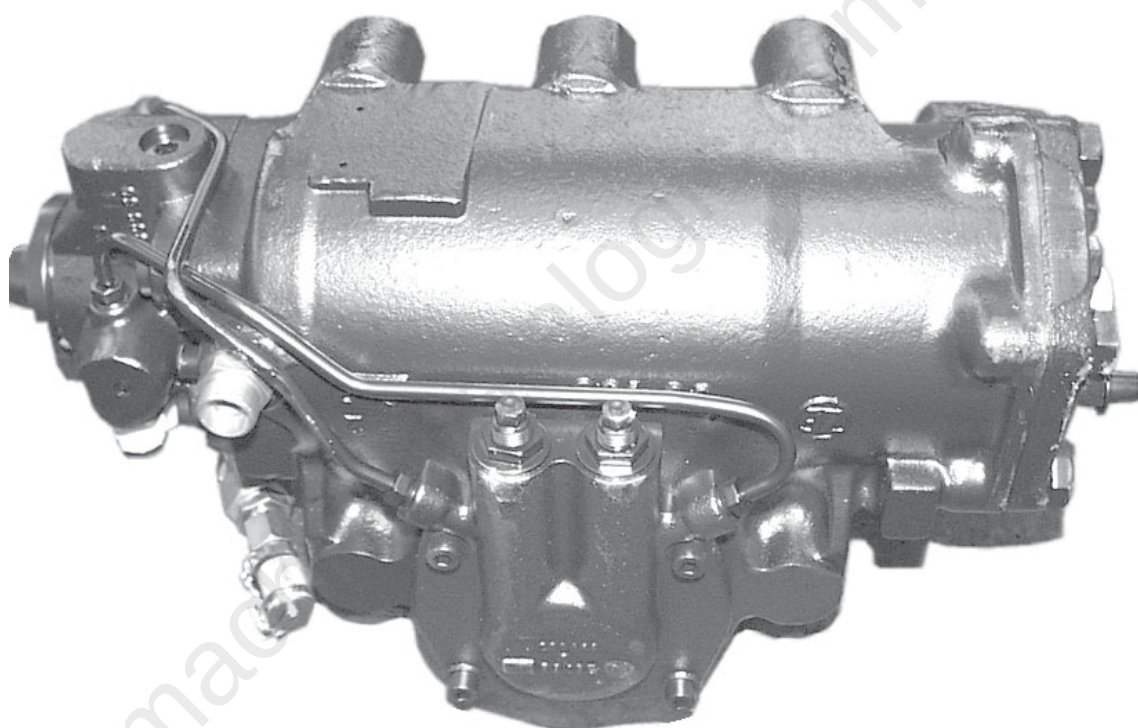


Service - Manual

ZF-Servocom

Type 8090 - 8099



890510608



Index



ZF-Servocom^R

Dual Circuit Versions

Types 8096 and 8099

**Instructions for
Operation, Maintenance and Inspection**

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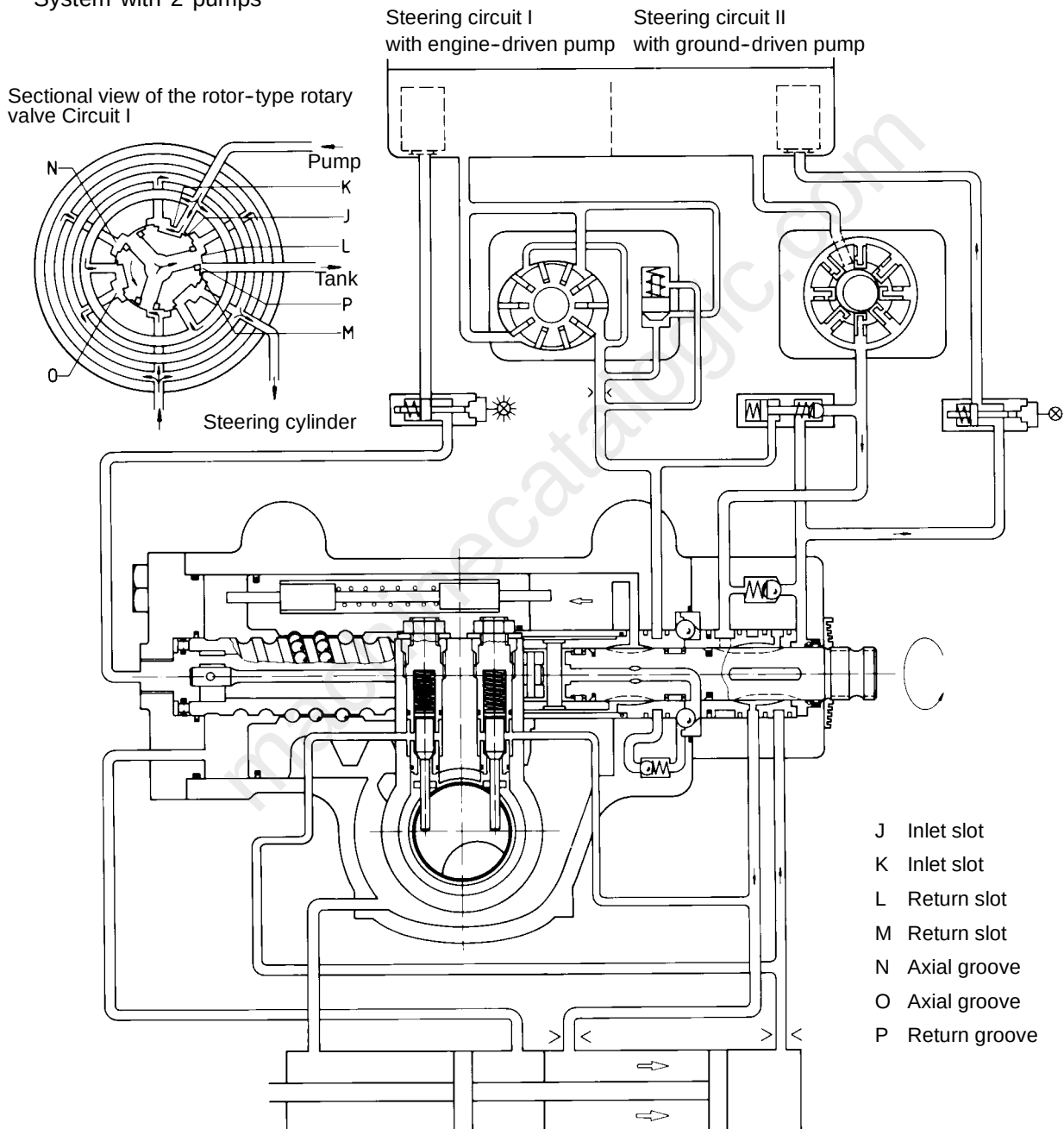
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The steering valve pertaining to steering circuit I will react somewhat earlier, thus ensuring that the major part of the steering operations is managed by the engine-driven pump. It is only during extreme cornering and during manoeuvring that steering circuit II is activated. Additional turning motion at the steering wheel makes the return slots L and M, respectively, in the steering valve of circuit II close completely. The pressure priority of steering circuit I thus enables an energy-saving operation of the dual circuit steering system.

Fig. 5

Steering valves in the operating position. Steering wheel turned counter-clockwise. Steering limiter valves closed, only the ground-driven pump (emergency steering pump) is delivering oil.

System with 2 pumps



The controlled dual circuit pressure relief valve (V) in the pressure line of steering circuit II restricts the hydraulic power in the dual power cylinder (H) to the amount of that of a single-circuit steering gear if, during manoeuvring, an additional thrust from the ground driven pump is acting upon the power cylinder and the mechanical transmission parts. At a standstill of the engine-driven pump, the controlled dual circuit pressure relief valve will remain closed (**Fig. 5**).

1 Check

