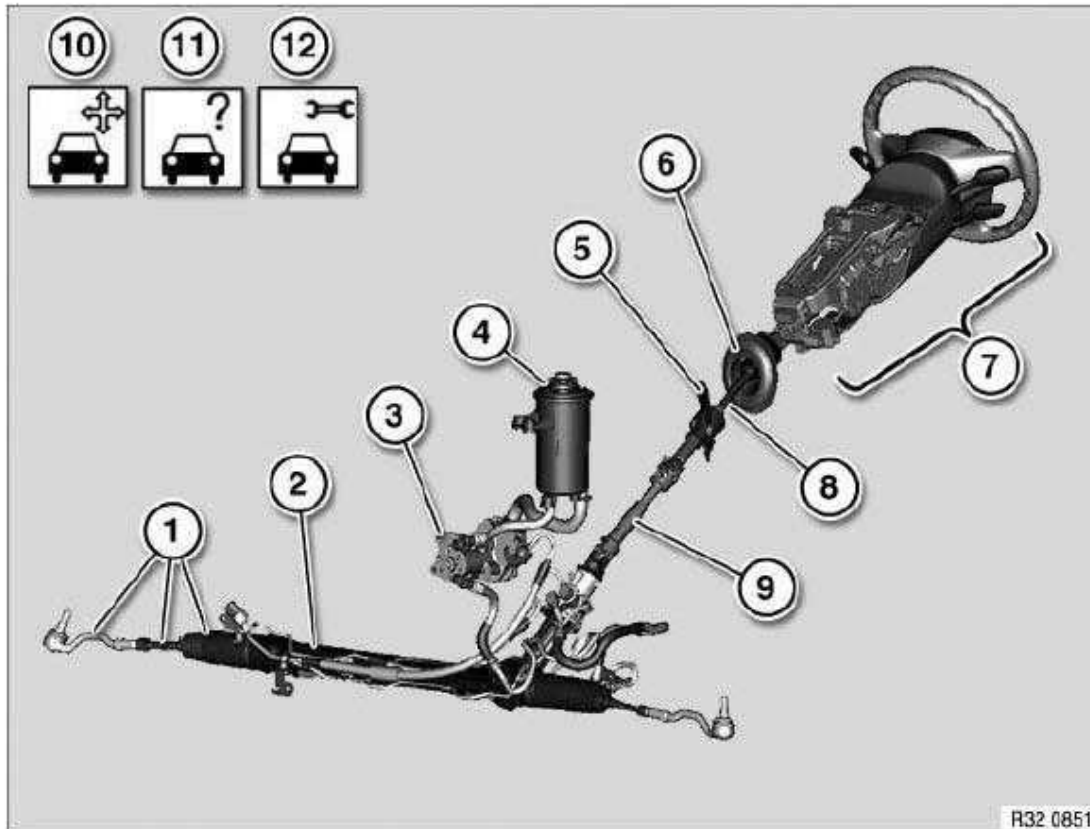


SUSPENSION

Steering and Wheel Alignment - Repair Instructions - X6

ELECTRONIC CHASSIS ALIGNMENT

32 OVERVIEW OF STEERING



1 [Tie rod end / tie rod / gaiter](#)

2 [Power steering gear](#)

3 [Vane pump](#)

4 [Oil container](#)

5 Bearing plate

6 Sleeve

7 [Overview of steering \(interior\)](#)

8 Steering spindle middle section

9 [Steering spindle lower section](#)

10 [Adjustment work](#)

11 Testing

12 [Troubleshooting](#)

[Overview, active front steering](#)

[Overview, Dynamic Drive](#)

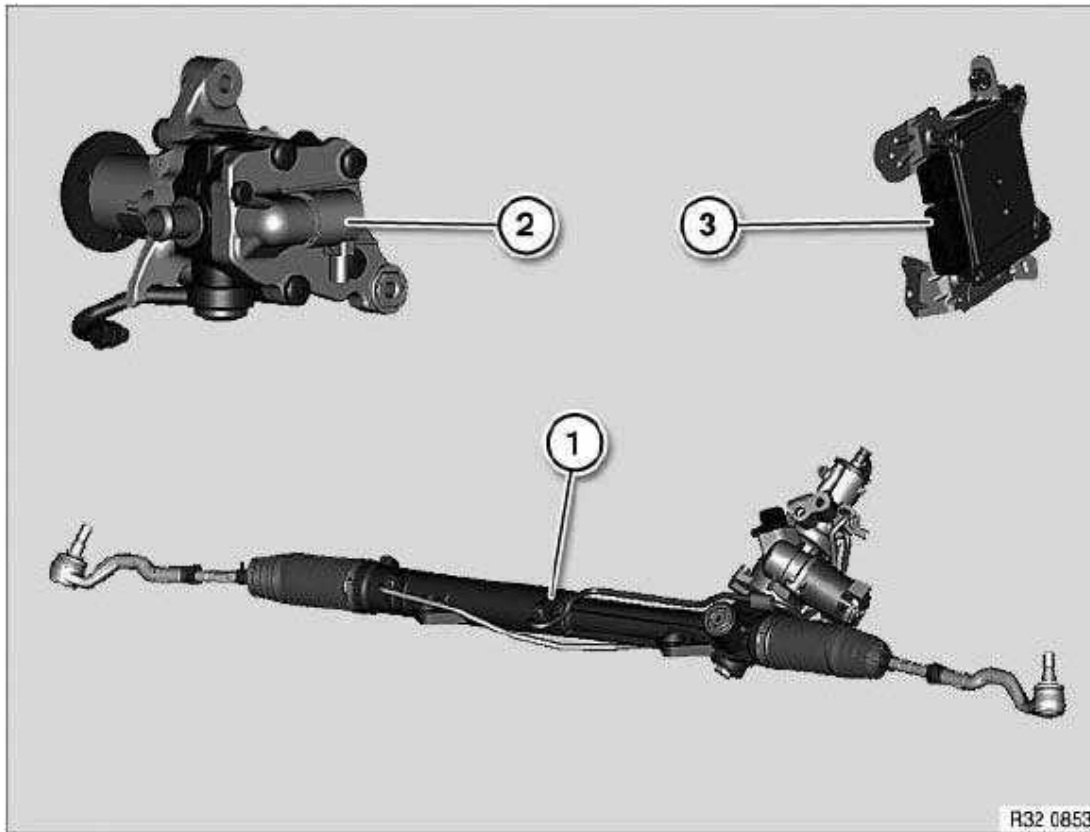
[Bleed power steering unit](#)

[Carry out steering angle sensor adjustment/adjustment for active front steering](#)

Fig. 1: Overview Of Steering

Courtesy of BMW OF NORTH AMERICA, INC.

32 OVERVIEW OF ACTIVE FRONT STEERING



- 1 Power steering gear
- 2 Eco valve (on power steering pump)
- 3 Control unit

Carry out adjustment for active front steering

Fig. 2: Overview Of Active Front Steering

Courtesy of BMW OF NORTH AMERICA, INC.

32 ... OVERVIEW OF STEERING (INTERIOR)



- | | | | |
|---|---|---|--|
| 1 | <u>Airbag unit</u> | 6 | <u>Steering angle sensor (see steering column switch cluster)</u> |
| 2 | <u>Steering wheel</u> | | |
| 3 | <u>Upper steering column casing</u> | | |
| 4 | <u>Steering column</u> | | |
| 5 | <u>Lower steering column casing</u> | | <u>Carry out steering angle sensor adjustment/adjustment for active front steering</u> |

Fig. 3: Overview Of Steering (Interior)

Courtesy of BMW OF NORTH AMERICA, INC.

32 00 ... ADDITIONAL WORK FOR CAMBER CORRECTION

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

NOTE: The upper control arm may only be replaced if the camber is outside the specified tolerance after toe adjustment.

Adjust **TOE-IN**.

Check camber values; if necessary, replace upper control arm with over- or underdimension variant. (See **31 12 002 REMOVING AND INSTALLING/REPLACING TOP LEFT CONTROL ARM** and **31 12 003**

REMOVING AND INSTALLING/REPLACING TOP RIGHT CONTROL ARM)

NOTE: Control arms with + or - marking (see Fig. 4) are camber correction arms:

- Underdimension variant

+ Overdimension variant

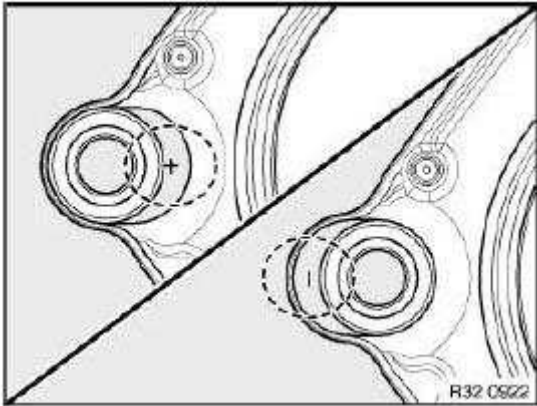


Fig. 4: Identifying Underdimension And Overdimension Variant
Courtesy of BMW OF NORTH AMERICA, INC.

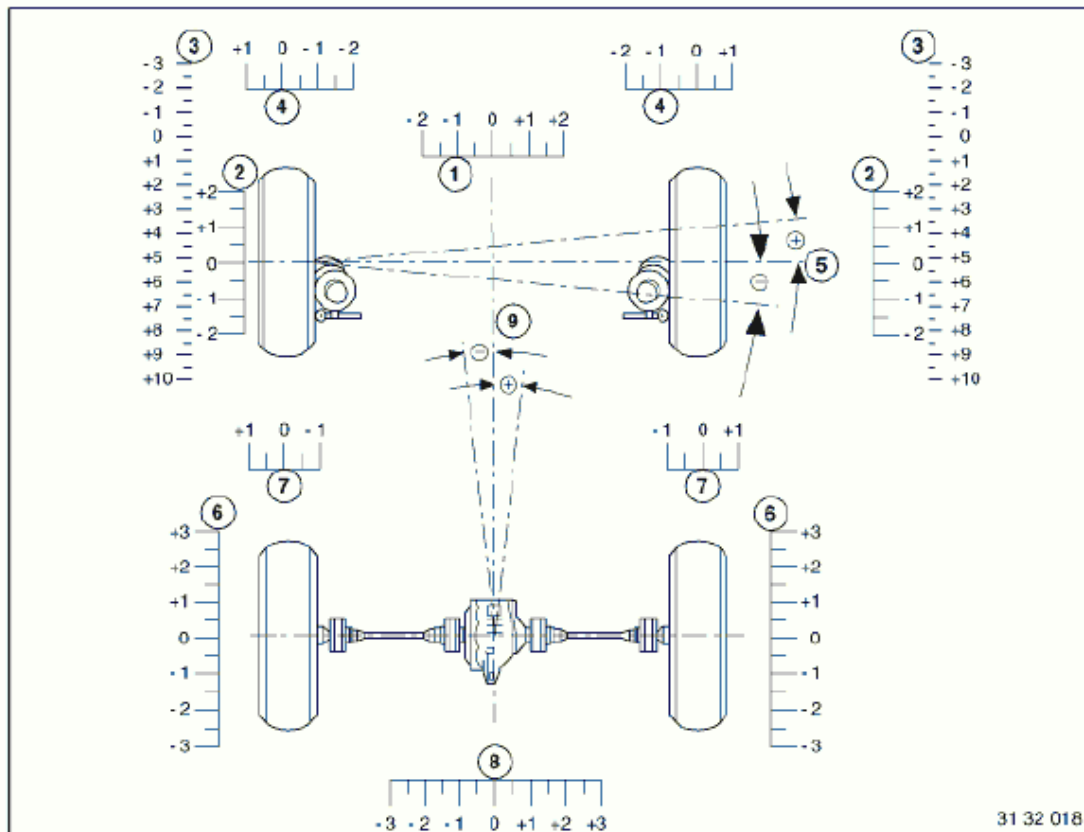
These camber correction arms are used to correct the camber values by 30 minutes. To be used only if the tolerance values are exceeded or undershot!

An unmarked control arm is a standard part.

After installation

- Check directional stability of car; if necessary, repeat TOE-IN adjustment

32 00 ... GENERAL CHASSIS AND SUSPENSION DEFINITIONS



- | | |
|---|------------------------|
| 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. 5: General Chassis And Suspension Definitions
 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.

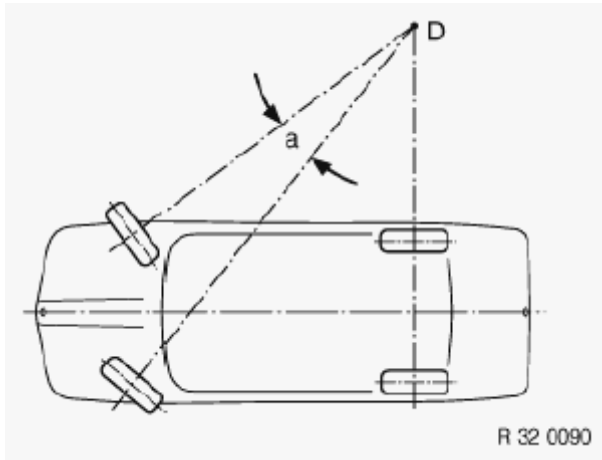


Fig. 6: Identifying Toe Angle
Courtesy of BMW OF NORTH AMERICA, INC.

Camber

Inclination of the wheel from the perpendicular.

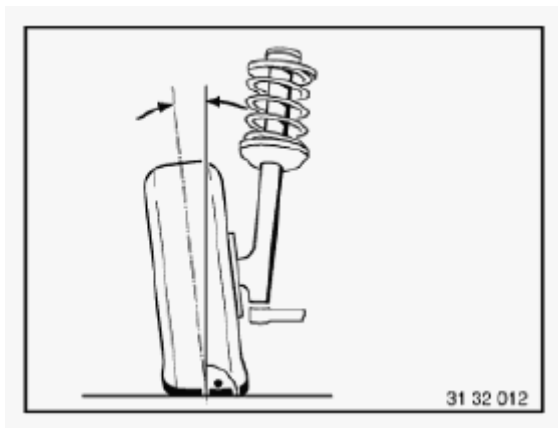


Fig. 7: Identifying Camber Angle
Courtesy of BMW OF NORTH AMERICA, INC.

Toe

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

- the wheels from vibrating and grinding
- excessive tire wear

- excessive strain on the steering linkage and its links/joints
- heavy vehicle steering

Measurement is performed in "straight-ahead mode".

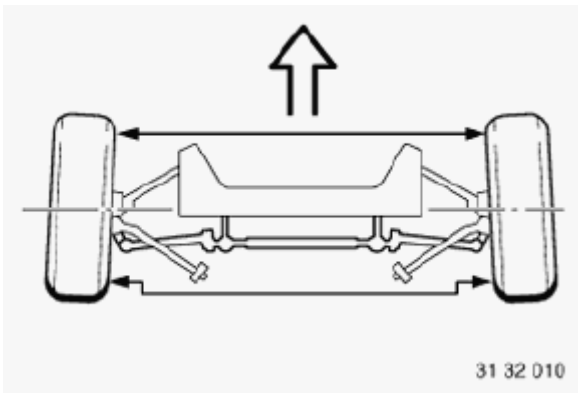


Fig. 8: Identifying Toe Angle
 Courtesy of BMW OF NORTH AMERICA, INC.

Caster

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

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

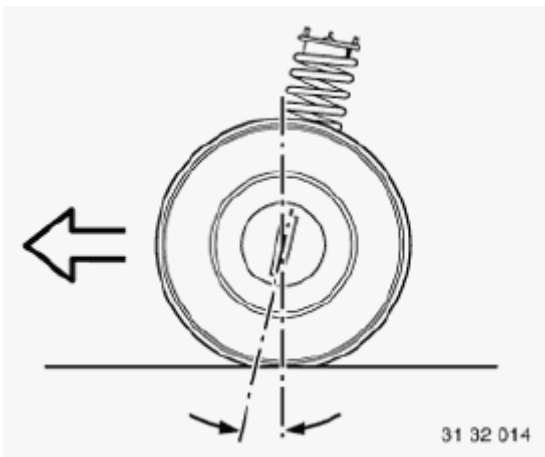


Fig. 9: Identifying Caster Angle
 Courtesy of BMW OF NORTH AMERICA, INC.

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.

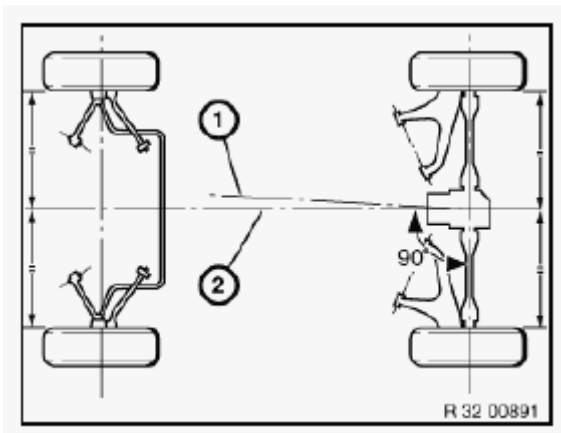


Fig. 10: Identifying Wheel Offset Angle
Courtesy of BMW OF NORTH AMERICA, INC.

Wheel offset

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

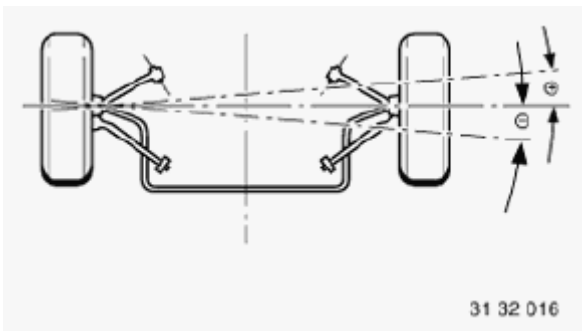


Fig. 11: Identifying Kingpin Offset/Scrub Radius Angle
Courtesy of BMW OF NORTH AMERICA, INC.

Kingpin offset/scrub radius

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

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

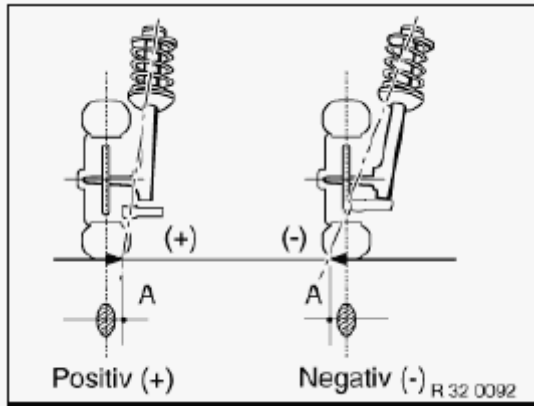


Fig. 12: Identifying Lifting Platform

Courtesy of BMW OF NORTH AMERICA, INC.

32 00 ... IDENTIFICATION OF SUSPENSION WITHOUT LABEL

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

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

Facts

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

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

Procedure

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

- A. Visible or noticeable damage to the steering gear
 - 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 **STEERING AND WHEEL ALIGNMENT - TECHNICAL DATA**).

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 **STEERING AND WHEEL ALIGNMENT - TECHNICAL DATA**) into vehicle
- Determine **VEHICLE RIDE HEIGHT**

NOTE: If the vehicle ride height is not inside the tolerance (refer to **STEERING AND WHEEL ALIGNMENT - TECHNICAL DATA**), 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 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION

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

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

C. If the vehicles in question have been involved in an accident

NOTE:

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

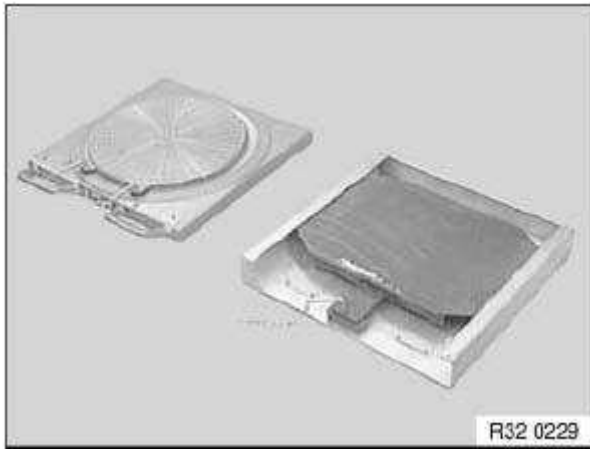


Fig. 13: Clamping Levers In Area Of Front Wheels
Courtesy of BMW OF NORTH AMERICA, INC.

- 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. 14: Clamping Levers In Area Of Front Wheels
 Courtesy of BMW OF NORTH AMERICA, INC.

- If necessary, attach spoiler adapter.



Fig. 15: Attaching Spoiler Adapter
 Courtesy of BMW OF NORTH AMERICA, INC.

- Enter customer and vehicle data
- Identify **CHASSIS VERSION** and select vehicle
- Enter tire pressure and tread depth
- Move **VEHICLE INTO DESIGN POSITION**
- Install brake tensioner.

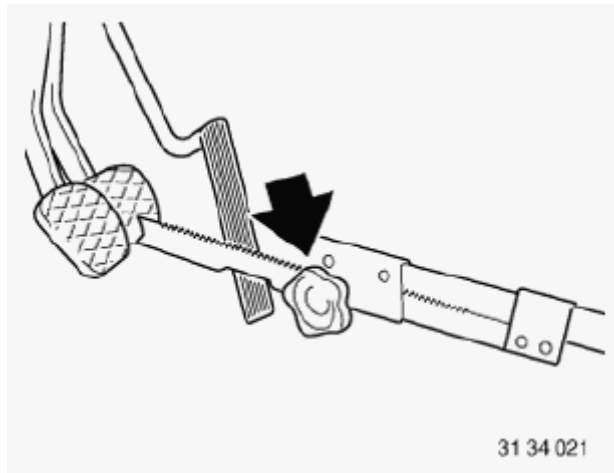


Fig. 16: Locating Brake Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

- Perform input measurement in accordance with equipment manufacturer's instructions.
- Compare specified values with actual values.
- If necessary, adjust front axle and rear axle. See **32 00 ... ADDITIONAL WORK FOR CAMBER CORRECTION**, **32 00 601 ADJUSTING TOE-IN ON FRONT AXLE**, and **32 00 620 ADJUSTING REAR 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. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT**.
- Insert locking pins into both rotary and sliding plates
- Remove chassis/wheel alignment system

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

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

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

NOTE:

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

NOTE:

- Check compliance with TEST CONDITIONS, bring vehicle to a stop if necessary.
- If the ride height is outside the tolerance range (+40/-20 mm), the vehicle must be loaded and measured/aligned in the DESIGN POSITION.

- 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

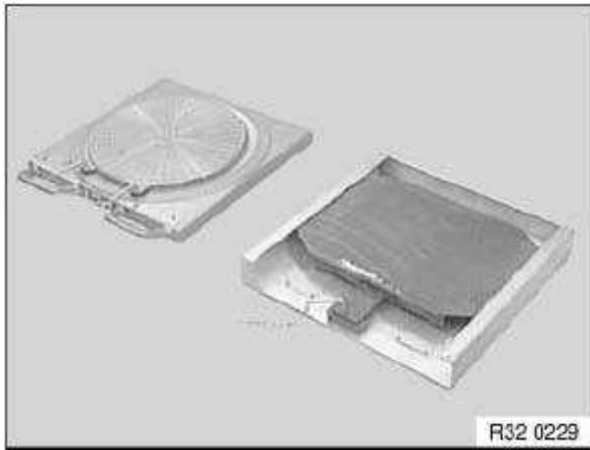


Fig. 17: Identifying Lifting Platform
Courtesy of BMW OF NORTH AMERICA, INC.

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

NOTE: When using quick-clamping units, perform RIM RUNOUT COMPENSATION after installing the pickups.



Fig. 18: Clamping Levers In Area Of Front Wheels
Courtesy of BMW OF NORTH AMERICA, INC.

- If necessary, attach spoiler adapter.



Fig. 19: Attaching Spoiler Adapter
Courtesy of BMW OF NORTH AMERICA, INC.

- Install brake tensioner.

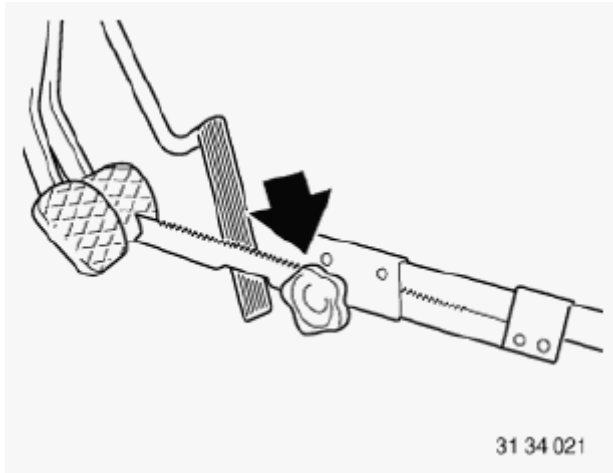


Fig. 20: Locating Brake Tensioner
Courtesy of BMW OF NORTH AMERICA, INC.

- Enter customer and vehicle data
- Identify **CHASSIS VERSION** and select vehicle
- Enter tire pressure and tread depth
- Measure and enter **VEHICLE RIDE HEIGHT**

If the ride height is outside the tolerance range (+40/- 20 mm), the vehicle must be loaded and measured/aligned in the **DESIGN POSITION**.

- Perform input measurement in accordance with equipment manufacturer's instructions.
- Compare specified values with actual values.
- If necessary, adjust front axle and rear axle. See **32 00 ... ADDITIONAL WORK FOR CAMBER CORRECTION**, **32 00 601 ADJUSTING TOE-IN ON FRONT AXLE**, and **32 00 620 ADJUSTING REAR 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. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT**.
- Insert locking pins into both rotary and sliding plates
- Remove chassis/wheel alignment system

32 00 601 ADJUSTING TOE-IN ON FRONT AXLE

NOTE: **Camber and toe-in influence each other. Adjust the toe-in first in order to simplify the adjustment procedure.**

Version with active front steering:

- Align steering wheel
- Set cumulative steering angle by means of the service function **"CARRY OUT INITIAL OPERATION/ADJUSTMENT FOR ACTIVE FRONT STEERING"** to "zero".
- If necessary, secure with steering wheel arrester

Version without active front steering:

If necessary, remove steering gear cover at top. See **51 71 ... REMOVING AND INSTALLING/REPLACING TOP LEFT STEERING GEAR COVER** and **51 71 ... REMOVING AND INSTALLING/REPLACING TOP RIGHT STEERING GEAR COVER** .

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.

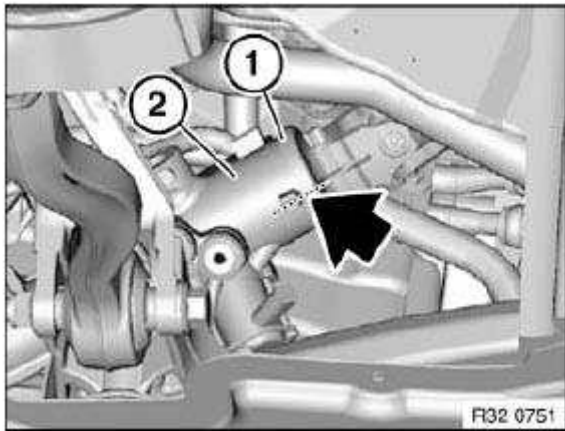


Fig. 21: Aligning Steering Wheel And Secure With Steering Wheel Arrester
Courtesy of BMW OF NORTH AMERICA, INC.

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.

Version with active front steering: Check cumulative steering angle; if necessary, set to "zero".

Check toe values, repeat adjustment if necessary.

Tighten down clamping nut (2).

Tightening torque **32 21 2AZ** .

Fit clamp (4).

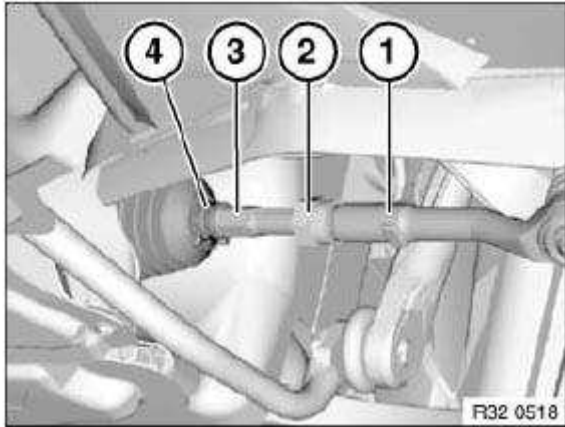


Fig. 22: Identifying Tie Rod And Clamp
Courtesy of BMW OF NORTH AMERICA, INC.

