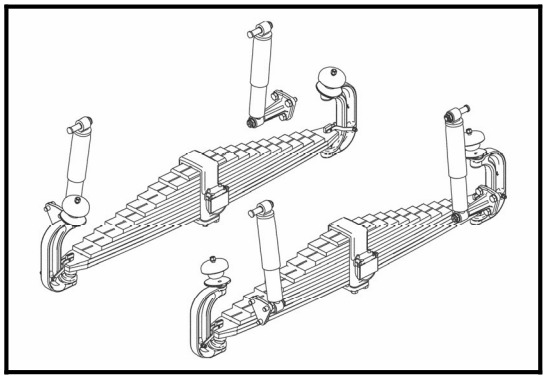


BEML - TATRA 815

26RR36 22 255 6x6.1R/50T, 51T

Workshop manual

Part 8 – SUSPENSION

Publication numer: 03-0254-ENG/00

TATRA, a.s. **1-st Edition 28-2-2007**

8 SUSPENSION

8.1 Description and Main Technical Specifications

The trucks BEML - TATRA **T 815 - 26Rr36 22 255 6x6.1R/50T** and BEML - TATRA **T 815 - 26Rr36 22 255 6x6.1R/51T** are sprung by torsion bars and leaf springs. The front axle is fitted with shock absorbers and all axles are fitted and rubber silent blocks.

The front axle is sprung by two longitudinally mounted torsion bars **2** attached in the rear holder of torsion bars **1**. The front part of the torsion bar is placed in the arm **3** of the torsion bar, which is connected to the half-axle using a pin and a hinge. When changing the length of the hinge (See Tab. **8.1**), the wheel camber can be adjusted. The suspension is completed with two fluid double-acting telescopic shock absorbers **4**.

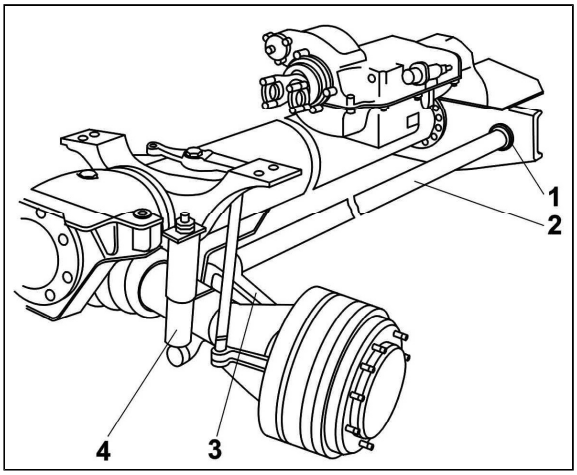


Fig. 8.1 Suspension of the front axle

The rear axles axles are sprung by two longitudinally mounted 14-leaf springs (120x20 mm) **13** (See Tab. **8.2**). Individual leaves seat in the spring yoke **8** and are clamped by means of four bolts and clamping washer **11** .

Springs are swing-mounted in the balance spring shackle, which allows big travels of wheels when driving in the rough terrain. Swing mounting consists of glide blocks **9** screwed to the front connecting part **7** and of lens **10** pressed in the spring yoke **8**. The swinging mounting is secured with lock yokes **12**, which is attached to the glide blocks **9**.
Leaf springs **13** are connected with half-axles **14** through hanger yokes (shackles) **1**. The upper part of the shackle seats on the half-axle supporting pin (bolt) **2** with its supporting socket (bearing pan) **3**. The lower part of the shackle is connected with the leaf spring **13** by the supporting pin **15** and supporting socket **16**.To prevent the spring shackle from falling out during the suspension operation, it is secured with lock **17**.
The half-axle travel is limited by rubber silentblocks **6**, which are screwed to the brackets **5** of silentbocks being welded to the frame **4**.

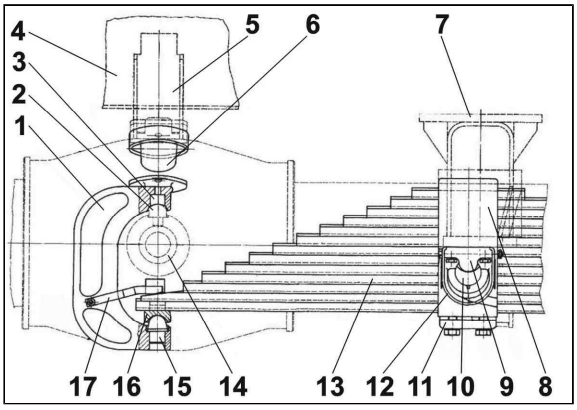


Fig. 8.2 Suspension of the rear axles

Tab. 8.1 Suspension main technical specifications (front axle)

Data	Unit	Value	
Torsion bar diameter	(mm)	61	
Torsion bar length		1,890	
Lengths of torsion bar suspensions		without notch	234
		1 notch	250
		2 notches	266
		3 notches	282
Shock absorber (front) PT 70 x 170	pcs	2	

Tab. 8.2 Suspension main technical specifications (rear axles)

Data		Unit	Value
N^{o} of leaves		pcs	14
Length of leaf 120 x 20 springs:	1st leaf	mm	1,540
	2nd leaf		1,540
	3rd leaf		1,340
	4th leaf		1,240
Length of leaf 120 x 16 springs:	5th leaf		1,130
	6th leaf		1,010
	7th leaf		885
	8th leaf		780
	9th leaf		690
	10th leaf		600
	11th leaf		520
	12th leaf		440
	13th leaf		370
	14th leaf		310

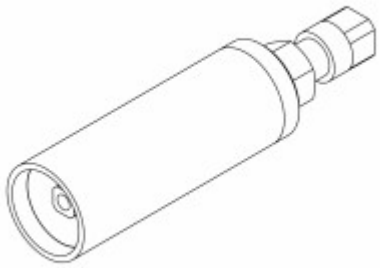
8.2 Faults Causes, Symptoms and Troubleshooting

Fault	Cause	Remedy	Mentioned in:
The half-axle leans against the silent block flange during the spring action	Worn or damaged bumper	Adjust or replace the torsion bar.	(See Subchapter **8.5.3**)
The front axle shaft touches the suspension stop permanently	Fatigue or broken torsion bar	Adjust the suspension or replace the torsion bar	(See Subchapter **8.5.6**)
Excessive wear of front tires at a correct steered wheels alignment	Faulty function of shock absorbers	Replace shock absorbers	(See Subchapter **8.5.7**)
Faulty function or loosen connection between the leaf spring and the axle shaft	Worn or damaged leaf spring lock	Replacement or repair of the spring lock	(See Subchapter **8.5.2**)
	Damaged spring yoke	Replacement of spring yoke	(See Subchapter **8.5.8**)
	Worn supporting pin or cup	Replacement of supporting pin or of the cup	
Permanent high deformation and/or half-axle seating on the rubber silentblock.	Fatigue leaf springs	Replace leaf springs.	(See Subchapter **8.5.9**)
	Broken leaf springs.		

