Front mechanical suspensions

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MECHANICAL FRONT SUSPENSIONS
DESCRIPTION

The front suspension has independent wheels of the type:

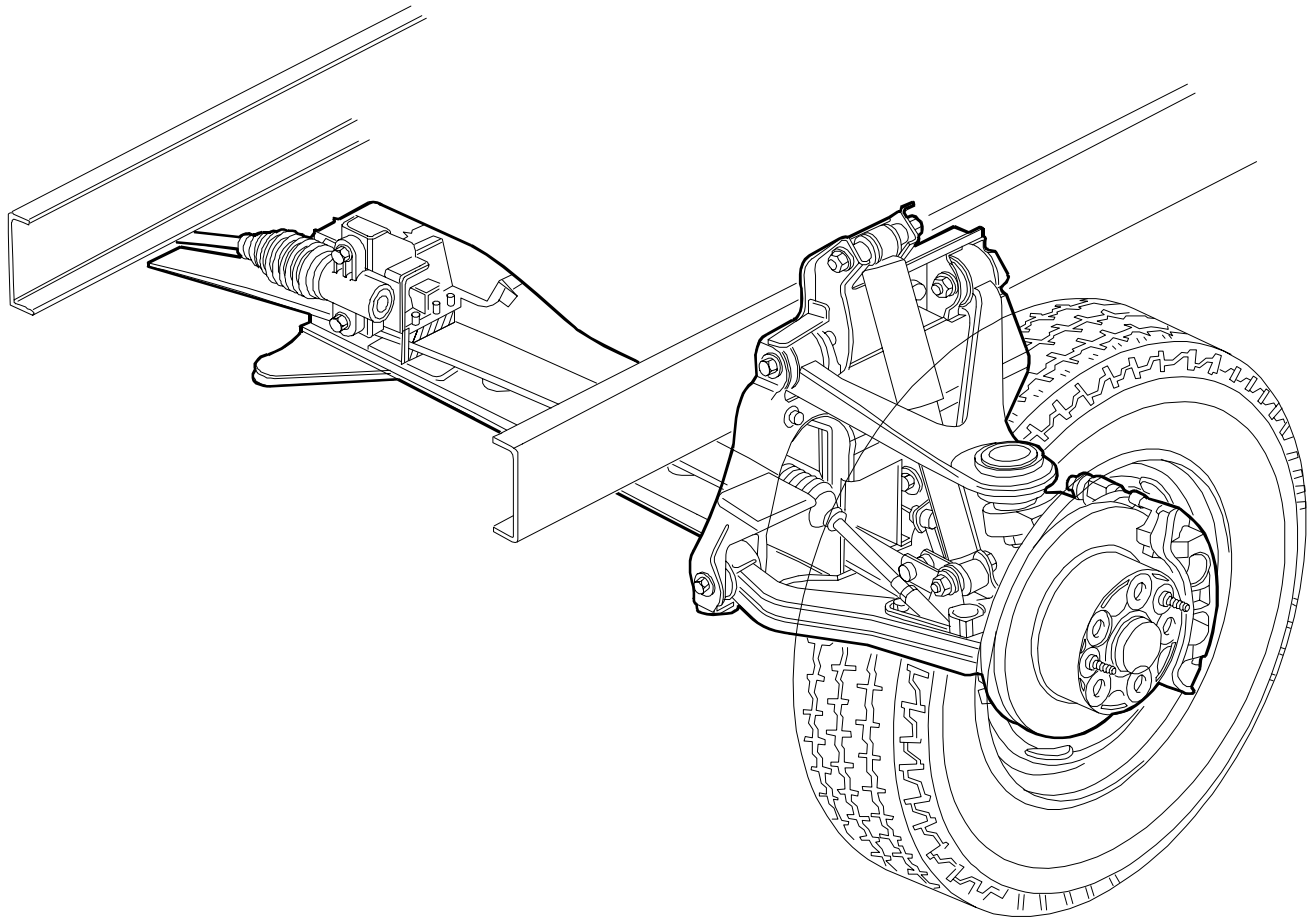
- with an articulated quadrilateral with a transverse leaf spring for axles 5817 and 5818;
- with longitudinal torsion bars for axle 5819 and 5823.

ARTICULATED QUADRILATERAL SUSPENSION WITH TRANSVERSE LEAF SPRING (vehicles 29l - 35s - 35c)

The suspension comprises:

- two top triangular suspension arms, composed of a sheet-metal shell, connected by elastic bushings to the crosspiece by pins articulated to the stub axle;
- two bottom triangular suspension arms, composed of two sheet-metal half-shells welded together, connected by elastic bushings with metal reinforcement to the crosspiece and pins articulated to the stub axle.
  The bottom suspension arms have reaction points for the leaf spring and the bottom mountings of the shock absorbers;
- a single-blade leaf spring, made of composite material for axles 5817 mounted on vehicles 29 L and 35 S, steel for axles 5818 mounted on vehicles 35 C; the spring is kept inside the crosspiece by two top reaction plugs fitted on the ends of the spring housed in the seats in the bottom suspension arms.
  The steel leaf spring, due to the resistance it provides for the rolling movements of the vehicle, makes mounting the front stabilizer bar superfluous;
- two double-acting hydraulic shock absorbers with integrated limit stops;
- stabilizer bar on vehicles 29 L - 35 S.

Figure 1

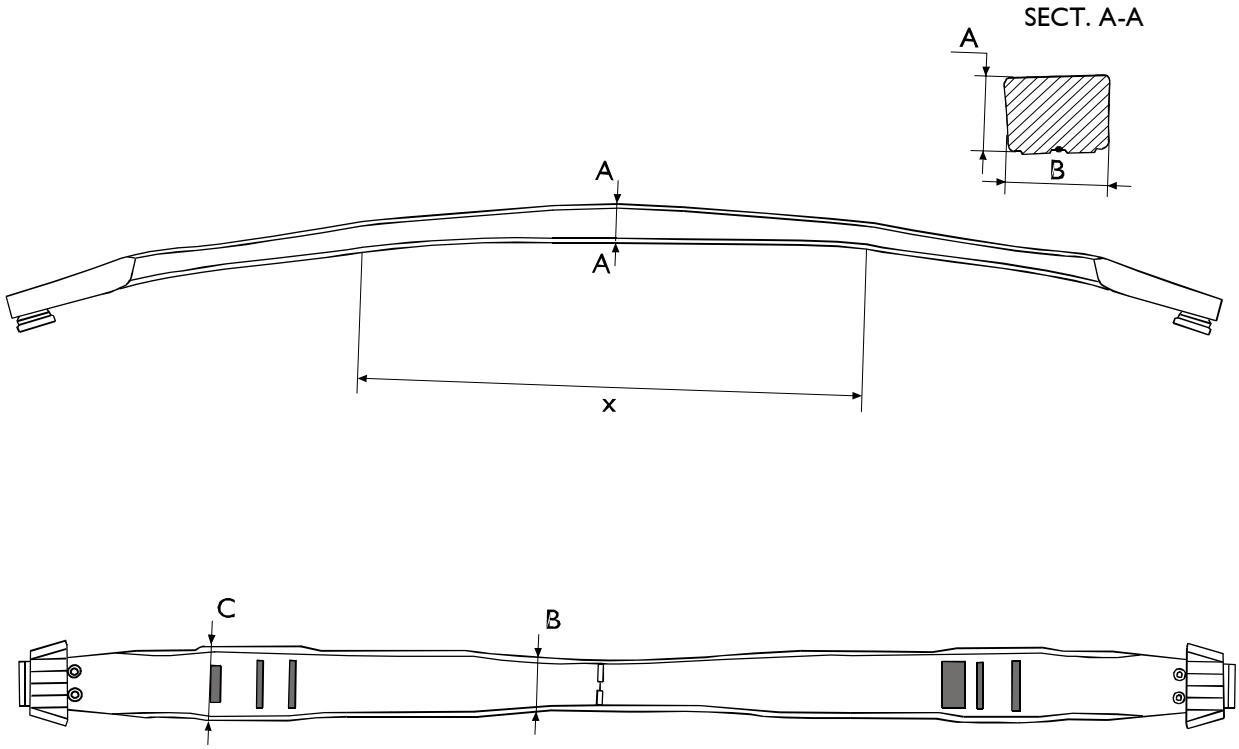


62102

SPECIFICATIONS AND DATA
Front leaf spring

Models: 29 L - 35 S			
Transverse			N° 1
Spring length	(mm)		1313.2
Sheet thickness measured at	(mm)	A	39.92 ± 0.50
Sheet width measured at	(mm)	B	56.0 ± 0.5
		C	81.0 ± 0.5

