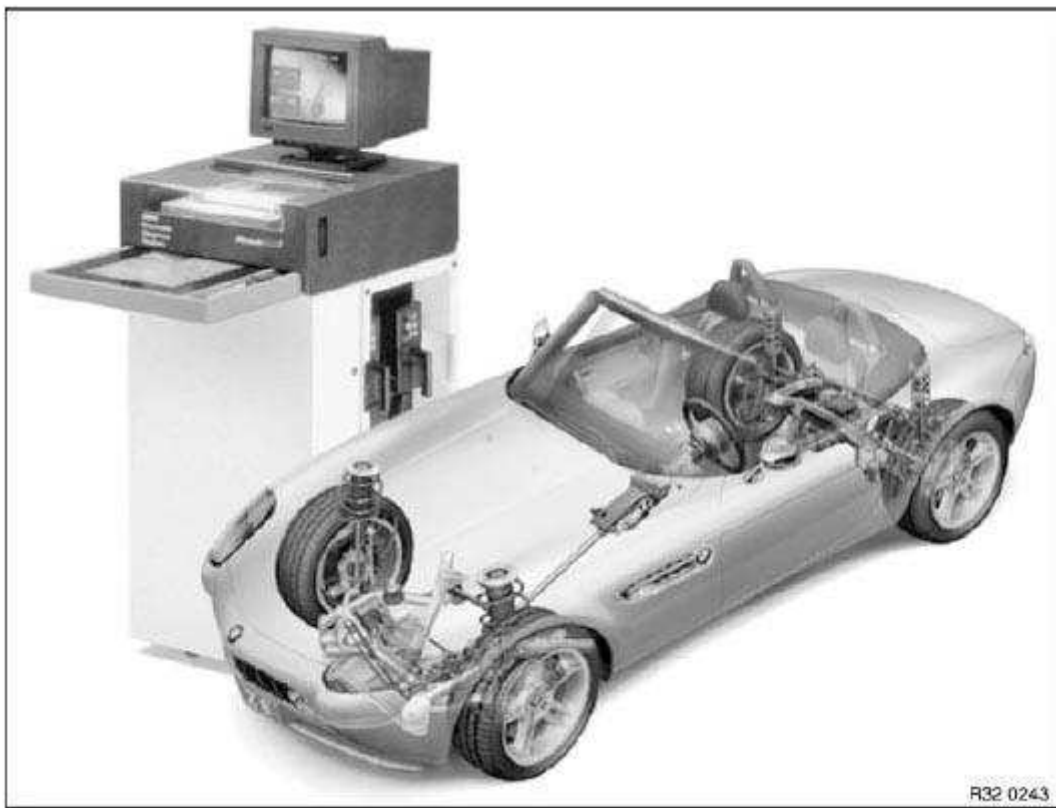


**Fig. 2: Kinematic Diagnosis System**  
Courtesy of BMW OF NORTH AMERICA, INC.

### 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 (KIDS).
- 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 KIDS.

### **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**



**Fig. 3: Display Kinematic Diagnosis System Technical Data**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

#### KINEMATIC DIAGNOSIS SYSTEM TECHNICAL DATA

|                             |                                                                                                                                          |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 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          | Loadbearing capacity 1000 kg, angle of rotation $\pm 360^\circ$ , 450 x 450 x 50 mm (L x W x H), sliding range $\pm 50$ mm, weight 18 kg |
| 6. Sliding plates           | Loadbearing capacity 1000 kg, angle of rotation $\pm 10^\circ$ , 450 x 450 x 50mm (L x W x H), sliding range $\pm 65$ mm, weight 17 kg   |
| 7. Electrical connection    | 100-115 V / 220-240 V 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 KIDS (8 languages)
- 1 BMW software and the BMW vehicle setpoint 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 center 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

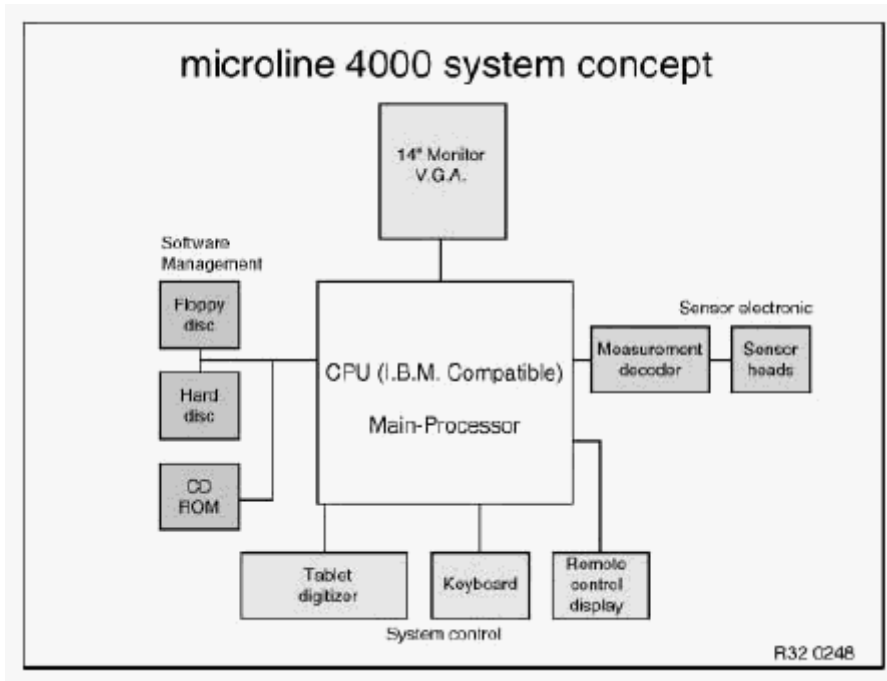


**Fig. 4: BMW Kinematic Diagnosis System Diagram**  
Courtesy of BMW OF NORTH AMERICA, INC.

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

#### 1. MOBILE WORKSTATION



**Fig. 5: Mobile Workstation**  
Courtesy of BMW OF NORTH AMERICA, INC.

## 2. MOBILE COMPACT CABINET



**Fig. 6: Mobile Compact Cabinet**  
Courtesy of BMW OF NORTH AMERICA, INC.

The larger workstation offers a small storage area for accessories, while 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 KIDS 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.



**Fig. 7: Computer**  
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.

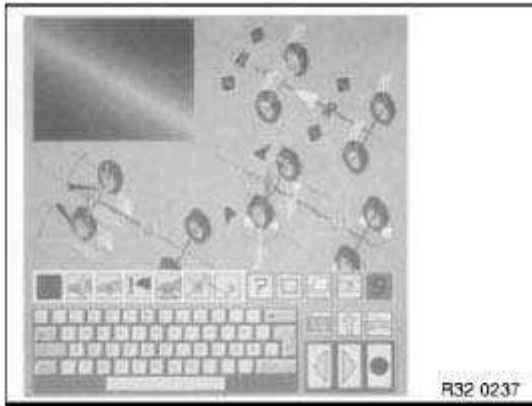


**Fig. 8: Graphical Tablet**

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).