8.3 List of Special Tools

Name: Puller of torsion bar from cross beam *Tool number:* PRM 0625.1	

Tab. 8.3 Special tools for the suspension

Name: Puller of torsion bar arm pin *Tool number:* PRM 3209.2	

8.4 Survey of Torque Specifications

Tab. 8.4 Suspension torque specifications

Data	Unit	Value
Front bracket bolts fixing the torsion bar	Nm	330±30
Leaf spring yoke clamping washer fastening screws		280±30

8.5 Working Procedures

8.5.1 Inspection of Tightening-up of Leaf Springs Clamping Washers Fastening Bolts

a) Reasons for Inspection

1. Technical servicing during the running-in period – after covering 2,500 – 3,000 km.
2. Leaf springs have been loosened.
3. Bolts of clamping washers have been loosened.

b) Technical Conditions

1. The tightening torque for bolts **1** (See Fig. **8.3**) fixing the leaf spring clip and the clamping washer must not be lower than **250 Nm**.

c) Inspection Procedure

1. Put the torque wrench on bolt heads **1** and check whether bolts are tightened properly. The torque specification makes **280 ± 30 Nm**.

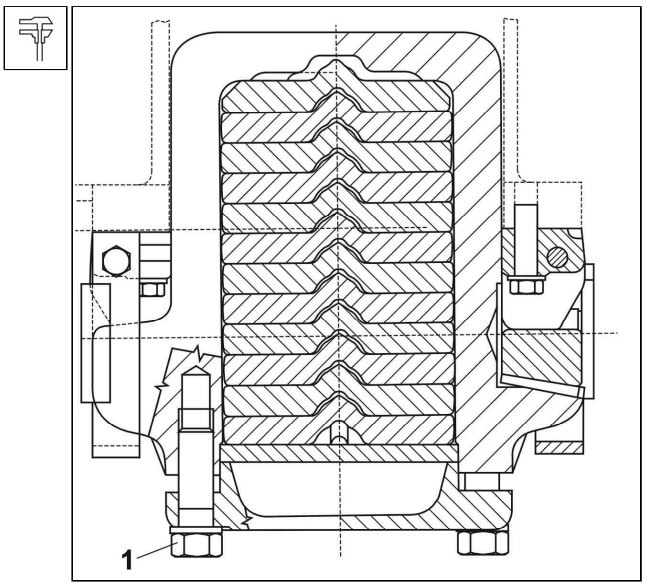


Fig. 8.3 Location of the leaf spring in the clip

8.5.2 Inspection of the Leaf Spring Lock Wear

a) Reasons for Inspection

1. A big clearance between the axle shaft and the leaf spring.

b) Technical Conditions

1. Allowable lock wear is **3 - 6 mm**

c) Inspection Procedure

1. Unscrew two nuts **1** and remove the fastening bolt **2** fixing the lock to the spring clamp **3**.
2. Remove the lock **2**.

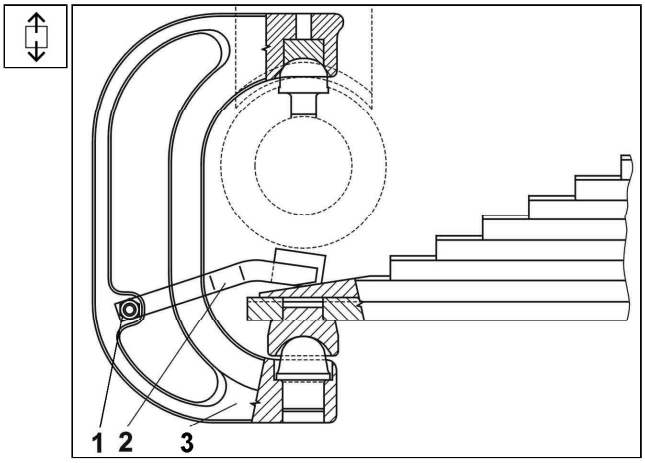


Fig. 8.4 Leaf spring lock - removal

3. Measure how much the leaf spring lock was battered.
4. Should the wear exceed **6 mm**, replace the lock or weld it on in the battered place and grind it off to reach the dimension of a new lock.

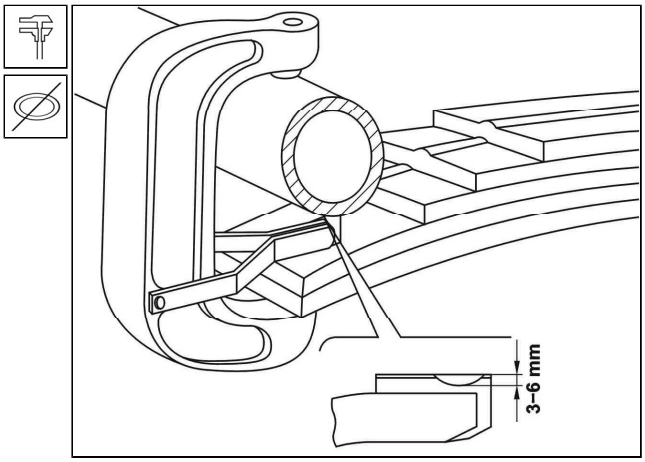


Fig. 8.5 Permissible wear of the leaf spring lock

5. Slide the lock **2** between the leaf spring and the axle shaft and install it on the spring clamp **3**.
6. Fit the fastening bolt on the lock and mount two nuts **1**.

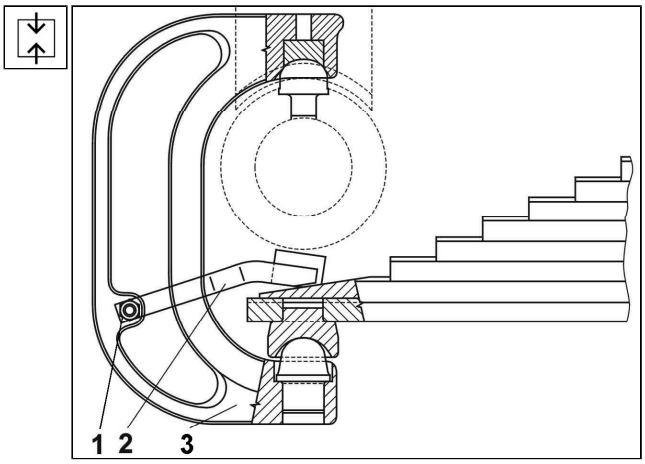


Fig. 8.6 Leaf spring lock - installation

8.5.3 Removal and Installation of the Half-axle Suspension Rubber Silent Block

a) Reasons for Removal

1. The silent block has been worn or damaged.
2. The half-axle leans against the silent block flange during the spring action
3. When the frame is changed.

b) Technical Conditions

1. No ones have been stipulated.

c) Removal Procedure

1. Dismount nut **1** and remove spring washer **2**.
2. Remove spring bumper **4** c/w spring bumper flange **3** from the auxiliary frame.

