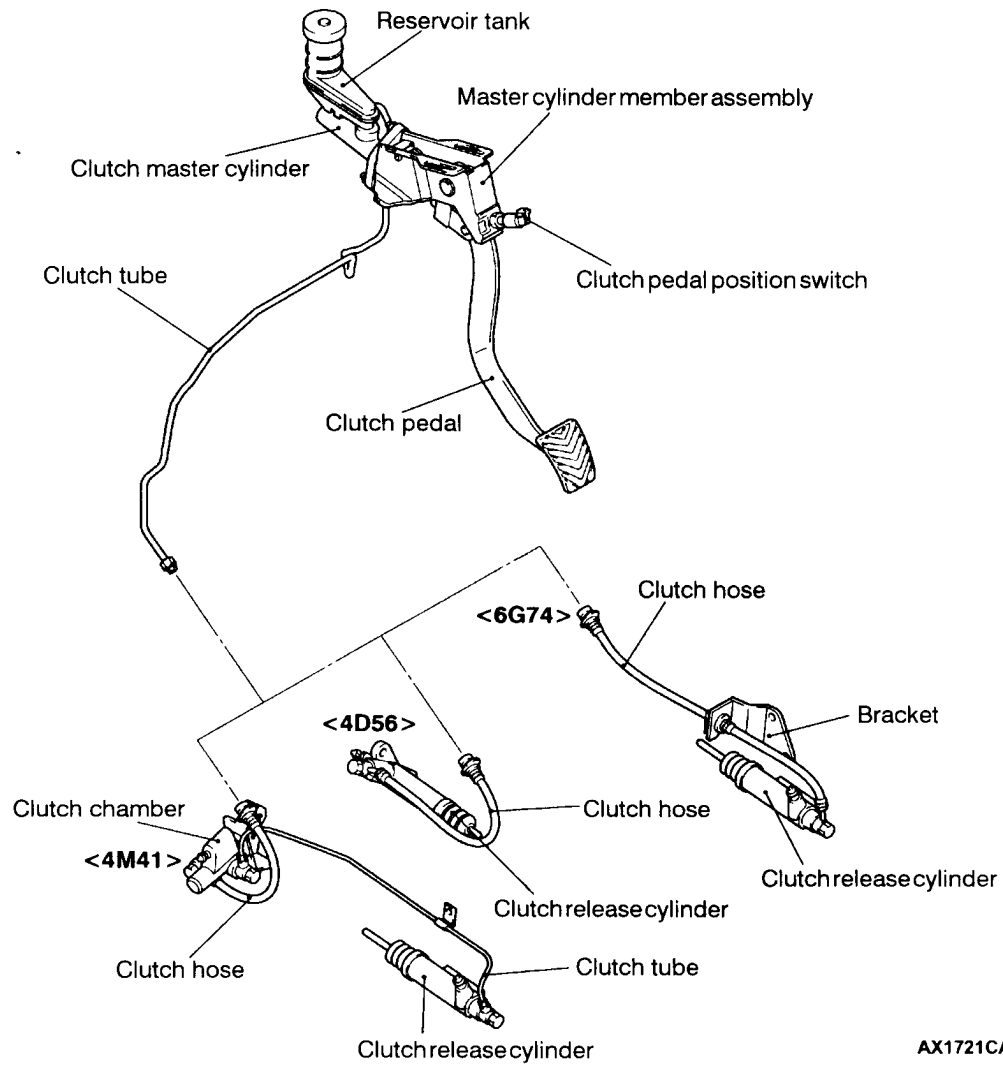

POWER TRAIN

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<R.H.drive vehicles>



AX1721CA

MANUAL TRANSMISSION

- A V5MT1 and V5M31 type transmission has been incorporated for the new PAJERO. These transmissions are basically the same as the transmission incorporated for the previous PAJERO.
- The part time 4WD used in the PAJERO SPORT and an super select 4WD II have been incorporated for 4WD system. This super select

4WD II uses a switch changeover motorized transfer changeover method, and planetary gears with VCU for the center differential mechanism. This is a 4WD system with outstanding transfer shift lever operation, steering ability, road ability and quietness.

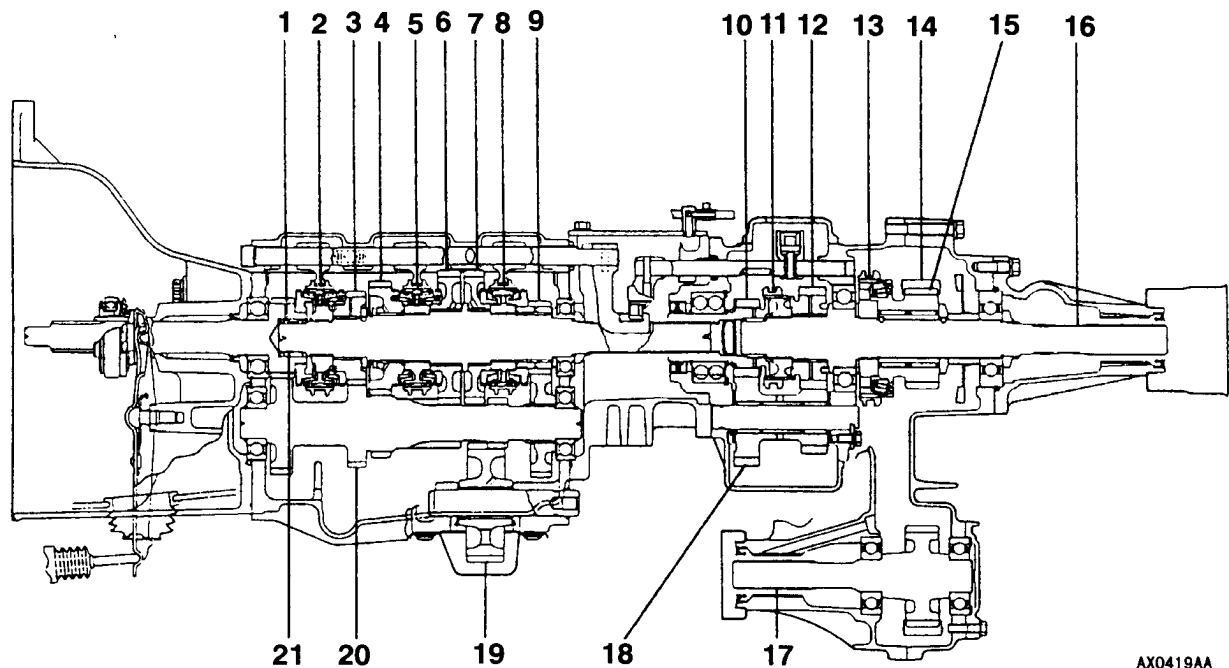
SPECIFICATIONS

Items		Specifications			
Transmission model		V5MT1-8-BFGL	V5M31-6-NFL	V5M31-6-XCL, V5M31-6-XC	V5M31-6-WDL, V5M31-6-WD
Engne model		4D5			4M4, 6G7
Transmission type		5-speed, floor-shift			
Transmission gear ratio	1st	3.918	3.952	4.234	4.234
	2nd	2.261	2.238	2.238	2.238
	3rd	1.395	1.398	1.398	1.398
	4th	1.000	1.000	1.000	1.000
	5th	0.829	0.819	0.761	0.819
	Reverse	3.925	3.553	3.553	3.553
Drive system		Part-time 4WD	Super select 4WD II		
Transfer type		2-speed, constant mesh			
Transfer gear rasio	High	1.000			
	Low	1.925	1.900		
Transmission oil	Specified lubricants	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4			
	Quantity ℓ	2.5	3.2		
Transfer oil	Specified lubricants	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4			
	Quantity ℓ	2.8			

402.000.00001 ; - 90 SHIP. No.
 46.000.00005 - 90 SHIP. No.
 47.000.00005 - 85 SHIP. No.

SECTIONAL VIEW

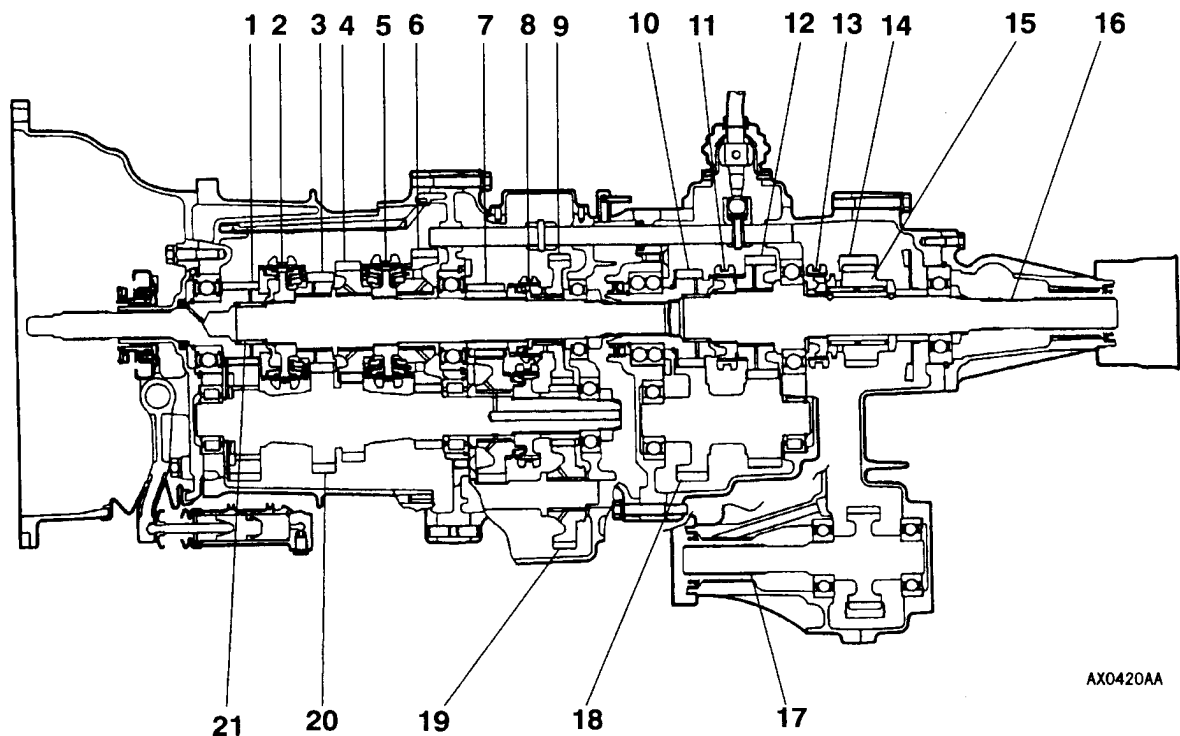
<V5MT1>



AX0419AA

- | | |
|-----------------------------|---------------------------|
| 1. Main drive pinion | 12. Low speed gear |
| 2. 3rd-4th synchronizer | 13. 2WD/4WD sleeve |
| 3. 3rd speed gear | 14. Chain |
| 4. 2nd speed gear | 15. Drive sprocket |
| 5. 1st-2nd synchronizer | 16. Rear output shaft |
| 6. 1st gear | 17. Front output shaft |
| 7. Reverse gear | 18. Transfer counter gear |
| 8. 5th-reverse synchronizer | 19. Reverse idler gear |
| 9. 5th gear | 20. Counter shaft |
| 10. Transfer input gear | 21. Main shaft |
| 11. High/Low sleeve | |

<V5M31>



AX0420AA

- | | |
|-----------------------------|---------------------------|
| 1. Main drive pinion | 14. 2WD/4WD synchronizer |
| 2. 3rd-4th synchronizer | 15. Drive sprocket |
| 3. 3rd speed gear | 16. Chain |
| 4. 2nd speed gear | 17. Viscous coupling unit |
| 5. 1st-2nd synchronizer | 18. Center differential |
| 6. 1st gear | 19. Rear output shaft |
| 7. 5th gear | 20. Transfer drive shaft |
| 8. 5th-reverse synchronizer | 21. Front output shaft |
| 9. Reverse gear | 22. Transfer counter gear |
| 10. Transfer input gear | 23. Reverse idler gear |
| 11. High/Low clutch | 24. Counter shaft |
| 12. Low speed gear | 25. Main shaft |
| 13. Differential lock hub | |

SUPER SELECT 4WD II (SS4 II)

The super select 4WD II system used in the new PAJERO consists of the previous system with the following features added.

- The shift actuator is controlled by a switch which works in conjunction with the transfer shift lever in order to change the driving mode. This maintains smoother lever operation and accurate drive mode selection.
- A planetary gear type center differential has been adopted which distributes the traction force to the

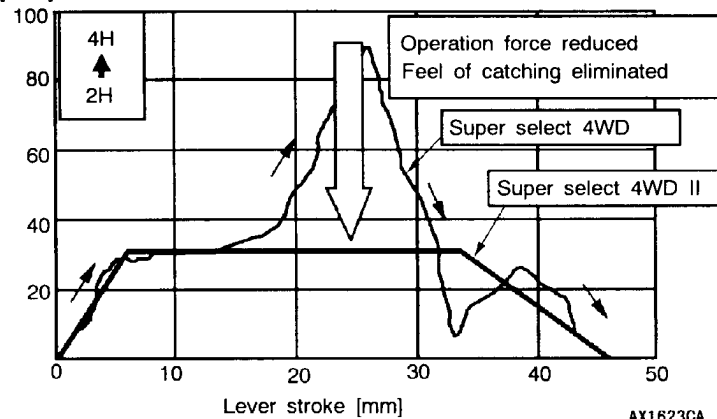
front and rear output shafts in the proportion of 33% to 67%, to maintain the driving stability which is a main feature of 4WD driving, and also to improve steering performance. Furthermore, the adoption of viscous coupling unit (VCU) makes it possible to distribute the driving force, depending on the road condition, between the ratio of 33% to 50% for the front wheel and 67% to 50% for the rear wheel.

DRIVE METHODS

Transfer select lever position	Drive system	High/low	Center differential	Road surface conditions
2H	2WD	High	Not operating	When driving on general roads and expressways
4H	Full-time 4WD	High	Operating (with viscous coupling unit differential limit)	When driving on general roads, expressways and slippery roads (better driving stability)
4HLc	Direct 4WD	High	Not operating	When driving on poor roads, sandy roads and snowy roads
4LLc	Direct 4WD	Low	Not operating	When greater traction force is required, such as when climbing and descending steep slopes

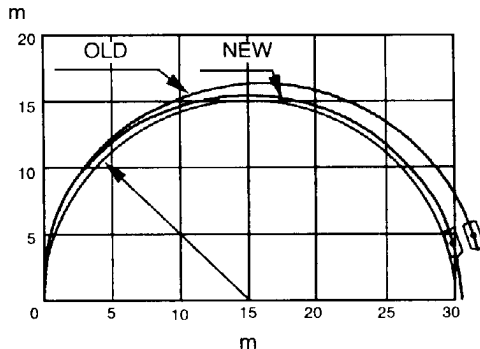
TRANSFER SHIFT LEVER OPERATION FORCE (WHEN CHANGING FROM 2H TO 4H)

Lever operation force [N•m]

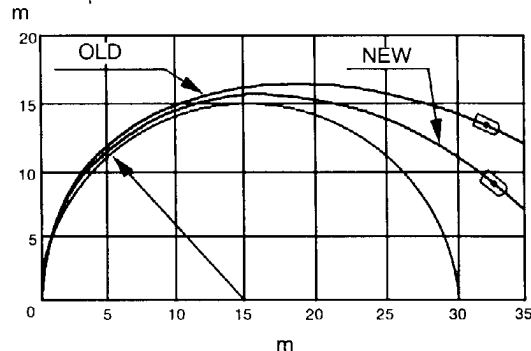


STEERING PERFORMANCE (AT 4H)

<GENERAL ROAD SURFACE>

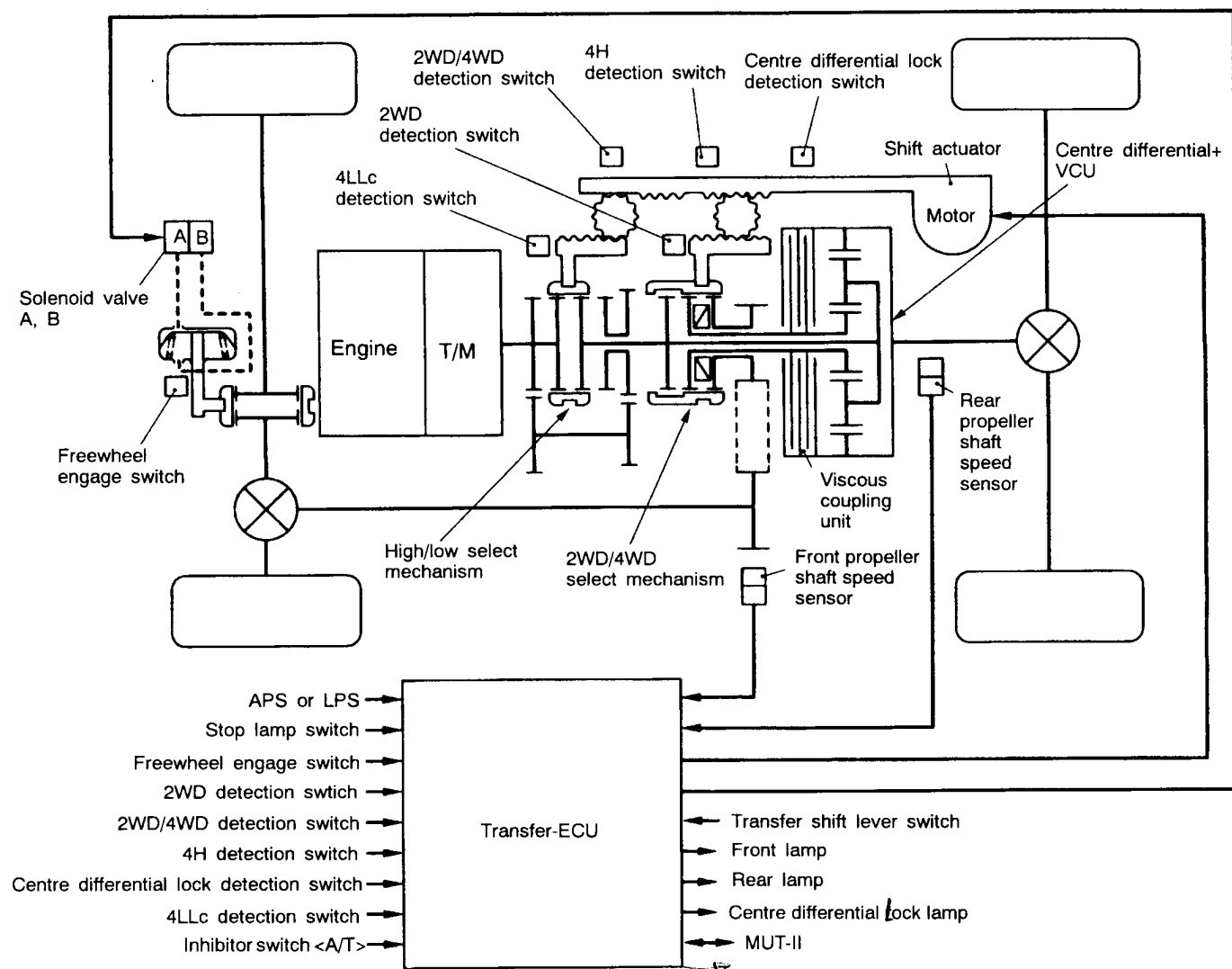


<LOW μ ROAD SURFACE>



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SYSTEM CONFIGURATION DIAGRAM

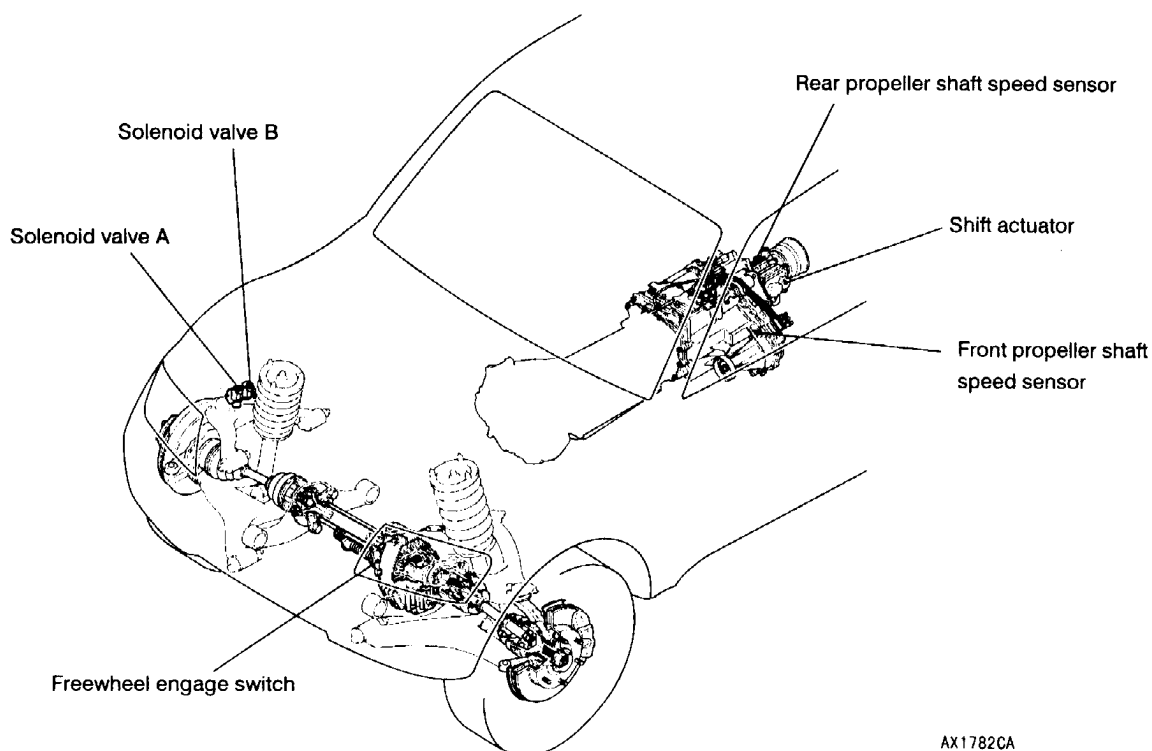


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всї рѣзня по частоте вращения переднего и
 заднего моста (передний до 5000 об/мин, задний
 по переход с 4H в 4LLc увеличивается).

MAIN STRUCTURAL PARTS

NAME OF STRUCTURAL PARTS	OUTLINE OF FUNCTIONS
Solenoid valve A, B	- Change the negative pressure route acting on the actuators in accordance with the signals from the transfer-ECU. - A and B turn ON/OFF at the same time.
Freewheel engage switch	Detects whether the freewheel mechanism is operating or not operating
4LLc detection switch	Detects the transfer shift range (Low position) from the High/Low shift rail position.
2WD detection switch	Detects the transfer condition (2H position) from the 2WD/4WD shift rail position.
2WD/4WD detection switch	Detects the transfer condition (2H, 4H position) from the main shift rail position
4H detection switch	Detects the transfer condition (4H, 4HLc position) from the main shift rail position.
Centre differential lock detection switch	Detects the transfer condition (4HLc, 4LLc position) from the main shift rail position.
Front propeller shaft speed sensor	Detects the front propeller shaft speed.
Rear propeller shaft speed sensor	Detects the rear propeller shaft speed.
Shift actuator	Changes the traction method in accordance with the signal from the transfer-ECU.
Transfer shift lever switch	Detects transfer shift lever position
Transfer-ECU	- Sends traction signals to the various mechanisms based on signals from the various switches and sensors. - Causes the indicator lamps inside the combination meter to flash in order to indicate the traction condition. - Causes the centre differential lock lamp to flash as a warning to the driver when there is a problem with the system.

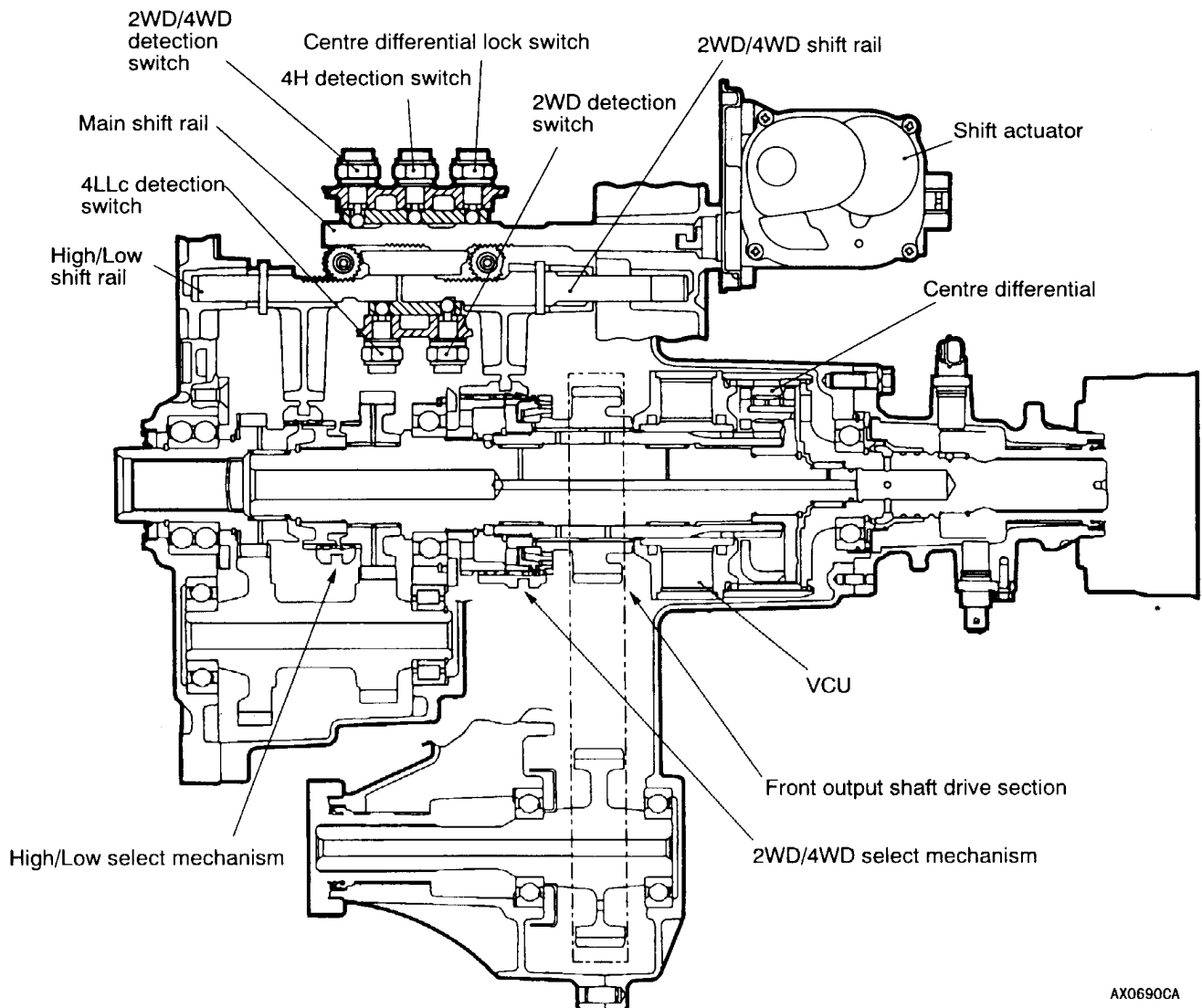
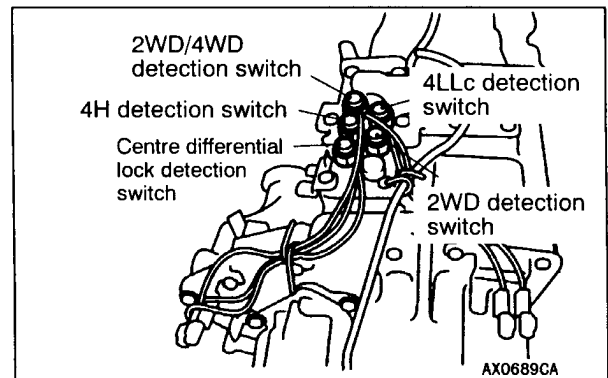
CONSTRUCTION

AX1782CA

TRANSFER POWER TRANSMISSION SYSTEM

The transfer of the super select 4WD II system consists of parts such as a high/low select mechanism, a 2WD/4WD select mechanism, a centre differential, a front output shaft drive section, and a viscous cou-

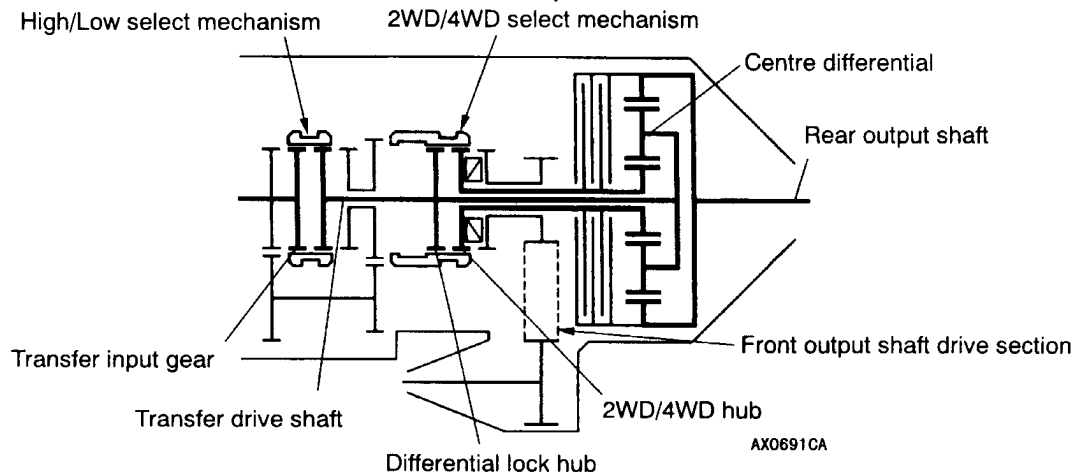
pling (VCU) as shown in the illustration below. In the addition, the shift rails are provided with a detection switch for control purposes.



When 2H is selected

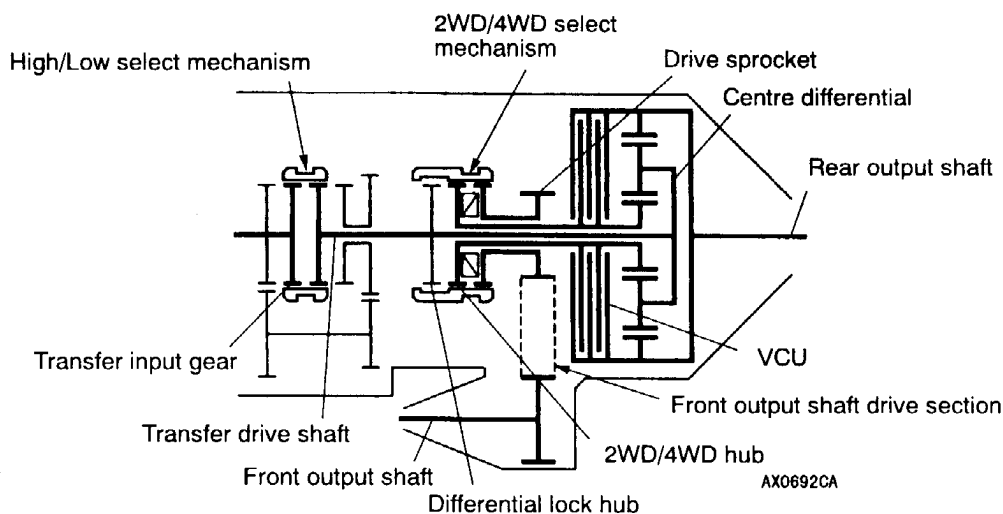
When the selector lever is at the 2H position, the High/Low select mechanism is set to High and the 2WD/4WD select mechanism is set to 2WD. The drive power from the transmission is transmitted directly from the transfer input gear to the transfer drive shaft. The drive power is then transmitted

to the 2WD/4WD drive section, and because the differential lock hub and 2WD/4WD hub are engaged and the centre differential does not operate, the drive power is thus transmitted only to the rear output shaft. At this time, the front output shaft drive section is free.

