SUBARU

GD-TT1
GD-TT2
GD-TV1
GD-TV2

SAMBAR

Maintenance Manual

Volume 1

SUBARU Co., Ltd.

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'99.2

G7341A

Preface

This book is the first volume of the **SAMBAR** maintenance manual, and provides an overview and explanations of maintenance procedures for the engine and power transmission systems.

Please read this volume carefully together with the second volume and use it as a reference for carrying out accurate and prompt maintenance for your vehicle.

In addition to this book, we have published the following materials, which we hope you will also make use of:

SAMBAR New Car Manual	'99-2	U7341A
SAMBAR Mantenance Manual Vol 2	'99-2	G7342A
SAMBAR Electrical wiring diagram collection	'99-2	X7341A
SAMBAR Troubleshooting & diagnosis	'99-2	P7341A

Please note that the contents of this manual are based on vehicles released in February 1999. Please note that the contents may not match future vehicles due to changes in vehicle specifications, etc.

If there are any changes to the specifications in the future, we will notify you via technical information or other means.

February 1999

Table of Contents

Fuji Heavy Industries Co., Ltd.

1 Overview

1 - 1 How to Read This Manual

[1] Scope of Explanation for Maintenance Work

Maintenance work can be broadly divided into three processes: diagnosis, repair, and final inspection. Diagnosis explains how to diagnose a malfunction to determine the cause of the malfunction, while repair explains how to remove, replace, disassemble, inspect, and adjust the parts. Final inspection is a comprehensive check of the vehicle =, including its function, operation, installation, and exterior paintwork, prior to delivery, but this is omitted in this book.

[2] How to Read the Explanations

The detailed table of contents for each section is organized by section, so please use the table of contents for each section. The explanations for maintenance procedures are basically written in the following order for each chapter: parts layout diagram > components > electronic control overview > fault diagnosis (major fault systems) > preparations for maintenance work > maintenance procedures, etc. However, the content varies depending on the chapter, and unnecessary items have been omitted. Also, fault diagnosis for electronic control units equipped with ECUs is summarized in a separate volume, “Fault Diagnosis Report”, so it has been omitted from this book.

■ Parts Layout Diagram

The installation location, condition, and part names of the systems components are listed so that you can see them.

■ Component Parts

It lists the system’s component configuration, component names, tightening torques for bolts and nuts, lubricants, reusable and no-reusable components, and maintenance standards.

■ Electronic Control Overview

It explains the system configuration, input/output diagram, self-diagnostic function, and trouble code list.

■ Fault Diagnosis (Major Fault Systems)

The means and methods for investigating the cause of the system failure are described in the tables or troubleshooting charts. Depending on the item, the main failure symptoms are also described.

■ Maintenance Preparations

The tables below lists the special tools, general purpose tools, gauges, and oils that you should prepare before starting work, and briefly explains the purpose of each.

However, we have omitted items that are likely to be kept on had at general repair shops, such as jacks and rigid jacks.

<Example of Entry>

Special tools for special use

*mark: Newly installed tool

区分	工具番号または型式	名称	用途
ST	49981 5400	エンジンスタンドCOMPL	エンジン分解・組立作業
	49845 5600	エンジンスタンドアタッチメント	エンジンスタンドとエンジン取付ボス部のアタッチメント
	49827 5800	フライホイールストッパー	クランクシャフトの回り止め
	49871 5410 49808 5800	カムタイミングアジャスタープレート カムタイミングアジャスターピン	カムスプロケット位置決め、脱着
*	49920 6400	クランクプーリーレンチ	クランクプーリー回り止め
*	49920 6500	アタッチメント	上記のアタッチメント
	49920 5700 39952 0802	クランクプーリー＆スプロケットプーラーボルト	クランクプーリー、クランクスプロケットの取外し
	49872 5500	リヤオイルシールガイド	クランクリヤオイルシールの圧入位置決め
	49872 5600	リヤオイルシールプレス	クランクリヤオイルシール圧入
	49874 5600	ピストンガイド	ピストンASSYのシリンダーへの挿入
	49958 6100	フロントオイルシールガイド	フロントオイルシール圧入
	49958 6200	フロントオイルシールガイド	フロントオイルシール圧入時の内径ガイド
油脂 その他	スリーボンド#1215B または#1215	液状ガスケット	オイルポンプのシリンダーブロック取付面等
	スリーボンド#1207F または#1207C	液状ガスケット	オイルパンフランジ取付面
	スリーボンド#1105	液状ガスケット	ベアリングキャップシール取付面
	オイル	エンジンオイル	部品取付時の塗布用

NOTE

- For ThreeBond liquid gaskets, the number after the # indicates the properties, and gaskets for the same purpose may vary in color.
  - It is not possible to determine the type of gasket based on the actual color alone.

■ Maintenance Instructions

Each device or part is described in the following order: Removal > Disassembly and Inspection > Assembly > Installation > Adjustment. However, for simple devices and parts, the description is grouped into removal, installation, disassembly, and inspection. Also, if the component illustration alone can explain the procedure, the “Maintenance Procedure” section has been omitted.

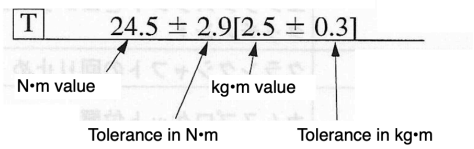
[3] Definitions of Terms & Symbols

＊基準値 : Indicates the value that represents the tolerance range during inspection and adjustment, or the judgment value for the operating condition.

注意 : Indicates important or dangerous work that requires attention.

参考 : Indicates additional information to make your work easier.

T : Indicates the tightening torque.
Unit: N•m (kg•m)
Example:

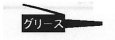


N•m is the torque symbol in the International System of Units (SI units) and is pronounced “Newton-meter.” The unit in [ ] is the conventional kg•m.
For details, see the tightening definition of Torque on the next page.

★ : Indicates non-reusable parts.

: Indicates oil injection and application.
Example:

: Indicates grease application.
Example:



Shell 6459N

: Indicates glue, liquid gaskets, etc.
Example:

Threebond #1207F

: Indicates a special tool.
Example:

92647000 Puller

[4] About SI Units

This book uses SI units (International Units) for some units (force, torque, pressure). The SI units are always written first, followed by conventional unites in square brackets. In addition, items related to notification documents such as engine specifications and performance curves are written in conventional units.

<Tighten Torque Information>

Example 1 T 54 ± 5 N•m [5.5 ± 0.5 kg•m]

↑ SI Units ↑ Conventional Unit

For torque, the unit symbol may be omitted.

Example 2 54 ± 5 N•m ← SI Unit

T [5.5 ± 0.5 kg•m] ← Conventional Unit

<Pressure Description>

Example 3 T 147 ± 29 kPa [1.5 ± 0.3 kg/cm²]

↑ SI Unit ↑ Conventional Unit

Example 4 T 49 ± 4 kPa [370 mmHg]

↑ SI Unit ↑ Conventional Unit

SI units are units established internationally to unify the conventional unit systems, and some counties around the world have already made the switch, and Japan is also moving forward with the switch to SI units, including in the areas of standards.

REFERENCE

<SI Unit List>

Item	SI Unit	Conventional Unit	Notes
Distance	m	m	1kg = 9.80655 N
Power	N	kg	
Weight	kg	kg	
Area	m^3	m^3	
Volume	ℓ	ℓ	
Torque	N•m	Kg•m Kg•cm	1 kg•m = 9.80655 N•m 1 kg•m = 0.0980665 N•m
Rotations	S^1 (times per second)	rpm	1 rpm = 1/6—s^{-1}
Pressure	kPa (kilopascal)	Kg/cm^2	1 kg/cm^2 = 98.0665 kPa
	KpA	mmHg	1 mmHg = 0.133322 kPa
Area	m^3	m^3	
Work Rate	W	PS	1 PS = 0.735499 kW
Calories	W•h	Cal	1 kcal = 1.16279 W•h

In this document, torque, force, pressure, etc are shown in SI units (traditional units are also listed).

The Multiple by Which the Unit is Multiplied	Name	Symbol	The Multiple by Which the Unit is Multiplied	Name	Symbol
10^{12}	Tera-	T	10^{-1}	deci-	d
10^9	Giga-	G	10^{-2}	centi-	c
10^6	Mega-	M	10^{-3}	milli-	m
10^3	Kilo-	k	10^{-6}	micro-	μ
10^2	Hecto-	h	10^{-9}	nano-	n
10	Deca-	da	10^{-12}	pico-	p

[5] Explanation of Terms

A/B	:	Airbag
ABS	:	Anti-lock Braking System
A/C	:	Air Conditioner
A/F	:	Air/fuel Ratio
ALT	:	Alternator
ASSY	:	Assembly
AT	:	Automatic Transmission
ATF	:	Automatic Transmission Fluid
BATT	:	Battery
COMPL	:	Complete
CPU	:	Central Processing Unit
CVT	:	Continuously Variably Transmission
DOHC	:	Double Overhead Camshafts
ECU	:	Electronic Control Unit
EGI	:	Electronic Gasoline Injection
E/G	:	Engine
ELR	:	Emergency Locking Retractor
EX	:	Exhaust
F/B	:	Fuse & Relay Box
FL	:	Fusible Link
Ft	:	Front
F/T	:	Full Time
FWD	:	Front Wheel Drive
H/U	:	Hydraulic Unit (ABS)
IG	:	Ignition
IN	:	Intake
INT	:	Intermittent (Intermediate)
ISC	:	Idle Speed Control
LH	:	Left Hand (Left Side)
LSD	:	Limited Slip Differential
M/B	:	Main Fuse & Relay Box
MPi	:	Multi-point Injection
MT	:	Manual Transmission
NA	:	Natural Aspiration (Naturally Aspirated)
NC	:	Normally Closed
NO	:	Normally Open
P/S	:	Power Steering
P/W	:	Power Window
PCD	:	Pitch Circle Diameter
RH	:	Right Hand (Right Side)
Rr	:	Rear
SC	:	Supercharger
SOHC	:	Single Overhead Camshaft
SOL/V	:	Solenoid Valve
SPi	:	Single Point Injection
SRS	:	Supplemental Restraint System (Auxiliary Restraint Device)
SSM	:	Subaru Select Monitor
SSCB	:	Subaru Signal Check Board
S/T	:	Selective
SW	:	Switch
T/M	:	Transmission
ViS-C	:	Viscous Coupling
VSV	:	Vacuum Switching Valve
W/H	:	Wiring Harness

1 - 2 Model List

■ Vehicle, Engine, & Transmission Classification List

Body			Model	Engine	Drive Method	Grade (Trim)	Transmission	Vehicle Classification	OP Code	Classification Division Number	Vehicle Name
Truck	Standard Roof	Three-sided Opening	GD-TT1	SOHC SPI	2WD	TB	5MT	TT1AS2A	RH	004	Truck TC
									RF	006	
							3AT	TT1AS2H	RH	015	
									RF	017	
						TC	5MT	TT1AS4A	RG	023	
							3AT	TT1AS4H	RG	028	
						JA	5MT	TT1ASDA	RJ	0031	Truck JA
									RK	033	
			GD-TT2	SOHC SPI	S/T 4WD	TB	EL+5MT	TT2AS2D	RH	008	Truck TB 4WD
									RF	077	
					F/T 4WD		3AT	TT2AS2H	RH	011	
									RF	013	
					S/T 4WD	TC	EL+5MT	TT2AS4D	RG	019	Truck TC 4WD
					F/T 4WD		3AT	TT2AS4H	RG	024	
				SOHC SC MPI	S/T 4WD	TC SC	EL+5MT	TT2AS5E	RG	027	Truck TC 4WD Supercharger
									HG	028	
					F/T 4WD		3AT	TT2AS5G	RG	030	
									HG	031	
Panel Van	High Roof	Both Sides Open	GD-TV1	SOHC SPI	2WD	VB	5MT	TV1A81A	RA	001	Panel Van VB
							3AT	TV1A81H	RA	005	
Van	High Roof	2 Seater	GD-TV1	SOHC SPI	2WD	VB	5MT	TV1A53A	RX	020	Van VB
									RA	021	
							3AT	TV1A53H	RX	025	
									RA	026	
		4 Seater				VB	5MT	TV1A51A	RX	037	Van VB
									RA	038	
							3AT	TV1A51H	RX	042	
									RA	043	
									RM	048	
						VC	5MT	TV1A54A	RE	050	Van VC
									RN	056	
									HE	051	
							3AT	TV1A54H	RE	053	
									RN	058	
									HE	054	

Engine Classification	Transmission Classification	Front Differential Classification	Main Optional Equipment								
			Power Steering	ABS	A/C	Driver Airbag	Radial Tires	Lumber Stay	Passenger Airbag	2 Tone	Compatible with 7 Prefectures
EN07VVNAAO	RM601ASAAD					○		○			
EN07VVNAAA					○	○		○			
EN07VVBAAO	TA981KDAAA					○	○	○			
EN07VVBAAA					○	○	○	○			
EN07VVNAAA	TM601ASAAD		○		○	○	○	○			
EN07VVBAAA	TA981KDAAA		○		○	○	○	○			
EN07VVNABO	TM601ASAAD						○	○			
EN07VVNABA					○		○	○			
EN07VVUAAO	TW601BSAAD	VK3FBN				○	○	○			
EN07VVUAAA					○	○	○	○			
EN07VVBAAO	TZ981KDAAA					○	○	○			
EN07VVBAAA					○	○	○	○			
EN07VVUAAA	TW601BSAAD		○		○	○	○	○			
EN07VVBAAA	TZ981KDAAA		○		○	○	○	○			
EN07YVUAAA	TQ601BBAAD	VK3FBN	○		○	○	○	○			
			○	○	○	○	○	○			
EN07YVBAAA	TZ981KBAAA	VK3FBN	○		○	○	○	○			
			○	○	○	○	○	○			
EN07VVNAAA	TM601ASAAD				○	○					
EN07VVNBAA	TA981KDAAA				○	○	○				
EN07VVNAAO	TM601ASAAD					○					
EN07VVNAAA					○	○					
EN07VVBAAO	TA981KDAAA					○	○				
EN07VVBAAA					○	○	○				
EN0YVVNAAO	TM601ASAAD					○					
EN07VVNAAA					○	○					
EN07VVBAAO	TA981KDAAA					○	○				
EN07VVBAAA					○	○	○				
					○	○	○				○
EN07VVNAAO	TM601ASAAD		○		○	○	○				
			○		○	○	○				○
EN07VVNAAA			○	○	○	○	○				
EN07VVBAAO	TA981KDAAA		○		○	○	○				
			○		○	○	○				○
EN07VVBAAA			○	○	○	○	○				

Body			Model	Engine	Drive Method	Grade (Trim)	Transmission	Vehicle Classification	OP Code	Classification Division Number	Vehicle Name
Van	High Roof	4 Seater	GD-TV2	SOHC SPI	S/T 4WD	VB	5MT	TV2A51A	RX	033	Van VB 4WD
									RA	034	
					F/T 4WD		3AT	TV2A51H	RX	039	Van VB 4WD 3AT
									RA	040	
									RM	046	
					S/T 4WD	VC	5MT	TV2A54A	RE	048	Van VC 4WD
									RN	054	
									HE	049	
					F/T 4WD		3AT	TV2A54H	RE	051	
									RN	057	
									HE	052	
Dias	High Roof	4 Seater	GD-TV1	SOHC SPI	2WD	Dias	5MT	TV1A56A	RE	059	Dias
									RN	063	
									BE	060	
									BB	060	
							3AT	TV1A56H	RE	061	
									RN	064	
									BE	062	
									BB	062	
				SOHC SC MPI		Dias SC	5MT	TV1A5KC	RE	065	Dias Supercharger
									BE	066	
									BB	066	
							3AT	TV1A5KG	RE	067	
									BE	068	
									BB	068	
			GD-TV2	SOHC SPI	S/T 4WD	Dias	5MT	TV2A56S	RE	059	Dias 4WD
									RN	063	
									BE	060	
									BB	060	
					F/T 4WD		3AT	TV2A56H	RE	061	
									RN	065	
									BE	062	
									BB	062	
				SOHC SC MPI	S/T 4WD	Dias SC	5MT	TV2A5KC	RE	067	Dias 4WD Supercharger
									BE	068	
									BB	068	
					F/T 4WD		3AT	TV2A5KG	RE	069	
									BE	070	
									BB	070	

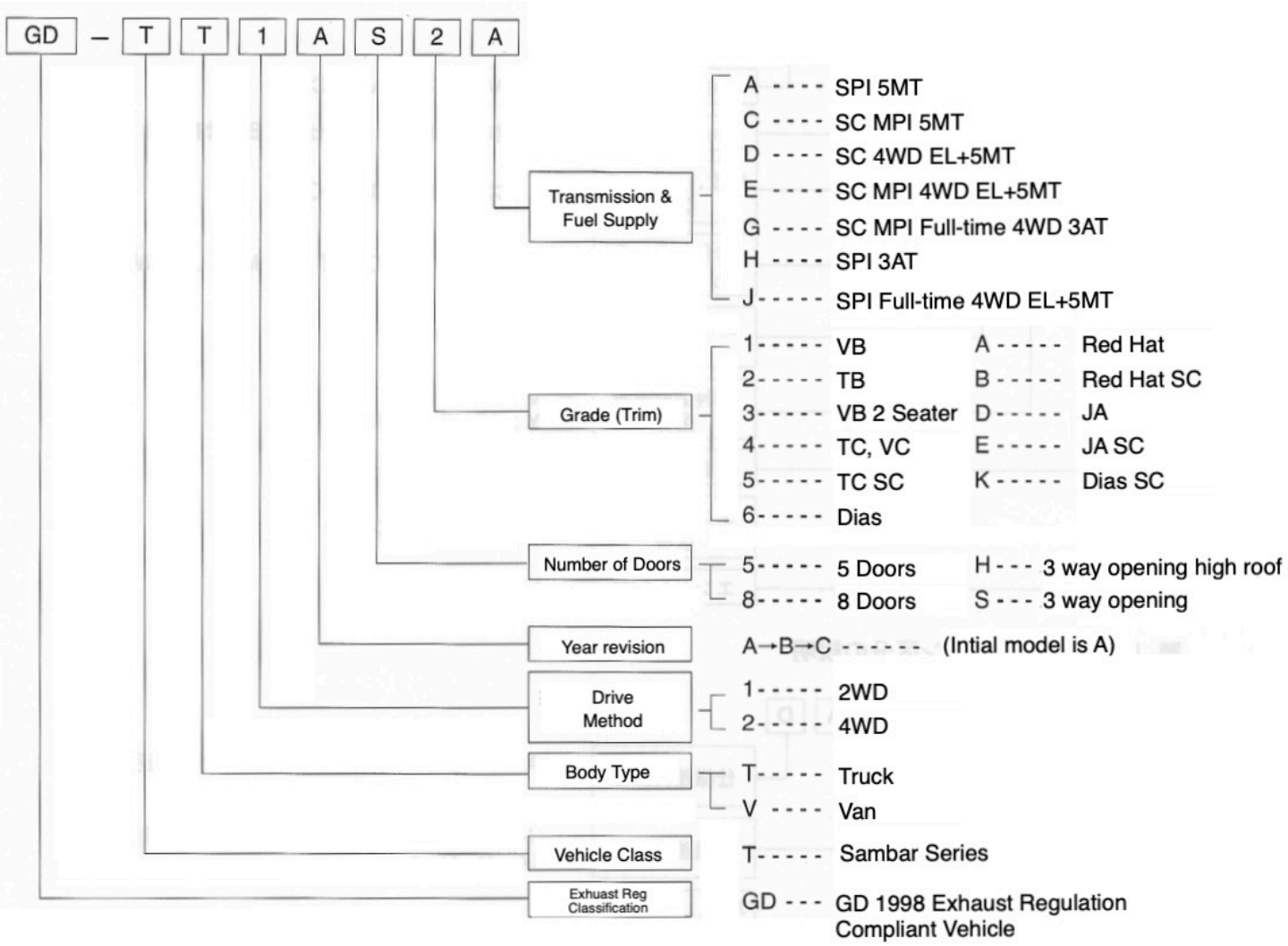
Engine Classification	Transmission Classification	Front Differential Classification	Main Optional Equipment								
			Power Steering	ABS	A/C	Driver Airbag	Radial Tires	Lumber Stay	Passenger Airbag	2 Tone	Compatible with 7 Prefectures
EN07VVUAAO	TW601DSAAD	VK3FBN				○					
ENO7VVUAAA					○	○					
EN07VVBAAO	TZ981KDAAA					○	○				
EN07VVBAAA					○	○	○				
					○	○	○				○
EN07VVUAAA	TW601DSAAD		○		○	○	○				
			○		○	○	○				○
	TW601DSAED		○	○	○	○	○				
EN07VVBAAA	TZ981KDAAA		○		○	○	○				
			○		○	○	○				○
			○	○	○	○	○				
EN07VVNAAA	TM601ASAAD		○		○	○	○				
			○		○	○	○				○
			○	○	○	○	○		○		
			○	○	○	○	○		○	○	
EN07VVBAAA	TA981KDAAA		○		○	○	○				
			○		○	○	○				○
			○	○	○	○	○		○		
			○	○	○	○	○		○	○	
EN07YVNAAA	TM601ABAAD		○		○	○	○				
			○	○	○	○	○		○		
			○	○	○	○	○		○	○	
EN07YVBAAA	TA981KBAAA		○		○	○	○				
			○	○	○	○	○		○		
			○	○	○	○	○		○	○	
EN07VVUAAA	TW601DSAAD	VK3FBN	○		○	○	○				
			○		○	○	○				○
	TW601DSAED		○	○	○	○	○		○		
			○	○	○	○	○		○	○	
EN07VVBAAA	TZ981KDAAA		○		○	○	○				
			○		○	○	○				○
			○	○	○	○	○		○		
			○	○	○	○	○		○	○	
EN07YVUAAA	TW601DBAED	VK3FBN	○		○	○	○				
			○	○	○	○	○		○		
			○	○	○	○	○		○	○	
EN07YVBAAA	TZ98QKBAAA		○		○	○	○				
			○	○	○	○	○		○		
			○	○	○	○	○		○	○	

■ Vehicle, Engine, & Transmission Classification List (Special Sales Vehicles)

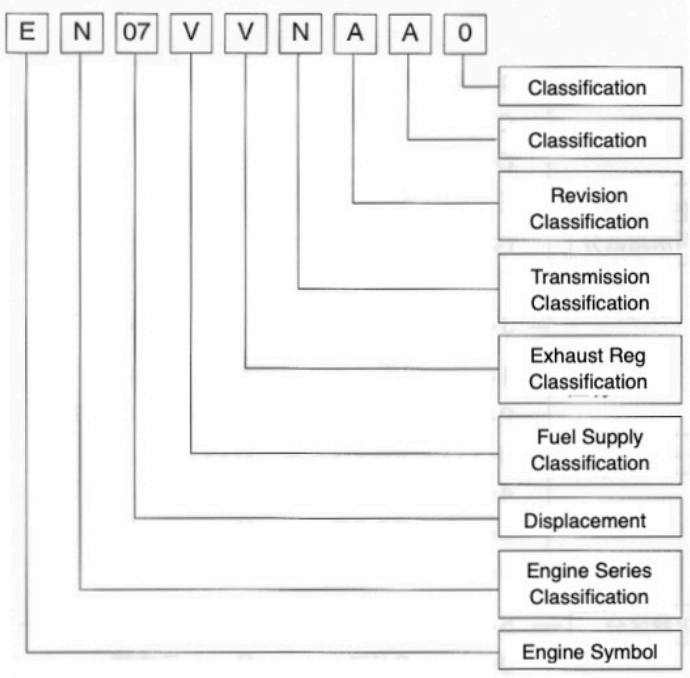
Body			Model	Engine	Drive Method	Grade (Trim)	Transmission	Vehicle Classification	OP Code	Classification Division Number	Vehicle Name
Truck	High Roof	Three Sides Open	GD-TT1	SOHC SPI	2WD	Red Hat	5MT	TT1AHAA	HX	037	Truck Red Hat
									HA	041	
				SOHC SC MPI		Red Hat SC	5MT	TT1AHBC	HA	049	Truck Red Hat Supercharger
							3AT	TT1AHBG	HA	057	
	Standard Roof		GD-TT2	SOHC SPI	S/T 4WD	TB JA	EL+5MT	TT2AS2D	OH	008	Truck TB JA 4WD
									OF	077	
					F/T 4WD		3AT	TT2AS2H	OH	011	
									OF	013	
					S/T 4WD	JA	EL+5MT	TT2ASDD	RJ	033	Truck JA 4WD
									RK	035	
					F/T 4WD		EL+5MT	TT2ASDJ	RJ	037	
									RK	039	
									RJ	041	
				SOHC SC MPI	F/T 4WD	JA SC	3AT	TT2ASEG	RK	050	Truck JA 4WD Supercharger
									RL	052	
									HX	054	
	High Roof			SOHC SPI	S/T 4WD	Red Hat	EL+5MT	TT2AHAD	HA	059	Truck Red Hat 4WD
									HA	063	
Panel Van	High Roof	Two Sides Open	GD-TV1	SOHC SPI	2WD	Red Hat	5MT	TV1A8AA	HA	013	Panel Van Red Hat
				SOHC SC MPI		Red Hat SC	3AT	TV1A8BG	HA	017	Panel Van Akabou Supercharger
			GD-TV2	SOHC SPI	S/T 4WD	Red Hat	EL+5MT	TV2A8AD	HA	009	Panel Van Akabou 4WD
Van	High Roof	2 Seater	GD-TV2	SOHC SPI	S/T 4WD	Red Hat	5MT	TV2A5AA	HA	026	Van Akabou 4WD

Engine Classification	Transmission Classification	Front Differential Classification	Main Optional Equipment							
			Power Steering	ABS	A/C	Driver Airbag	Radial Tires	Lumber Stay	Passenger Airbag	2 Tone
EN07VVNAOO	TM601ASAAD			○		○	○			
EN07VVNAOA				○	○	○	○			
EN07YVNAOA	TM601ABAAD			○	○	○	○			
EN07YVBAOA	TA981KCAAA			○	○	○	○			
EN07VVUABO	TW601BSAAD	VK3FBN				○	○	○		
EN07VVUABA					○	○	○	○		
EN07VVBAAO	TZ981KDAAA					○	○	○		
EN07VVBAAA					○	○	○	○		
EN07CCUABO	TW601BSAAD					○	○	○		
EN07VVUABA					○	○	○	○		
EN07VVNABO	TY601CSAAD					○	○	○		
EN07VVNABA					○	○	○	○		
			○		○	○	○	○		
EN07YVBAAO	TZ981KBAAA	VK3FBN				○	○	○		
EN07YVBAAA					○	○	○	○		
			○		○	○	○	○		
EN07VVUAOO	TW601BSAED	VK3FBN		○		○	○			
EN07VVUAOA				○	○	○	○			
EN07VVNAOA	TM601ASAAD	VK3FBN		○	○	○	○			
EN07YVBAOA	TA981KCAAA			○	○	○	○			
EN07VVUAOA	TW601BSAED			○	○	○	○			
EN07VVUAOA	TX601DSAED	VK3FBN		○	○	○	○			

■ Vehicle Classification Explanation



■ Heading Classification Explanation



0 : No A/C A : With A/C

0 : Red Hat A : Standard B : Farming

A : Start, then B→C

B : RR & F/T 4WD 3AT N : MT U : 4WD MT

V : Domestic commercial system

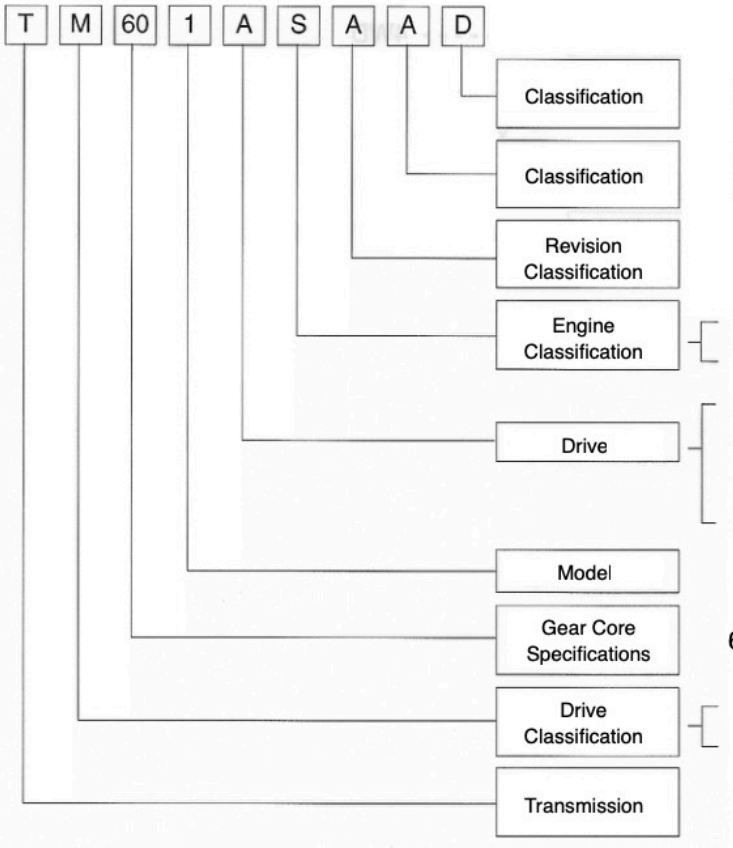
V : SOHC SPI
Y : SOHC SC MPI

07 : 660cc

N : Light 4-cylinder engine

E : Engine

■ Transmission Classification Explanation



A : Displays the differences in specifications for the engine and body (A, B, C…)

Displays the differences in specifications for the transmission (A, B, C…)

A : Start, then B→C

B : SOHC SC MPI D : SOHC SPI (AT)
C : Akabou S : SOHC SPI (MT)

A : 2WD 5MT
B : 4WD EL+5MT
C : Full-time 4WD EL+5MT
D : 4WD 5MT
K : 3AT (2WD & 4WD)

1 : Start, then 2→3

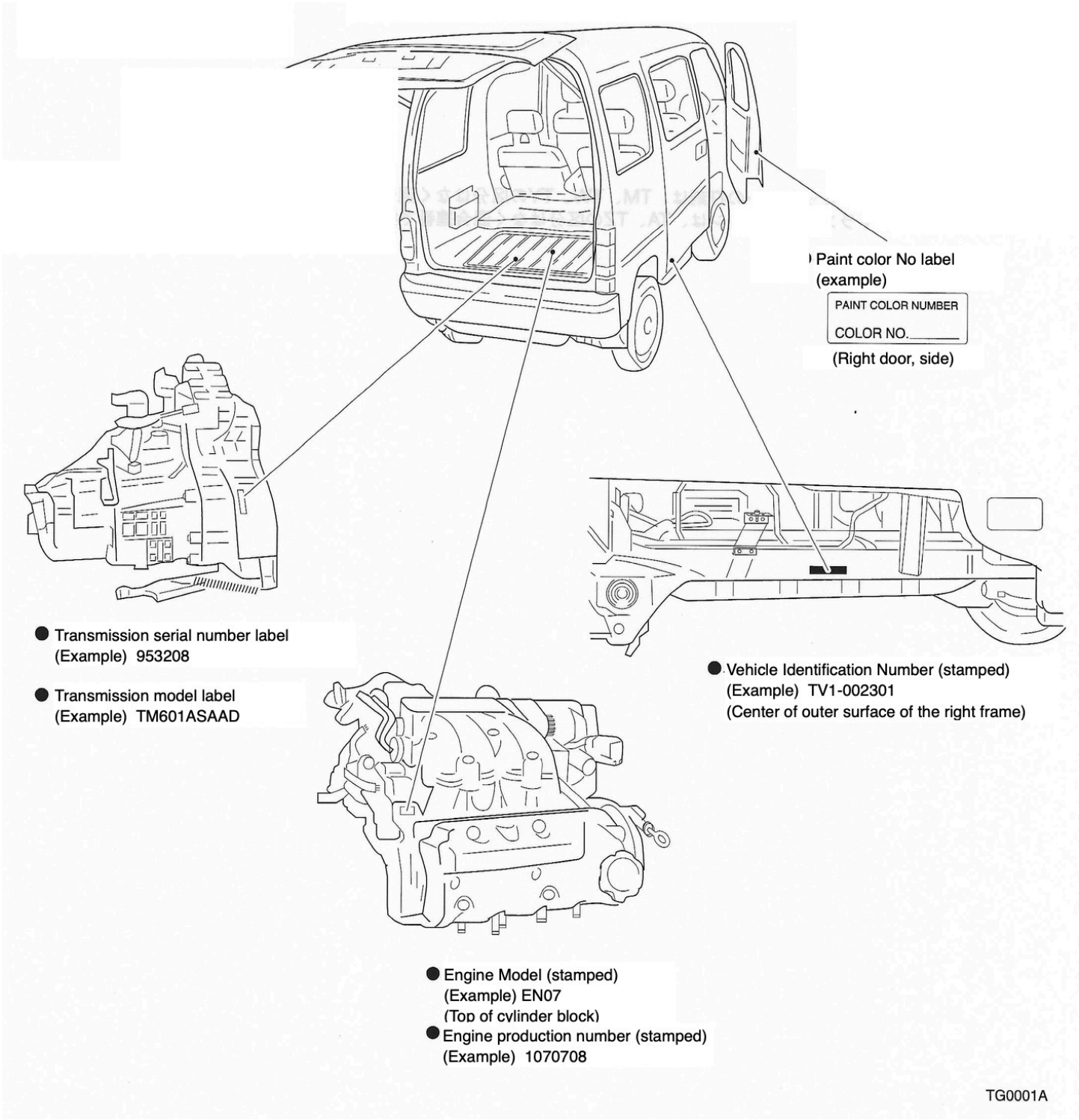
60 : 60mm (5mt) 98 : 98mm (3at)

A : AT M : MT W : 4WD MT
Y : Full-time 4WD MT Z : Full-Time 4WD AT

T : Transmission

1 - 3 Location of Various Stamped Numbers

■ Stamped Number Location



Stamping Starting No

<Vehicle>	<Engine>	<Transmission>
TT1-002001	EN07-974580	(M/T) TM, TW, TY-157379
TT2-002001		(A/T) TA, TZ-476085
TV1-002001		
TV2-002001		

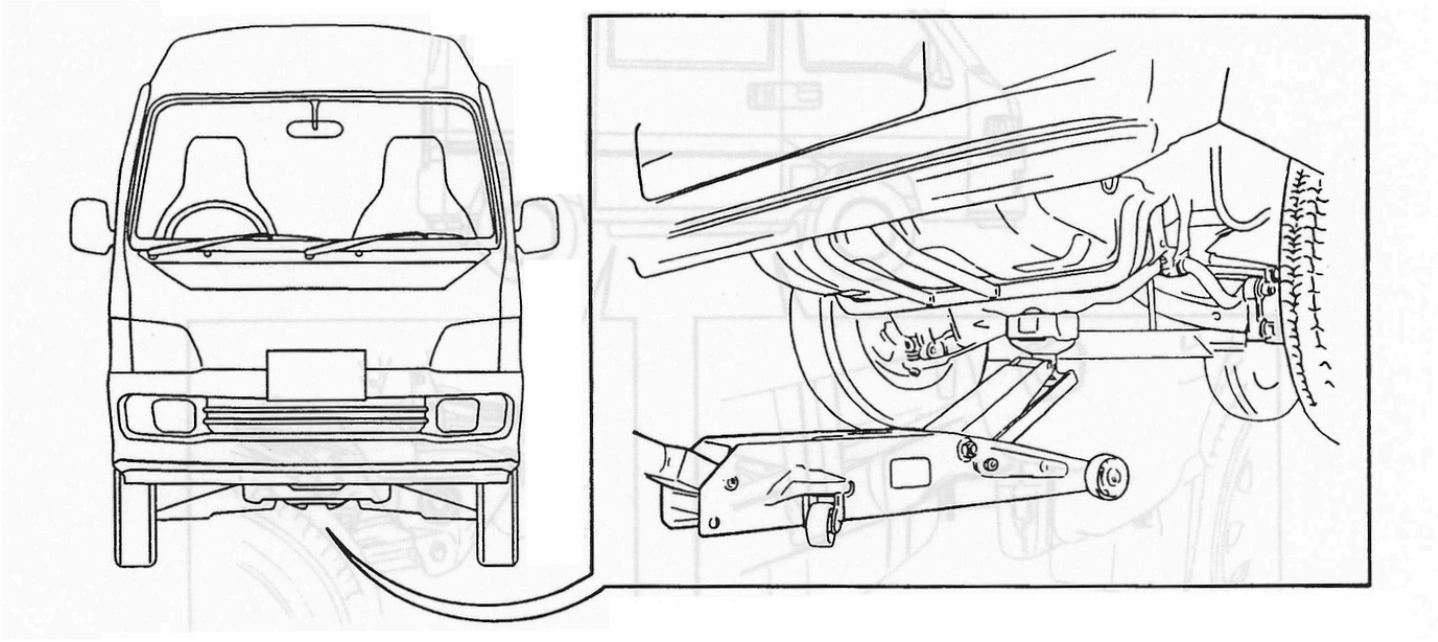
NOTES

1. Manual transmissions are stamped with mixed consecutive numbers, without any distinction between TM, TW, or TY.
2. Automatic transmissions are not classified as TA or TZ, but are identified by mixed serial numbers.

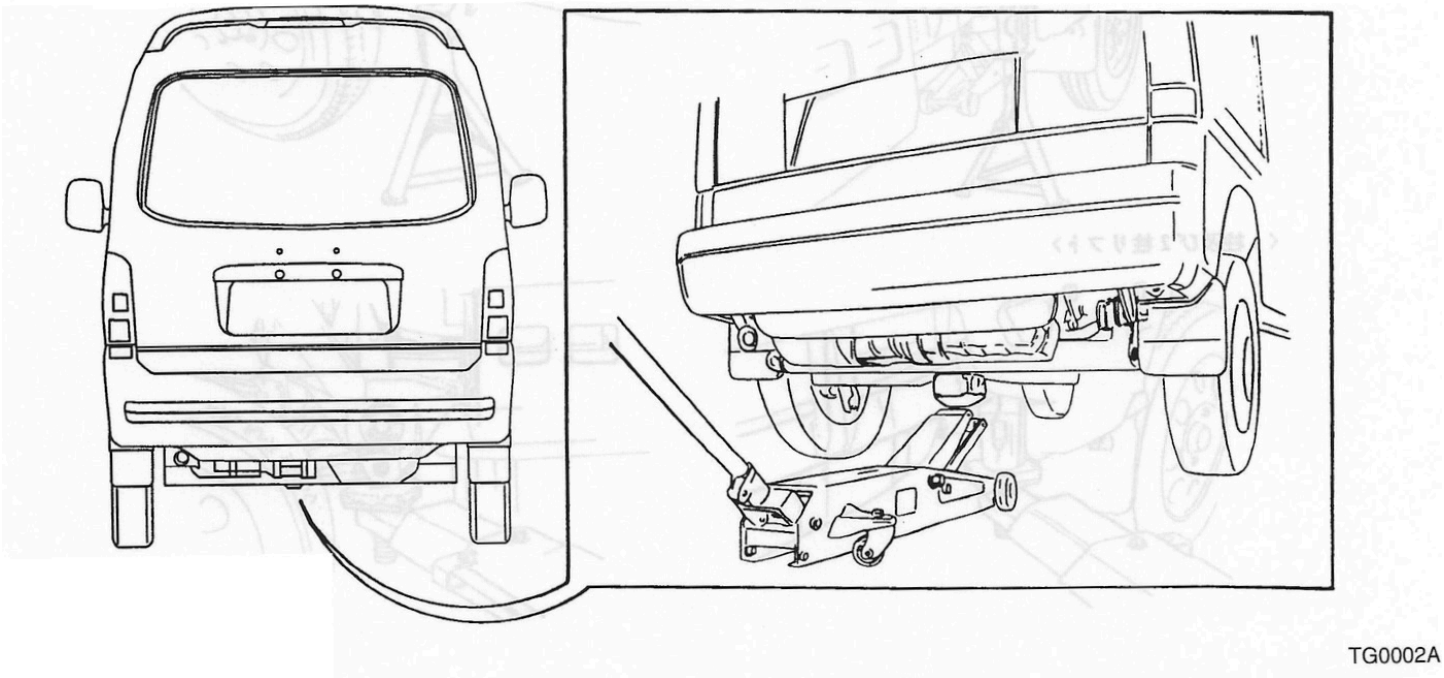
1 - 4 Lift and Jack Points

■ Garage

<Front>



<Rear>

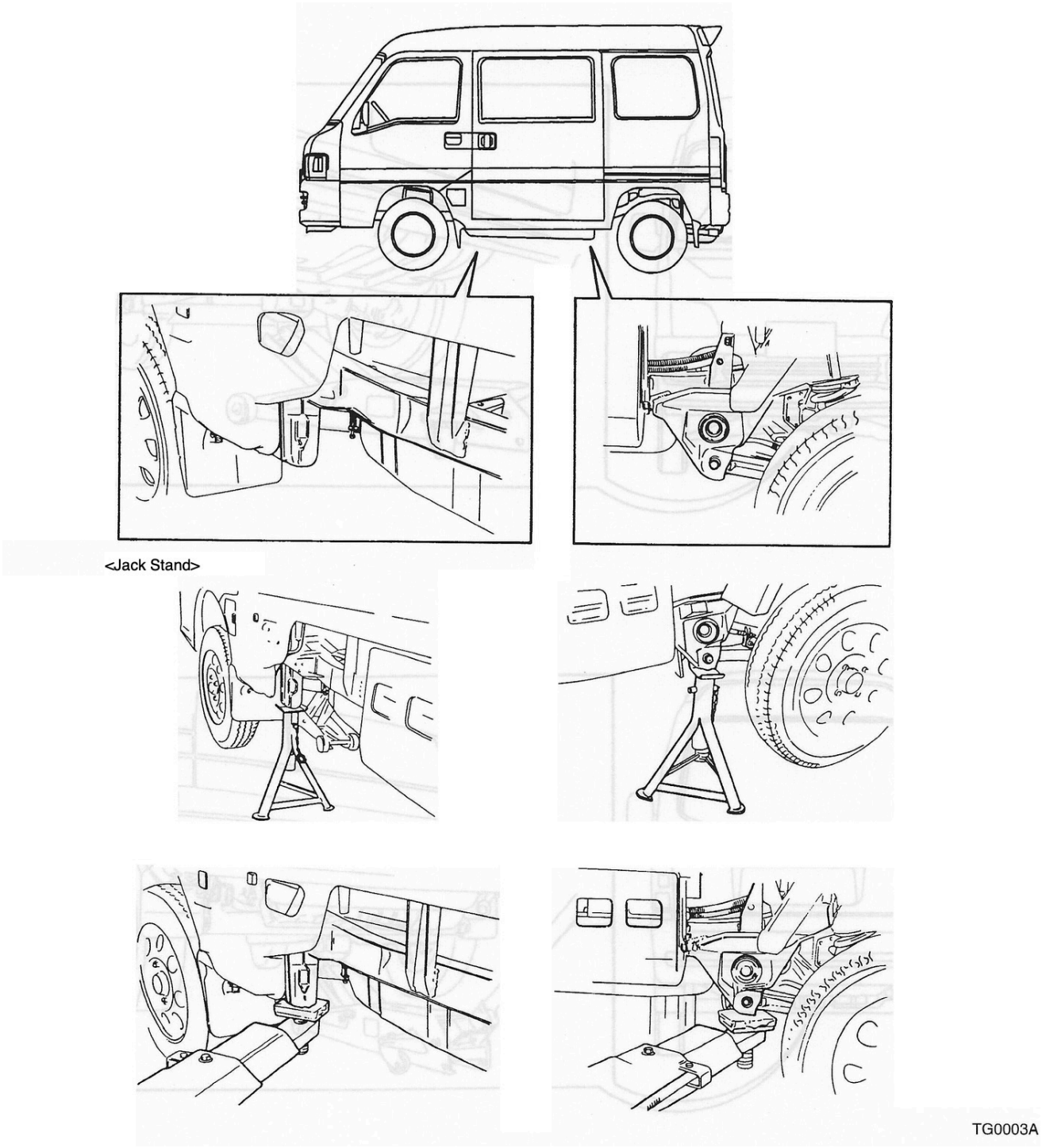


TG0002A

NOTES

- Always chock the tires to prevent the vehicle from rolling.
- Always support the vehicle with a jack stand before carrying out maintenance work.
- When jacking up the vehicle, make sure the spare wheel carrie is in place, regardless of whether the spare tire is installed or not. (Van, Dias 4WD)

■ Jack Stands & Lift



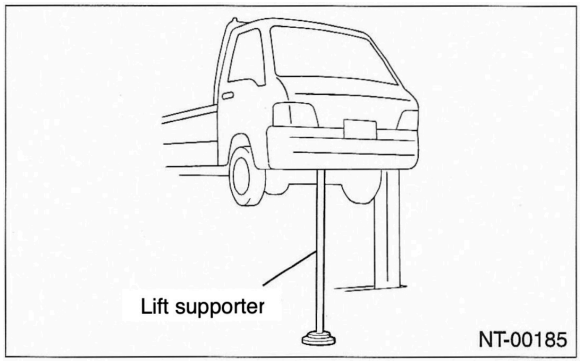
NOTES

- When lifting the vehicle, make sure to secure the spare wheel carrier in place, regardless of whether the vehicle has a spare tire or not. (Van, Dias 4WD)

<Securing the Vehicle When Removing the Engine>

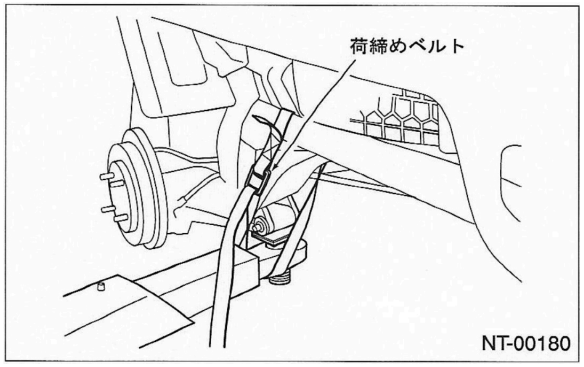
NOTES

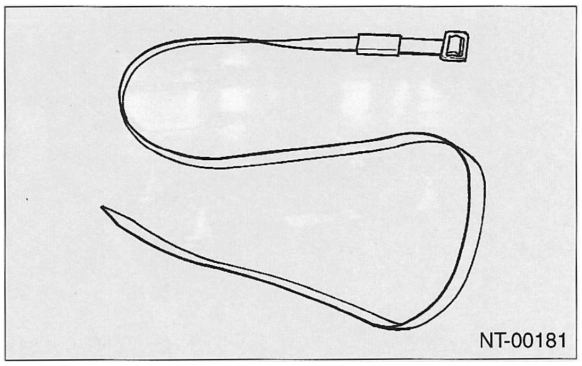
- When the vehicle is lifted at a jacking point and the engine is removed, it may lose balance and fall forward, so after lifting it up, secure the vehicle as follows before starting work.
- In general, work should be carried out using a two-post lift. If it is unavoidable to use a board-on type lift, follow the procedure shown (When using a board-on type lift make sure to use the dedicated equipment).
- After placing the vehicle on a lift and removing the engine, if you do not plan to move the lift until the work is completed, be sure to firmly support the front frame with lift supports or similar.



When Using a 2-Post Lift

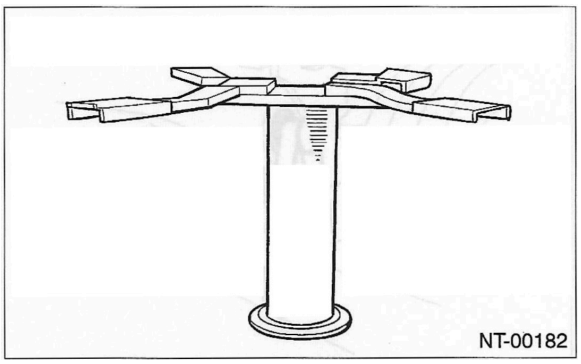
- Securely fasten the frame (near the rear suspension mounting area) to the lift arm using a strap or similar.
- Recommended product:
  - OH Industries., LTD cargo tie-down belt.
  - Width: 25mm
  - Length: 1.8m
  - Breaking strength: 250kg





When using a 1-Post Lift

- As with a two-post lift securely fasten the frame (near the rear suspension mounting area) to the lift using a strap or similar.

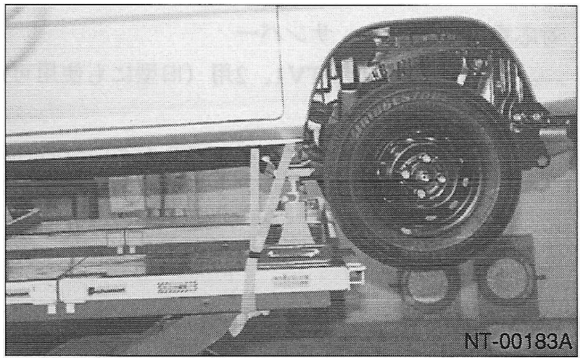


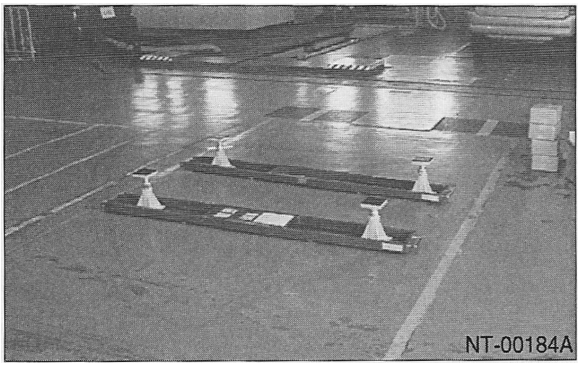
When Using a Board-On Type Lift

- Use the specified attachment for the lift and securely fasten the frame (near the rear suspension mounting area) to the lift with a securing strap or similar.
- Recommended product:
  - Nissan Altia
  - Frame attachment for board-on type
  - LM4000-0001

NOTES

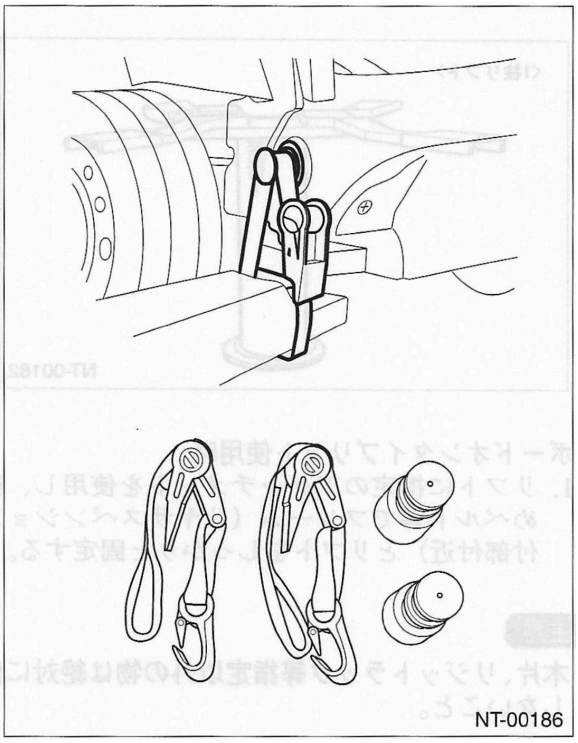
- Never use any items other than those specified, such as pieces of wood or jack stands.





REFERENCE

- Banzai Co., Ltd sells special tools that allow you to safely secure vehicles.



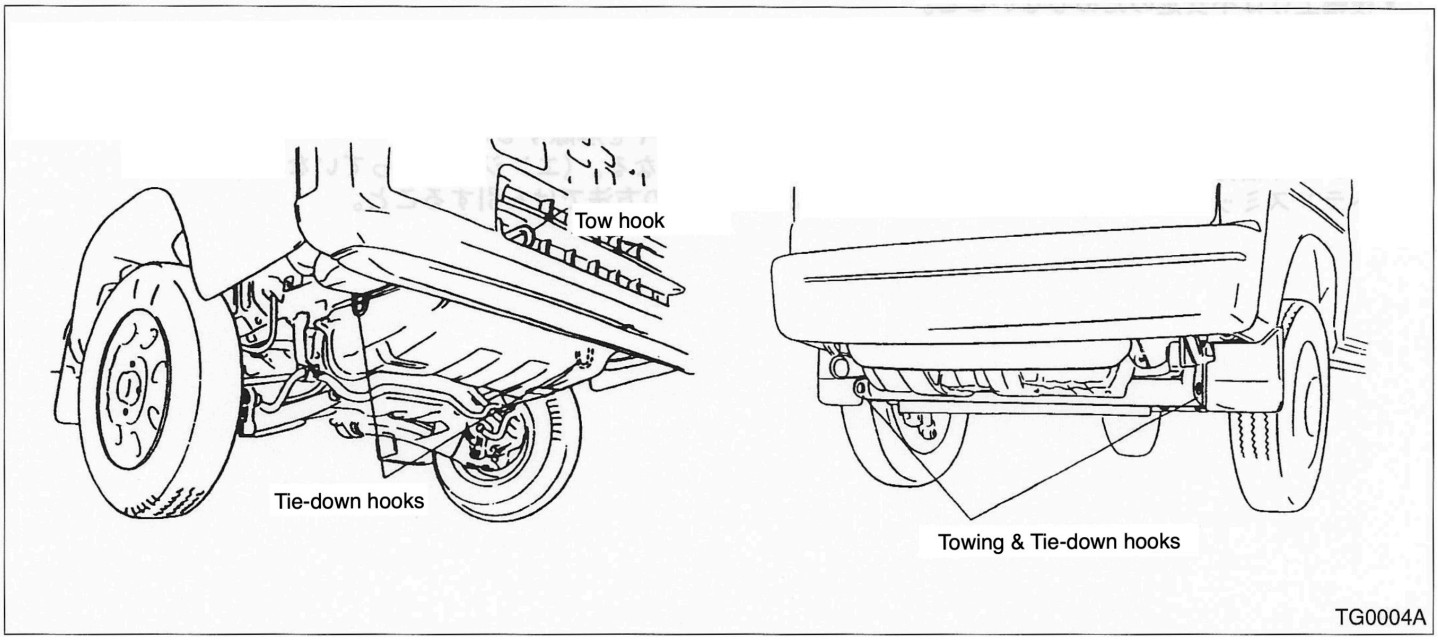
Name	:	Safety Clamp Kit
Components	:	2 Brackets 2 Racket Belts
Compatible Vehicles	:	Subaru Sambar TT1, TT2, TV1, TV2 (Also usable for older models)
List Price	:	25,000 YEN

Insert the plug into the frame and fasten the lift arm with a belt. Note that this is for arm lifts only and cannot be used with plate lifts.

For more information or inquiries about the above products, please contact any of Banzai's sales offices.

1 - 5 Towing & Tie-down

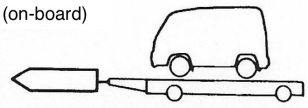
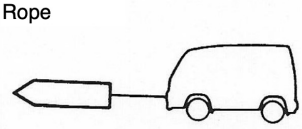
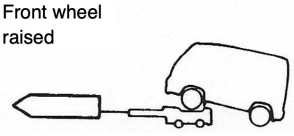
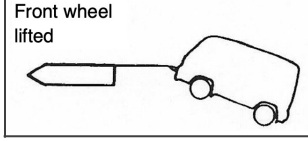
Towing & Tie-down Hooks



NOTE

- When towing or being towed using a rope, use the designated towing hook.
- Tie-down hooks are for use when transporting a vehicle, not for towing.

Towing Method

Towing Method	Cautions/ Prohibitions	Suitable for Vehicle				
		2WD		4WD		
		MT	AT	Selective MT	Full-time MT	Full-time AT
4-Wheel Lift (on-board) 	• In general, for 4WD vehicles, it is essential to tow with all 4 wheels raised.	○	○	○	○	○
Rope 	• Check that both the front and rear wheels rotate normally. • AT vehicles driving conditions: 30 km or less 30 km/h or less • Full-time vehicles (both MT & AT) must have 4WD disabled. Selective vehicles must be switched to 2WD.	○	△	△	△	△
Front wheel raised 	• Full-time vehicles (both MT & AT) must have 4WD disabled. Selective vehicles must be switched to 2WD.	○	○	△	△	△
Front wheel lifted 	• Prohibited as it will damage the bumper, front grille, etc. • Do not lift by the bumper.	X	X	X	X	X

○: OK X: Prohibited △: Conditionally OK

NOTES

- Do not raise the rear wheel as it will make the vehicle unstable.
- Check the gear oil and rear differential oil before driving.
- When towing, place the shift lever in the “N” position.
- Turn the ignition key to the “ACC” position and check that the steering wheel moves freely.
- Release the parking brake to prevent tire drag.
- The brake booster does not work, resulting in poor braking performance (when the engine is not running).
- In the event of an internal transmission failure, tow the vehicle using four wheels (mounted on the vehicle).

1 - 6 Work Basics

Precautions When Installing a Radio

Although carious computers (control units, ECUs) are designed with significant protection against external radio interference, installing a radio in a vehicle may have a negative effect on the ECU. Therefore, please make sure that users understand the following points:

1. The radio unit and antenna must be at least 200 mm away from the ECU.
2. Do not install a radio with an output of 10W or more.

Precautions When Installing Optional Parts

When installing optional electrical parts, follow the instructions and manuals, but pay attention to the following points.

1. Determine the size of the wiring harness taking into consideration the electrical load of optional parts so that excessive current does not flow through the wiring harness.
2. Route the wiring harness along the existing harness.
3. When using live circuits, protect them with tape or other means, secure them securely, and take care to prevent contact with other components.

Precautions When using a Car Wash

1. Avoid washing the computers and connectors (especially in the engine compartment)
2. High-pressure car washes and steam car washes may cause deformation or damage to plastic products due to water pressure and temperature, so keep the nozzle at least 30 cm away from the vehicle body washing.

Maintenance & Vehicle Protection

1. Be sure to attach fender covers, seat covers, etc. before starting work.
2. The intercooler fins and radiator fins are easily damaged, so do not allow them to come in contact with other parts.

Work Safety

1. When jacking up only the front or rear of a vehicle, be sure to use wheel chocks.
2. When jacking up a vehicle, always support it at a designated position with a jack stand.
3. When working with two or more people, they should call out to each other and check each other's safety.

Work Accuracy

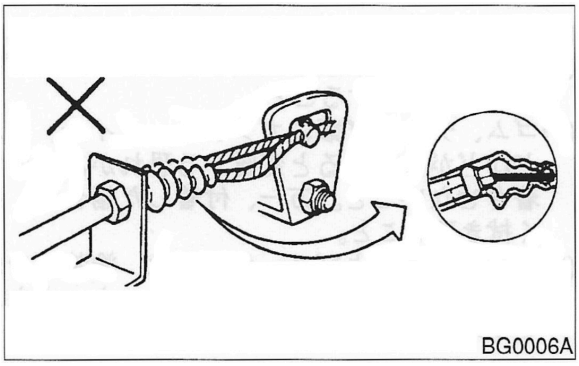
1. Identify the defective area and investigate the cause of the failure, and follow the procedures outlined in the manual.
2. The tightening torque and adjustment standards for bolts and must must comply with the specified maintenance standards.
3. Use the specified special tools.
4. Use genuine parts.

•Always use genuine SUBARU parts, oils, and consumables.

5. Do not reuse non-reusable parts (marked with ★).
6. When replacing bolts and nuts, be sure to use the specified parts.
7. Do not allow gasoline, oil, fluids, etc. to get on rubber or tubes as this may cause deterioration. If any of these gets on them, wipe them off quickly.

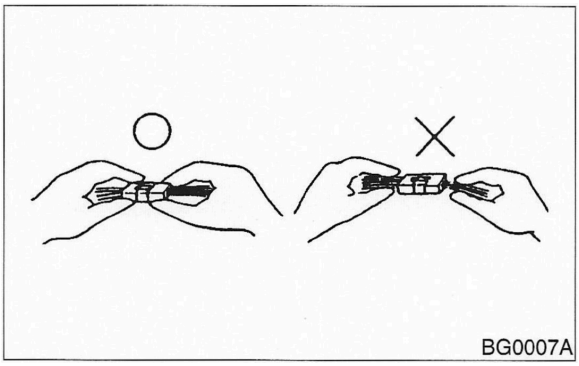
Cable Work

Route the accelerator, clutch, and other cables correctly (as they were when the vehicle was new). If the cables are bent too much, the lifespan of the cables may be shortened.

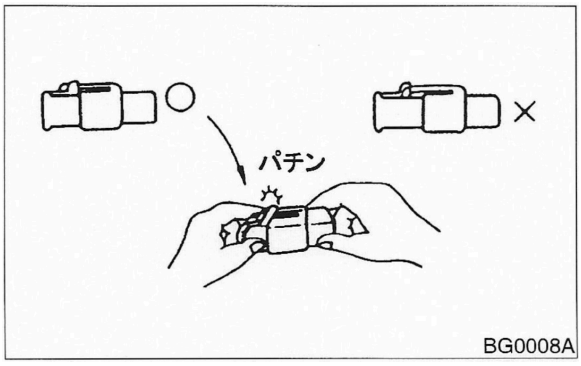


Electrical System Work

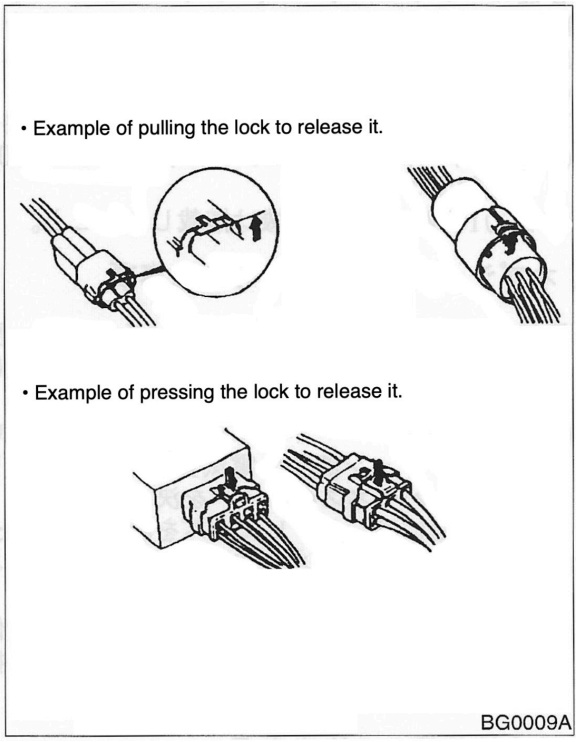
1. Always disconnect the negative battery terminal before starting work.
2. If a fuse blows, investigate the cause and repair it, and be sure to use a fuse of the specified capacity. Using a fuse with a larger capacity may not only damage the components but also cause a vehicle fire.
3. Connector installation precautions:
   1) Hold the connector body when removing it (do not pull on the harness).



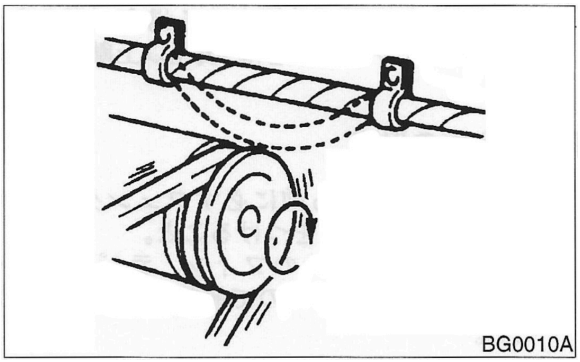
2) Make sure to fully insert the connector. For locking connectors, insert them completely until you hear a click.



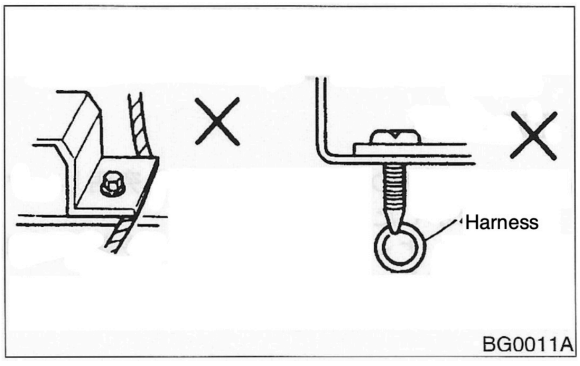
3) Always unlock the connector before disconnecting it.



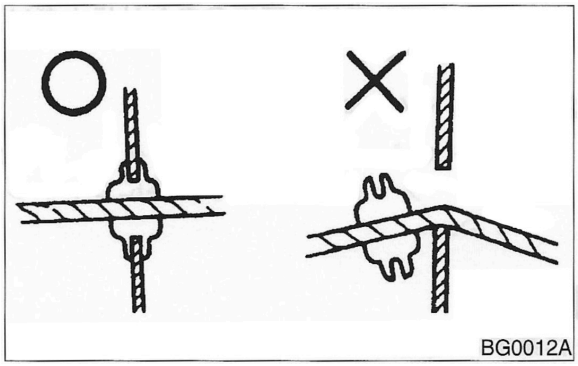
4) Clamp the wiring harness so that it does not come into contact with rotating, moving, or vibrating parts.



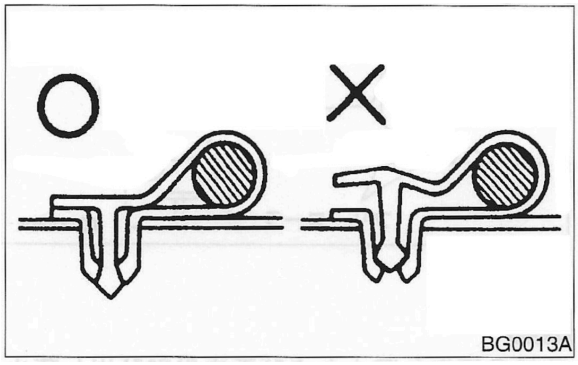
5) Routing the wiring harness so that it does not come into contact with the edges of the body, sharp corners, or the ends of the bolts or screws.



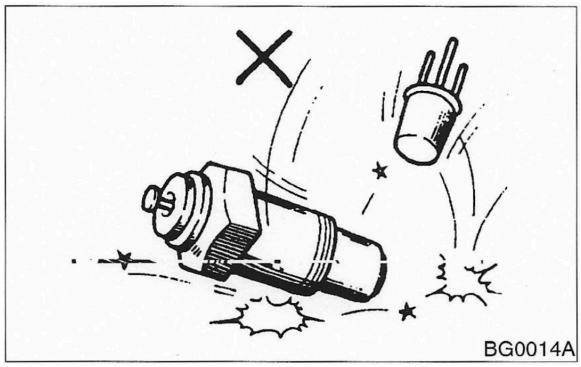
6) If the wiring harness has grommets, make sure they are securely installed.



7) Harness bands, clamps, clips, brackets, etc. must be securely attached for fixed.



8) Sensors and relays are extremely sensitive to impacts, so handle them carefully and avoid dropping or throwing them.



1 - 7 Measurement Procedures for Vehicle Inspections

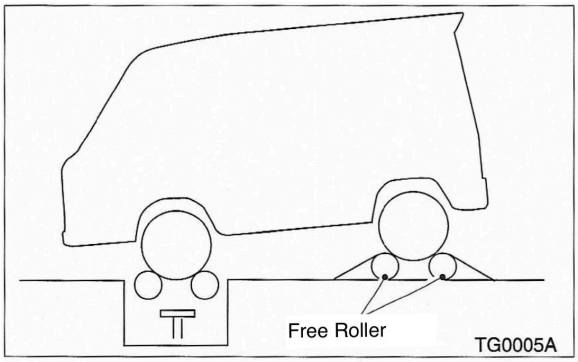
■ Precautions When Measuring Full-Time 4WD Vehicles

NOTES

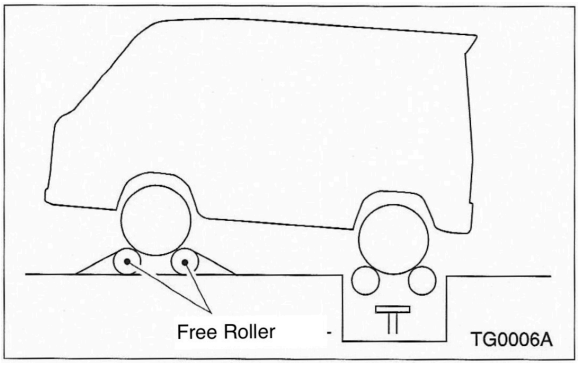
- Brake tests and speedometer tests during vehicle inspection must be carried out on a single-axle free roller facility at a minimum.

(1) Brake Test

1. Adjust the free roller to fit the vehicle's wheelbase and set it securely.
   - Wheelbase: 1885mm
2. The front or rear wheel is measured while on a free roller.



<Front Wheel Brake Test>



<Rear Wheel Brake Test>

3. When brake drag is too strong.
   - Check that the brake pads or brake shoes are not dragging.

<Judgement Criteria>

	Braking Force
Rear Wheel Sum	10% or more of the axle load
Difference between left & right wheels	8% or less of the axle load
Total Sum	More than 50% of the vehicle weight at the time of inspection

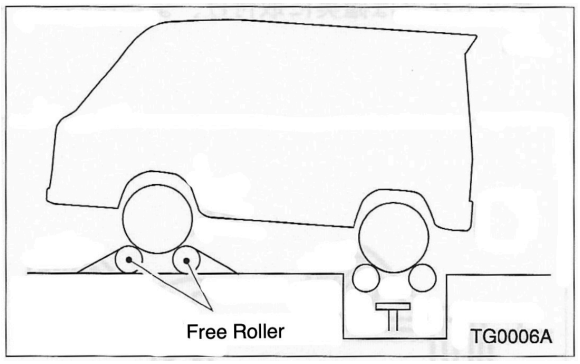
If all the wheels on the front axle are locked and measurement is difficult, the vehicle will be deemed to comply with the total in that state.

NOTES

- The vehicle may shift backward near the wheel lock and come off the tester and free roller. Before stepping on the crake pedal, make sure there are no people around the vehicle and it is safe.

(2) Speedometer Test

- Place the front wheel on the speedometer tester and the rear wheel securely on the free rollers to measure.



NOTES

- Avoid sudden clutch operation or sudden acceleration/ deceleration while testing.

NOTES

- To prevent the front wheels from swaying sideways and the vehicle from jumping out, attach tension hardware (chains, wires) to the front and rear tow hooks or tie-down hooks to secure the vehicle.
-

2 Engine

2 - 1 Engine Overview

Specifications

Engine Classification		EN07V	EN07Y
Cylinder Alignment		Inline 4 cylinder horizontally mounted	
Total Displacement (cc)		658	
Inner Diameter x Stroke (mm)		56.0 X 66.8	
Compression Ration		10.1	8.3
Valve Mechanism	**Method**	SOHC	
	Number of Valves	Intake 1 - Exhaust 1	
Fuel Supply Method		EGi (SPi)	EGi (MPi)
Type of Fuel		Unleaded Regular Gasoline	
Maximum Output (PS/rpm)		46/4600	58/6000
Maximum Torque (kg·m/rpm)		5.9/4000	7.5/4000
Ignition Timing °BTDC/rpm)	**MT**	10±3/750±50	
	AT	10±3/750±50	
Firing Order		#1-2-3-4	
Idling Speed (Rpm)	**MT**	750±50	
	AT	750±50	

2 - 2 Engine Inspection & Adjustment

■ Preparations

✻ Newly released tools

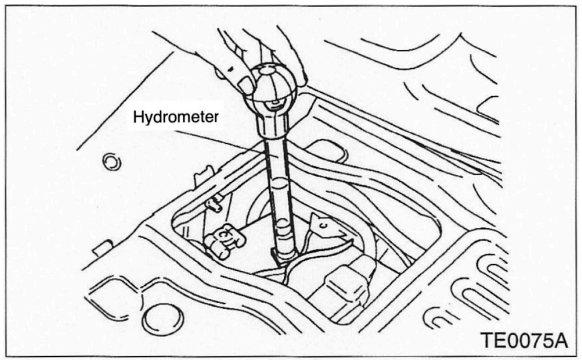
Classification	Tool Number	Name	Purpose
Instrument		Battery Hydrometer	Checking the battery charging status
		Radiator Cap Tester	Radiator cap and coolant leak check
		Coolant Tester	Checking coolant concentration
		Spark Plug Gap Gauge	Inspecting the spark plug gap
		Belt Tension Gauge	Checking the V-ribbed belt tension
		Engine Tuner (Tachometer, ignition timing meter)	Checking the engine speed and ignition timing
	Toyo Tech GU-51C	Compression Gauge	Compression measurement
		Vacuum Gauge	Intake manifold negative pressure measurement
		CO, HC Measure Meter	Exhaust gas CO & HC inspection
ST	49854 5400	Oil Filter Wrench	Oil filter removal
	✻ 49920 6400	Crank Pulley Wrench	Crank pulley stopper
	✻ 49920 6500	Attachment	Attachment for above
	22771 AA0120	Subaru Select Monitor Kit	Inspection of engine speed (Select Monitor + Connection Cable)
	24082 AA120	Cartridge for Subaru Select Monitor	For Select Monitor
	92543 1000	Tail Pipe Attachment	Exhaust gas CO & HC inspection
Others	Subaru Genuine	Engine Oil, Coolant, etc	Refilling engine oil, coolant, etc

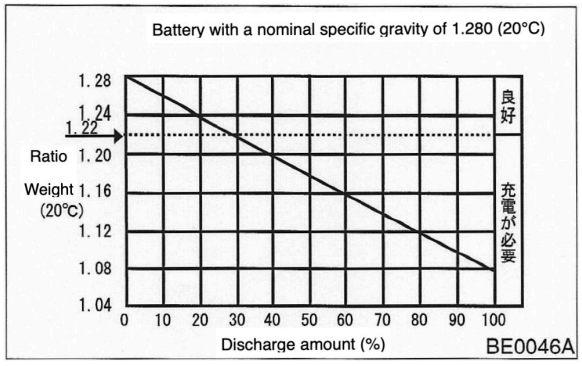
■ Maintenance Instructions

(1) Battery

<Inspection/Adjustment>

1. Check that the battery fluid is between the upper and lower levels.
2. If the battery fluid is below the lower level, add distilled water up to the upper level.
   - If it is above the upper level, drain it to the upper level to prevent overflow.
3. Check the battery's state of charge.
4. Check the terminal for contact and corrosion.
   - Apply a thin layer of grease or Vaseline to the positive terminal.





(2) Coolant

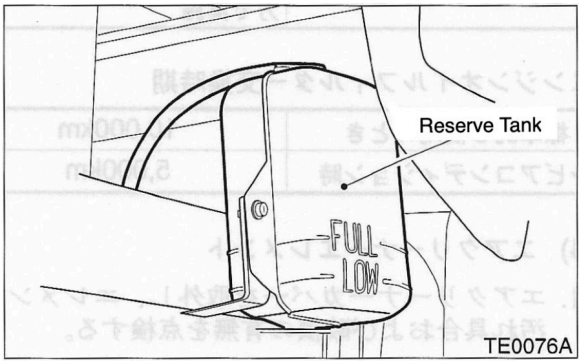
<Inspection/Replacement>

1. Check that the coolant level is the radiator reserve tank is between the FULL and LOW levels.

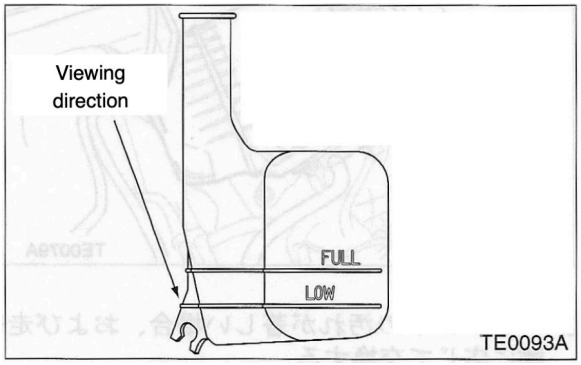
NOTE

- Check and add coolant when the engine is cold.
- Check that the hose is properly inserted to the bottom of the reserve tank, and correct if it is not.

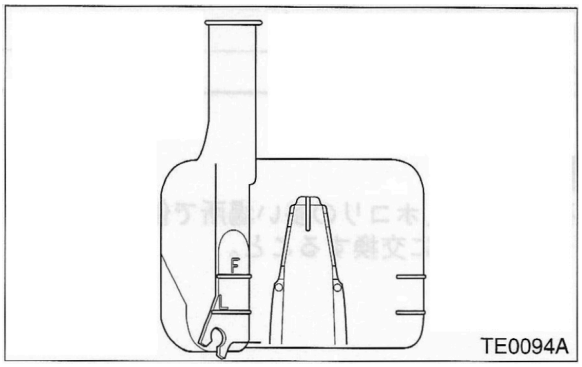
Truck



Van
Reserve tank from left side.



Reserve tank from the front side



2. If the level is close to LOW, add coolant up to the FULL level.
   - If the coolant is above the FULL line, remove the excess.
3. If the reserve tank is nearly empty or the hose is not inserted correctly, refill the coolant in the radiator or the engine hose, then add coolant unto the FULL level in the reserve tank.

- For instructions on how to change the coolant, refer to the Engine Cooling chapter.

✻ Coolant concentration and safe operation temperature.

Specification	General Use	Cold Region
Coolant Concentration	30%	50%
Safe use temperature (freezing)	-10°C (-15°C)	-28°C (-35°C)

✻ Inspection and replacement period

Inspection Period	Pre-delivery, 1 month inspection, 6 month inspection
Replacement Period	Every 40,000 km or every 2 years

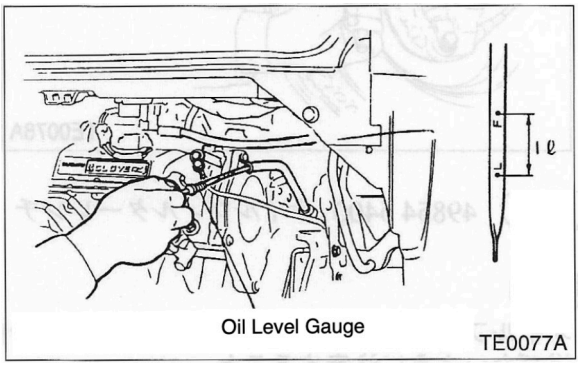
(3) Engine Oil & Oil Filter

<Inspection/Replacement>

1. Remove the engine oil level gauge and check the oil level and the oil condition. Wipe the tip of the level gauge with a cloth, then reinsert the level gauge and check the oil level.

NOTE

- Check the engine oil level with the vehicle on a level surface and after the engine has been stopped for at least 5 minutes.
- Make sure to insert the level gauge all the way to the base.



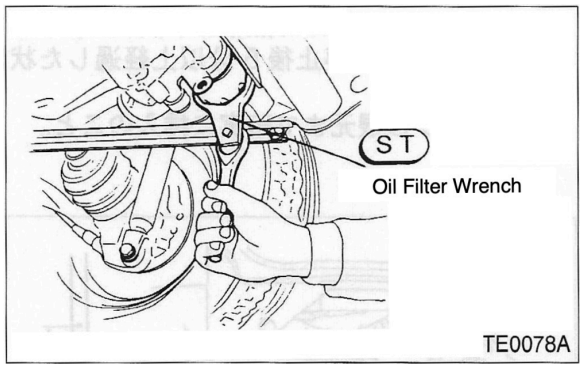
2. If the oil level is low, remove the oil filler cap and add oil until it reaches the full level.

Vehicle Type	Oil Type			Capacity (liters)	
	Oil Name	SAE Number	API Class	Lower Level	Full Level
MT	SG	10W-30	SG	≈1.4	≈2.4
	SH	10W-30	SH		
	SJ	5W-30	SJ		
AT	SG	10W-30	SG	≈1.5	≈2.5
	SH	10W-30	SH		
	SJ	5W-30	SJ		

NOTE
- In cold climates, we recommend using SJ oil (5W-30). When changing the oil filter add approximately 0.2 liters more than the amount listed above.
- Adjust the oil level using the oil level gauge, referring to the table above, and fill up to the FULL level.

<Removing the Oil Filter>

1. Replace the oil filter when the engine oil is very dirty and according to the mileage.
2. Jack up the vehicle and remove the under cover.
3. Prepare a suitable oil receiving container below the oil filter, and use an oil filter wrench to remove the oil filter.



ST 49854 5400 Oil Filter Wrench

NOTE
- When removing the oil filter, be careful not to get spilled oil on your body.

<Installing the Oil Filter>

1. Apply engine oil to the entire circumference of the ring on the oil filter mounting surface.
2. Install the filter by turning it by hand until the o-ring touches the engine mounting surface.
3. Once it touches the mounting surface, tighten it an additional 2/3 to 3/4 turns.
4. After installation, check the engine oil level with a level gauge.
   - After checking, start the engine and check that there are no oil leaks.

✻ Engine Oil Replacement Period

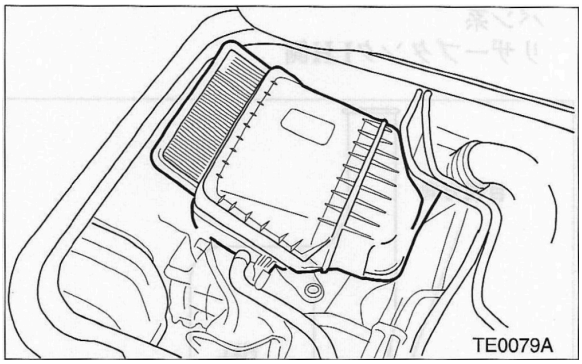
Standard Use	Every 10,000km or every 6 months, whichever comes first.
Severe Conditions	Every 5,000km or every 3 months, whichever comes fist.

✻ Engine Oil Filter Replacement Period

Standard Use	10,000km
Severe Conditions	5,000km

(4) Air Filter Assembly

1. Remove the air cleaner cover and check the filter for dirt or damage.



2. Replace the filter if it is very dirty or according to the mileage.

✻ Air Filter Replacement Period

Standard Use	40,000km
Severe Conditions	20,000km

NOTE
- If the vehicle is used in dusty conditions such as gravel roads, replace them sooner.

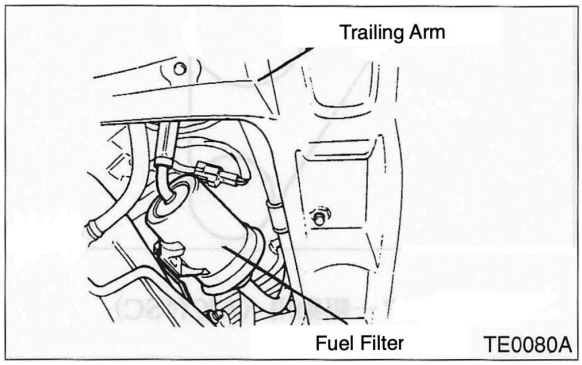
(5) Fuel Filter

1. Check for debris and water in the fuel filter. If there is water in the fuel filter, shake it with the inlet facing downward as to remove the water.
2. Replace if there is obvious clogging or cracks or when it is time for regular replacement.

✻ Fuel Filter Replacement Period

60,000km

3. Replacement Instructions
   1) Reduce the fuel pressure.
      • For fuel pressure reduction methods, refer to the chapter on engine removal and installation.
   2) Disconnect the negative (-) battery terminal cable.
   3) Remove the fuel filter from under the floor.



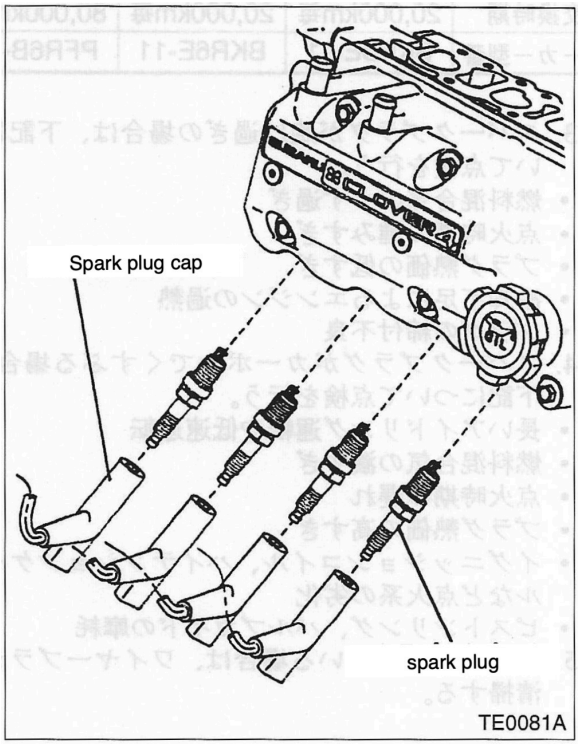
   4) Install the new fuel filter.

NOTE
• Make sure to insert the fuel hose securely.

(6) Spark Plug

<Removal and Inspection>

1. Remove the spark plug cap.



NOTE
• If the plug cap is stuck to the plug, turn it and then remove it. When doing this, tilting the cap or using pliers or other tools may damage the terminal fittings and the cap, so pull it straight out by hand.

2. Remove the spark plug and inspect the following items. Clean, repair, or replace as necessary.
   • Dirt on the electrode
   • Presence of deposits
   • Electrode gap
   • Cracks in the insulator insulation
   • Damage to the terminal
   • Damage to the gasket

NOTE
• Akabou vehicles use highly durable platinum plugs.

✻ Spark Plug Gap & Replacement Period

	General NA	General SC	Red Hat
Gap Reference Value	1.0~1.1mm	←	←
Replacement Period	Every 20,000km	Every 20,000km	Every 20,000km
Model #	BKR5E-11	BKR6E-11	BKR6B-11

3. If the spark plug is overheated, check the following:
   - Fuel mixture is too lean.
   - Ignition timing is too advanced
   - Spark plug thermal range is too low
   - Engine overheating due to insufficient cooling
   - Improper tightening of the plug
   - Damage to the gasket
4. If the spark plug is smoldering due to carbon, check the following:
   - Long idling or low speed driving.
   - Fuel mixture is too rich.
   - Ignition timing delay
   - The spark plug heat value is too high
   - Deterioration of the ignition system, such as the ignition coil or high tension cable.
   - Wear of piston rings and valve guides.
5. If the electrode is dirty, clean it with a wire brush.

NOTE

- Akabou vehicles use spark plugs with titanium tops, so please avoid using spark plug cleaner.

<Installation>

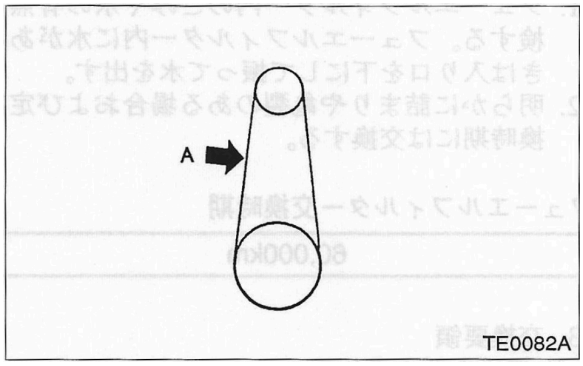
Insert the spark plug into the plug wrench and temporarily tighten it with your fingertips until the plug seats, then tighten it completely.

✻ Spark Plug Tightening Torque
T 21 ± 3N•m [2.1 ± 0.3kg•m]

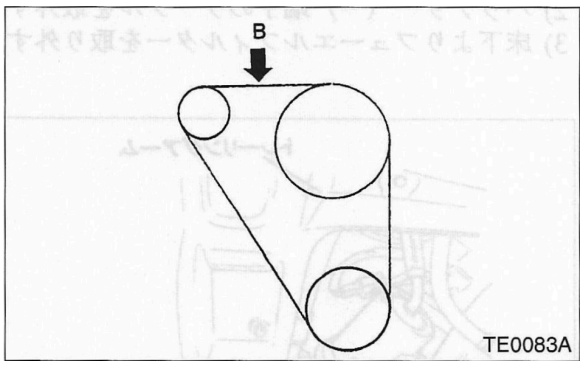
(7) V-Ribbed Belt

1. When the engine is running, check the belt for slack and alignment, and make sure that the belt does not wobble or rotate sideways.
2. Check the belt for cracks, damage, and oil buildup, and replace any that are severely damaged.
3. Check the amount of belt slack.

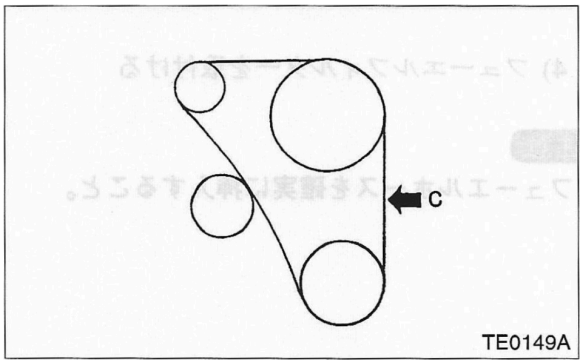
Alternator Belt (without A/C)



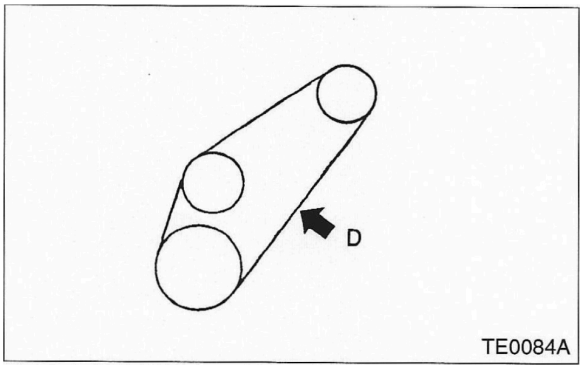
Alternator Belt (NA with A/C)



Alternator Belt (SC with A/C)



Supercharger Belt



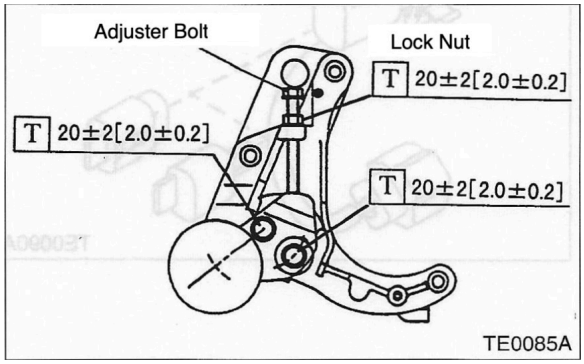
✻ Standard deflection value when pushed by hand (pushing force 98N [10kg])

Measurement Point	Used Belt	New Belt
A: Alternator without A/C	10.5~13.5mm	7.5~10.5mm
B: Alternator (NA with A/C)	6~7mm	5~6mm
C: Alternator (SC with A/C)	4~6mm	4~5mm
D: Supercharger	6.5~7.5mm	5.5~6.5mm

4. If the deflection is outside the standard value, adjust the belt tension.
   1) Alternator Belt
      • Loosen the alternator fixing bolts and adjust them to adjust the belt tension.

✻ Alternator Tightening Torque
T 25 ± 2 N•m [2.5 ± 0.2 kg•m]
T 19 ± 2 N•m [1.9 ± 0.2 kg•m] (Adjustment side)

   2) Supercharger Belt
      • Loosen the supercharger belt lock nut and adjust the belt tension by moving the belt tensioner using the adjustment bolt.



(8) Compression Pressure

<Inspection>

1. Warm up the engine thoroughly (until the radiator fan starts operating twice).
2. Disconnect the injector harness connector.
3. Remove all the spark plugs.
4. Install a compression gauge in the spark plug mounting hole and measure.

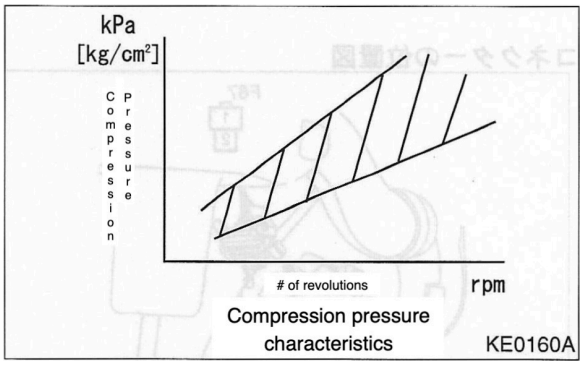
NOTE
- Use a compression gauge with a thread length of 18mm or less.
- Use a fully charged battery.
- Use a starter motor that is in good working order and in good condition.

3) Fully open the throttle valve.
4) Crank the engine with the starter motor and read the highest value when the gauge needle comes to a standstill.
5) Perform the test at least twice for each cylinder and check the variation in measurements.

5. If the compression test is low, check the following:
   1) Valve compression leak.
   2) Piston ring wear.
   3) Piston or cylinder wear.

✻ Compression Pressure

	NA (SN07V)	SC (EN07Y)
Compression Ratio	10.1	8.3
Compression Reference Value (kPa/rpm [kg/cm²/rpm])	1140/300 [11.6/300]	960/300
Differential Pressure between Cylinders (kPa [kg/cm²])	98 [1.0] or less	←
Limit (kPa [kg/cm²])	990 [10.1]	810 [8.3]



(9) Ignition Timing

NOTE

- Use a timing light to check the actual ignition timing. The Select Monitor's ignition timing is the ignition timing signal value from the control unit, so it may not match the actual ignition timing.

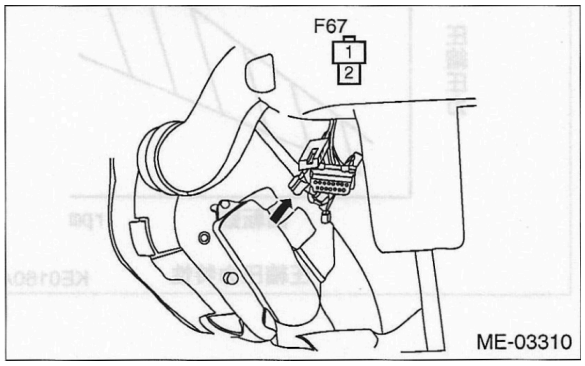
<Inspection>

1. Warm up the engine sufficiently (until the radiator fan starts operating.
2. Check the ignition timing using a timing light.
   1) Connect the test mode (D check) connector (green 2-pole).

NOTE

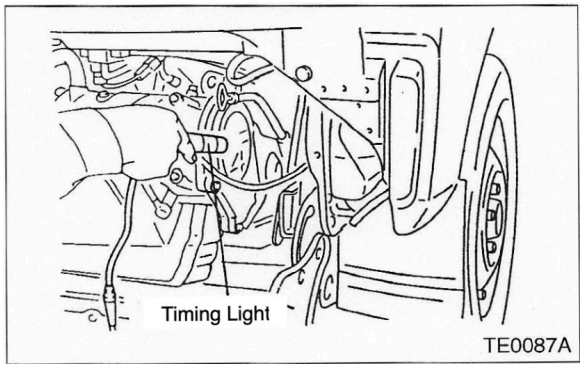
- If the connector is not connected, the ignition timing will appear to be delayed, and if a resistor adjusting the ignition timing is selected based on this, the engine may be damaged at high speeds and under high loads.

Connector location diagram

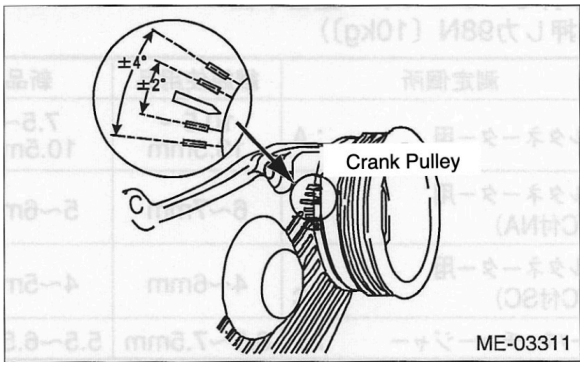


   2) Clamp the timing light onto the plug wire of the #1 cylinder and start the engine.
   3) Point a timing light at the crank pulley and check the ignition timing using the markings and indicator on the crank pulley.

How to apply timing light



Position of the markings and indicators

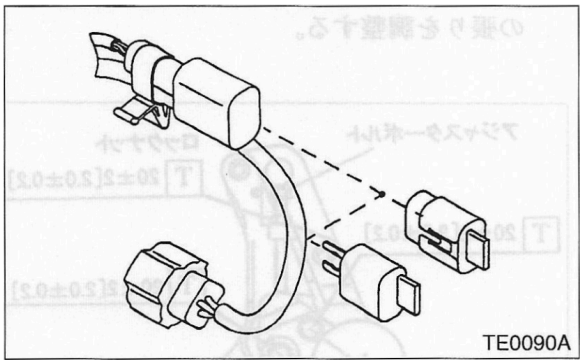


3. After completing the inspection, disconnect the test mode (D check) connector (2 green poles).

Standard Addition Time All Vehicles (BDTC/rpm)	10° ± 3° / 750 ± 50

<Adjustment>

1. Replace the ignition timing adjustment resistor or cap located above the engine harness rocker cover. (A difference of one rank in resistors corresponds to a difference of one degree in ignition timing.



(10) Ignition Timing

<Inspection>

1. Check that the condition of the air cleaner element, spark plug electrodes, hose connections, and ignition timing are normal.
2. Make sure the CHECK POWERTRAIN lamp on the instrument panel is not illuminated.
3. Warm up the engine sufficiently (until the radiator fans starts operating twice).
4. Set the select monitor or tachometer.
5. Check the idle speed.
6. The idling speed is automatically adjusted and cannot be manually adjusted. If the specified idling speed cannot be maintained, perform a fuel injection system failure diagnosis in accordance with the separate failure diagnosis book.
   1) Measure the engine speed under no load with the headlights, heater fan, rear defroster, radiator fan, air conditioning, etc not operating. (For AT vehicles, measurements are taken in N or P.
   2) Under the above no-load condition, turn on the A/C switch, and measure the rotation speed under load after the compressor has been operating for more than one minute.

✻ Idle Speed

	Load	MT Vehicles	AT Vehicles
EN07V	No Load	750±50	←
	A/C On	1050±50	←
EN07Y	No Load	750±50	←
	A/C On	1050±50	←

(11) Idle Vacuum Inspection

<Inspection>

7. Warm up the engine sufficiently (until the radiator fan starts operating twice.
8. Check the Select monitor or timing light.
   1) Inspection using the Select Monitor.
      • Connect the Select Monitor to the connector on the vehicle body.
      • Start the engine and adjust the Select Monitor menu to match the intake pipe pressure. (For instructions on how to use the Select Monitor, please refer to the SUBARU New Select Monitor User Manual).
   2) Inspect using the compound gauge.
      • Attach the compound gauge hose to the master back connection of the intake manifold and measure.
   3) Measure the vacuum pressure while the engine is idling (no load).
      • For AT vehicles, measure in N or P.

✻ Idle Vacuum Reference Values (mmHG/rpm)

	MT Vehicles	AT Vehicles
EN07V	-470~-380/750	-450~-350/750
EN07Y	-430~-350/750	-410~-330/750

4. If the deflection of the pointer is outside the range of the standard value or is abnormal, refer to the following and diagnose the fault.
   1) If it is lower than normal:
      • Leaking intake system gasket
      • Retarded ignition timing.
      • The valve clearance is narrow.
      • Large gap in the valve guide.
      • Lave seat leak.
   2) If it is higher than normal:
      • Ignition timing is too advanced.
   3) Fluctuates above and below normal values:
      • Ignition system malfunction.

(12) CO, HC Concentration

<Inspection>

1. Warm up the engine thoroughly.
   1) Warm up the engine until the radiator fan operates twice.
   2) Furthermore warm up the engine at approximately 3,000 rpm or 1 to 2 minutes.
2. Perform a D check and confirm that the CHECK POWERTRAIN lamp on the instrument panel indicates that there are no problems.
3. Check that the ignition timing and idle speed are normal.
4. Insert the probes of the Co & HC measuring meter into the tailpipe and measure the CO & HC concentrations while idling with no load.

NOTE

- Measurements should be carried out in a well-ventilated location that is not directly exposed to wind and rain.
- Make sure that outside air is not drawn into the probe insertion section (tail pipe section).

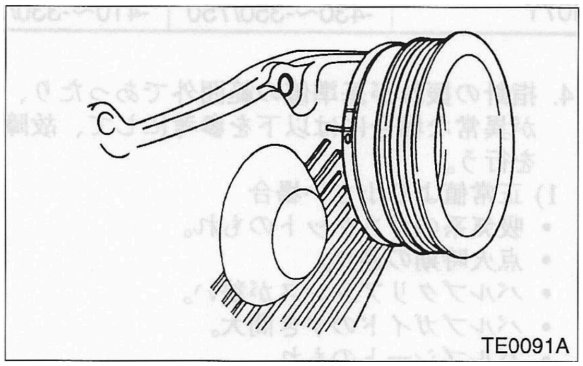
✻ CO & HC Concentration Standards

	Item	MT Vehicles	AT Vehicles
EN07V	CO	0.5% or less	←
	HC Concentration	450ppm or less	←
EN07Y	CO	0.5% or less	←
	HC Concentration	450ppm or less	←

(13) Valve Clearance

<Inspection>

1. Place the cylinder to be inspected at the top dead center of compression.
   - To achieve top dead center, align the 0° or 180° groove on each crank pulley with the 0° indicator on the belt cover.



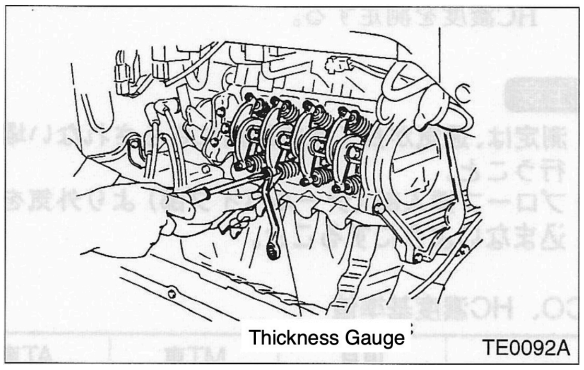
2. Remove the rocker cover.
   - Remove the blow-by hose from the air cleaner.
   - Remove the air cleaner, intercooler, and duct.
   - Remove the rocker cover.
3. Insert a feeler gauge and check the valve clearance.

<Adjustment>

1. Adjustments must be made when cold.

✻ Valve Clearance Standard Values

Intake	0.15 ± 0.02mm
Exhaust	0.20 ± 0.02mm
Nut Tightening Torque	10 ±1 N•m [1.0 ± 0.1 kg•m]



2. Rotate the crank pulley clockwise to bring the #1 cylinder to top dead center of compression.
   - To rotate the crankshaft, turn the steering wheel fully to the right to secure space inside the right tire, and then insert the crank pulley bolt through the service hole and rotate it.
3. Loosen the valve rocker arm nut and turn the adjustment screw to adjust the valve clearance.

✻ Adjustment Screw Tightening Torque
T 9 ± 1 N•m [0.9 ± 0.1 kg•m]

4. Then proceed to #3, #4, & #2 cylinders.
5. After completing the adjustment, rotate the crankshaft one full turn clockwise again and check the valve clearance.

Valve clearance can also be adjusted using the following procedure:

1. Bring #1 cylinder to top dead center.
2. Adjust the intake side and exhaust side of #1, the intake side of #2, and the exhaust side of #3.
3. Rotate the crankshaft clockwise one full revolution to bring #4 to top dead center.
4. Adjust the intake and exhaust sides of #4, the exhaust side of #2, and the intake side of #3.
5. Rotate the crankshaft clockwise one full turn and check the valve clearance.

✻ Valve Clearance Adjustment Procedure Quick Reference

Piston Position \ Cylinder #		#1		#2		#3		#4	
		IN	EX	IN	EX	IN	EX	IN	EX
1 Revolution of crankshaft	#1 Cylinder Top Dead Center	○	○	○			○		
	#4 Cylinder Top Dead Center				○	○		○	○

○ Clearance Adjustable

2 - 3 Engine Removal

■ Maintenance & Preparation Items

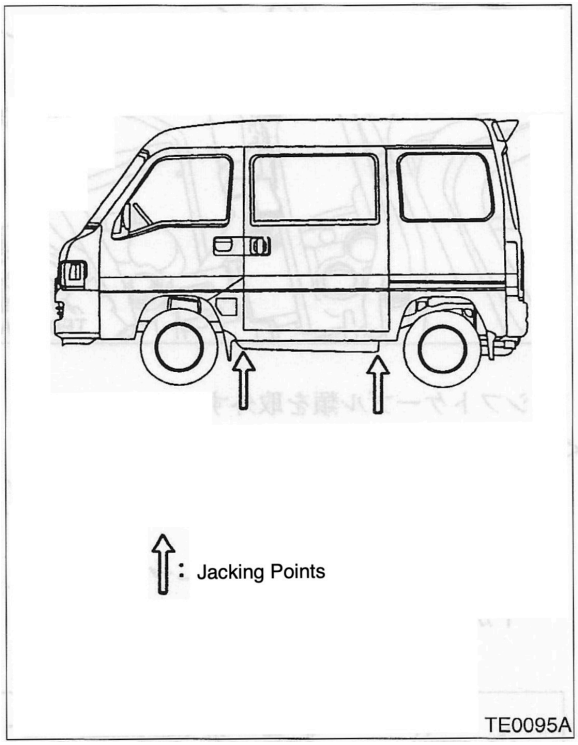
Classification	Tool Number	Description	Purpose
ST	28099PA100	Drive shaft remover	CV axle shaft (DOJ) removal
	49960 5400	Engine Hanger	Lifting when removing or installing the engine
Tools		Auto lift for raising and lowering the vehicle	Raising or lowering the vehicle body
		Engine Pedestal	Engine ASSY lifting or lowering
	For R134A	Compressor gas vent manifold	Air conditioning gas drain and refill
		Compressor gas recovery equipment	↑
Grease, Oil, & Other		Subaru Coolant	Refilling the coolant
		Transmission Oil (MT) Transmission Fluid (AT)	Refilling the transmission oil/fluid
		Air conditioner compressor gas	Air conditioner compressor gas refill
		Air conditioner compressor oil	Air conditioner compressor oil refill

■ Maintenance Instructions

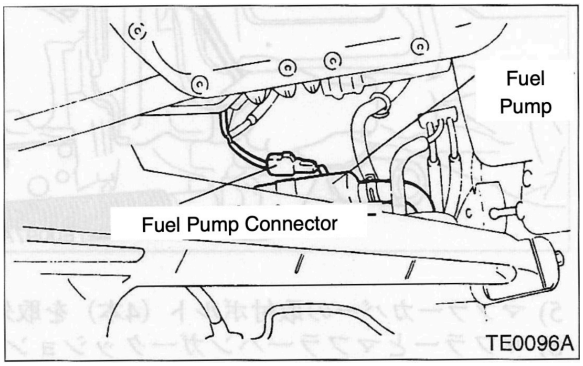
This book describes naturally aspirated cars as representative models. Other car models will also conform to this book.

<Removal>

1. Place the vehicle on a two-post lift.
   - For details, see 1-4 Lift & Jack-up Points

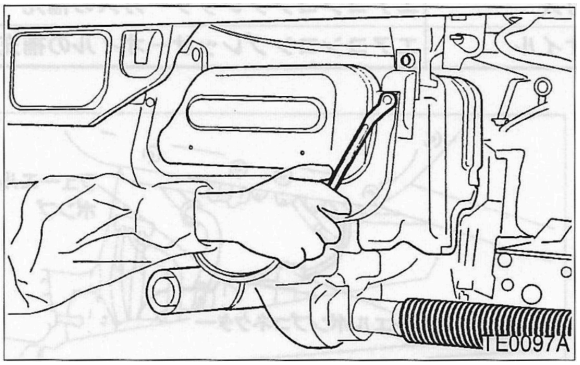


2. Recover air conditioning gas using gas recovery device.
3. Reduce the fuel pressure in the fuel system.
   - Disconnect the fuel pump harness connector.

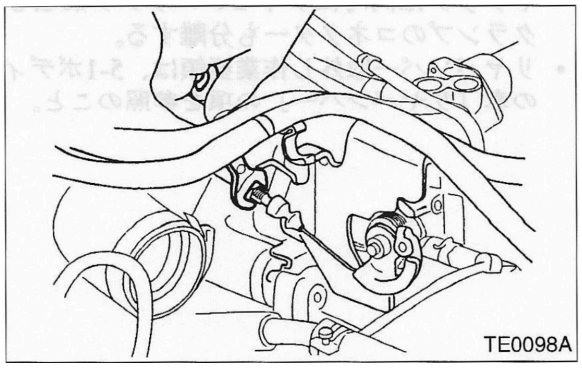


   - Lower the lift
   - Start the engine and run it until it stalls. After the engine stops, run the starter for another 5 seconds and then turn the ignition switch off.
4. Disconnect the battery terminals.
5. Remove the trap door.
6. Remove the rear bumper (Van/Dias) or the rear hood (trucks).
   - For the truck disconnect the license plate light and backup light connectors.
   - For rear bumper removal procedures, refer to the Rear Bumper section in the 5-1 Exterior Body chapter.

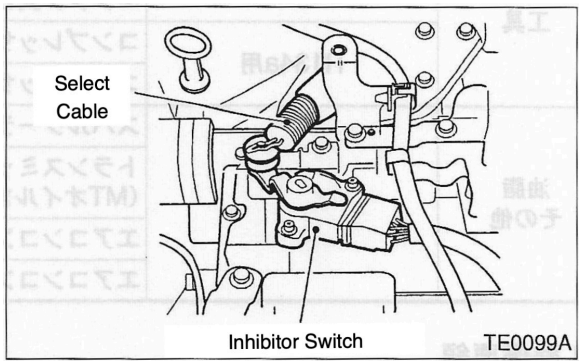
7. Remove the air cleaner case.
   - Remove the hoses from the air cleaner case.
   - Remove the air cleaner case mounting bolts and nuts, and remove the air cleaner case.
   - For instructions how to remove the air cleaner case, refer to the Air Cleaner Assembly section in the 2-8 Air Intake System chapter.
8. Raise the lift.
9. Remove the diagonal members (left and right).
10. Remove the muffler parts.
    1) Remove the rear bellows cover.
    2) Remove the exhaust manifold plate.
    3) Remove the front bellows cover.



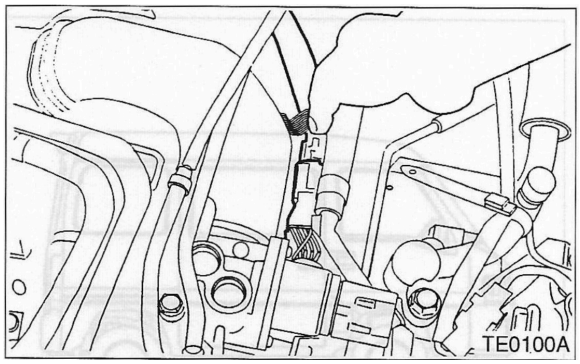
    4) Remove the muffler hanger bracket.
    5) Remove the four muffler mounting bolts.
    6) Remove the single mounting nut between the muffler and the front muffler hanger cushion.
    7) Remove the muffler flange and the exhaust manifold mounting bolts.
    8) Remove the muffler and the muffler cover together from the body.
       - For muffler removal procedures, refer to the chapter on 2-11 Exhaust System.
11. Remove the throttle body protector and remove the throttle wire.



12. Remove the electrical harnesses.
    1) Disconnect the starter cable and the starter harness from the starter.
    2) Disconnect the transmission harness connector.
    3) Disconnect the alternator battery terminal and connector.



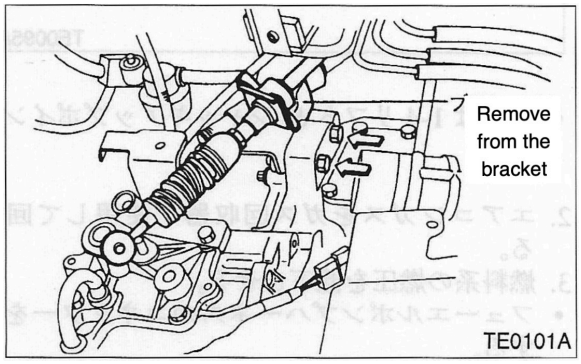
    4) Remove the engine and transmission grounds.
    5) Remove the engine main harness connector.



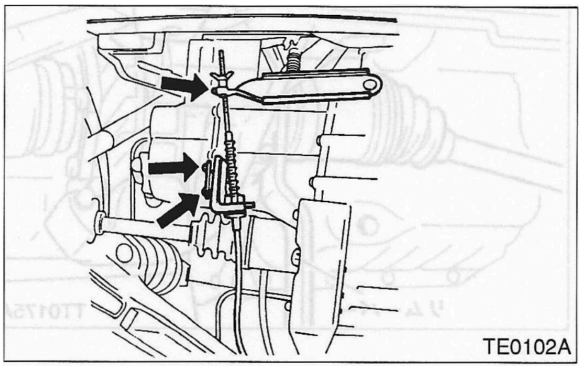
13. Remove the shift cables.

<MT Vehicles>

1. Remove the shift control cable and select control cable from the transmission (MT vehicles).
   - Remove the select control cable from under the floor.

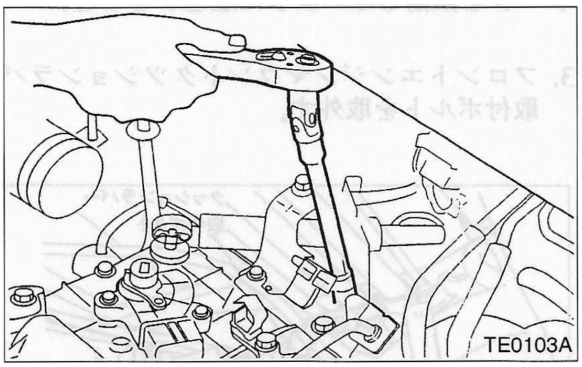


2. Remove the clutch cable from the fork lever, and remove the cable bracket from the transmission.

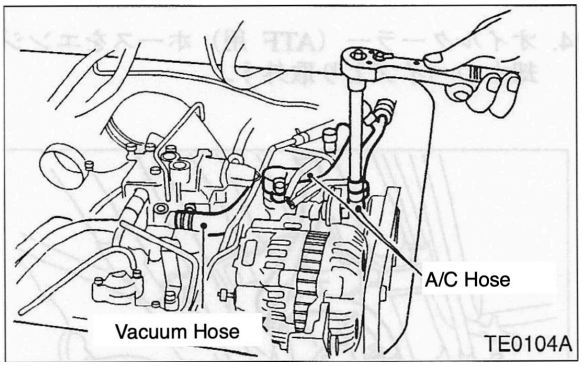


<AT Vehicles>

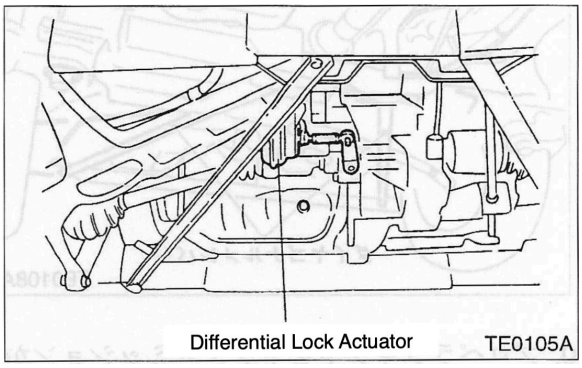
Remove the select cable and bracket from the transmission.



14. Remove the hoses.
    - Remove the brake master cylinder vacuum hose from the intake manifold.

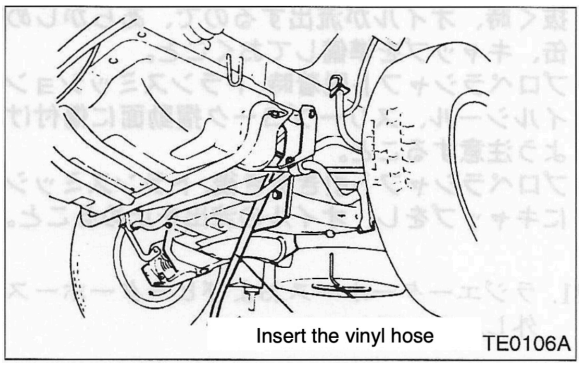


15. Raise the lift.
16. Remove the center under cover.
17. Remove the differential lock actuator assembly from the transmission (4WD vehicles with differential lock only).

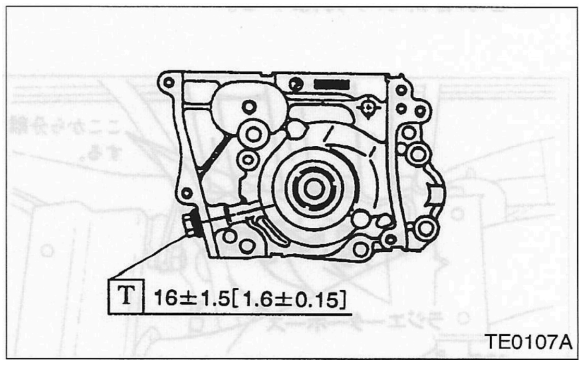


18. Drain the coolant.
    1) Drain the coolant from the radiator.

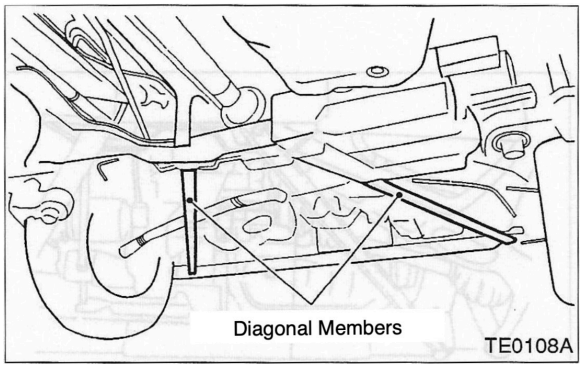
NOTE
- Prepare the vinyl hose to prevent the coolant from splashing, attach the hose to the drain cock outlet, and open the drain cock.
- Prepare a tray to collect the coolant.



