

## **GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING**

### **1. OPERATIONAL CHECKS**

This procedure is designed so the service man can make a quick check of the steering system using a minimum amount of diagnostic equipment. If you need additional information, refer to structure and function in group 1.

A location will be required which is level and has adequate space to complete the checks.

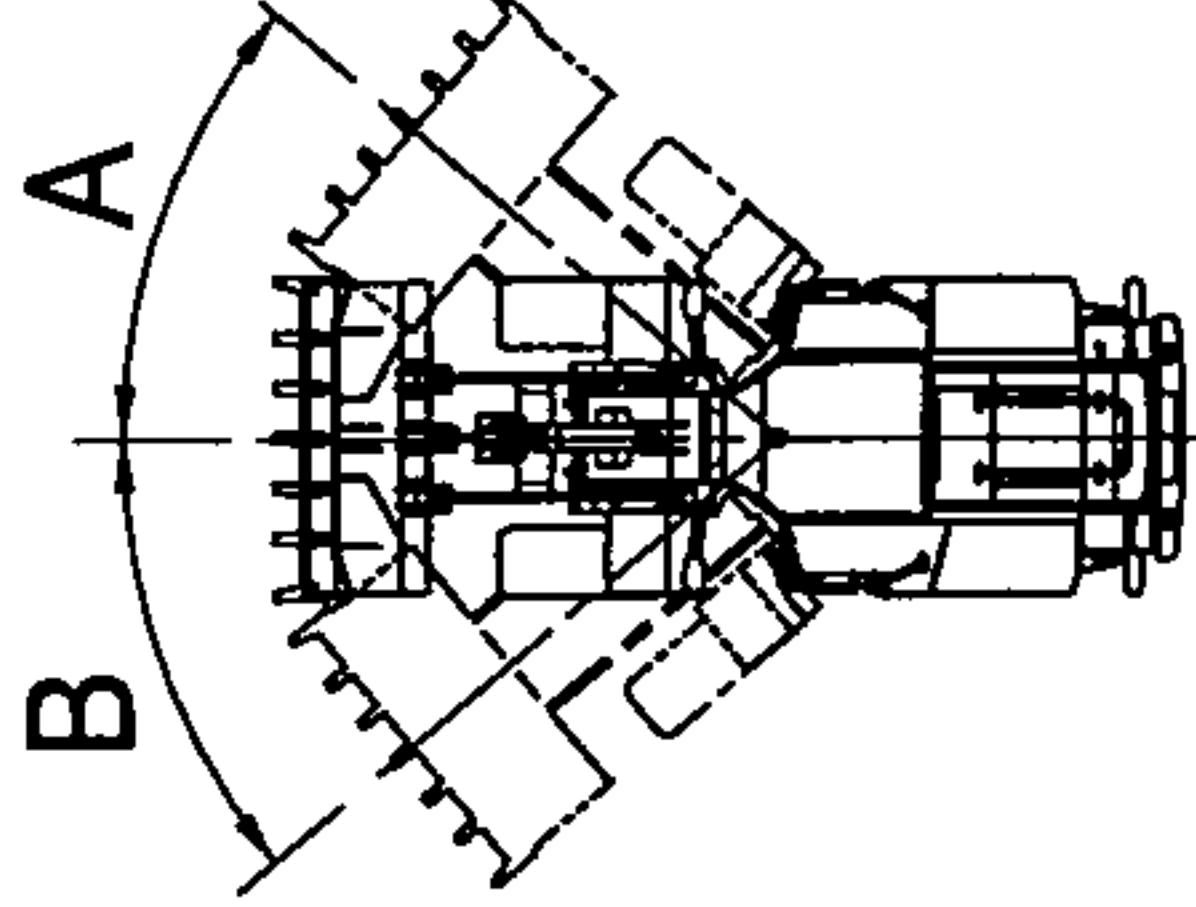
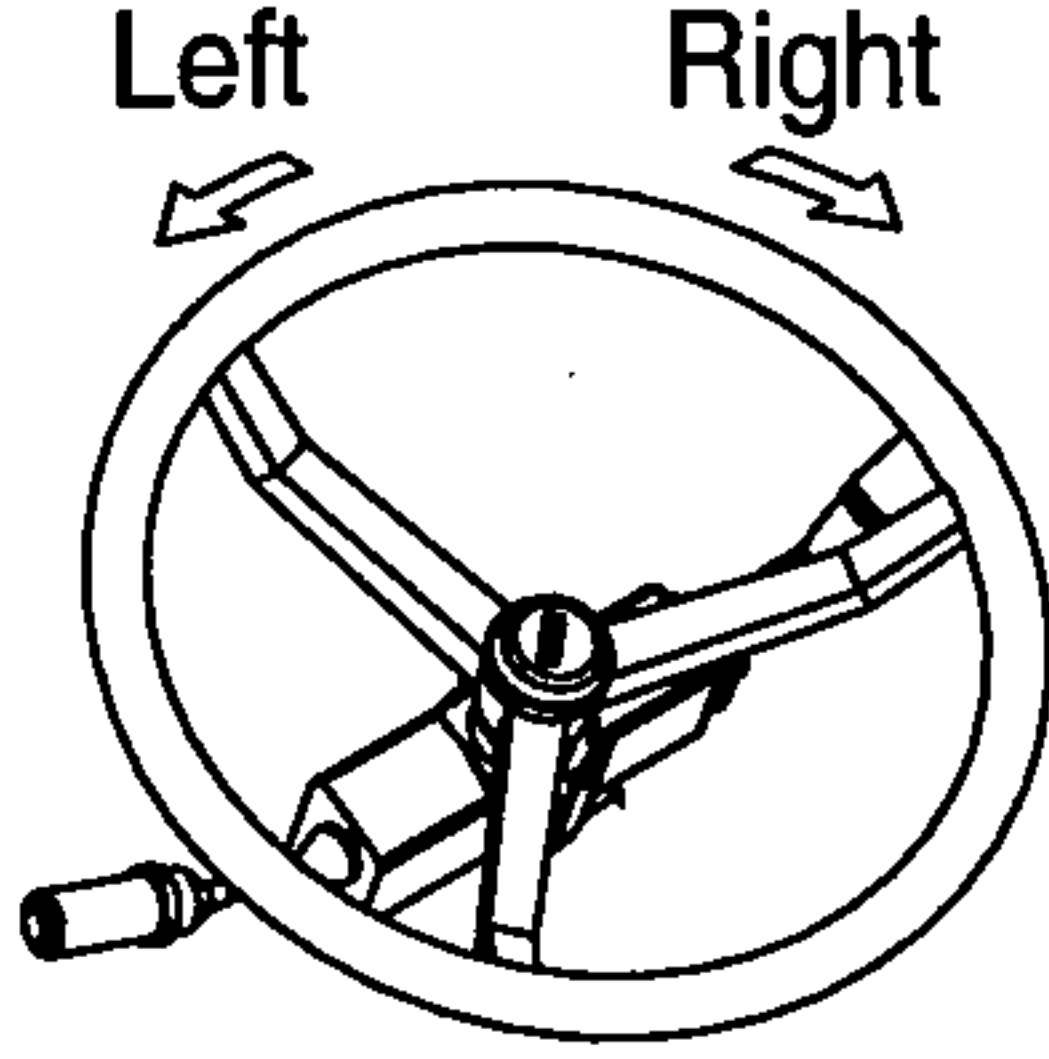
The engine and all other major components must be at operating temperature for some checks.

