Automatic Transmission Workshop Manual RC4A–EL

CONTENTS

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FOREWORD

This manual explains the structure, operation, and service points for the above-indicated automatic transmission.

In order to do these procedures safely, quickly, and correctly, you must first read this manual and any other relevant service materials carefully.

The information in this manual is current up to March, 2003. Any changes that occur after that time will not be reflected in this particular manual. Therefore, the contents of this manual may not exactly match the mechanism that you are currently servicing.

Mazda Motor Corporation
HIROSHIMA, JAPAN

GENERAL INFORMATION

00
SECTION

00–00 GENERAL INFORMATION

HOW TO USE THIS MANUAL

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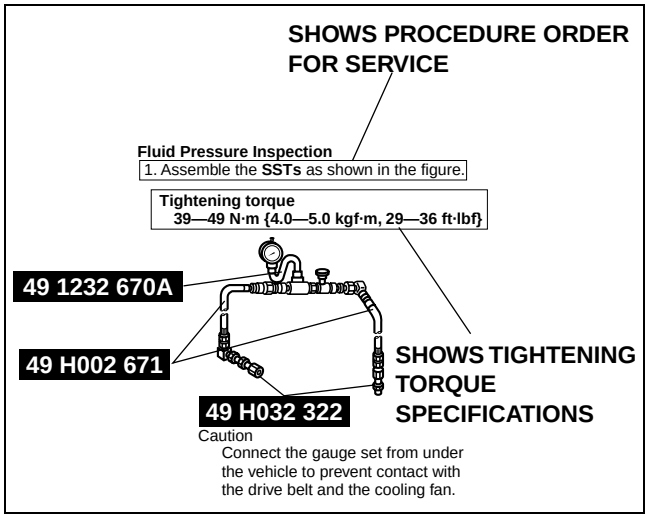
Range of Topics

- This manual contains procedures for performing all required service operations. The procedures are divided into the following five basic operations:
  - — Removal/Installation
  - — Disassembly/Assembly
  - — Replacement
  - — Inspection
  - — Adjustment
- Simple operations which can be performed easily just by looking at the vehicle (i.e., removal/installation of parts, jacking, vehicle lifting, cleaning of parts, and visual inspection) have been omitted.

Service Procedure
Inspection, adjustment

- Inspection and adjustment procedures are divided into steps. Important points regarding the location and contents of the procedures are explained in detail and shown in the illustrations.



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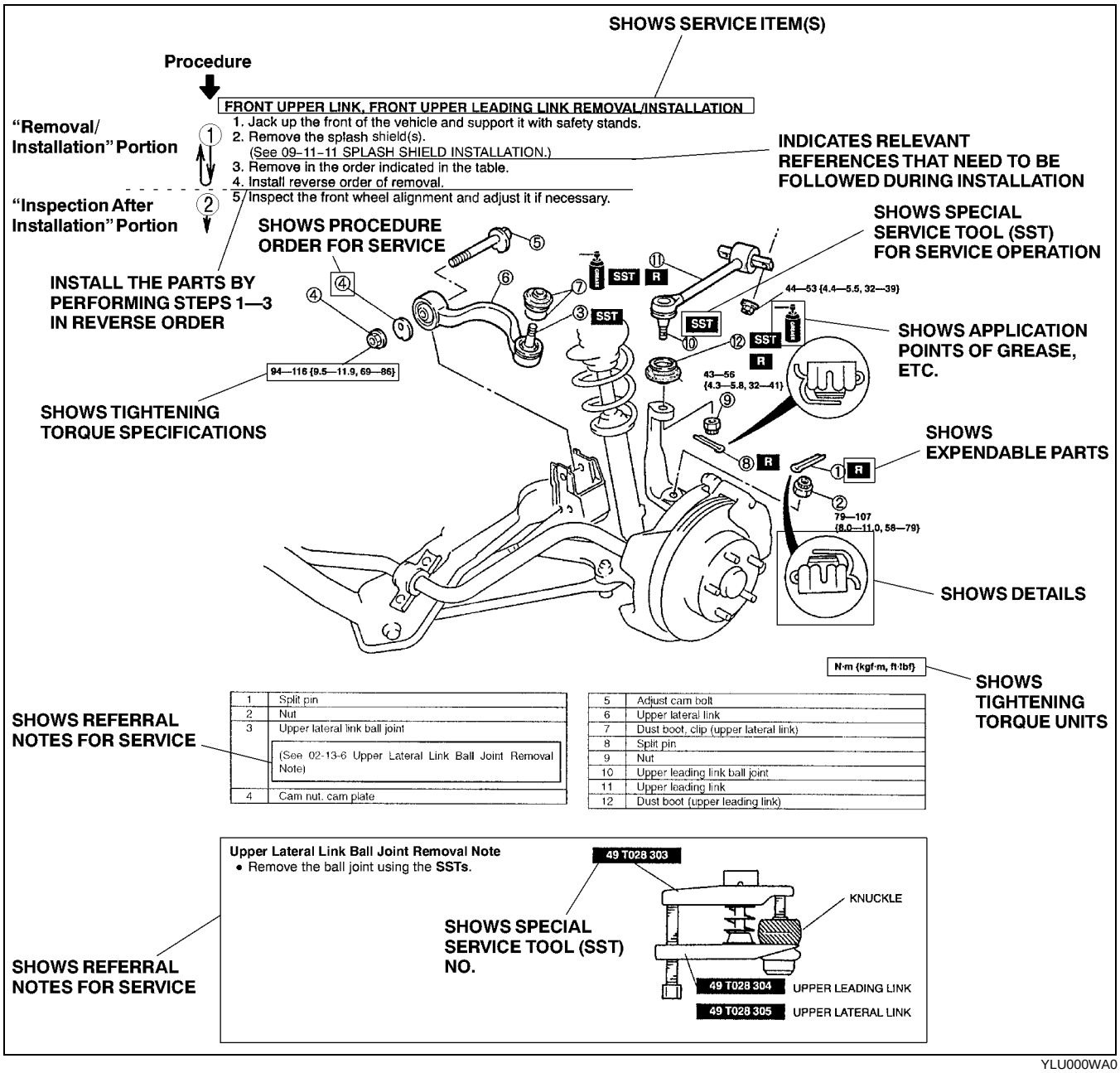
Repair procedure

1. Most repair operations begin with an overview illustration. It identifies the components, shows how the parts fit together, and describes visual part inspection. However, only removal/installation procedures that need to be performed methodically have written instructions.
2. Expendable parts, tightening torques, and symbols for oil, grease, and sealant are shown in the overview illustration. In addition, symbols indicating parts requiring the use of special service tools or equivalent are also shown.
3. Procedure steps are numbered and the part that is the main point of that procedure is shown in the illustration with the corresponding number. Occasionally, there are important points or additional information concerning a procedure. Refer to this information when servicing the related part.



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Symbols

- There are eight symbols indicating oil, grease, fluids, sealant, and the use of **SST** or equivalent. These symbols show application points or use of these materials during service.

Symbol	Meaning	Kind
	Apply oil	New appropriate engine oil or gear oil
	Apply brake fluid	New appropriate brake fluid
	Apply automatic transaxle/ transmission fluid	New appropriate automatic transaxle/ transmission fluid
	Apply grease	Appropriate grease
	Apply sealant	Appropriate sealant
	Apply petroleum jelly	Appropriate petroleum jelly
R	Replace part	O-ring, gasket, etc.
SST	Use SST or equivalent	Appropriate tools

Advisory Messages

- You will find several **Warnings**, **Cautions**, **Notes**, **Specifications** and **Upper and Lower Limits** in this manual.

Warning

- A Warning indicates a situation in which serious injury or death could result if the warning is ignored.

Caution

- A Caution indicates a situation in which damage to the vehicle or parts could result if the caution is ignored.

Note

- A Note provides added information that will help you to complete a particular procedure.

Specification

- The values indicate the allowable range when performing inspections or adjustments.

Upper and lower limits

- The values indicate the upper and lower limits that must not be exceeded when performing inspections or adjustments.

UNITS

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Electric current	A (ampere)
Electric power	W (watt)
Electric resistance	ohm
Electric voltage	V (volt)
Length	mm (millimeter)
	in (inch)
Negative pressure	kPa (kilo pascal)
	mmHg (millimeters of mercury)
	inHg (inches of mercury)
Positive pressure	kPa (kilo pascal)
	kgf/cm^2 (kilogram force per square centimeter)
	psi (pounds per square inch)
Number of revolutions	rpm (revolutions per minute)
Torque	N·m (Newton meter)
	kgf·m (kilogram force meter)
	kgf·cm (kilogram force centimeter)
	ft·lbf (foot pound force)
	in·lbf (inch pound force)
Volume	L (liter)
	US qt (U.S. quart)
	Imp qt (Imperial quart)
	ml (milliliter)
	cc (cubic centimeter)
	cu in (cubic inch)
	fl oz (fluid ounce)
Weight	g (gram)
	oz (ounce)

Conversion to SI Units (Système International d'Unités)

- All numerical values in this manual are based on SI units. Numbers shown in conventional units are converted from these values.

Rounding Off

- Converted values are rounded off to the same number of places as the SI unit value. For example, if the SI unit value is 17.2 and the value after conversion is 37.84, the converted value will be rounded off to 37.8.

Upper and Lower Limits

- When the data indicates upper and lower limits, the converted values are rounded down if the SI unit value is an upper limit and rounded up if the SI unit value is a lower limit. Therefore, converted values for the same SI unit value may differ after conversion. For example, consider 2.7 kgf/cm^2 in the following specifications:

  210—260 kPa {2.1—2.7 kgf/cm^2, 30—38 psi}
  270—310 kPa {2.7—3.2 kgf/cm^2, 39—45 psi}

- The actual converted values for 2.7 kgf/cm^2 are 264 kPa and 38.4 psi. In the first specification, 2.7 is used as an upper limit, so the converted values are rounded down to 260 and 38. In the second specification, 2.7 is used as a lower limit, so the converted values are rounded up to 270 and 39.

FUNDAMENTAL PROCEDURES

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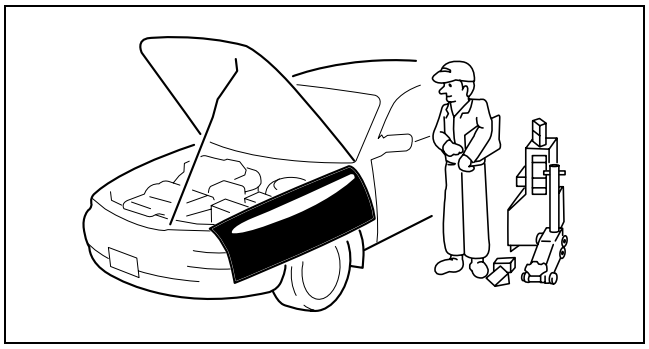
Preparation of Tools and Measuring Equipment

- Be sure that all necessary tools and measuring equipment are available before starting any work.



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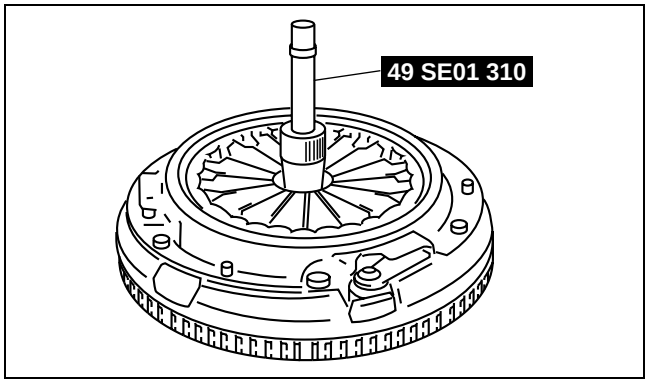
Special Service Tools

- Use special service tools or equivalent when they are required.



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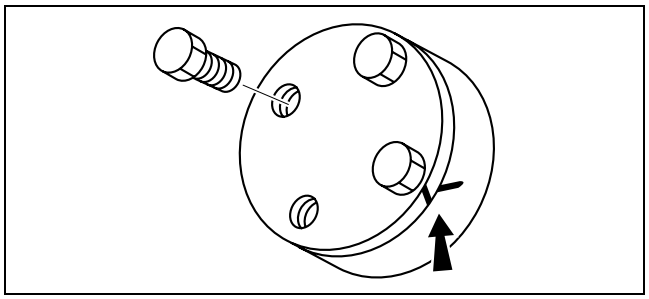
Disassembly

- If the disassembly procedure is complex, requiring many parts to be disassembled, all parts should be marked in a place that will not affect their performance or external appearance and identified so that reassembly can be performed easily and efficiently.



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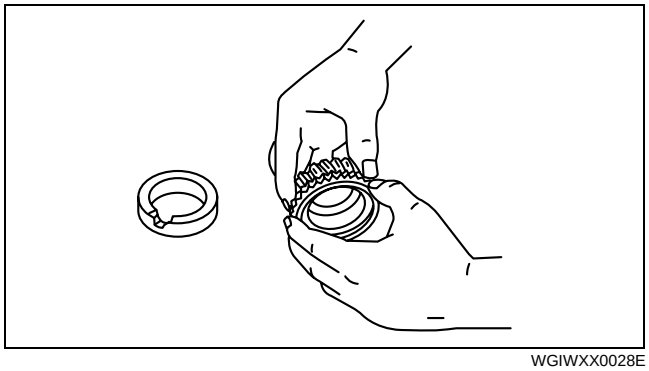
Inspection During Removal, Disassembly

- When removed, each part should be carefully inspected for malfunction, deformation, damage and other problems.



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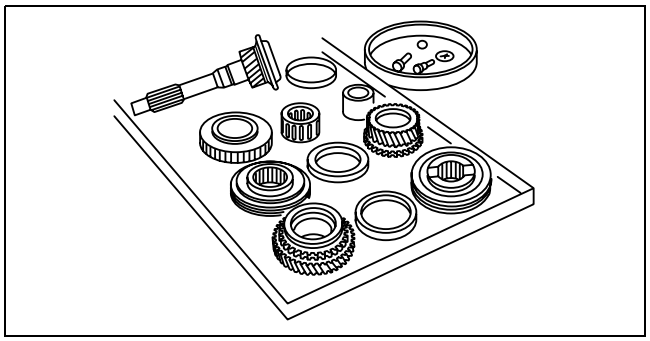
Arrangement of Parts

- All disassembled parts should be carefully arranged for reassembly.
- Be sure to separate or otherwise identify the parts to be replaced from those that will be reused.



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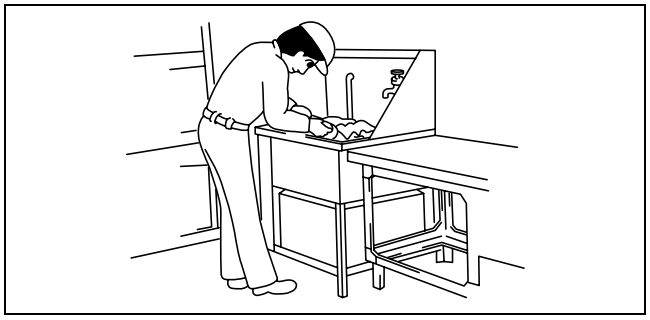
Cleaning of Parts

- All parts to be reused should be carefully and thoroughly cleaned in the appropriate method.

  Warning

  - **Using compressed air can cause dirt and other particles to fly out causing injury to the eyes. Wear protective eye wear whenever using compressed air.**



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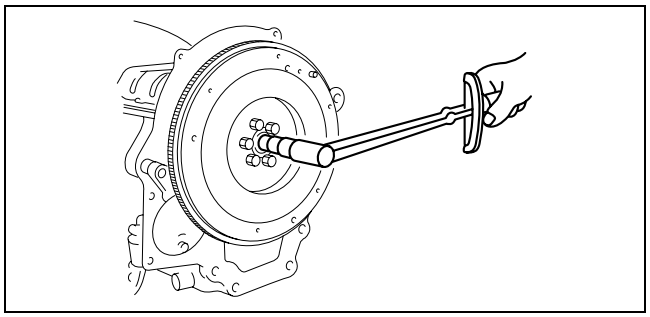
Reassembly

- Standard values, such as torques and certain adjustments, must be strictly observed in the reassembly of all parts.
- If removed, the following parts should be replaced with new ones:
  - — Oil seals
  - — Gaskets
  - — O-rings
  - — Lock washers
  - — Cotter pins
  - — Nylon nuts



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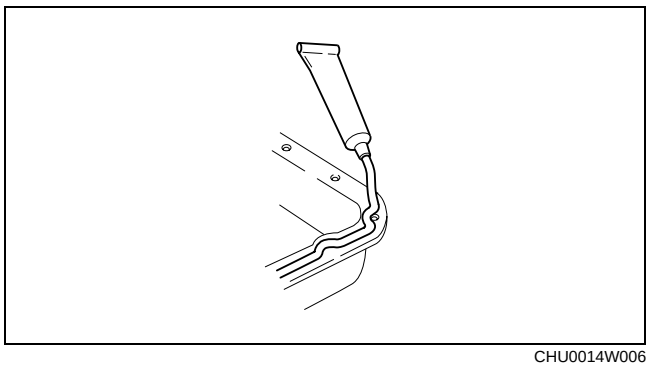
- Depending on location:
  - — Sealant and gaskets, or both, should be applied to specified locations. When sealant is applied, parts should be installed before sealant hardens to prevent leakage.
  - — Oil should be applied to the moving components of parts.
  - — Specified oil or grease should be applied at the prescribed locations (such as oil seals) before reassembly.



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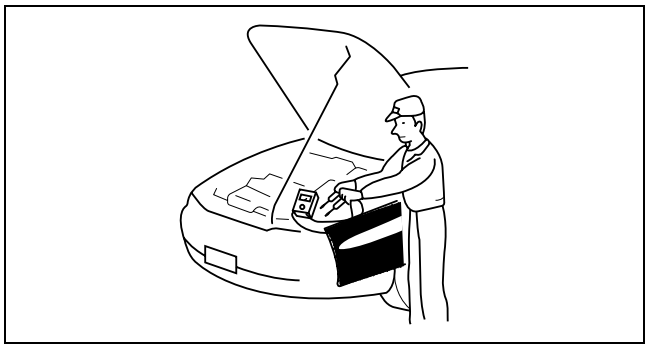
Adjustment

- Use suitable gauges and testers when making adjustments.



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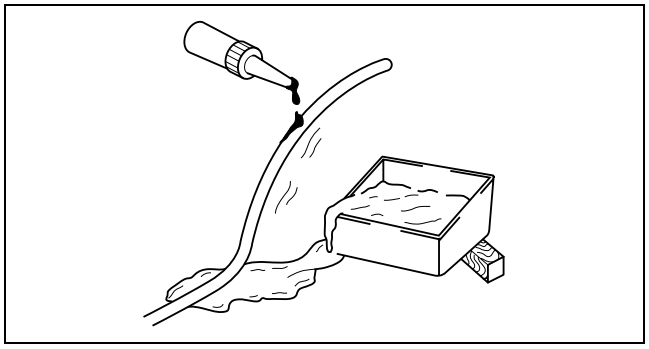
Rubber Parts and Tubing

- Prevent gasoline or oil from getting on rubber parts or tubing.



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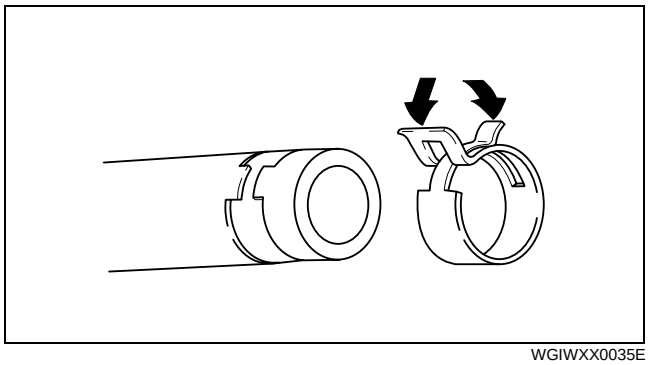
Hose Clamps

- When reinstalling, position the hose clamp in the original location on the hose and squeeze the clamp lightly with large pliers to ensure a good fit.



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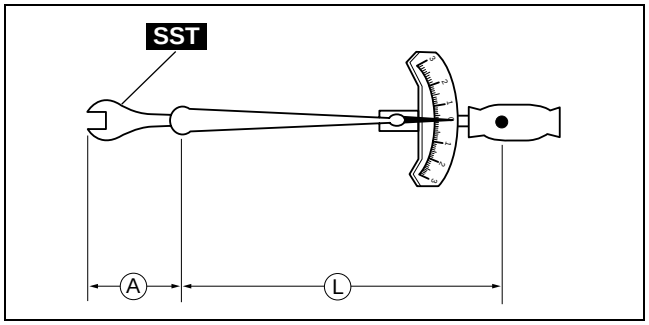
Torque Formulas

- When using a torque wrench-**SST** or equivalent combination, the written torque must be recalculated due to the extra length that the **SST** or equivalent adds to the torque wrench. Recalculate the torque by using the following formulas. Choose the formula that applies to you.

Torque Unit	Formula
N·m	N·m × [L/(L+A)]
kgf·m	kgf·m × [L/(L+A)]
kgf·cm	kgf·cm × [L/(L+A)]
ft·lbf	ft·lbf × [L/(L+A)]
in·lbf	in·lbf × [L/(L+A)]



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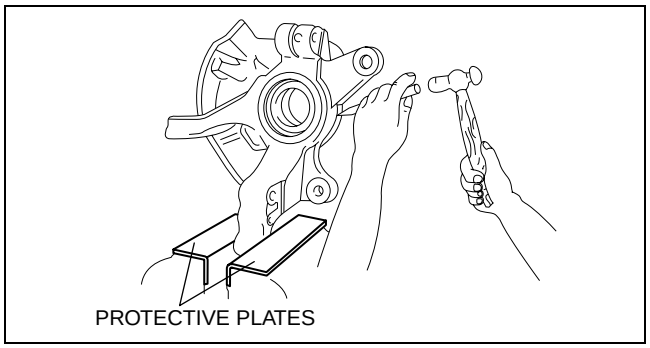
A : The length of the **SST** past the torque wrench drive.
L : The length of the torque wrench.

Vise

- When using a vise, put protective plates in the jaws of the vise to prevent damage to parts.



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ELECTRICAL SYSTEM

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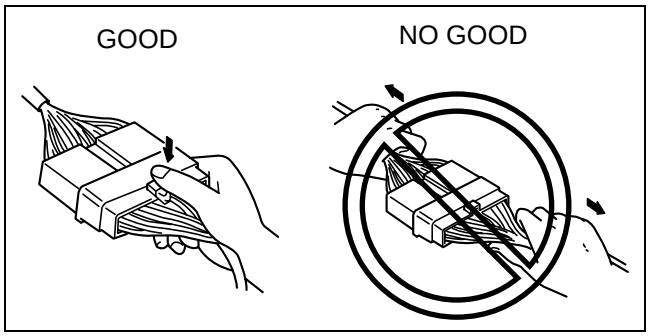
Connectors

Disconnecting connectors

- When disconnecting connector, grasp the connectors, not the wires.



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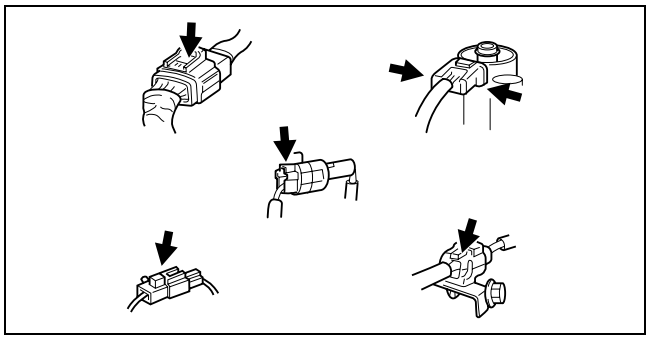
- Connectors can be disconnected by pressing or pulling the lock lever as shown.



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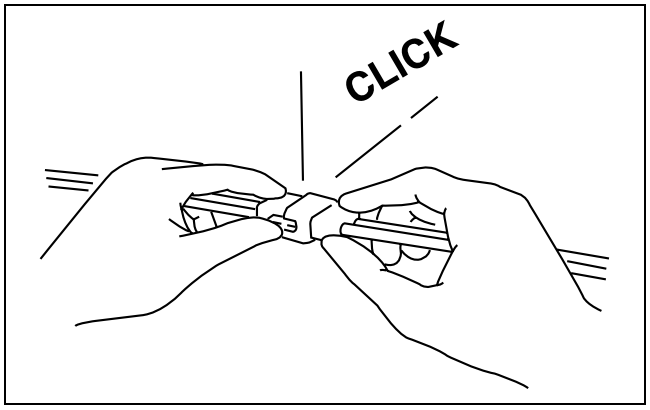
Locking connector

- When locking connectors, listen for a click indicating they are securely locked.



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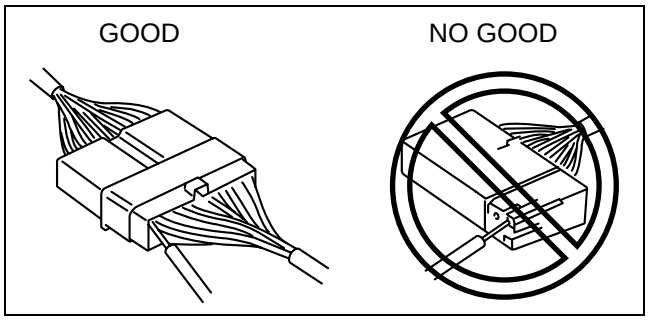
Inspection

- When a tester is used to inspect for continuity or measuring voltage, insert the tester probe from the wiring harness side.
- Inspect the terminals of waterproof connectors from the connector side since they cannot be accessed from the wiring harness side.

Caution

- **To prevent damage to the terminal, wrap a thin wire around the tester probe before inserting into terminal.**



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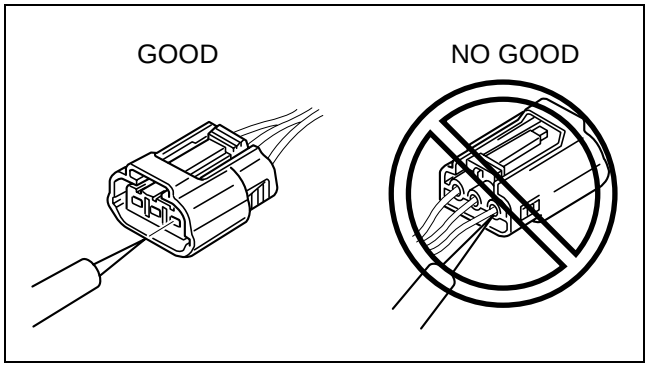

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SAE STANDARDS

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- In accordance with new regulations, SAE (Society of Automotive Engineers) standard names and abbreviations are now used in this manual. The table below lists the names and abbreviations that have been used in Mazda manuals up to now and their SAE equivalents.

SAE Standard		Remark		SAE Standard		Remark
Abbreviation	Name			Abbreviation	Name	
AP	Accelerator Pedal			MAP	Manifold Absolute Pressure	
APP	Accelerator Pedal Position			MAF	Mass Air Flow	
ACL	Air Cleaner			MAF sensor	Mass Air Flow Sensor	
A/C	Air Conditioning			MFL	Multiport Fuel Injection	
A/F	Air Fuel Ratio			OBD	On-board Diagnostic System	
BARO	Barometric Pressure			OL	Open Loop	
B+	Battery Positive Voltage			OC	Oxidation Catalytic Converter	
CMP sensor	Camshaft Position Sensor			O2S	Oxygen Sensor	
LOAD	Calculated Load Value			PNP	Park/Neutral Position	
CAC	Charge Air Cooler			PID	Parameter Identification	
CLS	Closed Loop System			PSP	Power Steering Pressure	
CTP	Closed Throttle Position			PCM	Powertrain Control Module	#3
CPP	Clutch Pedal Position			PAIR	Pulsed Secondary Air Injection	Pulsed injection
CIS	Continuous Fuel Injection System					
CKP sensor	Crankshaft Position Sensor			AIR	Secondary Air Injection	Injection with air pump
DLC	Data Link Connector					
DTM	Diagnostic Test Mode	#1				
DTC	Diagnostic Test Code(s)			SAPV	Secondary Air Pulse Valve	
DI	Distributor Ignition			SFI	Sequential Multiport Fuel Injection	
DLI	Distributorless Ignition					
EI	Electronic Ignition	#2		3GR	Third Gear	
ECT	Engine Coolant Temperature			TWC	Three Way Catalytic Converter	
EM	Engine Modification			TB	Throttle Body	
EVAP	Evaporative Emission			TP	Throttle Position	
EGR	Exhaust Gas Recirculation			TP sensor	Throttle Position Sensor	
FC	Fan Control			TCC	Torque Converter Clutch	
FF	Flexible Fuel			TCM	Transmission (Transaxle) Control Module	
4GR	Fourth Gear					
GEN	Generator			TR	Transmission (Transaxle) Range	
GND	Ground			TC	Turbocharger	
HO2S	Heated Oxygen Sensor	With heater		VSS	Vehicle Speed Sensor	
				VR	Voltage Regulator	
IAC	Idle Air Control			VAF sensor	Volume Air Flow Sensor	
IAT	Intake Air Temperature			WU-TWC	Warm Up Three Way Catalytic Converter	#4
KS	Knock Sensor					
MIL	Malfunction Indicator Lamp			WOP	Wide Open Throttle	

#1 : Diagnostic trouble codes depend on the diagnostic test mode.
#2 : Controlled by the PCM
#3 : Device that controls engine and powertrain
#4 : Directly connected to exhaust manifold

ABBREVIATIONS

CHU000000011A01

ATF	Automatic Transmission Fluid
AT	Automatic Transmission
CAN	Controller Area Network
SST	Special Service Tools
TFT	Transmission Fluid Temperature

TRANSMISSION/TRANSAXLE

05
SECTION

05–13Y AUTOMATIC TRANSMISSION

AUTOMATIC TRANSMISSION OUTLINE

CHU051301026A01

- A newly developed RC4A-EL type electronically controlled automatic transmission with four-speeds and a torque converter clutch mechanism combining advanced electronic and mechanical technologies has been adopted.
- The RC4A-EL type has been newly developed as an automatic transmission with state-of-the-art technology.
- In the RC4A-EL type automatic transmission, the part count is greatly reduced to lessen its size and weight. Also, a well-balanced powertrain mechanism with high reliability is adopted to improve marketability.

AUTOMATIC TRANSMISSION FEATURES

CHU051301026A02

Improved marketability	• The Sport AT has been adopted.
Superior shift quality	• Direct electronic shift control by duty-cycle solenoids has been adopted. • A feedback control system has been adopted. • A centrifugal balance clutch chamber has been adopted. • A plate-type clutch pack replaces the band brake in the 2-4 brake.
High efficiency, compactness, lightweight	• A miniature trochoid gear oil pump with torque converter direct drive has been adopted. • Due to complete electronic control of clutch engagement and release pressure, the forward one-way and overrunning clutches have been eliminated. • Due to the adoption of direct electronic clutch pressure control (direct electronic shift control), accumulators have been eliminated.
Improved reliability, reduced NVH (noise, vibration, and harshness)	• A pleat type oil strainer with fine mesh has been adopted. • A highly rigid transmission case has been adopted.

AUTOMATIC TRANSMISSION SPECIFICATIONS

CHU051301026A03

Item		Specifications
Transmission type		RC4A-EL
Gear ratio	1GR	2.785
	2GR	1.545
	3GR	1.000
	4GR	0.694
	Reverse	2.272
Hydraulic system (Number of drive/driven plates)	Low clutch	5/5
	High clutch	6/6
	Reverse clutch	2/2
	2-4 brake	4/8
	Low and reverse brake	4/5
Front planetary gear (Number of teeth)	Front sun gear	33
	Front pinion gear	21
	Front internal gear	75
Rear planetary gear (Number of teeth)	Rear sun gear	42
	Rear pinion gear	17
	Rear internal gear	75

AUTOMATIC TRANSMISSION CONSTRUCTION

CHU051301026A04

Outline of operation

- The outline of the electronically-controlled automatic transmission is classified into three systems: the powertrain system (includes the torque converter mechanism), the hydraulic control system, and the electronic control system.

Powertrain system

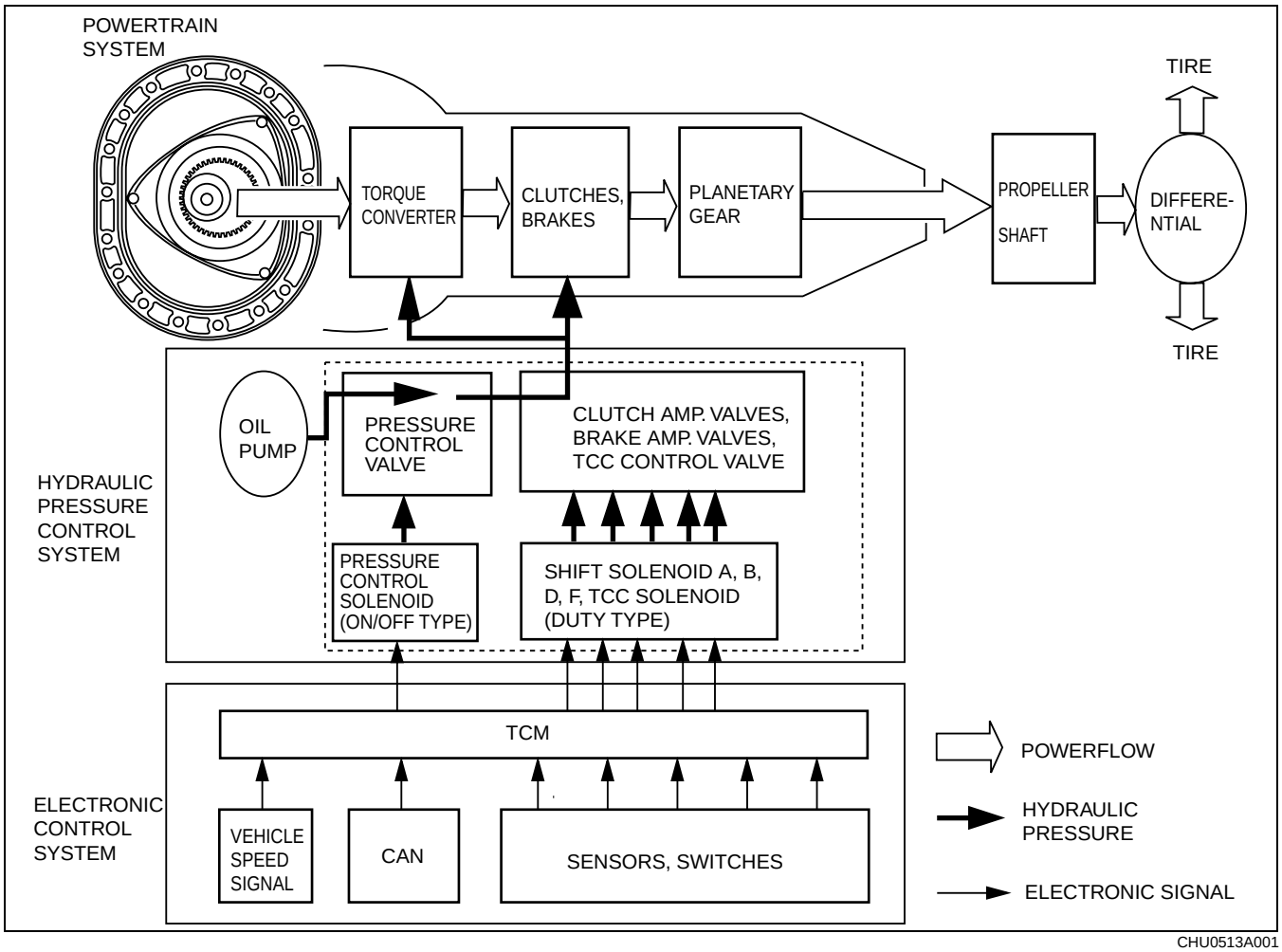
- Driving force from the engine is transmitted through the torque converter to the transmission.
- When the clutch and brakes are engaged by clutch pressure from the control valve, the planetary gear unit switches between fixed and input, and thus transmitted driving force is converted to optimum driving force.
- The converted driving force is transmitted to the propeller shaft, the differential, and the tires.

Hydraulic control system

- The solenoids operate, according to the signals from the TCM, to switch to high or low line pressure (depending on driving conditions) and regulate the clutch pressure.
- The on/off pressure control solenoid switches line pressure between high and low, duty cycle shift solenoids regulate clutch pressure, and duty cycle TCC solenoids control TCC.

Electronic control system

- The TCM sends signals that suit current driving conditions to the solenoids of the hydraulic control system, according to input signals from sensors and switches, and shifts gears.



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Position/Range	Mode	Gear position	Shift ratio	Shift pattern	Transmission								Operation of solenoid valve					Operation of oil pressure switch		
				Shift	TCC	Engine brake	Low clutch	High clutch	Reverse clutch	2-4 brake	Low and reverse brake	Low one-way clutch	Shift solenoid A	Shift solenoid B	Shift solenoid C	Shift solenoid F	TCC solenoid	Oil pressure switch B	Oil pressure switch C	Oil pressure switch F
P	—	—	—	—										X	X	X				
R	—	Reverse	2.272	—		X			X		X			X	X					X
N	—	—	—	—										X	X	X				
D	—	1GR	2.785				X					⊗		X	X	X				
		2GR	1.545			X	X			X					X	X		X		
		3GR	1.000			X	X	X						X		X			X	
		3GR TCC ON	1.000		X	X	X	X						X		X	X		X	
		4GR	0.694			X		X		X			X			X		X	X	
		4GR TCC ON	0.694		X	X		X		X			X			X	X	X	X	
M	MANUAL	1GR	2.785			X	X				X			X	X					
		2GR	1.545			X	X			X					X	X		X		
		3GR	1.000			X	X	X						X		X			X	
		4GR	0.694			X		X		X			X			X		X	X	
		4GR TCC ON	0.694		X	X		X		X			X			X	X	X	X	

↕ : Automatic shift according to set speed and throttle opening angle (During deceleration when in M range)
⇕ : Manual shift based on selector lever or steering shift switch operation
↑ : Consecutive shift by tapping selector lever or steering shift switch two times in the downshift direction
X : Operating (The solenoids are energized and the oil pressure switches are on)
⊗ : Transmits the torque only when driving

CHU0513A021

AUTOMATIC TRANSMISSION CROSS-SECTIONAL VIEW

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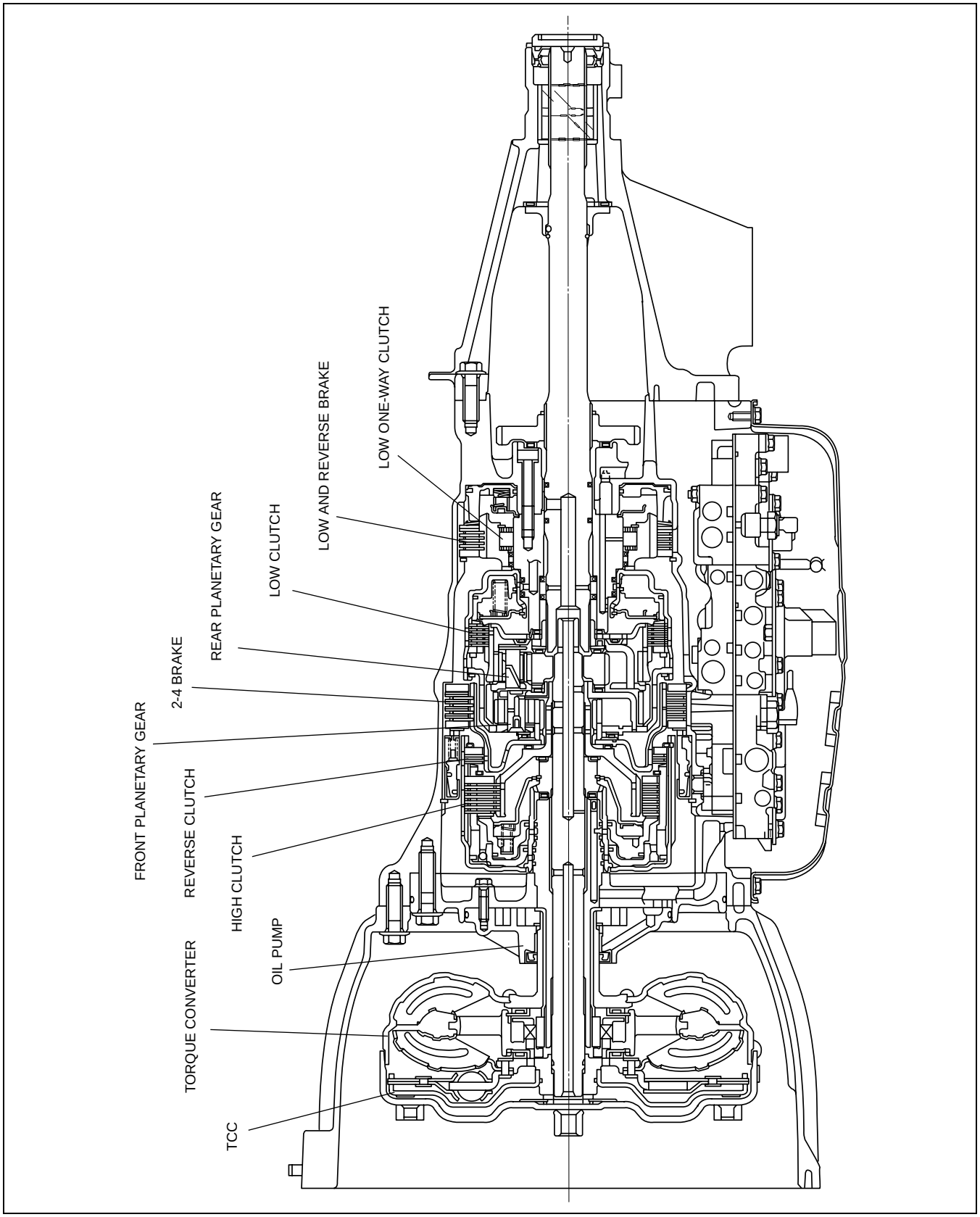

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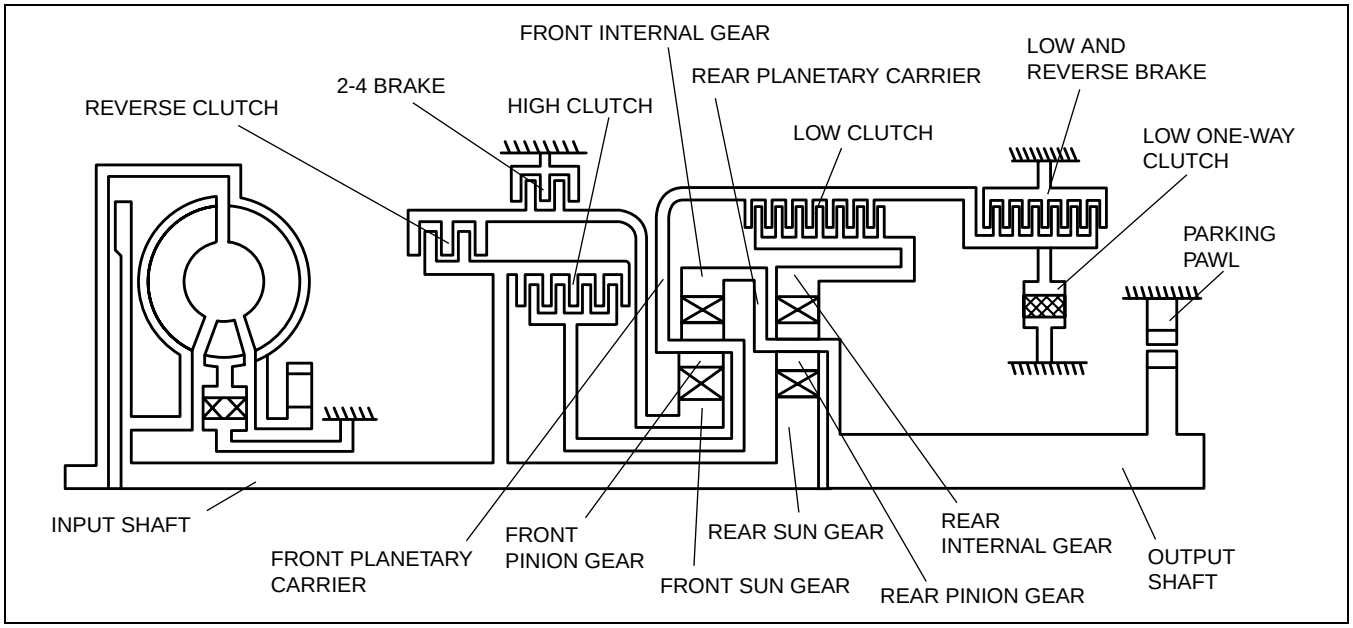
AUTOMATIC TRANSMISSION POWERTRAIN CONSTRUCTION/OPERATION

CHU051301026A06

Outline

- In the powertrain system, hydraulic pressure is transported from the control valves to operate the clutches and brakes and the planetary gear changes the gear ratio according to the vehicle driving condition.
- To improve shift quality, a plate-type clutch pack 2-4 brake, which has optimum control at low oil temperatures and is unaffected by changes over time, is used.
- A highly rigid transmission case has been adopted to reduce noise and vibration.
- The powertrain system of the RC4A-EL type consists of three pairs of clutches, two pairs of brakes, a one-way clutch, and two pairs of single type planetary gears.



CHU0513A004

Operation

Note

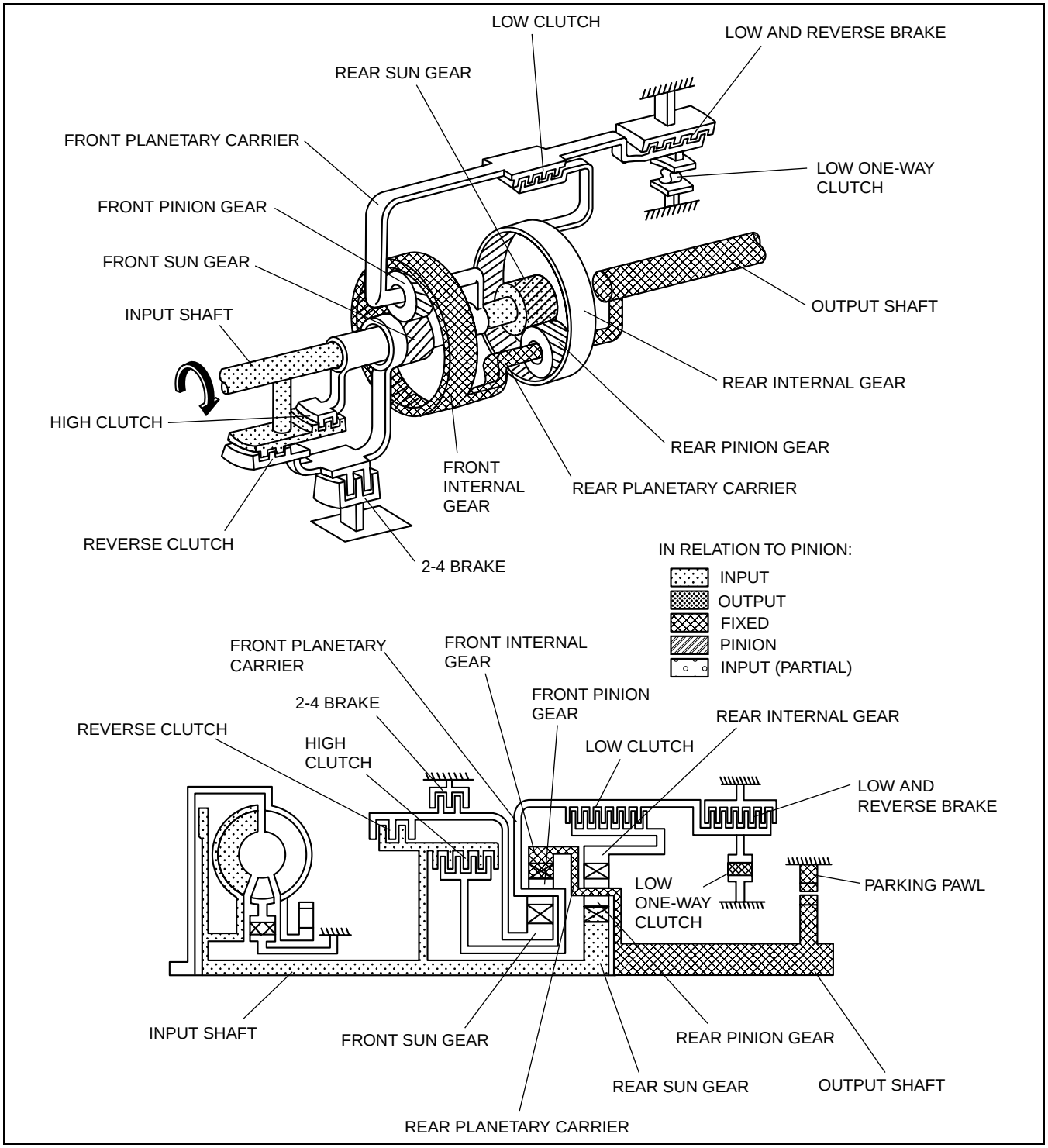
- All rotation directions are as viewed from the side cover.

