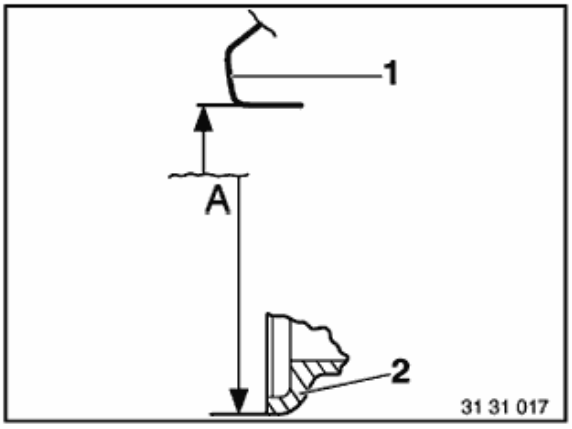
Car loaded down to normal position		Vehicle with complete equipment for normal operation with:
		2 x 68 kg on front seats (seats in central position) 1 x 68 kg on rear seat (center) 1 x 21 kg in luggage compartment (middle) and full fuel tank. Exception: M3 sports suspension Normal position for car empty weight
Requirements:		
		1. Specified rims and tires with even tire profile (see Wheels/Tires)
		2. Correct tire pressure (refer to instruction plate on vehicle)
		3. Specified wheel-bearing play (see Front/Rear Axle)
		4. Ride level check in normal position (see above) Ride level measurement, refer to Repair Manual 31 33 095 Warning! Repair vehicle in event of deviation from specified value (refer to Troubleshooting Repair Manual)
		5. On car with air springs, pull fuse of air supply system so that there is no regulation. Adjust correct ride level for alignment = spec. value ± 2mm / for E 36 M 3, E39 M5, E39 with M sports package spec. value ± 1mm by loading or unloading car.

Move vehicle into normal position,

refer to Technical Data MG 32



Measure actual ride-level height (A) from wheel-house lower edge (1) to rim flange (2) at height of wheel center.

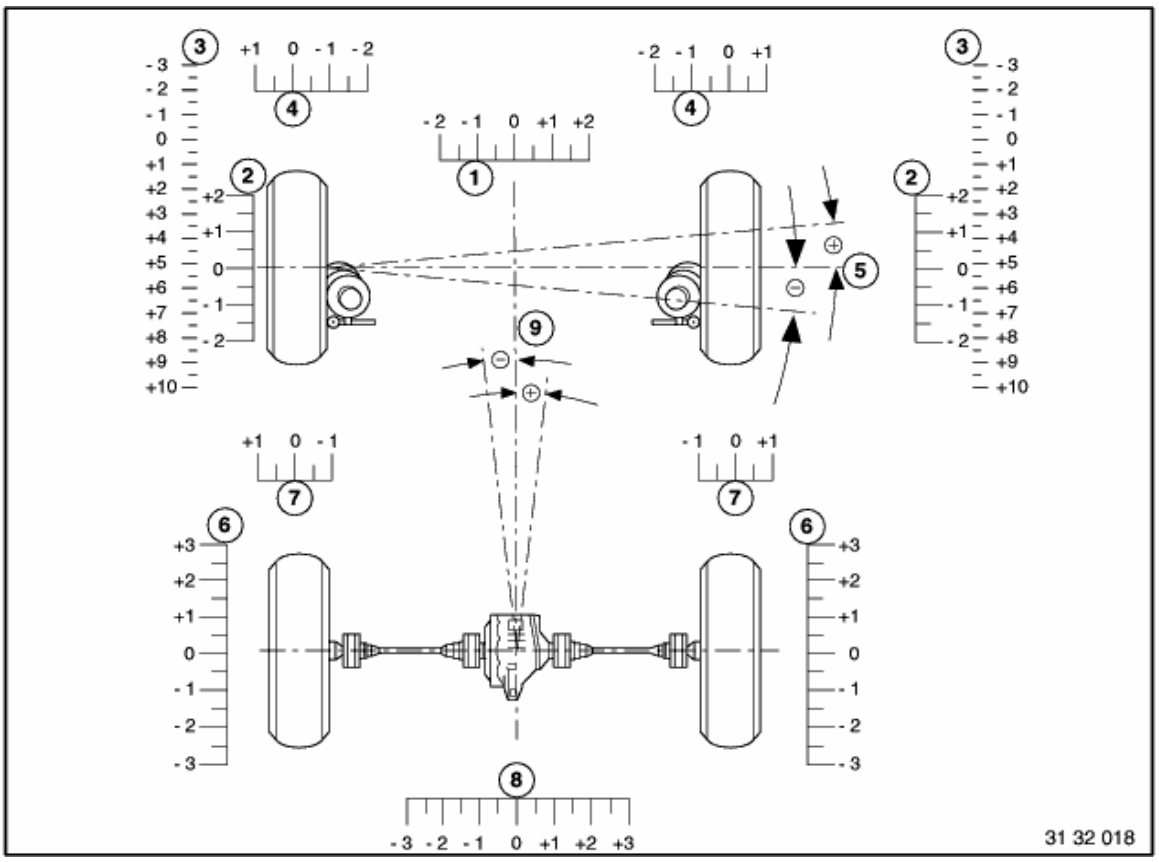
Establish the mean value in each case after previously raising and lowering the vehicle body for each wheel and from it the mean value of the axle.

