SECTION 3A1

DC 5-SPEED AUTOMATIC TRANSMISSION

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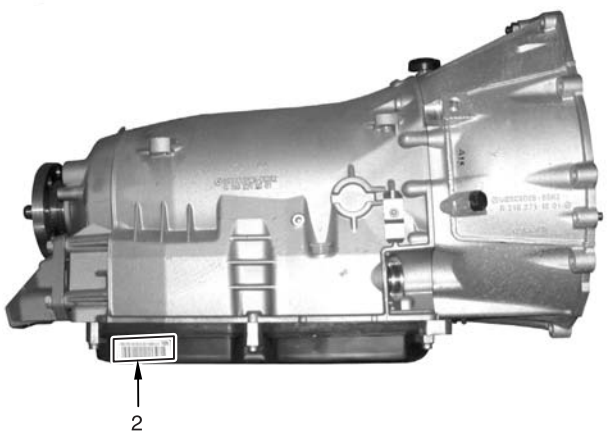
GENERAL INFORMATION

OVERVIEW

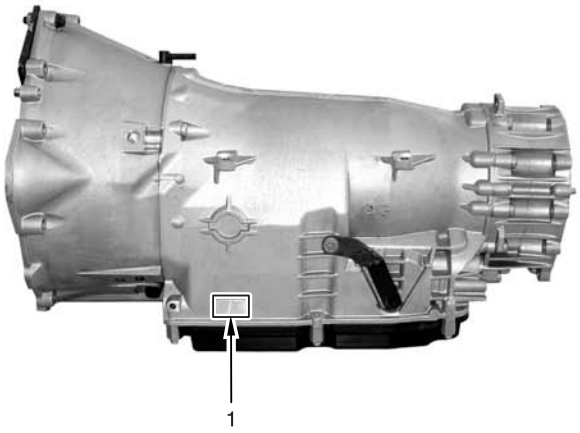
2WD



1 7202700600 — DC Part Number
722 600 0 — DC Variant Number
377900 — Serial Number

3 Automatic Transmission Assembly

4WD



722 600 0
- Engine Code Number
  - 34: D27DT (2WD)
  - 61: D27DT (4WD)
  - 62: E3.2 Engine (4WD)
- Transmission Type
- Automatic Transmission for Passenger Car

Y220_3A1001

▶ DC 5-Speed Automatic Transmission

DCAG 5-speed automatic transmission is an electronically controlled 5-speed transmission with a lockup clutch in the torque converter.

The ratios for the gears are realized by three planetary gear sets. The 5th gear is designed with a step-up ratio of 0.83 as an overdrive. The selector lever is controlled by electronically and mechanically. The gears are shifted by the corresponding combination of three hydraulically actuated multiple-disc brakes, three hydraulically actuated multiple-disc clutches and two mechanical one-way clutches.

This electronically controlled automatic transmission adjusts the operating pressure to provide proper shifting in relation to engine power. This function improves shifting quality significantly. And, the driver can select “S” (Standard) mode or “W” (Winter) mode according to the driving conditions.

This automatic transmission provides two gears even during reverse driving. The internal sensors and controls are connected to TCU by cylindrical 13-pin connector.

*** DCAG 5-speed automatic transmission offers the following advantages:**

1. Improved shifting quality
2. More gears
3. Extended working life and reliability
4. Reduced fuel consumption

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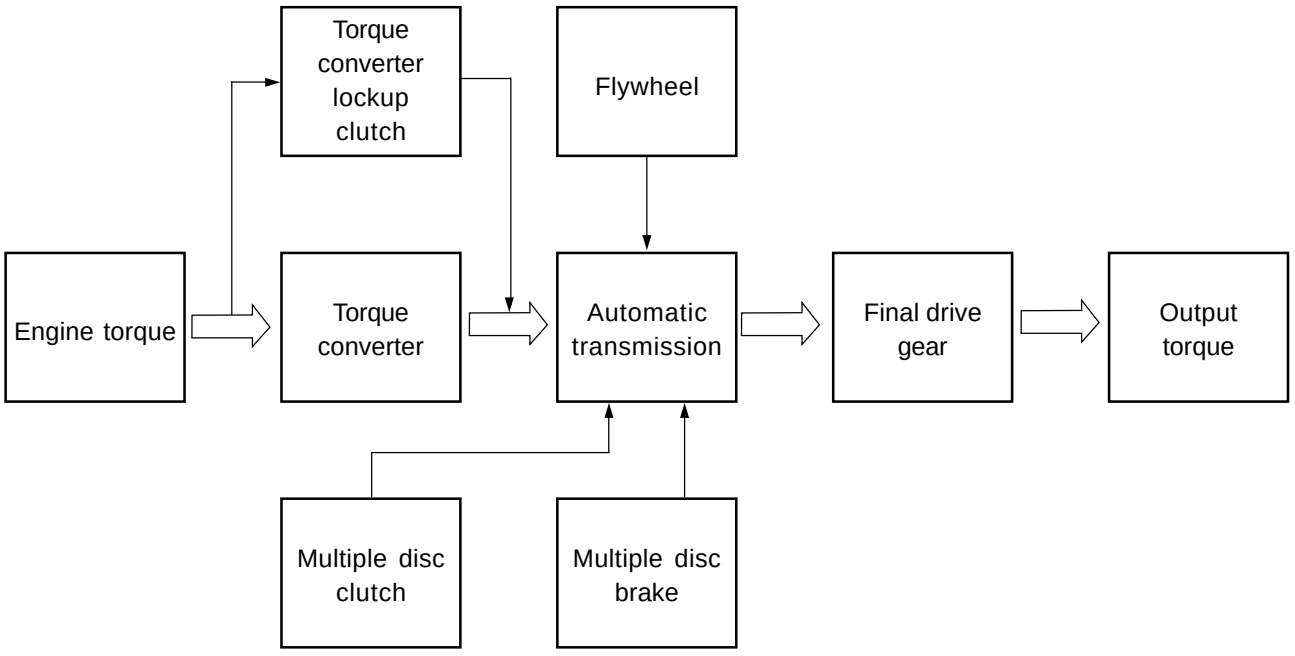
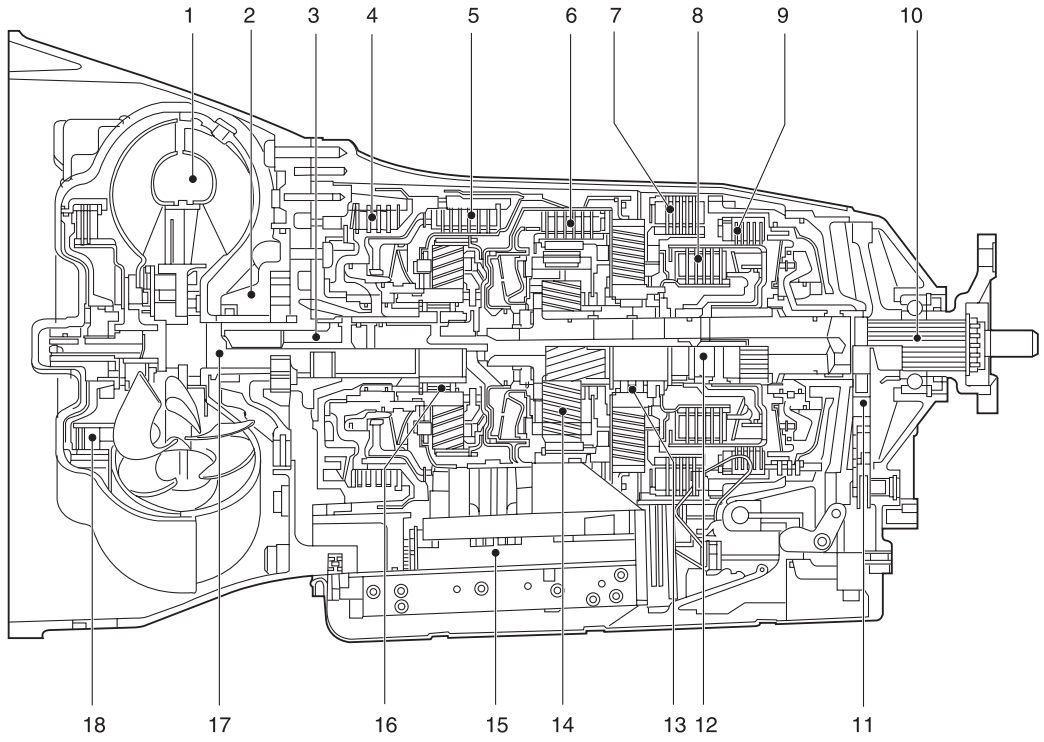
CHARACTERISTICS

Characteristic	Function and Description	Effect
Slope recognition (down hill, up hill)	Recognize it according to engine RPM and accelerator pedal position	Delay up shift
Engine torque limitation	During 1st gear driving or reverse driving with full throttle condition	Prevent automatic transmission from overheating
Engine torque decrease	Delay of ignition timing to reduce torque at all shifting moments	Improve shift quality
Engine rpm limitation	Limit engine rpm until the gears are fully engaged when shifting from “P” or “N” to “D”	Prevent shift shock
ESP Operation	When the ESP is controlling the engine torque, shifting is not available and vehicle starts off with 2nd gear.	Cannot use kick-down function and shift at maximum rpm
ABS Operation	Not any effect to brake control	
Fast-off function	Does not up shift when accelerator pedal is abruptly released	To get an engine brake effect during cornering
Altitude recognition	As altitude increases (atmospheric pressure reduces) engine torque decreases. Up shift while additionally depressing the accelerator pedal (adjusting shift diagram)	Improves driving performance and increases torque
Oil temperature	If transmission oil temperature is too low, the shifting point gets delayed in full throttle and kick down	Improves driving performance
Hydraulic pressure is produced in emergency driving mode	When starting the engine with cycling the ignition switch (“OFF” and “ON”) due to transmission trouble, the selector lever should be placed in “P” position. If starting the engine with selector lever “N” position, the lever should be moved into “P” position. Because, the hydraulic pressure can be produced in selector lever “P” position.	The hydraulic pressure flows with direct operation mode via “R” and “D” valve to operate “R” and “forward 2nd” gear.
Adaptation	Function to optimize the shifting quality.	To exclude play and wear



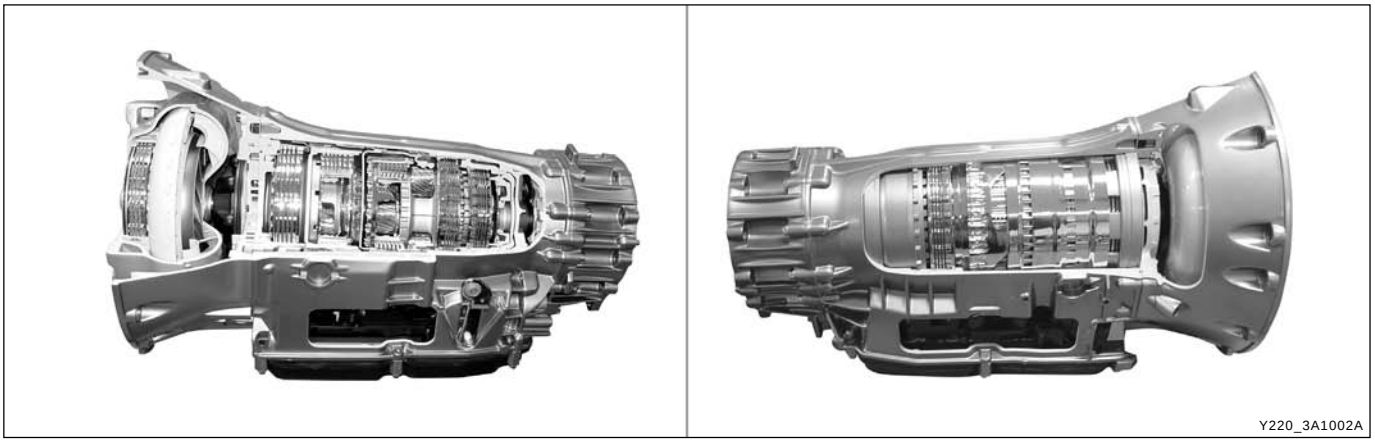
STRUCTURE



※ Basic structure of DC 5-speed automatic transmission

Y220_3A1002

1. Torque converter
2. Oil pump
3. Input shaft
4. Disc brake B1
5. Disc clutch C1
6. Disc clutch C2
7. Disc brake B3
8. Disc clutch C3
9. Disc brake B2
10. Output shaft
11. Parking lock gear
12. Intermediate shaft
13. Freewheel F2
14. Center planetary gear set
15. Electric control unit (valve body)
16. Freewheel F1
17. Stator shaft
18. Converter lockup clutch



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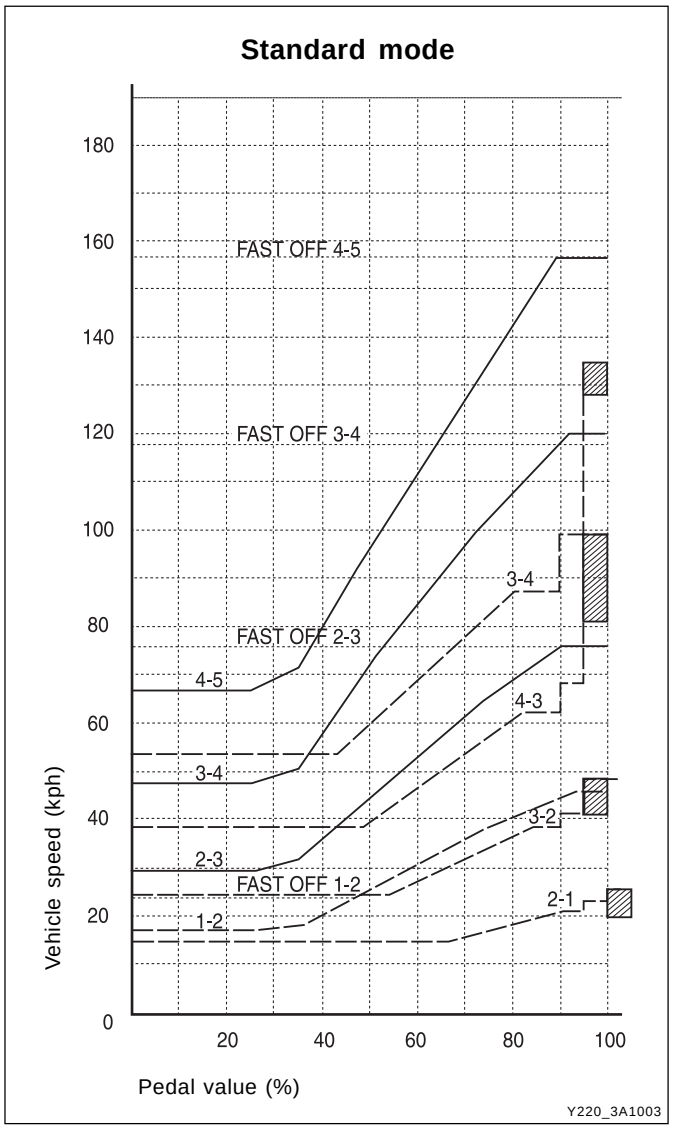
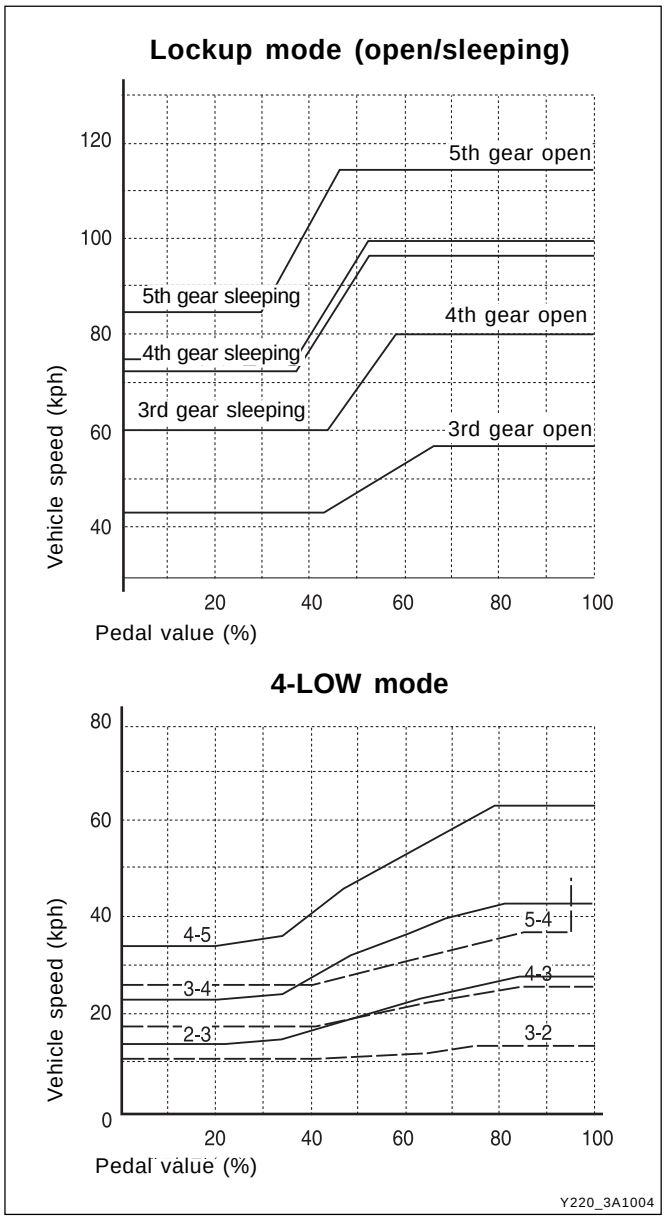
PERFORMANCE CURVE AND GENERAL CHARACTERISTICS





Note

1. ***Based on DI Engine + A/T equipped vehicle specifications***
   - ***Gear ratio***

     1st gear: 3.595 ***Rev. 1st gear: 3.167***
     2nd gear: 2.185 ***Rev. 2nd gear: 1.926***
     3rd gear: 1.405 ***Axle ratio: 3.31***
     4th gear: 1.000
     5th gear: 0.831
2. ***WINTER Mode: Standard Mode***
3. ***Allowable shifting point:***
   Upshift
   Downshift
   Lockup (sleeping)
   Unlock (open)
   FAST OFF
   Dynamic shift range
4. ***FAST OFF***
   - ***When abruptly releasing the accelerator pedal, the transmission remains at 4th gear other than 4 →4 shift (when slowly releasing the accelerator pedal, the transmission is shifted to 5th gear).***
5. ***Dynamic shift range***
   - ***When operating the accelerator pedal, the 4 →3 shift is completed by kick-down signal after completion of 4 →4 shift.***
   - ***When promptly operating the accelerator pedal, the 4 →3 shift is done in shaded arae.***

SPECIFICATIONS

Item		W5A330 (300)	W5A580 (400)
Input torque		330 Nm	580 Nm
Weight (including ATF)		78 kg	78 kg
Diameter (Torque converter)		270 mm	270 mm
Lockup function		Yes	Yes
Gear ratios	1st	3.951	3.595
	2nd	2.423	2.186
	3rd	1.486	1.405
	4th	1.000	1.000
	5th	0.833	0.831
	Reverse: S mode / W mode	3.147/1.93	3.167/1.926
Driving type		2WD (4WD)	
Fluid specification		Fuchs ATF 3353 or Shell ATF 3353	
Fluid capacity		approx. 8 ℓ	
Selector lever position	P.R.N.D	Mechanical	
	D+/D-	Electrical	
Parking lock system		Brake switch (signal) →TGS lever	
Reverse lock system		CAN →TGS lever	
Selected lever indication	P.R.N.D	Lever position	
	4, 3, 2, 1	CAN	
Oil temperature sensor	Resistance: R, D	0.5 ~ 2.5 kΩ	
	Resistance: P, N	20 kΩ	
TCU		EGS 52	
Shift solenoid valve (25°C)	Resistance	3.8 ± 0.2 Ω	
	Operating distance	0.2 mm	
	Operating current	1.5 ~ 2 A	
M/P, S/P solenoid valve (23°C)	Resistance	5.0 ± 0.2 Ω	
	Operating distance	0.6 mm	
	Operating current	0 ~ 1 A	
Lockup solenoid valve (25°C)	Resistance	2.5 ± 0.2 Ω	
	Operating distance	0.2 mm	
	Operating current	1.5 ~ 2.0 A	
	Operating range	3rd to 5th gears	
RPM sensor	Resistance	HALL type	
	Operating voltage	6 V	
Start lockout switch	Switch contact	ON (D, R position)	
	Switch contact	OFF (P, N position)	

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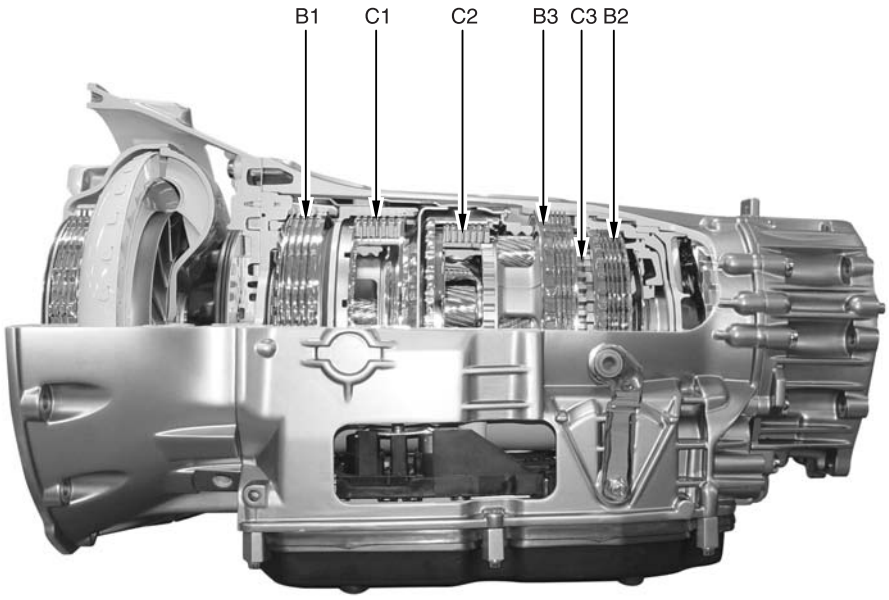
Item		W5A330 (300)	W5A580 (400)
Mode switch		W (Winter)	
		S (Standard)	
One-way clutch		F1, F2	
Planetary gear set	Plain planetary gear: 3 (number of pinion)	3, 4, 3	4, 4, 4
Disc clutch	Disc: C1, C3	Single, Double	
	Disc: C2	Only Double	
Disc brake	Disc: B1	Single, Double	
	Disc: B2, B3	Only Double	

POWER FLOW

▶ Sectional View



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Shifting elements

Gear	C1	C2	C3	B1	B2	B3	F1	F2
1			● 3)	● 3)	●		●	●
2	●		● 3)		●			●
3	●	●			●			
4	●	●	●					
5		●	●	● 3)			●	
P/N 1)			●	●				
P/N 2)	●		●					
R 1)			●	● 3)		●	●	
R 2)	●		●			●		

1) Selector program switch: “S” mode

2) Selector program switch: “W” mode

3) Overrun

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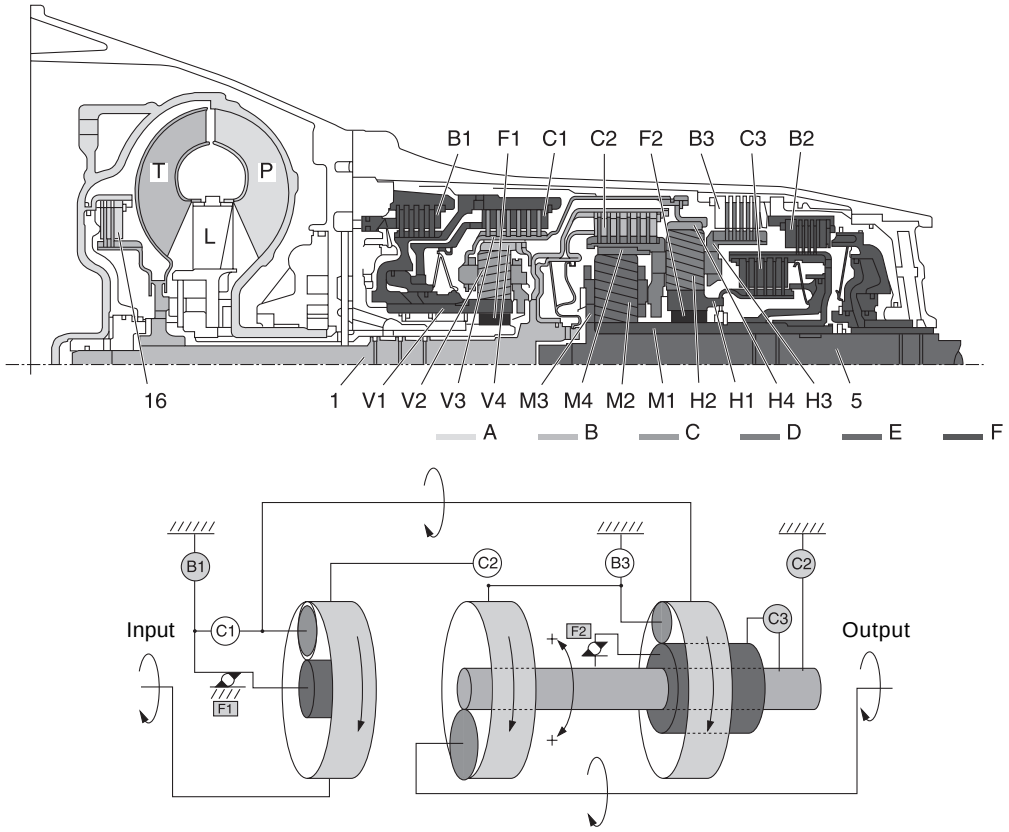
▶ 1st Gear (3.932)



16. Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. 3rd gear ratio
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

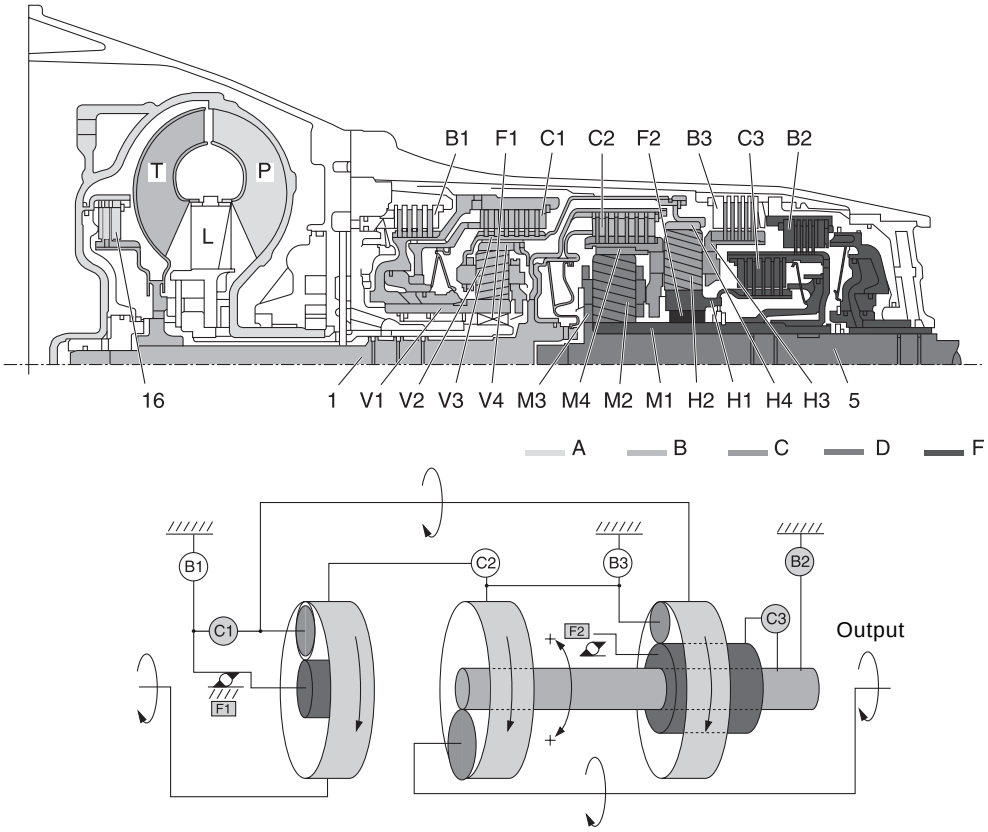
Y220_3A1006

* Input shaft: Clockwise rotation
* Front sun gear: Locked by F1 and B1, Planetary gear carrier: Rotation with reduced speed
* Rear ring gear: Counterclockwise rotation
* Rear sun gear: Locked by F2 and B2, Planetary gear carrier: Clockwise rotation with reduced speed
* Center ring gear: Clockwise rotation
* Center sun gear: Locked by B2, Rotation with reduced speed
* Output shaft: Clockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2	Lockup clutch
1			● 3)	● 3)	●		●	●	

3) Overrun

▶ 2nd Gear (2.408)



16. Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

Y220_3A1007

* Input shaft: Clockwise rotation
* Sun gear and planetary gear carrier: Clockwise rotation by C1 activation
* Rear ring gear: Clockwise rotation
* Rear sun gear: Locked by F2 and B2, Planetary gear carrier: Rotation with reduced speed
* Center ring gear: Clockwise rotation
* Sun gear: Locked by B2, Planetary gear carrier: Rotation with reduced speed
* Output shaft: Clockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
2	●		● 3)		●			●

3) Overrun

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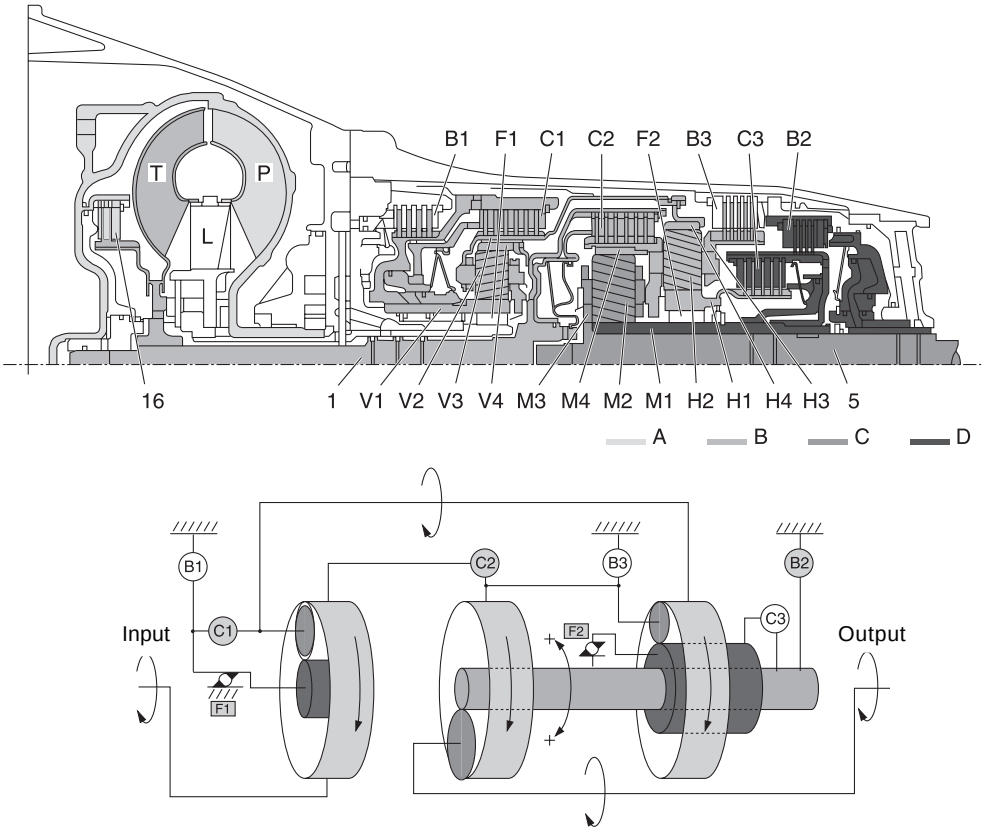
▶ 3rd Gear (1.486)



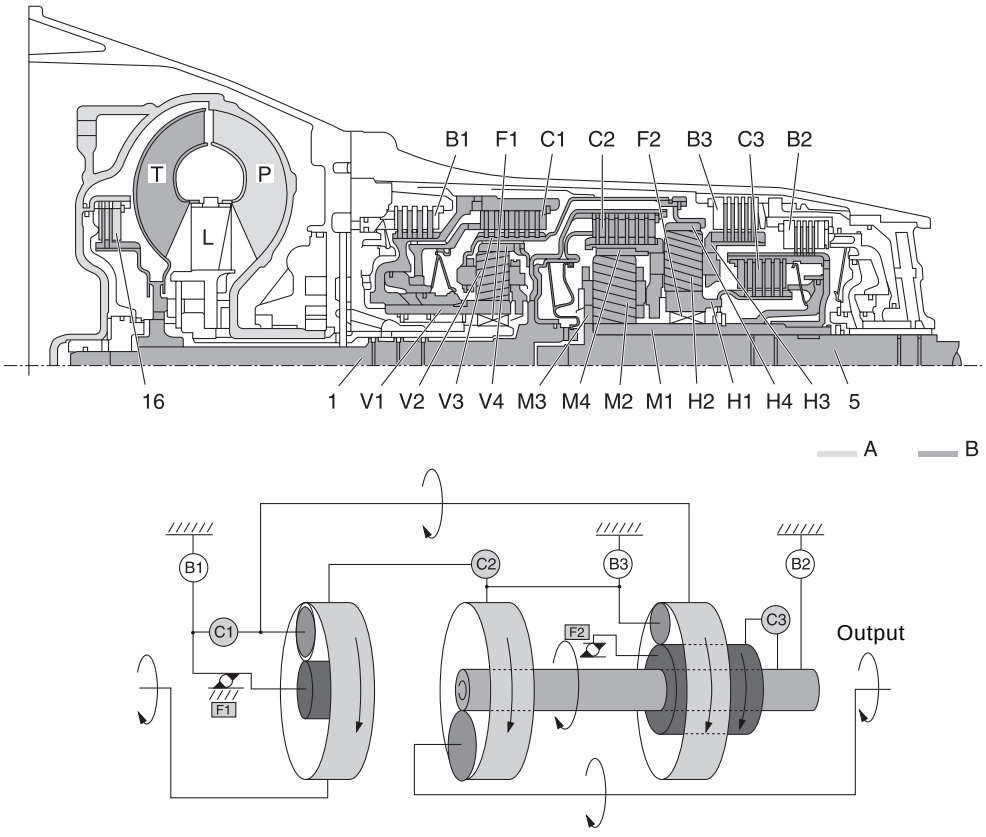
16. Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

Y220_3A1008

* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Center ring gear: Clockwise rotation by clutch 2 activation (direct connection)
* Center sun gear: Locked by B2, Planetary gear carrier: Clockwise rotation with reduced speed
* Output shaft: Clockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
3	●	●			●			

▶ 4th Gear (1.000)



16. Torque converter lockup clutch
A. Engine speed
B. Planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

Y220_3A1009

* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Center ring gear and rear planetary gear carrier: Clockwise rotation
* Front sun gear and planetary gear carrier: Clockwise rotation (direct connection)
* Rear ring gear: Clockwise rotation
* Rear sun gear: Rotation by ring gear and planetary gear carrier (direct connection)
* Center ring gear: Clockwise rotation by C3 activation
* Planetary gear carrier: Clockwise rotation by center sun gear and ring gear (direct connection)
* Output shaft: Clockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
4	●	●	●					

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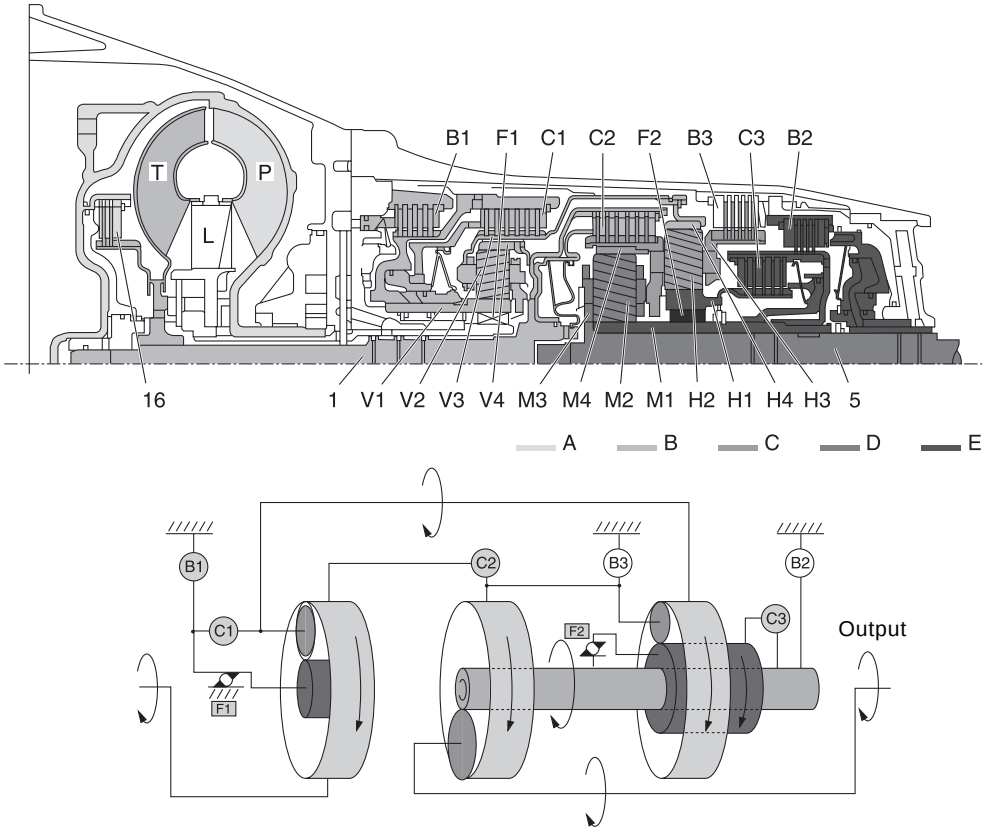
▶ 5th Gear (0.830)



16. Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. 3rd gear ratio
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

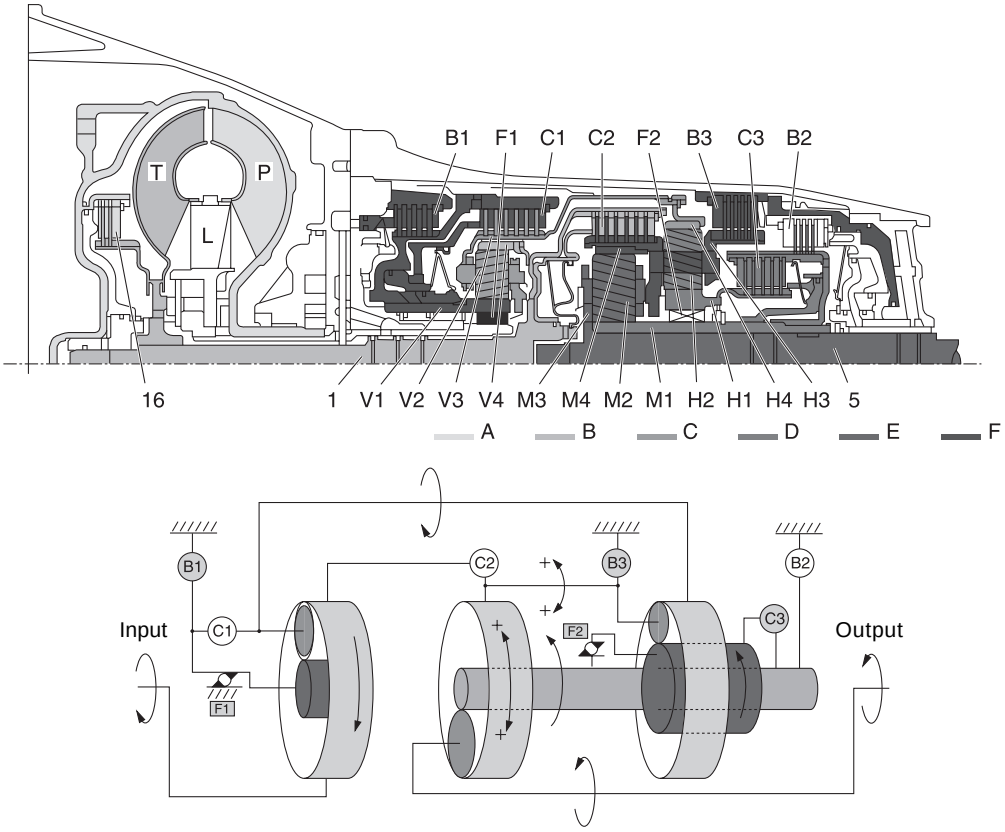
Y220_3A1010

* Input shaft: Clockwise rotation
* Front sun gear: Locked, Planetary gear carrier: Rotation with reduced speed
* Rear planetary gear carrier: Clockwise rotation with reduced speed
* Center ring gear and rear planetary gear carrier: Clockwise rotation by clutch C2 activation
* Rear sun gear: Clockwise rotation because rear planetary gear carrier rotates faster than rear ring gear (increased speed)
* Center sun gear: Clockwise rotation with increased speed by C3 activation
* Center planetary gear carrier: Clockwise rotation (increased speed)
* Output shaft: Clockwise rotation (increased speed)

Gear	C1	C2	C3	B1	B2	B3	F1	F2
5		●	●	● 3)			●	

3) Overrun

▶Reverse 1st Gear (3.160, “S” Mode)



16. Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
F. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

Y220_3A1011

* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Front sun gear: Locked by one-way clutch F1
* Front planetary gear carrier: Clockwise rotation (reduced speed)
* Rear planetary gear ring gear: Clockwise rotation
* Rear planetary gear carrier: Locked by B3
* Rear sun gear and center sun gear: Counterclockwise rotation (increased speed)
* Center ring gear: Locked by B3
* Center planetary gear carrier: Counterclockwise rotation (reduced speed)
* Output shaft: Counterclockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
R (S)			●	● 3)		●	●	

3) Overrun

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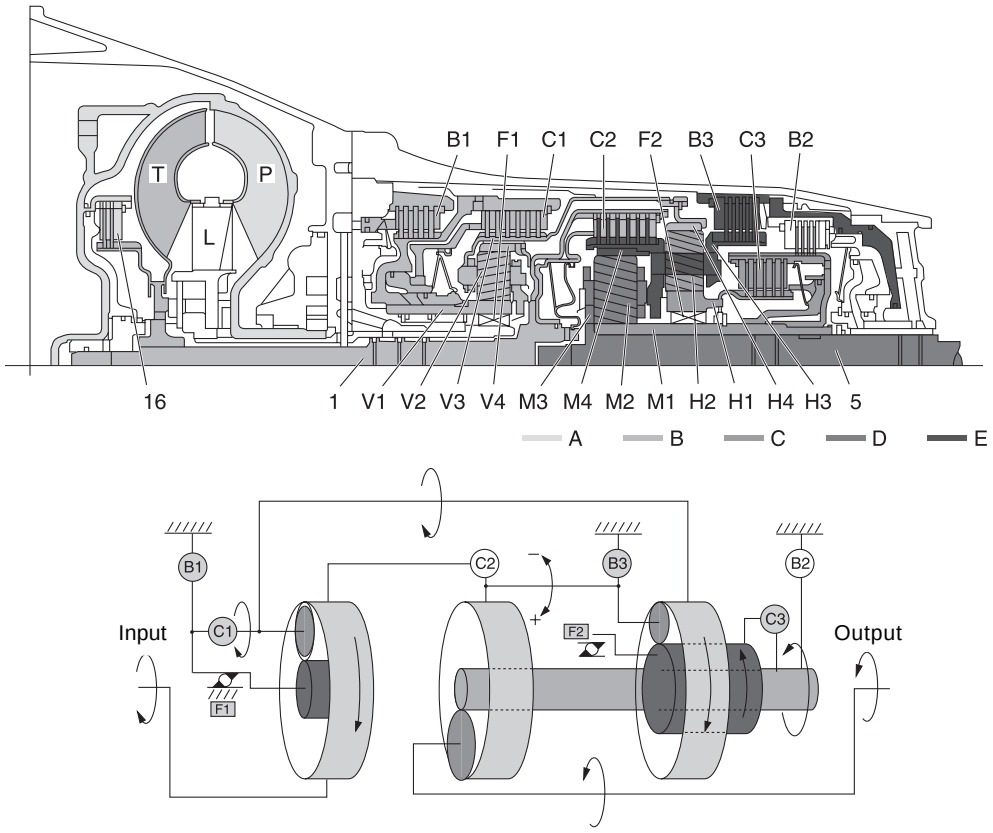
▶ Reverse 2nd Gear (1.930, "W" Mode)



16. Torque converter lockup clutch
A. Engine speed
B. Transmission, input shaft
C. 1st gear ratio
D. 2nd gear ratio
E. Mounting elements
H. Rear planetary gear set
L. Stator
M. Center planetary gear set
P. Impeller
T. Turbine wheel
V. Front planetary gear set

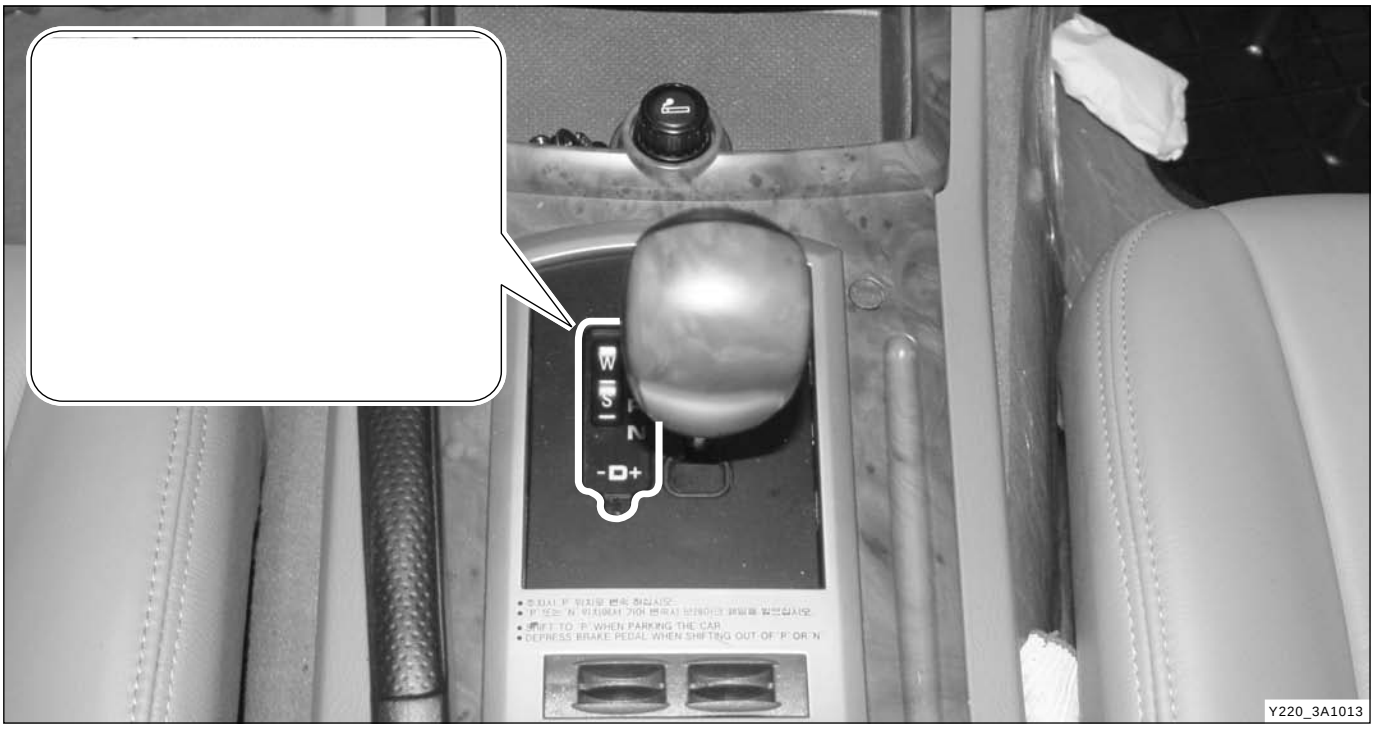
Y220_3A1012

* Input shaft: Clockwise rotation
* Front ring gear: Clockwise rotation
* Front planetary gear carrier: Clockwise rotation by clutch C1 activation (direct connection)
* Rear ring gear: Clockwise rotation
* Rear planetary gear carrier and center ring gear: Locked by brake B3
* Rear sun gear and center sun gear: Counterclockwise rotation (increased speed)
* Center planetary gear carrier: Counterclockwise rotation (reduced speed)
* Output shaft: Counterclockwise rotation

Gear	C1	C2	C3	B1	B2	B3	F1	F2
R (W)	●		●			●		

FUNCTION AND DESCRIPTION

SELECTOR LEVER



P: Parking and starting position

This position is used when the vehicle is parking, starting the engine or stationing the vehicle. In this position, the driving wheels are locked by parking pawl. To shift into any other positions, must depress the brake pedal (parking lock system).