Component description

Component	Function
Low clutch	• Transmits rotation of front planetary carrier to rear internal gear • Operates in 1GR, 2GR, or 3GR position
High clutch	• Transmits rotation of input shaft to front planetary carrier • Operates in 3GR or 4GR position
Reverse clutch	• Transmits rotation of reverse clutch drum to front sun gear • Operates when vehicle is reversing
2-4 brake	• Prevents rotation of front sun gear • Operates in 2GR or 4GR position
Low and reverse brake	• Prevents rotation of front planetary carrier • Operates when vehicle is reversing or in 1GR position (M range)
Low one-way clutch	• Locks clockwise rotation of front planetary carrier in 1GR position
Planetary gear	• The planetary gear functions as a transmission due to the engagement/disengagement of clutches and/or brakes, converts the transmitted driving force of the input shaft and transmits it to the output shaft.

Power Flow
P position

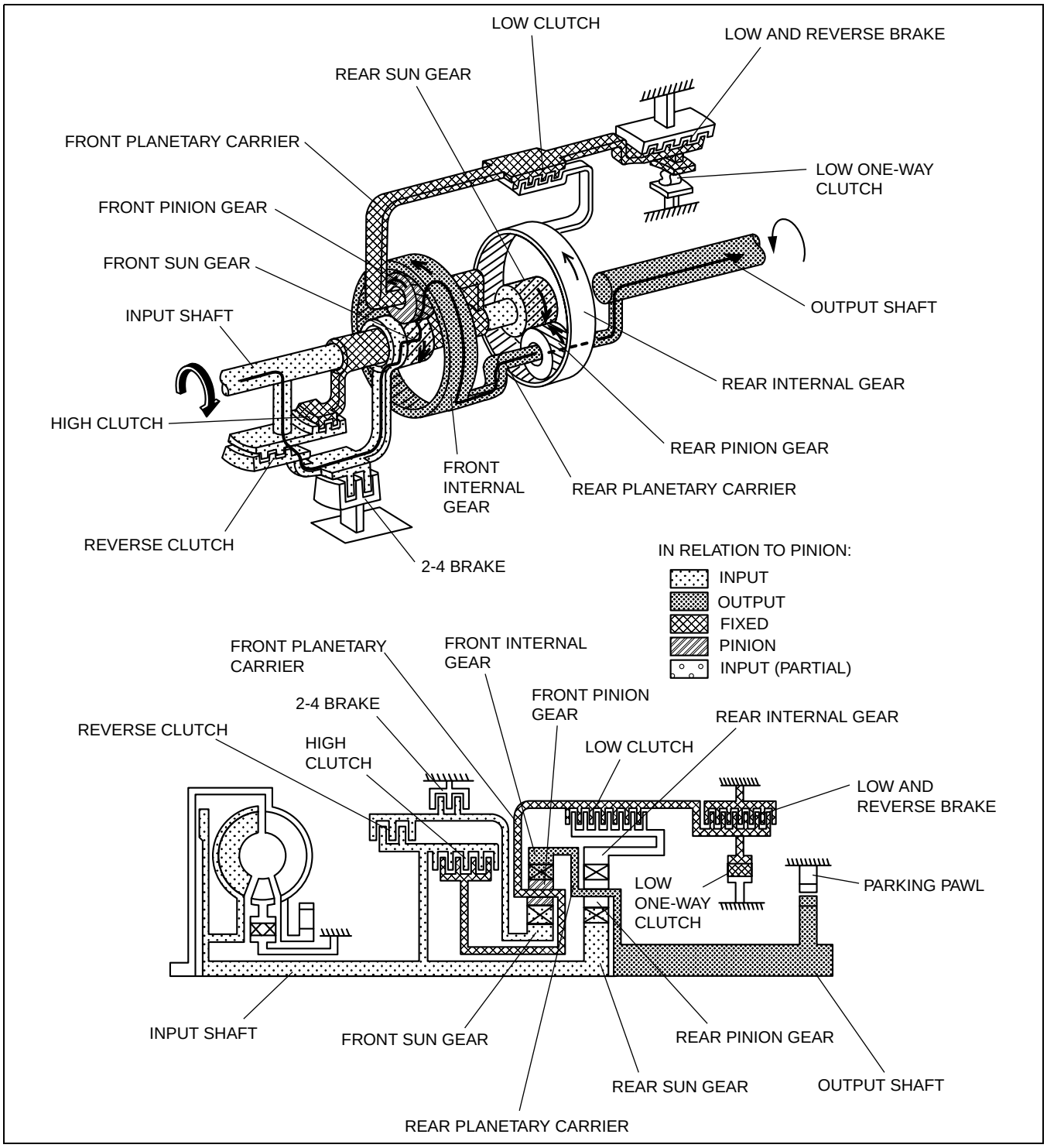
- The driving force of the input shaft is transmitted to the rear sun gear and the reverse and high clutch drum. However, since none of the clutches are operating, the driving force is not transmitted to the output shaft. Accordingly, the vehicle is under conditions enabling movement but since the parking pawl mechanically locks the output shaft, the rear planetary gear and front internal gear are locked. Due to this, the vehicle is stopped.



CHU0513A005

R position

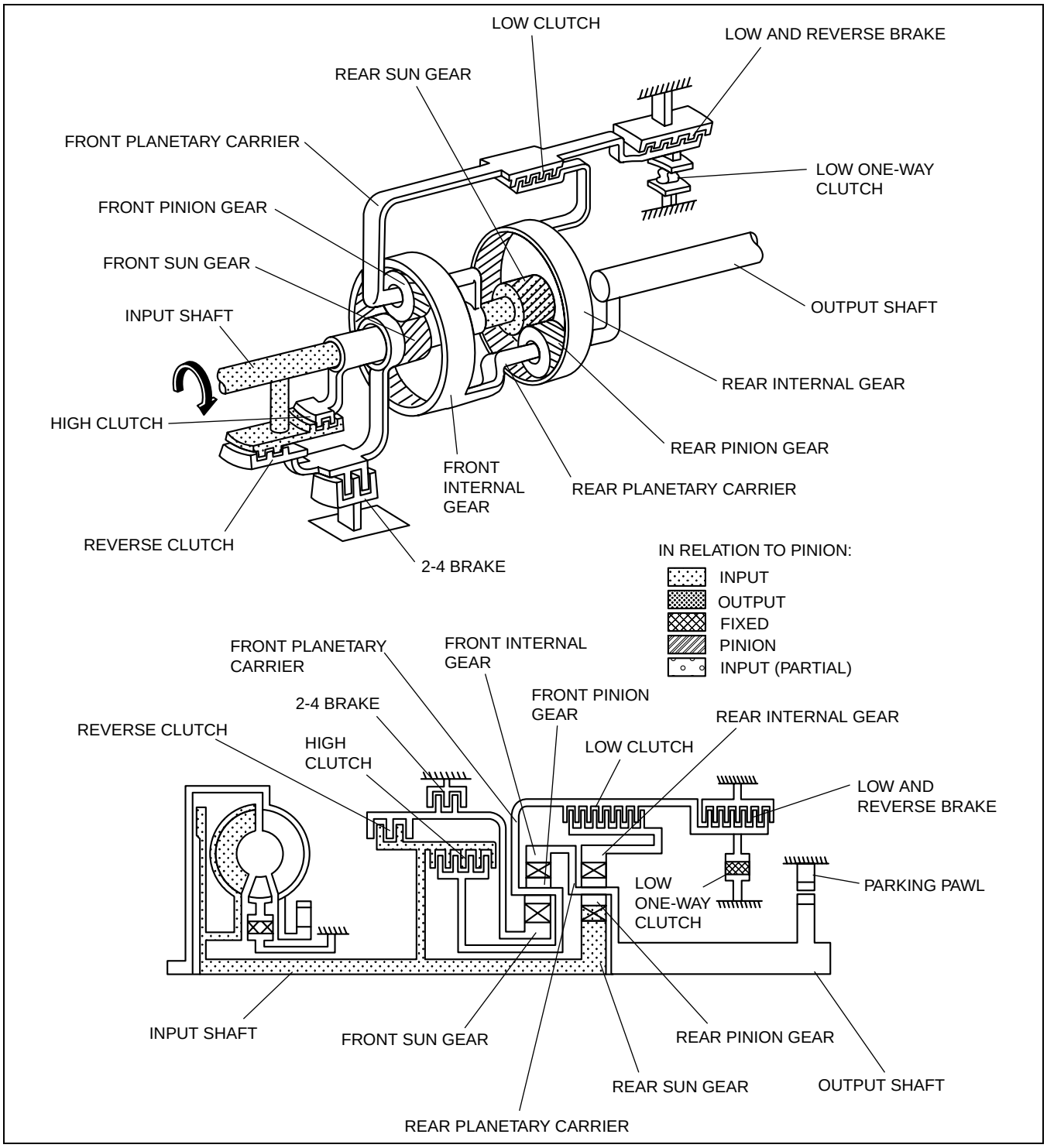
- Driving force from the input shaft is transmitted to the reverse and high clutch drum, then via the reverse clutch to the front sun gear, which rotates clockwise. At this point, the front pinion gear does not revolve because the front planetary carrier is locked by the low and reverse brake.
  Due to this, the front sun gear causes the front pinion gear to rotate axially counterclockwise. This rotation causes the front internal gear and the rear planetary gear to rotate counterclockwise. As a result, the output shaft also rotates counterclockwise and this driving force is transmitted via the propeller shaft to the driving wheels.



CHU0513A006

N position

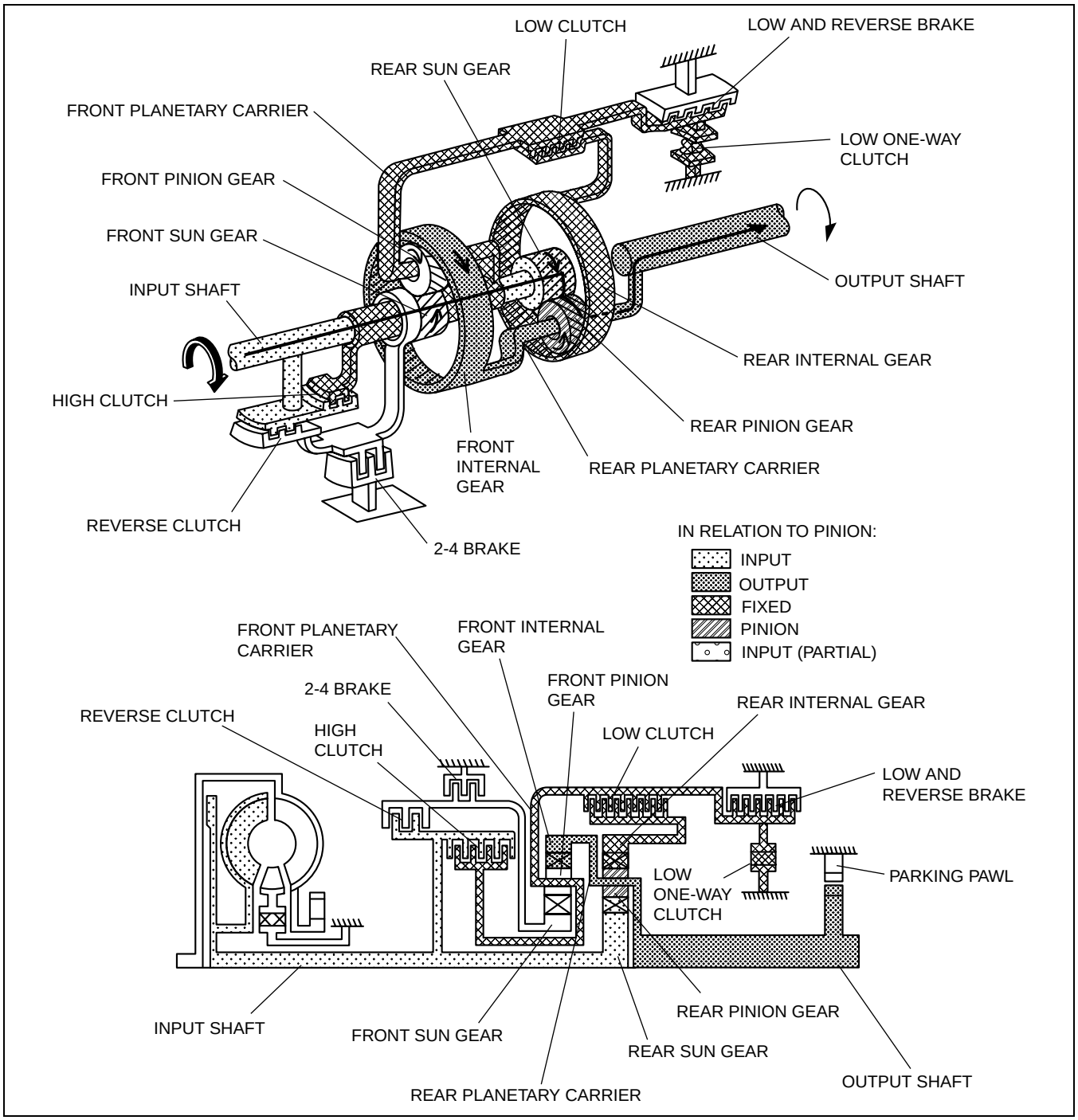
- Driving force from the input shaft is transmitted to the rear sun gear and the reverse and high clutch drum. However, since none of the clutches are operating, the driving force is not transmitted to the output shaft. Accordingly, the vehicle is the vehicle is able to roll.



CHU0513A007

D range 1GR

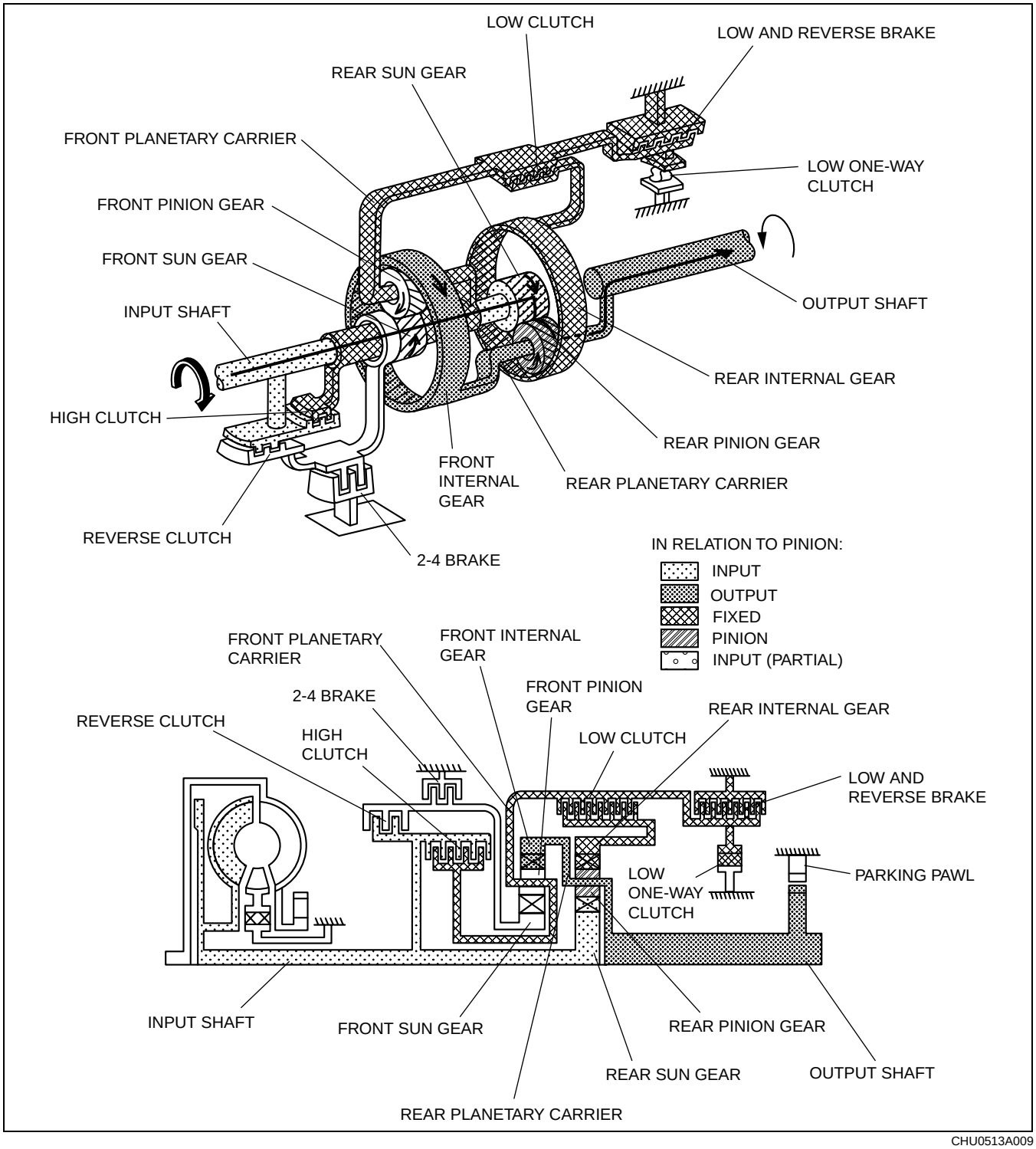
- Driving force from the input shaft is transmitted to the rear sun gear, which rotates clockwise, causing the rear pinion gear to rotate counterclockwise. At this point, since the rear planetary carrier is united with the output shaft (and therefore, the driving wheels), the load of the stopped vehicle fixes the rear planetary carrier and it does not revolve. Due to this, the counterclockwise rotation of the rear pinion gear causes the rear internal gear to also try to rotate counterclockwise but it is locked by the low one-way clutch via the low clutch. As a result, the rear pinion gear rotates axially counterclockwise, overcoming the load of the stopped vehicle and the rear planetary carrier revolves clockwise. Accordingly the output shaft also rotates clockwise and this driving force is transmitted via the propeller shaft to the driving wheels.
- During deceleration, the rear internal gear tries to rotate clockwise due to the rotation of the rear planetary carrier (rear pinion gear) being comparatively higher to that of the rear sun gear. At this point, since the low one-way clutch is not utilized and rotates freely, the rear internal gear rotates clockwise. In this way, engine braking is not actuated since the reverse torque from the driving wheels is not transmitted back towards the engine.



CHU0513A008

M range 1GR

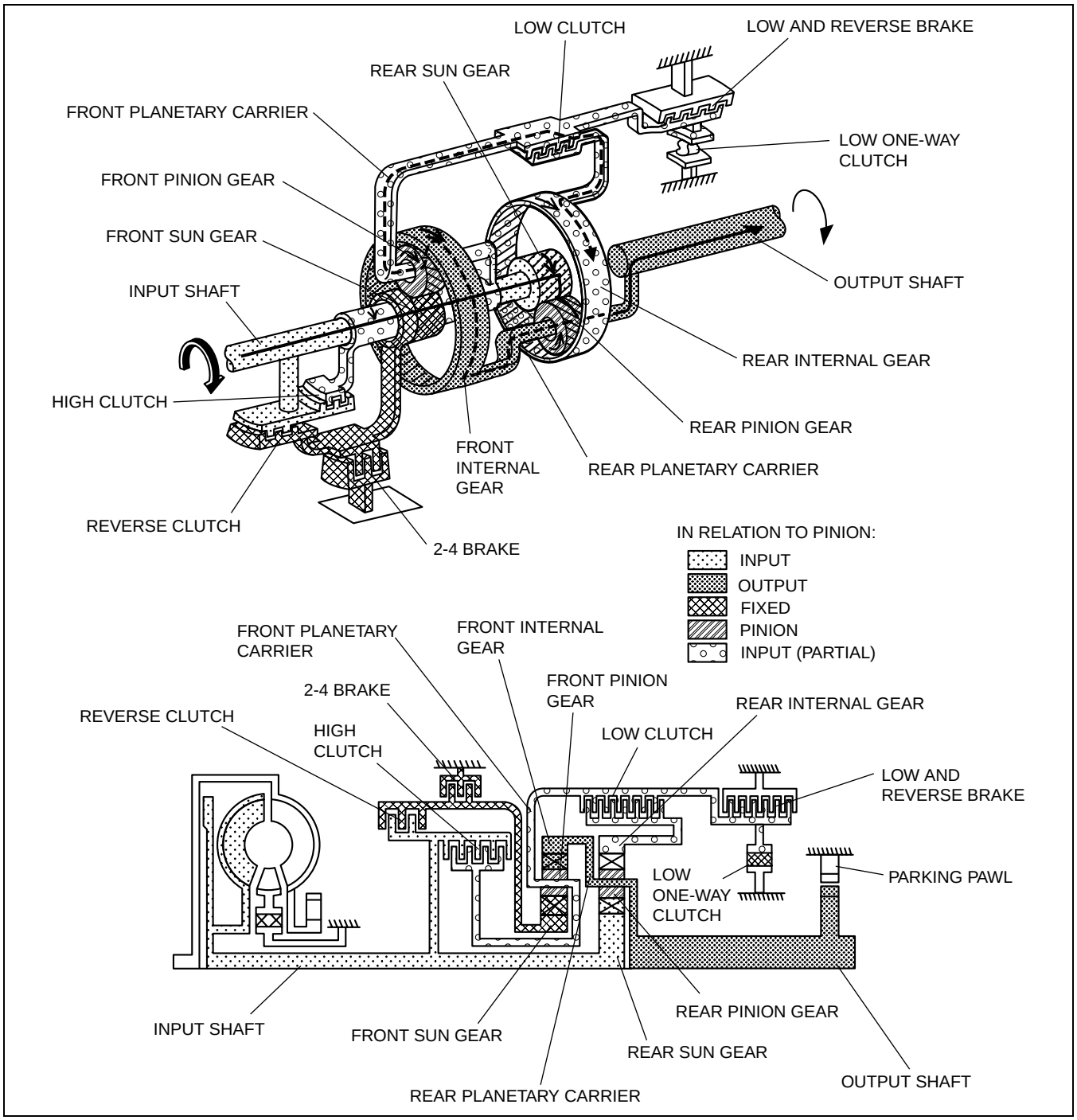
- The driving force from the input shaft is transmitted to the rear sun gear, which rotates clockwise causing the rear pinion gear to rotate counterclockwise. The rear internal gear does not rotate since it is locked by the low and reverse brake via the low clutch. As a result, the rear pinion gear rotates axially counterclockwise, overcoming the load of the stopped vehicle, causing the rear planetary carrier to revolve clockwise. Accordingly, the output shaft rotates clockwise and this driving force is transmitted via the propeller shaft to the driving wheels.
- During deceleration, the driving force is transmitted from the driving wheels. Due to this, the driving force becomes the reverse of that during acceleration and engine braking is actuated.



CHU0513A009

D, M range 2GR

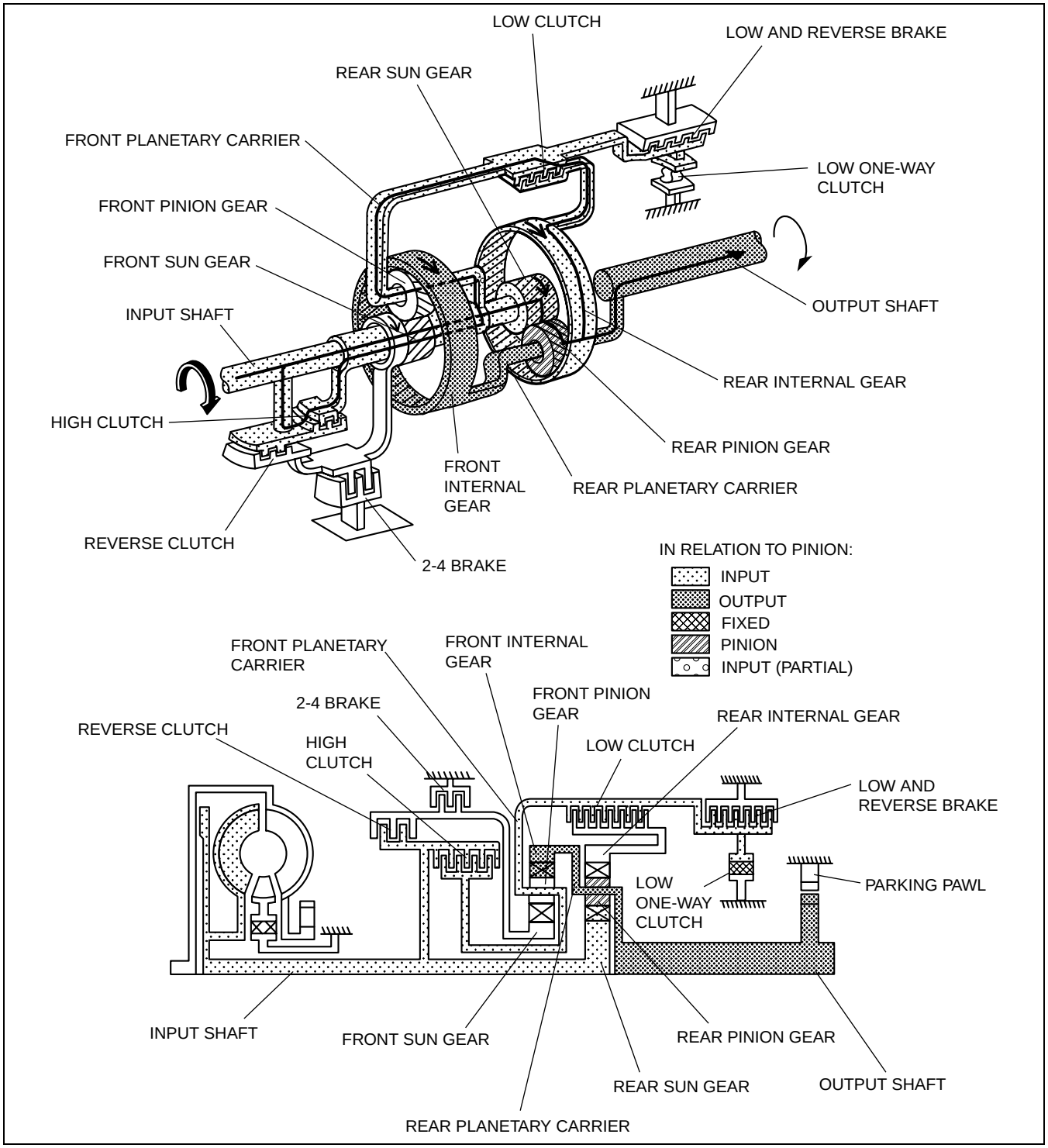
- The driving force from the input shaft is transmitted to the rear sun gear, which rotates clockwise causing the rear pinion gear to rotate counterclockwise. Then, the driving force causes the rear planetary carrier to rotate clockwise, similar to first gear. The front internal gear also rotates clockwise since it is united with the rear planetary gear. At this point, the front sun gear does not rotate because it is locked by the 2-4 brake. Due to this, the front pinion gear rotates axially clockwise and revolves clockwise, and the front planetary carrier rotates clockwise. The clockwise rotation of the front planetary carrier is transmitted via the low clutch to the rear internal gear, causing it to rotate clockwise.
  As a result, the rotation speed of the rear planetary carrier increases from that of first gear in proportion to the rotation of the rear internal gear. Accordingly, the driving force from the rear planetary carrier, whose speed has been increased, is transmitted via the propeller shaft to the driving wheels.
- During deceleration, the driving force is transmitted from the driving wheels. Due to this, the driving force becomes the reverse of that during acceleration and engine braking is actuated.



CHU0513A010

D, M range 3GR

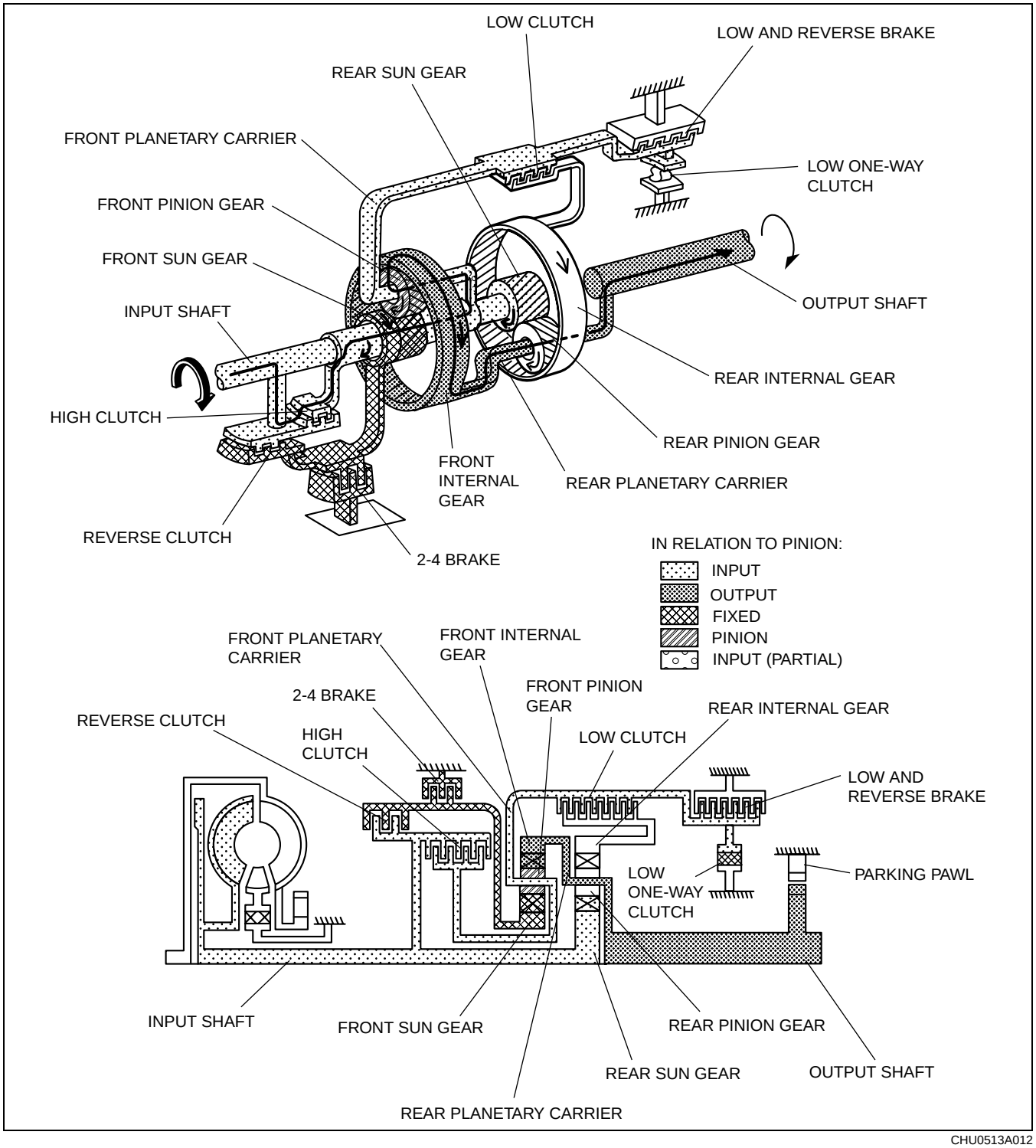
- The driving force from the input shaft is transmitted to the reverse and high clutch drum and then via the high clutch to the front planetary carrier, causing it to rotate clockwise. This clockwise rotation of the front planetary carrier is transmitted via the low clutch to the rear internal gear causing it to rotate clockwise. The driving force of the input shaft is transmitted to the rear sun gear and causing to rotate clockwise.
  At this point, since the rear sun gear and rear internal gear are rotating clockwise at the same speed, the rear pinion gear does not rotate axially, and the rear sun gear and rear internal gear become united and revolve. The force of this revolution is transmitted to the rear planetary carrier, the output shaft and then, via the propeller shaft to the driving wheels.
- During deceleration, the driving force is transmitted from the driving wheels. Due to this, the driving force becomes the reverse of that during acceleration and engine braking is actuated.



CHU0513A011

D, M range 4GR

- The driving force from the input shaft is transmitted to the reverse and high clutch drum and then via the high clutch to the front planetary carrier, causing it to rotate clockwise. At this point, the front sun gear does not rotate because it is locked by the 2-4 brake. Due to this the front pinion gear revolves clockwise and rotates axially clockwise. This rotation causes the front internal gear rotation to increase speed and the rear planetary carrier to rotate clockwise. Accordingly, the driving force from the sped-up rear planetary carrier is transmitted, via the propeller shaft, to the driving wheels.
- During deceleration, the driving force is transmitted from the driving wheels. Due to this, the driving force becomes the reverse of that during acceleration and engine braking is actuated.



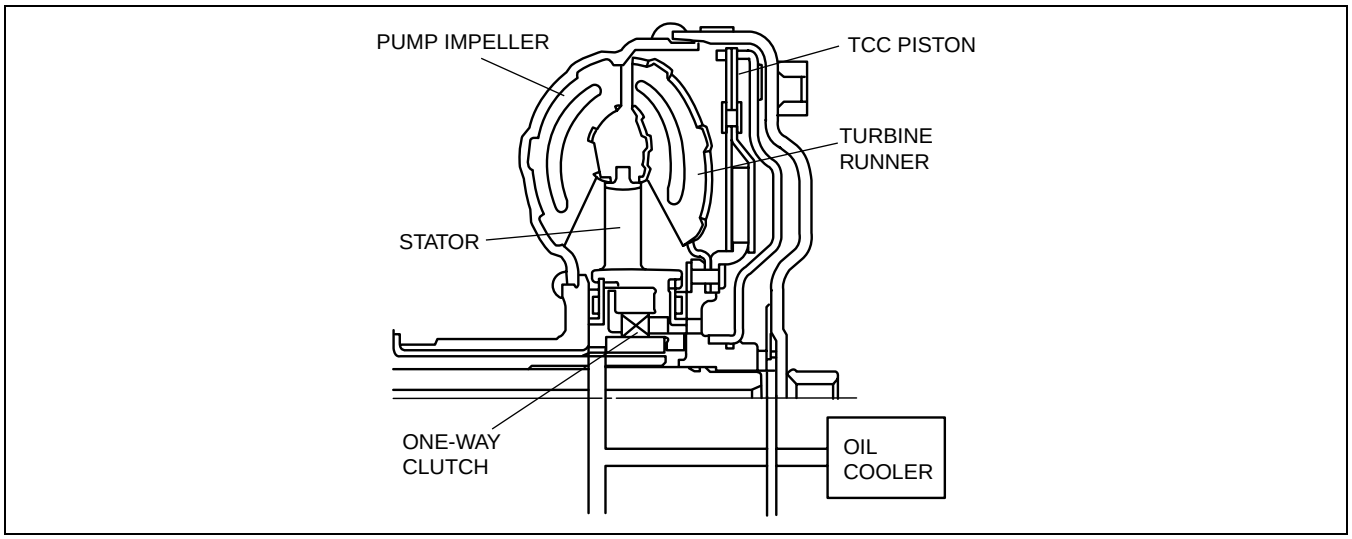
CHU0513A012

TORQUE CONVERTER CONSTRUCTION

CHU051319100A01

Outline

- The RC4A-EL type torque converter adopts a TCC mechanism.
- The TCC mechanism mechanically engages the pump impeller and the turbine runner under certain conditions, and transmits the power, not through the fluid, but directly, preventing the slip loss of the torque converter.
- The torque converter has obtained sufficient transmission efficiency and torque converting ratio to match the output characteristics of the engine.



CHU0513A013

OIL PUMP FUNCTION

CHU051319220A01

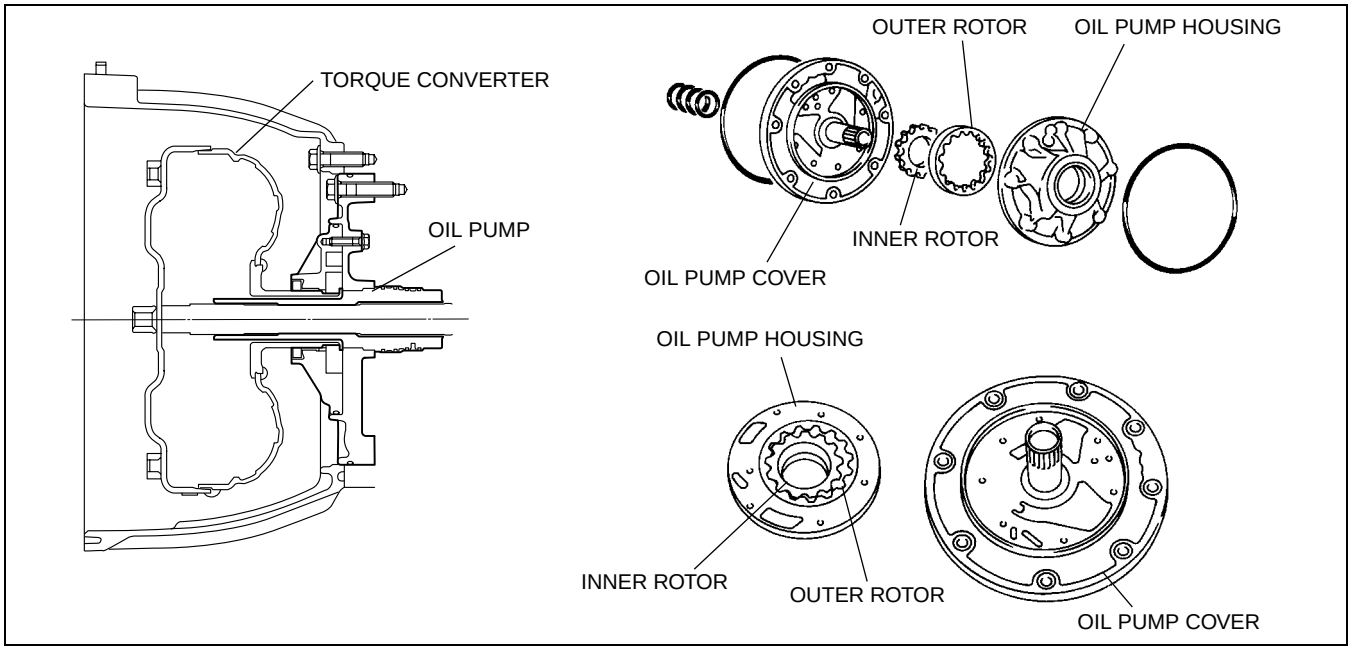
- The lightweight, compact, quiet trochoid gear oil pump feeds oil to the torque converter, lubricates the powertrain, and feeds oil to the hydraulic control system.

OIL PUMP CONSTRUCTION/OPERATION

CHU051319220A02

Construction

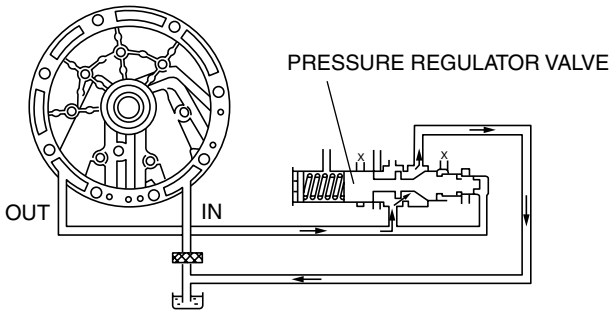
- The oil pump, mounted behind the torque converter, is driven directly by the torque converter.
- Inner and outer rotors are built into the pump housing in the oil pump.
- The inner rotor is driven by the torque converter in the same rotational direction as the engine.



CHU0513A014

Operation

- When the inner rotor in the oil pump rotates, ATF is drawn from the oil pan to the oil pump and then discharged to the pressure regulator valve.
- The amount of ATF discharged is proportional to the rotational speed of the torque converter.



CHU0513A015

CENTRIFUGAL BALANCE CLUTCH FUNCTION

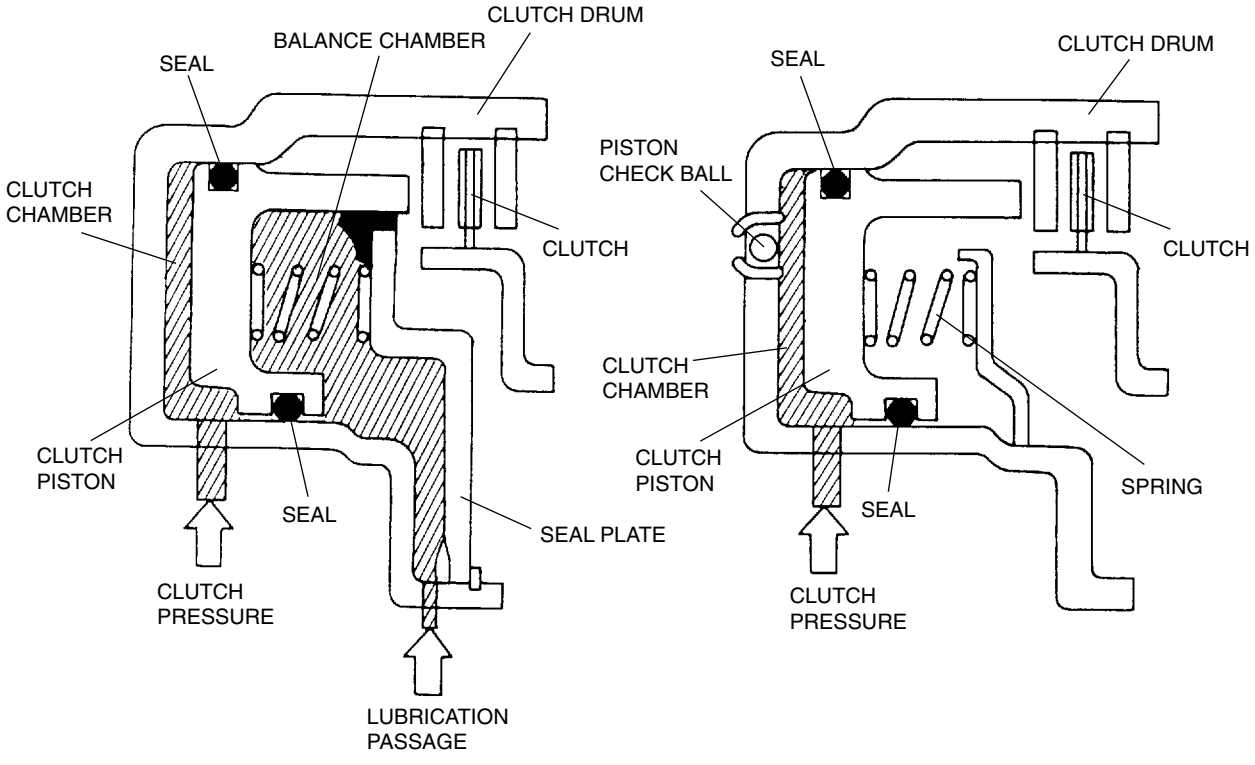
CHU051319500A01

- The centrifugal balance clutch, which replaces the conventional piston check ball, cancels centrifugal oil pressure generated during clutch drum rotation to prevent the clutch drag-engagement and to stabilize piston pressure during full rotation.

CENTRIFUGAL BALANCE CLUTCH CONSTRUCTION/OPERATION

CHU051319500A02

- Centrifugal balance clutch chambers are installed opposite the clutch chambers in the low and high clutches. The centrifugal balance clutch chambers are constantly filled with ATF from the exclusive hydraulic passage of the oil pump.



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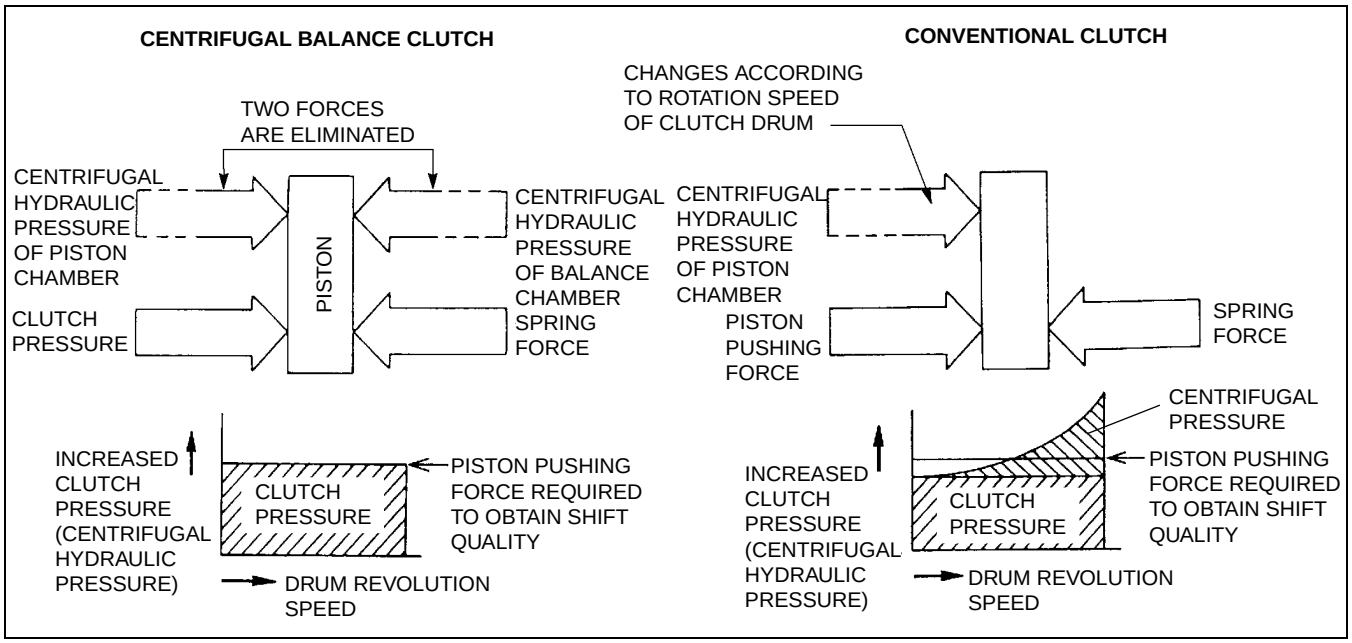
When The Clutch Pressure Not Applied

- When the clutch drum rotates, centrifugal force acts on the residual ATF in the clutch chamber to push against the piston. However, centrifugal force also acts on the ATF filled in the centrifugal balance clutch chamber to push back the piston. As a result, the two forces are eliminated and the piston remains stationary, thus preventing clutch engagement.

When The Clutch Pressure Applied

- When clutch pressure is applied to the clutch chamber, the clutch pressure overcomes the oil pressure and the spring force in the opposite centrifugal balance clutch chamber, and pushes the piston to engage the clutches. Because the centrifugal force acting on the clutch pressure in the clutch chamber is canceled by another centrifugal force acting on the ATF filled in the centrifugal balance clutch chamber, the influence of the centrifugal force created by the clutch drum revolution speed is eliminated. As a result, stable piston pushing force is obtained in all rotation ranges, and smoother shifts can be made.

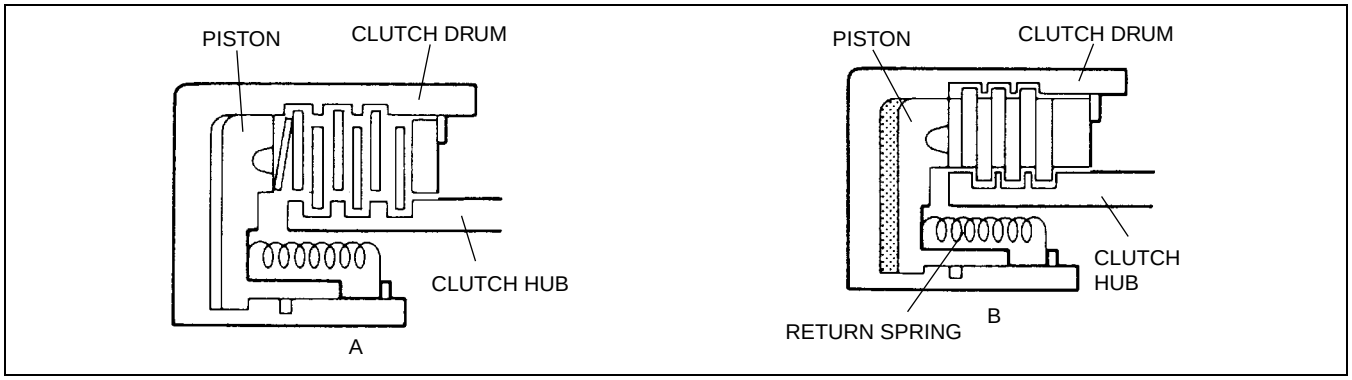


CHU0513A023

LOW CLUTCH, HIGH CLUTCH, REVERSE CLUTCH, 2-4 BRAKE, LOW AND REVERSE BRAKE DESCRIPTION CONSTRUCTION/OPERATION

CHU051319500A03

- The basic structure is as shown in the figure below. In figure A, the fluid is in the clutch plates (drive plates, driven plates) and the power is not transmitted because of the fluid slippage on each plate. Figure B shows the clutch condition with the hydraulic pressure acting on the piston; the drive plates and the driven plates are pressed tightly together to transmit the clutch drum rotation speed to the hub. When the hydraulic pressure in the piston is drained, the clutches are separated because of the return spring and return to the condition in figure A.