**When 4H is selected**

When the selector lever is at the 4H position, the High/Low select mechanism is set to High and the 2WD/4WD select mechanism is set to full-time 4WD. The drive power from the transmission is transmitted directly from the transfer input gear to the transfer drive shaft. Because the 2WD/4WD hub and the drive sprocket are engaged, the drive power is transmitted via the centre differential to the front output shaft. The centre differential distributes the drive power to the front and rear

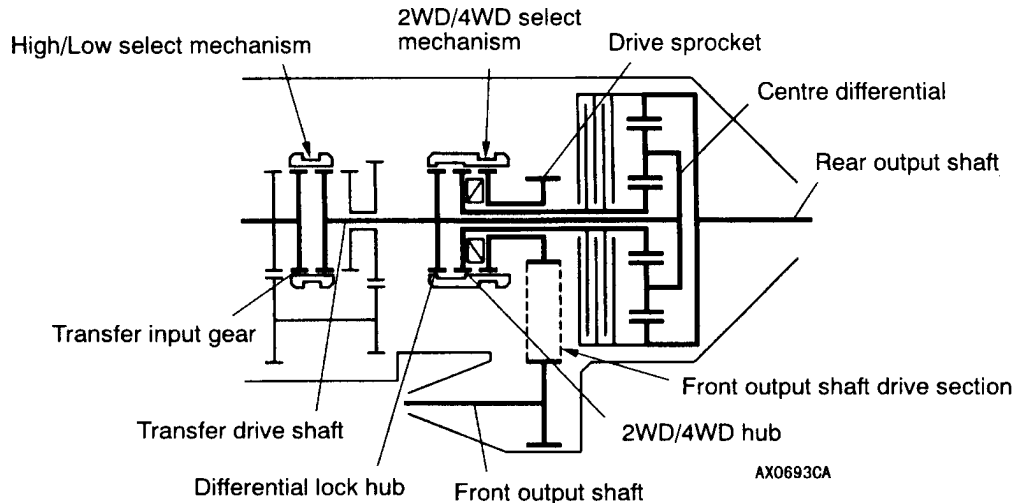
output shafts in the ratio of 33% to the front and 67% to the rear. At this time, the centre differential ensures that smooth driving is provided even if differences in rotation speed develop between the front and rear output shafts. In addition, the centre differential is equipped with a VCU which acts as a differential limiter, so that the drive power can be redistributed in accordance to the difference in rotation speed so that the optimum per distribution can be maintained at all times.



When 4HLc is selected

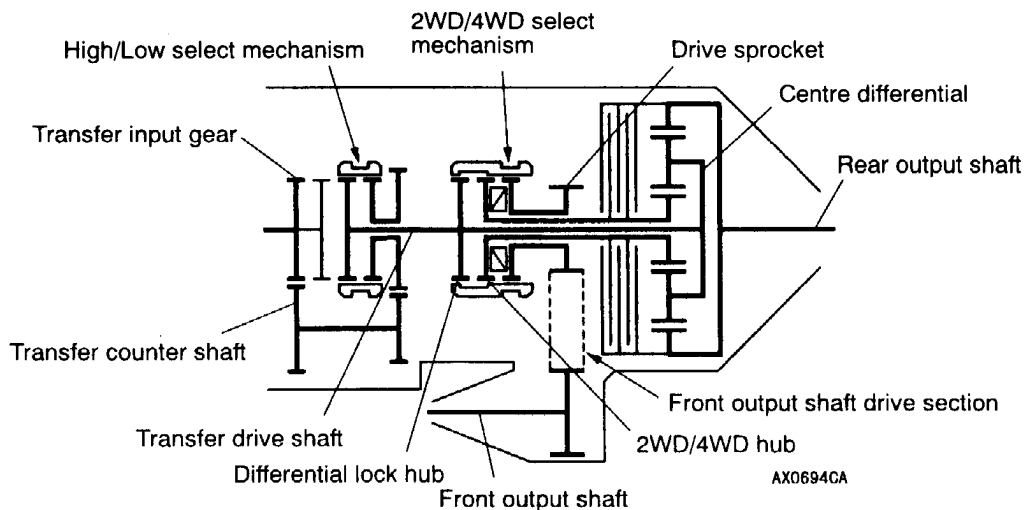
When the selector lever is at the 4HLc position, the High/Low select mechanism is set to High and the 2WD/4WD select mechanism is set to direct 4WD. The drive power from the transmission is transmitted directly from the transfer input gear to the transfer drive shaft. The drive power is then

transmitted to the 2WD/4WD select mechanism, and because the differential lock hub, 2WD/4WD hub and drive sprocket are engaged, the drive power is thus transmitted directly to the front and rear output shafts.

**When 4LLc is selected**

When the selector lever is at the 4LLc position, the High/Low select mechanism is set to Low and the 2WD/4WD select mechanism is set to direct 4WD. The drive power from the transmission is transmitted from the transfer input gear via the transfer counter shaft to the transfer drive shaft.

The drive power is then transmitted to the 2WD/4WD select mechanism, and because the 2WD/4WD hub, drive sprocket and differential lock hub are engaged, the drive power is thus transmitted directly to the front and rear output shafts.



2WD/4WD select mechanism

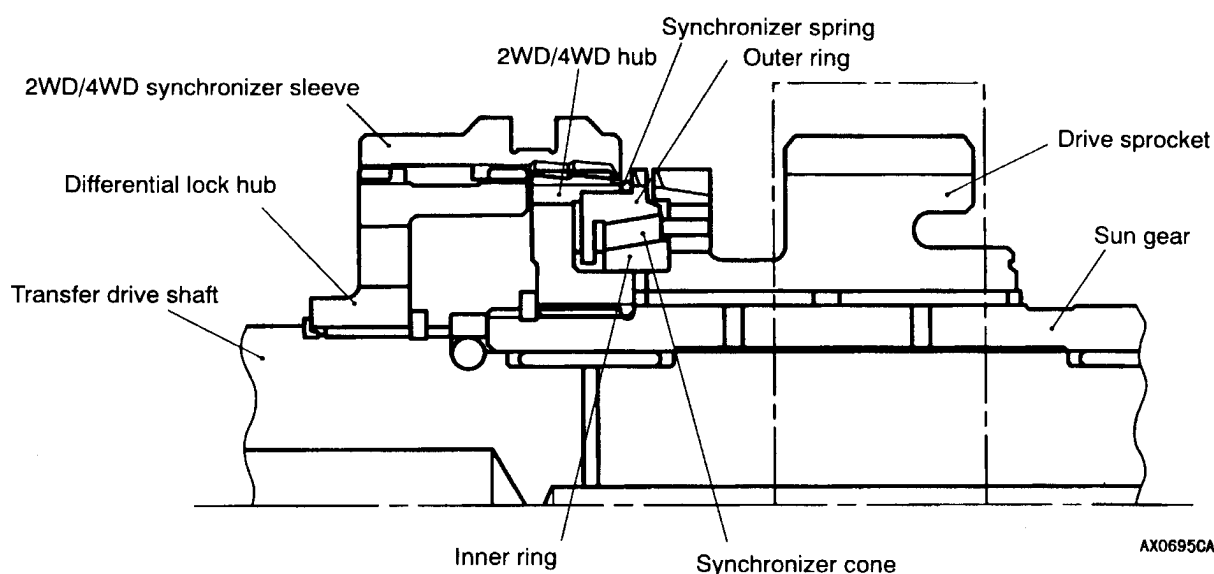
The 2WD/4WD select mechanism includes a differential lock function in addition to the High/Low select function, and it has a total of three selectable positions (2WD, full-time 4WD and direct 4WD). Furthermore, a synchronizer has been adopted so

that 2WD/4WD selection can be carried out while driving. In addition, a random chain has been adopted as the chain used to drive the front output shaft, in order to improve quietness of operation.

2WD/4WD SELECT MECHANISM STRUCTURAL PARTS

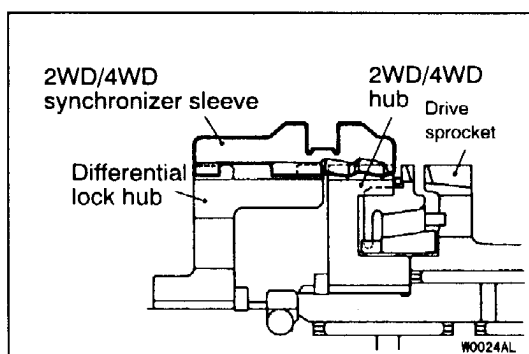
The 2WD/4WD select mechanism consists of parts such as a differential lock hub, a 2WD/4WD hub, a drive sprocket, a 2WD/4WD synchronizer sleeve, an outer ring, an inner ring, a synchronizer cone, and a synchronizer spring as shown in the illustration below.

The differential lock hub engages with the transfer drive shaft; the 2WD/4WD hub engages with the sun gear, outer ring and inner ring; and the drive sprocket engages with the synchronizer cone, to rotate as single units. The 2WD/4WD synchronizer sleeve engages with two or three of these units to select the drive method.



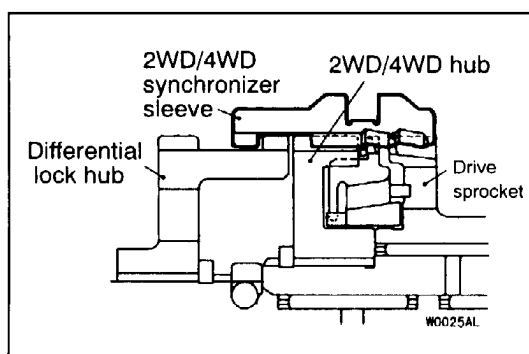
During 2WD (when 2H is selected)

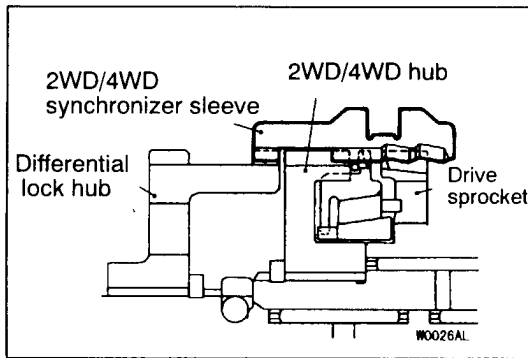
When 2H is selected, the sleeve is positioned as shown in the illustration at left, and the differential lock hub and the 2WD/4WD hub are engaged and the drive sprocket is free. Because of this, the transfer drive shaft and the sun gear rotate as a single unit, and the centre differential is locked. In addition, because the drive sprocket is free, the drive power is transmitted to only the rear output shaft to drive the rear wheels, and no power is transmitted to the front output shaft.



During full-time 4WD (when 4H is selected)

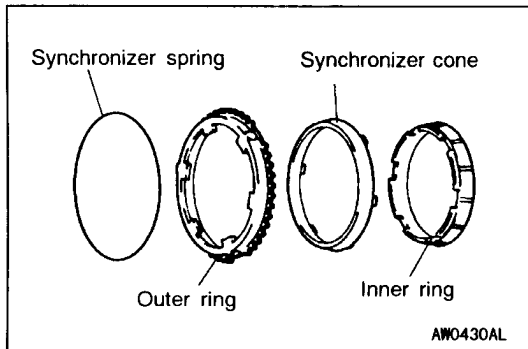
When 4H is selected, the sleeve is positioned as shown in the illustration at left, and the 2WD/4WD hub and the drive sprocket are engaged and the differential lock hub is free. Because of this, the drive power is distributed from the centre differential to both the sun gear and the rear output shaft. In addition, because the differential lock hub is free, the centre differential can freely rotate at differential speeds, so that if differences in rotation speeds should develop between the front and rear output shafts, these differences can be absorbed to maintain smooth driving.





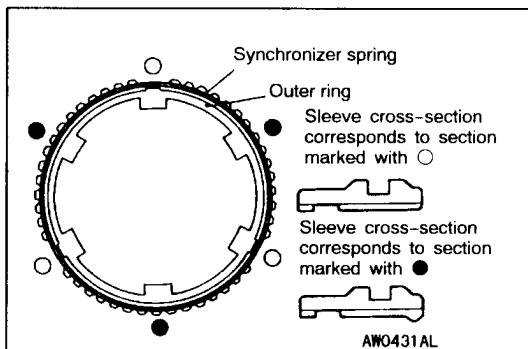
DURING DIRECT 4WD (WHEN 4HLC OR 4LLC IS SELECTED)

When 4HLC or 4LLC is selected, the sleeve is positioned as shown in the illustration at left, and the differential lock hub, 2WD/4WD hub and drive sprocket are all engaged. Because of this, the transfer drive shaft and the sun gear rotate as a single unit, and the centre differential is locked and the drive sprocket also rotates. As a result, the drive power is transmitted evenly to drive both the front and rear wheels at the same speed.

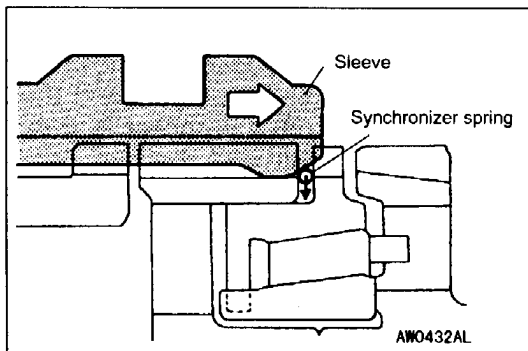


DOUBLE CONE SYNCHRONIZER

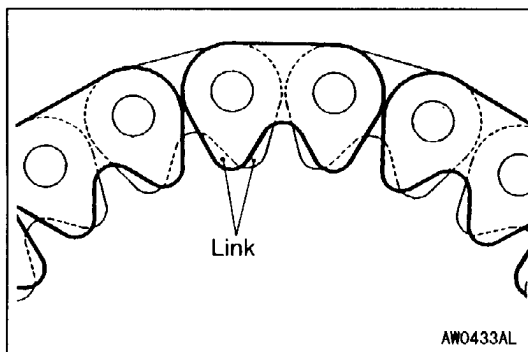
A double cone synchronizer has been adopted as the synchronizer in the 2WD/4WD select mechanism. This synchronizer has the structure shown in the illustration at left.



The synchronizer spring is ring-shaped, and it sits on top of the projections (marked with ○) on the outer ring and touches the outer ring. On the other hand, projections are located on the synchronizer spring side of the synchronizer sleeve splines which match the sections in between the tabs on the outer ring (marked with ●).



Because of this, when the sleeve moves to the side where the ring is, the centre of the synchronizer spring which is applied between the ring projections pushes the projections on the sleeve. As a result, the synchronizer spring pushes the outer ring, so that a pressing force is generated on the cone. When the sleeve pushes the synchronizer spring with a large-enough force, the synchronizer spring moves downwards and the sleeve contacts the chamfered part of the ring. In this way, the synchronizer spring works in the same way as the previous synchronizer gear and spring.



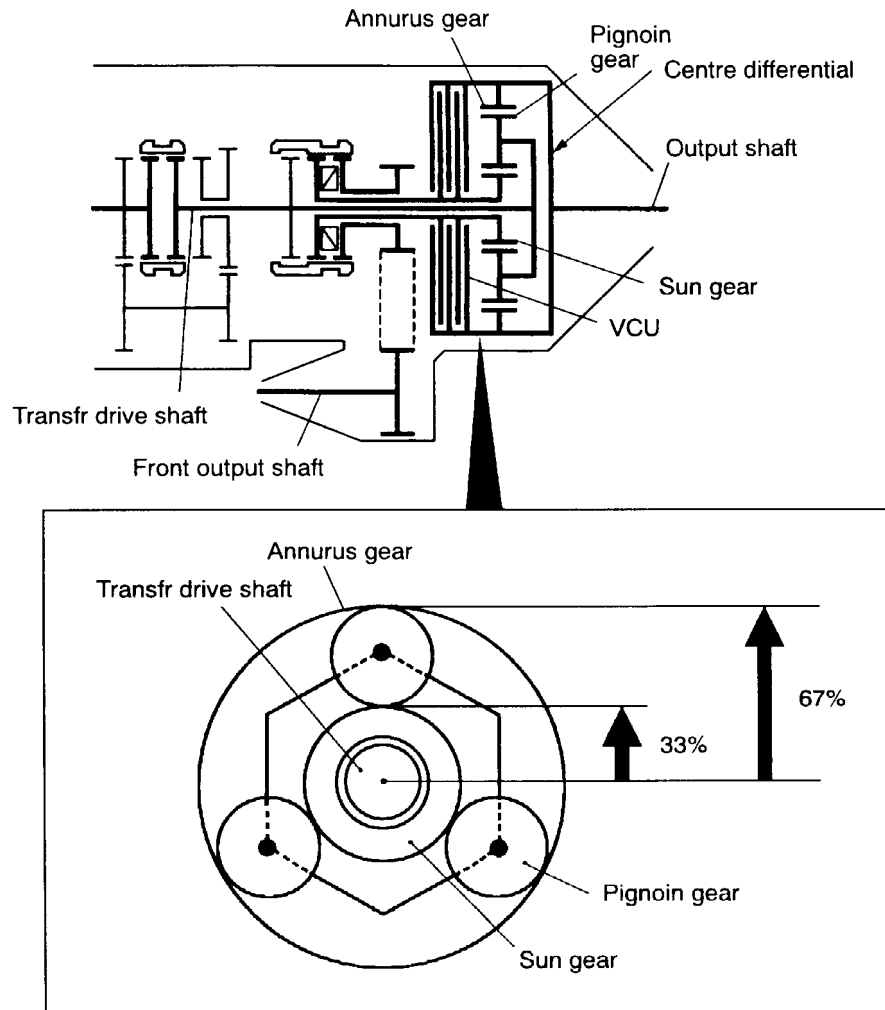
RANDOM CHAIN

The random chain consists of a combination of alternating links connected together, and serves to reduce the amount of noise generated when the chain engages the sprockets.

CENTRE DIFFERENTIAL

The drive force conveyed from the transmission to the transfer drive shaft is conveyed to the pinion gears of the centre differential. The drive force from there is conveyed to the front output shaft via the sun gear, and then to the rear output shaft via the annulus gear. The sun gear and annulus gear are simultaneously driven by the pinion gear, but as the number of gear teeth differs, the drive force

is distributed to the sun gear (front output shaft) at a percentage of 33%, and to the annulus gear (rear output shaft) at 67%. A VCU is mounted between the sun gear and annulus gear, and the drive force is changed within a range of 33 to 50% at the front output shaft and 67 to 50% at the rear output shaft. This enables travel corresponding to a variety of road surface conditions.



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SHIFT RAIL

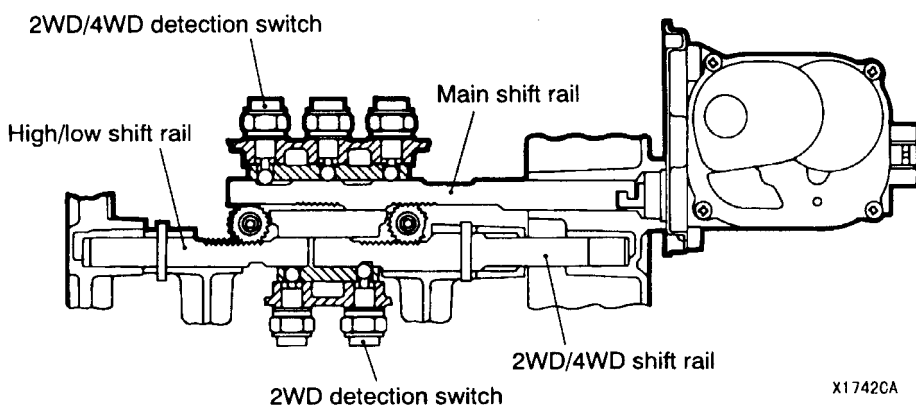
The main shift rail, 2WD/4WD shift rail and high/low shift rail are moved by a selected drive system.

A switch to detect the current drive system is mounted on each shift rail.

When 2H is selected

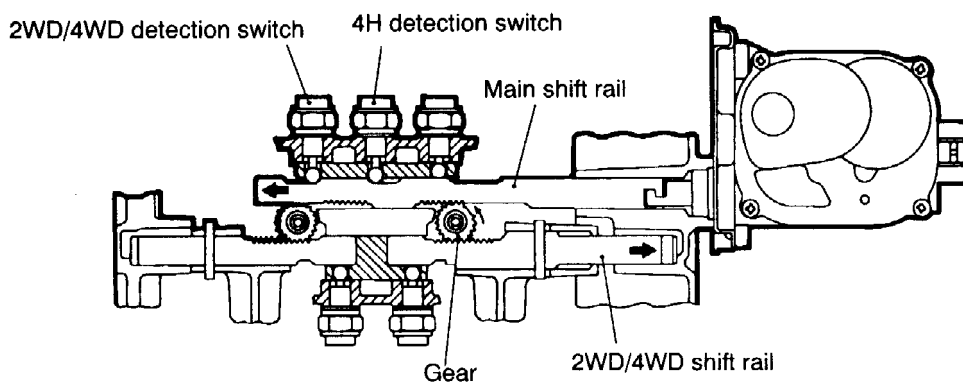
When 2H is selected, the main shift rail moves to the right side and the 2WD/4WD shift rail and high/low shift rail move to the left side as shown below. The 2WD detection switch and 2WD/4WD

detection switch turn ON with the groove provided on each shift rail to detect that the 2WD state is currently applied.

**When 4H is selected**

When 4H is selected, the main shift rail moves to the left side from 2H, and the 2WD/4WD shift rail is moved to the right side by the intermediate

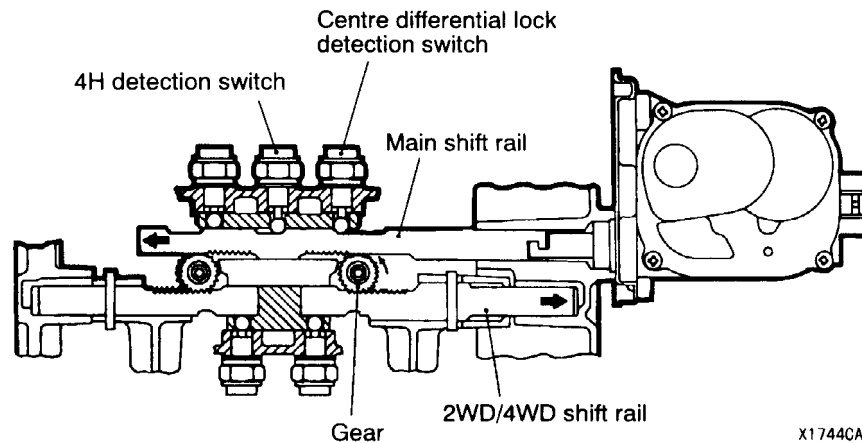
gear. At this time, the 2WD/4WD detection switch and 4H detection switch turn ON to detect that the full-time 4WD state is currently applied.



When 4HLc is selected

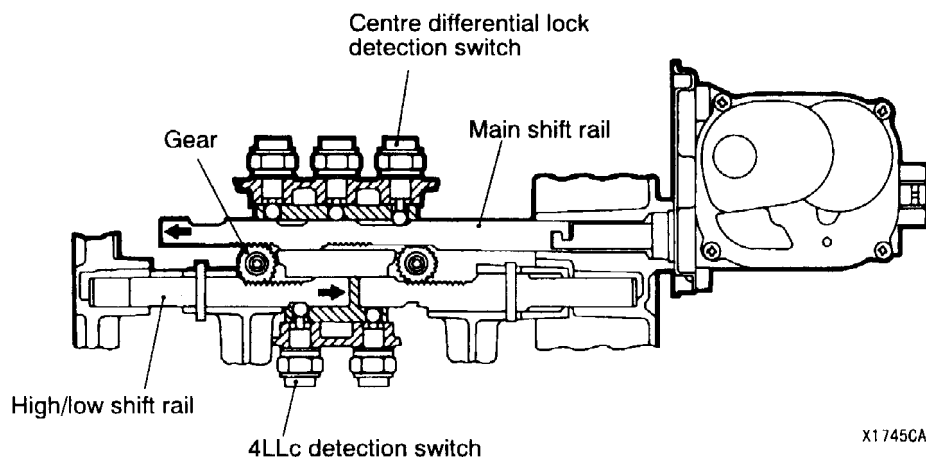
At 4HLc is selected, the main shift rail moves to the left side from 4H, and the 2WD/4WD shift rail is moved to the right side by the intermediate gear. This intermediate gear is missing some teeth, so even if the main shift rail attempts to move further

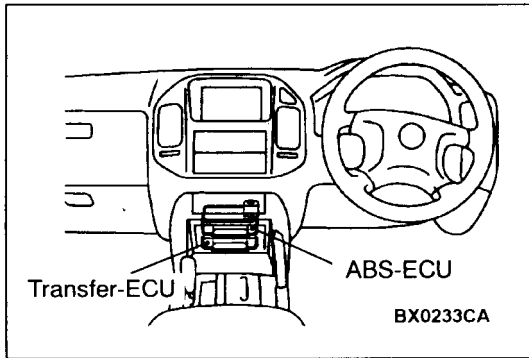
to the right, rotation is prevented. At this time, the 4H detection switch and centre differential lock detection switch turn ON to detect that the direct coupled 4WD (high range) state is currently applied.

**When 4LLc is selected**

When 4LLc is selected, the main shift rail moves to the left side from 4HLc, and the high/low shift rail is moved to the right by the intermediate gear. At this time, the centre differential lock detection

switch and 4LLc detection switch turn ON to detect that the direct coupled 4WD (low range) state is currently applied.





TRANSFER-ECU

The control unit determines the optimum select timing from the signals received from the various switches and sensors, and controls the shift actuators to select the drive method. In addition, it is also provided with a fail-safe function and a diagnosis function in case a problem occurs with the various switches and sensors or with the shift actuators.

Control Unit

The transfer-ECU has a hybrid-type 48-pin connector. The terminal layout is as follows.

1	2	3	4	5	6	7	8	9	10	11	12	13	31	32	33	34	35	36	37	38	39	40	41
14	15	16	17	18	19	20	21	22	23	24	25	26	42	43	44	45	46	47	48	49	50	51	52

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- | | |
|--|---|
| 1. Shift actuator | 24. Diagnosis control |
| 2. – | 25. Earth |
| 3. Shift actuator | 26. Earth |
| 4. – | 31. Backup power supply |
| 5. Accelerator pedal position sensor (APS)
<Except 4D5>, Lever position sensor
<4D5> | 32. Inhibitor switch N <A/T> |
| 6. – | 33. Inhibitor switch P <A/T> |
| 7. Front propeller shaft speed sensor | 34. Stoplamp switch |
| 8. – | 35. Earth <A/T> |
| 9. Rear propeller shaft speed sensor | 36. – |
| 10. – | 37. Rear wheel indicator lamp |
| 11. Diagnosis output | 38. Front wheel indicator lamp |
| 12. – | 39. Earth <6G7> |
| 13. Power supply | 40. Centre differential lock lamp |
| 14. – | 41. Solenoid valve A, B |
| 15. – | 42. Earth |
| 16. – | 43. 2WD detection switch |
| 17. – | 44. 2WD/4WD detection switch |
| 18. Sensor earth | 45. 4H detection switch |
| 19. – | 46. Centre differential lock detection switch |
| 20. Transfer shift lever switch 2H | 47. 4HLc detection switch |
| 21. Transfer shift lever switch 4H | 48. – |
| 22. Transfer shift lever switch 4HLc | 49. – |
| 23. Transfer shift lever switch 4Ilc | 50. Freewheel engage switch |
| | 51. – |
| | 52. – |

Fail-safe Function

A fail-safe function has been adopted which controls the power transmission if a problem occurs in any of the switches, sensors or shift actuators or inside the transfer-ECU, in order to maintain the safety of passengers and the vehicle as the

highest priority. In addition, when fail-safe operation is detected, the centre differential lock indicator lamp flashes at a rate of 1 Hz as a warning to the driver.

Diagnosis Function

The following function have been provided to make inspection of the Active Trac 4WD system easier.

- Diagnosis code output
- Service data output
- Actuator test

(1) Diagnosis Codes

20 different diagnosis codes are used by the system. When diagnosis codes are output, they are stored in the ECU. A backup power supply ensures that the diagnosis codes which have been stored in the ECU are not erased when the ignition switch is turned to the OFF position. (However,

the codes are erased if the battery terminals are disconnected.) Furthermore, the diagnosis codes can be read using the MUT-II, and they can also be read using the centre differential lock indicator lamp.

DIAGNOSIS CODE TABLE

ITEM		JUDGMENT CONDITION	FAIL-SAFE	DIAGNOSIS CODE NO.
Power supply voltage	Voltage drop	Power supply voltage 9.5 V or lower	Control start forbidden	11
	Overvoltage	Power supply voltage 18 V or higher	Control cancelled	12
Main relay (inside ECU)	Relay problem	Voltage is 6.0 V when relay is OFF, or lower than 6.0 V when relay is ON	Control cancelled	13
Accelerator pedal position sensor (APS) <Except 4D5>, Lever position sensor (LPS) <4D5>	Open circuit/ Malfunction of sensor	APS or LPS voltage is lower than 0.2 V when idling	Vehicle speed limit	21
Front propeller shaft speed sensor 1	Open circuit/ Short circuit/ Malfunction of sensor	Problem with input signal from the front differential speed sensor when driving at medium or low speed. (When fault is detected while changing from 2WD to 4WD)	Control start forbidden	22
Front propeller shaft speed sensor 2	Open circuit/ Short circuit/ Malfunction of sensor	Problem with input signal from the front propeller shaft speed sensor when the freewheel engage switch is on (When fault is detected in 4WD state)	Control start forbidden	23
Rear propeller shaft speed sensor 1	Open circuit/ Short circuit/ Malfunction of sensor	Problem with input signal from rear propeller shaft speed sensor when the APS or LPS voltage is 1.5 V or higher (When fault is detected in 2WD and 4WD state)	Control start forbidden	24

ITEM		JUDGMENT CONDITION	FAIL-SAFE	DIAGNOSIS CODE NO.
Rear propeller shaft speed sensor 2	Open circuit/ Short circuit/ Malfunction of sensor	Problem with input signal from rear propeller shaft speed sensor when the freewheel engage switch is on (When fault is detected in 4WD state)	Control start forbidden	25
Stoplamp switch	Open circuit/ Short circuit/ Malfunction of lamp/Malfunction of switch	Stoplamp switch is on for 15 minutes or more when driving at a vehicle speed of 15 km/h or more	Control interrupted (centre differential lock lamp flickers)	26
Transfer shift lever switch	Open circuit/ Short circuit/ Malfunction of switch	Problem with input signal from transfer shift lever switch	Control start forbidden	31
Transfer position switch 1	Open circuit/ Short circuit/ Malfunction of switch	Transfer selection does not complete while driving	Control forbidden	32
Solenoid valve A, B	Open circuit/ Short circuit/ Malfunction of solenoid valve	Solenoid valve energisation and ECU terminal voltage are not identical	Control start forbidden	34
Freewheel engage switch	Open circuit/ Short circuit/ Malfunction of switch	Solenoid valve energisation and ECU terminal voltage are not identical	Control forbidden	35
Problem with shift actuator	Open circuit/ Short circuit/ Malfunction of actuator	ECU terminal voltage is higher than main relay voltage (90% of rated voltage), or lower than main relay voltage (10% of rated voltage)	Control stopped	41
Short-circuit in shift actuator	Open circuit/ Short circuit/ Malfunction of actuator	Actual measurement value for actuator current is 1 A higher than target value	Control stopped	42
Open circuit in shift actuator	Open circuit/ Short circuit/ Malfunction of actuator	Main relay voltage is 6 V or higher, or actual measurement value for actuator current is lower than 0.1 A	Control stopped	43
Shift actuator overload	Open circuit/ Short circuit/ Malfunction of actuator	Computation required for driving an actuator takes more than 5 minutes	Control stopped	44
Incorrect tire diameter	Incorrect tire pressure/ Uneven tire sizes or different brands used	Front and rear wheel speed difference is greater than set value when the freewheel engage switch is on	Vehicle speed limited	45
Malfunction of transfer-ECU		Malfunction of ECU detected	Control stopped	51

(2) Service Data

The data which is input to the transfer-ECU is output to the diagnosis connector by means of a

serial bus, and can be read by connecting the MUT-II to the diagnosis connector.

