# FOREWORD

This workshop manual has been prepared to provide information regarding repair procedures on Hino Vehicles.

Applicable for FD1J, GD1J, FG1J, FL1J, FM1J series, equipped with J08C-TI engine

When making any repairs on your vehicle, be careful not to be injured through improper procedures.
As for maintenance items, refer to the Operation Manual.
All information and specifications in this manual are based upon the latest product information available at the time of printing.
Hino Motors reserves the right to make changes at any time without prior notice.
This manual is divided into 13 sections with a thumb index for each section at the edge of the pages.

Please note that the publications below have also been prepared as relevant service manuals for the components and systems in this vehicles.

| Manual Name | Pub. No. |
|---|---|
| J08C-TI Engine Workshop Manual | S5-YJ08E17A |

Hino Motors, Ltd.

# CHAPTER REFERENCES REGARDING THIS WORKSHOP MANUAL

Use this chart to the appropriate chapter numbers for servicing your particular vehicle.

| CHAPTER | MANUAL NO. | S1-YFDE09A | | | | |
|---|---|---|---|---|---|---|
| | MODELS | FD1J, GD1J, FG1J, FL1J, FM1J | | | | |
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| BRAKE EQUIPMENT | | BR01-001 | BR01-002 | | | |
| SERVICE BRAKE | | BR02-001 | BR02-002 | | | |
| ABS (ANTI-LOCK BRAKE SYSTEM) | | BR03-001 | BR03-002 | | | |
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| WHEEL & TIRE | | AX04-001 | | | | |
| SUSPENSION | | SU02-001 | SU02-002 | SU02-003 | SU02-004 | |
| CHASSIS FRAME | | FC02-001 | | | | |
| CAB | | CA02-001 | | | | |
| ELECTRICAL EQUIPMENT | | EL01-001 | | | | |
| ELECTRIC WIRE | | EL02-001 | | | | |
| BRAKE CONTROL (ABS) | | DN03-001 | DN03-002 | | | |
| BRAKE CONTROL (ES START) | | DN03-003 | | | | |
| BRAKE CONTROL (ELECTROMAGNETIC RETARDER) | | DN03-004 | | | | |

This manual does not contain items on half-tone dot meshing.

HINO

# WORKSHOP MANUAL

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# GENERAL INTRODUCTION (CHASSIS) GN02-001

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# GENERAL INTRODUCTION

## GENERAL PRECAUTIONS

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**Some recommended and standard maintenance services for your vehicle are included in this section. When performing maintenance on your vehicle be careful not to get injured by improper work. Improper or incomplete work can cause a malfunction of the vehicle which may result in personal injury and/or property damage. If you have any question about performing maintenance, please consult your Hino dealer.**

| CAUTION |
|---|
| **When working on your vehicle, observe the following general precautions to prevent personal injury and/or property damage in addition to the particular NOTICES or CAUTIONS in each chapter.**<br>• **Always wear safety glasses or goggles to protect your eyes.**<br>• **Remove rings, watches, ties, loose hanging jewelry and loose clothing before starting work on the vehicle.**<br>• **Bind long hair securely behind the head.**<br>• **When working on the vehicle, apply the parking brake firmly, place the gear shift lever in "Neutral" or "N" and block the wheels.**<br>• **Always turn off the starter switch to stop the engine, unless the operation requires the engine running. Removing the key from the switch is recommended.**<br>• **To avoid serious burns, keep yourself away from hot metal parts such as the engine, exhaust manifold, radiator, muffler, exhaust pipe and tail pipe.**<br>• **Do not smoke while working on the vehicle since fuel, and gas from battery are flammable.**<br>• **Take utmost care when working on the battery. It contains corrosive sulfuric acid.**<br>• **Large electric current flows through the battery cable and starter cable. Be careful not to cause a short which can result in personal injury and/or property damage.**<br>• **Read carefully and observe the instructions specified on the jack before using it.**<br>• **Use safety stands to support the vehicle whenever you need to work under it. It is dangerous to work under a vehicle supported only by a jack.**<br>• **When the cab is raised, always lock the cab stopper stay lock pin with the safety stopper. When the cab is lowered, always insert the stopper pin firmly to lock the cab lock lever.**<br>• **If it is necessary to run the engine after the cab is raised (tilted), make sure that the parking brake is firmly applied, the wheels are blocked, and the gear shift lever is positioned in "Neutral" before staring the engine.**<br>• **Run the engine only in a well-ventilated area to avoid inhalation of carbon monoxide.**<br>• **Keep yourself, your clothing and your tools away from moving parts such as the cooling fan and V-belts when the engine is running.**<br>• **Be careful not to damage lines and hoses by stepping or holding your feet on them.**<br>• **Be careful not to leave any tool in the engine compartment. The tool may be hit by moving parts, which can cause personal injury.** |

## TOWING

- When being towed, always place the gear shift lever in "Neutral" and release the parking brake completely. In order to protect the bumper, fit a protection bar against the lower edge of the bumper and put a wood block under the frame near the No. 1 cross member when attaching the towing chain. Never lift or tow the vehicle if the chain is in direct contact with the bumper.

**1. Towing procedures**

(1) Make sure that the propeller shaft of the vehicle to be towed is removed. When the differential gear or rear axle shaft is defective, remove both right and left rear axle shafts, then cover the hub opening to prevent loss of axle lubricant and entry of dirt or foreign matter.

(2) Use a heavy duty cable or rope when towing the vehicle. Fasten the cable securely to the towing hook on the frame.

(3) The angle of pulling direction of the cable fastened to the towing hook must not exceed 15 in horizontal and vertical directions from the straight ahead, level direction. Avoid using the hook in a way that subjects it to jerk, as in towing a vehicle trapped in a gutter.
(4) Keep the gear shift lever in Neutral.
(5) Make sure that the starter switch is kept in the "ON" position, if the engine is not running.
(6) Make sure that the engine of the towed vehicle is kept running. If the engine is off, no compressed air/ no vacuum will be available for the brake. This is dangerous, as the brake system does not function if the engine is not running.
In addition, the power steering system will not function. The steering wheel, therefore, will become unusually hard to turn, making it impossible to control the vehicle.
(7) Note that the engine brake and exhaust brake cannot be applied, if the propeller shaft is removed.
(8) Make a slow start to minimize shock. Towing speed should be less than 30 km/h {18 mile/h}.

**2. If the engine of the towed vehicle is defective, make sure that the vehicle is towed only by a tow truck designed for that purpose.**
(1) Front end towing (with front wheels raised off the ground)
When towing from the front end with the front wheels raised off the ground, remove the rear axle shafts to protect the transmission and differential gears from being damaged. The hub openings should be covered to prevent the loss of axle lubricant or the entry of dirt or foreign matter. The above-mentioned precautions should be observed for vehicles equipped with either manual or automatic transmission, and for even short distance towing. After being towed, check and refill the rear axle housing with lubricant if necessary.
(2) Rear end towing
When being towed with the rear wheels raised off the ground, fasten and secure the steering wheel in a straight-ahead position.

# HOW TO USE THIS WORKSHOP MANUAL

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This workshop manual is designed as a guide for servicing the vehicle.
An INDEX is provided on the first page of each chapter.

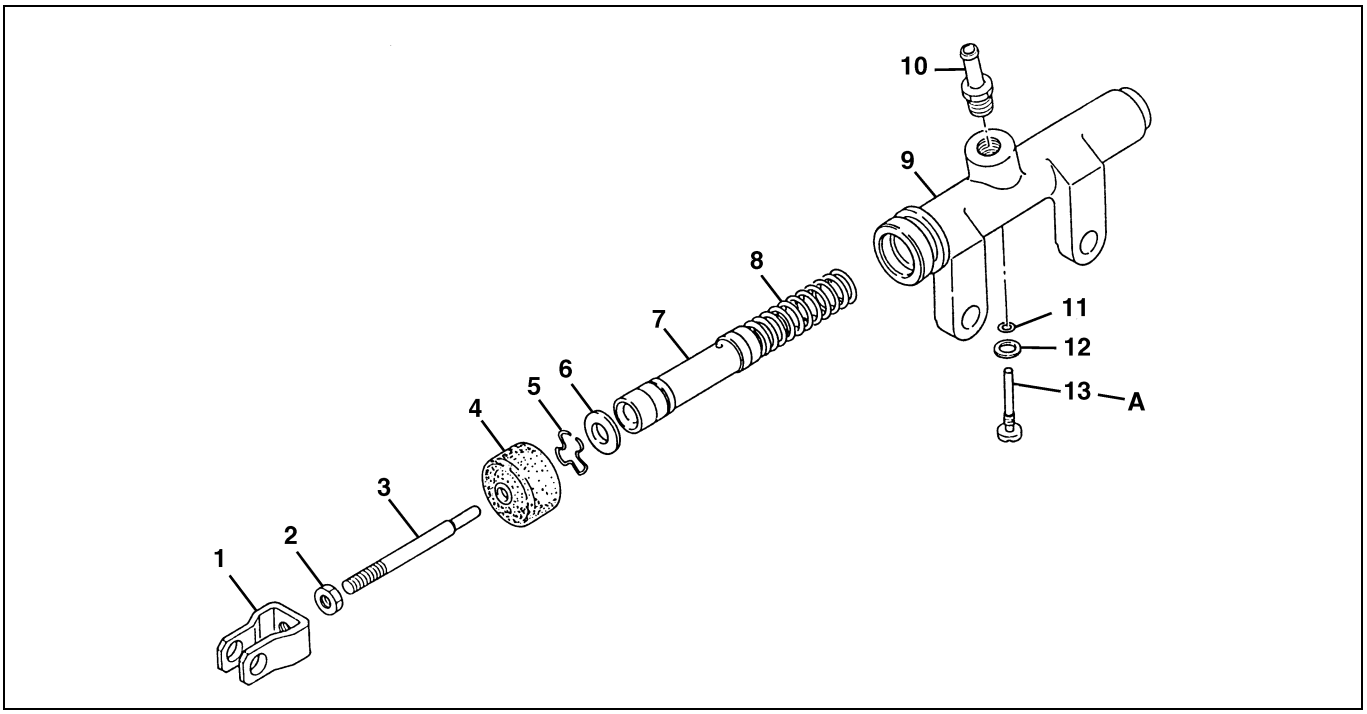
TROUBLESHOOTING is dealt with in each chapter.
When beginning operations, refer to the TROUBLESHOOTING section for a guide to appropriate diagnosis.

SPECIAL TOOL is dealt with in each chapter.
When ordering a special tool, confirm the part number with the applicable parts catalog.

- **RERAIR PROCEDURES**
Repair procedures when self-explanatory, such as simple installation and removal of parts, have been omitted. Illustrations, such as the one below, have been provided to make such simple procedures clear. Only essential procedures requiring specific directions have been dealt with explicitly.

## MAIN CYLINDER

EXAMPLE:



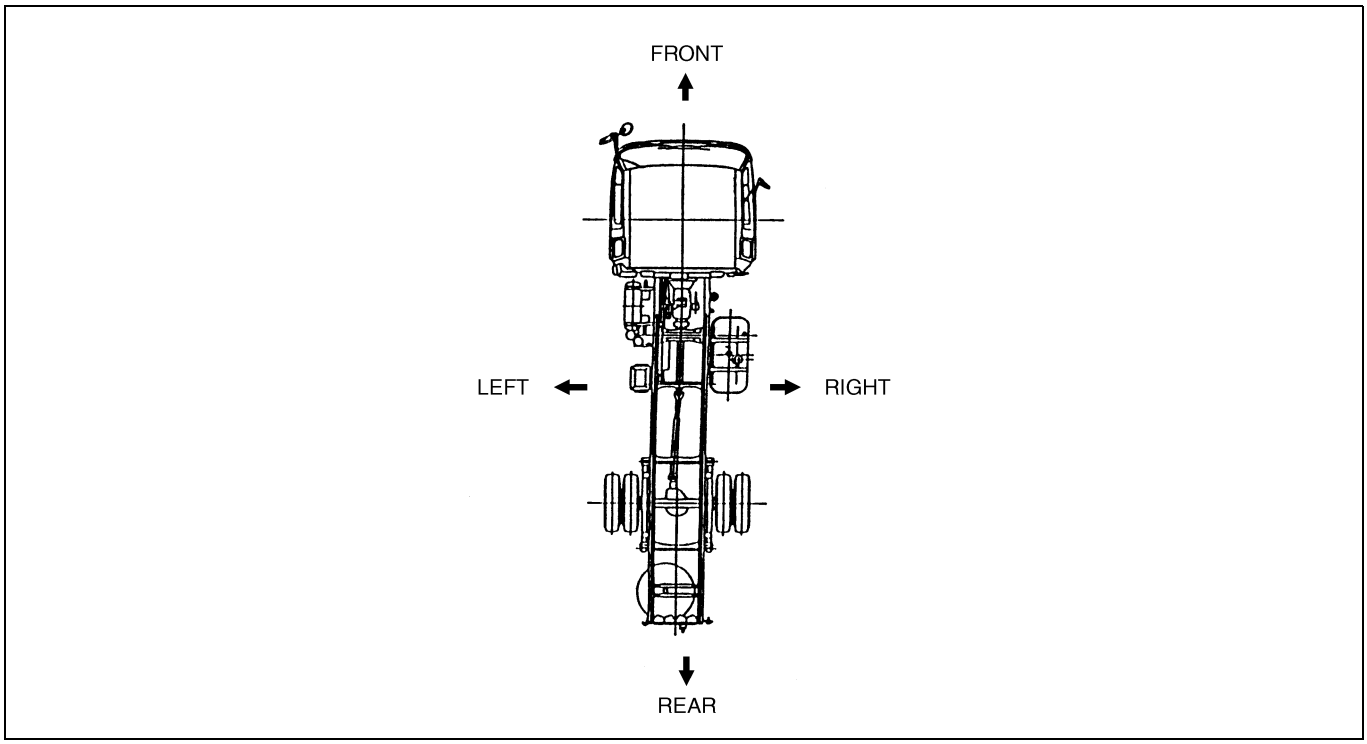

M00020100002

| | | | |
|---|---|---|---|
| 1 | Clevis | 8 | Return spring |
| 2 | Lock nut | 9 | Body |
| 3 | Push rod | 10 | Hose joint |
| 4 | Boot | 11 | O-ring |
| 5 | Retainer ring | 12 | Soft washer |
| 6 | Thrust washer | 13 | Bolt |
| 7 | Piston | | |

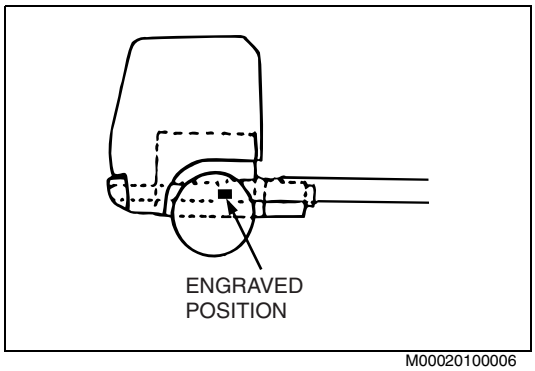
**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| 1 | 2.5-4.4 {25-45, 1.8-3.2} | | |

In some cases, illustrations may be of parts which differ in some nonessential way from the parts found on your particular vehicle. In such cases, the principle or procedure being illustrated applies regardless of such nonessential differences.




- **DEFINITION OF TERMS**
  Definition of vehicle right and left.
  Right and left refers to the left and right sides of the vehicle as seen while looking down the center line from the rear towards the front.




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# IDENTIFICATION INFORMATION

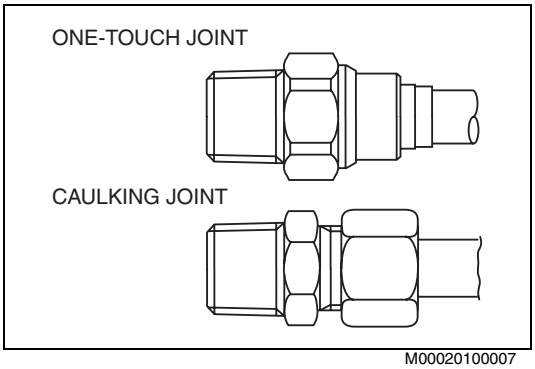
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- **IDENTIFICATION INFORMATION**
  These numbers are used for identification purposes when you have a vehicle registered or inspected. Please quote these numbers when ordering spare parts or reporting technical matter to receive prompt service attention.
- CHASSIS SERIAL NUMBER
  Chassis serial number is engraved on the left side frame near the front wheel.

# NYLON TUBE REPLACEMENT METHOD

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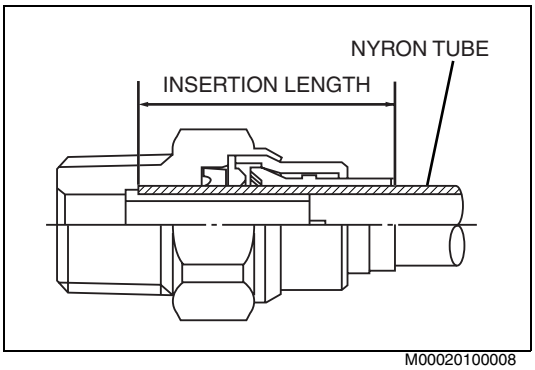
## NYLON TUBE REPLACEMENT METHOD




M00020100007

- In this vehicle, nylon tubes are used for all the air tubes except those on the charge line and the rear axle, the tubing for the wheel power signal, a portion of the accessory system tubing, and for the unloader tubing, and it is also used in joints, depending on the connection conditions of the two types of joints; one-touch joints and caulking joints.

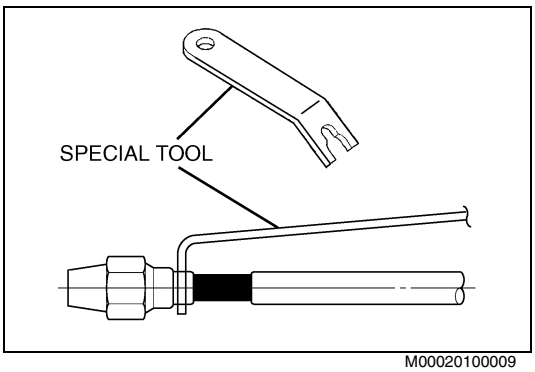
**NOTICE:**
**Since the function and quality of nylon tubes and joints are guaranteed as tube and joint sets, the use of parts other than Hino Genuine Parts must be avoided.**




M00020100008

**1. ONE-TOUCH JOINT NYLON TUBE INSERTION LENGTH**

| DIAMETER (Outside diameter x inside diameter) | INSERTION LENGTH mm {in.} |
|---|---|
| 6 x 4 | 20 {0.79} |
| 10 x 7.5 | 20 {0.79} |
| 12 x 9 | 21 {0.83} |

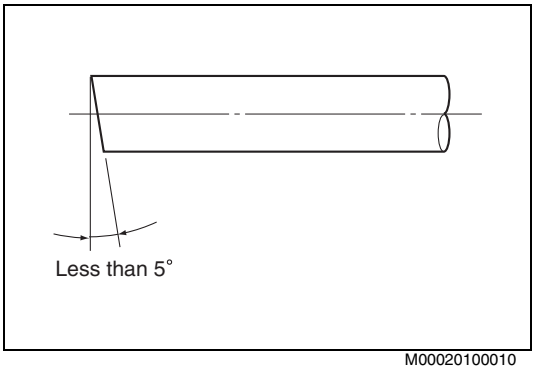



M00020100009

**2. REMOVAL OF A ONE-TOUCH JOINT**

(1) Make sure there is no dirt or grease stuck to the connector end. If the end is dirty, clean it thoroughly by air blowing or other means.

(2) Using the special tool for removing the nylon tube to push the connector end, pull off the nylon tube with your hand in one stroke, without stopping partway, pulling the tube in the connector axial direction.
**SST: Puller (09421-1490)**




M00020100010

## INSTALLATION OF A ONE-TOUCH JOINT AND CAULKING JOINT

- Make sure the joint interior is free of dirt grease. If the interior is dirty, clean it thoroughly by air blowing or other means.
- Cut off the tube end where the tube surface is scarred by the joint pinch marks, and make sure that the part of the tube inserted into the joint has no surface damage. If the tube is damaged, cut off the damaged part (provided that the tube length is more than sufficient).

**NOTICE:**
**Use the special nylon tube cutter when cutting the nylon tube, and cut the tube so that the angle of the cut end to the axial center is 85-95°.**

**1. INSTALLATION OF A ONE-TOUCH JOINT**

- Before inserting the tube, mark the insertion length on the tube with a white-out pen or similar implement, in accordance with the dimensions, "ONE-TOUCH JOINT NYLON TUBE INSERTION LENGTH." Then insert the tube firmly in place as far as the marked point.

**2. INSTALLATION OF A CAULKING JOINT**

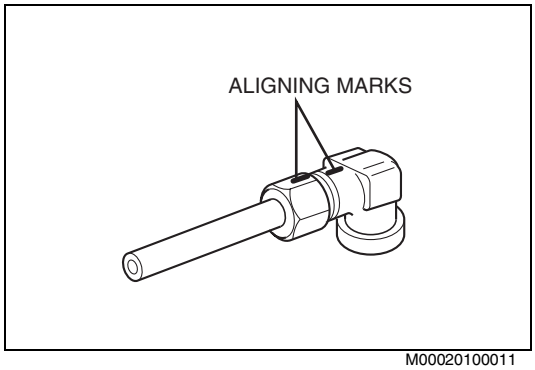
- Press in the tube so that it does not move (will not come out), and tighten the sleeve nut with the tightening tool to the torque shown in the following table.

**3. NYLON TUBE NUT TIGHTENING TORQUE**

**Unit: ·N·m {kgf·cm, lbf·ft}**

| NUT DIAMETERS | TIGHTENING TORQUE |
|---|---|
| M6 x 1 | 20-25 {200-260, 15-18} |
| M10 x 1.25 | 35-44 {350-450, 26-32} |
| M12 x 1.5 | 50-58 {500-600, 37-43} |
| M15 x 1.5 | 54-58 {550-600, 40-43} |

**NOTICE:**
**Nuts must be tightened to 5°- 35°C.**



M00020100011

**4. ASSEMBLING THE CAULKING JOINT (AFTER THE TUBE HAS FIRST BEEN REMOVED FROM THE JOINT AND THEN RE-INSTALLED IN THE SAME PLACE)**

(1) Make aligning marks on the connector and union to mark their positions before loosening the nut.

(2) When re-assembling the joint, tighten the nut until the pre-disassembly position (position of aligning marks) is reached, and then tighten the nut 60° more.

(3) Always check air leakage after assembling the joint. If air is leaking from the joint, continue tightening the sleeve nut until the leak stops.

(4) If the air leak does not stop, replace the tube, sleeve, and insert with new parts. If the air leak still continues, replace the nut and connector / union.

**NOTICE:**

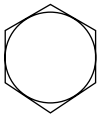
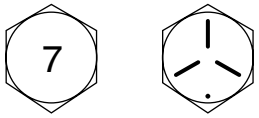
- **During repair or other work, make sure the temperature limit of the nylon tube is within -40-90°C, especially during paint drying work.**
- **During boring, welding, sanding, and other work, protect nylon tubes from tools, cuts, heat sources, and sparks, or remove the nylon tubes beforehand.**
- **Do not attach a welding equipment clamp near a nylon tube.**
- **Do not pour battery fluid or other acidic fluid on a nylon tube.**
- **Do not bend a nylon tube beyond the nylon tube bending radius R values shown in the following table. Also, do not use the remaining portion of a tube that has broken due to overbending.**

| OUTSIDE DIAMETER OF TUBE | MINIMUM BENDING RADIUS DURING HANDLING: R mm {in.} |
|---|---|
| 6 | 30 {1.18} |
| 10 | 65 {2.56} |
| 12 | 70 {2.76} |

# SPECIFIED TORQUE FOR STANDARD BOLTS AND NUTS

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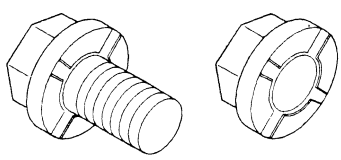
Unit: N·m {kgf·cm, lbf·ft.}

| Class | 4T | 7T | 9T |
|---|---|---|---|
| Representation / Diameter |  No Mark |   |   |
| M6 | 4.4-6.6 {45-67, 3.3-4.8} | 7.2-10.8 {74-110, 5.4-7.9} | 9.5-13.5 {94-140, 6.8-10.1} |
| M8 | 11.5-16.5 {114-172, 8.3-12.4} | 18.0-26.0 {179-269, 13.0-19.4} | 23.5-34.5 {237-355, 17.2-25.6} |
| M10 | 22.0-32.0 {221-331, 16.0-23.9} | 34.5-51.5 {351-527, 25.4-38.1} | 46.0-68.0 {466-698, 33.7-50.4} |
| M12 | 38.5-57.5 {392-588, 28.4-42.5} | 61.0-91.0 {621-931, 44.9-67.3} | 80.0-120.0 {816-1,224, 59.0-88.5} |
| M14 | 62.0-92.0 {629-943, 45.5-68.1} | 96.0-144.0 {976-1,464, 70.6-105.8} | 128.0-192.0 {1,304-1,956, 94.3-141.4} |
| M16 | 96.0-144.0 {976-1,464, 70.6-105.8} | 152.0-228.0 {1,552-2,328, 112.3-168.3} | 200.0-300.0 {2,040-3,060, 147.5-221.2} |
| M18 | 132.0-198.0 {1,344-2,016, 97.2-145.7} | 208.0-312.0 {2,120-3,180, 153.3-229.9} | 276.0-414.0 {2,816-4,224, 203.6-305.4} |
| M20 | 188.0-282.0 {1,920-2,880, 138.8-208.2} | 296.0-444.0 {3,024-4,536, 218.7-327.9} | 392.0-588.0 {4,000-6,000, 289.3-433.8} |
| M22 | 256.0-384.0 {2,616-3,924, 189.2-283.7} | 405.0-605.0 {4,120-6,180, 297.9-446.8} | 540.0-800.0 {5,470-8,210, 395.5-593.6} |
| M24 | 324.0-486.0 {3,304-4,956, 238.9-358.3} | 515.0-765.0 {5,220-7,840, 377.5-566.8} | 680.0-1,010.0 {6,900-10,340, 499.0-747.6} |

# SPECIFIED TORQUE FOR FLANGE BOLTS AND NUTS

M00020101BEC1006

Unit: N·m {kgf·cm, lbf·ft.}

| Class / Diameter | 7T | 9T | Shape |
|---|---|---|---|
| M10 | 41.5-61.5 {421-631, 30.5-45.6} | 55.0-82.0 {560-840, 40.5-60.7} |  |
| M12 | 73.0-109.0 {744-1,116, 53.8-80.7} | 96.0-114.0 {979-1,469, 70.8-106.2} | |

# CLUTCH MAIN UNIT (CS350)

CL02-001

**CLUTCH ASSEMBLY (CS350) ..... CL02-2**
DATA AND SPECIFICATIONS .....CL02-2
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TROUBLESHOOTING .....CL02-4
SPECIAL TOOL .....CL02-5
COMPONENT LOCATOR.....CL02-6
OVERHAUL .....CL02-7
INSPECTION AND REPAIR .....CL02-13

# CLUTCH ASSEMBLY (CS350)

## DATA AND SPECIFICATIONS

M02020103BEI2002

**CLUTCH FACING**

Unit: mm {in.}

| Material | Molded non-asbestos | Sintered metal (Ceramic metal) |
|---|---|---|
| Type | Dry single plate with damper spring | |
| Outside diameter | 350 {13.780} | |
| Inside diameter | 220 {8.661} | |
| Thickness | 4.5 {0.1772} | 4.41 {0.1736} |

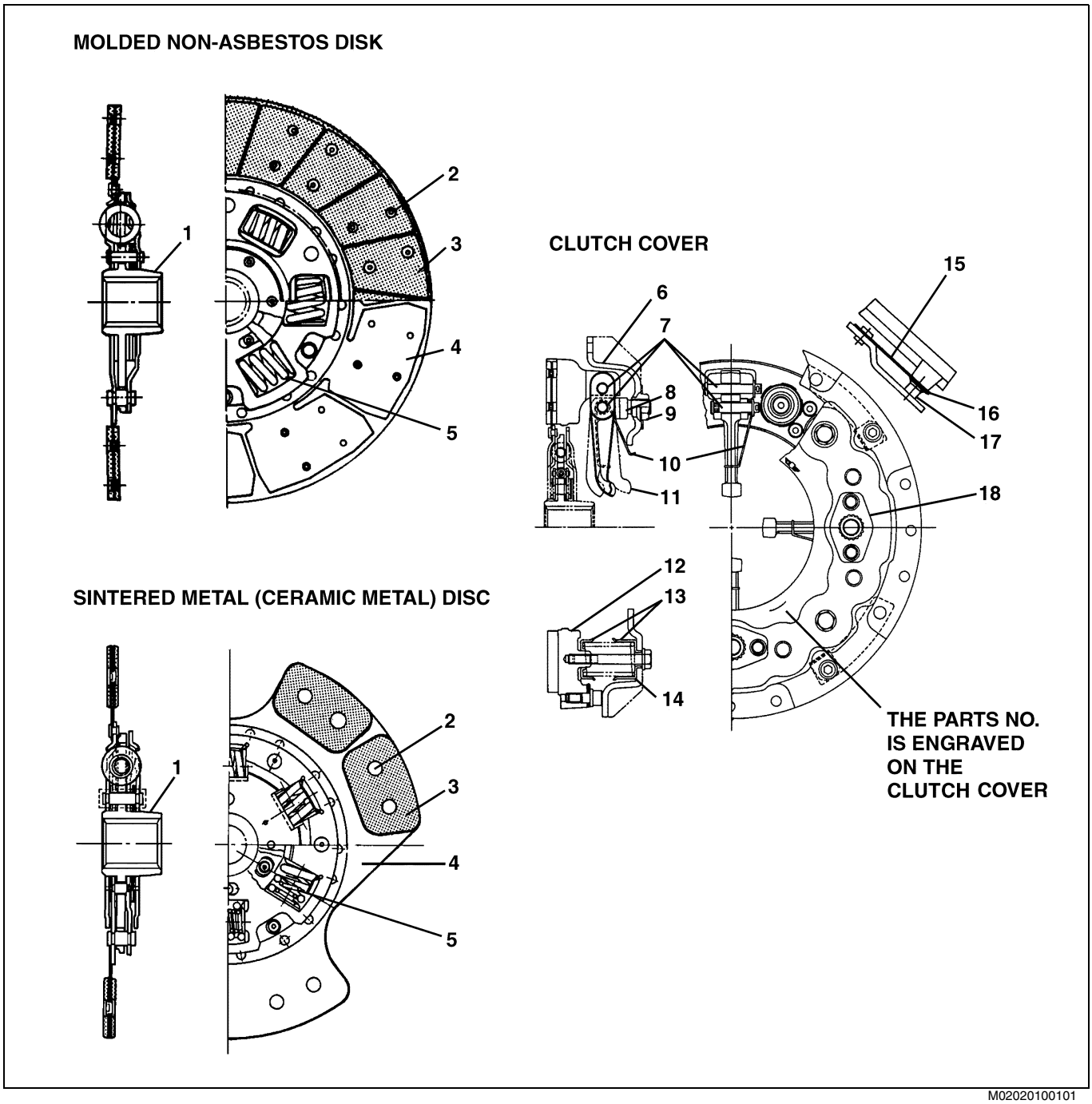
**COMPRESSION SPRING**

Unit: mm {in.}

| | |
|---|---|
| Clutch cover parts No. | 2730 |
| Free length | 83.4 {3.283} |
| Coil outside diameter | 30.5 {1.201} |
| Diameter of wire | 5.5 {0.217} |
| Quantity | 12 |
| Setting load | 1,243.5 N {126.8 kgf, 279.5 lbf} |
| Setting length | 54.8 {2.157} |

# DESCRIPTION

M02020103BEC1002




M02020100101

| | | | |
|---|---|---|---|
| 1 | Clutch disc hub | 10 | Torsion spring |
| 2 | Rivet | 11 | Release lever |
| 3 | Clutch facing | 12 | Pressure plate |
| 4 | Clutch plate | 13 | Spring seat |
| 5 | Damper spring | 14 | Compression spring |
| 6 | Clutch cover | 15 | Strap plate |
| 7 | Release lever pin | 16 | Friction washer |
| 8 | Release lever support | 17 | Strap plate bolt |
| 9 | Release lever support nut | 18 | Lock plate |

# TROUBLESHOOTING

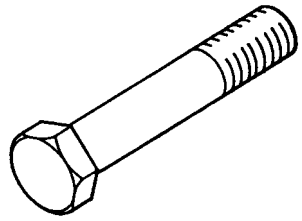
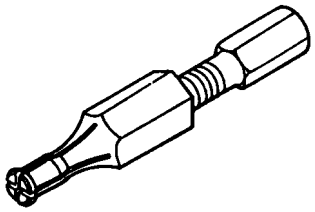
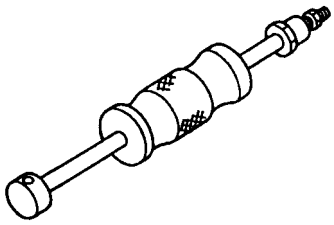
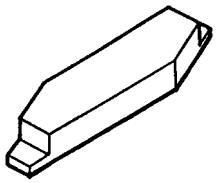
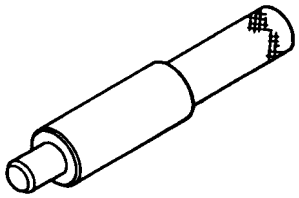
M02020103BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Clutch dragging** | Clutch disc distorted or warped. | Replace clutch disc. |
| | Release lever incorrectly adjusted. | Adjust release lever. |
| | Transmission input shaft worn. | Replace input shaft and check clutch hub for excessive wear. If worn, replace disc. Check flywheel housing alignment. |
| **Clutch slipping** | Release lever and release bearing clearance incorrectly adjusted. | Adjust clearance. |
| | Clutch disc facing gummed with oil or grease. | Replace facing or disc assembly. |
| | Release bearing worn. | Replace bearing. |
| | Clutch pedal free-play incorrectly adjusted. | Adjust free-play. |
| | Compression spring weak. | Replace compression spring. |
| | Clutch facing worn. | Replace facing or disc assembly. |
| **Vehicle vibrates when starting.** | Improper engine idling. | Adjust idling. |
| | Clutch control incorrectly adjusted. | Adjust clutch control. |
| | Clutch disc facing gummed with oil or grease. | Replace facing or disc assembly. |
| | Glazed flywheel friction surface. | Unglazed flywheel surface with coarse emery cloth, stroking parallel to machining lines. |
| | Clutch disc distorted or warped. | Replace disc. |
| | Improper clutch cover tightening. | Tighten bolts. |
| | Flywheel housing misalignment. | Replace flywheel housing. |
| | Release lever incorrectly adjusted. | Adjust release lever. |
| **Noisy clutch** | Release bearing worn or dried. | Replace release bearing. |
| | Pilot bearing worn. | Replace pilot bearing. |
| | Clutch disc distorted or warped. | Replace clutch disc. |
| | Flywheel housing misalignment. | Replace flywheel housing. |
| | Transmission input shaft or clutch disc spline worn. | Clean and lubricate or replace. |
| | Release lever incorrectly adjusted. | Adjust release lever. |
| | Insufficient lubrication of pedal and its accessories. | Lubricate. |
| | Insufficient lubrication of release bearing hub. | Lubricate. |
| | Transmission input shaft retainer rusted or soiled. | Clean or replace if rusted. |
| | Clutch pedal free-play incorrectly adjusted. | Adjust free-play. |
| **Clutch pedal can not be depressed.** | Clutch control incorrectly adjusted. | Adjust clutch control. |
| | Insufficient lubricant release bearing hub. | Lubricate. |
| **Change in clutch pedal give.** | Air trapped in clutch fluid. | Bleed air. |

# SPECIAL TOOL

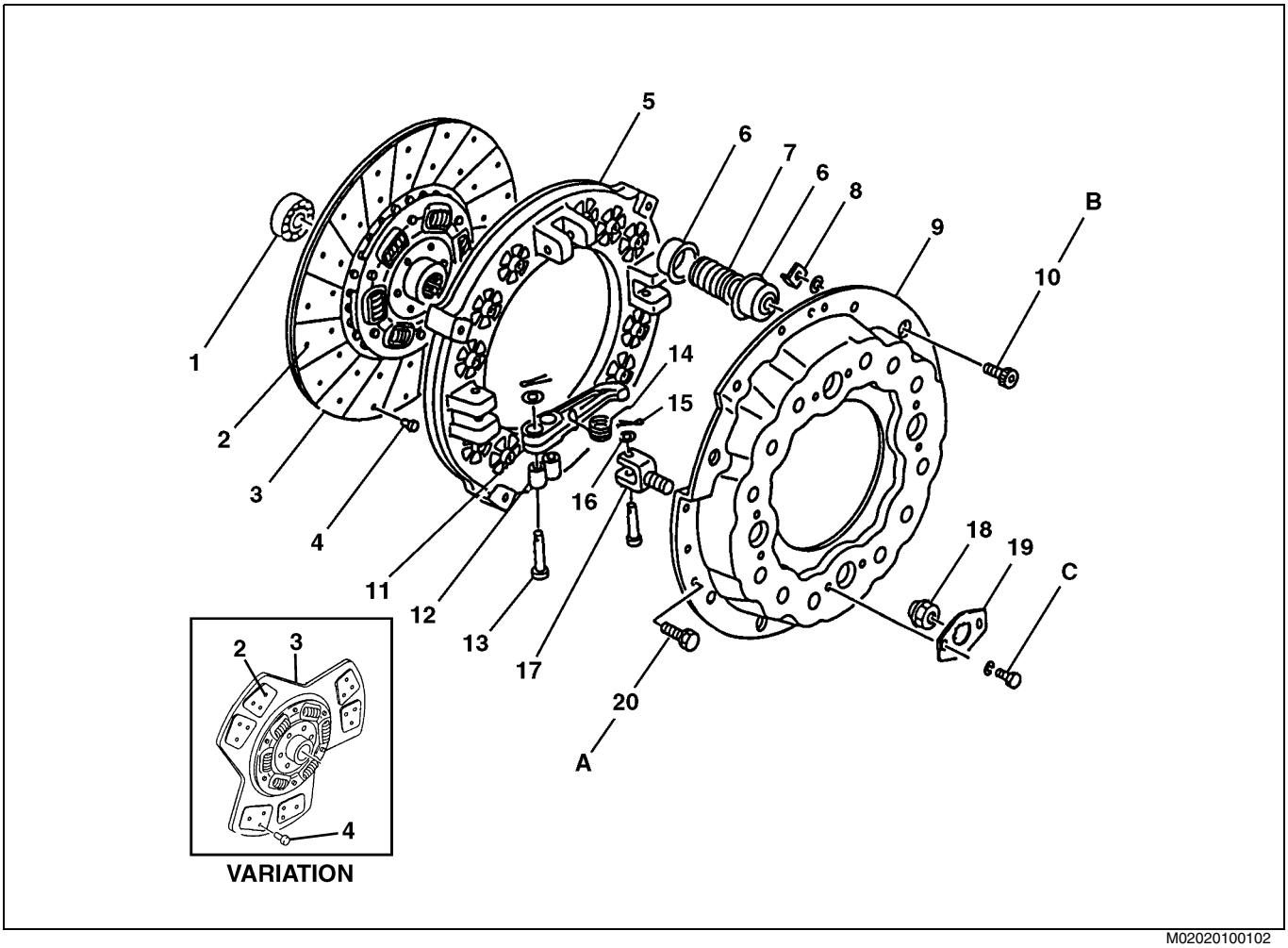
M02020103BEK1001

Prior to starting a clutch main unit overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 9010-10700 | CLUTCH PRESSURE PLATE FIXING BOLT | |
|  | 9260-10240 | PLAIN WASHER | |
|  | 09650-1970 | CLUTCH PILOT BEARING PULLER | |
|  | 09420-1442 | SLIDING HAMMER | |
|  | 09661-1030 | CLUTCH RELEASE LEVER HEIGHT GAUGE | |
|  | 09662-1200 | CLUTCH ALIGNING ARBOR | |

# COMPONENT LOCATOR

M02020103BED1002




M02020100102

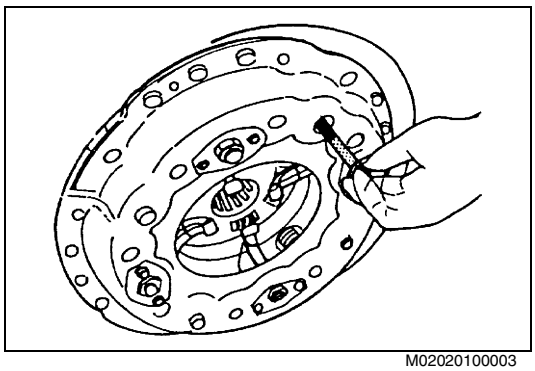
| | | | |
|---|---|---|---|
| 1 | Pilot bearing | 11 | Release lever |
| 2 | Clutch facing | 12 | Bushing |
| 3 | Disc assembly | 13 | Release lever pin |
| 4 | Rivet | 14 | Torsion spring |
| 5 | Pressure plate | 15 | Cotter pin |
| 6 | Spring seat | 16 | Plain washer |
| 7 | Compression spring | 17 | Release lever support |
| 8 | Friction washer | 18 | Release lever support nut |
| 9 | Clutch cover | 19 | Lock plate |
| 10 | Strap plate bolt | 20 | Fitting bolt |

**Tightening torque** **N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 37.5-48.5 {380-500, 28-36} | C | 11.8-17.7 {120-180, 9-13} |
| B | 39.2-49.0 {400-500, 29-36} | | |

# OVERHAUL

M02020103BEH2001



M02020100003

## IMPORTANT POINT - DISMOUNTING

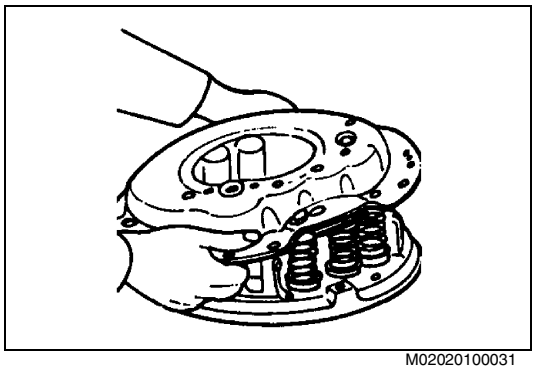
**1. REMOVE THE CLUTCH COVER AND DISC.**

(1) Install the four pressure plate fixing bolts and plain washers through the clutch cover into the tapped holes in the pressure plate.
**SST:**
**Pressure Plate Fixing Bolt (9010-10700)**
**Plain Washer (9260-10240)**

(2) Tighten the bolts in diagonal direction alternately and evenly to the compress the compression springs and release pressure plate tension.

(3) Loosen the fitting bolts.

**CAUTION:**
**When removing the clutch cover and clutch disc, be careful not to drop them on your foot.**



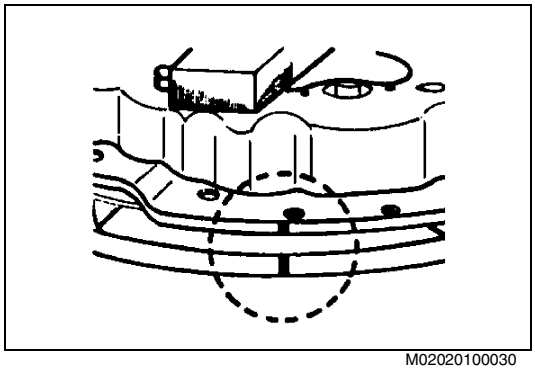
M02020100031

## IMPORTANT POINTS - DISASSEMBLY

**1. DISASSEMBLE THE CLUTCH COVER.**

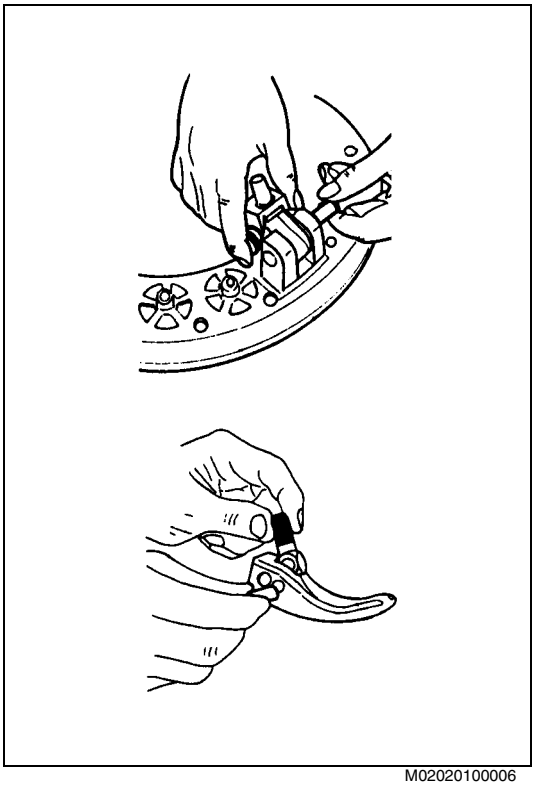
(1) Before removing the special tools and the strap plate bolt, compress the clutch cover to release the compression spring tension.

(2) Slowly release the press.



M02020100030

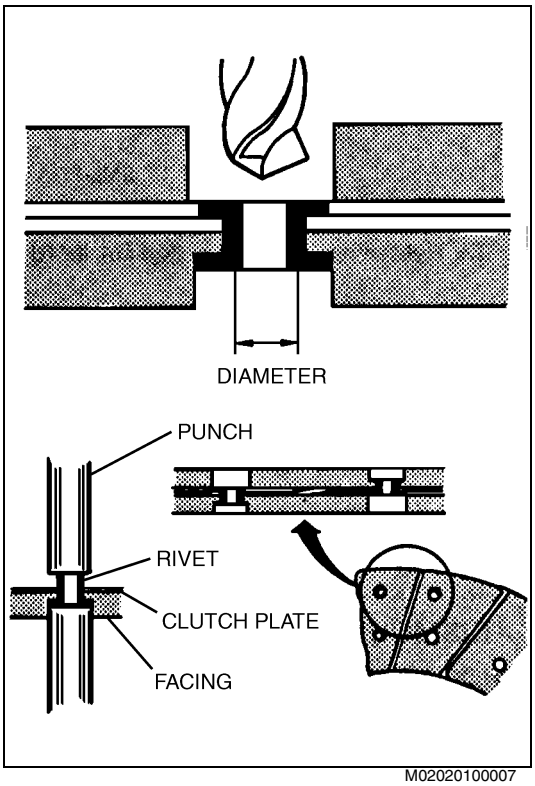
**NOTICE:**
**Before disassembling, make aligning marks on the clutch cover and pressure plate.**



M02020100006

**2. DISASSEMBLE THE RELEASE LEVER ASSEMBLY.**

(1) Remove the pin and the release lever.




M02020100007

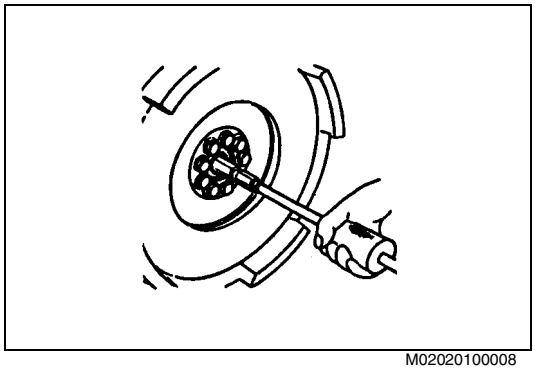
## IMPORTANT POINTS - ASSEMBLY

**1. REPLACE THE CLUTCH FACING.**

(1) Drill off the rivets with a 5 mm {0.197 in.} diameter drill.

**NOTICE:**
**Do not remove the clutch facing with a tapping rod and a hammer or a press.**

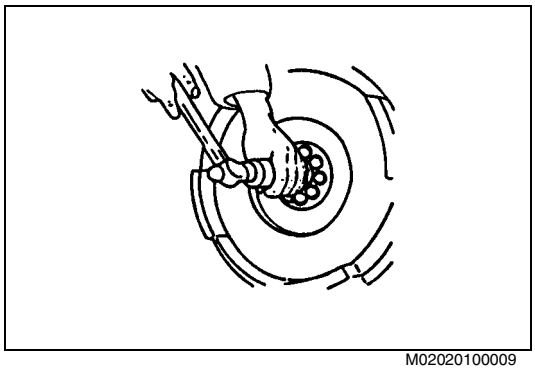
(2) Remove the old facing.
(3) Place the new facing on the clutch plate and insert the rivets into the holes so that the facing is held in position. (Secure the rivets with adhesive tape to prevent loosing them.)
(4) Using a suitable riveter, rivet the new facing. In order to distribute pressure evenly, rivet in diagonal direction alternately.
(5) Using a dial gauge, check the misalignment of the clutch disc after riveting.



M02020100008

**2. REPLACE THE PILOT BEARING.**

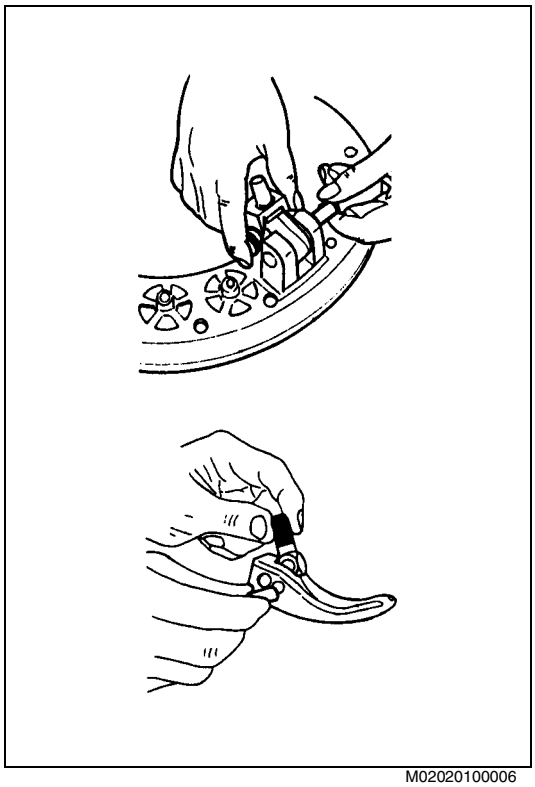
(1) Remove the pilot bearing.
**SST:**
**Pilot Bearing Puller (09650-1970)**
**Sliding Hammer (09420-1442)**



M02020100009

(2) Using a suitable tapping rod, install the pilot bearing.

**NOTICE:**
**After installing the pilot bearing, ensure that it rotates smoothly.**

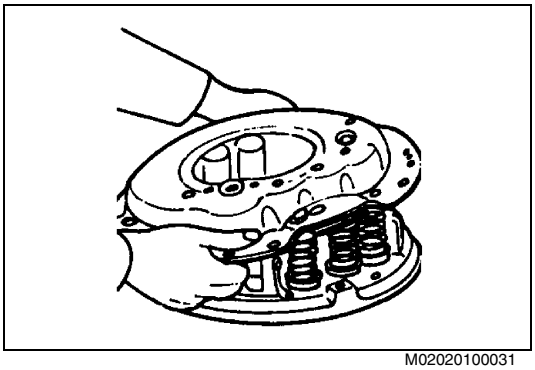


M02020100006

**3. INSTALL THE RELEASE LEVER.**

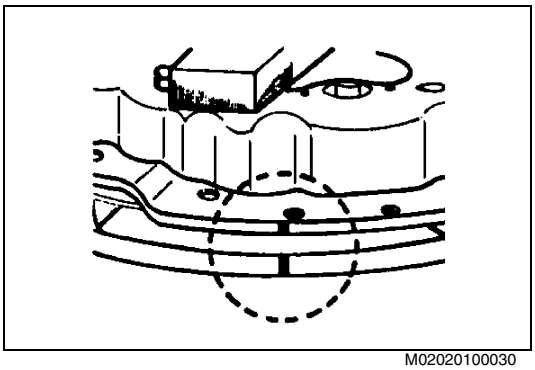
(1) Assemble the release lever, release lever support and torsion spring, then install the release lever assembly on the pressure plate.

**NOTICE:**
- **Do not coat any grease on the bushing.**
- **Coat lithium base grease to the sliding part between the clutch release lever and the pressure plate.**


M02020100031

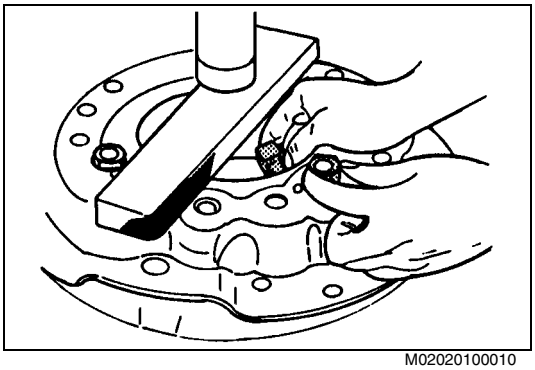
**4. INSTALL THE CLUTCH COVER.**

(1) Install the clutch cover in position according to the aligning marks. Compress the clutch cover to relieve the compression spring tension.


M02020100030

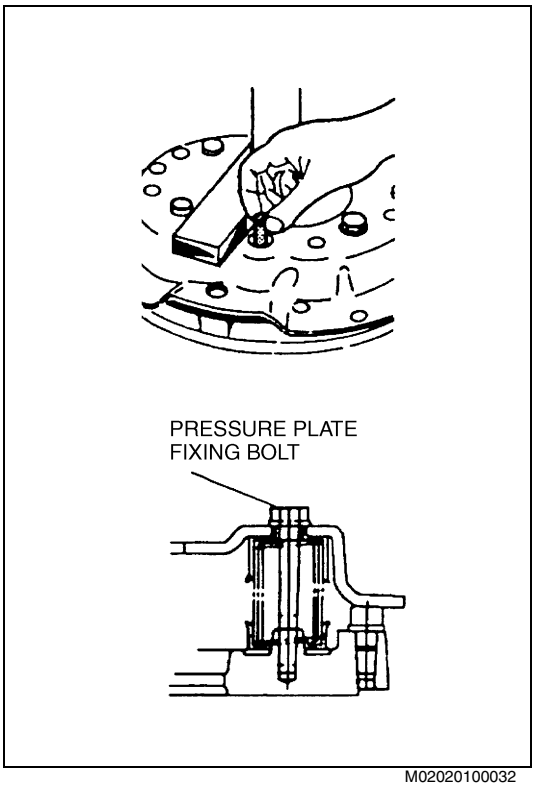
**NOTICE:**

- **When compressing the clutch cover, be sure to hook up the torsion springs between clutch cover and release lever.**
- **When compressing the clutch cover, pull the release lever support up through the holes in the clutch cover.**
- **Be sure to insert the compression spring upper seats in the pressure cover.**


M02020100010

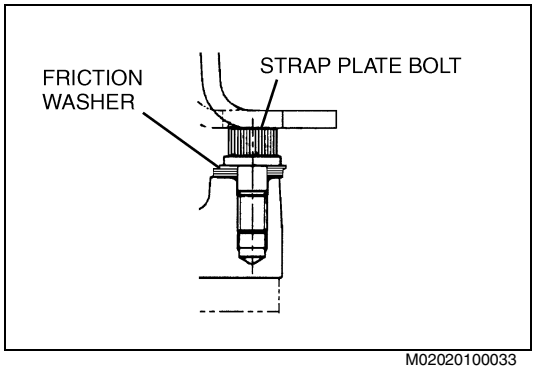
(2) Temporarily tighten the release lever support nuts.

**NOTICE:**
**Coat the spherical seat of the clutch cover and threaded section of the release lever support with a small amount of anti-seizure agent.**



M02020100032

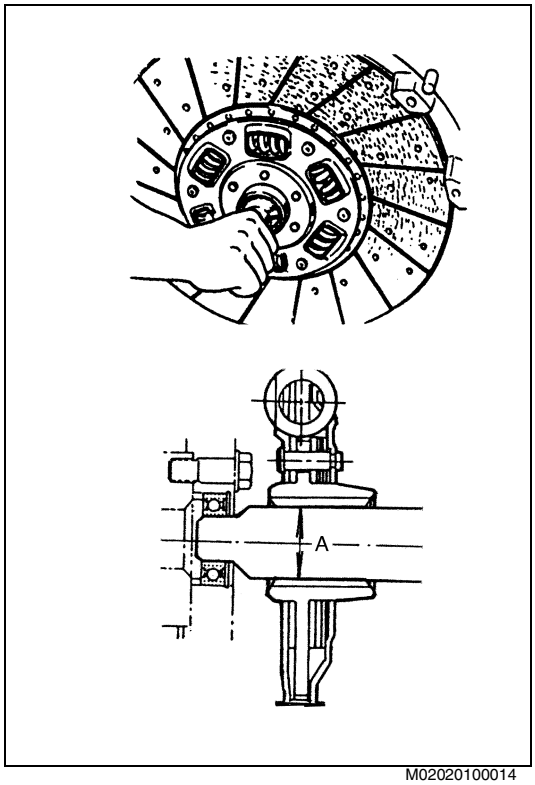
(3) Install the four pressure plate fixing bolts with the plain washers through the clutch cover into the tapped holes in the pressure plate.
**SST:**
**Pressure Plate Fixing Bolt (9010-10700)**
**Plain Washer (9260-10240)**



M02020100033

(4) Install the strap plate bolt with the friction washer and lock washer.

## IMPORTANT POINTS - MOUNTING



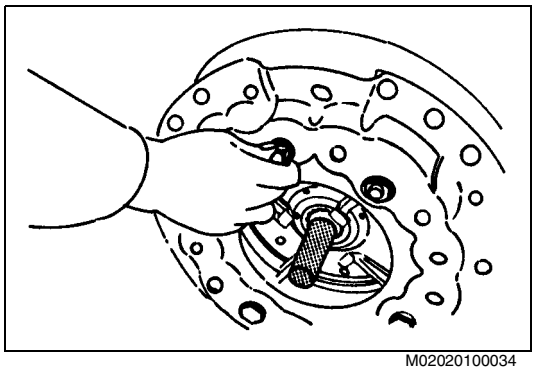
M02020100014

**1. INSTALL THE CLUTCH DISC ON THE FLYWHEEL.**

(1) Insert an aligning arbor or splined input shaft through the clutch disc hub and into the flywheel pilot bearing to position the clutch disc.

**SST: Clutch Aligning Arbor (09662-1200)**

**Disc hub diameter A: 36 mm {1.417 in.}**


M02020100034

**2. INSTALL THE CLUTCH COVER ASSEMBLY.**

(1) Insert the clutch cover aligning pins into each place of the clutch cover.

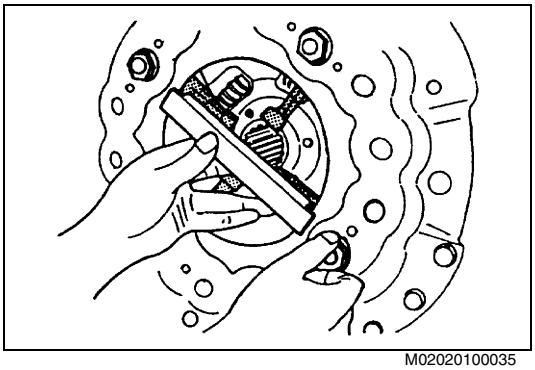
(2) Tighten the bolts evenly. Make several presses around the clutch cover until it is snug.

(3) Remove the pressure plate fixing bolts and plain washer.

(4) Remove the clutch aligning arbor.

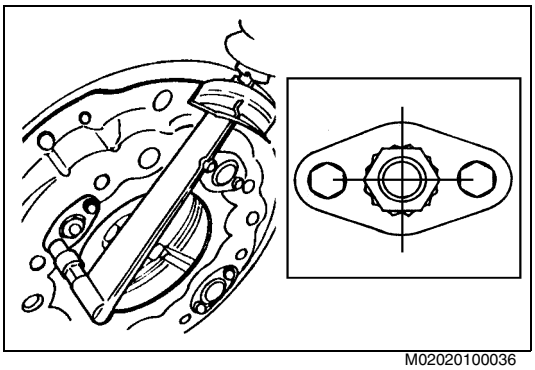
**NOTICE:**

**When installing a new clutch cover assembly, do not forget to remove the four pressure plate fixing bolts from the clutch cover.**


M02020100035

**3. ADJUST THE RELEASE LEVER HEIGHT WHEN INSTALLING A NEW CLUTCH DISC.**

(1) Adjust the clearance of the contact surface between the special tool and the release lever by turning the release lever support nut.
**Clearance: Zero**
**SST: Clutch Release Lever Height Gauge (09661-1030)**


M02020100036

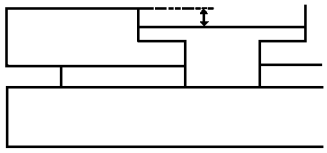
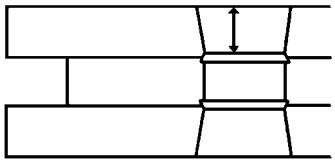
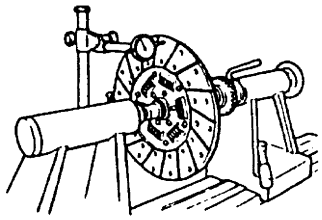
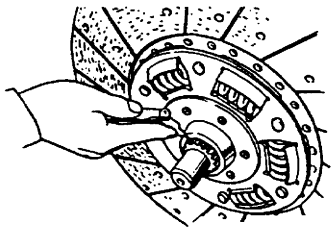
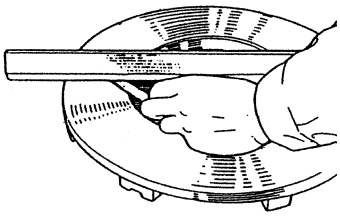
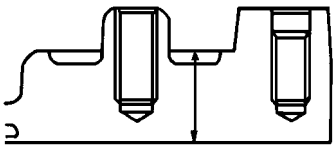
**4. INSTALL THE LOCK PLATE.**

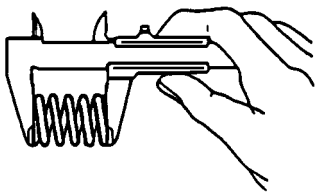
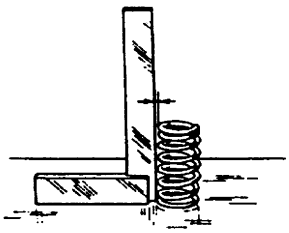
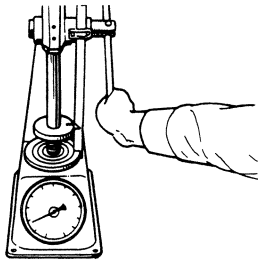
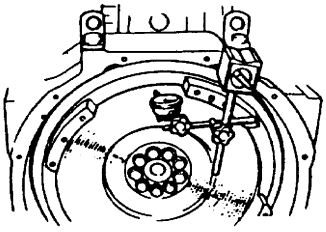
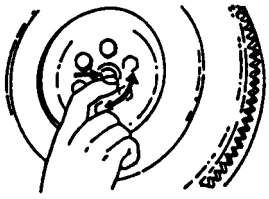
**NOTICE:**
**Be sure to lock the support nut with the lock plate.**

# INSPECTION AND REPAIR

M02020103BEH3002

Unit: mm {in.}

| Inspection item | | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|---|
| Rivet head depth | Molded non-asbestos | 2.2-2.8 {0.0866-0.1102} | 0.1 {0.0039} | Replace disc assembly or facing. | Measure  |
| | Sintered metal (Celamic metal) | 2.4 {0.0945} | 1.2 {0.0472} | Replace disc assembly or facing. | Measure  |
| Clutch disc misalignment | | 0-0.7 {0-0.0275} | 0.7 {0.0275} | Replace. | Measure  |
| Oily facings Loose rivets Broken or loose damper springs | | — | — | Replace disc assembly, if necessary. | Visual check |
| Clearance between clutch disc hub and transmission input shaft spline | | 0.05-0.15 {0.0020-0.0059} | 0.3 {0.0118} | Replace the clutch disc or the transmission input shaft. | Measure  |
| Pressure plate misalignment | | Less than 0.1 {0.0039} | 0.5 {0.0197} | Regrind the friction surface or replace. | Measure  |
| Pressure plate thickness | | 24 {0.945} | 23 {0.906} | Replace. | Measure  |
| Pressure plate friction surface scoring or roughness | | — | — | Regrind the friction surface or replace, if necessary. | Visual check |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Compression spring free length | 83.4 {3.283} | 79.2 {3.118} | Replace. | Measure  |
| Compression spring squareness | — | 5.0 {0.197} | Replace. | Measure  |
| Compression spring setting load at the specified setting length | 1,243.5 N {126.8 kgf, 279.5 lbf} at 54.8 {2.157} | 1,181.3 N {120.5 kgf, 266 lbf} at 54.8 {2.157} | Replace. | Measure  |
| Flywheel misalignment | — | 0.15 {0.059} | Regrind the friction surface or replace. | Measure  |
| Flywheel friction surface scoring or roughness | — | — | Regrind the friction surface or replace, if necessary. | Visual check |
| Pilot bearing improper rotation | — | — | Replace, if necessary. | Visual check  |

# CLUTCH MAIN UNIT (CS380)

CL02-002

**CLUTCH ASSEMBLY (CS380) ..... CL02-2**
DATA AND SPECIFICATIONS .....CL02-2
DESCRIPTION .....CL02-3
TROUBLESHOOTING .....CL02-4
SPECIAL TOOL .....CL02-5
COMPONENT LOCATOR.....CL02-6
OVERHAUL .....CL02-7
INSPECTION AND REPAIR .....CL02-12

# CLUTCH ASSEMBLY (CS380)

## DATA AND SPECIFICATIONS

M02020104BEI2001

**CLUTCH FACING**

Unit: mm {in.}

| | |
|---|---|
| **Material** | **Semi-molded non-asbestos** |
| **Type** | **Dry single plate with damper spring** |
| **Outside diameter** | **380 {14.961}** |
| **Inside diameter** | **220 {8.661}** |
| **Thickness** | **5.0 {0.197}** |

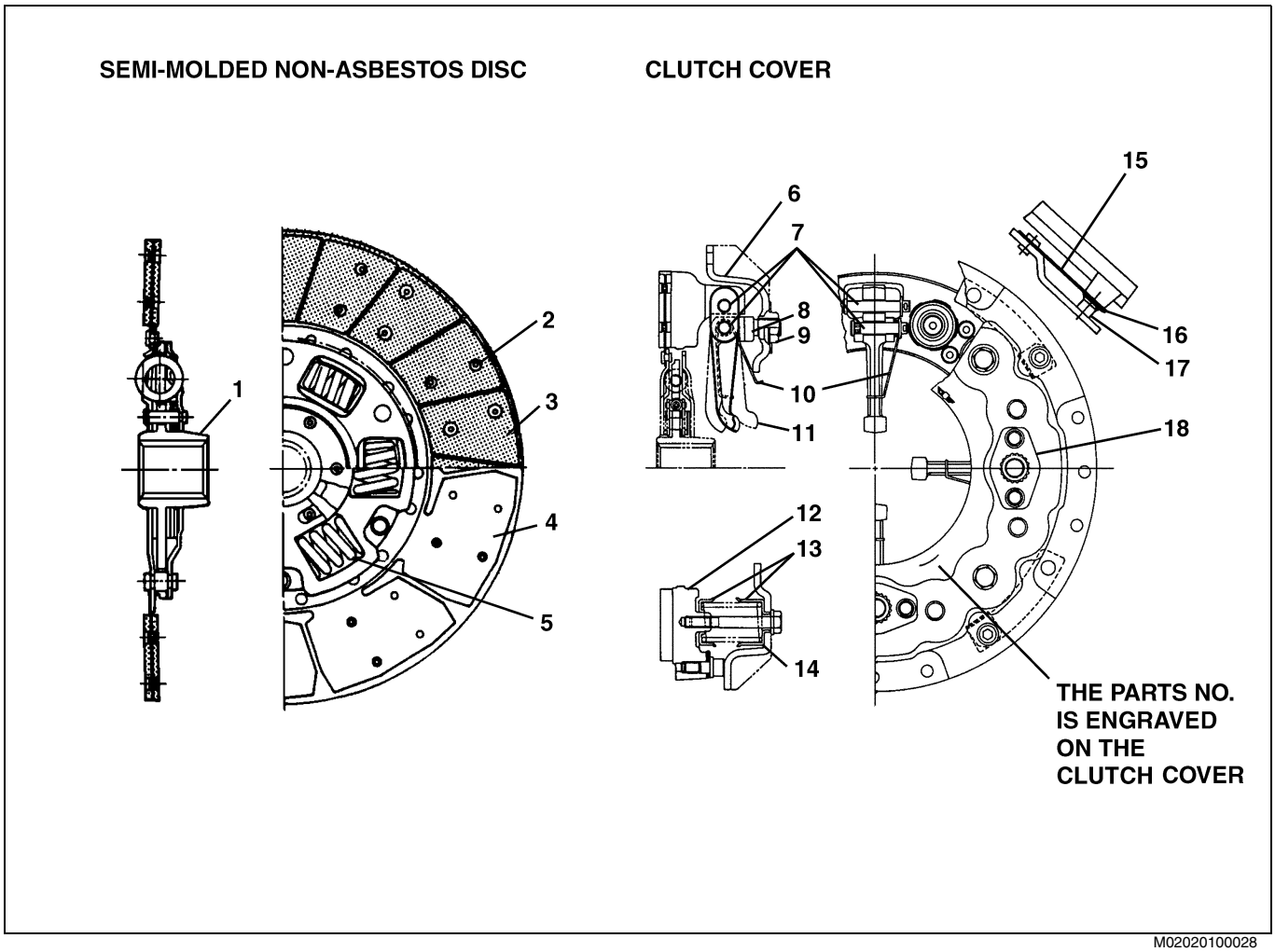
**COMPRESSION SPRING**

Unit: mm {in.}

| | |
|---|---|
| **Clutch cover parts No.** | **2740** |
| **Free length** | **92.9 {3.657}** |
| **Coil outside diameter** | **30.5 {1.201}** |
| **Diameter of wire** | **5.5 {0.217}** |
| **Quantity** | **12** |
| **Setting load** | **1,285N {131kgf, 288.8lbf}** |
| **Setting length** | **59.6 {2.346}** |

# DESCRIPTION

M02020104BEC1001




M02020100028

| | | | |
|---|---|---|---|
| 1 | Clutch disc hub | 10 | Torsion spring |
| 2 | Rivet | 11 | Release lever |
| 3 | Clutch facing | 12 | Pressure plate |
| 4 | Clutch plate | 13 | Spring seat |
| 5 | Damper spring | 14 | Compression spring |
| 6 | Clutch cover | 15 | Strap plate |
| 7 | Release lever pin | 16 | Friction washer |
| 8 | Release lever support | 17 | Strap plate bolt |
| 9 | Release lever support nut | 18 | Lock plate |

# TROUBLESHOOTING

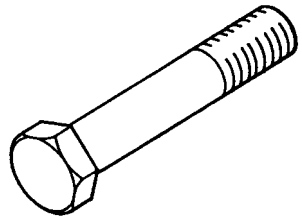
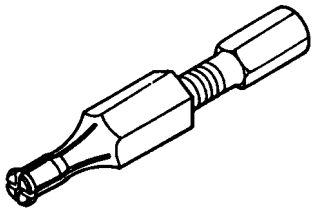
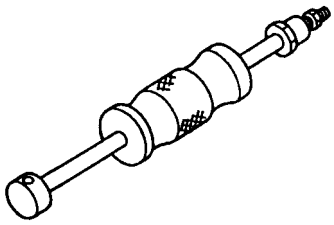
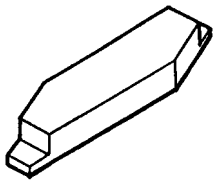
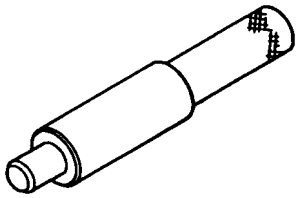
M02020104BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Clutch dragging** | Clutch disc distorted or warped | Replace clutch disc. |
| | Release lever incorrectly adjusted. | Adjust release lever. |
| | Transmission input shaft worn. | Replace input shaft and check clutch hub for excessive wear. If worn, replace disc. Check flywheel housing alignment. |
| **Clutch slipping** | Release lever and release bearing clearance incorrectly adjusted. | Adjust clearance. |
| | Clutch disc facing gummed with oil or grease. | Replace facing or disc assembly. |
| | Release bearing worn. | Replace bearing. |
| | Clutch pedal free-play incorrectly adjusted. | Adjust free-play. |
| | Compression spring weak. | Replace compression spring. |
| | Clutch facing worn. | Replace facing or disc assembly. |
| **Vehicle vibrates when starting.** | Improper engine idling. | Adjust idling. |
| | Clutch control incorrectly adjusted. | Adjust clutch control. |
| | Clutch disc facing gummed with oil or grease. | Replace facing or disc assembly. |
| | Glazed flywheel friction surface. | Unglazed flywheel surface with coarse emery cloth, stroking parallel to machining lines. |
| | Clutch disc distorted or warped. | Replace disc. |
| | Improper clutch cover tightening. | Tighten bolts. |
| | Flywheel housing misalignment. | Replace flywheel housing. |
| | Release lever incorrectly adjusted. | Adjust release lever. |
| **Noisy clutch** | Release bearing worn or dried. | Replace release bearing. |
| | Pilot bearing worn. | Replace pilot bearing. |
| | Clutch disc distorted or warped. | Replace clutch disc. |
| | Flywheel housing misalignment. | Replace flywheel housing. |
| | Transmission input shaft or clutch disc spline worn. | Clean and lubricate or replace. |
| | Release lever incorrectly adjusted. | Adjust release lever. |
| | Insufficient lubrication of pedal and its accessories. | Lubricate. |
| | Insufficient lubrication of release bearing hub. | Lubricate. |
| | Transmission input shaft retainer rusted or soiled. | Clean or replace if rusted. |
| | Clutch pedal free-play incorrectly adjusted. | Adjust free-play. |
| **Clutch pedal can not be depressed.** | Clutch control incorrectly adjusted. | Adjust clutch control. |
| | Insufficient lubricant release bearing hub. | Lubricate. |
| **Change in clutch pedal give.** | Air trapped in clutch fluid. | Bleed air. |

# SPECIAL TOOL

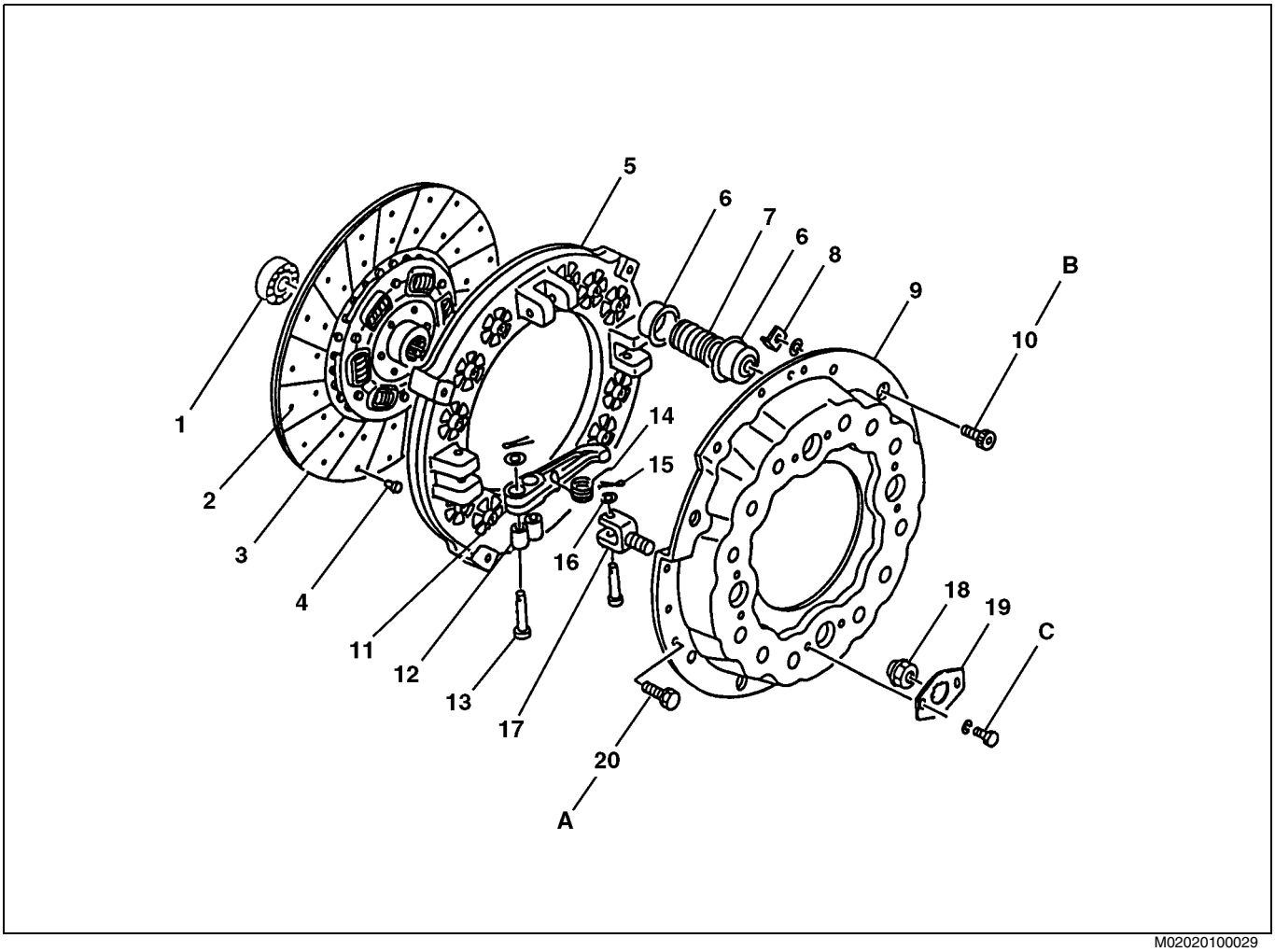
M02020104BEK1001

Prior to starting a clutch overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 9010-10700 | CLUTCH PRESSURE PLATE FIXING BOLT | |
|  | 9260-10240 | PLAIN WASHER | |
|  | 09650-1970 | CLUTCH PILOT BEARING PULLER | |
|  | 09420-1442 | SLIDING HAMMER | |
|  | 09661-1030 | CLUTCH RELEASE LEVER HEIGHT GAUGE | |
|  | 09662-1200 | CLUTCH ALIGNING ARBOR | |

# COMPONENT LOCATOR

M02020104BED1001




M02020100029

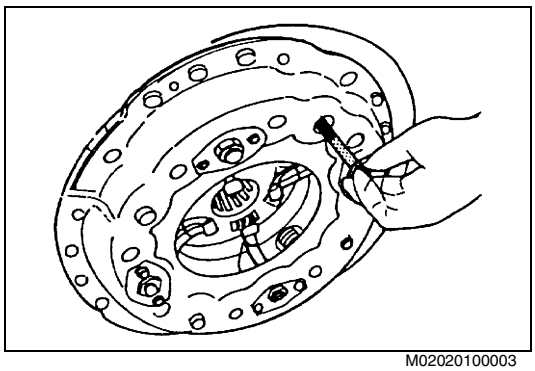
| | | | |
|---|---|---|---|
| 1 | Pilot bearing | 11 | Release lever |
| 2 | Clutch facing | 12 | Bushing |
| 3 | Disc assembly | 13 | Release lever pin |
| 4 | Rivet | 14 | Torsion spring |
| 5 | Pressure plate | 15 | Cotter pin |
| 6 | Spring seat | 16 | Plain washer |
| 7 | Compression spring | 17 | Release lever support |
| 8 | Friction washer | 18 | Release lever support nut |
| 9 | Clutch cover | 19 | Lock plate |
| 10 | Strap plate bolt | 20 | Fitting bolt |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 64-84 {653-856, 48-61} | C | 11.8-17.7 {120-180, 9-13} |
| B | 39.2-49.0 {400-500, 29-36} | | |

# OVERHAUL

M02020104BEH2001



M02020100003

## IMPORTANT POINT - DISMOUNTING

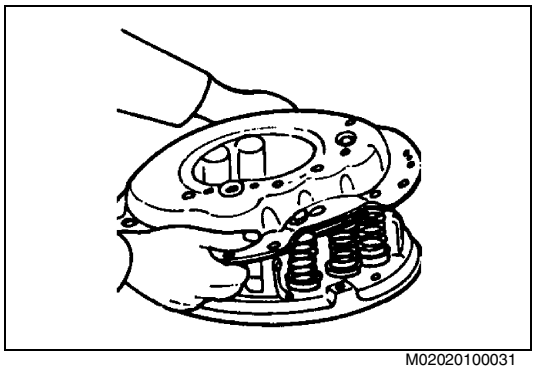
**1. REMOVE THE CLUTCH COVER AND DISC.**

(1) Install the four pressure plate fixing bolts and plain washers through the clutch cover into the tapped holes in the pressure plate.
**SST:**
**Pressure Plate Fixing Bolt (9010-10700)**
**Plain Washer (9260-10240)**

(2) Tighten the bolts in diagonal direction alternately and evenly to the compress the compression springs and release pressure plate tension.