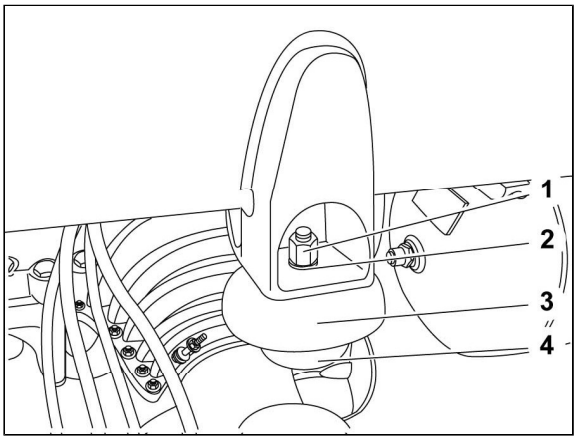


Fig. 8.7 Suspension rubber silent block - removal

d) Installation Procedure

1. Fit spring bumper flange **3** on the spring bumper **4** and install it into the auxiliary frame.
2. Use spring washer **2** and nut **1** to attach the spring bumper **4** to the auxiliary frame.

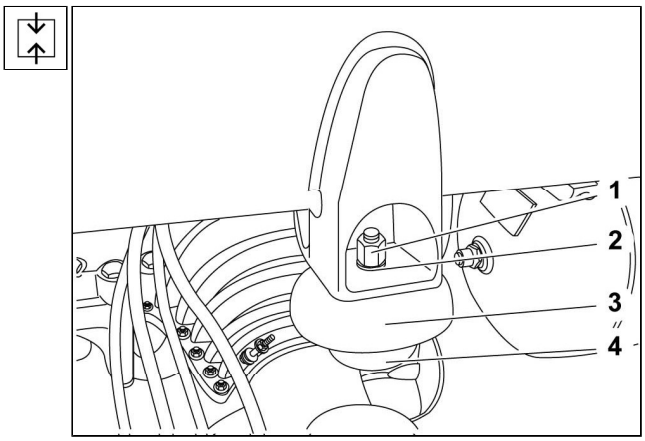


Fig. 8.8 Suspension rubber silent block - installation

8.5.4 Removal and Installation of the Front Axle Torsion Bar Arm Suspension

a) Reasons for Removal and Installation

1. The suspension has been damaged or deformed excessively.
2. The front wheels camber adjustment.

b) Technical Conditions

1. Use such a suspension to keep the values for a correct front wheels camber in accordance with the table (See Tab. **8.5**).
2. Replace spring washers with new ones.
3. Use the specified tools as per (See Tab. **8.3**) for removal and installation.
4. Inspect the front axle wheels camber after the suspension replacement (See Part **10**).
5. Apply the grease **Servo grease 'MP'** to bearing surfaces of torsion bar heads.

Note:
The significance of the dimension **Distance A** is obvious from the figure: (See Fig. **8.11**).

Tab. 8.5 Suspension dimensions allocation

Distance A (mm)		Suspension marking
from	to	
106	122	Without notch
122	138	One notch
138	154	Two notches
154	170	Three notches

c) Removal Procedure

1. Lift the front axle to a position, in which the suspension **5** gets loose. Proceed with care when placing a support stand beneath the front axle.
2. Dismount nut **8** and remove spring washer **7** and shims **2** and **6** from screw **1**.
3. Mount the puller **PRM 3209.2** onto screw **1** and press the pin **4** out of the torsion bar arm **3**.

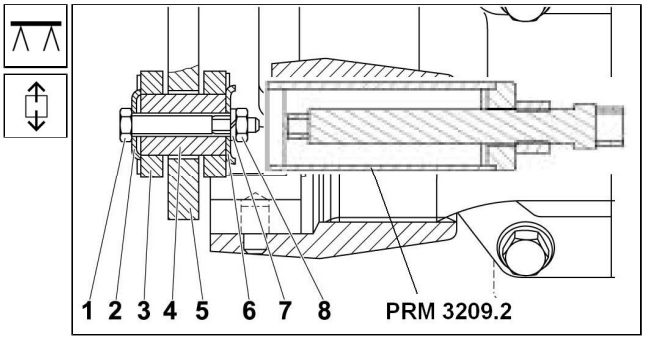


Fig. 8.9 Removal of the torsion bar arm pin

4. Withdraw the suspension **2** from the suspension pin **1**.

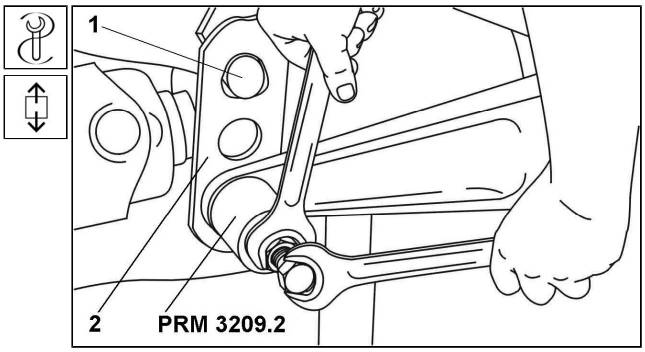


Fig. 8.10 Removal of the pin from the arm

d) Installation Procedure

Note:
Should the suspension of the same length like the original one (the dismounted one) be not at disposal, it is necessary to proceed per points **1** through **3**.

1. Gently lift the front axle to adjust the dimension of **276 mm** as precisely as possible. If the axle shaft needs to be raised or lowered during the suspension installation, you can do so by **8 mm** as a maximum. When both suspensions are replaced, the difference of the basic dimension (**284 mm**) on the LH and RH side of the vehicle must not exceed **8 mm**.
2. Measure up the distance **A**, which should range from **106 to 170 mm**. Should the measured value be not within this range, you must turn the torsion bar by one groove in the respective direction.
3. Install the suspension of the appropriate length **A** and marking as per (See Tab. **8.5**).
4. Slide screw **1** into pin **4** .
5. Smear the pin **4** with grease and press it into arm through the installed suspension **5** .
6. Mount shim **2** on screw and slide the shim **6** c/w spring washer **7** . Tighten the nut **8** to lock the pin.
7. Lift the front part of the vehicle, remove support stands and lower the vehicle to wheels.
8. Inspect the wheels camber in accordance with a procedure mentioned in the section (See Part **10**).

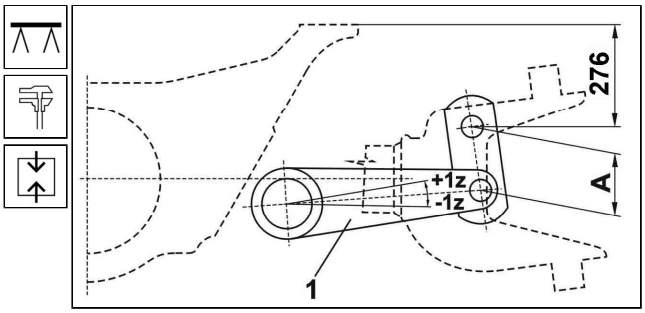


Fig. 8.11 Basic position for the adjustment of the front axle suspension

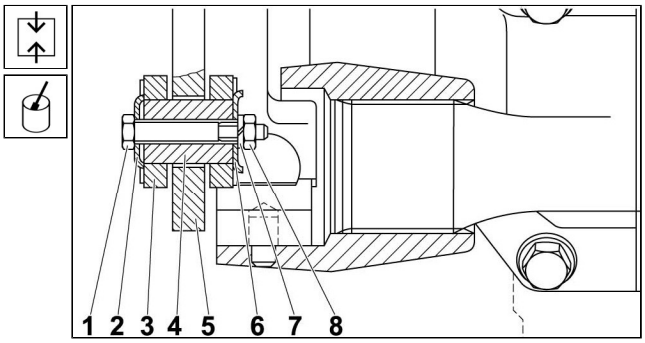


Fig. 8.12 Installation of the torsion bar arm pin

8.5.5 Removal and Installation of the Front Axle Suspension Torsion Bar Arm, Glide Block and Supporting Lens

a) Reasons for Removal and Installation

1. The torsion bar arm has been damaged excessively.
2. The arm grooves have been damaged.
3. There are cracks on the arm surface.
4. The glide block and lens have been worn excessively.

