INDEX

AUTOMATIC TRANSMISSION SERVICE GROUP

Technical Service Information

INTRODUCTION
SUBARU - 4 SPEED

This booklet contains information on the operation of the four speed Subaru automatic transaxle. Although this transaxle comes in two wheel and four wheel drive applications the transfer case is not covered. The teardown and assembly, lock-up converter system along with service and adjustment are shown in this manual.

We thank Subaru
for the illustrations and information
that have made this booklet possible.

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NOTES----NOTES----NOTES----NOTES

SERVICE PROCEDURE

1 General Precaution

When disassembling or assembling the automatic transmission, observe the following instructions.

1) Workshop

Provide a place that is clean and free from dust. Principally the conventional workshop is suitable except for a dusty place. In a workshop where grinding work, etc. which produces fine particles is done, make independent place divided by the vinyl curtain or the equivalent.

2) Worktable

The size of 1 x 1.5 m (40 x 60 in) is large enough to work, and it is more desirable that its surface be covered with flat plate like iron plate which is not rusted too much.

3) Cleaning of exterior

(1) Clean the exterior surface of transmission with steam and/or kerosene prior to disassembly, however it should be noted that vinyl tape be placed on the airbreather or oil level gauge to prevent infiltration of the steam into the transmission and also the cleaning job be done away from the place of disassembly and assembly.

(2) Partial cleaning will do, depending on the extent of disassembly (such as when disassembly is limited to some certain parts).

4) Disassembly, assembly and cleaning

(1) Disassemble and assemble the transmission while inspecting the parts in accordance with the Trouble-shooting.

(2) During job, don't use gloves.

Don't clean the parts with rags: Use chamois or nylon cloth.

(3) Pay special attention to the air to be used for cleaning.

Get the moisture and the dust rid of the air as much as possible.

Be careful not to scratch or dent any part while checking for proper operation with an air gun.

(4) Complete the job from cleaning to completion of assembly as continuously and speedily as possible in order to avoid occurrence of secondary troubles caused by dust. When stopping the job unavoidably cover the parts with clean chamois or nylon cloth to keep them away from any dust.

(5) Use kerosene, white gasoline or the equivalent as washing fluid.

Use always new fluid for cleaning the automatic transmission parts and never reuse. The used fluid is usable in disassemble and assemble work of engine and manual transmission.

(6) Although the cleaning should be done by dipping into the washing fluid or blowing of the pressurized washing fluid, the dipping is more desirable. (Do not rub with a brush.) Assemble the parts immediately after the cleaning without exposure to the air for a while. Besides in case of washing rubber parts, perform the job quickly not to dip them into the washing fluid for long time.

(7) Apply the automatic transmission fluid (ATF) onto the parts immediately prior to assembly, and the specified tightening torque should be observed carefully.

(8) Use vaseline if it is necessary to hold parts in the position when assembling.

(9) Drain ATF and differential gear oil into a saucer so that the conditions of fluid and oil can be inspected.

(10) Do not support axle drive shaft, stator shaft, input shaft or various pipes when moving transmission from one place to another.

(11) Always discard old oil seals and bushings, and install new ones.

(12) Do not reuse old pipes, gaskets, plugs (1/8"), spring pins, etc.

Install new ones.

(13) Be sure to replace parts which are damaged, worn, scratched, discolored, etc.

1. ATF LEVEL

1) Raise the ATF temperature to 60 to 80°C (140 to 176°F). [This temperature may be attained by running a distance of 5 to 10 km (3 to 6 miles)].

The level of ATF varies with fluid temperature. Pay attention to the fluid temperature when checking oil level. A change in the ATF level by oil temperature is shown in the following figure.

2) Ensure the vehicle is level. After selecting all positions (P, R, N, D, 3, 2), set the selector lever in "P" range. Measure fluid level with the engine idling.

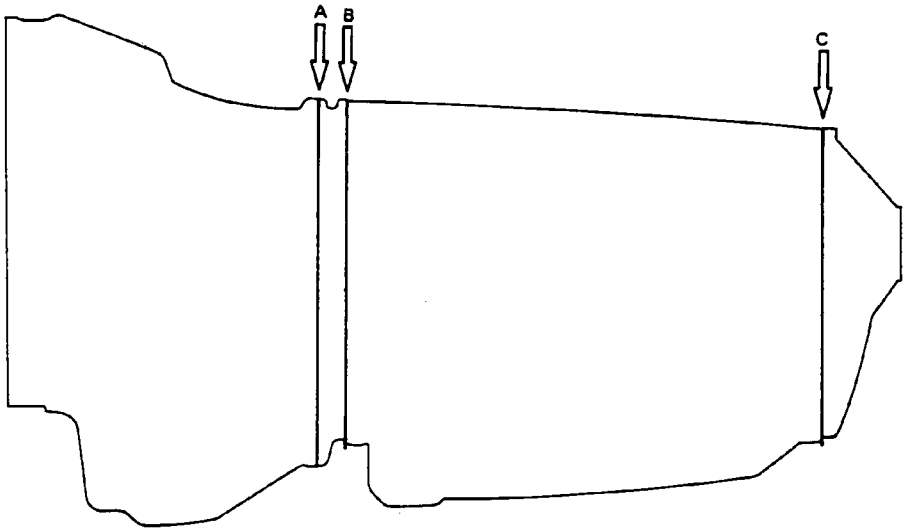
After running, idle the engine for one or two minutes before measurement.

3) If the fluid level is below the center between high and low marks, add the recommended ATF until the fluid level is found within the specified range (above the center between high and low marks). When the transmission is hot, the level should be above the center of upper and lower marks, and when it is cold, the level should be found below the center of these two marks.

Use care not to exceed the upper limit level.

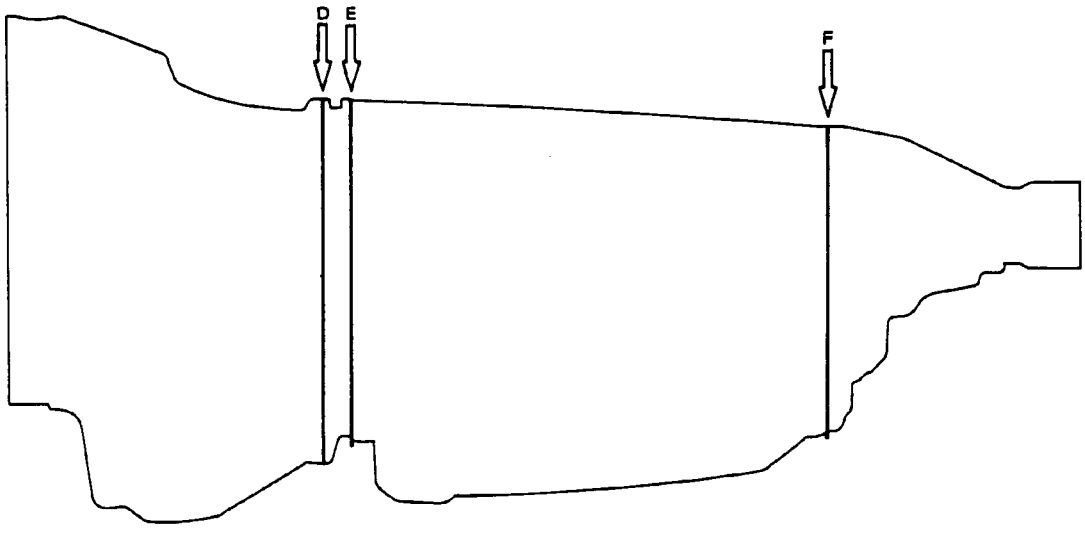
SECTIONS THAT CAN BE DETACHED/ASSEMBLED

2WD



Section A ... YES
Section B ... YES
Section C ... YES

4WD



Section D ... YES
Section E ... YES
Section F ... YES

On-Car Service

■ ATF level

1) ATF level varies with temperature as shown in figure. Remember that the addition of fluid to the upper limit mark when the transmission is cold will result in the overfilling of fluid.

