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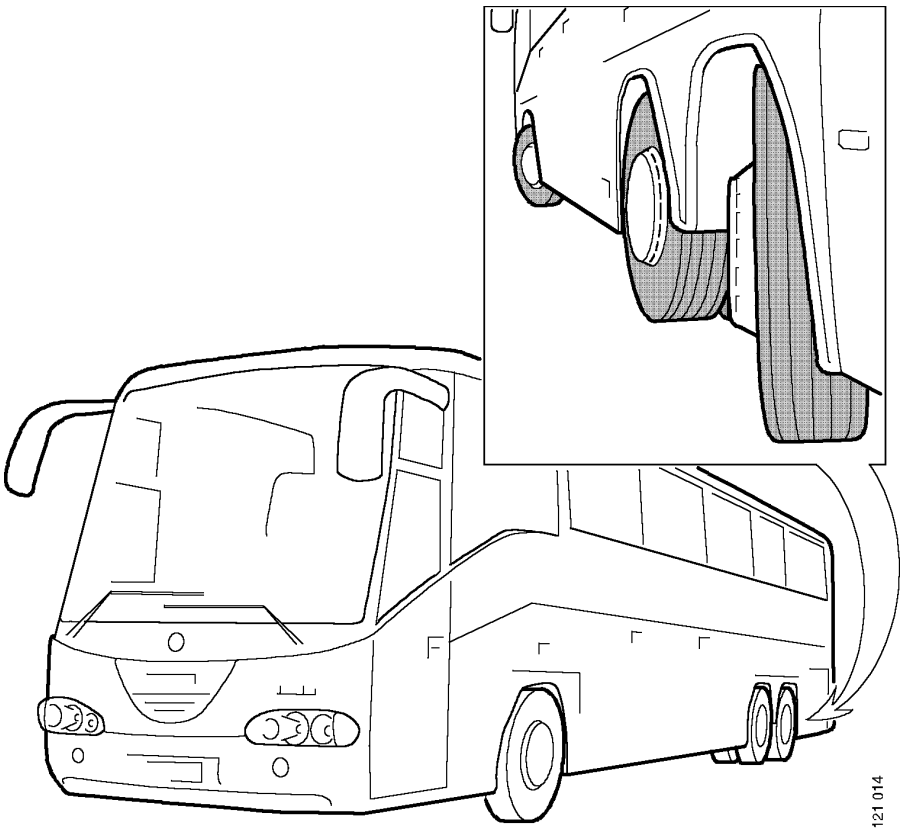
Issue 2 **en**

ARA860 steered tag axle behind driving axle

Function Description



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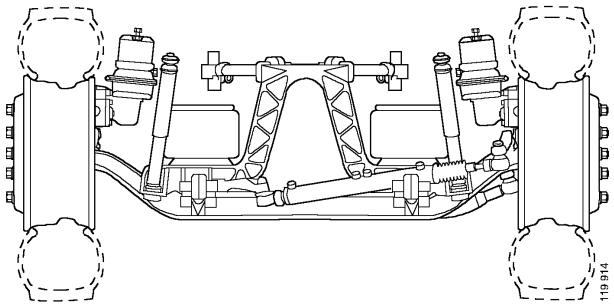
Function Description

General

ARA860 is a hydraulically steered tag axle, behind the driving axle. The tag axle hydraulic system is completely separated from the regular control system and pressurised up to approximately 14 bar. The axle is a modified AMA860. The tag axle control system consists of master cylinder, centering cylinder, pressure accumulator, pressure monitor, flow monitor, directional valve and a warning lamp. The power steering pump has a higher flow capacity than on buses with front-axle steering only.



ARA860

Buses with a rigid front axle (chassis classes UB and IB):

The master cylinder is located on the power steering gear and directly connected to the droparm. The centering cylinder is installed on the tag axle and actuates its droparm.

Buses with independent front wheel suspension (chassis-class EB):

The master cylinder is located on the opposite side of the power steering gear and connected to an intermediate droparm. The centering cylinder is installed on the tag axle and actuates its droparm.