If the mean value deviates from the nominal value,

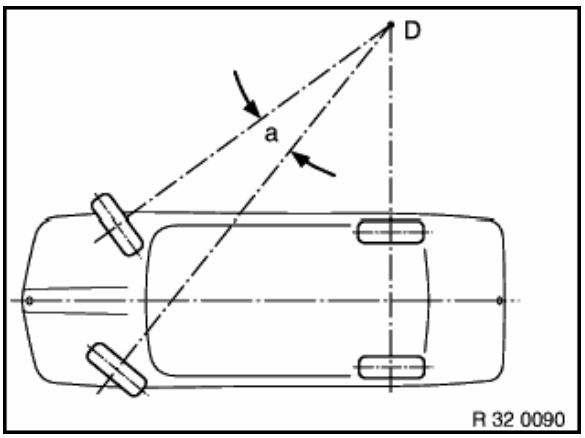
refer to Technical Data

Install new coil spring, refer to selection of coil springs in Parts Microfiche/EPC.

Ride level in normal position (attach tape measure to rim flange at bottom middle and measure to lower edge of wheel arch)		
Deviation from nominal value for all wheels together	Max. mm	10
Series		
16" rim	mm ± 10	613
17" rim	mm ± 10	628
18" rim	mm ± 10	641
Low-slung sports suspension		
16" rim	mm	593
17" rim	mm	608
18" rim	mm	621
Rough road package		
16" rim	mm ± 10	635
17" rim	mm ± 10	650
18" rim	mm ± 10	663



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



Toe angle difference

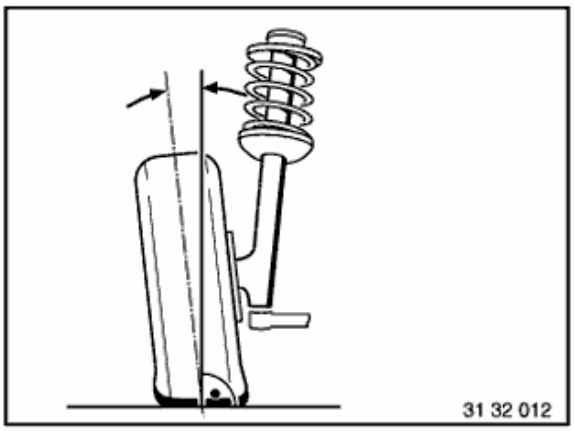
a Toe angle difference

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.

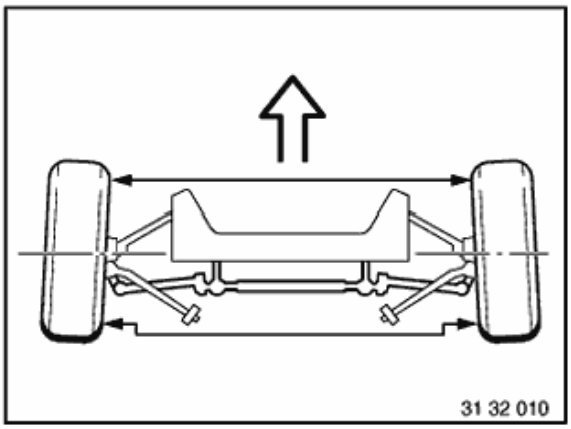
A correctly adjusted toe angle difference produces equal values for left and right lock with consideration of factory tolerances.

