FOREWORD

This supplement has been prepared to provide information covering general service repairs for DUTRO which underwent changes in December, 2003.

Applicable models: W0410, 420. XZU305, 345, 404, 412, 414, 420, 422, 424, 434 series

For the service specifications and repair procedures of the above model other than those listed in the supplement, refer to the following manuals.

Manual Name	Pub. No.
• DUTRO Chassis Workshop Manual	S1−YXZE05A
• DUTRO Electrical Wiring Diagram	S1−YXZE05A−SL
• W04D−J Engine Workshop Manual	S5−YW04E06A
• S05C Engine Workshop Manual	S5−YS05E06A
• M550 Manual Transmission Workshop Manual	S1−YXZE09A
• H260 Manual Transmission Workshop Manual	S1−YXZE07A
• H350 Manual Transmission Workshop Manual	S1−YXZE06A
• M150, 153 Manual Transmission Workshop Manual	S1−YXZE08A

All information in this manual is based on the latest product information at the time of publication. However, specifications and procedures are subject to change without notice.

If you find any failures in this manual, you are kindly requested to inform us by using the report form on the next page.

Workshop Manual Quality Report

Att.) Service Manager,
Your Distributor

Pub. No.		Issue Date	
Name of Dealer		Name of Reporter	
Subject			
Problem Description			
Correction Proposal			

CAUTION

This manual does not include all the necessary items about repair and service. This manual is made for the purpose of the use for the persons who have special techniques and certifications. In the cases that non−specialized or uncertified technicians perform repair or service only using this manual or without proper equipment or tool, that may cause severe injury to you or other people around and also cause damage to your customer's vehicle.

In order to prevent dangerous operation and damages to your customer's vehicle, be sure to follow the instruction shown below.

- Must read this manual thoroughly. It is especially important to have a good understanding of all the contents written in the PRECAUTION of "IN" section.
- The service method written in this manual is very effective to perform repair and service. When performing the operations following the procedures using this manual, be sure to use tools specified and recommended. If using non−specified or recommended tools and service method, be sure to confirm safety of the technicians and any possibility of causing personal injury or damage to the customer's vehicle before starting the operation.
- If part replacement is necessary, must replace the part with the same part number or equivalent part. Do not replace it with inferior quality.
- It is important to note that this manual contains various "Cautions" and "Notices" that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these "Cautions" and "Notices" are not exhaustive, because it is important to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

INTRODUCTION

HOW TO USE THIS MANUAL

010VV-01

GENERAL INFORMATION

1. GENERAL DESCRIPTION

(a) This manual is written in accordance with SAE J2008.

(b) Repair operations can be separated into 3 main processes:
1. Diagnosis
2. Removing/Installing, Replacing, Disassembling/Reassembling, Checking and Adjusting
3. Final Inspection

(c) This manual explains the ”Diagnosis” (found in the ”Diagnostics” section) and ”Removing and Installing, Replacing, Disassembling, Installing and Checking, and Adjusting”. ”Final Inspection” is omitted.

(d) The following essential operations are not written in this manual. However, these operations must be performed in actual situations.
(1) Operations with a jack or lift
(2) Cleaning of a removed part when necessary
(3) Visual check

2. INDEX

(a) An alphabetical INDEX section is provided at the end of the book as a reference to help you find the item to be repaired.

3. PREPARATION

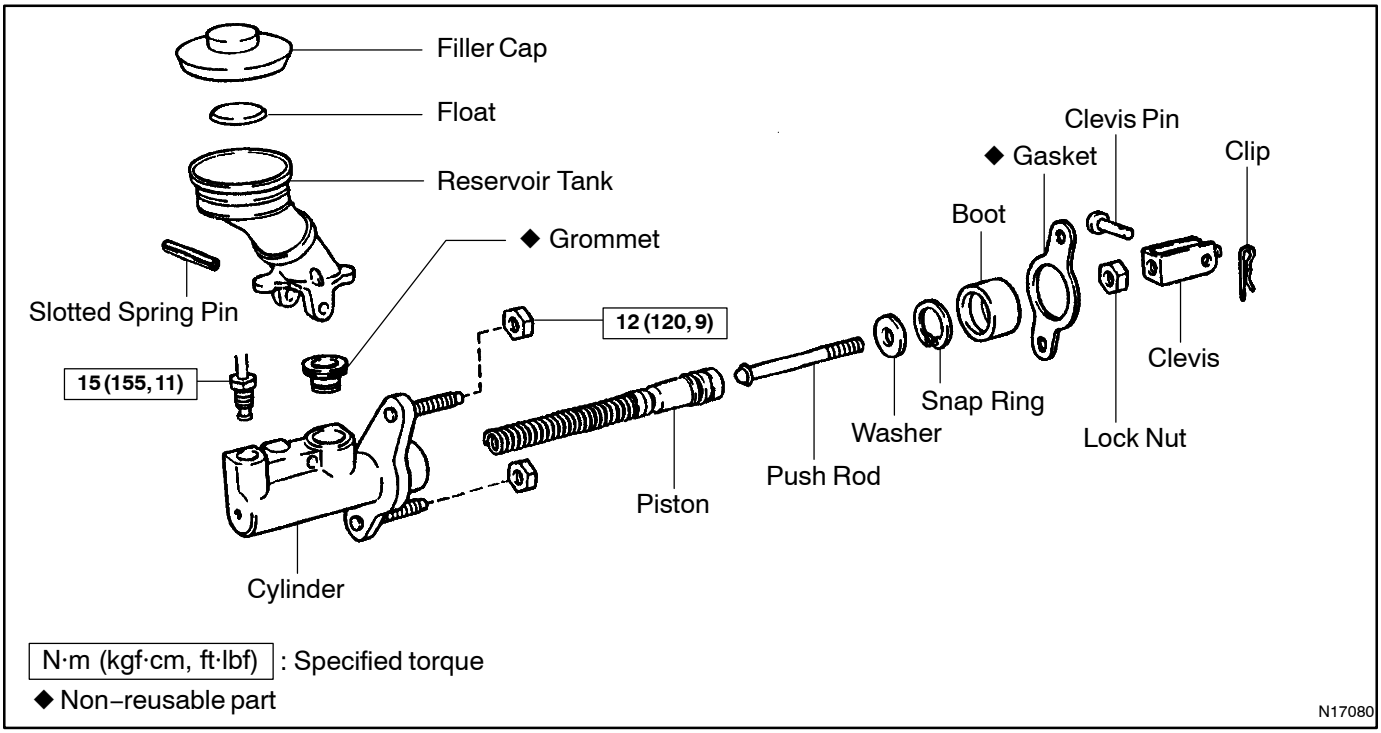
(a) Use of Special Service Tools (SST) and Special Service Materials (SSM) may be required, depending on the repair situation. Be sure to use SST and SSM when they are required and follow the working procedure properly. A list of SST and SSM is in the Preparation section of this manual.

4. REPAIR PROCEDURES

(a) A component illustrations is placed under the title where necessary.

(b) Non–reusable parts, grease application areas, precoated parts and torque specifications are noted in the component illustrations.

Example:



(c) Torque specifications, grease application areas and non–reusable parts are emphasized in the procedures.

NOTICE:

There are cases where such information can only be explained by using an illustration. In these cases, all the information such as torque, oil, etc. are described in the illustration.

(d) The installation procedures are the removal procedures in reverse order. However, only installation procedures requiring additional information are included.

(e) Only items with key points are described in the text. What to do and other details are placed in illustrations next to the text. Both the text and illustrations are accompanied by standard values and notices.

(f) Illustrations of similar vehicle models are sometimes used. In those cases, specific details may be different from the actual vehicle.

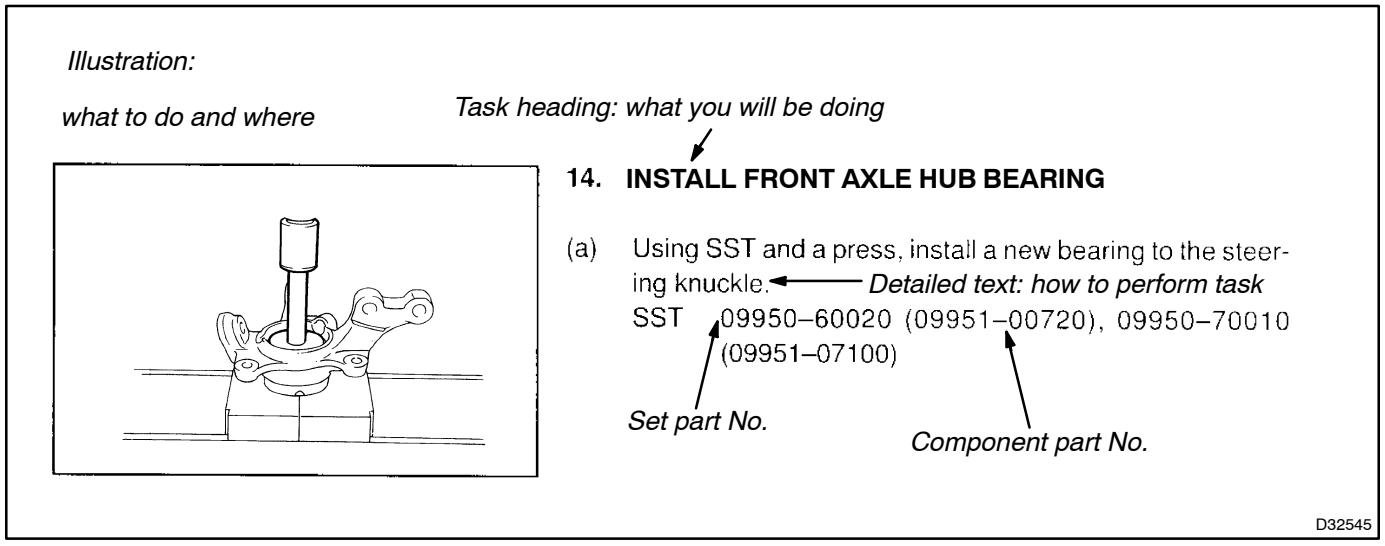
(g) Procedures are presented in a step–by–step format:

(1) The illustration shows what to do and where to do it.

(2) The task heading tells what to do.

(3) The explanation text tells how to perform the task. It also has information such as specifications and warnings.

Example:



HINT:

This format provides an experienced technician with a FAST TRACK to the necessary information. The task headings are easy to read and the text below the task heading provides detailed information. Important specifications and warnings are always written in bold type.

5. SERVICE SPECIFICATIONS

(a) SPECIFICATIONS are presented in bold–faced text throughout the manual. The specifications are also found in the Service Specifications section for quick reference.

6. TERMS DEFINITION

CAUTION	Possibility of injury to you or other people.
NOTICE	Possibility of damage to the components being repaired.
HINT	Provides additional information to help you perform repairs.

7. SI UNIT

(a) The units used in this manual comply with the SI UNIT (International System of Units) standard. Units from the metric system and the English system are also provided.

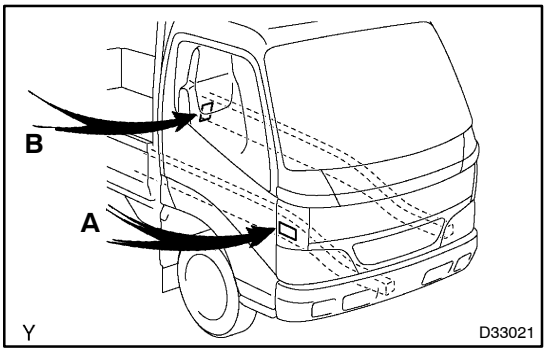
Example:

Torque: 30 N·m (310 kgf·cm, 22 ft·lbf)

IDENTIFICATION INFORMATION

VEHICLE IDENTIFICATION AND SERIAL NUMBERS

010VW-01

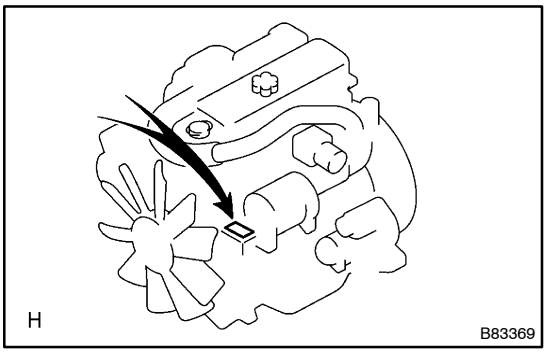


1. VEHICLE IDENTIFICATION NUMBER

(a) The vehicle identification number is stamped on the right frame as shown in the illustration. This number has also been stamped on the manufacturer's plate.

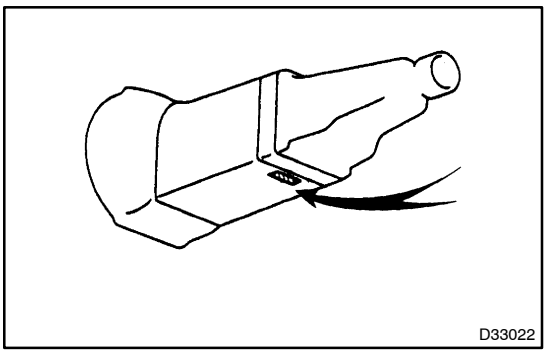
A: Vehicle Identification Number

B: Manufacturer's Plate



2. ENGINE SERIAL NUMBER AND TRANSMISSION SERIAL NUMBER

(a) The engine serial number is stamped on the cylinder block of the engine, as shown in the illustration.



(b) The transmission serial number is stamped on the transmission, as shown in the illustration.

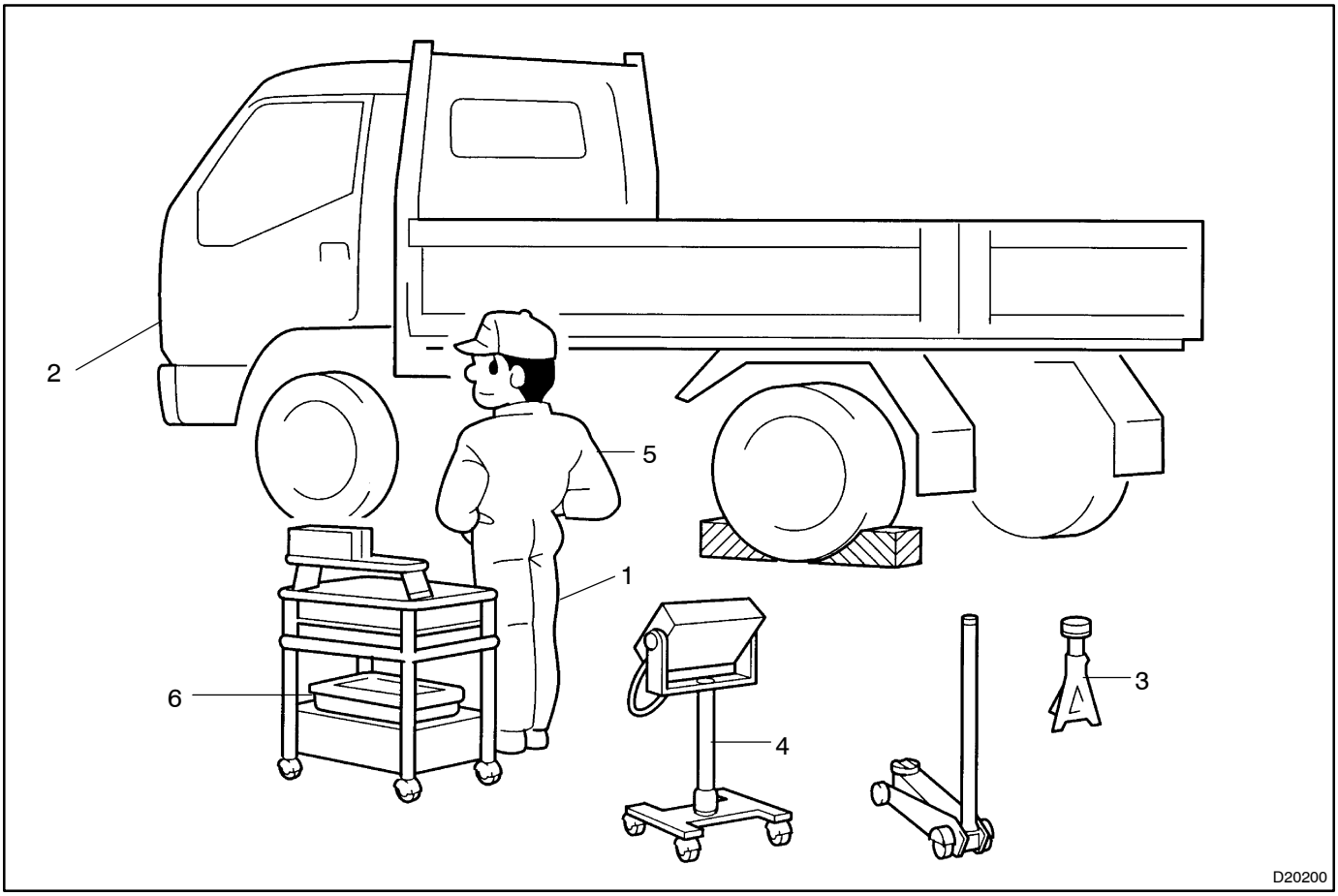
REPAIR INSTRUCTION

010VX–01

PRECAUTION

1. BASIC REPAIR HINT

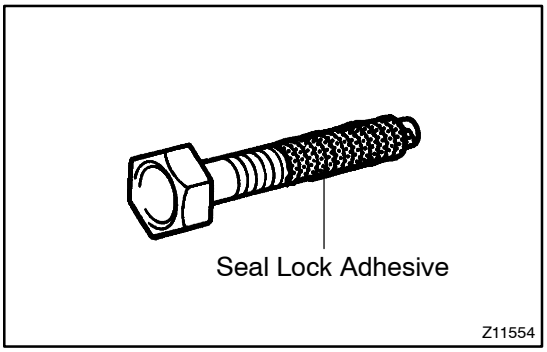
(a) HINTS ON OPERATIONS



1	Looks	• Always wear a clean uniform. • Hat and safety shoes must be worn.
2	Vehicle protection	• Prepare a grille cover, fender cover, seat cover and floor mat before starting the operation.
3	Safe operation	• When working with 2 or more persons, be sure to check safety for one another. • When working with the engine running, make sure to provide ventilation for exhaust fumes in the workshop. • If working on high temperature, high pressure, rotating, moving, or vibrating parts, wear appropriate safety equipment and take extra care not to injure yourself or others. • When jacking up the vehicle, be sure to support the specified location with a safety stand. • When lifting up the vehicle, use appropriate safety equipment.
4	Preparation of tools and measuring gauge	• Before starting operation, prepare a tool stand, SST, gauge, oil and parts for replacement.
5	Removal and installation, disassembly and assembly operations	• Diagnose with a thorough understanding of proper procedures and of the reported problem. • Before removing the parts, check the general condition of the assembly and for deformation and damage. • When the assembly is complicated, take notes. For example, note the total number of electrical connections, bolts, or hoses removed. Add matchmarks to insure re–assembly of components in the original positions. Temporarily mark hoses and their fittings, if needed. • Clean and wash the removed parts if necessary and assemble them after a thorough check.
6	Removed parts	• Place the removed parts in a separate box to avoid mixing them up with the new parts or contaminating the new parts. • As for non–reusable parts such as a gasket, an O–ring, and a self–locking nut, replace them with new ones following the instructions in this manual. • Retain the removed parts for customer inspection, if requested.

(b) JACKING UP AND SUPPORTING VEHICLE

(1) Care must be taken when jacking up and supporting the vehicle. Be sure to lift and support the vehicle at the proper locations (see page 01–14).



(c) PRECOATED PARTS

(1) Precoated parts are bolts and nuts. They are coated with a seal lock adhesive at the factory.

(2) If a precoated part is retightened, loosened or moved in anyway, it must be recoated with the specified adhesive.

(3) When reusing precoated parts, clean off the old adhesive and dry the part with compressed air. Then apply new seal lock adhesive appropriate to the bolts and nuts.

NOTICE:

Perform the torque with the lower limit value of the torque tolerance.

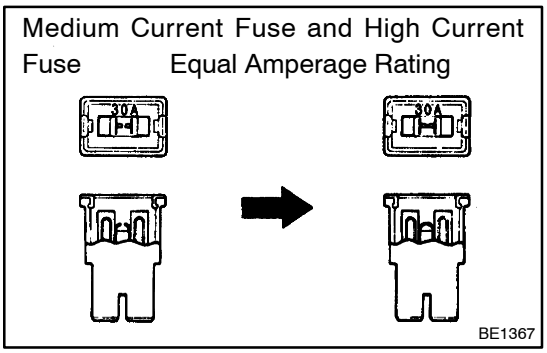
(4) Some seal lock agents harden slowly. You may have to wait for the seal lock agent to harden.

(d) GASKETS

(1) When necessary, use a sealer on gaskets to prevent leaks.

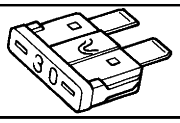
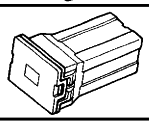
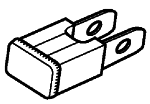
(e) BOLTS, NUTS AND SCREWS

(1) Carefully follow all the specifications for tightening torques. Always use a torque wrench.



(f) FUSES

(1) When replacing fuses, be sure that the new fuse has the correct amperage rating. DO NOT exceed the rating or use one with a lower rating.

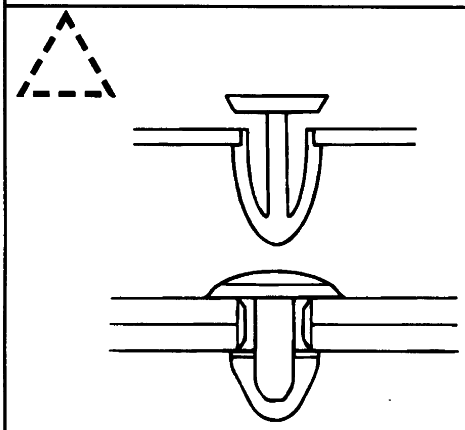
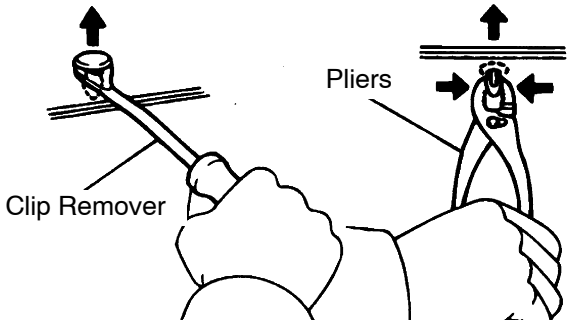
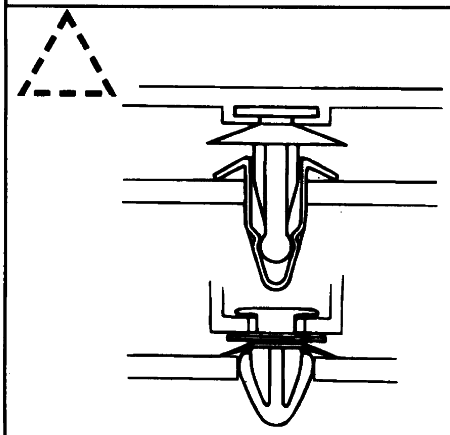
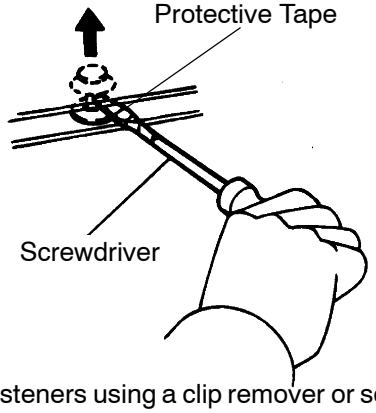
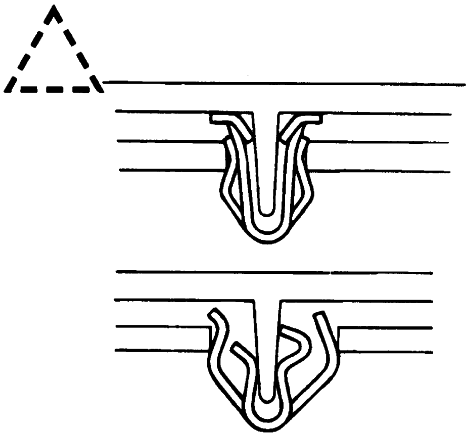
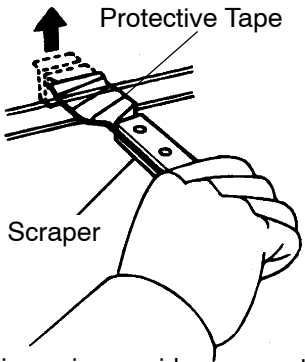
Illustration	Symbol	Part Name	Abbreviation
 BE5594	 IN0365	FUSE	FUSE
 BE5595	 IN0366	MEDIUM CURRENT FUSE	M–FUSE
 D27353	 IN0367	HIGH CURRENT FUSE	H–FUSE

(g) CLIPS

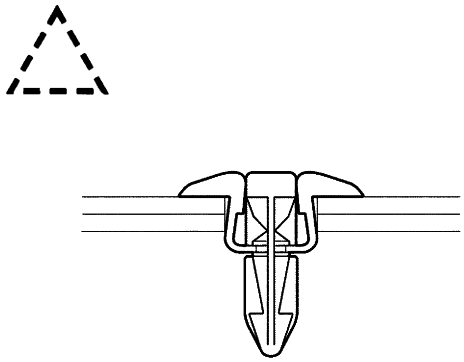
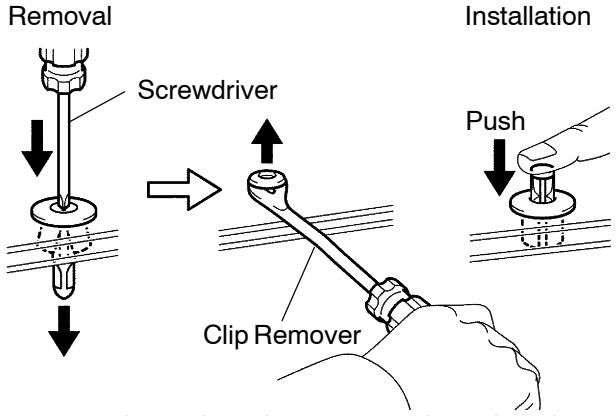
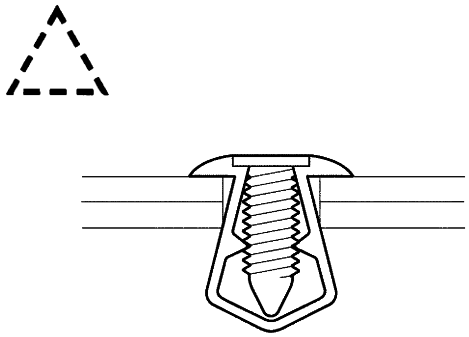
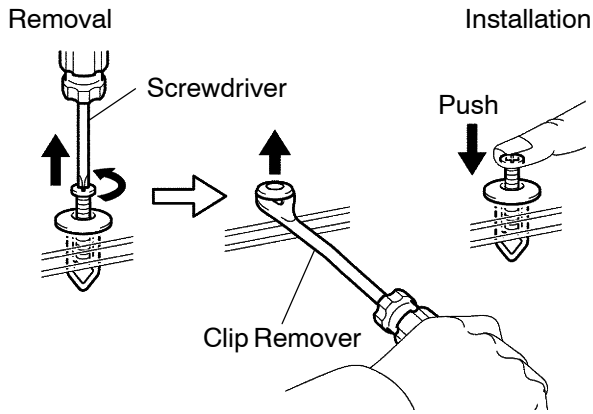
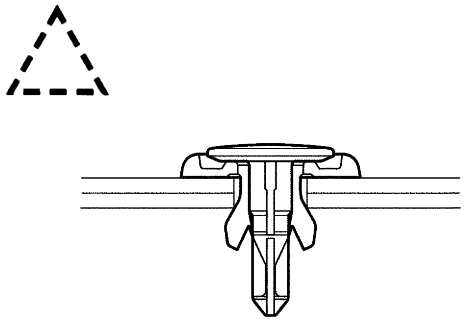
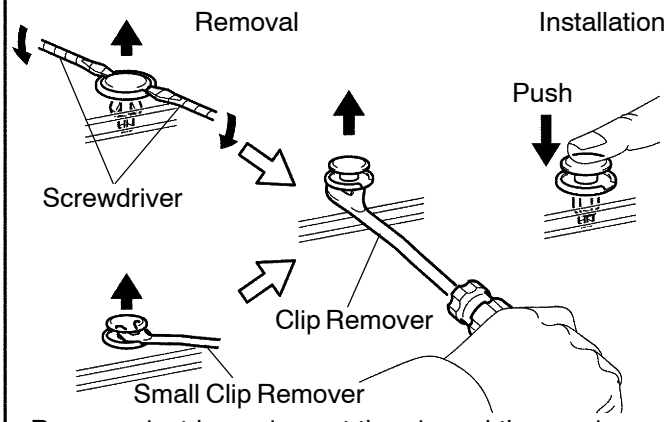
(1) The removal and installation methods of typical clips used in body parts are shown in the table below.