(3) Loosen the fitting bolts.

**CAUTION:**
**When removing the clutch cover and clutch disc, be careful not to drop them on your foot.**



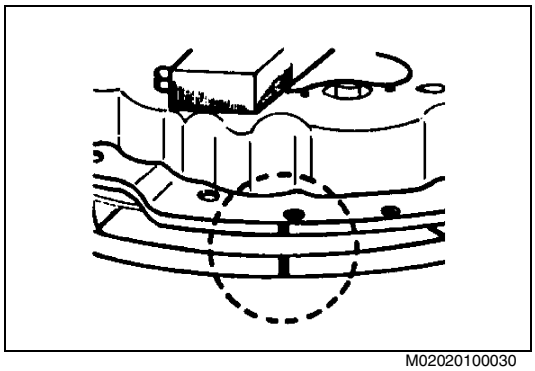
M02020100031

## IMPORTANT POINTS - DISASSEMBLY

**1. DISASSEMBLE THE CLUTCH COVER.**

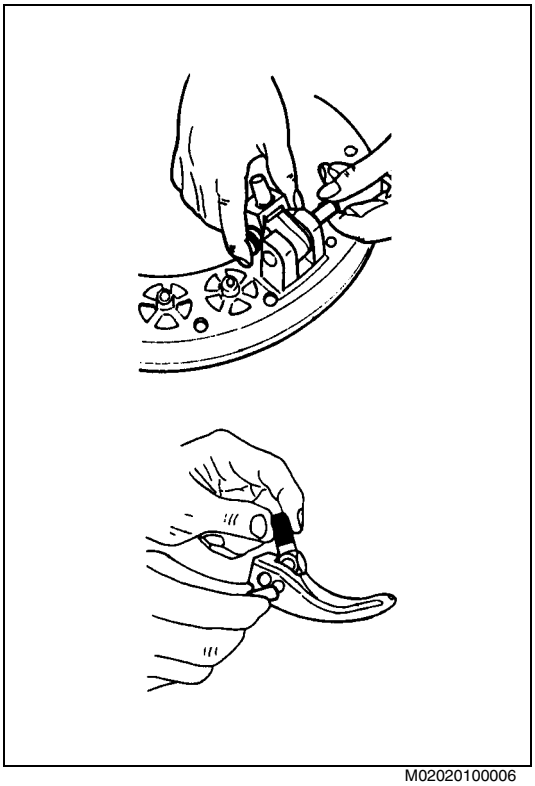
(1) Before removing the special tools and the strap plate bolt, compress the clutch cover to release the compression spring tension.

(2) Slowly release the press.



M02020100030

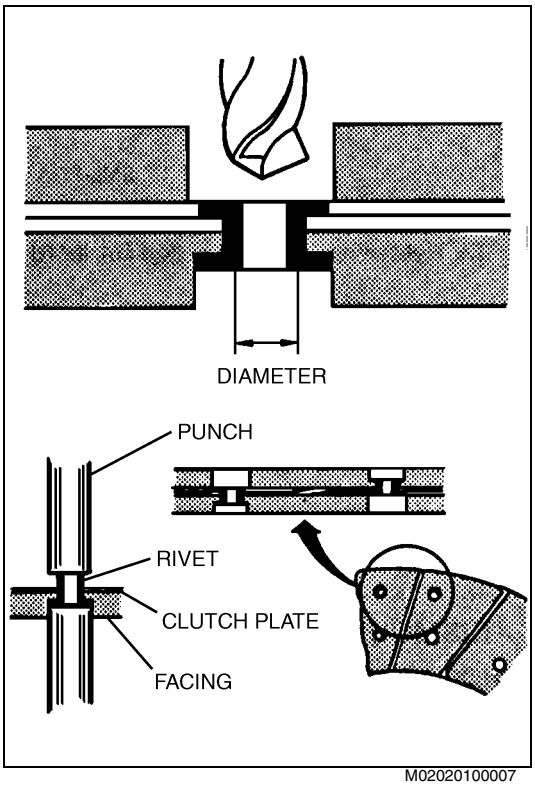
**NOTICE:**
**Before disassembling, make aligning marks on the clutch cover and pressure plate.**



M02020100006

**2. DISASSEMBLE THE RELEASE LEVER ASSEMBLY.**

(1) Remove the pin and the release lever.




M02020100007

## IMPORTANT POINTS - ASSEMBLY

**1. REPLACE THE CLUTCH FACING.**

(1) Drill off the rivets with a 5 mm {0.197 in.} diameter drill.

**NOTICE:**

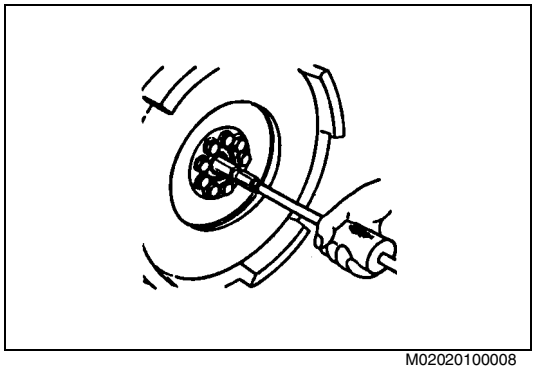
**Do not remove the clutch facing with a tapping rod and a hammer or a press.**

(2) Remove the old facing.

(3) Place the new facing on the clutch plate and insert the rivets into the holes so that the facing is held in position. (Secure the rivets with adhesive tape to prevent loosing them.)

(4) Using a suitable rivettor, rivet the new facing. In order to distribute pressure evenly, rivet in diagonal direction alternately.

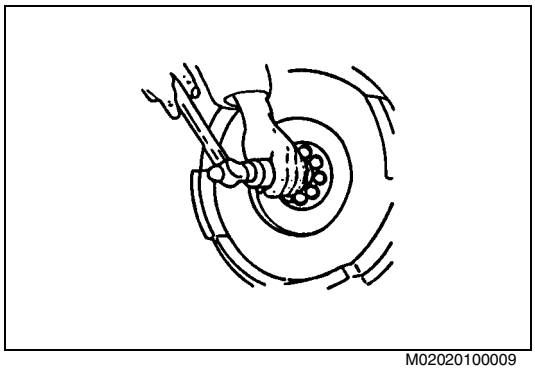
(5) Using a dial gauge, check the misalignment of the clutch disc after riveting.



M02020100008

**2. REPLACE THE PILOT BEARING.**

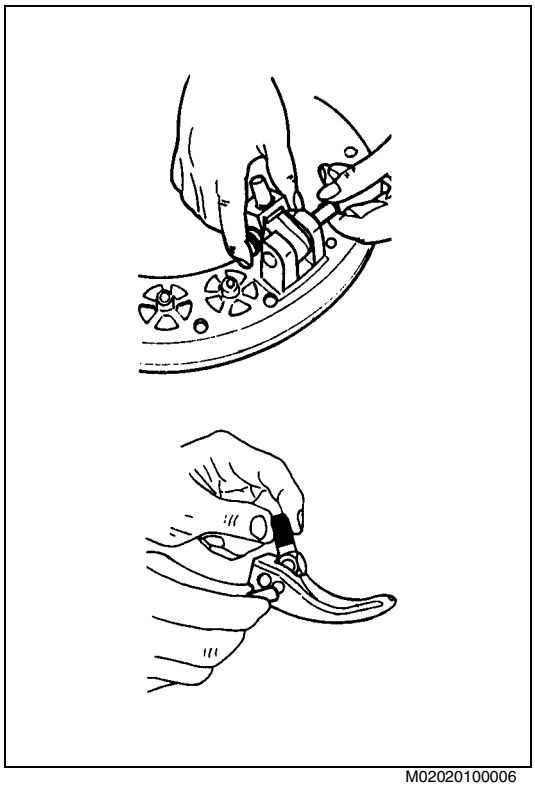
(1) Remove the pilot bearing.
**SST:**
**Pilot Bearing Puller (09650-1970)**
**Sliding Hammer (09420-1442)**



M02020100009

(2) Using a suitable tapping rod, install the pilot bearing.

**NOTICE:**
**After installing the pilot bearing, ensure that it rotates smoothly.**

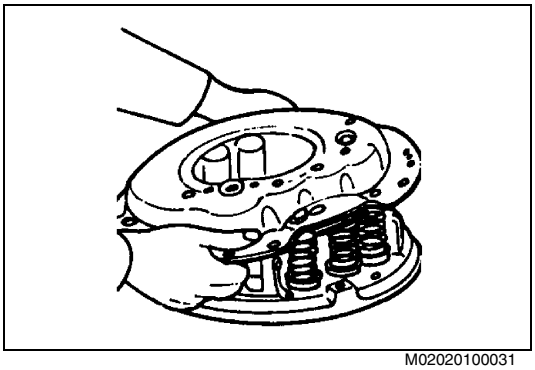


M02020100006

**3. INSTALL THE RELEASE LEVER.**

(1) Assemble the release lever, release lever support and torsion spring, then install the release lever assembly on the pressure plate.

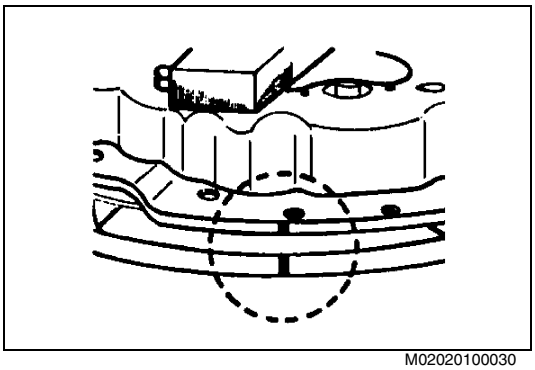
**NOTICE:**
- **Do not coat any grease on the bushing.**
- **Coat lithium base grease to the sliding part between the clutch release lever and the pressure plate.**



M02020100031

**4. INSTALL THE CLUTCH COVER.**

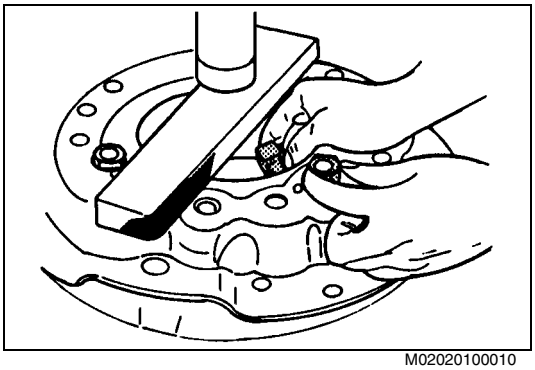
(1) Install the clutch cover in position according to the aligning marks. Compress the clutch cover to relieve the compression spring tension.



M02020100030

**NOTICE:**

- **When compressing the clutch cover, be sure to hook up the torsion springs between clutch cover and release lever.**
- **When compressing the clutch cover, pull the release lever support up through the holes in the clutch cover.**
- **Be sure to insert the compression spring upper seats in the pressure cover.**

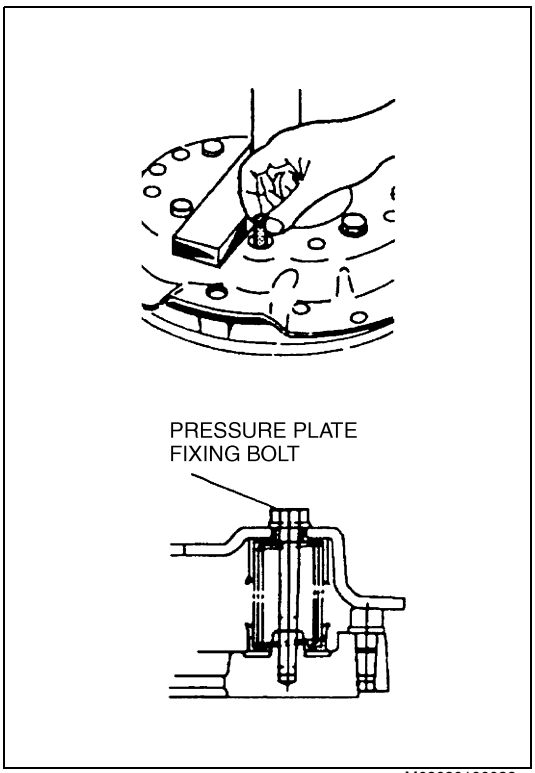


M02020100010

(2) Temporarily tighten the release lever support nuts.

**NOTICE:**

**Coat the spherical seat of the clutch cover and threaded section of the release lever support with a small amount of anti-seizure agent.**



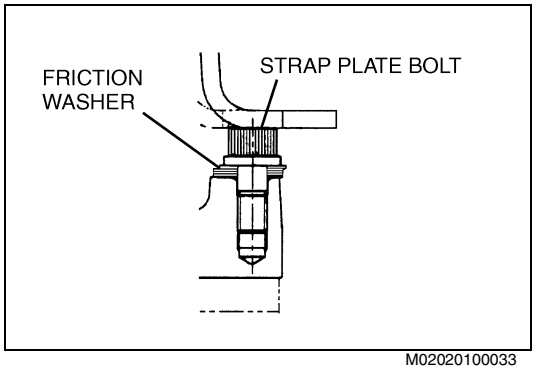

M02020100032

(3) Install the four pressure plate fixing bolts with the plain washers through the clutch cover into the tapped holes in the pressure plate.

**SST:**

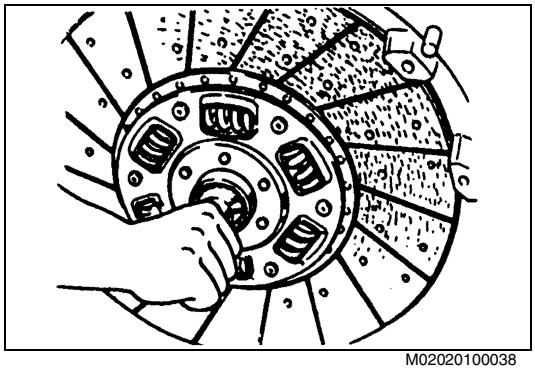
**Pressure Plate Fixing Bolt (9010-10700)**

**Plain Washer (9260-10240)**



M02020100033

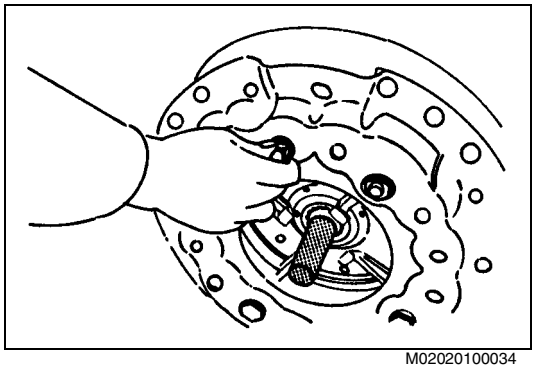
(4) Install the strap plate bolt with the friction washer and lock washer.


M02020100038

## IMPORTANT POINTS - MOUNTING

**1. INSTALL THE CLUTCH DISC ON THE FLYWHEEL.**

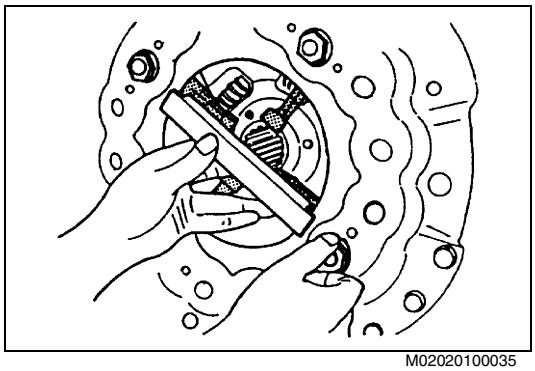
(1) Insert an aligning arbor or splined input shaft through the clutch disc hub and into the flywheel pilot bearing to position the clutch disc.
**SST: Clutch Aligning Arbor (09662-1200)**


M02020100034

**2. INSTALL THE CLUTCH COVER ASSEMBLY.**

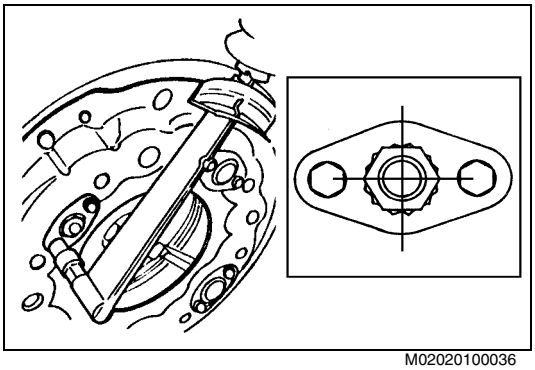
(1) Insert the clutch cover aligning pins into each place of the clutch cover.
(2) Tighten the bolts evenly. Make several presses around the clutch cover until it is snug.
(3) Remove the pressure plate fixing bolts and plain washer.
(4) Remove the clutch aligning arbor.

**NOTICE:**
**When installing a new clutch cover assembly, do not forget to remove the four pressure plate fixing bolts from the clutch cover.**


M02020100035

**3. ADJUST THE RELEASE LEVER HEIGHT WHEN INSTALLING A NEW CLUTCH DISC.**

(1) Adjust the clearance of the contact surface between the special tool and the release lever by turning the release lever support nut.
**Clearance: Zero**
**SST: Clutch Release Lever Height Gauge (09661-1030)**


M02020100036

**4. INSTALL THE LOCK PLATE.**

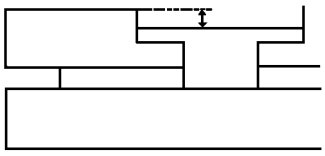
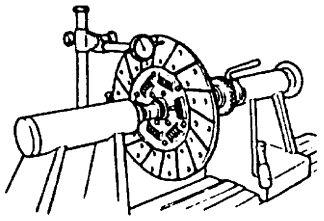
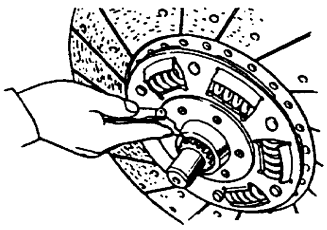
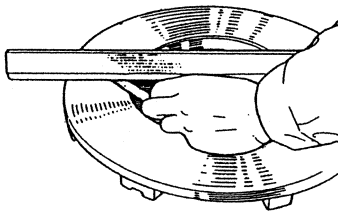
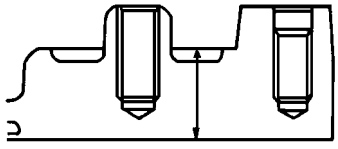
**NOTICE:**

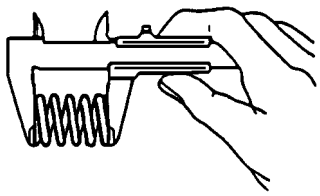
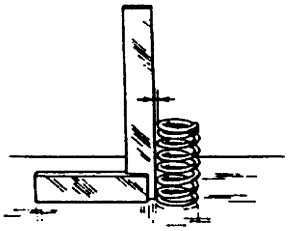
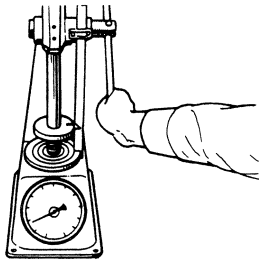
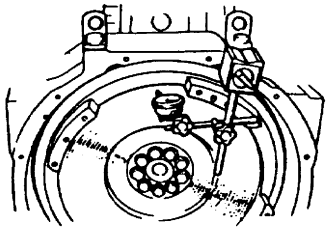
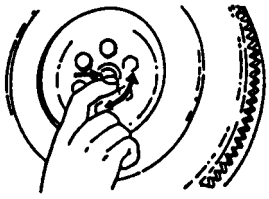
**Be sure to lock the support nut with the lock plate.**

# INSPECTION AND REPAIR

M02020104BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Rivet head depth | 2.2-2.8 {0.0867-0.1102} | 0.1 {0.0039} | Replace disc assembly or facing. | Measure  |
| Clutch disc misalignment | 0-1.3 {0-0.0511} | 1.3 {0.0512} | Replace. | Measure  |
| Oily facings Loose rivets Broken or loose damper springs | — | — | Replace disc assembly, if necessary. | Visual check |
| Clearance between clutch disc hub and transmission input shaft spline | 0.05-0.15 {0.0020-0.0059} | 0.3 {0.0118} | Replace the clutch disc or the transmission input shaft. | Measure  |
| Pressure plate misalignment | Less than 0.1 {0.0039} | 0.5 {0.0197} | Regrind the friction surface or replace. | Measure  |
| Pressure plate thickness | 23 {0.906} | 22 {0.866} | Replace. | Measure  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Pressure plate friction surface scoring or roughness | — | — | Regrind the friction surface or replace, if necessary. | Visual check |
| Compression spring free length | 92.9 {3.657} | 88.3 {3.476} | Replace. | Measure  |
| Compression spring squareness | — | 5.0 {0.197} | Replace. | Measure  |
| Compression spring setting load at the specified setting length (59.6 mm {2.346 in.}) | 1,285 N {131 kgf, 288.8 lbf} | 1,221 N {124.5kgf, 274.5lbf} | Replace. | Measure  |
| Flywheel misalignment | 0-0.1 {0-0.0039} | 0.15 {0.0059} | Regrind the friction surface or replace. | Measure  |
| Flywheel friction surface scoring or roughness | — | — | Regrind the friction surface or replace, if necessary. | Visual check |
| Pilot bearing improper rotation | — | — | Replace, if necessary. | Visual check  |

# CLUTCH CONTROL

CL03-001

**CLUTCH CONTROL UNIT ..... CL03-2**
DATA AND SPECIFICATIONS .....CL03-2
DESCRIPTION .....CL03-2
SPECIAL TOOL .....CL03-4
INSPECTION AND ADJUSTMENT .....CL03-4

**CLUTCH PEDAL AND RELEASE UNIT ... CL03-8**
COMPONENT LOCATOR.....CL03-8
OVERHAUL .....CL03-12
INSPECTION AND REPAIR .....CL03-14

**CLUTCH MASTER CYLINDER ..... CL03-15**
COMPONENT LOCATOR.....CL03-15
OVERHAUL .....CL03-16
INSPECTION AND REPAIR .....CL03-16

**CLUTCH BOOSTER ..... CL03-17**
COMPONENT LOCATOR.....CL03-17
OVERHAUL .....CL03-18
INSPECTION AND REPAIR .....CL03-23

# CLUTCH CONTROL UNIT

## DATA AND SPECIFICATIONS

M02030104BEI2002

**CLUTCH BOOSTER**

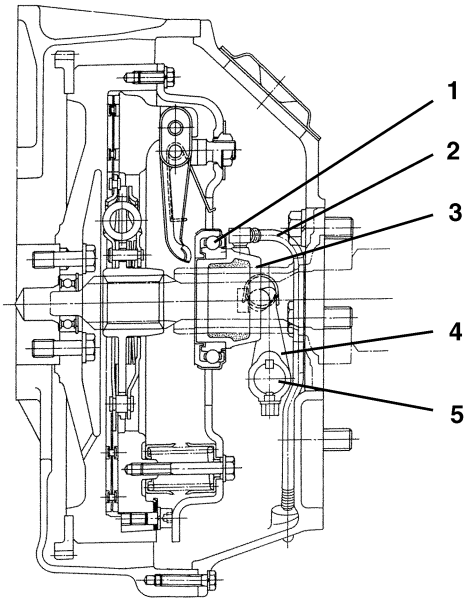
Unit: mm {in.}

| | |
|---|---|
| **Power cylinder inside diameter** | **90 {3.543}** |
| **Hydraulic cylinder inside diameter** | **19.8 {0.780}** |
| **Relay valve piston outside diameter** | **14.3 {0.563}** |
| **Valve piston outside diameter** | **27.0{1.063}** |

## DESCRIPTION

M02030103BEC1003

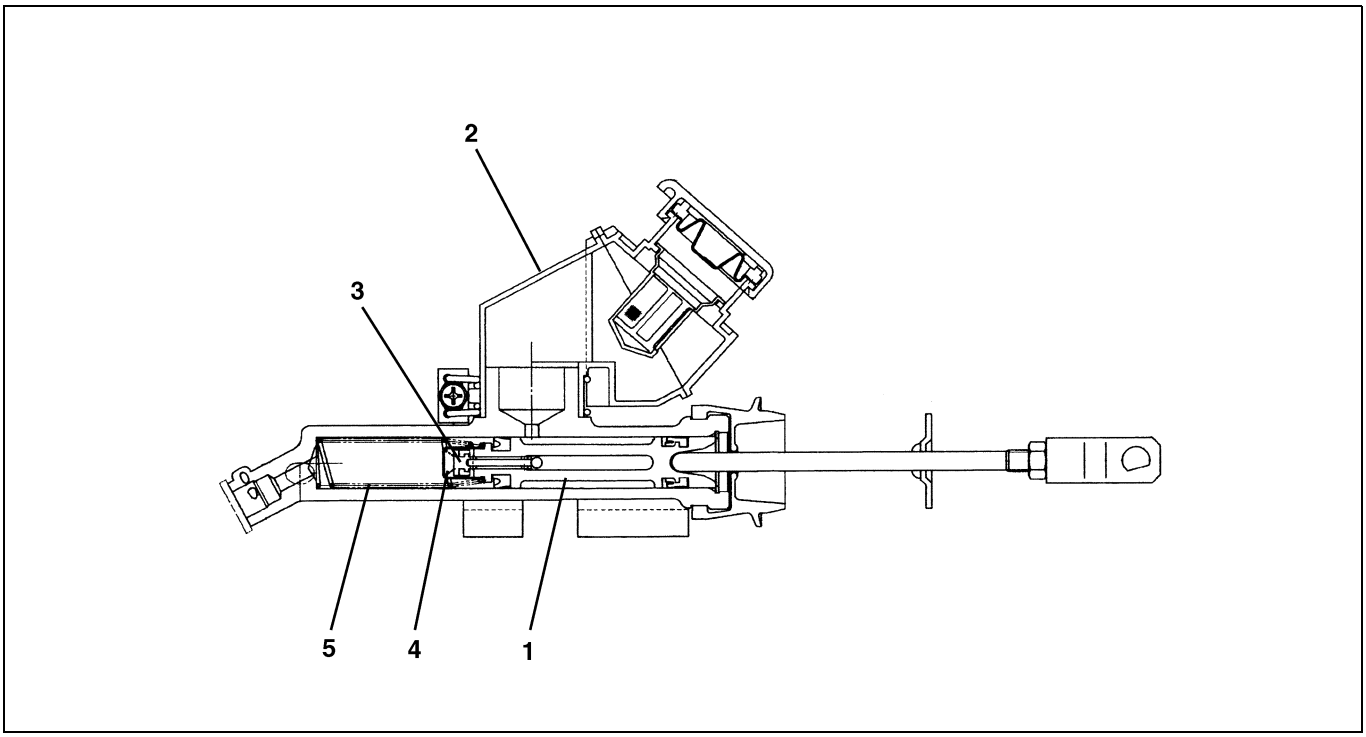
### CLUTCH RELEASE UNIT




M02030100001

| | | | |
|---|---|---|---|
| **1** | **Release bearing** | **4** | **Release fork** |
| **2** | **Lubrication hose** | **5** | **Release fork shaft** |
| **3** | **Release bearing hub** | | |

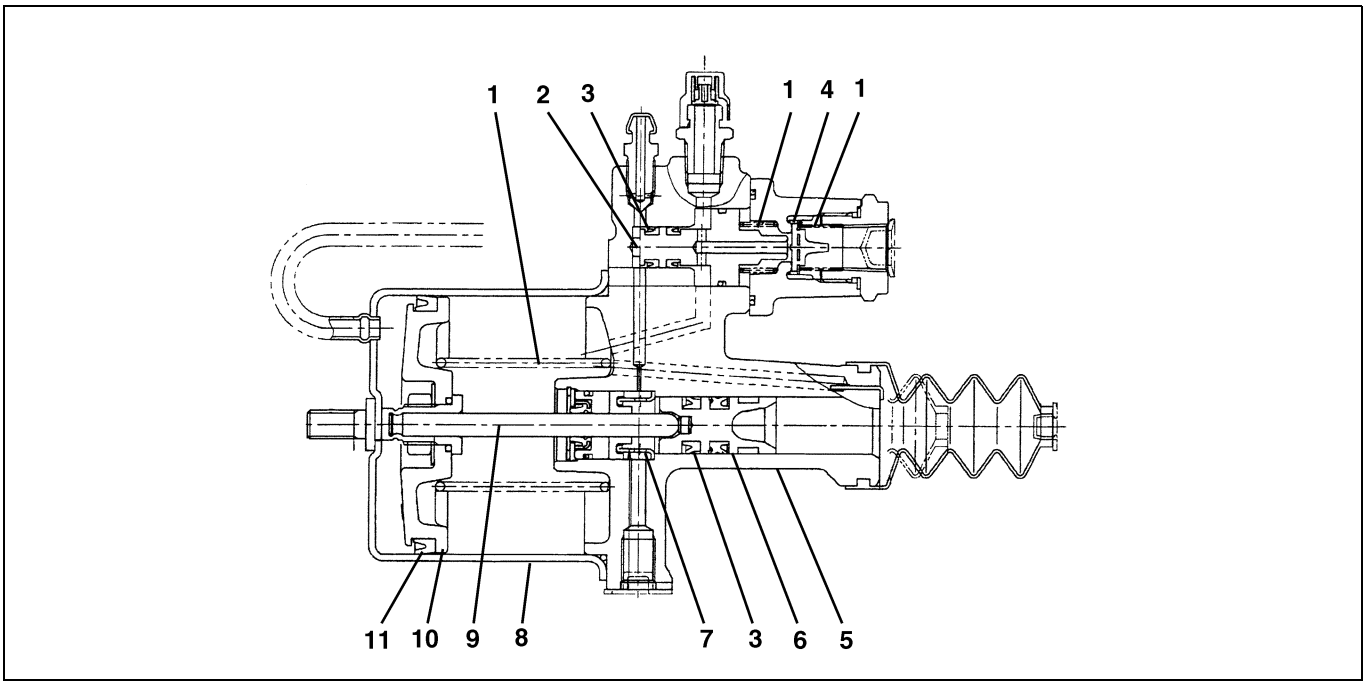
## MASTER CYLINDER




M02030100002

| | | | |
|---|---|---|---|
| 1 | Piston | 4 | Conical spring |
| 2 | Reservoir tank | 5 | Return spring |
| 3 | Check valve | | |

## CLUTCH BOOSTER



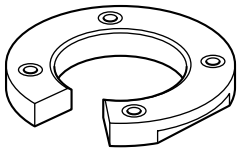
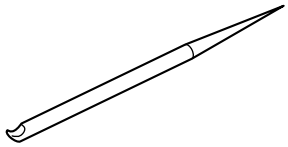
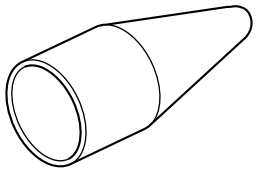
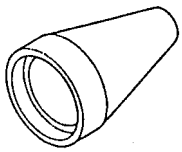
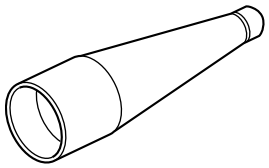
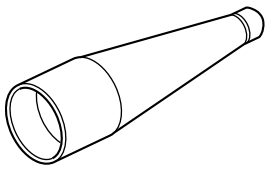

M02030100003

| | | | |
|---|---|---|---|
| 1 | Return spring | 7 | Retainer |
| 2 | Relay valve piston | 8 | Cylinder shell |
| 3 | Piston cup | 9 | Push rod |
| 4 | Poppet valve | 10 | Power piston |
| 5 | Hydraulic cylinder | 11 | Piston seal |
| 6 | Hydraulic piston | | |

# SPECIAL TOOL

M02030104BEK10002

Prior to starting a clutch booster overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09536-1020 | STAND | |
|  | 09653-1780 | HOOK | |
|  | 09657-2100 | GUIDE | |
|  | 09657-2090 | GUIDE | |
|  | 09657-2150 | GUIDE | |
|  | 09657-2160 | GUIDE | |

# INSPECTION AND ADJUSTMENT

M02030104BEH3002

## AIR BLEEDING

**1. BLEED THE AIR FROM HYDRAULIC LINE.**

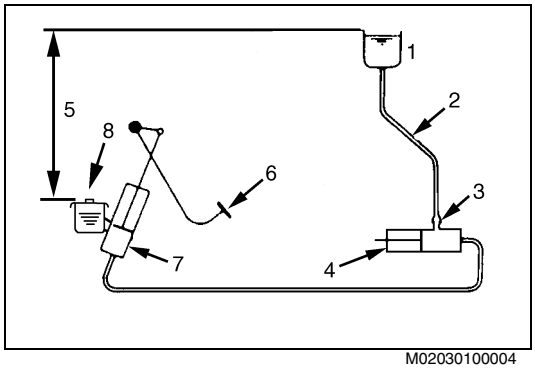
**NOTICE:**

- **Do not mix the clutch fluid with different types or brands.**
- **Be careful not to spill clutch fluid from the reservoir tank or from the air bleeder during air bleeding. Clutch fluid can damage the paint finish on the body or floor.**
- **There are two methods of bleeding, gravity bleeding and manual air bleeding.**

**2. GRAVITY BLEEDING**

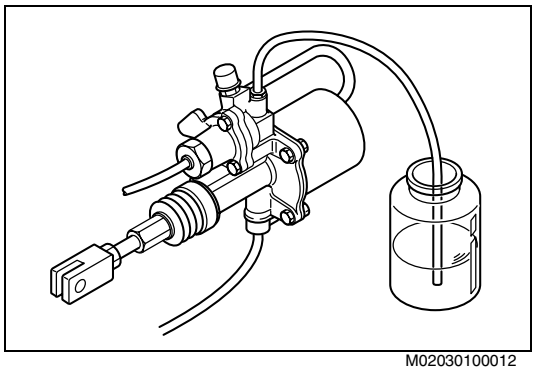
(1) Connect a funnel to a vinyl tube.
(2) Connect the other end of the vinyl tube to the bleeder screw.
(3) Hold the funnel about 1.5 m {4.92 ft} higher than the reservoir tank.
(4) Loosen the bleeder screw and pour the clutch fluid into the funnel.

(5) Observe the flow of clutch fluid into the reservoir tank.
(6) When the air bubbles cease, close the bleeder screw.
(7) Check the fluid level. If necessary, add or remove clutch fluid in order to match the "MAX" level.

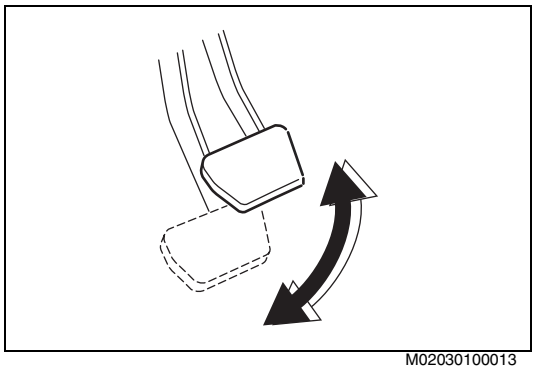


M02030100004

| |
|---|
| 1. Funnel filled with clutch fluid |
| 2. Vinyl tube (inside diameter: 6 mm) |
| 3. Bleeder |
| 4. Clutch booster |
| 5. About 1.5 m {4.92 ft} |
| 6. Clutch pedal |
| 7. Master cylinder |
| 8. Reservoir tank |

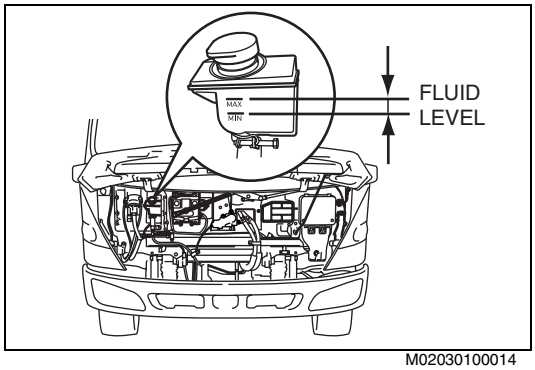

M02030100012

**3. MANUAL BLEEDING**
(1) Fill the reservoir with clutch fluid.
(2) Connect the bleeder tube to the clutch booster screw. Place the other end of tube in a container half-filled with clutch fluid.


M02030100013

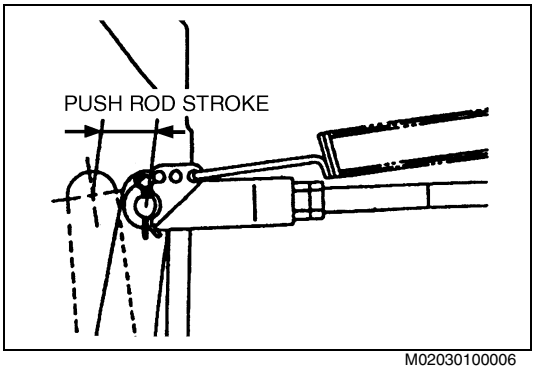
(3) Slowly pump the clutch pedal several times. While pressing on the pedal, loosen the bleeder screw. Repeat this procedure until there are no more air bubbles in the fluid.

**NOTICE:**
- **Do not return the clutch pedal before closing the bleeder screw.**
- **Keep the reservoir filled with clutch fluid.**
- **Re-bleeding will be necessary if the reservoir is emptied during bleeding operation.**



M02030100014

(4) Check the fluid level. If necessary, add or remove clutch fluid in order to match the "MAX" level.

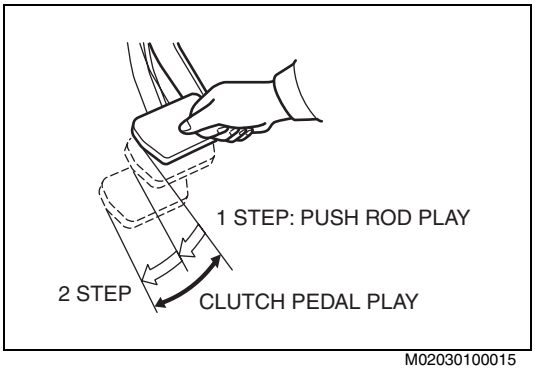


M02030100006

**4. AFTER BLEEDING, MAKE SURE THE PUSH ROD STROKE IS AS SPECIFIED.**

(1) Depress the clutch pedal fully and measure the push rod stroke. If the stroke is less than standard, re-bleed the hydraulic system.
**Standard: More than 19.5 mm {0.768 in.}**

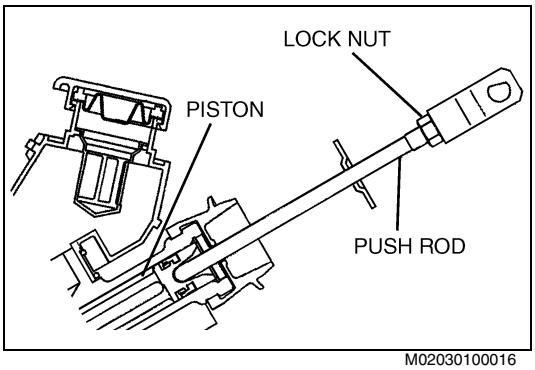
## CHECK AND ADJUSTMENT



M02030100015

**1. CHECK AND ADJUST THE CLUTCH PEDAL PLAY.**

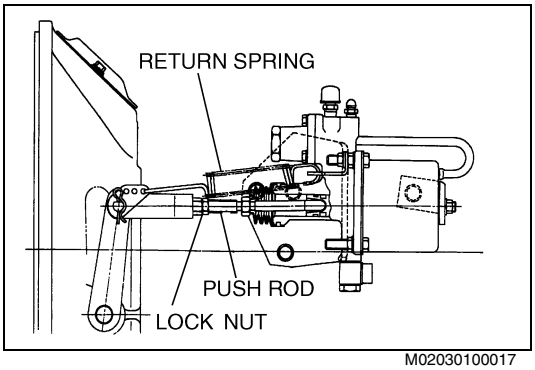
(1) Check the push rod play.
   a. If necessary, adjust the push rod play.



M02030100016

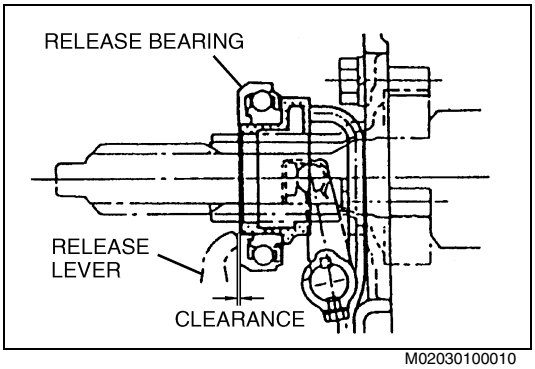
   b. Loosen the lock nut and turn the master cylinder push rod until the push rod play is correct.
   **Standard:**
   **Clearance between push rod and piston:**
   **0.5 mm {0.0197 in}**
   **Push rod play at pedal top: 2-4 mm {0.079-0.157 in.}**

   c. Tighten the lock nut.



M02030100017

(2) Check the clutch pedal play.
   a. Push the pedal until the beginning of clutch resistance is felt.
   **Assembly Standard: 52-65 mm {2.048-2.559 in.}**
   b. If necessary, adjust the clutch pedal play by adjusting the clutch release bearing clearance.
   c. Loosen the lock nut and turn the push rod counterclockwise until the release bearing contacts the release lever plate or release lever.

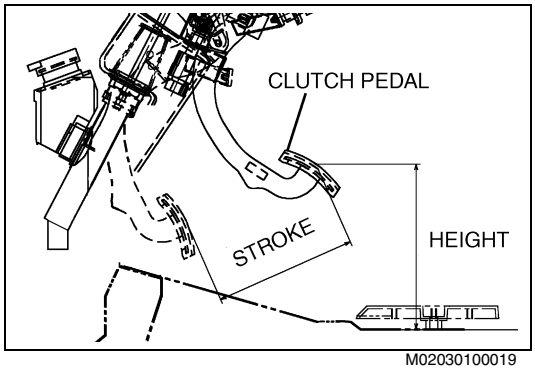


M02030100010

   d. Turn the push rod clockwise about 2.5 turns.

   **Standard: Clearance between release bearing and release lever plate or release lever: 2.0 mm {0.079 in.}**

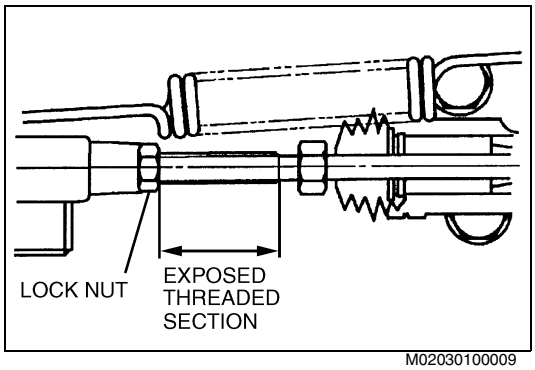
   e. Tighten the lock nut.



M02030100019

**2. CHECK THE CLUTCH PEDAL HEIGHT AND STROKE.**

| | Assembly Standard: |
|---|---|
| Pedal Height: | 169.2-179.2 mm {6.66-7.05 in.} |
| Pedal Stroke | 150-160 mm {5.91-6.29 in.} |



M02030100009

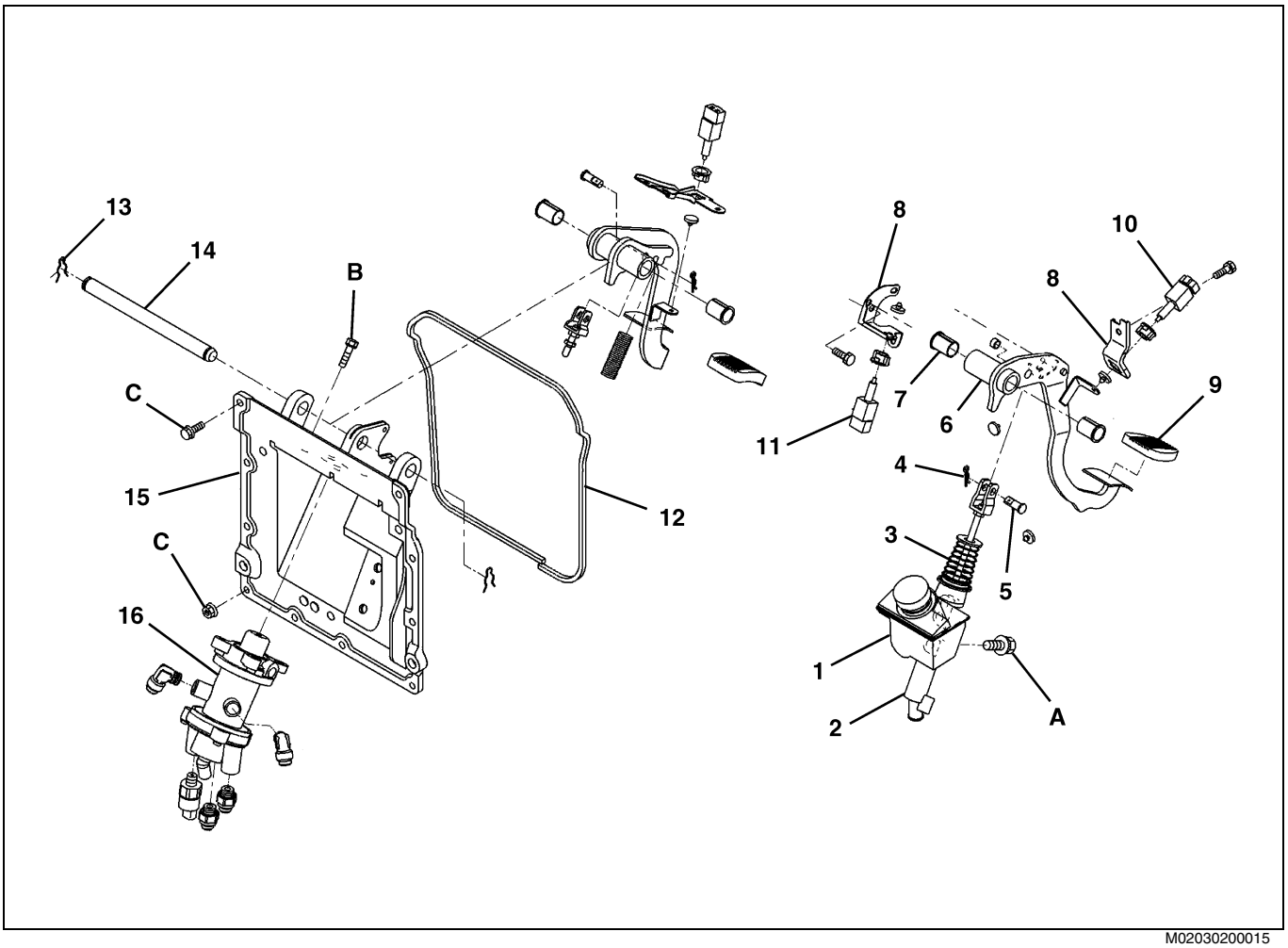
**3. CHECK THE LENGTH OF THE EXPOSED THREADED SECTION OF THE PUSH ROD. IF ITS LENGTH IS LESS THAN THE SERVICE LIMIT, IT IS TIME TO REPLACE THE CLUTCH FACING.**

| Transmission series | Service limit |
|---|---|
| LJ06S | 33 mm {1.299 in.} |
| MF06S | 20 mm {0.787 in.} |
| EATON FS6109/8209 | 11 mm {0.433 in.} |
| FULLER RT8908LL | 2.5 mm {0.098 in.} |

# CLUTCH PEDAL AND RELEASE UNIT

## COMPONENT LOCATOR

M02030204BED1002



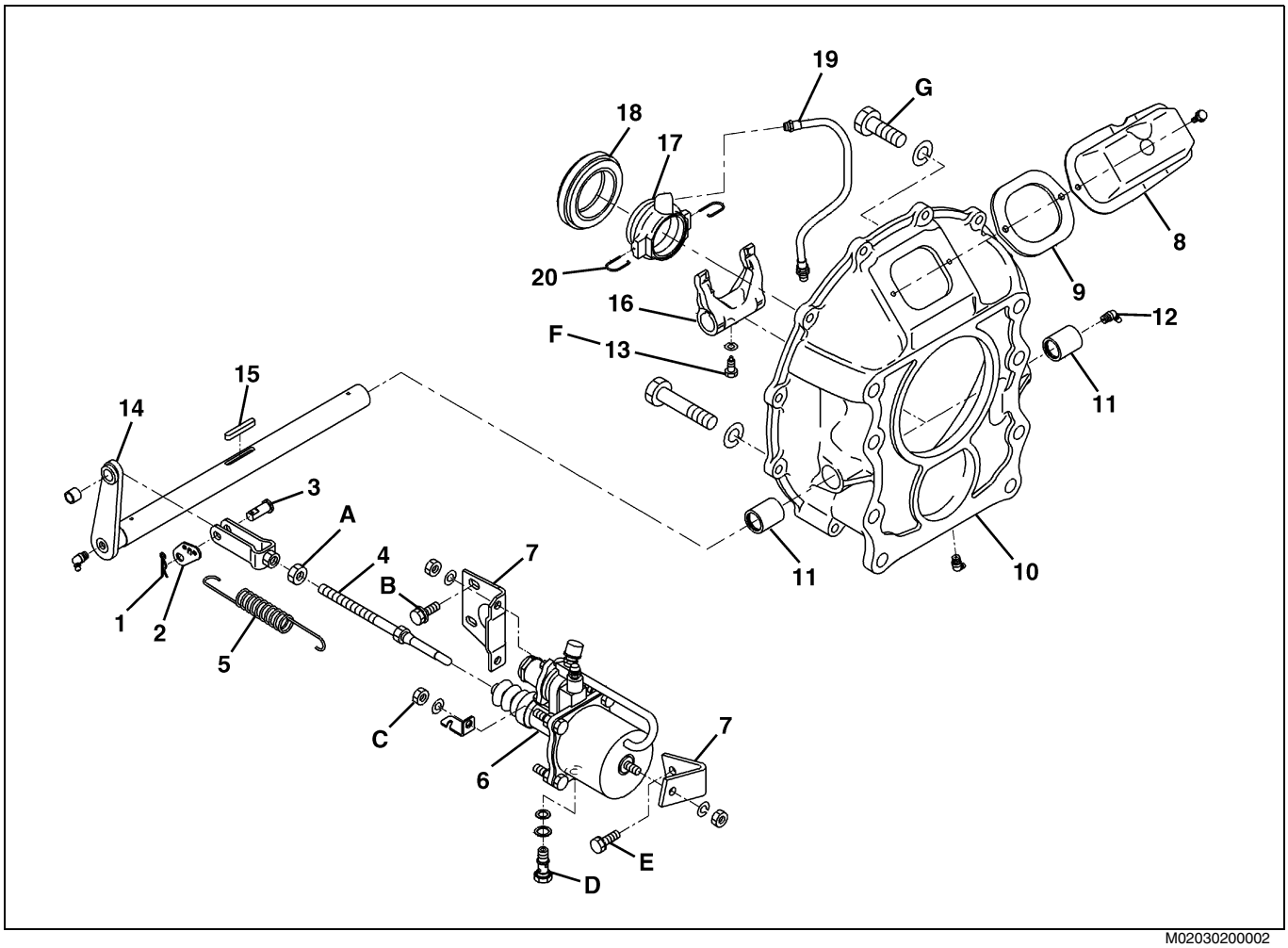

M02030200015

| | | | |
|---|---|---|---|
| 1 | Reservoir tank | 10 | Switch (For exhaust brake) |
| 2 | Master cylinder | 11 | Switch (For transmission P.T.O. control) (If so equipped.) |
| 3 | Return spring | | |
| 4 | Cotter pin | 12 | Seal |
| 5 | Pin | 13 | Clip |
| 6 | Clutch pedal | 14 | Pedal shaft |
| 7 | Bushing | 15 | Pedal bracket |
| 8 | Bracket | 16 | Brake valve |
| 9 | Pedal pad | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 39-91 {398-927, 29-67} | C | 18-31 {184-316, 14-22} |
| B | 9.5-18.5 {97-188, 7.1-13.5} | | |

## TRANSMISSION SERIES: LJ06S, MF06S



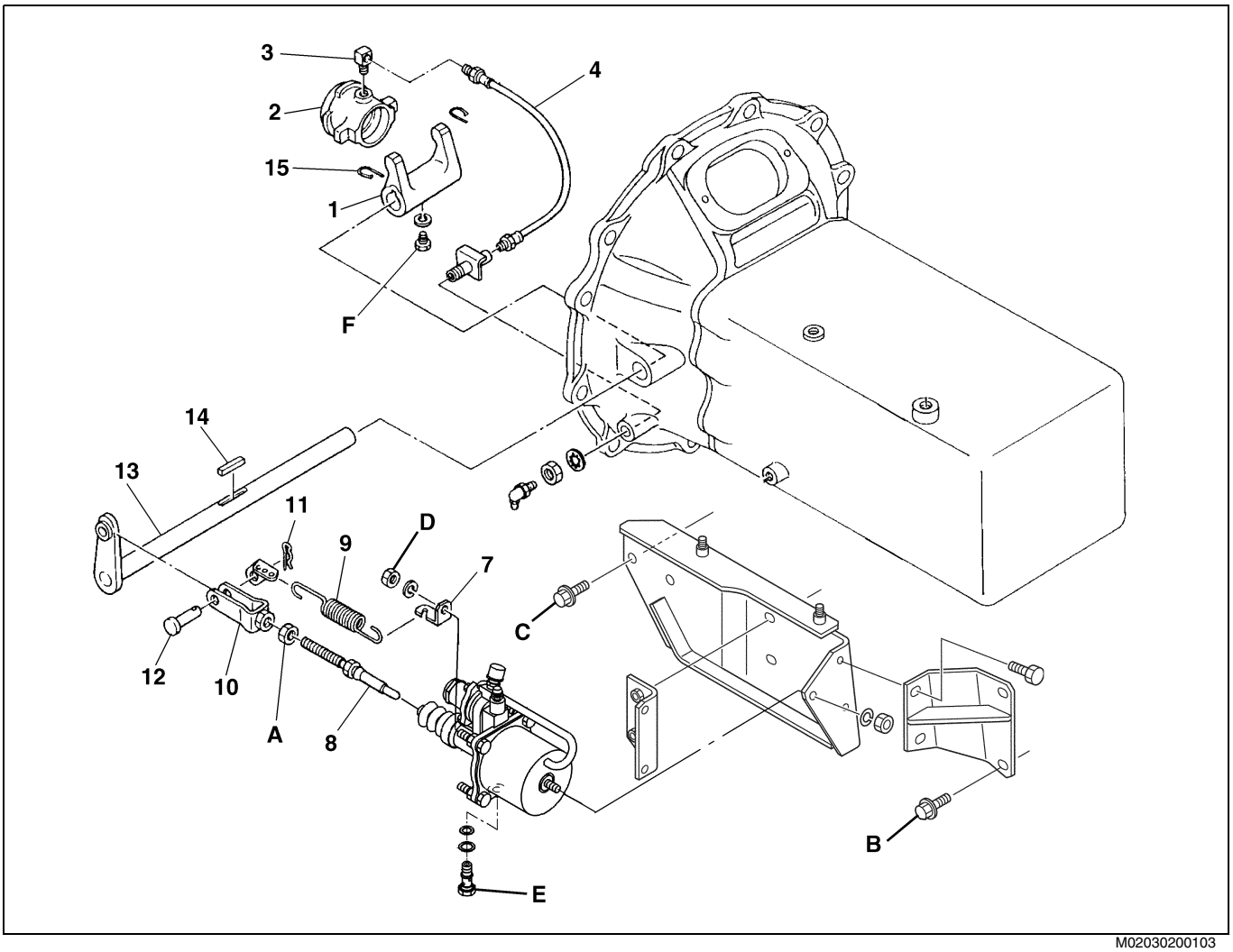

M02030200002

| | | | |
|---|---|---|---|
| 1 | Cotter pin | 11 | Release shaft bearing |
| 2 | Spring hanger | 12 | Lubrication fitting |
| 3 | Pin | 13 | Set screw |
| 4 | Push rod | 14 | Release shaft |
| 5 | Tension spring | 15 | Key |
| 6 | Clutch booster | 16 | Release fork |
| 7 | Bracket | 17 | Release bearing hub |
| 8 | Cover | 18 | Release bearing |
| 9 | Gasket | 19 | Lubrication hose |
| 10 | Clutch housing | 20 | Anti-rattle spring |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 45.5-58.5 {465-597, 34-43} | E | LJ06S: 37.5-48.5 {383-495, 28-35} |
| B | LJ06S: 37.5-48.5 {383-495, 28-35} | E | MF06S: 64-84 {653-857, 48-61} |
| B | MF06S: 64-84 {653-856, 47-61} | F | 14.5-17.5 {148-178, 11-12} |
| C | 37.5-48.5 {383-495, 28-35} | G | LJ06S: 246-322 {2,510-3,280, 182-237} |
| D | 27.5-32.5 {280-330, 20-23} | G | MF06S: 344-460 {3,510-4,690, 254-339} |

## TRANSMISSION SERIES: FS6109, FS8209



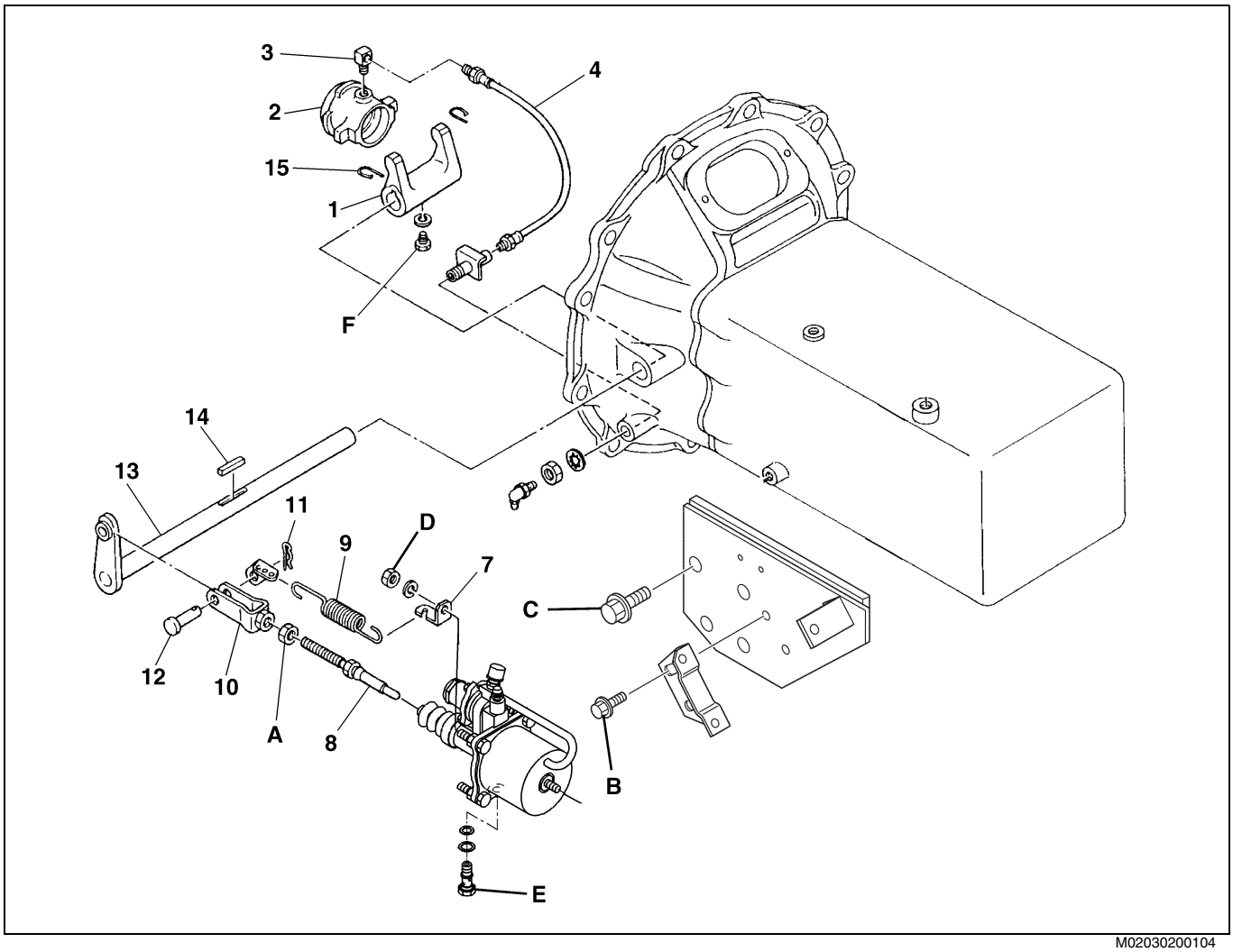

M02030200103

| | | | |
|---|---|---|---|
| 1 | Release fork | 9 | Tension spring |
| 2 | Release bearing hub | 10 | Clevis |
| 3 | Elbow | 11 | Cotter pin |
| 4 | Lubrication hose | 12 | Pin |
| 5 | Bracket | 13 | Release shaft |
| 6 | Clutch booster | 14 | Key |
| 7 | Spring hanger | 15 | Antirattle spring |
| 8 | Push rod | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 45.5-58.5 {465-597, 34-43} | D | 37.5-48.5 {383-495, 28-35} |
| B | 37.5-48.5 {383-495, 28-35} | E | 27.5-32.5 {280-330, 20-23} |
| C | 64-84 {653-857, 48-61} | F | 14.5-17.5 {148-178, 11-12} |

## TRANSMISSION SERIES: RT8908




M02030200104

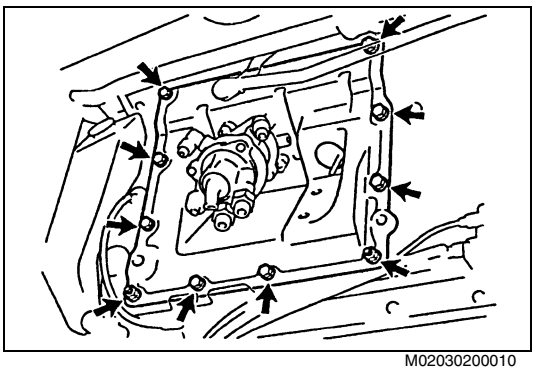
| | | | |
|---|---|---|---|
| 1 | Release fork | 9 | Tension spring |
| 2 | Release bearing hub | 10 | Clevis |
| 3 | Elbow | 11 | Cotter pin |
| 4 | Lubrication hose | 12 | Pin |
| 5 | Bracket | 13 | Release shaft |
| 6 | Clutch booster | 14 | Key |
| 7 | Spring hanger | 15 | Antirattle spring |
| 8 | Push rod | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 45.5-58.5 {465-597, 34-43} | D | 37.5-48.5 {383-485, 28-35} |
| B | 64-84 {653-857, 48-61} | E | 27.5-32.5 {280-330, 20-23} |
| C | 344-460 {3,510-4,690, 254-339} | F | 14.5-17.5 {148-178, 11-12} |

# OVERHAUL

M02030203BEH2003

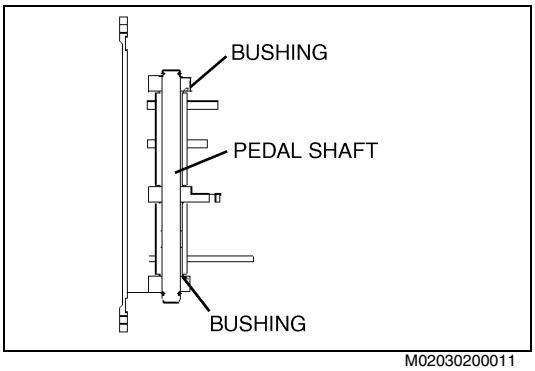

M02030200010

## IMPORTANT POINTS - DISMOUNTING

**1. REMOVE THE PEDAL UNIT ASSEMBLY.**

(1) Remove the 8 bolts and 2 nuts and dismount the pedal bracket assembly from the vehicle.