2) Fluid temperature rising speed

- By idling the engine
  Time for rising temperature to 60°C (140°F) with atmospheric temperature of 0°C (32°F): More than 25 minutes
(Reference)
Time for temperature rise to 30°C (86°F) with atmospheric temperature of 0°C (32°F): Approx. 8 minutes
- By running the vehicle
  Time for temperature rise to 60°C (140°F) with atmospheric temperature of 0°C (32°F): More than 10 minutes

3) Method for checking fluid level upon delivery or at periodic inspection.
Check fluid level after a warm-up run of approx. 10 minutes. During the warm-up period, the automatic transmission functions can also be checked.

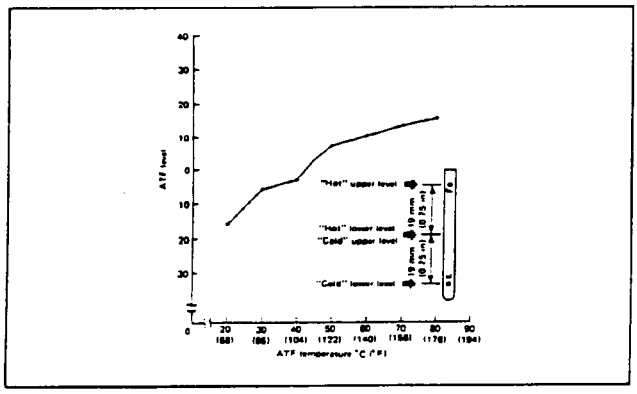


Fig. 277

2. DIFFERENTIAL GEAR OIL LEVEL

1) Ensure the vehicle

Do not check the oil level nor add oil to the case with the front end of the vehicle jacked up; this will result in an incorrect reading of the oil level.

2) Check whether the oil level is between the upper (F) and lower (L) marks. If it is below the lower limit mark, add oil until the level reaches the upper mark. The difference in level between upper and lower marks corresponds to 0.2ℓ (0.4 US pt, 0.4 Imp pt).

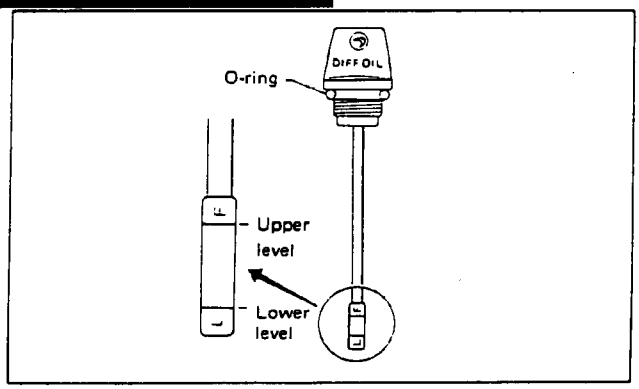


Fig. 278

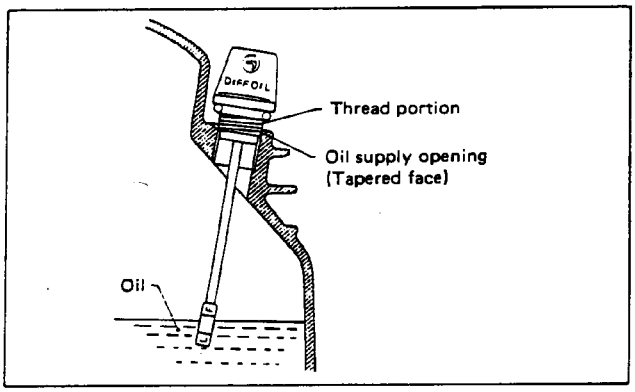


Fig. 279

3. OIL LEAKAGE CHECK POINTS

It is difficult to accurately determine the precise position of a oil leak, since the surrounding area also becomes wet with oil. The places where oil seals and gaskets are used are as follows:

<Jointing portion of the case>

- Transmission case and oil pump housing jointing portion
- Converter case and oil pump housing jointing portion
- Transmission case and transmission cover jointing portion (2WD)
- Transmission case and extension case jointing portion (4WD)

Converter housing

- Engine crankshaft oil seal
- Torque converter impeller sleeve oil seal
- A/T F cooler pipe connector
- Torque converter

Converter case

- Converter case
- Axle shaft oil seal
- O-ring on the outside diameter of axle shaft oil seal holder
- O-ring on the differential oil gauge
- Differential oil drain plug
- Speedometer cable mounting portion
- Location of steel balls

Oil pump housing

- Oil pump housing (Defective casting)
- O-ring on the test plugs
- Checking blind plugs
- Differential gear breather

Automatic transmission case

- Transmission case (Defective casting)
- Mating surface of oil pan
- O-ring on the test plugs
- Checking blind plugs (steel balls)
- Oil supply pipe connector
- ATF cooler pipe connector and gasket
- Oil pan drain plug
- O-ring on the transmission harness holder
- O-ring on the oil pump plugs
- ATF breather
- Shift lever oil seal

Extension case

- Extension case (Defective casting)
- O-ring on the revolution sensor
- Rear drive shaft oil seal
- Checking blind plugs (steel ball)
- O-ring on the test plug

Transmission cover

- Transmission cover (Defective casting)

The point listed above should be checked for fluid leak. Checking method is as follows:

- Place the vehicle in the pit, and check whether the leaking oil is ATF or not. The ATF is wine red in color, and can be discriminated easily from engine oil and gear oil.
- Wipe clean the leaking oil and dust from a suspectable area, using a noninflammable organic solvent such as carbon tetrachloride.
- Run the engine to raise the fluid temperature, and set the selector lever to "D" in order to increase the fluid pressure and quickly detect a leaking point.

4. ENGINE IDLING SPEED

Excessively low engine idling rpm will lead to rough engine operation and excessively high idling rpm will lead to a sudden shift shock or creeping when shifting from N to D or R.

Idling rpm for automatic transmission cars (N or P range): 800±100 rpm

5. BRAKE BAND

If the following abnormal shifting conditions are noted in a road test, the brake band must be adjusted.

- Shift state and adjustment

1) The 2nd gear state and 4th gear state can be achieved but:

- the engine rpm increase excessively shifting up from 2nd to 3rd.
- a shift delay (over 1 sec) accompanies at kickdown from 3rd to 2nd.

If any of these problems occurs, it is attributable to excessive clearance between the reverse clutch drum and brake band: Tighten the adjust screw by turning it clockwise.

2) The 2nd gear state and 4th gear state can be achieved, but:

- a braking phenomenon is noted when shifting up from 2nd to 3rd.

If this phenomenon is noted, it is attributable to excessively small brake band clearance: Loosen the adjust screw by turning it counterclockwise.

3) When accelerating, direct shift up from 1st to 3rd occurs: . . . . . Excessively large clearance.

When shifting up from 2nd to 3rd, tire slip occurs: . . . . . Excessively small clearance.

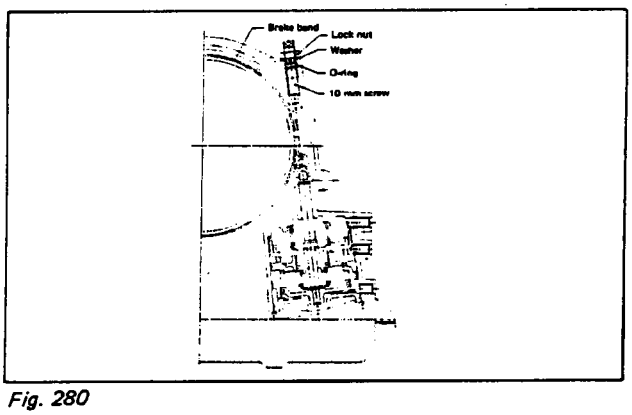


Fig. 280

■ Adjustment of the adjusting screw

1) Using a socket wrench, immobilize the end of the 10 mm screw projecting on the left side of the transmission case, and loosen the nut with a double-end wrench.
In the case of occurrence of problems 1) and 2) mentioned previously, perform the adjustment by loosening or tightening the nut within a range of 3/4 turn from this state.

Tool No.	Tool Name
398603610	SOCKET WRENCH

Do not loosen excessively; otherwise, the band strut on the servo piston will drop off.