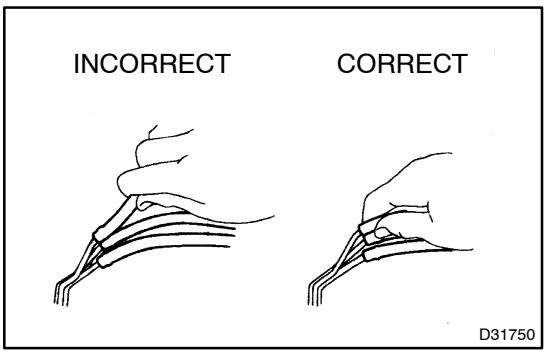
HINT:

If clips are damaged during a procedure, always replace the damaged clip with a new clip.

Shape (Example)	Removal/Installation
	 Remove clips from front or rear using a clip remover or pliers.
	 Remove fasteners using a clip remover or screwdriver.
	 Remove clips using a wide scraper to prevent panel damage.

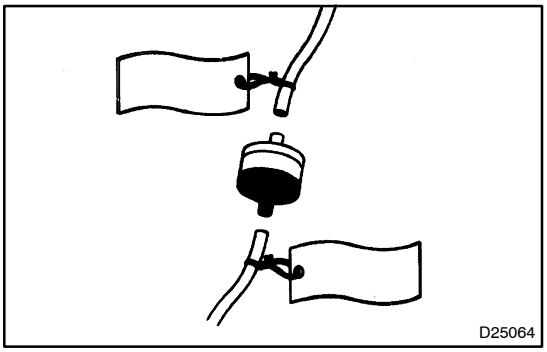
D25786

Shape (Example)	Removal/Installation
	 Remove rivet by pushing the center pin through and prying out the rivet shell.
	 Remove rivet by unscrewing the center pin and prying out the rivet shell.
	 Remove rivet by prying out the pin and then prying out the rivet shell.



(h) REMOVAL AND INSTALLATION OF VACUUM HOSES

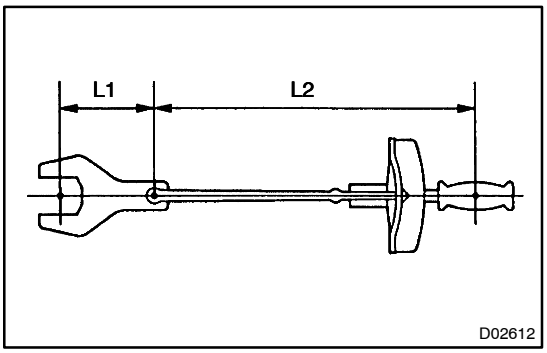
(1) To disconnect vacuum hose, pull and twist from the end of the hose. Do not pull from the middle of the hose as this may cause damage.



(2) When disconnecting vacuum hoses, use tags to identify where they should be reconnected.

(3) After completing the job, double check that the vacuum hoses are properly connected. The label under the hood shows the proper layout.

(4) When using a vacuum gauge, never force the hose onto a connector that is too large. Use a step–down adapter for adjustment. Once the hose has been stretched, it may leak air.

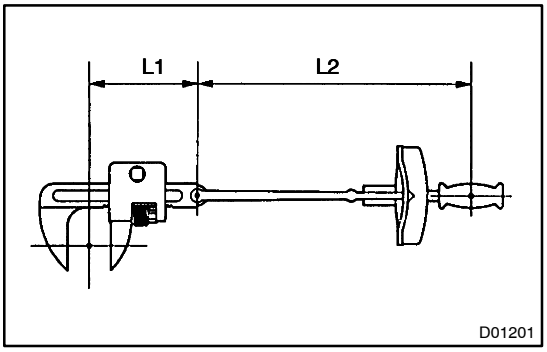


(i) TORQUE WHEN USING TORQUE WRENCH WITH EXTENSION TOOL

(1) If SST or an extension tool is combined with the torque wrench to extend its length, do not tighten the torque wrench to the specified torque values in this manual. The actual torque will be excessive.

(2) Use the formula below to calculate special torque values for situations where SST or an extension tool is combined with the torque wrench.

(3) Formula: T' = T x L2/(L1 + L2)



T'	Reading of torque wrench {N·m (kgf·cm, ft·lbf)}
T	Torque {N·m (kgf·cm, ft·lbf)}
L1	Length of SST or extension tool (cm (in.))
L2	Length of torque wrench (cm (in.))

2. FOR VEHICLES EQUIPPED WITH SRS AIRBAG

HINT:

The HINO DUTRO is equipped with an SRS (Supplemental Restraint System), such as the driver airbag and seat belt pretensioner.

Failure to carry out the service operations in the correct sequence could cause the SRS to unexpectedly deploy during servicing and lead to serious injury.

Furthermore, if a mistake is made when servicing the SRS, it is possible that the SRS may fail to operate properly. Before servicing (including removal or installation of parts, inspection or replacement), be sure to read the following section carefully.

(a) GENERAL NOTICE

(1) As the malfunction symptoms of the SRS are difficult to confirm, the Diagnostic Trouble Codes (DTCs) become the most important source of information when troubleshooting. When troubleshooting the SRS, always check the DTCs before disconnecting the battery (see Pub. No. S1–YXZE05A, page 05–213).

(2) Work must be started at least 90 seconds after the ignition switch is turned to the LOCK position and the negative (–) terminal cable is disconnected from the battery.
(The SRS is equipped with a back–up power source. If work is started within 90 seconds after turning the ignition switch to lock and disconnecting the negative (–) terminal cable from the battery, the SRS may deploy).
When the negative (–) terminal cable is disconnected from the battery, clock and audio system memory is erased. Before starting work, make a note of the settings of each memory system. When work is finished, reset the clock and audio systems as before.

CAUTION:

Never use a back–up power source (battery or other) to avoid erasing system memory. The back–up power source may inadvertently power the SRS and cause it to deploy.

(3) In minor collisions where the SRS does not deploy, the horn button assembly and seat belt pretensioner should be inspected before further use of the vehicle (see Pub. No. S1–YXZE05A, page 60–7 and 60–12).

(4) Never use SRS parts from another vehicle. When replacing parts, use new parts.

(5) Before repairs, remove the airbag sensor if impacts are likely to be applied to the sensor during repairs.

(6) Never disassemble and repair the airbag sensor assembly, horn button assembly or seat belt pretensioner.

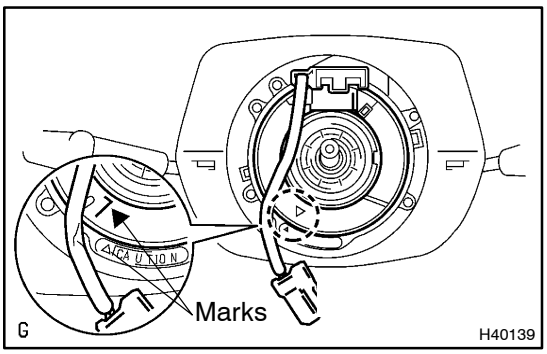
(7) Replace the center airbag sensor assembly and horn button assembly if:1) damage has occurred from being dropped, or 2) cracks, dents or other defects in the case, bracket or connector are present.

(8) Do not directly expose the airbag sensor assembly, horn button assembly to hot air or flames.

(9) Use a voltmeter/ohmmeter with high impedance (10 kΩ/V minimum) for troubleshooting electrical circuits.

(10) Information labels are attached to the SRS components. Follow the instructions on the labels.

(11) After work on the SRS is completed, check the SRS warning lamp (see Pub. No. S1–YXZE05A, page 05–213).



(b) SPIRAL CABLE (in Combination Switch)

(1) The steering wheel must be fitted correctly to the steering column with the spiral cable at the neutral position, otherwise cable disconnection and other troubles may occur. See Pub. No. S1–YXZE05A, page 60–15 concerning the correct installation of the steering wheel.

(c) HORN BUTTON ASSEMBLY (with Airbag)

(1) When removing the horn button assembly or handling a new horn button, it should be placed with the pad surface facing up. See illustration below.
Placing the horn button with the pad surface facing down may lead to a serious accident if the airbag accidentally inflates. Also, do not place anything on top of the horn button.

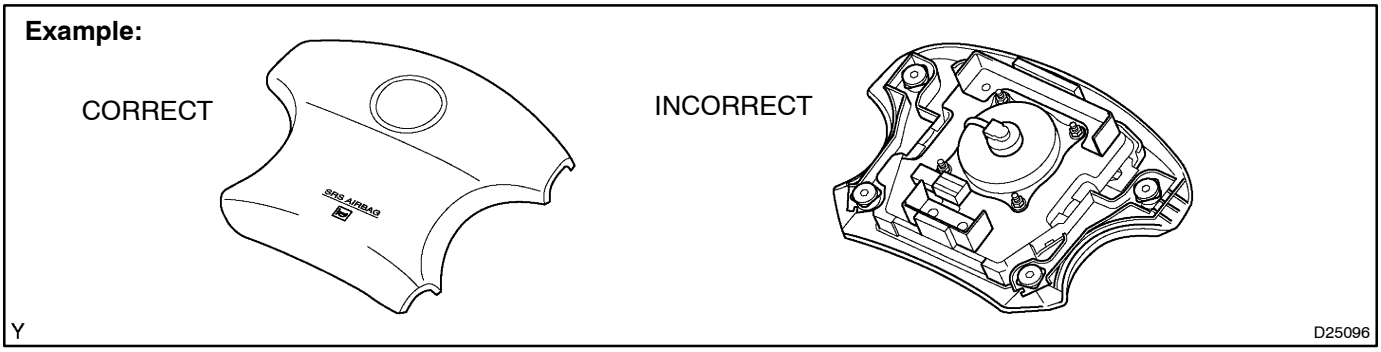
(2) Never measure the resistance of the airbag squib. This may cause the airbag to inflate, which could cause serious injury.

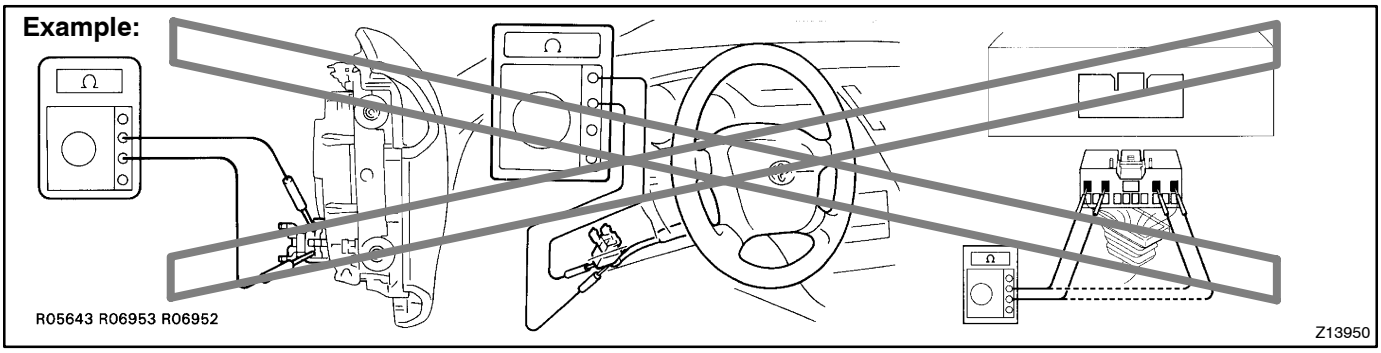
(3) Grease or detergents of any kind should not be applied to the steering wheel pad.

(4) Store the horn button assembly in an area where the ambient temperature is below 93°C (200°F), the humidity is not high and electrical noise is not nearby.

(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (4 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag or seat belt pretensioner deploying due to currents entering the squib wiring.

(6) When disposing of the vehicle or the horn button assembly by itself, the airbag should be inflated using an SST before disposal I (see Pub. No. S1–YXZE05A, page 60–7).
Perform the operation in a safe place away from electrical noise.





(d) SEAT BELT PRETENSIONER

(1) Never measure the resistance of the seat belt pretensioner. This may cause the seat belt pretensioner to activate, which could cause serious injury.

(2) Never disassemble the seat belt pretensioner.

(3) Never install the seat belt pretensioner on another vehicle.

(4) Store the seat belt pretensioner in an area where the ambient temperature is below 80˚C (176˚F), the humidity is not high and electrical noise is not nearby.

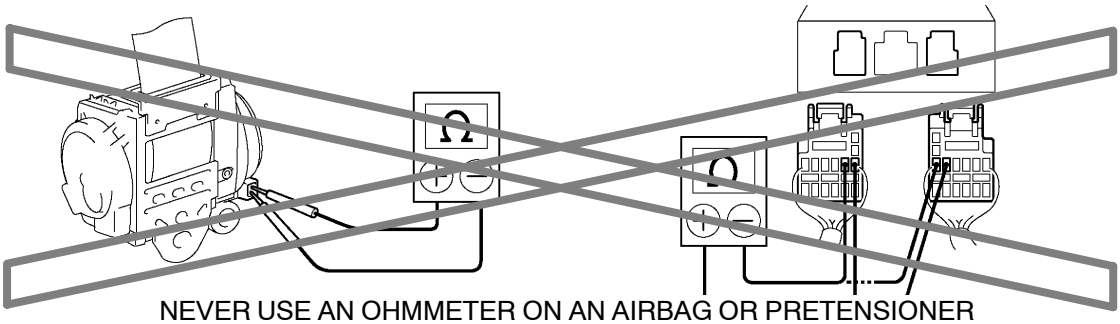
(5) When using electric welding anywhere on the vehicle, disconnect the airbag ECU connectors (2 pins). These connectors contain shorting springs. This feature reduces the possibility of the airbag deploying due to currents entering the squib wiring.

(6) When disposing of a vehicle or the seat belt pretensioner unit by itself, the seat belt pretensioner should be activated before disposal (see Pub. No. S1–YXZE05A, page 61–12). Activate in a safe place away from electrical noise.

(7) As the seat belt pretensioner is hot after being activated, allow some time for it to cool down sufficiently before disposal. Never apply water to try to cool down the seat belt pretensioner.

(8) Grease, detergents, oil or water should not be applied to the front seat outer belt.

Example:



NEVER USE AN OHMMETER ON AN AIRBAG OR PRETENSIONER

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(e) AIRBAG SENSOR ASSEMBLY

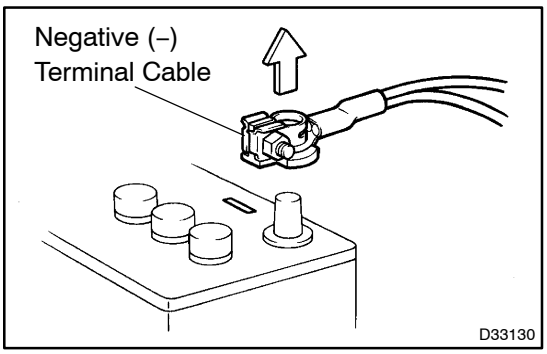
(1) Never reuse an airbag sensor assembly that has been involved in a collision where the SRS has deployed.

(2) The connectors to the airbag sensor assembly should be connected or disconnected with the sensor mounted on the floor. If the connectors are connected or disconnected while the airbag sensor assembly is not mounted to the floor, the SRS may activate.

(3) Work must be started at last 90 seconds after the ignition switch is turned to the LOCK position and the negative (–) terminal cable is disconnected from the battery, even if only loosening the set bolts of the airbag sensor assembly.

(f) WIRE HARNESS AND CONNECTOR

(1) The SRS wire harness is integrated with the instrument panel wire harness assembly. All the connectors in the system are a standard yellow color. If the SRS wire harness becomes disconnected or the connector becomes broken, repair or replace it.



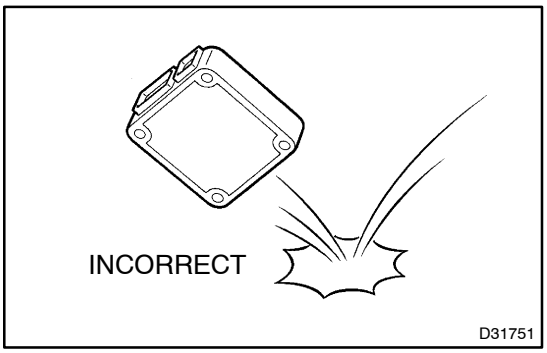
3. ELECTRONIC CONTROL

(a) REMOVAL AND INSTALLATION OF BATTERY TERMINAL

(1) Before performing electronic work, disconnect the battery negative (–) terminal cable beforehand to prevent component and wire damage caused by accidental short circuits.

(2) When disconnecting the terminal cable, turn the ignition switch and lighting switch OFF and loosen the terminal nut completely. Perform these operations without twisting or prying the terminal. Remove the battery cable from the battery post.

(3) Clock settings, radio settings, DTCs and other data are erased when the battery cable is removed. Before removing the battery cable, record any necessary data.



(b) HANDLING OF ELECTRONIC PARTS

(1) Do not open the cover or case of the ECU unless absolutely necessary. If the IC terminals are touched, the IC may be rendered inoperative by static electricity.

(2) To disconnect electronic connectors, pull the connector itself, not the wires.

(3) Be careful not to drop electronic components, such as sensors or relays. If they are dropped on a hard surface, they should be replaced.

(4) When cleaning the engine with steam, protect the electronic components, air filter and emission–related components from water.

(5) Never use an impact wrench to remove or install temperature switches or temperature sensors.

(6) When checking the resistance of a wire connector, insert the tester probe carefully to prevent terminals from bending.

4. REMOVAL AND INSTALLATION OF FUEL CONTROL PARTS

(a) PLACE FOR REMOVING AND INSTALLING OF FUEL SYSTEM PARTS

(1) Work in a place with good air ventilation that does not have welders, grinders, drills, electric motors, stoves, or any other ignition sources.

(2) Never work in a pit or near a pit as vaporized fuel will collect in those places.

(b) REMOVING AND INSTALLING OF FUEL SYSTEM PARTS

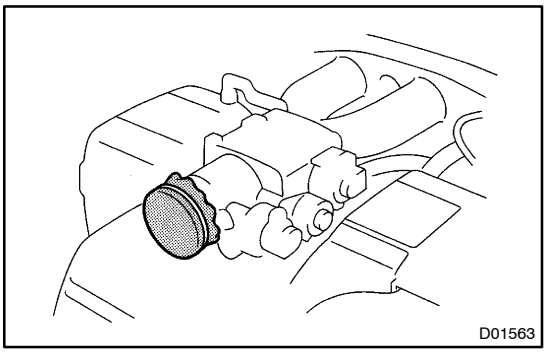
(1) Prepare a fire extinguisher before starting operation.

(2) To prevent static electricity, install a ground on the fuel changer, vehicle and fuel tank, and do not spray the area with water. The work surface will become slippery. Do not clean up spills with water as this will spread and gasoline and create a fire hazard.

(3) Avoid using electric motors, working lights and other electric equipment that can cause sparks or high temperatures.

(4) Avoid using iron hammers as they may create sparks.

(5) Dispose of fuel–contaminated shop rags separately using a fire resistant container.

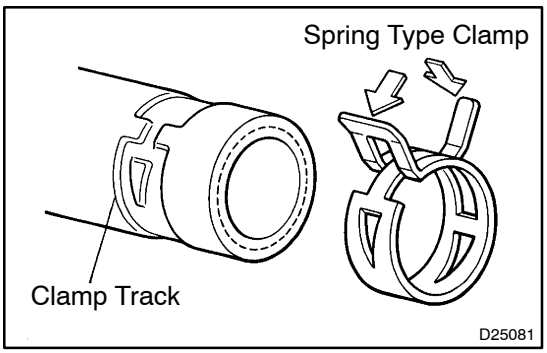


5. REMOVAL AND INSTALLATION OF ENGINE INTAKE PARTS

(a) If any metal tip is mixed in the inlet pass, that may damage the engine and turbocharger.

(b) When removing and installing the inlet system parts, cover the openings of the removed parts and engine openings. Use clean shop rags, gummed tape, or other suitable materials.

(c) When installing the inlet system parts, check that no metal particles have entered the engine or the installed part.



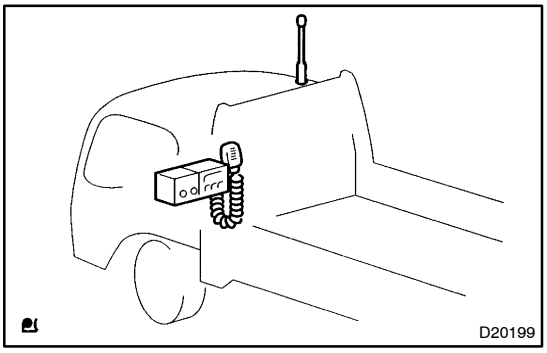
6. HANDLING OF HOSE CLAMPS

(a) Before removing the hose, check the clamp position so that it can be reinstalled in the same position.

(b) Replace deformed or dented clamps with a new one.

(c) When reusing a hose, attach the clamp on the clamp track portion of the hose.

(d) For a spring type clamp, you may want to spread the tabs slightly after installation by pushing in the direction of the arrow marks as shown in the illustration.



7. FOR VEHICLES EQUIPPED WITH MOBILE COMMUNICATION SYSTEM

(a) Install the antenna as far away from the ECU and sensors of the vehicle electronic systems as possible.

(b) Install an antenna feeder at least 20 cm (7.87 in.) away from the ECU and sensors of the vehicle electronic systems. For details of the ECU and sensors locations, refer to the section on applicable components.

(c) Keep the antenna and feeder separate from other wirings as much as possible. This will prevent signals from the communication equipment from affecting vehicle equipment and vice–versa.

(d) Check that the antenna and feeder are correctly adjusted.

(e) Do not install any high–powered mobile communication system.

010VY–01

VEHICLE LIFT AND SUPPORT LOCATIONS

1. NOTICE ABOUT VEHICLE CONDITION WHEN JACKING UP THE VEHICLE

(a) The vehicle must be unloaded before jacking up the vehicle. Never jack up/lift up a heavily loaded vehicle.

(b) When removing heavy equipment such as the engine and transmission, the center of gravity of the vehicle may shift. To stabilize the vehicle: place a balance weight in a location where it will not roll or shift; or use a mission jack to hold the jacking support.

2. NOTICE FOR USING 4 POST LIFT

(a) Follow the safety procedures outlined in its instruction manual.

(b) Use precautionary measures to prevent the free beam from damaging tires or wheels.

(c) Use wheel chocks to secure the vehicle.

3. NOTICE FOR USING JACK AND SAFETY STAND

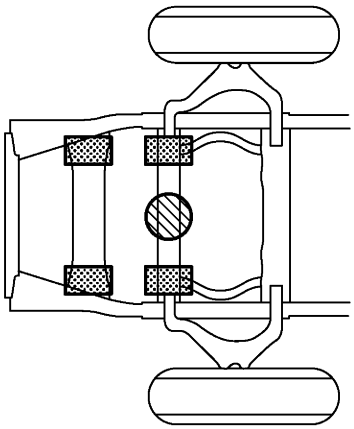
(a) Work in a flat area using wheel chocks at all times.