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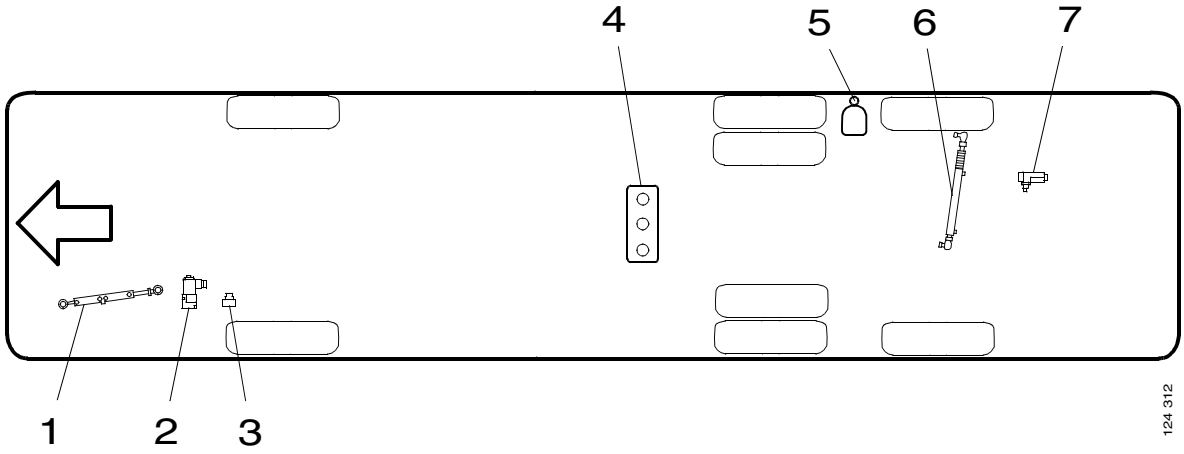
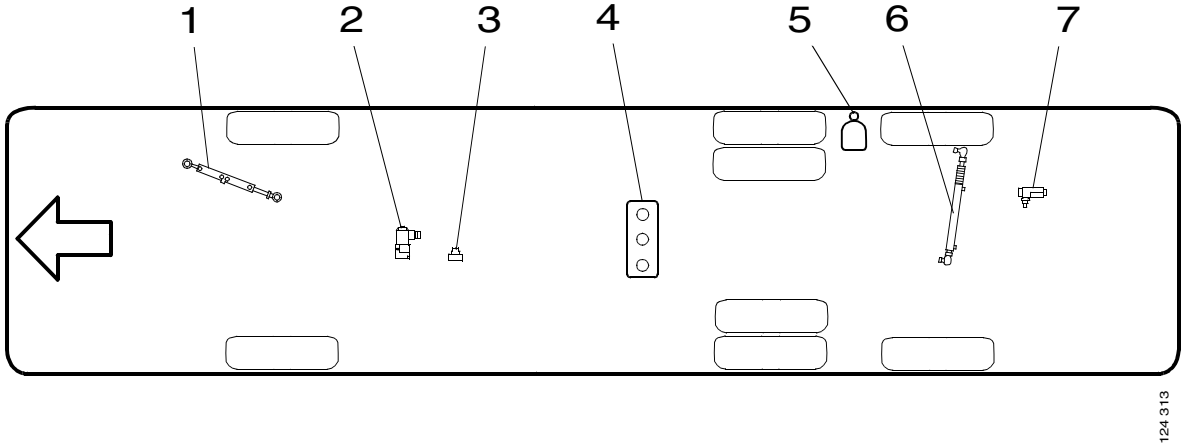
Components

Location of components

Bus with rigid front axle, chassis-classes UB and IB



Bus with independent front wheel suspension, chassis-class EB



Outline diagram, LHD bus

1 *Master cylinder*
2 *Directional valve V561*
3 *Pressure monitor T588*
4 *Filling connections*
5 *Pressure accumulator*
6 *Centering cylinder*
7 *Flow monitor T589*

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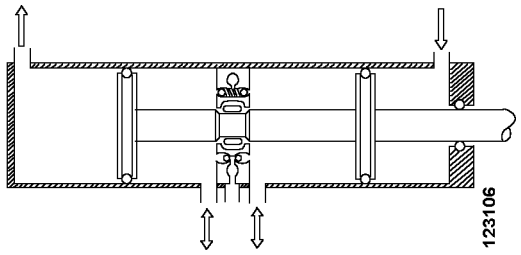
Master cylinder

The master cylinder has four chambers. Two of the chambers are connected to the power steering gear and are pressurised when the power steering gear is actuated by the steering wheel. The other two chambers are connected to two chambers in the centering cylinder and hydraulically transmit the steering forces to the wheels of the tag axle. The tag axle steering angle is not affected during the first 5 degrees of wheel lock angle on the front wheels in order to retain good directional stability.