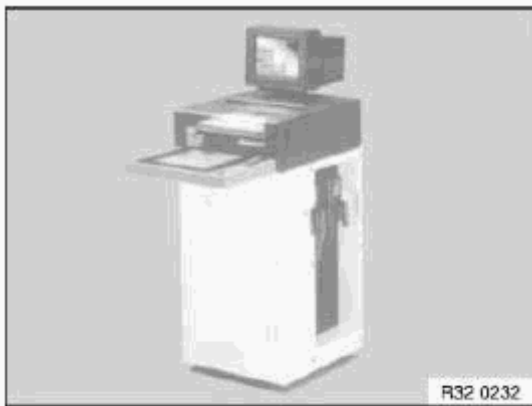


**Fig. 9: Equipment Cabinet**

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



**Fig. 10: 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 could theoretically be measured in angular seconds)
- Single track range of more than  $\pm 9$  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



**Fig. 11: 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 KIDS.

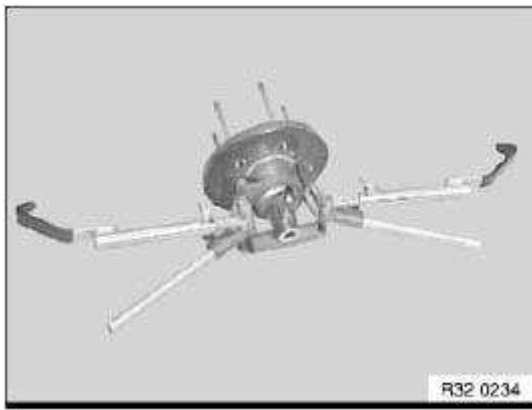


**Fig. 12: BMW Quick-Acting Clamp**  
Courtesy of BMW OF NORTH AMERICA, INC.

### 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 aluminium rotating plates

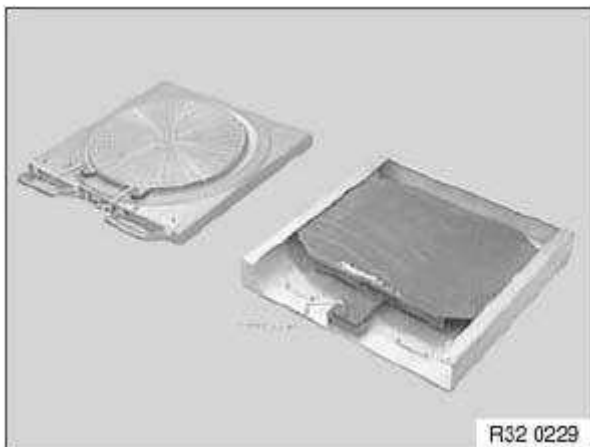
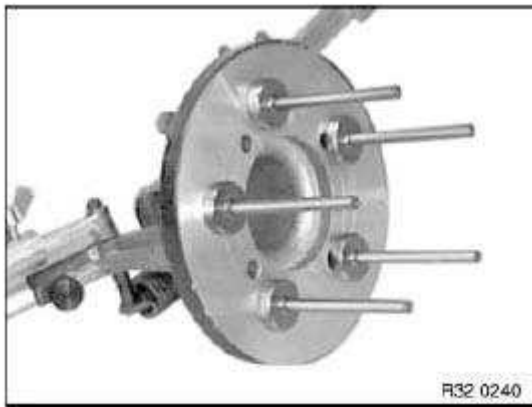


**Fig. 13: Rotating/Sliding Plates**

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 KIDS 1 (order number: BS 90 19 11).

**Fig. 14: 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.

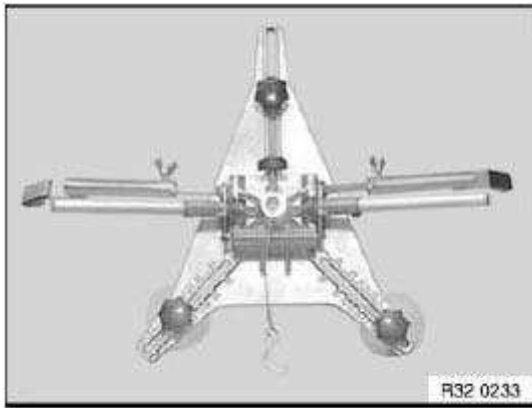


**Fig. 15: Spoiler Adapter**

Courtesy of BMW OF NORTH AMERICA, INC.

### 3.11 Quick-clamping units

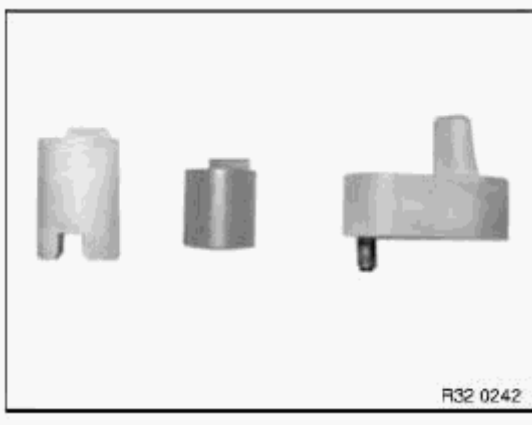
- Quick-clamping units for wheel alignment on non-BMW vehicles with rim run-out compensation.
- Rims without sensors boreholes (rims for BMW vehicles from other manufacturers)

**Fig. 16: Quick-Clamping Units**

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.

**Fig. 17: Retainers**

Courtesy of BMW OF NORTH AMERICA, INC.

## 4. WORKSTATION

### 4.1 Environment

DESCRIPTION AND REQUIREMENTS REFERENCE

| Description:                                                                                                                                                                        | Requirements:                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| All lifting platforms currently recommended by BMW (see ) for wheel alignment meet the requirements for the BMW KDS.                                                                | <ul style="list-style-type: none"><li>○ Wheel alignment pits</li><li>○ Pillar-type lifts with set-down device</li><li>○ 2 plunger-type lifting platforms with set-down device</li></ul>                 |
| 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. | <ul style="list-style-type: none"><li>○ Repair stands with set-down device</li><li>○ One measuring area (approx. 4.5 m x 7.0 m).</li><li>○ The rotating plates must be pinned to the platform</li></ul> |

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

- from left to right  $\pm 0.5\text{ mm}$
- from front to back  $\pm 1.0\text{ mm}$
- diagonally  $\pm 1.0\text{ mm}$ .

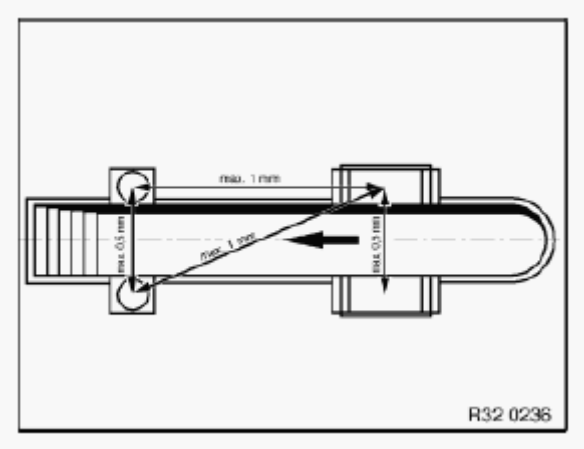


**Fig. 18: Rotating And Sliding Plates Height Difference**  
Courtesy of BMW OF NORTH AMERICA, INC.

**NOTE:** A difference in the height of the rotary plates of  $\pm 2\text{ mm}$  from left to right results in a measuring error of  $4.8^\circ$  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 centered 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 KIDS (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

- 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).

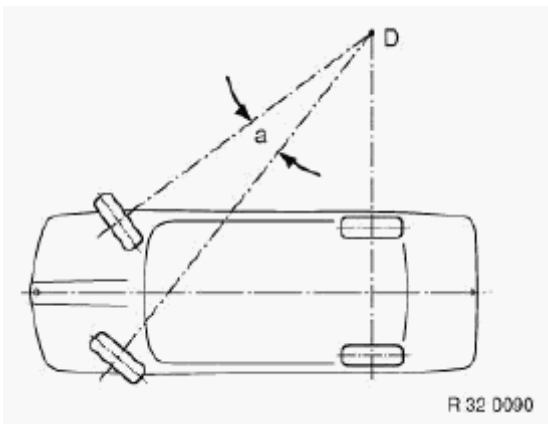


**Fig. 19: Toe-Differential Angle**  
Courtesy of BMW OF NORTH AMERICA, INC.

#### 5.2 Camber

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

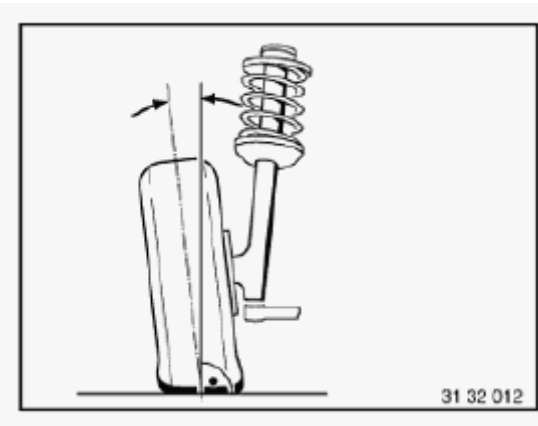


**Fig. 20: Camber Angle**

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 while driving (wobbling and grinding).

