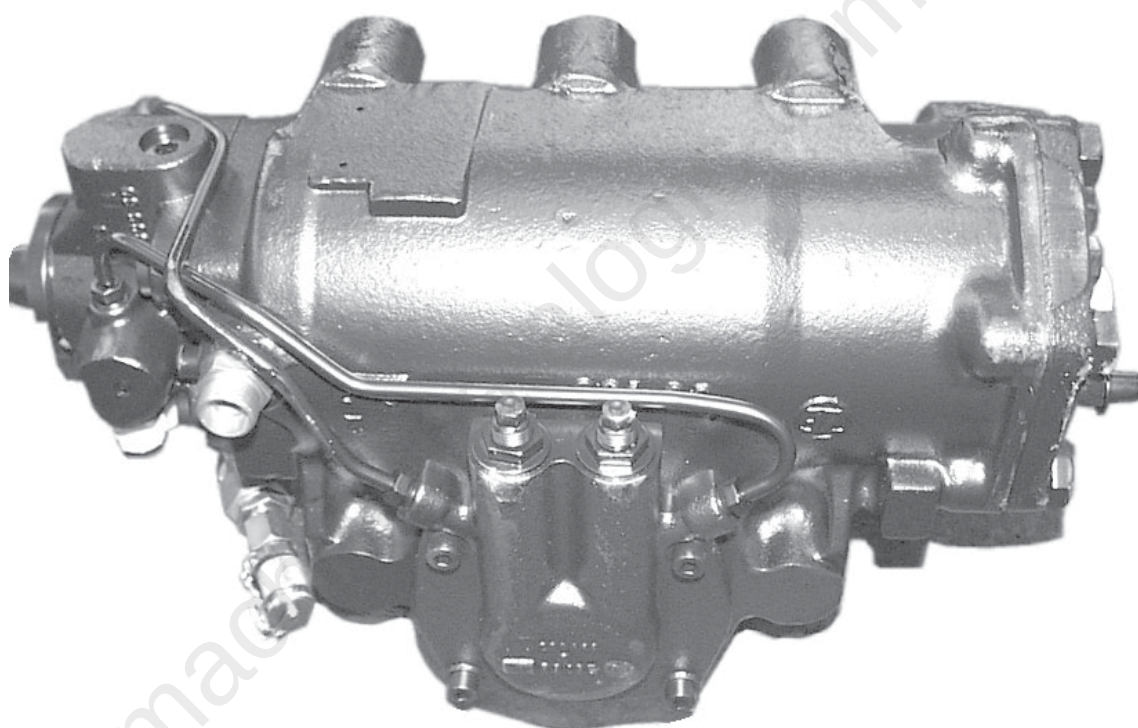


Service - Manual

ZF-Servocom

Type 8090 - 8099



890510608



Index

For systems with 3 pumps (**Figs 2, 4, 6 and 10**):

The lower valve controls steering circuit I with its engine-driven pump and an additional ground-driven pump (emergency steering pump).

This steering circuit feeds the fully integral steering gear as well as a separate power cylinder.

The upper valve is assigned to steering circuit II with a further engine-driven pump and a second power cylinder.

Normal driving operation is mostly handled by steering circuit I, while little power only is provided by steering circuit II.

It is only if the steering wheel is turned further, e.g. during parking, that steering circuit II is fully activated due to the complete closing of return slots L and M, respectively.

At engine standstill, the two engine-driven pumps (Q and R) of steering circuits I and II will stop working.

Power assistance is maintained by the switching-on of the emergency steering pump which continues to be driven by the rolling motion of the vehicle.

Adjustable steering limiter valves in the housing and/or the piston enable the hydraulic limitation of the respective steering circuits prior to reaching the end stops.

The following units/components can be installed outside the steering gear:

Flow indicators (U or a), which will inform the driver by the lighting of a signal lamp that a pump does not deliver any oil.

A **controlled dual circuit pressure relief valve** (V) in the pressure line of steering circuit II restricting the hydraulic power in the dual power cylinder (H) to that of a single circuit steering gear if, in the manoeuvring range, an additional thrust coming from the ground-driven pump (S) is acting upon the power cylinder and/or the mechanical power transmission elements.

A pressure relief valve (W) possibly intended for integration to the valve housing of this steering circuit can, thus, be omitted and is replaced by a replenishing valve (X).

3 For steering circuit II

In the event of a failure of steering circuit I, steering circuit II which previously and according to configuration only provided a restricted power assistance or no assistance at all is activated. By an additional turning motion at the steering wheel causing the valve rotor to be displaced further, the return slots L and M respectively in the upper steering valve, Circuit II, are closed completely. Power assistance is provided by the ground-driven pump (**Figs 1, 3, 5 and 9**) and the engine-driven pump, respectively (**Figs 2, 4, 6 and 10**). The oil flow through the valve rotor takes place in the same way as in steering circuit I (cf. description above).