SERVICE DATA TABLE

SER- VICE DATA NO.	ITEM	DISPLAY
1	Accelerator pedal position sensor (APS) <Except 4D5>, Lever position sensor (LPS) <4D5>	mV
2	Front propeller shaft speed sensor	km/h
3	Rear propeller shaft speed sensor	km/h
4	Difference in front and rear propeller shaft speeds	km/h
5	Vehicle speed	km/h
6	Transfer select lever position	2H/4H/4HLc/4LLc
7	Transfer position	2H/2H-4H/4H/4H-4HL/ 4HL/4HL-4LL/4LL
8	Main relay voltage	V
9	ECU power supply voltage	V
10	Shift actuator current	A
11	Target current	A
12	Shift actuator voltage	V
21	Ignition switch	ON/OFF
22	Transmission identification	MT/AT
23	Stoplamp switch	ON/OFF
24	Transfer shift lever switch 2H	ON/OFF
25	Transfer shift lever switch 4H	ON/OFF
26	Transfer shift lever switch 4HLc	ON/OFF
27	Transfer shift lever switch 4LLc	ON/OFF
28	Engine identification	GASOLINE/DIESEL
30	Solenoid valve A, B	ON/OFF
31	Inhibitor switch N <A/T>	ON/OFF
32	Inhibitor switch P <A/T>	ON/OFF
33	2WD detection switch	ON/OFF
34	2WD/4WD detection switch	ON/OFF
35	4H detection switch	ON/OFF
36	Centre differential lock detection switch	ON/OFF
37	4LLc detection switch	ON/OFF
38	Freewheel engage switch	ON/OFF

(3) Actuator test

The actuators can be force-driven by sending signals from the MUT-II to the transfer-ECU.

ACTUATOR TEST TABLE

ITEM NO.	CORRESPONDING ACTUA-TOR	TEST DETAILS	TEST CONDITIONS
1	Solenoid valve A, B	Drive the freewheel solenoid valve.	(1)Ignition switch: ON (2)Selector lever: P (3)Engine: Stopped
2	Shift actuator	Motor inside shift actuator running in normal direction	
3		Motor inside shift actuator running in reverse	

4WD indicator lamps are provided in the combination meter to indicate the driving conditions.

Centre differential lock indicator lamps
<Super select 4WD II>

DX1411CA

Transfer lever position		2H		→	4H	→	4L	→	4H	→	2H		
4WD indicator lamps	Front wheel lamps	OFF	ON	Flashing	ON	OFF	ON	OFF	ON	Flashing	ON	OFF	
	Rear wheel lamps	OFF	ON			OFF	ON	OFF	ON			OFF	
Ignition switch		OFF	ON									OFF	
HI/LOW detection switch		ON				OFF	ON	OFF	ON				
4WD detection switch		OFF		ON						OFF			
Freewheel solenoid valve		OFF	ON	OFF						ON			OFF
Freewheel engage switch		OFF			ON						OFF		

Transfer lever position		2H	→	4H	→	4HLc	→	4LLc	→	4HLc	→	4H	→	2H	→	4HLc	→	2H
4WD indicator lamps	Front wheel lamps	OFF	Fla-shin g	ON			Fla-shin g	ON	Fla-shin g	ON			Fla-shin g	OFF	Fla-shin g	ON	Flashing	OFF
	Centre differential lock lamps	OFF			Fla-shin g	ON				Fla-shin g	OFF			Fla-shin g	ON	Fla-shin g	OFF	
	Rear wheel lamps	ON					Fla-shin g	ON	Fla-shin g	ON								
Freewheel engage switch		OFF		ON										OFF		ON		OFF
2WD detection switch		ON	OFF										ON	OFF		ON		
2WD/4WD detection switch		ON			OFF						ON			OFF		ON		
4H detection switch		OFF		ON			OFF			ON			OFF		ON		OFF	
Centre differential switch		OFF				ON				OFF				ON		OFF		
4LLc detection switch		OFF						ON	OFF									

TRANSFER CONTROL

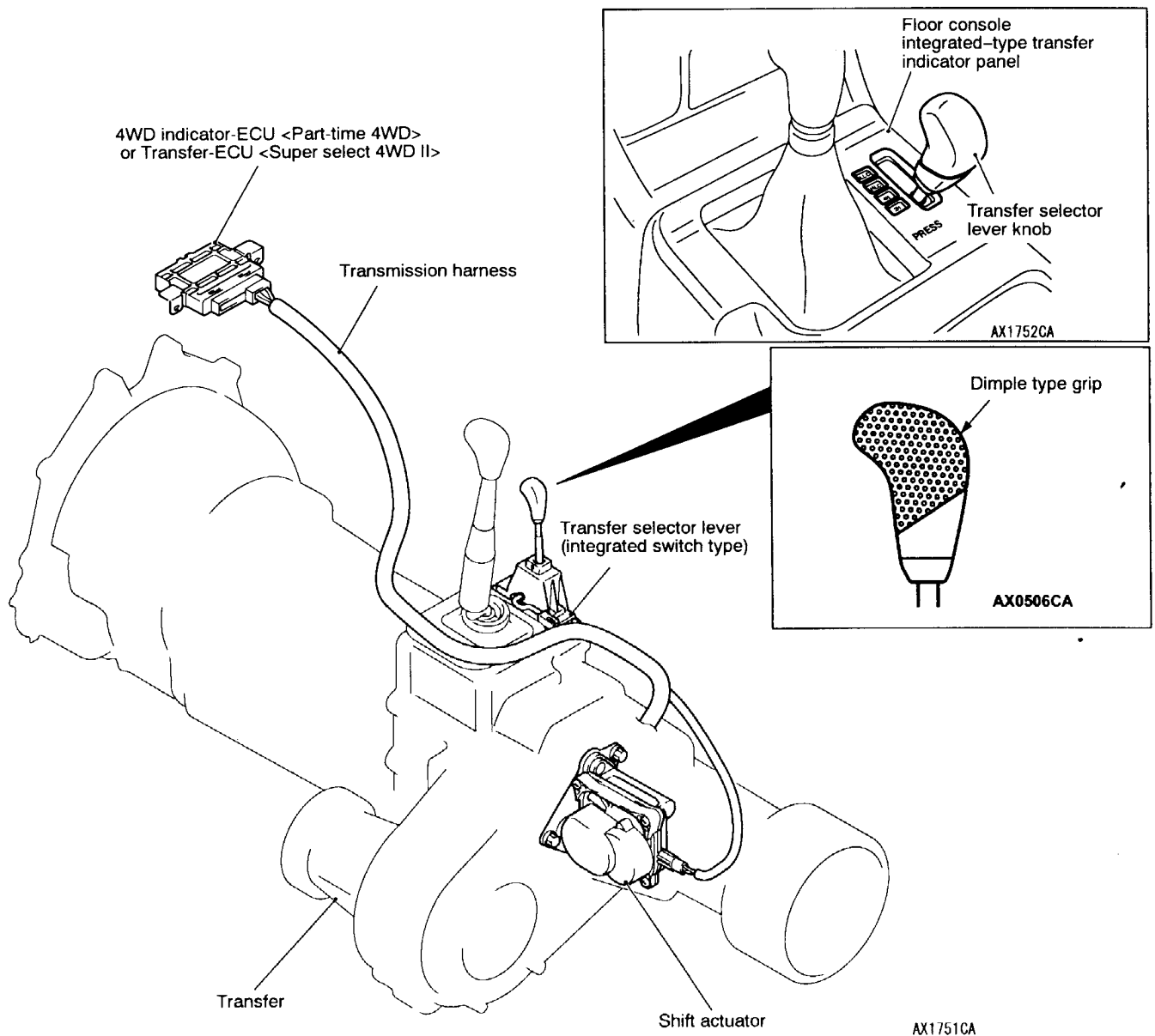
The transfer control with the part time 4WD is same as before.

A motor-driven select system is used for transfer control with the super select 4WD II.

The operation of this motor-driven select system is performed by an integrated transfer select lever and switch, which allow the driver to select any one of four modes (2H, 4H, 4HLc and 4LLc). In addition, the transfer-ECU controls the shift actuators which drive the drive mode select mechanism inside the transfer based on the electronic signals from the switch. This system has following features.

- Motor-driven drive mode selection allows the selector lever to be operated smoothly and also ensures accurate mode selection.
- The transfer indicator panel has a design which is integrated with the floor console to provide a feeling of high quality.
- The grip of the transfer selector lever knob has a dimple-type appearance to increase the feeling of high quality.

CONSTRUCTION DIAGRAM



AUTOMATIC TRANSMISSION

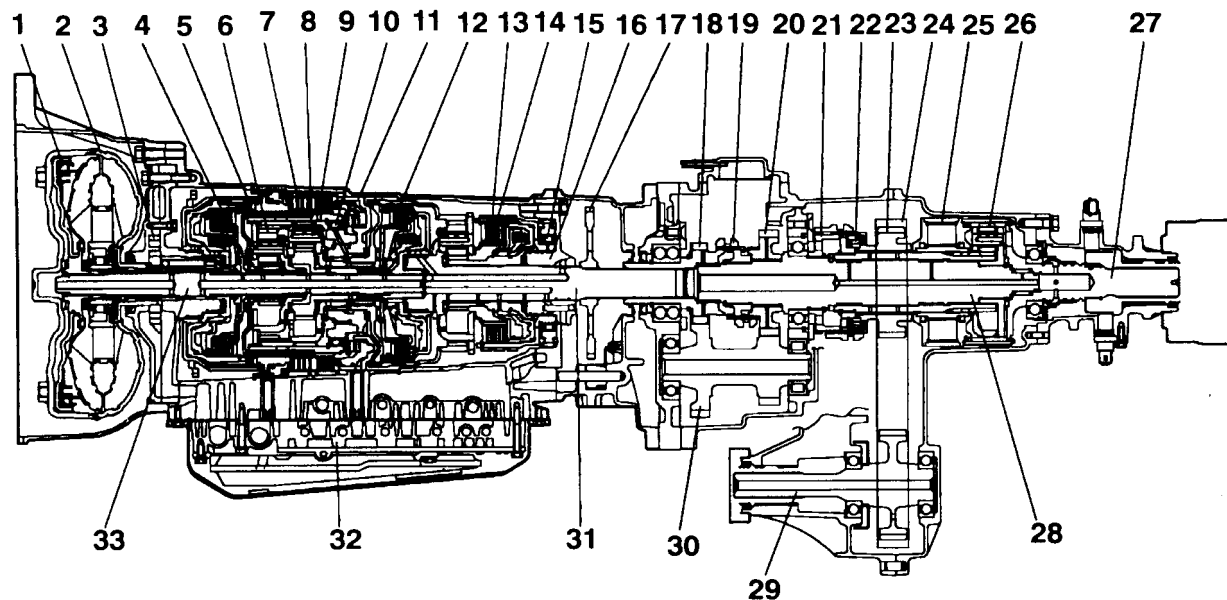
- A V5A51 type transmission has been incorporated for the new PAJERO. This transmission is that the V4A51 type 4 speeds transmission incorporated for the PAJERO SPORT has been improved to 5speeds. The construction and function of this transmission is basically the same as V4A51.
- An super select 4WD II has been incorporated for 4WD system as same as the manual transmission

SPECIFICATIONS

Items		Specifications	
Transmission model		V5A51-7-SDA	V5A51-7-ACA
Engine model		4M4	6G7
Torque converter	Type	3-element, 1-stage, 2-phase type	
	Lock-up	Provided	
	Stall torque ratio	1.6	1.8
Transmission type		5 forward speeds, 1 reverse speed, fully automatic	
Transmission gear ratio	1st	3.789	
	2nd	2.057	
	3rd	1.421	
	4th	1.000	
	5th	0.731	
	Reverse	3.865	
Drive system		Super select 4WD II	
Transfer type		2-speed, constant mesh	
Transfer gear ratio	High	1.000	
	Low	1.900	
Clutch		Multi-disk type × 4 sets	
Brake		Multi-disk type × 2 sets, band type × 1 set	
Manual control system		P-R-N-D (4 positions) + sport mode (up, down)	
Shift pattern control		Electronic control (INVECS-II)	
Hydraulic control during shifting		Electronic control (Each clutch hydraulically independently controlled)	
Lock-up clutch control		Electronic control	
Transmission oil	Specified lubricants	~~DIA QUEEN ATF SP-III M~~ , ATF SP III or equivalent ! <i>II gear oil</i>	
	Quantity ℓ	9.3	
Transfer oil	Specified lubricants	Hypoid gear oil SAE 75W-90 or 75W-85W conforming to API GL-4	
	Quantity ℓ	2.8	

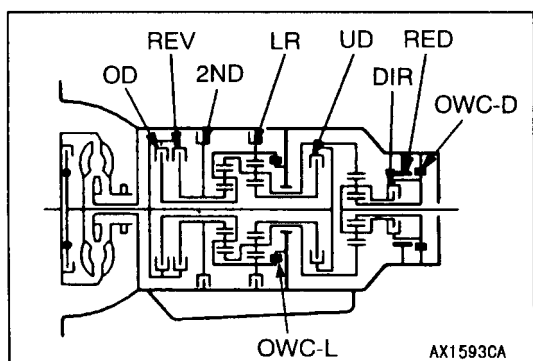
SECTIONAL VIEW

<V5A51>



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- | | |
|--------------------------------|---------------------------|
| 1. Damper clutch | 18. Transfer input gear |
| 2. Torque converter | 19. High/low clutch |
| 3. Oil pump | 20. Low speed gear |
| 4. Overdrive clutch | 21. Differential lock hub |
| 5. Reverse clutch | 22. 2WD/4WD synchronizer |
| 6. Overdrive planetary carrier | 23. Drive sprocket |
| 7. Second brake | 24. Chain |
| 8. Output planetary carrier | 25. Viscous coupling unit |
| 9. Low-reverse brake | 26. Center differential |
| 10. One-way clutch | 27. Rear output shaft |
| 11. Center support | 28. Transfer drive shaft |
| 12. Underdrive clutch | 29. Front output shaft |
| 13. Direct clutch | 30. Transfer counter gear |
| 14. Reduction brake band | 31. Output shaft |
| 15. One-way clutch | 32. Valve body |
| 16. Output shaft support | 33. Input shaft |
| 17. Parking gear | |



TRANSMISSION

NOTE

Refer to 2000 PAJERO SPORT Technical Information Manual (PYJE9804-A) for the contents except mentioned below.

The gear train consists of four multi-disc clutches, two multi-disc brakes, one band type brake, two one-way clutch, and three planetary gear sets. Each planetary gear set consists of a sun gear, carrier, pinion gears, and annulus gear.

Operating Elements and Their Functions

Operating element	Code	Function
Underdrive clutch	UD	Connects input shaft and underdrive sun gear
Reverse clutch	REV	Connects input shaft and reverse sun gear
Overdrive clutch	OD	Connects input shaft and overdrive planetary carrier
Direct clutch	DIR	Connects direct sun gear and direct planetary carrier
Low-reverse brake	LR	Locks low-reverse annulus gear and overdrive planetary carrier
Second brake	2ND	Locks reverse sun gear
Reduction brake	RED	Locks direct sun gear
One-way clutch <Direct clutch position>	OWC-D	Restricts rotating direction of direct sun gear
One-way clutch <Low reverse brake position>	OWC-L	Restricts rotating direction of low-reverse annulus gear

Selector Lever Positions and Operating Elements

Selector lever position		Operating element								
		Under drive clutch (UD)	Re-verse clutch (REV)	Over drive clutch (OD)	Direct clutch (DIR)	Low-reverse brake (LR)	Second brake (2ND)	Reduction brake (RED)	One-way clutch (OWC-D)	One-way clutch (OWC-L)
P	Parking					○		○		
R	Reverse		○			○		○		
N	Neutral					○		○		
D or sport mode	1st	○				○*		○	○	○
	2nd	○					○	○	○	
	3rd	○		○				○	○	
	4th	○		○	○					
	5th			○	○		○			

NOTE

*: Operates only when the vehicle is stationary (at approximately 10 km/h or less) and in the D range.

if in D range.

CLUTCHES

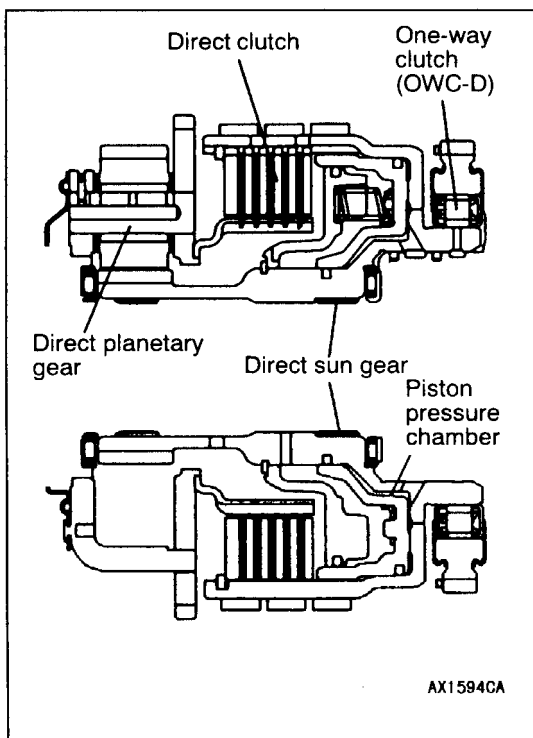
The gear changing mechanism utilizes four multi-disc clutches and two one-way clutches.

Underdrive Clutch

The underdrive clutch operates in 1st, 2nd, 3rd and 4th gears.

Overdrive Clutch

The overdrive clutch operates in 3rd, 4th and 5th gears.



Direct Clutch

The direct clutch is applied in the 4th and 5th speeds, and connects the direct planetary gears and direct sun gears. The direct clutch consists of the parts shown in the illustration at left. The hydraulic pressure is applied between the piston and retainer to transmit the drive force from the retainer to the hub when the piston presses against the clutch disc.

One-way Clutch

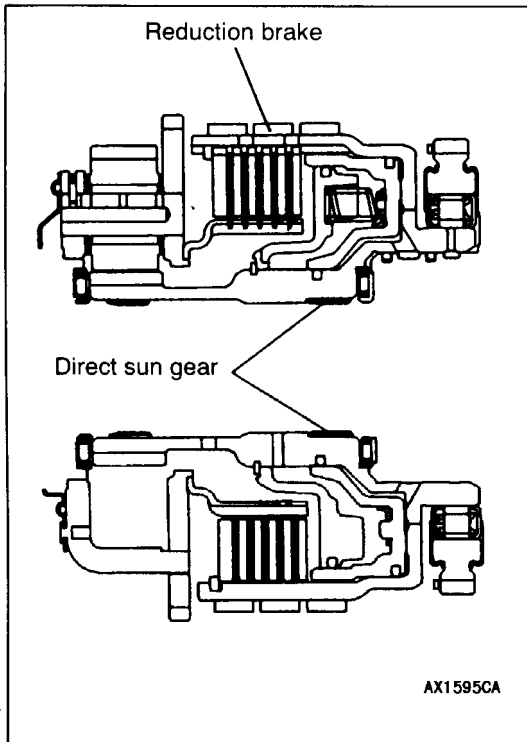
A sprag type one-way clutch is incorporated. This is applied in the 1st, 2nd and 3rd gears and limits the rotation direction to one direction. When the speed varies, the direct pinion turns in counterclockwise, so this clutch stops the direct sun gears from turning in clockwise.

BRAKES

The gear changing mechanism utilizes two multi-disc brakes and one band type brake.

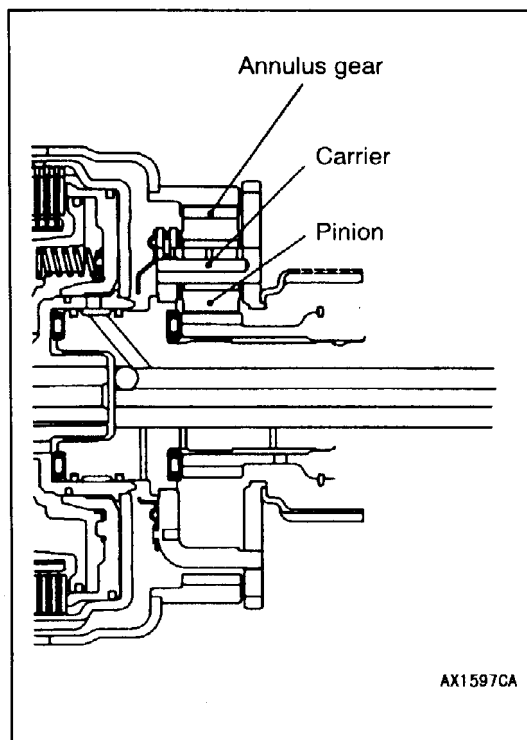
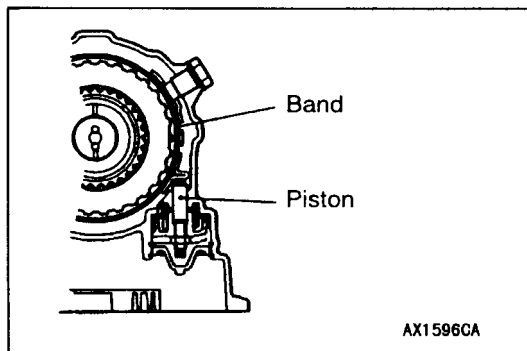
Second Brake

The second brake operates in 2nd and 5th gears and locks the reverse sun gear to the case.



Reduction brake

The reduction brake is applied in 1st, 2nd, 3rd or reverse gear or when shifting lever is at P or N to stop the direct sun gears and the overdrive planetary carrier to the case. The consists of the parts shown in the illustration at left. A structure that tightens the band by the reduction brake piston is incorporated.



POWER TRAIN

Direct planetary Gear

One set of planetary gears are incorporated on the output shaft side. The secondary gear ratio is produced by linking and fixing the carrier and sun gear.

POWER FLOW

First Gear

When the first gear is selected, the underdrive clutch, the one-way clutch (OWC-L), the low-reverse brake*, the reduction brake and the one-way clutch (OWC-D) are participating. The driving force from the input shaft is transmitted to the underdrive sun gear via the underdrive clutch. The driving force transmitted to the underdrive sun gear via the output pinion turns the low reverse annulus gear clockwise and at the same time turns the output planetary carrier counterclockwise with the fashion that the output pinion revolves around the underdrive sun gear.

However, since the one-way clutch (OWC-L) and the low-reverse brake* are engaged at this time, the low-reverse annulus gear is locked and the output planetary carrier only rotates counterclockwise.

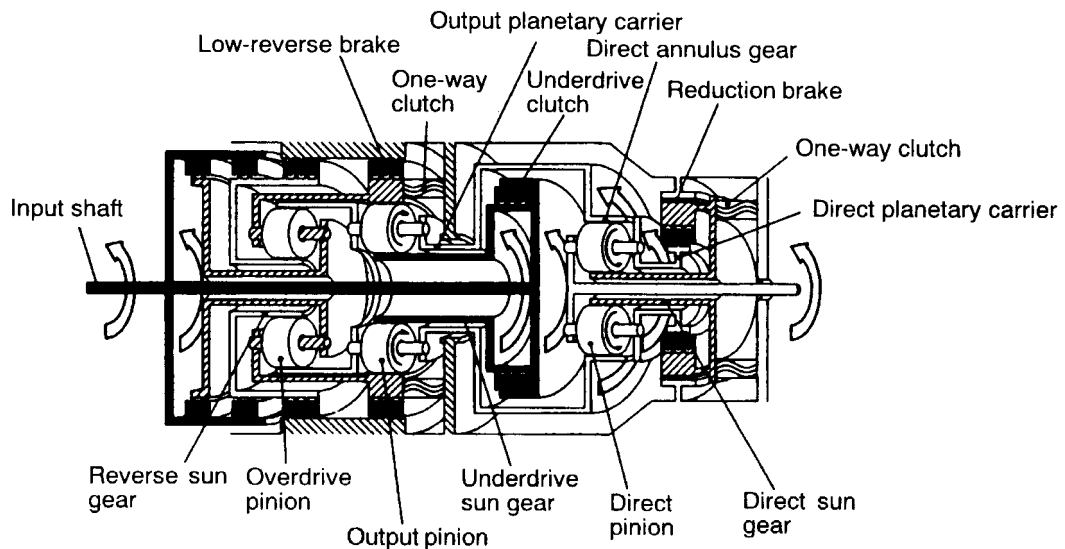
This driving force turns the direct pinion counterclockwise via the direct annulus gear. Since the

direct sun gear is locked by the one-way clutch, the direct planetary carrier rotates counterclockwise with the fashion that the direct pinion revolves around the direct sun gear to obtain reduction ratio of the first gear.

Since the output planetary carrier is connected to the output annulus gear, the overdrive pinion gear is driven at the same time. However, since the overdrive planetary carrier is locked by the one-way clutch (OWC-L) and the reverse sun gear is free to rotate, it runs idle and has no effect on the rotation of the output planetary carrier.

NOTE

*: The low-reverse brake is activated only when the vehicle is stationary (10 km/h or less) and in the D range.



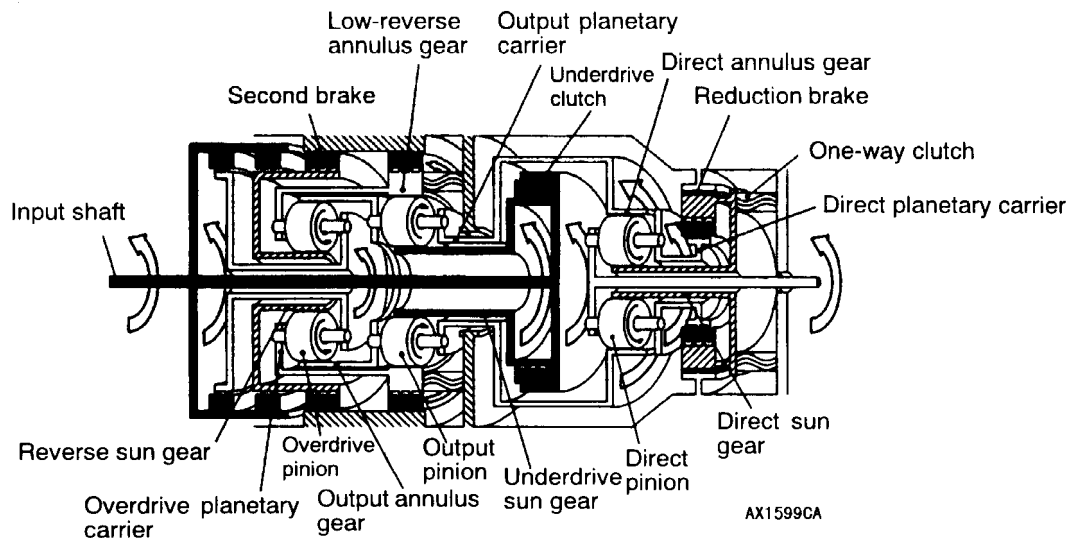
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Second Gear

When the second gear is selected, the underdrive clutch, the second brake, the reduction brake and the one-way clutch (OWC-D) are participating. The second brake is operated under the first gear condition, the reverse sun gear is locked and the driving force from the output annulus gear turns the overdrive planetary carrier counterclockwise with the fashion that the overdrive pinion revolves around the reverse sun gear.

Since the overdrive planetary carrier is connected

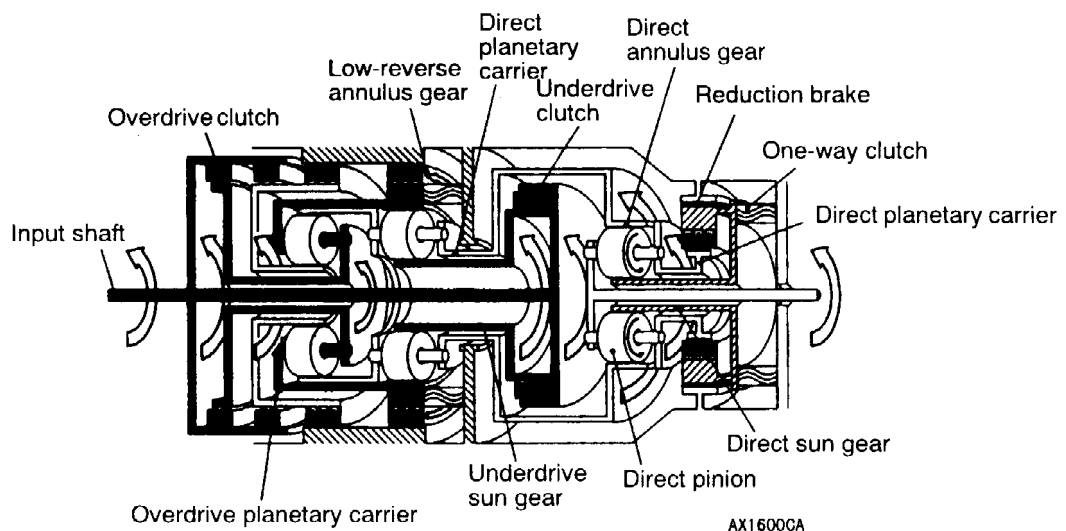
with the low-reverse annulus gear, the low-reverse annulus gear also rotates counterclockwise. This rotation of the low-reverse annulus gear is transmitted to the direct annulus gear via the output pinion, however, since the elements of the direct planetary gear are the same as that of the first gear, rotation amount of the low-reverse annulus gear is added to the rotation of the output planetary carrier to obtain the reduction ratio of the second gear.



Third Gear

When the third gear is selected, the underdrive clutch, the overdrive clutch, the reduction brake and the one-way clutch (OWC-D) are participating. Since the overdrive clutch connects the input shaft with the overdrive planetary carrier and the low reverse annulus gear, the rotation speed of the underdrive sun gear that is connected with the input shaft by the underdrive clutch and the rotation speed of the low-reverse annulus gear become

equal. Under this condition, the planetary gear set is locked and rotates as one body to transmit the driving force to the direct annulus gear. The operation of the direct planetary carrier elements is the same as the first gear, therefore, the reduction ratio of the third gear is obtained by the configuration that the planetary gear set rotates as one body under locked condition.

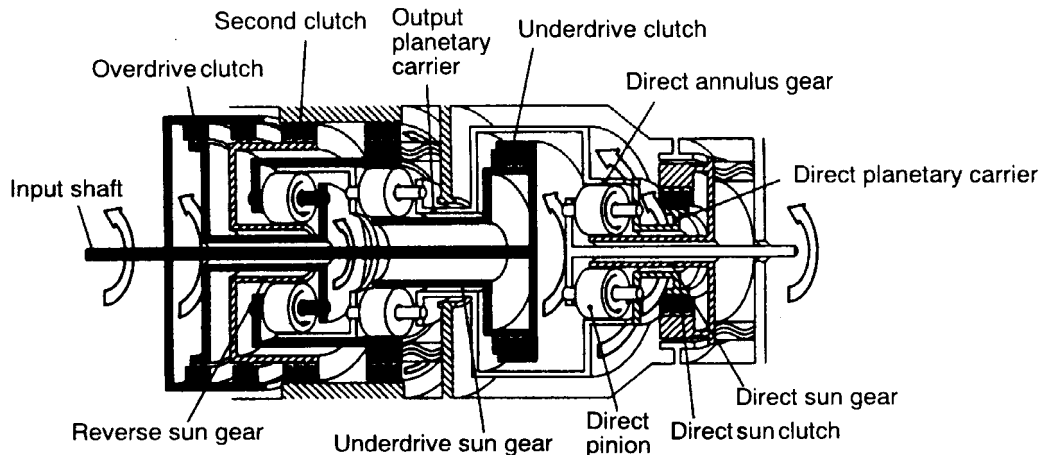


Fourth Gear

When the fourth gear is selected, the underdrive clutch, the overdrive clutch and the direct clutch are participating.