Figure 2



52322

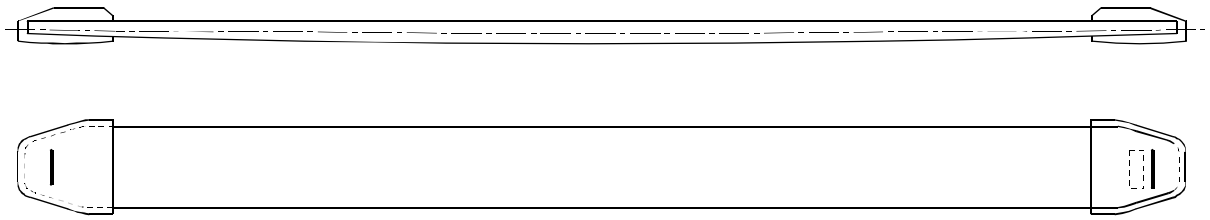
COMPOSITE LEAF SPRING

NEW LEAF SPRING CHECK DATA			
		29 L	35 S
STATIC LOAD	(N)	19865	21040
SAG WITH STATIC LOAD	(mm)	71.7	68.4
DYNAMIC LOAD	(N)	34270	37005
SAG WITH DYNAMIC LOAD	(mm)	123.7	120.4
FLEXIBILITY ± 5%1	(mm/kN)	277	307.0
DISTANCE BETWEEN SUPPORT PLUGS	(mm)	540	600

Front leaf spring

Models: 35 C		
Transverse		N° 1
Spring length	(mm)	1365 ± 3
Sheet thickness	(mm)	20 ± 0.2
Sheet width	(mm)	80 ± 0.5

Figure 3



50824

STEEL LEAF SPRING

NEW LEAF SPRING CHECK DATA					
POSITION	LOAD		CAMBER (mm)	FLEXIBILITY	
	daN	kg		mm/100 daN	mm/100 kg
STATIC LOAD	845.1	861.5	70.25	8.31	8.15
DYNAMIC LOAD	1453.3	1481.4	120.8		

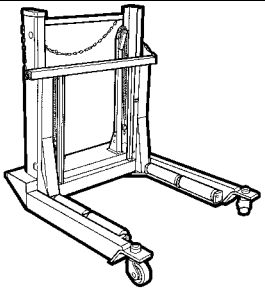
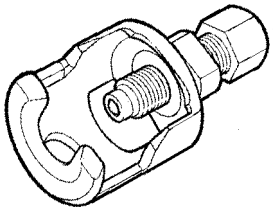
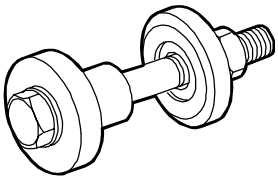
Front suspension stabilizer bar (axle 5817)

		Models: 29 L - 35 C
Stabilizer bar diameter	(mm)	18

Front shock absorbers

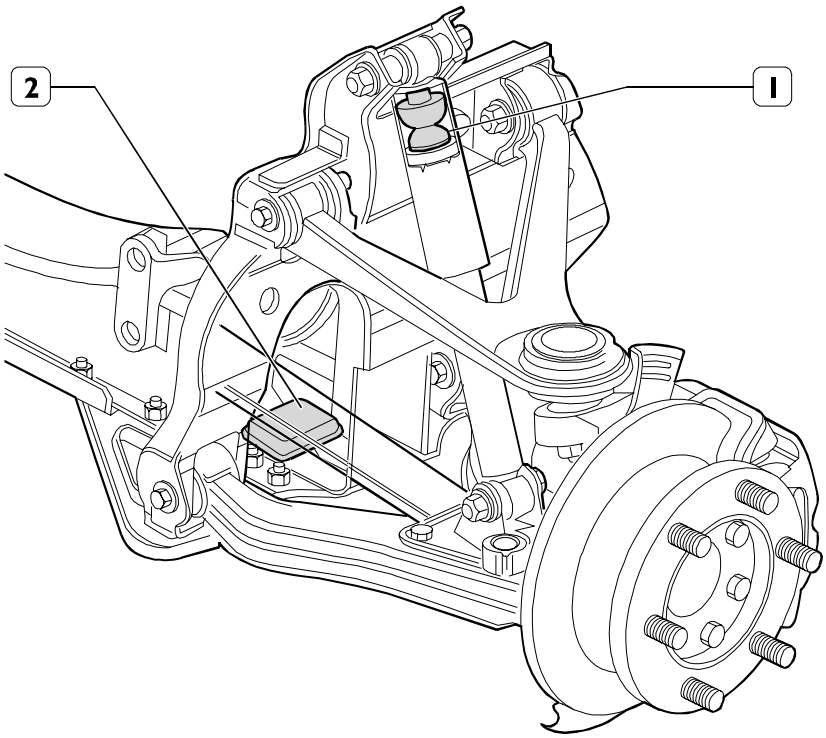
Models:	29 L - 35 S - 35 C		
		Mannesmann - Sachs	**Arvin Meritor**
	Distance between centre of eyes:		
	Open (mm)	405 ± 3	
	Closed (mm)	320 ± 3	
	Stroke (mm)	85	

TOOLS

TOOL NO.		DESCRIPTION
99321024		Hydraulic trolley for wheel removal and refitting
99347074		Extractor to take out link pins
99374179		Tool for disassembling and reassembling suspension arm flexible bushings

VEHICLE SUSPENSIONS 29 L - 35 S WITHOUT SWAY BAR
(recent production with rebound pad integrated in shock absorbers).

Figure 4



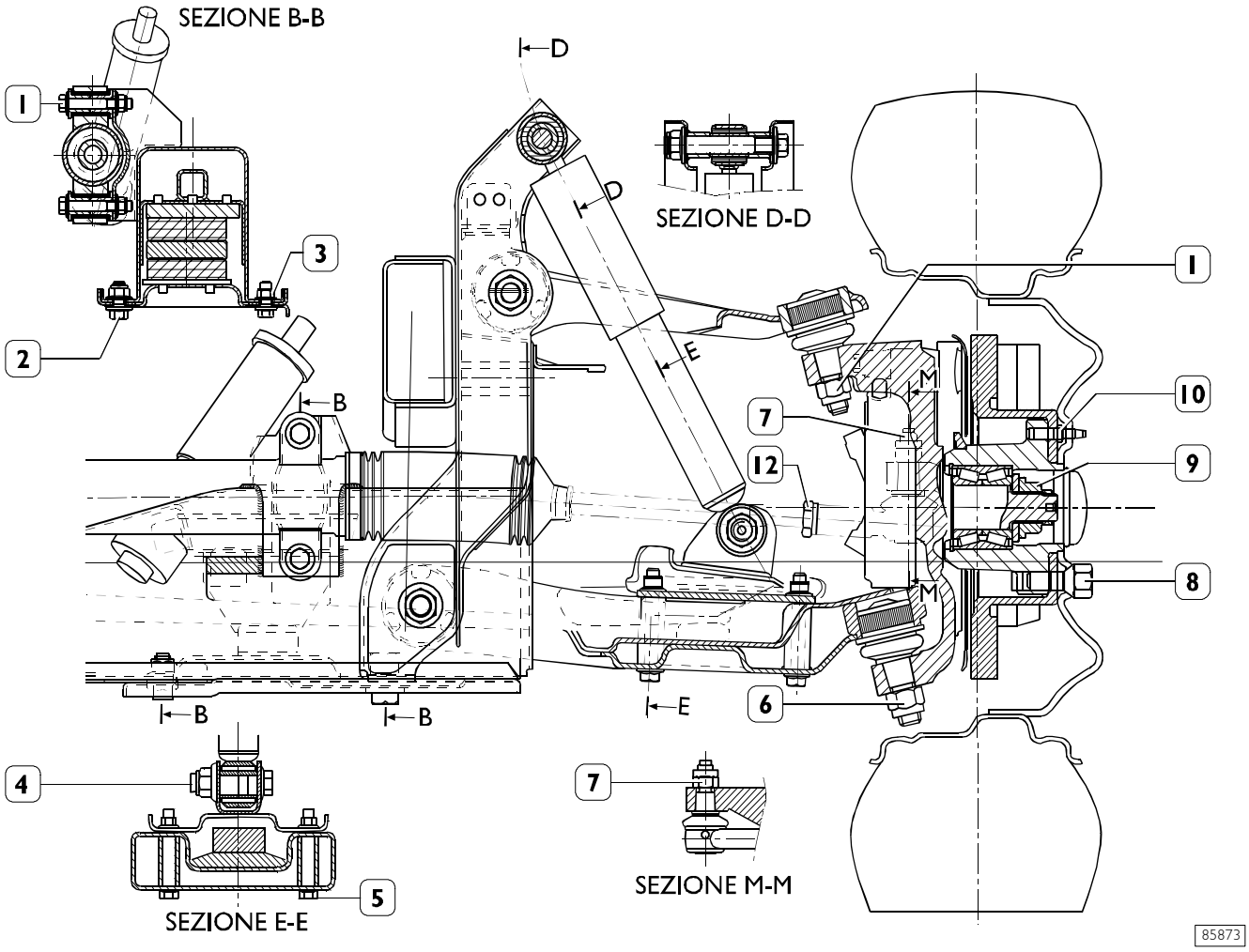
1. Built-in rebound - 2. Reaction pad.

