

## GROUP 2 OPERATIONAL CHECKS AND TROUBLESHOOTING

### 1. POWER TRAIN OPERATIONAL CHECKS

This procedure is designed so that the mechanic can make a quick check of the system using a minimum amount of diagnostic equipment. If you need additional information, read **Structure and function**, 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.

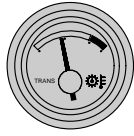
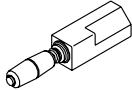
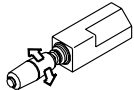
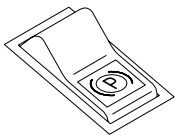
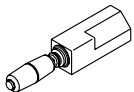
Locate system check in the left column and read completely, following the sequence from left to right. Read each check completely before performing.

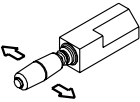
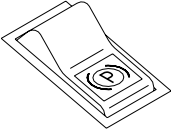
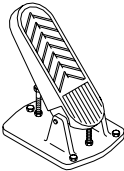
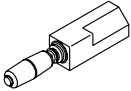

At the end of each check, if no problem is found(OK), that check is complete or an additional check is needed. If problem is indicated(NOT OK), you will be given repair required and group location. If verification is needed, you will be given next best source of information :

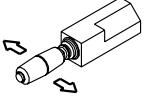
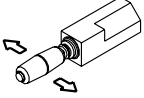
Chapter 2 : Troubleshooting

Group 3 : Tests and adjustments

※ Transmission oil must be at operating temperature for these checks.

Item	Description	Service action
<b>Transmission oil warm-up procedure</b>	  <p>Start engine. Apply service brakes and release parking brake.</p> <p>Move EGS lever to 3rd speed.</p> <p>Move EGS lever to forward "F" position.</p> <p>Increase engine speed to high idle for 30 seconds.</p> <p>Move EGS lever to neutral "N" position and run for 15 seconds.</p> <p>Repeat procedure until transmission temperature gauge arrow points to bar above dial.</p>	<b>OK</b> Check completed.
<b>Transmission noise check</b> Engine running.	 <p>Run engine at approximately 1600rpm.</p> <p>Drive unit with transmission in each forward and reverse speed.</p> <p><b>LISTEN</b> : Transmission must not make excessive noise in any range.</p> <p>Engine rpm must not "lug down" as unit is shifted between gears.</p>	<b>OK</b> Check completed.  <b>NOT OK</b> Go to transmission makes excessive noise group 3.
<b>Transmission "kick down" check</b> Engine running.	  <p>Release parking brake and shift to 2nd forward.</p> <p>Drive machine at approximately 5km/h and press EGS lever switch once.</p> <p><b>LOOK/FEEL</b> : Transmission must shift to and remain in 1st gear.</p> <p>Press EGS lever switch once.</p> <p><b>LOOK/FEEL</b> : Transmission must shift back to 2nd gear.</p> <p>Shift to (3rd or 4th) gear and press EGS lever switch once.</p> <p><b>LOOK/FEEL</b> : Transmission must not shift down.</p>	<b>OK</b> Check completed.  <b>NOT OK</b> Check connector at base of control valve.  <b>IF OK</b> Go to transmission controller circuit in group 1.

Item	Description	Service action
<b>Forward, reverse and 4th speed clutch pack drag check</b> ※ Transmission must be warmed up for this check. Engine running.	   <p>Park unit on level surface.</p> <p>Apply service brakes.</p> <p>Move EGS lever to neutral.</p> <p>Move EGS lever to 1st.</p> <p>Release parking brake and service brakes.</p> <p>Run engine at low idle.</p> <p><b>LOOK</b> : Unit must not move in either direction.</p> <p><b>NOTE</b> : If unit moves forward, either the forward pack or the 4th speed pack is dragging.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> If unit moves, repair transmission.</p>
<b>Transmission pressure, pump flow, and leakage check</b> Engine running.	  <p>Run engine at low idle.</p> <p>Release parking brake.</p> <p>Shift transmission to reverse, then forward, and then to 1st, 2nd, and 3rd speeds.</p> <p>Wait 5 seconds after each shift and observe transmission pressure indicator light.</p> <p><b>LOOK</b> : Indicator light must not come on.</p> <p><b>NOTE</b> : If light comes on in one gear only, leakage is indicated on that gear.</p> <p>If light comes on in all gears, low pump flow or pressure is indicated.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> Do transmission leakage test, system pressure test, or pump flow test in group 3.</p>