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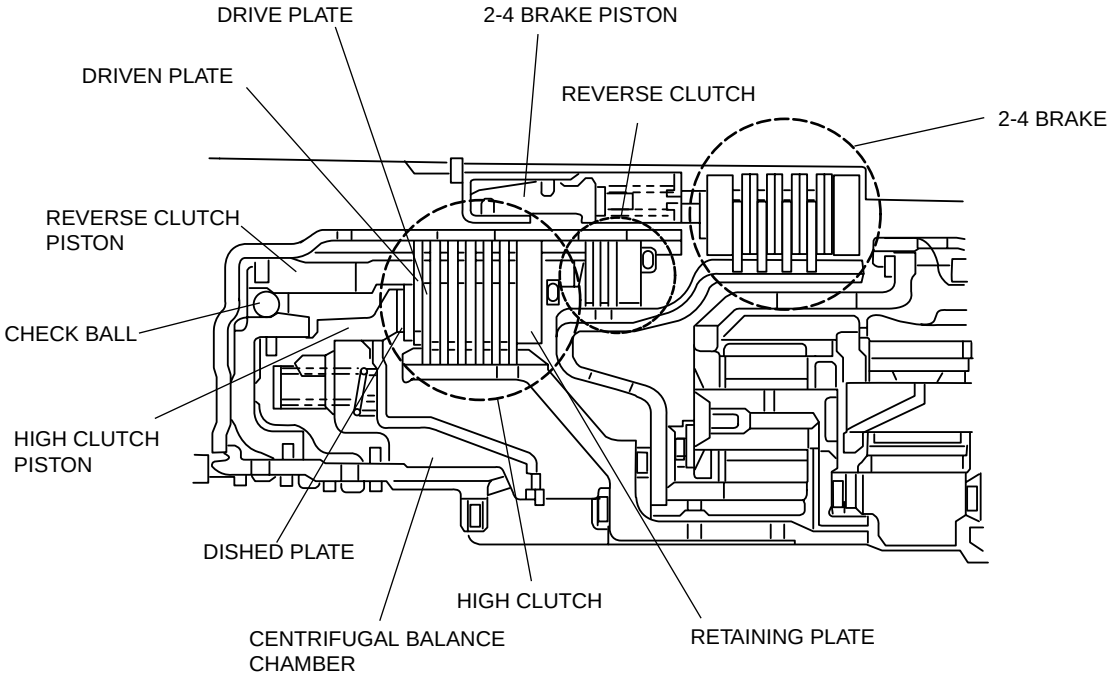
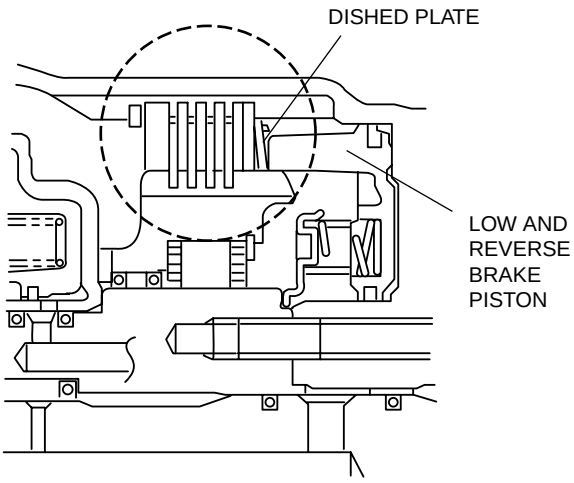
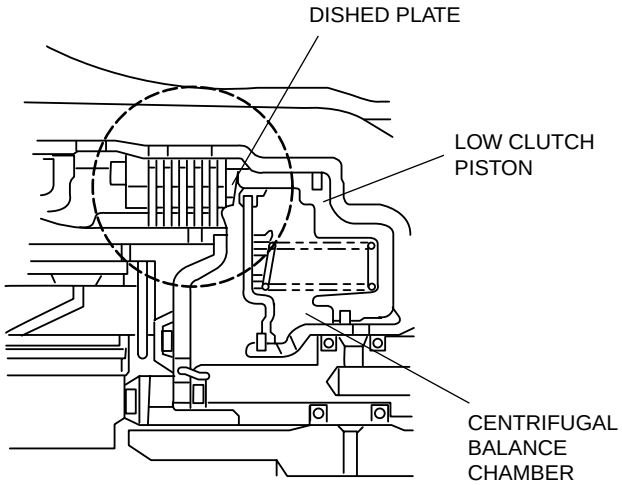
- The dished plates used for each clutch and brake reduce the shock caused by sudden clutch engagement. The piston check ball built in the reverse clutch drains the ATF only during freewheel to prevent the hydraulic pressure from increasing to half-engage the clutches because of the residual ATF. In the low clutch and high clutch, the centrifugal balance chamber is installed opposite the general clutch chamber.



HIGH CLUTCH, REVERSE CLUTCH, 2-4 BRAKE



LOW AND REVERSE BRAKE



LOW CLUTCH

CHU0513A016

LOW ONE-WAY CLUTCH CONSTRUCTION/OPERATION

CHU051319500A04

Construction

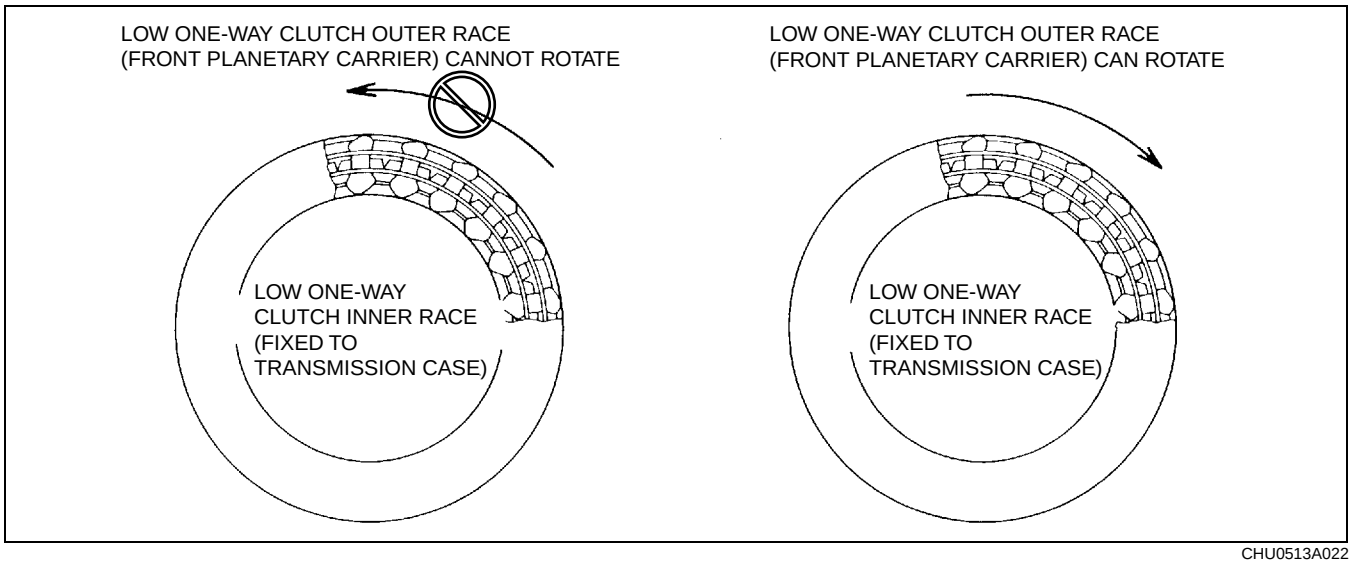
- The low one-way clutch locks the counter clockwise rotation (viewed from the torque converter side) of the front planetary carrier. The low one-way clutch operates in D, and M range of the 1GR.
- The low one-way clutch outer race is integrated with the front planetary carrier, and the low one-way clutch inner race is fixed to the transmission case.

Operation

- The low one-way clutch outer race (front planetary carrier) rotates clockwise (seen from the torque converter side) freely, but the sprags rise to lock the rotation when the outer race tries to rotate counter clockwise.
- The low one-way clutch locks the counter clockwise rotation of the front planetary carrier, and also locks the counterclockwise revolution of the rear planetary carrier via the low clutch.

Note

- All rotation directions are as viewed from the torque converter.



CHU0513A022

PLANETARY GEAR OUTLINE

CHU051319540A01

- The planetary gear is a transmission which converts the driving force of the input shaft to the optimal driving force and transmits it to the output shaft through the operation of each clutch and brake.
- A double arranged gear with a single planetary gear unit is adopted for the planetary gear; they are the front planetary gear and the rear planetary gear.
- The planetary gear consists of the internal gear, planetary carrier (pinion gears), and the sun gear.

PLANETARY GEAR STRUCTURE

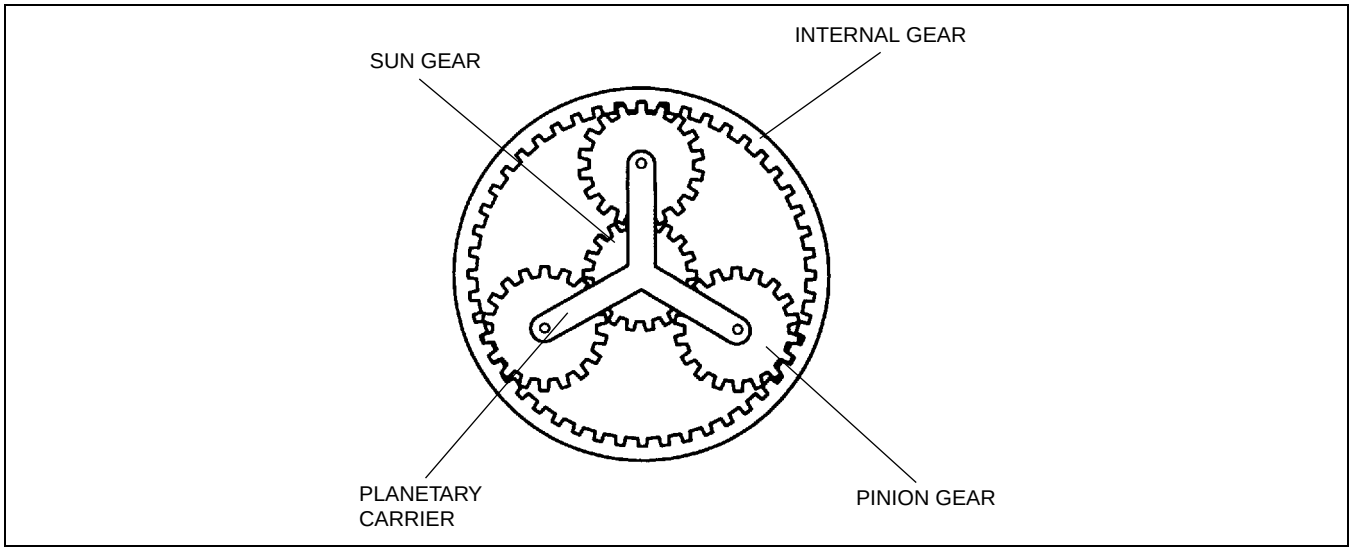
CHU051319540A02

- The front planetary gear is integrated with the one-way clutch outer race and engaged with the drive plate of the low and reverse brake. Because of this, when the front planetary gear rotates, the one-way clutch outer race and the drive plate of the low and reverse brake also rotate together.
- The front sun gear is installed inside of the front pinion gears, and the front internal gear is installed outside of the front pinion gears. The front sun gear is engaged with the reverse clutch drum, and the front internal gear is engaged with the rear planetary carrier.
- The rear planetary gear and the rear pinion gear have the rear sun gear installed inside and the rear internal gear outside. The rear sun gear is engaged with the input shaft, and the rear internal gear is engaged with the low clutch hub.

PLANETARY GEAR OPERATION

CHU051319540A03

- The planetary gear works as a transmission when the sun gear and the internal gear are engaged.
- The sun gear, installed inside of the pinion gears, and the internal gear, installed outside of the pinion gears, are engaged with their respective gears. The sun gear and the internal gear rotate on the center of the planetary gear.



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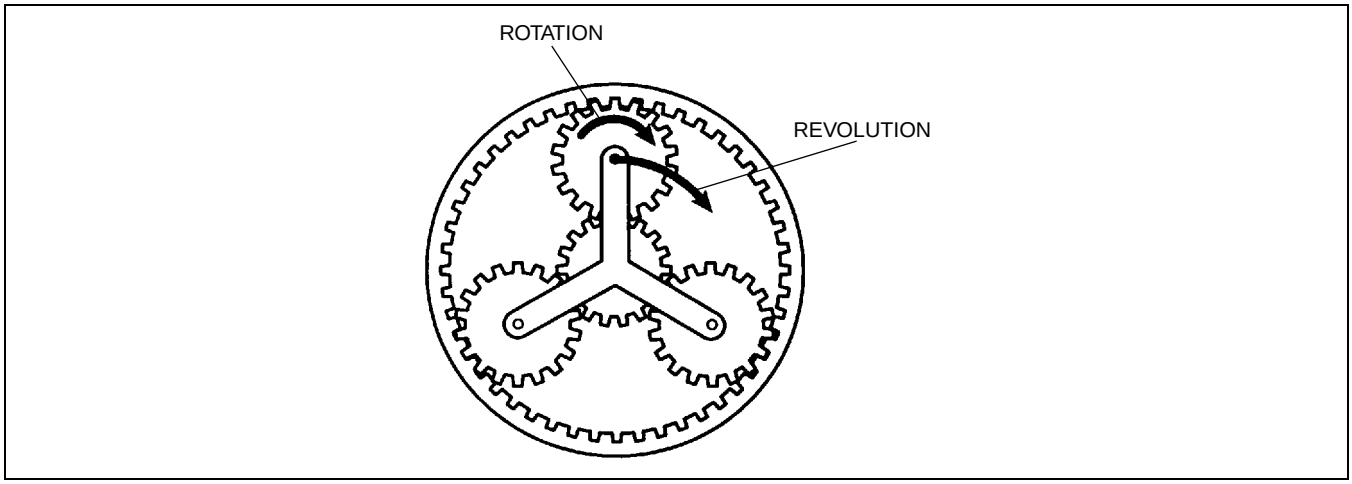
- The pinion gears turn in the following two ways:
  — On their own centers (“rotation”)
  — On the center of the planetary gear (“revolution”)



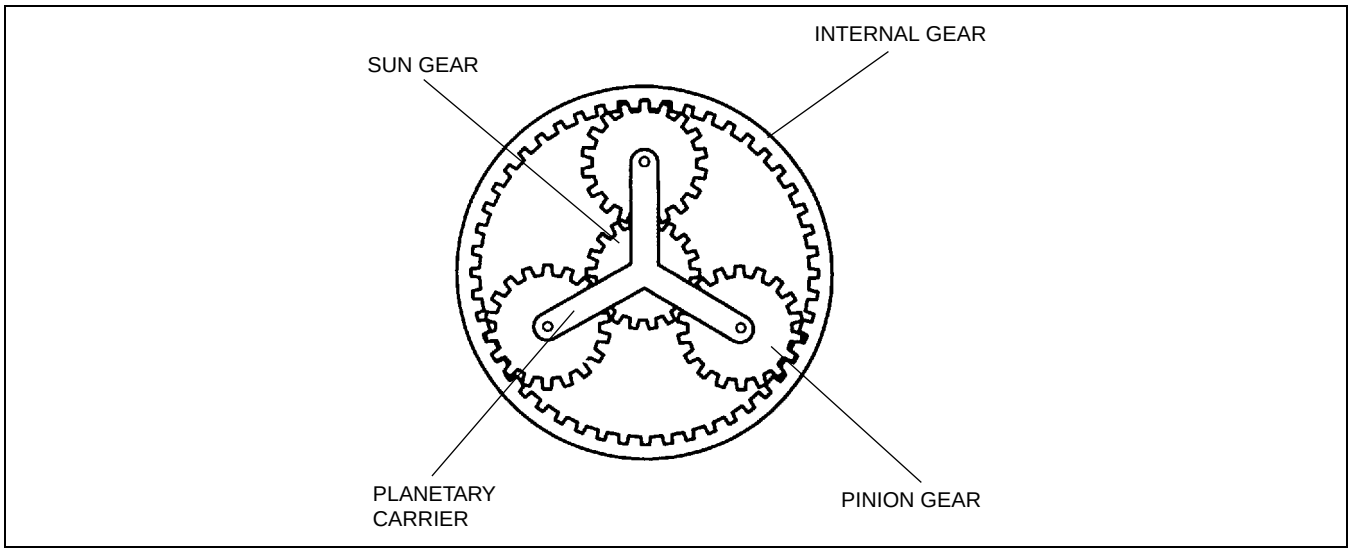
AEA5710A005

Gear Ratio of Each Range

- The relation between each element of the planetary gear set and the rotation speed is generally indicated in the formula below.
  $(Z_R+Z_S)\ N_C=Z_RN_R+Z_SN_S$----------(1)

Symbol key

Z : Number of teeth
N : Rotation speed
R : Internal gear
S : Sun gear
C : Planetary carrier (part of pinion gear)



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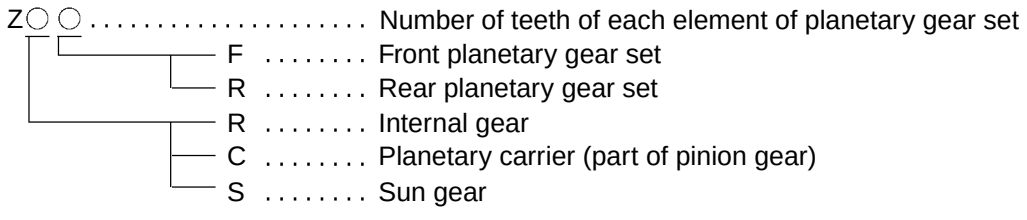
Number of teeth and symbol of each gear

Planetary gear		Number of teeth	Symbol
Front	Internal gear	75	Z_{RF}
	Planetary carrier (part of pinion gear)	21	Z_{CF}
	Sun gear	33	Z_{SF}
Rear	Internal gear	75	Z_{RR}
	Planetary carrier (part of pinion gear)	17	Z_{CR}
	Sun gear	42	Z_{SR}

Symbol key



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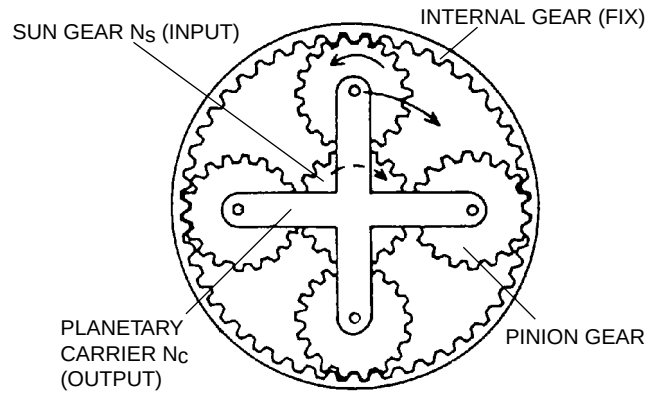
First Gear



REAR PLANETARY GEAR

AEA5710A008

Gear rotation speed

Planetary gear	Rear
Internal gear	0 (fix)
Planetary carrier	N_C (output)
Sun gear	N_S (input)

- Suppose the gear ratio in first gear is i_1,

$$i_1 = \frac{N_S}{N_C}$$

AEA5710A009

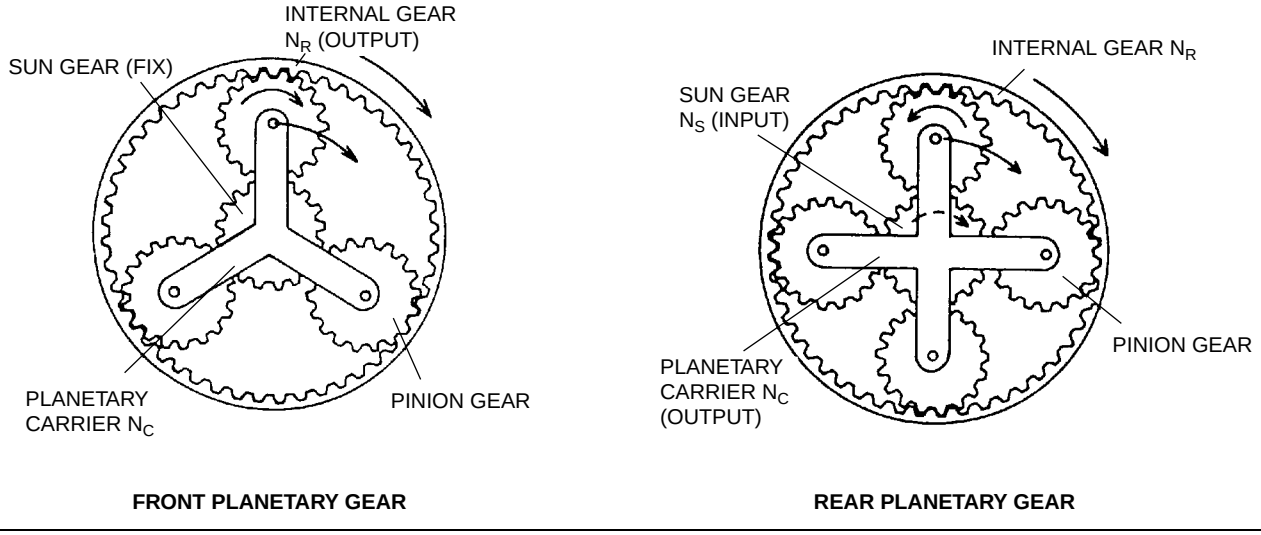
- From the result N_R=0 in formula (1), the relation between the gear ratio in first gear and the rotation speed of the planetary gear set is indicated in the formula below.
  $(Z_{RR}+Z_{SR})\ N_C=Z_{SR}N_S$
- Therefore,

$$i_1 = \frac{N_S}{N_C} = \frac{Z_{RR}+Z_{SR}}{Z_{SR}} = \frac{75+42}{42} \fallingdotseq 2.785$$

AEA5710A010

- As a result, the gear ratio in first gear is 2.785.

Second Gear



FRONT PLANETARY GEAR **REAR PLANETARY GEAR**

CHU0513A017

Gear rotation speed

Planetary gear	Front	Rear
Internal gear	N_R (output)	N_R
Planetary carrier	N_C	N_C (output)
Sun gear	0 (fix)	N_S (input)

Note
- The front internal gear and the rear planetary carrier are integrated.
- The front planetary carrier and the rear internal gear rotate at the same speed.

- Suppose the gear ratio in second gear is i_2,

$$i_2 = \frac{N_S}{N_R}$$

AEA5710A012

- From formula (1), the relation between the gear ratio in second gear and the rotation speeds of the front and the rear planetary gear sets is indicated in formulas (2) and (3).
  $(Z_{RF}+Z_{SF})\ N_C=Z_{RF}N_R+Z_{SF}N_S$----------(2)
  $(Z_{RR}+Z_{SR})\ N_R=Z_{RR}N_C+Z_{SR}N_S$----------(3)
- From the result $N_S=0$ in formula (2).

$$N_C = \left(\frac{Z_{RF}}{Z_{RF}+Z_{SF}}\right) N_R \text{ ----------(4)}$$

AEA5710A013

- Here we substitute formula (4) in formula (3).

$$Z_{SR}N_S = \frac{(Z_{RR}+Z_{SR})\ (Z_{RF}+Z_{SF})-Z_{RF}Z_{RR}}{Z_{RF}+Z_{SF}}\ N_R$$

AEA5710A014

- Therefore,

$$i_2 = \frac{N_S}{N_R} = \frac{(Z_{RR}+Z_{SR})\ (Z_{RF}+Z_{SF})-Z_{RF}Z_{RR}}{Z_{SR}\ (Z_{RF}+Z_{SF})} = \frac{(75+42)\ (75+33)-75\ x75}{42\ (75+33)} \fallingdotseq 1.545$$

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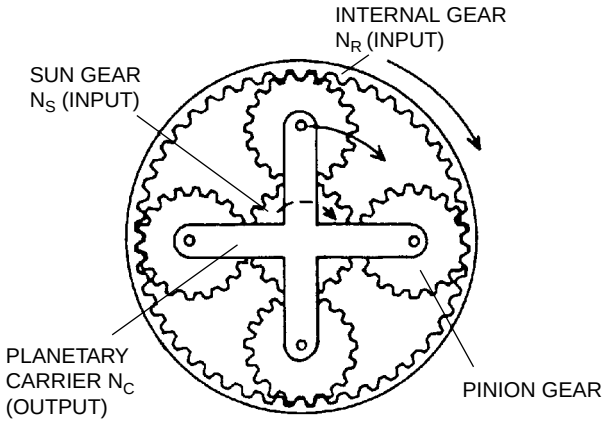
- As a result, the gear ratio in second gear is 1.545.

Third Gear



REAR PLANETARY GEAR

AEA5710A016

Gear rotation speed

Planetary gear	Rear
Internal gear	N_R (input)
Planetary carrier	N_C (output)
Sun gear	N_S (input)

- Here we have the result of $N_R=N_S$.
- Suppose the gear ratio in third gear is i_3,

$$i_3 = \frac{N_R}{N_C}$$

AEA5710A017

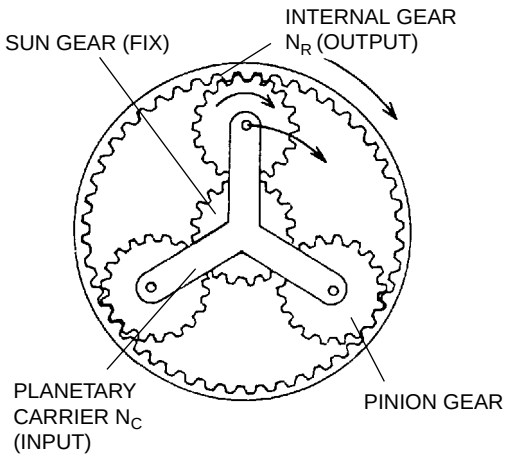
- From the result of $N_R=N_S$ in formula (1), the relation between the gear ratio in third gear and the rotation speed of the rear planetary gear set is indicated in the formula below.
  $(Z_{RR}+Z_{SR})\ N_C = (Z_{RR}+Z_{SR})\ N_R$
- Therefore,

$$i_3 = \frac{N_R}{N_C} = \frac{(Z_{RR}+Z_{SR})}{(Z_{RR}+Z_{SR})} = \frac{75+42}{75+42} \fallingdotseq 1.000$$

AEA5710A018

- As a result, the gear ratio in third gear is 1.000.

Fourth Gear



FRONT PLANETARY GEAR

AEA5710A019

Gear rotation speed

Planetary gear	Front
Internal gear	N_R (output)
Planetary carrier	N_C (input)
Sun gear	0 (fix)

- Suppose the gear ratio in fourth gear is i_4,

$$i_4 = \frac{N_C}{N_R}$$

AEA5710A020

- From the result of $N_S=0$ in formula (2), the relation between the gear ratio in fourth gear and the rotation speed of the front planetary gear set is indicated in the formula below.
  $(Z_{RF}+Z_{SF})\ N_C = Z_{RF}N_R$

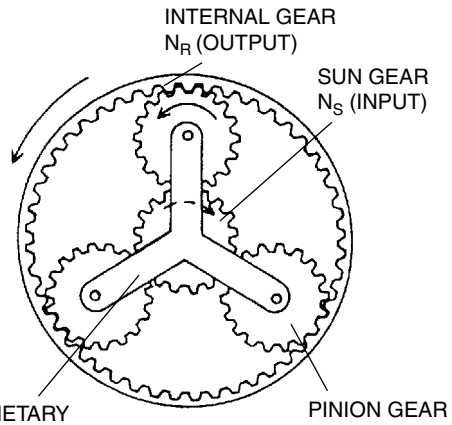
- Therefore,

$$i_4 = \frac{N_C}{N_R} = \frac{Z_{RF}}{Z_{RF}+Z_{SF}} = \frac{75}{75+33} \fallingdotseq 0.694$$

AEA5710A021

- As a result, the gear ratio in fourth gear is 0.694.

Reverse



FRONT PLANETARY GEAR

AEA5710A022

Gear rotation speed

Planetary gear	Front
Internal gear	N_R (output)
Planetary carrier	0 (fix)
Sun gear	N_S (input)

- Suppose the gear ratio in reverse gear is i_{REV},

$$i_{REV} = \frac{N_S}{N_R}$$

AEA5710A023

- From the result of N_C=0 in formula (2), the relation between the gear ratio during reverse movement and the rotation speed of the planetary gear set is indicated in the formula below.
  $(Z_{RF}+Z_{SF})\ 0=Z_{RF}N_R+Z_{SF}N_S$
- Therefore,

$$i_{REV} = \frac{N_S}{N_R} = \frac{Z_{RF}}{-Z_{SF}} = \frac{75}{-33} = -2.272$$

CHU0513A018

- As a result, the gear ratio in reverse is 2.272.

PARKING MECHANISM OUTLINE

CHU051321400A01

- When the selector lever is shifted to the P position, the parking pawl engages the parking gear and locks the output shaft (i.e., rotation of the driving wheels).

PARKING MECHANISM STRUCTURE

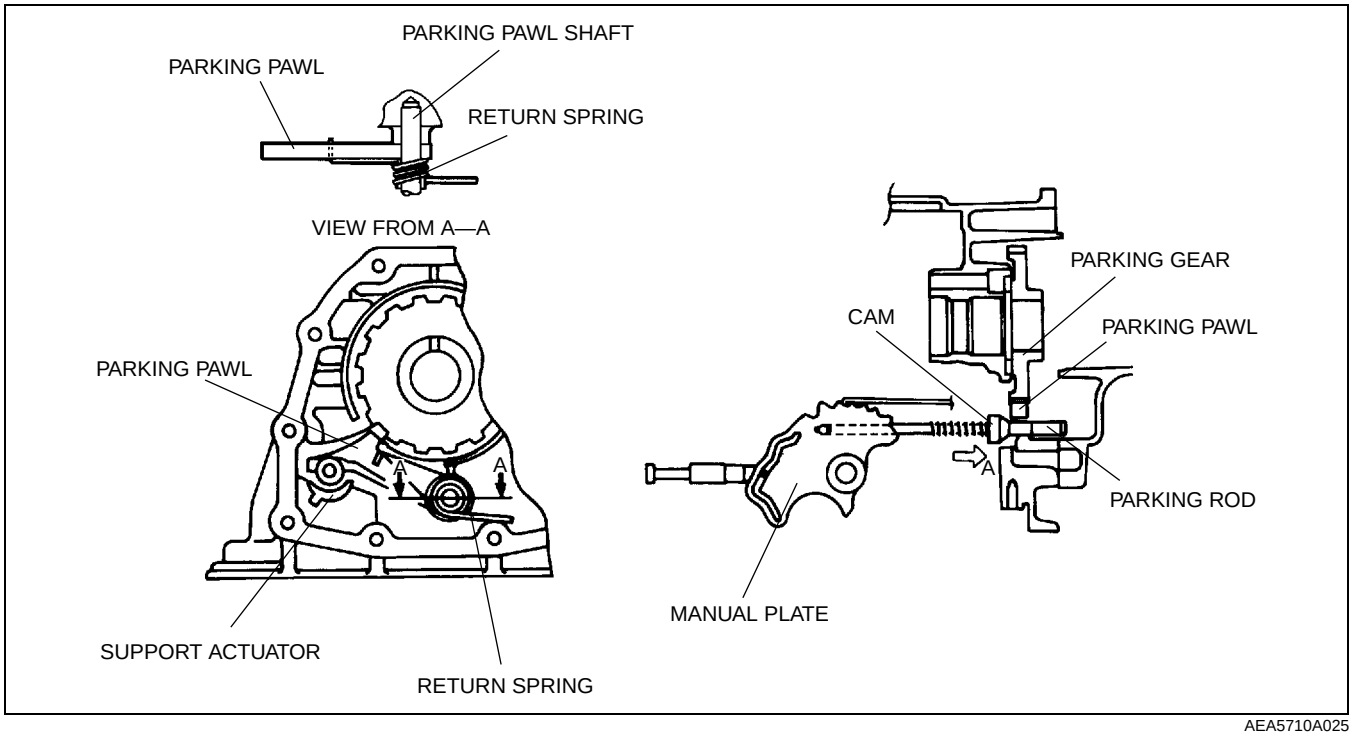
CHU051321400A02

- The parking pawl is installed in the transmission case via the parking pawl shaft and pushed to the support actuator by the return spring except in the P position.
- The parking rod component is designed to slide on the support actuator and is connected to the manual plate.

PARKING MECHANISM OPERATION

CHU051321400A03

- When the selector lever is moved to the P position, the manual shaft and the manual plate move. Then the parking rod component moves in the direction of arrow A, the parking rod component cam pushes up the parking pawl, and the parking pawl engages the parking gear.
- If the parking pawl hits the tooth of the parking gear, the parking pawl cannot be pushed up, so only the parking rod component is able to move. The cam presses the spring onto the parking pawl and the actuator. If the vehicle runs even a little under this condition, the wheels rotate and the parking gear also rotates slightly. As a result, the parking pawl slides into the groove, and engages the parking gear.
- Thus, the parking mechanism prevents the vehicle from moving in the P position.



AEA5710A025

CONTROL VALVE BODY OUTLINE

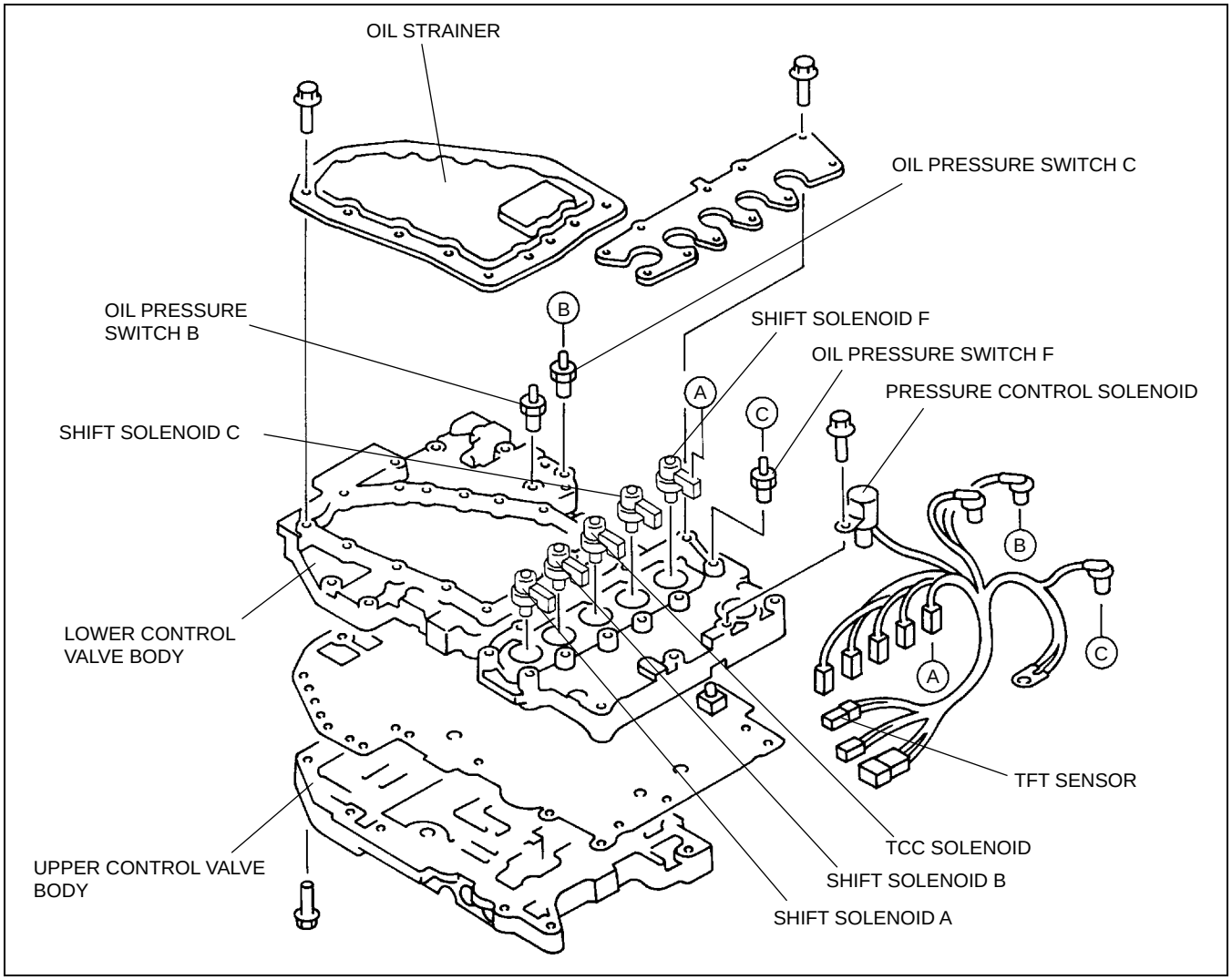
CHU051321100A01

- Direct electronic shift control simplifies the hydraulic system, and at the same time, reduces the number of component parts and the size of the control valve body.
- A fine mesh pleat type oil strainer installed in the control valve body filters impurities.

CONTROL VALVE BODY CONSTRUCTION

CHU051321100A02

- The control valve body comprises an upper control valve body and a lower control valve body.
- All solenoids, oil pressure switches, and the TFT sensor are installed in the lower control valve body.

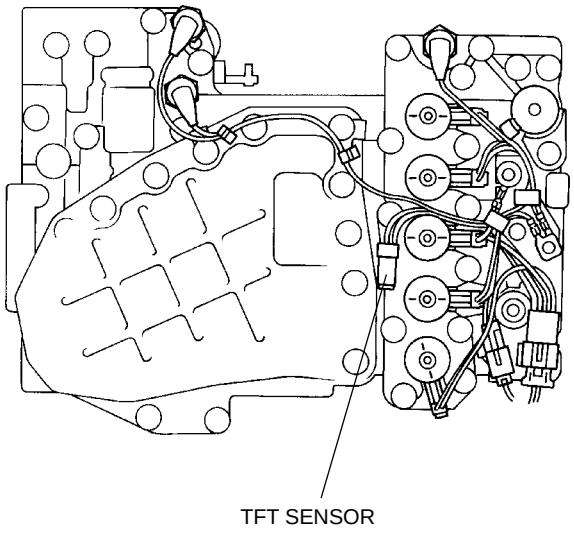


AEA5710T018

TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR OUTLINE

CHU051319200A01

- The TFT sensor detects the ATF temperature in the oil pan, and sends the control signal to the TCM. The TCM controls the driving pattern selection and the torque converter clutch based on the signal from the TFT sensor.

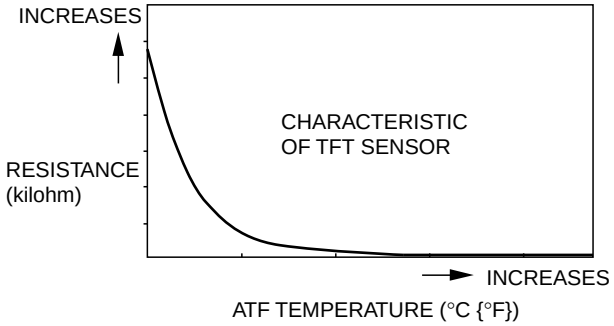


AEA5710T034

TRANSMISSION FLUID TEMPERATURE (TFT) SENSOR CONSTRUCTION/OPERATION

CHU051319200A02

- The TFT sensor is a thermistor type and the resistance changes according to the ATF temperature.
- The characteristic of the resistance is as shown in the figure below: when the ATF temperature increases, the resistance decreases, and when the ATF temperature decreases, the resistance increases.
- The TFT sensor is integrated with the wiring harness component.

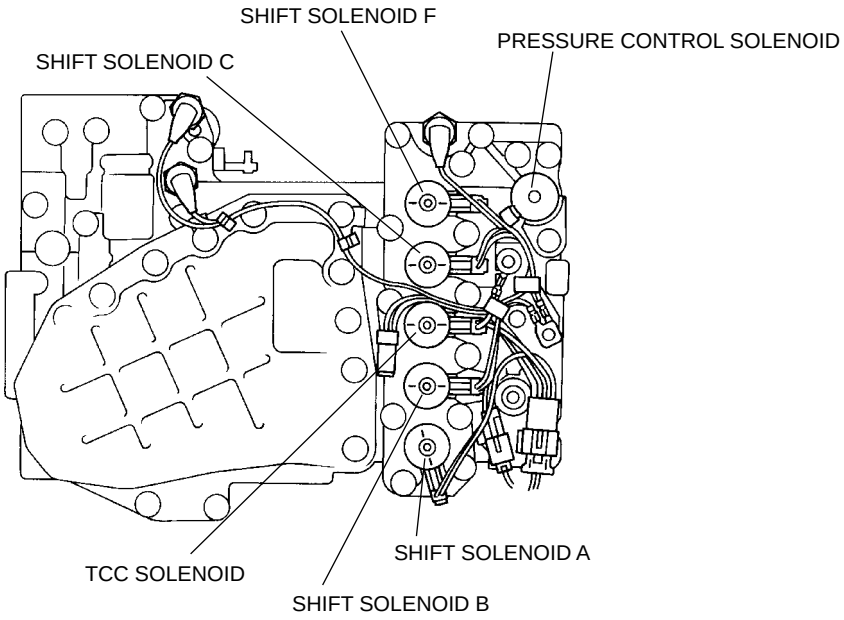


CHU0513A024

SOLENOID VALVE OUTLINE

CHU051321101A01

- All solenoid valves are three-way type and have superior responsiveness to hydraulic control.
- The solenoids have the following functions.



AEA5710T021

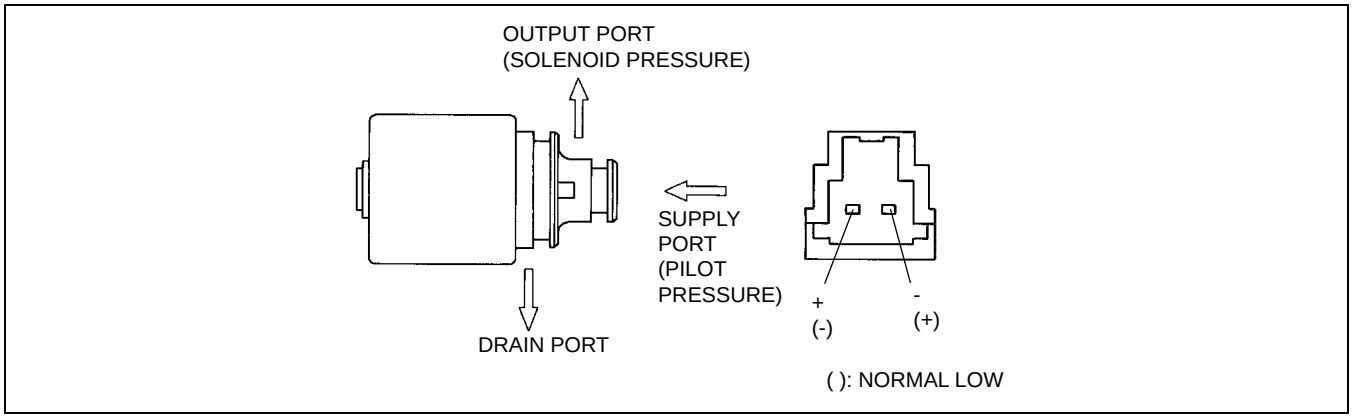
Function chart

Solenoid	Type	Characteristics	Function	
Pressure control solenoid	ON/OFF	Normal high (Supplies solenoid pressure to pressure control valve)	Set high or low line pressure depending on whether solenoid is energized or de-energized	
Shift solenoid A	Repeats ON and OFF at 50 Hz (20 ms cycle); duty cycle type	Normal high (Supplies solenoid pressure to amplifier valve)	Controls supply and drainage of solenoid pressure, according to change in on time ratio (0-100%) for one cycle	Controls amplifier valve, regulates low clutch pressure
Shift solenoid B				Controls amplifier valve, regulates 2-4 brake pressure
Shift solenoid C				Controls amplifier valve, regulates high clutch pressure
Shift solenoid F				Controls amplifier valve, regulates low and reverse brake pressure
TCC solenoid		Normal low (Drains solenoid pressure supplied to amplifier valve)		Controls TCC engagement and disengagement

SOLENOID VALVE CONSTRUCTION/OPERATION

CHU051321101A02

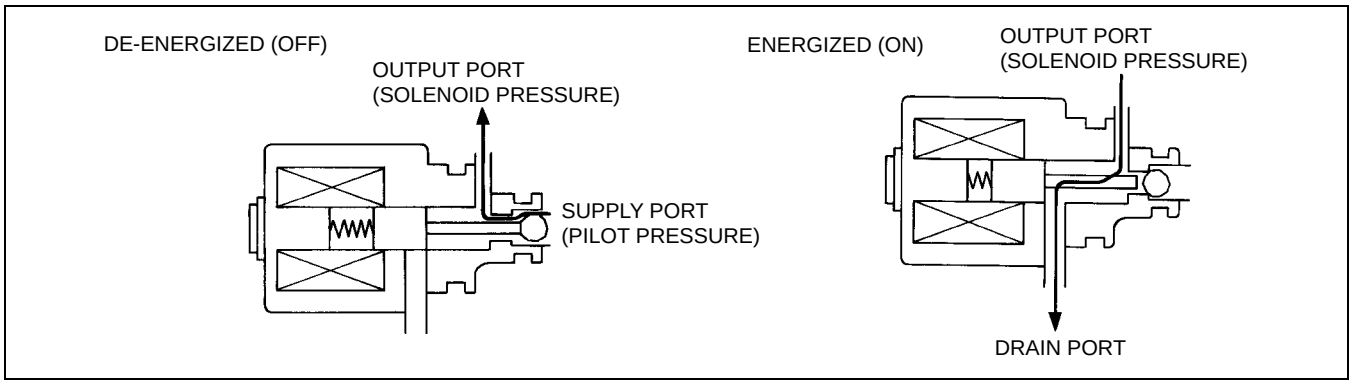
- The construction of all solenoids is the same, but the polarity of the positive and negative terminals is different.



AEA5710T022

Normal High

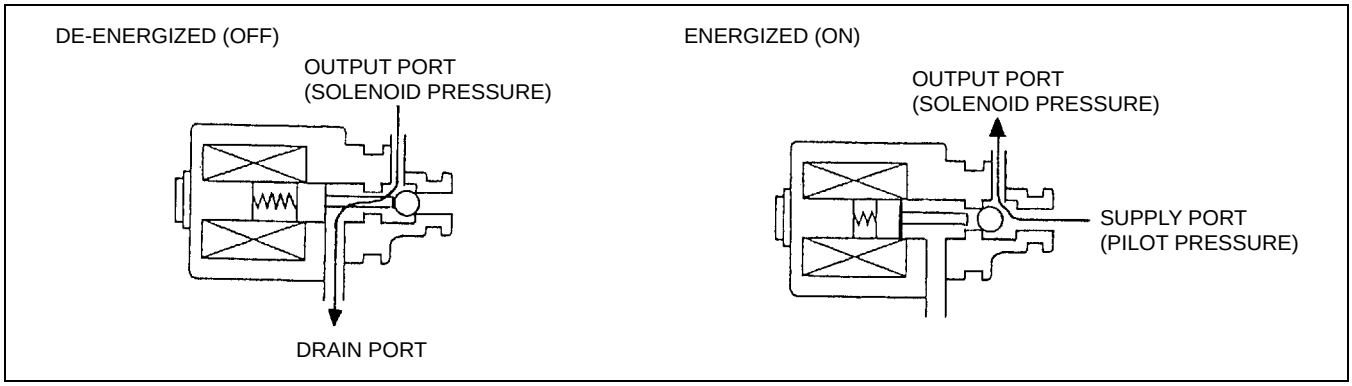
- De-energized (OFF) or duty 0%
  - — Because the output port (solenoid pressure) and the supply port (pilot pressure) connect in the solenoid, the solenoid pressure is supplied to the output port.
- Energized (ON) or duty 100%
  - — Because the output port (solenoid pressure) and the drain port connect, solenoid pressure is drained.



AEA5710T023

Normal Low

- De-energized (OFF) or duty 0%
  - — Because the output port (solenoid pressure) and the drain port connect in the solenoid, the solenoid pressure is drained.
- Energized (ON) or duty 100%
  - — Because the output port (solenoid pressure) and the supply port (pilot pressure) connect in the solenoid, the solenoid pressure is supplied to the output port.