The warning lamps of flow indicators (U) and (a) will light up to indicate a failure of the main pump and the emergency steering pump.

III. Function and setting of the hydraulic steering limiters

Note:

The ZF-Servocom in dual circuit version has 2 kinds of hydraulic steering limiters:

- Hydraulic steering limiter in the piston
- Hydraulic steering limiter in the cover

In steering gear versions with a hydraulic steering limitation in steering circuit I, the hydraulic steering limiter is assigned to the engine-driven pump, while the steering circuit II of these steering gear versions has no steering limiter at all.

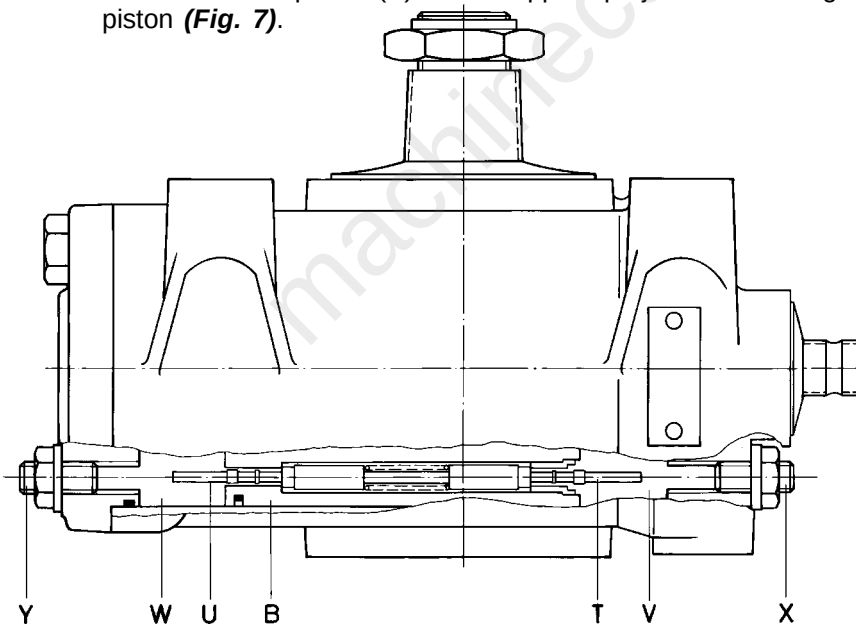
In steering gear versions having hydraulic steering limiters both in steering circuits I and II, the hydraulic steering limiter in the piston belongs to circuit I, while that in the housing cover belongs to circuit II (**Fig. 1 to 8**).

1 Functioning of the hydraulic steering limiter in the piston

Two steering limiter valves (T and U) with spring-loaded valve spools are arranged in longitudinal direction in the piston (B). Their tappets project over the right-hand and left-hand front faces of the piston (**Fig. 7**).

Fig. 7 Both steering limiter valves closed

- T RH steering limiter valve
- U LH steering limiter valve
- V RH cylinder chamber
- W LH cylinder chamber
- X RH adjusting screw
- Y LH adjusting screw



If the piston is moved to the right or to the left towards the lock stop, the valve tappets are actuated by the adjusting screws (X and Y) fastened in the housing and in the cylinder cover. Both steering limiter valves remain closed until one of the tappets hits against an adjusting screw.

If for instance the piston is displaced to the right (**Fig. 8**), the right-hand steering limiter valve (T) is actuated by the adjusting screw (X) before the piston end position is reached. At the same time, the valve spool (U) is displaced by the pressure oil so that the oil can flow away from power cylinder chamber (W) to cylinder chamber (V) and from there to the return line. If the piston is displaced to the left, the sequence as described above will take place by analogy.

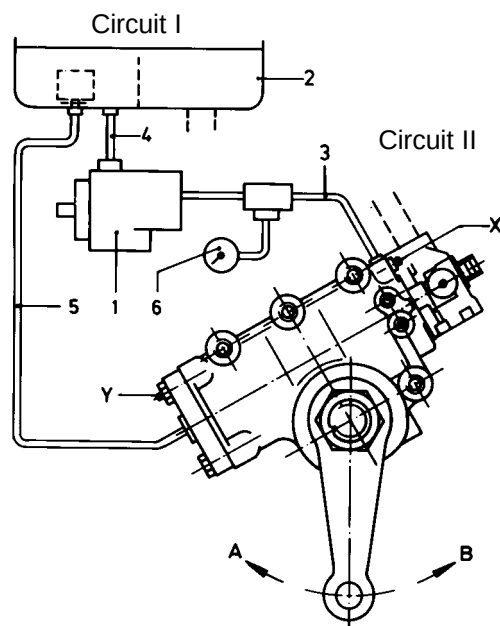


Fig.11: Steering limiters in the piston

X Adjusting screw of hydraulic steering limiter for drop arm travel in direction A