The operating condition of input shaft elements is the same as that of the third gear, where the planetary gear set is locked to rotate as one body. The driving force input to the output planetary carrier is transmitted from the direct annulus gear

connected with the output planetary carrier, via the direct pinion, to the direct sun gear and turns it clockwise. On the other hand, since the direct sun gear is connected with the direct planetary carrier by the direct clutch, they rotate counterclockwise as one body to obtain the reduction ratio of the fourth gear.



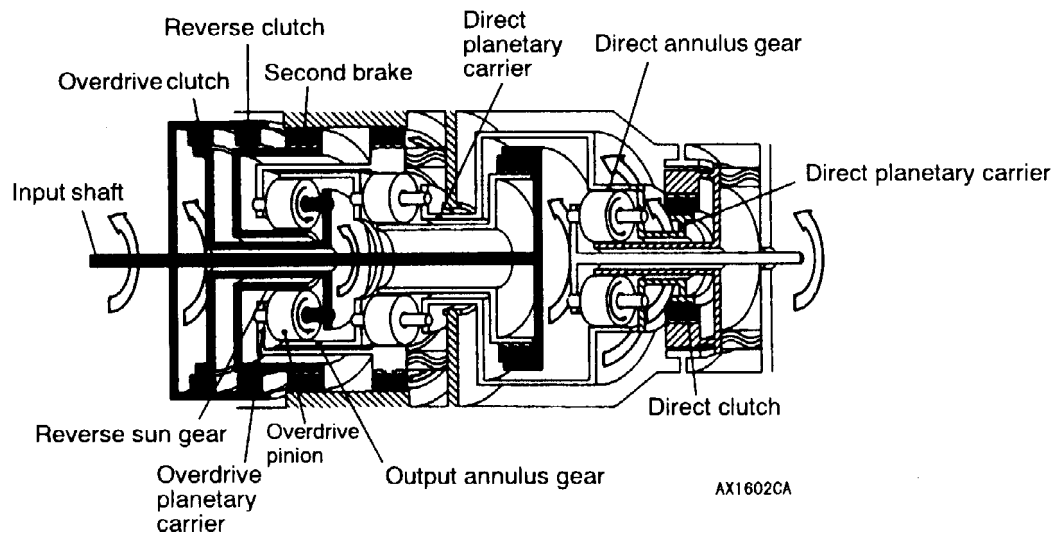
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Fifth Gear

When the fifth gear is selected, the overdrive clutch, the direct clutch and the second brake are participating.

The driving force of the input shaft is transmitted to the overdrive planetary carrier via the reverse clutch. On the other hand, since the reverse sun gear is locked by the second brake, rotation amount of the overdrive pinion that revolves around the reverse sun gear is added to the rotation of the overdrive planetary carrier and the resultant rotation

is transmitted to the output annulus gear. This driving force is then transmitted to the output planetary carrier that is connected to the overdrive planetary carrier and the direct annulus gear. Since the operating elements of the direct planetary carrier are the same as that of the fourth gear, the reduction ratio of the fifth gear is obtained by the revolution of the overdrive pinion.



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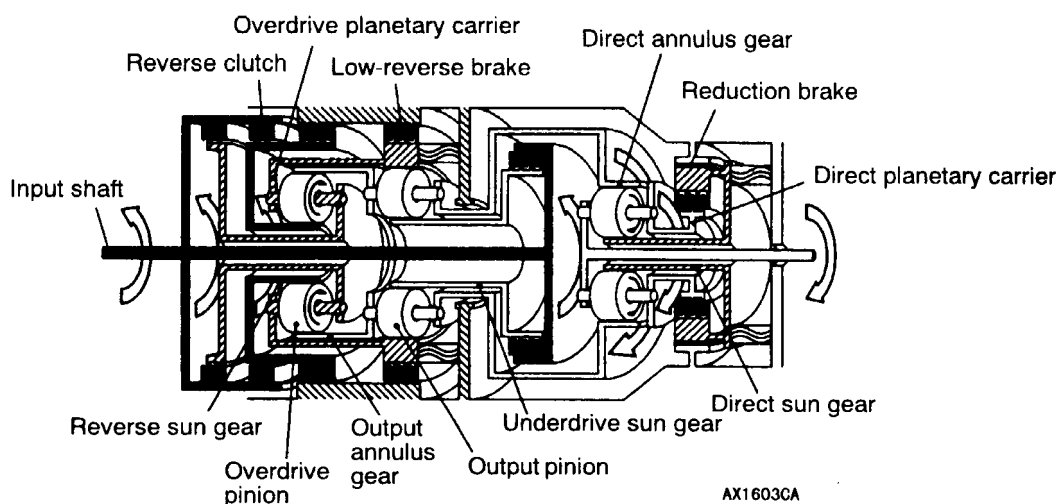
Reverse

When the reverse gear is selected, the reverse clutch, the low-reverse brake and the reduction brake are participating.

The driving force of the input shaft is transmitted to the reverse sun gear via the reverse clutch. On the other hand, since the overdrive planetary carrier is locked by the low-reverse brake, the driving force of the reverse sun gear is transmitted to the output annulus gear via the overdrive pinion as the clockwise rotating force. This driving force is then transmitted to the direct annulus gear via the output planetary carrier. Since the direct sun gear is locked

by the reduction brake, rotation amount of the direct pinion that revolves around the direct sun gear is added to rotate the direct planetary carrier clockwise. Thus the reduction ratio of reverse gear is obtained.

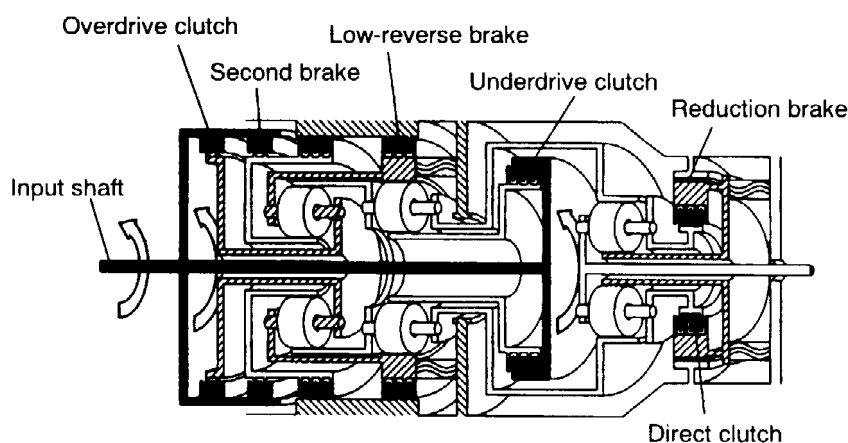
At this time, the output pinion is driven by the output planetary carrier, however, since the underdrive sun gear is free to rotate, it runs idle and has no effect on the rotation of the output planetary carrier.



Parking and Neutral

In parking and neutral, all of the clutches are disengaged and driving force from the input shaft is not transmitted to the planetary carrier. To enable

a quick shift to 1st gear or reverse, the low-reverse brake and reduction brake is operational.

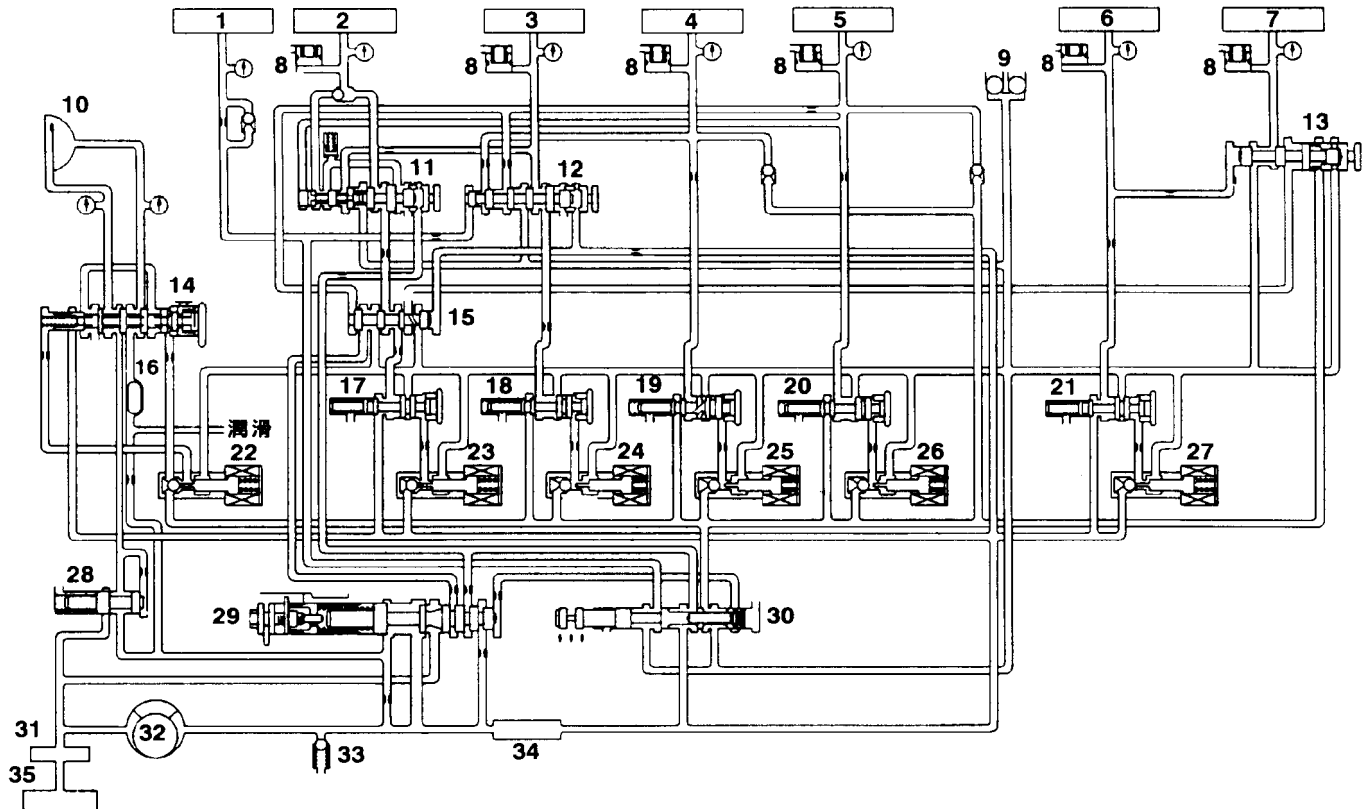


HYDRAULIC CONTROL SYSTEM

NOTE

Refer to 2000 PAJERO SPORT Technical Information Manual (PYJE9804-A) for the contents except mentioned below.

Hydraulic Circuit (Neutral)



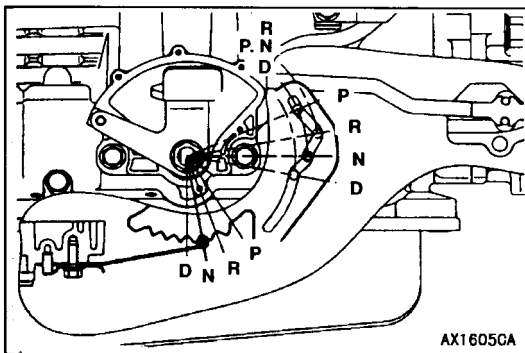
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- | | |
|--------------------------------|--------------------------------|
| 1. REV clutch | 19. UD pressure control valve |
| 2. LR clutch | 20. OD pressure control valve |
| 3. 2ND brake | 21. RED pressure control valve |
| 4. UD clutch | 22. DCC solenoid valve |
| 5. OD clutch | 23. LR solenoid valve |
| 6. RED brake | 24. 2ND solenoid valve |
| 7. DIR clutch | 25. UD solenoid valve |
| 8. Accumulator | 26. OD solenoid valve |
| 9. Check ball | 27. RED solenoid valve |
| 10. Damper clutch | 28. Torque converter pressure |
| 11. Failsafe valve A | 29. Regulator valve |
| 12. Failsafe valve B | 30. Manual valve |
| 13. Failsafe valve C | 31. Oil filter |
| 14. Damper clutch | 32. Oil pump |
| 15. Switch valve | 33. Relief valve |
| 16. Oil cooler | 34. Oil strainer |
| 17. LR pressure control valve | 35. Oil pan |
| 18. 2ND pressure control valve | |

Regulator Valve

The regulator valve maintains the hydraulic pressure from the oil pump at a constant line pressure.

Gear	Line pressure kPa
Parking and neutral	290
1st and 2nd	1,030
3rd, 4th and 5th	830
Reverse	1,520

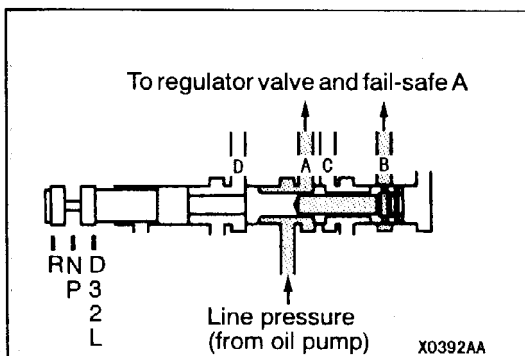


Manual Valve

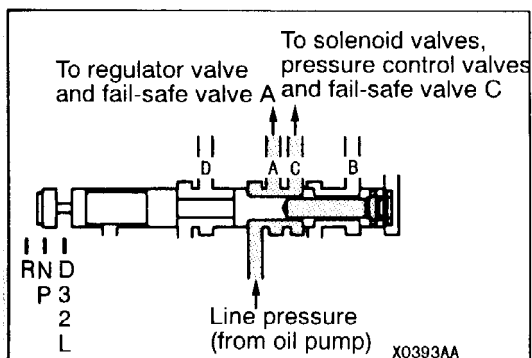
- The manual valve is interlocked with the selector lever next to the driver's seat. In accordance with the selector lever position, the manual valve switches fluid from one passage to another and thus feeds line pressure to the relevant valves.
- The selector lever has four positions of P, R, N and D, but the manual valve has only three positions of R, P-N and D because the valve positions are the same for P and N due to the action of the detent lever.

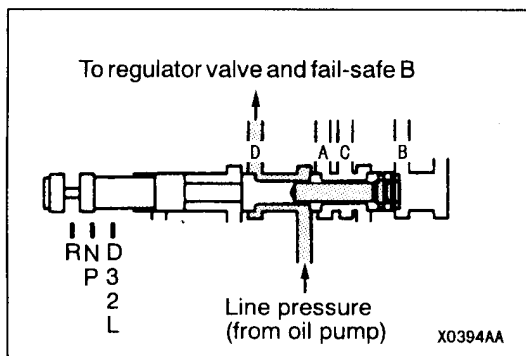
[Operation]

- (1) With the manual valve in the N-P position port A and port B are open such that line pressure is supplied to the regulator valve and fail-safe valve A.

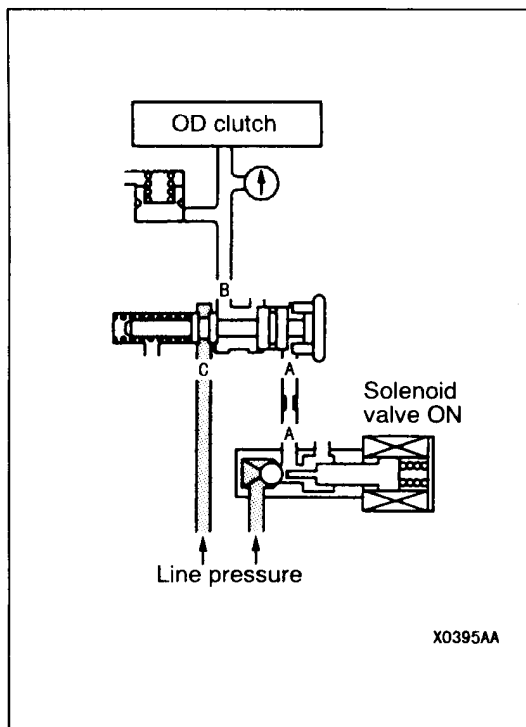


- (2) With the manual valve in the D position, port C and port D are open, in addition to the valves in step (1) [the N-P position], oil pressure is supplied to each solenoid valve and pressure control valve of the DCC clutch, the 2ND brake, the UD clutch, the OD clutch and the fail safe valve C.





- (3) With the manual valve in the R position, port E is open. Line pressure is thus supplied to the reverse clutch and fail-safe valve B.



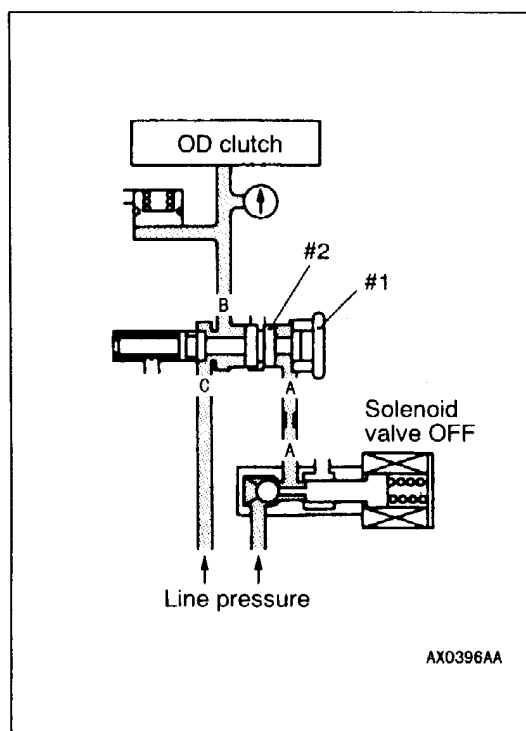
Pressure Control Valves and Solenoid Valves

- With the exception of the reverse clutch, there is one pressure control valve and one solenoid valve for every clutch and brake. The direct clutch uses either of the pressure control valve and the solenoid valve for the low-reverse brake by switching the switch valve.
- Under the control of the solenoid valves, the pressure control valves regulate the hydraulic pressure acting upon the elements and thus prevent the occurrence of shock during gear shifts.
- The solenoid valves are duty-controlled by signals from the A/T-ECU, converting these electric signals into hydraulic pressure.

[Operation]

The pressure control valves vary in shape but all operate in the same manner. By way of example, the following section describes the operation of the OD clutch arrangement.

- (1) When the solenoid valve is ON and the OD clutch is not operational, the fluid passage from the solenoid valve is closed, so there is no hydraulic pressure in line A. At this time, the pressure control valve is pushed toward the right by the force of its spring. Thus, port B is closed, and no hydraulic pressure is supplied to the OD clutch.
- (2) When the OD clutch becomes operational, the A/T-ECU instructs the solenoid valve to depress the check ball. This opens the fluid passage to line A, thus supplying hydraulic pressure to the pressure control valve. When hydraulic pressure is supplied from line A to the pressure control valve, the leftward force on the valve resulting from the surface area difference between land #1 and land #2 overcomes the force of the spring and pushes the valve toward the left. As a result, port B opens allowing the line pressure in line C to be supplied to the OD clutch. When the gear shift is complete, the solenoid valve is turned OFF, so the hydraulic pressure supplied to the OD clutch becomes equal to the line pressure.

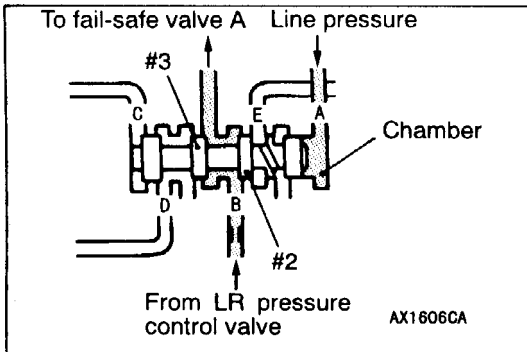


Switch Valve

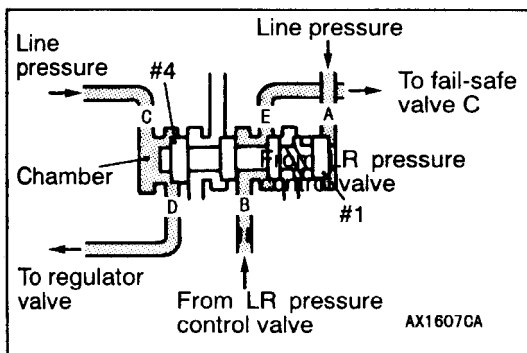
- When the OD clutch operates, hydraulic pressure from the switch valve is supplied to the regulator valve. As a result, the line pressure is reduced in 3rd, 4th and 5th gears.
- When the control relay is OFF and the fail-safe mechanism operates, the supply of hydraulic pressure from the LR pressure control valve to the LR brake is cut.

[Operation]

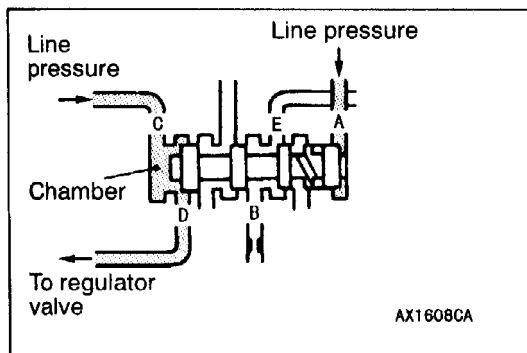
- (1) In gears other than 3rd, 4th and 5th, line pressure is supplied from port A to a chamber on the right-hand side of the valve. The valve is thus pushed toward the left. Even when hydraulic pressure is supplied from the LR pressure control valve to port B, the valve does not move since land #2 and land #3 have the same surface area.



- (2) In 3rd, 4th and 5th gears, hydraulic pressure is supplied also from port C to a chamber on the left hand side of the valve. Due to the surface area difference between land #1 and land #4, the valve is pushed toward the right. As a result, port D opens, and hydraulic pressure is supplied to the regulator valve. Since the port E is opened as well, when the oil pressure is supplied to port B, it is supplied to the direct clutch via the fail-safe valve C.

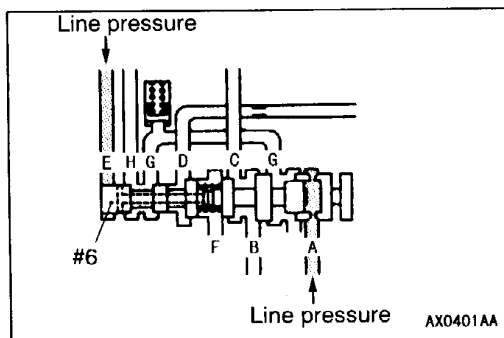
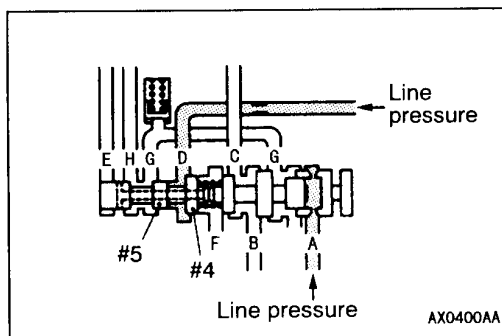
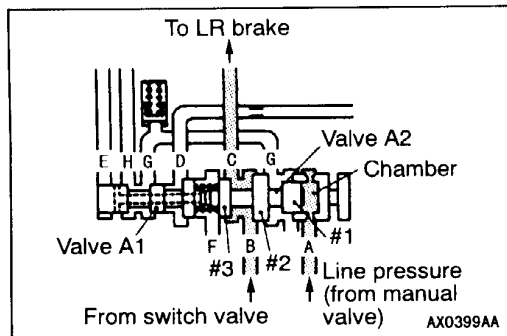


- (3) When the fail-safe mechanism operates, the solenoid valve is turned OFF. Hydraulic pressure is thus supplied to port B. In 3rd gear, however, the valve is pushed toward the right irrespective of the LR solenoid valve's condition. Also, land #2 and land #3 have the same surface area, so the valve does not move even if hydraulic pressure is supplied to port B.



Fail-Safe Valve A

- Fail-safe valve A releases the LR brake hydraulic pressure in the event of a fail-safe condition.
- In reverse, fail-safe valve A changes the fluid passage to the LR brake, and thus achieves quick, smooth gear shifts.

**[Operation]****(1) Neutral and First Gear**

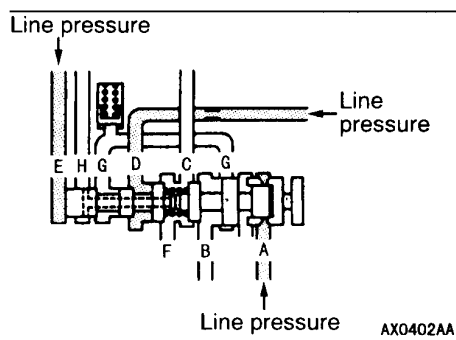
Line pressure from the manual valve is supplied by port A to a chamber on the right-hand side of the valve. Also, hydraulic pressure from the LR pressure control valve is supplied to port B via the switch valve. Thus, the force acting on land #1 overcomes the sum of the spring force and the force resulting from the surface area difference between land #2 and land #3. Valve A1 and valve A2 are thus pushed toward the left. As a result, port C opens, and hydraulic pressure from the LR pressure control valve is supplied to the LR brake.

(2) Second Gear

In addition to port A hydraulic pressure is supplied to port D. Thus, the force resulting from the hydraulic pressure acting upon land #1 overcomes the force resulting from the surface area difference between land #4 and land #5. As a result, valve A1 and valve A2 are pushed toward the left.

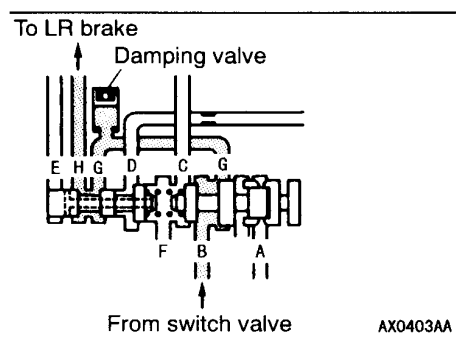
(3) Third Gear and Fourth Gear

In addition to port A, hydraulic pressure is supplied to port E. Thus, the force resulting from the hydraulic pressure acting upon land #1 overcomes the force resulting from the hydraulic pressure acting upon land #6. As a result, valve A1 and valve A2 are pushed toward the left.



(4) Fail-Safe Condition and Fifth Gear

In the event of a fail-safe condition resulting from a fault in the 2ND or OD solenoid valve, hydraulic pressure is supplied to either or both of ports E and D in addition to the pressure supplied to port A and port B. Thus, the sum of [the force resulting from the hydraulic pressure acting on land #6 or from the surface area difference between land #4 and land #5] and [the force resulting from the surface area difference between land #2 and land #3] overcomes the force resulting from the hydraulic pressure acting upon land #1. As a result, valve A1 and valve A2 are pushed toward the right. The LR brake pressure is thus discharged, and an interlock is prevented. In 5th gear too, valve A1 and valve A2 are pushed toward the right in this manner.

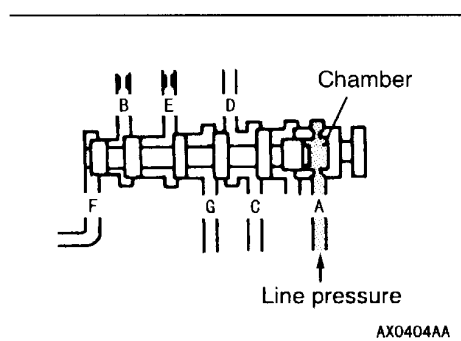


(5) Reverse

In reverse, so no hydraulic pressure is supplied to port A. Hydraulic pressure is supplied only from port B. As a result, valve A2 is pushed toward the right by the spring force and the force resulting from the surface area difference between land #2 and land #3. Valve A is pushed toward the left by the spring force. As a result, the LR brake pressure passes through port C and is rapidly released from port F, and the supply pressure is connected to the LR brake via port G and port H. By switching the hydraulic pressure supply line to the LR brake and temporarily dropping the supply pressure to the LR brake, this arrangement enables quick, smooth control of N→R and P→R shifts.

Fail-Safe Valve B

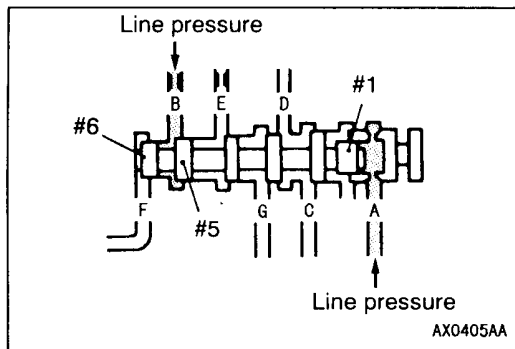
In the event of a fail-safe condition (when the control relay is OFF), fail-safe valve B cuts the supply of hydraulic pressure from the 2ND pressure control valve to the 2ND brake.



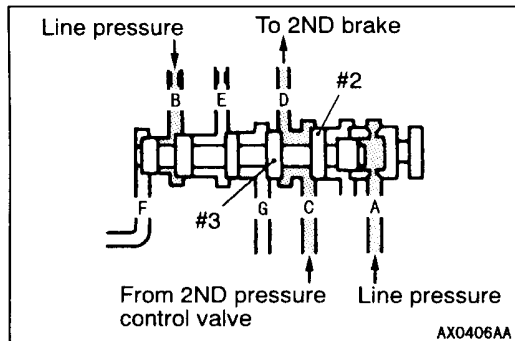
[Operation]

(1) Neutral

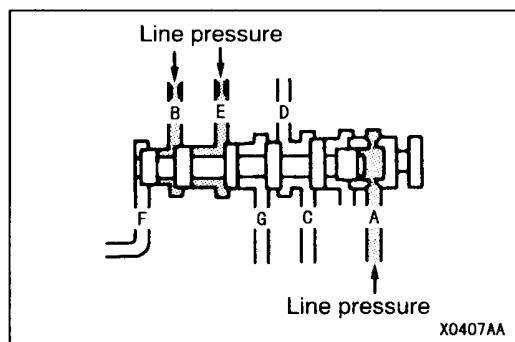
Line pressure is supplied from port A to a chamber on the right-hand side of the valve, so the valve is pushed toward the left.

**(2) First Gear**

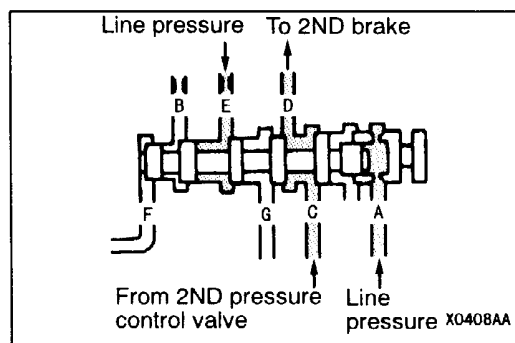
In addition to port A, hydraulic pressure is supplied to port B. Thus, the force resulting from the hydraulic pressure acting upon land #1 overcomes the force resulting from the surface area difference between land #5 and land #6. As a result, the valve is pushed toward the left.