b) Technical Conditions

1. Apply a coat of the grease **Servo grease 'MP'** to contact surfaces of torsion bar heads, torsion bar arms and grooves in the rear holder (cross girder) before installation.
2. Replace spring washers with new ones.
3. Use tools as per the table (See Tab. **8.3**) for removal and installation.

c) Removal Procedure

1. Remove the torsion bar arm suspension (See Subchapter **8.5.4**).
2. Remove the torsion bar from the torsion bar arm and move the arm out of the bracket (do not remove the torsion bar bracket). (See Subchapter **8.5.6**).
3. Press out (knock off) the pin **3** fixing the supporting lens **2** in bracket **1**.

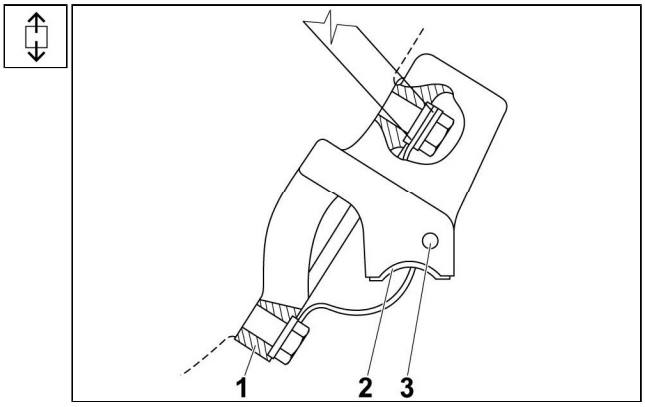


Fig. 8.13 Removal of supporting lens

4. Press the cylindrical pin **2** c/w glide block **1** out of the torsion bar arm **3.**

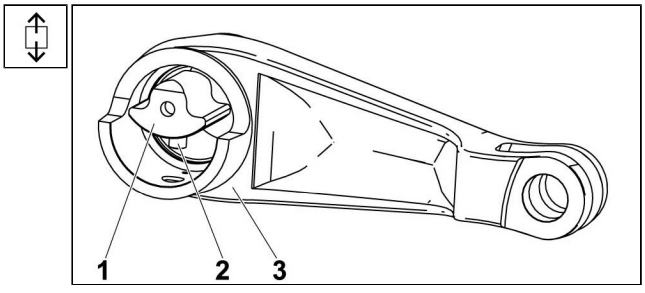


Fig. 8.14 Removal of the supporting block

d) Installation Procedure

1. Press a new cylindrical pin **2** into a glide block **1**. Press the glide block c/w cylindrical pin into a hole in the arm **3**.

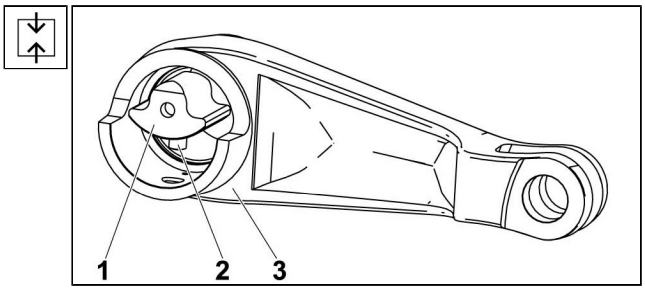


Fig. 8.15 Installation of the supporting block

2. Install the lens **2** into a front bracket **1** and lock it with a pin **3**. Hammer the pin with a punch to lock it on both sides to protect it from falling out.

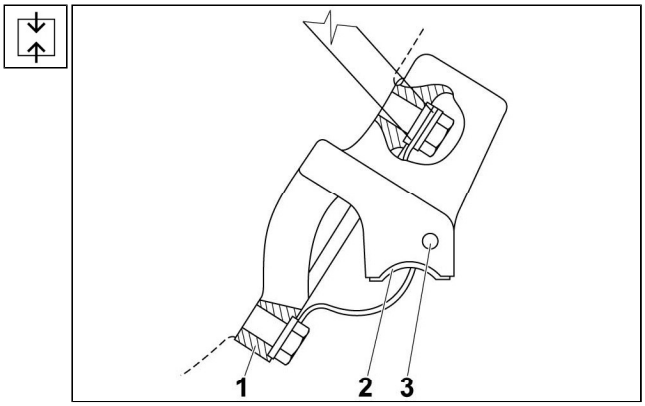


Fig. 8.16 Installation of the supporting lens

3. Install the torsion bar arm into a bracket and install the torsion bar (See Subchapter **8.5.6**).
4. Install the torsion bar arm suspension (See Subchapter **8.5.4**).

8.5.6 Removal and Installation of the Front Axle Suspension Torsion Bar

a) Reasons for Removal and Installation

1. The torsion bar protective layer has been damaged excessively.
2. The torsion bar has become fatigue (has been broken).
3. The torsion bar end grooves have been damaged.

b) Technical Conditions

1. The right-hand torsion bar differs from the left-hand torsion bar in shouldering and marking on the rod face.
2. Apply the grease **Servo grease 'MP'** to bearing surfaces of the torsion bar heads, torsion bar arm and grooves in the rear holder (cross girder) before installation.
3. Replace spring washers with new ones.
4. Do not damage the bar surface treatment during installation.
5. Use tools as per the table (See Tab. **8.3**) for removal.
6. Adjust the front axle wheels cambers after installation.

c) Removal Procedure

1. Remove the torsion bar arm suspension (See Subchapter **8.5.4**).
2. Dismount the lock ring **3**, washer **2** and distance ring **1** from the rear holder of the torsion bar.

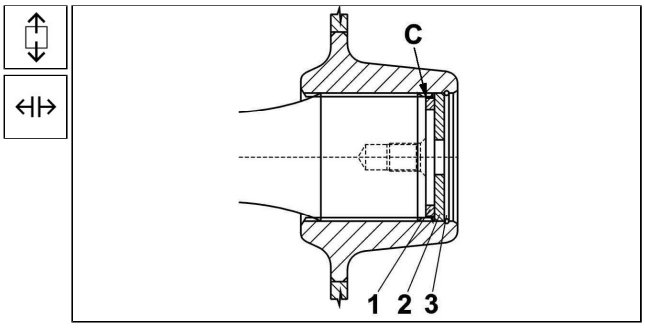


Fig. 8.17 Rear attachment of the torsion bar

3. Mount the screw **2** of the torsion bar puller **PRM 0625.1** into the threaded hole **1** in the torsion bar head. When tightening the nut **3** in the puller (remember to lock the screw **2** against rotation), the torsion bar head will get loose and move out of the rear holder grooves. After releasing the torsion bar, remove the puller **PRM 0625.1** and let the bar be inserted into rear holder grooves.

