

SUSPENSION**Steering and Wheel Alignment - Repair Instructions - 528xi, 535xi****00 ELECTRONIC CHASSIS ALIGNMENT****00 DANGER OF POISONING IF OIL IS INGESTED/ABSORBED THROUGH THE SKIN****Danger of poisoning!**

Ingesting oil or absorbing through the skin may cause poisoning!

Possible symptoms are:

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

Protective measures/rules of conduct:

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

First aid measures:

- Do not induce vomiting.

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

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

00 RISK OF INJURY IF OIL COMES INTO CONTACT WITH EYES AND SKIN**Danger of injury!**

Contact with eyes or skin may result in injury!

Possible symptoms are:

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

Protective measures/rules of conduct:

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

First aid measures:

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

NOTE: Do not use solvents/thinners.

00 SAFETY INSTRUCTIONS FOR HANDLING OIL

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

Recycling:

Observe country-specific waste-disposal regulations.

Measures if oil is unintentionally released:

- Personal precautionary measures: Danger of slipping! Keep non-involved persons away from the work area. Wear personal protective clothing/equipment.
- Environmental protection measures: Prevent oil from draining into drain channels, sewerage systems, pits, cellars, water and the ground.
- Limiting spread: Use oil blocks to prevent the surface spread of oil.
- Cleaning procedure: Bind and dispose of escaped oil with nonflammable absorbents.

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

00... ... RAISING VEHICLE WITH TROLLEY JACK

IMPORTANT: Observe the following trolley-jack-related instructions:

1. Use only BMW-distributed/approved trolley jacks which have rubber plate contact points.
2. Trolley jacks must be regularly serviced and always checked for functional reliability before they are used!
3. Check the rubber plate on the trolley jack prior to each use, replacing if necessary.

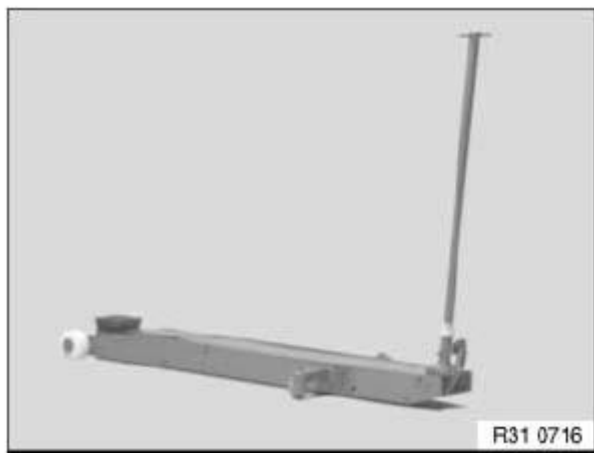


Fig. 1: Identifying Trolley Jack

Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: The vehicle may be raised with a trolley jack only at the following jacking points!

1. Carjacking point
2. Side carjacking points
3. Rear differential

Risk of damage: It is not permitted to raise the vehicle at the rear differential cover!

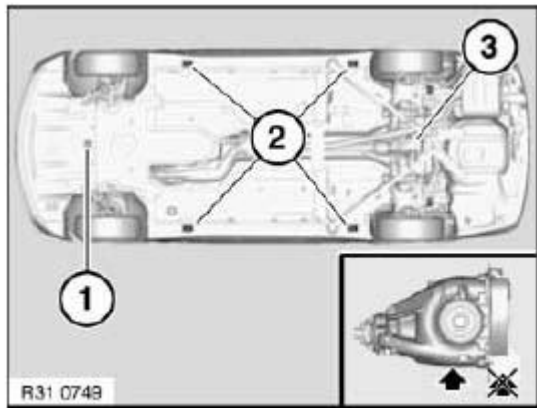


Fig. 2: Identifying Jacking Points

Courtesy of BMW OF NORTH AMERICA, INC.

31 00 ... FRONT AXLE + STEERING (AWD): WHEEL/CHASSIS ALIGNMENT CHECK MUST BE CARRIED OUT AFTER THE FOLLOWING WORK

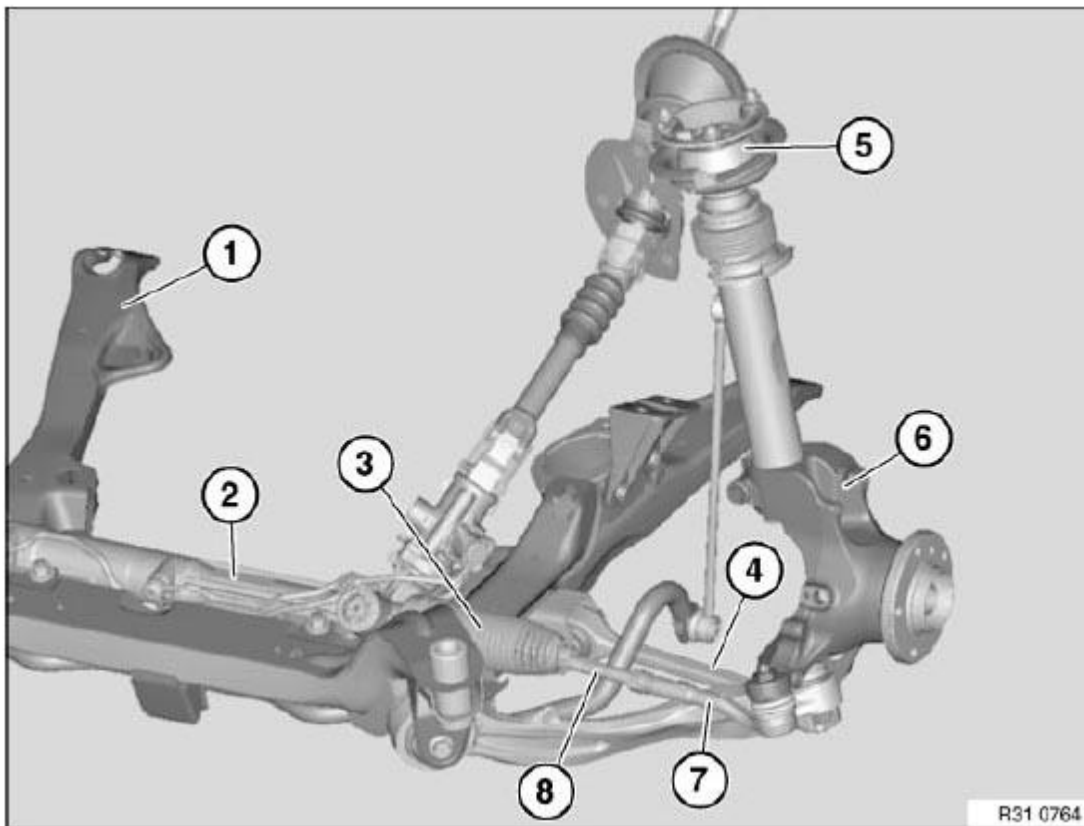


Fig. 3: Identifying Front Axle Components

Courtesy of BMW OF NORTH AMERICA, INC.

A wheel/chassis alignment check (see **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP**

TO DESIGN POSITION or KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH RIDE-HEIGHT MEASUREMENT WITHOUT LOAD) must be carried out after the following work:

- Release of following screw/bolt connections:
 - Steering gear to front axle carrier
 - Control arm to front axle carrier
 - Support bearing to body (if centering pin is missing)
 - Tie rod end to tie rod
- Replacement of following parts:
 1. Front axle carrier
 2. Steering gear
 3. Gaiter (if the tie rod end has to be screwed off)
 4. Control arm
 5. Support bearing (if centering pin is missing)
 6. Swivel bearing
 7. Tie rod end
 8. Tie rod

31 00 ... INSTRUCTIONS (DAMAGE TO SUSPENSION)

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

To repair vehicle correctly, depending on condition of vehicle, perform the following troubleshooting procedure:

You must also follow the **RULES AND GUIDELINES FOR ACCIDENT-RELATED REPAIRS TO THE STEERING GEAR**.

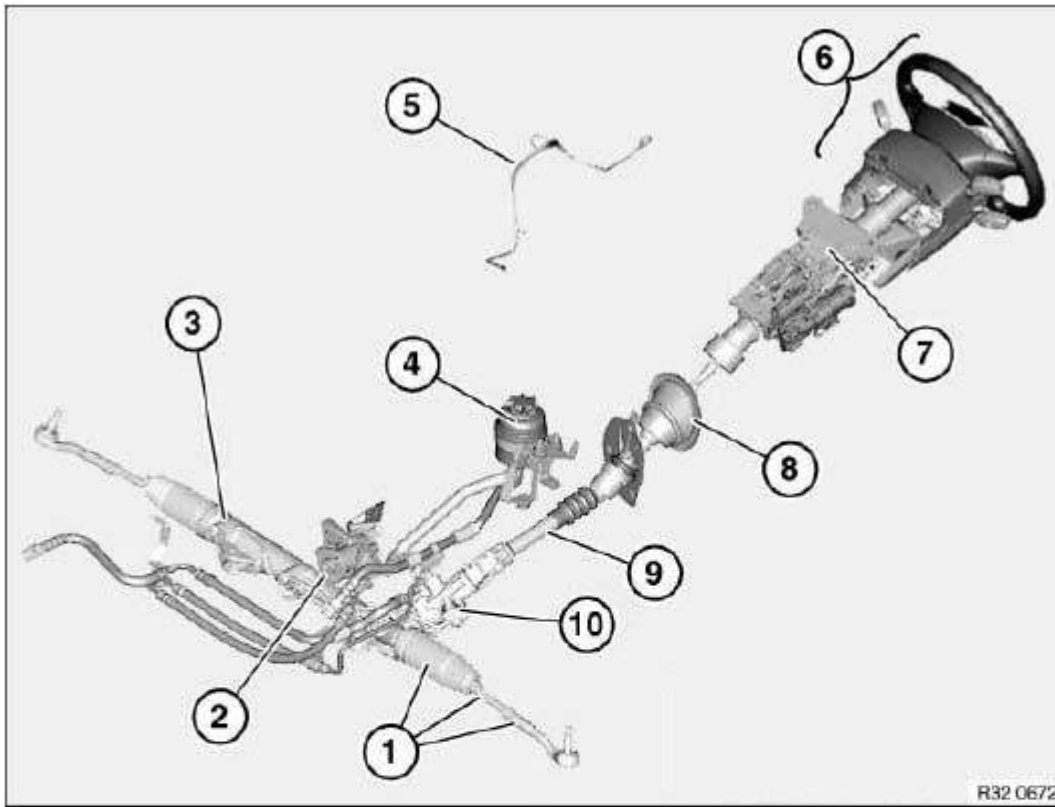
Troubleshooting

TROUBLESHOOTING CHART

Vehicle condition	Possible cause	Remedy
1 Camber inside/toe-in outside the nominal value, adjustment of track alignment possible	a. Screw connection not OK b. Tie rod or journal of tie rod end is deformed c. One or both tension struts is/are deformed d. Control arm deformed	a. Check screw connections: <u>TIE ROD END</u> to swivel bearing <u>TIE ROD</u> to power steering gear <u>POWER STEERING</u>

		<u>GEAR</u> to front axle carrier b. Replace <u>TIE ROD</u>, <u>TENSION STRUT</u> and <u>SWIVEL BEARING</u> IMPORTANT: If the journal of the tie rod end is deformed, the <u>POWER STEERING GEAR</u> must also be replaced c. Replace <u>TENSION STRUT</u> and <u>SWIVEL BEARING</u> d. Replace <u>CONTROL ARM</u>, <u>TENSION STRUT</u> and <u>SWIVEL BEARING</u>
2 Camber inside/toe-in outside the nominal value, adjustment of track alignment possible	Powerful forces acting on steering/front axle components	Replace <u>TIE RODS</u> Replace <u>SWIVEL BEARING</u> Replace <u>POWER STEERING GEAR</u> Replace <u>TENSION STRUT</u> Replace <u>CONTROL ARMS</u>
3 Camber/toe-in outside the nominal value, adjustment of track alignment not possible	Powerful forces acting on front axle with distortion of: a. Screw connections b. Front axle support c. See Pt. 1 b) to d) d. Spring strut/piston rod	a. Check screw connections, replace the relevant part if necessary b. Replace <u>FRONT AXLE CARRIER</u> c. See Pt. 1 b) to d) d. Replace <u>SPRING STRUT</u>

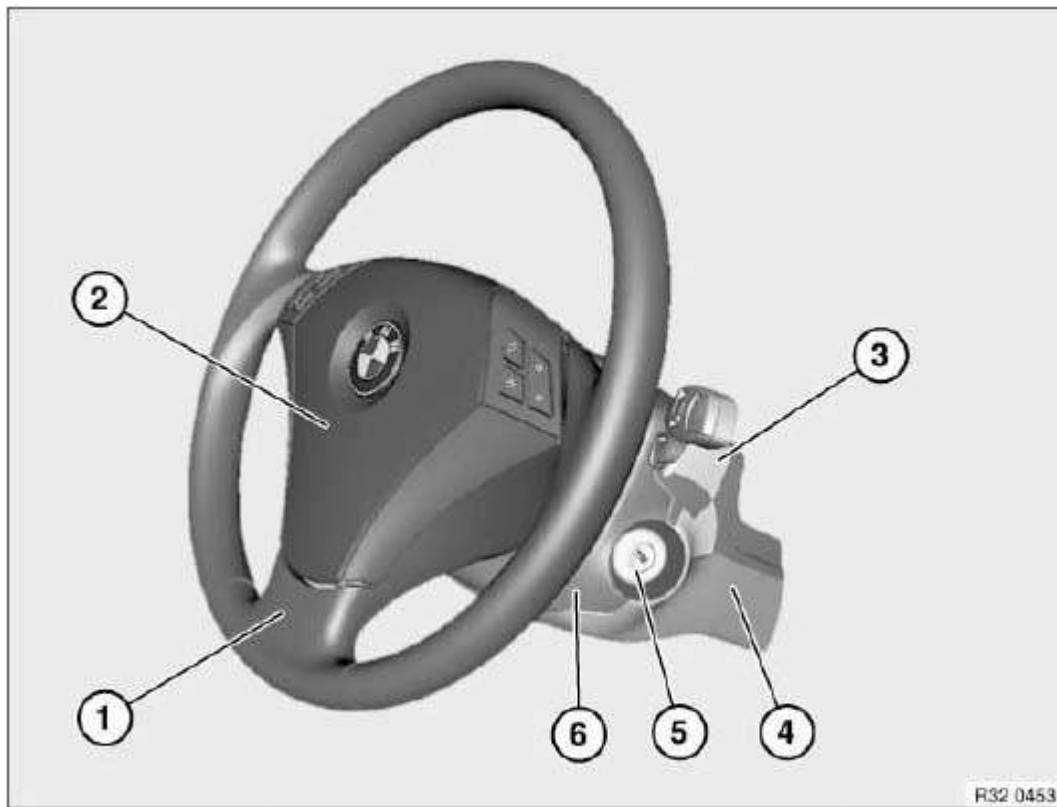
32 OVERVIEW OF STEERING (AWD)



- | | | | |
|---|---|----|---|
| 1 | <u>Tie rod / tie rod end / gaiter</u> | 7 | <u>Steering column / el. steering column lock</u> |
| 2 | <u>Vane pump</u> | 8 | <u>Sleeve</u> |
| 3 | <u>Power steering gear</u> | 9 | <u>Steering spindle lower section</u> |
| 4 | <u>Oil container</u> | 10 | <u>Servotronic converter</u> |
| 5 | Up to 09/2005: <u>Interlock cable</u> | | |
| 6 | <u>Overview of steering wheel/casing components</u> | | |

Fig. 4: Identifying Steering Components (AWD)
 Courtesy of BMW OF NORTH AMERICA, INC.

32 OVERVIEW OF STEERING WHEEL / CASING COMPONENTS / LOCK CYLINDER



- 1 Steering wheel / decorative strips
 2 Airbag unit
 3 Upper steering column casing

- 4 Lower steering column casing
 5 Lock cylinder
 6 Front steering column casing

Fig. 5: Identifying Steering Wheel Components
 Courtesy of BMW OF NORTH AMERICA, INC.

32 00 ... CHASSIS/WHEEL ALIGNMENT CHECK PROCEDURE

CHASSIS/WHEEL ALIGNMENT CHECKING PROCEDURE CHART

	Check adherence to test conditions					
	I V					
	Position vehicle on measuring stand					
	I V					
	Measure vehicle ride height		OK ->		Carry out CHASSIS/WHEEL ALIGNMENT CHECK with ride-	

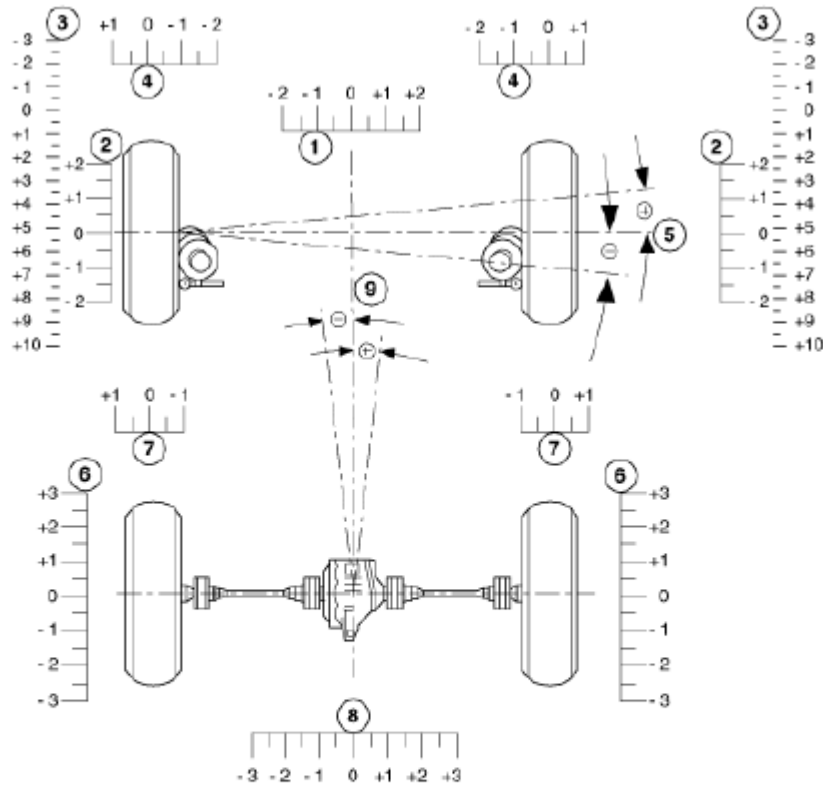
2010 BMW 535xi

SUSPENSION Steering and Wheel Alignment - Repair Instructions - 528xi, 535xi

					height measurement without load..	
	Read off setpoint value in KDS Tolerance -20 / +40 mm per wheel permissible Difference between left / right max. 10 mm permissible					
	Not OK / no data I V					
	Move vehicle into <u>NORMAL POSITION</u>					
	Introduce load and measure ride heights					
	Read off setpoint value in KDS Tolerance $\pm$ 10 mm per wheel permissible Difference between left / right max. 10 mm permissible		Not OK ->			
	OK I V				Check suspension for damage, repair if necessary	
	Move vehicle into <u>DESIGN POSITION</u>		<- Not OK			
	Add/distribute weights and measure ride heights					
	Read off setpoint value in KDS Tolerance $\pm$ 2 mm per wheel permissible Difference between left / right max. 2 mm permissible					
	I V					
	Carry out KDS					

**CHASSIS/WHEEL
ALIGNMENT
CHECK** with load
up to design
position

32 00 ... GENERAL CHASSIS AND SUSPENSION DEFINITIONS



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- | | |
|---|------------------------|
| 1. Toe | 5. Wheel offset |
| 2. Camber | 6. Camber |
| 3. Caster (with 10° or 20° wheel lock) | 7. Rear-wheel position |
| 4. Toe angle difference (with 20° wheel lock) | 8. Toe |
| | 9. Geometrical axis |

Fig. 6: Identifying Chassis And Suspension Dimensions

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.