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



Camber

Inclination of the wheel from the perpendicular.

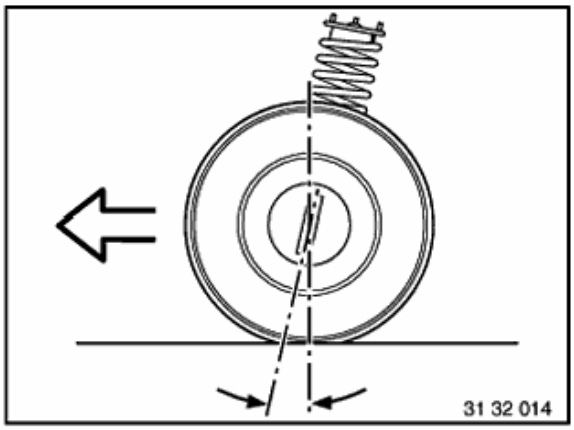


Toe

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

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

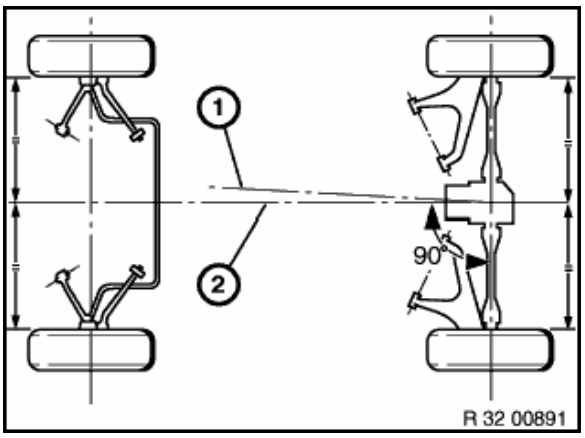
Measurement is performed in "straight-ahead mode".



Caster

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

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



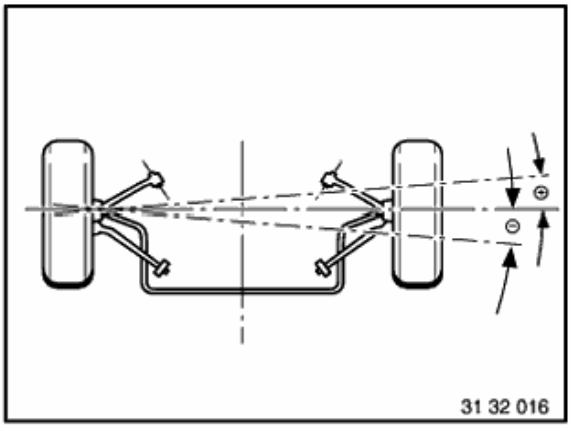
Geometrical axis 1

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

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

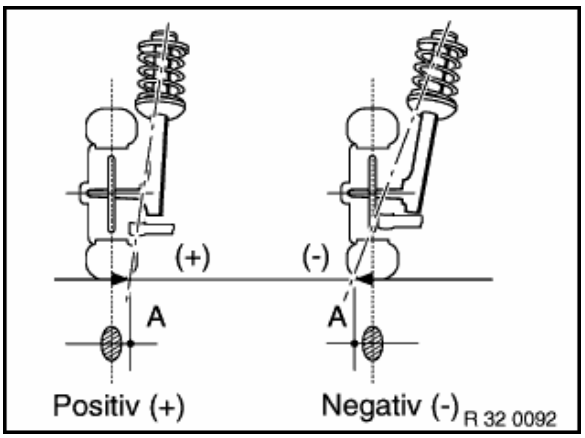
Symmetrical axis 2

Center line running through front and rear axles.



Wheel offset

Angle by which one front wheel is displaced more towards front or rear than the other front wheel.



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.