2) In case of the occurrence of problem 3) mentioned previously, perform the adjustment as follows:
Adjusting procedure: Tighten adjust screw to 9 N·m (0.9 kg-m, 6.5 ft-lb) torque, then back off two turns.

Do not tighten the adjusting screw with an excessively large torque.

3) With the adjusting screw immobilized, tighten the lock nut to 26±2 N·m (2.7±0.2 kg-m, 20±1.4 ft-lb) torque.

6. SHIFT SOLENOID OR VALVE BODY

When shift solenoid 1, 2 or 3 is faulty, duty solenoid A or B is faulty, the hydraulic control valve is sticking or malfunctioning (failure to shift, considerable shock in shifting, etc.) in accordance with trouble codes, inspect the shift solenoid valve or the control valve body as required.

(1) Removal of shift solenoid and valve body

1 CLEAN TRANSMISSION EXTERIOR
To help prevent contamination, clean the exterior of the transmission.

2 DRAIN TRANSMISSION FLUID
Remove the drain plug and drain fluid into a suitable container.

3 REMOVE OIL PAN AND GASKET

CAUTION:
Some fluid will remain in the oil pan. Be careful not to damage the filler tube and O-ring.

Remove all pan bolts, and carefully remove the pan assembly. Discard the gasket.

4 DISCONNECT FIVE CONNECTORS FROM SOLENOID

5 WHEN REPLACING LOCK-UP SOLENOID (Duty SOLENOID B)
(1) Remove the three bolts.
(2) Remove the solenoid.

Be careful not to damage the O-ring when installing the solenoid.

6 REMOVE OIL STRAINER
Remove the five bolts, and the oil strainer.

CAUTION:
Be careful as some oil will come out with the oil strainer.

7 REMOVE VALVE BODY
(1) Remove the eight long length bolts and eleven short length bolts.

CAUTION:
Be careful as some oil will come out with oil pressure circuits.

8 WHEN REPLACING SHIFT SOLENOID 1, 2, 3 and LINE PRESSURE SOLENOID (Duty solenoid A)
(a) For the shift solenoid 1, 2, 3
(1) Remove the two bolts and one nut.
(2) Remove the shift solenoid 1, 2, 3.
(b) For the line pressure solenoid (Duty solenoid A)
(1) Remove the one bolt and one nut.
Disassembly, inspection and assembly of valve body.
(2) Installation is in the reverse order of removal.

7. PARKING LINKAGE

When problems are in the parking linkage, remove the control valve body before inspection.

Before checking the parking pawl, parking actuator support, return springs, etc., remove the transmission from the car.

8. INHIBITOR SWITCH

The inhibitor switch allows the back-up lights to turn on when the select lever is in the R range and the starter motor to start when the lever is in the N or P range. It also monitors the input signal electronically controlled for each range and turns on the corresponding range lamp on the instrument panel.
When lamp operation, driving condition or starter motor operation is erroneous, first check the shift linkage for improper operation. If the shift linkage is functioning properly, check the inhibitor switch.

<Inspection>
Separate the cable end from the range select lever.

The N range is the 3rd position from the oil pump housing side.

(1) Using a circuit tester, check continuity in the connectors (for N, P, R, 3 and 2 ranges) at the inhibitor switch.

Refer to the Continuity Check chart under the heading "MECHANISM AND FUNCTION".

(2) Check if there is continuity at equal points when the select lever is turned 15° in both directions from the N range.
If there is continuity in one direction and no continuity in the other or if there is continuity at unequal points, adjust the inhibitor switch.

<Adjustment>
(1) Loosen the three inhibitor switch securing bolts.
(2) Shift the select lever to the N range.
(3) Insert STOPPER PIN (499267300) as vertical as possible into the holes in the inhibitor switch lever and switch body.
(4) Tighten the three inhibitor switch bolts.

Tightening torque:
2.0 - 2.5 N·m
(0.20 - 0.26 kg-m, 1.4 - 1.9 ft-lb)

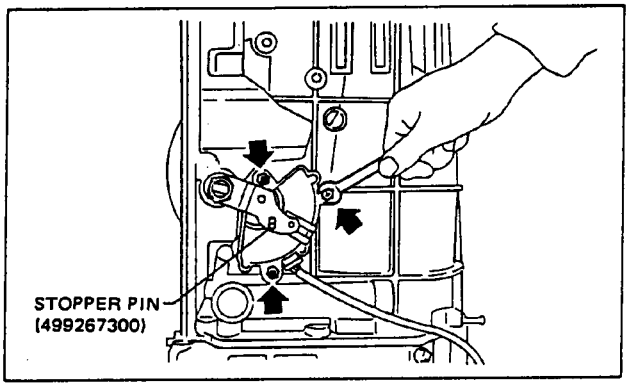


Fig. 281

(5) Repeat the above checks. If the inhibitor switch is determined to be "faulty," replace it.

9. TRANSMISSION HARNESS

The transmission harness conveys both input and output signals among the control unit, five/six (4WD) solenoids (inside the transmission) and temperature sensor. When a problem is manifested in accordance with trouble codes, check the harness and/or solenoids, as required.
Remove the control valve as outlined in step 6 above. Check the condition of each solenoid and temperature sensor. If O.K., check continuity in the transmission harness circuit using a circuit tester.

10. TRANSFER SOLENOID AND TRANSFER VALVE BODY

If unwanted "tight-corner braking" occurs when the steering wheel is turned fully at low speed, or the trouble code reveals a malfunctioning transfer solenoid, or if noise is heard from the solenoid, check the solenoid valve for improper operation, as follows:

1. **RAISE VEHICLE AND POSITION PAN TO CATCH ATF THAT MAY DRIP**
2. **REMOVE PROPELLER SHAFT**
3. **JACK UP TRANSMISSION SLIGHTLY**
Securely support the transmission on a transmission jack. Lift the transmission slightly to remove weight from the rear support member.
4. **REMOVE REVOLUTION SENSOR**
5. **REMOVE REAR MOUNTING BOLTS**
6. **REMOVE EXTENSION.**
(1) Remove the eleven bolts.
(2) Disconnect the transfer solenoid connector.

When extracting the extension, be careful of the connector fan duty sol. c in it.

7. **REMOVE EXTENSION GASKET**
8. **CLEAN AND INSPECT COMPONENT**

11. REVOLUTION SENSOR

When a problem exists in the revolution sensor as indicated by the corresponding trouble code, check the revolution sensor for improper operation.

5 Performance Test

- NECESSARY TEST GAUGES

1) Tachometer (It is desirable to be able to read to 50 rpm.)
2) Vacuum gauge (It is used for measuring intake manifold vacuum.)
3) Oil pressure gauge [0 to 2,452 kPa (0 to 25 kg/cm^2, 0 to 356 psi) range].

Set above gauges so that the driver can see them.

1. STALL TEST

The stall test is of extreme importance in diagnosing the condition of the automatic transmission and the engine. It should be conducted to measure the engine stall speeds in all shift ranges except the P and N ranges.

Purposes of the stall test

1) To check the operation of the automatic transmission clutch and brake band.
2) To check the operation of the torque converter.
3) To check engine performance.

Test methods

Prior to the stall tests, check to ensure the throttle valve opens fully, and that the levels of engine oil, cooling water and ATF are correct. Set the select lever in the P range and idle the engine at 1,200 rpm for several minutes until the ATF reaches approximately 60°C (140°F).

1) Install an engine tachometer at a location visible from the driver's compartment and mark the stall speed range on the tachometer scale.

Stall speed (at sea level):
Non-TURBO
2,450 – 2,850 rpm
TURBO
2,750 – 3,150 rpm

2) Place the wheel chocks at the front and rear of all wheels and engage the parking brake.
3) Move the manual linkage to ensure it operates properly, and shift the select lever to the D range.
4) While forcibly depressing the foot brake pedal, gradually depress the accelerator pedal until the engine operates at full throttle.
5) When the engine speed is stabilized, read that speed quickly and release the accelerator pedal.
6) Shift the select lever to Neutral, and cool down the engine by idling it for more than one minute.
7) Record the stall speed.
8) Perform the stall tests with the select lever in the 3, 2 and R ranges.

a. Do not continue the stall test for MORE THAN FIVE SECONDS at a time (from closed throttle, fully open throttle to stall speed reading). Failure to follow this instruction causes the engine oil and ATF to deteriorate and the clutch and brake band to be adversely affected.
Be sure to cool down the engine for at least one minute after each stall test with the select lever set in the P or N range and with the idle speed lower than 1,200 rpm.
b. If the stall speed is higher than the specified range, attempt to finish the stall test in as short a time as possible, in order to prevent the automatic transmission from sustaining damage.