In the general after sales service inspection of the vehicle concerned, all screwed connections and lines of the power steering gear, the pumps (engine- and ground-driven), the valves and the power cylinders are inspected for leakproofness. The piston rod of the power cylinder may be covered with a thin oil film but there must not be any oil drops.

If the steering gear was installed subsequently, the workshop that fitted it to the vehicle should carry out the above inspection after a mileage of 1,000 km or after 25 operating hours.

2 Oil grade

A suitable hydraulic oil must be used to ensure the perfect functioning of the steering gear and the pump. As the hydraulic oil also serves to lubricate the steering gear and the pump, only one oil is required for the whole steering system.

ATF oils having a viscosity of approx. 26 mm²/s (cSt) at 50° C, a pour point below -35 degrees and little tendency towards foaming are convenient for filling. Oils with higher viscosities may cause too high a depression in the suction line and, in consequence, pump noise. Some oil grades we can recommend for use with our steering gears are listed in our Chart of Lubricants, Sheet TE-ML 09.

3 Oil quantity

The power steering gear is supplied ex works without oil filling. The oil quantity required for the steering gear, without lines, oil tank and pump, is approx. 1.7 dm³.

4 Oil change

Note:

We recommend to change the oil when the steering gear or the pump, or both, are repaired or replaced. On such an occasion also the filters in the oil tank should be replaced and the lines should be cleaned. Prior to removing the cover from the oil tank, thoroughly clean the tank and its immediate surroundings to protect the oil from being soiled by impurities.