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.**

Adjusting camber

Replace nut (2) prior to adjustment and tighten to 5 Nm.

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

Tighten nut (2).

Tightening torque **33 32 2AZ** .

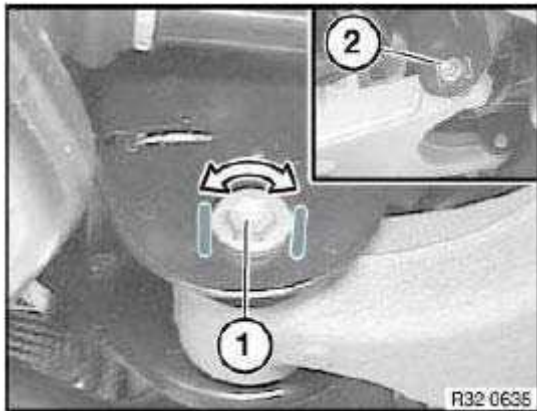


Fig. 23: Adjusting Camber To Setpoint Value
 Courtesy of BMW OF NORTH AMERICA, INC.

Adjusting toe

Replace nut (2) prior to adjustment and tighten to 5 Nm.

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

Tighten nut (2).

Tightening torque **33 32 5AZ** .

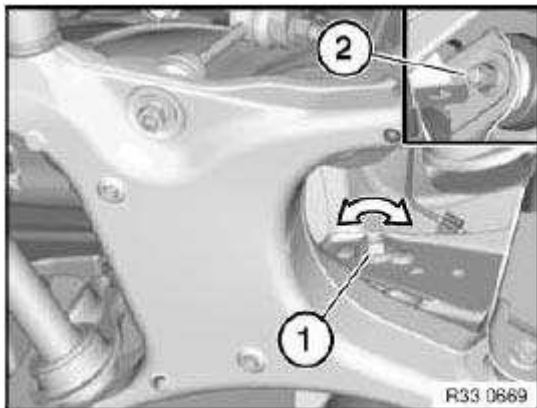


Fig. 24: Adjusting Toe To Specified Value
 Courtesy of BMW OF NORTH AMERICA, INC.

32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING

NOTE: **Adjustment of the active front steering must be carried out:**

- after adjustment work on the front axle/steering
- after all mechanical work on the steering system

- after replacement/programming or coding of the following components:
 - Steering column switch cluster
 - DSC control unit
 - Active front steering control unit
 - ARS control unit

Connect vehicle to BMW diagnosis system.

Select and carry out initial operation/adjustment for active front steering under Service functions.

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

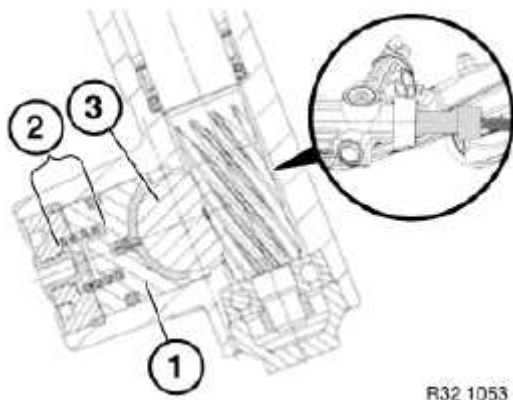


Fig. 25: Applying Force Distributed Via Tie Rod Into Horizontal And Vertical Forces
Courtesy of BMW OF NORTH AMERICA, INC.

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:** Turn on ignition and start engine

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

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

Necessary preliminary tasks:

- Remove **TIE ROD END**
- Remove **LOWER STEERING GEAR COVER**

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.

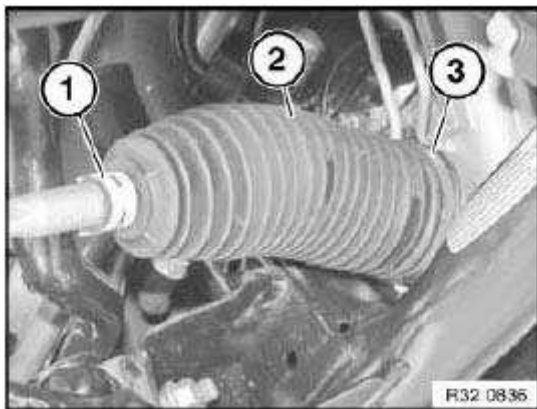


Fig. 26: Identifying Band Clamp And Clip
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT**.

STEERING GEAR WITH SERVO UNIT

32 13 006 BLEEDING POWER STEERING (VERSION WITH DYNAMIC DRIVE)

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!

Use only Pentosin CHF11S from original containers!

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

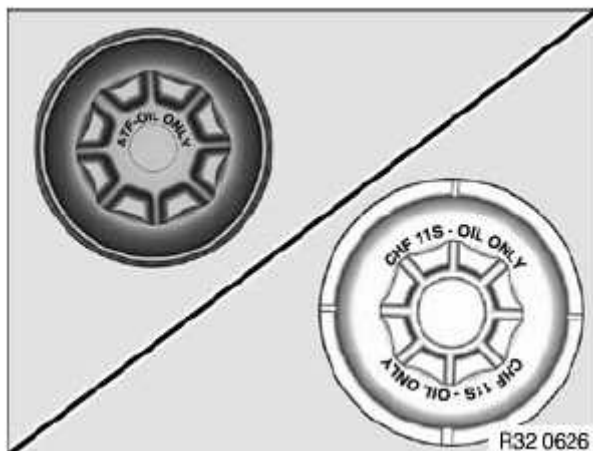


Fig. 27: Identifying Fluid Reservoirs Caps With Identification Marks

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 15 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.

Hydraulic fluid: BMW Service Operating Fluids

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

After filling:

- If necessary, carry out INITIAL DYNAMIC DRIVE OPERATION

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

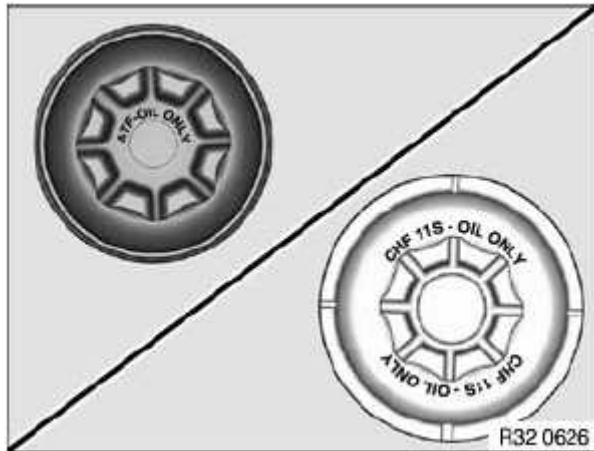


Fig. 28: Identifying Fluid Reservoirs Caps With Identification Marks
Courtesy of BMW OF NORTH AMERICA, INC.

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.

Hydraulic fluid: BMW Service Operating Fluids

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 POWER STEERING GEAR

WARNING: Secure engine in installation position with special tool to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **track rod end on both sides from swivel bearing**
- Version with Dynamic Drive: Remove both anti-roll bar links from anti-roll bar. See **31 35 005 REMOVING AND INSTALLING/REPLACING PUSH ROD (STABILIZER LINK) FOR LEFT/RIGHT STABILIZER.**
- Remove **lower section of steering spindle from steering gear**

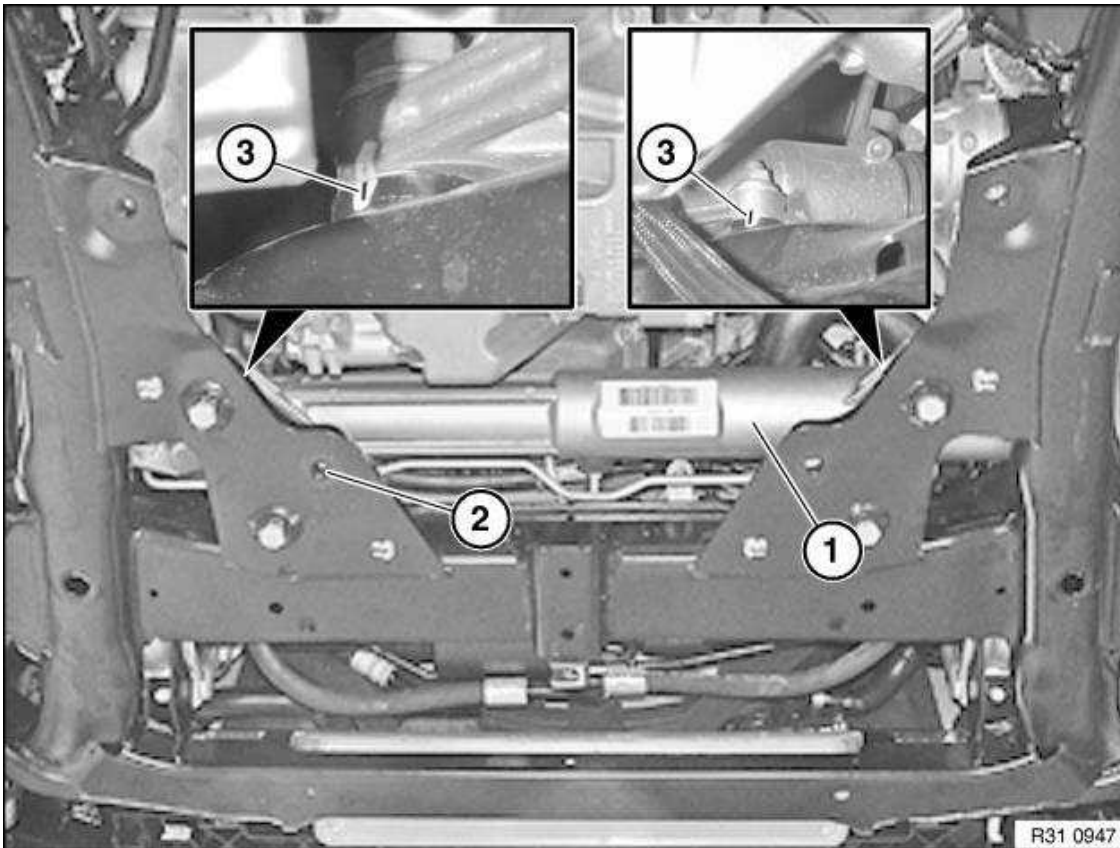


Fig. 29: Removing Power Steering Gear
Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: To avoid the need for axle/wheel alignment, mark position of steering gear (1) to front axle support (2). To do so, draw a wide white stripe on the rear bolting points (left and right) and apply a thin black marking (3) to this stripe.

Lower front axle support. See **31 11 506 LOWERING/RAISING FRONT AXLE CARRIER (UNIVERSAL**

LIFTER) .

Mark installation positions of pressure and return lines to power steering gear. Release banjo bolts (1). Disconnect pressure line (2) and return line (3) from power steering gear. Installation: Replace all sealing rings. Align pressure and return lines by way of markings and tighten down banjo bolts. Tightening torque 32 41 5AZ (pressure line), see **32 41 PUMP AND OIL SUPPLY** . Tightening torque 32 41 6AZ (return line), see **32 41 PUMP AND OIL SUPPLY** .

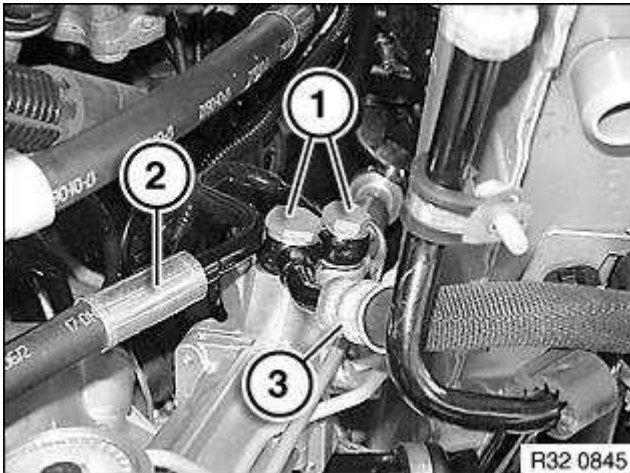


Fig. 30: Releasing Banjo Bolts

Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts and remove screws (1) towards bottom. Remove hydraulic steering gear (2) sideways between engine and front axle supports. Installation: When installing, make sure that the steering gear is realigned to the markings applied to the front axle support prior to removal. Replace screws and nuts. Tightening torque 32 00 1AZ, see **32 00 STEERING** .

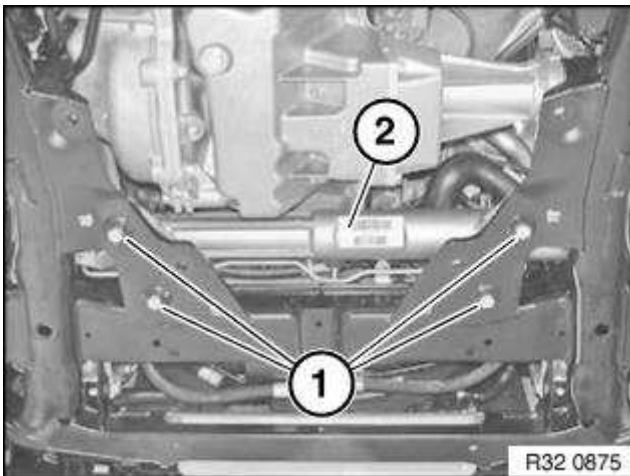


Fig. 31: Releasing Nuts And Remove Screws

Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **hydraulic system**
- Check pipe connections for leaks
- Carry out steering angle sensor adjustment
- If necessary, carry out initial Dynamic Drive operation. See **37 10 001 INITIAL OPERATION WITH TEST RUN OF DYNAMIC DRIVE** .

32 13 065 REMOVING AND INSTALLING/REPLACING POWER STEERING GEAR FOR ACTIVE FRONT STEERING

WARNING: Secure engine in installation position with special tool to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **TIE ROD END ON BOTH SIDES FROM SWIVEL BEARING**
- Replacement only: Remove **TIE ROD END AT BOTH ENDS OF TIE ROD**
- Version with Dynamic Drive: Remove **BOTH STABILIZER LINKS FROM STABILIZER**
- Remove **LOWER SECTION OF STEERING SPINDLE FROM STEERING GEAR**
- Slacken screw connection for **CONTROL ARM AT BOTTOM LEFT AND RIGHT ON FRONT AXLE CARRIER**
- Lower **FRONT AXLE SUPPORT**
- Disconnect plug connection for Eco valve on back of power steering pump

Carefully lower power steering gear.

Mark installation positions of pressure and return lines to power steering gear.

Release banjo bolts (1).

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

Installation:

Replace all sealing rings.

Align pressure and return lines by way of markings and tighten down banjo bolts.

Tightening torque **32 41 5AZ** (pressure line).

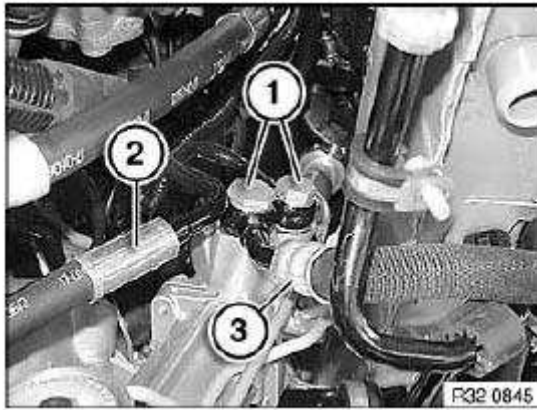


Fig. 32: Aligning Pressure And Return Lines Of Markings
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque **32 41 6AZ** (return line).

Remove power steering gear with wiring harness sideways between engine and front axle carriers.

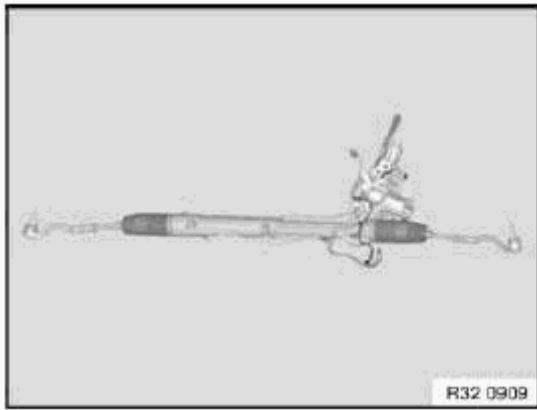


Fig. 33: Identifying Power Steering Gear With Wiring Harness
Courtesy of BMW OF NORTH AMERICA, INC.

Replacement

If necessary, release screws (1) and remove heat shield (2).

Disconnect plug connections (3) and remove connecting cable (4).

Installation:

Tightening torque **32 00 2AZ** .

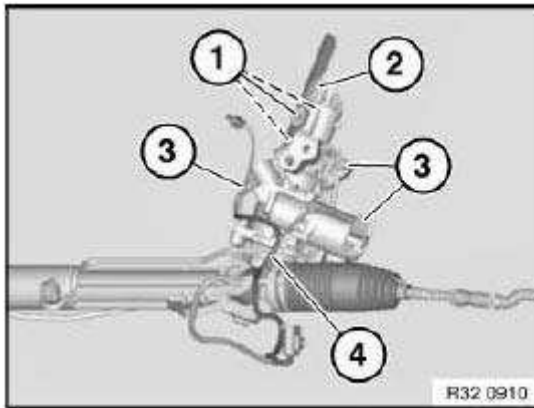


Fig. 34: Identifying Heat Shield And Plug Connections
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Fill and bleed hydraulic system. See **32 13 006 BLEEDING POWER STEERING (VERSION WITH DYNAMIC DRIVE)** or **32 13 006 BLEEDING POWER STEERING UNIT**.
- Check pipe connections for leaks
- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**
- Carry out **ADJUSTMENT FOR ACTIVE STEERING**
- If necessary, carry out **INITIAL DYNAMIC DRIVE OPERATION**

32 13 066 REPLACING ACTIVE FRONT STEERING HYDRAULIC STEERING GEAR

WARNING: Secure engine in installation position with special tool to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **track rod end on both sides from swivel bearing**
- Replacement: Remove **track rod end at both ends of track rod**
- Version with Dynamic Drive: Remove both anti-roll bar links from anti-roll bar. See **31 35 005**

REMOVING AND INSTALLING/REPLACING PUSH ROD (STABILIZER LINK) FOR LEFT/RIGHT STABILIZER .

- Remove **lower section of steering spindle from steering gear**
- Slacken screw connection for wishbone at bottom left and right on front axle support. See **31 12 004 REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT LOWER CONTROL ARM .**
- Lower front axle support
- Disconnect plug connection for Eco valve on back of power steering pump

Carefully lower hydraulic steering gear. Mark installation positions of pressure and return lines to hydraulic steering gear. Release banjo bolts (1). Disconnect pressure line (2) and return line (3) from hydraulic steering gear. Installation: Replace all sealing rings. Align pressure and return lines by way of markings and tighten down banjo bolts. Tightening torque, see 32 41 5AZ (pressure line) in **32 41 PUMP AND OIL SUPPLY .** Tightening torque, see 32 41 6AZ (return line) in **32 41 PUMP AND OIL SUPPLY .**

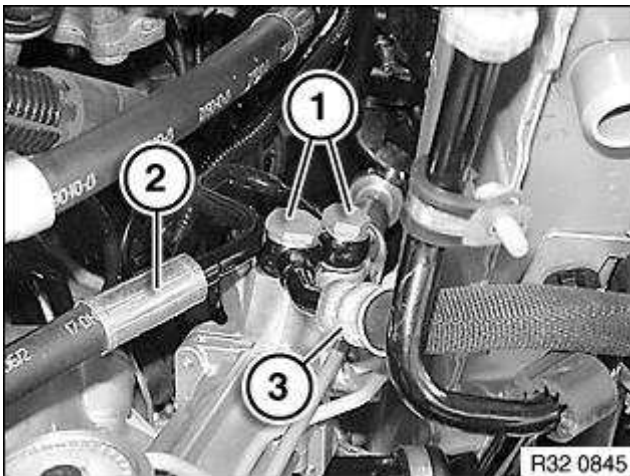


Fig. 35: Disconnect Pressure Line (2) And Return Line (3) From Hydraulic Steering Gear
Courtesy of BMW OF NORTH AMERICA, INC.

Remove power steering gear with wiring harness sideways between engine and front axle supports.

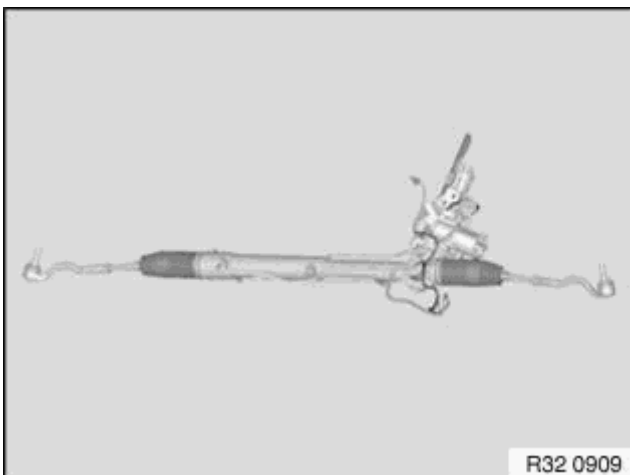


Fig. 36: Remove Power Steering Gear With Wiring Harness Sideways Between Engine And Front Axle

Supports

Courtesy of BMW OF NORTH AMERICA, INC.

If necessary, release screws (1) and remove heat shield (2). Disconnect plug connections (3) and remove connecting cable (4). Installation: Tightening torque, see 32 00 2AZ in **32 00 STEERING** .

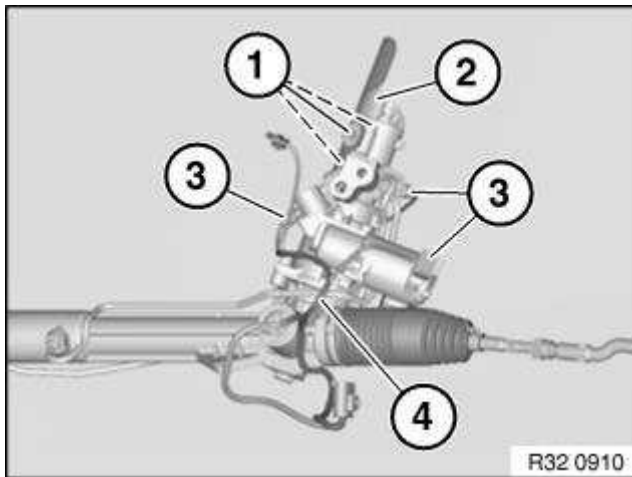


Fig. 37: If Necessary, Release Screws (1) And Remove Heat Shield (2)

Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **hydraulic system**
- Check pipe connections for leaks
- Carry out steering angle sensor adjustment
- If necessary, carry out initial Dynamic Drive operation. See **37 10 001 INITIAL OPERATION WITH TEST RUN OF DYNAMIC DRIVE** .

STEERING ARMS, TIE RODS, STEERING DAMPER

32 21 151 REPLACING LEFT OR RIGHT TIE ROD

Special tools required:

- **31 2 240**
- **31 2 246**

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.
Make sure special tool rests correctly on steel bushing of swivel bearing. The swivel bearing must be removed if the steel bushing moves.
Rubber gaiter of tie rod end must not be damaged!
Do not pull stainless steel ring off journal.

Slacken nut (1) two to three thread turns.

If necessary, replace lower section **31 2 242** with lower section **31 2 246** .

Press tie rod end (2) with special tool **31 2 240** off swivel bearing.

Unscrew nut (1) and remove tie rod end (2) from swivel bearing.

Installation:

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

Replace self-locking nut.

Tightening torque **32 21 3AZ** .

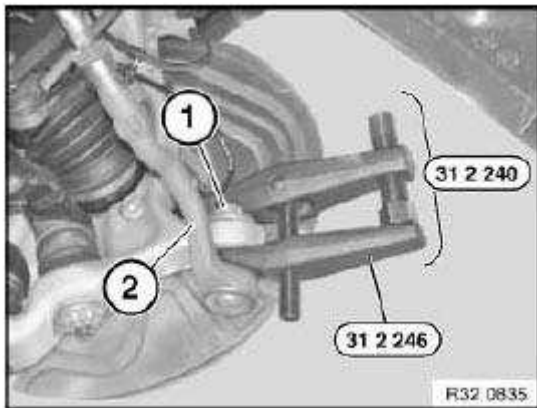


Fig. 38: Removing Tie Rod End From Swivel Bearing
Courtesy of BMW OF NORTH AMERICA, INC.

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

Slacken nut.

Unscrew tie rod end from tie rod.

Installation:

Check **GAITER** for damage, replace if necessary.

Refit clamping ring (1).

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

Tightening torque **32 21 2AZ** .

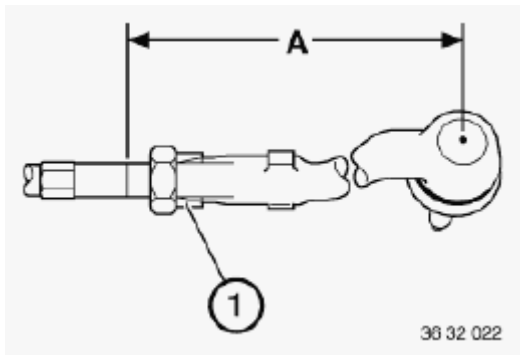


Fig. 39: Adjusting Of Front Axle

Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**.
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING 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:

Clean rack.

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

Grease rack .

Tightening torque **32 21 1AZ** .

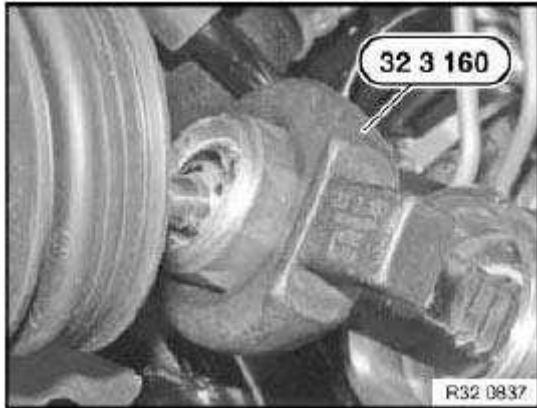


Fig. 40: Identifying Special Tool (32 3 160)

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 2AZ** .

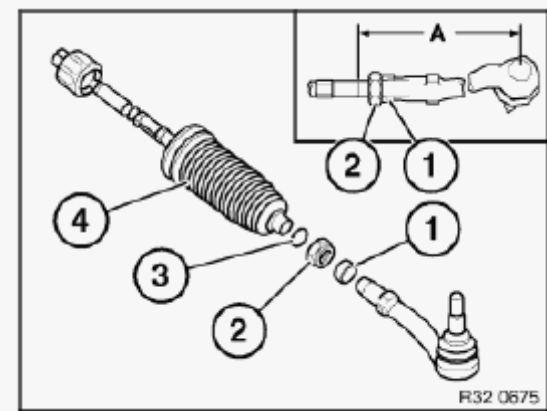


Fig. 41: Identifying Front Axle Dimension
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Only if replacing/removing tie rod end: Perform chassis alignment check. See 32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION or 32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION.
- Carry out steering angle sensor adjustment/adjustment for active front steering. See 32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING and 61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT.

STEERING COLUMN

32 31 ... NORMALIZATION OF ELECTRIC STEERING COLUMN ADJUSTMENT

NOTE: Normalization must be carried out after the following work:

- Removal or replacement of control panel in heater-A/C system or of steering column
- Repair work to electric steering column adjustment
- Coding/programming of IHKA control unit

Normalization of electric steering column adjustment is possible via the diagnosis system under the following path:

- Diagnosis
- Function selection
- Service functions
- Chassis
- Electric steering column adjustment



Fig. 42: Diagnosis System Screen

Courtesy of BMW OF NORTH AMERICA, INC.

32 31 003 REMOVING AND INSTALLING/REPLACING UPPER SECTION OF STEERING COLUMN TRIM

Special tools required:

- **00 9 323**

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

IMPORTANT: Risk of damage!