Shock absorber data

Models:	29 L - 35 S	
		Alvin Meritor
	Length between eyebolt centres:	
	Open (mm)	405 ± 3
	Closed (start of damping) (mm)	380 ± 3
	Closed (pad squeezed) (mm)	340 ± 3
	Stroke (mm)	65

TIGHTENING TORQUES
Vehicles 29 L - 35 S (without sway bar)

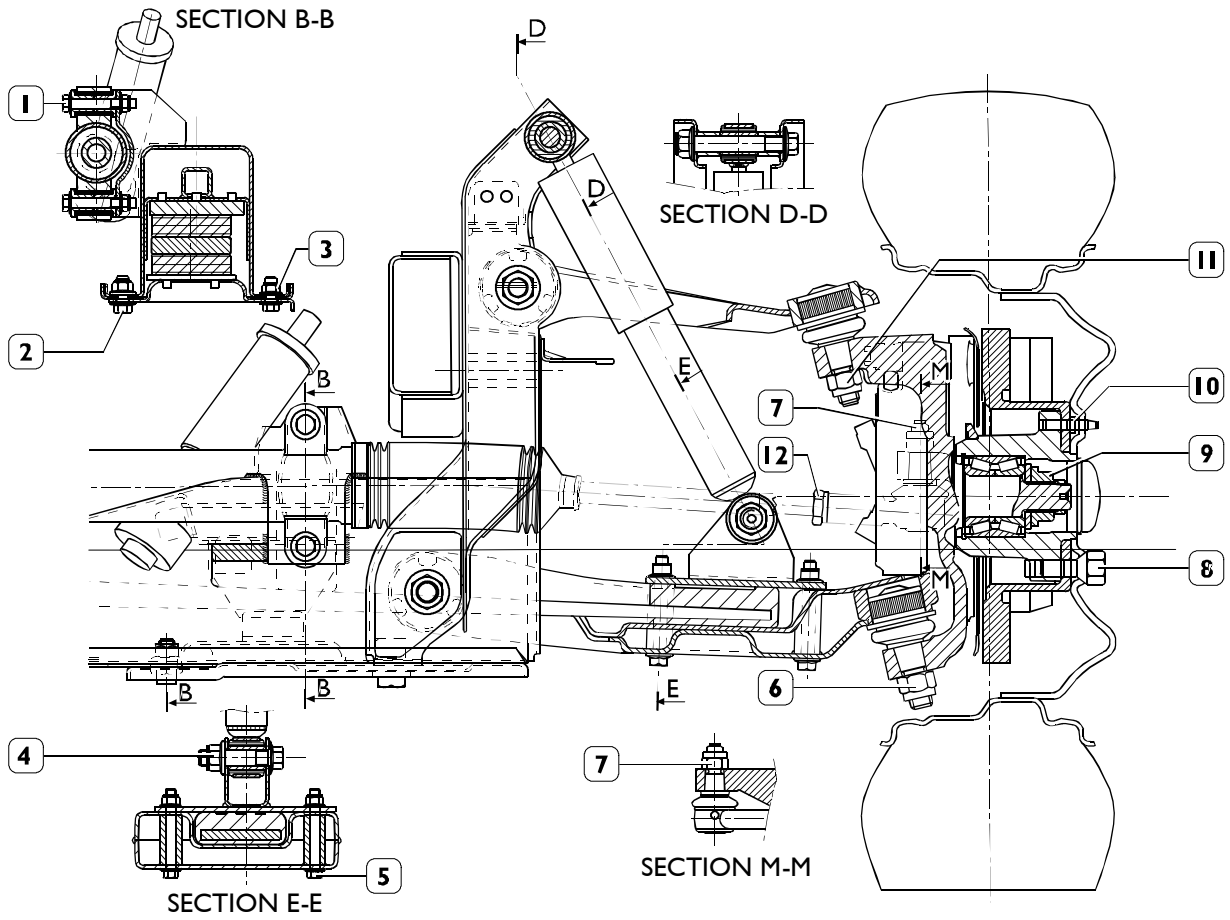
Figure 5



COMPONENT		TORQUE	
		Nm	kgm
1	Screw for nut securing steering gear housing	50 ÷ 61	5 ÷ 6.1
2	M12 screw for nut securing leaf spring mounting to the cross member	100 ÷ 124	10 ÷ 12.4
3	M10 screw for nut securing leaf spring mounting to the cross member	39 ÷ 48	3.9 ÷ 4.8
4	Nut for screw securing shock absorber top and bottom	124 ÷ 152	12.4 ÷ 15.2
5	Screw for nut securing shock absorber mounting to bottom suspension arm	39 ÷ 48	3.9 ÷ 4.8
6	Nut securing bottom suspension arm ball joint to the stub axle	160 ÷ 180	16 ÷ 18
7	Nut securing steering gear housing tie rod ball joint to the stub axle	68 ÷ 83	6.8 ÷ 8.3
8	Screw securing wheel	160	16
9	Nut securing hub to stub axle	256 ÷ 314	25.6 ÷ 31.4
10	Screw securing brake disc to wheel hub	19.5 ÷ 24	1.9 ÷ 2.4
11	Nut securing top suspension arm ball joint to the stub axle	125 ÷ 140	12.5 ÷ 14
12	Nut securing ball joint to the steering gear housing tie rod	70 ÷ 100	7 ÷ 10
-	Nut fixing stabilizer bar reaction link rod	35 ÷ 53	3.5 ÷ 5.4