(b) Support the specified location with a jack and safety stand accurately.

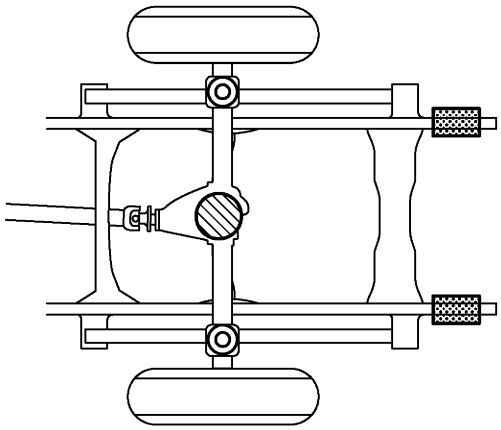
(c) Do not work or leave the vehicle with a support only by a jack. Be sure to support the vehicle together with a safety stand.

(d) Be careful and accurate in jacking up and down the vehicle.

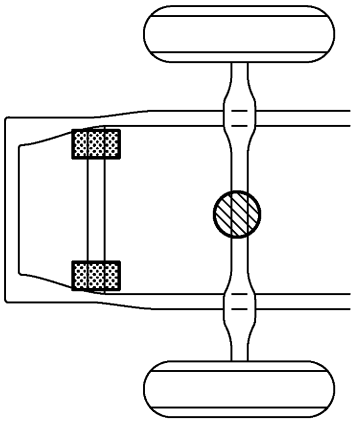
FRONT (IFS)

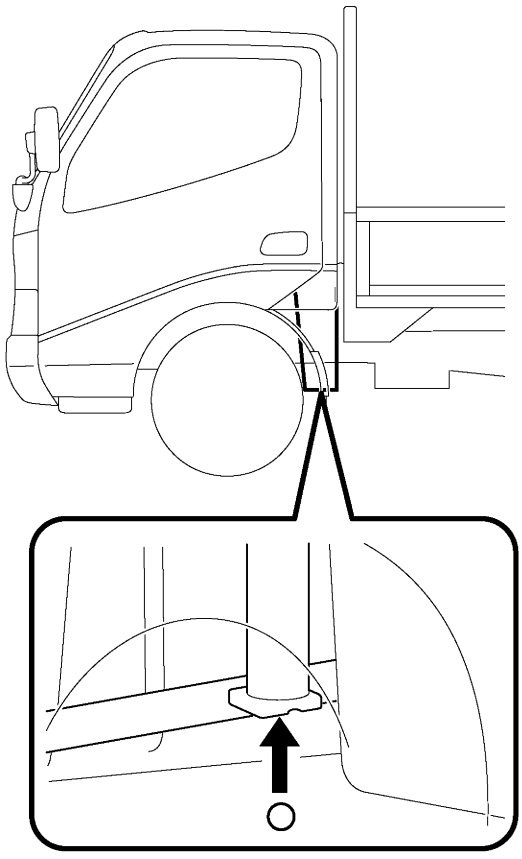


REAR



FRONT (RFS)





: SUPPORT POSITION

: JACK POSITION

SCREW JACK POSITION

○ : Front (Auxiliary member)

◎ : Rear (U–bolt seat)

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HOW TO TROUBLESHOOT ECU CONTROLLED SYSTEMS

010VZ–01

GENERAL INFORMATION

A large number of ECU controlled systems are used in the HINO DUTRO. In general, ECU controlled systems are considered to be very intricate, requiring a high level of technical knowledge to troubleshoot. However, most problem checking procedures only involve inspecting the ECU controlled system's circuits one by one. An adequate understanding of the system and a basic knowledge of electricity is enough to perform effective troubleshooting, accurate diagnoses and necessary repairs. Detailed information and troubleshooting procedures on major ECU controlled systems in this vehicle are outlined below:

System	See Page
1. ECD System (N04C–TF)	05–1
2. ABS & BA System	05–178
3. Easy & Smooth Starting System	05–265

FOR USING HAND–HELD TESTER

- Before using the tester (with 24 V VIM), the tester's operator manual should be read thoroughly.
- If the scan tool or tester cannot communicate with the ECU controlled systems when you have connected the cable of the tester to the DLC3 with the ignition switch and tester turned ON, there is a problem on the vehicle side or tester side.
  (1) If communication is normal when the tester is connected to another vehicle, inspect the diagnosis data link line (Bus⊕line) or ECU power circuit of the vehicle.
  (2) If communication is still impossible when the tester is connected to another vehicle, the problem is probably in the tester itself. Perform the Self Test procedures outlined in the tester operator's manual.

010W0-01

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

Carry out troubleshooting in accordance with the procedures below. Only a basic procedure is shown. Details in the Diagnostic Section show the most effective methods for each circuit. Confirm the troubleshooting procedures for the circuit you are working on before beginning troubleshooting.

1	VEHICLE BROUGHT TO WORKSHOP

2	CUSTOMER PROBLEM ANALYSIS

(a) Ask the customer about the conditions and environment when the problem occurred.

3	SYMPTOM CONFIRMATION AND DTC (AND FREEZE FRAME DATA) CHECK

(a) Check the battery positive voltage.
Standard: 18 to 27 V (Engine stopped)

(b) Visually check the wire harness, connectors and fuses for open and short circuits.

(c) Warm up the engine to the normal operating temperature.

(d) Confirm the problem symptoms and conditions, and check for DTCs according to the related chart.

OK → **Go to step 5**

NG

4	DTC CHART

(a) Check the results obtained in step 3. Then confirm the inspection procedures for the system or part using the DTC chart.

→ **Go to step 6**

5	PROBLEM SYMPTOMS CHART

(a) Check the results obtained in step 3. Confirm the inspection procedures for the system or part using the problem symptoms table.

6	CIRCUIT INSPECTION OR PARTS INSPECTION

(a) Confirm the circuit or part that should be checked using the problem symptoms table or the results obtained in step 4.

7	REPAIR

(a) Repair the affected system or part according to the instructions in step 6.

8	CONFIRMATION TEST

(a) After completing repairs, confirm that the malfunction no longer exists. If the malfunction does not recur, perform a confirmation test under the same conditions and in the same environment as when it occurred the first time.

END

CUSTOMER PROBLEM ANALYSIS

HINT:

- In troubleshooting, the problem symptoms must be confirmed accurately. Preconceptions should be discarded in order to give an accurate judgement. To clearly understand what the problem symptoms are, it is extremely important to ask the customer about the problem and the conditions at the time it occurred.
- As much information as possible should be gathered for reference. Even past problems that seem unrelated may also help in some cases. In the Diagnostic Section, a customer problem analysis table is provided for each system.
- 5 items are important points in the problem analysis:

Important Points with Customer Problem Analysis

- What ——— Vehicle model, system name
- When ——— Date, time, occurrence frequency
- Where ——— Road conditions
- Under what conditions? ——— Running conditions, driving conditions, weather conditions
- How did it happen? ——— Problem symptoms

(Sample) Supplemental Restraint System check sheet.

CUSTOMER PROBLEM ANALYSIS CHECK

SUPPLEMENTAL RESTRAINT SYSTEM Check Sheet

Inspector's Name _____

Customer's Name		**VIN**	
		Production Date	/ /
		License Plate No.	
Date Vehicle Brought In	/ /	**Odometer Reading**	**km miles**

Date Problem First Occurred	/ /
Weather	☐ Fine ☐ Cloudy ☐ Rainy ☐ Snowy ☐ Other
Temperature	**Approx.**

Vehicle Operation	☐ Starting ☐ Idling ☐ Driving [☐ Constant speed ☐ Acceleration ☐ Deceleration ☐ Other]

SYMPTOM CONFIRMATION AND DIAGNOSTIC TROUBLE CODE

HINT:

The diagnostic system in the TOYOTA DYNA has various functions.

- The first function is the Diagnostic Trouble Code (DTC) check. In a DTC check, a previous malfunction's DTC can be checked by a technician during troubleshooting. (A DTC is a code stored in the ECU memory whenever a malfunction in the signal circuits to the ECU occurs.)
- Another function is the Input Signal Check, which checks if the signals from various switches are sent to the ECU correctly.

  By using these functions, the problem areas can be narrowed down and troubleshooting is more effective.

  Diagnostic functions are incorporated in the following systems in the HINO DUTRO:

System	Diagnostic Trouble Code Check	Input Signal Check (Sensor Check)	Diagnotis Test Mode (Active Test)
ECD System (N04C–TF)	○ (with Check Mode)	○	○
ABS & BA System	○		
Easy & Smooth Starting System	○		

- In the DTC check, it is very important to determine whether the problem indicated by the DTC is: 1) still occurring, or 2) occurred in the past but has since returned to normal. In addition, the DTC should be compared to the problem symptom to see if they are related. For this reason, DTCs should be checked before and after confirmation of symptoms (i.e., whether or not problem symptoms exist) to determine current system conditions, as shown in the flowchart below.

  Never skip the DTC check. Failure to check DTCs may, depending on the case, result in unnecessary troubleshooting for systems operating normally or lead to repairs not pertinent to the problem. Follow the procedures listed in the flowchart in the correct order.
- A flowchart showing how to proceed with troubleshooting using the DTC check is shown below. Directions from the flowchart will indicate how to proceed either to DTC troubleshooting or to the troubleshooting of the problem symptoms.

1 DTC CHECK

2 MAKE A NOTE OF DTCS DISPLAYED AND THEN CLEAR THE MEMORY

3 SYMPTOM CONFIRMATION

a	Symptoms exist
b	No symptoms exist

a → Go to step 5

b

4 SIMULATION TEST USING SYMPTOM SIMULATION METHODS

5 DTC CHECK

a	DTC displayed
b	No DTC displayed

a → **TROUBLESHOOTING OF PROBLEM INDICATED BY DTC**

b

6 SYMPTOM CONFIRMATION

a	No symptoms exist
b	Symptoms exist

If a DTC was displayed in the initial DTC check, the problem may have occurred in a wire harness or connector in that circuit in the past. Check the wire harness and connectors (see page 01–27).

a → **SYSTEM NORMAL**

b

TROUBLESHOOTING OF EACH PROBLEM SYMPTOM

The problem is still occurring in a place other than the diagnostic circuit (the DTC displayed first is either for a past problem or a secondary problem).

SYMPTOM SIMULATION

HINT:

The most difficult case in troubleshooting is when no problem symptoms occur. In such cases, a thorough customer problem analysis must be carried out. A simulation of the same or similar conditions and environment in which the problem occurred in the customer's vehicle should be carried out. No matter how much skill or experience a technician has, troubleshooting without confirming the problem symptoms will lead to important repairs being overlooked and mistakes or delays.

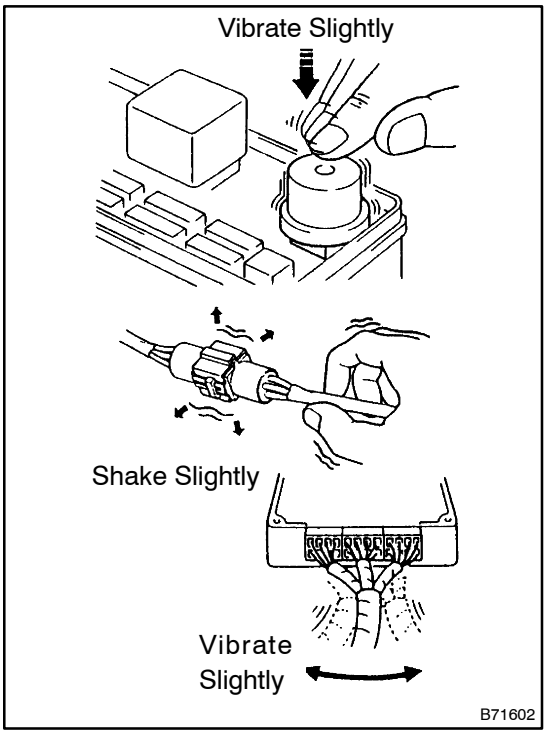
For example:

With a problem that only occurs when the engine is cold or occurs as a result of vibration caused by the road while driving, the problem can never be determined if the symptoms are being checked on a stationary vehicle or a vehicle with a warmed–up engine.

Vibration, heat or water penetration (moisture) is difficult to reproduce. The symptom simulation tests below are effective substitutes for the conditions and can be applied on a stationary vehicle.

Important points in the symptom simulation test:

In the symptom simulation test, the problem symptoms as well as the problem area or parts must be confirmed. First, narrow down the possible problem circuits according to the symptoms. Then, connect the tester and carry out the symptom simulation test, judging whether the circuit being tested is defective or normal. Also, confirm the problem symptoms at the same time. Refer to the problem symptoms table for each system to narrow down the possible causes.



1. VIBRATION METHOD: When vibration seems to be the major cause.

(a) PART AND SENSOR

(1) Apply slight vibration with a finger to the part of the sensor considered to be the cause of the problem and check whether or not the malfunction occurs.

HINT:

Applying strong vibration to relays may open relays.

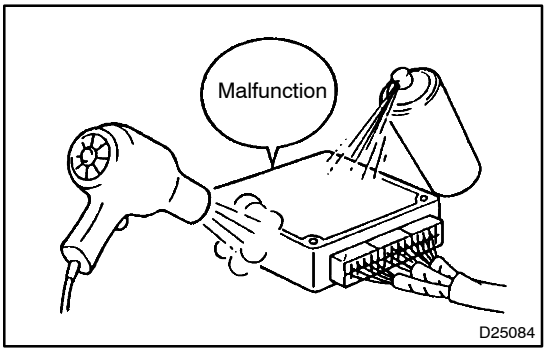
(b) CONNECTORS

(1) Slightly shake the connector vertically and horizontally.

(c) WIRE HARNESS

(1) Slightly shake the wire harness vertically and horizontally.

The connector joint and fulcrum of the vibration are the major areas that should be checked thoroughly.

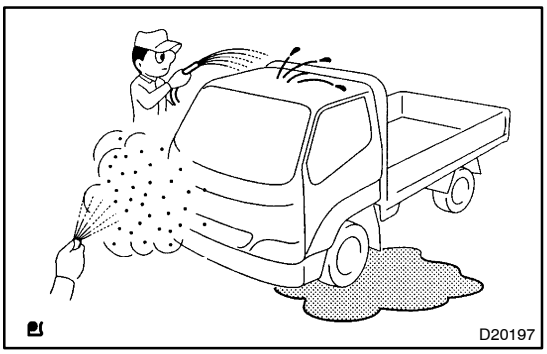


2. HEAT METHOD: If the problem seems to occur when the area in question is heated.

(a) Heat the component that is the possible cause of the malfunction with a hair dryer or similar device. Check if the malfunction occurs.

NOTICE:

- **Do not heat to more than 60°C (140°F). Exceeding this temperature may damage components.**
- **Do not apply heat directly to the parts in the ECU.**



3. WATER SPRINKLING METHOD: When the malfunction seems to occur on a rainy day or in high–humidity.

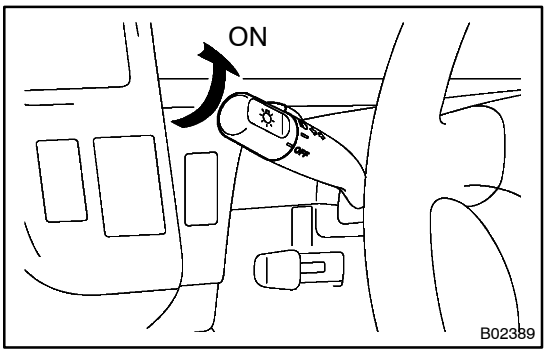
(a) Sprinkle water onto the vehicle and check if the malfunction occurs.

NOTICE:

- **Never sprinkle water directly into the engine compartment. Indirectly change the temperature and humidity by applying water spray onto the front of the radiator.**
- **Never apply water directly onto the electronic components.**

HINT:

If the vehicle has or had a water leakage problem, the leakage may have damaged the ECU or connections. Look for evidence of corrosion or shorts. Proceed with caution during water tests.



4. HIGH ELECTRICAL LOAD METHOD: When a malfunction seems to occur when electrical load is excessive.

(a) Turn on the heater blower, headlights, rear window defogger and all other electrical loads. Check if the malfunction reoccurs.

DIAGNOSTIC TROUBLE CODE CHART

Use Diagnostic Trouble Codes (DTCs) (from the DTC checks) in the table below to determine the trouble area and proper inspection procedure. The Supplemental Restraint System (SRS) DTC chart is shown below as an example.

- DTC No.
  Indicates the DTC.
- Page or Instructions
  Indicates the page where the inspection procedures for each circuit is to be found, or gives instructions for checking and repairs.

- Trouble Area
  Indicates the suspected problem areas.

- Detection Item
  Indicates the system or details of the problem.

DIAGNOSTIC TROUBLE CODE CHART

If a malfunction code is displayed during the DTC check, check the circuit for that code listed in the table below (Proceed to the page given for that circuit).

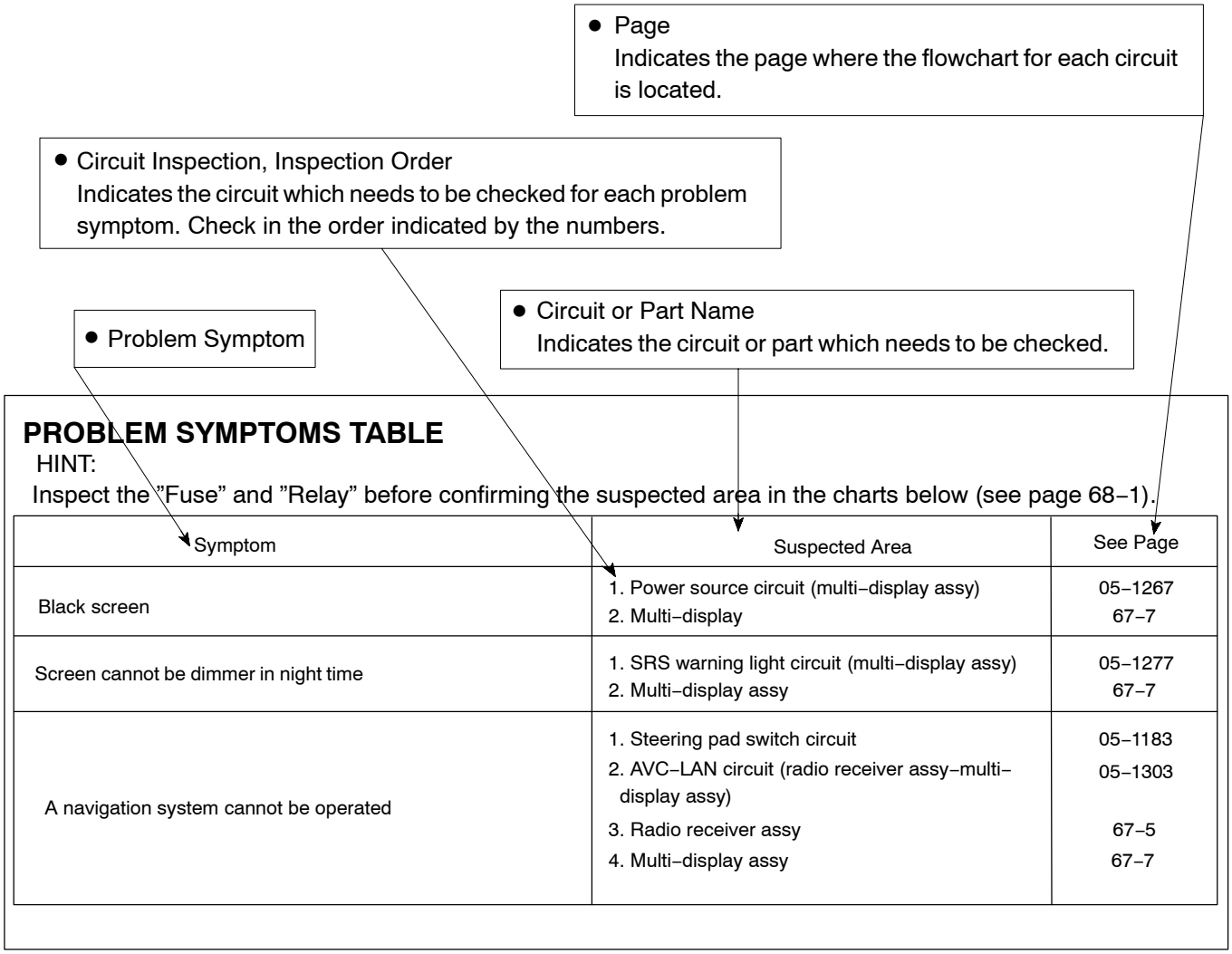
DTC No. (See Page)	Detection Item	Trouble Area	SRS Warning Light
B0100/13 (05–119)	● Short in D squib circuit	● Steering wheel pad (squib) ● Spiral cable ● Airbag sensor assembly ● Wire harness	ON
B0101/14 (05–124)	● Open in D squib circuit	● Steering wheel pad (squib) ● Spiral cable ● Airbag sensor assembly ● Wire harness	ON
B0102/11 (05–128)	● Short in D squib circuit (to ground)	● Steering wheel pad (squib) ● Spiral cable ● Airbag sensor assembly ● Wire harness	ON
B0103/12 (05–132)	● Short in D squib circuit (to B+)	● Steering wheel pad (squib) ● Spiral cable ● Airbag sensor assembly ● Wire harness	ON
B0105/53 (05–136)	● Short in P squib circuit	● Front passenger airbag assembly (squib) ● Airbag sensor assembly ● Wire harness	ON
B0106/54	● Open in P squib circuit	● Front passenger airbag assembly (squib) ● Airbag sensor assembly ● Wire harness	
	b circuit (to Ground)	● Front passenger airbag assembly (squib) ● Airbag sensor assembly ● Wire harness	

PROBLEM SYMPTOMS TABLE

The suspected circuits or parts for each problem symptom are shown in the table below. Use this table to troubleshoot when, during a DTC check, a ”Normal” code is displayed but the problem is still occurring. Numbers in the table show the inspection order in which the circuits or parts should be checked.

HINT:

In some cases, the problem is not detected by the diagnostic system even though a problem symptom is present. It is possible that the problem is occurring outside the detection range of the diagnostic system, or that the problem is occurring in a completely different system.



PROBLEM SYMPTOMS TABLE

HINT:

Inspect the ”Fuse” and ”Relay” before confirming the suspected area in the charts below (see page 68–1).

Symptom	Suspected Area	See Page
Black screen	1. Power source circuit (multi–display assy) 2. Multi–display	05–1267 67–7
Screen cannot be dimmer in night time	1. SRS warning light circuit (multi–display assy) 2. Multi–display assy	05–1277 67–7
A navigation system cannot be operated	1. Steering pad switch circuit 2. AVC–LAN circuit (radio receiver assy–multi–display assy) 3. Radio receiver assy 4. Multi–display assy	05–1183 05–1303 67–5 67–7

CIRCUIT INSPECTION

How to read and use each page is shown below.

● Circuit Description
The major role, operation of the circuit and its component parts are explained.

● DTC No. and Detection Item

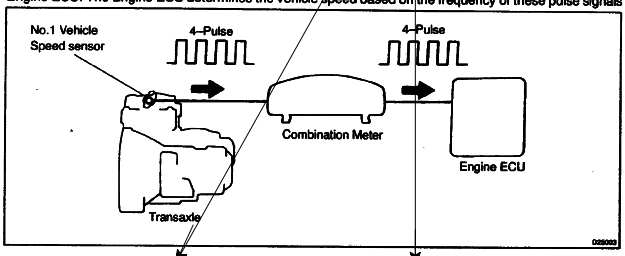
● Indicates the DTCs, DTC settings and suspected problem areas.

● Inspection Procedures
Use the inspection procedures to determine if the circuit is normal or abnormal. If it is abnormal, use it to determine whether the problem is located in the sensors, actuators, wire harness or ECU.

DTC P0500/42 VEHICLE SPEED SENSOR MALFUNCTION

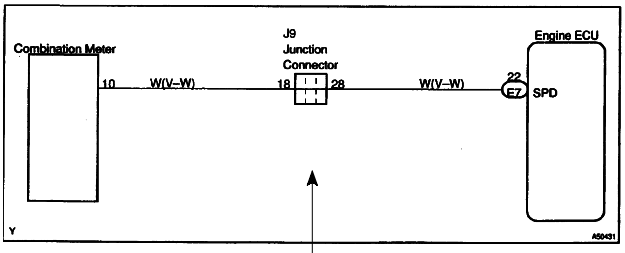
CIRCUIT DESCRIPTION

The vehicle speed sensor outputs a 4–pulse signal for every revolution of the rotor shaft, which is rotated by the transmission output shaft via the driven gear. After this signal is converted into a more precise rectangular waveform by the waveform shaping circuit inside the combination meter, it is then transmitted to the Engine ECU. The Engine ECU determines the vehicle speed based on the frequency of these pulse signals



DTC No.	DTC Detecting Condition	Trouble Area
P0500/42	During vehicle is being driven, no vehicle speed sensor signal to engine ECU (2 trip detection logic)	• Combination meter • Open or short in No.1 vehicle speed sensor circuit • No.1 vehicle speed sensor • Engine ECU

WIRING DIAGRAM



● Wiring Diagram
This shows a wiring diagram of the circuit.
Use this diagram together with ELECTRICAL WIRING DIAGRAM to thoroughly understand the circuit.
Wire colors are indicated by an alphabetical code.
B = Black, L = Blue, R = Red, BR = Brown,
LG = Light Green, V = Violet, G = Green,
O = Orange, W = White, GR = Gray, P = Pink,
Y = Yellow, SB = Sky Blue
The first letter indicates the basic wire color and the second letter indicates the color of the stripe.

INSPECTION PROCEDURE

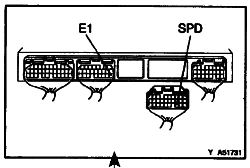
1 READ VALUE OF VEHICLE SPEED VALUE(SPEEDOMETER OPERATION)

(a) Select data monitor on the hand–held tester.
(b) Perform a test drive of the vehicle.
(c) Read the vehicle speed on the hand–held tester.
RESULT: The same as the speed displayed on the speed meter.