Item	Description	Service action
<b>Transmission shift modulation check</b> Engine running.	 <p>Run engine at approximately 1600rpm.</p> <p>Put transmission in 1st forward, shift several times from forward to reverse and reverse to forward. Repeat check in 2nd gear.</p> <p><b>LOOK</b> : Unit must slow down and change direction smoothly.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> Go to unit shifts too fast, chapter 2 in this group.</p>
<b>Torque converter check</b>	 <p>Start engine. Apply service brakes and release parking brake.</p> <p>Move EGS lever to 3rd speed.</p> <p>Move EGS lever to forward "F" position.</p> <p>Increase engine speed to high idle.</p> <p><b>LOOK</b> : Torque converter stall rpm must be within the following range. Stall rpm : 2300 ~ 2440rpm</p> <p>Move EGS lever to neutral "N" position and run for 15 seconds.</p>	<p><b>OK</b> Check completed.</p> <p><b>NOT OK</b> If stall rpm are too low or too high, problem may be engine power or torque converter.</p> <p><b>IF OK</b> Replace transmission torque converter.</p>

## 2. TROUBLESHOOTING

### 1) TRANSMISSION

※ 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/or adjustments(See group 3.)

Problem	Cause	Remedy
<b>Transmission slippage</b>	Low oil level.	Add oil.
	Wrong oil grade.	Change oil.
	Restricted transmission pump suction screen.	Remove and clean screen.
	Leak in transmission control valve or gasket.	Remove valve and inspect gaskets.
	Low transmission pump flow due to worn pump.	Do transmission pump flow test.
	Weak or broken pressure regulating valve spring.	Do transmission system pressure test.

Problem	Cause	Remedy
<b>Machine will not move</b>	<p>Low oil level.</p> <p>Applied park brake.</p> <p>No power to transmission controller.</p> <p>Malfunctioning parking brake solenoid valve.</p> <p>Restricted modulation orifice.</p> <p>Excessive leakage in transmission element.</p> <p>Worn clutch disks.</p> <p>Low or no transmission pressure.</p> <p>Service brake will not release.</p> <p>Failed torque converter.</p> <p>Broken shafts or gears.</p> <p>Broken drive shafts.</p> <p>Broken ring or pinion gear.</p>	<p>Add oil.</p> <p>Check parking brake fuse.</p> <p>Check continuity to parking brake switch.</p> <p>Check transmission controller fuse.</p> <p>Remove and inspect parking brake solenoid valve.</p> <p>Check for power to solenoid valve.</p> <p>Remove orifice and check for contamination and/or plugging. (Do not remove valve housing for this purpose.)</p> <p>Do transmission element leakage test using system pressure.</p> <p>Repair transmission.</p> <p>See transmission pressure is low in this group.</p> <p>Do brake pedal operational check.</p> <p>Do service and park system drag checks.</p> <p>Do torque converter stall test.</p> <p>If engine pulldown in normal, torque converter is good.</p> <p>Drain transmission to determine if large pieces of metal contamination are present.</p> <p>Inspect drive shafts and universal joints for external damage. Repair.</p> <p>If drive shaft rotate with transmission in gear but machine does not move, a differential failure is indicated. Repair.</p>
<b>Machine does not engage in low gear</b>	<p>Malfunctioning transmission control solenoid valve.</p> <p>Stuck spool in transmission control valve.</p> <p>Stuck modulation valve.</p> <p>Malfunctioning transmission speed sensor.</p>	<p>Check solenoid valve.</p> <p>Remove and inspect transmission control valve spools.</p> <p>Remove end cover to inspect modulation spool. Replace if necessary.</p> <p>Check speed sensor.</p>