Interpretation of stall test results

Stall speed (at sea level)	Assessment	Cause	Remarks
Higher than 2,850 rpm (Non-TURBO) or 3,150 rpm (TURBO)	Slippage of automatic transmission clutch, brake band, etc. (Further stall tests are not necessary.)	• Low line pressure (If stall speed is higher than specified range at any shift position). • One-way clutch slippage. (If stall speed is higher than specified range only in the D range.) • Slippage of Forward clutch. (If stall speed is higher than specified range in D, 3, 2, 1ST Hold range. • *1: Slippage of low & reverse brake or reverse clutch. (If stall speed is higher than specified range only in the R range.)	*1: Slippage of reverse clutch/ low & reverse brake can be judged by road tests. If engine compression can be used as a brake with select lever in the 1 range, reverse clutch is slipping; if it cannot be used, low & reverse brake is slipping.
2,450 – 2,850 rpm (Non-TURBO) or 2,750 – 3,150 rpm (TURBO)	• Control members are in good order in the D, 3, 2 and R ranges. • Engine in good order.		• One-way clutch can be checked for condition by road tests.**
Lower than 2,450 rpm (Non-TURBO) or 2,750 rpm (TURBO)	• Throttle not fully opened. • Erroneous engine operation or torque converter one-way clutch slippage.		
** Road test	• Acceleration is not properly made up to 50 km/h (31 MPH). • Car speed does not attain more than 80 km/h (50 MPH). • Operation is not proper at all car speeds.	One-way clutch slippage. *3: One-way clutch jamming. Erroneous engine operation.	*3: Abnormal temperature rise occurs.

2. TIME LAG TEST

If the shift lever is shifted while the engine is idling, there will be a certain time elapse or lag before the shock can be felt. This is used for checking the condition of the forward clutch, reverse clutch, low & reverse brake, forward one-way clutch and low one-way clutch

CAUTION:
(a) Perform the test at normal operation fluid temperature (50 to 80°C or 122 to 176°F).
(b) Be sure to allow a one minute interval between tests.
(c) Make three measurements and take the average value.

Measure time lag

1) Fully apply the parking brake.
2) Start the engine.

Check idling speed (A/C OFF)

"N" range: 800 rpm

3) Shift the shift lever from "N" to "D" range.

Using a stop watch, measure the time it takes from shifting the lever until the shock is felt.

Time lag: Less than 1.2 seconds

4) In same manner, measure the time lag for "N" → "R".

Time lag: Less than 1.5 seconds

Evaluation

1) If "N" → "D" time lag is longer than specified:
   - Line pressure too low
   - Forward clutch worn
   - Low one-way clutch not operating properly
2) If "N" → "R" time lag is longer than specified:
   - Line pressure too low
   - Reverse clutch worn
   - Low & Rev. clutch worn

3. LINE PRESSURE TEST

If the clutch or the brake band shows a sign of slippage or shifting sensation is not correct, the line pressure should be checked.

- Excessive shocks during upshifting or shifting takes place at a higher point than under normal circumstances, may be due to the line pressure being too high.
- Slippage or inability to operate the car may, in most cases, be due to loss of oil pressure for the operation of the clutch, brake band or control valve.

1) Line pressure measurement (under no load)

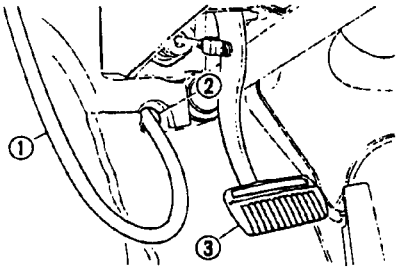
a. Before measuring line pressure, jack-up front wheels (front-wheel-drive model) or all wheels (4-wheel drive model).
b. Maintain temperature of ATF at approximately 80°C (176°F) during measurement.
(ATF will reach the above temperature after idling the engine for approximately 30 minutes with shift lever in "N" or "P".)

2) Line pressure measurement (under heavy load)

a. Before measuring line pressure, apply both foot and parking brakes with all wheels chocked (Same as for "stall" test conditions).
b. Measure line pressure for 5 to 10 seconds. Before measuring it again, idle the engine for 2 to 5 minutes.
c. Before measuring line pressure, always shift the lever from "D" to "2".
d. Maintain the temperature of ATF at approximately 80°C (176°F) during measurement. (ATF will reach the above temperature after idling the engine for approximately 30 minutes with the shift lever in "N" or "P".)

Measuring the line pressure

1) Temporarily attach the oil pressure gauge ASSY to a suitable place in the driver's compartment, remove the blind plug located in front of the toeboard and pass the hose of the Gauge ASSY to the engine compartment.



1 Pressure gauge hose
2 Hole in toe board (blank cap hole)
3 Brake pedal

Fig. 282

Tool No.	Tool Name
398573600	OIL PRESSURE GAUGE ASSY
498897100	OIL PRESSURE GAUGE ADAPTER

2) Connect the oil pressure adapter and the tip end of the gauge ASSY.
3) Run the engine and check the line pressures with the engine at a minimum-throttle and full-throttle operations.

Checking line pressure

1) Remove the line-pressure seal bolt and install the OIL PRESSURE GAUGE ADAPTER (498897100) instead.
2) Start the engine and warm it up by driving the car for at least 10 to 15 minutes.
3) Stop the engine. Connect an oil pressure gauge to the ADAPTER.
4) Check line pressure in accordance with the following chart.

< Standard line pressure >

Range	Min. line pressure 600 – 800 rpm	Max. line pressure Stall rpm
P	5.2 – 5.8	–
R	6.0 – 7.0	15.2 – 16.2
N	5.2 – 5.8	–
D	5.2 – 5.8	12.2 – 12.8
3	5.2 – 5.8	12.2 – 12.8
2	5.2 – 5.8	12.2 – 12.8
Accelerator pedal	Fully-closed	Fully-open

Checking transfer clutch pressure

1) Remove the transfer clutch pressure seal bolt and install the OIL PRESSURE GAUGE ADAPTER (498897100) instead.
2) Start the engine and allow it to warm up by driving the car for at least 10 to 15 minutes.
3) Stop the engine. Connect an oil pressure gauge to the ADAPTER.
4) Check transfer clutch pressure in accordance with the following chart.

	4WD mode		FWD mode
	Low pressure side	High pressure side	High pressure side
Range	600 – 800 rpm	Stall rpm	Stall rpm
R	0.5 – 0.8	7.3 – 8.0	0
D	0.5 – 0.8	7.3 – 8.0	0
Accelerator pedal	Fully-closed	Fully-open	Fully-open

If oil pressure is not produced or if it does not change in the 4WD mode, the duty solenoid C or transfer valve assembly may be malfunctioning. If oil pressure is produced in the FWD mode, the problem is similar to that in the 4WD mode.

4. ROAD TEST

Road tests should be conducted to properly diagnose the condition of the automatic transmission.

Speed change characteristics

The standard speed change characteristics are indicated in the following table.