Master cylinder

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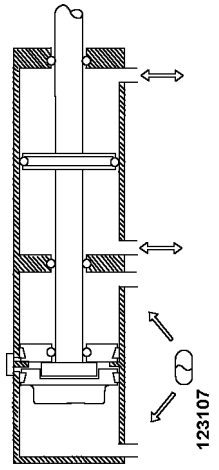
Centering cylinder

The centering cylinder has a steering section with two chambers and one centering section. When hydraulic oil from the master cylinder pressurises one of the steering section chambers, the piston rod is actuated and transmits the force to the droparm. When the steering changes direction, the other chamber is pressurised and the piston rod is pushed in the other direction. When the steering angle of the front wheels is less than 5 degrees, the two steering chambers are connected via a function in the master cylinder. In this position the centering section of the centering cylinder will be active. The centering section contains two pistons, one of which is fixed to the piston rod while the other piston is free. There is also a firmly fixed partition in the centering cylinder. The 14 bar system pressure acts on these pistons so that they are positioned against the fixed partition and in this way hold the wheels in the straight-ahead position. The pressure accumulator absorbs pressure surges in the system and retains the pressure in the system that makes the wheels of the tag axle tend towards the straight-ahead position when the steering wheel returns to centre.

If the hydraulic pressure in the system is too low, a pressure monitor will illuminate the warning lamp in the instrument panel.



Centering cylinder

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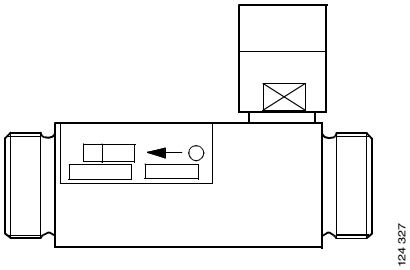
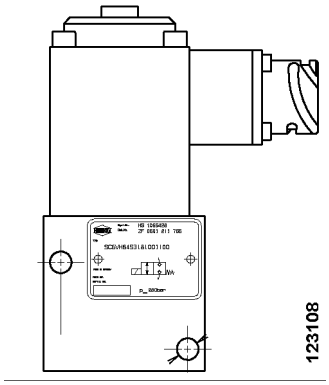
Flow monitor T589

In standard systems, the steering system includes a flow monitor which controls the directional valve. If the flow in the steering system is below 5 litres/minute, the flow monitor electrically operates the directional valve, and at the same time the warning lamp in the instrument panel illuminates.



Directional valve V561

There is a directional valve in the hydraulic system between the master cylinder and centering cylinder which is normally closed. The directional valve is actuated by the flow monitor. When the directional valve is open, the two steering chambers of the centering cylinder are connected.



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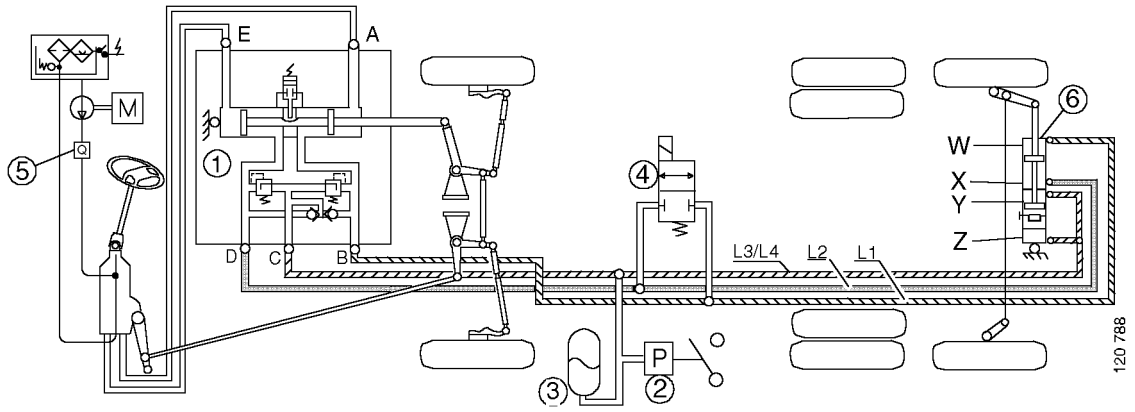
Outline diagram

Straight-ahead position



LHD bus

1 *Master cylinder*
2 *Pressure monitor*
3 *Pressure accumulator*
4 *Directional valve*
5 *Flow monitor*
6 *Centering cylinder*

