10.General Diagnostic Table

A: INSPECTION

Trouble	Possible cause	Corrective action
• Heavy steering effort in all ranges • Heavy steering effort at stand still • Steering wheel surges when turning.	1. Pulley belt • Unequal length of pulley belts • Adhesion of oil and grease • Loose or damage of pulley belt • Poor uniformity of pulley belt cross section • Pulley belt touches to pulley bottom • Poor revolution of pulleys (except oil pump pulley) • Poor revolution of oil pump pulley	Adjust or replace.
	2. Tire and wheel • Improper tires out of specification • Improper wheels out of specification • Tires not properly inflated *1	Replace or reinflate.
	3. Fluid • Low fluid level • Aeration • Dust mix • Deterioration of fluid • Poor warming-up of fluid *2	Refill, bleed air, replace or instruct the customer.
	4. Idle speed • Lower idle speed • Excessive drop of idle speed at start or at turning steering wheel *3	Adjust or instruct the customer.
	5. Measure hydraulic pressure.<Ref. to PS-51, INSPECTION, Oil Pump.>	Replace the problem parts.
	6. Measure steering effort.<Ref. to PS-56, INSPECTION, General Diagnostic Table.>	Adjust or replace.
• Vehicle leads to one side or the other. • Poor return of steering wheel to center • Steering wheel surges when turning.	1. Fluid line • Folded hose • Flattened pipe	Reform or replace.
	2. Tire and wheel • Flat tire • Mix use of different tires • Mix use of different wheels • Abnormal wear of tire • Unbalance of remained grooves • Unbalance of tire pressure	Adjust, fix or replace.
	3. Front alignment • Improper or unbalance caster • Improper or unbalance toe-in • Loose connection of suspension	Adjust or retighten.
	4. Others • Damaged joint assembly • Unbalanced height • One-sided weight	Replace, adjust or instruct the customer.
	5. Measure steering effort.<Ref. to PS-56, INSPECTION, General Diagnostic Table.>	Adjust or replace.

*1 If tires and/or wheels are wider, the load to power steering system is the more. Accordingly, in a condition, for example before fluid warms-up, relief valve may work before maximum turning angle. In this case, steering effort may be heavy. When measured hydraulic pressure is normal, there is no abnormal thing.
*2 In cold weather, steering effort may be heavy due to increased flow resistance of cold fluid. After warming-up engine, turn steering wheel from stop to stop several times to warm-up fluid. Then if steering effort reduces normally, there is no abnormal thing.
*3 In cold weather or with insufficient warm-up of engine, steering effort may be heavy due to excessive drop of idling when turning steering wheel. In this case, it is recommended to start the vehicle with increasing engine speed than usual. Then if steering effort reduces normally, there is no abnormal thing.

1. NOISE AND VIBRATION

CAUTION:
Don't keep the relief valve operated over 5 seconds at any time or inner parts of the oil pump may be damaged due to rapid increase of fluid temperature.

NOTE:
• Grinding noise may be heard immediately after the engine start in extremely cold condition. In this case, if the noise goes off during warm-up there is no abnormal function in the system. This is due to the fluid characteristic in extremely cold condition.
• Oil pump makes whine or growl noise slightly due to its mechanism. Even if the noise can be heard when steering wheel is turned at stand still there is no abnormal function in the system provided that the noise eliminates when the vehicle is running.
• When turning the steering wheel with service brake and/or parking brake applied, the noise is generated by creaking between disk and pads. However this does not indicate abnormal function in system.
• There may be a little vibration around the steering devices when turning steering wheel at standstill, even though the component parts have no defects.
Hydraulic systems are likely to generate this kind of vibration as well as working noise and fluid noise because of combined conditions, i.e., road surface and tire surface, engine speed and turning speed of steering wheel, fluid temperature and braking condition.
This phenomena does not indicate there is some abnormal function in the system.
The vibration can be known when steering wheel is turned repeatedly at various speeds from slow to rapid step by step with parking brake applied on concrete road and in "D" range for automatic transmission vehicle.

Trouble	Possible cause	Corrective action
Hiss noise (continuous) While engine is running.	Relief valve emits operating sound when steering wheel is completely turned in either direction. (Don't keep this condition over 5 seconds.)	Normal
	Relief valve emits operating sound when steering wheel is not turned. This means that the relief valve is faulty.	Defective Replace the oil pump.
Rattling noise (intermittent) While engine is running.	Interference with adjacent parts	Check the clearance. Correct if necessary. <Ref. to PS-46, INSPECTION, Pipe Assembly.>
	Loosened installation of oil pump, oil tank, pump bracket, gearbox or crossmember	Retighten.
	Loosened installation of oil pump pulley or other pulley(s)	Retighten.
	Loosened linkage or play of steering or suspension Loosened tightening of joint or steering column	Retighten or replace.
	Sound generates from the inside of gearbox or oil pump.	Replace the faulty parts of gearbox or oil pump.
Knocking When turning steering wheel in both direction with small angle repeatedly at engine ON or OFF.	Excessive backlash Loosened lock nut for adjusting backlash	Adjust and retighten.
	Loosened tightening or play of tie-rod, or tie-rod end	Retighten or replace.
Grinding noise (continuous) While engine is running.	Vane pump aeration	Inspect and retighten the fluid line connection. Refill fluid and vent air.
	Vane pump seizing	Replace the oil pump.
	Pulley bearing seizing of oil pump	Replace the oil pump.
	Folded hose, flat pipe	Replace.
Squeal, squeak (intermittent or continuous) While engine is running.	Maladjustment of pulley belt Damaged or charged pulley belt Unequal length of pulley belts	Adjust or replace. (Replace two belts as a set.)
	Run out or soilage of V-groove surface of oil pump pulley	Clean or replace.