Unclip steering column trim (1) at side with special tool 00 9 323 .



Fig. 43: Uncoupling Steering Column Trim With Special Tool (00 9 323)

Courtesy of BMW OF NORTH AMERICA, INC.

Tilt steering column trim (1) towards front.

Unclip steering column gap cover (2) from steering column trim (1).

Installation:

Tilt steering column trim towards rear, align by way of locks to lower section (of steering column trim) and press down.

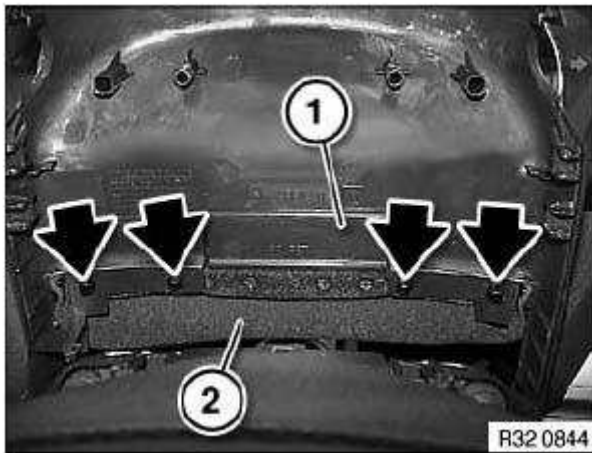


Fig. 44: Uncoupling Steering Column Gap Cover From Steering Column Trim
Courtesy of BMW OF NORTH AMERICA, INC.

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

Necessary preliminary tasks:

- Remove **TOP SECTION OF STEERING COLUMN CASING**
- Move steering column in "top" and "extended" position.

Press detent lugs outwards a little and unclip steering column trim downwards.

Installation:

Align steering column trim by means of detent lugs to steering column and press up as far as it will go.

Press steering column trim on both sides together a little and then press upwards completely until detent lugs snap into place.

Check installation position, correct if necessary.

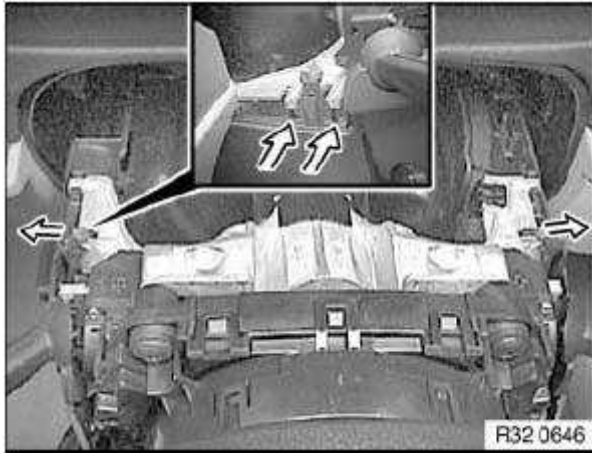


Fig. 45: Pressing Steering Column Trim On Both Sides
 Courtesy of BMW OF NORTH AMERICA, INC.

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

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

Necessary preliminary tasks:

M57T2:

- Remove acoustic cover

M57T2 TOP:

- Remove intake duct

N52:

- Remove gaiter with resonator

N54:

- Remove **CHARGE-AIR DUCT**

N62 (E70 only):

IMPORTANT: Pay attention to plug connection on coolant expansion tank and oil tank.

- Disconnect vacuum hose for brake booster

- Remove **OIL TANK FROM BODY** and place to one side
- Remove **EXPANSION TANK FROM BODY** and place to one side
- Disconnect plug connection on **HEATER WATER VALVE** , remove water valve from body and place to one side

Release clamping screws (1).

Push steering spindle (2) together and remove.

Installation:

Clean thread to remove all remnants of screw securing adhesive.

Replace clamping screws.

Connect steering spindle first to steering gear and then to steering spindle middle section.

Clamping screw must rest in steering gear groove or steering spindle middle section.

No kinking permitted!

Tightening torque **32 31 2AZ** .

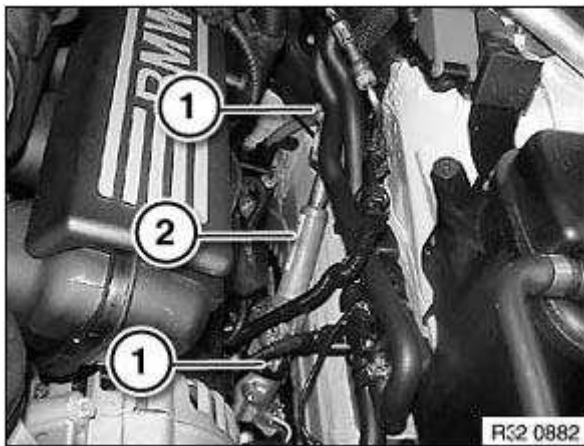


Fig. 46: Identifying Steering Spindle And Clamping Screws
 Courtesy of BMW OF NORTH AMERICA, INC.

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/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .

- Check directional stability of car

32 31 070 REMOVING AND INSTALLING/REPLACING STEERING SPINDLE LOWER SECTION (N63)

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

Necessary preliminary tasks:

- **REMOVE ENGINE COVER**
- Remove left **INTAKE FILTER HOUSING**
- Remove **EXPANSION TANK FROM BODY** and place to one side

Pay attention to plug connection on coolant expansion tank and oil tank.

- Remove **POWER STEERING FLUID RESERVOIR TANK FROM BODY** and place to one side
- Remove **WATER VALVE FOR HEATER**

Release clamping screws (1).

Push steering spindle (2) together and remove.

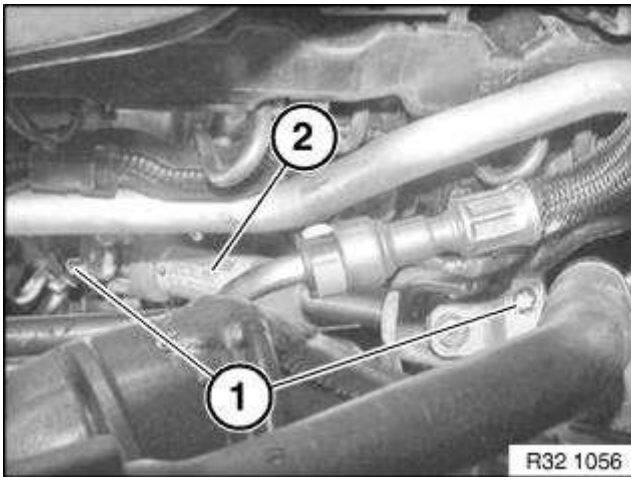


Fig. 47: Identifying Steering Spindle And Clamping Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Clean thread to remove all remnants of screw securing adhesive.

Replace clamping screws.

Connect steering spindle first to steering gear and then to steering spindle middle section.

Clamping screw must rest in steering gear groove or steering spindle middle section.

Tightening torque **32 31 2AZ** .

No kinking permitted!

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/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING 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 STEERING COLUMN SWITCH CLUSTER .**

After installation

- Replacement only: Carry out **PROGRAMMING/CODING**
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .

32 31 092 REMOVING AND INSTALLING/REPLACING STEERING COLUMN

IMPORTANT: To avoid damaging the coil spring cassette, it is necessary to remove the steering wheel because of the absence of a steering column lock!

Necessary preliminary tasks:

- Disconnect battery negative lead
- Remove steering wheel
- Remove steering column trims. See **32 31 003 REMOVING AND INSTALLING/REPLACING UPPER SECTION OF STEERING COLUMN TRIM** and **32 31 020 REMOVING AND INSTALLING/REPLACING LOWER SECTION OF STEERING COLUMN TRIM**
- Move steering column into "extended" position
- Replacement only: Remove **STEERING-COLUMN SWITCH CLUSTER**
- Remove **TRIM PANEL FOR PEDAL ASSEMBLY** .

Disconnect plug connection (1).

Unclip wiring harness (2) from steering column.

Installation:

Replace damaged wiring harness holder.

Make sure wiring harness is in correct position.

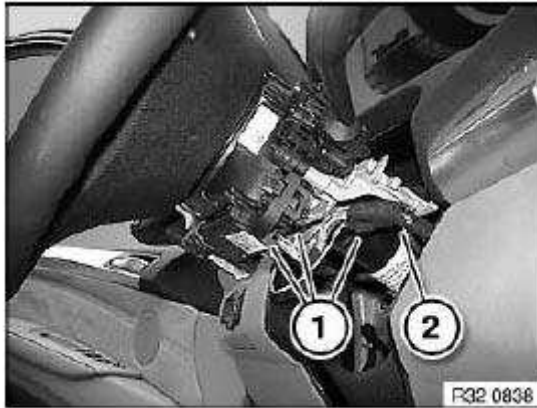


Fig. 48: Identifying Wiring Harness And Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Remove air duct in footwell.

Release clamping screw (1) and slide splined shaft (2) into steering column.

Installation:

Do not damage splined shaft (2).

Make sure shim (3) is in correct position.

Recut thread.

Replace clamping screw.

Clamping screw must rest in groove of upper steering spindle.

No kinking permitted!

Tightening torque **32 31 3AZ** .

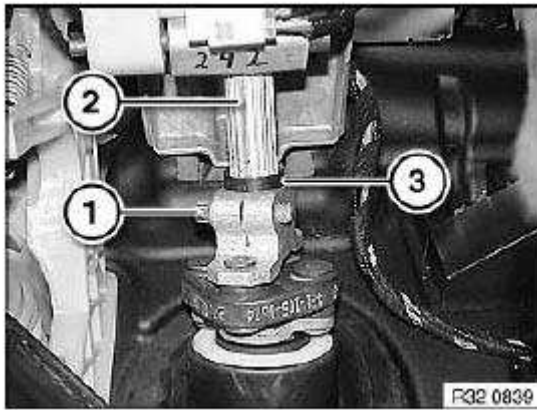


Fig. 49: Sliding Splined Shaft Into Steering Column
 Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1).

Unfasten screws (2).

Tightening torque **32 31 1AZ** .

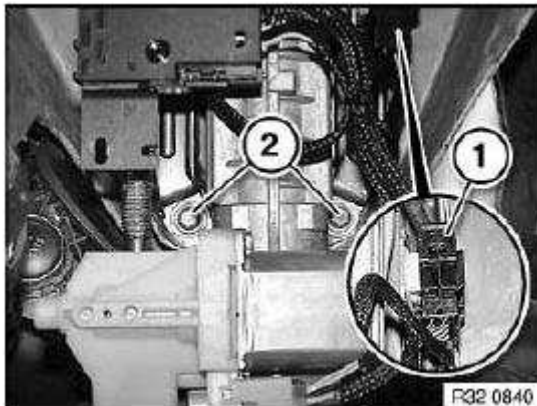


Fig. 50: Identifying Plug Connection And Screws
 Courtesy of BMW OF NORTH AMERICA, INC.

Secure steering column against falling out.

Release screws (1).

Tightening torque **32 31 1AZ** .

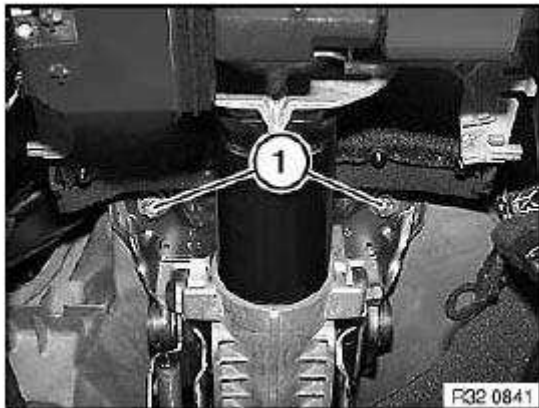


Fig. 51: Identifying Steering Column Screws
 Courtesy of BMW OF NORTH AMERICA, INC.

Remove steering column towards rear.

Installation:

When inserting steering column, make sure guide (1) is correctly fitted in instrument panel carrier.

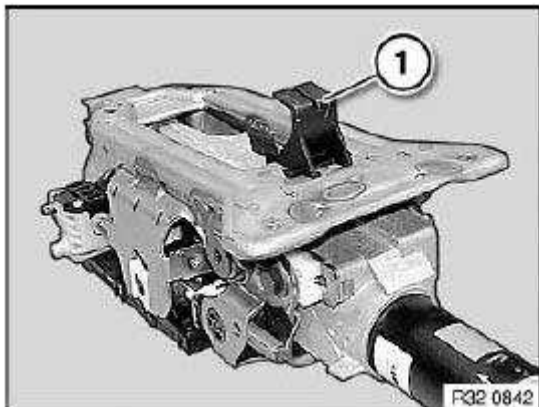


Fig. 52: Identifying Steering Column Guide
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .
- Carry out **NORMALIZATION** of electric steering column adjustment
- Replacement only: 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

STEERING WHEEL

32 33 ... REPLACING DESIGN COVER/ACCENT TRIM FOR SPORT STEERING WHEEL

Necessary preliminary tasks:

- Remove **BOTH SWITCHES FROM SPORT STEERING WHEEL**

Release screws (1).

Remove accent rim (2) from design cover (3).

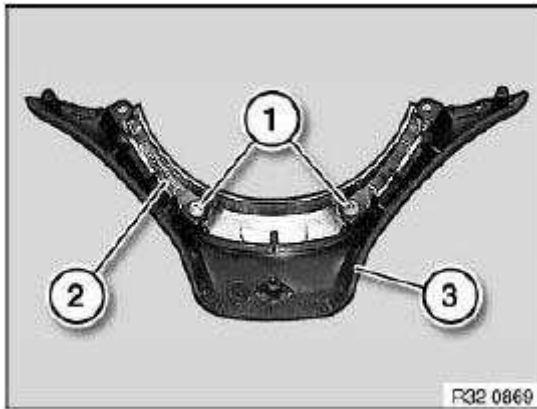


Fig. 53: Identifying Accent Rim And Design Cover
Courtesy of BMW OF NORTH AMERICA, INC.

32 33 000 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/steering wheel into straight-ahead position.

Disconnect plug connection (1).

If necessary, disconnect plug connection (2) for steering wheel heating.

Release screw (3) and remove steering wheel (4).

Installation:

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

Tightening torque **32 33 1AZ** .

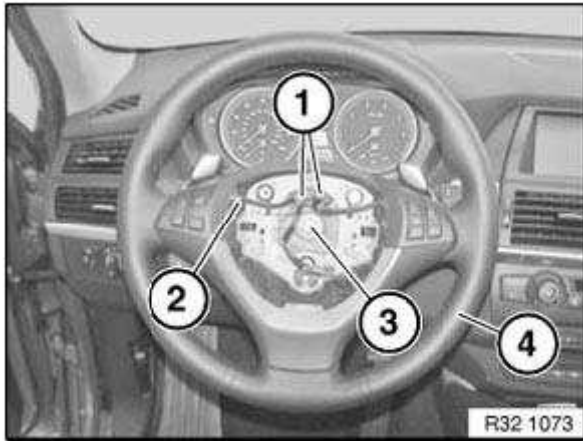


Fig. 54: Identifying Steering Wheel And Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Installation:

Version with steering wheel heating: Before fitting steering wheel on steering column, ensure correct cable routing.

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

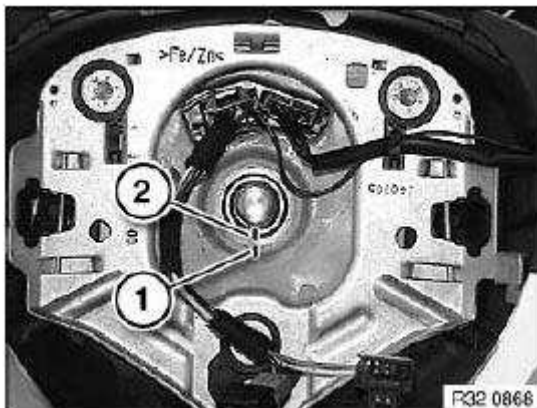


Fig. 55: Aligning Steering Wheel Of Marking To Steering Column Marking And Attach
Courtesy of BMW OF NORTH AMERICA, INC.

Replacement

- Modify **MULTIFUNCTION STEERING WHEEL SWITCH**
- If necessary, modify steering wheel module control unit.

- Remove SHIFT PADDLES FOR AUTOMATIC TRANSMISSION

STEERING WHEEL FOR AIRBAG

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 T30 (1) at an angle into concealed opening on reverse side of steering wheel until a spring resistance is felt (approx. 2 cm).

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

Repeat procedure on other side.

Installation:

Make sure electrical leads are correctly positioned.

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

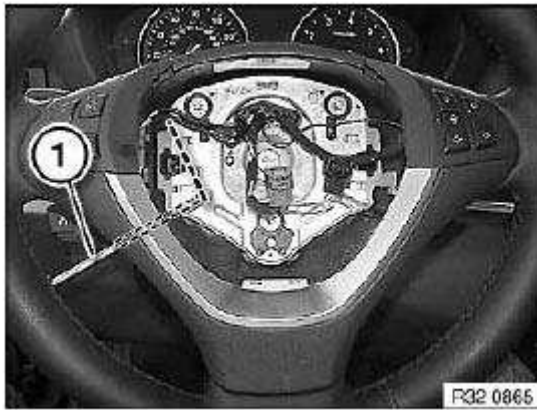


Fig. 56: Identifying Torx Screwdriver T30
 Courtesy of BMW OF NORTH AMERICA, INC.

WARNING: Risk of injury!

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

Tilt airbag unit (1) towards rear.

Disconnect **PLUG CONNECTIONS** (2) and remove airbag unit (1).

Installation:

Connect plugs to connections of same color on airbag unit.

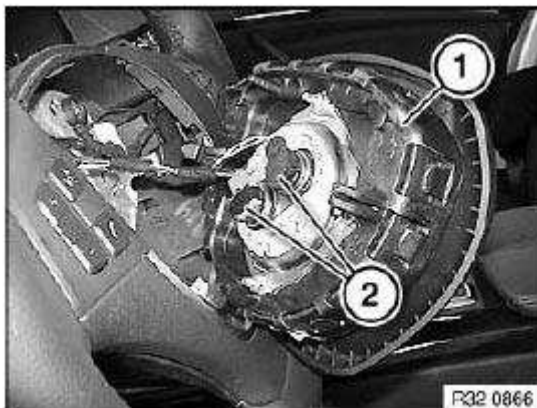


Fig. 57: Identifying Airbag Unit And Plug Connections
 Courtesy of BMW OF NORTH AMERICA, INC.

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.

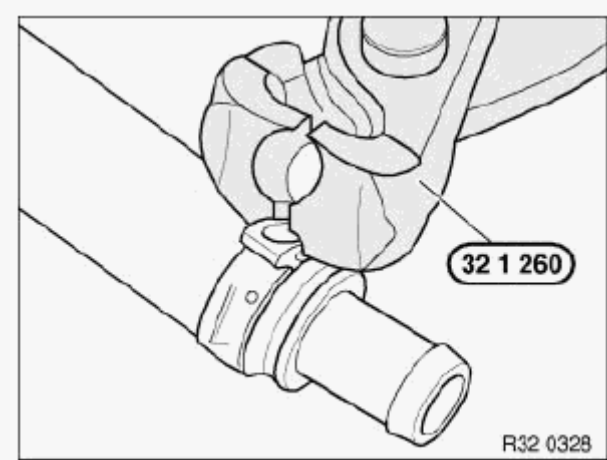


Fig. 58: Removing Clip With Special Tool (32 1 260)
Courtesy of BMW OF NORTH AMERICA, INC.

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

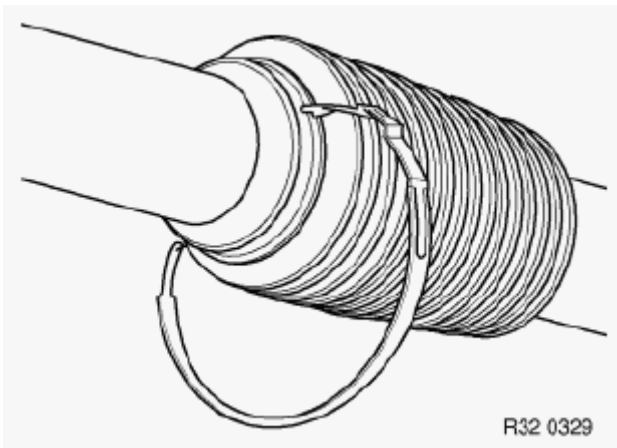


Fig. 59: Identifying Clip
Courtesy of BMW OF NORTH AMERICA, INC.

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

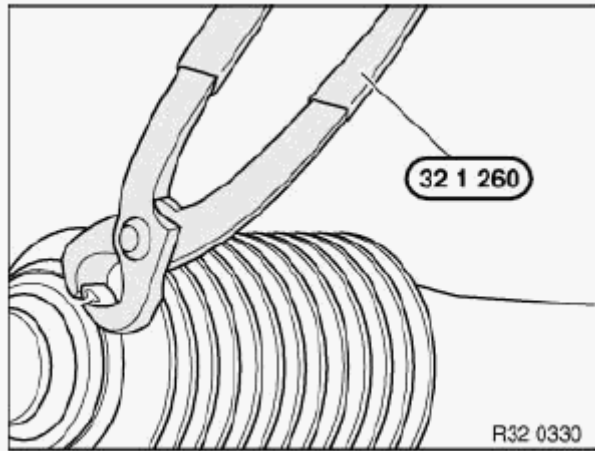


Fig. 60: Pressing Together With Special Tool (32 1 260)
 Courtesy of BMW OF NORTH AMERICA, INC.

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

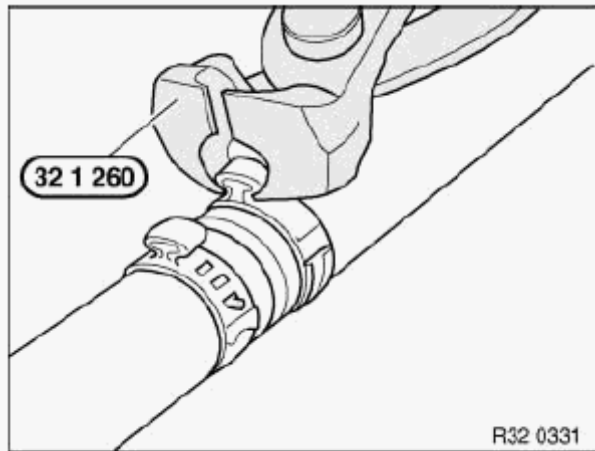


Fig. 61: Siding Cutter Of Special Tool (32 1 260)
 Courtesy of BMW OF NORTH AMERICA, INC.

IMPORTANT: Gap (A) max. 1 mm!

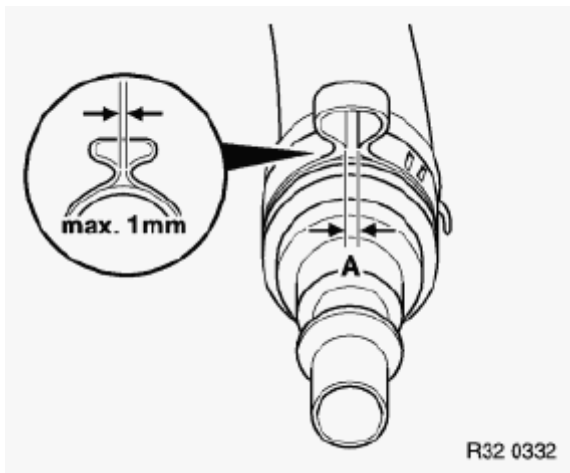


Fig. 62: Identifying Clamp Gap

Courtesy of BMW OF NORTH AMERICA, INC.

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

1) Quick-connect coupling with ID marking

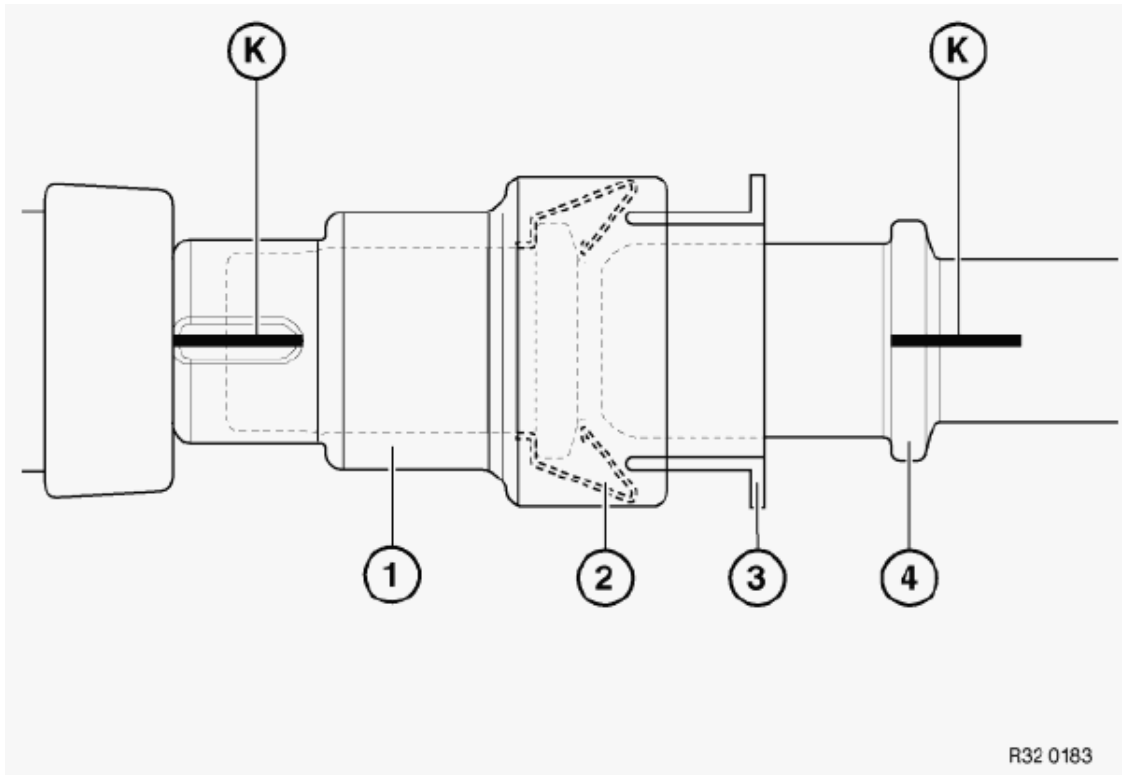


Fig. 63: Identifying Quick-Connect Coupling With ID Marking

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

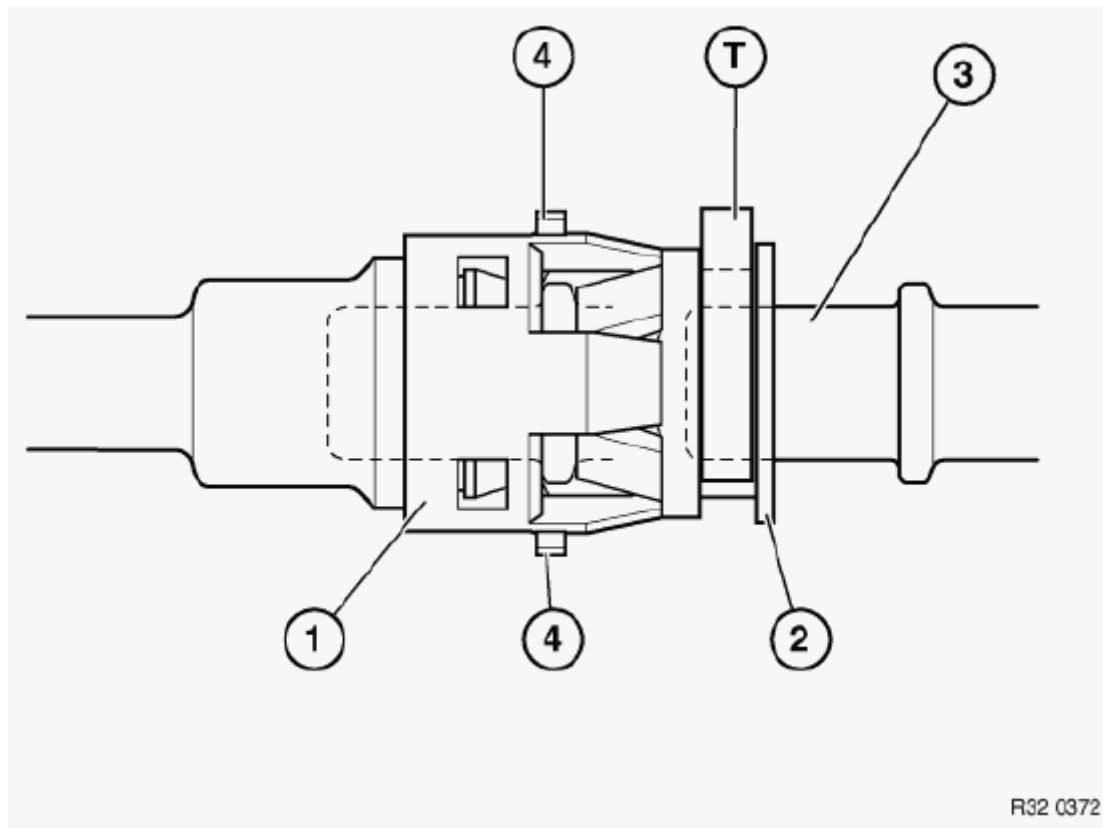


Fig. 64: Identifying Quick-Connect Coupling With Indication Pins

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 ... REPLACING LEVEL SWITCH FOR DYNAMIC DRIVE FLUID RESERVOIR

Unscrew nuts.