R: Reverse driving

Conversion between Standard and Winter switch changes the reverse gear ratio but must be operated before the selector lever is moved. Pressing on the Winter switch allows to have effective driving when driving on the slippery road surface and, also, possible to have smooth driving in reverse as it starts in 2nd gear.

N: Neutral, starting and towing position

The engine can be started in this position. And, this position is used in temporary stop. If it is necessary to tow a vehicle, use a professional tow truck service. If not available, use emergency towing by towing vehicle and lope. In this case, the towing distance should be limited by 50 km with 50 km/h of towing speed.

D: All forward gears (1st ~ 5th)

This position is for all normal forward driving in 1st to 5th gear. At 5th gear, the gear ratio is 0.83:1. When driving forward at the speed of over 10 km/h, the selector lever cannot be changed to “P” or “R” position by parking reverse block function.

4: Up shifting only up to 4th gear

In general, up to 4th gear is automatically shifted at the normal road driving position. In “D” position, while driving, pushing the lever in the left (–) direction once makes down shift to 4th gear, which is the same function as the O/D OFF (Over Drive OFF) of normal vehicle.

3: Up shifting only up to 3rd gear

Automatically shifts up to only 3rd gear and able to achieve engine brake effect on long slope/down hill and, in “D” position, pushing the lever in the left (–) direction twice makes down shift from 5th gear to 3rd gear.

2: Up shifting only up to 2nd gear

Automatically shifts up to only 2nd gear and used in mountain road, unpaved road and while being towed by trailer. It can achieve engine brake effect and, in D position, pushing the lever in the left (–) direction 3 times makes down shift from 5th gear to 2nd gear.

1: Driving in 1st gear only

Drives only in 1st gear, and used in long mountainous terrain, steep heel and unpaved road. It is used when engine brake effect for driving down hill is required.

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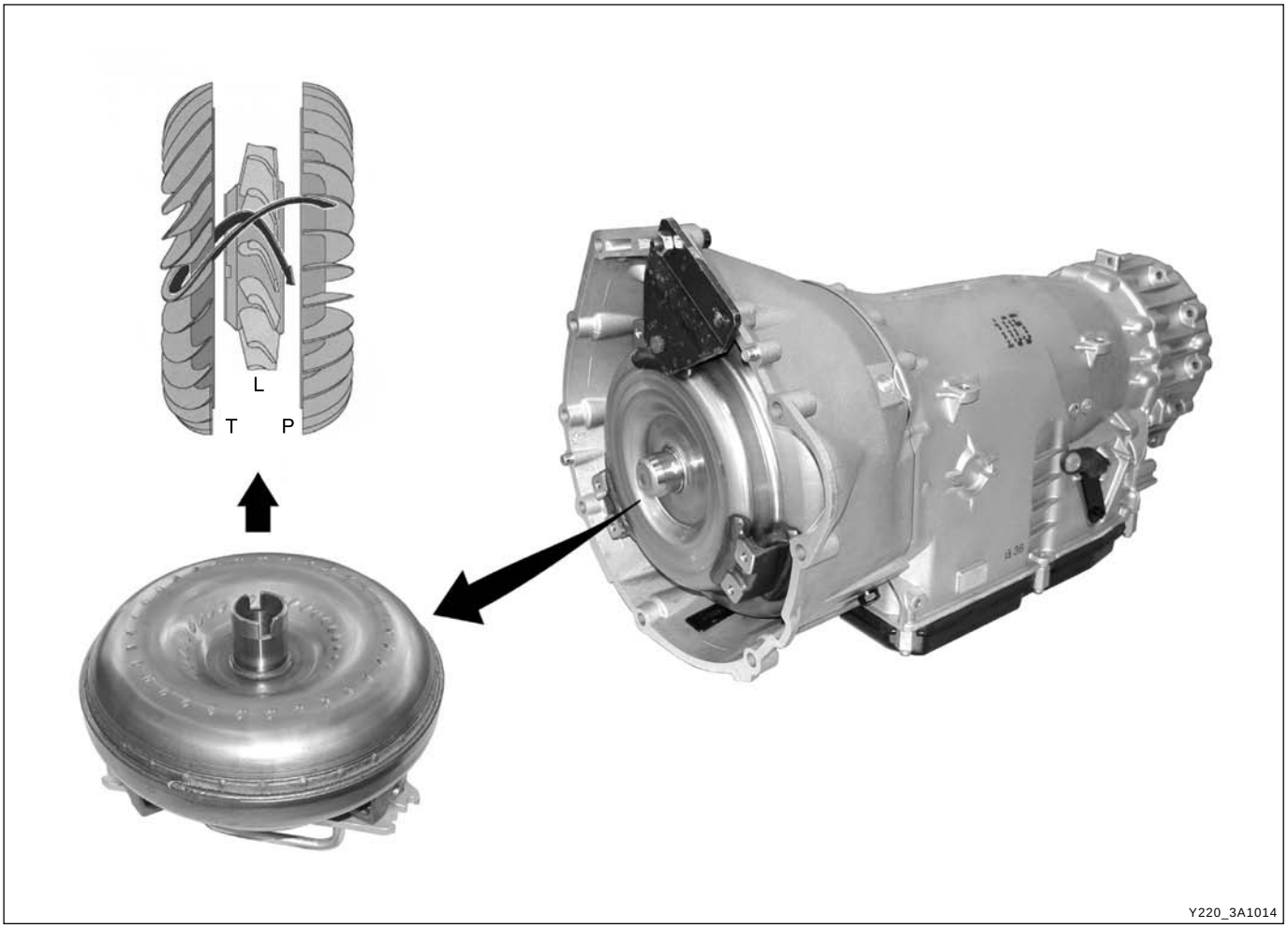
TORQUE CONVERTER

▶ Function (4WD)



Torque converter is installed between engine and automatic transmission. It consists of pump impeller, turbine and stator. The pump impeller is welded at converter housing and the converter housing is bolted at fly wheel.

The torque converter converts the mechanical energy from engine to hydraulic energy, and the turbine connected to transmission input shaft converts this hydraulic energy to mechanical energy again. The stator between pump and turbine increases the output torque from turbine by converting the flowing direction.

The stator has a torque converter area that changes the flowing direction and a fluid coupling area where the stator rotates. And, the lockup clutch integrated in torque converter prevents the power from losing and reduces fuel consumption.

Installation and Inspection

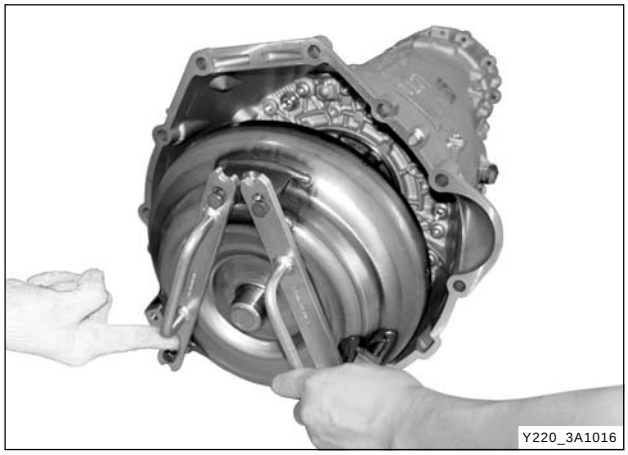
- Place the automatic transmission upright as shown in figure and install the torque converter by rotating the torque converter. When installing from sideway, the torque converter sealing ring may be damaged by driving flange which could cause oil leaks.

- Use special tools when removing and installing torque converter.

Notice

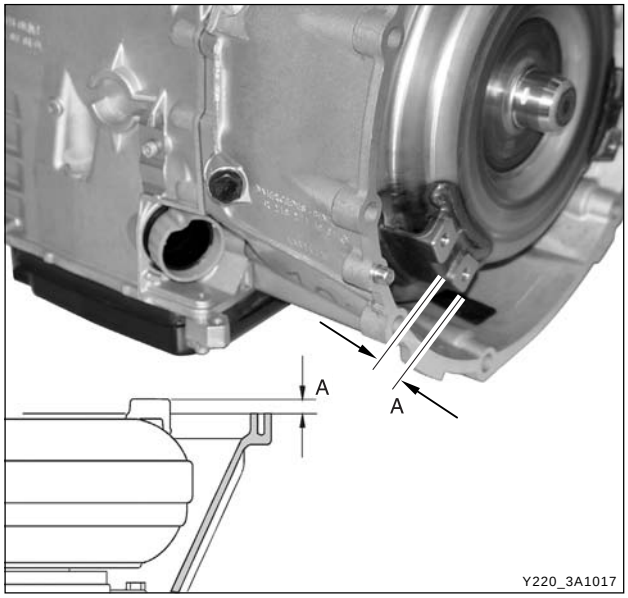
Place the automatic transmission upright when removing and installing torque converter.

If not, the oil seal may be damaged when servicing the torque converter.

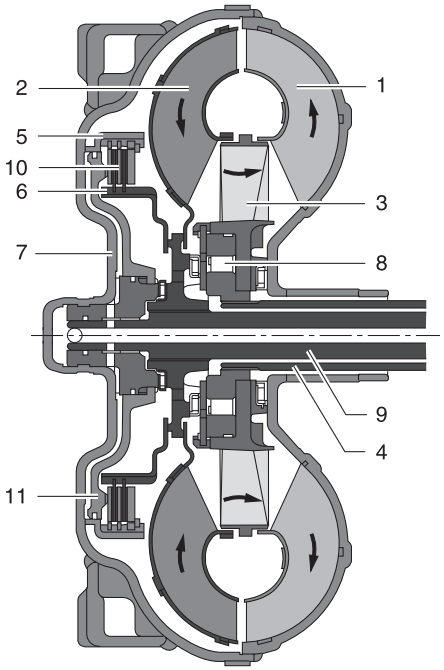


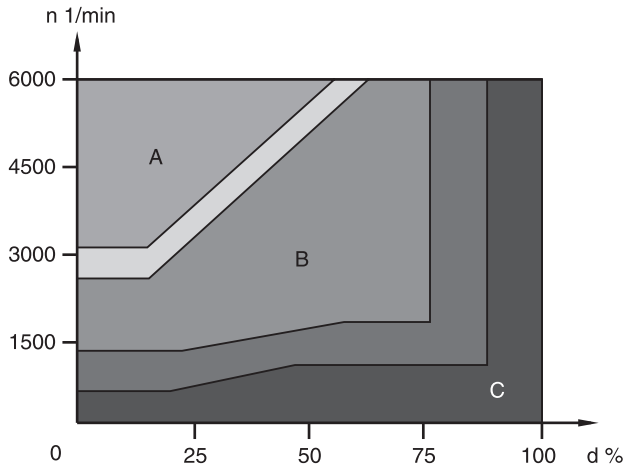
- The distance between the upper end of torque converter and the mating surface of automatic transmission housing should be within specified value as follows:

Specified installation height (A)	below 6.5 mm



LOCKUP CLUTCH





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1. Impeller wheel
2. Turbine wheel
3. Stator wheel
4. Stator shaft
5. Multiple disc clutch drum
6. Multiple disc clutch hub
7. Converter cover
8. One-way clutch
9. Input shaft
10. Multiple disc clutch pack
11. Piston

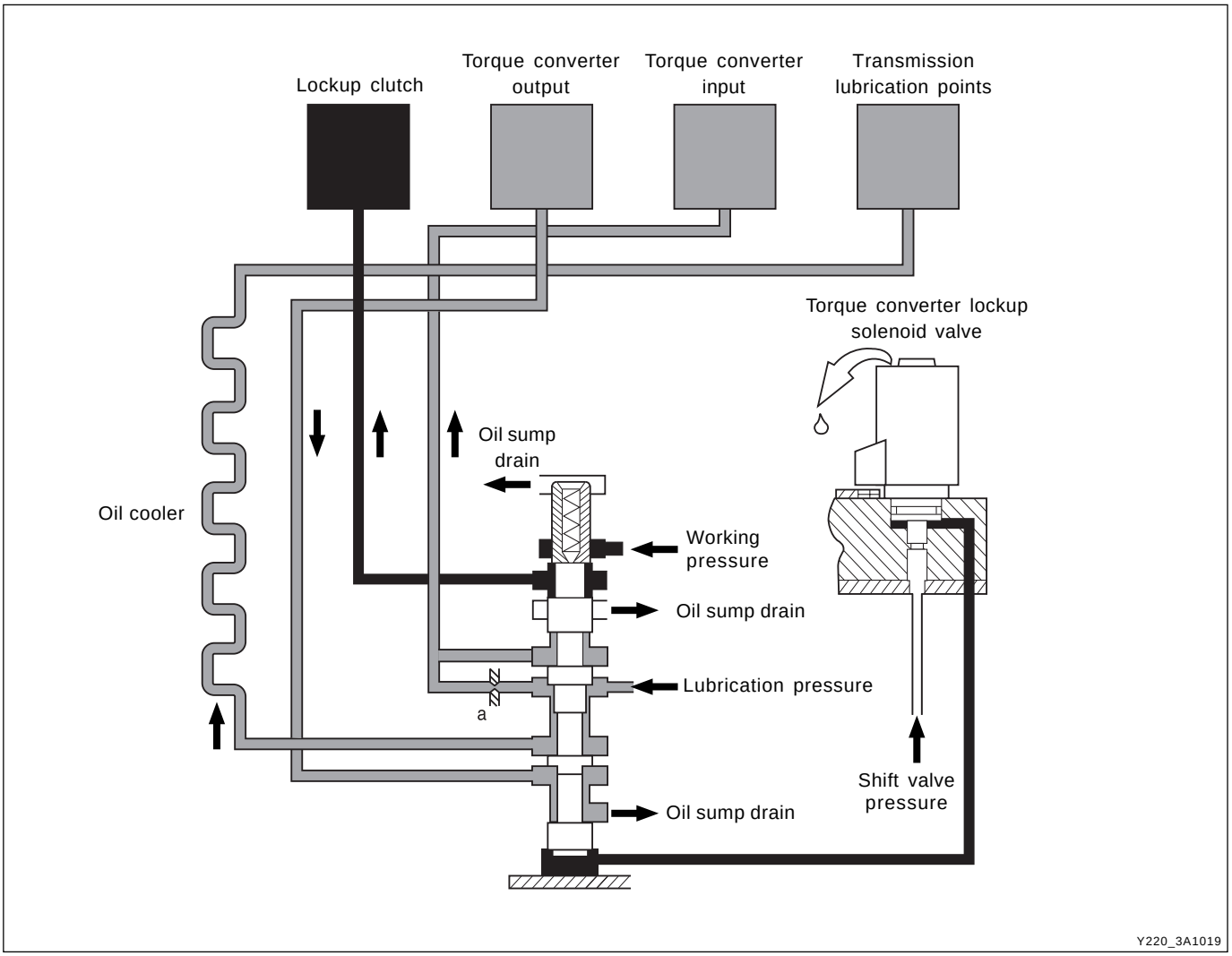
A : Closed (lockup clutch activates)
B : Slipping
C : Open (lockup clutch deactivates)
n : Transmission output speed
d : Accelerator pedal position

Lockup clutch consists of multiple disc clutches as shown in the figure and is activated in 3th, 4th and 5th gears. The aim of using torque converter lockup clutch is to reduce the fuel consumption and exhaust gas emissions of the vehicle by reducing torque converter slip. This stands in contradiction to the ride comfort demands made on the drive train with regard to its vibration behaviors. The task of the electronic transmission control is therefore to close the clutch in all driving situations relevant to fuel consumption, if possible, and ensure that the engine vibrations are isolated from the drive train.

The characteristic curves shown in the diagram illustrate the different operating states of the torque converter lockup clutch in relation to the accelerator pedal position and the transmission output speed, plotted for one transmission gear.

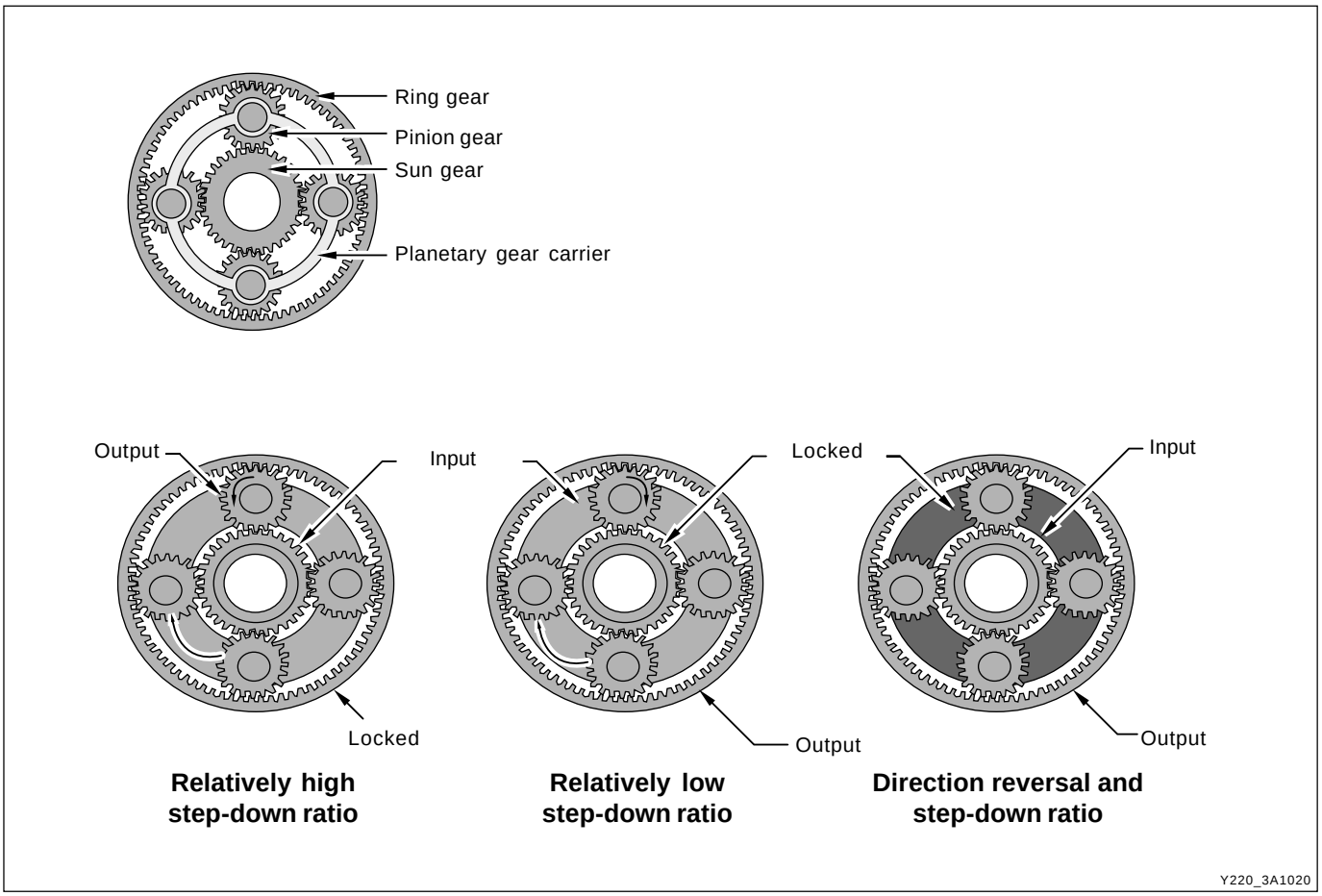
- Variables influencing the states of the torque converter lockup clutch:
  1. Accelerator pedal movement
  2. Uphill and downhill gradients
  3. Transmission shift functions
  4. Transmission oil temperature
  5. Load conditions
  6. Engine control influences

▶ Lockup Clutch Regulating Valve



Lockup clutch regulating valve controls the lockup clutch in torque converter and distributes the lubricating oil to the friction parts. TCU generates the lockup clutch control pressure by duty controlling the lockup solenoid valve, and this pressure is applied to the lockup clutch regulating valve to engage, disengage and slip the lockup clutch. When the lockup clutch control pressure is increased, the lockup clutch regulating valve moves up and the working pressure is applied to lockup clutch. In its regulating position (slipping, torque converter lockup clutch pressurized), a reduced volume of lubricating oil flows through the annular passage bypassing the torque converter and passing direct through the oil cooler into the transmission. The rest of the lubricating oil is directed via the throttle “a” into the torque converter in order to cool the torque converter lockup clutch.

PLANETARY GEAR SET



Relatively high step-down ratio

Ring gear locked

Sun gear driving (clockwise)

Planet gears driven (rotating counterclockwise)

Planet carrier driven (revolving clockwise)

Relatively low step-down ratio

Sun gear locked

Ring gear driving (clockwise)

Planet gears driven (rotating clockwise)

Planet carrier driven (revolving clockwise)

Direction reversal and step-down ratio

Planet carrier locked

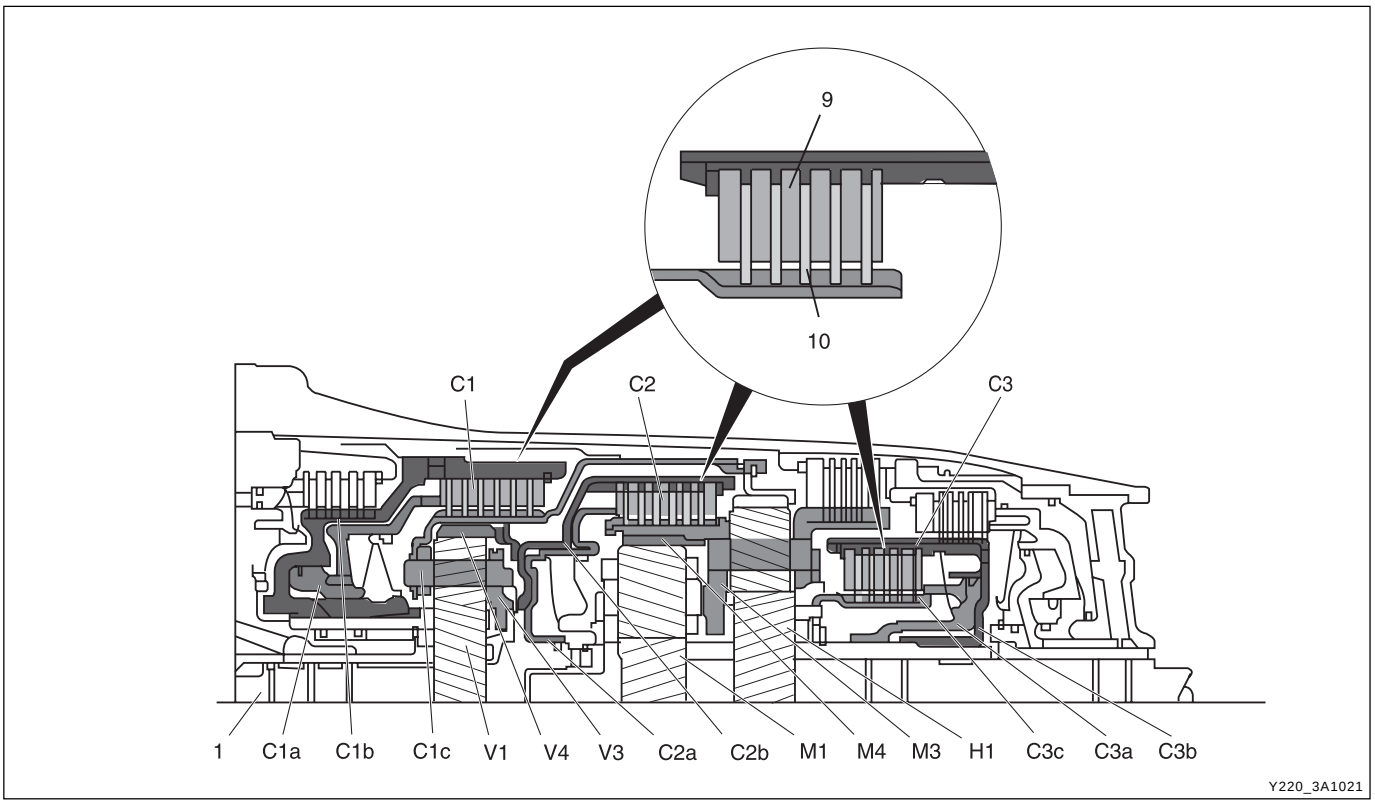
Sun gear driving (clockwise)

Planet gears driven (counterclockwise)

Ring gear driven (counterclockwise)

Gear ratio: teeth of sun gear / teeth of ring gear

MULTIPLE-DISC CLUTCH



1. Input shaft
9. Externally toothed disc
10. Internally toothed disc
H1. Rear sun gear
C1a. Piston C1
C1b. Externally toothed disc carrier C1
C1c. Internally toothed disc carrier C1
C2a. Piston C2
C2b. Externally toothed disc carrier C2
C3a. Piston C3
C3b. Externally toothed disc carrier C3
C3c. Internally toothed disc carrier C3
M1. Middle sun gear
M3. Middle planet carrier
M4. Middle ring gear
V1. Front sun gear
V3. Front planet carrier
V4. Front ring gear

Location

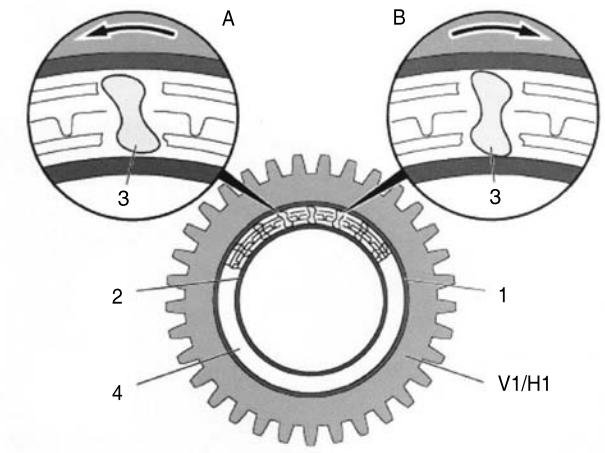
Three multiple-disc clutches, the front, middle and rear multiple-disc clutches K1, K2 and K3, are located in the planetary gear sets in the transmission housing.

Funtion and description

A multiple-disc clutch consists of a number of internally toothed discs (10) on an internally toothed disc carrier and externally toothed discs (9) on an externally toothed disc carrier.

If the piston (C1a) on multiple-disc clutch K1 is subjected to oil pressure, it presses the internal and external discs of the disc set together. The sun gear (V1) is locked with the planet carrier (V3) via the externally toothed disc carrier (C1b) and the internally toothed disc carrier (C1c). The front planetary gear set is thus locked and turns as a closed unit. If the multiple-disc clutch C2 is actuated via the piston (C2a), the piston compresses the disc set. The ring gear (V4) of the front planetary gear set is locked with the ring gear (M4) of the middle planetary gear set via the externally toothed disc carrier (K2b) and the middle planet carrier (M3) on which the internally toothed discs are seated. Ring gear (V4) and ring gear (M4) turn at the same speed as the input shaft (1). If the multiple-disc clutch C3 is actuated via the piston (C3a), the piston compresses the disc set. The sun gear (M1) of the middle planetary gear set is locked with the sun gear (H1) of the rear planetary gear set via the externally toothed disc carrier (C3b) and the internally toothed disc carrier (C3c). Sun gear (M1) and sun gear (H1) turn at the same speed.

FREEWHEEL



Y220_3A1022

1. Outer race
2. Inner race
3. Locking elements
4. Locking element cage

A. Rotation direction “A”
B. Rotation direction “B”
V1/H1. Front or rear sun gear

Location

Freewheels are installed in the front planetary gear set between the sun gear and the stator shaft, and in the rear planetary gear set between the sun gear and the intermediate shaft.

Function and description

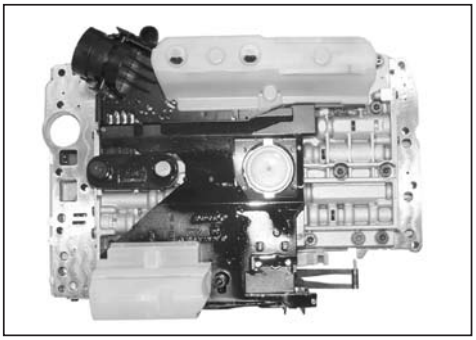
The freewheel consists of an outer race (1), an inner race (2), a number of locking elements (3) and a cage (4) for these locking elements.

If the inner race (2) of the freewheel is locked and the outer race (1) turns in direction “A”, the locking elements (3) adopt a diagonal position on account of their special contours, allowing the freewheel function.

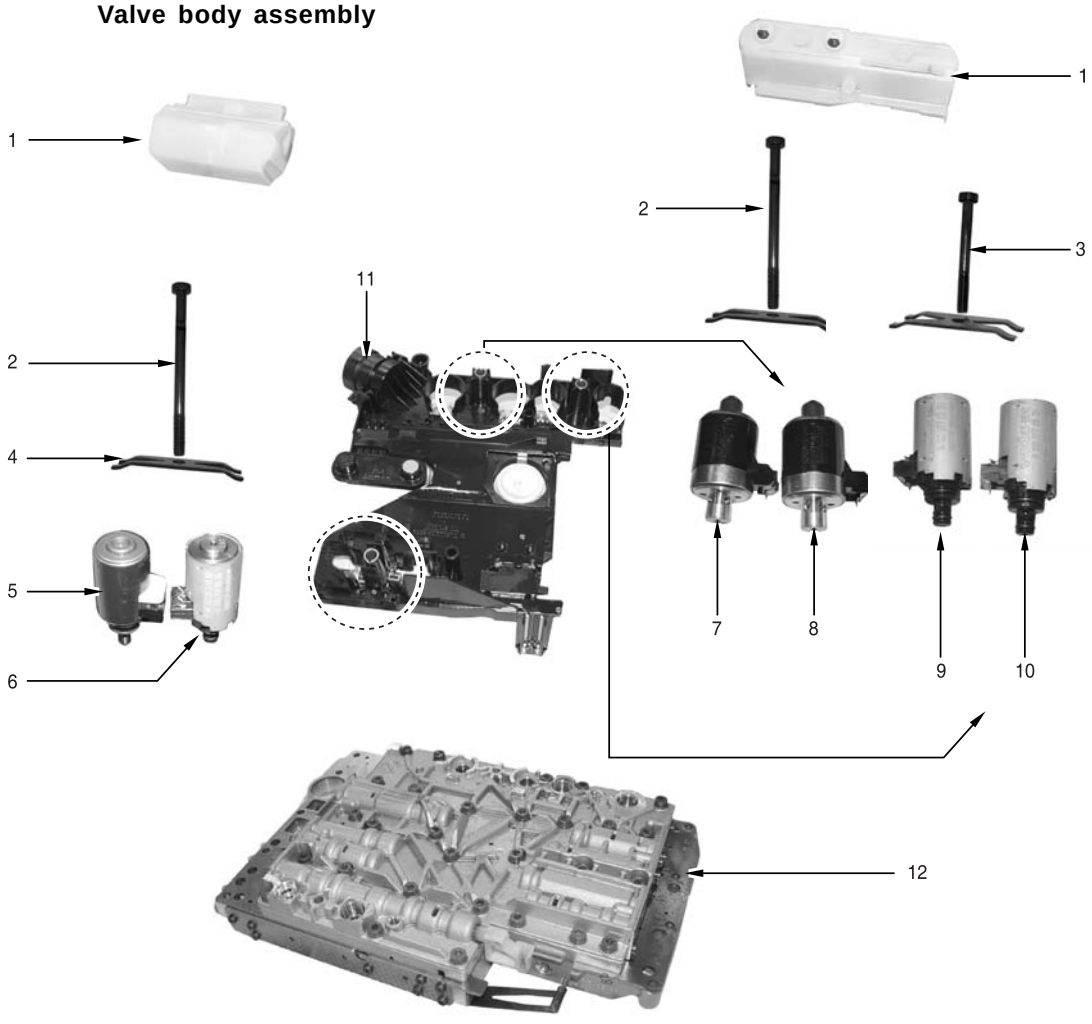
The outer race (1) slides over the locking elements (3) with negligible friction. If the rotation of the outer race (1) changes to direction “B”, the locking elements (3) stand up and lock the outer and inner races (1, 2) together.

SENSORS AND CONTROLS

▶ Components



Valve body assembly



1. Cap
2. Socket bolt (M6 x 32)
3. Socket bolt (M6 x 30)
4. Leaf spring
5. Lockup PWM solenoid valve
6. 2-3 shift solenoid valve
7. Shift pressure (SP) solenoid valve
8. Modulating pressure (MP) solenoid valve
9. 1-2/4-5 shift solenoid valve
10. 3-4 shift solenoid valve
11. Electronic control module
12. Lockup clutch control solenoid valve

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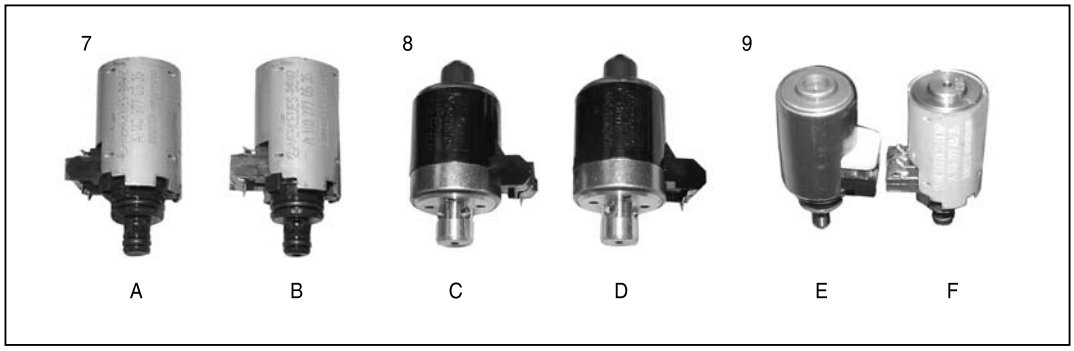
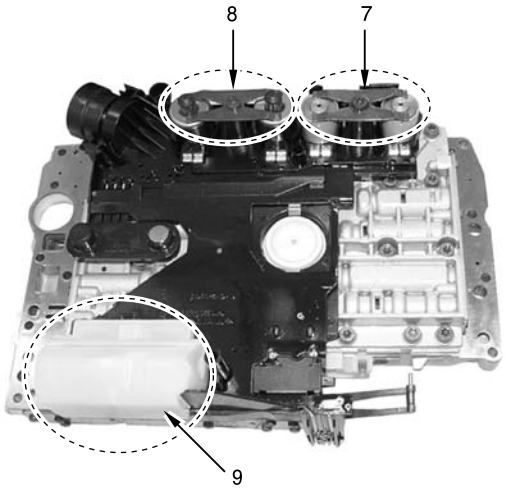
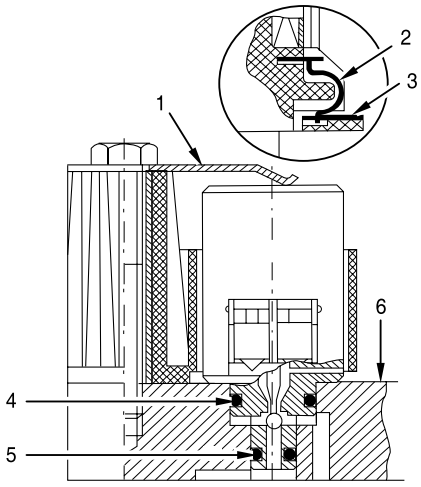
▶ Shift Pressure Control Solenoid Valve







Y220_3A1024

1. Leaf spring
2. Contact spring
3. Conductor track
4. O-ring
5. O-ring
6. Shift plate
7. Solenoid valve
   A. 1-2, 4-5 shift solenoid valve
   B. 3-4 shift solenoid valve
8. Solenoid valve
   C. Shift pressure control solenoid valve
   D. Modulating pressure control solenoid valve
9. Solenoid valve
   E. Lockup PWM solenoid valve
   F. 2-3 shift solenoid valve

Function

The plastic Electric Hydraulic Control Unit (EHU) is installed on the top of valve body. RPM sensor, start lock-out switch and oil temperature sensors are integrated in EHU.

The 13-pin connector is connected to automatic transmission via PCB.

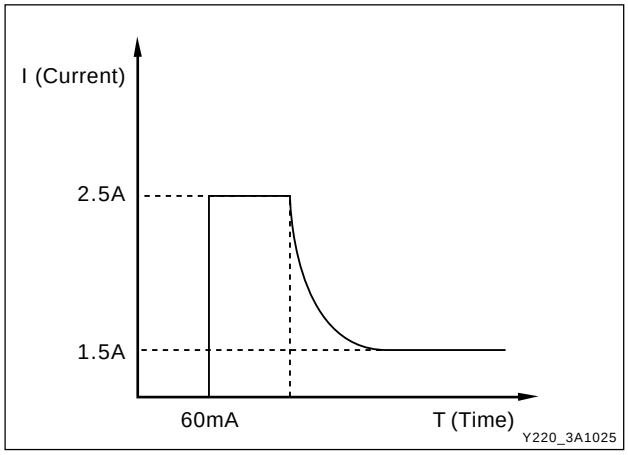
Three up/downshift solenoid valves are installed on the top of hydraulic control unit.

The solenoid valves are sealed with two O-rings against the valve body. The solenoid valves are pressed against the valve body by the leaf springs.

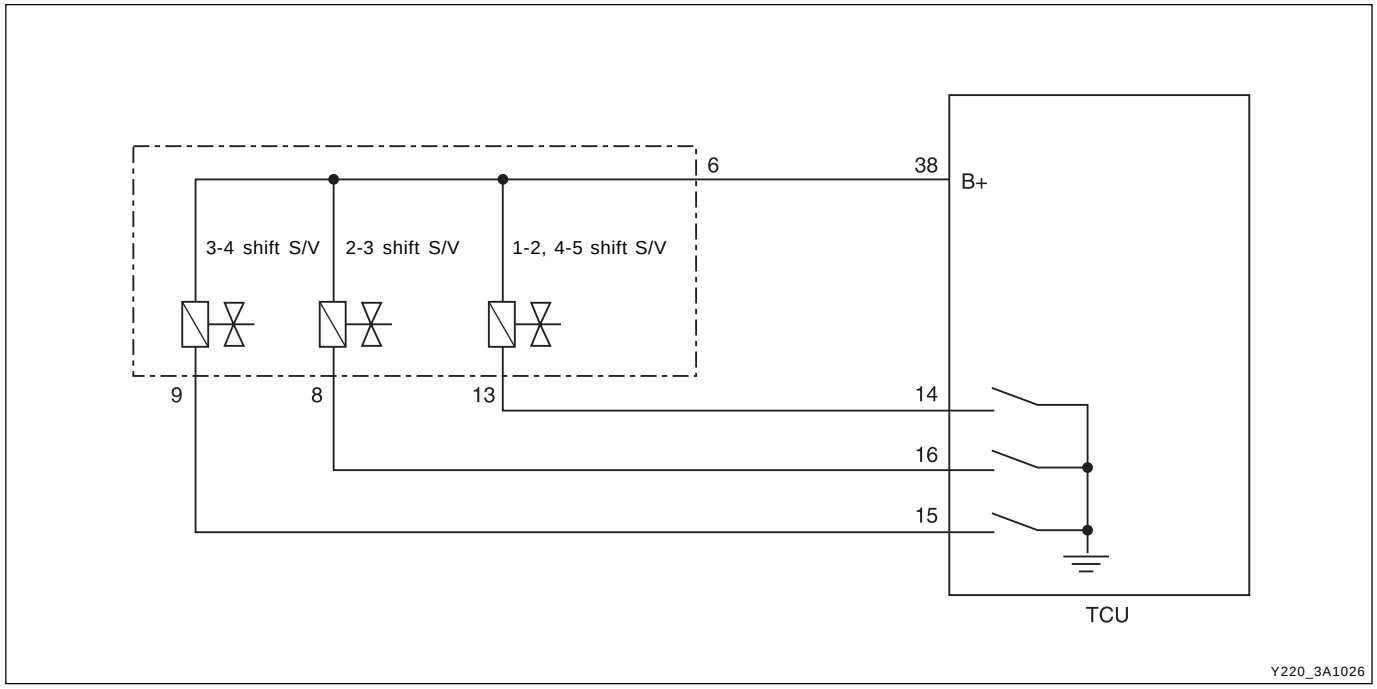
Characteristics of up/downshift solenoid valve

The solenoid valve remains energized and therefore open until the shift process is completed according to the engine and transmission conditions. If a solenoid valve is energized, it opens and transmits shift valve pressure to the corresponding command valve.