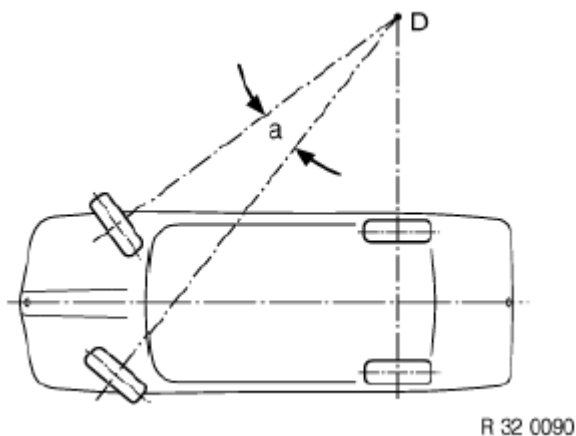


Fig. 7: Identifying Toe Angle Difference
Courtesy of BMW OF NORTH AMERICA, INC.

Camber

Inclination of the wheel from the perpendicular.

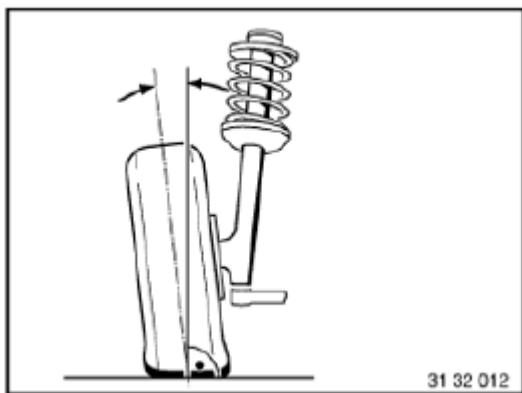


Fig. 8: Identifying Camber
Courtesy of BMW OF NORTH AMERICA, INC.

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".

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.

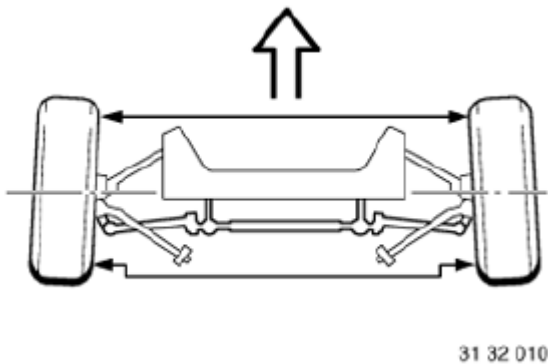
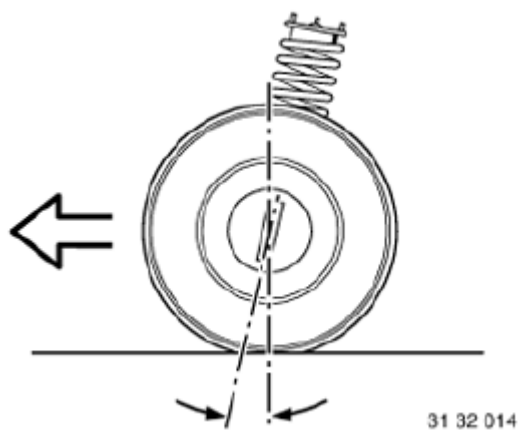


Fig. 9: Identifying Toe

Courtesy of BMW OF NORTH AMERICA, INC.

**Fig. 10: Identifying Caster**

Courtesy of BMW OF NORTH AMERICA, INC.

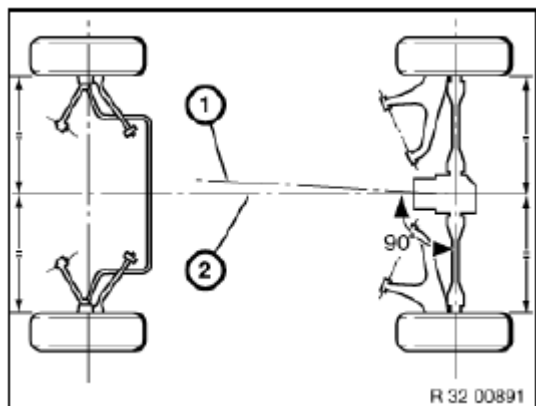
Geometrical axis 1

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

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

Symmetrical axis 2

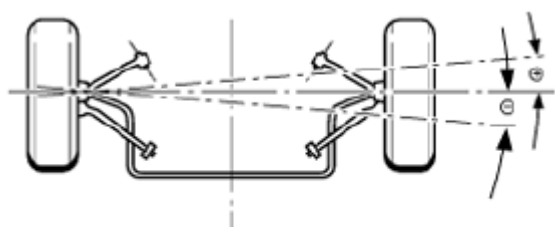
Center line running through front and rear axles.

**Fig. 11: Identifying Geometrical Axis 1**

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.



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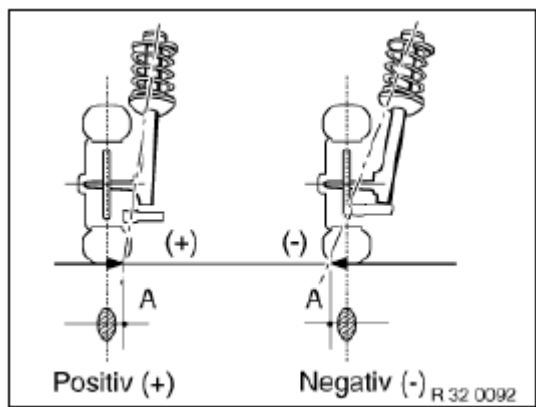
Fig. 12: Identifying Wheel Offset

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. 13: Identifying 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 ... IDENTIFYING SUSPENSION FROM LABEL ON FRONT AXLE

NOTE: The type of suspension can be identified from the label on the spring strut/shock absorber.

Label:

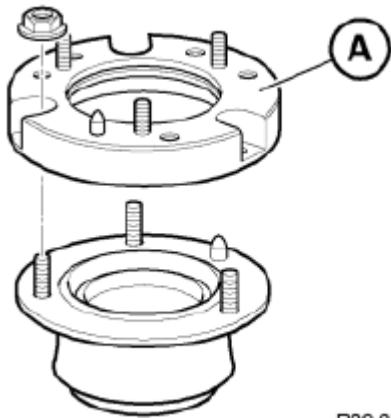
1. BMW part number
2. Type of suspension
 - BA = Standard suspension (basic)
 - SP = Sport suspension or rough road package SP
 - 60BAX = E60, E61 AWD
 - MSP = M Sport suspension
 - CHL = China Long
 - Option SA 815 = rough road package



Fig. 14: Identifying Spring Strut/Shock Absorber Label
Courtesy of BMW OF NORTH AMERICA, INC.

In the case of "SP" identification, there is a further distinction between:

- Sport suspension without spacer ring (A)
- Rough road package with spacer ring (A) above the support bearing



R32 0717

Fig. 15: Identifying Spacer Ring

Courtesy of BMW OF NORTH AMERICA, INC.

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
 - Version with electric steering gear (EPS): Examine in particular the control unit with all plug connections for damage and hairline cracks.
- B. Unacceptable torque increase and jamming when the steering gear is turned from lock to lock (without hydraulic/electrical 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**
- 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 Technical Data: See **FRONT AXLE - RIDE HEIGHT E60, E61** . **FRONT AXLE - RIDE HEIGHT E61 / AWD** , **REAR AXLE - RIDE HEIGHT E61** , or **REAR AXLE - RIDE HEIGHT E61 / AWD**).

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.
- 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 **TECHNICAL DATA**) into vehicle
- Determine **VEHICLE RIDE HEIGHT**

NOTE: If the vehicle ride height is not inside the tolerance (refer to FRONT AXLE - RIDE HEIGHT E60, E61 , FRONT AXLE - RIDE HEIGHT E61 / AWD , REAR AXLE - RIDE HEIGHT E61 , or REAR AXLE - RIDE HEIGHT E61 / AWD), 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 tire sizes.
2. Correct tread depth. The tread depth for each axle may differ from left to right by max. 1-2 mm.
3. Correct tire inflation pressure (see instruction plate on car).
4. Wheel bearing clearance OK
5. Steering backlash OK
6. Condition of suspension and shock absorbers OK: Visually inspect for breakage, etc.
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, tires 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.**

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

Fault	Cause	Remedy
Toe deviation	Tie rod end worn	Replace <u>TIE ROD END</u>
	Tie rod bent	Replace <u>TIE ROD</u>
	Rubber mount or ball joint of control arm faulty	Replace <u>CONTROL ARMS</u>
	Rubber mount or ball joint/guide joint of tension strut faulty	Replace <u>RUBBER MOUNT</u> or <u>GUIDE JOINT /BOTH TENSION STRUTS</u>
Camber deviation	Rubber mount or ball joint of control arm faulty	Replace <u>CONTROL ARMS</u>
	Control arm deformed	Replace <u>CONTROL ARMS</u>
	Rubber mount or ball joint/guide joint of tension strut faulty	Replace <u>RUBBER MOUNT</u> or <u>GUIDE JOINT /BOTH TENSION STRUTS</u>
	Tension strut deformed	Replace <u>BOTH TENSION STRUTS</u>
	Spring strut/piston rod of shock absorber deformed	Replace <u>FRONT SPRING STRUT</u>
	Ride height between driver's and passenger sides different	Check load, correct if necessary Replace <u>COIL SPRING</u>
	Front axle carrier deformed	Replace <u>FRONT AXLE CARRIER</u>
Caster deviation NOTE: Caster is defined by design and cannot be adjusted	Rubber mount or ball joint of control arm faulty	Replace <u>CONTROL ARMS</u>
	Control arm deformed	Replace <u>CONTROL ARMS</u>
	Rubber mount or ball joint/guide joint of tension strut faulty	Replace <u>RUBBER MOUNT</u> or <u>GUIDE JOINT /BOTH TENSION STRUTS</u>
	Tension strut deformed	Replace <u>BOTH TENSION STRUTS</u>
	Spring strut/piston rod of shock absorber deformed	Replace <u>FRONT SPRING STRUT</u>
	Front axle carrier deformed	Replace <u>FRONT AXLE CARRIER</u>
	Ride height between driver's and passenger sides different	Check load , correct if necessary Air spring strut: Carry out <u>RIDE-HEIGHT-CALIBRATION</u> Check <u>COIL SPRINGS</u> , replace if necessary

Toe-difference angle deviation Prerequisite: camber and caster are correct	Tie rods not adjusted uniformly	Adjust toe on left and right sides to same value
Wheel-offset deviation Prerequisite: front wheels have equal single toe to geometrical axis	Front axle carrier deformed	Replace <u>FRONT AXLE CARRIER</u>
	Control arm deformed	Replace <u>CONTROL ARMS</u>
	Tension strut deformed	Replace <u>BOTH TENSION STRUTS</u>

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

Substandard roadholding, atypical noises, tires 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

Fault	Cause	Remedy
Camber/toe deviation	Rubber mount/ball joint of control or guide arm faulty	Replace <u>CONTROL</u> or <u>GUIDE ARM</u>
	Control or guide arm deformed	Replace <u>CONTROL</u> or <u>GUIDE ARM</u>
	Ball joint in wheel carrier faulty	Replace <u>BALL JOINT</u>
	Integral link deformed	Replace <u>INTEGRAL LINK</u>
	Rubber mount of swinging arm faulty	Replace <u>SWINGING ARM</u>
	Swinging arm deformed	Replace <u>SWINGING ARM</u>
	Rubber mount of rear axle carrier faulty	Replace <u>RUBBER MOUNT</u>
	Rear axle carrier deformed	Replace <u>REAR AXLE CARRIER</u>
Rear-wheel position incorrect	Rear axle carrier laterally displaced/skewed	Replace <u>RUBBER MOUNT</u>

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

IMPORTANT: Carry out chassis/wheel alignment check in design position only:

- if the technical prerequisites for an alignment check with ride-height input

are lacking

- 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
- if the vehicles in question have been involved in an accident
- if the models are M models

NOTE:

- Read and comply with GENERAL INFORMATION AND DEFINITIONS.
- Read and comply with GENERAL CHASSIS DEFINITION.
- 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

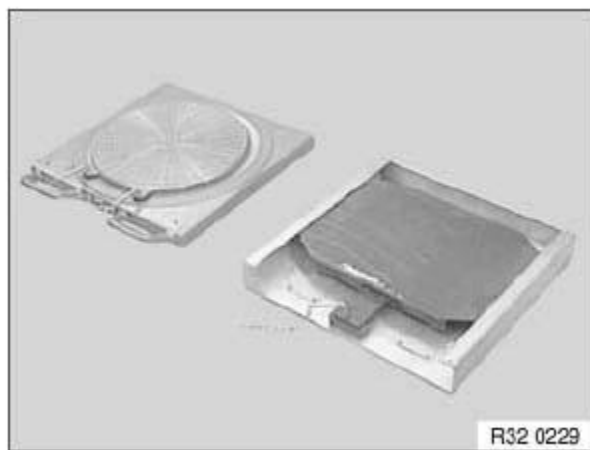


Fig. 16: Identifying Rotary And Sliding Plates
Courtesy of BMW OF NORTH AMERICA, INC.

- 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.



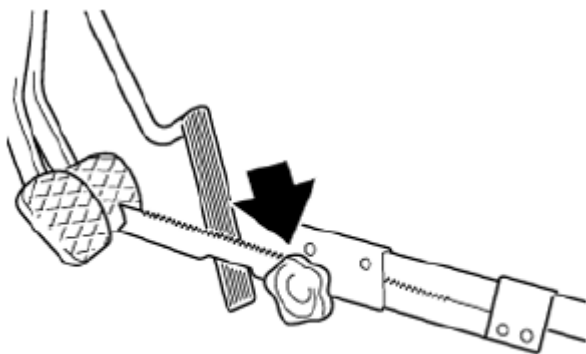
Fig. 17: Identifying Quick-Clamping Holder/Quick-Clamping Unit
Courtesy of BMW OF NORTH AMERICA, INC.

- If necessary, attach spoiler adapter.



Fig. 18: Identifying 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 IDENTIFICATION OF SUSPENSION WITHOUT LABEL and IDENTIFYING SUSPENSION FROM LABEL ON FRONT AXLE.
- Enter tire pressure and tread depth
- Move VEHICLE INTO DESIGN POSITION
- Install brake tensioner.



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Fig. 19: Locating Brake Tensioner

Courtesy of BMW OF NORTH AMERICA, INC.

E81, E82, E87, E88, E90, E91, E92, E93:

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

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 **LOWERING FRONT AXLE CARRIER** .

If necessary, adjust **FRONT AXLE** and **REAR AXLE**.

IMPORTANT: Only on cars with Active Cruise Control:

Because the axis of motion is the reference for ACC adjustment, it is necessary after an adjustment of the rear axle which alters the axis of motion also to

check the adjustment of the ACC sensor!

It is not necessary to check the ACC sensor after only one adjustment of the front axle!

- Perform output measurement in accordance with equipment manufacturer's instructions.
- Save and print out test record.
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT/ADJUSTMENT FOR ACTIVE FRONT STEERING**
- Insert locking pins into both rotary and sliding plates
- Remove chassis/wheel alignment system
- Drive vehicle off lifting platform
- If necessary, carry out **ADJUSTMENT OF ACC SENSOR**

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

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

- if the technical prerequisites for an alignment check with ride-height input are lacking
- 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
- if the vehicles in question have been involved in an accident
- if the models are M models

NOTE:

- Read and comply with **GENERAL INFORMATION AND DEFINITIONS**.
- Read and comply with **GENERAL CHASSIS DEFINITION**.
- Check compliance with **TEST CONDITIONS**, bring vehicle to a stop if necessary.
- 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

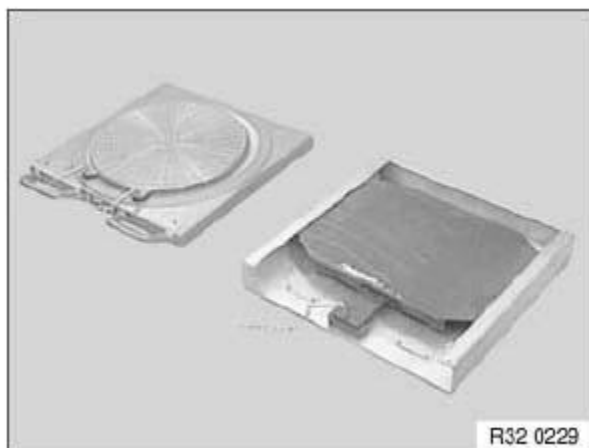


Fig. 20: Identifying Rotary And Sliding Plates
Courtesy of BMW OF NORTH AMERICA, INC.

- 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.



Fig. 21: Identifying Quick-Clamping Holder/Quick-Clamping Unit
Courtesy of BMW OF NORTH AMERICA, INC.