TIGHTENING TORQUES
Vehicles 29 L - 35 S

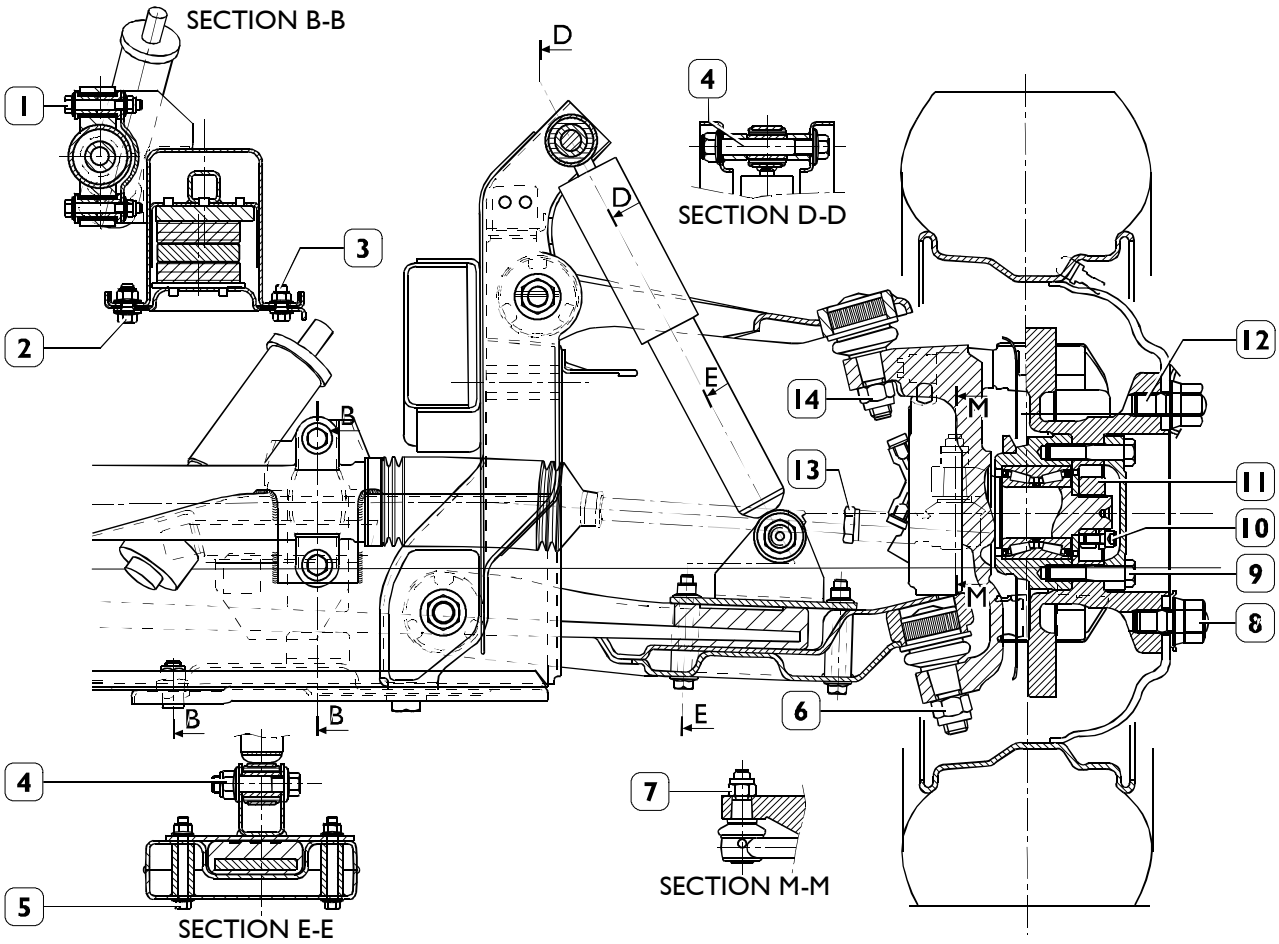
Figure 6



COMPONENT		TORQUE	
		Nm	kgm
1	Screw for nut securing steering gear housing	50 ÷ 61	5 ÷ 6.1
2	M12 screw for nut securing leaf spring mounting to the cross member	100 ÷ 124	10 ÷ 12.4
3	M10 screw for nut securing leaf spring mounting to the cross member	39 ÷ 48	3.9 ÷ 4.8
4	Nut for screw securing shock absorber top and bottom	124 ÷ 152	12.4 ÷ 15.2
5	Screw for nut securing shock absorber mounting to bottom suspension arm	39 ÷ 48	3.9 ÷ 4.8
6	Nut securing bottom suspension arm ball joint to the stub axle	160 ÷ 180	16 ÷ 18
7	Nut securing steering gear housing tie rod ball joint to the stub axle	68 ÷ 83	6.8 ÷ 8.3
8	Screw securing wheel	160	16
9	Nut securing hub to stub axle	256 ÷ 314	25.6 ÷ 31.4
10	Screw securing brake disc to wheel hub	19.5 ÷ 24	1.9 ÷ 2.4
11	Nut securing top suspension arm ball joint to the stub axle	125 ÷ 140	12.5 ÷ 14
12	Nut securing ball joint to the steering gear housing tie rod	70 ÷ 100	7 ÷ 10
-	Nut fixing stabilizer bar reaction link rod	35 ÷ 53	3.5 ÷ 5.4

TIGHTENING TORQUES
Vehicles 35 C

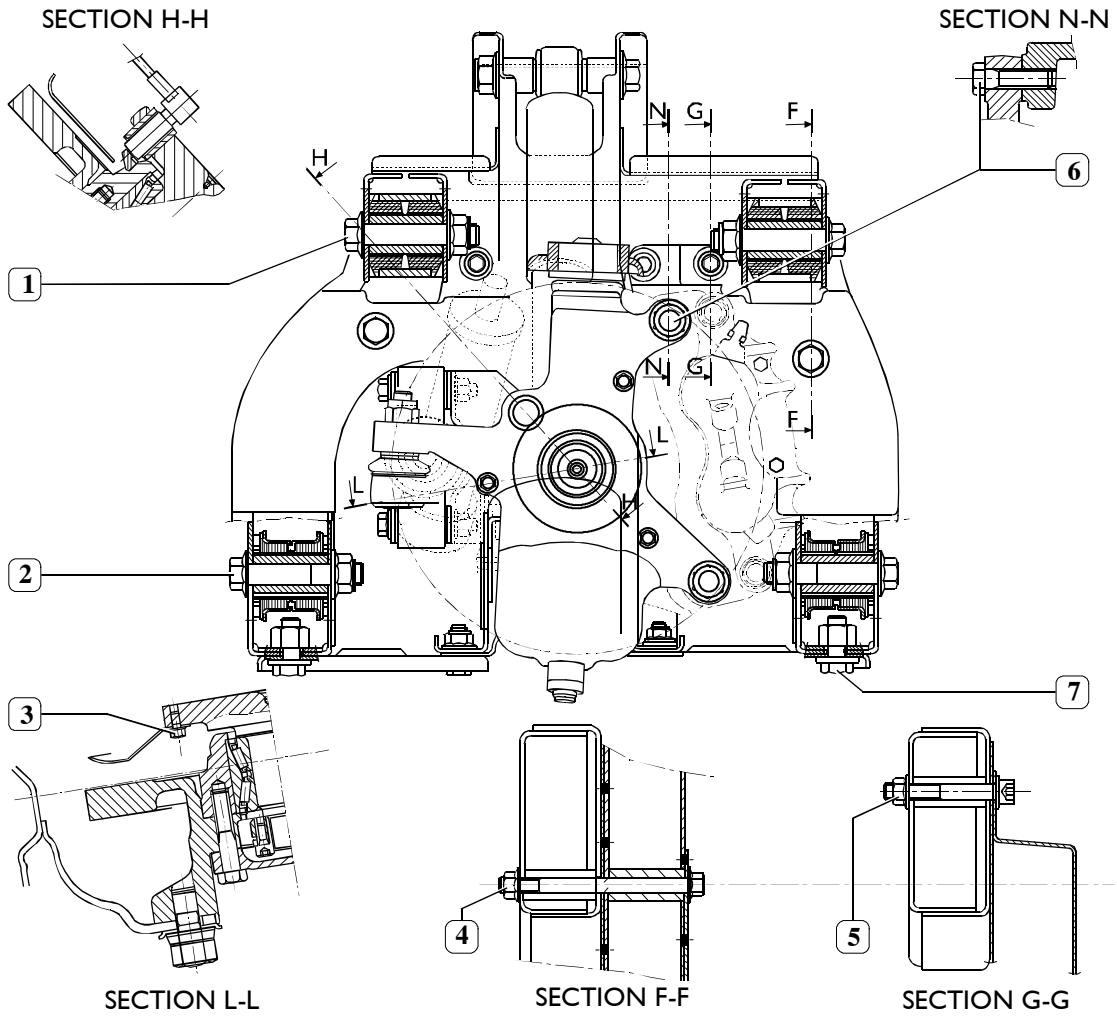
Figure 7



COMPONENT		TORQUE	
		Nm	kgm
1	Screw for nut securing steering gear housing	50 ÷ 61	5 ÷ 6.1
2	M12 screw for nut securing leaf spring mounting to the cross member	100 ÷ 124	10 ÷ 12.4
3	M10 screw for nut securing leaf spring mounting to the cross member	39 ÷ 48	3.9 ÷ 4.8
4	Nut for screw securing shock absorber top and bottom	124 ÷ 152	12.4 ÷ 15.2
5	Screw for nut securing shock absorber mounting to bottom suspension arm	39 ÷ 48	3.9 ÷ 4.8
6	Nut securing bottom suspension arm ball joint to the stub axle	160 ÷ 180	16 ÷ 18
7	Nut securing steering gear housing tie rod ball joint to the stub axle	68 ÷ 83	6.8 ÷ 8.3
8	Nut securing wheel	284 ÷ 342	28.4 ÷ 34.2
9	Screw securing cover and brake disc to wheel hub	98.1 ÷ 107.9	9.8 ÷ 10.7
10	Screw retaining ring nut securing hub to stub axle	20 ÷ 24	2 ÷ 2.4
11	Ghiera fissaggio mozzo al fuso snodo	257 ÷ 314	25.7 ÷ 31.4
12	Stud to brake disc (apply LOCTITE 242 or 270 sealant to the thread)	85 ÷ 104	8.5 ÷ 10.4
13	Nut securing ball joint to the steering gear housing tie rod	70 ÷ 100	7 ÷ 10
14	Nut securing top suspension arm ball joint to the stub axle	125 ÷ 140	12.5 ÷ 14

TIGHTENING TORQUES
Vehicles 29 L - 35 S - 35C

Figure 8



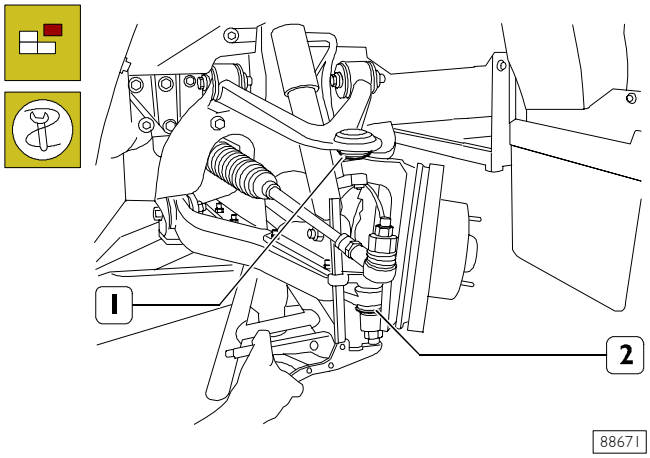
49352

COMPONENT		TORQUE	
		Nm	kgm
1 - 2	Screw for nut securing suspension arm to the top cross member and bottom to the cross member	170 ÷ 280	17 ÷ 28
3	Screw securing disc guard to the axle stub	6 ÷ 7.5	0.6 ÷ 0.7
4	Nut for screw securing cross member to chassis frame	83 ÷ 101	8.3 ÷ 10.1
5	Nut for screw securing cross member to chassis frame	83 ÷ 101	8.4 ÷ 10.1
6	Screw securing caliper mounting to the axle stub	170 ÷ 196	17.0 ÷ 19.6
7	M14 screw securing covers to the cross member	151 ÷ 184	15.1 ÷ 18.4