NON-TURBO (2WD)

		Throttle fully-open km/h (MPH)					
		1→2	2→3	3→4	4→3	3→2	2→1
D range	NORMAL	50±2.5 (31±12)	94±2.5 (58±2)	144±2.5 (89±2)	134±2.5 (83±2)	84±2.5 (52±2)	40±2.5 (25±2)
	POWER	56±2.5 (35±2)	104±2.5 (65±2)	155±2.5 (96±2)	145±2.5 (90±2)	94±2.5 (58±2)	45±2.5 (28±2)
3 range		56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	45±2.5 (28±2)
2 range	1st hold S/W OFF	56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	45±2.5 (28±2)
	1st hold S/W ON	56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	50±2.5 (31±2)

		Throttle fully-closed km/h (MPH)					
		1→2	2→3	3→4	4→3	3→2	2→1
D range	NORMAL	15±2.5 (9±2)	30±2.5 (19±2)	45±2.5 (28±2)	40±2.5 (25±2)	15±2.5 (9±2)	10±2.5 (6±2)
	POWER	15±2.5 (9±2)	30±2.5 (19±2)	50±2.5 (31±2)	40±2.5 (25±2)	20±2.5 (12±2)	10±2.5 (6±2)
3 range		15±2.5 (9±2)	30±2.5 (19±2)	–	–	20±2.5 (12±2)	10±2.5 (6±2)
2 range	1st hold S/W OFF	15±2.5 (9±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	10±2.5 (6±2)
	1st hold S/W ON	56±2.5 (35±2)	104±2.5 (65±2)	–	–	94±2.5 (58±2)	50±2.5 (31±2)

TURBO (2WD & 4WD)

		Throttle fully-open km/h (MPH)					
		1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
D range	NORMAL	53±2.5 (33±2)	99±2.5 (62±2)	152±2.5 (94±2)	142±2.5 (88±2)	88±2.5 (55±2)	40±2.5 (25±2)
	POWER	59±2.5 (37±2)	110±2.5 (68±2)	165±2.5 (103±2)	155±2.5 (96±2)	100±2.5 (62±2)	45±2.5 (28±2)
3 range		59±2.5 (37±2)	110±2.5 (68±2)	–	–	100±2.5 (62±2)	45±2.5 (28±2)
2 range	1st hold S/W OFF	18±2.5 (11±2)	110±2.5 (68±2)	–	–	100±2.5 (62±2)	10±2.5 (6±2)
	1st hold S/W ON	59±2.5 (37±2)	110±2.5 (68±2)	–	–	100±2.5 (62±2)	50±2.5 (31±2)

		Throttle fully-closed km/h (MPH)					
		1 → 2	2 → 3	3 → 4	4 → 3	3 → 2	2 → 1
D range	NORMAL	16±2.5 (10±2)	30±2.5 (19±2)	46±2.5 (29±2)	37±2.5 (23±2)	20±2.5 (12±2)	10±2.5 (6±2)
	POWER	18±2.5 (11±2)	30±2.5 (19±2)	55±2.5 (34±2)	40±2.5 (25±2)	20±2.5 (12±2)	10±2.5 (6±2)
3 range		18±2.5 (11±2)	30±2.5 (19±2)	–	–	20±2.5 (12±2)	10±2.5 (6±2)
2 range	1st hold S/W OFF	18±2.5 (11±2)	110±2.5 (68±2)	–	–	100±2.5 (62±2)	10±2.5 (6±2)
	1st hold S/W ON	59±2.5 (37±2)	110±2.5 (68±2)	–	–	100±2.5 (62±2)	50±2.5 (31±2)

Shift characteristics

Pay careful attention to ensure the shift is made smoothly at the proper car speed at which shifting begins.

1) Shifting shocks are encountered or smooth shifting does not occur.
2) Shifting occurs slowly in response to the condition of the engine throttle.

The above two problems are due to incorrect throttle pressure or other factors involved in throttle pressure.

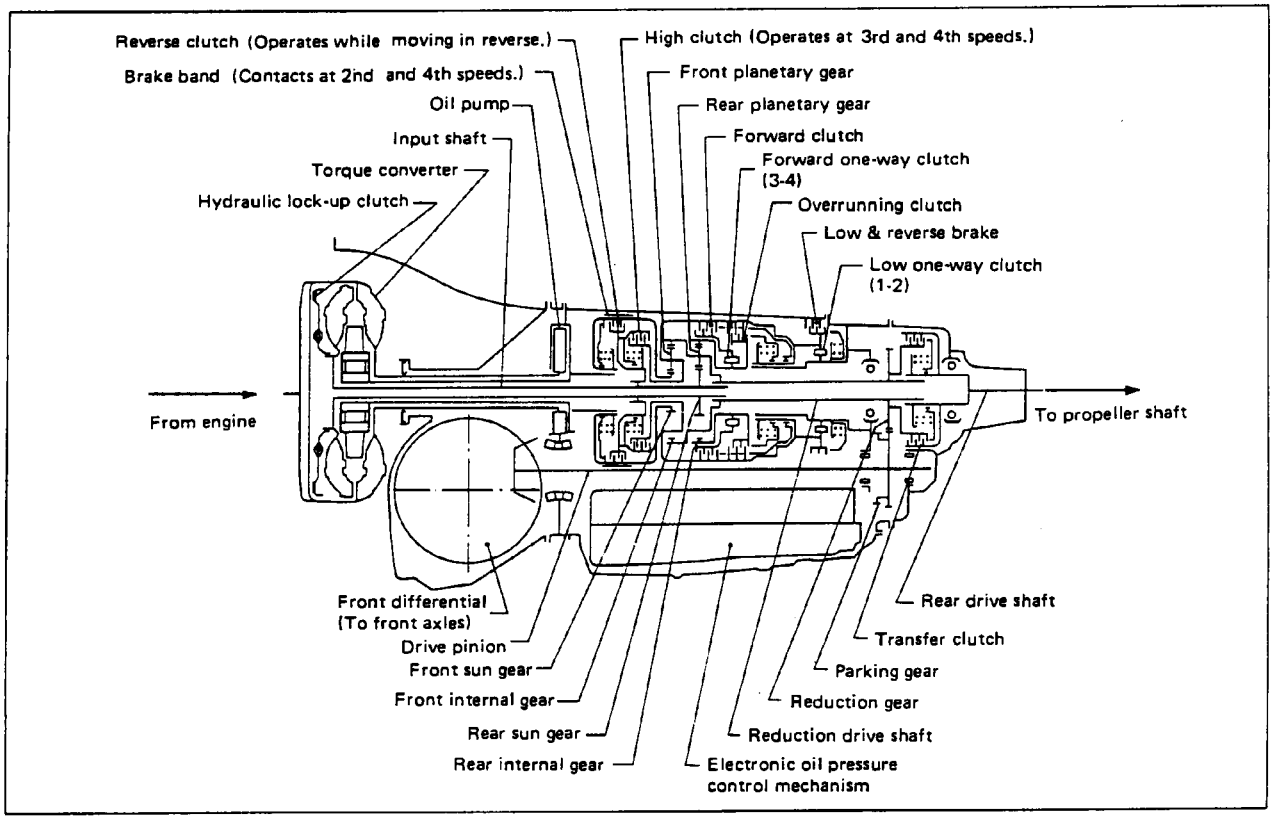
Checking for shift patterns

1) In the D range, shifting should be made as $D_1 \rightarrow D_2 \rightarrow D_3 \rightarrow D_4$ smoothly and vice versa; it should not be made in the R range.
2) Kick down should activate properly.
3) When the select lever is shifted from the D range to the 3 or 2 range, shifting should be made as 3 → 2 → 1. Engine compression can be utilized as a brake at 2 and 1st hold range.
4) With the shift lever in the 2 range, shifting should be made as 1 → 2 → 3 smoothly.
5) When pushing 1st hold switch, shifting should be made as 1 → 2 or 3 → 2 → 1.
6) The select lever should be locked when placed in the P range.

In road tests, if any abnormality is noticed, it is necessary to adjust the brake band. If by inspection the brake band is in good order, check the servo piston for any sign of oil leakage from the seal.

(1) Construction and operation

The gear train consists of two sets of planetary gears, four sets of multi-plate clutches, one brake band, one set of multi-plate brake and two sets of one-way clutches.



(2) N range and P range

1) N range

Because both the forward clutch and reverse clutch are in the release positions, the power of the input shaft is not transmitted to the drive pinion or the rear drive shaft.

2) P range

All controls do not operate, just as in the N range. The parking pawl interlocked with the selector lever meshes with the parking gear to mechanically hold the output shaft stationary, thus locking the power train.