Trouble	Possible cause	Corrective action
Sizzling noise (continuous) While engine is running.	Fluid aeration	Fix the wrong part causing aeration. Replace the fluid and vent air.
	Damaged pipe of gearbox	Replace the pipe.
	Abnormal inside of hose or pipe Flat hose or pipe	Rectify or replace.
	Abnormal inside of oil tank	Replace.
	Removed oil tank cap	Install the cap.
Whistle (continuous) While engine is running.	Abnormal pipe of gearbox or abnormal inside of hose	Replace the faulty parts of gearbox or hose.
Whine or growl (continuous or intermittent) While engine is running with/ without steering turned.	Loosened installation of oil pump, oil pump bracket	Retighten.
	Abnormal inside of oil pump, hose	Replace the oil pump, hose, if the noise can be heard when running as well as stand still.
	Torque converter growl, air conditioner compression growl	Remove the power steering pulley belt and confirm.
Creaking noise (intermittent) While engine is running with steering turned.	Abnormal inside of gearbox	Replace the faulty parts of gearbox.
	Abnormal bearing for steering shaft	Apply grease or replace.
	Generates when turning steering wheel with brake (service or parking) applied.	If the noise goes off when brake is released, it is normal.
Vibration While engine is running with/ without steering turned.	Too low engine speed	Adjust and instruct customers.
	Vane pump aeration	Fix the wrong part. Vent air.
	Damaged valve in oil pump, gearbox	Replace the oil pump, faulty parts of gearbox.
	Looseness of play of steering, suspension parts	Retighten.

2. MEASUREMENT OF STEERING EFFORT

	Step	Check	Yes	No
1	**CHECK STEERING EFFORT.** 1)Stop the vehicle on a concrete road. 2)Start the engine. 3)Idle the engine. 4)Install the spring scale on the steering wheel. 5)Pull the spring scale at an right angle to steering wheel, and measure both right and left steering wheel effort. NOTE: When turning the steering more quickly than necessary from a direction to the other direction at an engine speed over 2,000 rpm, steering effort may be heavy. This is caused by flow characteristic of oil pump and is not a problem.	Is the steering effort less than 31.4 N (3.2 kgf, 7.1 lb)?	Go to step **2.**	Adjust the backlash.
2	**CHECK STEERING EFFORT.** 1)Stop the engine. 2)Pull the spring scale at an right angle to the steering wheel, and measure both right and left steering wheel effort.	Is the steering effort less than 294.2 N (30 kgf, 66.2 lb)?	Go to step **3.**	Perform adjustment.
3	**CHECK STEERING WHEEL EFFORT.** 1)Remove the universal joint. 2)Measure the steering wheel effort.	Is the maximum steering effort less than 2.26 N (0.23 kgf, 0.51 lb)?	Go to step **4.**	Check, adjust and replace if necessary.
4	**CHECK STEERING WHEEL EFFORT.** Measure the steering wheel effort.	Is the difference of steering effort between clockwise and counterclockwise less than 20%?	Go to step **5.**	Check, adjust and replace if necessary.

	Step	Check	Yes	No
5	**CHECK UNIVERSAL JOINT.** Measure the folding torque of the joint (yoke of steering column side). <Ref. to PS-18, INSPECTION, Universal Joint.>	Is the folding torque less than 7.3 N (0.74 kgf, 1.64 lb)?	Go to step **6.**	Replace with new one.
6	**CHECK UNIVERSAL JOINT.** Measure the folding torque of the joint (yoke of gearbox side). <Ref. to PS-18, INSPECTION, Universal Joint.>	Is the folding torque less than 3.8 N (0.39 kgf, 0.86 lb)?	Go to step **7.**	Replace with new one.
7	**CHECK FRONT WHEEL.** Check the front wheel.	Are the front wheels for unsteady revolution or rattling and brake for dragging?	Inspect, readjust and replace if necessary.	Go to step **8.**
8	**CHECK TIE-ROD ENDS.** Remove the tie-rod ends.	Are the tie-rod ends of suspension for unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step **9.**
9	**CHECK BALL JOINT.** Remove the ball joint.	Are the ball joints of suspension for unsteady revolution or rattling?	Inspect and replace if necessary.	Go to step **10.**
10	**CHECK GEARBOX.** Measure the rotating of gearbox. <Ref. to PS-39, TURNING RESISTANCE OF GEARBOX, INSPECTION, Steering Gearbox.>	Is the rotating resistance of gear box less than 10.5 N (1.1 kgf, 2.4 lb)? Is the difference between clockwise and counterclockwise 20%?	Go to step **11.**	Readjust the backlash, and if ineffective, replace the faulty parts.
11	**CHECK GEARBOX.** Measure the sliding of gearbox. <Ref. to PS-38, SERVICE LIMIT, INSPECTION, Steering Gearbox.>	Is the sliding resistance of gear box less than 400 N (41 kgf, 90 lb)? Is the difference between right and left 20%?	Steering effort is normal.	Readjust the backlash, and if ineffective, replace the faulty parts.