**(3) Second Gear**

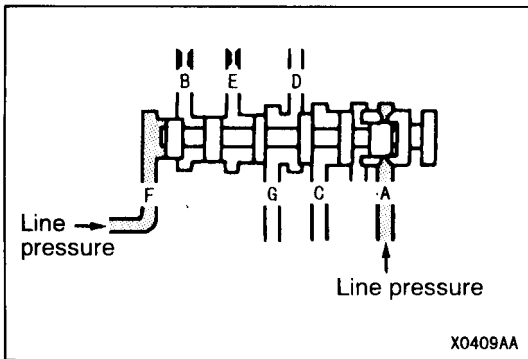
In addition to port A, hydraulic pressure is supplied to port B and, from the 2ND pressure control valve, to port C. Thus, the force resulting from the hydraulic pressure acting upon land #1 overcomes the sum of [the force resulting from the surface area difference between land #2 and land #3] and [the force resulting from the surface difference between land #5 and land #6]. As a result, the valve is pushed toward the left. This causes port D to open, so hydraulic pressure is supplied from the 2ND pressure control valve to the 2ND brake.

**(4) Third Gear and Fourth Gear**

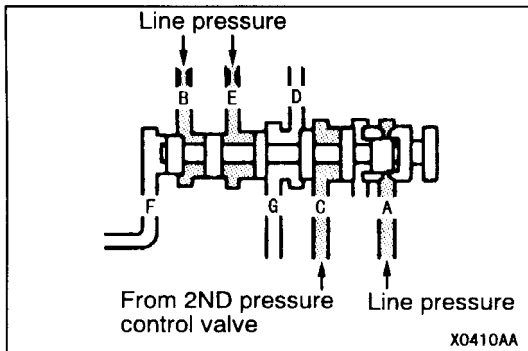
In addition to port A, hydraulic pressure is supplied to port B. Pressure is supplied also to port E. Thus, the force resulting from the hydraulic pressure acting upon land #1 overcomes the force resulting from the surface area difference between land #4 and land #6. As a result, the valve is pushed toward the left.

**(5) Fifth Gear**

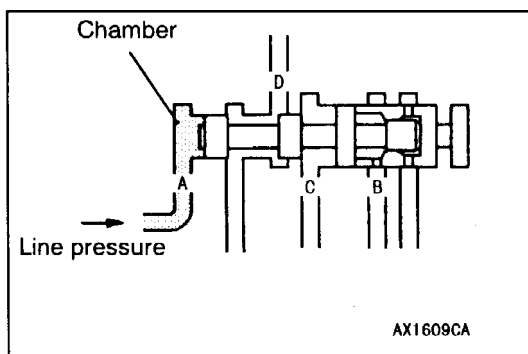
In addition to port A, hydraulic pressure is supplied to port C and port E. Thus, the force resulting from the hydraulic pressure acting upon land #1 overcomes the sum of [the force resulting from the hydraulic pressure acting upon the surface area difference between land #2 and land #3] and [the force resulting from the hydraulic pressure acting upon the surface area difference between land #4 and land #5]. As a result, the valve is pushed toward the left. This causes port D to open, so hydraulic pressure is supplied from the 2ND pressure control valve to the 2ND brake.

**(6) Reverse**

In addition to port A, line pressure from the manual valve is supplied from port F to a chamber at the right-hand side of the valve. Thus, the surface areas of land #1 and land #6 cause the valve to be pushed to the right.

**(7) Fail-Safe Operation (Control Relay OFF)**

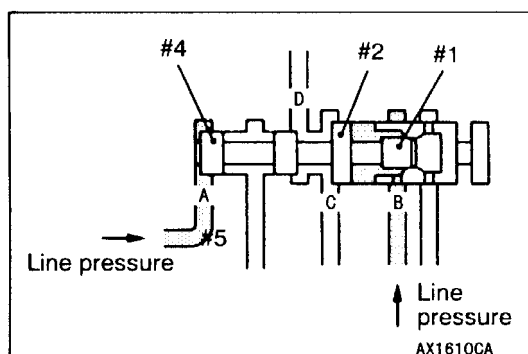
In the event of a fail-safe condition, the solenoid valve is turned OFF, so hydraulic pressure is supplied to port C. Thus, the force resulting from the hydraulic pressure acting upon land #1 overcomes the sum of [the force resulting from the surface area difference between land #2 and land #3] and [the force resulting from the surface area difference between land #4 and land #6]. As a result, port D is connected to port G the 2ND brake hydraulic pressure is released. Also, the hydraulic pressure from the 2ND pressure control valve is cut by fail-safe valve B.

**Fail-Safe Valve C**

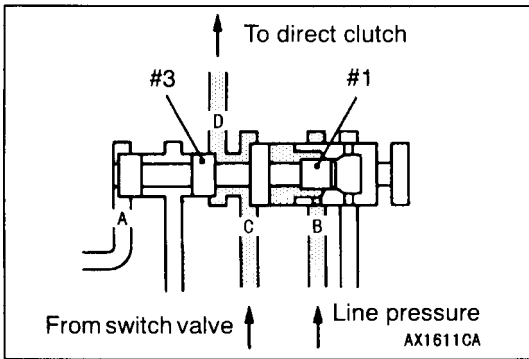
At fail-safe condition (control relay OFF), this valve cuts the oil pressure supply from the switch valve to the direct clutch.

[Operation]**(1) Neutral and Reverse**

Since the line pressure is supplied from the port A to the left chamber of the valve, the valve is pushed right.

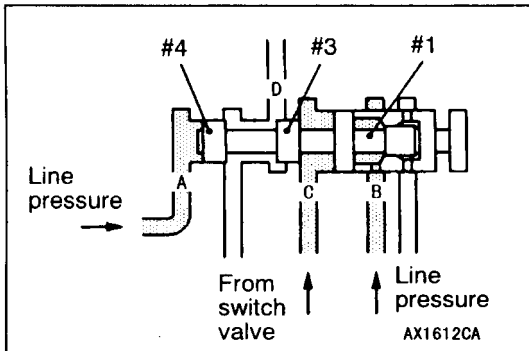
**(2) First Gear, Second Gear and Third Gear**

The line pressure is supplied from the port A and the port B. The force generated by oil pressure acting on the area difference of the land #1 and the land #2 overcomes the force generated by oil pressure acting on the land #4, therefore the valve is pushed left.



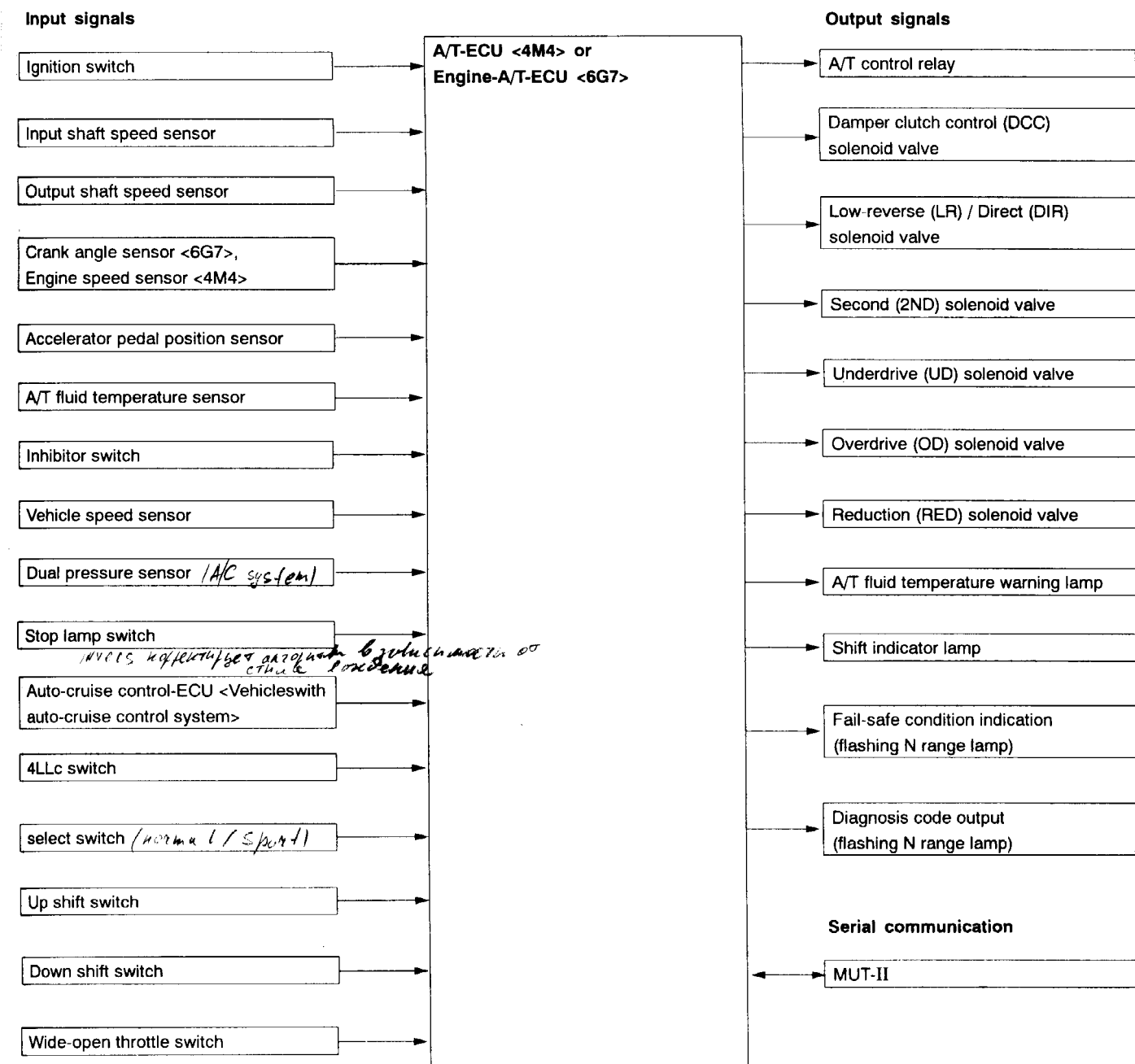
(3) Fourth Gear and Fifth Gear

Oil pressure is supplied to the port C in addition to the port B, but oil pressure is not supplied to the port A. Due to the force generated by oil pressure acting on the area difference of the land #1 and the land #3, the valve is pushed left. Thus the port D is opened to supply the oil pressure from the port C of the switch valve to the direct clutch.



(4) Fail-Safe Operation (Control Relay OFF)

Oil pressure is supplied from port B, port C and port A. Since the land #3 and the land #4 have the same area, the valve is pushed right by the oil pressure acting on the land #1. Accordingly, the oil pressure existing in the port D is exhausted from port E and the oil pressure supply from the port C of the switch valve to the direct clutch is cut.

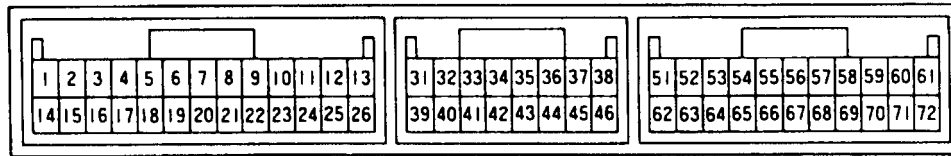


SENSORS AND ACTUATORS

Item		Function
Sensor	Input shaft speed sensor	Detects when input shaft speed
	Output shaft speed sensor	Detects when output shaft speed
	Crank angle sensor <6G7>, Engine speed sensor <4M4>	Detects engine speed
	Accelerator pedal position sensor	Detects extent of accelerator pedal depression
	A/T fluid temperature sensor	Detects A/T fluid temperature
	Inhibitor switch	Detects selector lever position
	Stop lamp switch	Detects brake operation/inoperation
	Vehicle speed sensor	Detects vehicle speed
	Dual pressure switch	Detects air conditioner operation/inoperation
	Auto-cruise control-ECU <Vehicles with auto-cruise control system>	Uses an ON/OFF signal to detect an OD-OFF demand from the auto-cruise control-ECU
	Transfer low detection switch	Detects that high or low is selected
	Select switch	Detects that sport mode is selected
	Up shift switch	Detects up–shift request of sport mode
	Down shift switch	Detects downshift request of sport mode
	Wide-open throttle switch	Detects that the accelerator pedal is depressed by means of a contact switch at the pedal
Actuator	A/T control relay	Turns solenoid valve power supply circuit ON/OFF
	DCC solenoid valve	Regulates hydraulic pressure to damper clutch control valve
	LR/DIR solenoid valve	Regulates hydraulic pressure to pressure control valve (for gear shift control)
	2ND solenoid valve	
	UD solenoid valve	
	OD solenoid valve	
	RED solenoid valve	
	N range lamp	Indicates that fail-safe is active and shows a diagnosis code
	Shift indicator lamp	Indicates present shift stage by lamp in combination meter
	A/T fluid temperature warning lamp	Gives a warning about A/T fluid temperature

CONTROL UNIT

The A/T-ECU uses a hybrid-type 64-pin connector of this connector are arranged as shown below.
<4M4>, 119-pin connector <6G7>. The terminals

<4M4>

9FA0133

- | | |
|--|---|
| 1. Underdrive solenoid valve | 37. – |
| 2. Solenoid valve power supply | 38. Back-up power supply |
| 3. Solenoid valve power supply | 39. – |
| 4. 1st gear shift indicator lamp | 40. – |
| 5. 3rd gear shift indicator lamp | 41. – |
| 6. 5th gear shift indicator lamp | 42. – |
| 7. A/T fluid temperature warning lamp | 43. Sensor earth |
| 8. – | 44. A/T fluid temperature sensor |
| 9. 4LLc switch | 45. Accelerator pedal position sensor (APS) |
| 10. A/C compressor load signal | 46. – |
| 11. Power supply | 51. Reduction solenoid valve |
| 12. Earth | 52. – |
| 13. Earth | 53. Communication output to engine-ECU |
| 14. Overdrive solenoid valve | 54. Communication input to engine-ECU |
| 15. Damper clutch control solenoid valve | 55. Inhibitor switch P |
| 16. Second solenoid valve | 56. Inhibitor switch N |
| 17. 2nd gear shift indicator lamp | 57. Select switch |
| 18. 4th gear shift indicator lamp | 58. Down shift switch |
| 19. – | 59. Stop lamp switch |
| 20. – | 60. – |
| 21. – | 61. – |
| 22. – | 62. Low-reverse / direct solenoid valve |
| 23. Diagnosis control | 63. Diagnosis output |
| 24. Power supply | 64. – |
| 25. Earth | 65. Wide-open throttle switch |
| 26. Earth | 66. Inhibitor switch R |
| 31. Input shaft speed sensor | 67. Inhibitor switch D |
| 32. Output shaft speed sensor | 68. Up shift switch |
| 33. Engine speed sensor | 69. Vehicle speed sensor |
| 34. – | 70. – |
| 35. – | 71. A/T control relay |
| 36. – | 72. Earth |

<6G7>

1	2	3	4		5	6	7	8	41	42	43		44	45	46	71	72	73	74		75	76	77	101	102	103	104		105	106	107																				
9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		47	48	49	50	51	52	53	54	55	56	57	78	79	80	81	82	83	84	85	86	87	88	89	108	109	110	111	112	113	114	115	116	117	118	119	120
24	25	26	27	28	29	30	31	32	33	34	35		58	59	60	61	62	63	64	65	66		90	91	92	93	94	95	96	97	98		121	122	123	124	125	126	127	128	129	130									

9FA0253

- | | |
|---|---|
| 1 to 6. Engine use | 98. Engine use |
| 7. A/T fluid temperature warning lamp | 101. Inhibitor switch P |
| 8 to 35. Engine use | 102. Inhibitor switch D |
| 41 to 44. Engine use | 103. Input shaft speed sensor |
| 45. Crank angle sensor | 104. Output shaft speed sensor |
| 46 to 49. Engine use | 105. 1st gear shift indicator lamp |
| 50. A/T control relay | 106. Second solenoid valve |
| 51 to 56. Engine use | 107. Damper clutch control solenoid valve |
| 57. Sensor earth | 108. Inhibitor switch R |
| 58 to 65. Engine use | 109. Select switch |
| 66. Backup power supply | 110. Down shift switch |
| 71 to 74. Engine use | 111. — |
| 75. — | 112. 4LLc switch |
| 76. Earth | 113. — |
| 77. Solenoid valve power supply | 114. — |
| 78. — | 115. Wide-open throttle switch |
| 79. — | 116. — |
| 80. Vehicle speed sensor | 117. 3rd gear shift indicator lamp |
| 81. Sensor earth | 118. 2nd gear shift indicator lamp |
| 82. Engine use | 119. Reduction solenoid valve |
| 83. A/C compressor load signal | 120. Underdrive solenoid valve |
| 84. Diagnosis control | 121. Inhibitor switch N |
| 85. Diagnosis output | 122. Up shift switch |
| 86. — | 123. Stop lamp switch |
| 87. — | 124. A/T fluid temperature sensor |
| 88. Earth | 125. — |
| 89. Solenoid valve power supply | 126. — |
| 90 to 94. Engine use | 127. 5th gear shift indicator lamp |
| 95. Accelerator pedal position sensor (APS) | 128. 4th gear shift indicator lamp |
| 96. — | 129. Low-reverse / direct solenoid valve |
| 97. Earth | 130. Overdrive solenoid valve |

CONTROL OVERVIEW**Shift Control****(1) Solenoid Valve Operation**

In each gear, the solenoid valves are controlled as appropriate by instructions from the A/T-ECU.

Gear	LR/DIR	2ND	UD	OD	RED
1st	OFF*/ON [LR]	ON	OFF	ON	OFF
2nd	ON [LR]	OFF	OFF	ON	OFF
3rd	ON [DIR]	ON	OFF	OFF	OFF
4th	OFF [DIR]	ON	OFF	OFF	ON
5th	OFF [DIR]	OFF	ON	OFF	ON
Reverse	OFF [LR]	ON	ON	ON	OFF
Neutral/Parking	OFF [LR]	ON	ON	ON	OFF

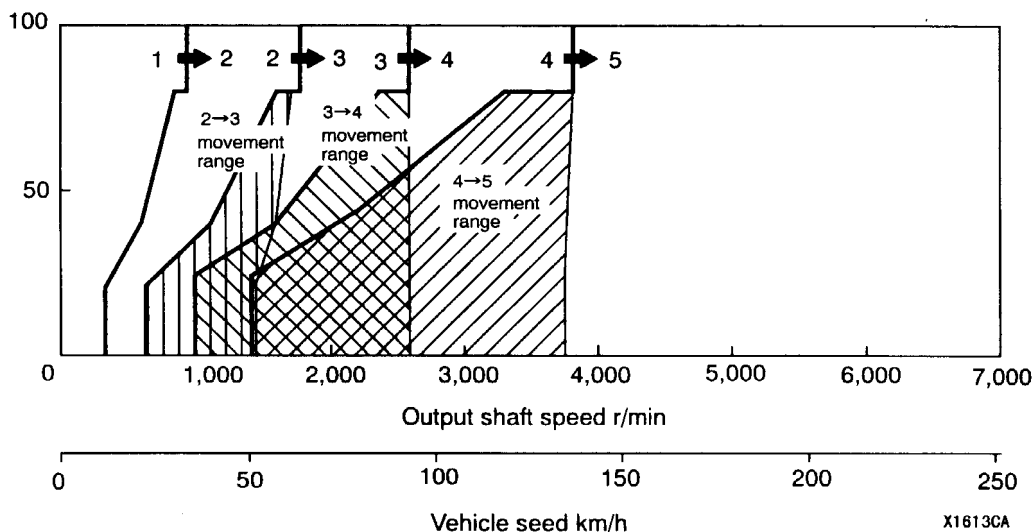
NOTE

*: Only when in the D range and the vehicle is stationary (approx. 10 km/h or less).

(2) Shift Pattern Control**<4M4>****UPSHIFT PATTERN**

Throttle opening %

Thick line: Standard shift pattern

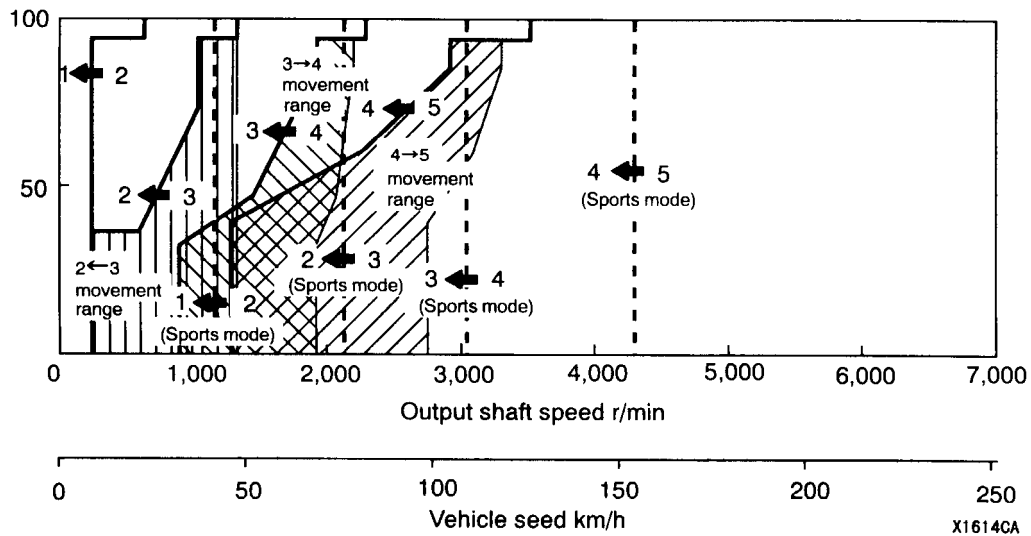


X1613CA

DOWNSHIFT PATTERN

Throttle opening %

Thick line: Standard shift pattern

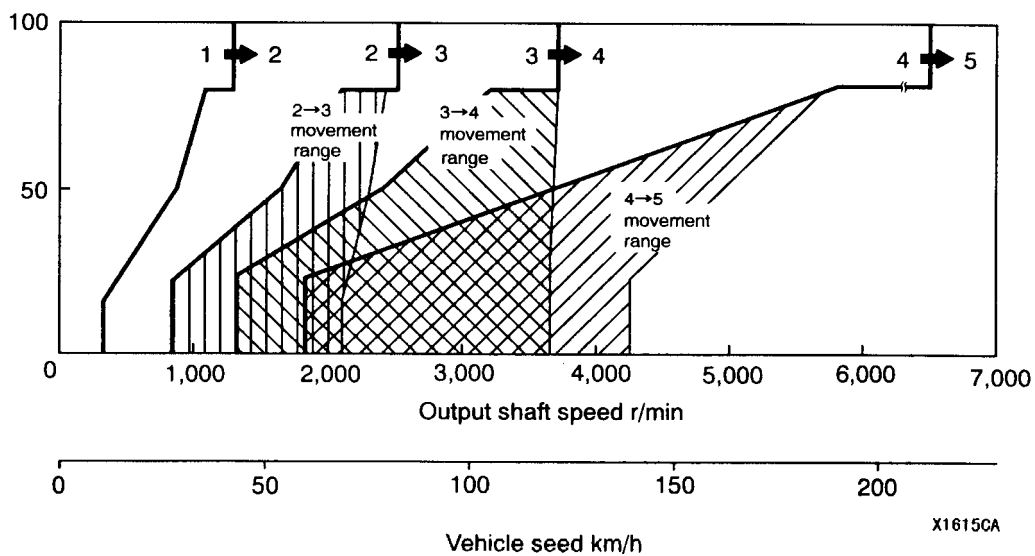


<6G7>

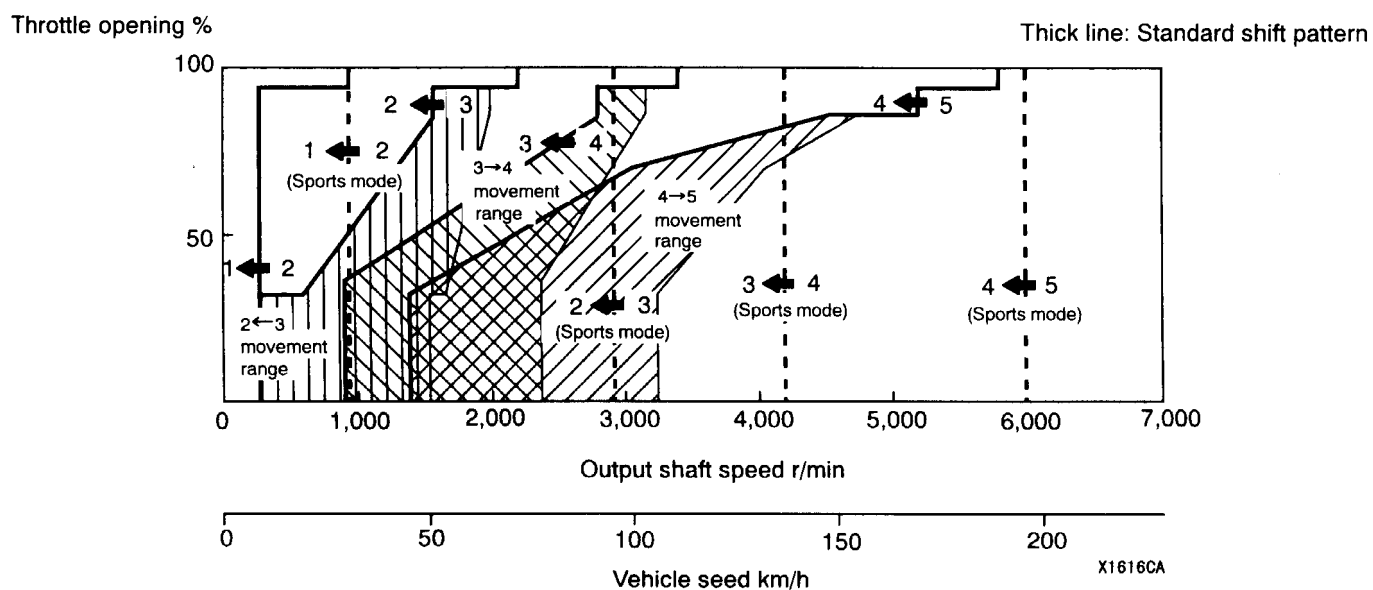
UPSHIFT PATTERN

Throttle opening %

Thick line: Standard shift pattern



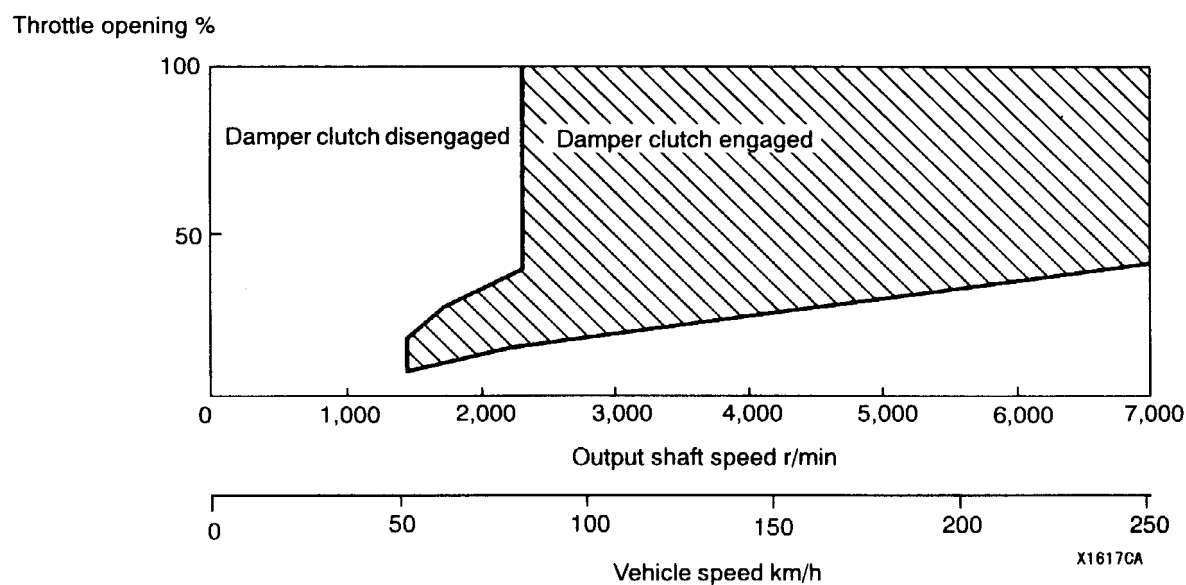
DOWNSHIFT PATTERN



Damper Clutch Control

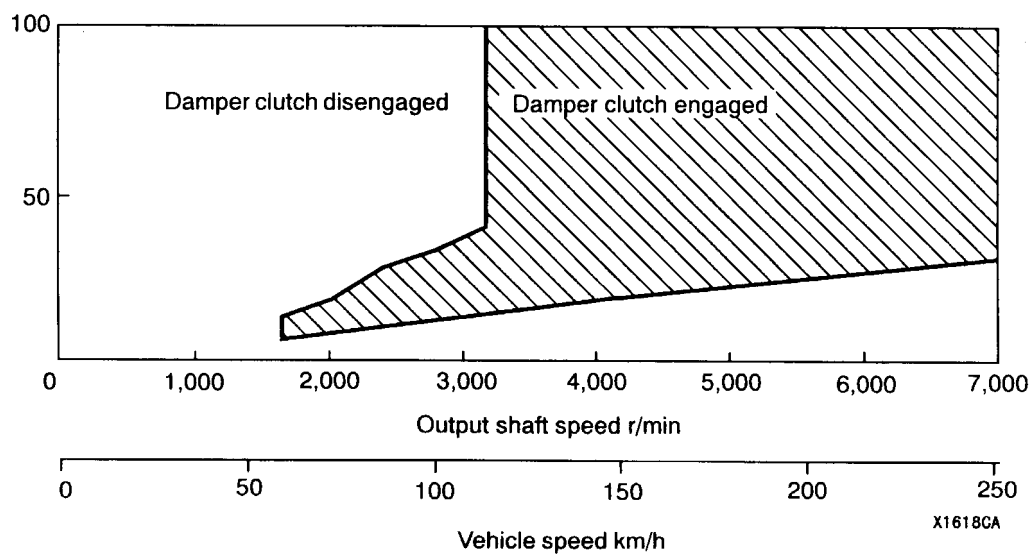
<4M4>

4th gear



5th gear

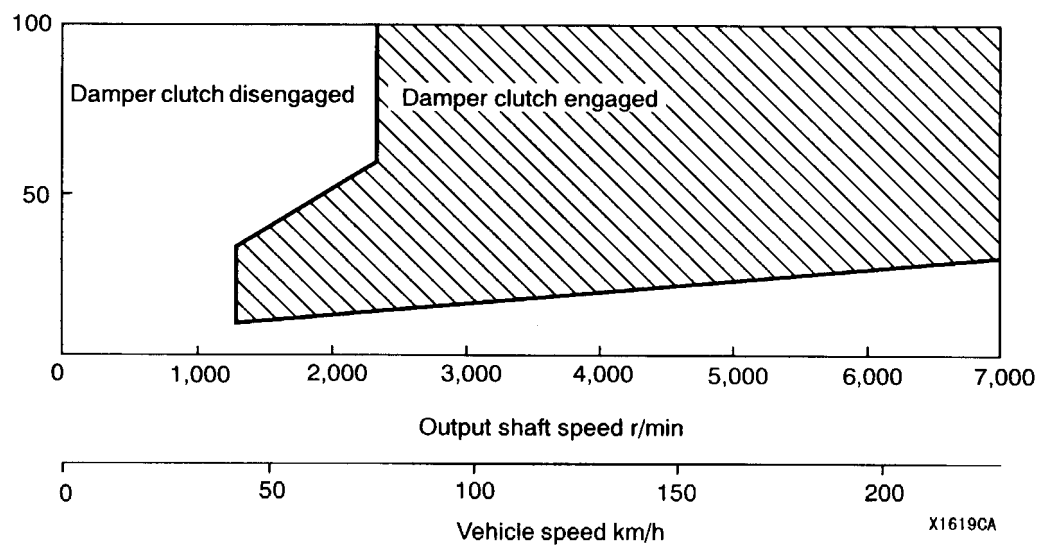
Throttle opening %



<6G7>

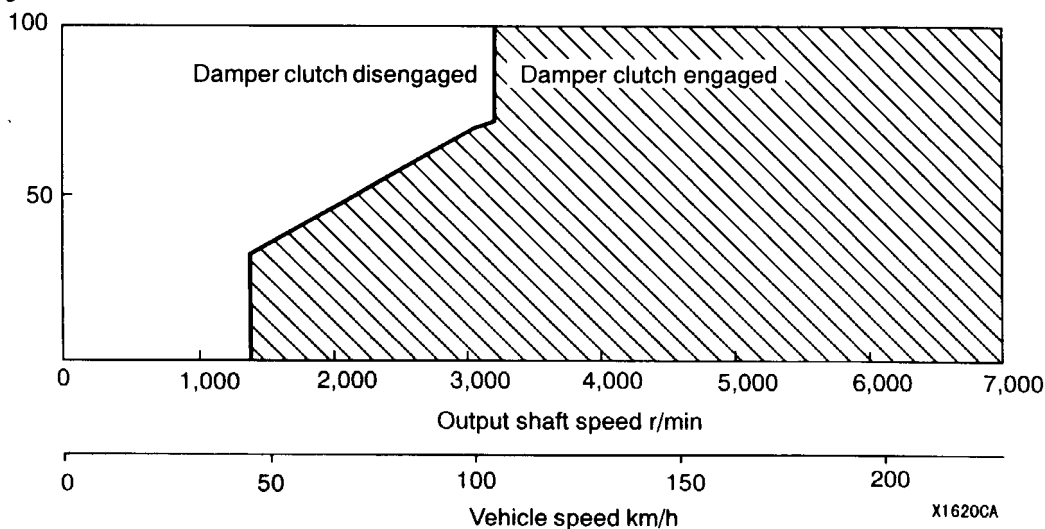
4th gear

Throttle opening %



5th gear

Throttle opening %



X1620CA

Diagnosis Classification Table

Item		Diagnosis code No.	Data list		Actuator test
			Item No.	Display	
Accelerator pedal position sensor (APS)	Short circuit	11	13	mV	–
	Open circuit	12			–
	Sensor maladjustment	14			–
A/T fluid temperature sensor	Open circuit	15	15	°C	–
Crank angle sensor <6G7>, Engine speed sensor <4M4>	Open circuit	21	21	RPM	–
Input shaft speed sensor	Short circuit/open circuit	22	22	RPM	–
Output shaft speed sensor	Short circuit/open circuit	23	23	RPM	–
Wide-open throttle switch	Short circuit/open circuit	25	25	ON/OFF	–
Stop lamp switch	Short circuit	26	26	ON/OFF	–
Vehicle speed sensor		–	29	km/H	–
LR/DIR solenoid valve	Short circuit/open circuit	31	31	%	1
UD solenoid valve	Short circuit/open circuit	32	32	%	2
2ND solenoid valve	Short circuit/open circuit	33	33	%	3
OD solenoid valve	Short circuit/open circuit	34	34	%	4
RED solenoid valve	Short circuit/open circuit	35	35	%	5
DCC solenoid valve	Short circuit/open circuit	36	36	%	6