REPAIRS

Check the clearance of upper swinging arm articulated head

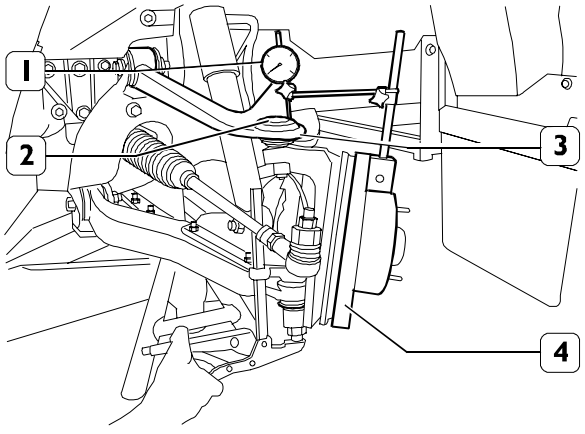
Figure 9



88671

Adjust vehicle on flat ground and lock rear wheels.
Unloosen rear wheels securing nuts.
By a hydraulic jack, lift the vehicle on front side and rest it on two supporting stands.
Unscrew wheels securing nuts and detach wheels again by hydraulic truck 99321024.
Check that protection cowlings (1 and 2) of articulated heads are not damaged.

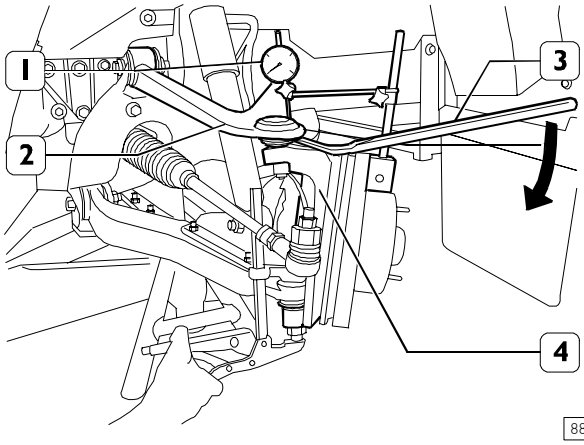
Figure 10



88672

Apply the magnetic base of comparator 99395684 (1) to brake disk (4) and position comparator tracer point on the top of the articulated head (2) of upper swinging arm (3). Pre-load comparator by approximately 4 mm.

Figure 11

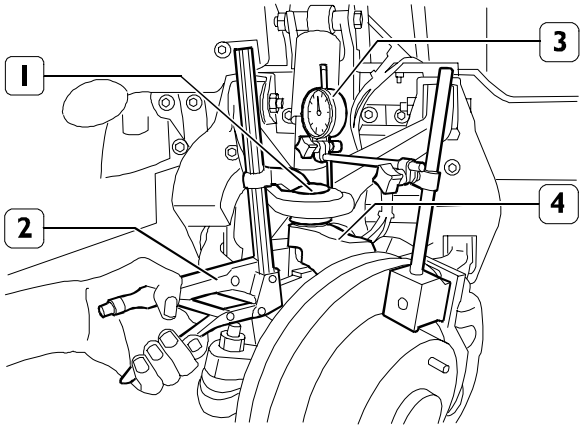


88673

By suitable lever (3) resting on articulated spindle (4), lift swinging arm (2) as much as possible and reset comparator (1).

In operation, take care not to damage the protection cowling of articulated head .

Figure 12

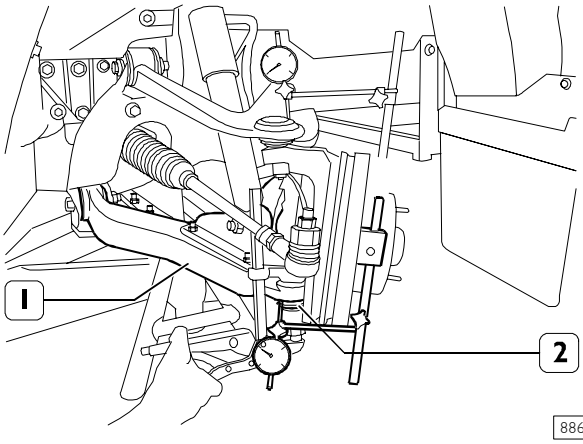


88674

By suitable pliers (2) applied on articulated head (1) and on articulated spindle (4), apply strong pressure on head and spindle and check comparator (3) hand displacement corresponding to articulated head clearance.
If detected value is between 1.5 and 2.0 mm, the swinging arm needs to be replaced, as described in relating chapter.

Check the clearance of lower swinging arm articulated head

Figure 13



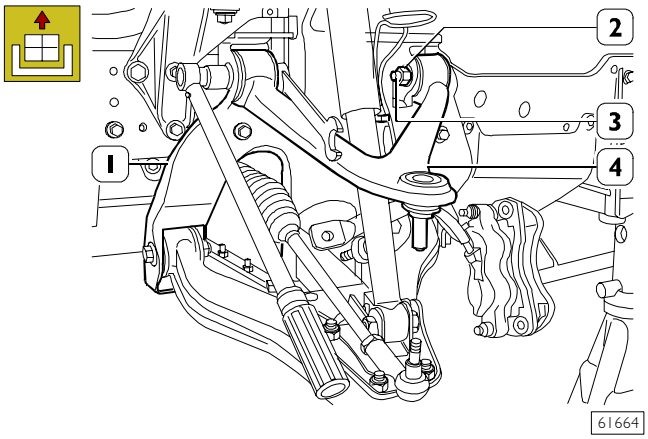
The check of the clearance of the articulated head (2) of lower swinging arm (1) is similar to the one of upper swinging arm.
If detected value is between 1.5 and 2.0 mm, the swinging arm needs to be replaced, as described in relating chapter.

500760 OVERHAULING THE SUSPENSION

Suspension arms

Removal

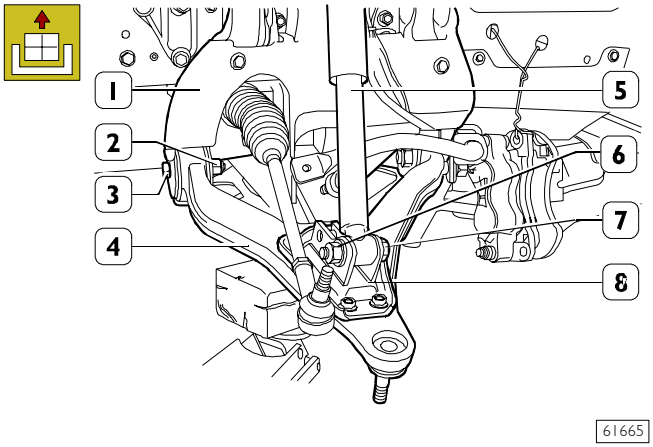
Figure 14



Remove the stub axle as described under the relevant heading (operation 520611 including removal of the wheel hubs operation 520620).

Take out the nuts (2), extract the screws (3) and remove the top suspension arm (4) from the mountings of the cross member (1).

Figure 15

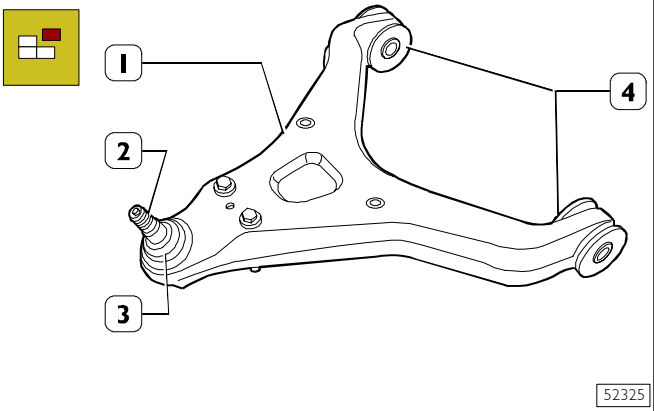


Take out the nut (6) and remove the shock absorber (5) from the mounting (8) of the bottom suspension arm, extracting the screw (7).
Take out the nuts (2), extract the screws (3) and remove the bottom suspension arm (4) from the mountings of the cross member (1).