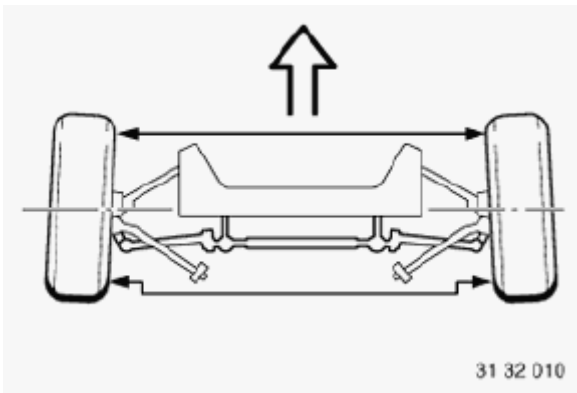
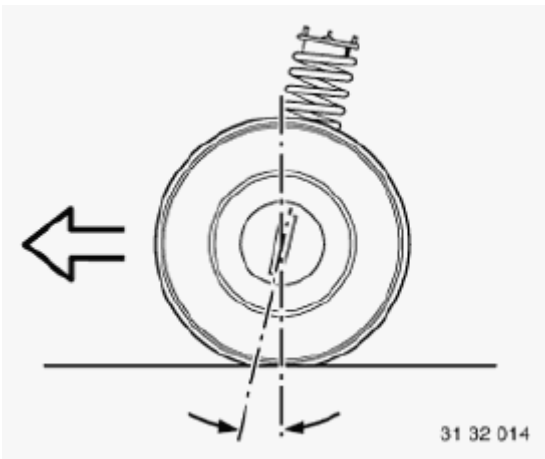


**Fig. 21: Toe-In**

Courtesy of BMW OF NORTH AMERICA, INC.

### 5.4 Castor

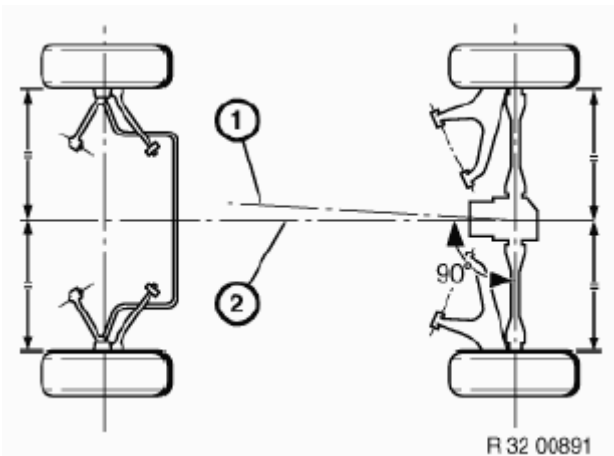
- The castor is the kingpin angle seen from the side in the opposite direction of travel. The line through the center of the spring strut mount and control arm ball joint corresponds to the kingpin.

**Fig. 22: 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 center line through the front and rear axes.

**Fig. 23: Geometrical Drive Axis/Symmetrical Axis**

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.

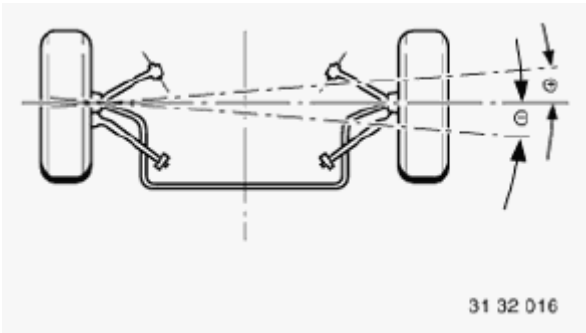


**Fig. 24: Wheel Displacement Angle**  
Courtesy of BMW OF NORTH AMERICA, INC.

5.7 Kingpin offset

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

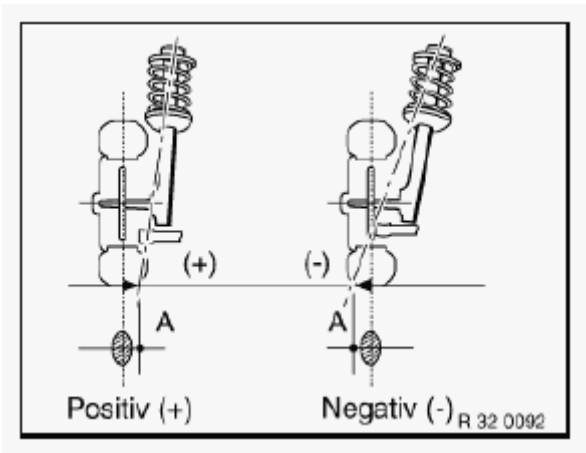


**Fig. 25: Kingpin Offset**  
Courtesy of BMW OF NORTH AMERICA, INC.

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 ADVANTAGES AND DISADVANTAGES

| Description                                                                   | Advantages                                            | Disadvantages                                          |
|-------------------------------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------|
| The rigid axle suspension has a rigid connection between both wheels or wheel | In the event of deflection taking place, there are no | Non-driven rear axles may also acquire negative camber |

## 2007 BMW X3

### STEERING Steering and Wheel Alignment - SI Techniques - X3

|                                                                                                                                                                                |                                                                                          |                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 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. | changes to the camber or wheel toe. This means: less tyre wear and good track stability. | as well as increasing tyre lateral guidance, thus increasing tyre wear. |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|

#### 6.2 Independent wheel suspension

#### INDEPENDENT WHEEL SUSPENSION ADVANTAGES AND DISADVANTAGES

| 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.

#### WHEEL ALIGNMENT SPECIFICATION

| Measuring options           | Measuring accuracy | In measuring range | Total measuring range |
|-----------------------------|--------------------|--------------------|-----------------------|
| Total wheel toe (VA + HA)   | $\pm 2'$           | $\pm 2^\circ$      | $\pm 18^\circ$        |
| Single wheel toe (VA + HA)  | $\pm 2'$           | $\pm 2^\circ$      | $\pm 9^\circ$         |
| Camber (VA + HA)            | $\pm 1'$           | $\pm 3^\circ$      | $\pm 10^\circ$        |
| Wheel displacement (VA)     | $\pm 2'$           | $\pm 2^\circ$      | $\pm 9^\circ$         |
| Geometrical drive axis      | $\pm 2'$           | $\pm 2^\circ$      | $\pm 9^\circ$         |
| 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. 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 KIDS specifications
- Rock the vehicle firmly with the brakes released to ensure a stable center 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 center 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**



**Fig. 26: Printing Layout Of Customer And Vehicle Identification 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 center plane of the vehicle.
- Before measuring the single wheel toe values on the front axle, the center 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 COMPARISON (BOSCH - BEISSBARTH)

|                                            | <b>Bosch</b>                        | <b>Beissbarth</b>                                               |
|--------------------------------------------|-------------------------------------|-----------------------------------------------------------------|
| 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

**NOTE:** 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 color 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 KIDS (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 KIDS (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 **KIDS 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 KIDS 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 **KIDS 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 KIDS 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  $\pm 306$  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.
- You can quit the delete function by pressing the cancel key (red dot).