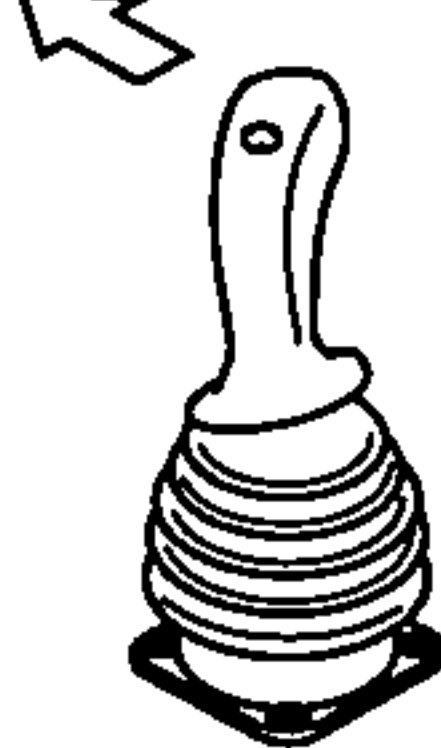
Locate system check in the left column and read completely, following this sequence from left to right. Read each check completely before performing.

At the end of each check, if no problem is found(OK), that check is complete or an additional check is needed. If problem is indicated(NOT OK), you will be give repair required and group location. If verification is needed, you will be give next best source of information :

- Chapter 2 : Troubleshooting
- Group 3 : Tests and adjustments

※ Hydraulic oil must be at operating temperature for these checks(Refer to page 6-51).

Item	Description	Service action
<p><b>Steering unit check</b></p>	 <p>Run engine at low idle.</p> <p>Turn steering wheel until frames are at maximum right(A) and then left(B) positions.</p> <p><b>LOOK</b> : Frames must move smoothly in both directions.</p> <p>When steering wheel is stopped, frames must stop.</p> <p><b>FEEL</b> : Excessive effort must not be required to turn steering wheel.</p> <p><b>NOTE</b> : It is normal for steering to drift from stops when steering wheel is released.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> Go to next check.</p>
<p><b>Steering system leakage check</b> Heat hydraulic oil to operating temperature. Run engine at high idle.</p>	 <p>Turn steering wheel rapidly until frames are against stop.</p> <p>Hold approximately 2kg on steering wheel.</p> <p>Count steering wheel revolutions for 1 minute.</p> <p>Repeat test in opposite direction.</p> <p><b>LOOK</b> : Steering wheel should rotate less than 7rpm.</p> <p><b>NOTE</b> : Use good judgment; Excessive steering wheel rpm does not mean steering will be affected.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> Do steering system leakage test in group 3 to isolate the leakage.</p>

Item	Description	Service action
<p><b>Priority valve(In flow amplifier) low pressure check</b></p>	<p>Park machine on a hard surface.</p> <p>Hold brake pedal down.</p> <p>Run engine at high idle.</p> <p>Steer machine to the right and left as far as possible.</p> <p><b>LOOK</b> : Machine must turn at least half way to the right and left stops.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> Do priority valve pressure test in group 3.</p>
<p><b>Priority valve(In flow amplifier) high pressure check</b></p> <p>Run engine at high idle.</p>	 <p>Steer to steering stop and release steering wheel.</p> <p>Roll bucket back and hold over relief and observe engine rpm.</p> <p>Turn steering wheel to steering stop and hold, observe engine rpm.</p> <p><b>LOOK</b> : Steering stall engine rpm must be higher than hydraulic stall rpm.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> Priority pressure is set too high. Do priority valve pressure test in group 3.</p>

## 2. TROUBLESHOOTING

※ Diagnose malfunction charts are arranged from most probable and simplest to verify, to least likely, more difficult to verify. Remember the following steps when troubleshooting a problem :

Step 1. Operational check out procedure(See group 3 in section 1)

Step 2. Operational checks(In this group)

Step 3. Troubleshooting

Step 4. Tests and adjustments(See group 3)

Problem	Cause	Remedy
<b>No steering</b>	Low oil level Failed steering pump Failed main pump drive Stuck priority valve spool Broken priority valve spring Relief valve in priority valve stuck open.	Add recommended oil. Remove and inspect return filter for metal pump particles. Do main pump flow test. Remove and inspect priority valve spool. Remove and inspect spring. Do priority valve relief cartridge leakage test in group 3.
<b>No hydraulic functions steering normal</b>	Shorted boom lower solenoid valve ground wire or wrong ground wire connected to solenoid. Boom lower solenoid valve stuck in actuated position Faulty or misadjusted pilot supply unit valve Stuck open system relief valve Locked safety valve Plugged pilot line filter Failed hydraulic pump Low secondary pressure of RCV	Disconnect wires from solenoid valve and check operation of hydraulics. Remove and inspect solenoid valve. Do pilot supply unit test in group 3. Replace relief valve. Unlock safety valve. Inspect and replace. Remove and inspect the pump. Check the pressure and replace if necessary.