Remove shims.

Installation:

Replace self-locking nuts.

Tightening torque **32 41 1AZ** .

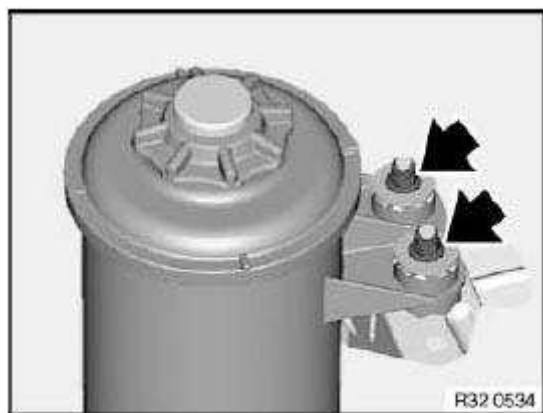


Fig. 65: Locating Self-Locking Nuts

Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: **Raise and/or turn fluid reservoir in order to gain better access to plug connection.**

Disconnect plug connection (1).

Turn level switch (2) through approx. 45° and remove towards bottom.

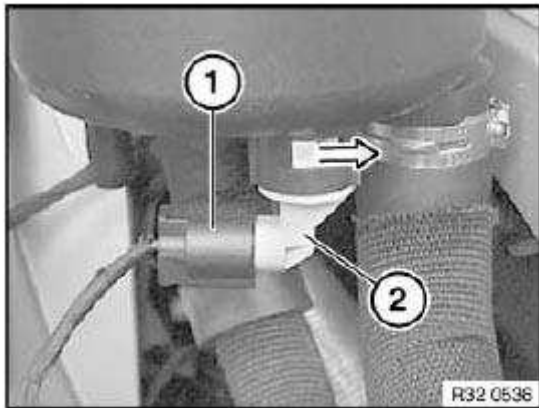


Fig. 66: Disconnecting Plug Connection
 Courtesy of BMW OF NORTH AMERICA, INC.

32 41 ... REPLACING PRESSURE LINE FOR DYNAMIC DRIVE (N54)

Remove **PRESSURE LINE (PART 1)** (from power steering pump to junction I on left engine carrier)

Remove **PRESSURE LINE (PART 2)** (from junction I to junction II on vehicle underbody on right)

Remove **RETURN LINE AT REAR (3)**

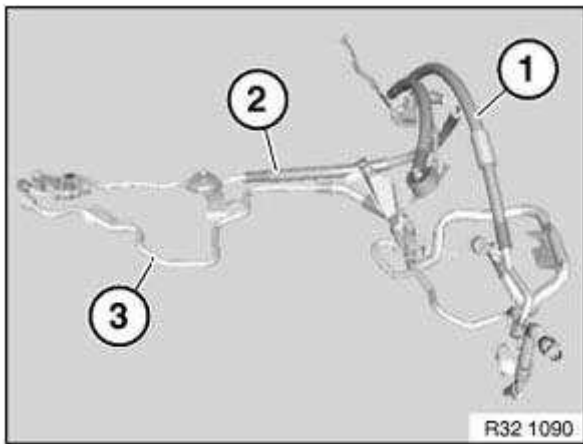


Fig. 67: Identifying Pressure Line (N54)
 Courtesy of BMW OF NORTH AMERICA, INC.

32 41 ... REPLACING PRESSURE LINE FOR DYNAMIC DRIVE (N63)

Remove pressure line part 1 (1) (from power steering pump to junction I on engine carrier)

Remove pressure line part 2 (2) (from junction I to junction II on vehicle underbody on right)

Remove return line at rear (3)

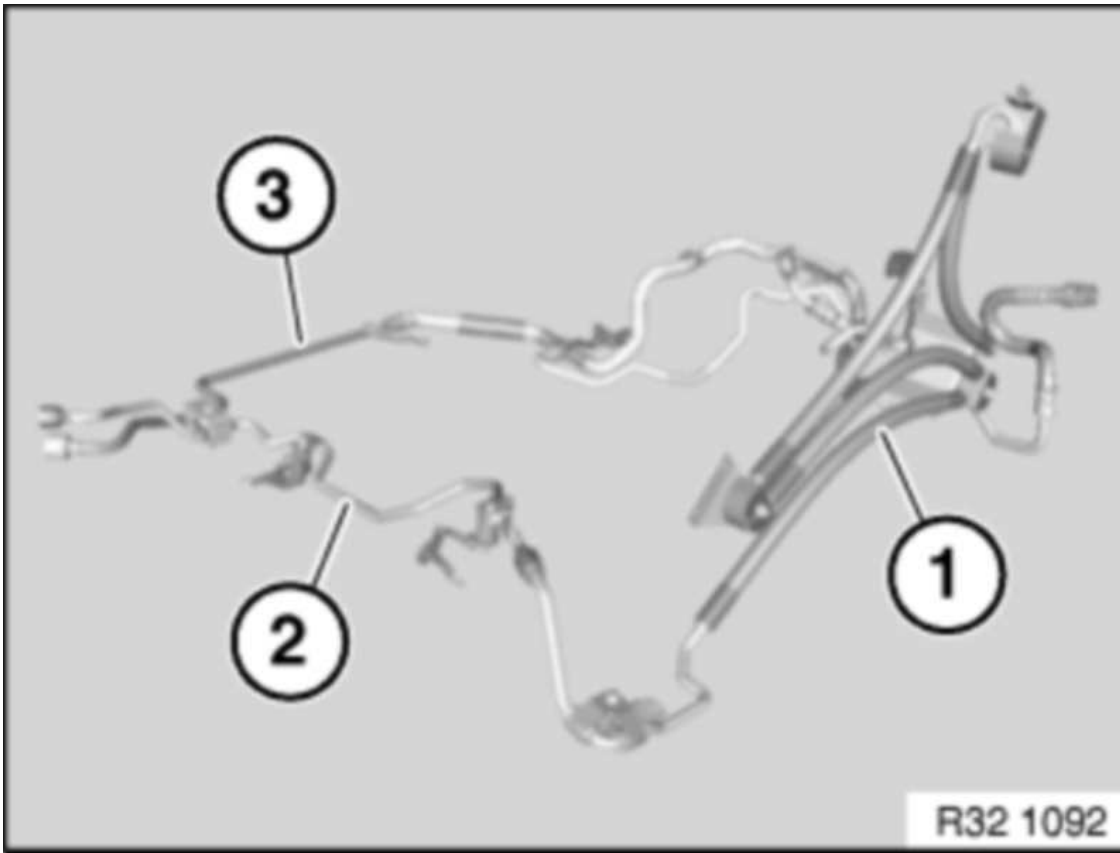


Fig. 68: Identifying Pressure Line (N63)
Courtesy of BMW OF NORTH AMERICA, INC.

32 41 ... REPLACING PRESSURE LINE FOR DYNAMIC DRIVE (PART 1) (N54)

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.

IMPORTANT: It is essential to adhere to conditions of absolute cleanliness when working on the fuel system.

- Do not allow any dirt particles or foreign bodies to get into the system
- Use only fluff-free cloths
- Remove all traces of dirt before removing pipes or individual components
- Seal all fuel system openings with protective caps

Recycling:

Catch and dispose of escaping fuel.

Catch and dispose of hydraulic fluid in a suitable container.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove underbody protection incl. cover. See **51 47 490 REMOVING AND INSTALLING/REPLACING FRONT UNDERBODY PROTECTION** , **51 47 491 REMOVING AND INSTALLING/REPLACING REAR UNDERBODY PROTECTION** , **51 71 ... REMOVING AND INSTALLING/REPLACING BOTTOM LEFT OR RIGHT STEERING GEAR COVER** , **51 71 ... REMOVING AND INSTALLING/REPLACING TOP LEFT STEERING GEAR COVER** , **51 71 ... REMOVING AND INSTALLING/REPLACING TOP RIGHT STEERING GEAR COVER** .
- Remove **REINFORCEMENT PLATE**
- Clamp **OFF BATTERY NEGATIVE LEAD**
- Drain **COOLANT** .
- Remove **ACOUSTIC COVER**
- Remove **TENSION STRUT FROM SPRING STRUT DOME ON LEFT**
- Disconnect coolant hoses above pressure line, remove if necessary
- Disconnect fuel feed and return lines above pressure line Open cover.

Release nut and remove battery positive lead (1) from battery positive terminal.

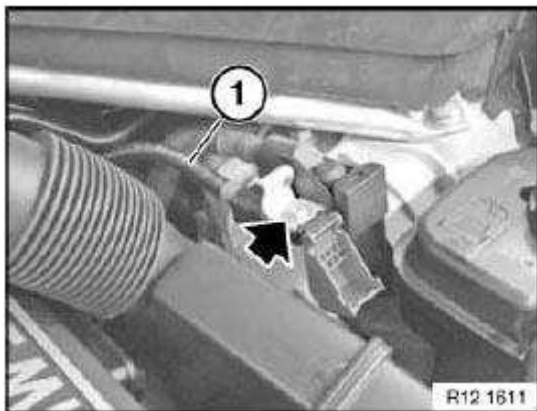


Fig. 69: Locating Battery Positive Lead
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws from flange (1) and remove pressure line.

Tightening torque **32 41 16AZ** .

Seal pressure line and power steering pump connection with suitable sealing plugs.

Installation:

Replace all sealing rings.

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

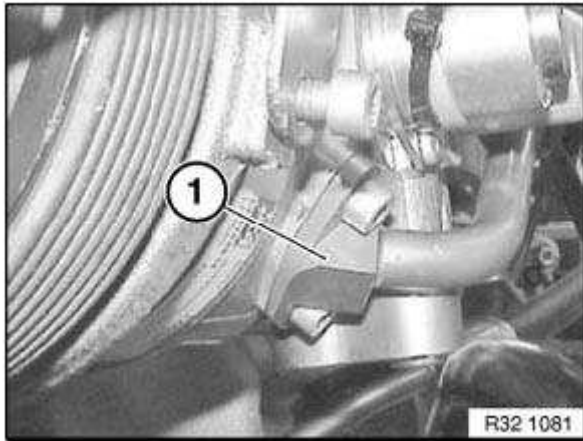


Fig. 70: Locating Hexagon Socket Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1) and remove bracket (2) from crankcase on left.

Tightening torque **32 41 18AZ** .

Installation:

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

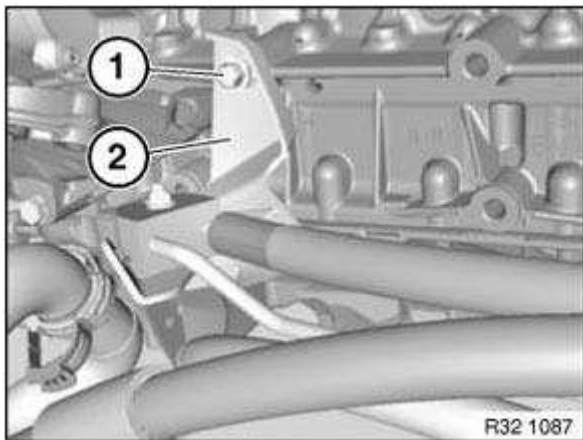


Fig. 71: Identifying Bracket Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1) and remove holder with expandable hose (3).

Tightening torque **32 41 18AZ** .

Installation:

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

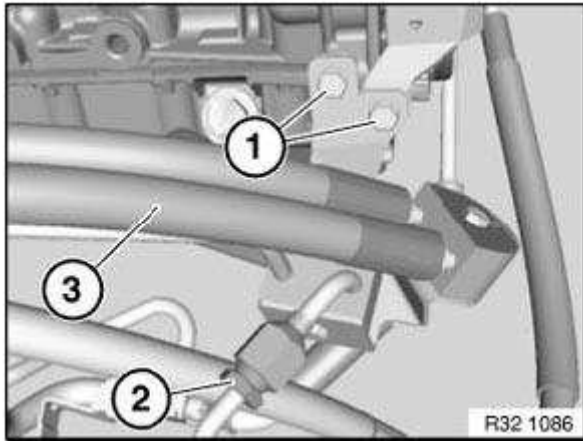


Fig. 72: Identifying Expandable Hose With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Picture shows M57T2.

Release banjo bolt (1).

From build date 10/08, release hexagon socket bolts from flange (1).

Tightening torque **32 41 11AZ** (banjo bolt).

Tightening torque **32 41 16AZ** (hexagon socket bolts).

Seal pressure lines with suitable sealing plugs.

Installation:

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

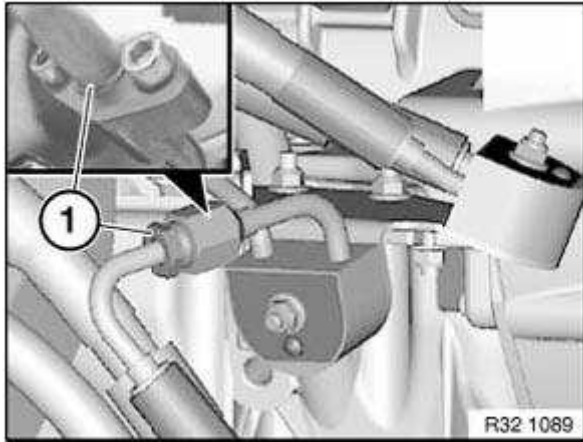


Fig. 73: Identifying Banjo Bolt
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Add COOLANT
- Fill HYDRAULIC SYSTEM
- VENTING COOLING SYSTEM AND CHECKING FOR WATER LEAKS
- Bleed HYDRAULIC SYSTEM and check line connections for leaks
- Carry out INITIAL DYNAMIC DRIVE OPERATION .

32 41 ... REPLACING PRESSURE LINE FOR DYNAMIC DRIVE (PART 2) (N54)

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove underbody protection incl. cover. See 51 47 ... REMOVING AND INSTALLING/REPLACING LEFT OR RIGHT UNDERBODY PANELLING and 51 47 490 REMOVING AND INSTALLING/REPLACING FRONT UNDERBODY PROTECTION .
- Remove REINFORCEMENT PLATE

- Partially remove **FRONT RIGHT WHEEL ARCH COVER (REAR SECTION)**

Picture shows M57T2

Release banjo bolt (1).

From build date 10/08, release hexagon socket bolts from flange (1).

Tightening torque **32 41 11AZ** (banjo bolt).

Tightening torque **32 41 7AZ** (bolt).

Seal pressure lines with suitable sealing plugs.

Installation:

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

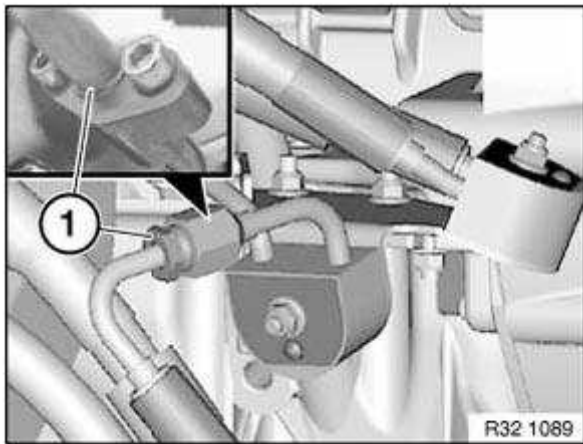


Fig. 74: Identifying Banjo Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) and remove heat shield (2).

Installation:

Tightening torque **32 41 14AZ** .

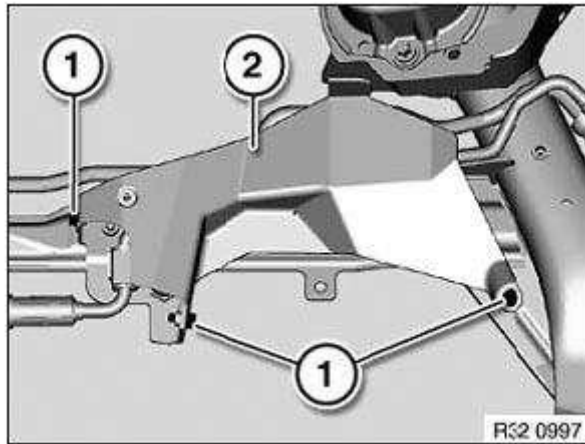


Fig. 75: Identifying Heat Shield Screws
 Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (1) and remove pressure line (2) from decoupling element.

Tightening torque **32 41 7AZ** .

Installation:

Replace self-locking nuts.

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

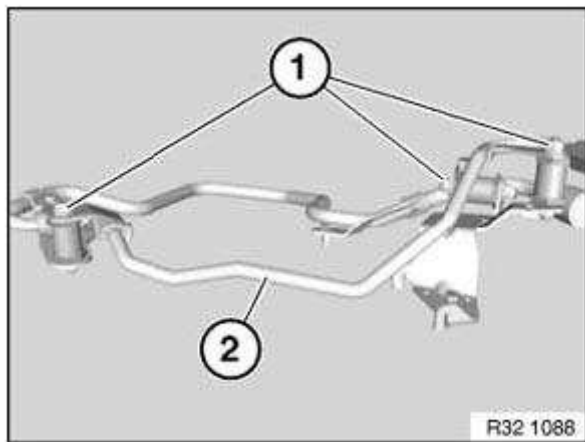


Fig. 76: Identifying Pressure Line With Nuts
 Courtesy of BMW OF NORTH AMERICA, INC.

Release banjo bolt (1).

Seal pressure lines with suitable sealing plugs.

Remove pressure line (2).

Installation:

Hydraulic lines are not permitted to contact each other or adjoining components.

Tightening torque **37 14 15AZ** .

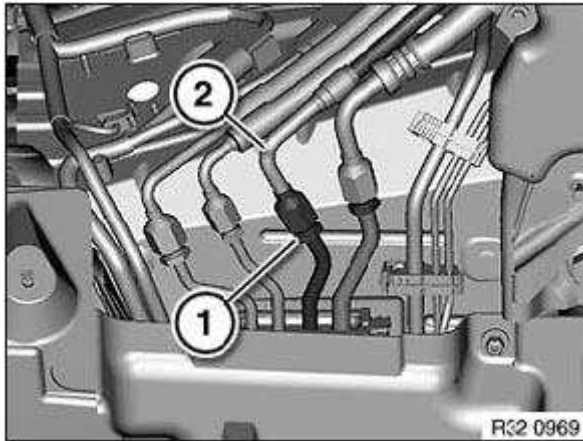


Fig. 77: Identifying Pressure Line And Banjo Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Carry out **INITIAL DYNAMIC DRIVE OPERATION** .

32 41 ... REPLACING RETURN LINE FOR DYNAMIC DRIVE (N54)

WARNING: Secure engine in installation position with special tool to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Lower **FRONT AXLE SUPPORT**
- Partially remove **FRONT RIGHT WHEEL ARCH COVER (REAR SECTION)**

Release **QUICK-CONNECT COUPLING** on power steering cooler.

Seal return line and power steering cooler connection with suitable sealing plugs.

Installation:

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

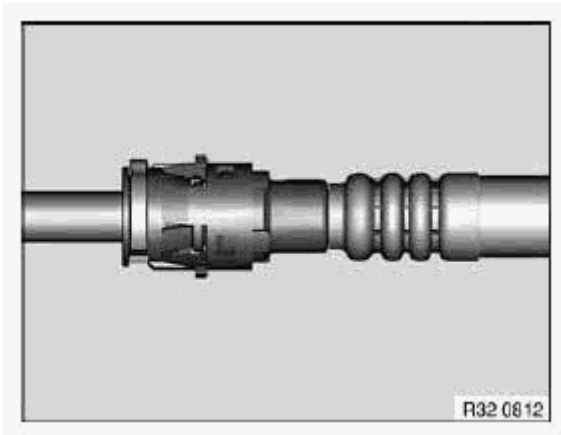


Fig. 78: Identifying Power Steering Cooler Connection With Suitable Sealing Plugs
 Courtesy of BMW OF NORTH AMERICA, INC.

Mark installation position of return line to power steering gear.

Release banjo bolt (1) and remove return line (2) from power steering gear.

Seal return line and power steering gear connection with suitable sealing plugs.

Installation:

Replace all sealing rings.

Align return line by way of markings.

Tightening torque **32 41 6AZ** .

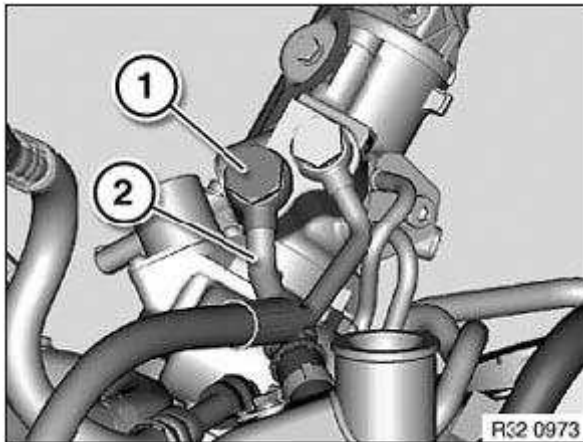


Fig. 79: Identifying Banjo Bolt And Return Line
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1).

Release nut (2) and remove clamp (3).

Installation:

Replace self-locking nuts.

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

Tightening torque **32 41 7AZ** .

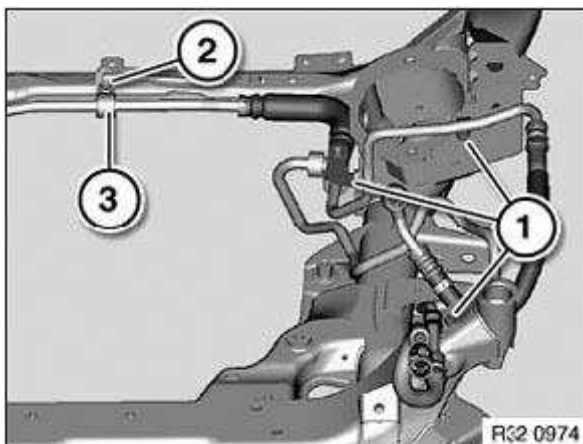


Fig. 80: Identifying Clamp With Nuts
 Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) and remove heat shield (2).

Installation:

Tightening torque **32 41 14AZ** .

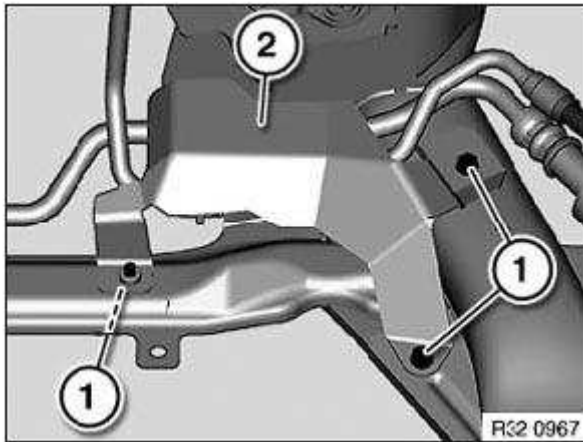


Fig. 81: Identifying Heat Shield With Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (1) and remove return line (2) from decoupling elements.

Tightening torque **32 41 7AZ** .

Installation:

Replace self-locking nuts.

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

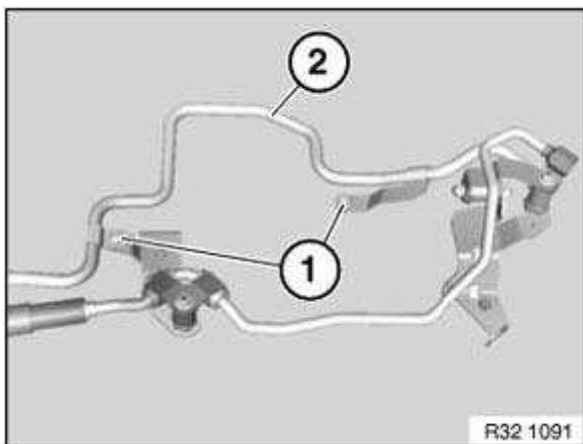


Fig. 82: Identifying Return Line With Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws from flange (1).

Tightening torque **32 41 16AZ** .

Seal return lines with suitable sealing plugs.

Remove return line (2).

Installation:

Hydraulic lines are not permitted to contact each other or adjoining components.

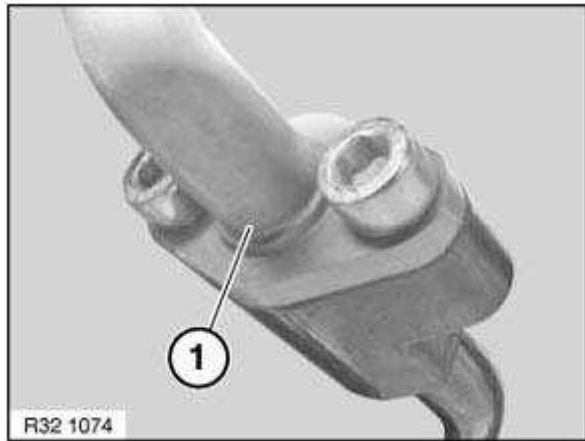


Fig. 83: Identifying Hexagon Socket Screws From Flange
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .
- Carry out **INITIAL DYNAMIC DRIVE OPERATION** .

32 41 ... REPLACING RETURN LINE FOR DYNAMIC DRIVE (N63)

WARNING: **SECURE ENGINE IN INSTALLATION POSITION WITH SPECIAL TOOL** to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Lower **FRONT AXLE SUPPORT**
- Partially remove **FRONT RIGHT WHEEL ARCH COVER (REAR SECTION)**

Release **QUICK-CONNECT COUPLING** on power steering cooler.

Seal return line and power steering cooler connection with suitable sealing plugs.

Installation:

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

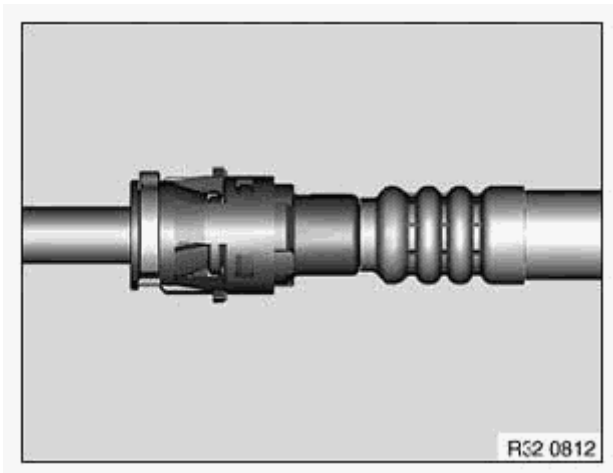


Fig. 84: Identifying Quick-Connect Coupling
Courtesy of BMW OF NORTH AMERICA, INC.

Mark installation position of return line to power steering gear.

Release banjo bolt (1) and remove return line (2) from power steering gear.

Seal return line and power steering gear connection with suitable sealing plugs.

Installation:

Replace all sealing rings.

Align return line by way of markings.

Tightening torque **32 41 6AZ** .