Replacing suspension arm bushings

Disassembly

Figure 16



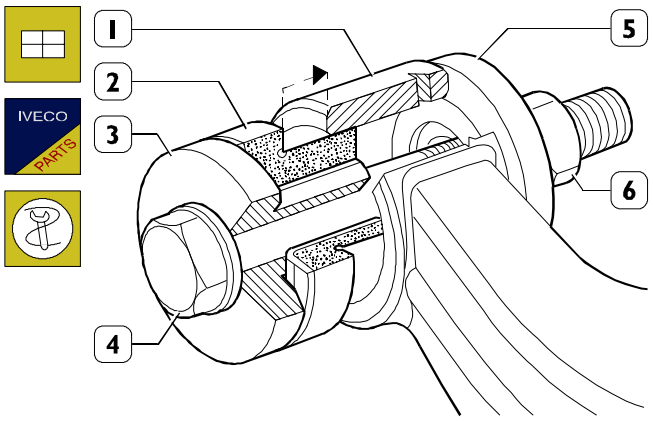
If there is damage to the caps (3) protecting the link pins (2) or if these have too much play, replace the suspension arm (1).

Using general tools, extract the flexible bushings (4) from the suspension arms (1).

Assembly

NOTE The flexible bushings of the bottom suspension arms are equipped with metal reinforcement.

Figure 17



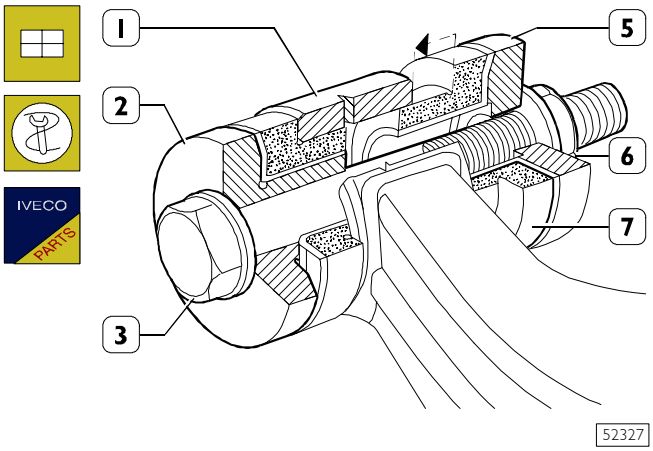
Insert the bushing (2) into the suspension arm (1).

Apply the parts (3 - 4 - 5 - 6) of the tool 99374179, as shown in the figure.

Screw on the nut (6) to make the bushing (2) flush with the suspension arm (1).

Remove the parts of tool 99374179.

Figure 18



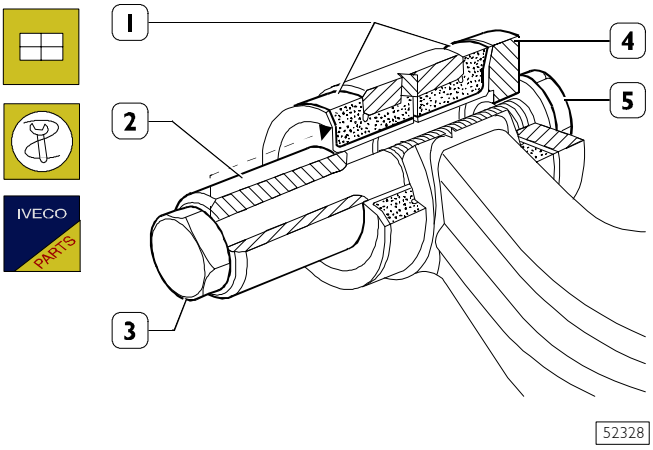
Insert the bushing (7) into the suspension arm (1).

Apply the parts (2 - 3 - 5 - 6) of the tool 99374179, as shown in the figure.

Screw on the nut (6) to make the bushing (7) flush with the suspension arm (1).

Remove the parts of tool 99374179.

Figure 19



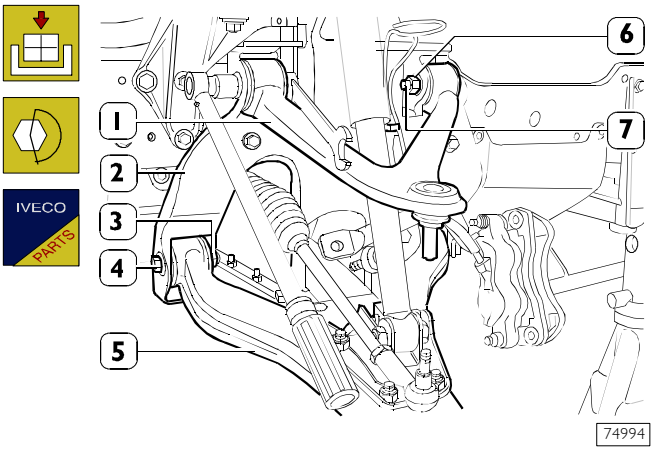
Insert the spacer (2) into the bushing (1).

Apply the parts (3 - 4 - 5) of the tool 99374179, as shown in the figure.

Screw on the nut (5) to fully insert the spacer (2) into the flexible bushings (1).

Refitting

Figure 20



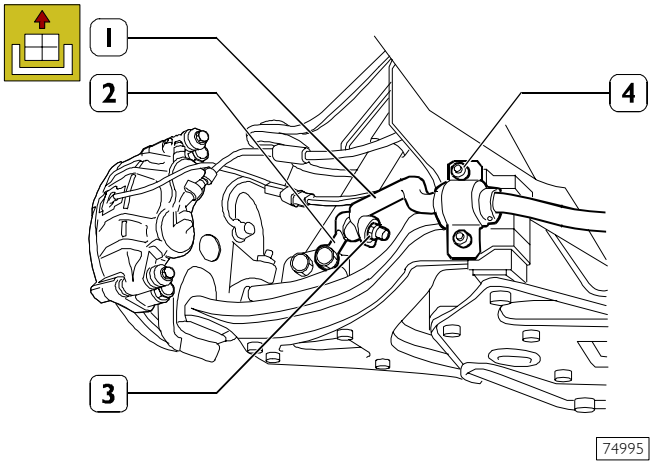
To refit the bottom (5) and top (1) suspension arms to the crosspiece (2), reverse the steps described for removal tightening the nuts (6 - 3) for the fixing screws (4 - 7) to the prescribed torque.

Self-locking nuts, once removed, must be replaced with new ones.

528030 STABILIZER BAR

Removal

Figure 21



FRONT STABILIZER BAR
VEHICLES 29 L - 35S

Unscrew the nuts (3) fixing the link rods to the stabilizer bar (1),
Unscrew the screws (4) fixing the stabilizer bar (1).
If necessary, unscrew the fixing nuts and remove the reaction link rods (2).

Check that the bushings and/or elastic elements are not worn or deteriorated; if they are, replace the relevant part.

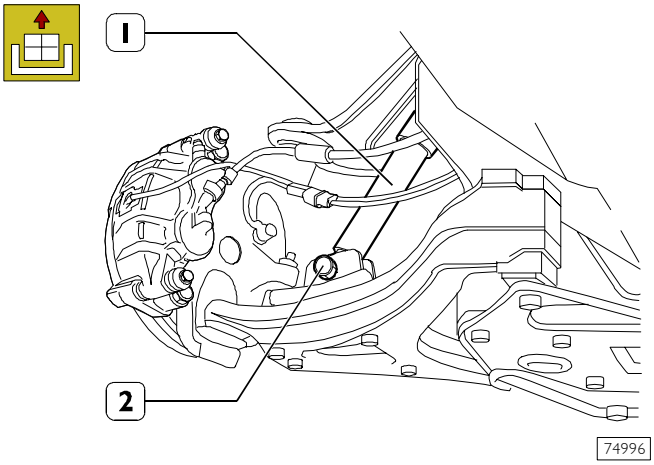
Refitting

For refitting, carry out the removal operations in reverse order and keep to the required tightening torques.

500910 FRONT SHOCK ABSORBERS

Removal

Figure 22



FRONT SHOCK ABSORBER
VEHICLES 29 L - 35S

Set the vehicle on level ground. Lock the rear wheels with a scotch, remove the wheel rim guards and loosen the screws or nuts fixing the wheel.
Lift the front of the vehicle and rest the chassis frame on supports.
Take out the screws or nuts fixing the wheel and remove them with tool 99321024.
Unscrew the top and bottom bolts (2) and remove the shock absorbers (1) from the vehicle.

Check that the bushings and/or elastic elements are not worn or deteriorated; if they are, replace the relevant part.

Check the efficiency of the shock absorbers with a suitable instrument.

Refitting

For refitting, carry out the removal operations in reverse order and keep to the required tightening torques.

LEAF SPRING

Removal

Set the vehicle on level ground.

Lock the rear wheels with chocks. Take off the wheel rim guards and loosen the screws or nuts securing the wheel.

Lift the front of the vehicle and rest the chassis frame on stands.
Take out the screws or nuts securing the wheel with tool 99321024.