Problem	Cause	Remedy
<b>Slow or hard steering</b>	<p>Too much friction in the mechanical parts of the machine</p> <p>Cold oil</p> <p>Low priority valve pressure setting</p> <p>Worn hydraulic pump</p> <p>Sticking priority valve spool</p> <p>Broken priority valve spring</p> <p>Pinched or restricted LS line</p>	<p>Lubricate bearings and joints of steering column or repair if necessary. Check steering column installation.</p> <p>Warm the hydraulic oil.</p> <p>Do priority valve pressure test in group 3. Clean or replace cartridge in bottom of priority valve.</p> <p>Do hydraulic pump performance check .</p> <p>Remove and inspect.</p> <p>Remove and inspect.</p> <p>Inspect line. Do priority valve LS port flow test in group 5.</p>
<b>Constant steering to maintain straight travel</b>	<p>Air in system</p> <p>Leakage in steering system</p> <p>Worn steering unit</p> <p>Leaf spring without spring force or broken</p> <p>Spring in double shock valve broken</p> <p>Gear wheel set worn</p> <p>Cylinder seized or piston seals worn</p>	<p>Check for foamy oil.</p> <p>Do steering system leakage check.</p> <p>Do steering system leakage check. Do steering unit neutral leakage test in group 3.</p> <p>Replace leaf springs.</p> <p>Replace shock valve.</p> <p>Replace gear wheel set.</p> <p>Replace defects parts.</p>
<b>Slow steering wheel movement will not cause any frame movement</b>	<p>Leakage in steering unit gerotor</p> <p>Worn steering unit gerotor</p>	<p>Do steering system leakage check.</p> <p>Do steering leakage check.</p>
<b>Steering wheel can be turned with frames against steering stop</b>	<p>Leakage in steering system</p>	<p>Do steering system leakage check.</p>
<b>Steering wheel turns with no resistance and causes no frame movement</b>	<p>Broken steering column or splined coupling</p> <p>Lack of oil in steering unit</p> <p>Leakage in steering system</p>	<p>Remove and inspect.</p> <p>Start engine and check steering operation.</p> <p>Do steering system leakage test in group 3.</p>

Problem	Cause	Remedy
<b>Erratic steering</b>	Air in oil Low oil level Sticking priority valve spool Loose cylinder piston Damaged steering unit	Check for foamy oil. Add recommended oil. Remove and inspect spool. Remove rod to inspect piston. Remove and inspect.
<b>Spongy or soft steering</b>	Air in oil Low oil level	Check for foamy oil. Add recommended oil.
<b>Free play at steering wheel</b>	Loose steering wheel nut Worn or damaged splines on steering column or unit	Tighten. Inspect.
<b>Steering unit binding or steering wheel does not immediately return to neutral when released</b>	Binding in steering column or misalignment of column High return pressure Contamination in steering unit Large particles of contamination in steering unit	Inspect. Check for a pinched or damaged return line. Inspect hydraulic filter for contamination. Repair cause of contamination. Flush hydraulic system. Inspect hydraulic filter for contamination. Repair cause of contamination. Flush hydraulic system.
<b>Steering unit locks up</b>	★ Thermal shock Worn or damaged steering unit	Do priority valve LS port flow test in group 5. This oil flow provides a warm-up flow to steering unit when not using the steering. Repair or replace steering unit.
<b>Abrupt steering wheel oscillation</b>	Improperly timed gerotor gear in steering unit	Time gerotor gear.
<b>Steering wheel turns by itself</b>	Lines connected to wrong port	Reconnect lines.
<b>Vibration in steering system or hoses jump</b>	High priority valve setting	Do priority valve pressure test in group 3.

★ Thermal stock is caused by a large temperature differential(Approx. 30°C, 50°F) between the steering valve and hydraulic oil. If the steering is not operated for a long period of time and the orifice in the bottom of the priority valve spool is plugged, the steering valve may bind up when the steering is operated if the hydraulic oil is hot enough.

Problem	Cause	Remedy
<b>Neutral position of steering wheel cannot be obtained, i.e. there is a tendency towards "motoring"</b>	<p>Steering column and steering unit out of line</p> <p>Too little or no play between steering column and steering unit input shaft</p> <p>Pinching between inner and outer spools</p>	<p>Align the steering column with steering unit.</p> <p>Adjust the play and, if necessary, shorten the splines journal.</p> <p>Contact the nearest service shop.</p>
<b>"Motoring" effect. The steering wheel can turn on its own.</b>	<p>Leaf springs are stuck or broken and have therefore reduced spring force</p> <p>Inner and outer spools pinch, possibly due to dirt</p> <p>Return pressure in connection with the reaction between differential cylinder and steering unit too high</p> <p>Oil is needed in the tank</p> <p>Steering cylinder worn</p> <p>Gear wheel set worn</p> <p>Spacer across cardan shaft forgotten</p>	<p>Replace leaf springs.</p> <p>Clean steering unit or contact the nearest service shop.</p> <p>Reduce return pressure.</p> <p>Fill with clean oil and bleed the system.</p> <p>Replace or repair cylinder.</p> <p>Replace gear wheel set.</p> <p>Install spacer.</p>