2) Drain the coolant from the engine.
    - Loosen the drain plug on the side of the water pump from under the vehicle and drain any remaining coolant from the engine.



19.Remove the diagonal members.

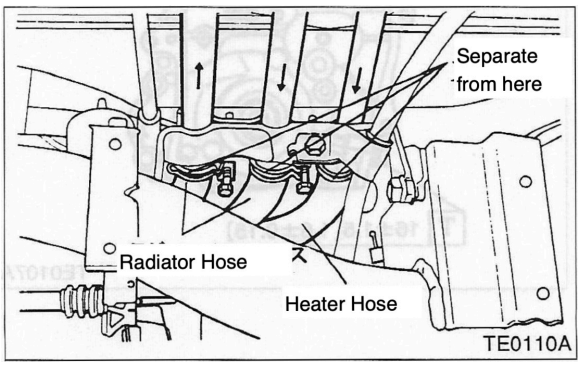


20.Separate the propeller shaft from the transmission (4WD vehicles only.
1) Remove the connecting bolts between the propeller shaft and the front differential.
2) Pull the propeller shaft out the transmission.
- For instructions on how to remove the propeller shaft, refer to the Propeller Shaft section in the 3-4 Drive System & Axle chapter.

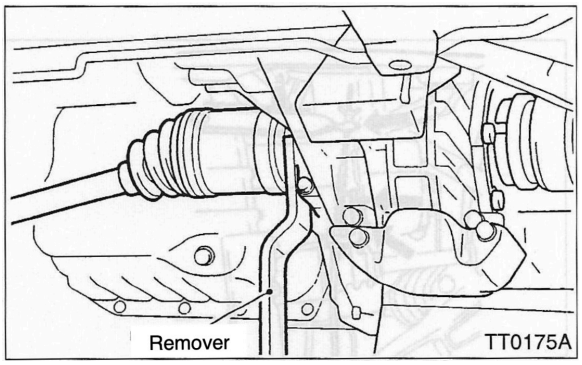
NOTE
- When pulling the propeller shaft out of the transmission, oil will spill out, so be sure to have an oil drain can and cap before hand.
- When removing or installing the propeller shaft, be careful not to damage the transmission oil seal or the sliding surface of the sleeve yoke.
- After removing the propeller shaft, cap the transmission to stop the oil from leaking.

21.Remove the radiator and heater hoses.
- Separate the two radiator hoses and theater hose from the water pipes.

NOTES
- When the hose is disconnected, coolant will spill out so be sure to place a coolant tray under the hose.



22.Separate the rear axle shafts (left and right) from the transmission.

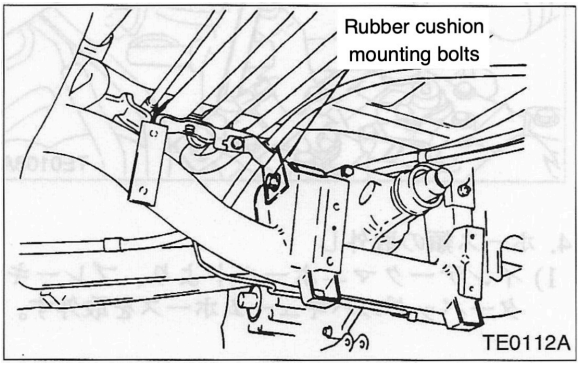


ST 28099PA100 Drive shaft remover

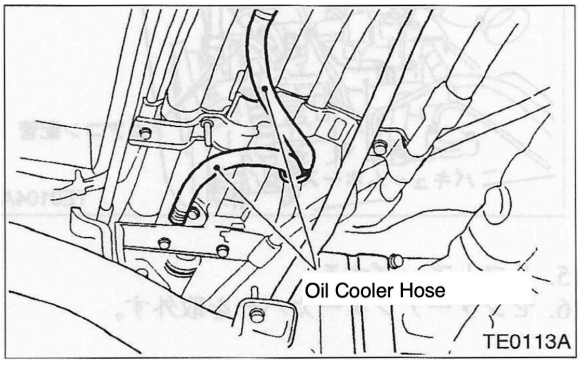
- For the left side, use a commercially available crowbar.

NOTE
- Be careful not to damage the boots.

23.Remove the front engine mount rubber cushion mounting bolts.

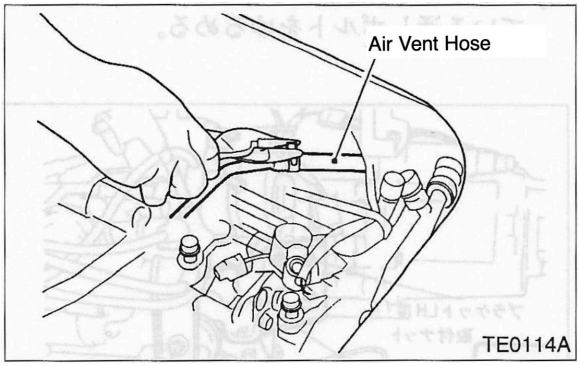


24.Remove the oil cooler (ATF) hose from the engine coolant pipe.

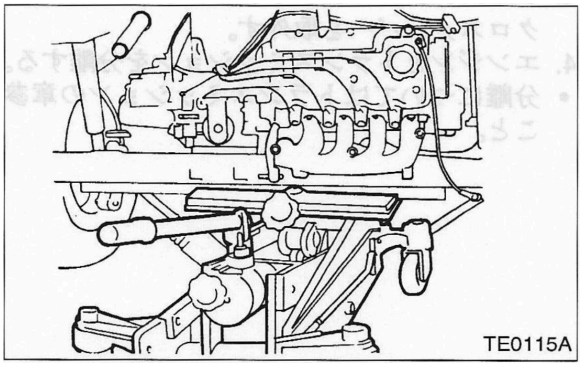


25.Lower the lift.

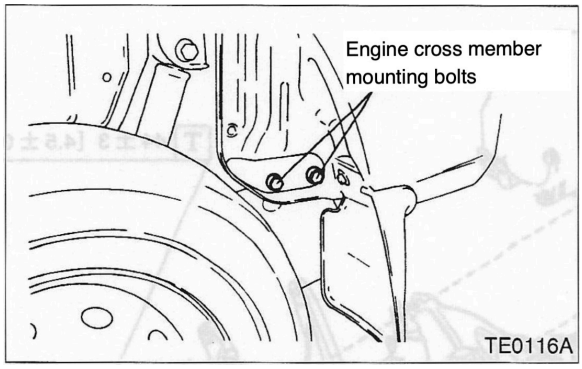
26.Disconnect the radiator air vent hose from the engine.



27.Inspect and confirm that all wiring and piping connections have been separated from the vehicle body and engine sides.
28.Insert the engine stand and adjust the height.

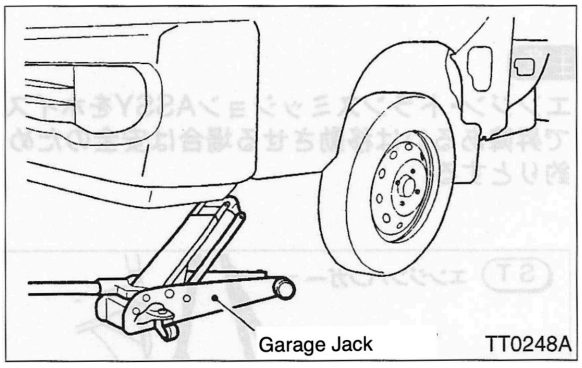


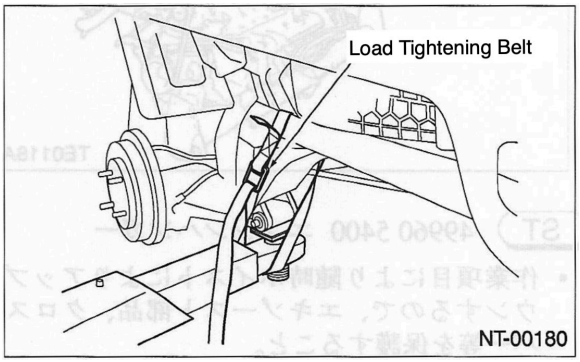
29.Remove the four engine cross member mounting bolts and separate it from the body.



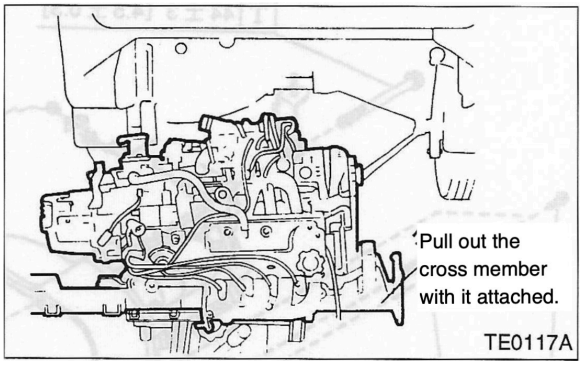
NOTE

- If the engine is removed while the vehicle is lifted at the jacking point, the front and rear balance of the vehicle may be lost and it may fall forward. For this reason, use a garage jack with a thick plate attached to the tray to support the center of the front cross member to maintain stability on the vehicle on the lift.
- Alternatively, secure the vehicle to the lift by following the procedure in Chapter 1-4 Securing the vehicle when removing the engine.





30.Pull the engine out of the vehicle with the cross member still attached.



NOTE

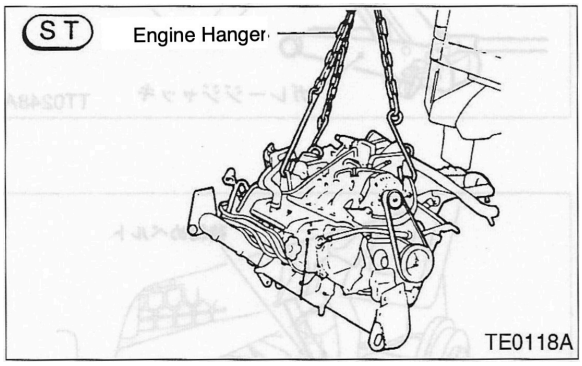
- When pulling out the engine, be careful not to catch it on harnesses, cables, etc.
- Be careful not to damage the boot (axle shaft).
- Keep bolts and removed parts in order.
- Do not ride on a vehicle with the engine removed while it is lifted up.

<Separating the Engine and Transmission>

1. Place the engine and transmission assembly removed from the vehicle on a vise or other suitable position for easy access.

NOTE

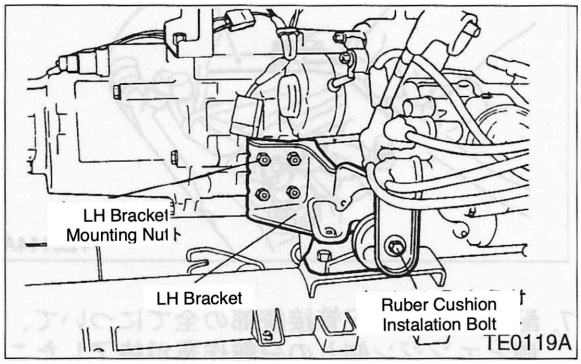
- When lifting, lowering, or moving the engine/transmission assembly using a hoist, use a three-point hoist for safety.



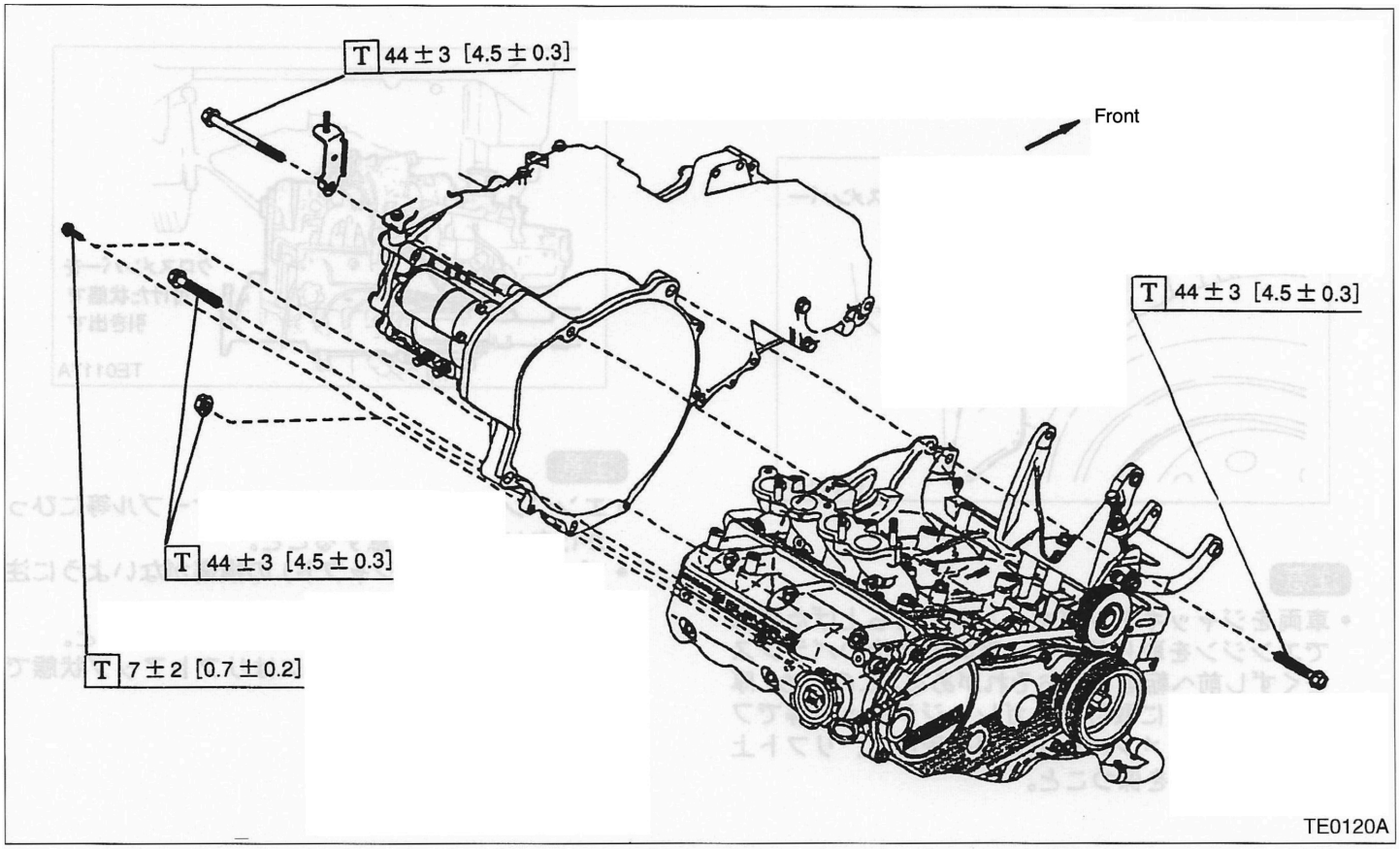
ST 49960 5400 Engine Hanger

- The hoist will be used to raise and lower the engine depending on the work being done, so be sure to protect the exhaust parts, cross members.

2. Removing the LH mounting bracket.
   1) Remove the clutch return spring.
   2) Remove the four mounting nuts from the LH bracket.
   3) Loosen the through bolts that secure the LH bracket and the LH rubber cushion.



   4) While moving the rear cross member, remove the LH bracket together with the cross member.
3. Separate the cross member from the RH rubber cushion and remove the cross member.
4. Separate the engine and transmission.
   - For separation, see the Transmission chapter.



<Engine Reassembly Instructions>

1. Combine the engine and transmission.

NOTE

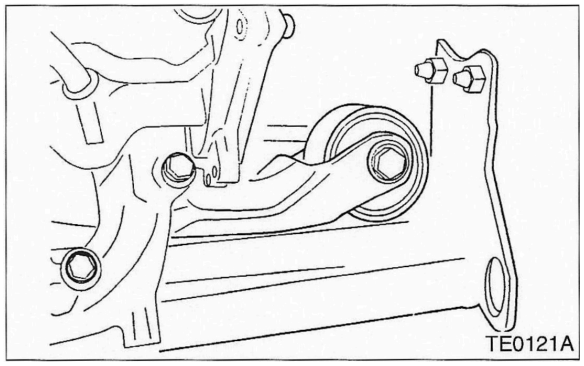
<MT Vehicles>

- Apply Nichimori TC5 or FX2200 grease evenly to the spline portion of the main shaft.
- Be careful not to cause deformation or damage due to contact between the main shaft and diaphragm spring.

<AT Vehicles>

- When assembling , be careful not to bend to the oil pump shaft.
- Check that the main drive gear oil seal has not fallen off onto the clutch side.
- A sealing sponge is glued to the the transmission joint surface of the engine rear plate, but if this sponge is damaged and cannot be reused, remove the sponge completely and apply an even lay of ThreeBond #1207F or #1207C liquid packing to the joint surface on the transmission side, then join the engine and transmission.

2. Attach the RH mounting bracket to the engine.
3. Attach the mounting bracket to the rubber cushion part of the cross member.



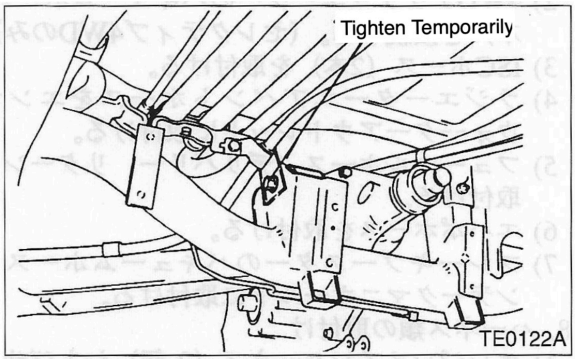
4. Install the LH mounting bracket.
   1) Align the LH bracket with the transmission side and tighten the four mounting nuts.
   T $62\frac{+9}{-6}N \cdot m\,[6.3\frac{+0.9}{-0.6}kg \cdot m]$
   2) Tighten the through bolts that attach the LH bracket and the LH rubber cushion.
   T 54 ± 10 N•m [5.5 ± 1.0 kg•m]

<Installation>

NOTES

- Procedures for installing the engine on the vehicle body. The procedure is the reverse of the removal procedure. This section describes the items not described in the removal procedure, the specific installation procedures, and the tightening torques for bolts and nuts when assembling the main parts.

1. Place the engine/transmission assembly on the engine support and set it on the vehicle body.
2. Insert the through bolt in the rubber cushion of the front engine mount and temporarily fasten it.



3. Install the 2 radiator hoses and 1 heater hose.

NOTE

- The hose should be inserted 30 to 35mm.
- Always install hose clamps in the specified direction.

4. Install the propeller shaft (4WD vehicles only).
   T $18\frac{+7}{-0}N \cdot m\,[1.8\frac{+0.7}{-0}kg \cdot m]$
   - For instructions on how to install the propeller shaft refer to the Propeller Shaft section in the 3-4 Drive System & Axle chapter.
5. Install the clutch cable. Install the clutch cable to the fork lever. Secure the clutch cable bracket.

NOTE

- Apply grease to the end to prevent uneven wear.

Grease	Autorex A
	Sunlight No 2

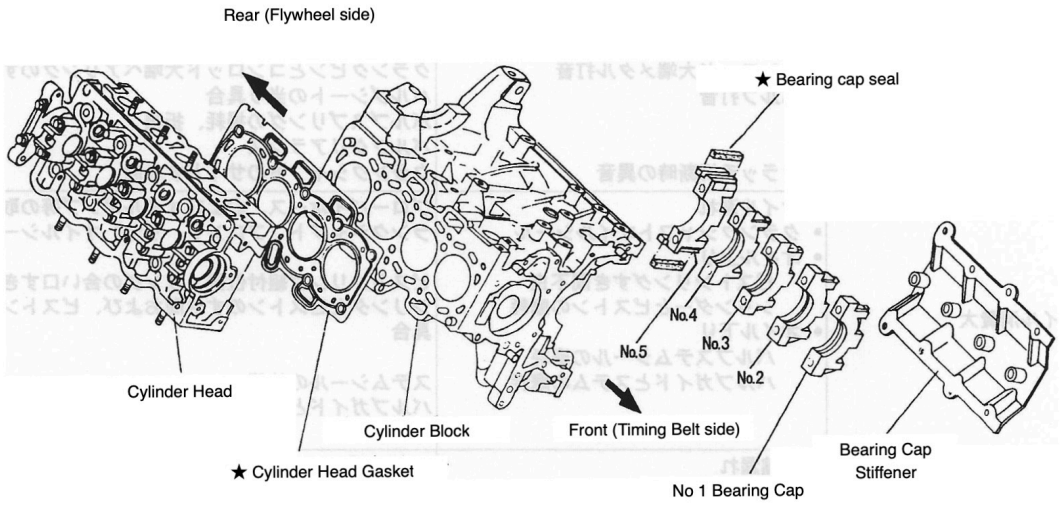
6. Cable Installation
   1) Attach the meter cable resin clamp.
   2) Attach the select control cable to the transmission (MT vehicles).
   3) Lower the lift.
   4) Attach the shift control cable to the transmission (MT vehicles).
   5) Install the AT selector cable (AT vehicles).
   6) Install the speedometer cable to the transmission.
   7) Attach the accelerator cable to the throttle body.
7. Hose Installation
   1) Install the two AT oil cooler hoses.
   2) Connect the two vacuum hoses to the 4WD actuator (selective 4WD only).
   3) Install the two ISC hoses.
   4) Attach the radiator air vent hose to the engine coolant outlet.
   5) Install the fuel hoses (delivery and return).
   6) Install the evaporative hose.
   7) Attach the brake booster vacuum hose to the intake manifold.
8. Harness Installation
   1) Connect the two main engine harnesses and the thermo switch connector.
   2) Connect the alternator terminals and connector.
   3) Install the engine grounding cable.
   4) Connect the starter cable and starter harness to the starter.
   5) Connect the transmission harness connector.
   6) Connect the O2 sensor harness connector.
9. Throttle Body Connector Installation
   1) Set the muffler and muffler cover together on the body.
   2) Connect the flange of the muffler to the exhaust manifold.
   3) Install the single mounting nut between the muffler and the front muffler hanger cushion.
   4) Install the four muffler cover mounting bolts.
   5) Install the muffler hanger bracket.
   6) Install the exhaust manifold plate.
   7) Install the front bellows cover.
   8) Install the rear bellows cover.
   9) Install the exhaust pipe cover.
      • For muffler installation procedures, refer to chapter 2-11 Exhaust System.
10. Install the diagonal members (left and right).

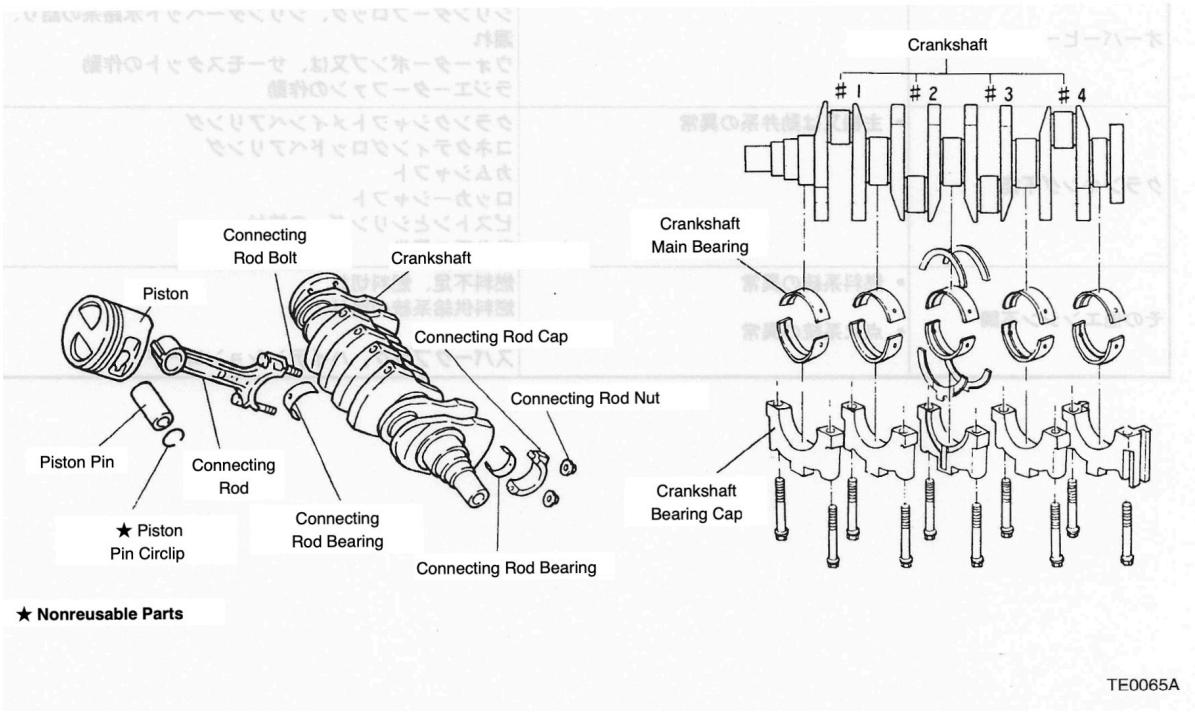
T 69 ± 18N • m [7.0 ± 1.8kg • m]

11. Air Cleaner Case Installation
    1) Install the air cleaner case.
    2) Connect the hoses.
       • For installation procedures, refer to the air cleaner assembly section in the 2-8 Air Intake System chapter.
12. Install the rear bumper (Van/Dias) or the rear hood (trucks).
    • Connect the license lamp and back up lamp connectors for the trucks.
13. Connect the fuel pump harness connector.
14. Connect the battery terminals.
15. Check the operation (for any snagging, etc) and amount of play of the accelerator cable, AT control cable, and clutch cable.
    • If adjustments are necessary, refer to the Clutch, AT and Pedal & Cable chapters to make adjustments.
16. Refill Coolant System
    • For instructions on how to fill the coolant, refer to chapter 2-7 Engine Cooling System.
17. Install the Trap Door.
18. Lower the vehicle from the lift.

2 - 4 Main Engine

■ Components & Parts





Common Failure Points

Failure Point	Possible Causes	Inspection Points
Internal Engine Noise	• Piston hitting sound • Piston pin tapping sound • Crankshaft main metal hammering noise • Connecting rod large end metal striking sound • Valve tapping sound • Abnormal noise when clutch is disengaged	• Piston clearance and piston contact condition • Connecting Rod small end bore diameter and piston clearance pin • Clearance between piston pin and piston • Crankshaft main bearing clearance • Clearance between crank pin and connecting rod beg end bearing • Valve seat contact • Valve spring wear and breakage • Valve clearance • Crankshaft side clearance

Large Oil Consumption	• Oil leak
	• Crankshaft Oil Seal
	• Oil Rise
	  • Poor piston ring clearance
	  • Piston and cylinder wear
	• Oil Down
	  • Worn valve stem seals
	  • Worn valve guides and stems
		• Blow-by hose and oil pump mounting parts.
		• Crankshaft (front & rear) oil seal condition
		• Piston ring assembly position, ring gap
		• Clearance between the cylinder and piston
		• Piston contact condition
		• Stem seal condition
		• Valve guide and valve system clearance
		• Valve stem condition

High Fuel Consumption	• Compression leak • Abnormal Combustion	• Cylinder head gasket wear • Loose cylinder head mounting bolts • Spark plug not tightened properly • Spark plug gasket wear • Intake manifold gasket • Valve seat contact • Piston ring wear • Carbon accumulation in the combustion chamber • Carbon buildup on the piston head
Overheating	• Lack of coolant.	• Head gasket wear • Cylinder block or cylinder head blocked coolant passage • Coolant leak • Water pump or thermostat operation • Radiator fan operation
Unable to Crank	• Abnormality in the main engine or valve train	• Crankshaft main bearing • Connecting rod bearing • Camshaft • Rocker shaft • Piston and cylinder seizure • Valve train abnormality
Other Engine Malfunctions	• Fuel system abnormality • Ignition system abnormality	• Fuel shortage, out of fuel • Clogged fuel supply system • Battery • Spark plugs, high tension cables

Preparations

Classification	Tool Number	Name	Purpose
ST	49981 5500	Engine stand COMPL	Engine disassembly/assembly work
	49845 5600	Engine stand attachment	Engine stand and engine mounting block attachment
	49827 5800	Flywheel stopper	Crankshaft anti-rotation
	49871 54100 49808 5800	Cam timing adjuster plate Cam timing adjuster pin	Cam sprocket positioning and removal
	49920 6400	Crank pulley wrench	Crank pulley stopper
	49920 6500	Attachment	Crank pulley stopper attachment
	49920 5700 39952 0802	Crank pulley Sprocket puller bolt	Removing the crank pulley and crank sprocket
	49854 5400	Oil filter wrench	Oil filter removal
	49872 5500	Rear oil seal guide	Crank rear oil seal positioning
	49872 5600	Rear oil seal press	Crank rear oil seal press-fit
	49874 5600	Piston guide	Inserting the piston assembly into the cylinder
	49958 6100	Front oil seal press	Front oil seal press-fit
	49958 6200	Front oil seal guide	Front oil seal positioning
Grease, Oil, & Other	Threebond #1215B Or #1215	Liquid gasket	Oil pump cylinder block mounting surface
	Threebond #1207F or #1207C	Liquid gasket	Oil flange mounting surface
	Threebond #1105	Liquid gasket	Bearing cap seal mounting surface
	Oil	Engine oil	For application when installing parts

■ Maintenance Instructions

(1) Cylinder Head

<Removal>

1. Place the engine assembly on the engine stand.

ST 49981 5500 Engine Stand COMPL
49845 5600 Engine Stand Attachment

NOTES

- If removing the cylinder head on the vehicle, perform the following steps before removing the cylinder head.
  1) Reduce the fuel pressure (see Engine Removal section).
  2) Remove the trap door.
  3) Lift up.
  4) Remove the engine compartment cover inside the right rear tire house.

2. Drain the engine oil and coolant.

✻ Engine oil drain plug tightening torque
T 39^{+5}_{-0} N • m [$4.0^{+0.5}_{-0}$ k g • m]

✻ Coolant drain plug (water pump) tightening torque
T 16 ± 1.5 N•m [1.6 ± 0.15kg•m]

3. Remove the V-belt, tensioner, alternator, blow-by hose, and water outlet housing.'
4. Remove the collector chamber (SC).
5. Remove the intake manifold.
6. Remove the ignition coil and high tension cables.
7. Remove the exhaust manifold cover and exhaust manifold.
8. Remove the oil level gauge, crank pulley, and belt cover.

ST 49920 6400 Crank Pulley Wrench
49920 6500 Crank Pulley Wrench Attachment
49827 5800 Flywheel Stopper

9. Remove the valve rocker cover.

10. Remove the cylinder head bolts in the order of ① to ⑩ in the

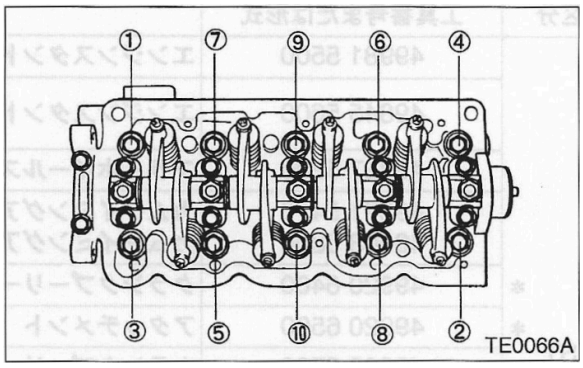


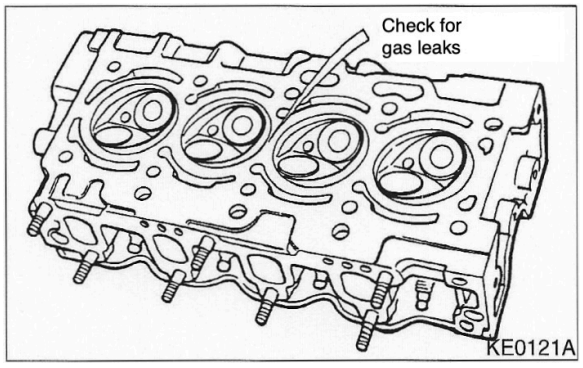
illustration.

NOTES

- When placing the removed cylinder head by itself, place a cloth underneath it with the mounting surface for the cylinder facing up.

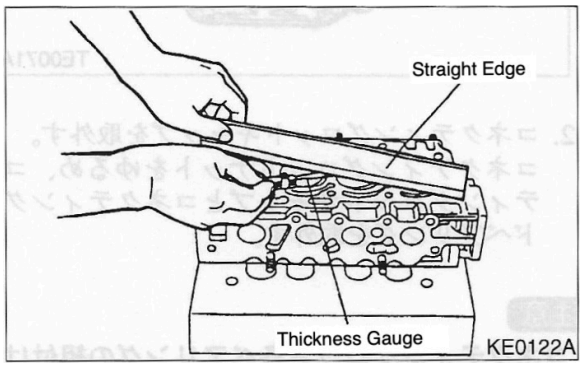
<Inspection/Adjustments>

1. Cylinder Head Combustion Chamber
   1) Check the cylinder head interface gasket for signs of gas leakage.
   2) Check for carbon deposits in the combustion chamber and remove any dirt of deposits. Check the contact surface of the valve seat and if there is poor contact, use compound to smooth it out and ensure that the contact area is 70% or more.
   3) Use a scraper to thoroughly remove any material adhering to the head gasket.
   4) Check for any other cracks or damage.



2. Check the mounting surface of the cylinder block. Use a straightedge to measure the distortion of the mounting surface with the cylinder block. If it is outside the limits, correct it by grinding.

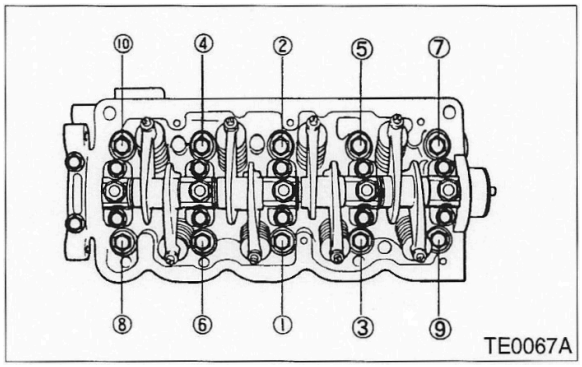
Strain Limit	0.05mm
Polishing Correction Limit	0.15mm
Cylinder head overall height (before Modification)	69.5 ± 0.1



<Assembly>

Use a new cylinder head gasket, clean the cylinder head and cylinder block mounting surfaces, and then install it on the cylinder block.

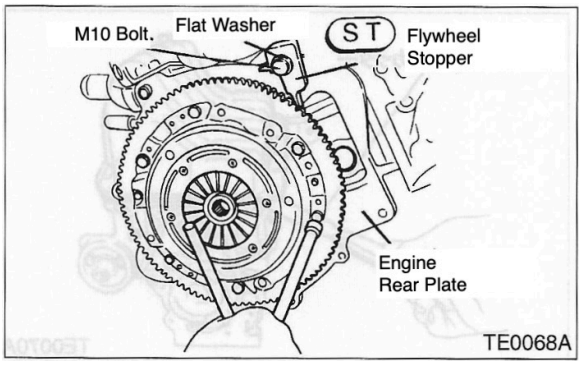
✻ How to tighten the cylinder head bolts
- Apply engine oil to the washer and the threads of the head bolt.
- Tighten each holt in the order shown in the diagram below to a torque of 29N•m [3.0 km•m]. After tightening all the bolts, loosen them completely.
- Tighten bolts ① to ⑥ in the same numerical order to a torque of 25 ± 0.5N•m [2.6 ± 0.05kg•m].
- Tighten bolts ⑦ to ⑩ in the same numerical order to a torque of 20 ± 0.5N•m [2.0 ± 0.05 kg•m].
- Finally, tighten all the bolts by an additional 90° from ① to ⑩ in numerical order.



(2) Cylinder Block

<Disassembly>

1. Removal of related parts
   - Drain the engine oil and coolant.
   - Remove the alternator, V-Belt, crank pulley, etc.
   - Remove the water outlet housing.
   - Remove the intake manifold.
   - Remove the ignition coil, high tension cables, etc.
   - Remove the exhaust manifold.
   - The above work procedure is the same as that for the cylinder head.
   - Remove the throttle chamber and ducts.
   - Remove the supercharger and ducts.
   - Remove the thermostat case and harness.
2. Remove the clutch and flywheel (MT) or drive plate (AT).



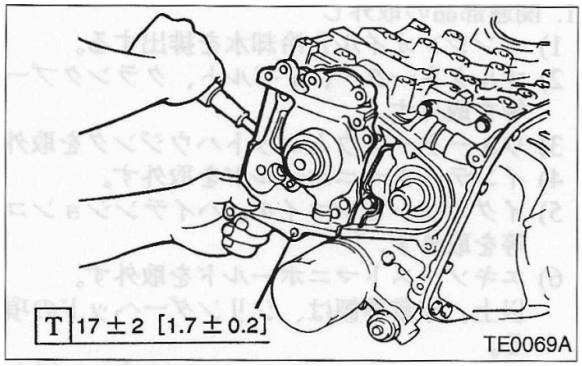
ST 49920 6400 Crank Pulley Wrench
49920 6500 Crank Pulley Wrench Attachment
49827 5800 Flywheel Stopper

✻ Clutch cover tightening torque
T 10 ± 0.7 N•m [1.0 ± 0.07 kg•m]

✻ Flywheel or drive plate tightening torque
T 44 ± 4 N•M [4.5 ± 0.4 kg•m]

3. Remove the rear plate.
4. Remove the timing belt sprocket.
   - Remove the level gauge guide and timing belt cover.
   - Remove the tensioner, timing belt, crank sprocket, cam sprocket, etc.
5. Remove the rocker cover and then remove the cylinder head and gasket.

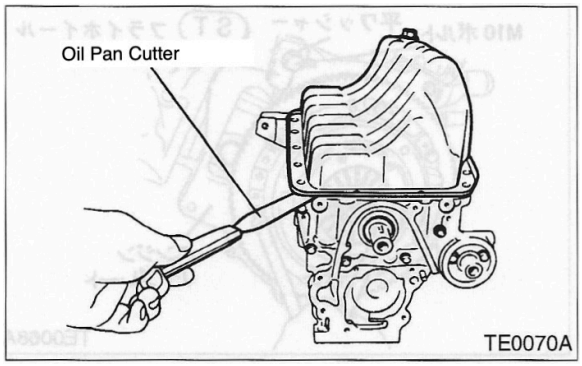
6. Remove the water pump.



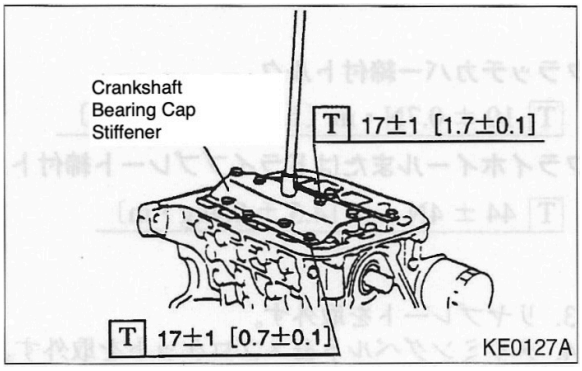
7. Remove the engine stand.
8. Remove the oil filter.

ST 49920 5400 Oil Filter Wrench

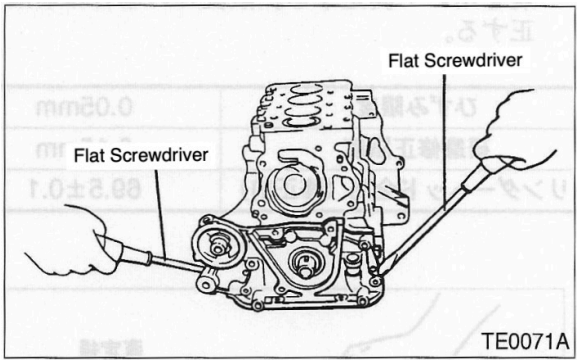
9. Use an oil pan cutter to remove the oil pan.



10. Remove the crankshaft bearing cap stiffener.



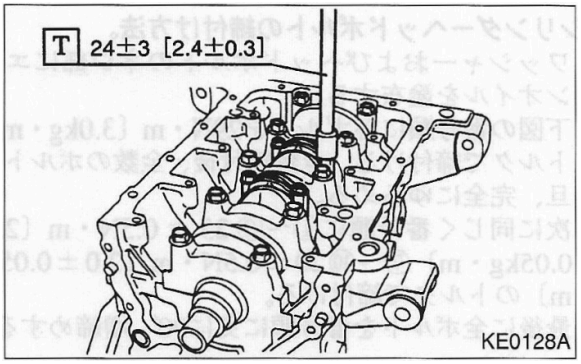
11. Remove the oil pump.



12. Remove the connecting rod cap.
    - Loosen the connecting rod nut and remove the connecting rod cap and connecting rod bearing.

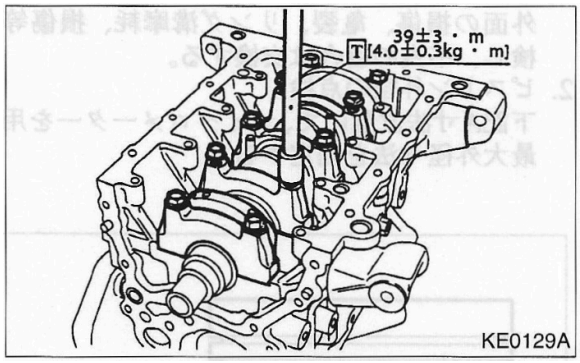
NOTES

- Arrange the connecting rod bearings in the correct order to avoid confusing their installation positions.
- Fit a vinyl tube over the threaded part of the connecting rod reamer bolt to prevent damage to the crankshaft pin, etc.



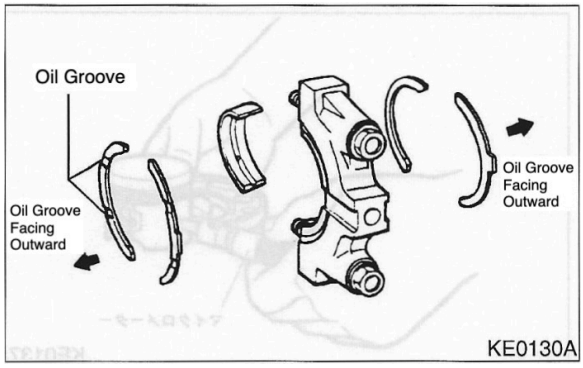
13.Remove the crankshaft bearing cap.
- Loosen the cap mounting bolt and remove the crankshaft bearing cap.

NOTES
- Arrange the main bearings in order so that their assembly position and directions are clear.

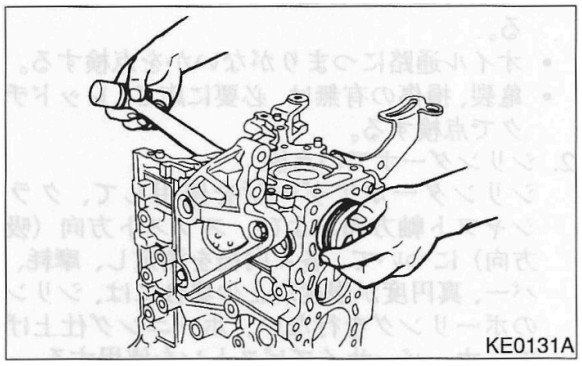


14.Remove the crankshaft.
- Remove the crankshaft and oil seal.
- Remove the main bearing while checking it's position.

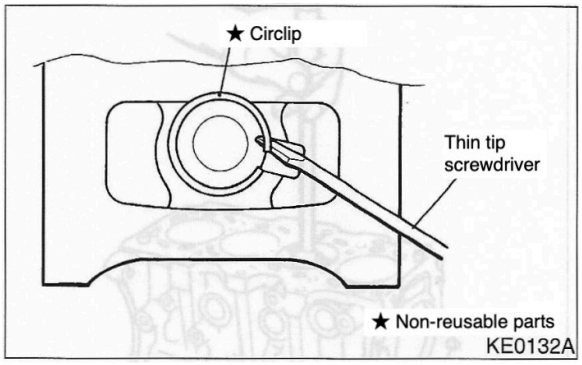
15.Remove the thrust bearing.



16.Removing the piston.
1) Press the top of the piston from the skirt side of the cylinder with the handle of a hammer or similar tool to push the piston and connecting rod together toward the cylinder head.
2) Write the cylinder number on the top of the piston for identification.



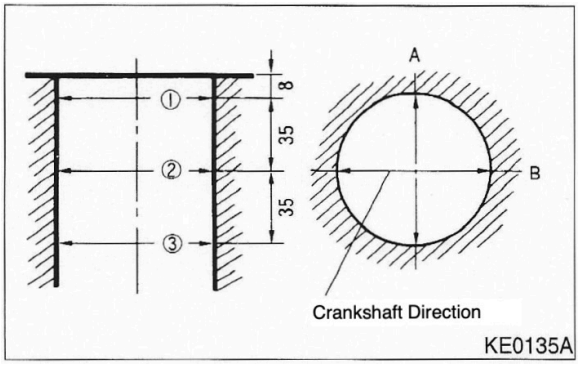
17.Disassembly of piston and connecting rod.
1) Use a thin-tipped screwdriver to remove the circlip.
2) Push out the piston pin and disassemble.



<Inspection>

1. Visual Inspection
   1) Clean the cylinder block.
      • Remove any residue from the gaskets, adhesives, etc.
      • Remove carbon buildup from the cylinder bore surface.
   2) Visually inspect for damage and cracks.
      • Check the joints and sealing points, especially the oil pump mounting surface and water pump mounting surface.
      • Check that the oil passages are not clogged.
      • If necessary, check for cracks or damage using a red check.
2. Check the cylinder bore.
   • Using a cylinder bore gauge, measure the inner diameter in the axial direction of the crankshaft and in the thrust direction (intake and exhaust direction). If wear, taper, or out-of-roundness is above the limit, bore and hone the cylinder, and use an oversized piston.


KE0134A



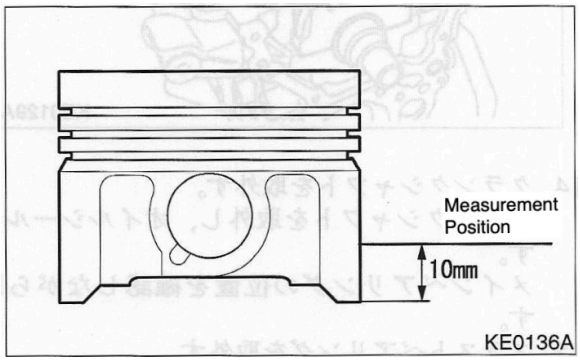
KE0135A

Cylinder Inner Diameter (Standard)	56.0~56.02mm
Roundness (Limit)	0.05mm
Taper (Limit)	0.05mm
Cylinder Inner Diameter (Limit)	56.5mm or less

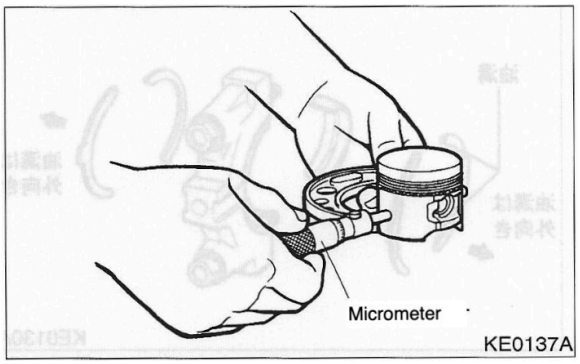
(3) Piston and Piston Ring

<Inspection>

1. Visual Inspection
   • Remove any carbon that has adhered to the top surface of the piston.
   • Check for damage to the outer surface, cracks, wear and tear on the ring groove, etc., and replace if defective.
2. Check the piston outer diameter.
   • At the position of dimension A below, measure the maximum out diameter using a micrometer.



KE0136A



KE0137A

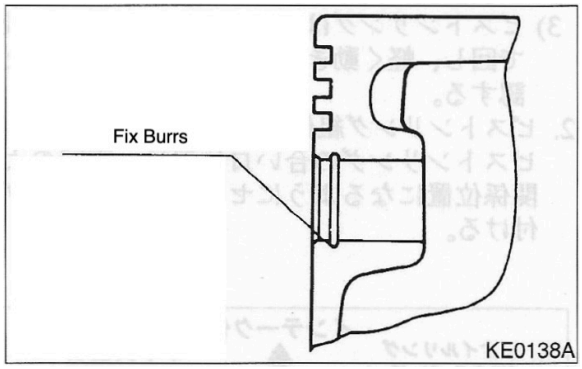
✻ Standard outer diameter of piston skirt (20°C)

Standard Value	**Size Category 1**	55.978~55.985mm
	Size Category 2	55.985~55.995mm
0.25 Oversize		56.225~56.245mm
0.50 Oversize		56.475~56.495mm

✻ Clearance between cylinder and piston

Standard Value	0.015~0.035mm
Limit Value	0.06mm

3. Check the piston pin hole
   - Inspect the piston circlip, and if there is any burr, correct it so that the piston pin can move.



4. Piston Pin Inspection
   1) Check for external damage and correct any minor scratches with waterproof sandpaper.
   2) Replace any parts that have significant external damage or wear.
   3) Check clearance between the piston and the piston pin.

Standard Clearance between piston and piston pin (20°C)	0.004~0.008mm
Limit	0.015mm

5. Check the piston pin circlip.
   - If the circlip is removed, replace it with a new one and do not reuse it.
   - Inspect the piston ring groove.
6. Clean the piston ring groove thoroughly and inspect it for damage, especially for signs of gas leakage.

(4) Piston Rings

1. Piston ring removal
   - Remove the piston rings from the piston using your fingers or a piston ring expander.

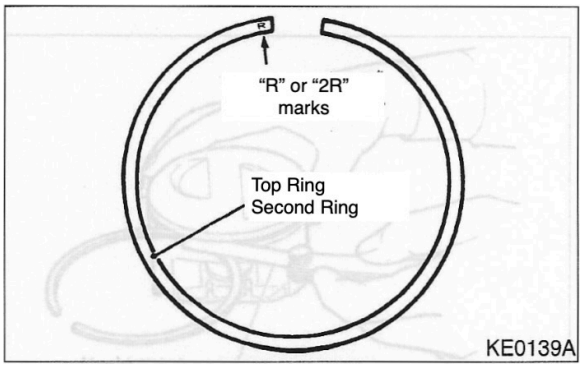
NOTES

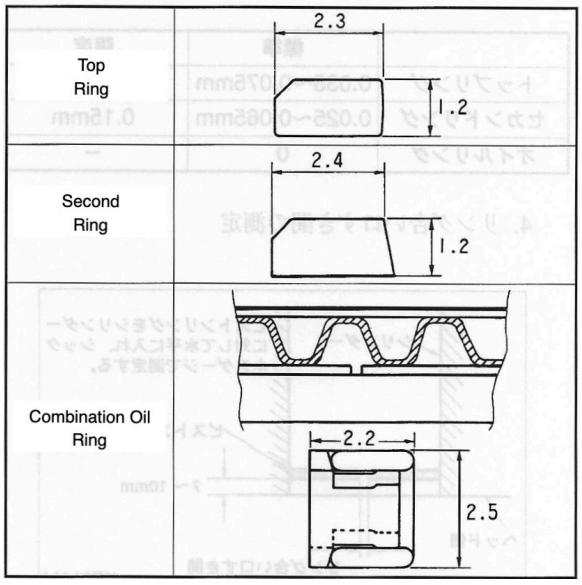
- Place the piston and piston rings so that their assembly positions and directions are clear.

2. Visual inspection
   - If the piston is broken, damaged, worn, or has lost tension, or if you are replacing it with an oversized piston, use a piston ring of the same size category as the piston being used (there are two oversized types: 0.25 & 0.5).

NOTES

- The piston ring gap is stamped with the symbol R or 2R. When assembling, make sure the stamped symbol faces the piston head.

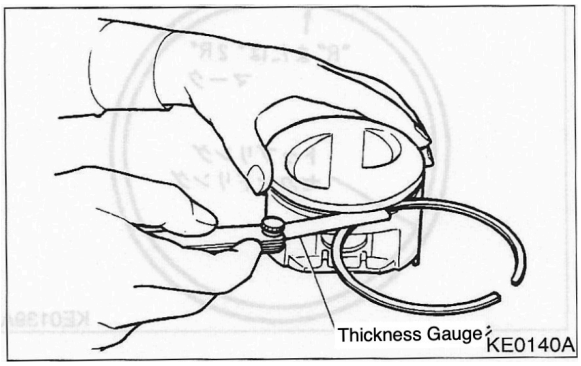




3. Ring groove clearance measurement.

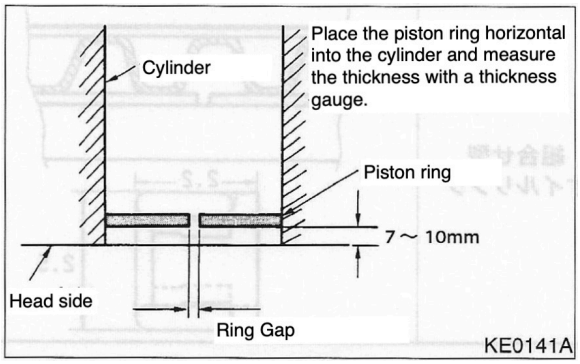
NOTES

• Clean the piston ring groove and piston ring.



	Standard	Limit
Top Ring	0.035~0.075mm	0.15mm
Second Ring	0.025~0.065mm	0.15mm
Oil Ring	0	-

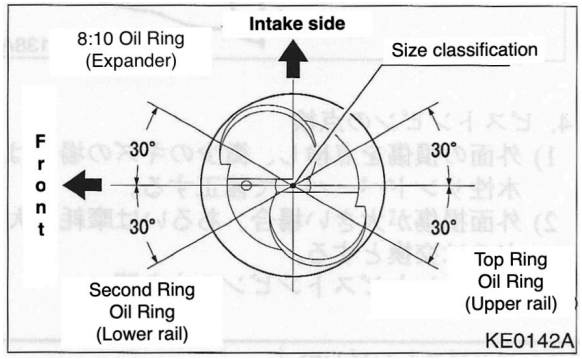
4. Measuring the gap, between the ring joints.



		Standard	Limit
Top Ring	For NA	0.15~0.30mm	0.8mm
	For SC	0.15~0.25mm	0.7mm
Second Ring		0.15~0.30mm	0.8mm
Oil Ring		0.1~0.6mm	1.0mm

<Assembly>

1. Piston assembly.
   1) Clean the piston ring groove thoroughly.
   2) Pay attention to the front and back assembly direction of both the top ring and second ring, and make sure the engraved symbol on the gap faces the top of the piston.
   3) After assembling the piston ring to the piston, turn it with a tool to check that it moves smoothly and is not getting caught.
2. Piston ring assembly position.
   • Set the piston ring gap positions as shown in the diagram below.



3. Piston ring identification.

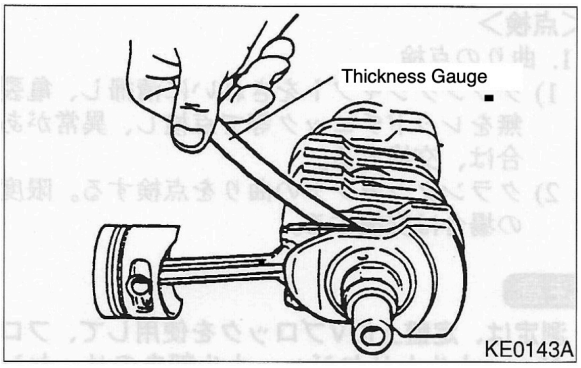
	Standard	Oversized 0.25	Oversized 0.50
Top Ring	Blue	R25	R50
Second Ring	Yellow	2R25	2R50
Oil Ring	Black	Blue	Red

• Standard rings have paint mark. (part of outer circumference, oil spacer is joint).
• Oversized is stamped (top, second), but oil has two paint marks.

(5) Connecting Rod

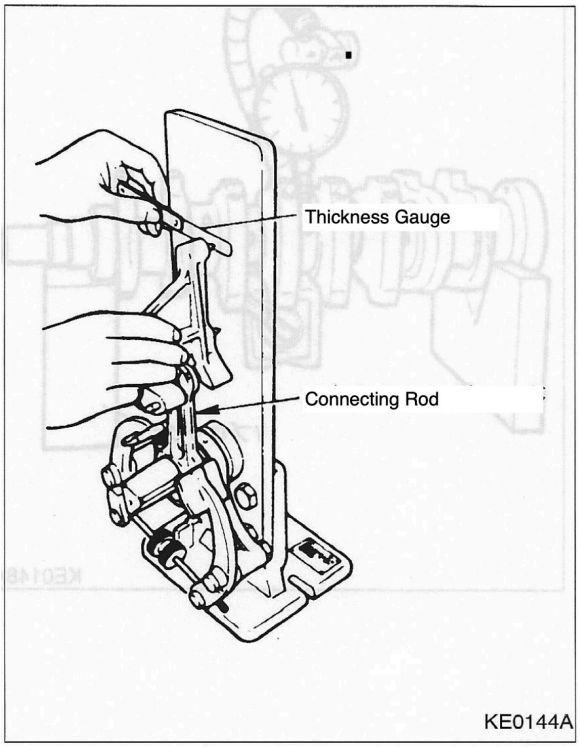
<Inspection>

1. Check the side clearance of the big end. Measure the side clearance between the crank pin web and the connecting rod. If it is greater than the limit, replace the connecting rod.

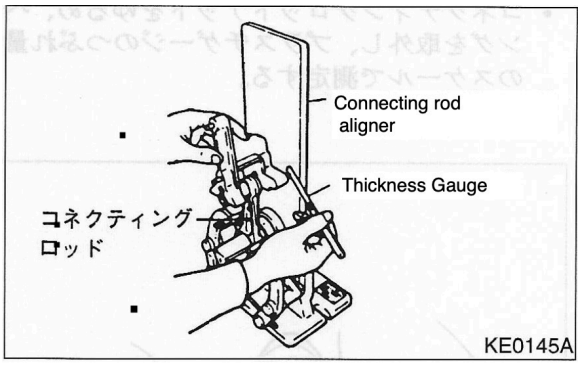


Big End Side Clearance	Limit
0.07~0.33mm	0.4mm

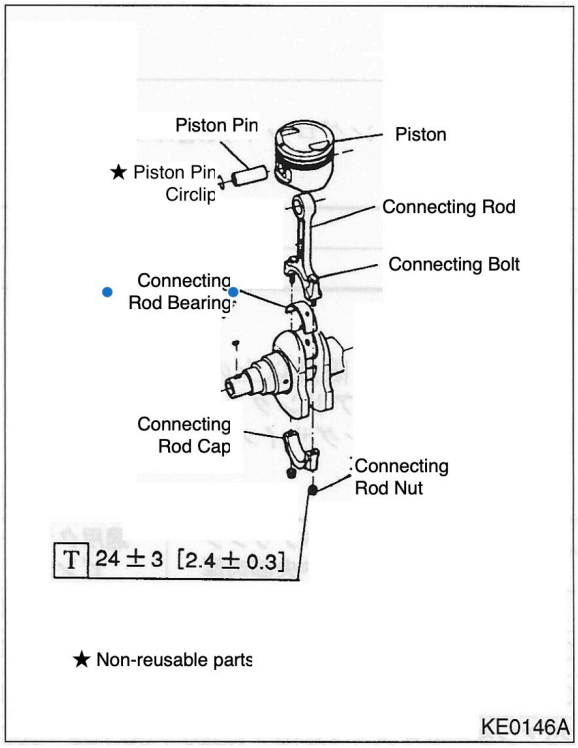
2. Check the connecting rod.
   1) Check the big end thrust surface for damage, If damaged, replace it.
   2) Use a connecting rod aligner to measure bending and twisting, and correct or replace any that exceed the limit.



Bending and Twisting Limits (Per 100mm)	0.1mm

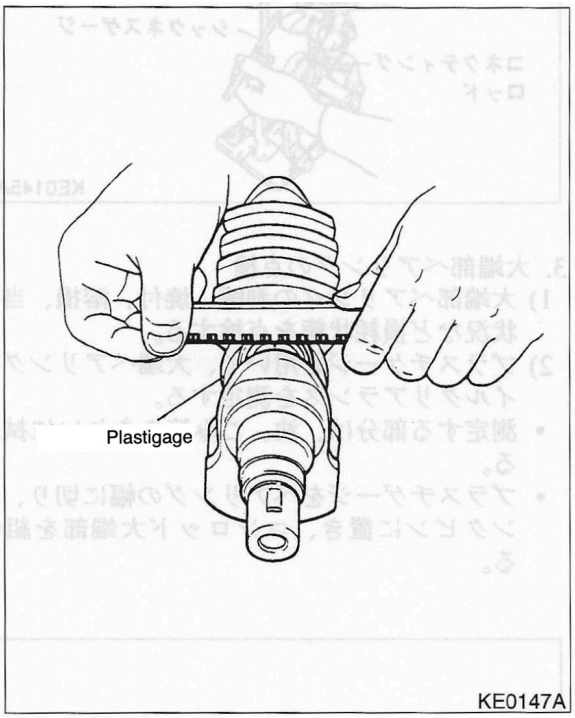


3. Inspection of the big end bearing.
   1) Check the big end bearing for wear such as peeling, seizure, melting, and contact surface condition.
   2) Using a x, measure the oil clearance of the big end bearing.
      - Wipe off any oil, dirt, etc. from the area to be measured.
      - Cut the plastigauge to the width of the bearing, place it on the crank pin, and assemble the big end of the connecting rod.



- Do not move the connecting rod relative to the crank pin during this procedure.

• Loosen the connecting rod nut, remove the bearing, and measure the amount of compression on the plastigauge using the scale on the bag.



3) Connecting rod big end oil clearance.

Standard	0.025~0.060mm
Limit	0.065mm

• If inspection reveals that the bearing is above the limit, replace it with the undersize bearing listed below.

4. Big end bearing size.

Bearing Size	Bearing Center Wall Thickness	Applicable Crank Pin Outer Diameter
Standard	1.488~1.498	30.989~31.000
0.03 Undersized	1.506~1.510	30.959~30.970
0.05 Undersized	1.516~1.520	30.939~30.950
0.25 Undersized	1.616~1.620	30.739~30.750

5. Inspection of small end.
• Inspect the rod small end hole, and if there is significant wear or damage, replace the connecting rod.

Connecting Rod Small End Hole and Piston Pin Clearance (Standard)	0.007~0.023mm
Gap Limit	0.028mm

NOTES
• The inner diameter of the small end may be measured differently in the longitudinal direction of the rod and in the direction perpendicular to it, so calculate the gap using the maximum dimension.

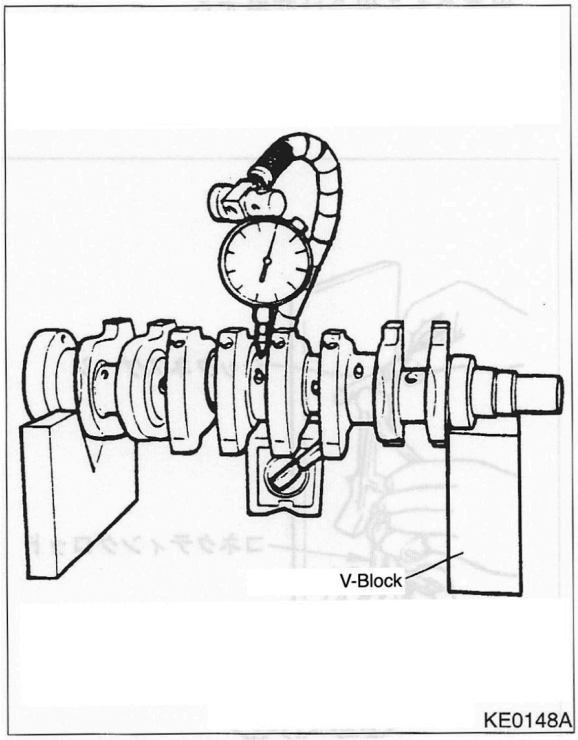
(6) Crankshaft

<Inspection>

1. Check for bends.
1) Clean the crankshaft thoroughly and check for cracks using a red check or similar tool. If any abnormalities are found, replace the crankshaft.
2) Check the crankshaft for bending. If it is bent beyond the limit, replace it.

NOTES
• Measurements are taken by placing the front and rear journals on a V-block on a surface plate and placing a dial gauge on the center journal.

Bending Limit	0.03mm



2. Check the journal diameter and crank pin.
   1) Check the journal and crank pin for wear and damage. If there is any problem, replace the journal and grind/repair the crank pin.
   2) If grinding and repairing is required, replace the bearing with an undersized one.

NOTES

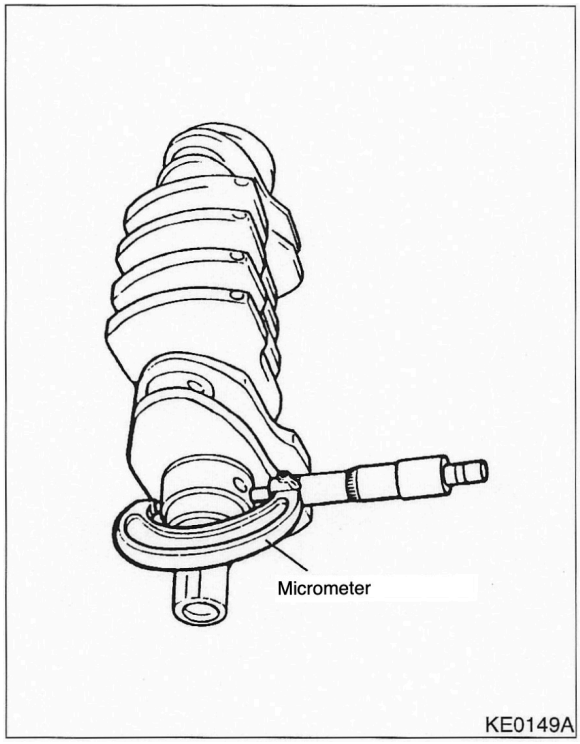
- There are three types of undersizes for both crank journal and crank pin: 0.02, 0.05, and 0.25, as shown in the table below.

Ellipticity	0.03mm
Taper Degree	0.02mm
Polishing Correction Limit	0.25mm

✻ Journal diameter and crank pin diameter reference dimensions and bearing dimensions

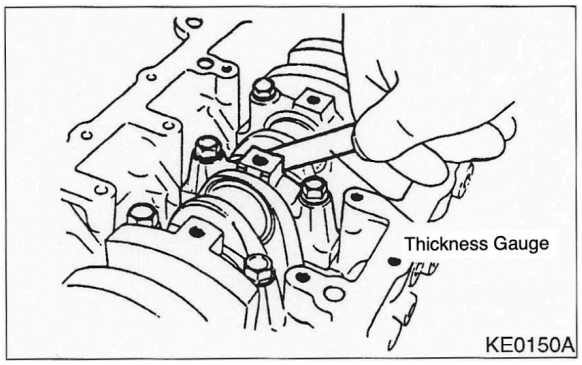
(Unit:mm)

Size Classification / Item		Crank Journal Part			Crank Pin
		#1	#2, #4, #5	#3	
Standard	Shaft Diameter	41.979~41.997	41.973~41.991	41.967~41.985	30.989~31.00
	Bearing Center Wall Thickness	1.494~1.512	1.494~1.512	1.494~1.512	1.488~1.498
0.03 Undersized	Shaft Diameter	41.943~41.961	41.943~41.961	41.943~41.961	30.959~30.970
	Bearing Center Wall Thickness	1.515~1.518	1.515~1.518	1.515~1.518	1.515~1.518
0.05 Undersized	Shaft Diameter	41.932~41.941	41.923~41.941	41.923~41.941	30.939~30.950
	Bearing Center Wall Thickness	1.525~1.528	1.525~1.528	1.525~1.528	1.516~1.520
0.25 Undersized	Shaft Diameter	41.723~41.741	41.723~41.741	41.723~41.741	30.739~30.750
	Bearing Center Wall Thickness	1.625~1.628	1.625~1.628	1.625~1.628	1.616~1.620



3. Checking the side clearance.
   - With the crankshaft installed in the cylinder block, measure the clearance in the axial direction of the crankshaft at the thrust bearing of the #3 journal.
   - If it exceeds the limit, replace the thrust bearing.

Crankshaft Side Clearance	Standard	Limit
	0.05~0.222	0.30



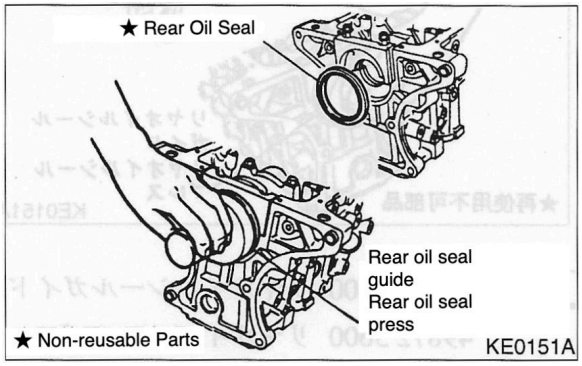
4. Main bearing inspection.
   - Check the condition of the contact surface of each bearing to see if there is any peeling, seizure, or melting damage.
   - Measure the oil clearance of each bearing using a plastigauge (see the crank pin section for instructions). If any abnormalities are found, replace the bearing.

✻ Bearing cap bolt tightening torque
T 39 ± 3 N•m [4.0 ± 0.3 km•m]

✻ Oil Clearance

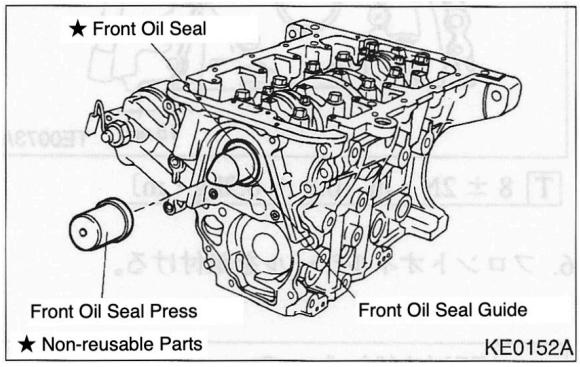
		Standard	Limit
Standard Size	#1 Journal	0.020~0.040	0.050
	#2, #4, #5 Journal	0.025~0.045	0.055
	#3 Journal	0.030~0.050	0.060
Undersized	0.03 Under	Conforms to standard size	Conforms to standard size
	0.05 Under		
	0.25 Under		

5. Check the rear oil seal.
   1) Visually inspect the seal lip for wear, cracks, and signs of oil leakage.
   2) If you remove the oil seal, do not reuse it; use a new one.



ST 49872 5500 Rear Oil Seal Guide
49872 5600 Rear Oil Seal Press

6. Inspect the front oil seal.
   1) The front oil seal is attached to the oil pump. Check it in the same way as the rear oil seal.
   2) When replacing the oil seal, use the special tool: Oil seal guide on the crankshaft and assemble it taken care not to turn up the lip.



ST 49958 6100 Front Oil Seal Guide
49958 6200 Front Oil Seal Press

(7) Main Engine Assembly

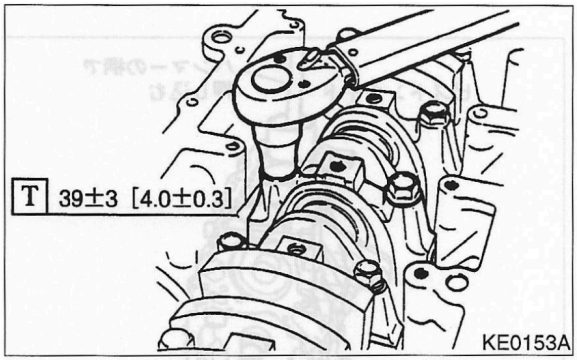
<Assembly>

1. Crankshaft assembly
   1) Place the block upside down and assemble the main bearings and thrust bearings in to the cylinder block.

NOTES

- Pay attention to the bearing combination.

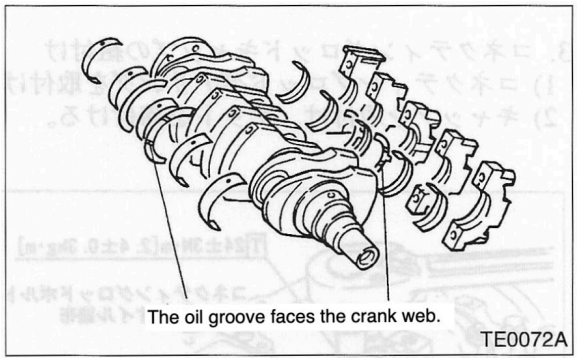
   2) Install the crankshaft.
   3) Assemble the main bearing into the bearing cap, and then



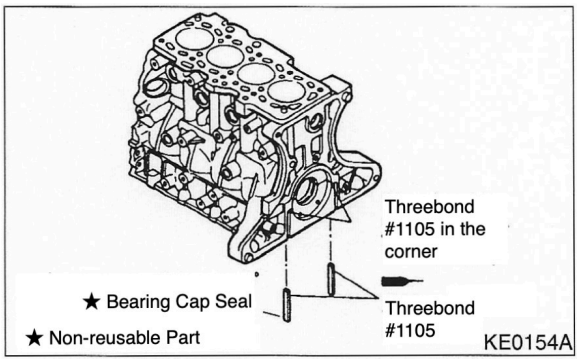
assemble the bearing cap together with the thrust bearing.

NOTES

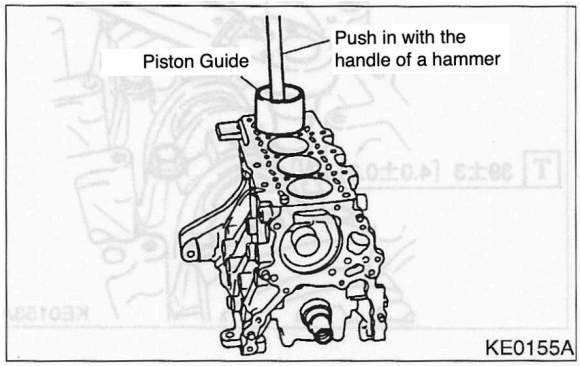
- Pay attention to the bearing combination and the orientation of the thrust bearing (the oil groove should face the crank web).



   4) Assemble the cylinder block bearing cap. Apply Threebond #1105 to the corner R of the cylinder block side and assemble the cap. Apply Threebond #1105 to the tip 1/3 of the seal insertion side and insert. Wipe off any excess.



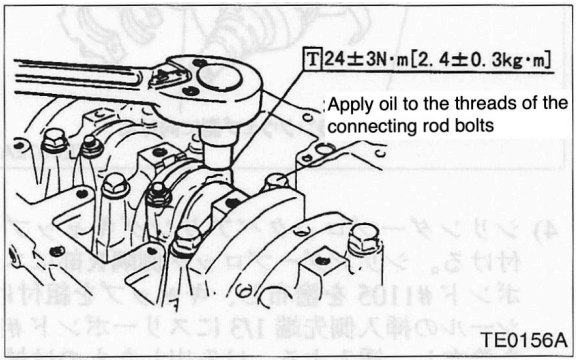
2. Piston and connecting rod assembly.
   1) Assemble the piston and connecting rod and then attach the vinyl lube to the connecting rod bolt.
   2) Insert the piston into the cylinder block.



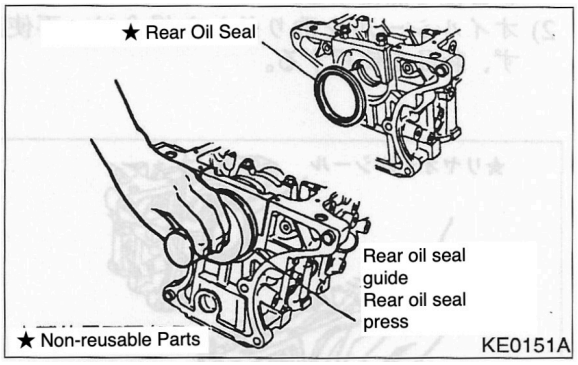
ST 49874 5600 Piston Guide

NOTES
- The connecting rod mark should face towards the front of the engine.

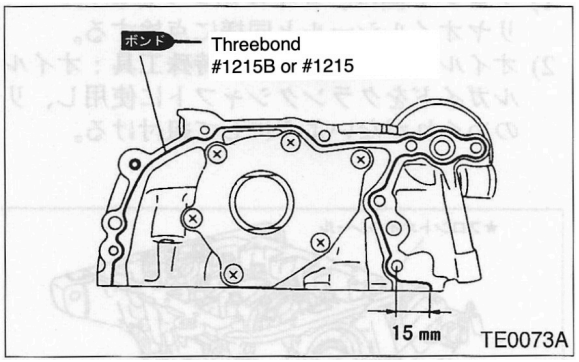
3. Assembling the connecting rod cap.
   1) Install the connecting rod bearing.
   2) Install the cap and tighten the nut.



4. Install the rear oil seal.

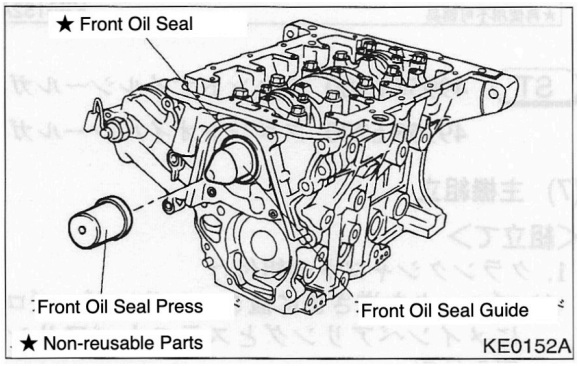


ST 49872 5500 Rear Oil Seal Guide
49872 5600 Rear Oil Seal Press



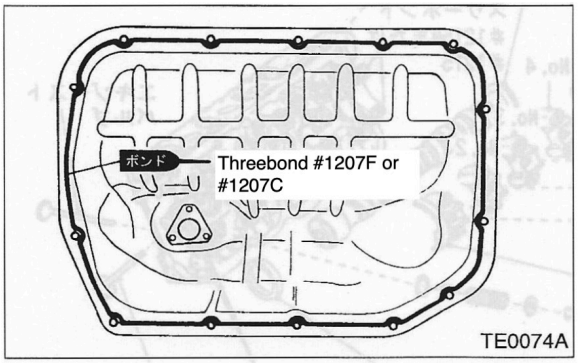
5. Install the oil pump.
   - Apply Threebond #1215B or #1215 between the back of the oil pump assembly and the cylinder block, then install.
     T 8 ± 2 N·m [0.8 ± 0.2 kg·m]

6. Install the front oil seal.



ST 49958 6100 Front Oil Seal Guide
49958 6200 Front Oil Seal Press

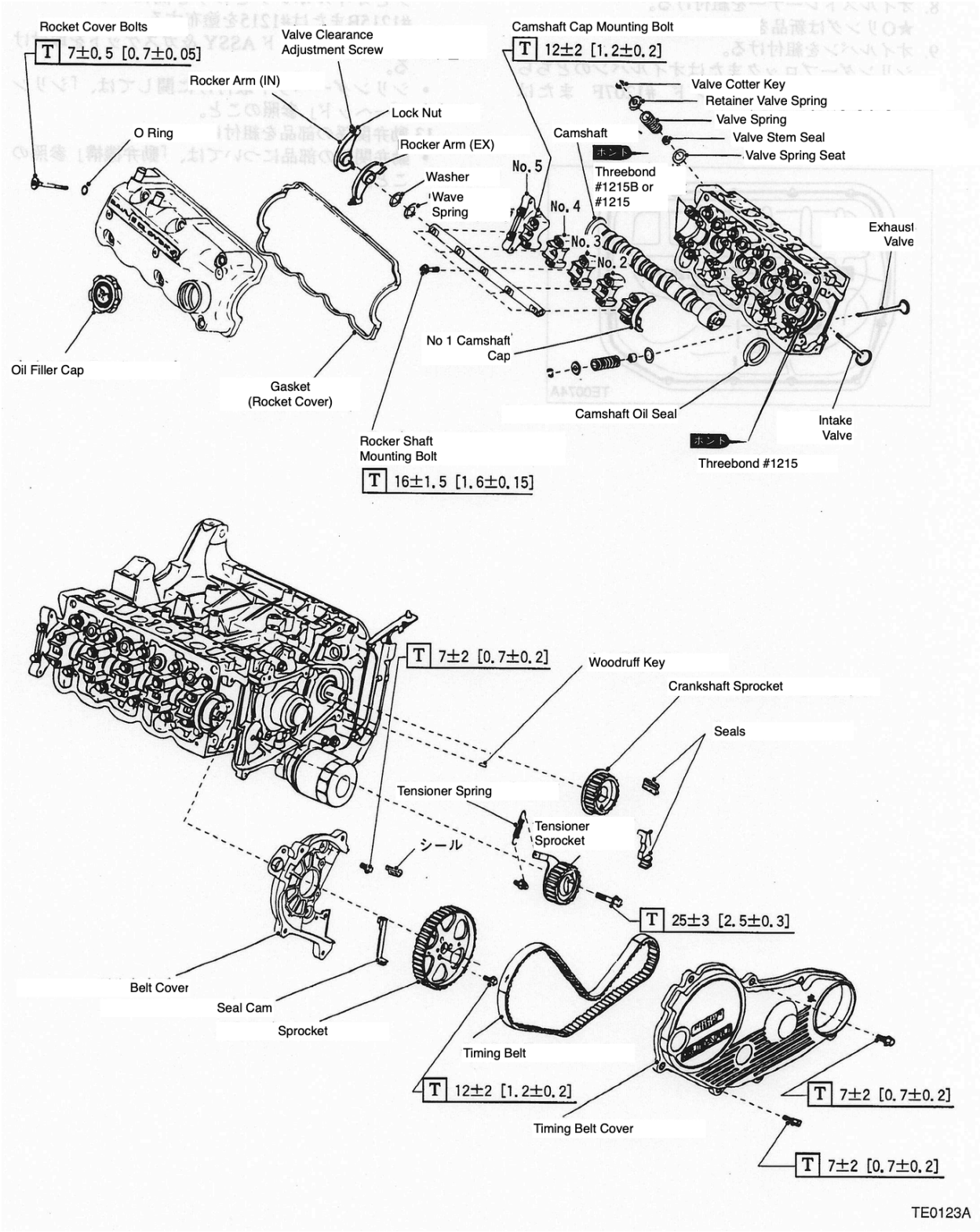
7. Assemble the crankshaft bearing stiffener.
8. Install the oil strainer.
   - ★ Use a new ring.
9. Install the oil pan.
   - Apply Threebond sealant #1207F or #1207C to either the cylinder block or oil pan.



10. Install the engine stand.
11. Install the water pump.
12. Apply Threebond #1215B or #1215 to the gap between the water pump and oil ring.
13. Install the cylinder head assembly and gasket.
14. For cylinder head installation, refer to the Cylinder Head section in this chapter.
15. Assemble the valve train parts.
16. For Valve Train related parts, see Valve Train Mechanism.

2 - 5 Valve Mechanism

■ Parts & Components



■ Maintenance Preparation Items

※ New Tool

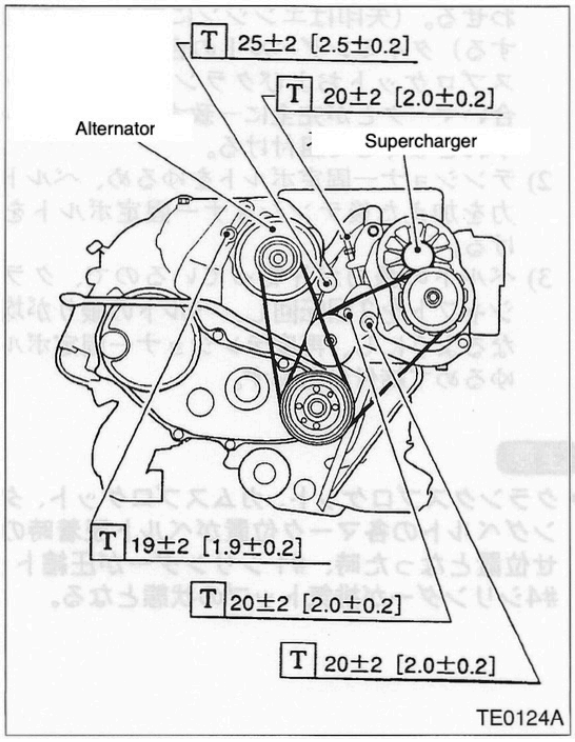
Classification	Tool Number	Name	Purpose
ST	49981 5500	Engine stand COMPL	Engine disassembly and assembly work
	49845 5600	Engine stand attachment	Engine disassembly and assembly work (stand auxiliary equipment)
	49976 5600	Cylinder head table	Removal and installation of valves, valve springs, and valve guides.
	49827 5800	Flywheel stopper	Flywheel stopper
	59920 6400	Crank pulley wrench	Crank pulley stopper
	49920 6500	Attachment	Above attachment
	49920 5700 49952 5500	Puller Bolt	Removing the crank pulley and crank sprocket
	49958 5500	Valve stem seal guide	Valve stem seal installation
	49958 5700	Camshaft oil seal guide	Camshaft oil seal press-fitting (for outer diameter press)
	49858 5800	Camshaft oil seal guide	Camshaft oil seal press-fitting (to protect inner lip)
	49976 5700	Valve guide remover	Valve guide removal
	49971 5800	Valve guide adjuster	Valve guide press-fit posititioning
	49971 5900	Valve guide reamer	Connecting the inner diameter after pressing in the valve guide
	49971 8000	Valve guide remover	Removal and installation of valves and valve springs
Grease, Oil, & Other	ThreeBond #1215B or #1215	Liquid gasket	Cam cap mounting surface
	Oil, Grease	Engine oil and grease	For application during part assembly

■ Maintenance Instructions

(1) Timing Belt & Sprocket

<Removing the Timing Belt>

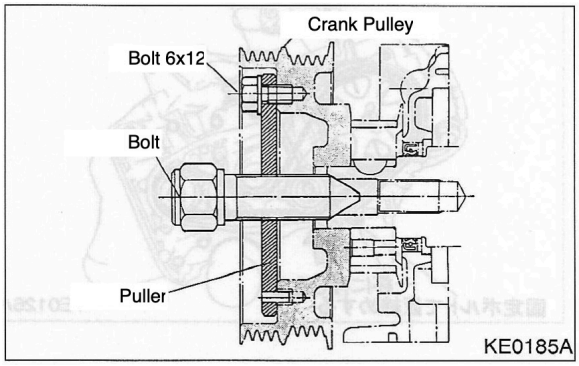
1. Remove the alternator and super charger V-belts.



2. Remove the crank pulley.
   1) Secure the flywheel or crank pulley with a stopper, and remove the crank pulley bolt.

ST
49827 5800 Flywheel Stopper
49920 6400 Crank Pulley Wrench
49920 6500 Attachment

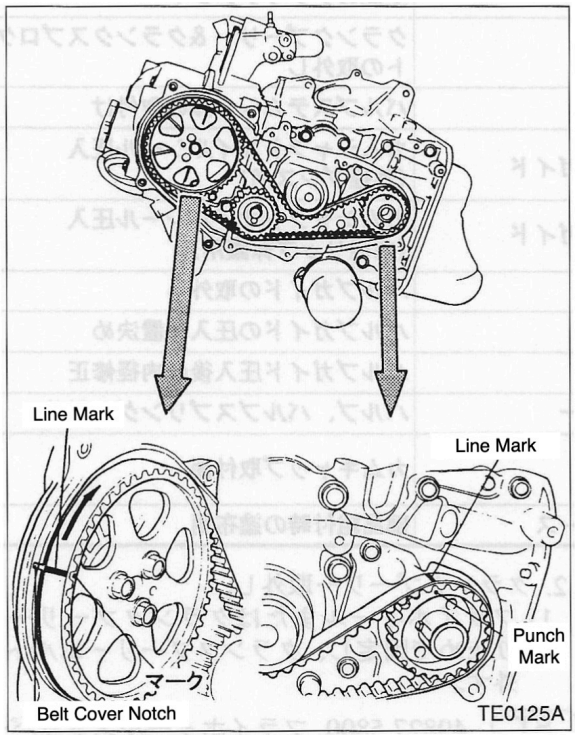
   2) Remove the crank pulley. If it is difficult to remove the crank pulley, use a puller and bolt to pull it out.



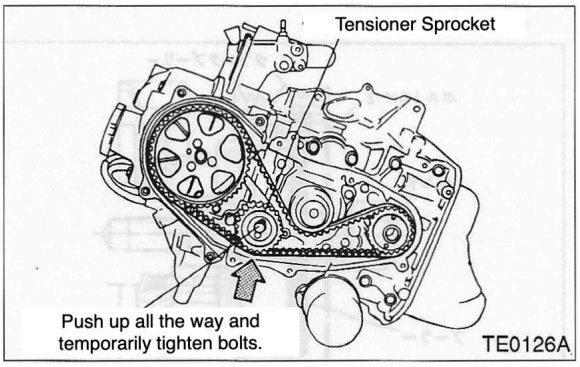
ST
49920 5700 Puller
49952 5500 Bolt

✻ Crank Pulley Bolt Tightening Torque
T 108 ± 10 N•m [11 ± 1.0 kg•m]

3. Removal of related parts.
   1) Remove the oil level gauge and guide.
   2) Remove the timing belt cover.
4. Removing the timing belt.
   1) Before removing the timing belt, use a crank pulley wrench to turn the cam sprocket so that it is position, make an arrow and a line mark on the belt indicating the direction or rotation.

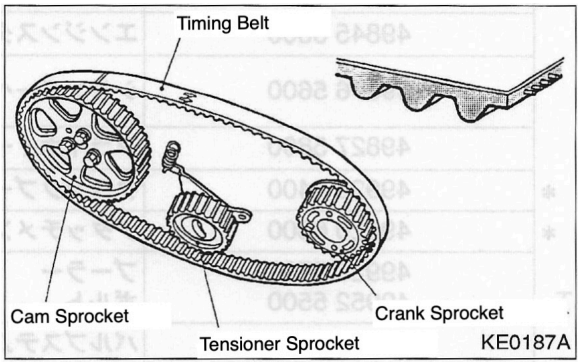


   2) Loosen the tensioner fixing bolt, move the tensioner sprocket fully in the belt loosening direction (arrow direction), and then tighten the fixing bolt.
   3) Remove the timing belt.



<Inspection of Timing Belt>

1. Visually inspect the teeth for chipping, cracks, and wear of the belt, and replace if any abnormalities are found.
2. Inspect the back of the belt and replace it if any cracks or fissures are found.



NOTES

- Do not allow oil, grease, coolant, water, etc, to adhere to the belt as this will shorten the belts lifespan.
- If it gets on your skin, remove it immediately.
- Do not bend the belt at a sharp angle or bend it in an L-shape.

<Installation of Timing Belt>

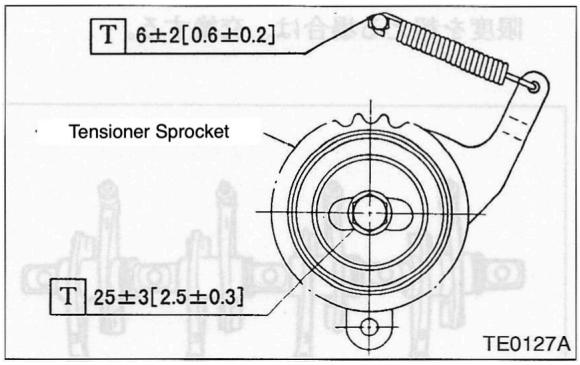
1. Set the position of the crankshaft sprocket and camshaft sprocket.
   1) Rotate the camshaft and align the timing punch mark on the cam sprocket with the notch on the top of the belt cover.
   2) Rotate the crankshaft and align the timing punch mark on the crank sprocket with the oil pump mold ridge line diagonally to the right as you face it.
2. Install the timing belt.
   1) Align the timing belt arrow with the direction of the engine (the arrow should point to the right as you face the engine). Assemble the belt without any misalignment, so that the timing belt alignment mark line is perfectly aligned with the alignment marks on the cam sprocket and crank sprocket.
   2) Loosen the tensioner fixing bolt, apply tension to the belt, and then tighten the tensioner fixing bolt.
   3) The belt tension is uneven, so turn the crankshaft two times make the belt tension even, then loosen and retighten the tensioner fixing bolt.

NOTES

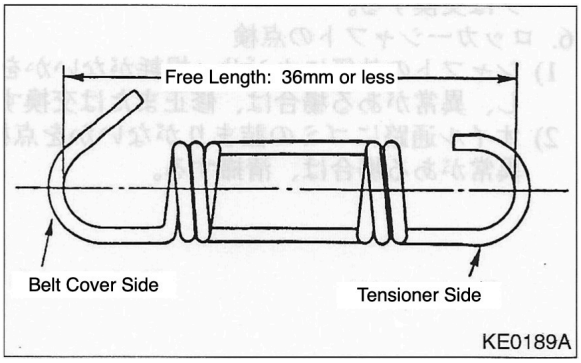
- When the marks on the crank sprocket, cam sprocket, and timing belt are aligned as the should be when removing and installing the belts, the #1 cylinder will be at the top of compression and the #4 cylinder will be at the top of exhaust.

<Sprocket Removal/Installation/Inspection>

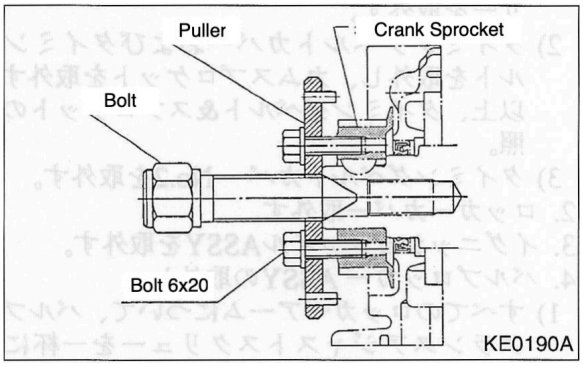
1. Removing and installing the belt tensioner.
   - To remove or install the belt tensioner, remove the timing belt first, then loosen the tensioner fixing bolt.
   - Do not remove only the spring.



2. Check the belt tensioner.
   1) Check that the tensioner sprocket rotates smoothly. If there is any abnormalities, replace it.
   2) Check the sprocket for damage to the tooth surface. If significant damage is found, replace it.
3. Check the tensioner spring.
   1) Check for damage to the spring hook and wear on the spring, and replace if any abnormalities are found.
   2) Check the damper inserted into the inner diameter of the spring and replace it if there is any abnormality such as breakage.



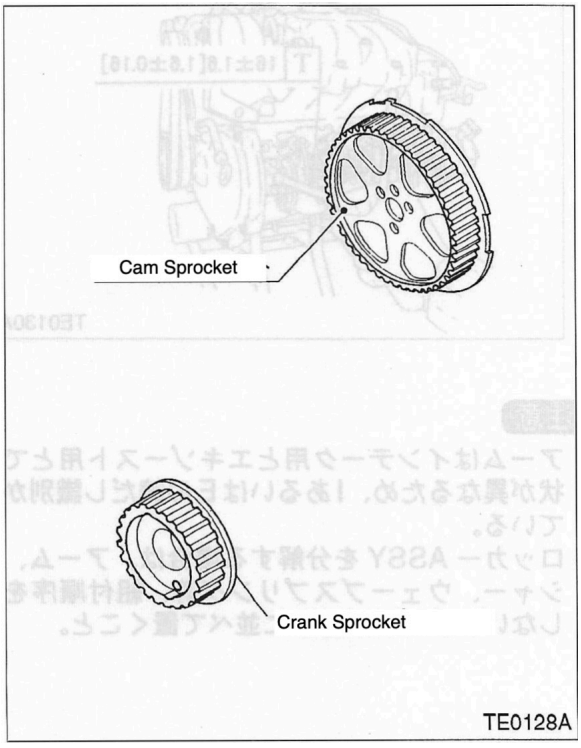
4. Remove the crank sprocket.
   - If the crank sprocket is difficult to remove, use a puller and bolt to remove it.



5. Check the crank sprocket and cam sprocket.
   1) Visually inspect the sprocket teeth for damage and wear.
   2) Check the keyway of the crank sprocket for wear.
   3) Check the down pin holes in the cam sprocket for wear.
   4) Check for dents on the outer periphery of the camshaft angle sensor plate .
      - If there is any abnormality, replace it.

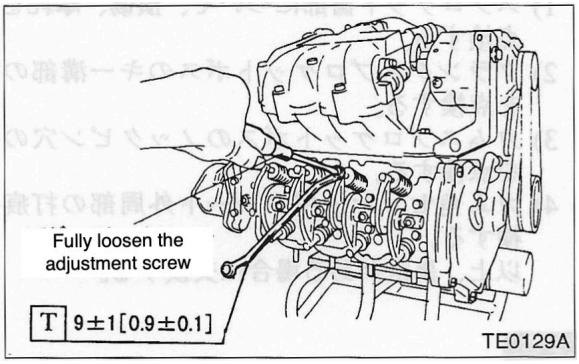
NOTES

- Scratches on the cam angle sensor place can cause incorrect cam angle determination, so be careful when handling the cam sprocket.

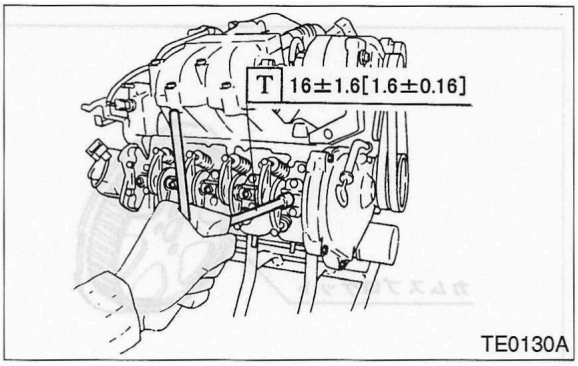


(2) Valve Rocker Assembly

1. Removal of related parts.
   1) Remove the V-ribbed belts that drive the alternator and supercharger, and remove the crank pulley.
   2) Remove the timing belt cover and timing belt, and then remove the cam sprocket. Refer to the Timing Belt & Sprocket section.
   3) Remove timing belt cover No 2.
2. Remove the rocker cover.
3. Remove the ignition coil assembly.
4. Remove the valve rocker assembly.
   1) For all rocker arms, loosen the valve clearance adjustment screws fully to free the connection between the cam lobe and spring force.



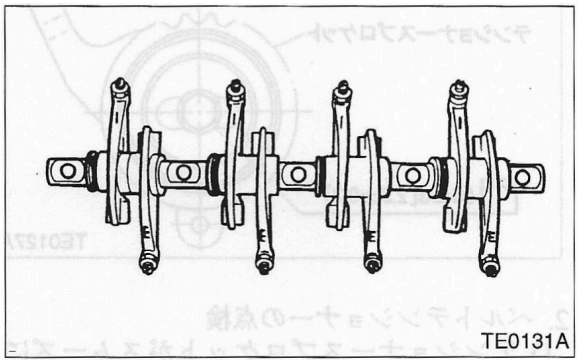
   2) Loosen the five rocker shaft mounting bolts and remove the rocker shaft as an assembly.



NOTES

- The arms for intake and exhaust have different shapes, so they are marked with a case “E”.
- When disassembling the rocker assembly, be sure to arrange the arms, washers, wave springs, etc. in the correct order to avoid confusion when assembling.

5. Rocker Arm Installation
   1) Check the movement of the arm relative to the rocker shaft, and if it does not move at the correct angle, replace the arm.
   2) Measure the inner diameter of the rocker arm and the outer diameter of the rocker shaft for both intake rocker arm and the exhaust rocker arm, and check the clearance between the rocker arm and the shaft.
      - If it exceeds the limit, replace it.



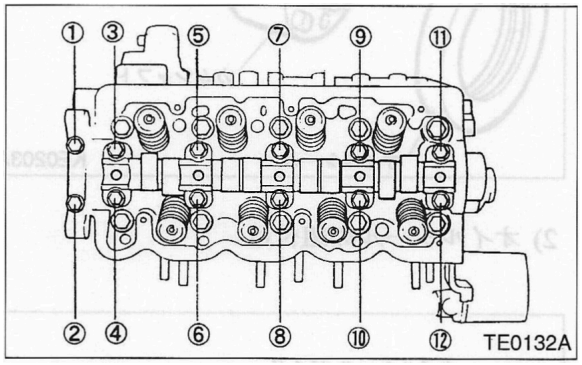
Clearance Between Rocker Arm Inner Diameter and Shaft (mm)	Standard	0.016~0.52
	Limit	0.1
Rocker Arm Inner Diameter (mm)	Standard	16.0~16.016
Rocker Shaft Outer Diameter (mm)	Standard	15.984~15.966

   3) Check the stopper part of the camshaft and repair any scratches.
   4) Check the contact point between the adjuster screw and the valve stem, and replace any valves that are found to be worn or abnormal.
6. Check the Rocker Shaft.
   1) Check the outer diameter of the shaft for galling or wear, and if any abnormalities are found, correct or replace them.
   2) Check the oil passages are not clogged with debris, and clean them if any abnormalities are found.

(3) Camshaft

<Removal/Inspection>

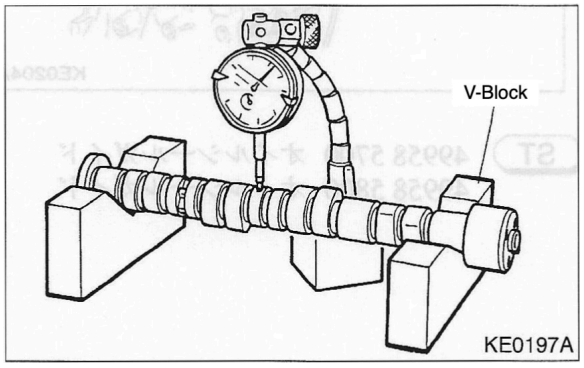
1. Removal of related parts.
   - Remove the timing shaft, cam sprocket, valve rocker cover, valve rocker assembly, ignition coil, etc.
   - For more information, please refer to the Valve Rocker Assembly section.
2. Camshaft removal and installation.
   1) To remove the camshaft cap, loosen the mounting bolts in the order shown in the diagram below.

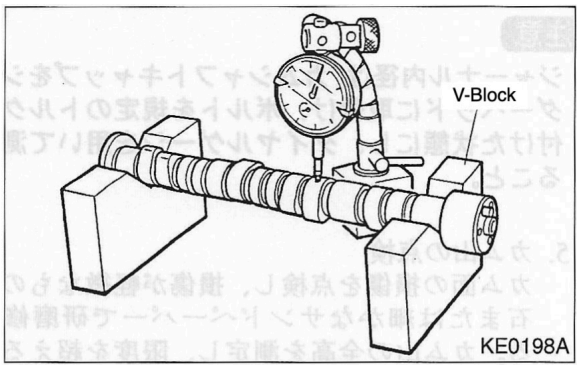


NOTES

- Do not remove the camshaft cap mounting bolts diagonally. Loosen and remove two bolts at a time.
- Arrange the camshaft caps in the correct to avoid confusion when assembling.

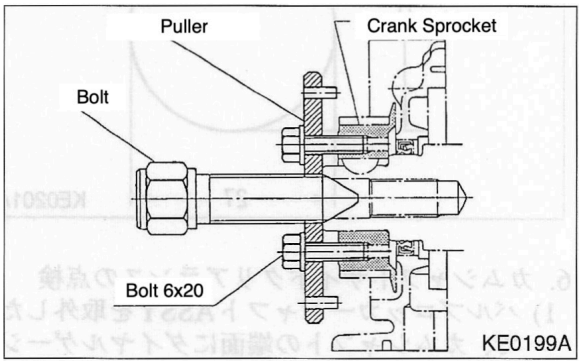
   2) Lift the camshaft with the oil seal attached and remove the oil seal.
3. Check for a bent camshaft.
   - Set a V-block on the surface and place a dial gauge on the central journal of the camshaft to check for bending and measure the eccentric wear of the base circle of each cam lobe.

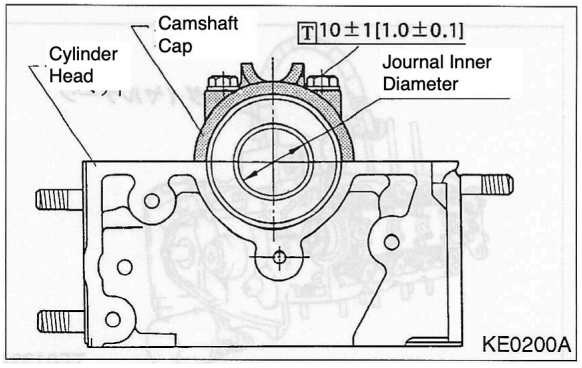




Bending Limit	0.025mm
Eccentric Wear Limit	0.020 mm

4. Camshaft Journal Inspection
   - Check the outer diameter of the camshaft journal, the inner diameter of the camshaft cap, and the inner diameter of the cylinder head journal for damage and wear, and if any abnormalities are found, replace the camshaft or camshaft cap. Measure the out diameter of the journal with a micrometer.





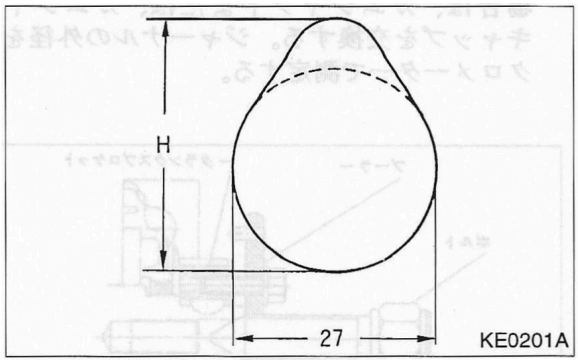
Journal Inner Diameter		26.0~26.021mm
Camshaft Journal Outer Diameter		25.939~25.955mm
Journal Gap	**Standard**	0.045~0.082mm
	Limit	0.1mm

NOTE

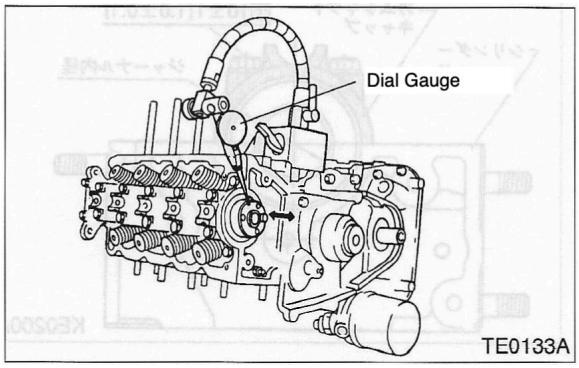
- The journal inner diameter should be measured using a dial gauge after the camshaft cap is attached to the cylinder head and the bolts are tightened to the specified torque.

5. Cam Lobe Inspection
   - Check the cam surface for damage, and if the damage is minor, grind it down with a grind stone or fine sand paper.
   - Measure the total height of the cam lobe, and replace any that exceed the limit.

	NA IN	NA EX	SC
Cam Lobe Over Height	31.42	31.74	31.47
Total Height Limit	31.12	31.47	31.17



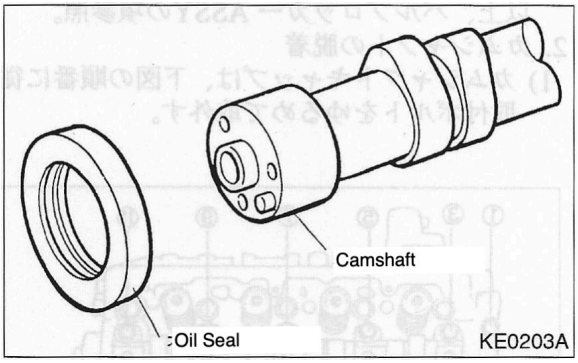
6. Check the camshaft side clearance
   1) With the valve rocker shaft assembly removed, place a dial gauge on the end face of the camshaft and measure the axial movement.

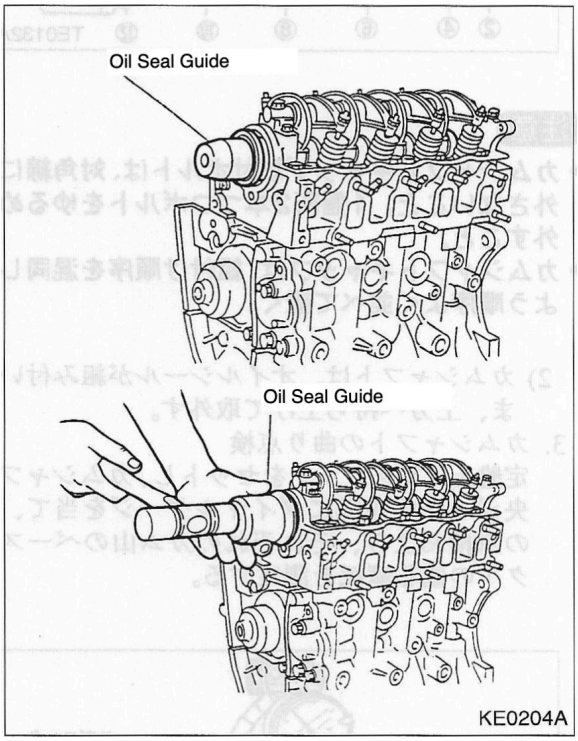


Side Clearance Standard	0.020~0.22mm
Gap Limit	0.5mm

   2) Visually inspect the camshaft thrust bearing part and correct any abnormalities such as galling.
      - As a result of above inspections 1 & 2, the side clearance is limited.
      - If it exceeds this, replace the camshaft or cylinder head.

7. Camshaft oil seal inspection and replacement.
   - If you remove the oil seal, do not reuse it but replace it with a new one.





ST 49958 5700 Oil Seal Guide
49958 5800 Oil Seal Guide

(4) Valves and Valve Springs

<Removal>

1. Removal of related parts.
   - Remove the timing belt, cam sprocket, valve rocker cover, valve rocker, ignition coil, camshaft, etc.
   - For the above, please refer to the Camshaft section.
2. Remote the intake manifold.
   1) For naturally aspirated vehicles, remove the intake manifold from the cylinder head with the throttle chamber still attached.
   2) For SC vehicles, remove the collection chamber, fuel delivery pipe, and injectors, and then remove the intake manifold.

✻ Intake manifold tightening torque
T 19 ± 2 N•m [1.9 ± 0.2 kg•m]

3. Remove the exhaust manifold and exhaust manifold.
4. Remove the cylinder head.
   1) Loosen the cylinder head bolts in the order shown in the

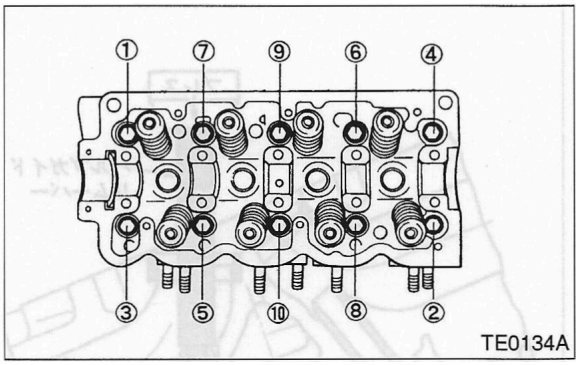
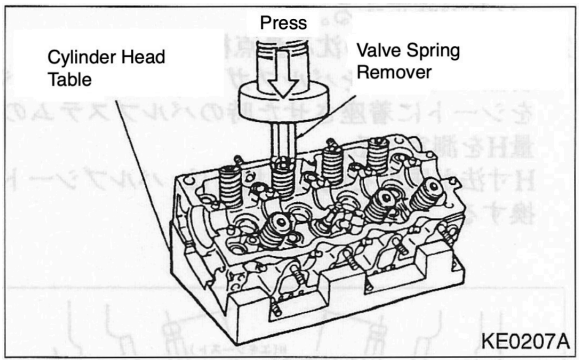


   diagram below.
   2) Remove the cylinder head gasket.
5. Remove the valve spring.
   1) Place the cylinder head assembly on the cylinder head table.
   2) Using a press, press the top of the valve retainer with a valve spring remover, remove the valve cotter key, and separate the valve and spring.

NOTE

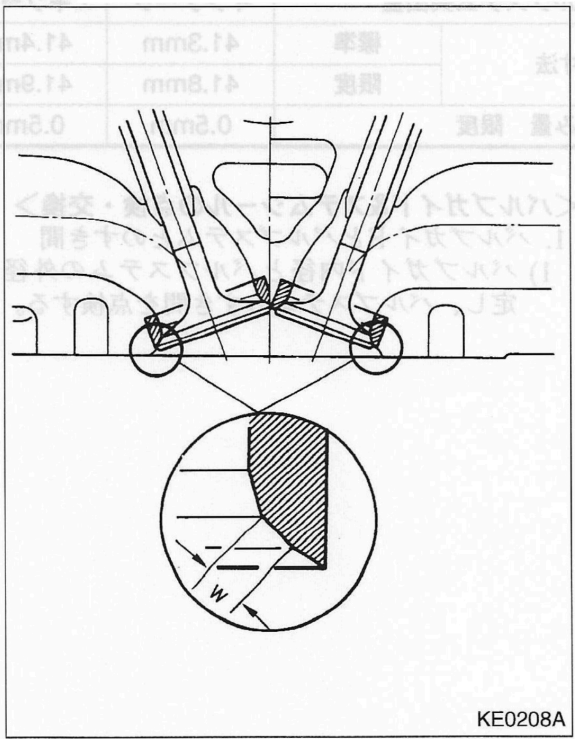
- Arrange disassembled valves, valve springs, etc in order to avoid mixing up the parts.



ST 49976 5600 Cylinder Head Table
49971 8000 Valve Spring Remover

<Valve Seat Inspection>

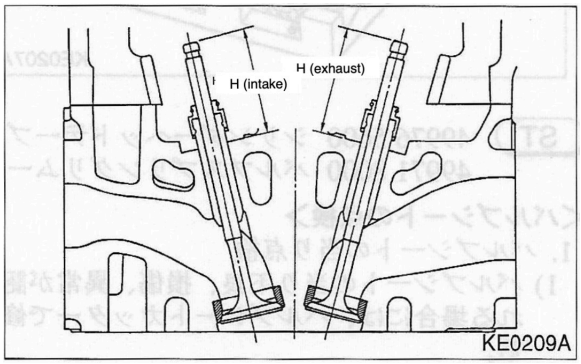
1. Check the valve seat contact
   1) If the valve seat is not properly seated, damaged, or abnormal, correct it with a valve seat cutter.



Valve Seat Width	Intake	Exhaust
	1.3mm	1.2mm

2) Use a compound to adjust the contact area between the valve seat and valve face so that it is at least 70% of the entire circumference.

2. Check the valve seat sinking amount.
   - Insert a new valve into the valve guide and measure the protrusion amount (H) of the valve stem when the valve is seated on the seat.
   - If the H dimension exceeds the limit, replace the valve seat.



Valve Stem Protrusion Amount		Intake	Exhaust
H Dimension	Standard	41.3mm	41.1mm
	Limit	41.8mm	41.9mm
Sinking Amount Limit		0.5mm	0.5mm

<Valve Guide & Stem Seal Inspection & Replacement>

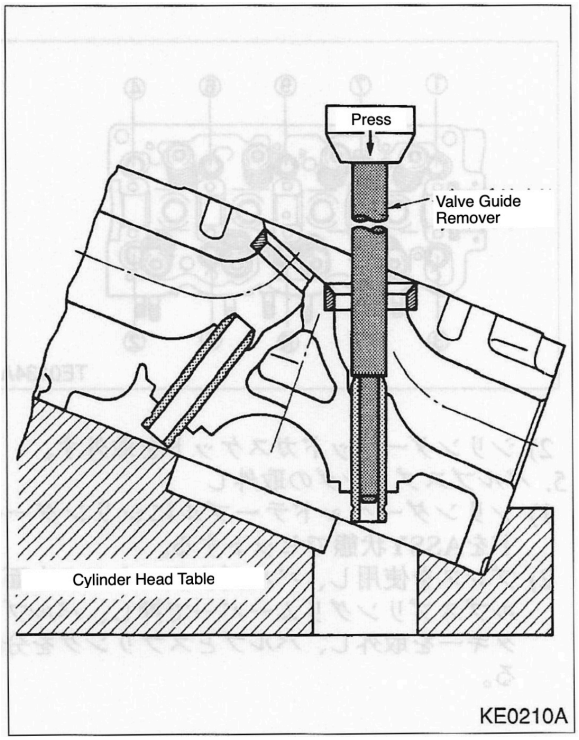
1. Gap Between the Valve Guide and the Valve Stem
   1) Measure the inner diameter of the valve guide and outer diameter of the valve stem, and check the valve stem clearance.

Valve Guide	Intake Valve	Exhaust Valve
Valve Stem Clearance	0.030~0.060	0.040~0.070
Gap Limit	0.130	0.150
Standard Valve Stem Outer Diameter	5.452~5.470	5.442~5.460
Standard Valve Guide Hole Diameter	5.50~5.512	5.50~5.512
Standard Engagement with Head	0.027~0.060	0.027~0.060

2) If the guide clearance exceeds the limit, replace the valve guide.

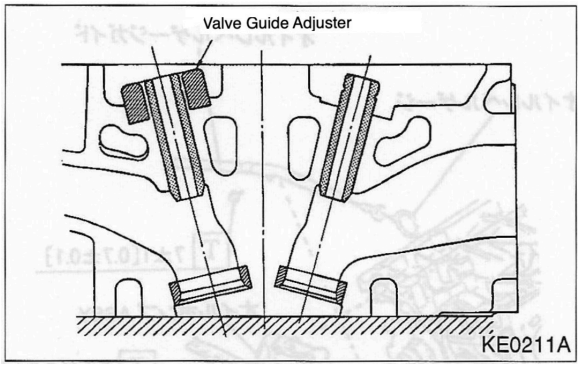
NOTE
- When replacing the valve guide, use an oversized valve guide outer diameter. See below for replacement instructions.