Once the oil has been drained, do not fill it in again. Avoid to mix oils.

Draining of the oil can be done as follows:

Jack up the steered axles and the drive axle pertaining to the ground-driven pump drive. Loosen the pipe lines at the bottom of the steering housing and remove the hose connections at the power cylinders. Engage a gear and have the engine run for a short time to suck the oil from the tank. During this, turn the steering wheel from lock to lock. Do not allow the engine to run for more than approx. 10 seconds (at idling speed and with the oil tank empty) in order not to cause any damage to the pump. After turning the engine off, again turn the steering wheel from lock to lock until no more oil is draining off. Attach the line connections again.

For steering gear versions without pipe connections:

Jack up the steered axle. Unscrew the pressure and return lines. Then have the engine run for a short time (10 seconds maximum) to suck the oil out of the pump and the tank. Turn the engine off and, for checking purposes, again turn the steering gear from lock to lock until no more oil drains off. A major residual quantity of oil will be left in the steering gear if the oil is drained this way. Depending on the degree of contamination of the oil (owing to wear of the inner parts of the pump, abrasion may for instance occur) it may become necessary to fully evacuate the steering gear. To this end, the steering gear has to be removed from the vehicle and opened by a ZF Service Station.

5 Replacing the filter

At the time of the main inspection ⁱ also the **filter cartridges** in the single chamber or multichamber oil tank should be replaced.

Note:

When pulling the used filter cartridges out, keep the lower bore closed to prevent soiled oil from the filter cartridge from flowing back to the tank or getting into the oil circuit. Prior to fitting a new cartridge, oil the filter carrier. If the oil tank is made of plastic material, remove the suction and return lines, remove the oil tank from the vehicle, empty and clean it and fit a new filter cartridge.

6 Oil filling and bleeding

6.1 Oil filling:

Note:

When the steering system is filled with hydraulic oil, there is a risk that impurities get into the steering gear oil circuit. To avoid malfunctions caused by foreign bodies in the system, maximum cleanliness is of paramount importance both at initial fill and when topping up with oil.

The oil for the steering gear and the pump is filled in through the filler neck of the single chamber or multichamber oil tank. For initial filling and oil change, it is convenient to remove the tank cover (this is possible for oil tanks made of sheet metal) and to fill hydraulic oil in up to the rim of the tank.

Start the engine at low speed and have it run at idling speed (if the drive axle drives the ground driven pump, jack it up and engage a gear) to fill the complete hydraulic system with oil. While the engine is running, the oil level in the tank will quickly drop.

To avoid any intake of air, the tank has, therefore, to be topped up permanently. We recommend to have two fitters carry out this work: one to start the engine and one to top up the oil sucked in by the pump.

If the engine speed was high and the suction flow strong, small air bubbles would be taken in again towards the pump and torn into tiny beads when passing through the pump. This could entail foaming and, in consequence, an excessively long bleeding process.

For steering systems fitted with radial piston pumps:

If the steering system is to be filled for the first time or refilled following repair work, fill oil into the pump port prior to mounting the suction line in order to avoid dry running in the initial running phase. Make sure that the bleeding of the suction line is done with particular care. In cases where a free oil intake of the radial piston pump is difficult, we recommend to first fill the suction line with oil.

6.2 Bleeding

When the steering system is filled with oil to an extent preventing the oil level from dropping below the upper mark of the oil dipstick, have the engine run at low speed for some time (with a gear engaged if the pump is ground-driven and with the drive axle jacked up). The major part of the air in the cylinder chambers will now escape. During this, monitor the oil level and, if it is still dropping, immediately top up with oil.

To accelerate the bleeding operation, we recommend to turn the steering wheel several times from lock to lock with the steered axle jacked up. In the extreme positions, do not pull any stronger at the steering wheel than necessary for the lock-to-lock turning operation. If necessary, again top up with oil until the oil level remains constant at the top mark of the oil dipstick and no more air bubbles are rising in the oil tank.

ⁱ Minor deviations are permissible if so requested by the vehicle manufacturer with a view to including the intervals in the vehicle maintenance routine.

1.4 Checking the play of the steering input shaft bearing in the steering column

By moving (shaking) the steering wheel sideward to and fro, check whether there is any play. If so, replace the bearing bush.

1.5 Checking the universal joint and the universal joint disc between upper steering input shaft and steering gear for angular play or stiff operation

If play (can be identified by the noticeable rattling noise occurring when the steering wheel is turned to and fro) or stiff operation are ascertained, fit a new part.