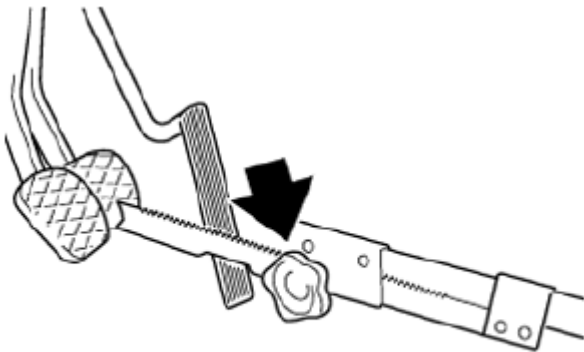
- If necessary, attach spoiler adapter.



R32 0241

Fig. 22: Identifying 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 IDENTIFICATION OF SUSPENSION WITHOUT LABEL and IDENTIFYING SUSPENSION FROM LABEL ON FRONT AXLE.
- Enter tire pressure and tread depth
- Measure and enter VEHICLE RIDE HEIGHT
- Install brake tensioner.



31 34 021

Fig. 23: Locating Brake Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

E81, E82, E87, E88, E90, E91, E92, E93:

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

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 **LOWERING FRONT AXLE CARRIER** .

If necessary, adjust **FRONT AXLE** and **REAR AXLE**.

IMPORTANT: Only on cars with Active Cruise Control:

Because the axis of motion is the reference for ACC adjustment, it is necessary after an adjustment of the rear axle which alters the axis of motion also to check the adjustment of the ACC sensor!

It is not necessary to check the ACC sensor after only one adjustment of the front axle!

- Perform output measurement in accordance with equipment manufacturer's instructions.
- Save and print out test record.
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT/ADJUSTMENT FOR ACTIVE FRONT STEERING**
- Insert locking pins into both rotary and sliding plates
- Remove chassis/wheel alignment system
- Drive vehicle off lifting platform.
- If necessary, carry out **ADJUSTMENT OF ACC SENSOR**

32 00 610 ADJUSTING TOE-IN AND CAMBER ON FRONT AXLE (AWD)

Special tools required:

- **32 3 190**

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 (hexagon socket) 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.

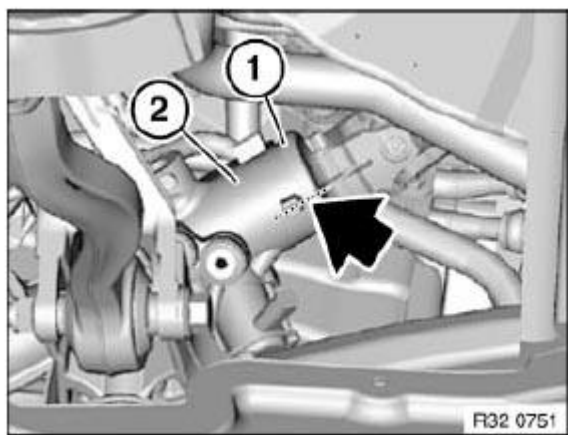


Fig. 24: Locating Markings On Cap And Steering Gear
Courtesy of BMW OF NORTH AMERICA, INC.

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** .

Fit clamp (4).

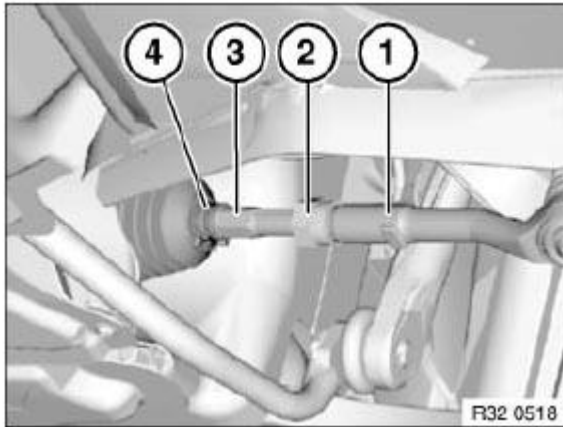


Fig. 25: Identifying Clamping Nut, Tie Rod End And Clamp
Courtesy of BMW OF NORTH AMERICA, INC.

Adjusting camber:

If necessary, remove protective cap.

Drive or twist out centering pin (1) in downward direction (hexagon socket).

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

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

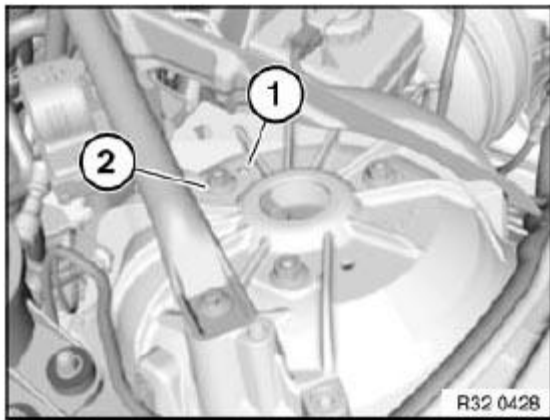


Fig. 26: Identifying Centering Pin
Courtesy of BMW OF NORTH AMERICA, INC.

Insert special tool **32 3 190** into wheel arch opening and over nut.

Replace nuts (3) and screw on but do not tighten down fully.

Turn nut (4) in special tool **32 3 190** to adjust camber to specified value.

Tighten down nuts (3).

Tightening torque **32 31 1AZ** .

Remove special tool **32 3 190** .

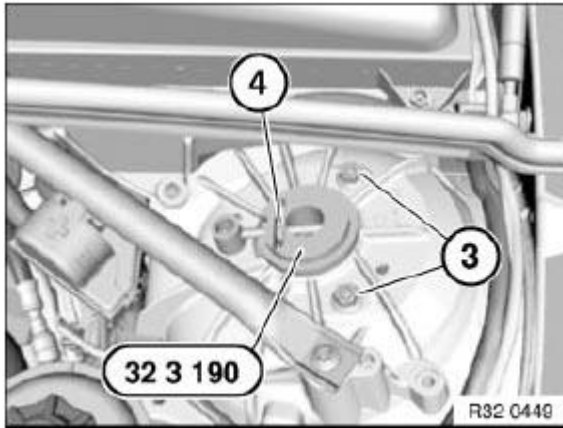


Fig. 27: Identifying Special Tool 32 3 190
Courtesy of BMW OF NORTH AMERICA, INC.

Replace nut (2) and tighten down.

Tightening torque **32 31 1AZ** .

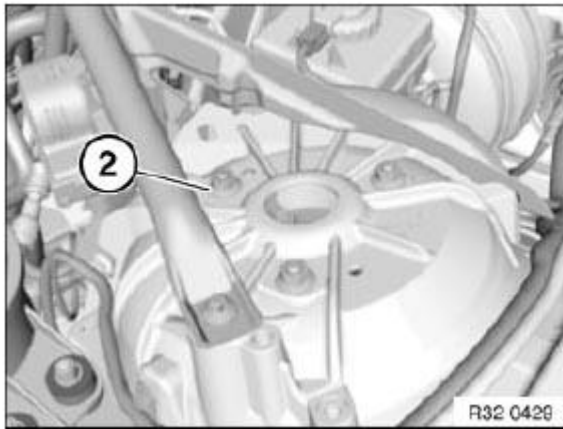


Fig. 28: Identifying Nut
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

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

32 00 620 ADJUSTING REAR AXLE

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

IMPORTANT: Only on cars with Active Cruise Control:

Because the axis of motion is the reference for ACC adjustment, it is necessary after an adjustment of the rear axle which alters the axis of motion also to check the ADJUSTMENT OF THE ACC SENSOR!

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 20AZ .

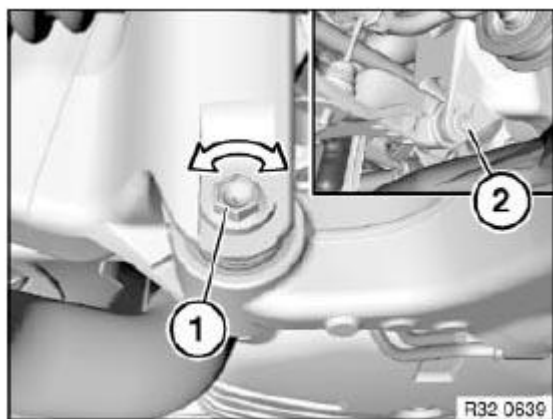


Fig. 29: Adjusting Camber

Courtesy of BMW OF NORTH AMERICA, INC.

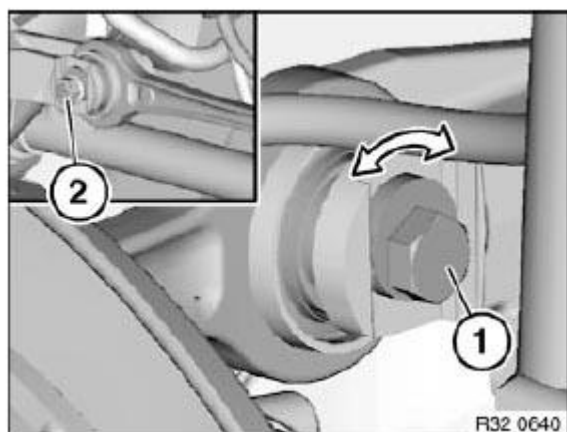
Adjusting toe:

Replace nut (2) and tighten to 5 Nm.

Turn eccentric bolt (1) to adjust toe to specified value.

Tighten nut (2).

Tightening torque 33 32 5AZ .

**Fig. 30: Adjusting Toe**

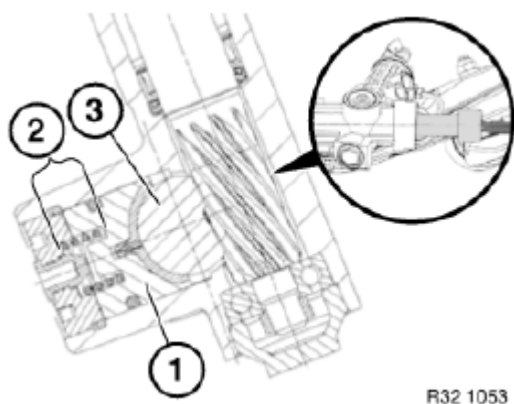
Courtesy of BMW OF NORTH AMERICA, INC.

11 MECHANICAL STEERING GEAR

32 11 ... NOTES ON CHECKING STEERING BACKLASH ON VEHICLES WITH RACK-AND-PINION STEERING (WITH FRONT AXLE RAISED)

NOTE: When the front axle is raised, the applied force is distributed via the tie rod into horizontal and vertical forces. If there is now no electric or hydraulic assistance, the forces created cause the thrust member (1) to be unloaded against the spring (2). The play created in this way is incorrectly referred to as steering backlash.

3 = Rack

**Fig. 31: Identifying Thrust Member And Spring**

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Target state: steering must be free from play in all the mechanical components (except for steering gear and tie rod)!

NOTE: For checking purposes, the steering gear must be pressurized by means of electric or hydraulic assistance.

- Hydraulic steering assistance: Start engine
- Electro-hydraulic steering assistance: Switch ignition on
- Electric steering assistance: Switch ignition on

32 11 100 REPLACING GAITER FOR STEERING GEAR ON LEFT OR RIGHT (AWD)

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**
- Remove steering gear cover at side

Clean tie rod.

Release band clamp (1) and **EAR CLIP** (3).

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.

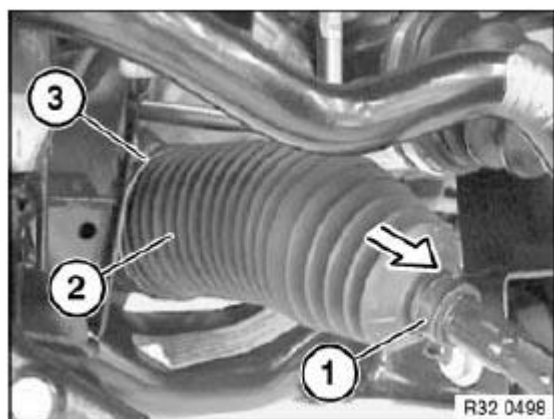


Fig. 32: Detaching Gaiter From Tie Rod
Courtesy of BMW OF NORTH AMERICA, INC.

Replace and grease O-ring (1).

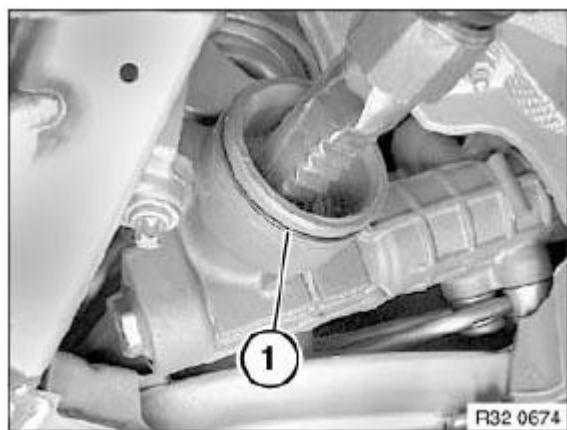


Fig. 33: Identifying O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Perform chassis alignment check. See **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH RIDE-HEIGHT MEASUREMENT WITHOUT LOAD**.
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT**

13 STEERING GEAR WITH SERVO UNIT

32 13 006 BLEEDING POWER STEERING UNIT

WARNING: DANGER OF POISONING if oil is ingested/absorbed through the skin!

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

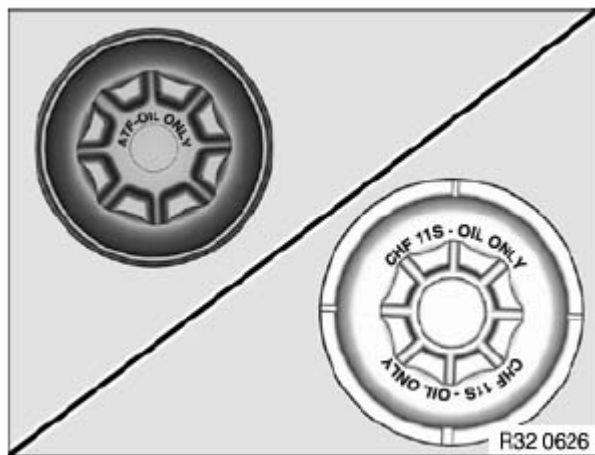


Fig. 34: Identifying Fluid Reservoir Caps
Courtesy of BMW OF NORTH AMERICA, INC.

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 (AWD)

WARNING: Danger to life!

SECURE ENGINE IN INSTALLATION POSITION to prevent it from falling down.

DANGER OF POISONING if oil is ingested/absorbed through the skin!

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.

Seal off hydraulic lines with plugs.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Secure **ENGINE IN INSTALLATION POSITION**
- Remove both **TIE ROD ENDS FROM SWIVEL BEARING**
- Replacement only: Remove both **TIE ROD ENDS FROM TIE ROD**
- Remove both **CONTROL ARMS FROM SWIVEL BEARING**
- Remove both **STABILIZER LINKS FROM STABILIZER**
- Lower **FRONT AXLE CARRIER** until power steering gear rests on output shaft

IMPORTANT: Replacement only:

Banjo bolt (A) for pressure line (expansion hose) must be replaced by banjo bolt with non-return valve (B).

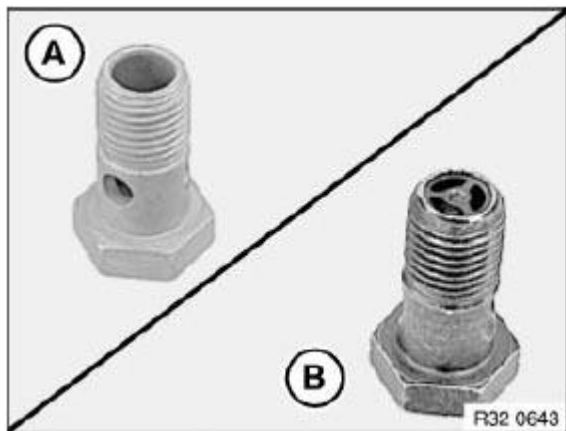


Fig. 35: Identifying Banjo Bolt With Non-Return Valve
 Courtesy of BMW OF NORTH AMERICA, INC.

Release banjo bolts (1, 4).

Remove brackets for pressure and return lines from front axle carrier.

Disconnect pressure line (2) and return line (3) from power steering gear.

Installation:

Replace all sealing rings.

Make sure hydraulic lines are laid without tension and with sufficient spacing to adjoining components.

Tightening torque **32 41 3AZ** .

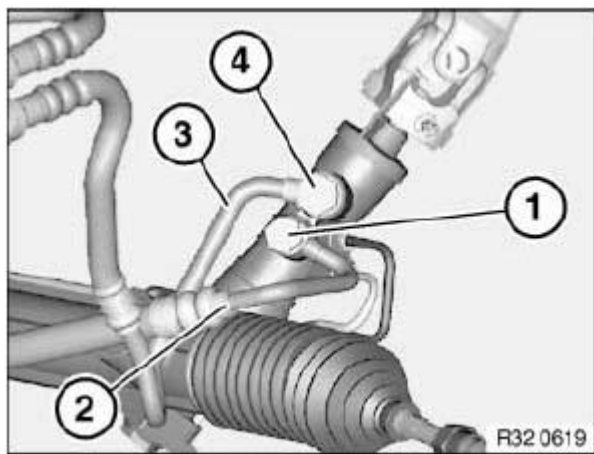


Fig. 36: Identifying Banjo Bolts, Pressure Line And Return Line
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) and remove nuts.

Installation:

Replace screws and self-locking nuts.

Tightening torque **32 00 1AZ** .

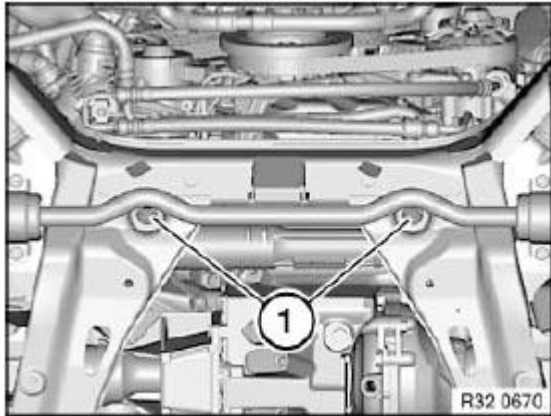


Fig. 37: Identifying Power Steering Gear Screws
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Pay attention to power steering hoses and lines when lowering. Hoses/lines must not be tensioned/bent/kinked!