2. Valve Guide Replacement
   1) Insert the remover into the guide, press it in, and remove the guide.



ST 49976 5600 Cylinder Head Table
49976 5700 Valve Spring Remover

2) Valve guide press-fit dimensions.
   • Make it the same height as the valve guide adjuster.

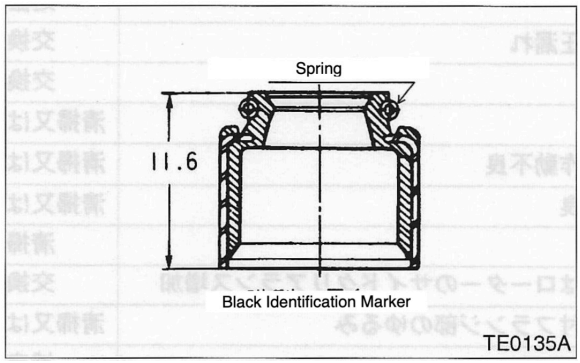


ST 49976 5800 Valve Guide Adjuster

3) Internal reaming.
   • After pressing the guide, correct any deformation of the inner diameter with a reamer.

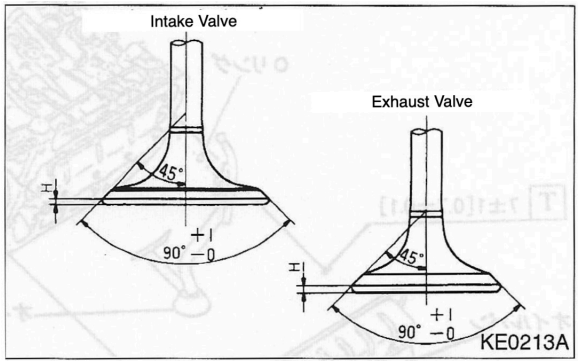
ST 49976 5900 Valve Guide Reamer

3. Check the valve stem oil seal.
   1) Check the inner seal for wear, interference, cracks, and loose springs, and replace any valves that are found to be abnormal.
   2) Replacing the stem oil seal
      • If the stem oil seal was removed from the valve guide, replace it.



ST 49958 5500 Valve Stem Seal Guide

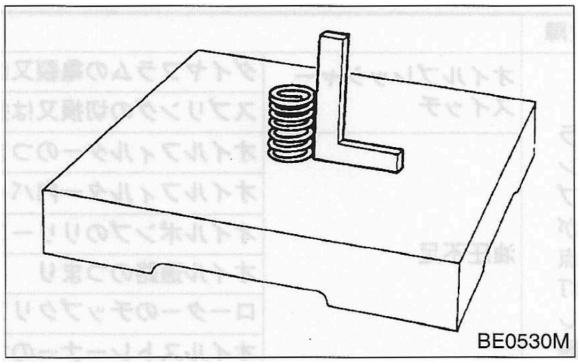
4. Inspection of intake and exhaust valves.
   1) Check the valve head, stem, and stem end for burns, wear, damage, deformation, etc.
   2) Check the thickness H of the valve head and the valve seat surface (face). If any abnormalities are found, repair or replace with a new one.



Item		Intake Valve	Exhaust Valve
Valve Head H Dimension	Standard	1.0mm	1.0mm
	Limit	0.5mm	0.5mm
Valve Umbrella Diameter		ø28 (ø26)mm	ø23mm
Valve Total Length		94.6mm	94.6mm

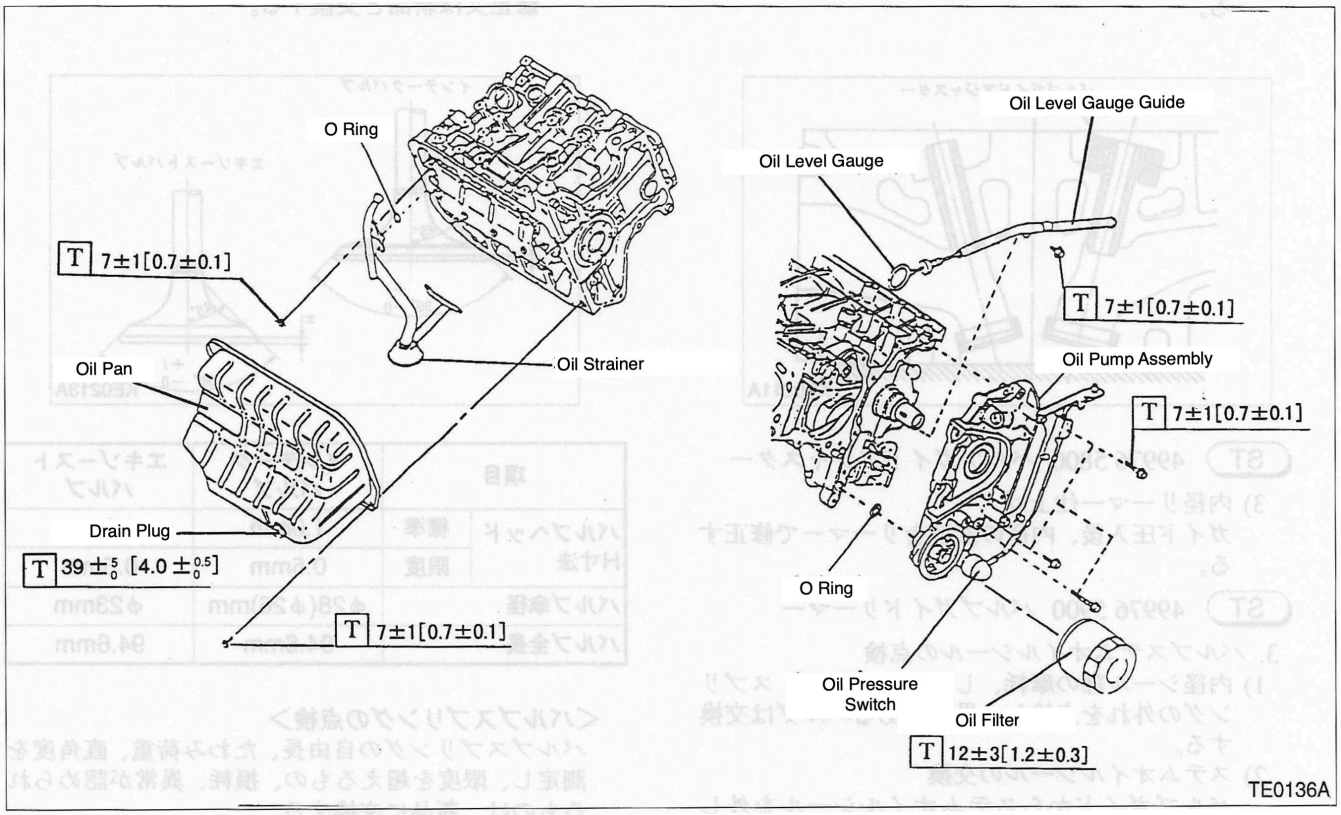
<Valve Spring Inspection>

Measure the free length, deflection load, and squareness of the valve spring, and replace any that exceed the limits or are found to be worn or abnormal with a new one.



		Intake Valve	Exhaust Valve
Free Length		43.27mm	←
Set	**Load kg**	16.9~19.5	←
	Spring	36.5mm	←
Lift	**Load kg**	45.3~50.1	←
	Spring	28.2mm	←
Squareness Limit		Within 2.5°	←
Identification Paint		Sky Blue	←

2 - 6 Engine Lubrication System



■ Part & Components

■ Fault Diagnosis

Fault	Possible Causes		Treatment
Lamp Stays On	Oil Pressure Switch	Diaphragm crack or pressure leak inside switch	Replace
		Spring breakage or contact seizure	Replace
	Lack of Oil Pressure	Clogged oil filter	Clean or Replace
		Malfunctioning bypass valve in the oil filter	Clean or Replace
		Oil pump relief valve malfunction	Clean or Replace
		Clogged oil passage	Clean
		Increased rotor tip clearance or increased rotor side clearance	Replace
		Oil strainer is clogged or mounting flange is loose	Clean or Replace
	Hydraulic Pressure not Rising	Insufficient amount of oil	Add Oil
		Damage to the oil strainer pipe or leakage from the mounting flange	Replace
		The rotor does not rotate	Replace
The Lamp does not Light Up		Lamp disconnected	Replace
		Poor point contact	Replace
		Wiring breakage	Clean
The Lamp Lights up Sometimes		Poor timing connector contact	Clean
		Poor wiring	Clean
		Insufficient oil pressure (insufficient oil amount)	Clean

Preparations

Classification	Tool Number	Name	Purpose
ST	49854 5400	Oil filter wrench	Oil filter removal
	49958 6100	Oil seal press	Front oil seal press fit
	49958 6200	Oil seal Guide	Inner diameter guard when pressing in the front oil seal.
Tool		Oil pan cutter	Oil pan removal
Grease, Oil, & Other	ThreeBond #1215B or #1215	Liquid gasket	Oil pump cylinder block installation
	ThreeBond #1207F or #1207C	Liquid gasket	Oil pan flange mounting surface
	Oil	Engine oil	For engine oil replenishment
	Coolant	Coolant	Fir coolant replenishment

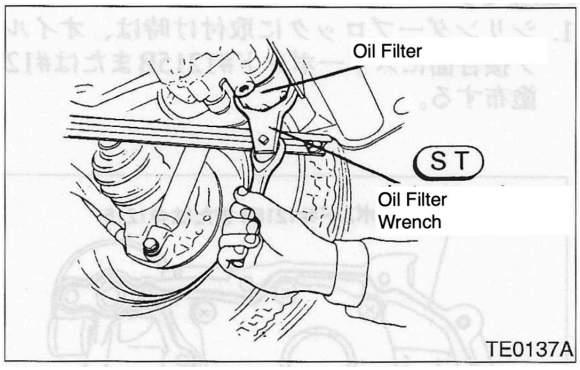
Maintenance Instructions

(1) Oil Filter

1. Inspect the oil filter.
   - Visually inspect the oil filter for oil leaks, damage, or deformation.
   - If any abnormalities are found, replace the oil filter regardless of the specified interval.

Replacement Interval	10,000km

NOTE
- If any abnormalities are found due to dirt or deterioration of the engine oil, investigate the cause.
- For engine oil changes, refer to the Engine Inspection and Adjustment Section.



2. Oil Filter Replacement
   1) Use an oil filter wrench to remove the oil filter.
      49854 5400 Oil Filter Wrench

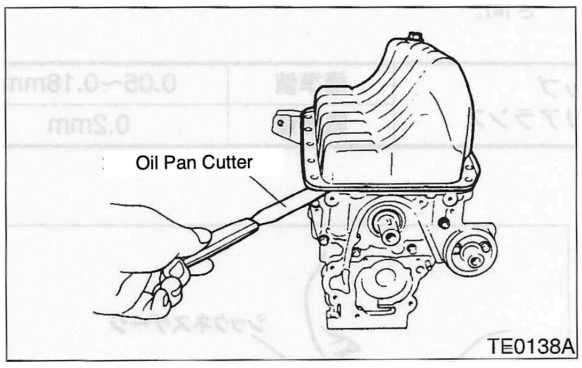
   2) To install, apply oil to the entire circumference of the ring on the oil filter mounting surface, then turn it by hand until it touches the oil pump mounting surface. After it touches the mounting surface, tighten it an additional 1/4 to 2/4 turn with an oil filter wrench.
      T 12.5 ± 2 N•m [1.25 ± 0.2 k•m]

   3) Check for oil leaks and check the oil level.
   - After replacing the oil filter, check the engine oil level with the level gauge, start the engine, and check for oil leaks.

(2) Oil Pump

<Removal>

1. Removal of related parts.
   - Remove the V-belt, crank pulley, timing belt cover, timing belt, crank sprocket, and other related parts.
2. Drain the engine oil and coolant.
3. Remove the engine stand.
   - Remove the engine stand, turn the engine upside down, and remove all the oil pan mounting bolts.
4. Remove the oil pan.

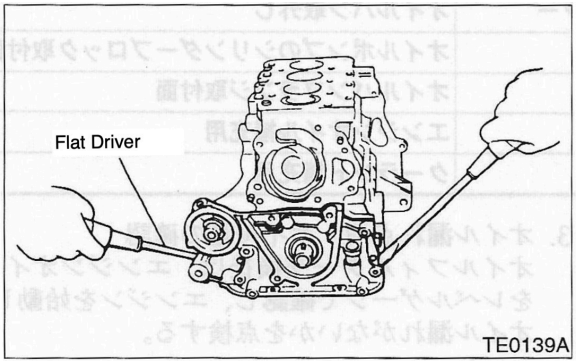


   - Use an oil pan cutter to remove the liquid gasket and remove the oil pan.

NOTE
- Do not use a screwdriver.

ST

5. Remove the oil pump.
   • Loosen the oil pump mounting bold and insert a screwdriver between it and the cylinder block to remove it.



<Inspection>

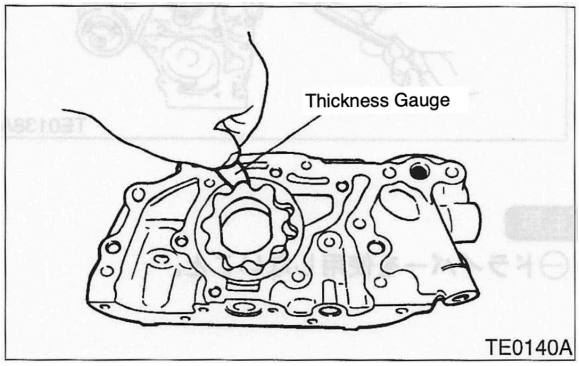
1. Remove the oil pump cover mounting bolts (flat head scews) and disassemble the oil pump.

NOTE
• After disassembly, check the rotor's assembly direction before replacing it.

✻ Oil pump cover mounting bolt tightening torque:
T 6 ± 1 N•m [0.6 ± 1.0 kg•m]

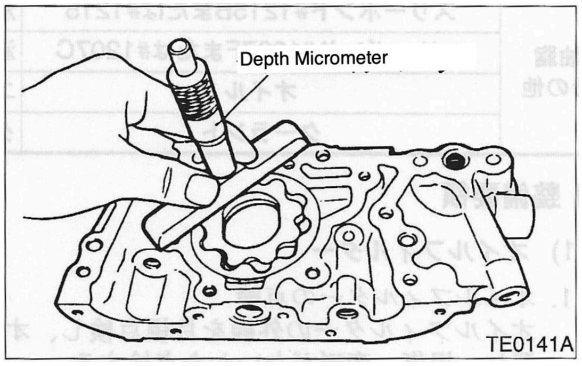
2. Check the tip clearance.
   • The gap between the inner rotor and outer rotor.

Tip Clearance	Standard	0.05~0.18mm
	Limit	0.2mm



3. Check side clearance.

Side Clearance	Standard	0.02~0.07mm
	Limit	0.15mm



4. Check the case radial clearance.
   • Use a thickness gauge to measure the clearance between the outer diameter of the outer rotor and the inner diameter of the oil pump case.

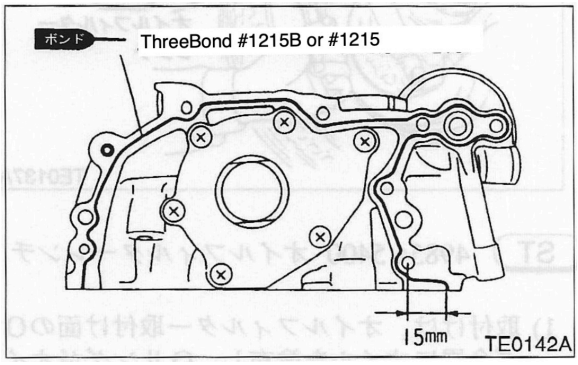
Radial Clearance	Standard	0.12~0.19mm
	Limit	0.25mm

If the limits are exceeded in steps 2, 3, and 4, replace the rotor set or pump body.

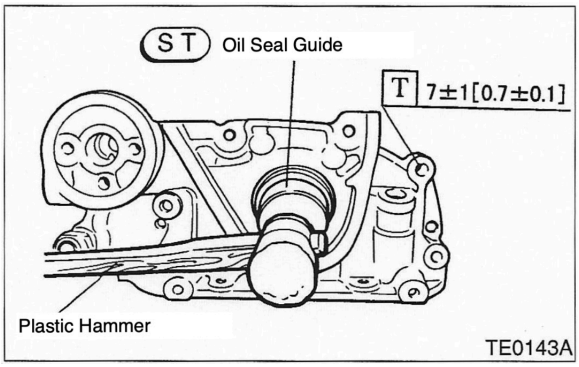
NOTE
• The relief valve is built into the oil pump body and cannot be disassembled.

<Assembly>

1. When installing to the cylinder block, apply ThreeBond #1215B or #1215 to the oil pump mating surface.



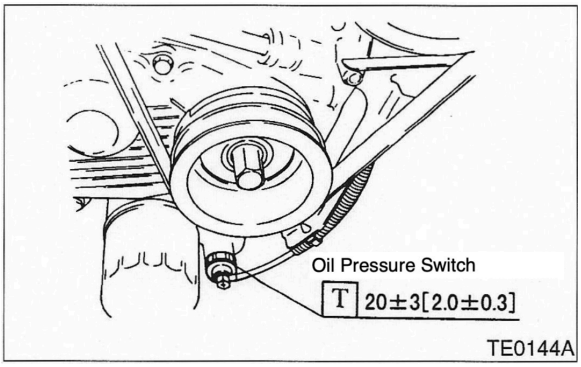
2. Replace the oil seal with a new one and assemble it using the oil seal guide.



ST 49858 6100 Oil Seal Guide
49858 6200 Oil Seal Guide

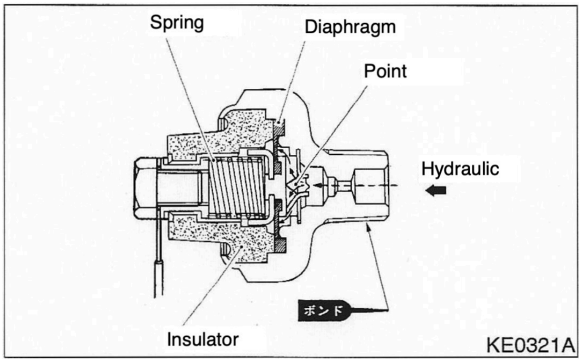
(3) Oil Pressure Switch

<Removal>



<Inspection>

1. Check between the terminal and the body with a circuit tester to make sure there is continuity.
   • Replace if defective.
2. When an oil pressure of 15 kPa [0.15kg/cm^2] is applied to part A. (i.e. after the engine has started), check with a circuit tester between the terminal and the body to confirm that there is no continuity.
   • Replace if defective.



<Installation>

Apply liquid gasket ThreeBond #1215B or #1215 to the threads and assemble to the oil pump.

(4) Oil Pan & Strainer

<Removal>

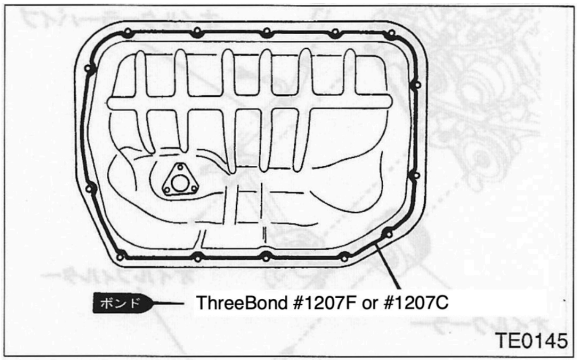
The oil pan mounting surface uses a liquid gasket, so use an oil pan cutter or scraper to remove the oil pan.

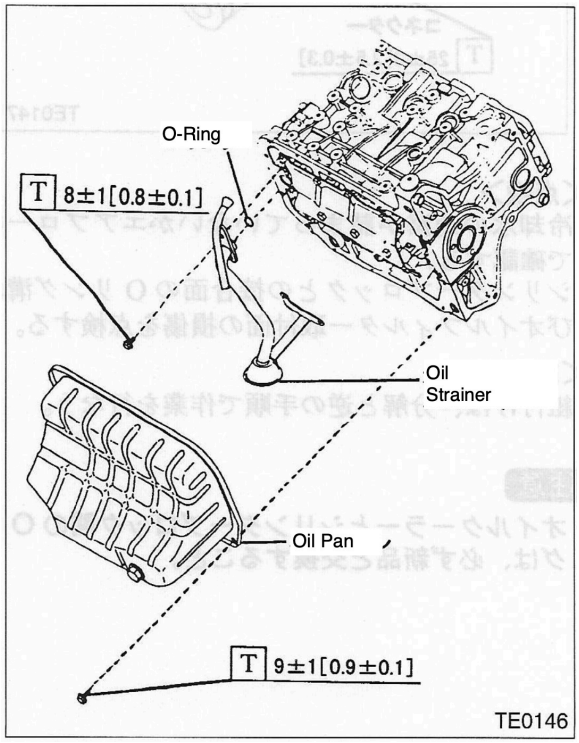
NOTE

• Do not damage the oil pan flange by inserting or prying with thick objects such as a screwdriver or chisel.

<Installation>

Apply ThreeBond #1207F or #1207C to the oil flange surface and assemble within 5 minutes.





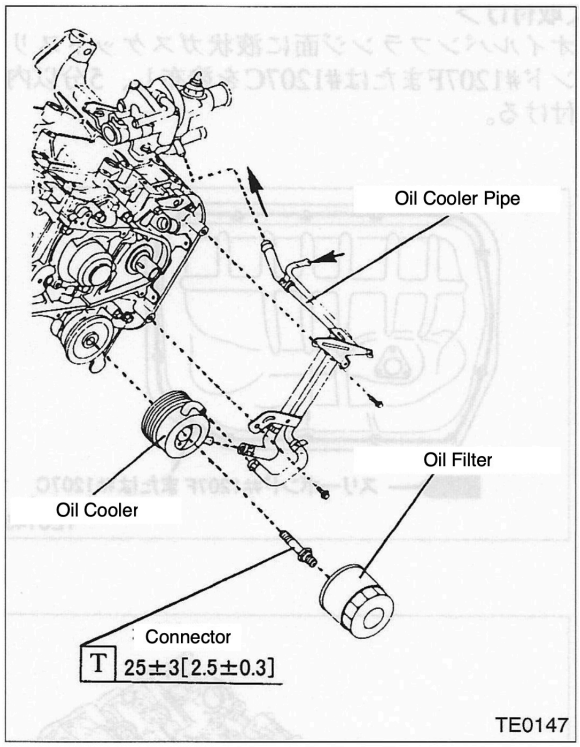
NOTE

- Do not start the engine within 30 minutes after installing the oil pan, as the liquid gasket will not be dry.

(5) Oil Cooler (AT & Akabou MSC-MT Vehicles)

<Removal>

- Drain the engine and coolant.
- Remove the oil filter.
- Remove the oil cooler connector.
- Remove the roller.
- Remove the L-shaped water piper connected to the cylinder block.



<Inspection>

- Use an air blower or similar tool to check that the cooling water passage is not clogged.
- Check the ring groove on the joint surface with the cylinder block and the oil filter mounting surface for damage.

<Installation>

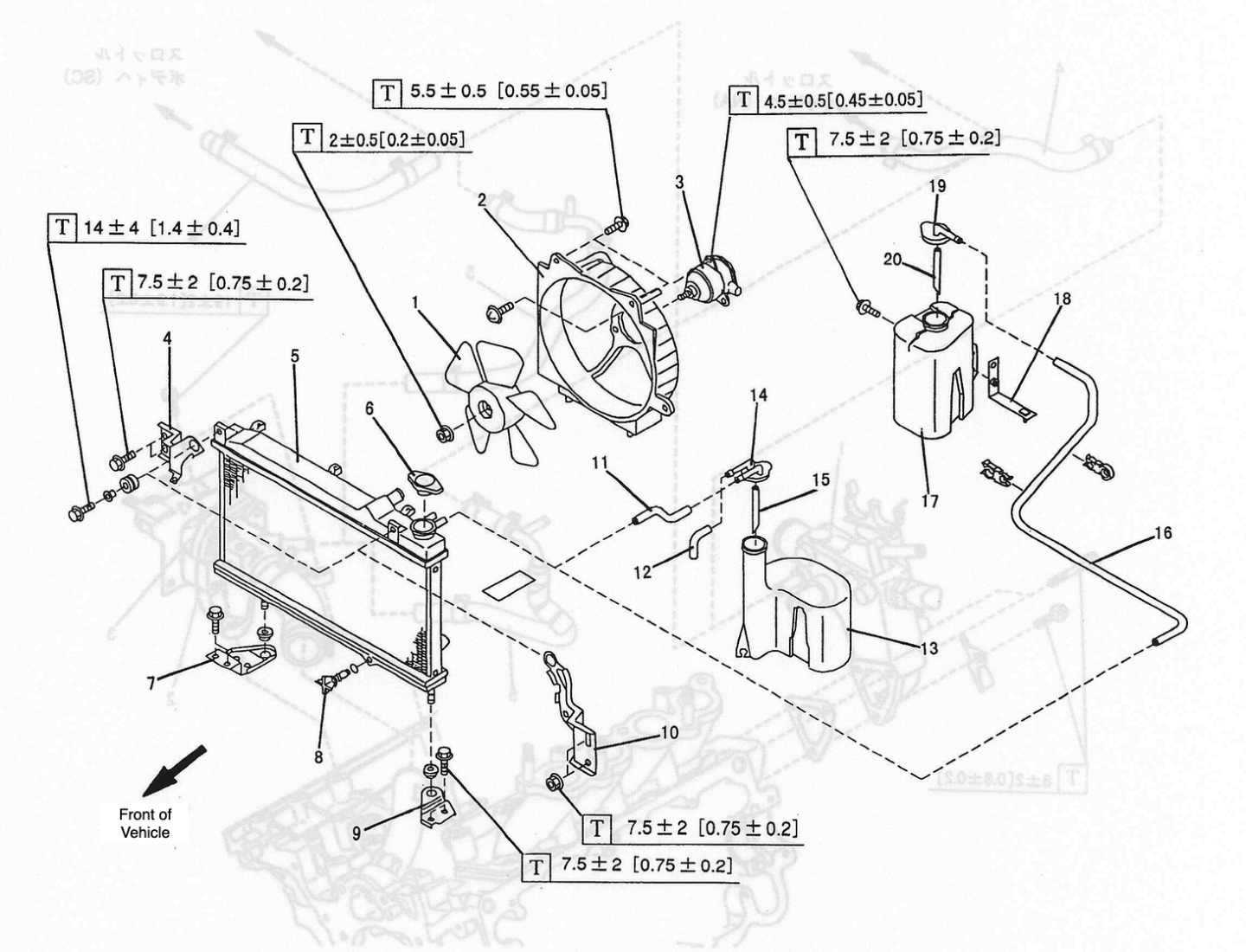
- Assembly is performed in the reverse order of disassembly.

NOTE

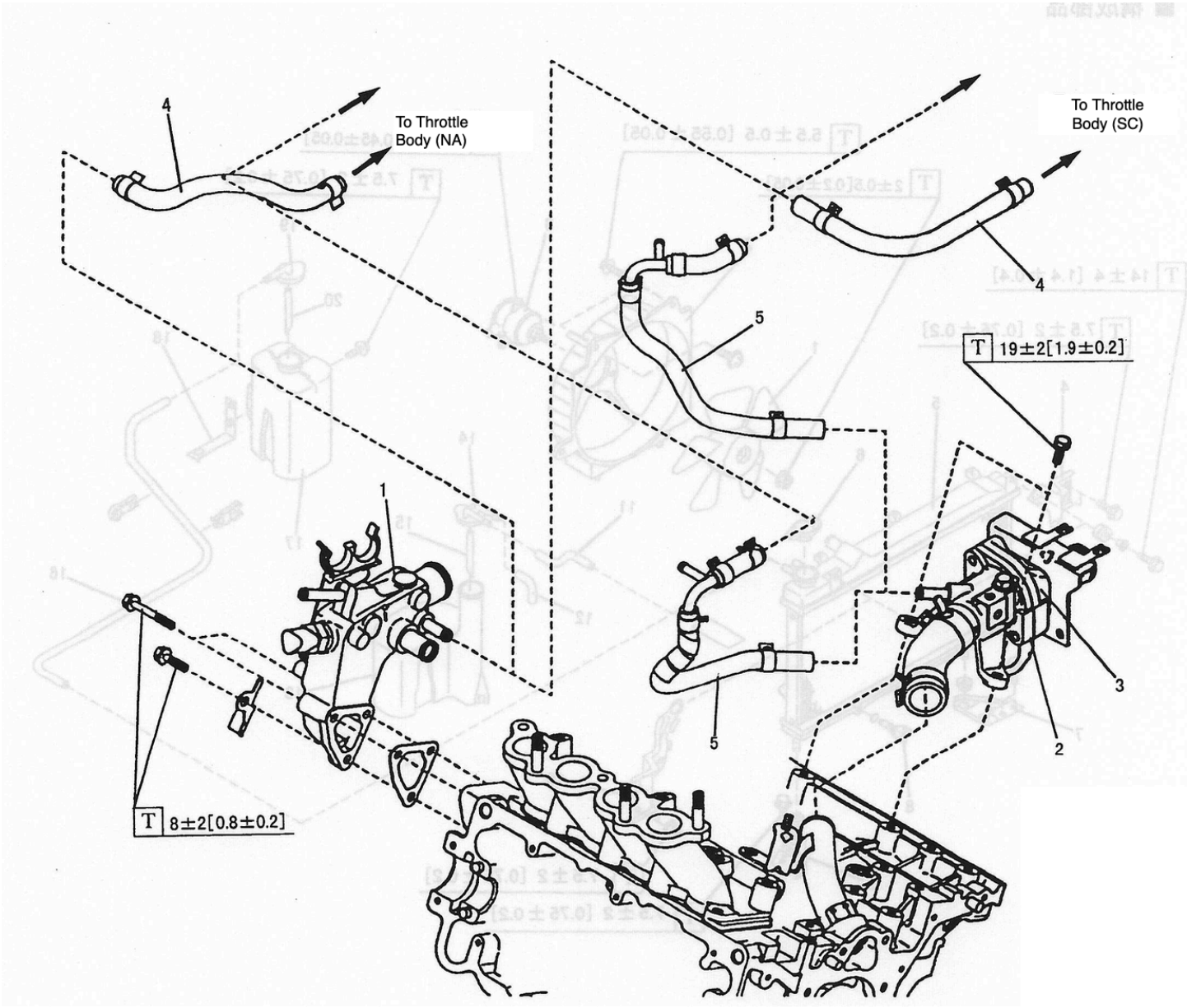
- The ring between the oil cooler and the cylinder block must be replaced with a new one.

2 - 7 Engine Cooling System

■ Parts & Components

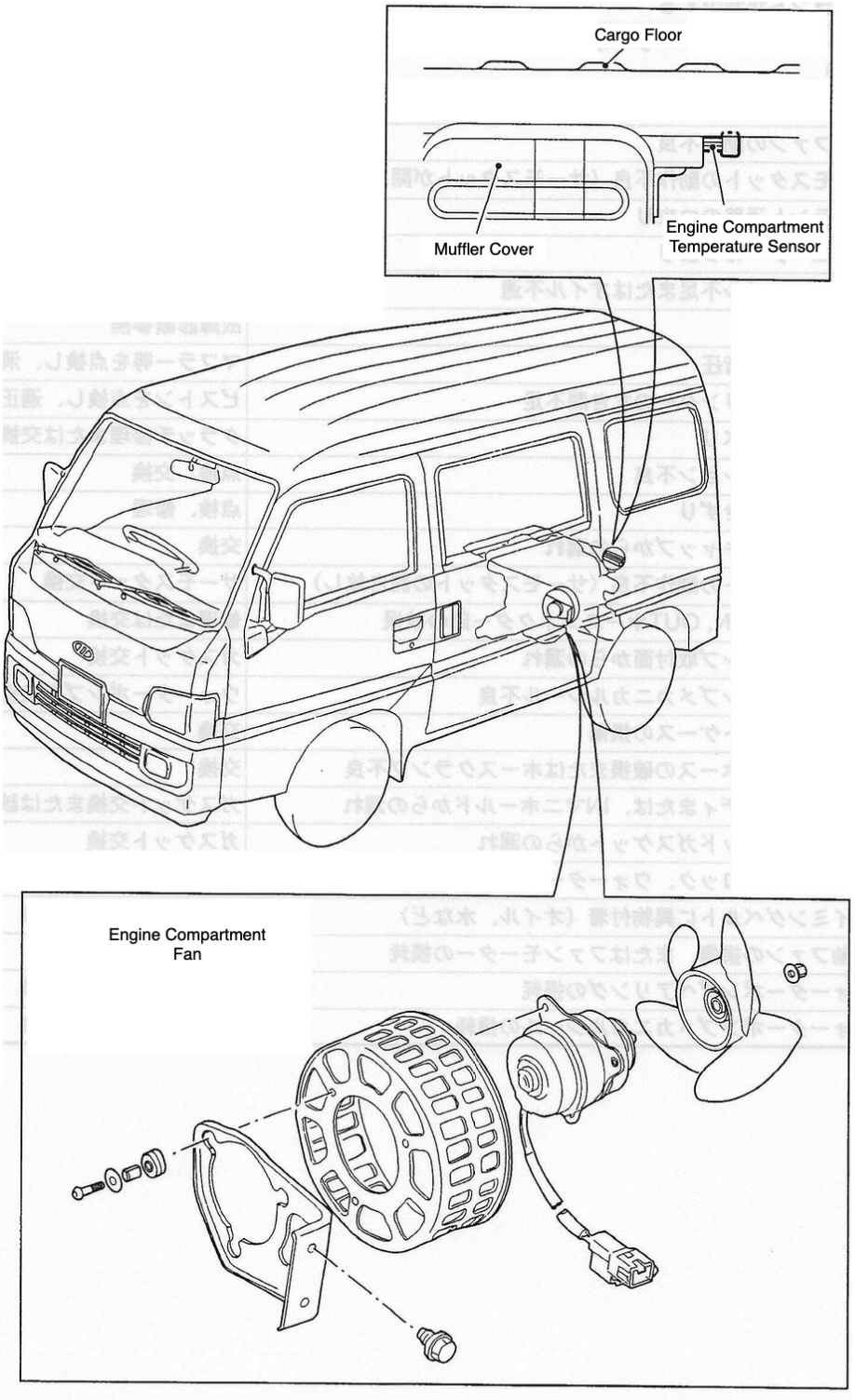


1. Radiator Fan
2. Shroud
3. Motor
4. Upper Braket RH
5. Radiator
6. Radiator Cap
7. Lower Bracket RH
8. Drain Plug
9. Lower Bracket LH
10. Upper Braket LH
11. Overflow Hose (Van, Dias)
12. Air Vent Hose (Van, Dias)
13. Reserve Tank (Van, Dias)
14. Reserve Tank Cap (Van, Dias)
15. Overflow Hose (Van, Dias)
16. Overflow Hose (Truck, Panel Van)
17. Reserve Tank (Truck, Panel Van)
18. Reserve Tank Bracket (Truck, Panel Van)
19. Reserve Tank Cap (Truck, Panel Van)
20. Overflow Hose (Truck, Panel Van)



1. Outlet Housing
2. Thermostat Housing
3. Thermostat Cover
4. Water Bypass Hose
5. Water Bypass Hose No2

Engine Compartment Fan System



TE0153A

Common Failure Points

Failure Point	Possible Causes	Treatment
Overheating	Low coolant	Replenish coolant
	Coolant leaking	Find the leak and repair it
	Insufficient drive of the water pump pulley (timing belt slippage)	Replace timing belt
	Water pump pulley rotation is not smooth or operation is poor	Replace water pump
	Electric fan malfunction	Diagnose fault and replace electric fan
	Thermostat malfunction (thermostat won't open)	Replace thermostat
	Clogged coolant passage	Flush coolant system
	Clogged radiator	Clean or repair radiator
	Insufficient or inadequate engine oil	Refill or replace engine oil
	Inappropriate air-fuel ratio	Refer to fault diagnosis
	Excessive back pressure in exhaust system	Clean or replace the muffler
	Insufficient clearance between the piston and cylinder	Inspect; repair or replace applicable parts
	Clutch slippage	Repair or replace clutch
	Bad transmission	Repair or replace transmission
	Brake drag	Repair or replace brakes
	Leaking radiator cap	Repair or replace radiator cap
Overcooling	Thermostat malfunction (thermostat stuck open)	Replace thermostat
Coolant Leak	Damage to the radiator IN/OU hose connector	Repair or replace radiator
	Leaking from the water pump mounting surface	Replace water pump gasket
	Water pump mechanical seal failure	Replace water pump
	Damage to the thermostat case	Replace thermostat case
	Broken radiator hose or faulty hose clamps	Replace hose and/or clamps
	Leaking from the throttle body or IN manifold	Replace gasket or applicable part
	Cylinder head gasket leak	Replace gasket
	Damage to the cylinder block, water pipe, etc	Inspect; repair or replace applicable parts
Abnormal Noise	Foreign matter (oil, water, etc) on the timing belt.	Replace timing belt
	Damage to the electric fan, or wear and tear on the fan motor	Repair or replace fan motor
	Water pump bearing wear	Replace water pump
	Water pump mechanical failure	Replace water pump

Preparations

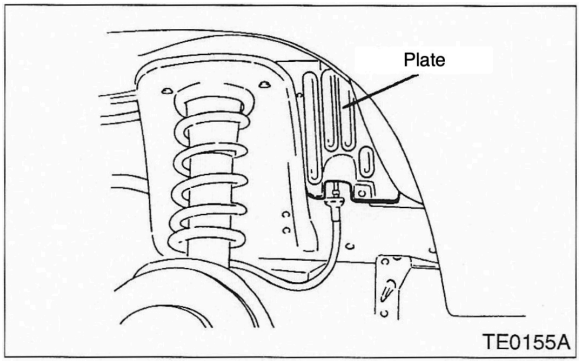
Item		Name	Purpose
Instrument	Nippon Denso Radiator Cap	Radiator cap tester	Inspecting the radiator and cap
Tool		Coolant tester	Coolant specific gravity measurement
Other		Subaru coolant	Refilling the coolant

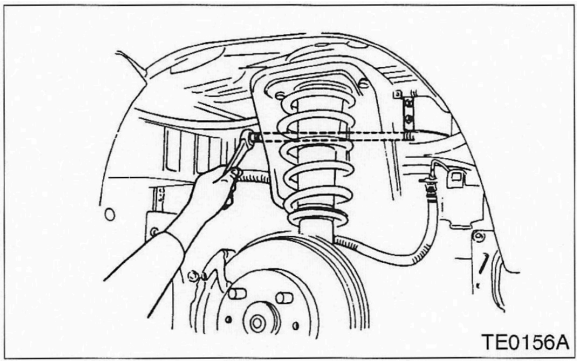
Maintenance Instructions

(1) Radiator Electric Fan

<Removal>

1. Disconnect the negative battery terminal.
2. Disconnect the radiator electric fan connector.
3. Remove the shroud mounting bolts.
   - To install the upper right mounting bolt (1 piece), remove the plate inside the right front wheel fender and follow the instructions in the diagram below.





4. Remove the fan along with the shroud.

<Inspection>

1. If the fan vibrates or makes abnormal noises, replace it.
   - Visually inspect the fan's exterior and replace it if any abnormalities are found.

<Installation>

1. Perform the removal procedure in reverse order.
2. After installing the radiator, perform a test run to confirm that the cooling fan rotates normally.

NOTE

- The cooling fan must not vibrate.

(2) Radiator

<Removal>

1. Refer to the radiator fan section (section 1) and remove the fan.
2. Refer to the cooling water refill/replacement instructions (section 6) and drain the cooling water.
3. Remove the propeller shaft and front differential gear (4WD only).
4. Remove the radiator in-hose and out-hose from the water pipe side under the floor and remove the two air bleed hoses from the radiator side.

NOTE

- Be careful as cooling water is flowing.

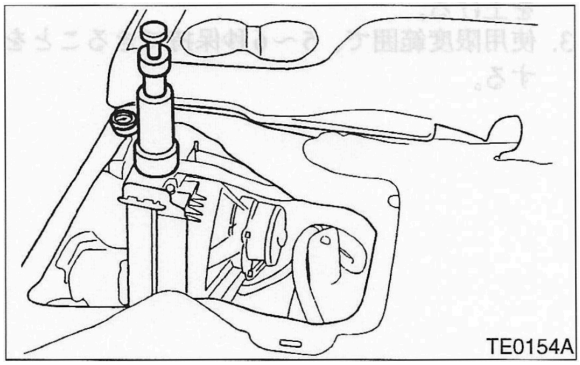
5. Remove the radiator bracket.
6. Remove the radiator from the vehicle.

<Visual Inspection>

Check for leaks and any external damage, including fin damage. If any abnormalities are found, repair or replace the battery.

<Leak Inspection>

1. Fill the radiator reservoir with cooling water until it is full.
2. Attach the radiator cap tester to the radiator.



3. Start the engine and warm it up (until the cooling fan cycles twice).

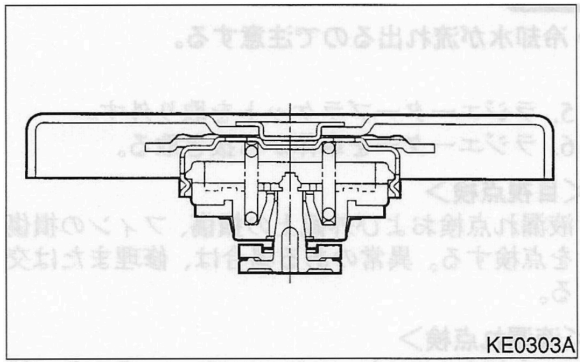
4. When the engine is warm, check that there are no leaks from the radiator body, radiator hose, hose connections, and other parts.

NOTE
- Always fill the cooling water tank with water before inspecting.
- Don't forget to install the O-rings and seals.
- Do not deform the radiator filler neck when removing or installing the tester.
- Wipe off any cooling water adhering to the inspection area.
- When removing the tester, cooling water will spray out, so use a rag or similar and take great care to avoid burns.

<Visual Inspection of the Radiator Cap>

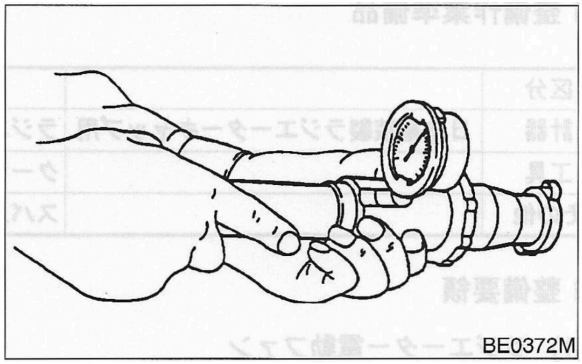
Remove the radiator cap and inspect the valve and rubber seal for damage, poor sealing, rust, etc.

NOTE
- If the cooling water temperature is high, removing the cap can cause dangerous spills. Be sure to wait until the cooling water temperature has dropped before opening the cap, and then wrap it in a cloth or similar.



<Radiator Cap Opening Pressure Inspection>

1. Thoroughly clean any rust or foreign matter inside the cap.
2. Apply water to the sealing surface of the cap, attach a cap tester, and increase the pressure until the gauge needle stops.
3. Confirm that you can hold the pressure for 5 to 6 seconds within the operating range.



Reference Value	108 ± 15 kPa [1.1 ± 0.15 kg/cm²]
Usage Limit	84 Pa [0.85 kg/cm²]

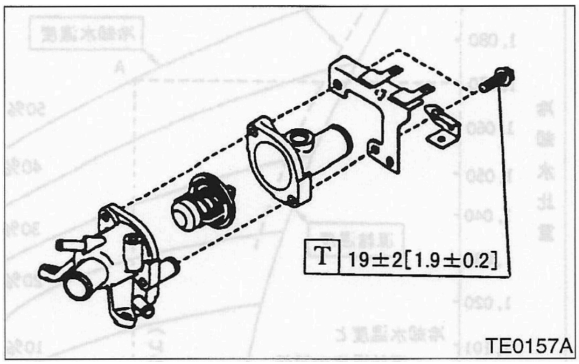
<Installation>

To install, follow the removal procedure in reverse.

(3) Thermostat

<Removal>

1. Loosen the bolts, remove the thermostat case, and take out the thermostat.



<Inspection>

1. If the valve is even slightly open at room temperature (20°C), replace it.
2. Place the thermostat in a hot water container and gradually increase the water temperature. Use a thermometer to check the temperature at which the valve begins and ends opening. If the temperature specifications and valve lift are abnormal, replace the thermostat.

✻ Reference Value:

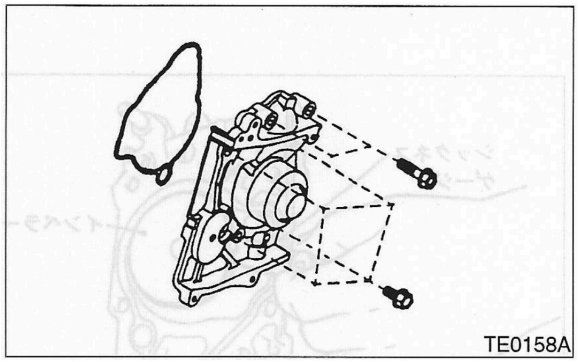
Engine		All Vehicles
Beginning to Open	Temperature (°C)	78 ± 2
	Lift Amount (mm)	0.35
Fully Open	Temperature (°C)	91
	Lift Amount (mm)	8.5 or more

3. Check the flange rubber packing and rubber sheet for signs of wear, and replace them if found to be defective.

(4) Water Pump

<Removal>

1. Remove the alternator drive belt, supercharger drive belt, and crank pulley.
2. Remove the oil level gauge guide.
3. Remove the timing belt cover.
4. Loosen the tensioner mounting bolts and remove the timing belt.
   - For installation and removal of steps 1 through 4, refer to the valve train section.
5. Remove the six water pump case mounting bolts.



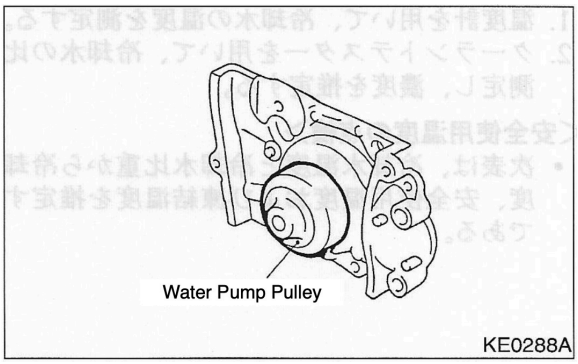
NOTE

- When assembling, temporarily secure the gasket to the water pump case with Vaseline or grease.

6. Remove the water pump along with the case.

<Inspection>

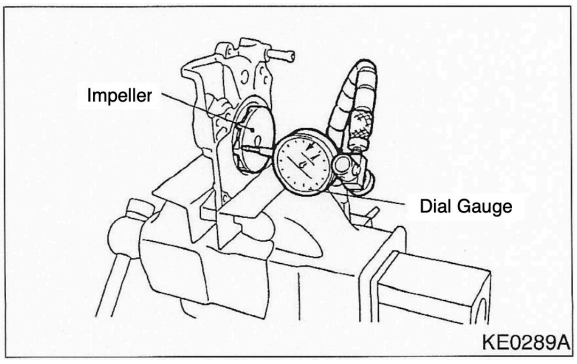
1. Check that the water pump bearing rotates smoothly and that there are no abnormal noises.



2. Check that the pulley looks normal.
3. Turn the pulley and check the runout of the impeller end face with a dial gauge.

✻ Reference Value:

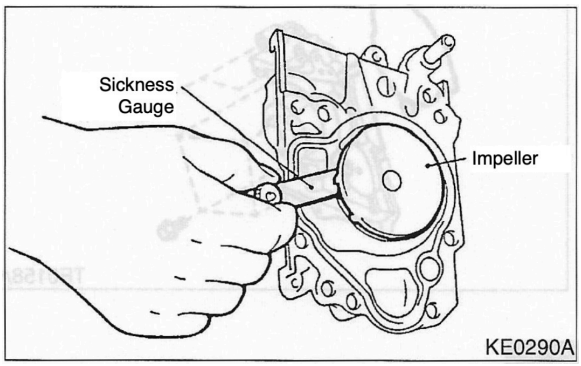
Surface Runout Limit	0.5 mm



4. Check impeller tip clearance.

❇ Tip Clearance Reference Value

Standard	Limit
0.3~0.9 mm	1.1 mm



5. If there is a water leak or if any abnormality is found in steps 1 to 4, replace the water pump assembly.

<Installation>

Follow the removal instructions in reverse.

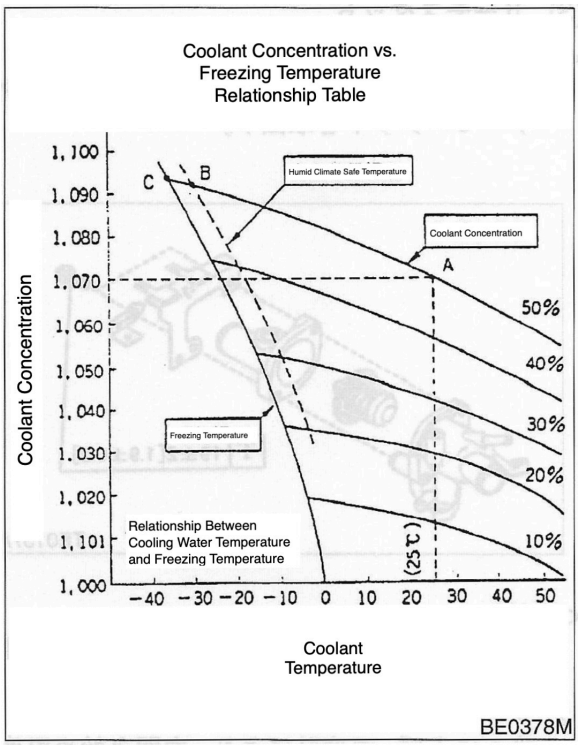
(5) Coolant Concentration

<Inspecting Coolant Density>

1. Use a thermometer to measure the temperature of the coolant.
2. Use a coolant tester to measure the specific gravity of the coolant and estimate its concentration.

<Inspecting the Safe Operating Temperature>

- The following table shows how to estimate the cooling water concentration, safe operating temperature, and freezing temperature from the cooling water temperature and specific gravity.



- How to use the table (example):
  - If the cooling water temperature is 25°C and the specific gravity is 1.070, the concentration is approximately 50% at point A, the safe operating temperature is -30°C at point B, and the freezing temperature is -37°C at point C.

NOTE

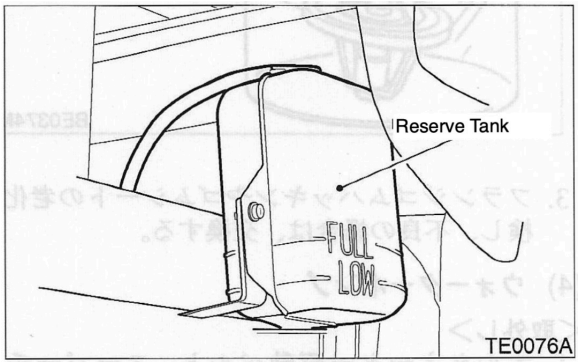
- The coolant concentration at the time of shipment from the factory is 50% for cold-weather models and 4WD vehicles, and 30% for standard 2WD vehicles.
- When replacing or refilling, use pure undiluted coolant (50% concentration).

(6) Refilling and Replacing Coolant

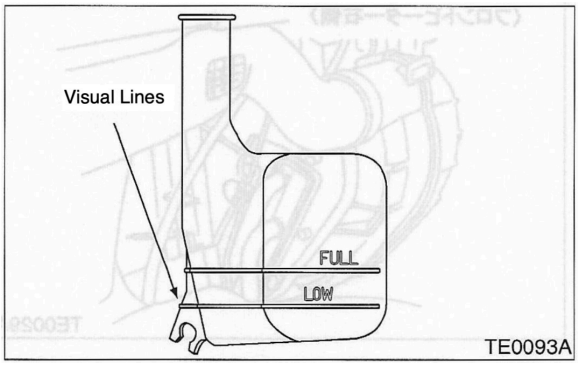
<Regular Inspection>

Check the cooling water level in the reserve tank when the engine is cold.

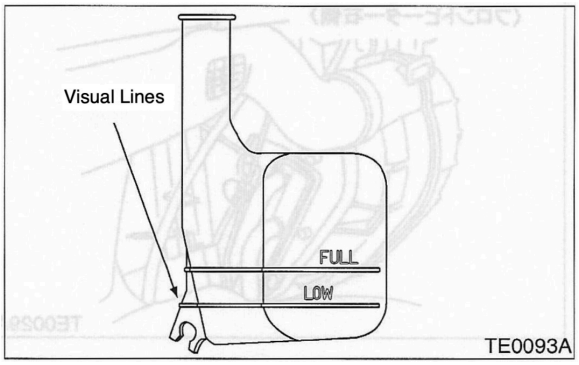
- Truck & Panel Van



• Van & Dias
<Reserve tank left side>



<Reserve tank front side>



<Regular Replenish>

1. If the fluid level in the reserve tank is near the LOW level, fill it up to the FULL level.
2. If the reserve tank is empty or the hose is not inserted all the way to the bottom, fill it with water from the radiator.

<When to Change the Coolant>

✻ Standard Value

Exchange Standard	Every 2 years or 40,000 km (First every 3 years or 40,000 km)

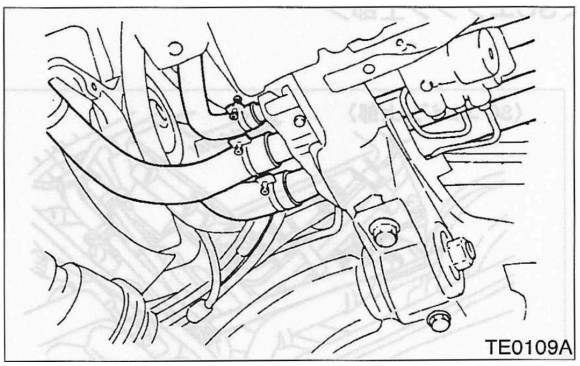
However, if the cooling water is significantly contaminated, it must be replaced immediately.

<Draining the Coolant>

NOTE

- When separating the hoses, be careful as cooling water will spill out.
- Mark the hoses before removing them to prevent incorrect assembly.

1. Connect a hose to the drain cock, remove the radiator cap, and drain the cooling water inside the radiator.
2. Separate the heater hoses (inlet and outlet).
3. Separate the engine-side heater hose, inlet hose, and outlet hose.



4. Remove the drain plug from the engine's water pump and drain the cooling water.
5. Drain the cooling water from the reserve tank.
6. Reconnect the separated pipes and hoses.

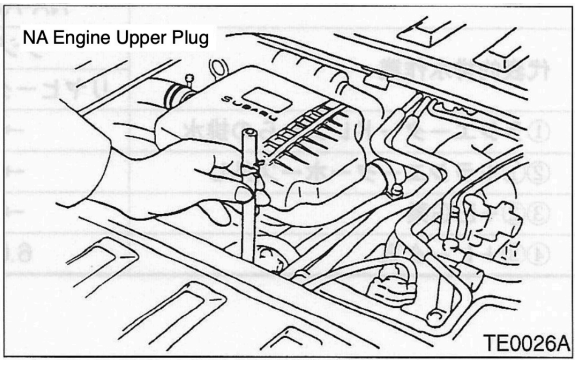
<Key Points>

1) Place the vehicle on a level surface.
2) Remove the plugs from three air bleed hoses: on top of the engine, behind the radiator, and on the right side of the front heater.
   - If all coolant has been drained, including from the heater circuit.

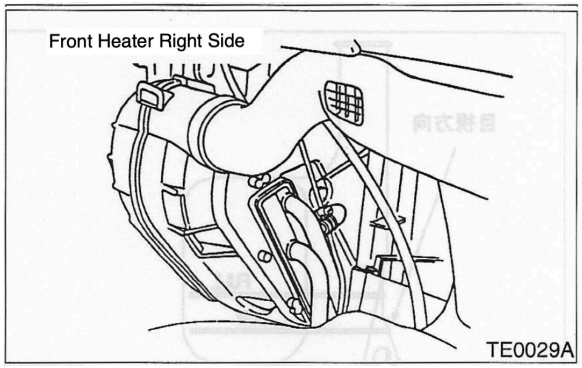
NOTE

- If cooling water remains in the heater system only when removing or installing the radiator or engine, only unplug the air bleed hose on the top of the engine.
- Keep the air bleed hose on the top of the engine and the air bleed hose on the left rear of the radiator open or in a high position.

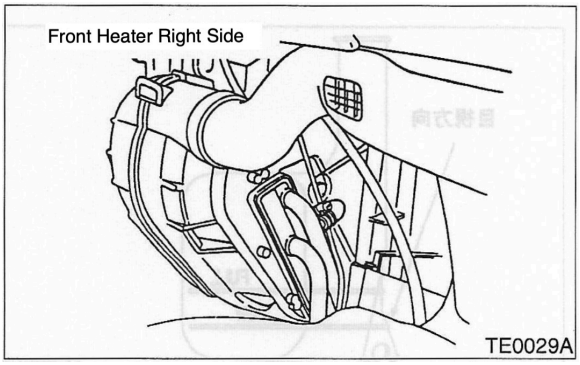
<NA Engine Upper Plug>



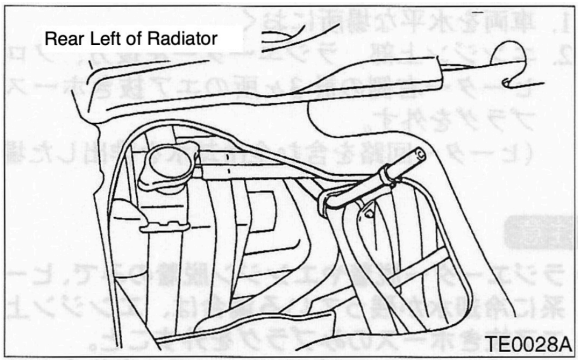
<SC Engine Upper Plug>



<Front Heater Right Side>



<Rear Left of Radiator>



3. Add cooling water up to the radiator.
4. Close the air vent and run the engine for approximately 1 minute.
5. After cooling, remove the air vent plug on the top of the engine and add cooling water up to the radiator.
6. Close the air vent and run the engine until the cooling fan starts.
7. Fill the reserve tank with cooling water until it reaches the FUL L level.

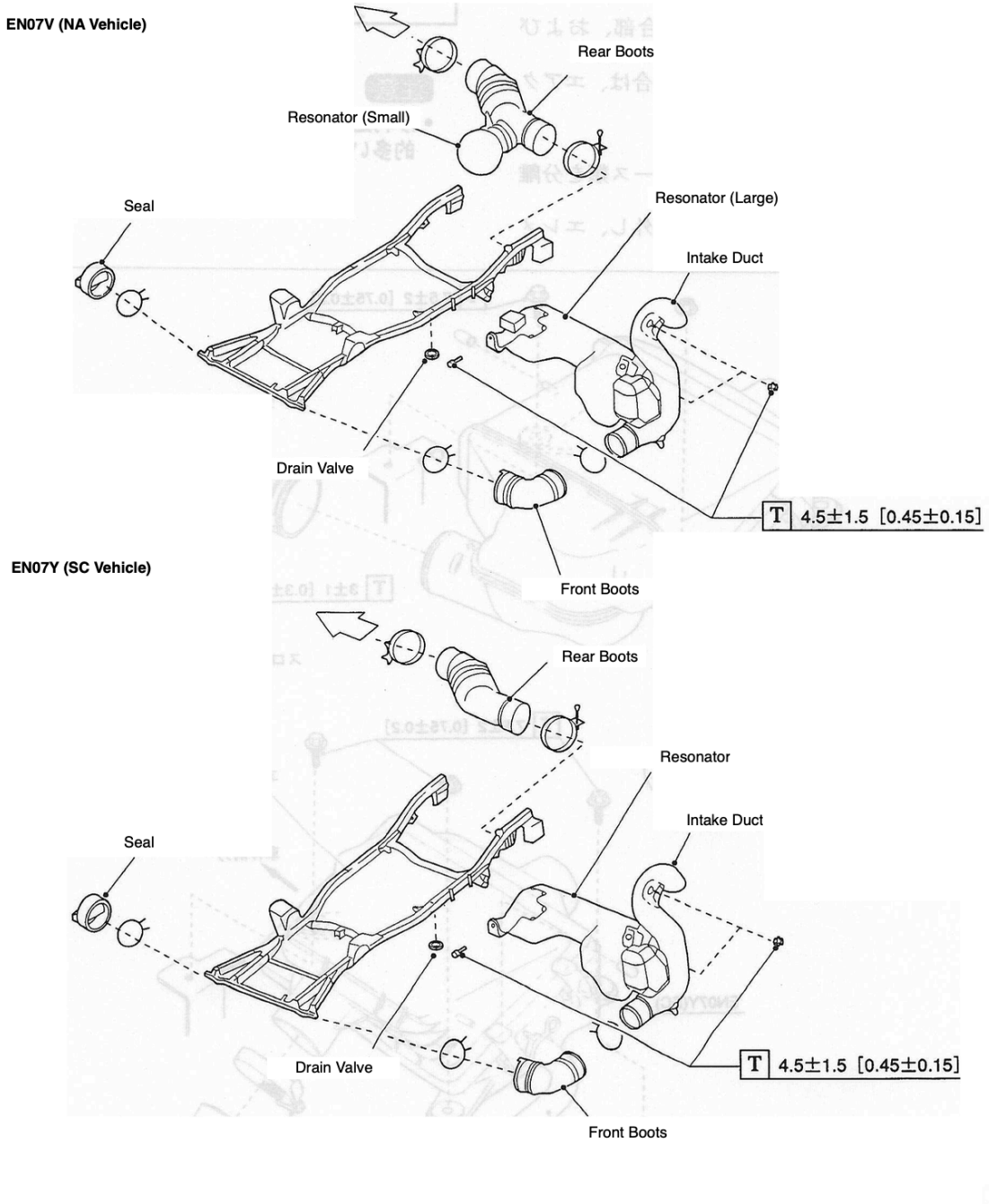
✻ Note: Quantity (ℓ)

Use the amount of water drained during typical maintenance work as a reference to determine whether the amount of water added was sufficient to fill the tank.

Vehicle Type	MSC-AT, MSC-MT, NA-AT		NA-MT	
Vehicle Components Drained	Radiator Pipe Diameter 2.8 mm		Radiator Pipe Diameter 2.2 mm	
	With Rear Heater	Without Rear Heater	With Rear Heater	Without Rear Heater
①: Drained coolant from radiator drain	→	2.4	→	2.0
②: ① + Radiator hose removal	→	3.7	→	2.8
③: ② + E/G system	→	4.2	→	3.3
④: ③ + Heater system	6.0	5.7	5.1	4.8

2 - 8 Air Intake System

■ Parts & Components



(1) Air Cleaner Case

<Inspection>

1. Inspect the case body for damage or cracks.
2. Inspect each hose connection for damage or cracks.
3. Inspect the air cleaner element joints and seals.
   - If any abnormalities are found in steps 1, 2, or 3 above, replace the air cleaner.

<Removal>

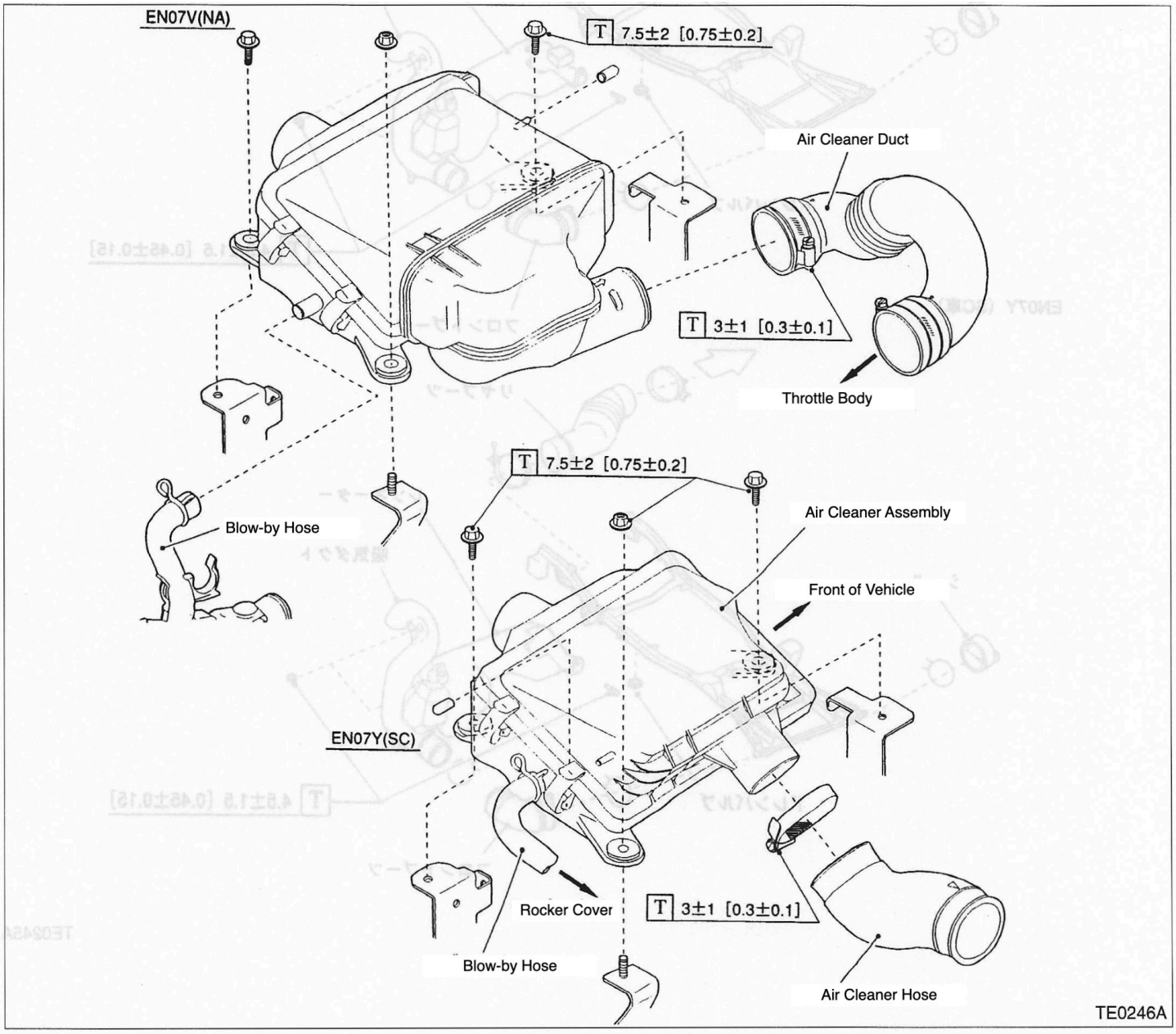
1. Separate the hoses connected to the air cleaner.
2. Remove the air cleaner case cover and remove the element.
3. Remove the air cleaner case.

✻ Recommended cleaning and replacement period for the air cleaner element.

Cleaning	Every 10,000 km
Replacement	Every 40,000 km or every 2 years

NOTE

- Clean and replace the cleaner element sooner if you are driving on a dusty road such as a gravel road or if you have driven a relatively long distance.



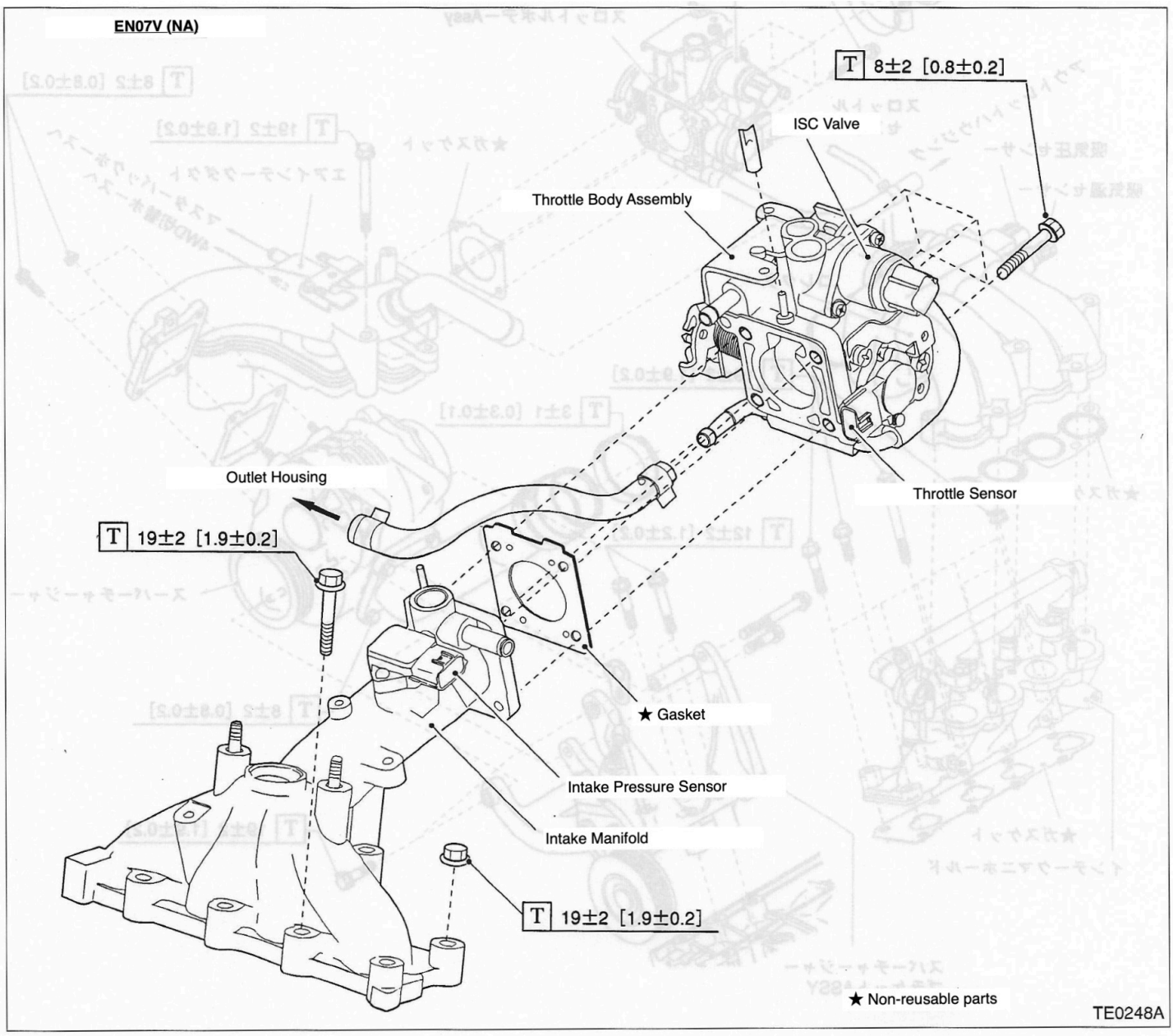
(2) Intake Manifold

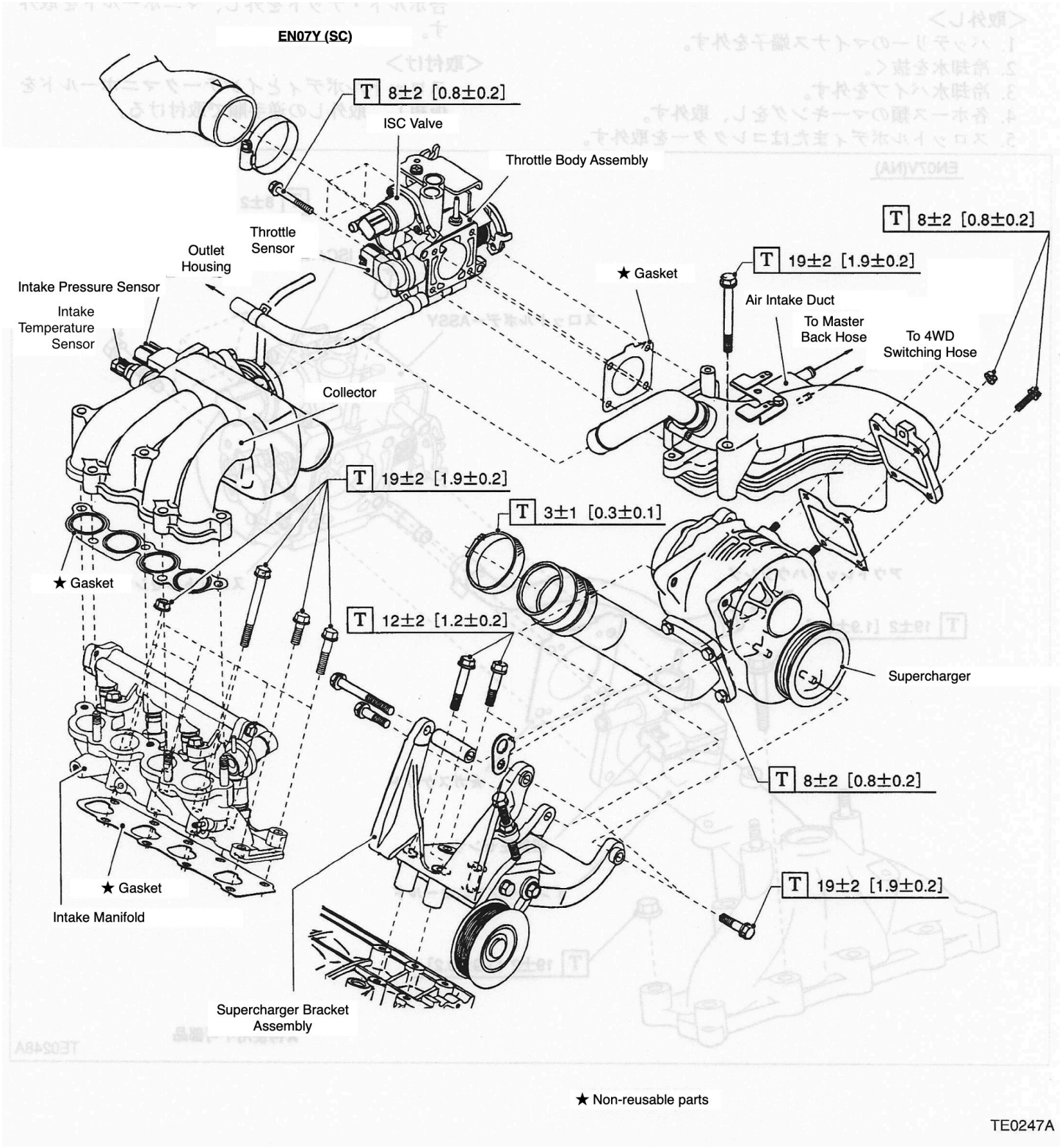
<Inspection>

1. Disconnect the battery's negative terminal.
2. Drain the cooling water.
3. Remove the cooling water pipe.
4. Mark and remove each hose.
5. Remove the throttle body or collector.
6. Remove the bolts and nuts connecting the engine body to the intake manifold, and remove the manifold.

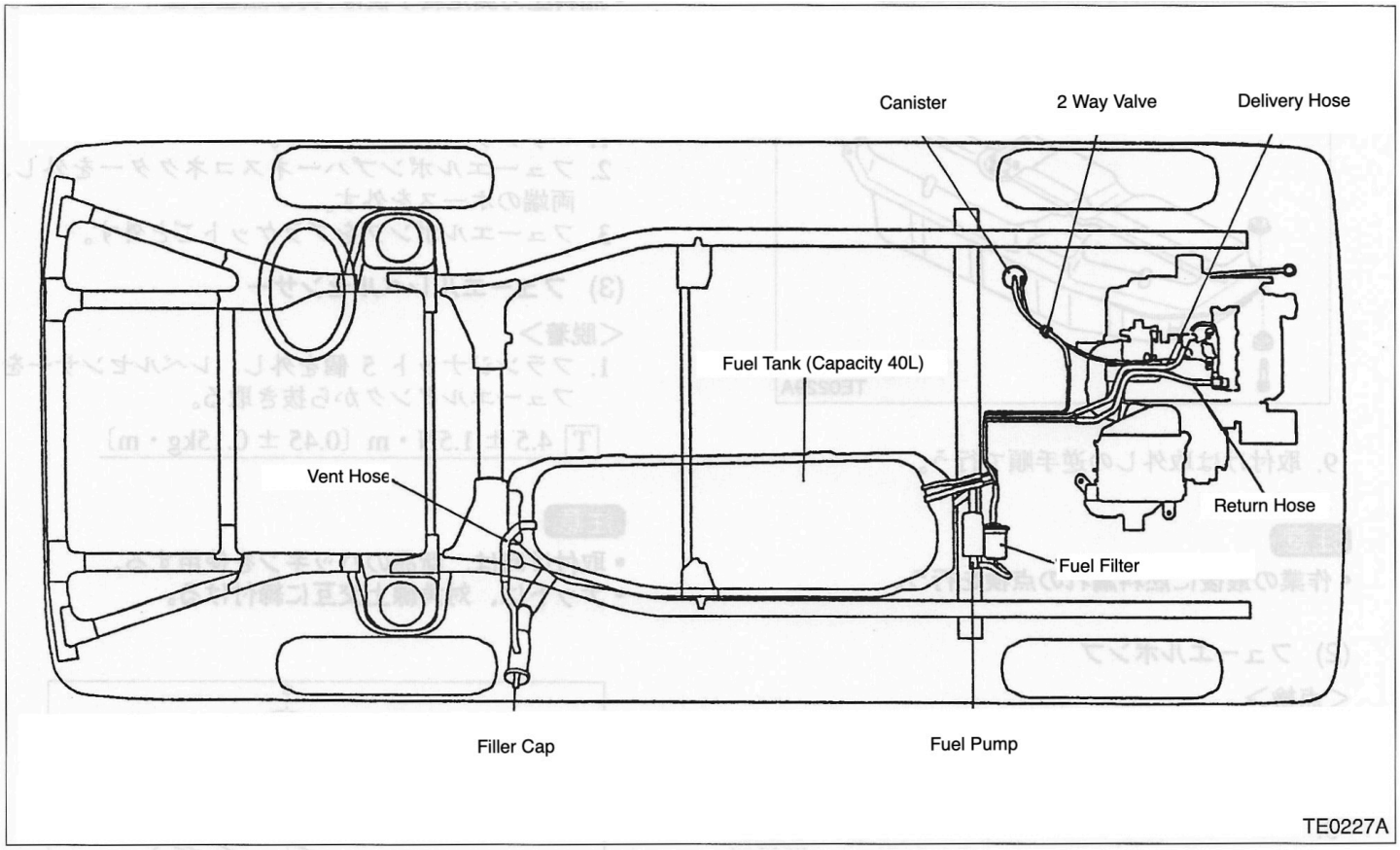
<Installation>

Temporarily assemble the throttle body and intake manifold, then install them in the reverse order of removal.




EN07Y (SC)
T 8±2 [0.8±0.2]
ISC Valve
Throttle Body Assembly
Throttle Sensor
Outlet Housing
Intake Pressure Sensor
Intake Temperature Sensor
T 8±2 [0.8±0.2]
T 19±2 [1.9±0.2]
★ Gasket
Air Intake Duct
To Master Back Hose
To 4WD Switching Hose
Collector
T 19±2 [1.9±0.2]
T 3±1 [0.3±0.1]
★ Gasket
T 12±2 [1.2±0.2]
Supercharger
T 8±2 [0.8±0.2]
★ Gasket
Intake Manifold
T 19±2 [1.9±0.2]
Supercharger Bracket Assembly
★ Non-reusable parts
TE0247A

2 - 9 Fuel System



■ Composition

■ Preparations

General Instrument	Fuel pressure gauge	Checking fuel pressure

■ Maintenance Instructions

(1) Fuel Tank

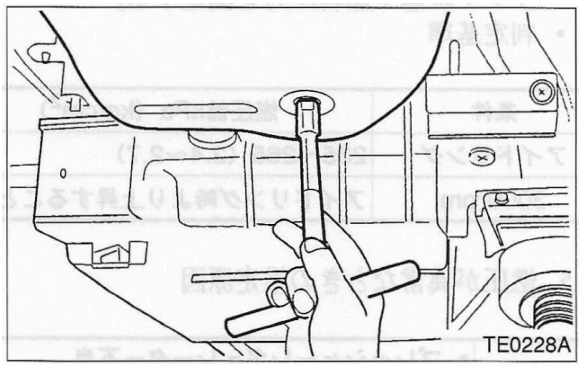
NOTE

- Fire is strictly prohibited.
- Work in a well ventilated area.

<Removal>

1. Place the vehicle on a lift.
2. Disconnect the fuel pump harness connector and run the engine until it stalls. Then crank the starter for 5 to 7 seconds to reduce fuel pressure.
3. Disconnect the battery terminals.
4. Remove the filler cap.
5. Remove the fuel tank drain bolt and drain the fuel.
   T 26 ± 7 N•m [2.6 ± 0.7kg•m]
6. Tighten the drain bolt.

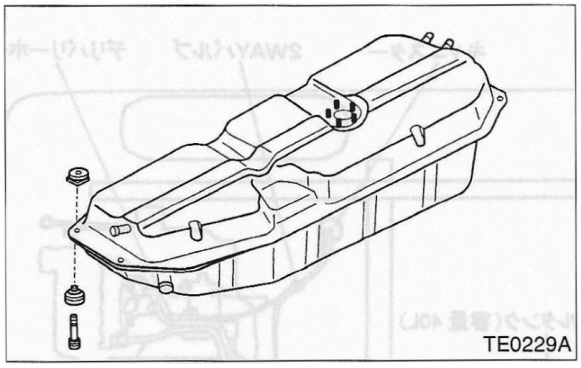
NOTE



- Use new packing. Do not reuse.

7. Disconnect the delivery hose, return hose, evaporative hose, filler hose, and vent hose from the fuel tank, and remove the fuel meter harness connector.

8. Remove the four bolts and remove the fuel tank.



9. Installation is the reverse of the removal procedure.

NOTE

• Check for fuel leaks after work is finished.

(2) Fuel Pump

<Inspection>

1. Reduce the fuel pressure.
2. Connect a fuel pressure gauge between the fuel filter and the fuel hose.
3. Connect the fuel pump harness connector, turn the ignition switch ON, and measure the fuel pressure.

Reference Value kPa (kg/cm²)	304 (3.1)

4. Start the engine, warm it up, and then measure the fuel pressure while it is idling.
   • Judgment criteria:

Conditions	Fuel Pressure Value kPa (kg/cm²)
Idling	235~265 (2.4~2.7)
3000 rpm	Rising from idling

5. Possible causes of abnormal fuel pressure.

High Fuel Pressure	• Defective pressure regulator • Clogged return system
Low Fuel Pressure	• Defective pressure regulator • Insufficient fuel pump discharge force • Clogged fuel supply system

If the standard fuel pressure is not achieved and the cause cannot be identified without any clogged or bent hoses, etc., replace the pressure regulator. The pressure regulator cannot be inspected separately.

NOTE

• After measuring the fuel pressure, reduce the fuel pressure again, then remove the fuel pressure gauge and connect the hose and connector.

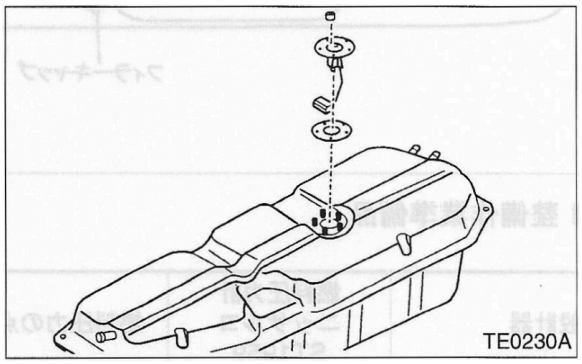
<Removal>

1. Disconnect the battery terminals.
2. Disconnect the fuel pump harness connector and remove the hoses on both ends.
3. Remove the fuel pump and its bracket.

(3) Fuel Level Sensor

<Removal>

1. Remove the five flange nuts and pull out the level sensor from the fuel tank.
   T 4.5 ± 1.5 N • m [0.45 ± 0.15kg • m]

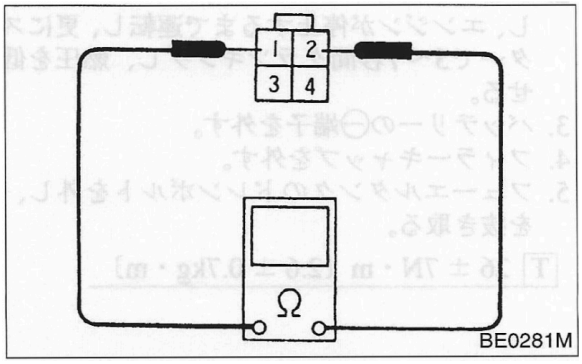


<Inspection>

1. Measure the resistance between the sensor terminals.

Terminal	Conditions	Reference Value Ω
1-2	Fuel	3.0 ± 1
	Empty	110 ± 1

Full, empty: The position where the float hits the stopper when it is moved up or down.

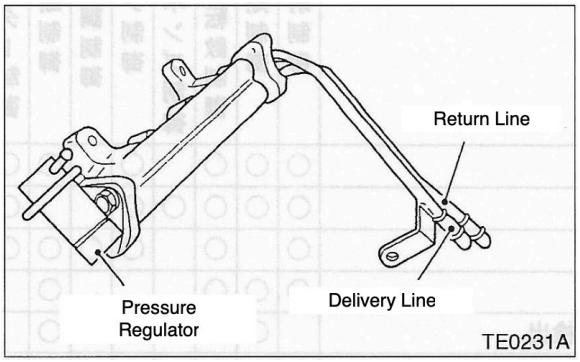


2. If the resistance value is outside the standard value, replace the level sensor.
   • The float position is non-adjustable.

(4) Pressure Regulator

<Removal>

1. Reduce the fuel pressure.
2. Remove the two mounting bolts and remove the pressure regulator from the delivery pipe.
   T 8 ± 2 N • m [0.8 ± 0.2kg • m]



<Installation>

1. Attach a new O-ring to the pressure regulator and install it.
2. After installation, check for fuel leaks.

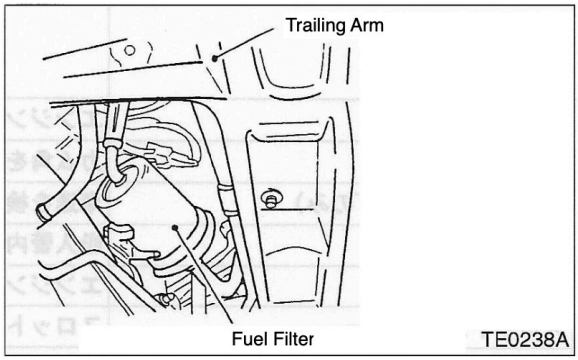
(5) Fuel Filter

<Removal>

1. Reduce the fuel pressure.
2. Disconnect the fuel hose, then loosen and remove the mounting bolts.
   T 7.5 ± 2 N • m [0.75 ± 0.2kg • m]

NOTE

• After installation, check for fuel leaks.



✻ When to replace the fuel filter:

Replacement Period	Private Use	60,000 km
	Business Use	40,000 km

2 - 10 Electronic Control System

■ System Configuration

(1) System Configuration Table

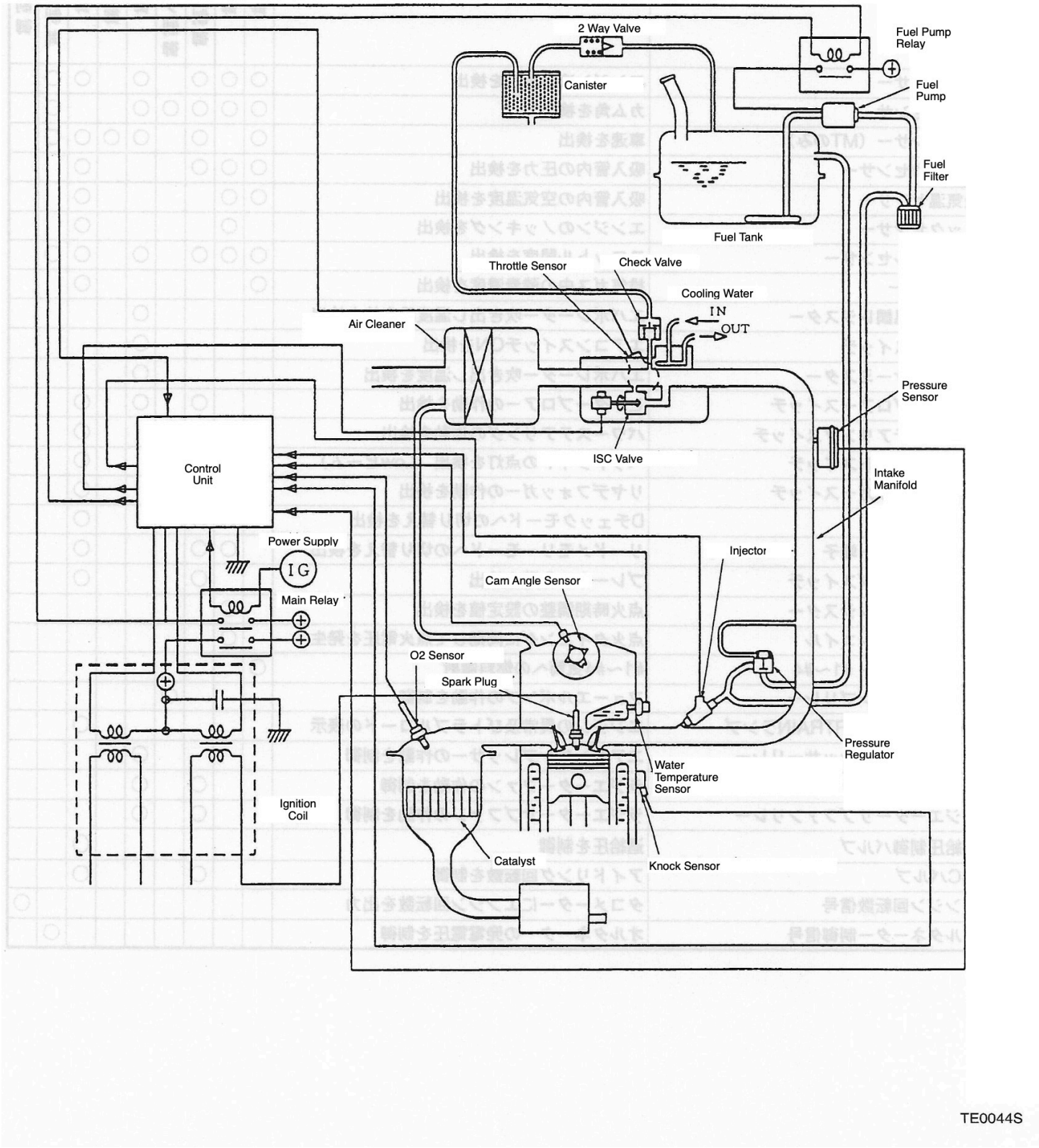
1.NA (EN07V)

Control Part	Control Unit (EGI-AT C/U)	Depending on the input signal from each sensor, it outputs to various actuators without performing any calculations for each control.	Fuel Injection Control	Ignition Timing Control	Idle Speed Control	Fuel Pump Control	Air Conditioner Control	ABS Cooperative Control	Self-Diagnosis Control	Alternator Control	Tachometer Control
Input Signal (Sensor, Switch, etc.)	Water Temperature Sensor	Detects engine coolant temperature	○	○	○		○		○	○	
	Cam Angle Sensor	Detects cam angle	○	○	○	○	○			○	
	Vehicle Speed Sensor (MT Only)	Detects vehicle speed	○		○		○	○	○	○	
	Intake Pressur Sensor	Detects the pressure inside the suction pipe	○	○	○				○		
	Knock Sensor	Detects engine knocking		○					○		
	Throttle Sensor	Detects throttle opening	○	○	○		○		○	○	
	O2 Sensor	Detects oxygen concentration in exhaust gas	○						○		
	Air Conditioner Temperature Control Register	Detects the evaporator outlet temperature setting					○				
	Air Conditioner Switch	Detects air conditioner switch ON					○				
	Air Conditioner Thermistor	Detects the evaporator outlet temperature					○				
	Heater Blower Switch	Detects heater blower operation			○		○		○		
	Power Steering Switch	Detects power steering operation			○				○		
	Low Beam Light Switch	Detects headlights on (Low Beam)			○				○		
	Rear Defogger	Detects rear defogger operation			○				○		
	Test Terminal	Detects switching to D-check mode		○	○				○		
	Read Memory Terminal	Detects switching to read memory mode		○	○				○		
	Ignition Timing Adjustment Register	Detects the ignition timing adjustment setting value		○							
Output Signal (Actuators	Ignition Coil	Generates ignition voltage in sync with ignition timing		○							
	Injector	Controls fuel injection into the cylinder	○								
	Fuel Pump Relay	Controls the operation of the fuel pump				○					
	CHECK POWERTRAIN Lamp	Engine abnormalities and trouble code display							○		
	Air Conditioner Compressor Relay	Controls the operation of the air conditioner compressor					○				
	Radiator Fan Relay	Controls the operation of the radiator fan			○		○				
	Radiator Sub-fan Relay	Controls the operation of the radiator sub-fan			○		○				
	ISC Valve	Idling speed control			○				○		
	Alternator Control Signal	Controls the voltage generating by the alternator								○	
	Engine Speed Signal	Outputs engine speed									○

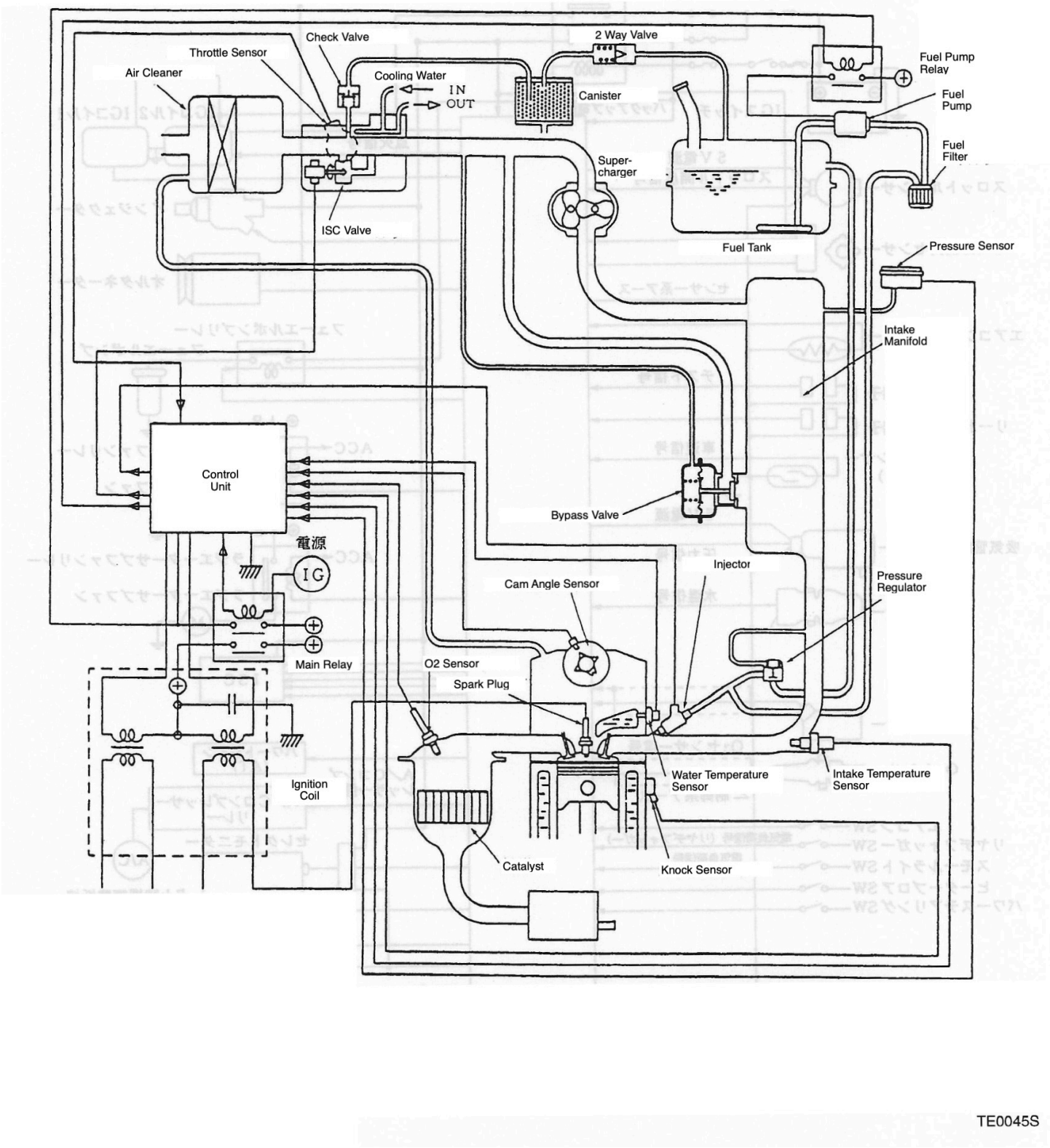
Control Part	Control Unit (EGI-AT C/U)	Depending on the input signal from each sensor, it outputs to various actuators without performing any calculations for each control.	Fuel Injection Control	Ignition Timing Control	Idle Speed Control	Fuel Pump Control	Air Conditioner Control	ABS Cooperative Control	Self-Diagnosis Control	Alternator Control	Tachometer Control
Input Signal (Sensor, Switch, etc.)	Water Temperature Sensor	Detects engine coolant temperature	○	○	○		○		○	○	
	Cam Angle Sensor	Detects cam angle	○	○	○	○	○			○	
	Vehicle Speed Sensor (MT Only)	Detects vehicle speed	○		○		○	○	○	○	
	Intake Pressur Sensor	Detects the pressure inside the suction pipe	○	○	○				○		
	Knock Sensor	Detects engine knocking		○					○		
	Throttle Sensor	Detects throttle opening	○	○	○		○		○	○	
	O2 Sensor	Detects oxygen concentration in exhaust gas	○						○		
	Air Conditioner Temperature Control Register	Detects the evaporator outlet temperature setting					○				
	Air Conditioner Switch	Detects air conditioner switch ON					○				
	Air Conditioner Thermistor	Detects the evaporator outlet temperature					○				
	Heater Blower Switch	Detects heater blower operation			○		○		○		
	Power Steering Switch	Detects power steering operation			○				○		
	Low Beam Light Switch	Detects headlights on (Low Beam)			○				○		
	Rear Defogger	Detects rear defogger operation			○				○		
	Test Terminal	Detects switching to D-check mode		○	○				○		
	Read Memory Terminal	Detects switching to read memory mode		○	○				○		
	Stop Lamp Switch	Detects brake operation			○				○		
Output Signal (Actuators	Ignition Timing Adjustment Register	Detects the ignition timing adjustment setting value		○							
	Ignition Coil	Generates ignition voltage in sync with ignition timing		○							
	Injectors #1-#4	Fuel injection into the cylinders #1-#4	○								
	Fuel Pump Relay	Controls the operation of the fuel pump				○					
	CHECK POWERTRAIN Lamp	Engine abnormalities and trouble code display							○		
	Air Conditioner Compressor Relay	Controls the operation of the air conditioner compressor					○				
	Radiator Fan Relay	Controls the operation of the radiator fan			○		○				
	Radiator Sub-fan Relay	Controls the operation of the radiator sub-fan			○		○				
	Supercharging Pressure Control Valve	Controls the boost pressure							○		
	ISC Valve	Idling speed control			○				○		
	Alternator Control Signal	Controls the voltage generating by the alternator								○	
	Engine Speed Signal	Outputs engine speed									○

2) System Diagram

1.NA (EN07V)

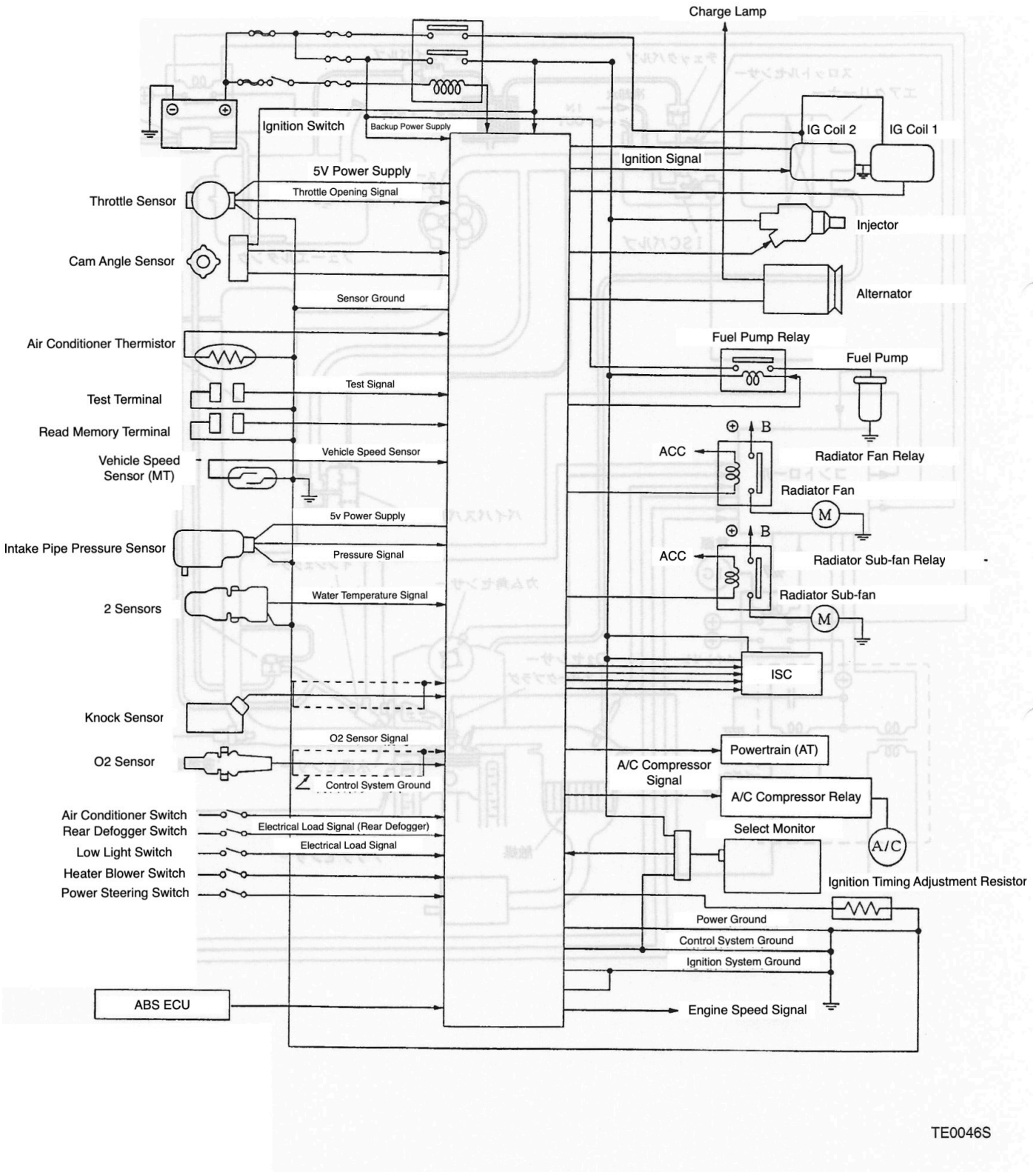


2.SC (EN07Y)

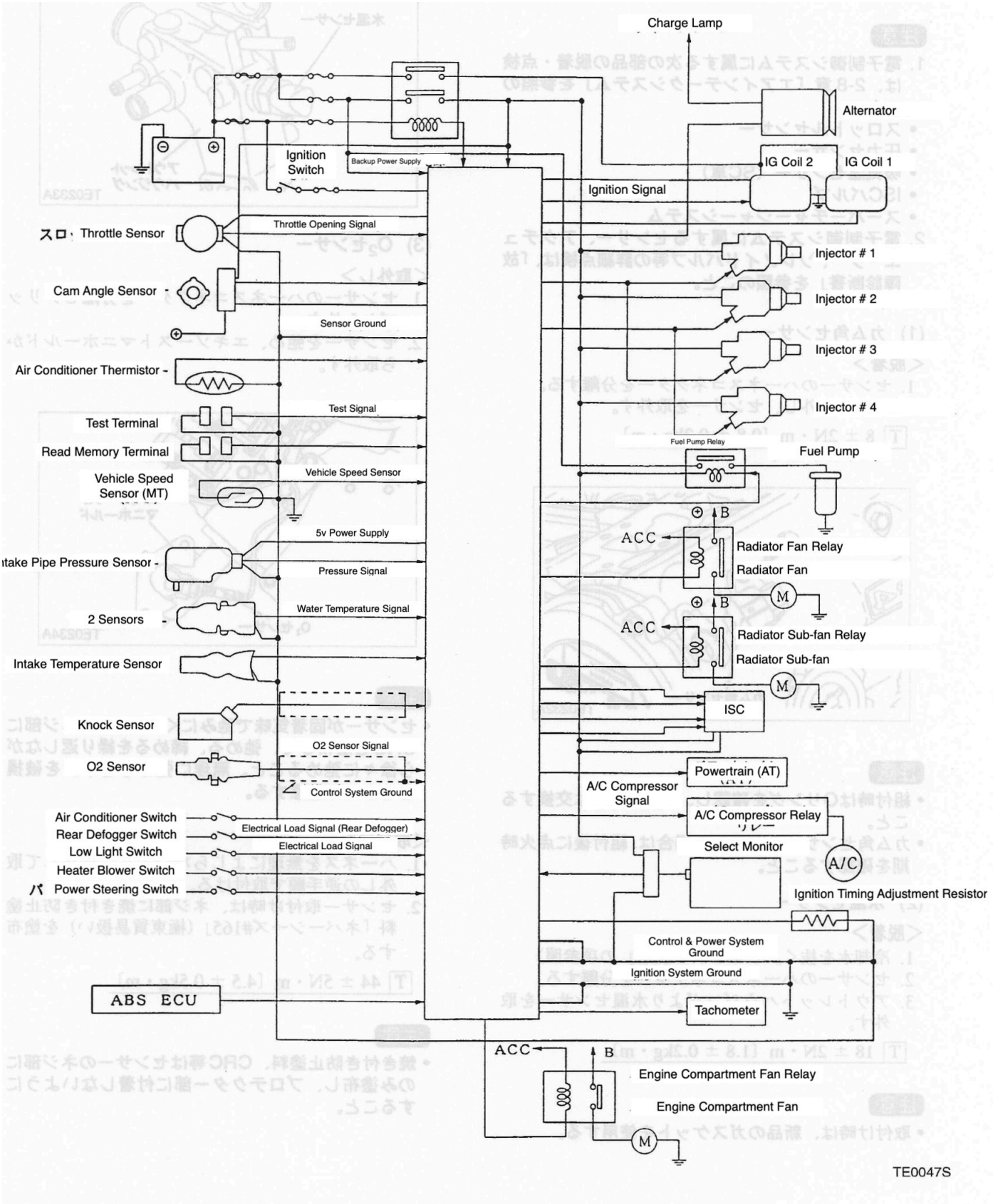

Throttle Sensor
Check Valve
2 Way Valve
Air Cleaner
Cooling Water
IN
OUT
Canister
Fuel Pump Relay
Fuel Pump
Fuel Filter
Super-charger
ISC Valve
Fuel Tank
Pressure Sensor
Intake Manifold
Control Unit
Bypass Valve
電源
IG
Injector
Cam Angle Sensor
Pressure Regulator
Main Relay
O2 Sensor
Spark Plug
Ignition Coil
Water Temperature Sensor
Intake Temperature Sensor
Catalyst
Knock Sensor
TE0045S

(3) Input/Output Diagram

1.NA (EN07V)



2.SC (EN07Y)


Charge Lamp
Alternator
Ignition Switch
Backup Power Supply
IG Coil 2
IG Coil 1
Ignition Signal
Throttle Sensor
Throttle Opening Signal
Injector # 1
Cam Angle Sensor
Injector # 2
Sensor Ground
Injector # 3
Air Conditioner Thermistor
Injector # 4
Test Signal
Test Terminal
Fuel Pump Relay
Read Memory Terminal
Fuel Pump
Vehicle Speed Sensor (MT)
Vehicle Speed Sensor
B
5v Power Supply
ACC
Radiator Fan Relay
Intake Pipe Pressure Sensor
Pressure Signal
Radiator Fan
M
B
Water Temperature Signal
ACC
2 Sensors
Radiator Sub-fan Relay
Intake Temperature Sensor
Radiator Sub-fan
M
ISC
Knock Sensor
O2 Sensor Signal
O2 Sensor
Powertrain (AT)
Control System Ground
A/C Compressor Signal
Air Conditioner Switch
A/C Compressor Relay
Rear Defogger Switch
Electrical Load Signal (Rear Defogger)
Select Monitor
Low Light Switch
Electrical Load Signal
A/C
Heater Blower Switch
Ignition Timing Adjustment Resistor
Power Steering Switch
Control & Power System Ground
Ignition System Ground
ABS ECU
Tachometer
ACC
B
Engine Compartment Fan Relay
Engine Compartment Fan
M
TE0047S

■ Maintenance Instructions

NOTE

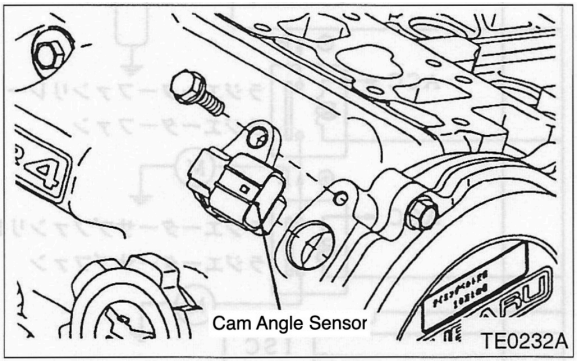
1. For removal, installation, and inspection of the following electronic control system parts, refer to Chapter 2-8, “Air Intake System.”
   - Throttle Sensor
   - Pressure Sensor
   - Intake Air Temperature Sensor (SC Vehicles)
   - ISC Valve
   - Supercharger System
2. For detailed inspection of sensors, actuators, solenoid valves, etc., belonging to the electronic control system, refer to the “Troubleshooting Report.”

(1) Camshaft Angle Sensor

<Removal>

1. Disconnect the sensor harness connector.
2. Remove the bolt and remove the sensor.

T 8 ± 2 N • m [0.8 ± 0.2kg • m]



NOTE

- When assembling, check the ring and replace it if it is defective.
- If the cam angle sensor is removed, be sure to check the ignition timing after reassembly.

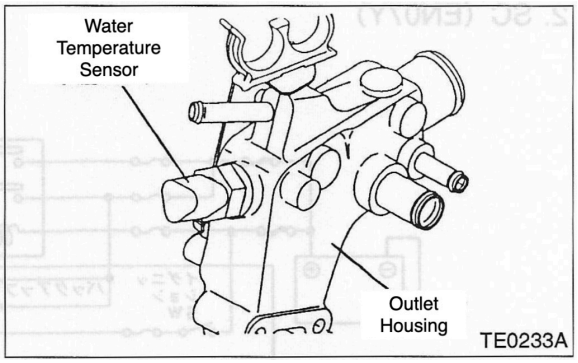
(2) Water Temperature Sensor

<Removal>

1. Drain the coolant.
   - See the "Engine Removal and Installation" section.
2. Disconnect the sensor harness connector.
3. Remove the water temperature sensor from the outlet housing.

NOTE

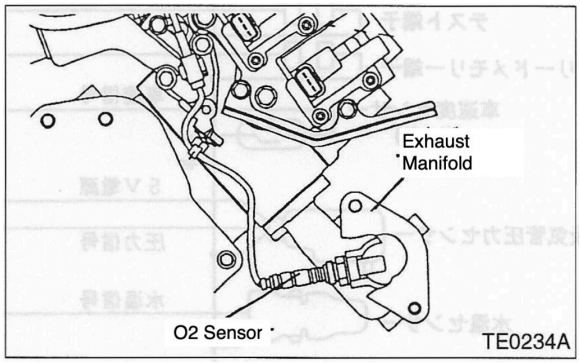
- When installing, use a new gasket.



(3) O2 Sensor

<Removal>

1. Disconnect and unclip the sensor harness connector.
2. Loosen the sensor and remove it from the exhaust manifold.



NOTE

- If the sensor is stuck and difficult to loosen, apply CRC to the screw and gradually loosen it by repeatedly loosening and tightening it. Be careful not to force the screw to loosen, as this may damage it.

<Installation>

1. Install the harness in the reverse order of removal, being careful not to twist it.
2. When installing the sensor, apply anti-seize paint "Never-Seez #165" to the threads.

NOTE

- Apply anti-seize paint, CRC, etc. only to the sensor threads, taking care not to allow it to adhere to the protector.

(4) Fuel Injectors

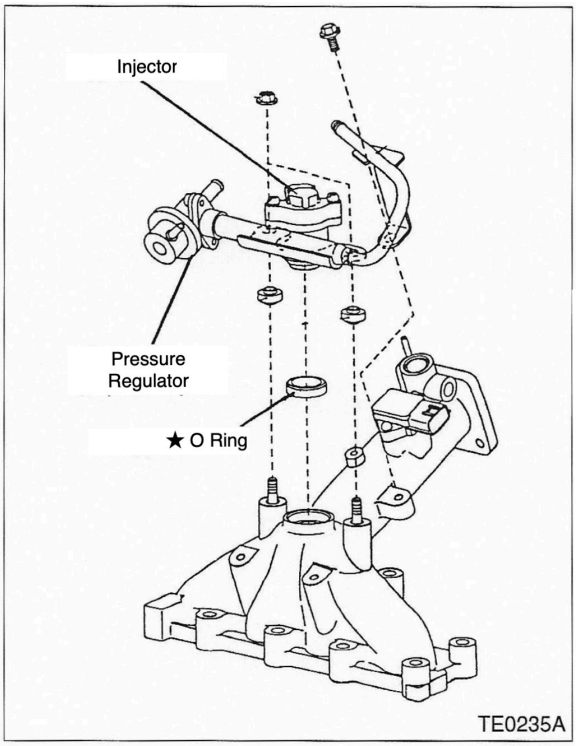
<Inspection>

1. Simple injector operation inspection: With the engine idling, touch the injector with a sound scope or screwdriver to hear the injector operating (tick-tick).
2. If there is no operating sound, check the injector circuit using the "Trouble Diagnosis Report" to determine whether there is an abnormality in the injector itself or the circuit.

<Removal>

1. SPi Vehicles
   1) Disconnect the fuel pump harness connector or fuel pump relay connector and run the engine until it stalls. Then crank the starter motor for 5 to 7 seconds to reduce fuel pressure.
   2) Disconnect the injector connector.
   3) Loosen the hose clips and remove the hoses (delivery, return, and vacuum).
   4) Loosen one bolt and two nuts, and remove the fuel pipe assembly (injector) from the intake manifold.

T 8 ± 2 N • m [0.8 ± 0.2kg • m]

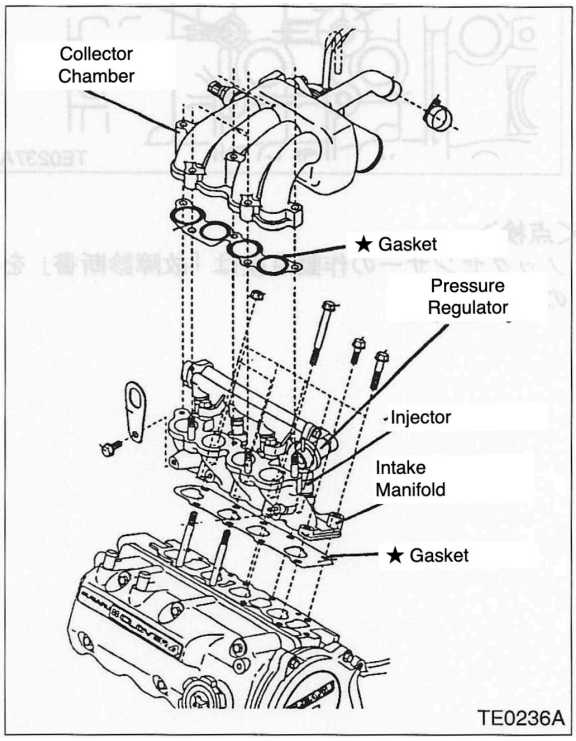


NOTE

• When removing the injector, pull it out straight without turning it.

2. MPi Vehicles
   • Reduce fuel pressure as you would for an SPi vehicle.
   1) Remove the collector chamber.
   2) Loosen the hose clips and remove the hoses (delivery and return) from the fuel pipe COMPL.
   3) Disconnect the injector connectors.
   4) Loosen the two nuts and remove the delivery pipe and injector together from the intake manifold.

T 19 ± 2 N • m [1.9 ± 0.2kg • m]



<Installation>

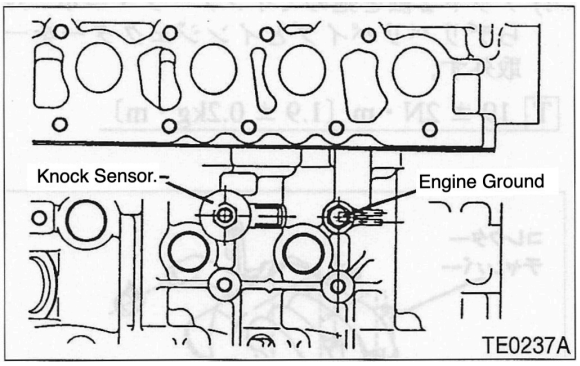
1. Replace the O-rings and seals with new ones and install them in the reverse order of removal.
   • Make sure the seals are securely installed in the intake manifold mounting holes, then press the MP i car and delivery pipe straight into the mounting holes.
2. Rotate the injector by hand to check that the O-ring is engaged and the seal is not torn.
3. After installation, check for fuel leaks.