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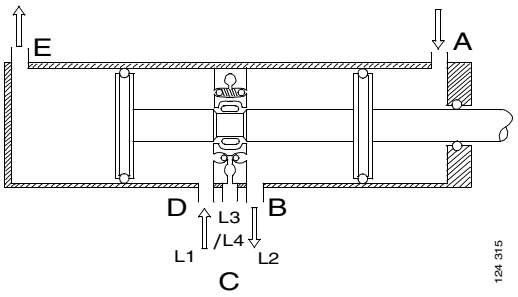
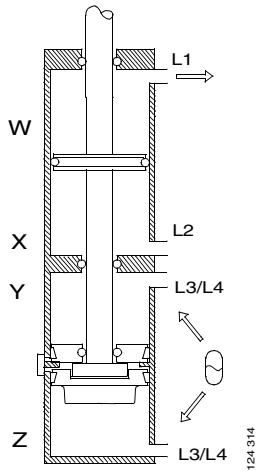
Chambers B and D of the master cylinder are interconnected when the wheels are in the straight-ahead position. The straight-ahead position is when the front wheel lock angle is less than 5 degrees. The two chambers Z and Y in the centering cylinder are pressurised by the pressure accumulator, which holds the wheels of the tag axle in the straight-ahead position.



Master cylinder chambers B and D are interconnected when the wheels are in the straight-ahead position.



Centering cylinder

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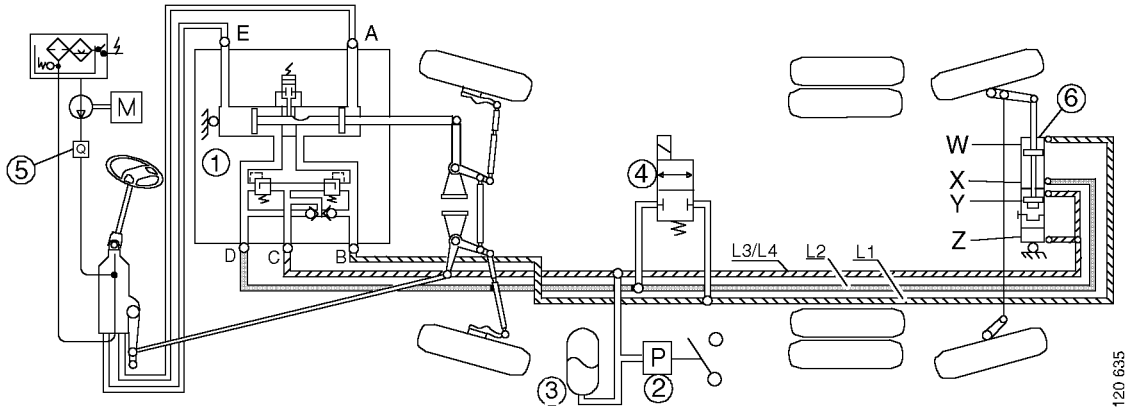
Right-hand turn



LHD bus

1 *Master cylinder*
2 *Pressure monitor*
3 *Pressure accumulator*
4 *Directional valve*
5 *Flow monitor*
6 *Centering cylinder*

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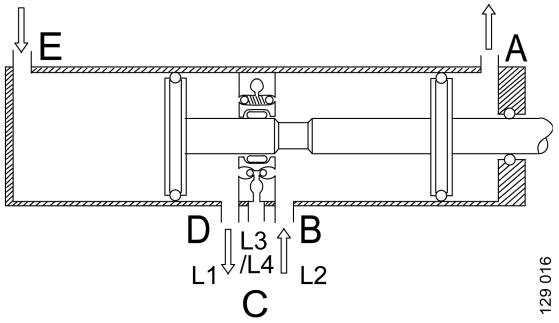
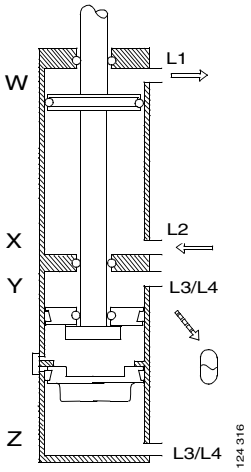
Chamber E in the master cylinder is pressurised by the power steering gear during a right hand turn and helps to move the piston so that chamber D is pressurised.

Hydraulic oil from chamber D is pressed into chamber X via pressure pipe L2 if the wheel lock angle is greater than 5 degrees.