Item		Diagnosis code No.	Data list		Actuator test
			Item No.	Display	
Gear shift incomplete	1st	41	–	–	–
	2nd	42	–	–	–
	3rd	43	–	–	–
	4th	44	–	–	–
	5th	45	–	–	–
	Reverse	46	–	–	–
Erroneous communication with engine-ECU		51	–	–	–
DCC solenoid valve	System defect	52	52	RPM	6
A/T control relay	Earth short circuit/open circuit	54	54	V	12
N range lamp		56	–	–	–
Inhibitor switch		–	61	P/R/N/D	–
Shift position		–	63	5th/4th/ 3rd/2nd/ 1st/N,P/ REV	–
A/C compressor switch		–	65	ON/OFF	–
OD-OFF signal <Vehicles with auto-cruise control system>		–	66	ON/OFF	–
Select switch		–	67	ON/OFF	–
Up shift switch		–	68	ON/OFF	–
Down shift switch		–	69	ON/OFF	–
Engine target effective pressure <6G7>		–	73	kPa	–
4LLc switch		–	75	ON/OFF	–
Engine theoretical effective pressure <4M4>		–	76	kPa	–
1st gear indicator lamp		–	–	–	7
2nd gear indicator lamp		–	–	–	8
3rd gear indicator lamp		–	–	–	9
4th gear indicator lamp		–	–	–	10
5th gear indicator lamp		–	–	–	11
INVECS-II cancel command		–	–	–	14

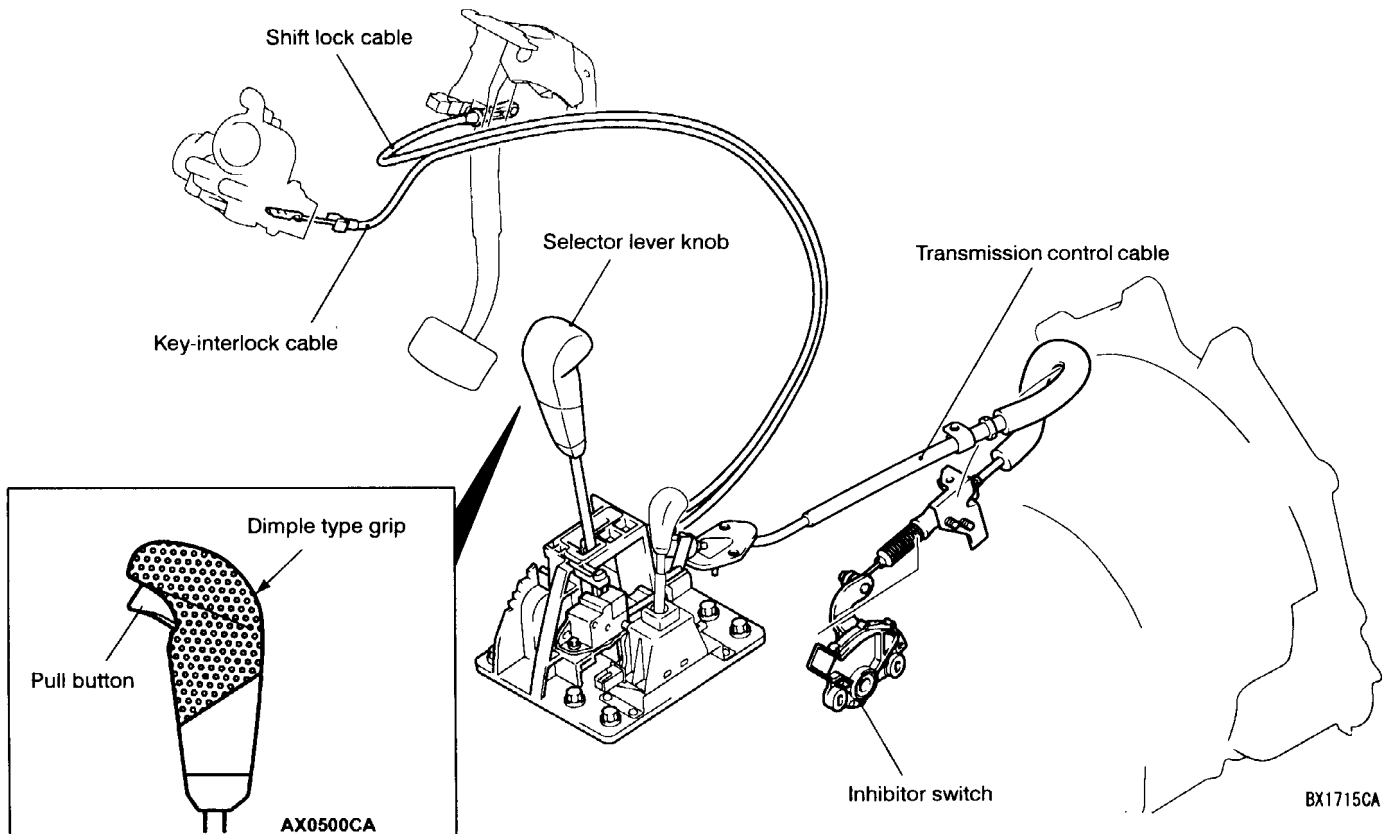
SUPER SELECT 4WD II (SS4 II)

Refer to P.2-7.

TRANSMISSION CONTROL

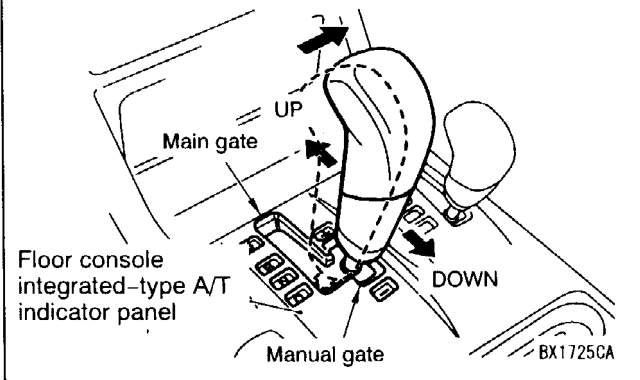
- A selector lever with two operation gates (a main gate and a manual gate) has been adopted for vehicles with Sports mode 5A/T.
- The A/T indicator panel has a design which is integrated with the floor console to increase the feeling of high quality.
- The selector lever knob has a pull-button located underneath the knob. This pull-button prevents mis-operation and improves selector lever operation and parking brake lever operation when using the armrest. In addition, the grip has a sporty and high-quality dimple-type appearance.
- An A/T mis-operation prevention mechanism (shift lock mechanism and key interlock mechanism) has been adopted to prevent the vehicle from starting off suddenly due to a selector lever mis-operation.

CONSTRUCTION DIAGRAM



BX1715CA

Sport mode 5A/T



A/T MIS-OPERATION PREVENTION MECHANISM

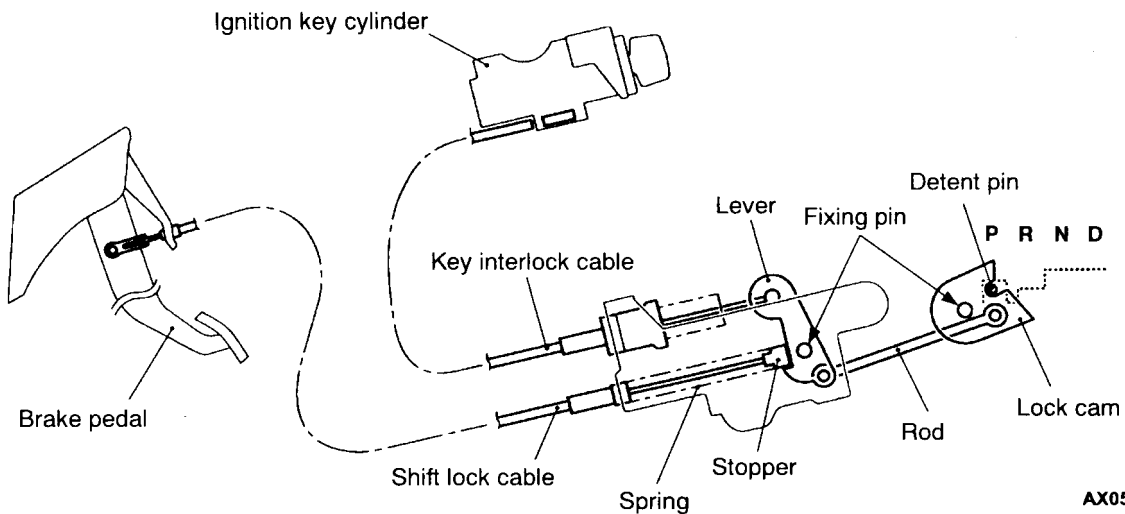
STRUCTURE

Shift Lock Cable Unit

The shift lock cable unit consists of parts such as a key interlock cable, a shift lock cable, a spring, a stopper, a lever and a rod.

The key interlock cable is connected to the lever, and restricts the movement of the lever by means of the ignition key cylinder operation. The shift lock cable stopper pushes against the lever by the force

of the spring, and restricts the movement of the lever through operation of the brake pedal. In addition, the lever and the lock cam of the selector lever assembly are linked by a rod, so that the lock cam restricts the movement of the detent pin which moves together with the selector lever push button.

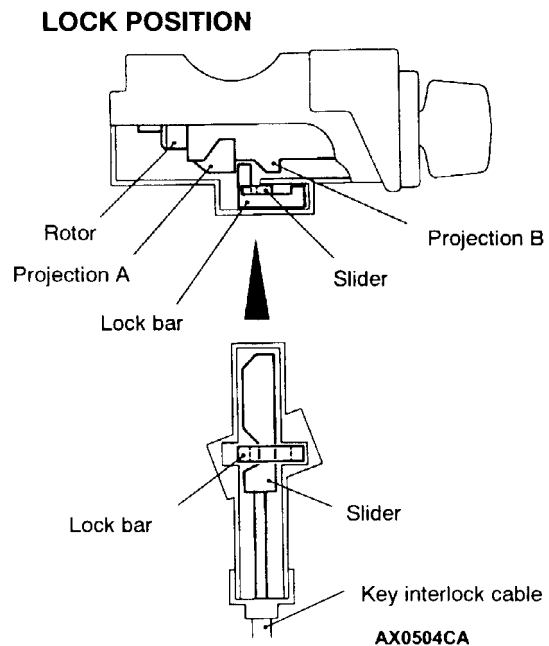
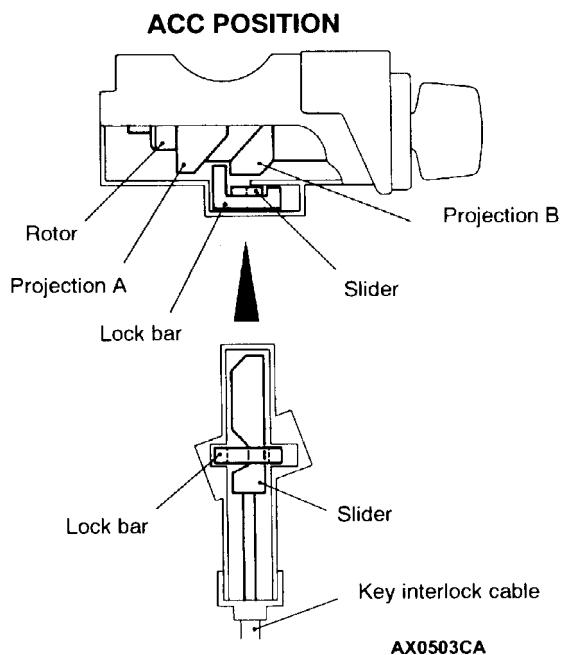


Ignition Key Cylinder

The key interlock is operated by a slider which is connected to projection A, projection B on the rotor, the lock bar and the key interlock cable.

When the ignition key is turned from the ACC position to the LOCK position, projection A on the

rotor which is linked to the ignition key cylinder pushes the lock bar to engage it with the groove in the slider, which restricts the operation of the key interlock cable.



OPERATION

Shift Lock Mechanism

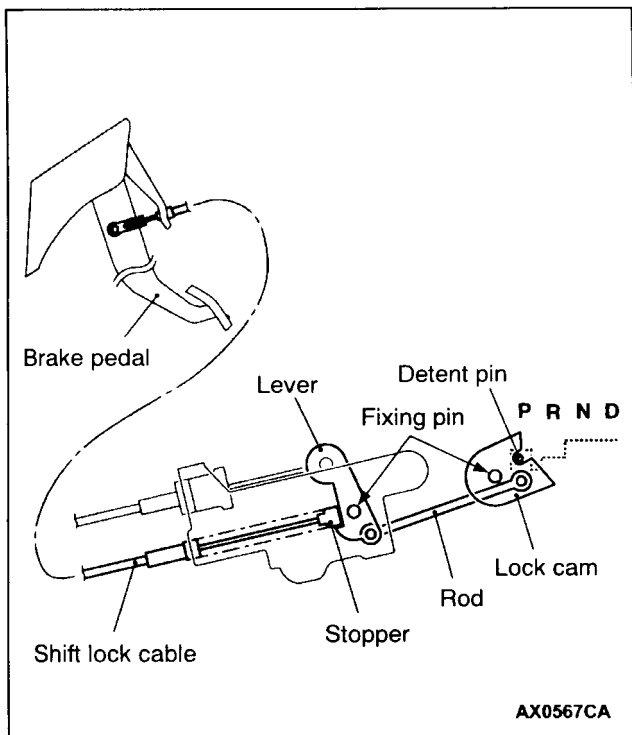
The selector lever can be moved from the P position to another position only when the following two conditions are satisfied.

- When the brake pedal is depressed
- When the ignition key is at a position other than LOCK

(1) When the brake pedal is released

When the selector lever is at the P position and the brake pedal is not depressed, the shift lock cable stopper restricts the movement of the selector lever, so that the rod and the lock cam do not move.

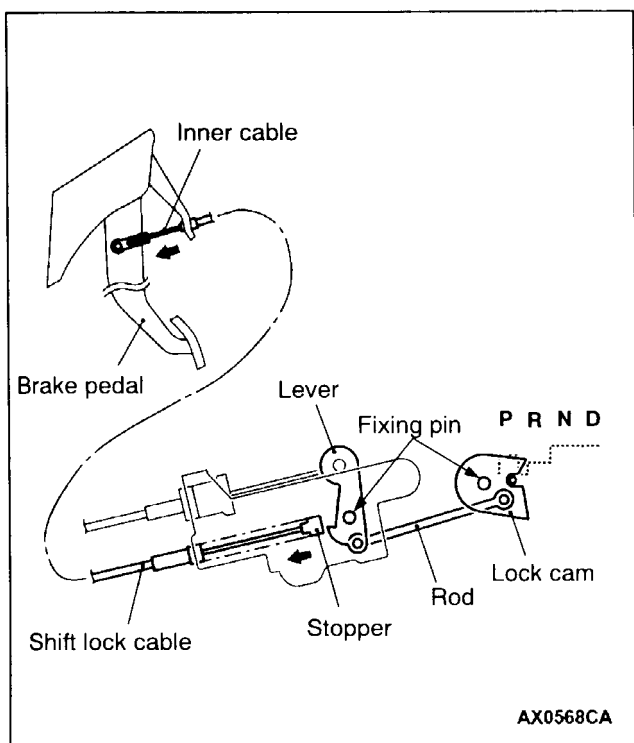
Because of this, the push button on the selector lever which is connected to the detent pin cannot be depressed, and so the selector lever cannot be moved from the P position to any other position.

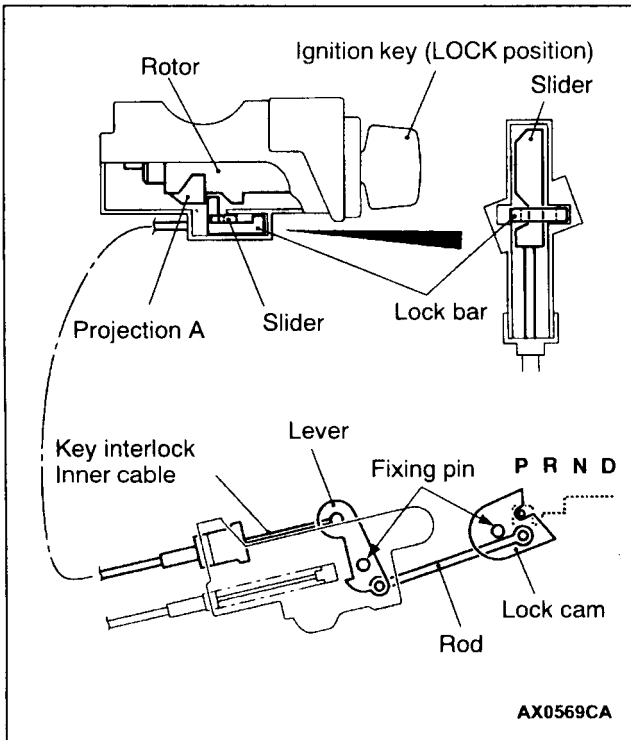
**(2) When brake pedal is depressed**

If the brake pedal is depressed from the situation in (1) above, the inner cable releases the shift lock cable stopper so that the selector lever is no longer being restricted. As a result of this, the lock cam which is connected to the rod can also rotate, so that the push button can then be pressed to move the selector lever from the P position to some other position.

NOTE

If the ignition key is at the LOCK position, the selector lever cannot be moved from the P position to any other position even if the brake pedal is depressed.

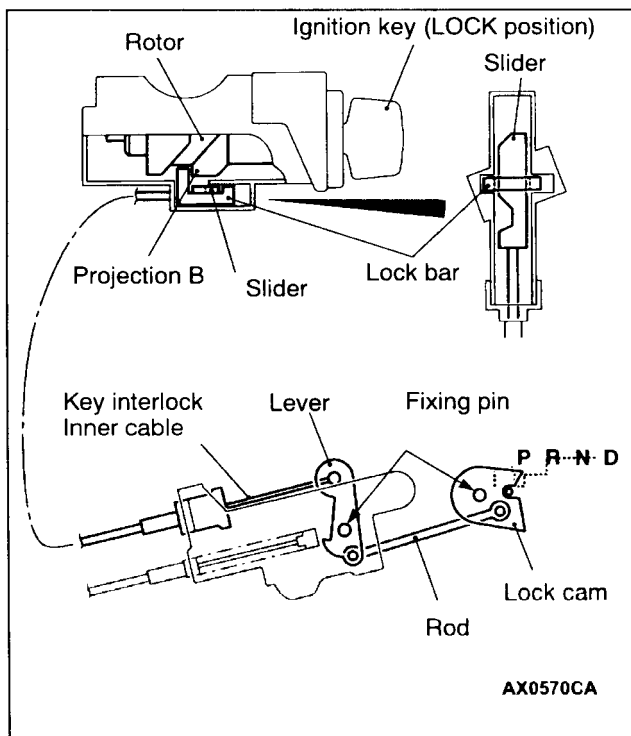




(3) When the ignition key is at the LOCK position or removed (selector lever at the P position)

The lock bar is engaged with the groove of the slider inside the ignition key cylinder, and the lock bar is restricted by projection A on the rotor, so that the key interlock inner cable cannot move and the lever, rod and lock cam also do not move.

As a result, even if you try to operate the selector lever, the lock cam cannot rotate, so that the push button on the selector lever cannot be depressed and the selector lever cannot be moved from the P position to any other position.



(4) When the ignition key is at a position other than the LOCK position (selector lever at the P position)

When the key is at a position between ACC and START, projection B on the rotor inside the ignition key cylinder causes the lock bar and the slider to disengage, so that the key interlock inner cable is free to move.

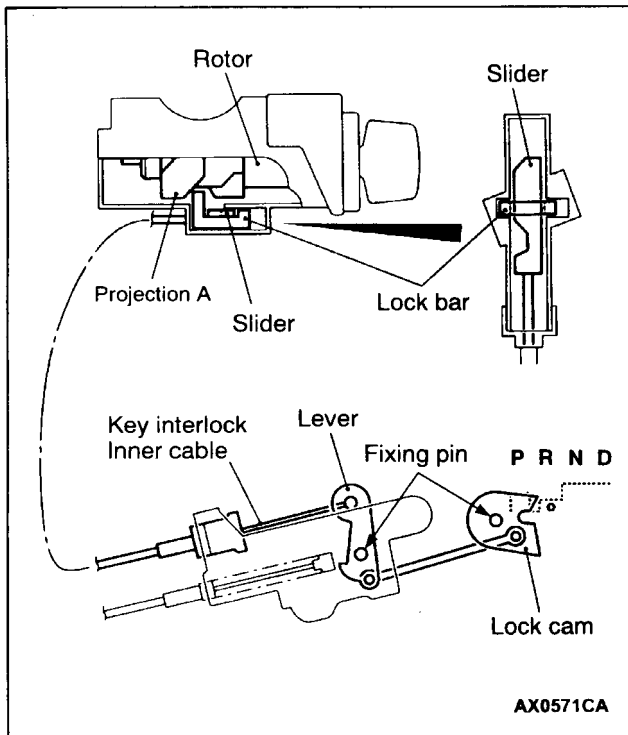
Accordingly, the lever and the rod also allow the connected lock cam to turn, so that the pushbutton can be depressed and the selector lever can be moved from the P position to some other position.

NOTE

If the brake pedal is not depressed, the selector lever cannot be moved from the P position to any other position even if the ignition key is at a position other than the LOCK position.

KEY INTERLOCK MECHANISM

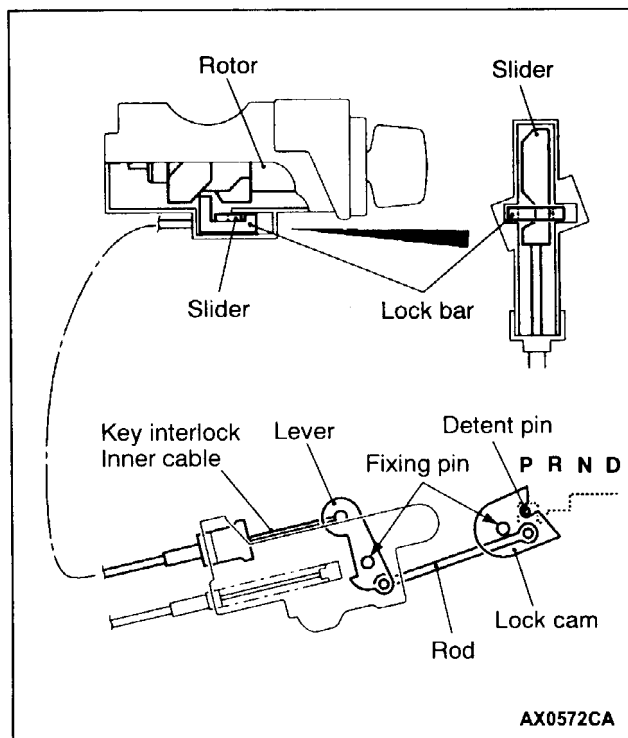
If the selector lever is not at the P position, the ignition key cannot be turned to the LOCK position and thus the key cannot be removed.



(1) When removing the ignition key while the selector lever is at a position other than P

The lock cam is held in the turned condition and the key interlock inner cable is also pulled towards the lever. Because of this, the slider and the lock bar inside the ignition key cylinder are disengaged and their movement is restricted.

Accordingly, if you try to turn the ignition key to the LOCK position, the lock bar is restricted by projection A on the rotor, so that the ignition key can only be turned as far as the ACC position and so the key cannot be removed.



(2) When removing the ignition key while the selector lever is at the P position

When the selector lever is at the P position and the selector lever pushbutton is released, the detent pin causes the lock cam to rotate. Then, the operation of the rod and the lever causes the key interlock inner cable to push the slider inside the ignition key cylinder. The movement of the slider also allows the lock bar to move, so that the rotor can rotate freely.

Accordingly, the ignition key can be turned to the LOCK position and then be removed.

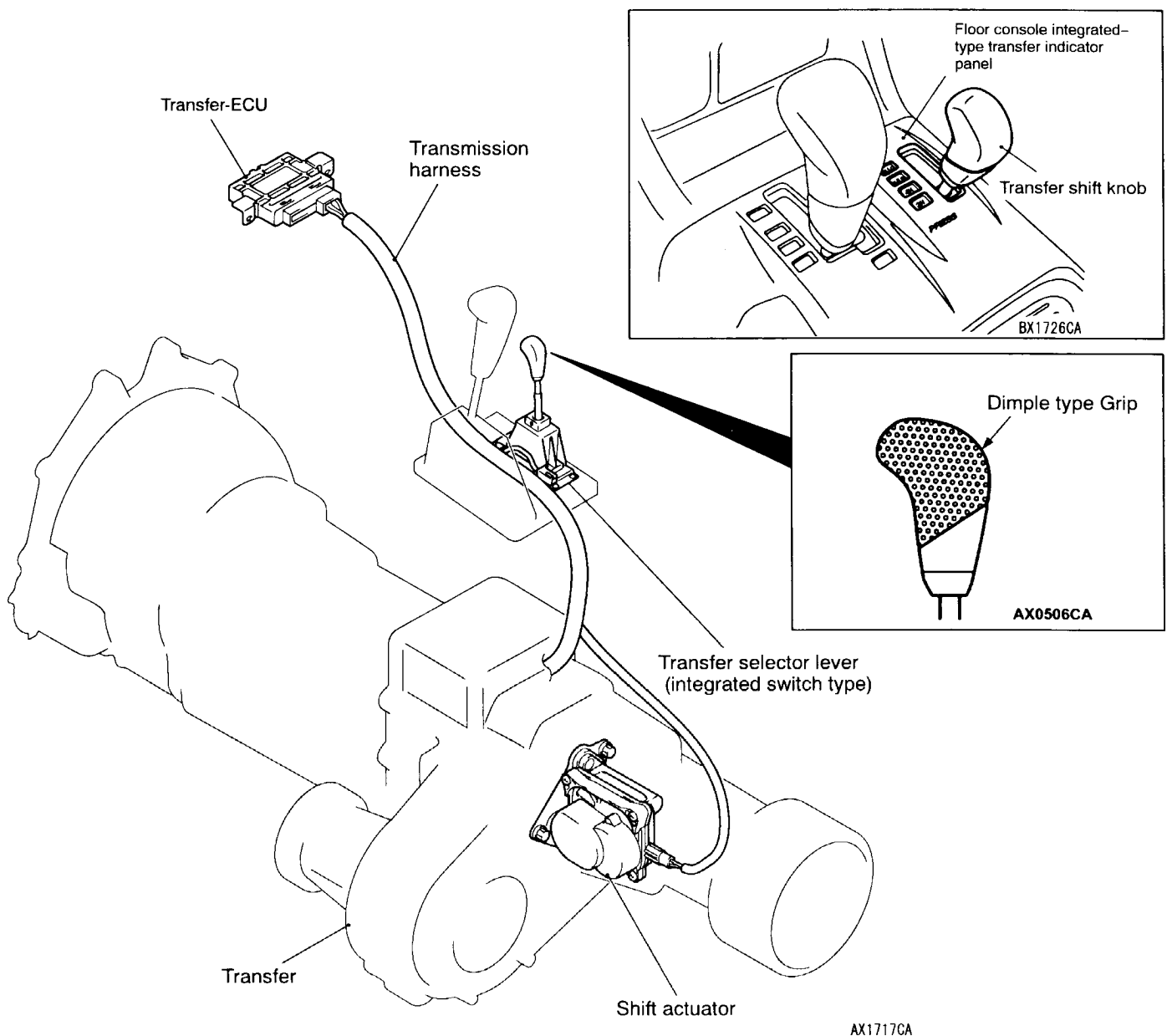
TRANSFER CONTROL

A motor-driven select system is used for transfer control with the super select 4WD II.

The operation of this motor-driven select system is performed by an integrated transfer select lever and switch, which allow the driver to select any one of four modes (2H, 4H, 4HLc and 4LLc). In addition, the transfer-ECU controls the shift actuators which drive the drive mode select mechanism inside the transfer based on the electronic signals from the switch. This system has following features.

- Motor-driven drive mode selection allows the selector lever to be operated smoothly and also ensures accurate mode selection.
- The transfer indicator panel has a design which is integrated with the floor console to provide a feeling of high quality.
- The grip of the transfer selector lever knob grip has a dimple-type appearance to increase the feeling of high quality.

CONSTRUCTION DIAGRAM



TRANSMISSION OIL COOLER

The transmission oil cooler is a water-cooled type which is built into the radiator.