## 14. MODIFICATIONS WITHIN PROGRAM

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

- Optimization of the rim run-out compensation in respect of speed.
- Optimization 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.
- Standardization of screen colors with the colors 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 DESCRIPTION CHART

| 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 DESCRIPTION CHART

## 2007 BMW X3

### STEERING Steering and Wheel Alignment - SI Techniques - X3

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

|                                      |                |
|--------------------------------------|----------------|
| d) Tension / traction strut deformed | traction strut |
|--------------------------------------|----------------|

### 15.3 Rear axle faults

#### REAR AXLE FAULTS DESCRIPTION CHART

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

## SUSPENSION

### Steering and Wheel Alignment - Special Tools - X3

## 32 STEERING AND WHEEL ALIGNMENT

### 32 1 020 SET OF TOOLS

#### Minimum set: Mechanical tools

Note: For changing wear parts on hydraulic lines (steering gear)

Series: E60, E61, E65, E66, E67, E83, RR1, RR2

Storage location: A45

SI number: 1 14 01 (766)

Order number: 32 1 020

Set of tools

Consisting of:

1 = 32 1 021 Slip bush

2 = 32 1 022 Thrust piece

3 = 32 1 023 Extractor

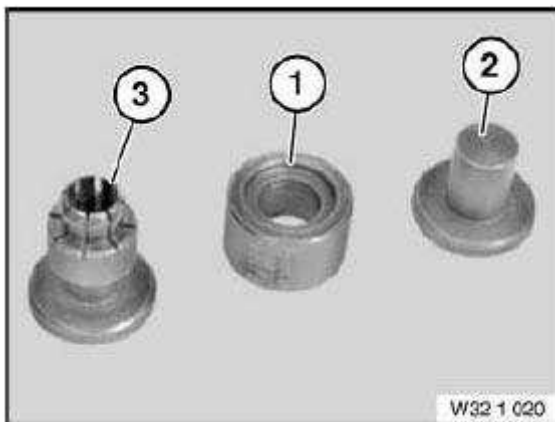


**Fig. 1: Set Of Tools (32 1 020)**

Courtesy of BMW OF NORTH AMERICA, INC.

### 32 1 030 LEVER

**Minimum set: Mechanical tools**

Note: For disconnecting hydraulic lines from steering gear and for locking adjustment unit (ASZE) at handbrake lever

Series: E60, E61, E63, E64, E65, E66, E67, E83, E85, E86, E87, E90, E91, E92, E93, RR1, RR2

Storage location: B45, C45

SI number: 1 14 01 (766)

Order number: 32 1 030

Lever

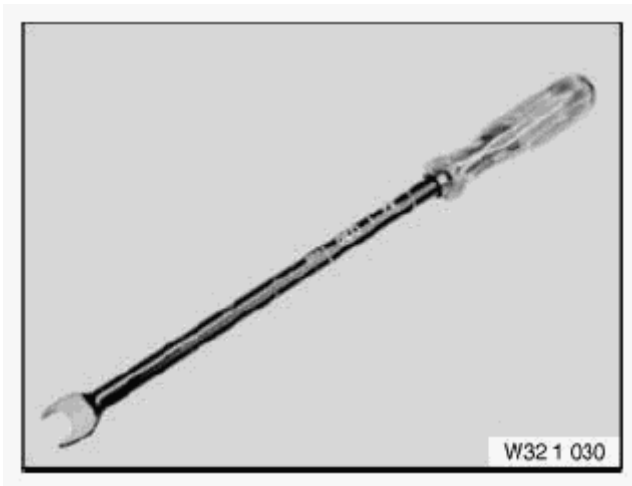


**Fig. 2: Lever (32 1 030)**

**Courtesy of BMW OF NORTH AMERICA, INC.**

**32 1 060 DRIFT**

In conjunction with: 00 5 500

Note: For rotary shaft seal of inner segment shaft in steering gear

Series: E24, E28, E30, E31, E32, E34, E36, E38, E38/3, E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E70, E83, E85, E86, E87, E90, E91, E92, E93, RR2

Storage location: B30

Order number: 32 1 060

Drift

**Fig. 3: Drift (32 1 060)**

Courtesy of BMW OF NORTH AMERICA, INC.

**32 1 260 PLIERS**

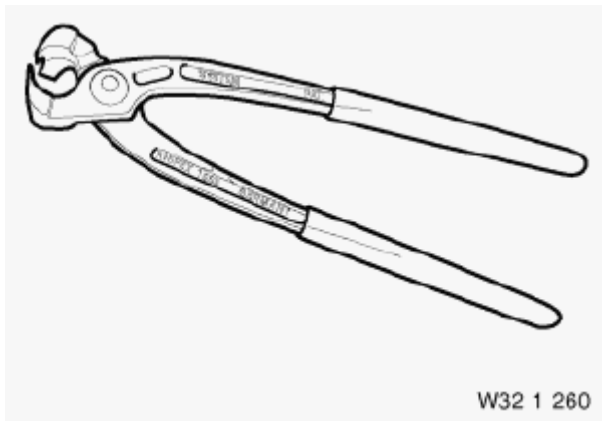
Note: For opening and fastening hose clamps

Series: E12, E21, E23, E24, E28, E30, E30/C, E30tou, E31, E32, E32/3, E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E70, E81, E83, E85, E86, E87, E90, E91, E92, E93, R50, R52, R53, RR1, RR2

SI number: 1 02 01 (667)

Order number: 32 1 260

Pliers

**Fig. 4: Pliers (32 1 260)**

Courtesy of BMW OF NORTH AMERICA, INC.

**32 1 270 PLUGS (SET)**

Minimum set: Mechanical tools

## 2007 BMW X3

### SUSPENSION Steering and Wheel Alignment - Special Tools - X3

Note: 27-piece, 3x per size - For sealing off hydraulic lines for brakes, steering etc.

Series: E12, E21, E23, E24, E28, E30, E30/C, E30tou, E31, E32, E32/3, E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E68, E70, E81, E83, E85, E86, E87, E90, E91, E92, E93, R50, R52, R53, R56, RR1, RR2

SI number: 1 14 01 (766)

Order number: 32 1 270

Plugs (set)



**Fig. 5: Plugs (32 1 270)**

Courtesy of BMW OF NORTH AMERICA, INC.

### 32 1 300 FORK

#### Minimum set: Mechanical tools

Note: For disconnecting hydraulic lines Engine: N73

Series: E60, E61, E65, E66, E67, E83

Storage location: B47

SI number: 1 05 03 (969)

Order number: 32 1 300

Fork



**Fig. 6: Fork (32 1 300)**

Courtesy of BMW OF NORTH AMERICA, INC.

### **32 3 030 SETTING TOOL**

#### **Minimum set: Mechanical tools**

Note: For setting toe-in on rear axle - rear axle with KDS

Series: E36, E46, E83, E85, E86

Storage location: C36

SI number: 1 02 98(302)

Order number: 32 3 030

Setting tool

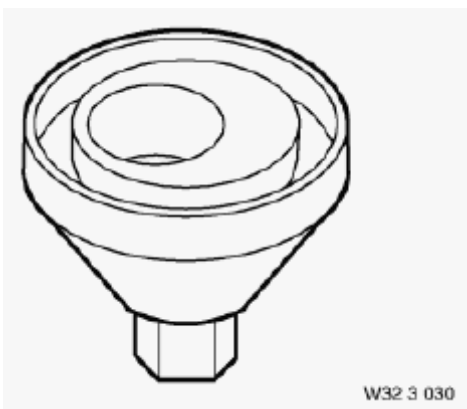


**Fig. 7: Setting Tool (32 3 030)**

Courtesy of BMW OF NORTH AMERICA, INC.