The piston in the centering cylinder moves so that the wheels of the tag axle steer in the opposite direction.



Master cylinder



Centering cylinder

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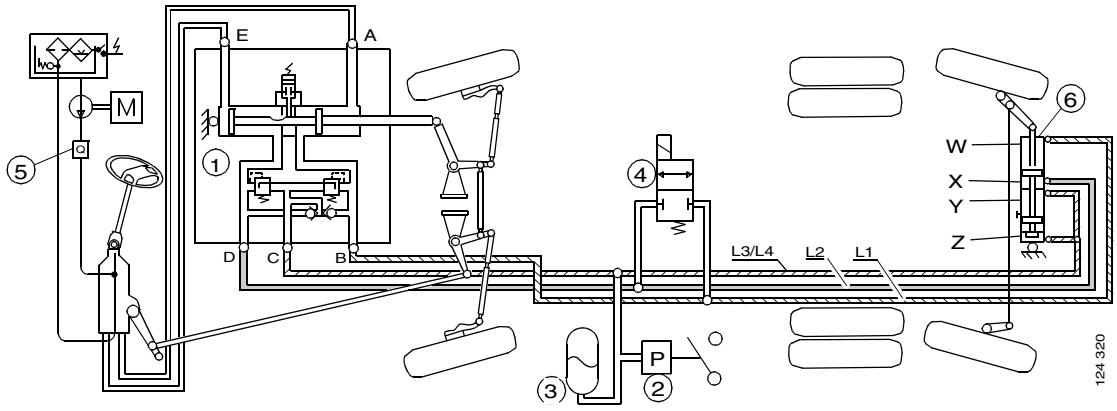
Left-hand turn



LHD bus

1 *Master cylinder*
2 *Pressure monitor*
3 *Pressure accumulator*
4 *Directional valve*
5 *Flow monitor*
6 *Centering cylinder*

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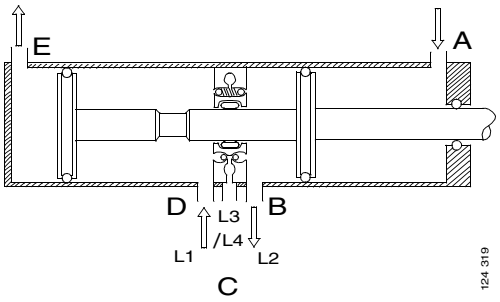
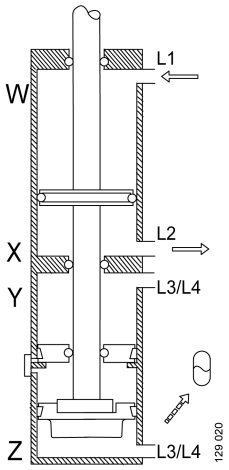
Chamber A in the master cylinder is pressurised by the power steering gear during a left hand turn and helps to move the piston so that chamber B is pressurised.

Hydraulic oil from chamber B is pressed into chamber W via pressure pipe L1 if the wheel lock angle is greater than 5 degrees.

The piston in the centering cylinder moves so that the wheels of the tag axle steer in the opposite direction.



Master cylinder



Centering cylinder

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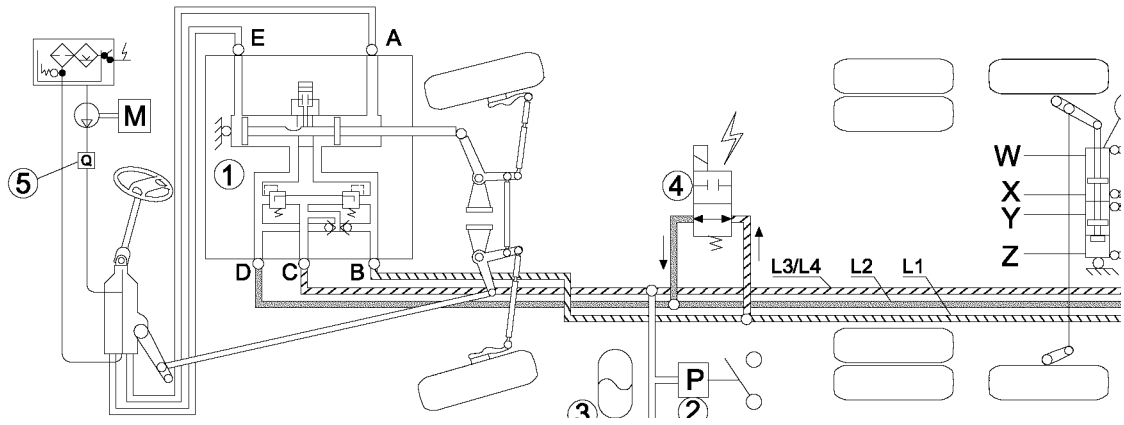
External forces acting on the steering

If an external force affects the wheels, the system pressure will rise until a safety valve in the master cylinder opens and allows the wheels to deflect. As soon as the vehicle is driven forward and the front wheels are in the straight-ahead position, (i.e. less than 5 degrees), the centering cylinder returns to its centre position if no external steering force remains.