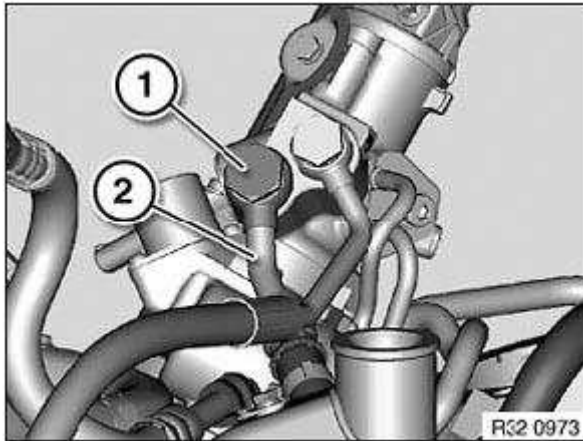


Fig. 85: Identifying Banjo Bolt And Return Line
Courtesy of BMW OF NORTH AMERICA, INC.

Release nuts (1) and remove return line (2) from decoupling elements.

Installation:

Replace self-locking nuts.

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

Tightening torque **32 41 7AZ** .

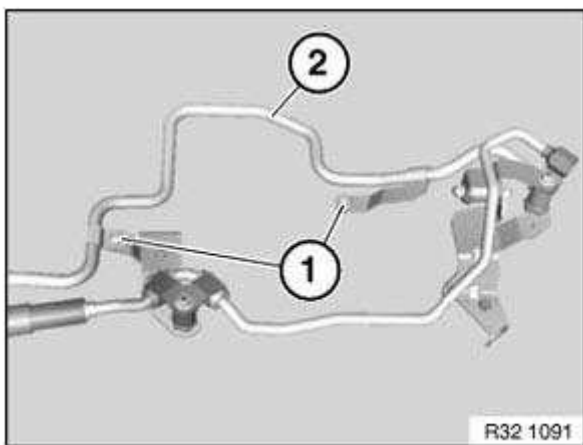


Fig. 86: Identifying Return Line With Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) and remove heat shield (2).

Installation:

Tightening torque **32 41 14AZ** .

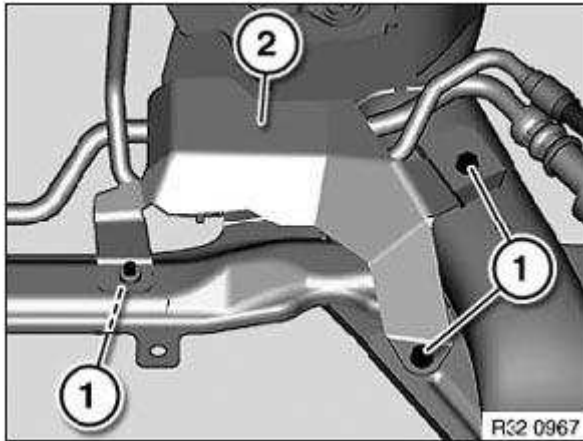


Fig. 87: Identifying Heat Shield With Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws from flange (1).

Tightening torque **32 41 16AZ** .

Seal return lines with suitable sealing plugs.

Remove return line (2).

Installation:

Hydraulic lines are not permitted to contact each other or adjoining components.

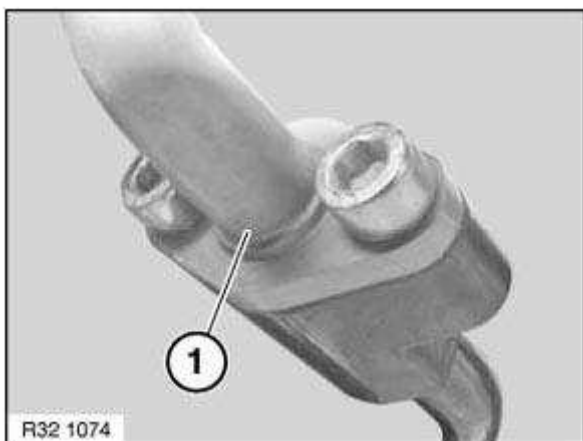


Fig. 88: Identifying Hexagon Socket Screws From Flange
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .
- Carry out **INITIAL DYNAMIC DRIVE OPERATION** .

32 41 033 REMOVING AND INSTALLING/REPLACING POWER STEERING PUMP FOR POWER STEERING GEAR WITH ACTIVE FRONT STEERING (N54)

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.
Seal off hydraulic lines with plugs.

IMPORTANT: Aluminium-magnesium materials.
No steel screws/bolts may be used due to the threat of electrochemical corrosion.
A magnesium crankcase requires aluminium screws/bolts exclusively.
Aluminium screws/bolts must be replaced each time they are released.
The end faces of aluminium screws/bolts are painted blue for the purposes of reliable identification.
Jointing torque and angle of rotation must be observed without fail (risk of damage).

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **FRONT UNDERBODY PROTECTION**
- Remove gaiter with resonator
- Remove **BELT PULLEY**

Release hose clamp (1) and detach suction line from power steering pump.

Release banjo bolt (2) and detach pressure line from power steering pump.

Installation:

Replace all sealing rings.

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

Align suction line by way of "P" marking to connection on power steering pump.

Tightening torque **32 41 4AZ** .

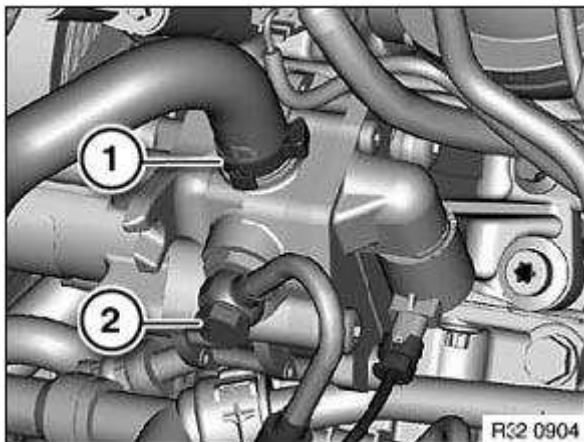


Fig. 89: Identifying Hose Clamp And Banjo Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Disconnect plug connection (1).

Release screws (2, 5).

Installation:

Reinstall holder (3).

Make sure vent line (4) is correctly seated in holder retaining clip (3).

Replace aluminium screws.

Observe screwing sequence!

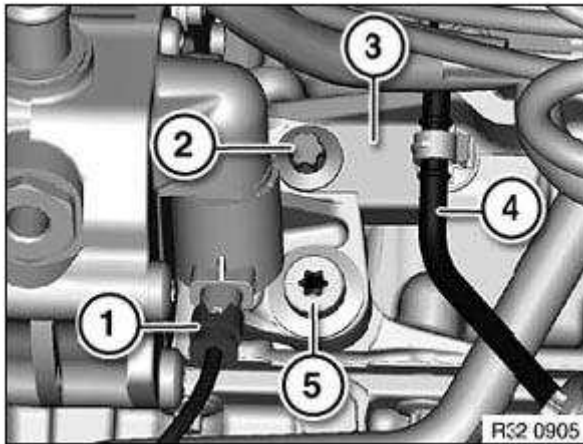


Fig. 90: Identifying Vent Line And Holder With Retaining Clip
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1) and remove power steering pump towards top.

Installation:

Replace aluminium screws.

Observe screwing sequence!

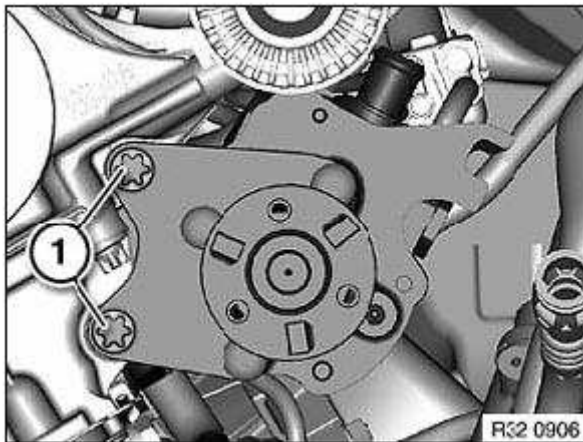


Fig. 91: Identifying Power Steering Pump Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

Screwing sequence

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

Tightening torque **32 41 3AZ** .

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

Tightening torque **32 41 3AZ** .

After installation

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

32 41 033 REMOVING AND INSTALLING POWER STEERING PUMP FOR POWER STEERING GEAR WITH ACTIVE FRONT STEERING (N63)

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.
Seal off hydraulic lines with plugs.**

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **BELT PULLEY**
- Remove **FAN COWL**
- Remove **FRONT ASSEMBLY UNDERSIDE PROTECTION**

Release union nut (2) and detach pressure line from power steering pump.

Release hose clamp (1) and detach suction line from power steering pump.

Disconnect plug connection on rear side of power steering pump.

Installation:

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

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

Tightening torque **32 41 4AZ** .

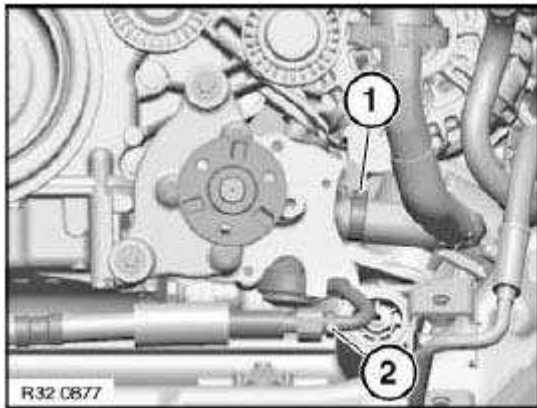


Fig. 92: Identifying Union Nut And Hose Clamp
Courtesy of BMW OF NORTH AMERICA, INC.

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

Installation:

Make sure screws are installed in correct positions.

- Screw (1) M10 x 50
- Screw (2) M10 x 130

Tightening torque **32 41 3AZ** .

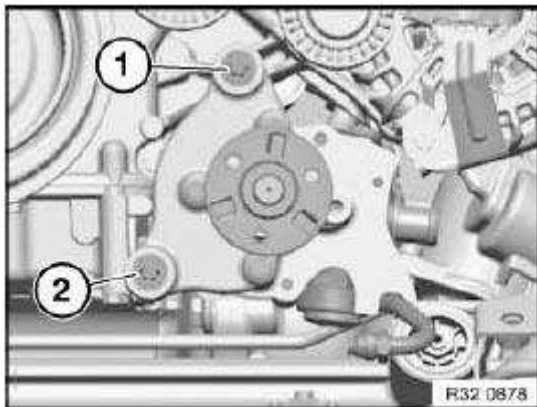


Fig. 93: Identifying Power Steering Pump And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

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

32 41 037 REMOVING AND INSTALLING/REPLACING POWER STEERING PUMP FOR POWER STEERING GEAR WITH DYNAMIC DRIVE (N54)

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.
Seal off hydraulic lines with plugs.

NOTE: When replacing power steering pump:
FLUID RESERVOIR must be replaced in event of metal abrasion, sluggish pump shaft or increased wear!
The filter integrated in the fluid reservoir can only absorb a limited amount of foreign particles. If the filter clogs, the hydraulic system can no longer be sufficiently protected.
Metal abrasion is perceived in the fluid reservoir as metallically glittering hydraulic fluid.
It is only necessary to replace the fluid reservoir because of leaks (e.g. at hose connections) only in the event of the unavoidably high ingress of dirt.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove acoustic cover
- Remove BELT PULLEY
- Remove left charge air line
- Remove STEERING GEAR COVER AT TOP

Release hose clamp (1) and detach suction line from power steering pump.

Version with active front steering: Disconnect plug connection (2).

Release banjo bolt (4) and detach pressure line for Dynamic Drive from power steering pump.

Release banjo bolt (3) and detach pressure line from power steering pump.

Installation:

Replace all sealing rings.

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

The identification (P) of the suction line and the rib of the power steering pump serve as a rough aid to alignment.

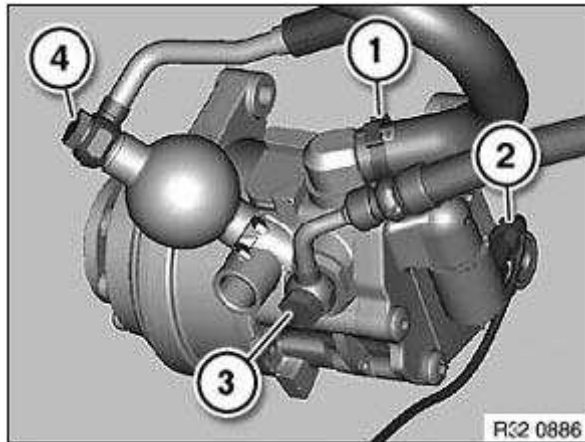


Fig. 94: Identifying Hose Clamp, Banjo Bolt And Plug Connection
Courtesy of BMW OF NORTH AMERICA, INC.

Tightening torque **32 41 4AZ** (for power steering).

Tightening torque **32 41 9AZ** (for Dynamic Drive).

Remove idler pulley (1).

Release bolts (2) and remove power steering pump towards top.

Tightening torque **32 41 3AZ** .

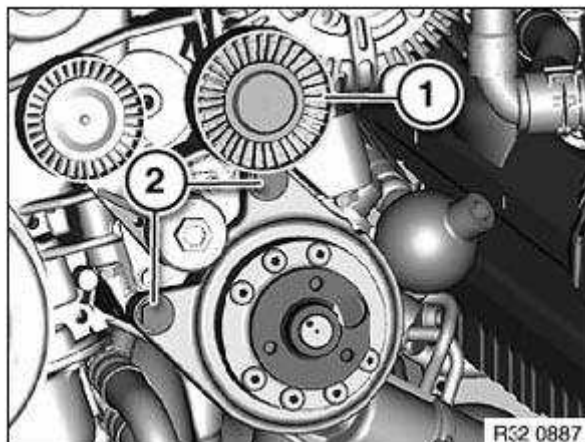


Fig. 95: Identifying Idler Pulley With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

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

- If necessary, carry out **INITIAL DYNAMIC DRIVE OPERATION**

32 41 037 REMOVING AND INSTALLING/REPLACING POWER STEERING PUMP FOR POWER STEERING GEAR WITH DYNAMIC DRIVE (N63)

NOTE: When replacing power steering pump:
FLUID RESERVOIR must be replaced in event of metal abrasion, sluggish pump shaft or increased wear!
The filter integrated in the fluid reservoir can only absorb a limited amount of foreign particles. If the filter clogs, the hydraulic system can no longer be sufficiently protected.
Metal abrasion is perceived in the fluid reservoir as metallically glittering hydraulic fluid.
It is only necessary to replace the fluid reservoir because of leaks (e.g. at hose connections) only in the event of the unavoidably high ingress of dirt.

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.
Seal off hydraulic lines with plugs.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **RADIATOR** .
- Remove **ALTERNATOR DRIVE BELT**

Disconnect plug-in connections (1) and (2).

Release hose clamp (3) and detach suction line from power steering pump.

Release union nut (4) and disconnect pressure line for power steering from power steering pump.

Tightening torque **32 41 4AZ** (for power steering).

Installation:

Replace all sealing rings.

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

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

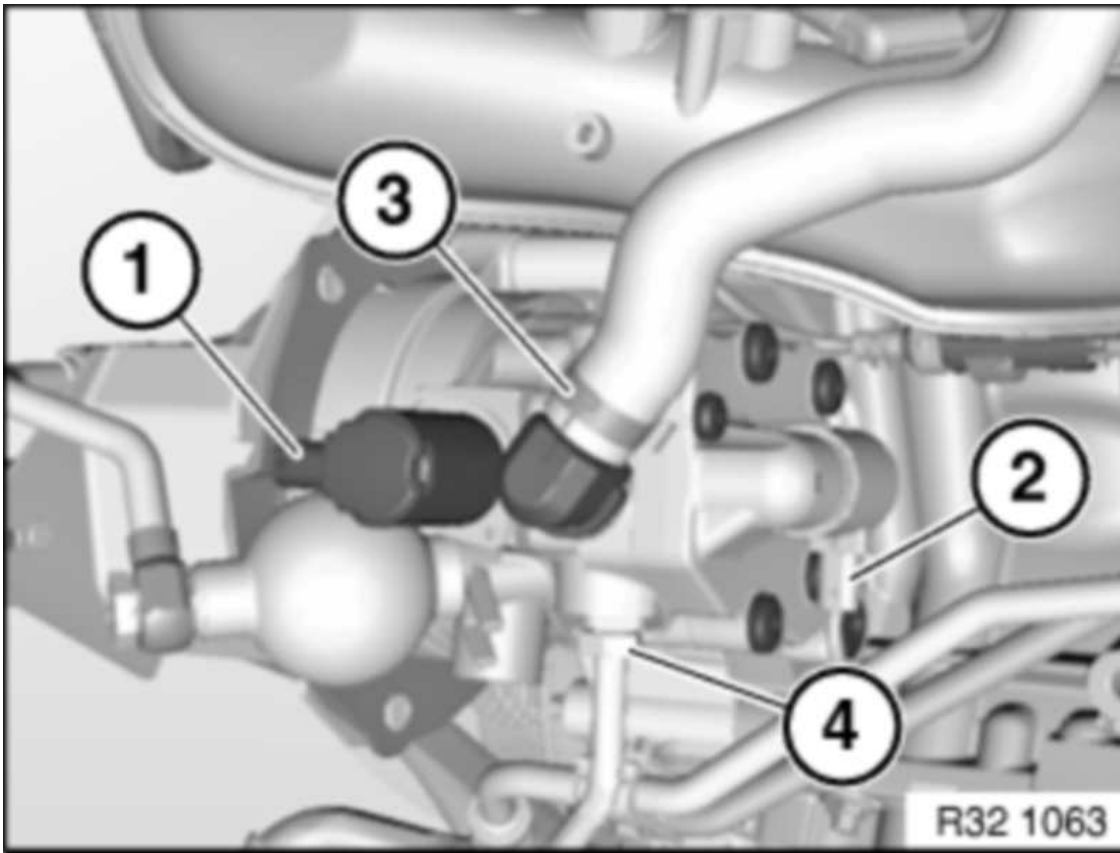


Fig. 96: Identifying Union Nut, Hose Clamp, And Plug-In Connections
Courtesy of BMW OF NORTH AMERICA, INC.

Release banjo bolt (1).

Tightening torque **32 41 3AZ** .

Release nuts (2) and place expandable hose (3) to one side.

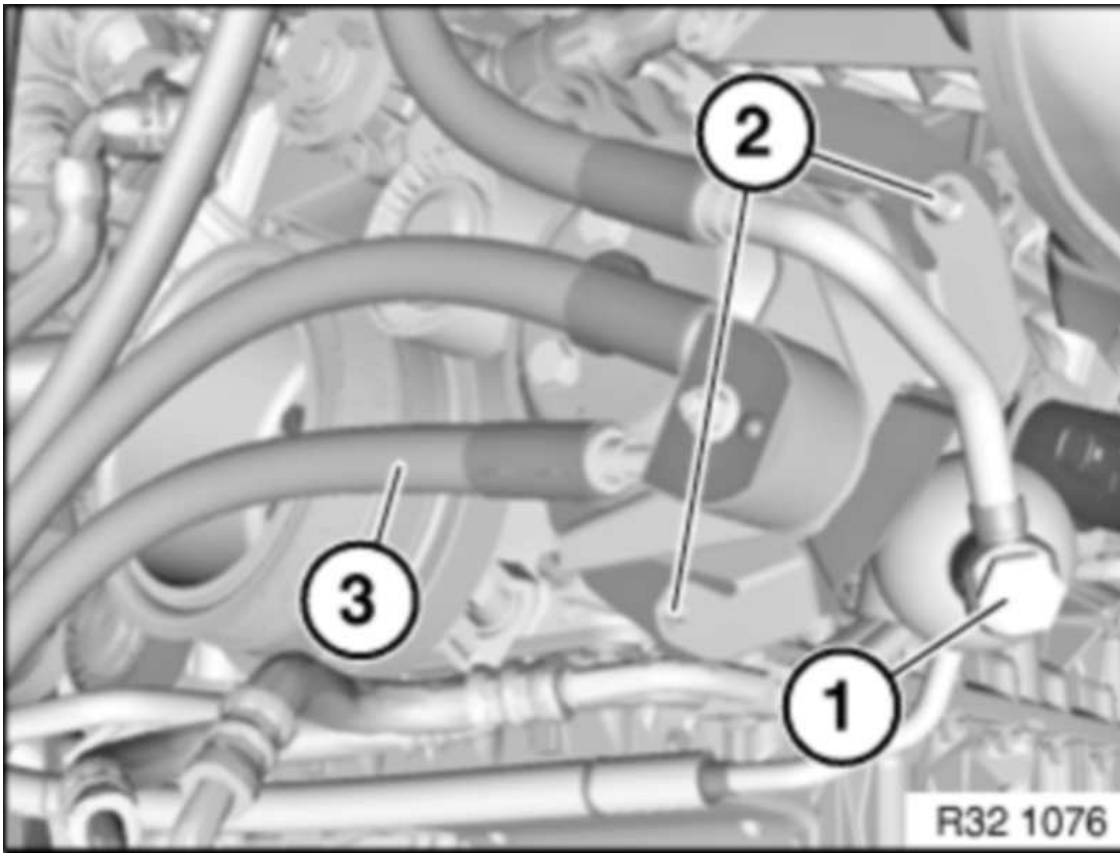


Fig. 97: Identifying Banjo Bolt, Nuts, And Expandable Hose
Courtesy of BMW OF NORTH AMERICA, INC.

Release bolts (1) and remove holder (2) and power steering pump towards bottom.

Tightening torque 32 41 3AZ .

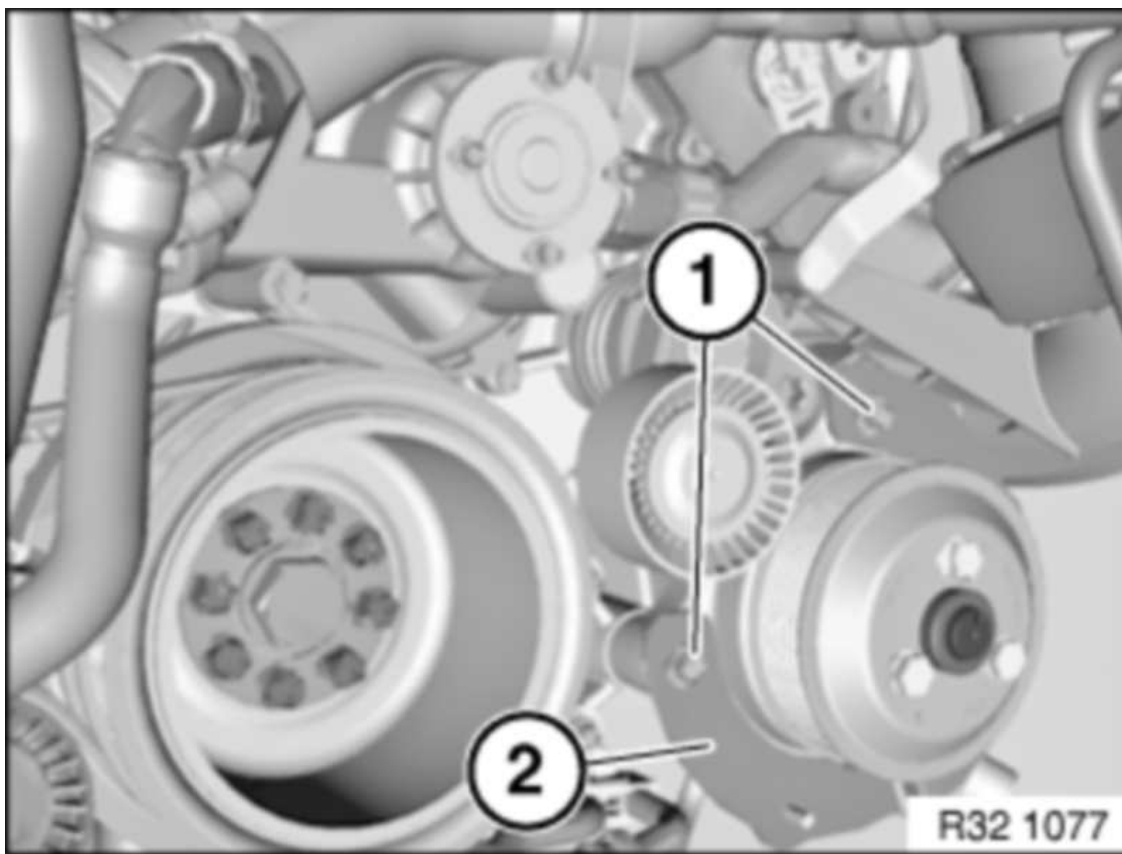


Fig. 98: Identifying Holder And Bolts

Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .
- 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 information "Replacing drive belt". See **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N54)** or **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N63)** .

Slacken bolts (1)

Relieve tension on drive belt and remove from belt pulley (2). See **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N54)** or **11 28 010 REPLACING ALTERNATOR DRIVE BELT (N63)** .

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

Installation:

Lettering on belt pulley (2) must point forwards.

Replace microencapsulated screws.

Tightening torque **32 41 2AZ** .

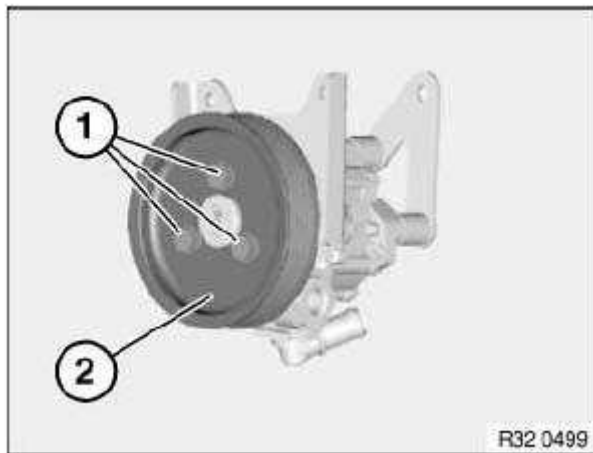


Fig. 99: Identifying Belt Pulley With Bolts
Courtesy of BMW OF NORTH AMERICA, INC.

32 41 250 REMOVING AND INSTALLING/REPLACING FLUID RESERVOIR 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.
Seal off hydraulic lines with plugs.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir

Unscrew nuts.

Remove shims.

Installation:

Replace self-locking nuts.

Tightening torque 32 41 1AZ .

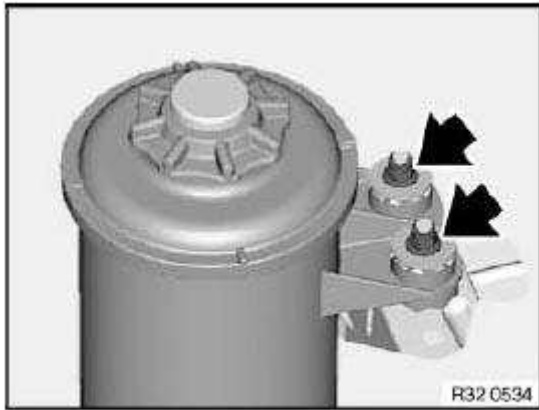


Fig. 100: Locating Self-Locking Nuts
Courtesy of BMW OF NORTH AMERICA, INC.

NOTE: **Raise and/or turn fluid reservoir in order to gain better access to plug connection and hoses.**

If necessary, disconnect plug connection at level switch.

Release suction line (2) and cooler return line (3) from fluid reservoir (1) and detach in direction of arrow.

Lift out fluid reservoir (1).

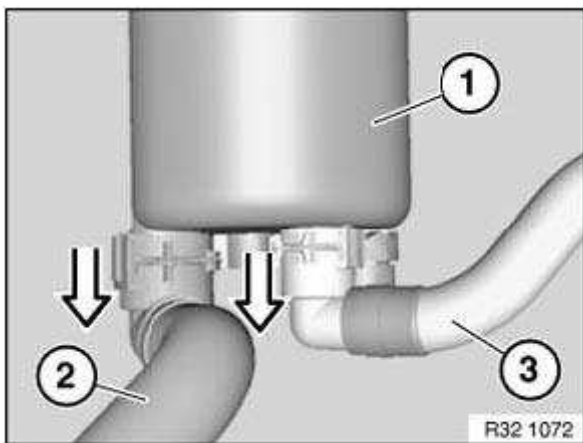


Fig. 101: Releasing Suction Line And Cooler Return Line From Fluid Reservoir
Courtesy of BMW OF NORTH AMERICA, INC.

Replacement

If necessary, remove level switch.

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 41 311 REPLACING SUCTION LINE FOR POWER STEERING (N54)

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **FRONT UNDERBODY PROTECTION**
- Remove **OIL RESERVOIR**

Expose suction line up to connection on vane pump.