**NOTICE:**
**Be careful not to damage the vehicle.**

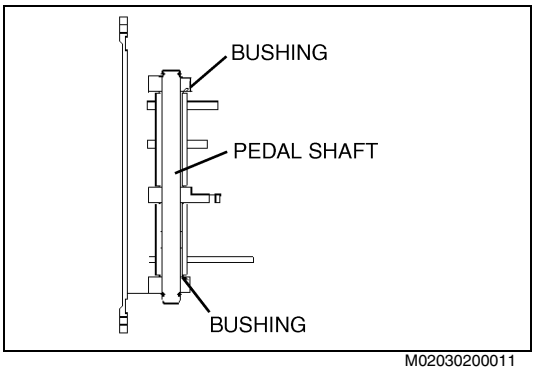


M02030200011

**2. REMOVE THE CLUTCH PEDAL.**

(1) Remove the stroke sensor from the clutch pedal.

(2) Remove the clip, and tap the pedal shaft lightly to remove the clutch pedal using a brass bar and a hammer.



M02030200011

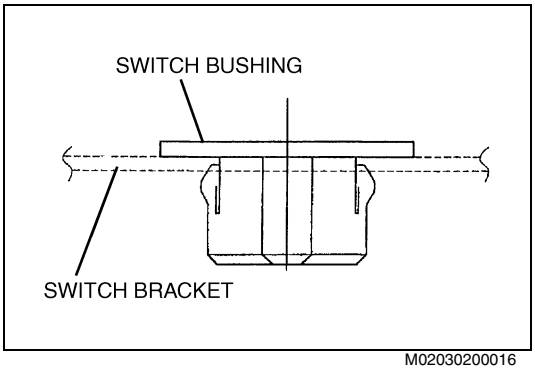
## IMPORTANT POINT - MOUNTING

**1. INSTALL THE CLUTCH PEDAL.**

(1) Apply lithium grease to the inner side and outer periphery of the bushing, and install the bushing to the inserting hole on the shaft part of the clutch pedal.

(2) Install the clutch pedal to the installing axle for pedal shaft and install the pedal shaft to the pedal bracket using a plastic hammer.

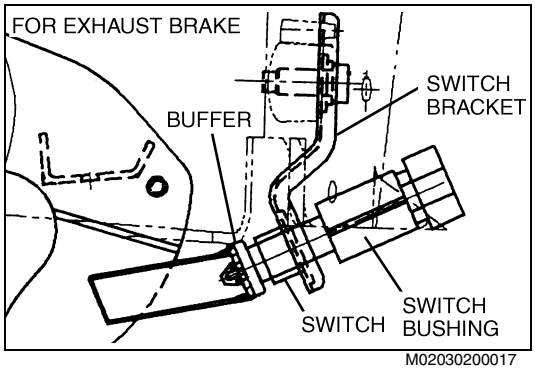
**2. INSTALL THE PEDAL UNIT ASSEMBLY.**



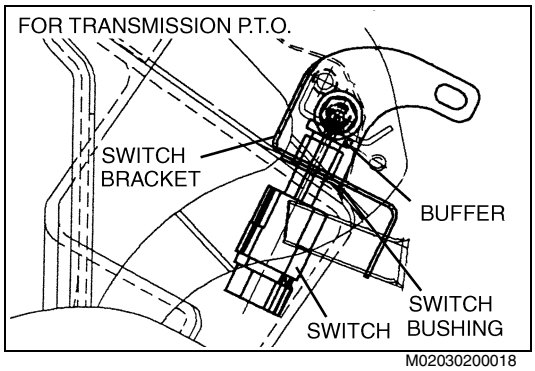
M02030200016

**3. INSTALL THE SWITCH FOR EXHAUST BRAKE AND TRANSMISSION P.T.O.**

(1) Install the switch bushing into the switch bracket.



M02030200017

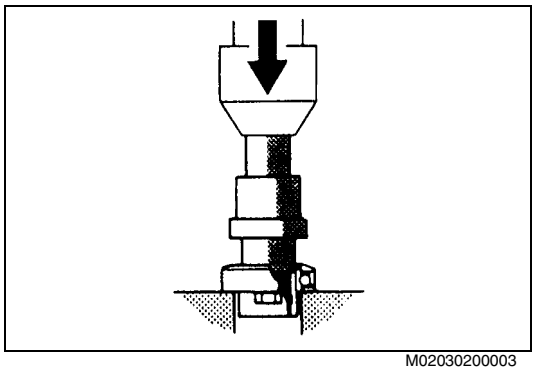


M02030200018

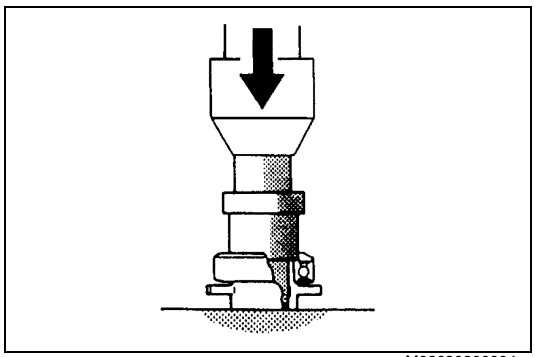
(2) Push the switch into the switch bushing until the switch pounds the buffer, then fix the switch by turning if clockwise.

**NOTICE:**
**Check that the switch body does not contact the buffer and also that the switch rightly function.**

## IMPORTANT POINTS - ASSEMBLY

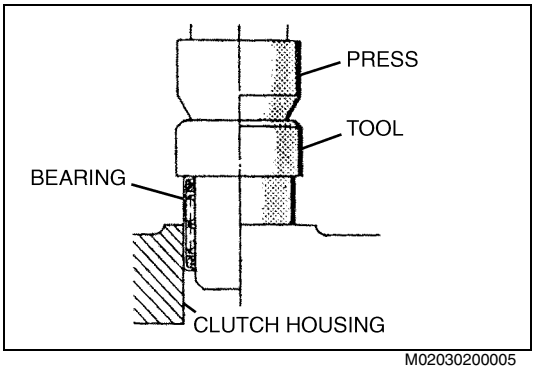

M02030200003

**1. REPLACE THE RELEASE BEARING.**
(1) Using a suitable tool and a press, remove the bearing from the release bearing hub.


M02030200004

(2) Press the bearing into the hub.

**NOTICE:**
- **After installing the bearing, ensure that it rotates smoothly.**
- **The bearing is permanently lubricated and require no cleaning or lubrication.**
- **In order to prevent damage to the race surface, press fit slowly by a press and do not apply impact loads.**

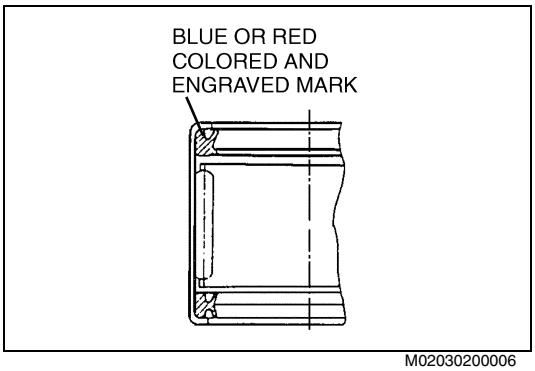


M02030200005

**2. REPLACE THE RELEASE SHAFT BEARING .**

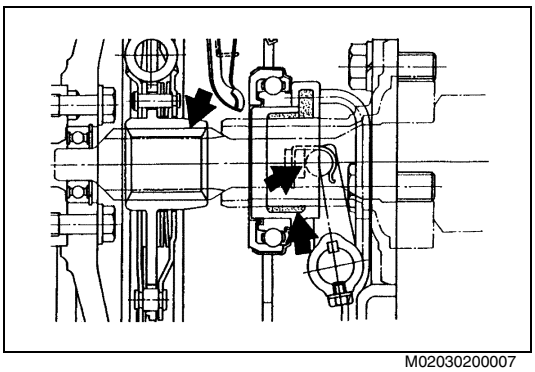
(1) Using a suitable tool and a press, remove the bearings from the clutch housing.

(2) Press the bearings into the housing.



M02030200006

**NOTICE:**
**The bearing must be installed with blue colored and engraved facing of the oil seal outward.**


M02030200007

**3. APPLY BEARING GREASE OR HEAT RESISTANCE GREASE.**

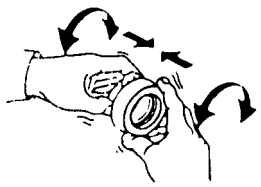
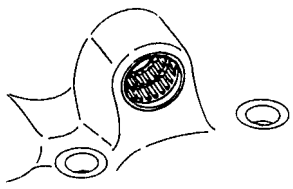
(1) Apply bearing grease to the following parts.
   a. The release fork and the release bearing hub contact point.
   b. The release bearing hub inner groove.

(2) Apply heat resistance grease to the transmission input shaft spline.

**NOTICE:**
**Apply a small amount of grease to the spline.**

# INSPECTION AND REPAIR

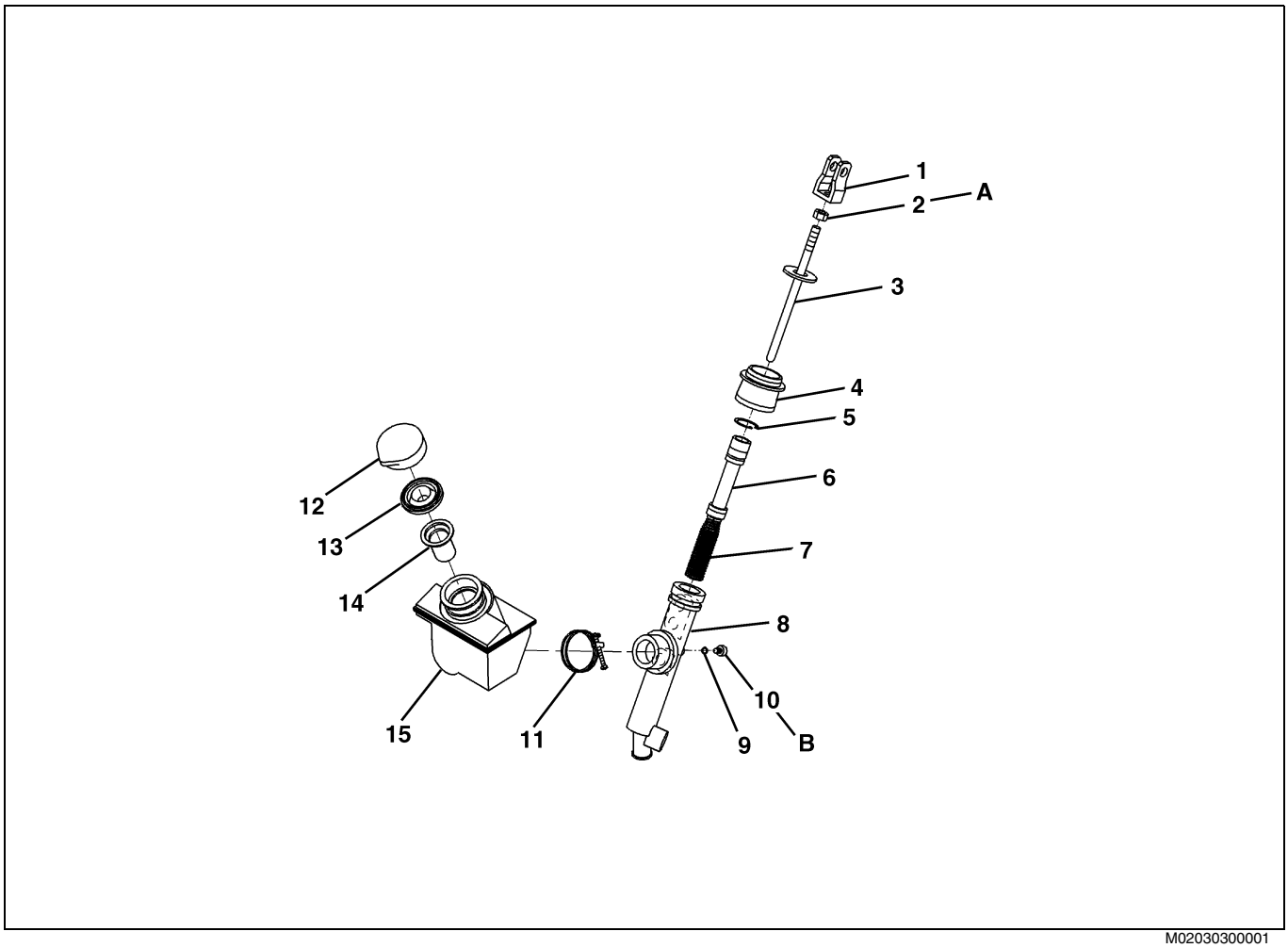
M02030203BEH3002

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Release bearing improper rotation** | — | — | **Replace release bearing, if necessary.** | **Visual check**  |
| **Release fork and release hub: Wear and damage** | — | — | **Replace the parts, if necessary.** | **Visual check** |
| **Release shaft bearing: Wear and damage** | — | — | **Replace the parts, if necessary.** | **Visual check**  |

# CLUTCH MASTER CYLINDER

## COMPONENT LOCATOR

M02030303BED1001




M02030300001

| | | | |
|---|---|---|---|
| 1 | Clevis | 9 | O-ring |
| 2 | Lock nut | 10 | Stopper bolt |
| 3 | Push rod | 11 | Clamp |
| 4 | Boot | 12 | Reservoir cap |
| 5 | Retainer ring | 13 | Gasket |
| 6 | Piston | 14 | Oil reservoir strainer |
| 7 | Return spring | 15 | Reservoir tank |
| 8 | Body | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 11.5-16.9 {118-172, 8.5-12.4} | B | 2.4-4.4 {25-45, 1.9-3.2} |

# OVERHAUL

M02030303BEH2001

## IMPORTANT POINT - DISMOUNTING

**1. REMOVE THE MASTER CYLINDER.**

**NOTICE:**

- **Before removing the master cylinder, drain the clutch fluid from the hydraulic line.**
- **Place a small drain pan under the master cylinder to catch the hydraulic fluid. Do not let the clutch fluid remain on a painted floor. Wash it off immediately.**

## IMPORTANT POINT - ASSEMBLY

**1. INSTALL THE RETURN SPRING AND PISTON TO THE CYLINDER.**

**NOTICE:**

**Lubricate the cylinder bore and piston with clean clutch fluid.**

# INSPECTION AND REPAIR

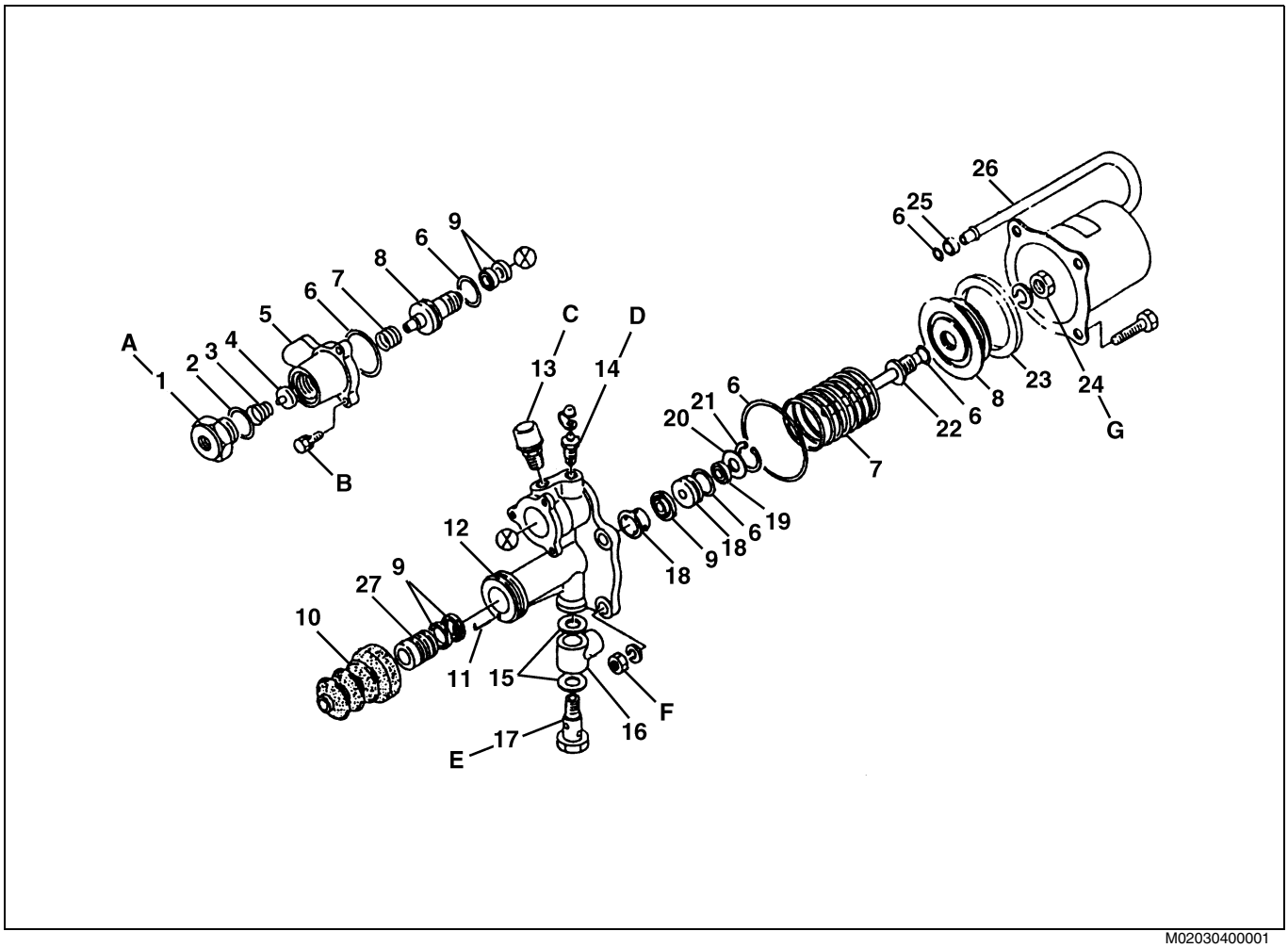
M02030303BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Piston seal and cup:<br>Wear and damage<br>Cylinder body bore:<br>Scoring and corrosion | — | — | Replace the piston assembly and/or cylinder body, if necessary. | Visual check |

# CLUTCH BOOSTER

## COMPONENT LOCATOR

M02030404BED1001




M02030400001

| | | | |
|---|---|---|---|
| 1 | Poppet valve adapter | 15 | Soft washer |
| 2 | Gasket | 16 | Oil pipe connector |
| 3 | Conical spring | 17 | Pipe joint bolt |
| 4 | Poppet valve | 18 | Cup and washer retainer |
| 5 | Poppet valve body | 19 | Oil seal |
| 6 | O-ring | 20 | Push rod washer |
| 7 | Return spring | 21 | Retainer ring |
| 8 | Piston | 22 | Push rod |
| 9 | Piston cup | 23 | Piston seal |
| 10 | Push rod boot | 24 | Lock nut |
| 11 | Pin | 25 | Collar |
| 12 | Cylinder | 26 | Cylinder shell |
| 13 | Exhaust port | 27 | Hydraulic piston |
| 14 | Air bleeder | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 19.6-29.4 {200-300, 15-21} | E | 27.5-32.5 {280-330, 20-23} |
| B | 3.9-5.9 {40-60, 2.9-4.3} | F | 19.6-29.4 {200-300, 15-21} |
| C | 14.7-19.6 {150-200,11-14} | G | 19.6-29.4 {200-300, 15-21} |
| D | 6.9-12.7 {70-130, 6-9} | | |

# OVERHAUL

M02030404BEH2001

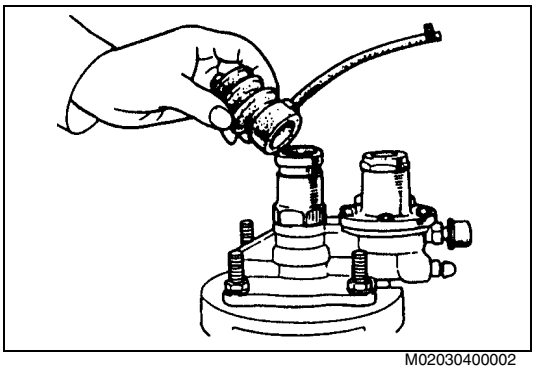
## IMPORTANT POINT - DISMOUNTING

**1. REMOVE THE CLUTCH BOOSTER.**

**NOTICE:**

- **Before removing the clutch booster, drain the clutch fluid from the hydraulic line.**
- **Apply the parking brake and bleed the pressure from the air brake system.**

## IMPORTANT POINTS - DISASSEMBLY

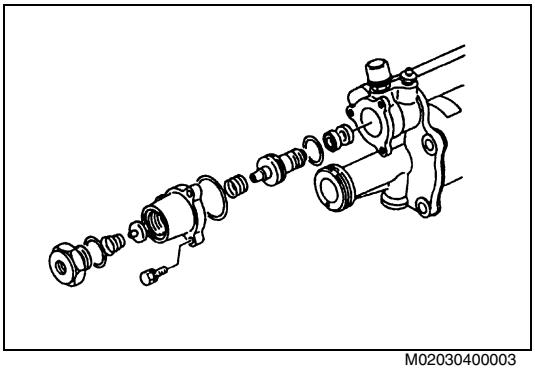


M02030400002

**1. SET THE CLUTCH BOOSTER ON A STAND.**

**SST: Stand (09536-1020)**

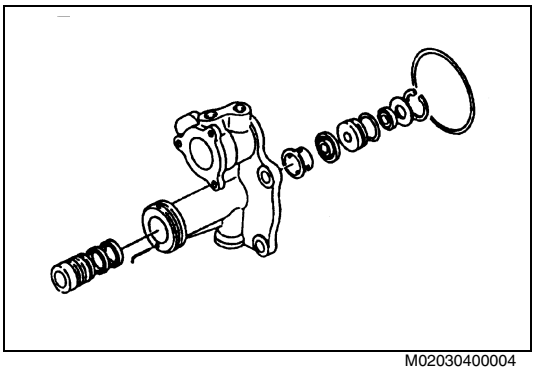
**NOTICE:**
**Before disassembling the air booster, clean the outside of the booster.**



M02030400003

**2. DISASSEMBLE THE CONTROL VALVE.**

(1) Remove the poppet valve adapter and gasket.
(2) Remove the conical spring and poppet valve.
(3) Remove the poppet valve body, return spring and piston.



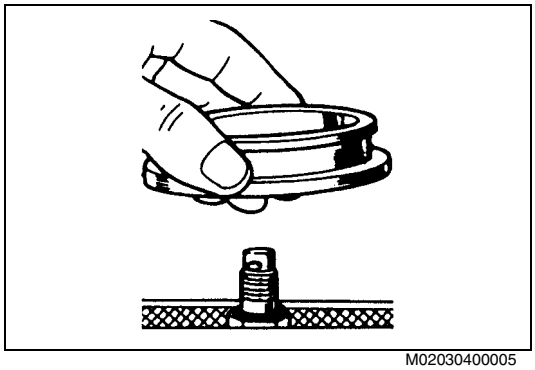
M02030400004

**3. DISASSEMBLE THE CYLINDER.**

(1) Remove the pin and piston.
(2) Remove the retainer ring.
(3) Remove the push rod washers, the cup and washer retainer, piston cup and the oil seal.
(4) Using the special tool, remove the O-ring.
**SST: Hook (09653-1780)**

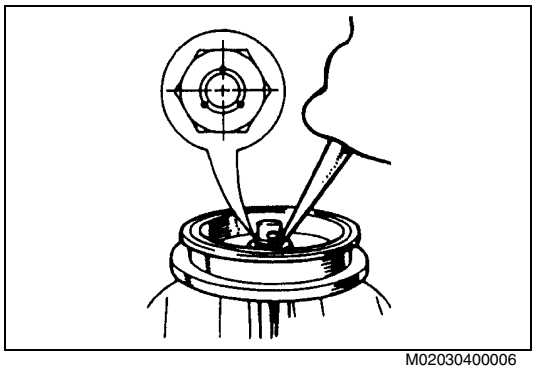
## IMPORTANT POINTS - ASSEMBLY

- There is red colored and brown colored grease in the overhaul kit.
- The red colored grease should be used for the piston, the oil seals, the O-rings, the piston cups on the end plate, hydraulic cylinder and the relay valve.
- The brown colored grease should be used for the O-rings, the gasket, the piston seal and the inside of the cylinder shell.

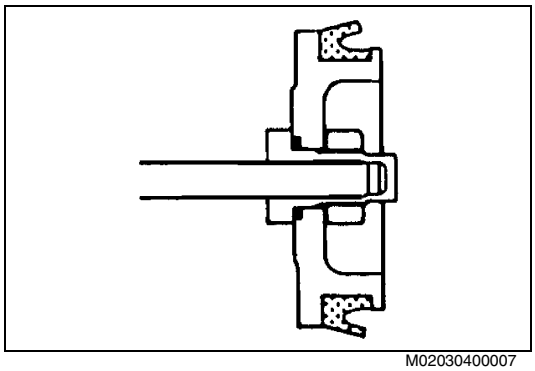

M02030400005

**1. ASSEMBLE THE POWER PISTON.**

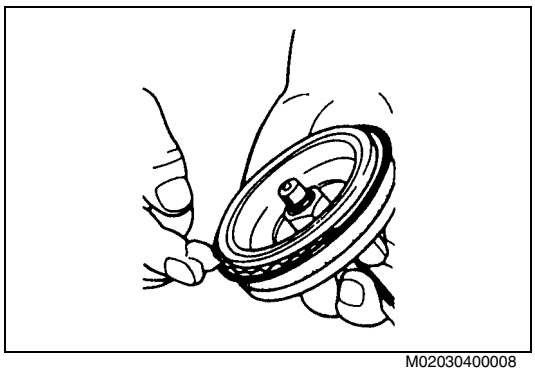
(1) Apply the brown colored grease to the O-ring and install the O-ring on the push rod.


M02030400006

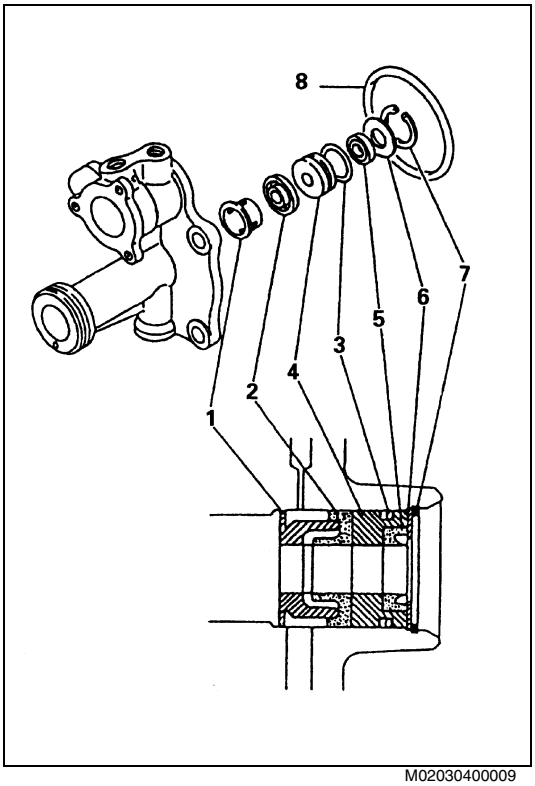
(2) After tightening the lock nut, secure the lock nut at three places with a punch to prevent loosening.


M02030400007

(3) Install the piston seal on the piston.


M02030400008

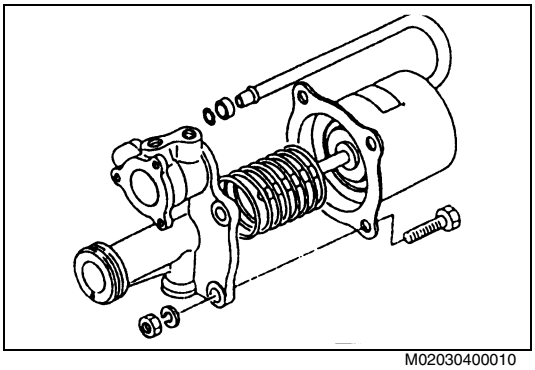
(4) Apply the brown colored grease on the piston seal and the inside of the cylinder shell.



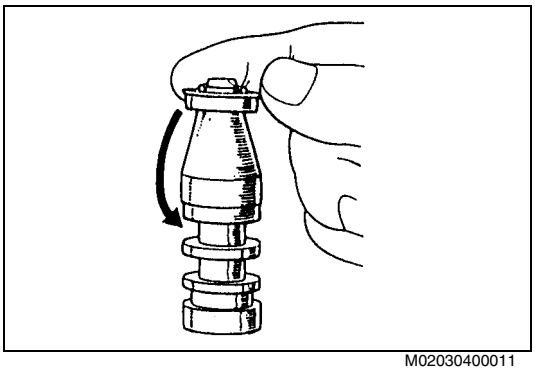
M02030400009

**2. ASSEMBLE THE CYLINDER.**
(1) Install the cup and washer retainer.
(2) Install the piston cup.
(3) Install the O-ring on the cup and washer retainer.
(4) Install the cup and washer retainer.
(5) Install the oil seal.
(6) Install the push rod washer.
(7) Install the retainer ring.
(8) Install the O-ring.

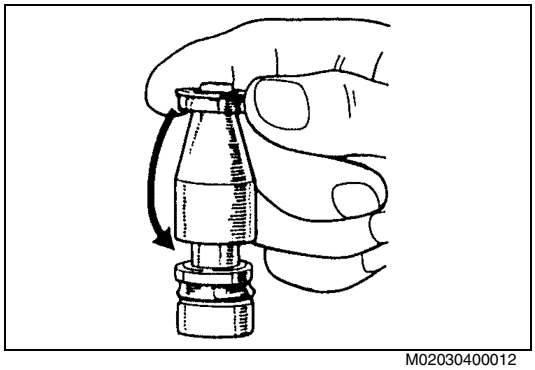
**NOTICE:**
**Coat the parts with red colored grease.**

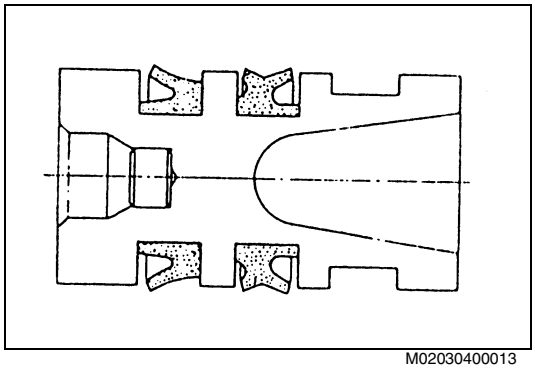

M02030400010

**3. INSTALL THE CYLINDER ASSEMBLY ON THE POWER PISTON.**
(1) Insert the control tube bushing and the seal on the control tube.

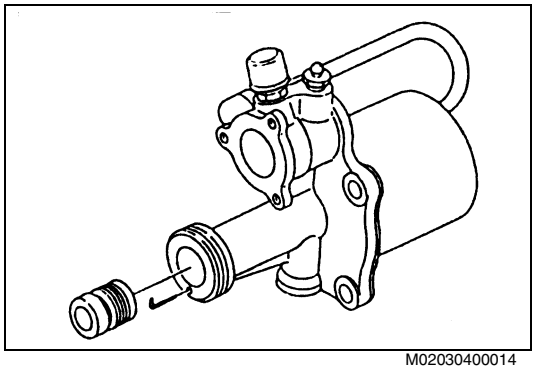

M02030400011

**4. ASSEMBLE THE HYDRAULIC CYLINDER.**
(1) Using the special tools, install the piston cups on the piston.
**SST:**
**Guide (09657-2090)**
**Guide (09657-2100)**

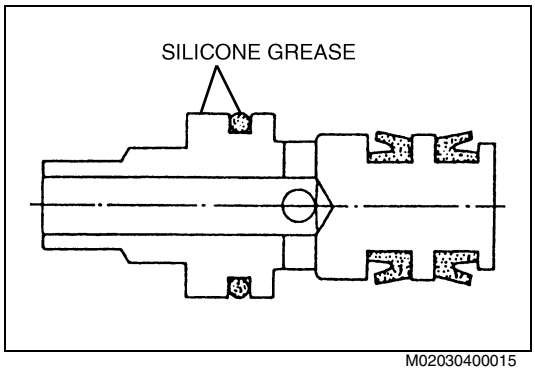

M02030400012


M02030400013

(2) Apply the red colored grease on the piston cups, the piston and the inside of the hydraulic cylinder.


M02030400014

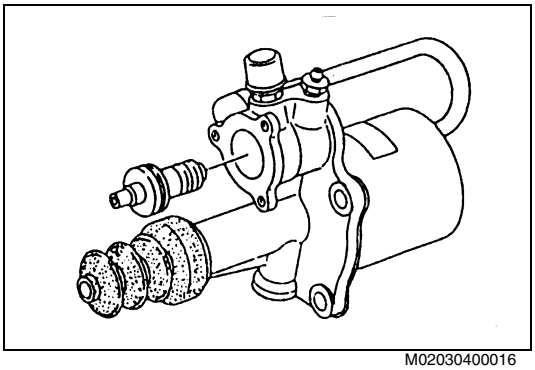
(3) Install the piston assembly in the hydraulic cylinder.
(4) Install the pin.



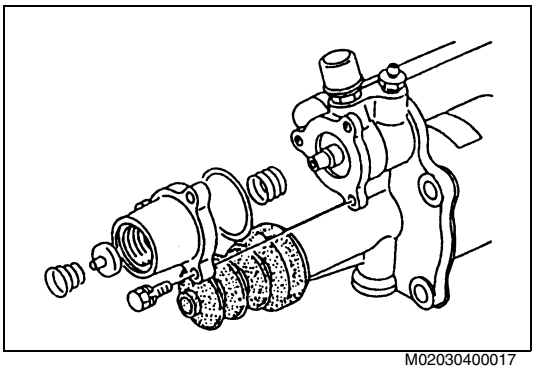
M02030400015

**5. ASSEMBLE THE PISTON.**
(1) Install the piston cups and O-ring on the piston.
(2) Coat the cups with red colored grease.
**SST:**
**Guide (09657-2150)**
**Guide (09657-2160)**

**NOTICE:**
- **Take care not to damage the piston cups when installing them on the piston.**
- **Coat the O-ring and sliding surfaces with silicone grease as shown in the figure.**

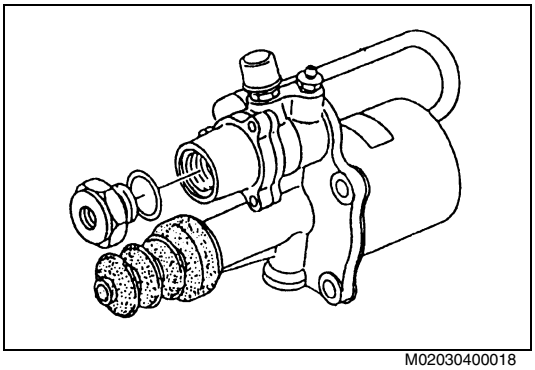

M02030400016

**6. INSTALL THE PISTON ASSEMBLY TO THE CYLINDER.**


M02030400017

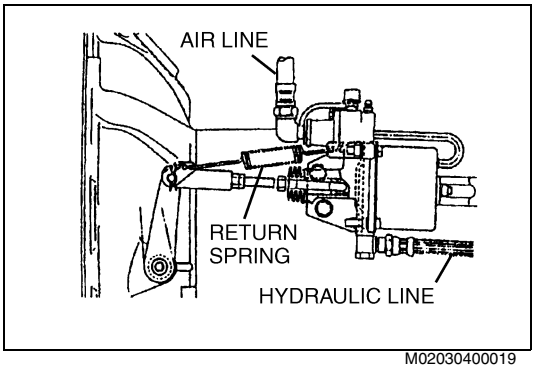
**7. INSTALL THE RETURN SPRING, O-RING, POPPET VALVE BODY, POPPET VALVE AND CONICAL SPRING.**

**NOTICE:**
**Coat the O-ring with brown colored grease.**


M02030400018

**8. INSTALL THE ADAPTER.**

(1) Coat the gasket with brown colored grease and install the gasket on the adapter.
(2) Install the adapter on the poppet valve body and tighten it.



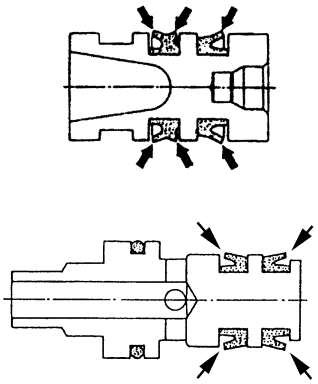
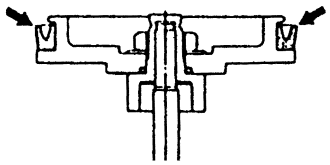
M02030400019

## IMPORTANT POINT - MOUNTING

**1. INSTALL THE CLUTCH BOOSTER.**
(1) Connect the air and hydraulic lines to the clutch booster.
(2) Install the return spring.

# INSPECTION AND REPAIR

M02030403BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Piston cup:<br>Wear and damage<br>Cylinder body bore:<br>Scoring and corrosion** | **—** | **—** | **Replace the parts, if necessary.** | **Visual check**<br>  |
| **Piston seal:<br>Wear and damage<br>Power cylinder bore:<br>Scoring and corrosion** | **—** | **—** | **Replace the parts, if necessary.** | **Visual check**<br>  |

# TRANSMISSION MAIN UNIT (LJ06S)

TR02-001

**TRANSMISSION ASSEMBLY (LJ06S)..... TR02-2**
DATA AND SPECIFICATIONS ..... TR02-2
DESCRIPTION ..... TR02-3
TROUBLESHOOTING ..... TR02-4
SPECIAL TOOL ..... TR02-5
DISMOUNTING AND MOUNTING ..... TR02-6

**GEAR SHIFT HOUSING (LJ06S) ..... TR02-8**
COMPONENT LOCATOR ..... TR02-8
OVERHAUL ..... TR02-11
INSPECTION AND REPAIR ..... TR02-15

**INPUT SHAFT, OUTPUT SHAFT, GEARS AND RELATED PARTS (LJ06S) ..... TR02-16**
COMPONENT LOCATOR ..... TR02-16
OVERHAUL ..... TR02-18
INSPECTION AND REPAIR ..... TR02-28

**COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS (LJ06S) ..... TR02-29**
COMPONENT LOCATOR ..... TR02-29
OVERHAUL ..... TR02-30
INSPECTION AND REPAIR ..... TR02-34

# TRANSMISSION ASSEMBLY (LJ06S)

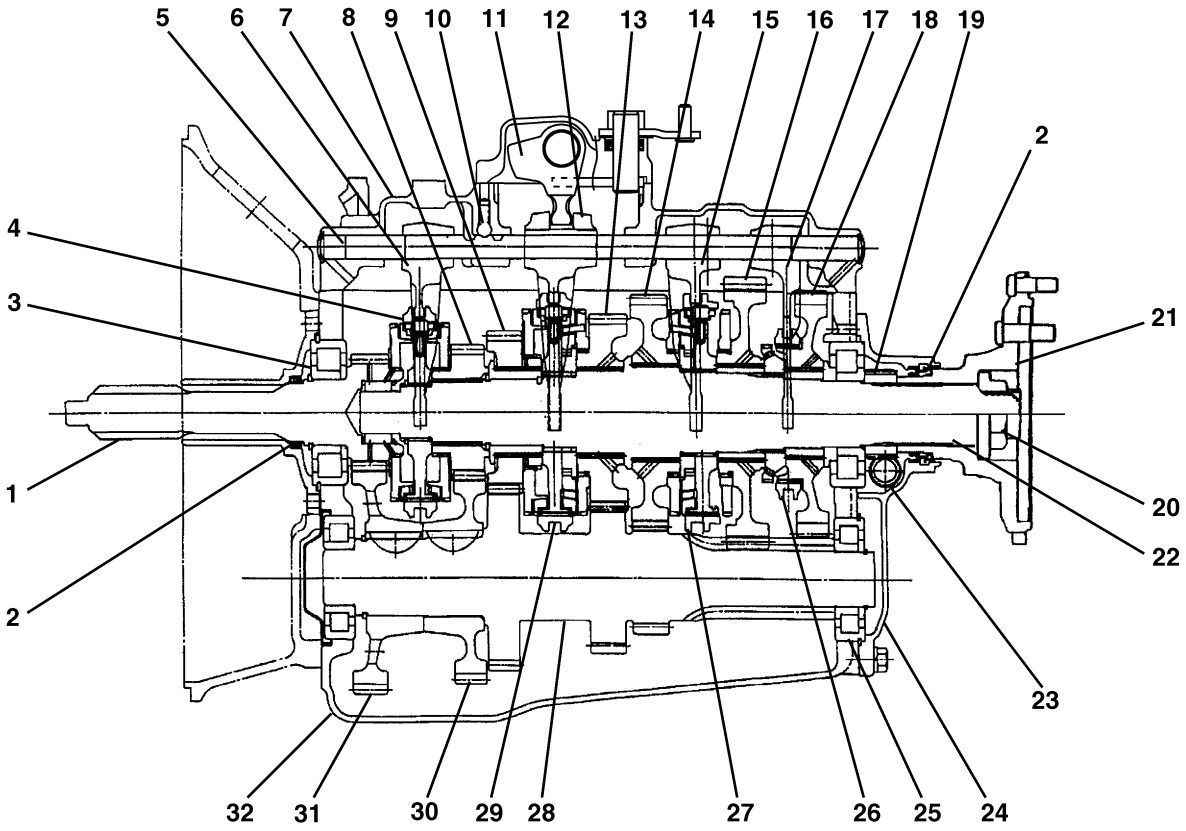
## DATA AND SPECIFICATIONS

M03020105BEI2002

| | | TYPE-A | TYPE-B |
|---|---|---|---|
| Type | Six forward speeds, one reverse 2, 3, 4, 5, 6th Synchromesh, 1st and Reverse, Constant mesh | | |
| Gear ratios: | 1st | 6.893 | 6.746 |
| | 2nd | 4.274 | 4.190 |
| | 3rd | 2.607 | 2.451 |
| | 4th | 1.564 | 1.474 |
| | 5th | 1.000 | 1.000 |
| | 6th | 0.770 | 0.823 |
| | Reverse | 6.453 | 6.453 |
| Number of teeth input shaft | 25 | | |
| Number of teeth counter shaft | Counter drive gear | 44 | 44 |
| | 1st gear | 12 | 12 |
| | 2nd gear | 21 | 21 |
| | 3rd gear | 27 | 28 |
| | 4th gear | 36 | 36 |
| | 5th gear | — | — |
| | 6th gear | 48 | 47 |
| | Reverse gear | 12 | 12 |
| Number of teeth output shaft | 1st gear | 47 | 46 |
| | 2nd gear | 51 | 50 |
| | 3rd gear | 40 | 39 |
| | 4th gear | 32 | 31 |
| | 5th gear | — | — |
| | 6th gear | 21 | 22 |
| | Reverse gear | 44 | 44 |
| Reverse idle gear | 23 | | |
| Power take-off opening | On left side of gear case | | |
| Oil capacity, gear box | Approx. 8.0 liters {1.76 Imp.gal/2.11 US gal.} | | |
| Oil capacity, gear box with power take-off | Approx. 8.5 liters {1.87 Imp.gal/2.25 US gal.} | | |
| Lubricant, type | Gear oil (API GL-4) | | |
| Viscosity, between-12 and 32°C {10 and 90°F} | SAE90 | | |
| Viscosity, above 32°C {90°F} | SAE140 | | |

# DESCRIPTION

M03020105BEC1002




M03020100093

| | | | |
|---|---|---|---|
| 1 | Input shaft | 17 | Reverse shift fork |
| 2 | Oil seal | 18 | Reverse gear |
| 3 | Front bearing retainer | 19 | Speedometer drive gear |
| 4 | 5th - 6th synchronizer unit | 20 | Nut |
| 5 | Shift shaft | 21 | Flange |
| 6 | 5th - 6th shift fork | 22 | Output shaft |
| 7 | Case cover | 23 | Speedometer driven gear |
| 8 | 6th gear | 24 | Rear bearing retainer |
| 9 | 4th gear | 25 | Cylindrical bearing |
| 10 | Steel ball | 26 | Reverse shift sleeve |
| 11 | Inner shift lever | 27 | 1st - 2nd synchronizer unit |
| 12 | 3rd - 4th shift fork | 28 | Counter shaft |
| 13 | 3rd gear | 29 | 3rd - 4th synchronizer unit |
| 14 | 2nd gear | 30 | Counter 6th gear |
| 15 | 1st - 2nd shift fork | 31 | Counter drive gear |
| 16 | 1st gear | 32 | Transmission case |

# TROUBLESHOOTING

M03020105BEF3002

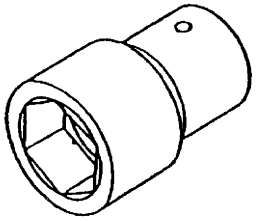
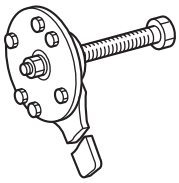
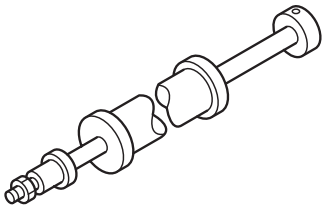
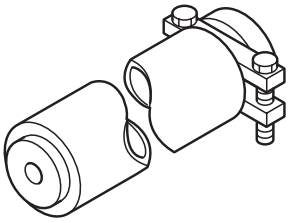
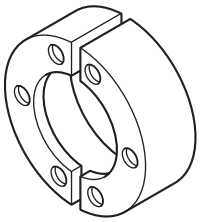
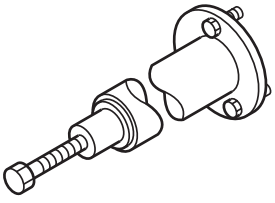
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Gear slip-off (Control system)** | Joint worn and/or damaged | Replace joint. |
| | Bolts and nuts loose | Tighten bolts and nuts. |
| | Improper link rod adjustment | Adjust link rod. |
| **Gear slip-off (Gear shift housing)** | Lock ball and spring distorted and/or broken | Replace or replace as required. |
| | Groove for shift shaft worn | Replace shift fork. |
| **Gear slip-off (Transmission gear)** | Synchronizer hub and sleeve worn | Replace as required. |
| | Synchronizer sleeve and gear clutch teeth worn or damaged | Replace as required. |
| | Input shaft and/or output shaft bearing worn and/or broken | Replace bearing. |
| | Retainer ring and/or thrust washer worn and/or broken | Replace as required. |
| | Loosened transmission to engine mounting bolts | Tighten bolts. |
| **Difficult gear engagement (Engine)** | Engine idling speed too high | Adjust engine idling. |
| **Difficult gear engagement (Clutch)** | Improper disengagement of clutch | Adjust clutch. |
| | Clutch disc sticking | Repair or replace. |
| | Clutch shifter sleeve bent | Replace shifter sleeve. |
| **Difficult gear engagement (Transmission)** | Input shaft and/or output shaft bearing worn and/or damaged | Replace bearing. |
| | Engine crankshaft pilot bearing worn and/or damaged | Replace bearing. |
| | Synchronizer cone and ring worn | Replace as required. |
| **Difficult gear engagement (Control system)** | Looseness of control system and/or improper adjustment | Tighten and adjust control system. |
| | Improper motion of gear shift lever | Adjust shift lever. |
| | Shift and select rod worn | Replace shift and select rod. |
| | Rigid relay shaft nylon bushing and/or sticking of shafts | Replace as required. |
| **Difficult gear engagement (Lubrication)** | Improper lubrication of control lever | Lubricate as required. |
| | Shortage gear oil and/or low oil viscosity | Add oil or change oil as required. |
| **Noise (Transmission)** | Grinding in transmission | Check for screws, bolts or other foreign materials in transmission. |
| | Loose transmission-to-engine mounting bolts | Tighten bolts. |
| | Worn or damaged gear and bearing | Replace as required. |
| **Noise (Lubrication)** | Shortage of gear oil and/or low oil viscosity | Add oil or change oil as required. |
| **Gear oil leaks (Transmission)** | Leaks at the front and rear bearing retainer seal and gasket, case cover gasket, sand hole of case or shift shaft expansion plug | Repair and replace as required. |
| | Improper amount of gear oil and lack of oil viscosity | Check oil level and type. |
| **Unable or very difficult to shift the gear when the engine is stopped.** | Improper adjustment of the gear control rod | Adjust the control rod. |
| | Looseness | Inspect and tighten each the bolts and the nuts. |

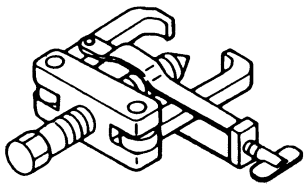
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Gear disengages when driving bumpy roads.** | Improper adjustment of the gear control rod | Adjust the control rod. |
| **The play of the lever is excessive.** | A joint is seriously worn. | Replace the joint. |
| | Looseness of tightening bolt and nut | Inspect and tighten each the bolts and the nuts. |

# SPECIAL TOOL

M03020105BEK1002

Prior to starting a transmission overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-5005 | SOCKET WRENCH | |
|  | 09650-1900 | PULLER | |
|  | 09420-1442 | SLIDING HAMMER | |
|  | 09650-2070 | INPUT SHAFT PULLER | |
|  | 09653-1180<br>09653-1200 | HOOK | |
|  | 09650-1881 | PULLER | |

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1101 | PULLER | |

# DISMOUNTING AND MOUNTING

M03020105BEH1002

## IMPORTANT POINTS - DISMOUNTING

**CAUTION:**
**Do not work on the transmission while it is still hot. This can result in personal injury.**

**1. BLOCK THE WHEELS.**

**2. DRAIN THE TRANSMISSION OIL.**

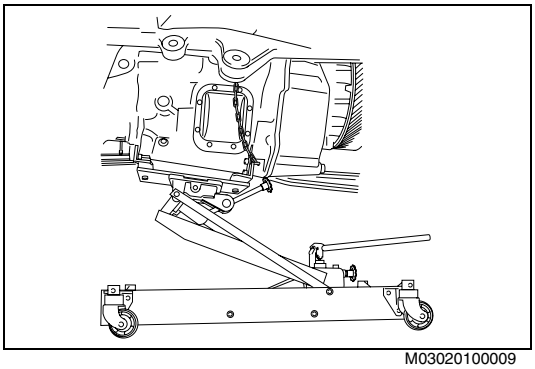
**3. DISCONNECT THE PROPELLER SHAFT.**

**4. DISCONNECT THE PARKING BRAKE CABLE.**

**5. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

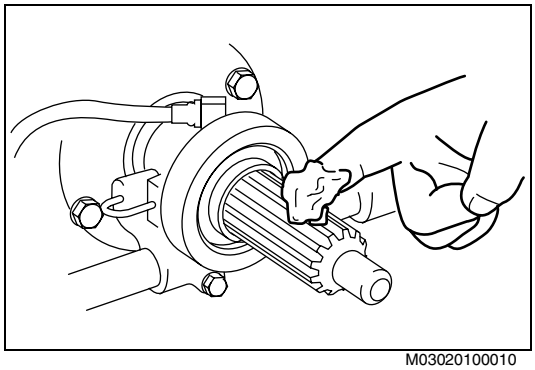
**6. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.**

**7. REMOVE THE CLUTCH BOOSTER.**



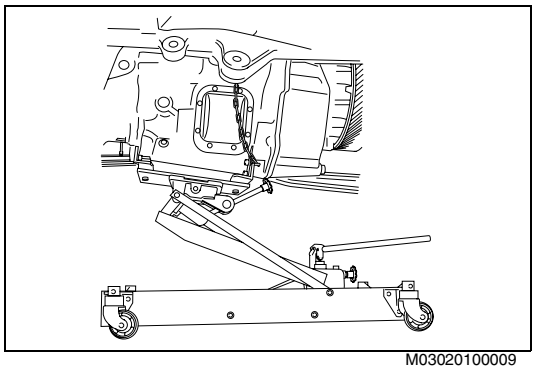
M03020100009

**8. REMOVE THE TRANSMISSION.**
(1) Remove the lower bolts around the clutch housing.
(2) Place a transmission jack under the transmission.
(3) Remove the remaining bolts around the clutch housing.
(4) Pull the transmission backwards. Lower the transmission jack and pull the transmission out from under the vehicle.


M03020100010

## IMPORTANT POINTS - MOUNTING

**1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.**


M03020100009

**2. INSTALL THE TRANSMISSION.**

**CAUTION:**
**In using the transmission jack, exercise good care to prevent the transmission dropping from the jack because the transmission is heavy and unstable.**

(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.
(2) Slip the transmission in and attach the clutch housing to the flywheel housing.
(3) Install the upper bolts around the clutch housing.
(4) Lower the transmission jack and pull the jack out from under the vehicle.
(5) Install the remaining bolts around the clutch housing.

**3. INSTALL THE CLUTCH BOOSTER.**

**4. CONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.**

**5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

**6. CONNECT THE PARKING BRAKE CABLE.**

**7. CONNECT THE PROPELLER SHAFT.**

**8. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.**

**9. CHECK THE CLUTCH PEDAL PLAY.**

Refer to chapter **CLUTCH CONTROL**.

**10. CHECK THE GEAR SHIFT IN EACH POSITION.**

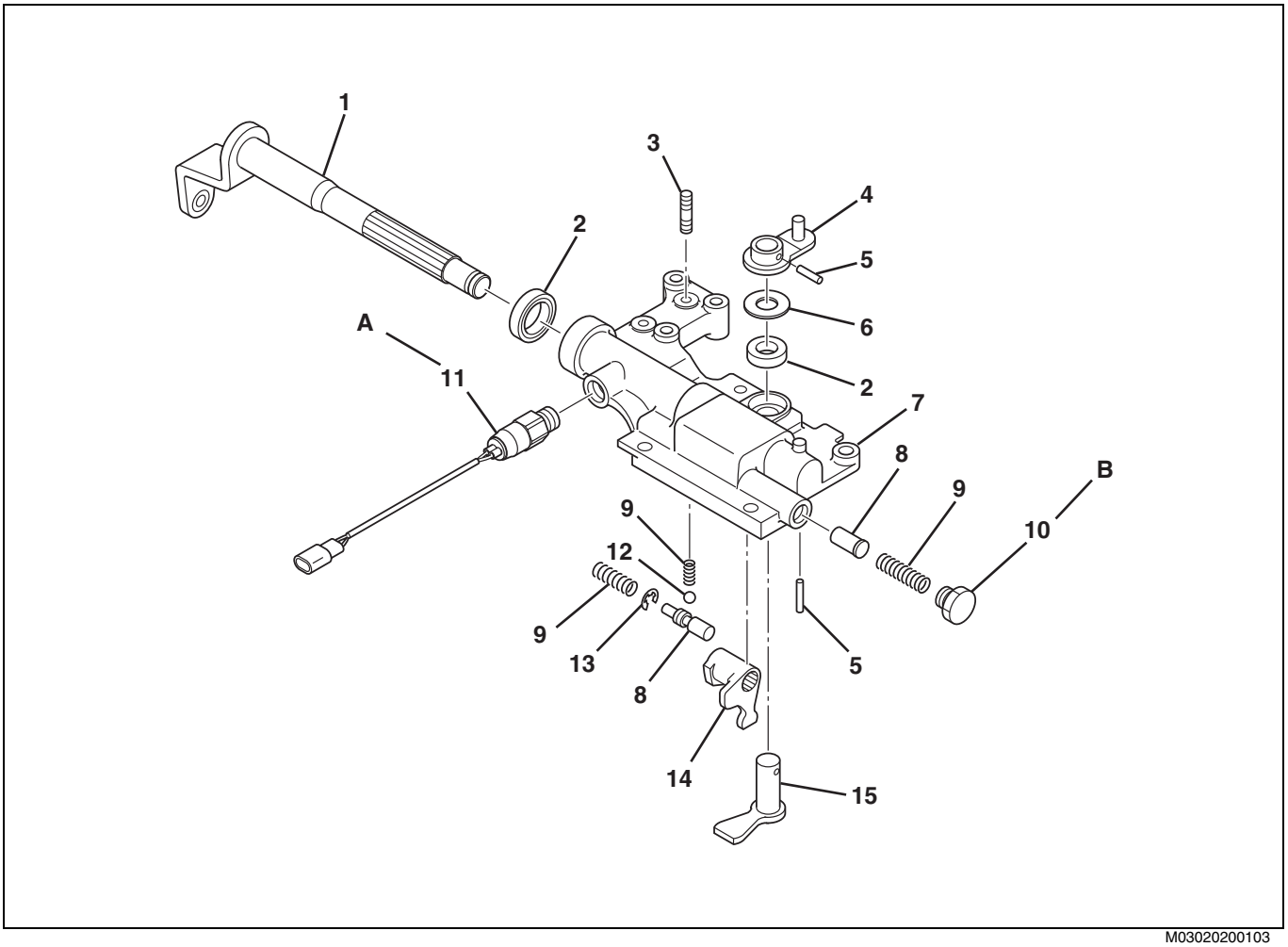
Refer to chapter **TRANSMISSION CONTROL**.

# GEAR SHIFT HOUSING (LJ06S)

## COMPONENT LOCATOR

M03020205BED1003

### WITHOUT POWER SHIFT



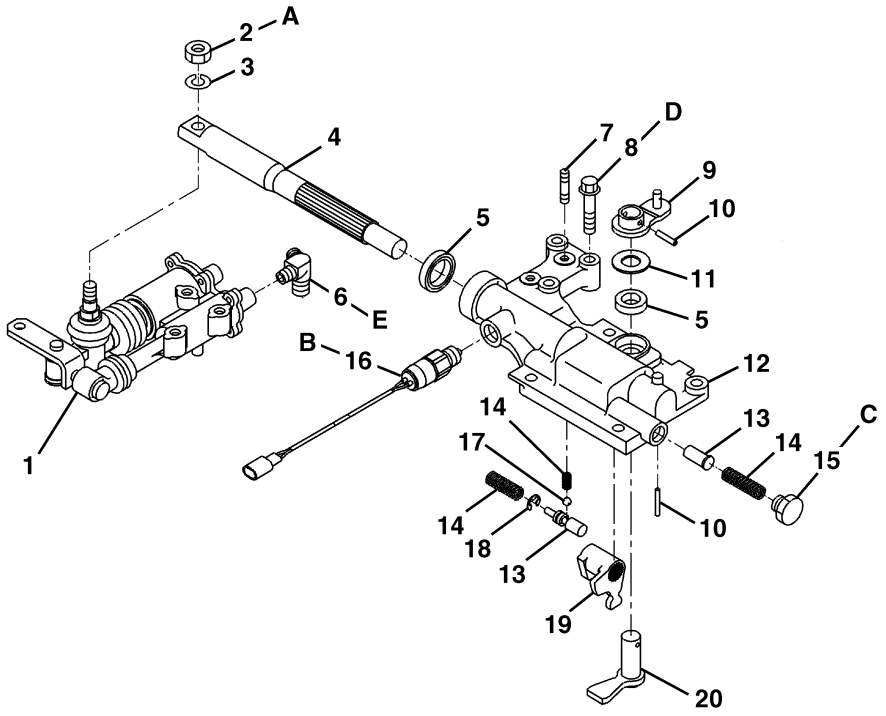

M03020200103

| | | | |
|---|---|---|---|
| 1 | Shift lever shaft | 9 | Compression spring |
| 2 | Oil seal | 10 | Plug |
| 3 | Stud | 11 | Neutral safety switch |
| 4 | Outer select lever | 12 | Steel ball |
| 5 | Pin | 13 | Retainer |
| 6 | Plain washer | 14 | Inner shift lever |
| 7 | Shift lever shaft housing | 15 | Select lever shaft |
| 8 | Lockout plunger | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 34-38 {350-390, 25-27} | B | 25-30 {255-306, 19-22} |

## WITH POWER SHIFT



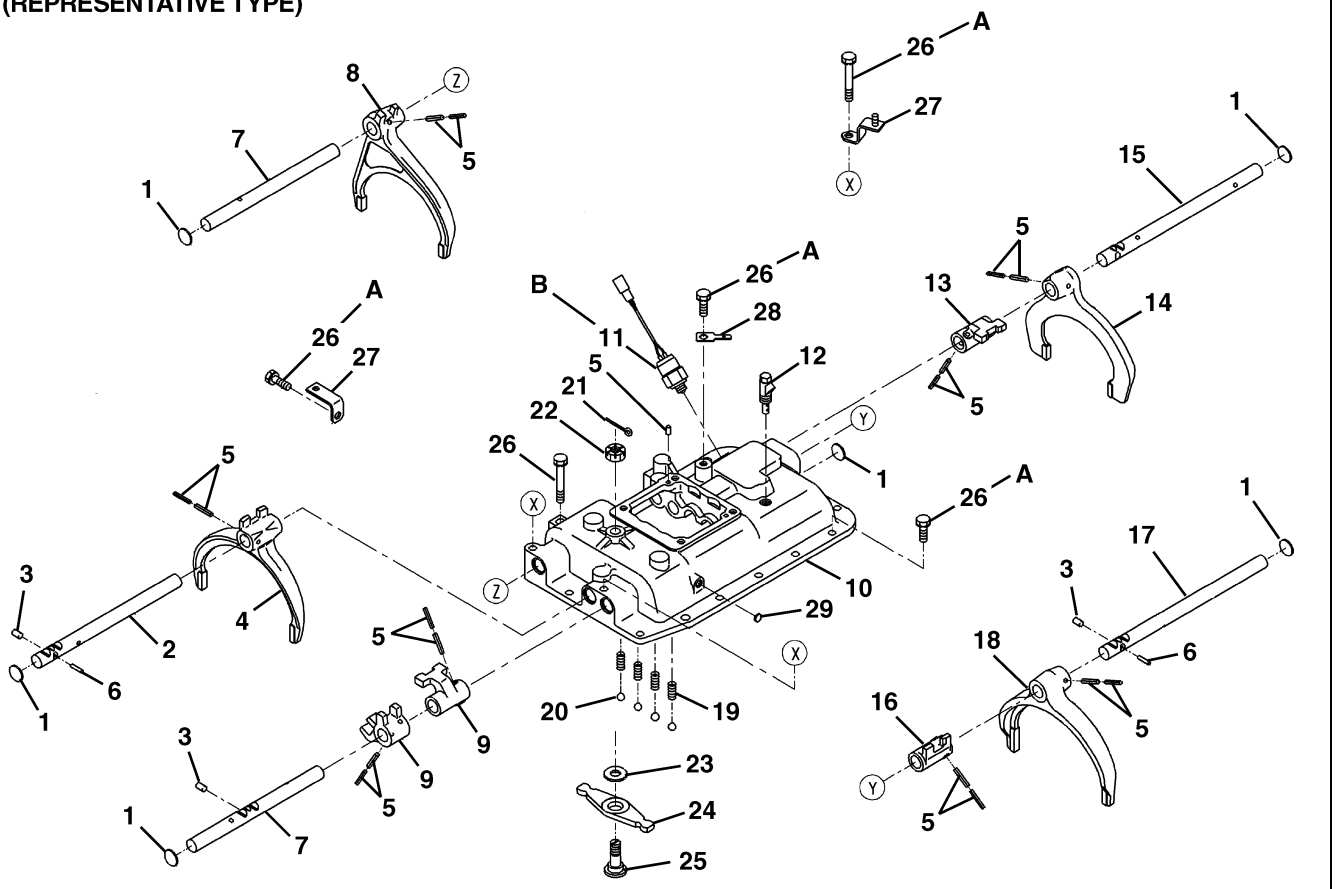

M03020200044

| | | | |
|---|---|---|---|
| 1 | Power shift unit assembly | 11 | Plain washer |
| 2 | Nut | 12 | Shift lever shaft housing |
| 3 | Spring washer | 13 | Lockout plunger |
| 4 | Shift lever shaft | 14 | Compression spring |
| 5 | Oil seal | 15 | Plug |
| 6 | Pipe joint | 16 | Neutral safety switch |
| 7 | Stud | 17 | Steel ball |
| 8 | Bolt | 18 | Retainer |
| 9 | Outer select lever | 19 | Inner shift lever |
| 10 | Pin | 20 | Select lever shaft |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 75.5-91.2 {770-930, 56-67} | D | 40.2-46.1 {410-470, 30-33} |
| B | 34-38 {350-390, 25-27} | E | 20-30 {204-305, 15-22} |
| C | 25-30 {255-306, 19-22} | | |

**(REPRESENTATIVE TYPE)**




M03020200045

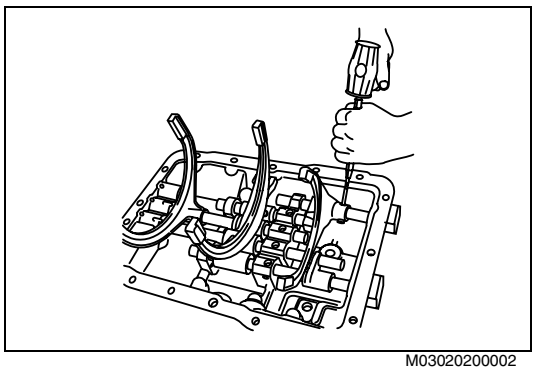
| | | | |
|---|---|---|---|
| 1 | Expansion plug | 16 | 1st - 2nd shift head |
| 2 | 3rd - 4th shift shaft | 17 | 1st - 2nd shift shaft |
| 3 | Interlock plunger | 18 | 1st - 2nd shift fork |
| 4 | 3rd - 4th shift fork | 19 | Compression spring |
| 5 | Pins | 20 | Steel ball |
| 6 | Interlock pin | 21 | Cotter pin |
| 7 | 5th - 6th shift shaft | 22 | Slotted nut |
| 8 | 5th - 6th shift fork | 23 | Plain washer |
| 9 | 5th - 6th shift head | 24 | Inversion lever |
| 10 | Transmission case cover | 25 | Inversion pin |
| 11 | Back - up lamp switch | 26 | Bolt |
| 12 | Air breather | 27 | Clip holder |
| 13 | Reverse shift head | 28 | Bracket |
| 14 | Reverse shift fork | 29 | Expansion plug |
| 15 | Reverse shift shaft | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 38.0-48.5 {380-500, 28-36} | B | 26-30 {265-300, 19-22} |

# OVERHAUL

M03020205BEH2003



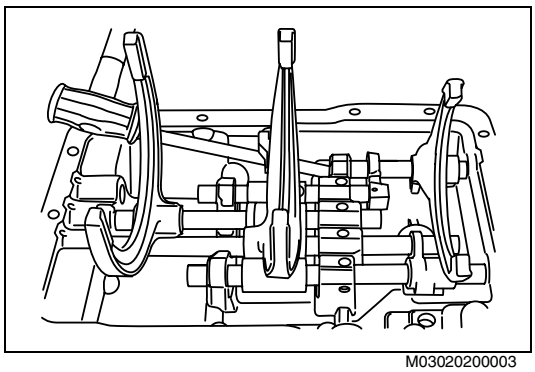
M03020200002

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE GEAR SHIFT SHAFT, SHIFT FORK AND SHIFT HEAD.**

(1) Set each shaft in the neutral position.

(2) Tap the shift head and shift fork fitting pins lightly with a 5 mm {0.197 in.} diameter tapping rod.

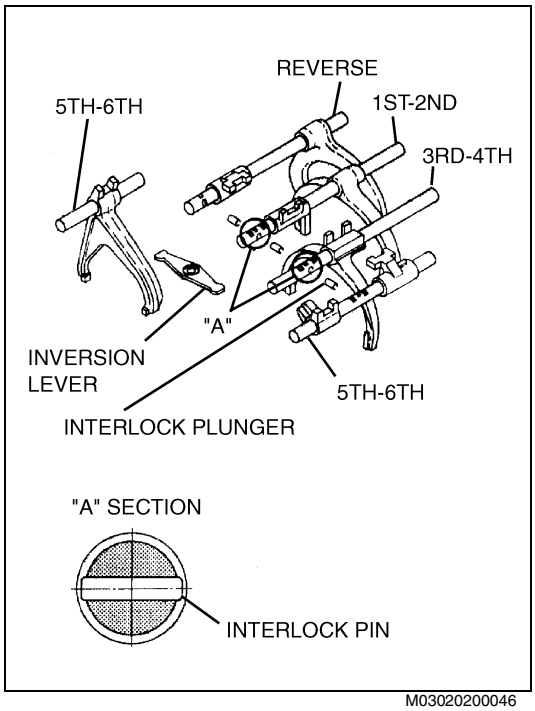


M03020200003

(3) Drive out the shift shafts and its expansion plugs one at a time. When removing the shift shaft, remove the shift fork and the shift head.

**NOTICE:**
**Take care not to damage the sliding bore.**

**CAUTION:**
**The steel ball may fly out of the hole when removing the shift shaft. Wear safety glasses during removal.**




M03020200046

## IMPORTANT POINTS - ASSEMBLY

**1. INSTALL THE STEEL BALL, COMPRESSION SPRING, SHIFT SHAFT, SHIFT FORK AND SHIFT HEAD.**

(1) Install the inversion lever and the pin.

(2) Place the ball and spring in the hole.

(3) Depress the ball and spring with a suitable tool.

**CAUTION:**
**The steel ball may fly out of the hole when installing the shift shaft. Wear safety glasses during installation.**

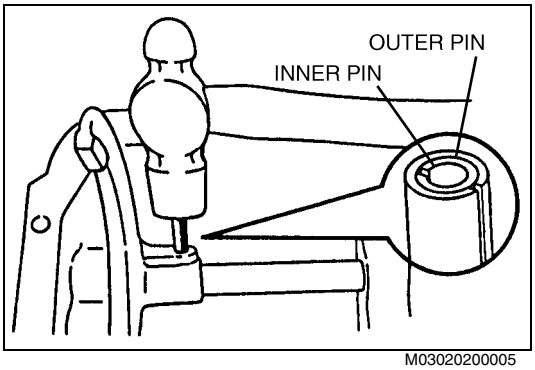
(4) Coat the shift shaft with gear oil.

(5) Align the shift fork and head and put the shift shaft through, and then slide the shift shaft over the ball.

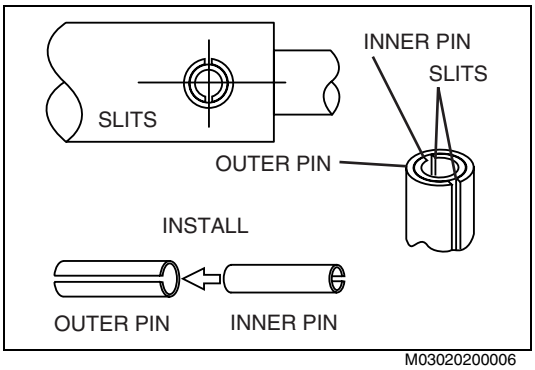
(6) Place the shift shaft in neutral position.

**NOTICE:**

- **Pay special attention to the position and direction of the shift fork and shift head.**
- **For 1st–2nd and 3rd–4th shift shafts, insert the interlock pin. Coat the interlock pin with chassis grease.**



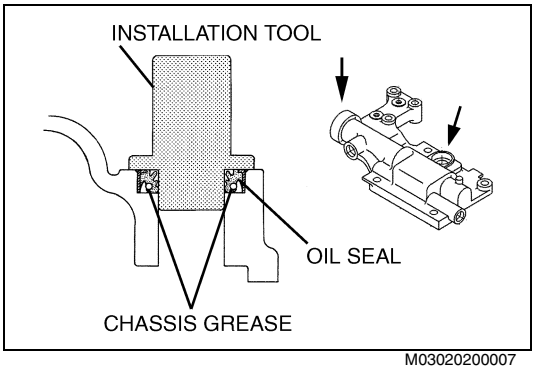
M03020200005



M03020200006

**2. SECURE THE SHIFT HEAD AND FORK WITH CONCENTRIC PINS.**

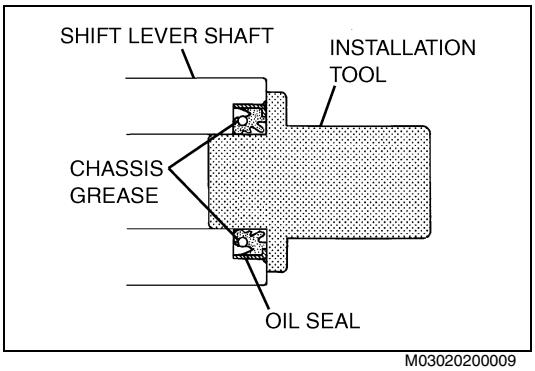
(1) Drive the concentric pins into the fork and the head. Make sure that the slits of the concentric pins are on opposite sides as shown.