Loss of flow from the power steering pump

Where there is a loss of flow from the power steering pump, both steering chambers of the centering cylinder are connected via the directional valve. No steering force is then transmitted to the tag axle. The tag axle now also steers to some extent and always tends towards the straight-ahead position.



1 *Master cylinder*
2 *Pressure monitor*
3 *Pressure accumulator*
4 *Directional valve*
5 *Flow monitor*
6 *Centering cylinder*

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Safety system

Electrical connection

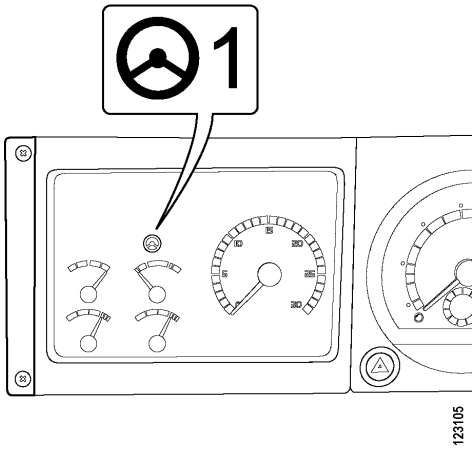
The safety system wiring diagram for tag axle ARA860 is in the Workshop Manual main group 16.

ARA860 has a system to ensure that the bus can be steered even if there is a loss of flow from the power steering pump. The system comprises a warning lamp, a directional valve, a flow monitor, a pressure monitor, a speed monitor, and four relays

The warning lamp in the safety system always comes on when the starter key is turned to the drive position and remains on until the flow in the power steering servo is normal.

The warning lamp also comes on when the following faults occur:

- Low oil pressure in tag axle hydraulic system.
- Low flow from power steering pump.
- Fuse 14 is defective.
- Fuse 18 is defective.



Safety system warning lamp

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Low oil pressure in tag axle hydraulic system

When the oil pressure in the tag axle hydraulic system is low, pressure monitor T588 closes to earth and warning lamp 0500 comes on.

Low flow from power steering pump

Directional valve V561 is activated when flow monitor T589 closes. Voltage is supplied to the directional valve via R590 (30-87) which is powered from fuse 14. The pull-in winding in R590 (85-86) is supplied with voltage from fuse 18. For R590 to be activated, T589 must close and earth the pull-in winding of R590. When T589 closes, the warning lamp comes on as well.

Fuses

If a fuse in the system blows, the warning lamp on the instrument panel comes on.

- **Fuse 14 from battery, permanent supply (pin 30)**

  If fuse 14 is faulty, R593 will not be activated. The warning lamp in 0500 lights up, being earthed via R593 (30-87a).

- **Fuse 18, ignition-on supply (pin 15)**

  If fuse 18 is faulty, R595 will not be activated. Warning lamp 0500 light up because it is earthed via R593 (30-87) and via R595 (85-86) to earth.

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Loss of power supply

The system control is normally powered by the ignition-on supply (pin 15), but if this is lost and the speed is over 5 km/h, it is driven by the permanent supply (pin 30).

Before a speed of 5 km/h is reached

No disconnection of the tag axle hydraulic function.

If the ignition-on supply (pin 15) fails and the speed is less than 5 km/h, the directional valve remains closed. If either the ignition-on (pin 15) supply or the permanent (pin 30) supply fails, the warning lamp light up.

When the speed exceeds 5 km/h for the first time

Once the speed exceeds 5 km/h, the system is powered via E597 until the permanent supply (pin 30) is interrupted.

As a result of the speed signal to E597, there is battery voltage up to R595 which is now not activated and the supply is via 87a-30. R594 will be activated and create an internal holding circuit, providing battery voltage right up to the pull-in winding on R590. R594 is activated until the battery voltage (pin 30) disappears.

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