Problem	Cause	Remedy
<b>Transmission pressure is low</b> (All gears)	<p>Low oil level.</p> <p>Failed transmission pressure switch.</p> <p>Plugged suction strainer.</p> <p>Stuck transmission pressure regulating valve or broken spring.</p> <p>Failed control valve gasket.</p> <p>Stuck modulation valve.</p>	<p>Check transmission oil level and refill if necessary.</p> <p>Verify transmission system pressure. Do transmission system pressure test.</p> <p>Transmission pump may be noisy if transmission suction screen is clogged. Drain transmission.</p> <p>Remove and clean suction screen.</p> <p>Also, check condition of transmission filter.</p> <p>Remove transmission pressure regulating valve. Inspect for damage(See transmission control valve).</p> <p>Inspect transmission control valve for external leakage. Remove control valve. Inspect or replace gasket.</p> <p>Remove end cover to inspect modulation spool and check torque on cap screws retaining control valve to transmission.</p>
<b>Transmission system pressure is low</b> (One or two gears)	<p>Failed transmission pump.</p> <p>Failed transmission control valve gasket.</p> <p>Leakage in clutch piston or seal ring.</p>	<p>Do pump flow test.</p> <p>Inspect transmission control valve for external leakage. Remove control valve. Inspect or replace gasket.</p> <p>Disassemble and repair.</p>
<b>Transmission shifts direction too low</b>	<p>Low oil level(Aeration of oil).</p> <p>Low transmission pressure.</p> <p>Restricted transmission pump suction screen.</p> <p>Low transmission pump flow.</p> <p>Excessive transmission element leakage.</p> <p>Stuck modulation valve.</p> <p>Restricted modulation orifice.</p> <p>Malfunctioning two stage piston.</p> <p>Restricted oil passages between control valve and transmission elements.</p>	<p>Add oil.</p> <p>Do transmission system pressure test.</p> <p>Remove and clean screen.</p> <p>Do transmission pump flow test.</p> <p>Do transmission element leakage test using system pressure.</p> <p>Remove end cover to inspect modulation spool. Replace if necessary.</p> <p>Remove orifice and inspect for contamination and /or plugging.</p> <p>Remove and inspect two stage piston.</p> <p>Remove control valve and inspect oil passage.</p>

Problem	Cause	Remedy
<b>Transmission direction shifts too fast</b>	<p>Wrong transmission controller.</p> <p>System pressure too high.</p> <p>Stuck modulation valve.</p> <p>Malfunctioning two stage piston.</p> <p>Stuck or missing check valves.</p> <p>Missing O-ring from end of modulation orifice.</p> <p>Broken piston return spring.</p>	<p>Check if transmission controller has been changed</p> <p>Do transmission system pressure test.</p> <p>Remove and inspect modulation valve. Replace if necessary. Also remove end cover to inspect modulation spool and control valve housing. Replace if necessary.</p> <p>Remove and inspect two stage piston.</p> <p>Inspect transmission control valve.</p> <p>Remove orifice and inspect port for O-ring.</p> <p>Disassemble and inspect clutch.</p>
<b>Machine "creeps" in neutral</b>	Warped disks and plates in transmission.	Check transmission.
<b>Transmission hydraulic system overheats</b>	<p>High oil level.</p> <p>Low oil level.</p> <p>Wrong oil grade.</p> <p>Park brake dragging.</p> <p>Pinched, restricted or leaking lube lines.</p> <p>Machine operated in too high gear range.</p> <p>Malfunction in temperature gauge or sender.</p> <p>Restricted air flow through oil cooler or radiator.</p> <p>Failed oil cooler bypass valve(In thermal bypass valve).</p> <p>Failed thermal bypass valve.</p> <p>Internally restricted oil cooler.</p> <p>Leakage in transmission hydraulic system.</p> <p>Malfunction in converter relief valve.</p> <p>Low transmission pump output.</p>	<p>Transmission overfilled or hydraulic pump seal leaking.</p> <p>Add oil.</p> <p>Change oil.</p> <p>Check for heat in park brake area.</p> <p>Check cooler lines.</p> <p>Operate machine in correct gear range.</p> <p>Install temperature sensor the verify temperature. Do tachometer/temperature reader installation procedure.</p> <p>Do radiator air flow test.</p> <p>Disassemble and inspect.</p> <p>Remove thermal bypass valve and check to see if machine still overheats. Do transmission oil cooler thermal bypass valve test.</p> <p>Do oil cooler restriction test.</p> <p>Do transmission system pressure, element leakage, and shift modulation test.</p> <p>Do converter out pressure test.</p> <p>Do transmission pump flow test.</p>