Unfasten hose clip (1).

Detach suction line (2) from vane pump.

Installation:

Identification (P) and rib (3) on vane pump connection must match up.

When installing the suction line, make sure it is laid without tension and there is a sufficient gap to the adjacent components.

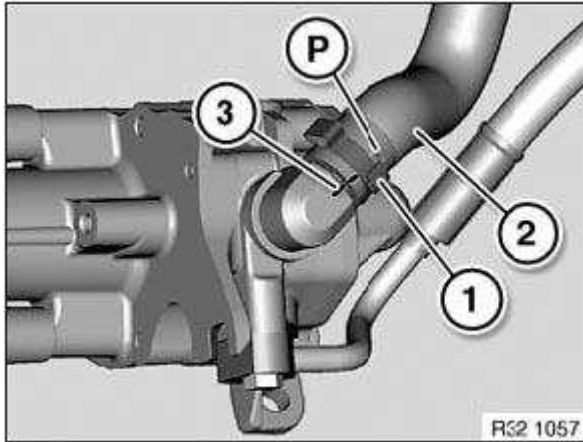


Fig. 102: Identifying Hose Clip, Suction Line And Rib
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

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

32 41 311 REPLACING SUCTION LINE FOR POWER STEERING (N63)

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **FRONT UNDERBODY PROTECTION**
- Remove **OIL RESERVOIR**

Unlock suction line (1) on hydraulic reservoir (2) and detach in direction of arrow.

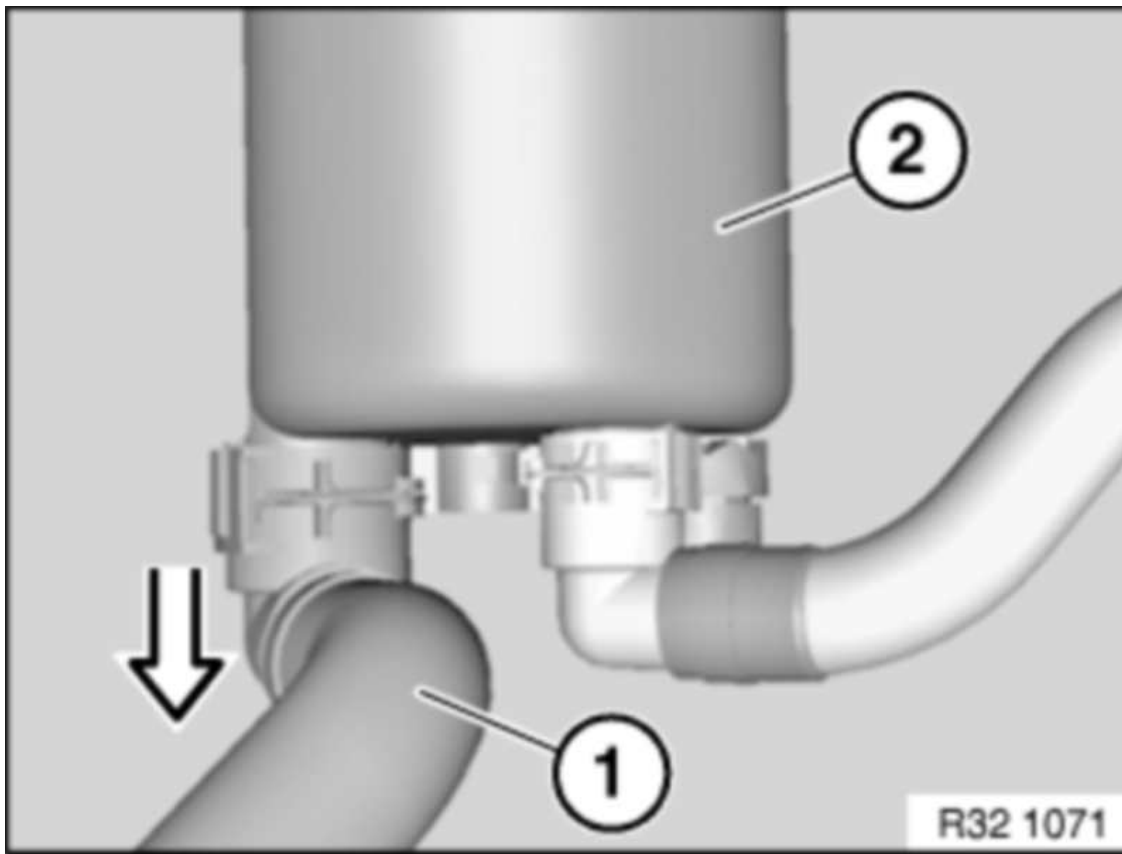


Fig. 103: Identifying Hydraulic Reservoir And Suction Line
Courtesy of BMW OF NORTH AMERICA, INC.

Expose suction line up to connection on vane pump.

Unfasten hose clip (2).

Detach suction line (1) from vane pump.

Installation:

Replace hose clamp (1).

Identification (P) of suction line and rib (3) on vane pump connections serve as an approximate guide to alignment.

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

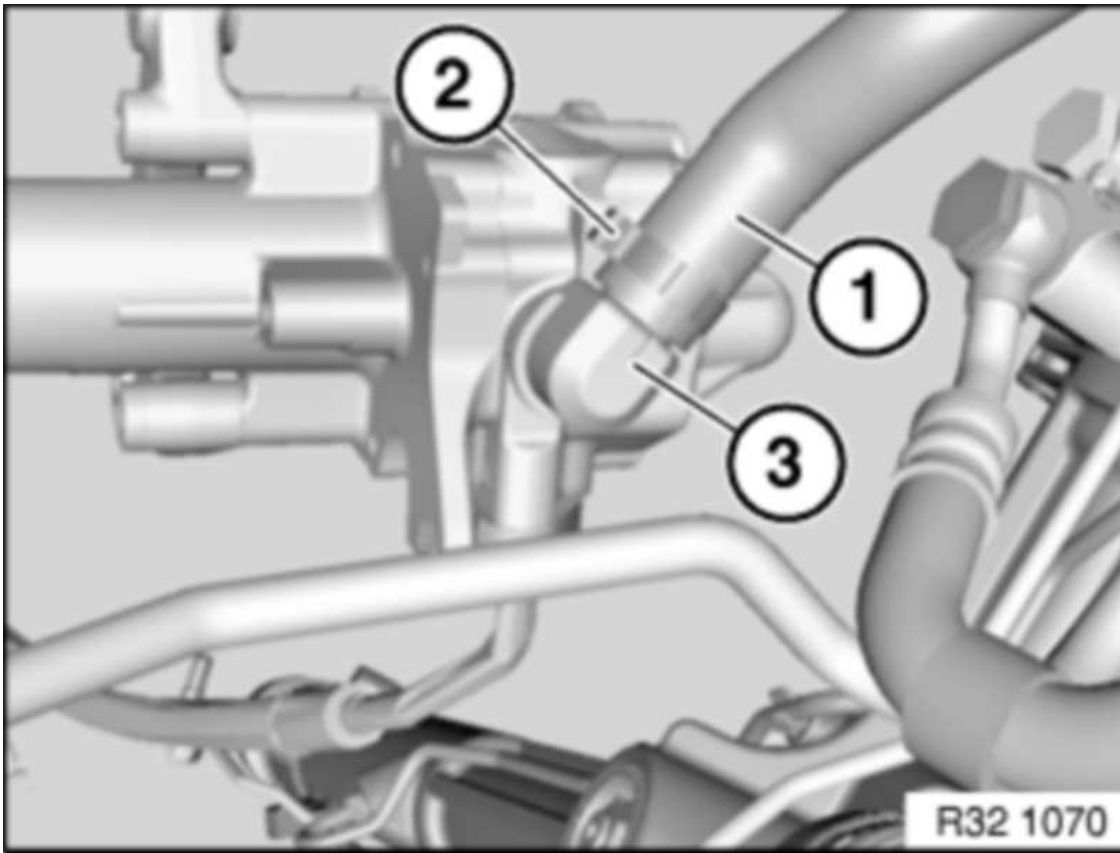


Fig. 104: Identifying Hose Clip, Suction Line And Rib
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

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

32 41 331 REPLACING PRESSURE LINE FOR POWER STEERING (N54)

WARNING: Secure engine in installation position with special tool to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Lower **FRONT AXLE CARRIER**

Release banjo bolt (1) and remove pressure line (2) from power steering gear.

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 5AZ** .

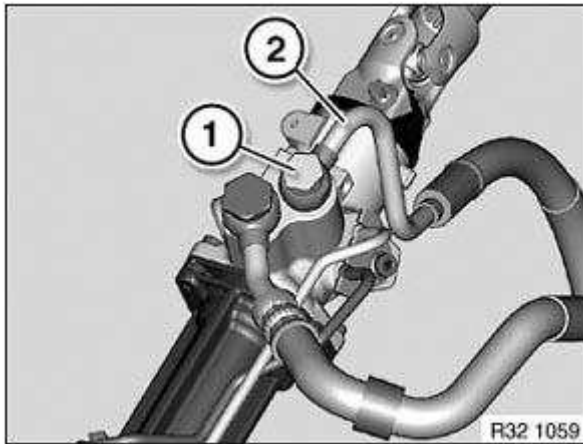


Fig. 105: Identifying Pressure Line And Banjo Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Expose pressure line up to connection on vane pump.

Release screw (1) and remove pressure line (2).

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 4AZ** .

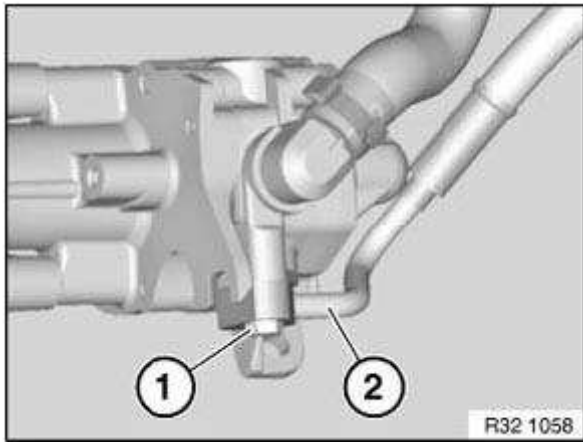


Fig. 106: Identifying Pressure Line Screw
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .

32 41 331 REPLACING PRESSURE LINE FOR POWER STEERING (N63)

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Lower **RADIATOR**
- Remove **UNDERBODY PROTECTION**

- Remove power steering pump
- Remove **STEERING GEAR COVER** on left
- Remove **AUXILIARY WATER PUMP**
- Remove transmission oil cooler

Release banjo bolt (1) and remove pressure line (2) from power steering gear.

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 5AZ** .

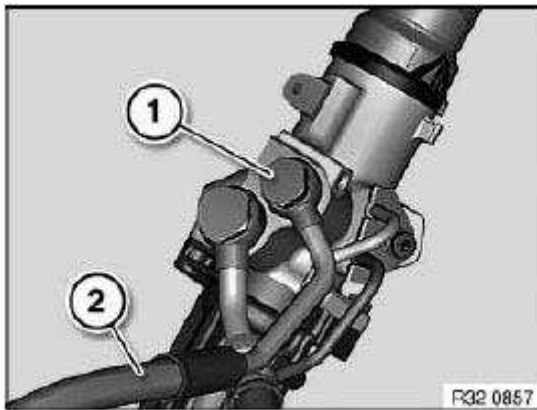


Fig. 107: Identifying Banjo Bolts And Pressure Line
Courtesy of BMW OF NORTH AMERICA, INC.

Expose pressure line up to connection on vane pump.

Release screw (1) and remove pressure line (2).

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 4AZ** .

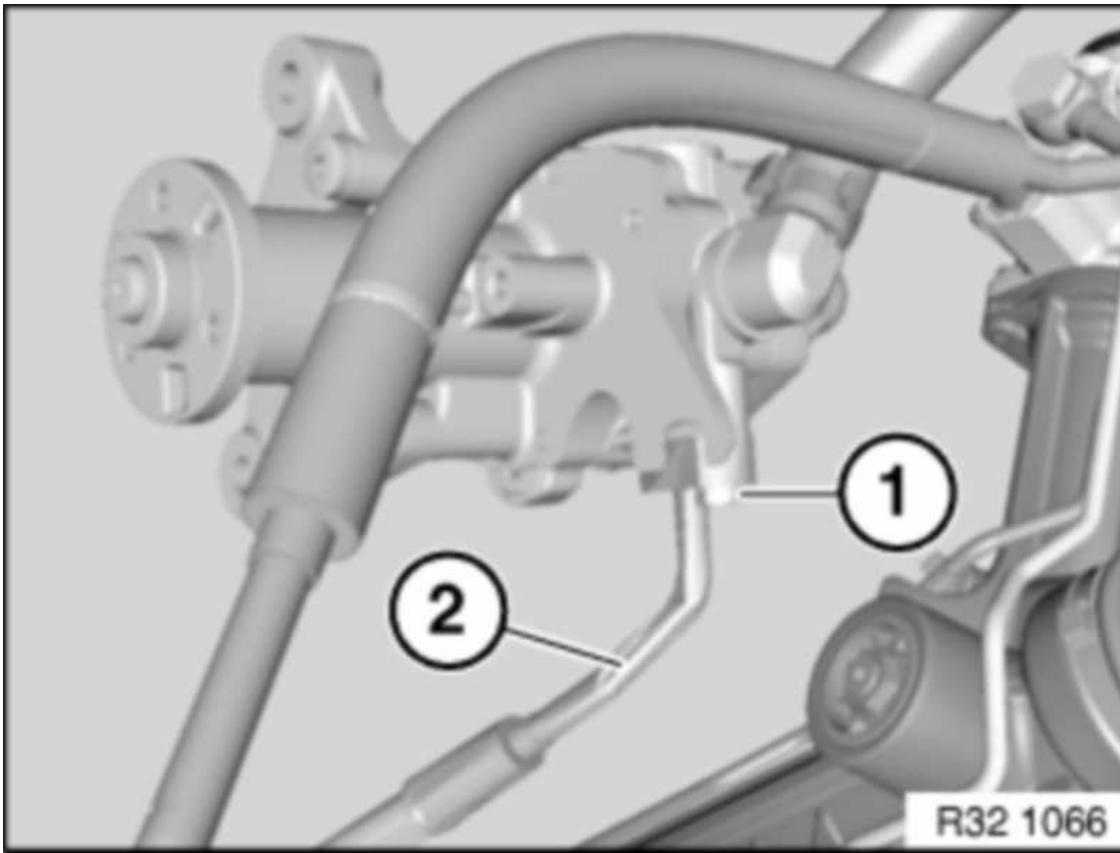


Fig. 108: Identifying Pressure Line And Screw
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

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

32 41 333 REPLACING PRESSURE LINE FOR DYNAMIC DRIVE (LINE PART 1) (N63)

WARNING: **SECURE ENGINE IN INSTALLATION POSITION WITH SPECIAL TOOL** to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Lower **FRONT AXLE CARRIER**

Release hexagon socket screws from flange (1) and detach pressure line from power steering pump.

Tightening torque **32 41 16AZ** .

Seal pressure line and power steering pump connection with suitable sealing plugs.

Installation:

Replace all sealing rings.

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

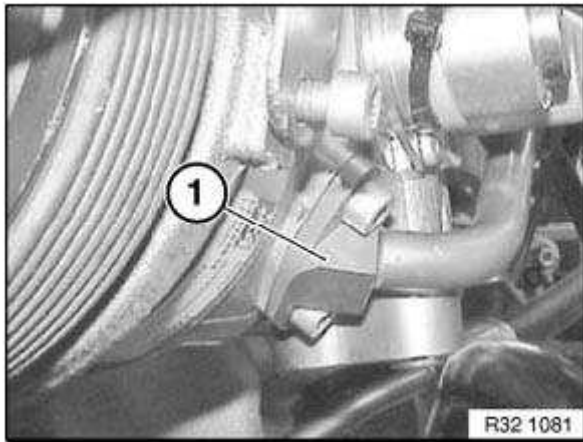


Fig. 109: Locating Hexagon Socket Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Unscrew nuts (1).

Tightening torque **32 41 8AZ** .

Release hexagon socket screw (2).

Tightening torque **32 41 17AZ** .

Installation:

Replace self-locking nut.

Make sure pressure line (3) is laid without tension and with sufficient spacing to adjoining components.

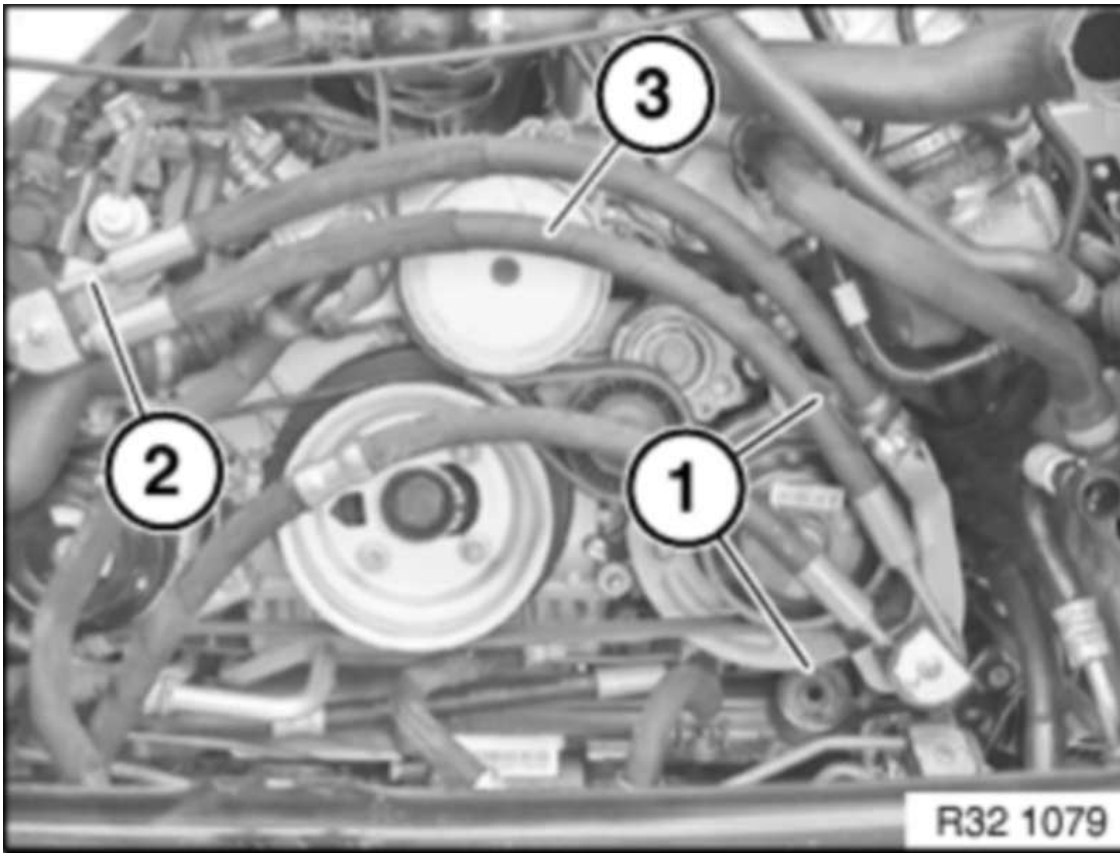


Fig. 110: Identifying Pressure Line, Nuts, And Hexagon Socket Screw
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) and remove heat shield (2).

Tightening torque **32 41 7AZ** .

Installation:

Make sure pressure line (3) is laid without tension and with sufficient spacing to adjoining components.

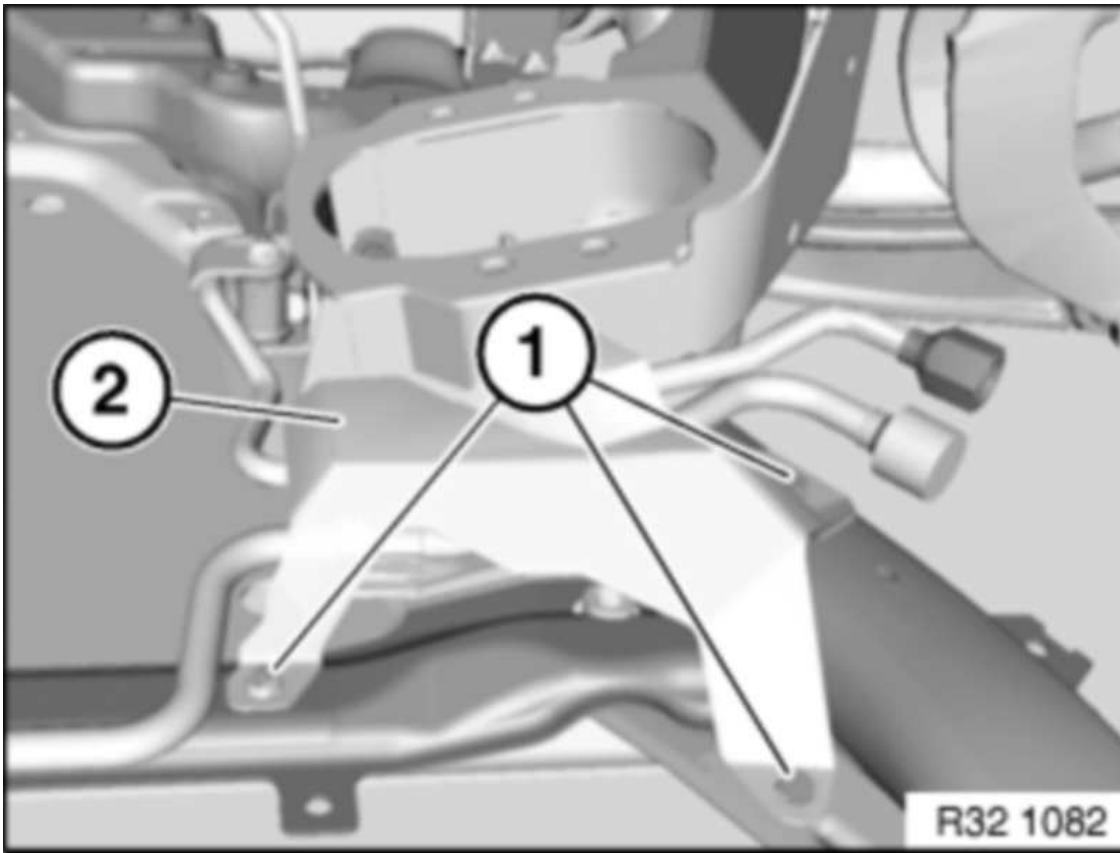


Fig. 111: Identifying Heat Shield And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release hexagon socket screws from flange (1).

Tightening torque **32 41 16AZ**

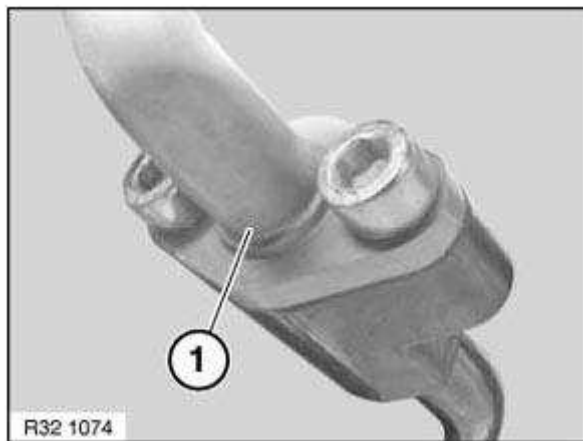


Fig. 112: Identifying Hexagon Socket Screws From Flange
Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .
- Carry out **INITIAL DYNAMIC DRIVE OPERATION** .

32 41 333 REPLACING PRESSURE LINE FOR DYNAMIC DRIVE (LINE PART 2) (N63)

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **UNDERBODY PROTECTION COMPLETELY**
- Remove **REINFORCEMENT PLATE**
- Partially remove **FRONT RIGHT WHEEL ARCH COVER (REAR SECTION)**

Release hexagon socket screws from flange (1).

Tightening torque **32 41 16AZ** .

Seal pressure line and power steering pump connection with suitable sealing plugs.

Installation:

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

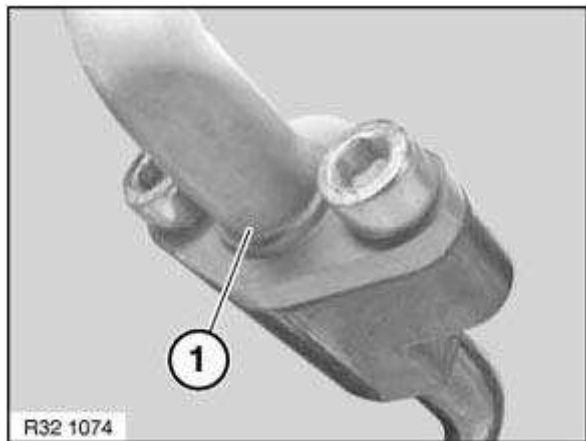


Fig. 113: Identifying Hexagon Socket Screws From Flange
Courtesy of BMW OF NORTH AMERICA, INC.

Release nut (1) and remove pressure line from decoupling element (2).

Tightening torque **32 41 7AZ** .

Installation:

Replace self-locking nut.

Make sure pressure line (3) is laid without tension and with sufficient spacing to adjoining components.

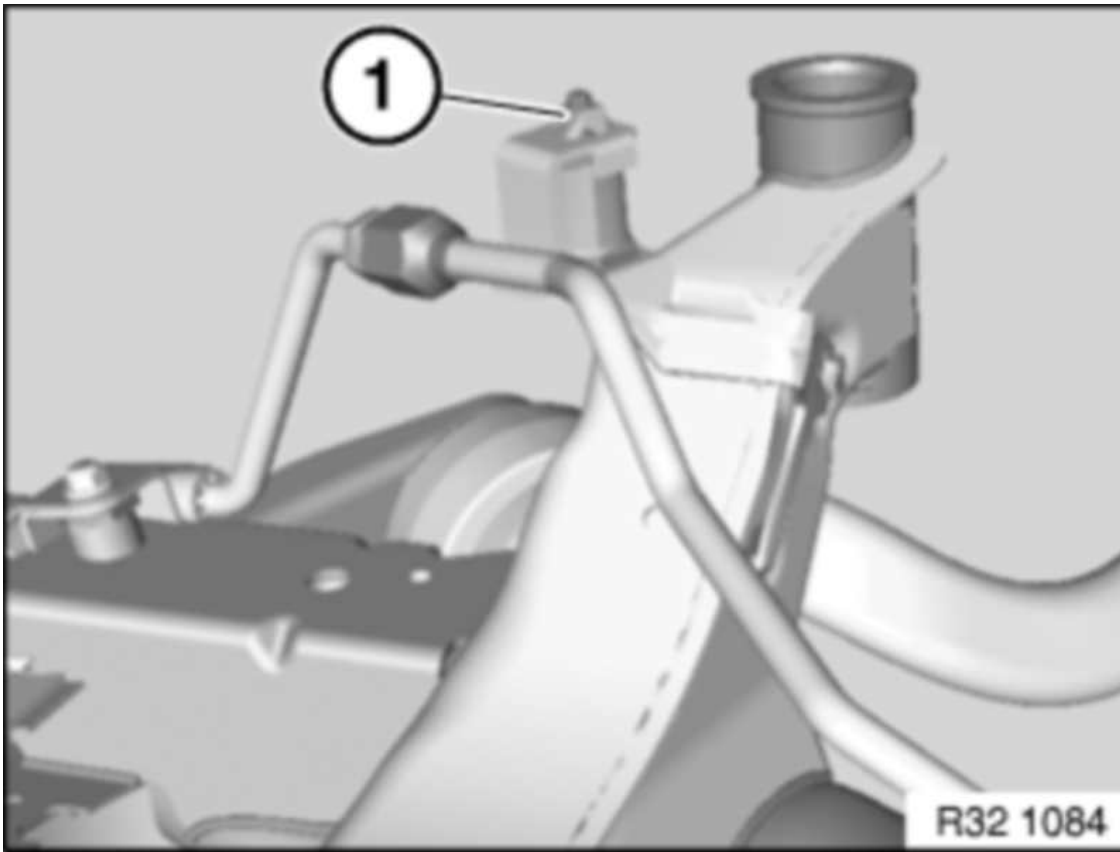


Fig. 114: Identifying Pressure Line And Nut
Courtesy of BMW OF NORTH AMERICA, INC.

Release screws (1) and remove heat shield (2).