This water cooled-type transmission oil cooler has an aluminium plate-type (layered type) construction

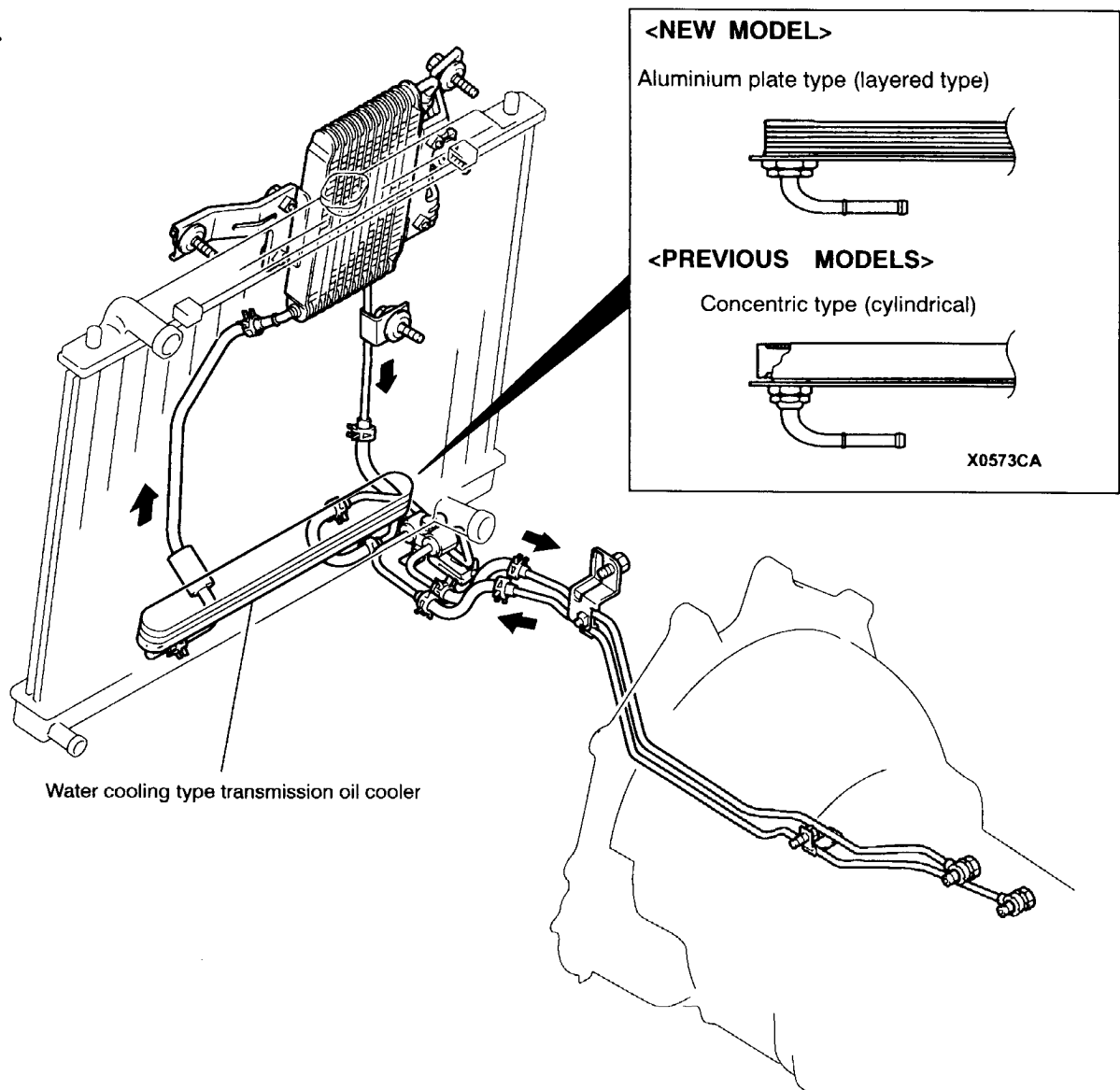
in contrast to the previous concentric-type (cylindrical) oil cooler. This new design has been adopted in order to improve cooling performance.

SPECIFICATION

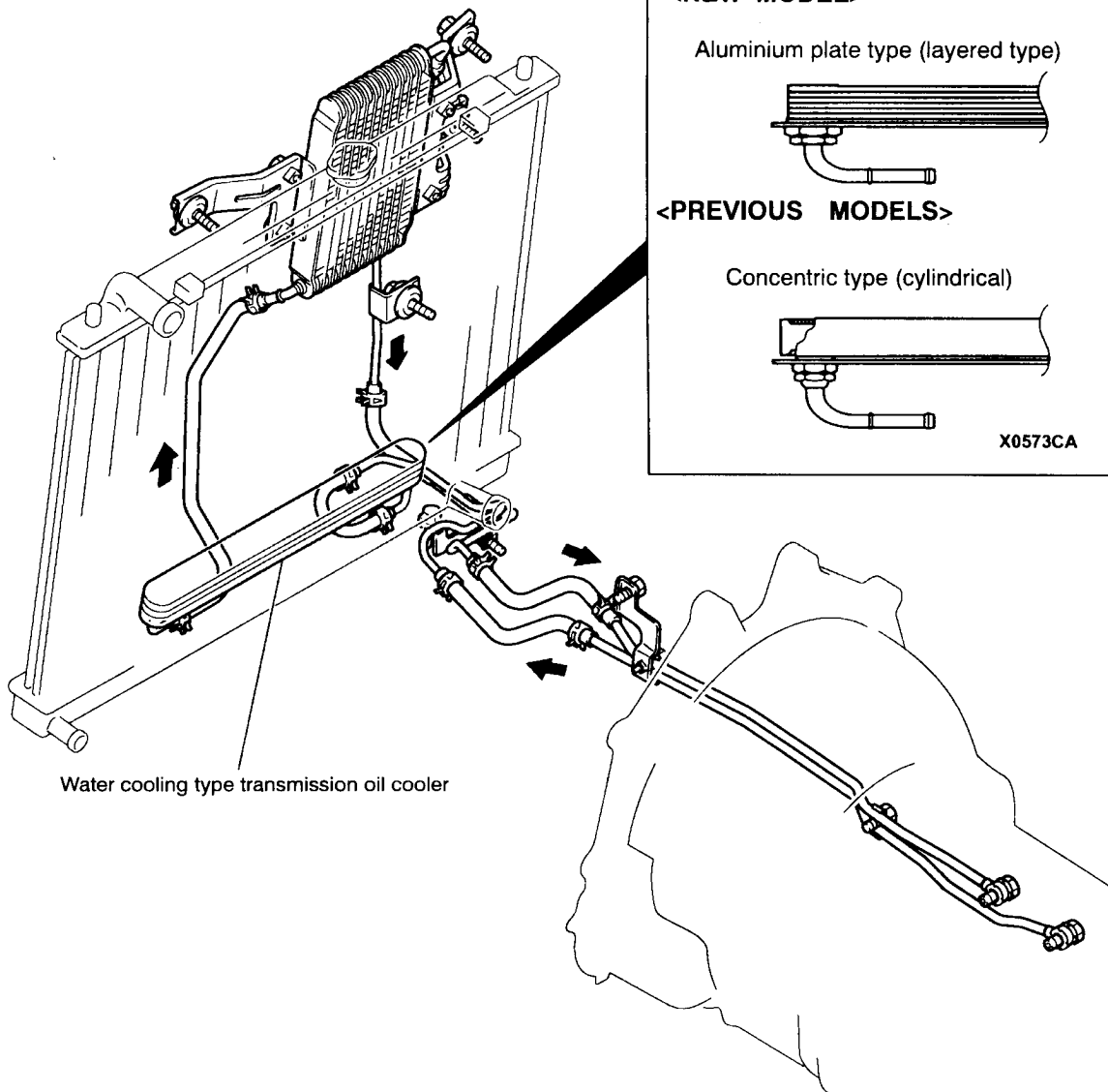
ITEM	NEW	OLD
Transmission oil cooler kJ/h	9,500	6,800

CONSTRUCTION DIAGRAM

<6G7>



<4M4>



AX1792CA

4WD INDICATOR LAMPS

Refer to P.2-23.

PROPELLER SHAFT

The PAJERO has two propeller shafts. The front propeller shaft connects the transfer and the front axle, and the rear propeller shaft connects the transfer and the rear axle.

Each propeller shaft is a two-joint type propeller shaft, and they have the following features.

- A snap-ring method of securing the journal bearing of the universal joint has been adopted.
- The rear propeller shaft has CFRP (carbon fibre-reinforced plastic) tube with an impact absorbing mechanism (collapsible) improve safety in the event of an impact.

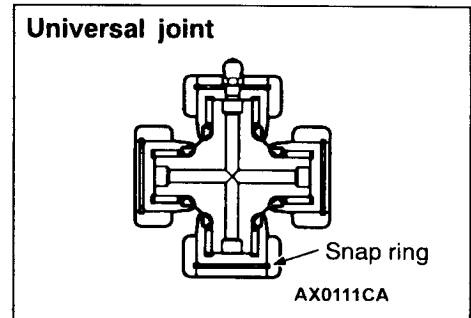
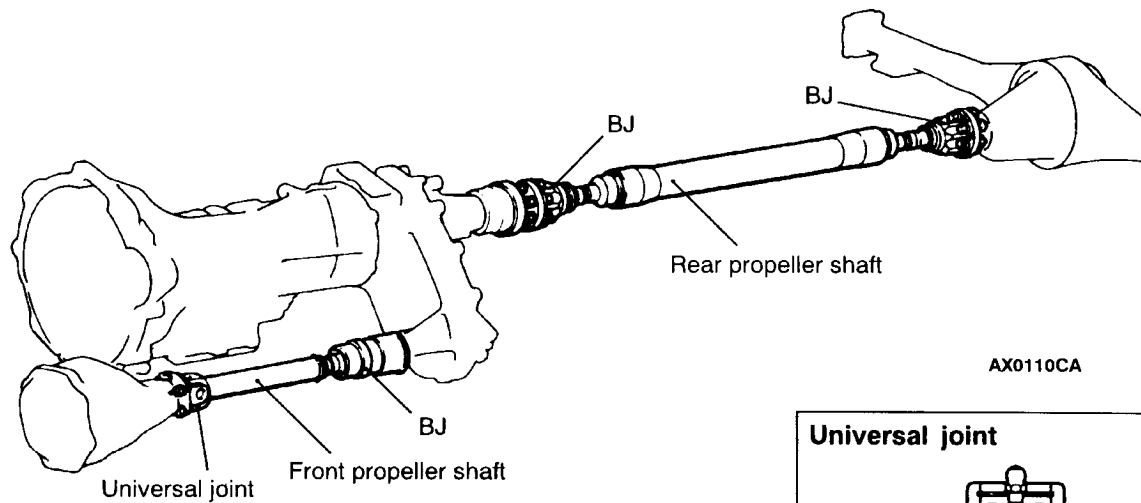
SPECIFICATIONS

Item			Short wheelbase		Long wheelbase	
Propeller shaft	Type		Front	2-joint type propeller shaft		
			Rear	2-joint type propeller shaft, CFRP tube		
Propeller shaft	Length × Outside diameter mm	Front	4D5 <Part Time 4WD>	675 × 50.8		
			4D5 <Super Select 4WD-II>	700 × 50.8		
			4M4-A/T	755 × 50.8		
			4M4-M/T, 6G7-M/T	703 × 50.8		
			6G7-A/T	685 × 50.8		
		Rear	4D5 <Part time 4WD>	670 × 79.1	900 × 79.1	
			4D5 <Super Select 4WD-II>	540 × 79.1	775 × 79.1	
			4M4-A/T	480 × 79.1	715 × 79.1	
			4M4-M/T, 6G7	540 × 79.1	775 × 79.1	
Joint type	Front		Universal joint & BJ			
	Rear		BJ × 2			
Universal joint	Type		Cross type (snap ring method)			
	Bearing		Lubrication type needle roller bearing			
	Journal diameter mm		14.689			

NOTE

The propeller shaft length indicates the length between the centre points of each joint.

CONSTRUCTION DIAGRAM



REAR PROPELLER SHAFT

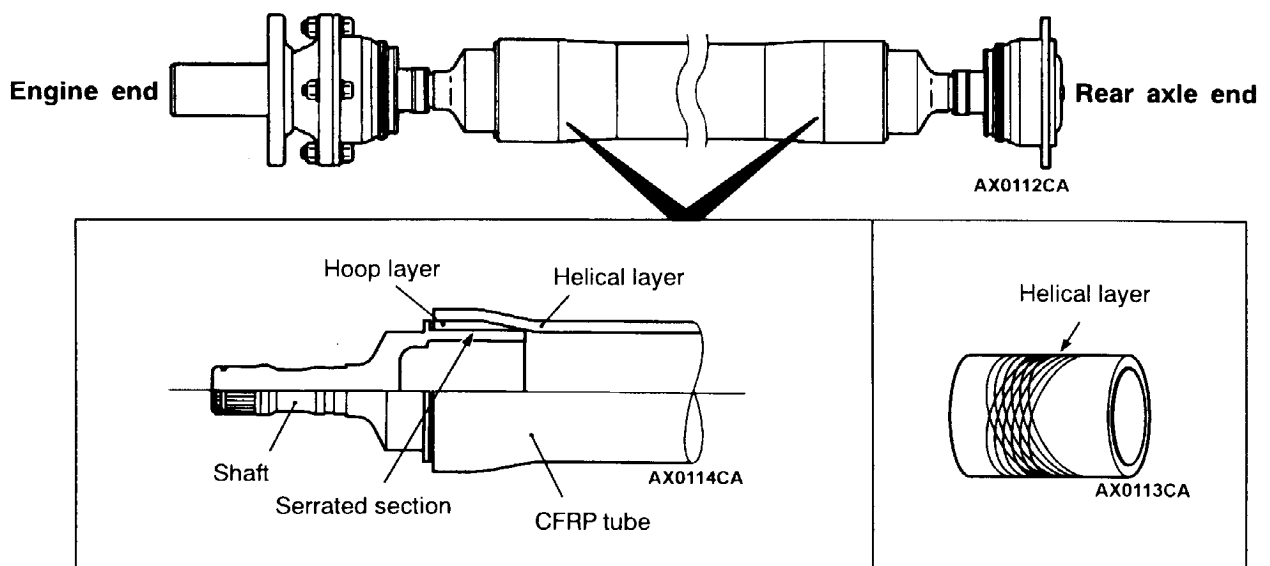
A carbon fibre-reinforced plastic propeller shaft has been adopted. In the event of an impact, the shaft moves inside the tube to allow the engine and the transmission to move backwards.

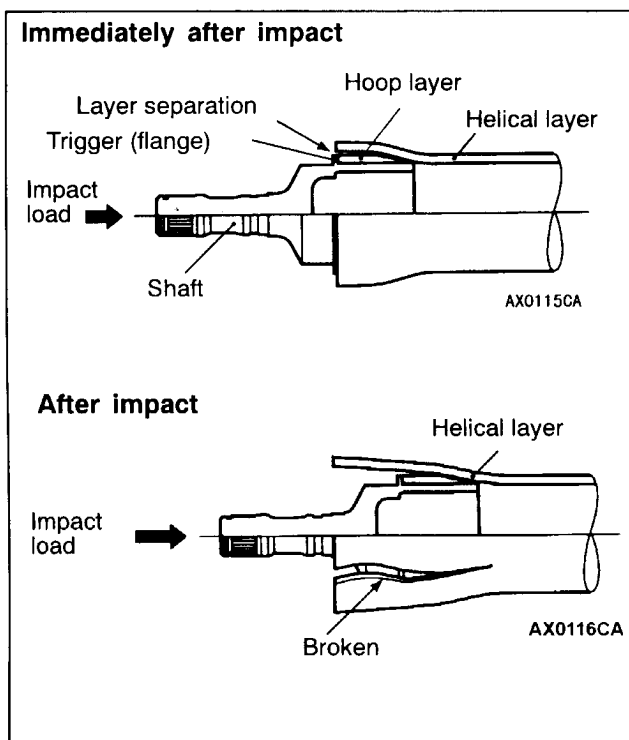
This propeller shaft transmits torque by means of a shaft with serrations which is press-fitted to a carbon fibre-reinforced plastic tube*. In addition, the carbon fibre-reinforced plastic tube consists of a helical layer and a hoop layer. The helical layer is wrapped in carbon fibres at an angle which gives optimal shaft strength and torsional strength. The

hoop layer has carbon fibres wrapped around its circumference for the purpose of supporting the press-fitted shaft and maintaining torque.

NOTE

Carbon fibre-reinforced plastic tube: A composite material made from epoxy resin with carbon fibres added for reinforcement. The winding angle of the carbon fibres can be adjusted to set the strength and elasticity of the material.



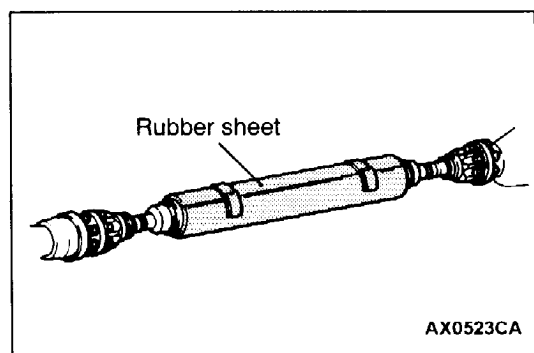
**COLLAPSING MECHANISM DURING IMPACTS**

When the vehicle receives an impact which causes a load to be applied to the propeller shaft from the direction of the engine, the trigger (flange) which is provided on the shaft contacts the hoop layer. When the load reaches a specified level, the trigger (flange) causes a layer separation to develop momentarily between the hoop layer and the helical layer. The wedge effect from the separated hoop layer causes a continuous break to form in the helical layer of the tube. This absorbs the force of the impact, while also allowing the engine and transmission to move backwards to maintain a sufficient crashable length and to absorb impact shocks.

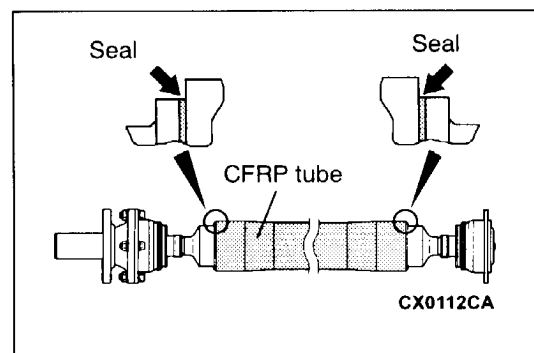
NOTES ON HANDLING THE CFRP PROPELLER SHAFT

The rear propeller shaft has a CFRP (Carbon Fibre Reinforced Plastic) tube. The following points must be strictly observed when handling this propeller shaft.

1. If the propeller shaft has a damaged tube, the extent of the damage should be checked during permeation damage checks.
2. If the tube is cracked, chipped or bent, the propeller shaft should be replaced with a new one.
3. Do not subject the tube to any shocks or damage.
4. If the propeller shaft is dropped by mistake, it should be replaced with a new one.



5. In order to prevent damage, the propeller shaft tube should be wrapped in a rubber sheet or special rubber sheet (part no. MR534563 for short wheelbase/part no. MR534564 for long wheelbase) with a thickness of 10 mm or more while working.



6. If there are any cracks or peeling in the seals at the ends of the CFRP tube shown in the illustration, replace the propeller shaft with a new one.
7. When disposing of the propeller shaft, it should be buried in landfill. CFRP tubes which are buried in landfill will not release any toxic substances.

FRONT AXLE

The front axle consists of front hubs, knuckles, wheel bearings, ball joints, front differential and freewheel clutch, and it has the following features.

- The front hubs have press-fitted unit bearings.
- A freewheel mechanism has been adopted which allows selection between 2WD and 4WD to be made while driving. When driving in 2WD, fuel consumption is improved and vibration is reduced.
- The drive shaft incorporates U.J.-D.O.J. type constant velocity joints with high transmission efficiency and low vibration and noise.
- ABS rotors for detecting the wheel speeds are press-fitted to the U.J. outer wheels in vehicles with ABS.

- The wheel bearings used are taper roller type unit bearings with strong transverse load bearing ability.
- The differential support method is a four-point elastic support method which reduces vibration and noise.

NOTE

1. The structure of the freewheel mechanism is basically the same as that used in previous vehicles.
2. U.J. is an abbreviation of Under cut Joint.

SPECIFICATIONS

FRONT AXLE

Item			Specification
Wheel bearings	Wheel bearing type		Taper roller type unit bearing
	Bearing (outside diameter × inside diameter) mm		88 × 50
Drive shaft	Joint type	Outside	U.J.
		Inside	D.O.J.
	Shaft length*1 × Shaft diameter mm	Right	353 × 28*2, 361.5 × 26*3
		Left	323 × 28*2, 330 × 26*3
Inner shaft	Shaft length × Shaft diameter mm		389.2 × 31.5
	Bearing (outside diameter × inside diameter) mm		62 × 35

NOTE

*1: The shaft length indicates the length between the center points of each joint.

*2: 4M41-M/T

*3: 4D56, 4M41-A/T, 6G74 GDI

FRONT DIFFERENTIAL

Item		Specification
Reduction gear type		Hypoid gear
Reduction ratio		4.900*1, 3.917*2, 4.100*3, 4.300*4
Differential gear type		Straight bevel gear
Number of teeth	Drive gear	49*1, 47*2, 41*3, 43*4
	Drive pinion	10*1,*3,*4, 12*2
	Side gear	14
	Pinion gear	10
Bearing (outside diameter × inside diameter) mm	Side	80.0 × 45.2
	Front	68.3 × 30.2
	Rear	72.2 × 36.5
Front differential gear oil		Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W: 1.2 ℓ

NOTE

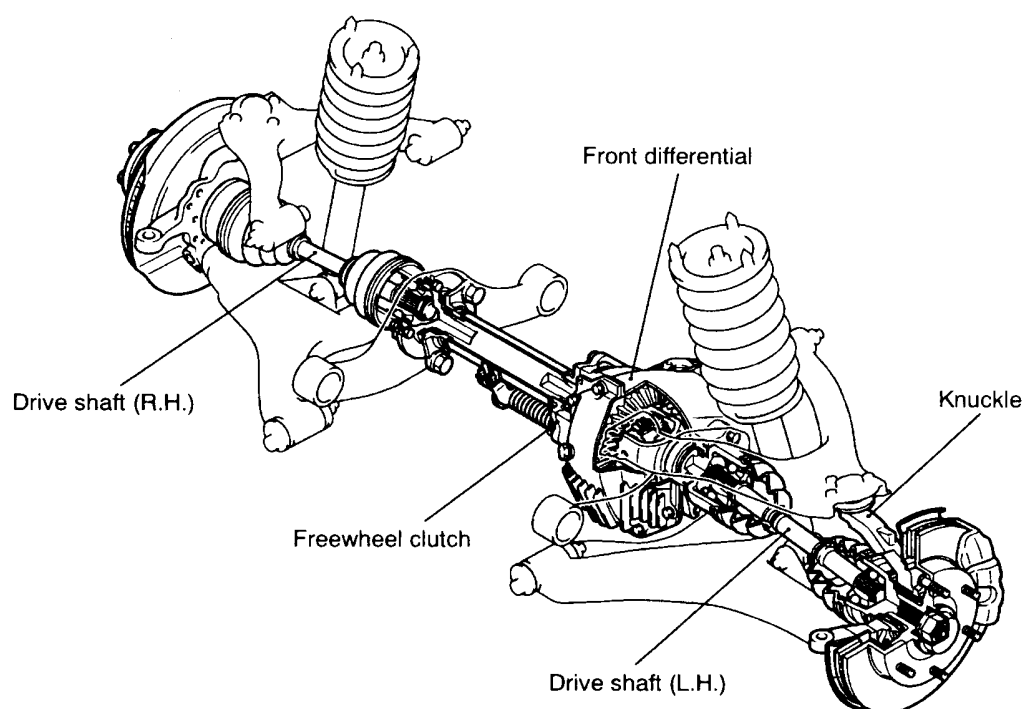
*1: 4D56

*2: 4M41-A/T

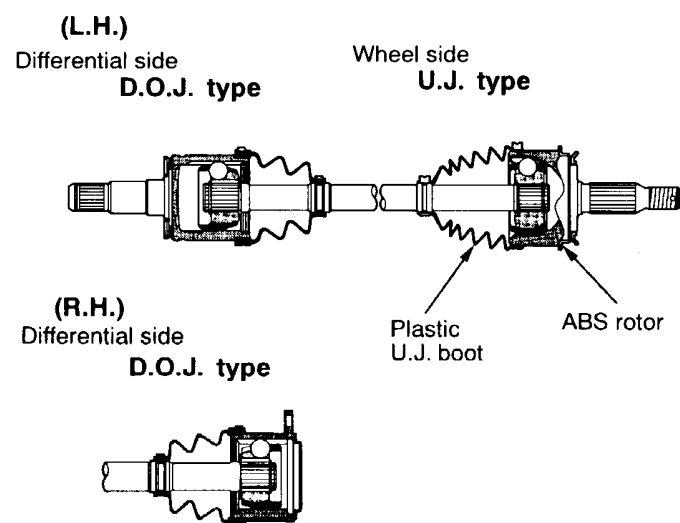
*3: 4M41-M/T

*4: 6G74 GDI

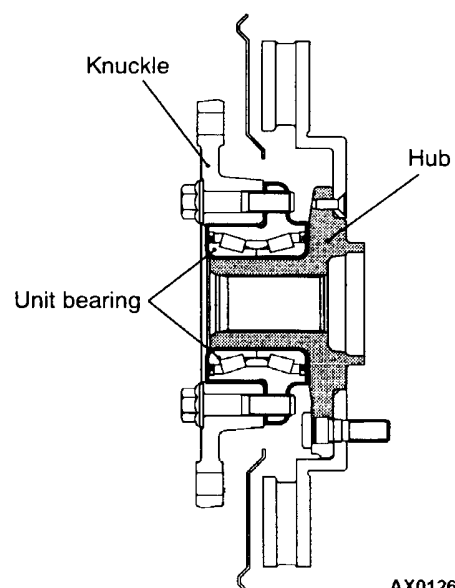
CONSTRUCTION DIAGRAM



AX0125CA

DRIVE SHAFT

AX0259CA

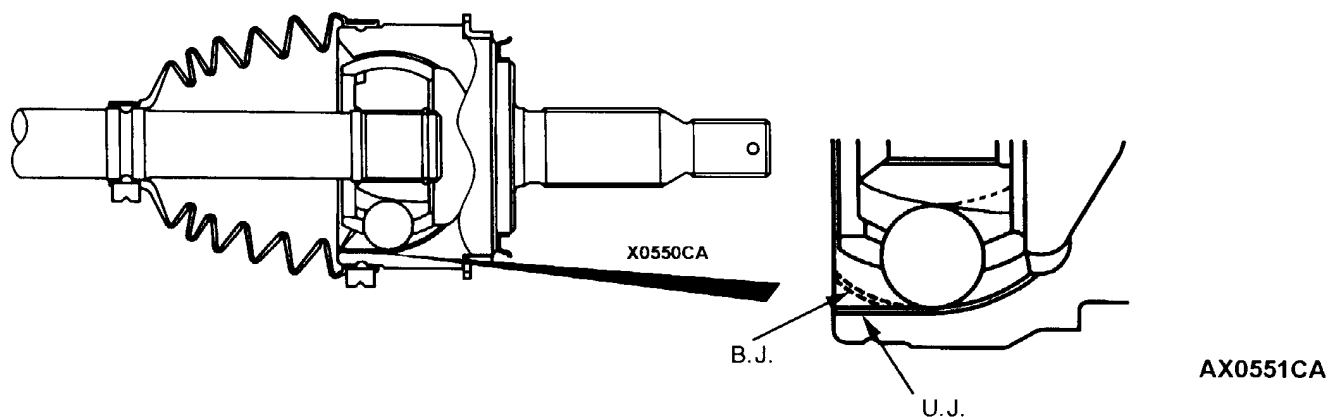


AX0126CA

U.J. TYPE JOINT

U.J. joints are constant-velocity joints with the sliding surfaces of the ball bearings inside the joints having a partially-cut section to increase the

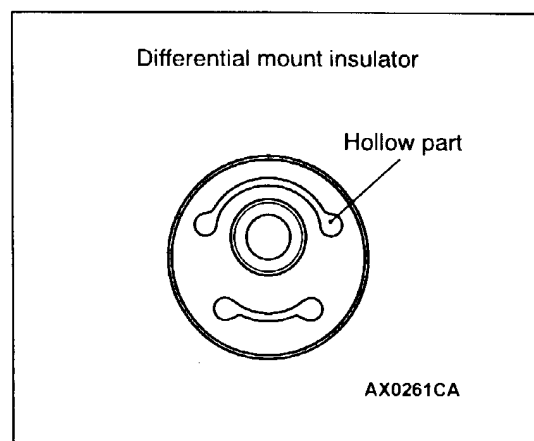
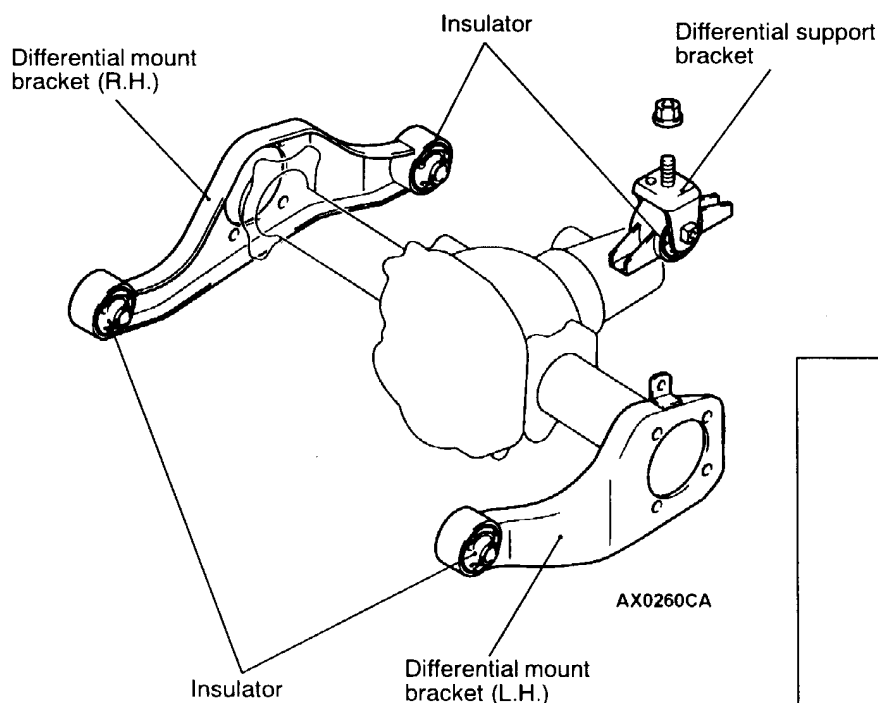
operating angle of the joint (to 48° compared with 45° for previous vehicles). The basic structure is the same as that of B.J.-type constant-velocity joints.



FRONT DIFFERENTIAL MOUNT

The differential support method for the front differential mount is an elastic support method with two supports at the front and two supports at the rear which reduces vibration and noise.

The differential mount insulators contain hollow parts which effectively absorb both small vibrations and large vibrations.



REAR AXLE

The rear axle has the following features.

- The drive shaft has D.O.J.-type constant-velocity joints on the differential side and B.J.-type constant-velocity joints on the hub side.
- Compact, high-capacity and highly-rigid taper roller-type unit bearings have been adopted as the wheel bearings.
- A hybrid LSD and a differential lock with LSD which help provide more power when driving on poor road surfaces such as muddy roads are available as an option.

- ABS rotors for wheel speed detection are press-fitted to the drive shaft.

NOTE

The normal differential and the hybrid LSD structures are basically the same as that used in previous vehicles.