Troubleshooting on the front axle

Fault	Cause	Remedy
1. Toe deviation	a) Vehicle not in normal position b) Tie rod(s) bent c) Ball joints on track rod(s) misaligned d) Rubber mount in control arm faulty	a) Height setting, refer to Technical Data HG 31 b Replacing track rod(s), refer to 32 21 231, 32 21 281 c) Replacing track rod(s), refer to 32 21 231, 32 21 281 d) Replacing control arm, refer to 31 12 001
2. Camber deviation: Camber is defined by design and cannot be adjusted.	a) Rubber mount in control arm faulty b) Control arm deformed c) Spring strut deformed d) Guide joint worn e) Spring deflection too great f) Front-axle carrier deformed g) Spring strut shock absorber mount mis-shapen h) Distortion in floor assembly (engine carrier)	a) Replacing control arm, refer to 31 12 001 b) Replacing control arm, refer to 31 12 001 c) Replacing spring strut, refer to 31 31 031 d) Replacing control arm, refer to 31 12 001 e) Replacing coil spring, refer to 31 33 100 Height setting, refer to Technical Data MG 31 f) Replacing front axle carrier, refer to 31 11 001 g) Repair front end h) Repair body

Troubleshooting on the front axle

Fault	Cause	Remedy
3. Caster deviation: caster is a design feature and cannot be adjusted.	a) Rubber mount for traction strut unserviceable b) Traction strut mis-shapen c) Control arm deformed d) Spring strut deformed	

	e) Wheel house deformed (spring-strut mount) f) Distortion in floor assembly (engine carrier)	a) Replacing rubber mount, refer to 31 12 148 b) Replacing traction strut, refer to 31 12 090 c) Replacing control arm, refer to 31 12 001 d) Replacing spring strut, refer to 31 31 031 e) Repair front end f) Repair body
4. Toe-difference angle deviation	Requirements: camber and caster are correct a) Tie rods not adjusted uniformly	a) Adjust toe on left and right sides to same value
5. Wheel-offset deviation	Requirements: front wheels have equal single toe to geometrical axis a) Front-axle carrier deformed b) Engine carrier deformed c) Control arm deformed d) Traction strut mis-shapen	a) Replacing front axle carrier, refer to 31 11 001 b) Repair body c) Replacing control arm, refer to 31 12 001 d) Replacing traction strut, refer to 31 12 090

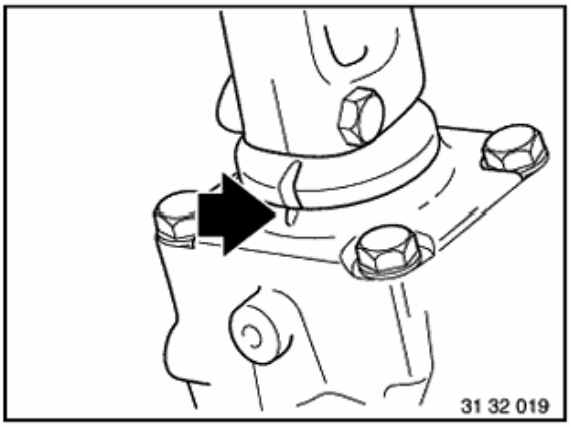
Troubleshooting on the rear axle

Fault	Cause	Remedy
6. Camber deviation	a) Vehicle not in normal position, spring deflection too great b) Rubber mount on rear axle carrier unserviceable c) Rear-axle carrier deformed d) Control arm deformed e) Traction strut mis-shapen f) Distortion in floor assembly g) Swinging arm mis-shapen	a) Height setting, refer to Technical Data MG 33 b) Replacing rubber mount, refer to 33 17 506 c) Check rear-axle carrier, replace if necessary d) Check control arm, replace if necessary, refer to 33 32 071 e) Check steering traction strut, replacing if necessary, refer to 33 32 091 f) Repair body g) Replace swinging arm, refer to 33 32 064
7. Rear-wheel position incorrect	a) Rear-axle carrier displaced laterally	a) Check rubber mounts on rear-axle carrier, replace if necessary

	b) Rubber mounts in rear-axle carrier faulty c) Control arm deformed d) Rubber mount and swinging arm unserviceable e) Rear-axle carrier deformed f) Traction strut mis-shapen	a) Height setting, refer to Technical Data MG 33 b) Replace rubber mounts c) Replacing control arm, refer to 33 32 071 d) Replace swinging arm, refer to 33 32 064 e) Check rear-axle carrier, replacing if necessary f) Check steering traction strut, replacing if necessary, refer to 33 32 091
9. Deviation from the geometric axis	Requirements: rear wheel total toe value must be correct. a) Distortion in floor assembly	a) Repair body