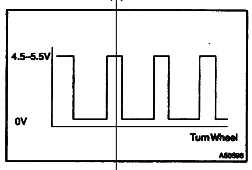
NG → **REPLACE COMBINATION METER ASSY**

OK

2 INSPECT ECU



(a) Check the output waveform.
HINT:
Using the oscilloscope function of hand–held tester, it is possible to check the function between the engine ECU and the knock control sensor. The waveform shown in the illustration is an example without noise and chattering.
(1) Connect the hand–held tester between the terminals SPD of the engine ECU E7 connector and E1 of the engine ECU E8 connector.
(2) Select the oscilloscope function on the hand–held tester. (Refer to the hand–held tester's instruction book for operating instructions.)



RESULT: Voltage is intermittently generated

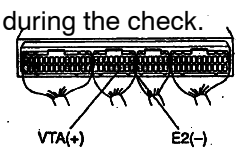
ITEM	CONTENTS
TERMINAL	SPD⇔E1
EQUIPMENT SET	5V/DIV, 20ms/DIV
CONDITION	Running at 20 km/h

HINT:
• The multitude gets shorter as the engine speed becomes faster.

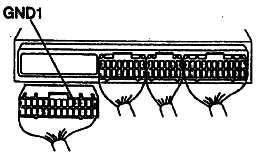
OK → **CHECK AND REPLACE ECU**

NG

● Indicates the condition of the connector of the ECU during the check.



Connector being checked is connected.
Connections of tester are indicated by (+), (–) after terminals name.



Connector being checked is disconnected.
For inspection of connector with body ground, there is nothing about the body ground written down.

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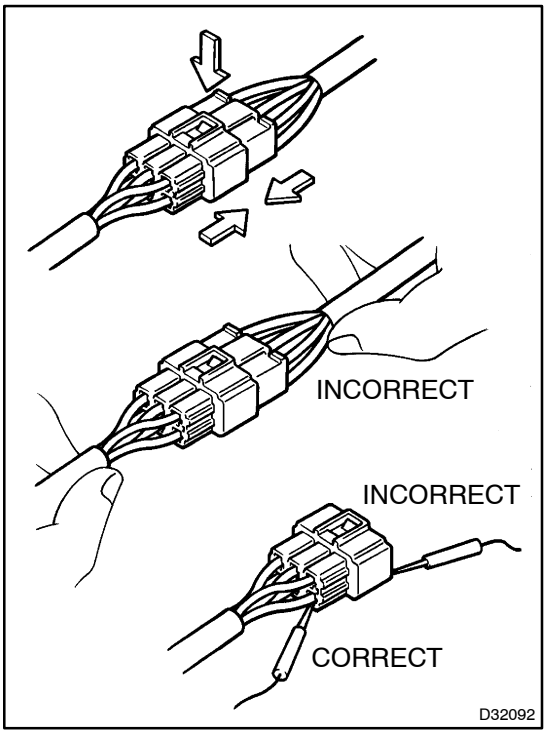
ELECTRONIC CIRCUIT INSPECTION PROCEDURE

1. BASIC INSPECTION

(a) RESISTANCE MEASURING CONDITION OF ELECTRONIC PARTS

(1) Unless stated, all resistance measurements should be made at an ambient temperature of 20°C (68°F). Resistance measurements may be outside the specifications if measured at high temperatures, i.e. immediately after the vehicle has been running. Measurements should be made after the engine has cooled down.



(b) HANDLING CONNECTORS

(1) When disconnecting a connector, first squeeze the mating halves tightly together to release the lock, then press the lock claw and separate the connector.

(2) When disconnecting a connector, do not pull on the harnesses. Grasp the connector directly and separate it.

(3) Before connecting the connector, check that there are no deformed, damaged, loose or missing terminals.

(4) When connecting a connector, press firmly until you hear the lock close with a ”click” sound.

(5) If checking the connector with a TOYOTA electrical tester, check it from the backside (harness side) of the connector using a mini test lead.

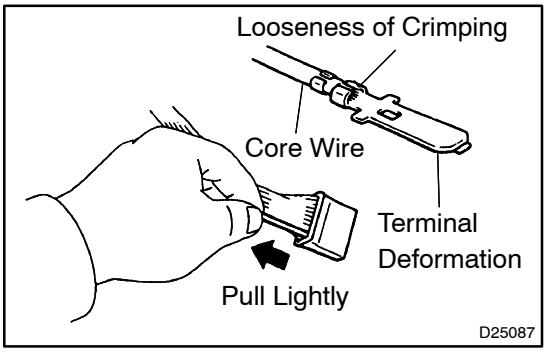
NOTICE:

- **As a waterproof connector cannot be checked from the backside, check by connecting a sub–harness.**
- **Do not damage the terminals by moving the inserted tester needle.**

(c) CHECKING CONNECTORS

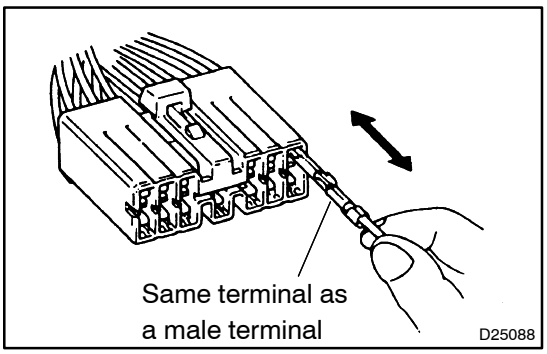
(1) Checking when the connector is connected:
Squeeze the connector together to confirm that it is fully inserted and locked.

(2) Checking when the connector is disconnected:
Check by pulling the wire harness lightly from the backside of the connector. Look for unlatched terminals, missing terminals, loose crimps or broken conductor wires.
Check visually for corrosion, metallic or foreign objects and water; and bent, rusted, overheated, contaminated, and deformed terminals.

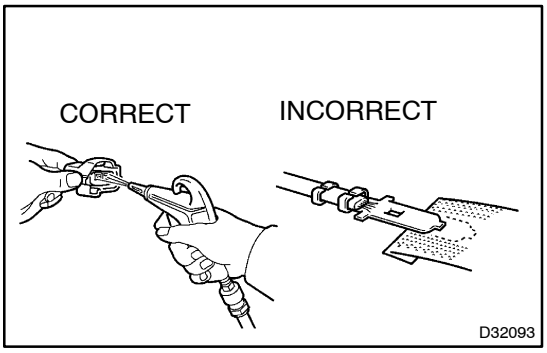


NOTICE:

When testing a gold–plated female terminal, always use a gold–plated male terminal.



(3) Checking the contact pressure of the terminal:
Prepare a spare male terminal. Insert it into a female terminal, and check for good tension when inserting and after full engagement.

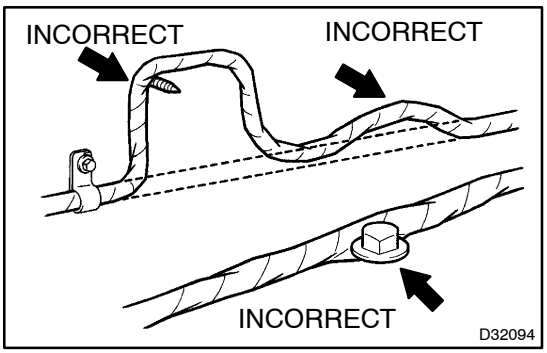


(d) REPAIR METHOD OF CONNECTOR TERMINAL

(1) If there is any dirt on the terminal, clean the contact point using an air gun or shop rag. Never polish the contact point using sandpaper as the platings may come off.

(2) If there is abnormal contact pressure, replace the female terminal. If the male terminal is gold–plated (gold color), use a gold–plated female terminal; if it is silver–plated (silver color), use a silver–plated female terminal.

(3) Damaged, deformed, or corroded terminals should be replaced. If the terminal will not lock into the housing, the housing may have to be replaced.



(e) HANDLING OF WIRE HARNESS

(1) If removing a wire harness, check the wiring and clamping before proceeding so that it can be restored in the same way.

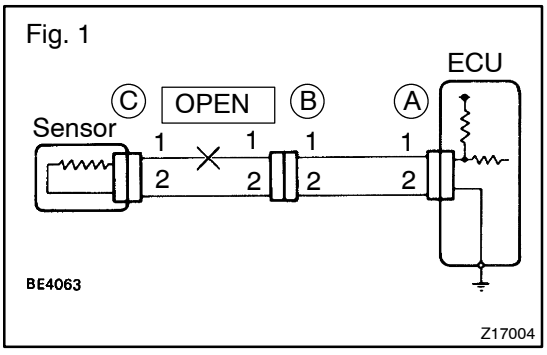
(2) Never twist, pull or slacken the wire harness more than necessary.

(3) Never make the wire harness come into contact with a high temperature part, or rotating, moving, vibrating or sharp–edged parts. Avoid panel edges, screw tips and similar sharp items.

(4) When installing parts, never pinch the wire harness.

(5) Never cut or break the cover of the wire harness. If it is cut or broken, replace it or securely repair it with vinyl tape.

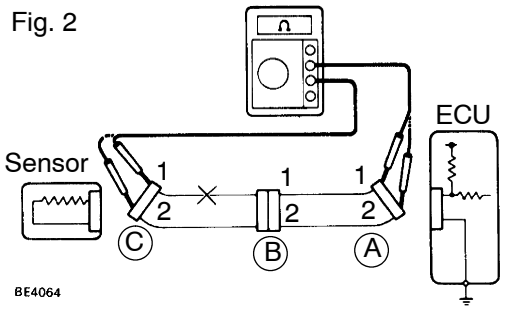
Fig. 1



2. CHECK OPEN CIRCUIT

(a) For an open circuit in the wire harness in Fig. 1, perform a resistance check (step b) or a voltage check (step c).

Fig. 2



(b) Check the resistance.

(1) Disconnect connectors A and C, and measure the resistance between them.

HINT:

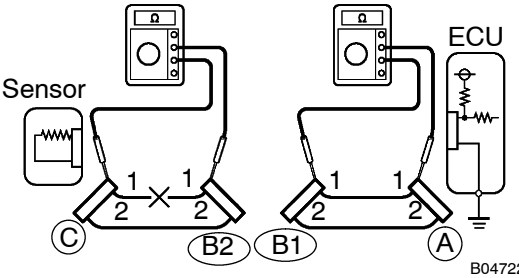
Measure the resistance while lightly shaking the wire harness vertically and horizontally.

Fig. 2:

Tester Connection	Specified Condition
Connector A terminal 1 – Connector C terminal 1	10 kΩ or higher
Connector A terminal 2 – Connector C terminal 2	Below 1 Ω

If your results match the examples above, an open circuit exists between terminal 1 of connector A and terminal 1 of connector C.

Fig. 3



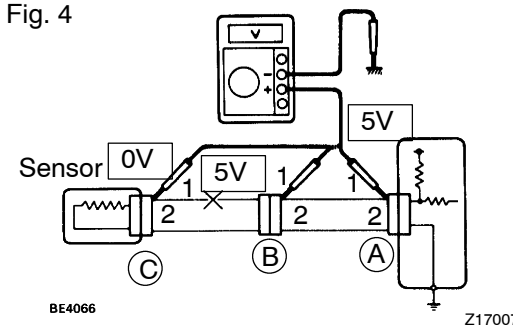
(2) Disconnect connector B and measure the resistance between the connectors.

Fig. 3:

Tester Connection	Specified Condition
Connector A terminal 1 – Connector B1 terminal 1	Below 1 Ω
Connector B2 terminal 1 – Connector C terminal 1	10 kΩ or higher

If your results match the examples above, an open circuit exists between terminal 1 of connector B2 and terminal 1 of connector C.

Fig. 4



(c) Check the voltage.

(1) In a circuit in which voltage is applied to the ECU connector terminal, an open circuit can be checked by conducting a voltage check.

Fig. 4:

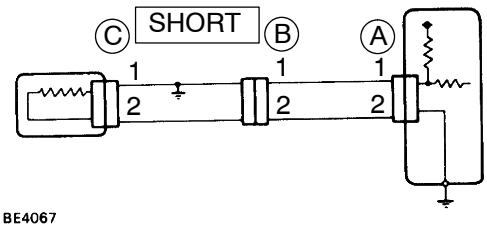
With each connector still connected, measure the voltage between the body ground and these terminals (in this order): 1) terminal 1 of connector A at the ECU 5 V output terminal, 2) terminal 1 of connector B, and 3) terminal 1 of connector C.

(2) Example results:

Tester Connection	Specified Condition
Connector A terminal 1 – Body ground	5 V
Connector B terminal 1 – Body ground	5 V
Connector C terminal 1 – Body ground	0 V

If your results match the examples above, an open circuit exists in the wire harness between terminal 1 of B and terminal 1 of C.

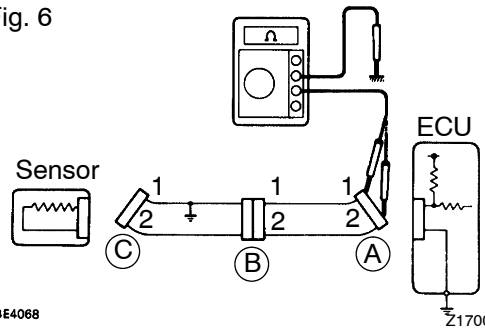
Fig. 5



3. CHECK SHORT CIRCUIT

(a) If the wire harness is ground shorted (Fig. 5), locate the section by conducting a resistance check with the body ground (below).

Fig. 6



(b) Check the resistance with the body ground.

(1) Disconnect connectors A and C, and measure the resistance between terminals 1 and 2 of connector A and the body ground.

HINT:

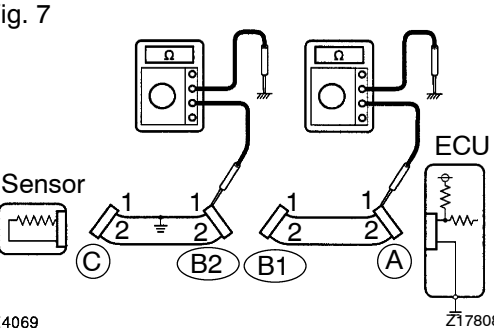
Measure the resistance while lightly shaking the wire harness vertically and horizontally.

Fig. 6:

Tester Connection	Specified Condition
Connector A terminal 1 – Body ground	Below 1 Ω
Connector A terminal 2 – Connector C terminal 2	10 kΩ or higher

If your results match the examples above, a short circuit exists between terminal 1 of connector A and terminal 1 of connector C.

Fig. 7



(2) Disconnect connector B and measure the resistance between terminal 1 of connector A and the body ground, and terminal 1 of connector B2 and the body ground.

Fig. 7:

Tester Connection	Specified Condition
Connector A terminal 1 – Body ground	10 kΩ or higher
Connector B2 terminal 1 – Body ground	Below 1 Ω

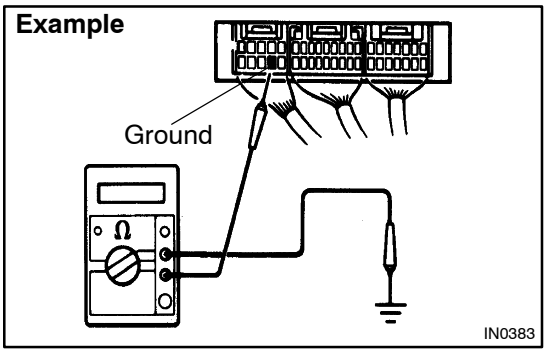
If your results match the examples above, a short circuit exists between terminal 1 of connector B2 and terminal 1 of connector C.

4. CHECK AND REPLACE ECU

NOTICE:

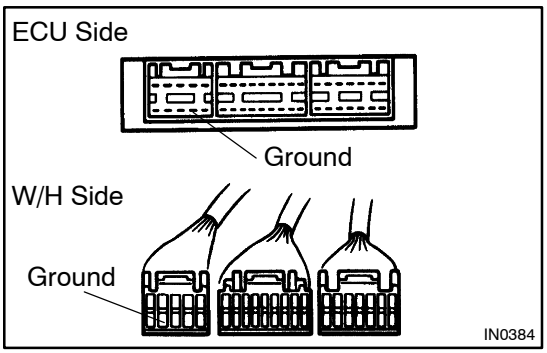
- **The connector should not be disconnected from the ECU. Perform the inspection from the backside of the connector on the wire harness side.**
- **When no measuring condition is specified, perform the inspection with the engine stopped and the ignition switch ON.**
- **Check that the connectors are fully seated. Check for loose, corroded or broken wires.**

(a) First check the ECU ground circuit. If it is faulty, repair it. If it is normal, the ECU could be faulty. Replace the ECU with a normal functioning one and check if the symptoms occur. If the trouble symptoms stop, replace the ECU.



(1) Measure the resistance between the ECU ground terminal and body ground.

Resistance: Below 1 Ω



(2) Disconnect the ECU connector. Check the ground terminals (on the ECU side and wire harness side) for evidence of bending, corrosion or foreign material. Lastly check the contact pressure of the female terminals.

TERMS

010W2-01

ABBREVIATIONS USED IN THIS MANUAL

Abbreviations	Meaning
ABS	Anti–Lock Brake System
A/C	Air Conditioner
AC	Alternating Current
ACC	Accessory
ACIS	Acoustic Control Induction System
ACM	Active Control Engine Mount
ACSD	Automatic Cold Start Device
A.D.D.	Automatic Disconnecting Differential
A/F	Air–Fuel Ratio
AFS	Adaptive Front–Lighting System
AHC	Active Height Control Suspension
ALR	Automatic Locking Retractor
ALT	Alternator
AMP	Amplifier
ANT	Antenna
APPROX.	Approximately
ASSY	Assembly
A/T, ATM	Automatic Transmission (Transaxle)
ATF	Automatic Transmission Fluid
AUTO	Automatic
AUX	Auxiliary
AVG	Average
AVS	Adaptive Variable Suspension
B+	Battery Voltage
BA	Brake Assist
BACS	Boost Altitude Compensation System
BAT	Battery
BDC	Bottom Dead Center
B/L	Bi–Level
B/S	Bore–Stroke Ratio
BTDC	Before Top Dead Center
BVSV	Bimetallic Vacuum Switching Valve
CAN	Controller Area Network
Calif.	California
CB	Circuit Breaker
CCo	Catalytic Converter For Oxidation
CD	Compact Disc
CF	Cornering Force
CG	Center Of Gravity
CH	Channel
CKD	Complete Knock Down
COMB.	Combination
CPE	Coupe
CPS	Combustion Pressure Sensor
CPU	Central Processing Unit
CRS	Child Restraint System
CTR	Center
C/V	Check Valve

Abbreviations	Meaning
CV	Control Valve
CW	Curb Weight
DC	Direct Current
DEF	Defogger
DFL	Deflector
DIFF.	Differential
DIFF. LOCK	Differential Lock
D/INJ	Direct Injection
DLC	Data Link Connector
DLI	Distributorless Ignition
DOHC	Double Overhead Camshaft
DP	Dash Pot
DS	Dead Soak
DSP	Digital Signal Processor
DTC	Diagnostic Trouble Code
DVD	Digital Versatile Disc
EBD	Electric Brake Force Distribution
EC	Electrochoromic
ECAM	Engine Control And Measurement System
ECD	Electronically Controlled Diesel
ECDY	Eddy Current Dynamometer
ECT	Electronic Control Transmission
ECU	Electronic Control Unit
ED	Electro–Deposited Coating
EDU	Electronic Driving Unit
EDIC	Electric Diesel Injection Control
EFI	Electronic Fuel Injection
E/G	Engine
EGR	Exhaust Gas Recirculation
EGR–VM	EGR–Vacuum Modulator
ELR	Emergency Locking Retractor
EMPS	Electric Motor Power Steering
ENG	Engine
ES	Easy & Smooth
ESA	Electronic Spark Advance
ETCS–i	Electronic Throttle Control System–intelligent
EVAP	Evaporative Emission Control
EVP	Evaporator
E–VRV	Electric Vacuum Regulating Valve
EX	Exhaust
FE	Fuel Economy
FF	Front–Engine Front–Wheel–Drive
F/G	Fuel Gauge
FIPG	Formed In Place Gasket
FL	Fusible Link
F/P	Fuel Pump
FPU	Fuel Pressure Up
Fr	Front
F/W	Flywheel
FW/D	Flywheel Damper
FWD	Front–Wheel–Drive

Abbreviations	Meaning
GAS	Gasoline
GND	Ground
GSA	Gear Shift Actuator
GPS	Global Positioning System
HAC	High Altitude Compensator
H/B	Hatchback
H–FUSE	High Current Fuse
HI	High
HID	High Intensity Discharge (Head Lamp)
HPU	Hydraulic Power Unit
HSG	Housing
HT	Hard Top
HV	Hybrid Vehicle
HWS	Heated Windshield System
IC	Integrated Circuit
IDI	Indirect Diesel Injection
IFS	Independent Front Suspension
IG	Ignition
IIA	Integrated Ignition Assembly
IN	Intake (Manifold, Valve)
INT	Intermittent
I/P	Instrument Panel
IRS	Independent Rear Suspension
ISC	Idle Speed Control
J/B	Junction Block
J/C	Junction Connector
KD	Kick–Down
LAN	Local Area Network
LB	Liftback
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LH	Left–Hand
LHD	Left–Hand Drive
L/H/W	Length, Height, Width
LLC	Long–Life Coolant
LNG	Liquified Natural Gas
LO	Low
LPG	Liquified Petroleum Gas
LSD	Limited Slip Differential
LSP & PV	Load Sensing Proportioning And Bypass Valve
LSPV	Load Sensing Proportioning Valve
MAP	Manifold Absolute Pressure
MAX.	Maximum
MIC	Microphone
MIL	Malfunction Indicator Lamp
MIN.	Minimum
MG1	Motor Generator No.1
MG2	Motor Generator No.2
MMT	Multi–mode Manual Transmission
MP	Multipurpose
MPI	Multipoint Electronic Injection

Abbreviations	Meaning
MPX	Multiplex Communication System
M/T, MTM	Manual Transmission (Transaxle)
MT	Mount
MTG	Mounting
N	Neutral
NA	Natural Aspiration
No.	Number
O2S	Oxygen Sensor
OC	Oxidation Catalyst
OCV	Oil Control Valve
O/D	Overdrive
OEM	Original Equipment Manufacturing
OHC	Overhead Camshaft
OHV	Overhead Valve
OPT	Option
ORVR	On–board Refilling Vapor Recovery
O/S	Oversize
PBD	Power Back Door
P & BV	Proportioning And Bypass Valve
PCS	Power Control System
PCV	Positive Crankcase Ventilation
PKB	Parking Brake
PPS	Progressive Power Steering
PROM	Programmable Read Only Memory
PS	Power Steering
PSD	Power Slide Door
PTC	Positive Temperature Coefficient
PTO	Power Take–Off
P/W	Power Window
PZEV	Partial Zero Emission Vehicle
R & P	Rack And Pinion
RAM	Random Access Memory
R/B	Relay Block
RBS	Recirculating Ball Type Steering
R/F	Reinforcement
RFS	Rigid Front Suspension
RH	Right–Hand
RHD	Right–Hand Drive
RLY	Relay
ROM	Read Only Memory
Rr	Rear
RRS	Rigid Rear Suspension
RSE	Rear Seat Entertainment
RWD	Rear–Wheel Drive
SC	Supercharger
SCV	Swirl Control Valve
SDN	Sedan
SEN	Sensor
SICS	Starting Injection Control System
SOC	State Of Charge
SOHC	Single Overhead Camshaft

Abbreviations	Meaning
SPEC	Specification
SPI	Single Point Injection
SRS	Supplemental Restraint System
SSM	Special Service Materials
SST	Special Service Tools
STD	Standard
STJ	Cold–Start Fuel Injection
SW	Switch
SYS	System
T/A	Transaxle
TACH	Tachometer
TBI	Throttle Body Electronic Fuel Injection
TC	Turbocharger
TCCS	Computer–Controlled System
TCV	Timing Control Valve
TDC	Top Dead Center
TEMP.	Temperature
TEMS	Electronically Modulated Suspension
TFT	Toyota Free–Tronic
TIS	Total Information System For Vehicle Development
T/M	Transmission
TRAC	Traction Control System
TURBO	Turbocharge
TWC	Three–Way Catalyst
U/D	Underdrive
U/S	Undersize
VCV	Vacuum Control Valve
VENT	Ventilator
VGRS	Variable Gear Ratio Steering
VIM	Vehicle Interface Module
VIN	Vehicle Identification Number
VPS	Variable Power Steering
VSC	Vehicle Stability Control
VSV	Vacuum Switching Valve
VTV	Vacuum Transmitting Valve
VVT–i	Variable Valve Timing–intelligent
w/	With
WGN	Wagon
W/H	Wire Harness
w/o	Without
WU–TWC	Warm Up Three–way Catalytic Converter
WU–OC	Warm Up Oxidation Catalytic Converter
1st	First
2nd	Second
2WD	Two Wheel Drive Vehicle (4 x 2)
3rd	Third
4th	Fourth
4WD	Four Wheel Drive Vehicle (4 x 4)
4WS	Four Wheel Steering System
5th	Fifth

010W3–01

GLOSSARY OF SAE AND HINO TERMS

This glossary lists all SAE–J1930 terms and abbreviations used in this manual in compliance with SAE recommendations, as well as their HINO equivalents.