Problem	Cause	Remedy
<b>Backlash</b>	Cardan shaft fork worn or broken Leaf springs without spring force or broken Worn splines on the steering column	Replace cardan shaft. Replace leaf springs. Replace steering column.
<b>Jerky steering</b>	LS port orifice missing Orifice in top end of priority valve spool missing	Inspect orifice. Disassemble and inspect.
<b>"Shimmy" effect. The steered wheels vibrate. (Rough tread on tires gives vibrations)</b>	Air in the steering cylinder  Mechanical connections or wheel bearings worn High priority valve setting pressure	Bleed cylinder. Find and remove the reason for air collection.  Replace worn parts.  Set pressure as regular value.
<b>Steering wheel can be turned slowly in one or both directions without the steered wheels turning.</b>	One or both shock valves are leaky or are missing in flow amplifier	Clean or replace defective or missing valves.
<b>Steering is too slow and heavy when trying to turn quickly.</b>	Insufficient oil supply to steering unit, pump defective or number of revolutions too low Relief valve setting too low Relief valve sticking owing to dirt Spool in priority valve sticking owing to dirt. Too weak spring in priority valve	Replace pump or increase number of revolutions. Adjust valve to correct setting. Clean the valve. Clean the valve, check that spool moves easily without spring. Replace spring by a stronger.
<b>"Kick back" in steering wheel from system. Kicks from wheels.</b>	Fault in the system	Contact authorized man or shop.

Problem	Cause	Remedy
<b>Heavy kick-back in steering wheel in both directions.</b>	Wrong setting of cardan shaft and gear-wheel set	Correct setting as shown in service manual.
<b>Turning the steering wheel activates the steered wheels opposite.</b>	Hydraulic hoses for the steering cylinders have been switched around	Connect lines to correct ports.
<b>Hard point when starting to turn the steering wheel</b>	Spring force in priority valve too weak Air in LS and / or PP pipes Clogged orifices in LS or PP side in priority valve Oil is too thick(Cold)	Replace spring by a stronger. Bleed LS and PP pipes. Clean orifices in spool and in connecting plugs for LS and PP. Let motor run until oil is warm.
<b>Too little steering force (Possibly to one side only).</b>	Pump pressure too low Too little steering cylinder Piston rod area of the differential cylinder too large compared with piston diameter	Correct pump pressure. Fit a larger cylinder Fit cylinder with thinner piston rod or 2 differential cylinders
<b>Leakage at either input shaft, end cover, gear-wheel set, housing or top part.</b>	Shaft defective Screws loose Washers or O-rings defective	Replace shaft seal, see Service manual Tighten screws Torque 3-3.5kgf · m or steering unit(3-3.5 kgf · m).

Problem	Cause	Remedy
<b>Amplification too large</b>	Dirty, leaky or missing check valve(10). Piston(9A) sticks in the open position.	Clean or replace check valve. Clean and check that the piston moves easily.
<b>Amplification too small</b>	Piston(9A) sticks in the closed position. Piston(9A) incorrectly installed	Clean and check that the piston moves easily. Rotate the piston 180° on its axis.
<b>Heavy turning of steering wheel and slow increase of amplification</b>	Dirty orifices(34) in directional valve. Dirty orifices(35) in the combi-valve spool. Dirty orifice(27) in housing. Dirty orifice(36) in LS port. Dirty orifice in throttle / check valve(31) in PP port. Dirty orifice(42) in priority valve.	Clean or replace orifice. Clean or replace orifice. Clean or replace orifice. Clean or replace orifice. Clean or replace throttle/check valve. Clean or replace orifice.
<b>No end stop in one or both directions</b>	One or both shock valves(21) set too low. Missing end stop plate(23) for directional valve.	Setting takes a long time without special equipment. Contact the nearest service shop. Fit end stop plates.
<b>"Hard" point when starting to turn the steering wheel.</b>	Air in LS and/or PP pipes. Spring(30) force in the built in priority valve too weak. Orifices in respectively LS or PP ports blocked.	Bleed pipes. Check or replace of necessary. Take out and clean orifices.
<b>No pressure build-up</b>	LS pressure limitation valve(19) adjusted too low Spool and sleeve in steering unit put together incorrectly Emergency control ball in steering unit missing Pump does not run or is defective	Remove plug and set to specified pressure. Take out spool set and turn the inner spool 180° in the outer sleeve.(See Group 4) Install new ball. Repair or replace pump.