(3) First speed of D or 3 range (D_1, 3_1)

- When the throttle is open wide, as during acceleration in the low-speed range, the forward clutch, one-way clutch (3-4) and one-way clutch (1-2) operate to prevent the rear internal gear from turning in the reverse direction.
- While coasting, the rear internal gear turns normally and the one-way clutch (3-4) is released and idles. Therefore, no power is transmitted and the engine does not provide braking action.
- During deceleration, the overrunning clutch is applied and the one-way clutch (3-4) is prevented from idling; however, since the one-way clutch (1-2) is released and is idling, reverse power is not transmitted and engine braking is not performed.

(4) Second speed of D, 3, or 2 range (D_2, 3_2, 2_2)

- During acceleration, the forward clutch is applied and connects the front planetary gear to the internal gear through the one-way clutch (3-4). Power is transmitted from the input shaft to the rear sun gear, turning the rear planetary carrier (i.e. front internal gear).
  Also, since the band brake is applied and the front sun gear is locked, the rear internal gear turns normally through the front planetary carrier and the forward clutch and one-way clutch (3-4) that are connected to that carrier. Thus, speed increases in proportion to the rotation of the rear internal gear compared with the first speed.
- Since the rear internal gear turns normally while coasting, the one-way clutch (3-4) is released and idles. Accordingly, reverse power is not transmitted to the engine and engine braking is not provided.
- During deceleration, the overrunning clutch operates to check idling of the one-way clutch (3-4). Reverse power is transmitted to the engine, providing engine braking action.

(5) Third speed of D or 3 range (D_3, 3_3)

- During acceleration, the high clutch is applied and the input shaft and front planetary carrier are connected. Further, the forward clutch and one-way clutch (3-4) operate to connect the front planetary carrier to the rear internal gear. Power is transmitted from the input shaft to the rear sun gear and rear internal gear. The rear sun gear and rear internal gear turn normally at the same speed. Therefore, the rear planetary carrier, rear sun gear and rear internal gear rotate normally as a unit.
- While coasting, because the rear internal gear turns normally, the one-way clutch (3-4) idles in a released state. Thus, reverse power is not transmitted to the engine and engine braking action is not provided.
- During deceleration, the overrunning clutch is applied and checks the reverse rotation of the one-way clutch (3-4). Thus, reverse power is transmitted to the engine and engine braking is performed.

(6) D-range fourth speed (D_4)

- During acceleration, the high clutch is applied and connects the input shaft to the front planetary carrier. Also, the forward clutch is applied, but it runs idle due to the one-way clutch (3-4) and takes no part in power transmission. Power is transmitted from the input shaft to the front planetary carrier by the function of the high clutch.
  When the front planetary carrier turns normally, because the front sun gear is held stationary by the brake band, the speed of the front internal gear increases and is delivered to the meshing reduction drive shaft in normal rotation.
- While coasting, because power transmission does not go through the one-way clutch, reverse power is transmitted to the engine and engine braking is performed.

(7) 2-range first speed or 1st hold first speed (2_1, 1st hold)

- During acceleration, the forward clutch and overrunning clutch are applied and the front planetary carrier and rear internal gear are connected. Also, the low & reverse brake is applied so that the front planetary carrier and internal gear remain stationary.
  The power flow is the same as in the first speed of "D", "3" and "2" range (except for the following points) and engine braking is performed.
  - Since the overrunning clutch is applied, the one-way clutch (3-4) is locked.
  - The low & reverse brake operates in place of the one-way clutch (1-2) and locks the rear internal gear.
- In coasting and deceleration, the idling of the one-way clutch (3-4) and one-way clutch (1-2) is checked, so that reverse power is transmitted to the engine and engine braking action is provided.

(8) R range

The reverse clutch is applied and power is transmitted from the input shaft through the reverse clutch to the front sun gear. Also, the low & reverse brake operates to lock the front planetary carrier. Therefore, when the front sun gear turns normally, the front internal gear slows and reverses.

<OPERATION OF EACH GEARSHIFT MEMBER>

			Rev./C	B/B	High/C	FWD/C	OWC (3-4)	OVR/C	Lo / Rev./B	OWC (1-2)
Selector lever operation	P									
	R		○						○	
	N									
	D	1ST				○	○			○
		2ND		○		○	○			
		3RD			○	○	○			
		4TH		○	○	○				
	3	1ST				○	○	○		○*2
		2ND		○		○	○	○		
		3RD			○	○	○	○		
	2	1ST				○	○	○	○	
		2ND *1		○		○	○	○		
		3RD			○	○	○	○		
Switchbutton handling	1st HOLD	1ST *1				○	○	○	○	
		2ND *1		○		○	○	○		
		3RD			○	○	○	○		

Only when selector lever is in "2" and 1st hold button is ON.

*1: For prevention of over-revolution
*2: Engine brake ineffective

Sol 1 (shift) and sol. 2 (shift)
If trouble occurs in either solenoid, the other one is turned OFF to attain the following gear setting to allow vehicle operation. Should trouble occur in both solenoids, the hydraulic circuit operates mechanically.

Shift position		Normal state			Faulty solenoid 1			Faulty solenoid 2			Faulty solenoids 1, 2		
		1	2	Gear	1	2	Gear	1	2	Gear	1	2	Gear
"D" range		O	O	1st	–	O→X	3rd	O→X	–	3rd	–	–	3rd
		X	O	2nd	–	O→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd
		O	X	4th	–	X	3rd	O→X	–	3rd	–	–	3rd
"3" range		O	O	1st	–	O→X	3rd	O→X	–	3rd	–	–	3rd
		X	O	2nd	–	O→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd
"2" range	1st hold switch released	O	O	1st	–	O→X	3rd	O→X	–	3rd	–	–	3rd
		X	O	2nd	–	O→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd
	1st hold switch operated	O	O	1st	–	O→X	3rd	O→X	–	3rd	–	–	3rd
		X	O	2nd	–	O→X	3rd	X	–	3rd	–	–	3rd
		X	X	3rd	–	X	3rd	X	–	3rd	–	–	3rd

O : Energized X : Non-energized – : Failed

Duty sol. A (Line pressure)
If duty solenoid A fails, the solenoid is turned OFF and line pressure is raised to maximum to enable vehicle operation.

Duty sol. B (Lock-up)
If duty solenoid B fails, the solenoid is turned OFF and lock-up is released.

Sol. 3 (Overrunning clutch)
If the overrunning clutch solenoid fails, the solenoid is turned OFF. The overrunning clutch will engage so that the engine brake will be applied when reducing vehicle speed.

Duty sol. C (Transfer)
When the duty solenoid C becomes inoperative, it turns OFF. This causes maximum oil pressure to be applied to the transfer clutch so that the power is always transmitted to rear axles. (Direct-coupling 4WD)

THROTTLE SENSOR

The throttle sensor provides electrical signals corresponding to the throttle opening. It has the following characteristics. The throttle opening and accelerator depression speed are detected by this throttle sensor output.

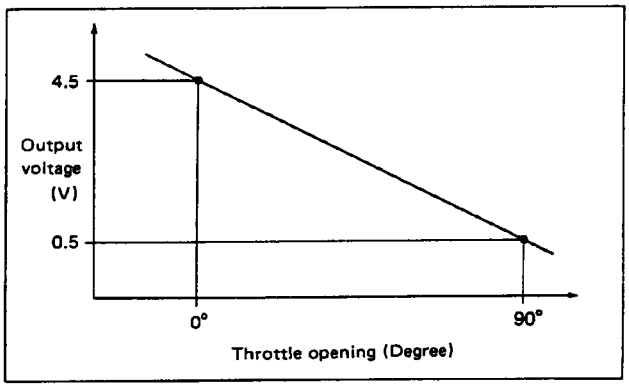


Fig. 76

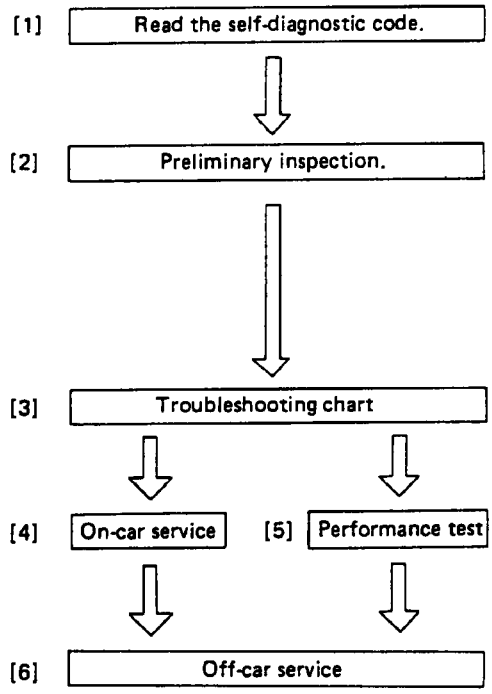
TROUBLESHOOTING

GENERAL NOTES

1) Problems in the electronic-controlled automatic transmission may be caused by failure of the engine, the electronic control system, the transmission proper, or by a combination of these. These three causes must be distinguished clearly when troubleshooting.