When lowering and raising, make sure the cover for the relevant tension strut rubber mount is free to move.

Press front axle carrier forwards to guide power steering gear past output shaft.

Lower front axle carrier further.

IMPORTANT: Pay attention to vacuum hose of electric switchover valve.

Slide power steering gear towards rear up to stop, rotate and remove at side.

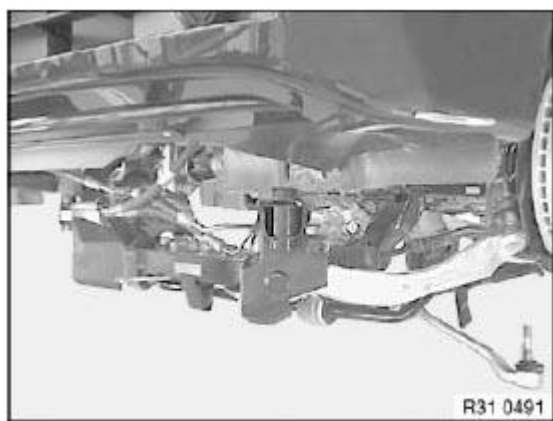


Fig. 38: Identifying Front Axle Carrier
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Perform chassis alignment check. See **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH RIDE-HEIGHT MEASUREMENT WITHOUT LOAD.**
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT**

32 13 650 REMOVING AND INSTALLING/REPLACING EH CONVERTER FOR SERVOTRONIC (AWD)

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

Necessary preliminary tasks:

- 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** .

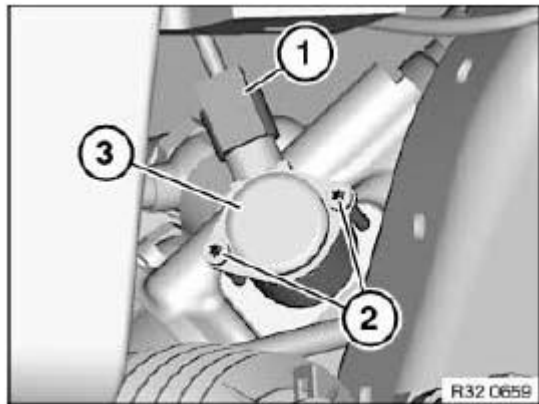


Fig. 39: Identifying Plug Connection And EH Converter
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**

21 STEERING ARMS, TIE RODS, STEERING DAMPER

32 21 151 REPLACING LEFT OR RIGHT TIE ROD END (AWD)

Special tools required:

- **31 2 300**

NOTE: If the tie rod end to tie rod screw/bolt connection is released, it is necessary after reinstallation to carry out a wheel/chassis alignment check.

Necessary preliminary tasks:

- Remove front wheel

IMPORTANT: Do not release tie rod end from swivel bearing with impact tool.

Rubber gaiter of tie rod end must not be damaged!

Release nut; if necessary, grip at hexagon.

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

Installation:

Keep tie rod end to swivel bearing connection clean and free from oil and grease.

Replace self-locking nut.

Tightening torque **32 21 3Z** .

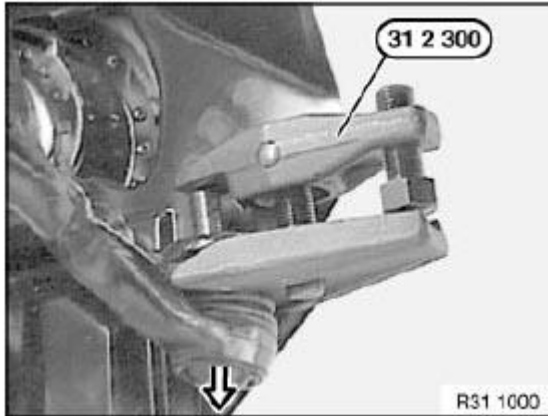


Fig. 40: Identifying Special Tool 31 2 300
Courtesy of BMW OF NORTH AMERICA, INC.

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** for damage, replace if necessary.

Mount clamping ring (1).

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

Tightening torque **32 21 5AZ** .

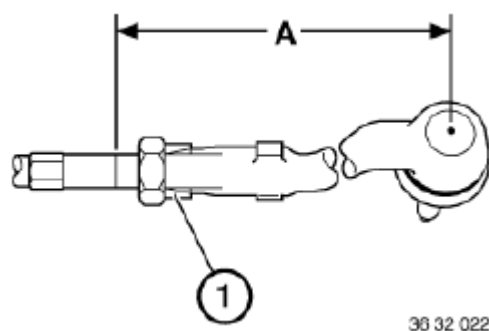


Fig. 41: Identifying Tie Rod End Dimension
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Perform chassis alignment check. See **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH RIDE-HEIGHT MEASUREMENT WITHOUT LOAD**.
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT**

32 21 231 REPLACING (REMOVING AND INSTALLING) LEFT OR RIGHT TIE ROD

Special tools required:

- **32 3 160**

IMPORTANT: The 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 FROM SWIVEL BEARING**
- Remove **GAITER FROM POWER STEERING GEAR** and slide back

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

Unscrew tie rod with special tool **32 3 160** from rack of power steering gear.

Installation:

Tightening torque **32 21 2AZ** .

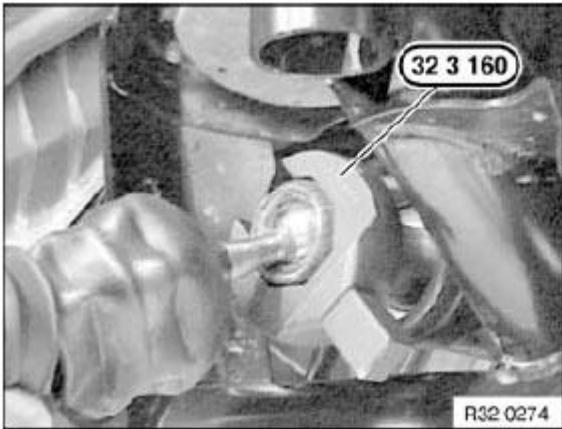


Fig. 42: Unscrewing Tie Rod With Special Tool 32 3 160
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean rack.

Check surface of rack for damage (e.g. corrosion).

Replace O-ring (1).

Grease rack and O-ring (1) .

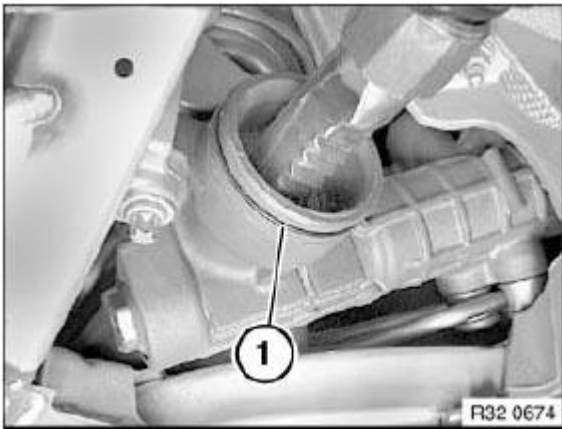


Fig. 43: Identifying O-Ring
Courtesy of BMW OF NORTH AMERICA, INC.

On replacement, assemble new part with gaiter:

- Determine measurement (A) on old part to simplify following adjustment of front axle
- Slacken 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 ear clamp and band clamp (3) onto tie rod
- Slide clamping nut (2) and clamping ring (1) onto tie rod
- Screw tie rod end onto tie rod to measurement (A)
- Tighten down clamping nut (2)

Tightening torque **32 21 5AZ** .

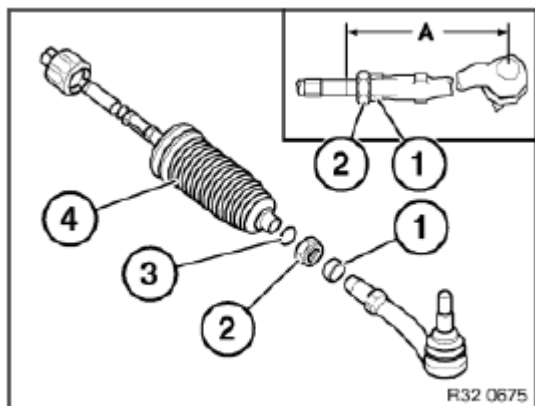


Fig. 44: Identifying Clamping Ring, Clamping Nut, Gaiter And Band Clamp

Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Only if replacing/removing tie rod end: Perform chassis alignment check. See **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH RIDE-HEIGHT MEASUREMENT WITHOUT LOAD**.
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT/ADJUSTMENT FOR ACTIVE FRONT STEERING**

31 STEERING COLUMN

32 31 004 REMOVING AND INSTALLING / REPLACING UPPER SECTION OF STEERING COLUMN TRIM

Necessary preliminary tasks:

- Remove **LOWER SECTION OF TRIM**
- Move steering column into "lower" and "extended" position

Unclip steering column cover (1) from upper section of trim.

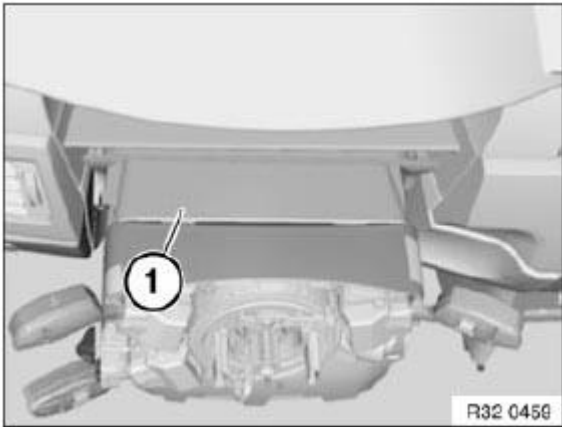


Fig. 45: Identifying Steering Column Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten screws.

Installation:

Replace expansion rivets.

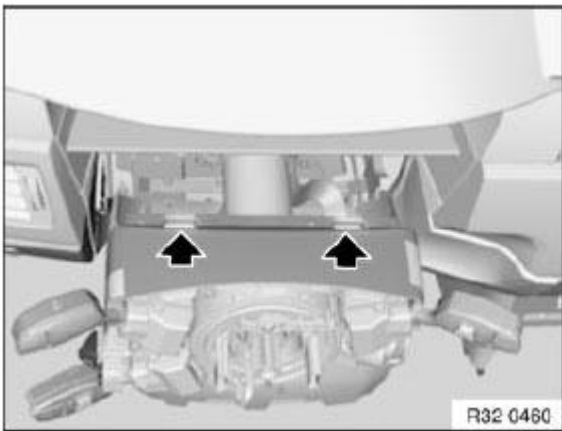


Fig. 46: Identifying Steering Column Trim Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Bend upper section of trim on both sides outwards and remove towards top.

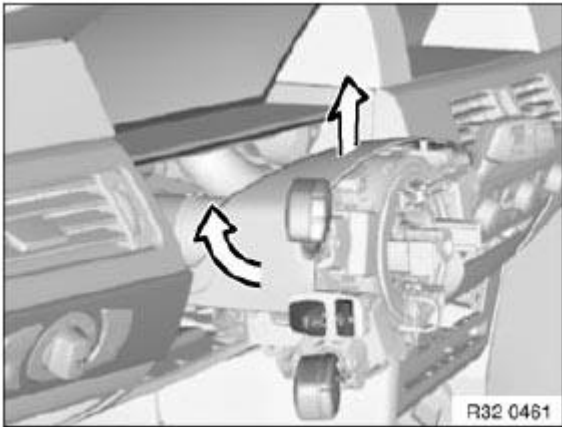


Fig. 47: Removing Upper Section Of Steering Column Trim
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Locks (2) must engage in hooks (1) on both sides.

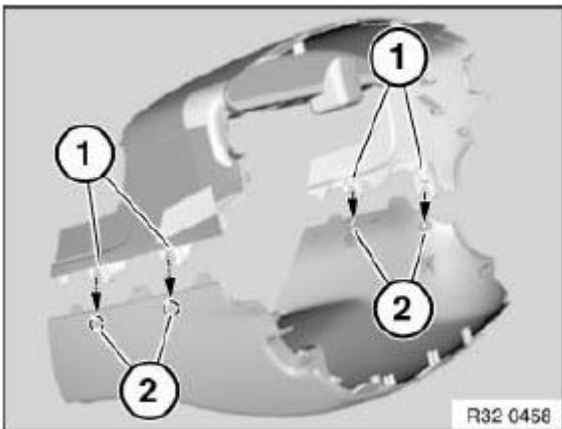


Fig. 48: Identifying Locks And Hooks
Courtesy of BMW OF NORTH AMERICA, INC.

32 31 010 REMOVING AND INSTALLING/REPLACING FRONT SECTION OF STEERING COLUMN COVER

Necessary preliminary tasks:

- Disconnect battery negative lead
- Remove steering wheel. See **REMOVING AND INSTALLING (REPLACING) STEERING WHEEL (UP TO 03/2007)**, **REMOVING AND INSTALLING/REPLACING STEERING WHEEL (FROM 03/2007)**, or **REMOVING AND INSTALLING/REPLACING SPORT STEERING WHEEL**.

Pull of front section.

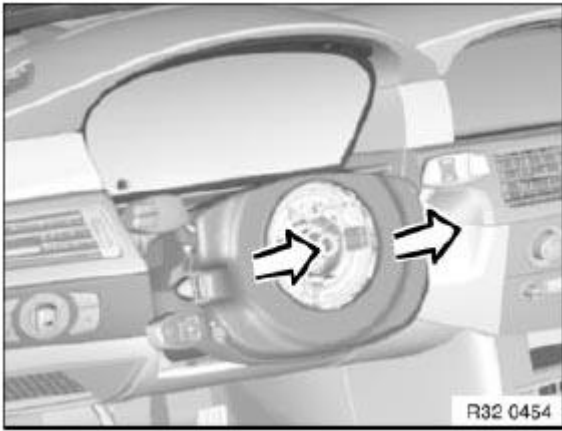


Fig. 49: Removing Front Section Of Steering Column Cover
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Locks (2) must engage in hooks (1).

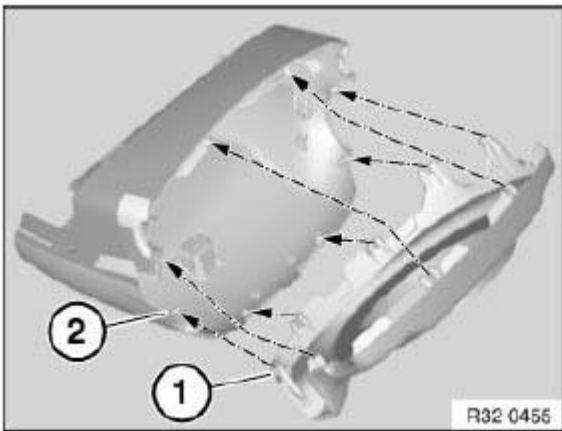


Fig. 50: Identifying Locks And Hooks
Courtesy of BMW OF NORTH AMERICA, INC.

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

Necessary preliminary tasks:

- Remove **FRONT SECTION OF TRIM**
- Move steering column in "top" and "extended" position.

Release screw.

Unclip lower trim section (1).

If necessary, unclip wiring harness from lower trim section (1).

Installation:

Replace expansion rivet.

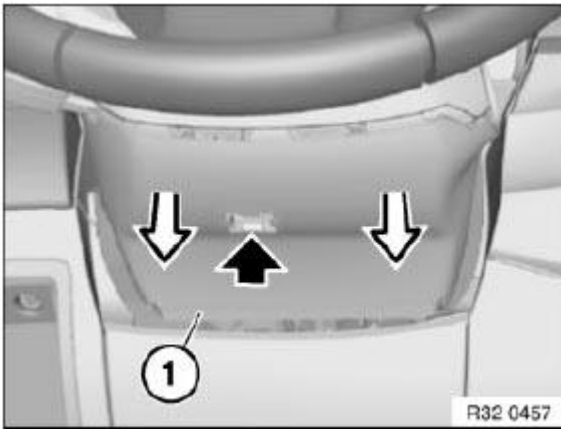


Fig. 51: Removing Lower Section Of Steering Column Trim
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Locks (2) must engage in hooks (1) on both sides.

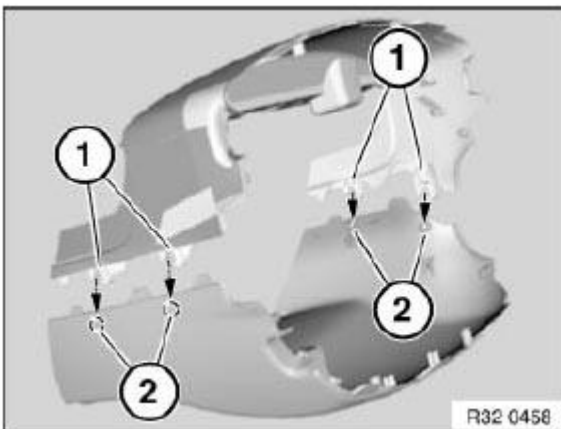


Fig. 52: Identifying Locks And Hooks
Courtesy of BMW OF NORTH AMERICA, INC.

Unclip steering column cover (1) from lower section of trim (2).

Remove lower section of trim (2).

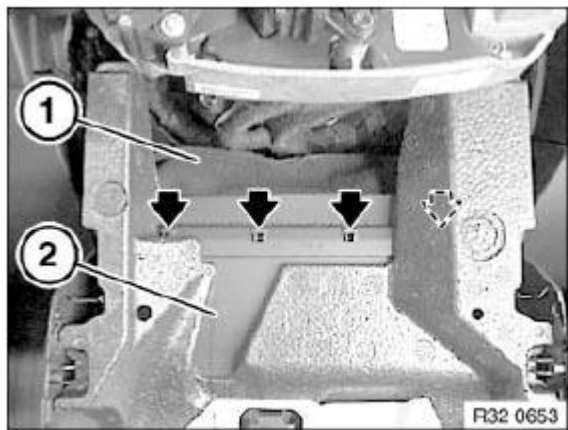


Fig. 53: Identifying Steering Column Cover And Lower Section Of Trim
Courtesy of BMW OF NORTH AMERICA, INC.