SPECIFICATIONS

Item		Normal Differential	Hybrid LSD	Differential Lock with LSD
Reduction gear type		Hypoid gear	Hypoid gear	Hypoid gear
Reduction ratio		4.900*1, 3.917*2, 4.100*3, 4.300*4	4.900*1, 3.917*2, 4.100*3, 4.300*4	4.900*1, 3.917*2, 4.100*3, 4.300*4
LSD type		–	Torque sensing +VCU	Torque sensing
Differential gear type (Type × number of gears)	Side gear	Straight bevel gear × 2	Helical gear × 2	Helical gear × 2
	Pinion gear	Straight bevel gear × 2	Long pinion × 4, Short pinion × 4	Long pinion × 4, Short pinion × 4
Number of teeth	Drive gear	49*1, 47*2, 41*3, 43*4	49*1, 47*2, 41*3, 43*4	49*1, 47*2, 41*3, 43*4
	Drive pinion	10*1,*3,*4, 12*2	10*1,*3,*4, 12*2	10*1,*3,*4, 12*2
	Side gear	18	22	22
	Pinion gear	10	7	7
Bearings (Outside diameter × Inside diameter) mm	Side	90.0 × 55.0	90.0 × 55.0	90.0 × 55.0
	Front	68.3 × 30.2	68.3 × 30.2	68.3 × 30.2
	Rear	79.4 × 36.5	79.4 × 36.5	79.4 × 36.5
Rear differential gear oil		Hypoid gear oil API classification GL-5 or higher SAE viscosity No. 90, 80W: 1.6 ℓ		

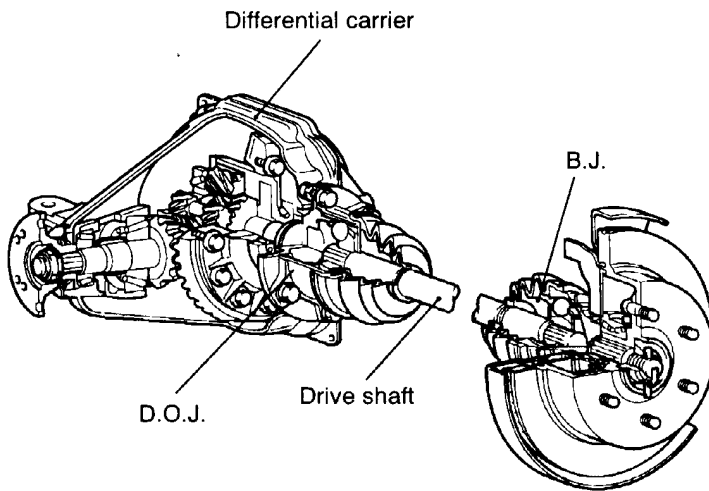
NOTE

*1: 4D56

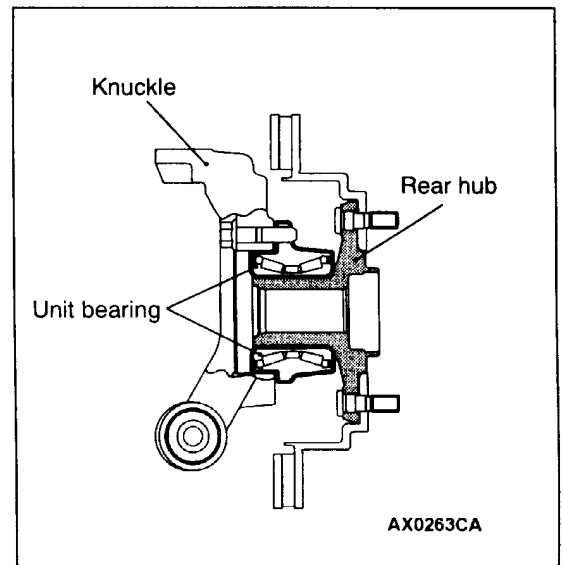
*2: 4M41-A/T

*3: 4M41-M/T

*4: 6G74 GDI

CONSTRUCTION DIAGRAM

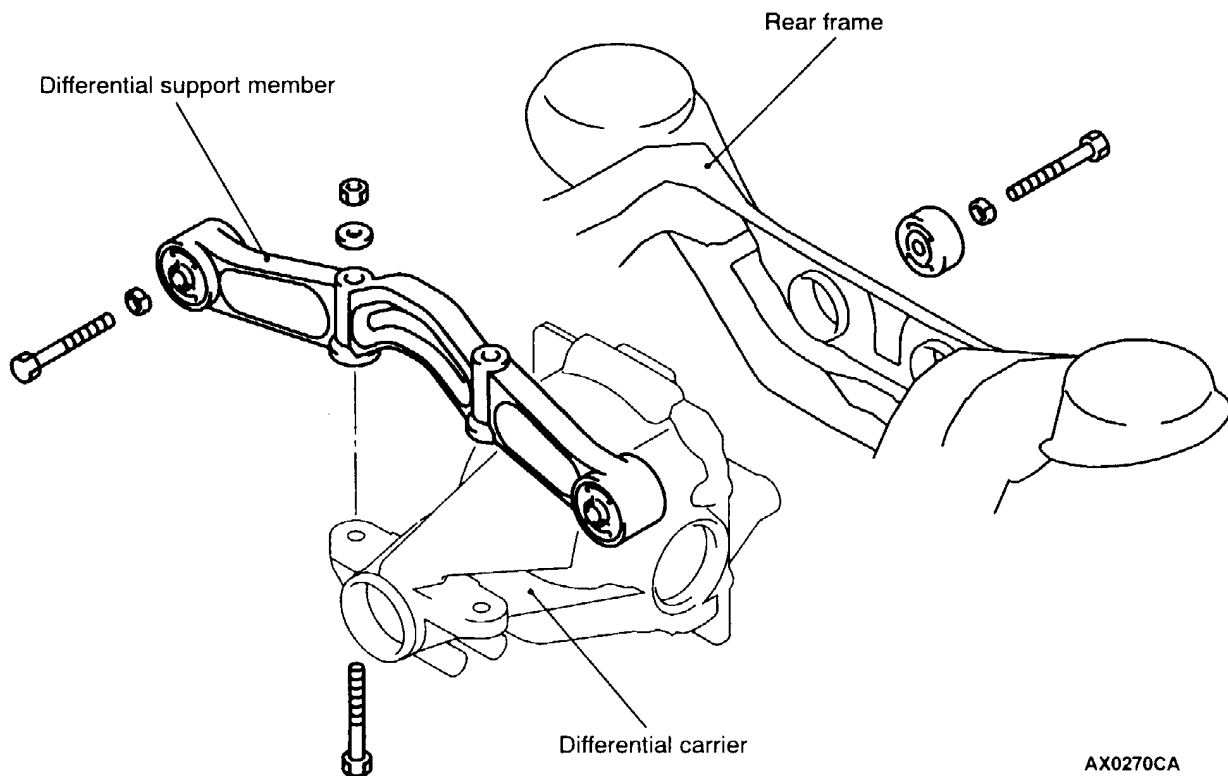
AX0262CA



AX0263CA

REAR DIFFERENTIAL MOUNT

The front of the differential carrier is installed to the differential mount member, and the rear is installed to the rear frame.



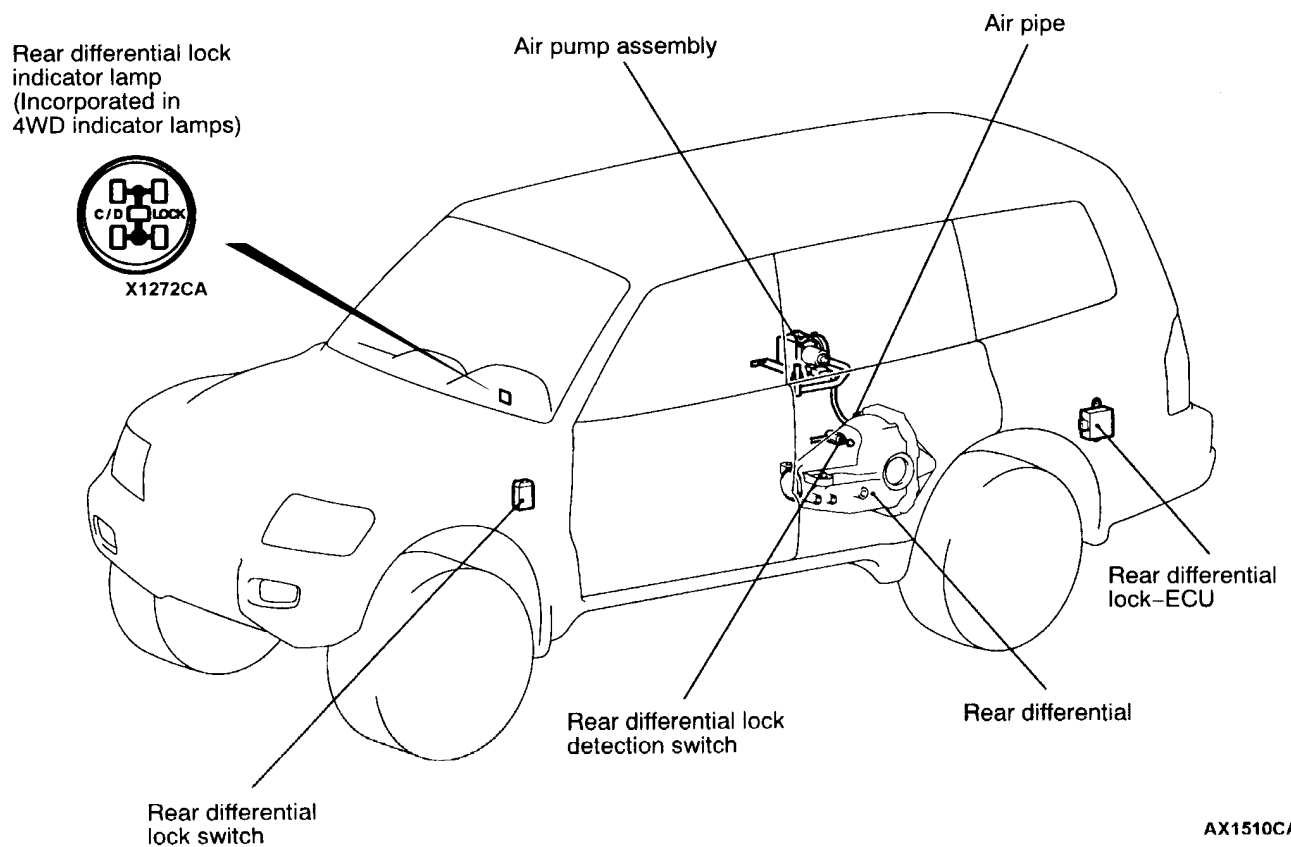
AX0270CA

REAR DIFFERENTIAL LOCK SYSTEM

The rear differential lock system has the following features.

- The combination of a torque sensitive-type helical LSD and a differential lock make it easier to remove the wheels when necessary, and also improve steering performance.
- The adoption of a helical LSD which minimizes changes in torque when accelerating and decelerating ensures excellent vehicle behavior control.
- Differential lock changeover is carried out by means of a differential lock switch which is located on the instrument panel or excellent ease of operation.
- An electronic control system has been adopted.

STRUCTURAL DIAGRAM

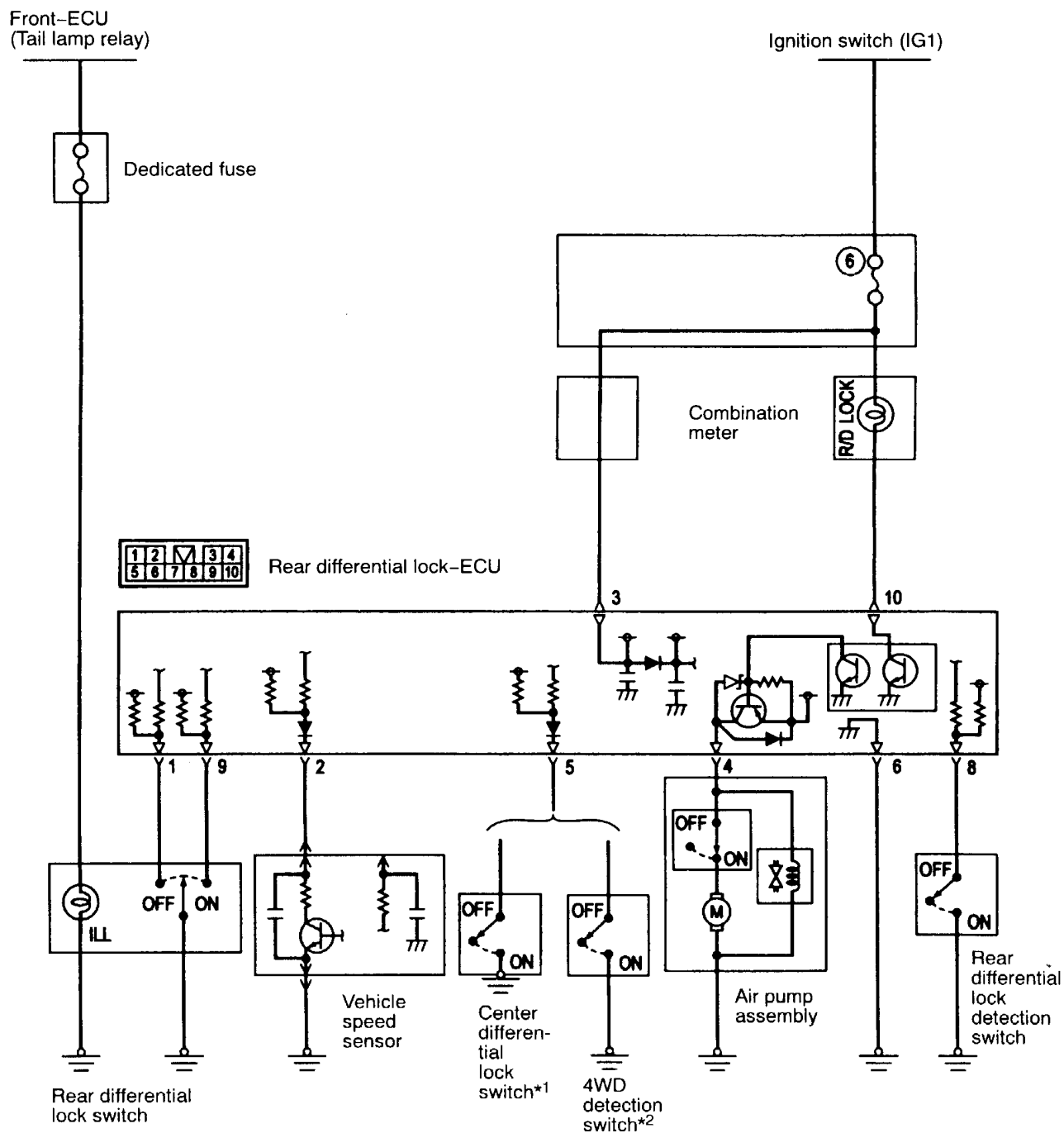


Part names		Out line of functions
ECU	Rear differential lock switch	This is an automatic return-type switch which sends ON/OFF signals to the rear differential lock-ECU.
	Rear differential lock indicator lamp	This is incorporated into the 4WD indicator lamps in the combination meter. It illuminates when the rear differential is locked, and flashes* during changeovers.
	Rear differential lock detection switch	This switch detects whether the rear differential is locked or free. It turns on and off together with the operation of the drive cam in the differential case.
	Air pump assembly	Operates in conjunction with the rear differential lock switch turning on and off. However, it can only operate when the vehicle speed is less than 12 km/h.
	Rear differential lock-ECU	Operates parts such as the air pump based on signals from the various switches.
Air hoses	Air hoses and pipes	These connect the air pump and the rear differential, and convey air from the air pump.
Differential lock section	Rear differential	The rear differential has built-in actuators and pressure plates, and is also equipped with a rear differential lock detection switch.

NOTE

*:The rear differential lock has a standby mechanism for the protection of the lock mechanism, so that the rear differential may not always lock straight away when the switch is operated. The indicator lamp will flash at such times. In addition, the indicator lamp also flashes during the interlock condition (when the ECU prevents changeover) when the switch is turned on while the vehicle is travelling at a speed of 12 km/h or more.

REAR DIFFERENTIAL LOCK SYSTEM CIRCUIT DIAGRAM



X1518CA

NOTE

*1: Indicates vehicles with Super Select 4WD II

*2: Indicates vehicles with Part Time 4WD

REAR DIFFERENTIAL LOCK

- The indicator lamp flashes while the differential is switching from free to locked, and then illuminates steadily when the operation is complete. In addition, the indicator lamp flashes and then switches off in the same way when the differential changes from locked to free.
- The rear differential cannot be switched to the locked condition when the vehicle speed is higher than 12 km/h as a safety measure and also to protect the lock mechanism, and the indicator lamp will flash if this is attempted. When the vehicle speed drops below 6 km/h, the differential will switch to the locked condition. In addition, the differential can be switch from the locked to the free condition when the vehicle speed is 12 km/h or above.

Rear differential lock switch	Vehicle speed	Air pump assembly	Rear differential operating condition	Rear differential indicator lamp
Neutral position	Unrelated	Not operating	Free	Switched off
From neutral to ON position	Less than 12 km/h	Operating	Changing from free to locked	Flashing to illuminated
	12 km/h or more	Not operating	Free	Flashing
From neutral to OFF position	Unrelated	Not operating	Changing from locked to free	Flashing to illuminated

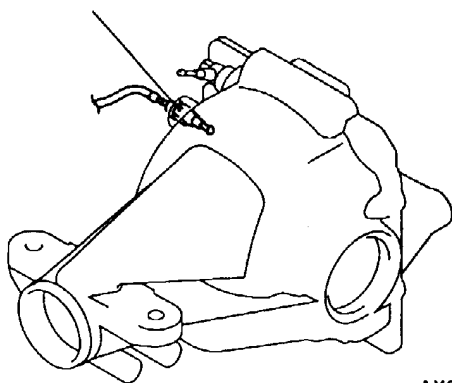
NOTE

The rear differential can only lock while the center differential is locked. If the center differential is unlocked, the rear differential will automatically unlock also.

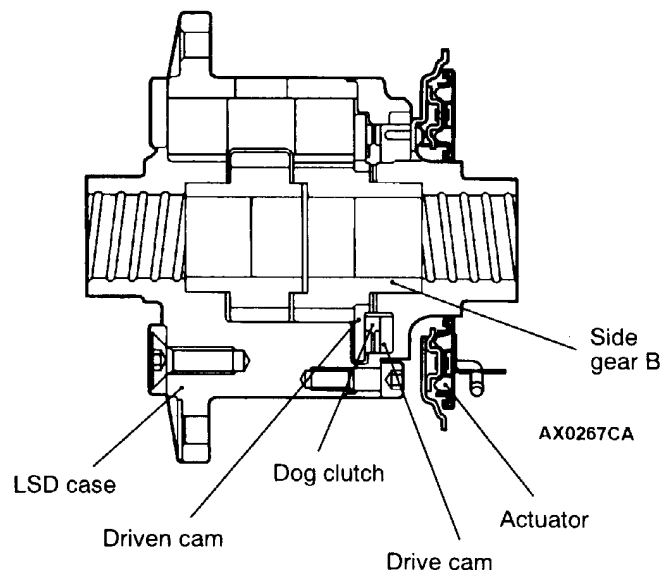
REAR DIFFERENTIAL BODY

- The rear differential body has a compact construction with a built-in diaphragm-type actuator, to increase reliability and resistance to objects such as flying stones. In addition, the differential lock detection switch is located on the differential carrier.
- The pneumatic pressure generated by the air pump assembly operates the actuator to engage the drive cam and the driven cam dog clutch, which serves to lock the LSD case and side gear B to prevent them from operating.

Rear differential lock detection switch



AX0266CA



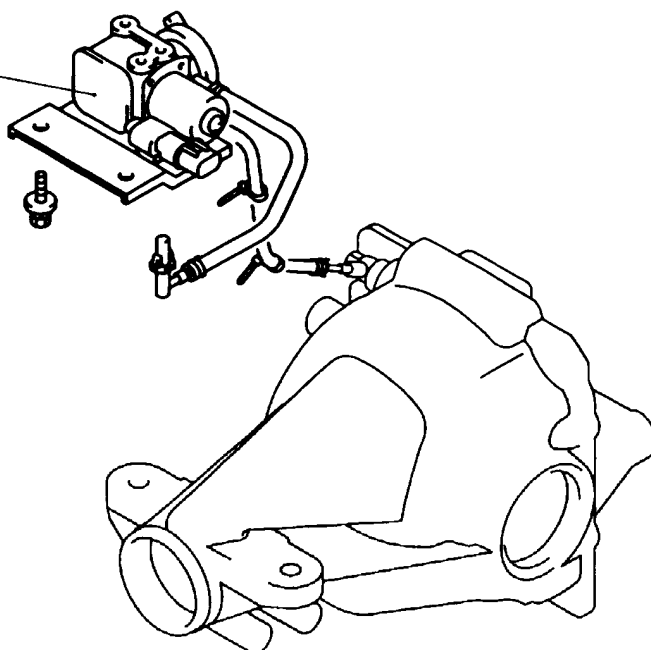
AX0267CA

AIR PUMP ASSEMBLY

- The air pump assembly is installed to the rear floor above the rear differential assembly by means of a bracket.
- The air pump assembly consists of a motor, a pressure switch and a release valve. When the differential lock switch is turned on, the motor operates to generate a pneumatic pressure which moves the actuator to the lock side.
- The operation of the pressure switch causes the pressure to be maintained at a constant pressure 24.5 – 39 kPa) in order to keep the differential locked. If the pressure rises above the maximum constant pressure (39 kPa), the pressure switch opens and causes the motor to stop temporarily. In addition, if the pressure drops below the minimum constant pressure (24.5 kPa), the pressure switch turns back on and the motor starts running again.
- When an OFF signal is input from the differential lock switch, the differential-ECU control causes the motor to stop, and also opens the release valve to allow the internal pressure to escape, thus releasing the differential lock.

Rear differential lock operating condition	Air pump assembly	Pressure switch	Release valve
From free to locked (when charged with air)	Operating	Changing from ON to OFF	Closed (when current is supplied)
Lock held condition	Not operating	OFF	Closed (when current is supplied)
From locked to free (when air is released)	Not operating	Changing from OFF to ON	Open (when current is not supplied)

Air pump assembly



AX0268CA

REAR DIFFERENTIAL LOCK INDICATOR LAMP

The rear differential indicator lamp of the 4WD indicator lamps in the combination meter flashes or illuminates with an orange (amber) colour.

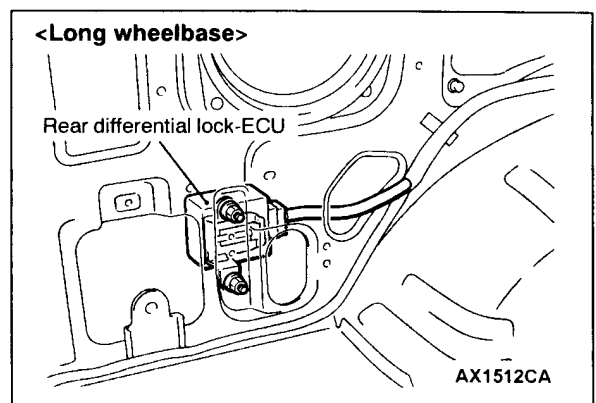
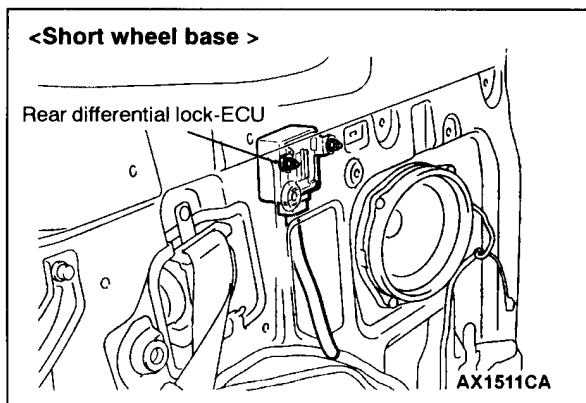
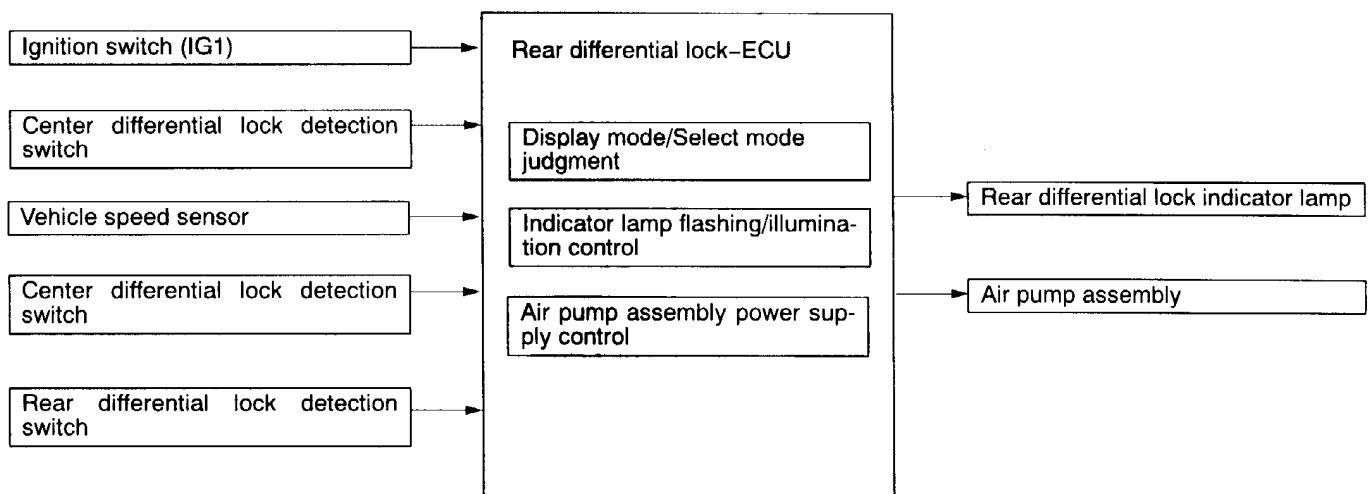
FUNCTION

- (1) The indicator lamp illuminates when the rear differential is locked. (when the dog clutch is engaged).
- (2) The indicator lamp flashes during changeover and when the interlock is active (when the control unit does not allow changeover from free to locked to occur because the vehicle speed is 12 km/h or higher).
- (3) The indicator lamp illuminates unconditionally for 5 seconds after the ignition switch is turned to ON (when the engine is started) in order to check the bulb.

Rear differential lock-ECU

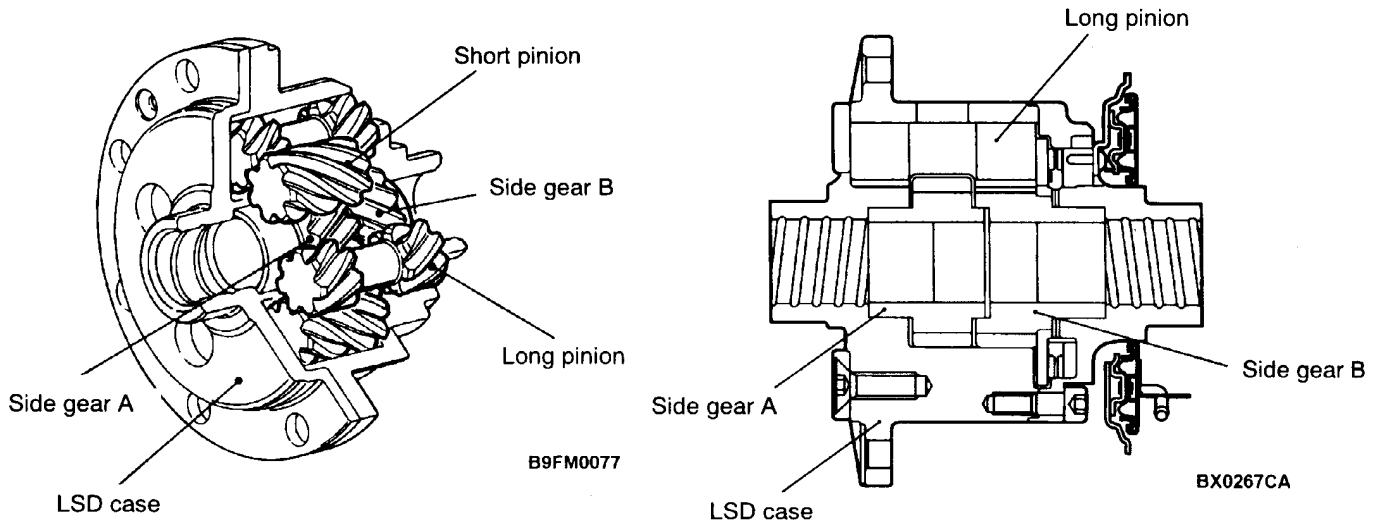
The ECU is installed to the quarter panel (L.H.) by means of a bracket, and it controls the following items.

- The power supply to the air pump assembly turns on and off in accordance with the ON/OFF signals from the rear differential lock switch and the center differential lock detection switch.
- When the vehicle speed is 12 km/h or more, the air pump assembly is prevented from turning from off to on.
- The rear differential lock indicator lamp turns on and off in accordance with the ON/OFF signals from the rear differential lock detection switch. However, the indicator lamp flashes during changeover and when the interlock is active.
- When the ignition switch is at the ON position, the indicator lamp illuminates for approximately 5 seconds regardless of the settings for each switch.

**SYSTEM BLOCK DIAGRAM**

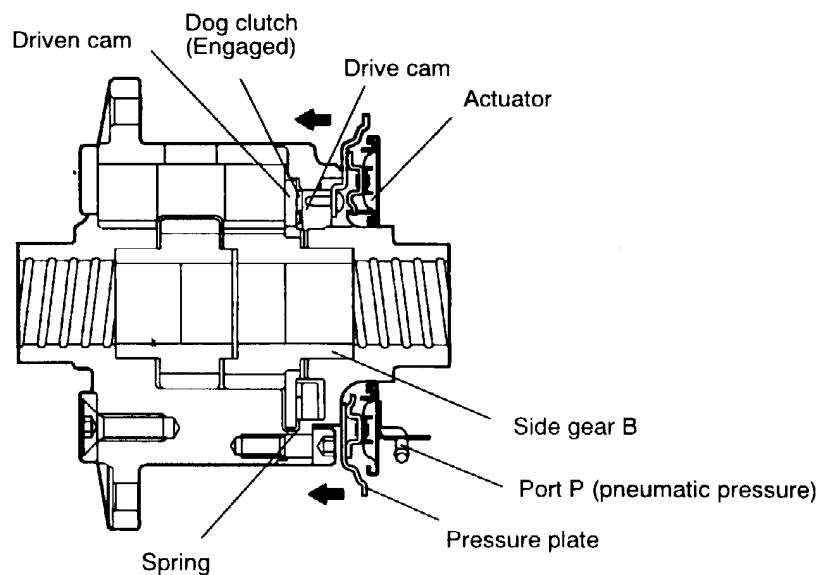
SYSTEM OPERATION**(1) Free**

The torque which is input to the helical LSD is transmitted from the differential case, long and short pinions and side gears A and B to the drive shafts.

**(2) Locked**

When pneumatic pressure is applied from port P, this operates the actuator to move the pressure plate and the drive cam in the direction of the arrow. Then, when the drive cam and the driven cam dog clutch are engaged, this prevents the differential case and side gear B from operating, so that the rear differential becomes locked.

In addition, there is another cam located between the differential case and the drive cam, so that the drive cam is pressed against the driven cam and cannot be released only when torque is being applied to the differential case.



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(3) Unlocked

When the pneumatic pressure applied via port P is released, the actuator no longer applies pressure to push the pressure plate. Thus when the torque is not applied to the differential case, the drive cam is moved in the direction of the arrow by the force of the spring. This releases it from the driven cam so that the rear differential returns to the free condition.