2) Troubleshooting should be conducted by rotating with simple, easy operations and proceeding to complicated, difficult operations. The most important thing in troubleshooting is to understand the customer's complaint, and distinguish between the three causes.

3) The general flow of troubleshooting is shown below:



Read the trouble code on the "POWER" indicator, and perform operation according to the code.

Check the following items:
- Fluid level
- Idling speed
- Inhibitor switch
- Shift linkage
- Tire inflation pressure
- Fluid leakage, etc.

See "Service Procedure".

1 Troubleshooting for Electrical Transmission Control System

1) Self-diagnosis function is builted in this electronical control system. Warning is noticed by lighting the POWER indicator.

(1) If a malfunction occurs in the speed sensor (No. 1 or 2), solenoid (No. 1, 2 or 3), duty solenoid (A, B or C), or throttle sensor system, the POWER indicator will be lighted for 2 seconds, subsequently blink once every 0.25 seconds (per 0.5 seconds cycle) during 8 seconds with the ignition switch turned to ON from OFF position. [See Fig. 1 (a).]

(2) If the system is operating normally (no malfunction), the POWER indicator will be turned on for 2 seconds period only with the same manner of ignition switch operation. [See Fig. 1 (b).]

Warning can be noticed only when the ignition switch is initially turned to ON.

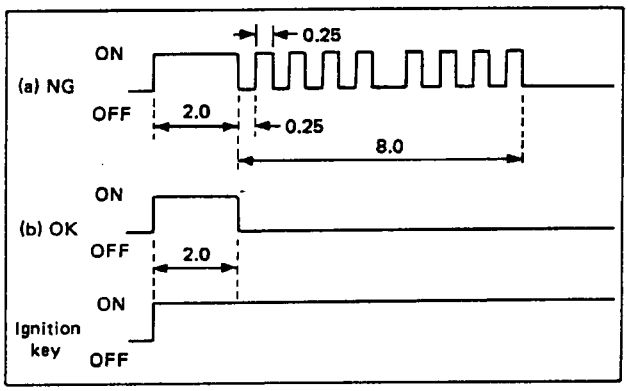
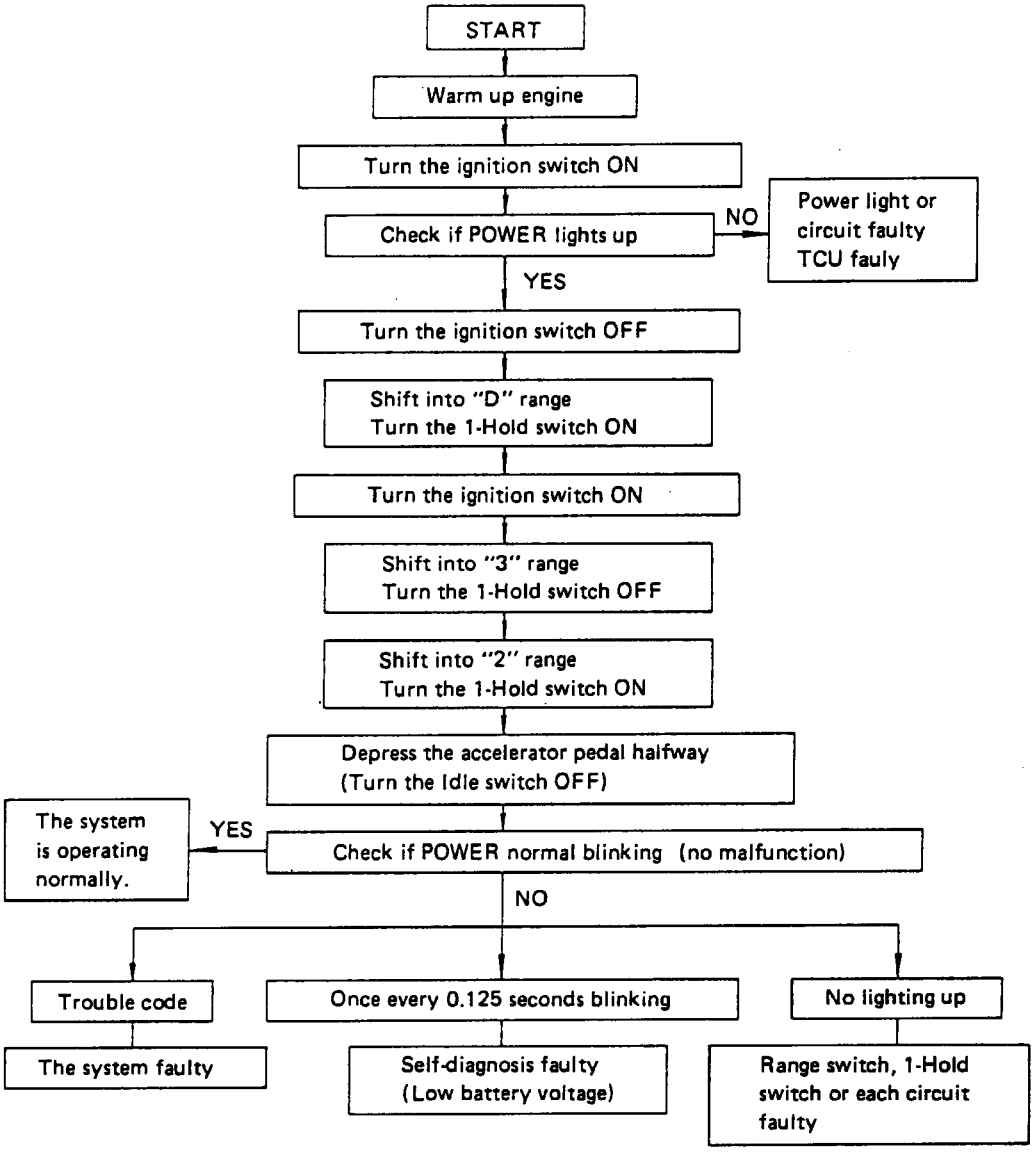


Fig. 274 POWER indicator signal (unit: second)

2) The diagnostic code can be read by the pattern of POWER indicator blink, according to specified operating procedure.
3) The diagnostic code (trouble code) is being memorized in the CPU (of TCU) and is not canceled even though the engine is turned off, dueing to back-up voltage. Consequently, after repair, it is necessary to turn the ignition switch off and then remove the fuse or disconnect the control unit connector for canceling the diagnostic code.

Low battery voltage will cause faulty operation of the diagnosis system. Therefore, always be sure to check the battery voltage first.