32 31 070 REMOVING AND INSTALLING / REPLACING STEERING SPINDLE LOWER SECTION (AWD)

IMPORTANT: If the lower section of the steering spindle is separated from the power steering gear/steering column, the steering column switch cluster may be damaged when the steering wheel is turned.

Necessary preliminary tasks:

- Remove **TRIM PANEL FOR PEDAL ASSEMBLY**

Release clamping screw (1).

NOTE: Before detaching steering spindle (3) from steering column, mark double joint in relation to steering column.

Detach double joint (2) of steering spindle (3) from steering column.

Pull upper section (2) out of steering spindle (3).

Installation:

Clean thread to remove all remnants of screw securing adhesive.

Replace clamping screw.

Clamping screw must rest in groove of steering column.

Tightening torque **32 31 1AZ** .

N52: Remove gaiter with resonator.

M57T2: Remove steering gear cover at side.

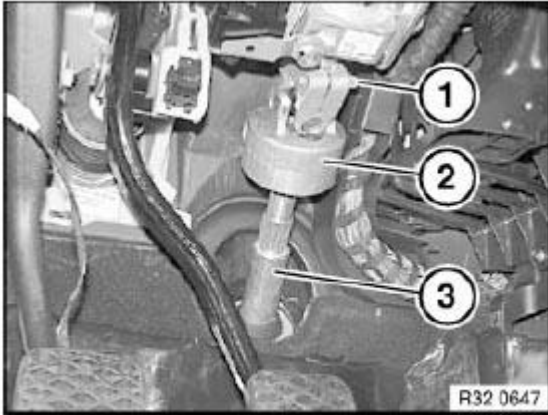


Fig. 54: Identifying Double Joint Of Steering Spindle
Courtesy of BMW OF NORTH AMERICA, INC.

Release clamping screw (1).

Move power steering gear into zero setting.

NOTE: **The markings on the cap and housing must match up (see arrow).**

Remove ignition key.

Detach steering spindle lower section (2) from power steering gear.

Installation:

Clean thread to remove all remnants of screw securing adhesive.

Replace clamping screw.

Tightening torque **32 31 1AZ** .

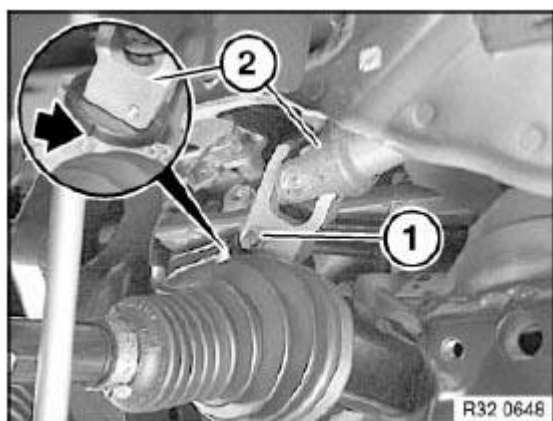


Fig. 55: Identifying Steering Spindle Lower Section
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Tightening torque **32 31 17AZ** .

Remove steering spindle lower section (2).

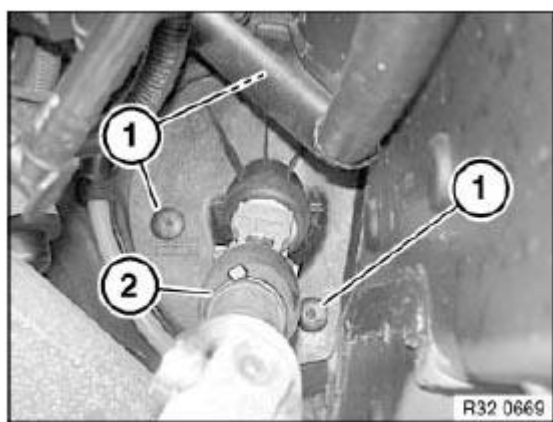


Fig. 56: Identifying Steering Spindle Lower Section
Courtesy of BMW OF NORTH AMERICA, INC.

Observe installation sequence:

1. If necessary, move power steering gear into zero position or steering wheel into straight-ahead position
2. Slide steering spindle lower section (1) through sleeve (3)
3. Slide double joint (2) into steering spindle lower section (1)
4. Attach steering spindle lower section (1) to power steering gear
5. Attach double joint (2) to steering column
6. Align bracket (4) to engine compartment partition wall and press into place

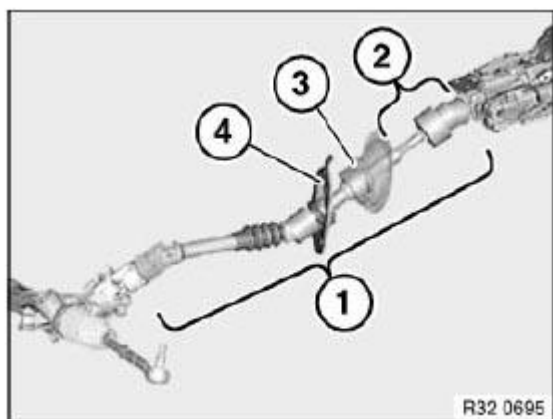


Fig. 57: Identifying Steering Spindle Lower Section, Double Joint, Sleeve And Bracket
 Courtesy of BMW OF NORTH AMERICA, INC.

7. Refer to the above-mentioned work steps for other notes on installation

After installation:

- Turn steering wheel in both directions to full lock. The airbag warning lamp must not light up in the process.
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT**
- Check directional stability of car

32 31 082 REMOVING AND INSTALLING/REPLACING STEERING ANGLE SENSOR

NOTE: Steering angle sensor is integrated in the **STEERING COLUMN STALK FIXTURE** .

After installation:

- Replacement only: Carry out **PROGRAMMING/CODING**
- Carry out **STEERING ANGLE SENSOR ADJUSTMENT/ADJUSTMENT FOR ACTIVE FRONT STEERING**

32 31 087 REMOVING AND INSTALLING/REPLACING STEERING COLUMN LOCK

NOTE: Steering column lock can only replaced in vehicles from 09/2005 with electric steering column adjustment.

Necessary preliminary tasks:

- Remove **TRIM PANEL FOR PEDAL ASSEMBLY** .

Disconnect plug connection (1).

NOTE: There is the risk of mixing up the 3-pin plug connection for the footwell light.
Release shear screws (2).
Remove steering column lock (3).

Installation:

Spherical side of shim must point to steering column lock (3).

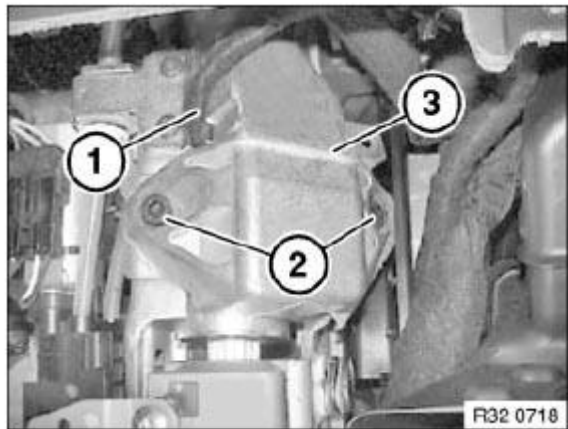


Fig. 58: Identifying Plug Connection And Steering Column Lock
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Carry out operational check.

32 31 090 REMOVING AND INSTALLING/REPLACING STEERING COLUMN

Necessary preliminary tasks:

- Return steering to straight-ahead drive setting and remove ignition key
- Remove **TRIM PANEL FOR PEDAL ASSEMBLY** .
- Remove **STEERING SPINDLE LOWER SECTION FROM STEERING COLUMN**
- Remove **UPPER SECTION OF TRIM**

Replacement only:

- Remove **FIXTURE FOR STEERING COLUMN STALK**

Vehicles (up to 09/2005) with automatic transmissions:

Remove interlock cable (1) from steering lock positioning unit.

Disconnect plug connections (2).

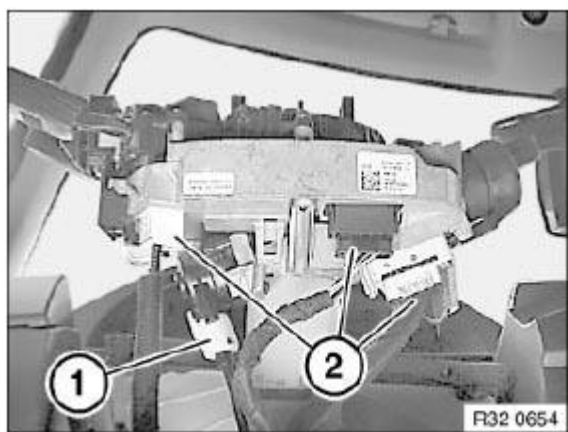


Fig. 59: Identifying Plug Connections And Interlock Cable
Courtesy of BMW OF NORTH AMERICA, INC.

Version with electric steering column adjustment (build date up to 09/2004):

NOTE: As from 09/2004 the new steering column with a 6-pin plug connection and matching adapter lead will be supplied.

Installation:

Fit adapter lead between wiring harness and steering column.

Secure adapter lead to wiring harness.

Version with electric steering column adjustment:

Disconnect plug connection (3) from drive for electric steering column adjustment.

From 09/2005: Disconnect plug connection from electric **STEERING COLUMN LOCK**.

Vehicles (up to 09/2005) with automatic transmissions:

Remove interlock cable (1) from steering column.

Remove wiring harness (2) from steering column and place to one side.

Installation:

Replace ribbon cable from ignition starter switch to CAS control unit and secure with adhesive tape. See **REMOVING AND INSTALLING/REPLACING IGNITION STARTER SWITCH** and **REMOVING AND INSTALLING (REPLACING) CONTROL UNIT FOR CAR ACCESS SYSTEM** .

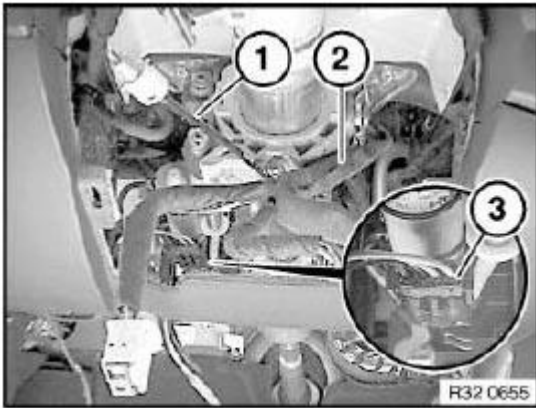


Fig. 60: Identifying Interlock Cable, Plug Connection And Wiring Harness
Courtesy of BMW OF NORTH AMERICA, INC.

Mark installation position of steering column.

Unfasten screws.

Tightening torque **32 31 6AZ** .

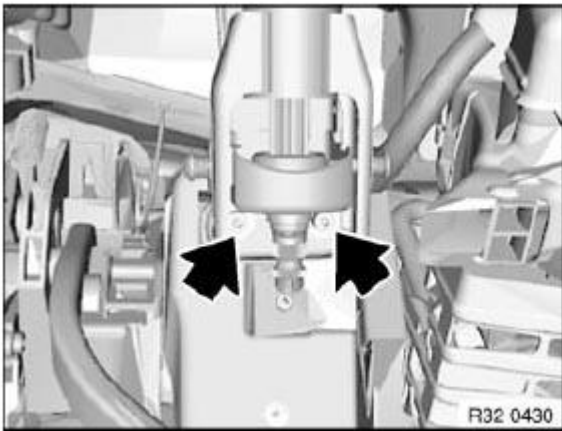


Fig. 61: Locating Steering Column Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Mark installation position of steering column (2).

Release screws (1).

Remove steering column (2) towards rear.

Installation:

Insert steering column (2) through instrument panel and insert screws (1).

Align steering column (2) by way of markings and tighten down screws (1).

Tightening torque **32 31 6AZ** .

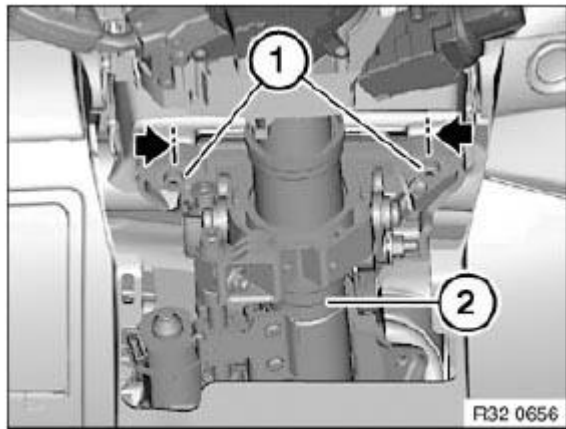


Fig. 62: Identifying Steering Column
Courtesy of BMW OF NORTH AMERICA, INC.

Replacement:

- Remove **IGNITION STARTER SWITCH**
- Remove **RING ANTENNA**
- Remove lock cylinder

After installation:

- Carry out **STEERING ANGLE SENSOR ADJUSTMENT/ADJUSTMENT FOR ACTIVE FRONT STEERING**
- 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 car

32 31 102 REPLACING SLEEVE FOR STEERING SPINDLE (4WD)

IMPORTANT: Do not kink floor panelling under any circumstances!

After installation:

- Carry out **STEERING ANGLE SENSOR ADJUSTMENT**

Necessary preliminary tasks:

- Remove **LOWER SECTION OF STEERING SPINDLE**
- Remove **ACCELERATOR PEDAL MODULE**
- Take floor panelling out of bulkhead and secure

Release nut (1) and press cable duct a little to one side.

Remove sleeve (2) from bulkhead.

Installation:

Grease/spray sleeve (2) from outside with silicone grease.

Align sleeve (2) by way of arrow to bulkhead and insert.

Check seating of sleeve (2), correct if necessary.

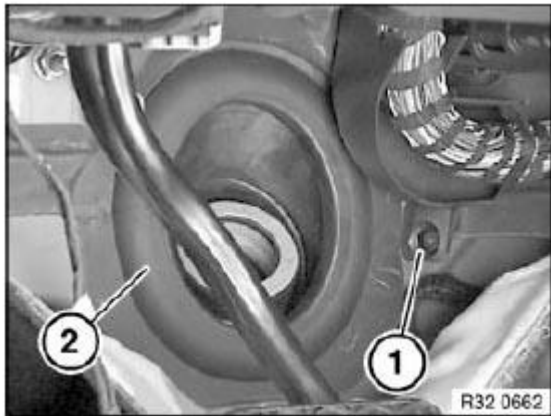


Fig. 63: Identifying Steering Spindle Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

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

- Remove lower section of steering spindle.

After installation:

- Carry out **STEERING ANGLE SENSOR ADJUSTMENT/ADJUSTMENT FOR ACTIVE FRONT STEERING**

Pop sleeve (1) out of bulkhead and press together.

Push steering spindle into steering column.

Remove sleeve (1) from steering column.

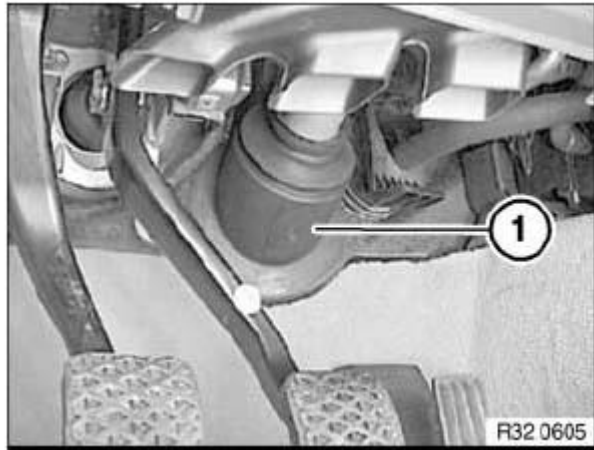


Fig. 64: Identifying Steering Spindle Sleeve
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Detach pull-in lug from sleeve and lubricate gap with silicone grease.

Press sleeve together, slide onto steering column, align to opening in bulkhead and insert in bulkhead.

NOTE: To prevent the sleeve from slipping out and to avoid complaints by the customer about noise, make sure that sealing lip (1) on engine compartment side rests against bulkhead all round and sealing lip (2) in inside the car rests against the damping.

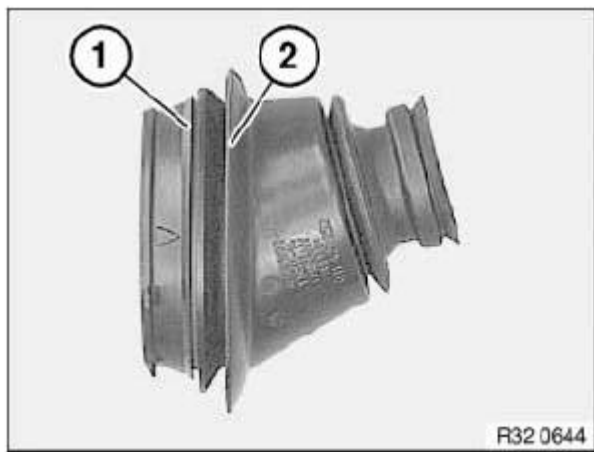


Fig. 65: Identifying Sealing Lip

Courtesy of BMW OF NORTH AMERICA, INC.

32 31 241 REPLACING ADJUSTING LEVER FOR STEERING COLUMN (STEERING COLUMN WITH NACAM CLAMP)

Necessary preliminary tasks:

- Remove LOWER SECTION OF STEERING COLUMN TRIM
- Remove TRIM PANEL FOR PEDAL ASSEMBLY .

Unclip adjusting lever.

Installation:

Align adjusting lever to steering column and attach straight to prevent the locks from being damaged.

Check locks after attachment, replace adjusting lever if necessary.

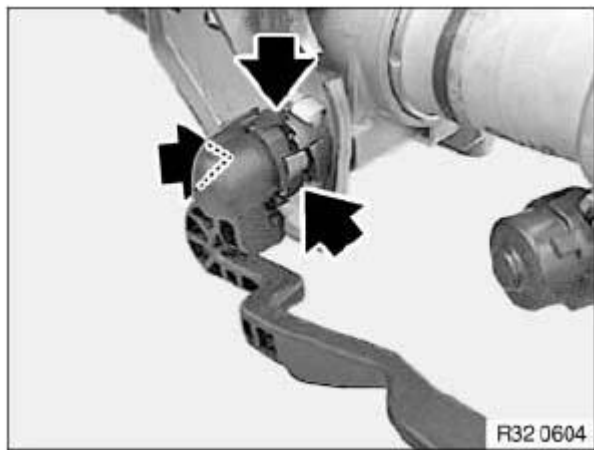


Fig. 66: Locating Adjusting Lever

Courtesy of BMW OF NORTH AMERICA, INC.