(5) Knock Sensor

<Removal>

1. Disconnect the sensor connector.
2. Remove the mounting bolts.

T 20 ± 3 N • m [2 ± 0.3kg • m]

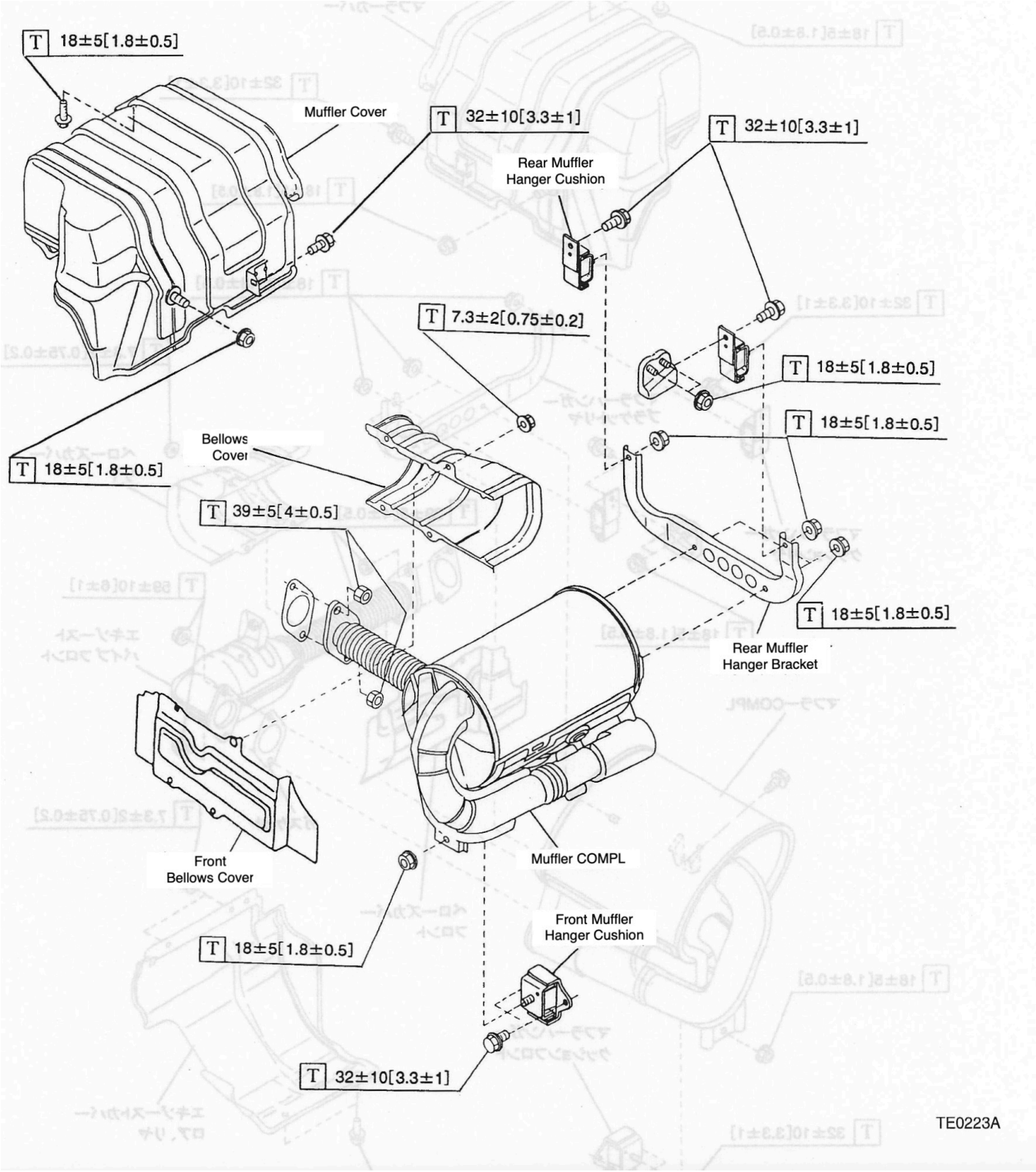


<Inspection>

For checking the operation of the knock sensor, refer to the "Troubleshooting Report."

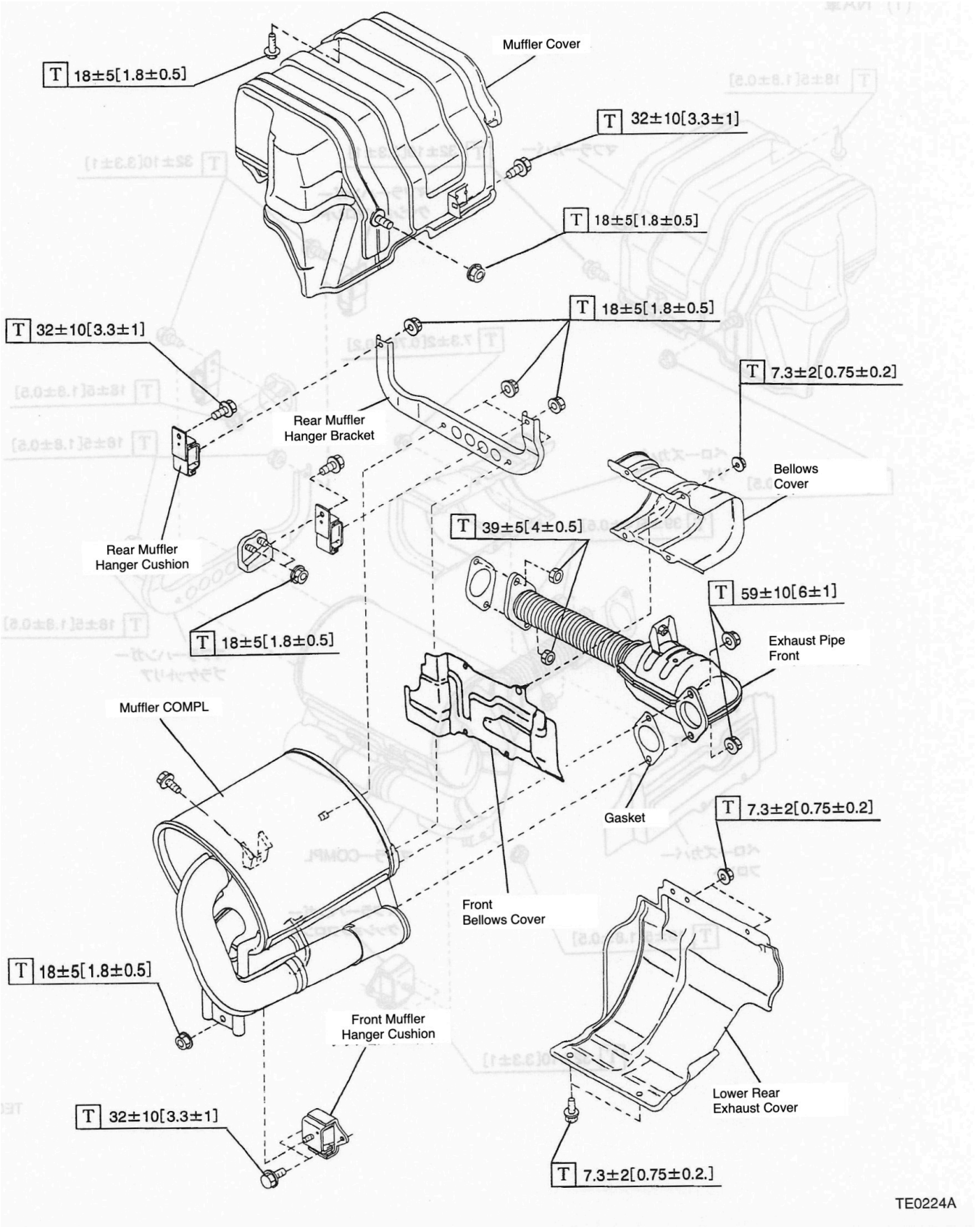
2 - 11 Exhaust System

■ Parts & Components

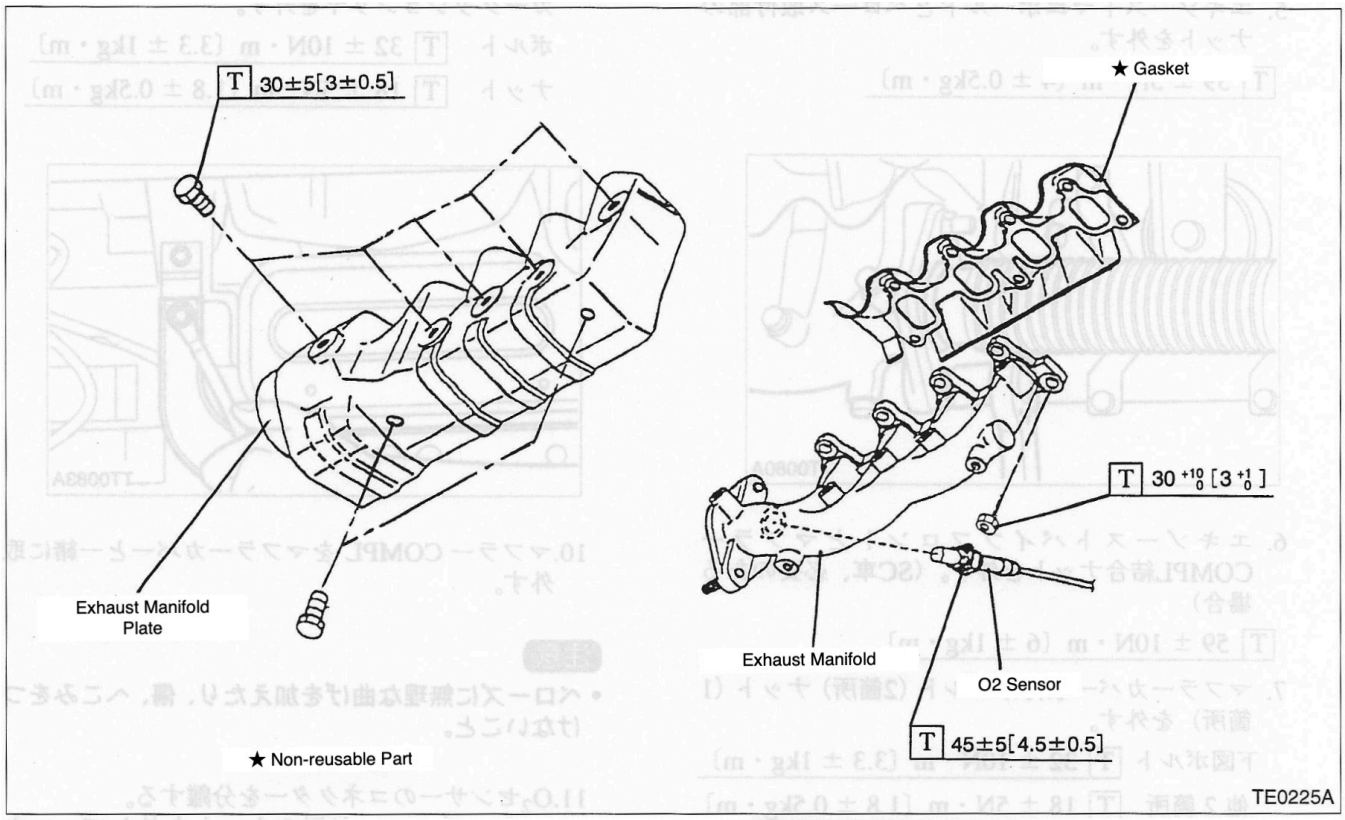


(1) NA Vehicles

(2) SC Vehicles



(3) Engine Area



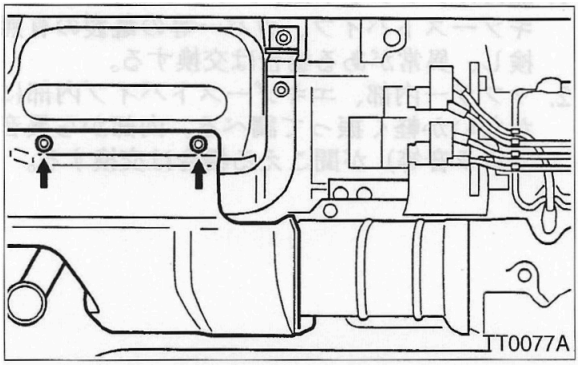
■ Maintenance Instructions

NOTE

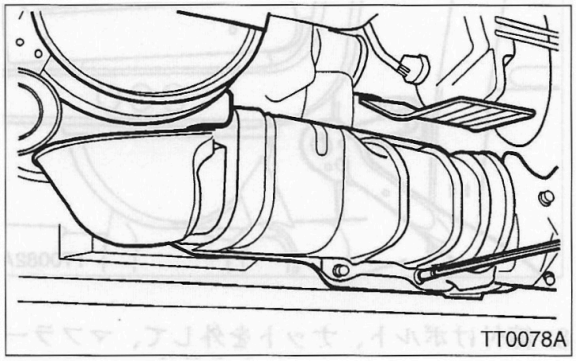
- When servicing the exhaust system, be careful not to get burned.
- After loosely tightening each joint, check the clearance with the body and alignment before tightening it completely.
- Perform a test run to confirm that there are no gas leaks from each joint.
- At the 1,000 km inspection, tighten all fasteners to the correct torque.

<Removal>

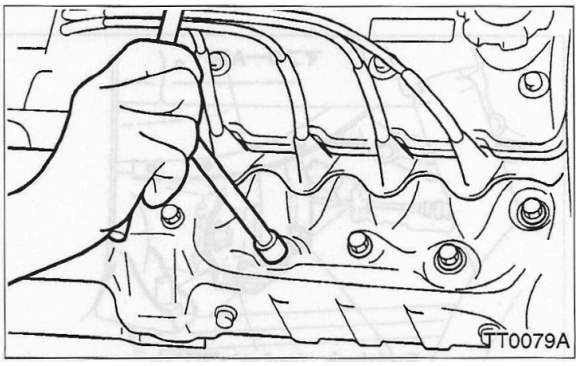
1. Remove the exhaust rear cover (SC vehicles).
T 7.23 ± 2 N•m [0.75 ± 0.2 kg•m]



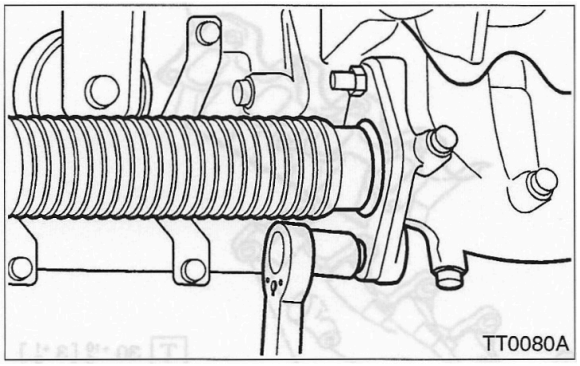
2. Remove the rear bellows cover.
T 7.3 ± 2 N•m [0.75 ± 0.2 kg•m]



3. Remove the exhaust manifold plate.
T 30 ± 5 N•m [3 ± 0.5 kg•m]

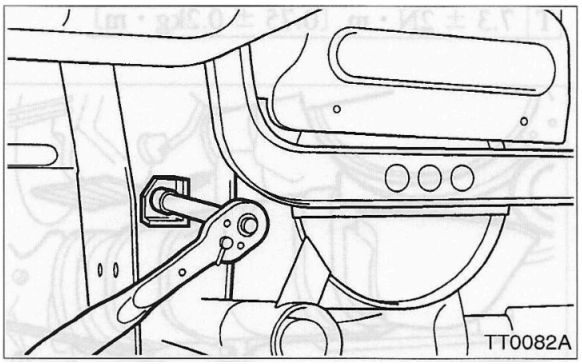


4. Remove the front bellows cover.
5. Remove the exhaust manifold and bellows mounting nuts.
T 39 ± 5 N•m [4 ± 0.5 kg•m]

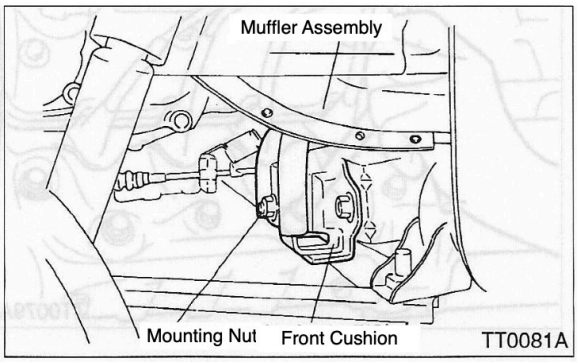


6. Remove the exhaust pipe front and Muffler connecting nuts (SC vehicles, if necessary).
T 59 ± 10 N•m [6 ± 1 kg•m]

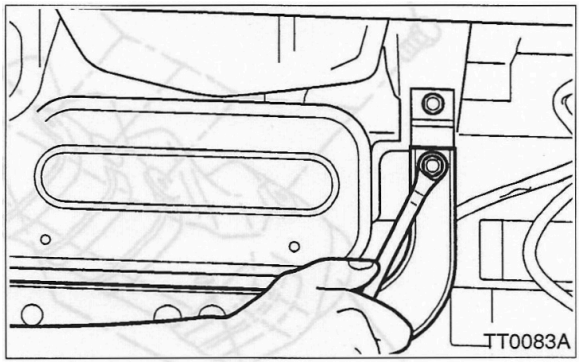
7. Remove the muffler cover mounting bolts (2 places) and nut (1 place).
Bolt shown below T 32 ± 10 N•m [3.3 ± 1 kg•m]
Two other locations T 18 ± 5 N•m [1.8 ± 0.5 kg•m]



8. Remove the fastening bolts and nuts and remove the front muffler hanger cushion.
Bolt T 32 ± 10 N•m [3.3 ± 1 kg•m]
Nut T 18 ± 5 N•m [1.8 ± 0.5 kg•m]



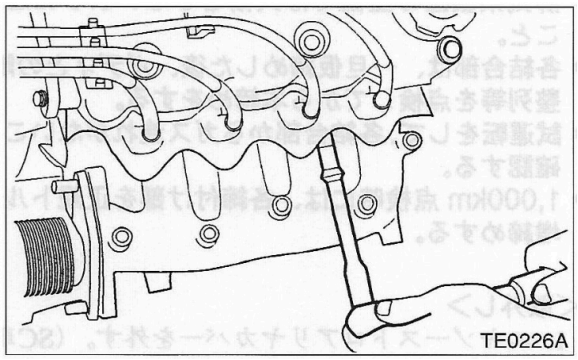
9. Remove the fastening bolts and nuts to remove the rear muffler hanger cushion.
Bolt T 32 ± 10 N•m [3.3 ± 1kg•m]
Nut T 18 ± 5 N•m [1.8 ± 0.5 kg•m]



10. Remove the Muffler COMPL together with the muffler cover.

NOTE
• Do not bend the bellows excessively, or scratch or dent it.

11. Disconnect the O2 sensor connector.
12. Remove the nut on the cylinder head side and remove the exhaust manifold.
T $30^{+10}_{-0}\,N \cdot m\,[3^{+1}_{-0}\,kg \cdot m]$



<Inspection>

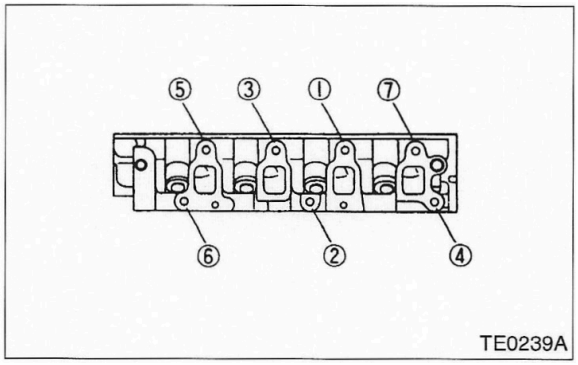
1. Check for cracks in the mounting brackets, cushions, muffler, exhaust pipe, and cover.
   • Replace any abnormalities.
2. Gently shake the inside of the muffler and exhaust pipe to check for abnormalities. If you hear any abnormal sounds (such as rattling) from inside, replace them.

<Installation>

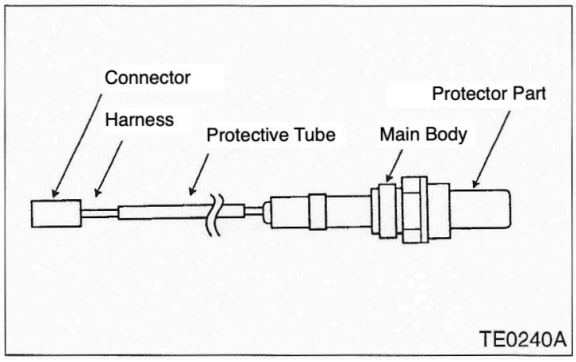
1. Attach the exhaust manifold to the cylinder head.

NOTE

1) Tighten the nuts in two steps to a torque of 30 +10 -0 N•m [3 +1 -0 kg•m] in the order shown in the diagram below.



2) 02 Sensor Handling Instructions
- Avoid dropping or other impacts.
- Avoid damaging the harness.
- Be careful not to allow oil, high-temperature anti-sticking agents, or other impurities to come into contact with the connector or protector.

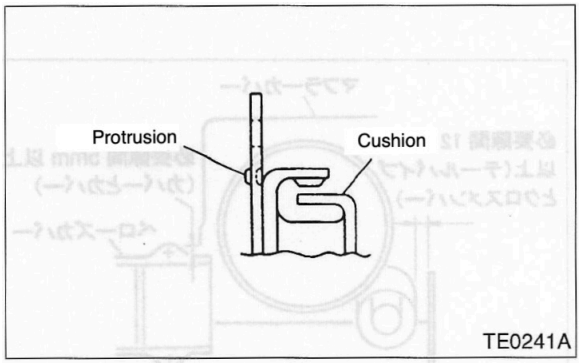


3) When transporting or installing the muffler, pay attention to the following:
- Do not scratch the bellows surface.
- Do not scratch the flange mounting surface.
- Do not damage the muffler, bracket, or rear weld bolt.
- Do not deform covers or brackets.
- Replace gaskets with new ones.

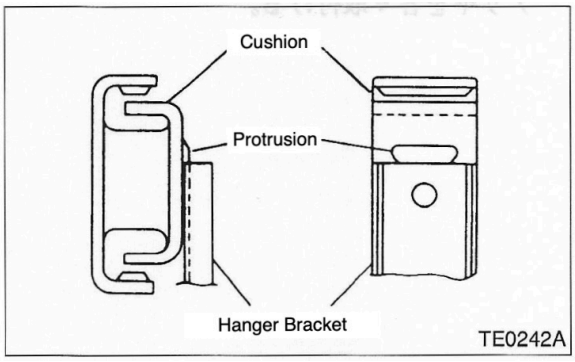
2. Assemble the muffler and muffler cover and insert them into the vehicle.
3. Install the rear muffler hanger bracket and cushion, and then temporarily tighten all fasteners.

NOTE

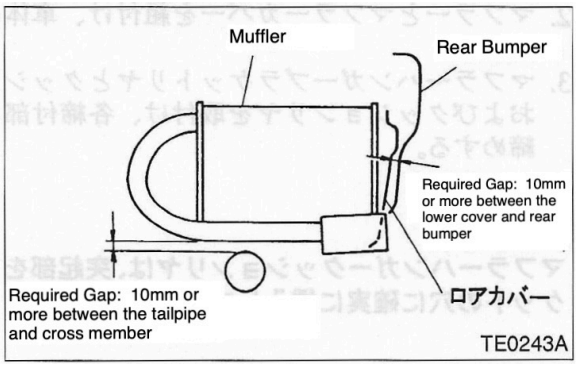
- Install the rear muffler hanger cushion by inserting the protrusion securely into the bracket hole.

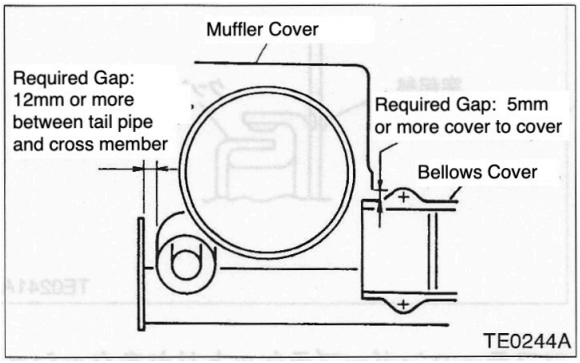


- When attaching the rear muffler hanger bracket to the cushion, be sure to press the top edge of the hanger bracket firmly against the protruding part of the cushion.



4. After all pre-tightening is complete, perform the final tightening.
5. After installation, check that the clearances are secured as shown in the following diagram.
   - If the clearances are insufficient, loosen and adjust the tightening parts, then tighten each part.

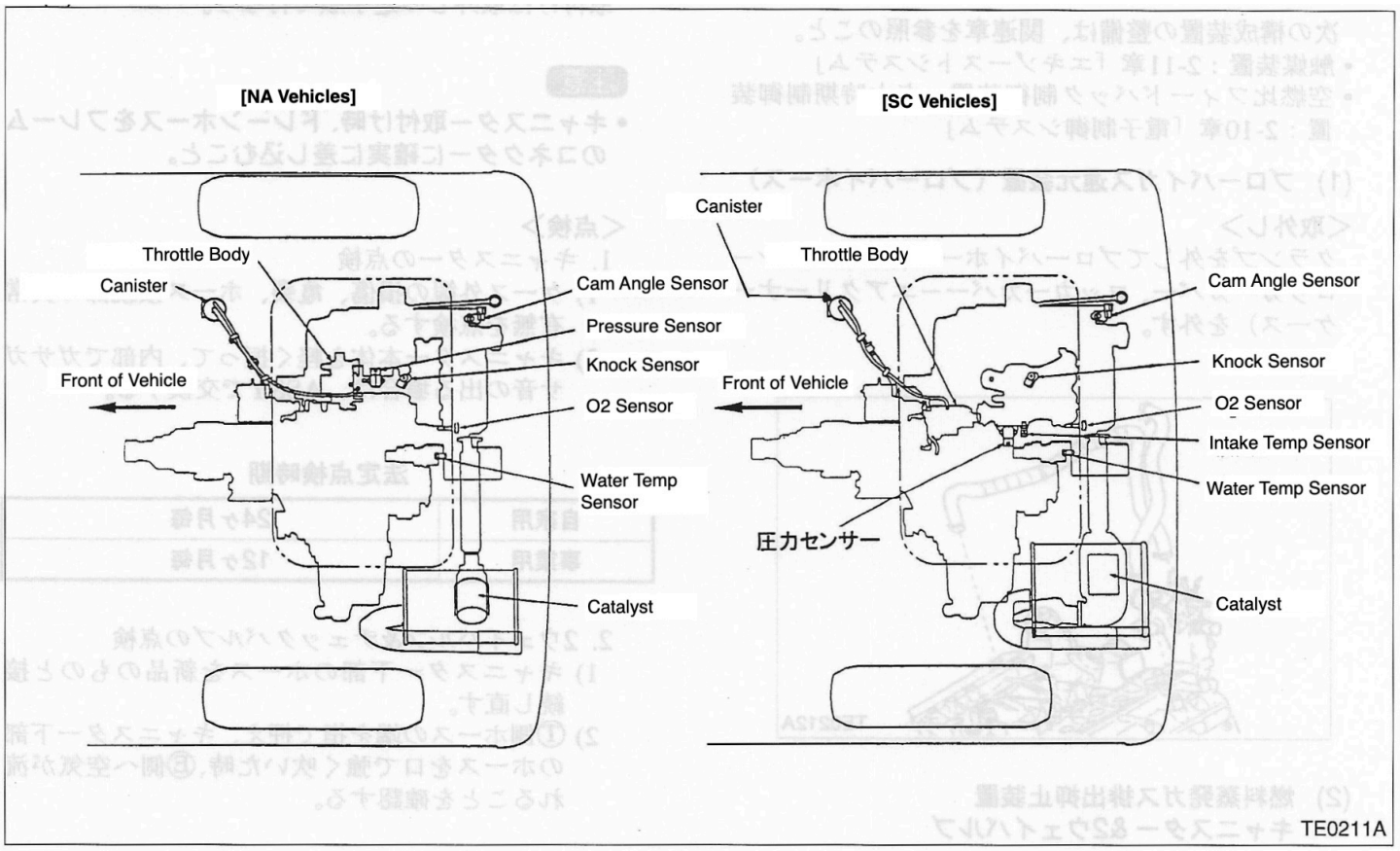




6. Start the engine, warm it up, and check for gas leaks from all joints.
7. Install the exhaust manifold plate, front and rear bellows covers, and lower exhaust cover.

2 - 12 Emission Control System

(1) Exhaust Purification System Layout



(2) Main Equipment Installation Location

Equipment Part Name	Format	Installation Position	
		NA (EN07V)	SC (EN07Y)
Throttle Body	Butterfly valve type	Intake Manifold Inlet	Supercharger inlet duct
O2 Sensor	Zirconia tube type	Exhaust manifold	Exhaust manifold
Catalyst	Monolith three-way catalyst	Muffler inlet	Front exhaust pipe
Cam Angle Sensor	Hall IC Type	Timing belt cover	Timing belt cover
Canister	Activated carbon type	Front right of engine	Front right of engine
Knock Sensor	Piezoelectric	Cylinder block	Cylinder block
Intake Temp Sensor	Thermistor Type	None	Collector chamber
Pressure Sensor	Semiconductor Type	Intake manifold	Collector chamber
Water Temperature Sensor	Thermistor Type	Outlet housing	Outlet housing

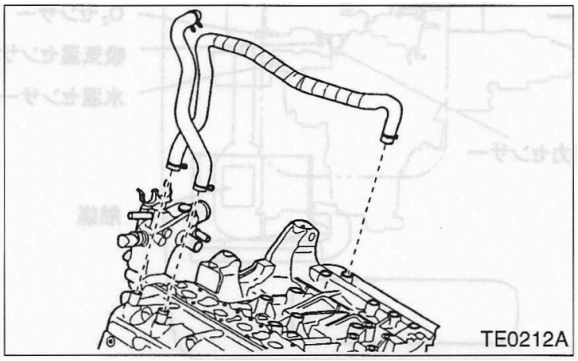
■ Equipment Instructions

For servicing the following components, refer to the relevant chapter:

- Catalytic Converter: Chapter 2-11 Exhaust System
- Air-fuel ration feedback control device, ignition timing control device: Chapter 2-10 Electronic Control System

(1) Blow-by Gas Reduction Device (Blow-by Hose)

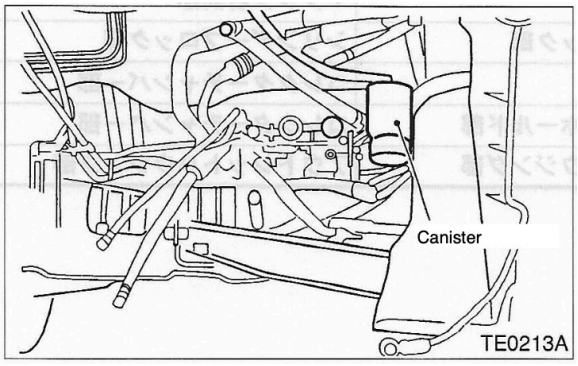
Remove the clamps and disconnect the blow-by hoses (oil pan-rocker cover, rocker cover-air cleaner case).



(2) Fuel Evaporative Emission Control Device (Canister & 2-way valve)

<Removal>

1. Loosen the clamp on the fuel tank side of the 2-way valve and pull out the fuel tank connecting hose.
2. Disconnect the engine side hose at the engine side of the check valve.
3. Pull the canister bottom drain hose of the the drain connector.
4. Lift the canister up and remove it.



<Installation>

Installation is the reverse of removal.

NOTE

- When installing the canister, be sure to insert the drain hose securely into the connector on the frame.

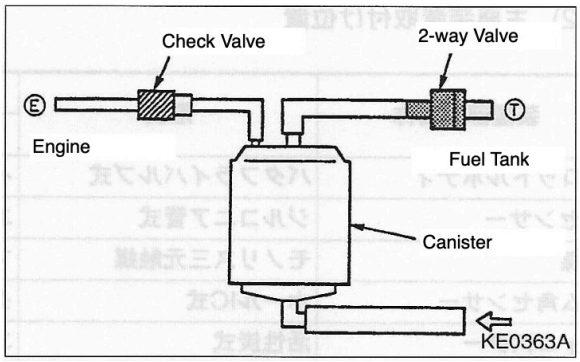
<Inspection>

1. Check the canister.
   1) Check the exterior of the case for damage, cracks, and abnormalities in the hose connections.
   2) Shake the canister body gently. If there is a rattling noise inside, replace the entire assembly.

✻ Legal Inspection Period

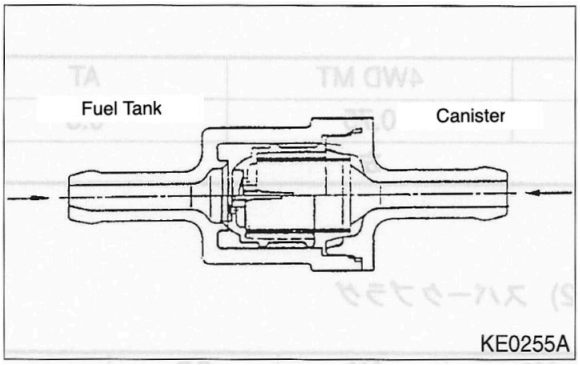
Private Use	Every 24 months
Business Use	Every 12 months

2. Inspection of 2-way valves and check valves.
   1) Reconnect the hose at the bottom of the canister with a new one.
   2) Hold the end of the side hose with your finger and blow strongly into the hose at the bottom of the canister with your mouth, and check that air flows to the engine side.



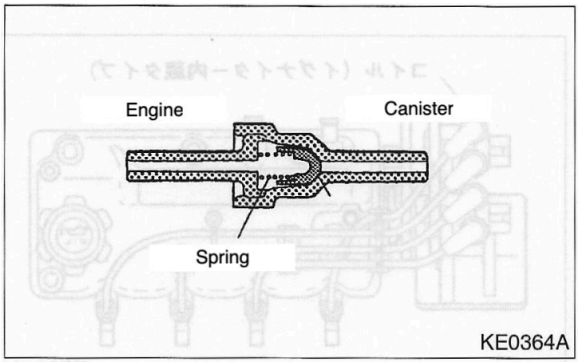
   3) Bend the canister's lower hose and hold it down with your fingers. Blow into the E side with your mouth and check that air is flowing out the T side.
   4) Bend the E side hose and hold it with your finger. Blow into the bottom hose with your mouth and check that air is flowing out the T side.
   5) If any abnormalities are found in the inspection results of items 2, 3, or 4; replace the entire assembly.

6) Two Way Valve - Make sure there is airflow in both directions as shown in the diagram below.



Blowing water from the tank side	No Air Flow
Normal airflow from the tank side	Air Flows
Weaker airflow from the canister	Air Flows

7) Check Valve



3. If any abnormalities are found in the inspections of 1 or 2, replace the 2-way valve or canister.

2 - 13 Engine Electrical

■ Specifications

[1] Starting Device

(1) Starter Motor

Car Model	2WD MT	4WD MT	AT
Output (kW)	0.65	0.75	0.8
Direction of Rotation	Left		

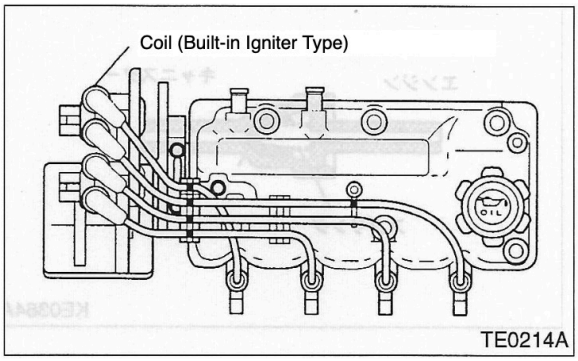
[2] Ignition Device

(1) Ignition Coil & Igniter

Item	Content
Type	Igniter built-in closed magnetic circuit type
Ignition Method	Two cylinders ignited simultaneously
Installation Location	Cylinder head side (left side)

(2) Spark Plug

Engine	NA	SC	-
Plug Model	BKR6E-11	BKR5E-11	(PFR6B-11)
Plug Gap	1.0~1.1 (mm)		
Electrode	Normal		Platinum
Manufacturer	NGK		



(3) High Tension Cables

Cable No	Length (mm)	Resistance (kΩ)
1	410	4.6~8.5
2	360	4.0~7.5
3	290	3.2~6.0
4	255	2.9~5.3

[3] Charging Device

(1) Alternator

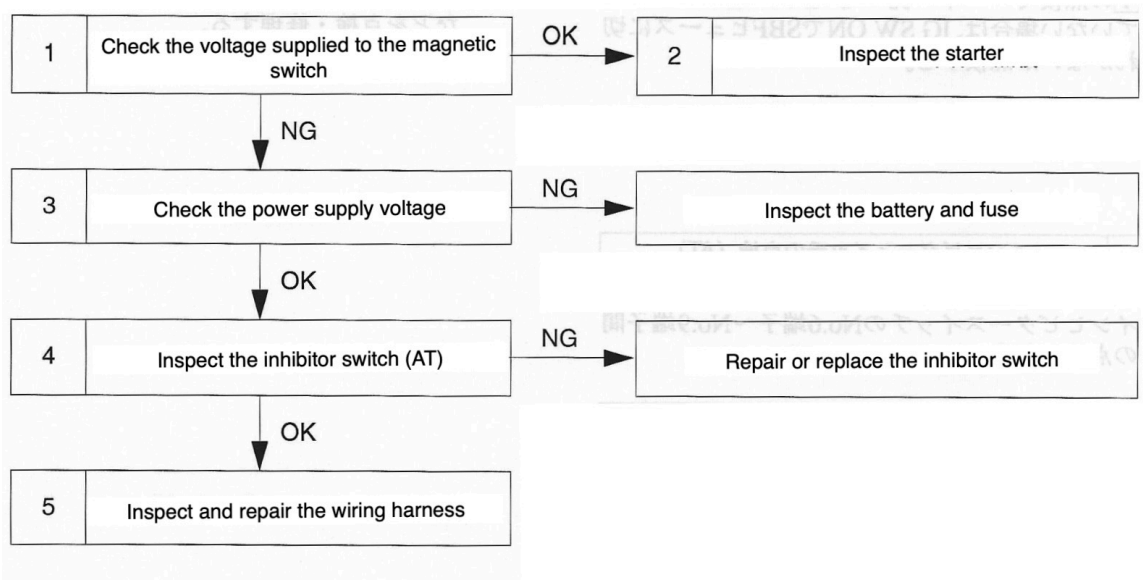
Normal Output (V-A)	12-55
Power Generation Control	Can be

(2) Battery

Destination	Standard	Cold Region
Battery Model	26B17L	38B20L
Capacity (5 hours rating) (V-AH)	12-21	12-28

■ Fault Diagnosis

(1) Items to Inspect if Starter Does Not Turn

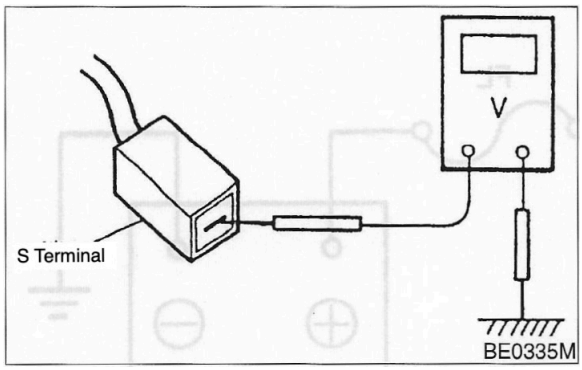


1	Check the voltage supplied to the magnetic switch

1. Disconnect the starter's S terminal.
2. With the Ignition switch ON, measure the voltage at the harness's S terminal.

NOTE

- For automatic transmission vehicles, keep the inhibitor switch in P or N range.

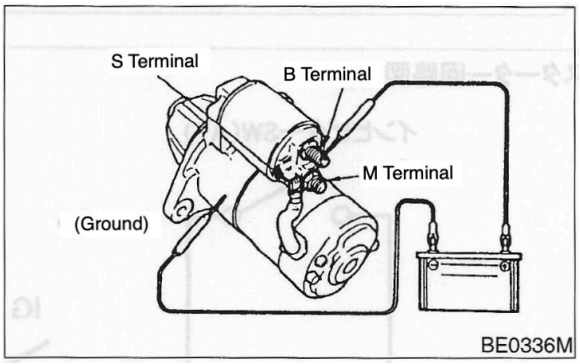


Reference Value	Battery Voltage

- If it is normal, inspect the starter itself.
- If there is no voltage, inspect the circuit between the battery and the starter motor.

2	Inspect the starter

1. Disconnect the starter from the engine.



2. Connect the terminal B to the positive ⊕ battery terminal, and connect the negative ⊖ terminal to the starter body.
3. With the starter in the above state, connect the starter's S terminal to the battery's positive ⊕ terminal and check to see if the starter rotates.
   - If it rotates, the starter is working properly. This may indicate a voltage drop due to insufficient battery capacity or rust on the harness terminals.
4. If the starter does not rotate, perform the following inspection.
   1) Separate the starter and battery.
   2) Confirm that the pinion can be turned easily with your fingers, then connect the battery's positive ⊕ terminal to the starter's M terminal and the battery's negative ⊖ terminal to the starter body to check whether the motor rotates.
      - If it does, the magnet switch may be faulty.
      - If it doesn't rotate, the starter itself may be defective.

3	Check the power supply voltage

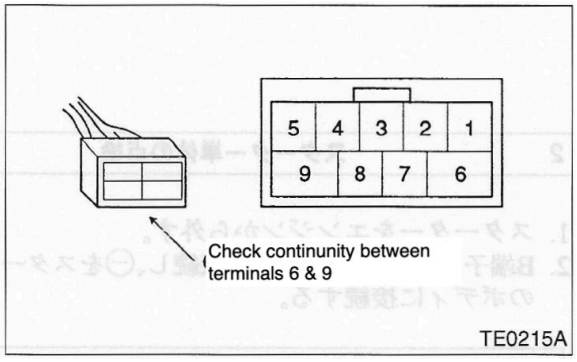
1. If the daily inspection shows that there is no voltage at the S terminal on the harness side, check with an Ignition switch is ON to see if the SBF fuse is blown.

Reference Value	Battery Voltage

4	Inspect the inhibitor switch (AT)

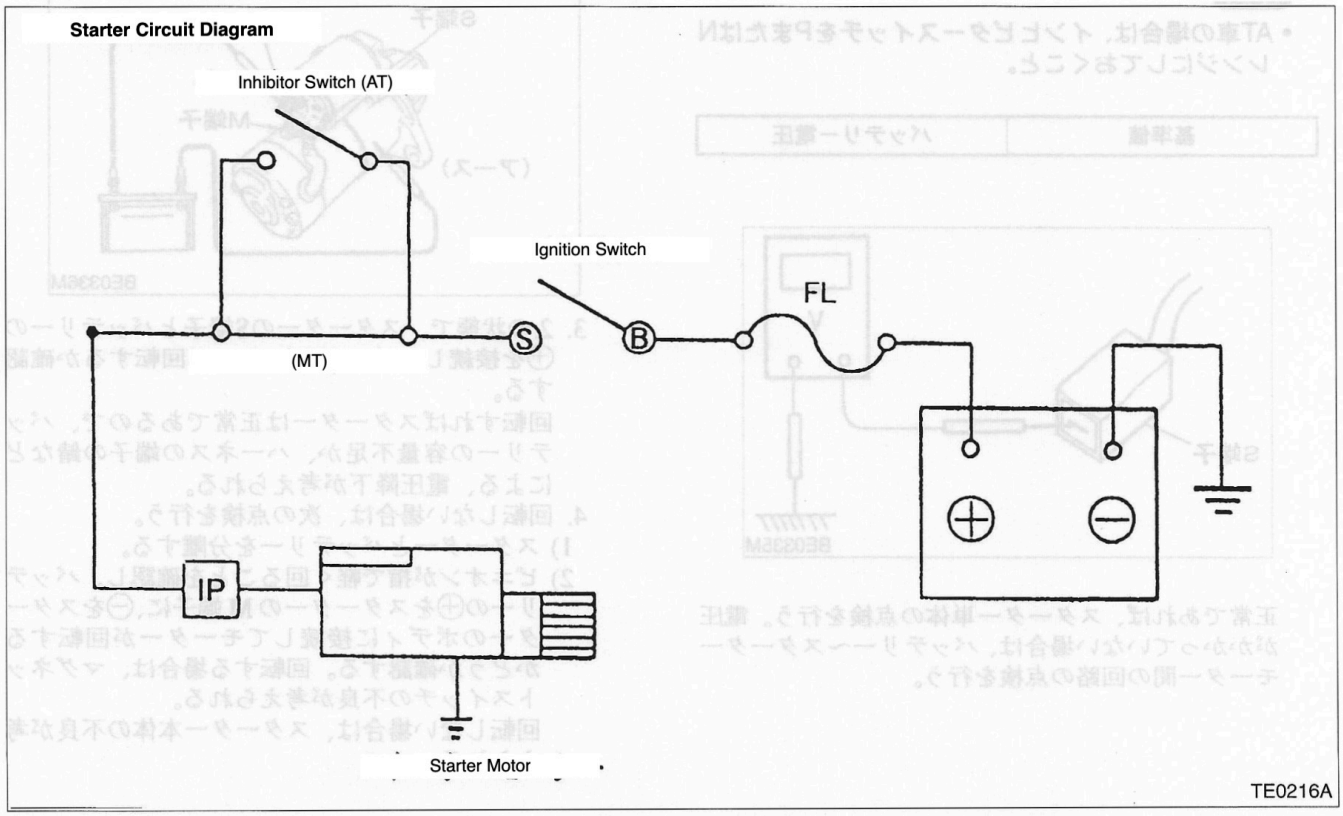
1. Inspect terminals No. 6 to No. 9 of the inhibitor switch.

Reference Value	Wire Continuity

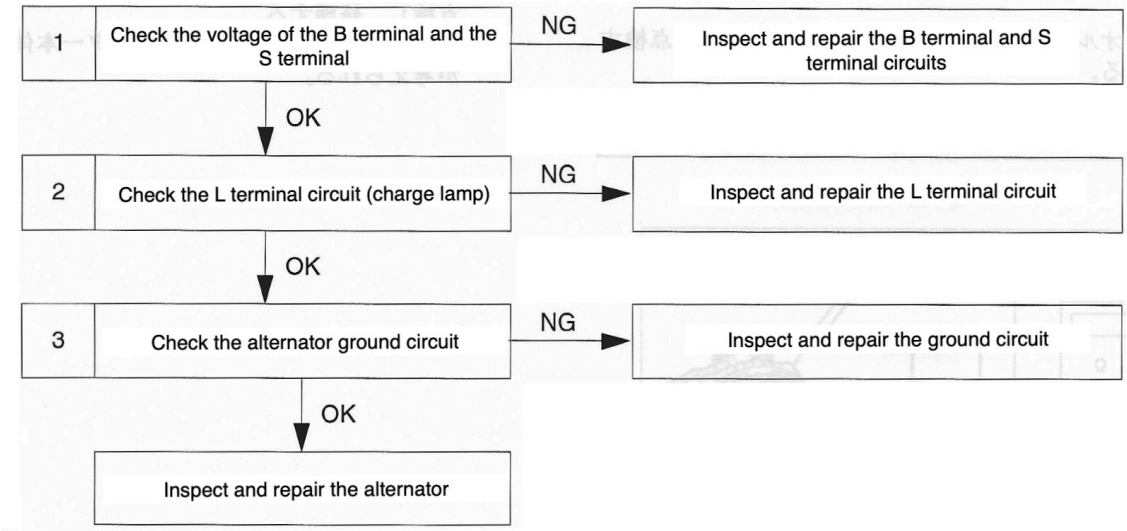


5	Inspect and repair the wiring harness

1. Refer to the starter circuit diagram and inspect and repair the harness for continuity.



(2) Items to Inspect When Not Charging

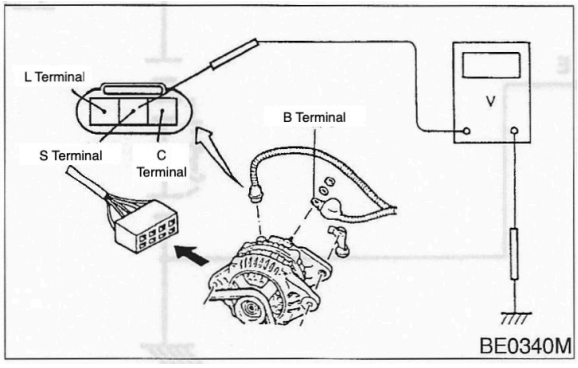


NOTE

If the battery voltage is low due to a dead battery, check with a charged, known-good battery.

1	Check the voltage supplied to the magnetic switch

1. Disconnect the B and S terminals of the alternator and check that battery voltage is being applied to the harness connector.

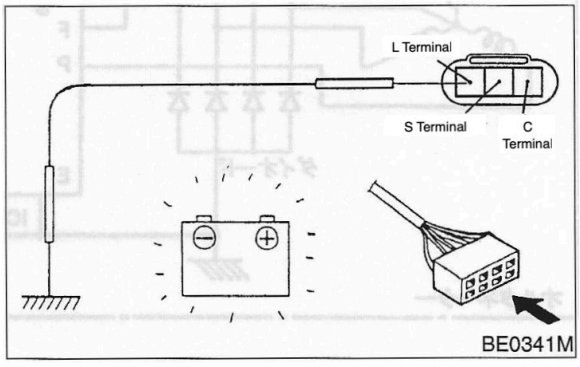


2. If there is no voltage, check the harness and fuse between the battery and alternator terminals B and S.

2	Inspect the starter

1. With the Ignition switch ON, ground the L terminal of the alternator harness and check that the charge lamp comes on.

Reference Value	Charge lamp lights up

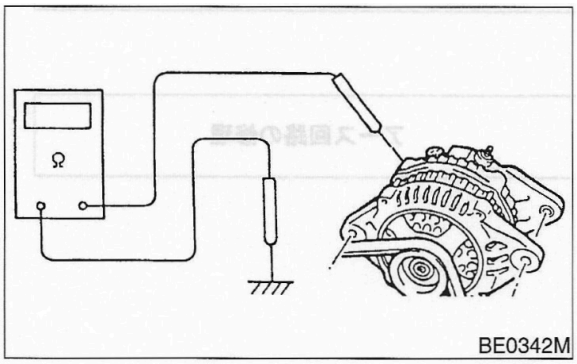


2. If the charge lamp does not light, check for the following:
   - A blown fuse
   - A broken charge lamp
   - A poor connector connection
   - A broken harness

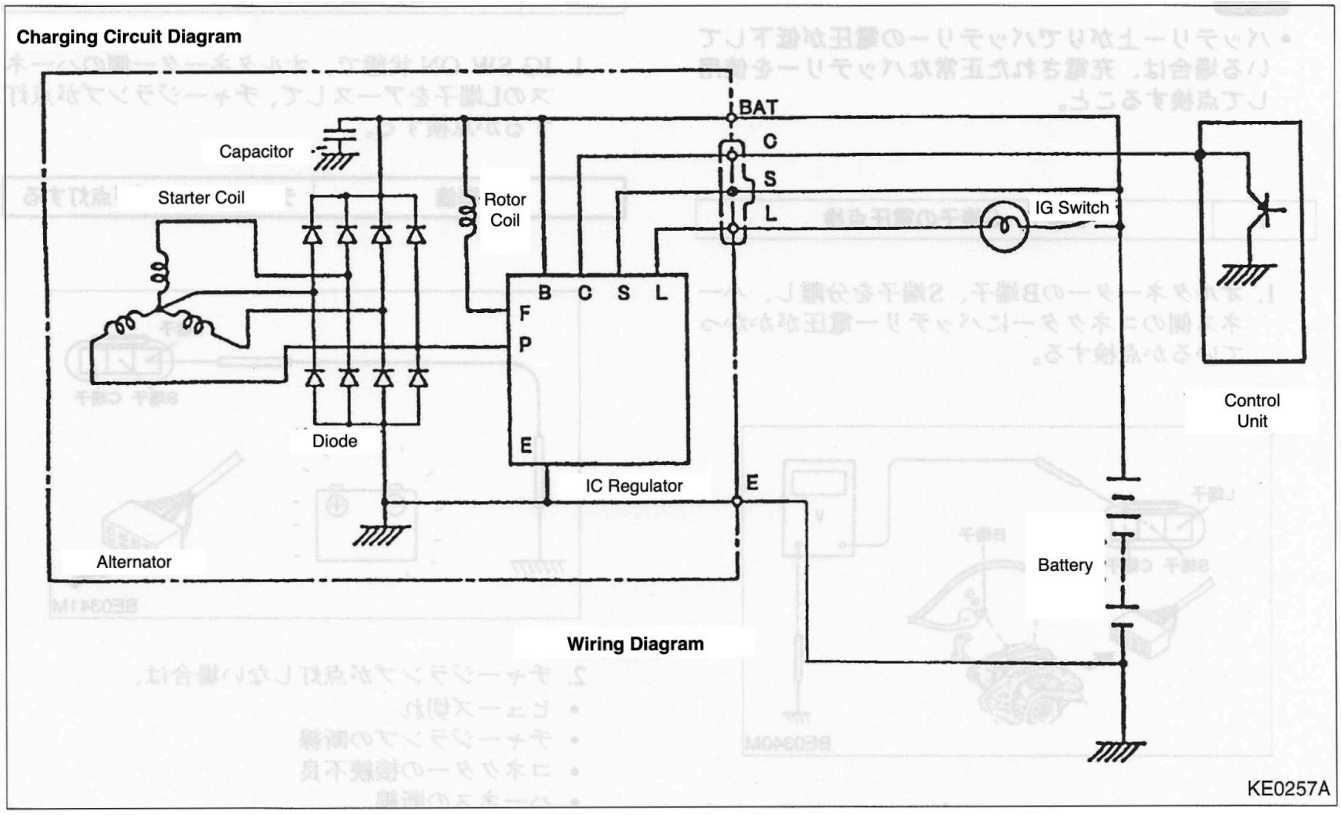
3	Check the alternator ground circuit

1. Check the continuity between the alternator and the body.

Reference Value	With continuity



2. If there is no continuity, inspect and repair the alternator installation, body ground, and engine ground.
3. If there is continuity, the alternator itself may be faulty.

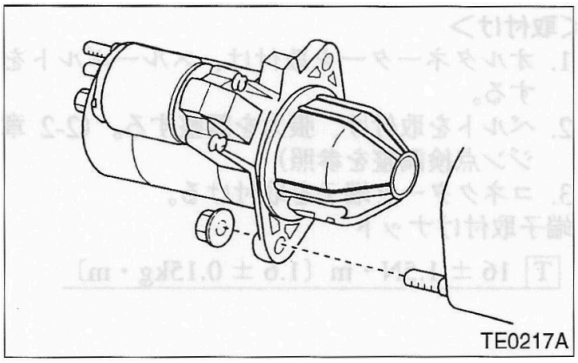


Preparation Instructions

(1) Starter

<Removal>

1. Disconnect the battery terminals.
2. Disconnect the starter harness.
   - Magnet switch (S terminal)
   - Main power supply (B terminal)
3. Remove the starter mounting bolt and nut, and remove the starter.



<Installation>

Installation is the reverse of removal.

1. Starter Mounting Bolt and Nut Tightening Torque
   Bolt T 44 ± 3N•m [4.5 ± 0.3 kg•m]
   Nut T 25 ± 3N•m [2.5 ± 0.3 kg•m]
2. Power Terminal Mounting Nut Tightening Torque
   T 15.5 ± 1.5 N•m [1.6 ± 0.15 kg•m]

NOTE

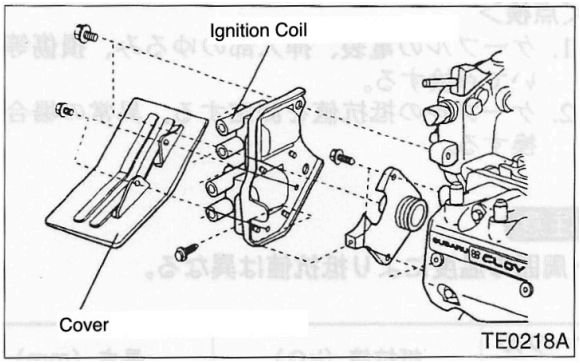
- Because a large current flows through the main power terminal, be sure to check that there is no rust or foreign matter attached to it before tightening it.

(2) Ignition Coil & Igniter

<Removal>

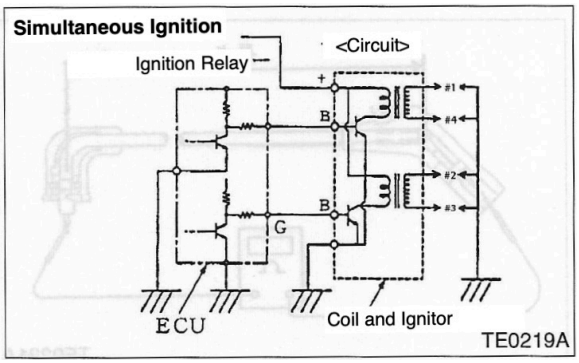
1. Separate the high-tension cable from the coil.
2. Separate the harness connector.
3. Remove two M6 bolts and the ignition coil cover.
4. Remove two M8 bolts and one M6 bolt to remove the ignition coil assembly along with the bracket.

Tightening torque:
M8 Bolt
T 19 ± 2 N•m [1.9 ± 0.2 kg•m]
M6 Bolt
T 8 ± 2 N•m [0.8 ± 0.2 kg•m]



<Inspection>

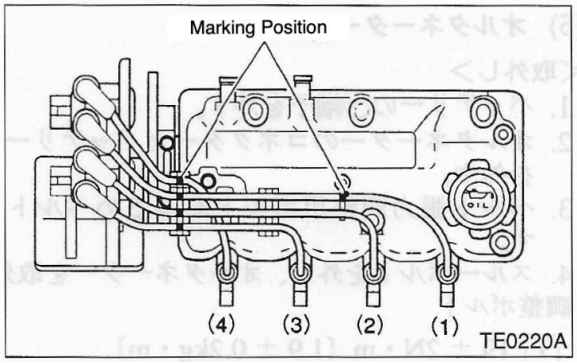
If no sparks fly from the spark plug, refer to the "Troubleshooting Report" to determine whether the coil and igniter are working properly. Resistance cannot be measured because the igniter has a built-in coil.



(3) High Tension Cables

<Installation>

1. Securely insert the high-tension cables into the spark plug and ignition coil.
2. Align the markings on each high-tension cable with the clamps.
3. Ensure there is at least 5 mm of clearance between high-tension cables.



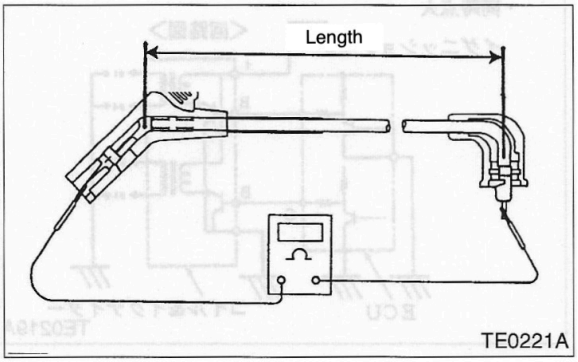
<Inspection>

1. Inspect the cable for cracks, looseness at the insertion point, damage, etc.
2. Measure the cable's resistance.
   • Replace it if abnormal.

NOTE

• Resistance value varies depending on the ambient temperature.

Cable No	Resistance (kΩ)	Length (mm)
1	4.6~8.5	410
2	4.0~7.5	360
3	3.2~6.0	290
4	2.9~5.3	255



(4) Spark Plugs

<Removal>

Plug Type: BKR6E-11, BKR5E-11, PFR6B-11
T 21 ± 3 N•m [2.1 ± 0.3 kg•m]

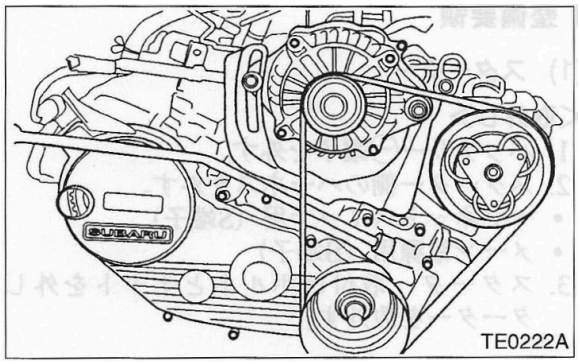
<Inspection>

For spark plug inspection, refer to Chapter 2-2 “Engine Inspection and Adjustment.”

(5) Alternator

<Removal>

1. Disconnect the battery terminals.
2. Disconnect the alternator connector and battery terminals.
3. Loosen the belt tension adjustment bolt and remove the belt.
4. Remove the through bolt and remove the alternator.
   Adjustment Bolt
   T 19 ± 2 N•m [1.9 ± 0.2 kg•m]
   Through Bolt
   T 25 ± 2 N•m [2.5 ± 0.2 kg•m]



<Installation>

1. Install the alternator and insert the through bolt.
2. Install the belt and adjust the tension.
   • See Chapter 22, Engine Inspection and Adjustment.
3. Install the connector and terminal.
   Terminal Mounting Nut
   T 16 ± 1.5 N•m [1.6 ± 0.15 kg•m]

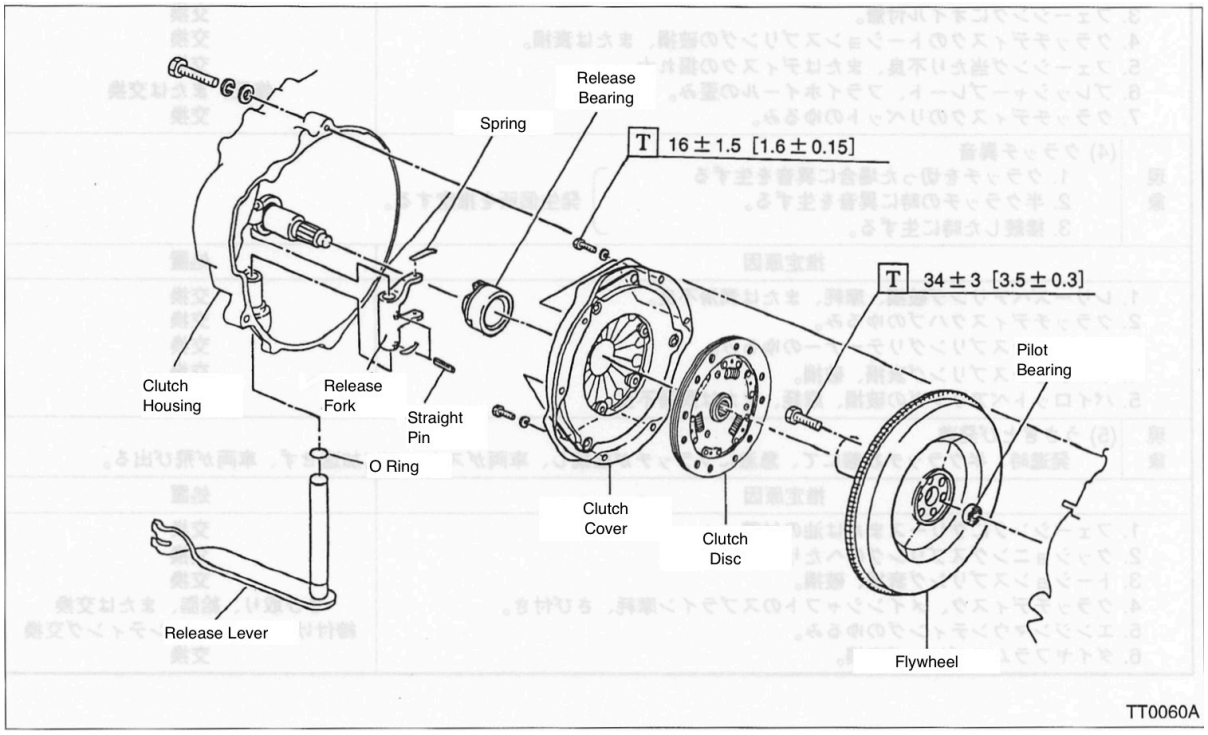
3 Transmission

3 - 1 Clutch & Flywheel

Specifications

Item		Content
Clutch	Type	Dry type, single plate, diaphragm type
	Control	Mechanically operated
Clutch Pedal	Type	Hanging
	Lever Ratio	4.4
	Total Stroke (mm)	131~136
Clutch Release	Lever Ratio	4.0
	Bearing Type	Self-aligning type
Clutch Cover	Type	Bush type
	Mounting (set) Load Capacity N (mm)	2600 (265)
	Mounting Pitch Circle Diameter (mm)	ø203
Clutch Disc	Facing Dimensions Outer diameter x inner diameter x thickness (mm)	170x120x3.0
	Total Friction Area (cm^2)	114
	Number of Spline Teeth	23
	Number of Torsion Springs	3
	Material	Woven (non-asbestos)
Flywheel	Mounting Pitch Circle Diameter (mm)	ø203
	Ring Gear Outer Diameter (mm)	ø246.6
	Height (mm)	21
	Pilot Bearing	Can be

Components & Parts



Common Failure Points

Phenomenon	**(1) Clutch slippage** If the clutch is slipping, it may be difficult to notice at first, but be careful if the following occurs: 1.When changing gears, the engine feels like it's revving up. 2.The car loses speed, especially when accelerating suddenly, and does not accelerate as fast as the engine speed 3.When pitching, the car has no power and smells of burning facings.

Presumed Cause	Treatment
1.There is no play in the clutch pedal.	1.Adjustment
2.There is no play at the end of the release lever.	2.Adjustment
3.Oil on the clutch facing	3.Exchange
4.Worn clutch facings.	4.Exchange
5.Diaphragm spring weakening	5.Exchange
6.Distorted or damaged pressure plate or flywheel.	6.Modify or replace
7.Release bearing sleeve malfunction.	7.Modify or replace
8.Malfunction of the operating system.	8.Modify or replace

Phenomenon	**(2) Clutch disengagement failure** This phenomenon causes heavy shifting and poor shift feel, especially when shifting into low gear.

Presumed Cause	Treatment
1.Large clutch pedal play.	1.Adjustment
2.The clutch release lever has a lot of play.	2.Adjustment
3.Cracked facing of clutch disc.	3.Exchange
4.The splines on the clutch disc hub are worn and rusty.	4.Rust removal, greasing, or replacement
5.Large runout of the clutch disc facing surface.	5.Modify or replace
6.Clutch disc sticking (oil or water adhesion):	6.Exchange
7.Malfunction of the operating system.	7.Modify or replace

Phenomenon	**(3) Clutch judder** When the car starts to move with the clutch partially engaged, it causes unpleasant vibrations throughout the body.

Presumed Cause	Treatment
1.Loose engine mounting.	1.Tighten or replace the mounting
2.Clutch cable is not properly routed.	2.Correction
3.Oil adheres to the facing.	3.Exchange
4.Broken or weakened clutch disc torsion spring.	4.Exchange
5.Poor facing contact or large disc runout.	5.Exchange
6.Pressure plate and flywheel distortion.	6.Modify or replace
7.Loose rivets on the clutch disc.	7.Exchange

Phenomenon	**(4) Abnormal clutch noise** 1.Abnormal noise occurs when the clutch is released 2.An abnormal noise occurs when the clutch is partially engaged. 3.Occurs when connecting.

Presumed Cause	Treatment
1.Release bearing is damaged, worn, or poorly lubricated.	1.Exchange
2.Loose clutch disc hub.	2.Exchange
3.Loose torsion spring retainer.	3.Exchange
4.Torsion spring weakened or broken.	4.Exchange
5.Pilot bearing damaged, worn, or poorly lubricated.	5.Exchange

Phenomenon	**(5) Rabbit Jump Start** When starting, the clutch suddenly engages in a half-engaged state, causing the vehicle to not accelerate smoothly and to jump forward.

Presumed Cause	Treatment
1.Grease or oil on the facing.	1.Exchange
2.Cushioning spring wear.	2.Exchange
3.Torsion spring is weakened or broken.	3.Exchange
4.Clutch disc and main shaft splines are worn and rusty.	4.Rust removal, greasing, or replacement
5.Loose engine mountings.	5.Tightening or replace the mounting
6.Diaphragm spring weakened.	6.Exchange

Maintenance Preparation Items

Classification	Tool Number	Description	Purpose
ST	49827 5800	Flywheel stopper	Stop flywheel rotation
	89975 4112	Snap ring press	Pilot bearing press fit
	49974 5400	Clutch disc guide	Clutch disc centering
	39879 1700	Straight pin remover	Degreasing the clutch release lever CP
Instrument	-	Dial Gauge	Measuring the runout of the clutch disc
Grease, Oil, & other	-	FX2200 Clutch Grease	Main shaft spline coating
	-	Unilube #2 or equivalent	Application in other designated areas

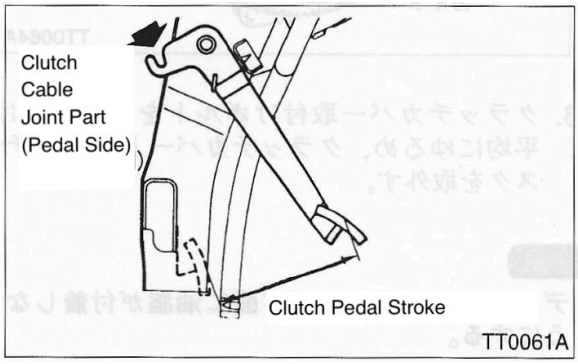
Maintenance Instructions

(1) Clutch Pedal Play and Stroke

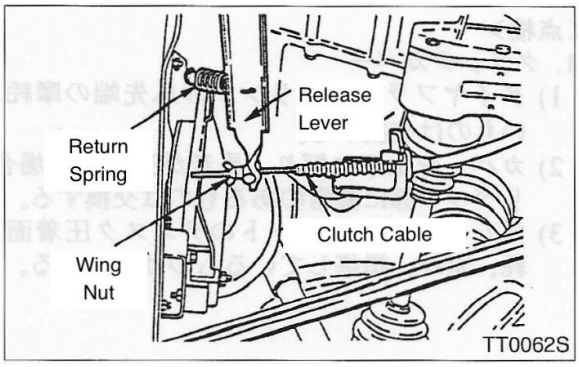
<Inspection/Adjustment>

1. Check the amount of free play and stroke at the center of the clutch pedal pad.

Standard Value (mm)	Amount of Play 5~15
	Stroke Volume 131~136



2. If the clutch pedal free play is outside the standard value, adjust it by turning the wing nut at the end of the cable (release lever end) attached to the underside of the transmission inside the engine compartment.



(2) Release Bearing and Release Lever

<Removal>

1. Remove the transmission from the vehicle.
   - For the procedure, refer to Chapter 3-2, Section [3].
2. Remove the two springs from the release fork and pull out the release bearing.

NOTE

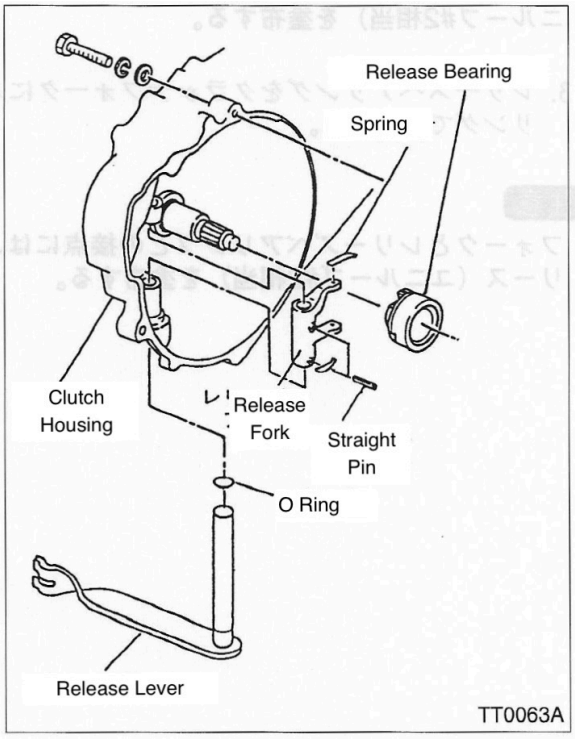
- Do not deform the spring.

3. Remove the two straight pins using the special tool, Straight Pin Remover 2.

39879 1700 Straight Pin Remover 2

ST

4. Remove the clutch release fork and clutch release lever CP.



<Inspection>

1. Release bearing
   1) The bearing must rotate smoothly when rotated while being pushed in the thrust direction.
   2) If the contact points between the bearing and the fork are worn or damaged, replace them.
   3) If the sliding part between the clutch housing and the clutch is worn or damaged, replace it.

NOTE
- The bearings are oil-free and contain grease, so they do not need to be washed.

2. Release fork
   - If the contact point with the release bearing is worn or damaged, replace it.
3. Release lever
   - If the connection part with the cable or the sliding part with the clutch housing is worn or damaged, replace it

<Installation>

1. Place the clutch release lever in the transmission and install the clutch release fork.
2. Drive in two straight pins.

NOTE
- Use new straight pins and O-rings. Drive the straight pin so that the slit is perpendicular to the axis.
- Apply grease (Unilube #2 or equivalent) to the sliding part with the clutch housing.

3. Install the release bearing onto the clutch fork with the spring.

NOTE
- Apply grease (Unilube #2 or equivalent) to the contact points between the fork and release bearing.

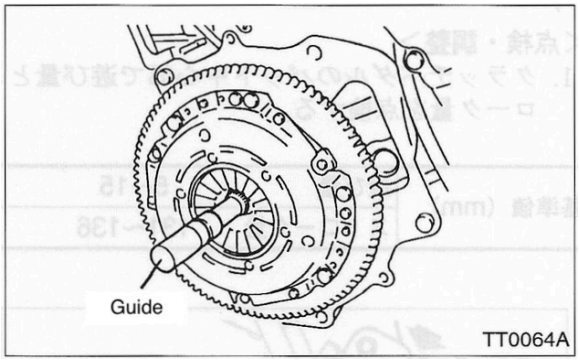
(3) Clutch Assembly

<Removal>

1. Remove the transmission from the vehicle.
   - For the procedure, refer to Chapter 3-2, Section [3].
2. Insert the special tool, clutch disc guide, to prevent the clutch disc from falling off.

S T 49974 5500 Clutch Disc Guide

NOTE
- Apply oil or grease to the tip of the clutch disc guide.



3. Loosen the clutch cover mounting bolts evenly in several steps, then remove the clutch cover and clutch disc.

NOTE
- Avoid getting oil or grease on the disc facing surface.

4. Attach the special flywheel stopper tool to secure the flywheel in place.

S T 49827 5800 Flywheel Stopper

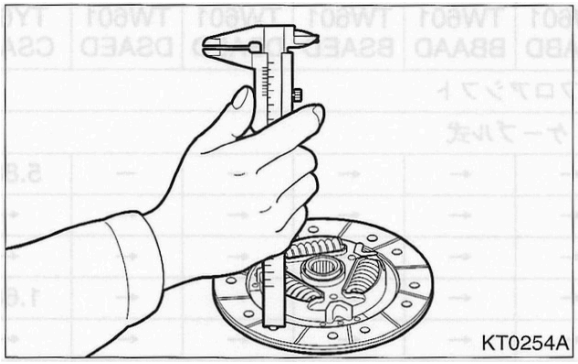
5. Loosen the flywheel mounting bolts and remove the flywheel.

<Inspection>

1. Clutch cover
   1) Replace any diaphragm springs with excessive wear on the tips of their claws.
   2) Shake the cover up and down, and if there is any abnormal noise or abnormality in the rivets, replace it.
   3) Replace any pressure plate whose disc contact surface is worn, distorted or damaged.

2. Clutch Disc
   1) Replace any facings that are worn beyond the limit.
      • Measure the rivet sinking depth with a vernier caliper.

Sinking Limit (MM)	0.3

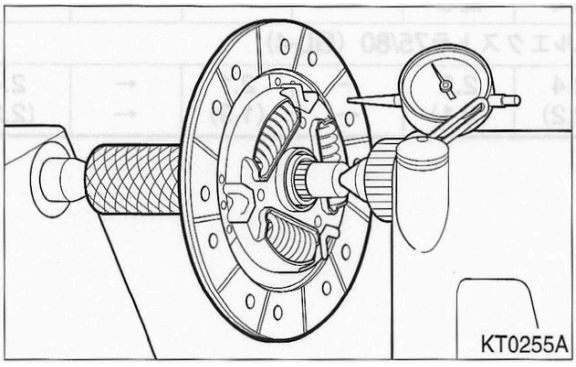


   2) Replace any torsion springs that are damaged, worn, or have loose spline hubs or rivets.
   3) Special tool: Use a clutch disc guide to check the runout of the outer periphery of the facing.

Runout Limit (mm)	0.5
Measurement Point (mm)	ø160

If it exceeds the limit, correct or replace it.

S T 49974 5500 Clutch Disc Guide



   4) Replace any facings that have oil on them.

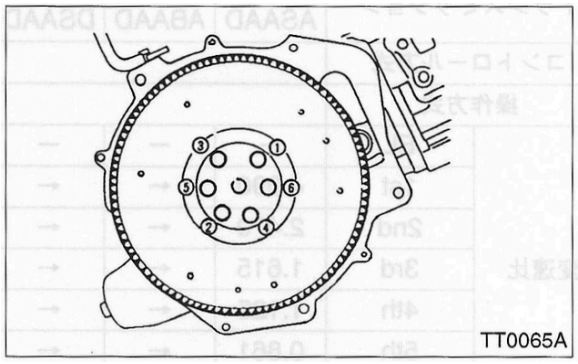
NOTE
• Do not wash the clutch disc.

3. Flywheel
   1) If the contact surface between the clutch disc and the facing is damaged, repair or replace it.
   2) Turn the pilot bearing and replace it if there is any rattle or abnormal noise.
   3) If the ring gear is significantly worn or damaged, replace it.

<Installation>

1. Temporarily fasten the flywheel.
2. Install the special flywheel stopper tool and tighten the flywheel bolts in the order shown in the illustration.

S T 49827 5800 Flywheel Stopper



NOTE
• Apply liquid gasket (ThreeBond #1215) to the threaded part of the mounting bolt and tighten.

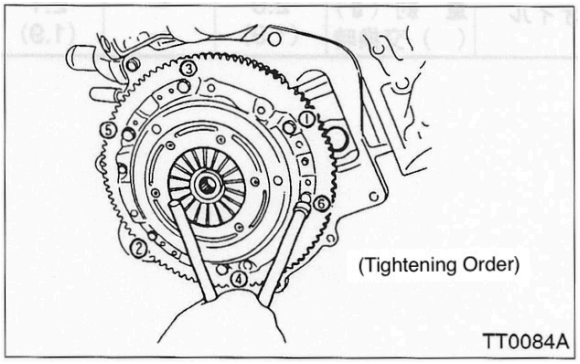
T 34 ± 3 [3.5 ± 0.3]

3. Insert the special tool: clutch disc guide into the clutch' disc and install it on the flywheel.

S T 49974 5500 Clutch Disc Guide

4. Align the knock holes on the clutch cover with the knocks on the flywheel, and install with the bolts.

T 16 ± 1.5 [1.6 ± 0.15]



5. Remove the clutch disc guide.

NOTE
• Before installing the transmission, apply grease (FX2200) to the spline portion of the main shaft.

3 - 2 Manual Transmission

[1] Common

■ Specifications

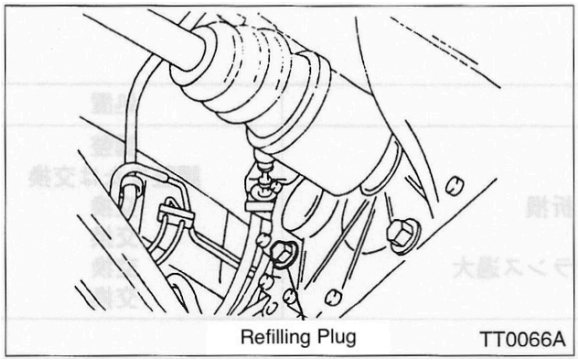
Drive Method		2WD		Selective 4WD							F/T 4WD
Engine		NA	SC	NA	←	←	SC	NA	SC	NA	←
Transmission		TM601 ASAAD	TM601 ABAAD	TW601 DSAAD	TW601 BSAAD	TW601 BSABD	TW601 BBAAD	TW601 BSAED	TW601 DBAED	TW601 DSAED	TY601 CSAAD
Control Method		Floor Shift									
Operation Method		Cable Type									
Gear Ratio	EL	-	-	-	5.888	←	←	←	-	-	5.88
	1st	4.090	←	←	←	←	←	←	←	←	←
	2nd	2.470	←	←	←	←	←	←	←	←	←
	3rd	1.615	←	←	←	←	←	←	←	←	1.680
	4th	1.125	←	←	←	←	←	←	←	←	←
	5th	0.861	←	←	←	←	←	←	←	←	←
	Reverse	4.166	←	←	5.866	←	←	←	4.166	←	5.866
Transfer Gear Ratio		-	-	0.269	0.269	←	0.270	0.269	0.270	0.269	←
Transfer Bevel Gear Ratio		-	-	0.947	←	←	←	←	←	←	←
Final Gear Ratio		6.500	6.166	6.500	6.500	←	6.166	6.500	6.166	6.500	←
Speedometer Gear Ratio		6.000	5.600	6.000	6.000	←	5.600	6.000	5.600	6.000	←
2nd Double Cone Synchro		-	-	-	○	○	○	○	-	-	○
ABS Compatible Transmission		Common with or without	Common with or without	-	-	-	Common with or without	○	Common with or without	○	-
Differential	# of Pinions	2	←	←	←	←	←	←	←	←	←
	Rack	None	←	←	←	Yes	None	←	←	←	←
Oil	Type	Subaru Gear Oil Extra 75/80 (GL-4)									
	Approximate Amount (ℓ) when Replacing	2.0 (1.9)	← ←	2.1 (1.9)	2.3 (2.1)	2.4 (2.2)	2.3 (2.1)	← ←	2.1 (1.9)	← ←	2.4 (2.2)

[2] On-board Inspection and Replacement

■ Inspection/Replacement Procedures

<Oil Leak & Oil Level Inspection>

1. Visually check for oil leaks from the mating surfaces of the clutch housing, transmission case, and side case, drain plug, drive shaft oil seal, etc.
2. Oil level check
   1) Lift up the vehicle.
   2) Remove the fuel filler plug.
      T 34 ± 4 [3.5 ± 0.4]

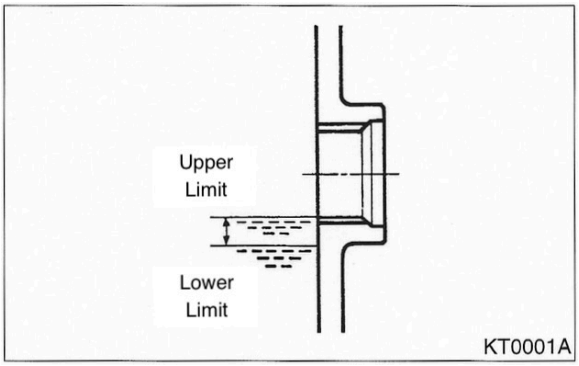


3. Check the oil level.

NOTE

• Check the oil after it has cooled down to room temperature.

Oil Level	From the bottom of the oil filler plug Between 0 and 6 mm

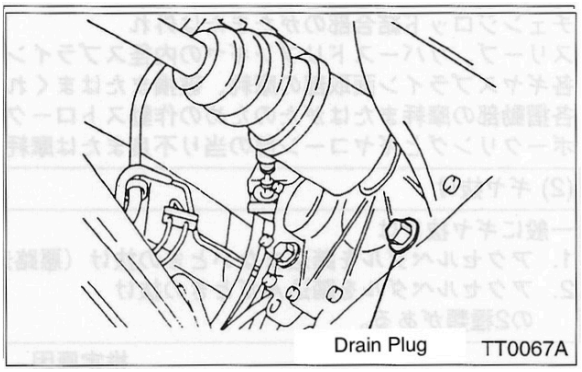


<Inspection and Replacement Periods>

Inspection	Before delivery, at the 1 month inspection, At the 12 month inspection
Replacement	Every 40,000 km

<Oil Change>

1. Lift up the vehicle.
2. Remove the drain plug at the bottom of the differential and drain the oil completely.
3. Replace the gasket with a new one and tighten the drain plug.
   T 34 ± 4 [3.5 ± 0.4]



4. Remove the oil filler plug and add oil.

Name	Subaru Gear Oil Extra 75-80	
Oil Amount (ℓ)	2WD	About 1.9
	5MT + Selective 4WD	
	EL + 5MT + Selective 4WD	About 2.1
	EL + 5MT + Selective 4WD + Diff Lock	About 2.2
	NA EL + 5MT + Full-time 4WD	

5. Check that the oil level is up to the standard.
6. Replace the gasket with a new one and tighten the oil filler plug.

■ Common Failure Points

Phenomenon	(**1) Difficulty in shifting gears.** The causes of difficult gear shifting can be divided into three categories: change rod-related, clutch-related, and transmission-related. After confirming that the change rod and clutch functions are normal, check the transmission.

Presumed Cause	Treatment
1.Change rod joint loose or detached 2.Wear, damage or burrs on the inner diameter spline chamfer of the sleeve and reverse driven gear 3.Any wear, damage or burrs on the chamfer of each gear spline. 4.Insufficient operating stroke due to wear or play in the sliding parts 5.Poor contact or wear between the balk ring and gear cone	1.Adjust or replace 2.Exchange 3.Exchange 4.Fix or replace 5.Exchange

Phenomenon	**(2) Gear slip** Generally, there are two type of gear slippage 1.Slippage when not pressing the accelerator pedal (when driving on rough roads) 2.Slippage when pressing the accelerator pedal

Presumed Cause	Treatment
1.Loose engine mounting 2.Change rod joint loose or detached 3.Shifter fork wear, checking ball spring wear, or breakage 4.Worn out lock ball groove of shift rod 5.Excessive spline clearance of synchronizer hub and coupling sleeve 6.Wear on the chamfer and side of the splines of each gear	1.Adjust 2.Adjust or replace 3.Exchange 4.Exchange 5.Exchange 6.Exchange

Phenomenon	**(3) Transmission Noise** If the noise occurs when the vehicle is stopped (engine idling) and stops when the clutch is released, it can be assumed to be the transmission.

Presumed Cause	Treatment
1.Insufficient or inadequate lubrication 2.Wear or damage to gears and bearings • If the only the tooth surfaces are only, they will produce a high-pitched whining noise at high speeds. However, if they are damaged, they will produce periodic knocking noises (thumps, thumps) even at low speeds. 3.Wear of each spline.	1.Tighten or replace the mounting 2.Correction 3.Exchange 4.Exchange 5.Exchange 6.Modify or replace 7.Exchange

Phenomenon	**(4) Damage to the differential (case, gear, bearing, etc.)** The causes of difficult gear shifting can be divided into three categories: change rod-related, clutch-related, and transmission-related. After confirming that the change rod and clutch functions are normal, check the transmission.

Presumed Cause	**Treatment**
1.Insufficient or inadequate oil 2.Overload or clutch malfunction, severe vehicle use 3.Excessive backlash between the final gear and drive pinion 4.Excessive backlash due to wear of the differential bevel gear, washer (35.1 x 45 x t), and differential pinion 5.Loose final gear tightening bolt	Separate the differential and replace any damaged parts. Also, inspect each part for abnormalities and replace them accordingly. Adjust the gear's backlash, tooth contact, etc. properly. Add the appropriate amount of genuine gear oil. Avoid harsh driving of the vehicle.

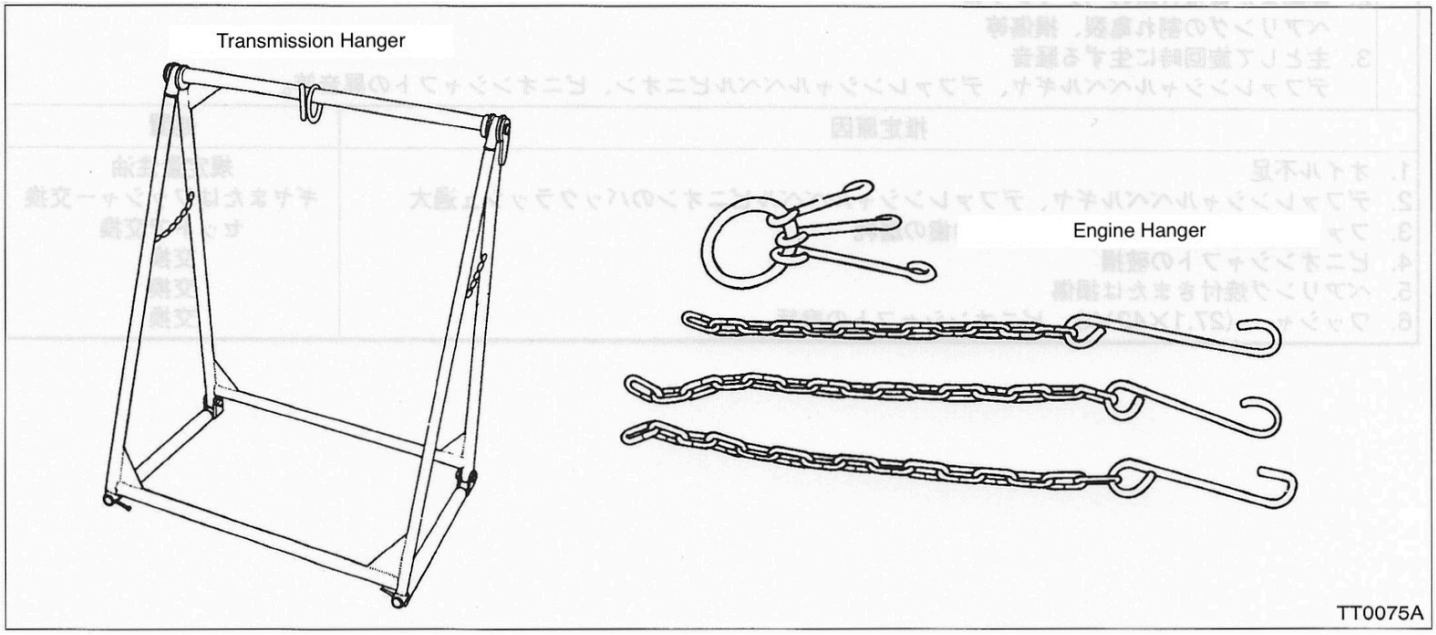
Phenomenon	**(5) Differential and final gear noise** Noise is always a problem when it comes to differential and final gear failure, and the symptoms of failure will be audible. Be particularly careful with final gear noise, as it can easily be confused with other gear sounds. There are the following types of noise: 1. Noise when starting or changing gears • If the noise increases as the vehicle speed increases, it may be due to insufficient gear oil or improper gear meshing. 2. Bearing noise when driving or coasting • Bearing cracks, damage, etc. 3. Noise that occurs mainly when turning • Abnormal noise from the differential bevel gear, differential bevel pinion, or pinion shaft, etc.

Presumed Cause	**Treatment**
1.Insufficient oil. 2.Excessive backlash in the differential bevel gear and differential bevel pinion. 3.Worn teeth on the final gear and drive pinion. 4.Broken pinion shaft. 5.Bearing seizure or damage. 6.Worn washer (27.1 x 42mm) or pinion shaft.	1.Add the appropriate amount of genuine gear oil. 2.Replace gear and/or washer 3.Replace as a set 4.Exchange 5.Exchange 6.Exchange

[3] Transmission Removal & Installation

■ Maintenance Preparation Items

Classification	Tool Number	Description	Purpose
ST	28099PA100	Drive shaft remover	Drive shaft removal
	92265 0000	Transmission hanger	Hanging a small chain block
	49960 5400	Engine hanger	Removing and installing the engine
Instrument	-	Auto lift	Raising and lowering the vehicle
	-	Small chain block (commercially available)	Removing and installing the transmission
	-	Garage jack (with a thick plank attached to the tray)	Engine support
Grease, Oil, & other	-	A piece of wood (≈ 100mm wide x 40mm thick)	Fixing the clutch release lever
	-	Plank (≈ 300mm long x 320mm wide x 100mm thick)	Fixed to the garage jack



■ Maintenance Instructions

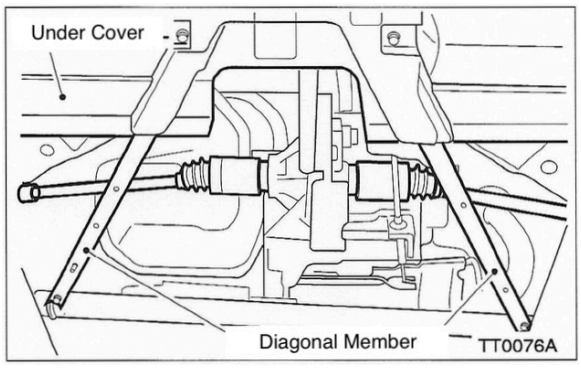
<Removal>

1. Place the vehicle on the lift.
2. Disconnect the battery terminals.
   - Dias Van: Fold the passenger seat back and open the battery cover.
   - Trucks: Battery box on the bottom right of the bed.
3. Remove the trapdoor.
4. Remove the rear bumper.

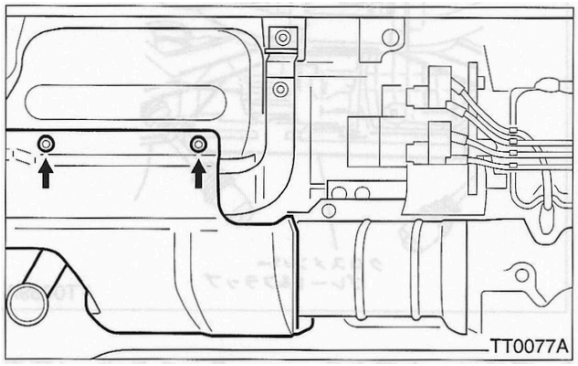
NOTE

- Disconnect the lamp harness connector

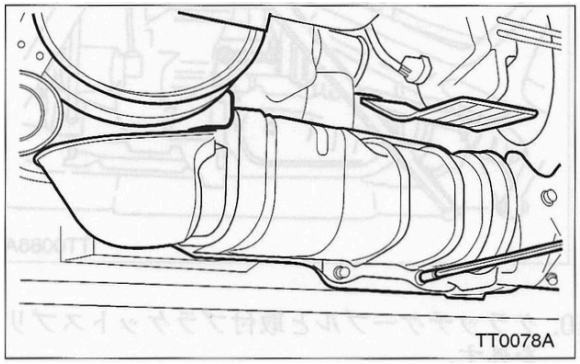
5. Lift up the vehicle, remove the center under cover and rear bulkhead splashboard, and remove both the left and right diagonal members.
   T 69 ± 10 [7.0 ± 1.0]



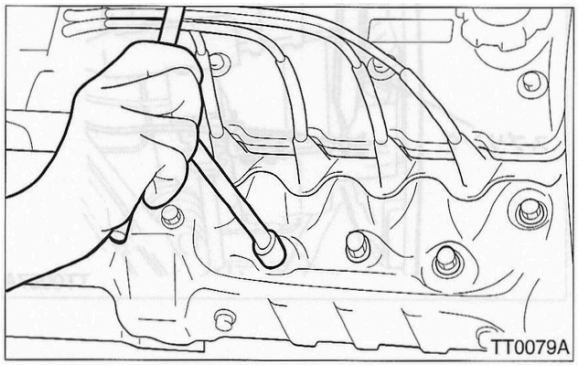
6. Remove the muffler assembly.
   1) Remove the exhaust cover (SC vehicles only).
      T 7.4 ± 2 [0.75 ± 0.2]



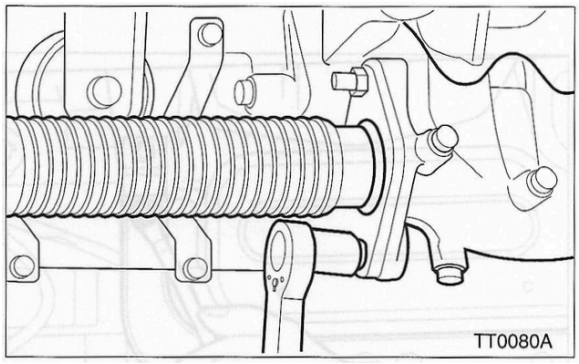
   2) Remove the bellows cover (R).
      T 7.4 ± 2 [0.75 ± 0.2]



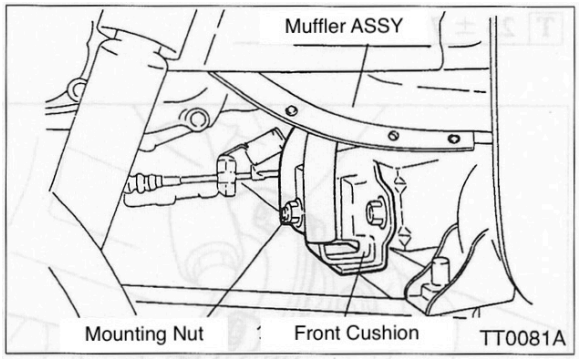
   3) Remove the exhaust manifold plate.
      T 30 ± 5 (3 ± 0.5]



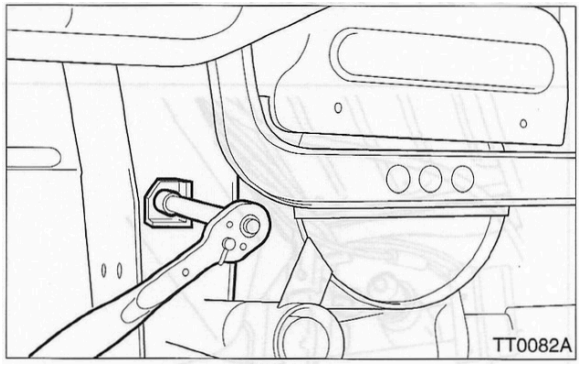
   4) Remove the nuts connecting the exhaust manifold to the bellows.
      T 40 ± 5 (4.0 ± 0.5]



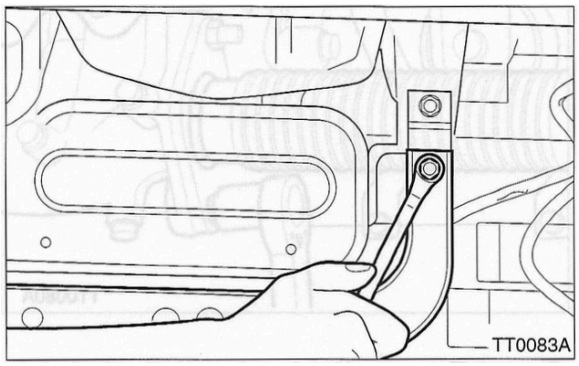
   5) Remove the muffler hanger front cushion.
      Bolt T 33 ± 10 [3.3 ± 1]
      Nut T 18 ± 5 [1.8 ± 0.5]



   6) Remove the two muffler cover mounting bolts and one nut (3 places).
      Bolt in the diagram below T 32 ± 10 [3.2 ± 1]
      Two other locations T 18 ± 5 [1.8 ± 0.5]

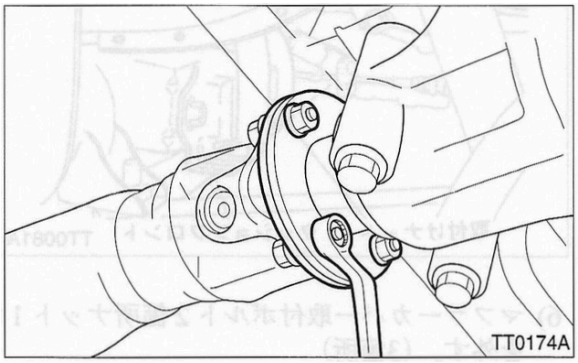


7) Remove the rear muffler hanger bracket and rear muffler hanger cushion.
Bolt T 33 ± 10 [3.3 ± 1.0]
Nut T 18 ± 5 [1.8 ± 0.5]

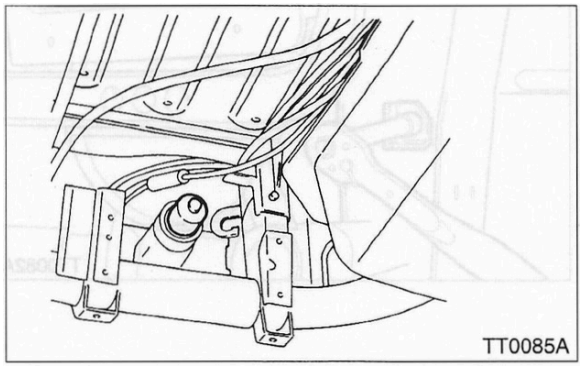


8) Remove the muffler assembly along with the muffler cover.

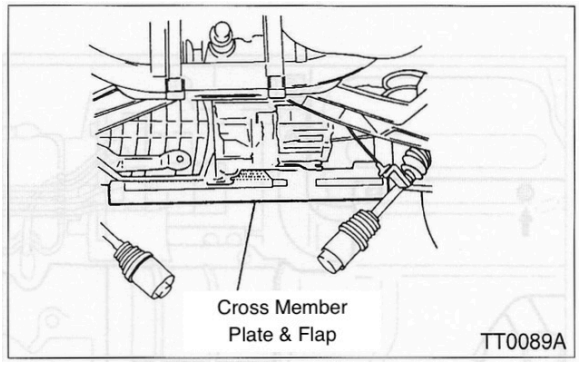
7. Remove the connecting bolts to the front differential and remove the propeller shaft (4WD vehicles).
T 25 ± 7 [2.5 ± 0.7]



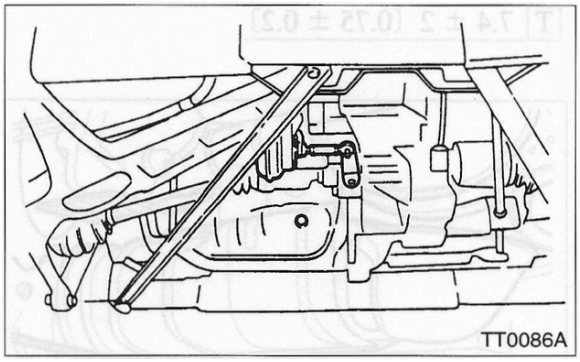
NOTES
• When the propeller shaft is pulled out, oil will leak out, so insert the cap into the extension.



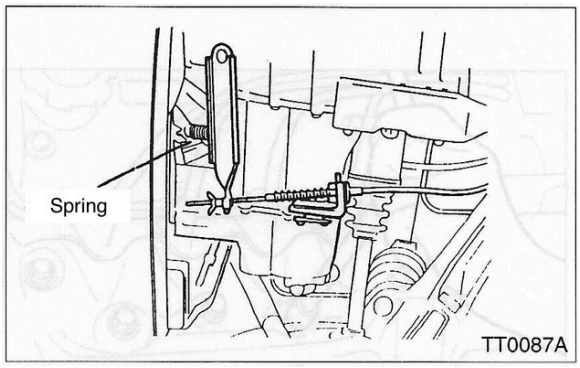
8. Remove the cross member plate and flap from the engine cross member.



9. Remove the differential lock actuator (if equipped).



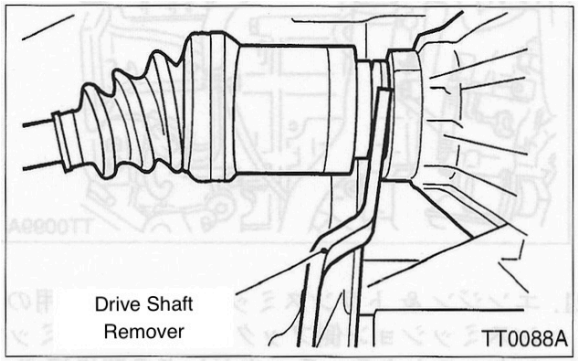
10. Remove the clutch cable and mounting bracket spring.



T 7.4 ± 2 [0.75 ± 0.2]

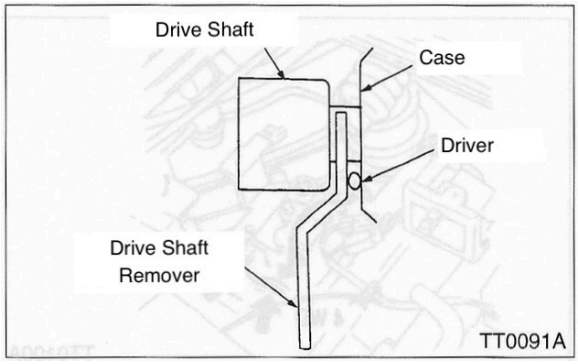
11.Remove the rear drive shaft. Use the Shin Special Tool Drive Shaft Remover to separate the drive shaft from the axle shaft.

ST 28099PA100 Drive shaft remover

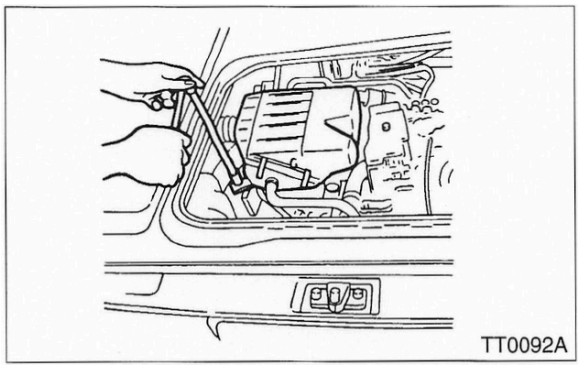


NOTE

- When using a drive shaft remover, use the lever as a fulcrum to remove the drive shaft.
- When installing, use a new snap ring.

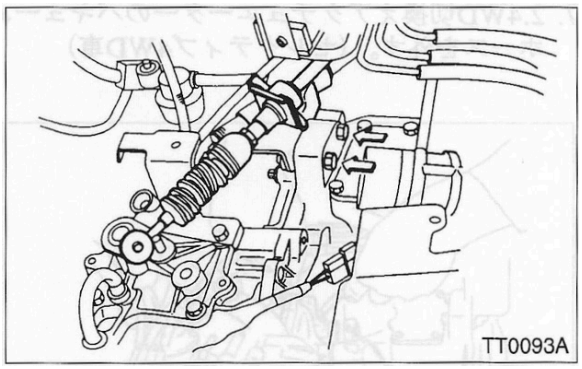


12.Remove the air cleaner.

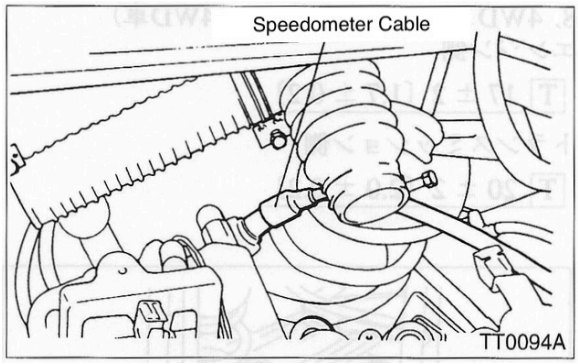


13.Remove the shift and select control cable and bracket from the transmission.

T 7.4 ± 2 [0.75 ± 0.2]

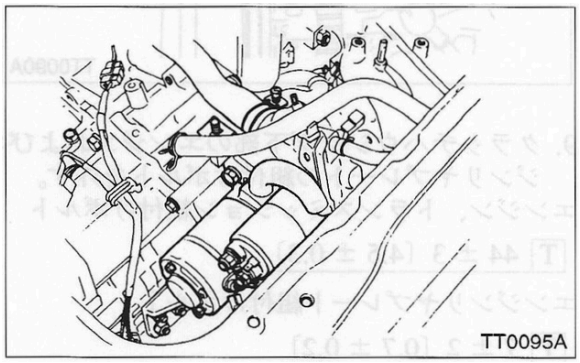


14.Disconnect the speedometer cable from the transmission.

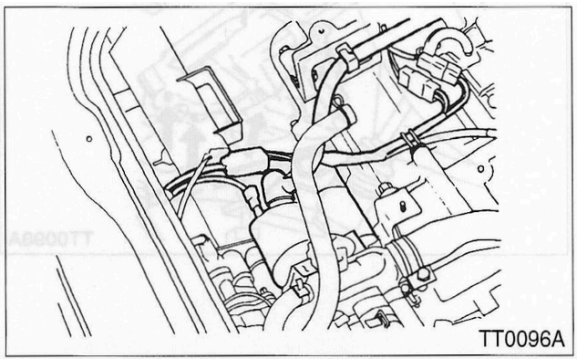


15.Disconnect the starter from the transmission.

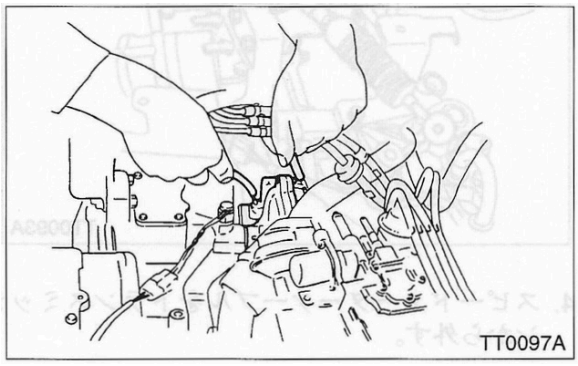
T 25 ± 3 [2.5 ± 0.3]



16.Remove the transmission harness connector and ground wire.

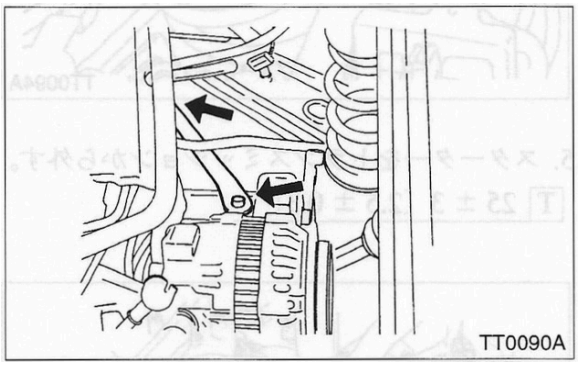


17.Disconnect the vacuum hose from the 4WD shift actuator (selective 4WD vehicles).



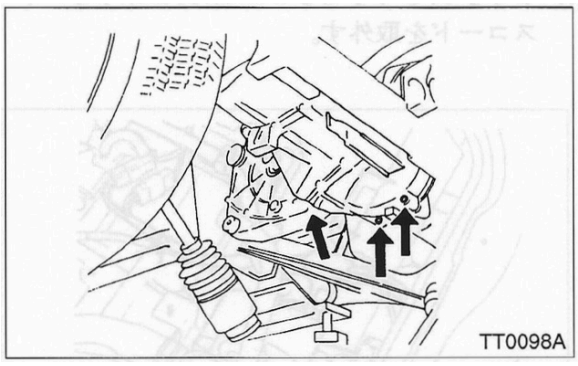
18.Remove the 4WD stiffener. (4WD vehicles)
Engine Side
T 17 ± 2 [1.7 ± 0.2]

Transmission Side
T 20 ± 2 [2.0 ± 0.2]

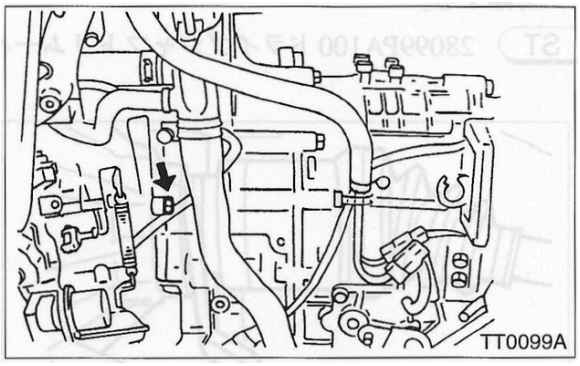


19.Remove the engine and engine rear plate assembly bolts located below the clutch housing.
Engine and transmission assembly bolts
T 44 ± 3 [4.5 ± 0.3]

Engine rear plate assembly bolt
T 7± 2 [0.7 ± 0.2]



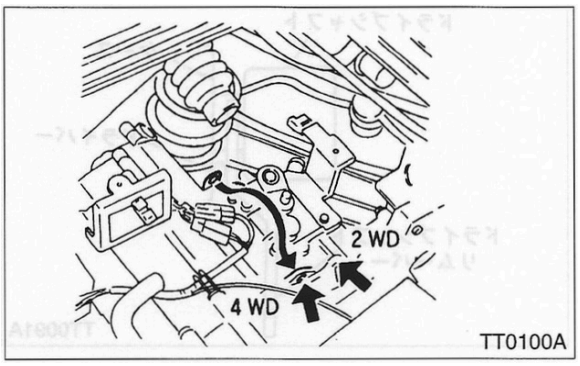
20.Remove the engine and engine rear plate assembly bolts above the transmission



21.Move the transmission-side hook used to lift the engine and transmission between the transmission case and the clutch housing.

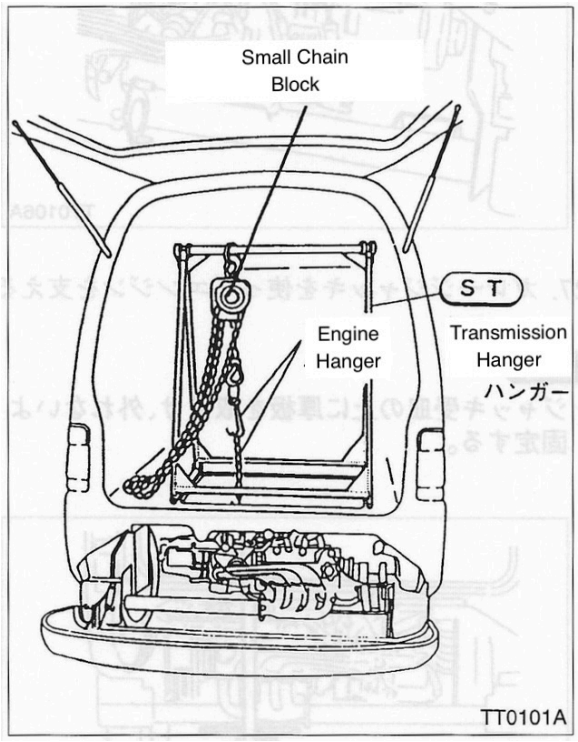
NOTE

- Of the two lifting holes on the top of the transmission, use the rear one for 4WD vehicles and the front one for 2WD vehicles.

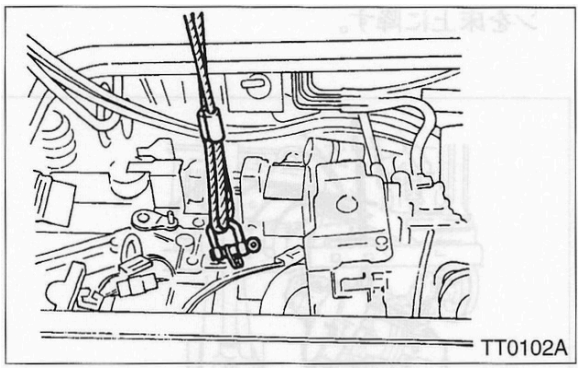


22.Hang the transmission.
- Set the special tool transmission hanger, small chain block, and engine hanger on the vehicle, and hang the hook on the moved transmission side.

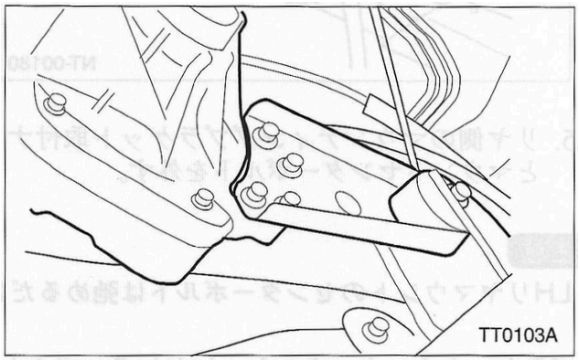
ST 92265 0000 Transmission hanger
49960 5400 Engine hanger



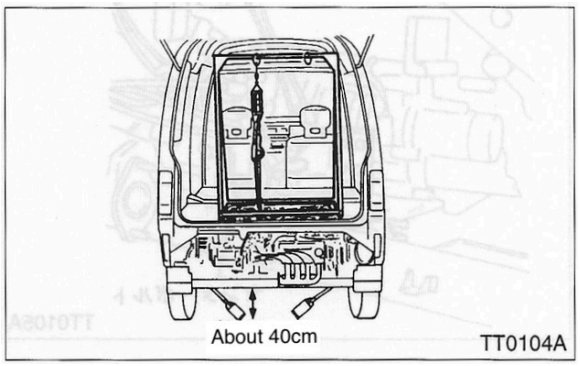
NOTE
- For balance reasons, the transmission is lifted using a single line.