SAE ABBREVIATIONS	SAE TERMS	HINO TERMS ( )—ABBREVIATIONS
A/C	Air Conditioning	Air Conditioner
ACL	Air Cleaner	Air Cleaner (A/CL)
AIR	Secondary Air Injection	Air Injection (AI)
AP	Accelerator Pedal	–
B+	Battery Positive Voltage	Battery Voltage (+B)
BARO	Barometric Pressure	High Altitude Compensator (HAC)
CAC	Charge Air Cooler	Intercooler
CARB	Carburetor	Carburetor
CFI	Continuous Fuel Injection	–
CKP	Crankshaft Position	Crank Angle
CL	Closed Loop	Closed Loop
CMP	Camshaft Position	Cam Angle
CPP	Clutch Pedal Position	–
CTOX	Continuous Trap Oxidizer	–
CTP	Closed Throttle Position	LL ON, Idle ON
DFI	Direct Fuel Injection (Diesel)	Direct Injection (D/INJ)
DI	Distributor Ignition	–
DLC1 DLC2 DLC3	Data Link Connector 1 Data Link Connector 2 Data Link Connector 3	1: Check Connector 2: Total Diagnosis Communication Link (TDCL) 3: OBD II Diagnostic Connector
DTC	Diagnostic Trouble Code	Diagnostic Trouble Code
DTM	Diagnostic Test Mode	–
ECL	Engine Control Level	–
ECM	Engine Control Module	Engine ECU (Electronic Control Unit)
ECT	Engine Coolant Temperature	Coolant Temperature, Water Temperature (THW)
EEPROM	Electrically Erasable Programmable Read Only Memory	Electrically Erasable Programmable Read Only Memory (EEPROM), Erasable Programmable Read Only Memory (EPROM)
EFE	Early Fuel Evaporation	Cold Mixture Heater (CMH), Heat Control Valve (HCV)
EGR	Exhaust Gas Recirculation	Exhaust Gas Recirculation (EGR)
EI	Electronic Ignition	Distributorless Ignition (DLI)
EM	Engine Modification	Engine Modification (EM)
EPROM	Erasable Programmable Read Only Memory	Programmable Read Only Memory (PROM)
EVAP	Evaporative Emission	Evaporative Emission Control (EVAP)
FC	Fan Control	–
FEEPROM	Flash Electrically Erasable Programmable Read Only Memory	–
FEPROM	Flash Erasable Programmable Read Only Memory	–
FF	Flexible Fuel	–
FP	Fuel Pump	Fuel Pump
GEN	Generator	Alternator
GND	Ground	Ground (GND)

HO2S	Heated Oxygen Sensor	Heated Oxygen Sensor (HO_2S)
IAC	Idle Air Control	Idle Speed Control (ISC)
IAT	Intake Air Temperature	Intake or Inlet Air Temperature
ICM	Ignition Control Module	–
IFI	Indirect Fuel Injection	Indirect Injection (IDL)
IFS	Inertia Fuel–Shutoff	–
ISC	Idle Speed Control	–
KS	Knock Sensor	Knock Sensor
MAF	Mass Air Flow	Air Flow Meter
MAP	Manifold Absolute Pressure	Manifold Pressure Intake Vacuum
MC	Mixture Control	Electric Bleed Air Control Valve (EBCV) Mixture Control Valve (MCV) Electric Air Control Valve (EACV)
MDP	Manifold Differential Pressure	–
MFI	Multiport Fuel Injection	Electronic Fuel Injection (EFI)
MIL	Malfunction Indicator Lamp	Check Engine Lamp
MST	Manifold Surface Temperature	–
MVZ	Manifold Vacuum Zone	–
NVRAM	Non–Volatile Random Access Memory	–
O2S	Oxygen Sensor	Oxygen Sensor, O_2 Sensor (O_2S)
OBD	On–Board Diagnostic	On–Board Diagnostic System (OBD)
OC	Oxidation Catalytic Converter	Oxidation Catalyst Convert (OC), CCo
OP	Open Loop	Open Loop
PAIR	Pulsed Secondary Air Injection	Air Suction (AS)
PCM	Powertrain Control Module	–
PNP	Park/Neutral Position	–
PROM	Programmable Read Only Memory	–
PSP	Power Steering Pressure	–
PTOX	Periodic Trap Oxidizer	Diesel Particulate Filter (DPF) Diesel Particulate Trap (DPT)
RAM	Random Access Memory	Random Access Memory (RAM)
RM	Relay Module	–
ROM	Read Only Memory	Read Only Memory (ROM)
RPM	Engine Speed	Engine Speed
SC	Supercharger	Supercharger
SCB	Supercharger Bypass	Electronic Air Bypass Valve (E–ABV)
SFI	Sequential Multiport Fuel Injection	Electronic Fuel Injection (EFI), Sequential Injection
SPL	Smoke Puff Limiter	–
SRI	Service Reminder Indicator	–
SRT	System Readiness Test	–
ST	Scan Tool	–
TB	Throttle Body	Throttle Body
TBI	Throttle Body Fuel Injection	Single Point Injection Central Fuel Injection (Ci)
TC	Turbocharger	Turbocharger
TCC	Torque Converter Clutch	Torque Converter

TCM	Transmission Control Module	Transmission ECU, ECT ECU
TP	Throttle Position	Throttle Position
TR	Transmission Range	–
TVV	Thermal Vacuum Valve	Bimetallic Vacuum Switching Valve (BVSV) Thermostatic Vacuum Switching Valve (TVSV)
TWC	Three–Way Catalytic Converter	Three–Way Catalytic (TWC) Manifold Converter CC_{RO}
TWC+OC	Three–Way + Oxidation Catalytic Converter	CC_R + CCo
VAF	Volume Air Flow	Air Flow Meter
VR	Voltage Regulator	Voltage Regulator
VSS	Vehicle Speed Sensor	Vehicle Speed Sensor
WOT	Wide Open Throttle	Full Throttle
WU–OC	Warm Up Oxidation Catalytic Converter	–
WU–TWC	Warm Up Three–Way Catalytic Converter	–
3GR	Third Gear	–
4GR	Fourth Gear	–

PREPARATION

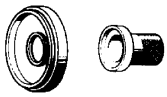
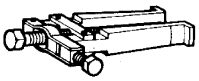
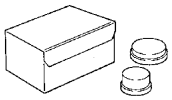
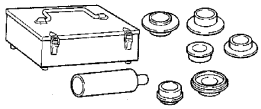
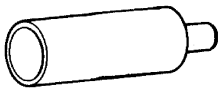
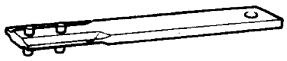
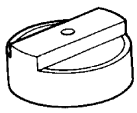
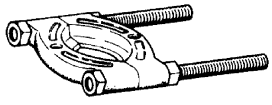
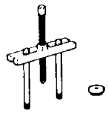
REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A and S1–YXZE10A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

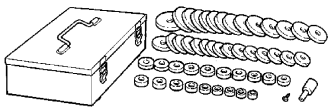
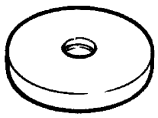
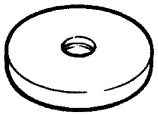
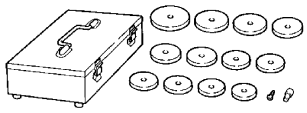
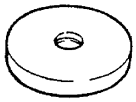
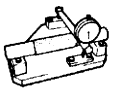
DIFFERENTIAL

PREPARATION

023VR–01

SST

	09223–15020	Oil Seal & Bearing Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09223–78010	Crankshaft Oil Seal Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09308–10010	Oil Seal Puller	REAR DIFFERENTIAL CARRIER OIL SEAL(SH12) DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09315–00022	Clutch Release Bearing Remover & Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09316–60011	Transmission & Transfer Bearing Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09316–00011)	Replacer Pipe	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09316–00071)	Replacer ”F”	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09504–00011	Differential Side Bearing Adjusting Nut Wrench	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09518–36020	Rear Axle Hub Oil Seal Replacer	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–00020	Bearing Remover	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–00030	Bearing Remover Attachment	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–40011	Puller B Set	DIFFERENTIAL CARRIER ASSY REAR(SH12)

	(09957–04010)	Attachment	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–60010	Replacer Set	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09951–00640)	Replacer 64	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09951–00650)	Replacer 65	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09950–60020	Replacer Set No.2	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	(09951–00680)	Replacer 68	DIFFERENTIAL CARRIER ASSY REAR(SH12)
	09640–1370	Pinion Depth Gauge	DIFFERENTIAL CARRIER ASSY REAR(SH12)

Equipment

Brass bar	
Chisel	
Dial gauge	
Hammer	
Press	
Snap ring expander	
Torque wrench	
Vernier caliper	
Vise	

SERVICE SPECIFICATIONS

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A and S1–YXZE10A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

DIFFERENTIAL

0325B–01

SERVICE DATA

Differential oil	Oil type		Hypoid oil API GL–5
	Recommended oil viscosity Capacity		SAE 90
	Capacity		5.2 liters (5.5 US qts, 4.8 Imp.qts)
Differential carrier assy rear	Ring gear runout	Maximum	0.10 mm (0.0039 in.)
	Ring gear backlash	Gear Ratio 5.375	0.18 to 0.23 mm (0.0072 to 0.0092 in.)
		5.833	0.25 to 0.33 mm (0.0098 to 0.0130 in.)
		4.875, 5.125, 5.571, 6.167, 6.500	0.20 to 0.28 mm (0.0079 to 0.0110 in.)
	Side gear backlash	Standard	0.2 to 0.6 mm (0.0079 to 0.0236 in.)
		Maximum	0.9 mm (0.0035 in.)
	Drive pinion preload (Reused bearing)		0.98 to 1.47 N•m (10 to 15 kgf•cm, 9 to 13 in.•lbf)
	Drive pinion preload (New bearing)		1.47 to 1.96 N•m (15 to 20 kgf•cm, 13 to 17 in.•lbf)
	Side bearing preload (Reused bearing)	Gear Ratio 4.875	0.21 to 0.30 N•m (2.1 to 3.0 kgf•cm, 1.8 to 2.6 in.•lbf)
		5.125	0.20 to 0.28 N•m (2.0 to 2.9 kgf•cm, 1.7 to 2.5 in.•lbf)
		5.375	0.19 to 0.27 N•m (1.9 to 2.7 kgf•cm, 1.7 to 2.4 in.•lbf)
		5.571	0.18 to 0.26 N•m (1.8 to 2.6 kgf•cm, 1.6 to 2.3 in.•lbf)
		5.833	0.17 to 0.25 N•m (1.8 to 2.5 kgf•cm, 1.5 to 2.2 in.•lbf)
		6.167	0.16 to 0.23 N•m (1.7 to 2.4 kgf•cm, 1.5 to 2.1 in.•lbf)
		6.500	0.16 to 0.22 N•m (1.6 to 2.3 kgf•cm, 1.4 to 2.0 in.•lbf)
	Side bearing preload (New bearing)	Gear Ratio 4.875	0.31 to 0.40 N•m (3.1 to 4.1 kgf•cm, 2.7 to 3.5 in.•lbf)
		5.125	0.29 to 0.38 N•m (3.0 to 3.9 kgf•cm, 2.6 to 3.3 in.•lbf)
		5.375	0.28 to 0.36 N•m (2.8 to 3.7 kgf•cm, 2.5 to 3.2 in.•lbf)
		5.571	0.27 to 0.35 N•m (2.7 to 3.5 kgf•cm, 2.4 to 3.1 in.•lbf)
		5.833	0.26 to 0.33 N•m (2.6 to 3.4 kgf•cm, 2.3 to 2.9 in.•lbf)
		6.167	0.24 to 0.31 N•m (2.5 to 3.2 kgf•cm, 2.2 to 2.8 in.•lbf)
		6.500	0.23 to 0.30 N•m (2.4 to 3.0 kgf•cm, 2.1 to 2.6 in.•lbf)
	Conical distance		27.0 mm (1.063 in.)
	Inner diameter of the pinion – Outer diameter of the spider	Standard	0.140 to 0.261 mm (0.0055 to 0.0103 in.)
		Maximum	0.4 mm (0.016 in.)
	Side gear thrust washer thickness	Standard	1.9 to 2.1 mm (0.075 to 0.083 in.)
		Minimum	1.7 mm (0.070 in.)
	Pinion gear thrust washer thickness	Standard	1.5 to 1.7 mm (0.059 to 0.070 in.)
		Minimum	1.3 mm (0.051 in.)
Drive pinion preload adjustment	Spacer		14.400 mm (0.5669 in.) 14.425 mm (0.5679 in.) 14.450 mm (0.5689 in.) 14.475 mm (0.5699 in.) 14.500 mm (0.5709 in.) 14.525 mm (0.5719 in.) 14.550 mm (0.5728 in.) 14.575 mm (0.5738 in.) 14.600 mm (0.5748 in.) 14.625 mm (0.5758 in.) 14.650 mm (0.5768 in.) 14.675 mm (0.5778 in.) 14.700 mm (0.5787 in.) 14.725 mm (0.5797 in.) 14.750 mm (0.5807 in.) 14.775 mm (0.5817 in.) 14.800 mm (0.5827 in.) 14.825 mm (0.5837 in.) 14.850 mm (0.5846 in.) 14.875 mm (0.5856 in.)
Tooth contact adjustment	Shim		0.30 mm (0.0118 in.) 0.40 mm (0.0157 in.) 0.45 mm (0.0177 in.) 0.50 mm ((0.0197 in.)

0325C–01

TORQUE SPECIFICATION

Part Tightened	N·m	kgf·cm	ft·lbf
Drain plug	50	510	37
Filler plug	50	510	37
Rear drive pinion companion flange sub–assy rear x Differential carrier	435	4,440	321
Differential case LH x Differential case RH	190	1,950	141
Differential case x Ring gear	190	1,950	141
Retainer (drive pinion bearing) x Differential carrier	22	225	16
Drive pinion bearing cage x Differential carrier	74	755	55
Bearing cap x Differential carrier	210	2,150	155
Adjusting nut lock x Bearing cap	22	225	16
Differential carrier x Rear axle housing	52	530	38

DIFFERENTIAL

REFER TO DUTRO WORKSHOP MANUAL
(Pub. No. S1–YXZE05A and S1–YXZE10A)
NOTE: The following pages contain only the points which differ from the above listed manuals.

DIFFERENTIAL SYSTEM (SH12)

2907L–02

PRECAUTION

1. **Before overhaul, clean the outside of the differential assembly to prevent sand or mud from entering inside the differential carrier during overhaul.**
2. **Always arrange the disassembled parts in order and protect them from dust.**
3. **Before installation, thoroughly clean and dry each part and then apply hypoid gear oil to it. Do not use alkaline cleaner for aluminum or rubber parts and ring gear set bolts. Also, do not clean the rubber parts, such as O–rings and oil seals with white gasoline.**
4. **Coat all the sliding surfaces and rotating parts with hypoid gear oil.**
5. **When holding a component part with a vice, be sure to place an aluminum sheet under the part. Do not put it directly on the vice.**
6. **Be careful not to damage the contact surfaces of the case. Such damage may cause oil leakage.**
7. **Before applying sealant, remove the deposits of the oil sealant and clean the part to be sealed using white gasoline.**
8. **Do not supply oil immediately after installing the sealed parts. Leave it for at least an hour.**
9. **Damage on the surface being contact with an oil seal, O–ring and gasket may cause oil leakage. Special attention should be paid.**
10. **When press–fitting an oil seal, be careful not to damage the oil seal lip and outside periphery.**
11. **When replacing a bearing, replace the inner and outer races as a set.**

290AD–01

PROBLEM SYMPTOMS TABLE

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the likely cause of the problem. Check each part in order. If necessary, replace these parts.

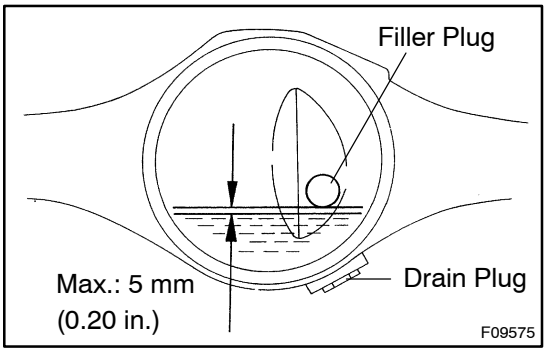
Symptom	Suspect Area	See page
Oil leak from rear differential	1. Oil level (Too high or wrong grade)	29–3
	2. Rear differential front oil seal (Worn or damaged)	29–5
	3. Companion flange (Loose or damaged)	29–5
Oil leak from drive pinion shaft	1. Oil level (Too high or wrong grade)	29–3
	2. Rear differential front oil seal (Worn or damaged)	29–5
	3. Companion flange (Loose or damaged)	29–5

DIFFERENTIAL OIL (SH12)

2907M–02

REPLACEMENT

1. DRAIN DIFFERENTIAL OIL



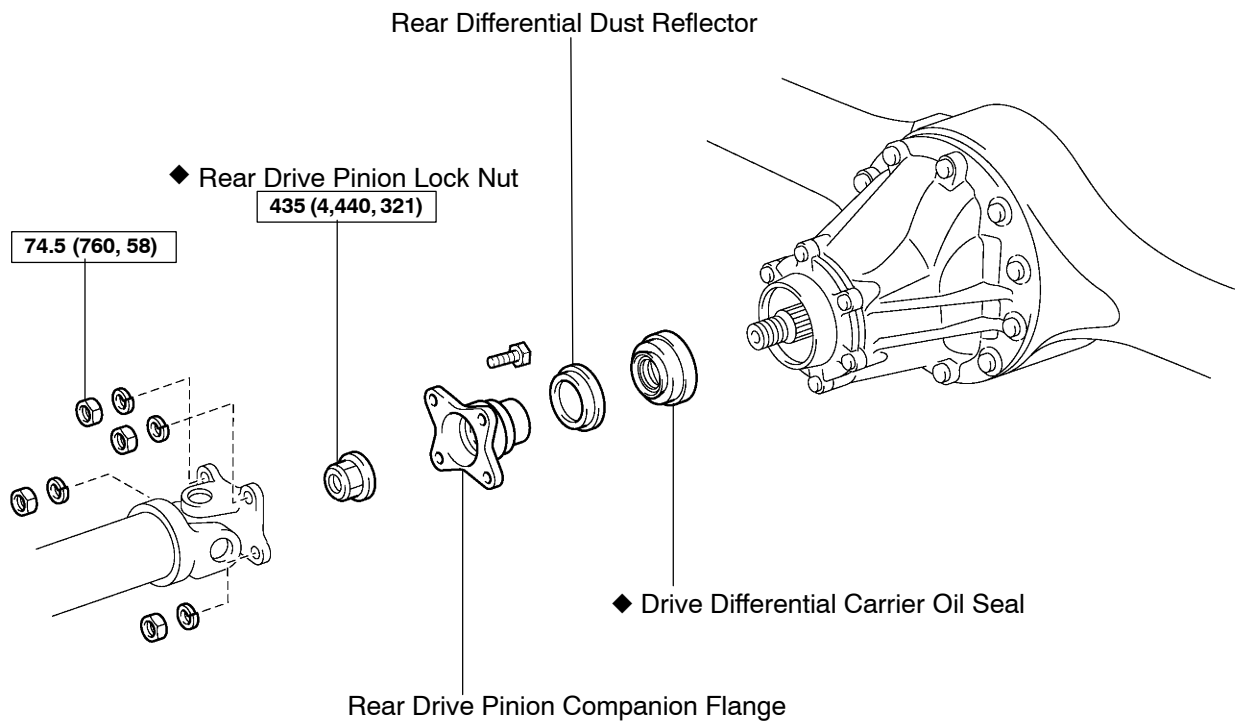
2. ADD DIFFERENTIAL OIL

Oil type: Hypoid gear oil API GL–5
Recommended oil viscosity: SAE 90
Capacity: 5.2 liters (5.5 US qts, 4.8 Imp. qts)
Torque for drain and filler plugs:
50 N·m (510 kgf·cm, 37 ft·lbf)

REAR DIFFERENTIAL CARRIER OIL SEAL (SH12)

290A9–01

COMPONENTS



N·m (kgf·cm, ft·lbf) : Specified torque

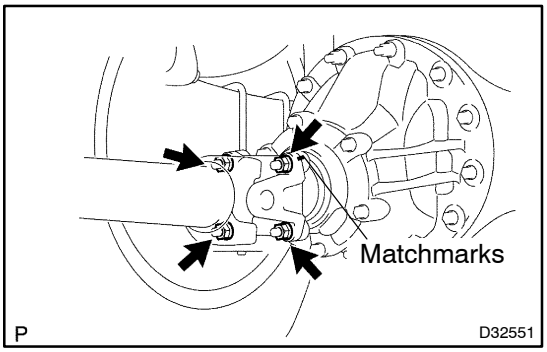
T ◆ Non–reusable part

D33088

2907O–02

REPLACEMENT

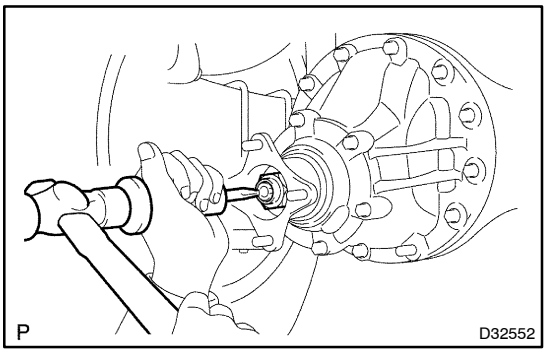
1. DRAIN DIFFERENTIAL OIL (See page 29–3)



2. DISCONNECT PROPELLER SHAFT ASSY

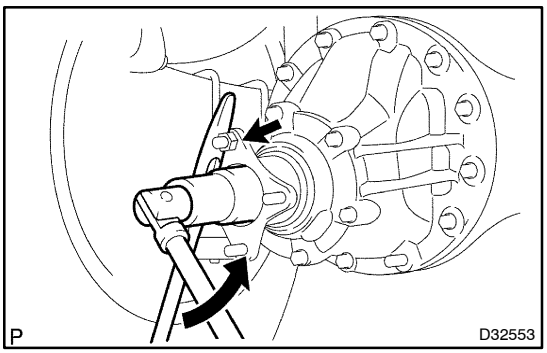
(a) Place matchmarks on the flanges.

(b) Remove the 4 nuts and 4 washers, and disconnect the rear propeller shaft.



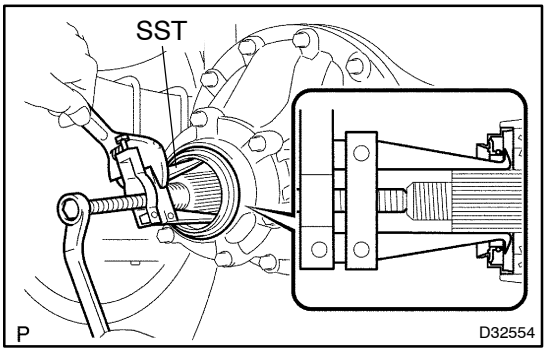
3. REMOVE REAR DRIVE PINION COMPANION FLANGE SUB–ASSY REAR

(a) Using a chisel and hammer, loosen the staked part of the nut.



(b) Hold the flange in place with the tire lever and remove the nuts using the socket wrench.

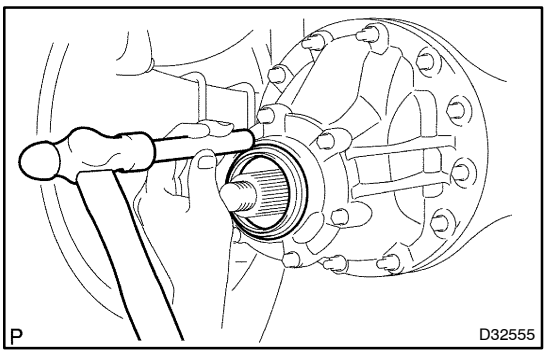
(c) Remove the drive pinion companion flange.



4. REMOVE REAR DIFFERENTIAL CARRIER OIL SEAL

(a) Using SST, remove the oil seal.

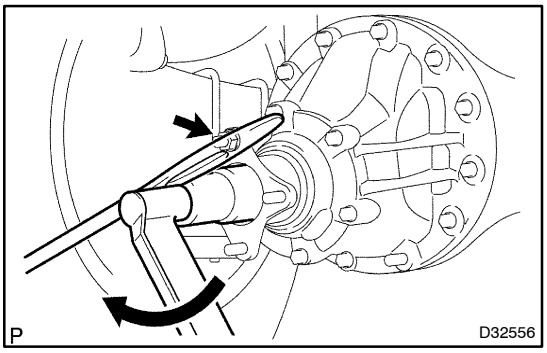
SST 09308–10010



5. INSTALL REAR DIFFERENTIAL CARRIER OIL SEAL

(a) Apply MP grease to the lip of a new oil seal.

(b) Using a brass bar and hammer, tap in the oil seal.
Oil seal drive in depth: 0 mm (0 in.)

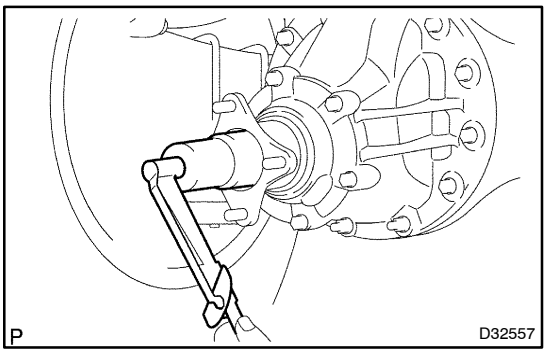


6. INSTALL REAR DRIVE PINION COMPANION FLANGE SUB–ASSY REAR

(a) Install the companion flange on the drive pinion.

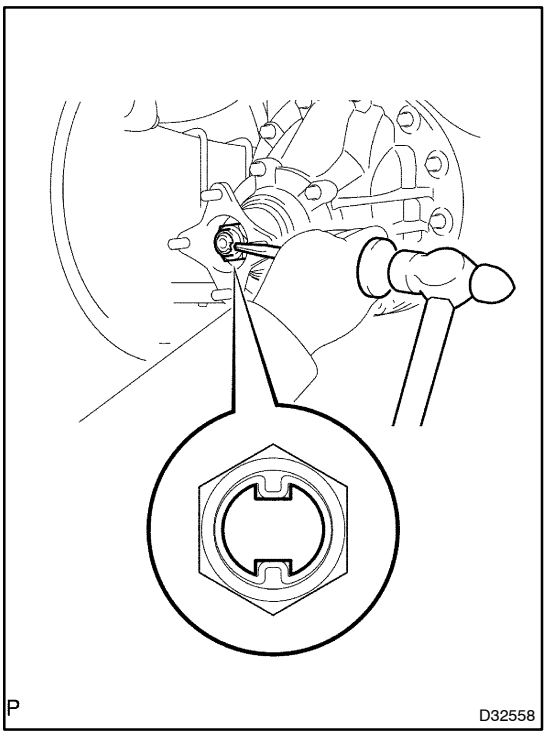
(b) Apply a light coat of gear oil on the threads of a new companion flange nut.