Working Current	1.5 ~ 2.0 A
Operating distance	0.2 mm
Resistance	3.8 ± 0.2 Ω (25°C)



Circuit diagram



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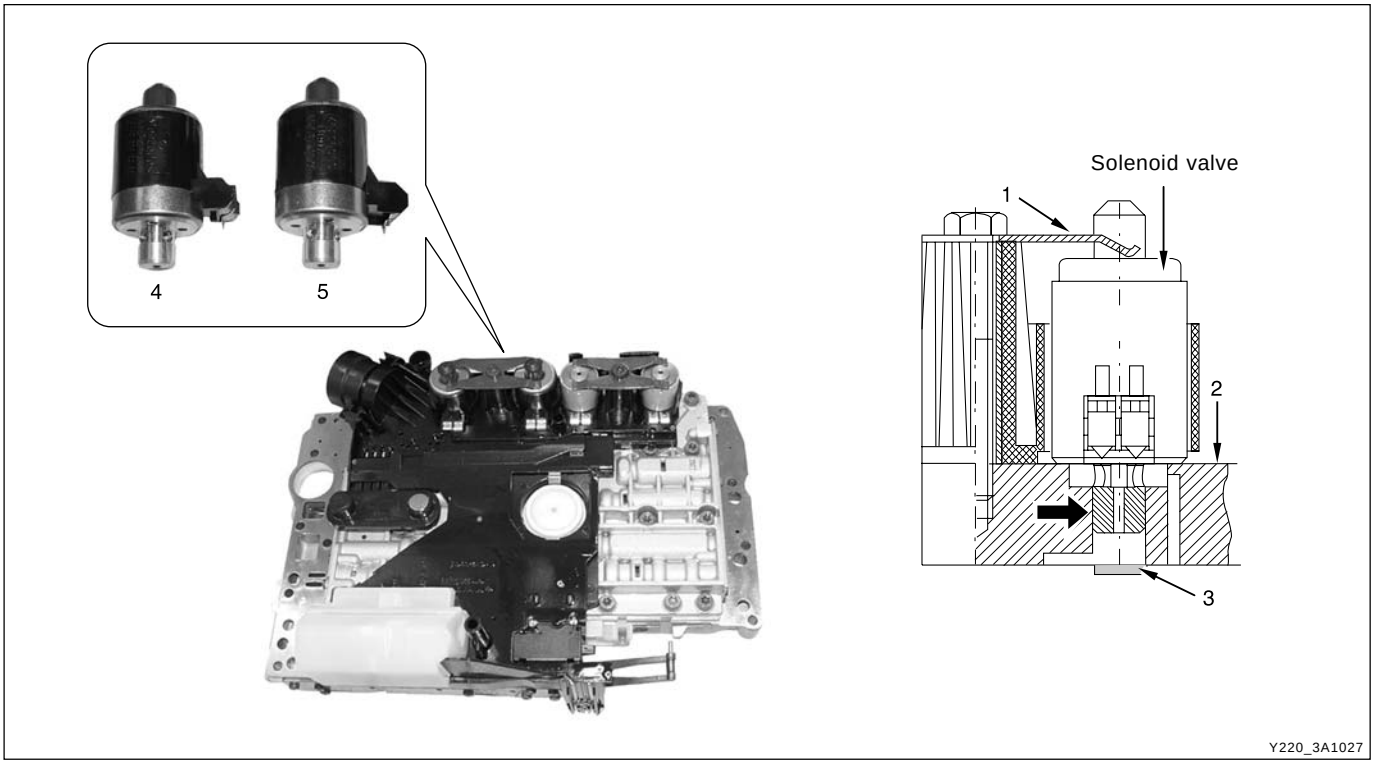
▶ Modulating Pressure (MP) and Shift Pressure (SP) Control Solenoid Valve



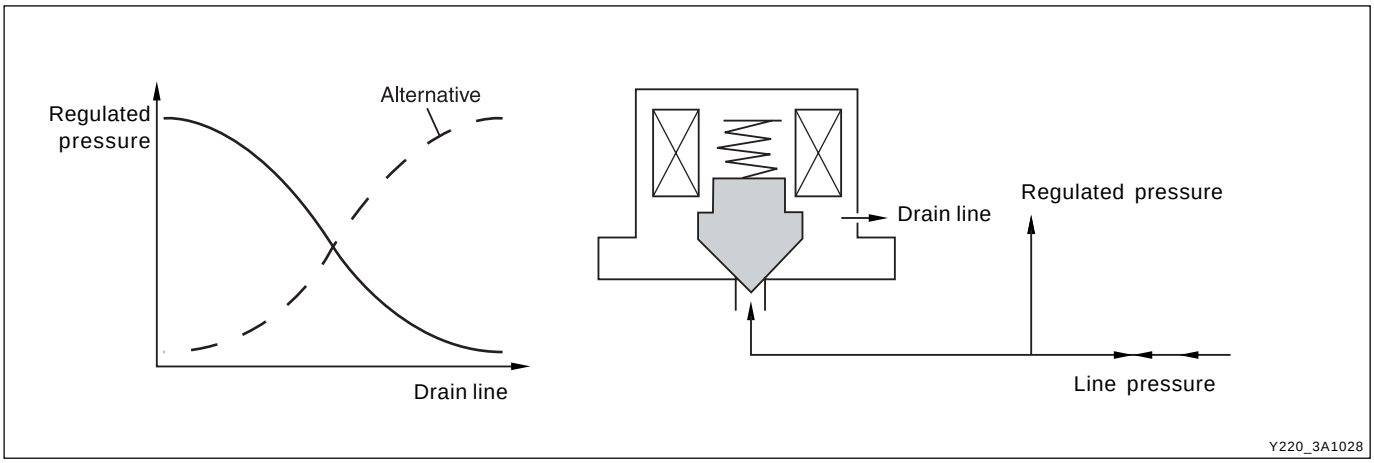
1. Leaf spring
2. Shift plate
3. Strainer
4. MP control solenoid valve
5. SP control solenoid valve

Function

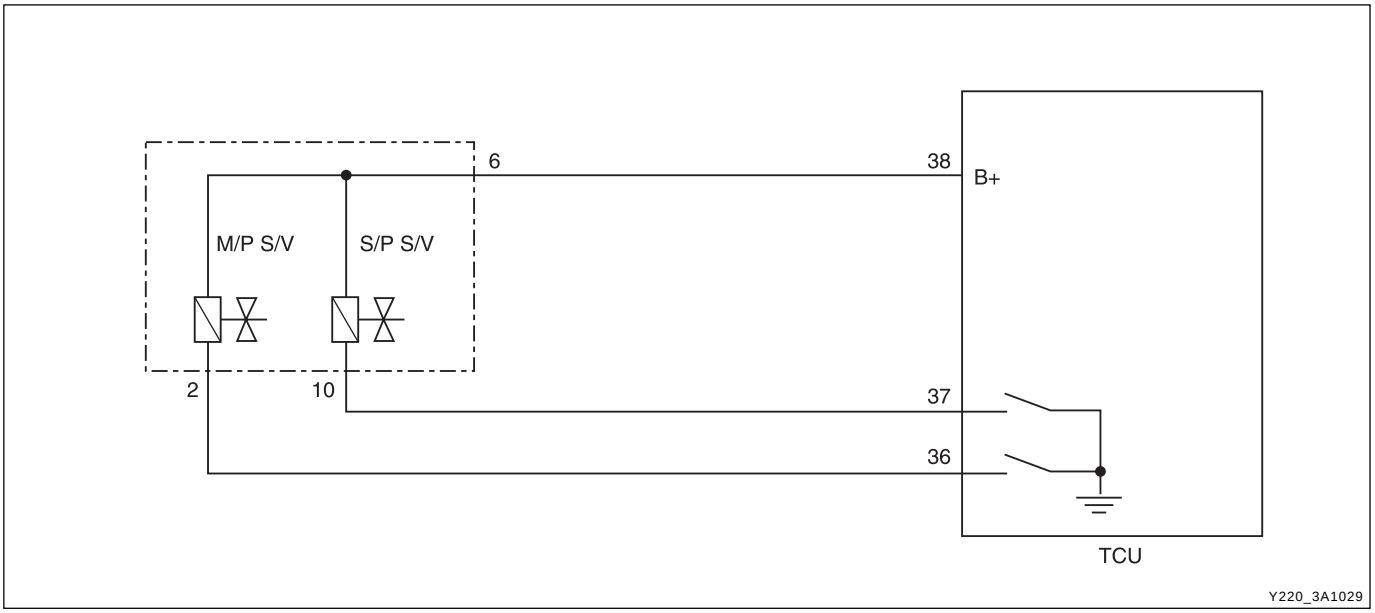
These valves control the modulating pressure and the shift pressure by applying appropriate electric current to solenoid valves according to driving condition of engine and transmission.

When the electric current from TCU is high/low, the regulated pressure decreases/increases.

Working Current	0 ~ 1.0 A
Operating distance	0.6 mm
Resistance	5 ± 0.2 Ω (25°C)



Circuit diagram



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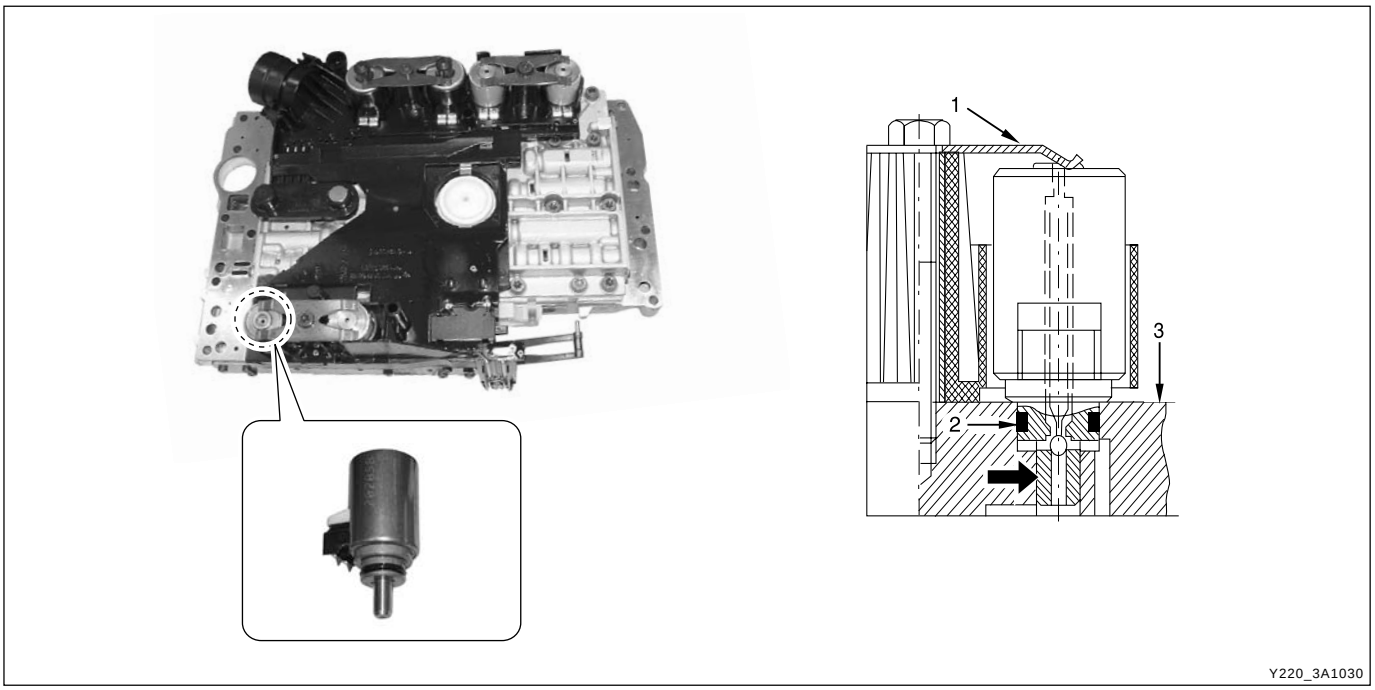
▶ Lockup Solenoid Valve



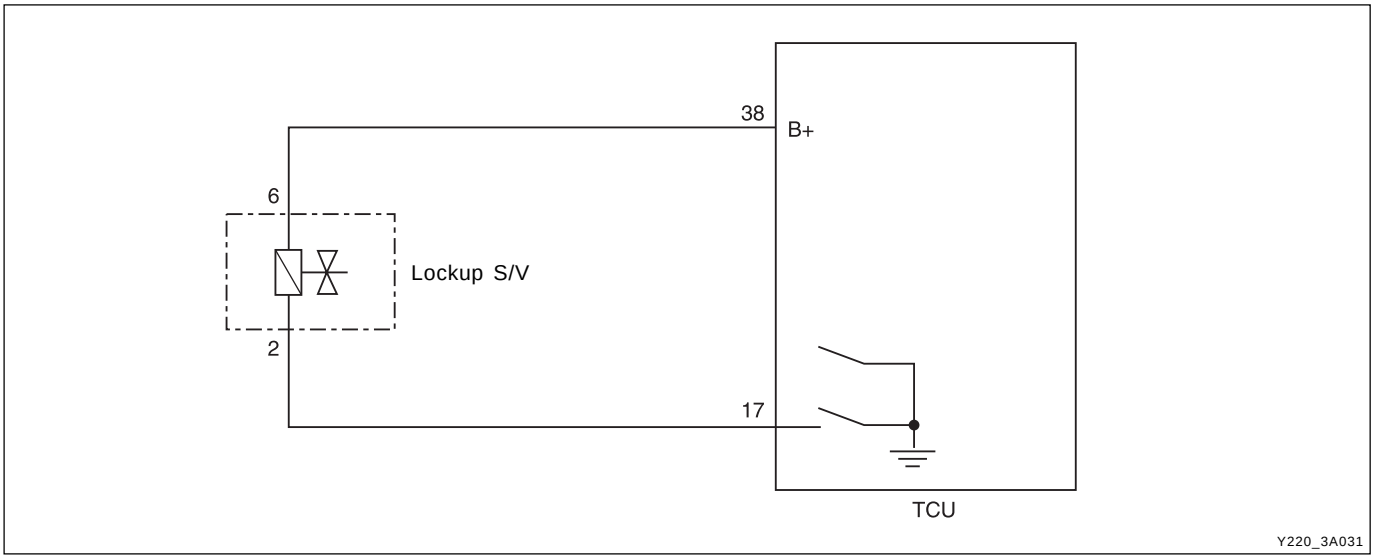
1. Leaf spring
2. O-ring
3. Shift plate

Function

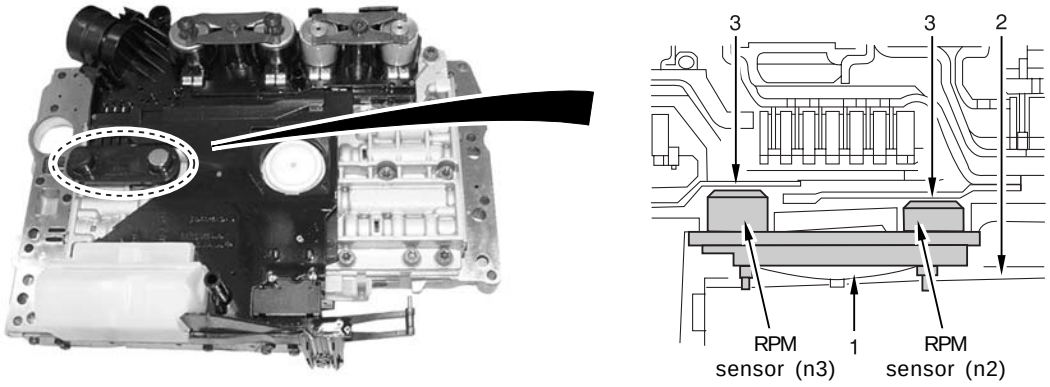
This valve activates and releases the lockup clutch by adjusting the current to solenoid valve according to engine throttle opening value and output shaft speed. The lockup clutch operates in 3rd, 4th and 5th gear with steps to reduce shift shocks.

Working Current	1.5 ~ 2.0 A
Operating distance	0.2 mm
Resistance	2.5 ± 0.2 Ω (25°C)
Operating range	3, 4, 5 shift

Circuit diagram



▶ RPM Sensor



1. Leaf spring
2. Valve body
3. Pulse ring

Function

The RPM sensors are fixed to the shell of the hydraulic control unit via the contact tabs. A leaf spring, which rests against the valve body, presses the RPM sensors against the transmission housing. This ensures a precise distance between RPM sensors and impulse rings. RPM sensor (n3) detects the speed of the front sun gear and RPM sensor (n2) detects the speed of the front planetary carrier. If the speed sensor is defective, the transmission is operated in emergency driving mode. Below table shows the detection of speed sensor.

Gear	N2	N3
1	•	-
2	•	•
3	•	•
4	•	•
5	•	-
R (S mode)	•	-
R (W mode)	•	•

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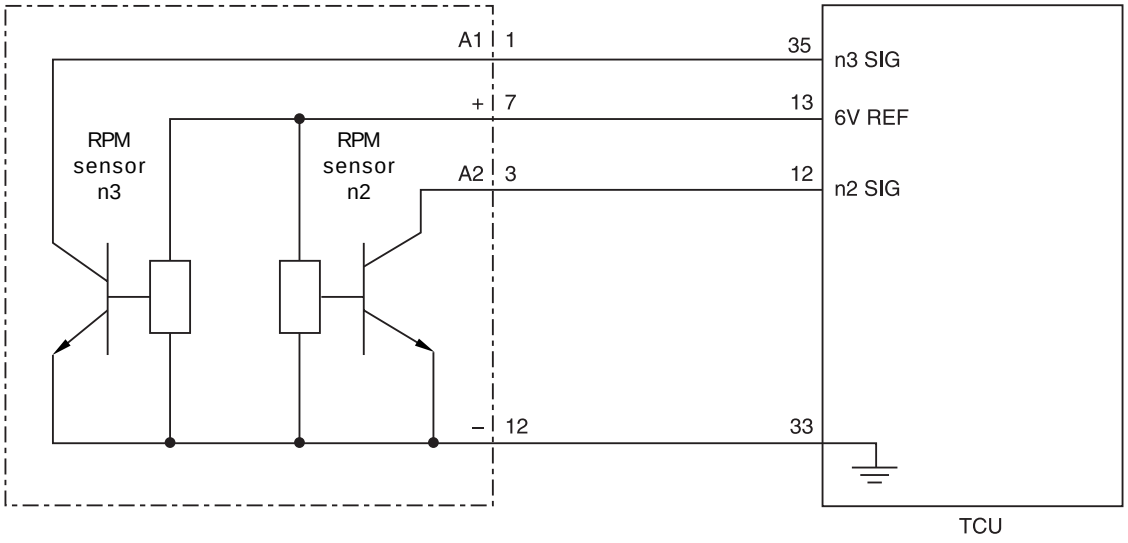
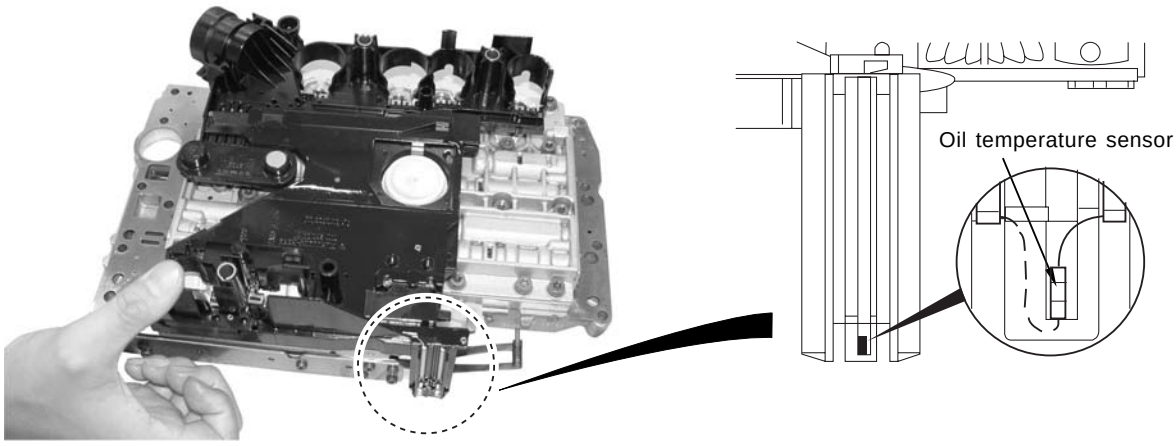
Circuit diagram



▶ Oil Temperature Sensor



Y220_3A1035

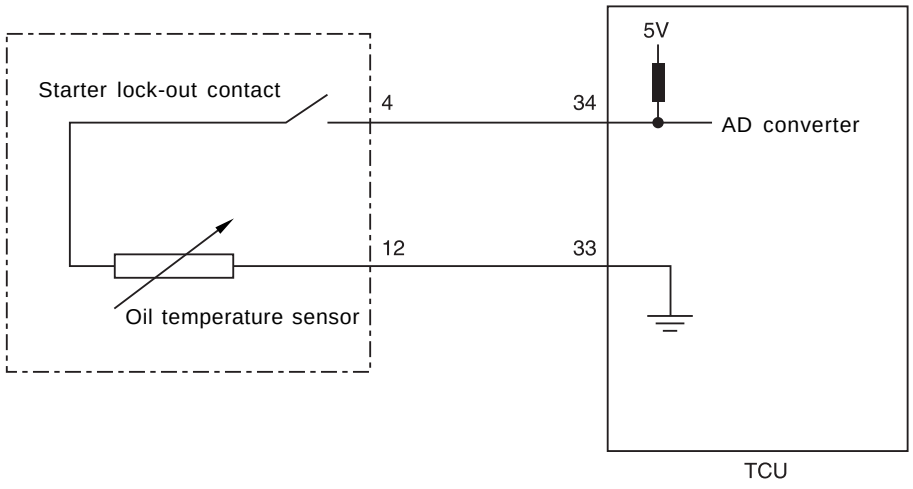
Function

The oil temperature sensor is installed in hydraulic control unit and is connected in series with the starter lock-out contact.

This means that the temperature signal is transferred to TCU when the starter lock-out contact is closed.

The oil temperature has a considerable effect on the shifting time and therefore the shift quality. By measuring the oil temperature, shift operations can be optimized in all temperature ranges.

Circuit diagram



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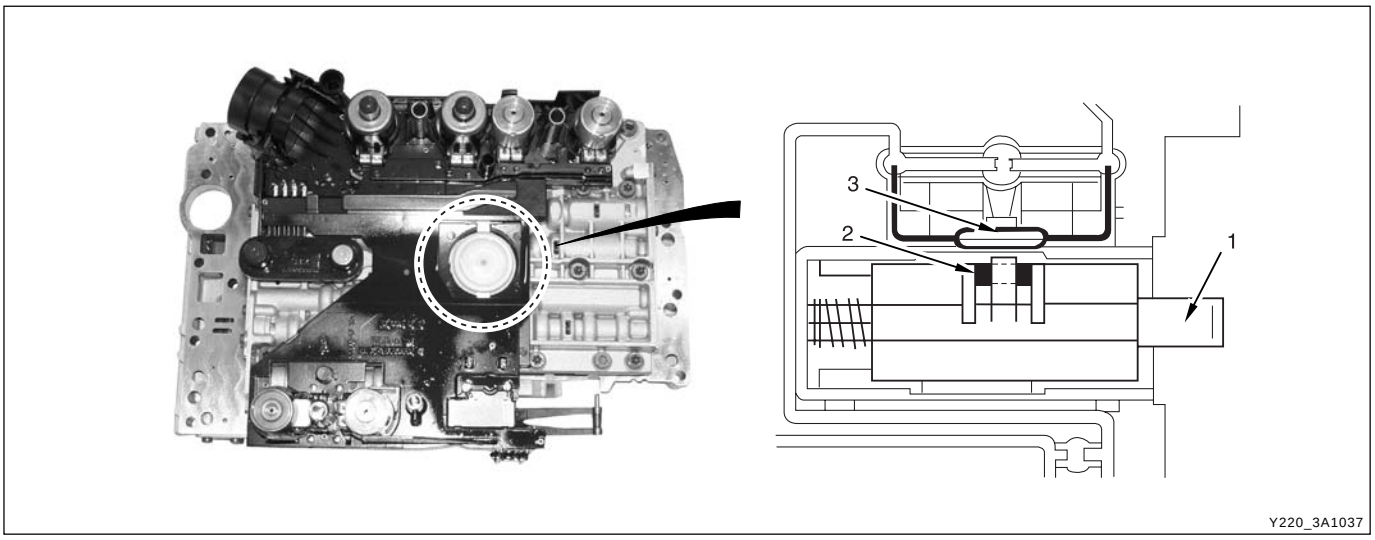
▶ Starter Lock-out Contact



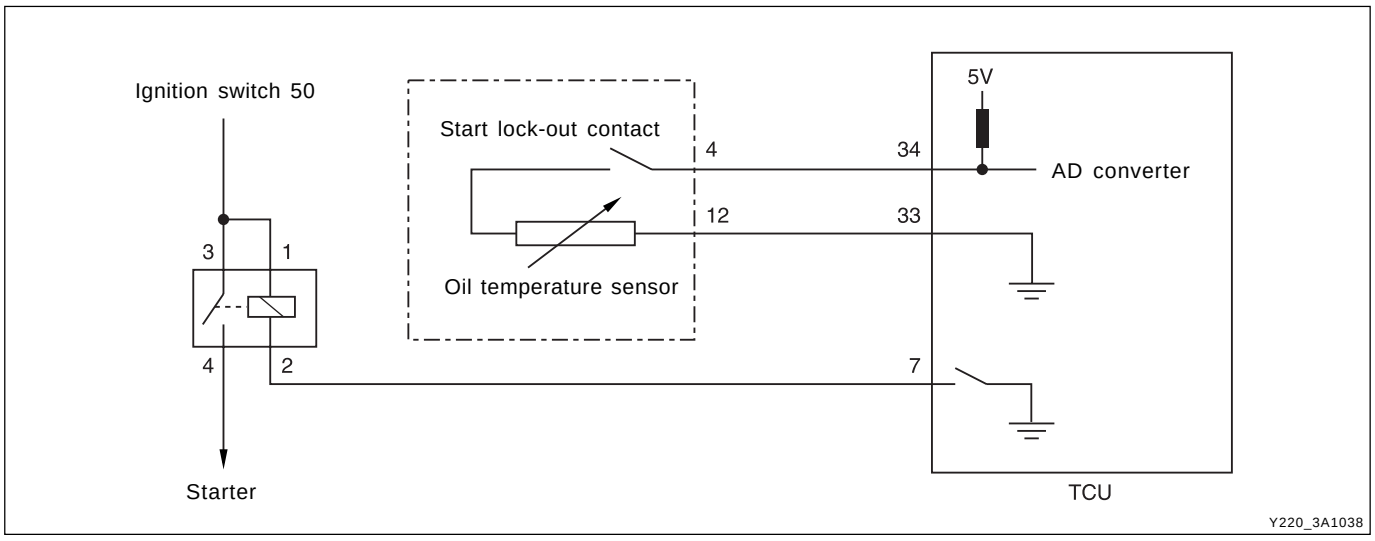
1. Plunger
2. Permanent magnet
3. Reed contact

Function

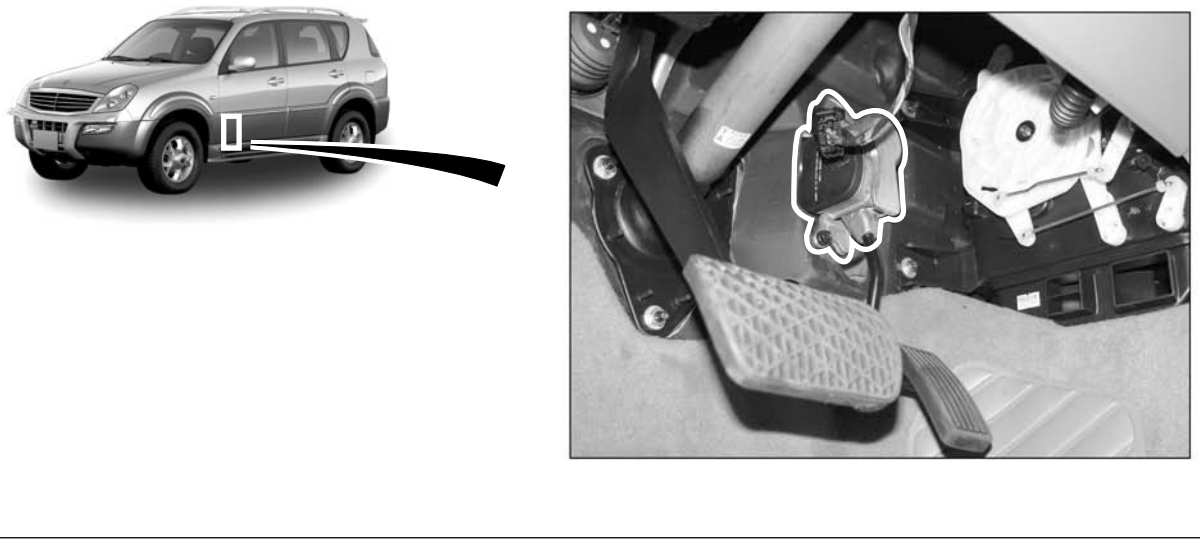
The starter lock-out contact is installed beside oil temperature sensor and is actuated by a cam rail, which is located on the latching plate.

In the selector lever positions “P” and “N”, the permanent magnet is moved away from the reed contact. This opens the reed contact and the transmission control module receives an electrical signal. The transmission control module activates the starter lock-out relay module. This closes the electrical circuit to the starter in selector lever positions “P” and “N” via the starter lock-out relay module. In other words, when the selector lever is in driving positions, the contact is closed and the starter cannot be operated.

Circuit diagram



▶ Kick-down Control



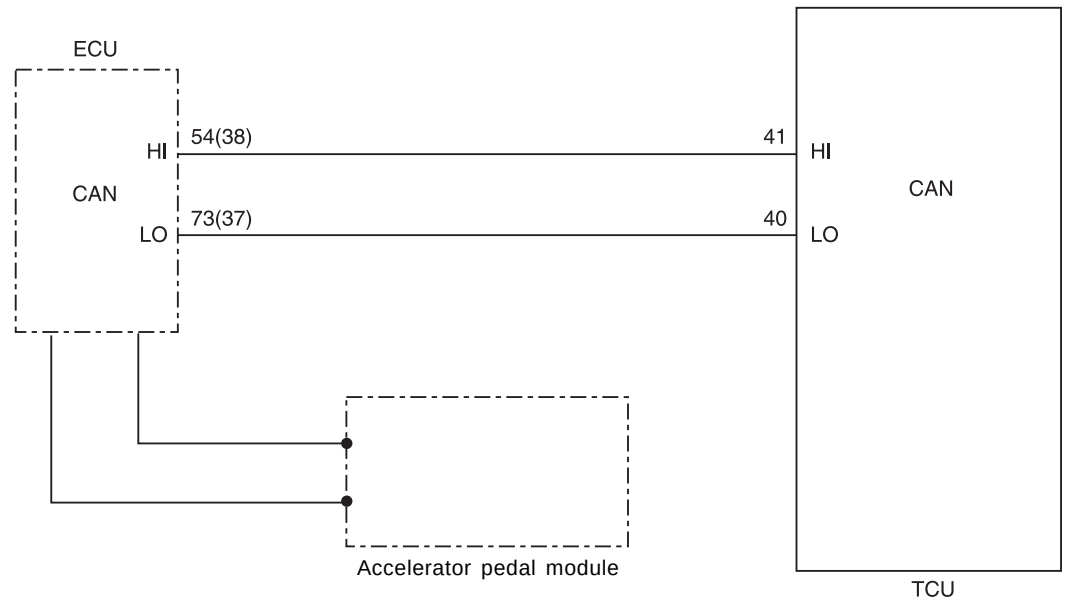
Y220_3A1039

Function

When the throttle valve is partially opened, the shifting point gets faster. When the throttle valve is widely opened, shifting point is delayed because the system needs low speed gear with bigger driving force.

Kick-down control is a system that enables to get bigger driving force as the down shift occurs by suddenly increasing the throttle openings during constant driving. It has no separate kick-down switch where the down shift operates when a certain point (about 1 second) lapses after opening of full throttle. The signal recognition allows to send control signal to TCU from engine ECU via CAN communication.

Circuit diagram



( ) : For gasoline engine

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▶ Mode Switch

Function

The mode switch is installed beside the selector lever and it has two modes of “S” mode (Standard Mode) and “W” mode (Winter Mode).

- “S” mode is used in normal driving (starts off with 1st gear). TCU (Transmission Control Unit) provides pleasant driving by changing the shifting pattern according to the driving habits (downhill gripping: approx. 11 ~ 13.5 %)
- When “W” mode is selected, the Winter mode indicator in meter cluster comes on, and the vehicle starts off with 2nd gear to achieve smooth starting on the icy or slippery road.

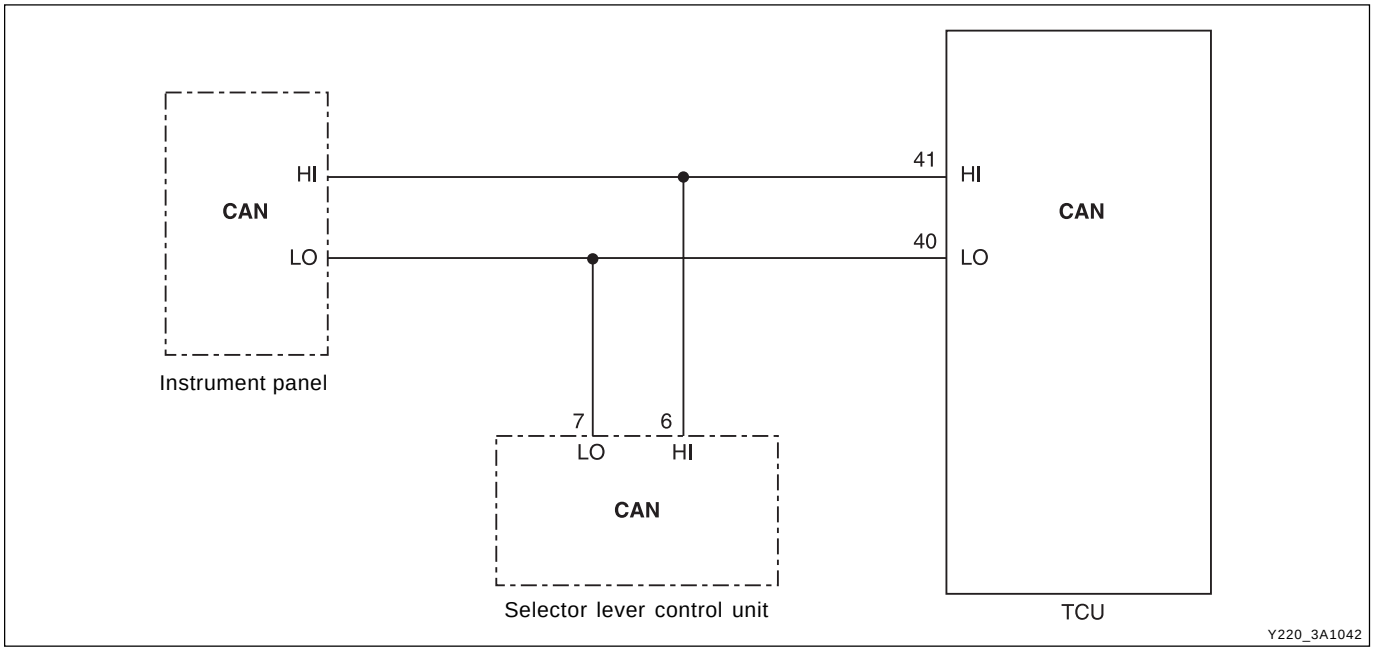
In winter mode, the up shift becomes faster and the down shift becomes slower for improving fuel consumption. The “W” mode is automatically changed to “S” mode in full throttle or kick-down operation. The vehicle can starts off with 2nd reverse gear (gear ratio: 1.92 ~ 1.93) when the “W” mode is selected. It is very useful on icy and slippery road. However, in this case, the “W” switch should be selected before placing the selector lever to “R” position.

Even though “W” mode is selected, the vehicle starts off with 1st gear in following:

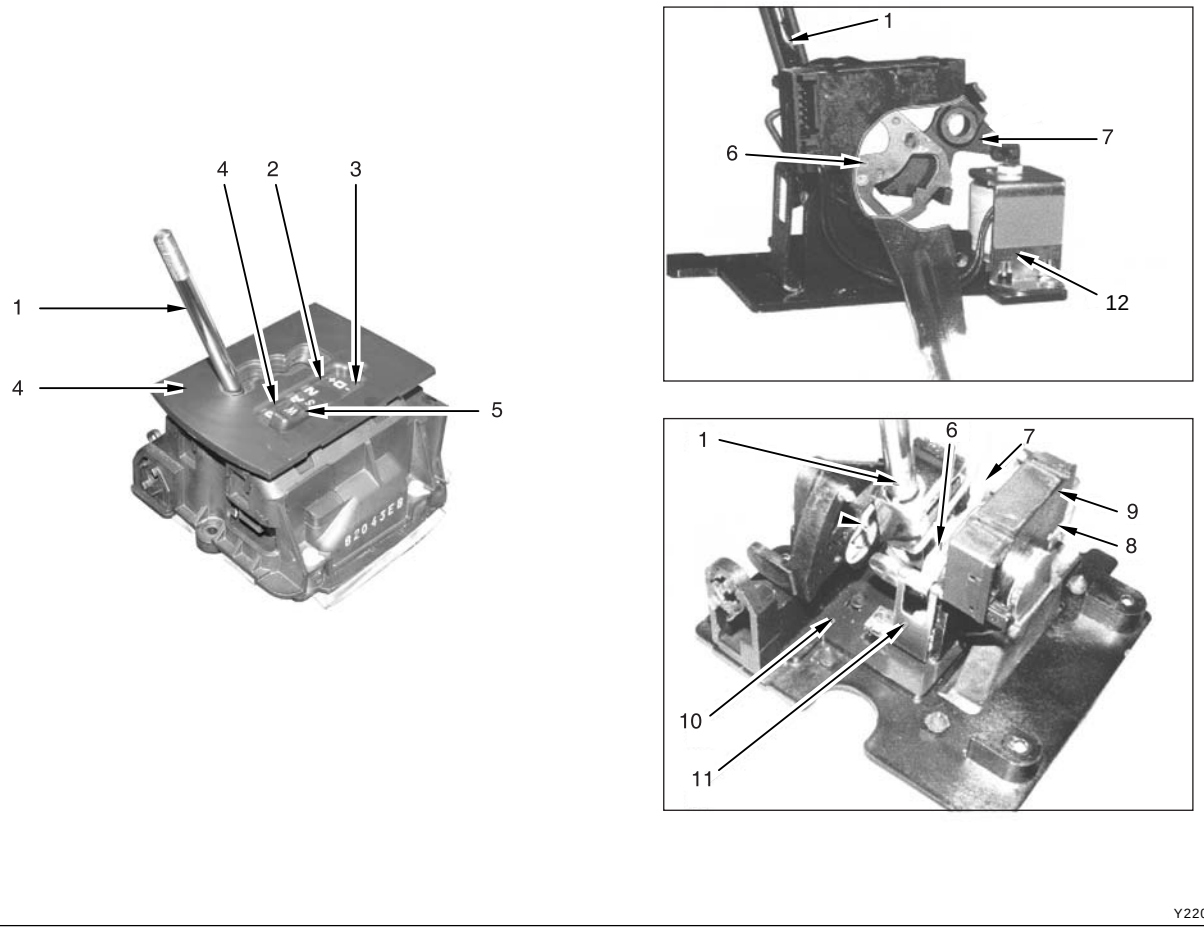
When the system recognizes the mode switch operation, the selector lever control unit sends the control signal TCU via CAN communication.

1. When the selector lever is in “1” position.
2. When fully depressing the accelerator pedal or when starting off with kick-down condition.

Circuit diagram



▶ Reverse/Parking (R/P) Lock System



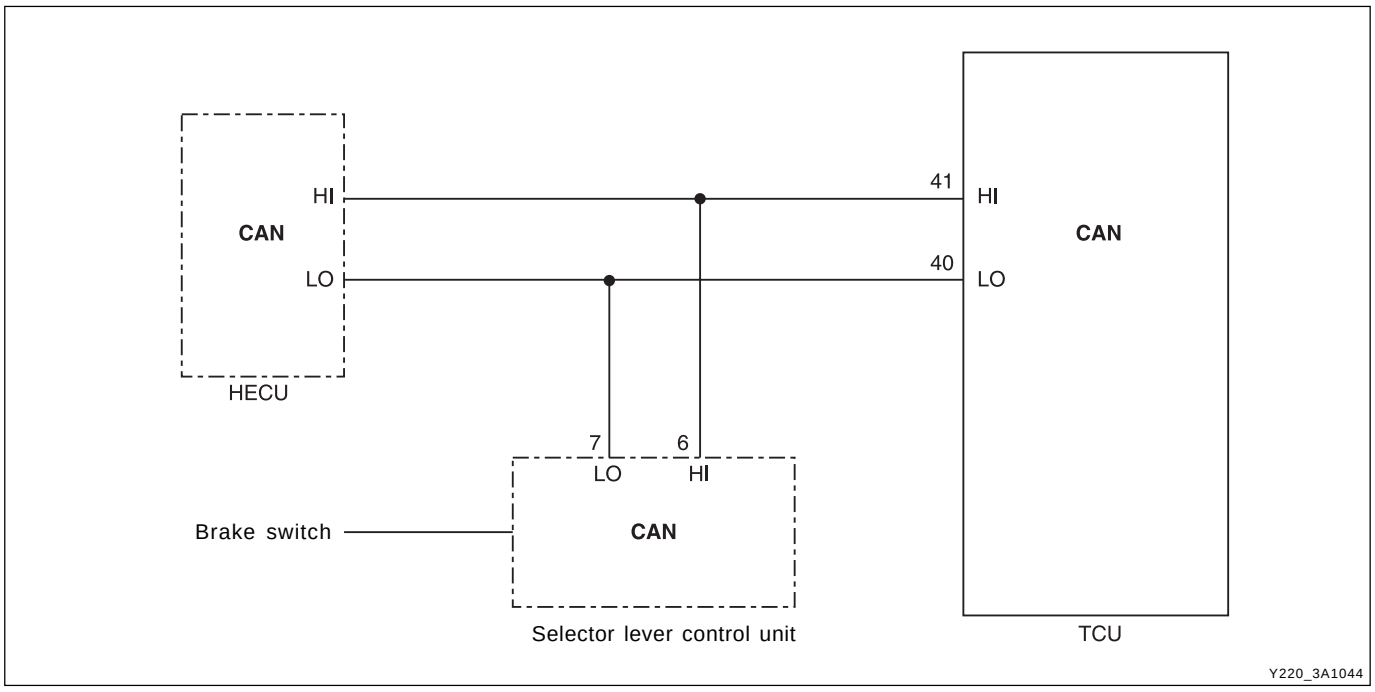
1. Selector lever
2. Shift pattern display
3. Parking lock release flap
4. Selector lever control unit
5. Mode switch
6. Locking disc
7. Locking lever
8. Shift detene spring
9. Potentiometer for detecting selector lever position
10. Base body
11. Spring of shift detent mechanism
12. Solenoid valve

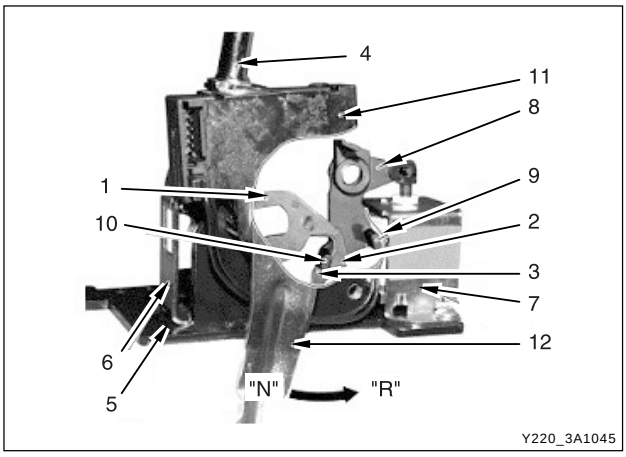
Function

Reverse (R) lock system is a safety system that prevents the selector lever from shifting to “P” or “R” position by activating the solenoid valve when the selector lever unit determines that the vehicle speed exceeds 10 km/h by checking the speed signal from wheel speed sensor via CAN communication.