M03020200007

**3. INSTALL THE OIL SEAL.**

(1) Drive a new oil seal into the shift lever shaft housing with the installation tool.



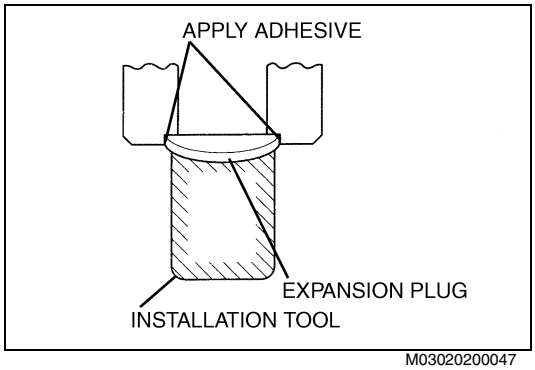
M03020200009

(2) Drive a new oil seal into the shift lever shaft with the installation tool.

(3) Coat the sealing surface between the seal lips with chassis grease.

**NOTICE:**

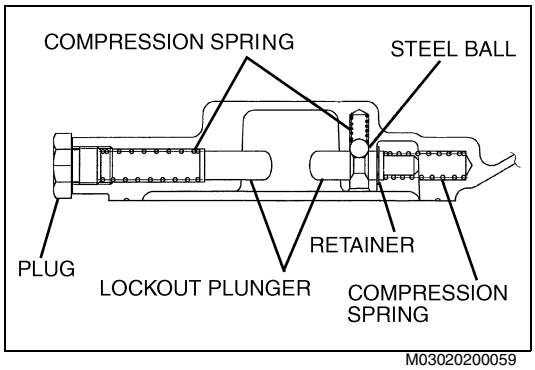
- **Always use a new oil seal.**
- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**



M03020200047

**4. INSTALL THE EXPANSION PLUG.**

(1) Apply adhesive all around to the expansion plug.



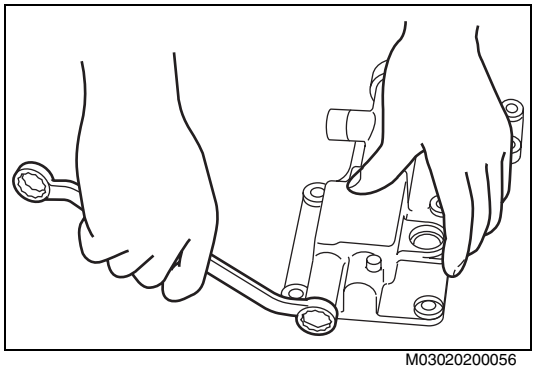
M03020200059

**5. INSTALL THE LOCKOUT PLUNGER, THE STEEL BALL AND THE COMPRESSION SPRING.**

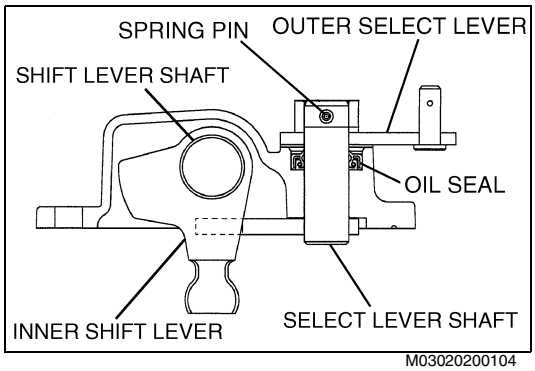
(1) Coat the lockout plunger with bearing grease.

(2) Put the compression spring and the steel ball, then install the lockout plunger as shown in the figure.

**NOTICE:**
**When installing the lockout plunger, be careful not to spring out the steel ball.**


M03020200056

(3) After applying adhesive to the plug, put the compression spring and install the plug.



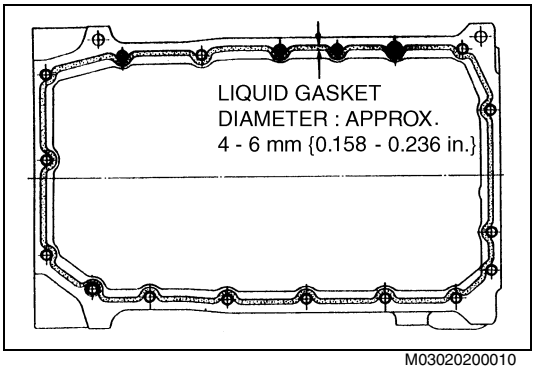
M03020200104

**6. INSTALL THE SHIFT LEVER SHAFT AND INNER SHIFT LEVER.**

(1) Install the shift lever shaft into the shift lever shaft housing bore, installing the inner shift lever on the shaft.

(2) Align the hole of the outer select lever with the hole of the select lever shaft to fix them with spring pin.

**NOTICE:**
**When installing the select lever shaft, be sure to align the holes of select lever shaft and outer select lever with the spring pin.**



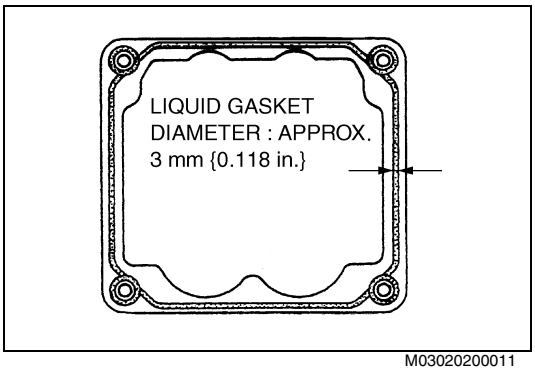
M03020200010

**7. INSTALL THE TRANSMISSION CASE COVER.**

(1) Coat the face of the transmission case with liquid gasket.

**NOTICE:**

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



M03020200011

**8. INSTALL THE SHIFT LEVER SHAFT HOUSING.**

(1) Coat the face of the transmission case cover with liquid gasket.

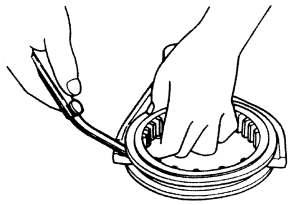
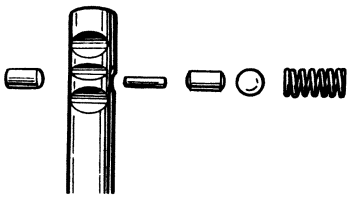
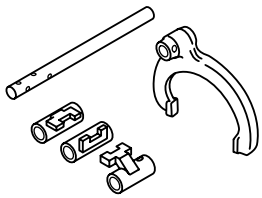
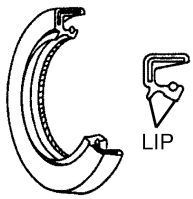
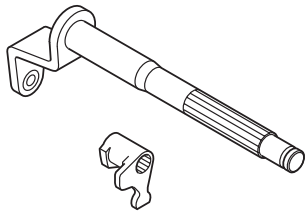
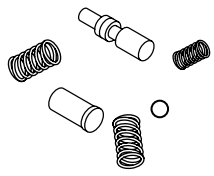
**NOTICE:**

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

# INSPECTION AND REPAIR

M03020205BEH3002

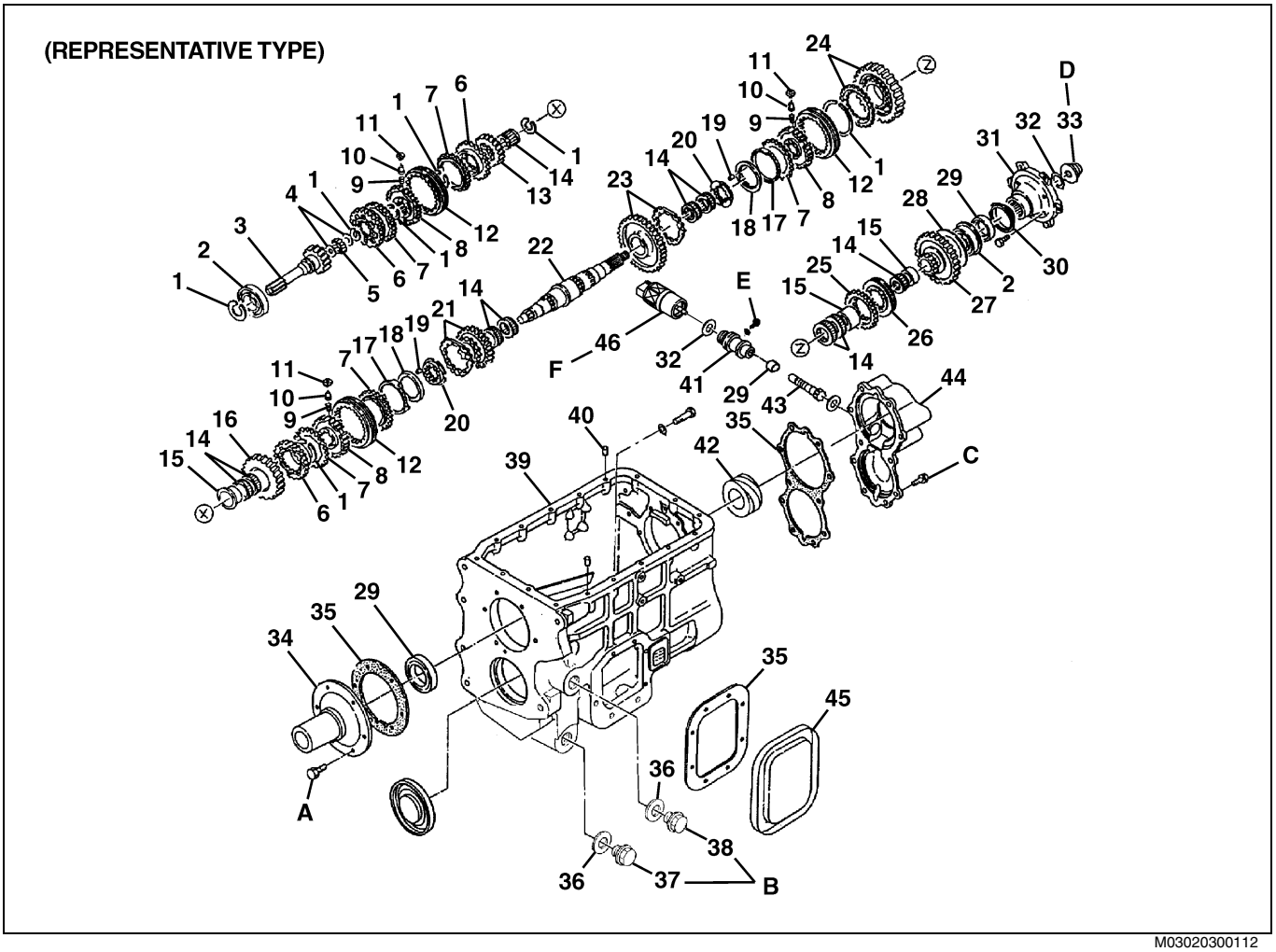
**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Clearance between shift fork and sleeve** | **0.2-0.45 {0.0079-0.0177}** | **1.0 {0.039}** | **Replace.** | **Measure**  |
| **Interlock pin, interlock plunger, compression spring and steel ball wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Shift head, shift fork and shift shaft wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Oil seal lip wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**   |
| **Shift lever shaft and inner shift lever wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Compression spring and lockout plunger and steel ball wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# INPUT SHAFT, OUTPUT SHAFT, GEARS AND RELATED PARTS (LJ06S)

## COMPONENT LOCATOR

M03020305BED1002



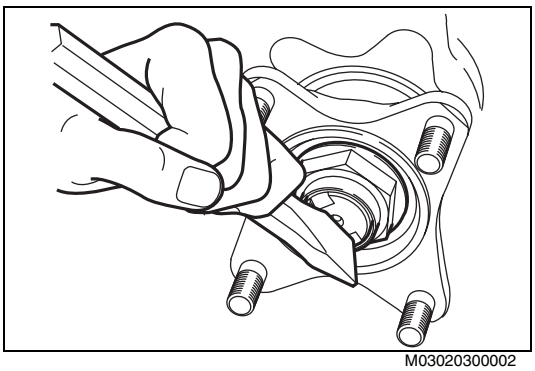
| | | | |
|---|---|---|---|
| 1 | Retainer ring | 24 | 1st gear sub-assembly |
| 2 | Cylindrical bearing | 25 | Constant hub |
| 3 | Input shaft | 26 | Constant sleeve |
| 4 | Spacer | 27 | Reverse gear |
| 5 | Roller bearing | 28 | Thrust washer |
| 6 | Synchronizer cone | 29 | Oil seal |
| 7 | Synchronizer ring | 30 | Dust deflector |
| 8 | Synchronizer hub | 31 | Universal joint flange |
| 9 | Compression spring | 32 | O-ring |
| 10 | Synchronizer head | 33 | Nut |
| 11 | Synchronizer key | 34 | Front bearing retainer |
| 12 | Synchronizer sleeve | 35 | Gasket |
| 13 | 6th gear | 36 | Soft washer |
| 14 | Needle roller bearing | 37 | Drain plug |
| 15 | Bushing | 38 | Filler plug |
| 16 | 4th gear | 39 | Transmission case |
| 17 | Synchronizer double cone | 40 | Straight pin |
| 18 | Synchronizer inner cone | 41 | Speed meter driven gear bushing |
| 19 | Pin | 42 | Speed meter drive gear |
| 20 | Synchronizer bushing | 43 | Speed meter driven gear |
| 21 | 3rd gear sub-assembly | 44 | Rear bearing retainer |
| 22 | Output shaft | 45 | Power take-off cover |
| 23 | 2nd gear sub-assembly | 46 | Speed sensor |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 54-68 {550-700, 40-50} | D | 587-783 {6,000-8,000, 434-578} |
| B | 79-117 {806-1,193, 59-86} | E | 8.5-10.5 {87-107, 6.3-7.7} |
| C | 63.5-84.5 {650-870, 47-62} | F | 14.7-29.3 {150-300, 11-23} |

# OVERHAUL

M03020305BEH2002


M03020300002

## IMPORTANT POINTS - DISASSENMBLY

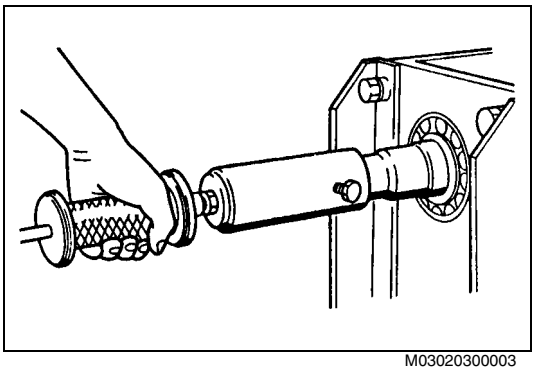
**1. REMOVE THE OUTPUT SHAFT LOCK NUT.**

(1) The lock nut has been caulked, so before loosening it, lift the caulked part completely out of the shaft groove.

(2) Using the special tool or the commercial tool, remove the lock nut.

**NOTICE:**
**Before loosening the lock nut, engage two gears so that the output shaft can not be turned around.**

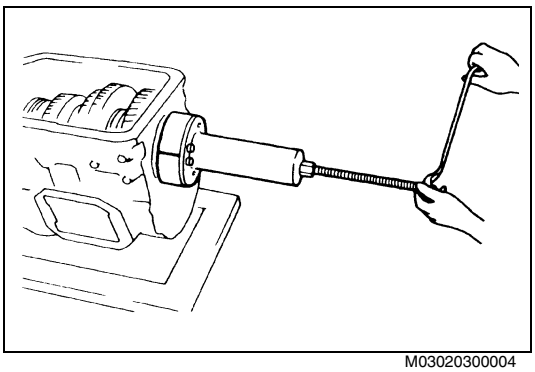
**SST: Socket Wrench (09839-5005)**


M03020300003

**2. REMOVE THE INPUT SHAFT.**

(1) Using the special tools, pull out input shaft with the accompanying bearings.

**SST:**
**Input Shaft Puller (09650-2070)**
**Sliding Hammer (09420-1442)**


M03020300004

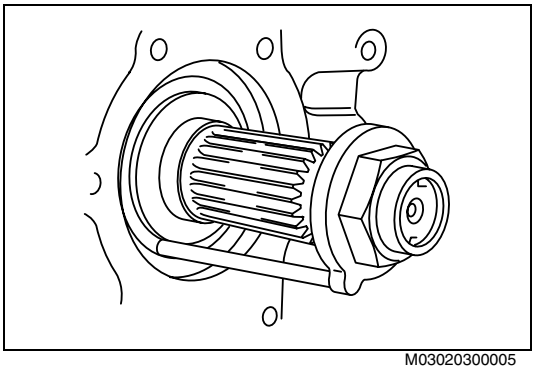
**3. REMOVE THE OUTPUT SHAFT REAR BEARING.**

(1) Remove the retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**

(2) Using the special tools, remove the output shaft rear bearing.
**SST:**
**Hook (09653-1200)**
**Puller (09650-1881)**

**NOTICE:**
**Insert the hook's click into the groove for the retainer ring, then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.**

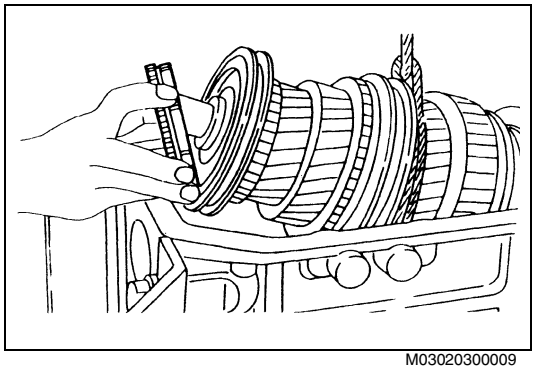

M03020300005

**4. REMOVE THE OUTPUT SHAFT ASSEMBLY FROM THE TRANSMISSION CASE.**

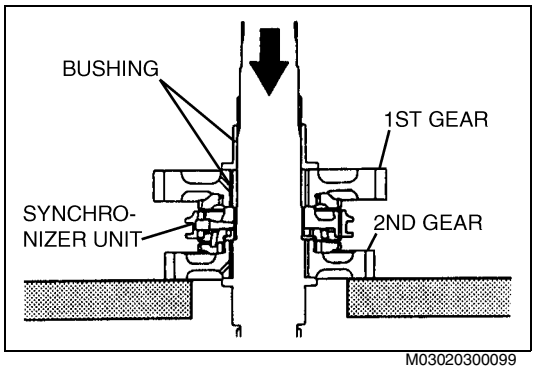
(1) Attach a jig to the end of the output shaft.

**CAUTION:**
**If the output shaft assembly is removed from the transmission without a jig, the reverse gear will drop from the shaft, which can result in the personal injury.**

(2) Attach a suitable hook or other lifting device around the 3rd-4th speed synchronizer sleeve and carefully lift the output shaft assembly from the transmission case.


M03020300009

(3) When removing the output shaft assembly, remove the synchronizer ring and the cone of the input shaft gear.



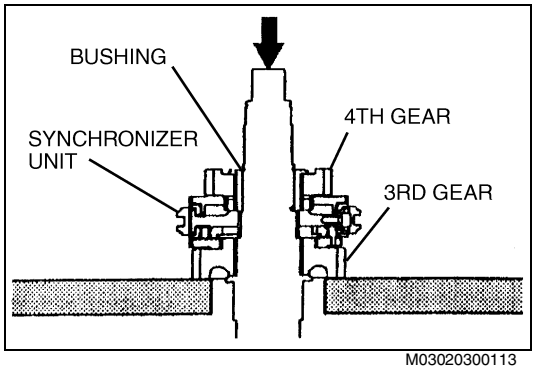
M03020300099

**5. REMOVE THE BUSHINGS FROM THE OUTPUT SHAFT.**

(1) Support the 2nd gear and press the output shaft rear end through the bushings, 1st gear, synchronizer unit, 2nd gear and needle roller bearings.

**NOTICE:**
**When removing the output shaft, do not allow the shaft to drop on a hard surface.**

**CAUTION:**
**Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**

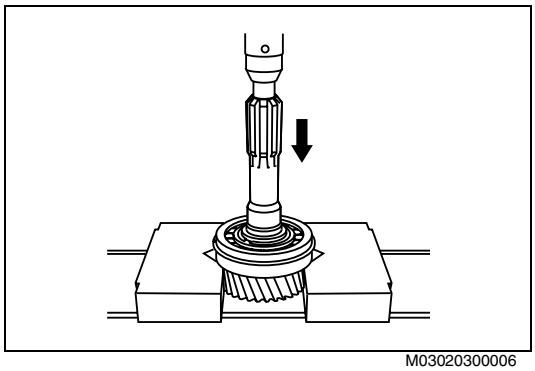


M03020300113

(2) Support the 3rd gear and press the output shaft rear end through the bushing, the 4th gear, the synchronizer unit and the needle roller bearings.

**NOTICE:**
**When removing the output shaft, do not allow the shaft to drop on a hard surface.**

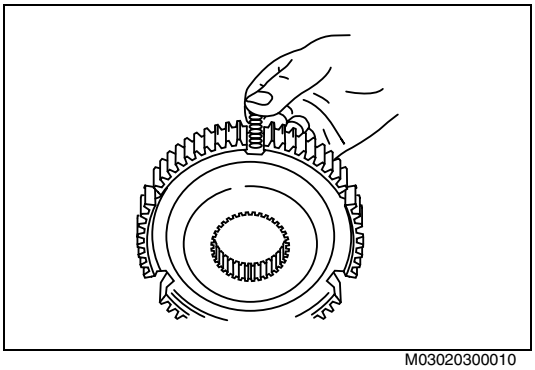
**CAUTION:**
**Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**


M03020300006

**6. DISASSEMBLE THE INPUT SHAFT.**

(1) Remove retainer ring.
(2) Using a press, remove the cylindrical bearing.

**CAUTION:**
**Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**

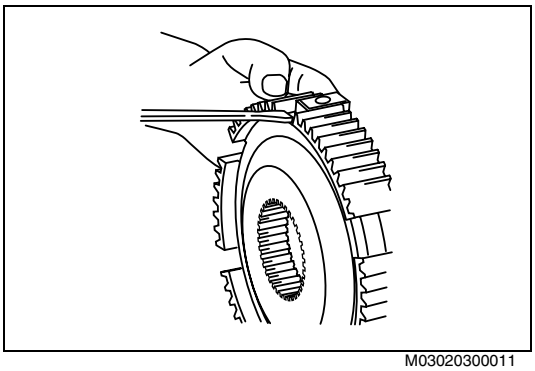

M03020300010

## IMPORTANT POINTS - ASSEMBLY

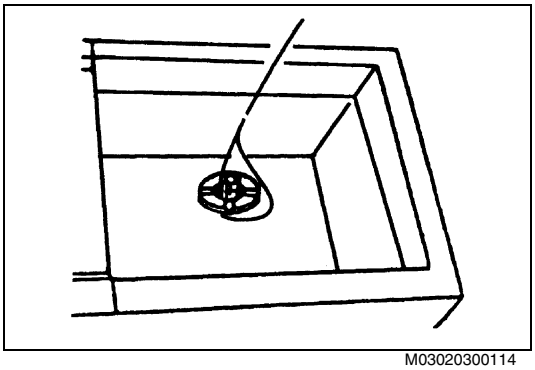
**1. ASSEMBLE THE SYNCHRONIZER UNIT.**

(1) Install the compression spring.

**CAUTION:**
**The compression spring is spring steel and may fly out of the hole during assembly. Wear safety glasses during assembly.**


M03020300011

(2) Install the synchronizer key and head.


M03020300114

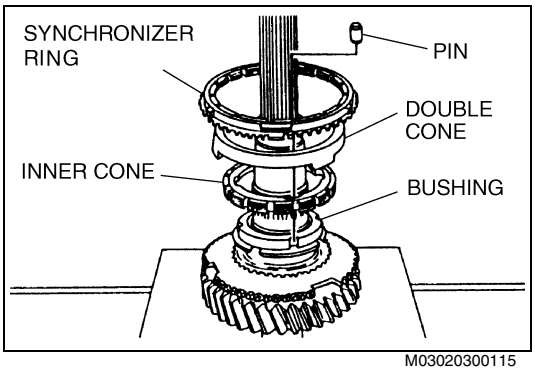
**2. INSTALL THE 2ND GEAR, SYNCHRONIZER UNIT, 1ST GEAR, 1ST GEAR BUSHING AND REVERSE GEAR BUSHING.**

(1) Install the 2nd gear.

(2) Heat the 2nd synchronizer bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer bushing on the shaft.

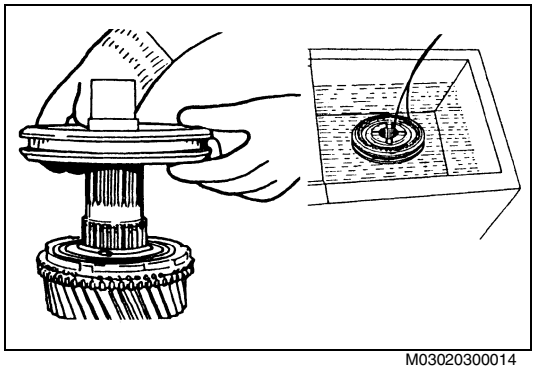
**NOTICE:**
**Do not heat the synchronizer bushing in excess of 150°C {302°F}.**

**CAUTION:**
**Never touch hot oil and heated synchronizer bushing with your bare hand. This can result in personal injury.**



M03020300115

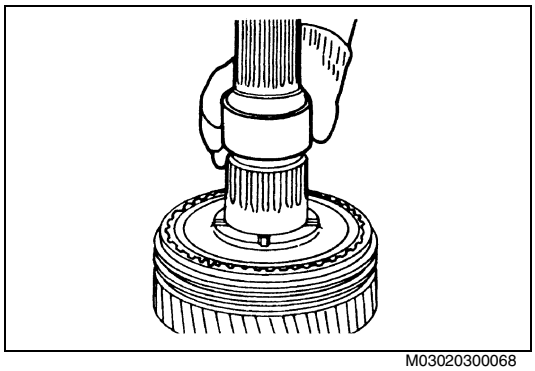
(3) Install the synchronizer bushing, synchronizer inner cone, synchronizer double cone, synchronizer ring and pins.


M03020300014

(4) Heat the 2nd synchronizer unit for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer unit on the shaft.

**NOTICE:**
**Do not heat the synchronizer unit in excess of 150°C {302°F}.**

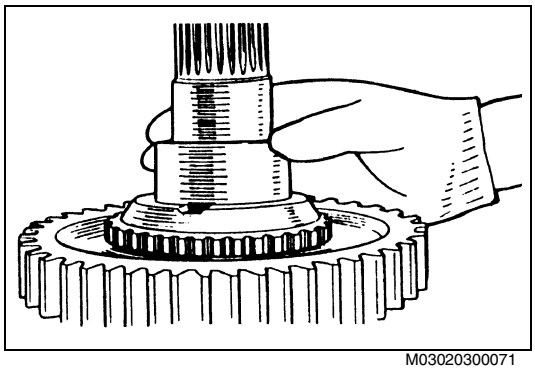
**CAUTION:**
**Never touch hot oil and heated synchronizer unit with your bare hand. This can result in personal injury.**


M03020300068

(5) Heat the 1st gear bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the bushing on the shaft.

**NOTICE:**
**Do not heat the bushing in excess of 150°C {302°F}.**

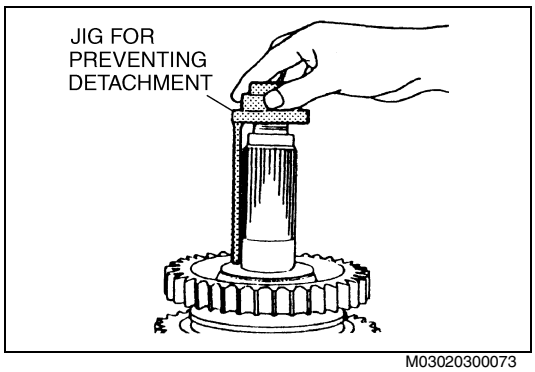
**CAUTION:**
**Never touch hot oil and heated bushing with your bare hand. This can result in personal injury.**


M03020300071

(6) Heat the reverse gear bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the bushing on the shaft.

**NOTICE:**
**Do not heat the bushing in excess of 150°C {302°F}.**

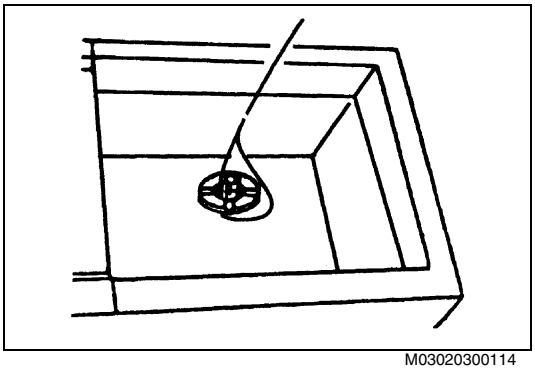
**CAUTION:**
**Never touch hot oil and heated bushing with your bare hand. This can result in personal injury.**



M03020300073

(7) Hold the thrust washer with a jig.

**CAUTION:**
**If the output shaft assembly is installed to the transmission without a jig, the reverse gear will drop from the shaft, which can possibly result in personal injury.**



M03020300114

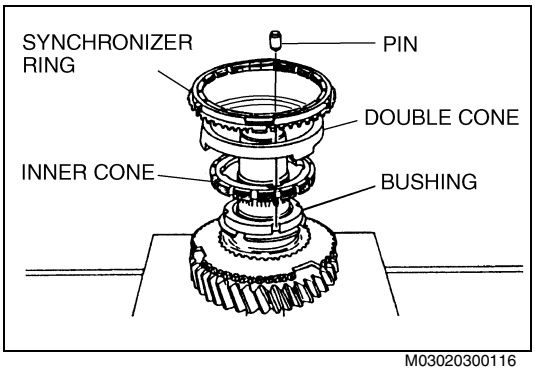
**3. INSTALL THE 3RD GEAR, SYNCHRONIZER UNIT, 4TH GEAR AND BUSHING ON THE SHAFT.**

(1) Install the 3rd gear.

(2) Heat the 3rd synchronizer bushing for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer bushing on the shaft.

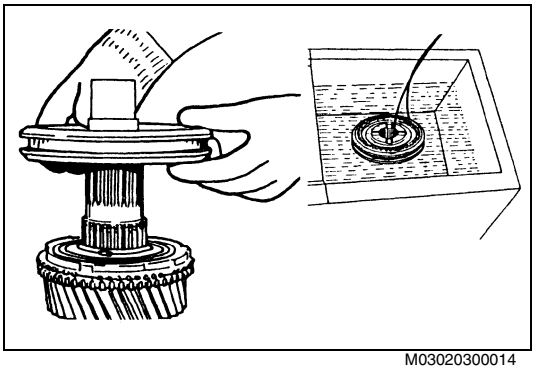
**NOTICE:**
**Do not heat the synchronizer bushing in excess of 150°C {302°F}.**

**CAUTION:**
**Never touch hot oil and heated synchronizer bushing with your bare hand. This can result in personal injury.**




M03020300116

(3) Install the synchronizer bushing, synchronizer inner cone, synchronizer double cone, synchronizer ring and pin.

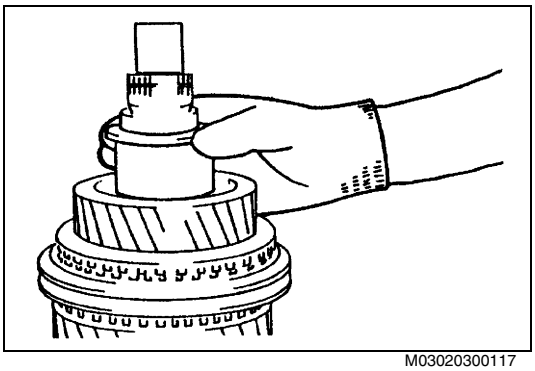


M03020300014

(4) Heat the 3rd-4th synchronizer unit for about 5 minutes in oil heated to 120°C to 130°C {248°F to 266°F}.
Then install the synchronizer unit on the shaft.

**NOTICE:**
**Do not heat the synchronizer unit in excess of 150°C {302°F}.**

**CAUTION:**
**Never touch hot oil and heated synchronizer unit with your bare hand. This can result in personal injury.**

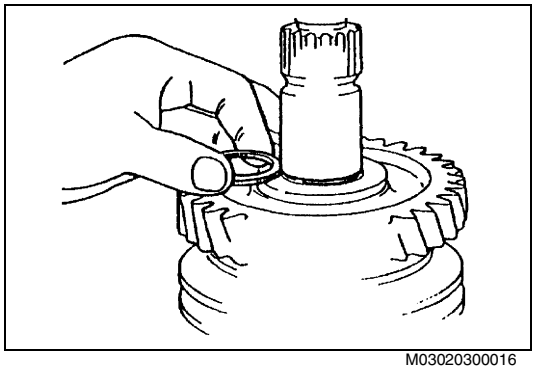


M03020300117

(5) Install the 4th gear and needle roller bearing.

(6) Install the 4th gear bushing.
Heat the bushing to approximately 120°C to 130°C {248°F to 266°F} in a heater and place on output shaft against the end stop.

**CAUTION:**
**Never touch hot oil and heated bushing with your bare hand. This can result in personal injury.**

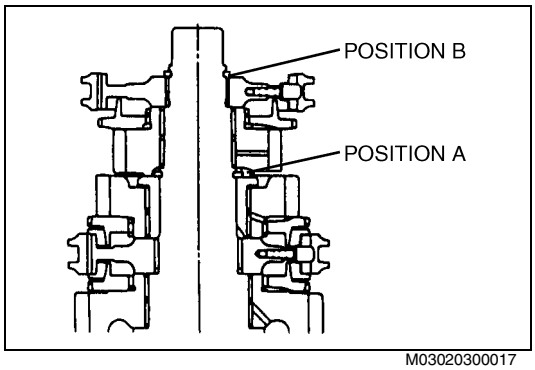


M03020300016

**4. INSTALL THE GEARS, BUSHINGS, NEEDLE ROLLER BEARING, SYNCHRONIZER UNITS AND OTHER PARTS ON THE OUTPUT SHAFT.**

(1) Select a retainer ring that will provide a tight fit.
**Clearance: Less than 0.1 mm {0.0039 in.}**

**NOTICE:**
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**




M03020300017

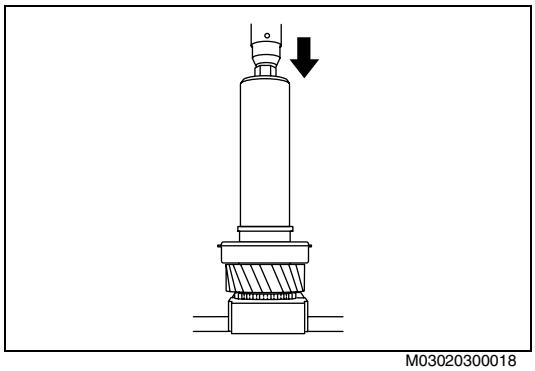
**Retainer rings are available in the following sizes: Position A**

| Thickness | Color code |
|---|---|
| 2.4 mm {0.0945 in.} | None |
| 2.5 mm {0.0984 in.} | Blue |
| 2.6 mm {0.1024 in.} | Green |
| 2.7 mm {0.1063 in.} | Yellow |
| 2.8 mm {0.1102 in.} | Red |

**Retainer rings are available in the following sizes: Position B**

| Thickness | Color code |
|---|---|
| 2.45 mm {0.0965 in.} | None |
| 2.55 mm {0.1004 in.} | Blue |

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.**

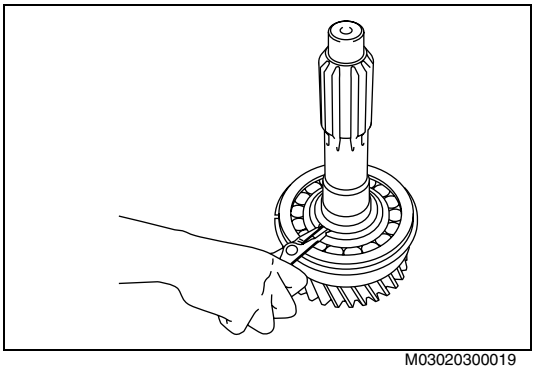


M03020300018

**5. ASSEMBLE THE INPUT SHAFT.**

(1) Using a press, install the cylindrical bearing to the input shaft.

**NOTICE:**
- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race.**


M03020300019

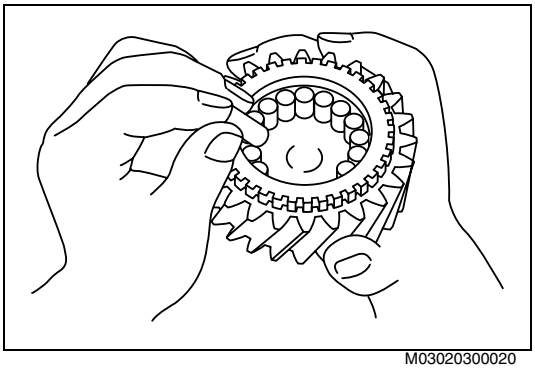
(2) Select a retainer ring, that will provide a tight fit.
**Clearance: Less than 0.1 mm {0.0039 in.}**

**NOTICE:**
- **Always use a new retainer ring.**
- **Make sure that the the retainer ring seats in the groove.**

**Retainer rings are available in the following sizes**

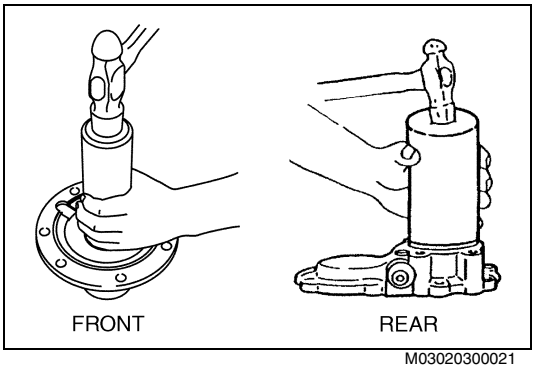
| Thickness | Color code |
|---|---|
| 2.4 mm {0.0945 in.} | None |
| 2.5 mm {0.0984 in.} | Blue |
| 2.6 mm {0.1024 in.} | Green |
| 2.7 mm {0.1063 in.} | Yellow |

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.**


M03020300020

**6. INSTALL THE ROLLER BEARING IN THE COUNTERBORE OF THE INPUT SHAFT.**
(1) Apply gear oil to the bearings.
(2) Place spacers at both ends of the bearings.
(3) Install the retainer ring.

**NOTICE:**
**Always use roller bearings of uniform diameter (16 pieces per set). There are 3 types of roller bearings in different diameters. There are distinguished by the colors red, blue, and white.**

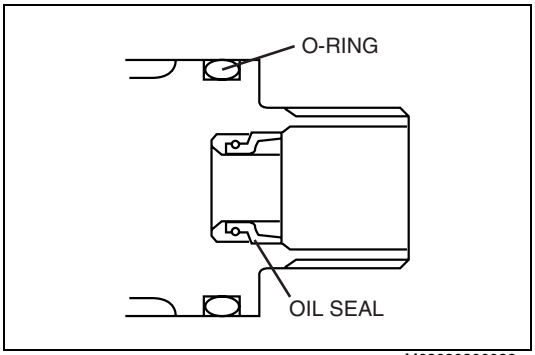


M03020300021

**7. REPLACE THE OIL SEAL OF THE FRONT AND REAR BEARING RETAINER.**
(1) Using a screwdriver, remove the oil seal from the bearing retainer.
(2) Using a press and a suitable installing tool, press the oil seal into the bearing retainer.

**NOTICE:**
- **Coat gear oil to oil seal surface.**
- **Be sure the oil seal is installed in the proper direction.**

(3) Coat chassis grease to the sealing surface between the seal lips.

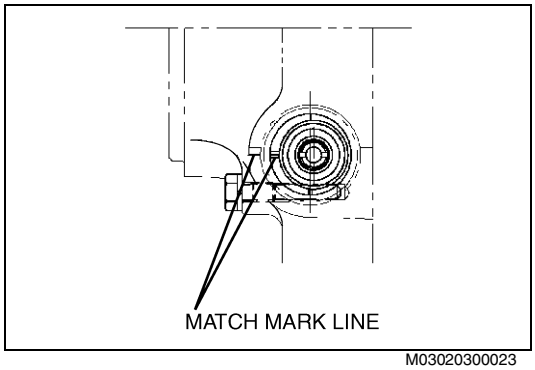


M03020300022

**8. INSTALL THE SPEEDOMETER DRIVEN GEAR BUSHING.**
(1) Install the O-ring and oil seal to the bushing.

**NOTICE:**
- **Coat the O-ring, oil seal and driven gear with chassis grease.**
- **Make sure that the oil seal is installed in the correct direction when replacing it.**

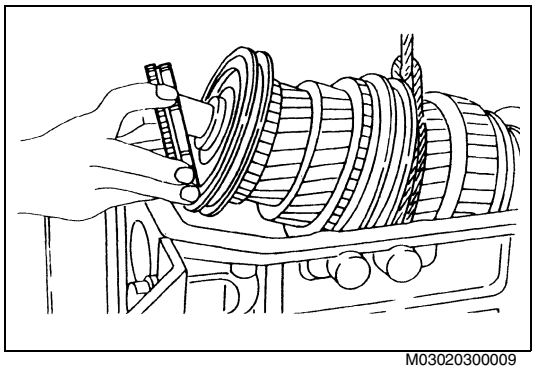
(2) Match the mark line on the bushing with the mark line on the rear bearing retainer.



M03020300023

(3) Align the speedometer driven gear bushing hole with the hole of the rear bearing retainer.

| Number of the drive gear teeth | Number of the driven gear teeth | The mark should be matched to the mark on retainer |
|---|---|---|
| 7 | 18 | One line |


M03020300009

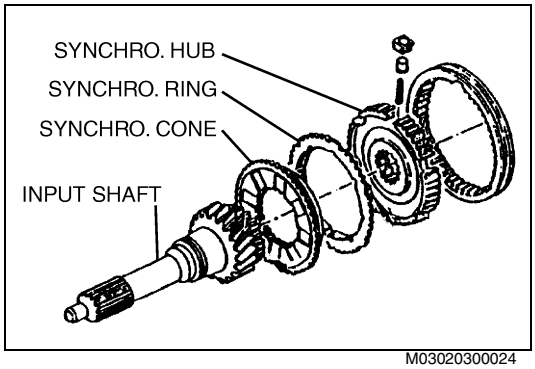
**9. INSTALL THE OUTPUT SHAFT ASSEMBLY IN THE TRANSMISSION CASE.**

(1) Using ropes or some other lifting device, carefully lower the output shaft assembly into the case. When installing the output shaft, install the synchronizer ring and cone of the input shaft gear.

(2) Place the output shaft assembly in position.

**NOTICE:**
**Attach a jig to the end of output shaft.**

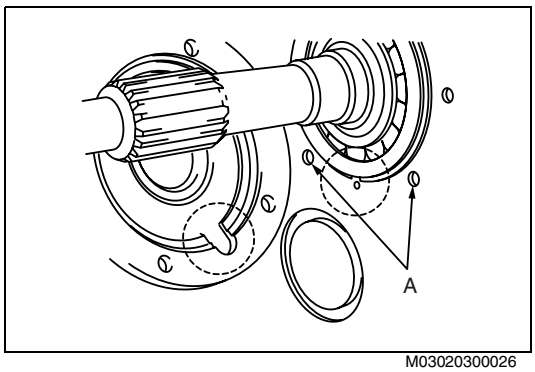
**CAUTION:**
**If the output shaft assembly is installed to the transmission without a jig, the reverse gear will drop from the shaft, which can possibly result in the personal injury.**



M03020300024

**10. INSTALL THE INPUT SHAFT INTO THE TRANSMISSION CASE.**

(1) Mesh the synchronizer cone to the input shaft.
(2) Align the synchronizer hub slot with synchronizer ring.

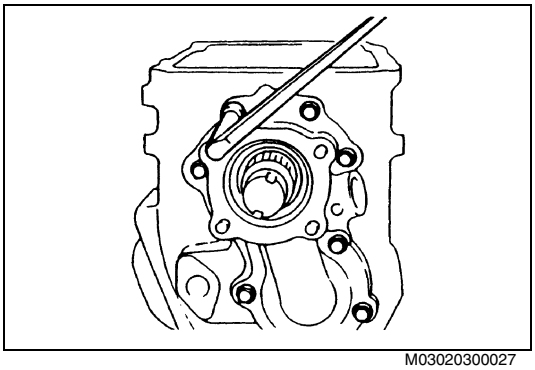


M03020300026

**11. INSTALL THE FRONT BEARING RETAINER.**

(1) Coat both sides of the gasket with liquid gasket.
(2) Apply liquid gasket or sealing tape to the bolt "A".

**NOTICE:**
- **When installing the bearing retainer, the gasket must be installed in such a way that the gasket notch matches the oil drain hole on the case so as not to block the hole.**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #HP-17 or equivalent.**



M03020300027

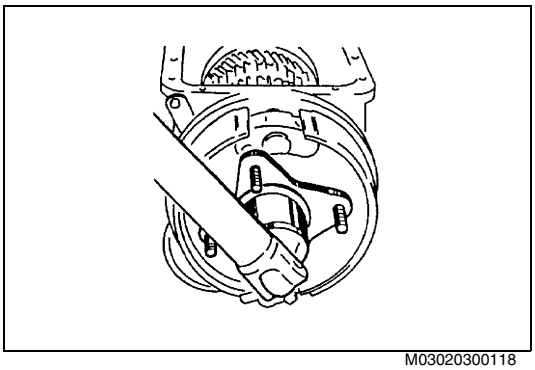
**12. INSTALL THE REAR BEARING RETAINER.**

(1) Coat both sides of the gasket with liquid gasket.

**NOTICE:**

- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #HP-17 or equivalent.**

(2) Apply liquid gasket or sealing tape to the bolt.



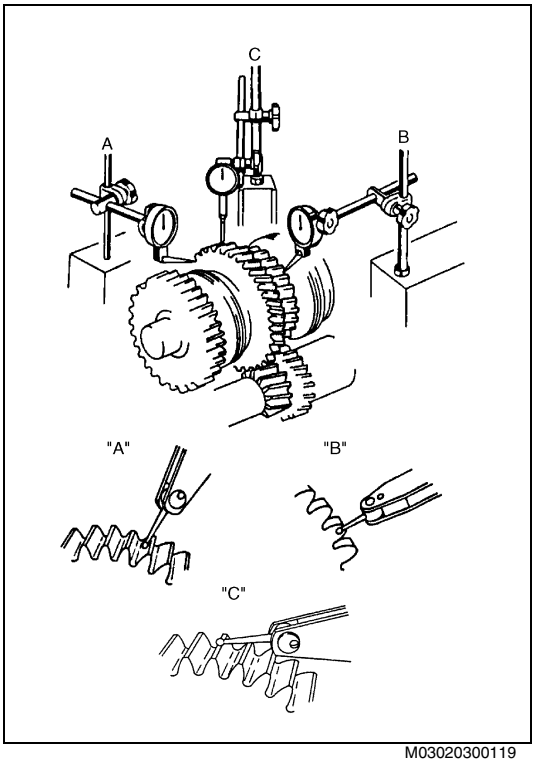
M03020300118

**13. INSTALL THE OUTPUT SHAFT LOCK NUT.**

(1) Before tightening the lock nut engage two gears so that the shaft can not be turned around.

(2) Install the lock nut to the output shaft and tighten it.
**SST: Socket Wrench (09839-5005)**

**NOTICE:**
**Do not damage the O-ring.**




M03020300119

**14. MEASURE THE GEAR BACKLASH, END PLAY AND RADIAL PLAY.**

(1) Block the counter shaft with a pry bar when measuring.

**<BACKLASH (A)>** Unit: mm {in.}

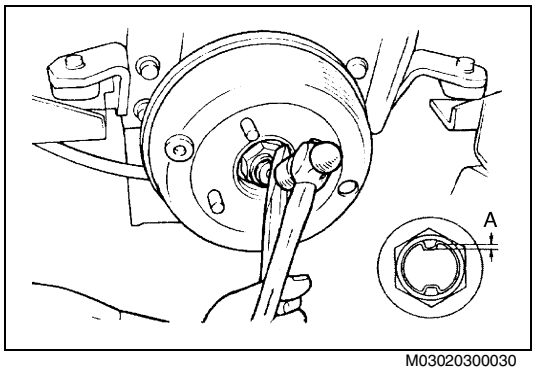
| | Assembly Standard | Service Limit |
|---|---|---|
| Reverse gear | 0.08-0.16 {0.0032-0.0062} | 0.4 {0.0157} |
| 1st gear | 0.08-0.18 {0.0032-0.0070} | |
| 2nd gear | 0.08-0.16 {0.0032-0.0062} | |
| 3rd gear | | |
| 4th gear | 0.04-0.12 {0.0016-0.0047} | |
| 6th gear | | |
| Input shaft gear | | |

**<END PLAY (B)>** Unit: mm {in.}

| | Assembly Standard | Service Limit |
|---|---|---|
| Reverse gear | 0.20-0.35 {0.0079-0.0137} | 0.5 {0.0197} |
| 1st gear | 0.15-0.30 {0.0060-0.0118} | |
| 2nd gear | | |
| 3rd gear | | |
| 4th gear | | |
| 6th gear | 0.15-0.50 {0.0060-0.0196} | |

**<RADIAL PLAY (C)>** Unit: mm {in.}

| | Assembly Standard |
|---|---|
| **Reverse gear** | **0.033-0.111 {0.0013-0.0043}** |
| **1st gear** | |
| **2nd gear** | **0.022-0.071 {0.0009-0.0027}** |
| **3rd gear** | **0.020-0.068 {0.0008-0.0026}** |
| **4th gear** | **0.021-0.095 {0.0009-0.0037}** |
| **6th gear** | **0.021-0.062 {0.0009-0.0024}** |



M03020300030

**15. CAULK THE OUTSIDE RIM OF THE OUTPUT SHAFT LOCK NUT.**

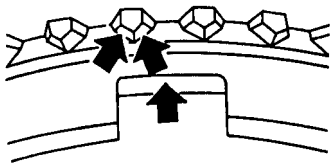
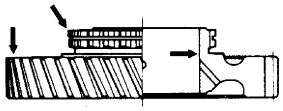
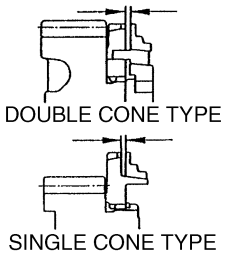
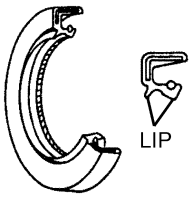
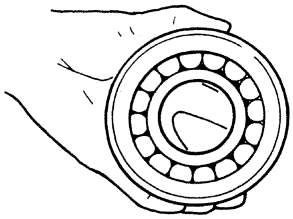
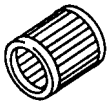
(1) Using a hammer and a chisel, caulk the outside rim of the lock nut into the groove on the output shaft.
**A: More than 1.5 mm {0.0591 in.}**

**NOTICE:**
- **The caulking should fit the groove thoroughly.**
- **The caulking should be done without rift.**

# INSPECTION AND REPAIR

M03020305BEH3002

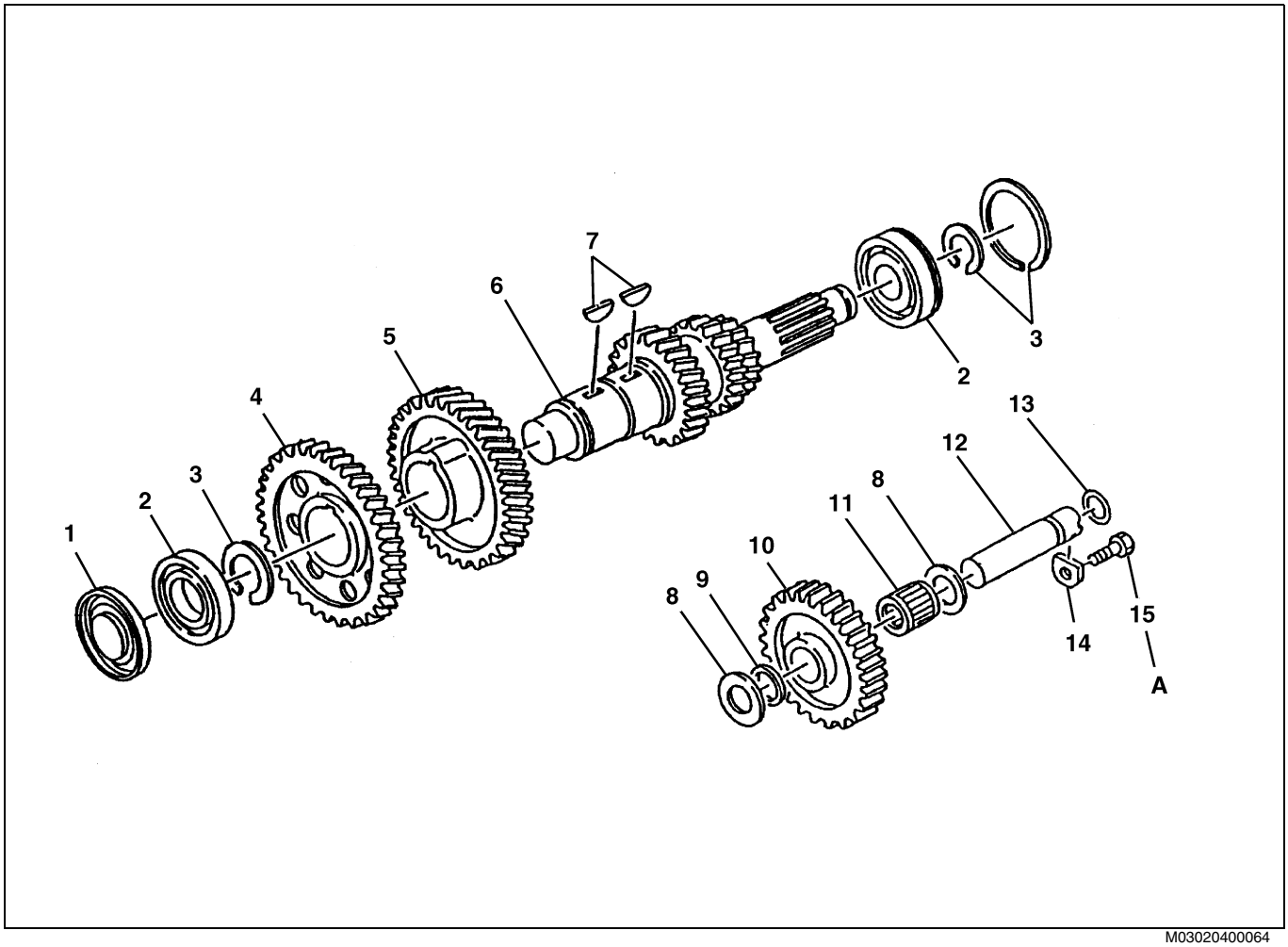
Unit: mm {in.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Synchronizer ring, deformity, crack and excessive damage | — | — | Replace, if necessary. | Visual check  |
| Gear excessive wear, chips and cracks | — | — | Replace, if necessary. | Visual check  |
| Clearance between synchronizer ring and synchronizer cone or gear sub assembly | 2nd, 3rd and 4th gear 1.0-1.8 {0.0394-0.0708}<br>6th and Input gear 1.2-2.0 {0.0473-0.0787} | 0.2 {0.0079} | Replace the synchronizer ring and/or gear sub assembly. | Measure   |
| Oil seal lip wear and damage | — | — | Replace, if necessary. | Visual check   |
| Cylindrical bearing and ball bearing improper rotation | — | — | Replace, if necessary. | Visual check  |
| Needle roller bearing in deformed shape | — | — | Replace, if necessary. | Visual check  |

# COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS (LJ06S)

## COMPONENT LOCATOR

M03020405BED1002




M03020400064

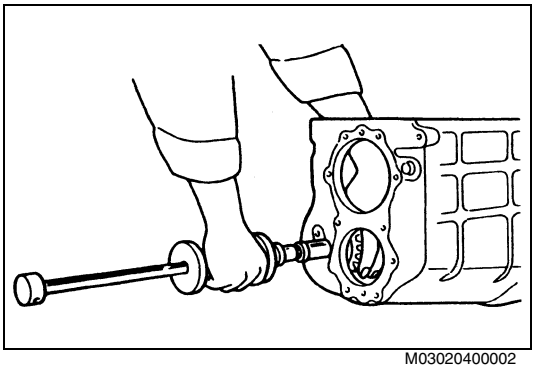
| | | | |
|---|---|---|---|
| 1 | Seal cover | 9 | Spacer |
| 2 | Cylindrical roller bearing | 10 | Reverse idler gear |
| 3 | Retainer ring | 11 | Needle roller bearing |
| 4 | Counter drive gear | 12 | Reverse idler shaft |
| 5 | Counter 6th gear | 13 | O-ring |
| 6 | Counter shaft | 14 | Lock plate |
| 7 | Woodruff key | 15 | Bolt |
| 8 | Thrust washer | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 19-25 {190-260, 14-18} | | |

# OVERHAUL

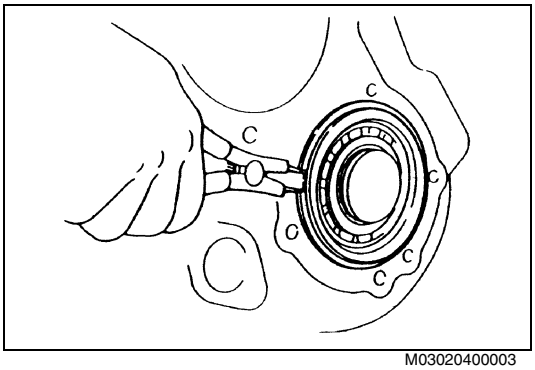
M03020405BEH2002


M03020400002

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE IDLER SHAFT AND IDLER GEAR.**

(1) Using a special tool, pull out the reverse idler shaft while holding the reverse idler gear thrust washers and bearing inside the case.
**SST: Sliding Hammer (09420-1442)**

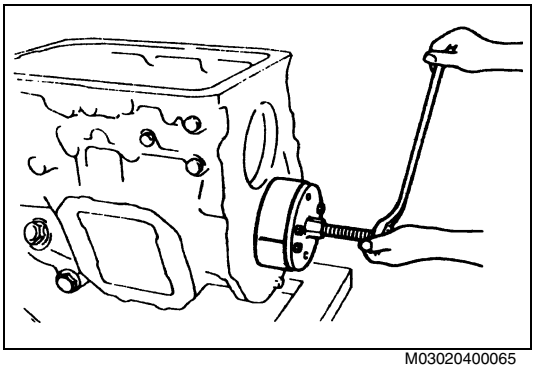


M03020400003

**2. REMOVE THE COUNTER SHAFT REAR BEARING.**

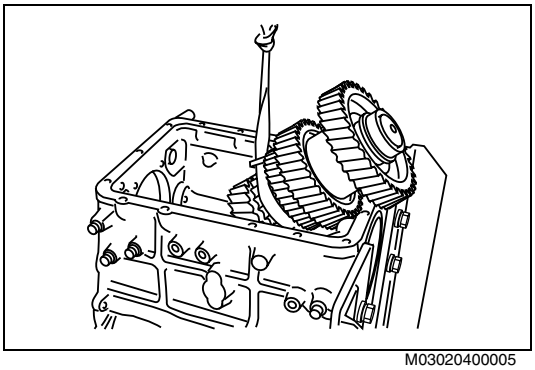
(1) Remove the retainer rings from the counter shaft and the cylindrical roller bearing.

**CAUTION:**
**The retainer ring is spring steel and may fly out of groove during removal. Wear safety glasses during removal.**


M03020400065

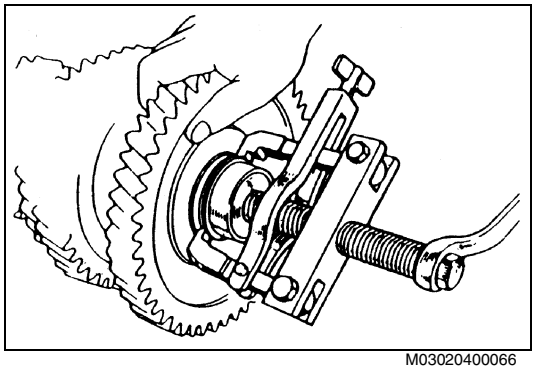
(2) Install the special tools on the rear cylindrical roller bearing and remove it.
**SST:**
**Hook (09653-1180)**
**Puller (09650-1900)**

**NOTICE:**
**Insert the hook's click into the groove for the retainer ring then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.**


M03020400005

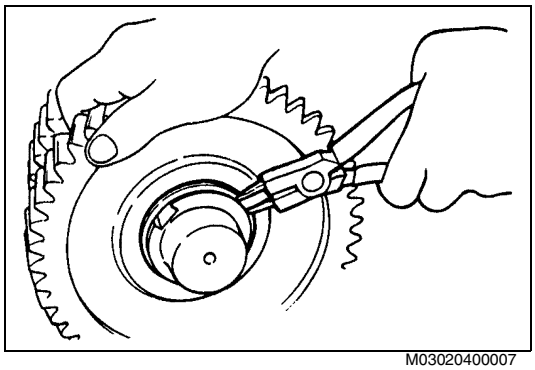
**3. REMOVE THE COUNTER SHAFT FROM THE TRANSMISSION CASE.**

(1) Tie a rope or hook around the counter shaft and carefully pry the counter shaft assembly rearward until the front end of the shaft is cleared out of the front cylindrical roller bearing.
(2) Carefully lift the counter shaft assembly from the case.


M03020400066

**4. REMOVE THE CYLINDRICAL ROLLER BEARING INNER RACE.**

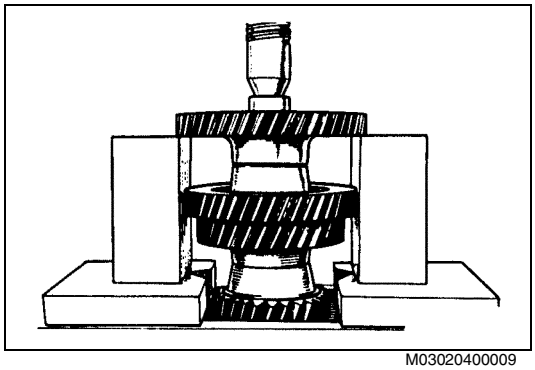
(1) Using a special tool on the inner race, pull out the front cylindrical roller bearing inner race from the counter shaft.
**SST: Puller (09650-1101)**


M03020400007

**5. REMOVE THE COUNTER SHAFT GEARS.**

(1) Remove the retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**

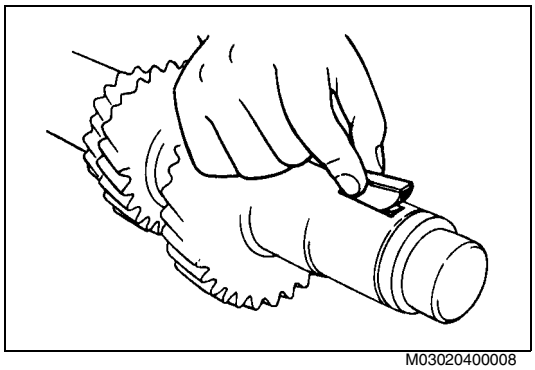

M03020400009

(2) Support the counter shaft drive gear as close as possible to the gear hub and press the counter shaft front end until it is free of the drive gear.

(3) Support the counter 6th gear under the gear teeth and press the counter shaft out of the gear.

**NOTICE:**
**When removing the counter shaft gears, do not allow the shaft to drop to on a hard surface.**

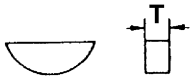
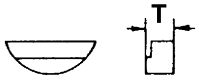
**CAUTION:**
**Never put your feet under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**

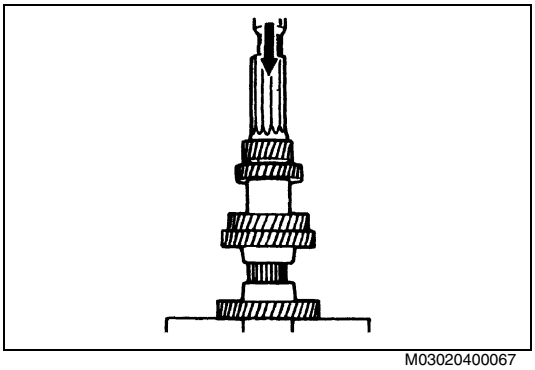

M03020400008

## IMPORTANT POINTS - ASSEMBLY

**1. INSTALL THE COUNTER DRIVE GEAR AND COUNTER 6TH GEAR.**

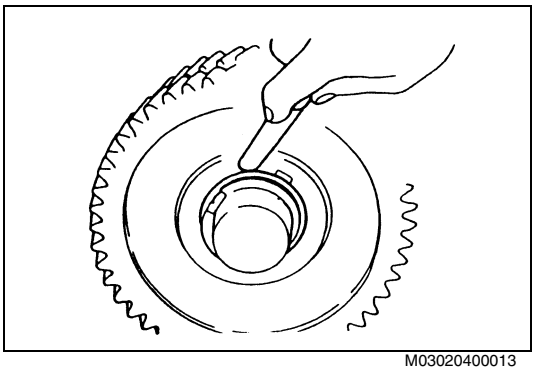
(1) Select the proper size key according to the size of the key groove.

| Thickness (T) | Shape |
|---|---|
| **10.015-10.024 mm {0.3943-0.3946 in.}** |  |
| **10.080-10.090 mm {0.3969-0.3972 in.}** |  |


M03020400067

(2) Press the counter shaft into the gears making certain that the key and keyway are aligned.

**NOTICE:**
**Ensure that the gears are installed in the proper direction.**


M03020400013

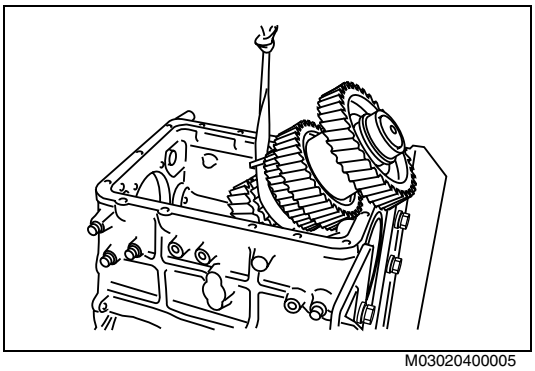
(3) Select a retainer ring that will provide a tight fit and install it on the shaft.

**NOTICE:**
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in place.**

**Clearance: Less than 0.1 mm {0.0039 in.}**
**Retainer rings are available in the following sizes**

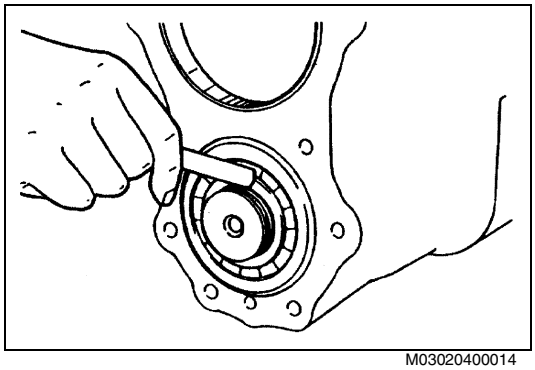
| Thickness | Color code |
|---|---|
| 2.4 mm {0.0945 in.} | Brown |
| 2.5 mm {0.0984 in.} | Blue |
| 2.6 mm {0.1024 in.} | Green |
| 2.7 mm {0.1063 in.} | Yellow |
| 2.8 mm {0.1102 in.} | Red |

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.**


M03020400005

**2. INSTALL THE COUNTER SHAFT IN THE TRANSMISSION CASE.**

**NOTICE:**
- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race.**


M03020400014

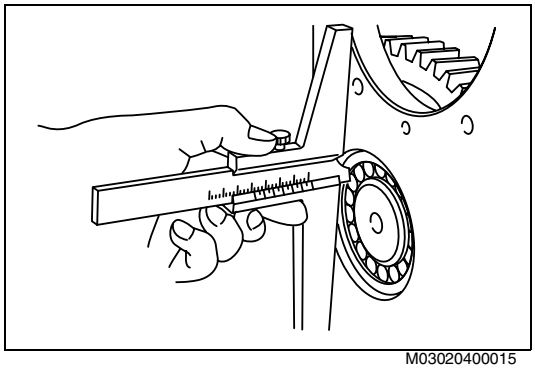
(1) Select a retainer ring that will provide a tight fit and install it on the shaft.

