

## **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.

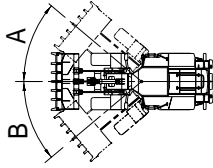
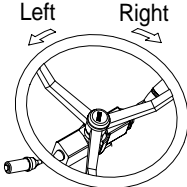
At the end of each check, if no problem is found(OK), that check is complete or an additional check is needed. If problem is indicated(NOT OK), you will be given repair required and group location.

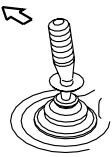
If verification is needed, you will be given next best source of information :

Chapter 2 : Troubleshooting

Group 3 : Tests and adjustments

※ Hydraulic oil must be at operating temperature for these checks(Refer to page 6-54).

Item	Description	Service action
<b>Steering unit check</b>  	<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>
<b>Steering system leakage check</b> Heat hydraulic oil to operating temperature. Run engine at high idle.	 <p>Turn steering wheel rapidly until frames are against stops.</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 5rpm.</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>
<b>Priority valve low pressure check</b>	<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>

Item	Description	Service action
<b>Priority valve high pressure check</b> Run engine at high idle.	 <p>Steer to steering stop and release wheel.</p> <p>Roll bucket back and hold over relief and observe engine rpm.</p> <p>Turn 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.	Add recommended oil.
	Restricted suction line.	Check.
	Failed hydraulic pump.	Remove and inspect return filter for metal pump particles.
	Failed main hydraulic pump drive.	Remove main hydraulic pump and inspect drive gear.
	Stuck priority valve spool.	Remove and inspect priority valve spool.
	Broken priority valve spring.	Remove and inspect spring.
	Relief valve in priority valve stuck open.	Do priority valve relief cartridge leakage test in group 3.
	Failed hydraulic lines.	Check.
<b>Slow or hard steering</b>	Too much friction in the mechanical parts of the machine.	Lubricate bearings and joints of frame or cylinders or repair if necessary. Check steering column installation.
	Cold oil.	Warm the hydraulic oil.
	Low priority valve pressure setting.	Do priority valve pressure test in group 3.
	Worn hydraulic pump.	Do hydraulic pump performance check.
	Sticking priority valve spool.	Remove and inspect.
	Broken priority valve spring.	Remove and inspect.
	Pinched or restricted LS line.	Inspect line. Do priority valve LS port flow test in group 3.
	Low system relief valve setting.	Test and adjust if necessary.
	Low overload relief valves setting.	Test and adjust if necessary.

Problem	Cause	Remedy
<b>Constant steering to maintain straight travel</b>	Air in system. Leakage in steering system. Worn steering unit.  Leaf spring without spring force or broken. Spring in overload relief valve broken. Gear wheel set worn. Cylinder seized or piston seals worn.	Check for foamy oil. Do steering system leakage check. Do steering unit neutral leakage test in group 3. Replace leaf springs. Replace overload relief valve. Replace gear wheel set. Replace defects parts.
<b>Slow steering wheel movement will not cause any frame movement</b>	Leakage in steering system. Worn steering unit gerotor.	Do steering system leakage check. Do steering unit leakage check.
<b>Steering wheel can be turned with frames against steering stop</b>	Leakage in steering system.	Do steering system leakage check.
<b>Steering wheel turns with no resistance and causes no frame movement</b>	Broken steering column or splined of steering unit. Lack of oil in steering unit.  Leakage in steering system.	Remove and inspect.  Start engine and check steering operation.  Do steering system leakage test in group 3.
<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 valve.	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.	Inspect.  Check for a pinched or damaged return line.  Inspect hydraulic filter for contamination. Repair cause of contamination. Flush hydraulic system.

Problem	Cause	Remedy
<b>Steering unit locks up</b>	<p>Large particles of contamination in steering unit.</p> <p>★ Thermal shock</p> <p>Worn or damaged steering unit.</p>	<p>Inspect hydraulic filter for contamination. Repair cause of contamination. Flush hydraulic system.</p> <p>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.</p> <p>Repair or replace steering unit.</p>
<b>Abrupt steering wheel oscillation</b>	Improperly timed gerotor gear in steering unit.	Time gerotor gear.
<b>Steering wheel turns by itself</b>	<p>Lines connected to wrong port.</p> <p>Worn or damaged steering unit.</p>	<p>Reconnect lines.</p> <p>Repair or replace steering unit.</p>
<b>Vibration in steering system or hoses jump</b>	High priority valve setting.	Do priority valve pressure test in group 3.
<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>Replace leaf springs.</p> <p>Clean steering unit or contact the nearest service shop.</p> <p>Reduce return pressure.</p>
<b>Backlash</b>	<p>Cardan shaft fork worn or broken.</p> <p>Leaf springs without spring force or broken.</p> <p>Worn splines on the steering column.</p>	<p>Replace cardan shaft.</p> <p>Replace leaf springs.</p> <p>Replace steering column.</p>
<b>Jerky steering</b>	<p>LS port orifice missing.</p> <p>Orifice in top end of priority valve spool missing.</p>	<p>Inspect orifice.</p> <p>Disassemble and inspect.</p>

★ Thermal shock is caused by a large temperature differential(Approx 30°C, 50°F) between the steering unit 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 unit may bind up when the steering is operated if the hydraulic oil is hot enough.

Problem	Cause	Remedy
<b>"Shimmy" effect</b> <b>The steered wheels vibrate</b> (Rough tread on tires gives vibrations.)	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 the whole time without the steered wheels moving</b>	Oil is needed in the tank. Steering cylinder worn. Gear wheel set worn. Spacer across cardan shaft forgotten.	Fill with clean oil and bleed the system. Replace or repair cylinder. Replace gear wheel set. Install spacer.
<b>Steering wheel can be turned slowly in one or both directions without the steered wheels turning</b>	One or both anticavitation valves are leaky or are missing in overload relief valves.  One or both overload relief valves are leaky.	Clean or replace defect or missing valves.  Clean or replace.
<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</b> <b>Kicks from wheels</b>	Fault in the system.	Contact authorized man or shop.
<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 group 4.
<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 line. Clogged orifices in LS or PP side in priority valve. Oil is too thick(Cold).	Replace spring by a stronger. Bleed LS and PP line. Clean orifices in spool and in connecting plugs for LS and PP. Let machine run until oil is warm.
<b>Too little steering force</b>	Pump pressure too low.	Correct pump pressure.