AEA5710T024

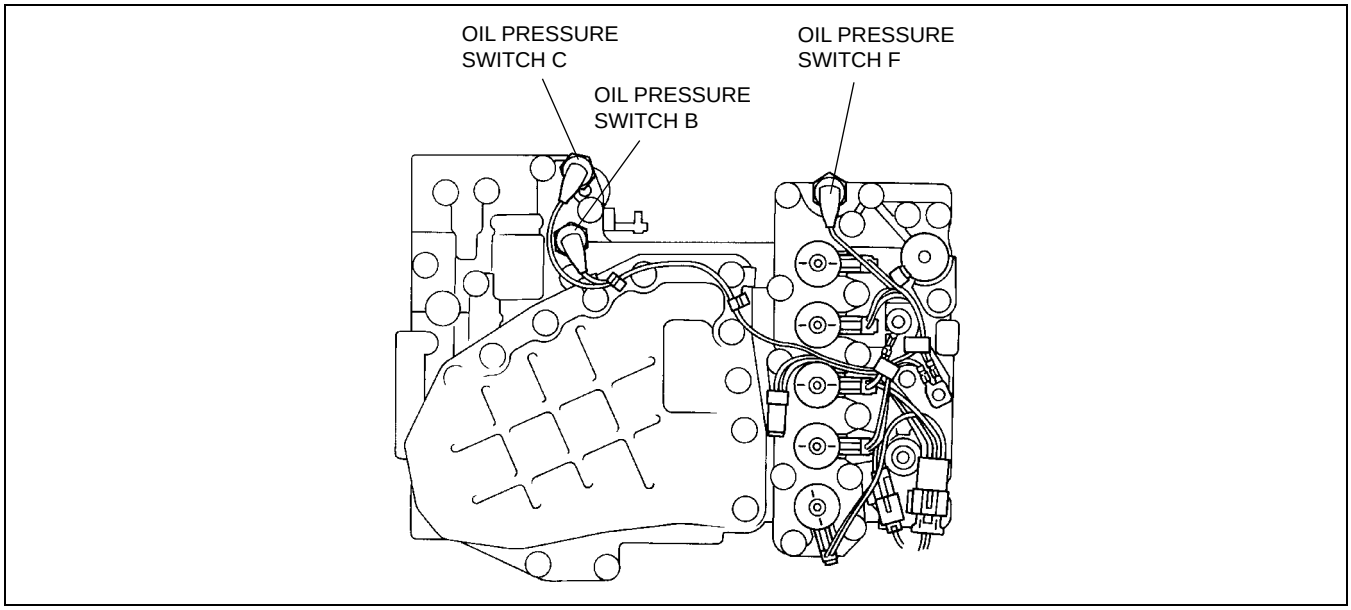
OIL PRESSURE SWITCH OUTLINE

CHU051319200A03

- The oil pressure switches detect pressure applied to the clutch and brakes, and sends control signals to the TCM.
- The TCM controls clutch engagement based on these signals.
- The oil pressure switches have the following functions:

Function chart

Oil pressure switch	Function
Oil pressure switch B	Detects pressure applied to 2-4 brake
Oil pressure switch C	Detects pressure applied to high clutch
Oil pressure switch F	Detects pressure applied to low and reverse brake

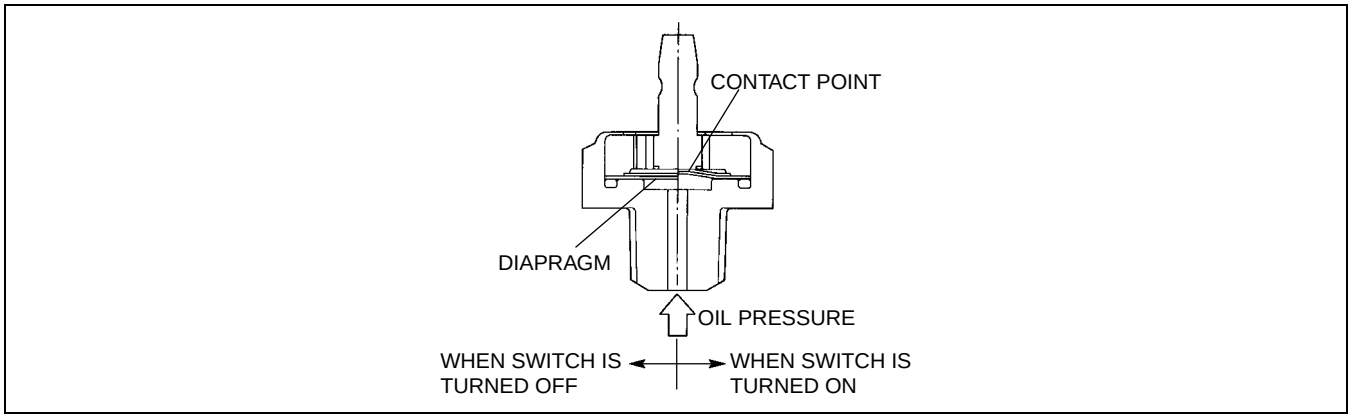


AEA5710T036

OIL PRESSURE SWITCH CONSTRUCTION/OPERATION

CHU051319200A04

- While clutch or brake pressure is applied, the oil pressure switches turn on when the oil pressure reaches the operating pressure of the switch, and turn off when the oil pressure is below the operating pressure of the switch.
- The oil pressure switches are mounted on the lower control valve.

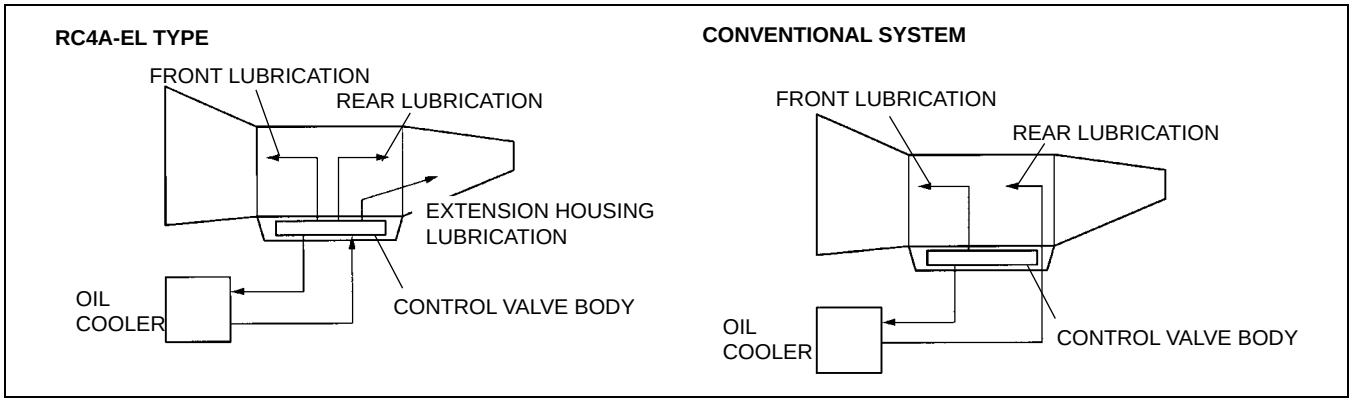


AEA5710T037

LUBRICATION SYSTEM CONSTRUCTION

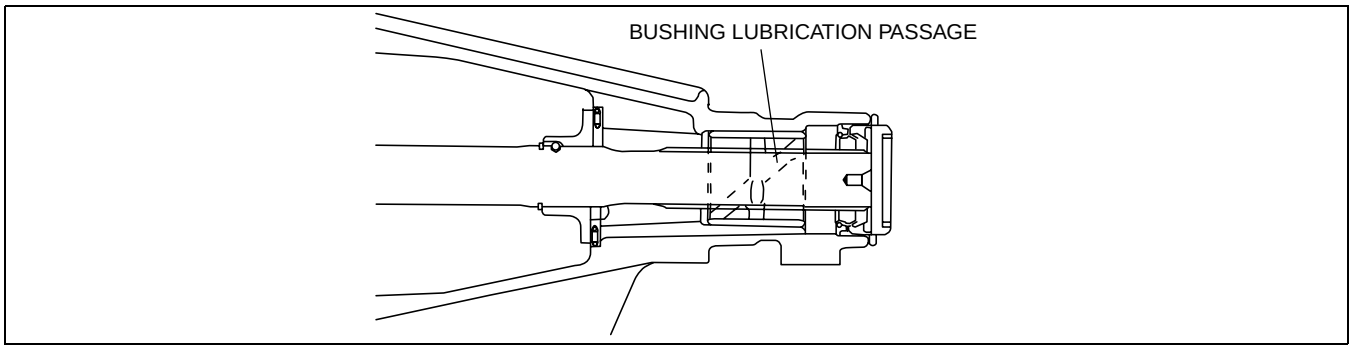
CHU051301026A07

- In the conventional system, the rear section is lubricated by ATF returning from the ATF oil cooler. In the new system, all parts are lubricated directly from the control valve.
- With this construction, the system is unaffected by the ATF oil cooler, and thus a steady amount of lubricant is supplied.



AEA5710T026

- A passage located in the rear of the extension housing supplies a steady amount of lubricant exclusively to the bushing.

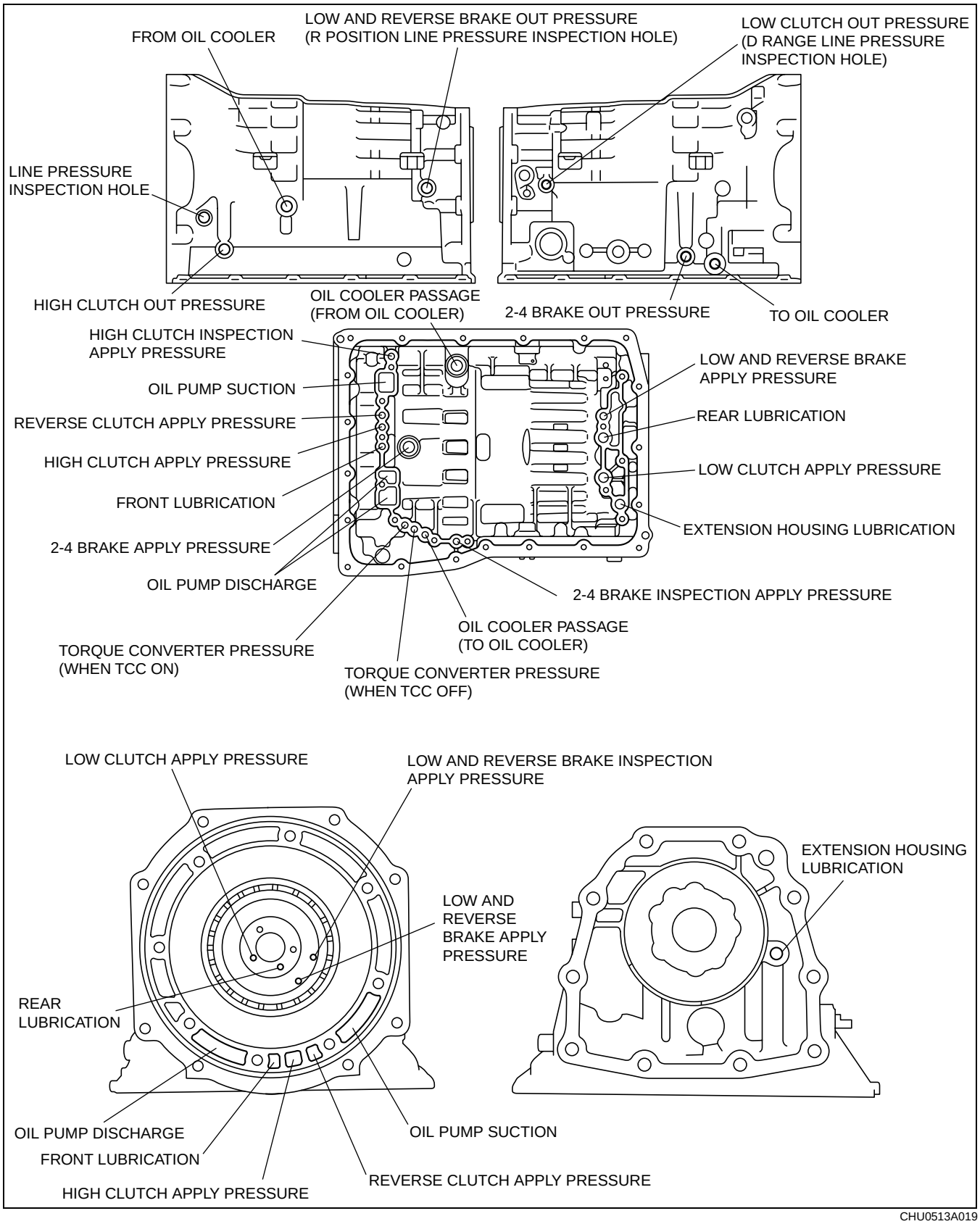


CHU0513A020

OIL PRESSURE PASSAGE CONSTRUCTION

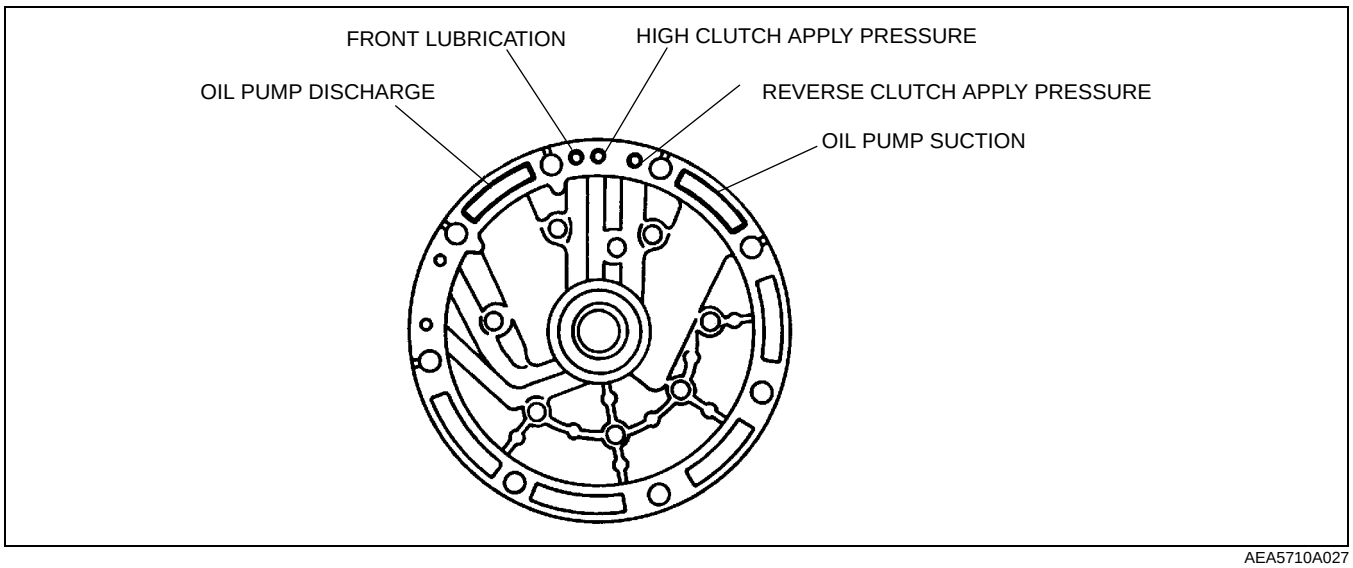
CHU051301026A08

Transmission Case



CHU0513A019

Oil Pump



AEA5710A027

05–13Z AUTOMATIC TRANSMISSION

AUTOMATIC TRANSMISSION CLEANING

CHU051301026A09

Cleaning Notes

1. Clean the transmission exterior thoroughly with steam, cleaning solvents, or both, before disassembly.

   Warning
   - **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

2. Clean the removed parts with cleaning solvent, and dry with compressed air. Clean out all holes and passages with compressed air, and verify that there are no obstructions.

AUTOMATIC TRANSMISSION DISASSEMBLY

CHU051301026A10

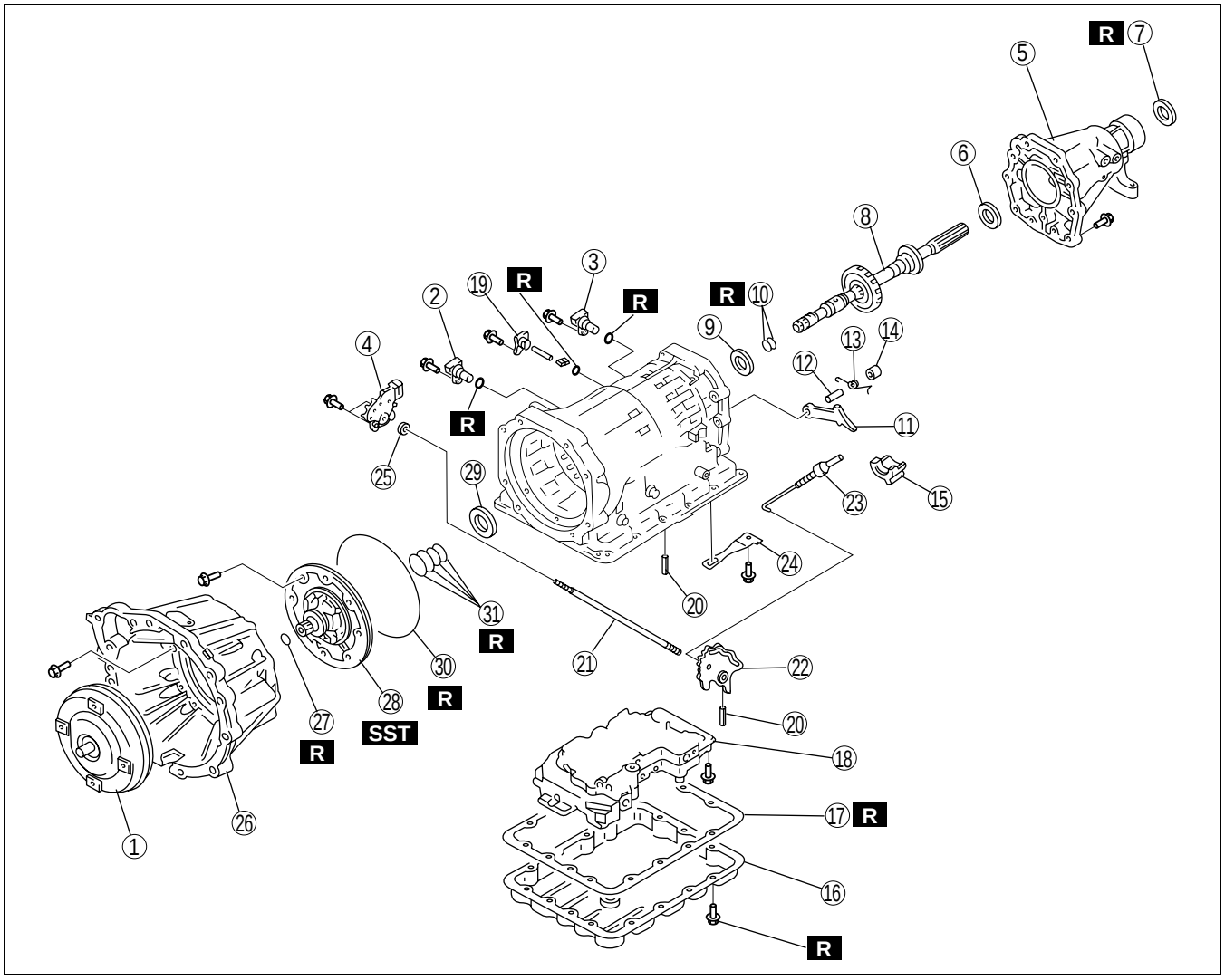
Precaution

General notes

1. Disassemble the transmission in a clean area (dust-proof work space) to prevent entry of dust into the mechanisms.
2. Inspect the individual transmission components in accordance with the QUICK DIAGNOSIS CHART during disassembly.
3. Use only plastic hammers when applying force to separate the light alloy case joints.
4. Never use rags during disassembly; they may leave particles that can clog fluid passages.
5. Because several parts resemble one another, arrange them so that they do not get mixed up.
6. Disassemble the control valve component and thoroughly clean it when the clutch or brake band has burned or when the ATF has degenerated.

   Warning
   - **Although the stand has a self-locking brake system, there is a possibility that the brake may not hold when the transmission is held in a lopsided position on the stand. This would cause the transmission to turn suddenly, causing serious injury. Never keep the transmission tilted to one side. Always hold the rotating handle firmly when turning the transmission.**

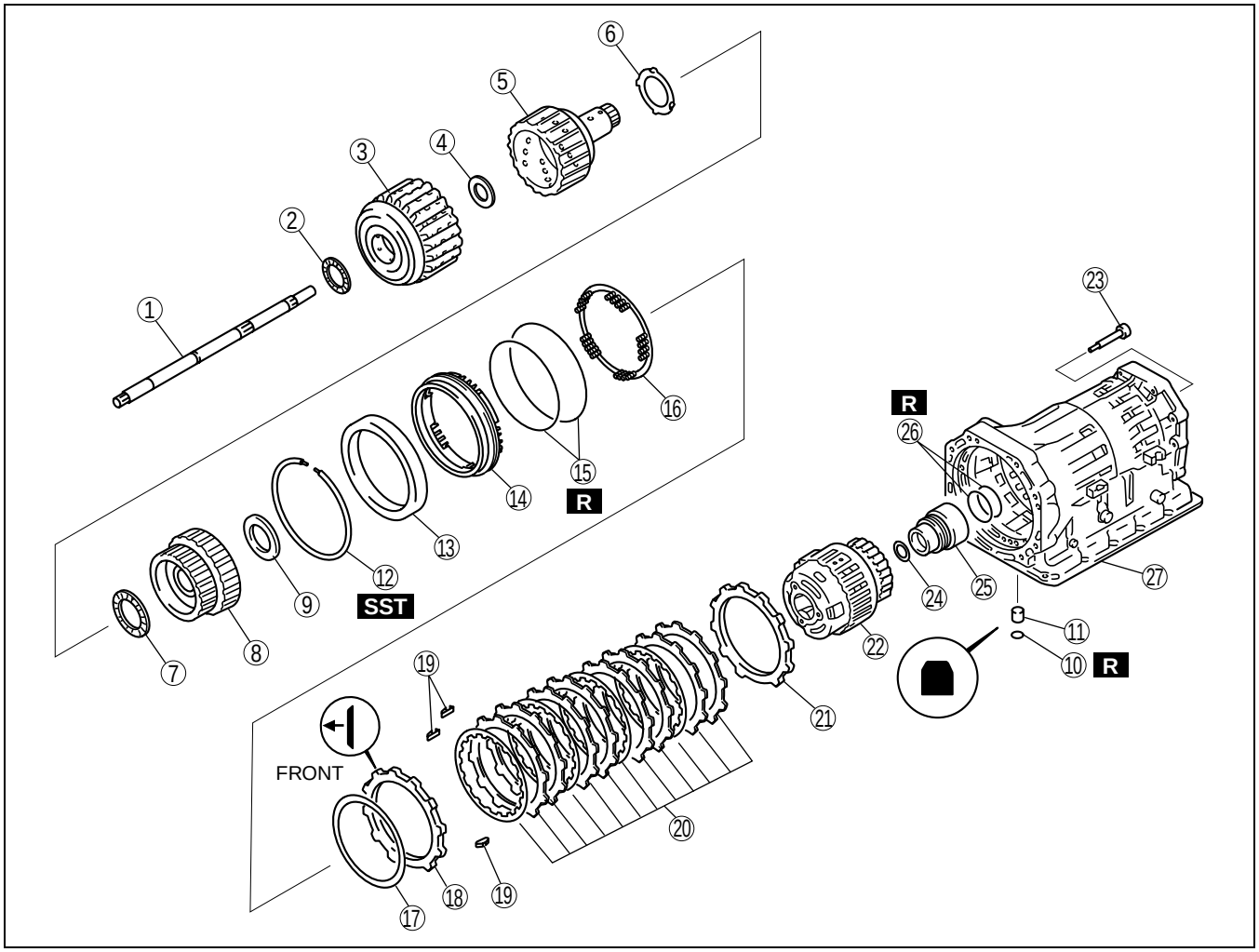
Disassembly
Components



CHU0513A111

1	Torque converter
2	Turbine sensor
3	VSS
4	TR switch
5	Extension housing
6	Bearing
7	Oil seal
8	Output shaft component
9	Bearing
10	Seal ring
11	Parking pawl
12	Parking pawl shaft
13	Return spring
14	Parking pawl spacer
15	Actuator support
16	Oil pan

17	Gasket
18	Control valve body
19	Wiring harness component
20	Roll pin
21	Manual shaft
22	Manual plate
23	Parking rod
24	Detent spring
25	Oil seal
26	Torque converter housing
27	O-ring
28	Oil pump
29	Bearing race
30	O-ring
31	Seal ring



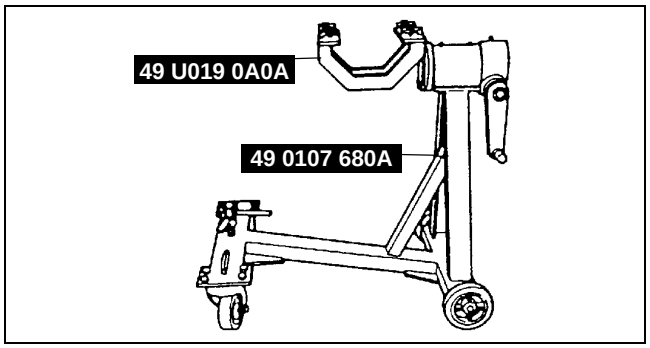
CHU0513A112

1	Input shaft
2	Bearing
3	Reverse and high clutch drum
4	Bearing
5	High clutch hub
6	Bearing race
7	Bearing
8	Front sun gear
9	Bearing race
10	Seal ring
11	Sleeve
12	Snap ring
13	2-4 brake retainer
14	2-4 brake piston

15	Seal ring
16	Return spring
17	Dished plate
18	Retaining plate
19	Spring
20	Drive and driven plate
21	Retaining plate
22	Carrier component
23	Bolt
24	Bearing
25	Low one-way clutch inner race
26	Seal ring
27	Transmission case

Disassembly procedure

1. Remove the torque converter, and immediately turn it so that the hole faces upward. This will help to keep any remaining fluid from spilling.
2. Assemble the **SSTs**.

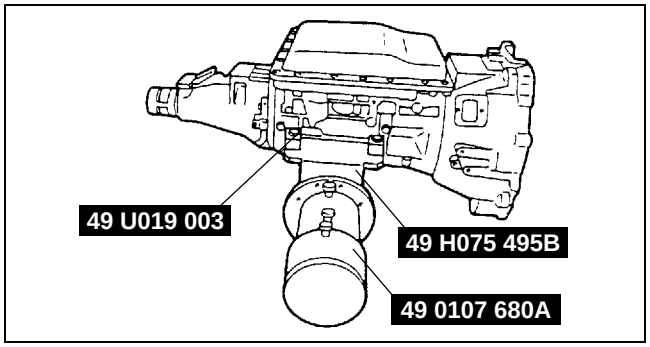


AEA5610A003

3. Mount the transmission on the **SSTs**.
4. Turn down the oil pan in order to gather any material.

Caution

- **Be careful not to scratch the mating surfaces of the control valve body cover and the transmission case.**

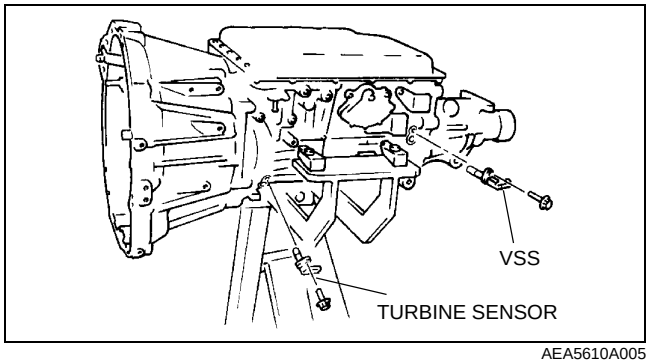


AEA5610A004

5. Remove the oil pan and the gasket.
6. Examine any material found in the oil pan or on the magnet to determine the condition of the transmission.
   - If large amounts of material are found, replace the torque converter and carefully inspect the transmission for the cause.

Material	Cause
Clutch facing material	Drive plate wear
Steel (magnetic)	Bearing, gear, and driven plate wear
Aluminium (non magnetic)	Aluminium part wear

7. Install the oil pan with a few bolts to protect the control valve body.
8. Remove the turbine sensor and the vehicle speed sensor (VSS).
9. Remove the O-ring from the turbine sensor and the VSS.

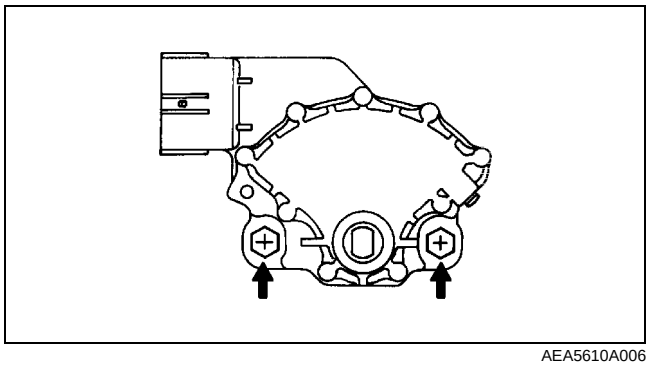


AEA5610A005

10. Remove the TR switch.

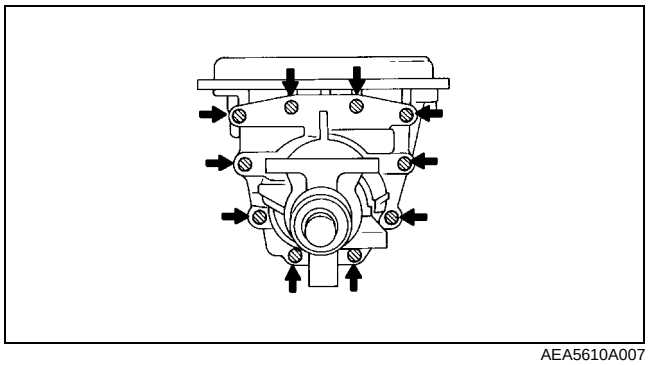
Caution

- **Denting the parking components will reduce the performance of the transmission. When handling the components, be careful not to drop them.**



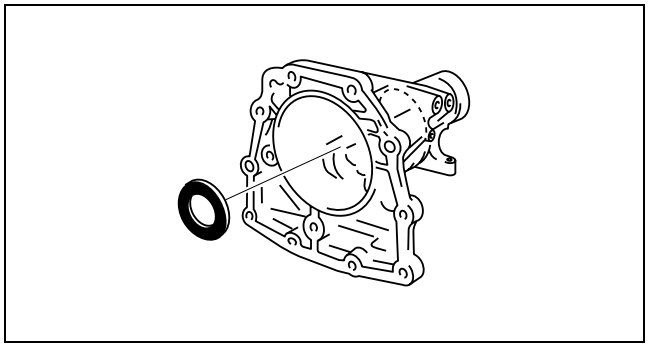
AEA5610A006

11. Remove the extension housing as shown in the figure.



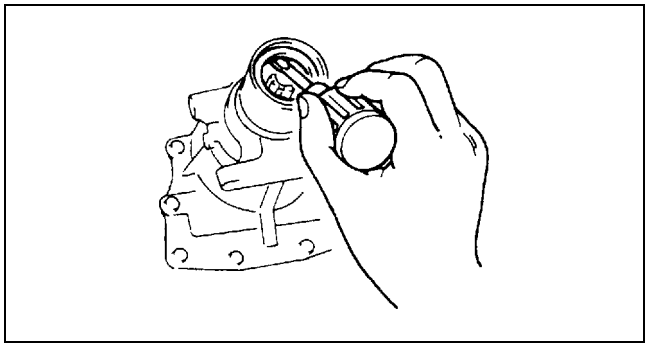
AEA5610A007

12. Remove the bearing from the extension housing.



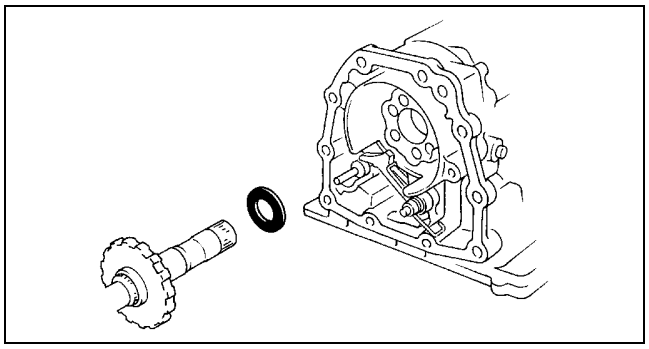
BHJ0513A162

13. Remove the oil seal from the extension housing using a flathead screwdriver.



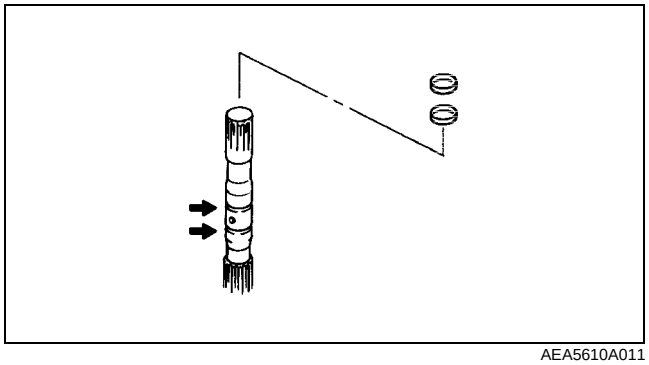
AEA5610A009

14. Remove the output shaft component and the bearing.



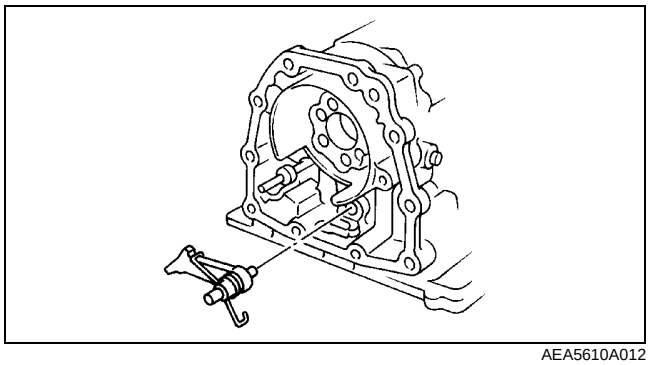
AEA5610A010

15. Remove the seal rings from the output shaft component.



AEA5610A011

16. Remove the parking pawl, shaft, spring, and the spacer.

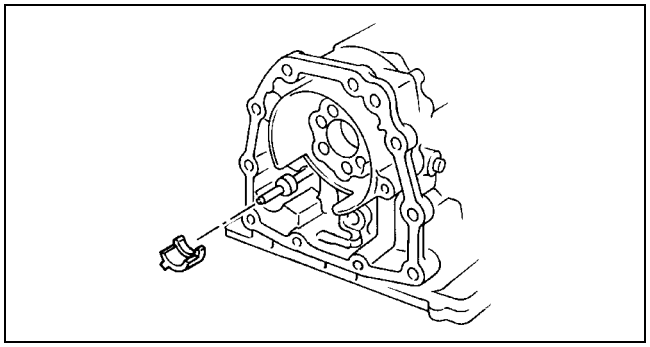


AEA5610A012

17. Remove the actuator support.

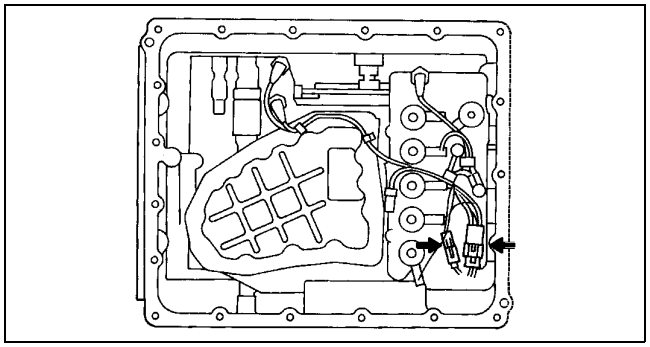
Note
- Do not reuse the oil pan installation bolts as they are coated.

18. Remove the oil pan.



AEA5610A013

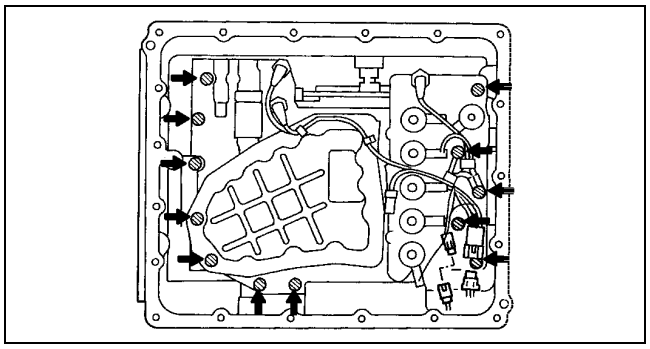
19. Disconnect the harness component as shown in the figure.



AEA5610A014

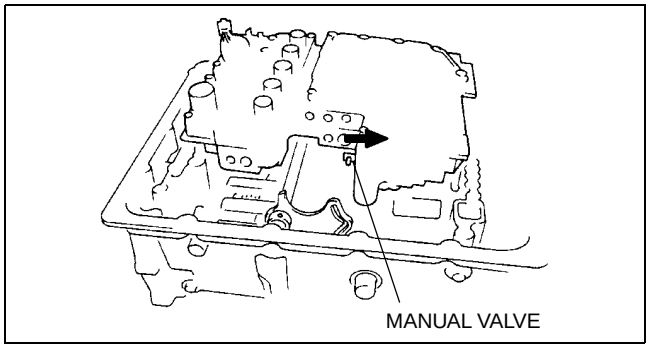
20. Remove the bolts as shown in the figure.

Note
- When removing control valve body, be careful not to drop the manual valve.
- Do not move the manual valve in the direction of arrow to prevent the pin for the manual valve rotation prevention from falling from the control valve body.



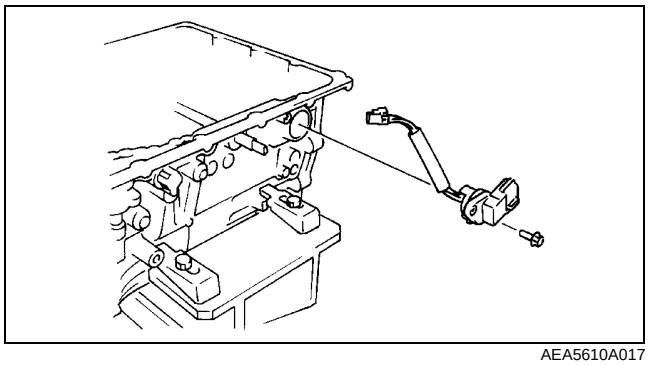
AEA5610A015

21. Remove the control valve body.



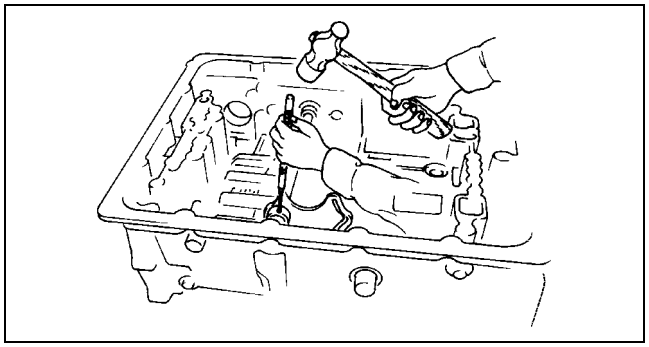
AEA5610A016

22. Remove the harness component.
23. Remove the O-ring from the harness component.



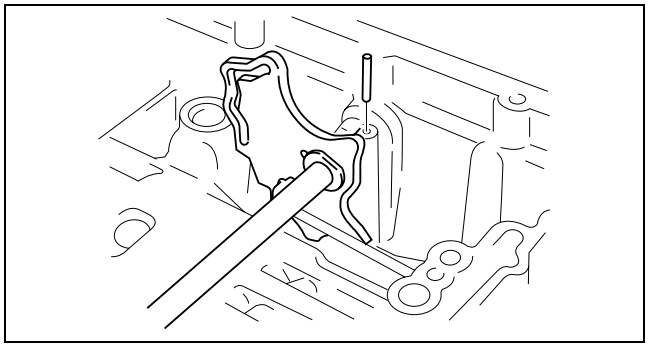
AEA5610A017

24. Remove the roll pin using a pin punch.



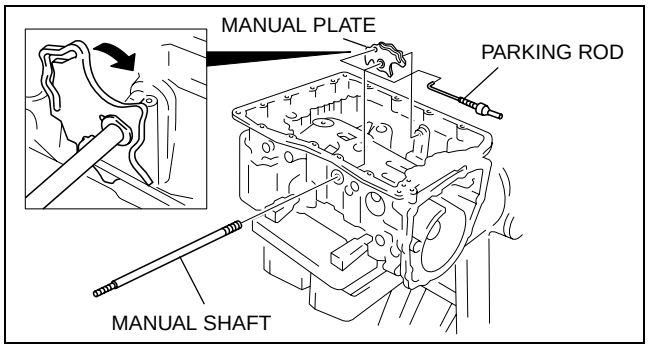
AEA5610A018

25. Remove the roll pin.



BHJ0513A106

26. Remove the manual shaft, manual plate and parking rod.

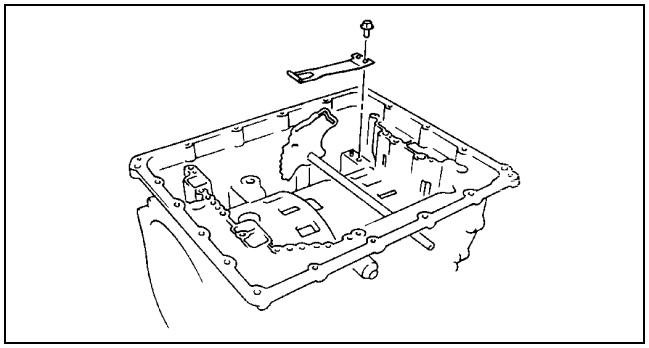


CHU0513A113

27. Remove the detent spring.

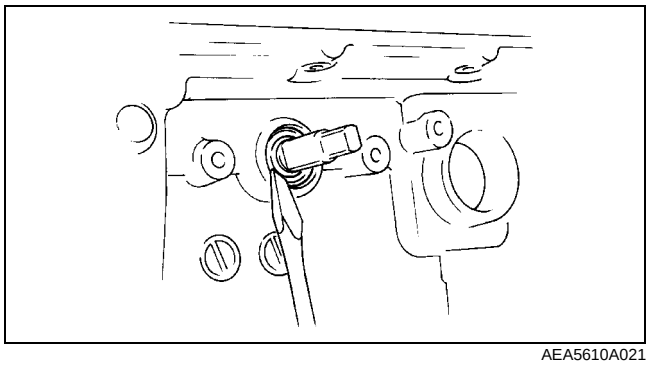
Caution

- **Scratching the transmission will reduce the performance of the transmission. When removing the oil seal, be sure to prevent the flathead screwdriver from contacting the transmission.**



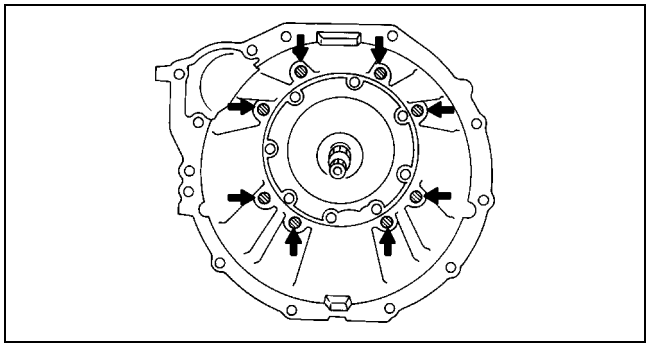
AEA5610A020

28. Remove the oil seal using a flathead screwdriver.



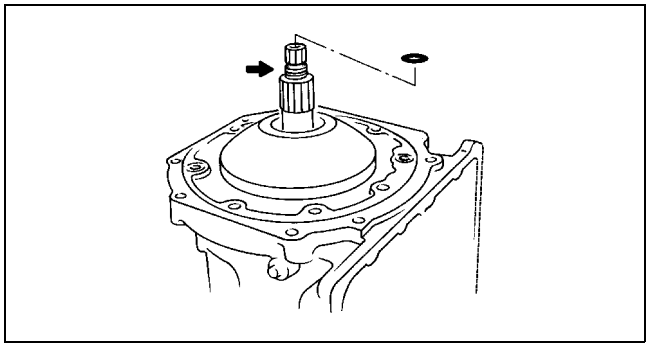
AEA5610A021

29. Remove the torque converter housing as shown in the figure.



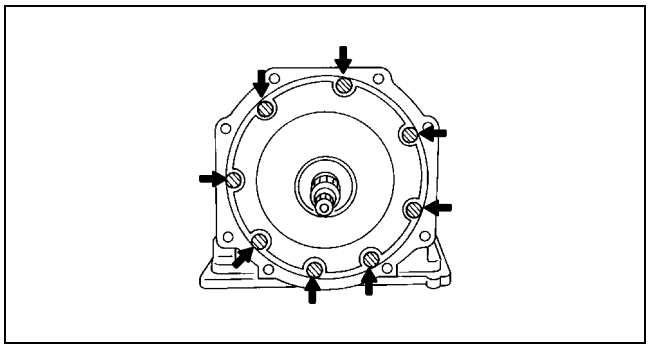
AEA5610A022

30. Remove the O-ring from the input shaft.



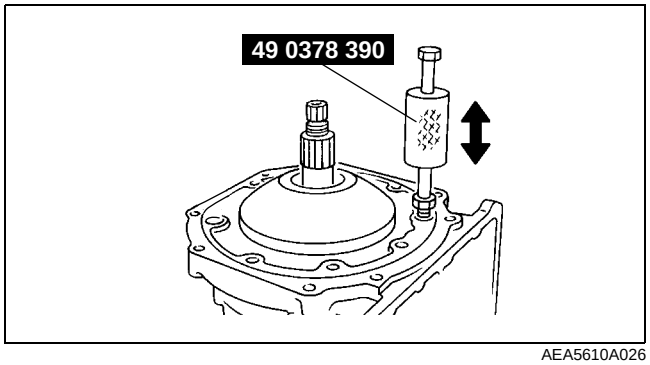
AEA5610A023

31. Remove the bolts as shown in the figure.



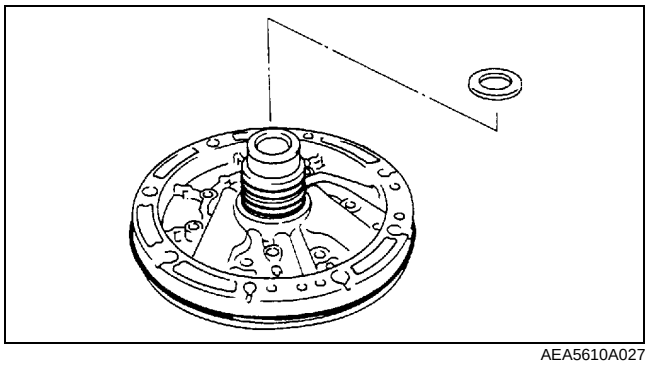
AEA5610A024

32. Install the **SST** to the oil pump.
33. While pulling the oil pump shaft upward, remove the oil pump by sliding the weight of the **SST**.
34. Remove the **SST** from the oil pump.
35. Remove any old sealant from the oil pump.