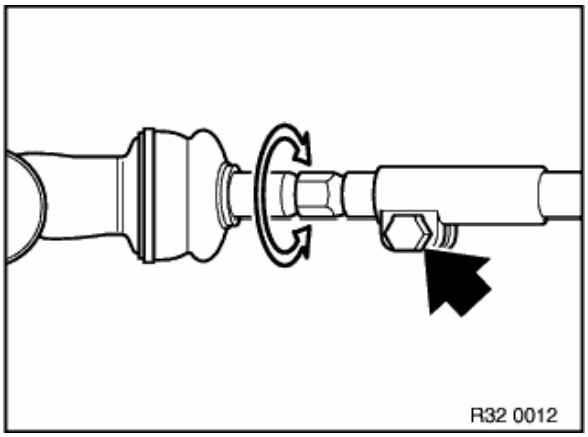
Caution!

On vehicles with Electronic Damper Control / Dynamic Stability Control, "steering angle compensation" must be performed with the BMW Service Tester after every wheel alignment operation.



Adjust toe and toe-difference angle.

Move steering gear into straight-ahead setting (marks on housing and steering shaft).



Loosen clamping screws on track rods.

Set toe-in of left and right wheels to specified value,

refer to Technical Data Gr. 32

by turning steering tie rod.

Installation:

Ensure that the ball joints are not twisted.

Tightening Torque,

refer to Technical Data 32 21 4AZ

Observe test conditions		
Front axle:		
Total toe		0° 14' ±10'
Camber (difference between left/right max. 40')		- 13' ± 30'
Track differential angle with 20° lock on inside wheel (Difference between left/right max. 30')		-1° 35' ± 30'
Caster (difference between left/right max. 30')		
With ± 10° wheel lock		5° 58' ± 30'
With ± 20° wheel lock		6° 06' ± 30'
Front wheel displacement		0° ± 15'
Maximum wheel lock		
Inside wheel	approx. °	43
Outside wheel	approx. °	33
Turning circle	approx. m	11.6 (E38/2:12.2)
Rear axle:		
Total toe		0° 18' ±10'
Camber (difference between left/right max. 15')		
Alignment check		-1° 30' ± 20'
Adjustment		-1° 27' ± 5'
Geometrical axis deviation		0° ± 12'

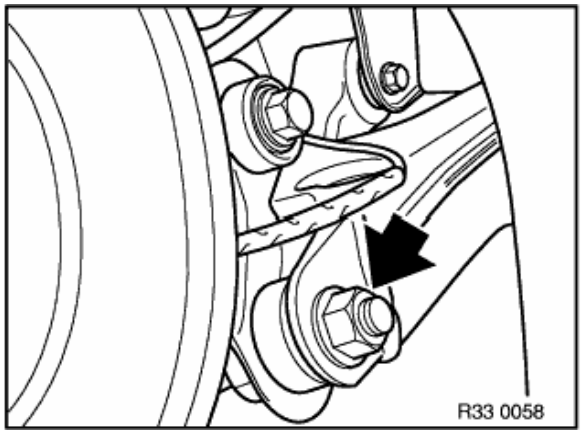
	Type	Thread	Tightening specification	Measure
1AZ Tie rod to ball joint (castle nut)	E21			60 Nm
2AZ Tie rod/axial joint to rack	E21, E30			75 Nm
	E36, E34, E39, E52			71 Nm
	E46 / E85 / E87			100 +10 Nm
	E53, E83			110 +10 Nm
	E60 / E61 / E63 / E64 / E65 / E66			110 Nm
3AZ Tie rod end nut Attention! Tie rod end with split-pin hole must not be bolted with a self-locking nut.	E34 / 325iX			50 Nm
	E38, E39, E46, E52, E85			65 Nm
	E53, E67, E83			80 Nm
	E60 / E61 / E63 / E64 / E65 / E66 / E87		Replace nut	165 Nm
	Other			36.5 ± 3.5 Nm
4AZ Tie rod clamping screw	E38, E39		tighten in empty weight or normal position	27 Nm
	E87		tighten in normal position	30 + 5 Nm
	all others		tighten in empty weight or normal position	14 Nm
5AZ Tie rod clamping nut	E36, E46, E34 / 325iX, E85			45 Nm