OUTPUT OF DIAGNOSTIC CODE



HOW TO READ TROUBLE CODE

In case of malfunction, trouble code will be observed by the specified signal of POWER indicator. The sequence of blinking shows each faulty system and the term of long segment (0.6 sec) blink means its own faulty system code. (See Fig. 2.)
Example: Shift solenoid No. 1 fault

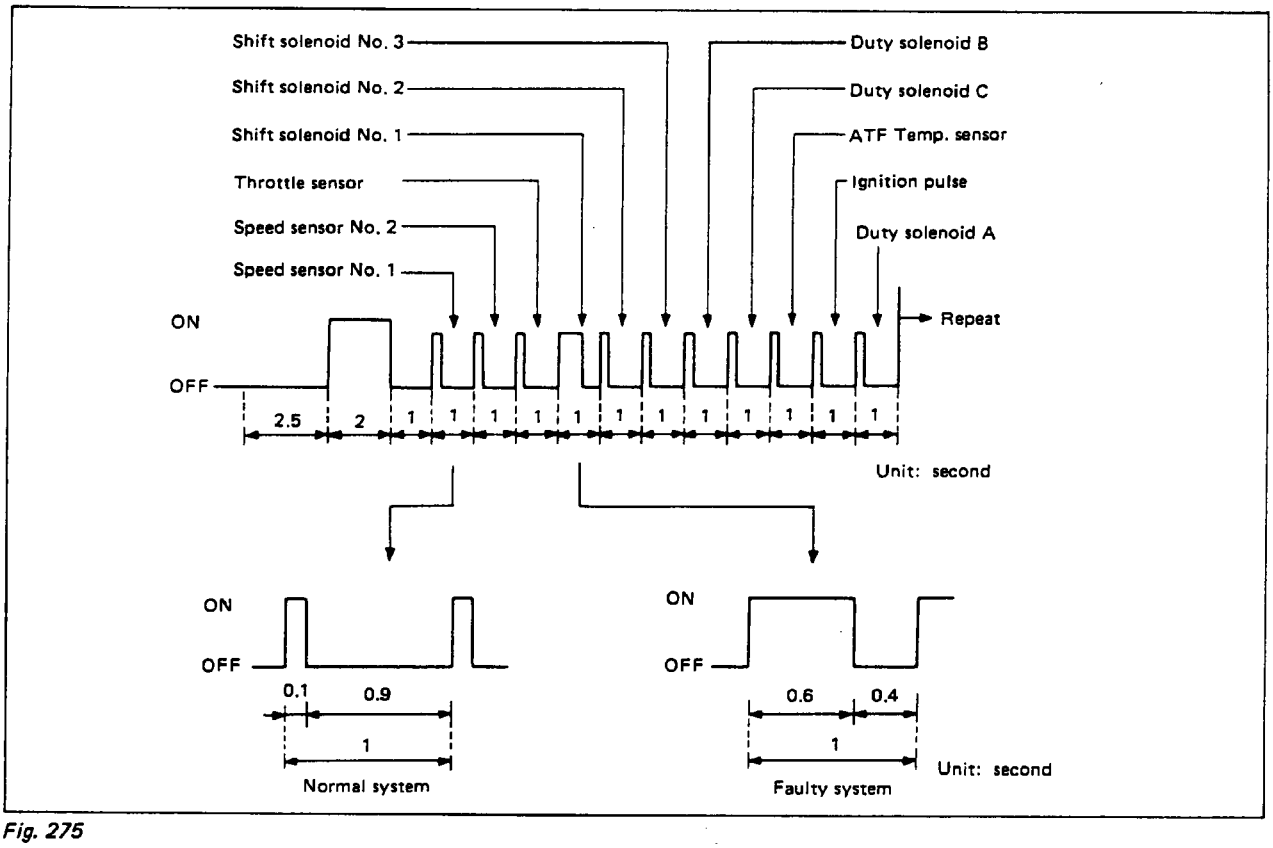
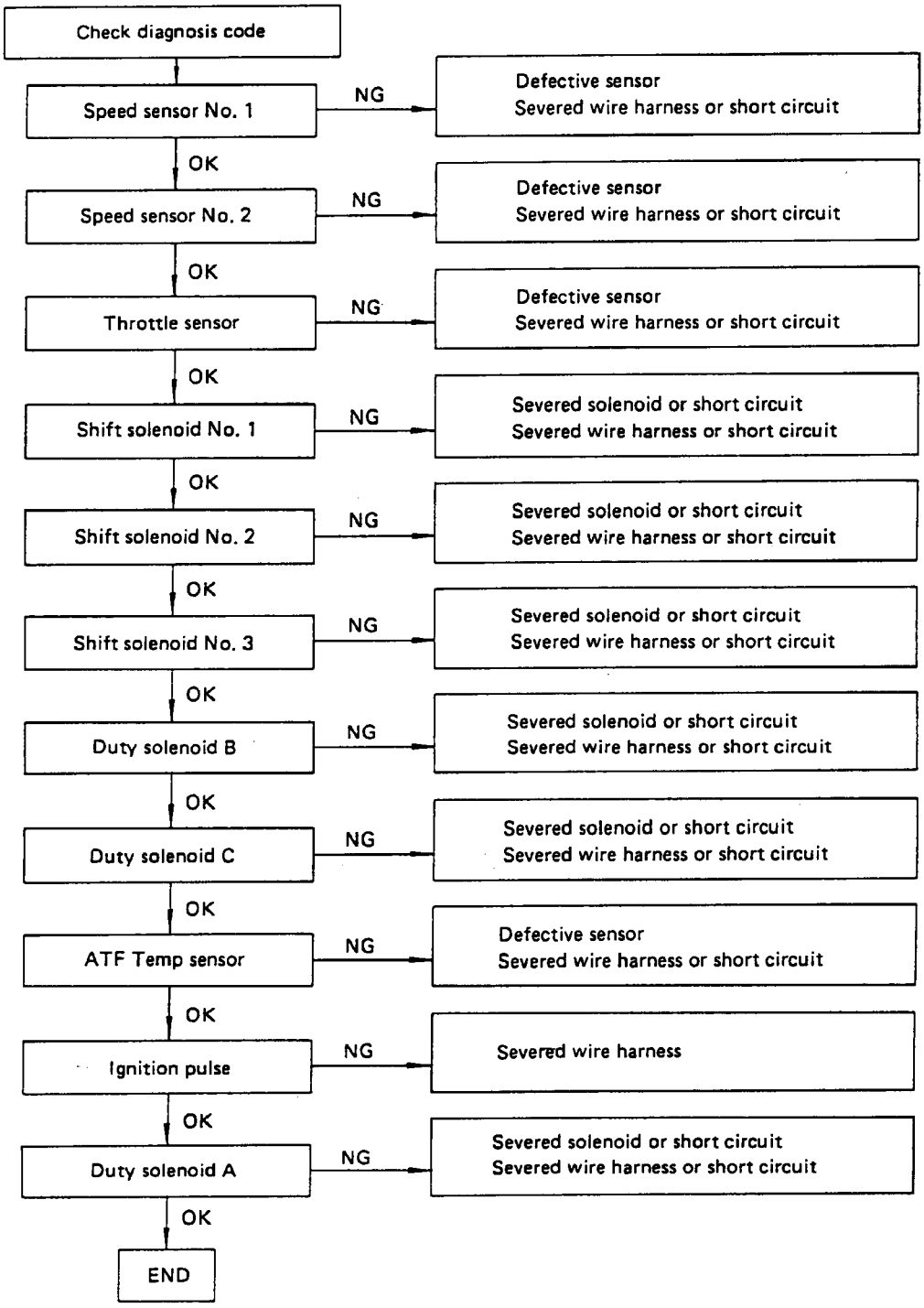


Fig. 275

Blinking POWER Indicator
(when the ignition switch is turned to ON)



	Trouble	Possible cause
1	No shift	① Shift solenoid No. 1 and/or No. 2 • Severed or short circuit ② Speed sensor No. 1 and No. 2 • Defective or severed ③ Power source and grounding • Severed or short circuit
2	Shift point too high or too low	① Throttle sensor • Defective, severed or short circuit ② Speed sensor No. 1 • Defective or severed
3	No up-shift to overdrive (after warm-up)	① Range switch • Severed or short circuit ② ATF temp sensor • Defective or severed ③ Cruise control unit • Operation unusual or short circuit
4	No back-up (after warm-up)	① Duty solenoid B • Severed or short circuit ② ATF temp sensor • Defective, severed or short circuit ③ Ignition pulse • Severed wire harness ④ Idle switch • Severed or short circuit
5	No engine braking effect at "3" range	① Shift solenoid No. 3 • Severed or short circuit ② Throttle sensor • Defective, severed or short circuit ③ Range switch • Severed or short circuit
6	Excessive shift shock	① Duty solenoid A • Severed or short circuit ② Throttle sensor • Defective, severed or short circuit
7	Excessive tight corner braking	① Duty solenoid C • Severed or short circuit ② Throttle sensor • Defective, severed or short circuit ③ Speed sensor No. 1 • Defective, severed or short circuit