33 STEERING WHEEL

32 33 ... REPLACING DECORATIVE STRIP FOR SPORT STEERING WHEEL

The procedure is described in the article "... MULTIFUNCTION STEERING WHEEL SWITCHES".

32 33 ... REPLACING DECORATIVE STRIPS FOR STEERING WHEEL (UP TO 03/2007)

Special tools required:

- 61 3 120

Necessary preliminary tasks:

- Remove **AIRBAG UNIT**

Release screws (1).

IMPORTANT: Risk of breakage!

Carefully remove multifunction steering wheel switches with decorative strips and retaining plate (2) from steering wheel.

Disconnect plug connections on reverse side and remove retaining plate (2).

Installation:

Make sure connecting cables are correctly routed.

Make sure that decorative strips and both multifunction steering wheel switches are correctly positioned on steering wheel (guide pins must not be damaged).

Tightening torque **32 33 2AZ** .

Release screws (1) and remove decorative strips (2).

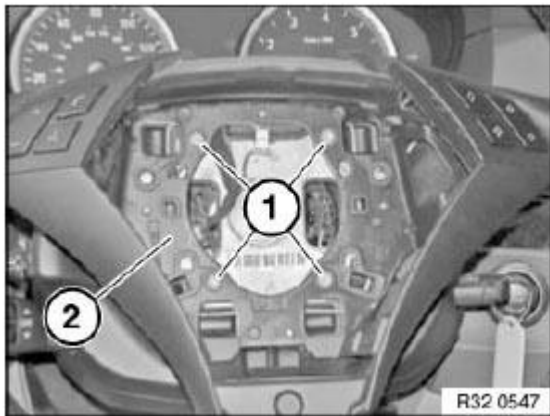


Fig. 67: Identifying Retaining Plate

Courtesy of BMW OF NORTH AMERICA, INC.

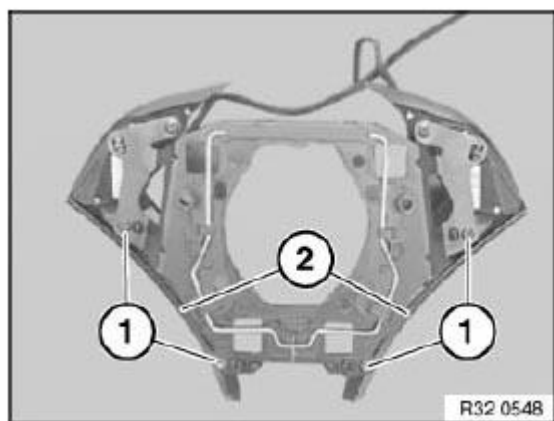


Fig. 68: Identifying Decorative Strips Screws
 Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Attach decorative strips (1) to retaining plate (2) (do not tighten down screws (3)).

Lay retaining plate (2) with decorative strips (1) on special tool **61 3 120**.

Tighten down screws (3).

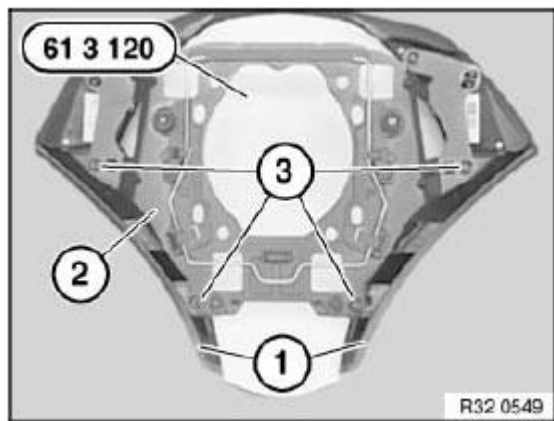


Fig. 69: Identifying Decorative Strips And Retaining Plate
 Courtesy of BMW OF NORTH AMERICA, INC.

32 33 001 REMOVING AND INSTALLING (REPLACING) STEERING WHEEL (UP TO 03/2007)

NOTE: Wheel/chassis alignment is not necessary after the steering wheel has been removed and installed or replaced.

Necessary preliminary tasks:

- Remove **AIRBAG UNIT**
- Replacement only: Remove **RETAINING PLATE FOR MULTIFUNCTION STEERING WHEEL SWITCH**

Move wheels/steering wheel into straight-ahead position.

Disconnect plug connection(s) and remove connecting lead(s) from steering wheel.

Release screw (1) and remove steering wheel.

Secure volute spring cassette with adhesive tape against twisting.

Installation:

Make sure connecting lead(s) is/are correctly laid.

Tightening torque **32 33 1AZ** .

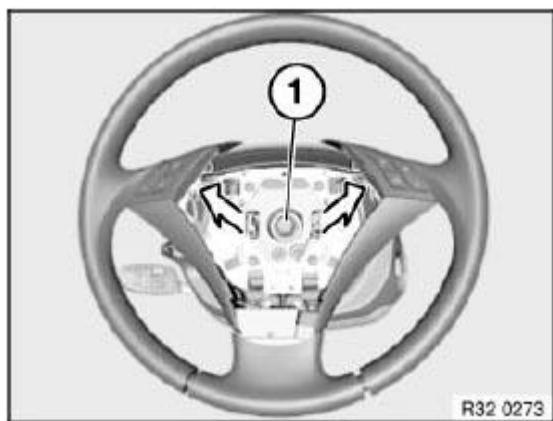


Fig. 70: Removing Steering Wheel

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage!

Locking pin (1) must engage in recess of driver (2).

Installation:

Align steering wheel using grooved tothing to steering column and attach.

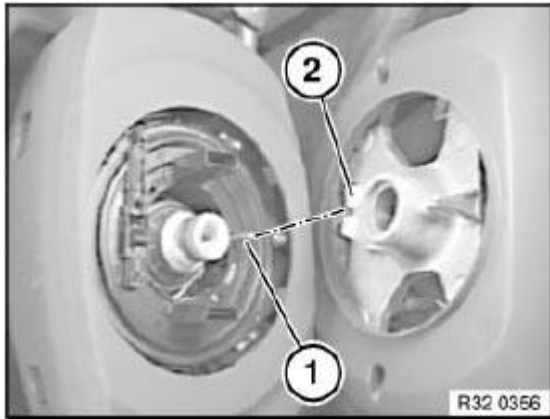


Fig. 71: Identifying Locking Pin And Driver

Courtesy of BMW OF NORTH AMERICA, INC.

32 33 001 REMOVING AND INSTALLING/REPLACING STEERING WHEEL (FROM 03/2007)

NOTE: Wheel/chassis alignment is not necessary after the steering wheel has been removed and installed or replaced.

Necessary preliminary tasks:

- Remove **AIRBAG UNIT**
- Replacement only: Remove **RETAINING PLATE FOR MULTIFUNCTION STEERING WHEEL SWITCH**

Move wheels/steering wheel into straight-ahead position.

Disconnect plug connection (1).

Release screw (2) and remove steering wheel.

Installation:

Make sure connecting lead(s) is/are correctly laid.

Tightening torque **32 33 1AZ** .

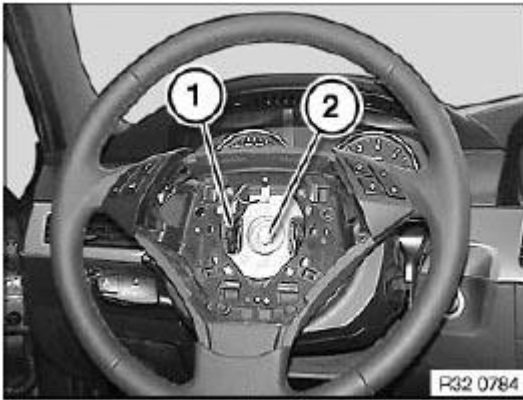


Fig. 72: Identifying Plug Connection And Steering Wheel Screw
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Risk of damage!
Driver (1) must engage in opening (2).

Installation:

Align steering wheel using grooved toothing to steering column and attach.

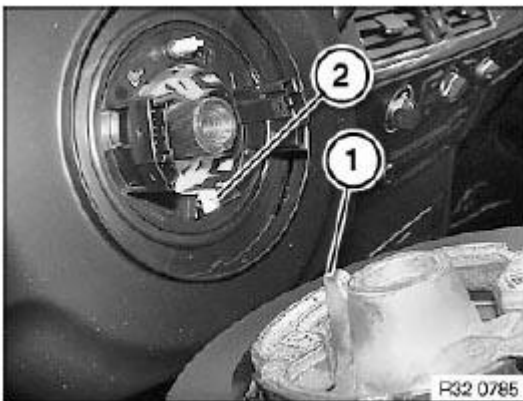


Fig. 73: Identifying Driver
Courtesy of BMW OF NORTH AMERICA, INC.

Replacement:

- Modify LANE DEPARTURE WARNING MOTOR ELECTRICS

32 33 010 REMOVING AND INSTALLING/REPLACING SPORT STEERING WHEEL

NOTE: Wheel/chassis alignment is not necessary after the steering wheel has been removed and installed or replaced.

Necessary preliminary tasks:

- Remove **AIRBAG UNIT**

Move wheels/sport steering wheel into straight-ahead position.

Disconnect plug connection (1).

Release screw (2) and remove sport steering wheel.

Secure volute spring cassette with adhesive tape against twisting.

Installation:

Make sure connecting lead(s) is/are correctly laid.

Tightening torque **32 33 1AZ** .

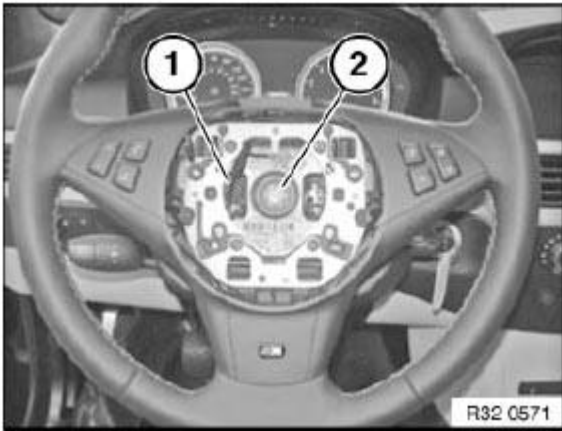


Fig. 74: Identifying Plug Connection And Steering Wheel Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Align sport steering wheel using grooved toothing (1) to steering column and attach.

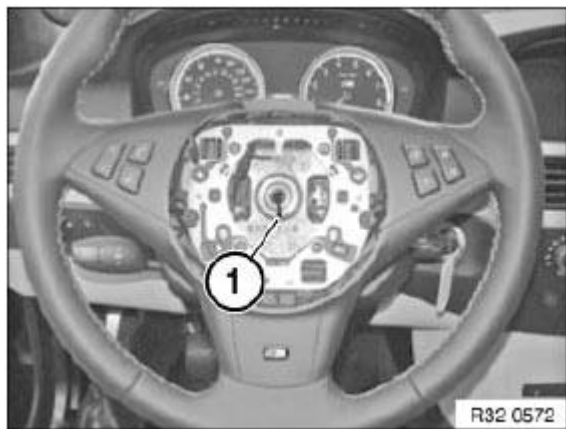


Fig. 75: Identifying Grooved Toothing
 Courtesy of BMW OF NORTH AMERICA, INC.

Replacement:

- Remove **RETAINING PLATE FOR MULTIFUNCTION STEERING WHEEL SWITCH**
- Version with Sequential Manual Gearbox/Transmission: Remove shift paddles. See **REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT SHIFT PADDLE FOR SMG TRANSMISSION** or **REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT SHIFT PADDLE FOR AUTOMATIC TRANSMISSION**.
- Version with Lane Departure Warning: Remove **LANE DEPARTURE WARNING MOTOR ELECTRICS**

34 STEERING WHEEL FOR AIRBAG

32 34 020 REMOVING AND INSTALLING/REPLACING AIRBAG UNIT

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

- Comply with **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 **REMOVING AND INSTALLING (REPLACING) STEERING WHEEL (UP TO 03/2007)** or **REMOVING AND INSTALLING/REPLACING STEERING WHEEL (FROM 03/2007)**.

Follow procedure after airbag triggering.

NOTE: To avoid airbag rattling on standard steering wheels, it is essential to replace the retaining plate together with the airbag unit.

Necessary preliminary tasks:

- Disconnect battery negative lead

Insert T25/T27 Torx screwdriver (1) from below into hole (2) until a springy resistance can be felt through annular spring (3) of airbag unit.

Continue to press in T25/T27 Torx screwdriver (1) until airbag unit is released.

Installation:

Make sure connecting lines are correctly positioned.

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

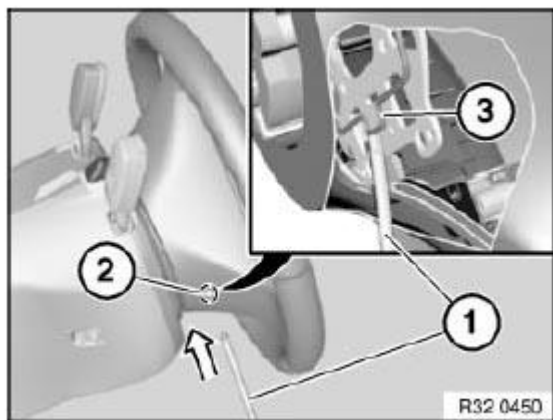


Fig. 76: Inserting Torx Screwdriver Into Hole
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury!

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

Build date up to 03/2007:

Disconnect plug connection (1) and remove airbag unit.

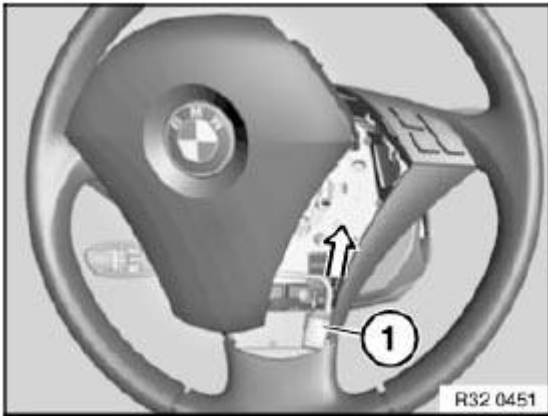


Fig. 77: Disconnecting Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Build date after 03/2007:

Disconnect plug connection (1) and remove airbag unit (2).

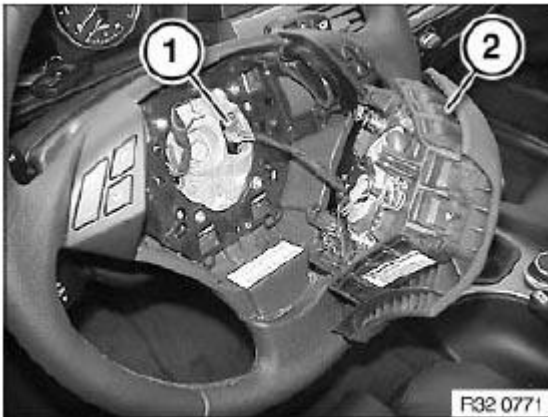


Fig. 78: Identifying Plug Connection And Airbag Unit
Courtesy of BMW OF NORTH AMERICA, INC.

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 **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!
Follow procedure after airbag triggering.

Necessary preliminary tasks:

- Disconnect battery negative lead

Insert Torx screwdriver (T25) from below into opening on rear side of steering wheel until a spring resistance is felt (approx. 3 cm).

Increase pressure on annular spring using Torx screwdriver (T25) until airbag unit is unlocked on both sides.

Installation:

Make sure connecting cables are correctly routed.

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

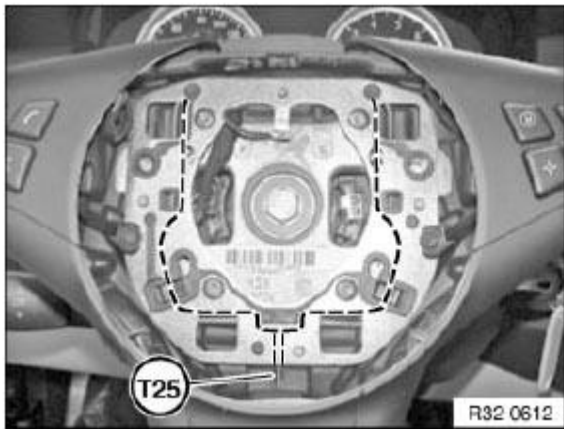


Fig. 79: Identifying Torx Screwdriver (T25)
Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Danger of injury!
Airbag unit may only be set down with the airbag itself facing upwards .

Tilt airbag unit (1) towards front.

Disconnect plug connection (2) and remove airbag unit (1).

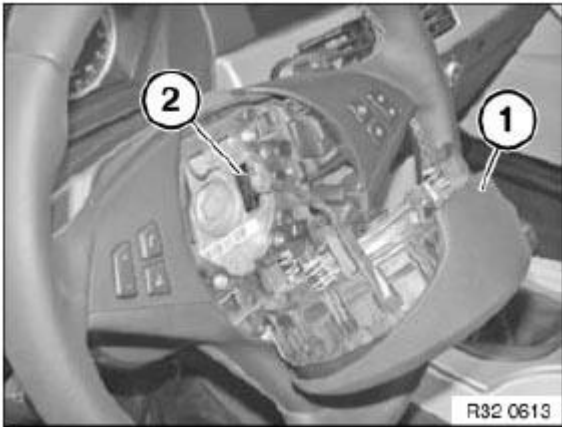


Fig. 80: Identifying Plug Connection And Airbag Unit
Courtesy of BMW OF NORTH AMERICA, INC.

41 PUMP AND OIL SUPPLY

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

Special tools required:

- 32 1 260

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.

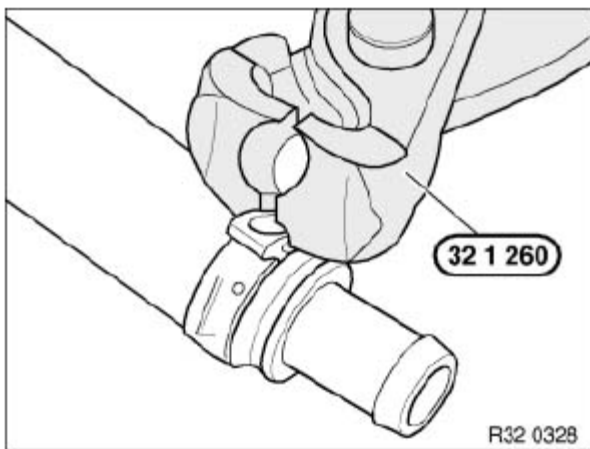


Fig. 81: Identifying Special Tool 32 1 260
Courtesy of BMW OF NORTH AMERICA, INC.