(c) Using a tire lever, hold the flange and tighten the nut.
Torque: 435 N·m (4,440 kgf·cm, 320 ft·lbf)



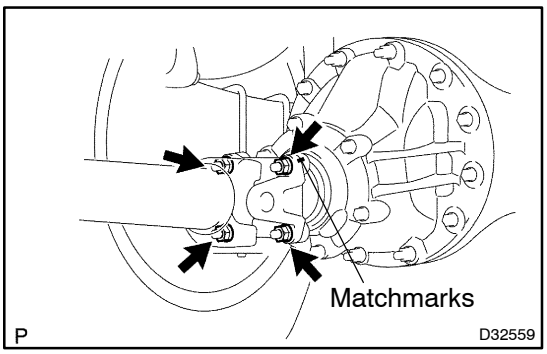
7. INSPECT TOTAL PRELOAD

(a) Using a torque wrench, measure the maximum torque within the backlash between the drive pinion and ring gear when the companion flange begins to rotate.
Preload:
1.48 to 2.45 N·m (15 to 25 kgf·cm, 13 to 22 in.·lbf)



8. INSTALL COMPANION FLANGE ROCK NUT

(a) Using a chisel and hammer, stake the nut to the bolt as shown in the illustration.



9. INSTALL PROPELLER SHAFT ASSY

(a) Align the matchmarks and connect the propeller shaft to the companion flange with the 4 bolts, 4 washers and 4 nuts.

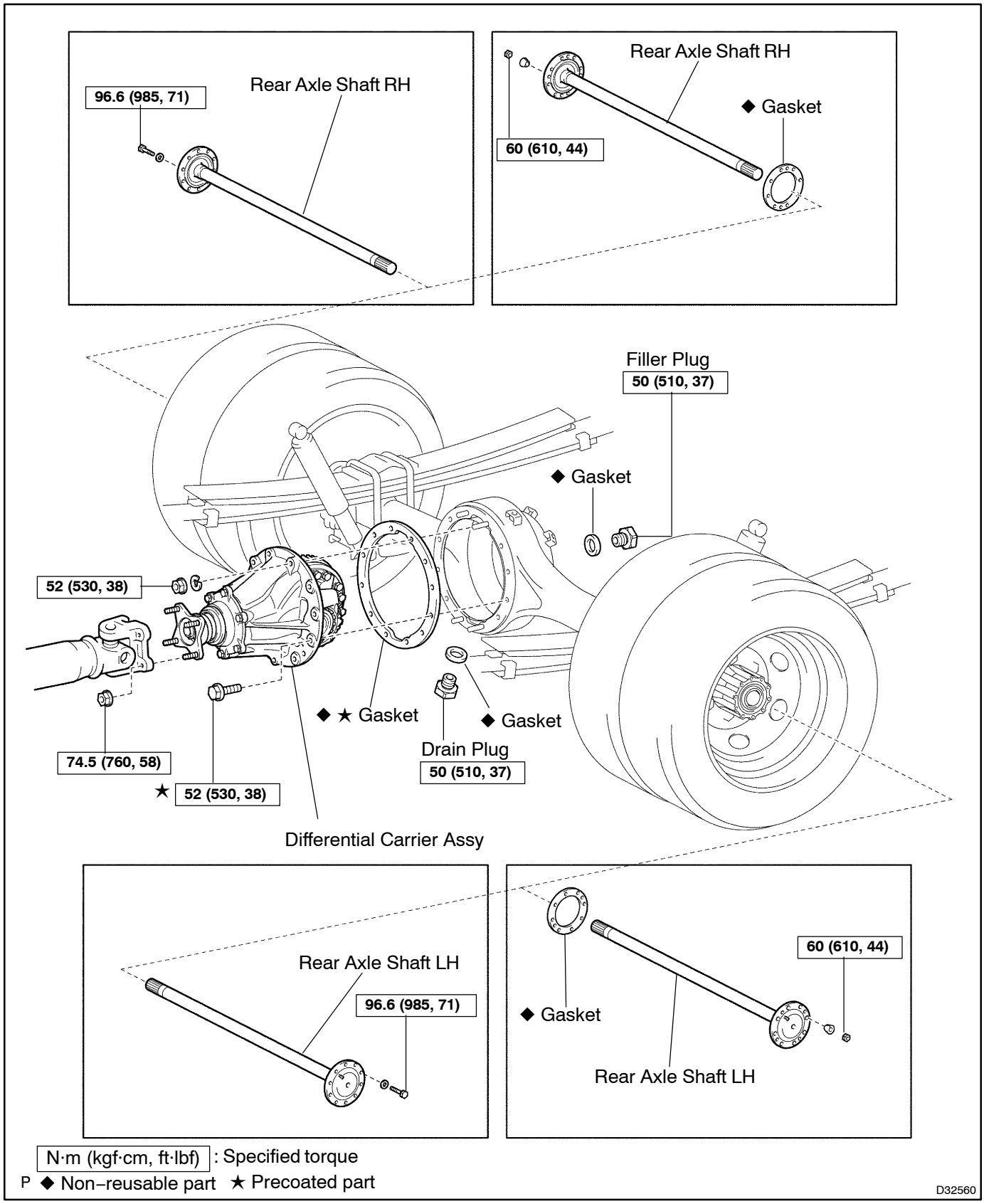
(b) Tighten the nuts (see pub No. S1–YXZE05A, page 30–4 or 30–11).

10. ADD DIFFERENTIAL OIL (See page 29–3)

DIFFERENTIAL CARRIER ASSY REAR (SH12)

290AA–01

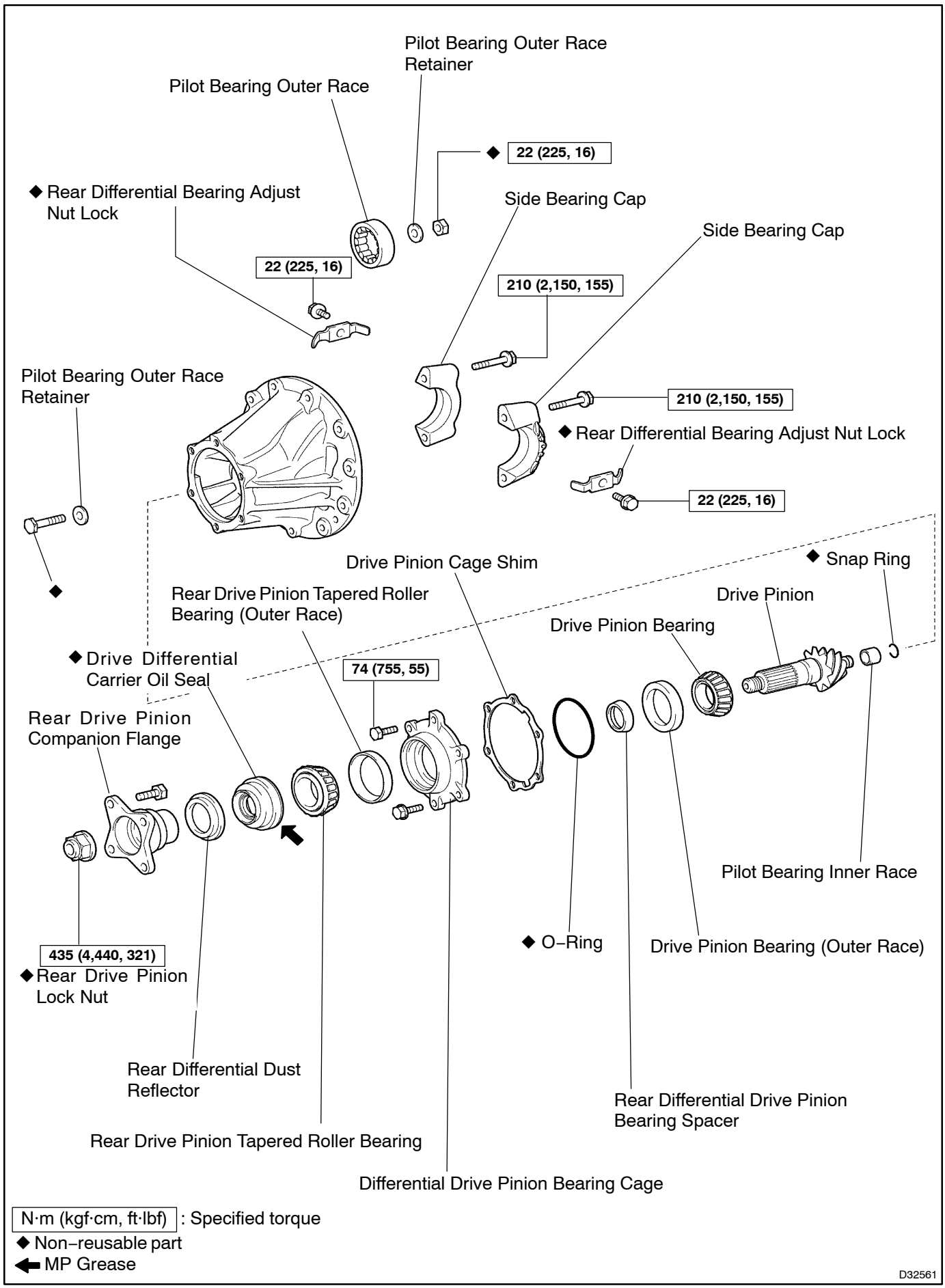
COMPONENTS

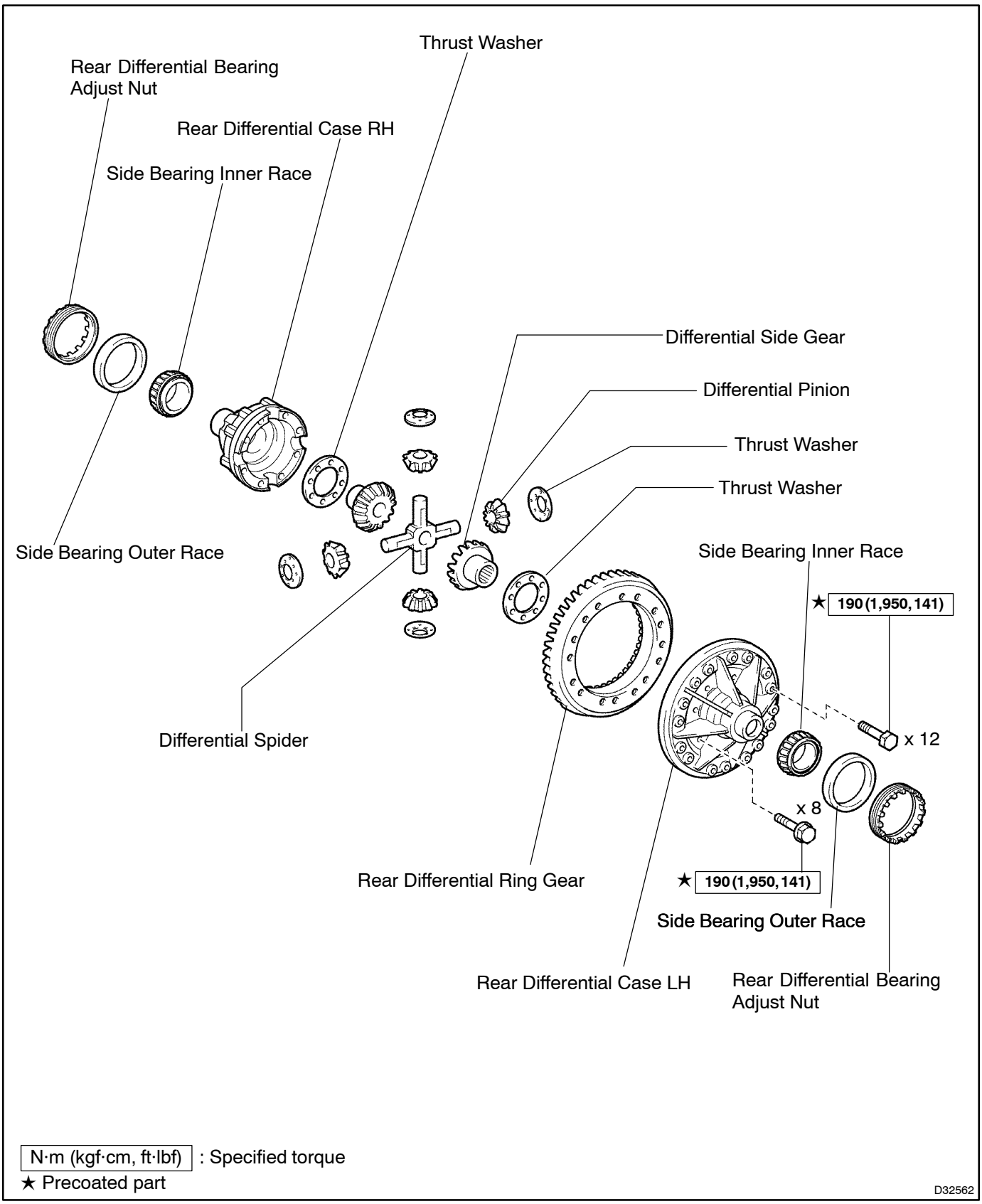


N·m (kgf·cm, ft·lbf) : Specified torque

P ◆ Non–reusable part ★ Precoated part

D32560


Pilot Bearing Outer Race Retainer
Pilot Bearing Outer Race
◆ 22 (225, 16)
◆ Rear Differential Bearing Adjust Nut Lock
Side Bearing Cap
Side Bearing Cap
22 (225, 16)
210 (2,150, 155)
Pilot Bearing Outer Race Retainer
210 (2,150, 155)
◆ Rear Differential Bearing Adjust Nut Lock
22 (225, 16)
◆
Drive Pinion Cage Shim
◆ Snap Ring
Rear Drive Pinion Tapered Roller Bearing (Outer Race)
Drive Pinion
Drive Pinion Bearing
◆ Drive Differential Carrier Oil Seal
74 (755, 55)
Rear Drive Pinion Companion Flange
Pilot Bearing Inner Race
◆ O–Ring
Drive Pinion Bearing (Outer Race)
435 (4,440, 321)
◆ Rear Drive Pinion Lock Nut
Rear Differential Dust Reflector
Rear Differential Drive Pinion Bearing Spacer
Rear Drive Pinion Tapered Roller Bearing
Differential Drive Pinion Bearing Cage
N·m (kgf·cm, ft·lbf) : Specified torque
◆ Non–reusable part
MP Grease
D32561



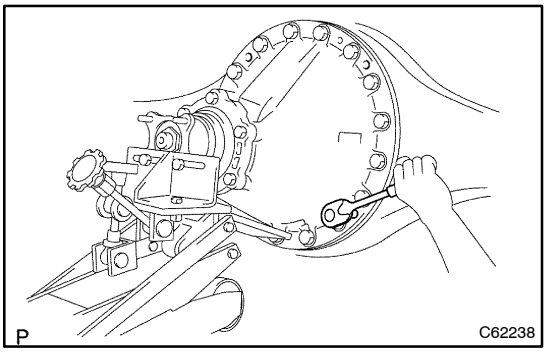
N·m (kgf·cm, ft·lbf) : Specified torque
★ Precoated part

D32562

290AB–01

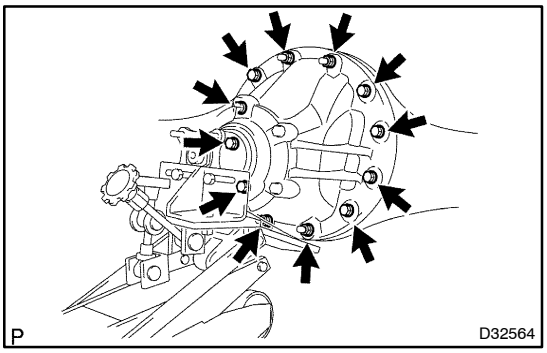
OVERHAUL

1. **DRAIN DIFFERENTIAL OIL (See page 29–3)**
2. **REMOVE REAR AXLE SHAFT (See pub No. S1–YXZE05A, page 30–72 or 30–75)**
3. **REMOVE PROPELLER SHAFT ASSY (See pub No. S1–YXZE05A, page 30–4 or 30–11)**



4. REMOVE REAR DIFFERENTIAL CARRIER ASSY

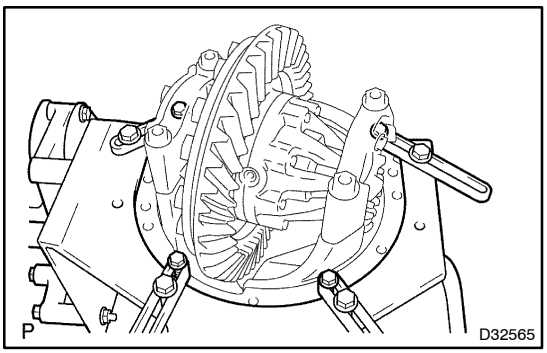
(a) Using a jack, support the differential carrier.



(b) Remove the 8 bolts, 4 nuts and differential carrier.

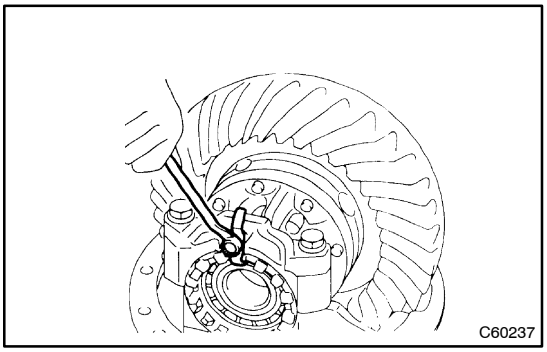
NOTICE:

Be careful not to damage the installation surface.

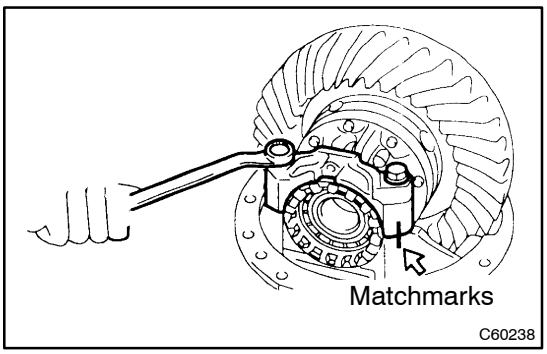


5. REMOVE REAR DIFFERENTIAL CASE SUB–ASSY

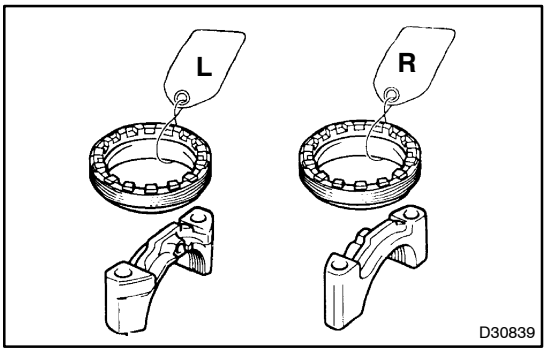
(a) Fix the differential carrier.



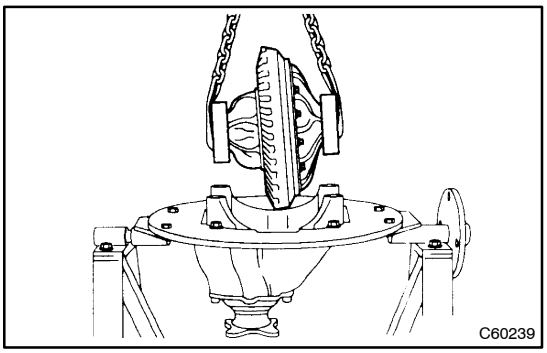
(b) Remove the 2 adjusting nut locks.



(c) Place matchmarks on the bearing cap and differential carrier.
(d) Remove the 4 bolts, 2 bearing caps and 2 adjusting nuts.
(e) Remove the differential case together with the bearing outer races from the carrier.

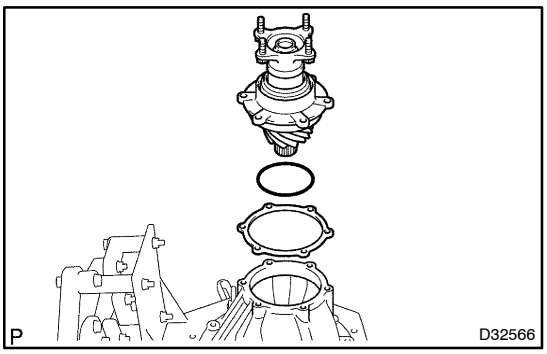


HINT:
Tag the removed parts to show the location for installation.



(f) Using a chain block, remove the differential gear from the differential carrier.
(g) Remove the side bearing outer race.

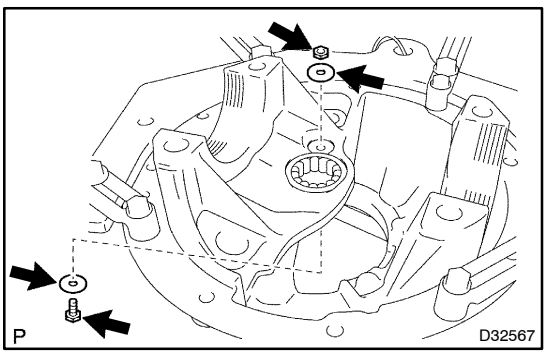
HINT:
Tag the removed parts to show the location for installation.



6. REMOVE DRIVE PINION SUB–ASSY

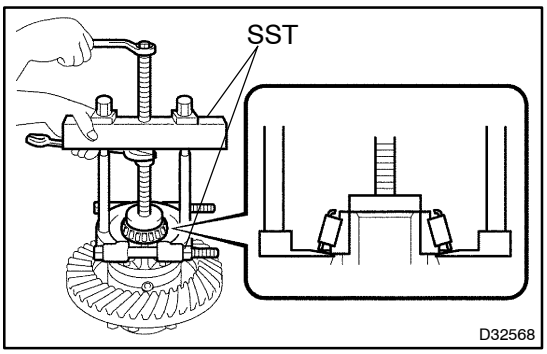
(a) Remove the 6 bolts.
(b) Remove the drive pinion, shims and O–ring from the differential carrier.

HINT:
For easy removal, remove the outer races, using a brass bar and hammer.



7. REMOVE PILOT BEARING OUTER RACE

(a) Remove the bolt, nut and 2 bearing retainers.
(b) Remove the outer race from the differential carrier.

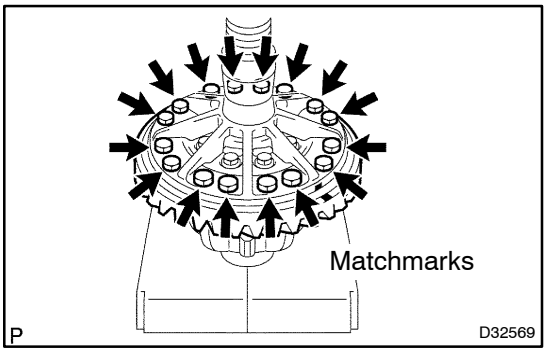


8. REMOVE SIDE BEARING INNER RACE

(a) Using SST, remove the 2 inner races from the differential case.

SST 09950–60020, (09951–00680), 09950–40011, (09957–04010), 09950–00020, 09950–00030

If reusing the bearings, arrange them so that the right bearing and left bearing can be distinguished.

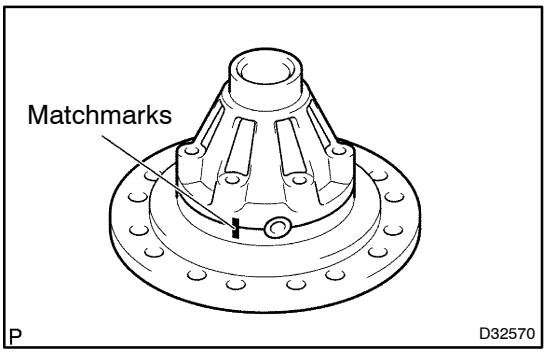


9. REMOVE RING GEAR

(a) Place matchmarks on the ring gear and differential case.
(b) Using a press, fix the differential carrier.
(c) Remove the 16 bolts.
(d) Using a plastic hammer, remove the ring gear to separate it from the differential case.

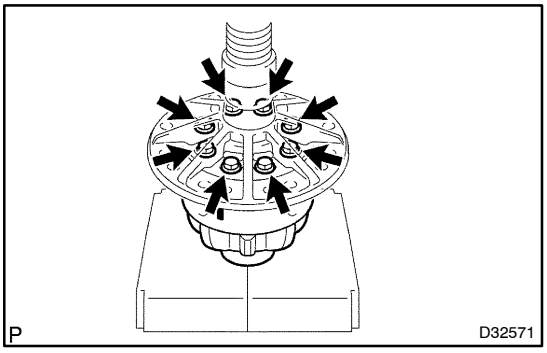
NOTICE:

Be careful not to drop the ring gear.

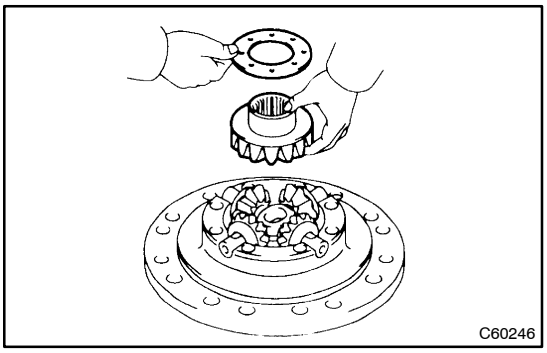


10. REMOVE DIFFERENTIAL CASE

(a) Place matchmarks on the LH and RH cases.