	E39 / E52 / E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67 / E83			51 Nm
6AZ Steering drop arm to steering gear	E32, E34			59 Nm
		M26	Tightening value may be exceeded up to correct position to locking plate	at least 180 Nm
		M22	Tightening value may be exceeded up to correct position to locking plate	at least 140 Nm
	E38 / E39		Note direction of screw thread. In direction of travel: from left on LHD or from right on RHD vehicle	61 Nm
	E31			70 Nm
7AZ Steering guide arm to front axle carrier	E39			62 Nm
	All	M10		42 Nm
	All	M12		85 Nm
8AZ Track rod arm to strut	E12, E24 / until 5.82		Bolts secured with: Wire	55 Nm
	E28, E23, E24 / from 5.82		Bolts secured with: Loctite No. 270 Clean threads of tapped bores and bolts.	62 Nm
	E31, E32, E34		Bolts secured with: Loctite No. 270 Clean threads of tapped bores and bolts.	110 Nm
	M3		Bolts secured with: Loctite No. 270 Clean threads of tapped bores and bolts.	30 Nm
9AZ Tie rod arm to control arm	E12, E23, E24 / until 5.82			66 Nm
	M3			66 Nm

	E24 / from 5.82, E28, E32, E31, E34			93 Nm
10AZ Leading strut to tie rod arm	E23			93 Nm
11AZ Trailing strut to tie rod arm	E31, E32, E34			93 Nm

Note:

Any change in camber always involves a change in toe: for this reason, the camber must always be adjusted first.

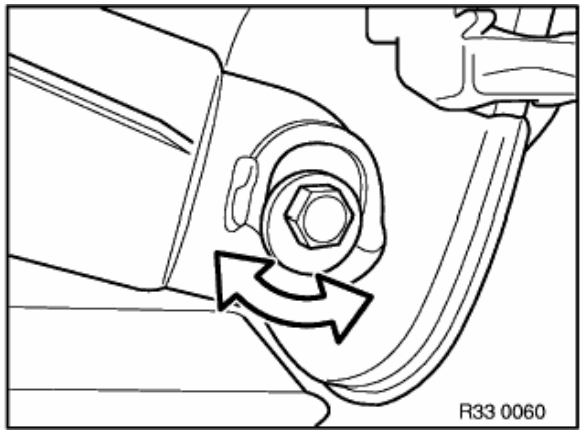


Adjusting camber:

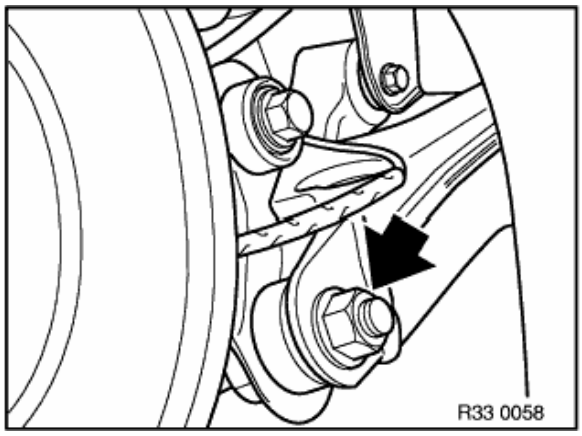
Replace and tighten down disk collar nut,

tightening torque 33 32 22AZ.

Release disk collar nut again by 0.5 ... 1 turn.



Adjust camber to specified value with eccentric screw.

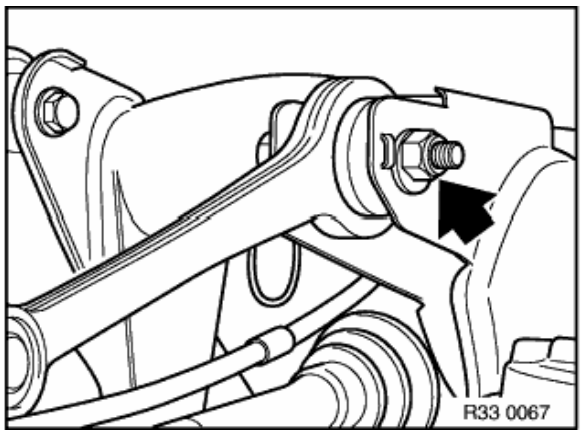


Tighten down disk collar nut,

tightening torque 33 32 22AZ.