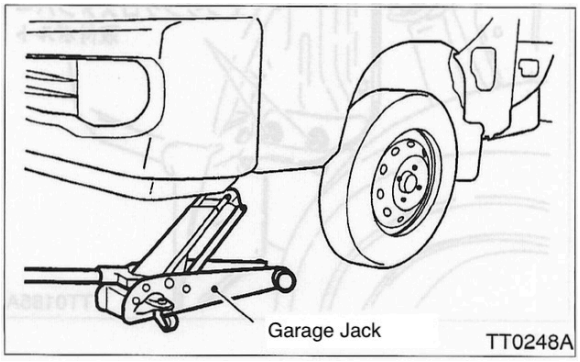
23.Lift the car and remove the front engine mount.
Bracket Bolt
T 62 ± 5 [6.3 ± 0.5]
Cushion Center Bolt
T 88 ± 10 [9.0 ± 1]

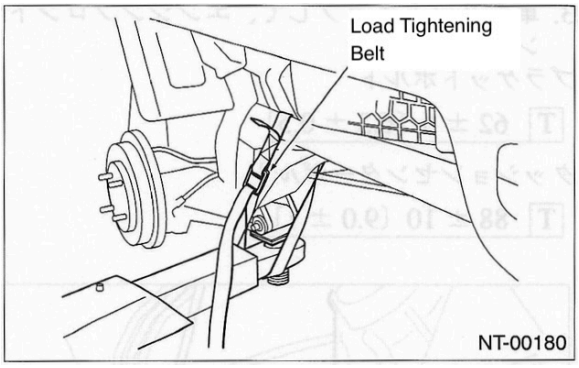


24.Lower the car down and stop it when the engine cross member is about 40cm above the ground.



NOTE
- If the engine is removed while the vehicle is lifted at the jack-up point, the front and rear balance of the vehicle may be lost and it may fall forward. For this reason, support the center of the front cross member with a garage jack or similar device with a thick plate attached to the tray to maintain the stability of the vehicle on the lift.
- Alternatively, secure the vehicle to the lift by following the procedure in Chapter 1-4 Securing the vehicle when removing the engine.



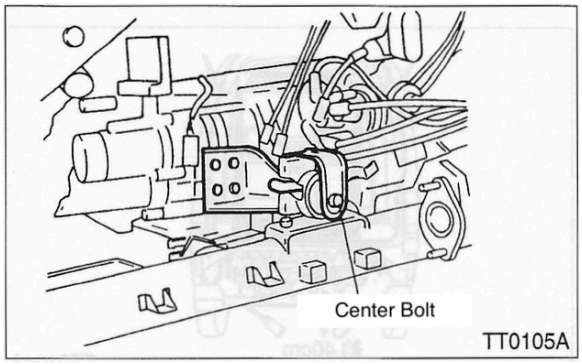


25.Remove the rear mounting bracket fixing nut and mount center bolt.

NOTE

• Simply loosen the center bolt of the LH rear mount.

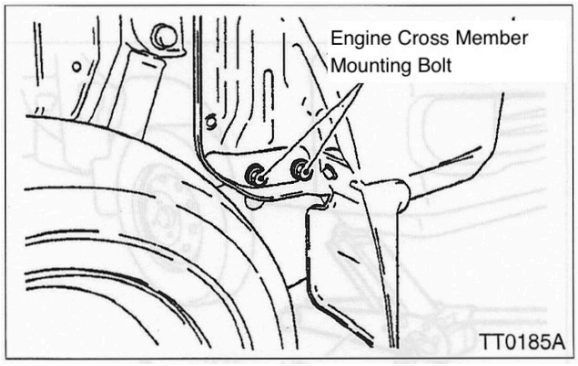
Bracket nut, cushion center bolt
T 70 ± 8 [7 ± 0.8]



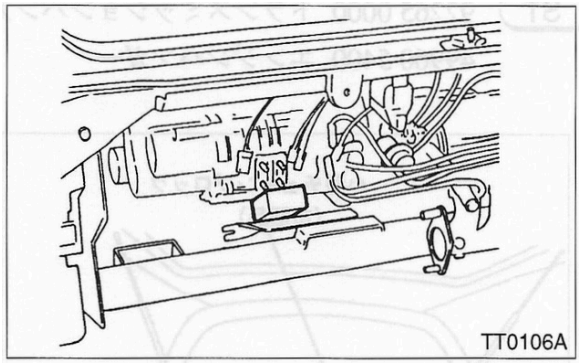
• Loosen the engine cross member mounting bolts (two on each side), shift the cross member towards the rear, and remove the mounting bracket.

T 64 ± 10 [6.5 ± 10]

• Just loosen the cross member mounting bolts, do not remove them.



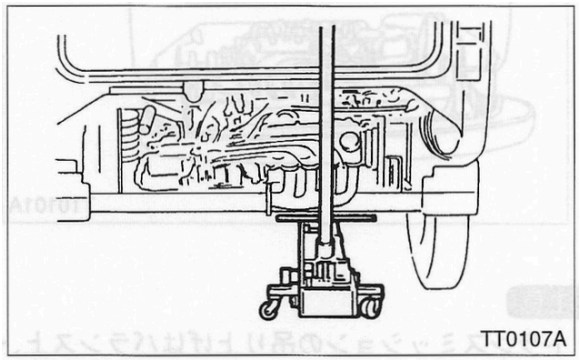
26.Place a piece of wood between the transmission release lever and the transmission body to secure the release key lever in place so that it does not move towards the transmission.



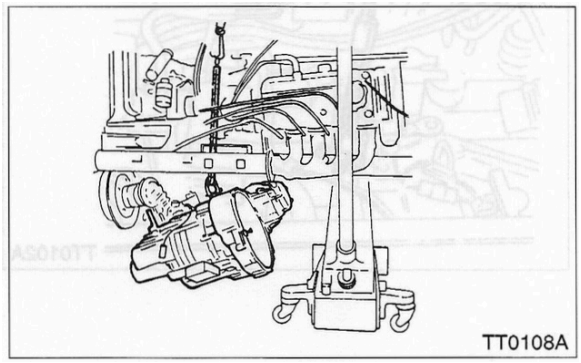
27.Use a garage jack to support the engine.

NOTE

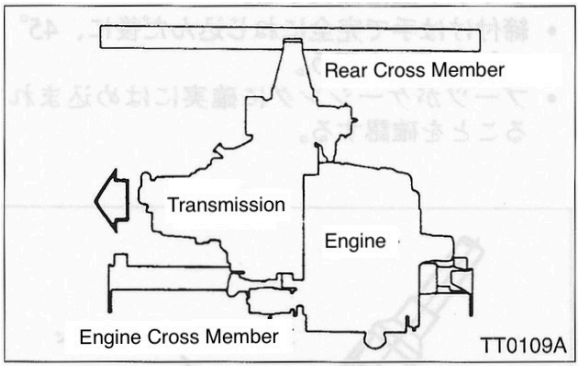
• Attach a thick plate to the top of the jack tray and secure it so that it does not come off.



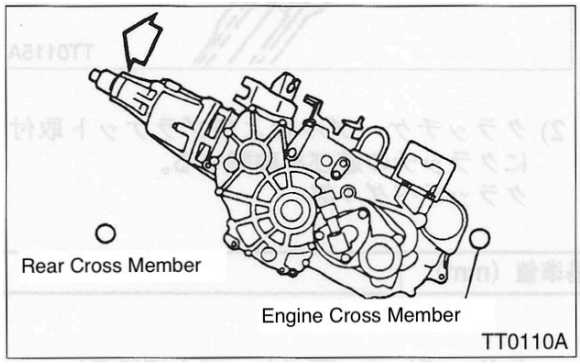
28.Separate the engine and transmission and use the chain block to lower the transmission onto the floor.



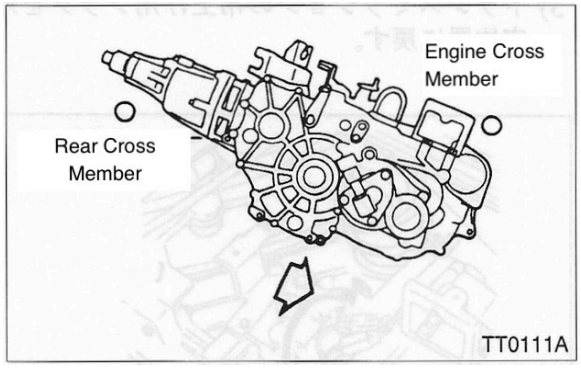
29. When dismounting, the 4WD transmission should be operated as follows:
    1) Separate the transmission from the engine.



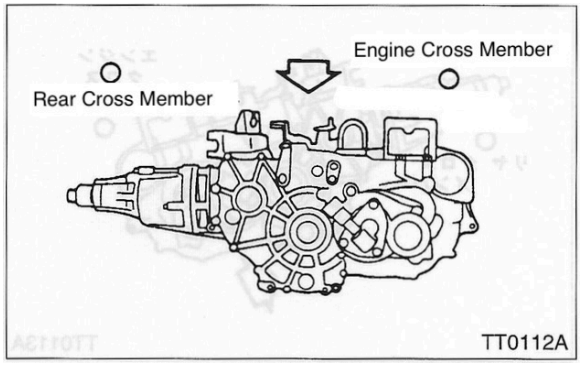
    2) Raise the front of the transmission.



    3) Lower the transmission clutch housing under the engine cross member.



    4) Place the transmission under the rear cross member and engine cross member, and lower it onto the floor.

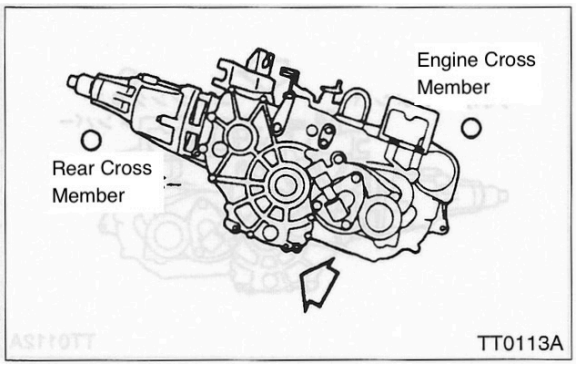


NOTE
- Use a garage jack to adjust the engine so that it does not tilt. When doing this, be careful not to let the O2 sensor come into contact with the ground or cross member.
- When lowering the transmission, be careful not to damage the brake pipe section with the tip of the transmission (the side where the propeller shaft is inserted).
- The work must be done by two people.
  - One person operates the chain block, the other removes and installs the transmission.
- To avoid any accidents, be careful not to place your hands or feet under the transmission.
- Even after removing the transmission, support the engine with a garage jack

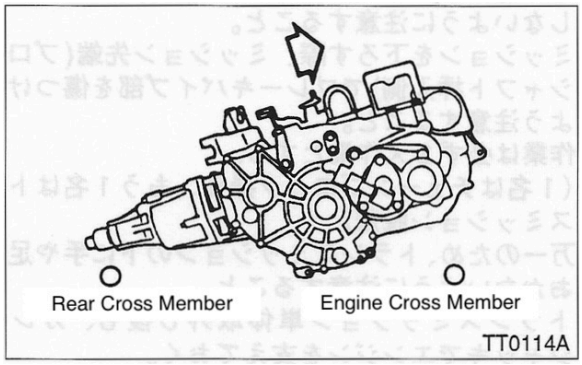
<Installation>

1. Place the transmission on the underside of the rear cross member and engine cross member, and attach a small chain hoist attached to the special tool transmission hanger and the special tool engine hanger to the transmission lifting hook.
2. Use the chain block to attach the transmission to the engine. For 4WD vehicles, assemble as follows:

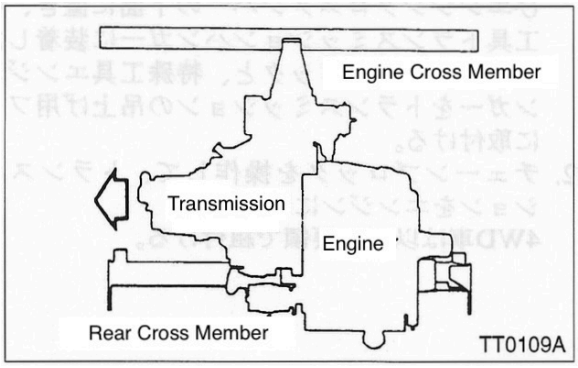
1) Pull the transmission rearward and raise the front part (extension part) to the top of the rear cross member.



2) Raise the transmission clutch housing to the top of the engine cross member.



3) Assemble the transmission and engine.



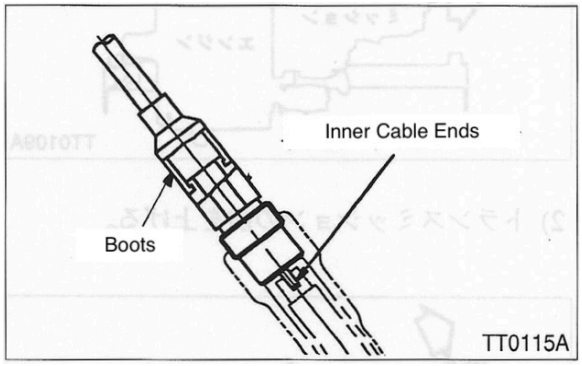
NOTE

- To prevent the transmission release lever from moving toward the transmission, place a piece of wood between the release lever and the transmission body to secure it in place.
- Be careful not to damage the rear axle boots with the transmission.

3. Installation is the reverse of the removal procedure. The differences are as follows:

1) Speedometer cable installation

- Insert the end of the inner cable into the transmission shaft groove.
- After tightening by hand, tighten it by 45 to 90 degrees.
- Make sure the boot is securely fitted into the casing.



2) After installing the clutch cable and bracket, check the clutch free play.

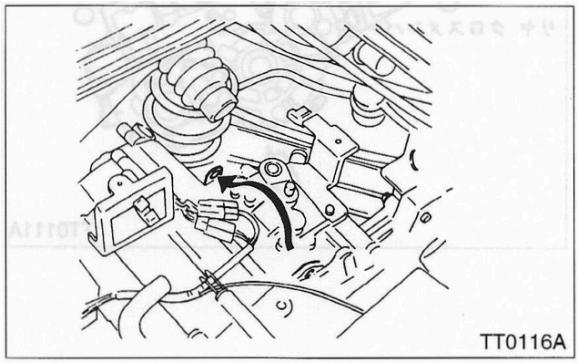
✻ Clutch Pedal

Standard Value (mm)	10~15

✻ Release Lever (at cable end)

Standard Value (mm)	1.0~2.0

3) Remove the transmission lifting hook and return it to its original position.

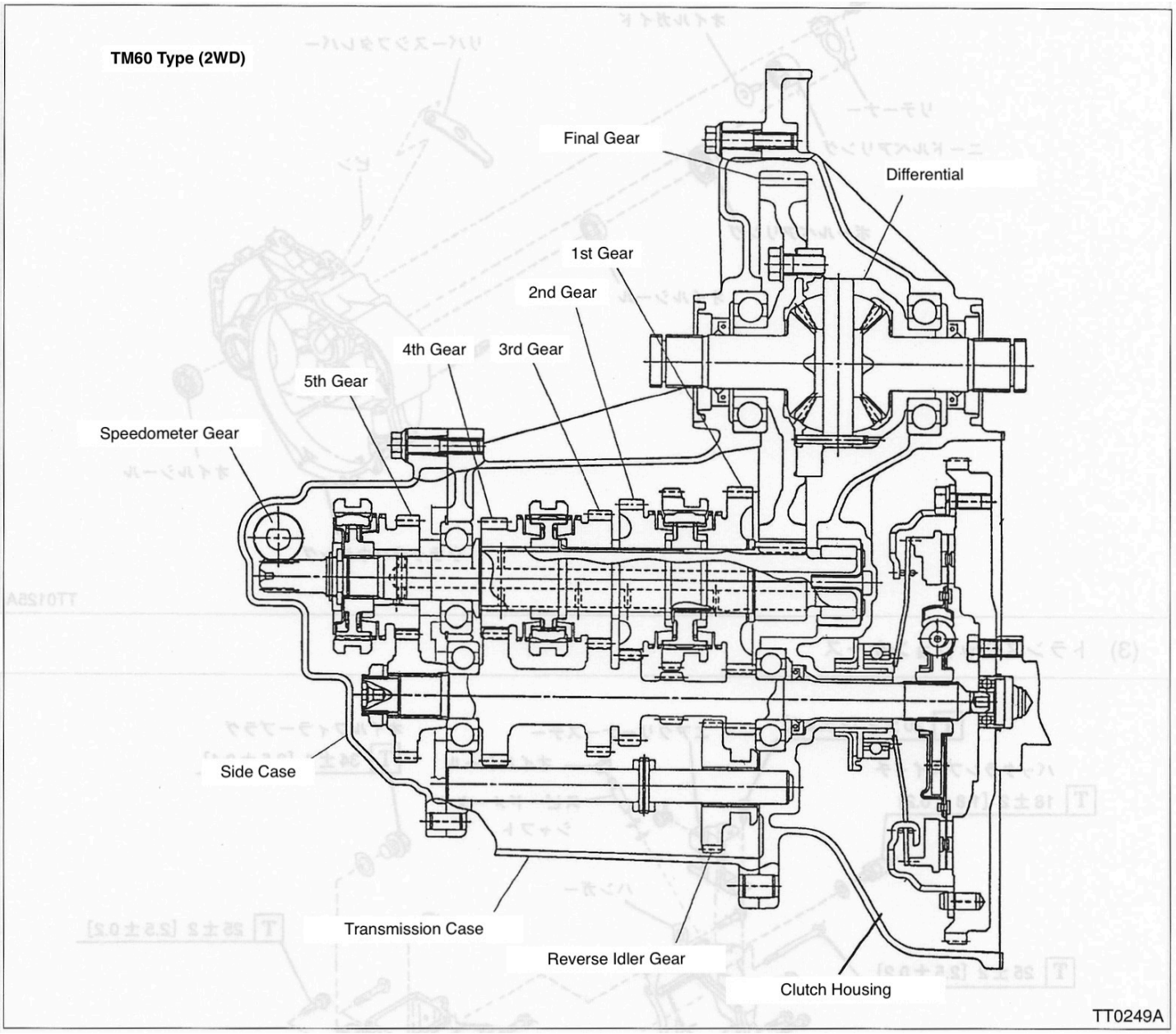


4) Installing the muffler assembly For installation, refer to the engine exhaust system section.

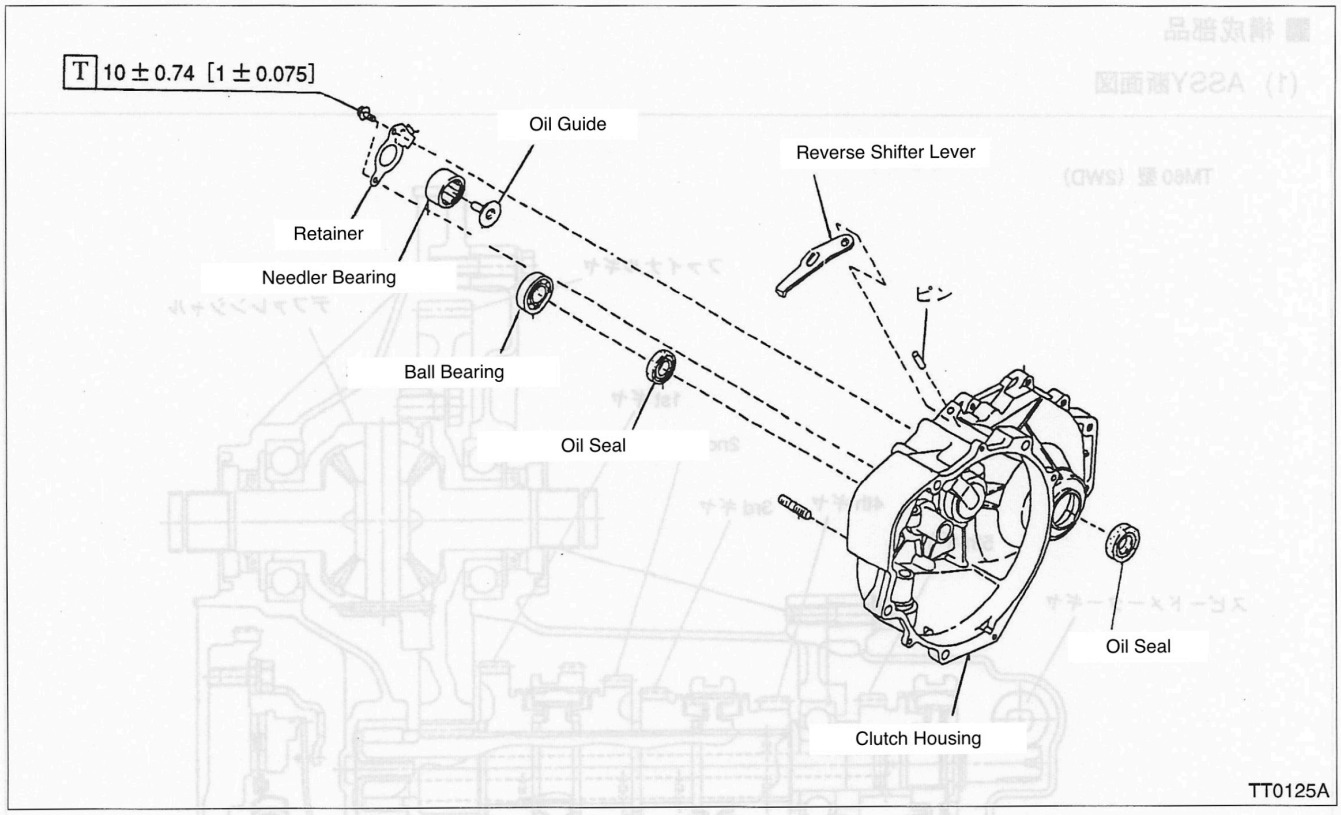
[4] TM60 Type (2WD) Transmission Disassembly & Assembly

■ Component Parts

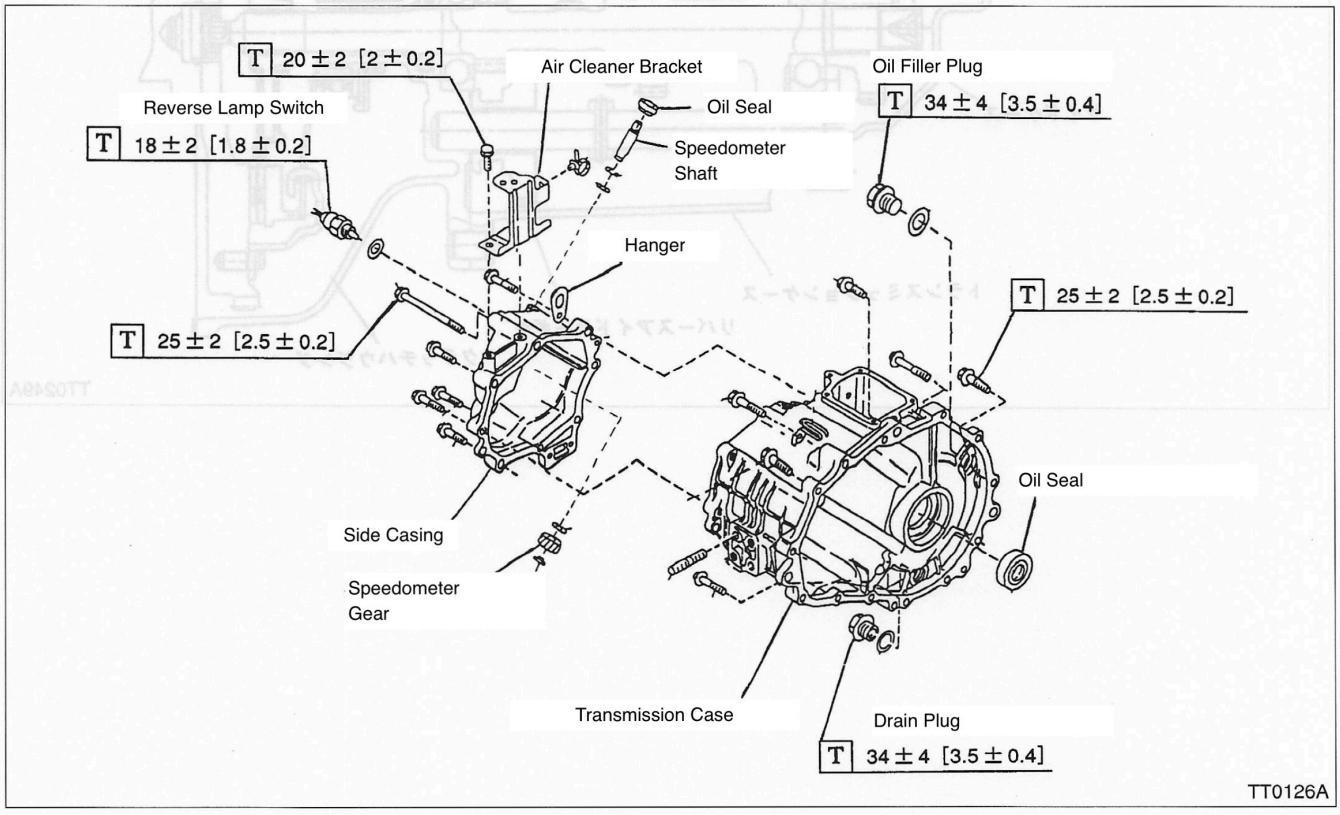
(5) ASSY Cross Section



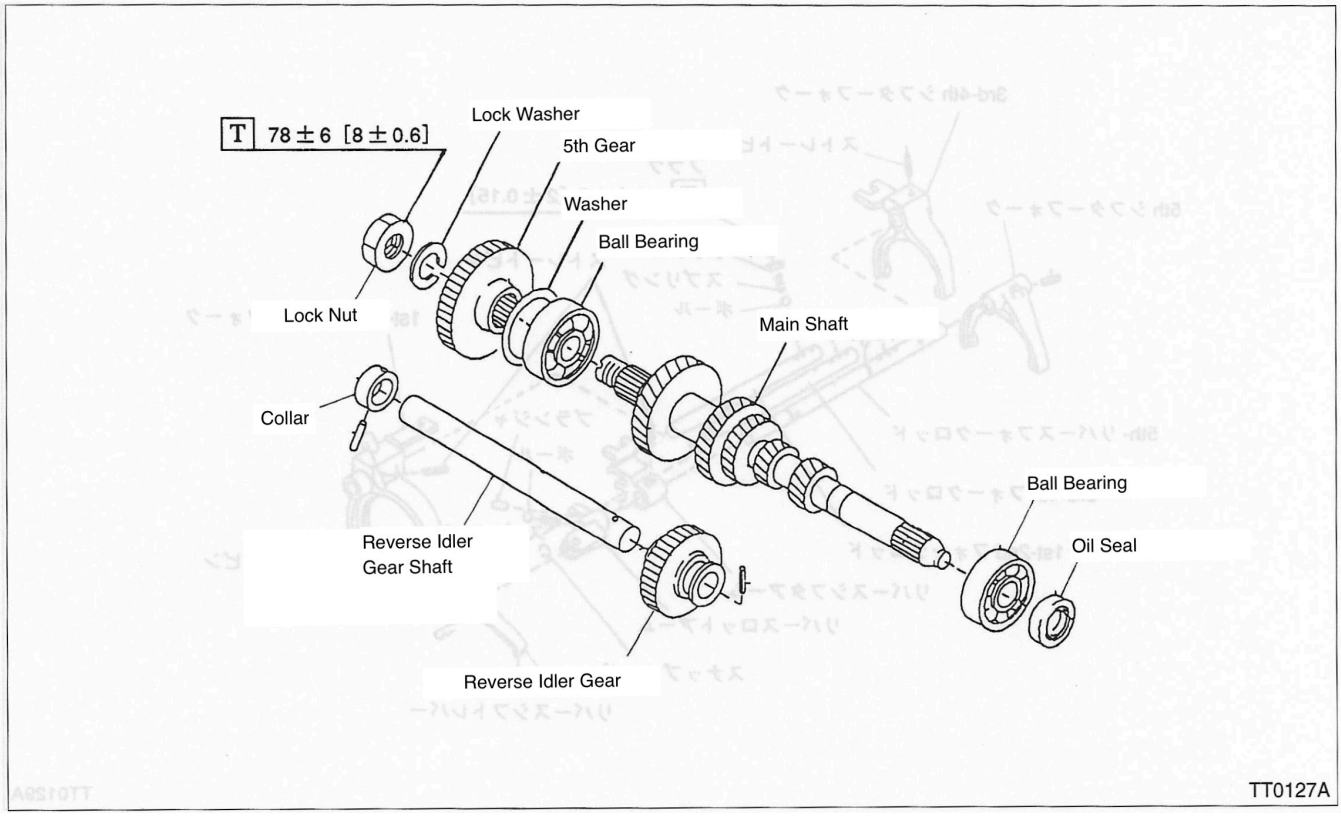
(2) Clutch Housing



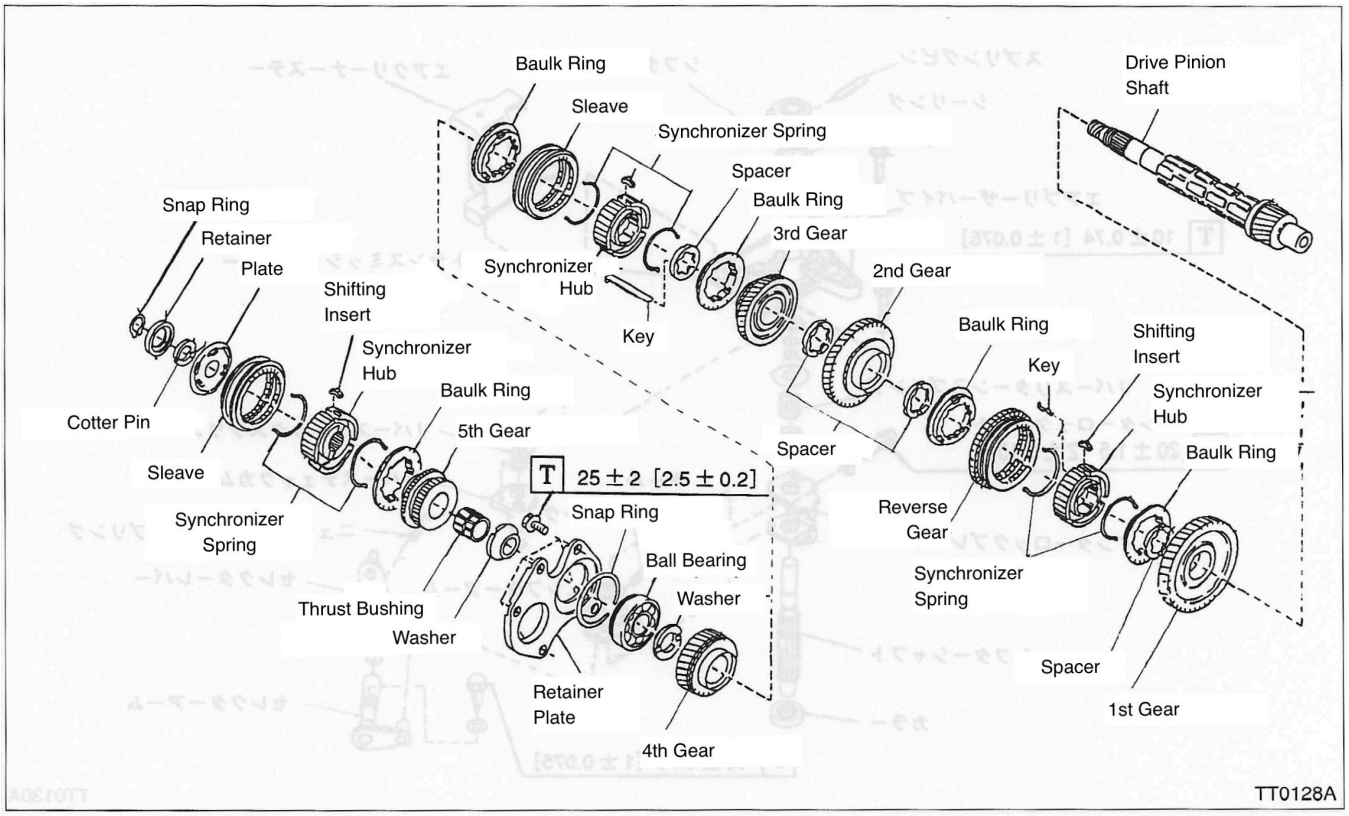
(3) Transmission Case



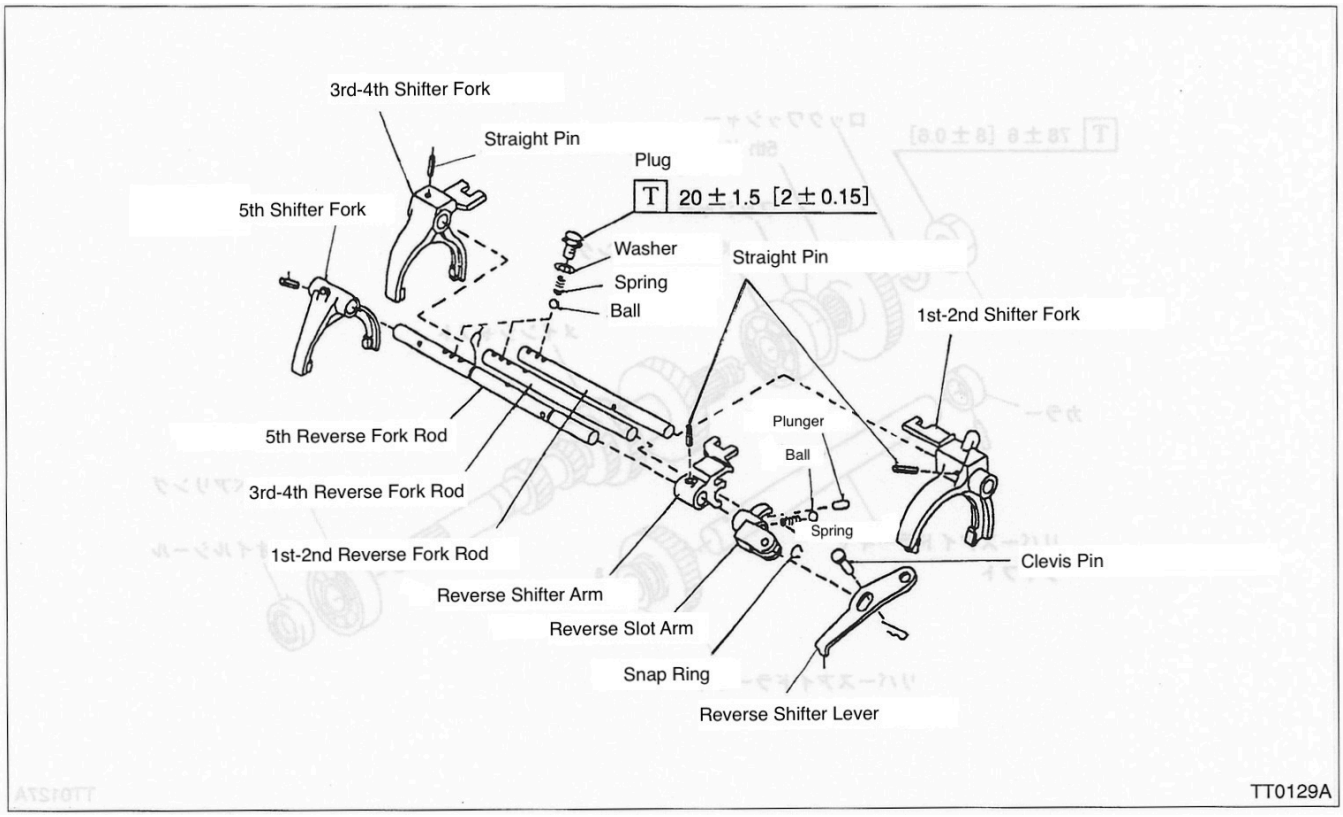
(4) Main Shaft & Reverse Idler Gear



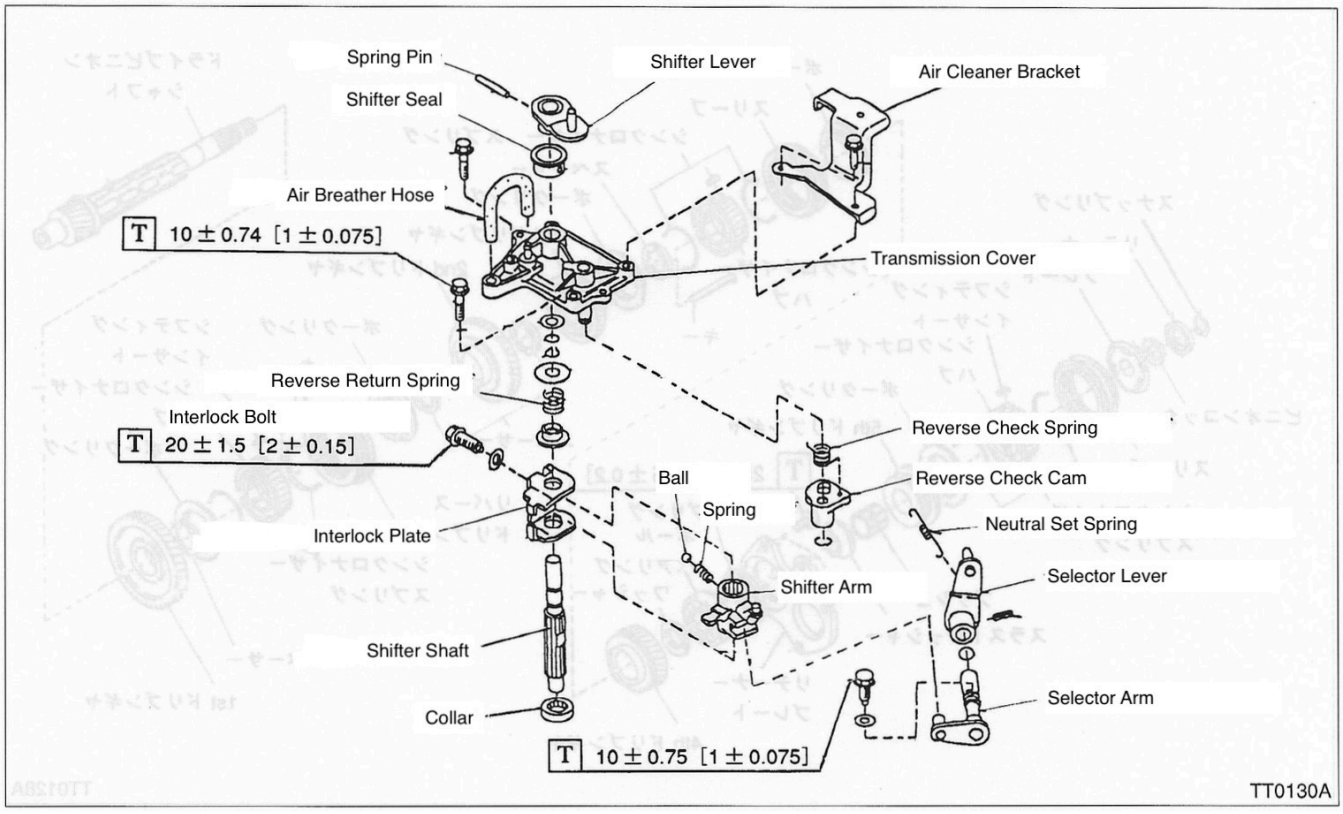
(5) Drive Pinion Shaft



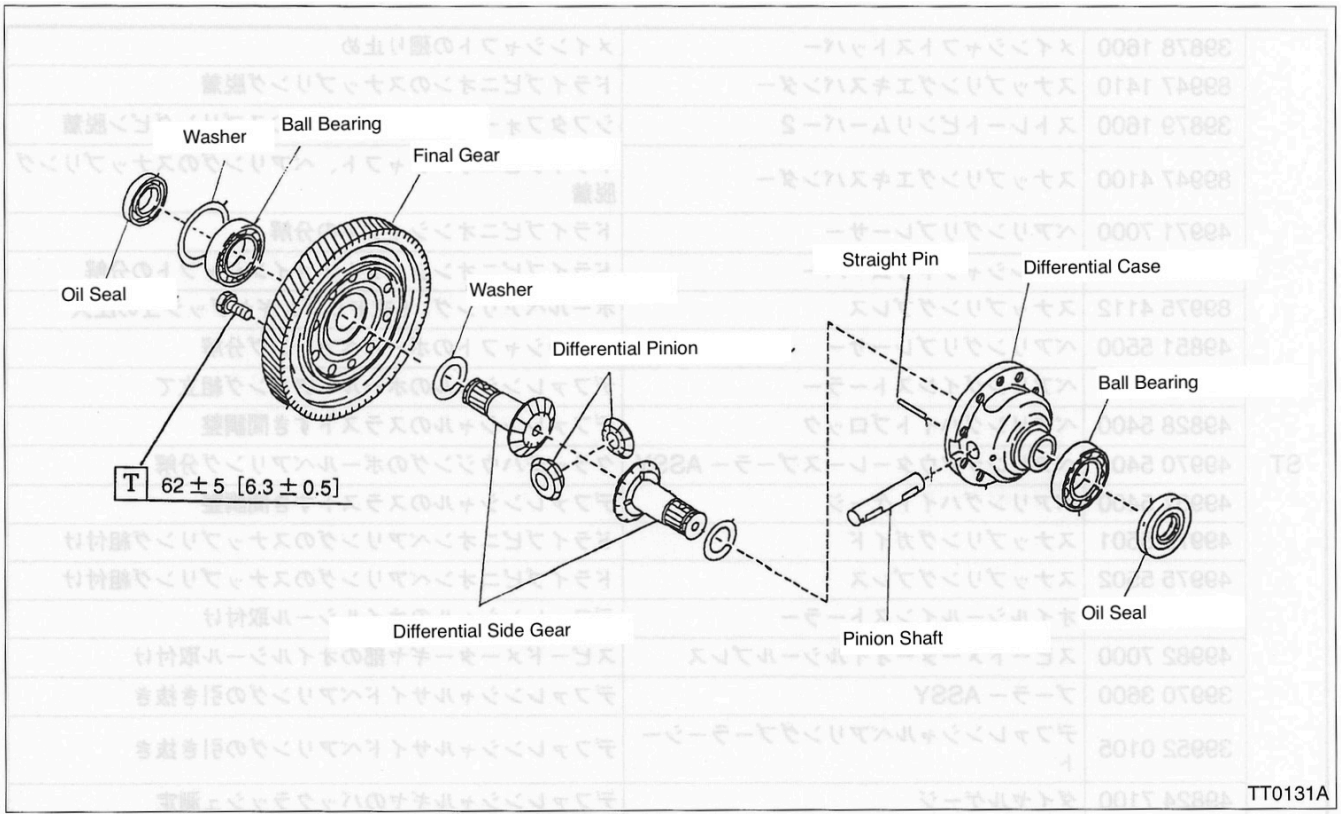
(6) Shifter Fork & Fork Rod



(7) Shifter Lever & Selector Lever



(8) Differential Gear



■ Maintenance Preparation Items

Classification	Tool Number	Description	Purpose
ST	39878 1600	Main shaft stopper	Main shaft rotation stopper
	89947 1410	Snap ring expander	Driver pinion snap ringer removal
	39879 1600	Straight pin remover 2	Shifter fork and shifter lever spring pin removal and installation
	89947 4700	Snap ring expander	Drive pinion shaft, bearing snap ring
	49971 7000	Bearing replacer	Disassembly of the drive pinion shaft
	89986 4100	Main shaft remover	Disassembly of the drive pinion shaft main shaft
	89975 4112	Snap ring press	Ball bearings, 5-speed driven gear bush press-fit
	49851 5500	Bearing replacer	Disassembly of the main shaft ball bearing
	89958 0100	Bearing installer	Differential ball bearing assembly
	49828 5400	Bearing height block	Differential thrust clearance adjustment
	49970 5401	Bearing outer racer puller ASSY	Disassembly of the ball bearing in the clutch housing
	49957 5400	Bearing height gauge	Differential thrust clearance adjustment
	49975 5501	Snap ring guide	Drive pinion bearing snap ring assembly
	49975 5502	Snap ring press	Drive pinion bearing snap ring assembly
	49817 5700	Oil seal installer	Differential oil seal installation
	49982 7000	Speedometer oil seal press	Installing the oil seal for the speedometer gear
	39970 3600	Puller ASSY	Pulling out the differential side bearing
	39952 0105	Differential bearing puller	Pulling out the differential side bearing
	49824 7100	Dial gauge	Measuring backlash in differential gears
	49824 7001	Magnet base	Measuring backlash in differential gears
	89975 4201	Snap ring press	Press-fitting drive pinion ball bearings
Instrument	-	Depth Gauge	Differential, main shaft, and drive pinion thrust clearance
	-	Thickness Gauge	Drive pinion thrust clearance adjustment
Grease, Oil, & other	-	Grease (Unilube #2 Equivalent)	Oil seal application
	-	Liquid Gasket (ThreeBond 1215-B)	Transmission case and cover coating

■ Maintenance Instructions

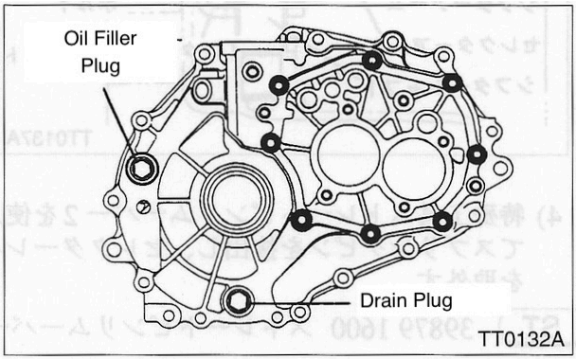
(1) Transmission Body (5MT)

<Disassembly>

1. Clean any oil, grease, dirt, etc. from the outside of the transmission.
2. Remove the drain plug and drain the oil. After draining, re-tighten the drain plug.
   T 34 ± 4 [3.5 ± 0.4]

NOTE

- Use new gaskets.
- Remove any debris from the drain plug magnet.



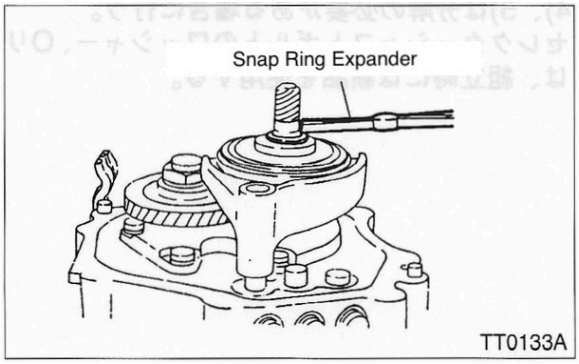
3. Remove the clutch release fork, bearing, etc.
4. Loosen the eight mounting bolts and remove the side case.

NOTE

- Remove by tapping lightly with a plastic hammer.
- Please handle with care as it contains a nylon speedometer gear.

5. Use the special tool snap ring expander to remove the snap ring at the tip of the drive pinion.

ST 89947 1410 Snap Ring Expander

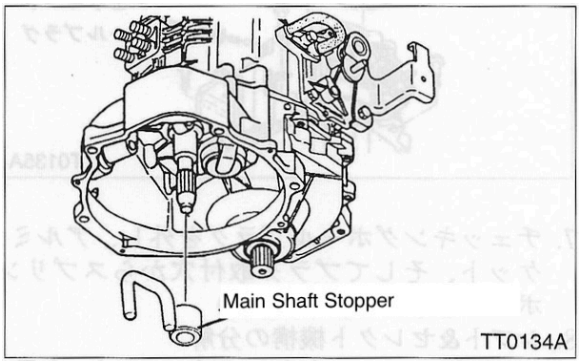


6. Remove the retainer and cotter from the drive pinion.
7. Use the special tool straight pin remover 2 to remove the straight pin from the shifter fork.

ST 39879 1600 Straight Pin Remover 2

8. Remove the sleeve and hub along with the 5-speed shifter fork.
9. Remove the balk ring and 5th-speed driven gear.
10. Insert the special tool, the main shaft stopper, into the spline part of the main shaft, align it with the groove in the housing, and assemble it.

ST 39878 1600 Main shaft stopper

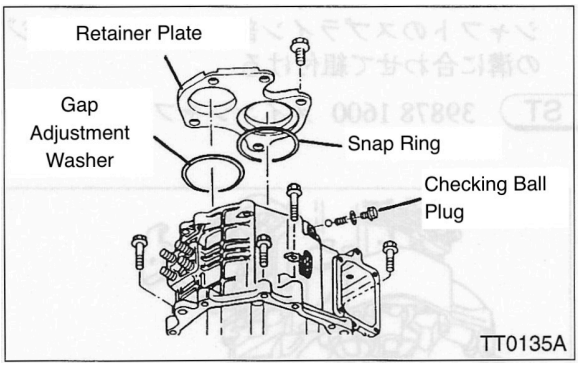


11. Remove the lock nut from the main shaft after unscrewing it.
    T 78 ± 6 [8 ± 0.6]
12. Remove the lock washer and 5th-speed drive gear from the main shaft
13. Remove the main shaft stopper (special tool) and wrap vinyl tape around the spline area. Also
    wrap vinyl tape around the spline area (both sides) of the differential bevel gear (to prevent scratches on the oil seal).
14. Remove the five mounting bolts and remove the bearing retainer plate from the transmission case.
    T 25 ± 2 [2.5 ± 0.2]

15.Using the special tool snap ring expander, remove the snap ring from the drive pinion shaft bearing.

ST 89947 4100 Snap Ring Expander

16.Remove the thrust clearance adjustment washer from the main shaft.

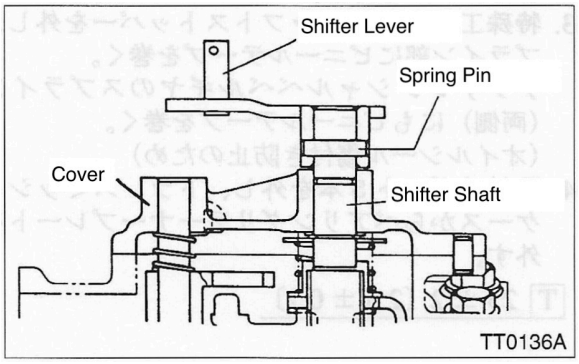


17.Remove the checking ball plug, aluminum gasket, spring, and ball from the plug mounting hole (3 locations).

18.Disassembly of the shift and select mechanism

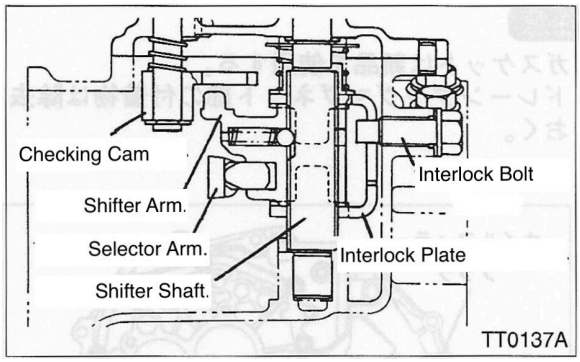
1)Use the special tool, straight pin remover 2, to remove the spring pin that attaches the shifter shaft and shifter lever, and then remove the shifter lever.

ST 39879 1600 Straight Pin Remover 2



2)Remove the four mounting bolts from the transmission case and remove the transmission cover.
T 10 ± 0.74 [1 ± 0.075]

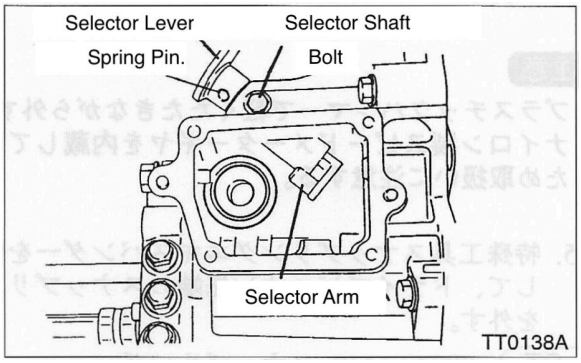
3)Remove the interlock bolt, and then remove the interlock plate, shifter arm, and shifter shaft.
T 20 ± 1.5 [2 ± 0.15]



4)Use the special tool, straight pin remover 2, to remove the spring pin and remove the selector lever.

ST 39879 1600 Straight Pin Remover 2

5)Remove the selector shaft bolt and remove the selector arm.
T 10 ± 0.74 (1 ± 0.075)



NOTES

- Steps 4 & 5 are performed when disassembly is necessary.
- Use new washers and O rings for the selector shaft bolt when assembling.

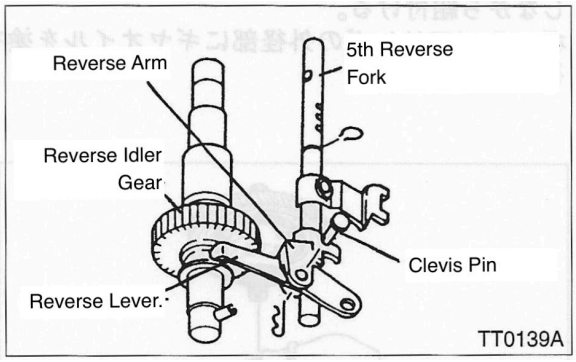
19.Remove the 13 mounting bolts and separate the transmission case and clutch housing.
T 25 ± 2 [2.5 ± 0.2]

NOTE
• Separate by tapping lightly with a plastic hammer.

20.Remove the thrust clearance adjustment washer from the differential side bearing.

NOTE
• The adjustment washer may be stuck to the transmission case, so be sure not to lose it.

21.Remove the clevis pin from the reverse fork rod arm, and remove the reverse shifter lever from the clutch housing dowel pin.



22.Remove the reverse idler shaft together with the reverse idler gear.
23.Remove the 5th-reverse fork rod.
24.Remove the main shaft assembly and drive pinion assembly along with the 1st-2nd and 3rd-4th fork rods from the clutch housing.

NOTE
• Shake left and right to remove.

25.Remove the differential assembly from the clutch housing.

<Inspection>

Disassembled parts should be thoroughly cleaned and inspected.

NOTE
• Never clean the oil seal with gasoline as this will increase the inner diameter of the lip.

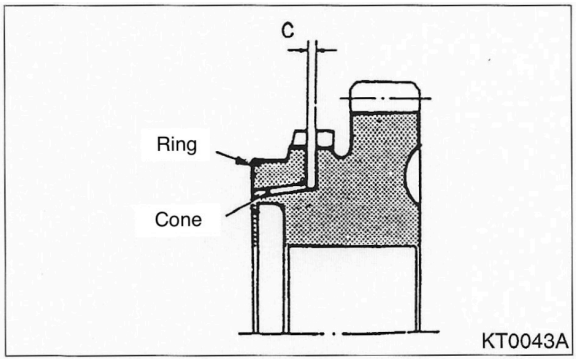
1. Gears
   1) Replace if the tooth surface is broken, damaged or abnormally worn.
   2) If the cone part that contacts the balk ring is seized or damaged, replace it.
   3) If the inner surface or end face of the bearing is abnormally worn or damaged, replace it.
   4) If there is abnormal wear or damage on the end faces of spacers, replace them.
   5) Gear thrust clearance (side clearance).

Unit: mm

Gap	Reference Value
1st Gear	0.11~0.48
2nd-3rd Gear	0.11~0.43
4th Gear	0.05~0.34
5th Gear	0.10~0.29

2. Baulk Ring
   1) If the inner surface or tooth surface of the ring is damaged or abnormally worn, replace it.
   2) When the ring is pressed against the cone, the clearance C between the surfaces of the ring and the cone facing each other is measured.

Reference Value of C (mm)	1.2
C Limit (mm)	0.5



   3) If the contact surface with the shifting insert is abnormally worn, replace it.
3. Shifting Insert
   • Replace if there is excessive wear or other defects.

4. Differential
   1) Replace the final gear and drive pinion if there is damage or excessive wear on the tooth surface.
   2) If there is excessive wear on the needle bearing rolling surface of the drive pinion shaft or the hexagonal spline gear sliding surface, replace them.
   3) Replace the differential pinion, differential bevel gear, washer (27.1 x 42 x t), and pinion shaft if they are damaged, worn, or seized.
   4) If the differential case is cracked or has any other problems, replace it.
5. Bearings
   • Exchange if there is seizure, wear, abnormal noise, or uneven rotation.
   • In addition, to check for abnormal noises or uneven rotation, apply gear oil and rotate the gear.
6. Oil seals Pines
   • If the lip is deformed, hardened, or worn, replace it. If the outer periphery of the oil seal is damaged, replace it.
7. Gear shift mechanism
   1) Clearance between the shifter fork and the groove of the coupling sleeve.

Unit: mm

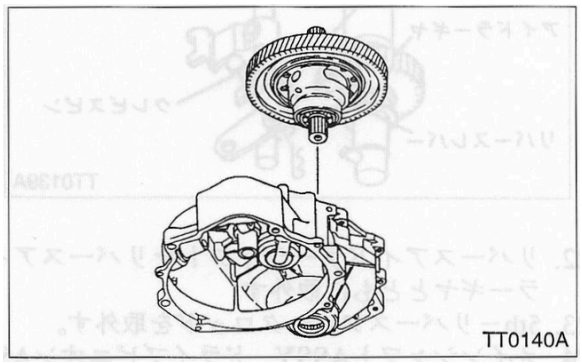
	Reference Value
1st-2nd Gear	0.4~0.6
3rd-4th Gear	↑
5th Gear	↑

   2) If the lock ball, checking ball spring, etc. are abnormally worn or deformed, replace them.
   3) Replace any other parts that are excessively worn, bent, or defective.

<Assembly/Adjustment>

1. Assembly Precautions
   1) If you have removed oil seals from the speedometer gear, main shaft, or differential, replace them with new ones.
   2) When replacing or cleaning any oil seal, apply grease to the race lip. (However, apply gear oil to threaded parts.)
   3) All gaskets, both paper and aluminum, must be replaced if disassembled.
   4) Apply gear oil to all sliding parts such as bearings and gears.
   5) Tightening torque is expressed in T N•m [kg•m].
2. Assemble the differential assembly to the clutch housing.

NOTE
• Wrap vinyl tape around the spline part of the differential.
• Assemble carefully so as not to peel or damage the oil seal.
• Apply gear oil to the outer diameter of the ball bearing rod.



3. Assemble the drive pinion assembly and main shaft assembly to the clutch housing along with the 1st-2nd and 3rd-4th shifter forks.

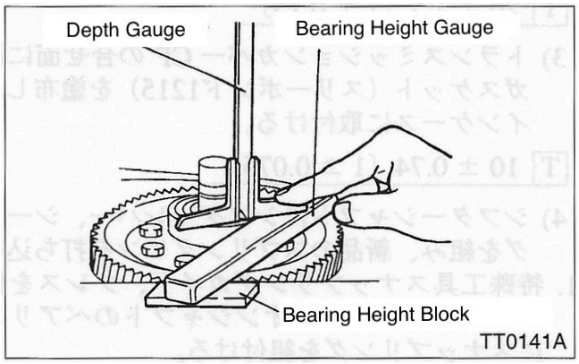
NOTE
• Vinyl tape on the spline of the main shaft roll.
• Apply gear oil to the sliding parts of the fork and sleeve

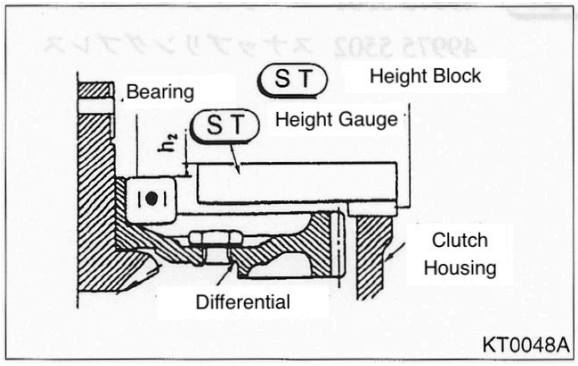
4. Insert the plunger into the arm of the reverse fork rod and assemble it to the clutch housing.

NOTE
- Apply grease to the plunger to prevent it from falling off.
- Assemble the arm in the designated position of the fork rod (where the lock ball is in the groove of the rod).

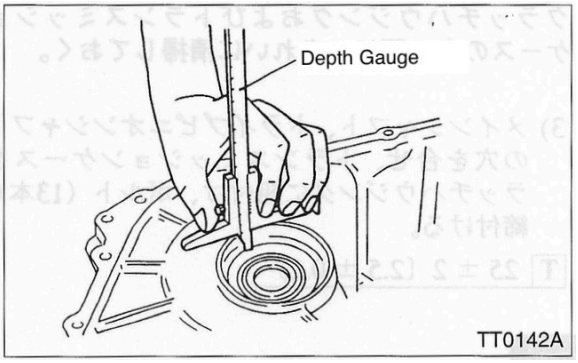
5. Insert the reverse shifter lever into the straight pin of the clutch housing, assemble it with the reverse slot arm, and secure it with the clevis pin.
6. Assemble the reverse idler gear together with the reverse idler shaft into the clutch housing.
7. Differential thrust clearance adjustment
   1) Set the special tool, bearing height block, and gauge on the mating surface of the main case, and use a depth gauge to measure the dimension (h2) between the end face of the outer trace of the ball bearing and the height gauge.

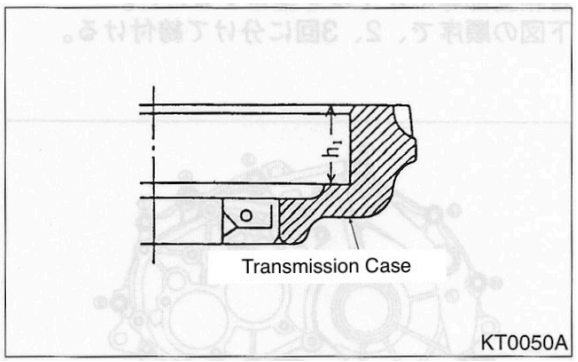
ST 49828 5400 Bearing Height Block
49957 5400 Bearing Height Gauge





   2) Measure the depth (h1) from the end face of the bearing insertion part of the transmission case to the bearing receiving surface.





   3) Calculate the thrust clearance (C) using the following formula, select a washer, and adjust the clearance to the standard value of 0 to 0.2 mm.
      - C=h1-(20.5-h2)
      - C: Thrust clearance (0~0.2mm)
      - h1: Depth of bearing insertion part on transmission case side.
      - h2: Height from the bearing end face to the special tool/ bearing height gauge.
      - 20.5: Special tool thickness (15+5.5).

C (mm)	Washer (61x71x0.2)
0.2 or less	Not used
Over 0.2 and 0.4 or less	1 piece used
Over 0.4	2 pieces used

8. Transmission case assembly
   1) Install the washer selected in the previous section into the differential part of the transmission case.

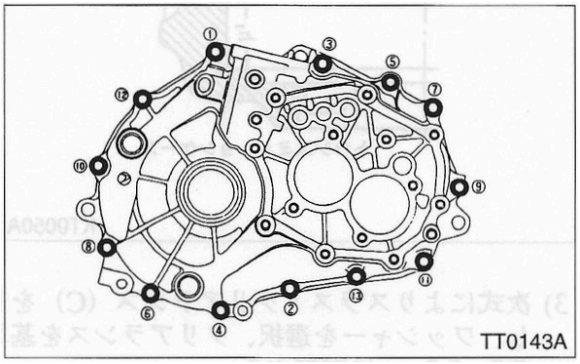
NOTE
- Apply Vaseline to the washer to prevent it from falling off.

2) Apply liquid gasket (ThreeBond 1215-B) to the mating surface of the clutch housing.

NOTE
- Clean the mating surfaces of the clutch housing and transmission case thoroughly.

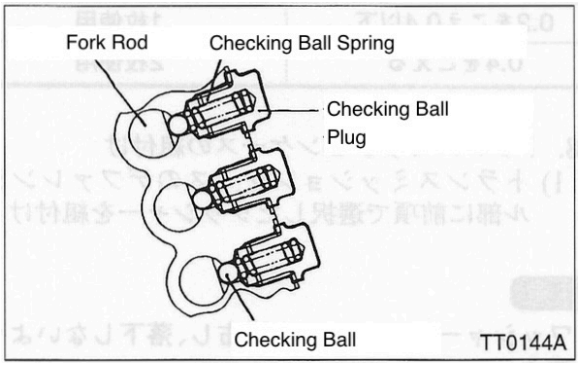
3) Align the holes of the main shaft, drive pinion shaft, etc., and assemble the transmission case to the clutch housing, then tighten with the 13 bolts.
T 25 ± 2 [2.5 ± 0.2]

NOTE
- Apply oil to each bearing part, etc.
- Tighten in two or three steps in the order shown in the diagram below.



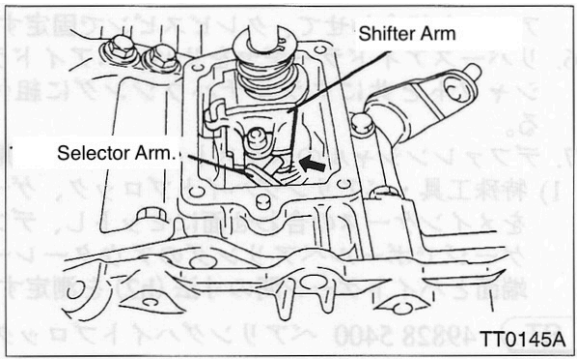
9. Assemble the checking ball, spring, and washer into the transmission case, and then tighten with the plugs (3 places).
T 20 ± 1.5 [2 ± 0.15]

NOTE
- Use new washers.



10. Assembly of the shift and select mechanism.
1) Assemble the collar inside the main case, and assemble the interlock and shifter shaft assembly while operating the selector lever.

NOTE
- The fork throttle should be in the neutral position.
- Insert the tip of the selector arm into the groove of the shifter arm.



2) Tighten the interlock bolt.
T 20 ± 1.5 [2 ± 0.15]

3) Apply liquid gasket (ThreeBond 1215) to the mating surface of the transmission cover CP, and install it to the main case.
T 10 ± 0.74 [1 ± 0.075]

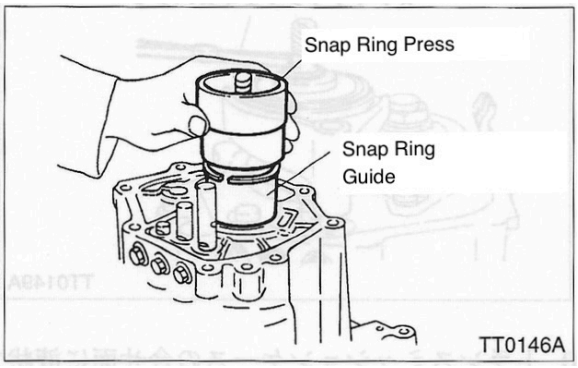
4) Assemble the shifter lever and seal onto the shifter shaft and drive in a new spring pin.

11. Using the special tool, snap ring guide and press, install the snap ring onto the drive pinion shaft bearing.

ST
49975 5501 Snap ring guide
49975 5502 Snap ring press

Notes

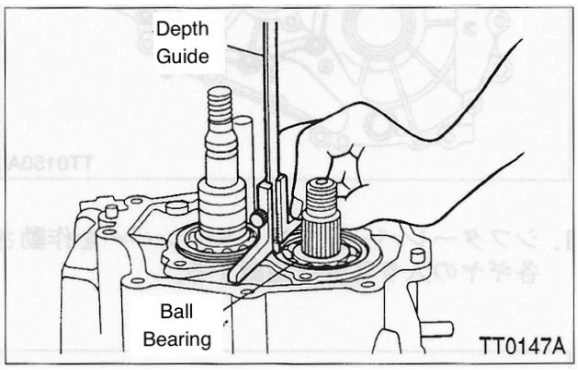
• Forcefully shift the shifter lever from 1st to 2nd gear, and raise it until the ball bearing groove is above the end face of the main case. Then, use the special tool, a snap ring press, to press the snap ring into the bearing groove and assemble it.



12.Adjusting the thrust clearance of the main shaft.

• Measure the depth (L) between the end face of the transmission case and the end face of the ball bearing, and select the number of washers according to the table below so that the thrust clearance is 0 to 0.2 mm.

L (mm)	Washer (46x55.2x0.2)
0.2 or less	Not used
Over 0.2 and 0.4 or less	1 piece used
Over 0.4	2 pieces used



13.Assemble the washer and bearing retainer plate determined in the previous section to the main shaft bearing section and tighten with the five bolts.

T 25 ± 2 [25 ± 0.2]

14.Place the special tool, main shaft stopper, on the main shaft.

ST 39878 1600 Main shaft stopper

NOTE

• Keep the vinyl tape on the spline area.

15.Assemble the 5-speed driven gear onto the drive pinion shaft, the 5-speed drive gear onto the main shaft, and the lock washer, and tighten with the lock nut.

T 78 ± 6 [8 ± 0.6]

NOTE

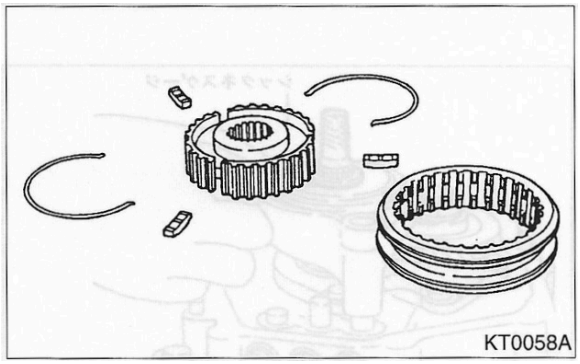
• Apply gear oil to the lock nut.
• Crimp the lock nut in two places.

16.5-speed sleeve and hub assembly

1)Assemble the coupling sleeve and shifting insert into the synchronizer hub.

NOTE

• Align the insert with the spline recess of the sleeve.



2)The spring rod base is installed 120° offset from the spring rod base on one side.

3)Assemble the sleeve and insert stopper plate on the 5th-speed driven gear side and the opposite side.

17.Place the 5-speed shifter fork into the coupling sleeve groove, align the sleeve and fork with the drive pinion shaft, and align the 5-speed shifter fork holes with the reverse fork rod.

18.Use the special tool, straight pin remover 2, to drive the spring pin into the 5-speed fork.

ST 39879 1600 Straight Pin Remover 2

19.Adjust the thrust clearance of the drive pinion shaft and assemble.

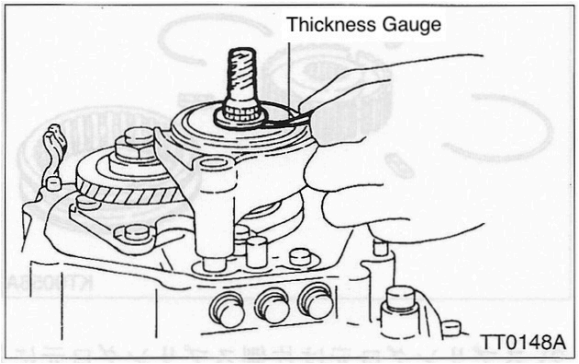
1)Assemble the drive pinion cotter and retainer onto the drive pinion shaft, and measure the clearance between the insert stopper plate and the cotter with a thickness gauge.

Clearance Standard Value (mm)	0~0.04

If the clearance is outside the standard value, select a drive pinion cotter from the table below.

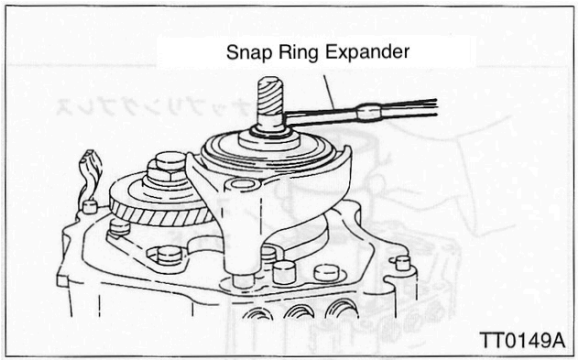
✻ Drive Pinion Cotter

Part Number	**Thickness (mm)**	**Part Number**	**Thickness (mm)**
44137 5401	2.36	44137 5408	2.64
44137 5402	2.40	44137 5409	2.68
44137 5403	2.44	44137 5501	2.72
44137 5404	2.48	44137 5502	2.76
44137 5405	2.52	44137 5503	2.80
44137 5406	2.56	44137 5504	2.84
44137 5407	2.60		



2)Assemble the selected cotter, cover it with the drive pinion retainer, and assemble the snap ring using the special tool snap ring expander.

ST 89947 1410 Snap Ring Expander

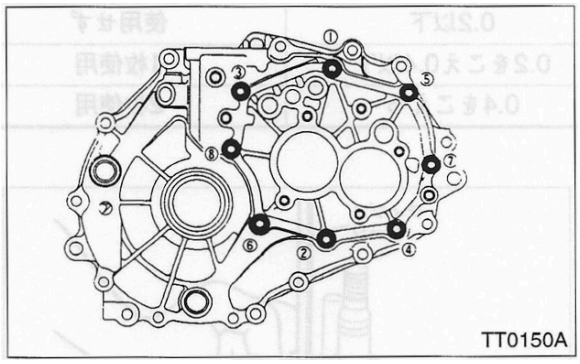


20.Apply liquid gasket (Threebond 1215-B) to the mating surfaces of the transmission case, then assemble the side case and tighten with the eight bolts.

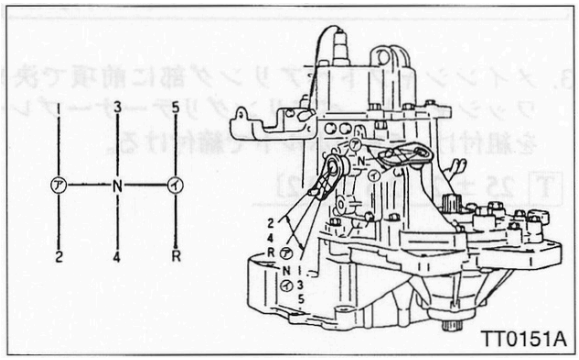
T 25 ± 2 [2.5 ± 0.2]

NOTE

• Tighten in the order shown in the diagram below.



21.Operate the shifter lever and selector lever and check that each gear is engaged.



22.Assemble the release lever, release bearing, etc.
23.Remove the oil filler plug from the transmission case and fill the oil in.
  • Once the filling is complete, tighten the plug.

NOTE
• Use new gaskets.

T 34 ± 4 [3.5 ± 0.4]

Oil Name	Subaru Gear Oil Extra 75-80
Oil Volume (ℓ)	2.0

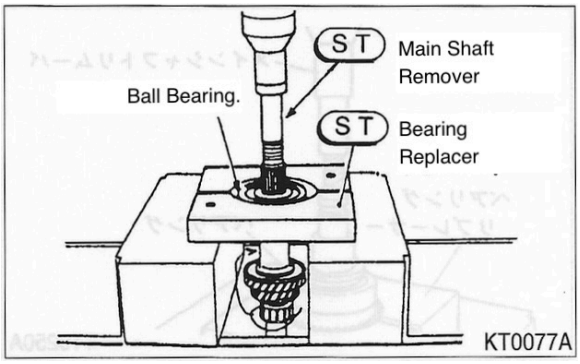
(2) Main Shaft Assembly

<Disassembly>

Remove the ball bearings from the main shaft using special tools, a main shaft remover and a bearing replacer.

ST 49851 5500 Bearing Replacer
89986 4100 Main shaft rear

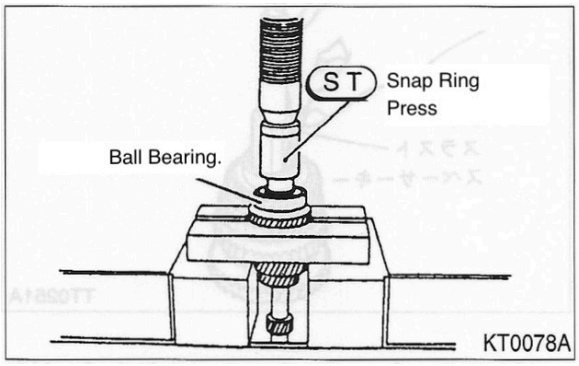
NOTE
• Do not remove the ball bearing on the rear side of the main shaft unless necessary. If you do remove it, replace it with a new one.



<Assembly>

Use a special tool, a snap ring press, to press the ball bearing into the main shaft.

ST 89975 4112 Snap Ring Press



(3) Drive Pinion Shaft Assembly

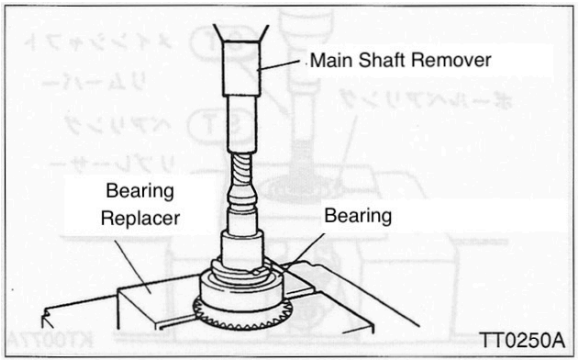
<Disassembly>

1. Using the special tools bearing replacer and main shaft remover, remove the bearing, 5th thrust washer, and 5th gear bushing.

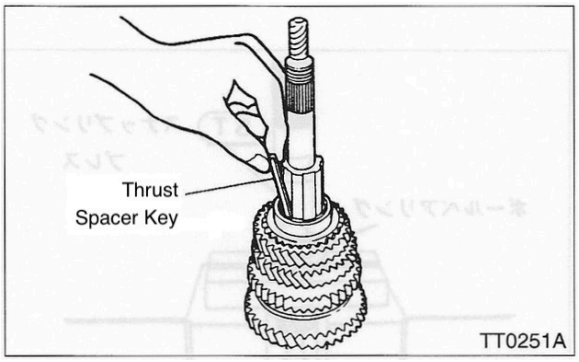
S T 49971 7000 Bearing Replacer
89986 4100 Main Shaft Remover

NOTE

• The bearing replacer is inserted into the groove of the 4th gear.



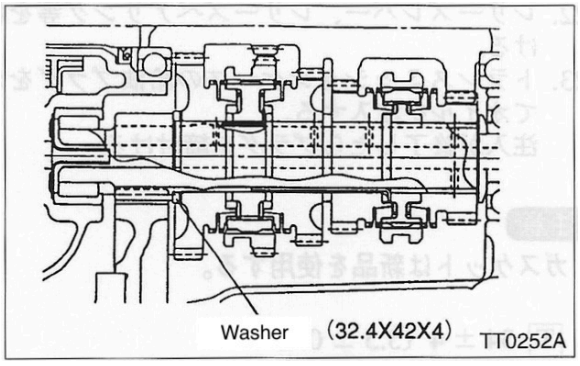
2. Remove the washer, 4th driven gear, balk ring, sleeve and hub, and then remove the thrust spacer key.



3. Remove the gear thrust spacer 2, 3rd gear, gear thrust spacer, 2nd gear, gear thrust spacer, thrust spacer key 2, baulk ring, gear & hub assembly, baulk ring, gear thrust spacer, and 1st gear in that order.

NOTE

• Turn the gear thrust spacer one tooth to remove it.
• Do not remove the washer (32.4 x 42 x 4) unless necessary. If you do remove it, replace it with a new one.

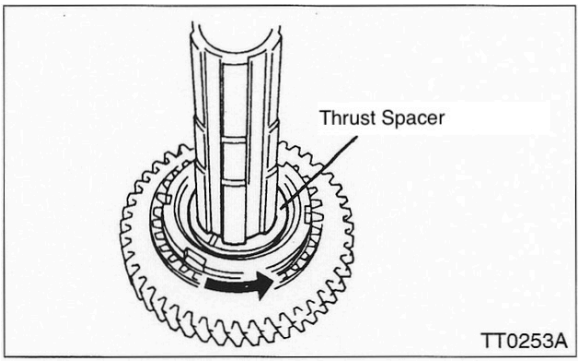


<Assembly>

1. When disassembling the washer (32.4 x 42 x 4), press a new washer onto the drive pinion shaft
2. Assemble the 1st driven gear, balk ring, and gear thrust spacer.

NOTE

• The gear thrust spacer is rotated one tooth.

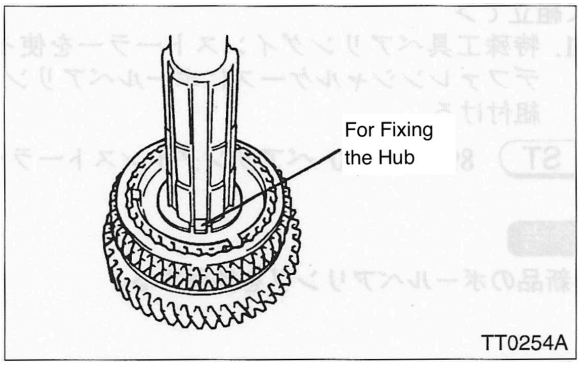


3. Assemble the gear and hub assembly.

NOTE

• Install the synchronizer spring by shifting it 120° from the spring base on one side, and check that the insert has not fallen off.
• Assemble the synchronizer hub so that the missing tooth part of the square spline is not near the oil hole of the drive pinion shaft. Also, remember that this missing tooth part will be the assembly position for the spacer fixing key.

4. Install the hub fixing key, then assemble the gear thrust spacer 2, baulk ring, 2nd gear, gear thrust spacer 2, and 3rd gear in that order.



5. Assemble the gear thrust spacer and gear thrust spacer key.

NOTE
- The end face of the spacer with the notched groove (width 6.6 mm, depth 1.5 mm) should face the 4th gear, turn it one tooth, and insert the key into the notched groove before assembling.
- Install the key in a position where it will not block the oil hole in the drive pinion shaft.

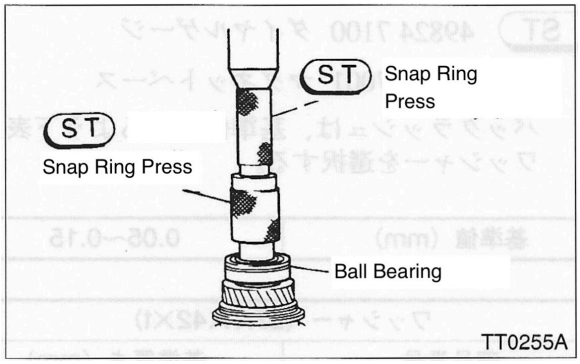
6. Assemble the balk ring, sleeve & hub assembly, balk ring, 4th gear, and washer.

NOTE
- Install the washer with the oil groove end facing the 4th gear.

7. Use the special tool snap ring press to press in the ball bearing.

ST 89975 4102 Snap Ring Press
89975 4112 Snap Ring Press

NOTE
- Install the ball bearing with the snap ring groove facing the 5th gear side.



8. Use the special tool snap ring press to press in the thrust washer and 5th gear bushing.

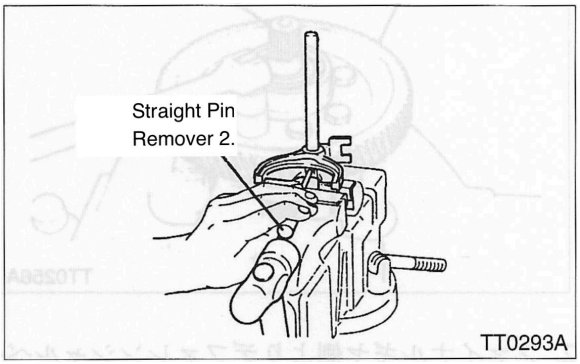
ST 89975 4102 Snap Ring Press

(4) Shifter Fork & Fork Rod

<Disassembly>

Use the special tool, straight pin remover 2, to knock out the spring pin from the fork rod and separate the shifter fork and fork rod.

ST 39879 1600 Straight Pin Remover 2



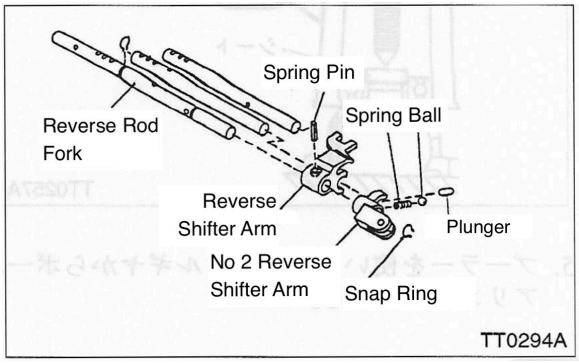
<Assembly>

1. Secure the fork rod and shifter fork with the spring pin.

NOTE
- Use a new spring pin.
- Install the spring pin so that the split is facing the axial direction of the fork rod.

2. For the reverse fork rod, secure the reverse shifter arm with the spring pin, place the spring and ball into reverse shifter arm 2, and insert it into the fork rod while pressing down on the ball with a screwdriver or similar tool.

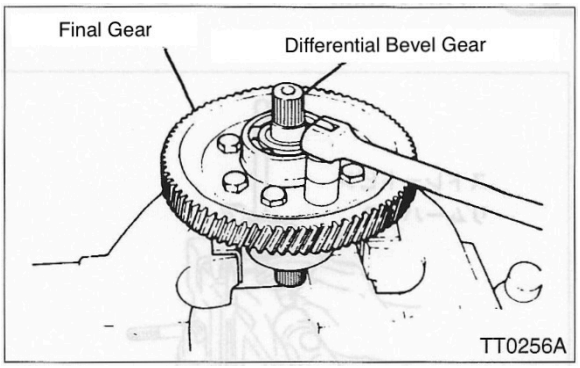
NOTE
- Apply grease to the plunger and insert it into the reverse arm 2.



(5)Differential Assembly

<Disassembly>

1. Remove the 8 bolts and remove the final gear.
   T 62 ± 5 [6.3 ± 0.5]



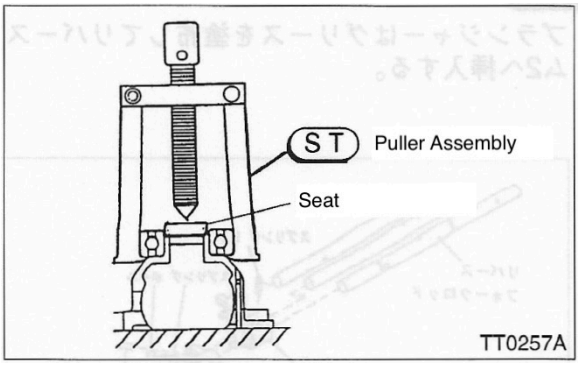
2. Remove the differential bevel gear and adjusting washer from the final gear side.
3. Remove the straight pin from the differential case, remove the pinion shaft, and then remove the pinion, bevel gear, and adjusting washer.

NOTE

- The polished part of the bevel gear must not scratch the sliding part of the oil seal.

4. Using the special tool puller assembly and seat, remove the ball bearing from the differential case.

ST 39970 3600 Puller ASSY
39952 0105 Differential Bearing Puller Seat



5. Use a puller to remove the ball bearing from the final gear.

NOTE

- Do not remove the ball bearings unless necessary. If you do remove them, replace them with new ones.

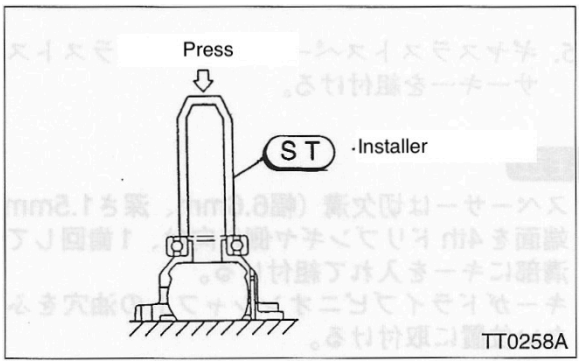
<Assembly>

1. Use the special tool bearing installer to install the ball bearings into the differential case.

ST 89958 0100 Bearing Installer

REFERENCE

- Use new ball bearings.



2. Using the special tool bearing installer, install the ball bearings into the final gear.

ST 89958 0100 Bearing Installer

NOTE

- Use new ball bearings.

3. Gear assembly
   1) Assemble the bevel pinion, washer, bevel gear, pinion shaft, and straight pin to the differential case.
   2) Install the washer and bevel gear on the final gear side.
4. Tighten the differential case and final gear with eight bolts.
   T 62 ± 5 [6.3 ± 0.5]
5. Use the special tool dial gauge and magnetic base to measure the backlash.

ST 49824 7100 Dial Gauge
49824 7001 Magnetic Base

Select a washer from the table below so that the backlash falls within the standard value.

Standard Value (mm)	0.05~0.15

Washer (27.1x42xt)	
Part Number	**Thickness**
80302 7041	1.000
80302 7042	1.050
80302 7043	1.100

(6) Clutch Housing

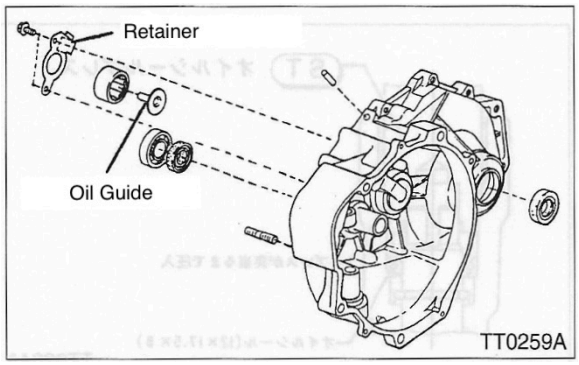
<Disassembly>

1. Remove the oil guide, needle bearing, and retainer from the drive pinion by removing the two bolts.
   T 10 ± 0.75 [1 ± 0.075]
2. Remove the oil seal R from the differential.
3. Using the special tool, bearing outer race puller assembly, remove the ball bearing from the main shaft and remove the oil seal.

ST 49970 5401 Bearing Outer Race Puller Assembly

NOTE

- Do not remove unless necessary. If you do remove it, replace it with a new one.

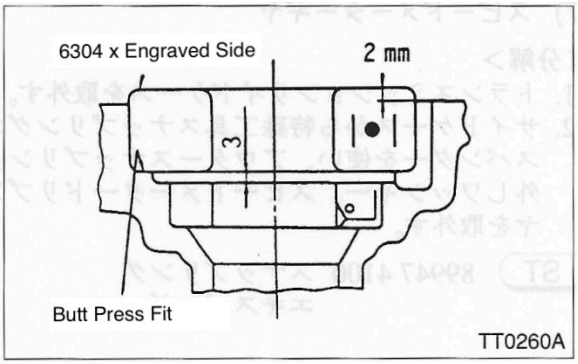


<Assembly>

1. Install the oil seal and ball bearing on the main shaft.

NOTE

- Apply grease (equivalent to Unilube 2) to the oil seal lip and press the dust lip downward.
- Press-fit the ball bearing with the engraved side facing upwards.

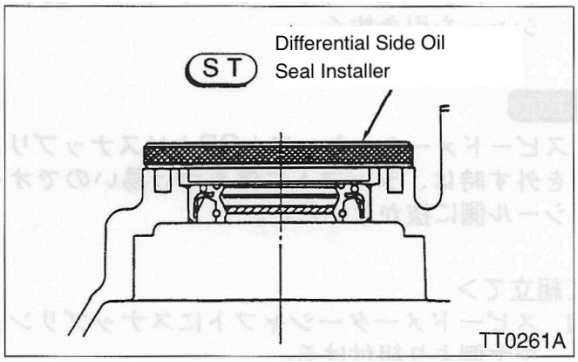


2. Using the special tool oil seal installer, install the oil seal R to the differential.

ST 49817 5700 Oil Seal Installer

NOTE

- Use the right-side only (marked on the right → R). Be careful not to assemble the main case type (left side only) incorrectly as it may cause oil leaks.
- Apply gear oil to the oil seal lip surface.



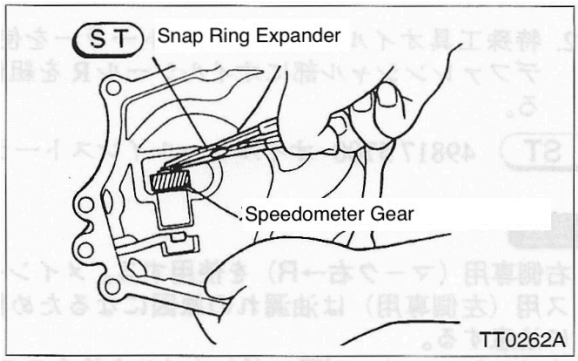
3. Assemble the oil guide, needle bearing, and retainer to the drive pinion with two bolts.

(7) Speedometer Gear

<Disassembly>

1. Remove the transmission side case.
2. Using the special tool snap ring expander, remove the outer snap ring from the side case, and then remove the washer and speedometer driven gear.

ST 89947 4100 Snap Ring Expander



3. Pull out the oil seal, speedometer shaft CP, and washer from the speedometer cable mounting side.

NOTE

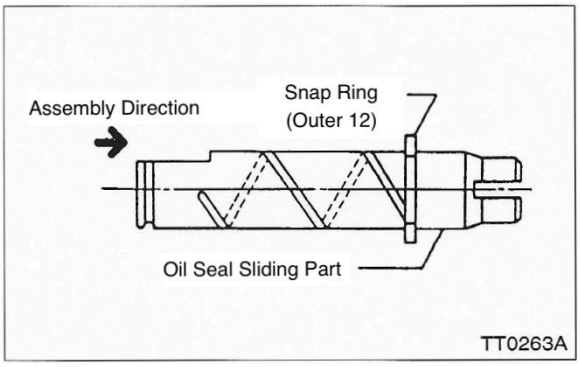
- When removing the snap ring from the speedometer shaft CP, do not pull it towards the oil seal side as this may damage the shaft.

<Assembly>

1. Install the snap ring onto the speedometer shaft from the gear side.

NOTE

- Use a new snap ring.
- Do not assemble from the oil seal sliding side.



2. Place a washer (12.5 × 15.5 x 7) under the snap ring of the speedometer shaft CP, and insert the shaft CP into the side case.
3. Insert the washer and speedometer driven gear onto the shaft CP, and install the snap ring using the special tool snap ring expander.

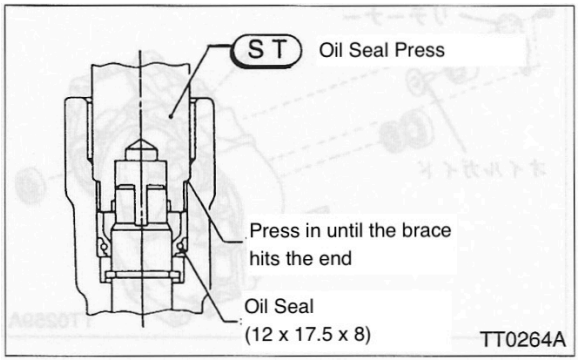
ST 8994 74100 Snap Ring Expander

4. Use the special tool, speedometer oil seal press, to press in the oil seal.

ST 49982 7000 Speedometer Oil Seal Press

NOTE

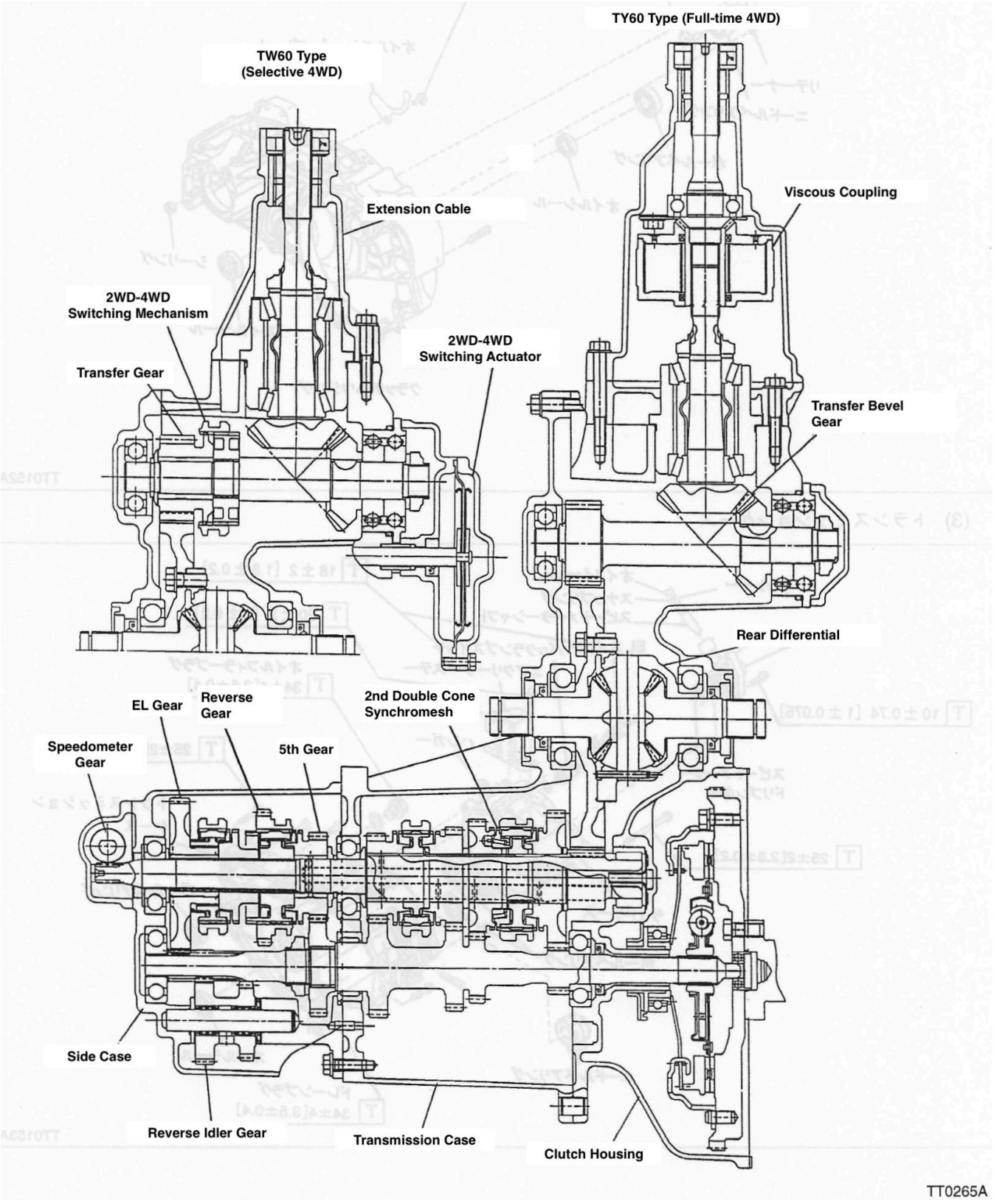
- Use a new oil seal.
- Apply grease (equivalent to Unilube 2) to the lip.



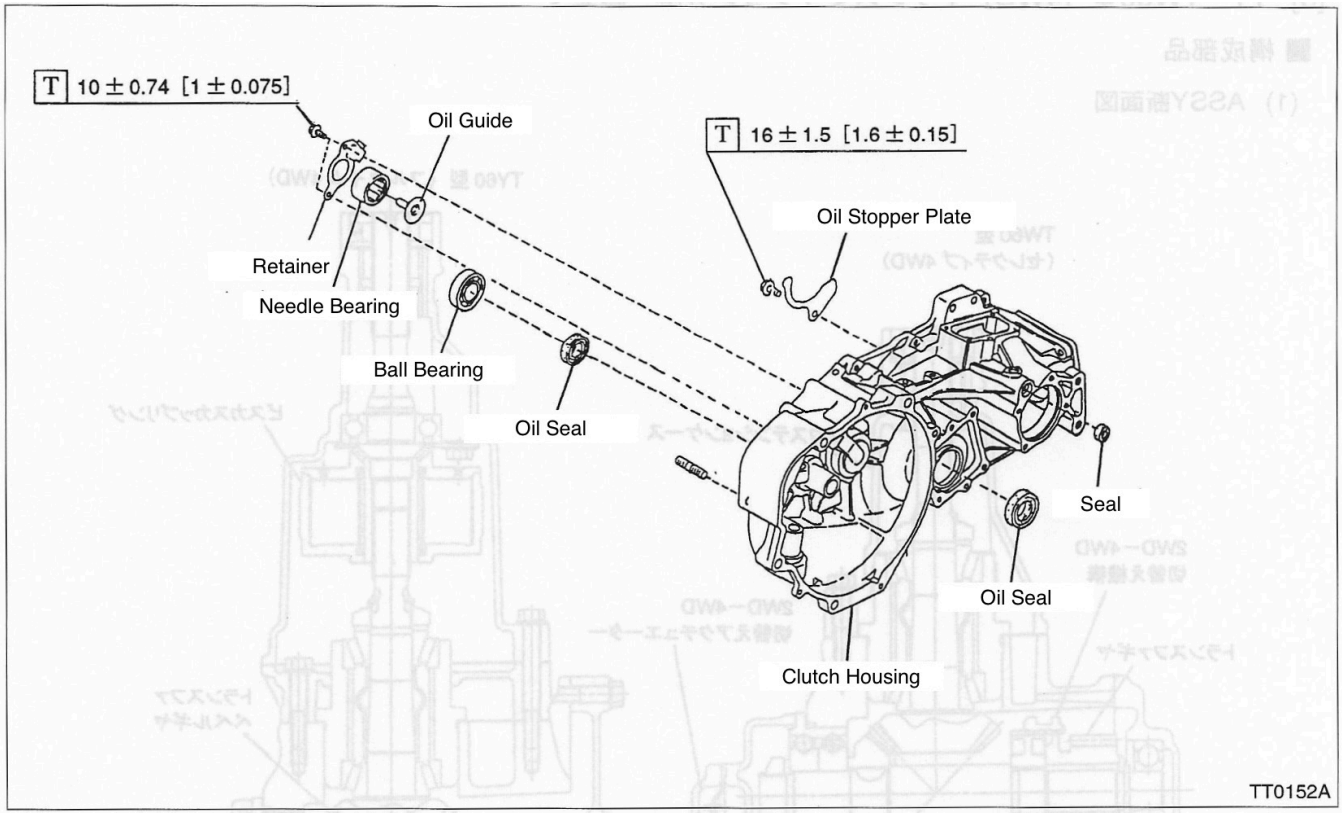
[5] TY·TW60 Type (4WD) Transmission Disassembly & Assembly