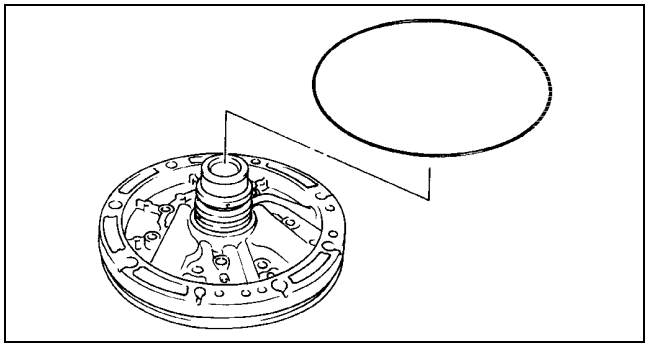
AEA5610A026

36. Remove the bearing from the oil pump.



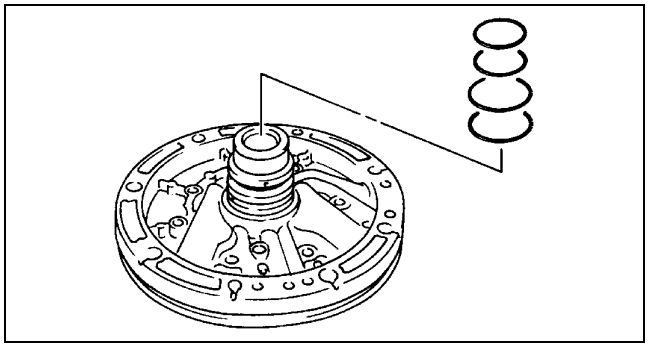
AEA5610A027

37. Remove the O-ring from the oil pump.



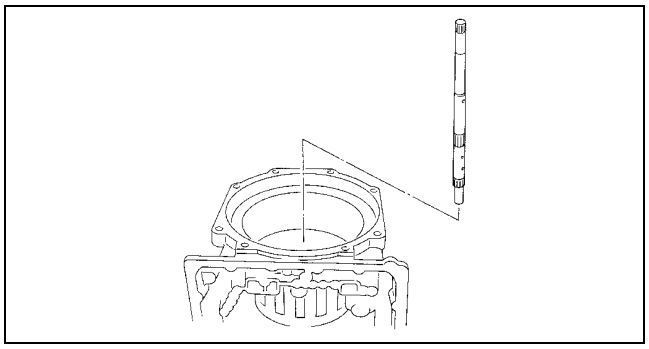
AEA5610A028

38. Remove the seal rings from the oil pump.



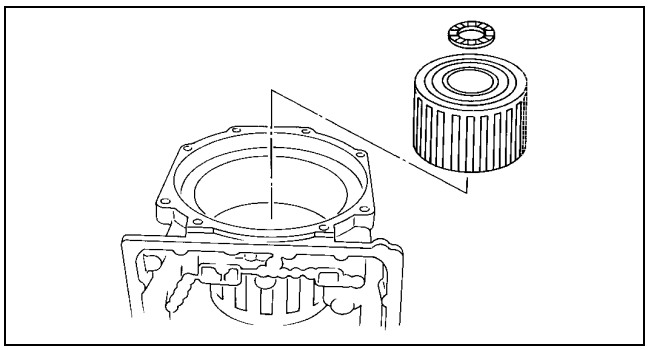
AEA5610A029

39. Remove the input shaft.



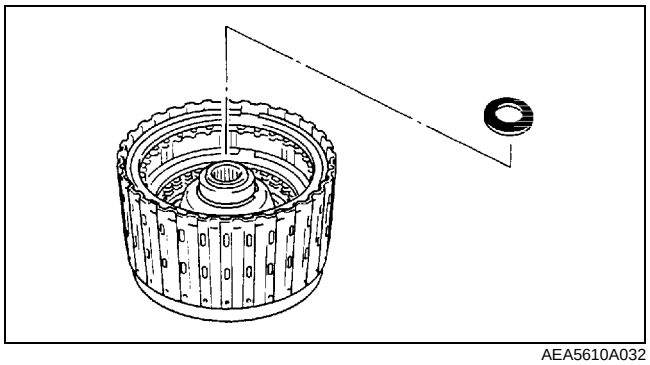
AEA5610A030

40. Remove the bearing and the reverse and high clutch drum.



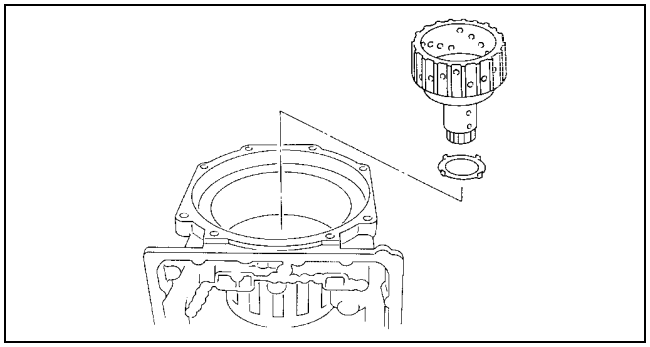
AEA5610A031

41. Remove the bearing from the reverse and high clutch drum.



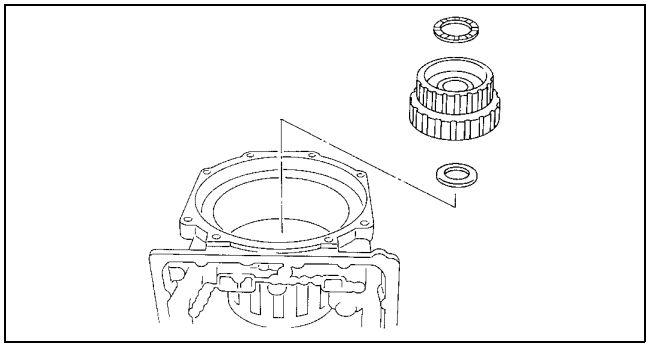
AEA5610A032

42. Remove the high clutch hub and the bearing race.



AEA5610A033

43. Remove the bearing, front sun gear, and the bearing race.
44. Inspect the 2-4 brake operation. (See 05–13Z–28 2-4 BRAKE PREINSPECTION.)

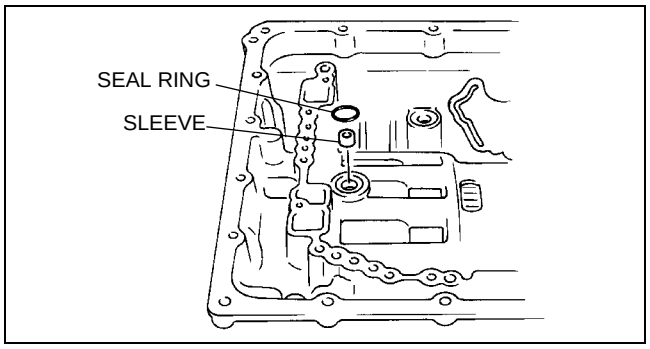


AEA5610A034

45. Remove the seal ring and the sleeve.

Caution

- **Be sure to center the SSTs on the transmission case. Otherwise, the return spring can be damaged.**

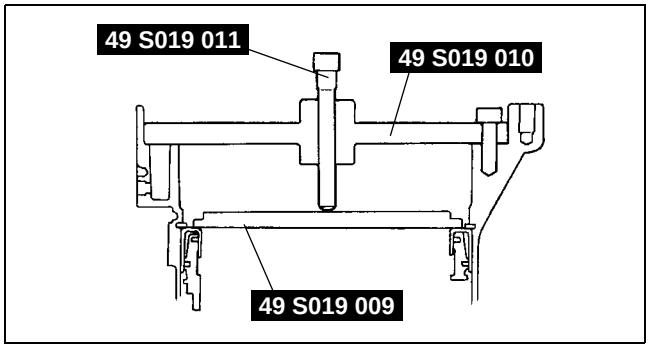


AEA5610A035

46. Install the **SSTs** to the transmission case.

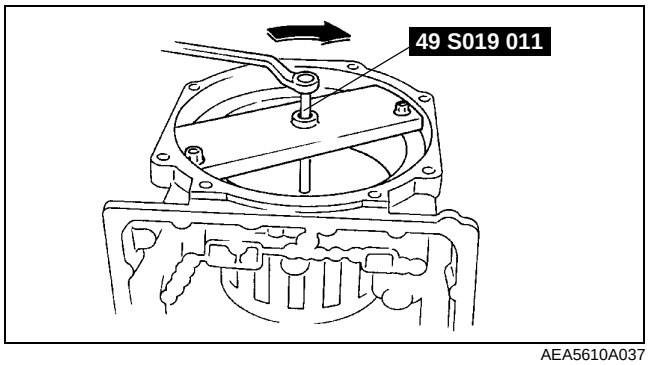
Caution

- **Do not compress the 2-4 brake retainer excessively. Doing so can damage the return spring.**



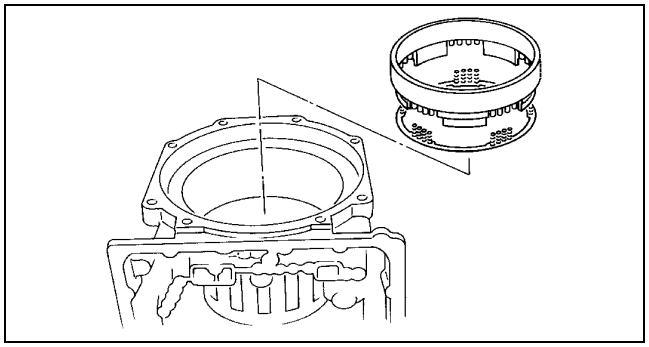
AEA5610A036

47. Compress the 2-4 brake retainer using the **SST**.
48. Remove the snap ring.
49. Remove the **SSTs**.

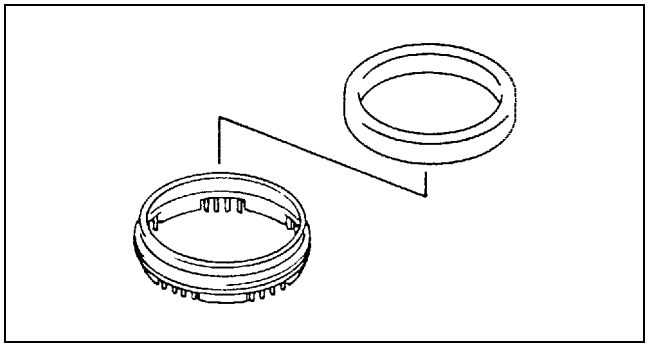


AEA5610A037

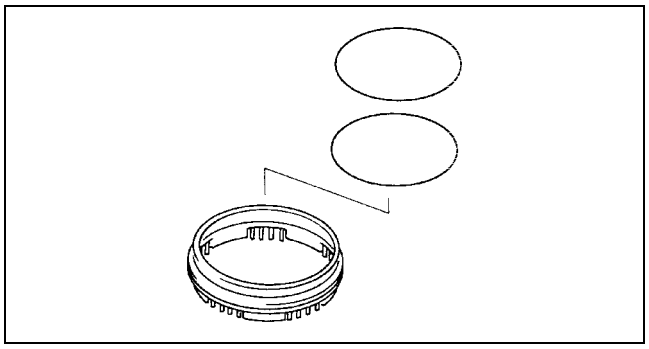
50. Remove the 2-4 brake retainer and the return spring.


AEA5610A038

51. Remove the 2-4 brake piston from the 2-4 brake retainer.

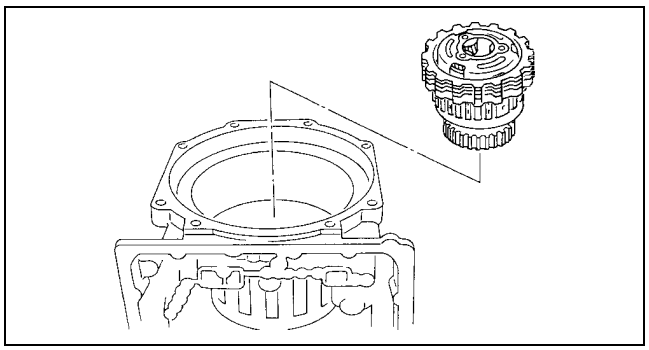

AEA5610A039

52. Remove the seal rings from the 2-4 brake piston.

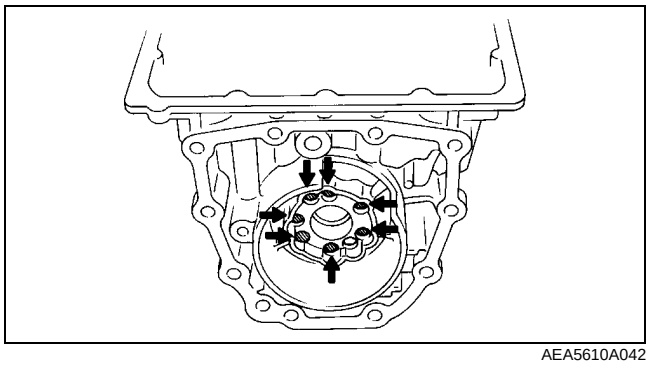

AEA5610A040

53. Remove the carrier component, plates of the 2-4 brake, and the N-spring.

Note
- Remove the low one-way clutch inner race by loosening the bolts evenly and gradually. Otherwise, the low one-way clutch inner race will slant and become irremovable.

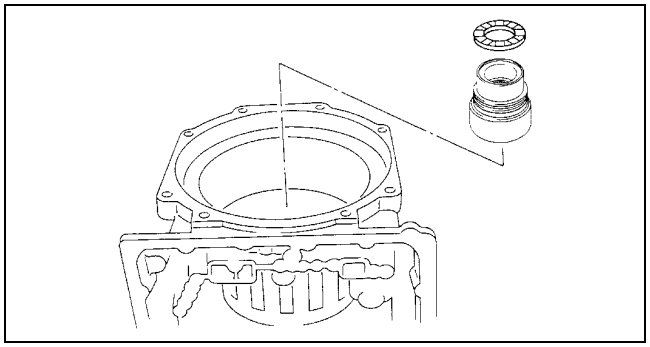

AEA5610A041

54. Remove the bolts.



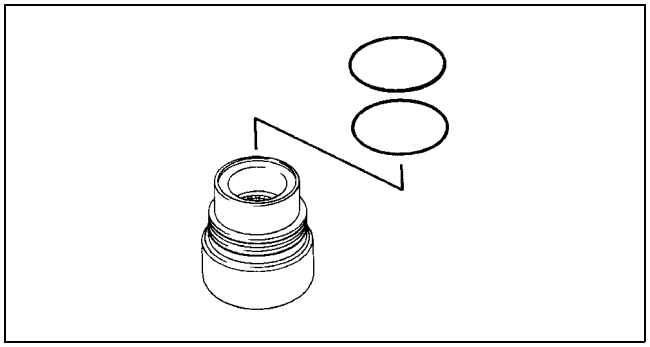
AEA5610A042

55. Remove the bearing and the low one-way clutch inner race.



AEA5610A043

56. Remove the seal rings from the low one-way clutch inner race.

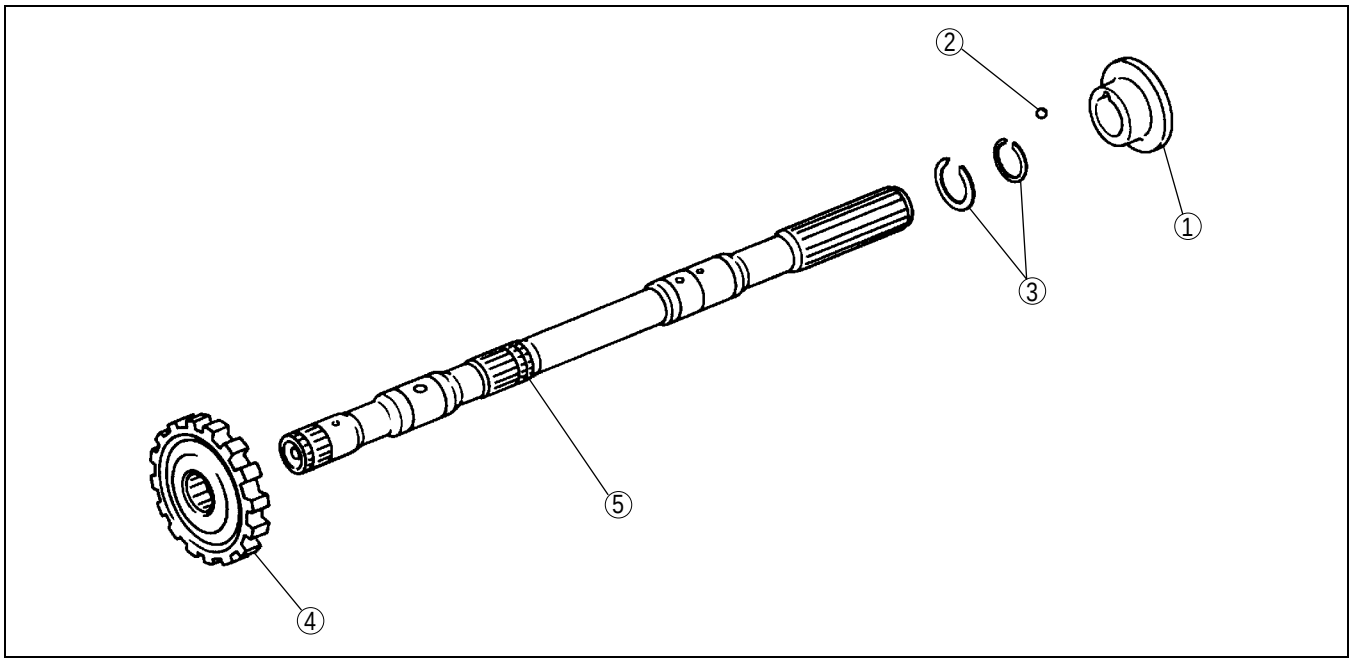


AEA5610A044

OUTPUT SHAFT COMPONENT DISASSEMBLY

CHU051301026A11

1. Disassemble in the order indicated in the table.



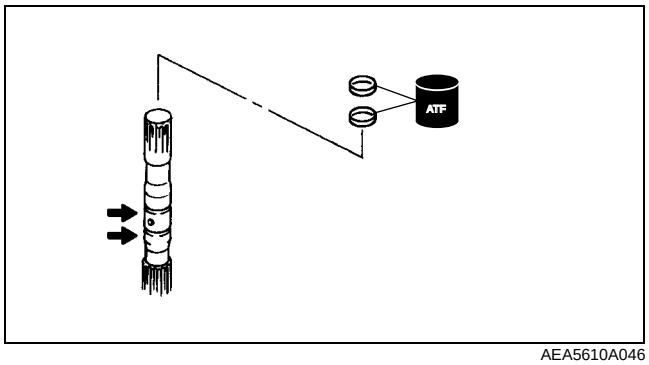
AEA5610A045

1	Spacer
2	Ball
3	Snap ring
4	Parking gear
5	Output shaft

OUTPUT SHAFT COMPONENT INSPECTION

CHU051301026A12

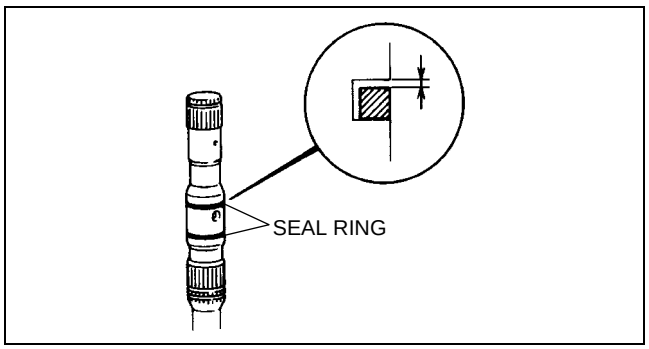
1. Install new seal rings.



AEA5610A046

2. Measure the clearance between the seal rings and the seal ring grooves.
   - If the clearance is out of the specification, replace the output shaft.

   Specification
   0.10—0.25 mm {0.0040—0.0098 in}

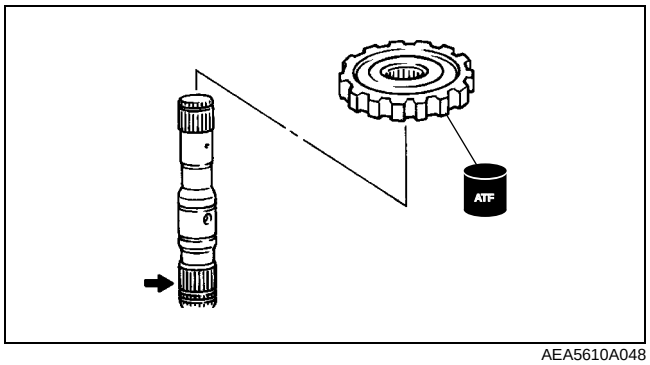


AEA5610A047

OUTPUT SHAFT COMPONENT ASSEMBLY

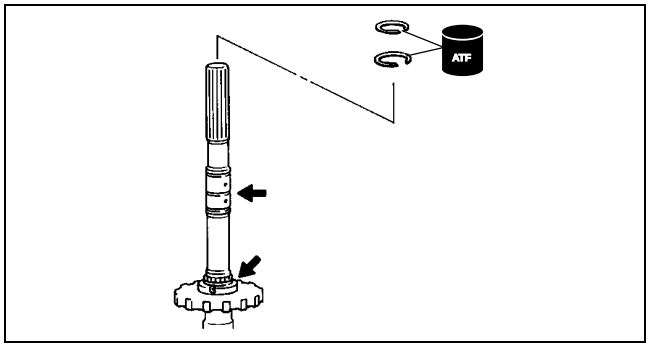
CHU051301026A13

1. Install the parking gear.



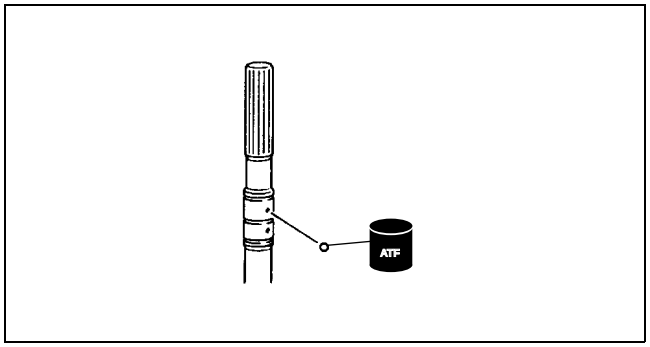
AEA5610A048

2. Install the snap rings.



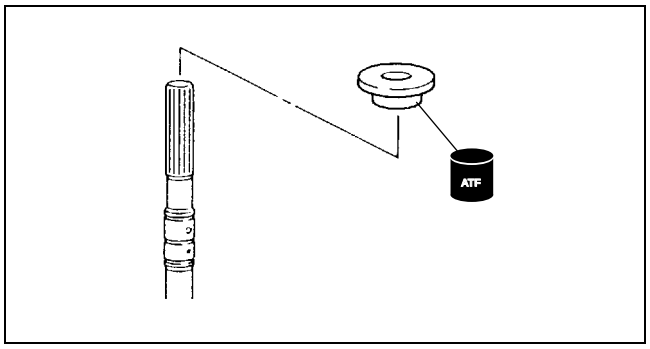
AEA5610A049

3. Install the ball.



AEA5610A050

4. Install the spacer.

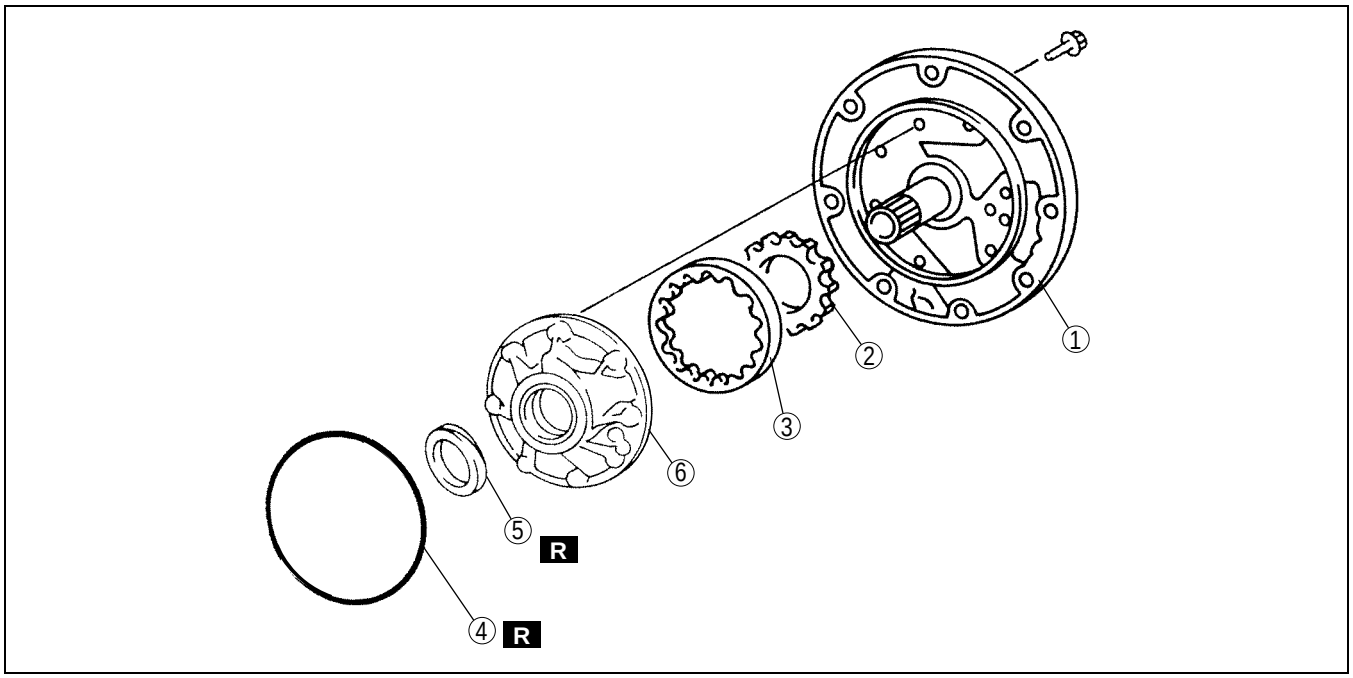


AEA5610A051

OIL PUMP DISASSEMBLY

CHU051319220A03

1. Disassemble in the order indicated in the table.

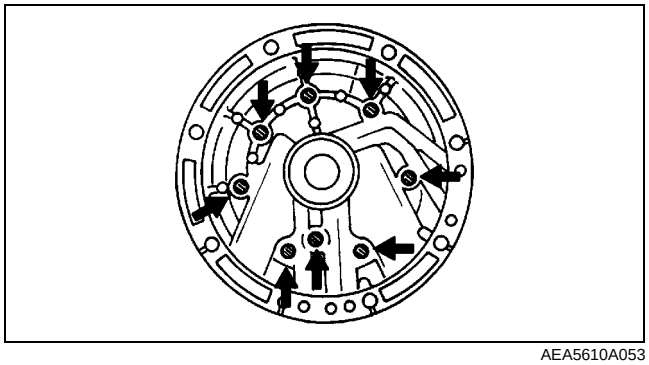


AEA5610A052

1	Oil pump cover (See 05–13Z–16 Oil Pump Cover Disassembly Note.)
2	Inner rotor (See 05–13Z–17 Inner Rotor Disassembly Note.)
3	Outer rotor
4	O-ring
5	Oil seal
6	Oil pump housing

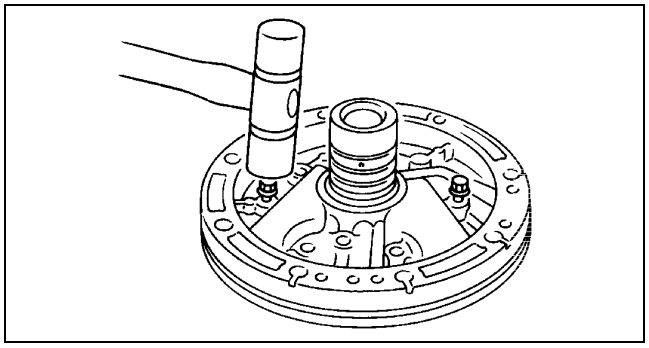
Oil Pump Cover Disassembly Note

1. Loosen the mounting bolts evenly.



AEA5610A053

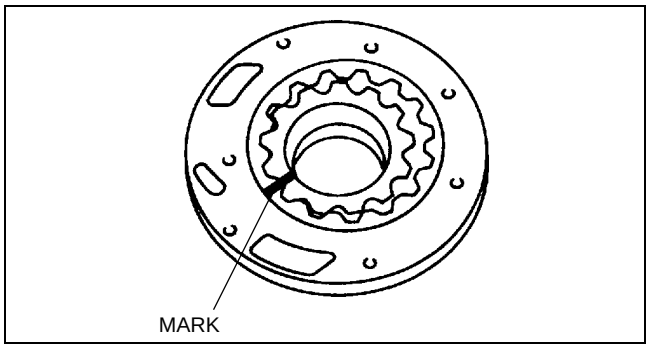
2. Lightly tap the head of the mounting bolts with a plastic hammer to remove the oil pump cover.



AEA5610A054

Inner Rotor Disassembly Note

1. Mark the inner and outer rotors without scratching or denting them.
2. Remove the inner rotor.



AEA5610A055

OIL PUMP INSPECTION

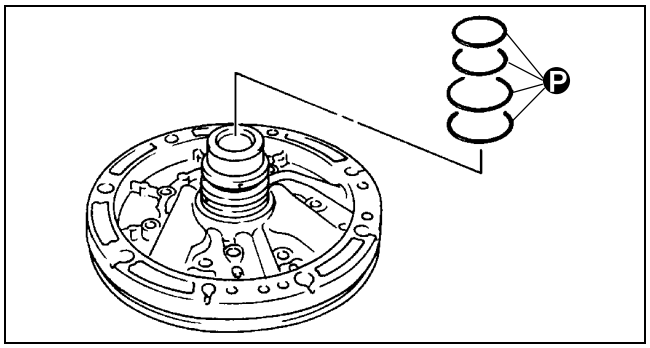
CHU051319220A04

Oil Pump Cover Inspection

Note

- Install large seal rings to the front side and small seal rings to the rear side.

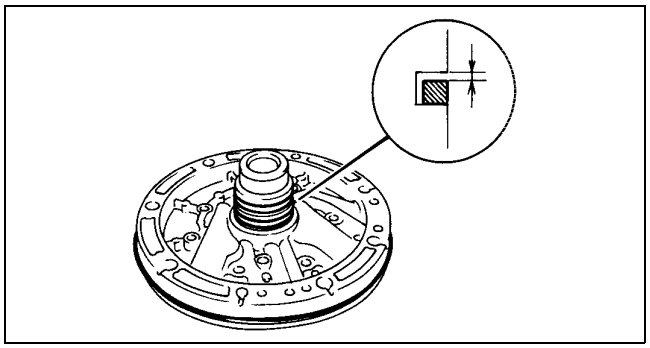
1. Install new seal rings to the oil pump cover.



AEA5610A056

2. Measure the clearance between the seal rings and the seal ring grooves.
   - If the clearance is not within the specification, replace the oil pump cover.

   Specification
   0.10—0.25 mm {0.0040—0.0098 in}

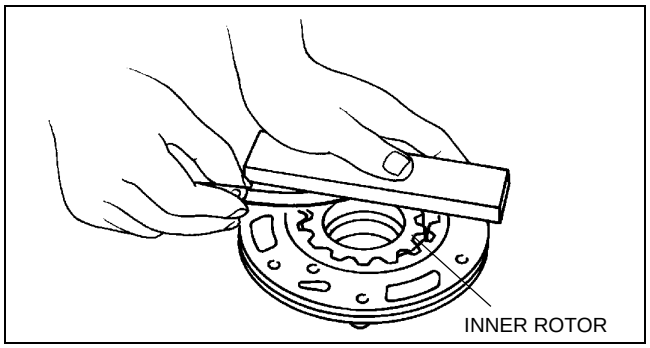


AEA5610A057

Inner Rotor Inspection

1. Measure the clearance between the inner rotor and the oil pump cover.
   - If the clearance is not within the specification, replace the inner rotor.

   Specification
   0.02—0.04 mm {0.0008—0.0015 in}

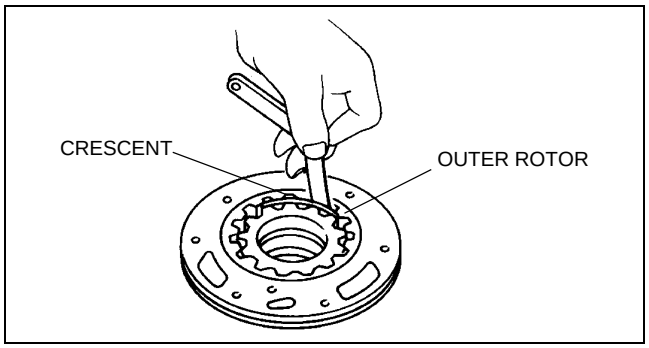


AEA5610A058

Outer Rotor Inspection

1. Measure the clearance between the outer rotor and the crescent.
   - If the clearance is not within the specification, replace the outer rotor.

   Specification
   0.02—0.15 mm {0.0008—0.0059}

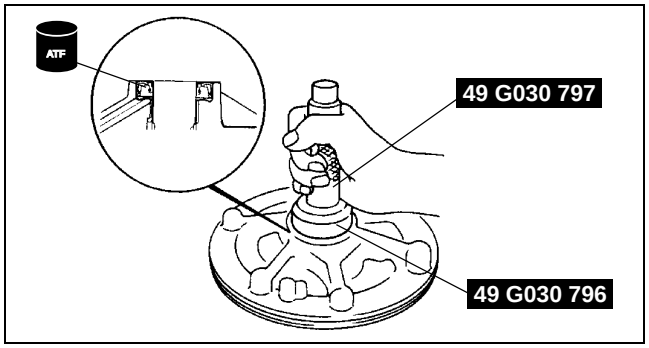


AEA5610A059

OIL PUMP ASSEMBLY

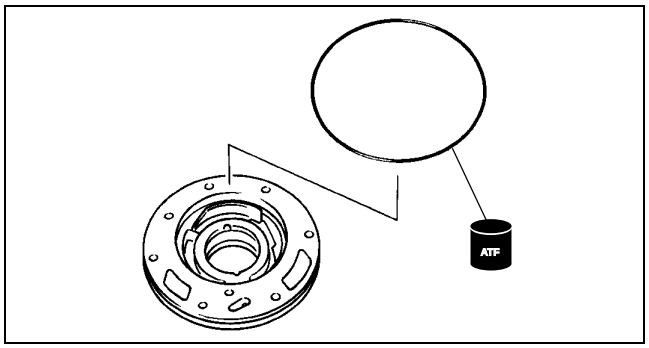
CHU051319220A05

1. Install a new oil seal to the oil pump housing using the **SSTs**.



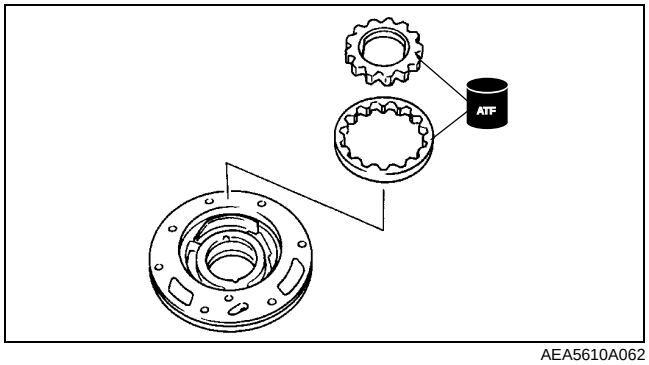
AEA5610A060

2. Install a new O-ring to the oil pump housing.



AEA5610A061

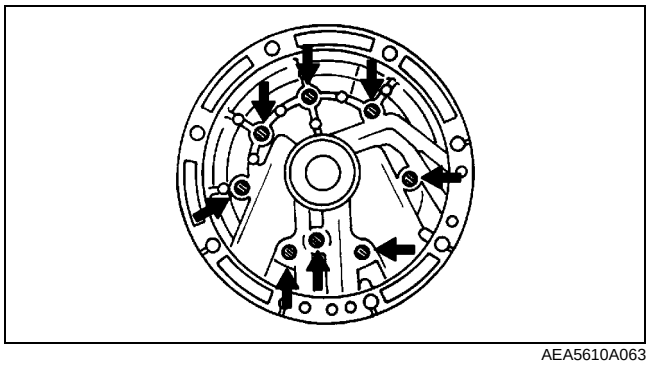
3. Align the marks and install the outer and inner rotors.



AEA5610A062

4. Apply ATF to the oil pump housing and install it to the oil pump cover.

Tightening torque
7.0—11.0 N·m {72—112 kgf·cm, 63—97 in·lbf}



AEA5610A063

REVERSE AND HIGH CLUTCH DRUM PREINSPECTION

CHU051319500A05

Reverse Clutch Inspection

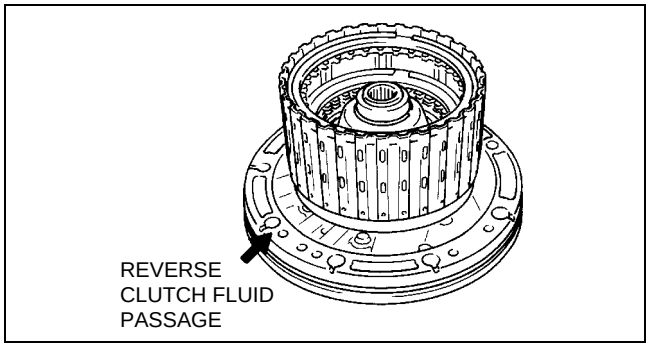
1. Install the reverse and high clutch drum to the oil pump.

Warning
- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

Caution
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**

2. Apply compressed air to the part indicated in the figure and inspect the reverse clutch operation.
   - If there is any malfunction, inspect the reverse clutch piston and the seal rings.

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A064

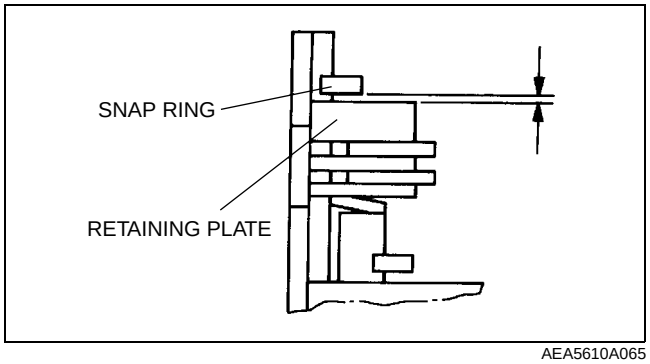
3. Measure the clearance between the retaining plate and the snap ring.
   - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

Specification
0.6—0.9 mm {0.0237—0.0354 in}

Retaining plate sizes

mm {in}

4.8 {0.191}	5.0 {0.197}
5.2 {0.205}	5.4 {0.213}



AEA5610A065

High Clutch Inspection

1. Install the reverse and high clutch drum to the oil pump.

Warning

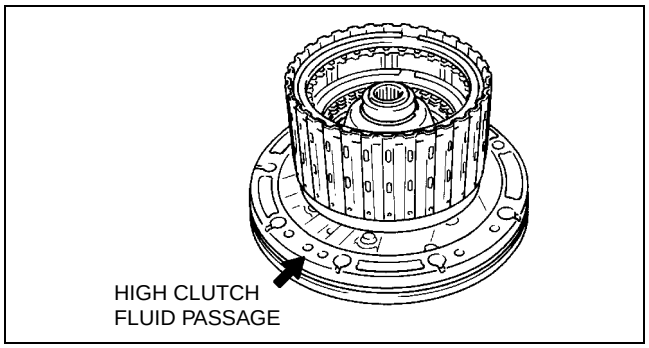
- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

Caution

- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**

2. Apply compressed air to the part indicated in the figure and inspect the high clutch operation.
   - If there is any malfunction, inspect the seal rings.

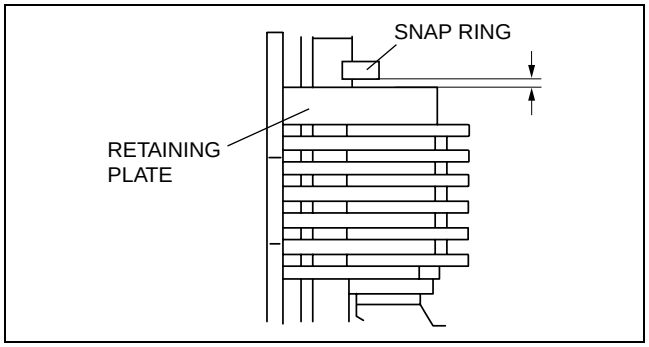
Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A066

3. Measure the clearance between the retaining plate and the snap ring.
   - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

Specification
1.2—1.4 mm {0.0473—0.0551 in}



CHU0513A101

Retaining plate sizes

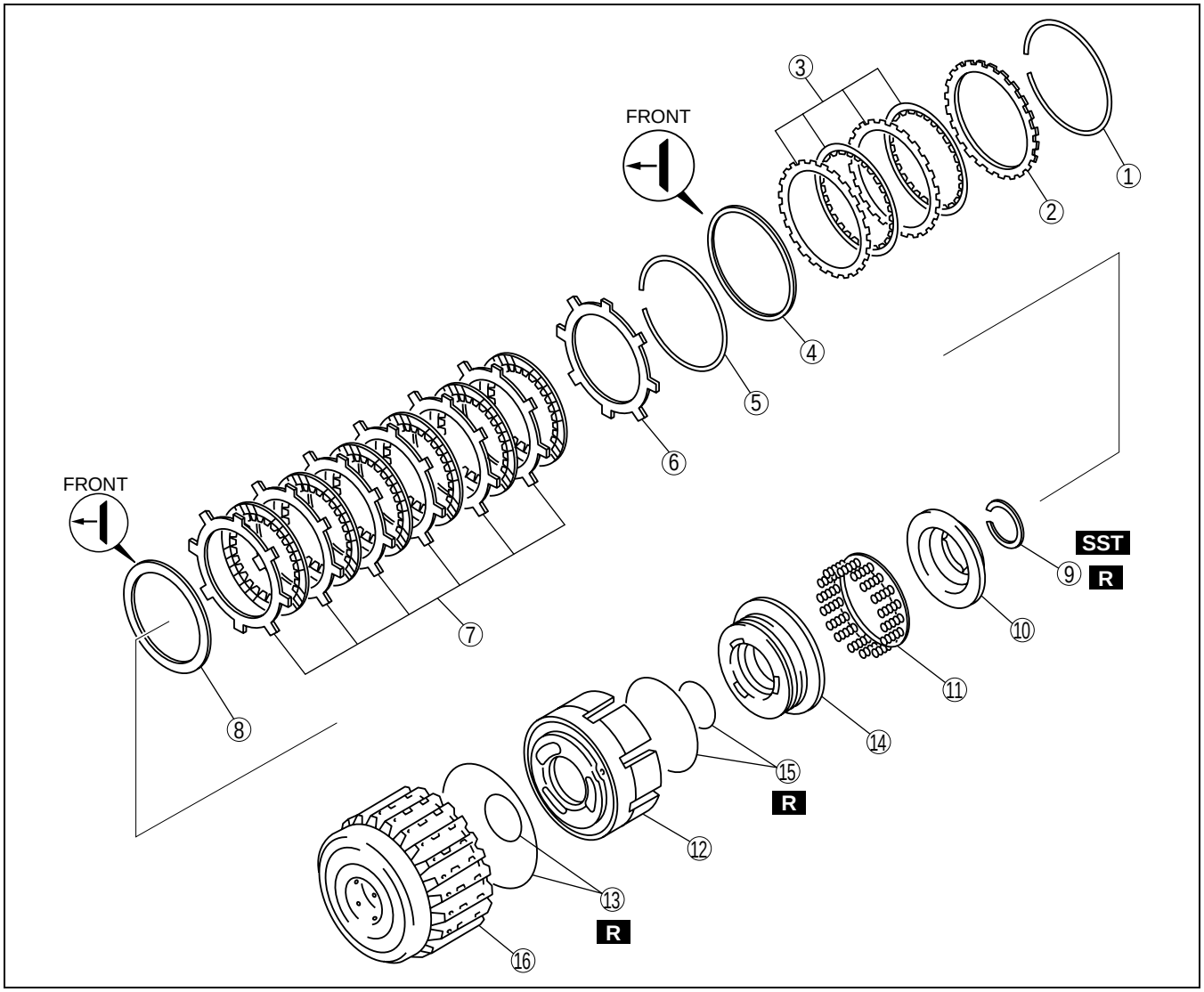
mm {in}

4.6 {0.181}	4.7 {0.185}	4.8 {0.191}
4.9 {0.193}	5.0 {0.197}	5.1 {0.201}
5.2 {0.205}	5.3 {0.209}	5.4 {0.213}

REVERSE AND HIGH CLUTCH DRUM DISASSEMBLY

CHU051319500A06

1. Disassemble in the order indicated in the table.



CHU0513A102

1	Snap ring
2	Retaining plate
3	Drive and driven plate
4	Dished plate
5	Snap ring
6	Retaining plate
7	Drive and driven plate
8	Dished plate
9	Snap ring (See 05–13Z–22 Snap Ring Disassembly Note.)

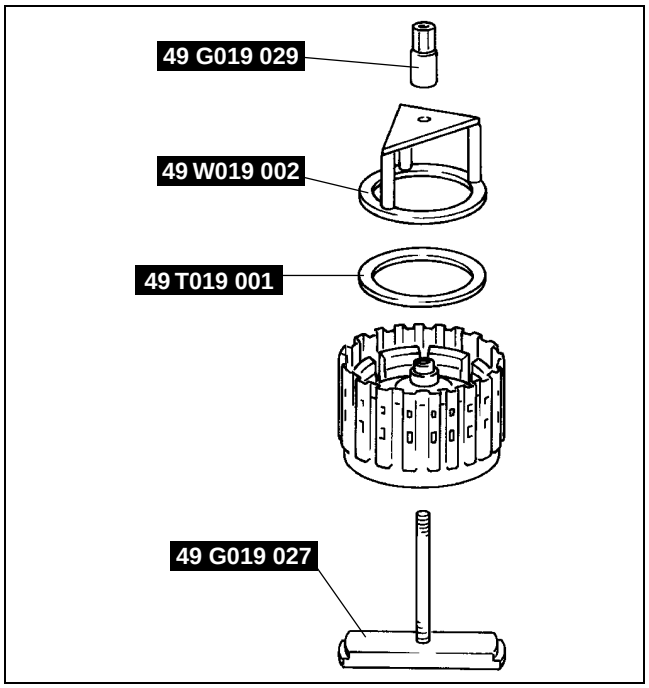
10	High clutch cover
11	Return spring
12	Reverse clutch piston (See 05–13Z–22 Reverse Clutch Piston Disassembly Note.)
13	Seal ring
14	High clutch piston
15	Seal ring
16	Reverse and high clutch drum

Snap Ring Disassembly Note

1. Install the **SSTs** in the clutch drum as shown.

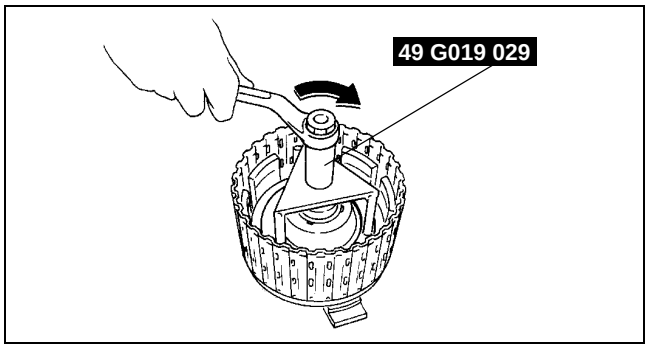
Caution

- **Do not compress the high clutch cover excessively. Doing so can damage the return spring.**



AEA5610A069

2. Compress the high clutch cover using the **SST**.
3. Remove the snap ring.
4. Remove the **SSTs**.



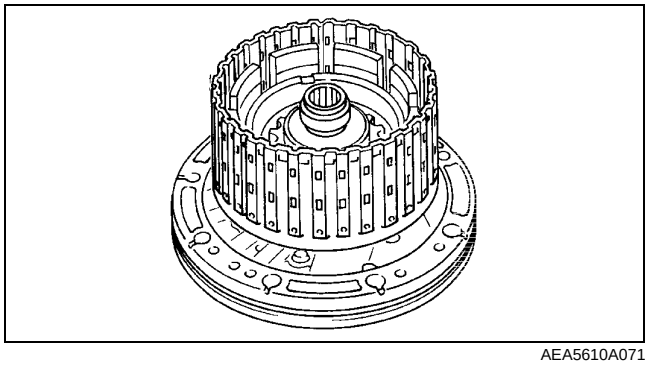
AEA5610A070

Reverse Clutch Piston Disassembly Note

Warning

- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

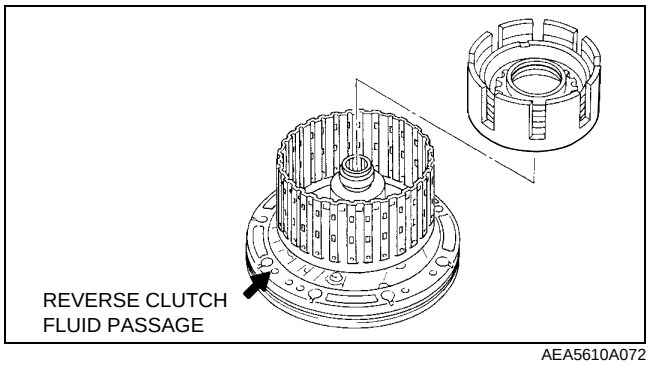
1. Install the reverse and high clutch drum to the oil pump.



AEA5610A071

2. Apply compressed air to the port indicated in the figure and remove the reverse clutch piston.

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A072

REVERSE AND HIGH CLUTCH DRUM INSPECTION

CHU051319500A07

Drive Plate Inspection

1. Measure the facing thickness in three places and calculate the average.
   - If it is less than the minimum specification, replace the drive plate.

Standard
2.0 mm {0.079 in}
Minimum
1.8 mm {0.071 in}

Return Spring Inspection

1. Measure the spring specification.
   - If not as specified, replace the return spring.

Specification

Outer diameter (mm {in})	Free length (mm {in})	No. of coils	Wire diameter (mm {in})
8.0 {0.315}	27.1 {1.067}	10.2	1.1 {0.043}

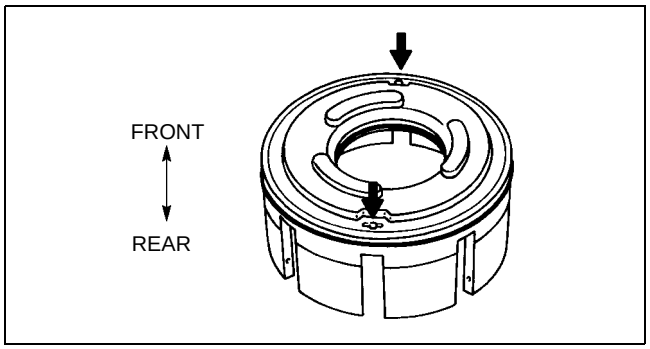
Reverse Clutch Piston Inspection

Warning
- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

1. Verify that there is airflow when applying compressed air through the fluid passage of the reverse clutch piston.
   - If there is any malfunction, replace the reverse clutch piston.

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.