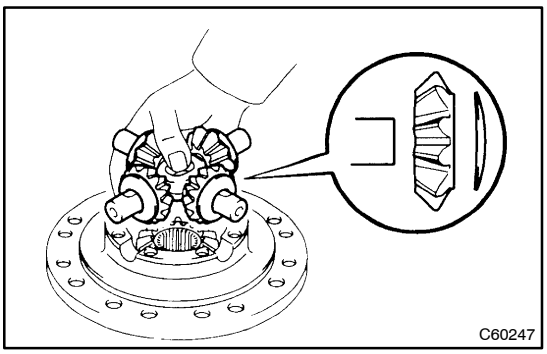


(b) Remove the 8 bolts.
(c) Using a plastic hammer, separate the LH and RH cases.

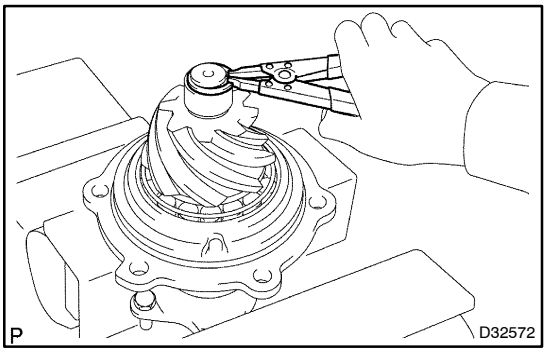


11. REMOVE REAR DIFFERENTIAL SPIDER

(a) Remove the side gear thrust washer and side gear.



(b) Remove the 4 pinion gear thrust washers, 4 pinion gears and spider.
(c) Remove the 4 side gear thrust washers and side gear.

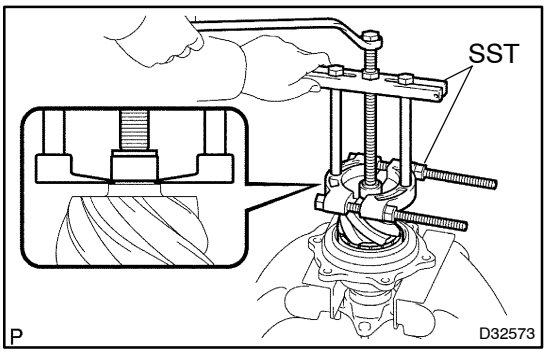


12. REMOVE PILOT BEARING INNER RACE

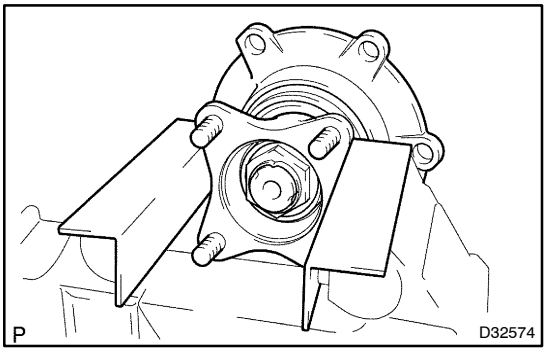
(a) Using a snap ring expander, remove the snap ring.
(b) Using a grinder, make a groove to the inner race.

NOTICE:

Use a cloth or similar object as a cover, at the time of snap ring installation, to prevent the snap ring from flying off.

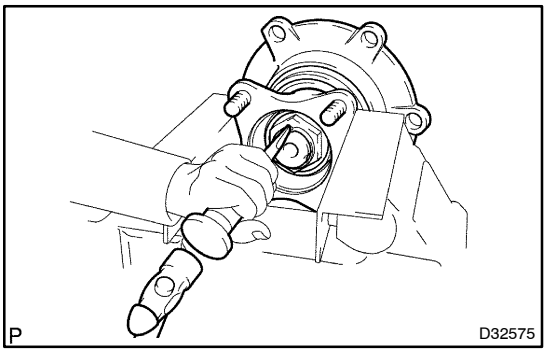


(c) Using SST, remove the inner race from the drive pinion.
SST 09950–00030, 09950–00020

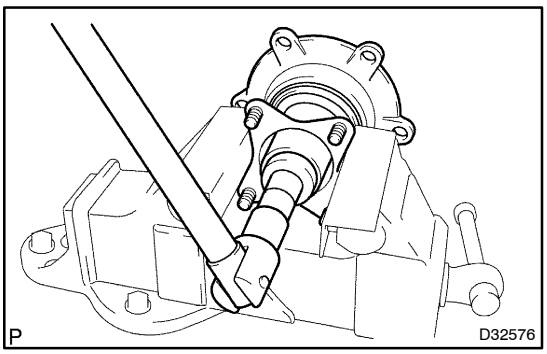


13. REMOVE REAR DRIVE PINION COMPANION FLANGE

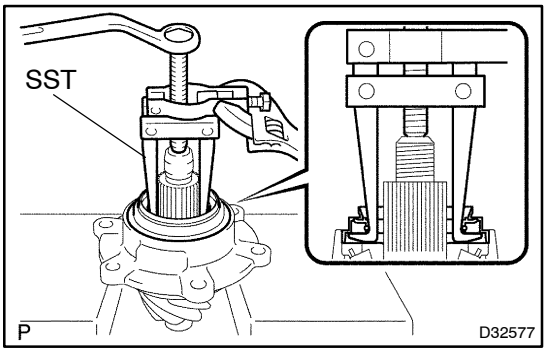
(a) Using a vise, hold the companion flange.



(b) Using a chisel and hammer, unstake the lock nut.

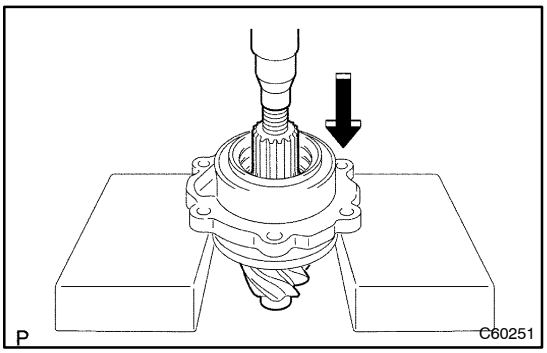


(c) Remove the lock nut and companion flange.



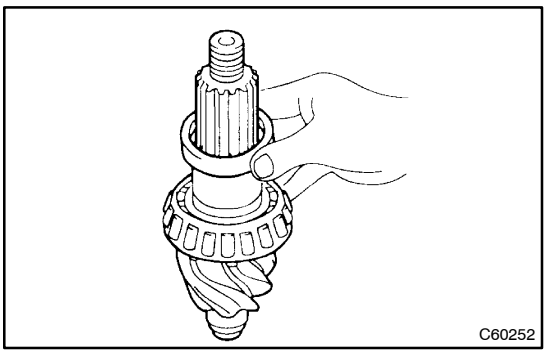
14. REMOVE REAR DIFFERENTIAL CARRIER OIL SEAL

(a) Using SST, remove the oil seal.
SST 09308–10010

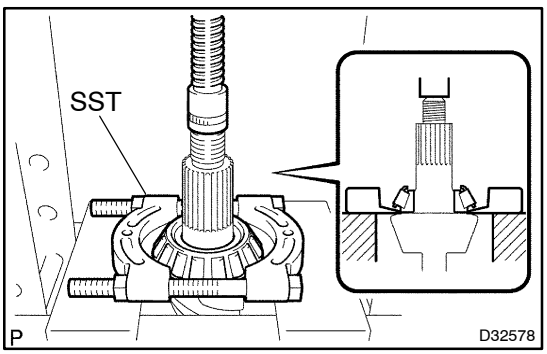


15. REMOVE DIFFERENTIAL DRIVE PINION

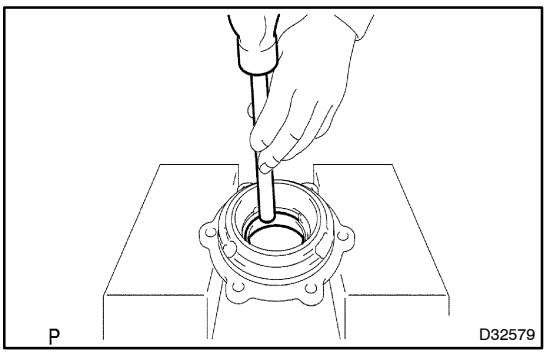
(a) Using a press, press out the drive pinion from the drive pinion cage.



(b) Remove the drive pinion bearing spacer.



(c) Using SST and a press, press out the rear bearing inner race.
SST 09950–00020



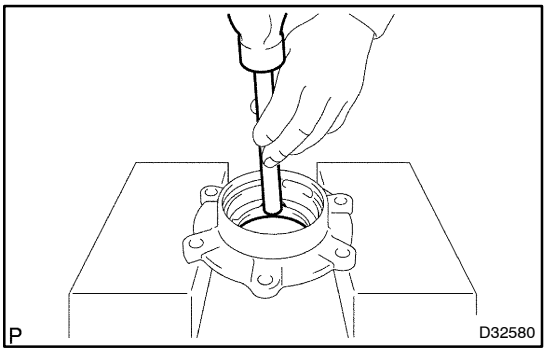
16. REMOVE FRONT BEARING OUTER RACE

(a) Using a brass bar and hammer, tap out the bearing oil seal.

(b) Using a brass bar and hammer, tap out the bearing outer race.

NOTICE:

Do not damage the inner surface of the cage.

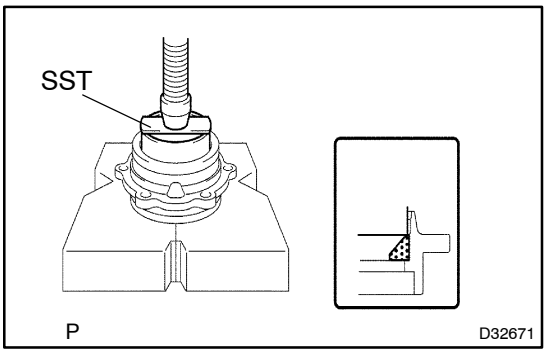


17. REMOVE REAR BEARING OUTER RACE

(a) Using a brass bar and hammer, tap out the bearing outer race.

NOTICE:

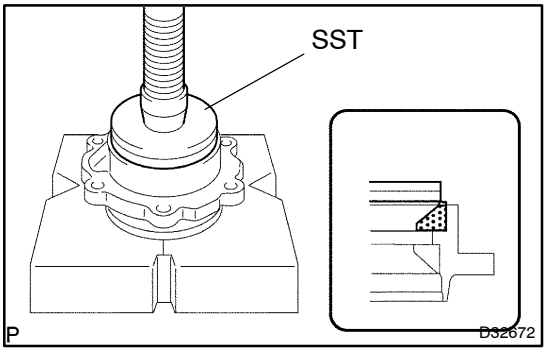
Do not damage the inner surface of the cage.



18. INSTALL FRONT BEARING OUTER RACE

(a) Using SST and a press, press in the front bearing outer race onto the differential cage.

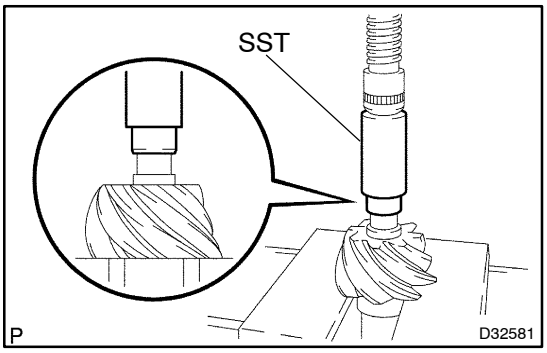
SST 09518–36020



19. INSTALL REAR BEARING OUTER RACE

(a) Using SST and a press, press in the rear bearing outer race onto the differential cage.

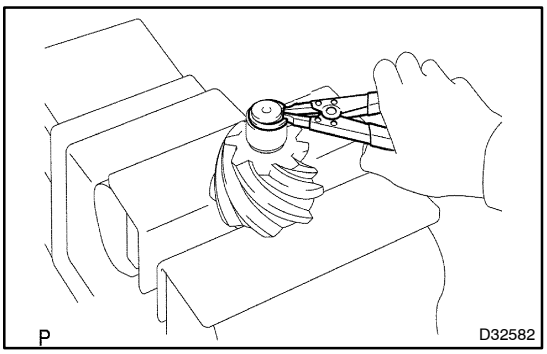
SST 09223–78010



20. INSTALL PILOT BEARING INNER RACE

(a) Using SST and a press, press in the inner race onto the shaft of the drive pinion.

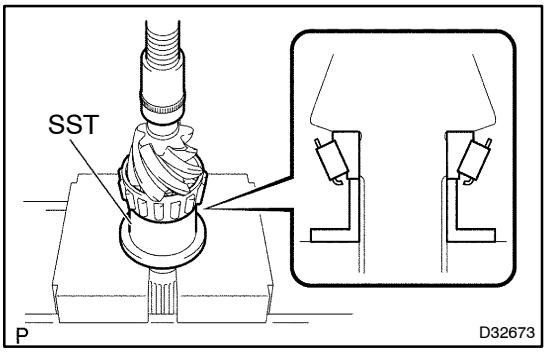
SST 09316–60011 (09316–00011, 09316–00071)



(b) Using a snap ring expander, install a new snap ring in the groove on the drive pinion tip.

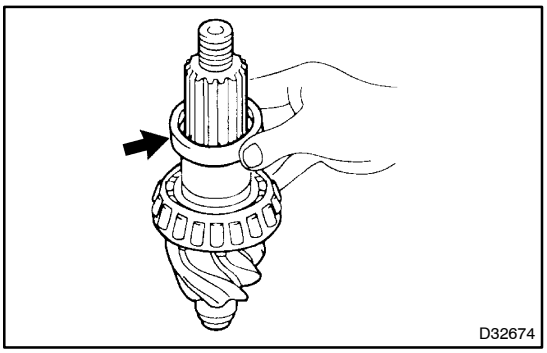
NOTICE:

Use a cloth or similar object as a cover, at the time of snap ring installation, to prevent the snap ring from flying off.

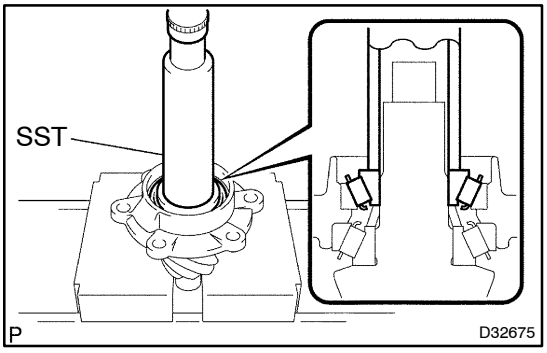


21. INSTALL REAR BEARING INNER RACE

(a) Using SST and a press, press in the inner race onto the drive pinion.
SST 09315–00022

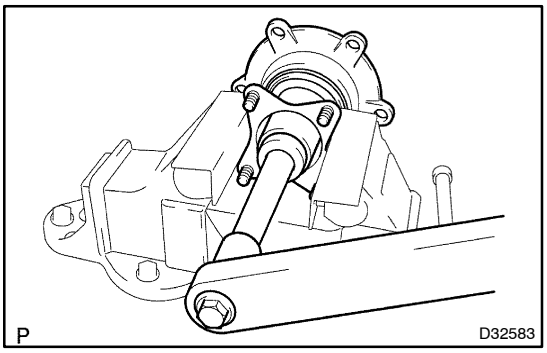


(b) Install the differential drive pinion bearing spacer.



22. INSTALL DIFFERENTIAL DRIVE PINION BEARING CAGE

(a) Using SST and a press, press in the drive pinion cage and front bearing inner race onto the drive pinion.
SST 09316–60011



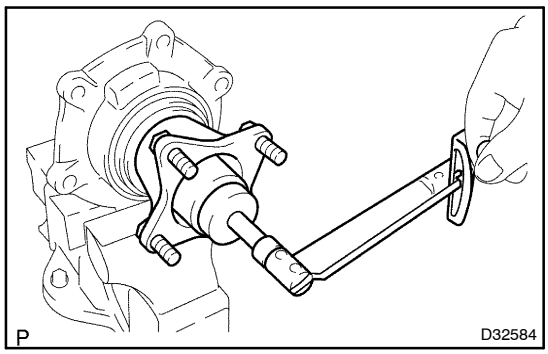
23. ADJUST DIFFERENTIAL DRIVE PINION PRELOAD

(a) Install the flange yoke and a new lock nut on the drive pinion, and fix the drive pinion assembly in a vise.

(b) Using a deep socket wrench (36 mm), tighten the lock nut.
Torque: 435 N·m (4,440 kgf·cm, 321 ft·lbf)

NOTICE:

Do not install an oil seal before preload measurement.



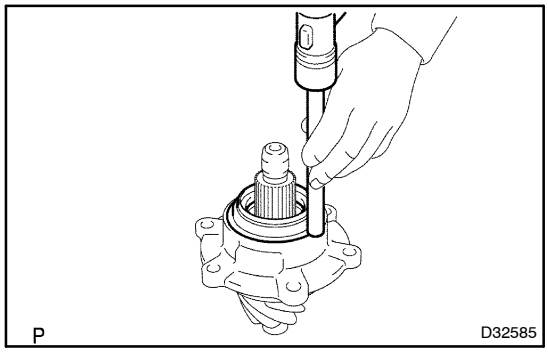
(c) Using a torque wrench, measure the preload at the lock nut part.
Preload:

New bearing	1.47 to 1.96 N·m (15 to 20 kgf·cm, 13 to 17 in.·lbf)
Reused bearing	0.98 to 1.47 N·m (10 to 15 kgf·cm, 9 to 13 in.·lbf)

NOTICE:
When either bearing is new, use the preload for a new bearing.

(d) When the measured value exceeds the specified preload, select a spacer by increasing or decreasing the value and adjust the preload.
Spacer thickness:

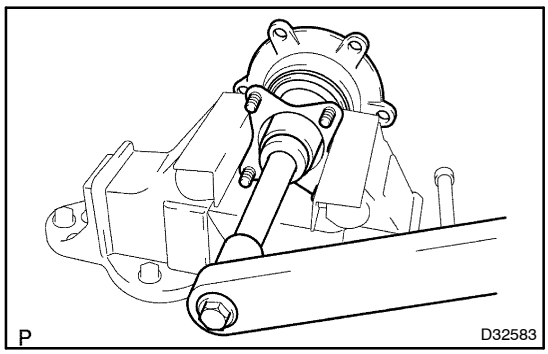
14.400 mm (0.5669 in.)	14.650 mm (0.5768 in.)
14.425 mm (0.5679 in.)	14.675 mm (0.5778 in.)
14.450 mm (0.5689 in.)	14.700 mm (0.5787 in.)
14.475 mm (0.5699 in.)	14.725 mm (0.5797 in.)
14.500 mm (0.5709 in.)	14.750 mm (0.5807 in.)
14.525 mm (0.5719 in.)	14.775 mm (0.5817 in.)
14.550 mm (0.5728 in.)	14.800 mm (0.5827 in.)
14.575 mm (0.5738 in.)	14.825 mm (0.5837 in.)
14.600 mm (0.5748 in.)	14.850 mm (0.5846 in.)
14.625 mm (0.5758 in.)	14.875 mm (0.5856 in.)



24. INSTALL REAR DIFFERENTIAL CARRIER OIL SEAL

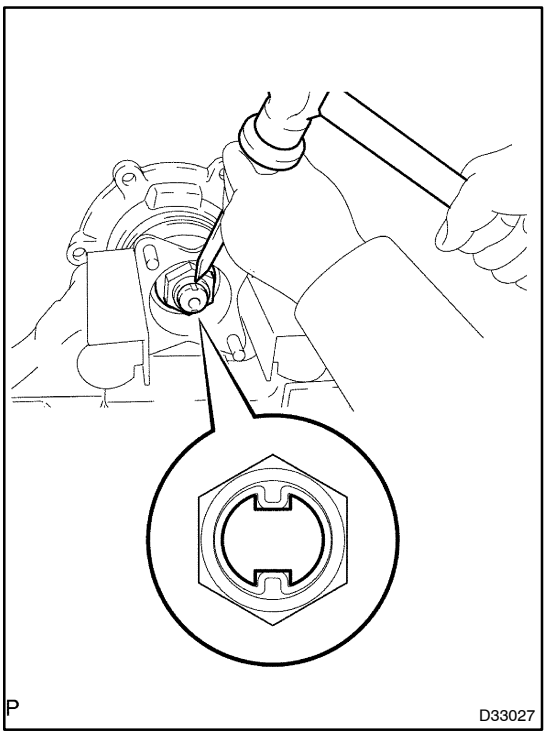
(a) After preload adjustment, remove the companion flange and use a plastic hammer to tap in a new oil seal into the differential carrier cage.

NOTICE:
Hit the oil seal uniformly to drive it in.

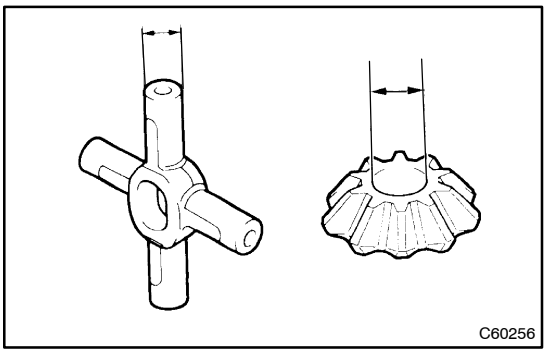


25. INSTALL REAR DRIVE PINION COMPANION FLANGE

(a) Install the companion flange with the lock nut.
Torque: 435 N·m (4,450 kgf·cm, 322 ft·lbf)



(b) Using a chisel and hammer, caulk the lock nut positively at the shaft groove (2 places).



26. INSPECT SPIDER BEARING

(a) Using a micrometer, measure the outer diameter of the spider.

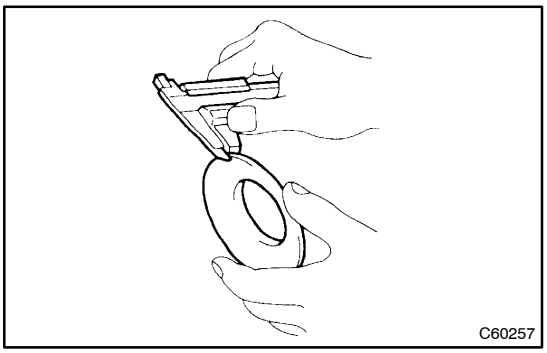
(b) Using a caliper gauge, measure the inner diameter of the pinion.

(c) Measure the clearance by subtracting the outer diameter of the spider from the inner diameter of the pinion.

Clearance:

Standard	0.140 to 0.261 mm (0.0055 to 0.0103 in.)
Maximum	0.4 mm (0.016 in.)

If the clearance is greater than the maximum, replace the spider bearing.



27. INSPECT SIDE GEAR THRUST WASHER AND PINION THRUST WASHER

(a) Using a vernier caliper, measure the thickness of the side gear thrust washer and pinon gear thrust washer.

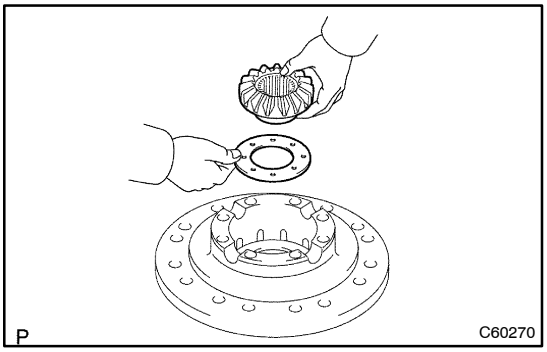
Thickness of side gear thrust washer:

Standard	1.9 to 2.1 mm (0.075 to 0.083 in.)
Minimum	1.7 mm (0.070 in.)

Thickness of pinion gear thrust washer:

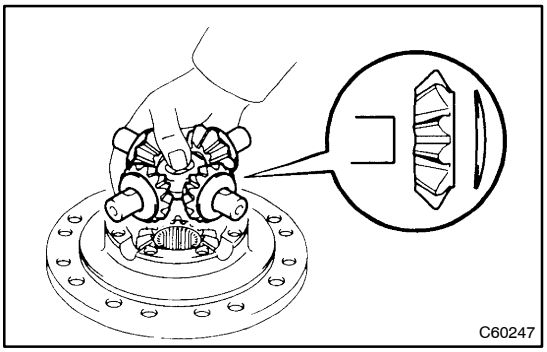
Standard	1.5 to 1.7 mm (0.059 to 0.070 in.)
Minimum	1.3 mm (0.051 in.)

If the value is less than the minimum, replace the side gear thrust washer or pinon gear thrust washer.



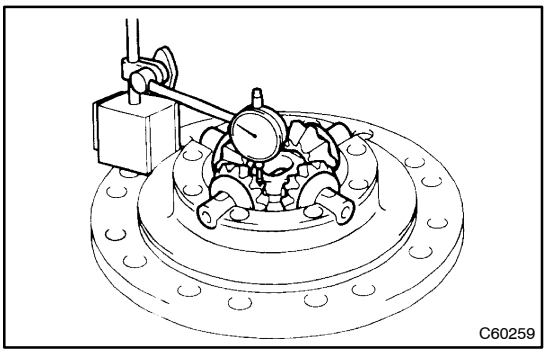
28. INSTALL REAR DIFFERENTIAL SPIDER

(a) Install the thrust washer on the slide gear.



(b) Install the 4 pinion gears and 4 thrust washers to the spider.

(c) Install the spider with the pinion gears to the LH case.



29. ADJUST DIFFERENTIAL SIDE GEAR BACKLASH

(a) Using a dial gauge, measure the side gear backlash.

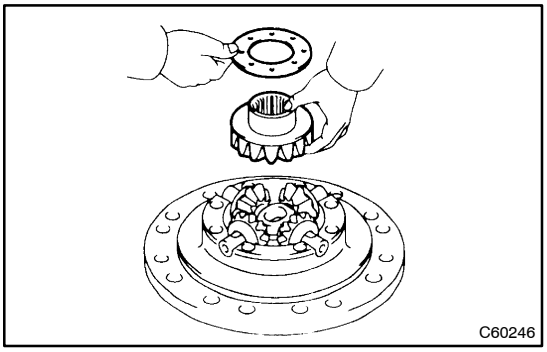
Backlash:

Standard	0.20 to 0.60 mm (0.0079 to 0.0236 in.)
Maximum	0.9 mm (0.035 in.)