Tightening torque **32 41 14AZ** .

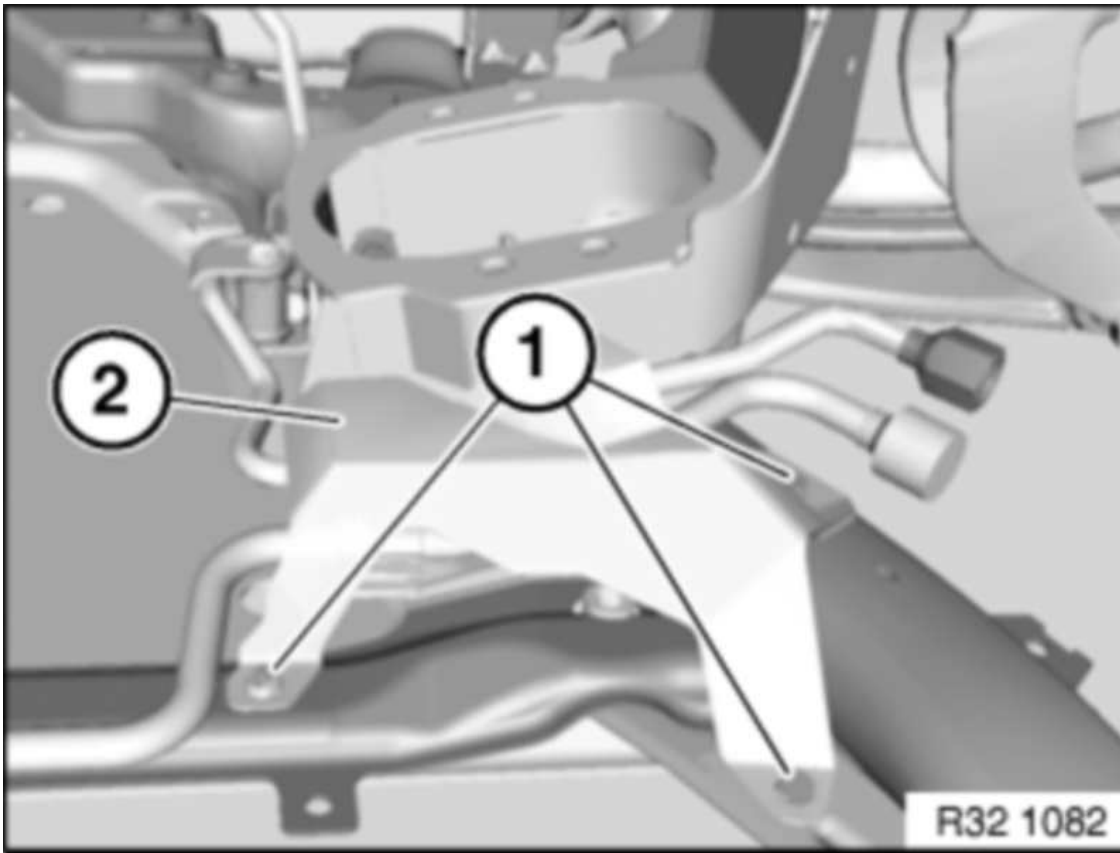


Fig. 115: Identifying Heat Shield And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release screw (1).

Tightening torque **32 41 7AZ** .

Release screw (2) and remove bracket (3).

Installation:

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

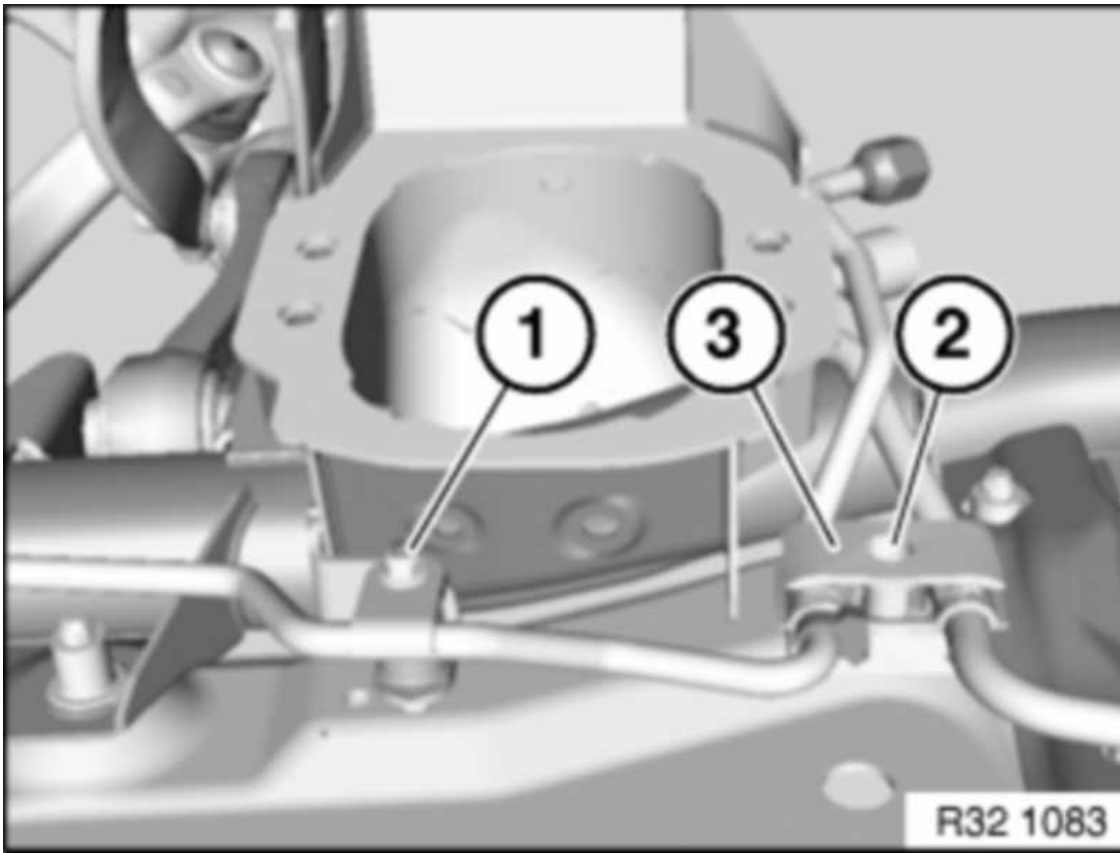


Fig. 116: Identifying Bracket And Screws
Courtesy of BMW OF NORTH AMERICA, INC.

Release banjo bolt (1).

Tightening torque **32 41 15AZ** .

Seal pressure lines with suitable sealing plugs.

Remove pressure line (2).

Installation:

Hydraulic lines are not permitted to contact each other or adjoining components.

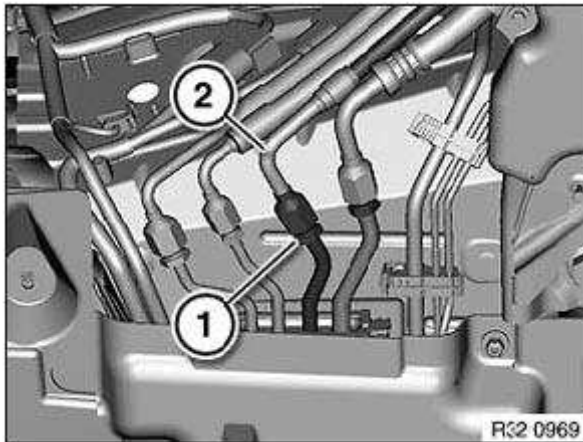


Fig. 117: Identifying Pressure Line And Banjo Bolt
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation:

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Carry out **INITIAL DYNAMIC DRIVE OPERATION** .

32 41 341 REPLACING COOLER RETURN LINE FOR POWER STEERING (M57T2, N54, N63)

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Remove **FRONT UNDERBODY PROTECTION**
- Remove **OIL RESERVOIR**

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

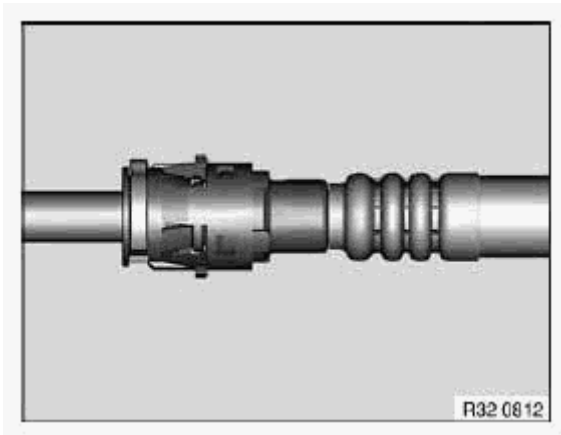


Fig. 118: Identifying Power Steering Cooler Connection With Suitable Sealing Plugs
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

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

32 41 351 REPLACING RETURN LINE FOR POWER STEERING (M57T2, N52K, N62TU)

WARNING: Secure engine in installation position with special tool to prevent it from falling down.

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Lower **FRONT AXLE CARRIER**

- M57T2: Remove pipe between intercooler and manifold

NOTE: **Picture created using X5 4.8i as an example. There may be differences in detail in the case of other models.**

Release banjo bolt (1) and remove return line (2) from power steering gear.

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 6AZ** .

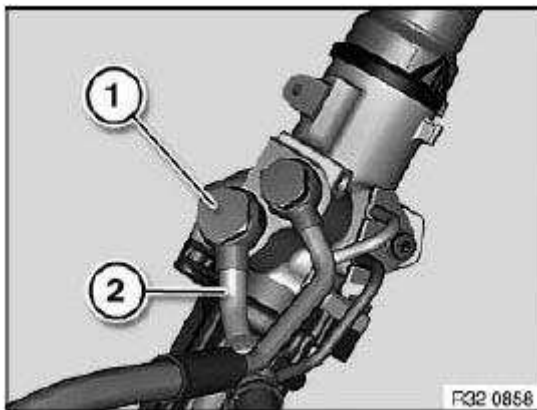


Fig. 119: Identifying Return Line And Banjo Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Expose return line up to connection on power steering cooler.

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

Remove return line.

Installation:

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

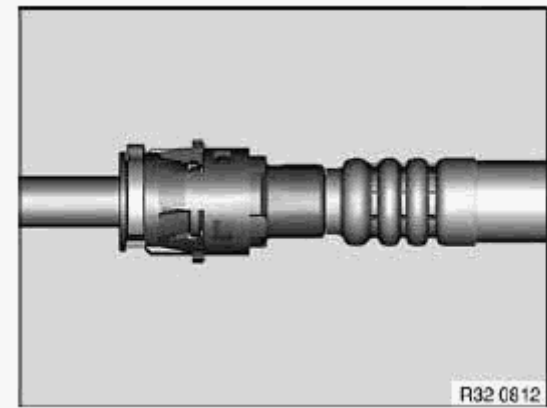


Fig. 120: Identifying Power Steering Cooler Connection With Suitable Sealing Plugs
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**
- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .

32 41 351 REPLACING RETURN LINE FOR POWER STEERING (M57T2, N54, N63)

WARNING: Secure engine in installation position with special tool to prevent it from falling down. See **11 00 670 SECURING ENGINE IN INSTALLATION POSITION (N54)** or **11 00 670 SECURING ENGINE IN INSTALLATION POSITION (N63)**

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.

Necessary preliminary tasks:

- Draw off and dispose of hydraulic fluid from fluid reservoir
- Lower **FRONT AXLE CARRIER**
- M57T2: Remove pipe between intercooler and manifold

NOTE: **Picture created using X5 4.8i as an example. There may be differences in detail in the case of other models.**

Release banjo bolt (1) and remove return line (2) from power steering gear.

Installation:

Replace all sealing rings.

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

Tightening torque **32 41 6AZ** .

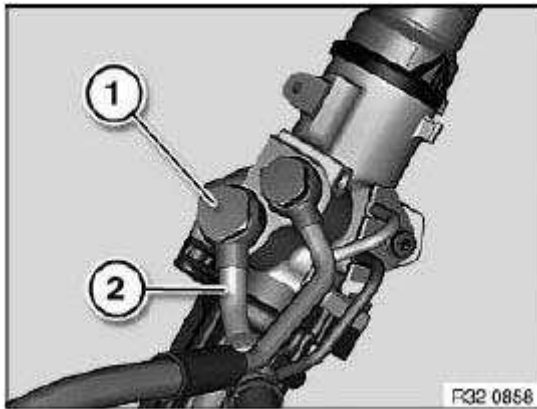


Fig. 121: Identifying Return Line And Banjo Bolt
Courtesy of BMW OF NORTH AMERICA, INC.

Expose return line up to connection on power steering cooler.

Release holder (2) from return line (3).

Tightening torque **32 41 15AZ** .

Unfasten screw fitting (1).

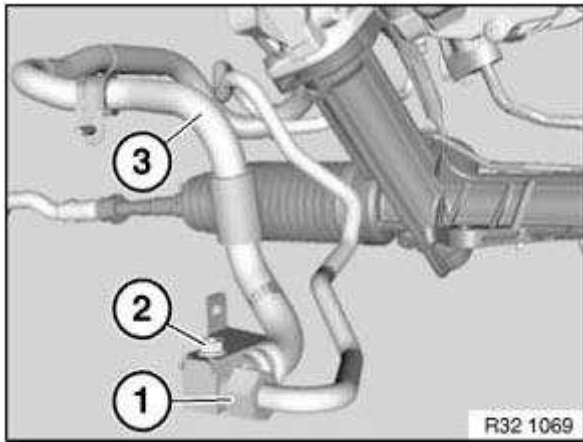


Fig. 122: Releasing Holder From Return Line
 Courtesy of BMW OF NORTH AMERICA, INC.

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

Remove return line.

Installation:

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

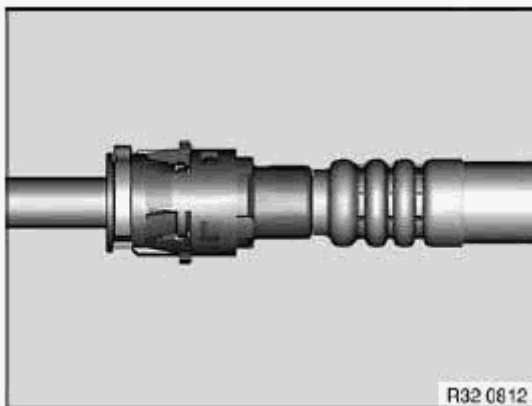


Fig. 123: Identifying Power Steering Cooler Connection With Suitable Sealing Plugs
 Courtesy of BMW OF NORTH AMERICA, INC.

After installation

- Fill and bleed **HYDRAULIC SYSTEM**
- Check pipe connections for leaks
- Perform chassis alignment check. See **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION** or **32 00 150 KDS CHASSIS/WHEEL ALIGNMENT CHECK WITH LOAD UP TO DESIGN POSITION**

- Carry out steering angle sensor adjustment/adjustment for active front steering. See **32 10 005 ADJUSTMENT FOR ACTIVE FRONT STEERING** and **61 31 996 CARRYING OUT STEERING ANGLE SENSOR ADJUSTMENT** .

ELECTRONIC POWER STEERING

32 43 010 REMOVING AND INSTALLING/REPLACING CONTROL UNIT FOR ACTIVE FRONT STEERING

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

Necessary preliminary tasks:

- Disconnect **BATTERY NEGATIVE LEAD**
- Partially remove **FRONT LEFT WHEEL ARCH COVER (REAR SECTION)**

Release nuts (1) and if necessary remove grounding cable (2).

Unclip cable holder (3).

Remove control unit from guide (5) and disconnect plug connections (4).

Installation:

Replace damaged cable holder.

Tightening torque **32 43 1AZ** .

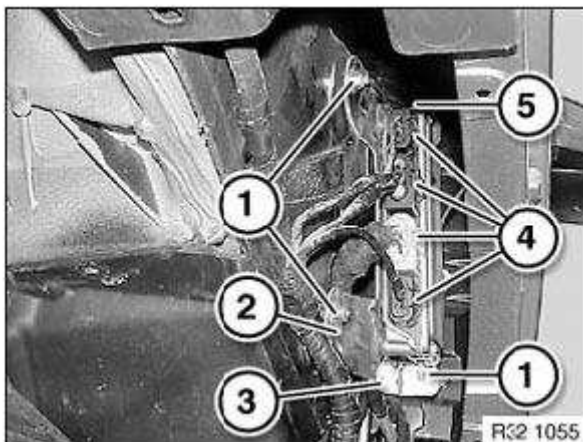


Fig. 124: Identifying Grounding Cable And Cable Holder With Plug Connections
Courtesy of BMW OF NORTH AMERICA, INC.

After installation

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

TROUBLESHOOTING

32 90 ... TROUBLESHOOTING ON STEERING

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

TROUBLESHOOTING CHART

Fault	Cause	Remedy
Steering wheel play too high	Screws at lower section of steering spindle to steering gear/steering spindle middle section loose	Replace screws and tighten down (refer to <u>REMOVING AND INSTALLING/REPLACING LOWER SECTION OF STEERING SPINDLE</u>)
	Screws at steering spindle middle section to steering spindle lower section/steering column loose	Replace screws and tighten down (refer to <u>REMOVING AND INSTALLING/REPLACING LOWER SECTION OF STEERING SPINDLE</u> for N54, and <u>REMOVING AND INSTALLING/REPLACING STEERING SPINDLE LOWER SECTION (N63)</u> for N63.)
	Journal of tie rod end deformed	○ Check steering gear rack; if necessary, replace <u>STEERING GEAR</u> ○ Replace <u>TIE ROD ENDS</u>
	Tie rod end worn	Check tie rods, replace if necessary
		Replace <u>TIE ROD END</u>
	Steering gear rack damaged	Replace <u>STEERING GEAR</u>
	refer to <u>TROUBLESHOOTING ON FRONT AXLE</u>	
Steering wheel inclination	Refer to BMW diagnosis system "Troubleshooting tree wheel/chassis alignment check"	
	Refer to <u>TROUBLESHOOTING ON FRONT AXLE</u>	

STEERING

Steering and Wheel Alignment - Service Techniques - X6

STEERING AND WHEEL ALIGNMENT

KINEMATIC DIAGNOSIS SYSTEM AND ENVIRONMENT : BMW KDS (BEISSBARTH)



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

1. Foreword

1.1 Objectives

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

- Creation of guidelines for working with the BMW Kinematic Diagnosis System (KDS).
- Familiarisation with wheel alignment technology for current vehicles and clarifying any questions which arise in this connection.
- Transparency and clarification of different terms.

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

1.2 Further development of the BMW Kinematic Diagnosis System

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

1.3 Technical Data



Fig. 2: Technical Data Screen Display
Courtesy of BMW OF NORTH AMERICA, INC.

1.	Display	17" graphic screen with high-resolution graphics (640 x 480 pixels with 256 colours)
2.	On-screen text	in the appropriate national language
3.	Wheel dimensions	12"...20"
4.	Vehicle memory locations	unlimited
5.	Rotating plates	Load bearing capacity 1000 kg, angle of rotation $\pm 360^\circ$, 450 x 450 x 50 mm (L x W x H), sliding range ± 50 mm, weight 18 kg
6.	Sliding plates	Load bearing capacity 1000 kg, angle of rotation $\pm 10^\circ$, 450 x 450 x 50 mm (L x W x H), sliding range ± 65 mm, weight 17 kg
7.	Electrical connection	100...115 V / 220...240 V 50/60 Hz, 0.5 kW (other connections on request)

1.4 Scope of delivery

- 1 PC display device with graphic screen, graphical tablet, small or large equipment cabinet including automatic charging station, DIN A4 dot matrix printer
- 4 Measuring sensors with CCD camera technology and infrared data transmission with built-in power supply
- 1 Cable set (comprising 4 cables)
- 1 Brake clamping device
- 1 Steering lock device

- 2 Electronic precision rotating plates with integrated sensor without access ramps
- 2 Sliding plates without access ramps
- 4 BMW quick-clamping units, comprising a P8-68 locating bell and P267 01 quick-acting clamp including coated holding claws
- 1 Operating instructions for BMW KDS (8 languages)
- 1 BMW software and the BMW vehicle setpoint data with setting screens as well as text for the measurement preparations

1.5 Accessories required

- 2 Locating rods for positioning the vehicle
- 1 Set of sand bags for the prescribed loading

1.6 Accessories recommended

- 4 Quick-clamping units
- 2 Sets of access ramps
- 1 Remote control/display
- 1 Trolley (for ballast bags, rotating and sliding plates and 4 quick-acting clamps)

2. Measuring options using the BMW Kinematic Diagnosis System

2.1 Front axle

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

2.2 Rear axle

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

2.3 Other measuring options

- Rear wheel displacement
- Wheelbase difference
- Lateral displacement on right
- Lateral displacement on left
- Track difference

- Axial displacement

3. System description

3.1 BMW Kinematic Diagnosis System 1, based on the Beissbarth ML4000

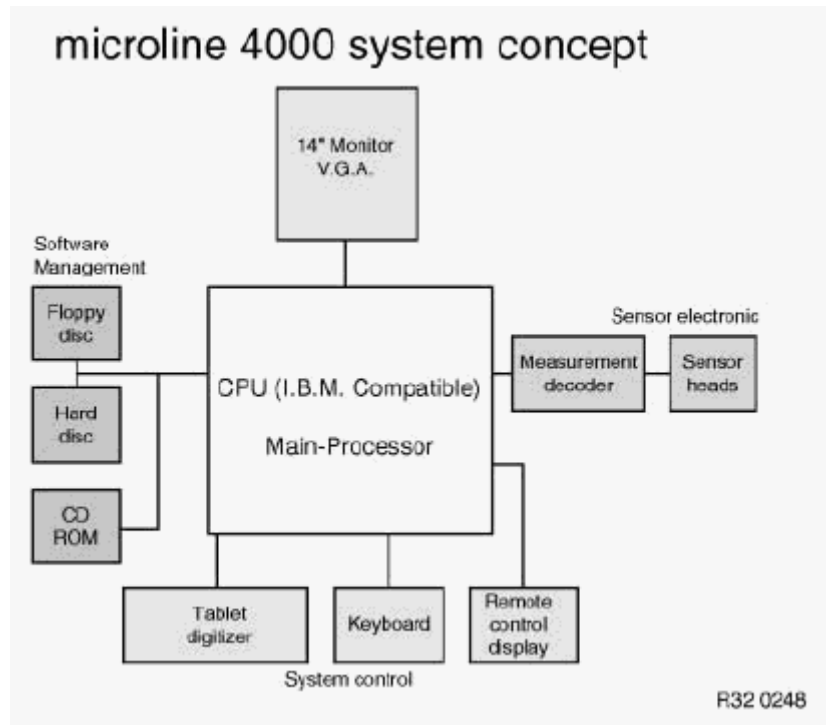


Fig. 3: CPU Communication Diagram
 Courtesy of BMW OF NORTH AMERICA, INC.

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

1. Mobile workstation



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

2. Mobile compact cabinet



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

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

3.2 Computer



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

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

3.3 Graphical tablet

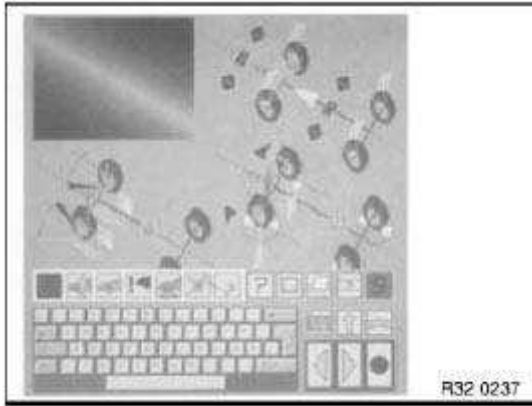


Fig. 7: Identifying Graphical Tablet
 Courtesy of BMW OF NORTH AMERICA, INC.

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

3.4 Equipment cabinet

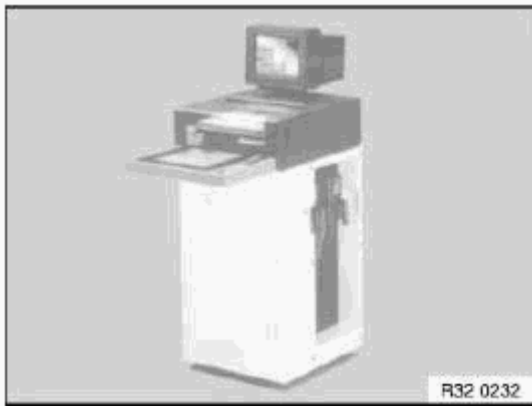


Fig. 8: Identifying Equipment Cabinet
 Courtesy of BMW OF NORTH AMERICA, INC.

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

3.5 Remote display



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

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

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

3.6 Measuring sensors with CCD camera



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

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

Benefits:

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

3.7 BMW Quick-acting clamp

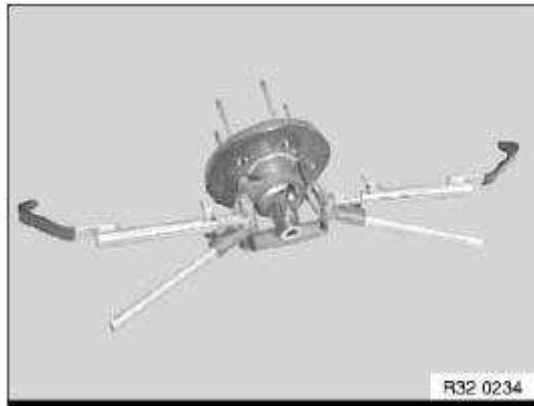


Fig. 11: Identifying BMW Quick-Acting Clamp
 Courtesy of BMW OF NORTH AMERICA, INC.

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

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

○

3.8 Rotating/sliding plates

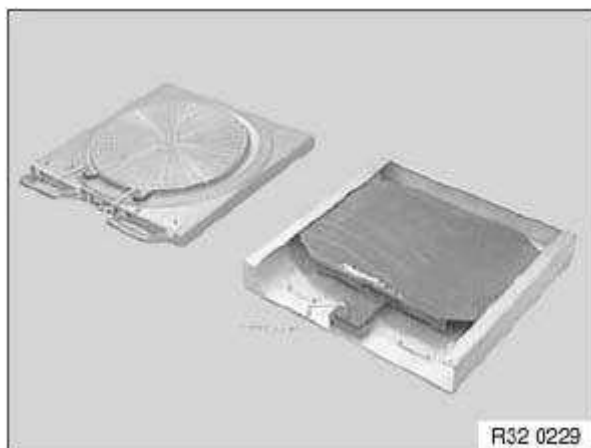


Fig. 12: Identifying Rotating/Sliding Plates

Courtesy of BMW OF NORTH AMERICA, INC.

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

3.9 Sensor pins

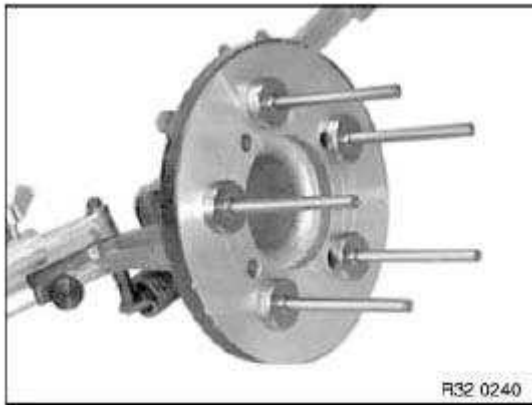


Fig. 13: Identifying Sensor Pins

Courtesy of BMW OF NORTH AMERICA, INC.

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

3.10 Spoiler adapter



Fig. 14: Identifying Spoiler Adapter

Courtesy of BMW OF NORTH AMERICA, INC.

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

3.11 Quick-clamping units

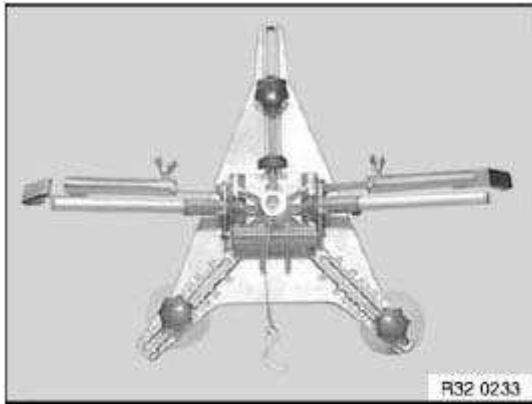


Fig. 15: Identifying Quick-Clamping Units
Courtesy of BMW OF NORTH AMERICA, INC.