Front to rear	Airflow
Rear to front	Non airflow



AEA5610A073

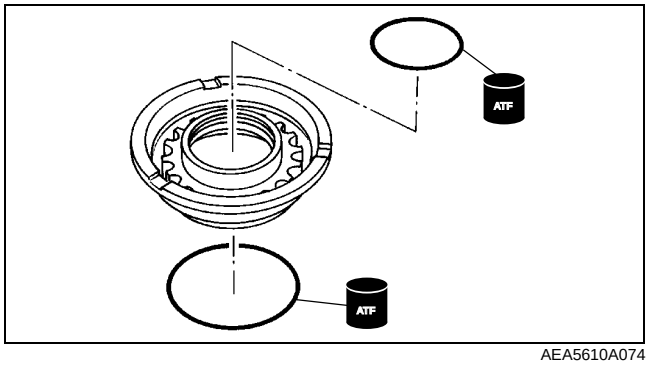
REVERSE AND HIGH CLUTCH DRUM ASSEMBLY

CHU051319500A08

Warning

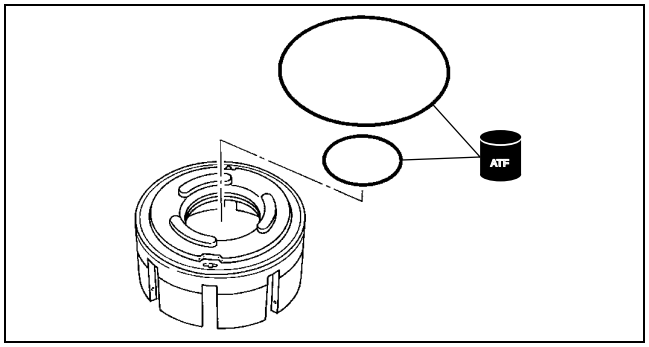
- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

1. Install new seal rings to the high clutch piston.



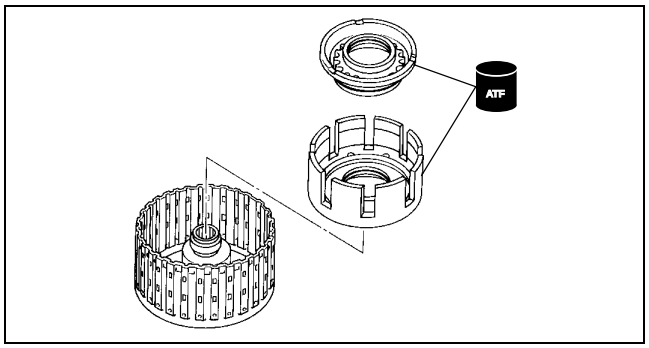
AEA5610A074

2. Install new seal rings to the reverse clutch piston.



AEA5610A075

3. Install the reverse clutch piston and the high clutch piston.

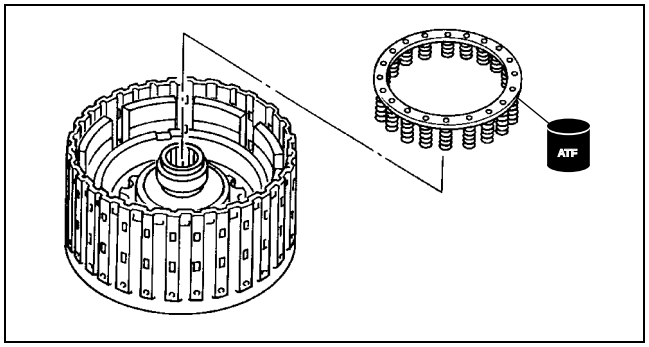


AEA5610A076

4. Install the return spring.

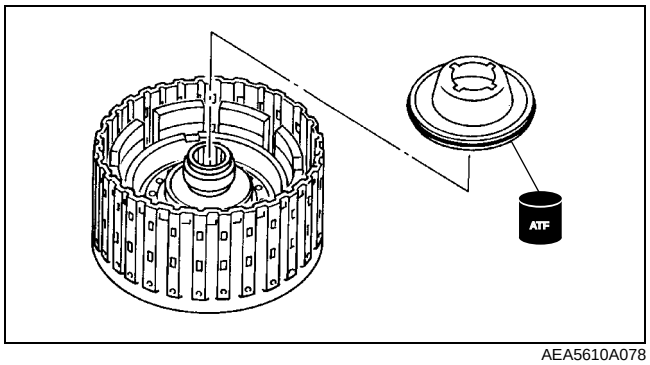
Caution

- **If the high clutch cover is not centered, the seal rubber around the circumference of the cover will hit against the return spring and become damaged. Be sure to center the high clutch cover on the return spring.**



AEA5610A077

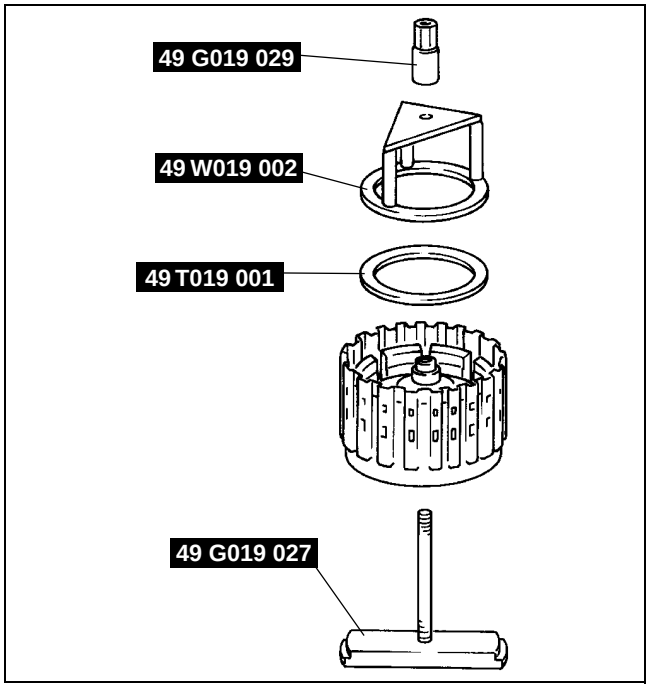
5. Install the high clutch cover.



AEA5610A078

6. Install the **SSTs** as shown in the figure.

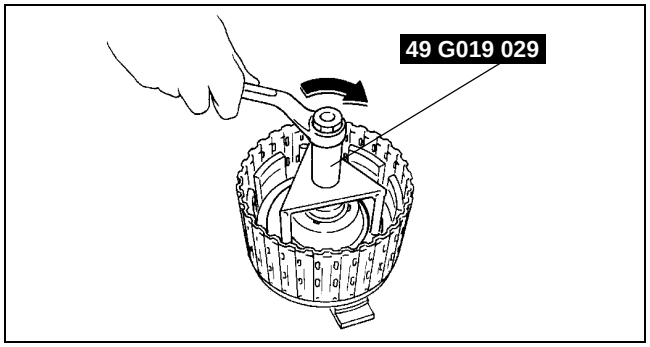
Caution
- **Do not compress the high clutch cover excessively. Doing so can damage the return spring.**



AEA5610A079

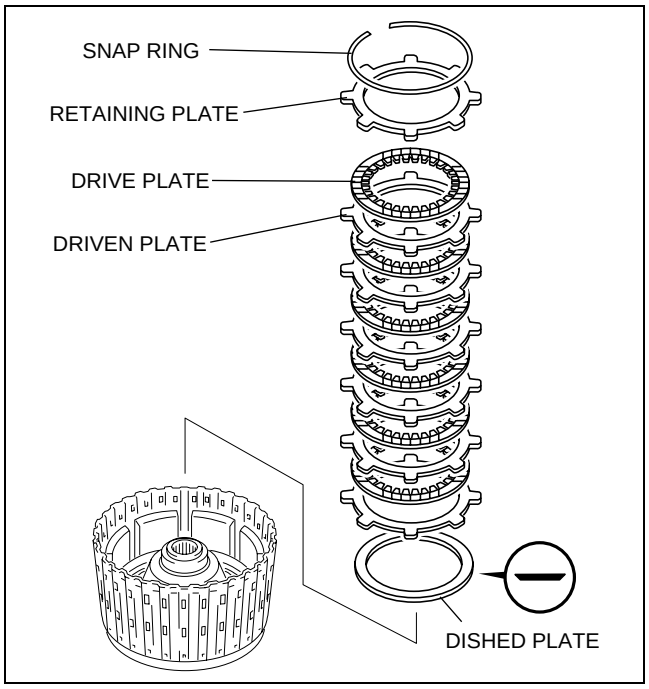
7. Compress the high clutch cover using the **SST**.
8. Install a new snap ring.
9. Remove the **SSTs**.
10. Apply ATF to the plates of the high clutch.

Caution
- **If the dished plate is not installed in the specified direction, it may be damaged or not operate properly. Install the plate exactly as shown in the figure.**



AEA5610A080

11. Install the plates and the snap ring to the reverse and high clutch drum in the following order:
Dished—Driven—Drive—Driven—Drive—Driven—Drive—Driven—Drive—Driven—Drive—Driven—Drive—Retaining

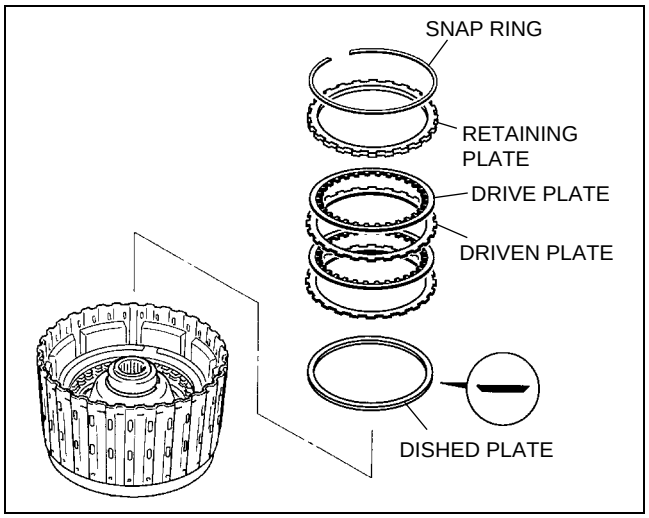


CHU0513A103

12. Apply ATF to the plates of the reverse clutch.

Caution
- **If the dished plate is not installed in the specified direction, it may be damaged or not operate properly. Install the plate exactly as shown in the figure.**

13. Install the plates and the snap ring to the reverse and high clutch drum in the following order:
Dished—Driven—Drive—Driven—Drive—Retaining



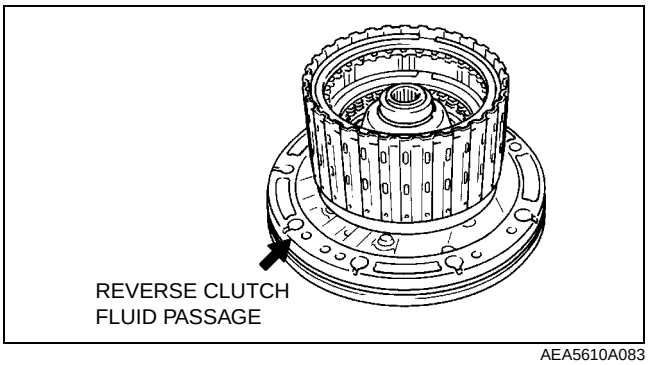
AEA5610A082

14. Install the reverse and high clutch drum to the oil pump.

Caution
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**

15. Apply compressed air to the part indicated in the figure and inspect the reverse clutch operation.
    - If there is any malfunction, inspect the seal rings.

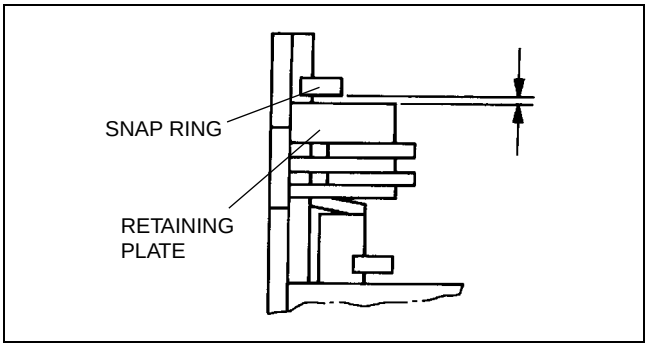
    Air pressure
    390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A083

16. Measure the clearance between the retaining plate and the snap ring.
    - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

    Specification
    0.6—0.9 mm {0.0237—0.0354 in}



AEA5610A084

Retaining plate sizes

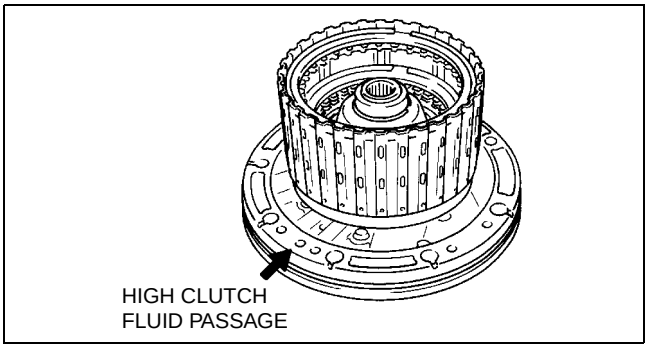
mm {in}

4.8 {0.191}	5.0 {0.197}
5.2 {0.205}	5.4 {0.213}

Caution
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**

17. Apply compressed air to the part indicated in the figure and inspect the high clutch operation.
    - If there is any malfunction, inspect the seal rings.

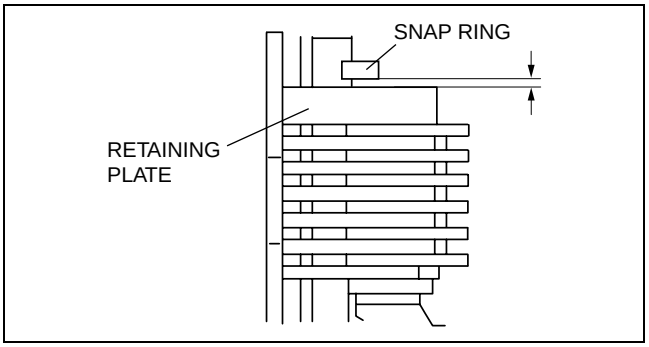
    Air pressure
    390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A085

18. Measure the clearance between the retaining plate and the snap ring.
    - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

    Specification
    1.2—1.4 mm {0.0473—0.0551 in}



CHU0513A101

Retaining plate sizes

mm {in}

4.6 {0.181}	4.7 {0.185}	4.8 {0.191}
4.9 {0.193}	5.0 {0.197}	5.1 {0.201}
5.2 {0.205}	5.3 {0.209}	5.4 {0.213}

2-4 BRAKE PREINSPECTION

CHU051319500A09

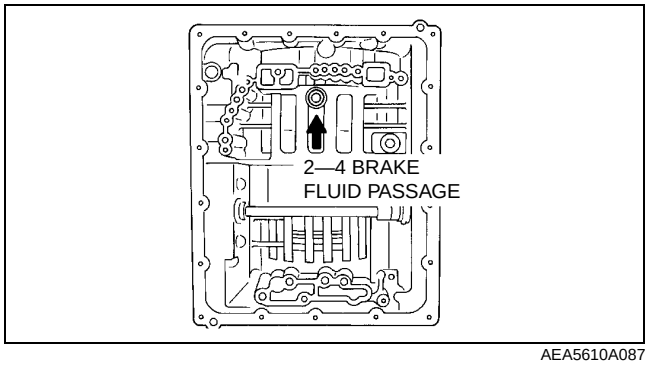
Clutch Operation Inspection

Warning
- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

Caution
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**

1. Apply compressed air to the part indicated in the figure and inspect the 2-4 brake operation.
   - If there is any malfunction, inspect the seal rings.

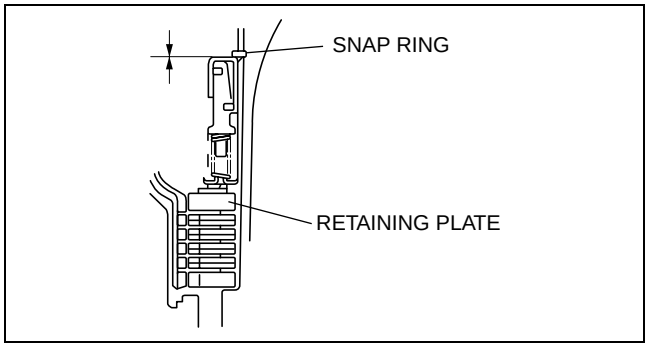
Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A087

2. Measure the clearance between the 2-4 brake retainer and the snap ring.
   - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

Specification
1.0—1.4 mm {0.0394—0.0551 in}



CHU0513A104

Retaining plate sizes

mm {in}

5.2 {0.205}	5.4 {0.213}	5.6 {0.220}
5.8 {0.228}	6.0 {0.236}	6.2 {0.244}

2-4 BRAKE INSPECTION

CHU051319500A10

Return Spring Inspection

1. Measure the spring specification.
   - If not as specified, replace the return spring.

Specification

Outer diameter (mm {in})	Free length (mm {in})	No. of coils	Wire diameter (mm {in})
6.9 {0.272}	22.5 {0.886}	10.0	0.9 {0.035}

Drive Plate Inspection

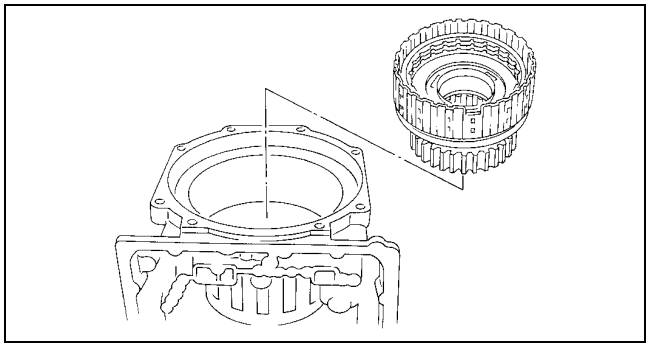
1. Measure the facing thickness in three places and calculate the average.
   - If it is less than the minimum specification, replace the drive plate.

Standard
2.0 mm {0.079 in}
Minimum
1.8 mm {0.071 in}

CARRIER COMPONENT PREINSPECTION

CHU051319540A04

1. Remove the front carrier.
2. Remove the rear sun gear.
3. Remove the rear carrier.
4. Remove the internal gear.
5. Install the low clutch drum to the transmission case correctly.



AEA5610A089

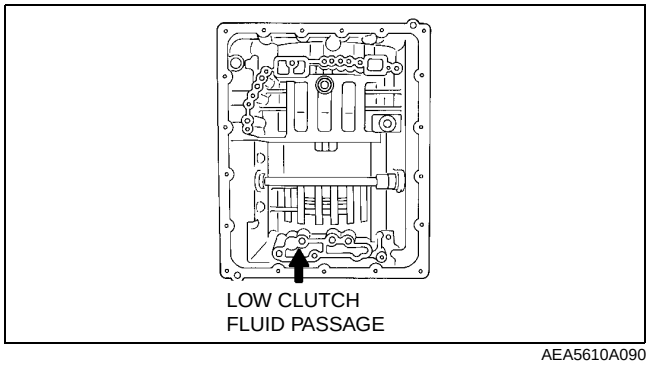
Warning

- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

Caution

- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**

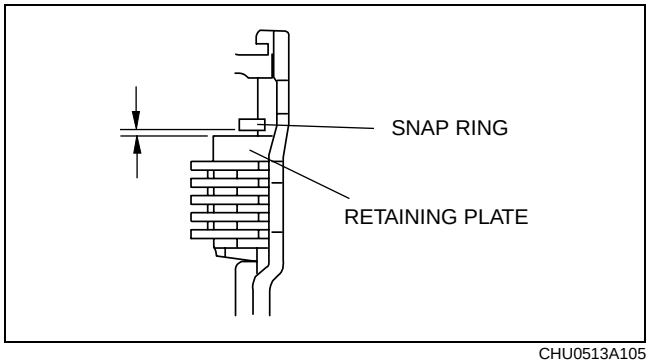
6. Apply compressed air to the part indicated in the figure and inspect the low clutch operation.
   - If there is any malfunction, inspect the seal rings.



AEA5610A090

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.

7. Measure the clearance between the retaining plate and the snap ring.
   - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.



CHU0513A105

Specification
0.9—1.3 mm {0.036—0.051 in}

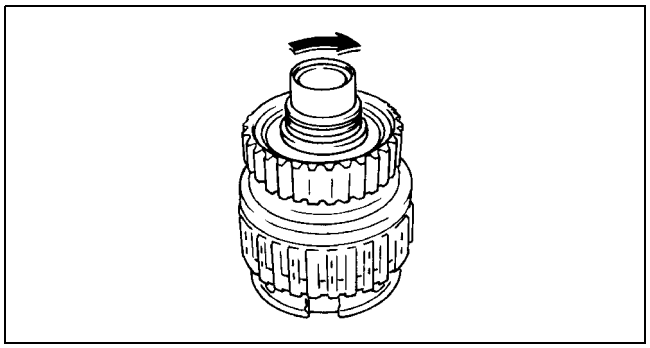
Retaining plate sizes

mm {in}

3.8 {0.150}	4.0 {0.157}	4.2 {0.165}
4.4 {0.173}	4.6 {0.181}	4.8 {0.189}

Low One-way Clutch Inspection

1. Install the low one-way clutch inner race to the carrier component.
2. Verify that the low one-way clutch inner race rotates smoothly when turned clockwise.
   - If the inner race does not rotate smoothly, replace the low one-way clutch.
3. Verify that the low one-way clutch inner race locks when turned counter clockwise.
   - If the inner race does not lock, replace the low one-way clutch.

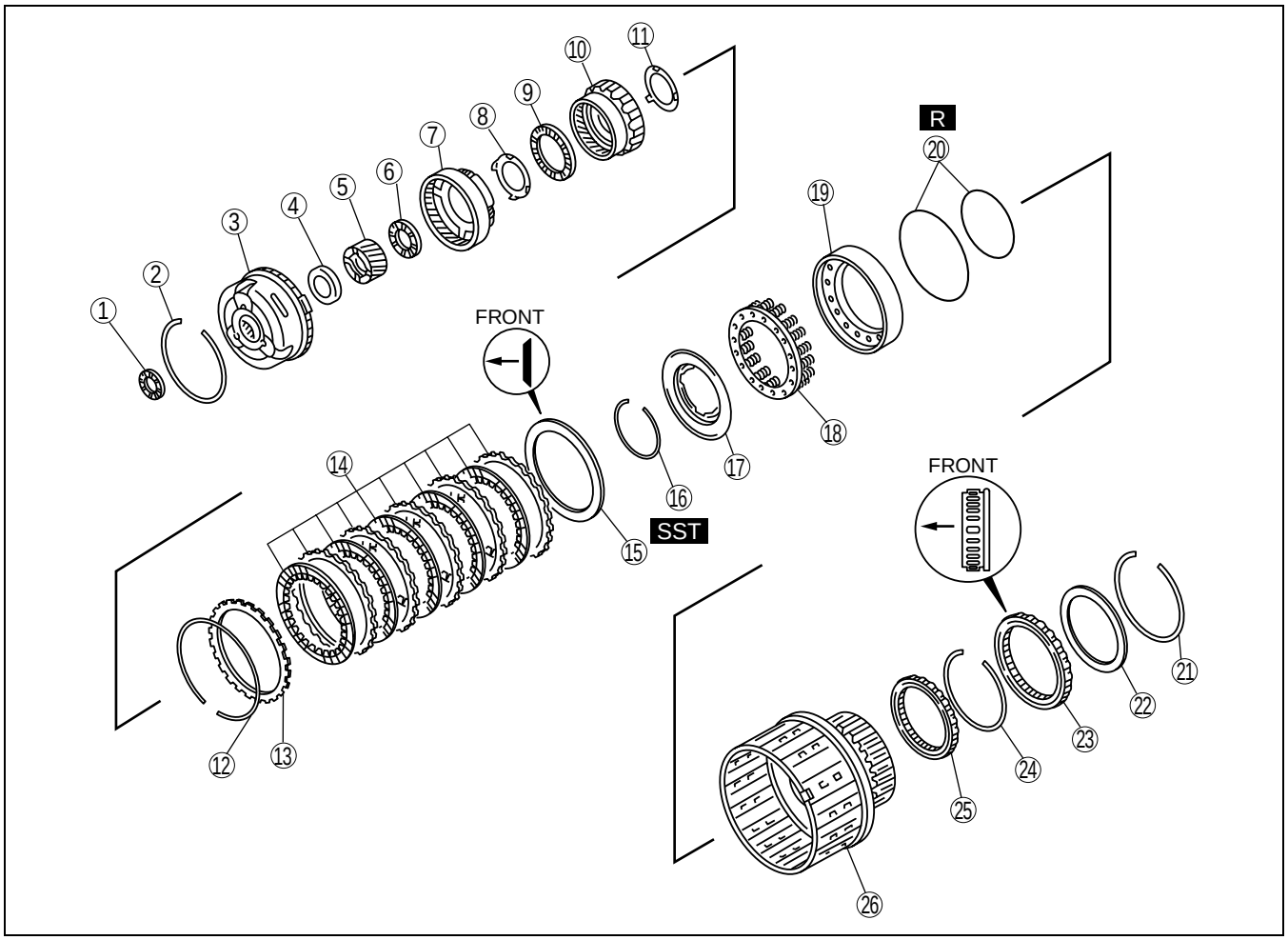


AEA5610A092

CARRIER COMPONENT DISASSEMBLY

CHU051319540A05

1. Disassemble in the order indicated in the table.



CHU0513A106

1	Bearing
2	Snap ring
3	Front carrier
4	Bearing
5	Rear sun gear
6	Bearing
7	Rear carrier
8	Bearing race
9	Bearing
10	Internal gear
11	Bearing race
12	Snap ring
13	Retaining plate
14	Drive and driven plate

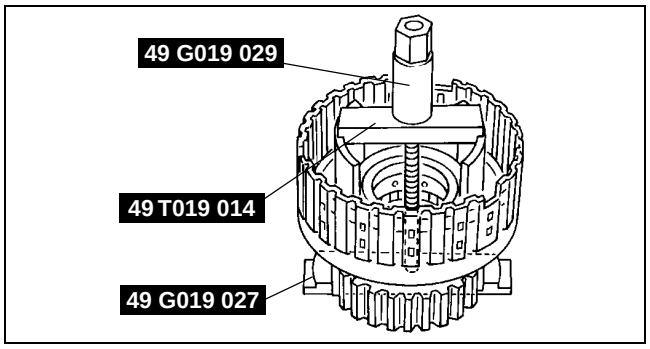
15	Dished plate
16	Snap ring (See 05–13Z–31 Snap Ring Disassembly Note.)
17	Cancel cover
18	Return spring
19	Low clutch piston (See 05–13Z–31 Low Clutch Piston Disassembly Note.)
20	Seal ring
21	Snap ring
22	Side plate
23	Low one-way clutch
24	Snap ring
25	Bearing
26	Low clutch drum

Snap Ring Disassembly Note

1. Install the **SSTs** in the clutch drum as shown.

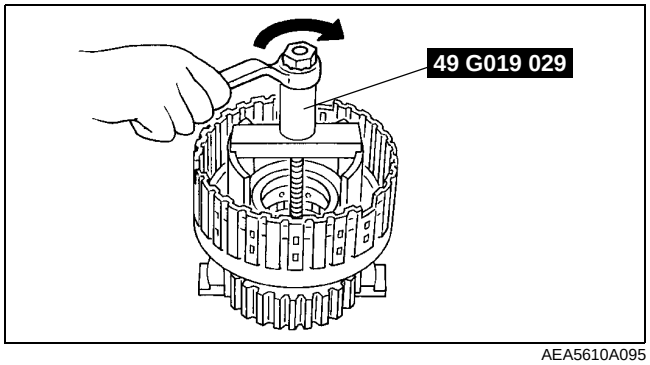
Caution

- **Do not compress the cancel cover excessively. Doing so can damage the return spring.**



AEA5610A094

2. Compress the cancel cover using the **SST**.
3. Remove the snap ring.
4. Remove the **SSTs**.



AEA5610A095

Low Clutch Piston Disassembly Note

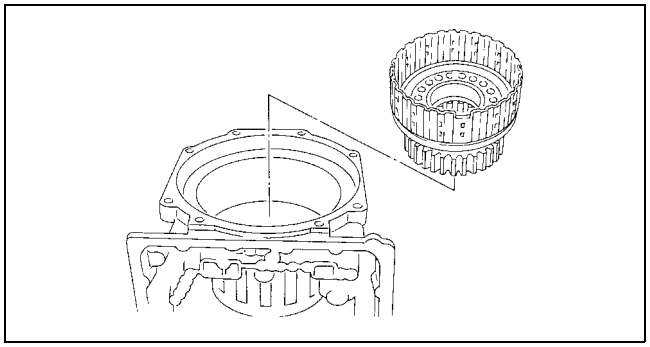
1. Install the low one-way clutch inner race to the transmission case.
2. Install the low clutch drum to the transmission case correctly.

Warning

- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

Caution

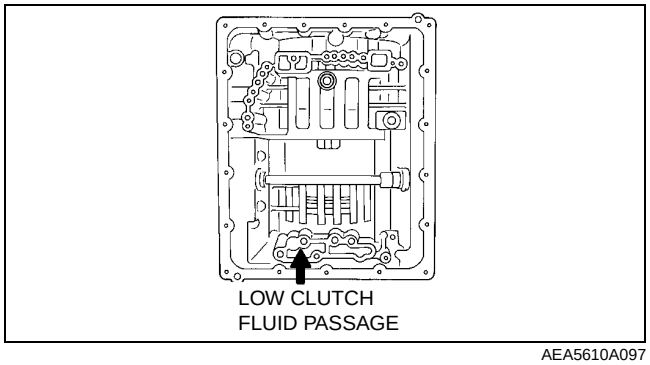
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal. Do not apply compressed air for more than the aforementioned time when testing the system.**



AEA5610A096

3. Apply compressed air to the part indicated in the figure and remove the low clutch piston.

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A097

CARRIER COMPONENT INSPECTION

CHU051319540A06

Drive Plate Inspection

1. Measure the facing thickness in three places and calculate the average.
   - If it is less than the minimum specification, replace the drive plate.

Standard
2.0 mm {0.079 in}
Minimum
1.8 mm {0.071 in}

Return Spring Inspection

1. Measure the spring specification.
   - If not within the specification, replace the return spring.

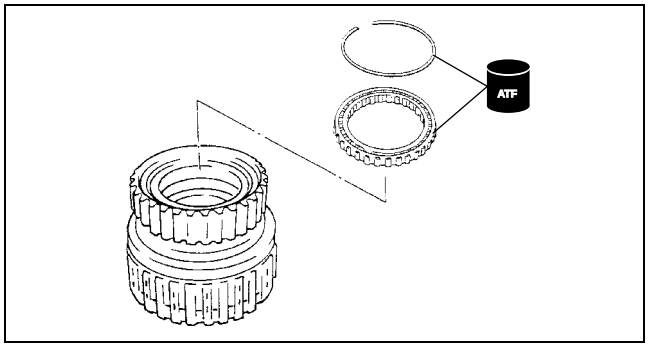
Specification

Outer diameter (mm {in})	Free length (mm {in})	No. of coils	Wire diameter (mm {in})
9.7 {0.382}	36.4 {1.433}	9.9	1.2 {0.047}

CARRIER COMPONENT ASSEMBLY

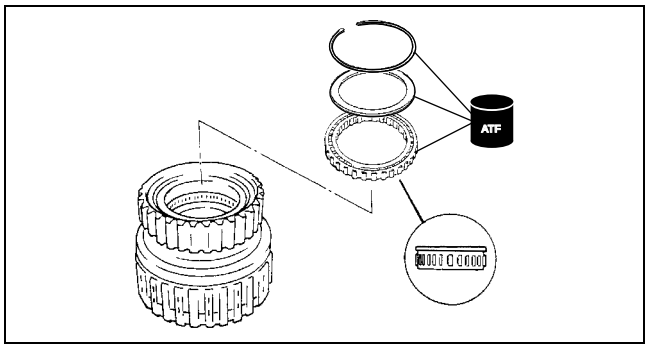
CHU051319540A07

1. Install the bearing and the snap ring.



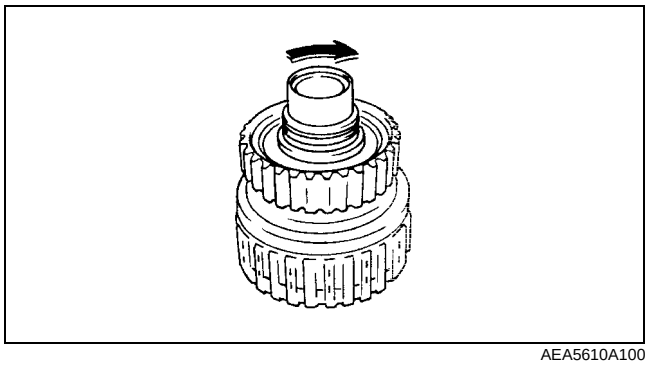
AEA5610A098

2. Install the low one-way clutch and the side plate.
3. Install the low one-way clutch inner race.



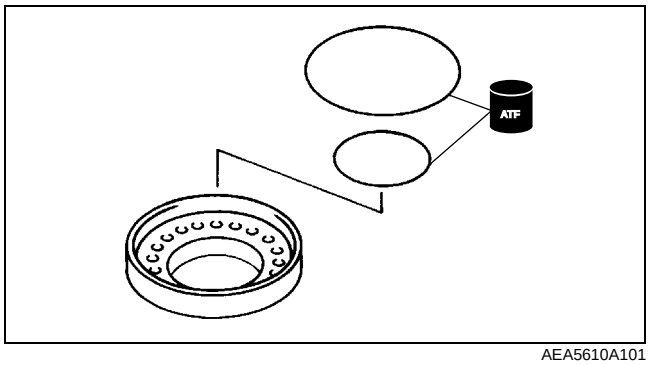
AEA5610A099

4. Verify that the low one-way clutch inner race rotates smoothly when turned clockwise.
   - If the inner race does not rotate smoothly, replace the low one-way clutch.
5. Verify that the low one-way clutch inner race locks when turned counter clockwise.
   - If the inner race does not lock, replace the low one-way clutch.
6. Remove the low one-way clutch inner race.



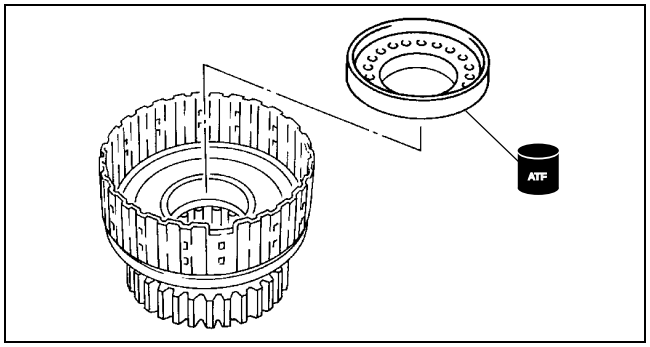
AEA5610A100

7. Install new seal rings to the low clutch piston.



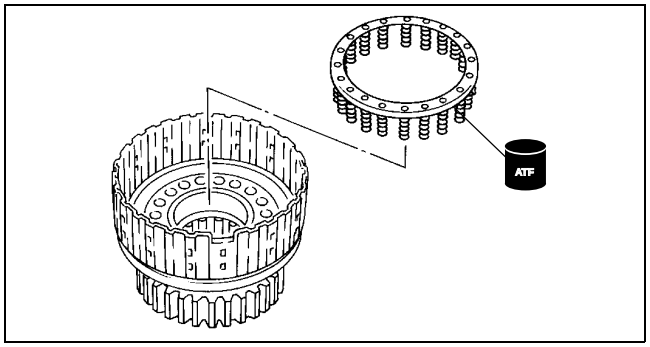
AEA5610A101

8. Install the low clutch piston.



AEA5610A103

9. Install the return spring.

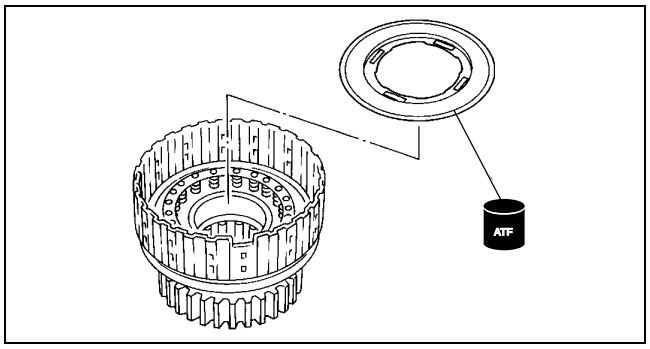


AEA5610A102

10. Install the cancel cover.

Caution

- **Be sure to center the SSTs on the low clutch drum. Otherwise, the return spring can be damaged.**

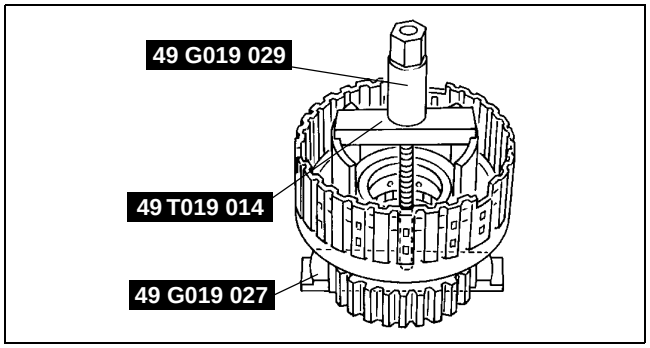


AEA5610A104

11. Install the **SSTs** as shown in the figure.

Caution

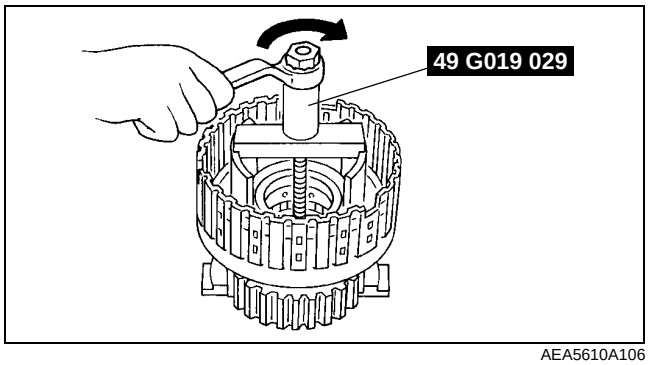
- **Do not compress the cancel cover excessively. Doing so can damage the return spring.**



AEA5610A105

12. Compress the cancel cover using the **SST**.
13. Install the snap ring.
14. Remove the **SSTs**.
15. Apply ATF to the plates of the low clutch.

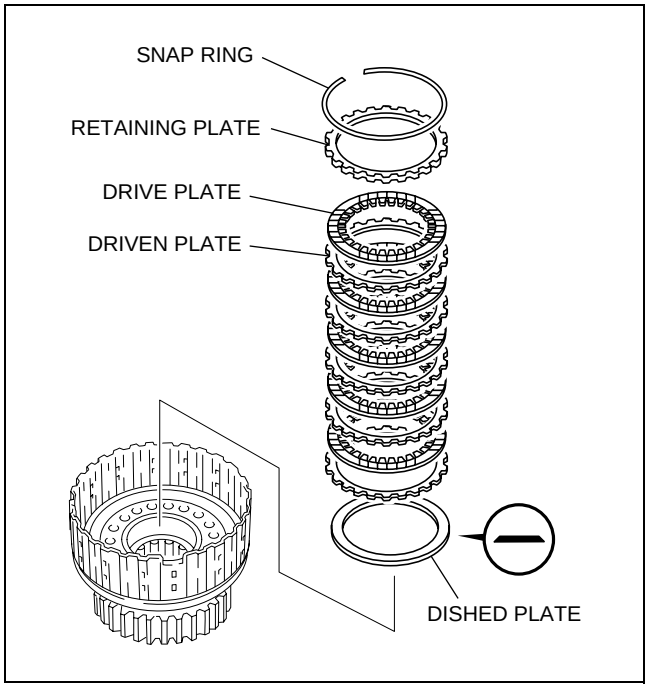
Caution
- **If the dished plate is not installed in the specified direction, it may be damaged or not operate properly. Install the plate exactly as shown in the figure.**



AEA5610A106

16. Install the plates and the snap ring to the low clutch drum in the following order:

Dished—Driven—Drive—Driven—Drive—Driven—Drive—Driven—Drive—Driven—Drive—Retaining

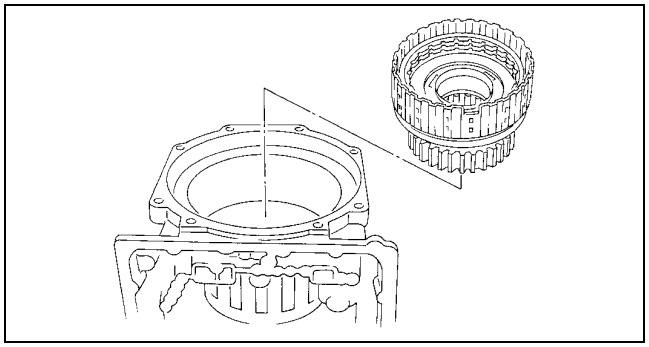


CHU0513A107

17. Install the low one-way clutch inner race to the transmission case.
18. Install the low clutch drum to the transmission case correctly.

Warning
- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

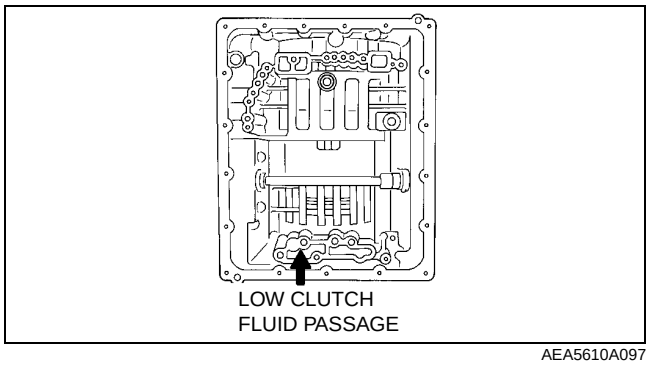
Caution
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**



AEA5610A108

19. Apply compressed air to the part indicated in the figure and inspect the low clutch operation.
    - If there is any malfunction, inspect the seal rings.

    Air pressure
    390 kPa {4.0 kgf/cm^2, 57 psi} max.

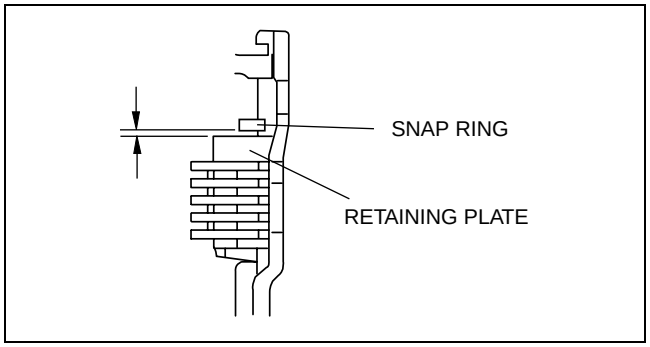


AEA5610A097

20. Remove the low clutch drum from the transmission case.

21. Measure the clearance between the retaining plate and the snap ring.
    - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

    Specification
    0.9—1.3 mm {0.036—0.051 in}



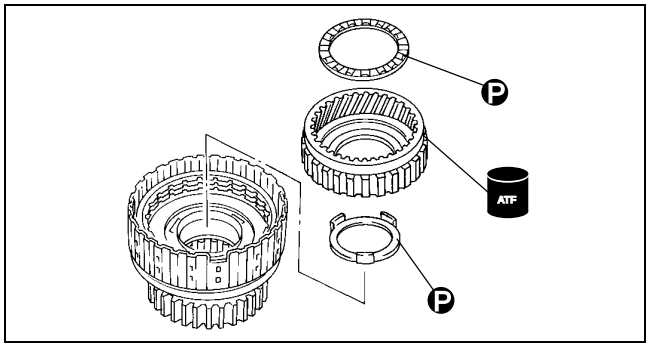
CHU0513A105

Retaining plate sizes

mm {in}

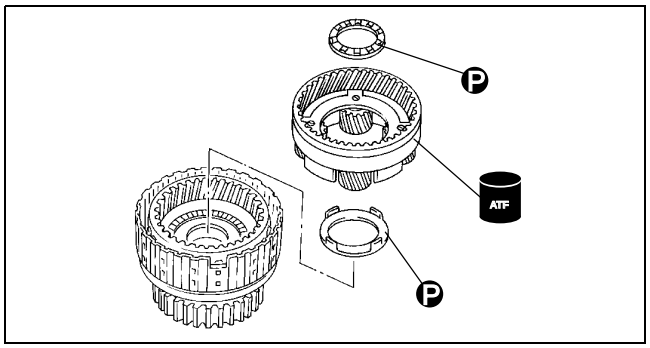
3.8 {0.150}	4.0 {0.157}	4.2 {0.165}
4.4 {0.173}	4.6 {0.181}	4.8 {0.189}

22. Install the bearing race, internal gear, and the bearing.



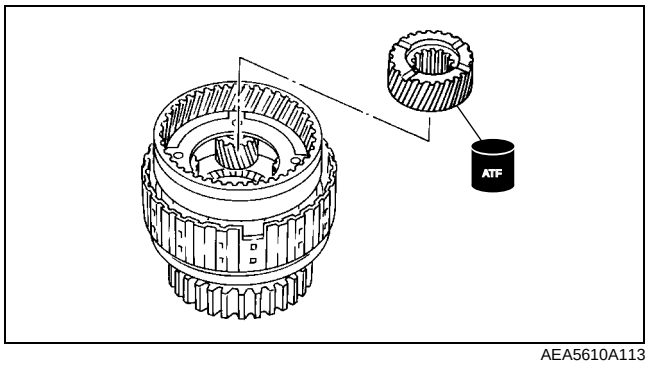
AEA5610A111

23. Install the bearing race, rear carrier, and the bearing.



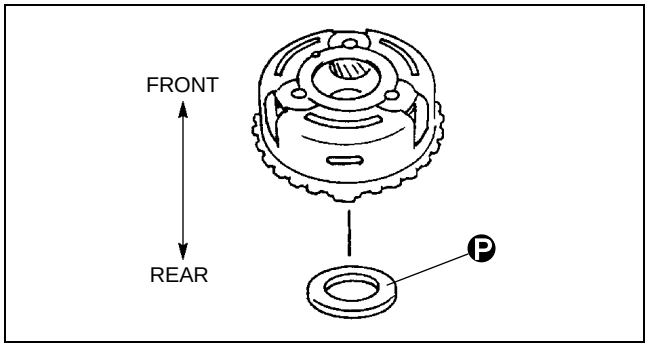
AEA5610A112

24. Install the rear sun gear.



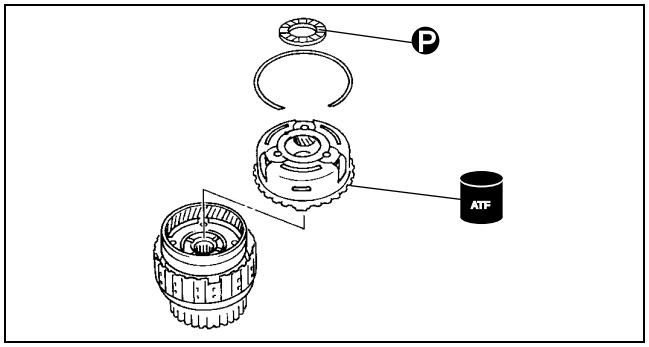
AEA5610A113

25. Install the bearing to the front carrier with the black surface facing rear side.



AEA5610A114

26. Install the front carrier, snap ring, and the bearing.



AEA5610A115

LOW AND REVERSE BRAKE PREINSPECTION

CHU051319500A11

Warning

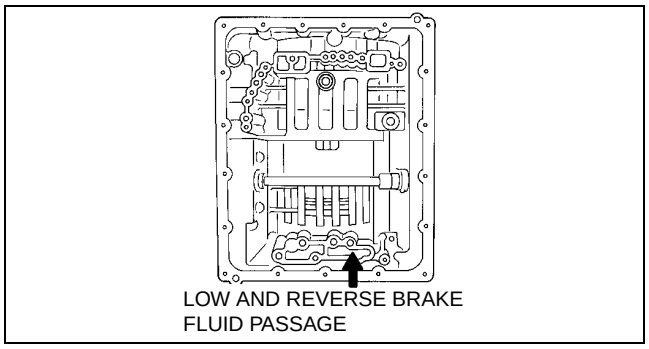
- **Using compressed air can cause dirt and other particles to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

Caution

- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**

1. Apply compressed air to the part indicated in the figure and inspect the low and reverse brake operation.
   - If there is any malfunction, inspect the seal rings.