If the backlash is greater than the maximum, replace the parts.

HINT:

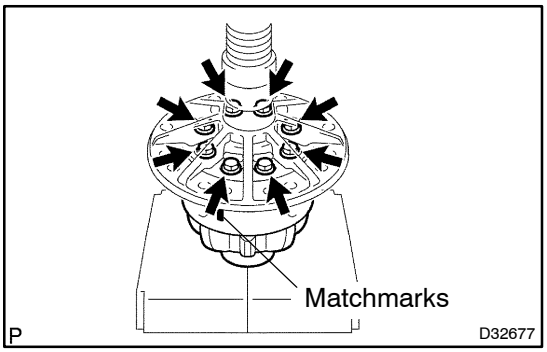
Measure the backlash at the RH case and LH case.



30. INSTALL REAR DIFFERENTIAL SIDE GEAR

(a) Install the side gear and thrust washer to the RH case.

(b) Apply gear oil to each part.



31. INSTALL DIFFERENTIAL CASE

(a) Align the matchmarks on the differential cases LH and RH.

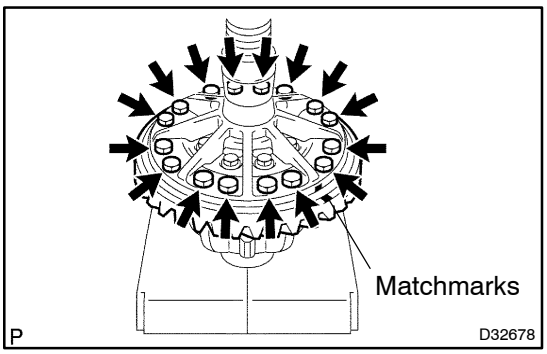
(b) Using a press, fix the differential.

(c) Apply sealant to the threads of the 8 bolts and install them.

Sealant:

Part No. 08833–00100, THREE BOND 1360K or equivalent

Torque: 190 N·m (1,950 kgf·cm, 141 ft·lbf)



32. INSTALL DIFFERENTIAL RING GEAR

(a) Align the matchmarks on the ring gear and differential.

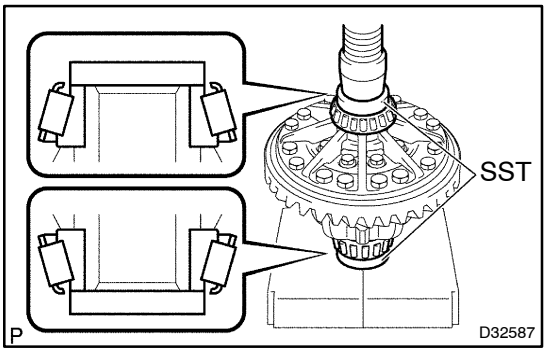
(b) Using a press, fix the differential.

(c) Apply sealant to the threads of the 16 bolts and install them.

Sealant:

Part No. 08833–00100, THREE BOND 1360K or equivalent

Torque: 190 N·m (1,950 kgf·cm, 141 ft·lbf)



33. INSTALL SIDE BEARING INNER RACE

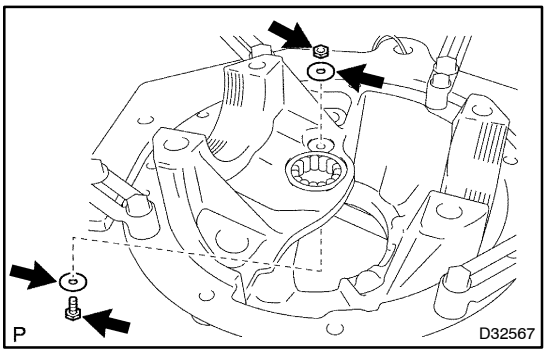
(a) Install the side spacer to the differential case LH.

(b) Using SST and a press, press in the 2 inner races onto the differential case.

SST 09223–15020, 09950–60010 (09951–00640, 09951–00650)

NOTICE:

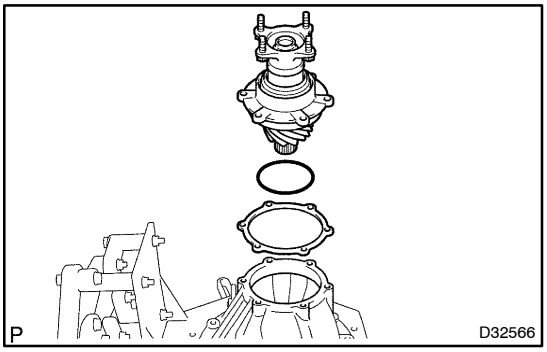
Check that the left and right inner races are not interchanged.



34. INSTALL PILOT BEARING OUTER RACE

(a) Install the bearing with the 2 retainers, a new bolt and nut.

Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)



35. INSTALL DRIVE PINION SUB–ASSY

(a) Apply bearing grease to a new O–ring.

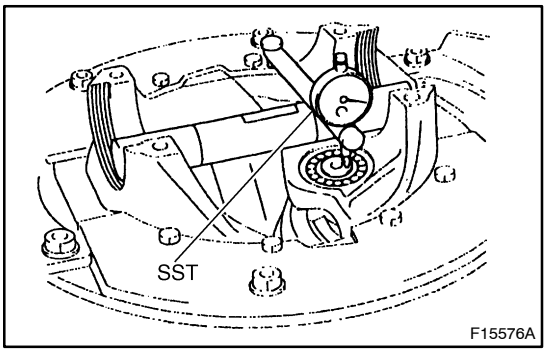
(b) Install the O–ring to the groove of the differential carrier cage.

NOTICE:

Be sure to use a new O–ring.

(c) Install the drive pinion and O–ring to the differential carrier with the 6 bolts and shims.

Torque: 74 N·m (755 kgf·cm, 55 ft·lbf)



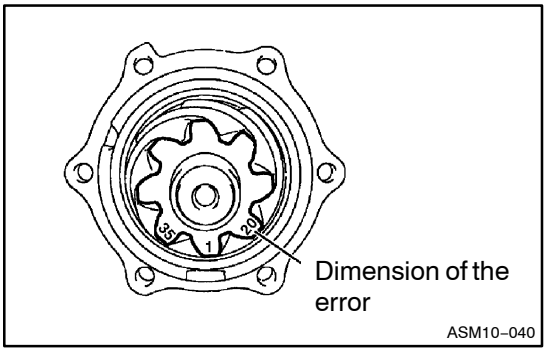
(d) Measure the depth from the installation surface of the side bearing to the tip of the drive pinion (this depth is the conical distance).

Conical distance (Reference): 27.0 mm (1.063 in.)

SST 09640–1370

HINT:

- Make a note of the dimension of the error when manufactured which is stamped on the pinion tip before the installation of the drive pinion, then use it to calculate the conical distance.



- The conical distance is the basic dimension when the tooth contact of the drive pinion and the ring gear is adjusted. Setting them in this dimension makes the tooth contact best. Additionally, because of machine processing, dimension of the error when manufactured against the standard dimension is stamped on the tip of the pinion. The dimension that takes dimension of the error when manufactured and the standard dimension into account is the basic dimension.

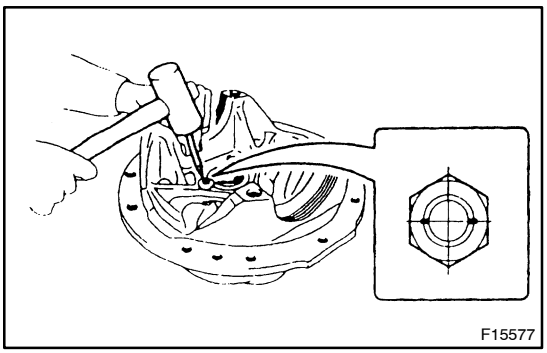
(e) Depending on the difference between the measured value and reference value (conical distance), adjust the thickness of the shim.

Shim thickness:

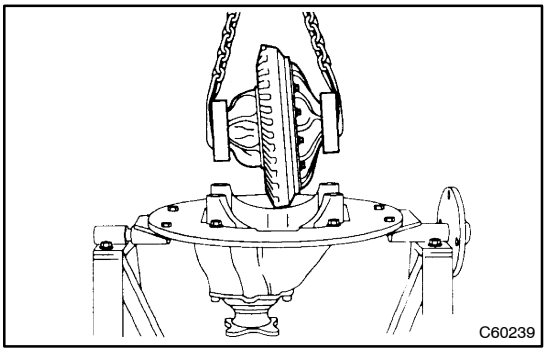
0.30 mm (0.0118 in.)	0.45 mm (0.0177 in.)
0.40 mm (0.0157 in.)	0.50 mm (0.0197 in.)

HINT:

- Basic value = Standard value + Dimension of the error when manufactured
- When dimension of the error when manufactured is stamped by –20, the actual dimension of the error when manufactured means –0.2 mm (–0.0079 in.).
  (Standard value + Dimension of the error when manufactured = Basic Dimension [27.0 mm (1.063 in.) + (–0.2 mm (–0.0079 in.)) = 26.8 mm (1.0551 in.)])



(f) Using a punch, caulk the 2 portions of the pilot bearing lock nut.



36. INSTALL REAR DIFFERENTIAL CASE SUB–ASSY

(a) Place the bearing outer races on their respective bearings.

NOTICE:

Check that the left and right outer races are not interchanged.

(b) Using a chain block, install the differential case.

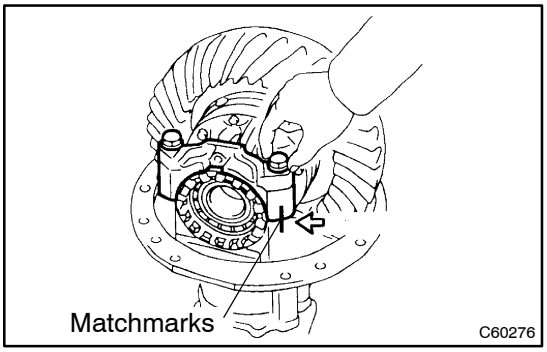
HINT:

Tilting the differential gear assy, install the differential carrier.

(c) Install the 2 adjusting nuts on the carrier and make sure the nuts are properly threaded.

HINT:

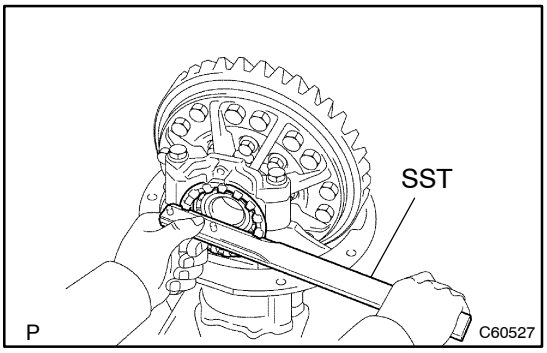
Making the 2 adjusting nuts horizontal to the side bearing, insert them from the top of the differential carrier.



(d) Align the matchmarks on the cap and carrier. Temporarily install the side bearing caps with the bolt.

HINT:

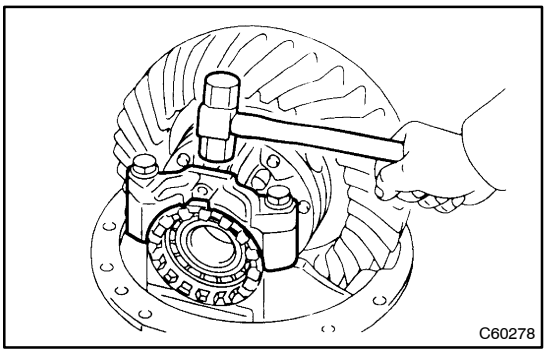
If the bearing cap does not tightly fit the carrier, the adjusting nuts may not be properly threaded. Reinstall the adjusting nuts if necessary.



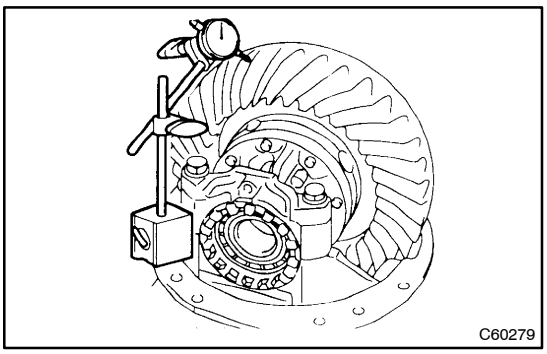
37. ADJUST DIFFERENTIAL SIDE BEARING PRELOAD

(a) Using SST, fully tighten the adjusting nut on the ring gear side. Then, loosen the nut by the 1/4 rotation.
SST 09504–00011

(b) Use the same procedures on the other side.



(c) Using a hammer, lightly tap the top of the side bearing cap so that the bearing fits.



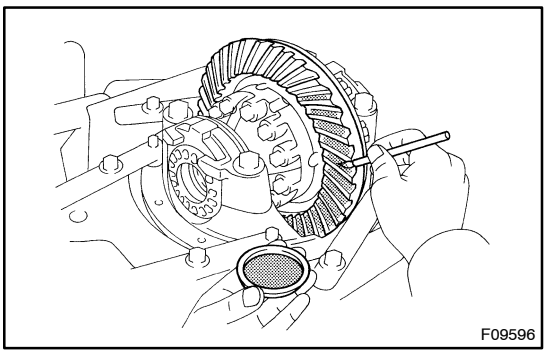
(d) Using a dial gauge, measure the backlash.
Backlash:

Reduction Ratio	Standard
5.375	0.18 to 0.23 mm (0.0072 to 0.0092 in.)
4.875, 5.125, 5.571, 6.167, 6.500	0.20 to 0.28 mm (0.0079 to 0.0110 in.)
5.833	0.25 to 0.33 mm (0.0098 to 0.0130 in.)

HINT:

Perform the measurements at 3 or more positions around the circumference of the ring gear, and adjust the side bearing preload as necessary.

(e) The backlash should be adjusted by turning the left and right adjusting nuts by equal amounts. For example, loosen the nut on the left side one notch and torque the nut on the right side one notch.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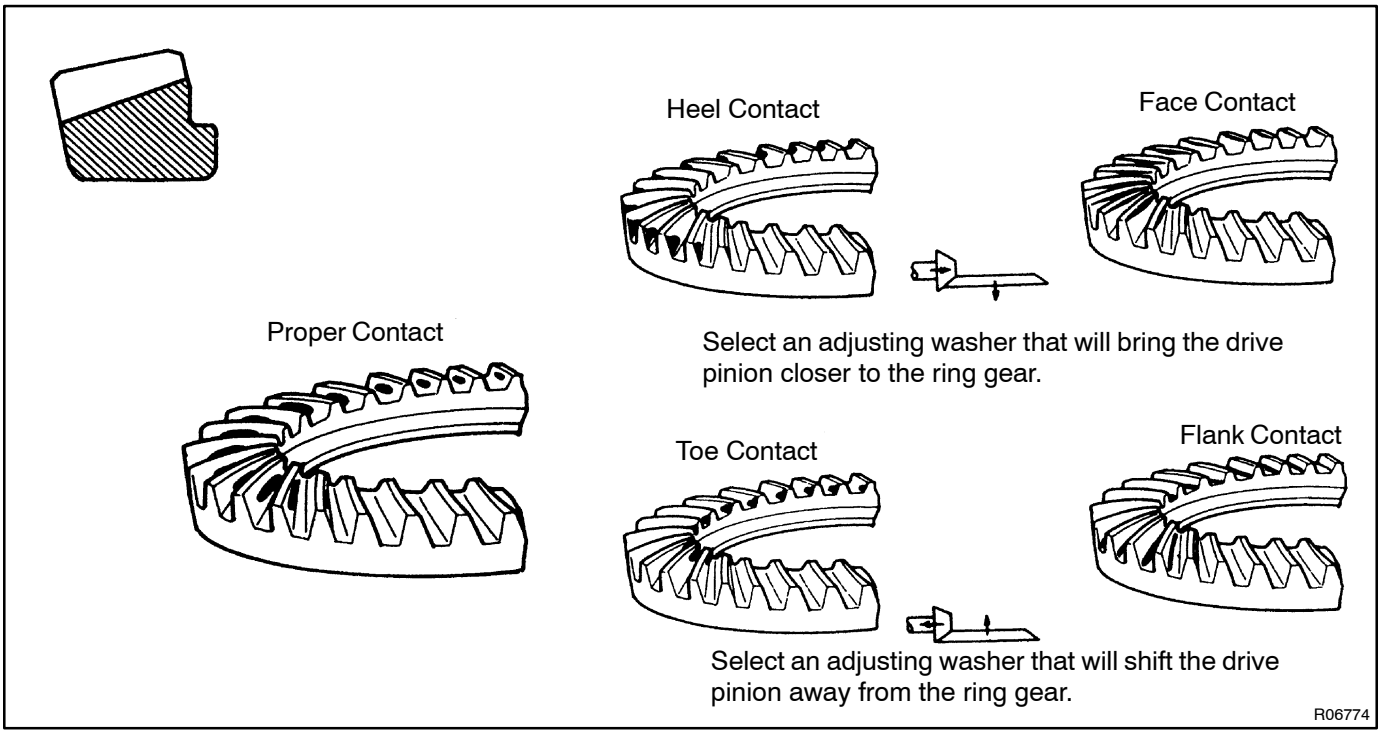
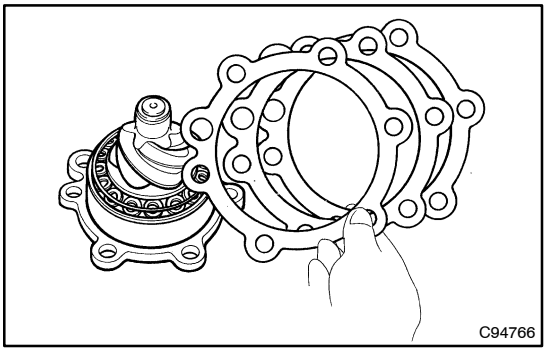
38. INSPECT TOOTH CONTACT BETWEEN RING GEAR AND DRIVE PINION

(a) Coat 3 or 4 teeth at 3 different positions on the ring gear with red lead.

(b) Turn the companion flange in both directions to inspect the ring gear for proper tooth contact.




C94766

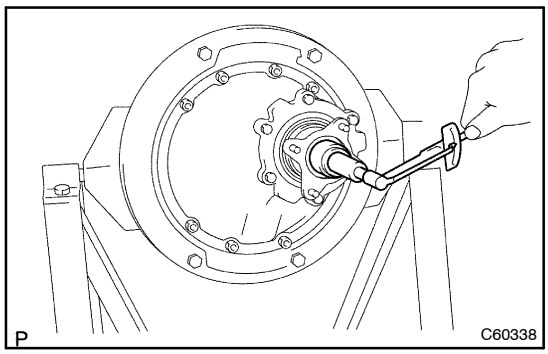
If the teeth are not properly contacting each other other, use the value below to select a proper shim for correction.

Shim thickness:

0.30 mm (0.0118 in.)	0.40 mm (0.0157 in.)
0.45 mm (0.0177 in.)	0.50 mm (0.0197 in.)

HINT:

Use one or more shims for adjustment.



39. MEASURE TOTAL PRELOAD

(a) Using a torque wrench, measure the total preload.

HINT:

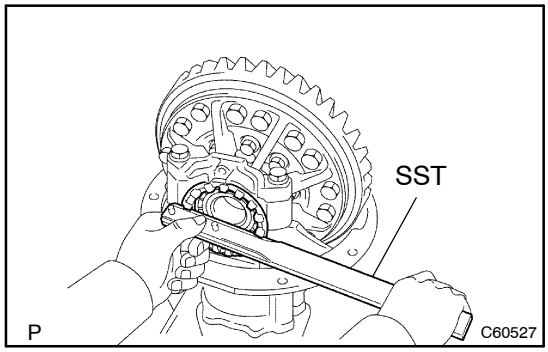
Total preload = Drive opinion preload + Side bearing preload.

Side bearing preload (new bearing):

Reduction Ratio	Standard
4.875	0.31 to 0.40 N•m (3.1 to 4.1 kgf•cm, 2.7 to 3.5 in.•lbf)
5.125	0.29 to 0.38 N•m (3.0 to 3.9 kgf•cm, 2.6 to 3.3 in.•lbf)
5.375	0.28 to 0.36 N•m (2.8 to 3.7 kgf•cm, 2.5 to 3.2 in.•lbf)
5.571	0.27 to 0.35 N•m (2.7 to 3.5 kgf•cm, 2.4 to 3.1 in.•lbf)
5.833	0.26 to 0.33 N•m (2.6 to 3.4 kgf•cm, 2.3 to 2.9 in.•lbf)
6.167	0.24 to 0.31 N•m (2.5 to 3.2 kgf•cm, 2.2 to 2.8 in.•lbf)
6.500	0.23 to 0.30 N•m (2.4 to 3.0 kgf•cm, 2.1 to 2.6 in.•lbf)

Side bearing preload (new bearing):

Reduction Ratio	Standard
4.875	0.21 to 0.30 N•m (2.1 to 3.0 kgf•cm, 1.8 to 2.6 in.•lbf)
5.125	0.20 to 0.28 N•m (2.0 to 2.9 kgf•cm, 1.7 to 2.5 in.•lbf)
5.375	0.19 to 0.27 N•m (1.9 to 2.7 kgf•cm, 1.7 to 2.4 in.•lbf)
5.571	0.18 to 0.26 N•m (1.8 to 2.6 kgf•cm, 1.6 to 2.3 in.•lbf)
5.833	0.17 to 0.25 N•m (1.8 to 2.5 kgf•cm, 1.5 to 2.2 in.•lbf)
6.167	0.16 to 0.23 N•m (1.7 to 2.4 kgf•cm, 1.5 to 2.1 in.•lbf)
6.500	0.16 to 0.22 N•m (1.6 to 2.3 kgf•cm, 1.4 to 2.0 in.•lbf)

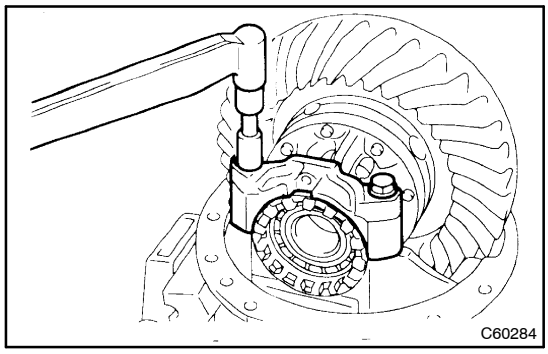


If the result is not as specified, then turn the left/right adjusting nuts using SST to adjust the preload.

SST 09504–00011

NOTICE:

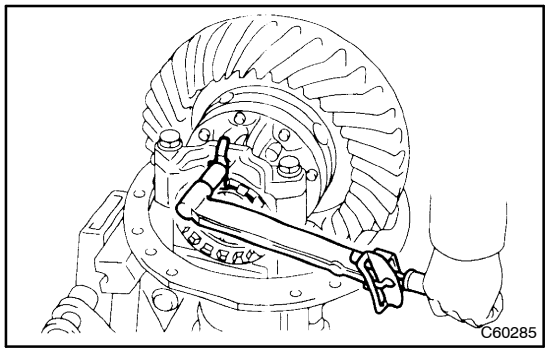
When adjusting with the adjusting nuts, tighten one and another by an equal amount so that the adjustment of the backlash will not be out of order.



(b) Tighten the 2 bearing caps with the 4 bolts.
Torque: 210 N·m (2,150 kgf·cm, 156 ft·lbf)

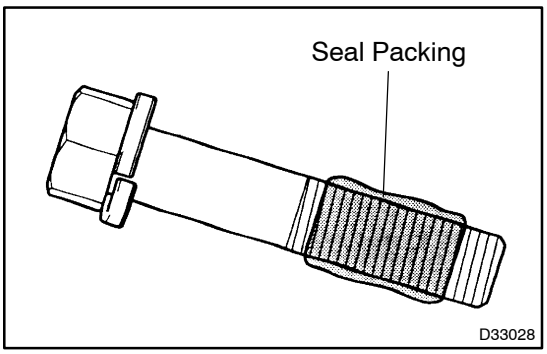
(c) Recheck the total preload.

(d) Recheck the ring gear backlash (see step 37).



40. INSTALL REAR DIFFERENTIAL BEARING ADJUSTING NUT LOCK

(a) Install 2 new nut locks on the bearing caps.
Torque: 22 N·m (225 kgf·cm, 16 ft·lbf)



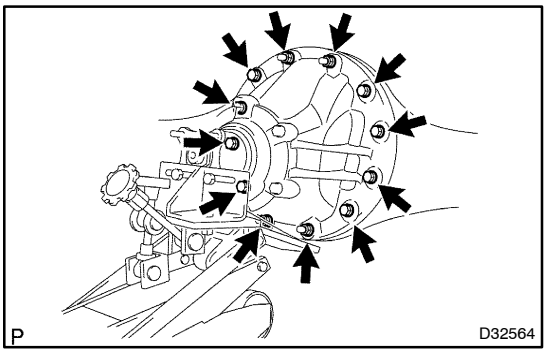
41. INSTALL REAR DIFFERENTIAL CARRIER ASSY

(a) Clean the contact surface of the differential case and rear axle housing.

(b) Apply seal packing to a new gasket, and install that to the rear axle housing.
Seal packing: Three bond 1215 or 1216

(c) Apply seal packing to the differential carrier bolts.
Seal packing: Three bond 1215 or 1216

NOTICE:
Install the bolts within 20 minutes after seal packing is applied.



(d) Using a jack, install the differential carrier into the axle housing with the 8 bolts and 4 nuts.
Torque: 52 N·m (530 kgf·cm, 38 ft·lbf)

42. INSTALL PROPELLER SHAFT ASSY (See pub No. S1–YXZE05A, page 30–4 or 30–11)
43. INSTALL REAR AXLE SHAFT (See pub No. S1–YXZE05A, page 30–72 or 30–75)
44. ADD DIFFERENTIAL OIL (See page 29–3)