Y Adjusting screw of hydraulic steering limiter for drop arm travel in direction B

- | | |
|-----------------|------------------|
| 1 Pump | 4 Suction line |
| 2 Oil tank | 5 Return line |
| 3 Pressure line | 6 Pressure gauge |

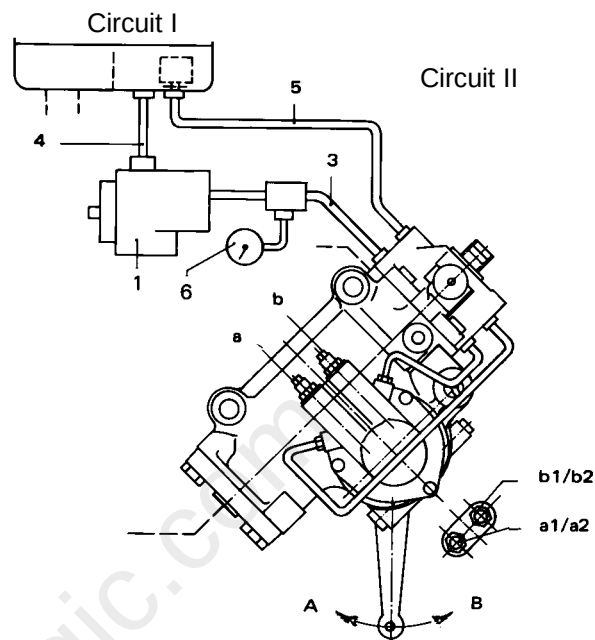
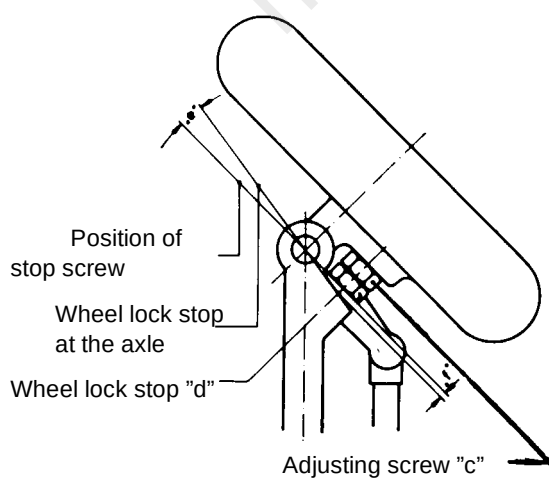


Fig.12: Steering limiter in the cover

a Adjusting screw of hydraulic steering limiter for drop arm travel in direction A

b Adjusting screw of hydraulic steering limiter for drop arm travel in direction B



In **Fig. 13**, dimension "f" shows the distance that should exist between the wheel lock stop components at the moment the hydraulic steering limiter reacts, if the vehicle manufacturer specifies a distance dimension.

- until date of manufacture 12/93

Kind of use	1st. Inspection on the vehicle	2nd Inspection on the vehicle	3rd Inspection
- Long-distance vehicles	100 000 km 60 000 miles	200 000 km 120 000 miles	300 000 km 180 000 miles
- Vehicles in long and- short distance use	100 000 km 60 000 miles	175 000 km 105 000 miles	250 000 km 150 000 miles
- Construction site vehicles and vehicles in off-road use	80 000 km 50 000 miles 2 500 op.-hrs	150 000 km 90 000 miles 4 500 op.-hrs.	200 000 km 120 000 miles 6 000 op.-hrs.



Attention:

For the sake of increased traffic safety, we recommend to dismantle the steering gear and the pump at the 3rd inspection, to check the mechanical parts (visual inspection of all parts and crack inspection of parts subjected to high loads) and to fit new sealing components. This work should be carried out by a ZF-Service-Station.

- starting from date of manufacture 1/94

Kind of use	1st Inspection on the vehicle	further inspections on the vehicle
- Construction site vehicles - Vehicles in short-distance use - Vehicles with extreme loads	200 000 km 6 000 op.-hrs or at latest 5 years from first use	every 200 000 km 6 000 op.-hrs or at latest 5 years from first use
- Long-distance vehicles - Buses	500 000 km	after a further 250 000 km, ea.

Checking the valve:

Remove the pressure relief and flow limiting valve from the ZF oil pump. Check the valve spool and the bore in the valve housing for visible wear. The bores in the valve spool must not be clogged. The spool must be easily movable in the bore and must not get caught. If necessary, install a new valve.