### **32 3 110 RELEASING TOOL**

**Minimum set: Mechanical tools**

Note: For unlocking lock cylinder in steering wheel lock during removal

Series: E31, E32, E34, E36, E36/7, E38, E39, E46, E60, E61, E63, E64, E83, E85, E86, R50, R52, R53

Storage location: A31

SI number: 1 06 94 (801)

Order number: 32 3 110

Releasing tool

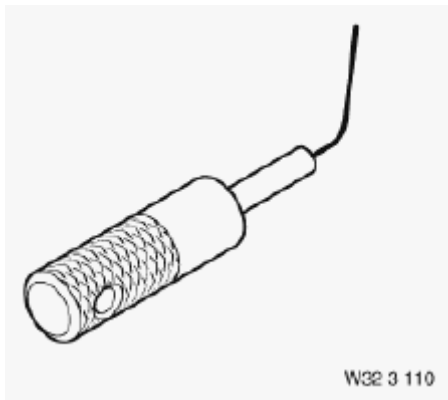


**Fig. 8: Releasing Tool (32 3 110)**

Courtesy of BMW OF NORTH AMERICA, INC.

**32 3 140 SETTING TOOL****Minimum set: Mechanical tools**

Note: For setting front camber.

Series: E38, E39, E46, E53, E65, E66, E67, E81, E83, E85, E86, E87, E90, E91, E92, E93

Storage location: C35

SI number: 1 15 05 (200)

Order number: 32 3 140

Setting tool

Consisting of:

5 = 32 3 145 Disc

Note: For adjusting camber on front axle

6 = 32 3 146 Spindle

7 = 32 3 147 Knurled screw

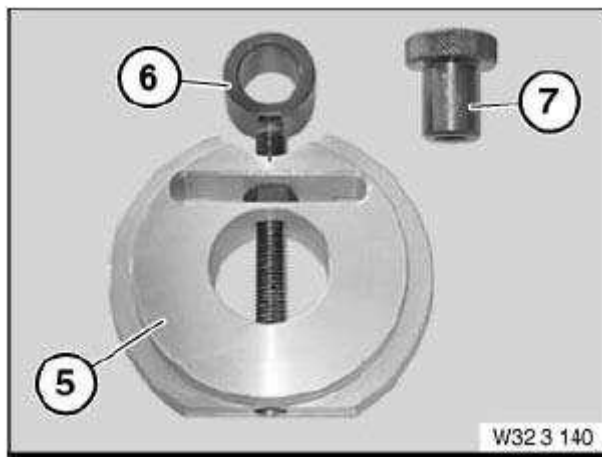


**Fig. 9: Setting Tool (32 3 140)**

Courtesy of BMW OF NORTH AMERICA, INC.

### **32 3 160 T-HANDLED SOCKET WRENCH WAF 38**

#### **Minimum set: Mechanical tools**

Note: For setting camber on front axle

Series: E53, E60, E61, E63, E64, E65, E66, E67, E70, E81, E83, E87, E90, E91, E92, E93

Storage location: A39

SI number: 1 15 99 (483)

Order number: 32 3 160

T-handled socket wrench WAF 38

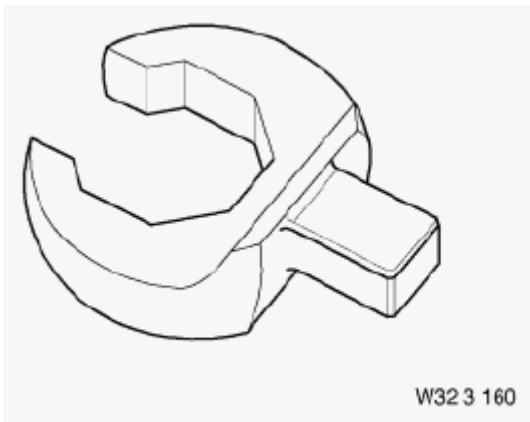


**Fig. 10: T-Handled Socket Wrench WAF 38 (32 3 160)**  
**Courtesy of BMW OF NORTH AMERICA, INC.**

### **32 4 000 FIXTURE**

Note: For checking pump pressure in power steering system

Series: E12, E21, E23, E24, E28, E30, E31, E32, E34, E36, E38, E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E70, E81, E83, E85, E86, E87, E90, E91, E92, E93

Order number: 32 4 000

Fixture

Consisting of:

1 = 32 4 001 Pressure gauge 16 bar

2 = 32 4 002 Pressure gauge 160 bar

3 = 32 4 003 Test fixture without pressure gauge

4 = 32 4 004 Line

5 = 32 4 005 Connecting piece

Note: For screwing into hydraulic pump / model series: E23, E46, E52, E53, E64, E65, E66, E85

6 = 32 4 006 Connecting piece

Note: For screwing into test fixture 32 4 003 / model series: E23, E46, E52, E53, E64, E65, E66, E85

7 = 32 4 007 Connecting piece M18x1.5

Note: For screwing into pressure regulator / model series: E32, E34

8 = 32 4 008 Connecting piece M14x1.5

Note: For screwing into test fixture / model series: E32, E34

9 = 32 4 009 Ball valve

11 = 32 4 011 Adapter M14 x 1.5

12 = 32 4 012 Adapter M16 x 1.5

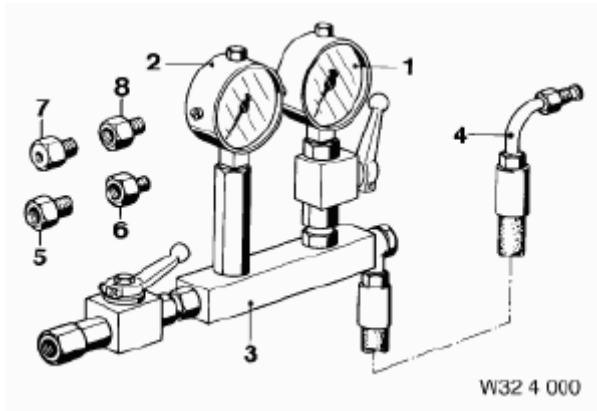


**Fig. 11: Fixture (32 4 000)**

**Courtesy of BMW OF NORTH AMERICA, INC.**

## SUSPENSION

## Steering and Wheel Alignment - Technical Data - X3

## 00 ELECTRONIC CHASSIS ALIGNMENT

## 32 00 CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E83

## TECHNICAL DATA - CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E83

|                                    |  |                                                                                                                                                                                                                          |
|------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Car loaded down to normal position |  | Vehicle with complete equipment for normal operation with:<br>2 x 68 kg on front seats (seats in central position);<br>1 x 68 kg on rear seat (center);<br>1 x 21 kg in luggage compartment (center) and full fuel tank. |
|------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 32 00 WHEEL ALIGNMENT E83 SERIES SPORT SUSPENSION (NOT LOW SLUNG)

## TECHNICAL DATA - WHEEL ALIGNMENT E83 SERIES SPORT SUSPENSION (NOT LOW SLUNG)

|                                                                                                   |  |                                          |
|---------------------------------------------------------------------------------------------------|--|------------------------------------------|
| Observe test conditions, see <b>32 00 ... TEST CONDITIONS FOR CHASSIS/WHEEL ALIGNMENT CHECK</b> . |  |                                          |
| Front axle:                                                                                       |  |                                          |
| Total toe                                                                                         |  | 0° 6' ± 12'                              |
| Camber (difference between left/right max. 30')                                                   |  | -20' ± 30'                               |
| Toe angle difference                                                                              |  | (difference between left/right max. 30') |
| - with 20° lock on inside wheel                                                                   |  | 2° 16' ± 30'                             |
| Caster angle                                                                                      |  | (difference between left/right max. 30') |
| Front wheel displacement                                                                          |  | 0° ± 15'                                 |
| Maximum wheel lock                                                                                |  |                                          |
| - Inside wheel                                                                                    |  | 38°                                      |
| - Outside wheel                                                                                   |  | 31°                                      |
| Rear axle:                                                                                        |  |                                          |
| Total toe                                                                                         |  | 0° 16' ± 12'                             |
| Camber (difference between left/right max. 15')                                                   |  | -2° ± 25'                                |
| Geometrical axis deviation                                                                        |  | 0° ± 12'                                 |