**NOTICE:**
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in place.**

**Clearance: Less than 0.1 mm {0.0039 in.}**
**Retainer rings are available in the following sizes.**

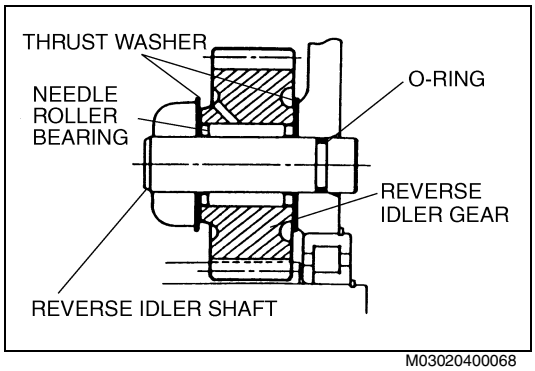
| Thickness | Color code |
|---|---|
| 2.4 mm {0.0945 in.} | Green |
| 2.5 mm {0.0984 in.} | Brown |
| 2.6 mm {0.1024 in.} | Sky-blue |
| 2.7 mm {0.1063 in.} | Black |

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.**


M03020400015

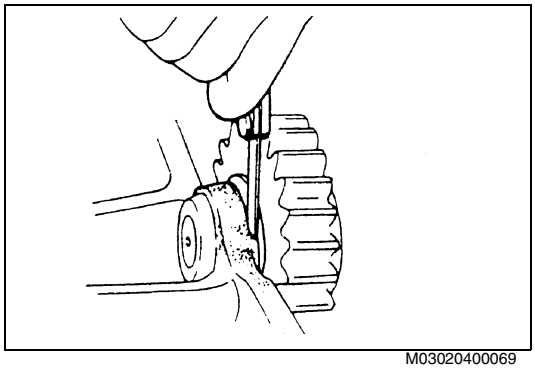
**3. DISTANCE BETWEEN THE GEAR CASE OUTER SURFACE AND THE FRONT BEARING OUTER RACE.**
**Assembly Standard: 1.7-2.2mm {0.0670-0.0866 in.}**

**4. PRESS IN THE SEAL COVER AND MAKE IT FLUSH WITH THE CASE FRONT.**

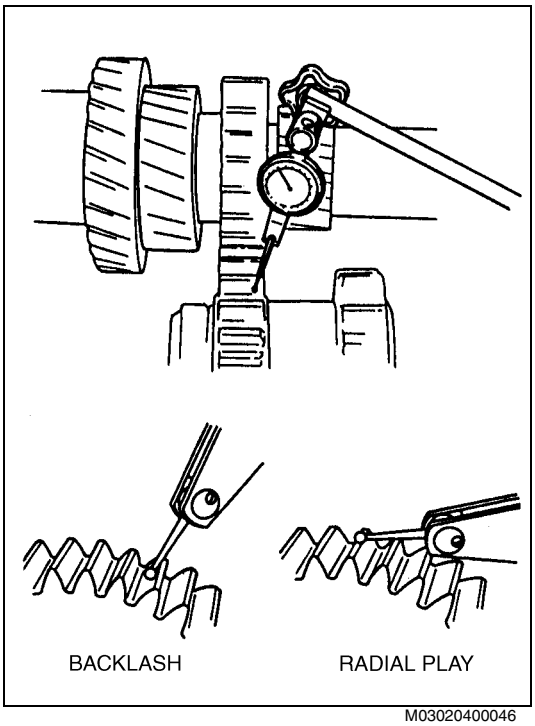


M03020400068

**5. INSTALL THE REVERSE IDLER GEAR.**
**NOTICE:**
- **Apply a light coat of gear oil to the needle roller bearing, spacer and thrust washers before assembling them.**
- **Be sure the gear is installed in the proper direction.**
- **Make sure that O-ring is in the shaft groove.**


M03020400069

**6. MEASURE THE REVERSE IDLER GEAR END PLAY.**
**Assembly Standard: 0.15-0.70mm {0.0060-0.0275 in.}**
**Service Limit: 0.7 mm {0.0276 in.}**



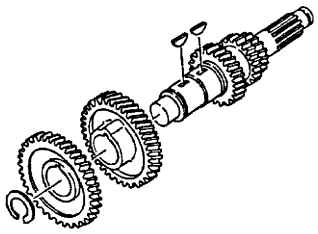
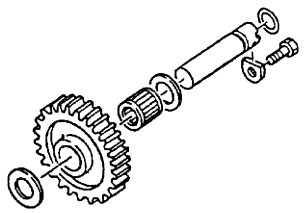
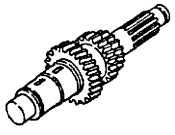
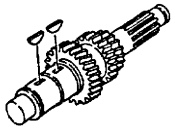

M03020400046

**7. MEASURE THE BACKLASH BETWEEN THE REVERSE IDLER GEAR AND THE COUNTER SHAFT REVERSE GEAR.**
**Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}**
**Service Limit: 0.4 mm {0.0157 in.}**

**8. MEASURE THE REVERSE IDLER GEAR RADIAL PLAY.**
**Assembly Standard: 0.016-0.055 mm {0.0007-0.0021 in.}**

# INSPECTION AND REPAIR

M03020405BEH3002

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| All gears for cracks and defects | — | — | Replace, if necessary. | Visual check  |
| Idler gear, shaft and needle roller bearing wear and damage | — | — | Replace, if necessary. | Visual check  |
| Counter shaft wear, chips and cracks | — | — | Replace, if necessary. | Visual check  |
| Counter shaft key way damage and looseness | — | — | Replace the counter shaft and/or key, If necessary. | Visual check  |

# TRANSMISSION MAIN UNIT (MF06S)

TR02-002

**TRANSMISSION ASSEMBLY (MF06S).... TR02-2**
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COMPONENT LOCATOR ..... TR02-14
OVERHAUL ..... TR02-15
INSPECTION AND REPAIR ..... TR02-24

**COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS (MF06S) ..... TR02-25**
COMPONENT LOCATOR ..... TR02-25
OVERHAUL ..... TR02-26
INSPECTION AND REPAIR ..... TR02-31

# TRANSMISSION ASSEMBLY (MF06S)

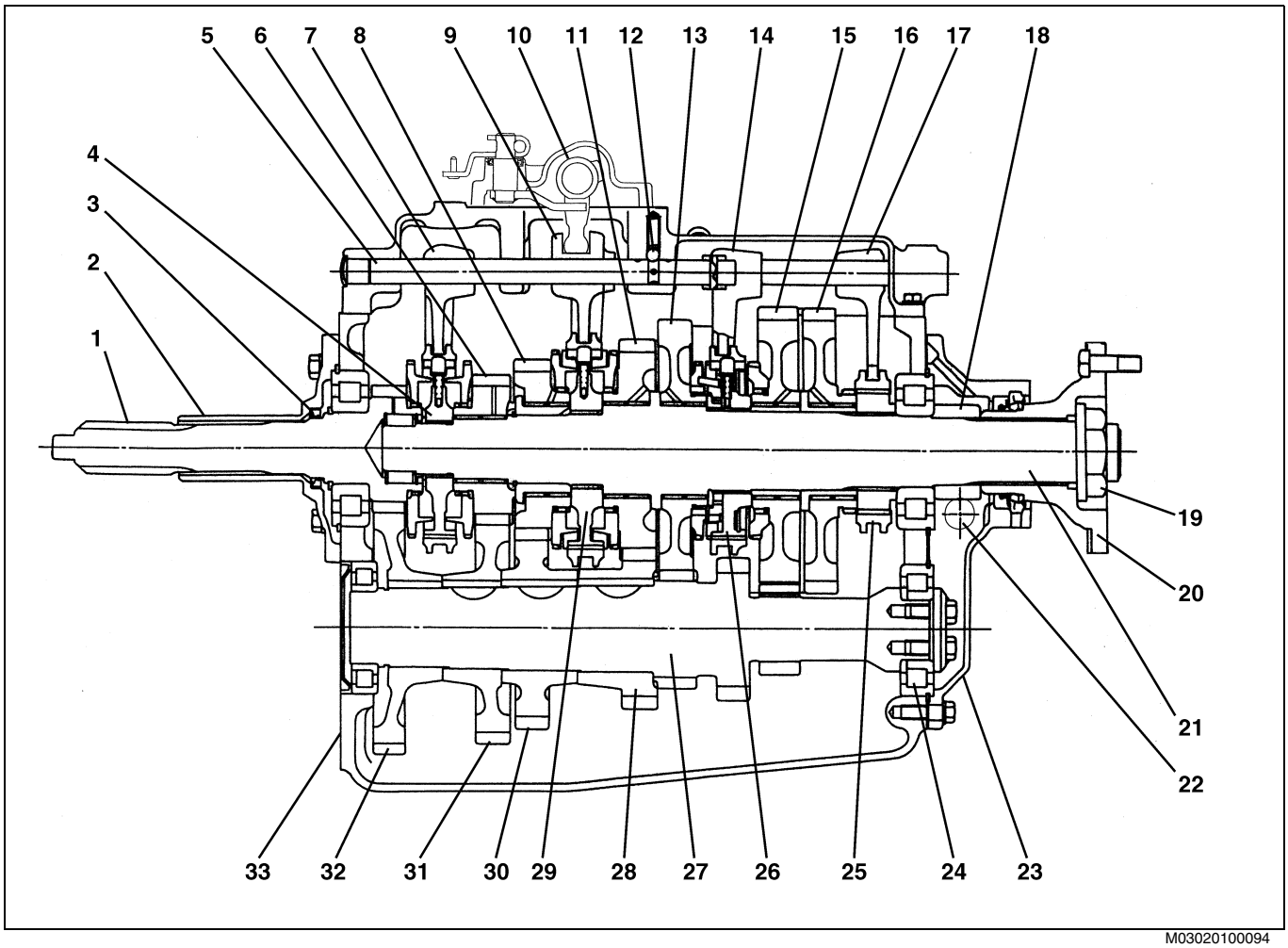
## DATA AND SPECIFICATIONS

M03020307BEI2003

| | | | |
|---|---|---|---|
| Type | | Six forward speeds, one reverse<br>2, 3, 4, 5, 6th Synchromesh, 1st and Reverse,<br>Constant mesh | |
| Gear ratios: | 1st | 8.189 | 7.395 |
| | 2nd | 5.086 | 4.758 |
| | 3rd | 3.076 | 3.076 |
| | 4th | 1.936 | 1.936 |
| | 5th | 1.341 | 1.341 |
| | 6th | 1.000 | 1.000 |
| | Reverse | 7.142 | 7.142 |
| Number of teeth input shaft | | 22 | |
| Number of teeth counter shaft | Counter drive gear | 47 | 47 |
| | 1st gear | 12 | 13 |
| | 2nd gear | 21 | 22 |
| | 3rd gear | 25 | 25 |
| | 4th gear | 32 | 32 |
| | 5th gear | 43 | 43 |
| | 6th gear | — | — |
| | Reverse gear | 21 | 21 |
| Number of teeth output shaft | 1st gear | 46 | 45 |
| | 2nd gear | 50 | 49 |
| | 3nd gear | 36 | 36 |
| | 4rd gear · | 29 | 29 |
| | 5th gear | 27 | 27 |
| | 6th gear | — | — |
| | Reverse gear | 46 | 46 |
| Reverse idle gear | | 29/19 | |
| Power take-off opening | | On left side of gear case | |
| Oil capacity, gear box | | Approx. 11.5 liters {2.53 Imp.gal/3.04 US gal.} | |
| Oil capacity, gear box with power take-off | | Approx. 11.8 liters {2.6 Imp.gal/3.1 US gal.} | |
| Lubricant, type | | Gear oil (API GL-4, MIL-L-2105) | |
| Viscosity, between-12 and 32°C {10 and 90°F} | | SAE90 | |
| Viscosity, above 32°C {90°F} | | SAE140 | |

# DESCRIPTION

M03020107BEC1002




M03020100094

| | | | |
|---|---|---|---|
| 1 | Input shaft | 18 | Speedometer drive gear |
| 2 | Front bearing retainer | 19 | Nut |
| 3 | Oil seal | 20 | Flange |
| 4 | 5th - 6th synchronizer unit | 21 | Output shaft |
| 5 | Shift shaft | 22 | Speedometer driven gear |
| 6 | 5th gear | 23 | Rear bearing retainer |
| 7 | 5th - 6th shift fork | 24 | Cylindrical bearing |
| 8 | 4th gear | 25 | Reverse shift sleeve |
| 9 | 3rd - 4th shift fork | 26 | 1st - 2nd synchronizer unit |
| 10 | Inner shift lever | 27 | Counter shaft |
| 11 | 3rd gear | 28 | Counter 3rd gear |
| 12 | Steel ball | 29 | 3rd - 4th synchronizer unit |
| 13 | 2nd gear | 30 | Counter 4th gear |
| 14 | 1st - 2nd shift fork | 31 | Counter 5th gear |
| 15 | 1st gear | 32 | Counter drive gear |
| 16 | Reverse gear | 33 | Transmission case |
| 17 | Reverse shift fork | | |

# TROUBLESHOOTING

M03020107BEF3002

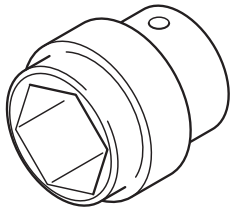
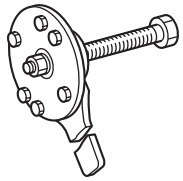
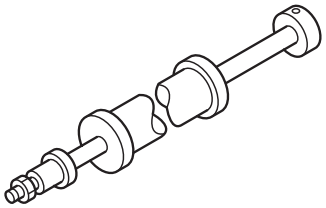
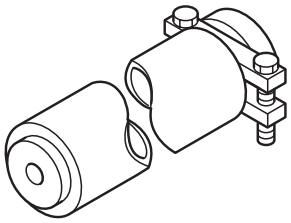
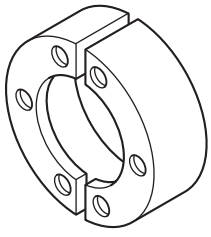
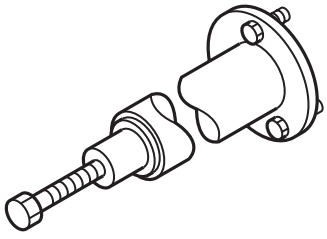
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Gear slip-off (Control system)** | Joint worn and/or damaged | Replace joint. |
| | Bolts and nuts loose | Tighten bolts and nuts. |
| | Improper link rod adjustment | Adjust link rod. |
| **Gear slip-off (Gear shift housing)** | Lock ball and spring distorted and/or broken | Repair or replace as required. |
| | Groove for shift shaft worn | Replace shift fork. |
| **Gear slip-off (Transmission gear)** | Synchronizer hub and sleeve worn | Replace as required. |
| | Synchronizer sleeve and gear clutch teeth worn or damaged | Replace as required. |
| | Input shaft and/or output shaft bearing worn and/or broken | Replace bearing. |
| | Retainer ring and/or thrust washer worn and/or broken | Replace as required. |
| | Loosened transmission to engine mounting bolts | Tighten bolts. |
| **Difficult gear engagement (Engine)** | Engine idling speed too high | Adjust engine idling. |
| **Difficult gear engagement (Clutch)** | Improper disengagement of clutch | Adjust clutch. |
| | Clutch disc sticking | Repair or replace. |
| | Clutch shifter sleeve bent | Replace shifter sleeve. |
| **Difficult gear engagement (Transmission)** | Input shaft and/or output shaft bearing worn and/or damaged | Replace bearing. |
| | Engine crankshaft pilot bearing worn and/or damaged | Replace bearing. |
| | Synchronizer cone and ring worn | Replace as required. |
| **Difficult gear engagement (Control system)** | Looseness of control system and/or improper adjustment | Tighten and adjust control system. |
| | Improper motion of gear shift lever | Adjust shift lever. |
| | Shift and select rod worn | Replace shift and select rod. |
| | Rigid relay shaft nylon bushing and/or sticking of shafts | Replace as required. |
| **Difficult gear engagement (Lubrication)** | Improper lubrication of control lever | Lubricate as required. |
| | Shortage gear oil and/or low oil viscosity | Add oil or change oil as required. |
| **Noise (Transmission)** | Grinding in transmission | Check for screws, bolts or other foreign materials in transmission. |
| | Loose transmission-to-engine mounting bolts | Tighten bolts. |
| | Worn or damaged gear and bearing | Replace as required. |
| **Noise (Lubrication)** | Shortage of gear oil and/or low oil viscosity | Add oil or change oil as required. |
| **Gear oil leaks (Transmission)** | Leaks at the front and rear bearing retainer seal and gasket, case cover gasket, sand hole of case or shift shaft expansion plug | Repair and replace as required. |
| | Improper amount of gear oil and lack of oil viscosity | Check oil level and type. |
| **Unable or very difficult to shift the gear when the engine is stopped.** | Improper adjustment of the gear control rod | Adjust the control rod. |
| | Looseness | Inspect and tighten each the bolts and the nuts. |

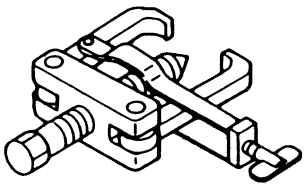
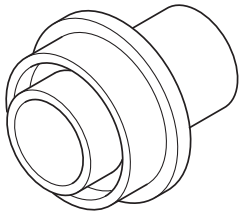
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Gear disengages when driving bumpy roads.** | Improper adjustment of the gear control rod | Adjust the control rod. |
| **The play of the lever is excessive.** | A joint is seriously worn. | Replace the joint. |
| | Looseness of tightening bolt and nut | Inspect and tighten each the bolts and the nuts. |

# SPECIAL TOOL

M03020107BEK1002

Prior to starting a transmission overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-6504 | SOCKET WRENCH | |
|  | 09650-1900 | PULLER | |
|  | 09420-1442 | SLIDING HAMMER | |
|  | 09650-2070 | INPUT SHAFT PULLER | |
|  | 09653-1190<br>09653-1210 | HOOK | |
|  | 09650-1882 | PULLER | |

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1101 | PULLER | |
|  | 09659-1250 | ADAPTER | |

# DISMOUNTIG AND MOUNTING

M03020107BEH1003

## IMPORTANT POINTS - DISMOUNTING

**CAUTION:**
**Do not work on the transmission while it is still hot. This can result in personal injury.**

**1. BLOCK THE WHEELS.**

**2. DRAIN THE TRANSMISSION OIL.**

**3. DISCONNECT THE PROPELLER SHAFT.**

**4. DISCONNECT THE PARKING BRAKE CABLE.**

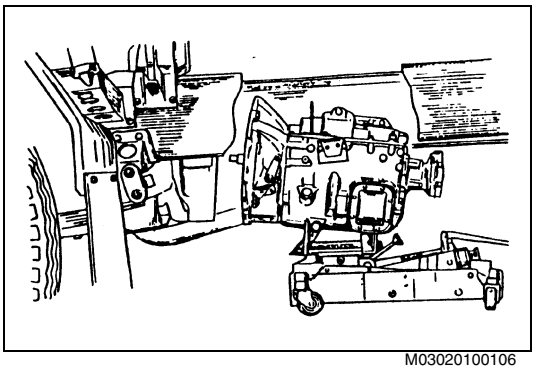
**5. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

**6. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.**

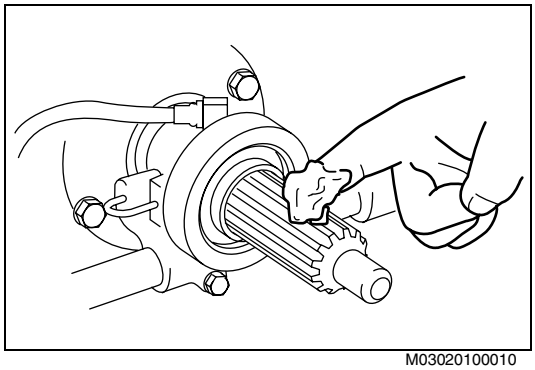
**7. REMOVE THE CLUTCH BOOSTER.**

**8. REMOVE THE TRANSMISSION.**

(1) Remove the lower bolts around the clutch housing.
(2) Place a transmission jack under the transmission.
(3) Remove the remaining bolts around the clutch housing.
(4) Pull the transmission backwards. Lower the transmission jack and pull the transmission out from under the vehicle.

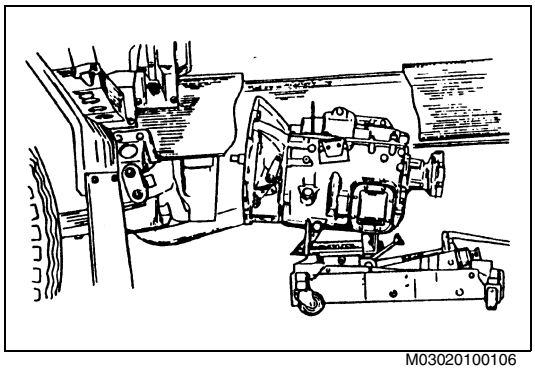


M03020100106


M03020100010

## IMPORTANT POINTS - MOUNTING

**1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.**


M03020100106

**2. INSTALL THE TRANSMISSION.**

**CAUTION:**
**In using the transmission jack, exercise good care to prevent the transmission dropping from the jack because the transmission is heavy and unstable.**

(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.
(2) Slip the transmission in and attach the clutch housing to the flywheel housing.
(3) Install the upper bolts around the clutch housing.
(4) Lower the transmission jack and pull the jack out from under the vehicle.
(5) Install the remaining bolts around the clutch housing.

**3. INSTALL THE CLUTCH BOOSTER.**

**4. CONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.**

**5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

**6. CONNECT THE PARKING BRAKE CABLE.**

**7. CONNECT THE PROPELLER SHAFT.**

**8. FILL THE TRANSMISSION WITH GEAR OIL UP TO THE FILLER PLUG HOLE.**

**9. CHECK THE CLUTCH PEDAL PLAY.**

Refer to chapter **CLUTCH CONTROL**.

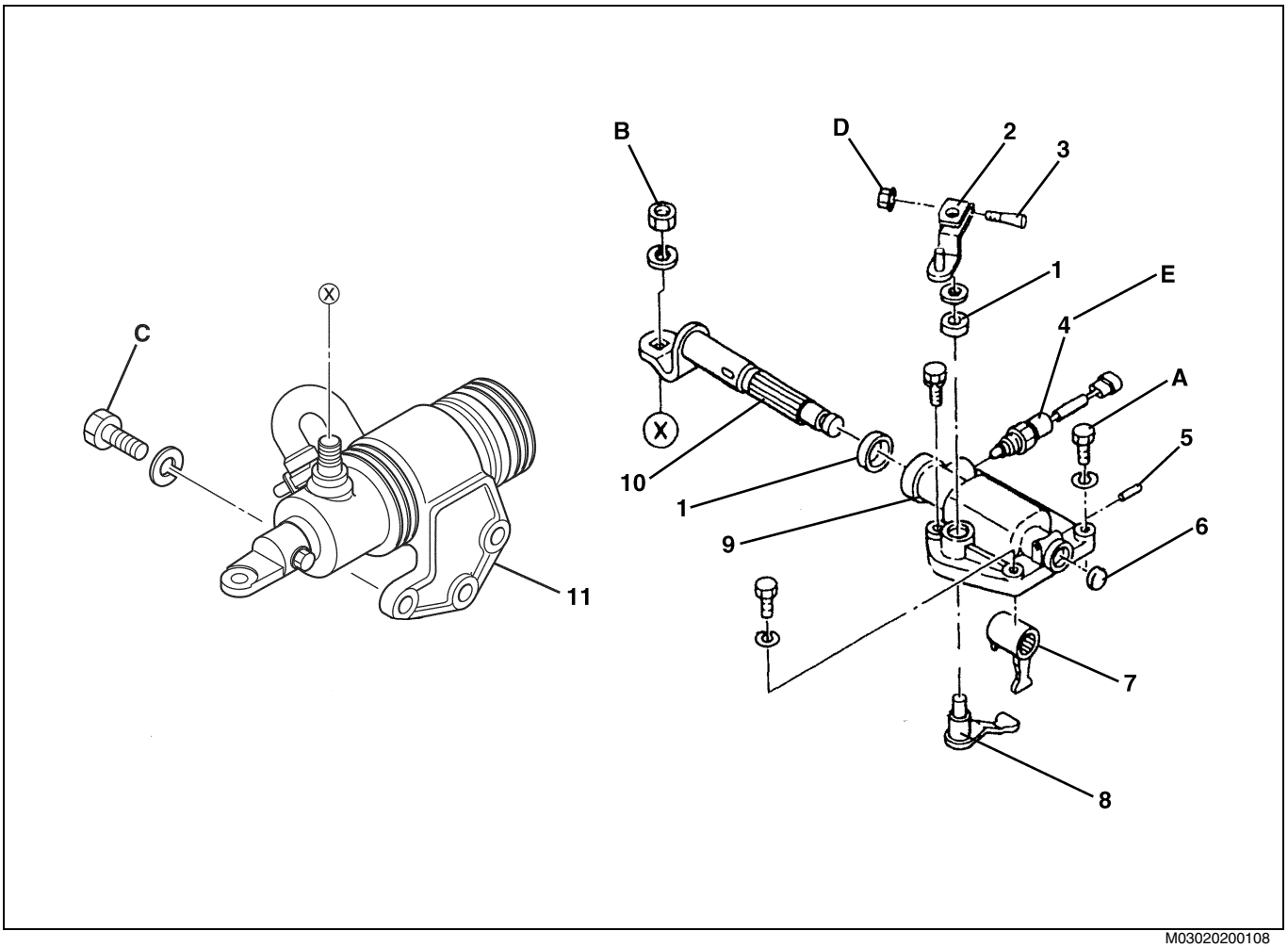
**10. CHECK THE GEAR SHIFT IN EACH POSITION.**

Refer to chapter **TRANSMISSION CONTROL**.

# GEAR SHIFT HOUSING (MF06S)

## COMPONENT LOCATOR

M03020207BED1002

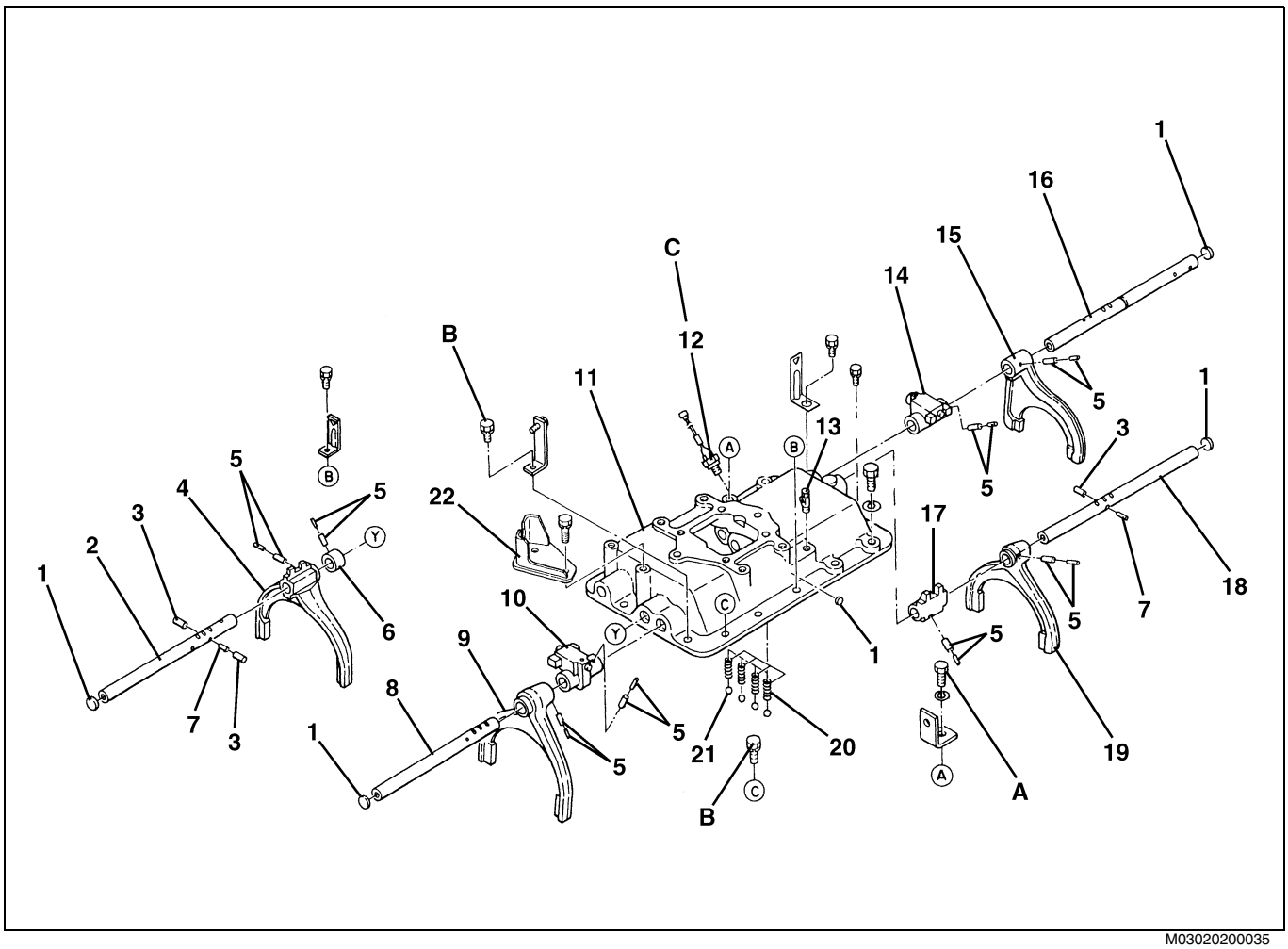



M03020200108

| | | | |
|---|---|---|---|
| 1 | Oil seal | 7 | Inner shift lever |
| 2 | Outer select lever | 8 | Select lever shaft |
| 3 | Select lever pin | 9 | Shift lever shaft housing |
| 4 | Neutral switch | 10 | Shift lever shaft |
| 5 | Lock pin | 11 | Power shift unit |
| 6 | Expansion plug | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 37.5-48.5 {383-494, 28-35} | D | 9.8-11.8 {100-120, 7.3-8.6} |
| B | 101-147 {1,030-1,498, 75-108} | E | 34-38 {347-387, 26-28} |
| C | 64-86 {653-876, 48-63} | | |




M03020200035

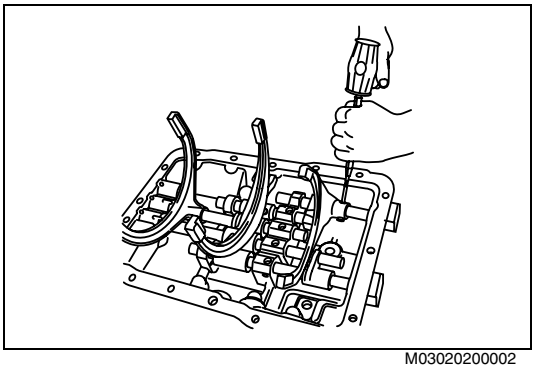
| | | | |
|---|---|---|---|
| 1 | Expansion plug | 12 | Back-up lamp switch |
| 2 | 3rd - 4th shift shaft | 13 | Air breather |
| 3 | Interlock plunger | 14 | Reverse shift head |
| 4 | 3rd - 4th shift fork | 15 | Reverse shift fork |
| 5 | Concentric pins | 16 | Reverse shift shaft |
| 6 | Collar | 17 | 1st - 2nd shift head |
| 7 | Interlock pin | 18 | 1st - 2nd shift shaft |
| 8 | 5th - 6th shift shaft | 19 | 1st - 2nd shift fork |
| 9 | 5th - 6th shift fork | 20 | Compression spring |
| 10 | 5th - 6th shift head | 21 | Steel ball |
| 11 | Transmission case cover | 22 | Link rod support lower bracket |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 93-117 {950-1,200, 69-86} | C | 26-30 {266-305, 20-22} |
| B | 37.5-48.5 {383-494, 28-35} | | |

# OVERHAUL

M03020207BEH2002



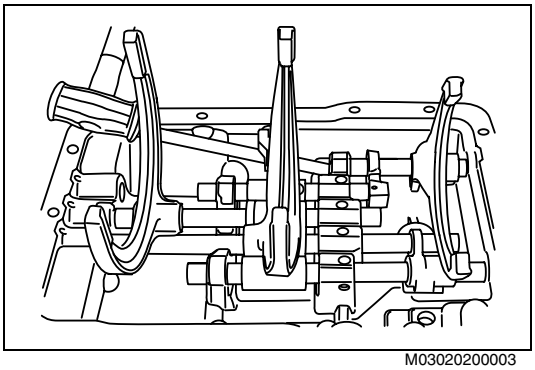
M03020200002

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE GEAR SHIFT SHAFT, SHIFT FORK, SHIFT HEAD AND COLLAR.**

(1) Set each shaft in the neutral position.

(2) Tap the shift head and shift fork fitting pins lightly with a 3.5mm {0.138 in.} diameter tapping rod.

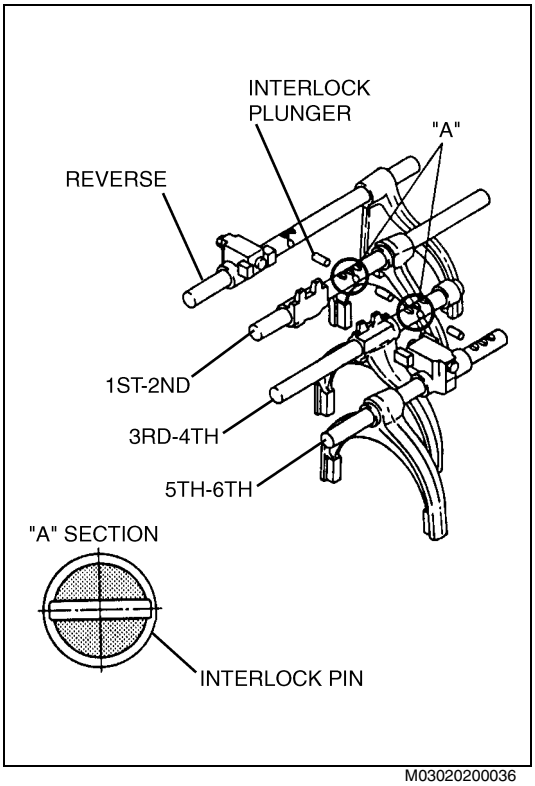


M03020200003

(3) Drive out the shift shafts and its expansion plugs one at a time. When removing the shift shaft, remove the shift fork and the shift head.

**NOTICE:**
**Take care not to damage the sliding bore.**

**CAUTION:**
**The steel ball may fly out of the hole when removing the shift shaft. Wear safety glasses during removal.**




M03020200036

## IMPORTANT POINTS - ASSEMBLY

**1. INSTALL THE STEEL BALL, COMPRESSION SPRING, SHIFT SHAFT, SHIFT FORK AND SHIFT HEAD.**

(1) Place the ball and spring in the hole.

(2) Depress the ball and spring with a suitable tool.

**CAUTION:**
**The steel ball may fly out of the hole when installing the shift shaft. Wear safety glasses during installation.**

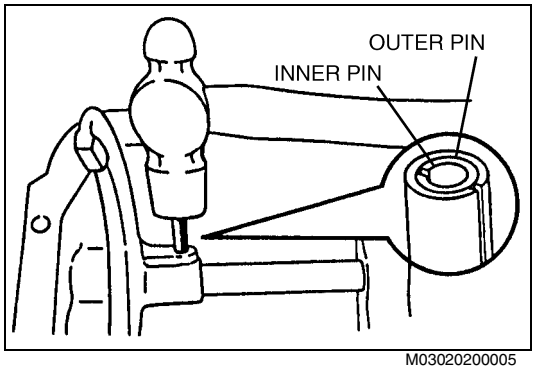
(3) Coat the shift shaft with gear oil.

(4) Align the shift fork and head and put the shift shaft through, and then slide the shift shaft over the ball.

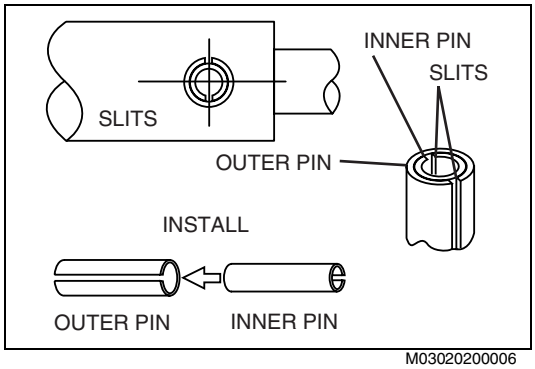
(5) Place the shift shaft in neutral position.

**NOTICE:**

- **Pay special attention to the position and direction of the shift fork and shift head.**
- **For 1st-2nd and 3rd-4th shift shafts, insert the interlock pin. Coat the interlock pin with chassis grease.**



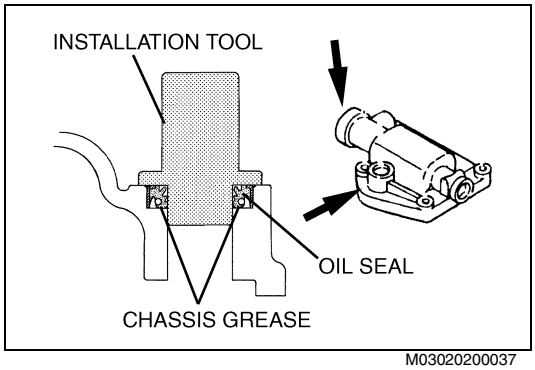
M03020200005



M03020200006

**2. SECURE THE SHIFT HEAD AND FORK WITH CONCENTRIC PINS.**

(1) Drive the concentric pins into the fork and the head. Make sure that the slits of the concentric pins are on opposite sides as shown.



M03020200037

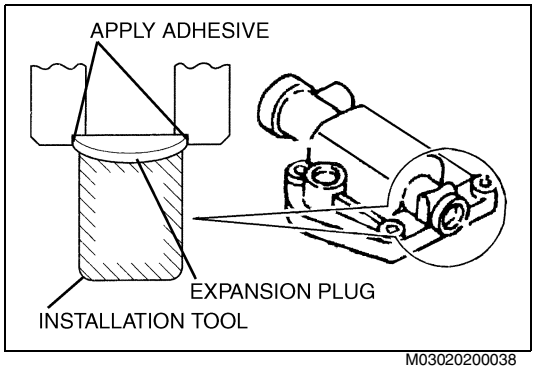
**3. INSTALL THE OIL SEAL.**

(1) Drive the new oil seal into the shift lever shaft housing with the installation tool.

(2) Coat the sealing surface between the seal lips with chassis grease.

**NOTICE:**

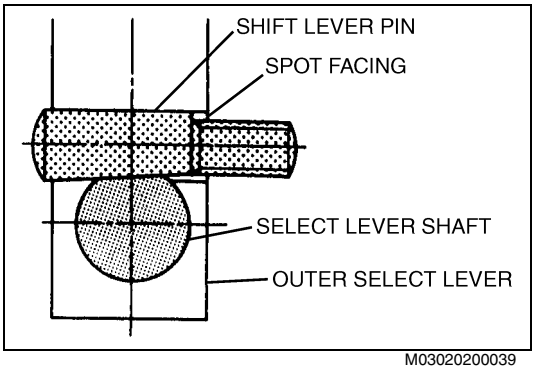
- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**



M03020200038

**4. INSTALL THE EXPANSION PLUG.**

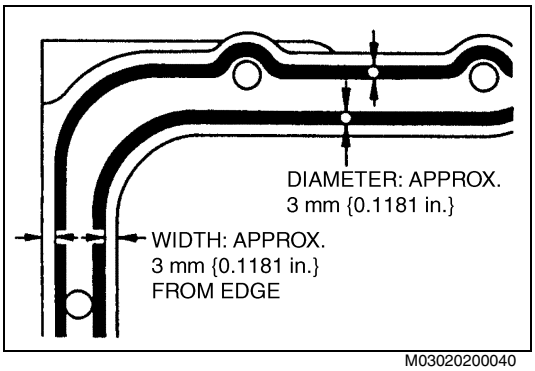
(1) Apply adhesive all around to the expansion plug.



M03020200039

**5. INSERT THE SHIFT LEVER PIN INTO THE OUTER SELECT LEVER.**

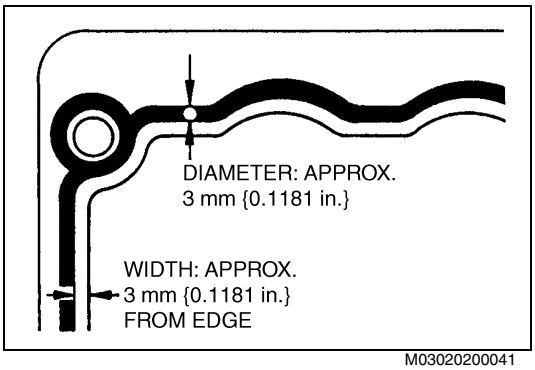
**NOTICE:**
**Pay attention to the position of the shift and the direction of the shift lever pin.**



M03020200040

**6. INSTALL THE TRANSMISSION CASE COVER.**
(1) Coat the face of the transmission case with liquid gasket.

**NOTICE:**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



M03020200041

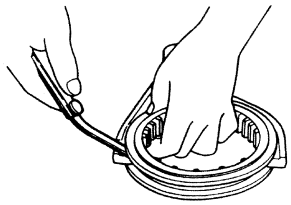
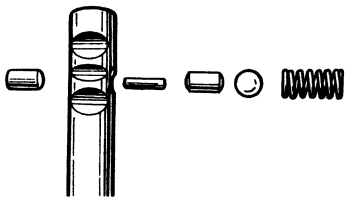
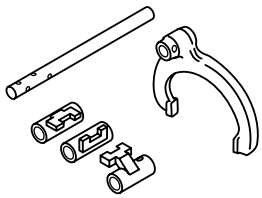
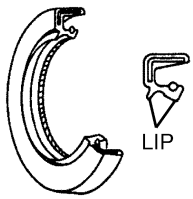
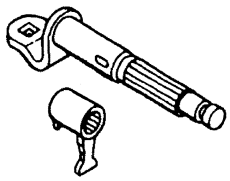
**7. INSTALL THE SHIFT LEVER SHAFT HOUSING.**
(1) Coat the face of the transmission case cover with liquid gasket.

**NOTICE:**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

# INSPECTION AND REPAIR

M03020207BEH3002

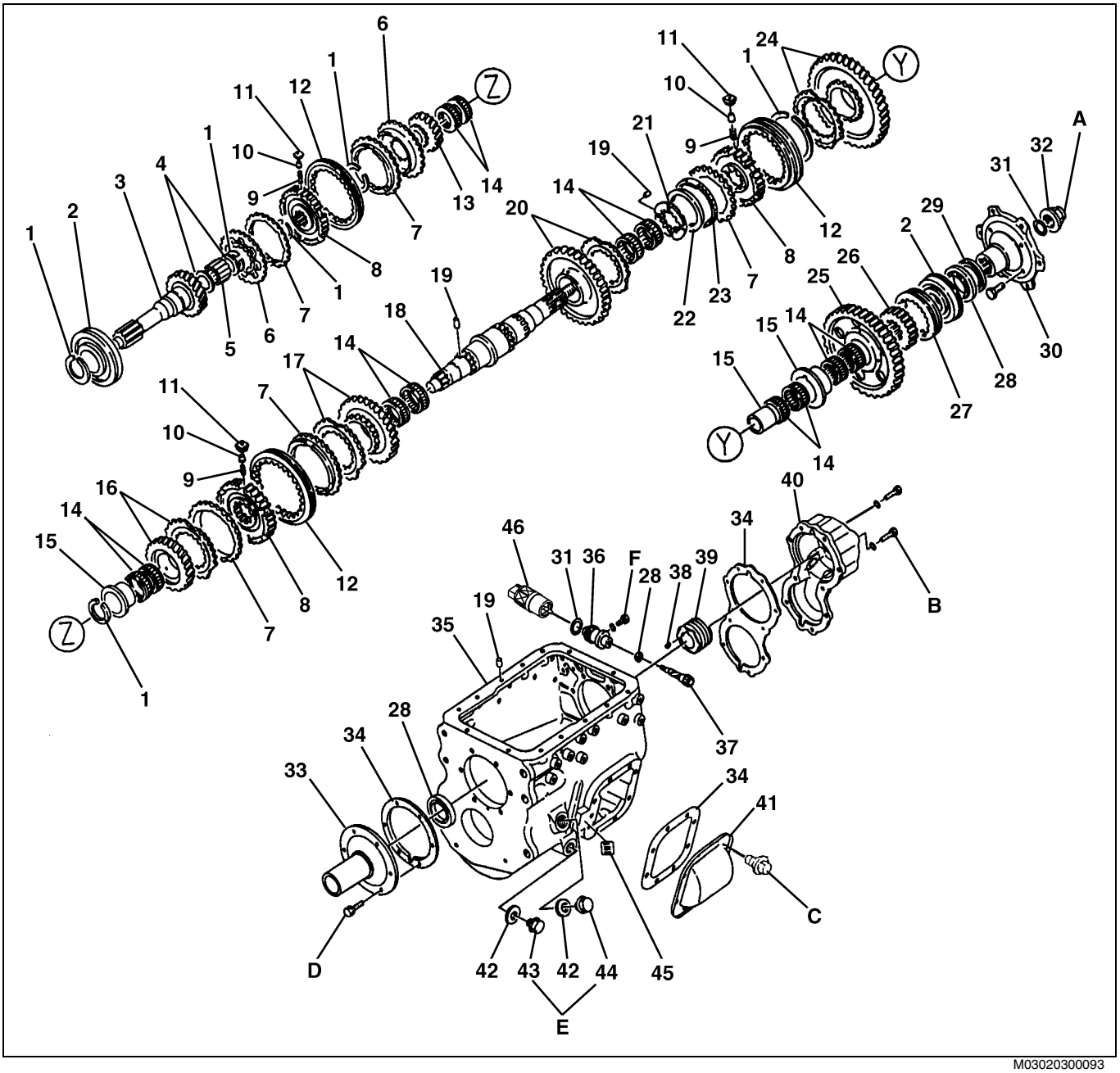
Unit: mm {in.}

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Clearance between shift fork and sleeve | 0.20-0.45 {0.0079-0.0177} | 1.0 {0.0394} | Replace. | Measure  |
| Interlock pin, interlock plunger, compression spring and steel ball wear and damage | — | — | Replace, if necessary. | Visual check  |
| Shift head, shift fork and shift shaft wear and damage | — | — | Replace, if necessary. | Visual check  |
| Oil seal lip wear and damage | — | — | Replace, if necessary. | Visual check   |
| Shift lever shaft and inner shift lever wear and damage | — | — | Replace, if necessary. | Visual check  |

# INPUT SHAFT, OUTPUT SHAFT, GEARS AND RELATED PARTS (MF06S)

## COMPONENT LOCATOR

M03020307BED1002




M03020300093

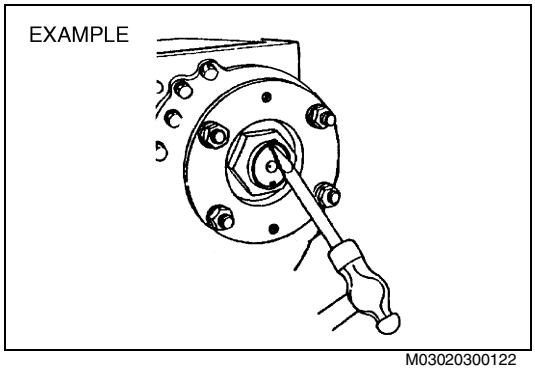
| | | | |
|---|---|---|---|
| 1 | Retainer ring | 24 | 1st gear sub-assembly |
| 2 | Cylindrical bearing | 25 | Reverse gear |
| 3 | Input shaft | 26 | Constant hub |
| 4 | Spacer | 27 | Constant sleeve |
| 5 | Roller bearing | 28 | Oil seal |
| 6 | Synchronizer cone | 29 | Dust deflector |
| 7 | Synchronizer ring | 30 | Universal joint flange |
| 8 | Synchronizer hub | 31 | O-ring |
| 9 | Compression spring | 32 | Nut |
| 10 | Synchronizer head | 33 | Front bearing retainer |
| 11 | Synchronizer key | 34 | Gasket |
| 12 | Synchronizer sleeve | 35 | Transmission case |
| 13 | 5th gear | 36 | Speedometer driven gear bushing |
| 14 | Needle roller bearing | 37 | Speedometer driven gear |
| 15 | Bushing | 38 | Key |
| 16 | 4th gear sub-assembly | 39 | Speedometer drive gear |
| 17 | 3rd gear sub-assembly | 40 | Rear bearing retainer |
| 18 | Output shaft | 41 | Power take-off cover |
| 19 | Pin | 42 | Soft washer |
| 20 | 2nd gear sub-assembly | 43 | Drain plug |
| 21 | Synchronizer bushing | 44 | Filler plug |
| 22 | Synchronizer inner cone | 45 | Transmission speedometer gear and gear ratio plate |
| 23 | Synchronizer double cone | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 587-783 {6,000-8,000, 434-578} | D | 64-86 {650-870, 47-62} |
| B | 73-93 {750-950, 55-68} | E | 79-117 {800-1,200, 58-86} |
| C | 19.5-24.5 {200-250, 15-18} | F | 19-25 {190-260, 14-18} |

# OVERHAUL

M03020307BEH2003

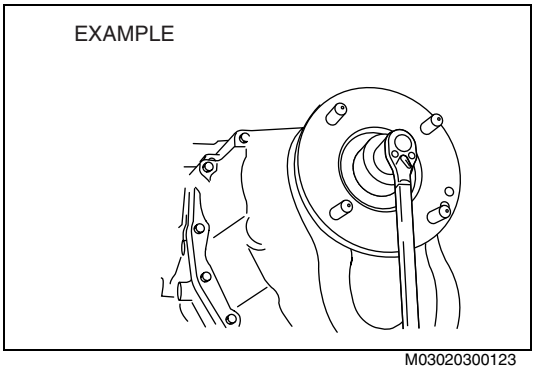


M03020300122

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE OUTPUT SHAFT LOCK NUT.**

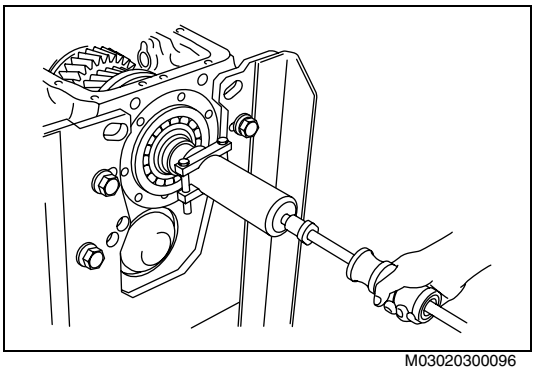
(1) The lock nut has been caulked, so before loosening it, lift the caulked part completely out of the shaft groove.



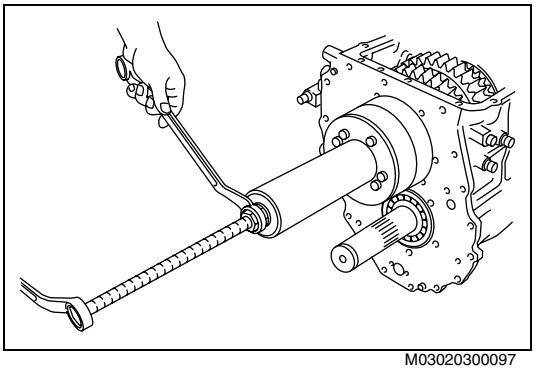
M03020300123

(2) Using the special tool or the commercial tool, remove the lock nut.
**SST: Socket Wrench (09839-6504)**

**NOTICE:**
**Before loosening the lock nut, engage two gears so that the output shaft can not be turned around.**


M03020300096

**2. REMOVE THE INPUT SHAFT.**
(1) Using the special tools, pull out input shaft with the accompanying bearings.
**SST:**
**Input Shaft Puller (09650-2070)**
**Sliding Hammer (09420-1442)**

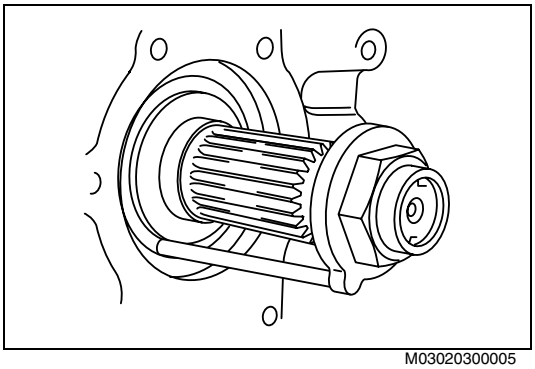

M03020300097

**3. REMOVE THE OUTPUT SHAFT REAR BEARING.**
(1) Remove the retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**

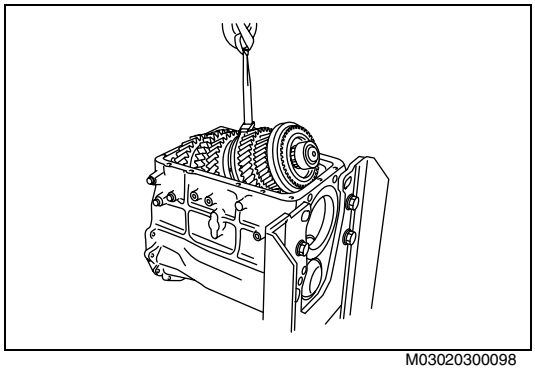
(2) Using the special tools, remove the output shaft rear bearing.
**SST:**
**Hook (09653-1210)**
**Puller (09650-1882)**

**NOTICE:**
**Insert the hook's click into the groove for the retainer ring, then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.**

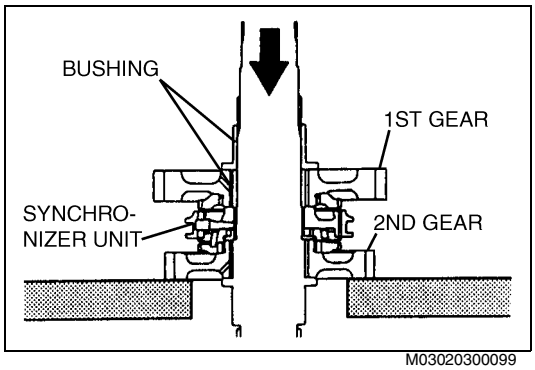

M03020300005

**4. REMOVE THE OUTPUT SHAFT ASSEMBLY FROM THE TRANSMISSION CASE.**
(1) Attach a jig to the end of the output shaft.

**CAUTION:**
**If the output shaft assembly is removed from the transmission without a jig, the reverse gear will drop from the shaft, which can possibly result in the personal injury.**


M03020300098

(2) Attach a suitable hook or other lifting device around the 3rd-4th speed synchronizer sleeve and carefully lift the output shaft assembly from the transmission case.
(3) When removing the output shaft assembly, remove the synchronizer ring and the cone of the input shaft gear.

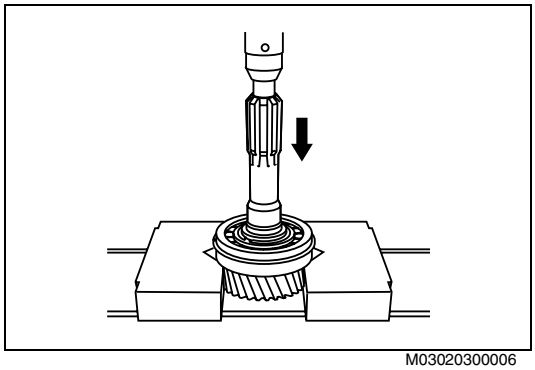


M03020300099

**5. REMOVE THE BUSHINGS FROM THE OUTPUT SHAFT.**
(1) Support the 2nd gear and press the output shaft front end through the bushings, 1st gear, synchronizer unit, 2nd gear and needle roller bearings.

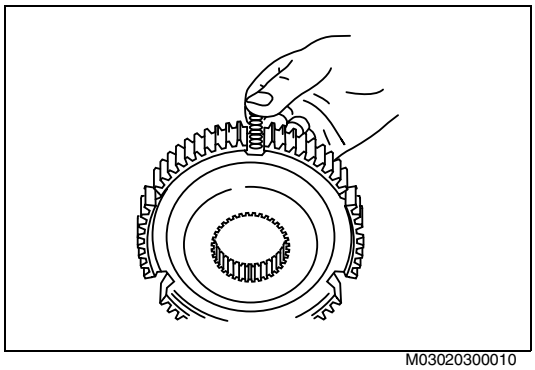
**NOTICE:**
**When removing the output shaft, do not allow the shaft to drop on a hard surface.**

**CAUTION:**
**Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**


M03020300006

**6. DISASSEMBLE THE INPUT SHAFT.**
(1) Remove retainer ring.
(2) Using a press, remove the cylindrical bearing.

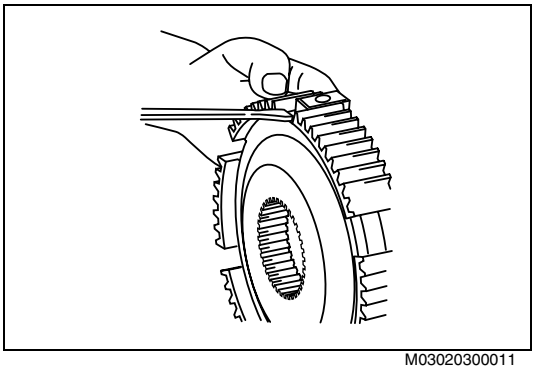
**CAUTION:**
**Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**


M03020300010

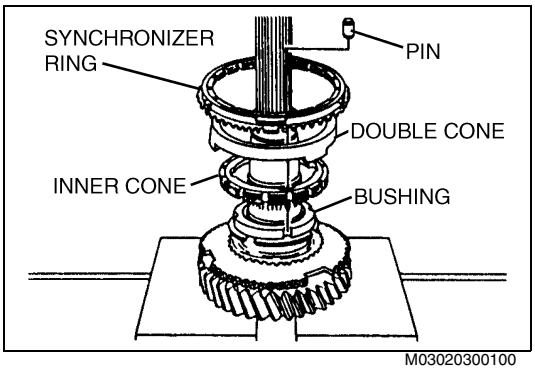
## IMPORTANT POINTS - ASSEMBLY

**1. ASSEMBLE THE SYNCHRONIZER UNIT.**
(1) Install the compression spring.

**CAUTION:**
**The compression spring is spring steel and may fly out of the hole during assembly. Wear safety glasses during assembly.**


M03020300011

(2) Install the synchronizer key and head.



M03020300100

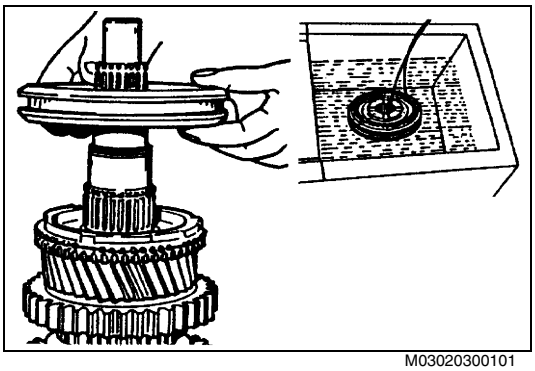
**2. INSTALL THE 2ND GEAR, SYNCHRONIZER UNIT, 1ST GEAR, 1ST GEAR BUSHING AND REVERSE GEAR BUSHING.**

(1) Install the needle roller bearing and 2nd gear.

**NOTICE:**

**Coat the needle roller bearing with gear oil during installation to provide initial lubrication.**

(2) Install the synchronizer bushing, synchronizer inner cone, synchronizer double cone, synchronizer ring and pins on the 2nd gear.


M03020300101

(3) Heat the synchronizer unit and bushing for about 5 minutes in water or oil heated to 80-100°C {176-212°F}.

(4) Install the synchronizer unit and other parts on the output shaft.

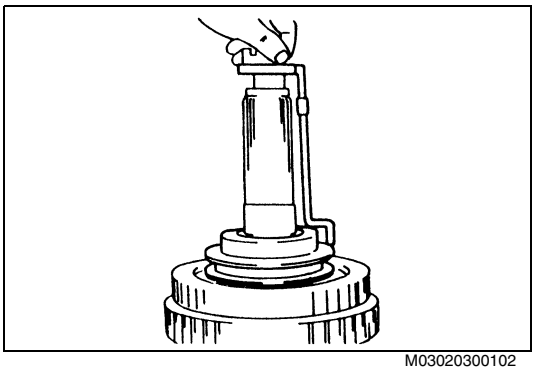
(5) Place the bushing on the output shaft against the end stop.

**NOTICE:**

- **Do not heat the synchronizer unit and bushing in excess of 120°C {248°F}.**
- **If the unit is heated in hot water, remove moisture before installation.**

**CAUTION:**

**Never touch hot water or hot oil and heated synchronizer unit and bushing with your bare hand. This can result in personal injury.**


M03020300102

**3. INSTALL THE REVERSE GEAR.**

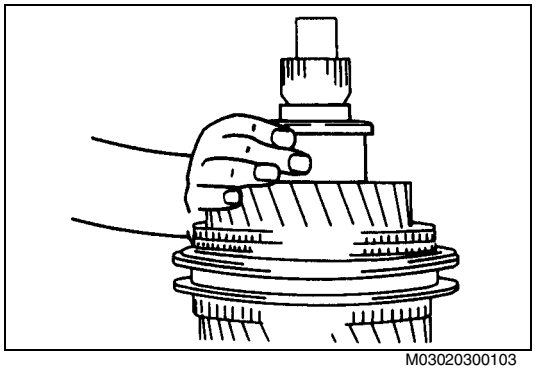
(1) Install the needle roller bearing and reverse gear.

(2) Install the constant hub and constant sleeve.

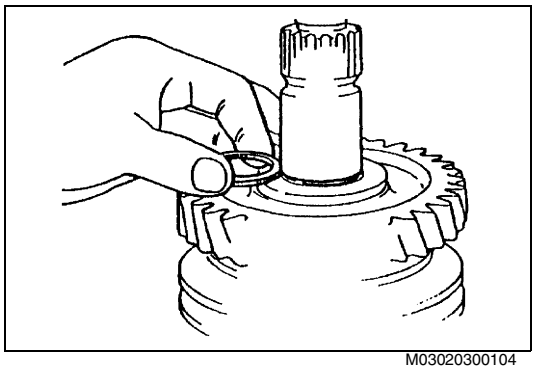
(3) Hold the constant hub with jig.

**CAUTION:**

**When installing the output shaft assembly in the transmission case, be careful not to drop the reverse gear from the shaft.**


M03020300103

**4. INSTALL THE 3RD AND 4TH GEAR.**
(1) Install the needle roller bearing and 3rd gear.
(2) Install the 3rd-4th gear synchronizer unit.
(3) Install the pin, 4th gear, needle roller bearing and bushing.

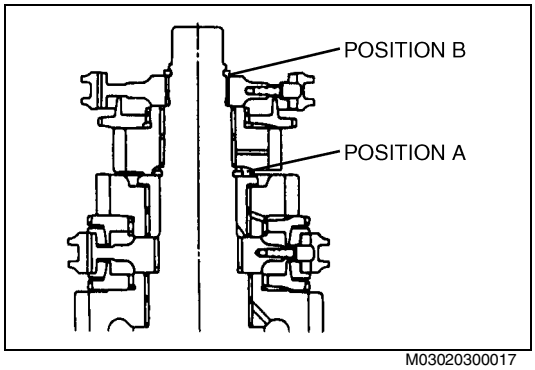

M03020300104

**5. INSTALL THE GEARS, BUSHINGS, NEEDLE ROLLER BEARING, SYNCHRONIZER UNITS AND OTHER PARTS ON THE OUTPUT SHAFT.**

**NOTICE:**
**Coat the needle roller bearings with gear oil during installation to provided initial lubrication.**

(1) Select a retainer ring that will provide a tight fit.
**Clearance: Less than 0.1 mm {0.0039 in.}**

**NOTICE:**
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**



M03020300017

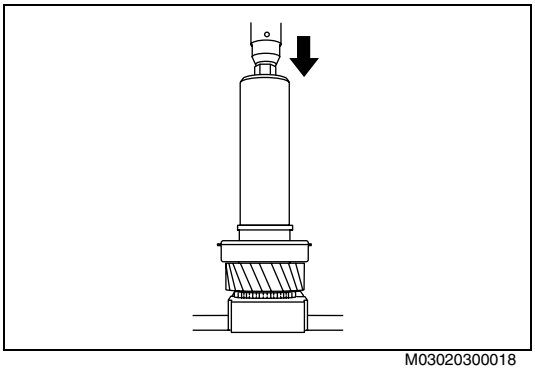
**Retainer rings are available in the following sizes: Position A**

| Thickness | Color code |
|---|---|
| 2.4 mm {0.0945 in.} | None |
| 2.5 mm {0.0984 in.} | White |
| 2.6 mm {0.1024 in.} | Green |
| 2.7 mm {0.1063 in.} | Brown |
| 2.8 mm {0.1102 in.} | Blue |

**Retainer rings are available in the following sizes: Position B**

| Thickness | Color code |
|---|---|
| 2.35 mm {0.0925 in.} | White |
| 2.45 mm {0.0965 in.} | None |
| 2.55 mm {0.1004 in.} | Blue |

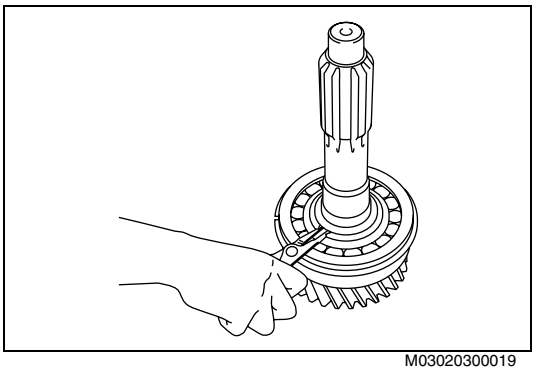
**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.**


M03020300018

**6. ASSEMBLE THE INPUT SHAFT.**

(1) Using a press, install the cylindrical roller bearing to the input shaft.

**NOTICE:**
- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race.**


M03020300019

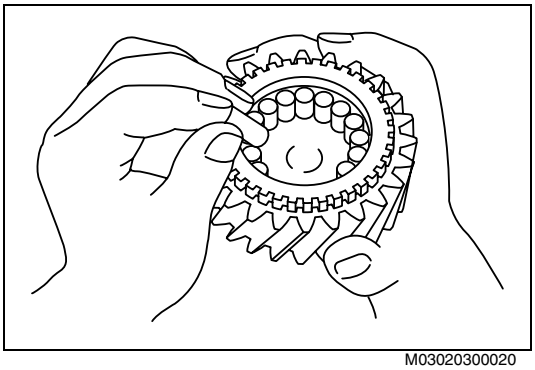
(2) Select a retainer ring.
**Clearance: Less than 0.1 mm {0.0039 in.}**

**NOTICE:**
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in the groove.**

**Retainer rings are available in the following sizes.**

| Thickness | Color code |
|---|---|
| 2.8 mm {0.1102 in.} | None |
| 2.9 mm {0.1141 in.} | Blue |
| 3.0 mm {0.1181 in.} | Green |
| 3.1 mm {0.1220 in.} | Yellow |
| 3.2 mm {0.1260 in.} | Red |

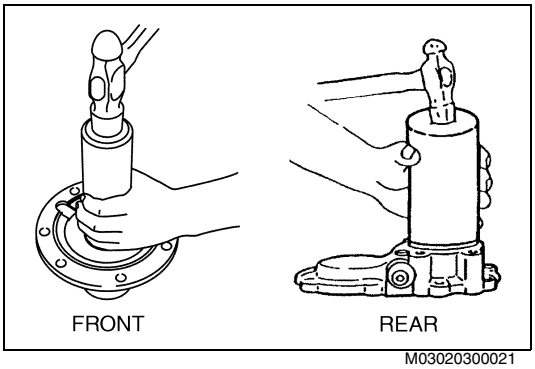
**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.**


M03020300020

**7. INSTALL THE ROLLER BEARING IN THE COUNTERBORE OF THE INPUT SHAFT.**

(1) Apply gear oil to the bearings.
(2) Place spacers at both ends of the bearings.
(3) Install the retainer ring.

**NOTICE:**
**Always use roller bearings of uniform diameter (15 pieces per set). There are 3 types of roller bearings in different diameters. There are distinguished by the colors red, blue, and white.**



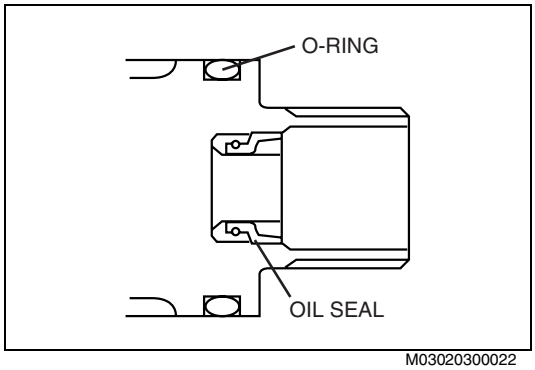
M03020300021

**8. REPLACE THE OIL SEAL OF THE FRONT AND REAR BEARING RETAINER.**

(1) Using a screwdriver, remove the oil seal from the bearing retainer.
(2) Using a press and a suitable installing tool, press the oil seal into the front bearing retainer.
(3) Using a press and a special tool, press the oil seal into the rear bearing retainer.
**SST: Adapter (09659-1250)**

**NOTICE:**
**Be sure the oil seal is installed in the proper direction.**

(4) Coat chassis grease to the sealing surface between the seal lips.



M03020300022

**9. INSTALL THE SPEEDOMETER DRIVEN GEAR BUSHING.**

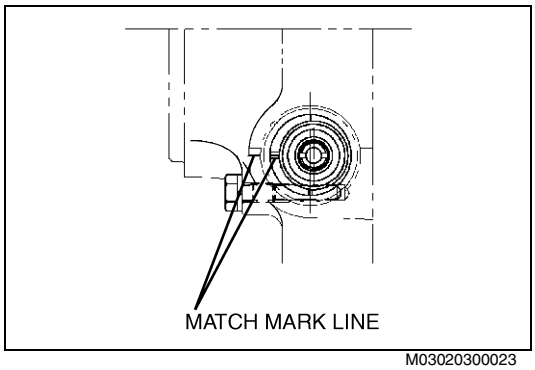
(1) Install the O-ring and oil seal to the bushing.

**NOTICE:**

- **Coat the O-ring, oil seal and driven gear with chassis grease.**
- **Make sure that the oil seal is installed in the correct direction when replacing it.**

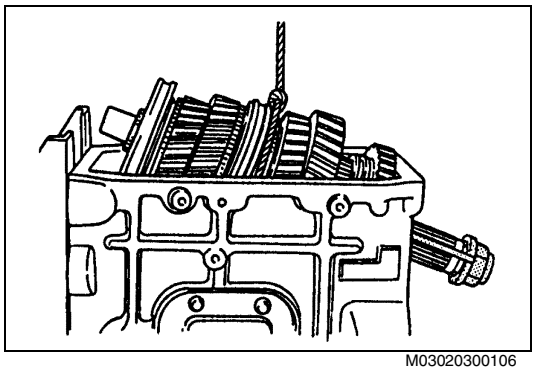
(2) Match the mark line on the bushing with the mark line on the rear bearing retainer.

(3) Align the speedometer driven gear bushing hole with the hole of the rear bearing retainer.



M03020300023

| Number of the drive gear teeth | Number of the driven gear teeth | The mark should be matched to the mark on retainer |
|---|---|---|
| 7 | 18 | 18 |

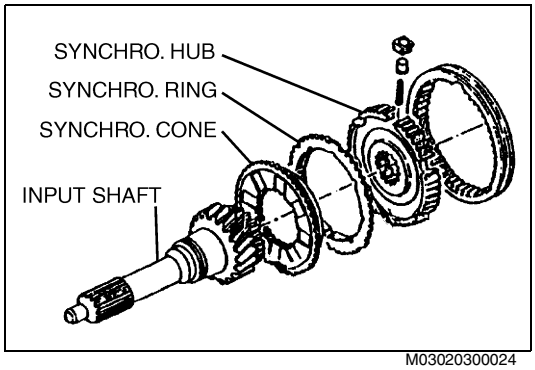

M03020300106

**10. INSTALL THE OUTPUT SHAFT ASSEMBLY IN THE TRANSMISSION CASE.**

(1) Using ropes or some other lifting device, carefully lower the output shaft assembly into the case.

(2) When installing the output shaft assembly, install the synchronizer ring and cone of the input shaft gear.

(3) Place the output shaft assembly in position.

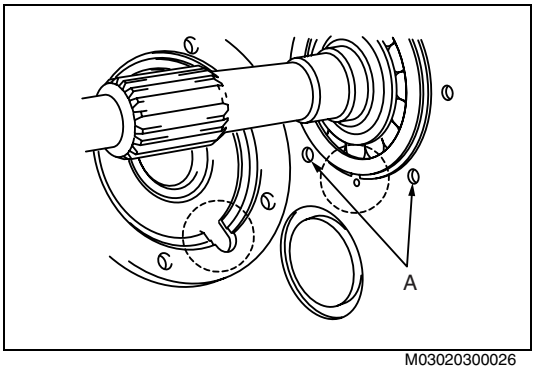


M03020300024

**11. INSTALL THE INPUT SHAFT INTO THE TRANSMISSION CASE.**

(1) Mesh the synchronizer cone to the input shaft.

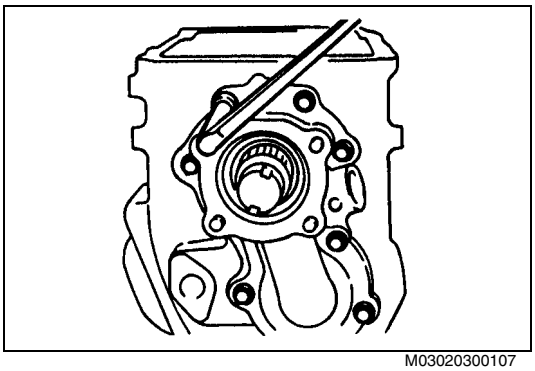
(2) Align the synchronizer hub slot with synchronizer ring.



M03020300026

**12. INSTALL THE FRONT BEARING RETAINER.**
(1) Coat both sides of the gasket with liquid gasket.
(2) Apply liquid gasket or sealing tape to the bolt "A".

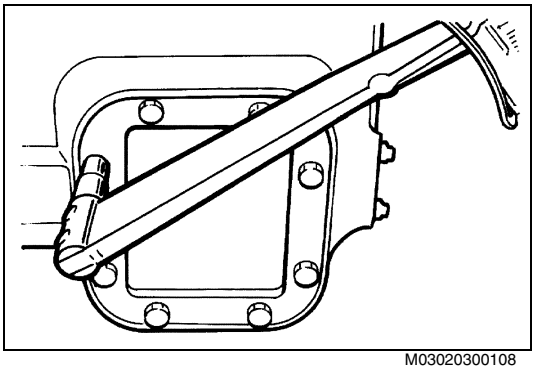
**NOTICE:**
- **When installing the bearing retainer, the gasket must be installed in such a way that the gasket notch matches the oil drain hole on the case so as not to block the hole.**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**


M03020300107

**13. INSTALL THE REAR BEARING RETAINER.**
(1) Coat both sides of the gasket with liquid gasket.

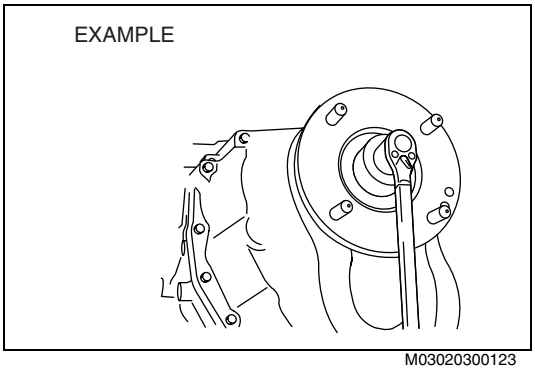
**NOTICE:**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**

(2) Apply liquid gasket or sealing tape to the bolt.