Caution!

The disk collar nut must be replaced again if it is tightened down more than 10 times during adjustment. The self-locking effect becomes too slight.

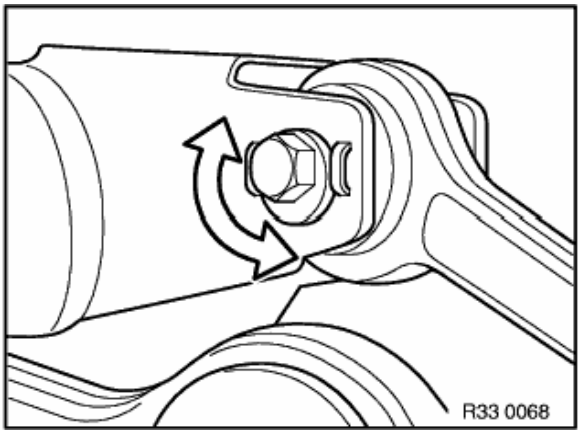


Adjusting toe-in:

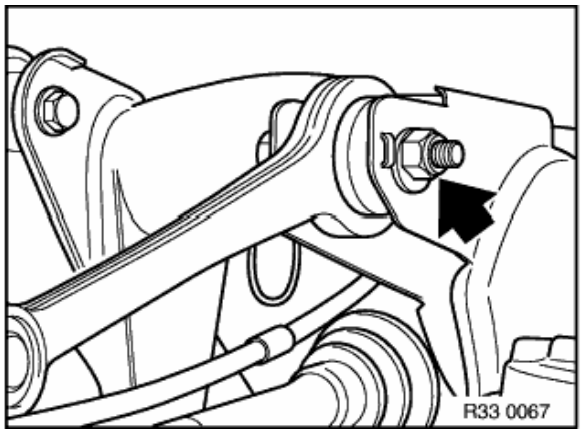
Replace and tighten down disk collar nut,

tightening torque 33 32 5AZ.

Release disk collar nut again by 0.5 ... 1 turn.



Adjust toe-in to specified value with eccentric screw.



Tighten down disk collar nut,

tightening torque 33 32 5AZ.

Caution!

The disk collar nut must be replaced again if it is tightened down more than 10 times during adjustment. The self-locking effect becomes too slight.

	Type	Thread	Tightening specification	Measure
1AZ Trailing arm to rear axle carrier	E34 / M5		Replace screw; tighten with special tool 33 3 060 and torque wrench Hazet 6291-2CT	55 Nm
	All		tighten in normal position	67 Nm
	All	10.9		77 Nm
2AZ Trailing arm to console	E31	M14 x 1.5		127 Nm
3AZ Trailing arm to wheel carrier	E31	M18 x 1.5		278 Nm
4AZ Traction strut to wheel carrier	E31		Tapered spigot and bore must be free of grease	80 Nm
	E38 / E39 / E52 / E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67		Tapered spigot and bore must be free of grease Jointing torque Torque angle	65 Nm 56 Nm 90 ± 15°
5AZ Control arm to rear axle support	E31		tighten in normal position	95 Nm
	E38, E52, Toe-in adjustment		tighten in empty weight or normal position	60 Nm
	E39, Toe-in adjustment		tighten in empty weight or normal position With torque wrench Hazet 6290-CT	60 Nm
	E53, Toe-in adjustment		tighten in empty weight or normal position with special tool 32 3 150 and torque wrench Hazet 6291-ICT	59 Nm