■ Component Parts

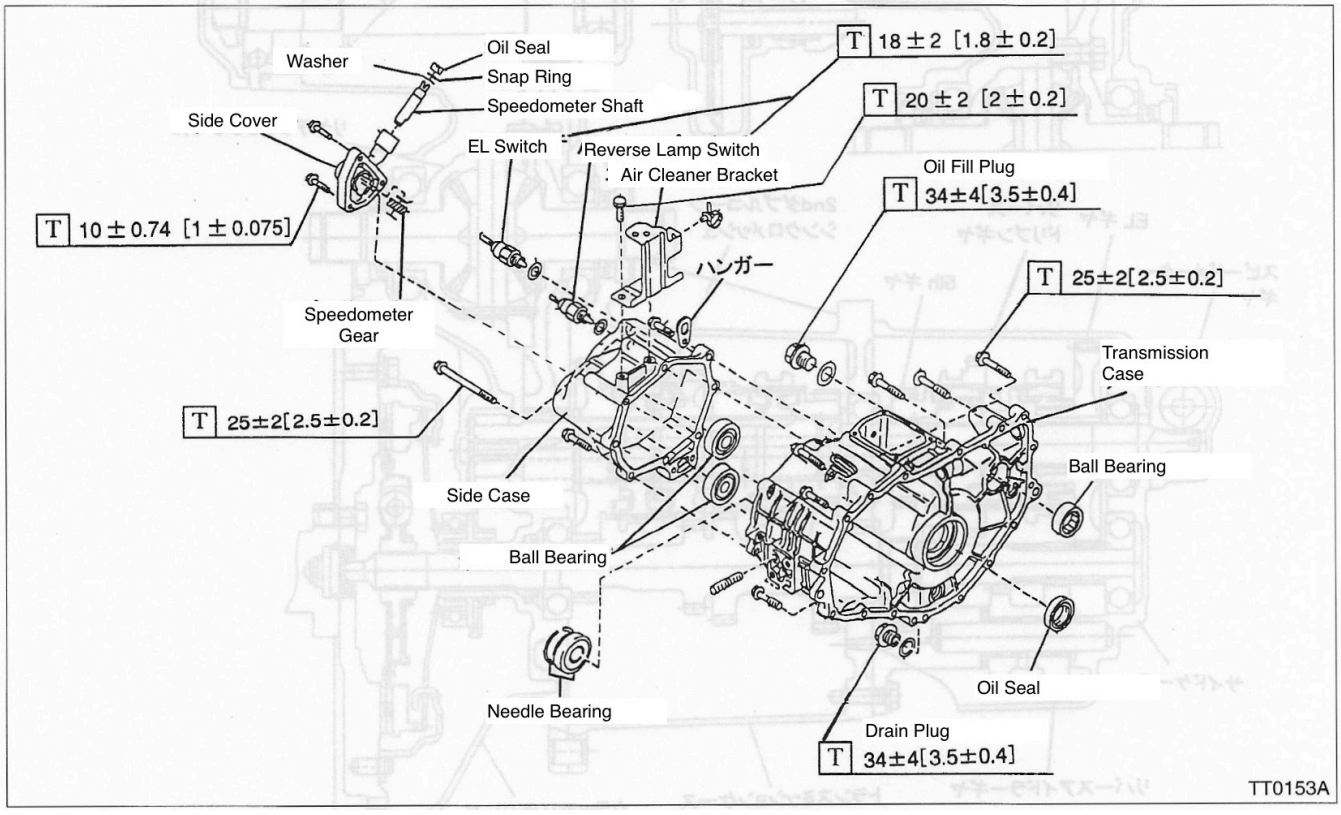
(1) Cross Section Assembly



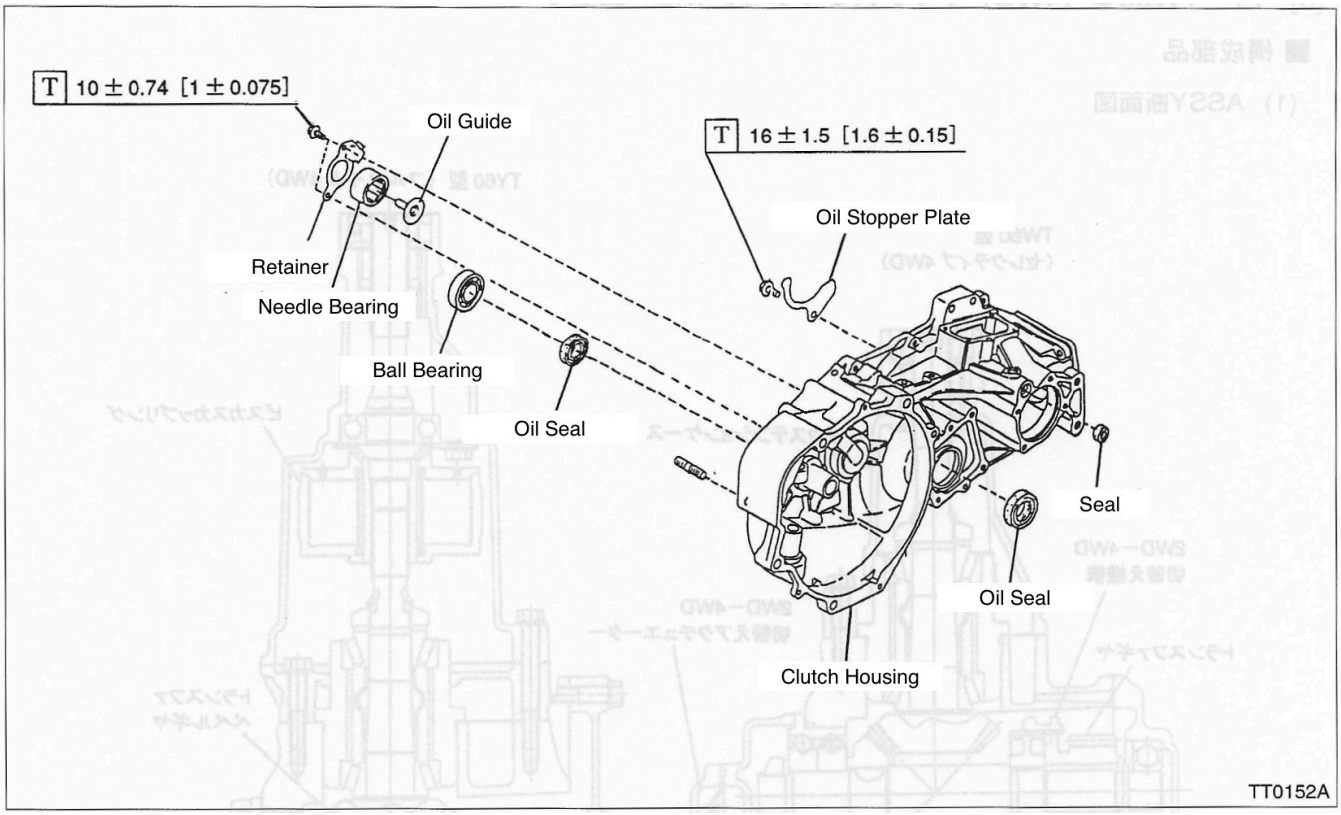
(2) Clutch Housing



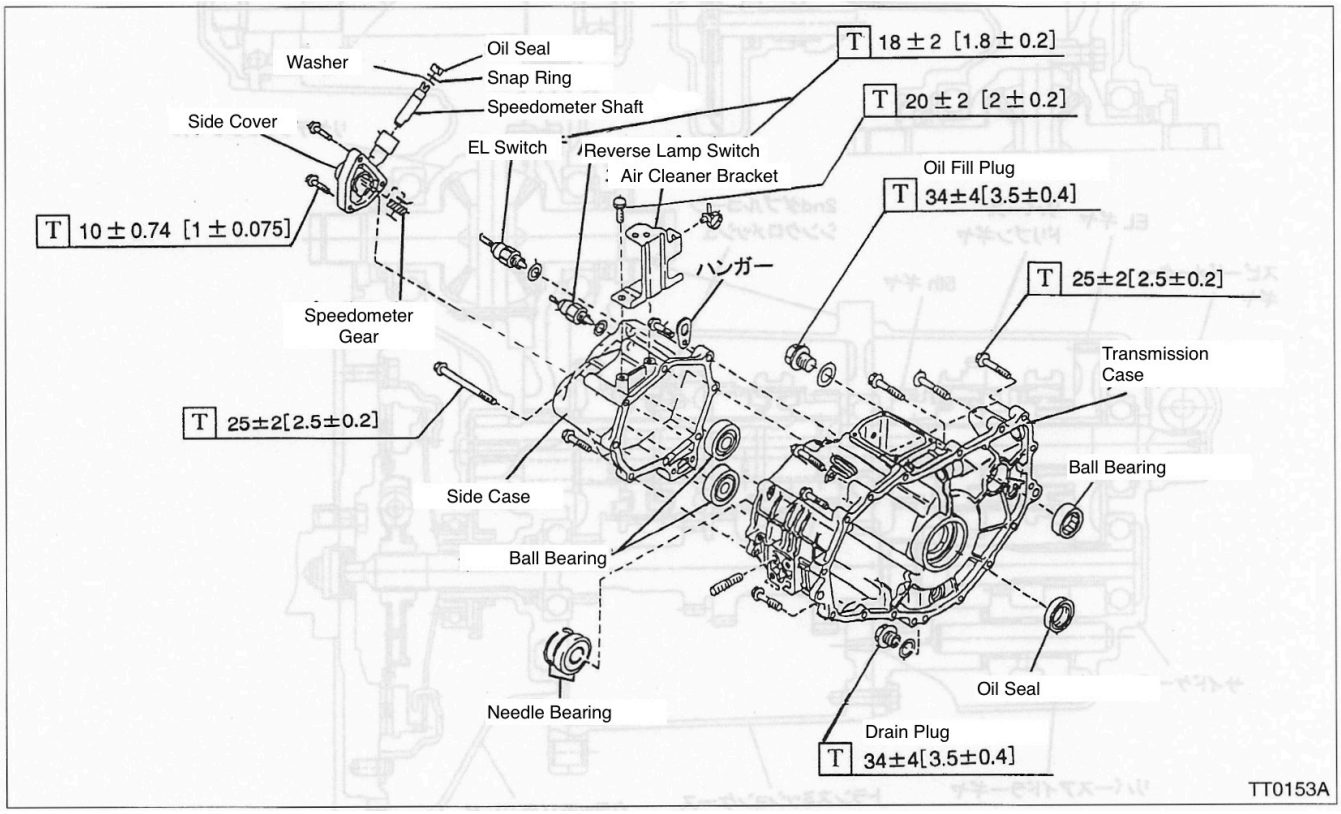
(3) Transmission Case



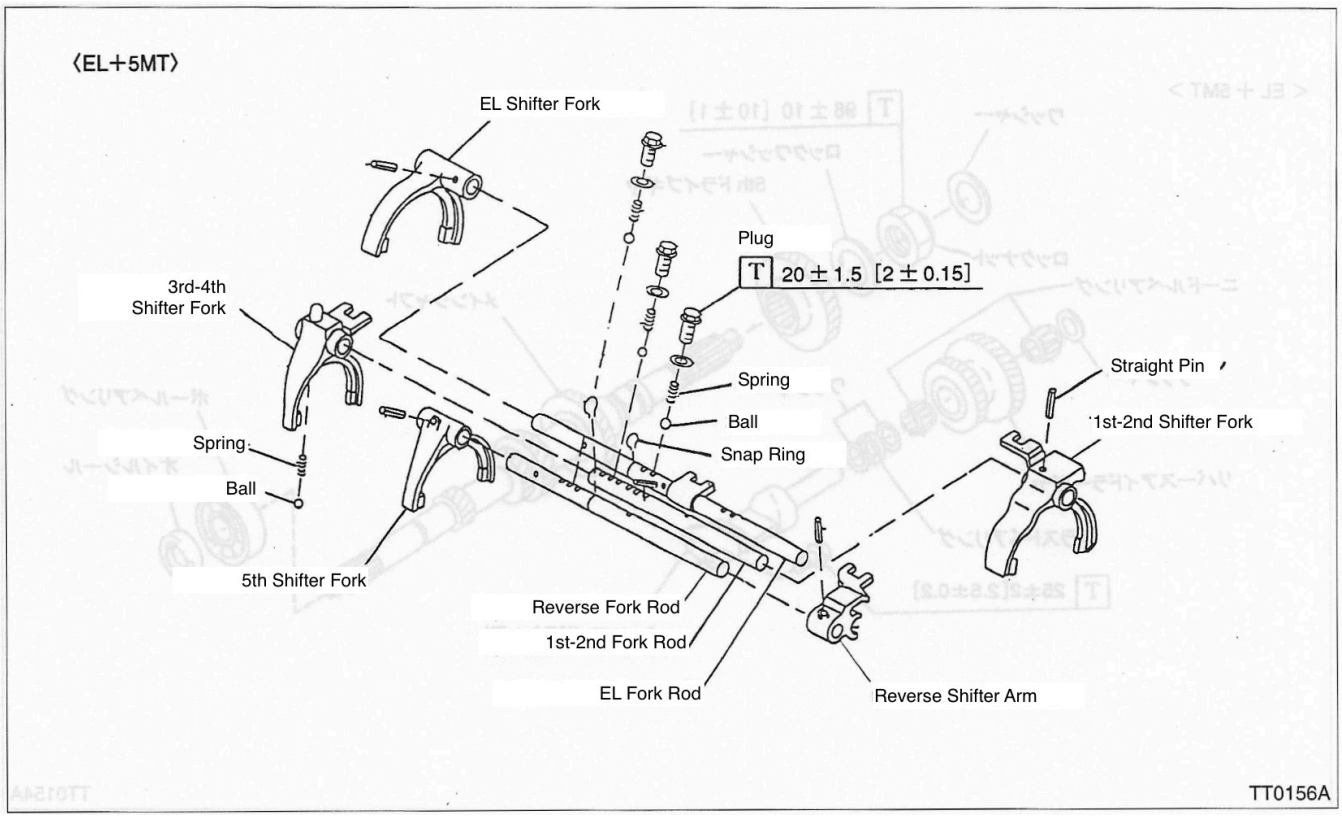
(4) Main Shaft & Reverse Idler Gear



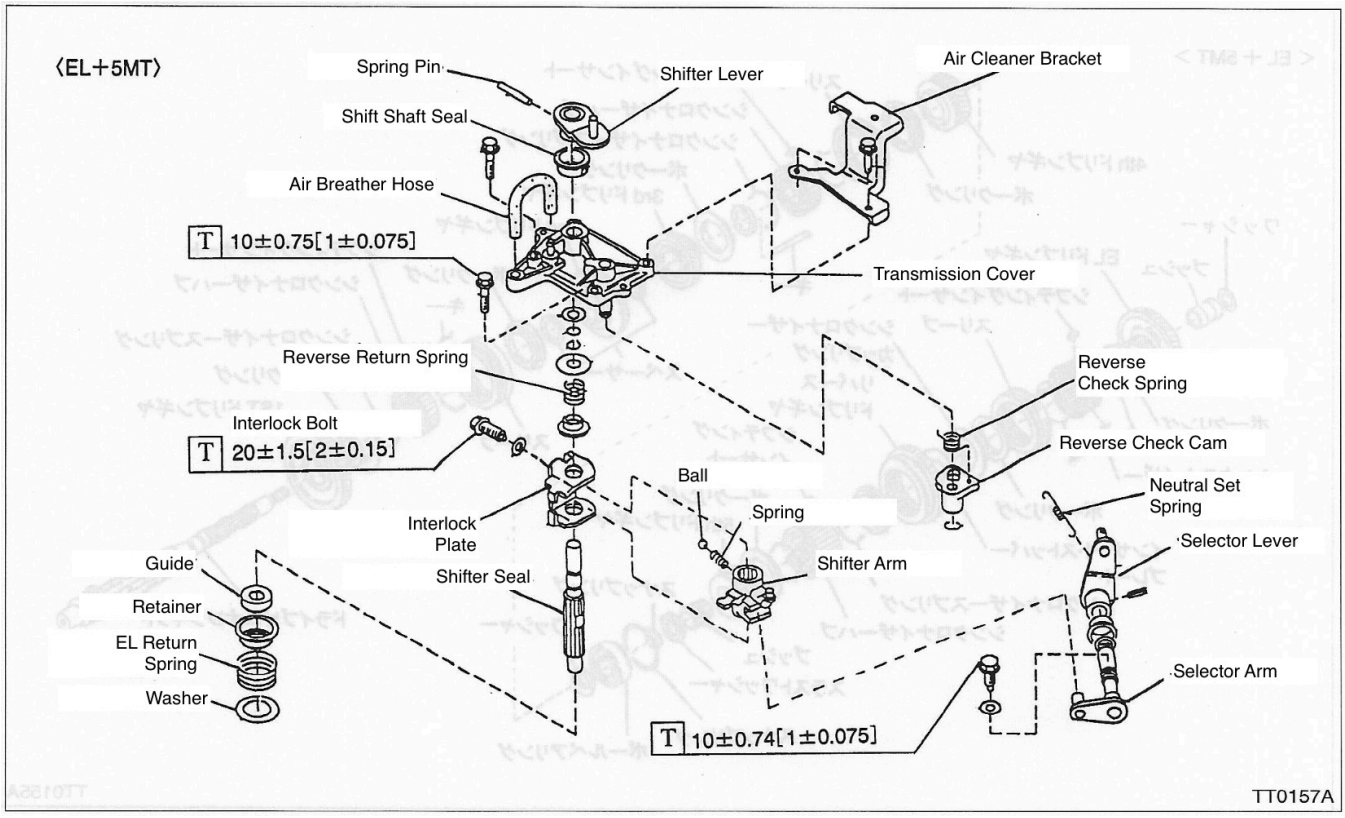
(5) Drive Pinion Shaft



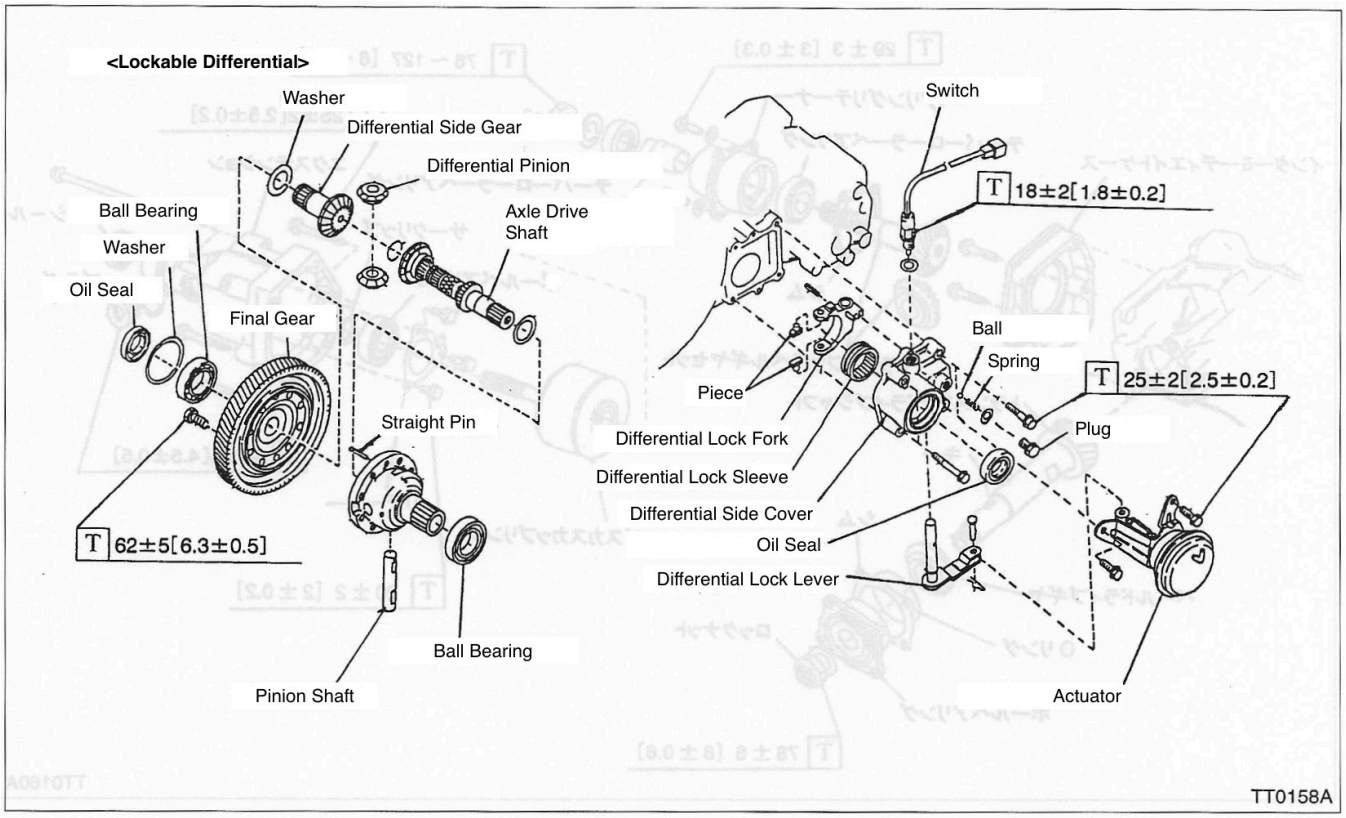
(6) Shifter Fork & Fork Rod



(7) Shifter Lever and Selector Lever

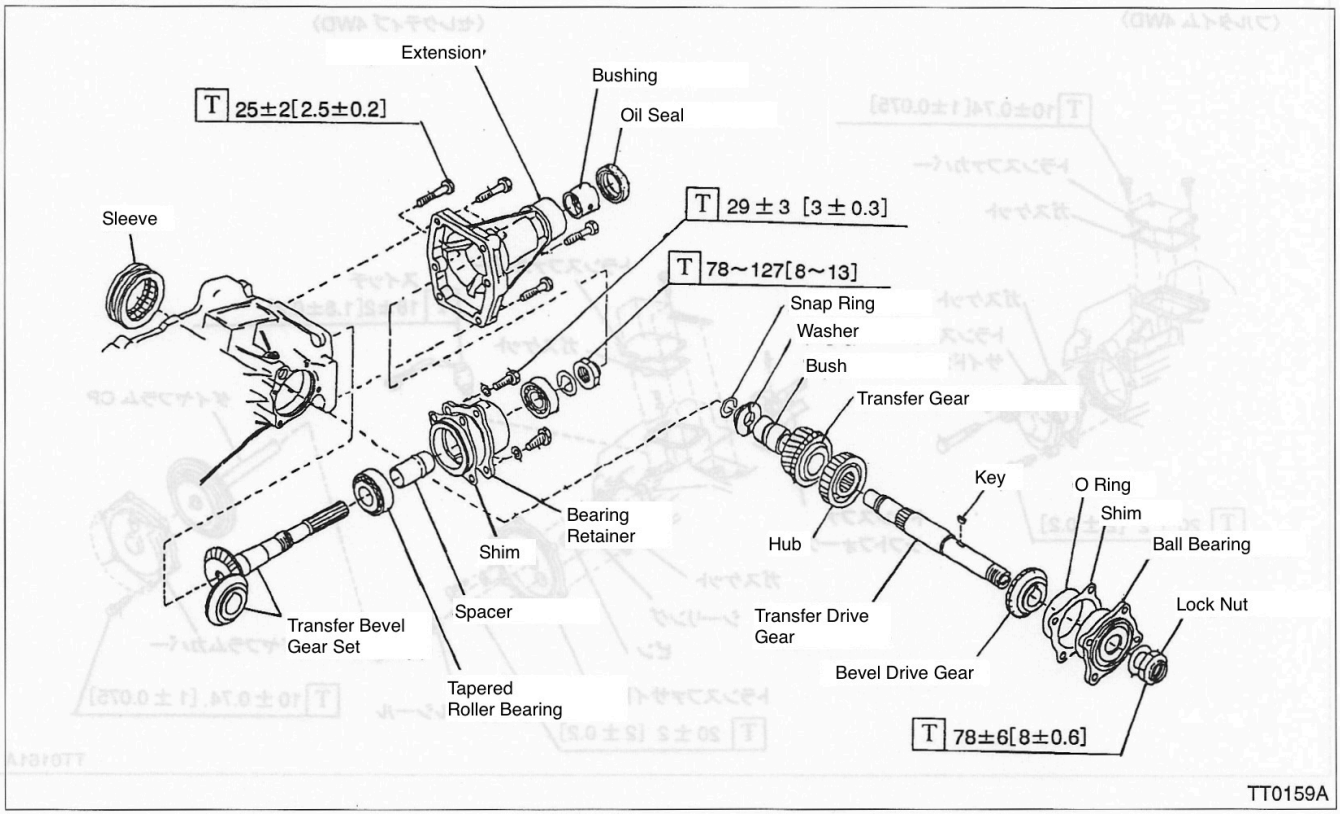


(8) Differential Gear

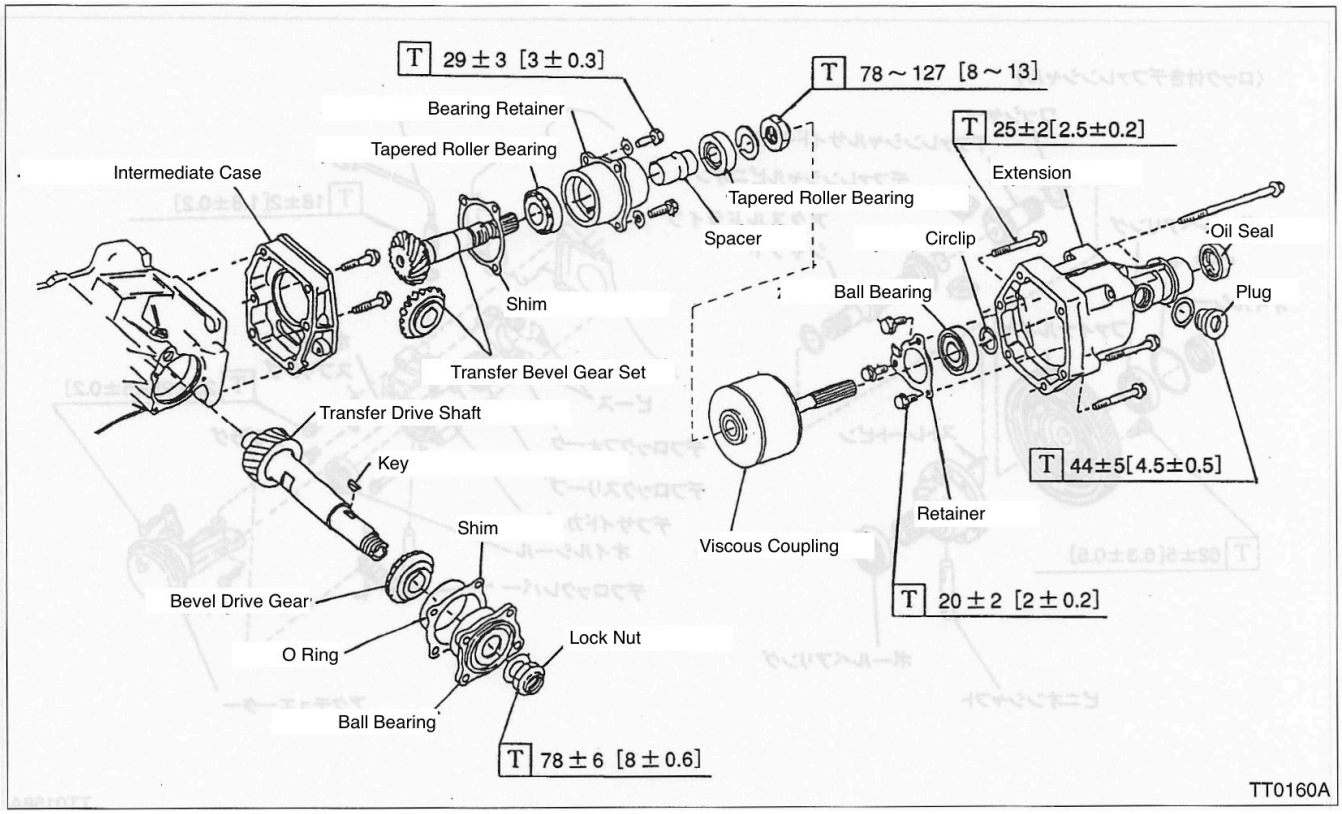


(9) Transfer & Extension

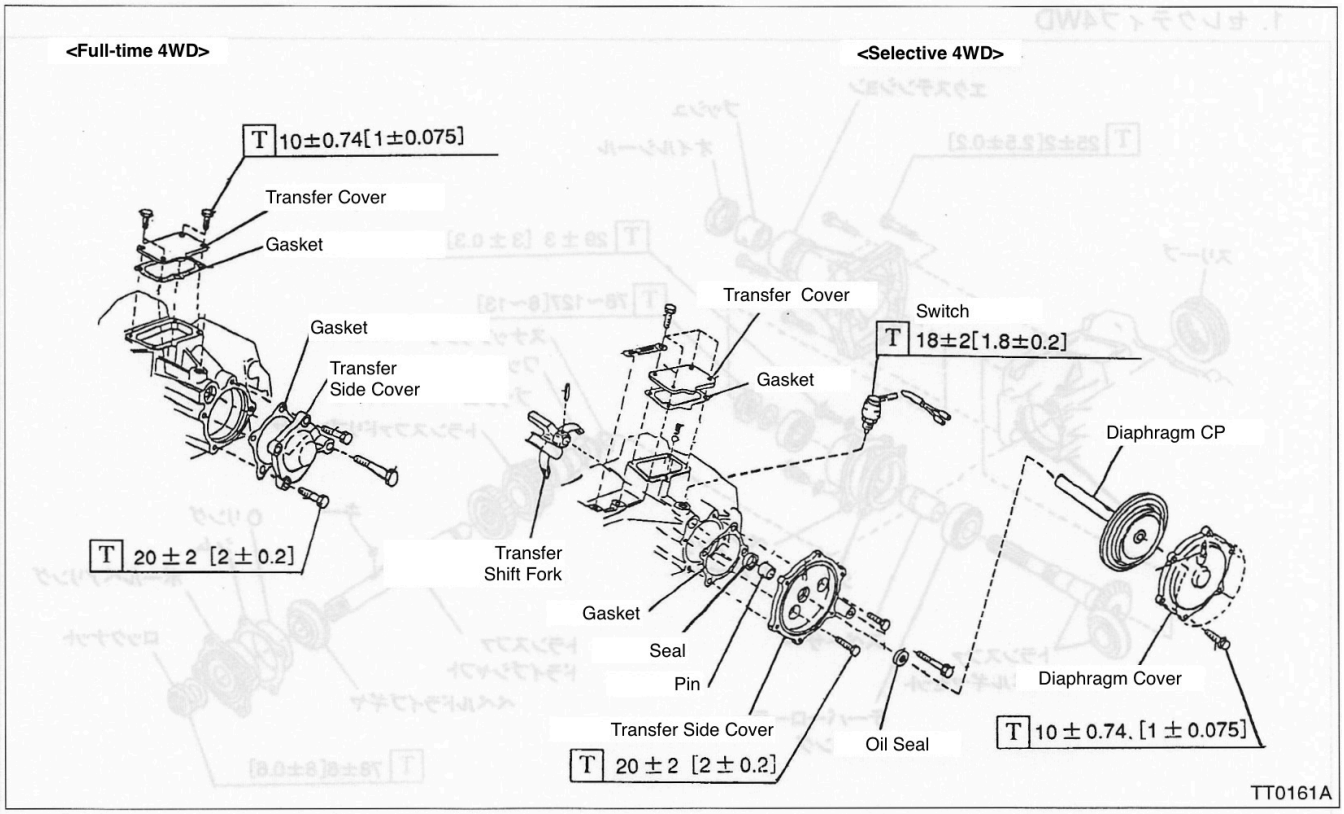
1.Selective 4WD



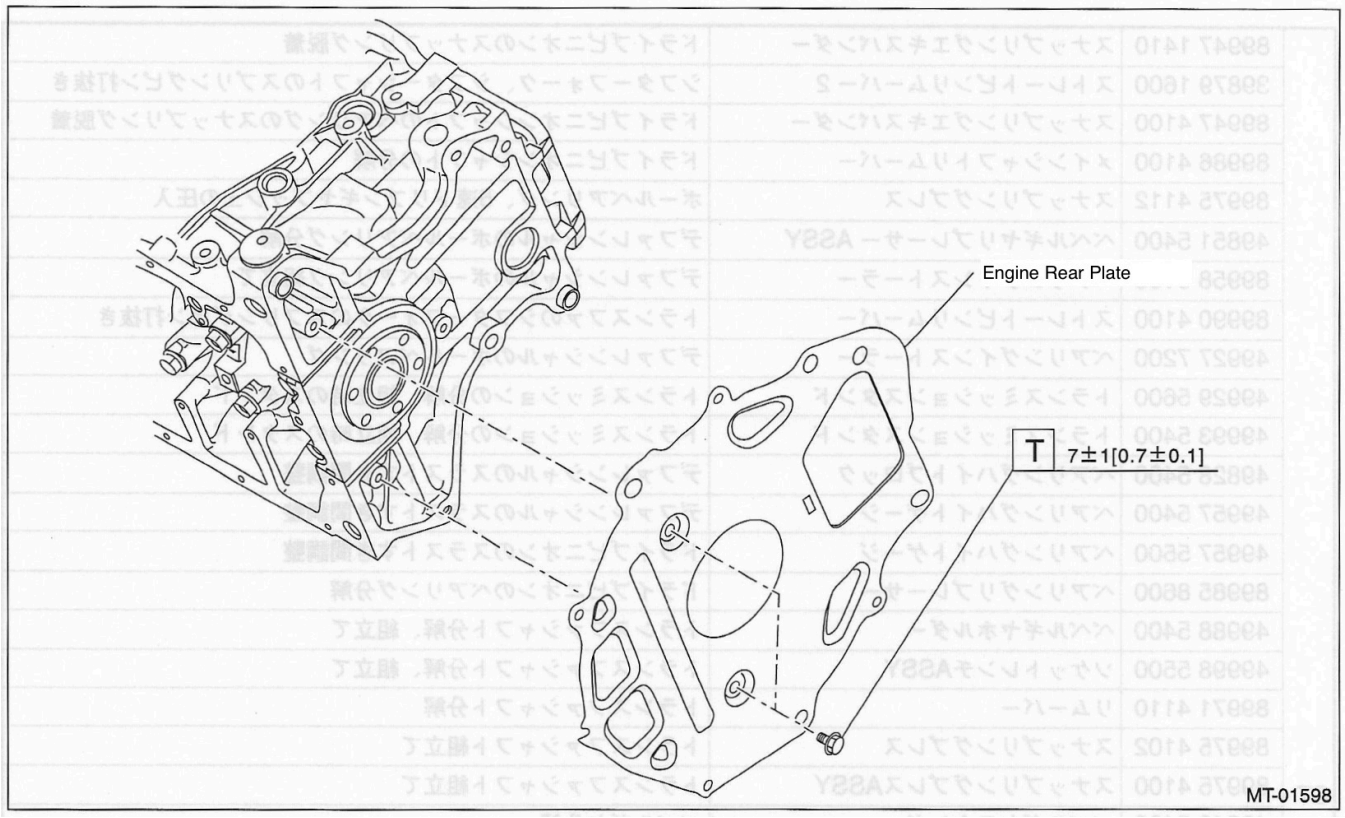
2. Full-time 4WD



3. Transfer Control



(10) Engine Rear Plate



■ Maintenance Preparation Items

Classification	Tool Number	Description	Purpose
ST	89947 1410	Snap ring expander	Drive pinion snap ring removal
	39879 1600	Straight pin remover 2	Punching out spring pins for shifter forks and shifter shafts
	89947 4100	Snap ring expander	Removing and installing the snap ring for the drive pinion shaft
	89986 4100	Main shaft remover	Disassembly of the drive pinion shaft
	89975 4112	Snap ring press	Press-fitting ball bearings and 5-speed driven gear bushings
	49851 5400	Bevel gear replacer assembly	Disassembly of differential ball bearings
	89958 0100	Bearing installer	Differential ball bearing assembly
	89990 4100	Straight pin remover	Punching out the spring pin of the transfer shifter fork
	49927 7200	Bearing installer	Differential ball bearings
	49929 5600	Transmission stand	Stand for disassembling and assembling the transmission
	49993 5400	Transmission stand	Stand for disassembling and assembling the transmission
	49828 5400	Bearing height block	Differential thrust clearance adjustment
	49957 5400	Bearing height gauge	Differential thrust clearance adjustment
	49957 5500	Bearing height gauge	Drive pinion thrust clearance adjustment
	89985 8600	Bearing replacer	Disassembly of drive pinion bearing
	49988 5400	Bevel gear holder	Transfer shaft disassembly and assembly
	49998 5500	Socket wrench assembly	Transfer shaft disassembly and assembly
	89971 4110	Remover	Transfer shaft disassembly
	89975 4102	Snap ring press	Transfer shaft assembly
	89975 4100	Snap ring press assembly	Transfer shaft assembly
	49840 5400	Bevel gear stand	Bevel gear disassembly
	39852 7700	Oil seal outer puller assembly	Bevel gear disassembly
	39847 7701	Drive pinion outer race drift handle	Bevel gear preload adjustment
	39847 7702	Bearing outer race drift	Bevel gear preload adjustment
	49821 5402	Differential carrier stand	Bevel gear preload adjustment
	49850 5402	Bevel gear dummy shaft	Bevel gear preload adjustment
	49850 5700	Bevel gear gauge	Bevel gear height adjustment
	49817 5400	Bevel Gear Bearing Installer	Bevel gear height adjustment
	900 CL	Torque Wrench	Bevel gear assembly
	49825 5400	Magnetic Base Plate	Bevel gear backlash adjustment
	49824 7001	Magnetic Base	Bevel gear backlash adjustment
	49824 7100	Dial Gauge	Bevel gear backlash adjustment
	49992 5400	Handle	Bevel gear tooth contact inspection
	49982 7000	Speedometer oil seal press	Installing the oil seal for the speedometer gear
	39878 1600	Main shaft stopper	Main shaft rotation stopper
	49975 5501	Snap ring guide	For assembling snap ring (outer 56)
	49975 5502	Snap ring press	For assembling snap ring (outer 56)
	49841 5500	Oil shield lift	Press-fitting the extension oil seal
Instruments, Oils, etc		Conforms to TM60 model	

■ Maintenance Instructions

(1) Transmission body (EL+5MT)

<Disassembly>

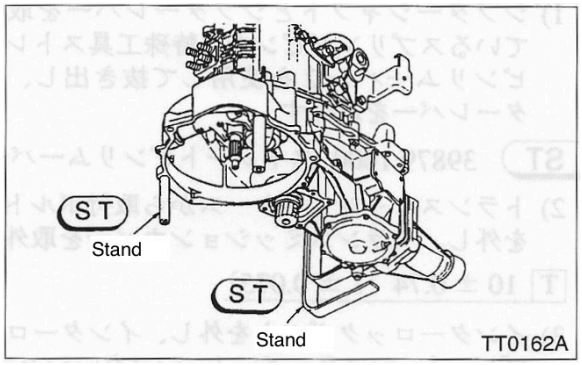
1. Clean any oil, grease, dirt, etc. from the outside of the transmission.
2. Remove the drain plug and drain the oil. After draining, reinstall the drain plug.
   T 34 ± 4 [3.5 ± 0.4]

NOTE

- Use new gaskets.
- Remove any deposits from the drain plug and magnet.

3. Attach the special tool, the transmission stand, to the front mount bracket mounting area and the two engine mounting bolt locations.

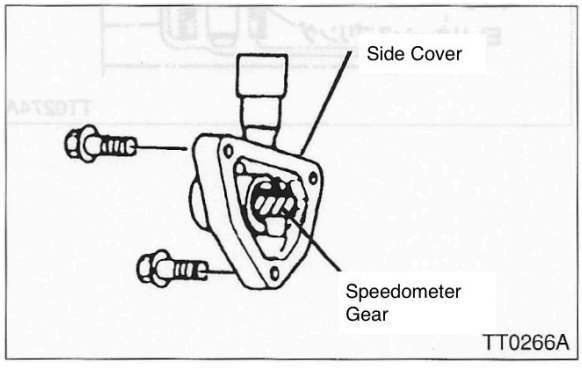
ST 49929 5600 Transmission Stand
49993 5400 Transmission Stand



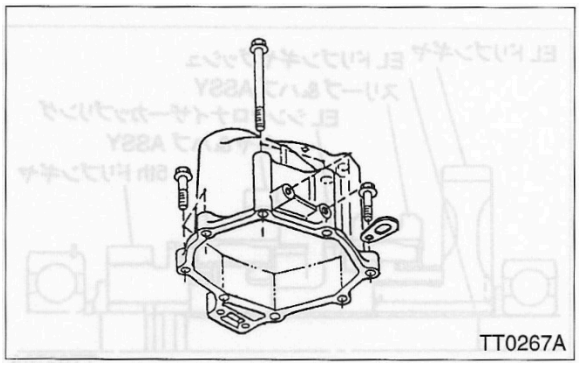
4. Loosen the three mounting bolts and remove the side cover.
   T 10 ± 0.74 [1 ± 0.075]

NOTE

- Please handle with care as it contains a nylon speedometer gear.



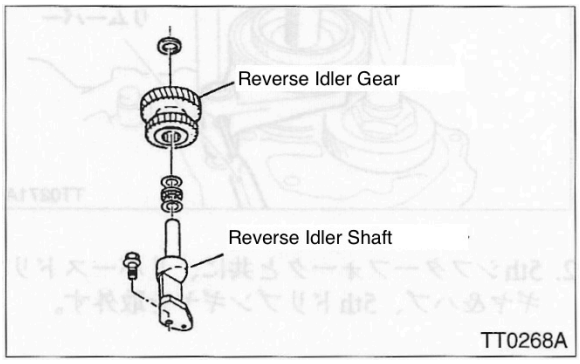
5. Loosen the eight mounting bolts and remove the side case.
   T 25 ± 2 [2.5 ± 0.2]



6. Remove the EL driven gear and EL gear bushing.
7. Remove the reverse idler gear together with the needle bearing, washer and shaft.
   T 25 ± 2 [2.5 ± 0.2]

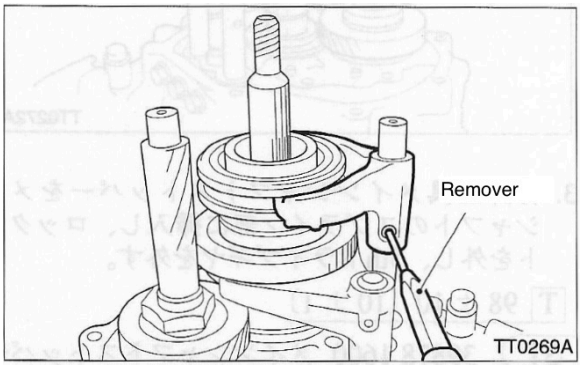
NOTE

- When removing the reverse idler shaft, lift the main shaft 1 to 2 mm to remove it.

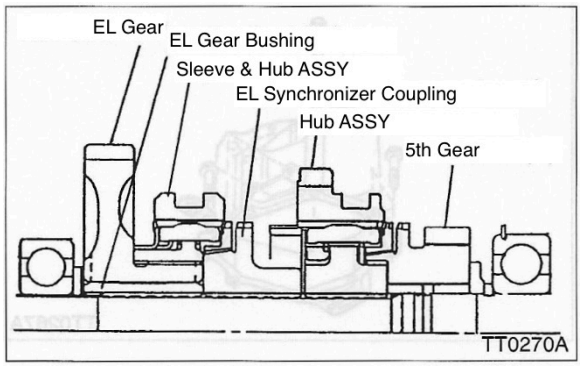


8. Use the special tool, a straight pin remover, to remove the spring pin from the EL shifter fork.

ST 39879 1600 Straight Pin Remover 2

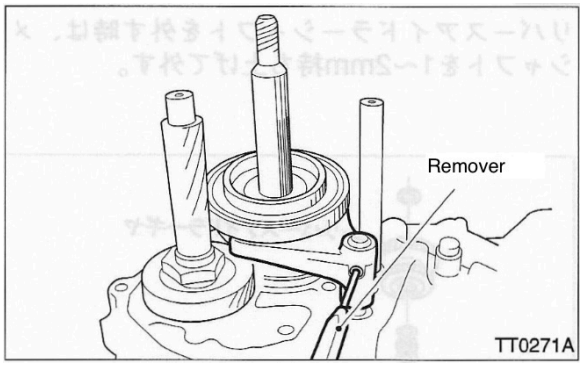


9. Remove the sleeve and hub assembly along with the EL shifter fork.
10. Remove the balk ring and EL synchronizer coupling.

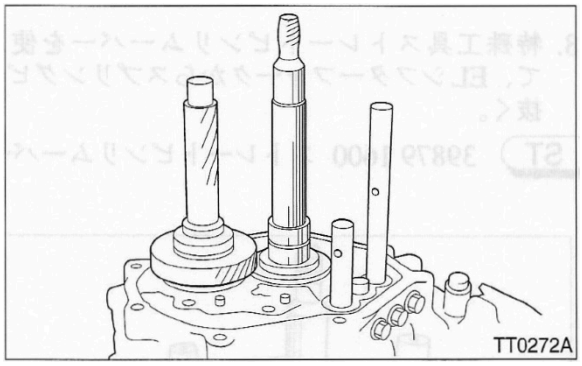


11. Use the special tool, straight pin remover 2, to remove the spring pin from the 5th shifter fork.

S T 39879 1600 Straight Pin Remover 2



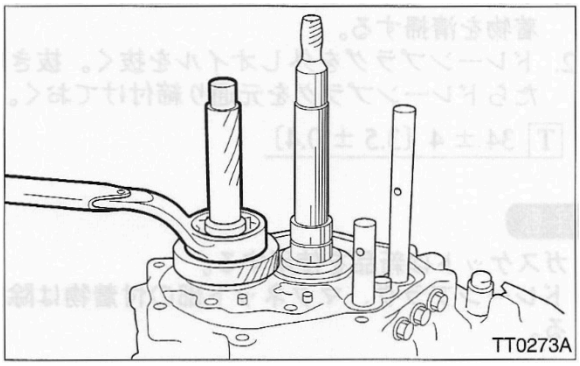
12. Remove the reverse driven gear & hub, 5th driven gear along with the 5th shifter fork.



13. Insert the main shaft stopper special tool into the splined portion of the main shaft, remove the lock nut, and remove the 5th drive gear.
T 98 ± 10 [10 ± 1]

S T 39878 1600 Main shaft stopper

NOTE
• Remove lock nut.



14. Using the special tool snap ring expander, remove the snap ring from the EL fork rod.

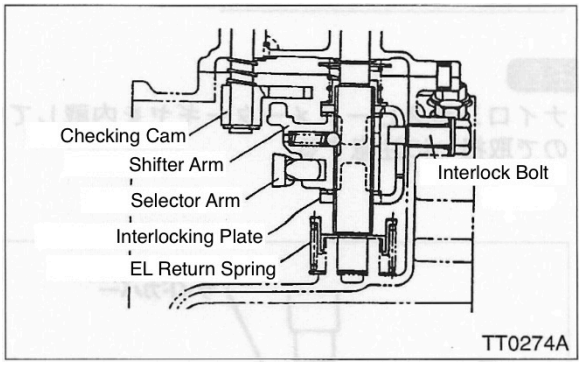
89947 1410 Snap Ring Expander

15. Disassembly of the shift and select mechanism.
1) Use the special tool, straight pin remover 2, to remove the spring pin that attaches the shifter shaft and shifter lever, and then remove the shifter lever.

39879 1600 Straight Pin Remover 2

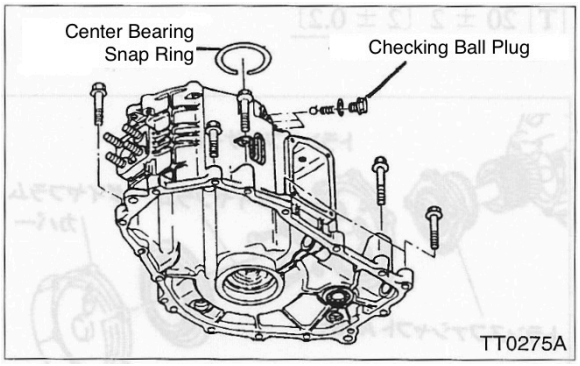
2) Remove the four mounting bolts from the transmission case and remove the transmission cover.
T 10 ± 0.74 [1 ± 0.075]

3) Remove the interlock bolt, and then remove the interlock plate, shifter arm, shifter shaft, and EL return spring.



16.Using the special tool snap ring expander, remove the snap ring from the drive pinion center bearing.

S T 89947 4100 Snap Ring Expander



17. Remove the checking ball plug, aluminum gasket, spring, and ball (3 locations).
T 20 ± 1.5 [2 ± 0.15]

18.Wrap vinyl tape around the splines of the main shaft and differential bevel gear.
(To prevent damage to the oil seal)

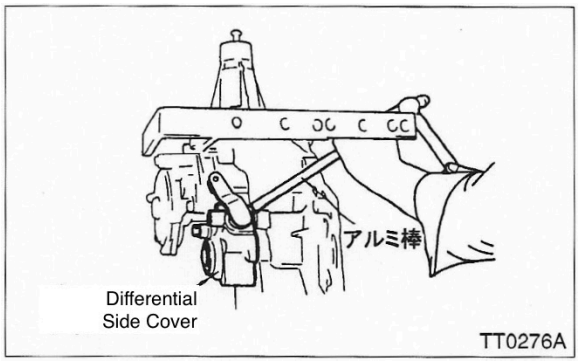
19.Remove the 13 mounting bolts and separate the transmission case and clutch housing.

NOTE
• Do not pry the case joints with a screwdriver or other tool.

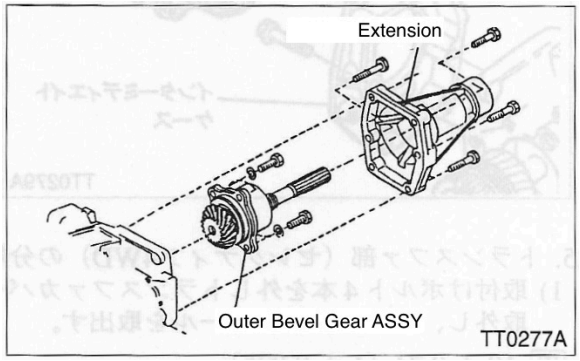
20.Remove the EL fork rod from the clutch housing, and remove the drive pinion, main shaft, and two fork rods together.

21.Remove the differential assembly from the clutch housing.

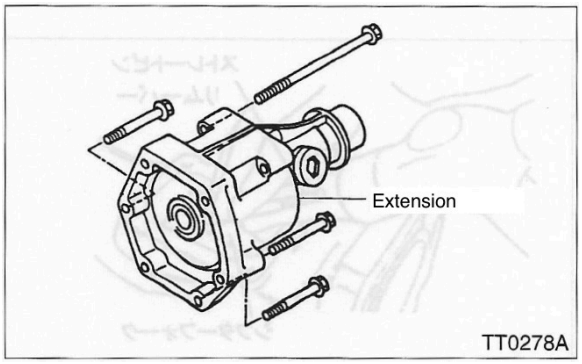
22.Removing the differential side cover (MT with differential lock). Remove the four mounting bolts and Remove the door cover.
T 25 ± 2 [2.5 ± 0.2]



23.Remove the extension (selective 4WD).
1)Remove the six mounting bolts and remove the extension.
T 25 ± 2 [2.5 ± 0.2]
2)Remove the four mounting bolts and remove the bevel gear assembly,
T 29 ± 3 [3 ± 0.3]

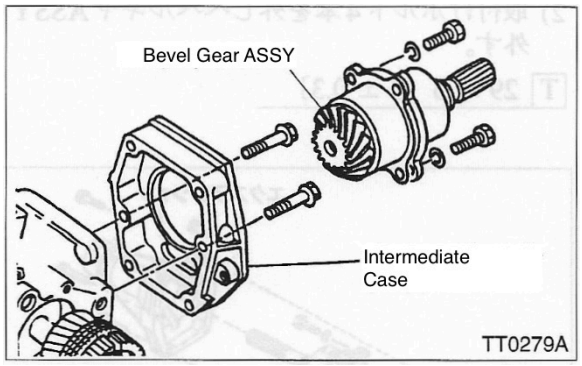


24.Remove extension (full-time 4WD).
1)Remove the six mounting bolts and remove the extension.
T 25 ± 2 [2.5 ± 0.2]



2)Remove the two mounting bolts and remove the intermediate case.
T 25 ± 2 [2.5 ± 0.2]

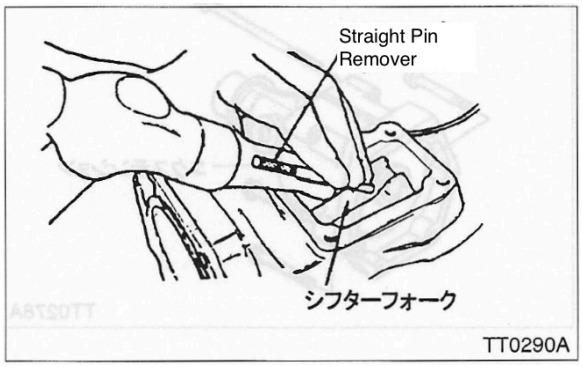
3) Remove the four mounting bolts and remove the bevel gear assembly.
T 30 ± 3 [3 ± 0.3]



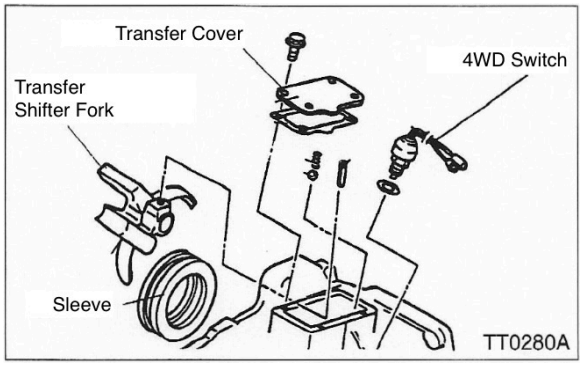
25. Disassembly of transfer case (selective 4WD).
1) Remove the four mounting bolts, remove the transfer cover, and take out the spring and ball.
T 10 ± 0.74 [1 ± 0.075]

2) Use the special tool, a straight pin remover, to remove the spring pin from the transfer shifter fork, and then remove the shifter fork and sleeve from the transfer case.

ST 89990 4100 Straight Pin Remover

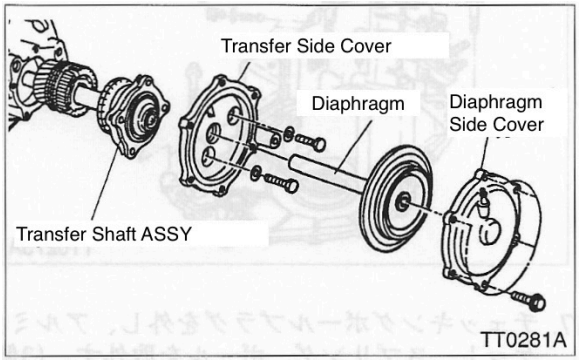


3) Remove the 4WD switch.
T 18 ± 2 [1.8 ± 0.2]

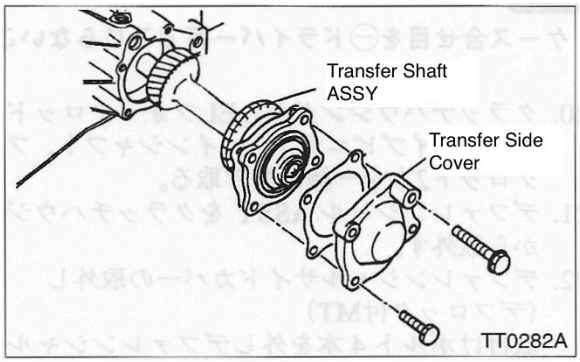


4) Remove the six mounting bolts, remove the diaphragm cover, and then remove the transfer shifter rod and diaphragm CP.
T 10 ± 0.74 [1 ± 0.075]

5) Remove the four mounting bolts and remove the transfer side cover and transfer shaft assembly.
T 20 ± 2 [2 ± 0.2]



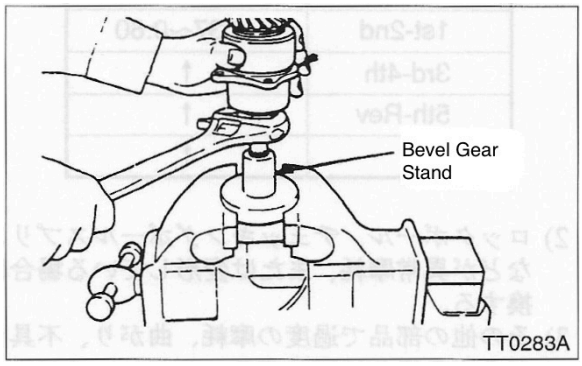
26. Disassembly of the transfer case (full-time 4WD)
1) Remove the four mounting bolts and remove the transfer cover.
2) Remove the four mounting bolts and remove the transfer side cover and transfer shaft assembly.
T 20 ± 2 [2 ± 0.2]



27.Disassembly of the bevel driven gear assembly
1)Use the special tool bevel gear stand to remove the lock nut from the bevel gear assembly.

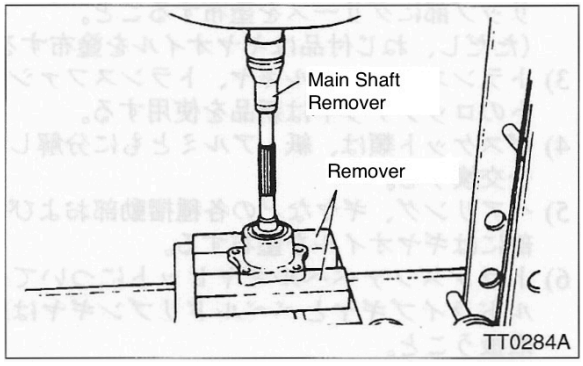
S T 49840 5400 Bevel Gear Stand

NOTE
• Remove the crimp before removing.



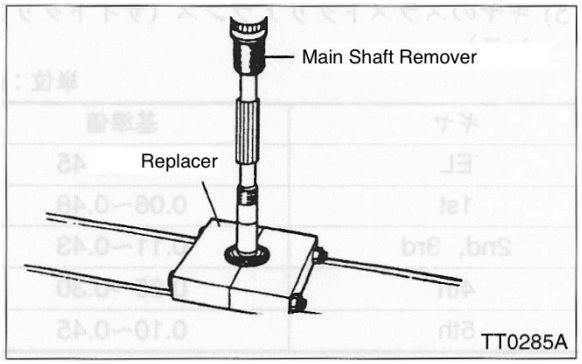
2)Remove the lock washer and use the special tool, main shaft remover, to remove the bevel driven gear from the bearing retainer.

S T 89986 4100 Main shaft remover
89971 4110 Remover



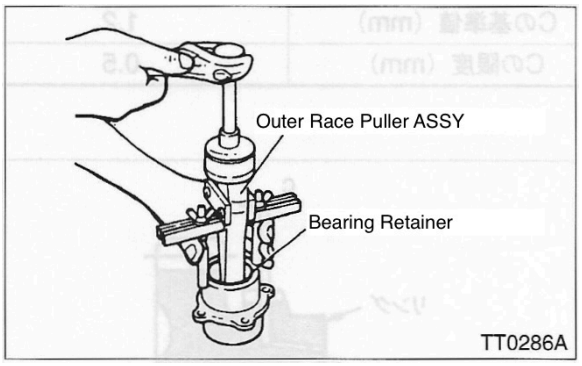
3)Remove the front bearing cone, and use the special tools bevel gear replacer and main shaft remover to remove the rear bearing cone from the bevel driven gear.

S T 49851 5400 Bevel Gear Replacer
89986 4100 Main shaft remover



4)Use the special tool, oil seal outer race puller assembly, to remove the bearing race from the bearing retainer.

S T 39852 7700 Oil Seal Outer Race Puller Assembly



<Inspection>

Disassembled parts should be thoroughly cleaned and inspected.

NOTE
• Never clean the oil seal with gasoline as this will increase the inner diameter of the lip.

1.Gears
1)Replace if the tooth surface is broken, damaged or abnormally worn.
2)If the cone part that contacts the balk ring is seized or damaged, replace it.
3)If the inner surface or end face of the bearing is abnormally worn or damaged, replace it.
4)If there is abnormal wear or damage on the end faces of spacers, replace them.

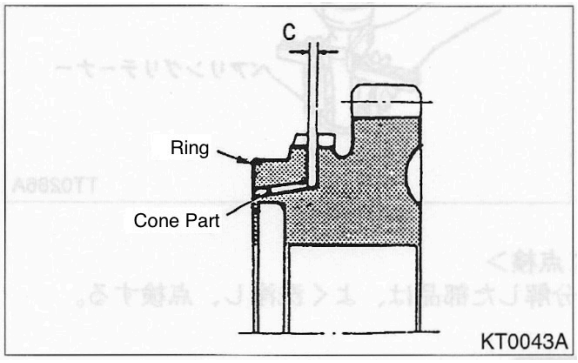
5) Gear thrust clearance (side clearance).

Unit: mm

Gear	Reference Value
EL	0.10~0.45
1st	0.06~0.48
2nd & 3rd	0.11~0.43
4th	0.05~0.30
5th	0.10~0.45

2. Baulk Ring
   1) If the inner surface or tooth surface of the ring is damaged or abnormally worn, replace it.
   2) When the ring is pressed against the cone, measure the clearance C between the surfaces where the ring and cone face each other.

C Reference Value (mm)	1.2
C Limit (mm)	0.5



   3) If the contact surface with the shifting insert is abnormally worn, replace it.
3. Shifting insert
   • Replace if there is excessive wear or other defects.
4. Differential
   1) Replace the final gear and drive pinion if there is damage or excessive wear on the tooth surface.
   2) If there is excessive wear on the needle bearing rolling surface of the drive pinion shaft or the hexagonal spline gear sliding surface, replace them.
   3) Replace the differential pinion, differential bevel gear, washer (27.1 x 42 x 1), and pinion shaft if they are damaged, worn, or seized.
   4) If the differential case is cracked or has any other problems, replace it.
5. Bearings
   • Replace if there is seizure, wear, abnormal noise, or uneven rotation.
   • In addition, to check for abnormal noises or uneven rotation, apply gear oil and rotate the gear.
6. Oil seals
   • Replace the oil seal if the lip is deformed, hardened, or worn.
   • Replace the oil seal if the outer periphery is damaged.
7. Gear shift mechanism
   1) Clearance between the shifter fork and the groove of the coupling sleeve.

Unit: mm

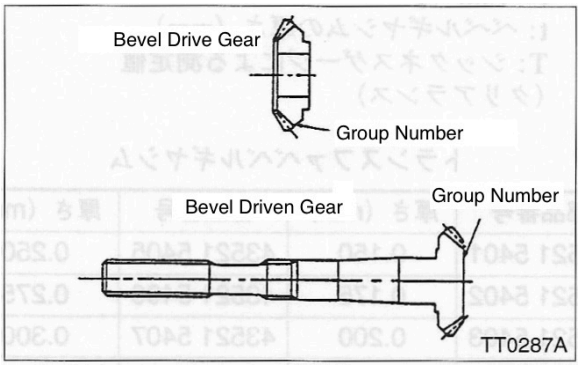
	Standard Value
1st-2nd	0.37~0.60
3rd-4th	↑
5th-Rev	↑
EL	↑

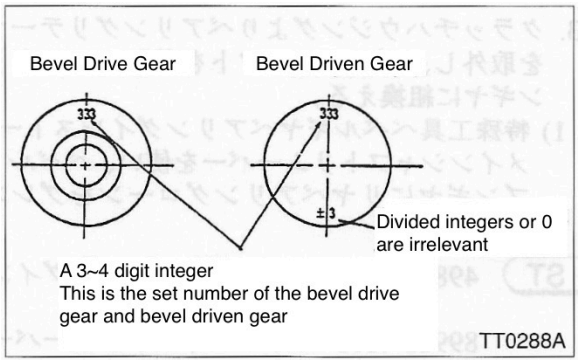
   2) If the lock ball, checking ball spring, etc. are abnormally worn or deformed, replace them.
   3) Replace any other parts that are excessively worn, bent, or defective.

<Assembly/Adjustment>

1. Precautions when assembling
   1) If oil seals are removed from the extension, speedometer gear, gear shift, main shaft, or differential, replace them with new ones.
   2) When replacing or cleaning any oil seal, apply grease to the lip.(However, apply gear oil to threaded items.)
   3) Use new lock nuts for the transfer bevel gear and transfer shaft.
   4) Gaskets, both paper and aluminum, should be replaced if disassembled.
   5) Apply gear oil to various sliding parts such as bearings and gears, as well as press-fit parts.
   6) Regarding transfer bevel gear sets, the bevel drive gear and bevel driven gear must be handled as a set.

7) Tightening torque is expressed in T N・m [kg・m].

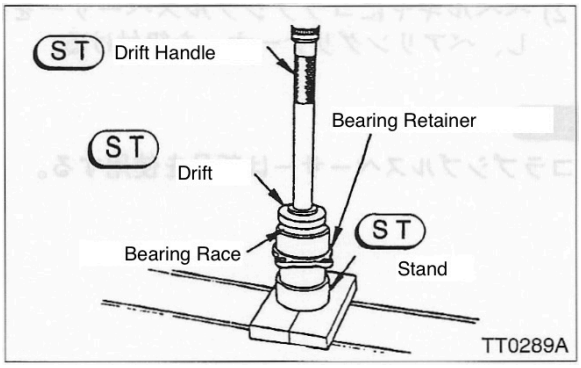




2. Bevel gear height adjustment

1) Use the special tools: drive pinion outer race drift handle, bearing outer race drift, and differential carrier stand to press fit the front and rear bearing races into the bearing retainers.

ST 39847 7701 Drive Pinion Outer Race Drift Handle
39847 7702 Bearing Outer Race Drift
49821 5402 Differential Carrier Stand

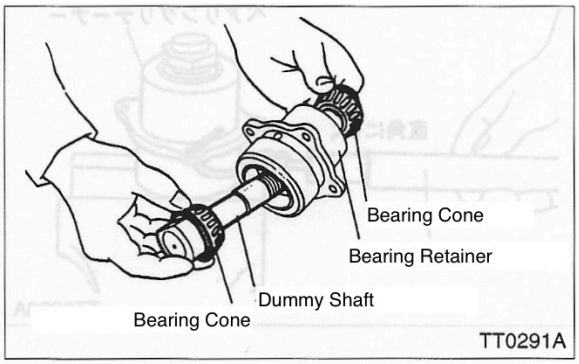


2) Place the rear bearing cone, bearing retainer, front bearing cone, and lock washer onto the special bevel gear dummy shaft, and loosely tighten the lock nut (just by hand).

ST 49850 5402 Bevel Gear Dummy Shaft

NOTE

- Apply a sufficient amount of gear oil to the bearings.
- Spacers are not installed.
- Use new lock nuts.

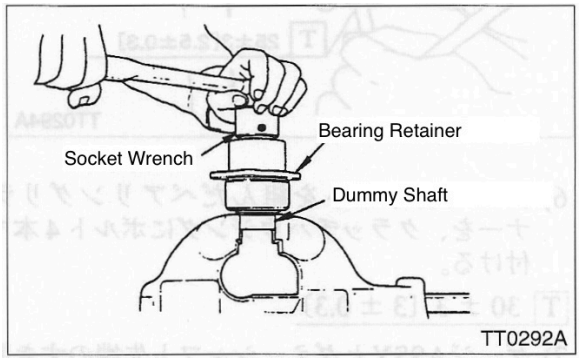


3) Use the special tool socket wrench to tighten until the correct preload is achieved.

ST 49998 5500 Socket wrench

NOTE

- Do not tighten in one go. Tighten in two or three steps while checking item 4).
- Be careful not to apply too much preload, and do not tighten the dummy shaft so much that it cannot be turned by hand, as this will damage the bearings.

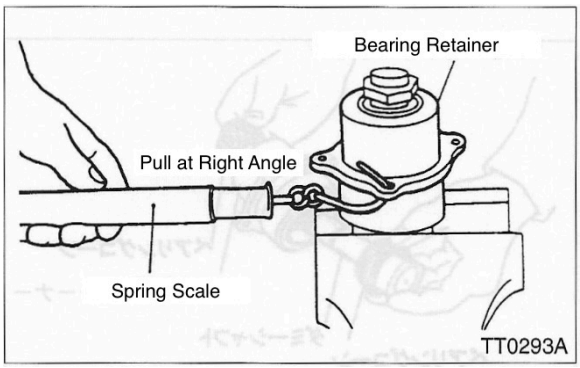


4) Bearing preload measurement

- Place a spring balance on the bolt hole of the bearing retainer and read the load when it starts to move.

Load	**N [kg]**	9.3~19.6 [0.95~2.0]
Starting Torque	**N・cm [kg・cm]**	39~78 [4.0~8.0]

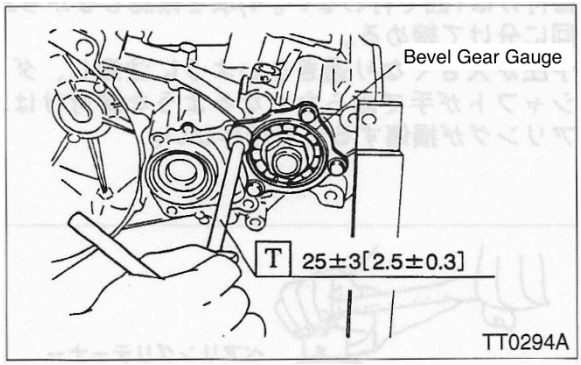
NOTE
• Turn the bearing retainer several times before measuring.



5) Insert the special tool, bevel gear gauge assembly, into the transfer shaft hole in the clutch housing and tighten it with the four bolts.

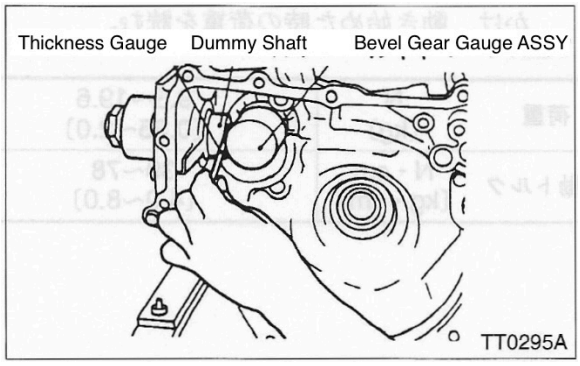
S T 49850 5700 Bevel Gear Gauge ASSY

T 25 ± 3 [2.5 ± 0.3]



6) Tighten the bearing retainer with the dummy shaft to the clutch housing with four bolts.
T 30 ± 3 [3 ± 0.3]

7) Measure the gap between the gauge assembly and the end of the dummy shaft with a thickness gauge.



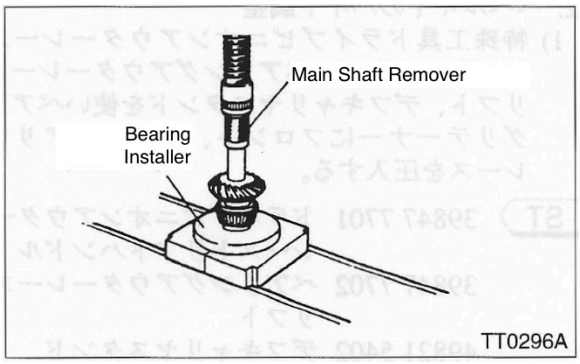
Calculate the bevel gear shim thickness using the following formula and select the shim from the following table.
t=1.00-T
t: Bevel gear shim thickness (mm)
T: Thickness gauge measurement (clearance)

✻ Transfer Bevel Gear Shim

Part Number	Thickness (mm)	Part Number	Thickness (mm)
43521 5401	0.150	43521 5405	0.250
43521 5402	0.175	43521 5406	0.275
43521 5403	0.200	43521 5407	0.300
43521 5404	0.225	43521 5408	0.500

3. Remove the bearing retainer from the clutch housing, remove the dummy shaft and replace it with the bevel driven gear.
1) Using the special tools bevel gear bearing installer and main shaft remover, press the rear bearing cone into the bevel driving gear.

S T 49817 5400 Bevel Gear Bearing Installer
89986 4100 Main Shaft Remover

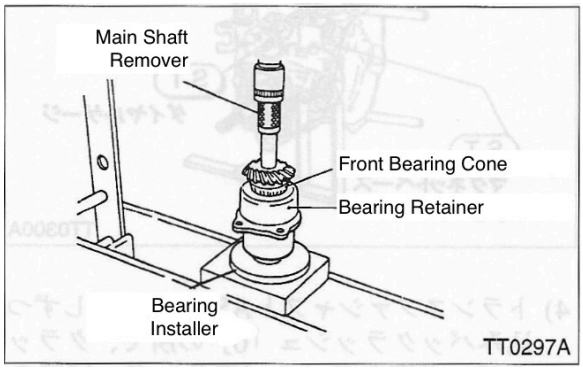


2) Insert the collapsible spacer into the bevel gear and assemble the pairing retainer.

NOTE
• Use new collapsible spacers.

3) Use the special tools, bevel gear bearing installer and main shaft remover, to press in the front bearing cone.

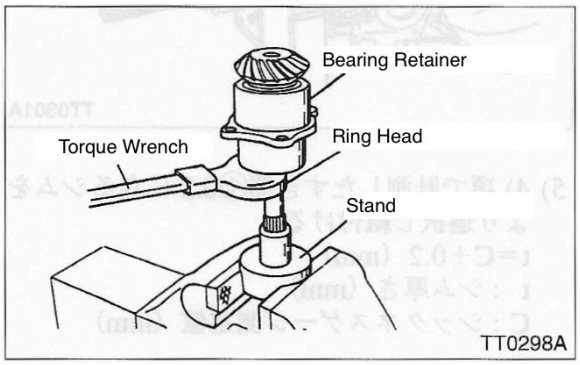
S T 49817 5400 Bevel Gear Bearing Installer
89986 4100 Main shaft remover



NOTE
• Apply gear oil to the bearings.

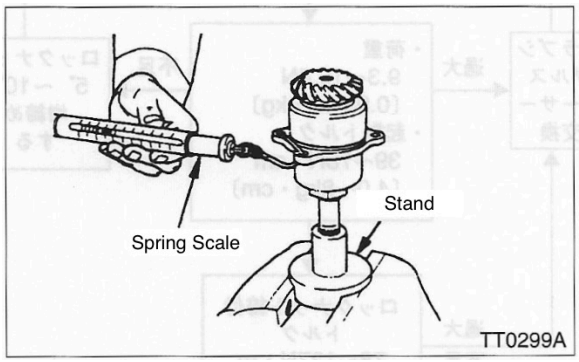
4) Insert the lock washer and tighten the lock nut using the special tool, bevel gear stand.

S T 49840 5400 Bevel Gear Stand

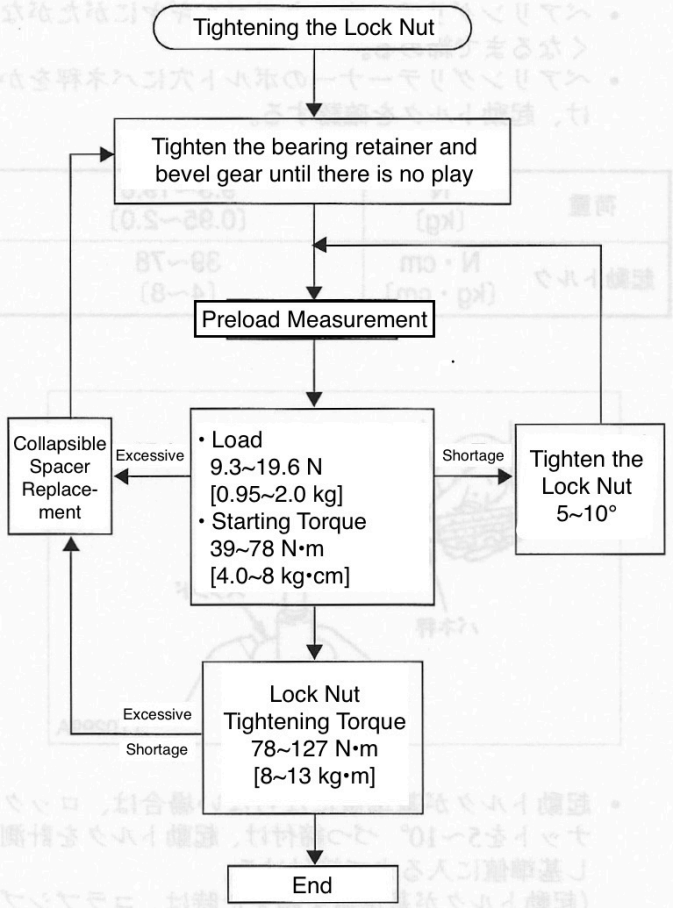


Lock nut tightening procedure (bearing preload adjustment)
• Tighten the bearing retainer and bevel gear until there is no play.
• Place a spring balance on the bolt hole of the bearing retainer and check the starting torque.

Load	**N [kg]**	9.3~19.6 [0.95~2.0]
Starting Torque	**N · cm [kg · cm]**	39~78 [4~8]



• If the starting torque does not reach the standard value, tighten the lock nut in 5 to 10 degree increments, measure the starting torque, and continue tightening until it reaches the standard value.
(If the starting torque exceeds the standard value, replace the collapsible spacer.)
• Repeat until the lock nut tightening torque reaches the specified value and the preload value reaches the specified value.
T 78~127 [8~13]



NOTE
- Do not make any adjustments that loosen the lock nut.

5) Tighten the lock nuts in two places.

4. Selection of bevel gear backlash adjustment shims

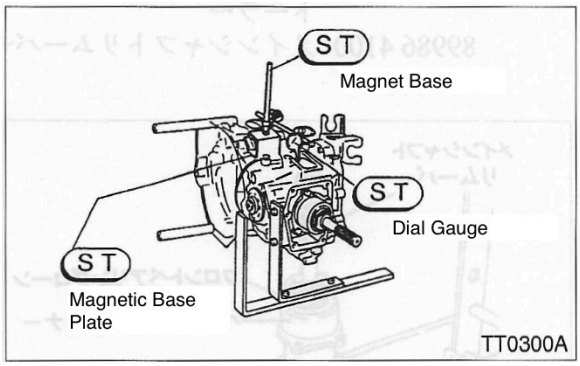
1) Assemble the transfer shaft assembly to the clutch housing.

NOTE
- Do not assemble shims or rings.
- Leave a gap of several mm between the clutch housing surface and the ball bearing flange surface.

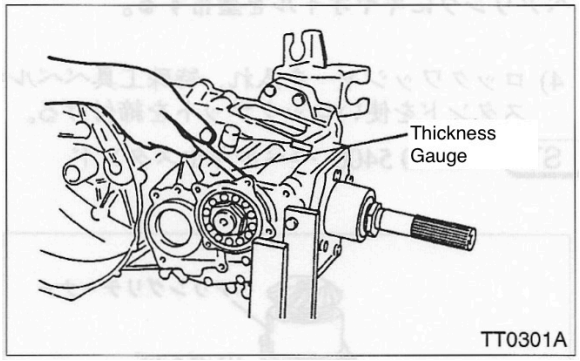
2) Place the bevel gear shim selected in 2-7) into the bevel driven gear assembly and assemble it to the clutch housing.
T 30 ± 3 [3 ± 0.3]

3) Attach the special tool magnet base plate to the clutch housing, and set the dial gauge and magnet base in place.

ST 49825 5400 Magnetic Base Plate
49824 7001 Magnetic base
49824 7100 Dial Gauge



4) Push the transfer shaft assembly in little by little until the backlash is "0", then use a thickness gauge to measure the clearance between the clutch housing surface and the ball bearing flange.



5) Select and assemble the shim from the table below that will make the gap measured in step 4 + 0.2.
t=C+0.2 (mm)
t: Shim thickness (mm)
C: Thickness gauge measurement (mm)

Part Number	Thickness (mm)	Part Number	Thickness (mm)
84196 8601	0.150	84196 8605	0.500
84196 8602	0.200	84196 8606	0.175
84196 8603	0.250	84196 8607	0.225
84196 8604	0.300	84196 8608	0.275

T 29 ± 3 [3 ± 0.3]

6) Hold the transfer shaft assembly and move the bevel driven gear to measure the backlash.

Reference Backlash (mm)	0.1~0.15

NOTE
• If the backlash is outside the standard value, reselect the shim.

7) Remove the bevel driven gear assembly and transfer shaft assembly, insert the shim and O-ring into the shaft assembly, and install it into the clutch housing.
T 20 ± 3 [2 ± 0.3]

NOTE
• Use a new ring.

8) Install the bevel driven gear assembly together with the shim into the clutch housing.
T 29 ± 3 [3 ± 0.3]

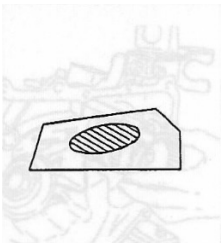
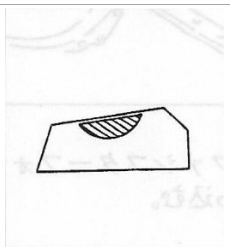
NOTE
• Apply oil to the bearings.
• Apply a thin, uniform coat of grease to the tooth surface of the bevel gear (to check tooth contact).

5. Bevel gear tooth contact inspection
1) Use the special tool socket wrench ASSY to attach the lock nut of the transfer shaft ASSY and tighten it with the screw so that there is no play.

ST 49998 5500 Socket Wrench Assembly

2) Hold the bevel driven gear spline with a cloth, etc., and attach the special tool handle to the socket wrench. Turn it several times to check the tooth contact.

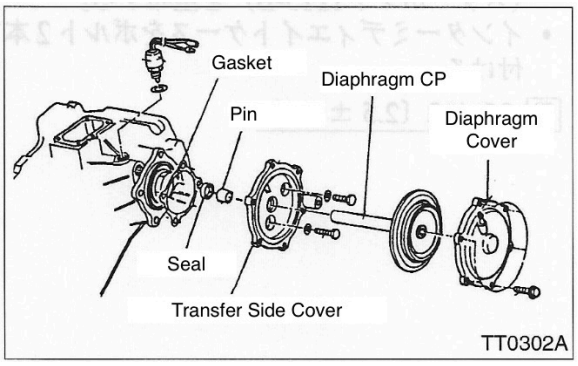
ST 49992 5400 Handle

Bevel Driven Gear Tooth Contact (Driver Side Shown)		
Inspection	**Situation**	**Adjustment**
Correct tooth contact		
Face Contact (tooth tip contact) Occurs when the ship (bevel gear height) is thin or the backlash is large		Replace the shim (bevel gear height) with a thicker one, and replace the shim (drive pinion) with a thinner one.
Flank contact (Root contact) Occurs when the ship (bevel gear height) is thick or the backlash is small		Replace the shim (bevel gear, height) with a thinner one, and replace the shim (drive pinion) with a thicker one.
With a bevel driven gear, the convex side is the drive side and the concave side is the coast side		

3) If the backlash and tooth contact are not correct, readjust them.

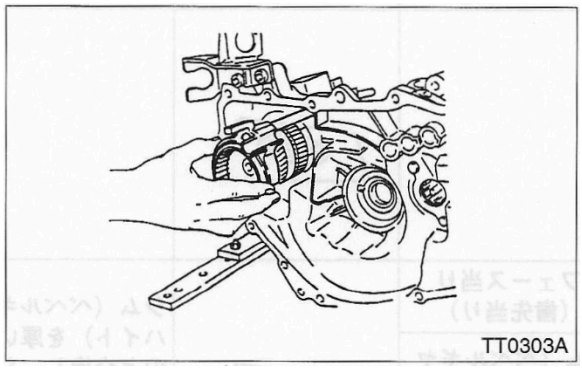
6. Transfer shaft assembly
1) Install the gasket, then install the transfer side cover together with the sealing and pin using the bolts that fasten the bearing together.
T 20 ± 2 [2 ± 0.2]

2) Install the transfer shifter rod and diaphragm CP.
3) Install the diaphragm cover with the six bolts.
T 10 ± 0.74 [1 ± 0.075]



4) Install the 4WD switch.
T 18 ± 2 [1.8 ± 0.2]

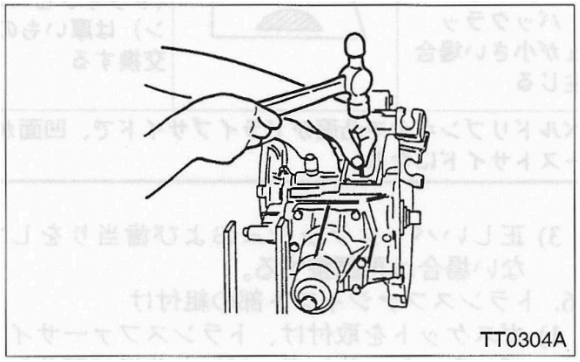
5) Assemble the sleeve onto the transfer shifter fork and then assemble it to the shifter rod and hub.



6) Drive the spring pin into the transfer shifter fork.

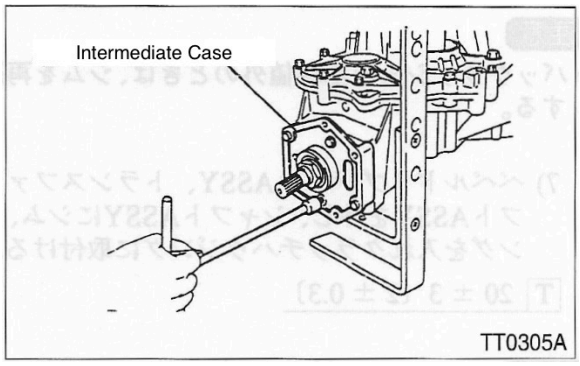
NOTE

• Use a new spring pin.



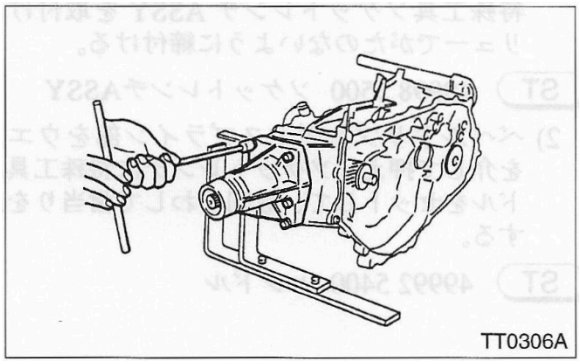
7) Assemble the checking ball and spring, then install the gasket and transfer cover.
T 10 ± 0.74 [1 ± 0.075]

7. Installing the extension case
1) Full-time 4WD
• Degrease the mating surfaces of the clutch housing and intermediate case, then apply a liquid gasket (ThreeBond 1215-B).
• Assemble the intermediate case with two bolts.
T 25 ± 2 [2.5 ± 0.2]



• Degrease the mating surfaces of the intermediate case and extension case, then apply liquid gasket (ThreeBond 1215-B).
• Attach the extension case and viscous coupling with six bolts.
T 25 ± 2 [2.5 ± 0.2]

2) Selective 4WD
• Degrease the mating surfaces of the extension and clutch housing, then apply a liquid gasket (Threebond 1215-B).
• Attach the extension with six bolts.
T 25 ± 2 [2.5 ± 0.2]



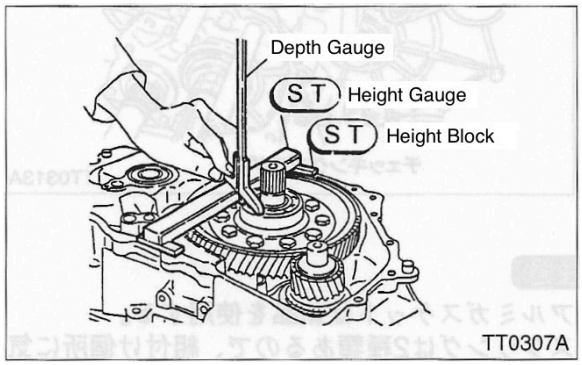
8. Assembly of the differential assembly
1) Assemble the differential assembly to the clutch housing.

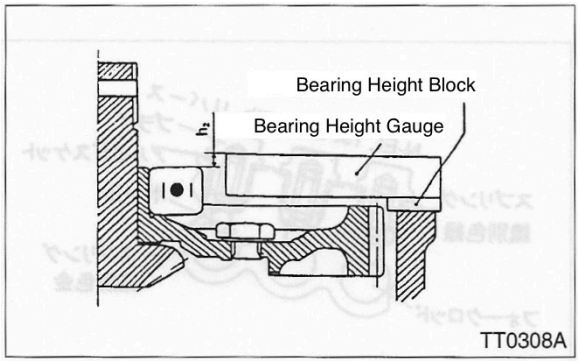
NOTE

• Wrap vinyl tape around the spline part of the differential side gear.
• Assemble taking care not to turn over the lip of the oil seal.

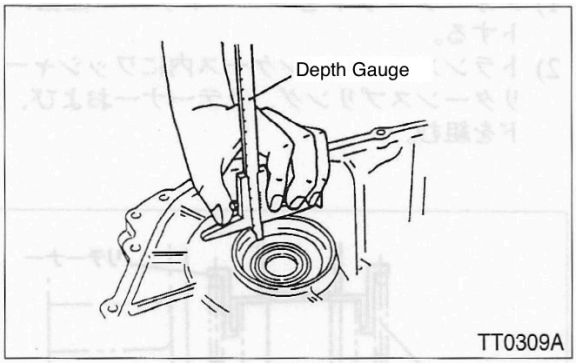
2) Adjust the thrust clearance of the differential assembly.
- Place the special tool, bearing height block, on the mating surface with the main case, place the special tool, bearing height gauge, on top, and measure the depth (h2) of the ball bearing outer ring with a depth gauge.

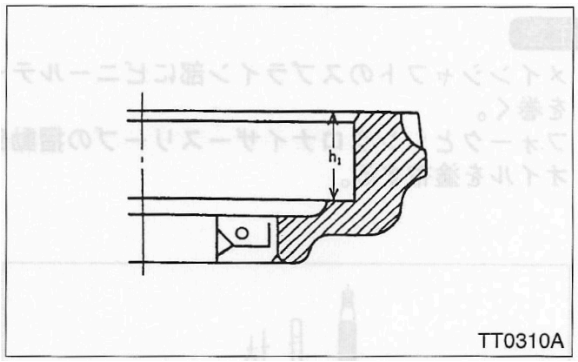
ST 49828 5400 Bearing Height Block
49957 5400 Bearing Height Gauge





- Measure the depth (h1) of the ball bearing part of the main case.





- Calculate using the following formula, select a washer, and adjust the gap to 0~0.2.
  $C = h_1 (20.5\text{-}h2)$
  C = Thrust clearance (0~0.2)
  h_1 = Main case side depth
  h_2 = bearing outer ring height

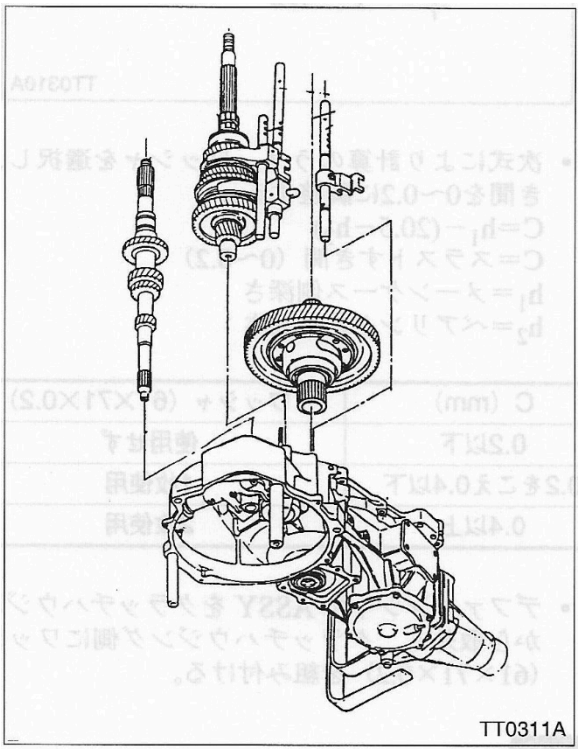
C (mm)	Washer (61x71x0.2)
0.2 or less	Not used
Over 0.2 and 0.4 or less	1 piece used
Over 0.4	2 pieces used

- Remove the differential assembly from the clutch housing and install a washer (61 x 71 x 0.2) on the clutch housing side.

NOTE
- Wrap vinyl tape around the spline and assemble carefully to prevent the lip of the oil seal from curling up.

9. Assemble the main shaft and drive pinion shaft assembly together with the 1st-2nd fork rod and 5th-reverse fork rod.

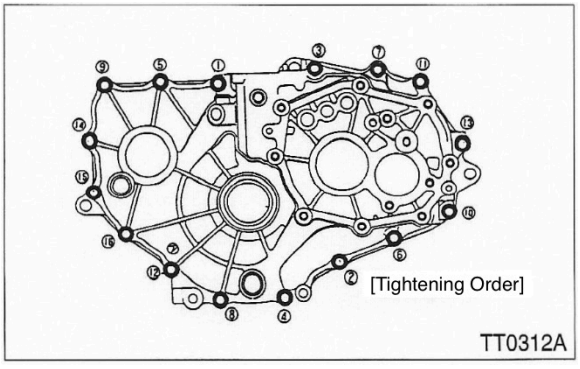
NOTE
- Wrap vinyl tape around the spline part of the main shaft.
- Apply oil to the sliding parts of the fork and synchronizer sleeve.



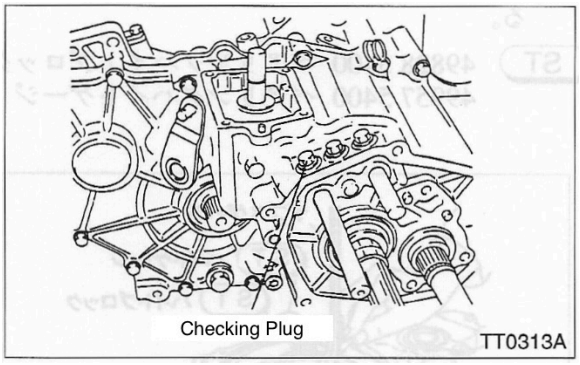
10.Install the EL fork rod.
11.Degrease the mating surfaces of the clutch housing and transmission case, then apply liquid gasket (ThreeBond 1215-B).
12.Align the holes in the main shaft, drive pinion, differential, and transfer case bearings with the holes in the fork rods, then assemble the transmission case and tighten with 16 bolts.

NOTE
- Apply oil to each bearing and sliding part.

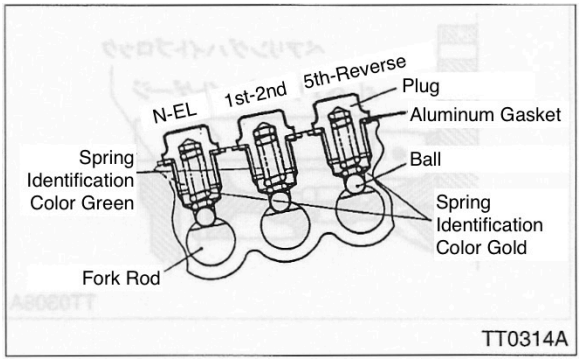
T 25 ± 2 [2.5 ± 0.2]



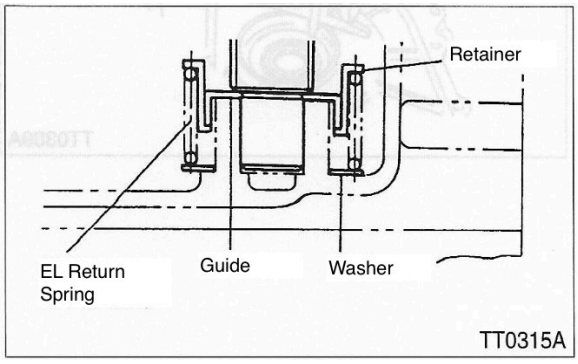
13.Insert the ball (7.9) into the checking plug, attach the aluminum gasket, and tighten the plug (3 places).
T 20 ± 1.5 [2 ± 0.15]



NOTE
- Use a new aluminum gasket.
- There are two types of springs, so be careful where you assemble them.

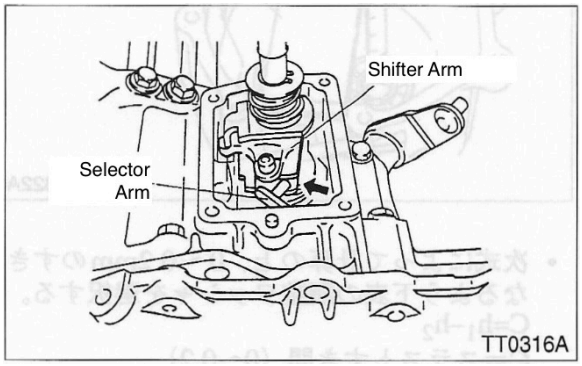


14.Interlock & shifter shaft assembly
1)Set the fork rod to the neutral position.
2)Assemble the washer, EL return spring, retainer, and guide into the transmission case.

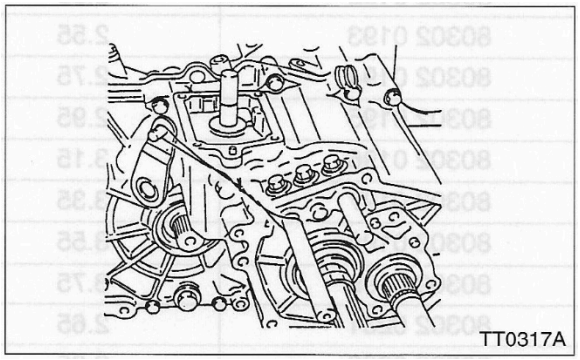


3) Assemble the interlock and shifter shaft assembly and tighten the interlock bolt.
T 20 ± 1.5 [2 ± 0.15]

4) Assemble the tip of the selector arm into the groove of the shifter arm.



5) While operating the selector lever, push down the interlock & shifter shaft assembly until it touches the collar, and then secure the selector lever in place with a wire or similar tool.



6) Degrease the mating surfaces of the transmission cover CP and the transmission case, then apply liquid gasket (ThreeBond 1215-B).
7) While pushing up the reverse check cam, assemble the transmission cover CP.
T 10 ± 0.74 [1 ± 0.075]

8) Assemble the shifter lever onto the shifter shaft and drive in the spring pin.

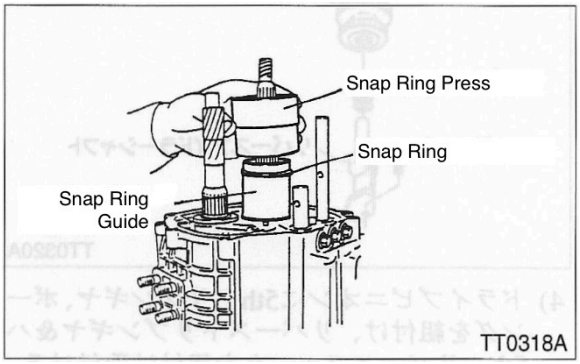
NOTE
• Use a new spring pin.

15. Assembling the side cases
1) Drive pinion center bearing snap ring assembly
• Place the special tool snap ring guide on the drive pinion bearing, and assemble the snap ring (outer 56) to the tapered part of the guide.

ST 49975 5501 Snap Ring Guide

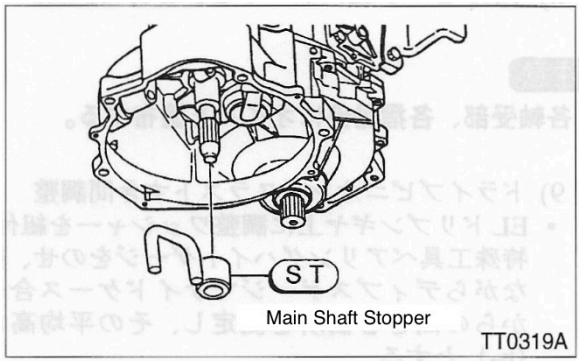
• Using the special tool snap ring press, assemble the snap ring into the bearing groove while lifting the drive pinion shaft by hand.

ST 49975 5502 Snap Ring Press



2) 5th Gear Assembly
• Remove the vinyl tape from the main shaft spline, and assemble the special tool, main shaft stopper, by aligning it with the groove in the clutch housing.

ST 39878 1600 Main shaft stopper



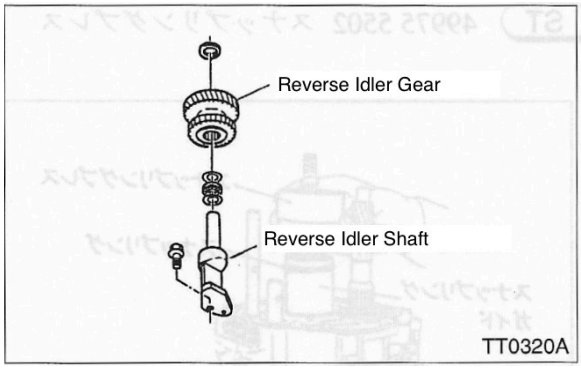
• Assemble the 5th drive gear and lock washer onto the main shaft spline and tighten with the lock nut.

T 98 ± 10 [10 ± 1]

NOTE
• Apply gear oil to the lock nut.
• The lock nut is fixed by crimping in two places.

3) Install the reverse idler gear together with the shaft.
T 25 ± 2 [2.5 ± 0.2]

NOTE
- When assembling the reverse idler shaft, lift the main shaft 1 to 2 mm.

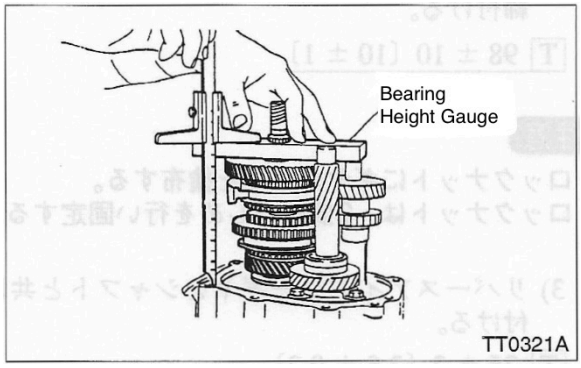


4) Assemble the 5th gear and baulk ring to the drive pinion, and assemble and install the 5th reverse fork to the reverse gear and hub.
5) Hammer a straight pin into the 5th reverse fork.
6) Assemble the insert stopper plate, EL synchronizer coupling and bushing.
7) Assemble the sleeve & hub and EL fork to the EL driven gear, and install it on the drive pinion.
8) Insert the slate pin into the EL fork.

NOTE
- Apply oil to each bearing and sliding part.

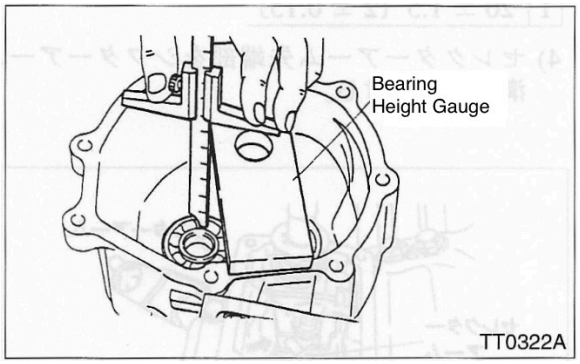
9) Drive pinion thrust clearance adjustment
   - Install an adjustment washer on the EL driven gear, place the special tool bearing height gauge on it, and while holding it down, measure the height from the side case mating surface at two points with a depth gauge, and take the average height as (h_2).

S T 49957 5500 Bearing Height Gauge



   - Measure the depth of the inner ring of the ball bearing in the side case CP using the special tools, bearing height gauge and depth gauge, and let this depth be (h_1).

S T 49957 5500 Bearing Height Gauge

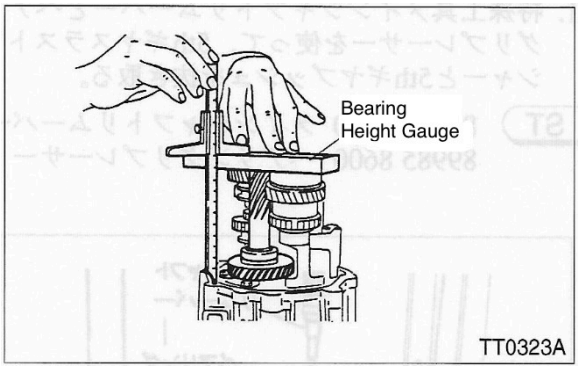


   - Calculate using the following formula and select the adjustment washer from the table below to ensure a gap of 0 to 0.2 mm.
     $C = h_1 - h_2$
     C = Thrust clearance (0~0.2)
     h_1 = Depth to inner ring of bearing
     h_2 = Height to washer

Washer (20x38x1)	t (mm)
80302 0191	2.15
80302 0192	2.35
80302 0193	2.55
80302 0194	2.75
80302 0195	2.95
80302 0196	3.15
80302 0197	3.35
80302 0198	3.55
80302 0199	3.75
80302 0231	2.65
80302 0232	2.85
80302 0233	3.05
80302 0234	3.25

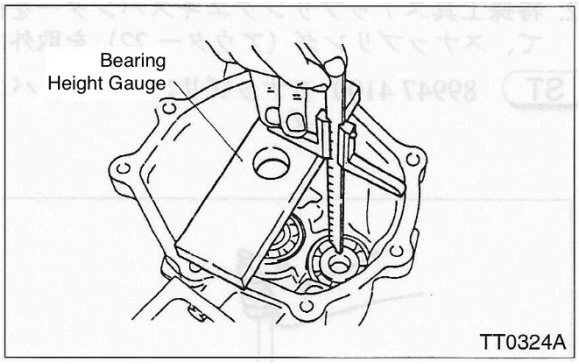
10) Main shaft thrust clearance adjustment: Install an adjustment washer onto the EL gear of the main shaft, place the special tool bearing height gauge on top, and while holding it down, measure the height from the side case mating surface at two points with a depth gauge, and use the average value as (h_2).

ST 49957 5500 Bearing Height Gauge



- Measure the depth of the inner ring of the ball bearing in the side case CP using the special tools, bearing height gauge and depth gauge, and the value is (h_1).

ST 49957 5500 Bearing Height Gauge



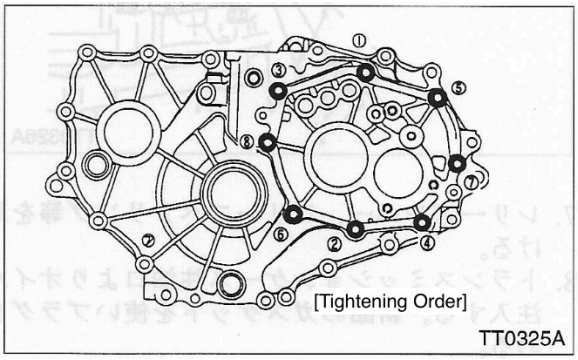
- Calculate using the following formula and select the adjustment washer from the table below to ensure a gap of 0~0.2 mm.
  C = h_1-h_2
  C = Thrust clearance (0~0.2)
  h_1 = depth to inner ring of bearing
  h_2 = height to washer

Washer (25.2x26x1)	t (mm)
80301 5120	0.9
80301 5121	1.1
80301 5122	1.3
80301 5123	1.5
80301 5124	1.2
80301 5125	1.4
80301 5126	1.0
80301 5150	1.6

11)Degrease the mating surfaces of the transmission case and side case, then apply liquid gasket (ThreeBond1215-B).

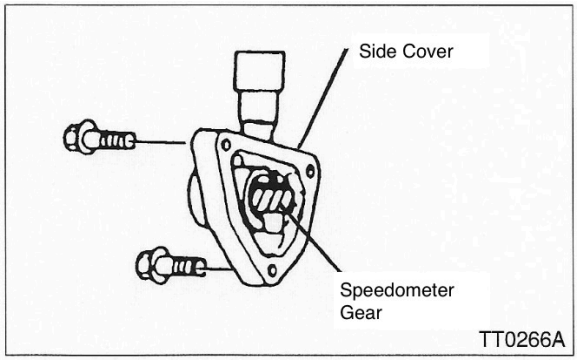
12)Tighten the side case CP with the eight bolts, aligning it with the bearings and holes of the main shaft, drive pinion, and reverse idler shaft.

NOTE
- Tighten the transmission hook to one bolt (point ③).
  T 25 ± 2 [2.5 ± 0.2]

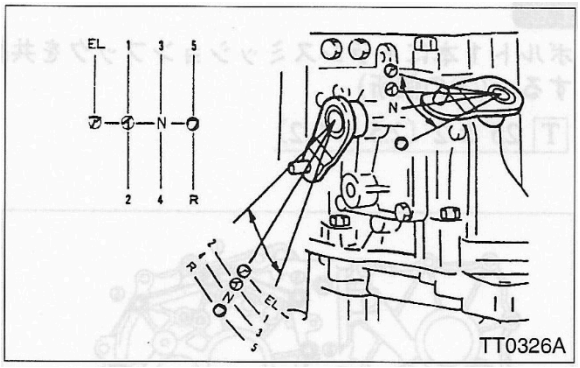


13)Degrease the mating surfaces of the side case and side cover, then apply liquid gasket (ThreeBond 1215-B), and tighten the side cover assembly with the three bolts.
T 10 ± 0.74 [1 ± 0.075]

NOTE
- The speedometer gear is made of nylon, so be careful not to deform it during assembly.
- Apply gear oil to each sliding part.
- Fill the area where the speedometer drive gear goes with approximately 6 grams of grease (equivalent to Sunlight 2).



16.Gear change check
- Operate the shifter lever and selector lever and check that each gear is engaged.



17.Install the release lever, release bearing, etc.
18.Fill the oil into the transmission case oil filler hole. Tighten the plug using a new gasket.
T 34 ± 4 [3.5 ± 0.4]

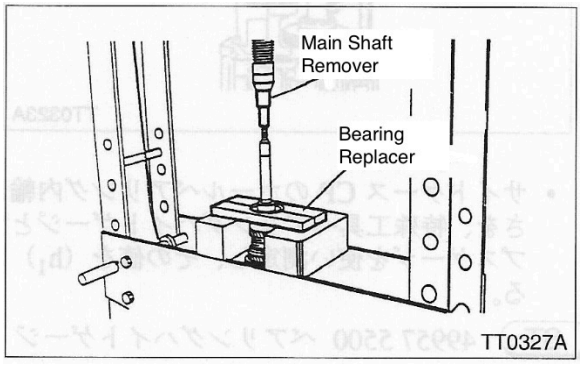
Oil Name	Subaru Gear Oil Extra 75-80	
Oil Amount (ℓ)	Selective 4WD 5MT	: 2.1
	Selective 4WD EL+5MT	: 2.3
	Selective 4WD EL+5MT+Differential Lock	: 2.4
	Full-time 4WD EL+5MT	: 2.4

(2) Drive pinion shaft assembly

<Disassembly>

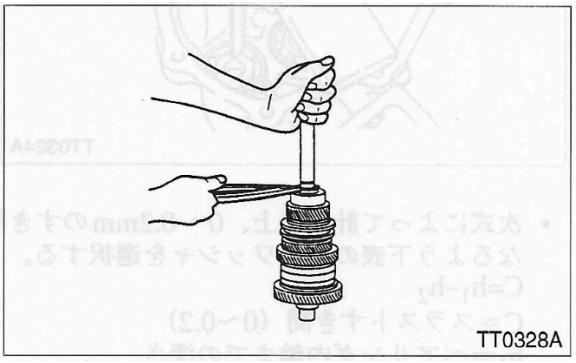
1.Using the special tools, main shaft remover and bearing replacer, remove the 5th gear thrust washer and 5th gear bushing.

ST 89986 4100 Main Shaft Remover
89985 8600 Bearing Replacer



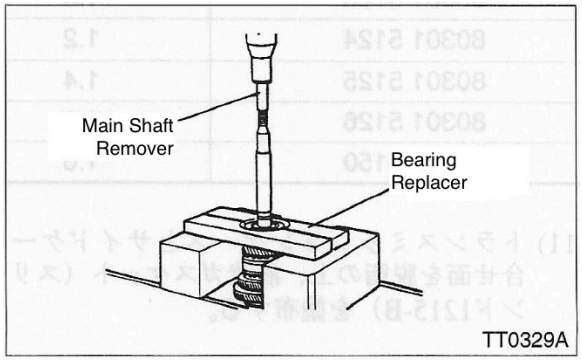
2.Use the special tool snap ring expander to remove the snap ring (outer 22).

ST 89947 4100 Snap Ring Expander



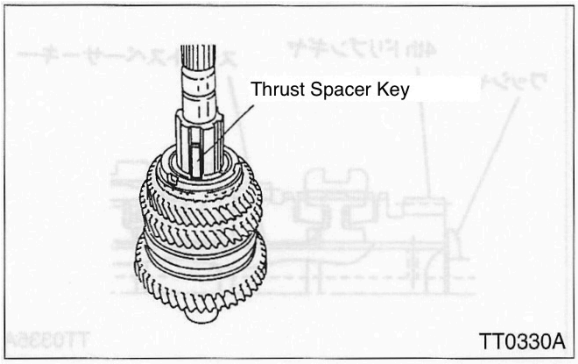
3.Use the special tools main shaft remover and bearing replacer to remove the center bearing.

ST 89986 4100 Main Shaft Remover
89985 8600 Bearing Replacer



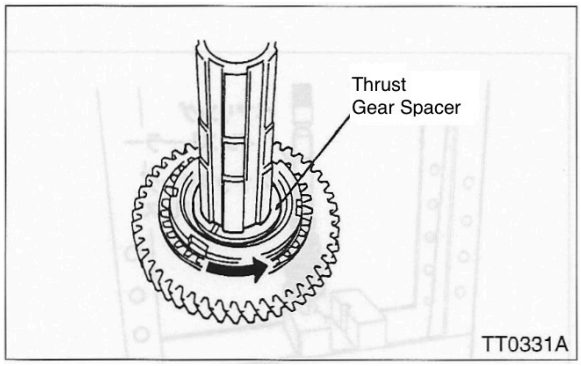
4. Remove the washer, 4th driven gear, balk ring, sleeve & hub assembly, and thrust spacer key.

NOTE
- Note the installation position of the thrust spacer key.

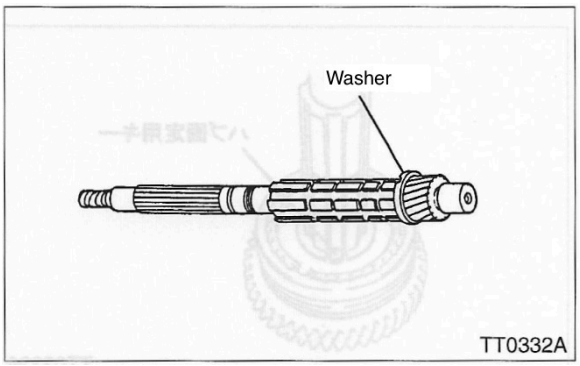


5. Remove the gear thrust spacer No. 2, 3rd driven gear, gear thrust spacer, 2nd driven gear, gear thrust spacer, sleeve & hub assembly, gear thrust spacer No. 2, and 1st driven gear in this order. SITA ETP

NOTE
- Rotate the gear thrust spacer one tooth to remove it.

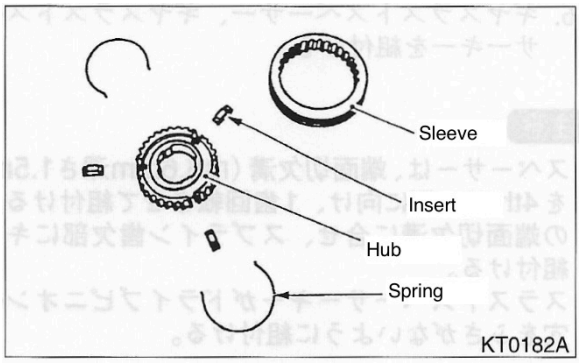


- Do not remove the washer shown in the diagram below unless necessary. If you do remove it, replace it with a new one.



<Assembly>

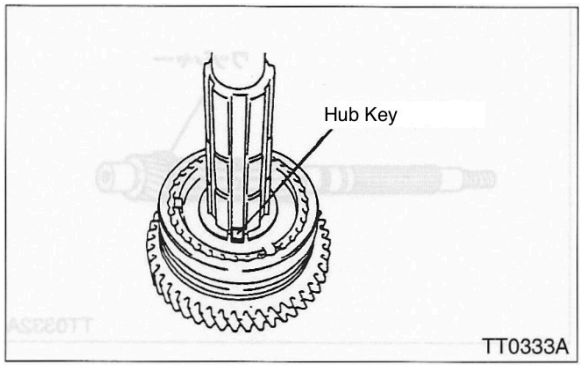
1. Press the washer onto the drive pinion shaft.
2. Assemble the 1st driven gear and baulk ring.
3. Assembling and installing the 1st and 2nd sleeves and hubs.
   1) Assemble the coupling sleeve and shifting insert into the synchronizer hub.



   2) Shift the spring rod base 120° from the spring rod base on one side to check that the assembled insert does not fall off.
   3) Assemble the sleeve and hub assembly to the drive pinion shaft. Turn the baulk ring to check that the insert is in the balk ring groove.

NOTE
- Assemble the synchronizer hub so that the missing tooth part of the square spline is somewhere other than the oil hole of the drive pinion shaft. Also, this missing tooth part will be the assembly position for the key to secure the spacer, so be sure to remember the position of the missing tooth part.

4. Install the spacer key for fixing the hub into the missing spline teeth area of the drive pinion and synchronizer hub.



5. Assemble in the following order: gear thrust spacer No. 2, balk ring, 2nd driven gear, gear thrust spacer No. 2, and 3rd driven gear.

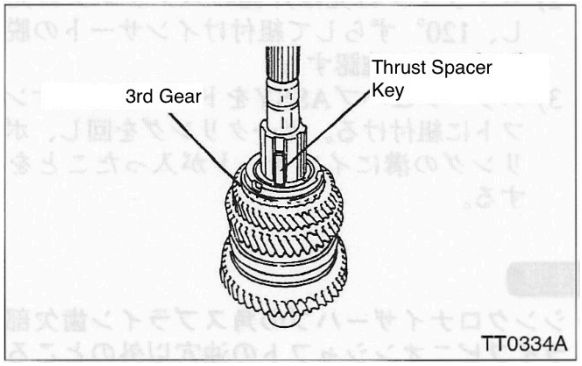
NOTE

- Rotate the gear thrust spacer one tooth.

6. Gear thrust spacer, gear thrust spacer

NOTE

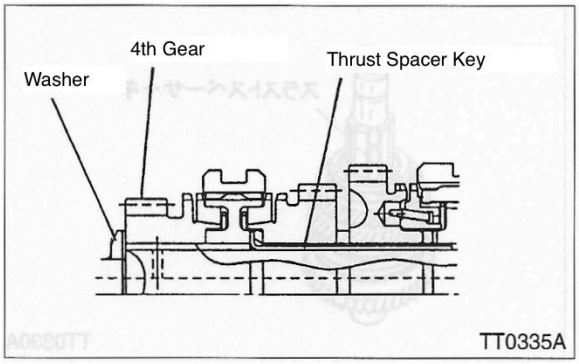
- The spacer has a notched groove on the end face (width 6.6 mm, depth 1.5 mm). Rotate it one tooth toward the 4th gear and assemble it. Align it with the notch on the end face and assemble the key to the spline tooth missing part.
- Assemble the thrust spacer key so that it does not block the oil hole of the drive pinion.



7. Assemble the balk ring, sleeve & hub assembly, balk ring, 4th driven gear, and washer.

NOTE

- Attach the washer with the oil groove side facing the 4th gear.
- Check that the insert is fully inserted into the ball ring.

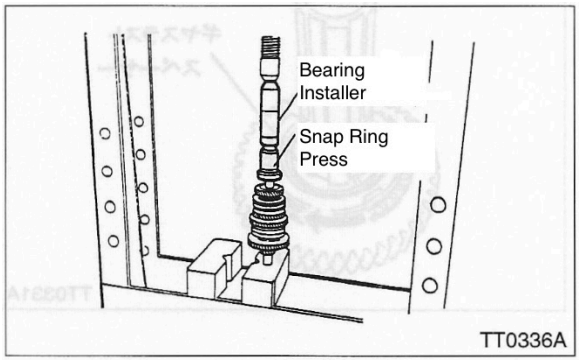


8. Use the special tool, bearing installer, and snap ring press to press in the ball bearing.

S T	89958 0100	Bearing Installer
	89975 4112	Snap Ring Press

NOTE

- Assemble the ball bearing so that the snap ring groove faces the 5th gear.



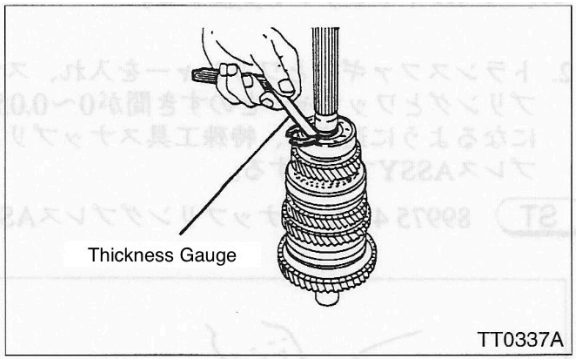
9. Place the snap ring (outer 22) into the snap ring mechanism, measure with a thickness gauge so that the gap between it and the inner race surface of the ball bearing is 0 to 0.05 mm, select the gap from the table below, and assemble using the special tools, snap ring press, and bearing installer.

S T	89975 4112	Snap Ring Press
	89958 0100	Bearing Installer

NOTE

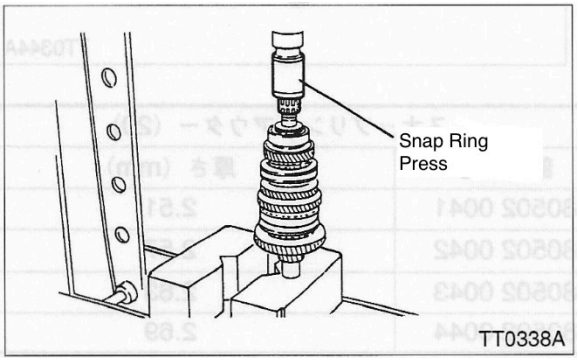
- Always use a new snap ring and make sure it is securely in the groove.
- Be careful not to scratch the rolling surface of the drive pinion needle bearing.

Snap Ring (Outer 22)			
Part Number	**Standard Thickness (mm)**	**Part Number**	**Standard Thickness (mm)**
80502 2050	2.45	80502 2053	2.63
80502 2051	2.41	80502 2054	2.69
80502 2052	2.57	80502 2055	2.39



10. Use the special tool, a snap ring press, to press the thrust plate and bushing into place.

S T 89975 4112 Snap ring press



(3) Transfer Shaft Assembly

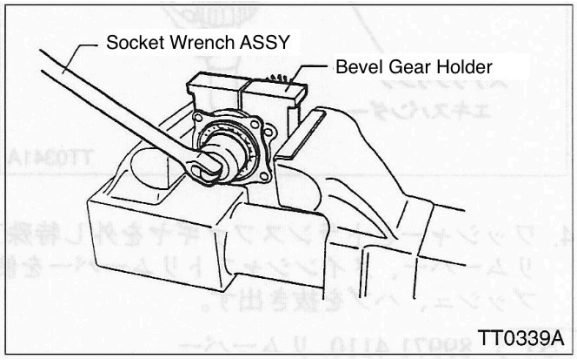
<Disassembly>

1. Use the special tool bevel gear holder and socket wrench assembly to remove the lock nut.

S T 49988 5400 Bevel Gear Holder
49998 5500 Socket Wrench ASSY

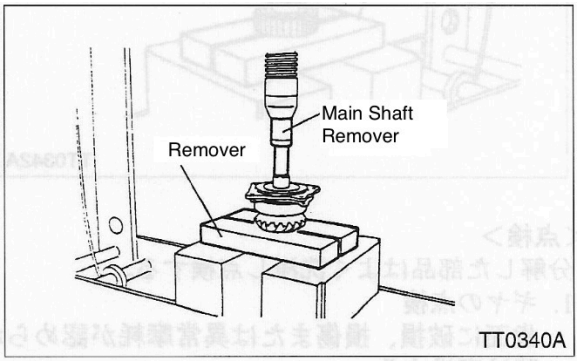
NOTE

- Raise the crimp and then remove.



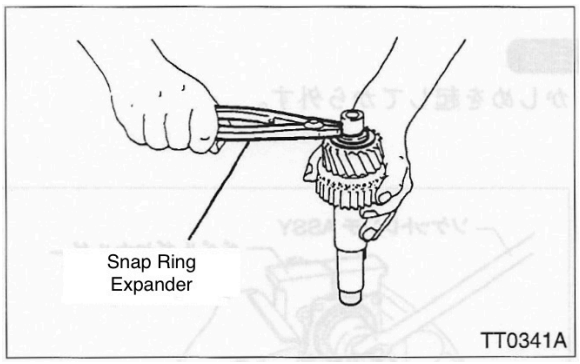
2. Use the special tool remover and main shaft remover to remove the bevel drive gear and ball bearing.

S T 89971 4110 Remover
89986 4100 Main shaft remover



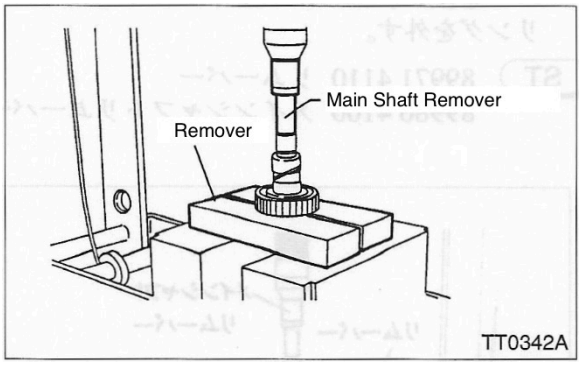
3. Use the special tool snap ring expander to remove the snap ring. (hereafter referred to as Selective 4WD)

ST 89947 4100 Snap Ring Expander



4. Remove the washer and transfer gear, and use the special tool remover and main shaft remover to extract the bushing and hub.

ST 89971 4110 Remover
89986 4100 Main Shaft Remover



<Inspection>

Disassembled parts should be thoroughly cleaned and inspected.

1. Gear inspection
   - Replace if damage, breakage or abnormal wear is found on the tooth surface.
2. Bearing
   - Replace if there is seizure, wear, abnormal noise, or the rotation is not smooth.

<Adjustment/Assembly>

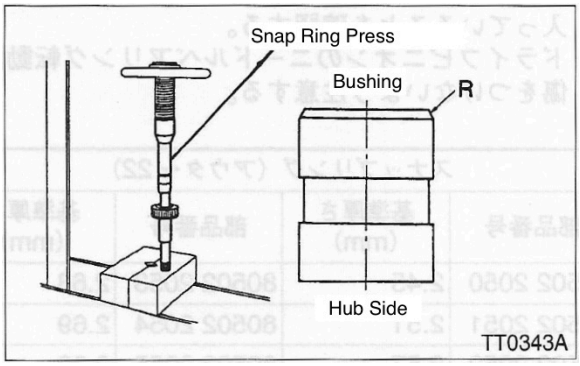
1. Place the spring onto the transfer shaft and press in the bushing using a special tool, a snap ring press.

ST 89975 4102 Snap Ring Press

NOTE

- Pay attention to the direction in which the bush is pressed in.

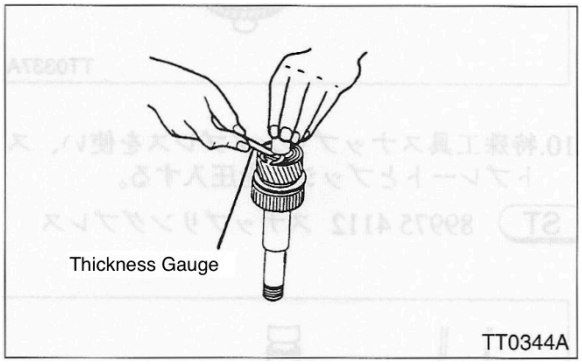
- Apply gear oil to the inner diameter of the bushing.



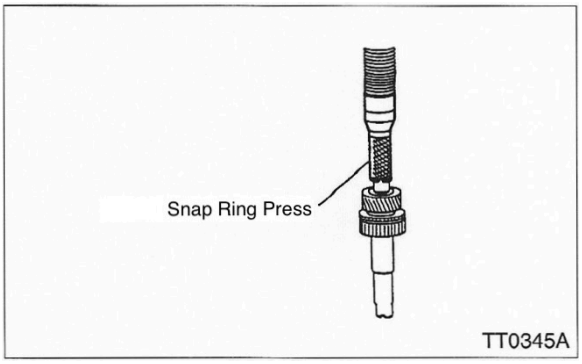
- When replacing bevel gears, replace the drive and driven bevel gear sets.

2. Insert the transfer gear and washer, and adjust the gap between the snap ring and washer to 0-0.05 mm, then press in using the special tool, snap ring press assembly.

ST 899754100 Snap Ring Press Assembly

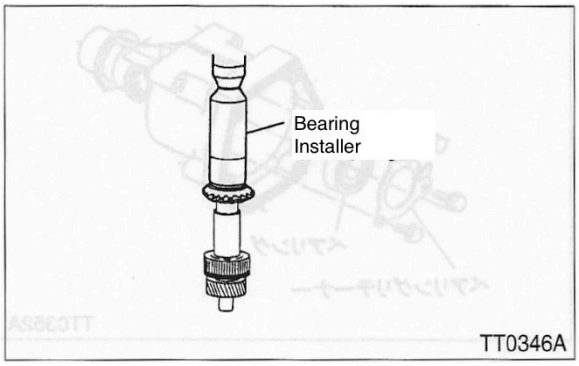


Snap Ring (Outer 20)	
Part Number	**Standard Thickness (mm)**
80502 0041	2.51
80502 0042	2.57
80502 0043	2.63
80502 0044	2.69



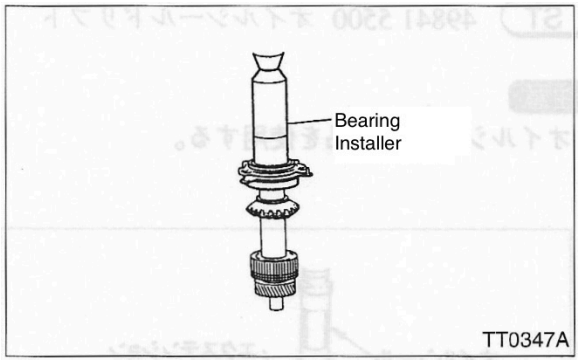
3. Drive a key into the transfer shaft and press in the bevel drive gear using a special tool, a pairing installer.

S T 89958 0100 Bearing Installer



4. Use the special tool bearing installer to press in the ball bearing.

S T 89958 0100 Bearing Installer



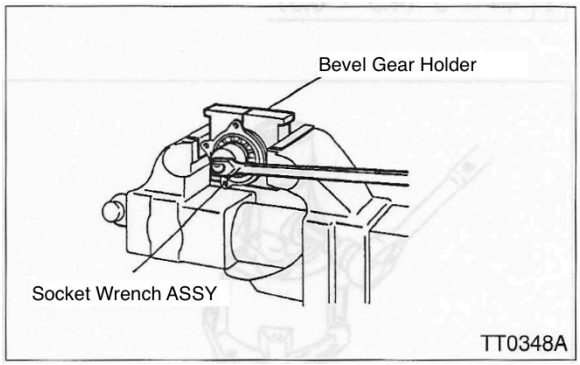
5. Insert the lock washer and use the special tool bevel gear holder and socket wrench assembly to tighten the lock nut.

S T 49988 5400 Bevel Gear Holder
49998 5500 Socket Wrench Assembly

NOTE

• Use new lock nuts.

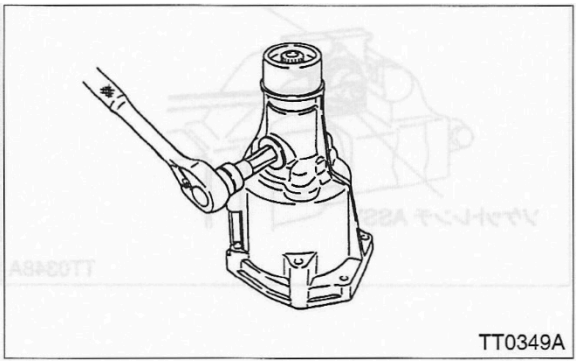
• After tightening the lock nut, crimp it in one place.
T 78 ± 6 [8 ± 0.6]



(4) Extension (Full-time 4WD)

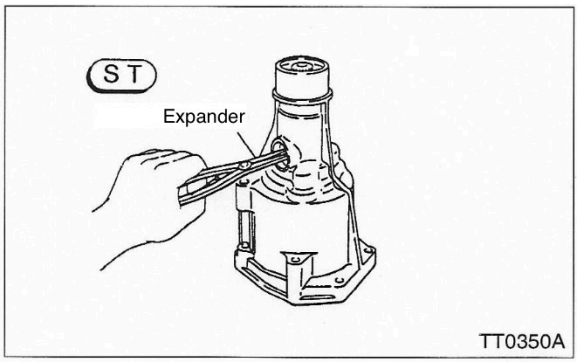
<Disassembly>

1. Remove the plug from the service hole on the extension case.
   T 44 ± 5 [4.5 ± 0.5]



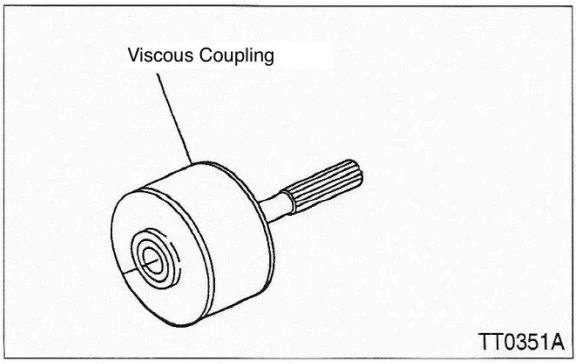
2. Use the special tool snap ring expander to remove the snap ring from the service hole.