2 Checking for external leakage:

- Start the engine.
- Check whether all screwed connections and all lines of the steering system as well as the sealing rings on the steering gear and on the pump are leakproof. Re-tighten the screwed connections if necessary and replace damaged sealing rings. When fitting the new sealing rings, it is advisable to use our special tools to protect the rings.
- Check all hoses and all lines for possible traces of chafing and embrittlements. Replace damaged parts.



Attention:

When you replace hose lines or parts with visible external damages, such as for instance cracks, only use pressure-tested parts and spare parts released by the vehicle manufacturer.

- Switch the engine off.

3 Replacing the filter

Note:

Prior to removing the oil tank cover, thoroughly clean the tank and its immediate surroundings to protect the hydraulic oil from being soiled with impurities.

- Unscrew the screw plugs of the oil tank cover and remove the cover.
- Seize the used filter cartridge at the metal collar and pull it out. While doing so, keep the bore of the filter cartridge closed to prevent the soiled oil from flowing back to the oil tank.
If the oil tank is made of plastic material, remove the suction and return lines. Remove the tank from the vehicle, empty it and fit a new filter cartridge.
- Oil the filter carrier and insert the new filter cartridge with the metal collar pointing upward.

3.2 Checking the permissible bending of the steering input shaft

- Jack up the steered axle to enable an easy manual lock-to-lock turning of the steering gear.
- Take off the steering wheel and remove the ball bearing bush or the self-aligning bearing from the jacket tube of the separately built-in bevel box.
- By turning the steering input shaft through at least 360°, find out whether the steering input shaft is bent. The measuring can be carried out with the help of a dial gauge or a depth gauge. Measuring should always start from the same point on the periphery of the jacket tube. Determine the bending of the steering input shaft by dividing by 2 the radial run-out measured. The maximum permissible bending depends on the length of the jacket tube and the diameter of the steering input shaft. In this connection, please refer to graph **Fig. 21** as well as to the explanations on determining the length of the jacket tube.