**2007 BMW X3****SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3****SUSPENSION****Steering and Wheel Alignment - Tightening Torques - X3****00 ELECTRONIC CHASSIS ALIGNMENT****32 00 STEERING****STEERING - TIGHTENING TORQUES**

|                                         | Type                                                     | Thread      | Tightening specification                                                                        | Measure |
|-----------------------------------------|----------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------|---------|
| 1AZ Steering gear to front axle carrier | E21                                                      |             |                                                                                                 | 50 Nm   |
|                                         | E21 (power steering)                                     |             |                                                                                                 | 41 Nm   |
|                                         | E12, E23, E24                                            |             |                                                                                                 | 42 Nm   |
|                                         | E24 / from 5.82, E28, E31, E32, E34                      | M12         |                                                                                                 | 80 Nm   |
|                                         | E28, E30, E36, E46                                       | M10         |                                                                                                 | 42 Nm   |
|                                         | E32/3 / 750iLs                                           | M10<br>10.9 |                                                                                                 | 110 Nm  |
|                                         | E38                                                      | M10 8.8     | Press steering gear outwards to stop on front axle support and first tighten both front screws. | 42 Nm   |
|                                         | E38 / Ball-and-nut steering, E39 / Ball-and-nut steering | M10<br>10.9 |                                                                                                 | 62 Nm   |
|                                         | E39 / Rack-and-pinion steering gear, E52                 | M10         | Replace screws                                                                                  | 42 Nm   |
|                                         | E53                                                      | M12<br>10.9 |                                                                                                 |         |
|                                         |                                                          |             | Jointing torque                                                                                 | 50 Nm   |
|                                         |                                                          |             | Torque angle                                                                                    | 90 °    |
|                                         | E60 / REAR END, E61 / REAR END, E63, E64, E65, E66, E67  |             | Replace screws & nuts                                                                           |         |
|                                         |                                                          |             | Jointing torque                                                                                 | 56 Nm   |
|                                         |                                                          |             | Torque angle                                                                                    | 90 °    |
|                                         | E61 / Four Wheel Drive, E60 / Four Wheel Drive           | M12         | Replace screws & nuts                                                                           | 120 Nm  |
|                                         | E83                                                      | M12         | Replace screws & nuts                                                                           | 100 Nm  |
|                                         | E85, E86                                                 | M10         | Replace screws & nuts                                                                           | 42 Nm   |

**13 STEERING GEAR**

**2007 BMW X3****SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3****32 13 POWER STEERING GEAR****POWER STEERING GEAR - TIGHTENING TORQUES**

|                                                   | Type                                          | Thread                | Tightening specification | Measure |
|---------------------------------------------------|-----------------------------------------------|-----------------------|--------------------------|---------|
| 6AZ Ring nut                                      | E30                                           | with 2.5 mm dia. wire |                          | 120 Nm  |
|                                                   | E30                                           | with 3.5 mm dia. wire |                          | 150 Nm  |
| 7AZ Valve housing to case                         | E30                                           |                       |                          | 18 Nm   |
| 8AZ Pressure piece cover                          | E30                                           |                       |                          | 18 Nm   |
| 9AZ Internal lines to steering gear               | E30                                           | M10                   |                          | 10 Nm   |
|                                                   | E30 / E60 / E61 / E63 / E64 / E67             | M12                   |                          | 20 Nm   |
|                                                   | E65 / E66                                     | M12                   |                          | 30 Nm   |
|                                                   | E60 / E61 / E63 / E64                         | M18                   |                          | 25 Nm   |
|                                                   | E65 / E66                                     | M18                   |                          | 60 Nm   |
| 10AZ Coupling bolt with hexagon socket            | E34 (AWD)                                     |                       |                          | 20 Nm   |
| 11AZ Pipe (pipe cringe) to steering gear          | E30 / E36                                     |                       |                          | 8 Nm    |
| 12AZ Servotronic converter to power steering gear | E60 / E61 / E63 / E64 / E65 / E66 / E67 / E83 |                       |                          | 3 Nm    |

**21 STEERING ARMS, TIE RODS, STEERING DAMPER****32 21 STEERING ARMS****STEERING ARMS - TIGHTENING TORQUES**

|                                        | Type                                                              | Thread | Tightening specification | Measure     |
|----------------------------------------|-------------------------------------------------------------------|--------|--------------------------|-------------|
| 1AZ Tie rod to ball joint (castle nut) | E21                                                               |        |                          | 60 Nm       |
| 2AZ Tie rod / axial joint to rack      | E21, E30                                                          |        | Replace retaining plate  | 75 Nm       |
|                                        | E34, E36                                                          |        | Replace retaining plate  | 71 Nm       |
|                                        | E39, E52                                                          |        |                          | 71 Nm       |
|                                        | E46, E85 / except S54, E86 / except S54                           |        |                          | 100 + 10 Nm |
|                                        | E53, E60, E61, E63, E64, E65, E66, E67, E83, E85 / S54, E86 / S54 |        |                          | 110 Nm      |
| 3AZ Tie rod end to                     |                                                                   |        |                          |             |

## 2007 BMW X3

### SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3

|                                              |                                                               |     |                                                                                                       |                 |
|----------------------------------------------|---------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------|-----------------|
| steering knuckle / swivel bearing            | E34 / Four Wheel Drive                                        |     | Replace nut                                                                                           | 50 Nm           |
|                                              | E36                                                           |     | Replace nut                                                                                           | 36 Nm           |
|                                              | E38, E39, E52                                                 |     | Replace nut                                                                                           | 65 Nm           |
|                                              | E46, E85, E86                                                 |     | Use of impact screwdriver not permitted! Replace nut                                                  | 65 Nm           |
|                                              | E53, E60 / Four Wheel Drive, E61 / Four Wheel Drive, E67, E83 |     | Replace nut                                                                                           | 80 Nm           |
|                                              | E60 / REAR END, E61 / REAR END, E63, E64, E65, E66            |     | Replace nut                                                                                           | 165 Nm          |
| 4AZ Tie rod clamping screw                   | E38, E39                                                      |     |                                                                                                       | 27 Nm           |
|                                              | E12, E23, E24, E28, E30, E31, E32, E34                        |     |                                                                                                       | 14 Nm           |
| 5AZ Tie rod end to tie rod (clamping nut)    | E34 / Four Wheel Drive, E36, E46, E85, E86                    |     |                                                                                                       | 45 Nm           |
|                                              | E39, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83         |     |                                                                                                       | 51 Nm           |
| 6AZ Steering drop arm to steering gear       | E32, E34 / Four Wheel Drive                                   |     |                                                                                                       | 59 Nm           |
|                                              | E23                                                           | M26 | Tightening value may be exceeded up to correct position to locking plate                              | at least 180 Nm |
|                                              | E12, E23, E24, E28                                            | M22 | Tightening value may be exceeded up to correct position to locking plate                              | at least 140 Nm |
|                                              | E31                                                           |     |                                                                                                       | 70 Nm           |
|                                              | E38, E39                                                      |     | Note direction of screw thread. In direction of travel: from left on LHD or from right on RHD vehicle | 61 Nm           |
| 7AZ Steering guide arm to front axle carrier | E39                                                           |     |                                                                                                       | 62 Nm           |
|                                              | E23, E24, E28, E31, E32, E34, E38                             | M10 |                                                                                                       | 42 Nm           |
|                                              | E12, E23, E24                                                 | M12 |                                                                                                       | 85 Nm           |
| 8AZ Track rod arm to strut                   | E12, E24(upto 5.82)                                           |     | Bolts secured with: Wire                                                                              | 55 Nm           |
|                                              | E23, E24 (from 5.82), E28                                     |     | Bolts secured with: Loctite No. 270<br>Clean threads of tapped bores and bolts.                       | 62 Nm           |
|                                              | E31, E32, E34                                                 |     | Bolts secured with: Loctite No. 270<br>Clean threads of tapped bores and                              | 110 Nm          |