ST 89947 1410 Snap Ring Expander

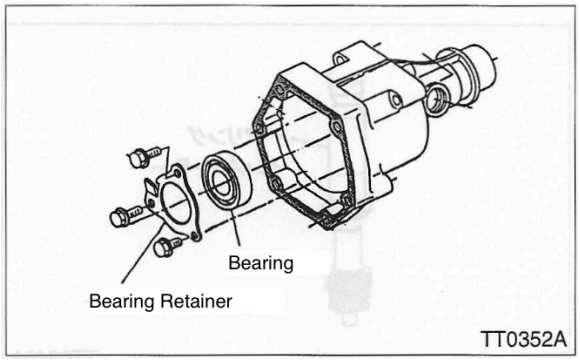


3. Remove the viscous coupling from the extension case.

NOTE
- Viscous coupling is non-disassembly.



4. Remove the three bearing retainer mounting bolts, and then remove the bearing retainer and bearing.
   T 20 ± 2 [2 ± 0.2]



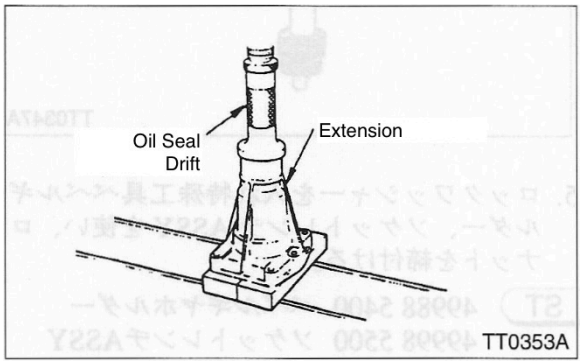
5. Remove the oil seal.

<Assembly>

1. Use the special tool, oil shield lift, to press the oil seal into the extension case.

498415500 Oil Shield Lift

NOTE
- Use a new oil seal.



2. Assemble in the reverse order of disassembly.

NOTE
- Apply grease (Autolex A) to the bearings.
- Use new plugs and washers for the service holes.

(5) Differential Side Cover (Transmission with Differential Lock)

<Disassembly>

1. Remove the four bolts from the clutch housing and remove the differential side cover.

NOTE

• Wrap vinyl tape around the axle shaft spline.

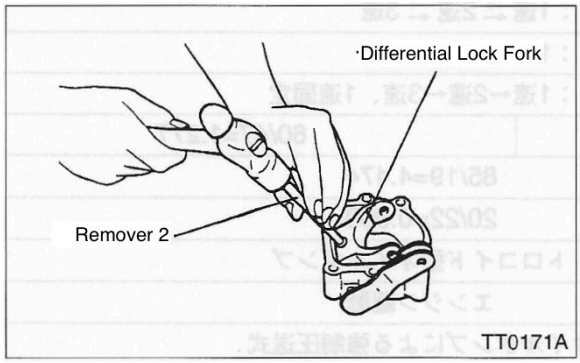
T 25 ± 2 [2.5 ± 0.2]

2. Remove the differential lock sleeve and piece from the differential lock fork.
3. Remove the differential lock detection switch.
   T 18 ± 2 [1.8 ± 0.2]

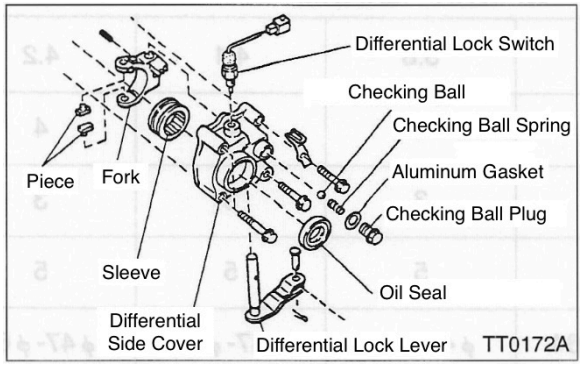
4. Remove the checking ball plug, gasket spring and pole.
   T 20 ± 2 [2 ± 0.2]

5. Remove the straight pin (45) from the differential lock fork using the special tool straight pin remover 2.

ST 39879 1600 Straight Pin Remover 2



6. Remove the differential lock fork and differential lock lever from the differential side cover.



<Inspection>

If the differential lock sleeve or axle shaft is damaged, worn or defective, replace it.

<Assembly>

1. Install the differential lock lever and differential lock fork to the differential side cover.

NOTE

• Use a new O ring and apply oil when assembling.

2. The assembly procedure is the reverse of the disassembly procedure.

NOTE

• Use new aluminum gaskets for the differential lock switch and checking ball plug.

3. Adjusting the differential lock turnbuckle
   1) Set the differential lock lever to the OFF position.
   2) Adjust the dimensions of the turnbuckle of the differential lock actuator (align the hole at the tip of the turnbuckle with the OFF position of the differential lock lever).

NOTE

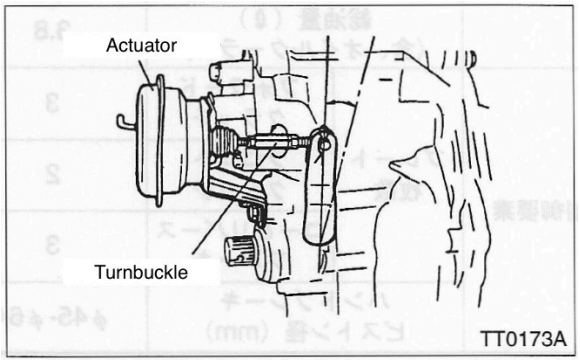
• When assembling the actuator and differential lock lever after assembling the clevis pin and snap pin, turn the turnbuckle 1/2 turn (counterclockwise) and tighten it to the specified torque.

T 10 ± 0.7 [1 ± 0.07]

   3) Check the differential lock shift
      • Operate the actuator with a Mighty Pack or similar and check that the differential lock (ON/OFF) switches smoothly.

NOTE

• If adjustment is necessary, use the turnbuckle.



• Check the continuity of the differential lock detection switch.

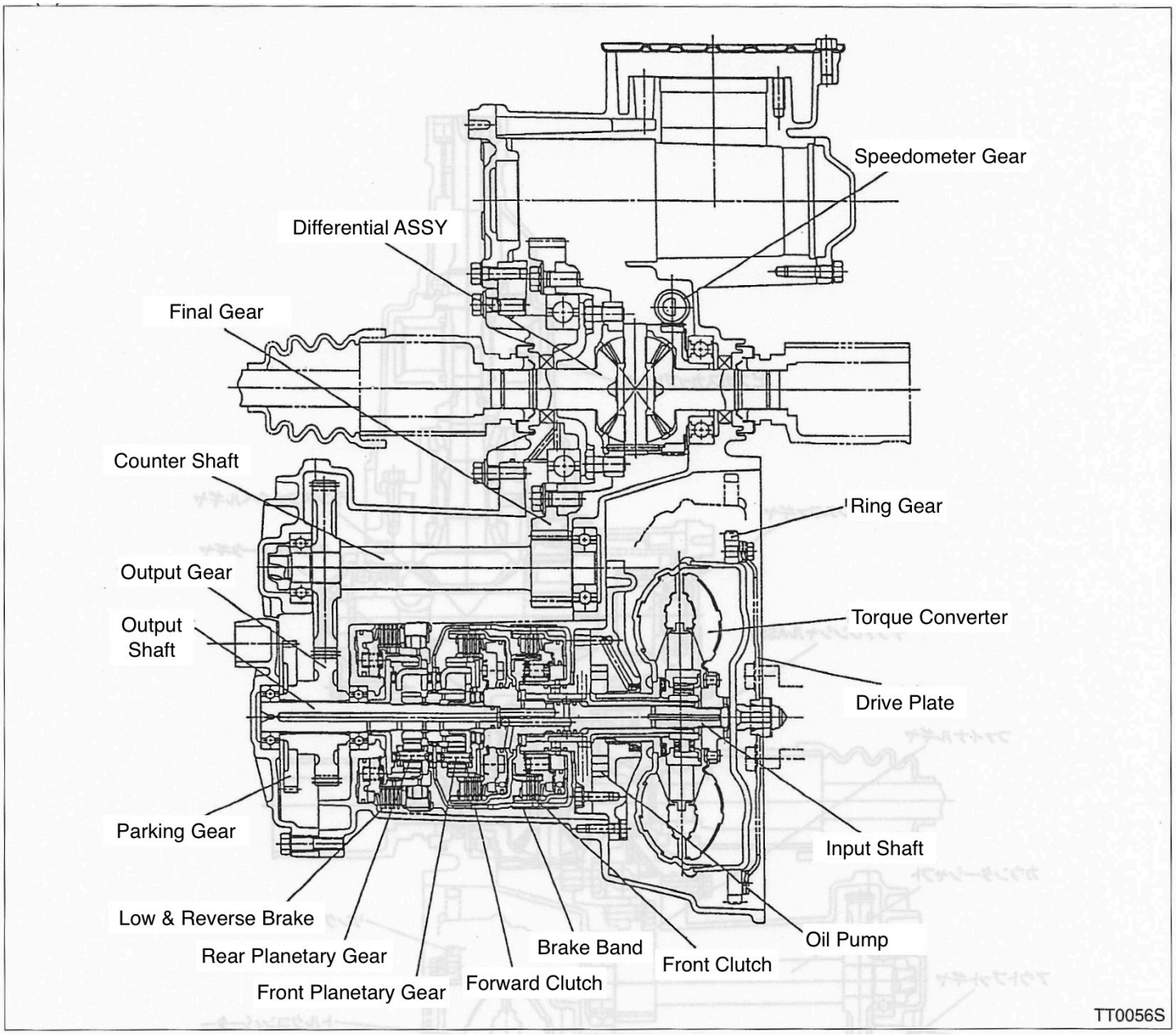
3 - 3 Automatic Transmission

[1] Common

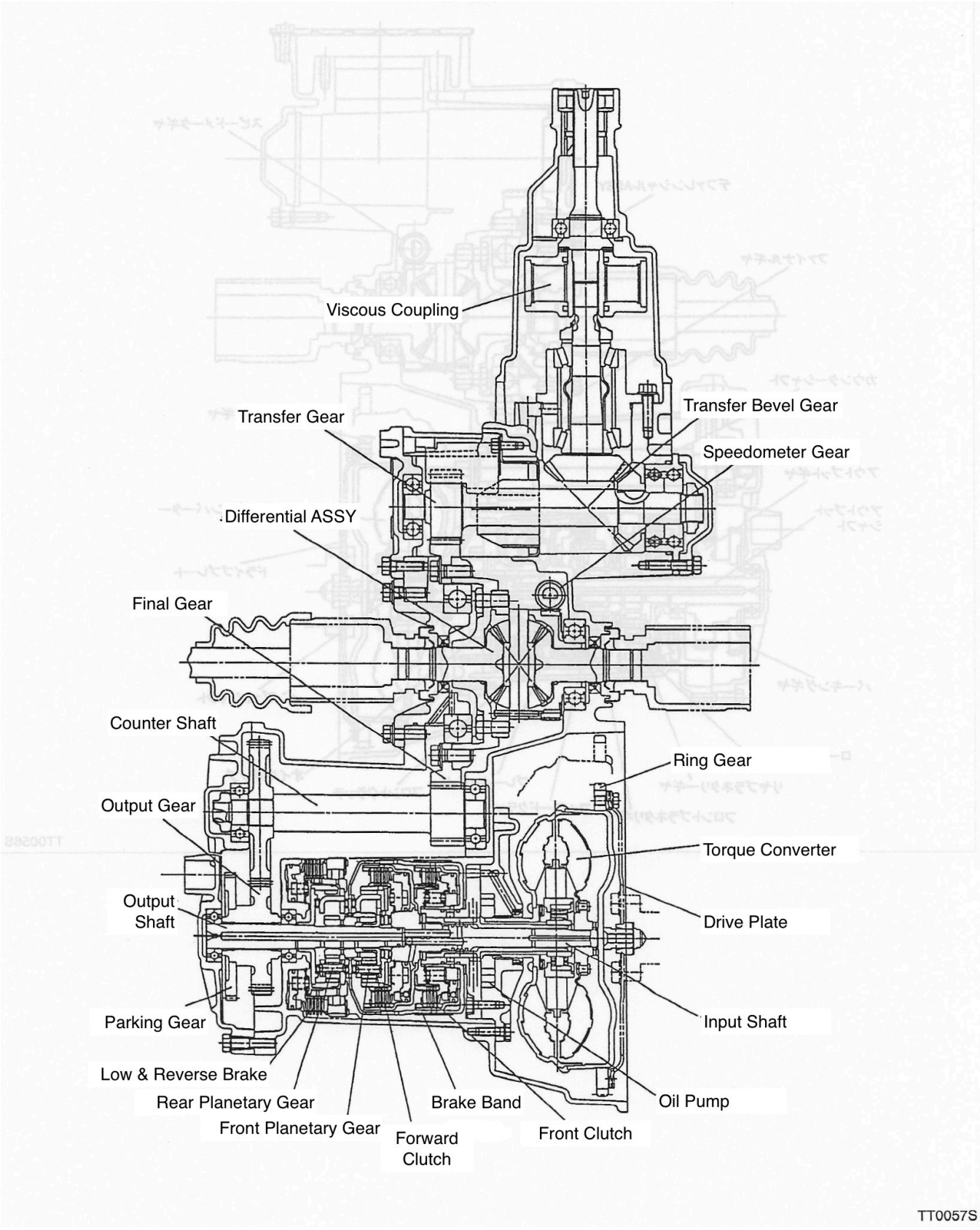
■ Specifications

Vehicle Model			NA		SC		
			2WD	4WD	2WD	2WD	4WD
			General	General	General	Red Hat	General
Transmission Classification			TA981 KDAAA	TZ981 KDAAA	TA981 KBAAA	TA981 KCAAA	TZ981 KBAAA
Torque Converter	Model		Symmetrical, Three-element, One-stage, Two-phase Type				
	Stall Torque Ratio		2.05		2.06		
	Stall Speed (rpm)		2500~3100	2500~3100	2800~3200	2800~3200	2800~3200
Transmission	Model		3 Forward Gears, 1 Reverse Gear, Planetary Gear Type				
	Control Element		Wet Multi-plate Clutch (2 sets), Band Brake (1 set),		Wet Multi-plate Brake (1 set) One-way Clutch (1 set)		
	Gear Ratio	1st Gear	2.659	Front Sun Gear Teeth: 35 Rear Sun Gear Teeth: 31 Front Pinion Gear Teeth: 16 Rear Pinion Gear Teeth: 18		Front Internal Gear Teeth: 66 Rear Internal Gear Teeth: 66	
		2nd Gear	1.530				
		3rd Gear	1.000				
		Reverse	2.129				
	Select Pattern		6 ranges (P, R, N, D, 2, 1) by Selector Lever and Power Mode E by Power Switch				
	Select Position		P (Park) : Transmission is in neutral, output shaft fixed, engine can be started				
			R (Reverse): Reverse				
			N (Neutral) : Transmission is in neutral, engine can be started				
			D (Drive) : 1st Gear ⇄ 2nd Gear ⇄ 3rd Gear				
			2 (Second) : 1st Gear ⇄ 2nd Gear ← 3rd Gear				
			1 (First) : 1st Gear ← 2nd Gear ← 3rd Gear, 1st Gear Fixed				
	Primary Reduction Ratio		66/47 = 1.404		60/47 = 1.277		
	Final Reduction Ratio		85/19 = 4.474				
	Speedometer Reduction Ratio		20/22 = 0.909				
Oil Pump	Model		Trochoid Oil Pump				
	Drive Method		Engine Driven				
Lubrication	Lubrication Method		Forced Oil Pump				
	Oil Cooling Method		External Cylinder Oil Cooler (Water-cooled)			External Cylindrical Oil Cooler (Water-cooled) + Air-cooled Oil Cooler	External Cylindrical Oil Cooler (Water-cooled)
	Oil Used		Subaru ATF (3AT only)				
	Total Oil Volume (ℓ) (Including Oil Cooler)		3.8	4.2	3.8	4.1	4.2
Control Element	Number of Plates	Forward Clutch	3	3	4	4	4
		Front Clutch	2	2	3	3	3
		Low & Reverse	3	3	5	5	5
	Handbrake Piston Diameter (mm)		ø45-ø64	ø45-ø64	ø47-ø64	ø47-ø64	ø47-ø64

(1) TA981 Type (2WD) Transmission Assembly Cross Section

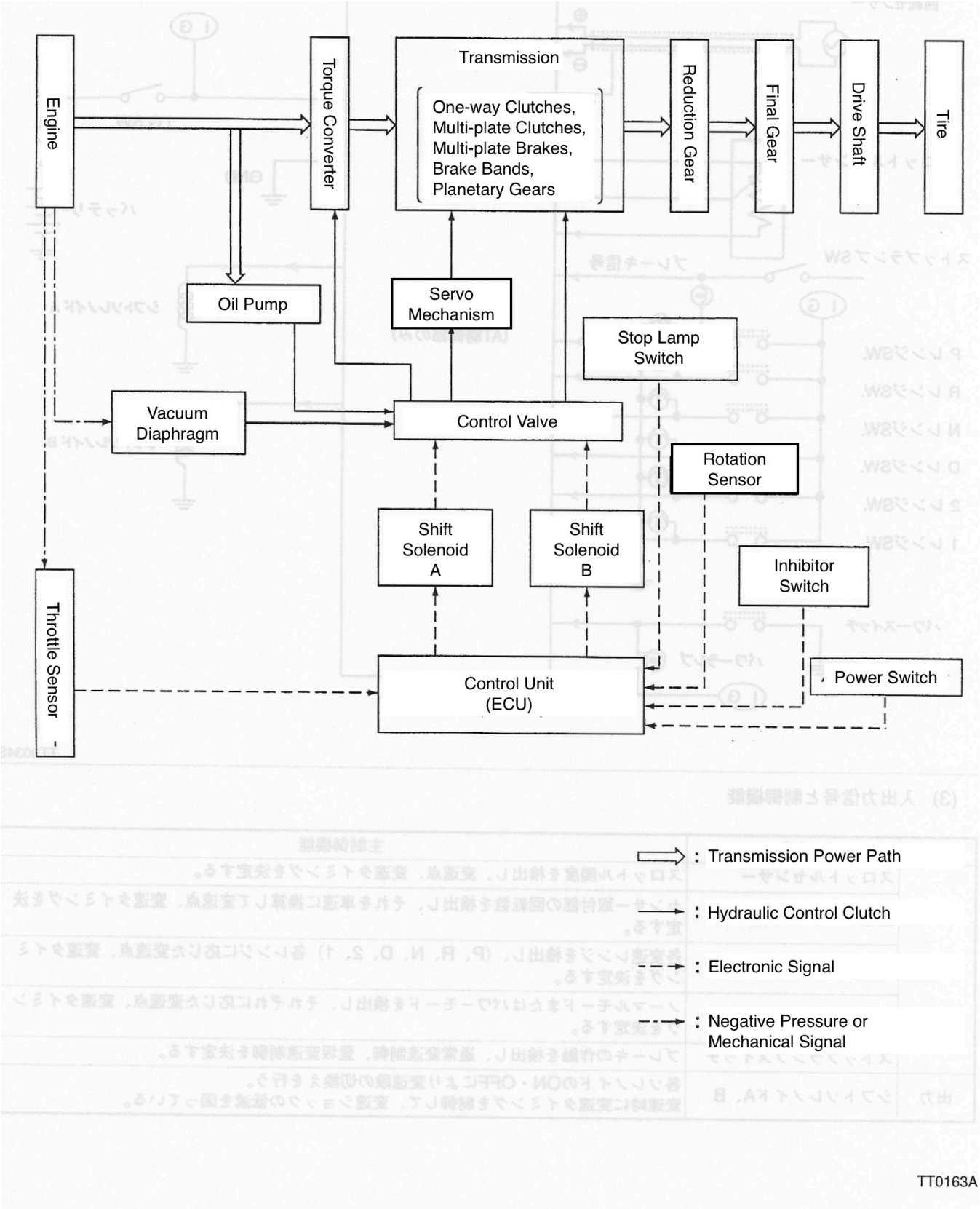


(2) TZ981 Type (4WD) Transmission Assembly Cross Section

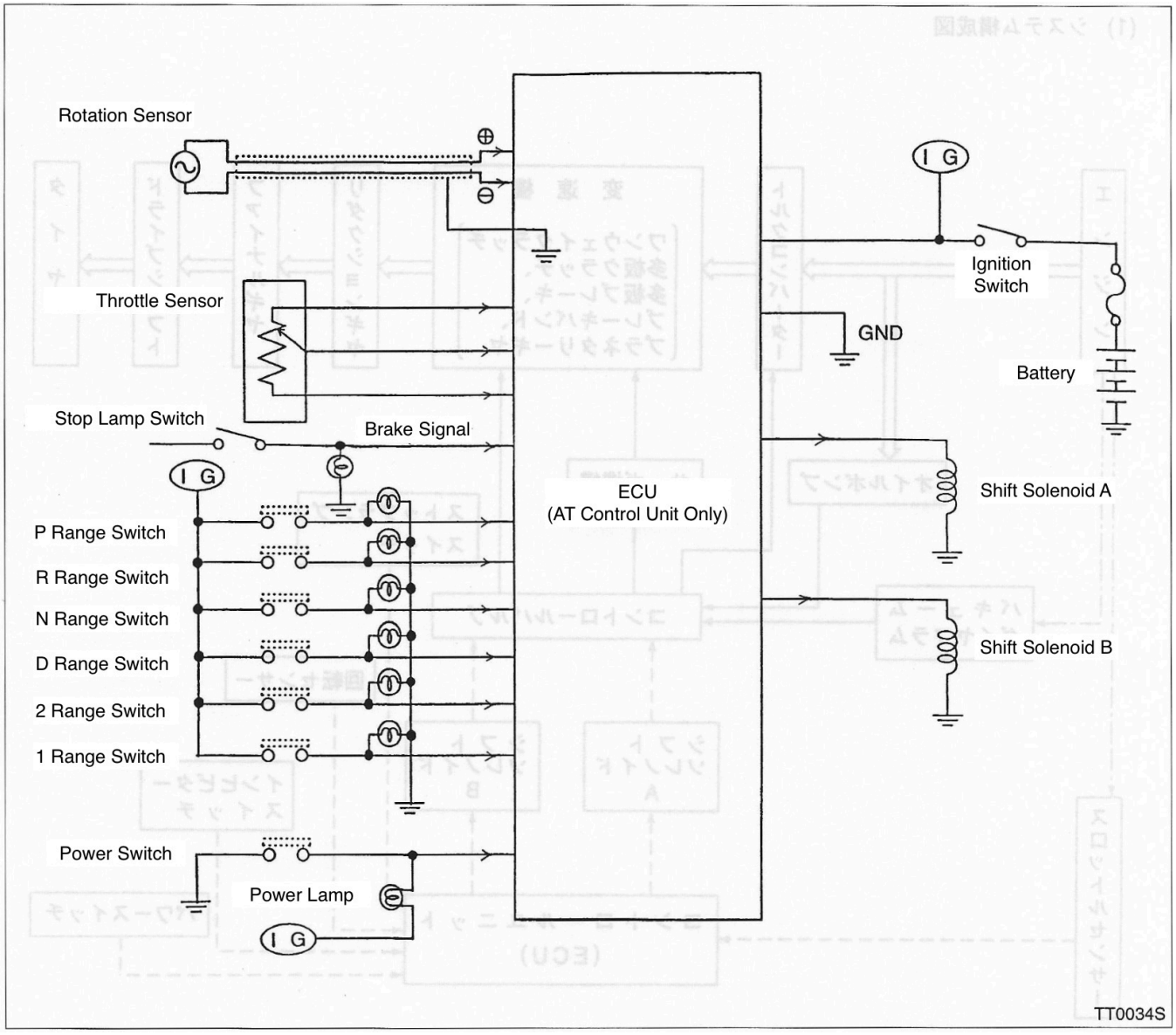


■ Electronic Control Unit (ECU) Overview

(1) System Configuration Diagram



(2) Input/Output Diagram



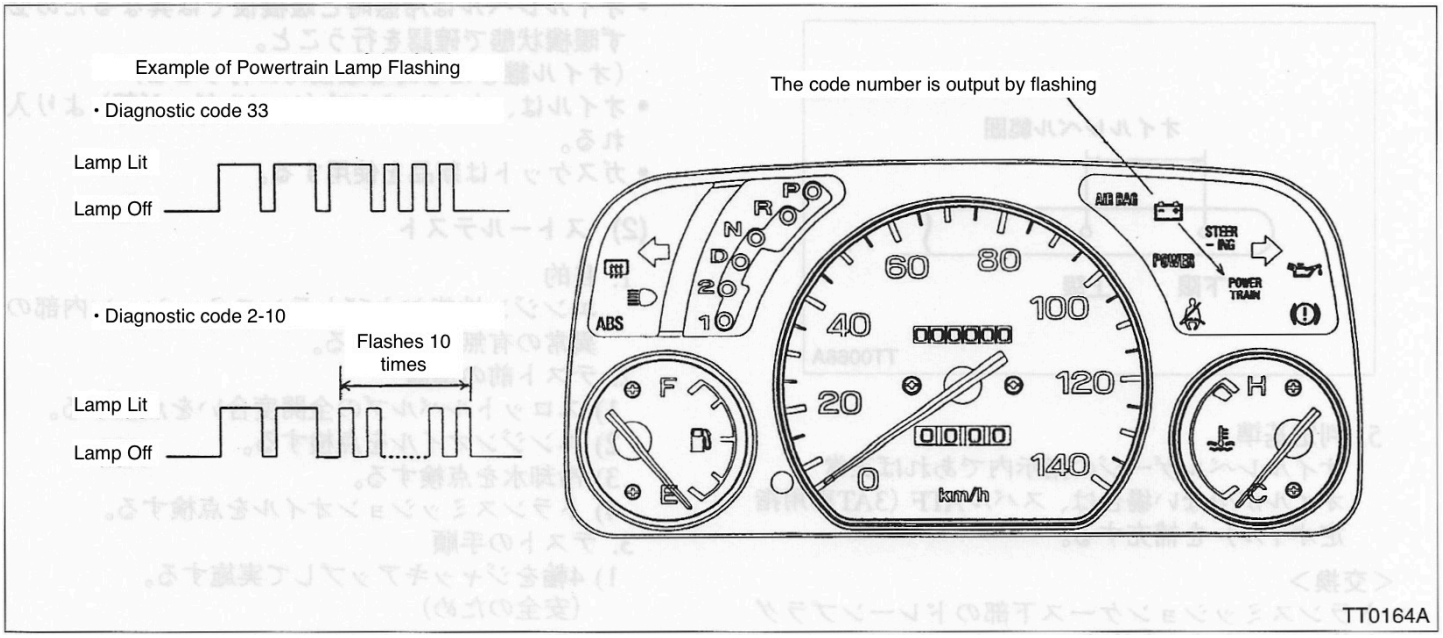
(3) Input/Output Signals and Control Functions

Classification	Name	Main Control Function
Input	Throttle Sensor	Detects the throttle opening and determines the shift points and timing.
	Rotation Sensor	The rotation speed at the sensor mounting point is detected and converted into vehicle speed to determine the shift point and timing.
	Inhibitor Switch	It detects each gear range (P, R, N, D, 2, 1) and determines the gear shift points and timing for each range.
	Power Mode Switch	It detects whether the vehicle is in normal mode or power mode, and determines the appropriate gear shift points and timing.
	Stop Lamp Switch	It detects the operation of the brakes and determines normal speed change control and hill-climbing speed change control.
Output	Shift Solenoids A & B	The gears are changed by turning each solenoid on and off. The timing of gear changes is controlled to reduce gear change shock.

(4) Self-Diagnosis Function and Backup Control

If a malfunction occurs in the input/output signals listed in the table below (only items related to 3AT are listed), the POWER TRAIN lamp in the combination meter will flash to output a diagnostic code and notify you of the malfunction. The diagnostic code is also displayed on the select monitor.

Diagnostic Code	Diagnostic Details	Diagnosis Details	Back Up Control
31	Throttle Sensor	Open or Short	The opening is fixed and controlled at a specified level.
33	Rotation Sensor System	Open or Short	Fixed to 3rd gear
71	Shift Solenoid A	The signal line for shift solenoid A is open or	Fixed to 3rd gear
72	Shift Solenoid B	The signal line for shift solenoid B is open or	Fixed to 3rd gear
46	Brake Signal System	Open (SW OFF failure) or short (SW ON failure)	Fault diagnosis only
57	Inhibitor SW System (D Check Only)	Open (no input) or short (multiple signal inputs)	When multiple signal inputs are detected during U check, the range is determined in the following order: D>N, P>R>2>1. However, the dialog code is not output during U-check.
2-10	Power Mode Switch System (D Check Only)	Open (SW OFF failure) or short (SW ON failure)	Fault diagnosis only with D check



(5) Select monitor

The Select Monitor (SSM) can be used to check various data processed within the ECU, switch ON/OFF signals, etc., and can be used to diagnose malfunctions in electronic control systems.

Data Display	Input and output signal data is displayed directly and compared with the reference value to detect disconnections in the sensor signal system. It is possible to detect short circuits and abnormal characteristics of sensors.
LED Display	The ON/OFF status of input/output signals and operating status can be determined by the LED lighting.
Diagnosis Code Display	Displays the diagnosis code in the backup memory.
Memory Clear	Clear the diagnosis code in the backup memory.

NOTE

• A new type of select monitor will be used

[2] On-board Inspection & Replacement

■ Preparation Items

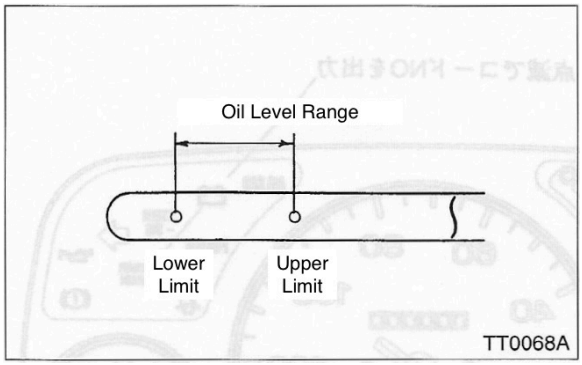
Classification	Tool Number	Description	Purpose
ST	49889 5600	Pressure gauge adapter	Line pressure measurement
	49857 5400	Oil pressure gauge	Line pressure measurement
	49889 7700	Pressure gauge adapter	Line pressure measurement

■ Inspection/Replacement Procedures

(1) Oil Inspection & Change

<Inspection>

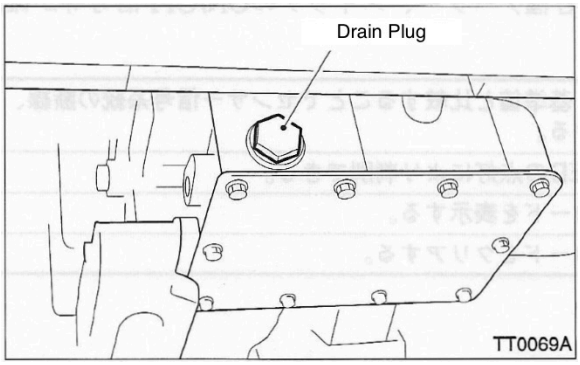
1. Warm up the engine by running it until the oil temperature reaches 60-80°C (normal operating condition). (As a guideline, this should be until the radiator fan operates twice.)
2. With the engine idling, move the selector lever from Ⓟ to ①, then return it to Ⓟ.
3. Park the vehicle on a level surface and keep it idling in Ⓟ range (air conditioning OFF).
4. Check the oil level with the level gauge.



5. Judgment criteria:
   - If the oil level is within the indicated range, it is normal.
   - If the oil level is low, add Subaru ATF (oil designated for 3AT).

<Exchange>

Remove the drain plug at the bottom of the transmission case and drain the oil.



Drain plug tightening torque
Ⓣ 39 ~ 54 [4.0 ~ 5.5]

<Oil Type, Amount, and Change Interval>

Vehicle Type			Subaru ATF (3AT Only)
Oil Volume (ℓ)	Total Amount (with Oil Cooler)	2WD General	3.8
		2WD Red Hat	4.1
		4WD General	4.2
	When removed from drain plug		Approximately 1.5

NOTE
- The oil level differs when the engine is cold and after it has warmed up, so be sure to check it when the engine is warm. (Also, add oil when the engine is warm.)
- Add oil through the oil pipe (level gauge part).
- Use new gaskets.

(2) Stall Test

1. Purpose
   - Check engine performance and internal transmission for abnormalities.
2. Preparation before the test
   1) Check the throttle valve's full opening.
   2) Check the engine oil.
   3) Check the cooling water.
   4) Check the transmission oil.
3. Test procedure
   1) Jack up all four wheels. (For safety)

NOTE
- If it is unavoidable to carry out the work on the ground, park the vehicle in an open area and make sure that the surrounding area is safe.

   2) Warm up the engine sufficiently and bring the transmission oil temperature to 60-80°C.
   3) Install an engine tachometer in a position visible from the driver's seat.
   4) Chock the front and rear wheels and apply the handbrake fully.
   5) Start the engine. (Turn off the air conditioner.)
   6) Set the selector lever to Ⓓ.
   7) Press the brake pedal firmly and depress the accelerator pedal fully.

8) Once the engine speed has stabilized, quickly read the speed (stall speed) (within 5 seconds) and release the accelerator pedal.
9) Place the engine in N and let it cool down for at least one minute while idling (after each cycle).
10) Perform a similar stall test in R, ②, & ①.

✻ Stall Rotation Speed

Engine	Standard Value (rpm)
NA	2500~3100
SC	2800~3200

✻ Stall Test Judgement

Stall Test Results	Probable Cause
Lower than the standard value	• Insufficient engine output • Defective torque converter
D & ② are higher than the standard value ① & R are lower than the standard value	• One-way clutch slippage
D, ②, & ① are higher than the standard value R is normal	• Forward clutch slippage
Only R is higher than the standard value	• Front clutch slippage • Low & reverse brake slippage
R & ① are higher than the standard value D & ② are normal	• Low & reverse brake slippage
All ranges are higher than the standard value	• Low line pressure

(3) Line pressure test

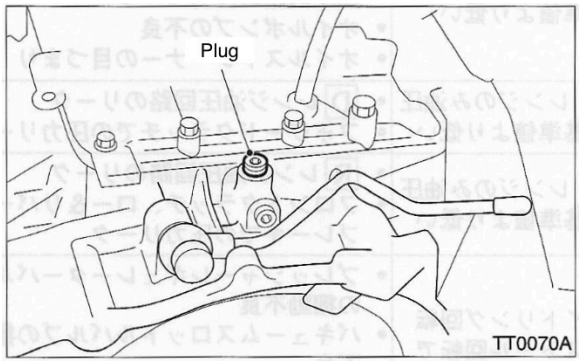
1. Purpose
   • Check the performance of the oil pump, the operating condition of each part, and leaks in the hydraulic circuit.
2. Preparation before the test
   • Same as the stall test in (2)
3. Test procedure
   1) Remove the air cleaner, remove the blind plug for checking the line pressure on the top of the transmission, and install the special tool, pressure gauge adapter, and oil pressure gauge.

ST 49889 5600 Pressure Gauge Adapter
49857 5400 Oil Pressure Gauge
49889 7700 Pressure Gauge Adapter Set

NOTE
• Be sure to use the washers (2 pieces) in the adapter set.

Plug tightening torque
T 7~9 [0.7~0.9]

NOTE
• Plugs cannot be reused. Always use new ones.



2) Jack up all four wheels (for safety).

NOTE
• If it is unavoidable to carry out the work on the ground, park the vehicle in an open area and make sure that the surrounding area is safe.

3) Warm up the engine sufficiently and make sure the transmission oil temperature is between 60 and 80°C.
4) Chock the wheels at the front and rear and apply the handbrake fully.
5) Press the brake pedal firmly and measure the line pressure for a short period of time (within 5 seconds) under the following driving conditions.

NOTE
• After each test, place the engine in N range (for 5 seconds) and allow it to cool down at idle for at least 1 minute.
• Measure oil pressure quickly during stall (within 5 seconds).

✻ Standard Value When Idling kPa (kg/cm²)

Engine	Range	Line Pressure Standard Value
NA SC	D	420~460 [4.3~4.7]
	R	860~960 [8.8~9.8]

✻ Standard Value at Stall kPa [kg/cm²]

Engine	Range	Line Pressure Standard Value
NA	D	660~750 [6.7~7.6]
	R	1360~1540 [13.9~15.7]
SC	D	720~780 [7.3~8.0]
	R	1480~1640 [15.1~16.7]

6) Line pressure test result.

Test Results	Probable Cause
In each range, the oil pressure is higher than the standard value	• Defective vacuum diaphragm • Defective vacuum hos
In each range, the oil pressure is lower than the standard value.	• Defective vacuum diaphragm • Defective vacuum hose • Pressure leak in hydraulic circuit • Oil pump malfunction • Oil strainer is clogged
[D] range only: Oil pressure is lower than the standard value	• [D] range hydraulic circuit leak • Pressure leak in the forward clutch
[R] range only: oil pressure is lower than the standard value	• [R] range hydraulic circuit leak • Front clutch, low and reverse brake pressure leak
Pressure does not change between idling and stall rotation	• Pressure regulator valve not sliding properly • Vacuum throttle valve not sliding properly • Vacuum hose is disconnected • Oil strainer is clogged

(4) Time Lag Test

1. Purpose
   - While the engine is idling, operate the selector lever and measure the time it takes to feel a shock. Check the clutch, low and reverse brakes, oil pressure, etc.

1. Inspection Procedure
   1) Warm up the engine and bring the transmission oil temperature to 60-80°C.
   2) Apply the handbrake and press the brake pedal.
   3) Start the engine and check the idling speed.

Engine	Idling Speed (rpm)
NA, SC	750 ± 50 (A/C off)

4) Use a stopwatch to measure the time from when you shift the selector lever from [N] to [D] or [N] to [R] until you feel a shock.

✻ Reference value

[N]→[D]	1.2 seconds or less
[N]→[R]	1.4 seconds or less

5) Judgment of time lag test.

Test Results	Probable Cause
[N]→[D] time is greater than the standard value	• Oil Pressure is low • Forward clutch wear
[N]→[R] time is greater than the standard value	• Oil pressure is low • Front clutch wear • Low and reverse break wear

(5) Road test

1. Purpose
   - Check the shift points, shift shock, engine brake condition, etc.
2. Inspection guidelines

1) Inspections must be carried out using a chassis dynamometer (free roller). If it is necessary to carry out the inspection on a public road, ensure that it is safe to do so.
2) Warm up the engine and allow the transmission oil temperature to reach 60-80°C.
3) Check the tire pressure.

Inspection Items	Inspection Guidelines
Ⓓ range shifting function	Check that the gears change from 1st⇄2nd⇄3rd during normal driving (typical city driving).
Ⓓ range shift shock situation	Check the shock conditions during each upshift and downshift during normal driving.
Shift point when accelerator pedal is fully open (throttle opening 100%)	Start the vehicle in Ⓓ range with the accelerator pedal fully depressed, and check the upshift speed from 1st→2nd→3rd (see the gear shift chart).
Kickdown function	1.Perform the kickdown operation in each gear position, confirm that the downshift occurs, and check the kickdown speed. (See the gear shift chart.) 2.Check the shock condition when kicking down.
Engine brake operation	1. While driving in 3rd gear in Ⓓ range (40-50 km/h), shift from Ⓓ →② range and check the engine braking effect in 2nd gear. 2. While driving in 2nd gear in ② range (30-40 km/h), shift from ② →① range and check the engine braking effect in 1st gear.
Strange noise	Check for abnormal noises while driving and when shifting gears.
Power switch function	Start the vehicle in D range with the accelerator pedal about half open, and check the upshift speed from 1st→2nd, and check the upshift speed and any abnormal noise with the switch ON and OFF. (With the switch ON, the vehicle speed will shift to the higher gear.) Caution: Keep the accelerator pedal open at the same position.
Ⓡ range operation	Start off in Ⓡ range and make sure it does not shift gears.
Ⓟ range operation	Stop the vehicle on a slope (approximately 5° or more), shift into Ⓟ range, and release the handbrake lever. At this time, make sure the vehicle does not move.

Gear table (km/h)

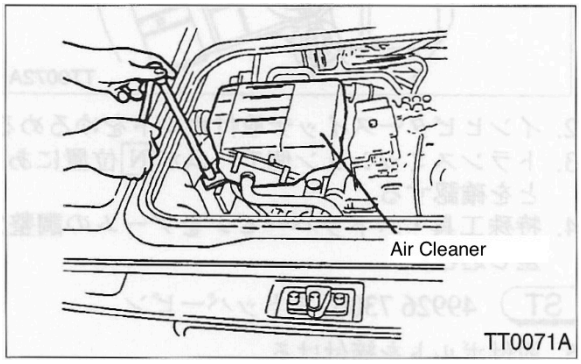
Conditions / Engine	Ⓓ Range (Power SW OFF)					② Range (Power SW OFF)	① Range (Power SW OFF)
	Throttle Open 100%		Throttle Open	Throttle Open 100%			
	1st→2nd	2nd→3rd	2nd→3rd	3rd→2nd	2nd→1st	3rd→2nd	2nd→1st
NA	26~31	51~56	24~29	44~49	23~28	60~66	34~39
SC	31~36	59~64	24~29	44~49	26~31	69~75	38~43

(Note) Speedometer reading

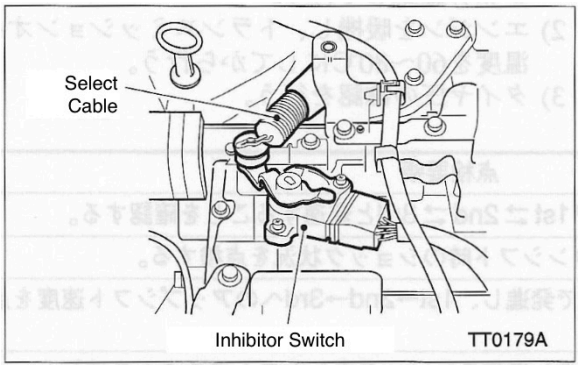
(6) Inhibitor Switch

<Inspection>

1. Remove the air cleaner.
   Ⓣ 6.5 ± 0.5 [0.65 ± 0.05]



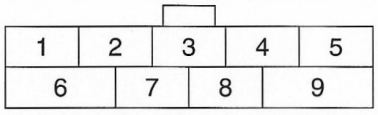
2. Disconnect the inhibitor switch connector.



3. Check the continuity between the terminals for each range.

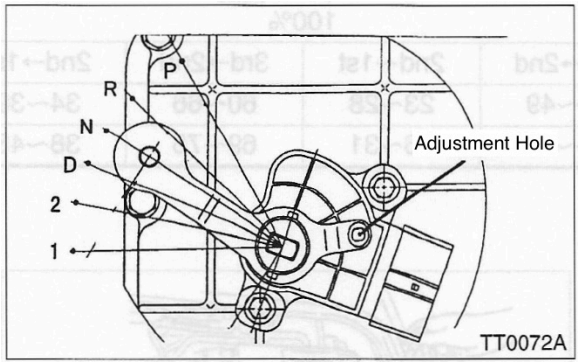
Range \ Terminal No	6	9	1	4	5	3	8	2	7
P	○	○	○	○					
R			○		○				
N	○	○	○			○			
D			○				○		
2			○					○	
1			○						○

✻ Inhibitor Switch Connector



<Adjustment>

1. Place the selector in [N] range.



2. Loosen the inhibitor switch mounting bolt.
3. Check that the transmission side arm is in the [N] position.
4. Insert the special tool stopper pin into the adjustment hole on the arm.

ST 49926 7300 Stopper pin

5. Tighten the mounting bolts.
   [T] 2.5 ~ 4.0 [0.25~0.4]
6. Remove the special tool and stopper pin.

<Detachment>

1. Use the special tool, a straight pin remover, to remove the spring pin and pull out the selector lever.

ST 89990 4100 Straight Pin Remover

2. Loosen the inhibitor switch mounting bolt and pull out the inhibitor switch.
3. Installation is the reverse of removal. See the "Adjustment" section.

NOTE

• Use a new spring pin.

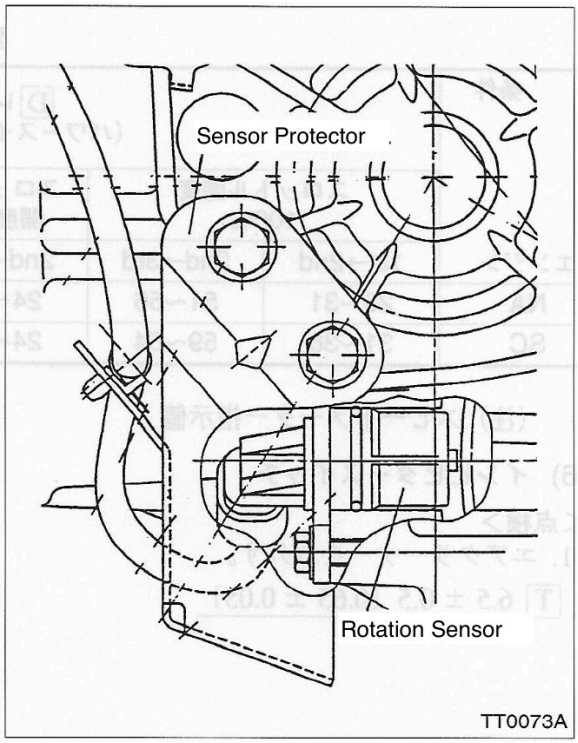
(7) Rotation Sensor

<Detachment>

1. Loosen the two sensor protector mounting bolts and remove the sensor protector.
   [T] 16~21 [1.6~2.1]
2. Disconnect the connector.
3. Loosen the rotation sensor mounting bolt and remove the rotation sensor.
   [T] 6~8 [0.6~0.8]

NOTE

• When assembling, use a new o ring.



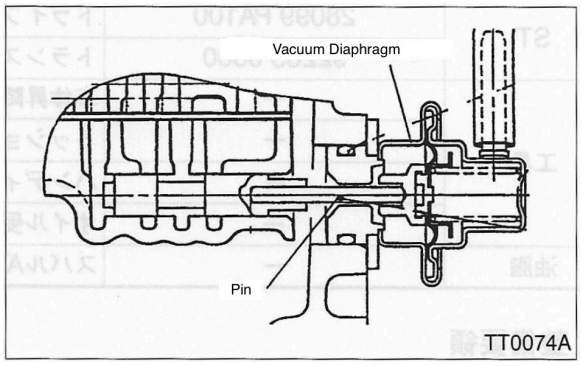
(8) Vacuum Diaphragm

<Detachment>

1. Remove the vacuum hose.
2. Loosen the vacuum diaphragm mounting bolts and pull out the vacuum diaphragm.
   T 6~8 [0.6~0.8]

NOTE

- A pin will come out, so remove it.
- When assembling, use a new o ring.



[3] Transmission Removal & Installation

■ Maintenance Preparation Items

Classification	Tool Number	Description	Purpose
ST	28099 PA100	Drive shaft remover	Remove axle shaft
	92265 0000	Transmission hanger	For engine support
Tool	-	Vehicle lift for raising and lowering the vehicle body	Raising and lowering vehicle body
	-	Transmission jack	Removal and installation of the transmission
	-	Handy bar (crowbar)	Remove the rear left axle shaft
	-	Oil Pan	ATF recovery
Grease & Oils	-	Subaru ATF (3AT only)	ATF replenishment

■ Maintenance Instructions

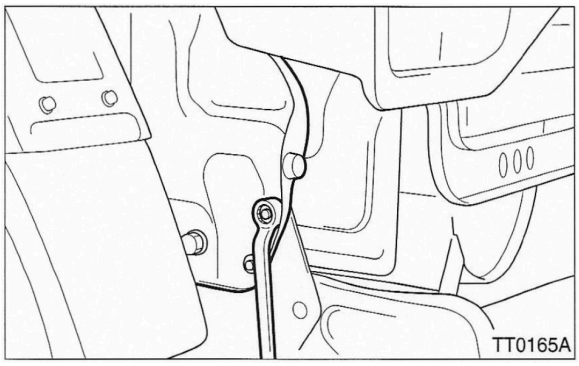
<Removal>

This is for a SC-4WD truck. Please refer to this chapter when installing or removing the bolts on other vehicles such as vans or 2WD. The tightening torque is shown in T N·m (kg·m).

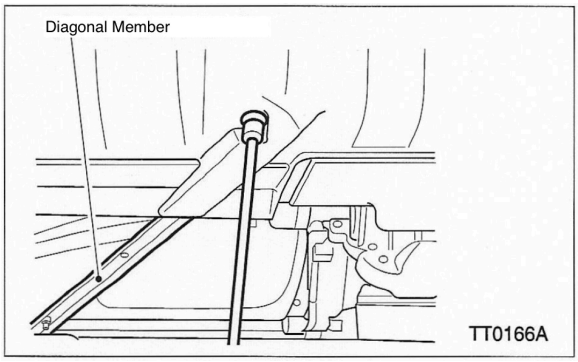
1. Place the vehicle on the lift.
2. Remove the battery cover and disconnect the battery terminals.
3. Remove the trapdoor.
4. Remove the rear bumper.

NOTE

• Disconnect the lamp harness connector.



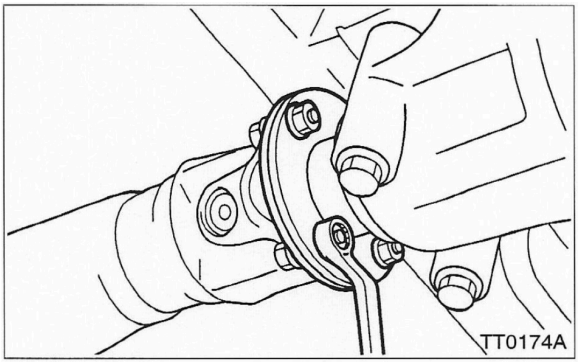
5. Lift up the vehicle and remove the under cover and diagonal members (both left and right).
   T 69 ± 10 [7.0 ± 1.0]



6. Remove the muffler assembly.
   • For removal procedures, refer to section [3] of the Manual Transmission.
7. Remove the connecting bolts to the front differential and remove the propeller shaft.
   T 25 ± 7 [2.5 ± 0.7]

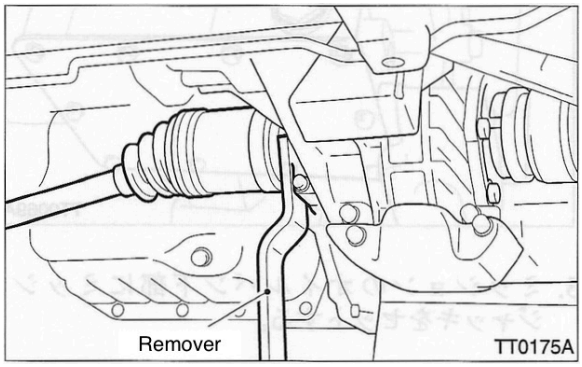
NOTE

• After the propeller shaft is removed, oil will leak out, so insert a cap on the transmission side to prevent this.



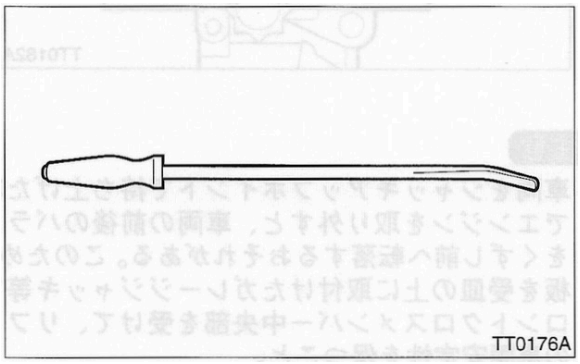
8. Remove the rear drive shaft.
   1) RH side
      • Use the special tool drive shaft remover to separate the drive shaft from the axle shaft.

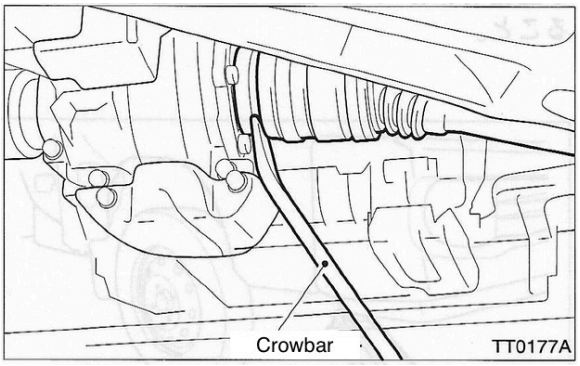
ST 28099 PA100 Drive Shaft Remover



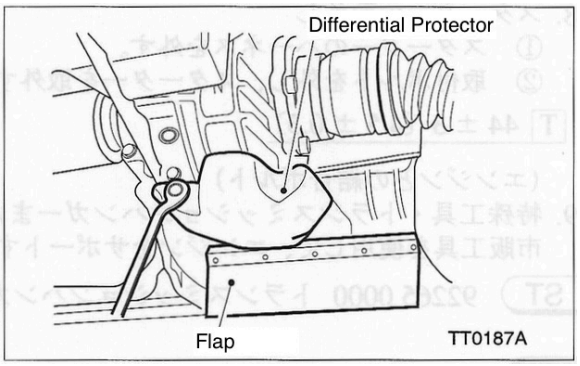
   2) LH side
      • Use a commercially available tool such as a crowbar to separate the drive shaft from the axle shaft.

REFERENCE
• Handy Bar LZ2-600 (KTC, Kyoto Machine Tools KK)

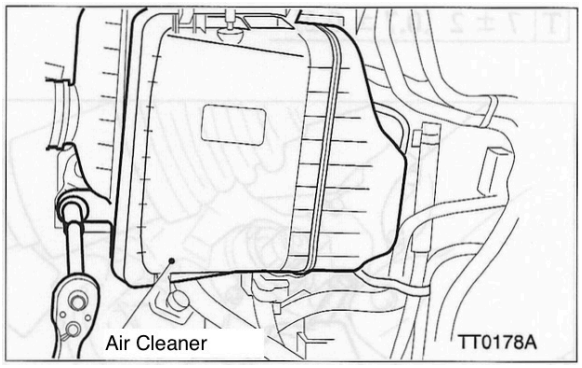




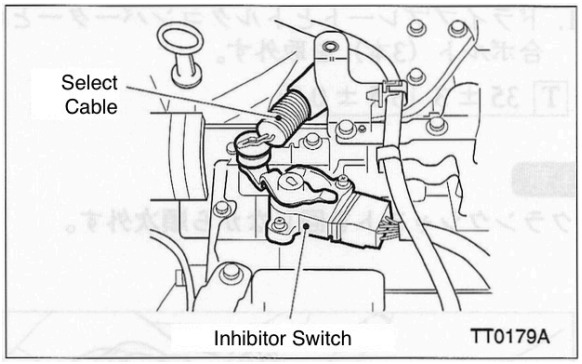
9. Remove the two bolts and remove the flap CP (differential protector).
   T 33 ± 10 [3.3 ± 1]



10. Remove the mounting bolts and hoses from the trap door side, and then remove the air cleaner.
    T 6.5 ± 0.5 [0.65 ± 0.05]



11. Disconnect the inhibitor switch connector.



12. Disconnect the select cable on top of the transmission.
13. Disconnect the speedometer cable.
14. Disconnect the RPM sensor and shift solenoid connectors.
15. Loosen the clamps and remove the IN and OUT ATF oil cooler hoses.

NOTE
• Prevent oil leaks from hoses and pipes.

16. Remove the ground cord.
17. Remove the air breather hose (SC vehicles only).

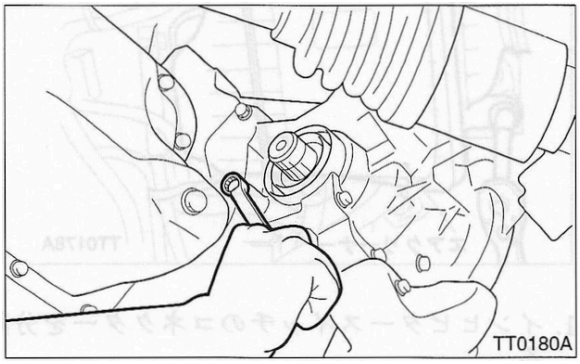
18.Removing the starter
1)Disconnect the starter harness.
2)Remove the mounting bolts and remove the starter.
T 44 ± 3 [4.5 ± 0.3]
(Bolt that connects to the engine)

19.Support the engine using a special tool/transmission hanger or commercially available tools.

ST 92265 0000 Transmission Hanger

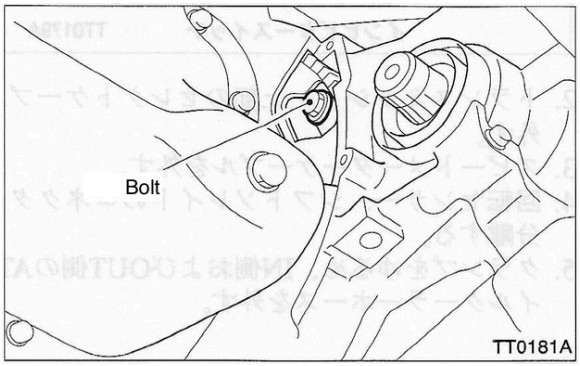
REFERENCE
- Commercially available tool: Engine support bridge Banzai Co., Ltd. ESB-2

20.Remove the mounting bolts and remove the flywheel housing cover.
T 7 ± 2 [0.7 ± 0.2]

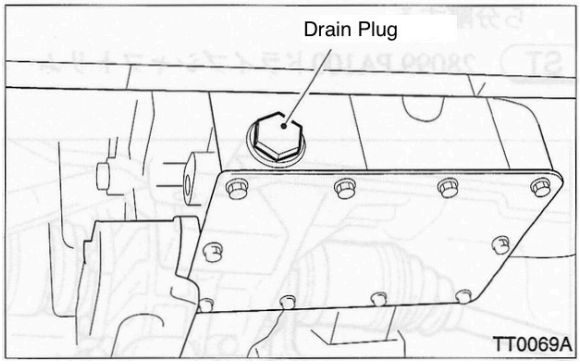


21.Remove the three bolts connecting the drive plate and torque converter.
T 35 ± 3 [3.5 ± 0.3]

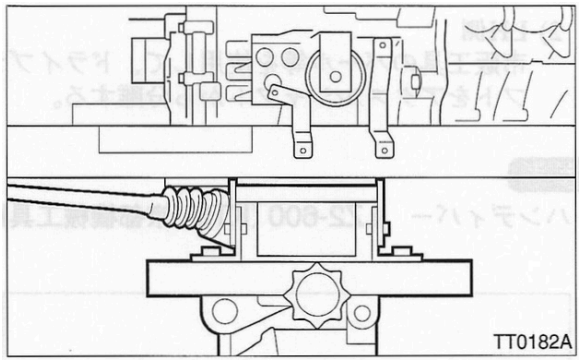
NOTE
- Remove the crankshaft one by one while turning it.



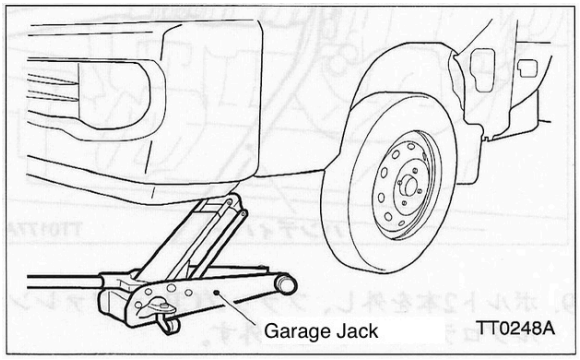
22.Remove the drain plug and drain the ATF.
T 39~54 [4.0~5.5]

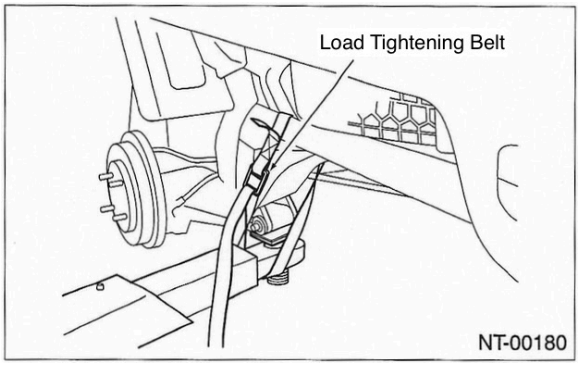


23.Place the transmission jack under the transmission oil pan.

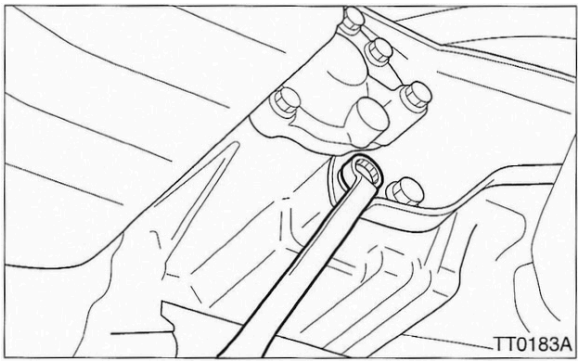


NOTE
- If the engine is removed while the vehicle is lifted on a jack-up point, the front and rear balance of the vehicle may be lost and it may fall forward. For this reason, use a garage jack with a thick plate attached to the tray to support the center of the front cross member, thereby maintaining the stability of the vehicle on the lift.
- Alternatively, securely secure the vehicle to the lift by following the procedure in Chapter 1-4 <Securing the vehicle when removing the engine>.



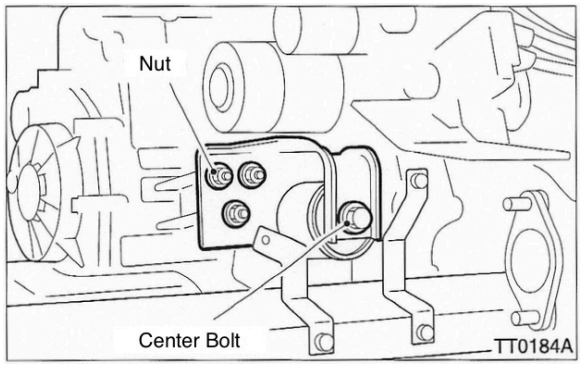


24.Remove the front mounting.
T 62 ± 5 [6.3 ± 0.5]



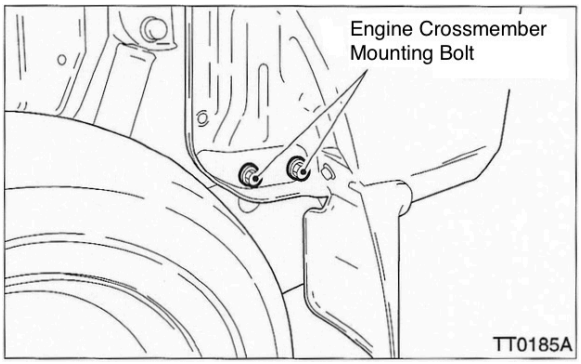
25.Remove the rear mounting bracket fixing nut and mount set bolt.

Nut	T 90 ± 10 [9 ± 1]
Center Bolt	T 70 ± 8 [7 ± 0.8]

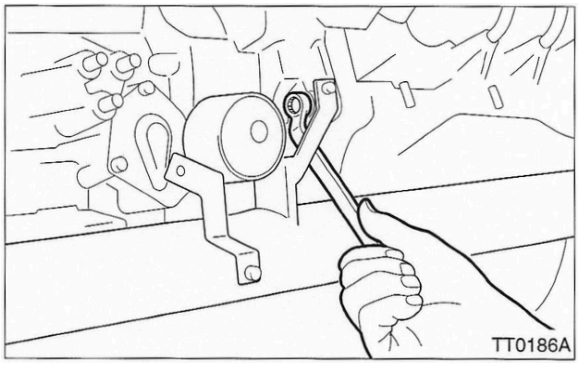


26.Loosen the engine cross member mounting bolts (two on each side), shift the cross member towards the rear, and remove the mounting bracket.
T 64 ± 10 [6.5 ± 1.0]

NOTE
- Just loosen the cross member mounting bolts, do not remove them.
- Insert a piece of wood between the engine and the cross member.



27.Remove the bolts connecting the transmission to the engine and remove the transmission from the vehicle.
T 44 ± 3 [4.5 ± 0.3]



NOTE
- Use a garage jack to adjust the engine so that it does not tilt.
  - When doing this, be careful not to let the O2 sensor come into contact with the ground or cross member.
- When removing the transmission, be careful not to damage the brake pipe section with the tip of the transmission (the side where the propeller shaft is inserted).

<Installation>

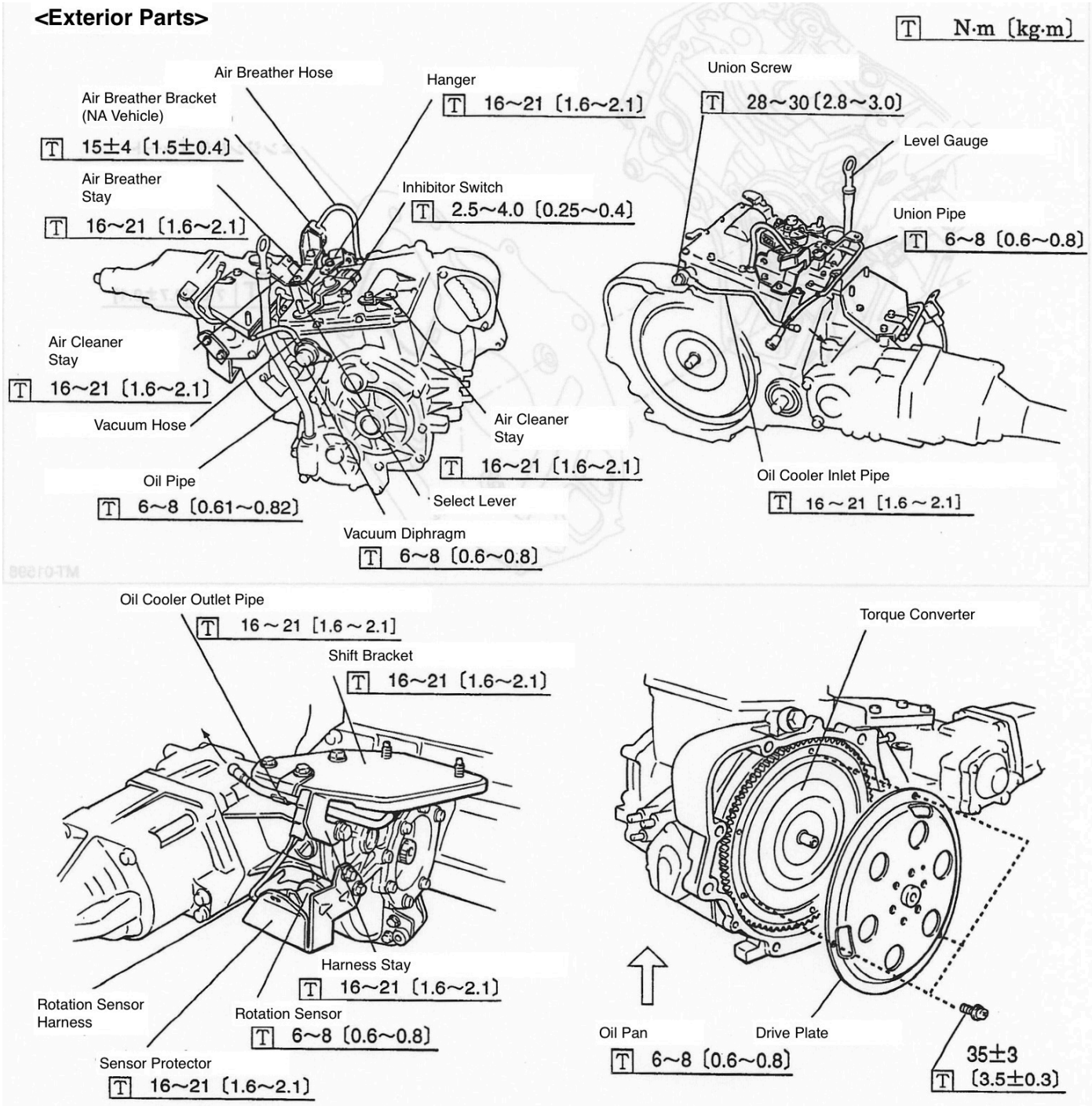
Follow the removal procedure in reverse.

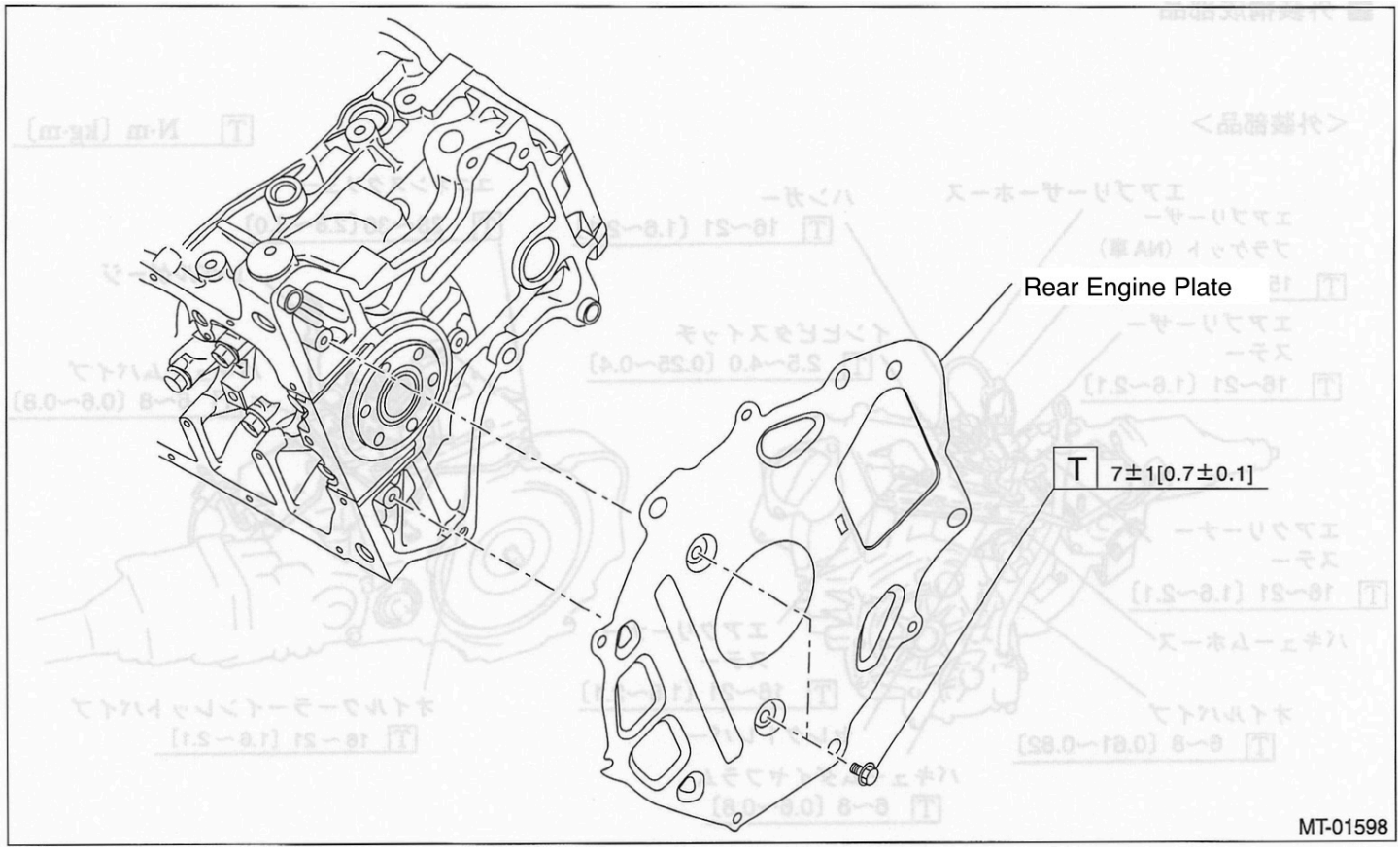
NOTE
- For 4WD, the extension contains ATF to lubricate the transfer gear. When installing, do not tilt the transmission unnecessarily to prevent the ATF from moving toward the transmission case.
- Use new gaskets.
- When inserting the drive shaft, make sure it is securely inserted.

- For installing the speedometer cable, refer to the manual transmission installation section.
- For installing the muffler assembly, refer to the section on engine exhaust system.
- Check the ATF level with the level gauge, and if it is insufficient, add oil through the oil pipe. See [2] On-board Inspection.

■ Exterior Components

<Exterior Parts>

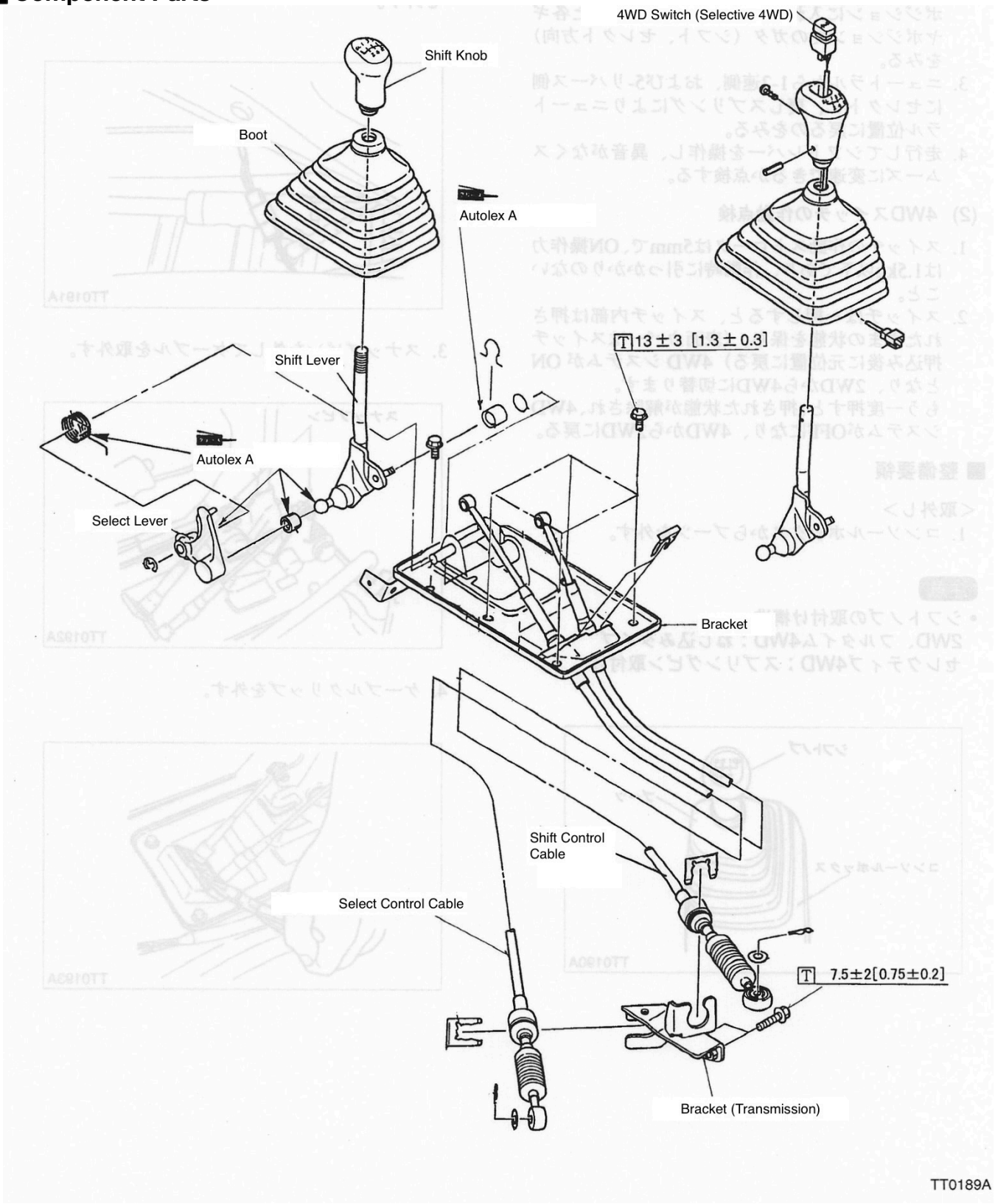



Rear Engine Plate
T
7±1[0.7±0.1]
MT-01598

3 - 4 Shift & Select System

[1] Gear Shift System (MT Vehicle)

■ Component Parts



■ On-board Inspection

(1) Operation mechanism inspection

1. In the neutral position, rock the shift lever to check for any play.
2. Depress the clutch pedal and move the shift lever to each gear position to check whether it shifts smoothly and whether there is any play (in the shift and select directions) at each gear position.
3. From neutral, select 1st-2nd gear and 5th-reverse, and watch as the return spring returns to the neutral position.
4. While driving, operate the shift lever and check that gears change smoothly and without any abnormal noises.

(2) Check the Operation of the 4WD Switch

1. The switch operating stroke is 5 mm, the ON operating force is 1.5 kg or less, and there is no sticking when operating.
2. When you press the switch once, the inside of the switch will remain pressed (the surface cover will return to its original position after pressing the switch), the 4WD system will be turned on, and the vehicle will switch from 2WD to 4WD.
   - Pressing it again will release the pressed state, turn off the 4WD system, and return from 4WD to 2WD.

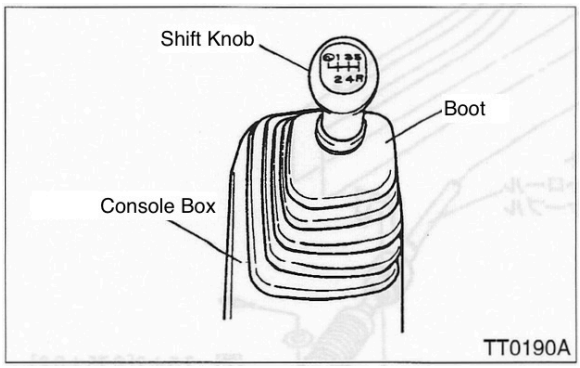
■ Maintenance Instructions

<Removal>

1. Remove the boot from the console box.

NOTE

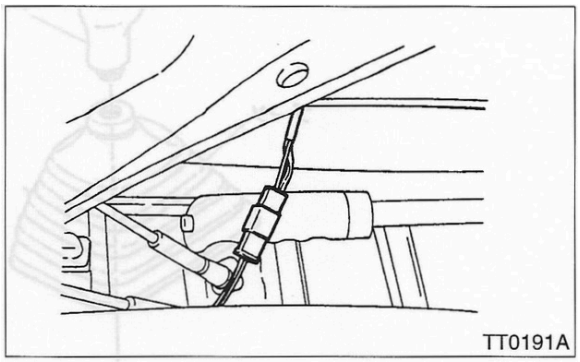
- Shift knob mounting structure
  - 2WD & Full-time 4WD: Screw-in type
  - Selective 4WD: Spring pin installation



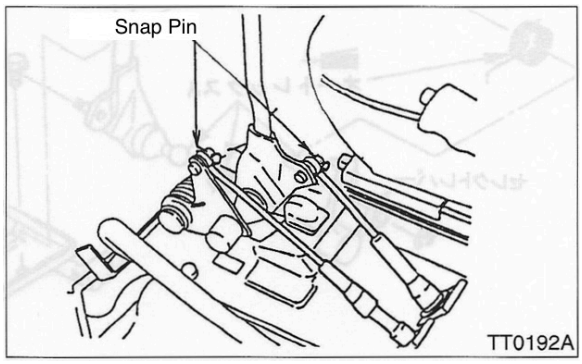
2. Remove the console box (see the section on body interior).

NOTE

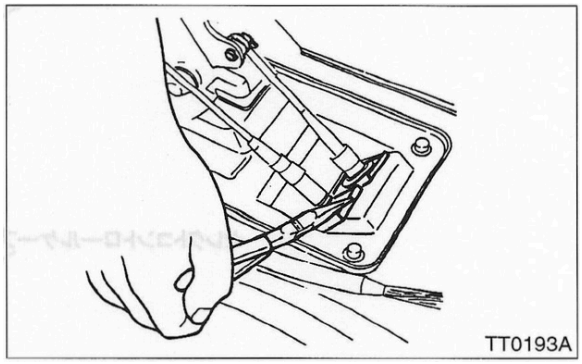
- For selective 4WD vehicles, remove the 4WD switch connector.



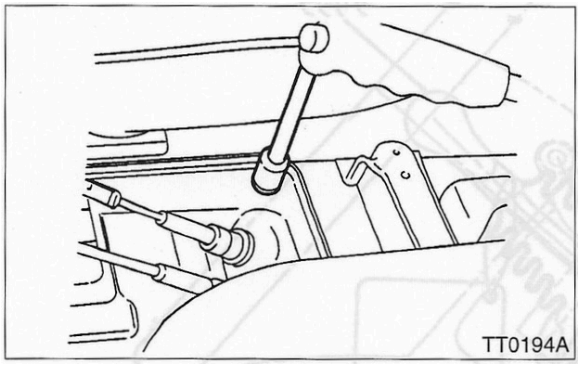
3. Remove the snap pin and remove the cable.



4. Remove the cable clip.

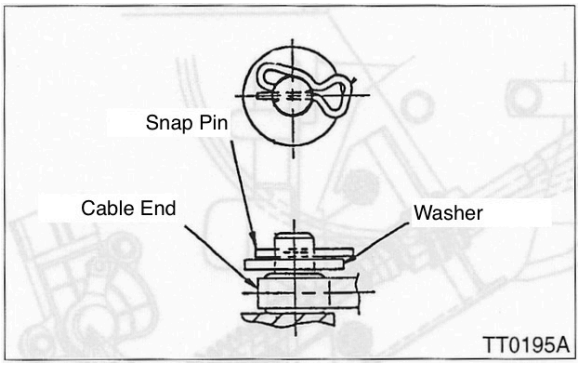


5. Remove the bracket mounting bolts from the gear shift control lever assembly, and remove the lever assembly.
   T 13 ± 3 [1.3 ± 0.3]



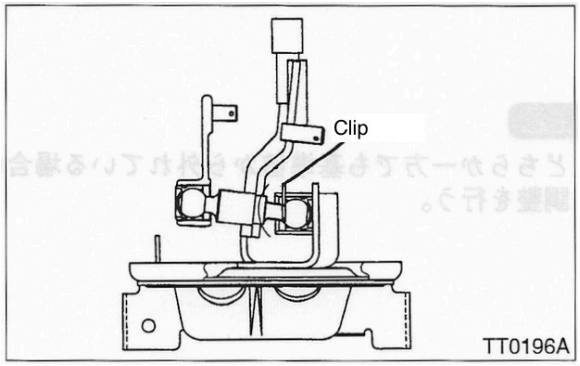
<Installation>

- Installation is the reverse of removal procedure.
- When assembling the snap pin at the end of the cable, insert it securely from the rear of the vehicle (for both shift and select).



<Disassembly>

- Remove the snap ring and remove the selector lever, then remove the clip and remove the gear shift lever.



<Inspection>

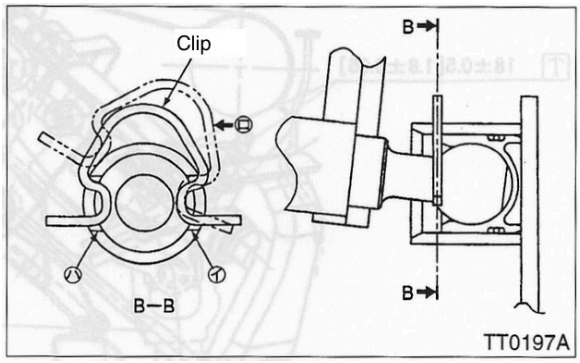
- Check each part for damage, cracks, deterioration, wear, looseness, bends, etc.

<Assembly>

1. Assemble the shift lever to the bracket
   1) Place the tip of the clip into the groove.
   2) Push the clip in the direction of the arrow.
   3) Place the clip in the groove.

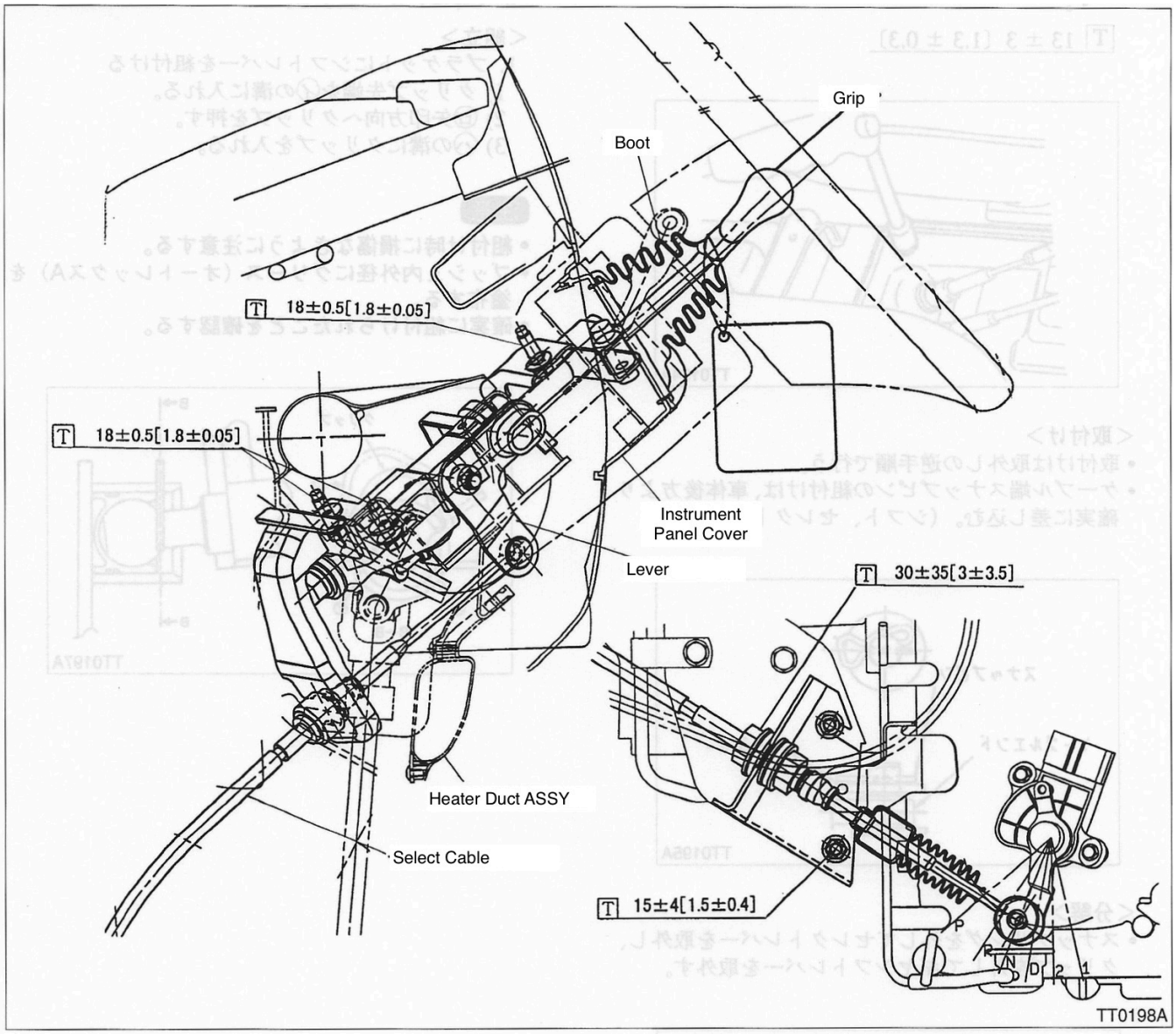
NOTE

- Be careful not to damage it when assembling.
- Apply grease (Autolex A) to the inner and outer diameters of the bushing.
- Check that it is securely assembled.



[2] Gear Select System (3AT Vehicles)

■ Component Parts



■ On-board Inspection

(1) Select Cable Inspection

1. Set the selector lever to N range and push it toward R range without pulling it up to check the amount of overstroke at the top of the grip.

Standard Value (mm)	1~5

2. Set the selector lever to range ② and check the amount of overstroke at the top of the grip when it is pushed toward range ① without being pulled up.

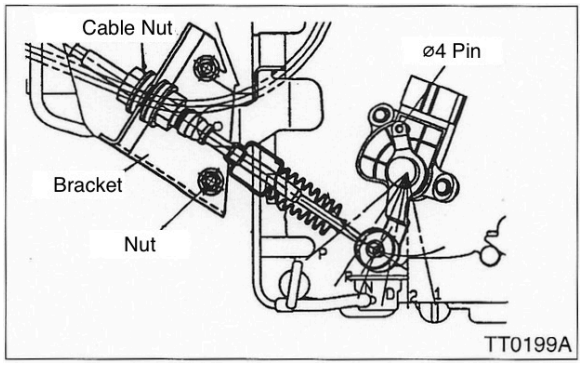
Standard Value (mm)	1~5

NOTE

- If either of the values is outside the standard value, adjustments will be made.

<Adjustment>

1. Place the selector lever in [N] range.
2. Open the trap door and remove the air cleaner (see the engine section).
3. Insert the locating pin into the pin hole (44) at the end of the transmission selector arm.
4. Remove the two nuts that secure the select cable bracket.
   [T] 15 ± 4 [1.5 ± 0.4]



5. The mounting holes on the select cable bracket are elongated, so if the bolt is within the range of the elongated holes, tighten the two nuts at that position. If the bolt is out of position, loosen the cable nuts and adjust the bolt so that it fits into the elongated hole.
   [T] 29~34 [3~3.5]

NOTE

- Do not push or pull the cable with force while working.
- Unplug the ø4 pin and check the reference values for [N] range and ② range when inspecting the select cable.

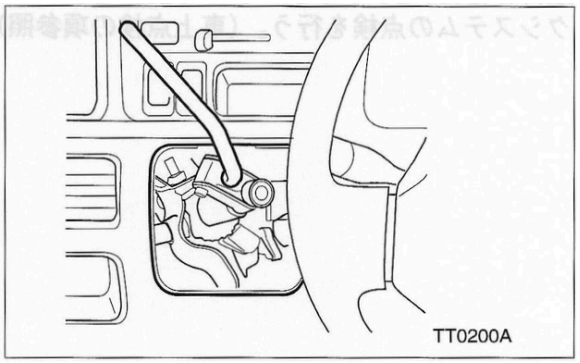
(2) Check the shift lock system

1. Place the selector lever in [P] range.
   - In [P] range, the key plate can be removed by turning it to the LOCK position, but make sure that it cannot be turned to the LOCK position in any other range than [P] range. (key interlock device)
2. Turn the ignition switch to ON or ACC.
3. Make sure that the selector lever cannot be moved from the [P] range to another position without depressing the brake pedal.
4. Check that the selector lever can be moved from [P] range to another position when the brake pedal is depressed. (Shift lock device)
5. Check that the buzzer sounds intermittently when the selector lever is in [R] range.
6. Turn the ignition switch OFF, pull the shift lock release lever down, and check that the selector lever can be moved from [P] range to another range.

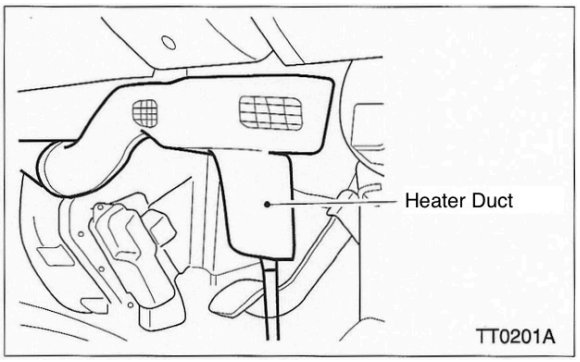
■ Maintenance Instructions

<Removal>

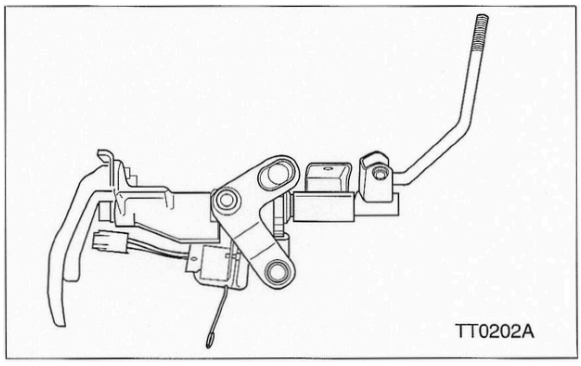
1. Remove the grips, boots, and instrument panel cover.



2. Remove the heater duct assembly.



3. Remove the snap pin and washer connecting the select cable to the lever, and then remove the cable eye end from the arm.
4. Remove the clip that secures the outer cable to the bracket.
5. Remove the select cable from the clip on the side of the heater and pull the cable out onto the floor.
6. Disconnect the harness connector.
7. Remove the three mounting bolts from the selector lever assembly, and then remove the selector lever assembly.
   [T] 18 ± 0.5 [1.8 ± 0.05]



<Installation>

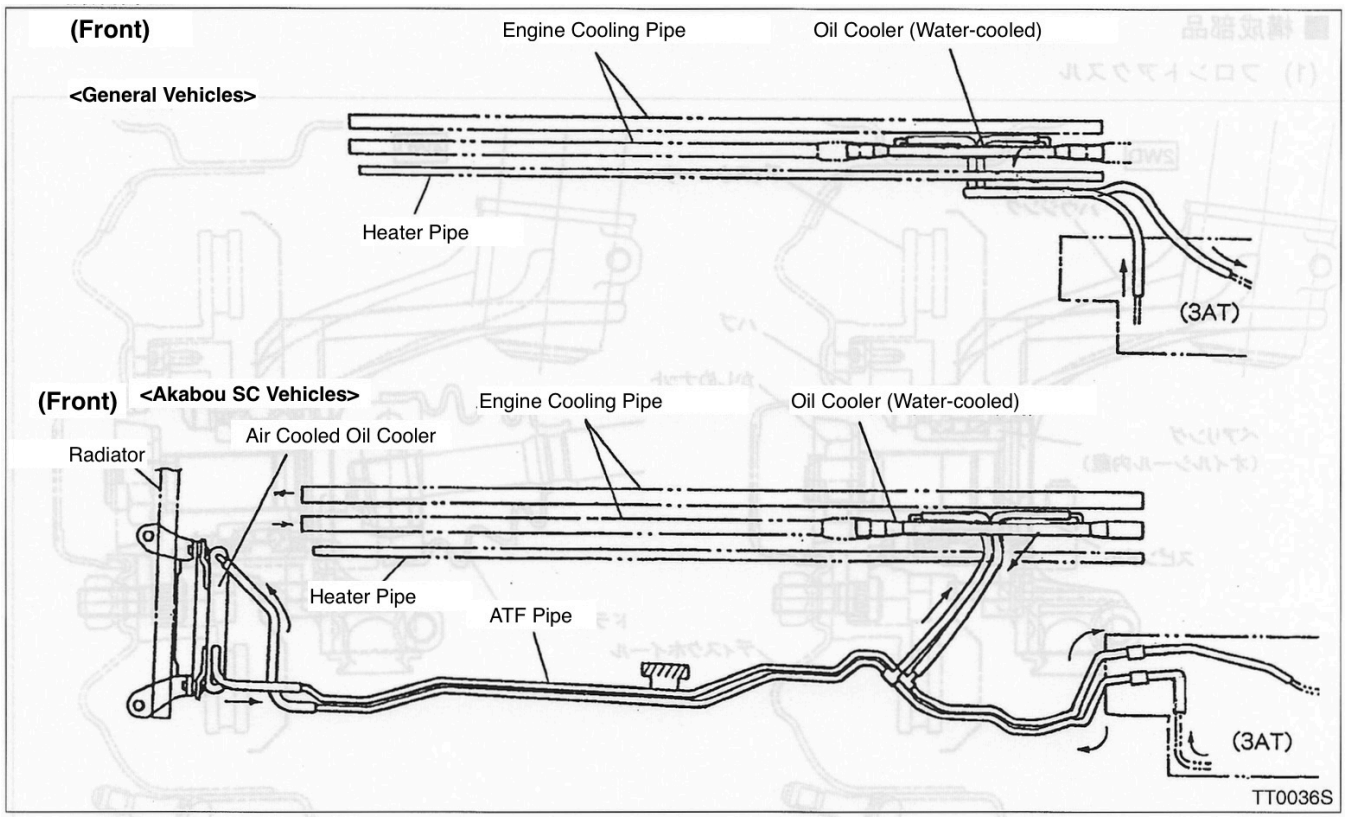
Installation is the reverse of removal procedure.

NOTE

- After installation, adjust the select cable and inspect the shift lock system (see the On-Board Inspection section).

3 - 5 Oil Cooling System (3AT Vehicles)

Component Parts



Maintenance Instructions

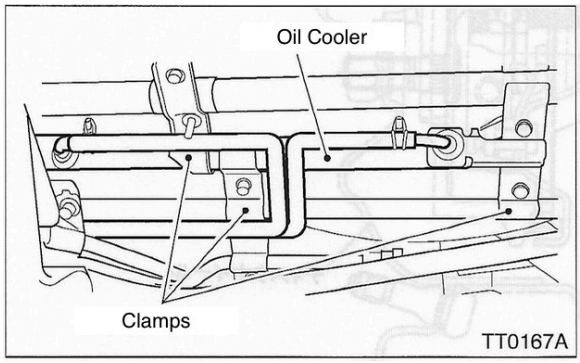
<Removal>

1. Drain the engine coolant (see the section on engine cooling systems).
2. Loosen the clamps on the IN and OUT sides of the oil cooler and remove the hose.

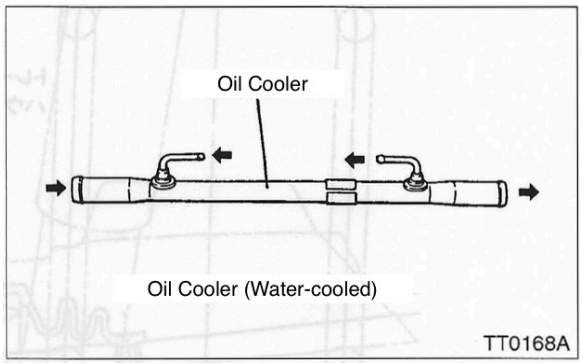
NOTE

- ATF will leak out, so plug the hose side and the oil cooler side with a rubber plug or similar.

3. Remove the mounting bolts and remove the oil cooler clamp.
   T 7.5 ± 2 [0.75 ± 0.2]



4. Loosen the clamp connecting the oil cooler to the engine



cooling pipe and remove the oil cooler.

<Installation>

Follow the removal procedure in reverse.

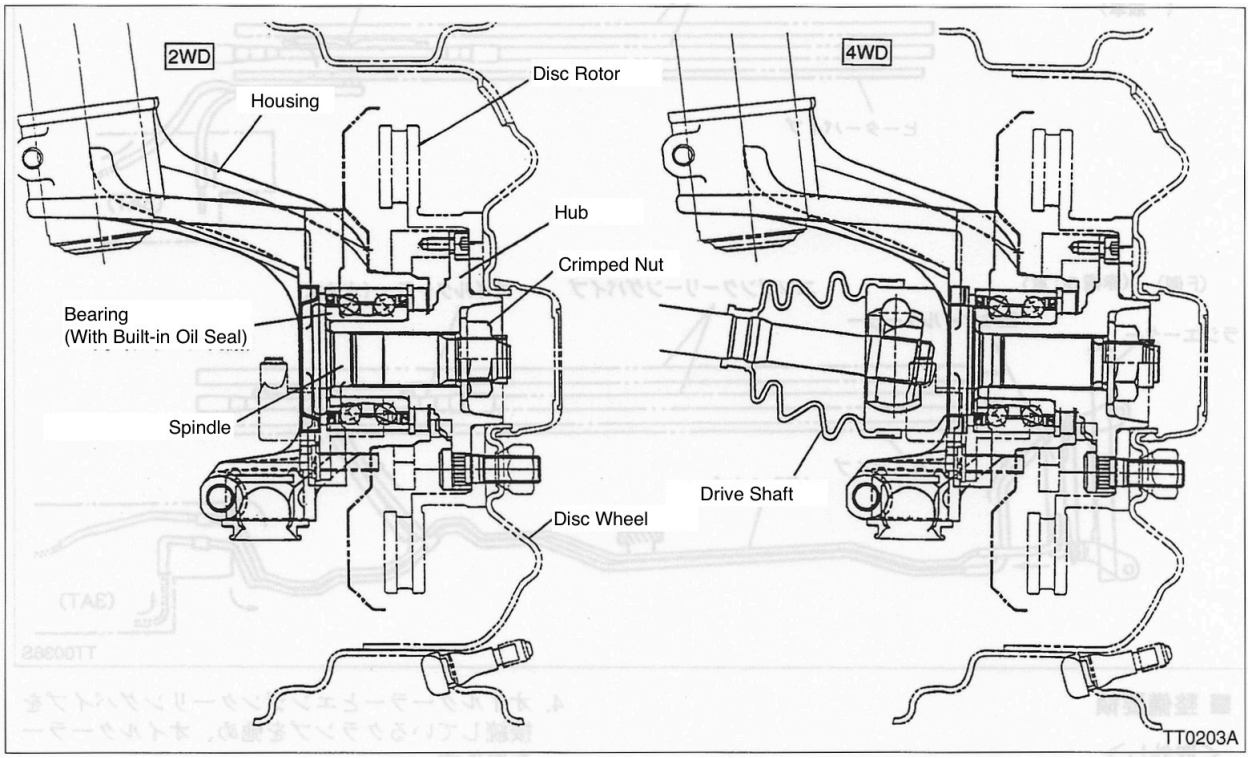
NOTE

- For information on adding engine coolant, refer to the section on engine cooling system.

3 - 6 Drive System & Axle

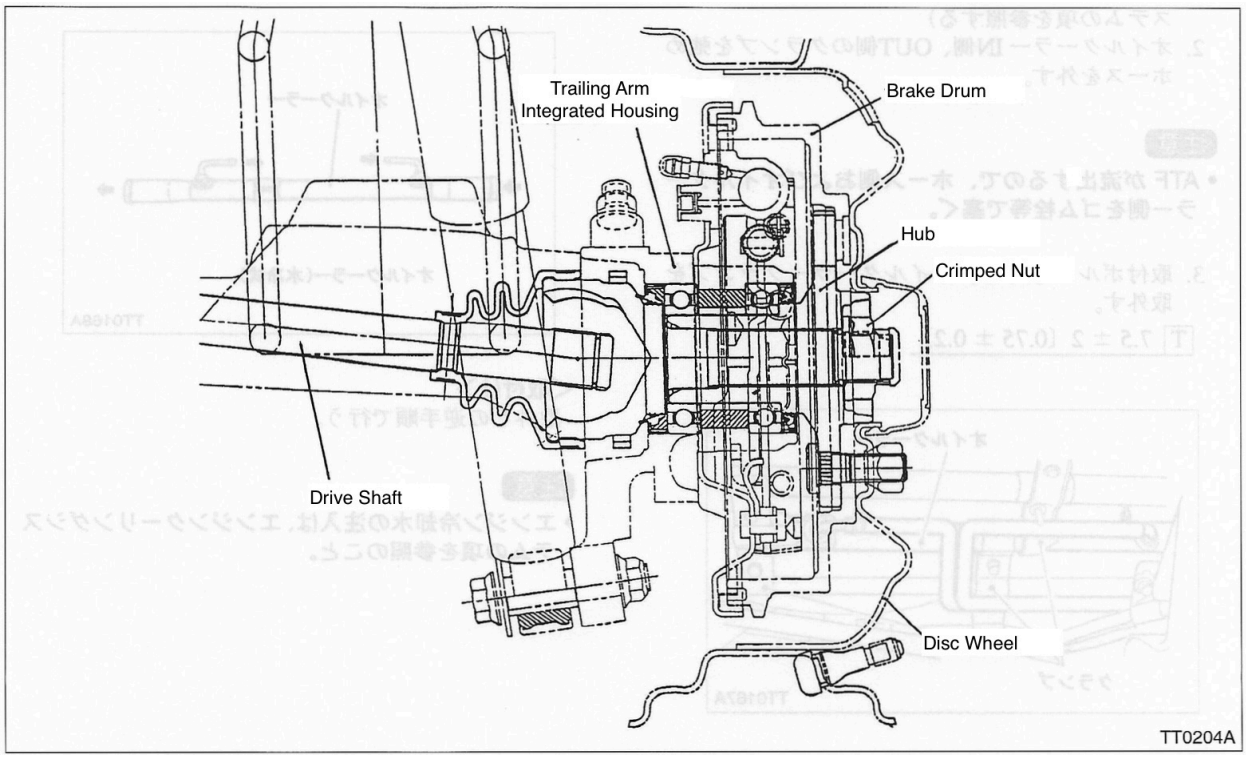
[1] Axle

■ Component Parts



(1) Front Axle

(2) Rear Axle



■ Maintenance Preparation Items

(1) Front Axle

Classification	Tool Number	Description	Purpose
ST	28099 PA100	Drive shaft remover	Drive shaft removal
	92707 0000	Puller	Drive shaft extraction
	92708 0000	Hub stand	Hub COMPL removal
	98399 TC000	Hub puller ASSY	Hub COMPL removal (new)
	92262 0000	Housing stand	Hub COMPL removal
	92261 0000	Bearing puller	Hub COMPL removal
	92260 0000	Hub installer	Hub COMPL assembly
	92263 0000	Spacer	Hub COMPL assembly
Tool	-	Snap ring pliers	Snap ring removal
Instrument	-	Magnetic stand dial gauge	Bearing play measurement

(2) Rear Axle

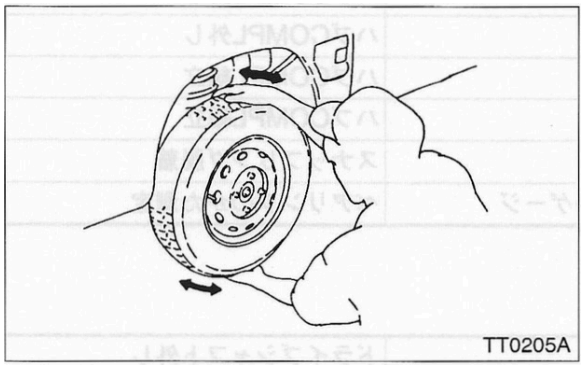
Classification	Tool Number	Description	Purpose
ST	28099 PA100	Drive shaft remover	Drive shaft removal
	92707 0000	Puller	Drive shaft extraction
	92708 0000	Hub stand	Hub COMPL removal
	92263 0000	Spacer	Hub COMPL assembly
	28499 TC000	Installer	Trailing arm disassembly and assembly (new)
	28499 TC010	Base	Trailing arm disassembly and assembly (new)
	92745 0000	Hub installer	Hub assembly
Tool	-	Snap ring pliers	Snap ring removal
Grease, Oils, etc	-	Grease (Shell 6459N)	Bearings, oil seal, & lubrication

■ Maintenance Instructions

(1) On-board inspection

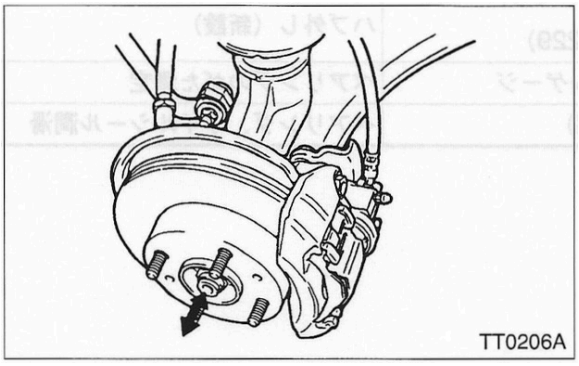
<Wheel bearing play>

1. Move the tire by placing your hands on the top and bottom to check for any looseness in the wheel bearings and for any abnormal noises such as brake dragging when turning the wheel.



2. Remove the wheel, secure a dial gauge to the housing or strut, and measure the axial play.

Standard Value (mm)	**Front**	0.05 or less
	Rear	0.3 or less



(2) Front axle

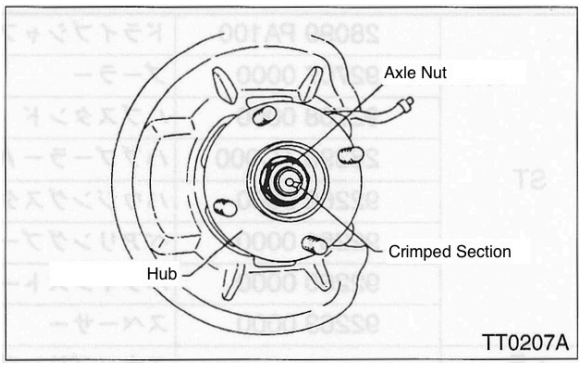
<Removal>

1. Jack up the vehicle and remove the front wheel.
   T 88 ± 10 [9 ± 1]
2. Use a chisel or similar tool to raise the crimp on the axle nut.
3. Remove the axle nut with a socket wrench.
   T 177 ± 20 [18 ± 2]

NOTE

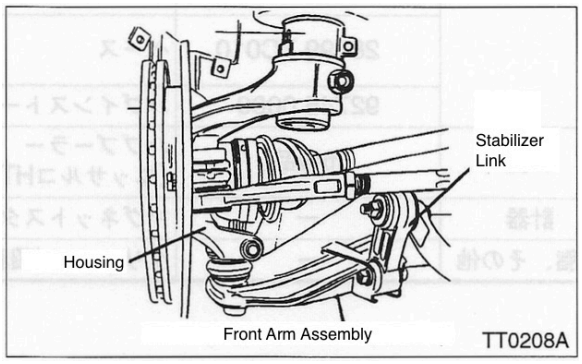
- Loosening the axle nuts while the tire is on the ground may damage the bearings, so when loosening or tightening the axle nuts, do not jack up the vehicle

After the setup, work is carried out with the wheels removed.



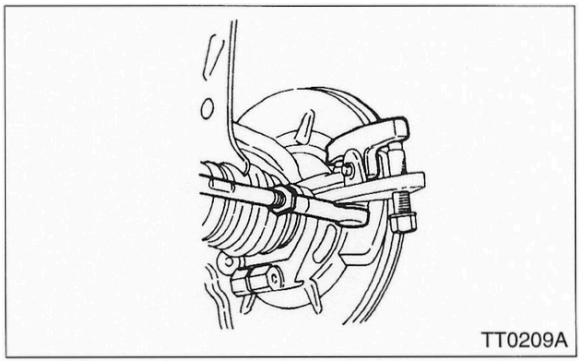
4. Disconnect the stabilizer link from the transverse link, remove the bolts, and pull the ball joint part of the transverse link out of the housing.
   Stabilizer Link 2008
   T 29 ± 5 [3 ± 0.5]

   Ball Joint 000080S
   T 58 ± 12 [5.9 ± 1.2]



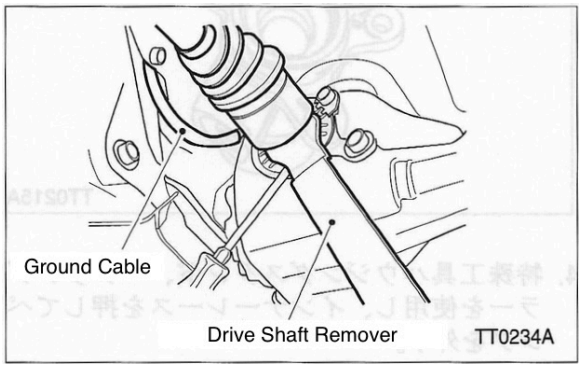
5. Remove the tie rod end from the knuckle arm.
   T 25 ~ 29 [2.5 ~ 3.0]

(Tighten within a 60° range and align the cotter pin hole.)



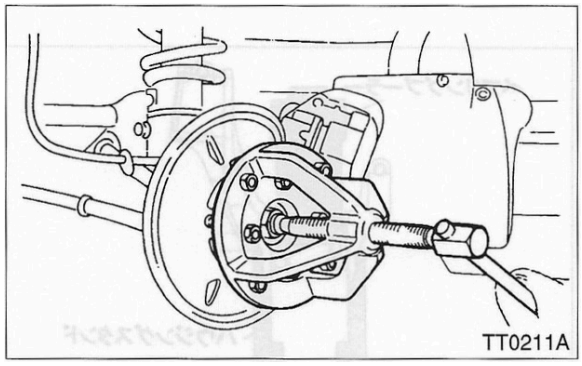
6. Use the special tool drive shaft remover to disconnect the drive shaft from the front differential, and while pushing the housing outward, pull the drive shaft out of the front differential.

ST 28099 PA100 Drive Shaft Remover

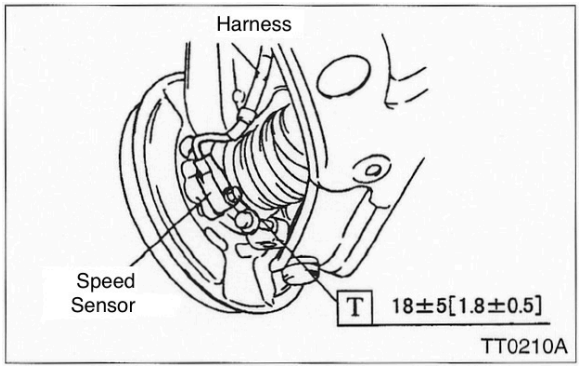


7. Remove the BJ from the front hub spline and remove the front drive shaft assembly. If the spline is stuck, use a special tool puller.

ST 92707 0000 Puller

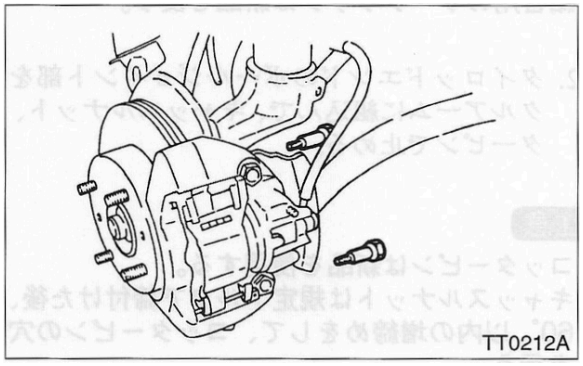


8. For vehicles equipped with ABS, separate the ABS speed sensor from the housing.
T 18 ± 5 [1.8 ± 0.5]

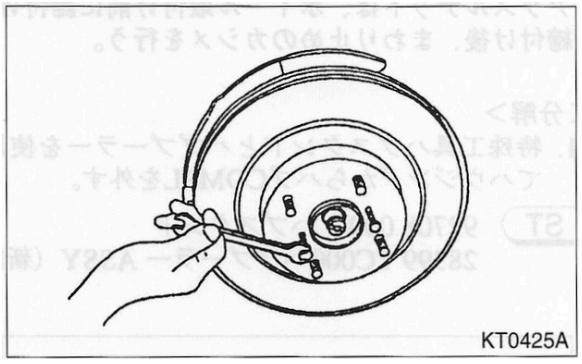


9. Remove the brake caliper assembly from the housing.
T 70~95 [7~9.5]

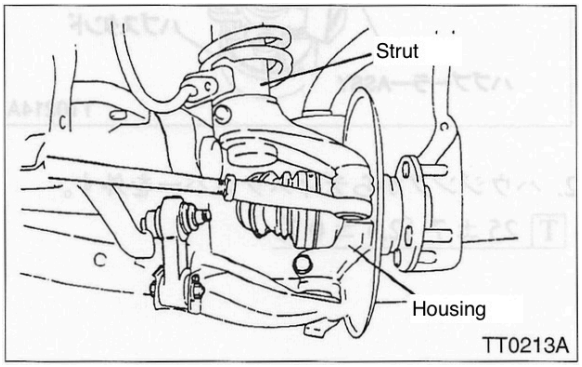
NOTE
• Hang the removed caliper assembly with wire or similar.



10. Remove the disc from the hub. If the disc rotor is stuck to the hub, thread an 8mm bolt into the screw hole on the disc rotor to lift it off the hub.



11. Remove the bolts connecting the housing and strut, and separate the housing and strut.
T 66 ± 7 [6.6 ± 0.7]



<Installation>

Installation is the reverse of removal procedure.
The difference between the removal procedures are as follows:

1. Align the DOJ spline with the differential spline, and push the housing to push in the DOJ.

NOTE
- Use new circlips.

2. Assemble the ball joint part of the tie rod end into the knuckle arm and secure with a castle nut and cotter pin.

NOTE
- Use new cotter pins.
- After tightening the castle nut to the specified torque, tighten it further by no more than 60° and align the cotter pin hole.

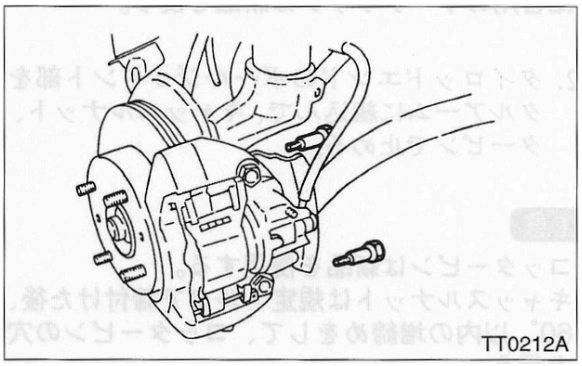
3. Tighten the axle nut.

NOTE
- Use new axle nuts.
- Tighten the axle nuts before installing the wheel.
- After tightening, crimp to prevent rotation.

<Disassembly>

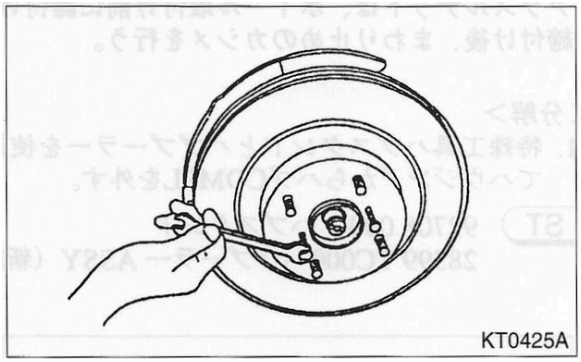
1. Use the special tools hub stand and hub puller to remove the hub COMPL from the housing.