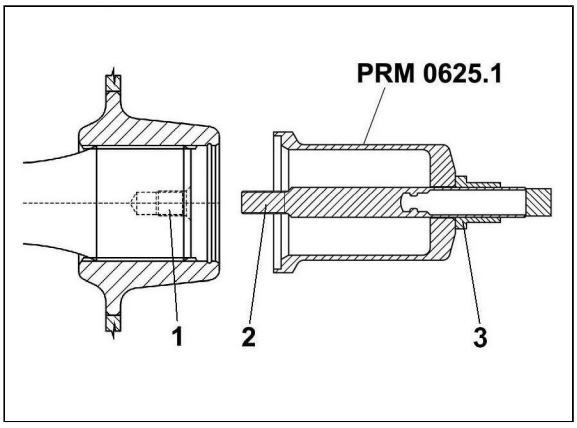


Fig. 8.18 Torsion bar release

4. Withdraw the arm **1** from torsion bar grooves.

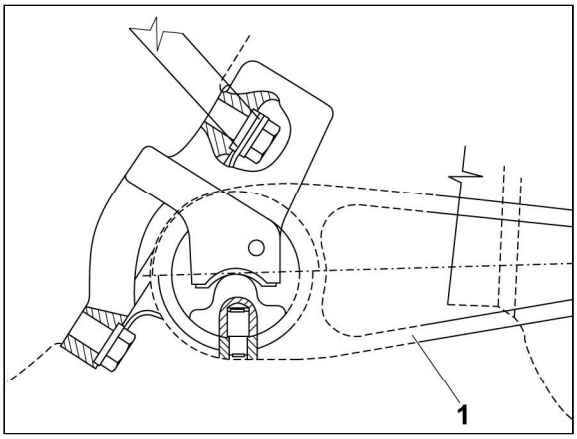


Fig. 8.19 Torsion bar arm - removal

5. Dismount screws **2** and remove the torsion bar yoke **4** together with screws. Unscrew screws **5** and remove the bracket **1** from the cross girder.
6. Move the torsion bar **3** out of the rear holder forwards.

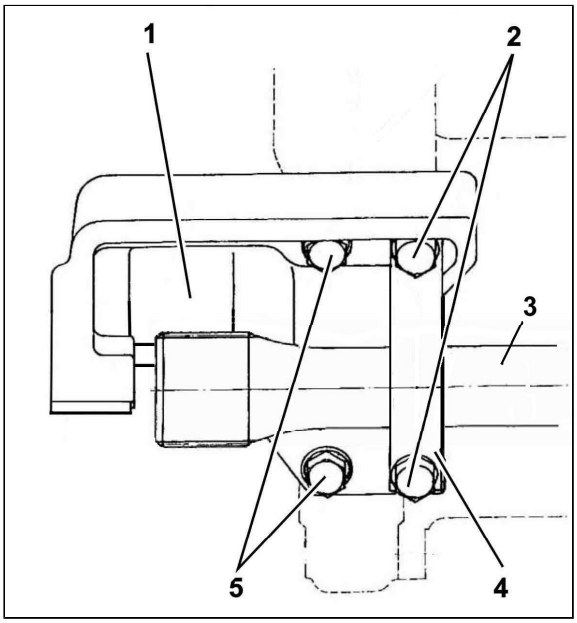


Fig. 8.20 Removal of the torsion bar bracket

d) Installation Procedure

1. Apply the grease **Servo grease 'MP'** to bearing surfaces of the torsion bar heads, torsion bar arm and grooves in the rear holder.
2. Slide the torsion bar in position in the rear holder so that it does not obstruct the installation of the torsion bar front bracket.
3. Use screws **5** c/w spring washers to attach the bracket **1** to the cross girder **2**. Pull screws **3** c/w spring washers through holes in the bar yoke **4**, fit washers on screws (between bracket and yoke) and use screws **3** c/w yoke **4** to attach the bracket **1** to the cross girder **2**.
4. Tighten screws **3** and **5** to the torque of **330 ± 30 Nm**.

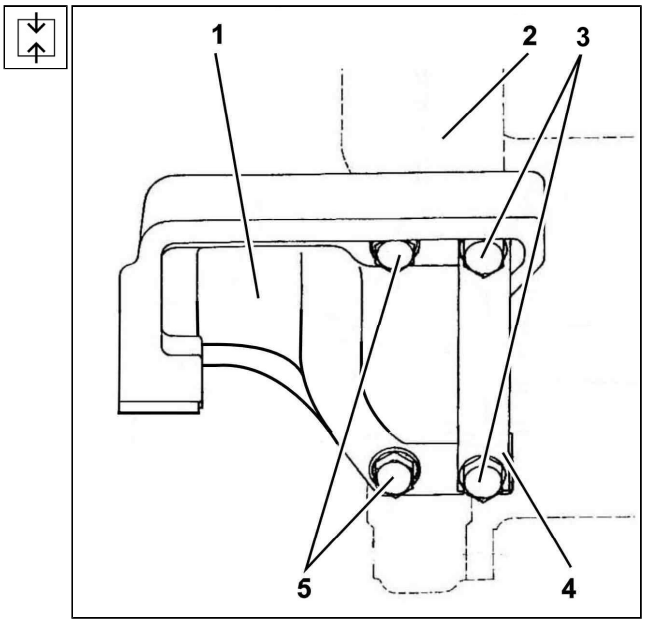


Fig. 8.21 Installation of the torsion bar bracket

5. Slide the torsion bar **3** into yoke **1** and fit the complete arm **2** (fitted with lock ring and glide block) on the torsion bar head (grooves). Move the torsion bar into position in the rear holder and set position of the arm **2** for assembly of the suspension approximately.

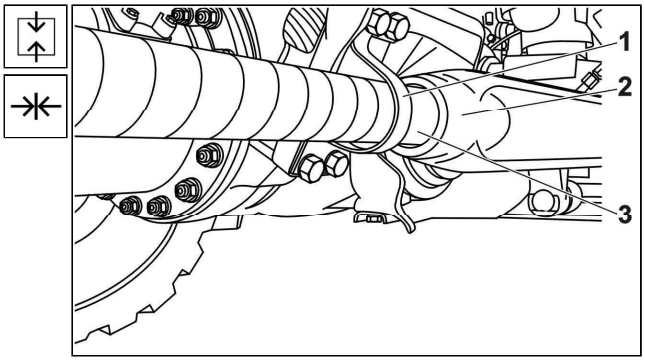


Fig. 8.22 Torsion bar yoke

6. Press the torsion bar into the torsion bar arm so that it rests against the lock ring **2**.
7. Move the torsion bar c/w arm the most forwards as possible so that the arm **7** would touch the bracket **1**.