Parking (P) lock system uses the signals from brake switch other than conventional cable system to shift to other positions. The wiring harness for detecting brake switch operation is connected to selector lever control unit.

Circuit diagram





1. Locking disc
2. Cam (P lock)
3. Cam (R lock)
4. Selector lever
5. Base body
6. Mode switch
7. R/P locking solenoid
8. Locking lever
9. Tab on lock lever (P lock)
10. Tab on lock lever (R lock)
11. Potentiometer for detecting selector lever position
12. Intermediate lever

Function of reverse (R) lock

Above a speed of approx. 10 km/h, the R/P locking solenoid is actuated by the selector lever control unit. The R/P lock lever (8) is turned to the lock position. The tab on lock lever (10) locks the locking disc (1). The selector lever (1) cannot be shifted into selector position “R”.

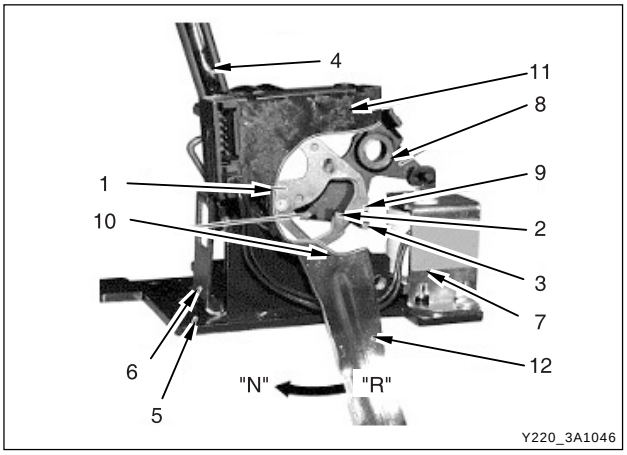
Function of parking (P) lock

The selector lever position “P” is locked whenever the R/P locking solenoid is not actuated by selector lever control unit.

The prerequisites for this are as follows:

* No voltage supply to the selector lever control unit (Ignition switch is not positioned to “ON”)
* Brake pedal not depressed

Under these conditions, the locking lever (8) is in the locking position. The tab on lock lever (9) locks the locking disc (1). It is not possible to shift the selector lever out of selector lever position “P”.

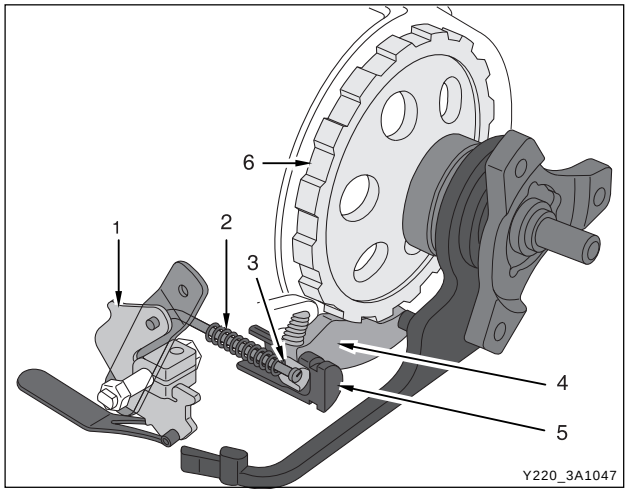


1. Locking disc
2. Cam (P lock)
3. Cam (R lock)
4. Selector lever
5. Base body
6. Mode switch
7. R/P locking solenoid
8. Locking lever
9. Tab on lock lever (P lock)
10. Tab on lock lever (R lock)
11. Potentiometer for detecting selector lever position
12. Intermediate lever

▶ Parking Lock Mechanism

Location and function

The parking lock gear (6) is located on the output shaft in the rear section of the transmission housing. In selector lever position “P”, the cone (3) slides between the parking lock pawl (4) and the guide sleeve (5). The parking lock pawl (4) is therefore pushed against the parking lock gear (6). If the tooth of the parking lock pawl (4) does not engage in a tooth space when the vehicle is stationary, but rather touches a tooth of the parking lock gear (6), the cone (3) is pre-tensioned by the spring (2) and positioned ready for operation. If the parking lock gear (6) continues to turn, the parking lock pawl (4) engages in the next tooth space. To prevent damage due to misuse, the widths of the tooth spaces are designed such that the parking lock pawl (4) can only engage when the vehicle is stationary or moving very slowly. If the vehicle rolls faster, the shape of the teeth prevents the parking lock pawl (4) from engaging.



1. Detent plate
2. Spring
3. Cone
4. Parking lock pawl
5. Guide sleeve
6. Parking lock gear

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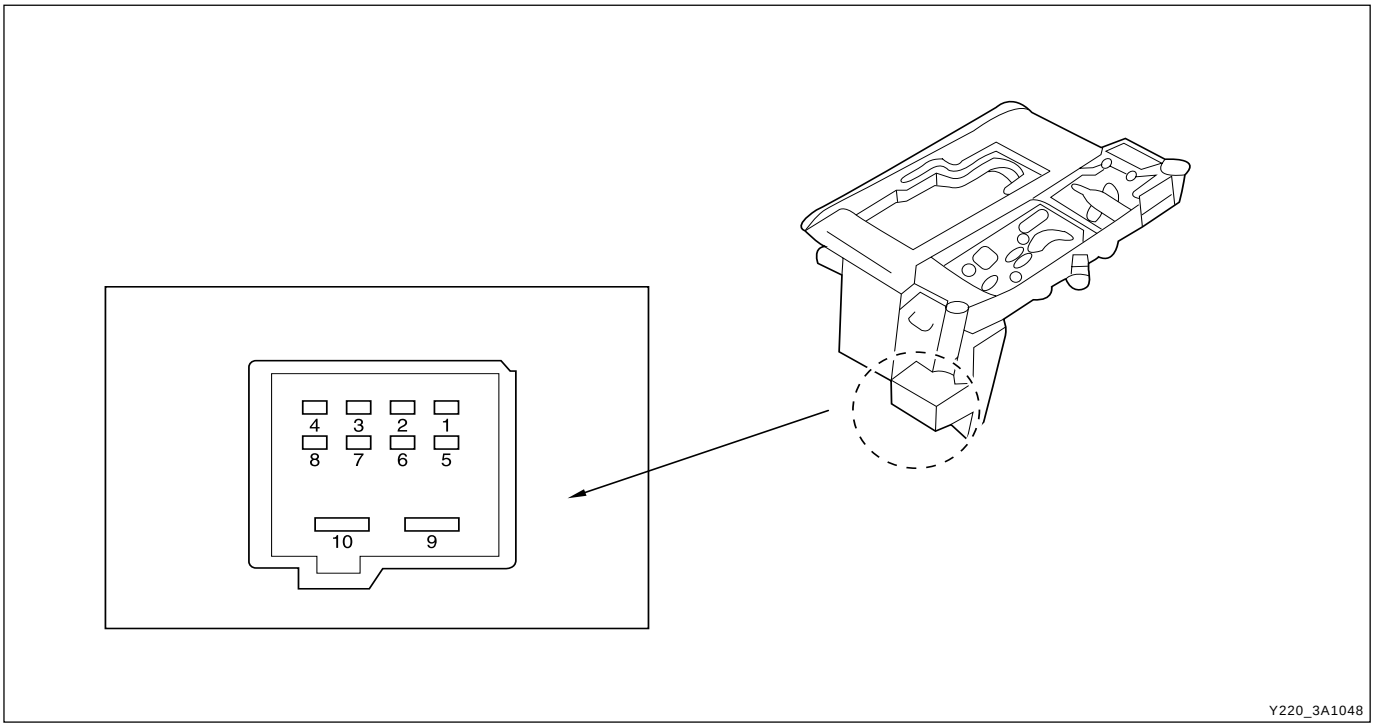
▶ Selector Lever Control Unit

Function

Selector lever control unit functions as follows:

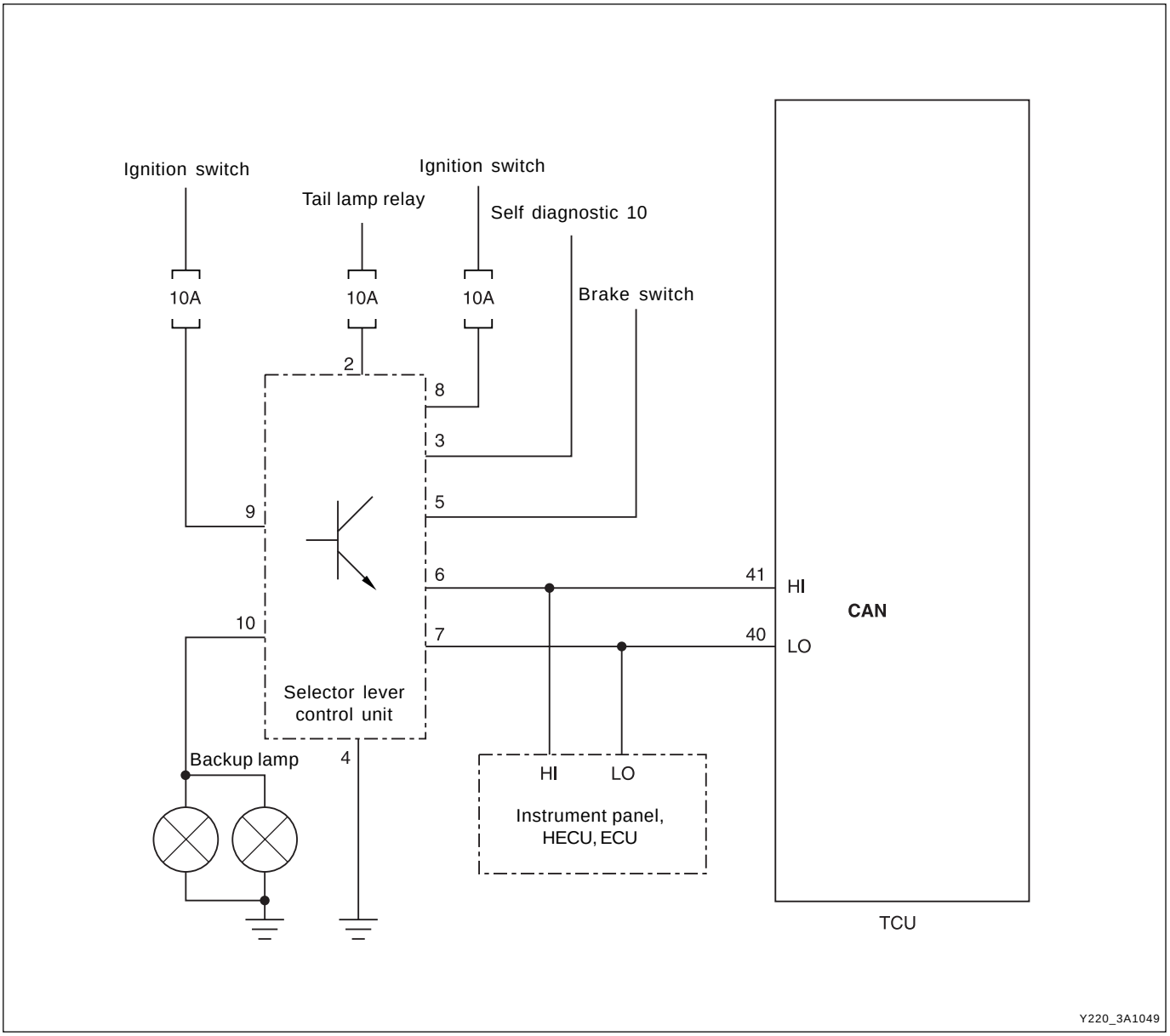
A. Informing the selector lever's position to other units via CAN.
B. Turning on the selector lever indicator while tail lamp is turning on.
C. Turning on the back-up lamp during reverse driving.
D. Operating the parking/reverse lock system.



Terminals

Pin No.	Use For	Remark
8	Selector lever unit power	
6	CAN HI	Connected to HECU, ECU, TCU, instrument panel etc.
7	CAN LO	
5	Brake switch signal	Parking lock operation
3	Self diagnosis	
2	Tail lamp	Turning on position indicator
9	Back-up lamp power	
10	Back-up lamp	
4	Ground	

Circuit diagram



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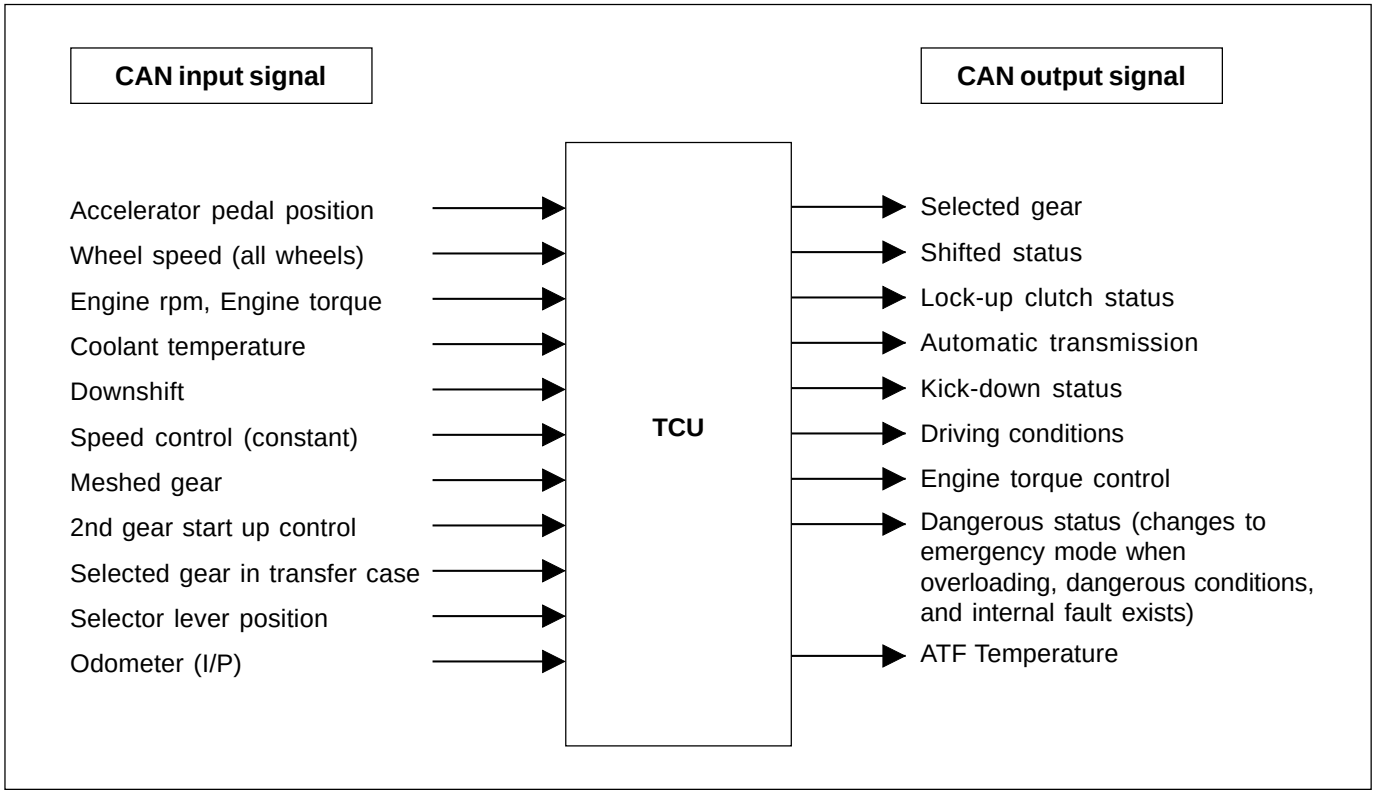
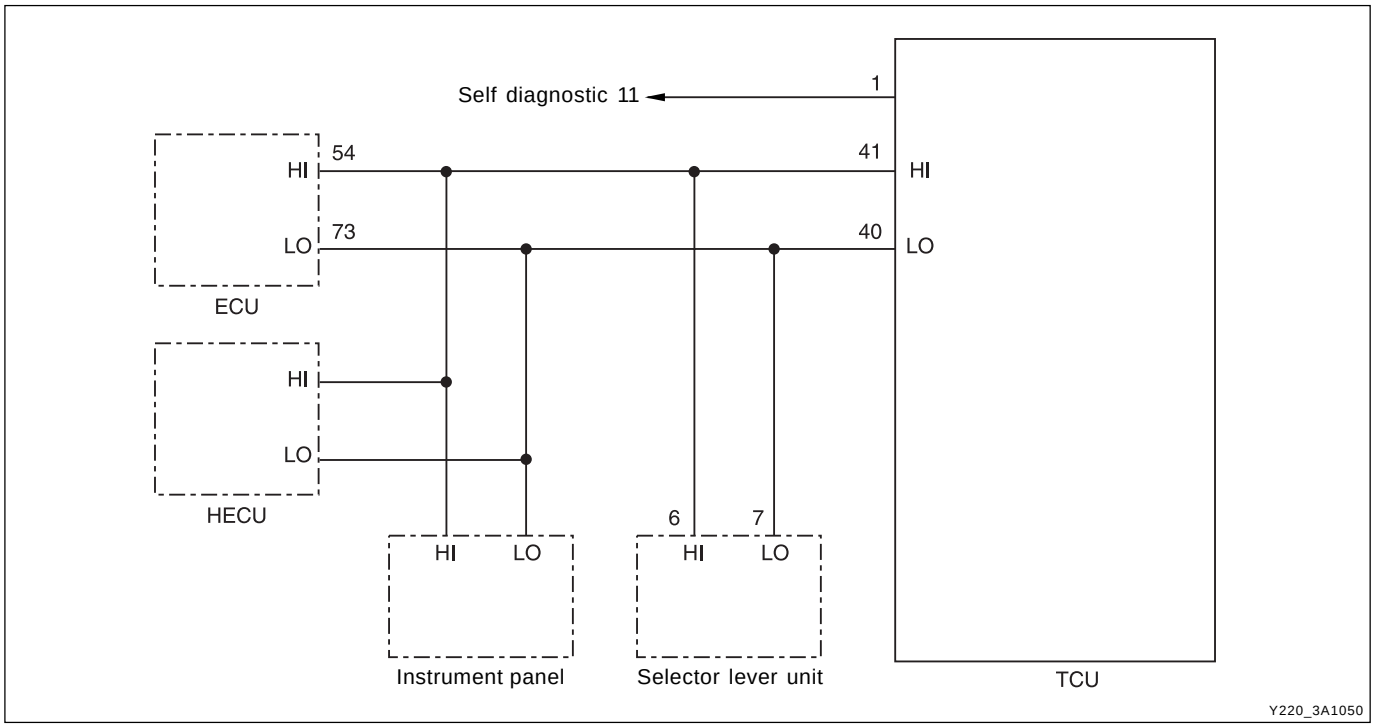
▶ CAN (Controller Area Network)

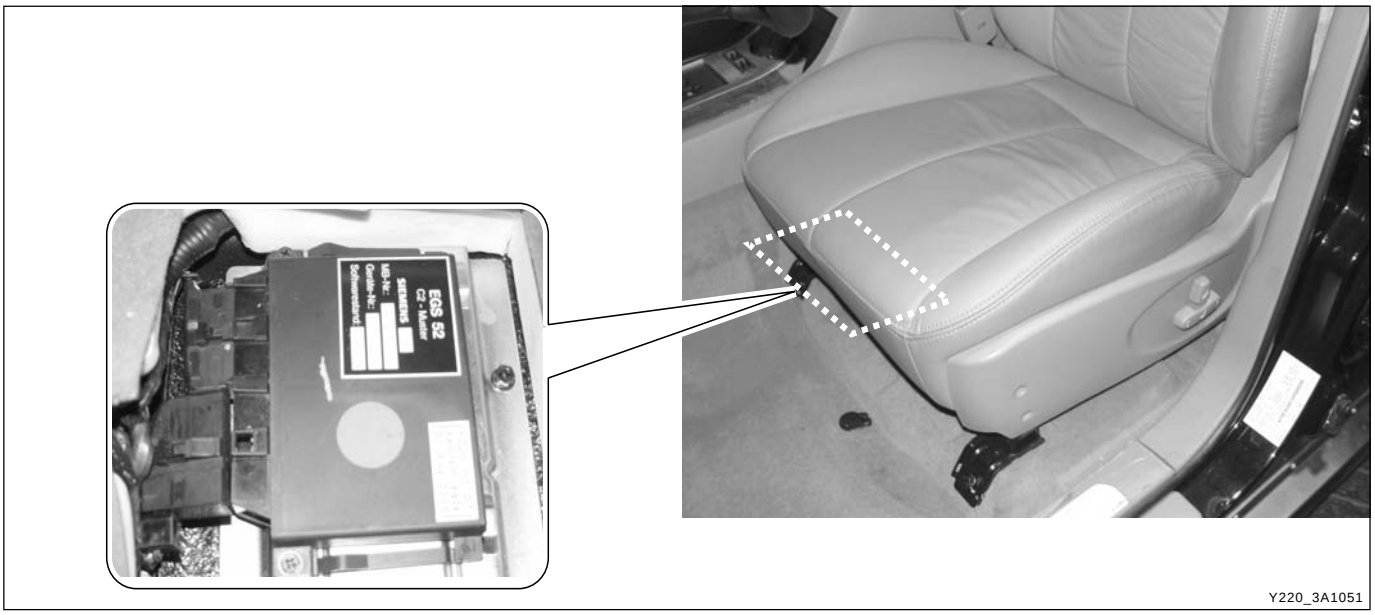
Function



Circuit diagram



▶ TCU (Transmission Control Unit)



Function

TCU controls the gear groups according to the driving conditions. It receives the driving data from many sensors and switches as input signals. It is also connected with ECU, HECU, instrument panel and selector lever control unit.

1. Shifting Method

   Basic shift operation includes up-shift and down-shift for all gear groups. Shift control unit determines driving resistance, accelerator pedal position, vehicle speed and some parameters (road surface condition, up hill and down hill gradients, trailer driving conditions, catalytic converter conditions, driving habits and automatic transmission oil temperature) to select a shift gear.

2. Down Shift

   When engine speed increases excessively, the down shift does not occur. When driving down hill, the transmission is quickly down shifted to 3rd gear to get an engine brake effect in speed control mode. This down shift is operated when there is above 7 km/h difference from stored speed value and possible at below 125 Km/h.

3. Engine RPM Adjustment

   During shifting, the engine torque is reduced to optimize the shift operation by delaying the ignition time.

4. Lock-Up Clutch Control

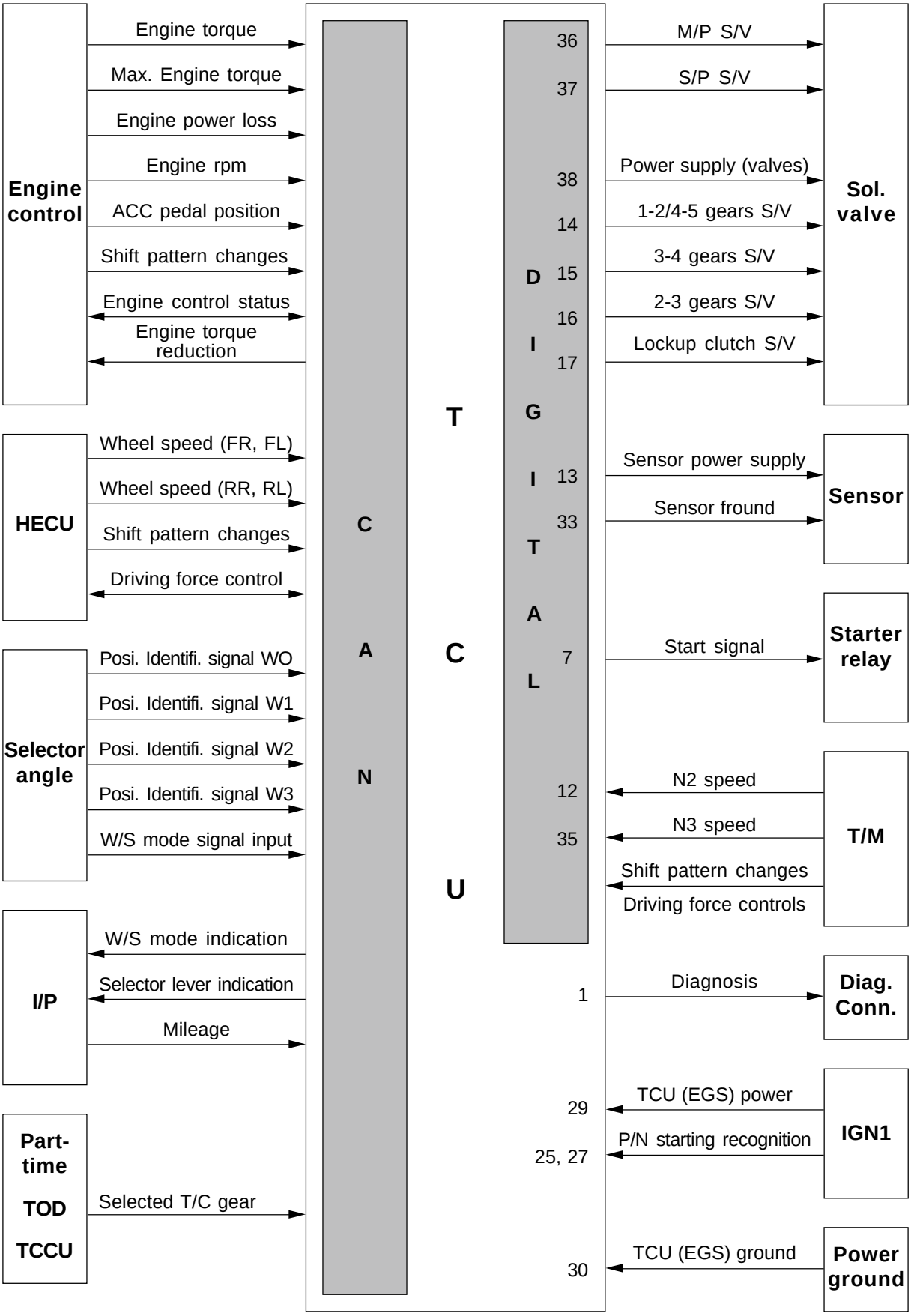
   The lockup clutch in torque converter is activated in 3rd, 4th and 5th gear and operates in sequence via PWM solenoid valve.

5. Others

   The transmission is automatically controlled to compensate durability and wear.

   The shift control values such as shifting point, shifting time, pressure during shifting, and lockup clutch control are permanently saved and the diagnosis is partially available.

TCU block diagram



▶ Characteristics of TCU and Automatic Transmission (Emergency Driving Mode)

The emergency driving mode is to minimize vehicle's operation when is a mode for maintaining minimum driving condition when the automatic transmission is defective. In emergency driving mode, excessively long driving and unreasonable driving should be avoided to prevent bigger fault occurring in advance. Emergency driving mode can largely be divided in electrical defective and hydraulic pressure/mechanical defective.

Electrical defective

- If an electrical defective occurs in transmission during driving, current shift gear position is held.
  A. Shut off of various solenoid valves
  B. Internal pressure in transmission increases (shift shock gets bigger when changing selector lever due to maximized MP and SP)
  C. Lockup clutch is released

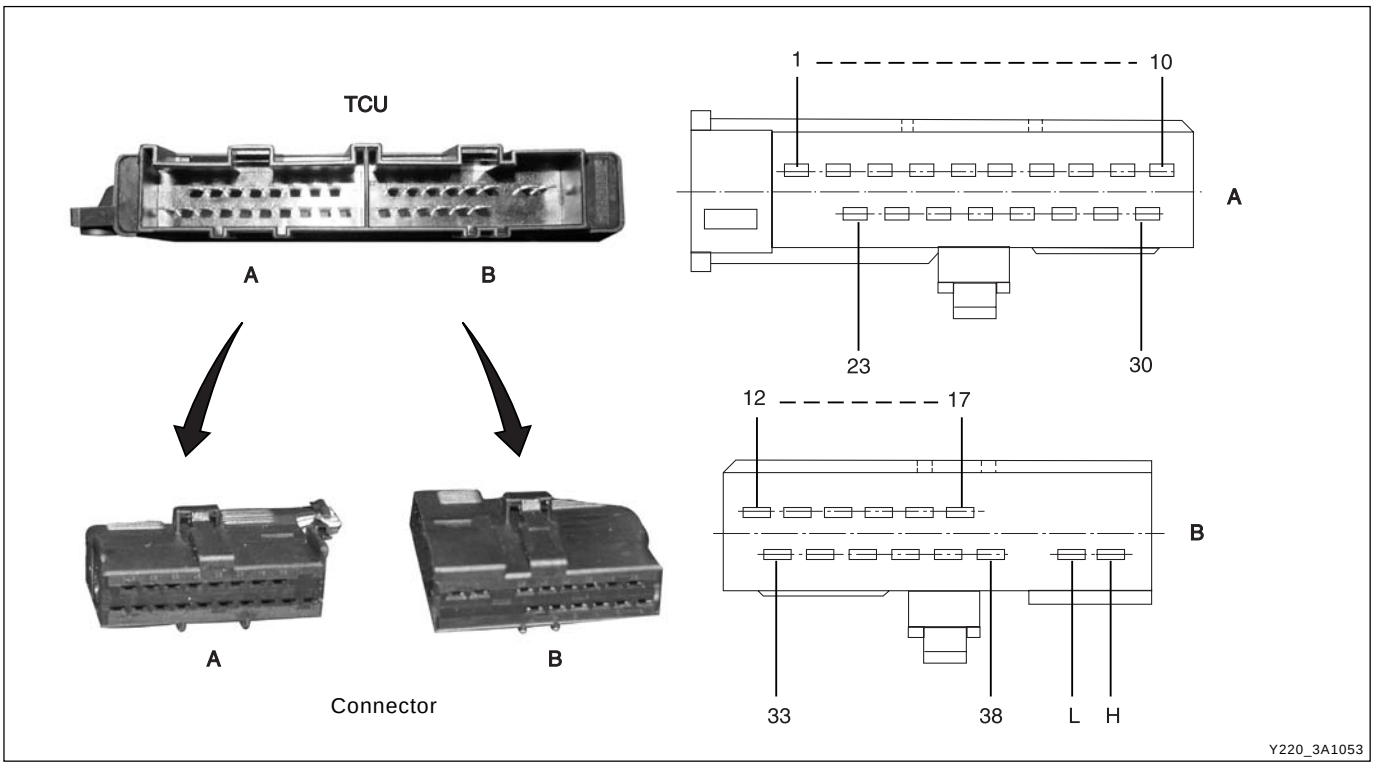
- If the shift operation cannot be activated, the driver must reset the system as follows:
  A. Stop the vehicle and place the selector lever to "P" position.
  B. Wait for 10 seconds after stopping the engine (release hydraulic pressure)
  C. Start the engine.
  D. Place the selector lever to "D" or "R" position.

Mechanical/hydraulic pressure defective

- Characteristics that appears in the vehicle are as below:
  A. Holds at 3rd gear (It can be held at proper gear if the fault occurs at 3rd gear)
  B. Electrical devices operate normally and the shift shock is acceptable during shift operation.

- If the shift operation cannot be activated, the driver must reset the system as follows:
  A. Stop the vehicle.
  B. Wait for 10 seconds after stopping the engine (release hydraulic pressure).
  C. In most cases, it is reset when the engine is started and the vehicle operates normally.

Connector arrangement and pin functions



Pin No.	Description	Connected to
1	Diagnostic	Diagnostic connector pin No.11
7	Initiating the starter relay	Starter relay
12	RPM sensor N2	13-pin plug No.3
13	RPM sensor voltage supply	13-pin plug No.7
14	1-2, 4-5 solenoid valve	13-pin plug No.13
15	3-4 solenoid valve	13-pin plug No.9
16	2-3 solenoid valve	13-pin plug No.11
17	Lockup clutch solenoid valve	13-pin plug No.11
29	TCU voltage supply	-
30	Ground	-
33	RPM sensor ground	13-pin plug No.12
34	ATF temperature, Starter lock-out contact	13-pin plug No.4
35	RPM sensor N3	13-pin plug No.1
36	Modulating pressure solenoid valve	13-pin plug No.2
37	Shift pressure solenoid valve	13-pin plug No.10
38	Each solenoid valve voltage	13-pin plug No.6
L	CAN Low	ECM, HECU, selector lever unit, instrument panel
H	CAN High	ECM, HECU, selector lever unit, instrument panel

OTHER FUNCTIONS

▶ Oil Level Control

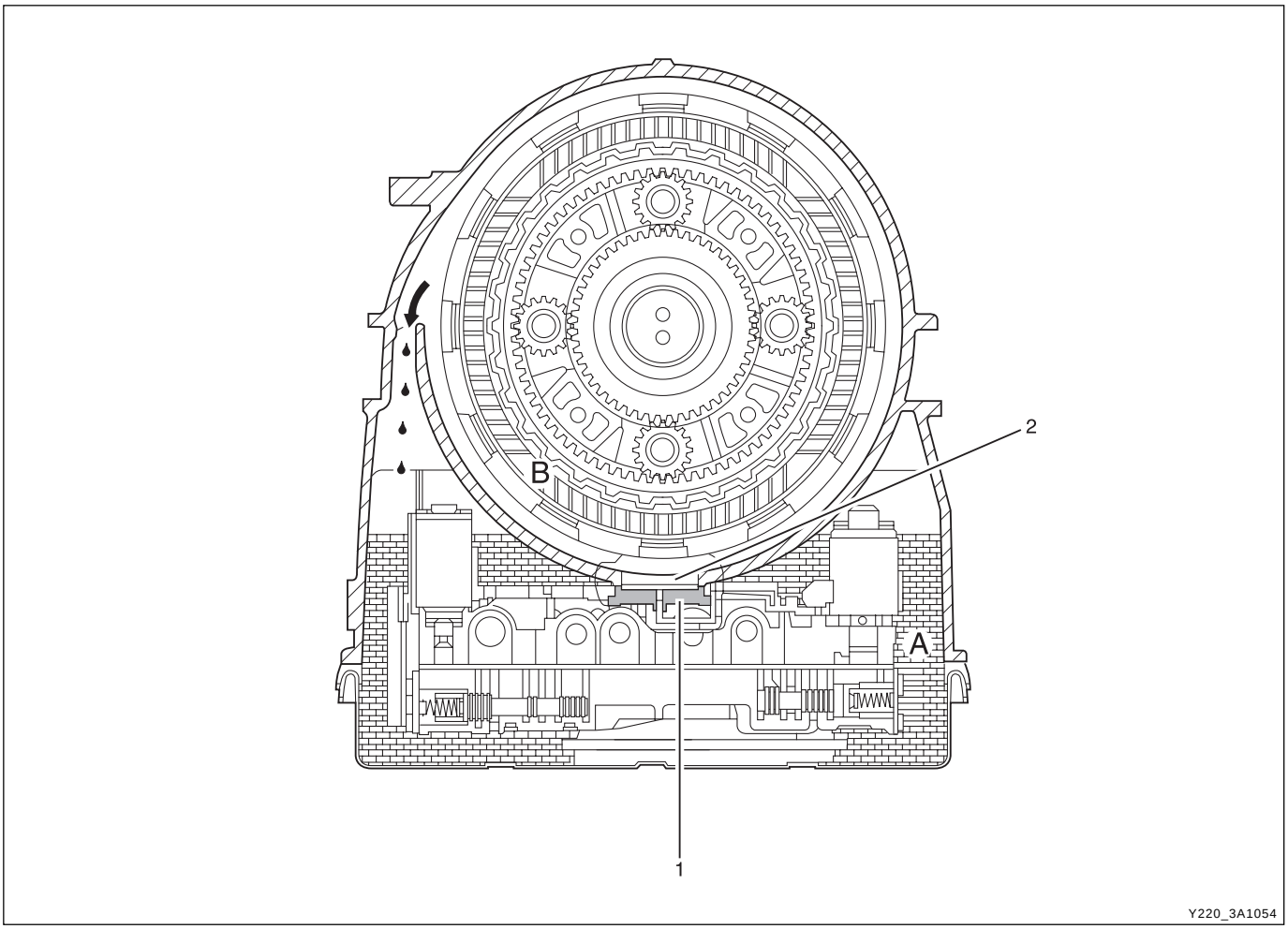
Function

This is the function that closes the opening between oil chamber and planetary gear set chamber, so that the gear set does not splash in oil if the oil level rises.

The lubricating oil flowing continuously out of the gear sets returns through the opening (2) into the oil chamber. If the oil level rises, the oil forces the float (1) against the housing.

The float separates the oil chamber from the gear set chamber. The lubricating oil which escapes further from the gear sets is thrown against the housing wall by the rotating parts and flows now through the upper opening (arrow) back into the oil chamber.

Reduction of power losses and prevention of fluid loss from the transmission at high fluid level.



1. Float
2. Opening

A. Oil chamber
B. Planetary gear set chamber

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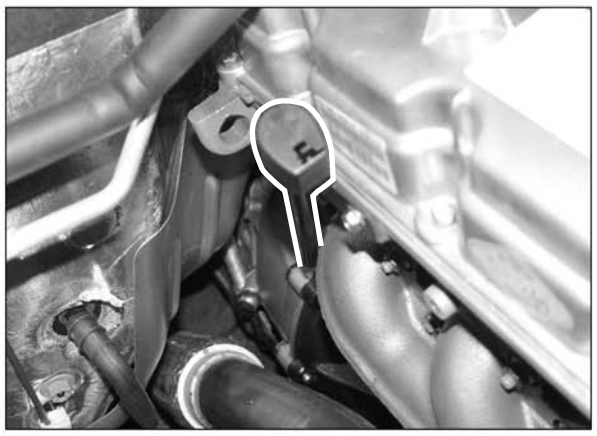
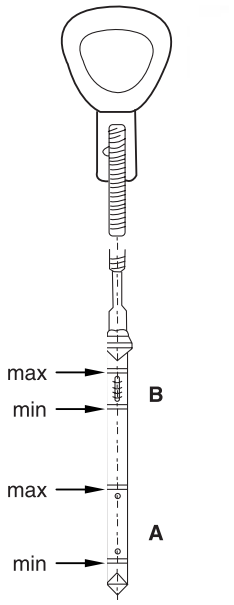
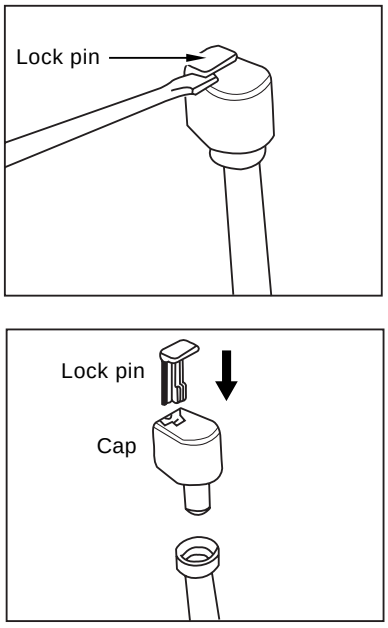
▶ Oil Check and Specification







Y220_3A1055

Checking and adding Tip

A. Place the vehicle on level ground. Pull out the lock pin and remove the cap (add 4 to 5 liter if oil has been completely drained out).

B. Place the selector lever to “P” position. Start the engine and leave it idling (add 2.5 liter if oil has been completely drained out).

C. Warm the engine up while moving the selector lever to all positions. Check if the oil temperature is approx. 80°C with a scanner (apply the parking brake).

: Selector lever position - R or D

D. Check the oil level with oil dipstick while engine is running in “P” position.

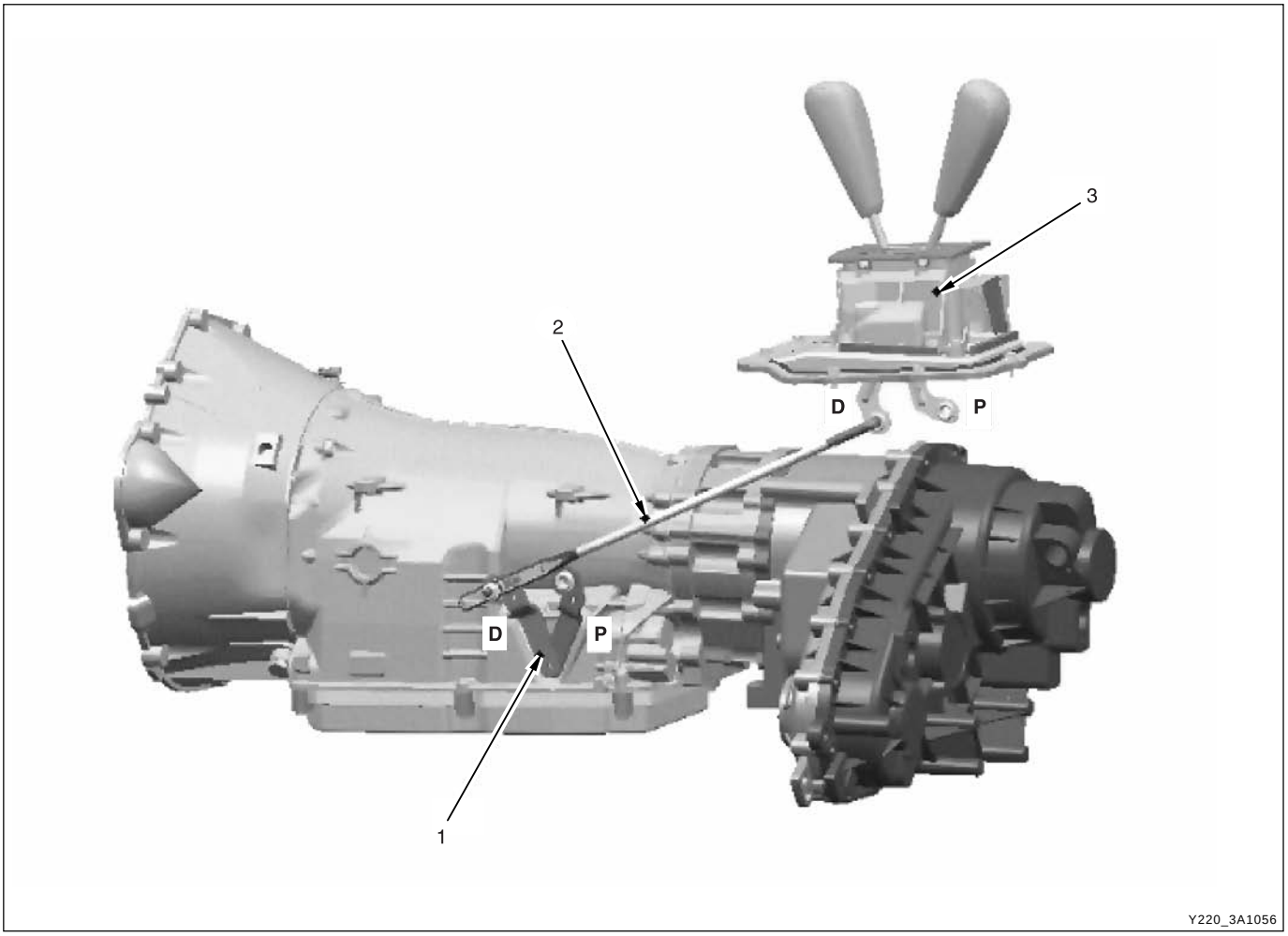
E. Check several times with attention, and add or drain the oil as required.