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

3.12 Retainers



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

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

4. Workstation

4.1 Environment

ENVIRONMENT

Description:

All lifting platforms currently recommended by BMW for wheel alignment meet the requirements for the BMW KDS.

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

Requirements:

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

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

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

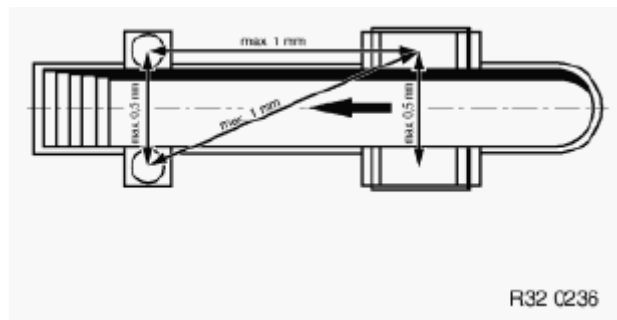


Fig. 17: Identifying Support Surfaces Dimension
Courtesy of BMW OF NORTH AMERICA, INC.

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

4.2 Preconditions for alignment

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

be aligned must be moved.

4.3 Measuring tolerance

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

4.4 Levelling the measuring station

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

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

5. Chassis-related terms

5.1 Toe-differential angle

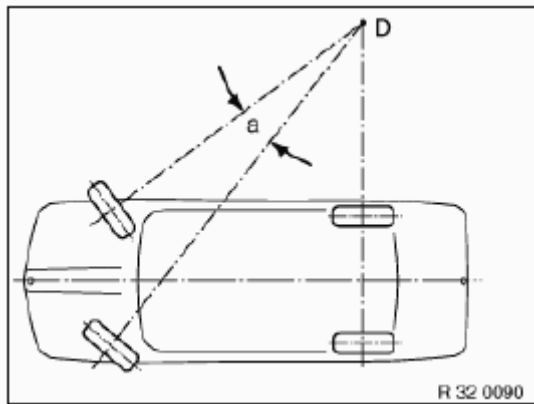


Fig. 18: Identifying Toe-Differential Angle

Courtesy of BMW OF NORTH AMERICA, INC.

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

5.2 Camber

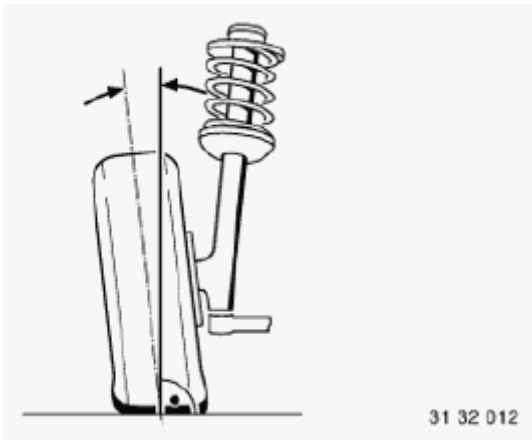


Fig. 19: Identifying Camber
Courtesy of BMW OF NORTH AMERICA, INC.

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

5.3 Toe-in

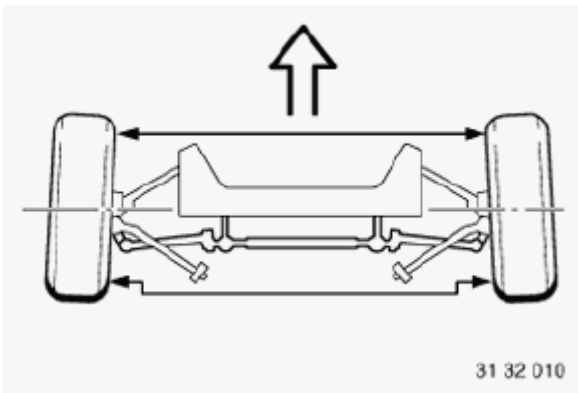


Fig. 20: Identifying Toe-In
Courtesy of BMW OF NORTH AMERICA, INC.

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

5.4 Castor

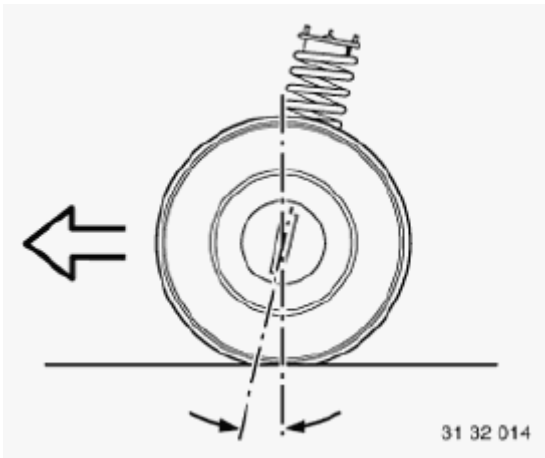


Fig. 21: Identifying Castor

Courtesy of BMW OF NORTH AMERICA, INC.

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

5.5 Geometrical drive axis/symmetrical axis

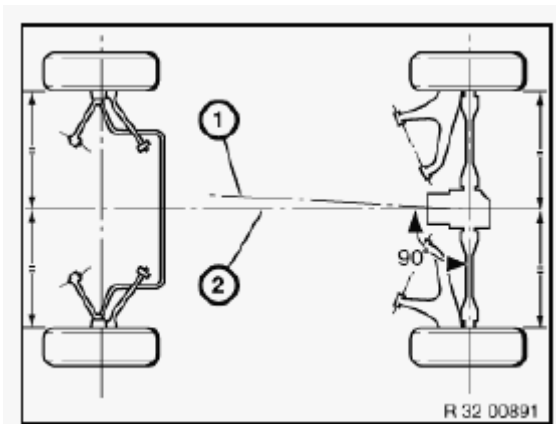


Fig. 22: Identifying Geometrical Drive Axis/Symmetrical Axis

Courtesy of BMW OF NORTH AMERICA, INC.

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

5.6 Wheel displacement angle

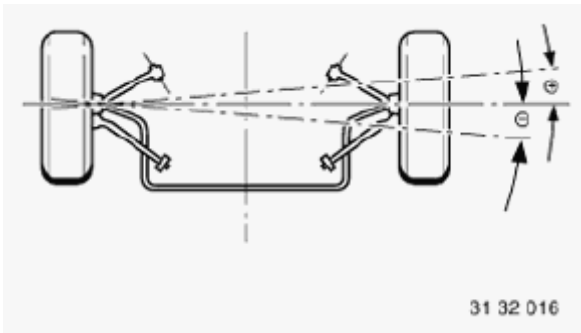


Fig. 23: Identifying Wheel Displacement Angle
Courtesy of BMW OF NORTH AMERICA, INC.

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

5.7 Kingpin offset

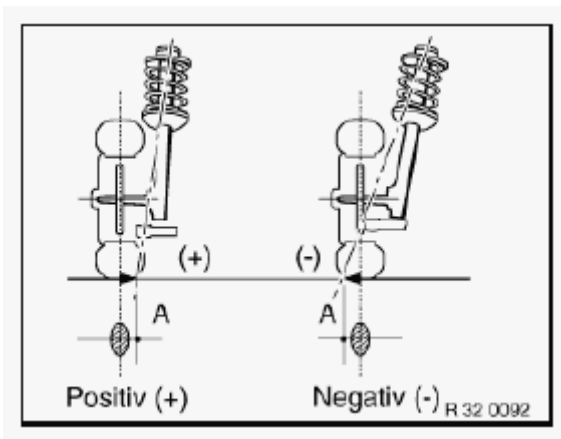


Fig. 24: Identifying Kingpin Offset
Courtesy of BMW OF NORTH AMERICA, INC.

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

6. Wheel suspension

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

6.1 Rigid axle suspension

RIGID AXLE SUSPENSION DESCRIPTION CHART

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

6.2 Independent wheel suspension

INDEPENDENT WHEEL SUSPENSION DESCRIPTION CHART

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

7. Wheel alignment/procedure

7.1 Measuring options

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

WHEEL ALIGNMENT/PROCEDURE

Measuring options	Measuring accuracy	In measuring range	Total measuring range
Total wheel toe (VA + HA)	± 2'	± 2°	± 18°
Single wheel toe (VA + HA)	± 2'	± 2°	± 9°
Camber (VA + HA)	± 1'	± 3°	± 10°
Wheel displacement (VA)	± 2'	± 2°	± 9°
Geometrical drive axis	± 2'	± 2°	± 9°
Castor	± 4'	± 18°	± 22°
Kingpin inclination	± 4'	± 18°	± 22°
Toe-differential angle	± 4'	± 20°	± 20°
Maximum steering angle (VA)	± 4'	± 60°	± 300°
Maximum steering angle (HA)	± 4'	± 9°	± 9°
Castor correction range	± 4'	± 7°	± 10°

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

7.2 Preparatory work

Before commencing the measurement, preparatory work must be carried out at the measuring area and on the vehicle . Preparatory work includes:

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

7.3 Initial/final measurement

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

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

7.4 Printing out the data



Fig. 25: Printing Data

Courtesy of BMW OF NORTH AMERICA, INC.

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

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

8. Special features

8.1 Free wheel alignment

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

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

8.2 System settings

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

9. BMW Kinematic Diagnosis System comparison (Bosch - Beissbarth)

COMPARISON CHART

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

10. Control modification (menu)

10.1 Remote control with display

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

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

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

10.2 Brief operating instructions

1. Activate the remote control with the "**ON**" button (it may also be switched on during alignment). The title page will appear on the LCD.
2. Select "**Straight ahead**" of the "**Initial measurement**", "**Adjustment work**" or "**Final measurement**" at the measuring equipment cabinet. The steering graphics for "**Straight ahead**" will

appear on the LCD.

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

10.3 Display support

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

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

- The **"Hour glass"** icon in the LCD display means: **"Please wait"**.
- The **"Battery"** icon in the top right-hand corner of the LCD display means that the battery reserve has been reached.
- To switch off the remote control: press the **"F"** key for 5 seconds, then return it to its charging unit or connect it to a charge cable. The title illustration will again appear as a charging check.
- If, during the measurement, the remote control has been placed back in the charging unit, it must be switched on again using the **"ON"** button.

11. Updating the software/setpoint data

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

11.1 Requirements

- BMW KDS (Beissbarth/Bosch)
- TIS CD program status (Beissbarth): from CD 12/95
- EPC program status: from 12/95
- TIS CD program status (Bosch): from CD 08/97
- DIS program status: from V 6.0
- 3.5" diskettes, 1.44 MB (Beissbarth 5 diskettes/Bosch 1 diskette)

11.2 Procedure (Beissbarth)

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

11.3 Procedure (Bosch)

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

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

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

12. Creating, copying and editing setpoint data

12.1 Copying

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

12.2 Creating

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

12.3 Editing

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

13. Special functions

13.1 Customer-specific printer report header

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

13.2 Adjusting options

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

13.3 Rotating plate test

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

13.4 Viewing and deleting customer entries from database

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

14. Modifications within program

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

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

15. Faults

15.1 Tyre faults

TYRE FAULTS REFERENCE

Fault	Effect
1 Wheel toe, camber, toe-differential angle and castor not correct	1 Severe tire squeaking even at relatively low speeds
2 Excessive toe-in and excessive positive camber	2 Tires are worn down on one outside edge in the longitudinal direction
3 Excessive negative camber	3 Tyre wear on inside edge
4 Worn front-axle suspension on front-wheel-drive vehicles	4 Increased noise/Vehicle pulls on one side when accelerating
5 Incorrect wheel alignment	5 Wheels scrubbing/Tyre surface shows feathering in the tread
6 Play in the suspension due to mechanical parts (suspension, steering)	6 Washout/Wobbling of front wheels
7 Tyre pressure too low	7 Outside tire surface wear

15.2 Front axle faults

FRONT AXLE FAULTS REFERENCE

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

15.3 Rear axle faults

REAR AXLE FAULTS REFERENCE

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

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

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

SUSPENSION

Steering and Wheel Alignment - Special Tools - X6

32 1 260 PLIERS

NOTE: For opening and fastening hose

Series: E12, E21, E23, E24, E28, E30, E E32, E32/3, E34, E34tou, E36, E E36/7, E36/C, E36tou, E38, E38 E39tou, E46, E46/16, E46/2, E4 E52, E53, E60, E61, E63, E64, E E71, E81, E82, E83, E85, E86, E E92, E93, R50, R52, R53, R55,

SI number: 1 02 01 (667)

Order number: 32 1 260

Pliers

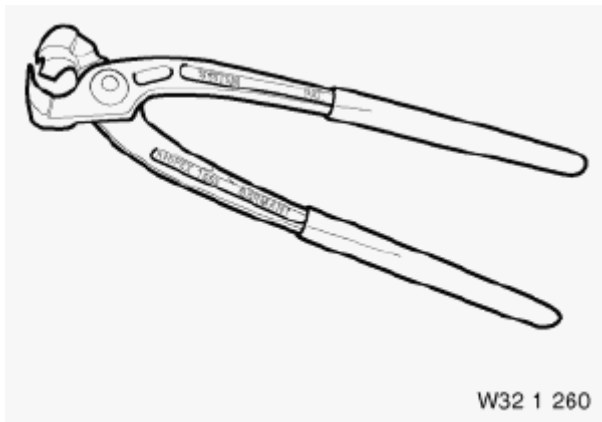


Fig. 1: Identify Special Tool (32 1 260)

Courtesy of BMW OF NORTH AMERICA, INC.

32 1 270 PLUGS (SET)

Minimum set: Mechanical tools

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

Series: E12, E21, E23, E24, E28, E30, E30/C, E30tou, E31, E32, E32/3, E34, E34tou, E36, E36/2, E36/3, E36/5, E36/7, E36/C, E36tou, E38, E38/3, E39, E39PL, E39tou, E46, E46/16, E46/2, E46/3, E46/5, E46/C, E52, E53, E60, E61, E63, E64, E65, E66, E67, E68, E70, E71, E81, E82, E83, E85, E86, E87, E88, E90, E91, E92, E93, F01, F02, R50, R52, R53, R55, R56, RR1, RR2, RR3

SI number: 1 14 01 (766)

Order number: 32 1 270

Plugs (set)



Fig. 2: Identify Special Tool (32 1 270)

Courtesy of BMW OF NORTH AMERICA, INC.

32 2 100 OPEN-ENDED SPANNER WAF 27

NOTE: For adjusting left track rod at steering gear rack

Series: E21, E30, E60, E61, E71, E81, E82, E87, E88, E90, E91, E92, E93, R56

Storage location: Y4

Order number: 32 2 100

Open-ended spanner WAF 27

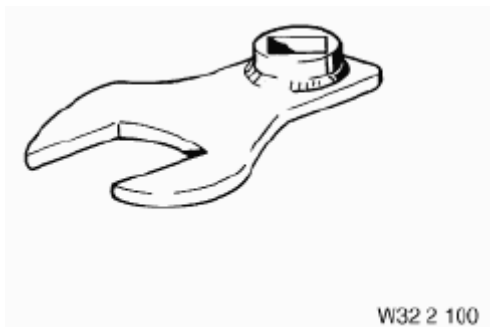


Fig. 3: Identify Special Tool (32 2 100)

Courtesy of BMW OF NORTH AMERICA, INC.

32 3 160 T-HANDED SOCKET WRENCH WAF 38

Minimum set: Mechanical tools

NOTE: For setting camber on front axle

Series: E53, E60, E61, E63, E64, E65, E66, E67, E70, E71, E81, E83, E87, E90, E91, E92, E93

Storage location: A11

SI number: 1 15 99 (483)

Order number: 32 3 160

T-handled socket wrench WAF 38

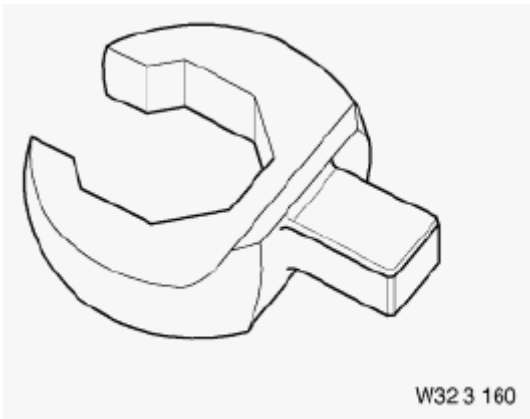


Fig. 4: Identify Special Tool (32 3 160)
Courtesy of BMW OF NORTH AMERICA, INC.

32 4 000 FIXTURE

NOTE: For checking pump pressure in power steering system

Series: E12, E21, E23, E24, E28, E30, E31, E32, E34, E36, E38, E39, E46, E52, E53, E60, E61, E63, E64, E65, E66, E67, E70, E71, E81, E82, E83, E85, E86, E87, E88, E90, E91, E92, E93

Order number: 32 4 000

Fixture

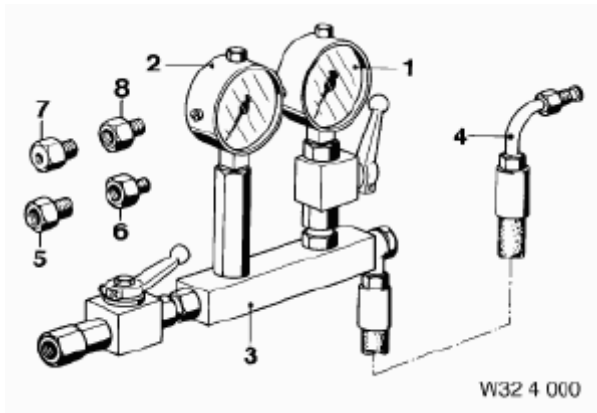


Fig. 5: Identify Special Tool (32 4 000)
Courtesy of BMW OF NORTH AMERICA, INC.

Consisting of:

- 1 = 32 4 001 Pressure gauge 16 bar
- 2 = 32 4 002 Pressure gauge 160 bar
- 3 = 32 4 003 Test fixture without pressure gauge
- 4 = 32 4 004 Line
- 5 = 32 4 005 Connecting piece

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

- 6 = 32 4 006 Connecting piece

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

- 7 = 32 4 007 Connecting piece M18 x 1.5

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

- 8 = 32 4 008 Connecting piece M14 x 1.5

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

- 9 = 32 4 009 Ball valve

- 11 = 32 4 011 Adapter M14 x 1.5

12 = 32 4 012 Adapter M16 x 1.5

SUSPENSION

Steering and Wheel Alignment - Technical Data - X6

ELECTRONIC CHASSIS ALIGNMENT

32 00 CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E71

CHASSIS/WHEEL ALIGNMENT - NORMAL POSITION E71 - SPECIFICATION

<u>32 00 ... MOVING VEHICLE INTO NORMAL POSITION</u>	Vehicle with complete equipment for normal operation with: 2 x 68 kg on front seats (seats in central position); 1 x 68 kg on rear seat (centre); 1 x 21 kg in luggage compartment (centre) and full fuel tank.
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32 00 WHEEL ALIGNMENT E71 1 - AXLE AIR SPRING

WHEEL ALIGNMENT E71 1 - AXLE AIR SPRING - SPECIFICATION

<u>OBSERVE TEST CONDITIONS!</u>		
Front axle:		
Total toe		0° 10' ± 12'
Adjustment total toe ⁽¹⁾		0° 10' ± 4'
Toe difference ⁽²⁾ single wheel between left/ right		max. 12'
Camber (difference between left/right max. 30')		- 31' ± 30'
Adjustment camber ⁽¹⁾		- 31' ± 25'
Toe angle difference		(difference between left/right max. 20')
○ with 20° lock on inside wheel		- 2° 18' ± 30'
Caster angle		(difference between left/right max. 30')
Front wheel displacement		0° ± 15'
Maximum wheel lock		
○ Inside wheel	approx. °	37° 18'
○ Outside wheel	approx. °	31° 00'
Rear axle:		
Total toe		0° 10' ± 12'
Adjustment total toe ⁽¹⁾		
Camber (difference between left/right max. 30')		- 1° 30' ± 25'
Adjustment camber ⁽¹⁾		- 1° 30' ± 5'
Geometrical axis deviation		0° ± 12'
(1) To minimize adjusting errors (measuring inaccuracies), use a narrower tolerance for adjusting toe/camber.		
(2) Toe difference front axle = criterion for steering wheel inclination		

32 00 WHEEL ALIGNMENT E71 SERIES

WHEEL ALIGNMENT E71 SERIES - SPECIFICATION

<u>OBSERVE TEST CONDITIONS!</u>		
Front axle:		
Total toe		0° 10' ± 12'
Adjustment total toe ⁽¹⁾		0° 10' ± 4'
Toe difference ⁽²⁾ single wheel between left/ right		max. 12'
Camber (difference between left/right max. 30')		- 31' ± 30'
Adjustment camber ⁽¹⁾		- 31' ± 25'
Toe angle difference		(difference between left/right max. 20')
○ with 20° lock on inside wheel		- 2° 18' ± 30'
Caster angle		(difference between left/right max. 30')
Front wheel displacement		0° ± 15'
Maximum wheel lock		
○ Inside wheel	approx. °	37° 18'
○ Outside wheel	approx. °	31° 00'
Rear axle:		
Total toe		0° 10' ± 12'
Adjustment total toe ⁽¹⁾		
Camber (difference between left/right max. 30')		- 1° 30' ± 25'
Adjustment camber ⁽¹⁾		- 1° 30' ± 5'
Geometrical axis deviation		0° ± 12'
(1) To minimize adjusting errors (measuring inaccuracies), use a narrower tolerance for adjusting toe/camber.		
(2) Toe difference front axle = criterion for steering wheel inclination		

32 00 WHEEL ALIGNMENT E71 STANDARD/ 1-AXLE AIR SPRING WITH ADAPTIVE DRIVE (OPTIONAL EXTRA SA 2VA)

WHEEL ALIGNMENT E71 STANDARD/ 1-AXLE AIR SPRING WITH ADAPTIVE DRIVE (OPTIONAL EXTRA SA 2VA) - SPECIFICATION

<u>OBSERVE TEST CONDITIONS!</u>		
Front axle:		
Total toe		0° 14' ± 12'
Adjustment total toe ⁽¹⁾		0° 10' ± 4'
Toe difference ⁽²⁾ single wheel between left/ right		max. 12'
Camber (difference between left/right max. 30')		- 20' ± 30'
Adjustment camber ⁽¹⁾		- 31' ± 25'

Toe angle difference		(difference between left/right max. 20')
○ with 20° lock on inside wheel		- 2° 06' ± 30'
Caster angle		(difference between left/right max. 30')
Front wheel displacement		0° ± 15'
Maximum wheel lock		
○ Inside wheel	approx. °	37° 18'
○ Outside wheel	approx. °	31° 00'
Rear axle:		
Total toe		0° 10' ± 12'
Adjustment total toe ⁽¹⁾		
Camber (difference between left/right max. 30')		- 1° 30' ± 25'
Adjustment camber ⁽¹⁾		- 1° 30' ± 5'
Geometrical axis deviation		0° ± 12'
(1) To minimize adjusting errors (measuring inaccuracies), use a narrower tolerance for adjusting toe/camber.		
(2) Toe difference front axle = criterion for steering wheel inclination		

PUMP AND OIL SUPPLY

32 41 PUMP AND OIL SUPPLY E71/M57T2/N54/N63

PUMP AND OIL SUPPLY E71/M57T2/N54/N63 - SPECIFICATION

Impeller pump	max. bar	127 ... 135
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SUSPENSION

Steering and Wheel Alignment - Tightening Torques

ELECTRONIC CHASSIS

32 00 STEERING

STEERING - TIGHTENING TORQUE SPECIFICATIONS

	Type	Thread	Tightening specification	Measure
1AZ Steering gear to front axle carrier	E70, E71	M10	Replace screws & nuts	
			Jointing torque	56 Nm
			Torque angle	90 °
2AZ Heat shield to steering gear	E70, E71	M6		8 Nm

STEERING ARMS, TIE RODS, STEERING DAMPER

32 21 STEERING ARMS, TIE RODS, STEERING DAMPER

STEERING ARMS - TIGHTENING TORQUE SPECIFICATIONS

	Type	Thread	Tightening specification	Measure
1AZ Tie rod to rack	E70, E71			110 +10 Nm
2AZ Tie rod end to tie rod	E70, E71			51 Nm
3AZ Tie rod end to swivel bearing	E70, E71	M14	Replace nut	80 Nm

STEERING COLUMN

32 31 STEERING COLUMN

STEERING COLUMN - TIGHTENING TORQUE SPECIFICATIONS

	Type	Thread	Tightening specification	Measure
1AZ Steering column to instrument panel carrier	E70, E71	M8		21.4 Nm
2AZ Lower steering spindle to power steering gear/centre steering spindle	E70, E71	M8	Recut thread Replace clamping screw No subsequent buckling permitted!	28 Nm
			Recut thread	

3AZ Centre steering spindle to steering column/lower steering spindle	E70, E71	M8	Replace clamping screw No subsequent buckling permitted!	28 Nm
4AZ Centre steering spindle to bearing plate	E70, E71			20 Nm
5AZ Bearing plate to body	E70, E71			8 Nm

STEERING WHEEL

32 33 STEERING WHEEL

STEERING WHEEL - TIGHTENING TORQUE SPECIFICATIONS

	Type	Thread	Tightening specification	Measure
1AZ Steering wheel to steering column	E70, E71	M14		62.5 Nm

PUMP AND OIL SUPPLY

32 41 PUMP AND OIL SUPPLY

PUMP AND OIL SUPPLY - TIGHTENING TORQUE SPECIFICATIONS

	Type	Thread	Tightening specification	Measure
1AZ Oil reservoir to holder	E70, E71,	M6		5.3 Nm
2AZ Belt pulley to vane pump/power steering pump	E70, E71	M8 8.8	Replace microencapsulated screws	21 Nm
	E70, E71	M8 10.9	Replace microencapsulated screws	24 Nm
3AZ Vane pump/power steering pump to engine	E70/N62TU/M57T2	M10		38 Nm
	E70, E71	M8		21.4 Nm
	E71/ N54	M10 x 35		38 Nm
	E71/ N63	M10		40 Nm
	E71/ M57T2	M10		38 Nm
	E70/N52	M10, M12	Observe screwing sequence	
			Jointing torque	20 Nm
			Torque angle	90 °
4AZ Pressure line for power steering to vane pump/power steering pump	E70/N62TU			35.6 Nm
	E70/E71/M57T2/N54, E70/N52	M14	Replace all sealing rings	33 Nm
	E71/ N63	M8	Replace all sealing rings	28 Nm

5AZ Pressure line to power steering gear	E70	M14	Replace all sealing rings	33 Nm
	E71	M14	Replace all sealing rings	30 Nm
6AZ Return line to power steering gear	E70, E71	M16	Replace all sealing rings	35 Nm
7AZ Mounting, hydraulic lines	E70, E71	M6		7.5 Nm
8AZ Dynamic Drive pressure line to power steering pump	E70, E71	M16		37.5 Nm
	E70/N62TU	M6		8 Nm
9AZ Dynamic Drive pressure line to screwed-in pulsation damper	E70/N52/M57T2	M14		30 Nm
10AZ Dynamic Drive pressure line to removed pulsation damper	E70/N62TU	M16		35 Nm
11AZ Pressure line to cutting line	E70	M16		30 Nm
	E70/N62TU	M6		8 Nm
12AZ Dynamic Drive pressure line to engine support arm	E70/E71/M57T2	M6		9.5 Nm
13AZ Dynamic Drive pressure line to crankcase	E70/N52K	M8	Replace aluminum screws. Use only Helicoil made of aluminum for thread repairs. Jointing torque and angle of rotation must be observed without fail.	
			Jointing torque	8 Nm
			Torque angle	45 °
14AZ Heat shield	E70, E71	M6		8 Nm
15AZ Holder, return hose to front axle carrier	E71	M6		7.5 Nm
16AZ Flange screw connection	E71	M6		8 Nm
17AZ Pressure hose to holder	E71	M6		8 Nm
18AZ Bracket to crankcase	E71	M12		66 Nm

ELECTRONIC POWER STEERING

32 43 ELECTRONIC POWER STEERING

ELECTRONIC POWER STEERING - TIGHTENING TORQUE SPECIFICATIONS

	Type	Thread	Tightening specification	Measure
1AZ Active front steering control unit to body	E70, E71	M6		7.5 Nm
2AZ Rotation rate sensor to body	E70, E71	M6		8 Nm