On the right-hand side:

- ❑ using a hydraulic jack, slightly lift the stub axle so as to limit the load of the leaf spring;
- ❑ disconnect the electrical connection (1) for indicating brake lining wear;
- ❑ disconnect the ABS speed sensor (4) (if there is one);
- ❑ take out the screws (2) securing the brake caliper to the axle stub and remove it. Remove the brake linings from the brake caliper (3) and support this adequately to prevent strain on the brake pipes;

Check the state of the brake linings and brake disc as described in the BRAKES section.

- ❑ take out the nut locking the link pin of the tie rod (20) and, with tool 99347074 (19), remove the link pin (20) of the steering tie rod from the stub axle;
- ❑ take out the nut (21) and, with tool 99347074 (19), remove the link pin (22) of the top suspension arm from the stub axle;
- ❑ take out the nuts (16) and screws (18) securing the shock absorber mounting (15) to the bottom suspension arm;
- ❑ lower the hydraulic jack;

Repeat the similar operations on the left-hand side;

- ❑ take out the nuts (6 and 5) and screws (10 and 11) and remove the covers (8, 9 and 12) from the cross member (7).

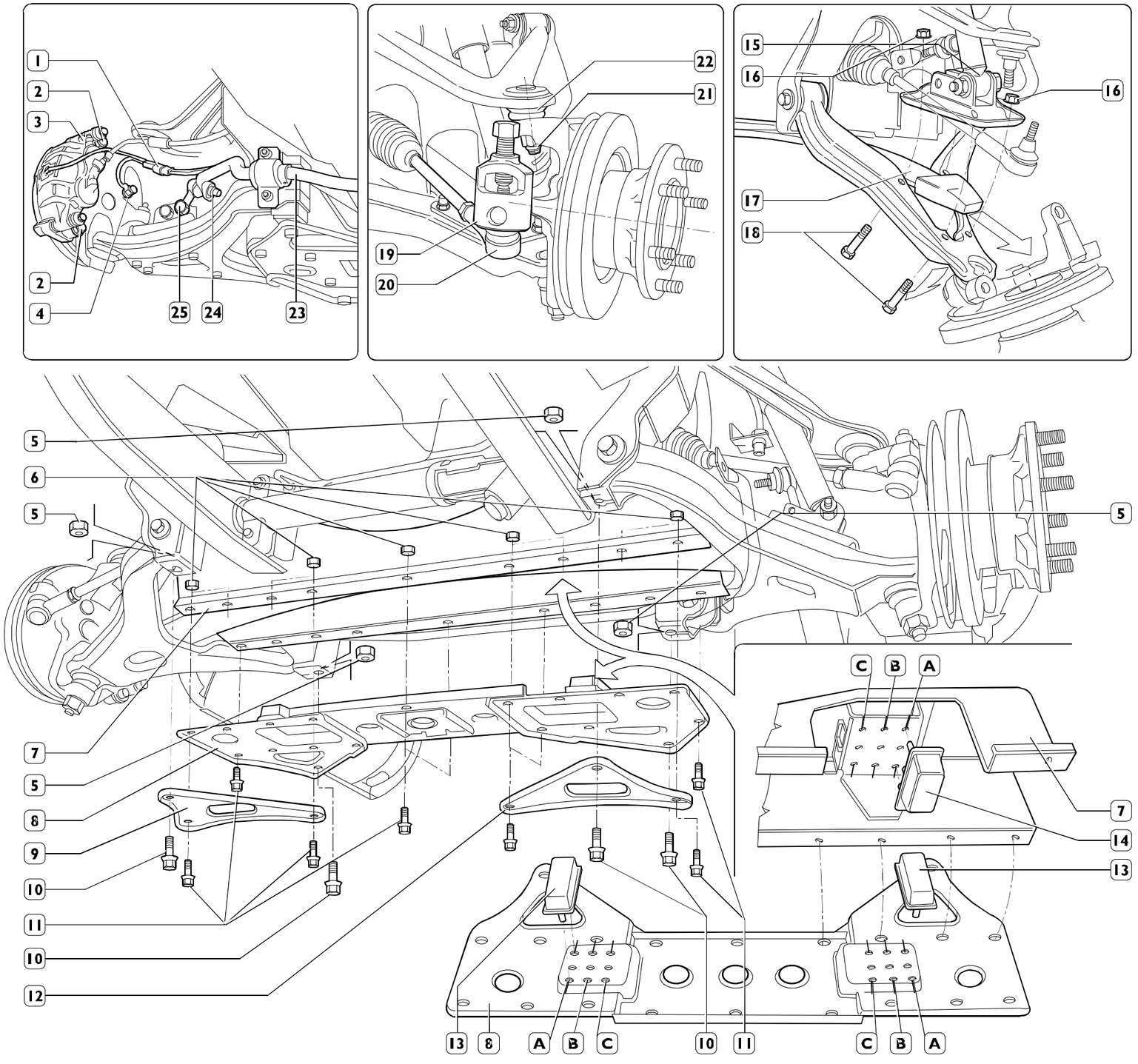
Note the assembly position of the bottom flexible plugs (13) on the cover (8).

Remove the leaf spring (17).

Note the assembly position of the top flexible plugs (14) in the cross member (7).

For axle 5817 (vehicles 29L - 35S), remove nut (24) and disconnect crankpin (25) from stabiliser bar (23).

Figure 23



Refitting

Carry out the operations described for removal in reverse order, but you must take the following precautions:

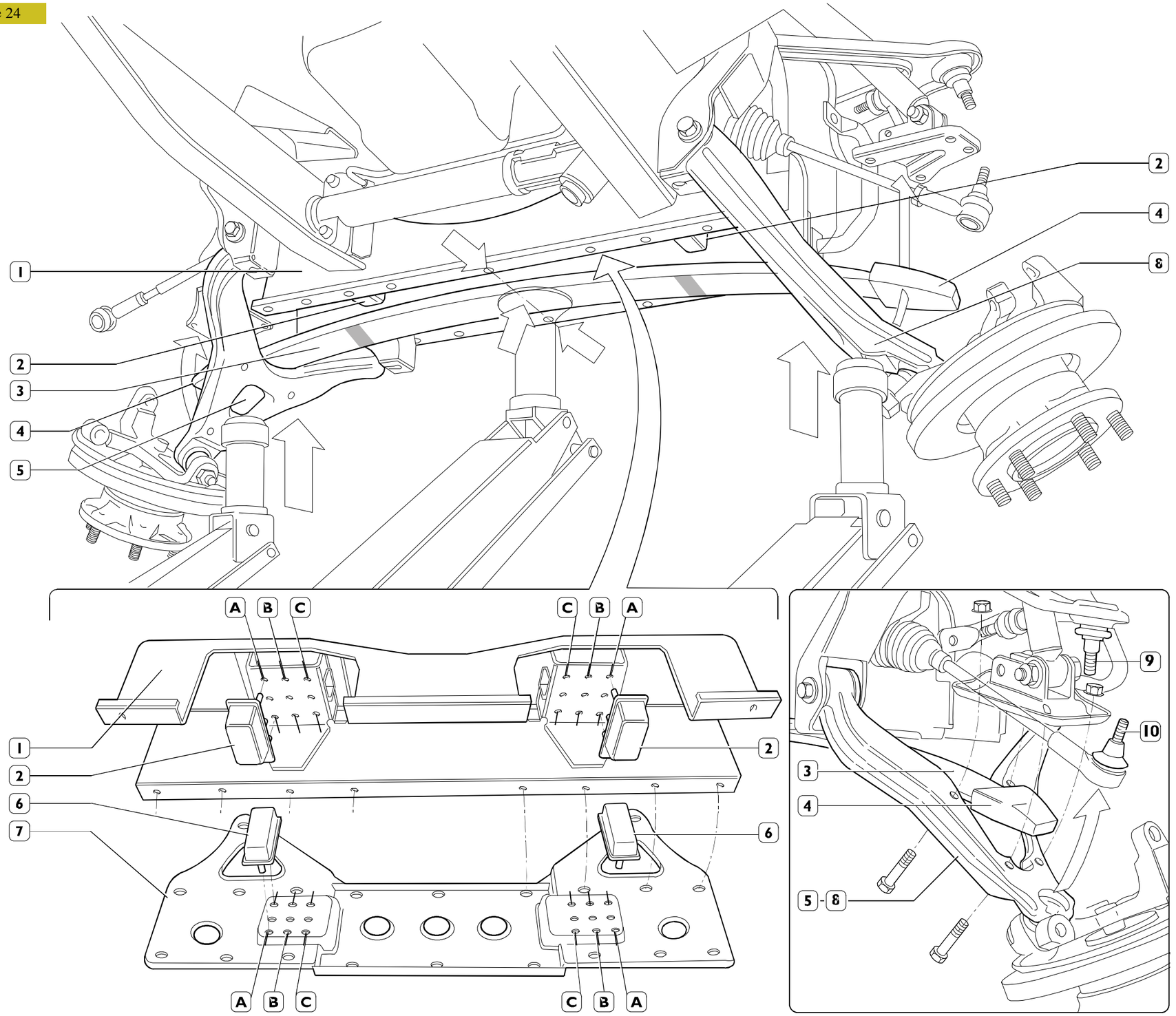
- ❑ fit the top flexible plugs (2) in the cross member (1) at the position found during disassembly;
- ❑ fit the flexible plugs (4) onto the ends of the new leaf spring (3);
- ❑ fit the leaf spring (3) into the cross member and support it with a hydraulic lift;
- ❑ with two lifts arranged under the stub axles, lift them together, checking that the flexible plugs (4) of the leaf spring (3) get correctly positioned in the honeycomb of the bottom suspension arms (5 and 8) and the centre line (⇒) of the leaf spring is aligned with the central holes (⇒) della traversa (1), of the cross member (1), max. error ±2 mm;
- ❑ then complete refitting by tightening the screws or nuts to the required torque;
- ❑ position the bottom flexible plugs (6) on the cover (7) at the position found during disassembly;
- ❑ mount the cover (7) and tighten the screws and nuts to the required torque.