Automatic transmission fluid capacity and specification

Fluid capacity	Approx. 8 ℓ
Specification	Fuchs ATF 3353 or Shell ATF 3353

▶ Shift Rod Adjustment

Adjustment



1. Range lever
2. Shift rod
3. Selector lever

D. "D" range
P. "P" range

A. Disengage the shift rod from range lever and place the range lever at "D" position.
B. Place the selector lever at "D" position.
C. Insert the shift rod into range lever and tighten nut.

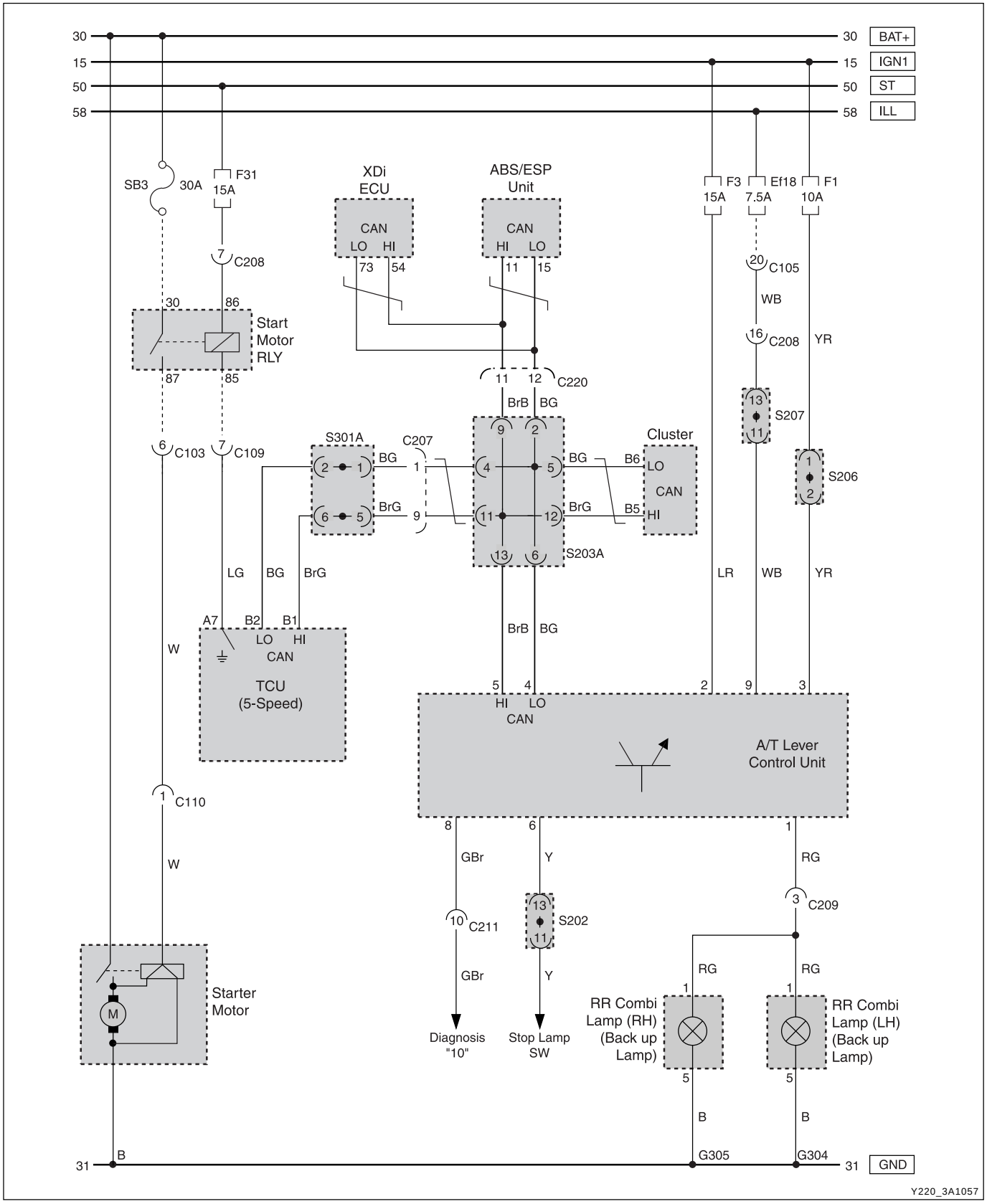
Notice

Lock the selector lever so that it will not move.

D. Check if the indication lamp in meter cluster indicates correct gear position while moving the selector lever to "P", "R", "N", and "D" position.
E. Check if the engine can be started at selector lever "P" or "N" position.

CIRCUIT DIAGRAM

▶ Starter, Selector Lever, CAN Communication



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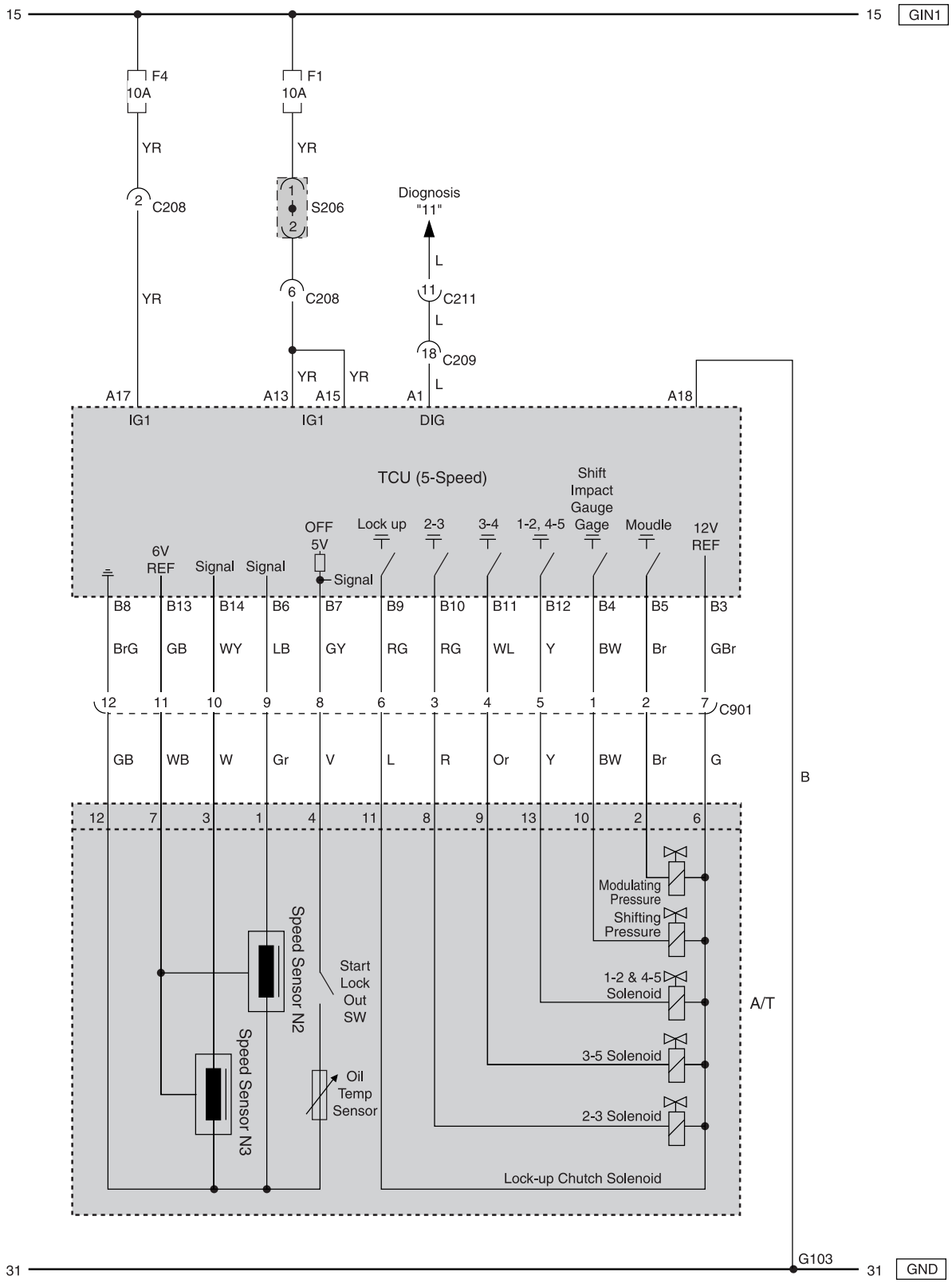
▶ Solenoid, Oil Temperature Sensor, RPM Sensor (N2, N3)



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TROUBLE CODE AND DIAGNOSIS

TROUBLE DIAGNOSIS WITH SCANNER

▶ Scanner Installation

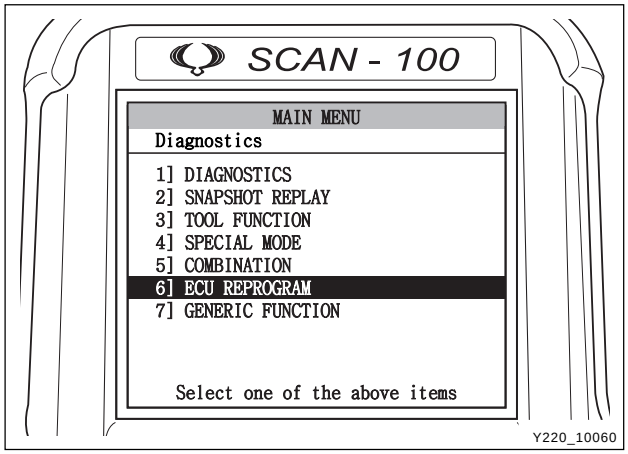
1. Connect the scanner connector to the diagnostic socket.
2. Turn the ignition switch to “ON” position.
3. Select [DIAGNOSTICS] in [MAIN MENU] screen and press [ENTER].
4. Select [REXTON] in [VEHICLE SELECTION] screen and press and press [ENTER].
5. Select [TCU] in [CONTROL UNIT SELECTION] screen and press [ENTER].
6. Select [TROUBLE CODE] in [FUNCTION SELECTION] screen and press [ENTER].
7. Determine the DTC and locate the trouble cause.

▶ TCU Coding for DC 5-Speed Automatic Transmission

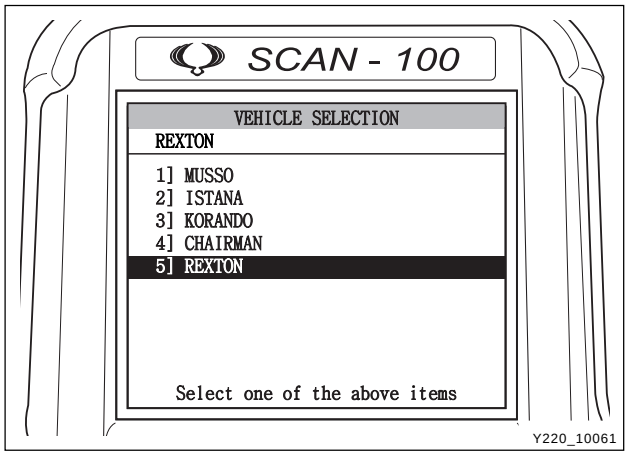
If the TCU or automatic transmission has been replaced, the TCU should be coded with Scan-i.

Entering the diagnosis procedures

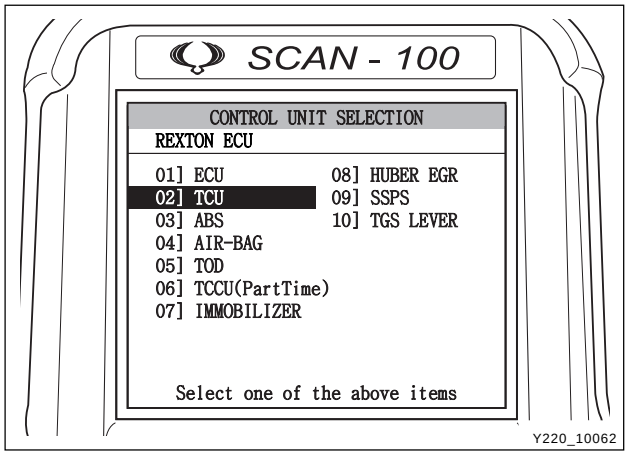
1. Select “6] ECU REPROGRAM” and press ENTER in MAIN MENU screen.



2. Select “5] REXTON” and press ENTER in VEHICLE SELECTION screen.



3. Select “2] TCU” and press ENTER in CONTROL UNIT SELECTION screen.



4. Select the transmission type and enter into the coding section.

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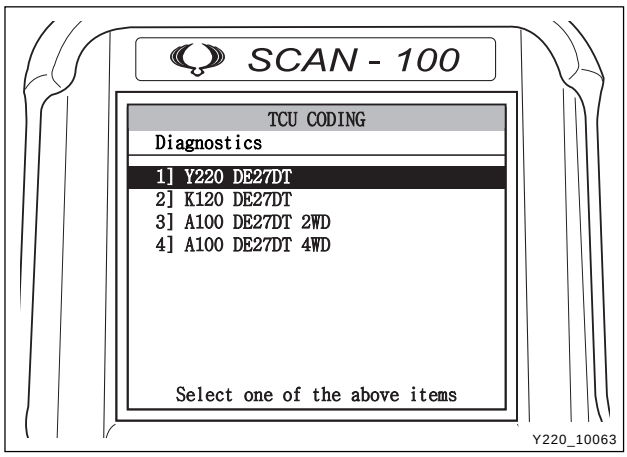
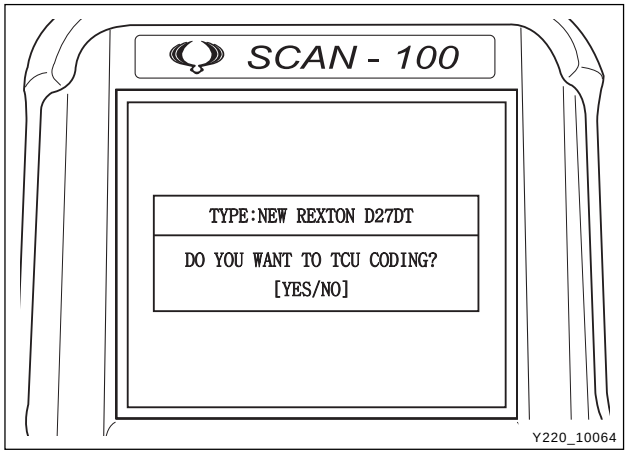
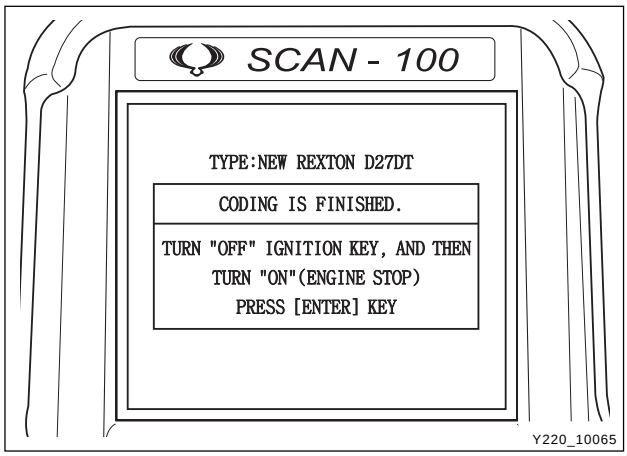


5. Select “1] Y220 DE27DT” and press ENTER in TCU CODING screen.



6. If the message as shown in the figure appears, select “YES” to start coding and press ENTER.



7. If the message as shown in the figure appears, turn the ignition key to “OFF” position and then turn it “ON” again.

▶ DTC (Diagnosis Trouble Code) of DC5AT

Trouble Code	Defectives	Action
P2000	Faulty TCU internal watchdog test	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2001	Faulty TCU internal watchdog function	- Self-diagnosis. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2002	Faulty TCU external watchdog test	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2003	Faulty TCU external watchdog function	- Self-diagnosis. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2004	Faulty TCU Clock	- Self-diagnosis. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2005	Faulty TCU RAM	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2006	Faulty TCU RAM CAN-Controller 1	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2007	Faulty TCU RAM CAN-Controller 2	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2008	Faulty TCU ROM	- Self-diagnosis with IGN ON. - When the TCU internal checksum is different from scanner checksum. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P200A	Faulty TCU EEPROM	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P200B	Faulty TCU CPU (internal)	- Self-diagnosis. - Check harness contact.
P200C	Faulty TCU program control	- Self-diagnosis. - Check harness contact.
P2010	No TCU variant coding	- Self-diagnosis with IGN ON. - When the TCU coding is not exist. - Check again after TCU coding.
P2011	Faulty TCU variant coding	- Self-diagnosis with IGN ON. - When the TCU coding is faulty. - Check again after TCU coding.
P2012	Faulty TCU checksum	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2013	Faulty TCU (internally)	- Self-diagnosis with IGN ON. - Cycle the IGN switch from OFF to ON. Check and replace TCU if the trouble still exists.
P2100	Defective 1-2, 4-5 shift solenoid valve	- When 1-2 or 4-5 shift solenoid valve is defective. - Measure the resistance of 1-2 or 4-5 shift solenoid valve (turn the IGN OFF, then and disconnect TCU connector). • TCU connector terminals: B12, B3 • Specified value: 3.8 ± 0.2 Ω - Triggered emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P2101	1-2, 4-5 shift solenoid valve - short	- When 1-2 or 4-5 shift solenoid valve is defective. - Measure the resistance of 1-2 or 4-5 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B12, B3 • Specified value: 3.8 ± 0.2 Ω - Triggered emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2102	Defective 2-3 shift solenoid valve	- When 2-3 shift solenoid valve is defective. - Measure the resistance of 2-3 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B10, B3 • Specified value: 3.8 ± 0.2 Ω - Triggered emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2103	2-3 shift solenoid valve - short	- When 2-3 shift solenoid valve is defective. - Measure the resistance of 2-3 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B10, B3 • Specified value: 3.8 ± 0.2 Ω - Triggered mechanical emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2104	Defective 3-4 shift solenoid valve	- When 3-4 shift solenoid valve is defective. - Measure the resistance of 3-4 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B11, B3 • Specified value: 3.8 ± 0.2 Ω - Triggered mechanical emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2105	3-4 shift solenoid valve - short	- When 3-4 shift solenoid valve is defective. - Measure the resistance of 3-4 shift solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B11, B3 • Specified value: 3.8 ± 0.2 Ω - Triggered mechanical emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2106	Defective lockup clutch solenoid valve	- Measure the resistance of lockup clutch solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B9, B3 • Specified value: 2.5 ± 0.2 Ω - Triggered emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P2107	Defective modulator pressure solenoid valve	- Measure the resistance of modulator pressure solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B5, B3 • Specified value: 5.0 ± 0.2 Ω - Triggered emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2108	Defective shift pressure solenoid valve	- Measure the resistance of shift pressure solenoid valve (turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B4, B3 • Specified value: 5.0 ± 0.2 Ω - Triggered emergency mode when the defective is detected. • Electrical error: Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2200	Faulty rpm sensor N2 signal	- When the rpm sensor N2 detects 0 rpm of front sun gear speed. - Check the related harness for open, short and contact. • TCU connector terminal B6: rectangular wave signal B8: signal ground B13: 6V
P2203	Faulty rpm sensor N3 signal	- When the rpm sensor N3 detects 0 rpm of planetary gear carrier speed. - Check the related harness for open, short and contact. • TCU connector terminal B6: rectangular wave signal B8: signal ground B13: 6V
P220A	Abnormal rpm sensor output signal (N2, N3)	- When the rpm difference between rpm sensor N2 and N3 is over 150 rpm. - Check the related harness for open, short and contact.
P2220	Oil temperature sensor - short	- Turn the IGN OFF, then disconnect TCU connector. - Selector lever position: R or D - Measure the resistance of oil temperature sensor. • TCU connector terminals: B7, B8 - Check the related harness for open, short and contact.
P2221	Abnormal oil temperature sensor signal	- Turn the IGN OFF, then disconnect TCU connector. - Selector lever position: R or D - Measure the resistance of oil temperature sensor. • TCU connector terminals: B7, B8 - Check the related harness for open, short and contact.
P2222	Abnormal oil temperature sensor signal	- Turn the IGN OFF, then disconnect TCU connector. - Selector lever position: R or D - Measure the resistance of oil temperature sensor. • TCU connector terminals: B7, B8 - Check the related harness for open, short and contact.
P2300	Faulty CAN communication	- Turn the IGN OFF, then disconnect TCU connector. - Check the communication line for open, short and contact. - Measure the resistance of CAN line: B1, B2 • Specified value: approx. 120 Ω

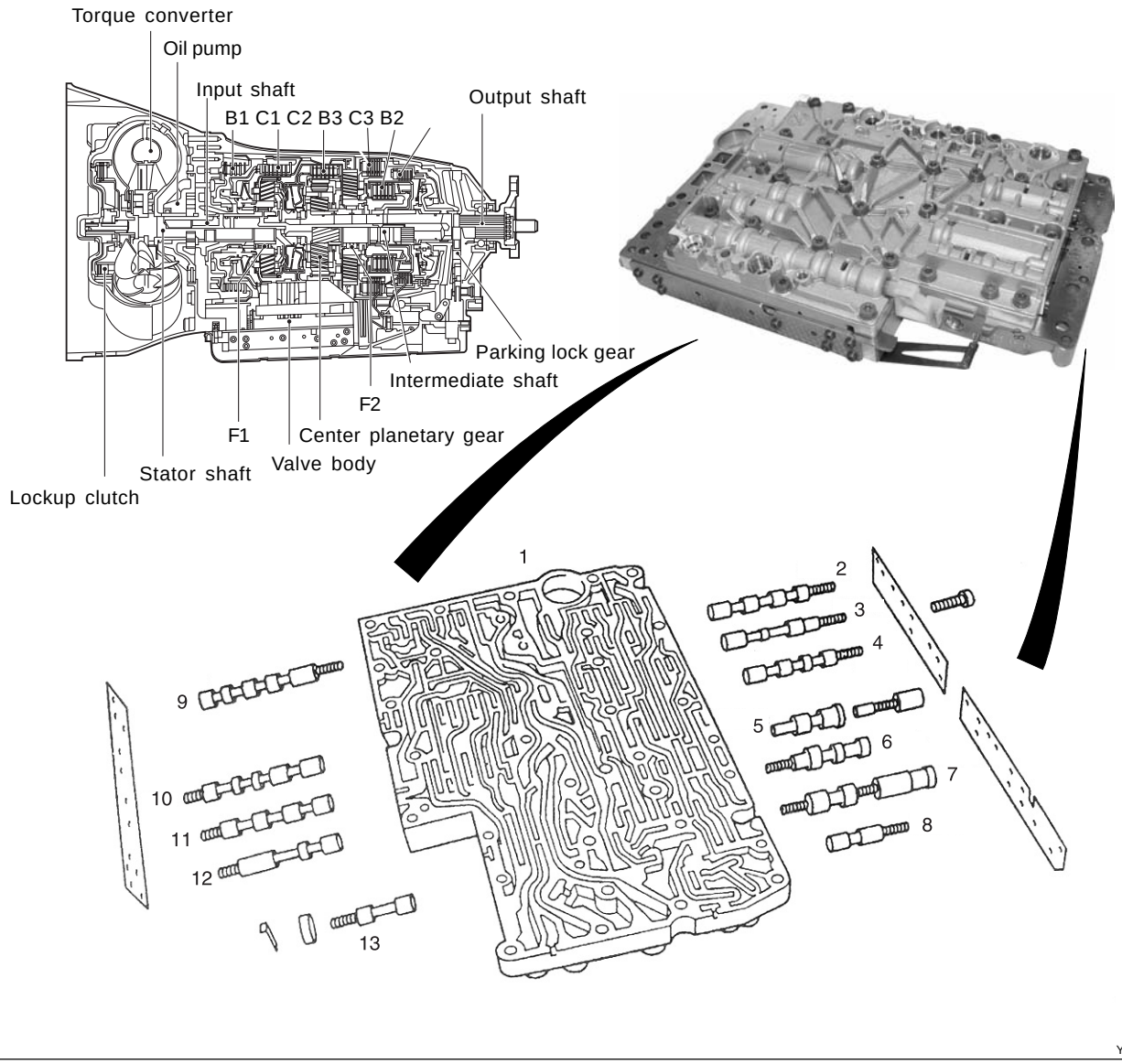
Trouble Code	Defectives	Action
P2301	Faulty CAN communication	- Turn the IGN OFF, then disconnect TCU connector. - Check the communication line for open, short and contact. - Measure the resistance of CAN line: B1, B2 • Specified value: approx. 120 Ω
P2310	CAN: Faulty brake system communication	- Check CAN communication line H and L. - Check ABS/ESP unit. - Check the related harness for open, short and contact.
P2311	CAN: Faulty ECU communication	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2312	CAN: Faulty ECU communication	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2313	CAN: Faulty selector lever control communication	- Check CAN communication line H and L. - Check selector lever. - Check the related harness for open, short and contact.
P2315	CAN: Faulty instrument panel communication	- Check CAN communication line H and L. - Check instrument cluster. - Check the related harness for open, short and contact.
P2317	CAN: Faulty communication between TCCU/TOD and CAN	- Check CAN communication line H and L. - Check TCCU/TOD unit. - Check the related harness for open, short and contact.
P2330	CAN: Faulty brake system signal	- Check CAN communication line H and L. - Check ABS/ESP unit. - Check the related harness for open, short and contact.
P2331	CAN: Faulty ECU message	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2332	CAN: Faulty ECU message	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2333	CAN: Faulty selector lever signal	- Check CAN communication line H and L. - Check selector lever. - Check the related harness for open, short and contact.
P2335	CAN: Faulty instrument cluster signal	- Check CAN communication line H and L. - Check instrument cluster. - Check the related harness for open, short and contact.
P2337	CAN: Faulty TCCU/TOD	- Check CAN communication line H and L. - Check TCCU/TOD unit. - Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P2400	CAN: Faulty rear RH wheel speed sensor signal	- Check CAN communication line H and L. - Check ABS/ESP unit. • Check wheel speed sensor connector. • Check the air gap between tooth wheel and wheel speed sensor. Check tooth wheel installation. (specified air gap: 0.309~0.958 mm). • Check the numbers of tooth wheel: 48 - Check the related harness for open, short and contact.
P2401	CAN: Faulty rear LH wheel speed sensor signal	- Check CAN communication line H and L. - Check ABS/ESP unit. • Check wheel speed sensor connector. • Check the air gap between tooth wheel and wheel speed sensor. Check tooth wheel installation. (specified air gap: 0.309~0.958 mm). • Check the numbers of tooth wheel: 48 - Check the related harness for open, short and contact.
P2402	CAN: Faulty front RH wheel speed sensor signal	- Check CAN communication line H and L. - Check ABS/ESP unit. • Check wheel speed sensor connector. • Check the air gap between tooth wheel and wheel speed sensor. Check tooth wheel installation. (specified air gap: 0.335~0.945 mm) • Check the numbers of tooth wheel: 48
P2403	CAN: Faulty front LH wheel speed sensor signal	- Check CAN communication line H and L. - Check ABS/ESP unit. • Check wheel speed sensor connector. • Check the air gap between tooth wheel and wheel speed sensor. Check tooth wheel installation. (specified air gap: 0.335~0.945 mm) • Check the numbers of tooth wheel: 48
P2404	CAN: No brake signal	- Check CAN communication line H and L. - Check ABS/ESP unit. - Check the related harness for open, short and contact.
P2405	CAN: No accelerator pedal signal	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2406	CAN: No engine torque signal	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2407	CAN: No ESP signal	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2408	CAN: No minimum engine torque signal	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2409	CAN: No maxmum engine torque signal	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.

Trouble Code	Defectives	Action
P240A	CAN: No engine rpm signal	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P240B	CAN: No engine coolant temperature signal	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P240C	CAN: No selector lever position signal	- Check CAN communication line H and L. - Check selector lever. - Check the related harness for open, short and contact.
P240D	CAN: No transfer case position signal	- Check CAN communication line H and L. - Check TCCU/TOD unit. - Check the related harness for open, short and contact.
P2500	Invalid transmission gear ratio	- Cycle the IGN switch from OFF to ON. Check A/T system again after a certain period of driving. - If the trouble still exists, replace A/T assembly. - To protect transmission, any shift is not available.
P2501	Excessive engine rpm	- Check CAN communication line H and L. - Check engine ECU. - Check the related harness for open, short and contact.
P2503	Current selected gear	- Check selector lever. - Check the related harness for open, short and contact.
P220B	Excessive N2, N3 rpm	- Check rpm sensor N2 and N3.
P2510	Torque converter lockup clutch stuck	- Check the hydraulic lines for leaks (valve No.22 in valve body). - Check the resistanve of lockup clutch solenoid valve (Turn the IGN OFF, then disconnect TCU connector). • TCU connector terminals: B9, B3 • Specified value: 2.5 ± 0.2 Ω - Triggered emergency mode when the defective is detected. • Fixed at 2nd gear in “D” range. - Check the related harness for open, short and contact.
P2511	Faulty torque converter lockup heat control	- Check the hydraulic lines for leaks.
P2520	Faulty recognition of torque reduction	- Check ECU.
P2502	Poor gear mesh, transmission slip	- Check the hydraulic lines for leaks. - Check oil filter.
P2600	Too low TCU supplying voltage	- Check TCU supplying voltage.
P2601	Too high TCU supplying voltage	- Check TCU supplying voltage.
P2602	Abnormal solenoid valve supplying voltage	- Check solenoid supplying voltage.
P2603	Abnormal speed sensor supplying voltage	- Check speed sensor supplying voltage. • TCU connector terminals B13: 6V

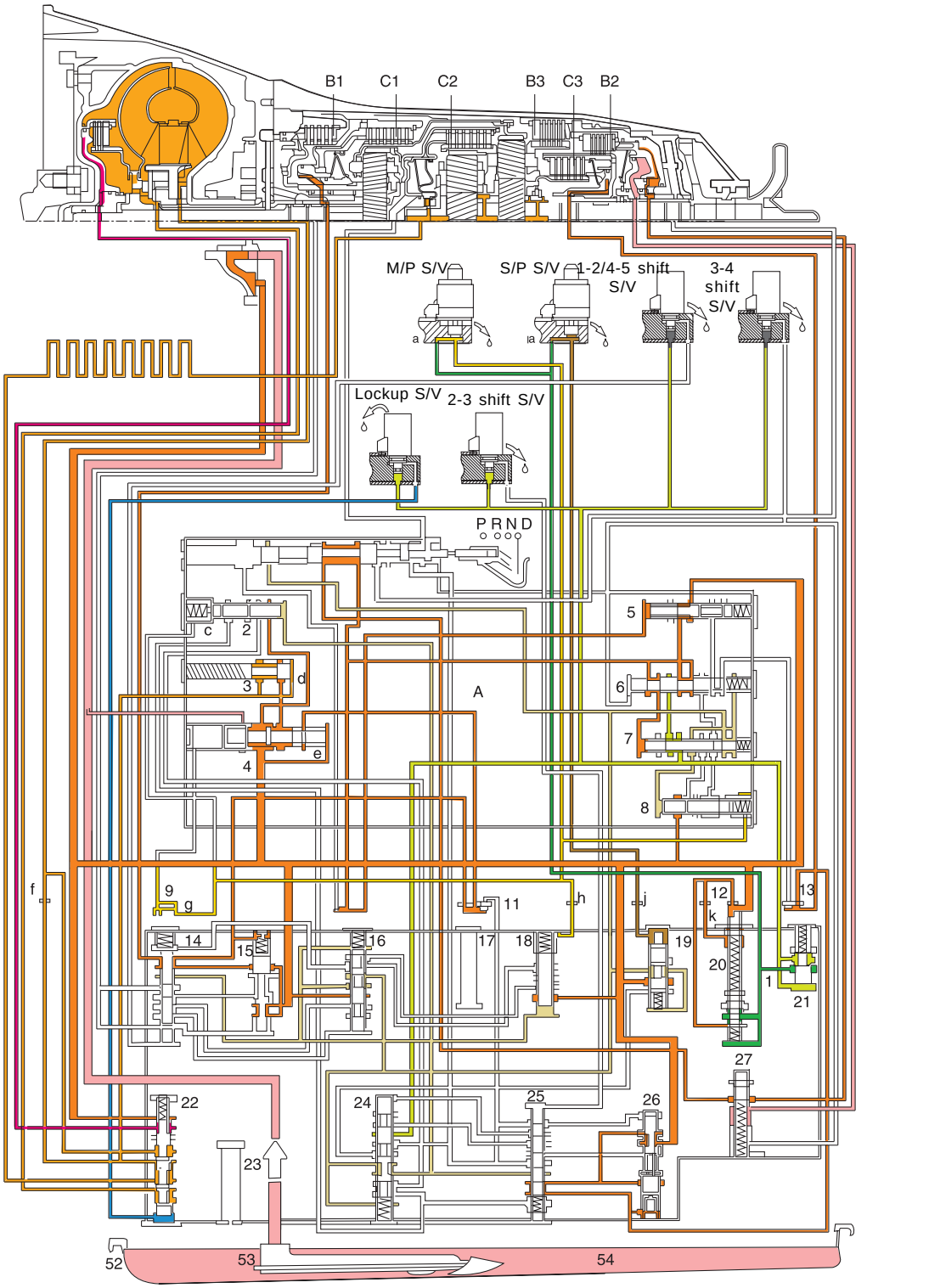
HYDRAULIC SYSTEM

STRUCTURE OF VALVE BODY



1. Shift housing
2. 1-2/4-5 command valve
3. 1-2/4-5 holding pressure shift valve
4. 1-2/4-5 shift pressure shift valve
5. 1-2/4-5 overlap control valve
6. Shift pressure control valve
7. Regulating pressure control valve
8. Shift valve pressure control valve
9. Torque converter lockup clutch control valve
10. 2-3 shift pressure shift valve
11. 2-3 command valve
12. 2-3 holding pressure shift valve
13. Shift valve B2

HYDRAULIC CIRCUIT



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1. Selector valve
2. 2-3 overlap control valve
3. Lubricating pressure control valve
4. Operating pressure control valve
5. Holding pressure shift valve
6. Command valve
7. 3-4 shift valve
8. 3-4 overlap control valve
9. One-way throttle valve
10. Ball change over valve
11. Ball change over valve
12. Filter screen
13. Ball change over valve
14. 1-2/4-5 command valve
15. 1-2/4-5 holding pressure shift valve
16. 1-2/4-5 shift valve
18. 1-2/4-5 overlap control valve
19. Shift pressure control valve
20. Regulating pressure control valve
21. Shift valve pressure control valve
22. Lock-up clutch control valve
24. 2-3 shift valve
25. 2-3 command valve
26. 2-3 holding pressure shift valve
27. B 2 shift valve
28. Modulating pressure solenoid valve
29. Shift pressure solenoid valve
30. 1-2/4-5 shift solenoid valve
31. 3-4 shift solenoid valve
32. Lock-up solenoid valve
33. 2-3 shift solenoid valve
50. Oil pump
51. Oil cooler
52. Oil pan
53. Oil filter
54. Oil sump

p-A. Operating pressure
p-Sm. Lubricating pressure
p-KUB. Lock-up clutch operating pressure
p-RV. Control valve pressure

p-Mod. Modulating pressure
p-S/RMV. Solenoid valve shift pressure
p-S. Shift pressure

p-SV. Shift valve pressure
p-S/KUB. Lock-up clutch control pressure
Huile. Reserved oil

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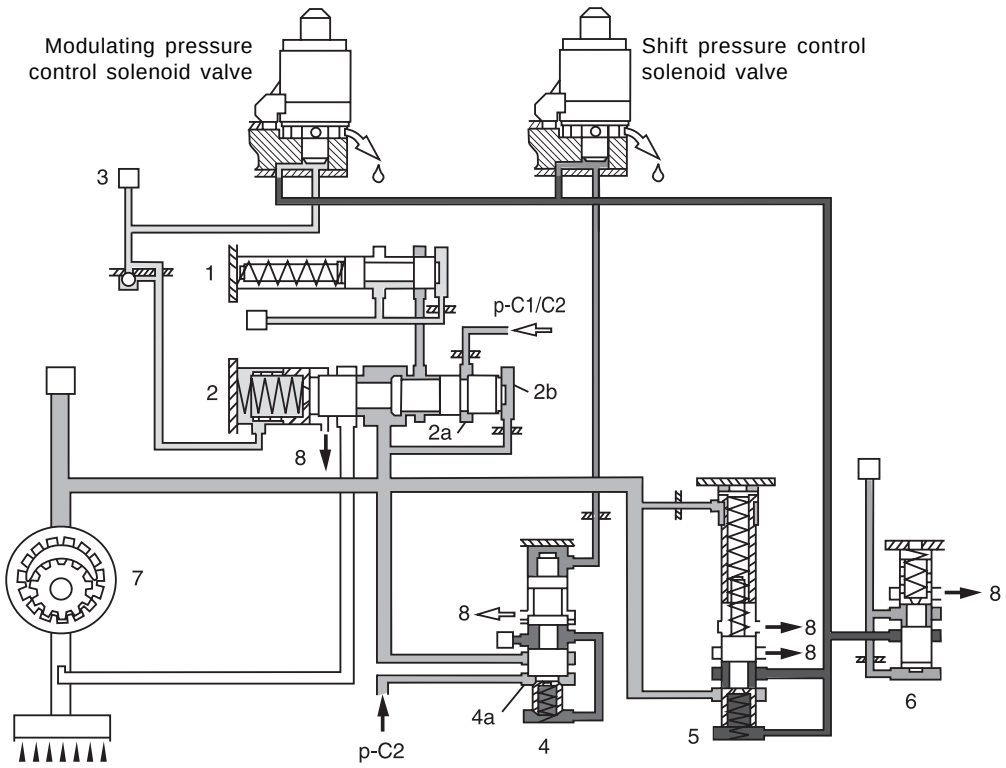
AFFECTED VIN	

▶ Oil Pressure



1. Lubricating pressure control valve
2. Operating pressure control valve
3. One-way throttle valve
4. Shift valve pressure pressure control valve
5. Control valve pressure control valve
6. Shift pressure control valve
7. Oil pump
8. Drain

p-A. Operating pressure

Operating Pressure (p-A)

The inscribed gear type oil pump is installed into torque converter housing and is driven via the drive flange of the torque converter.

The operating pressure produced from oil pump supplies oil pressure to mail line in hydraulic system to operate the actuator. The operating pressure is the highest pressure in the hydraulic system. All other pressures are derived from it.

The operating pressure is regulated at the operating pressure control valve depending on load (modulating pressure) and driving range (C1, C2 pressure). The spring in the operating pressure control valve adjusts a minimum pressure level (base pressure).

Lubricating Pressure (p-SM)

This pressure limits the pressure in torque converter and lubricates and cools the mechanical transmission parts.

At the operating pressure control valve, excess fluid is diverted to the lubricating pressure control valve (1) and, from there, regulated for transmission lubrication use (including torque converter).

Control Valve Pressure (p-RV)

The control valve pressure is set at the control pressure regulating valve (5) in relation to the operating pressure up to 8 bar.

This pressure supplies oil to modulating pressure (MP) solenoid valve, shift pressure (SP) solenoid valve, shift valve pressure control valve (6).

Modulating Pressure (p-Mod)

The modulating pressure is adjusted at the modulating pressure control solenoid valve. The height of modulating pressure is dependent on engine load by TCU. It acts on the operating pressure control valve and the pressure overlap control valve. It increases the operating pressure (line pressure) when the load is heavy.

Shift Pressure (p-S)

The shift pressure is adjusted at the shift pressure control solenoid valve and shift pressure control valve (4). Additional pressure from clutch C2 acts on the shift pressure control valve. As a result, the shift pressure in 2nd gear is reduced.

Shift Valve Pressure (p-SV)

The shift valve pressure converts the control valve pressure (p-RV) to shift valve pressure. Then it supplies oil to command valve, lockup solenoid valve, and shift pressure control solenoid valves.

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▶ Shift Groups

The hydraulic control range (including shift elements), which is responsible for the pressure distribution before, during and after a gear change, is designated a shift group.

The hydraulic system consists of 3 shift groups.

A shift group can be in two phases.

- Shift phase
- Stationary phase

In the shift phase, a change takes place in one shift group of the engaged clutch/brake. The other two shift groups are then in the stationary phase.

Shift group C1/B1 (gear change 1-2/4-5) is responsible for the up/down shifts 1-2/2-1 and 4-5/5-4.

It includes:

- Clutch C1
- Brake B1
- Command valve
- Holding pressure shift valve
- 1-2/4-5 shift solenoid valve
- Pressure overlap control valve
- 1-2/4-5 shift solenoid valve

Shift group C2/C3 (gear change 2-3) is responsible for the up/down shifts 2-3/3-2.

It includes:

- Clutch C2
- Clutch C3
- Command valve
- Holding pressure shift valve
- 2-3 shift solenoid valve
- Pressure overlap control valve
- 2-3 shift solenoid valve

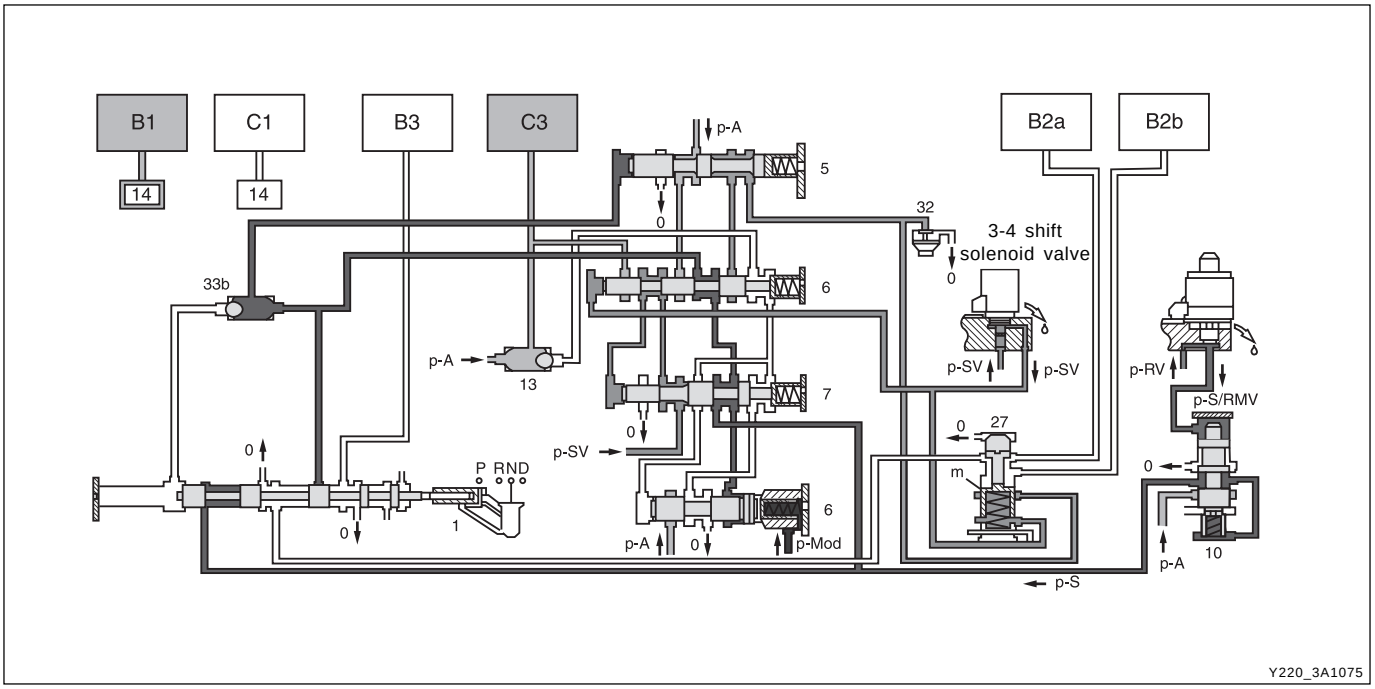
Shift group C3/B2 (gear change 3-4) is responsible for the up/down shifts 3-4/4-3 and the engagement process.