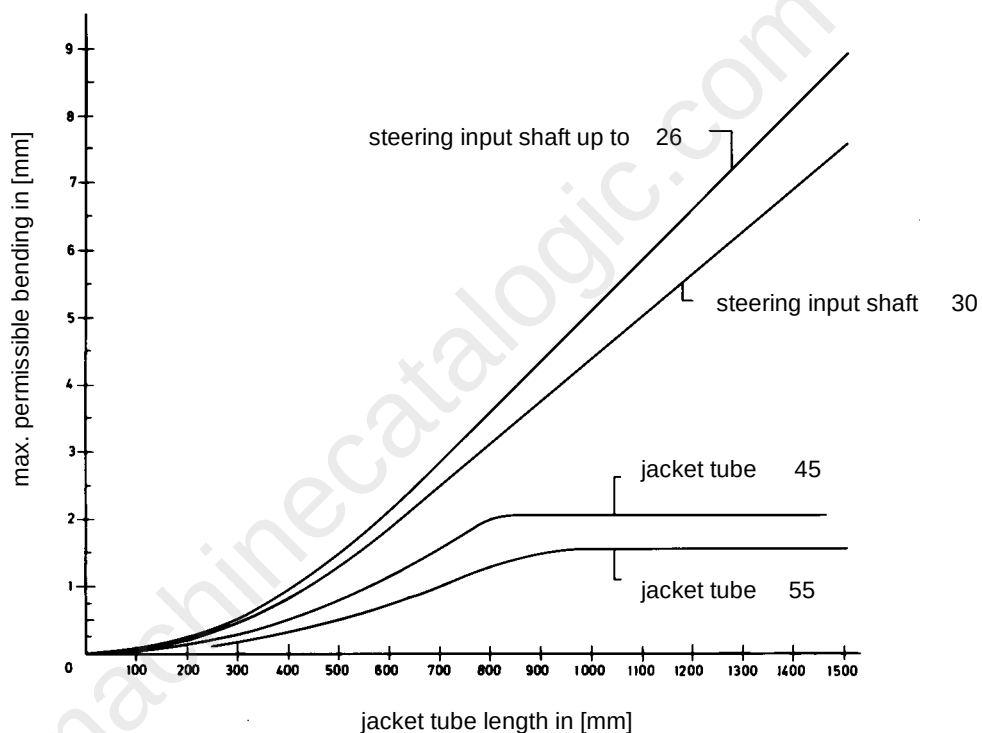


Fig. 21

3.3 Checking the permissible bending of the jacket tube

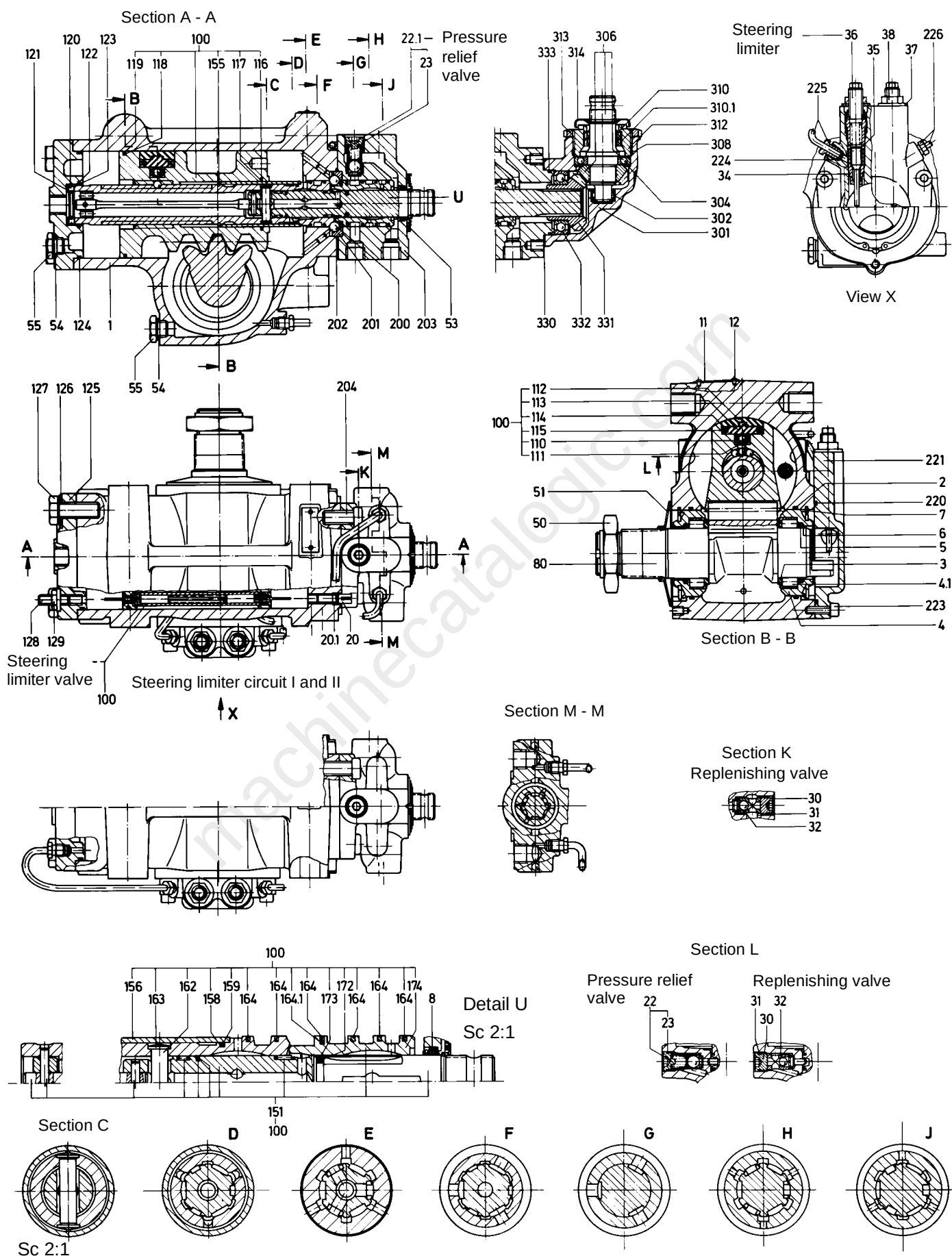
To carry out this check, provide the steering input shaft with a mark at any place on its periphery. Now continue to turn the input shaft step by step (at least 4 steps). After each step, measure the distance to the mark on the input shaft starting from the external diameter of the jacket tube and using the depth gauge. As the steering input shaft side directed towards the measuring point revolving on the jacket tube is always the same, the radial run-out of the input shaft itself is not part of the measuring. To determine the bending of the jacket tube, determine the difference between maximum and minimum dimension and divide this value by 2. The maximum permissible bending depends on the length and the diameter of the steering input shaft. In this connection, please refer to graph **Fig. 21** as well as to the explanations on determining the length of the jacket tube.



Attention:

This check is to be carried out, too, at the time of the main inspection of the steering gear, as well as on any vehicle involved in an accident having caused damages to its the front area.

Key to picture numbers, sect. drawings and exploded views



Full Version Available

ZF Servocom 8090-8099 Steering System Service Manual

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