M03020300108

**14. INSTALL THE POWER TAKE-OFF COVER.**
(1) Coat both sides of the gasket with liquid gasket.

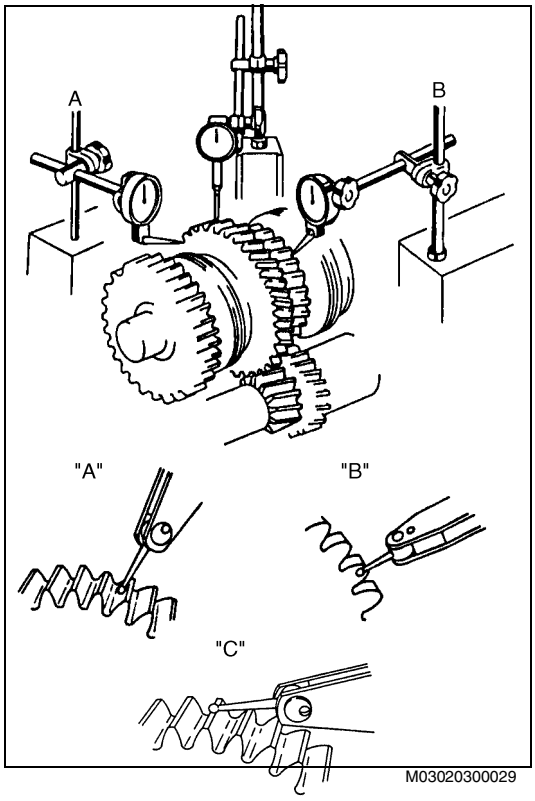
**NOTICE:**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



M03020300123

**15. INSTALL THE OUTPUT SHAFT LOCK NUT.**
(1) Before tightening the lock nut engage two gears so that the shaft can not be turned around.
(2) Install the lock nut to the output shaft and tighten it.
**SST: Socket Wrench (09839-6504)**

**NOTICE:**
**Do not damage the O-ring.**




**16. MEASURE THE GEAR BACKLASH, END PLAY AND RADIAL PLAY.**

(1) Block the counter shaft with a pry bar when measuring.

(2) Measure the gear backlash, end play and radial play at four points of each gear.

**<BACKLASH (A)>** Unit: mm {in.}

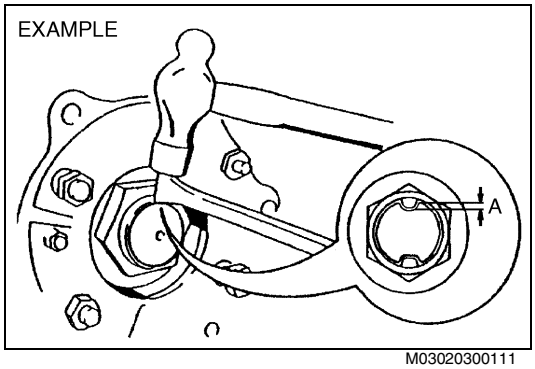
| | Assembly Standard | Service Limit |
|---|---|---|
| Reverse gear | 0.08-0.16 {0.0032-0.0062} | 0.4 {0.0157} |
| 1st gear | | |
| 2nd gear | 0.05-0.13 {0.0020-0.0051} | |
| 3rd gear | | |
| 4th gear | | |
| 5th gear | 0.08-0.16 {0.0032-0.0062} | |
| Input shaft gear | | |

**<END PLAY (B)>** Unit: mm {in.}

| | Assembly Standard | Service Limit |
|---|---|---|
| Reverse gear | 0.15-0.30 {0.0060-0.0118} | 0.5 {0.0197} |
| 1st gear | | |
| 2nd gear | | |
| 3rd gear | | |
| 4th gear | | |
| 5th gear | 0.15-0.50 {0.0049-0.0162} | |

**<RADIAL PLAY (C)>** Unit: mm {in.}

| | Assembly Standard |
|---|---|
| Reverse gear | 0.015-0.085 {0.0006-0.0033} |
| 1st gear | 0.012-0.061 {0.0005-0.0024} |
| 2nd gear | 0.012-0.061 {0.0005-0.0024} |
| 3rd gear | 0.013-0.083 {0.0006-0.0032} |
| 4th gear | 0.015-0.078 {0.0006-0.0030} |
| 5th gear | 0.110-0.155 {0.0044-0.0061} |




**17. CAULK THE OUTSIDE RIM OF THE OUTPUT SHAFT LOCK NUT.**

(1) Using a hammer and a chisel, caulk the outside rim of the lock nut into the groove on the output shaft.
**A: More than 1.5 mm {0.0591 in.}**

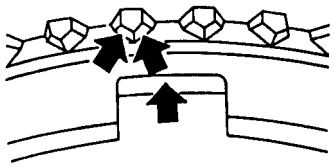
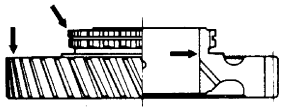
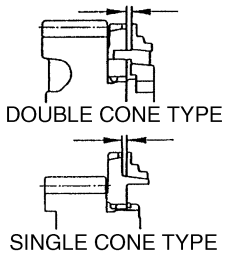
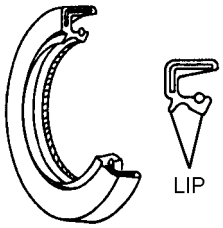
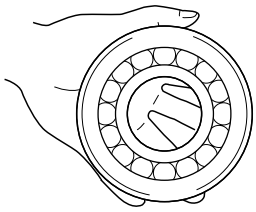
**NOTICE:**

- **The caulking should fit the groove thoroughly.**
- **The caulking should be done without rift.**

# INSPECTION AND REPAIR

M03020307BEH3002

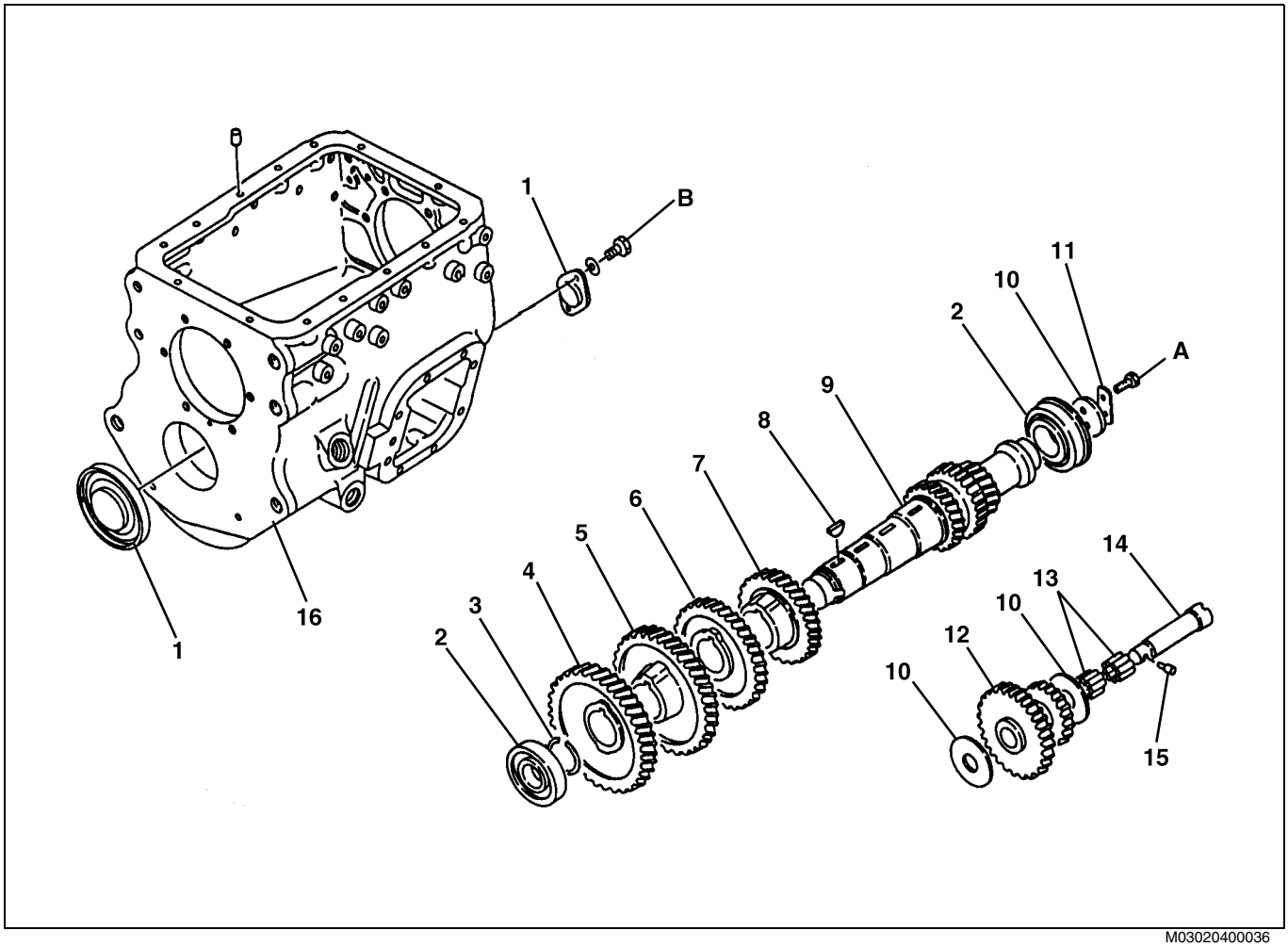
Unit: mm {in.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Synchronizer ring, deformity, crack and excessive damage | — | — | Replace, if necessary. | Visual check  |
| Gear excessive wear, chips and cracks | — | — | Replace, if necessary. | Visual check  |
| Clearance between synchronizer ring and synchronizer cone or gear sub assembly | 2nd gear 1.1-2.55 {0.044-0.101} | 0.2 {0.0079} | Replace the synchronizer ring and/or gear sub assembly. | Measure   |
| | 3rd, 4th gear 1.15-1.8 {0.046-0.070} | | | |
| | 5th, Input gear 1.1-1.9 {0.044-0.074} | | | |
| Oil seal lip wear and damage | — | — | Replace, if necessary. | Visual check   |
| Cylindrical bearing and ball bearing improper rotation | — | — | Replace, if necessary. | Visual check  |
| Needle roller bearing in deformed shape | — | — | Replace, if necessary. | Visual check  |

# COUNTER SHAFT, REVERSE IDLER SHAFT AND GEARS (MF06S)

## COMPONENT LOCATOR

M03020407BED1002




M03020400036

| | | | |
|---|---|---|---|
| 1 | Seal cover | 9 | Counter shaft |
| 2 | Cylindrical roller bearing | 10 | Thrust washer |
| 3 | Retainer ring | 11 | Lock plate |
| 4 | Counter drive gear | 12 | Reverse idler gear |
| 5 | Counter 5th gear | 13 | Needle roller bearing |
| 6 | Counter 4th gear | 14 | Reverse idler shaft |
| 7 | Counter 3rd gear | 15 | Set screw |
| 8 | Woodruff key | 16 | Transmission case |

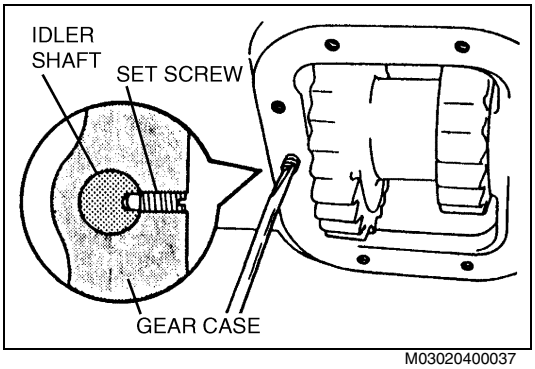
**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 64-86 {653-876, 48-63} | B | 37.5-48.5 {383-494, 28-36} |

# OVERHAUL

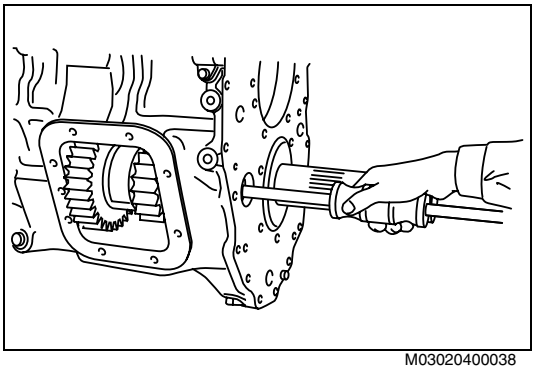
M03020407BEH2002

## IMPORTANT POINTS - DISASSEMBLY

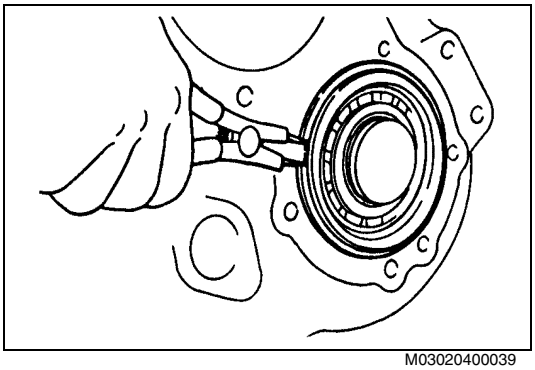


M03020400037

**1. REMOVE THE IDLER SHAFT SET SCREW.**
(1) Using a screwdriver, remove the reverse idler shaft set screw.

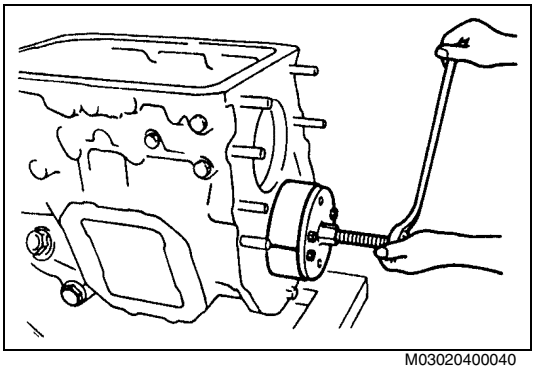

M03020400038

**2. REMOVE THE IDLER SHAFT AND IDLER GEAR.**
(1) Using the special tool, pull out the reverse idler shaft while holding the reverse idler gear thrust washers and bearing inside the case.
**SST: Sliding Hammer (09420-1442)**


M03020400039

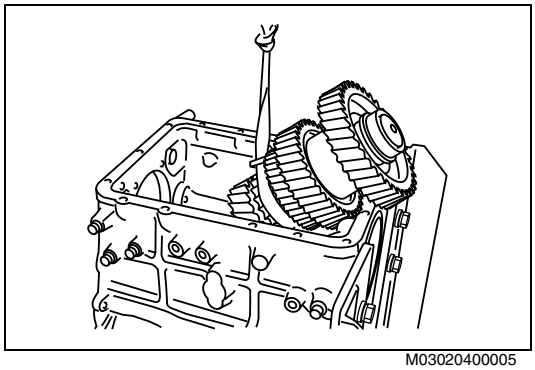
**3. REMOVE THE COUNTER SHAFT REAR BEARING.**
(1) Remove the retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of groove during removal. Wear safety glasses during removal.**


M03020400040

(2) Install the special tools on the rear cylindrical roller bearing and remove it.
**SST:**
**Hook (09653-1190)**
**Puller (09650-1900)**

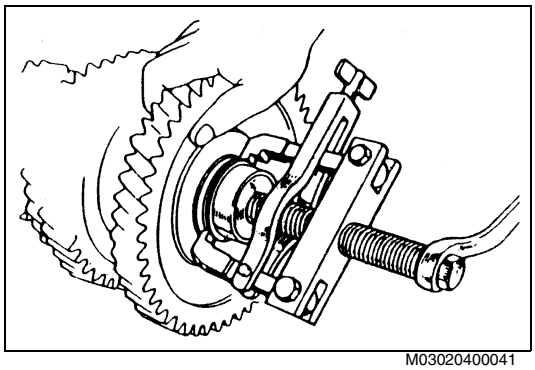
**NOTICE:**
**Insert the hook's click into the groove for the retainer ring then secure the puller to the hook with bolts. Secure the puller so that it does not turn, then rotate the bolt to pull the bearing out.**


M03020400005

**4. REMOVE THE COUNTER SHAFT FROM THE TRANSMISSION CASE.**

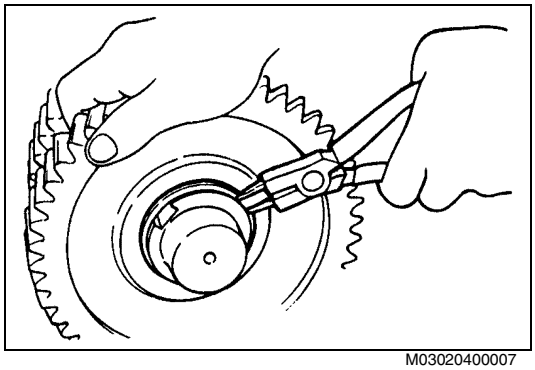
(1) Tie a rope or hook around the counter shaft and carefully pry the counter shaft assembly rearward until the front end of the shaft is cleared out of the front cylindrical roller bearing.

(2) Carefully lift the counter shaft assembly from the case.


M03020400041

**5. REMOVE THE CYLINDRICAL ROLLER BEARING INNER RACE.**

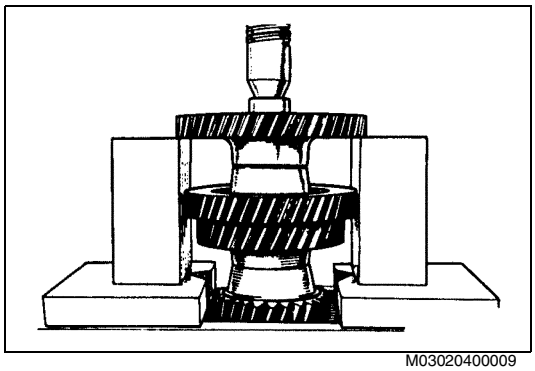
(1) Using the special tool on the inner race, pull out the front cylindrical roller bearing inner race from the counter shaft.
**SST: Puller (09650-1101)**


M03020400007

**6. REMOVE THE COUNTER SHAFT GEARS.**

(1) Remove the retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**


M03020400009

(2) Support the counter shaft drive gear as close as possible to the gear hub and press the counter shaft front end until it is free of the drive gear.

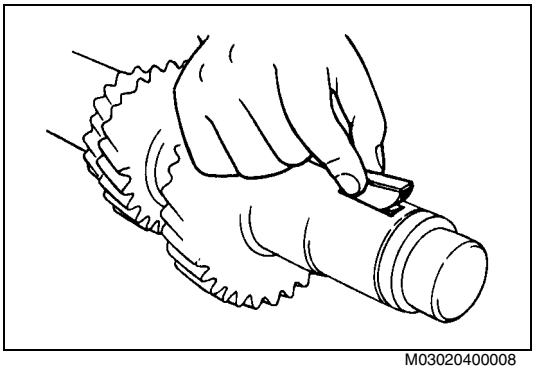
(3) Support the counter 5th gear under the gear teeth and press the counter shaft out of the gear.

(4) Support the counter 4th gear under the gear teeth and press the counter shaft out of the gear.

(5) Support the counter 3rd gear under the gear teeth and press the counter shaft out of the gear.

**NOTICE:**
**When removing the counter shaft gears, do not allow the shaft to drop to on a hard surface.**

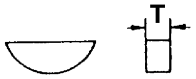
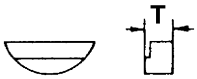
**CAUTION:**
**Stay out from under the shaft during removal. The shaft could drop suddenly, which can result in personal injury.**

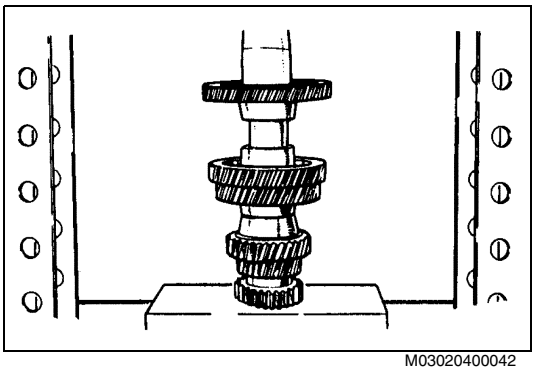

M03020400008

## IMPORTANT POINTS - ASSEMBLY

**1. INSTALL THE COUNTER DRIVE GEAR, COUNTER 3RD, 4TH AND 5TH GEAR.**

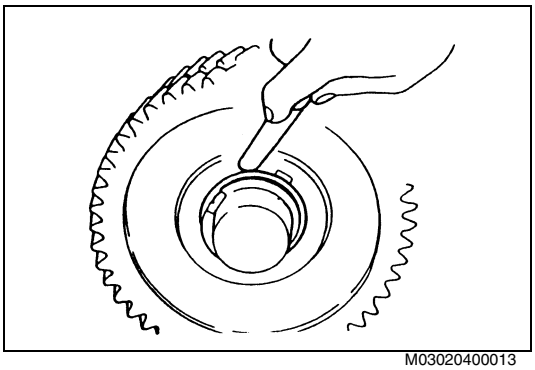
(1) Select the proper size key according to the size of the key groove.

| Thickness (T) | Shape |
|---|---|
| **12.018-12.029 mm {0.4732-0.4735 in.}** |  |
| **12.070-12.085 mm {0.4752-0.4757 in.}** |  |


M03020400042

(2) Press the counter shaft into the gears making certain that the key and keyway are aligned.

**NOTICE:**
**Be sure that the gears are installed in the proper direction.**


M03020400013

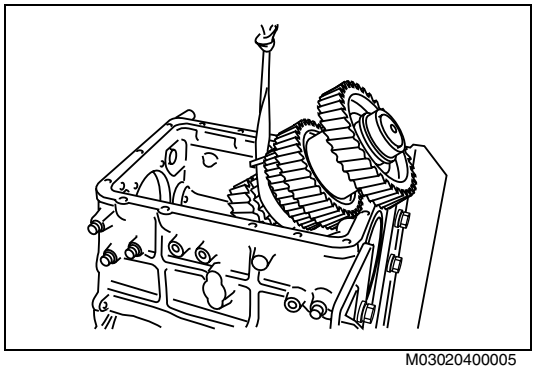
(3) Select a retainer ring that will provide a tight fit and install it on the shaft.

**NOTICE:**
- **Always use a new retainer ring.**
- **Make sure that the retainer ring seats in place.**

**Retainer rings are available in the following sizes**

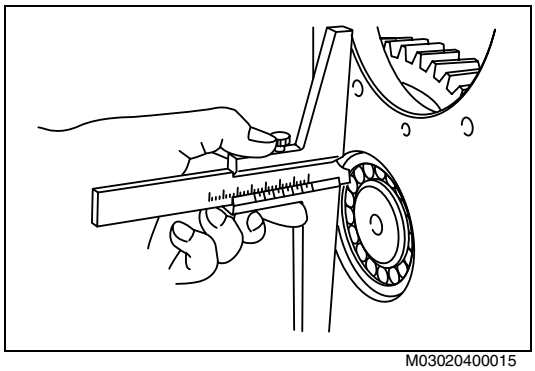
| Thickness | Color code |
|---|---|
| **2.45 mm {0.0965 in.}** | **White** |
| **2.55 mm {0.1004 in.}** | **Red** |
| **2.65 mm {0.1043 in.}** | **Yellow** |
| **2.75 mm {0.1083 in.}** | **Blue** |
| **2.85 mm {0.1122 in.}** | **Green** |
| **2.95 mm {0.1161 in.}** | **Brown** |

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during installation. Wear safety glasses during installation.**


M03020400005

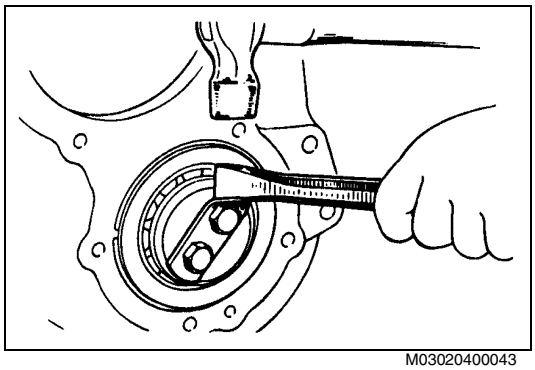
**2. INSTALL THE COUNTER SHAFT IN THE TRANSMISSION CASE.**

**NOTICE:**
- **When installing the bearing side ring, place the larger chamfering side to the gear.**
- **Do not put any pressure on the outer race.**


M03020400015

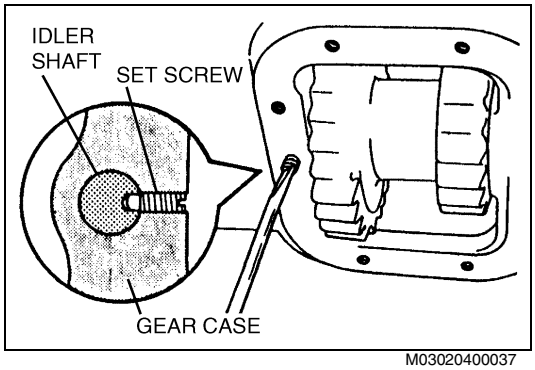
**3. DISTANCE BETWEEN THE GEAR CASE OUTER SURFACE AND THE FRONT BEARING OUTER RACE.**
**Assembly Standard: 6.5-7.0mm {0.26-0.28 in.}**

**4. PRESS IN THE SEAL COVER NOT TO HAVE MISMATCH WITH THE CASE FRONT.**


M03020400043

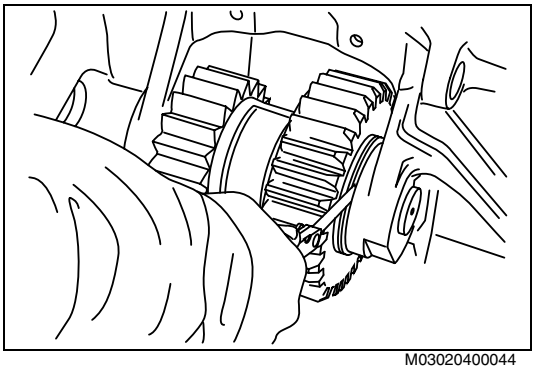
**5. INSTALL THE THRUST WASHER AND LOCK PLATE.**
(1) Install the thrust washer and lock plate on the rear end of counter shaft.
(2) Secure the bolts by staking the lock plate.

**NOTICE:**
- **Caulk the lock plate to the flat surface of the bolt.**
- **For the lock plate contacting the protruding portion of the bolt, caulk only the half on the tightening side.**



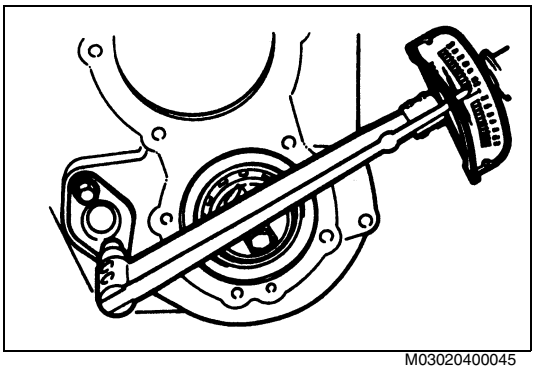
M03020400037

**6. INSTALL THE REVERSE IDLER GEAR.**
(1) Coat the two thrust washers with grease to hold the washers in place against each side of the idler gear.
(2) Insert the idler shaft until the thread hole of the set screw in the shaft is aligned correctly with the thread hole in the case rib, so that the screw can be installed.
(3) Tighten the set screw until the screw head is completely below the transmission case surface.



M03020400044

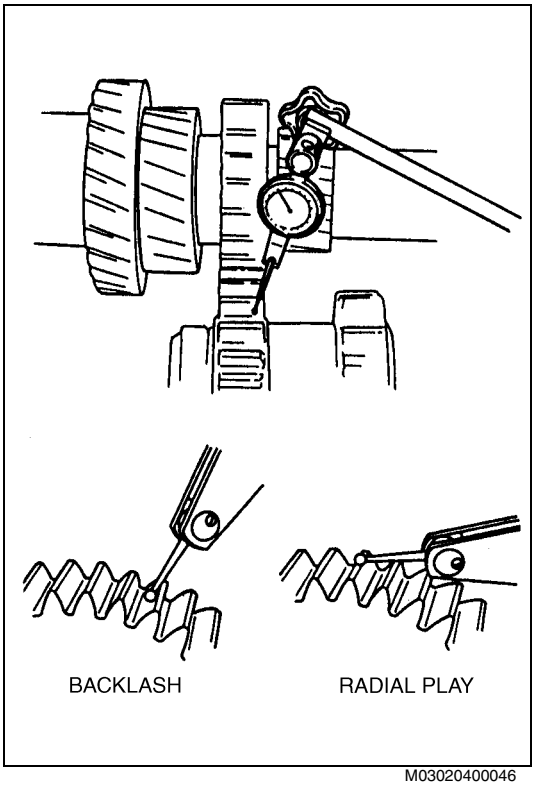
**7. MEASURE THE REVERSE IDLER GEAR END PLAY.**
**Assembly Standard: 0.30-0.75 mm {0.0119-0.0295 in.}**
**Service Limit: 1.2 mm {0.0472 in.}**



M03020400045

**8. INSTALL THE SEAL COVER.**
(1) Coat seal cover with liquid gasket.

**NOTICE:**
- **The trace of the liquid gasket must be continuous.**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**



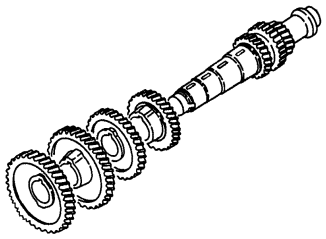
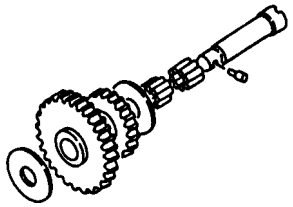
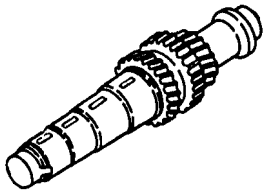
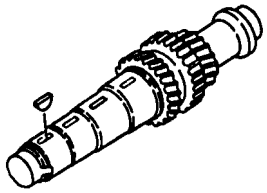

M03020400046

**9. MEASURE THE BACKLASH BETWEEN THE REVERSE IDLER GEAR AND THE COUNTER SHAFT REVERSE GEAR.**
**Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}**
**Service Limit: 0.4 mm {0.0157 in.}**

**10. MEASURE THE REVERSE IDLER GEAR RADIAL PLAY.**
**Assembly Standard: 0.008-0.240 mm {0.0004-0.0094 in.}**

# INSPECTION AND REPAIR

M03020407BEH3002

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| All gears for cracks and defects | — | — | Replace, if necessary. | Visual check  |
| Idler gear, shaft and needle roller bearing wear and damage | — | — | Replace, if necessary. | Visual check  |
| Counter shaft wear, chips and cracks | — | — | Replace, if necessary. | Visual check  |
| Counter shaft key way damage and looseness | — | — | Replace the counter shaft and/or key, If necessary. | Visual check  |

# TRANSMISSION MAIN UNIT (EATON FS6109)

TR02-003

**TRANSMISSION ASSEMBLY (EATON FS6109)..... TR02-2**

DATA AND SPECIFICATION..... TR02-2
DISMOUNTING AND MOUNTING ..... TR02-3

# TRANSMISSION ASSEMBLY
# (EATON FS6109)

## DATA AND SPECIFICATION

M03020118BEI2001

| | | | |
|---|---|---|---|
| **Manufacture** | **EATON** | | |
| **Transmission Model** | **FS6109** | | |
| **Gear ratios** | **CRAWLER** | **12.637** | **LOW RANGE** |
| | **1ST** | **8.806** | **LOW RANGE** |
| | **2nd** | **6.550** | |
| | **3rd** | **4.768** | |
| | **4th** | **3.548** | |
| | **5th** | **2.481** | **HIGH RANGE** |
| | **6th** | **1.845** | |
| | **7th** | **1.343** | |
| | **8th** | **1.000** | |
| | **REVERSE** | **13.210** | |
| **Oil capacity, gear box** | **Without power take-off** | **Approx. 8.5 litters {1.87 Imp.gal., 2.25 US.gal.}** | |
| | **With power take-off** | **Approx. 9 litters {1.98 Imp.gal., 2.38 US.gal.}** | |
| **Lubricant type** | | **Mild EP gear oil (API GL-4, MIL-L-2105)** | |
| **Viscosities** | **At -26 °C to 21 °C (-14.8 °F to 68.0 °F)** | **SAE 80W** | |
| | **At -12 °C to 37 °C (10.4 °F to 98.6 °F)** | **SAE 90** | |
| | **At -26 °C to 38 °C (-14.8 °F to 100.4 °F)** | **SAE 80W-90** | |

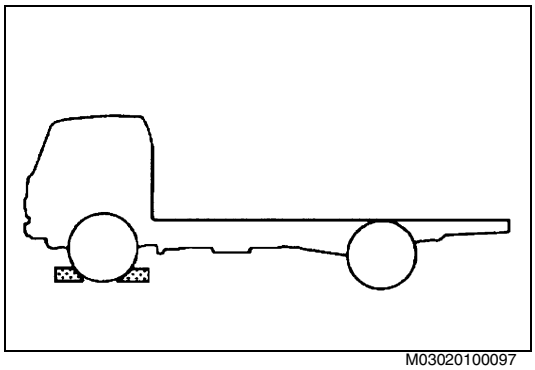
**NOTICE:**
**For other details, refer to EATON manuals.**

# DISMOUNTING AND MOUNTING

M03020118BEH1001

## IMPORTANT POINTS - DISMOUNTING

**CAUTION:**
**Do not work on the transmission while it is still hot. This can result in personal injury.**



M03020100097

**1. BLOCK THE WHEELS.**

**2. DRAIN THE TRANSMISSION OIL.**

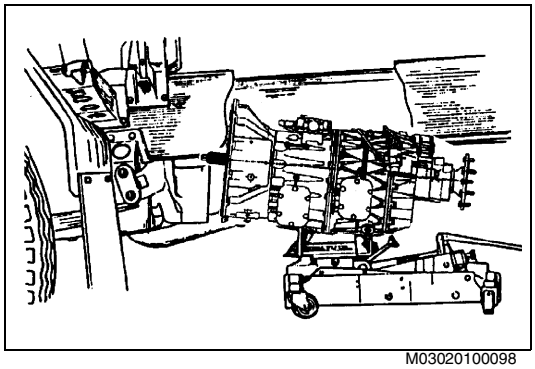
**3. DISCONNECT THE PROPELLER SHAFT.**

**4. DISCONNECT THE PARKING BRAKE CABLE.**

**5. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

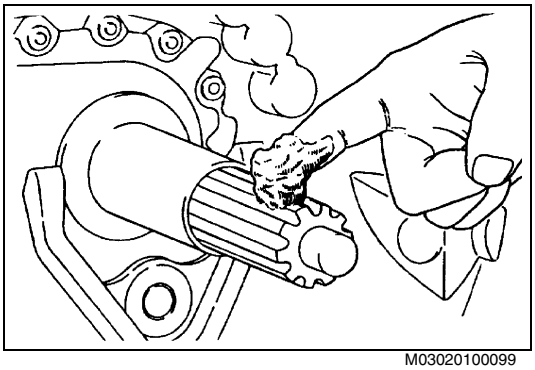
**6. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.**

**7. REMOVE THE CLUTCH BOOSTER.**



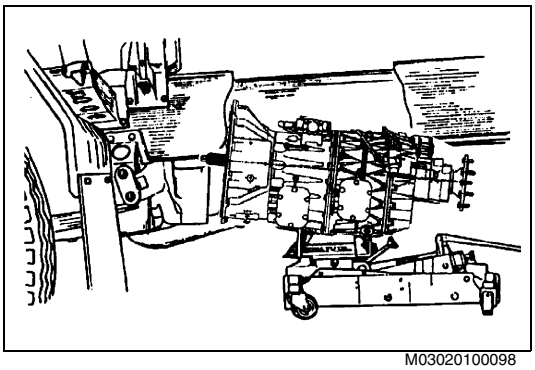
M03020100098

**8. REMOVE THE TRANSMISSION.**
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


M03020100099

## IMPORTANT POINTS - MOUNTING

**1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.**

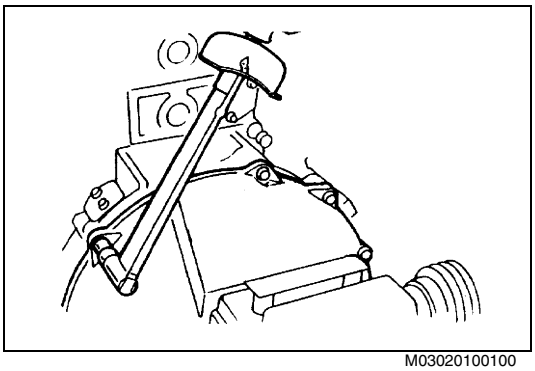

M03020100098

**2. INSTALL THE TRANSMISSION.**

(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

**NOTICE:**
**Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.**

(2) Install the upper nuts or bolts around the clutch housing.
(3) Lower the transmission jack and pull the jack out from under the vehicle.


M03020100100

(4) Install the remaining nuts or bolts around the clutch housing.
**Tightening Torque:**
**37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}**

**3. INSTALL THE CLUTCH BOOSTER.**

**4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.**

**5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

**6. CONNECT THE PARKING BRAKE CABLE.**

**7. CONNECT THE PROPELLER SHAFT.**

## DISASSEMBLY AND ASSEMBLY

**NOTICE:**
**When disassembling and assembling the transmission, refer to the MANUFACTURE ORIGINAL MANUAL.**

# TRANSMISSION MAIN UNIT (EATON FS8209)

TR02-004

**TRANSMISSION ASSEMBLY (EATON FS8209)..... TR02-2**

DATA AND SPECIFICATION..... TR02-2
DISMOUNTING AND MOUNTING ..... TR02-3

# TRANSMISSION ASSEMBLY
# (EATON FS8209)

## DATA AND SPECIFICATION

M03020119BEI2003

| | | | |
|---|---|---|---|
| **Manufacture** | **EATON** | | |
| **Transmission Model** | **FS8209** | | |
| **Gear ratios** | **CRAWLER** | **12.637** | **LOW RANGE** |
| | **1ST** | **8.806** | **LOW RANGE** |
| | **2nd** | **6.550** | |
| | **3rd** | **4.768** | |
| | **4th** | **3.548** | |
| | **5th** | **2.481** | **HIGH RANGE** |
| | **6th** | **1.845** | |
| | **7th** | **1.343** | |
| | **8th** | **1.000** | |
| | **REVERSE** | **13.210** | |
| **Oil capacity, gear box** | **Without power take-off** | **Approx. 8.5 litters {1.87 Imp.gal., 2.25 US.gal.}** | |
| | **With power take-off** | **Approx. 9 litters {1.98 Imp.gal., 2.38 US.gal.}** | |
| **Lubricant type** | | **Mild EP gear oil (API GL-4, MIL-L-2105)** | |
| **Viscosities** | **At -26 °C to 21 °C (-14.8 °F to 68.0 °F)** | **SAE 80W** | |
| | **At -12 °C to 37 °C (10.4 °F to 98.6 °F)** | **SAE 90** | |
| | **At -26 °C to 38 °C (-14.8 °F to 100.4 °F)** | **SAE 80W-90** | |

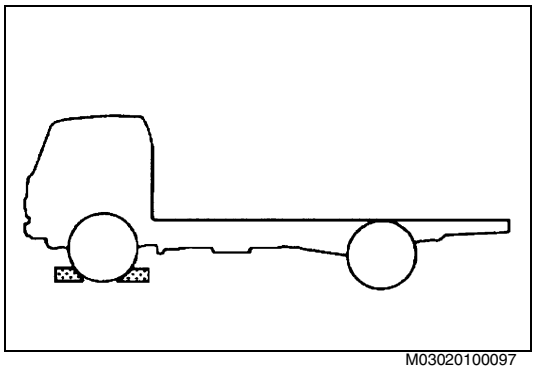
**NOTICE:**
**For other details, refer to EATON manuals.**

# DISMOUNTING AND MOUNTING

M03020119BEH1003

## IMPORTANT POINTS - DISMOUNTING

**CAUTION:**
**Do not work on the transmission while it is still hot. This can result in personal injury.**



M03020100097

**1. BLOCK THE WHEELS.**

**2. DRAIN THE TRANSMISSION OIL.**

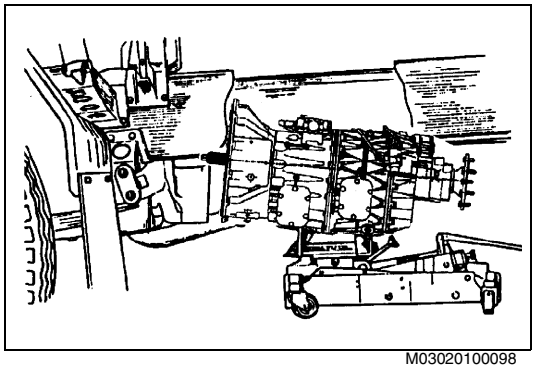
**3. DISCONNECT THE PROPELLER SHAFT.**

**4. DISCONNECT THE PARKING BRAKE CABLE.**

**5. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

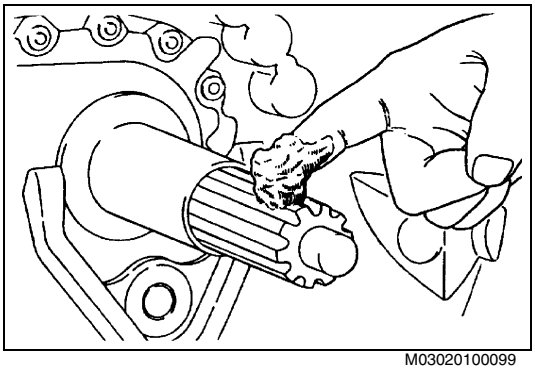
**6. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.**

**7. REMOVE THE CLUTCH BOOSTER.**



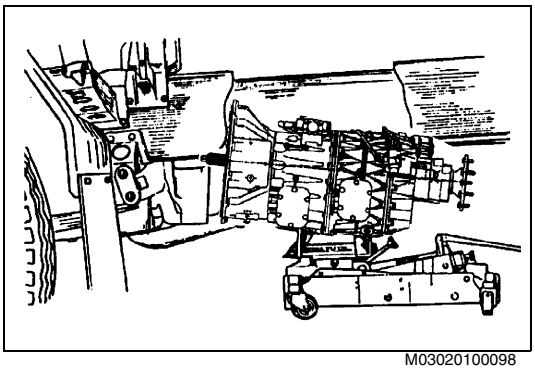
M03020100098

**8. REMOVE THE TRANSMISSION.**
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


M03020100099

## IMPORTANT POINTS - MOUNTING

**1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.**

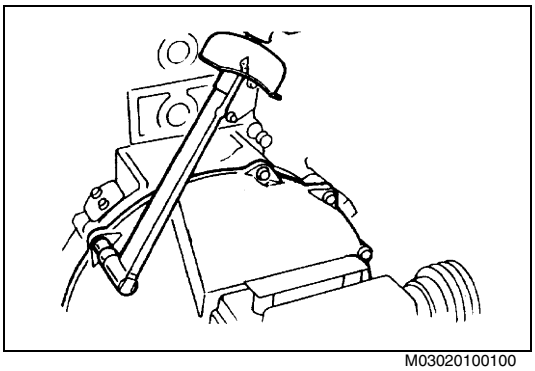

M03020100098

**2. INSTALL THE TRANSMISSION.**

(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

**NOTICE:**
**Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.**

(2) Install the upper nuts or bolts around the clutch housing.
(3) Lower the transmission jack and pull the jack out from under the vehicle.


M03020100100

(4) Install the remaining nuts or bolts around the clutch housing.
**Tightening Torque:**
**37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}**

**3. INSTALL THE CLUTCH BOOSTER.**

**4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.**

**5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

**6. CONNECT THE PARKING BRAKE CABLE.**

**7. CONNECT THE PROPELLER SHAFT.**

## DISASSEMBLY AND ASSEMBLY

**NOTICE:**
**When disassembling and assembling the transmission, refer to the MANUFACTURE ORIGINAL MANUAL.**

# TRANSMISSION MAIN UNIT (FULLER RT8908LL)

TR02-005

**TRANSMISSION ASSEMBLY (FULLER RT8908LL) ..... TR02-2**

DATA AND SPECIFICATION..... TR02-2
DISMOUNTING AND MOUNTING ..... TR02-3

# TRANSMISSION ASSEMBLY (FULLER RT8908LL)

## DATA AND SPECIFICATION

M03020120BEI2001

| | | | | |
|---|---|---|---|---|
| **Manufacture** | | **EATON** | | |
| **Transmission Model** | | **FULLER RT8908LL** | | |
| **Gear ratios** | | **1ST** | **19,577** | **LOW RANGE** |
| | | **2nd** | **12,658** | |
| | | **3rd** | **8,390** | |
| | | **4th** | **6,229** | |
| | | **5th** | **4,578** | |
| | | **6th** | **3,404** | **HIGH RANGE** |
| | | **7th** | **2,464** | |
| | | **8th** | **1,829** | |
| | | **9th** | **1,344** | |
| | | **10th** | **1,000** | |
| | | **Rev. L** | **20,467** | **LOW RANGE** |
| | | **Rev. M** | **13,243** | **MIDDLE RANGE** |
| | | **Rev. H** | **3,889** | **HIGH RANGE** |
| **Lubricants type** | | **Eaton roadranger CD50 transmission fluid (API CD)** | | **Mineral gear oil with rust and oxidation inhibitor (API GL-1)** |
| **Oil capacity, gear box** | | **Approx. 13.0 litters {3.43 Imp.gal., 2.86 US.gal.}** | | |
| **Viscosities** | **Below -12 °C {10.4 °F}** | **SAE 50** | | **SAE 80W** |
| | **Above -12 °C {10.4 °F}** | | | **SAE 90** |

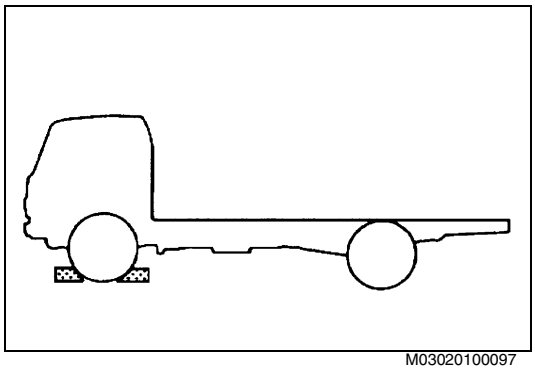
**NOTICE:**
**For other details, refer to EATON manuals.**

# DISMOUNTING AND MOUNTING

M03020120BEH1001

## IMPORTANT POINTS - DISMOUNTING

**CAUTION:**
**Do not work on the transmission while it is still hot. This can result in personal injury.**



M03020100097

**1. BLOCK THE WHEELS.**

**2. DRAIN THE TRANSMISSION OIL.**

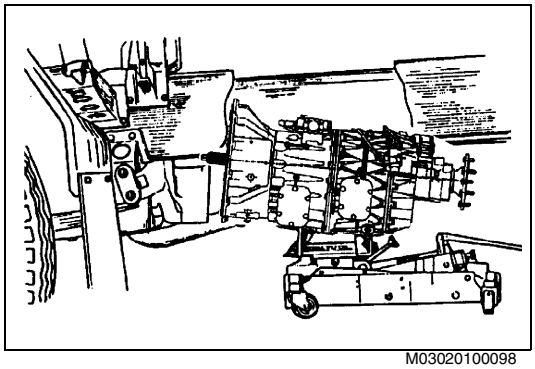
**3. DISCONNECT THE PROPELLER SHAFT.**

**4. DISCONNECT THE PARKING BRAKE CABLE.**

**5. DISCONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

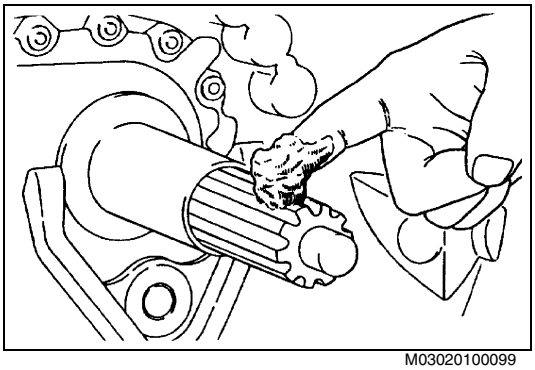
**6. DISCONNECT THE TRANSMISSION CONTROL CABLES WITH THE CABLE BRACKET.**

**7. REMOVE THE CLUTCH BOOSTER.**



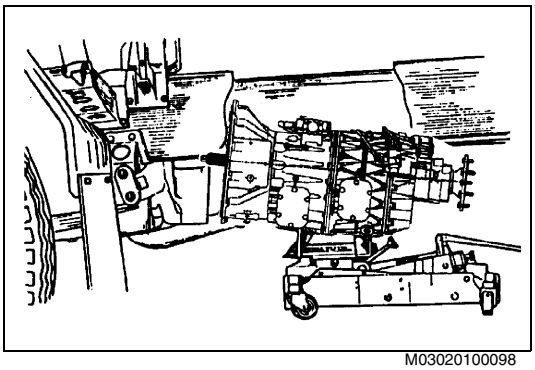
M03020100098

**8. REMOVE THE TRANSMISSION.**
(1) Remove the lower bolts around the clutch housing.
(2) Support the transmission using a transmission jack or lifting wires to prevent it from falling.
(3) Remove the remaining bolts around the clutch housing.
(4) Remove the transmission.


M03020100099

## IMPORTANT POINTS - MOUNTING

**1. APPLY HEAT-RESISTANT GREASE TO THE INPUT SHAFT SPLINE.**

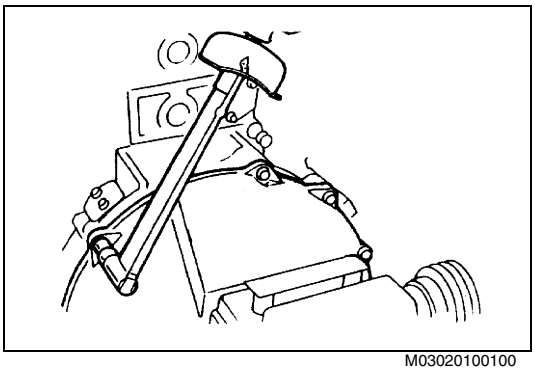

M03020100098

**2. INSTALL THE TRANSMISSION.**

(1) Jack up the transmission until the input shaft spline and the clutch disc spline align.

**NOTICE:**
**Do not let the rear of the transmission drop and do not let the transmission hang unsupported in the spline hubs of the driven discs because it distorts them and could cause poor clutch operation or clutch release problems.**

(2) Install the upper nuts or bolts around the clutch housing.
(3) Lower the transmission jack and pull the jack out from under the vehicle.


M03020100100

(4) Install the remaining nuts or bolts around the clutch housing.
**Tightening Torque:**
**37.5-48.5 N·m {382-494 kgf·cm, 28-35 lbf·ft}**

**3. INSTALL THE CLUTCH BOOSTER.**

**4. CONNECT THE TRANSMISSION CONTROL CABLE WITH THE CABLE BRACKET.**

**5. CONNECT THE ELECTRIC HARNESS AND OTHER ATTACHMENTS.**

**6. CONNECT THE PARKING BRAKE CABLE.**

**7. CONNECT THE PROPELLER SHAFT.**

## DISASSEMBLY AND ASSEMBLY

**NOTICE:**
**When disassembling and assembling the transmission, refer to the MANUFACTURE ORIGINAL MANUAL.**

# AUTOMATIC TRANSMISSION (ALLISON MD3060P, MD3560P)

TR04-001

**AUTOMATIC TRANSMISSION ASSEMBLY ..... TR04-2**

TROUBLESHOOTING ..... TR04-2
SPECIAL TOOL ..... TR04-2
DISMOUNTING AND MOUNTING ..... TR04-2

# AUTOMATIC TRANSMISSION ASSEMBLY

## TROUBLESHOOTING

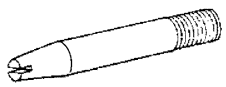
M03040101BEF3001

**NOTICE:**
**When diagnosing transmission problem, refer to the Allison Shop Manual or troubleshooting procedures for detailed information on items that could be causing the problem.**

## SPECIAL TOOL

M03040101BEK1001

Prior to removal and installing of automatic transmission, it is necessary to have this special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09657-1370 | SPACER COUPLING GUIDE | |

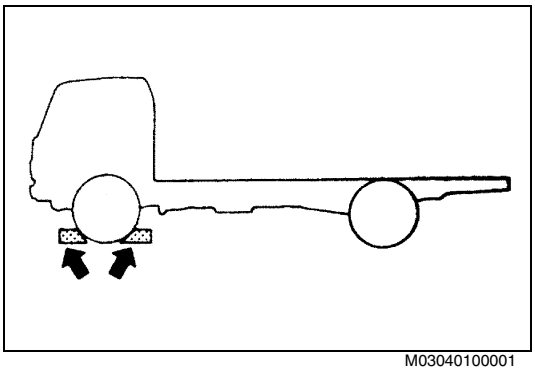
## DISMOUNTING AND MOUNTING

M03040101BEH1001

### IMPORTANT POINTS - DISMOUNTING

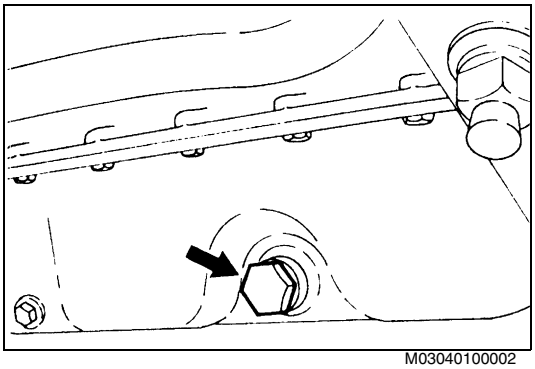
**NOTICE:**
**Allison transmission repairs are to be performed by an authorized Allison service dealer.**

**CAUTION:**
**Do not work on the transmission while it is still hot. This can result in personal injury.**

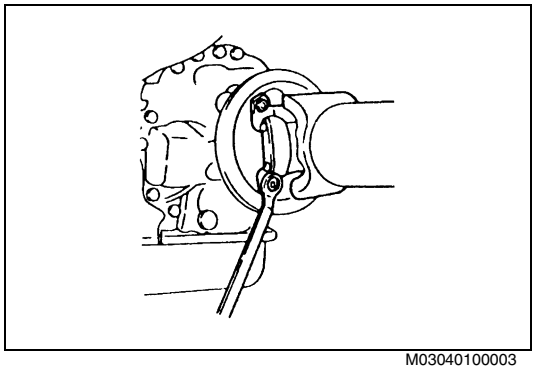

M03040100001

**1. BLOCK THE WHEELS.**
(1) Park the vehicle on level ground.
(2) Block the wheels.

**NOTICE:**
**Be sure to apply wheel stoppers at the front tires.**


M03040100002

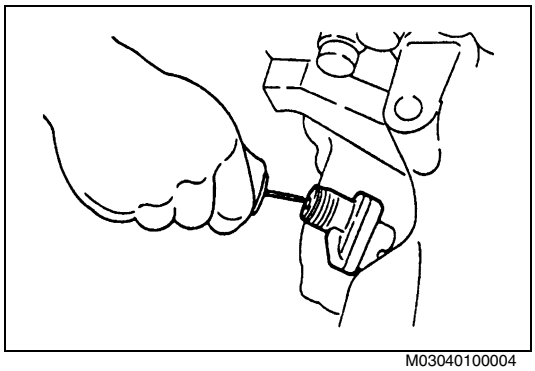
**2. DRAIN THE AUTOMATIC TRANSMISSION FLUID.**
(1) Place the drain pan under the transmission.
(2) Remove the drain plug from the transmission and allow the fluid to drain.


M03040100003

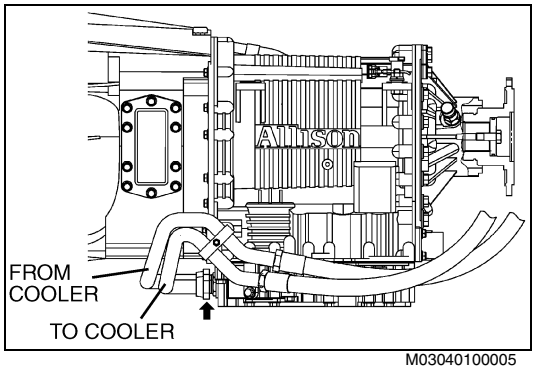
**3. REMOVE THE PROPELLER SHAFTS.s**

(1) Disconnect the yoke from the transmission flange, and remove the center bearing holder.

(2) Move the forward end of the propeller shaft out of the way.

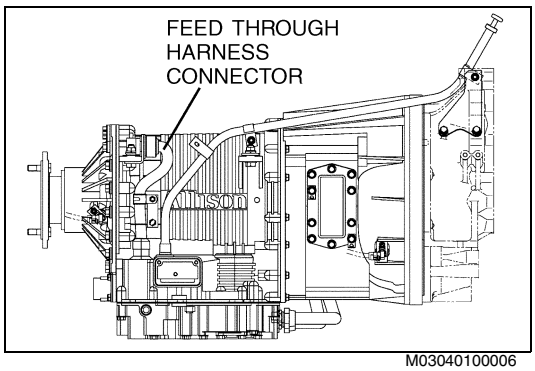

M03040100004

**4. REMOVE THE SPEED SENSOR HARNESS FROM THE REAR OF THE TRANSMISSION.**



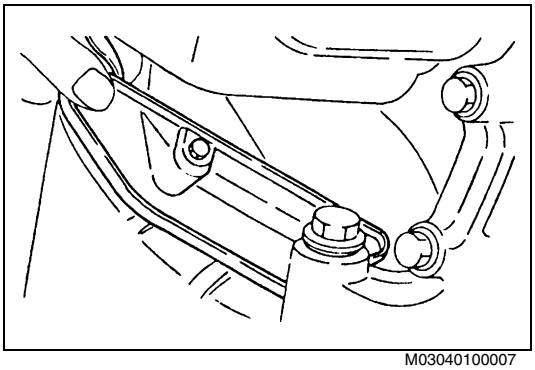
M03040100005

**5. DISCONNECT THE OIL COOLER LINES AT THE TRANSMISSION.**

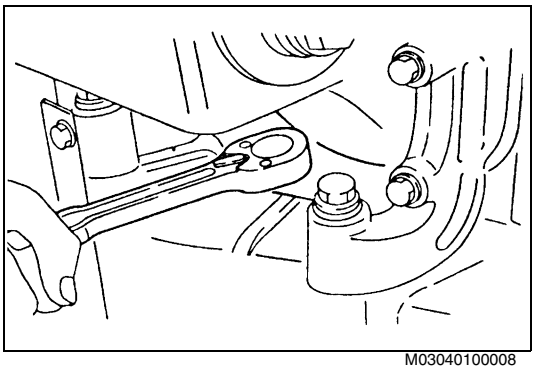


M03040100006

**6. DISCONNECT THE FEED THROUGH HARNESS CONNECTOR.**


M03040100007

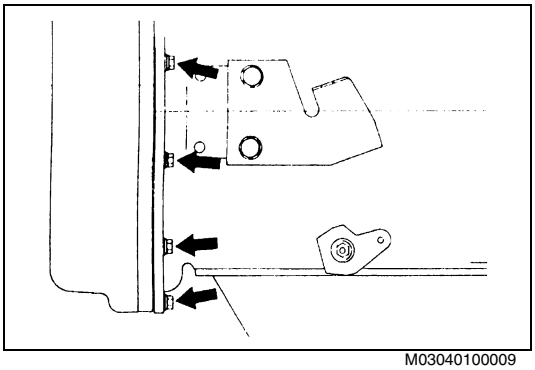
**7. REMOVE INSPECTION COVER FROM THE BOTTOM FRONT SIDE OF THE FLYWHEEL HOUSING.**


M03040100008

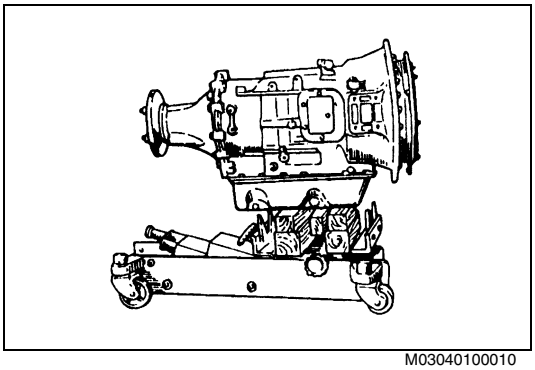
**8. REMOVE THE SIX COUPLING FROM THE FLYWHEEL ATTACHING BOLTS.**

(1) Turn the flywheel manually to match the attaching bolt to the slot on the inspection opening at the bottom front side of the flywheel housing.

(2) Remove the coupling bolts one by one.


M03040100009

**9. REMOVE THE CONVERTER HOUSING ATTACHING BOLTS.**


M03040100010

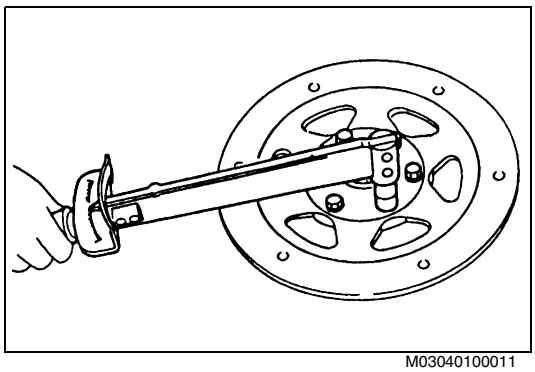
**10. POSITION A TRANSMISSION JACK UNDER THE TRANSMISSION AND SECURE THE TRANSMISSION TO THE JACK WITH A SAFETY CHAIN OR WIRE CABLE.**

**11. REMOVE THE REMAINING CONVERTER HOUSING FROM THE FLYWHEEL HOUSING ATTACHING BOLTS.**

**12. PULL OUT THE TRANSMISSION BACKWARDS.**

**CAUTION:**
**Do not lower the front end of the transmission. If lowered, the torque converter may slide out of the transmission and you may be injured.**

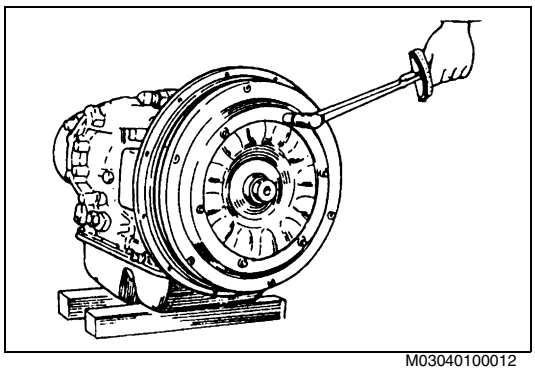
## IMPORTANT POINTS - MOUNTING



M03040100011

**1. TIGHTEN THE FLEX PLATE, SPACER COUPLING AND WEAR PLATE.**
**Tightening Torque:**
**64-85 N·m {653-867 kgf·cm, 48-62 lbf·ft}**

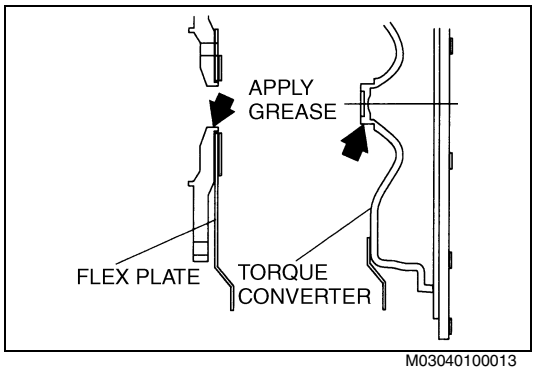
**NOTICE:**
**Before tightening, face the chamfered outer rim of the wear plate to the flex plate. If assembled to the contrary, the wear plate edge hits the flex plate and its strength is reduced. Painted surface of the wear plate should be located facing the transmission side.**



M03040100012

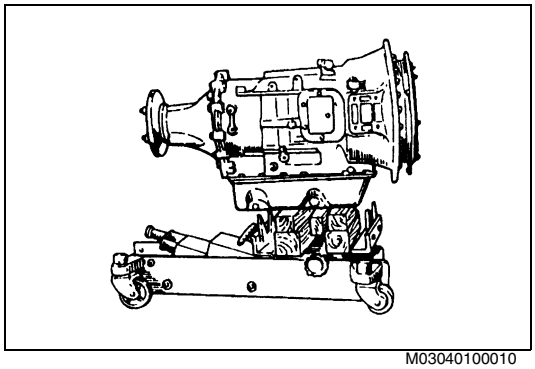
**2. TIGHTEN THE TORQUE CONVERTER AND THE ADAPTER PLATE.**
**Tightening Torque:**
**24-29 N·m {245-296 kgf·cm, 18-21 lbf·ft}**

**NOTICE:**
**Apply grease containing molybdenum disulfide to the boss at the end of the torque converter before assembling. Without grease, the flex plate will not slide well and abnormal force will be generated, causing the flex plate to break.**




M03040100013

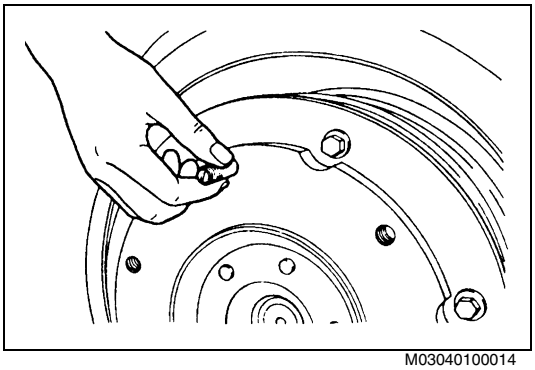
**3. INSTALL THE ASSEMBLY CONSISTING OF FLEX PLATE, COUPLING PLATE AND WEAR PLATE TO THE CONVERTER. THEN TIGHTEN THE FLEX PLATE AND ADAPTER PLATE TOGETHER.**
**Tightening Torque:**
**44-54 N·m {449-551 kgf·cm, 31-39 lbf·ft}**



M03040100010

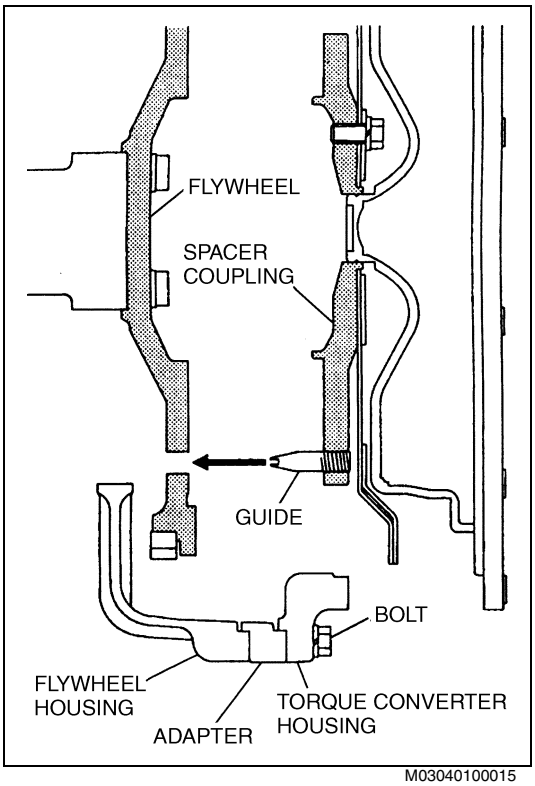
**4. MOUNT THE TRANSMISSION ASSEMBLY ON A TRANSMISSION JACK. THEN MOVE THE ASSEMBLY INTO THE POSITION.**

**CAUTION:**
**Do not lower the front end of the transmission. If lowered, the torque converter may slide out of the transmission and you may be injured.**



M03040100014

**5. SCREW THE SPECIAL TOOL "GUIDE" BY HAND INTO THE SPACER COUPLING OF THE TRANSMISSION ASSEMBLY. ROTATE THE TORQUE CONVERTER SO THAT THE GUIDE FACES DOWNWARD.**
**SST: Spacer coupling guide (09657-1370)**




M03040100015

**6. ROTATE THE ENGINE TO ALIGN THE FITTING HOLE OF THE ENGINE FLYWHEEL AND SPACER COUPLING WITH THE INSPECTION HOLE ON THE FRONT OF THE FLYWHEEL HOUSING.**

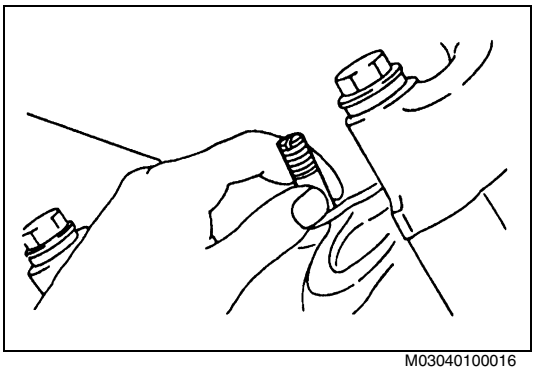
**NOTICE:**
**First switch off the power so that the engine will not start.**

**7. MOVE THE TRANSMISSION JACK SLOWLY AND INSERT THE GUIDE INTO THE FITTING HOLE OF THE FLYWHEEL.**

**NOTICE:**
**Do not lower the front side of the transmission. If lowered, the torque converter may slide out of the transmission and you may be injured.**

**8. MOVE THE TRANSMISSION JACK SLOWLY AND ADJUST BY BRINGING THE FITTING FACES OF THE TORQUE CONVERTER HOUSING AND THE FLYWHEEL HOUSING OR ADAPTER HOUSING TOGETHER.**

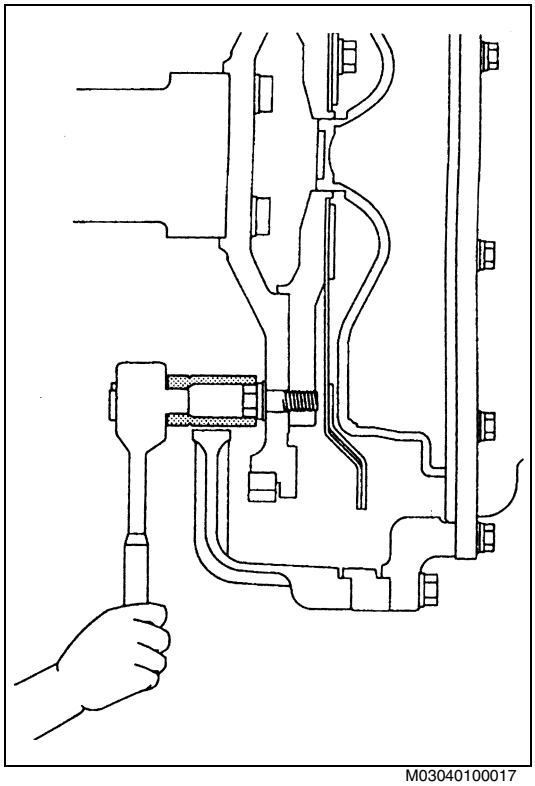
**9. TIGHTEN THE BOLTS TO JOIN THE TORQUE CONVERTER HOUSING AND THE FLYWHEEL HOUSING.**
**Tightening Torque:**
**52-61 N·m {522-622 kgf·cm, 38-44 lbf·ft}**



M03040100016

**10. LOWER AND REMOVE THE TRANSMISSION JACK.**

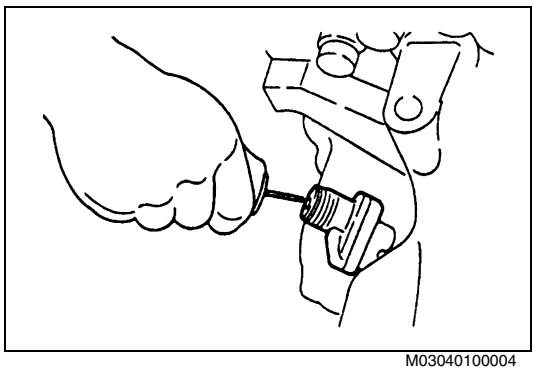
**11. TAKE THE GUIDE OUT OF THE INSPECTION HOLE ON THE FLYWHEEL HOUSING FRONT WITH A SCREW DRIVER.**


M03040100017

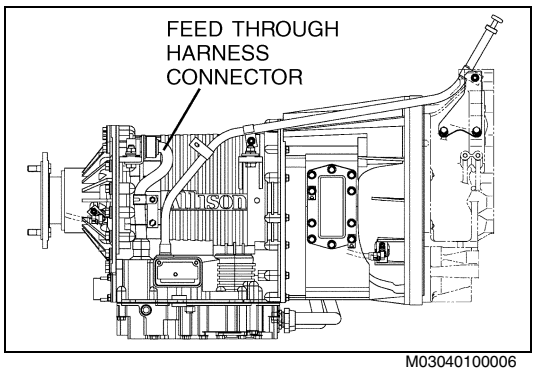
**12. LIGHTLY TIGHTEN THE BOLTS JOINING THE FLYWHEEL AND THE SPACER COUPLING THROUGH THE INSPECTION HOLE. IN ORDER TO TIGHTEN THE BOLTS, TURN THE RING GEAR WITH A SCREW DRIVER THROUGH THE TIMING ADJUSTMENT HOLE ON THE UPPER PART OF THE FLYWHEEL HOUSING.**

**NOTICE:**
**If the ring gear does not turn smoothly with a screw driver, remove the transmission and repeat the procedure again from 6 above, because the hub ends of the flywheel and the spacer coupling do not fit well. Tightening bolts in such a condition will cause damage to the bolts and jamming of the engine.**

**13. TIGHTEN THE BOLTS PRETIGHTENED IN STEP 12.**
**Tightening Torque:**
**64-85 N·m {653-867 kgf·cm, 48-62 lbf·ft}**

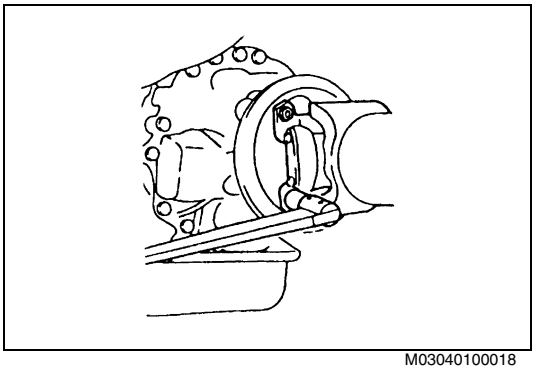

M03040100004

**14. INSTALL THE SPEED SENSOR HARNESS TO THE REAR PART OF THE TRANSMISSION.**



M03040100006

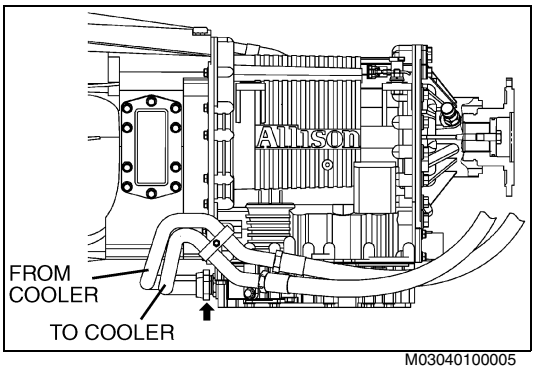
**15. CONNECT THE FEED THROUGH HARNESS CONNECTOR.**



M03040100018

**16. INSTALL THE PROPELLER SHAFT YOKE TO THE TRANSMISSION FLANGE.**
**Tightening Torque:**
**128-156 N·m {1,300-1,600 kgf·cm, 94-115 lbf·ft}**

**17. INSTALL THE CENTER BEARING HOLDER TO THE FRAME.**




M03040100005

**18. CONNECT THE OIL COOLER LINE.**
(1) For connecting the transmission case and joints, insert O-rings in the grooves of the joints before tightening.