It includes:

- Clutch C3, 3-4 pressure overlap control valve
- Brake B2, 3-4 shift solenoid valve
- Brake B3
- Command valve
- Holding pressure shift valve
- 3-4 shift solenoid valve

HYDRAULIC CIRCUIT WHEN STARTING ENGINE

▶ Selector Lever "N"

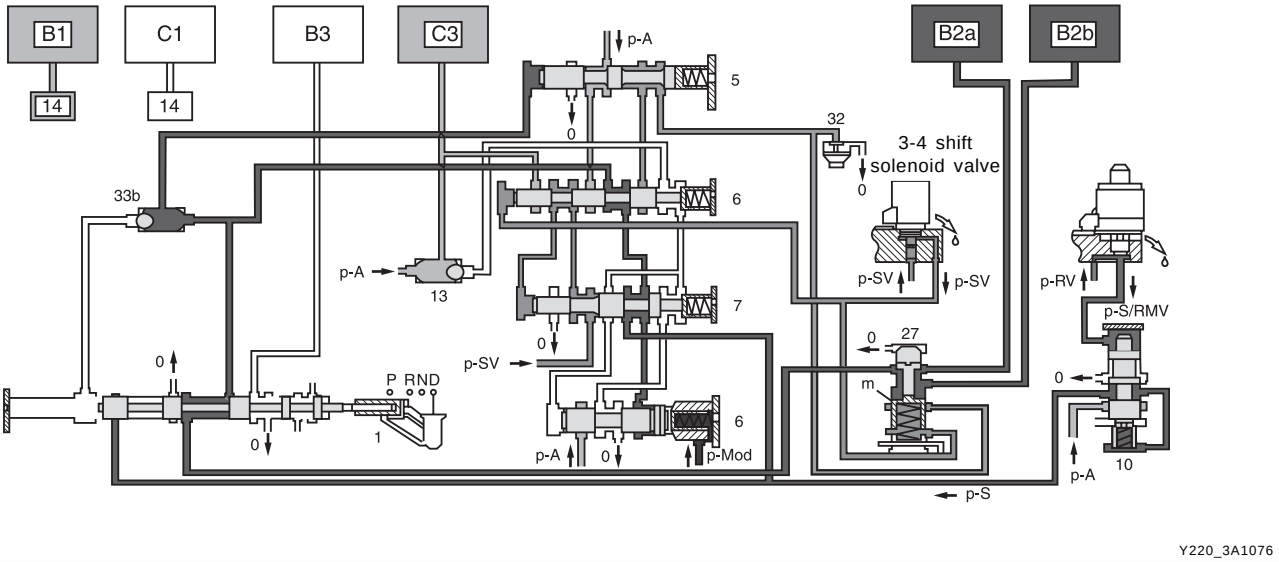


1. Selector valve
5. 3-4 holding pressure shift valve
6. 3-4 command valve
7. 3-4 shift pressure shift valve
8. 3-4 overlap control valve
10. Ball valve
13. Ball valve
14. 1-2/4-5 command valve
19. Shift pressure control valve
27. B2 shift valve

B2a. B2 piston
B2b. Opposite face of B2 piston
m. Annular surface
p-A. Operating pressure
p-Mod. Modulating pressure
p-RV. Control valve pressure
p-S. Shift pressure
p-S/RMV. Shift pressure/control solenoid valve
p-SV. Shift valve pressure

The operating pressure (p-A) is formed and travels via the 2-3 holding pressure shift valve, the 2-3 command valve and ball valve (13) to clutch C3 and via the 3-4 command valve (6) to the end face of the 3-4 shift pressure shift valve (17). The 3-4 shift pressure pressure shift valve is moved against the force of the spring towards the right. At the same time, the 3-4 solenoid valve is energized. This allows shift valve pressure (p-SV) to enter the spring chamber of the shift valve B2 (27) and to reach the end face of the 3-4 command valve (6). The shift valve B2 (27) is held in the upper position and the 3-4 command valve (6) switches towards the right. At the end face of the 3-4 shift pressure shift valve (7), the operating pressure (p-A) is replaced by shift valve pressure (p-SV).

▶ Hydraulic Circuit When Moving Selector Lever From “N” to “D” (Shift Phase)

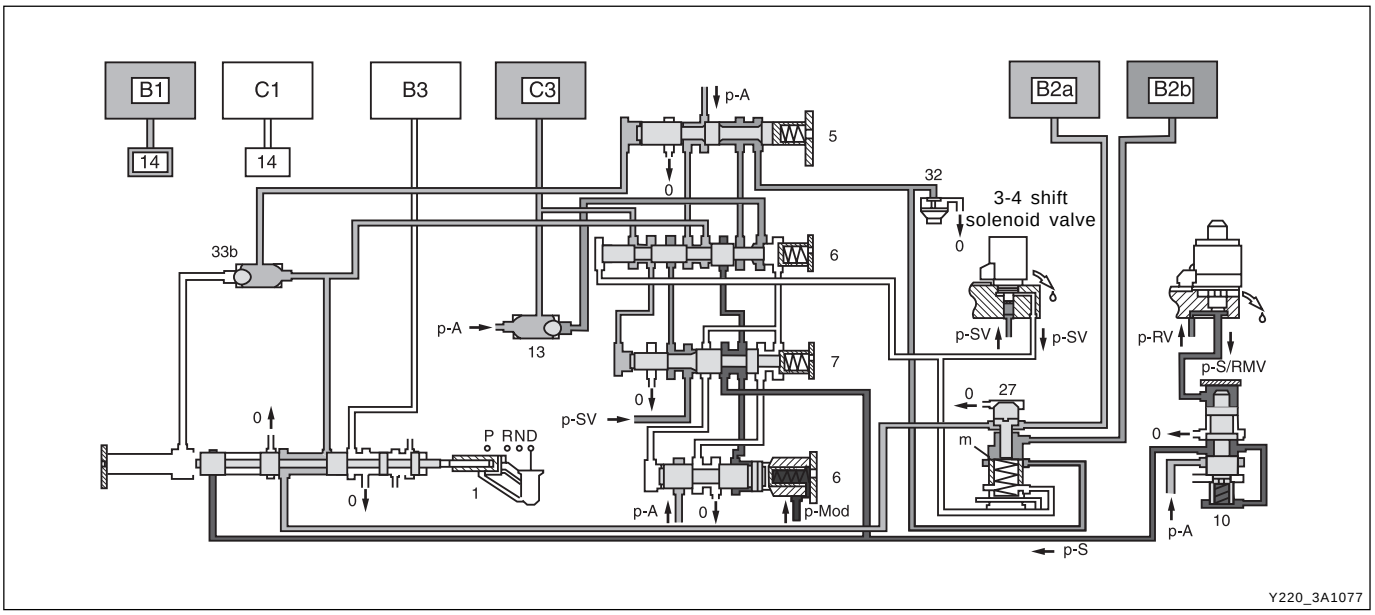


1. Selector valve
5. 3-4 holding pressure shift valve
6. 3-4 Command valve
7. 3-4 shift pressure shift valve
8. 3-4 overlap control valve
10. Ball valve
13. Ball valve
14. 1-2/4-5 Command valve
19. Shift pressure control valve
27. B2 shift valve

B2a. B2 piston
B2b. Opposite face of B2 piston
m. Annular surface
p-A. Operating pressure
p-Mod. Modulating pressure
p-RV. Control valve pressure
p-S. Shift pressure
p-S/RMV. Shift pressure/control solenoid valve
p-SV. Shift valve pressure

The selector valve (1) opens the shift pressure (p-S) feed connection from the ball valve (10) with the shift valve B2 (27). With the shift valve B2 (27) in the upper position, shift pressure (p-S_ travels behind the piston B2 (B2a) and simultaneously to the opposing face of the piston B2 (B2b). The brake B2 begins to close.

▶ Hydraulic Circuit When Selector Lever is in “D” Position (1st Gear)

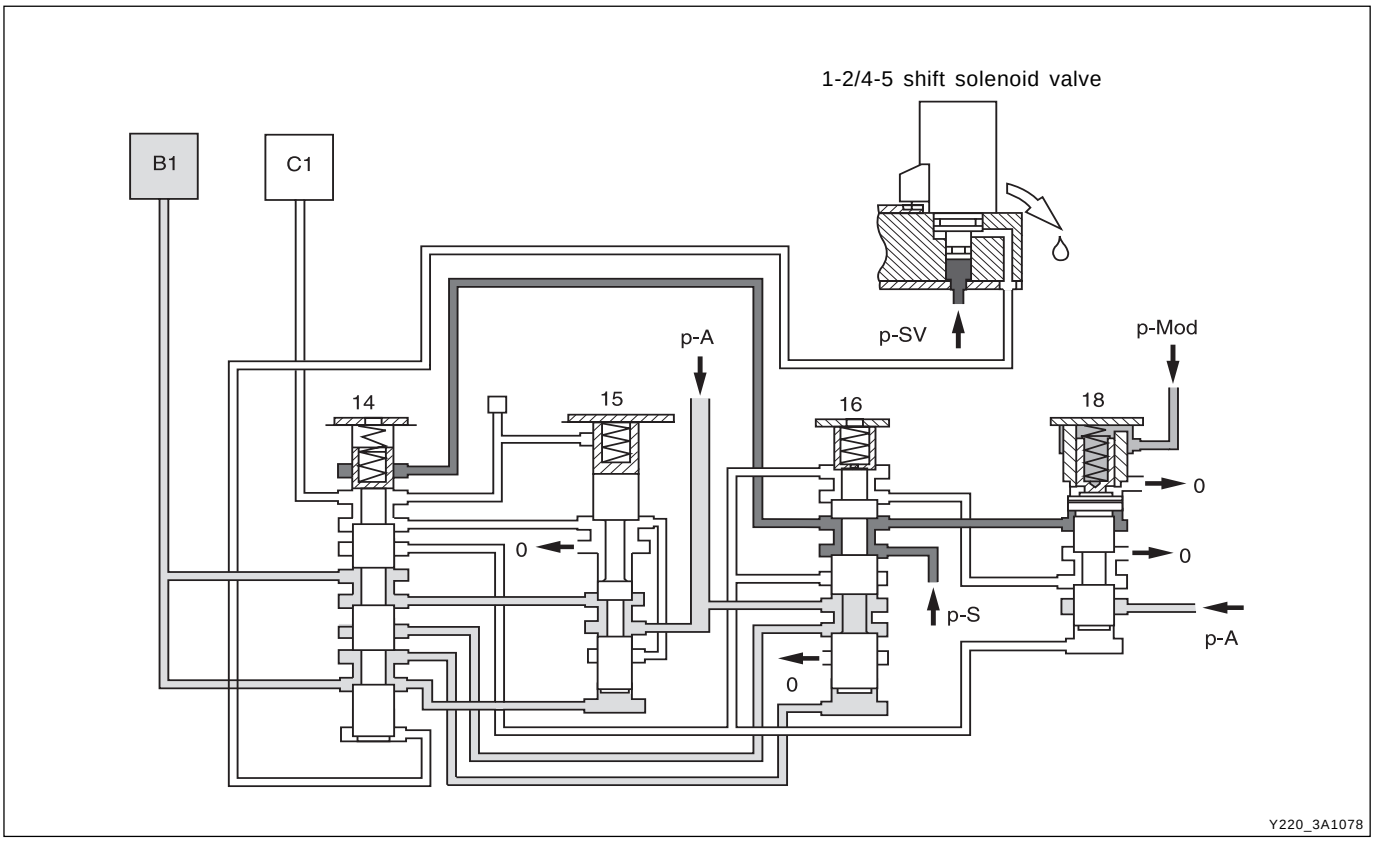


1. Selector valve
5. 3-4 holding pressure shift valve
6. 3-4 Command valve
7. 3-4 shift pressure shift valve
8. 3-4 overlap control valve
10. Ball valve
13. Ball valve
14. 1-2/4-5 Command valve
19. Shift pressure control valve
27. B2 shift valve
32. Pressure holding valve

B2a. B2 piston
B2b. Opposite face of B2 piston
m. Annular surface
p-A. Operating pressure
p-Mod. Modulating pressure
p-RV. Control valve pressure
p-S. Shift pressure
p-S/RMV. Shift pressure/control solenoid valve
p-SV. Shift valve pressure

The pressure on the opposing face of the piston B2 (B2b) ensures a soft activation of the brake B2. The TCU monitors the activation sequence via the speed of input shaft, which slows down as the frictional connection in the brake increases. When the speed drops to the specified level, TCU shuts off the power to the 3-4 shift solenoid valve. The spring chamber of the shift valve B2 (27) is depressurized and switches downwards. This connects the line to the opposing face of the piston B2 (B2b) with the pressure holding valve (32). The pressure on the opposing face of the piston B2 (B2b) drops to a residual pressure. The 3-4 command valve (6) moves to the left. The operating pressure (p-A) travels via the holding pressure shift valve (5) and the 3-4 command valve (6) to the piston of brake B2 (B2a). The activation sequence is completed and 1st gear is engaged.

▶ Hydraulic Circuit After Shifted to 1st Gear

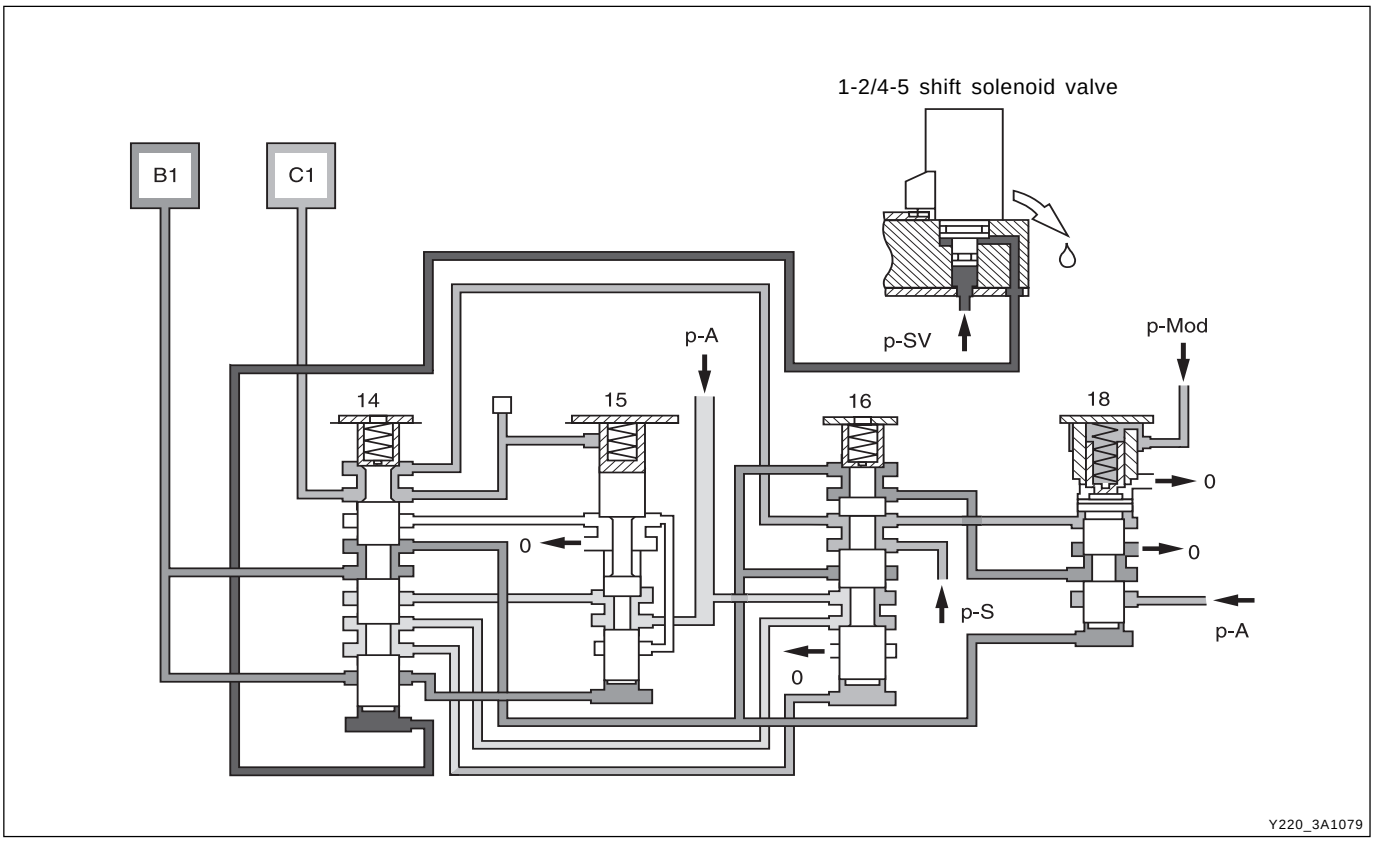


14. 1-2/4-5 command valve
15. 1-2/4-5 holding pressure shift valve
16. 1-2/4-5 shift valve
18. 1-2/4-5 pressure overlap control valve

0. Return flow to oil sump
p-A. Operating pressure
p-MOD. Modulating pressure
p-S. Shift pressure
p-SV. Shift valve pressure

The end face of 1-2/4-5 command valve (14) is kept unpressurized via the 1-2/4-5 solenoid valve. The operating pressure is applied to the brake B1 via the holding pressure shift valve (15). The clutch C1 is unpressurized. The operating pressure from brake B1 acts against the holding pressure shift valve (15) and the end face of 1-2/4-5 shift pressure shift valve (16).

▶ Hydraulic Circuit During Shift Phase

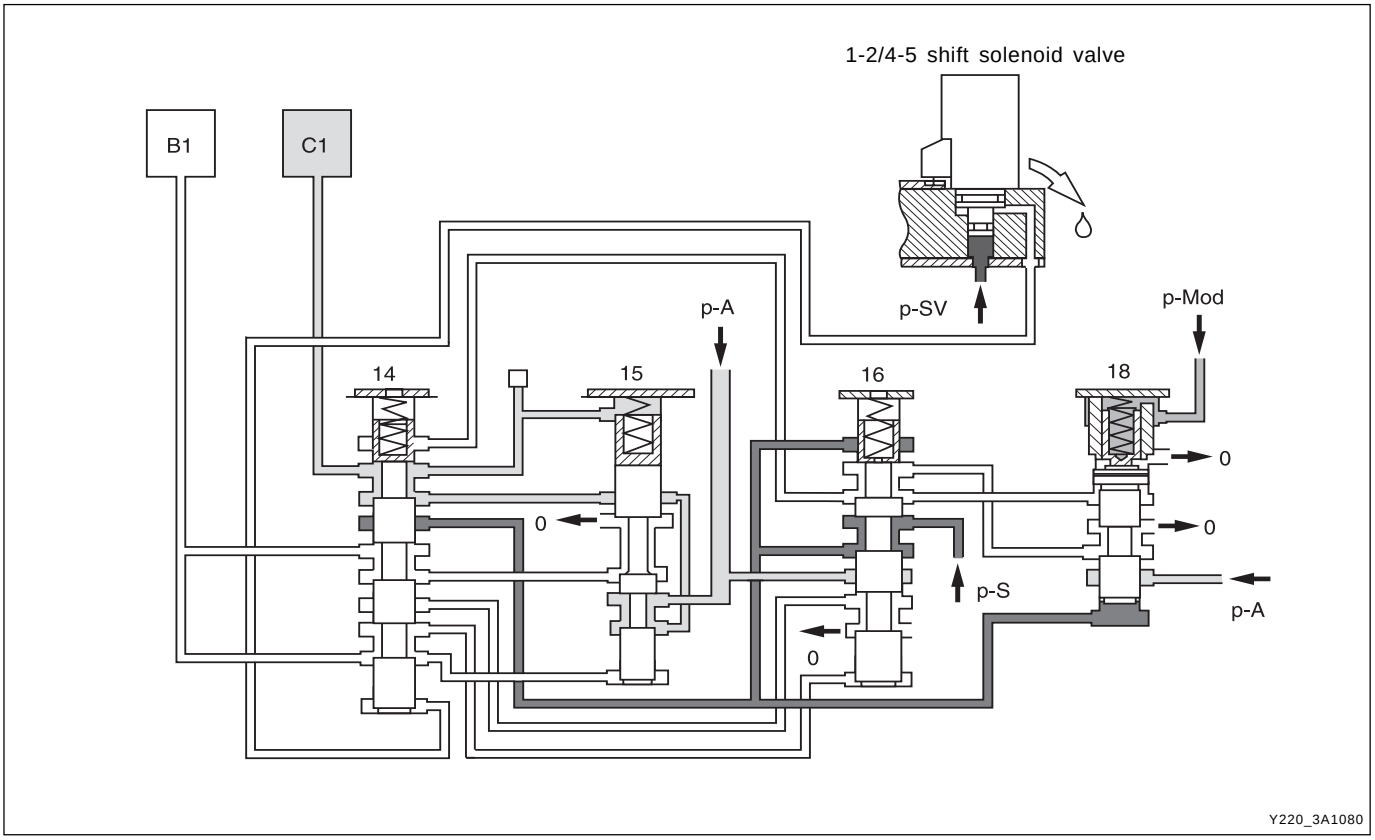


14. 1-2/4-5 command valve
15. 1-2/4-5 holding pressure shift valve
16. 1-2/4-5 shift valve
18. 1-2/4-5 pressure overlap control valve

0. Return flow to oil sump
p-A. Operating pressure
p-MOD. Modulating pressure
p-S. Shift pressure
p-SV. Shift valve pressure

The shift valve pressure (p-SV) is directed onto the end face of the 1-2/4-5 command valve (14) via the 1-2/4-5 shift solenoid valve. The command valve (14) moves up and the shift pressure (p-S) coming from the 1-2/4-5 shift pressure shift valve (16) is routed via the command valve (14) to clutch C1. Overlap pressure is simultaneously applied to brake (B1) from the pressure overlap control valve (18). The B1 pressure acting on the end face of shift pressure shift valve (16) is replaced by operating pressure (p-A). The increasing shift pressure (p-S) on clutch C1 acts on the annular surface of the pressure overlap control valve (18) and reduces the overlap pressure controlled by the pressure overlap control valve (18). It will shift at a corresponding pressure on the holding pressure shift valve (15).

▶ Hydraulic Circuit After Completed Gear Change

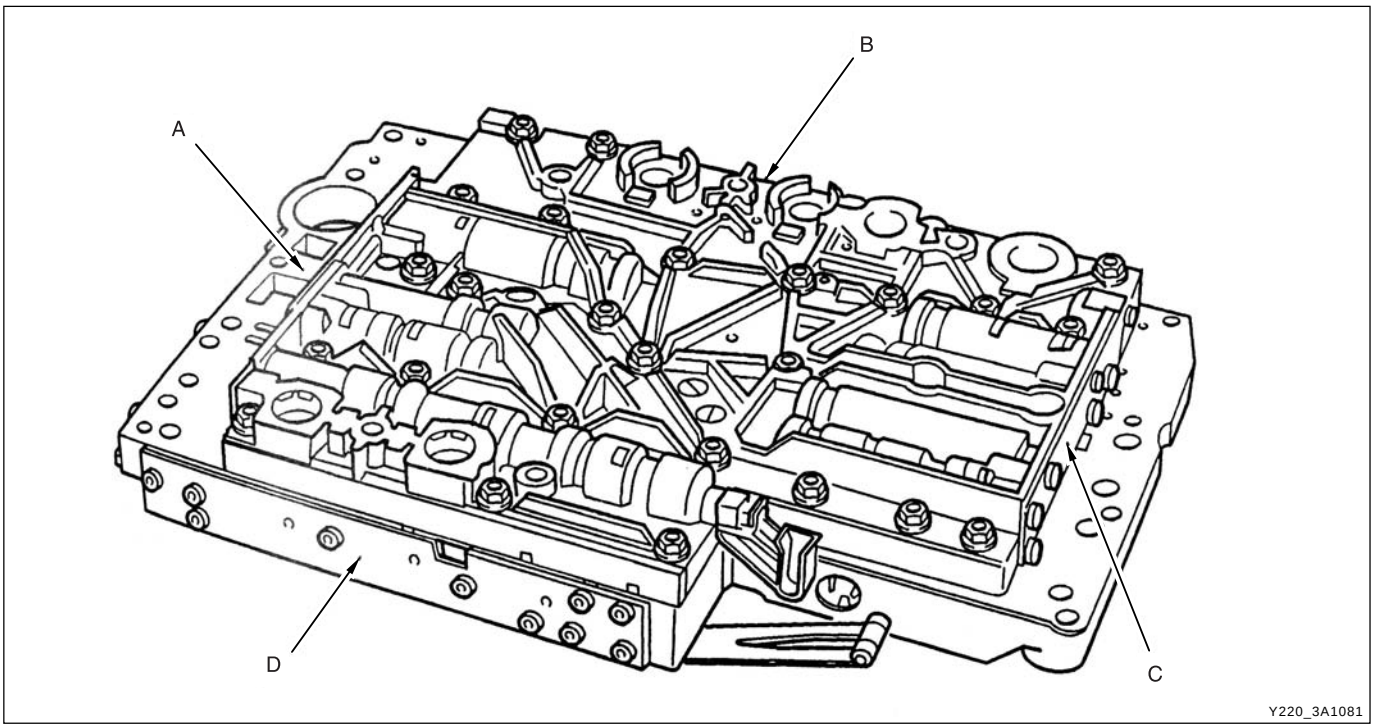


14. 1-2/4-5 command valve
15. 1-2/4-5 holding pressure shift valve
16. 1-2 /4-5 shift valve
18. 1-2/4-5 pressure overlap control valve

0. Return flow to oil sump
p-A. Operating pressure
p-MOD. Modulating pressure
p-S. Shift pressure
p-SV. Shift valve pressure

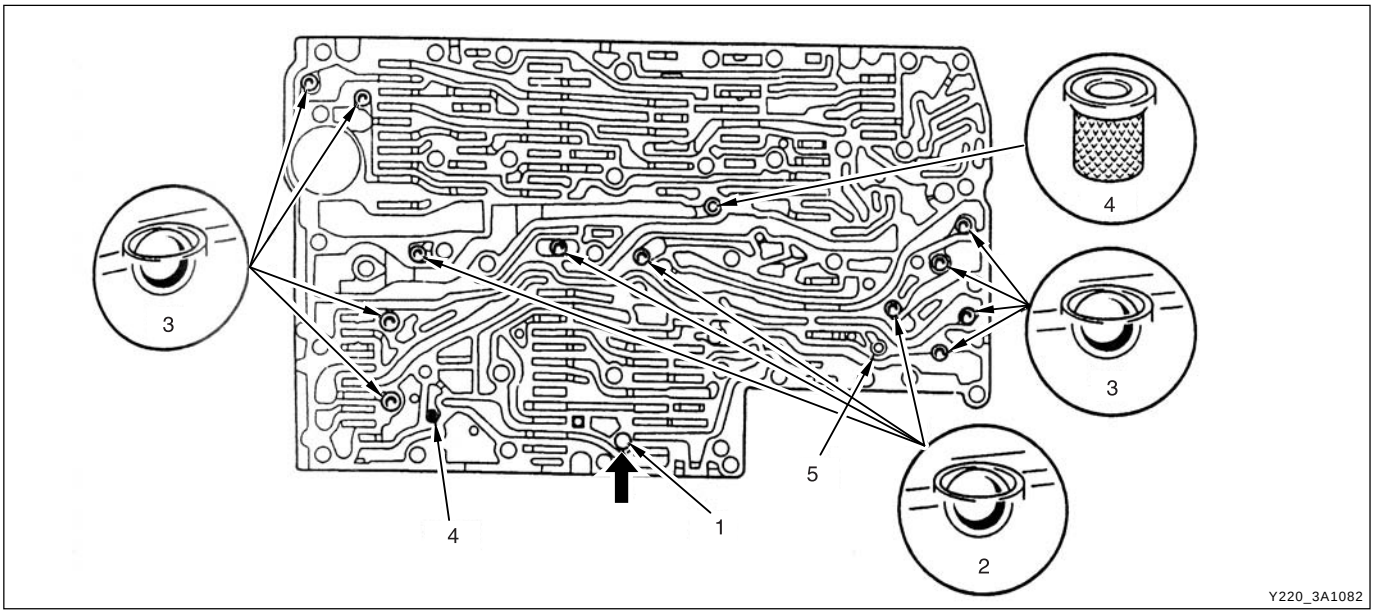
The 1-2/4-5 shift solenoid valve interrupts the pressure on the end face of the command valve (14) and it returns to its base position. The operating pressure (p-A) is now applied to clutch C1 via the holding pressure shift valve (15) and the command valve (14). The brake B1 is disengaged (unpressurized). The spring of the shift pressure shift valve (16) moves it into base position.

STRUCTURE OF ELECTRO-HYDRAULIC CONTROL MODULE (SHIFT PLATE)



A. Adjusting valve: Operating pressure, Lubricating pressure, 2-3 group overlap
B. 1-2/4-5 shift group, control valve: Control valve pressure, Shift valve pressure
C. 3-4 shift group
D. 2-3 shift group, Clutch lockup control valve, shift valve B2

▶ Rear Section



1. Dowel pin
2. Valve ball (plastic)
3. Valve ball (steel)
4. Filter
5. Plastic valve

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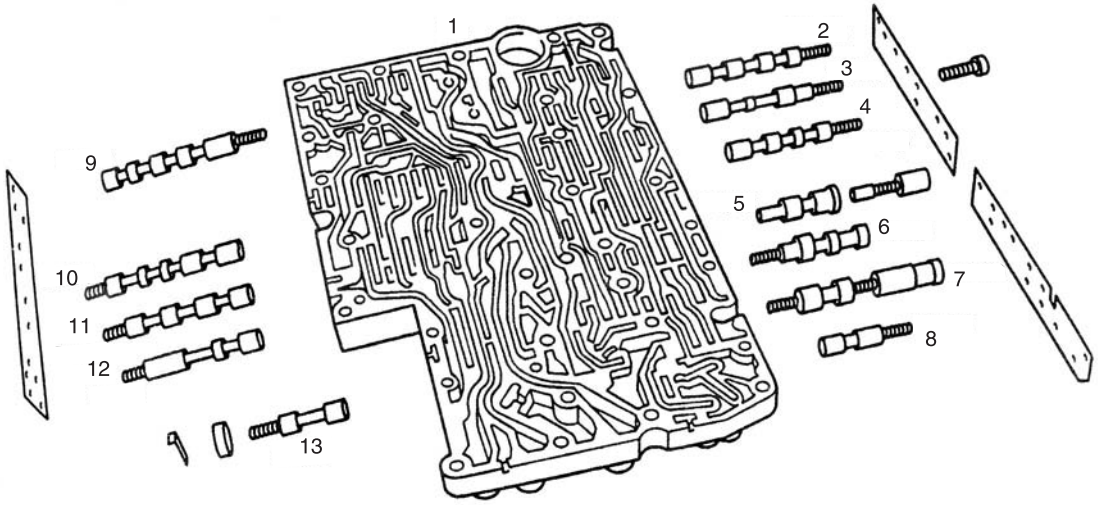
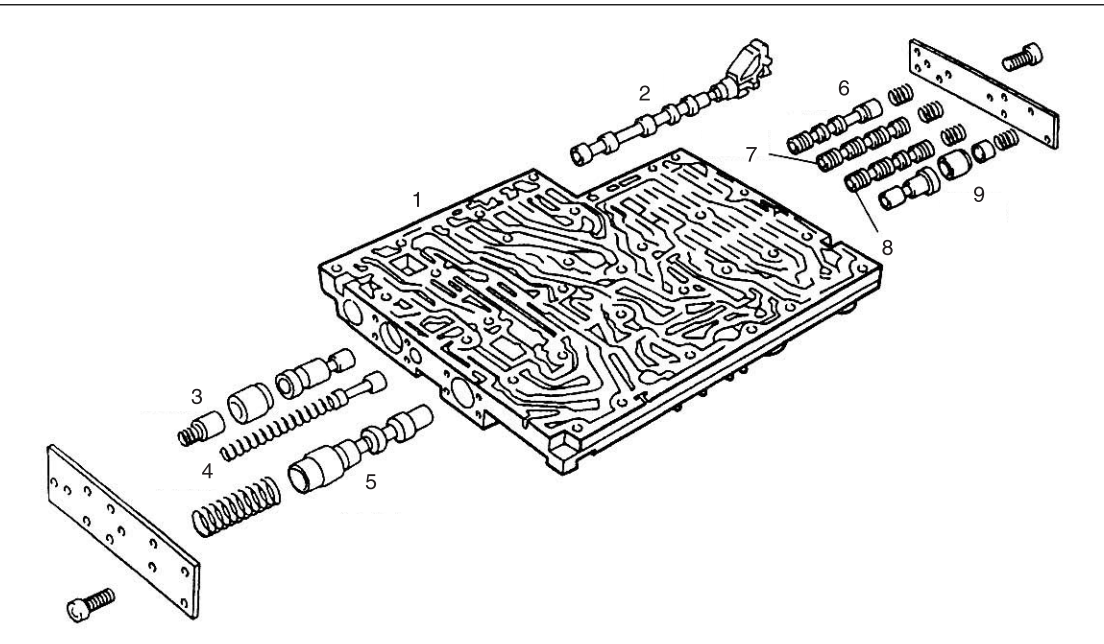
▶ Left Section



1. Shift housing
2. 1-2/4-5 command valve
3. 1-2/4-5 holding pressure shift valve
4. 1-2/4-5 shift pressure shift valve
5. 1-2/4-5 overlap control valve
6. Shift pressure control valve
7. Regulating pressure control valve
8. Shift valve pressure control valve
9. Torque converter lockup clutch control valve
10. 2-3 shift pressure shift valve
11. 2-3 command valve
12. 2-3 holding pressure shift valve
13. Shift valve B2

▶ Right Section



1. Valve housing
2. Selector valve
3. 2-3 overlap control valve
4. Lubricating pressure control valve
5. Operating pressure control valve
6. 3-4 holding pressure shift valve
7. 3-4 command valve
8. 3-4 shift pressure shift valve
9. 3-4 overlap control valve

Removal and Installation

1. Remove the leaf spring (5).
2. Remove the bolt (1).

   Installation Notice

Tightening torque	8 Nm

3. Remove the shift housing (4) from valve housing (2).

   Notice

   Befor installation, make sure to insert the dowel pin into correct position.

4. Remove the sealing plate (3).

   Notice

   Be careful not to lose 4 plastic balls and 8 steel balls in shift housing.

5. Unscrew the bolts from shift housing and valve housing and remove the side cover.

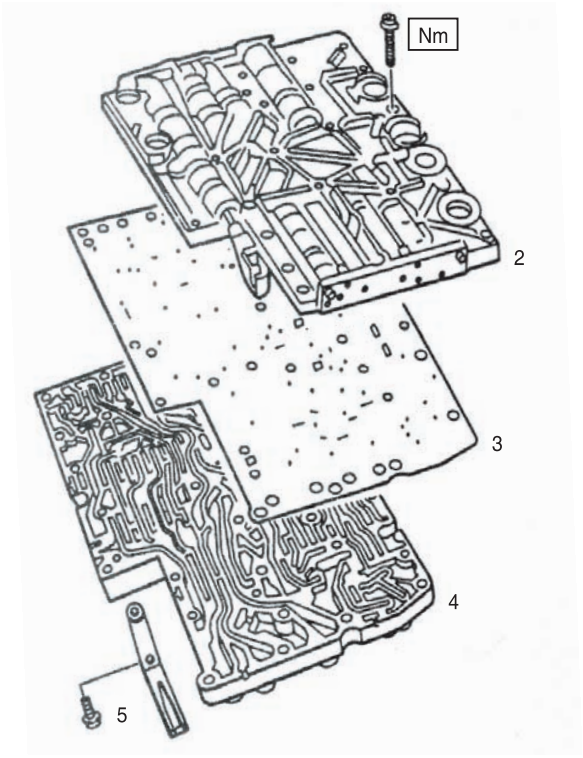
   Installation Notice

Tightening torque	14 Nm

   Notice

   Check the valves for damage, and replace if necessary.

6. Install in the reverse order of removal.



1. Bolts (29)
2. Valve housing
3. Sealing plate
4. Shift housing
5. Leaf spring

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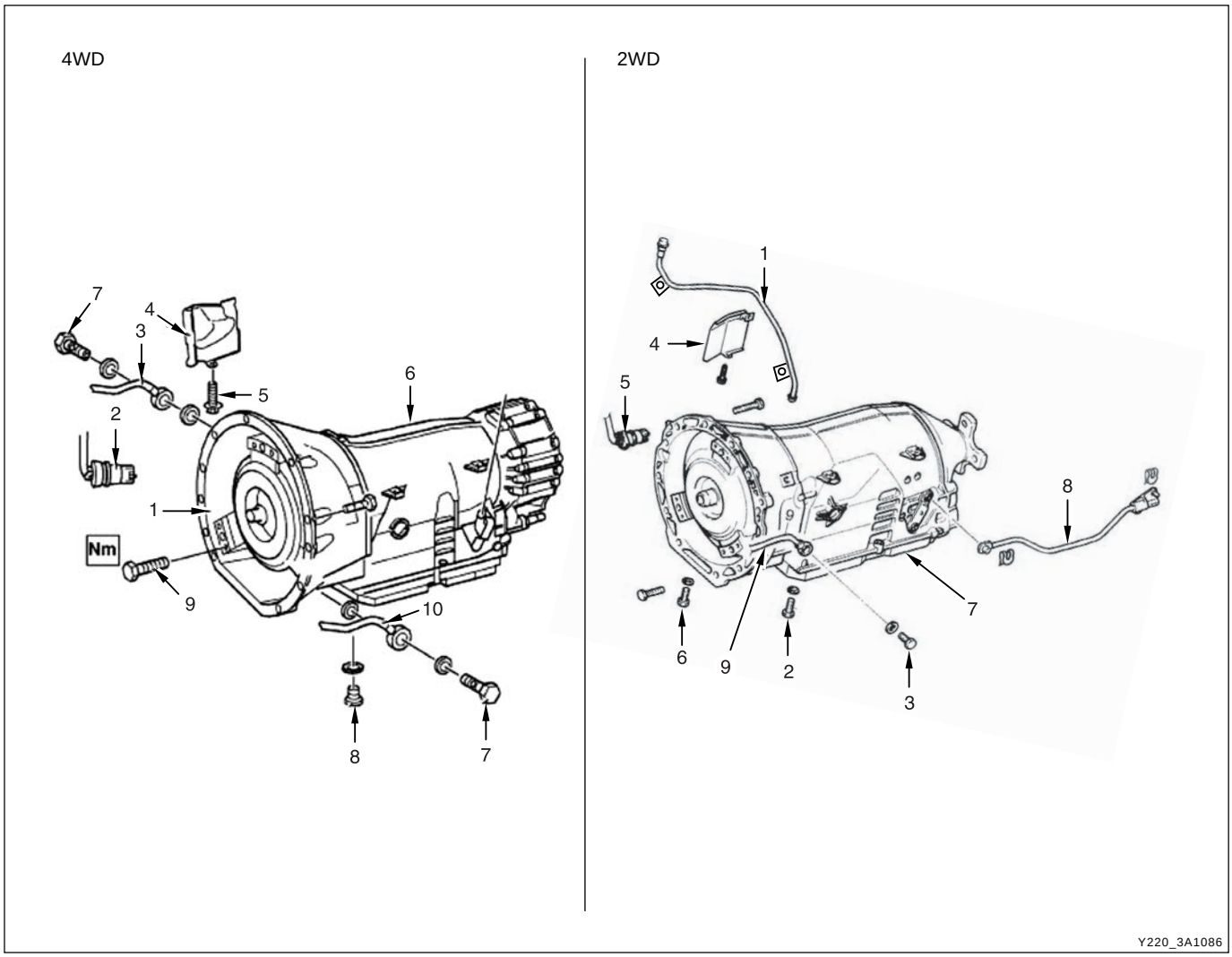
AFFECTED VIN	

REMOVAL AND INSTALLATION (DC 5-SPEED A/T)

COMPONENTS LOCATOR



4WD

1. Torque converter housing
2. Plug connector
3. Oil line
4. Shield
5. Bolts
6. Transfer case adapter housing
7. Union plugs
8. Drain plug
9. Torque converter bolts
10. Oil line

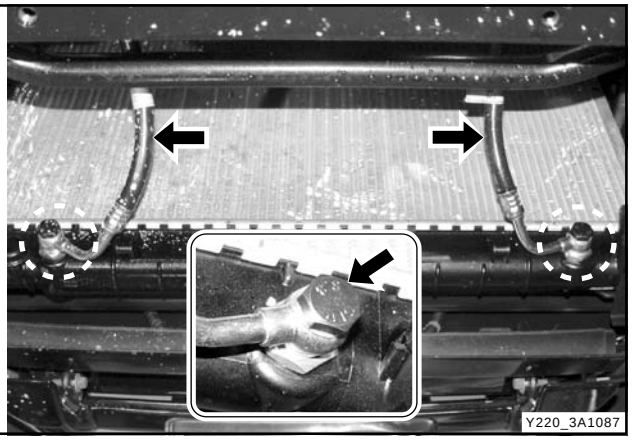
2WD

1. Oil filler pipe
2. Drain plug
3. Union bolt
4. Oil line
5. Plug connector
6. Torque converter bolts
7. Transmission assembly
8. Shift rod

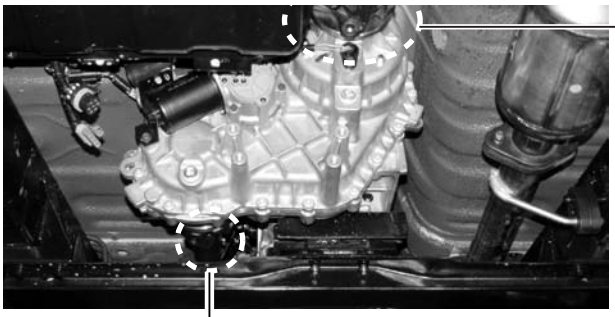
Removal and Installation

※ Preceding work: Disconnect negative battaery cable.

* Make sure that the oil cooler pipe hose is not be twisted, oil cooler pipe (radiator side) is not clogged. If it is contaminated with foreign materials, thoroughly clean before replacing transmission assembly (This work is necessary when removing and installing the radiator).



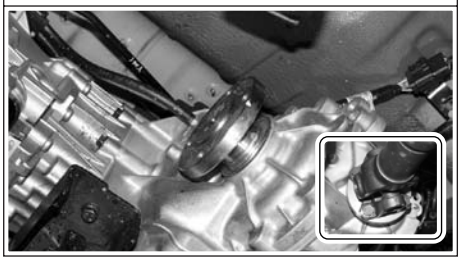
1. Unscrew the bolts and remove the front and rear propeller shafts.