	E60 / E61 / E63 / E64 / E65 / E66 / E67 / Toe-in adjustment		tighten in empty weight or normal position	65 Nm
6AZ Support arm to rear axle support	E31	M14 x 1.5		127 Nm
7AZ Support arm to wheel carrier	E31			150 Nm
8AZ Upper control arm to wheel carrier	E31	M14 x 1.5		127 Nm
	E38, E52			160 Nm
	E39			142 Nm
	E53 / E60 / E61 / E63 / E64 / E65 / E66		Replace nut	165 Nm
	E67			110 Nm
9AZ Interconnecting link to trailing arm	E31	M16 x 1.5	Tapered spigot and bore both free of grease	120 Nm
10AZ Integral arm to upper control arm	E31	M14 x 1.5		127 Nm
11AZ Upper/lower control arms to trailing arm	E36, E46	M12 x 1.5	tighten in empty weight or normal position	110 Nm
12AZ Trailing arm to console	E36, E46			110 Nm
	E85, E83	M12x1.5 10.9		100 Nm
13AZ Trailing arm console to body	E36, E46, E83, E85			77 Nm
14AZ Upper control arm to rear axle carrier	E31	M12 x 1.5	tighten in normal position	77 Nm
	E36	M12 10.9	tighten in empty weight or normal position Always replace antifatigue bolts with combination bolts and washers, see BMW Parts Service	77 Nm
	E38, E39, E52		tighten in empty weight or normal position	110 Nm
	E46, E85		tighten in empty weight or normal position	77 Nm
	E83		tighten in normal position	77 ± 10 Nm

	E53 / E60 / E61 / E63 / E64		tighten in empty weight or normal position	100 Nm
	E65, E66, E67		tighten in empty weight or normal position Jointing torque Torque angle	 100 Nm 90 ± 15°
15AZ Lower control arm to rear axle carrier	E36	M12 10.9	tighten in empty weight or normal position Always replace antifatigue bolts with combination bolts and washers, see BMW Parts Service	77 Nm
	E46, E85		tighten in empty weight or normal position	77 Nm
	E83		tighten in normal position	77 ± 10 Nm
16AZ Support bracket on body	E21, E30			28 Nm
17AZ Compression strut on body	All	M8 8.8		21 Nm
	All	M8 10.9		30 Nm
	E60, E65, E66, E67	M10 10.9		38 Nm
	E61 / E63 / E64	M10 10.9		45 Nm
18AZ Auxiliary control arm to trailing arm and rear axle carrier	All	M14 x 1.5	tighten in normal position	127 Nm
19AZ Additional strut on rear axle carrier	E32, E34	M12 x 1.5		110 Nm
20AZ Swinging arm to rear axle support	E38	Front	tighten in empty weight or normal position	60 Nm
	E39	Front	tighten in empty weight or normal position	58 Nm
	E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67	Front	tighten in empty weight or normal position	100 Nm
	E52	Front	tighten in empty weight or normal position	105 Nm
	E38	Rear	tighten in empty weight or normal position	130 Nm

	E39, Camber adjustment	Rear M12	tighten in empty weight or normal position	115 Nm
	E39 / Touring, E39 / M5, Camber adjustment	Rear M14	tighten in empty weight or normal position	174 Nm
	E53 / E60 / E61 / E63 / E64 / E65 / E66 / E67 / Camber adjustment	Rear M14	tighten in empty weight or normal position	165 Nm
	E52	Rear M14	tighten in empty weight or normal position	160 Nm
21AZ Integral link on front wheel carrier	E38, E39, E53, E52		tighten in empty weight or normal position	105 Nm
	E60 / E61 / E63 / E64 / E65 / E66 / E67		tighten in empty weight or normal position	100 Nm
22AZ Screw connection, swinging arm, integral link, wheel carrier	E38, E52, Camber adjustment		tighten in empty weight or normal position	236 Nm
	E39		tighten in empty weight or normal position	256 Nm
	E53, E65, E66		tighten in empty weight or normal position	250 Nm
	E60 / E61 / E63 / E64 / E67		tighten in empty weight or normal position	240 Nm
23AZ V-strut to tension strut / body	E46 / M3		Replace screws Jointing torque Torque angle	 59 Nm 90 °
24AZ Upper control arm to trailing arm	E85	M12x1.5 8.8	tighten in empty weight or normal position	100 Nm
	E83	M12x1.5	tighten in empty weight or normal position	106 Nm
25AZ Lower control arm to trailing arm	E85	M12x1.5 10.9	tighten in empty weight or normal position	77 Nm
	E83	M12x1.5 10.9	tighten in empty weight or normal position	100 Nm

26AZ Tension strut to compression strut / body	E83	M10		60 Nm
27AZ Heat shield to compression strut	E83	M6		5 Nm