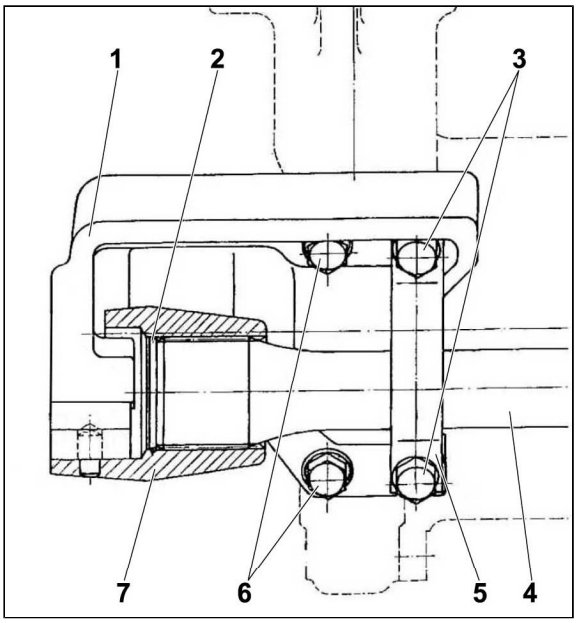


Fig. 8.23 Installation of the torsion bar arm

8. Install the torsion bar suspension (See Subchapter **8.5.4**).

9. Use washer **2** and spacer washers **1** to adjust the clearance **"C"** so that the longitudinal displacement of the torsion bar is possible within the range of **1 to 5 mm**.
10. Fill the space between the torsion bar and washer **2** with grease **Servo grease 'MP'**. Lock the washer **2** with lock ring **3**.

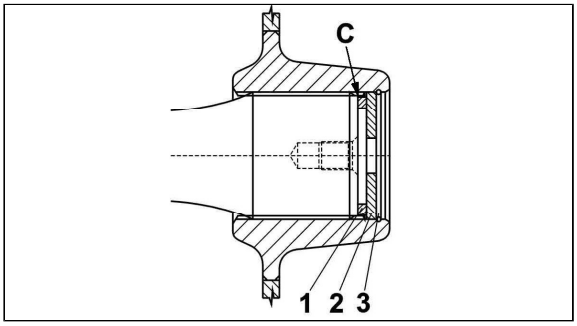


Fig. 8.24 Rear attachment of the torsion

11. Use the jack to lift the front part of the vehicle, remove support stands and lower the vehicle on wheels.
12. Check the wheels cambers (See Part **10**).

8.5.7 Removal and Installation of the Suspension Shock Absorbers

a) Reasons for Removal

1. The shock absorber has been damaged mechanically.
2. The shock absorber is leaky.
3. Rubber bushings fixing the shock absorber have been worn.
4. Damaged shock absorber bracket on the axle shaft.

b) Technical Conditions

1. Apply the paste **LOCTITE ANTISEIZE** to shock absorber eyes and pins before installation.

c) Removal Procedure

1. Lift the driver's cab.
2. Remove the plug from the hole in the frame on place of the shock absorber upper attachment.
3. Dismount nuts **3** and **4** from the shock absorber upper attachment **2** and remove washer **5** c/w washer **1**.

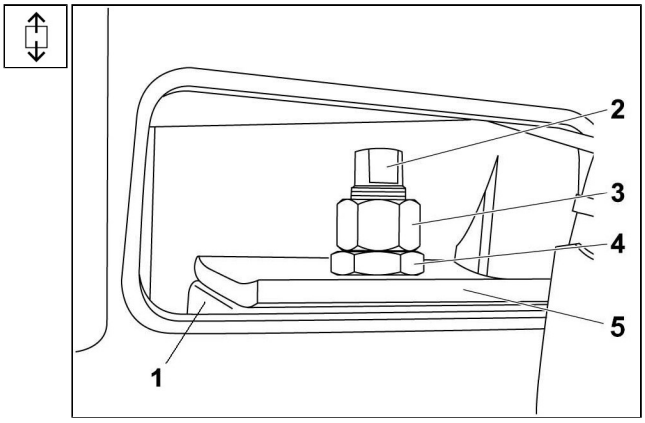


Fig. 8.25 Upper attachment of the front suspension shock absorber - removal

4. Remove split pin **2**, dismount nut **3** and press the shock absorber pin **4** out of the suspension shock absorber eye **1** and shock absorber bracket on the axle shaft.
5. Remove the suspension shock absorber **1** from the auxiliary frame downwards.

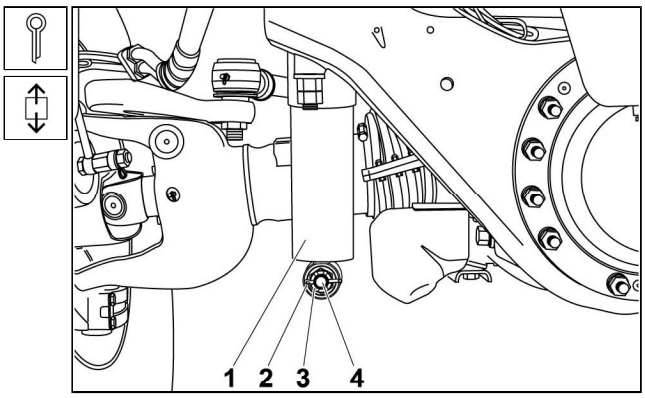


Fig. 8.26 Lower attachment of the front suspension shock absorber - removal

d) Installation Procedure

1. Slide the spacer and rubber washer on the threaded part of the shock absorber **2**.
2. Slide the threaded part of the shock absorber **2** into a hole on the auxiliary frame and fit the rectangular rubber plate **1** and washer **5** on it.
3. Mount the nut **4** (low) and then the nut **3**.
4. Tighten the nut **4** as far it goes to the spacer and tighten the nut **3** to lock it.

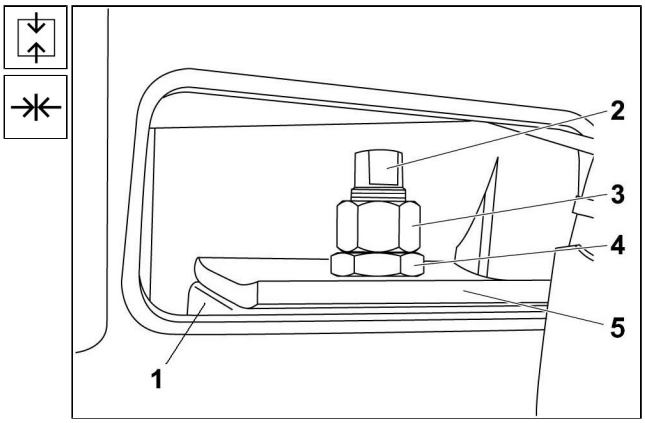


Fig. 8.27 Upper attachment of the front suspension shock absorber - installation

5. Apply the paste **LOCTITE ANTISEIZE** to the shock absorber pin **4**.
6. Slide the shock absorber pin **4** into a shock absorber bracket on the axle shaft and shock absorber eye **1**.
7. Mount nut **3** , tighten it with the nearest slot towards a hole in the thread and secure with the split pin **2**.