Rear propeller shaft

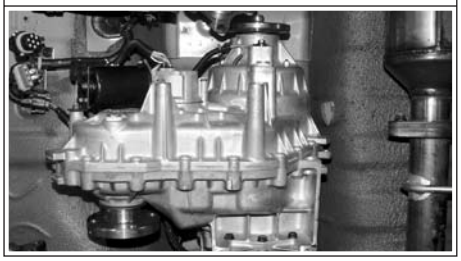
17M : 81~89 N·m
14M : 70~80 N·m

Front propeller shaft



17M : 81~89 N·m
14M : 70~80 N·m

Removed



Oil draining

**** If necessary, drain the oil. However, when removing or installing the transmission without any other processes, just add oil excluding drainage.***

Installation Notice

Tightening torque	14 Nm

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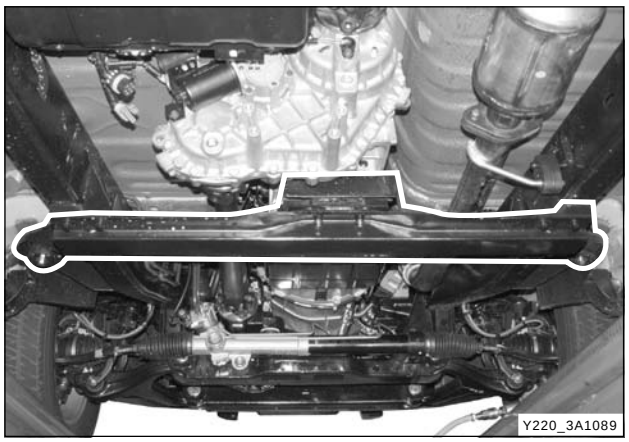
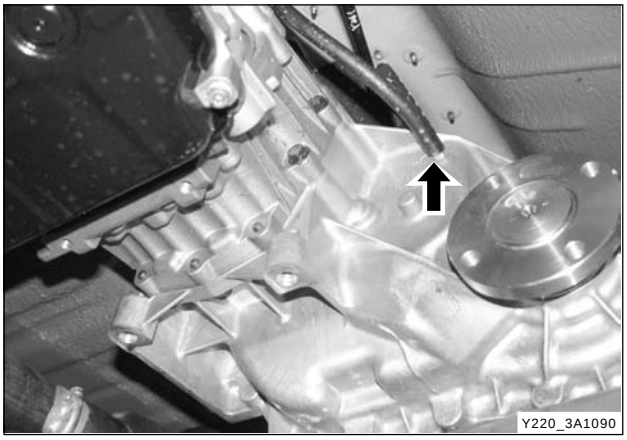
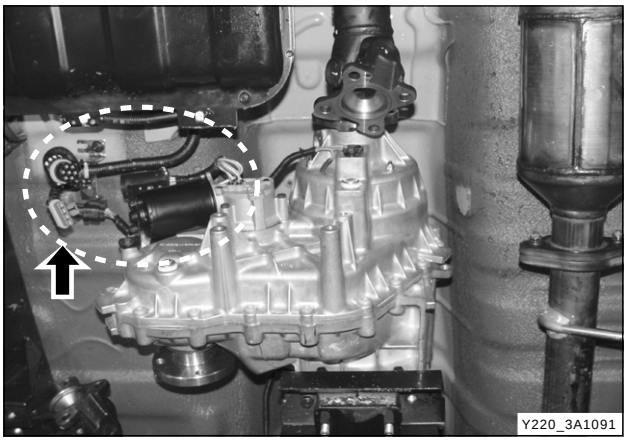


2. Remove the cross member and insulator under the connection area of transfer case and transmission.

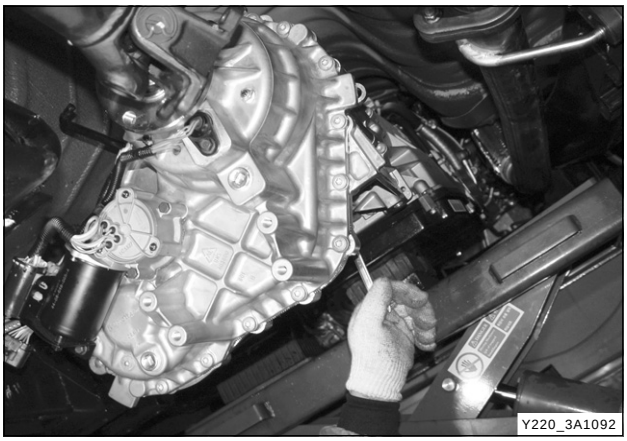
Tightening torque	Left/Right: 36 ~ 44 Nm
	Center: 20 Nm



3. Separate the air bleed hose from transfer case.



4. Disconnect transmission wiring harness from transfer case.



5. Unscrew the transfer case bolts (12M x 11) and remove the transfer case.

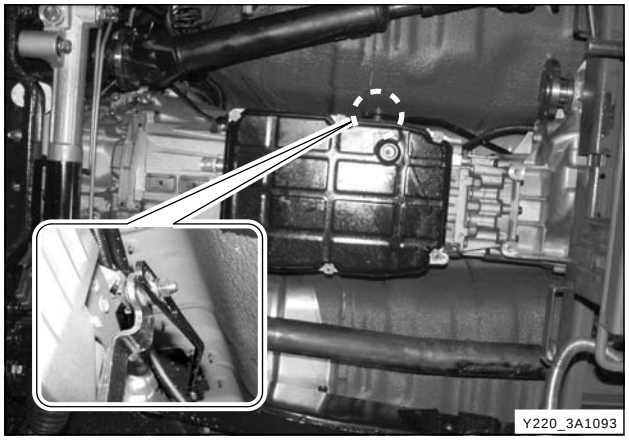
Installation Notice

Tightening torque	20 ~ 25 Nm

6. Disconnect selector lever.

Notice

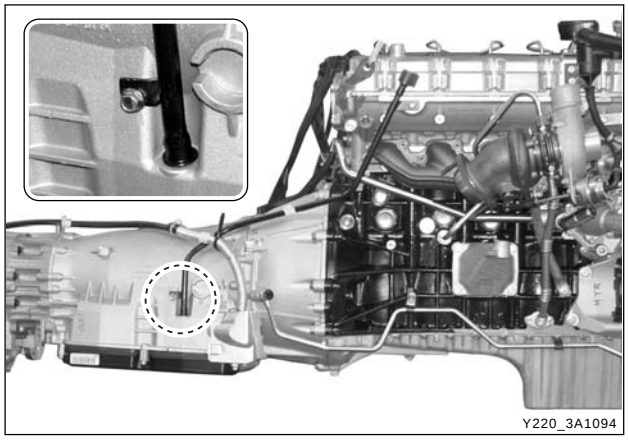
Place the selector lever at "P" position when removing/installing selector lever and wire cable.



7. Unscrew the bolts and remove the oil dipstick pipe and mounting bracket.

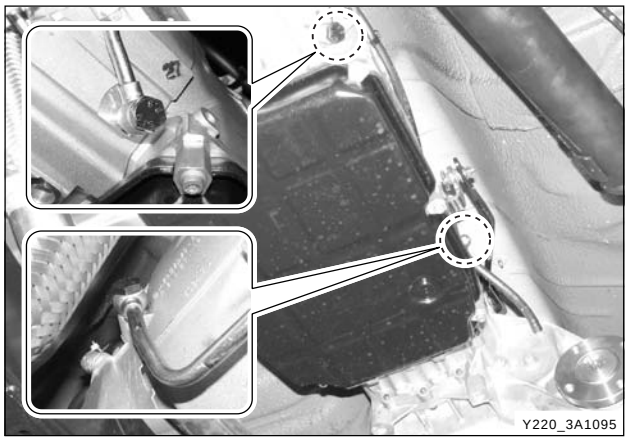
Installation Notice

Tightening torque	14 Nm



8. Unscrew the bolts and separate both oil cooler lines (supply/return).

Tightening torque	34 ± 4 Nm



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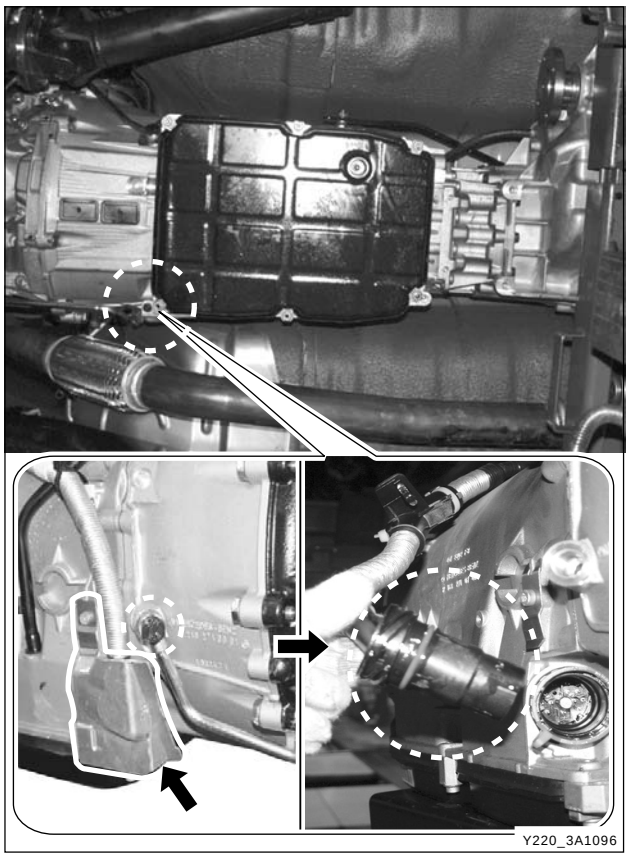
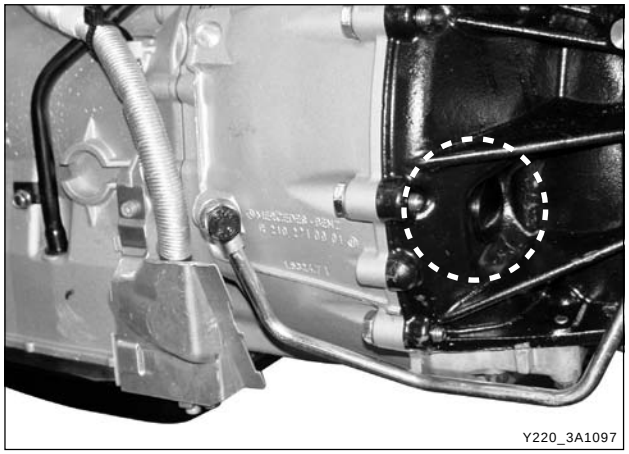


9. Unscrew the plug connector shield bolt and remove the plug connector from automatic transmission.



10. Remove the torque converter bolts from drive plate.

Installation Notice

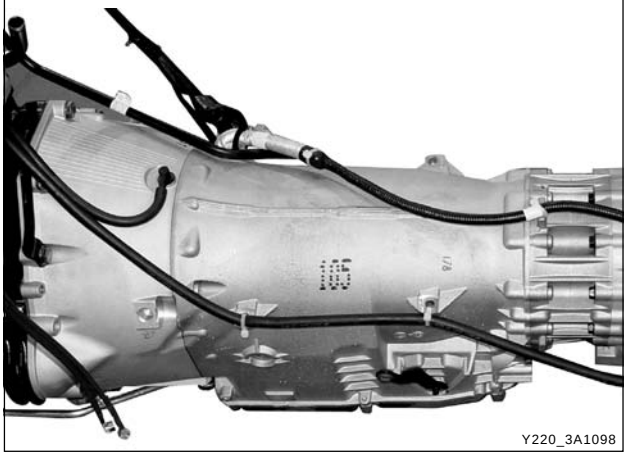
Tightening torque	42 Nm

11. Unscrew the transmission mounting bolts and remove the transmission assembly.

Tightening torque	50 ~ 60 Nm

Notice

Be careful not to drop torque conver.



Y220_3A1098

12. Remove the torque converter with special tool.

Notice

Apply a small amount of transmission oil on drive flange before installing torque converter.

Installation Notice

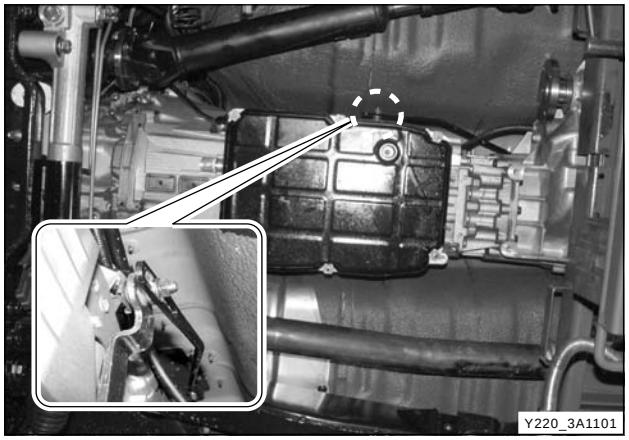
Distance "A"	below 6.5 mm

Y220_3A1099

13. Install in the reverse order of removal.

Notice

- ***Add transmission oil and check the level.***
- ***Thoroughly clean the transmission before installation.***



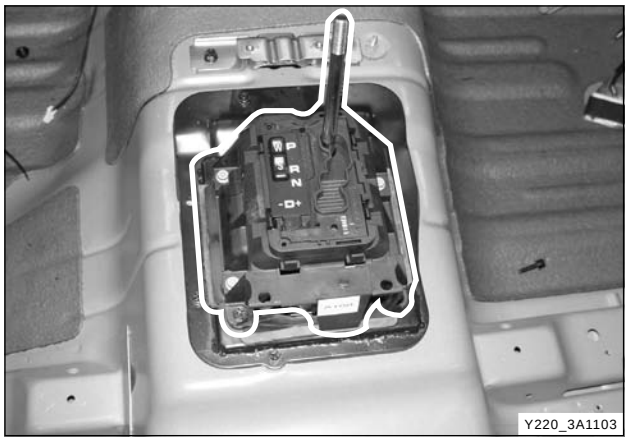
Selector Assembly - Removal and Installation

1. Separate selector lever.

Notice

Place the selector lever at "P" position when removing/ installing selector lever and wire cable.

2. Remove the console box (refer to "Body" section).
3. Remove the senter and rear air duct.



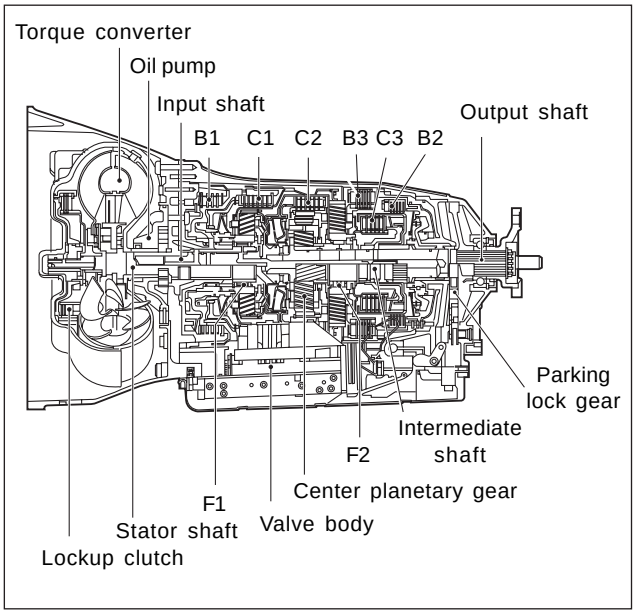
4. Unscrew the bolts and remove the selector assembly.

Installation Notice

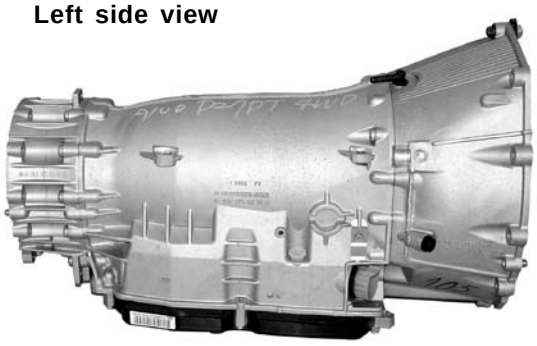
Tightening torque	6 Nm

DISASSEMBLY AND REASSEMBLY (DC 5-SPEED A/T)

COMPONENTS

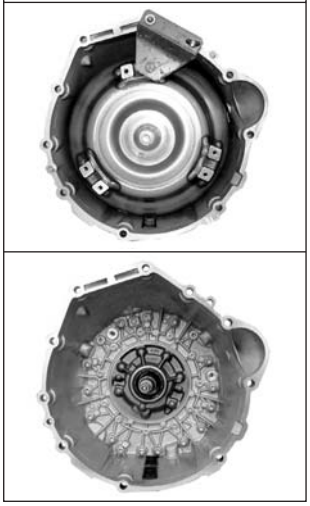


Left side view



Right side view

Front view



Rear view

Under view

Y220_3A1104

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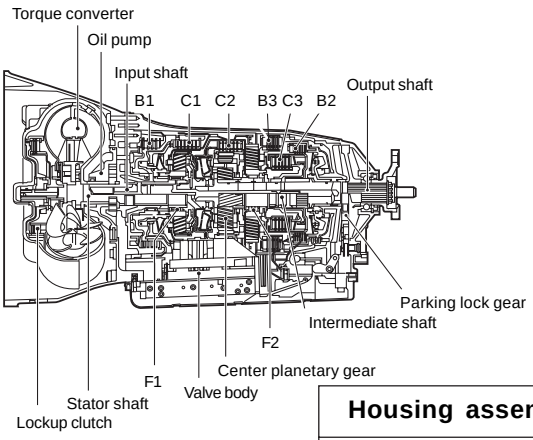
COMPONENTS ASSEMBLY



C3 assembly

C2 assembly

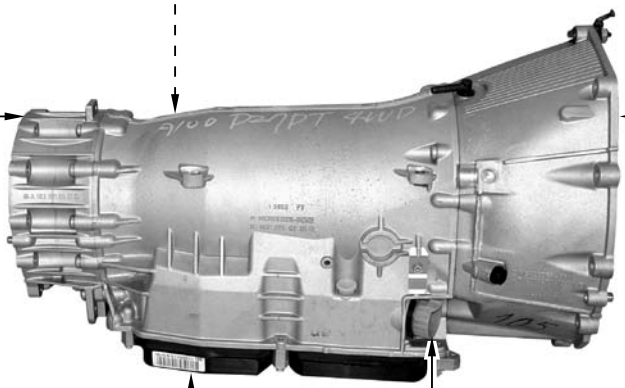
C1 assembly

B1 assembly

B3 assembly

Housing assembly

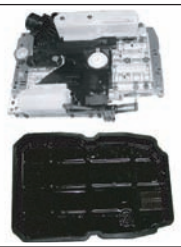
B2 assembly



Output flange

Oil pump

Valve body and oil pan



Adaptor plug (transmission wiring connection)

Torque converter

Y220_3A1105

▶ Friction Disc

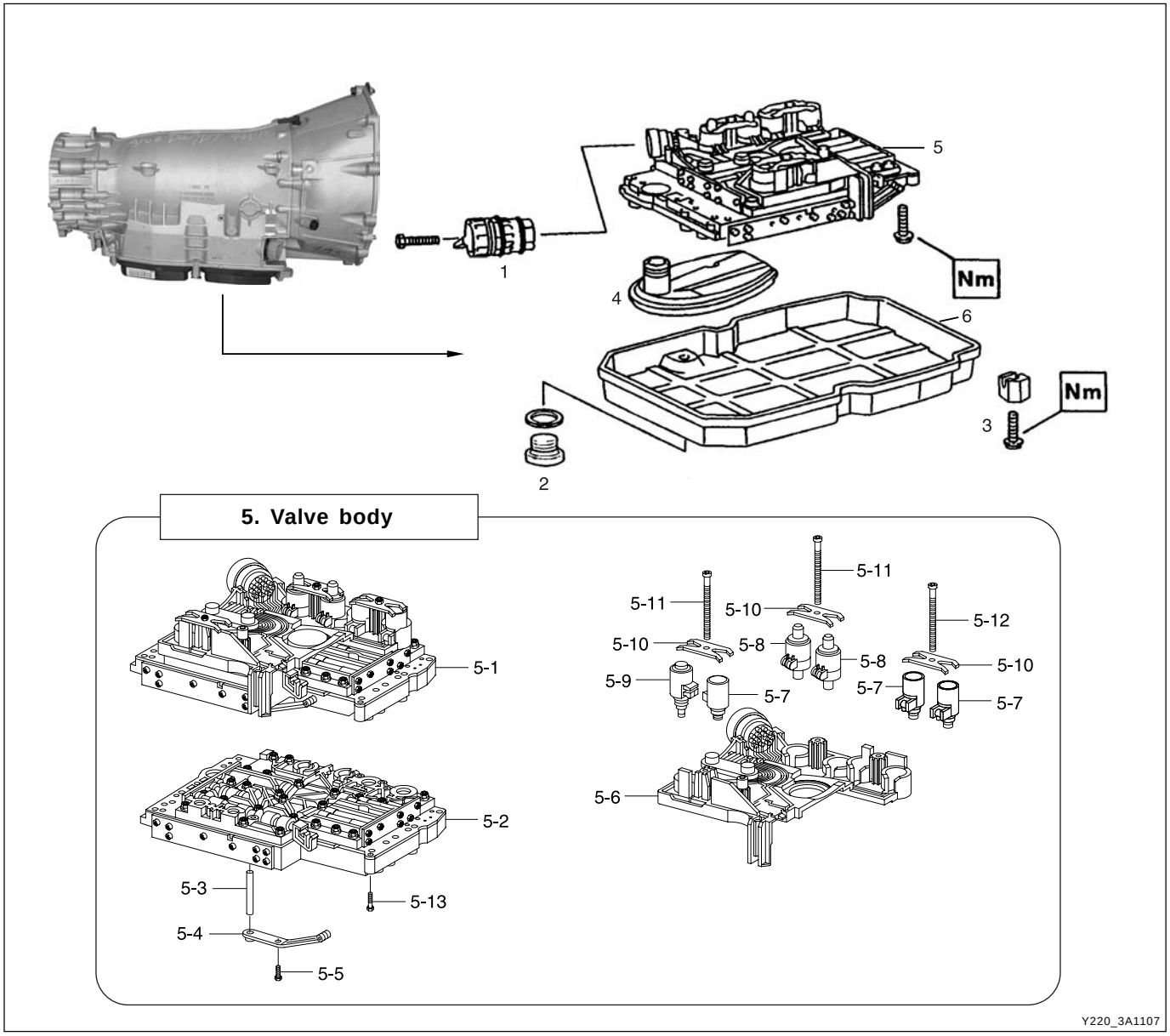
Transmission	Friction Disc	C1	C2	C3	B1	B2	B3	Remark
W5A300 (G32D: 4WD)	Numbers	4	4	4	3	5	4	
	Type	Single face	Dual face	Single face	Single face	Dual face	Dual face	
W5A400 (D27DT: 4WD)	Numbers	5	5	4	4	5	5	
	Type	Single face	Dual face	Single face	Single face	Dual face	Dual face	

▶ Tightening Torque

No	Description	Tightening Torque (Nm)	Remark
1	Oil drain plug (oil pan)	14	Heaxgon, 5 mm
2	Oil filler pipe (upper)	12 ~ 14	-
3	Oil filler pipe (lower)	7 ~ 8	-
4	Oil cooler pipe	30 ~ 38	-
5	Oil pan	8	T 30
6	Torque converter housing/oil pump	20	-
7	Transmission rear mounting bracket (both sides)	36 ~ 44	-
8	Transmission rear mounting bracket (center)	20	-
9	Torque converter bolt	42	-
10	Converter housing/engine	50 ~ 60	-
11	Converter housing/transmission housing	20	T 45
12	Valve body	8	T 30
13	Valve body side cover	4	T 30
14	Solenoid valve	8	-
15	12-sided collar nut	200	12-sidede, each 30 mm
16	B2 housing bolt	16	T 45
17	Selector lever unit bolt	6	-

DISASSEMBLY AND REASSEMBLY

▶ Valve Body Assembly



1. Guide bush
2. Drain plug
3. Bolts
4. Oil filter
5. Valve body

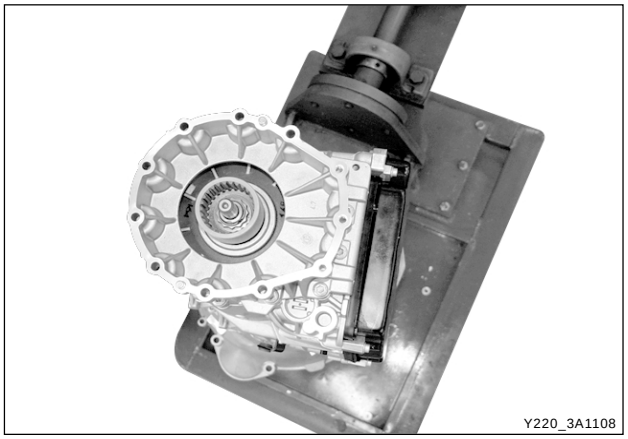
5-1. Valve body assembly
5-2. Body assembly
5-3. Pin
5-4. Plate leaf spring
5-5. Bolts
5-6. Electric kit
5-7. Solenoid valve
5-8. Lifting solenoid valve
5-9. Solenoid valve
5-10. Plate spring
5-11. Screw
5-12. Screw
5-13. Bolts
6. Oil pan

Disassembly and Reassembly

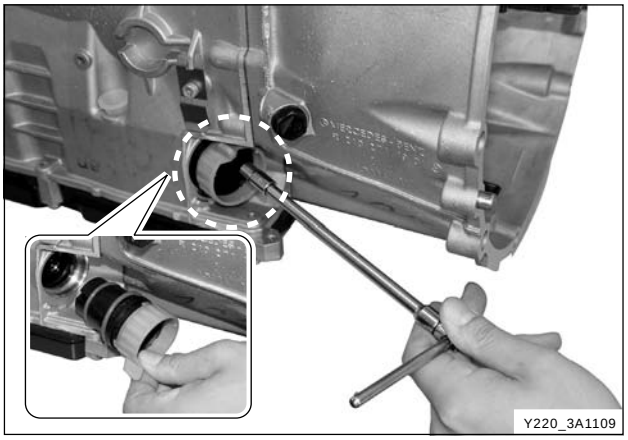
※ Preceding work: Install the transmission on work bench.

Note

- ***To eliminate unnecessary working time and process, prepare general tools, special tools, and gaskets before starting work.***
- ***The automatic transmission is very precise equipment. Keep the transmission clean and tighten the bolts with specified tightening torque.***



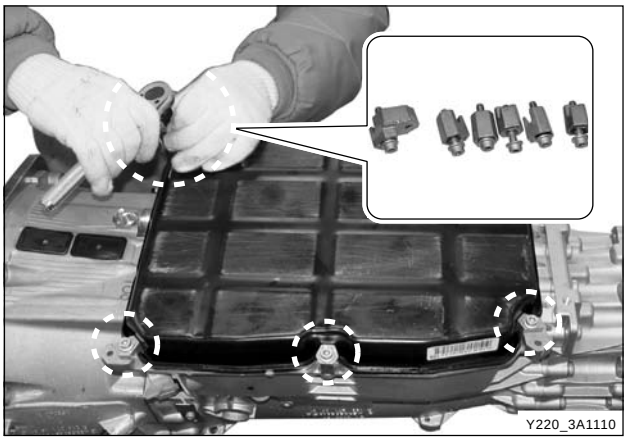
1. Unscrew the bolt and remove the guide bush (1).



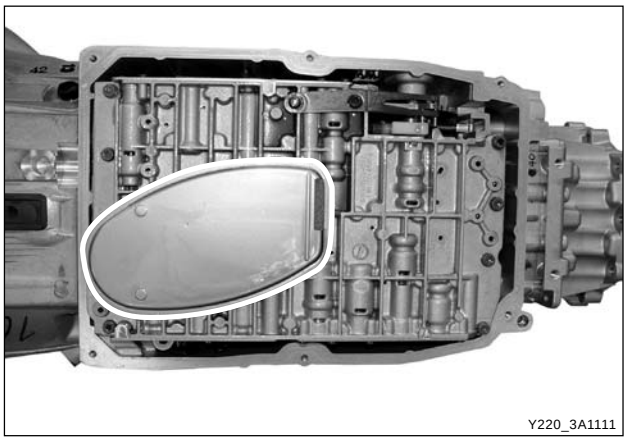
2. Unscrew the oil pan bolts and remove the oil pan (6).

   Installation Notice

Tightening torque	8 Nm



3. Remove the oil filter.



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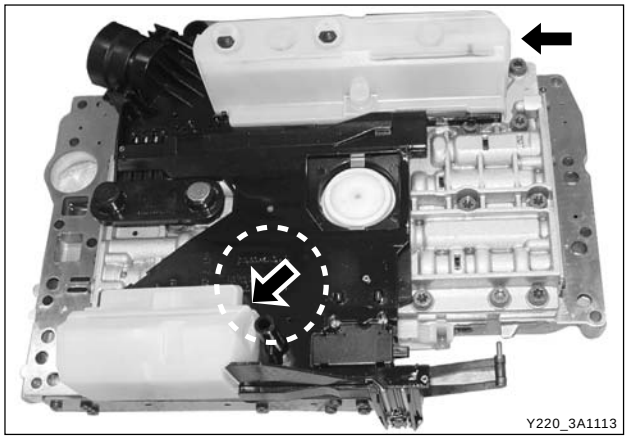
4. Unscrew the bolts and remove the valve body from transmission housing.

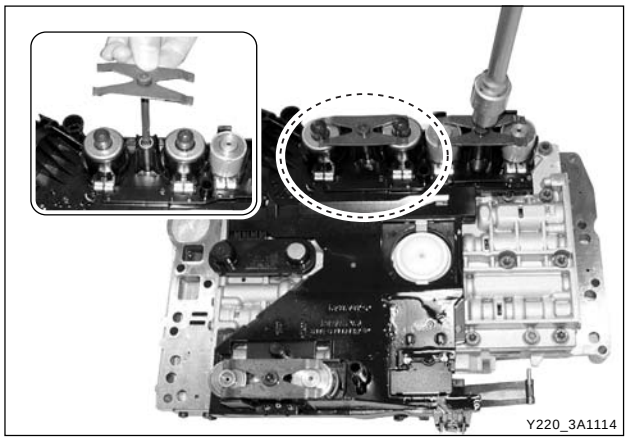
Installation Notice

Tightening torque	8 Nm



5. Disassembly and reassemblt the valve body assembly.

5-1. Remove the solenoid valve cap.



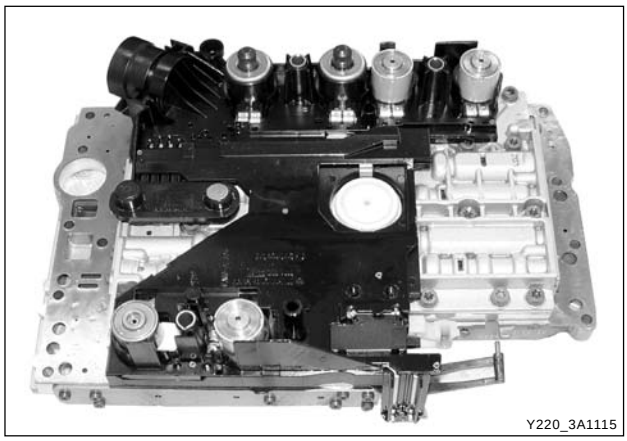
5-2. Unscrew the bolts on solenoid valve and remove the leaf springs.

Installation Notice

Tightening torque	8 Nm

Notice

The socket bolts do not have same length. Be careful not to mix up.



5-3. Remove the solenoid valves from valve body.

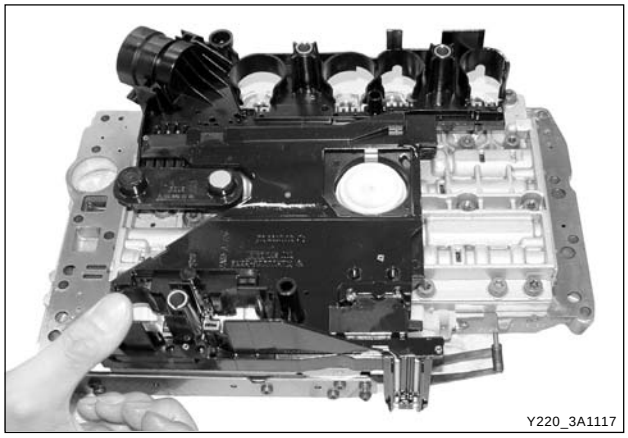
Notice

1. ***Make sure to install the solenoid valves at correct locations.***
2. ***Check the O-rings, and replace if necessary.***

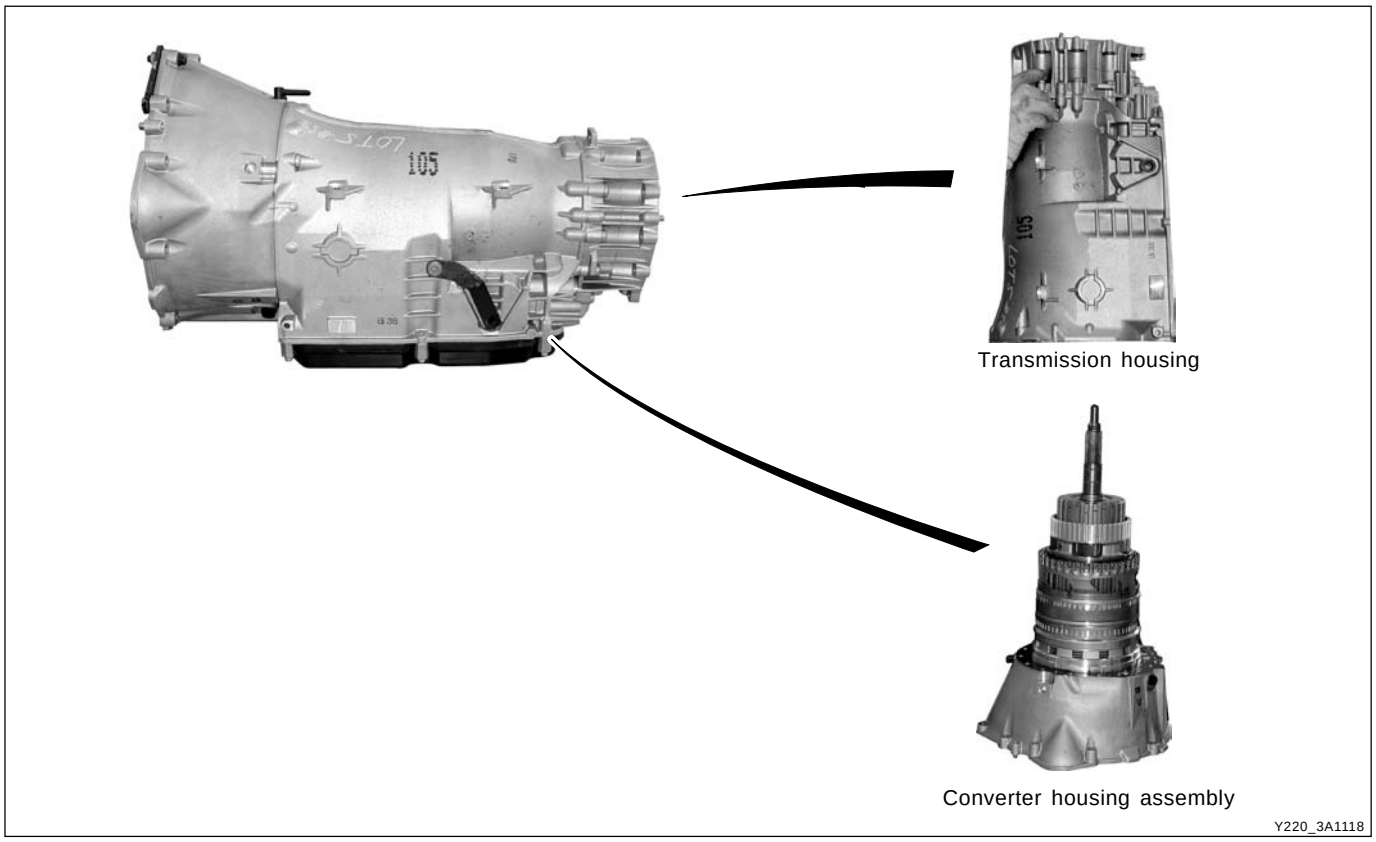
5-4. Remove the electronic control module (Y3/6) from shift plate.

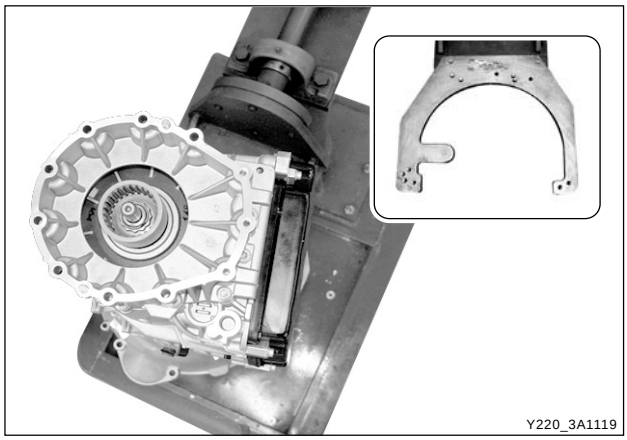
Notice

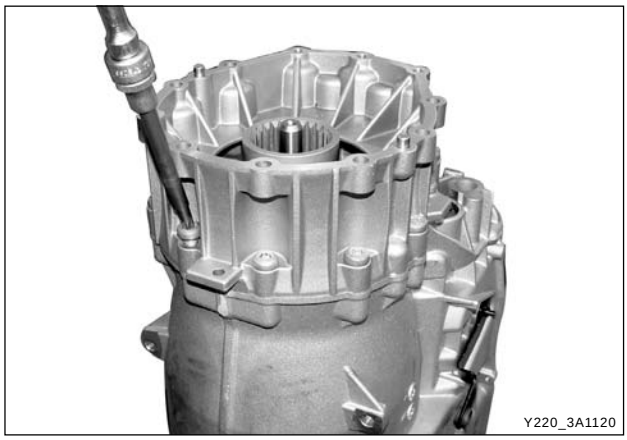
Correctly align the electronic control module onto the shift plate by using two central pins when installing.



▶ Converter Housing and Transmission Housing







Disassembly and Reassembly

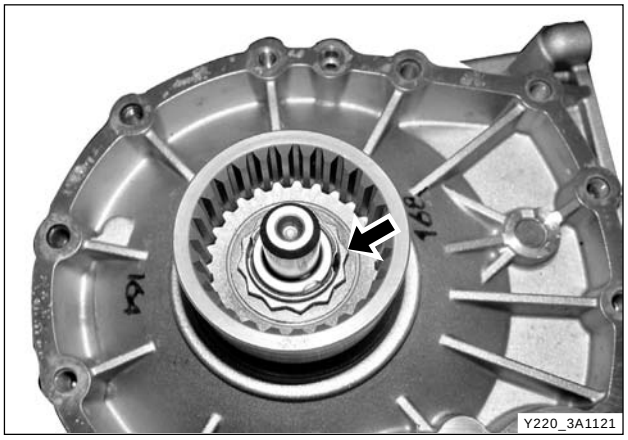
1. Install the transmission assembly on work bench.

2. Remove the rear extension housing from transmission housing.

Installation Notice

Tightening torque	30 ~ 35 Nm

3. Stretch out the bent point in 12-sided collar nut on output shaft.



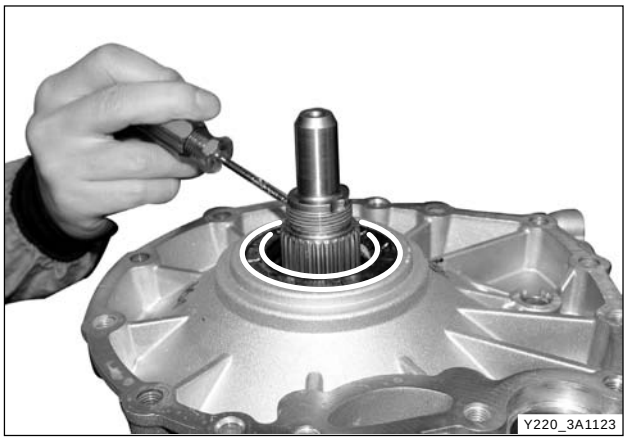
4. Unscrew the collar nut with special tool and remove output shaft flange.

Installation Notice

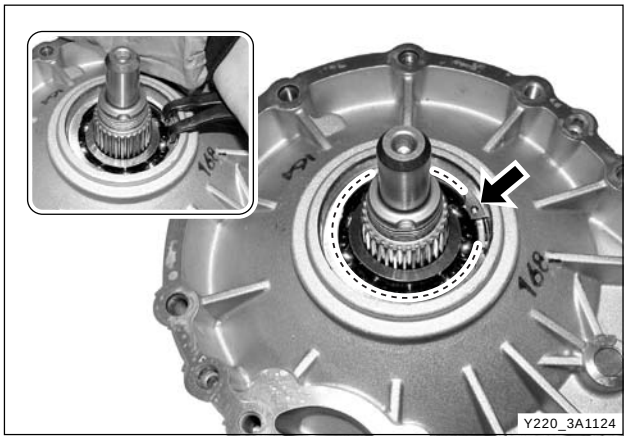
Tightening torque	200 Nm

* Bend the collar nut to lock it during installation.

5. Remove the rear oil seal ring.



6. Remove the snap ring with snap ring pliers and remove the washer.

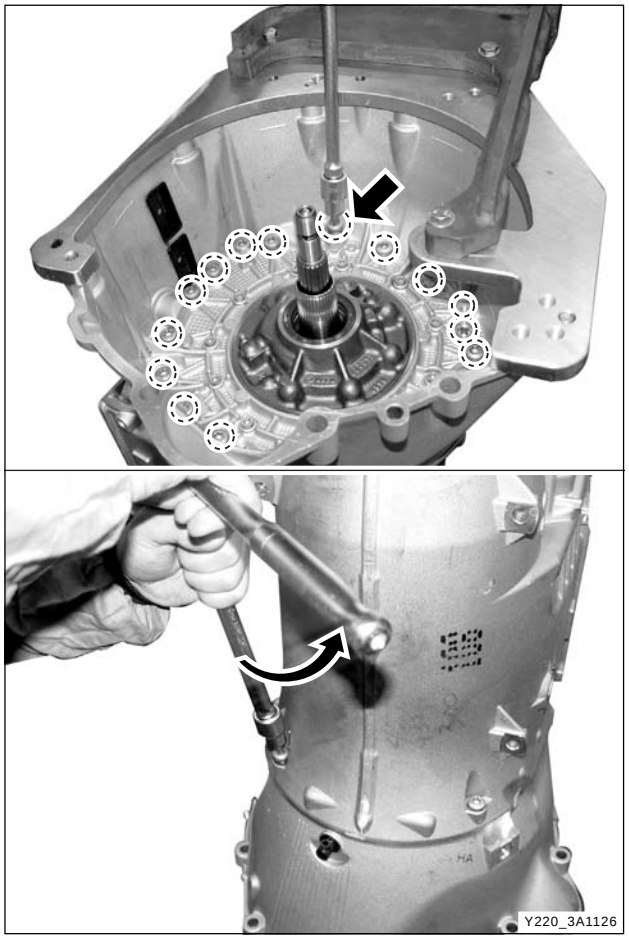


7. Remove the ball bearing from transmission housing.
   - Install the flare clamping pliers.
   - Install the puller onto inner bearing race.
   - Rotate the clamping pliers counterclockwise (arrow direction) to tighten.

Puller 001 589 50 33 00

Collet chuck 140 589 06 34 00

   - Remove the ball bearing from transmission housing with spanner.



8. Unscrew the socket bolts fastening converter housing and transmission housing and remove the transmission housing from converter housing.

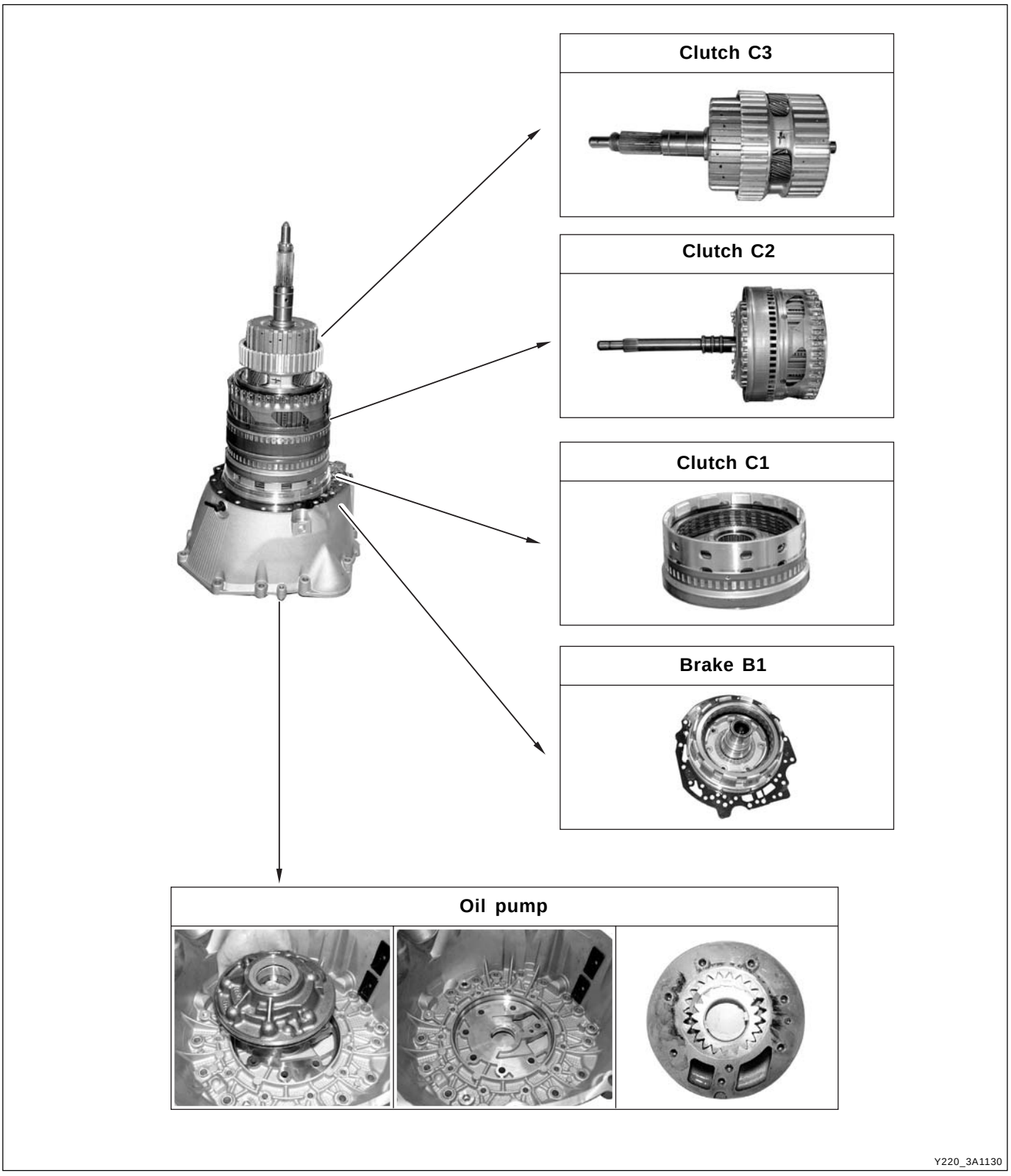
Installation Notice

Tightening torque	20 Nm

Note

Slightly turn the transmission housing to left and right direction to make the removal process easier.