**2007 BMW X3****SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3**

|                                    |                                     |  |                                                                                 |       |
|------------------------------------|-------------------------------------|--|---------------------------------------------------------------------------------|-------|
|                                    |                                     |  | bolts.                                                                          |       |
|                                    | E30 / M3                            |  | Bolts secured with: Loctite No. 270<br>Clean threads of tapped bores and bolts. | 30 Nm |
| 9AZ Tie rod arm to control arm     | E12, E23, E24 (up to 5.82)          |  |                                                                                 | 66 Nm |
|                                    | E30 / M3                            |  |                                                                                 | 66 Nm |
|                                    | E24 (from 5.82), E28, E31, E32, E34 |  |                                                                                 | 93 Nm |
| 10AZ Leading strut to tie rod arm  | E23                                 |  |                                                                                 | 93 Nm |
| 11AZ Trailing strut to tie rod arm | E31, E32, E34                       |  |                                                                                 | 93 Nm |

**31 STEERING COLUMN****32 31 STEERING COLUMN****STEERING COLUMN - TIGHTENING TORQUES**

|                                                                                                      | Type                                                                                                 | Thread  | Tightening specification               | Measure |
|------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------|----------------------------------------|---------|
| 1AZ Universal joint / coupling to steering gear / steering spindle                                   | E12, E24 / until 5.82                                                                                |         | Replace clamping screw                 | 25 Nm   |
|                                                                                                      | E21, E23, E24 / from 5.82, E28, E30, E31, E32, E34, E46, E52, E60, E61, E63, E64, E65, E66, E67, E83 |         | Recut thread<br>Replace clamping screw | 22 Nm   |
|                                                                                                      | E36, E38, E39                                                                                        |         | Recut thread<br>Replace clamping screw | 19 Nm   |
|                                                                                                      | E53 / Steel joint                                                                                    | M8 10.9 | Recut thread<br>Replace clamping screw | 24 Nm   |
|                                                                                                      | E53 / Aluminium joint                                                                                | M8 10.9 | Recut thread<br>Replace clamping screw | 28 Nm   |
|                                                                                                      | E85, E86                                                                                             | M8      | Recut thread<br>Replace clamping screw | 30 Nm   |
| 2AZ Bearing block for steering column adjustment to instrument panel carrier and pedal bearing block | E31, E32, E34                                                                                        | M8      |                                        | 22 Nm   |
| 3AZ Hexagon screw to bearing                                                                         |                                                                                                      |         |                                        |         |

# 2007 BMW X3

## SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3

|                                                                   |                                                  |             |                                        |        |
|-------------------------------------------------------------------|--------------------------------------------------|-------------|----------------------------------------|--------|
| block for steering column adjustment                              | E12, E24 / until 5.82                            | M10 x 115   |                                        | 25 Nm  |
|                                                                   | E28, E24 / from 5.82                             | M8 x 110    |                                        | 22 Nm  |
|                                                                   | E23                                              | M10 x 170   |                                        | 27 Nm  |
|                                                                   | E31, E32, E34                                    |             | Observe repair instruction.            |        |
|                                                                   | E38, E39, E53                                    | M8          | Adjustment lever in clamped position   | 3.0 Nm |
|                                                                   | E46, E83                                         | M8          | Value 1                                | 4.0 Nm |
|                                                                   |                                                  |             | Value 2                                | 4.8 Nm |
|                                                                   | E85, E86                                         | M8          | Adjusting lever without needle bearing | 6 Nm   |
|                                                                   |                                                  |             | Adjusting lever with needle bearing    | 3.2 Nm |
| 4AZ Clamp / shackle for outer steering tube                       | E12, E21, E24, E28                               |             |                                        | 22 Nm  |
|                                                                   | E23                                              |             |                                        | 10 Nm  |
| 5AZ Airbag: Steering column to holder                             | E23, E24, E28                                    |             |                                        | 18 Nm  |
| 6AZ Steering column to instrument panel / support tube            | E60, E61, E63, E64, E65, E66, E67, E83, E85, E86 |             |                                        | 21 Nm  |
| 7AZ Steering column to dashboard                                  | E12, E23, E24, E28                               |             |                                        | 14 Nm  |
| 8AZ Sliding piece (screw / nut)                                   | E46                                              |             |                                        | 9.5 Nm |
| 9AZ Control unit, steering column (CIM) to steering column        | E65, E66, E67                                    |             |                                        | 2.5 Nm |
| 10AZ Bracket for sleeve to body                                   | E85, E86                                         | M6          |                                        | 2.4 Nm |
|                                                                   | E83                                              | M6          |                                        | 2.8 Nm |
| 11AZ Cable holder to steering column                              | E46                                              | M5 (silver) |                                        | 8.8 Nm |
|                                                                   | E46                                              | M5 (black)  |                                        | 4 Nm   |
| 12AZ Electric drive to steering column                            | E65, E66                                         | M6          |                                        | 8 Nm   |
|                                                                   | E60, E61, E63, E64                               |             |                                        | 6 Nm   |
| 13AZ Steering spindle to double universal joint / universal joint | E53, E65, E66, E67, E83                          |             | Recut thread<br>Replace clamping       | 28 Nm  |

**2007 BMW X3****SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3**

|                                                                 |                                                |    |                                        |         |
|-----------------------------------------------------------------|------------------------------------------------|----|----------------------------------------|---------|
|                                                                 |                                                |    | screw                                  |         |
| 14AZ Universal joint with corrugated tube to steering gear      | E65, E66, E67                                  |    | Recut thread<br>Replace clamping screw | 22 Nm   |
| 15AZ Bearing block of steering column to bulkhead               | E83                                            | M8 | Replace nuts                           | 21.4 Nm |
| 16AZ Steering column to bearing block                           | E83                                            | M6 | Stick in nut again                     | 8.8 Nm  |
| 17AZ Steering spindle middle section to assembly partition wall | E60 / Four Wheel Drive, E61 / Four Wheel Drive |    |                                        | 6 Nm    |

**33 STEERING WHEEL****32 33 STEERING WHEEL****STEERING WHEEL - TIGHTENING TORQUES**

|                                                                 | Type                                                                                          | Thread | Tightening specification | Measure |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------|--------------------------|---------|
| 1AZ Steering wheel to steering column                           | E12, E21, E24, E23, E28, E30                                                                  | Nut    |                          | 80 Nm   |
|                                                                 | E31, E32, E34, E36, E38, E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83, E85, E86 | Screw  |                          | 62.5 Nm |
| 2AZ Retaining plate to steering wheel                           | E60, E61, E63, E64                                                                            | M5     |                          | 6 Nm    |
| 3AZ Voltage regulator to steering wheel                         | E60, E61                                                                                      | M5x12  | Replace screws           | 3 Nm    |
| 4AZ Engine electrics, Lane Departure Warning, to steering wheel | E60, E61                                                                                      | M5x12  | Replace screws           | 4 Nm    |

**34 STEERING WHEEL FOR AIRBAG****32 34 AIRBAG AND AIRBAG STEERING WHEEL****AIRBAG AND AIRBAG STEERING WHEEL - TIGHTENING TORQUES**

|                                   | Type                                    | Thread | Tightening specification | Measure |
|-----------------------------------|-----------------------------------------|--------|--------------------------|---------|
| 1AZ Airbag unit to steering wheel | E23 / E24 / E28 / E30 / E31 / E32 / E34 |        | Airbag unit I            | 8 Nm    |
|                                   | E36 / E38 / E39 / E46                   |        | Airbag unit II           | 2 Nm    |
|                                   | E53 / E83                               | M6     |                          | 8 Nm    |