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

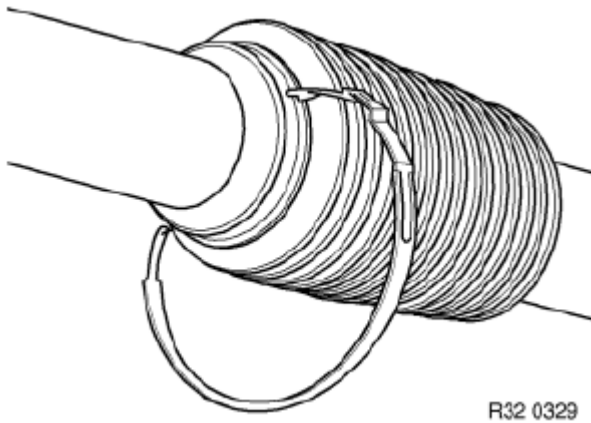


Fig. 82: Identifying Ear Clip
Courtesy of BMW OF NORTH AMERICA, INC.

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

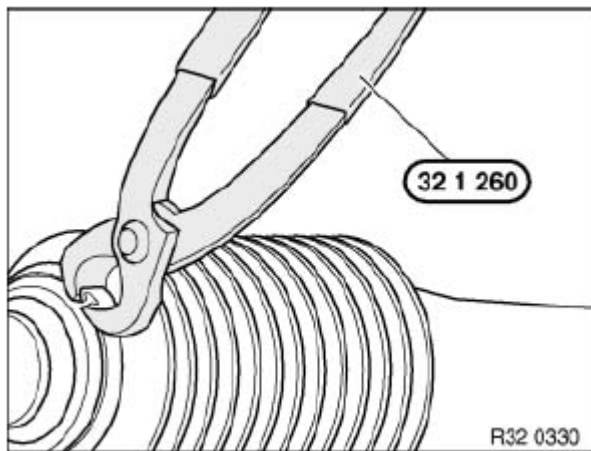


Fig. 83: Pressing Ear Together With Special Tool 32 1 260
Courtesy of BMW OF NORTH AMERICA, INC.

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

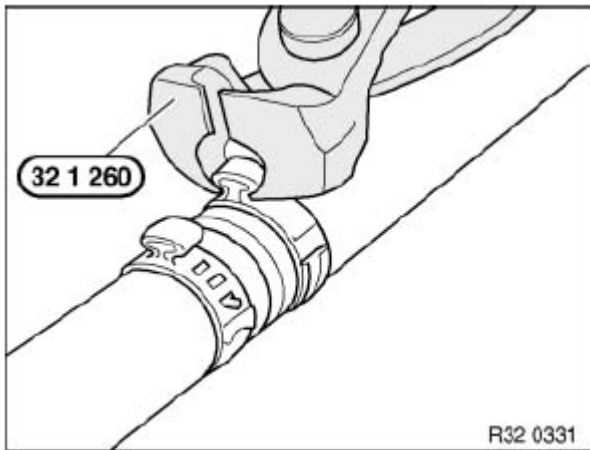


Fig. 84: Identifying Special Tool 32 1 260

Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Gap (A) max. 1 mm!

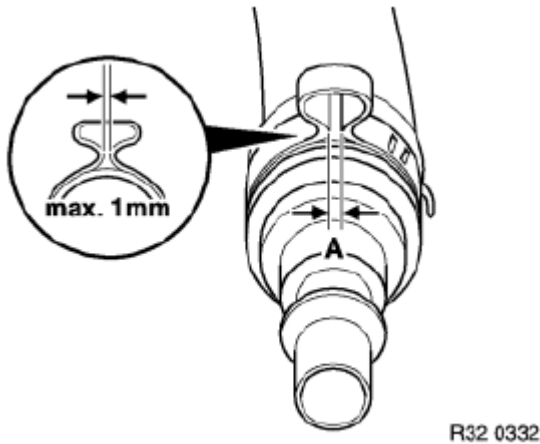


Fig. 85: Identifying Ear Gap

Courtesy of BMW OF NORTH AMERICA, INC.

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

Special tools required:

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

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

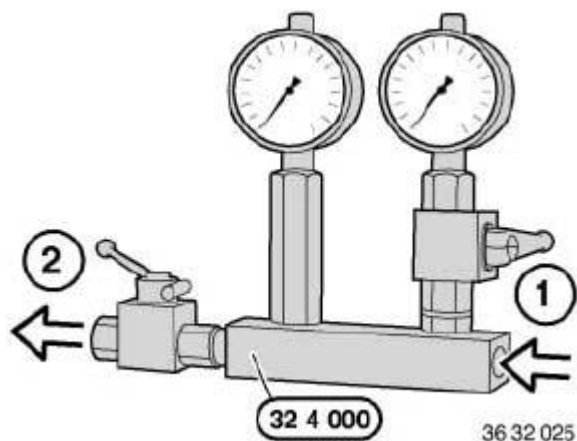


Fig. 86: Identifying Special Tool 32 4 000

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.

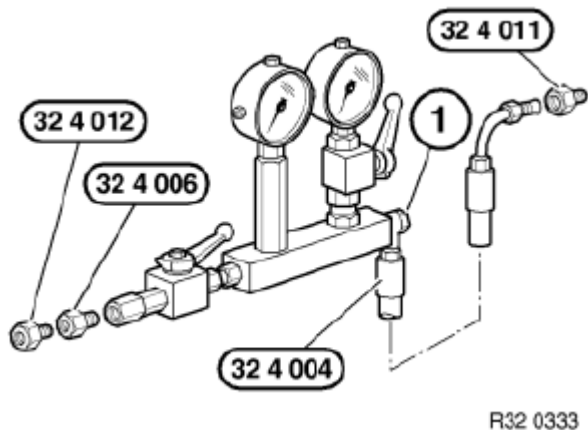


Fig. 87: Identifying Special Tools

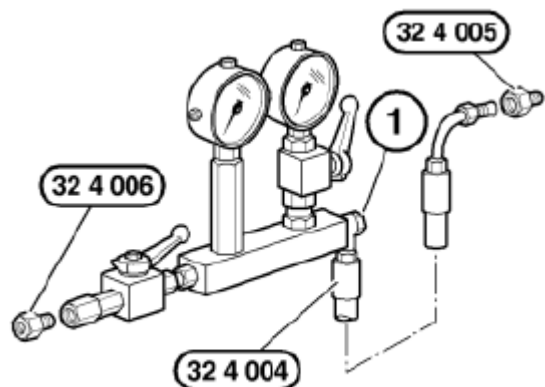
Courtesy of BMW OF NORTH AMERICA, INC.

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.



R32 0334

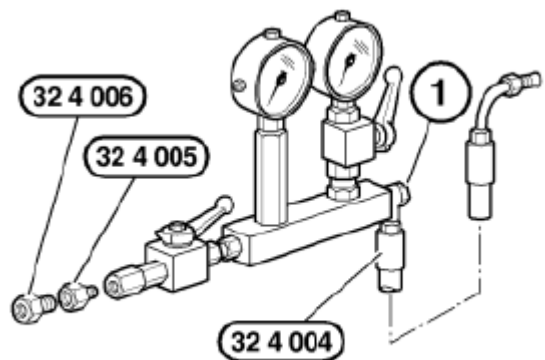
Fig. 88: Identifying Special Tool 32 4 004 And 32 4 005
Courtesy of BMW OF NORTH AMERICA, INC.

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.

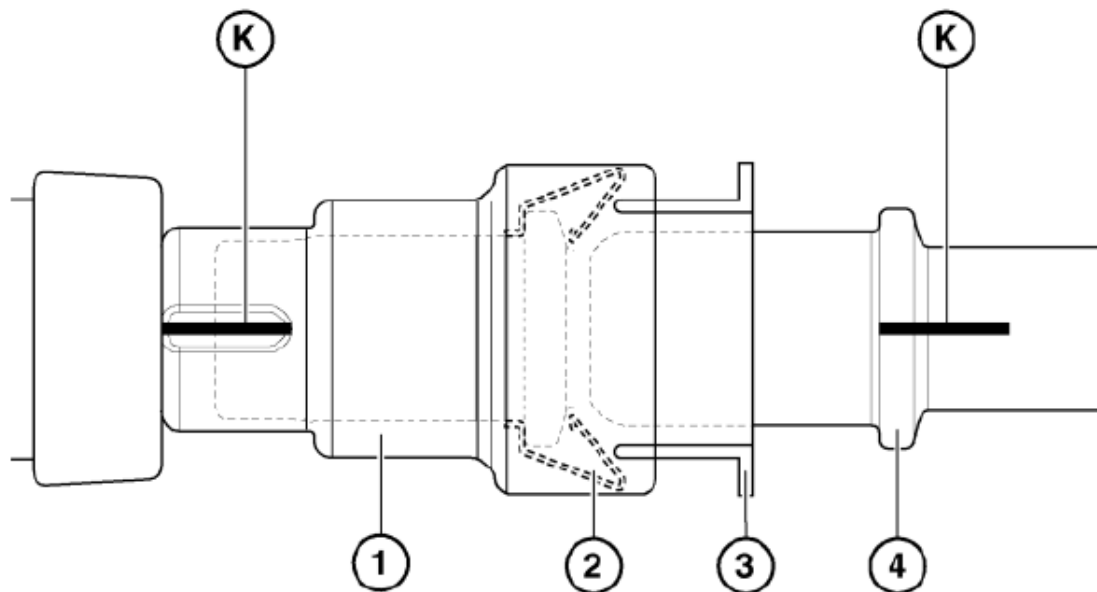


R32 0335

Fig. 89: Identifying Special Tool 32 4 004, 32 4 005 And 32 4 006
Courtesy of BMW OF NORTH AMERICA, INC.

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

1. Quick-connect coupling with ID marking



R32 0183

Fig. 90: Identifying Quick-Connect Coupling 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).

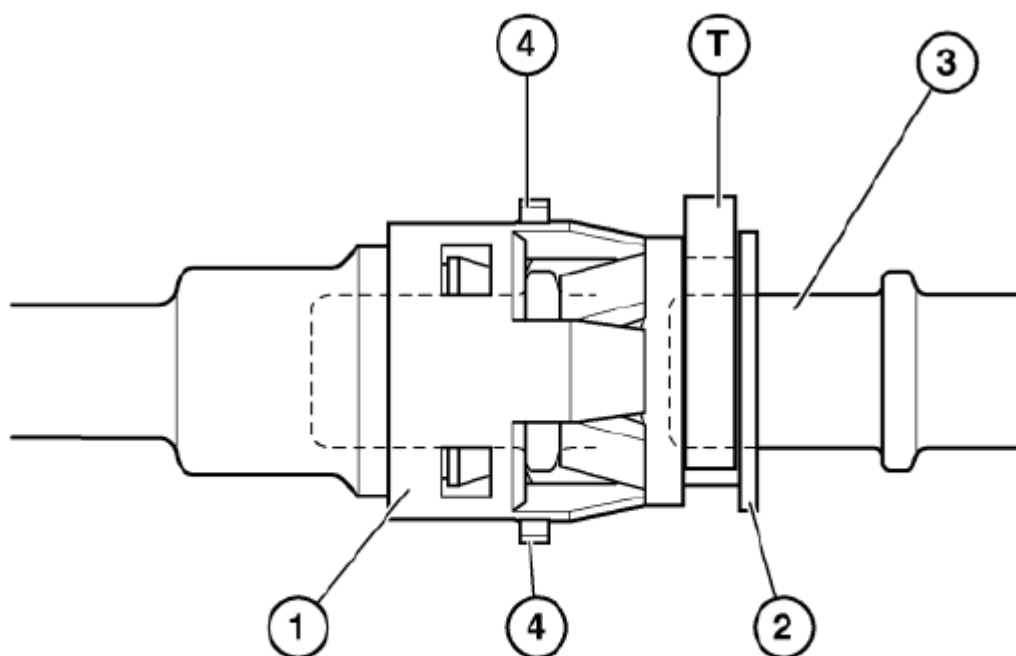
Assembly:

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



R32 0372

Fig. 91: Identifying Quick-Connect Coupling 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.

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32 41 009 CHECKING FUNCTION OF POWER STEERING VANE PUMP

Special tools required:

- 32 4 000

WARNING: DANGER OF POISONING if oil is ingested/absorbed through the skin!

RISK OF INJURY if oil comes into contact with eyes and skin!

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.

Recycling:

Catch and dispose of hydraulic fluid in a suitable container.

Observe country-specific waste-disposal regulations

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove FRONT UNDERBODY PROTECTION
- Disconnect PRESSURE LINE FROM VANE PUMP

Version with Dynamic Drive only:

- NOTE:**
1. Pressure line to valve block (Dynamic Drive)
 2. Pressure line to power steering gear
 3. Suction line from fluid reservoir

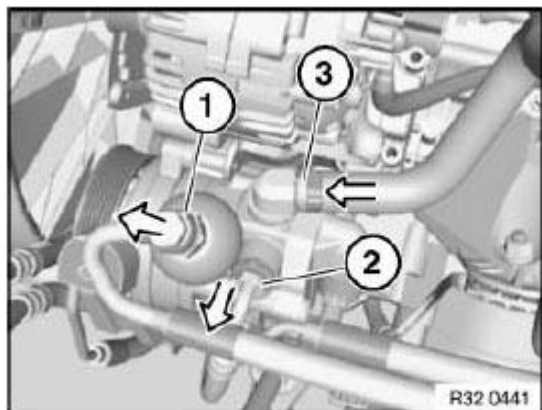


Fig. 92: Disconnecting Power Steering Gear Pressure Line
 Courtesy of BMW OF NORTH AMERICA, INC.

Connecting special tool:

Connect special tool 32 4 000 (refer to **NOTES ON USE**) with new sealing rings to vane pump and pressure line.

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

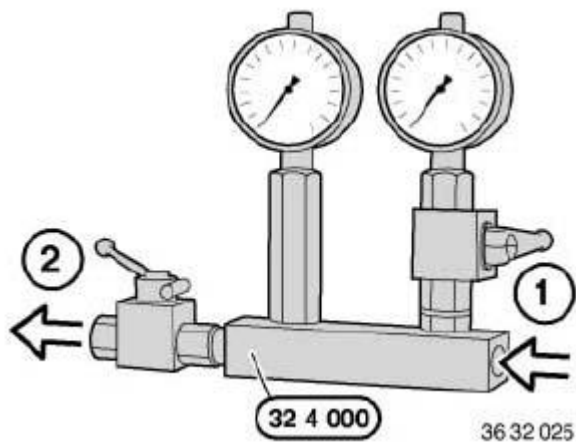


Fig. 93: Identifying Special Tool 32 4 000
 Courtesy of BMW OF NORTH AMERICA, INC.

Checking pump pressure:

1. Close valve (A).
2. Open valve (B).
3. Fill and bleed hydraulic system
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 %.

Check belt tension if the nominal pressure is undershot by more than 10 %. Replace vane pump if belt tension is OK.

After installation:

- Fill and bleed hydraulic system
- Check pipe connections for leaks
- Version with Dynamic Drive: If necessary, carry out **INITIAL DYNAMIC DRIVE OPERATION**

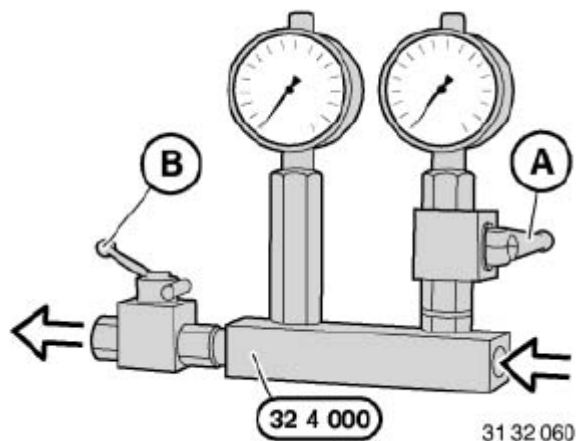


Fig. 94: Identifying Special Tool 32 4 000 And Valve
Courtesy of BMW OF NORTH AMERICA, INC.

32 41 060 REMOVING AND INSTALLING/REPLACING VANE PUMP FOR POWER STEERING (N54)

WARNING: Danger to life!

SECURE ENGINE IN INSTALLATION POSITION to prevent it from falling down.

DANGER OF POISONING if oil is ingested/absorbed through the skin!

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.

Close off pipe connections with plugs.*Recycling:*

Catch and dispose of hydraulic fluid in a suitable container.

Observe country-specific waste-disposal regulations

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **BELT PULLEY**
- Lower **FRONT AXLE SUPPORT**

Release screws (1, 2) and remove power steering pump towards front.

Installation:

Observe installation sequence at end of document.

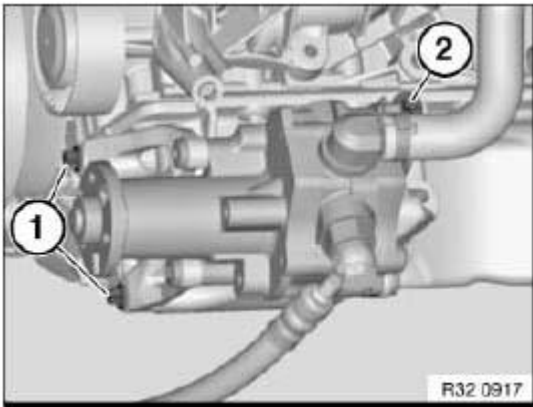


Fig. 95: Identifying Power Steering Pump Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release banjo bolt (2) and detach pressure line (1) from vane pump.

Installation:

Replace all sealing rings.

Tightening torque **32 41 3AZ** .

Release hose clamp (3) and detach suction line (4) from vane pump.

Remove vane pump.

Installation:

Markings (5) on suction line and vane pump connection must match up.