**NOTICE:**
**Apply automatic transmission fluid to the O-rings when inserting them. If the fluid is not applied, the O-rings will not be inserted smoothly and will thus be damaged, causing oil to leak.**

**19. REMOVE THE CAP OF THE OIL FILLER TUBE AND POUR AUTOMATIC TRANSMISSION FLUID INTO THE TUBE.**

**Automatic transmission fluid:**
**Refer to the owner's manual.**

**NOTICE:**
**For further details, consult your nearest ALLISON representative or ALLISON service station.**

# P.T.O. (POWER TAKE-OFF) (LJ06S TRANSMISSION)

TR05-001

**POWER TAKE-OFF ASSEMBLY ..... TR05-2**
DATA AND SPECIFICATIONS ..... TR05-2
DESCRIPTION ..... TR05-2
TROUBLESHOOTING ..... TR05-3

**POWER TAKE-OFF UNIT ..... TR05-4**
COMPONENT LOCATOR ..... TR05-4
OVERHAUL ..... TR05-5
INSPECTION AND REPAIR ..... TR05-10

# POWER TAKE-OFF ASSEMBLY

## DATA AND SPECIFICATIONS

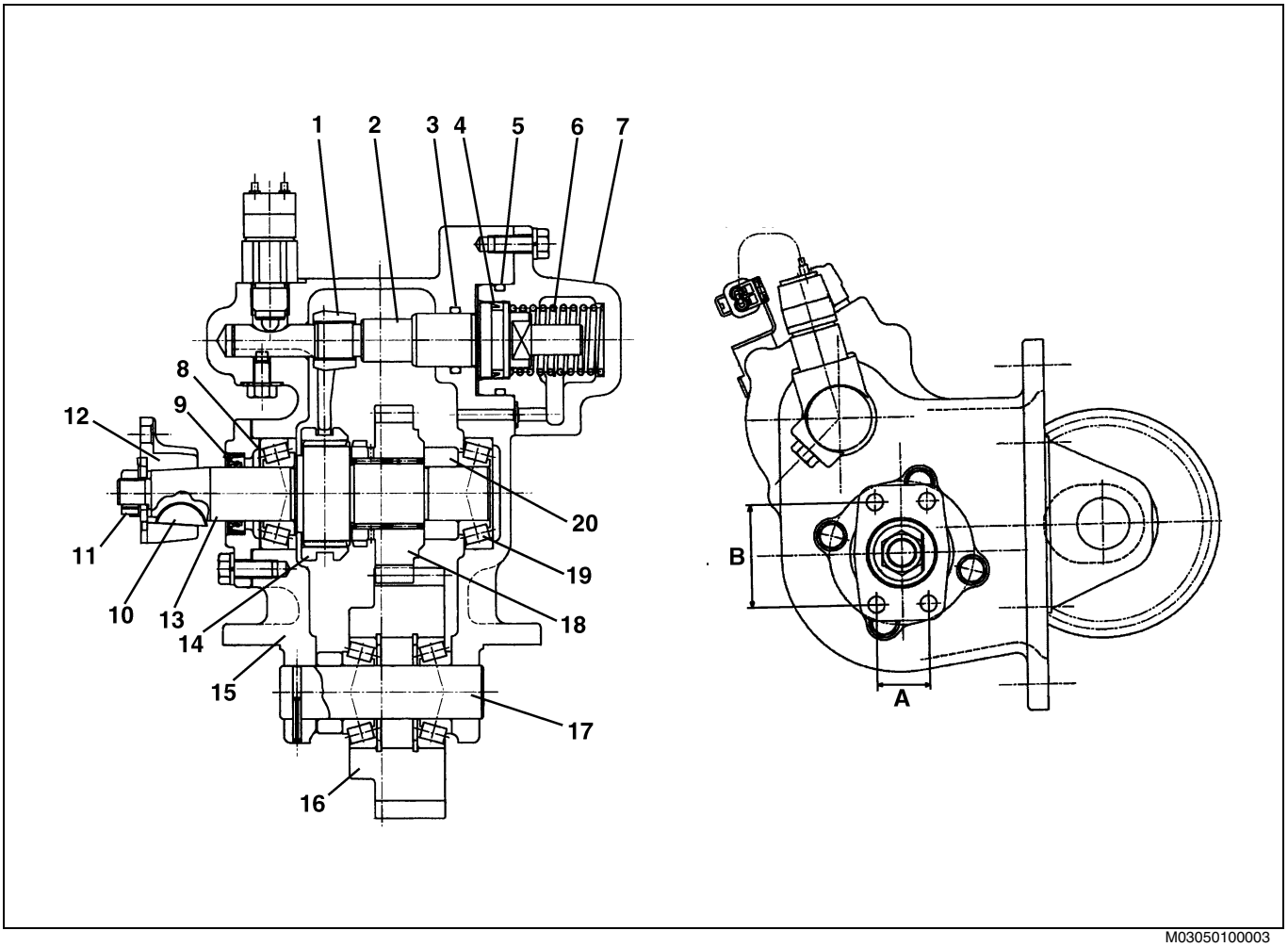
M03050102BEI2003

**POWER TAKE-OFF**

| | |
|---|---|
| **Type** | **Side power take-off<br>Driven by engaging the output shaft gear with counter 4th gear** |
| **Direction of rotation** | **Opposite engine's** |
| **Gear ratio** | **23/26** |
| **Size of output shaft flange** | **25 x 50 mm {0.985 x 1.968 in.} (A x B: Refer to description below)** |

## DESCRIPTION

M03050102BEC1003




M03050100003

**POWER TAKE-OFF UNIT**

| | | | |
|---|---|---|---|
| **1** | **Shift fork** | **11** | **Lock nut** |
| **2** | **Shift shaft** | **12** | **Output shaft flange** |
| **3** | **O-ring** | **13** | **Output shaft** |
| **4** | **Shift shaft piston cup** | **14** | **Shift sleeve** |
| **5** | **O-ring** | **15** | **Power take-off case** |
| **6** | **Compression spring** | **16** | **Input gear** |
| **7** | **Case cover** | **17** | **Input shaft** |
| **8** | **Shim** | **18** | **Output gear** |
| **9** | **Oil seal** | **19** | **Taper roller bearing** |
| **10** | **Woodruff key** | **20** | **Collar** |

# TROUBLESHOOTING

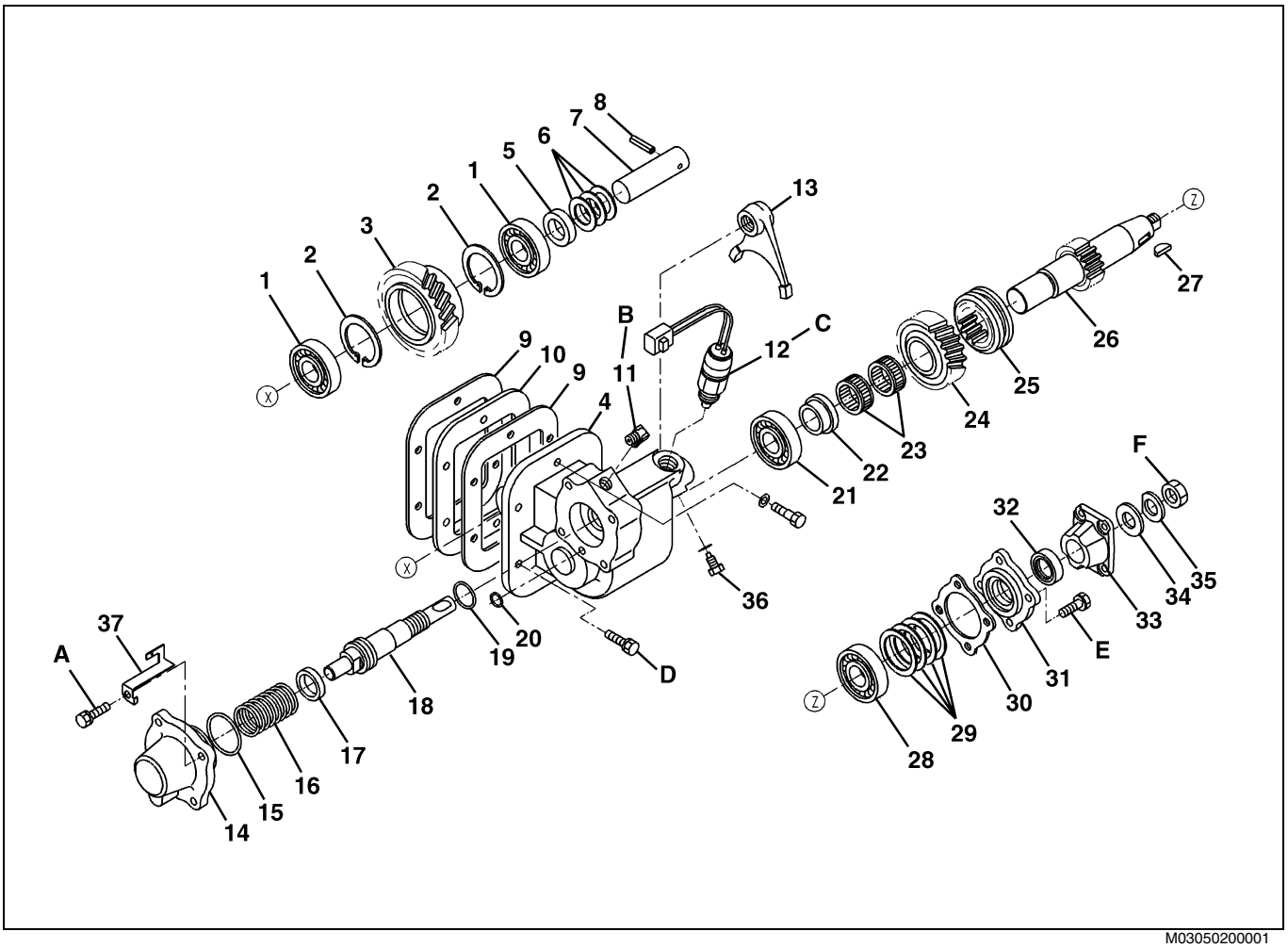
M03050102BEF3002

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Noise** | Bearing worn and/or damaged. | Replace bearing. |
| | Output gear worn and/or damaged. | Replace gear. |
| | Too much play in gear backlash. | Use proper power take-off gasket. |
| | Shortage gear oil and/or low oil viscosity. | Add oil or change oil as required. |
| **Can not be operated** | Faulty switches | Replace switch. |
| | Faulty solenoid valve. | Replace solenoid valve. |

# POWER TAKE-OFF UNIT

## COMPONENT LOCATOR

M03050202BED1006




M03050200001

| | | | |
|---|---|---|---|
| 1 | Taper roller bearing | 20 | O-ring |
| 2 | Retainer ring | 21 | Taper roller bearing |
| 3 | Input gear | 22 | Collar |
| 4 | Power take-off case | 23 | Needle roller bearing |
| 5 | Spacer | 24 | Output gear |
| 6 | Shim | 25 | Shift sleeve |
| 7 | Input shaft | 26 | Output shaft |
| 8 | Spring pin | 27 | Woodruff key |
| 9 | Power take-off case gasket | 28 | Taper roller bearing |
| 10 | Power take-off case adapter | 29 | Shim |
| 11 | Elbow | 30 | Gasket |
| 12 | Power take-off position switch | 31 | Seal cover |
| 13 | Shift fork | 32 | Oil seal |
| 14 | Case cover | 33 | Output shaft flange |
| 15 | O-ring | 34 | Plain washer |
| 16 | Compression spring | 35 | Lock washer |
| 17 | Shift shaft piston cup | 36 | Set screw |
| 18 | Shift shaft | 37 | Bracket |
| 19 | O-ring | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| **A** | **19-25 {200-250, 15-18}** | **D** | **54-68 {550-700, 40-50}** |
| **B** | **39.5-58.5 {400-600, 29-43}** | **E** | **19-25 {200-250, 15-18}** |
| **C** | **48.5-67.5 {500-700, 37-50}** | **F** | **39.2-47.0 {400-480, 29-34}** |

# OVERHAUL

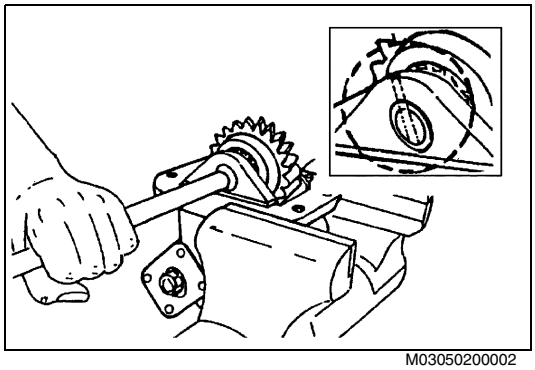
M03050202BEH2007

## IMPORTANT POINT - DISMOUNTING

**CAUTION:**
**Do not work on the transmission while it is still hot.**
**This can result in personal injury.**

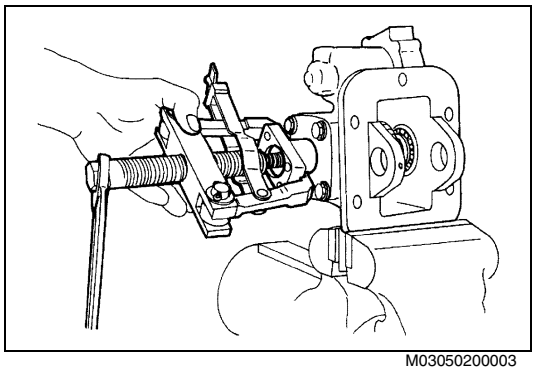
**1. DRAIN THE TRANSMISSION OIL.**

## IMPORTANT POINTS - DISASSEMBLY



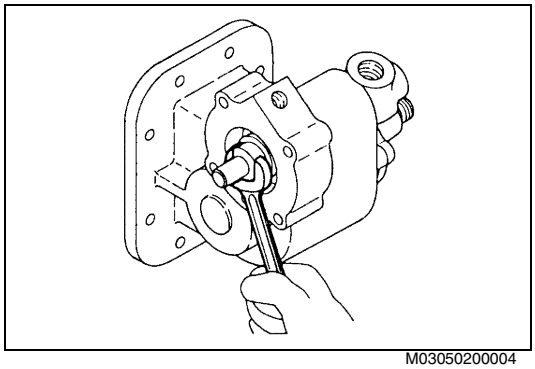
M03050200002

**1. SET THE POWER TAKE-OFF ON A VISE.**
**REMOVE THE INPUT GEAR.**
(1) Drive the spring pin into the hole of the shaft.
(2) Drive out the input shaft.



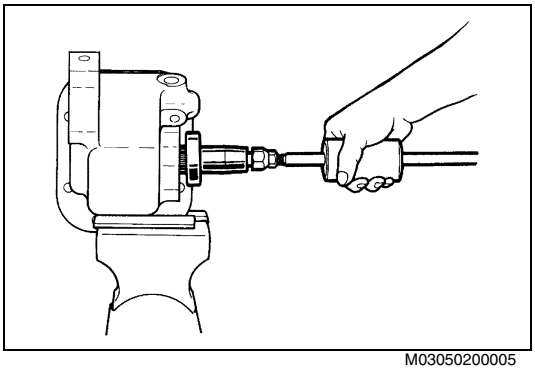
M03050200003

**2. REMOVE THE OUTPUT SHAFT FLANGE.**
(1) Remove the lock nut.
(2) Use a suitable puller to remove the output shaft flange.



M03050200004

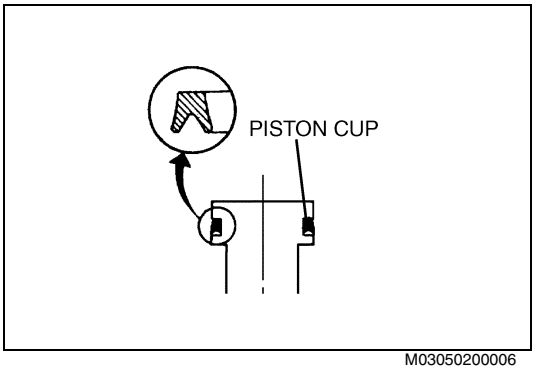
**3. REMOVE THE SHIFT SHAFT.**
(1) Remove the shift shaft set screw.
(2) Remove the case cover and compression spring.
(3) Unscrew the shift shaft to separate the shift shaft from the shift fork.


M03050200005

**4. REMOVE THE OUTPUT SHAFT.**

(1) Remove the woodruff key.
(2) Remove the seal cover.
(3) Use a suitable tool to pull out the output shaft from the case. As the output shaft is removed, remove the taper roller bearing, shift sleeve, output gear, needle roller bearing, collar and shift fork from the output shaft and power take-off case.

## IMPORTANT POINTS - ASSEMBLY

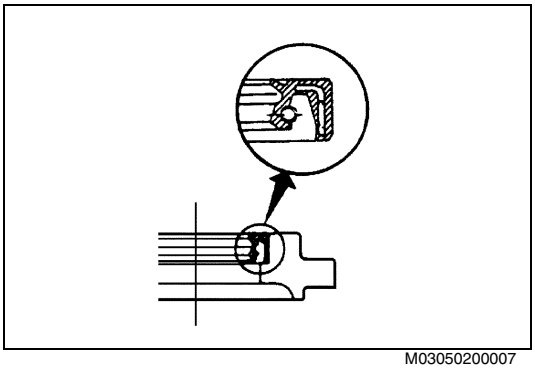


M03050200006

**1. INSTALL THE PISTON CUP ON THE SHIFT SHAFT.**

**NOTICE:**

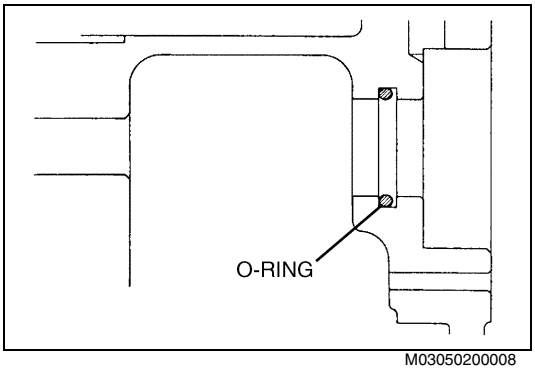
- **Coat the piston cup with grease.**
- **Be sure the piston cup is installed in the proper direction.**


M03050200007

**2. INSTALL THE OIL SEAL INTO THE SEAL COVER.**

**NOTICE:**

- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**
- **Coat the sealing surface between the seal lips with chassis grease.**

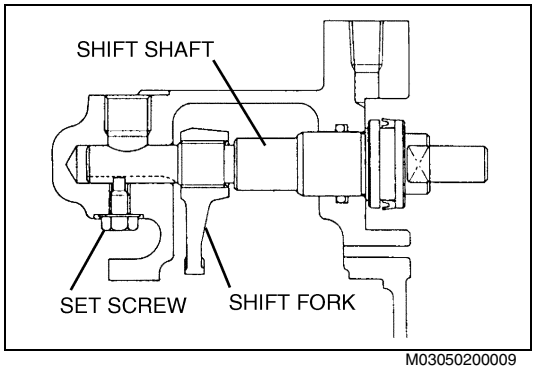


M03050200008

**3. INSTALL THE SHIFT SHAFT AND SHIFT FORK TO THE POWER TAKE-OFF CASE.**

(1) Install the O-ring on the case.

**NOTICE:**
**Coat the O-ring with grease.**



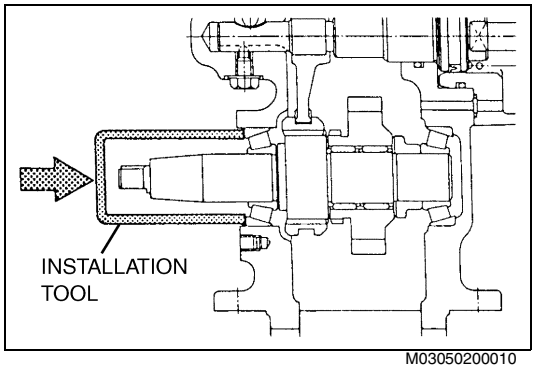
M03050200009

(2) Set the shift fork in its original position.

**NOTICE:**

**Be sure the shift fork is installed in the correct direction.**

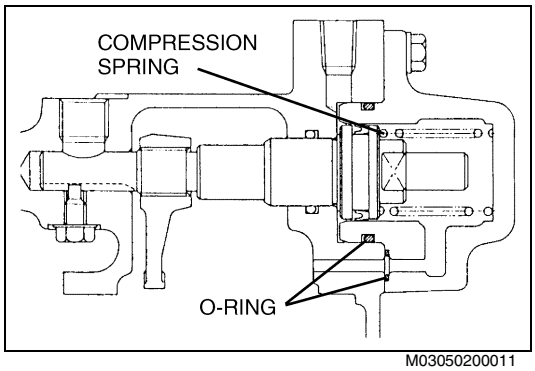
(3) Screw the shift shaft into the thread of the shift fork.
(4) Rotate the shift shaft so that slot of the shift shaft is aligned with set screw hole.



M03050200010

**4. INSTALL THE OUTPUT SHAFT TO THE POWER TAKE-OFF CASE.**

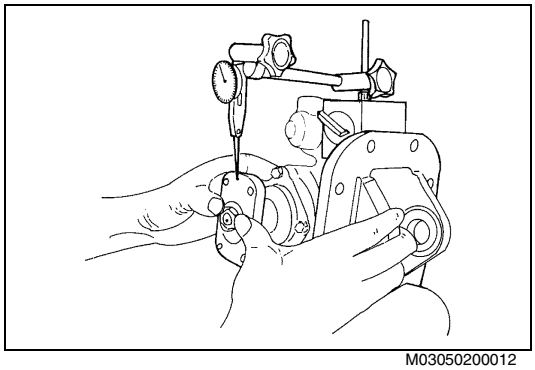
(1) Install the taper roller bearing into the case.
(2) Set the shift sleeve in its original position.
(3) Install the output shaft through the shift sleeve, needle roller bearing, output gear and collar into the case.
(4) Drive the output shaft into the taper roller bearing inner race.
(5) Drive the taper roller bearing on the output shaft.
(6) Drive the outer race in the case.



M03050200011

**5. INSTALL THE CASE COVER ON THE POWER TAKE-OFF CASE.**

(1) Install the O-ring and compression spring on the case cover.


M03050200012

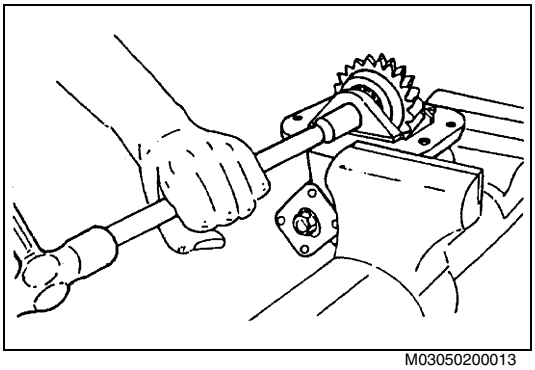
**6. CHECK THE OUTPUT SHAFT AXIAL PLAY.**

(1) Use a dial gauge to check the output shaft axial play.
**Assembly Standard:0-0.05 mm {0-0.0019 in.}**

(2) If it is not within specification, adjust the axial play with shims.

**Shims are available in following sizes.**

| | |
|---|---|
| **Shim Thickness:** | **0.05 mm {0.0020 in.}** |
| | **0.10 mm {0.0039 in.}** |
| | **0.20 mm {0.0079 in.}** |
| | **0.50 mm {0.0197 in.}** |

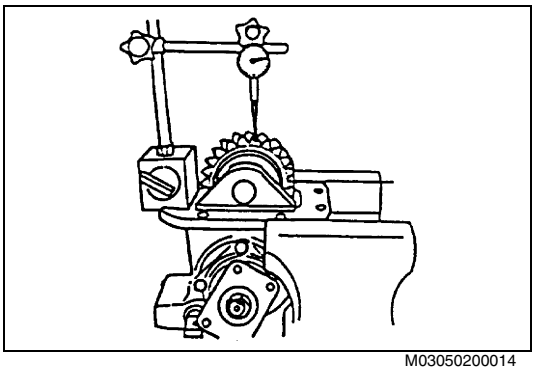

M03050200013

**7. INSTALL THE INPUT GEAR.**

(1) Place the taper roller bearing, input gear, shims and spacer in its original position.

(2) Drive the input shaft through the input gear into the case.

**NOTICE:**
**Rotate the input shaft so that slot of the input shaft is aligned with hole of the case.**

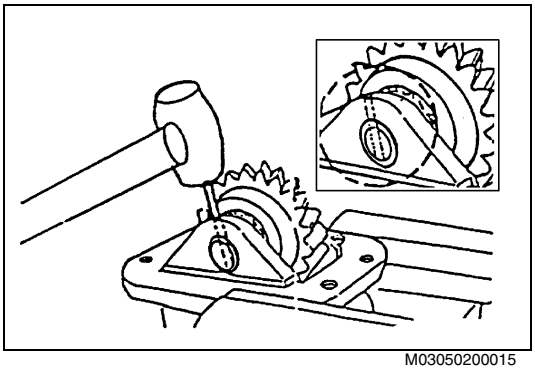

M03050200014

**8. CHECK THE INPUT GEAR AXIAL PLAY.**

(1) Use a dial gauge to check the input gear axial play.
**Assembly Standard:0-0.05 mm {0-0.0019 in.}**

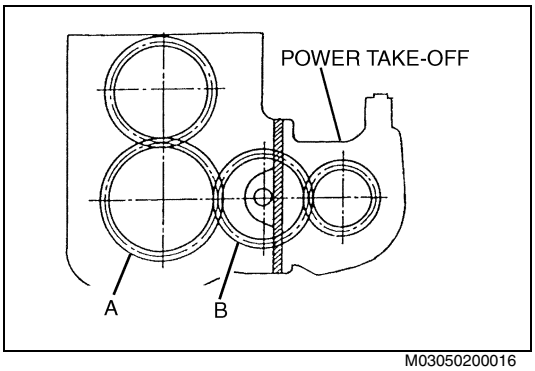
(2) If it is not within specification, adjust the axial play with shims.
**Shims are available in following sizes.**

| | |
|---|---|
| **Shim Thickness:** | **0.05 mm {0.0020 in.}** |
| | **0.10 mm {0.0039 in.}** |
| | **0.20 mm {0.0079 in.}** |
| | **0.50 mm {0.0197 in.}** |


M03050200015

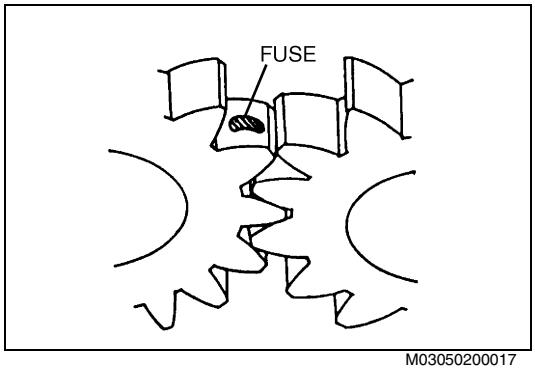
**9. AFTER MEASURING THE AXIAL PLAY, INSTALL THE SPRING PIN INTO THE HOLE.**

## IMPORTANT POINTS - MOUNTING



M03050200016

**1. MEASURE THE BACKLASH BETWEEN THE GEAR A AND B.**



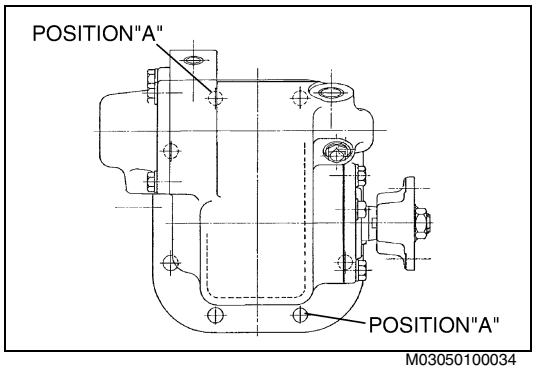
M03050200017

(1) Put the fuse (ϕ1 x 10 mm) on the surface of gear B with grease.

(2) Rotate the gears and measure the thickness of fuse.
(3) The measurement should be carried out the three points on the gears.
**Assembly Standard:**
**0.09-0.25 mm {0.0036-0.0098 in.}**
(4) If it is not within specification, adjust the backlash with adapter.
**Adapters are available in following size.**

| Adapter Thickness: |
|---|
| Groove line: None 6.12 mm {0.2409 in.} |
| Groove line: One 5.99 mm {0.2358 in.} |
| Groove line: Two 5.86mm {0.2307 in.} |

**NOTICE:**
**Gasket thickness: 0.19 mm {0.0075 in.}**



M03050100034

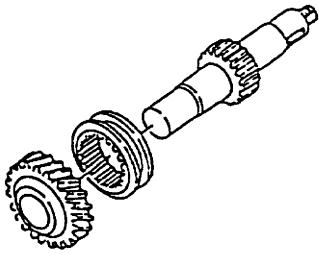
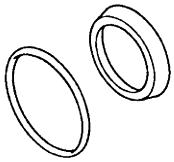
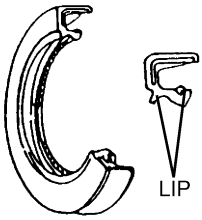
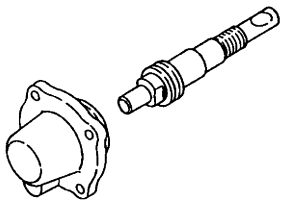
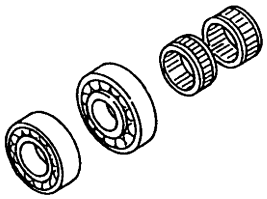
**2. INSTALL THE POWER TAKE-OFF ON THE TRANSMISSION.**
(1) Install the power take-off on the transmission with gasket.
**NOTICE:**
**The trace of the liquid gasket should be continuous. The liquid gasket should be ThreeBond #HP-17 or equivalent.**

(2) Install the reamer bolts to the position "A".

**3. FILL THE TRANSMISSION WITH TRANSMISSION OIL.**

# INSPECTION AND REPAIR

M03050202BEH3003

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Output shaft and output gear: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **O-ring and cup: Wear** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Oil seal lip: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**   |
| **Shift shaft and case cover bore: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Bearing: Improper rotation** | — | — | **Replace, if necessary.** | **Visual check**  |

# P.T.O. (POWER TAKE-OFF) (MF06S TRANSMISSION)

TR05-002

**POWER TAKE-OFF ASSEMBLY ..... TR05-2**
DATA AND SPECIFICATIONS ..... TR05-2
DESCRIPTION ..... TR05-2
TROUBLESHOOTING ..... TR05-3

**POWER TAKE-OFF UNIT ..... TR05-4**
COMPONENT LOCATOR ..... TR05-4
OVERHAUL ..... TR05-5
INSPECTION AND REPAIR ..... TR05-9

# POWER TAKE-OFF ASSEMBLY

## DATA AND SPECIFICATIONS

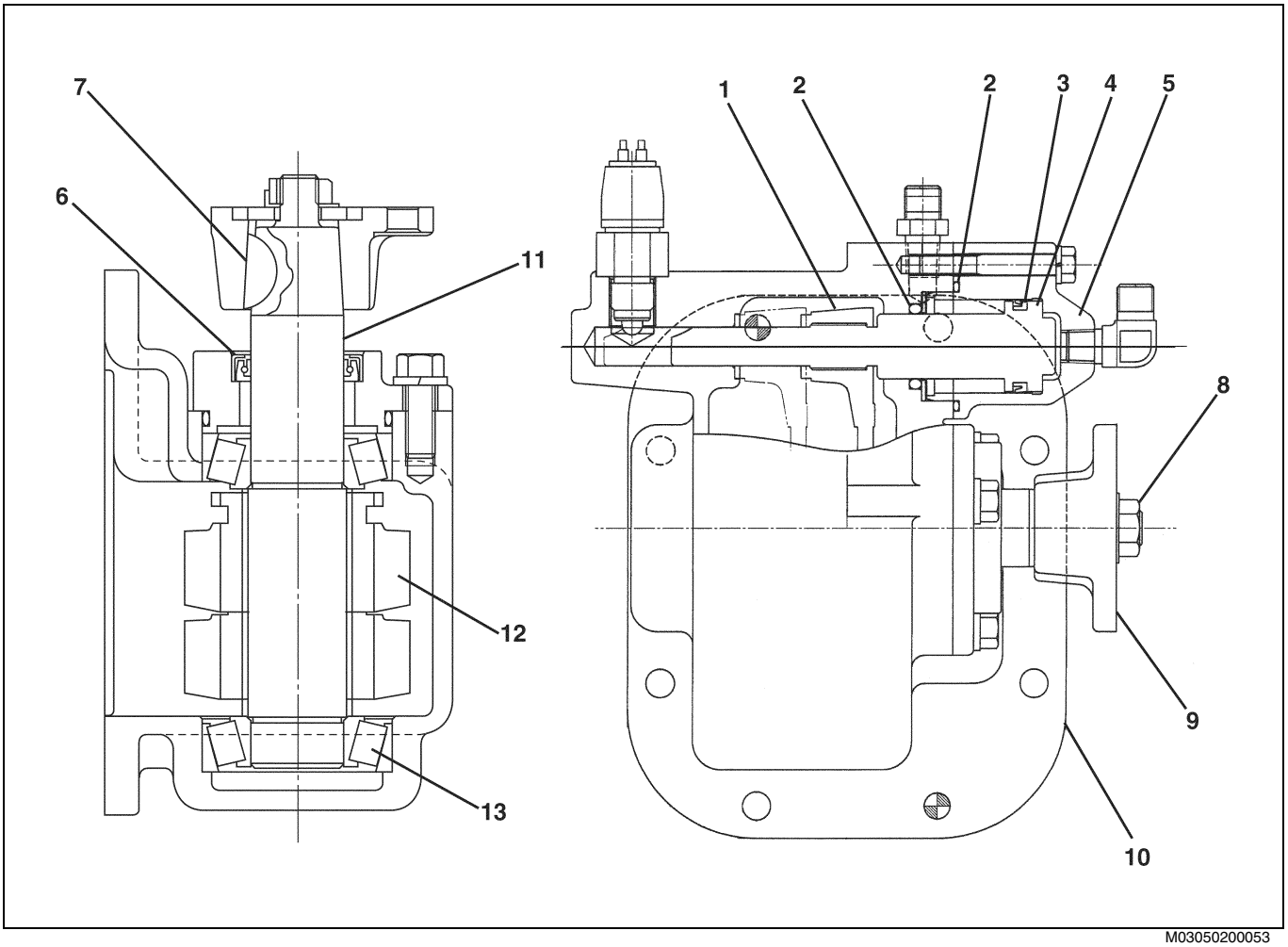
M03050102BEI2004

**POWER TAKE-OFF**

| | |
|---|---|
| **Type** | **Side power take-off<br>Driven by engaging the output shaft gear with counter 4th gear** |
| **Direction of rotation** | **Opposite engine's** |
| **Gear ratio** | **12/29** |
| **Size of output shaft flange** | **35 x 60 mm {1.378 x 2.362 in.}** |

## DESCRIPTION

M03050102BEC1004




M03050200053

**POWER TAKE-OFF UNIT**

| | | | |
|---|---|---|---|
| **1** | **Shift fork** | **8** | **Lock nut** |
| **2** | **O-ring** | **9** | **Output shaft flange** |
| **3** | **Shift shaft piston cup** | **10** | **Power take-off case** |
| **4** | **Shift shaft** | **11** | **Output shaft** |
| **5** | **Case cover** | **12** | **Output gear** |
| **6** | **Oil seal** | **13** | **Taper roller bearing** |
| **7** | **Woodruff key** | | |

# TROUBLESHOOTING

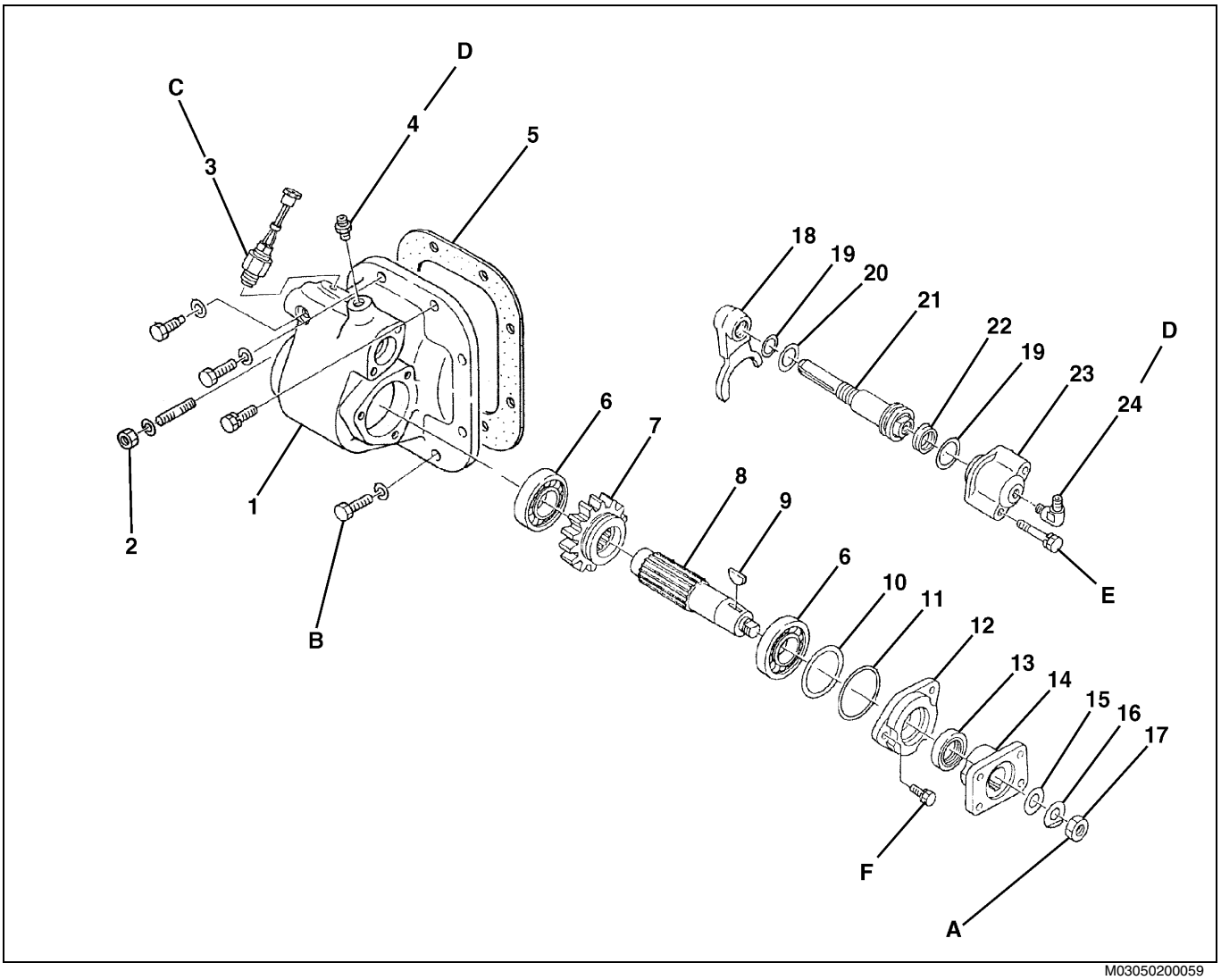
M03050102BEF3004

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Noise** | Bearing worn and/or damaged. | Replace bearing. |
| | Output gear worn and/or damaged. | Replace gear. |
| | Too much play in gear backlash. | Use proper power take-off gasket. |
| | Shortage gear oil and/or low oil viscosity. | Add oil or change oil as required. |
| **Can not be operated** | Faulty switches | Replace switch. |
| | Faulty solenoid valve. | Replace solenoid valve. |

# POWER TAKE-OFF UNIT

## COMPONENT LOCATOR

M03050202BED1007




M03050200059

| | | | |
|---|---|---|---|
| 1 | Power take-off case | 13 | Oil seal |
| 2 | Nut | 14 | Output shaft flange |
| 3 | Position switch | 15 | Plain washer |
| 4 | Connector | 16 | Lock washer |
| 5 | Power take-off case gasket | 17 | Lock nut |
| 6 | Taper roller bearing | 18 | Shift fork |
| 7 | Output gear | 19 | O-ring |
| 8 | Output shaft | 20 | Collar |
| 9 | Woodruff key | 21 | Shift shaft |
| 10 | Shim | 22 | Shift shaft piston cup |
| 11 | O-ring | 23 | Case cover |
| 12 | Seal cover | 24 | Elbow |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 39.2-47 {400-480, 29-34} | D | 39.5-58.5 {400-600, 29-43} |
| B | 44.5-53.5 {450-545, 33-39} | E | 19-25 {200-250, 15-18} |
| C | 48.5-67.5 {500-690, 36-49} | F | 49-62 {500-630, 36-45} |

# OVERHAUL

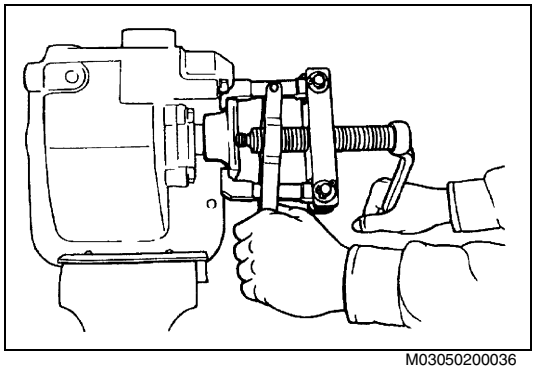
M03050202BEH2008

## IMPORTANT POINT - DISMOUNTING

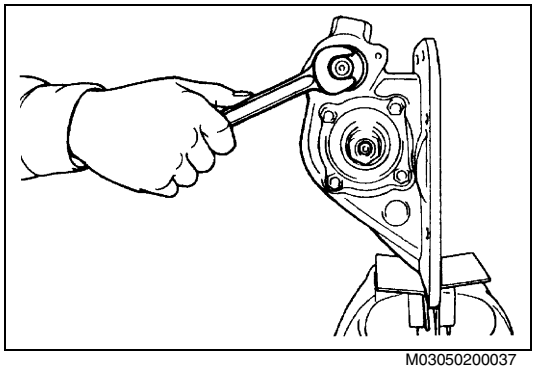
**CAUTION:**
**Do not work on the transmission while it is still hot.**
**This can result in personal injury.**

**1. DRAIN THE TRANSMISSION OIL.**
**EXHAUST ALL AIR FROM THE AIR TANKS.**

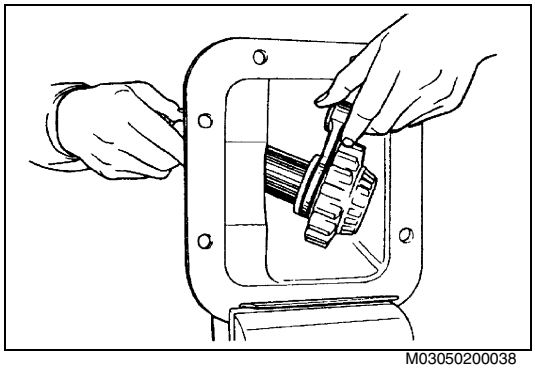
## IMPORTANT POINTS - DISASSEMBLY


M03050200036

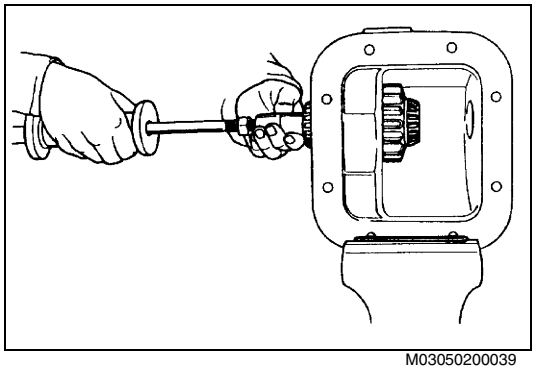
**1. SET THE POWER TAKE-OFF ON A VISE.**
**REMOVE THE OUTPUT SHAFT FLANGE.**
(1) Remove the lock nut.
(2) Use a suitable puller to remove the output shaft flange.


M03050200037

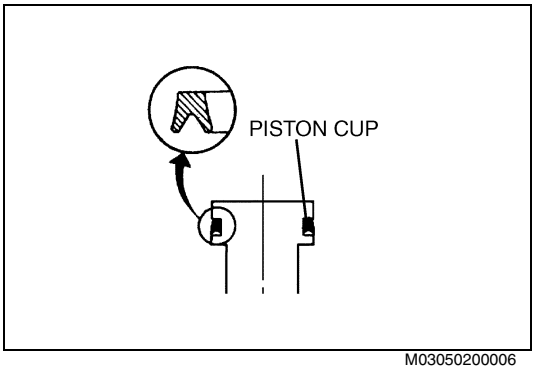
**2. REMOVE THE SHIFT SHAFT.**
(1) Remove the case cover.
(2) Unscrew the shift shaft to separate the shift shaft from the shift fork.


M03050200038

**3. REMOVE THE OUTPUT SHAFT.**
(1) Remove the seal cover.
(2) Remove the shift fork from the output gear.


M03050200039

(3) Use a suitable sliding hammer to pull out the output shaft with taper roller bearing from the case. As the output shaft is remove the output gear and taper roller bearing from the output shaft and P.T.O. case.



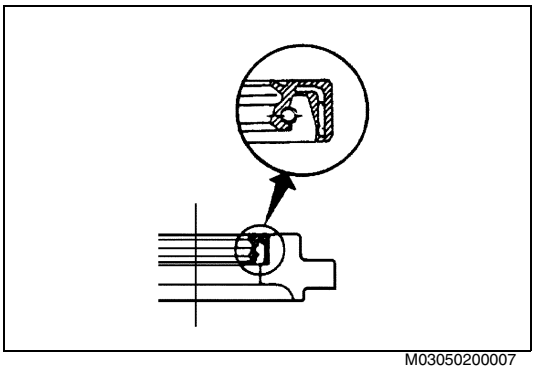
M03050200006

## IMPORTANT POINTS - ASSEMBLY

**1. INSTALL THE PISTON CUP ON THE SHIFT SHAFT.**

**NOTICE:**

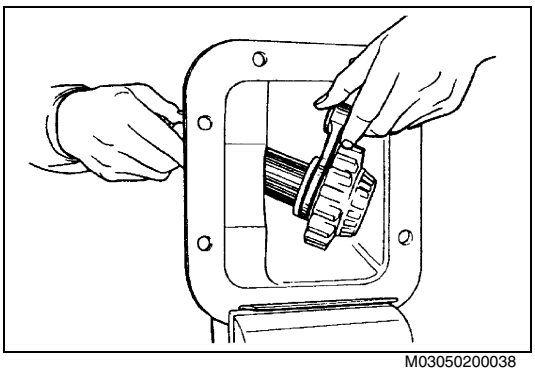
- **Coat the piston cup with grease.**
- **Be sure the piston cup is installed in the proper direction.**


M03050200007

**2. INSTALL THE OIL SEAL INTO THE SEAL COVER.**

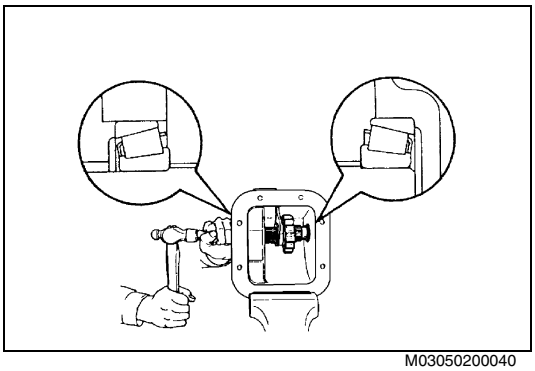
**NOTICE:**

- **Take care not to damage the seal lip.**
- **Be sure the oil seal is inserted in the proper direction.**
- **Coat the sealing surface between the seal lips with chassis grease.**

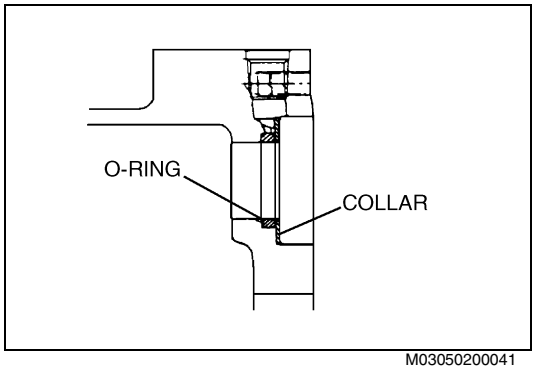

M03050200038

**3. INSTALL THE SHIFT FORK AND OUTPUT SHAFT TO THE POWER TAKE-OFF CASE.**

(1) Install the output shaft through the output gear into the case.
(2) Set the shift fork in its original position.
(3) Set the taper roller bearing in its original position.


M03050200040

(4) Drive the output shaft into the taper roller bearing inner race.
(5) Drive the taper roller bearing on the output shaft.
(6) Drive the outer race in the case.



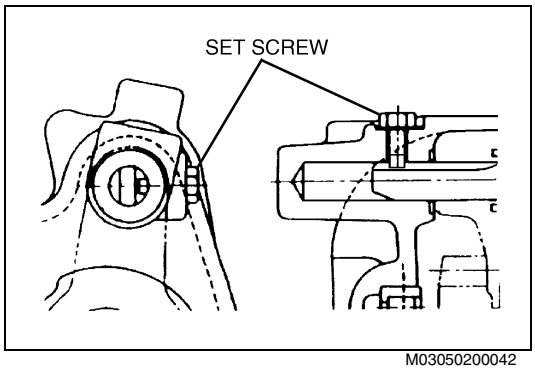
M03050200041

**4. INSTALL THE SHIFT SHAFT AND SHIFT FORK TO THE POWER TAKE-OFF CASE.**

(1) Install the O-ring and collar on the case.

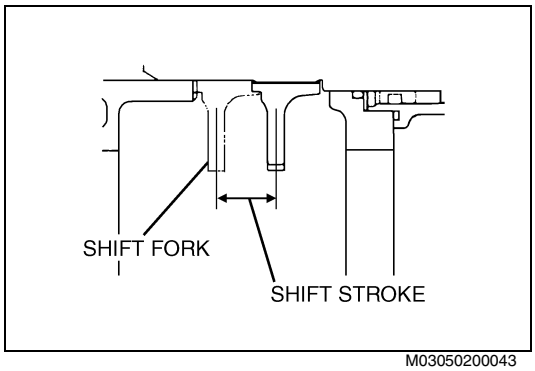
**NOTICE:**
**Coat the O-ring with grease.**

(2) Screw the shift shaft into the thread of the shift fork.
(3) Check the rotating torque of shift shaft.
**Assembly Standard:More than 4.9 N·m{50 kgf·cm,3.61lbf·ft}**



M03050200042

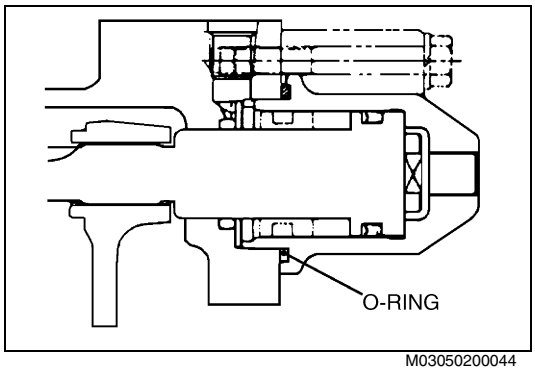
(4) Rotate the shaft so that slot of the shift shaft is aligned with set screw hole.



M03050200043

**5. CHECK THE SHIFT FORK STROKE.**

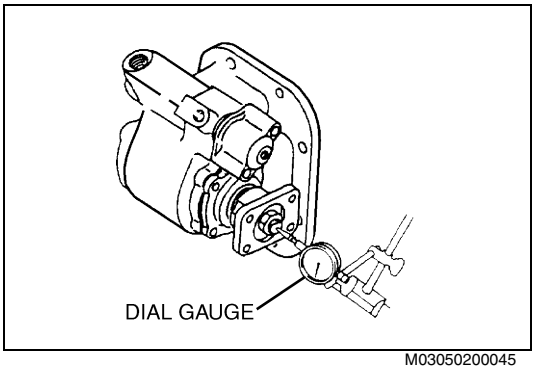
(1) Use a suitable measuring tool check the shift stroke.
**Assembly Standard:26.0-27.5 mm {1.024-1.082 in}**
(2) If it is not within specification, adjust the stroke by rotating the shift shaft.



M03050200044

**6. INSTALL THE CASE COVER ON THE CASE.**

(1) Install the O-ring on the case cover.



M03050200045

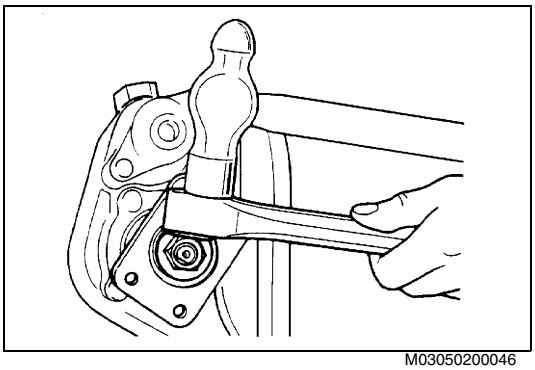
**7. CHECK THE OUTPUT SHAFT AXIAL PLAY.**

(1) Use a dial gauge to check the output shaft axial play.
**Assembly Standard:0-0.05 mm {0-0.0019 in.}**

(2) If it is not within specification, adjust the axial play with shims.

**Shims are available in following sizes.**

| | |
|---|---|
| **Shim Thickness:** | **0.05 mm {0.0020 in.}** |
| | **0.10 mm {0.0039 in.}** |
| | **0.20 mm {0.0079 in.}** |
| | **0.50 mm {0.0197 in.}** |


M03050200046

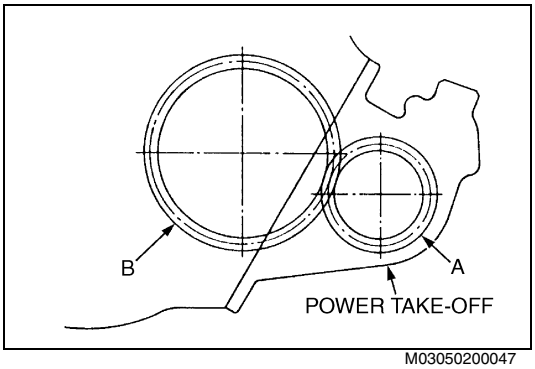
**8. INSTALL THE LOCK NUT ON THE OUTPUT SHAFT.**
**Secure the lock nut by caulking the lock plate.**

**NOTICE:**

- **Stake the lock plate with the flat surface of the nut.**
- **For the lock plate contacting the protruding portion of the nut, caulk only the half on the tightening side.**

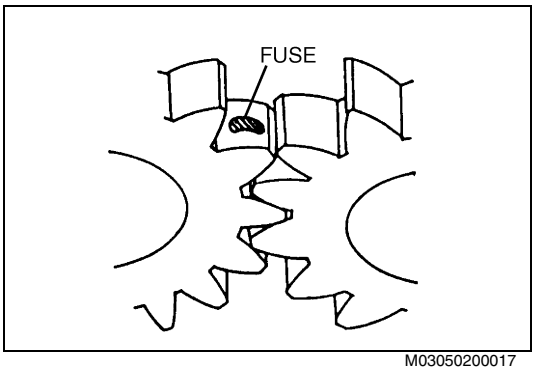
## IMPORTANT POINTS - MOUNTING

**1. MEASURE THE BACKLASH BETWEEN THE GEAR A AND B.**



M03050200047

(1) Put the fuse (ϕ1 x 10 mm) on the surface of gear A with grease.

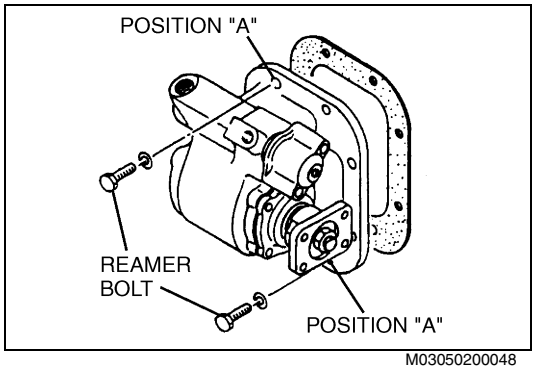


M03050200017

(2) Rotate the gears and measure the thickness of fuse.

(3) The measurement should be carried out the three points on the gears.
**Assembly Standard:**
**0.080-0.16 mm {0.0032-0.0062 in.}**

**NOTICE:**
**Power take-off case gasket thickness: 0.5 mm {0.0197 in.}**



M03050200048

**2. INSTALL THE POWER TAKE-OFF ON THE TRANSMISSION.**

(1) Install the power take-off on the transmission with gasket.

**NOTICE:**

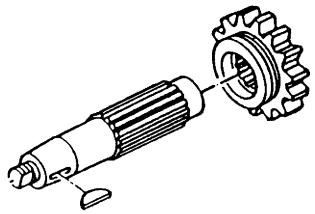
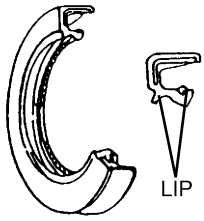
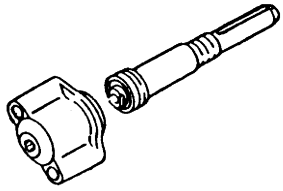
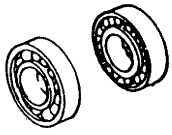
**The trace of the liquid gasket should be continuous. The liquid gasket should be ThreeBond #HP-17 or equivalent.**

(2) Install the reamer bolts to the position "A".

**3. FILL THE TRANSMISSION WITH TRANSMISSION OIL.**

# INSPECTION AND REPAIR

M03050202BEH3004

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Output shaft and output gear: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **O-ring and cup: Wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Oil seal lip: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**   |
| **Shift shaft and case cover bore: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Bearing: Improper rotation** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# P.T.O. (POWER TAKE-OFF) (EATON)

TR05-003

**POWER TAKE-OFF ASSEMBLY ..... TR05-2**
DATA AND SPECIFICATIONS ..... TR05-2
DESCRIPTION ..... TR05-3
TROUBLESHOOTING ..... TR05-3

**POWER TAKE-OFF UNIT ..... TR05-4**
COMPOMENT LOCATOR ..... TR05-4
OVERHAUL ..... TR05-5

# POWER TAKE-OFF ASSEMBLY

## DATA AND SPECIFICATIONS

M03050102BEI2005

**POWER TAKE-OFF**

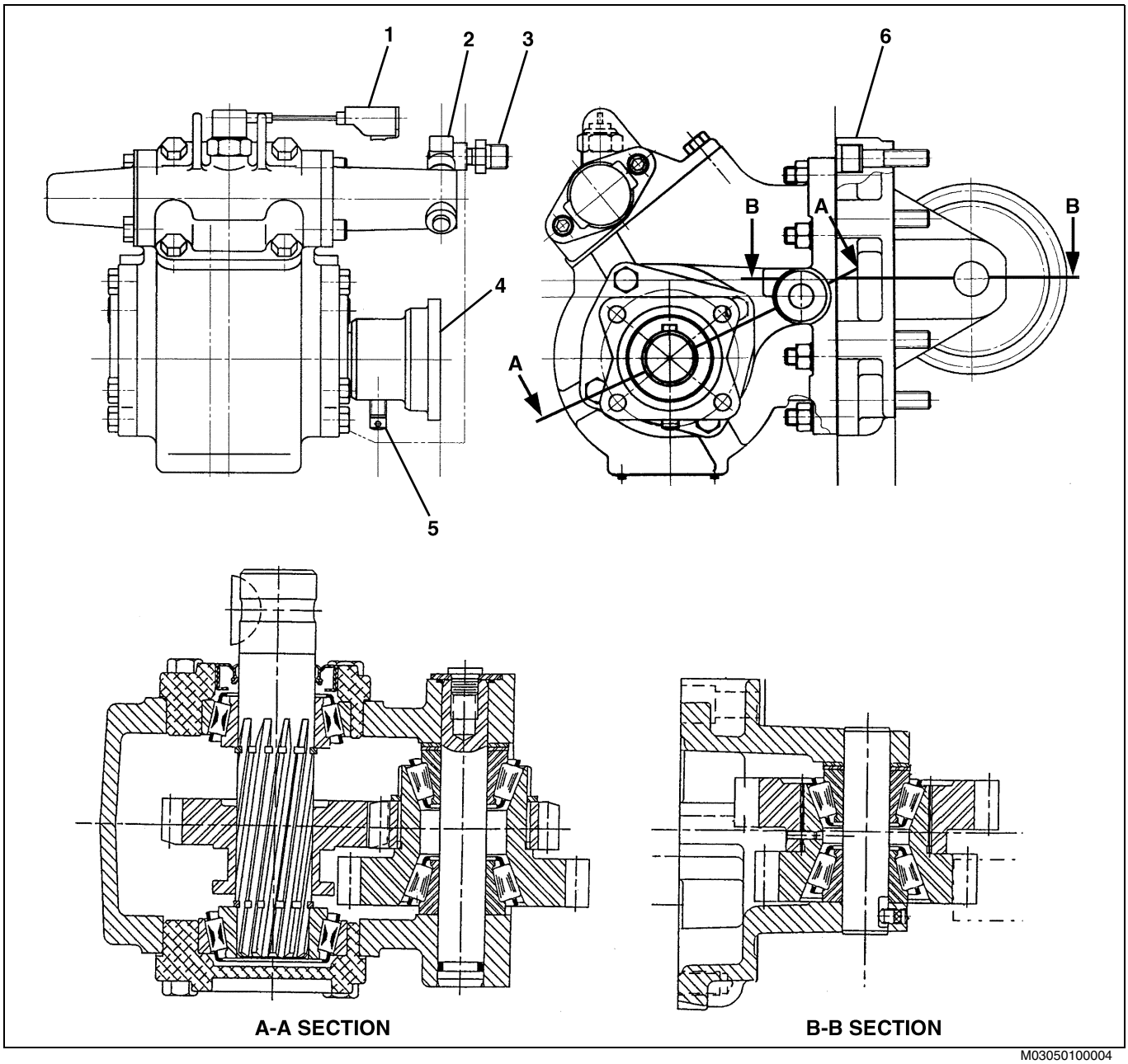
| | |
|---|---|
| **Maximum output torque** | **338 N·m {3,447 kgf·cm, 249 lb·ft}** |
| **Direction of rotation** | **Counterclockwise viewed from output shaft flange** |
| **Ratio** | **1.183 (43/33 x 18/32 x 22/24 x 37/21)** |
| **Size of output shaft flange** | **Pitch circle diameter 79.375 mm {3.125 in.}** |

**POWER TAKE-OFF CONTROL**

| | |
|---|---|
| **Type** | **Electric-pneumatic control** |

# DESCRIPTION

M03050102BEC1005




M03050100004

**POWER TAKE-OFF UNIT**

| | | | |
|---|---|---|---|
| 1 | Harness | 4 | Output shaft flange |
| 2 | Elbow | 5 | Lock bolt |
| 3 | Connector | 6 | Adapter |

# TROUBLESHOOTING

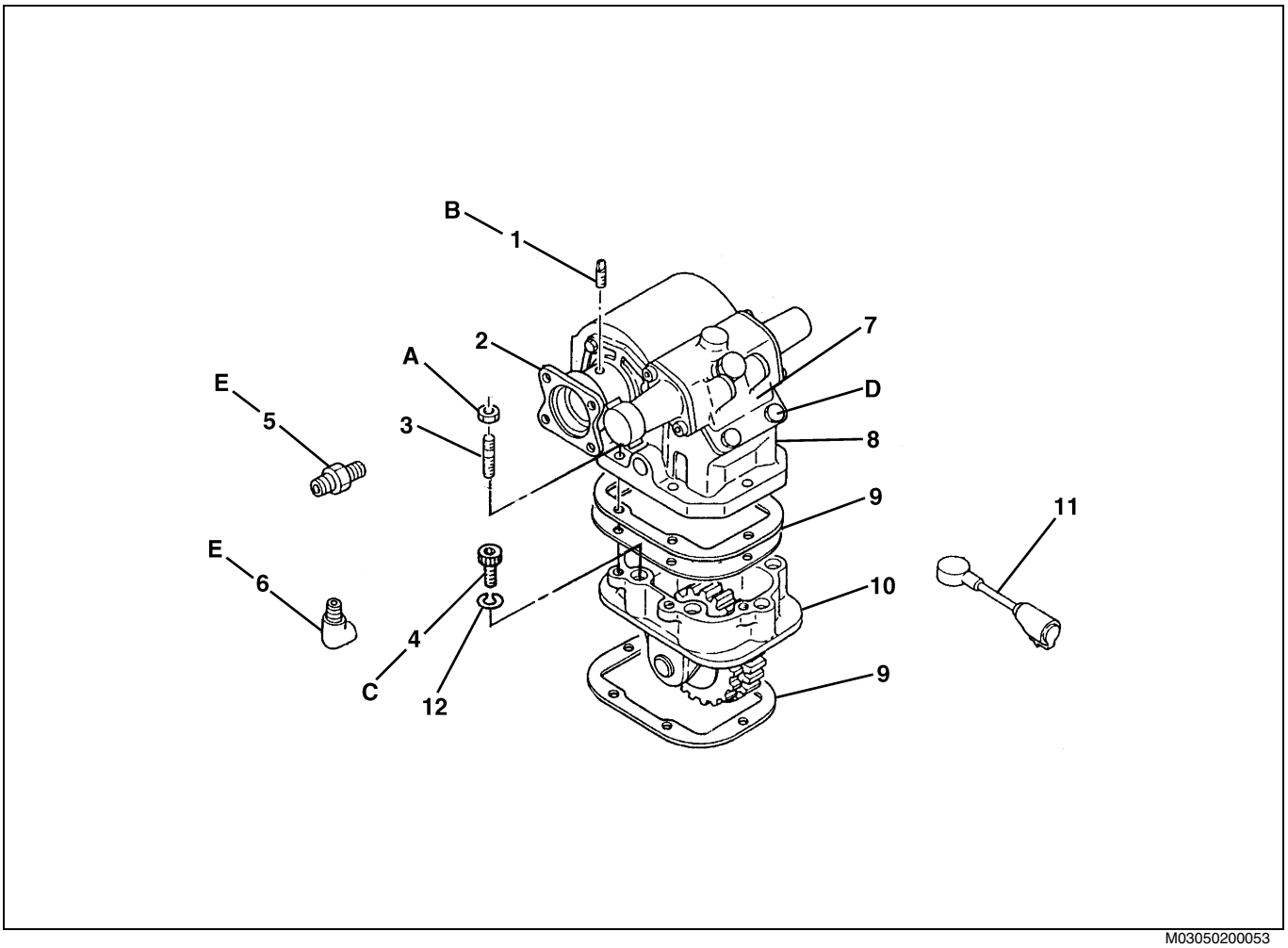
M03050102BEF3005

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Noise** | Bearing worn and/or damaged. | Replace bearing. |
| | Output gear worn and/or damaged. | Replace gear. |
| | To much play in gear backlash. | Use proper power take-off gasket. |
| | Shortage gear oil and/or low oil viscosity. | Add oil or change oil as required. |

# POWER TAKE-OFF UNIT

## COMPOMENT LOCATOR

M03050202BED1005




M03050200053

| | | | |
|---|---|---|---|
| 1 | Lock bolt | 7 | P.T.O. shift housing |
| 2 | Output shaft flange | 8 | Power take-off unit |
| 3 | Stud bolt | 9 | Gasket |
| 4 | Hexagon bolt | 10 | Adapter |
| 5 | Connector | 11 | Harness |
| 6 | Elbow | 12 | Copper washer |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 48-54 {490-550, 36-39} | D | 23-27 {235-275, 17-19} |
| B | 52-60 {531-611, 39-44} | E | 10.8-16.2 {111-165, 9-11} |
| C | 41-47 {419-479, 31-34} | | |

# OVERHAUL

M03050202BEH2006

## IMPORTANT POINTS - MOUNTING

**CAUTION:**
**Do not work on the transmission while it is still hot.**
**This can result in personal injury.**

**1. DRAIN THE TRANSMISSION OIL.**

**2. REMOVE THE POWER TAKE-OFF COVER AND GASKET.**

(1) Remove the power take-off cover and gasket then clean the aperture pad using a putty knife or wire brush.

**NOTICE:**
**Stuff a rag in the aperture opening to prevent dirt from entering the transmission while you are cleaning it.**

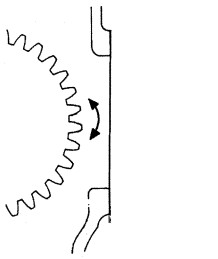
**3. CHECK THE BACKLASH.**

(1) Using your hand, rock the P.T.O. drive gear in the transmission and the driven gear in the P.T.O. assembly.