S T 92708 0000 Hub Stand
28399 TC000 Hub Puller ASSY (New)



2. Remove the disc cover from the housing.
T 25 ± 7 [2.5 ± 0.7]

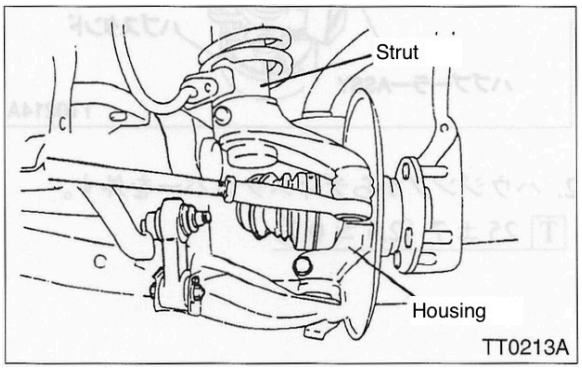
3. Remove the snap ring by prying it out with a screwdriver or similar tool.



4. Using the special tool, housing stand and bearing puller, press the inner race and remove the bearing.

S T 92262 0000 Housing stand
92261 0000 Bearing puller

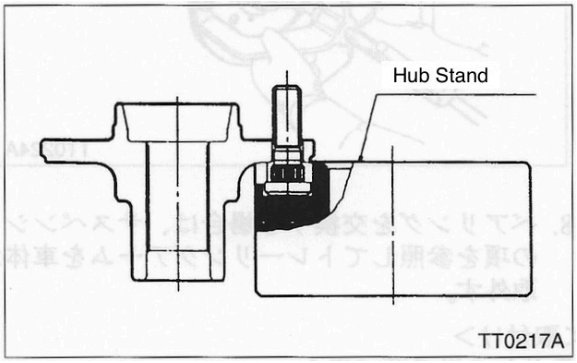
NOTE
- Do not remove the bearings and hubs unless there is any abnormality such as rattle in the bearings, strange noises, or damage to the bolts on the hub COMPL. If removed, do not reuse.



5. Use the special tool hub stand to press out the hub bolt.

S T 92708 0000 Hub Stand

NOTE
- Do not hit the hub bolts with a hammer to remove them, as this will deform the hub.

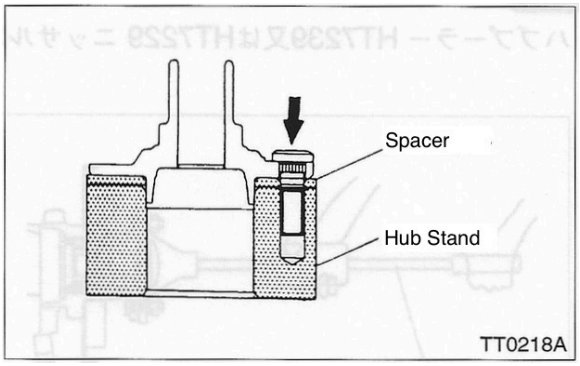


<Assembly>

1. Use the special tools hub stand and spacer to press the hub bolt into the hub.

NOTE
- To prevent the hub bolt from falling over, use the 12mm hole in the hub stand.
- Press in the hub bolt until the seating surface is in tight contact with the hub.

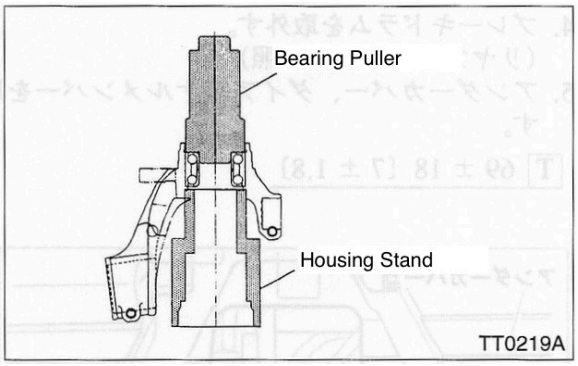
ST 92708 0000 Hub Stand
92263 0000 Spacer



2. Using the special tools housing stand and bearing puller, press the new bearing with built-in oil seal into the housing.

NOTE
- Completely remove dust and foreign matter from inside the housing

ST 92262 0000 Housing Stand
92261 0000 Bearing Puller



3. Install the snap ring.

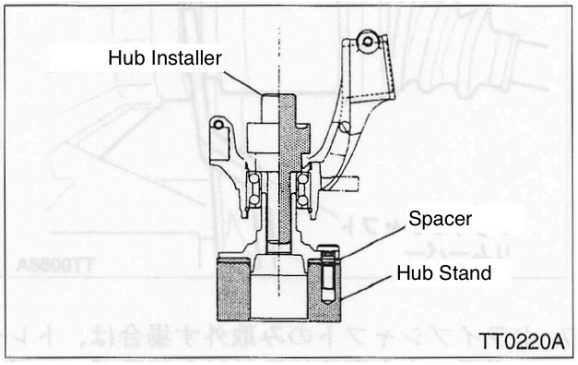
NOTE
- Make sure it is fully assembled into the groove.
- Use a new snap ring.

4. Attach the disc cover to the housing.
T 25 ± 7 [2.5 ± 0.7]

5. Use the special tool hub installer, hub stand, and spacer to press the hub COMPL into the housing.

NOTE
- Completely remove dust and foreign matter from the polished surface of the hub.

ST 92260 0000 Hub Installer
92708 0000 Hub Stand
92263 0000 Spacer



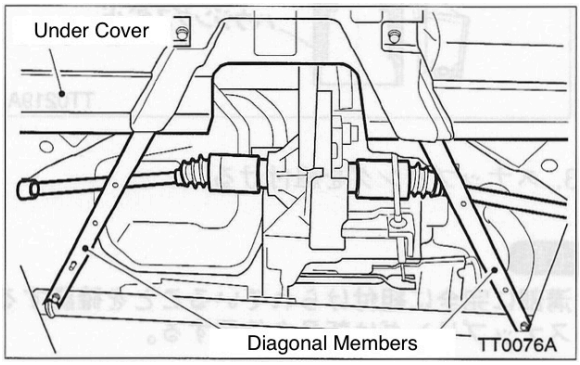
(3) Rear axle

<Removal>

1. Jack up the vehicle and remove the rear wheel.
T 88 ± 10 [9 ± 1]

2. Use hubcap pliers to remove the hubcap.

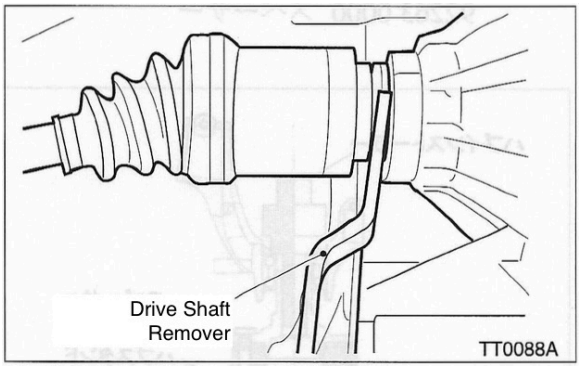
3. Use a chisel or similar tool to loosen the crimped axle nut, and then use a socket wrench to remove the axle nut.
   T 186 ± 20 [19 ± 2]
4. Remove the brake drum (see the rear brake section).
5. Remove the under cover and diagonal member.
   T 69 ± 18 [7 ± 1.8]



6. Using the special tool drive shaft remover, remove the snap ring connecting the drive shaft to the differential and remove the shaft from the differential.

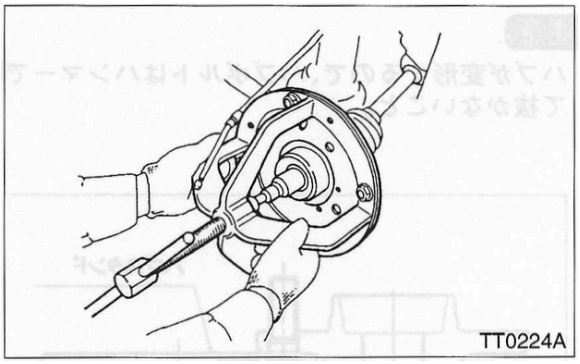
NOTE
- Hang the removed drive shaft with a wire so that it does not get in the way.

S T 28099 PA100 Drive Shaft Remover



7. If removing only the drive shaft, with the trailing arm attached to the vehicle, remove the BJ from the hub spline and remove the drive shaft assembly.
   - If the spline is stuck, use a special tool called a puller to remove it.

S T 92707 0000 Puller



8. If replacing the bearings, refer to the Suspension section and remove the trailing arm from the vehicle.

<Installation>

Follow the removal procedure in reverse.

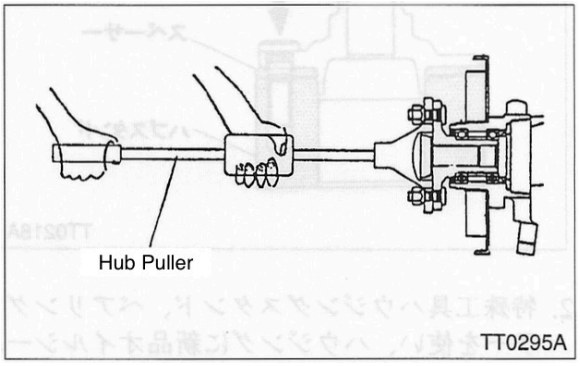
1. Tighten the axle nuts.

NOTE
- Use new axle nuts.
- Tighten the axle nuts before installing the wheels.
- After tightening, crimp to prevent rotation.

<Disassembly>

1. Fix the trailing arm in a vise and use a commercially available tool such as a hub puller to remove the hub from the trailing arm.

REFERENCE
- Hub puller HT7239 or HT7229, manufactured by Nissarco

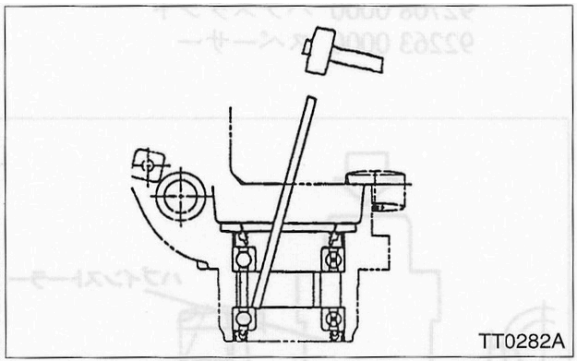


2. Remove the oil seal and bearing from the trailing arm.

NOTE
- Do not disassemble unless abnormalities such as loose bearings, strange noises, or broken hub bolts are found during regular inspections.
- Disassembled oil seals and bearings cannot be reused.

1) Move the spacer radially with your fingers.

2) Place a brass rod or similar object against the inner race of the bearing and gently tap it with a hammer to remove the bearing along with the oil seal.

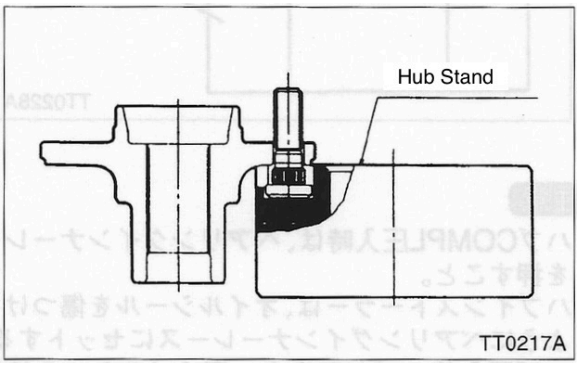


3) Use the special tool Hub Stand to press out the hub bolt.

S T 92708 0000 Hub Stand

NOTE

- Do not hit the hub bolt with a hammer to remove it as this will deform the hub.



<Inspection>

Disassembled parts should be inspected after wiping or cleaning to remove any dirt.

1) Check whether the spacer is damaged or deformed.
2) Check the hub for wear and damage on the mounting surface and bearing mounting shaft.
3) Check whether the hub bolts are deformed or damaged.
4) Check the bearing mounting holes of the housing (trailing arm) for wear, damage, or deformation.

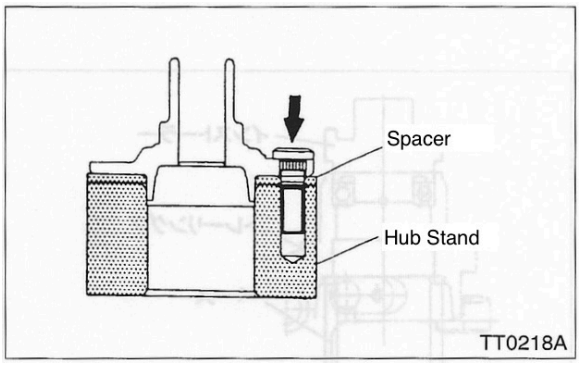
<Assembly>

1. Using the special tool hub stand and spacer, press the hub bolt into the hub.

NOTE

- To prevent the hub bolt from falling over, use the 12mm hole in the hub stand.
- Press in the hub bolt until the seating surface is in tight contact with the hub.

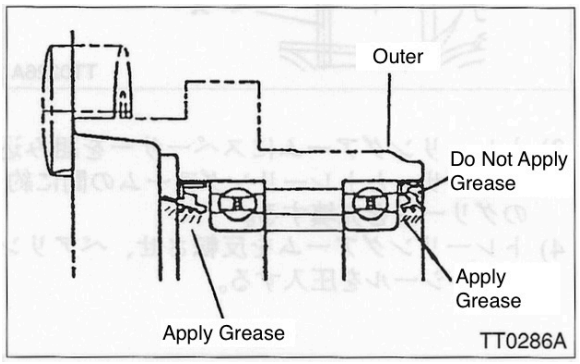
S T 92708 0000 Hub stand
92263 0000 Spacer



2. Using the special tool installer and stand, press the ball bearing and oil seal into the trailing arm.

NOTE

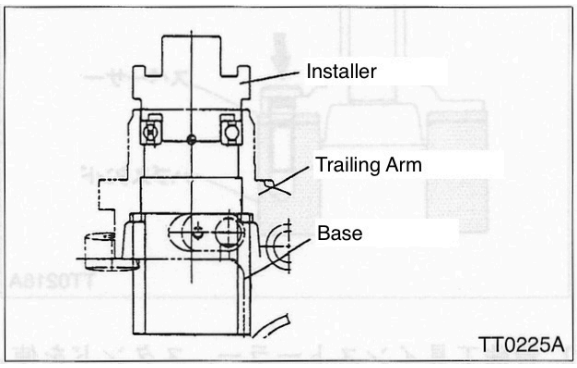
- Fill the outer and inner bearings with grease before assembly.
- If there is too much grease on the outer oil seal, the grease will leak out and adhere to the brake drum, making braking impossible, so be careful.



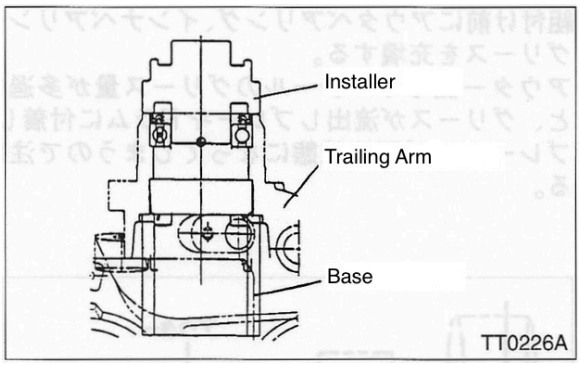
S T 28499 TC000 Installer (New)
28499 TC010 Base (New)

1) Apply grease to the bearing and press it in.

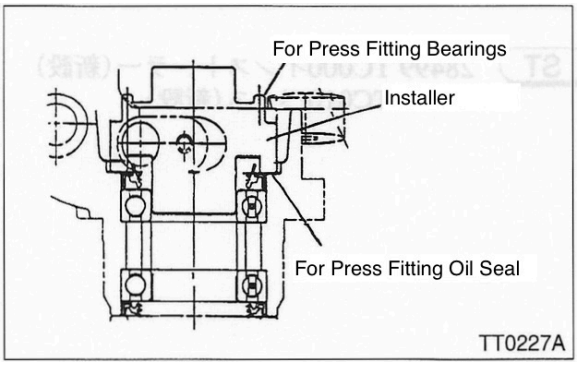
Specified Grease	Showa Shell 6495N



2) Apply grease to the oil seal and press it in. (The installer should be facing the opposite direction.)



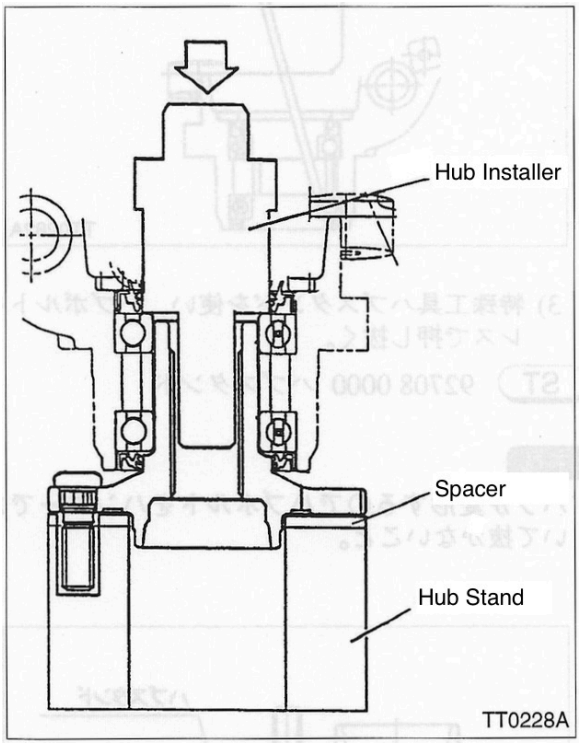
3) Install the spacer into the trailing arm and fill approximately 25g of grease between the spacer and the trailing arm.
4) Turn the trailing arm over and press in the bearing and oil seal.



NOTE
- When pressing in the oil seal, use the installer with the larger outer diameter and press it in until it contacts the machined surface of the trailing arm.

5) Using the special tool hub installer, spacer, and hub stand, press the hub COMPL into the trailing arm ASSY.

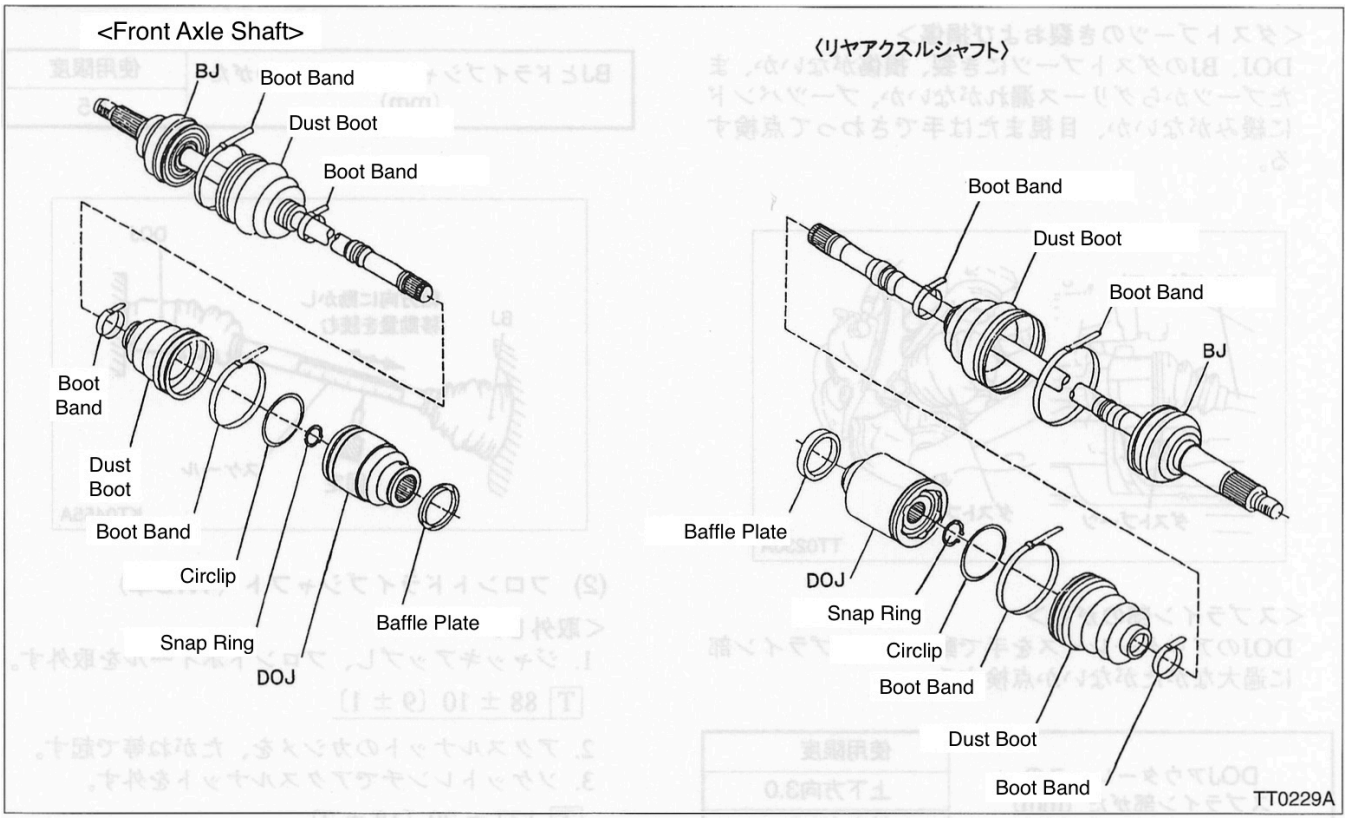
ST
92745 0000 Hub Installer
92708 0000 Hub Stand
92263 0000 Spacer



NOTE
- When pressing in the hub COMPL, press the bearing inner race.
- Set the hub installer on the bearing inner race so as not to damage the oil seal.
- If grease is present on the contact surface between the hub and the outer oil seal after pressing in the hub, wipe it off with a cloth or similar.

[2] Drive Shaft

■ Component Parts



■ Maintenance Preparation Items

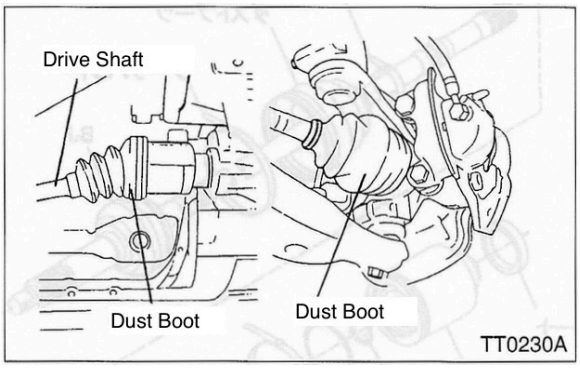
Classification	Tool Number	Description	Purpose
ST	92509 1000	Band tightener	For attaching boot bands
	28099 PA100	Drive shaft remover	Pulling the DOJ out of differential
	92112 2000	Puller	Pull BJ out of the hub
Tool	-	Snap ring pliers	Snap ring removal
	-	Scale	Backlash measurement
Instrument	-	Magnetic stand, dial gauge	Backlash measurement
Grease & Oils	-	Grease (Molylex No 2 or NTG2218)	For BJ lubrication
	-	Grease (VU-3A702)	For DOJ lubrication

■ Maintenance Instructions

(1) On-board inspection

<Cracks and Damage to Dust Boots>

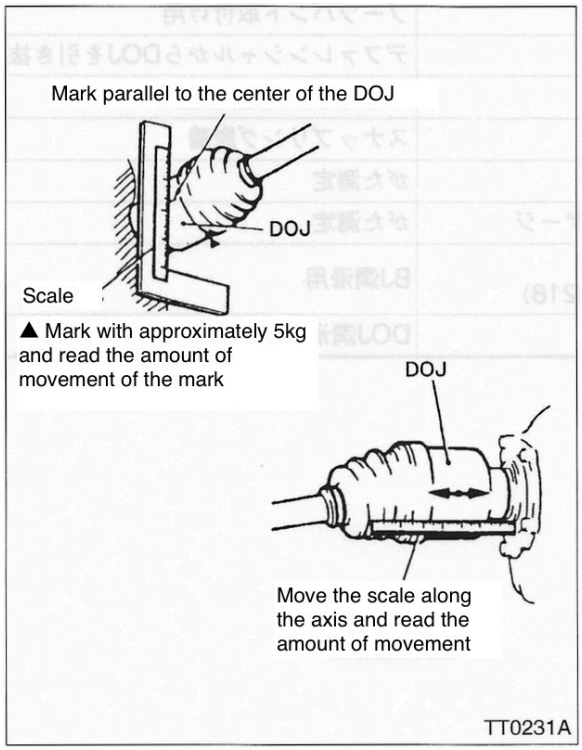
Visually or by touch, check the dust boots of DOJ and BJ for cracks or damage, for grease leaks from the boots, and for loose boot bands.



<Spline Play>

Move the DOJ outer race by hand and check that there is no excessive play in the spline area.

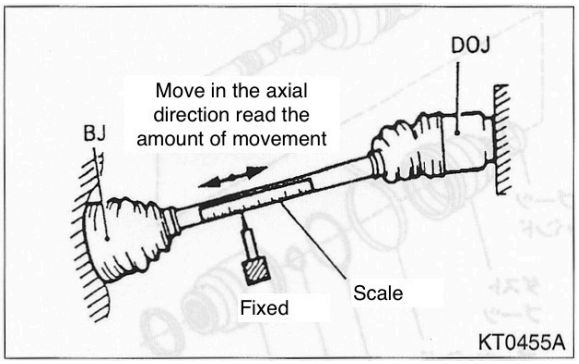
DOJ Outer Race Spline Play (mm)	Usage Limit
	Vertical Direction 3.0
	Axial 2.0



<Play in the Universal Joint>

Move the universal joint by hand up and down and left and right to check that there is no excessive play in the universal joint.

Axial play between BJ and drive shaft (mm)	Usage Limit
	1.5



(2) Front Drive Shaft (4WD vehicle)

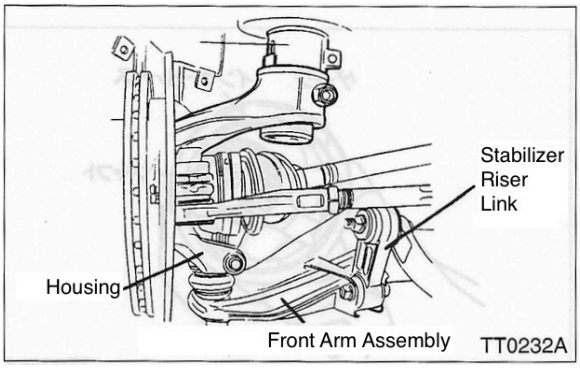
<Removal>

1. Jack up the vehicle and remove the front wheel.
   T 88 ± 10 [9 ± 1]
2. Use a chisel or similar tool to raise the axle nut crimp.
3. Remove the axle nut with a socket wrench.
   T 177 ± 20 [18 ± 2]

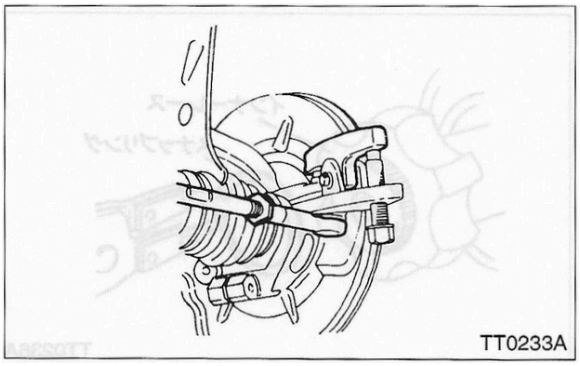
NOTE

• Loosen the axle nuts with the wheel removed.

4. Remove the stabilizer link from the front arm assembly, remove the bolt, and pull the ball joint part of the front arm assembly out of the housing.
   Stabilizer Link
   T 29 ± 5 [3 ± 0.5]
   Ball Joint
   T 58 ± 12 [5.9 ± 1.2]

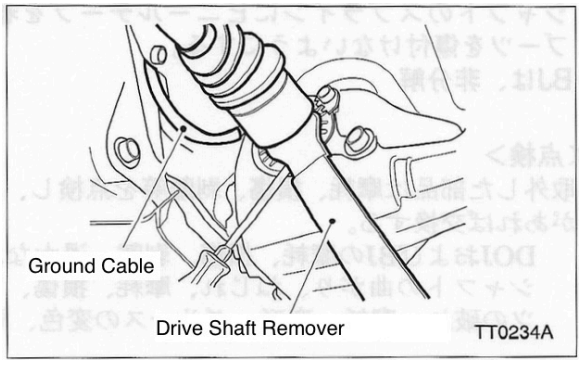


5. Remove the tie rod end from the knuckle arm.
   T 25~30 [2.5~3.0]



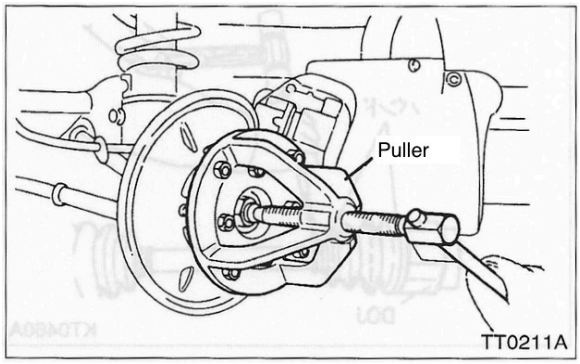
6. Use the special tool drive shaft remover to separate the DOJ from the differential.

ST 28099 PA100 Drive Shaft Remover



7. Remove the BJ from the hub spline and remove the drive shaft assembly.
   • If the spline is stuck, use a special tool puller to remove it.

ST 92707 0000 Puller



<Installation>

Installation is the reverse of removal.
The difference from removal is:

1. Align the DOJ spline with the differential spline, and push the housing to push in the DOJ.

NOTE
- Use new circlips for joining.

2. Assemble the ball joint part of the tie rod end into the knuckle arm and secure with a castle nut and cotter pin.

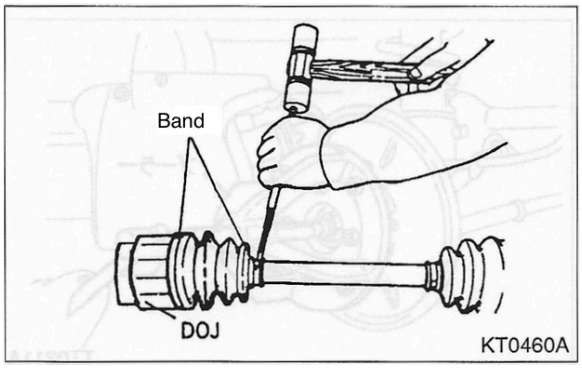
NOTE
- Use new cotter bins.
- After tightening the castle nut to the specified torque, tighten it further by up to 60° and align the holes in the cotter bin.

3. Tighten the axle nut.

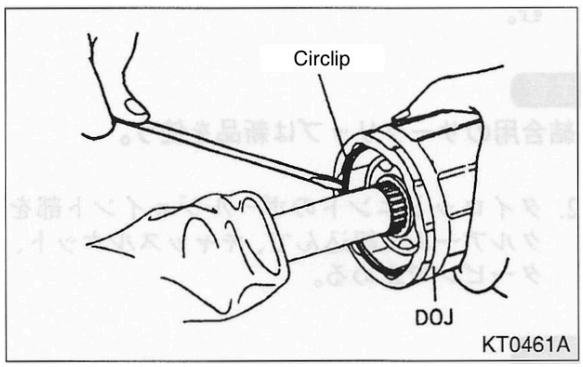
NOTE
- Use new axle nuts.
- Tighten the axle nuts before installing the wheels.
- After tightening, crimp to prevent rotation.

<Disassembly>

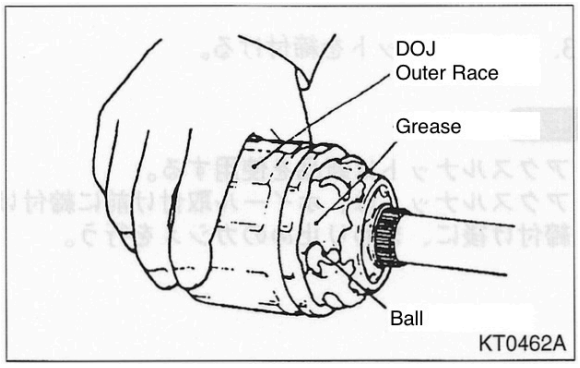
1. Use a screwdriver or pliers to lift up the boot band on the large diameter side of the DOJ.
2. Loosen and remove the band using a screwdriver or pliers, being careful not to damage the boot.



3. Remove the boot band on the smaller diameter side of the DOJ in the same way.
4. Remove the large diameter side of the boot from the DOJ outer race.
5. ⊖Use a screwdriver or similar tool to remove the circlip from the



mouth of the DOJ outer race.

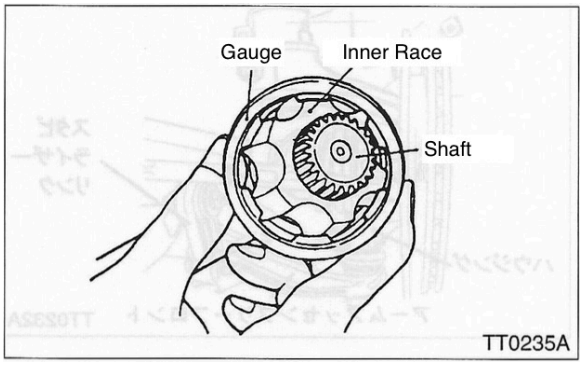


6. Remove the DOJ outer race from the drive shaft.
7. Wipe off the grease and remove the ball.

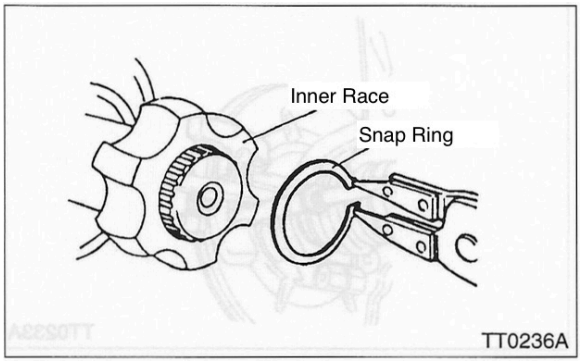
NOTE

- Be careful not to lose the six balls.
- Special grease is used, so be careful not to mix it with other greases.

8. Rotate the cage half a pitch relative to the inner race track and slide it toward the boot.



9. Remove the snap ring connecting the inner race to the shaft, and pull out the inner race.



10. Remove the cage from the shaft and remove the boot.
11. Remove BJ's boots in the same manner as steps 1 to 3 above.

NOTE

- Wrap vinyl tape around the shaft splines to prevent damage to the boots.
- BJ is non-disintegrating

<Inspection>

- Inspect the removed parts for wear, damage, peeling, etc., and replace them if any abnormalities are found.
  - Wear, damage, and peeling of DOJ and BJ; excessive shaft bending, twisting, wear, and damage; boot tear, wear, and deformation; grease discoloration and liquefaction.

<Assembly>

1. Install the BJ boot in place and fill it with the specified grease.

BJ Size	Specified Grease	Filling Amount (g)
71AC	NTG2218	40~60
75AC	Molylex No 2	55~75

2. Insert the DOJ boot into the center of the shaft.

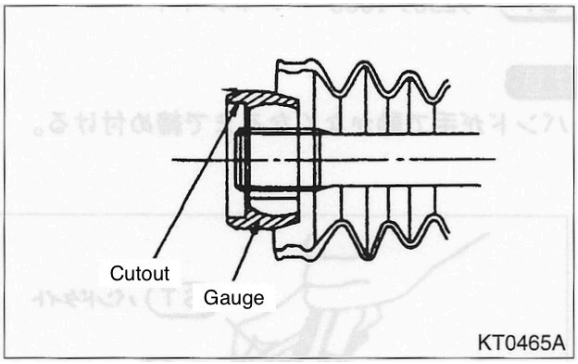
NOTE

- Wrap vinyl tape around the shaft splines to prevent damage to the boots.

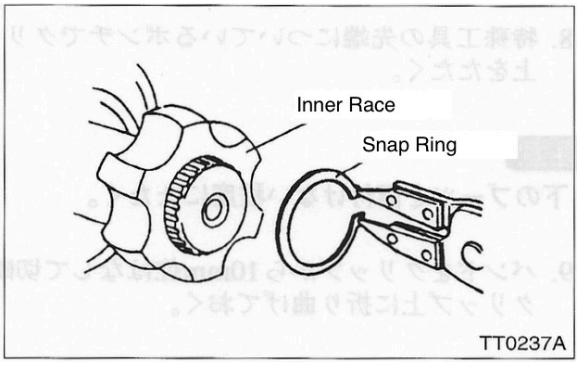
3. Insert the DOJ cage into the shaft.

NOTE

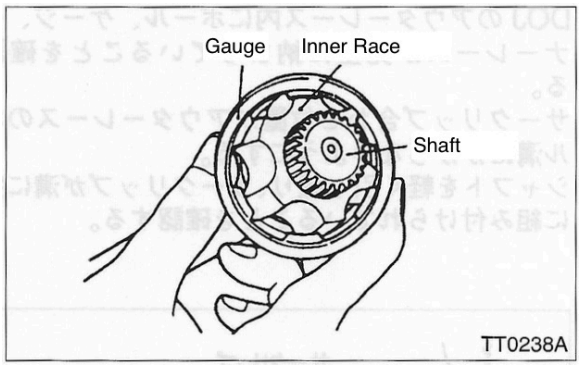
- The cage has a directionality, so insert it with the notched side facing the shaft end.



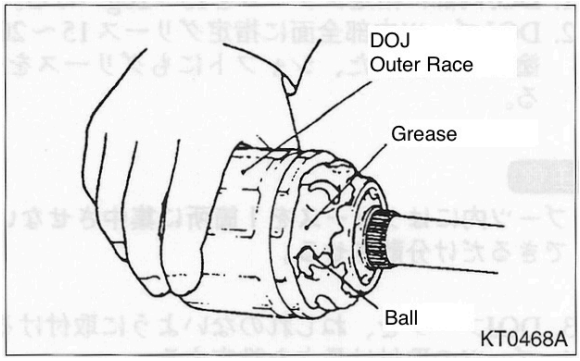
4. Assemble the DOJ inner race onto the shaft and secure it with a snap ring. When secured, make sure that the snap ring is completely seated on the shaft.



5. Insert the cage pocket into the inner race tracks, rotate it half a pitch, and assemble the cage to the inner race.

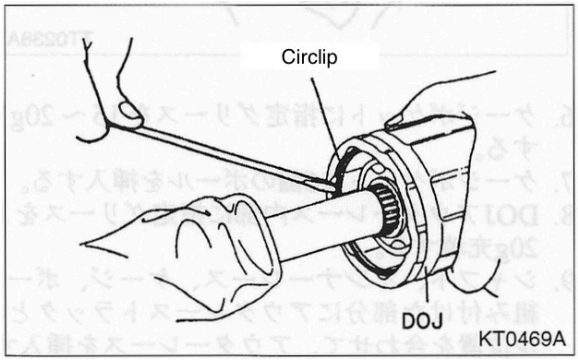


6. Fill the cage pocket with 15 to 20g of the specified grease.
7. Insert six balls into the cage pockets.
8. Fill the DOJ outer race with 15 to 20g of the specified grease.
9. Align the outer race track with the ball position in the assembled section of the shaft, inner race, cage, and balls, and insert the outer race.



10.Assemble the circlip onto the DOJ outer race.

NOTE
- Make sure that the ball, cage, and inner race are completely seated inside the DOJ outer race.
- Make sure the circlip alignment position does not come into contact with the ball groove of the outer race.
- Pull the shaft gently to check that the circlip is completely installed in the groove.



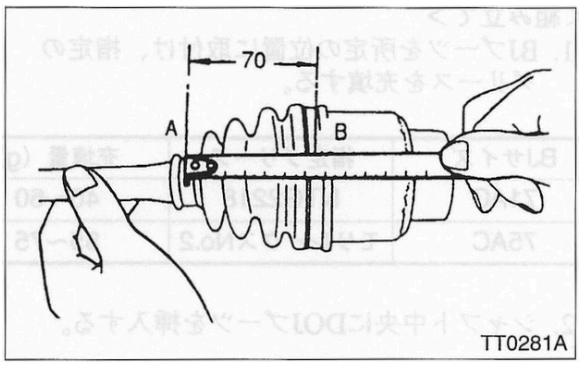
11.Apply 15~20g of the specified grease to the inside of the DOJ.
12.Apply 15~20 g of the specified grease to the entire inside of the DOJ boot. Also apply grease to the shaft.

NOTE
- Do not concentrate the grease in one place inside the boots, but distribute it as much as possible.

13.Install the DOJ boot without twisting it.
14.Set the installation length of the boot.

NOTE
- Thoroughly wipe off any grease or other residue from the inside of the boot and the large diameter of the boot.
- Adjust the distance between DOJ boot bands A and B to the specified dimensions and tighten the boot bands to prevent too little or too much air in the boots.

DOJ Size	Distance Between A & B (mm)
71AC	70



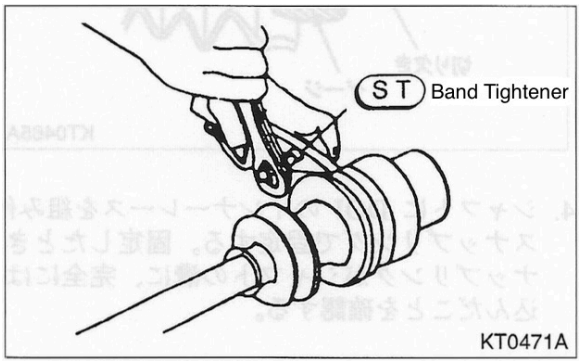
15.Pass the band through the clip and wrap it around the boot twice, aligning it with the band groove.

NOTE
- Use a new band.

16.Hold the end of the band with pliers and press the clip to tighten it securely.
17.Use the special tool Band Tight to tighten the band.

ST 92509 1000 Band Tightener

NOTE
- Tighten the band until it no longer moves with your hands.



18.Use the punch attached to the tip of the special tool to hit the top of the clip.

NOTE
- Hit the boots gently without damaging them.

19.Cut the band about 10mm away from the clip and fold it over the clip.

NOTE
- Make sure the cut end of the band does not come off the clip.

20.Shake the DOJ to distribute the grease.

(3) Rear Drive Shaft

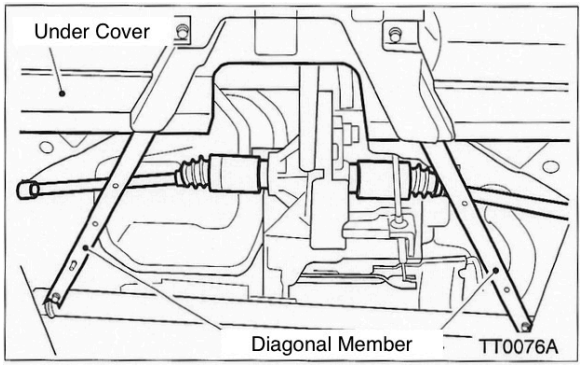
<Removal>

1. Jack up the vehicle and remove the rear wheel.
   T 88 ± 10 [9 ± 1]
2. Use a chisel or similar tool to loosen the axle nut crimp, then use a socket wrench to remove the axle nut.
   T 186 ± 20 [19 ± 2]
3. Remove the brake drum and brake assembly.
   • See the rear brake section.

NOTE

• Cap the removed brake pipe.
• Always use a flare nut wrench when removing or installing flare nuts.

4. Remove the diagonal member and under cover.
   T 69 ± 18 [7 ± 1.8]

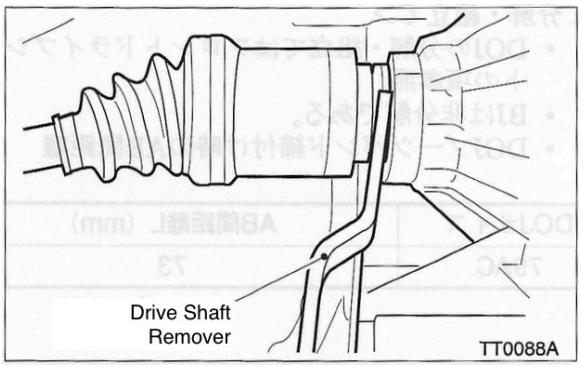


5. Using the special tool drive shaft remover, remove the snap ring connecting the drive shaft to the differential and remove it from the differential.

NOTE

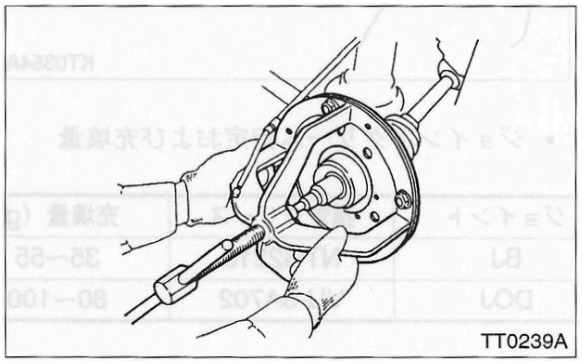
• When assembling, use a new snap ring.

ST 28099 PA100 Drive Shaft Remover



6. Remove the BJ from the hub spline and remove the drive shaft assembly.
   • If the spline is stuck, use a puller to remove it.

ST 92707 0000 Puller



<Installation>

Follow the removal procedure in reverse.
• Tighten the axle nuts.

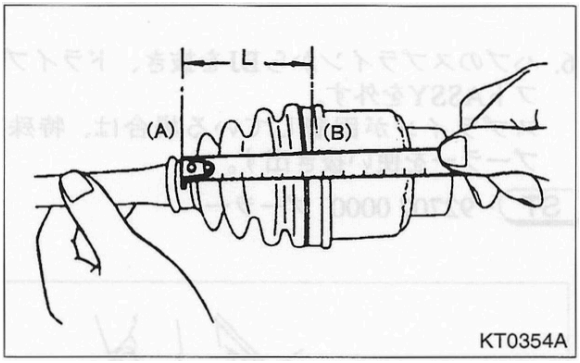
NOTE

• Use new axle nuts.
• Tighten the axle nuts before installing the wheels.
• After tightening, crimp to prevent rotation.

<Disassembly/Assembly>

- For disassembly and assembly of DOJ, refer to the Front Drive Shaft section.
- BJ is non-decomposable.
- Distance between A and B when tightening DOJ boot band.

DOJ Size	Distance Between A & B (mm)
79AC	73



- Joint grease specification and filling amount.

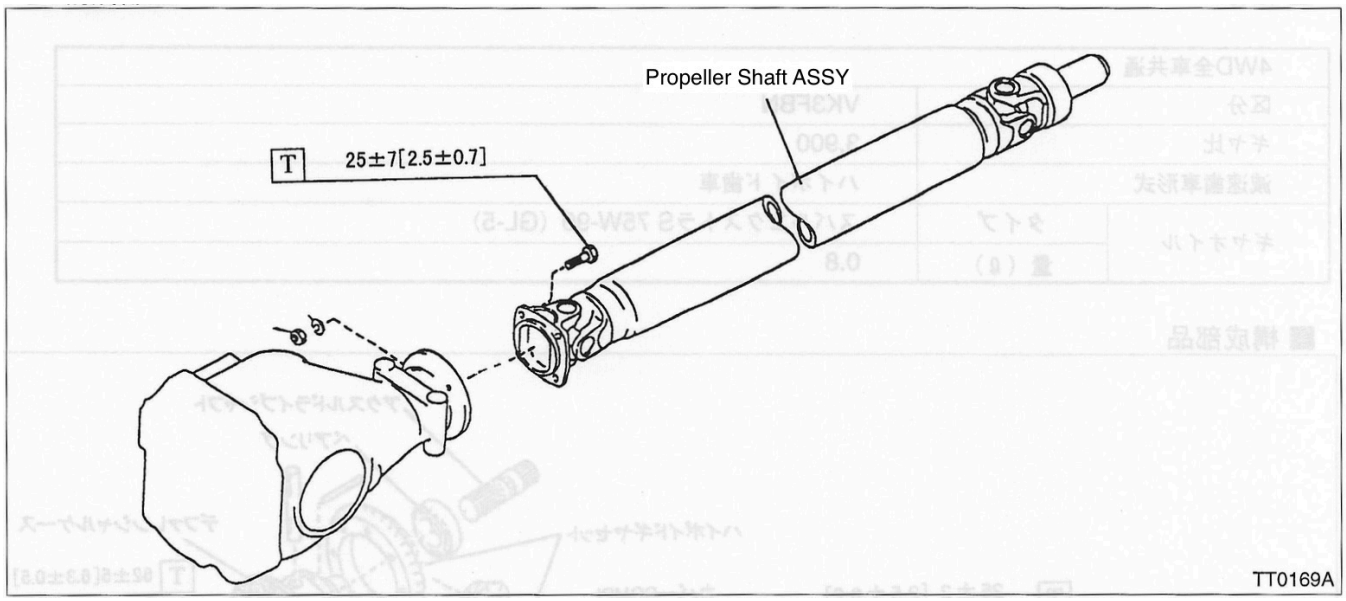
Joint	Specified Grease	Filling Amount (g)
BJ	NTG2218	35~55
DOJ	VU-3A702	80~100

NOTE

- Special grease is used, so be careful not to mix it with other greases or make mistakes.

[3] Propeller Shaft (4WD Vehicles)

■ Component Parts



■ Maintenance Preparation Items

Instrument	-	Dial gauge with magnetic stand	For measuring tube deflection
Grease, Oils, & Other	-	Idemitsu Autolex A or Showa Shell Sunlight No 2	For the spline part of the sleeve yoke

■ Maintenance Instructions

(1) On-board Inspection

1. Check that the flange mounting bolts are not loose.
2. Turn the propeller shaft by hand and check that there is no play in the spline or joint.
3. Rotate the front wheel slowly and measure the runout of the propeller shaft at the center.

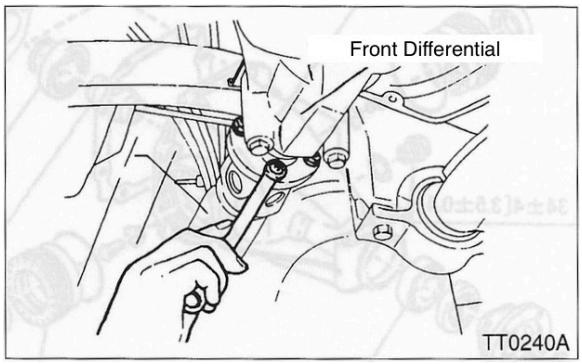
Runout Standard (mm)	0.6 or less

4. Dents and cracks on the tube surface

(2) Detachment

<Removal>

1. Remove the under cover.
2. Loosen and remove the connecting bolts between the propeller shaft and the front differential.
   T 25 ± 7 [2.5 ± 0.7]



3. Pull the propeller shaft out of the transmission.

NOTE

- Remove the oil seal and sleeve yoke carefully so as not to damage the sliding surfaces.
- When removing the propeller shaft from the transmission, oil will leak out, so have an oil drain can and cap ready beforehand.

<Installation>

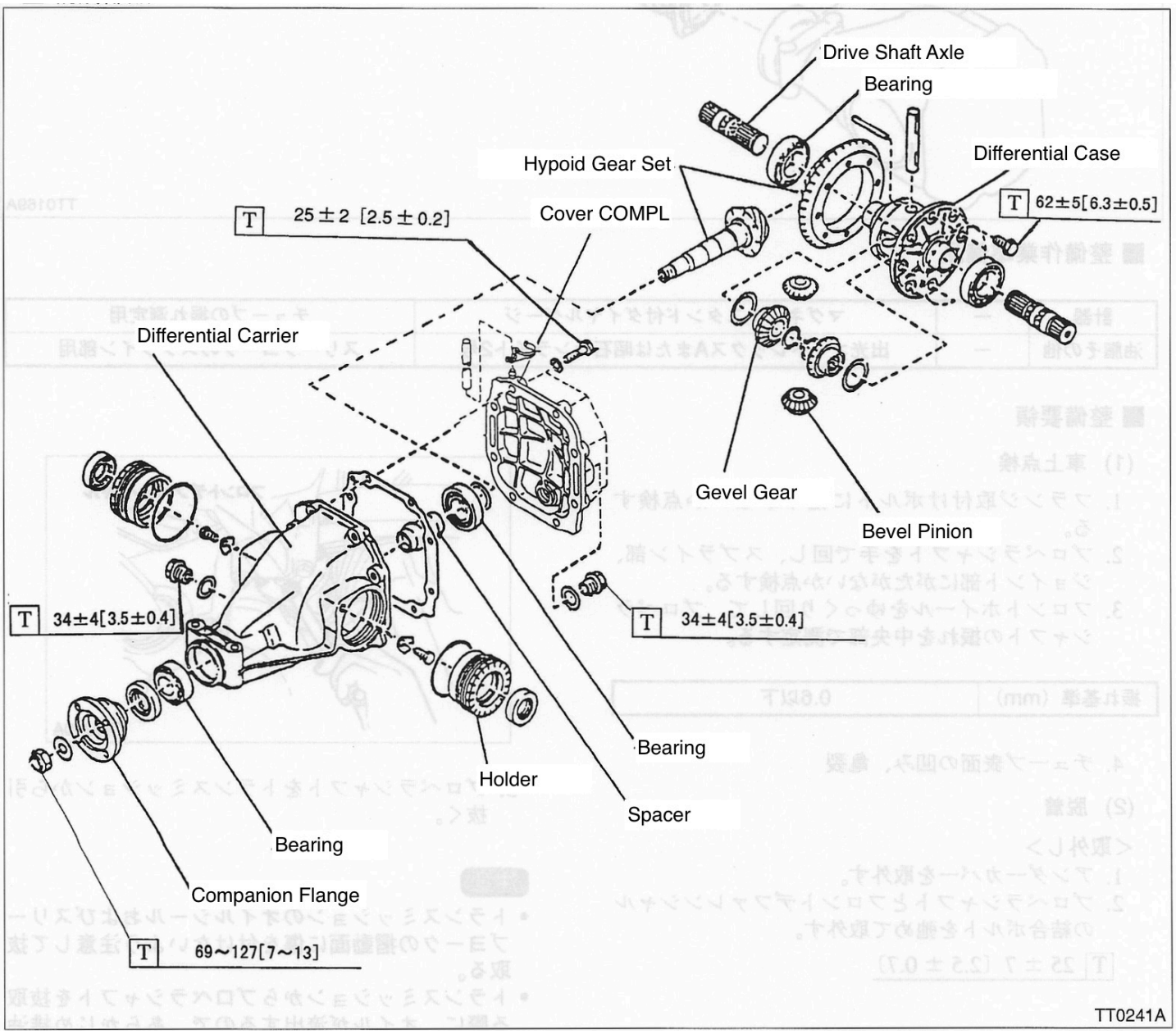
Follow the removal procedure in reverse.

[4] Front Differential (4WD Vehicles)

■ Specification

Common to All 4WD Vehicles		
Classification		VK3FBN
Gear Ratio		3.900
Reduction Gear Type		Hypoid Gear
Gear Oil	**Type**	Subaru Extra S 75W90 (GL-5)
	Amount (ℓ)	0.8

■ Component Parts



■ Maintenance Preparation Items

Classification	Tool Number	Description	Purpose
ST	39842 7700	Companion Flange Wrench	Removing & installing the driver pinion
	39847 7701	Handle	Front & rear bearing race removal
	39847 7702	Drift	Front & rear bearing press-fit
	39852 7700	Oil Seal Outer Race Puller ASSY	Remove bearing outer race & oil seal
	39952 0105	Seat	Side bearing removal
	39978 0104	Weight	Press-fitting rear bearing cone and oil seal
	39978 0111	Oil Seal Holder Wrench	Remove holder
	39979 0110	Installer	Press-fit oil seal into holder
	49810 7000	Replacer	Remove the oil seal from the holder
	49817 5500	Installer	Press in the front bearing cone
	49821 5402	Stand	Bearing assembly
	49821 5500	Carrier	Stand for disassembly and assembly
	49824 7001	Magnet base	Hypoid gear backlash measurement
	49824 7100	Dial gauge	Hypoid gear backlash measurement
	59841 5400	Drift	Press-fitting the oil seal
	49847 5403	Drift	Press-fitting of side bearing cones
	49848 5400	Drift	Press-fitting of side bearing cones
	49850 5501	Gauge	Large height adjustment of hypoid gear
	49850 5502	Dummy shaft	Hypoid gear height adjustment
	49851 5500	Replacer	Front bearing cone removal
	49966 7000	Thickness gauge	Hypoid gear height adjustment
	49970 5401	Puller ASSY	Pulling out the side bearing outer race
	49970 5404	Seat	Used at the same time as above
	49992 5400	Handle	Hypoid gear tooth contact check
	89947 1410	Snap ringer expander	Attaching and detaching the snap ring
	59952 4100	Puller set	Pulling out the side bearing
	89975 4102	Press	Press-fitting the front bearing cone
	89986 4100	Remover	Press-fitting the front bearing cone
	89990 4100	Remover	Attaching and detaching the straight pins
	28099 PA100	Drive shaft remover	Removing and installing the drive shaft from the rear differential
Instrument	-	Scale	Measurement of starting torque
Grease & Oils	Grease	Unilube #2 or equivalent	Apply to the lip of the oil seal
Others	Oil	Gear oil	Apply when assembling parts
	Komyotan		Hypoid gear tooth contact measurement

■ Maintenance Instructions

(1) On-board Inspection

1. Oil leak inspection
   - Check for oil leaks from the mating surfaces of the carrier and cover, oil seal, drain, filler plug, etc.
2. Oil level check
   - Remove the filler plug and check that the oil level is between 0 and 5 mm from the bottom of the filler plug hole (by touching with your finger).
3. Oil change
   1) Remove the drain plug and drain the oil. After draining, use a new gasket to re-tighten the drain plug.
      T 34 ± 4 [3.5 ± 0.4]

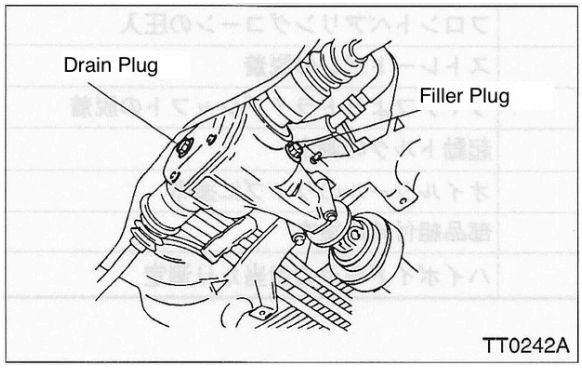
NOTE

- Remove any deposits from the magnet part of the drain plug.

   2) Remove the filler plug and add gear oil.

Oil Level	Capacity (ℓ)
Bottom side of screw hole	0.7
5mm below the bottom of the stew hole	0.65

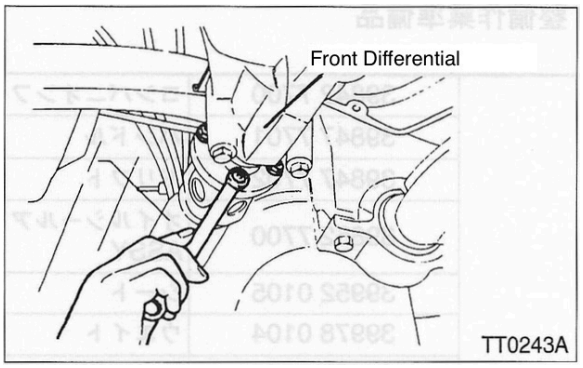
   3) Check (by touching with your finger) that the oil level is 0 to 5 mm from the bottom of the filler plug hole.
   4) Tighten the filler plug using a new gasket.
      T 34 ± 4 [3.5 ± 0.4]



(2) Detachment

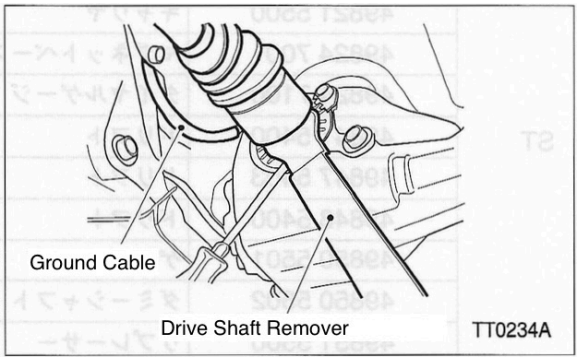
<Removal>

1. Lift up the vehicle, remove the undercover, loosen the bolts connecting it to the propeller shaft, and remove the propeller shaft.
   T 25 ± 7 [2.5 ± 0.7]



2. Use the special tool drive shaft remover to remove the DOJ from the differential.

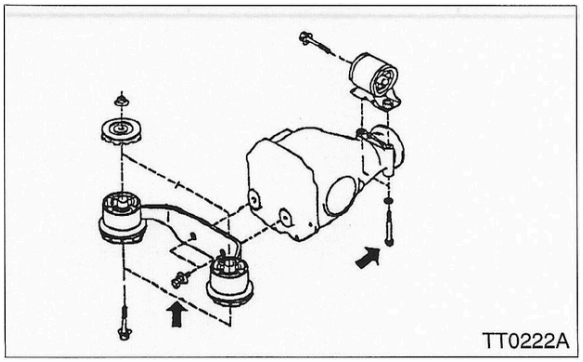
ST 28099 PA100 Drive Shaft Remover



NOTE

- The DOJ cannot be completely removed from the axle shaft, so leave the retaining snap ring removed.

3. Loosen the mounting bolt and remove the earth cord.
4. Support the front differential body with a transmission jack (commercially available).
5. Remove the two differential member mounting bolts (front)
   T 88 ± 10 [9 + 1]
6. Remove the two rear differential mount mounting bolts.
   T 59 ± 9 [6 ± 0.9]



7. Gradually lower the transmission jack while unscrewing the splines on the left and right DOJs and removing the front differential.

<Installation>

1. Installation is the reverse of removal procedure.
2. Use a new DOJ retaining snap ring.
3. Place the differential assembly lower than the normal position (the position where the left and right DOJ splines came off during removal), and gradually raise the jack to align the left and right DOJ splines.
4. After the splines have engaged, raise the differential to its normal mounting position.

(3) Disassembly and Assembly of the Front Differential

<Disassembly>

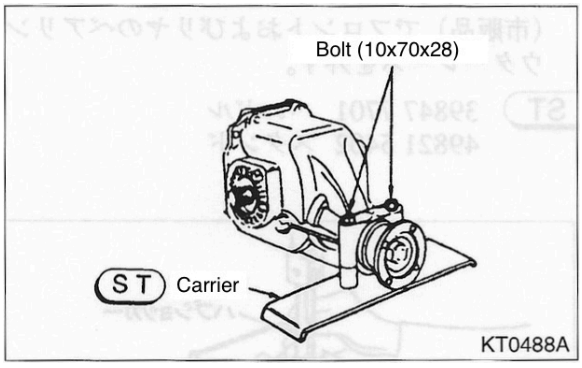
1. Remove the drain plug and drain the gear oil. After draining, re-tighten the plug using a new gasket.
   T 34 ± 4 [3.5 ± 0.4]

NOTE

• Remove any deposits from the drain plug magnet.

2. Install the special tool carrier on the front differential.

ST 49821 5500 Carrier

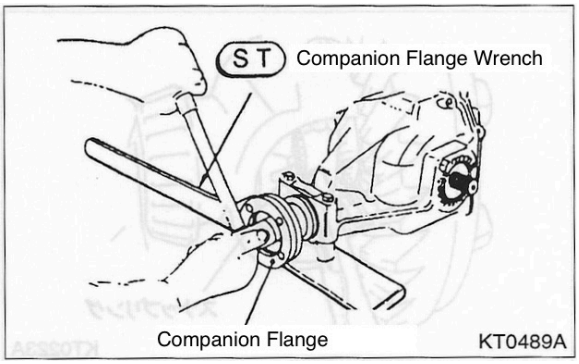


3. Remove the drive pinion lock nut.

ST 39842 7700 Companion Flange Wrench

NOTE

• Remove the crimp before loosening.

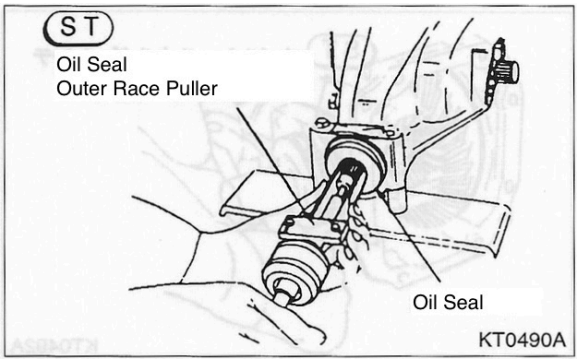


4. Remove the washer and companion flange.
5. Remove the oil seal.

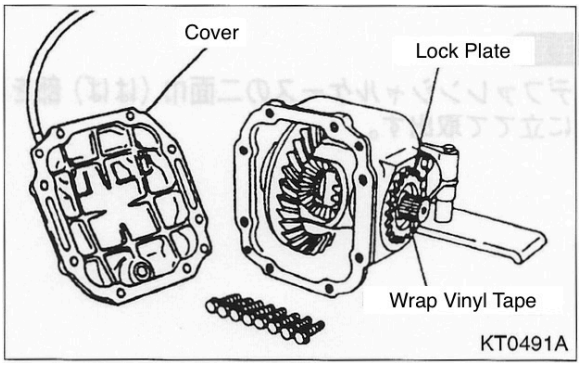
ST 39852 7700 Oil Seal Outer Race Puller Assembly

NOTE

• When assembling, use a new oil seal.



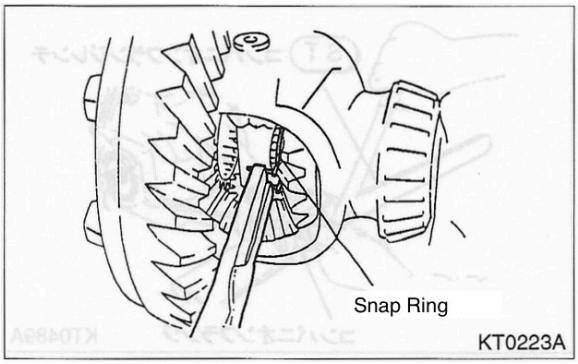
6. Remove the 8 bolts and remove the cover.



7. Wrap vinyl tape around the splined portion of the drive shaft.
8. Remove the bolts and remove the left and right lock plates.

9. Remove the snap ring.

ST 89947 1410 Snap Ring Expand

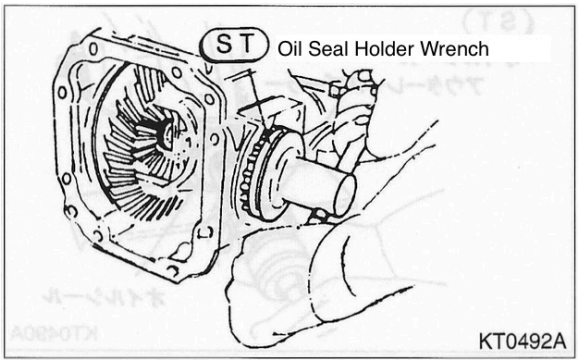


10. Loosen the COMPL on both the left and right holders and remove both axle drive shafts.

ST 39978 0111 Oil Seal Holder Wrench

NOTE

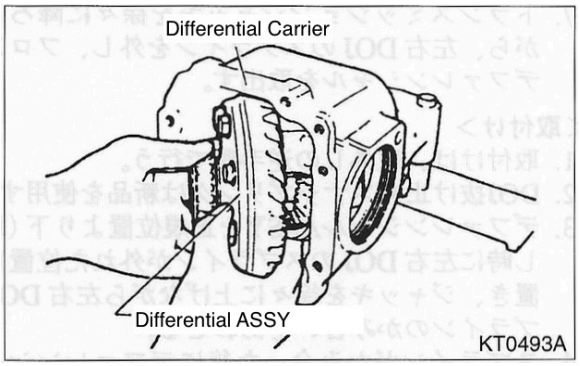
- Do not swap the left and right axle drive shafts



11. Remove the differential assembly from the differential carrier.

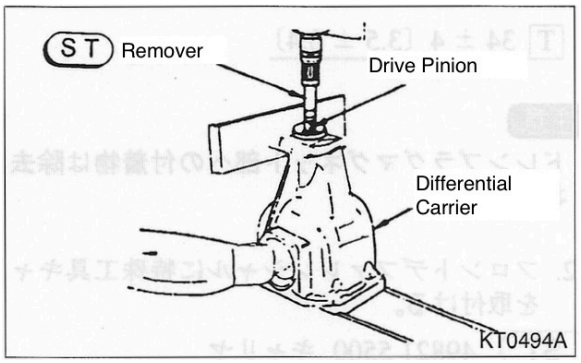
NOTE

- Hold the differential case so that the width across the front is vertical and remove it.



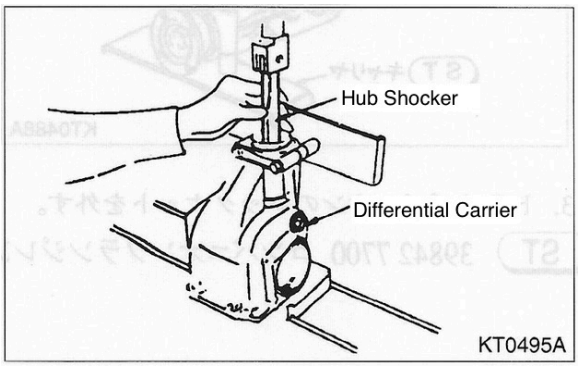
12. Remove the drive pinion shaft and front bearing cone from the differential carrier.

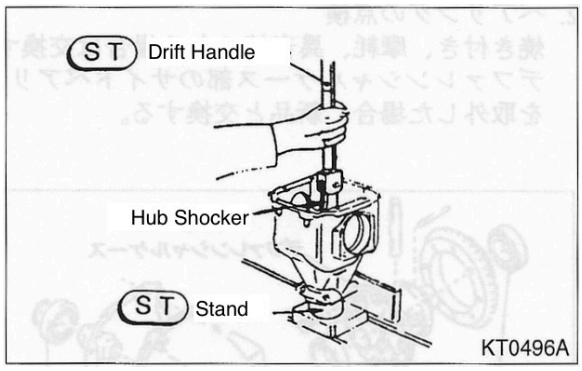
ST 89986 4100 Remover



13. Remove the front and rear bearing outer races from the differential carrier using a hub shocker (commercially available).

ST 39847 7701 Handle
49821 5402 Stand

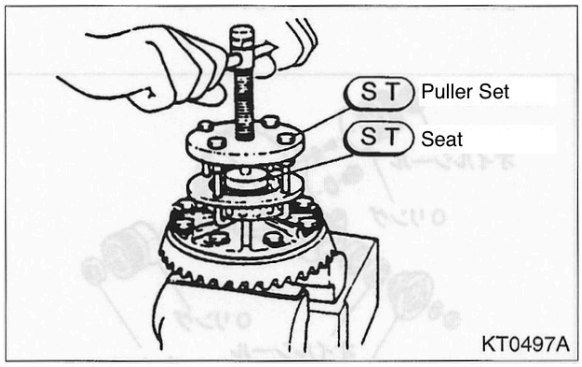




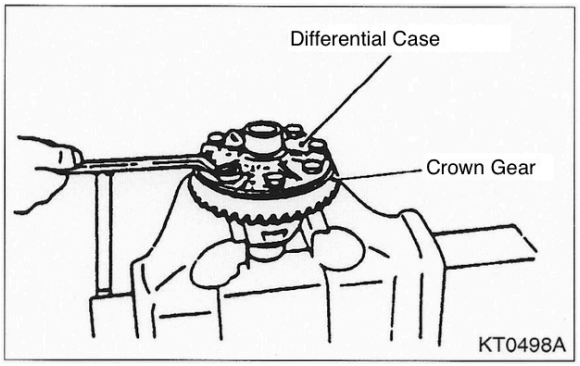
14.Disassembly of differential assembly
1)Remove the bearing cone from the differential.

ST 89952 4100 Puller Set
39952 0105 Seat

NOTE
• Use new bearings when assembling.



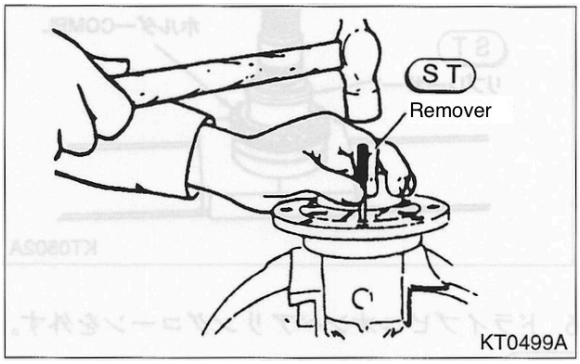
2)Remove the 8 bolts and remove the crown gear.



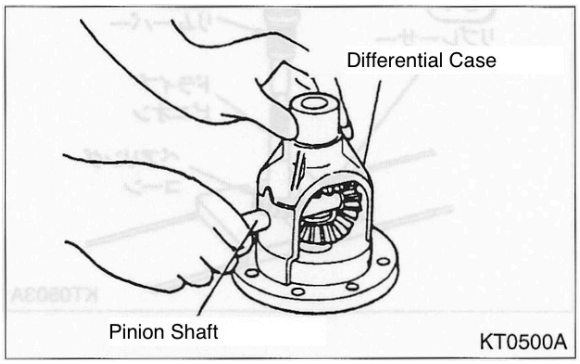
3)Drive the straight pin into the crown gear.

ST 89990 4100 Remover

NOTE
• The pin hole openings of the differential case pins are crimped, so be careful of the crimping and do not forcefully remove them.

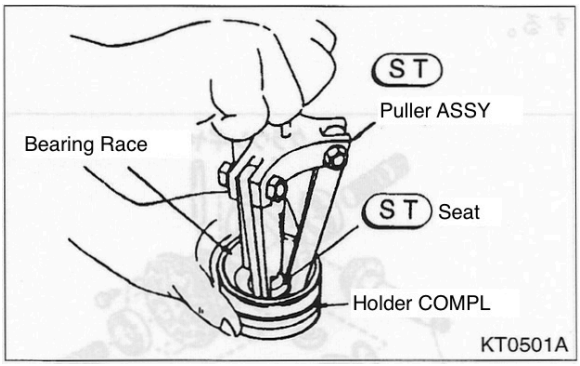


4)Remove the pinion shaft, and remove the bevel pinion, bevel gear, and washer (35.1 x 45 x t).



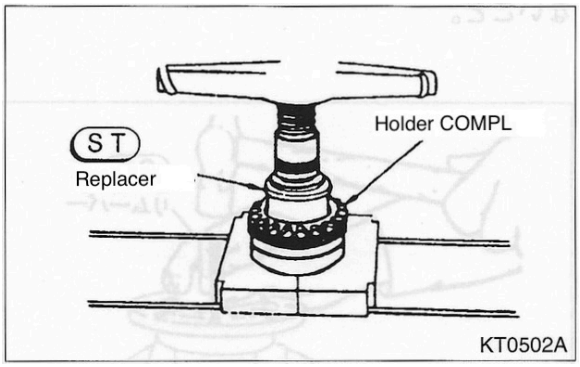
15.Disassembly of the COMPL holder (both left and right)
1)Remove the bearing race.

ST 49970 5401 Puller ASSY
49970 5404 Seat



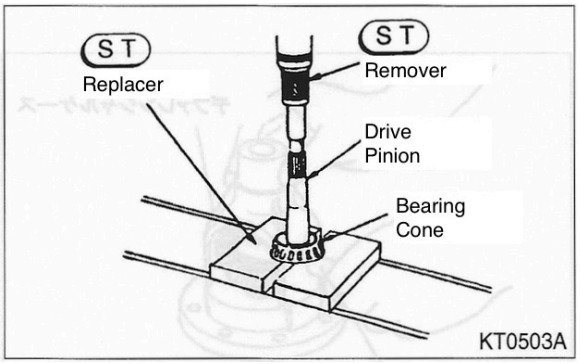
2) Remove the oil seal.

ST 49810 7000 Replay Summer



16. Remove the drive pinion pairing cone.

ST 49851 5500 Replacer
89986 4100 Remover



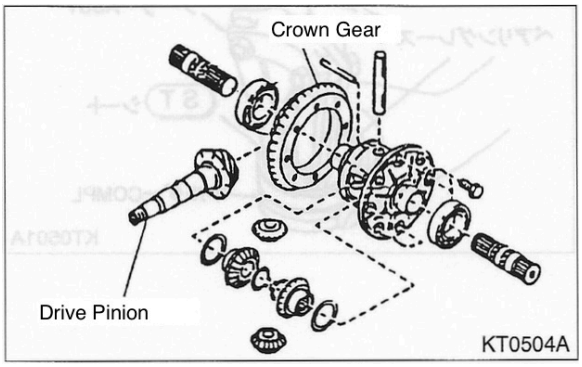
<Inspection>

Disassembled parts should be thoroughly cleaned and inspected.

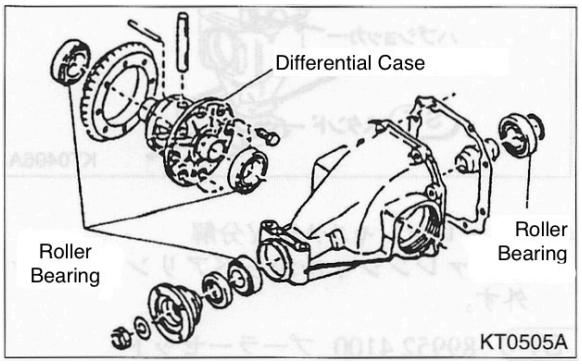
1. Replace the crown gear if it is damaged, seized, or has abnormal wear.

NOTE

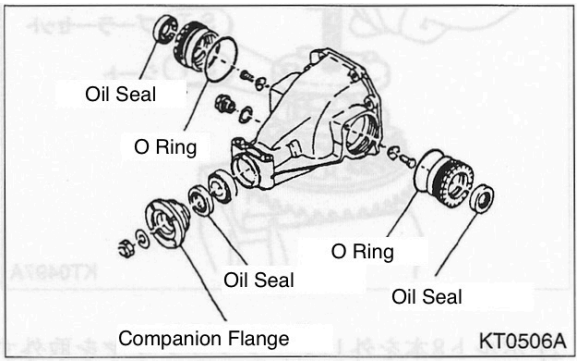
• Replace the drive pinion and crown gear as a set.



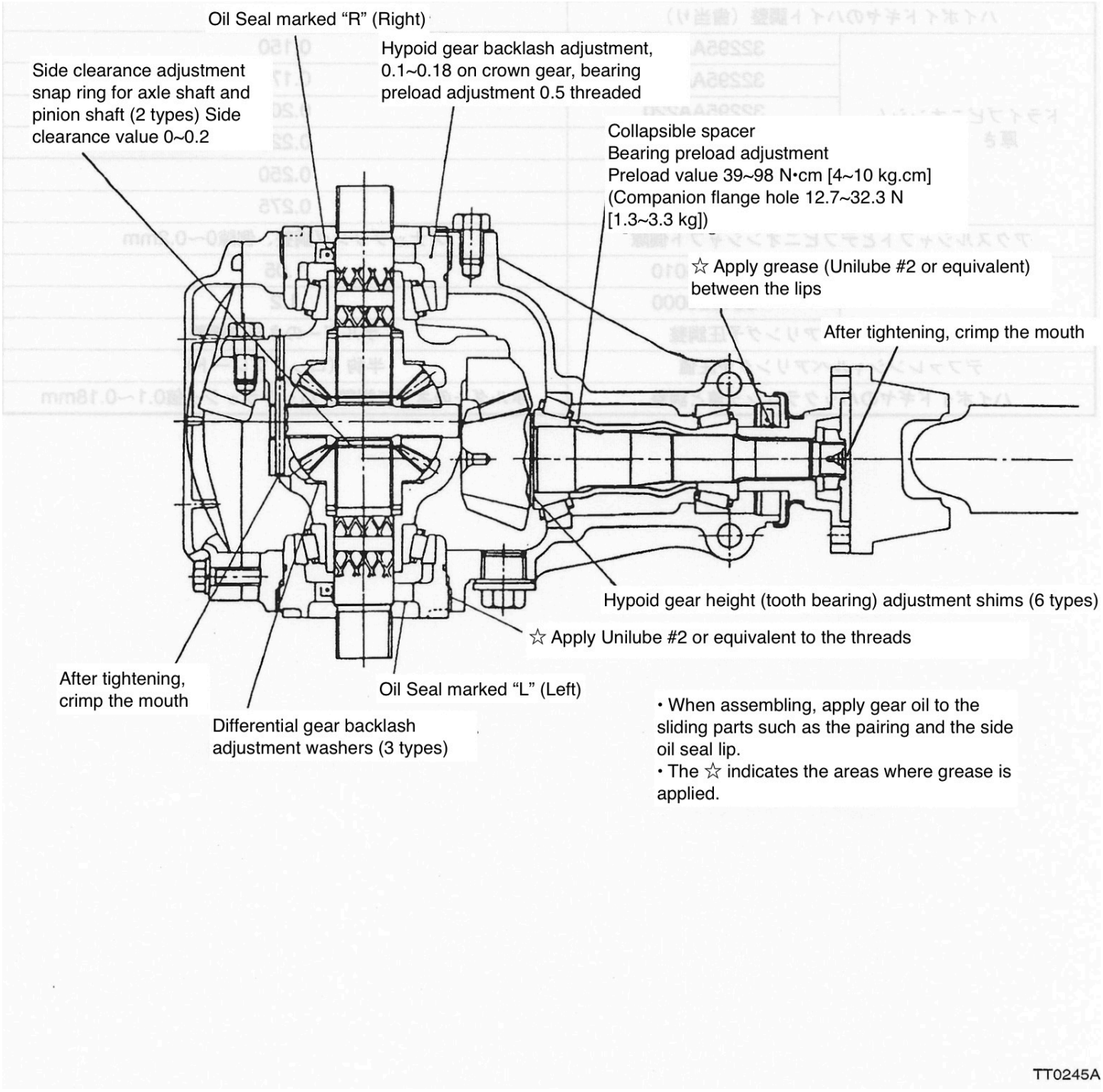
2. Inspect the bearings. Replace any that are seized, worn, or making strange noises. If the side bearings in the differential case have been removed, replace them with new ones.



3. Replace the oil seal if the lip is deformed, hardened, worn or damaged.
4. Replace the O-ring if the sealing surface is deformed, hardened, worn or damaged.
5. Replace any companion flanges with damaged oil seal sliding parts.



<Adjustment Points>



<Adjustment Criteria>

Item		Content
Differential gear backlash value and adjustment		Adjust with the washer on the back of the side gear, backlash value 0.05~015mm
Washer (35.1 x 45 x t) Thickness (mm)	803135011	0.950
	803135013	1.000
	803135015	1.050
Drive pinion bearing preload adjustment		Adjustable with collapsible spacers
Drive pinion bearing preload value		12.7~32.3 N [1.3~3.3 kg] at companion flange hole (Starting torque 3998 N•cm [10 kg•cm]
Hypoid gear height adjustment (tooth contact)		Shim adjustment
Drive pinion shim Thickness (mm)	32295AA200	0.150
	32295AA210	0.175
	32295AA220	0.200
	32295AA230	0.225
	32295AA240	0.250
	32295AA250	0.275
Axle shaft and differential pinion shaft side clearance		Snap ring adjustment, side clearance 0~0.2 mm
Snap ring thickness (Mm)	805026010	1.05
	031526000	1.2
Differential bearing preload adjustment		Adjust with the screw on the holder
Differential bearing preload value		Lock plate
Hypoid gear backlash value and adjustment		Adjustable with the holder screw, backlash value 0.1~0.18 mm

<Precautions when Assembling>

1. If the oil seal has been removed from the retainer, replace it with a new one.
2. If the oil seal was removed from the differential carrier, replace it with a new one.
3. If the differential side bearing was removed from the differential case, replace it with a new one.
4. Replace the gasket with a new one.
5. Use a new drive pinion spacer
6. Use a new drive pinion lock nut.
7. Apply gear oil to the differential side oil seal lip.
8. Apply grease to the oil seal lip of the differential carrier.

Specified Grease	Unilube #2 or equivalent

9. Apply grease to the thread surface of the retainer assembly.

Specified Grease	Unilube #2 or equivalent

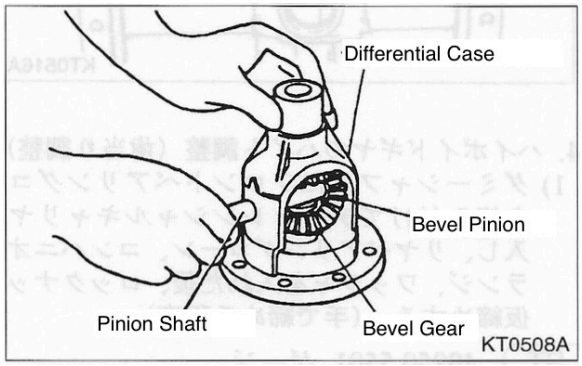
10. Do not mix up the left and right differential side oil seals.

NOTE

- If the side oil seal is installed backwards, it may cause oil leakage.

<Assembly>

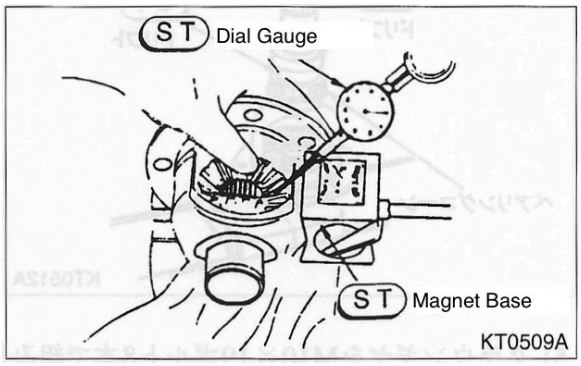
1. Assembling the differential assembly
   1) Assemble the bevel gear and bevel pinion gear into the differential case, and insert the pinion shaft.



2) Measure the backlash.

ST 49824 7001 Magnetic Base
49824 7100 Dial Gauge

Standard Value (mm)	0.05~0.15



NOTE

- To measure backlash, place one tooth of the bevel pinion between two teeth of the bevel gear. If the backlash is inappropriate, select and replace the washer (35.1 x 45 x t).

❇ Washer (35.1 x 45 x 1)

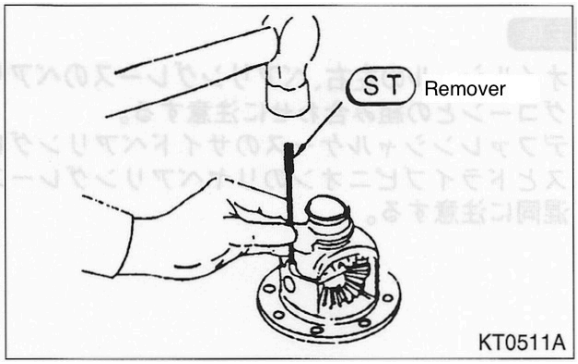
Part Number	Thickness (mm)	Part Number	Thickness (mm)
803135011	0.95	803135015	1.05
803135013	1.00		

3) Drive the straight pin in from the crown gear side.

ST 89990 4100 Remover

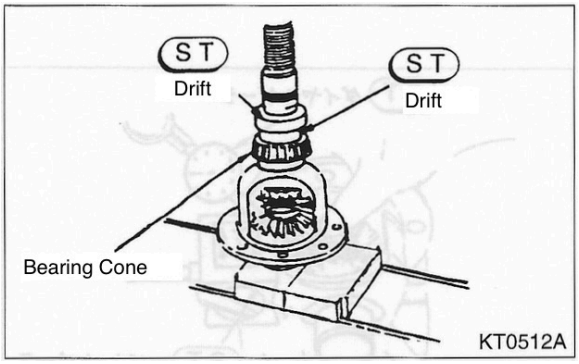
NOTE

- After inserting, be sure to tighten the opening.



4) Press in the differential side bearing cone.

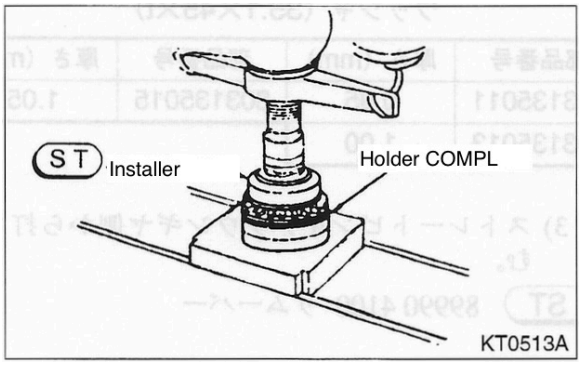
ST 49848 5400 Drift
49847 5403 Drift



5) Assemble the crown gear with eight M10 x 19 bolts.
T 62 ± 5 [6.3 ± 0.5]

2. Assembling the holder COMPL
1) Press in the oil seal.

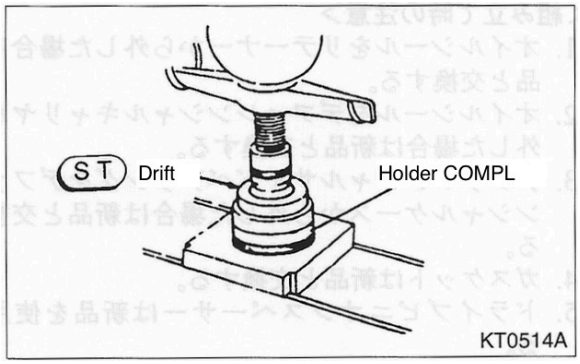
ST 39979 0110 Installer



2) Press in the bearing race.

ST 39847 7702 Drift

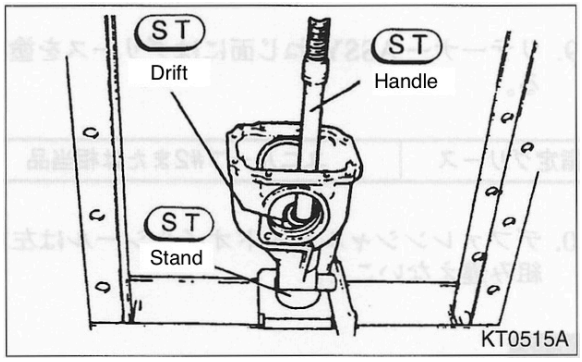
NOTE
- Pay attention to the left and right oil seals and the combination with the bearing cone of the bearing race.
- Be careful not to confuse the side bearing race of the differential case with the rear bearing race of the drive pinion.



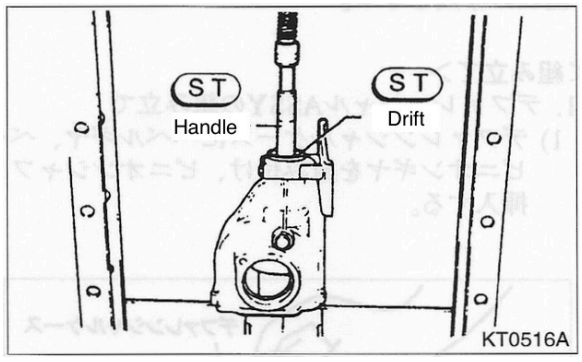
3. Press fit the front and rear bearing races into the differential carrier.

ST 39847 7701 Handle
49847 5403 Drift
39847 7702 Drift
49821 5402 Stand

• Front Bearing



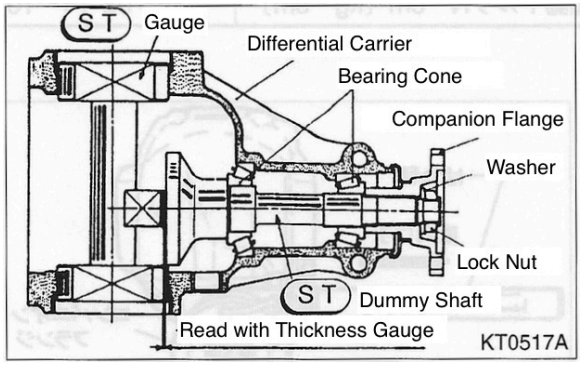
• Rear Bearing



4. Hypoid gear height adjustment (tooth contact adjustment)
1) Assemble the front bearing cone onto the dummy shaft and insert it into the differential carrier. After that, put in the rear bearing cone, companion flange, and washer, and then loosely tighten the lock nut (just by hand).

ST 49850 5501 Gauge
49850 5502 Dummy Shaft
49966 7000 Thickness Gauge

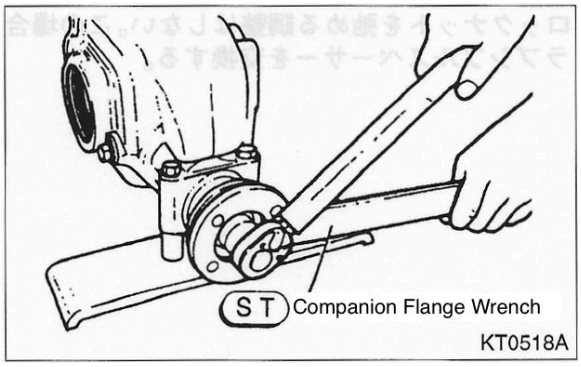
NOTE
- Apply enough gear oil to the bearings.
- Do not assemble the collapsible spacer.
- Do not assemble the height adjustment shim of the drive pinion.
- Use new lock nuts.



2) Tighten the lock nut until the regular preload is released Yes.

ST 39842 7700 Companion Flange Wrench

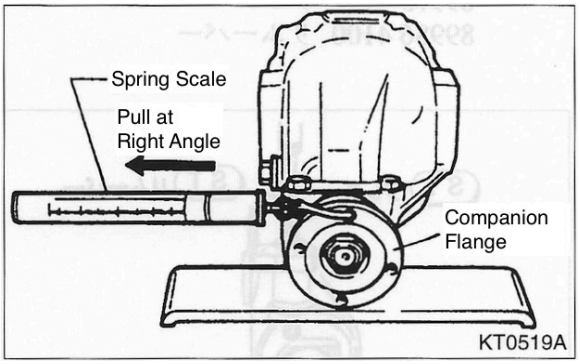
NOTE
- Do not tighten in a single step. Tighten in two to three stages while checking item 3).
- Be careful not to apply excessive preload; do not tighten to the point where the dummy shaft can no longer be rotated by hand, as this will damage the bearing. (If this occurs, stop and proceed to item 3).)



3) Put a spring in the companion flange bolt hole, read the load when it starts moving.

Load N [kg]	12.7~32.3 [1.3~3.3]
Starting Torque N·cm [kg·cm]	39~98 (4~10)

NOTE
- The load is measured by rotating the dummy shaft several times.



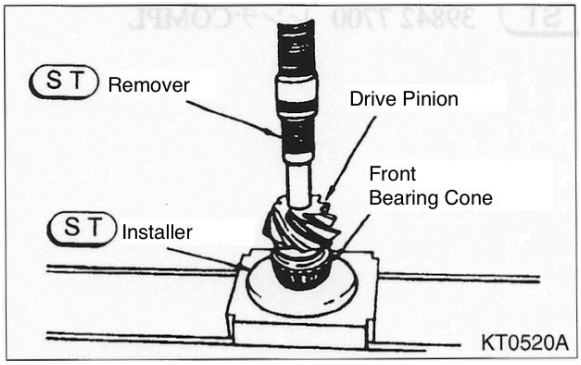
4) Insert the gauge through the window in the differential carrier and measure between the thickness gauge and the dummy shaft.
5) The thickness gauge reading is the desired shim thickness.

✻ Shim (Drive Pinion)

Part Number	Thickness (mm)	Part Number	Thickness (mm)
32295AA200	0.150	32295AA230	0.225
32295AA210	0.175	32295AA240	0.250
32295AA220	0.200	32295AA250	0.275

5. Replace the dummy shaft attached to the differential carrier with the drive pinion.
1) Insert the shim (drive pinion) determined in the previous section into the drive pinion and press in the front bearing cone.

ST 49817 5500 Installer
89986 4100 Remover

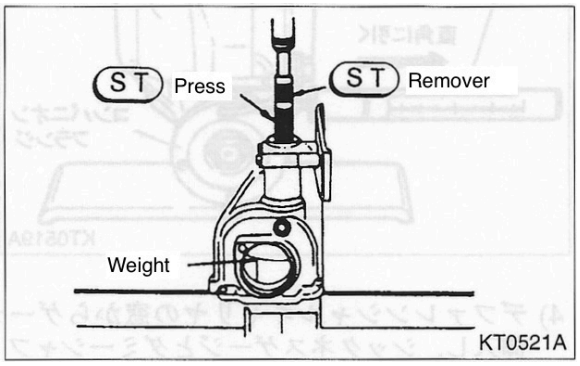


2) Place a collapsible spacer on the drive pinion and insert it into the front differential.

NOTE
- Apply gear oil to the bearings.

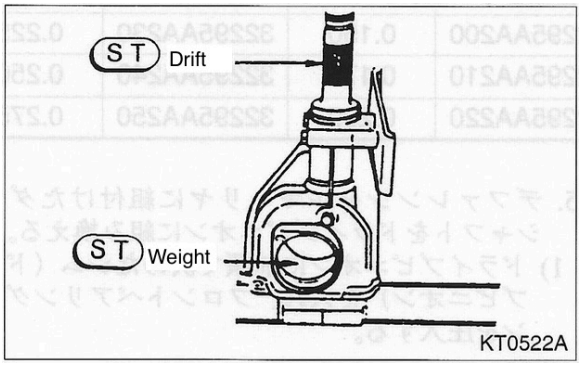
3) Insert or press in the rear bearing cone.
- Special tools used for press fitting

ST 39978 0104 Weight
89975 4102 Press
89986 4100 Remover



4) Press in the oil seal.

ST 49841 5400 Drift
39978 0104 Weight

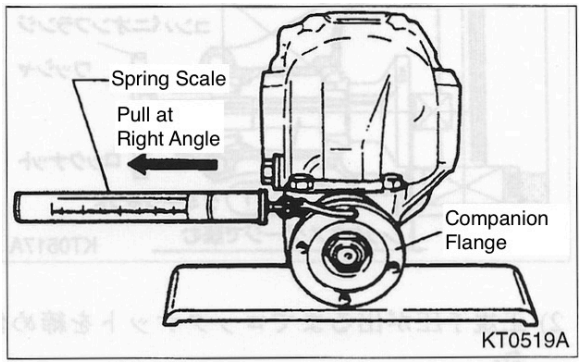


5) Insert the companion flange and washer, and tighten the lock nut.

ST 39842 7700 Wrench COMPL

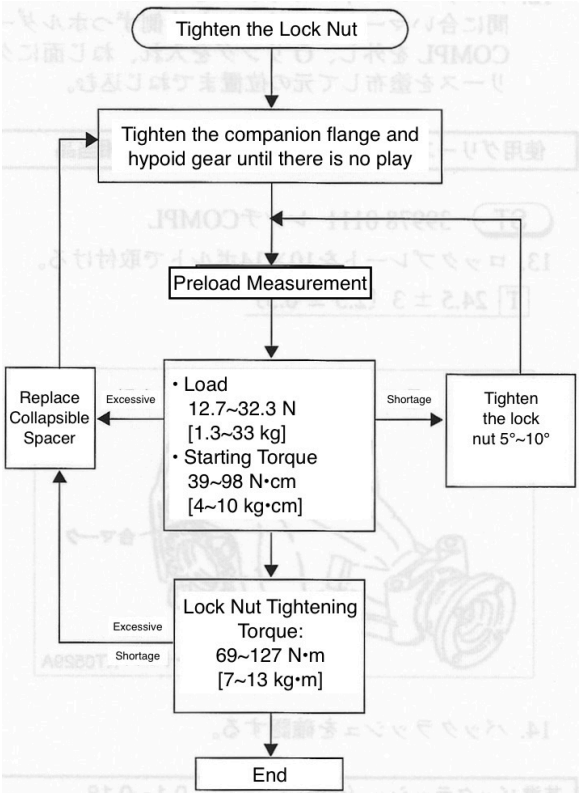
6. Tighten the lock nut
1) Tighten the companion flange and front differential until there is no play.
2) Measure the preload. Place a spring balance on the companion flange and read the load when it starts to move.

Load N [kg]	12.7~32.3 [1.3~3.3]
Starting Torque N·cm [kg·cm]	39~98 (4~10)

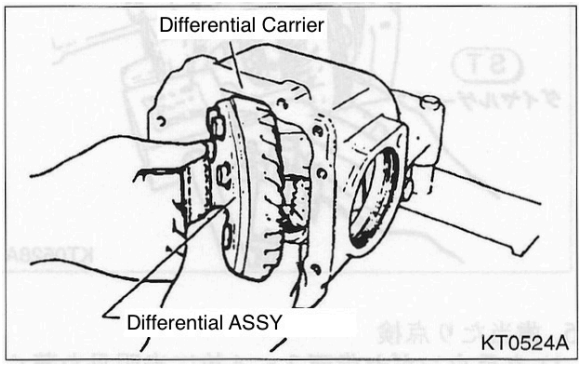


3) If the preload is insufficient, tighten the lock nut by 5°~10° and perform step 2). If the preload is excessive, replace the collapsible spacer and perform step 1) again.
4) Repeat until the lock nut tightening torque reaches the specified value and the preload value reaches the specified value.
T 69~127 [7~13]

NOTE
- Do not crimp until the teeth have made contact.
- Do not loosen the lock nut. In this case, replace the collapsible spacer.



7. Place the differential assembly into the differential carrier.



8. Insert the left and right drive shafts.

NOTE

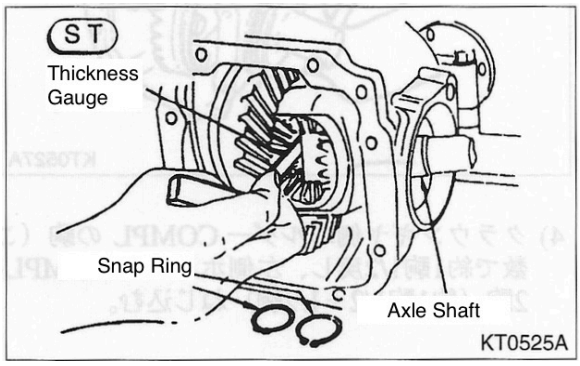
• Wrap vinyl tape around the spline part that meshes with the DOJ.

9. Assemble the snap ring. Select a snap ring so that the clearance between the drive shaft tip and pinion shaft is 0~0.2 mm.

ST 49966 7000 Thickness Gauge

✻ Snap Ring

Part Number	Thickness (mm)
805026010	1.05
31526000	1.2



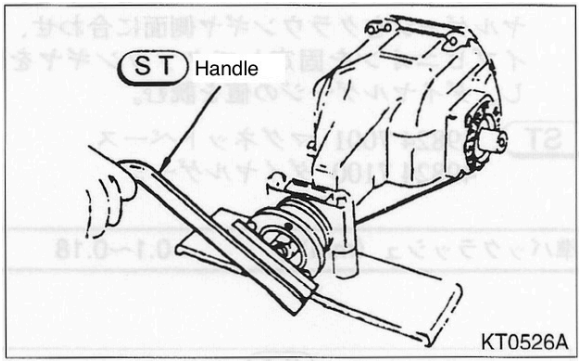
10. Lightly screw in the left and right holders COMPL.

NOTE

• Be careful as the oil seal has a left-right direction.
• Do not put in the ring.

11. Adjust the backlash of the hypoid gear and the preload of the differential side bearing
   1) Turn the drive pinion to loosen the differential side bearing.

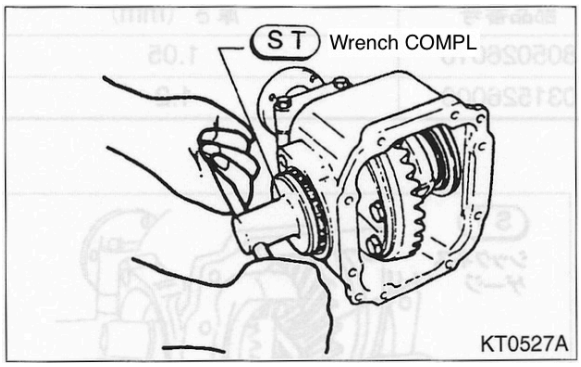
ST 49992 5400 Handle



   2) Screw in the holder COMPL on the crown gear side (right side) and stop when it lightly touches the screw.

ST 39978 0111 Oil Seal Holder Wrench COMPL

3) Screw in the left side holder COMPL and stop when it lightly touches it.



4) Move the crown gear side holder COMPL back by about 1.5 links, and screw in the left side holder COMPL by about 2 links (about 1.5 links + 1.5 links).

NOTE

- About the screw-in amount of the left side holder COMPL
  ST •[Crown gear side holder COMPL return amount + left side holder 1/2 link] So, 1/2 link is preloaded.
  •Make sure to check the installation direction of the oil seal (oil fill hole side "L" "left"

5) Temporarily tighten the lock plate.

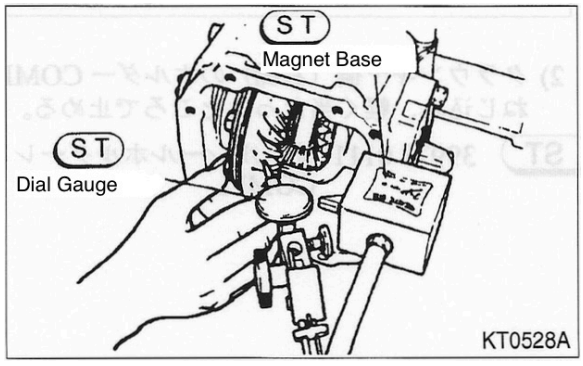
NOTE

- If you turn the pieces over, they will shift by 1/2 a piece.

6) Measure the backlash. Place the magnet base on the differential carrier, align the dial gauge with the side of the crown gear, fix the drive pinion, move the crown gear, and read the value on the dial gauge.

49824 7001 Magnetic Base
49824 7100 Dial Gauge

Standard Backlash (mm)	0.1~0.18

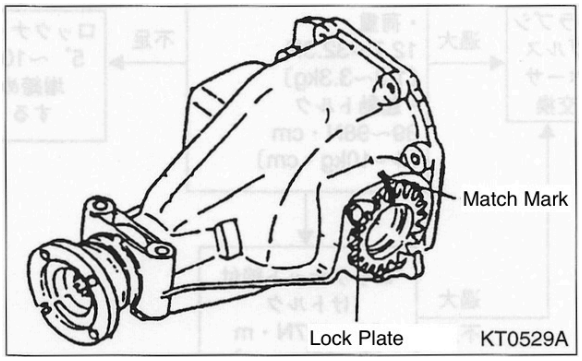


12. Differential carrier and holder COMPL: After marking the gap, remove the holder COMPL one side at a time, insert the O-ring, apply grease to the threads, and screw it back into place.

Specified Grease	Unilube #2 or equivalent

ST 39978 0111 Wrench COMPL

13. Attach the lock plate with 10x14 bolts.
T 24.5 ± 3 [2.5 ± 0.3]

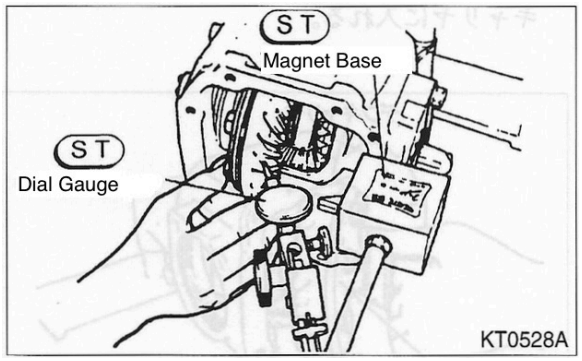


14. Check for backlash.

Standard Backlash (mm)	0.1~0.18

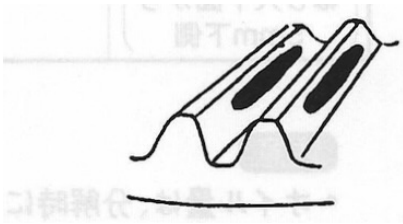
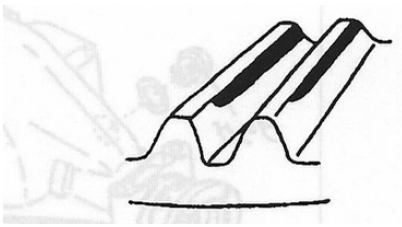
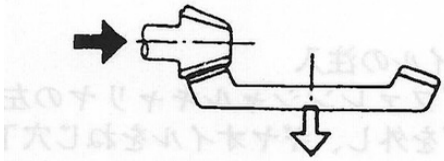
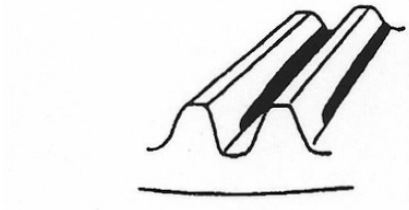
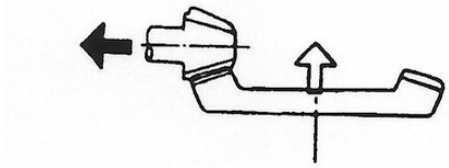
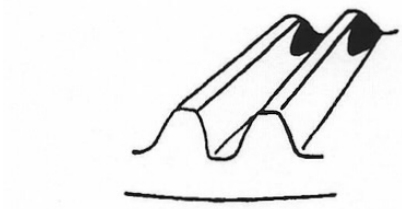
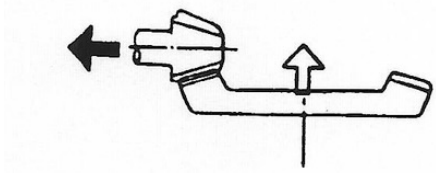
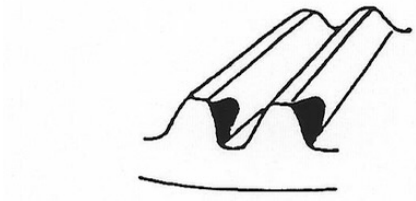
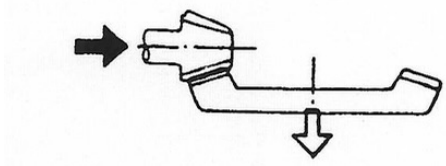
15. Tooth contact inspection
1) Apply a thin, uniform coat of Komyotan to 3 to 4 tooth surfaces of the crown gear.
2) Hold the left and right drive shafts with your hands using a rag, and turn the drive pinion several times with the handle.

ST 49992 5400 Handle



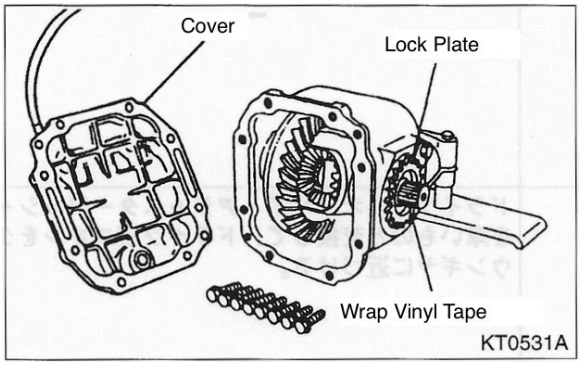
<Tooth Contact Check>

✻ Crown Gear and Drive Pinion Tooth Contact

Inspection	Situation	Adjustment
• With correct tooth contact and no load, the tooth surface makes contact in the center or slightly towards the toe side, approximately 50-60% of the way across (during operation, the contact point shifts towards the heel side).		-
• Face contact (contact on the tooth tip side) occurs when the backlash it too large.	 The noise level is high, and there is a high risk of damage to the tooth tips.	Replace the drive pinion height adjuster washer with a thicker one to move the drive pinion closer to the crown gear. 
• Flank contact (contact at the tooth root side) often occurs when the backlash is set too tightly.	 Noise increases and stepped wear on the tooth tips occurs easily.	Replace the drive pinion height adjuster washer with a thinner one to move the drive pinion away from the crown gear. 
• Toe contact (contact on the short side)	 The contact surface is small and can cause toe damage.	Same as adjusting the flank. 
• Heel contact (contact on the large end)	 The contact surface is small and can cause heel damage.	Same as adjusting the face. 

3) If the correct tooth contact is not achieved, start again from step 4, adjusting the drive pinion height.

16. Crimp one lock nut on the drive pinion.
17. Install the gasket and cover using eight M8 x 35 bolts.
T 16 ± 0.5 [1.6 ± 0.05]



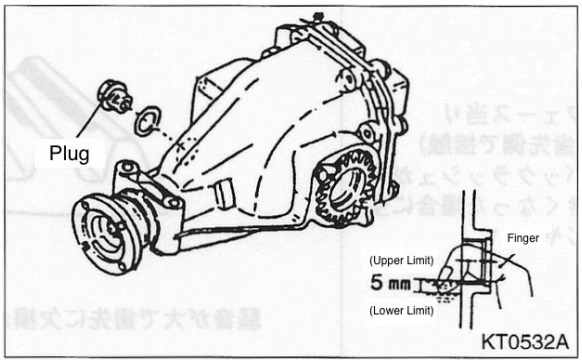
18. Oil injection
1) Remove the plug on the left side of the differential carrier and pour gear oil up to the bottom of the screw hole. The oil level should be 5mm below the bottom of the screw hole (check with your finger). Then tighten the plug together with the aluminum gasket.
T 34 ± 4 [3.5 ± 0.4]

2) Oil Amount

✻ Subaru Extra S Oil (75W-90.GL-5)

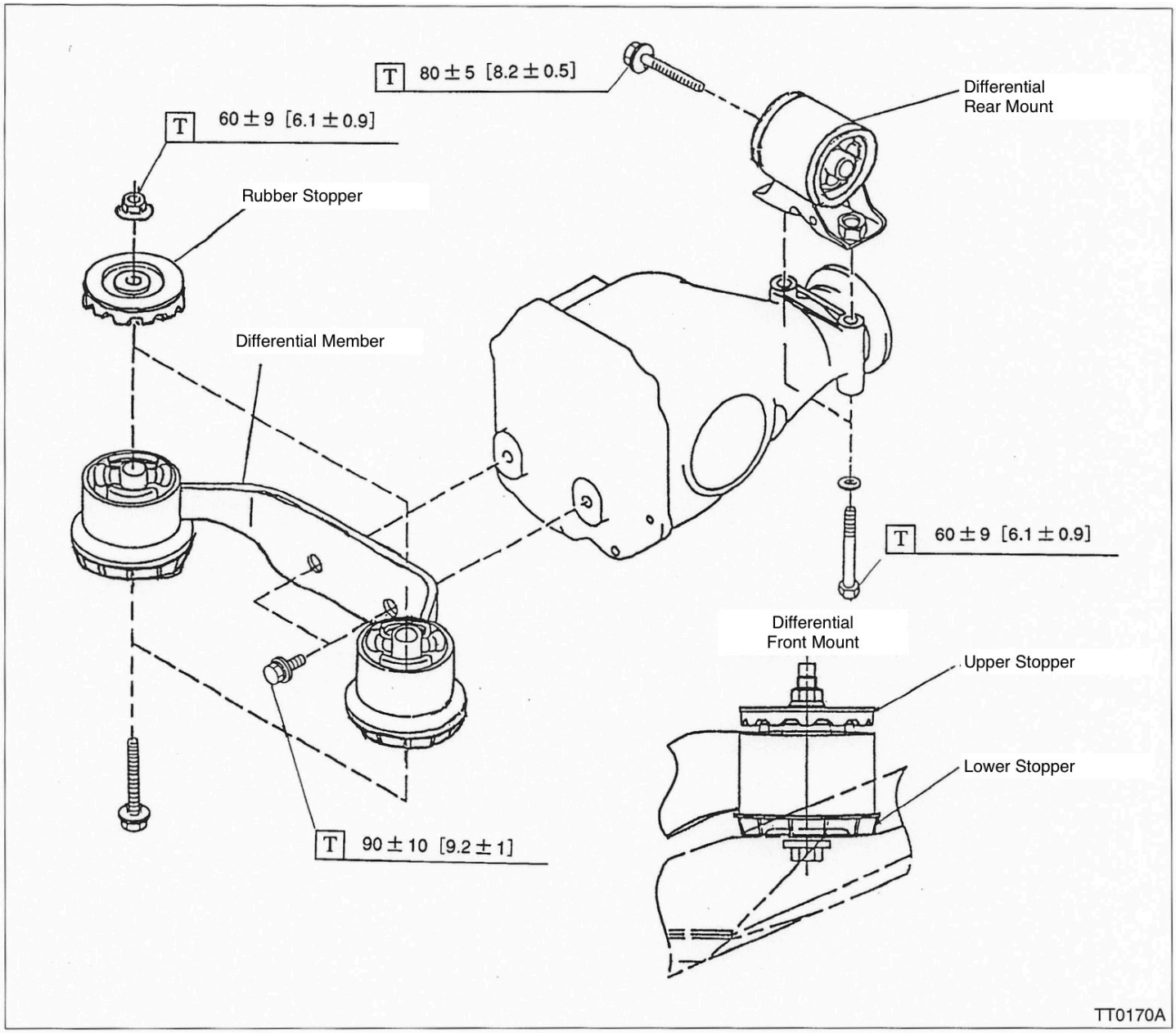
Oil Level	Capacity (ℓ)
Bottom side of screw hole	0.8
5mm below the bottom of the	0.75

NOTE
- The oil volume is approximately 0.1 liters more than when the oil is changed during an on-board inspection, as there is no residual oil when the vehicle is disassembled.



[5] Front Differential Mount

■ Component Parts



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