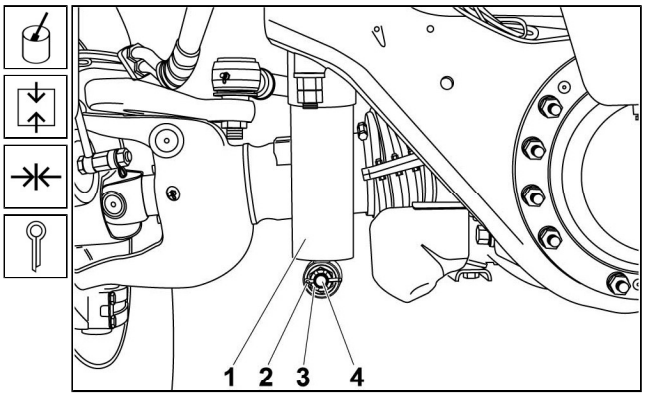


Fig. 8.28 Lower attachment of the front suspension shock absorber - installation

8. Install the plug in the hole in the frame on place of the shock absorber upper attachment.
9. Lower the driver's cab.

8.5.8 Removal and Installation of the Spring Clamp, Supporting Pin, Bearing Pan and Leaf Spring Lock

a) Reasons for Removal and Installation

1. The hanger yoke has cracks on the surface.
2. Supporting pins, bearing pans and working areas of locks have been worn.

b) Technical Conditions

1. Allowable lock wear is **3 - 6 mm**.
2. Apply the agent **FLUIDFILM - AR** to preserve all non-protected bearing surfaces.

c) Removal Procedure

1. Unscrew two nuts **7** and remove the fastening bolt **1** fixing the lock to the spring clamp **6**.
2. Remove the lock **1**.
3. Use the jack to lift the end of the leaf spring so that the spring clamp **6** is released and remove the clamp from supporting pin **3** and bearing pan **4**.
4. Press the supporting pin **5** and bearing pan **2** out of the spring clamp **6** and press the bearing pan **4** out of the spring leaf.

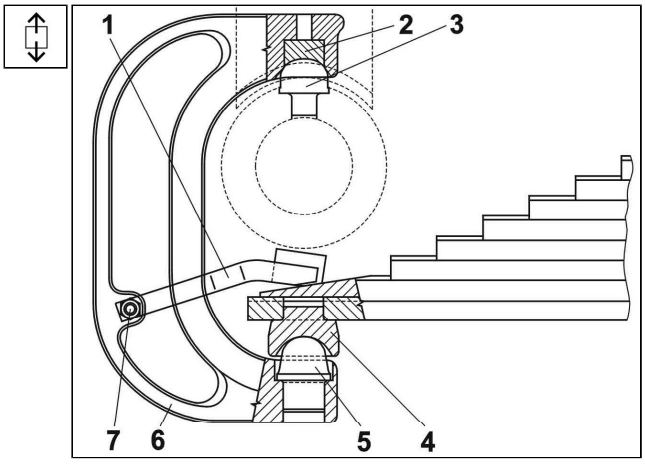


Fig. 8.29 Spring clamp - removal

d) Installation Procedure

1. Press the bearing pan **2** and supporting pin **5** into a spring clamp **6**.
2. Press the bearing pan **3** into a leaf spring.
3. Fit the spring clamp **5** onto the supporting pin **3** on the axle shaft.
4. Use the jack to lift the end of the leaf spring and fit the clamp into a bearing pan **4**.
5. Measure the lock wear **1**.
6. It the wear exceeds **6 mm**, replace the lock or weld on and grind it off to achieve the dimension of a new lock.
7. Install the lock **1** between the leaf spring and the axle shaft and fit it on the spring clamp **6**.
8. Insert the lock-fastening bolt and mount two nuts **7**.

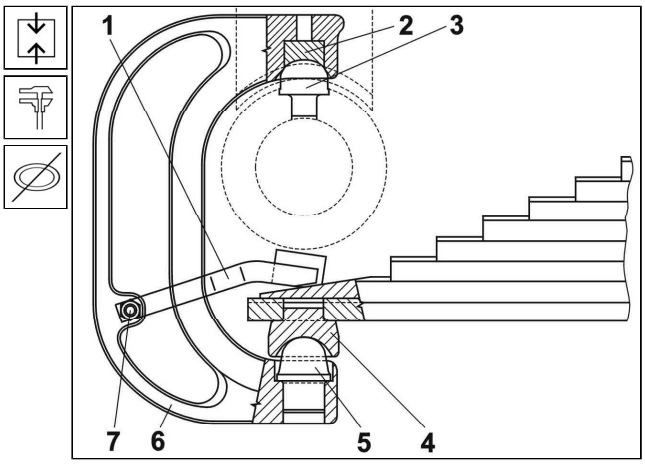


Fig. 8.30 Spring clamp - installation

8.5.9 Removal and Installation of the Leaf Spring

a) Reasons for Removal

1. Some leaf springs have been broken.
2. Leaf springs have become fatigue.

b) Technical Conditions

1. Apply the anti-corrosive agent **FLUIDFILM - AR** to preserve all non-protected bearing surfaces before installation.

c) Removal Procedure

1. Lift the respective part of the vehicle and support it beneath the connecting part.
2. Dismount vehicle wheels on the side where the leaf spring will be replaced (See Part **11**).
3. Remove spring clamps in accordance with: (See Subchapter **8.5.8**).
4. Use the movable jack to raise the leaf spring partially.
5. Unscrew nuts **4** and remove spring washers **3**.
6. Remove bolts **1** and withdraw lock clamps **2**.
7. Lower the leaf spring onto the movable lift and remove it from beneath the vehicle.

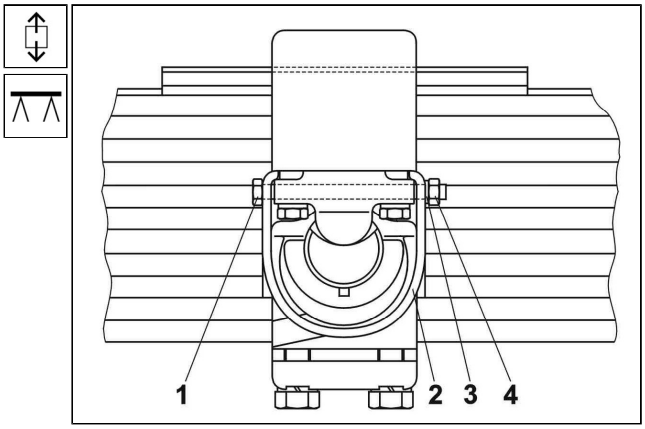


Fig. 8.31 Lock clip - removal

8. Compress the leaf spring under a press in the spring clip **1**.
9. Unscrew bolts **3** c/w spring washers 4.
10. Remove clamping washer **2**.
11. When the press is released, remove spring leaves from the leaf spring clip **1** and replace the spring leaf if necessary.