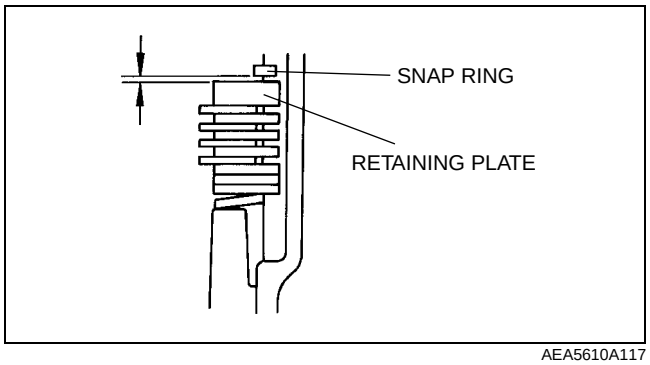
Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A116

2. Measure the clearance between the retaining plate and the snap ring.
   - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

Specification
0.7—1.1 mm {0.028—0.043 in}



AEA5610A117

Retaining plate sizes

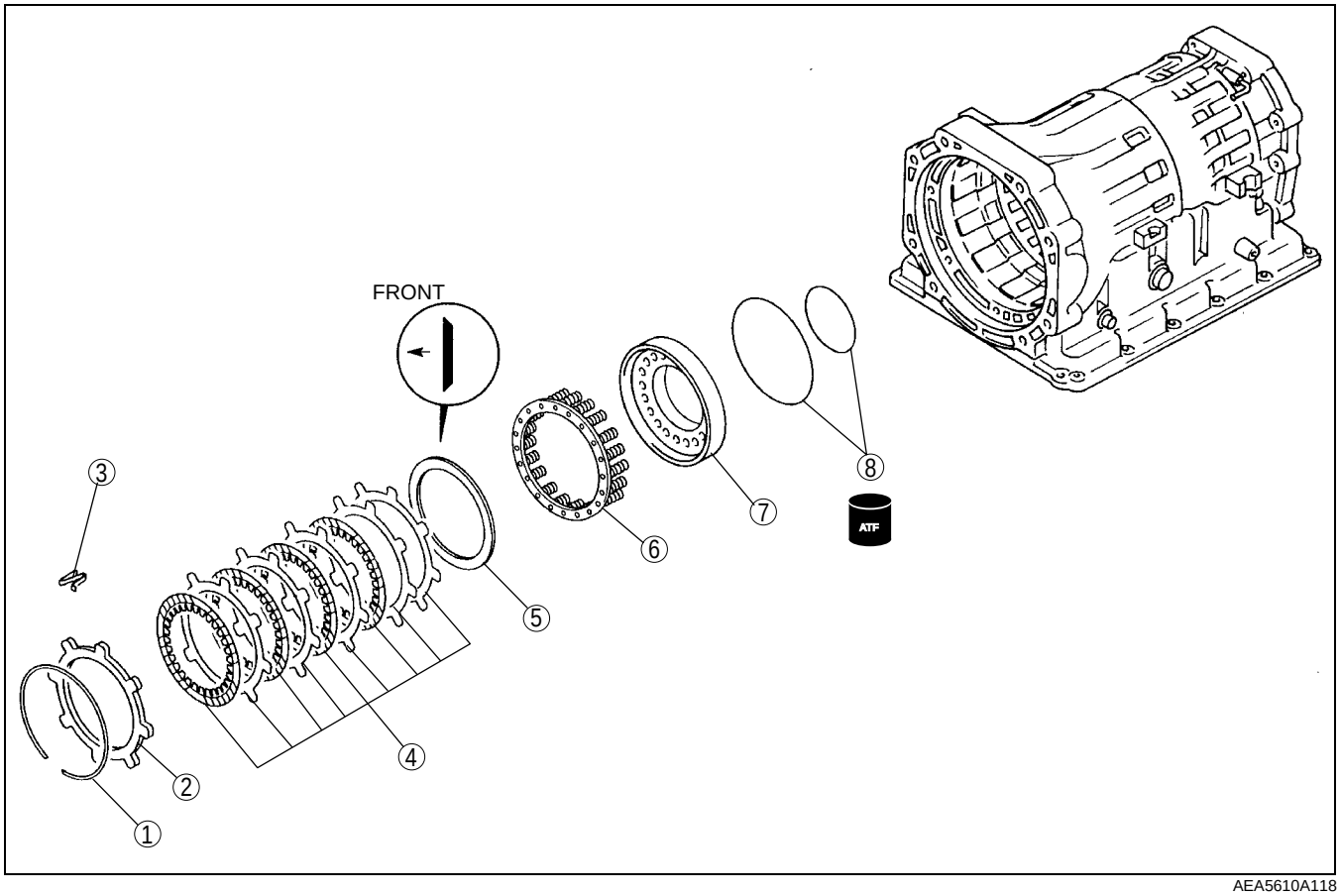
mm {in}

5.2 {0.205}	5.4 {0.213}	5.6 {0.220}
5.8 {0.228}	6.0 {0.236}	–

LOW AND REVERSE BRAKE DISASSEMBLY

CHU051319500A12

1. Disassemble in the order indicated in the table.



AEA5610A118

1	Snap ring
2	Retaining plate
3	N-spring
4	Drive and driven plate
5	Dished plate

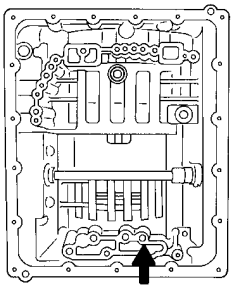
6	Return spring
7	Low and reverse brake piston (See 05–13Z–38 Low and Reverse Brake Piston Disassembly Note.)
8	Seal ring

Low and Reverse Brake Piston Disassembly Note

Warning
- **Using compressed air can cause dirt and other particle to fly out, causing injury to the eyes. Wear protective eye wear whenever using compressed air.**

1. Apply compressed air to the part indicated in the figure and remove the low and reverse brake piston.

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



LOW AND REVERSE BRAKE FLUID PASSAGE

AEA5610A119

LOW AND REVERSE BRAKE INSPECTION

CHU051319500A13

Drive Plate Inspection

1. Measure the facing thickness in three places and determine the average of the three readings.
   - If it is less than the minimum specification, replace the drive plate.

Standard
2.0 mm {0.079 in}
Minimum
1.8 mm {0.071 in}

Return Spring Inspection

1. Measure the spring specification.
   - If not within the specification, replace the return spring.

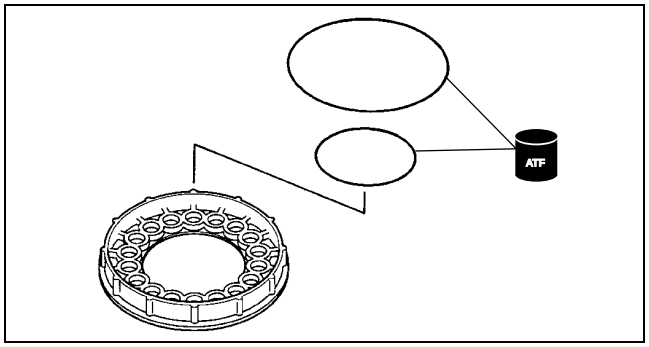
Specification

Outer diameter (mm {in})	Free length (mm {in})	No. of coils	Wire diameter (mm {in})
11.2 {0.441}	22.3 {0.878}	4.8	1.1 {0.043}

LOW AND REVERSE BRAKE ASSEMBLY

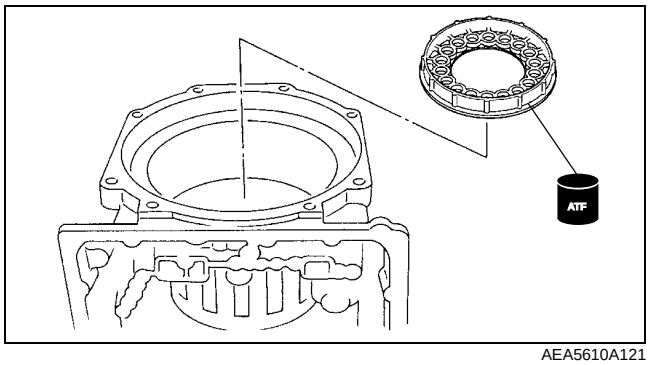
CHU051319500A14

1. Install new seal rings to the low and reverse brake piston.



AEA5610A120

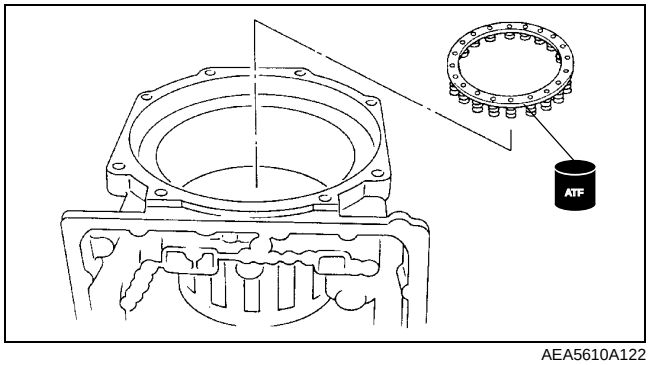
2. Install the low and reverse brake piston.



AEA5610A121

3. Install the return spring.

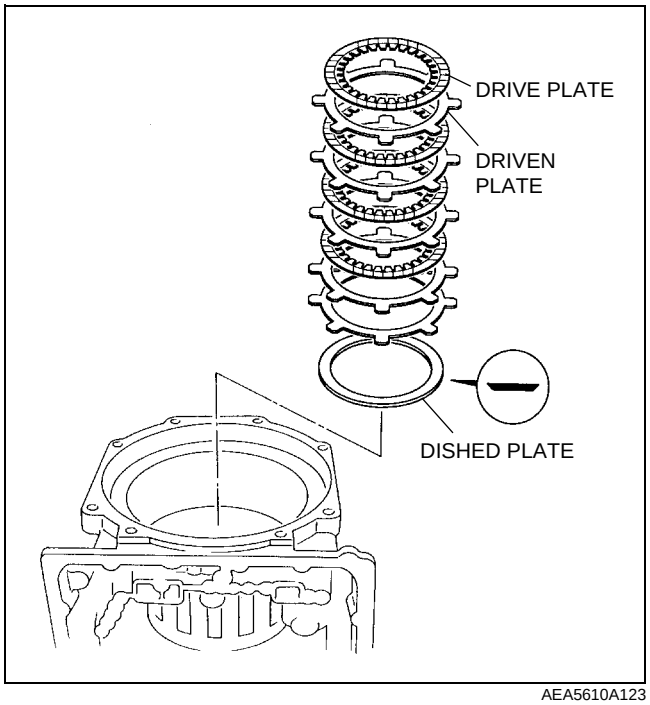
Caution
- **If the dished plate is not installed in the specified direction, it may be damaged or not operate properly. Install the plate exactly as shown in the figure.**



AEA5610A122

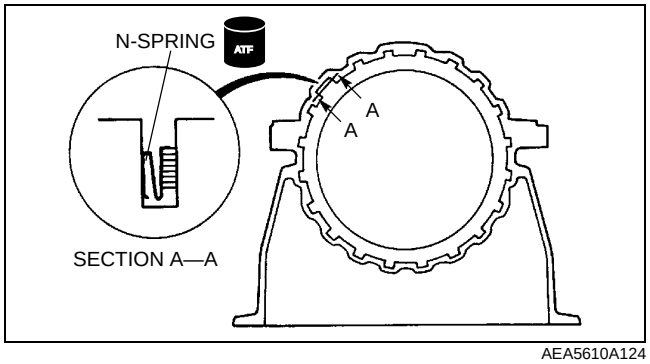
4. Apply ATF to the dished plate, driven plates, and the drive plates, and install them to the transmission case in the following order:

Dished—Driven—Driven—Drive—Driven—Drive—Driven—Drive—Driven—Drive



AEA5610A123

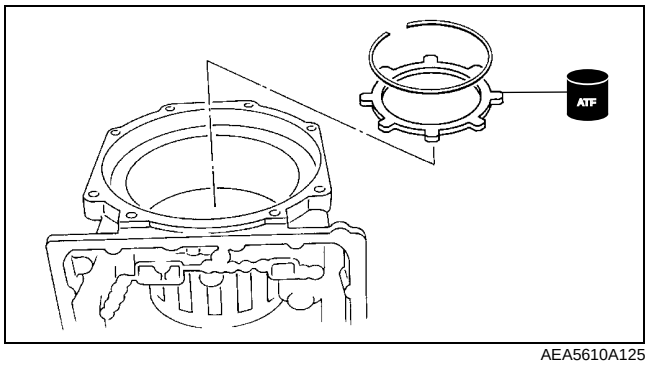
5. Install the N-spring.



AEA5610A124

6. Install the retaining plate and the snap ring.

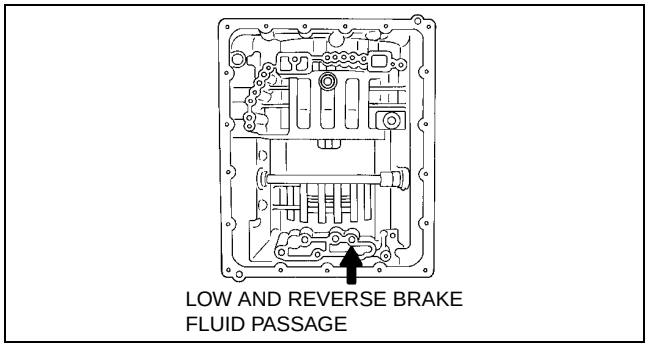
Caution
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**



AEA5610A125

7. Apply compressed air to the part indicated in the figure and inspect the low and reverse brake operation.
   - If there is any malfunction, inspect the seal rings.

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A126

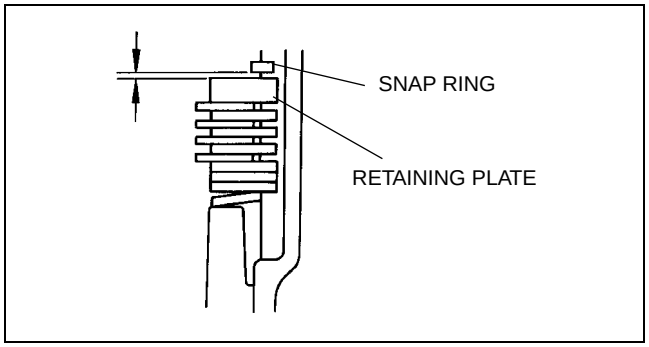
8. Measure the clearance between the retaining plate and the snap ring.
   - If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

Specification
0.7—1.1 mm {0.028—0.043 in}

Retaining plate sizes

mm {in}

5.2 {0.205}	5.4 {0.213}	5.6 {0.220}
5.8 {0.228}	6.0 {0.236}	–

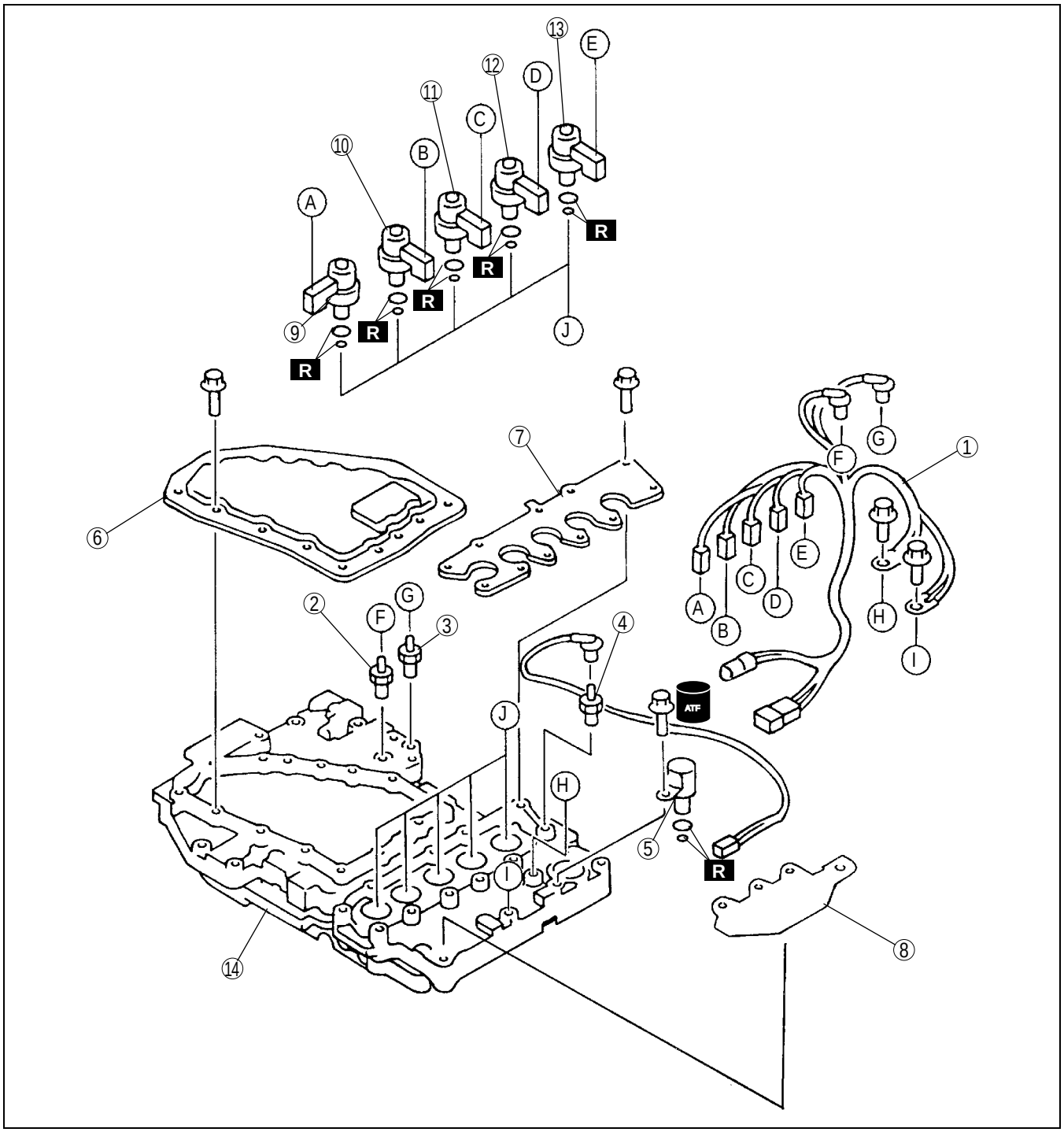


AEA5610A127

CONTROL VALVE BODY DISASSEMBLY

CHU051321100A03

1. Disassemble in the order indicated in the table.



AEA5610A128

1	Harness component
2	Oil pressure switch B
3	Oil pressure switch C
4	Oil pressure switch F
5	Pressure control solenoid
6	Oil strainer
7	Fix plate

8	Harness bracket
9	Shift solenoid A
10	Shift solenoid B
11	TCC solenoid
12	Shift solenoid C
13	Shift solenoid F
14	Control valve body

CONTROL VALVE BODY ASSEMBLY

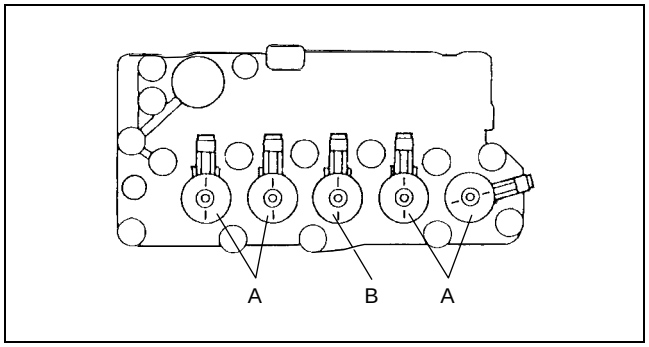
CHU051321100A04

Caution

- **Denting or scratching the control valve body components will reduce the performance of the transmission to shift properly. When handling these components or the valve body that contains them, be careful not to drop or hit them.**

1. Apply ATF to new O-rings, and install them to the solenoids.
2. Install the solenoid as shown in the figure.

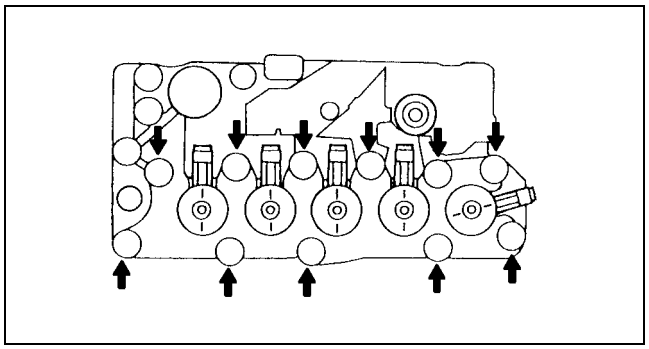
Solenoid	Color of connector
A	Brown
B	Gray



AEA5610A129

3. Install the harness bracket and the fix plate.

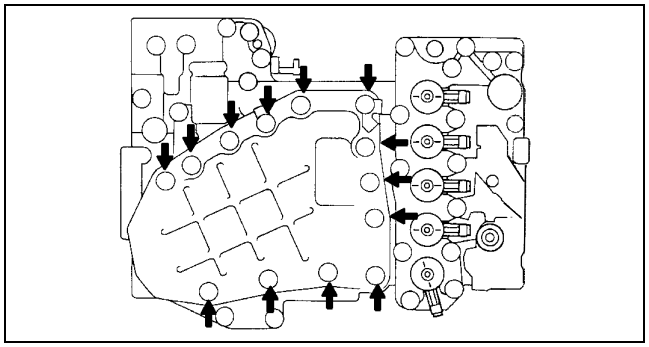
Tightening torque
6.9—8.8 N·m {71—89 kgf·cm, 62—77 in·lbf}



AEA5610A130

4. Install the oil strainer.

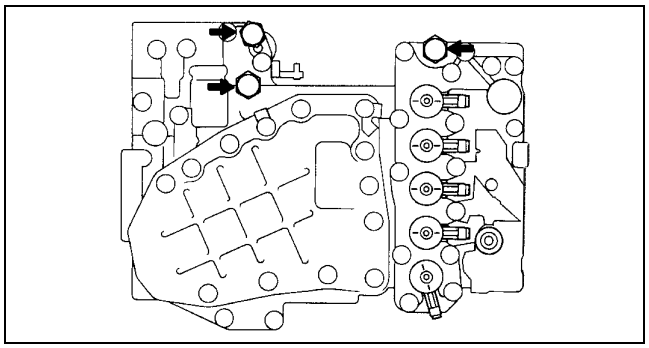
Tightening torque
6.9—8.8 N·m {71—89 kgf·cm, 62—77 in·lbf}



AEA5610A131

5. Install the oil pressure switch.

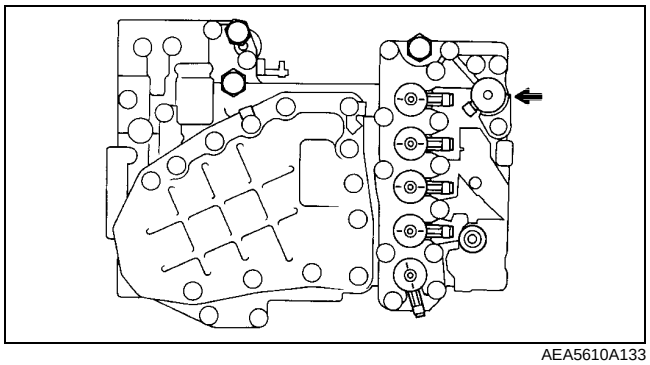
Tightening torque
4.0—4.9 N·m {40—50 kgf·cm, 35—43 in·lbf}



AEA5610A132

6. Install the pressure control solenoid.

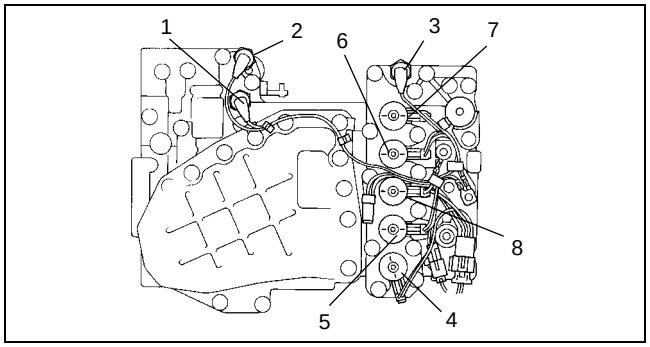
Tightening torque
6.9—8.8 N·m {71—89 kgf·cm, 62—77 in·lbf}



AEA5610A133

7. Install the harness component as shown in the figure.

No.	Name	Color of harness
1	Oil pressure switch B	Brown
2	Oil pressure switch C	Gray
3	Oil pressure switch F	Pink
4	Shift solenoid A	Orange
5	Shift solenoid B	Blue
6	Shift solenoid C	Green
7	Shift solenoid F	Red
8	TCC solenoid	Yellow



AEA5610A134

AUTOMATIC TRANSMISSION ASSEMBLY

CHU051301026A14

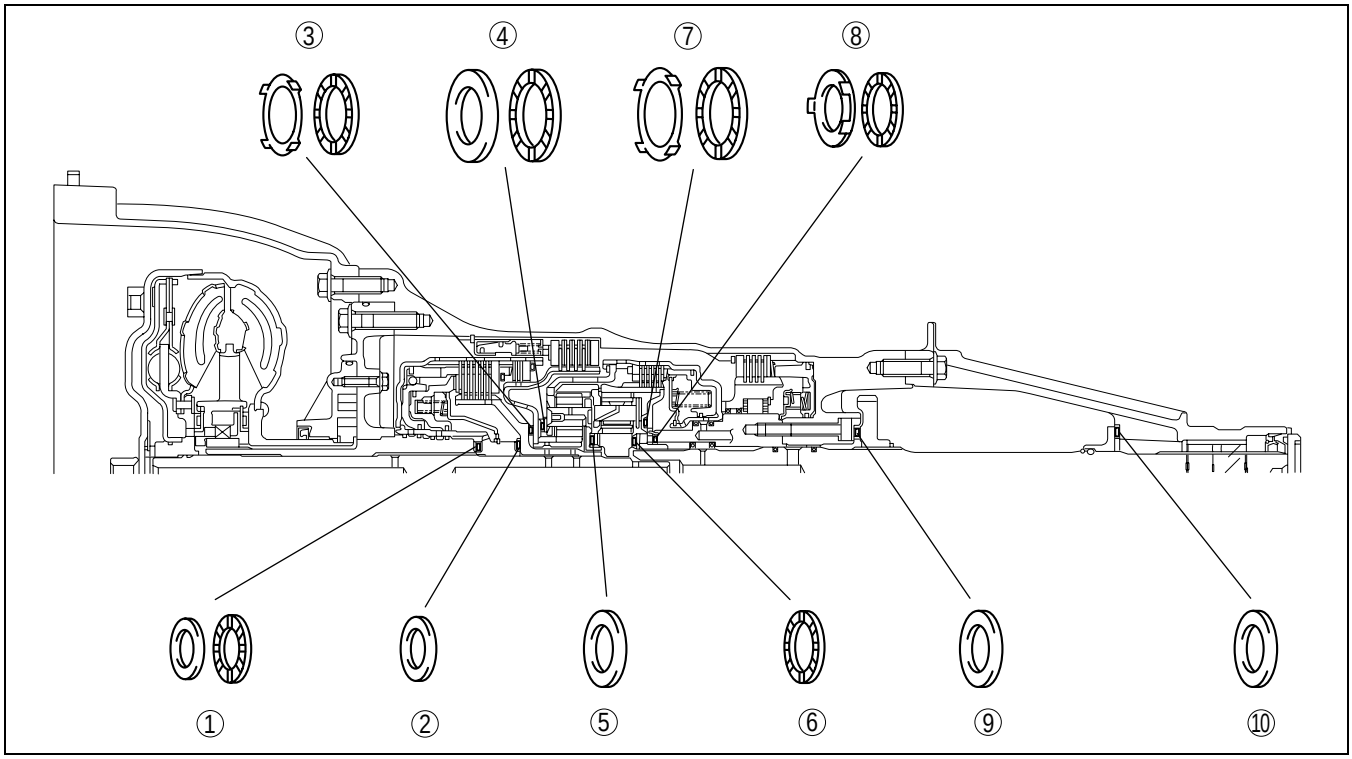
Precaution

1. If the drive plates are replaced with new ones, soak the new part in ATF for at least **2 h** before installation.
2. Before assembly, apply ATF to all seal rings, rotating parts, O-rings, and sliding parts.
3. All O-rings, seals, and gaskets must be replaced with new ones included in the overhaul kit.
4. Use petroleum jelly, not grease, during reassembly.
5. When it is necessary to replace a bushing, replace the subcomponent that includes that bushing.
6. Assemble the housing within **10 min** after applying sealant, and allow it to cure at least **30 min** after assembly before filling the transmission with ATF.

Warning

- **Although the stand has a self-locking brake system, there is a possibility that the brake may not hold when the transmission is held in a lopsided position on the stand. This would cause the transmission to turn suddenly, causing serious injury. Never keep the transmission tilted to one side. Always hold the rotating handle firmly when turning the transmission.**

Assembly
Bearing and race locations



CHU0513A108

Outer diameter of bearing and race

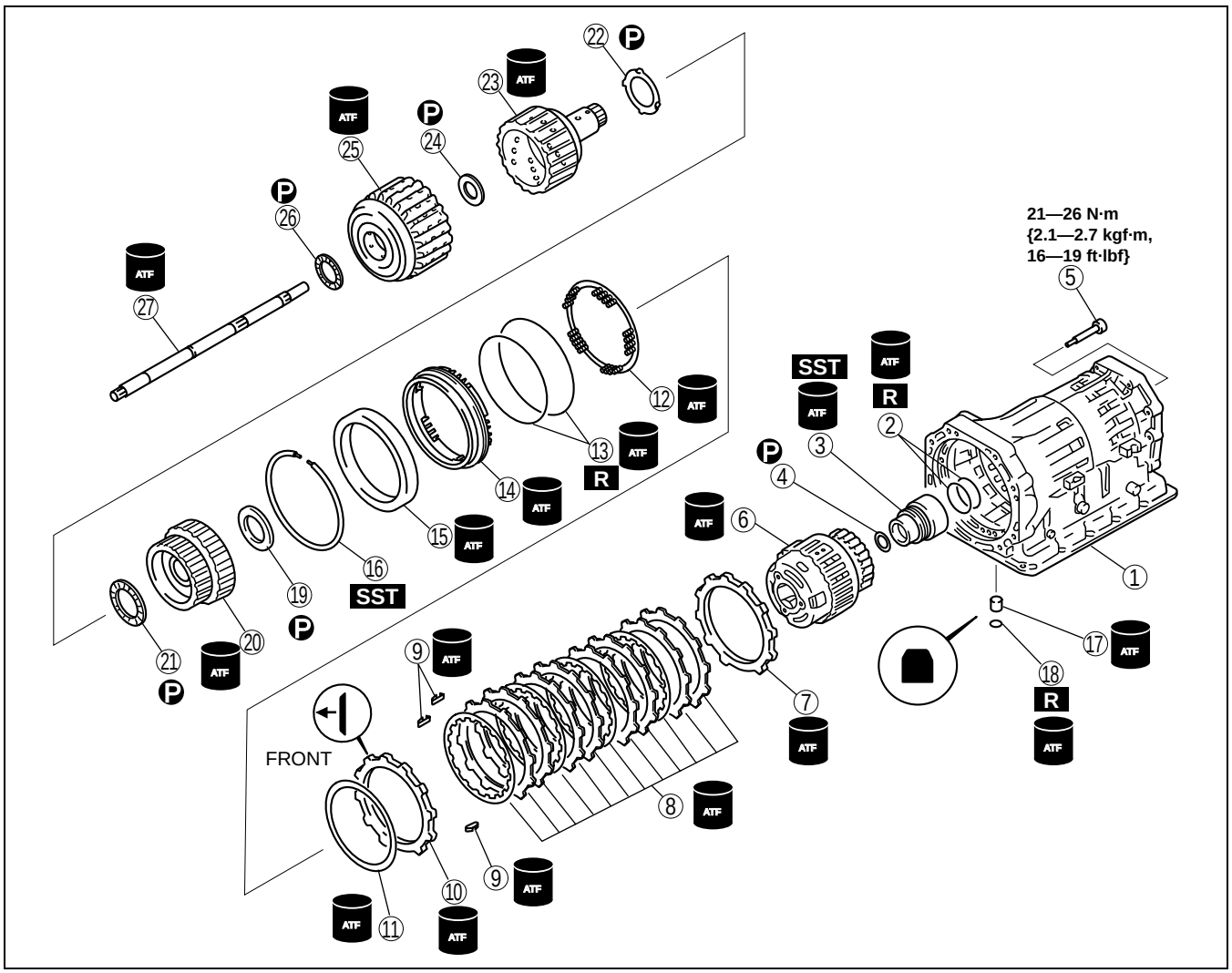
mm {in}

Part name	1	2	3	4	5	6	7	8	9	10
Bearing	46 {1.81}	46 {1.81}	65 {2.56}	73 {2.87}	53 {2.09}	53 {2.09}	78 {3.07}	53.4 {2.102}	64 {2.52}	64 {2.52}
Bearing race	45 {1.77}	–	64 {2.52}	72 {2.83}	–	–	76 {2.99}	51 {2.01}	–	–

Installed direction of one-piece unit bearings

Bearing	Black surface
2	Rear side
5	Rear side
9	Rear side
10	Front side

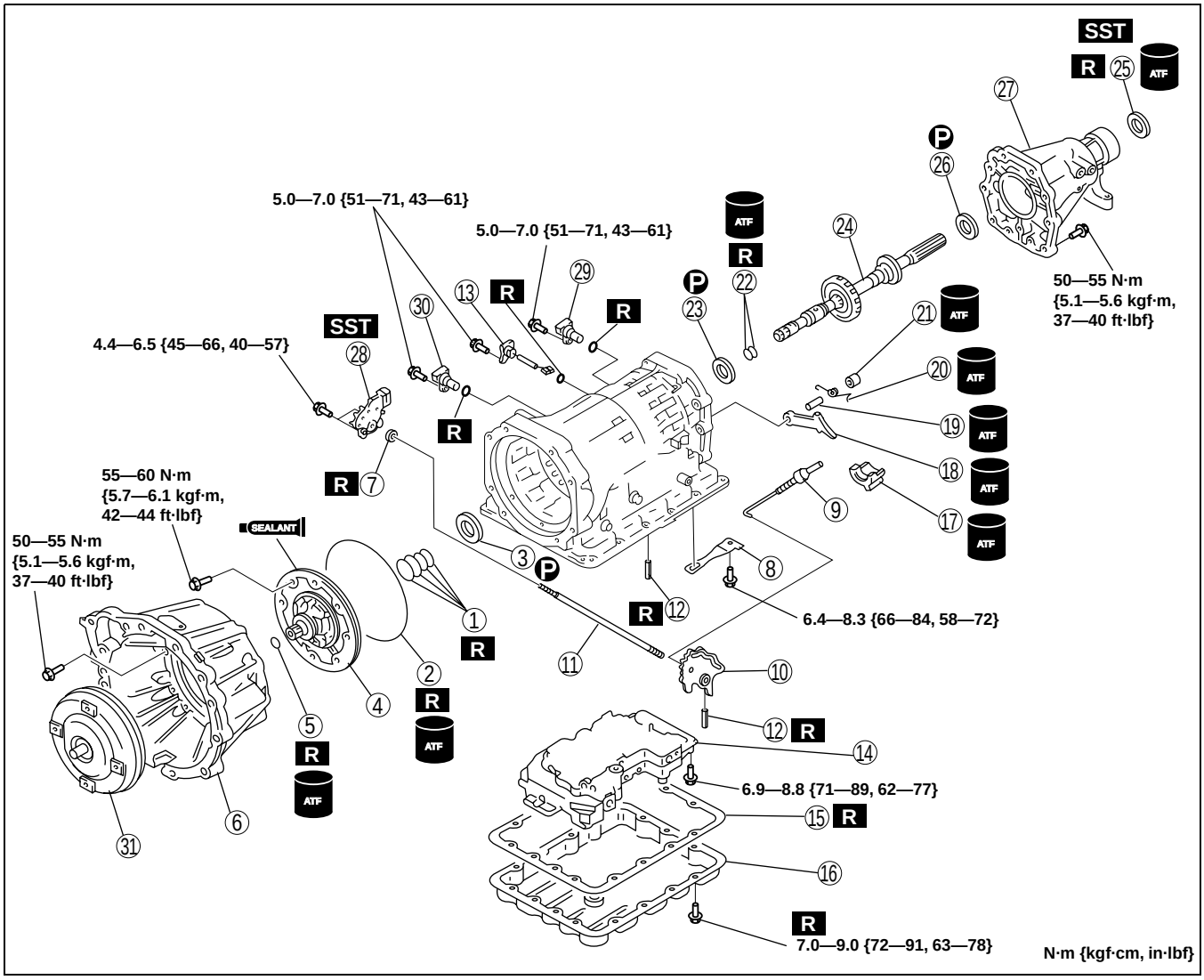
Components



CHU0513A109

1	Transmission case
2	Seal ring
3	Low one-way clutch inner race
4	Bearing
5	Bolt
6	Carrier component
7	Retaining plate
8	Drive and driven plate
9	Spring
10	Retaining plate
11	Dished plate
12	Return spring
13	Seal ring
14	2-4 brake piston

15	2-4 brake retainer
16	Snap ring
17	Sleeve
18	Seal ring
19	Bearing race
20	Front sun gear
21	Bearing
22	Bearing race
23	High clutch hub
24	Bearing
25	Reverse and high clutch drum
26	Bearing
27	Input shaft



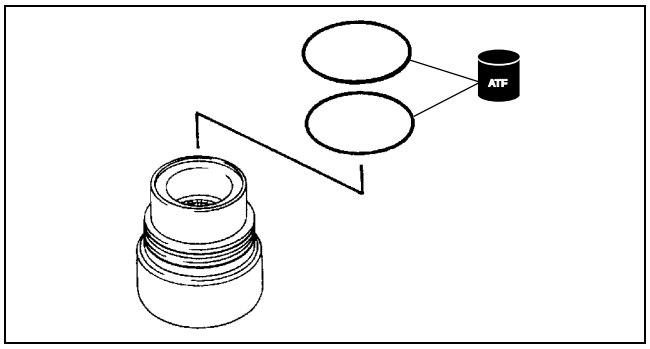
CHU0513A110

1	Seal ring
2	O-ring
3	Bearing race
4	Oil pump
5	O-ring
6	Torque converter housing
7	Oil seal
8	Detent spring
9	Parking rod
10	Manual plate
11	Manual shaft
12	Roll pin
13	Wiring harness component
14	Control valve body
15	Gasket
16	Oil pan

17	Actuator support
18	Parking pawl
19	Parking pawl shaft
20	Return spring
21	Parking pawl spacer
22	Seal ring
23	Bearing
24	Output shaft component
25	Oil seal
26	Bearing
27	Extension housing
28	TR switch
29	VSS
30	Turbine sensor
31	Torque converter

Assembly procedure

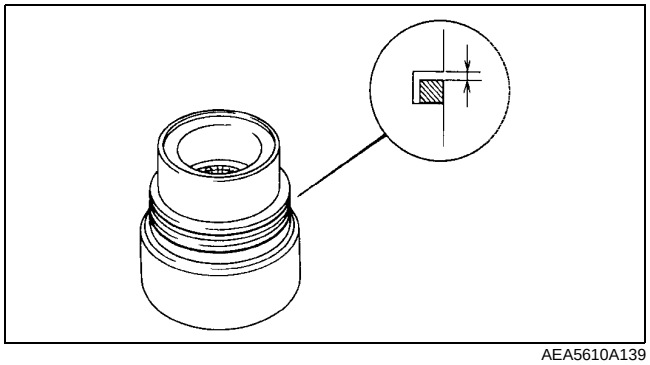
1. Install new seal rings to the low one-way clutch inner race.



AEA5610A138

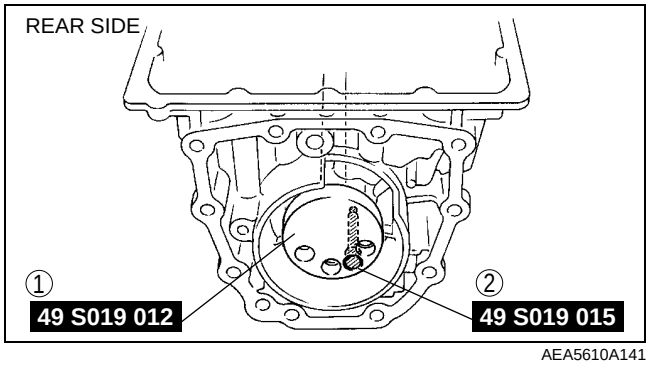
2. Measure the clearance between the seal rings and the seal ring grooves.
   - If the clearance is not within the specification, replace the low one-way clutch inner race.

   Specification
   0.10—0.25 mm {0.0040—0.0098 in}



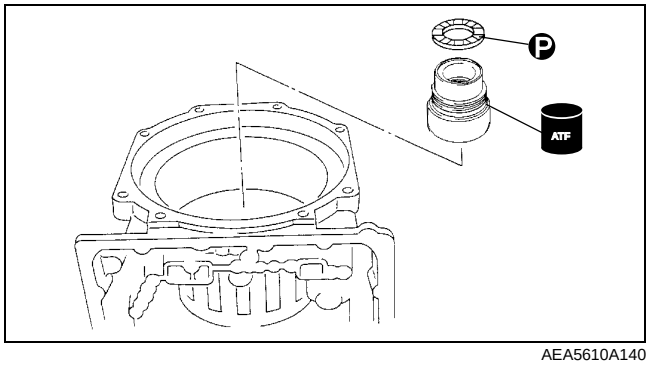
AEA5610A139

3. Set the **SSTs** in the order shown.



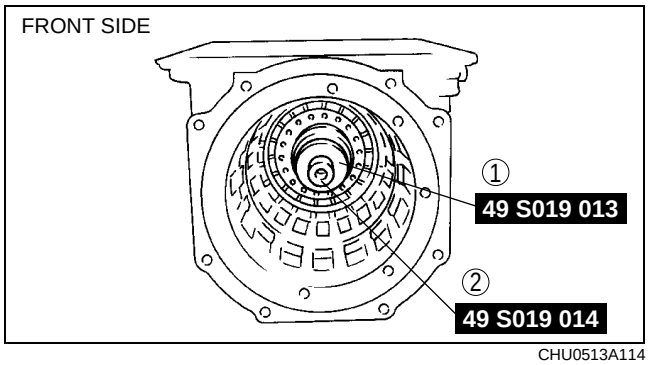
AEA5610A141

4. Install the low one-way clutch inner race and the bearing.



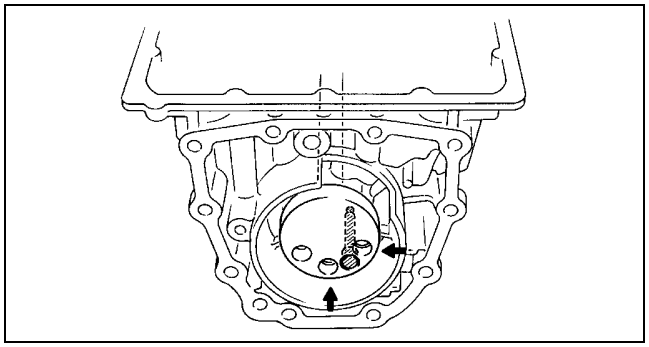
AEA5610A140

5. Set the **SSTs** in the order shown.



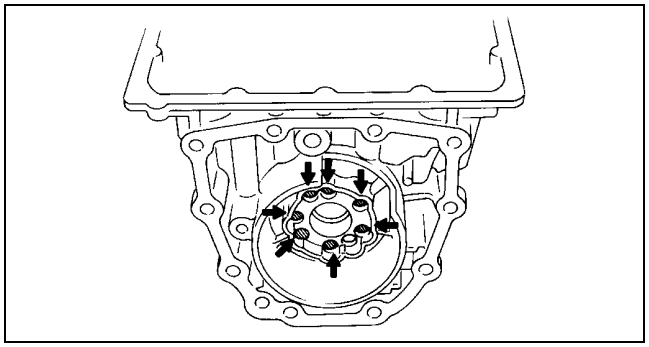
CHU0513A114

6. Hand tighten the bolts as shown in the figure.
7. Remove the **SSTs**.

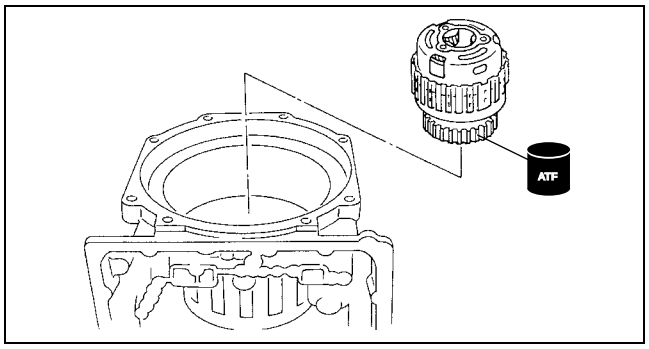

AEA5610A143

8. Tighten the bolts evenly and gradually.

Tightening torque
21—26 N·m {2.1—2.7 kgf·m, 16—19 ft·lbf}


AEA5610A144

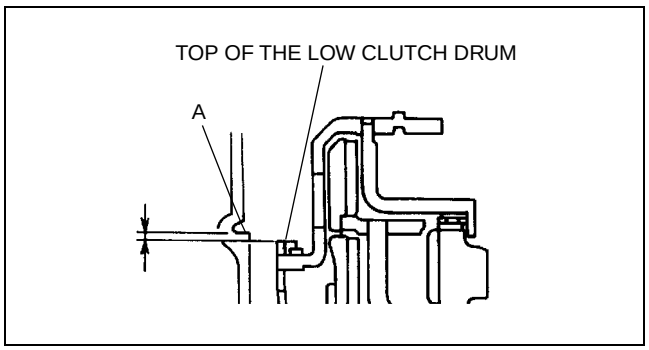
9. Install the carrier component.



AEA5610A145

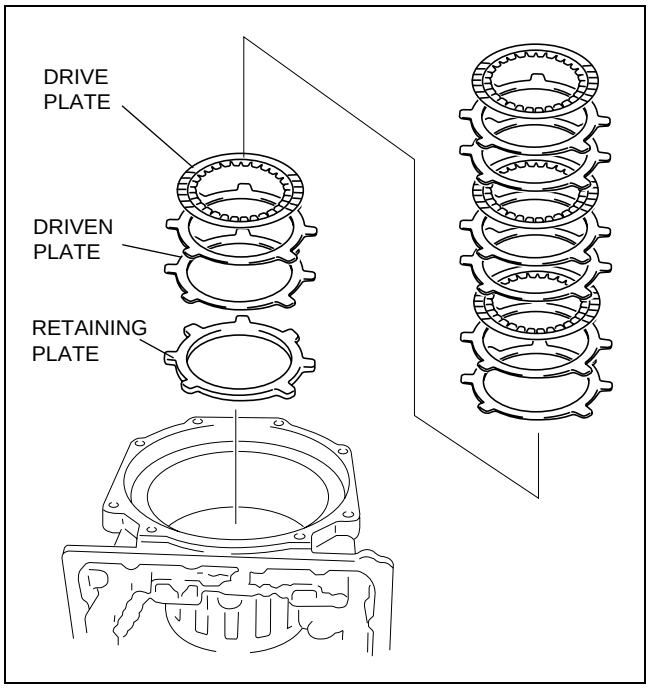
10. Verify that the top of the low clutch drum is lower than surface A (receiving surface of the 2-4 brake plate) of the transmission case.

Note
- Install the thickest driven plate after the retaining plate.



AEA5610A146

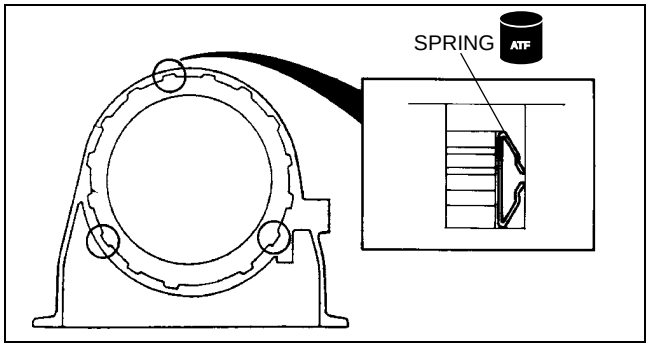
11. Apply ATF to the retaining plate, driven plates, and the drive plates, and install them to the transmission case in the following order:
Retaining—Driven—Driven—Drive—Driven—Driven—Drive—Driven—Driven—Drive—Driven—Driven—Drive



CHU0513A115

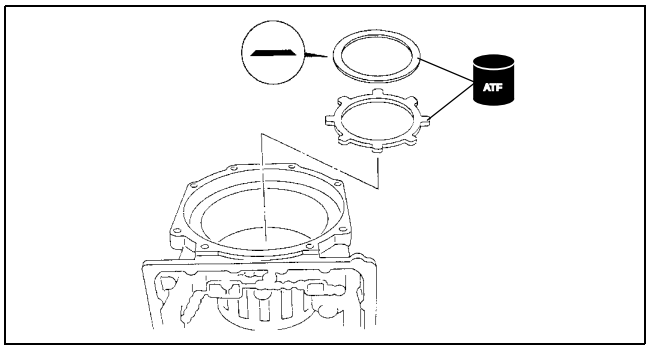
12. Install the spring.