## 41 PUMP AND OIL SUPPLY

### 32 41 PUMP AND OIL SUPPLY

#### PUMP AND OIL SUPPLY - TIGHTENING TORQUES

|                                                                                                                                             | Type                                                                                                                              | Thread         | Tightening specification                             | Measure |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------|---------|
| 1AZ Power steering pump / bearing block of power steering pump to crankcase / oil sump / oil filter unit carrier / A / C compressor carrier | E39 / M5                                                                                                                          |                | Observe tightening sequence                          | 25 Nm   |
|                                                                                                                                             | E46 / M57TU, E53 / M57TU, E60 / M57TU / M57T2, E61 / M57TU / M57T2, E65 / M57TU / M57T2, E66 / M57T2, E83 / M47T2 / M57TU / M57T2 | M6             |                                                      | 8 Nm    |
|                                                                                                                                             | E65 / N62 / N73, E66 / N62 / N73, E67 / N62 / N73                                                                                 | M8             | Replace nuts                                         | 21 Nm   |
|                                                                                                                                             | E60 / N52 / N53, E61 / N52 / N53, E63 / N52 / N53, E64 / N52 / N53, E65 / N52, E66 / N52, E83 / N52                               | M10 x 33       | Replace aluminium screws Observe repair instruction  |         |
|                                                                                                                                             |                                                                                                                                   |                | Jointing torque                                      | 20 Nm   |
|                                                                                                                                             |                                                                                                                                   |                | Torque angle                                         | 90 °    |
|                                                                                                                                             | E60 / N54, E61 / N54                                                                                                              | M10            | Observe repair instruction                           | 38 Nm   |
|                                                                                                                                             | E36, E38, E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E83                                                              |                | Note shims, refer also to Service Information Gr. 32 | 21 Nm   |
|                                                                                                                                             | E85 / S54, E86 / S54                                                                                                              | M8             |                                                      | 21 Nm   |
| 2AZ Pump bracket on engine support                                                                                                          | E38 / M60 / 1 / M60 / 2 / M62, E39 / M62                                                                                          |                |                                                      | 22 Nm   |
| 3AZ Hydraulic line connections to vane pump / power steering pump and steering gear / banjo bolts, steering hydraulics                      | E38                                                                                                                               | Banjo bolt M12 | Replace sealing rings                                | 33 Nm   |
|                                                                                                                                             | E36, E39, E46, E52                                                                                                                | Banjo bolt M14 | Replace sealing rings                                | 35 Nm   |
|                                                                                                                                             | E38                                                                                                                               | Banjo bolt M14 | Replace sealing rings                                | 39 Nm   |
|                                                                                                                                             | E53, E60, E61, E63, E64, E65, E66, E85 / S54, E86 / S54                                                                           | Banjo bolt M14 | Replace sealing rings                                | 33 Nm   |
|                                                                                                                                             | E36, E38, E39, E46 / S54, E52                                                                                                     | Banjo          | Replace sealing                                      | 40 Nm   |

## 2007 BMW X3

### SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3

|                                                                   |                                                  | bolt M16       | rings                           |        |
|-------------------------------------------------------------------|--------------------------------------------------|----------------|---------------------------------|--------|
|                                                                   | E46 / N40 / N42 / N45 / N46                      | Banjo bolt M16 | Replace sealing rings           | 42 Nm  |
|                                                                   | E53, E60, E61, E63, E64, E65, E66                | Banjo bolt M16 | Replace sealing rings           | 39 Nm  |
|                                                                   | E83 / N46, E85 / S54, E86 / S54                  | Banjo bolt M16 | Replace sealing rings           | 35 Nm  |
|                                                                   | E38, E53                                         | Banjo bolt M18 | Replace sealing rings           | 45 Nm  |
|                                                                   | E36, E38, E39, E46, E53, E60, E61, E63, E64, E83 | Cap screw      | Replace sealing ring            | 36 Nm  |
|                                                                   | E65, E66, E67                                    | Cap screw      | Replace sealing ring            | 39 Nm  |
| 4AZ Hydraulic line connections to DS controller                   | E31, E32, E34                                    |                |                                 | 40 Nm  |
| 5AZ Mounting of hydraulic line                                    | E60, E61, E63, E64, E65, E66, E67                | M6             | Screw, nut or rubber-metal body | 7.5 Nm |
|                                                                   | E60, E61, E65, E66, E67                          | M8             | Screw, nut or rubber-metal body | 19 Nm  |
|                                                                   | E83, E85 / S54, E86 / S54                        | M6             | Screw, nut or rubber-metal body | 8 Nm   |
| 6AZ Holder, expansion hose, to vane pump / power steering pump    | E60, E61, E63, E64, E65, E66                     | M6 8.8         |                                 | 7.5 Nm |
|                                                                   | E65 / M67                                        | M8-8           |                                 | 19 Nm  |
| 7AZ Mounting hydraulic pump to engine block / oil sump            | E65                                              |                |                                 | 3 Nm   |
| 8AZ Oil reservoir to body (Dynamic Drive / active front steering) | E60, E61                                         | M6             |                                 | 5.5 Nm |
| 9AZ Oil reservoir to holder                                       | E60, E61, E63, E64, E67, E83                     | M6             |                                 | 4 Nm   |
|                                                                   | E85 / S54, E86 / S54                             | M6             |                                 | 5.5 Nm |
| 10AZ Expansion hose part 1 to part 2                              | E60, E61, E63, E64, E65, E66                     |                |                                 | 30 Nm  |
| 11AZ Expansion hose mounting                                      | E60                                              | M6             |                                 | 10 Nm  |
| 12AZ Line fastening steering hydraulics                           | E60                                              | M6             |                                 | 7.5 Nm |
|                                                                   | E60                                              | M8             |                                 | 19 Nm  |
| 13AZ Oil tank holder to body                                      | E83                                              | M8             |                                 | 19 Nm  |
| 14AZ Belt pulley to power steering pump                           | E60, E61, E63, E64, E65, E66, E67                | M8 8.8         |                                 | 22 Nm  |
|                                                                   | E39, E46, E53, E65, E66, E67                     | M8 10.9        |                                 | 27 Nm  |
|                                                                   | E83 / M54 / N46                                  | M8             |                                 | 28 Nm  |

## 2007 BMW X3

### SUSPENSION Steering and Wheel Alignment - Tightening Torques - X3

|                                                          |                                                                  |         |                          |       |
|----------------------------------------------------------|------------------------------------------------------------------|---------|--------------------------|-------|
|                                                          | E83 / M57TU / M57T2 / M47T2, E85 / S54, E86 / S54                | M8      |                          | 22 Nm |
| 15AZ Bracket, pressure line, Dynamic Drive, to oil sump  | E65 / M57TU / M57T2, E66 / M57T2                                 |         |                          | 19 Nm |
| 16AZ Bracket, pressure line, to steering gear            | E60, E61, E63, E64                                               | M8      |                          | 19 Nm |
| 17AZ Bracket, hydraulic line, to stabilizer bar mounting | E60, E61, E63, E64                                               | M6      |                          | 12 Nm |
| 18AZ Bracket, power steering pump, to crankcase          | E63 / N52, E64 / N52                                             | M10     | Replace aluminium screws |       |
|                                                          |                                                                  |         | Jointing torque          | 20 Nm |
|                                                          |                                                                  |         | Torque angle             | 90 °  |
| 19AZ                                                     |                                                                  |         |                          |       |
| 20AZ Power steering pump to water pump                   | E46 / N40 / N42 / N45 / N46                                      | M8      |                          | 32 Nm |
|                                                          | E83 / N46                                                        | M8      |                          | 28 Nm |
| 21AZ Bracket, pressure line (ARS), to crankcase          | E63 / N52, E64 / N52                                             | M10     | Replace aluminium screws |       |
|                                                          |                                                                  |         | Jointing torque          | 20 Nm |
|                                                          |                                                                  |         | Torque angle             | 90 °  |
|                                                          | E60 / N52, E61 / N52, E63 / N52, E64 / N52, E65 / N52, E66 / N52 | M8x17.5 | Replace aluminium screw  |       |
|                                                          |                                                                  |         | Jointing torque          | 8 Nm  |
|                                                          |                                                                  |         | Torque angle             | 45 °  |
| 22AZ Pressure line to power steering gear                | E85 / S54, E86 / S54                                             | M14     | Replace sealing rings    | 33 Nm |
| 23AZ Return line to power steering gear                  | E85 / S54, E86 / S54                                             | M16     | Replace sealing rings    | 35 Nm |