The nylon self-locking nuts must be replaced with new ones every time they are taken down.

NOTE To block rotation of the pins of the swivel heads (9 - 10), insert a suitable Allen wrench into the hexagon sunk in it.

For axle 5817 tighten the nut (24) (Figure 23) fixing the link rod to a torque of 44 ± 9 Nm.

Figure 24



61663

TORSION BAR SUSPENSION
(Axle 5819 - vehicles 35C - 40C - 45C - 50C)

Description

The torsion bar suspension is composed of:

- ❑ two bottom suspension arms.
- ❑ two top suspension arms;
- ❑ two longitudinal torsion bars;
- ❑ two hydraulic shock absorbers;
- ❑ two bottom reaction tie rods;
- ❑ two top reaction tie rods;
- ❑ a stabilizer bar;
- ❑ two rubber pads.

The longitudinal torsion bars are anchored at the front to the top suspension arms and at the rear to a mounting secured to the chassis frame.

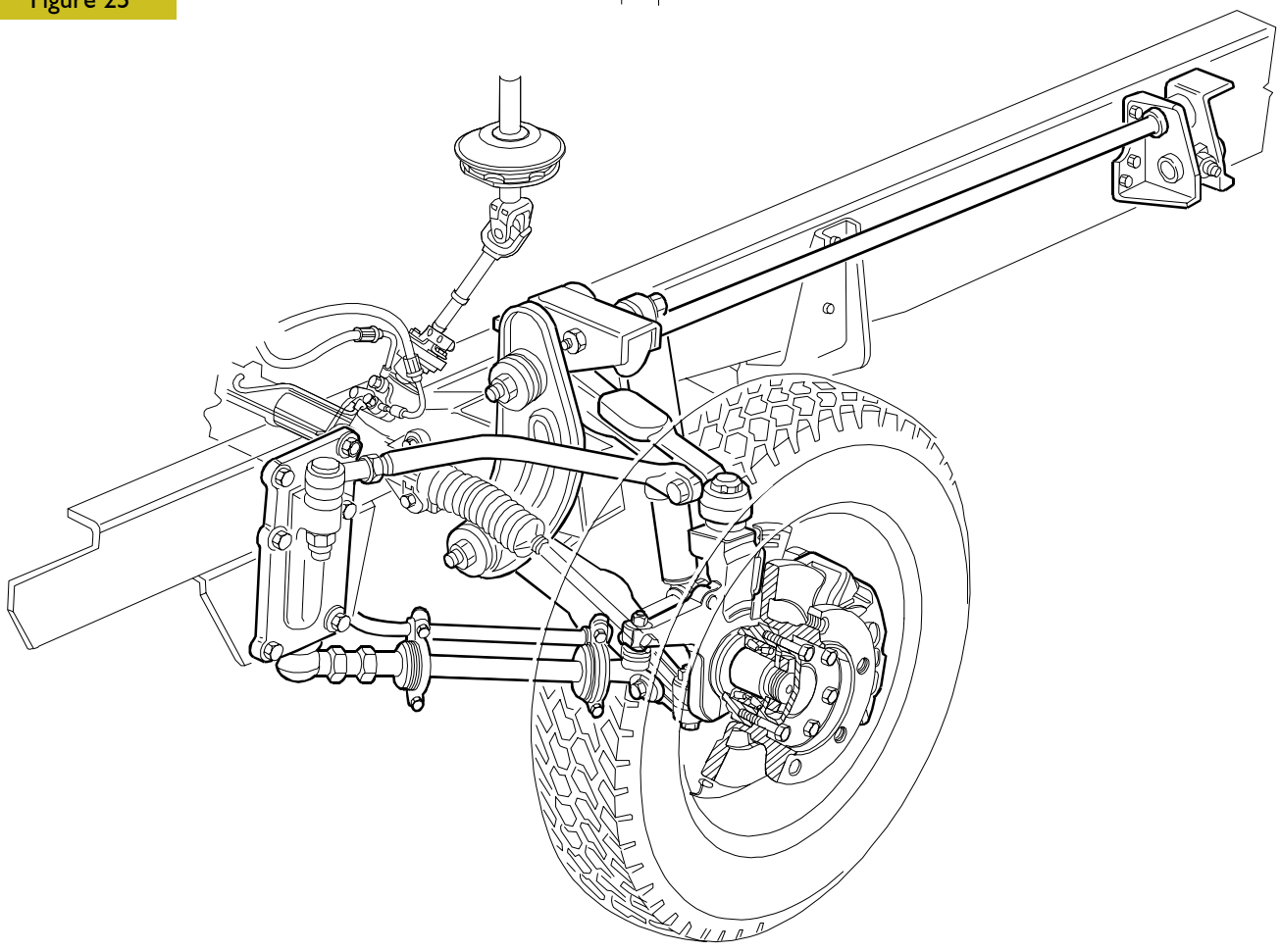
The hydraulic shock absorbers are the double-acting telescopic type.

The side tie rods are mounted at the front to the chassis frame mounting by means of adjustable link pins, and at the rear to the transverse levers.

The purpose of the stabilizer bar, mounted on the bottom reaction screw stays, is to maintain the parallelism between the axis of the wheels and the chassis frame, cancelling any load unbalance on the wheels mounted on the same axle.

The purpose of the rubber pads fixed on the top mounting of the shock absorbers is to limit the upward movement of the suspension.

Figure 25



ASSEMBLY DRAWING OF FRONT TORSION BAR SUSPENSION

SPECIFICATIONS AND DATA

Torsion bar suspension with independent wheels, stabilizer bar and hydraulic shock absorbers		Models			
		35 C	40 C	45 C	50 C
Torsion bar diameter	mm	29			
Top tie rod adjustment distance		378 ± 0.15 mm 220.4 ± 0.15 mm			
Bottom tie rod adjustment distance		364.5 ± 0.15 mm 300.4 ± 0.15 mm			

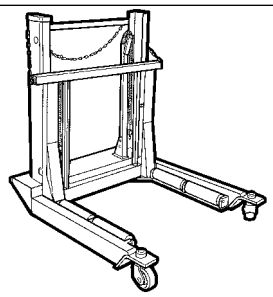
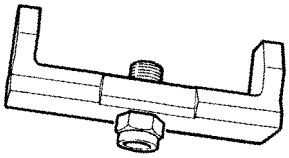
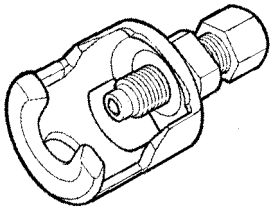
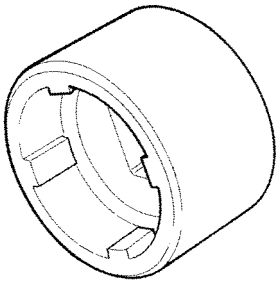
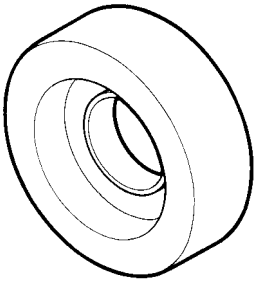
Front shock absorbers

Models:		35 C - 40 C - 45 C - 50 C	
		Mannesmann - Sachs	Arvin Meritor
	Distance between centre of eyes:		
	Open mm	430 ± 3	444 ± 3 mm
	Closed mm	280 ± 3	286 ± 3 mm
	Stroke mm	150	158 mm

Stabilizer bar diameter

Models:		35 C - 40 C - 45 C - 50 C	
Stabilizer bar diameter	mm	16	20

TOOLS

TOOL NO.		DESCRIPTION
99321024		Hydraulic trolley for wheel removal - refitting
99347060		Extractor to take out tie rod link pins
99347074		Extractor to take out steering tie rod link pins and suspension arms
99357144		Wrench for ring nut securing link pins
99374241		Tool for disassembling and reassembling front suspension flexible bushings