If after this check the maximum pressure of the pump is still too low, examine the inner parts of the pump for wear. If there is wear, replace the pump.

b) For steering systems with pressure relief valve **rearward of** the tester:



Attention:

If the tester is installed in accordance with description b), make absolutely sure that during the entire period of pressure testing the engine is run at idling speed only. An increase in engine speed would entail an immediate and sharp rise in oil pressure, which could cause the pressure line to become defective or the pump to seize.

At engine idling speed, and while watching the pressure gauge, slowly close the shut-off valve of the tester until the maximum pressure indicated is attained.

Do not continue to close the valve then (admit maximum pressure for a short time only – 5 seconds maximum – to avoid a heating up of the pump inner parts and, in consequence, a premature wear of these parts).

Have the shut-off valve return to its initial position. If nominal pressure is not achieved during this measuring (permissible deviation –10%), examine the flow limiting valve for proper functioning and, if necessary, put the valve in order again.

Checking the valve:

Remove the flow limiting valve from the ZF oil pump. Check the valve spool and the bore in the valve housing for visible wear. The bore in the valve spool must not be clogged. The spool must be easily movable in the bore and must not get caught. If necessary, install a new valve.

If after this check the maximum pressure of the pump is still too low, examine the inner parts of the pump for wear. If there is wear, replace the pump.

7.3 Checking the ZF pump for correct flow rate, using the Servotest 550 power steering tester:

Note:

Specified values for flow rate, test pressure and test speed, as well as designations and operation of the power steering tester: please refer to the separate operating instructions for Servotest 550.

At engine idling speed, progressively close the shut-off valve until the test pressure specified for the pump type in question is attained, and read the flow rate value.

- 4.. Close all oil lines with plugs to avoid contamination.
5. Please check the marking of the sector shaft and of the drop arm for alignment.

Note:

If the markings are not in line with each other ask the vehicle manufacturer for possible differing assembly instructions, before performing the assembly.

6. Pull off steering arm using tool [6].



Attention:

Under no circumstances should the steering arm be removed by heating or by driving in a wedge between the neck of the housing and the steering arm or by hammering, as this causes damage within the steering gear and material changes to the steering arm.

Do not turn steering systems with automatically adjustable hydraulic steering limiters into limit positions when the steering linkage has been removed – see Section II Para. 1.5. If necessary, fit new sliding sleeve assemblies (20 or 128).

- 7 Disconnect universal joint or flexible coupling between steering gear and steering column or separately installed angle gear. Do not hit the steering shaft axially when dismantling the steering wheel.
8. Remove fastening screws on housing and extract steering system.

IX. Fitting the steering gear to the vehicle

Note:

To guarantee a safe functioning of the steering system as a whole, make sure that there is maximum cleanliness when the units pertaining to the steering system are installed and when the lines are laid. To avoid malfunctions caused by foreign bodies or impurities in the oil circuit of the steering gear, the plugs in the ports of the steering gear, the pump, the power cylinder, the valves etc. should be removed at the moment the lines are connected, only. Connecting lines and screwed connections must be thoroughly cleaned and deburred.

- 1 Remove dirt and paint from the locating surfaces of the bracket and steering gear mounting bosses.
- 2 Put the steering gear into the bracket and screw in the mounting screws. Tighten the screws to the specified tightening torque.



Attention:

By all means, avoid any twisting that may be caused in the steering gear/bracket assembly when you are fastening the jacket tube and the steering input shaft to the splashboard or the dashboard, in particular if the system is equipped with a separate bevel box with flanged-on jacket tube. Twistings can generate bending torques in particular in the steering input shaft which, depending on their amount and frequency, may even entail fatigue failures or affect the clearance of the steering gear, respectively.

- 3 Check as follows whether the steering gear has been installed correctly:
 - 3.1 Check the clearance of the steering gear and the separately installed bevel box in their assembly with the bearing bracket, the drop arm and the drag link(s).

Fault	Cause	Remedy
steering wheel play	→ steering gear mounting is loose	→ tighten j
	→ ball joints are not play-free	→ replace
	→ u/j's are loose	→ tighten
	→ axle guide components are not play-free	→ check repair
	→ internal malfunction of steering gear	→ replace steering gear
Steering is self-acting	→ internal malfunction of steering gear	→ replace steering gear
oil level too low	→ oil tank cover leaking or not closed	→ repair
	→ pressure line and/or ports leaking	→ check repair
	→ steering gear and/or leaking	→ check repair
steering gear noise	→ internal malfunction of steering gear	→ replace steering gear
j	Refer to vehicle manufacturer's instructions	

Full Version Available

ZF Servocom 8096 + Servocom 8099 Steering System Service Manual

ZF Servocom 8096, Servocom 8099 steering system service manual with repair, limiter setting and troubleshooting procedures. Instant PDF download.

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