▶ Converter Housing Assembly



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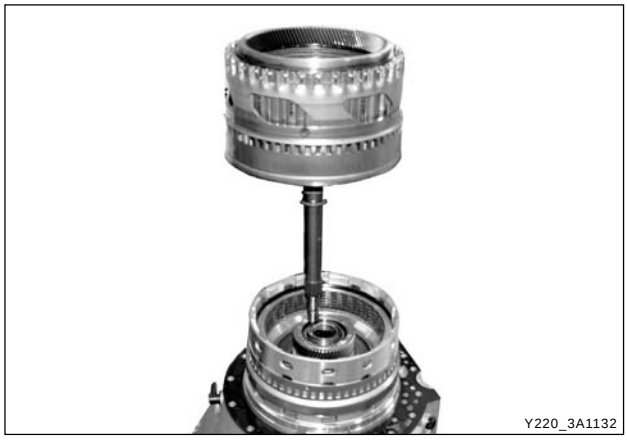
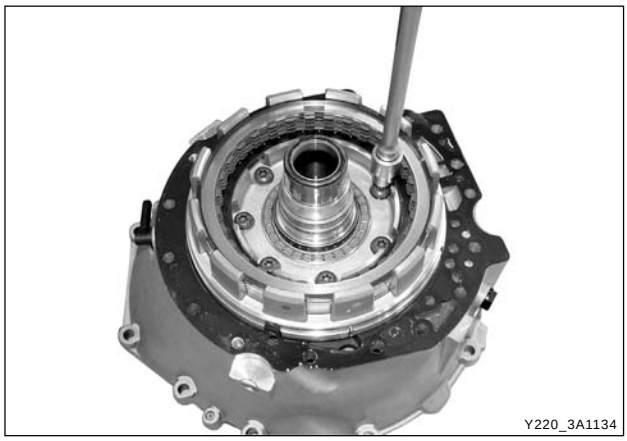
Disassembly and Reassembly

1. Remove the clutch C3 from converter housing assembly.



2. Remove the clutch C2 from converter housing assembly.

3. Remove the clutch C1 from converter housing assembly.



4. Remove the brake B1.

4-1. Remove the bolts on brake B1.

Installation Notice

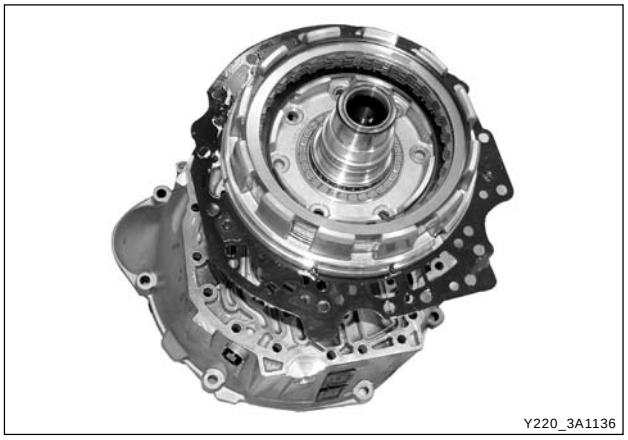
Tightening torque	16 Nm

4-2. Remove the bolts in converter housing.

Installation Notice

Tightening torque	8 Nm

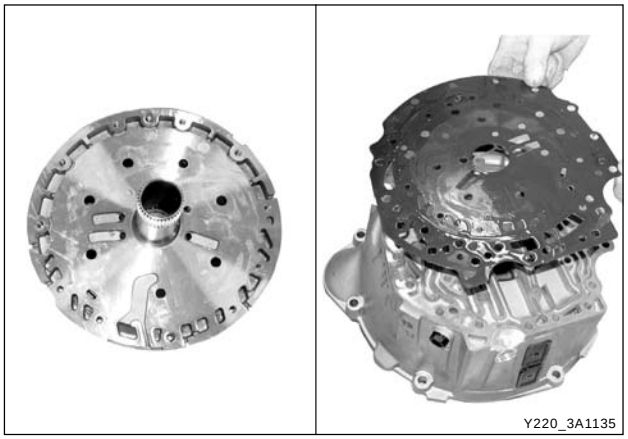
4-3. Remove the brake B1 from converter housing.



4-4. Separate the plate from valve body.

Notice

- ***Install two bolts on the opposite side of disc brake B1 and tap the surface of disc brake B1 with plastic hammer to remove it ftom converter housing.***
- ***Align the dowel pin (arrow) on disc brake B1 and groove in converter housing when installation.***
- ***Apply the sealant on the socket bolts and tighten them.***



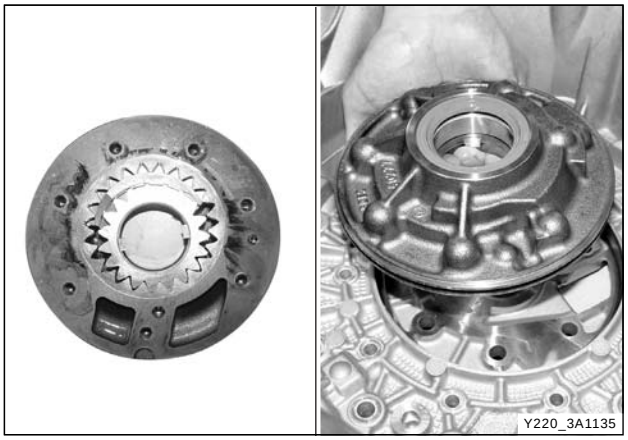
5. Unscrew the bolts and remove the oil pump.

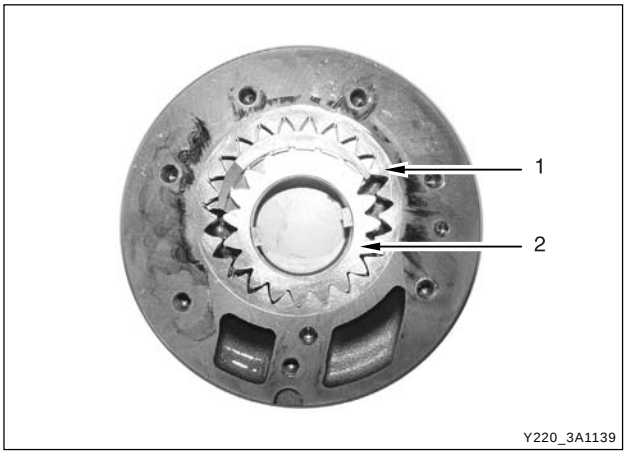
Installation Notice

Tightening torque	20 Nm

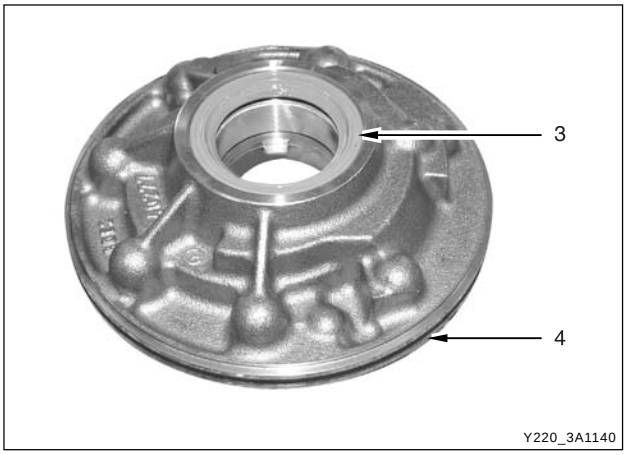
Notice

Install two bolts on the opposite side of oil pump housing and tap the surface of oil pump with plastic hammer to remove it from converter housing.





5-1. Remove the pump gears (1, 2) from pump housing.



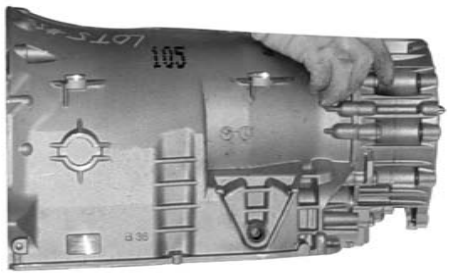
5-2. Check the radial seal ring (3), and replace if necessary.

5-3. Replace the O-ring (4) with new one.

Notice

- ***Lubricate the pump gears (1, 2) before installation.***
- ***Place the pump gear (2) into pump housing and install the pump gear (1) onto the pump housing chamber.***

▶ Transmission Housing Assembly

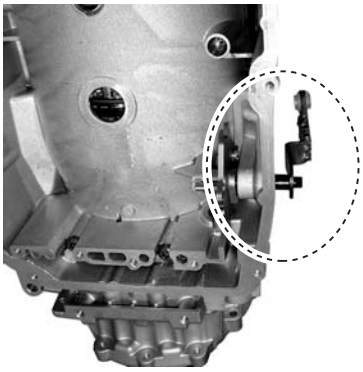


Parking lock gear

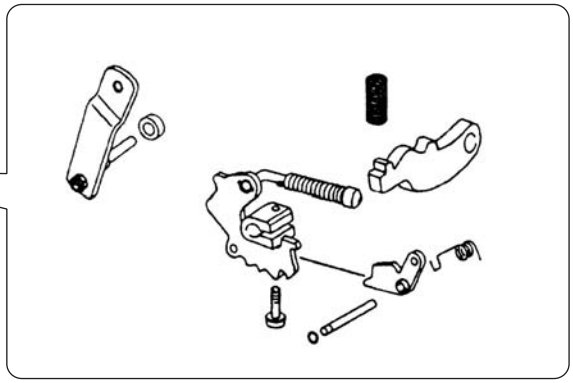
Brake B2

Brake B3

Snap ring



Components of selector lever



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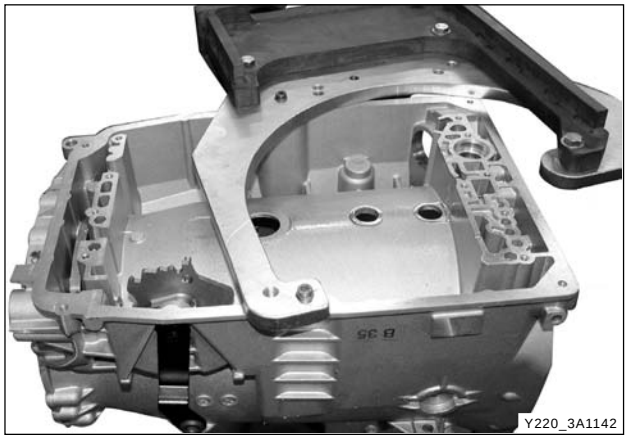
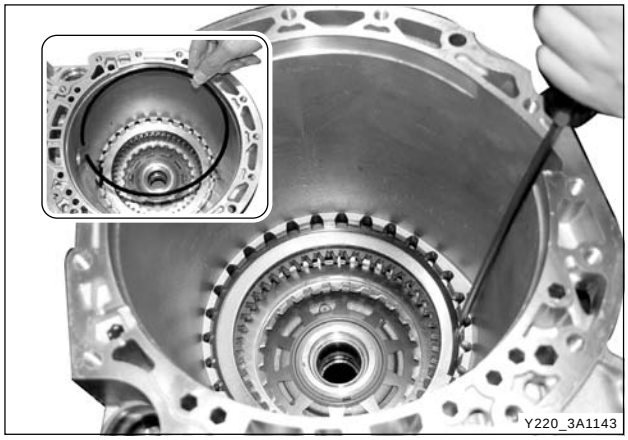
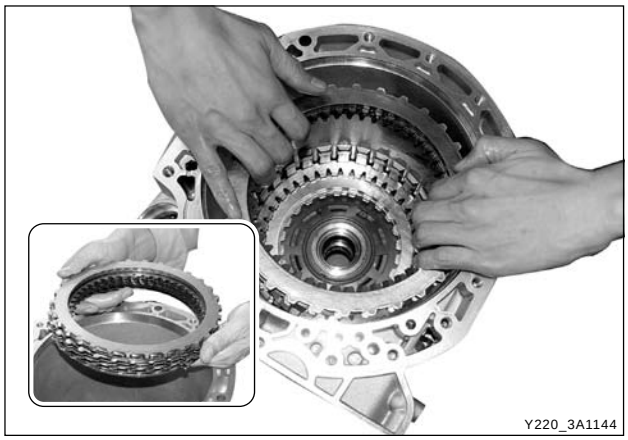


Disassembly and Reassembly

1. Install the transmission assembly on work bench.



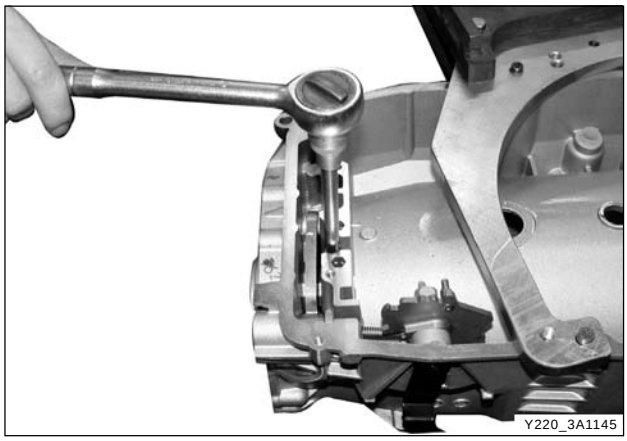
2. Remove the snap ring from transmission housing.



3. Remove the spring washer and disc pack B3 from transmission housing.

Notice

- ***To make the removal easier, remove the disc pack B3 while compressing it.***
- ***Check each disc for wear and burnt out.***

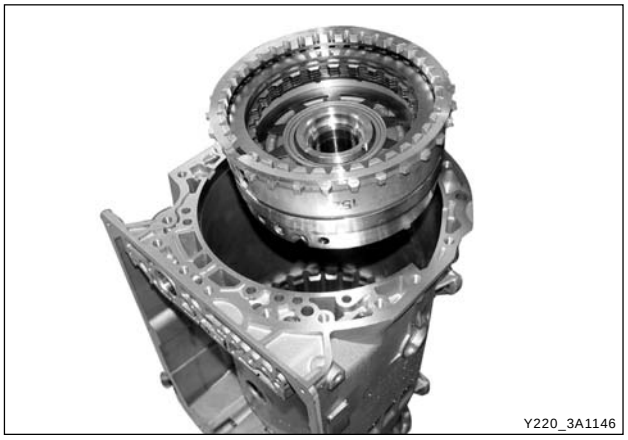


4. Remove the fixing bolts for brake B2 from transmission housing.

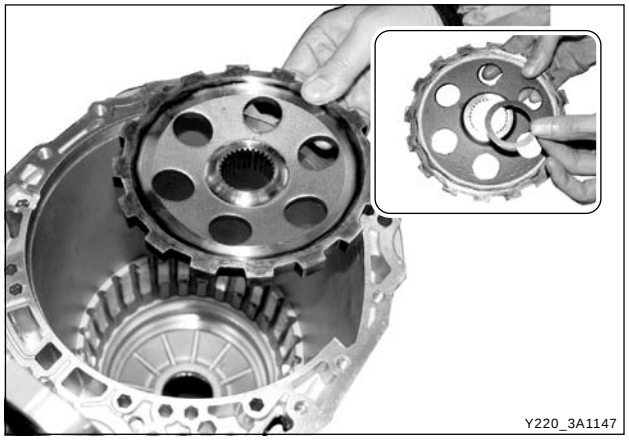
Installation Notice

Tightening torque	16 Nm

5. Remove the disc brake B2 from transmission housing.



6. Remove the parking lock gear.



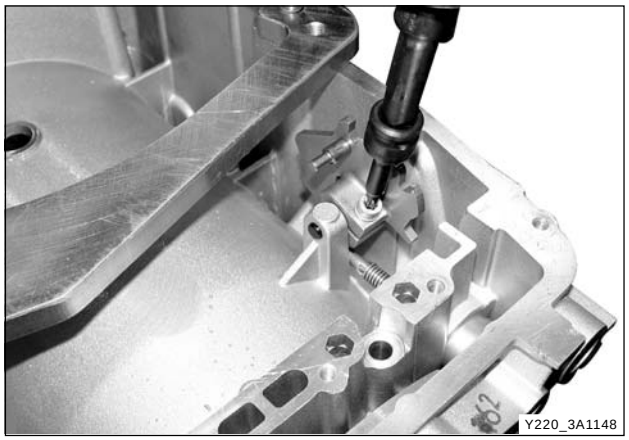
7. Remove the fixing bolts for range selector lever.

Installation Notice

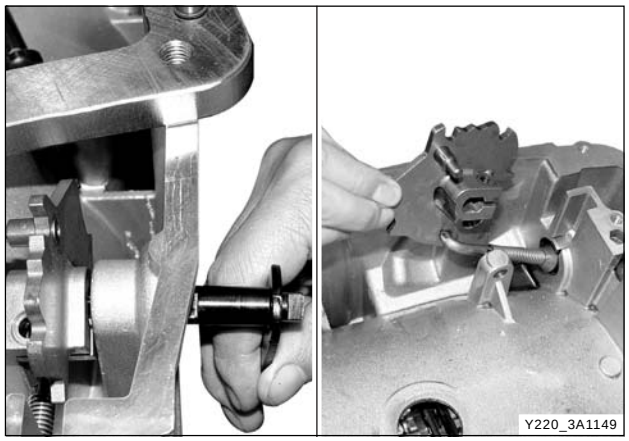
Tightening torque	8 Nm

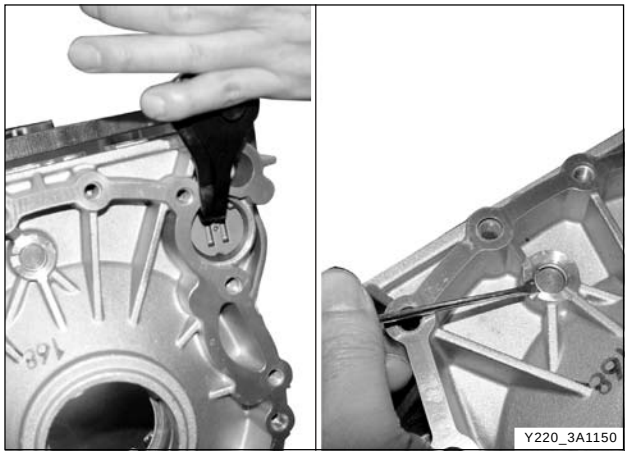
Notice

Check the sealing ring for damage.

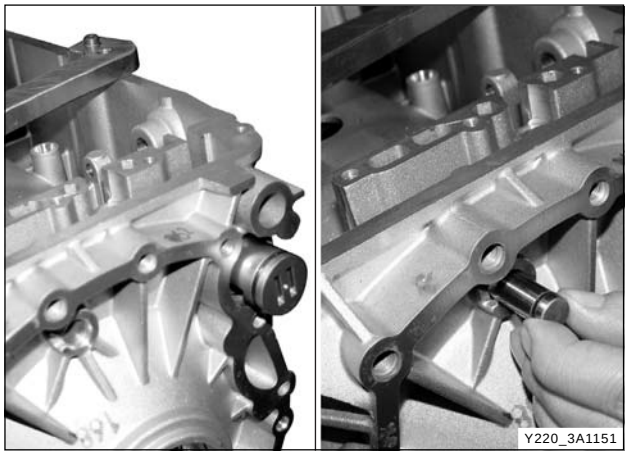


8. Remove the range selector lever, rod and detent plate.

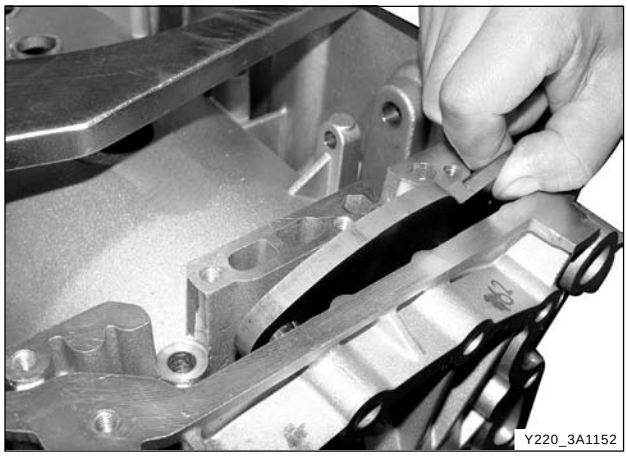




9. Remove the snap rings from parking lock pawl.



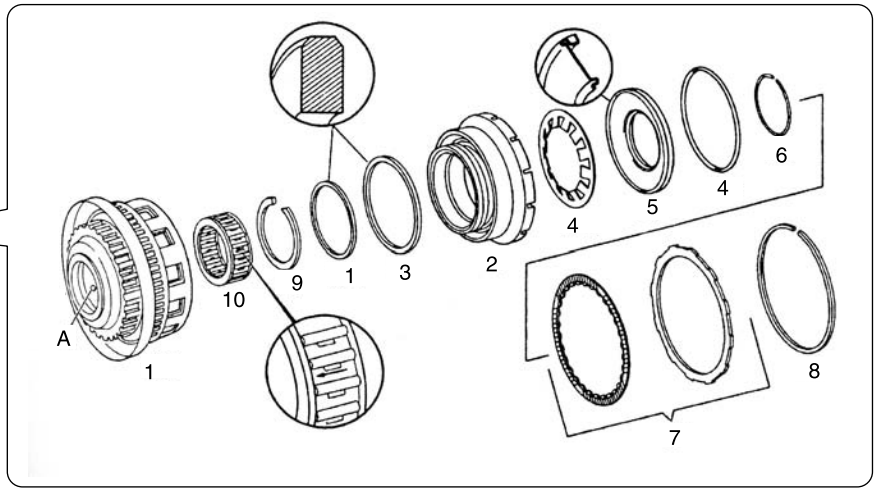
10. Remove the pin from transmission housing.



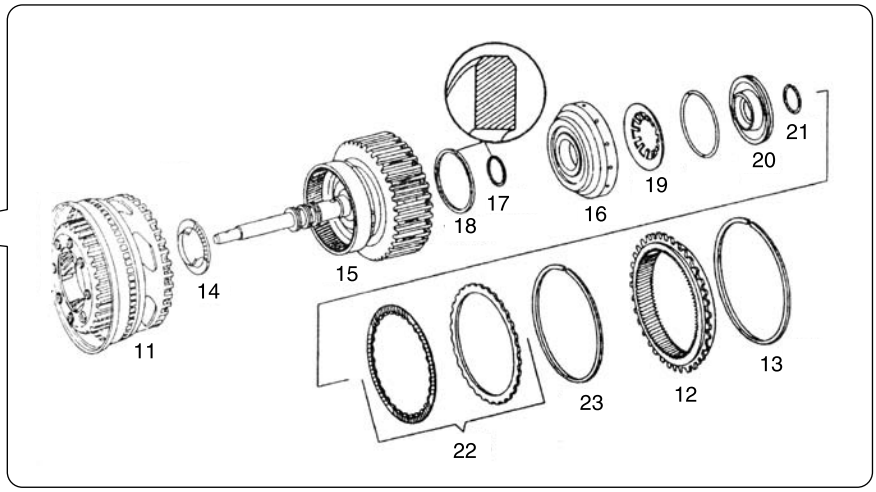
11. Remove the parking lock pawl from transmission housing.

▶ Components of Each Assembly

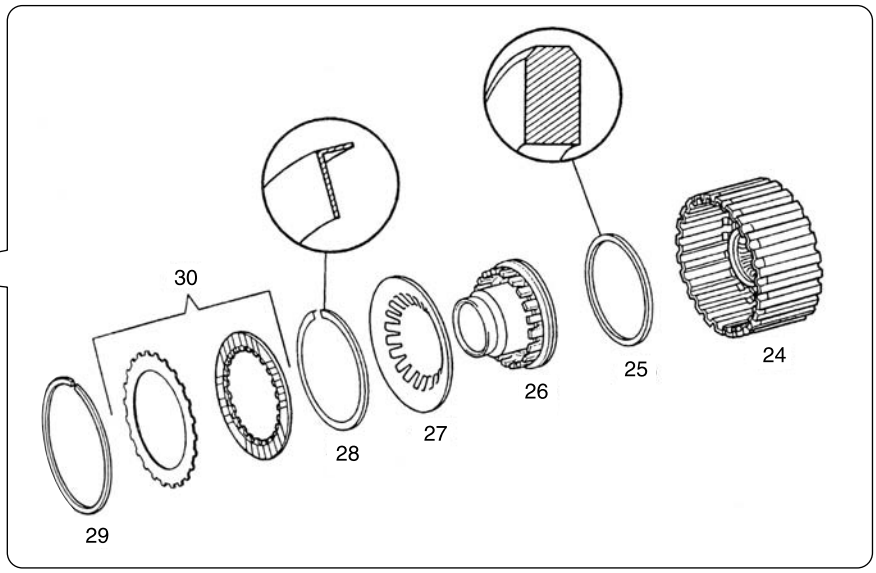
Clutch C1



Clutch C2



Clutch C3



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Clutch C1

1. Sealing ring in disc carrier
2. Piston
3. Sealing ring in piston
4. Return spring
5. Spring plate
6. Snap ring
7. Disc and steel plate
8. Snap ring
9. Snap ring
10. One-way clutch F1

A. Oil gallery in clutch C1

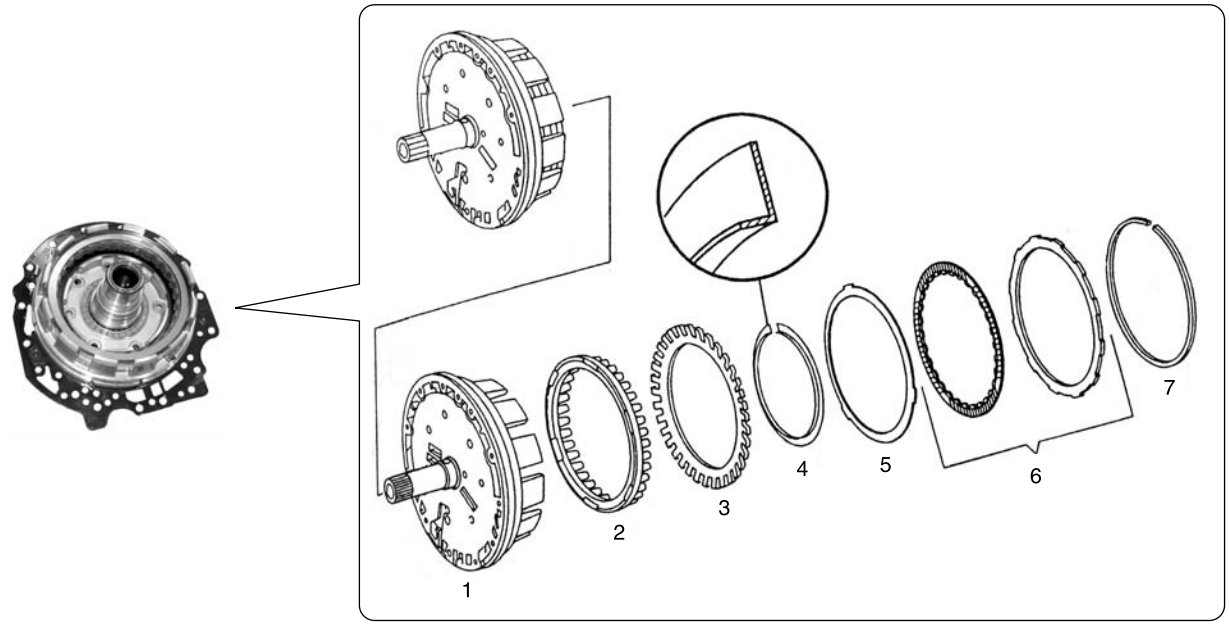
Clutch C2

11. Front planetary gear set
12. Gear wheel
13. Snap ring
14. Thrust bearing
15. Clutch C2 and input shaft
16. Piston
17. Inner sealing ring in piston
18. Outer sealing in piston
19. Return spring
20. Spring plate
21. Snap ring
22. Disc and steel plate
23. Snap ring

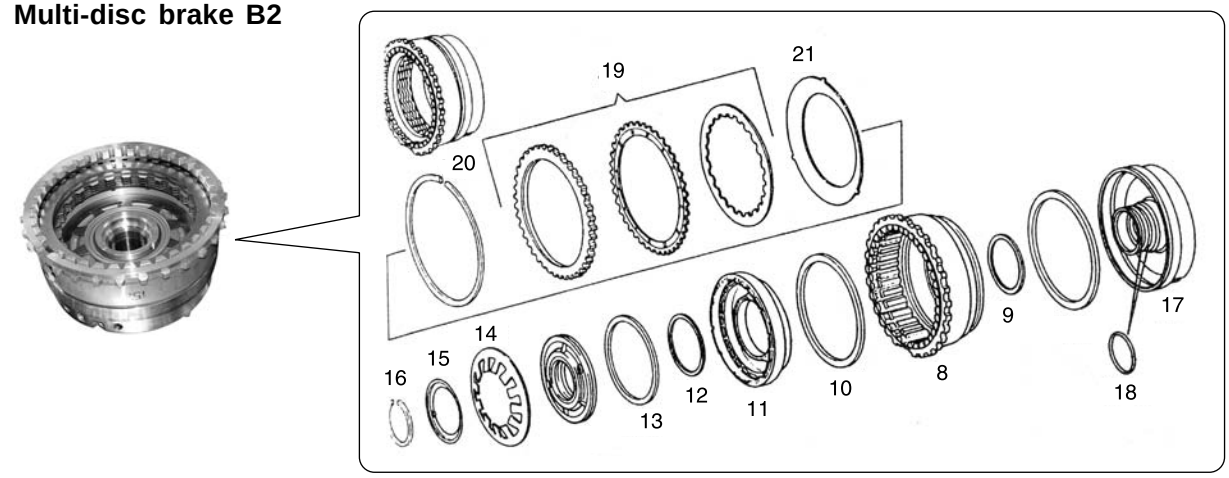
Clutch C3

24. Clutch C3
25. Sealing ring
26. Piston
27. Disc spring
28. Snap ring
29. Disc pack
30. Snap ring

Multi-disc brake B1



Multi-disc brake B2



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Multi-disc brake B1

1. Disc brake B1
2. Piston
3. Return spring
4. Snap ring
5. Cushion spring
6. Disc and steel plate
7. Snap ring

Multi-disc brake B2

8. Disc carrier B2
9. Sealing ring
10. Sealing ring
11. Piston in B2
12. Sealing ring in piston guide ring
13. Sealing ring in piston guide ring
14. Return spring
15. Spring plate
16. Snap ring
17. Piston guides in B2 and B3
18. O-ring
19. Disc and steel plate
20. Snap ring
21. Cushion plate

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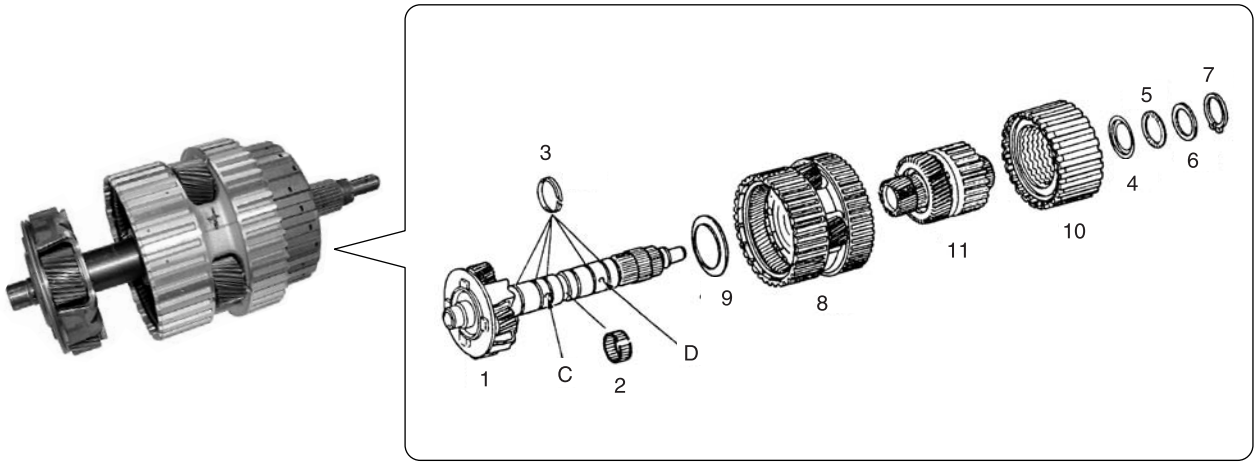
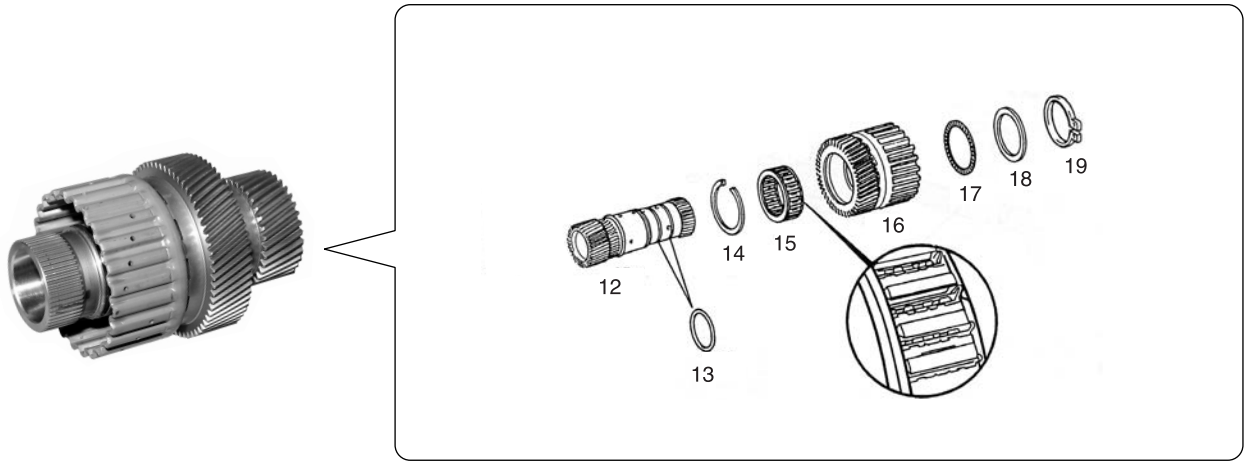
Rear gear set and center output shaft



Rear freewheel and rear hollow shaft



Y220_3A1157

Rear gear set and center output shaft

1. Output shaft in center gear set
2. Needle bearing
3. Teflon ring
4. Thrust washer
5. Thrust needle bearing
6. Shim
7. Snap ring
8. Rear gear set
9. Thrust washer
10. Clutch C3
11. Rear hollow shaft

C. Oil outlet port in clutch C3
D. Oil inlet port in clutch C3

Rear freewheel and rear hollow shaft

12. Hollow shaft
13. O-ring
14. Snap ring
15. Freewheel
16. Inner disc carrier and rear sun gear/clutch C3
17. Thrust needle bearing
18. Shim
19. Snap ring

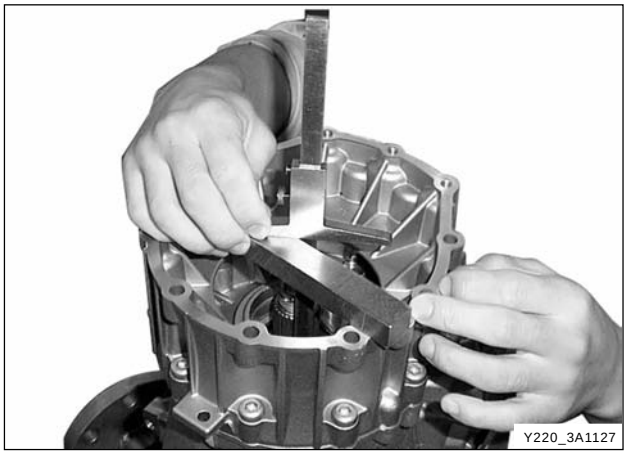
▶ Installation

1. Measure the clearance between the ball bearing and the parking lock gear.
   - Place the straightener on top of transmission housing and measure the distance of “a” with auge.
   - Measure the distance (b) from straightener to the ball bearing groove on mating surface with gauge.
   - Adjust the axial play “E” with adjusting shim.

ex)

Distance “a”	49.90 mm
Distance “b”	49.00 mm
Difference	0.90 mm
Axial play “E”	0.40 mm
Shim size	0.50 mm

Axial play (specified value)	0.3 ~ 0.5 mm



Notice

Select a proper thickness of shim:
0.2, 0.3, 0.4, 0.5 mm

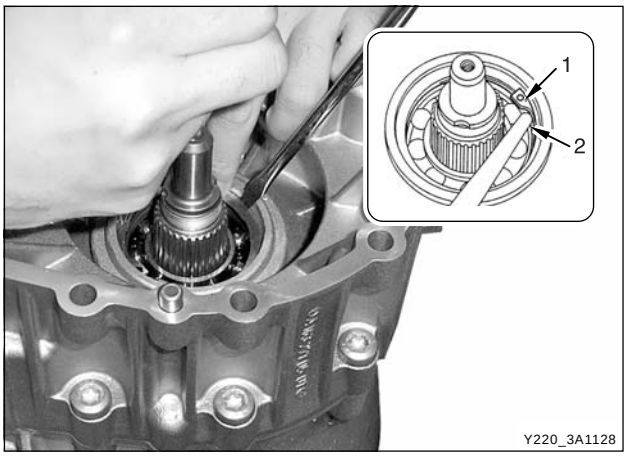
2. Install a shim.

   Straightedge 126 589 04 31 00

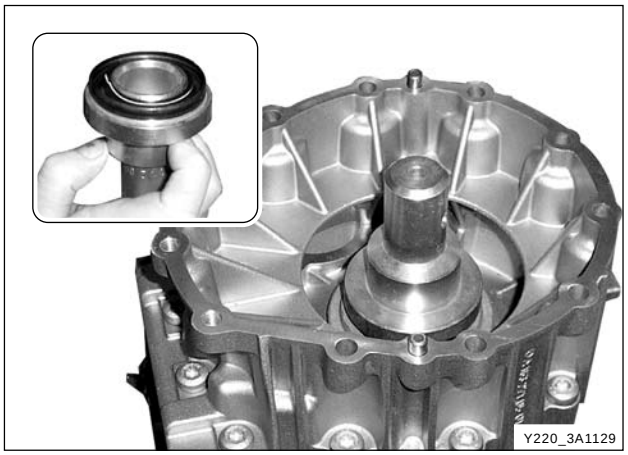
3. Insert the ball bearing into rear part of transmission housing.

Notice

Measure the clearance between ball bearing (2) and snap ring. Install the appropriate size of snap ring. (2.0, 2.1, 2.2 mm)



4. Install the radial sealing ring.



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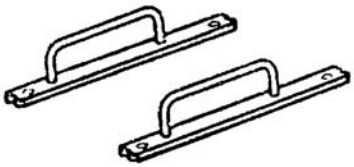
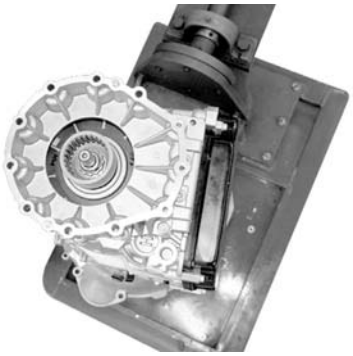
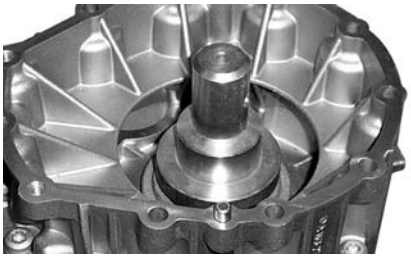
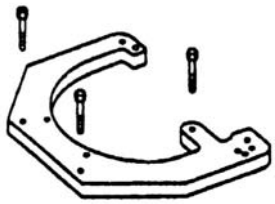
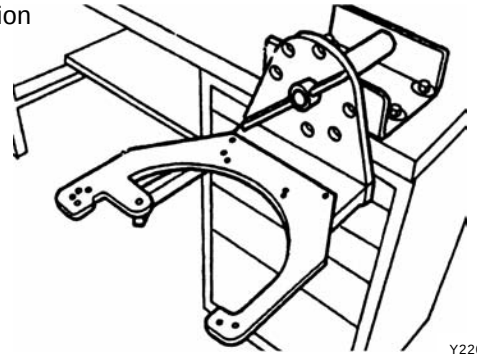
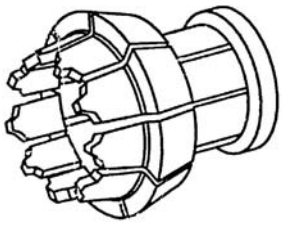
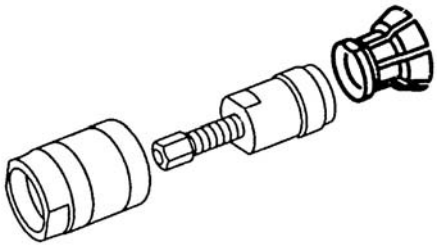
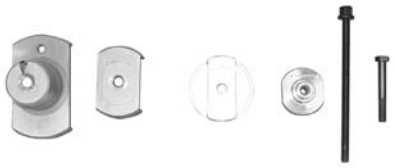
SPECIAL TOOLS AND EQUIPMENT

Name and Part Number	Application
W 126 589 01 62 00 **Handle**  Y220_3A1176	Removal and installation of torque converter  Y220_3A1177
W 116 589 06 59 00 **Fixture stand**  Y220_3A1178	Fixing automatic transmission  Y220_3A1179
W 140 589 12 15 00 **Drift punch**  Y220_3A1180	Installation of sealing ring  Y220_3A1181
W 001 589 50 33 00 **Puller**  Y220_3A1182	Removal and installation of transmission housing ball housing  Y220_3A1183

Name and Part Number	Application
W 140 589 34 63 00 **Mounting plate**  Y220_3A1184	Fixing automatic transmission  Y220_3A1185
W 140 589 06 34 00 **Collet chuck**  Y220_3A1186	Removal and installation of transmission housing ball bearing  Y220_3A1187
W 140 589 13 43 00 **Piston puller**  Y220_3A1188	Removal and installation of B1, B2, B3 piston  Y220_3A1189
Socket wrench  Y220_3A1190	Removal and installation of collar nut for output shaft  Y220_3A1191

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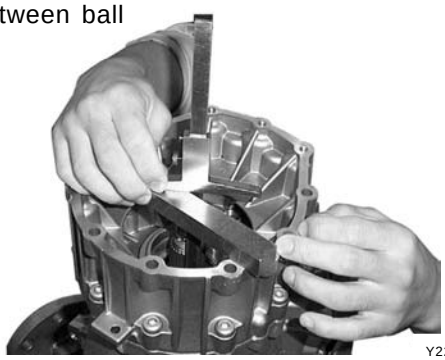
Name and Part Number	Application
128 589 04 31 00 **Straightedge**  Y220_3A1192	Measuring the clearance between ball bearing and parking lock gear  Y220_3A1193
Compressor  Y220_3A1194	Compressing clutch and disc brake  Y220_3A1195