Problem	Cause	Remedy
<b>Excessive transmission noise</b> (Under load or no load)	Too low engine low idle. Worn parts or damaged in transmission.  Warped drive line between engine and torque converter.  Low or no lube.	Check engine low idle speed.  Remove transmission suction screen. Inspect for metal particles. Repair as necessary.  Inspect drive line.  Do converter-out and lube pressure test. Do transmission pump flow test.
<b>Foaming oil</b>	Incorrect type of oil.  High oil level.  Low oil level.  Air leak on suction side of pump.	Change oil.  Transmission overfilled or hydraulic pump seal leaking.  Add oil.  Check oil pickup tube on side of transmission.
<b>Oil ejected from dipstick</b>	Plugged breather.	Inspect breather on top of transmission. Replace.
<b>Machine vibrates</b>	Aerated oil.  Low engine speed.  Failed universal joints on transmission drive shaft or differential drive shafts.	Add oil.  Check engine speed.  Check universal joints.
<b>Machine lacks power and acceleration</b>	Engine high idle speed set too low.  Incorrect transmission oil.  Aerated oil.  Low transmission pressure.  Warped transmission clutch.  Torn transmission control valve gasket.  Brake drag.  Failed torque converter.  Low engine power.	Check high idle adjustment.  Change oil.  Add oil.  Do transmission system pressure test.  Do transmission clutch drag checks.  Inspect gasket.  Do brake drag check.  Do torque converter stall speed test.  Do engine power test.
<b>Torque converter stall RPM too high</b>	Aerated oil.  Stuck open converter relief valve.  Leakage in torque converter seal.  Torque converter not transferring power(Bent fins, broken starter).	Put clear hose on thermal bypass outlet port. Run machine to check for bubbles in oil.  Do converter-out pressure test.  Do converter-out pressure test.  Replace torque converter.

Problem	Cause	Remedy
<b>Torque converter stall RPM too low</b>	Low engine power. Mechanical malfunction.	Do engine power test. Remove and inspect torque converter.
<b>Transmission pressure light comes ON when shifting from forward to reverse</b> (All other gears OK)	Low oil level. Cold oil. Leak in reverse pack.	Add oil. Warm oil to specification. Do transmission pressure, pump flow, and leakage check.
<b>Transmission pressure light comes ON for each shift</b>	Cold oil. No time delay in monitor. Restriction in modulation orifice. Stuck modulation valve. Low transmission pressure circuit. Leak in transmission pressure circuit. Failed transmission pump. Clogged filter.	Warm oil to specification. Do monitor check. Remove orifice and inspect for restriction and/or plugging. Remove and inspect. Do transmission system pressure test. Do converter out pressure test. Do transmission pump flow test. Inspect filter. Replace.

## 2) DIFFERENTIAL / AXLE

Problem	Cause	Remedy
<b>Differential low on oil</b>	External leakage.	Inspect axle and differential for leaks.
<b>Excessive differential and/or axle noise</b>	Low oil level in differential.  Incorrect type of oil.  Dragging brakes.  Failed pinion bearing.  Incorrect gear mesh pattern between ring and pinion gear.  Failed differential pinion gears and/or cross shafts.  Failed axle bearing.  Mechanical failure in axle planetary.	Check oil. Remove drain plug and inspect for metal particles in differential case. Disassemble and determine cause.  Change oil  Do brake check.  Remove and inspect pinion. Check to ensure pinion housing was indexed.  Remove pinion gear housing and inspect ring and pinion gear.  Remove differential housing drain plug and inspect for metal particles. Disassemble and inspect.  Do axle bearing adjustment check.  Remove differential. Inspect, repair.
<b>Oil seeping from outer axle seal</b>	Excessive end play in axle.  Worn outer bearing and/or cup.  Overfilled differential.	Do axle bearing adjustment check.  Disassemble and inspect outer axle bearing, cup, spacer, and seal. Replace, if necessary.  Check differential oil return system for excessive internal restriction.
<b>Axle overheats</b>	Low differential oil.  Overfilled differential.  Brake drag.	Add oil.  See differential overfills with oil in this group.  See brakes drag in this group.

## 3) DRIVE LINE

Problem	Cause	Remedy
<b>Excessive drive line vibration or noise</b>	Yokes not in line on drive shafts.  Worn front drive line support bearing.  Bent drive shaft.  Loose yoke retaining nuts(Drive shafts wobble at high speed).  Rear axle oscillating support.  Lack of lubrication.	Inspect. Align drive shaft yokes.  Inspect, repair.  Inspect all drive shafts. Replace.  Inspect. Replace.  Inspect, repair.  Lubricate with proper grade of grease.