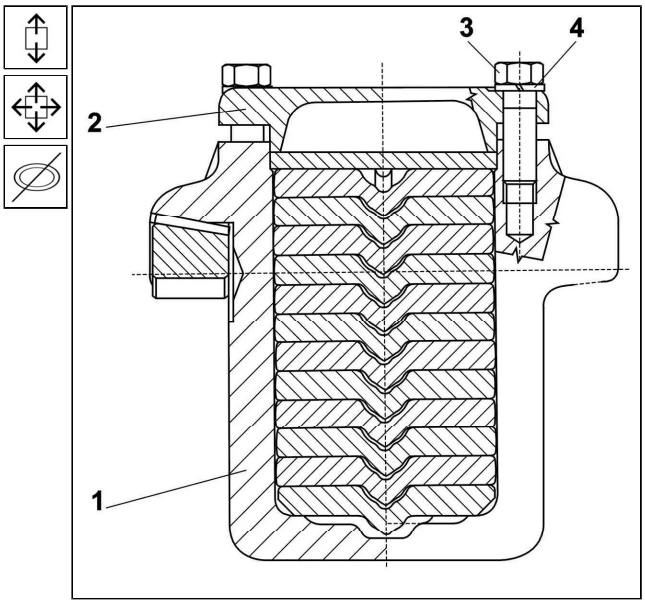


Fig. 8.32 Leaf spring in the clip - removal

12. Unscrew bolts **1** c/w spring washers **2**.
13. Remove glide blocks **3** from the cross girdeg of the connecting part **4**.

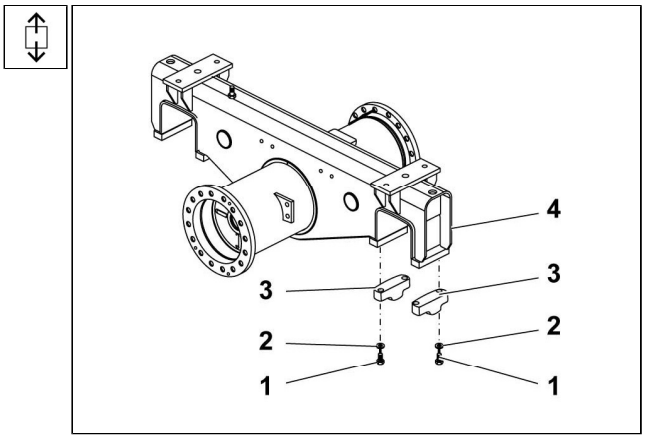


Fig. 8.33 Glide blocks- removal

d) Installation Procedure

1. Place the glide blocks **3** to the cross girdeg of the connecting part **4** and screw on with bolts c/w spring washers **2.** Smear bolt screws with paste **LOCTITE 270**.

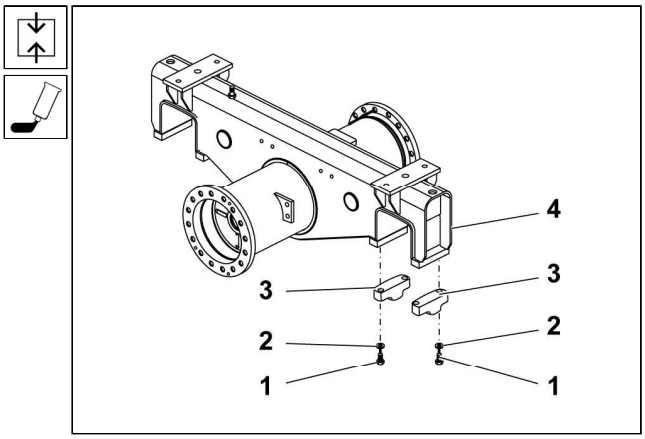


Fig. 8.34 Glide blocks - installation

2. Place spring leaves or a new leaf spring into the leaf spring clip **1** and set into a centre.

   Note:
   A new leaf spring is delivered being clamped with a clip. When the leaf spring is installed into a clamp, partially compress the leaf spring under a press and remove the clip.

3. Carry out the inspection of the leaf springs position so that you measure the distance from the spring leaf end to the spring clamp centre on last two longest spring leaves. Measure it on both ends of the leaf spring. The difference of the measured values must not exceed 10 mm. If need be, check the position of all spring leaves.
4. Compress the spring leaves in the place of the leaf spring clip **1** in a press.
5. Fit the clamping washer **2** on the leaf spring clip **1** and use bolts **3** c/w spring washers 4 to attach it**.**
6. Tighten bolts **3** to the torque of **280 ±30 Nm**.

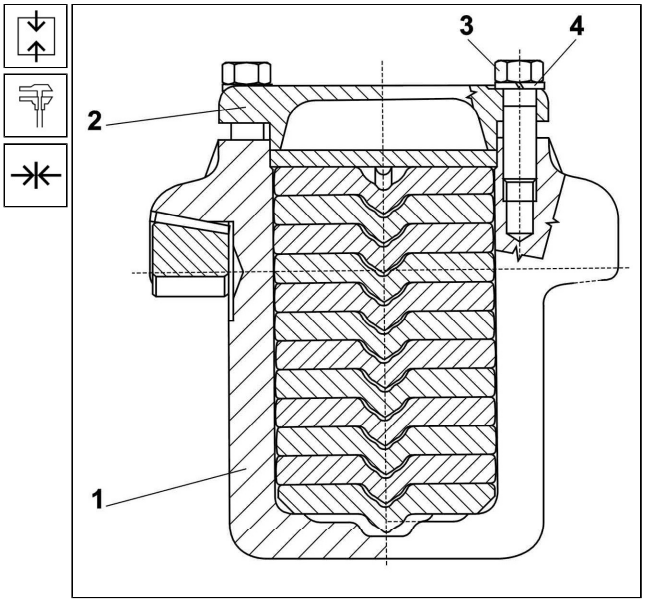


Fig. 8.35 Leaf spring in the clip - installation

7. Place the leaf spring c/w clip on the movable lift and move it under the axle shafts.
8. Lift the leaf spring and slide it into a cross girder of the connecting part.
9. Fit lock clips **2** and use bolts **1** , spring washers **3** and nuts **4** to attach them.
10. Release the movable jack.

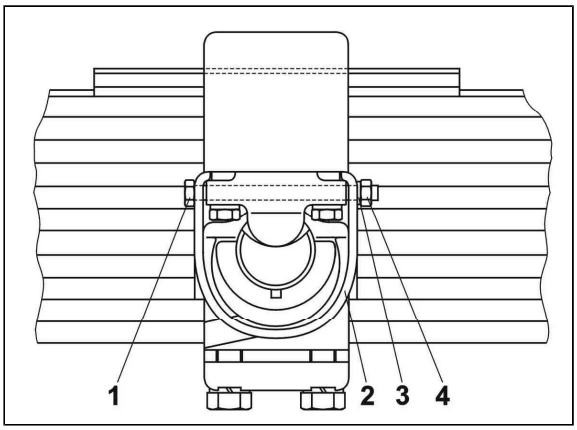


Fig. 8.36 Lock clip - installation

11. Install spring clamps in accordance with: (See Subchapter **8.5.8**).
12. Mount vehicle wheels (See Part **11**).
13. Remove the support from beneath the connecting part.