Caution
- **If the dished plate is not installed in the specified direction, it may be damaged or not operate properly. Install the plate exactly as shown in the figure.**



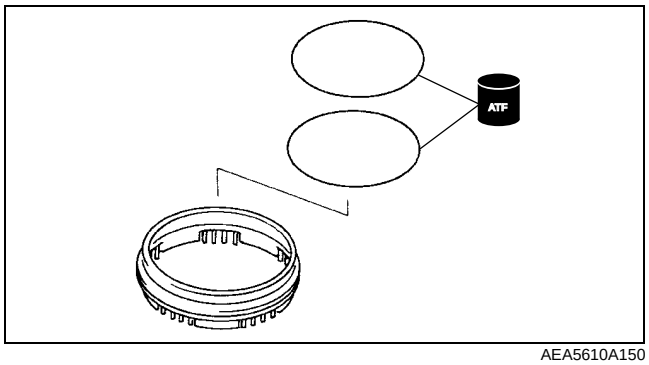
CHU0513A116

13. Install the retaining plate and the dished plate.



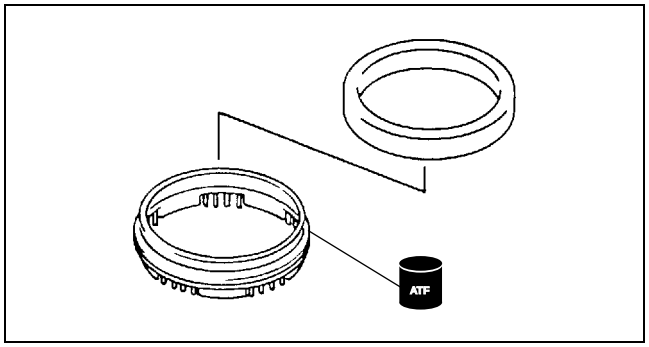
AEA5610A149

14. Install new seal rings to the 2-4 brake piston.



AEA5610A150

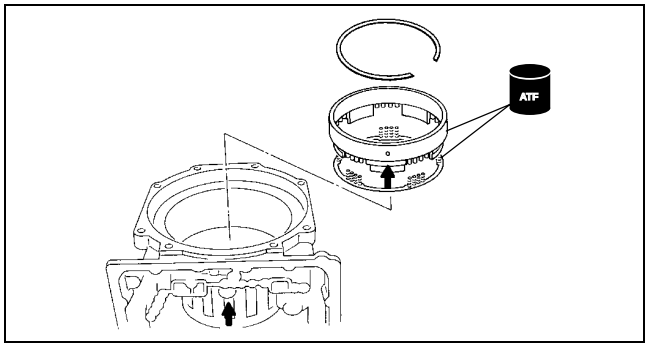
15. Install the 2-4 brake piston to the 2-4 brake retainer.



AEA5610A151

16. Align the fluid passage and install the return spring, 2-4 brake retainer, and the snap ring.

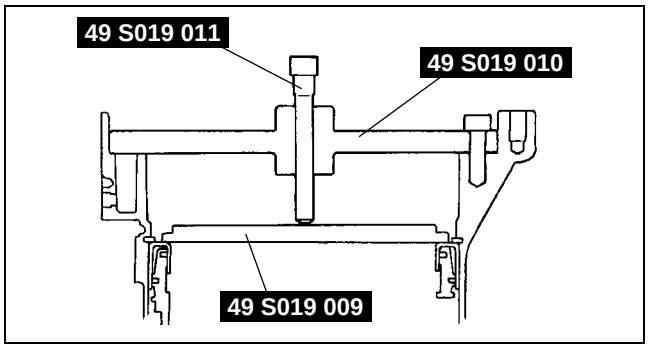
Caution
- **Be sure to center the SSTs on the transmission case. Otherwise, the return spring can be damaged.**



AEA5610A152

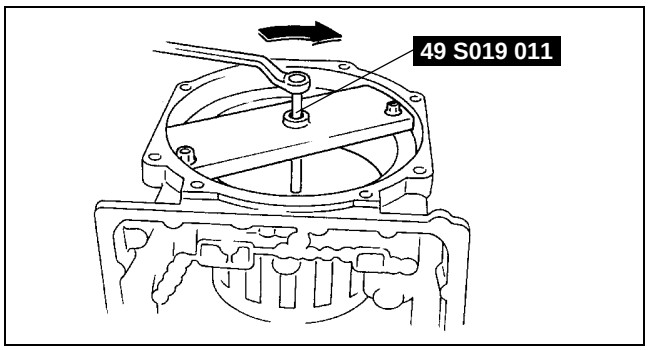
17. Set the **SSTs** to the transmission case.

Caution
- **Do not compress the 2-4 brake retainer excessively. Doing so can damage the return spring.**



AEA5610A153

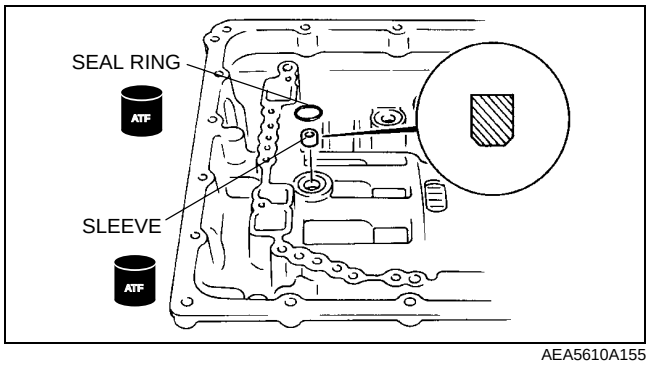
18. Compress the 2-4 brake retainer using the **SST**.
19. Install the snap ring.
20. Remove the **SSTs**.



AEA5610A154

21. Install the sleeve and a new seal ring.

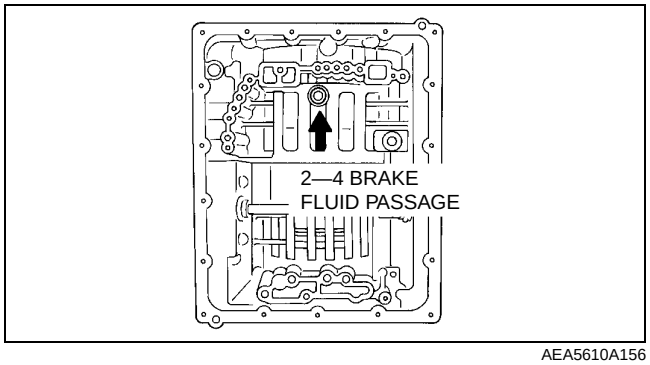
Caution
- **Applying compressed air to the assembled clutch pack for more than 3 s at a time will damage the seal.**
- **Do not apply compressed air for more than the aforementioned time when testing the system.**



AEA5610A155

22. Apply compressed air to the part indicated in the figure and inspect the 2-4 brake operation.
- If there is any malfunction, inspect the seal rings.

Air pressure
390 kPa {4.0 kgf/cm^2, 57 psi} max.



AEA5610A156

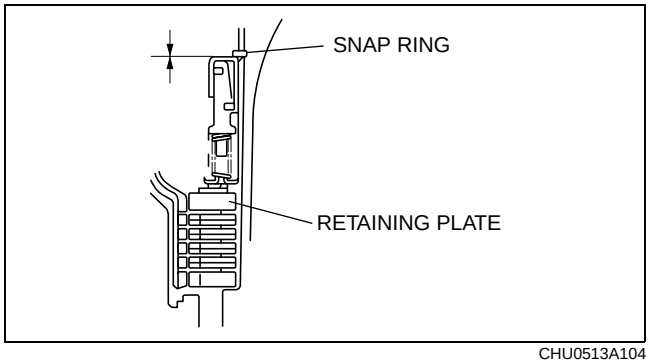
23. Measure the clearance between the 2-4 brake retainer and the snap ring.
- If the clearance is not within the specification, adjust the clearance by installing the correct retaining plate.

Specification
1.0—1.4 mm {0.0394—0.0551 in}

Retaining plate sizes

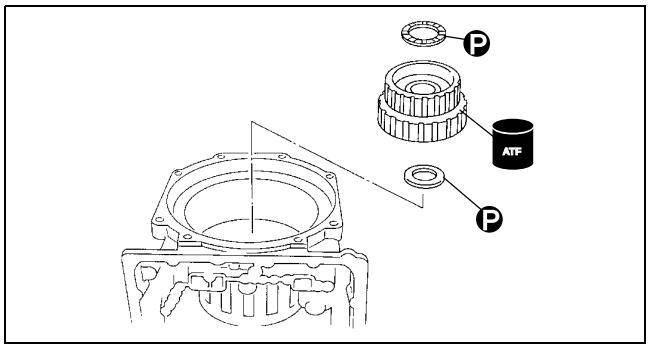
mm {in}

5.2 {0.205}	5.4 {0.213}	5.6 {0.220}
5.8 {0.228}	6.0 {0.236}	6.2 {0.244}



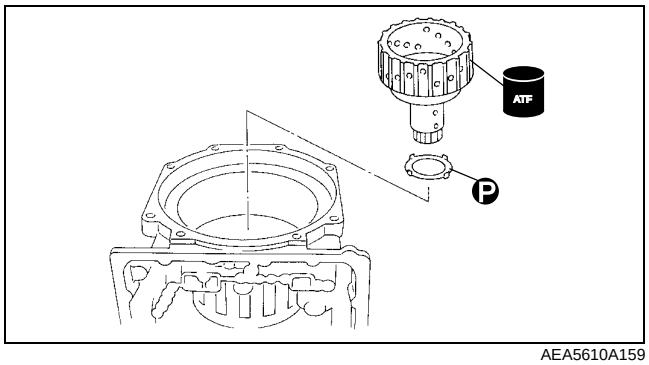
CHU0513A104

24. Install the bearing race, front sun gear, and the bearing.



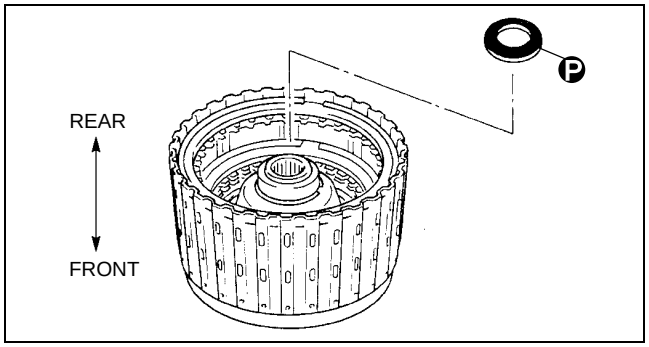
AEA5610A158

25. Install the bearing race and the high clutch hub.



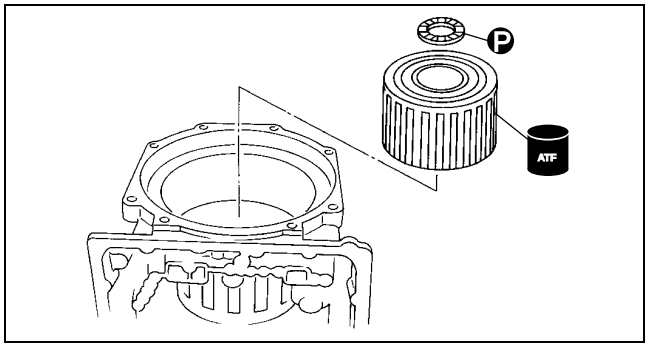
AEA5610A159

26. Install the bearing to the reverse and high clutch drum with the black surface facing rear side.



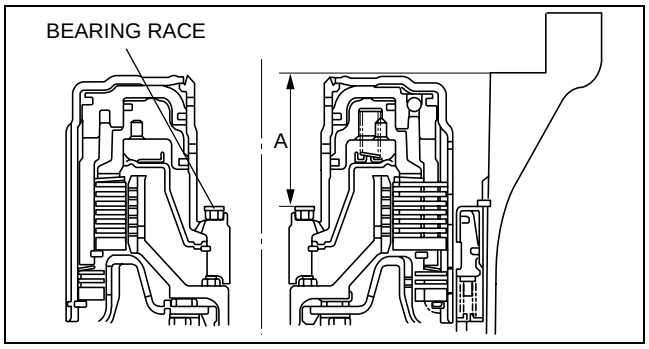
AEA5610A160

27. Install the reverse and high clutch drum and the bearing.
28. Use the following procedure to adjust the total end play.



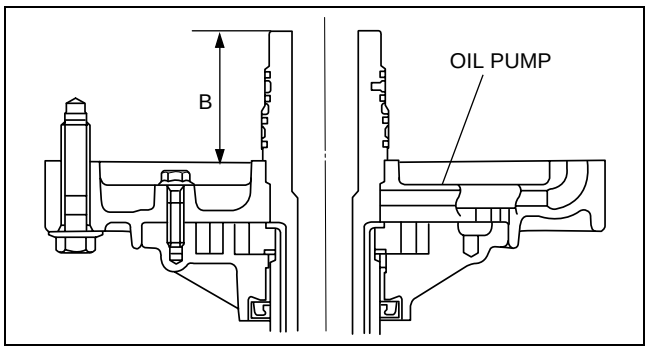
AEA5610A161

(1) Install the bearing race (oil pump installation race) to the reverse and high clutch drum and measure dimension A shown in the figure.



CHU0513A117

(2) Measure the dimension B shown in the figure.



CHU0513A118

(3) Calculate the total end play by using the formula below.
- If the total end play is not within the specification, adjust the total end play by selecting the correct bearing race (oil pump installation race).

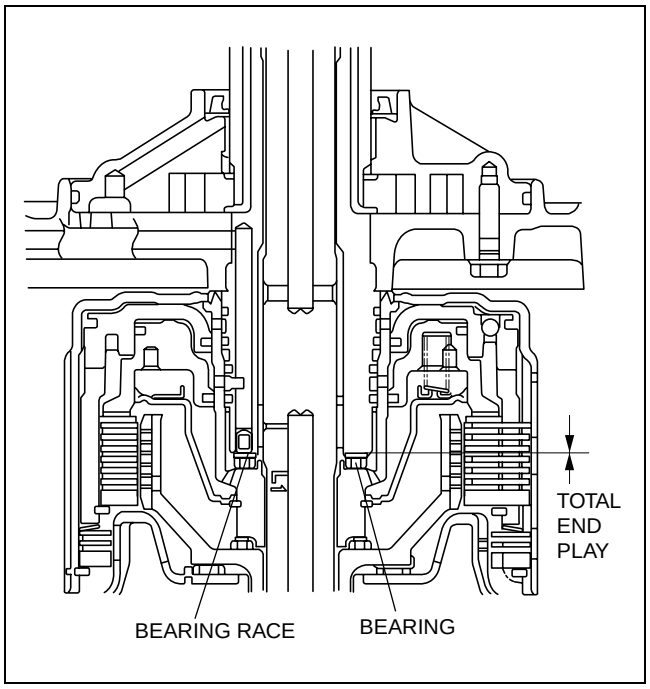
Formula
Total end play= dimension A–dimension B

Specification
0.25—0.55 mm {0.0099—0.0216 in}

Bearing race sizes

mm {in}

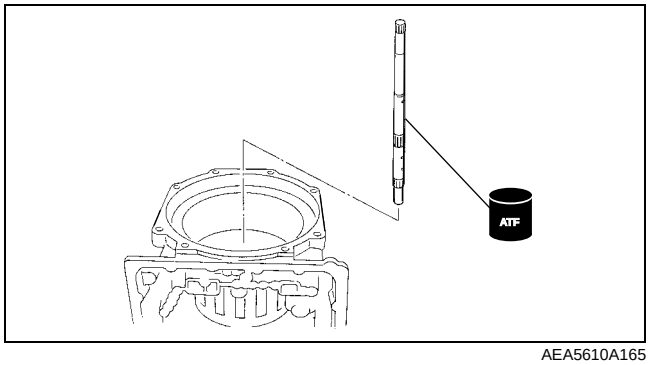
1.4 {0.055}	1.6 {0.063}	1.8 {0.071}
2.0 {0.079}	2.2 {0.087}	2.4 {0.094}



CHU0513A119

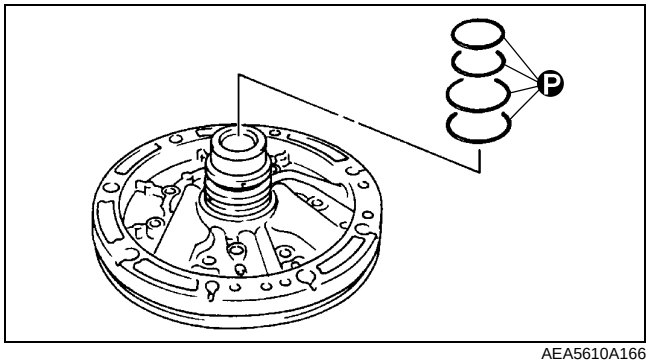
29. Install the input shaft.

Note
- Install large seal rings to the front side and small seal rings to the rear side.



AEA5610A165

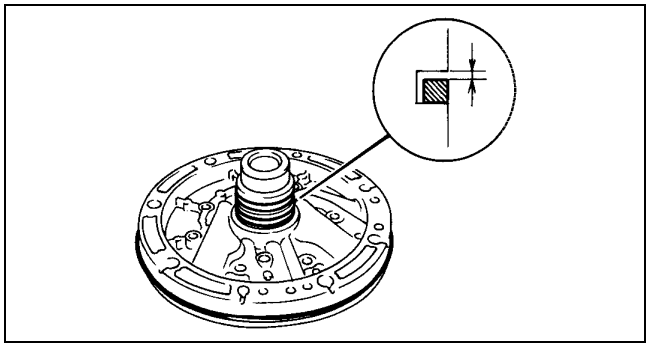
30. Install new seal rings to the oil pump.



AEA5610A166

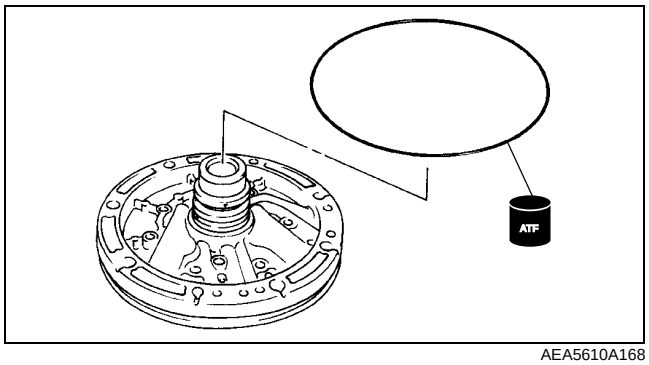
31. Measure the clearance between the seal rings and the seal ring grooves.
- If the clearance is not within the specification, replace the oil pump cover.

Specification
0.10—0.25 mm {0.0040—0.0098 in}



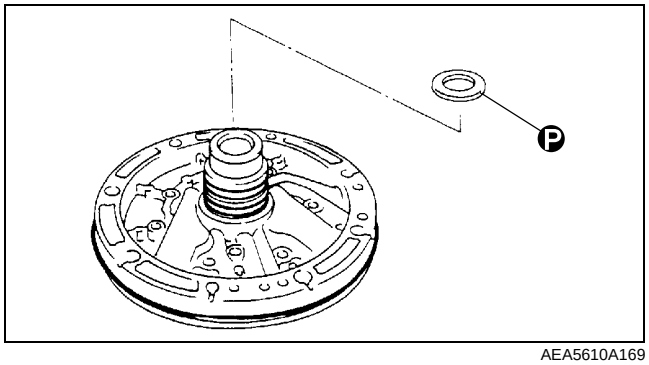
AEA5610A167

32. Install a new O-ring to the oil pump.



AEA5610A168

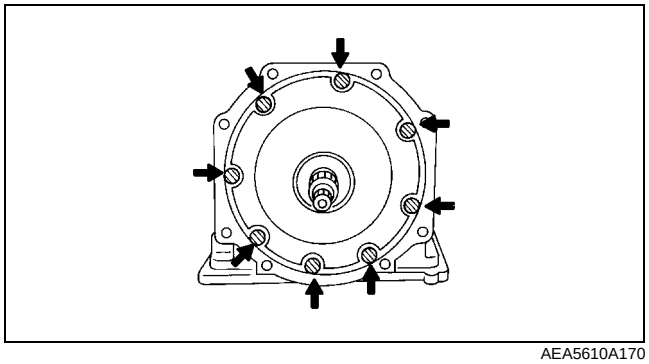
33. Install the bearing race to the oil pump.
34. Apply sealant to the oil pump installation bolts.
35. Apply ATF to the O-ring around the oil pump.



AEA5610A169

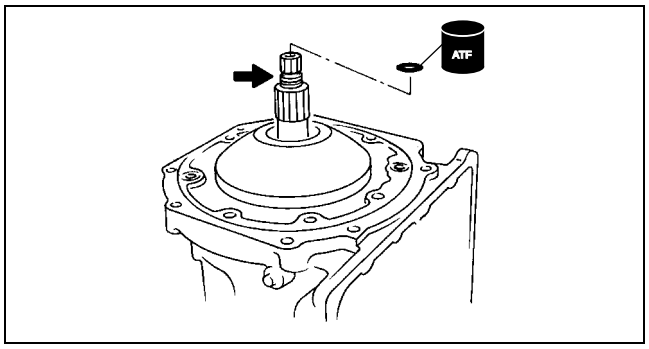
36. Install the oil pump.

Tightening torque
55—60 N·m {5.7—6.1 kgf·m, 42—44 ft·lbf}



AEA5610A170

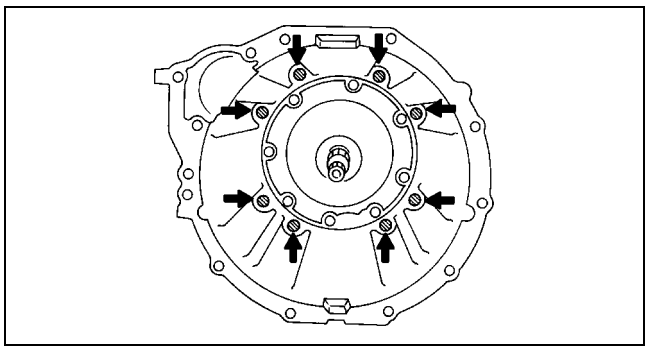
37. Install a new O-ring to the input shaft.



AEA5610A171

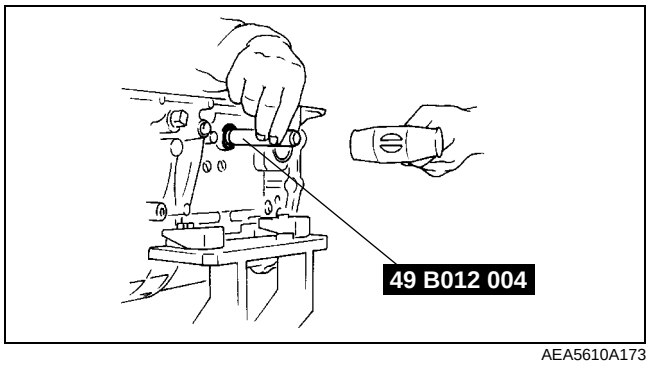
38. Install the torque converter housing.

Tightening torque
50—55 N·m {5.1—5.6 kgf·m, 37—40 ft·lbf}



AEA5610A172

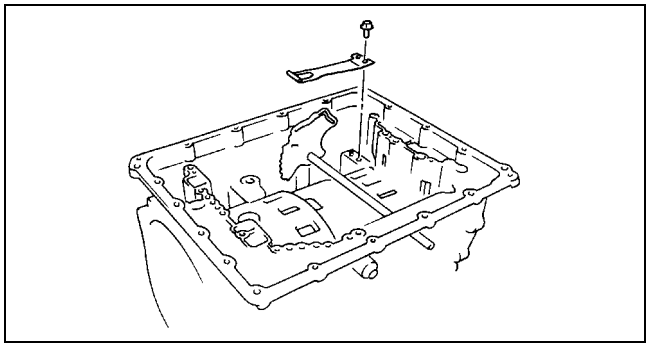
39. Install a new oil seal using the **SST**.



AEA5610A173

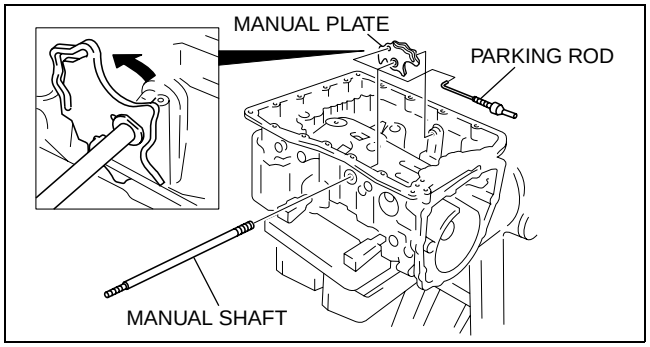
40. Install the detent spring.

Tightening torque
6.4—8.3 N·m {66—84 kgf·cm, 58—72 in·lbf}



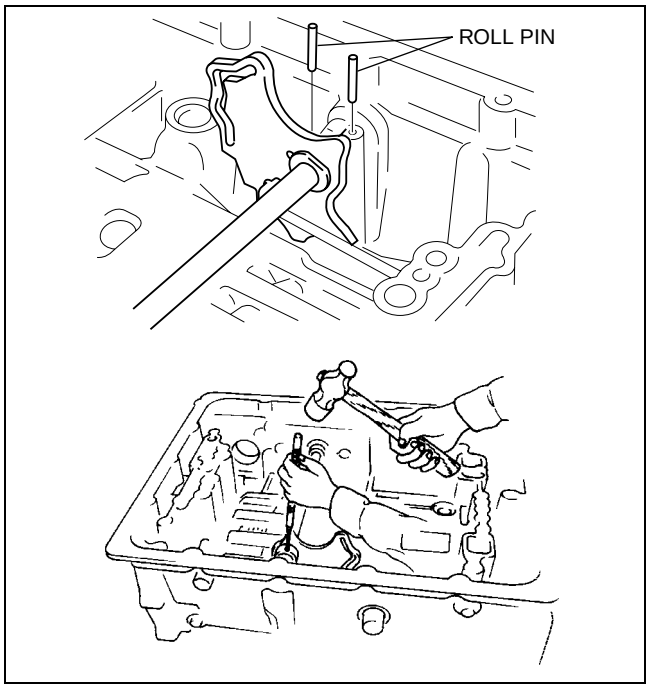
AEA5610A174

41. Install the manual shaft, manual plate and parking rod as shown in the figure.
42. Rotate the manual plate until the detent spring catches on the indented part of the manual plate.



CHU0513A120

43. Install a new roll pin using a pin punch.
44. Apply ATF to a new O-ring, and install it to the harness component.

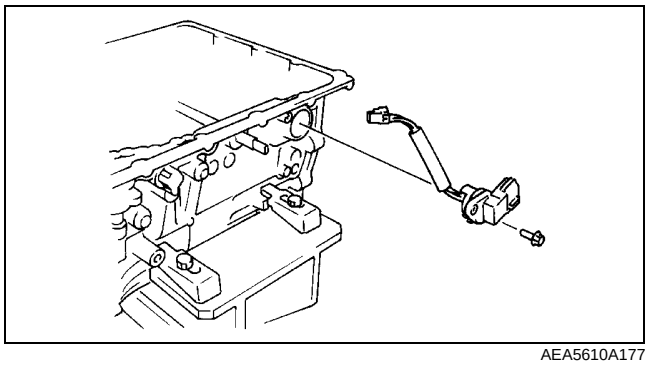


CHU0513A121

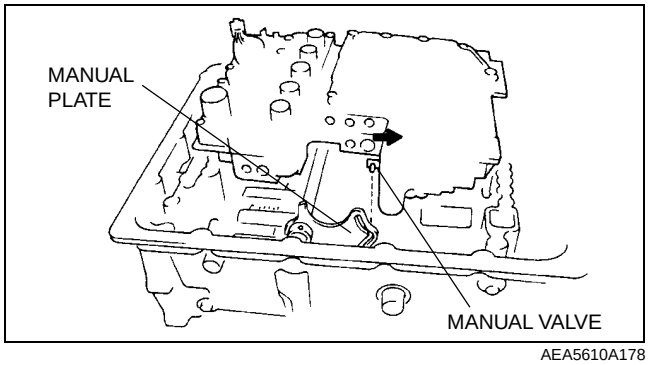
45. Install the harness component.

Tightening torque
5.0—7.0 N·m {51—71 kgf·cm, 43—61 in·lbf}

Note
- Do not move the manual valve in the direction of arrow to prevent the pin for the manual valve rotation prevention from falling from the control valve body.


AEA5610A177

46. Align the manual valve and the manual plate, and set the control valve body.

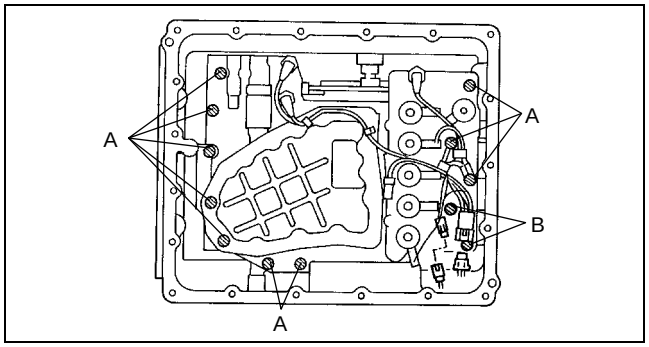


AEA5610A178

47. Tighten the bolts evenly and gradually.

Bolt	Bolt length below the head (mm {in})
A	30 {1.181}
B	40 {1.575}

Tightening torque
6.9—8.8 N·m {71—89 kgf·cm, 62—77 in·lbf}



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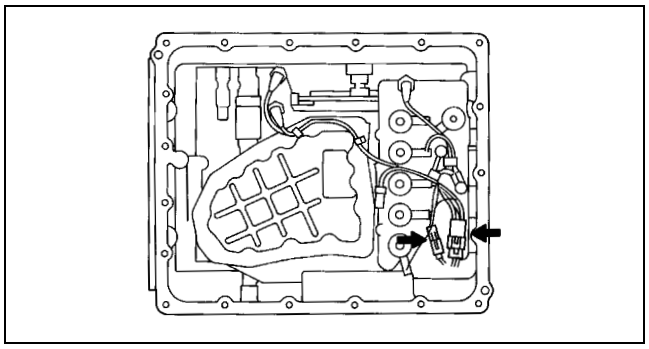
48. Connect the connector.

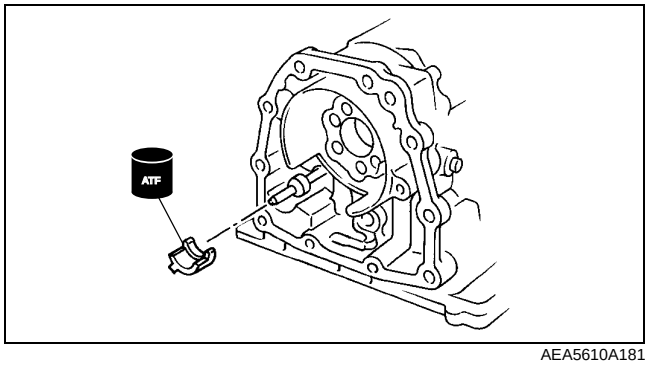
Note
- Do not reuse the oil pan installation bolts as they are coated.

49. Install a new gasket and the oil pan with new bolts.

Tightening torque
7.0—9.0 N·m {72—91 kgf·cm, 63—78 in·lbf}

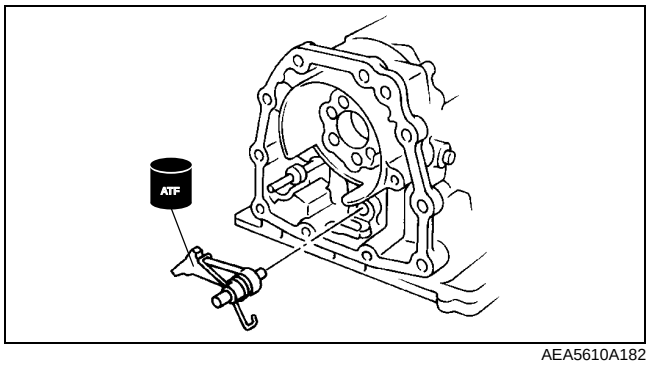

AEA5610A180

50. Install the actuator support.



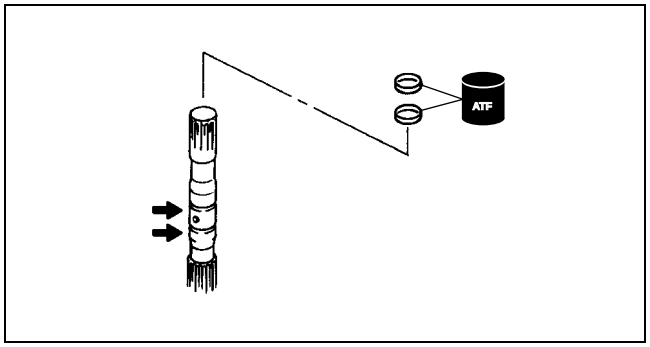
AEA5610A181

51. Install the parking pawl, shaft, spring, and the spacer.



AEA5610A182

52. Install new seal rings to the output shaft component.

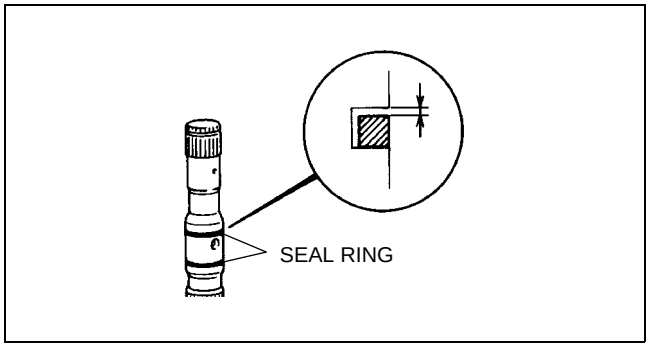


AEA5610A183

53. Measure the clearance between the seal rings and seal ring grooves.
    - If the clearance is not within the specification, replace the output shaft.

    Specification
    0.10—0.25 mm {0.0040—0.0098 in}

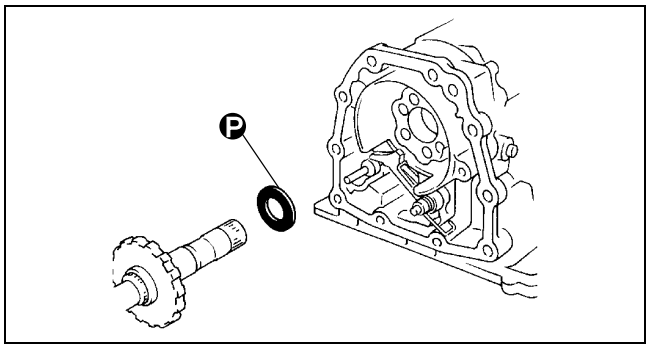
    Note
    - Install the bearing to the transmission case with the black surface facing the rear side.



AEA5610A184

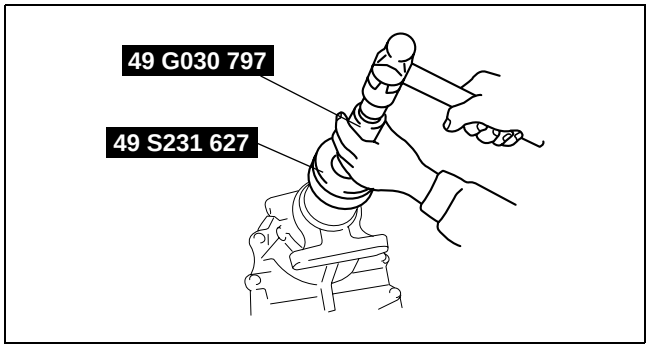
54. Install the bearing and the output shaft component.
55. Apply ATF to a new oil seal.

    Note
    - When installing the oil seal to the extension housing, tap the **SSTs** until the stopper on the oil seal circumference contacts the extension housing.



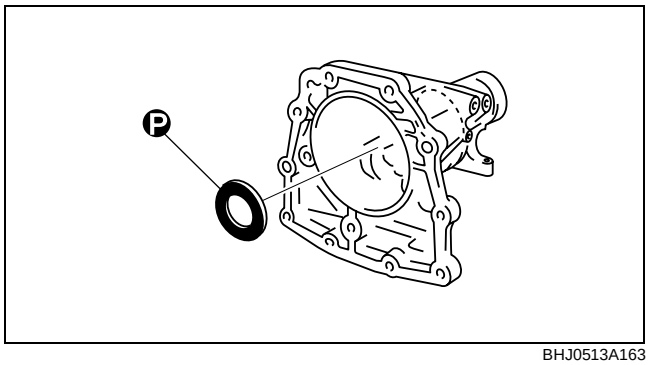
AEA5610A185

56. Install the oil seal to the extension housing using the **SSTs**.



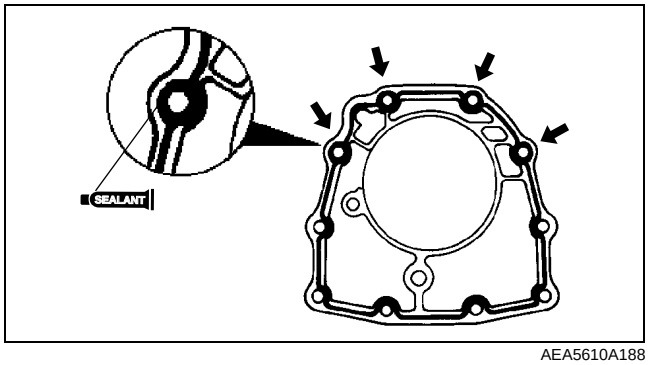
BHJ0513A155

57. Install the bearing to the extension housing.



BHJ0513A163

58. Apply a light coat of sealant to the contact surfaces of the transmission case and the extension housing. (For the four locations indicated in the figure, apply sealant to the entire circumference of the bolt holes.)



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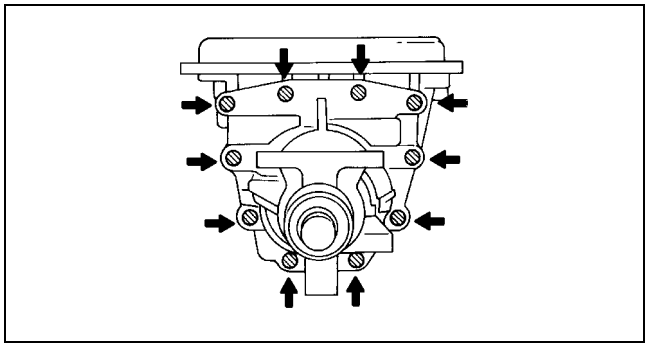
59. Install the extension housing.

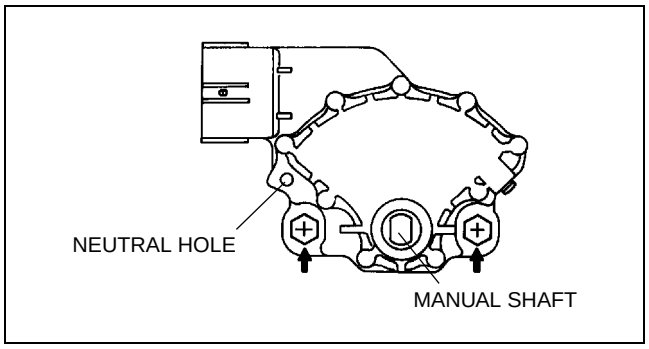
Tightening torque
50—55 N·m {5.1—5.6 kgf·m, 37—40 ft·lbf}



AEA5610A189

60. Install the TR switch, and hand-tighten the mounting bolts.

Caution
- **Improper adjustment of the TR switch will cause abnormal operation of the automatic transmission. Be sure to use the SST to adjust the TR switch correctly.**

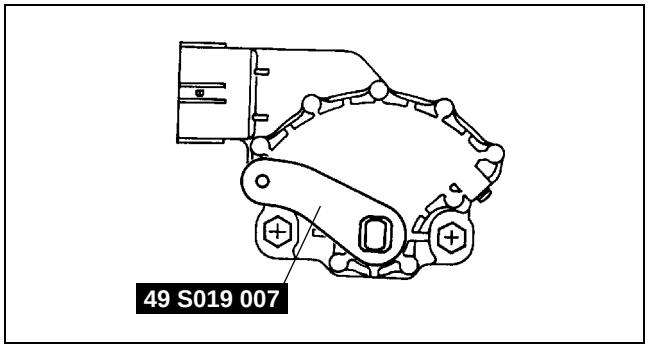


AEA5610A190

61. Using the **SST** and by turning the TR switch, adjust the positions of the manual shaft and the TR switch neutral hole.
62. Tighten the TR switch installation bolts.

Tightening torque
4.4—6.5 N·m {45—66 kgf·cm, 40—57 in·lbf}

63. Remove the **SST**.
64. Apply ATF to new O-rings and install them to the VSS and the turbine sensor.



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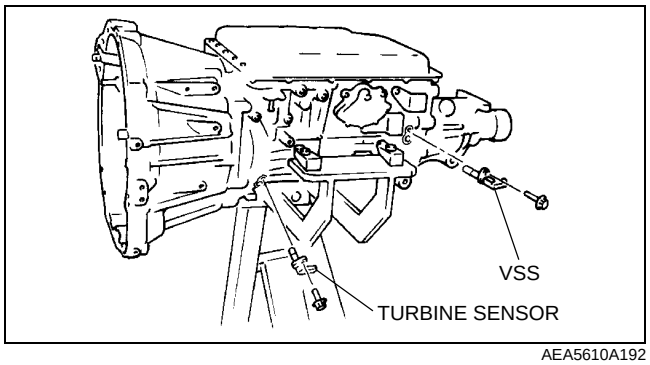
65. Install the VSS and the turbine sensor.

Tightening torque
5.0—7.0 N·m {51—71 kgf·cm, 43—61 in·lbf}

66. Pour ATF into the torque converter.
67. Shake the torque converter to clean the inside and pour out the solvent.
68. Pour ATF into the torque converter.
69. Install the torque converter.



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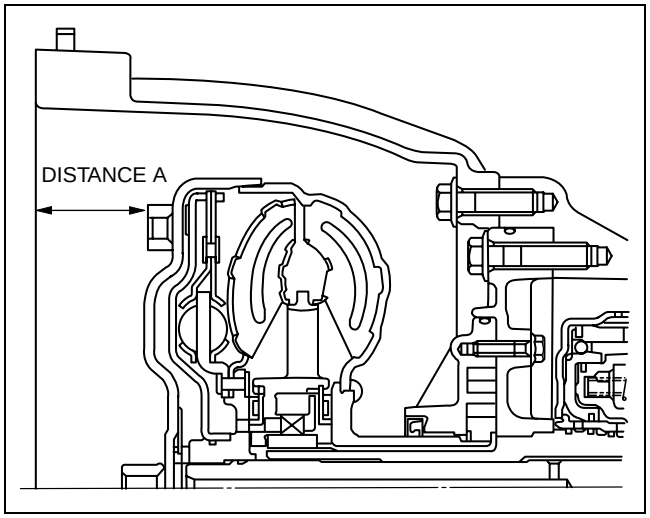
70. To ensure that the torque converter is installed accurately, measure distance A between the end of the torque converter and the end of the converter housing.
    - If the distance is not within the specification, install the torque converter correctly.

Specification
50 mm {1.97 in} or more



CHU0513A122

05–50 TECHNICAL DATA

TECHNICAL DATA

CHU055001026A01

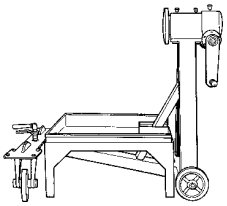
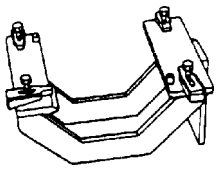
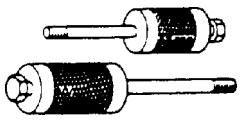
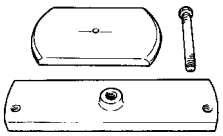
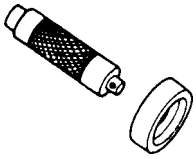
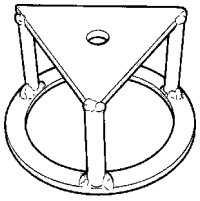
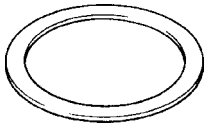
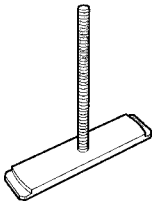
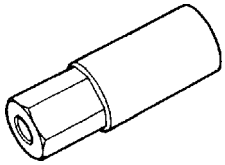
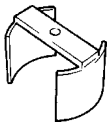
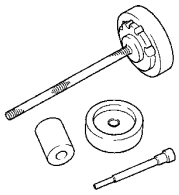
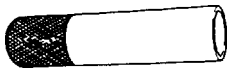
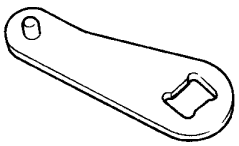
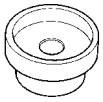
Item			Transmission type
			RC4A-EL
Oil pump	Body clearance	(mm {in})	0.02—0.04 {0.0008—0.0015}
	Tip clearance	(mm {in})	0.02—0.15 {0.0008—0.0059}
	Seal ring and groove clearance	(mm {in})	0.10—0.25 {0.0040—0.0098}
Reverse clutch	Number of drive/driven plates		2/2
	Drive plate thickness	(mm {in})	Minimum: 1.8 {0.071}
	Clutch clearance	(mm {in})	0.6—0.9 {0.0237—0.0354}
	Retaining plate size	(mm {in})	4.8 {0.191}, 5.0 {0.197}, 5.2 {0.205}, 5.4 {0.213}
High clutch	Number of drive/driven plates		6/6
	Drive plate thickness	(mm {in})	Minimum: 1.8 {0.071}
	Clutch clearance	(mm {in})	1.2—1.4 {0.0473—0.0551}
	Retaining plate size	(mm {in})	4.6 {0.181}, 4.7 {0.185}, 4.8 {0.191}, 4.9 {0.193}, 5.0 {0.197}, 5.1 {0.201}, 5.2 {0.205}, 5.3 {0.209}, 5.4 {0.213}
2-4 brake	Number of drive/driven plates		4/8
	Drive plate thickness	(mm {in})	Minimum: 1.8 {0.071}
	Clutch clearance	(mm {in})	1.0—1.4 {0.0394—0.0551}
	Retaining plate size	(mm {in})	5.2 {0.205}, 5.4 {0.213}, 5.6 {0.220}, 5.8 {0.228}, 6.0 {0.236}, 6.2 {0.244}
Low clutch	Number of drive/driven plates		5/5
	Drive plate thickness	(mm {in})	Minimum: 1.8 {0.071}
	Clutch clearance	(mm {in})	0.9—1.3 {0.036—0.051}
	Retaining plate size	(mm {in})	3.8 {0.150}, 4.0 {0.157}, 4.2 {0.165} 4.4 {0.173}, 4.6 {0.181}, 4.8 {0.189}
Low and reverse brake	Number of drive/driven plates		4/5
	Drive plate thickness	(mm {in})	Minimum: 1.8 {0.071}
	Clutch clearance	(mm {in})	0.7—1.1 {0.028—0.043}
	Retaining plate size	(mm {in})	5.2 {0.205}, 5.4 {0.213}, 5.6 {0.220}, 5.8 {0.228}, 6.0 {0.236}
Output shaft	Seal ring and groove clearance	(mm {in})	0.10—0.25 {0.0040—0.0098}
Low one-way clutch inner race	Seal ring and groove clearance	(mm {in})	0.10—0.25 {0.0040—0.0098}
Total end play	Total end play	(mm {in})	0.25—0.55 {0.0099—0.0216}
	Bearing race size	(mm {in})	1.4 {0.055}, 1.6 {0.063}, 1.8 {0.071}, 2.0 {0.079}, 2.2 {0.087}, 2.4 {0.094}
Distance between end of torque converter and face of converter housing		(mm {in})	50 {1.97} or more

Spring	Item			
	Outer diameter (mm {in})	Free length (mm {in})	No. of coils	Wire diameter (mm {in})
High clutch return spring	8.0 {0.315}	27.1 {1.067}	10.2	1.1 {0.043}
2-4 brake return spring	6.9 {0.272}	22.5 {0.886}	10.0	0.9 {0.035}
Low clutch return spring	9.7 {0.382}	36.4 {1.433}	9.9	1.2 {0.047}
Low and reverse brake return spring	11.2 {0.441}	22.3 {0.878}	4.8	1.1 {0.043}

05–60 SERVICE TOOLS

SPECIAL TOOLS

CHU056001026A01

49 0107 680A Engine stand 	49 U019 0A0A Transmission hanger set 	49 0378 390 Oil pump puller 
49 S019 0A1 Spring compressor set 	49 G030 795 Oil seal installer 	49 W019 002 Body 
49 T019 001 Attachment 	49 G019 027 Attachment A 	49 G019 029 Nut 
49 T019 014 Body 	49 S019 0A2 Inner race setting tool set 	49 B012 004 Valve seal pusher 
49 S019 007 Set plate 	49 S231 627 Attachment 	—