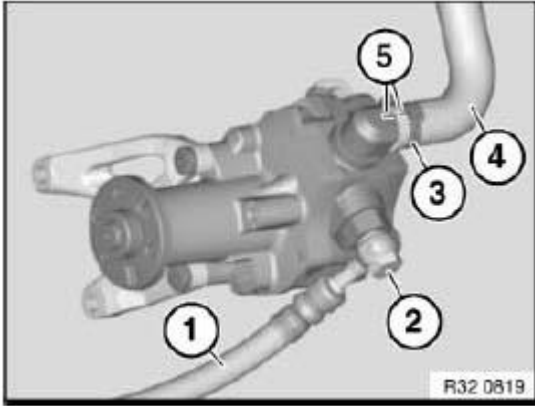


Fig. 96: Identifying Banjo Bolt, Pressure Line, Hose Clamp And Suction Line
Courtesy of BMW OF NORTH AMERICA, INC.

Installation sequence:

1. Insert screws (1, 2) (do not tighten down)
2. Tighten first screw (2) and then screws (1) to 2 Nm
3. Tighten down screws (1)

Tightening torque **32 41 1AZ** .

4. Release screw (2) and check screw fastening point for gap freedom
5. Tighten down screw (2)

Tightening torque **32 41 1AZ** .

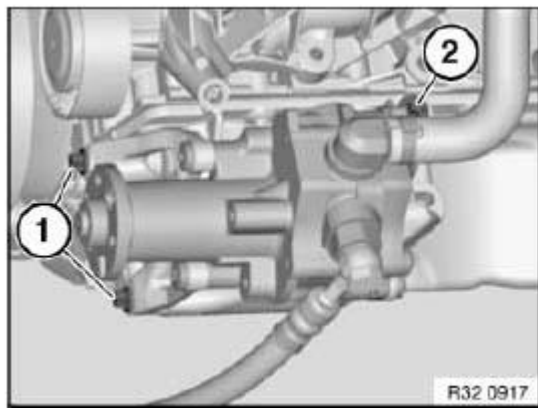


Fig. 97: Identifying Power Steering Pump Screws
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks

32 41 037 REMOVING AND INSTALLING POWER STEERING PUMP FOR POWER STEERING GEAR WITH DYNAMIC DRIVE (N52, N53)

See **Removing and installing power steering pump for power steering gear with Dynamic Drive (N52, N53)** .

32 41 060 REMOVING AND INSTALLING (REPLACING) POWER STEERING VANE PUMP (N52, N53)

See **Removing and installing (replacing) power steering vane pump (N52, N53)** .

32 41 311 REPLACING SUCTION LINE FOR POWER STEERING (N52, N53)

See **Replacing suction line for power steering (N52, N53)** .

32 41 332 REPLACING PRESSURE LINE FOR POWER STEERING (N52, N53)

See **Replacing pressure line for power steering (N52, N53)** .

32 41 351 REPLACING RETURN LINE FOR POWER STEERING (N52, N53)

See **Replacing return line for power steering (N52, N53)** .

32 41 061 REPLACING POWER STEERING VANE PUMP

WARNING: DANGER OF POISONING if oil is ingested/absorbed through the skin!

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.

Close off pipe connections with plugs.

Recycling:

Catch and dispose of hydraulic fluid in a suitable container.

Observe country-specific waste-disposal regulations

Necessary preliminary tasks:

- Remove **VANE PUMP**

Release screws (1) and remove belt pulley (2).

Installation:

Lettering on belt pulley (2) points forwards.

Tightening torque **32 41 14AZ** .

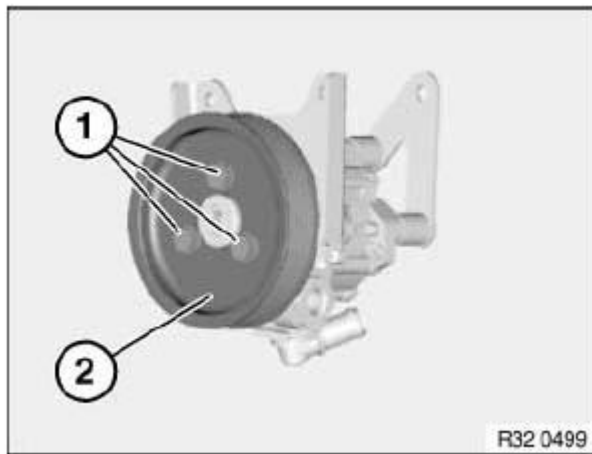


Fig. 98: Identifying Belt Pulley Screws
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks

- Version with Dynamic Drive: If necessary, carry out **INITIAL DYNAMIC DRIVE OPERATION**

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** .

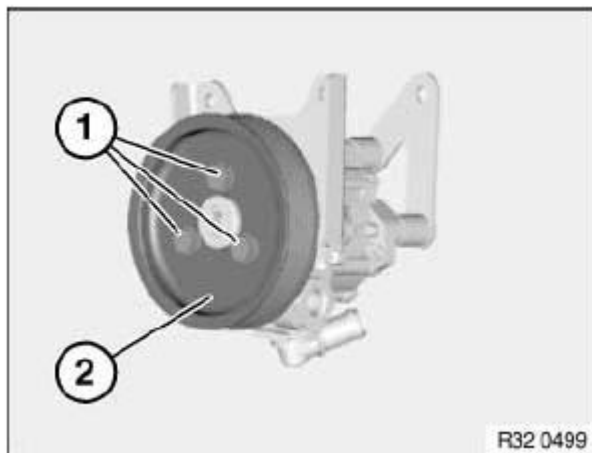


Fig. 99: Identifying Belt Pulley Bolts

Courtesy of BMW OF NORTH AMERICA, INC.

32 41 250 REMOVING AND INSTALLING/REPLACING FLUID RESERVOIR FOR POWER STEERING

Special tools required:

- **32 1 260**

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
- M54, N52, N53, N54: Remove intake filter housing

Release screw (1).

Tightening torque **32 41 9AZ** .

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

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

Disconnect suction and cooler return lines from fluid reservoir, check and if necessary replace.

Lift out fluid reservoir.

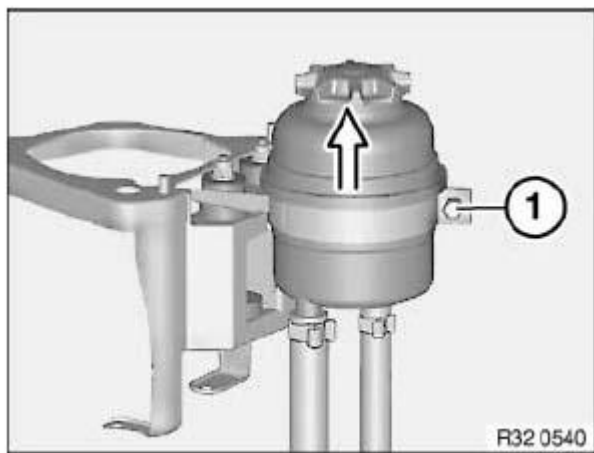


Fig. 100: Lifting Out Fluid Reservoir
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks

32 41 311 REPLACING SUCTION LINE FOR POWER STEERING (N54 AWD)

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 **FRONT UNDERBODY PROTECTION**
- Remove steering gear cover at side

Version with automatic transmission:

Release bolts (1).

Remove bracket (2) for transmission oil cooler lines from front axle carrier.

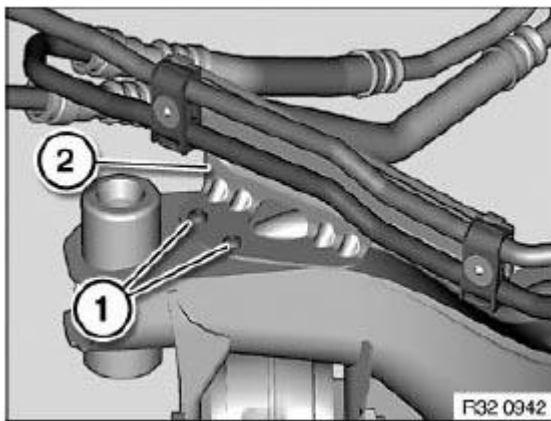


Fig. 101: Identifying Bracket For Transmission Oil Cooler Lines
Courtesy of BMW OF NORTH AMERICA, INC.

Unfasten hose clip (1).

Detach suction line (2) from vane pump; if necessary, remove return line for power steering from front axle carrier.

Installation:

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

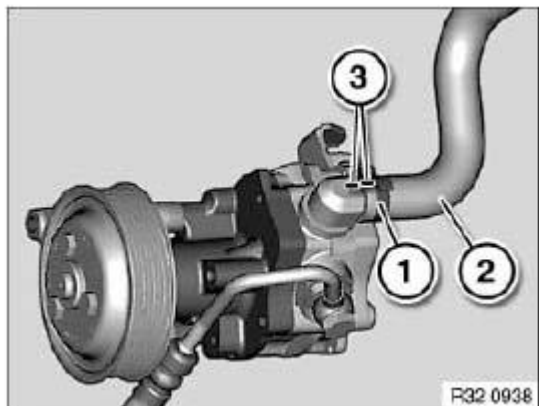


Fig. 102: Identifying Suction Line And Hose Clip
 Courtesy of BMW OF NORTH AMERICA, INC.

Expose suction line up to connection on fluid reservoir.

Remove **FLUID RESERVOIR FROM MOUNTING BRACKET/BODY.**

Unfasten hose clip (1).

Disconnect suction line (2) from fluid reservoir.

Installation:

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

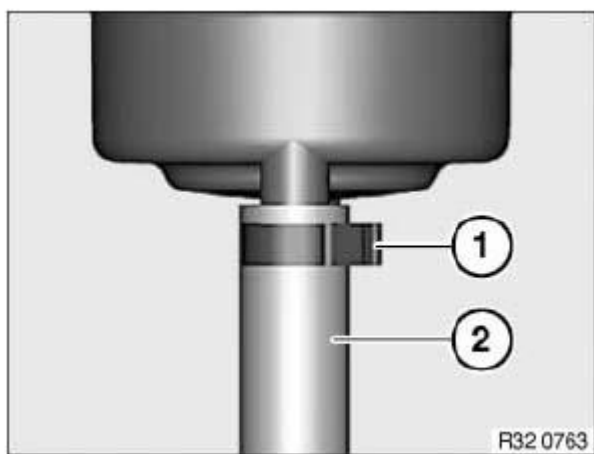


Fig. 103: Identifying Hose Clip And Suction Line
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**

- Check pipe connections for leaks

32 41 332 REPLACING PRESSURE LINE FOR POWER STEERING (N54 AWD)

**IMPORTANT: Adhere to the utmost cleanliness. Do not allow any dirt to enter the hydraulic system.
Close off pipe connections 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
- Lower **FRONT AXLE SUPPORT**

Release banjo bolt (1) and detach pressure line (2) from vane pump.

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 3AZ** .

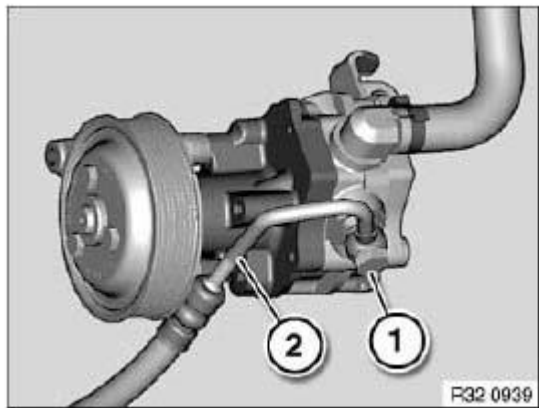


Fig. 104: Identifying Banjo Bolt And Pressure Line
Courtesy of BMW OF NORTH AMERICA, INC.

Expose pressure line up to connection on power steering gear.

Release banjo bolt (1) and remove pressure line (2).

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 3AZ** .

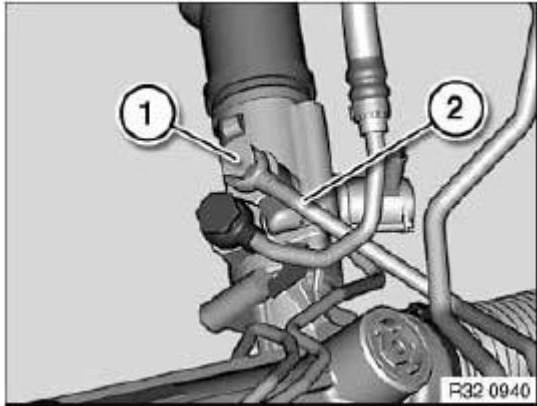


Fig. 105: Identifying Banjo Bolt And Pressure Line
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks

32 41 341 REPLACING COOLER RETURN LINE FOR POWER STEERING

WARNING: **DANGER OF POISONING** if oil is ingested/absorbed through the skin!

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.

Close off pipe connections with plugs.

Recycling:

Catch and dispose of hydraulic fluid in a suitable container.

Observe country-specific waste-disposal regulations

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **FRONT UNDERBODY PROTECTION**
- M54, N52, N53: Remove intake filter housing
- N54: Remove charge-air duct

Remove **FLUID RESERVOIR FROM BRACKET**.

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

Installation:

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

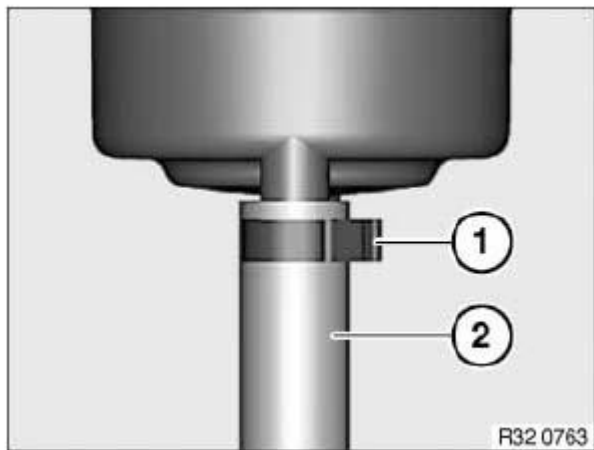


Fig. 106: Identifying Hose Clamp And Cooler Return Line
Courtesy of BMW OF NORTH AMERICA, INC.

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

Release **QUICK-CONNECT COUPLING** and seal power steering cooler connection with a suitable plug.

Installation:

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

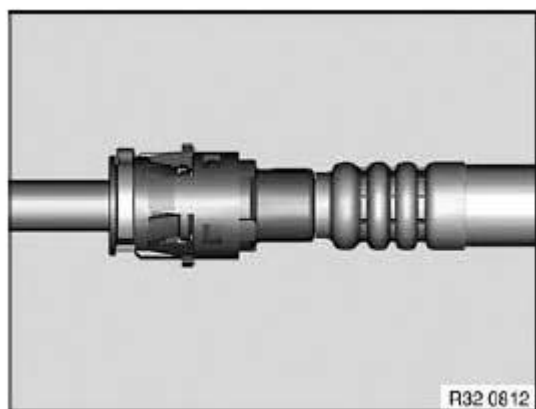


Fig. 107: Identifying Cooler Return Line For Power Steering
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks

32 41 351 REPLACING RETURN LINE FOR POWER STEERING (N54 AWD)

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

Close off pipe connections 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
- Lower **FRONT AXLE SUPPORT**

Release **QUICK-CONNECT COUPLING** and seal power steering cooler connection with a suitable plug.

Installation:

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

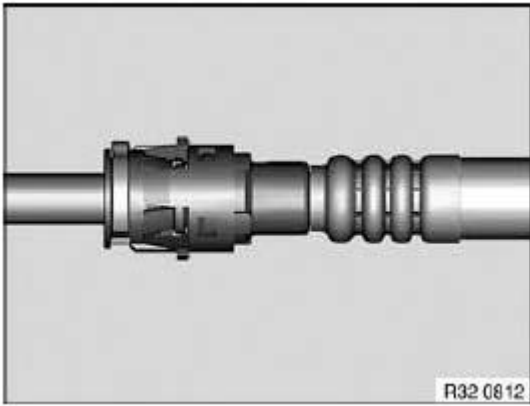


Fig. 108: Identifying Return Line For Power Steering (N54 AWD)
Courtesy of BMW OF NORTH AMERICA, INC.

Expose return line up to connection on power steering gear.

Release banjo bolt (1) and remove return line (2).

Installation:

Replace all sealing rings.

When tightening down banjo bolt, make sure stop (3) rests correctly on power steering gear.

Tightening torque **32 41 3AZ** .

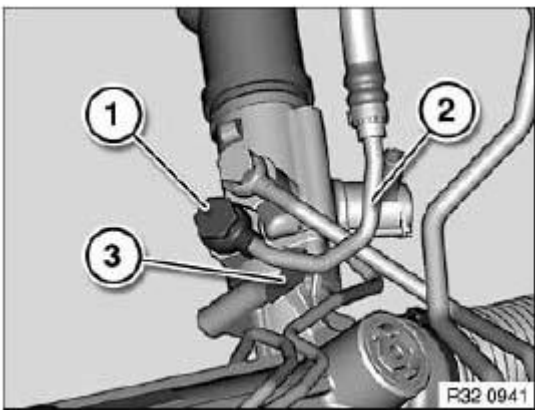


Fig. 109: Identifying Banjo Bolt And Return Line
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks

90 TROUBLESHOOTING

32 90 ... TROUBLESHOOTING ON STEERING (4WD)

Observe **TROUBLESHOOTING ON FRONT AXLE AND DIAGNOSIS HELP FOR STEERING (SI)**.

TROUBLESHOOTING CHART

Fault	Cause	Remedy
Excessive steering wheel play/steering wheel shake	Screw connections, steering spindle lower section to steering gear, loose	Replace screws and tighten down (refer to <u>REMOVING AND INSTALLING/REPLACING LOWER SECTION OF STEERING SPINDLE</u>)
	Connection, steering spindle lower section to assembly partition wall, loose	Tighten down screws (refer to <u>REMOVING AND INSTALLING/REPLACING STEERING SPINDLE LOWER SECTION</u>)
	Journal of tie rod end deformed	Replace <u>STEERING GEAR</u> and <u>TIE ROD ENDS</u>
	Tie rod end worn	Check steering gear rack; if necessary, replace <u>STEERING GEAR</u>
		Check <u>TIE RODS</u> , replace if necessary
		Replace <u>TIE ROD END</u>
Steering wheel inclination	Steering gear rack damaged	Replace <u>STEERING GEAR</u>
	refer to <u>TROUBLESHOOTING ON FRONT AXLE</u>	
	refer to <u>TROUBLESHOOTING ON FRONT AXLE</u>	