**NOTICE:**
**Rocking the gears provides two important factors.**

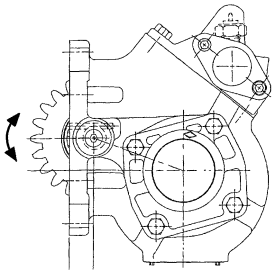
**a. It shows you the amount of backlash that has been designed into each unit.**

**b. It is helpful in establishing the proper backlash when installing the P.T.O.**



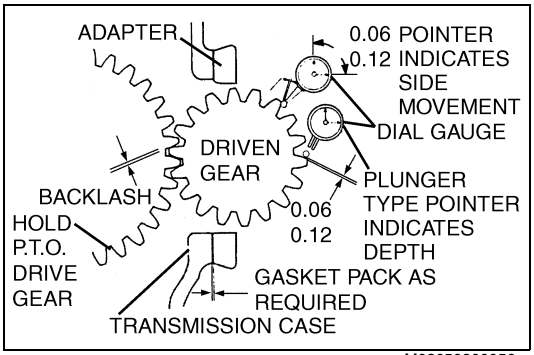
P.T.O. DRIVE GEAR IN TRANSMISSION

M03050200054



P.T.O. DRIVEN GEAR IN P.T.O.

M03050200055




M03050200056

**4. CHECK THE BACKLASH BETWEEN THE P.T.O. DRIVE GEAR IN THE TRANSMISSION AND THE DRIVEN GEAR IN THE ADAPTER.**

(1) Install the correct number of gaskets and adapter to the transmission.

**NOTICE:**

- **Do not use sealant between gaskets because you may want to add or subtract gaskets to obtain proper backlash.**
- **Do not stack more than 3 gaskets together.**
- **Usually one thick gasket 0.50 mm {0.20 in.} will be required.**

(2) Secure the adapter to the transmission.

(3) Mount the dial gauge so that it registers movement of the driven gear of the adapter.

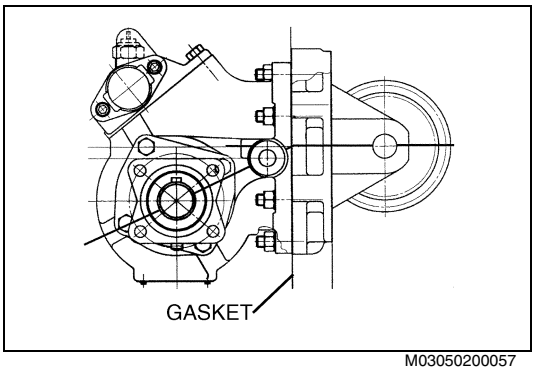
**NOTICE:**
**See figure for proper location of dial indicator contact point. (Two common type dial gauges shown.)**

(4) Hold the P.T.O. drive gear in transmission with a screw driver or bar and rock the driven gear in adapter back and forth with your hand.

(5) Note the total movement on the dial gauge. Then, adjust the backlash by adding or subtracting gaskets.
**Assembly Standard: 0.15-0.30 mm {0.006-0.011 in.}**

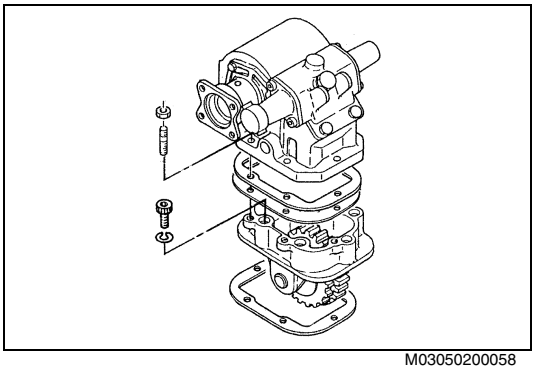
**NOTICE:**
**A 0.25 mm {0.010 in.} gasket will change backlash approx. 0.152 mm {0.006 in.}. A 0.51 mm {0.020 in.} gasket changes backlash approx. 0.305 mm {0.012 in.}.**

(6) After checking for proper backlash, remove the adapter and gaskets from the transmission. Keep the gaskets as a "package".



M03050200057

**5. CHECK THE BACKLASH BETWEEN DRIVEN GEAR IN THE ADAPTER AND INPUT GEAR IN THE P.T.O.**
(1) Bench mount the adapter to the P.T.O. with gasket.
(2) Mount the dial gauge, then hold the input gear in P.T.O. with a screw driver or bar and rock the driven gear in adapter back and forth with your hand.
(3) Note the total movement on the dial gauge.
(4) Adjust the backlash by adding or subtracting gaskets.
**Assembly Standard: 0.15-0.30 mm {0.006-0.011 in.}**


M03050200058

**6. MOUNT THE ADAPTER AND THE P.T.O.**
(1) Remount the adapter assembly, all gaskets and the P.T.O. to the transmission in their respective sequence.
(2) Secure all nuts and hexagon bolts to proper torque.
(3) Run the P.T.O. momentarily and check for noise.

**NOTICE:**
**The transmission and P.T.O. have no lubrication at this time so running time should be as short as possible.**

**a. If the P.T.O. whines it may be mounted too tight, too little backlash. This indicates that gaskets should be added.**

**b. If the P.T.O. clatters it may be mounted too loose, too much backlash. This indicates that gaskets should be removed.**

# TRANSMISSION/TRANSFER CONTROL TR06-001

**TRANSMISSION CONTROL UNIT ..... TR06-2**
TROUBLESHOOTING ..... TR06-2

**TRANSMISSION CONTROL LINKAGE ... TR06-4**
COMPONENT LOCATOR ..... TR06-4
OVERHAUL ..... TR06-5
ADJUSTMENT ..... TR06-6

**POWER SHIFT**
**(FOR LJ06 TRANSMISSION) ..... TR06-8**
DESCRIPTION ..... TR06-8
PROPOSAL TOOL ..... TR06-9
COMPONENT LOCATOR ..... TR06-10
OVERHAUL ..... TR06-11
INSPECTION AND REPAIR ..... TR06-20

**POWER SHIFT**
**(FOR MF06 TRANSMISSION) ..... TR06-21**
DESCRIPTION ..... TR06-21
SPECIAL TOOL ..... TR06-22
COMPONENT LOCATOR ..... TR06-23
OVERHAUL ..... TR06-24
INSPECTION AND REPAIR ..... TR06-30

# TRANSMISSION CONTROL UNIT

## TROUBLESHOOTING

M03060101BEF3002

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Unable to shift the gear or very difficult to shift when the engine is turned off.** | Control cable damage, breakage, or heat-related deterioration or deformation | Replace the cables. |
| | Loose part | Inspect and tighten. |
| | Damaged shift lever assembly | Replace the shift lever. |
| | Damaged power shift or faulty shift operation. | Replace the power shift. |
| | Damaged or broken transmission upper cover (lever, spring, etc.) | Replace. |
| | Improperly adjusted control cable | Adjust. |
| | The looseness of tightening bolt and nut | Inspect and tighten each bolt and nut. |
| **Gear disengages when driving bumpy roads.** | Improperly adjusted control cable | Adjust. |
| | Loose control cable joint | Tighten or replace. |
| **The play of the lever is excessive.** | A joint is seriously worn | Replace the joint. |
| | The looseness of tightening bolt and nut | Inspect and tighten each bolt and nut. |

## WITH POWER SHIFT

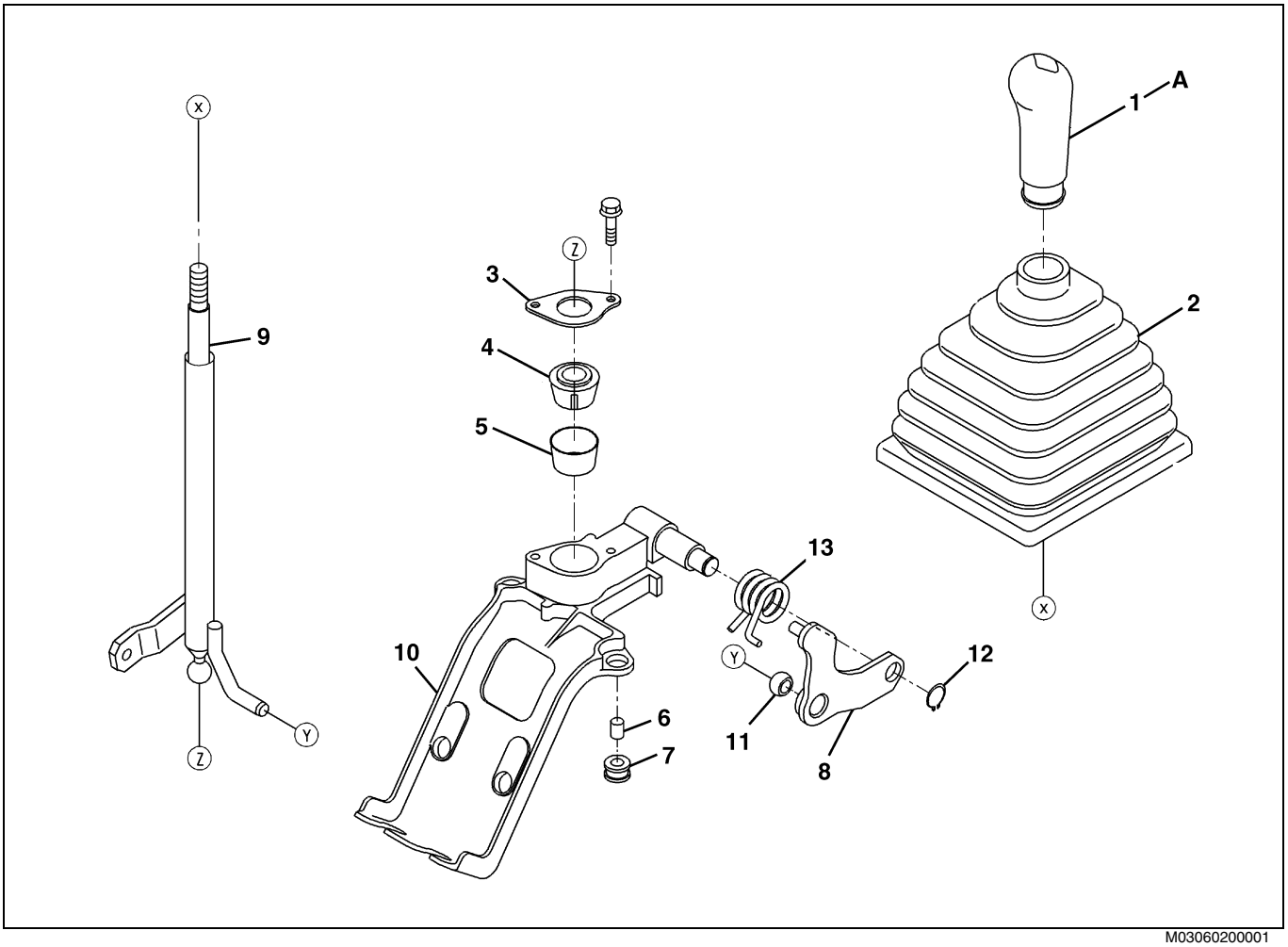
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Air leaks from connector exhaust port or actuating rod when not operating** | Improper installation of square ring | Clean or replace. |
| | Worn or damaged O-ring, valve seat and valve seal. | Clean or replace. |
| | Scored pipe | Repair or replace. |
| **Air leaks from connector** | Improper tightening | Clean, retighten after sealing. |
| **Air leaks from actuating rod when pushing** | Scored pipe | Repair or replace. |
| | Worn or damaged lifter seat | Replace. |
| | Worn or damaged O-ring or scored lifter or O-ring groove. | Clean or replace. |
| | Improper valve seal assembly | Replace. |
| | Improper tightening of cylinder | Retighten. |
| **Air leaks from connector exhaust port when pushing** | Scored pipe | Repair or replace. |
| | Worn or damaged piston O-ring | Clean, replace or re-install. |
| | Improper installation of piston packing | Replace. |
| | Damaged piston | Replace. |
| **Air leaks between shift rod and cylinder or housing** | Worn or damaged oil seal | Replace. |
| | Scored rod | Repair or replace. |
| | Broken piston retainer ring | Replace. |
| **Air leaks from air connector when pulling** | Same as air leaks from actuating rod when pushing | Same as air leaks from actuating rod when pushing |
| | Damaged tube square ring | Replace or re-install. |
| **Air leaks from actuating rod when pulling** | Improper tightening | Clean, retighten after sealing. |
| **Shift lever shifts heavy** | Damaged shifter rod | Repair or replace. |
| | Damaged sliding surface of housing or cylinder | Repair. |
| | Insufficient lubricant | Lubricate. |
| | Control cable hesitation (Inner cable buckling, breakage, heat deformation, or damage, buckling due to faulty cable arrangement, or entry of water or foreign materials into cable due to damaged boot) | Replace the cables. |
| | Faulty power shift operation [Valve air leakage (entry of foreign materials)] | Replace the power shift. |
| | Faulty power shift operation (air pipe air leakage) | Inspect and repair pipe. |
| | Entry of water or foreign materials due to damaged power shift boot (Rusted ball joint, damaged O-ring or packing, rusted or damaged rod) | Inspect and repair. |
| **No air pressure to power shift unit when trying to shift** | Clogged air pipe to power shift unit | Clean or repair. |
| | Clogged pipe | Clean. |
| | Improper installation of conical spring | Re-install. |

# TRANSMISSION CONTROL LINKAGE

## COMPONENT LOCATOR

M03060201BED1001

### CAB SIDE (REPRESENTATIVE TYPE)



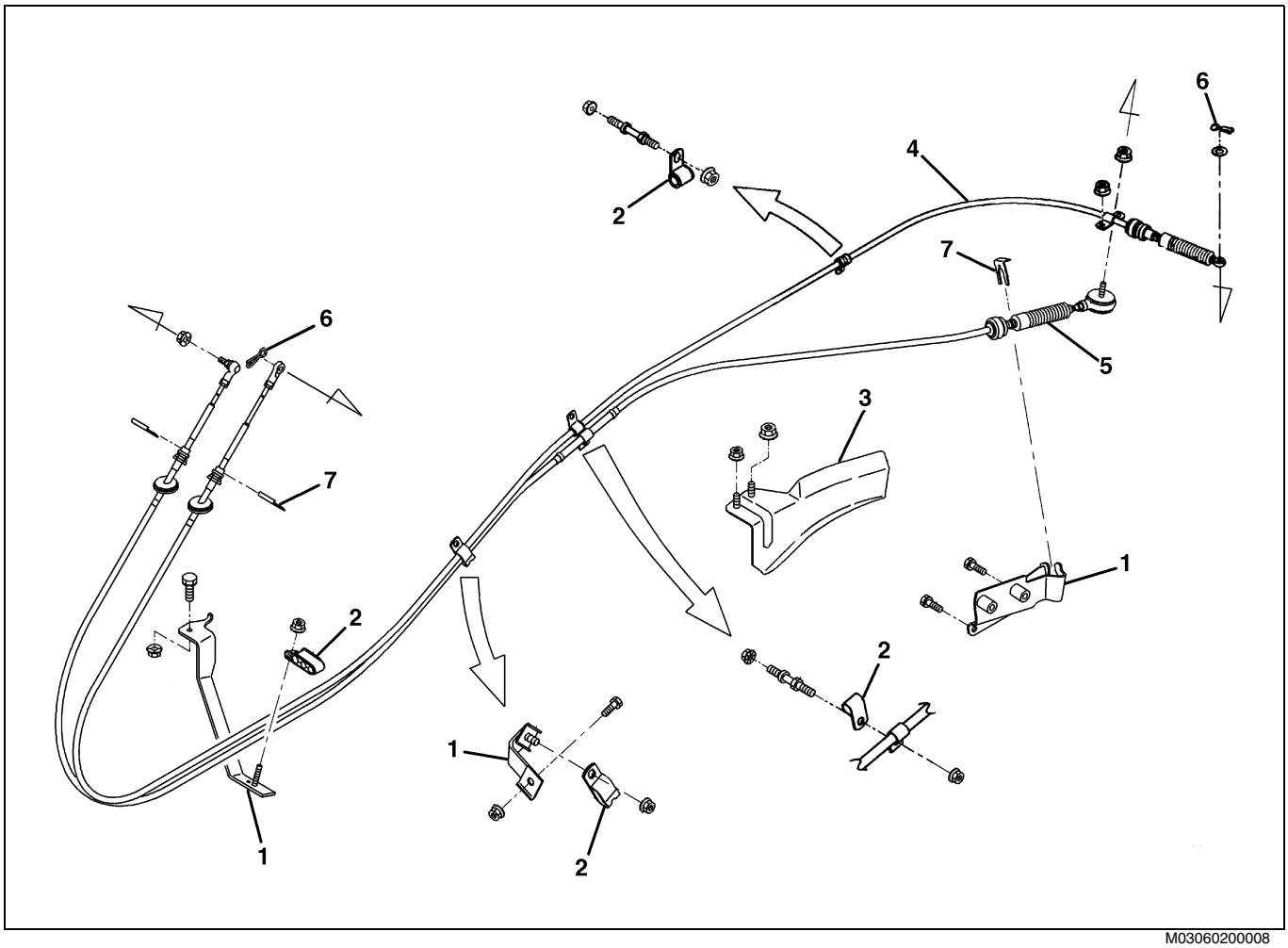

M03060200001

| | | | |
|---|---|---|---|
| 1 | Shift lever knob | 8 | Select lever |
| 2 | Shift lever boot | 9 | Shift lever |
| 3 | Plate | 10 | Control rod support |
| 4 | Ball joint | 11 | Ball |
| 5 | Rubber seat | 12 | E-ring |
| 6 | Distance piece | 13 | Spring |
| 7 | Rubber cushion | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 6.9-8.9 {70-90, 5.1-6.5} | | |

## CHASSIS SIDE (REPRESENTATIVE TYPE)

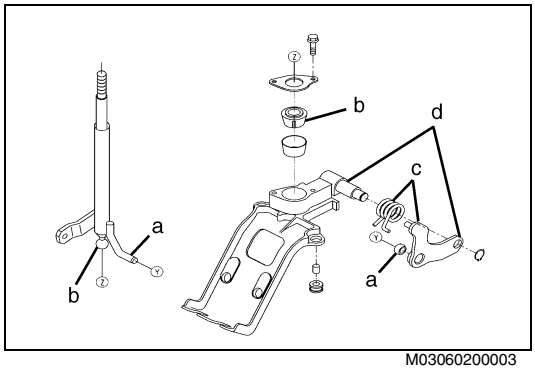



M03060200008

| | | | |
|---|---|---|---|
| 1 | Cable retaining bracket | 5 | Control cable (Shift) |
| 2 | Clip | 6 | Pin |
| 3 | Gear control insulator | 7 | Clamp |
| 4 | Control cable (Select) | | |

# OVERHAUL

**M03060201BEH2001**




M03060200003

## IMPORTANT POINTS - ASSEMBLY

**1. COAT THE LITHIUM BASE GREASE OR CHASSIS GREASE.**

(1) Coat lithium base grease to the following parts.

a. Shift lever and ball contact point.

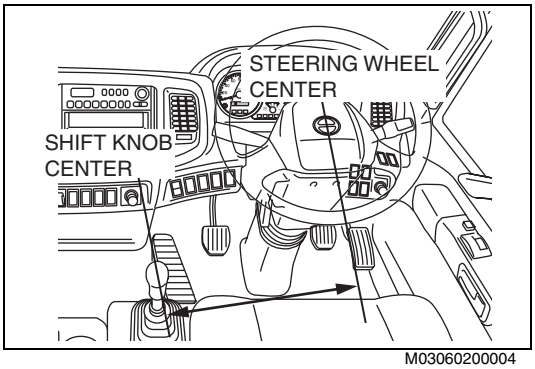
b. Shift lever and ball joint contact point.

c. Select lever and spring contact point.

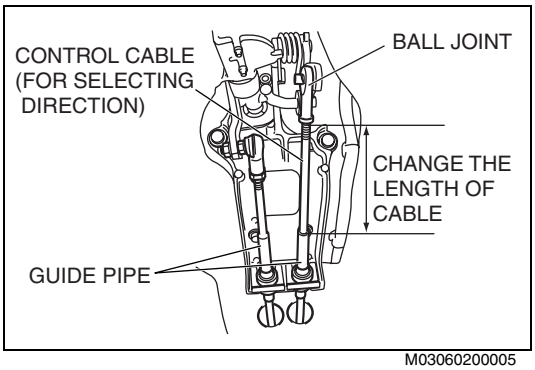
d. Shift lever and select lever contact point.

# ADJUSTMENT

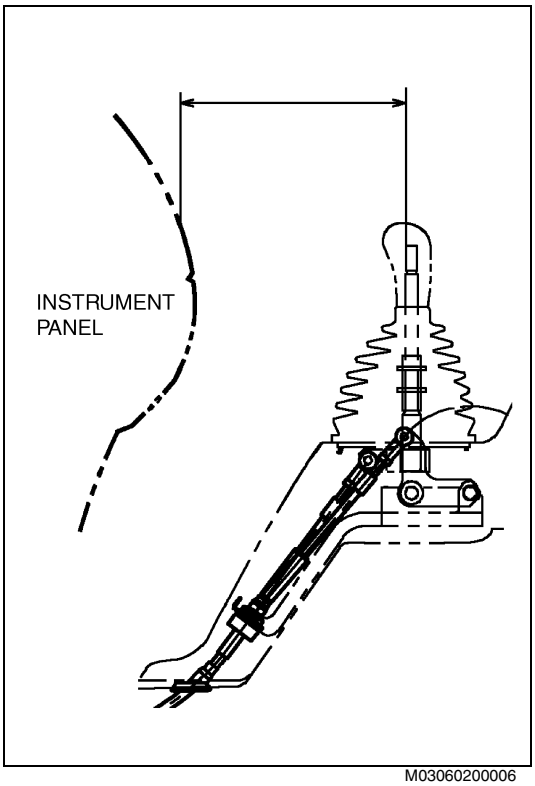
M03060201BEH3003



M03060200004



M03060200005



M03060200006

## ADJUSTMENT PROCEDURE

**1. ADJUST THE NEUTRAL POSITION OF THE GEAR SHIFT LEVER.**

(1) Check that the distance between the knob center and the steering wheel center conforms to the following;

| Transmission series | Assembly standard |
|---|---|
| LJ06S, MF06S | 350-380 mm {13.780-14.960 in.} |
| EATON FS6109, 8209 | 375-405 mm{14.764-15.944 in.} |
| FULLER RT8908LL | 375-405 mm{14.764-15.944 in.} |

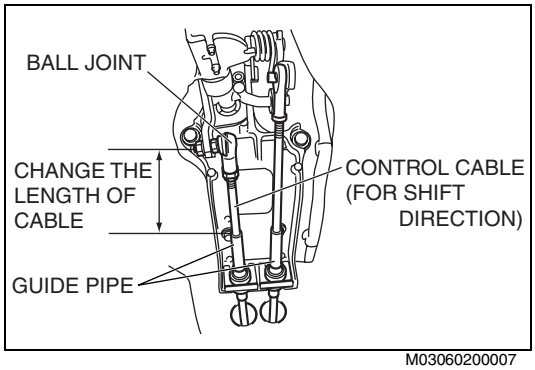
(2) If not, adjust the length of the select control cable.

| Length of cable | Position of selecting direction |
|---|---|
| To lengthen it | Distance gets shorter. (Lever leans right side.) |
| To shorten it | Distance gets longer. (Lever leans left side.) |

**NOTICE:**

- **Do not adjust cables with holding guide pipe.**
- **When changing the length of cable, do not bend the cable.**

(3) Check that the distance between the knob center and the instrument cluster conforms to the following;
**Assembly standard: 235-265 mm {9.252-10.433 in.}**



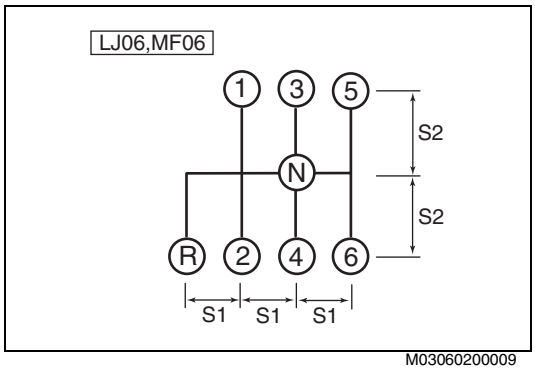
M03060200007

(4) If not, adjust the length of the shift lever control cable.

| Length of cable | Position of shifting direction |
|---|---|
| To lengthen it | Distance gets longer. (Lever leans backward.) |
| To shorten it | Distance gets shorter. (Lever leans frontward.) |

**NOTICE:**
- **Do not adjust cables with holding guide pipe.**
- **When changing the length of cable, do not bend the cable.**

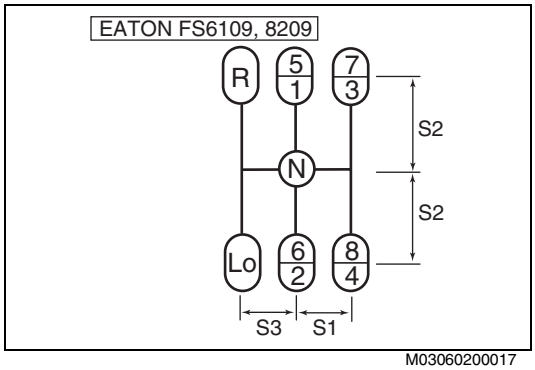
**2. CHECK THE SHIFT AND SELECT STROKE.**



M03060200009

**Select stroke** Unit: mm {in.}

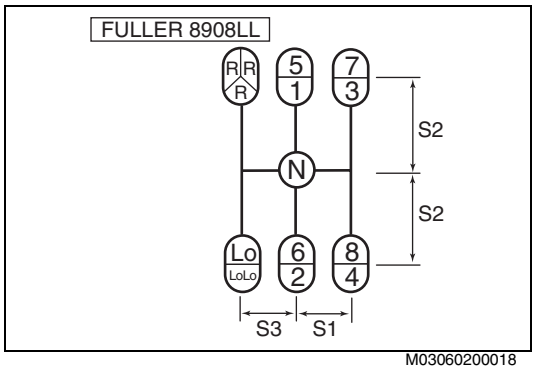
| | S1 | S3 |
|---|---|---|
| LJ06S | 45-55{1.772-2.165} | — |
| MF06S | | |
| FULLER 8908LL | 75-85 {2.952-3.346} | 55-65 {2.166-2.559} |
| EATON FS6109, 8209 | 50-70 {1.968-2.755} | 60-80 {2.362-3.149} |



M03060200017

**Shift stroke** Unit: mm {in.}

| | S2 |
|---|---|
| LJ06S (Without Power Shift) | 100-120{3.937-4.724} |
| LJ06S (With Power Shift) | 90-110{3.544-4.330} |
| MF06S | 75-95{2.953-3.740} |
| FULLER RT8908LL | 100-120{3.937-4.724} |
| EATON FS6109, 8209 | 110-130{4.331-5.118} |

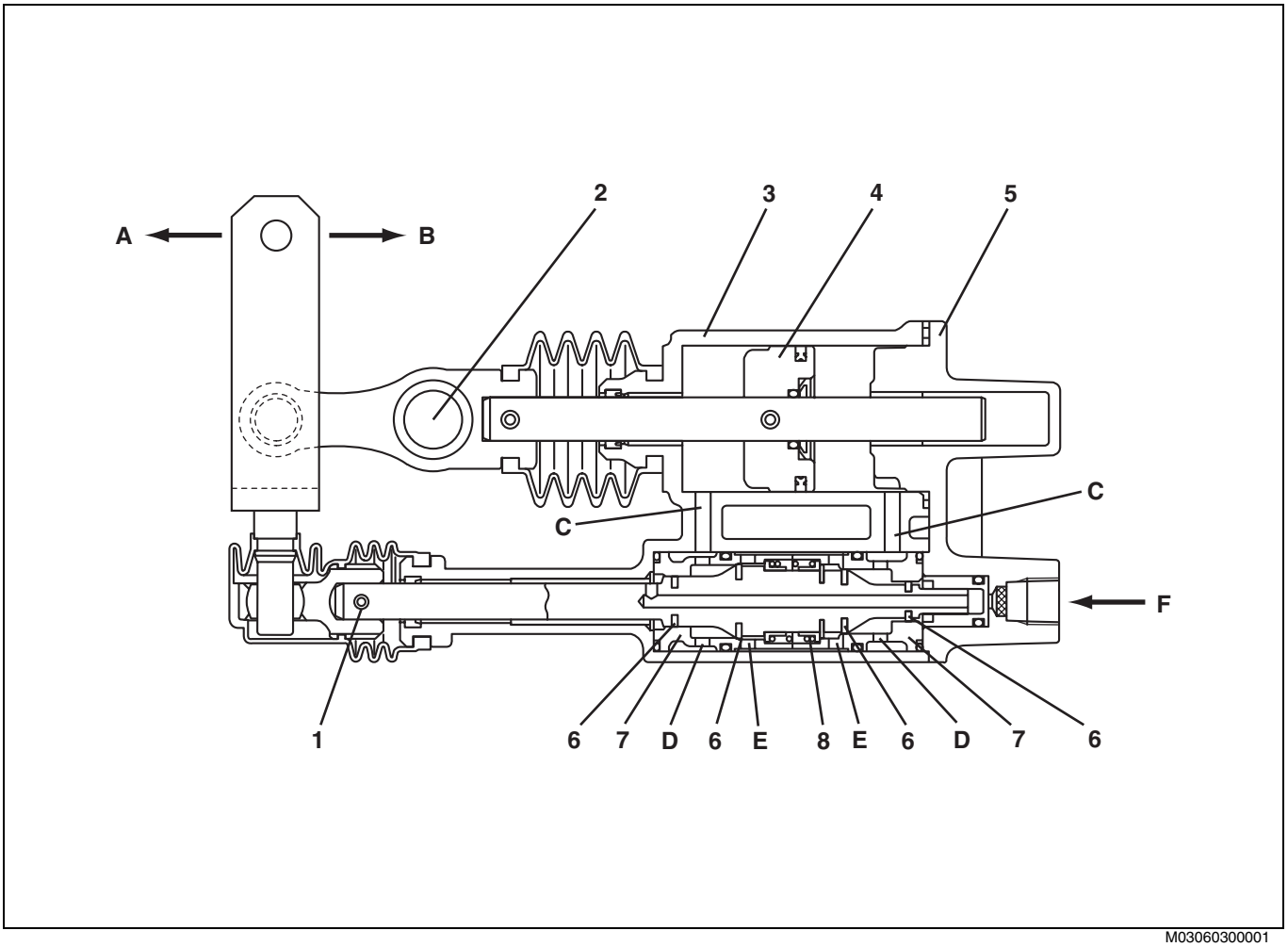


M03060200018

# POWER SHIFT (FOR LJ06 TRANSMISSION)

## DESCRIPTION

M03060301BEC1002

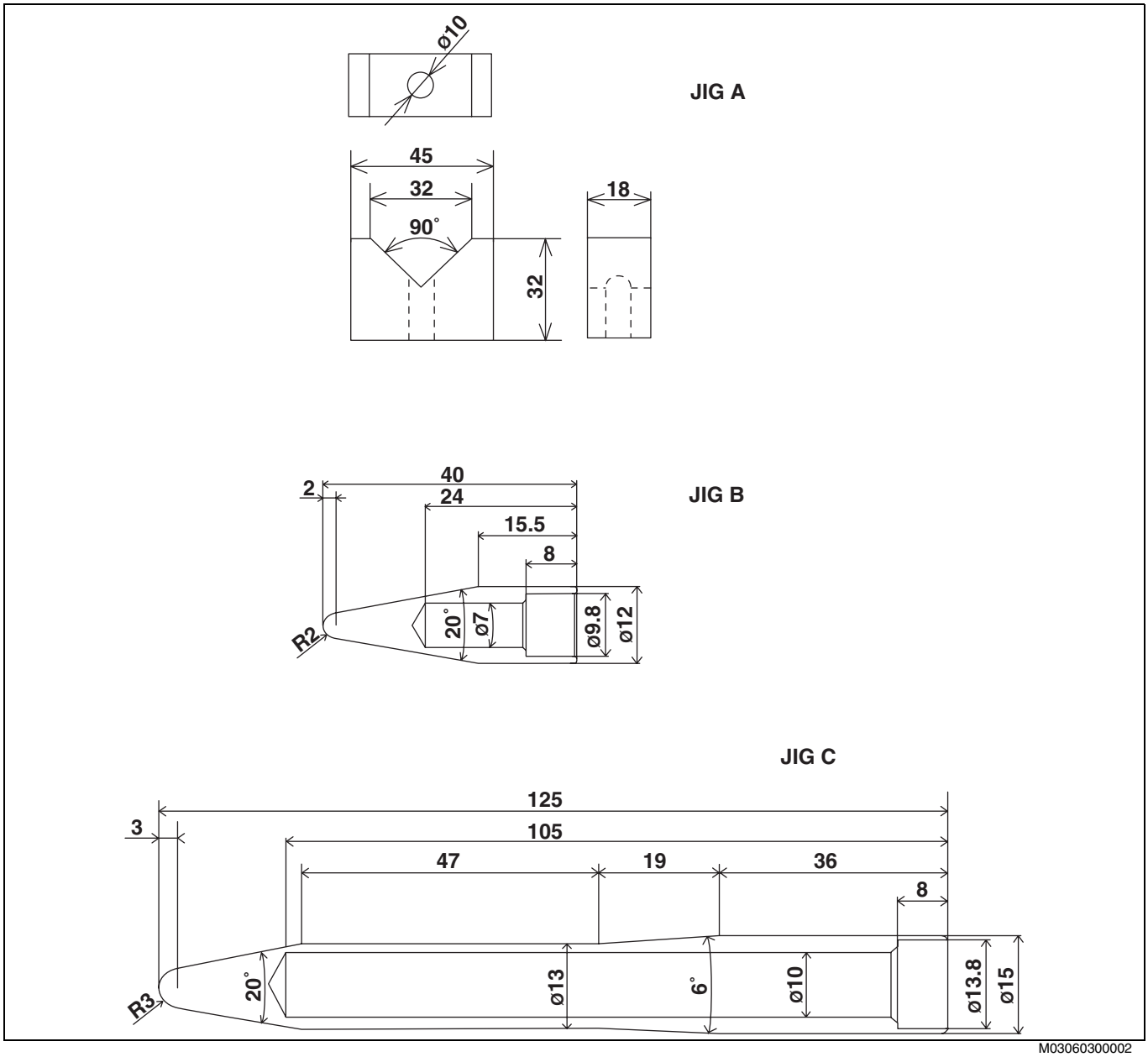



M03060300001

| | | | |
|---|---|---|---|
| 1 | Valve joint | 8 | Return spring |
| 2 | Joint | A | Front |
| 3 | Booster cylinder | B | Rear |
| 4 | Piston | C | Air inlet and outlet |
| 5 | Cover | D | Air inlet |
| 6 | Valve seal | E | Air outlet |
| 7 | Valve seat | F | Compressed air |

# PROPOSAL TOOL

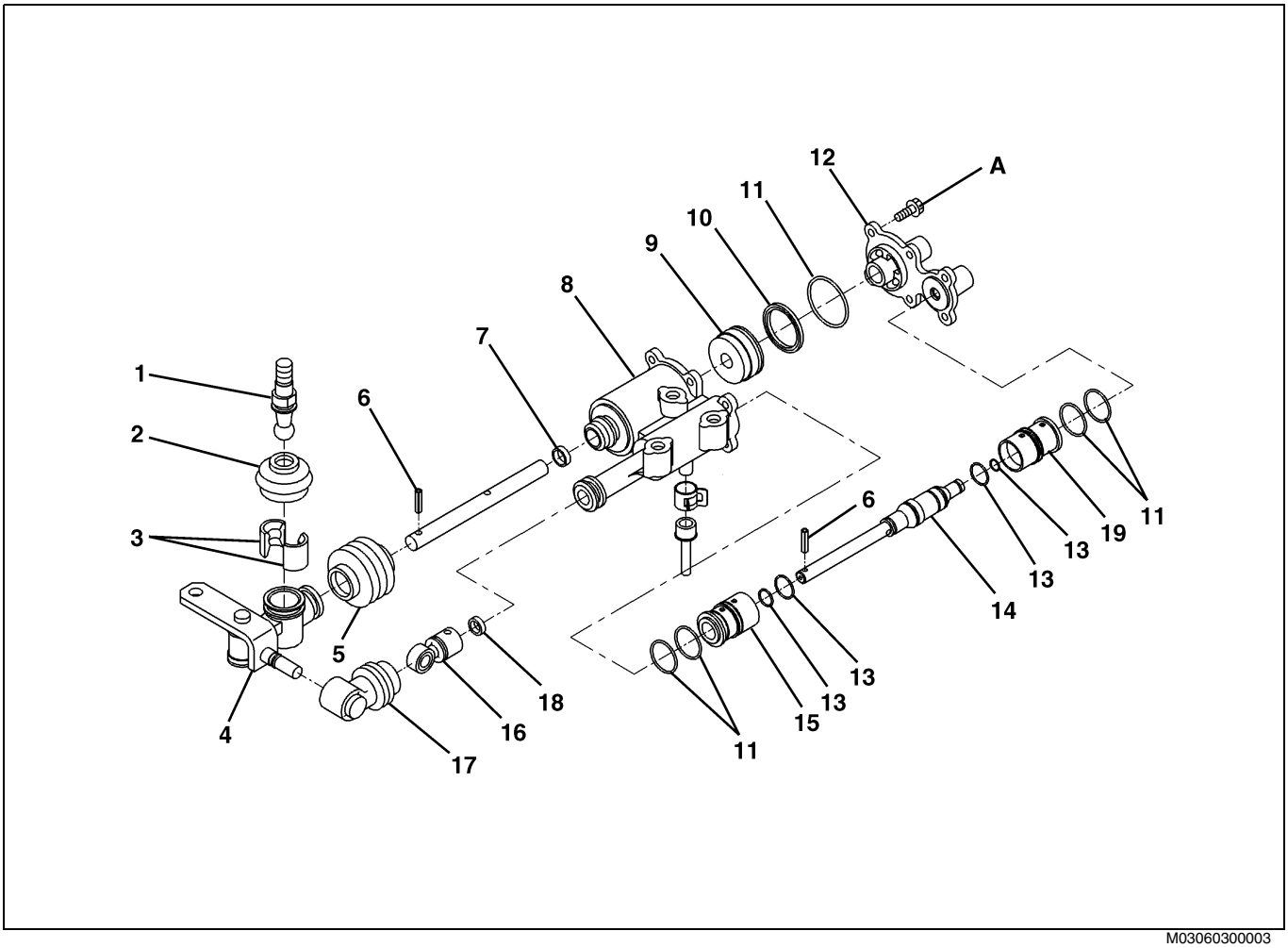
M03060301BEK1002




M03060300002

# COMPONENT LOCATOR

M03060301BED1002




M03060300003

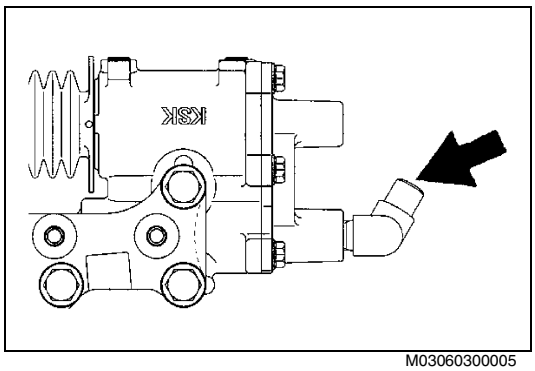
| | | | |
|---|---|---|---|
| 1 | Ball joint stud | 11 | O-ring |
| 2 | Dust boot C | 12 | Cover |
| 3 | Ball joint | 13 | Valve seal |
| 4 | Joint | 14 | Power shift valve sub-assembly |
| 5 | Dust boot A | 15 | Valve seat A |
| 6 | Spring pin | 16 | Ball joint assembly |
| 7 | Rod seal A | 17 | Dust boot B |
| 8 | Booster cylinder | 18 | Rod seal B |
| 9 | Piston | 19 | Valve seat B |
| 10 | Piston seal | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 4.0-7.8 {40-80, 2.9-5.7} | | |

# OVERHAUL

M03060301BEH2002

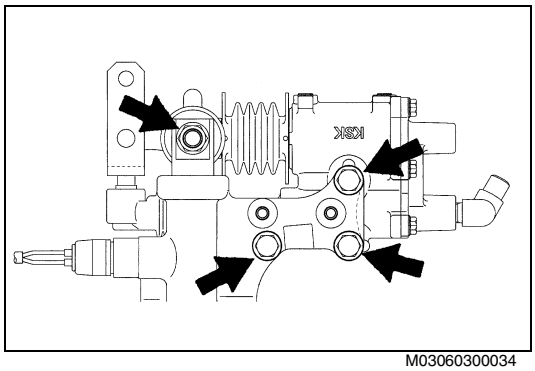

M03060300005

## IMPORTANT POINT - DISMOUNTING

**1. REMOVE THE AIR PIPE AND AIR HOSE OF THE POWER SHIFT.**

(1) Loosen the flare nuts of air pipe and air hose on the side of the power shift unit to remove the pipe and hose.

**NOTICE:**
**Cover the removed air pipe, air hose and power shift unit to prevent foreign materials from entering.**


M03060300034

## IMPORTANT POINT - MOUNTING

**1. MOUNT THE POWER SHIFT.**

(1) Mount the power shift to the transmission assembly.
**Tightening Torque:**
**40.2-46.1 N·m {410-470 kgf·cm, 30-33 lbf·ft}**

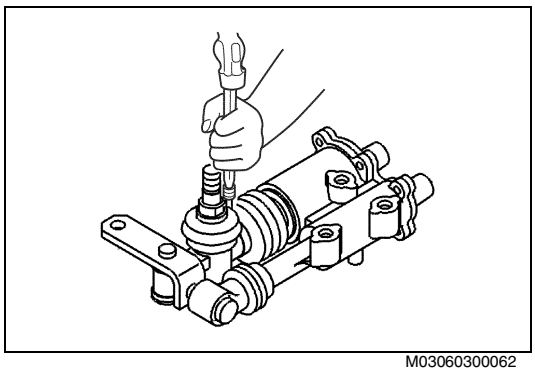
(2) Install the shift lever shaft to the power shift.
**Tightening Torque:**
**75.5-91.2 N·m {770-929 kgf·cm, 56-67 lbf·ft}**

## IMPORTANT POINTS - DISASSEMBLY

**1. CAUTIONS DURING DISASSEMBLY**

(1) In order to maintain airtightness, handle all parts with care and do not forcefully remove any parts.

(2) Disassembly and assembly should be done in a clean position. Especially, remove dirt and dust attached to exterior parts before disassembling them and do operation with bare hands when assembling them, being careful not to allow foreign materials to enter.


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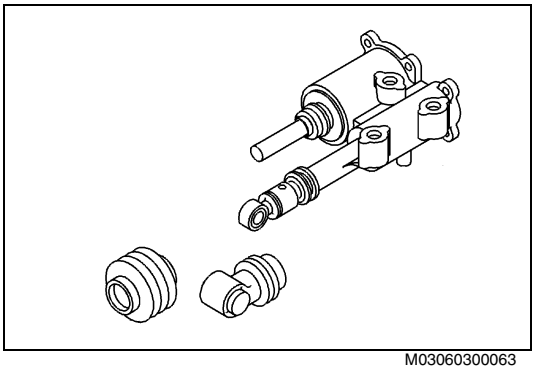
**2. DISASSEMBLE THE POWER SHIFT.**

(1) Remove the clips and exhaust hoses.

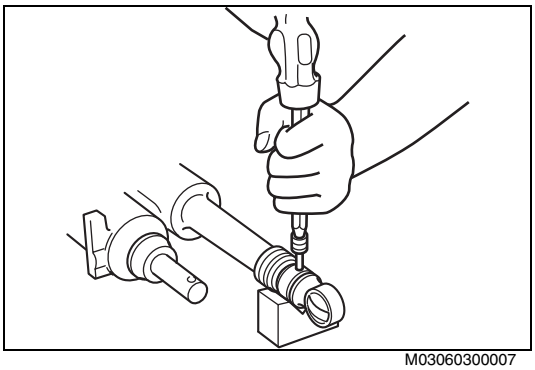
(2) Remove the boot C by inserting a spacer 13-15 mm {0.512-0.590 in} wide under the ball joint assembly and drive out the spring pin with a 5.0 mm {0.197 in.} diameter tapping rod.

(3) Remove the joint assembly.

**HINT:**
**If the fitting part of the rod and joint assembly cannot be removed, tap the joint assembly body lightly to remove it. At this time, be careful not to damage the rod part in the booster cylinder.**

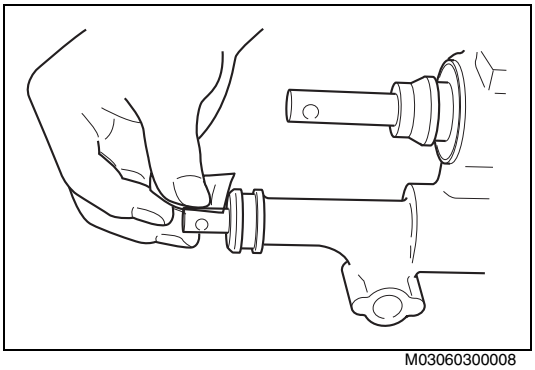

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(4) Remove the boot A and B.


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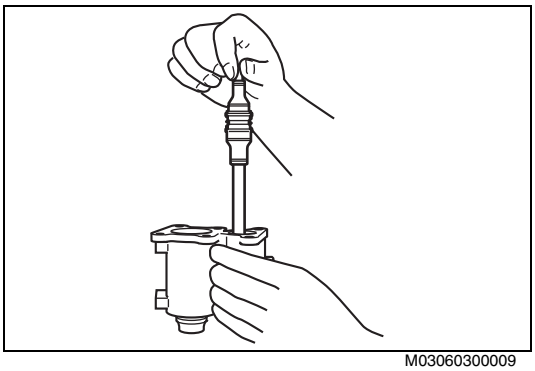
(5) Put the ball joint assembly on the jig A and drive out the spring pin with a tapping rod to remove the ball joint assembly.

**HINT:**
**If the fitting part of the rod and ball joint assembly cannot be removed, tap the ball joint assembly body lightly to remove it. At this time, be careful not to damage the rod part in the booster cylinder.**


M03060300008

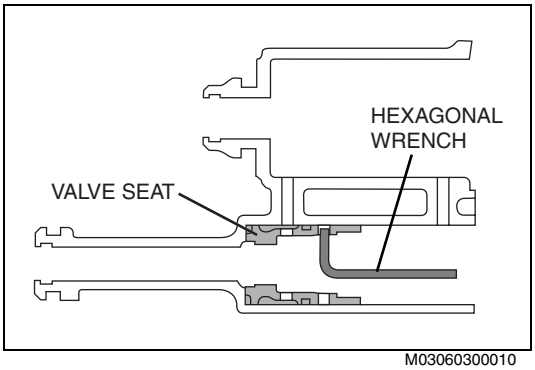
(6) When removing the power shift valve sub-assembly and piston from booster cylinder, rod seals can be damaged by holes for spring pin at the end. So wipe off grease on the end of the shaft and make sure that there is no flaws, burrs and gouge on the seals.

**NOTICE:**
**Remove flaws completely with a emery paper (No.1000) if there is any flaw, burr and gouge.**


M03060300009

**3. PULL OUT THE POWER SHIFT VALVE AND PISTON.**

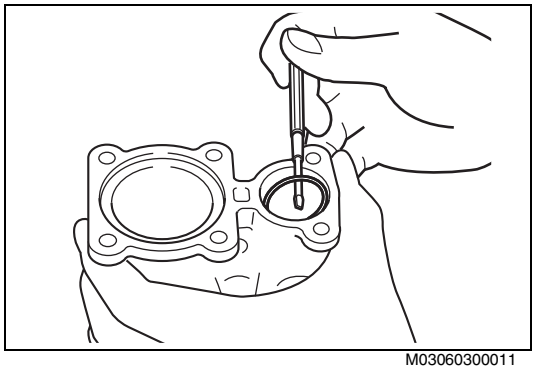
(1) Remove the power shift valve sub-assembly from the booster cylinder slowly.



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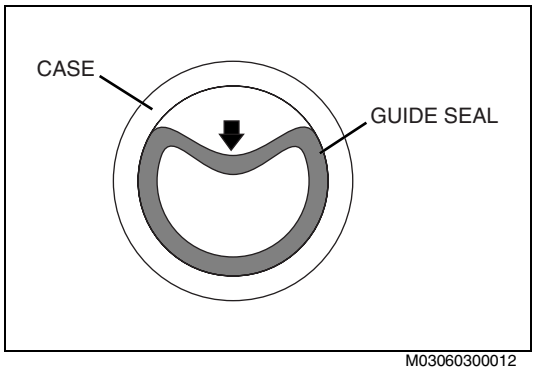
(2) Pull out the valve seat A by inserting a hexagonal wrench 4 mm {0.157 in.} width across flats into the hole of the valve seat A.

**NOTICE:**
**Be careful not to damage the inner surface of the cylinder.**


M03060300011

(3) Remove the O-ring on the inner part of the cylinder using a flat blade precision screwdriver etc.

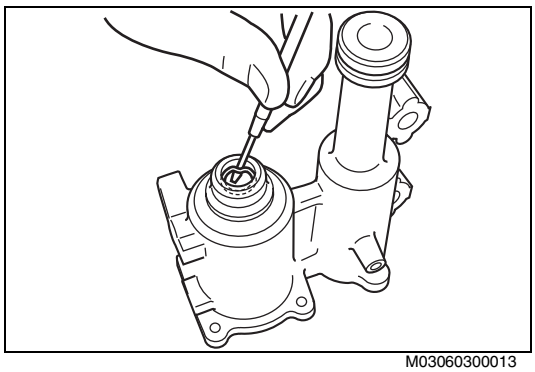
**NOTICE:**
**Be careful not to damage the inner surface of the cylinder.**



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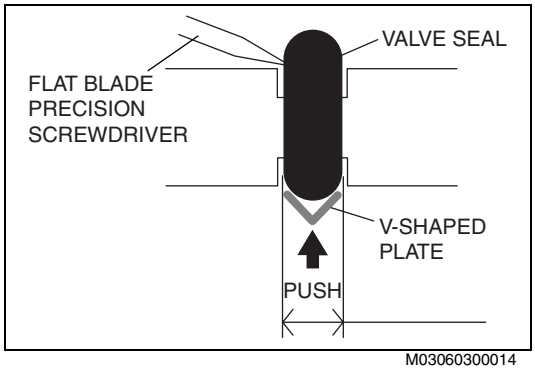
**4. REMOVE THE ROD SEALS.**

(1) Push aside the upper part of the rod seals inside slowly using a flat blade precision screwdriver etc.


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(2) Pull up the rod seals slowly by inserting another flat blade precision screwdriver between the cylinder and the rod seals with the rod seals pushed aside inside, and remove the rod seals.

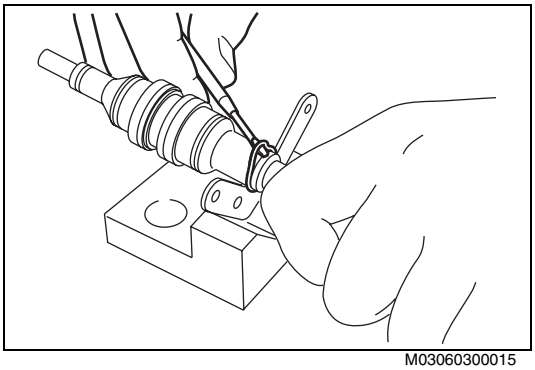
**NOTICE:**
**Be careful not to damage the inner groove of the cylinder by the point of the precision screwdiver etc.**



M03060300014

**5. REMOVE THE VALVE SEAL.**

(1) Attach the V-shaped plate 1.2-1.5 mm {0.0473-0.0590 in.} wide under the valve seal and push up the valve seal to rise it up.

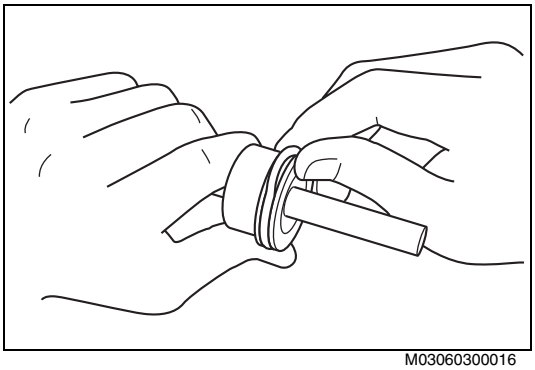

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(2) Remove the valve seal by inserting a flat blade precision screwdriver between the power shift valve sub-assembly and valve seal.

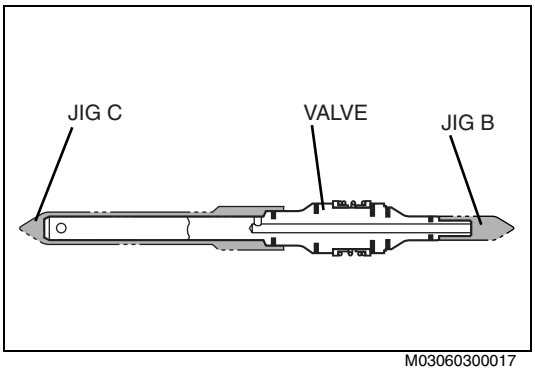
**NOTICE:**
**Be careful not to damage the valve shaft and valve seal.**

## IMPORTANT POINTS - ASSEMBLY

**1. CAUTIONS DURING ASSEMBLY**
(1) In order to maintain airtightness, handle all parts with care and do not forcefully assemble any parts.
(2) Assemble parts carefully so that dirt and foreign materials do not enter the assembled parts.


M03060300016

**2. ASSEMBLE THE PISTON SEAL AND VALVE SEAL.**
(1) Apply silicone grease to the piston seal and install it to the piston.

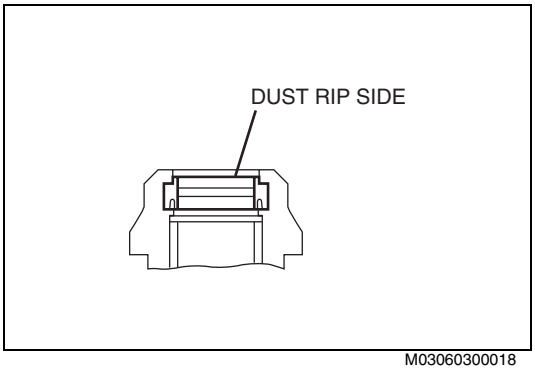


M03060300017

(2) Apply silicone grease to the valve seal A and B and install them to the valve sub-assembly using a jig B and a Jig C.

**NOTICE:**
**Be careful not to distort the valve seals.**

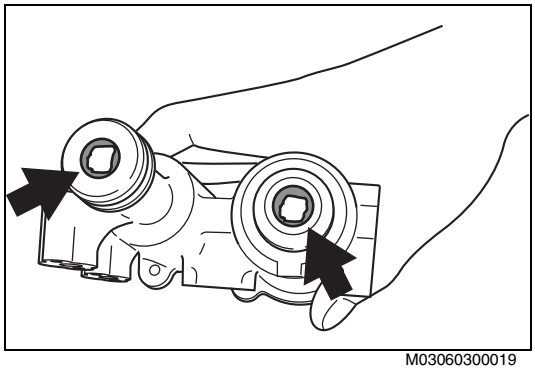
(3) Apply silicone grease to the valve seal C and D and install it to the valve sub-assembly.



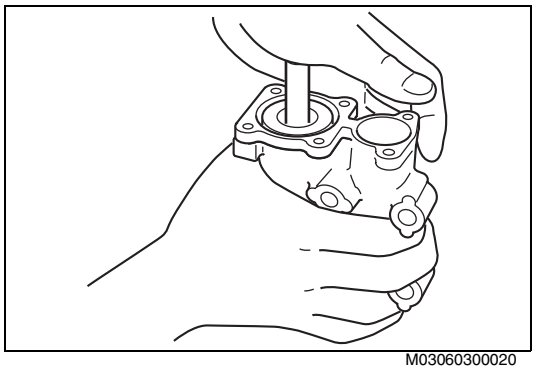
M03060300018

**3. ASSEMBLE THE ROD SEAL.**
(1) Push the rod seals in the booster cylinder, bending them to fit them in easily with fingers.
Install the rod seals into the groove of the booster cylinder surely using a flat blade precision screwdriver.

**NOTICE:**
- **Be careful of installing direction of the rod seals.**
- **Be careful not to damage the lip part of the booster cylinder and rod seals.**

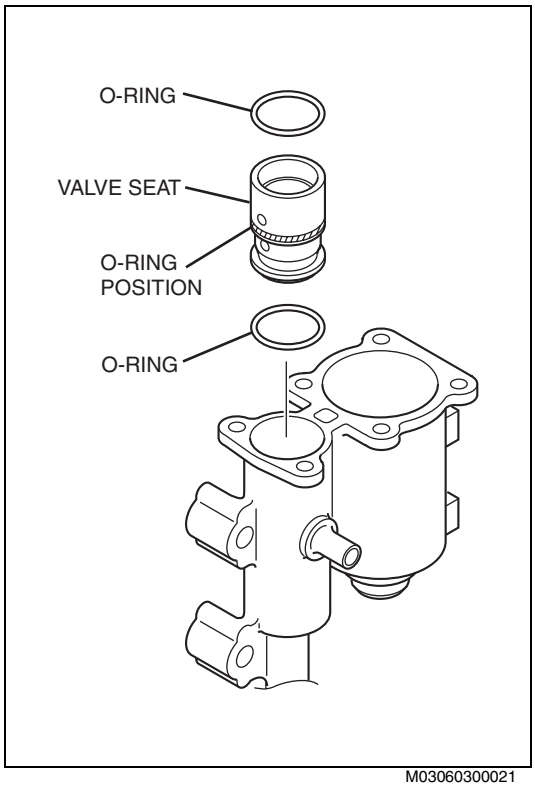

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(2) Apply silicone grease to the inner surface of the rod seals.


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**4. ASSEMBLE THE PISTON AND POWER SHIFT VALVE SUB-ASSEMBLY.**

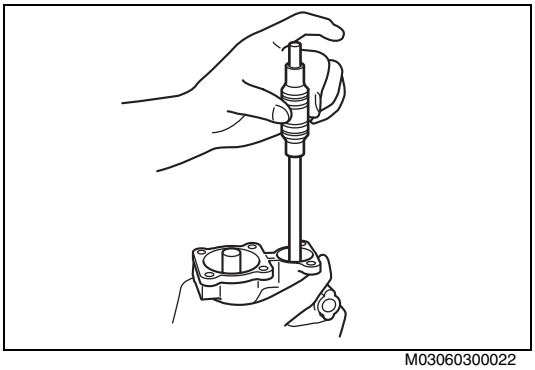
(1) Apply silicone grease to the inner surfaces of the valve cylinder part and piston cylinder part in the booster cylinder.
(2) Apply silicone grease to the outer periphery of the piston seal and insert the piston assembly into the booster cylinder slowly.



M03060300021

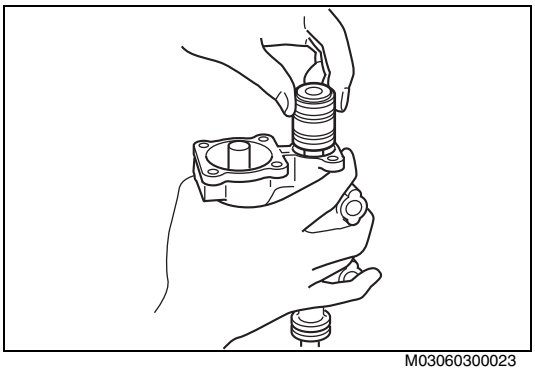
(3) Insert the O-ring into the inner part of the booster cylinder.
(4) Fit the O-ring to the outer periphery of the valve seat A.
(5) Apply silicone grease to the inner surface of the valve seat A and insert it into the inner part of the booster cylinder slowly.

**NOTICE:**
**Be careful of inserting direction of the valve seat.**


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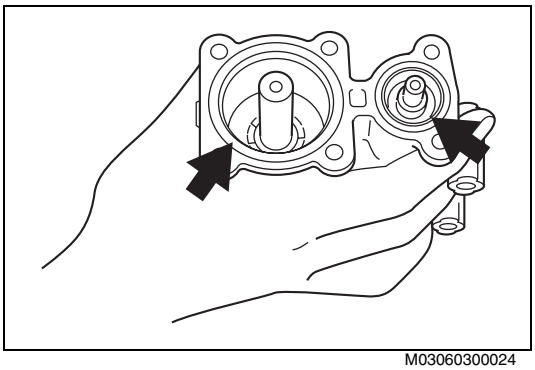
(6) After applying silicone grease to the outer periphery of the valve seal, insert the valve sub-assembly into the booster cylinder slowly.

(7) Fit the O-ring to the valve seat B.


M03060300023

(8) Apply silicone grease to the inner surface of the valve seat B and insert it into the booster cylinder slowly.

**NOTICE:**
**Be careful of inserting direction of the valve seat.**


M03060300024

**5. INSTALL THE COVER.**

(1) Install the O-ring to the booster cylinder.

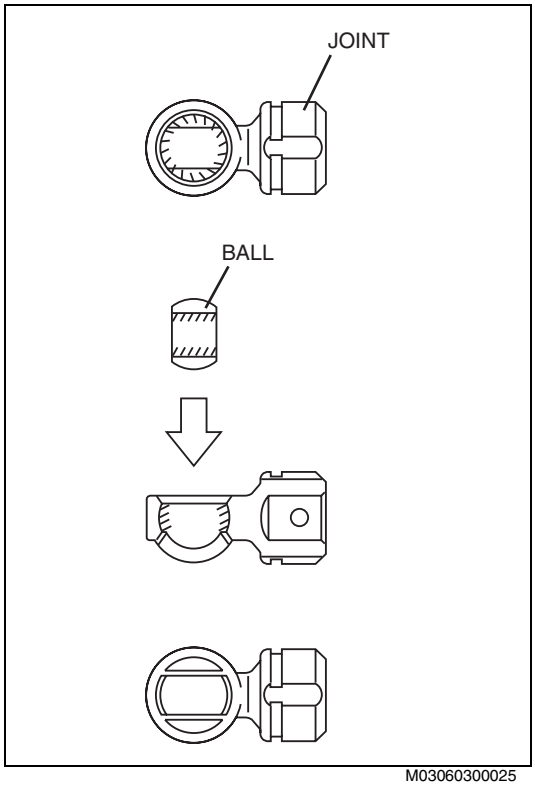
(2) Apply silicone grease to the inner surface of the bearing in the cover and install the cover to the booster cylinder.

**NOTICE:**
**Tighten the bolts in twice to prevent the cover from distorting due to warp of the cover.**

**6. CHECK THE OPERATION.**

(1) By moving the top of piston 3 or 4 times, make sure that it moves smoothly and sliding resistance is 9.8 N {1 kgf, 2.2 lbf} or less.

(2) Move the valve sub-assembly to male sure that its motion is smooth without binding.

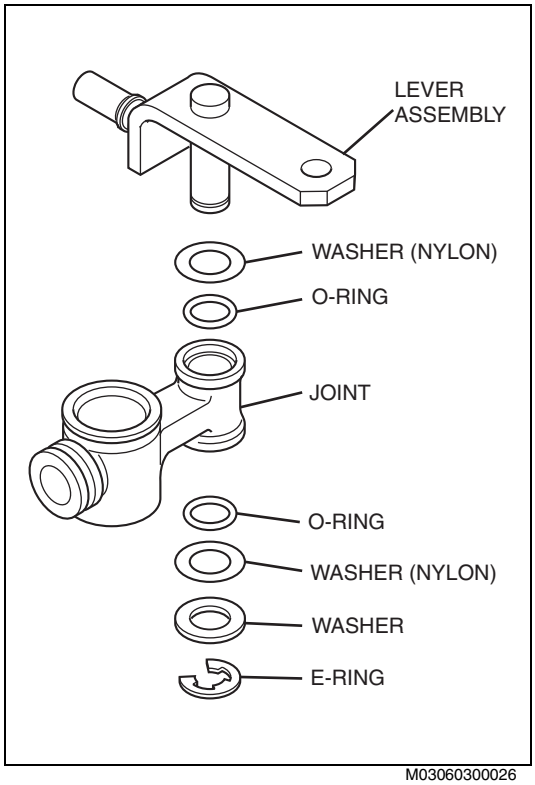


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**7. ASSEMBLE THE BALL JOINT ASSEMBLY.**

(1) Apply silicone grease to the whole of the ball and the inner surface of the ball joint case.

(2) Install the ball with it stood into the joint.



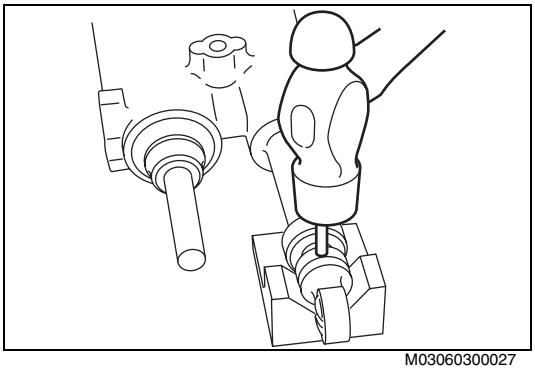
M03060300026

**8. ASSEMBLE THE JOINT ASSEMBLY.**

(1) Apply silicone grease to the O-ring and the inner surface of the joint.

(2) Install each component part to the lever assembly and install the E-ring.

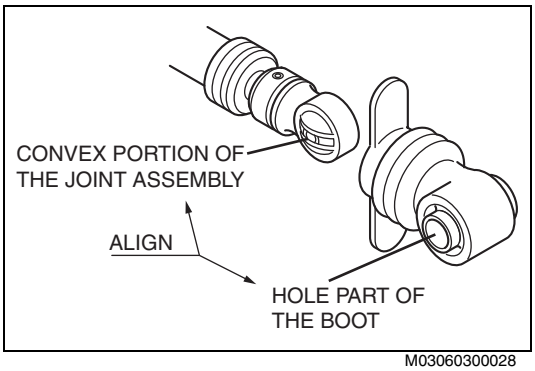
**NOTICE:**
**Be careful of installing position of the joint.**


M03060300027

**9. ASSEMBLE THE BALL JOINT ASSEMBLY.**

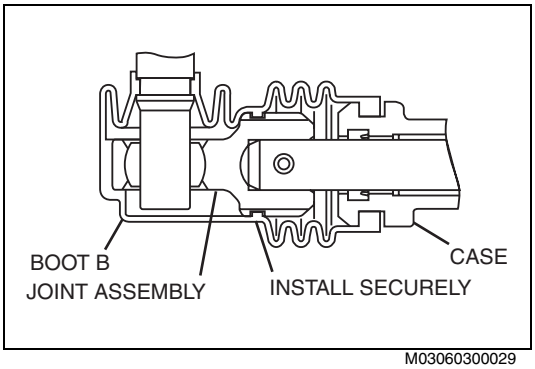
(1) Put the ball joint assembly on a jig A and align the hole of the valve assembly with the ball joint assembly to drive a new spring pin into them.

(2) Cover the ball joint assembly with the dust boot B and install the dust boot B into the groove of the booster cylinder.

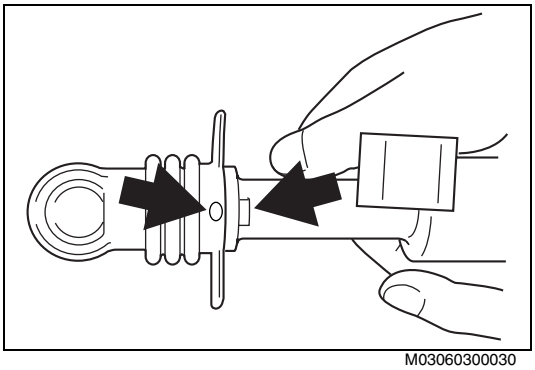


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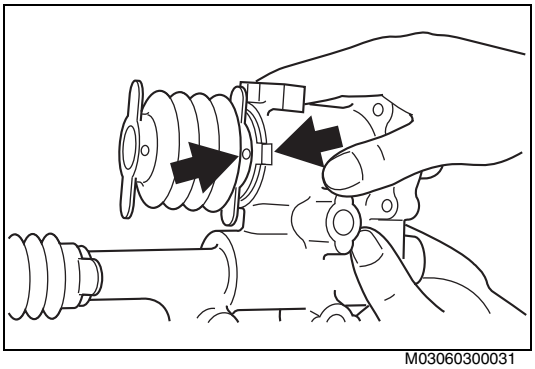
(3) Cover the convex portion of the ball joint assembly with the dust boot B, aligning the convex portion with the hole part of the dust boot B.
Install the inner convex portion of the dust boot B into the groove of the ball joint assembly securely.



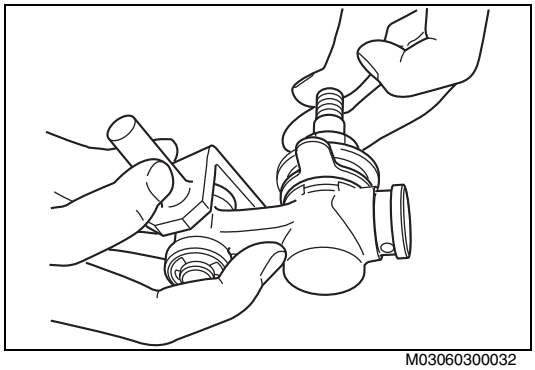
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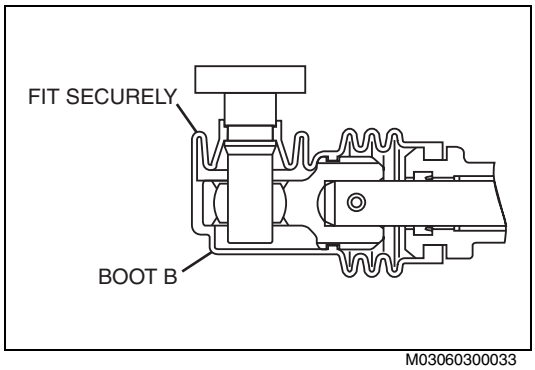
(4) Align the concave mark with the convex mark of boot B.


M03060300031

(5) Install the boot A to the groove of the booster cylinder and align the concave mark of the boot A with the convex mark of the booster cylinder.

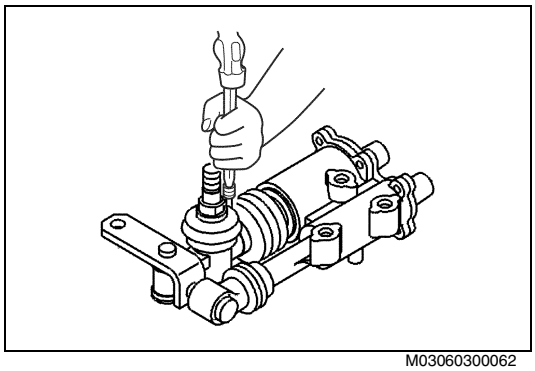

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(6) Apply silicone grease to the inner surface of the boot C and install it to the joint assembly.



M03060300033

(7) Insert the top of the lever of the joint assembly to the boot B strongly.
Fit the boot B to the groove of the lever securely.


M03060300062

(8) Insert a spacer 13-15 mm {0.512-0.590 in.} wide under the ball joint assembly.
And align the hole position of the ball joint assembly with the one of piston to drive the spring pin into them using a 7-8 mm {0.2756-0.3149 in.} diameter tapping rod.

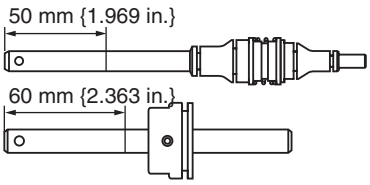
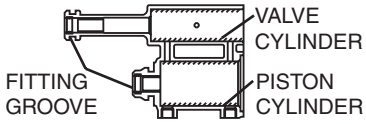
## IMPORTANT POINT - INSPECTION

**1. INSPECT AIR LEAKAGE.**

(1) Supply the compressed air of 735 kPa {7.5 kgf/cm$^2$, 107 lbf/in$^2$} and mark sure of the neutral of the valve and the valve operation of the both pushing and pulling direction.

# INSPECTION AND REPAIR

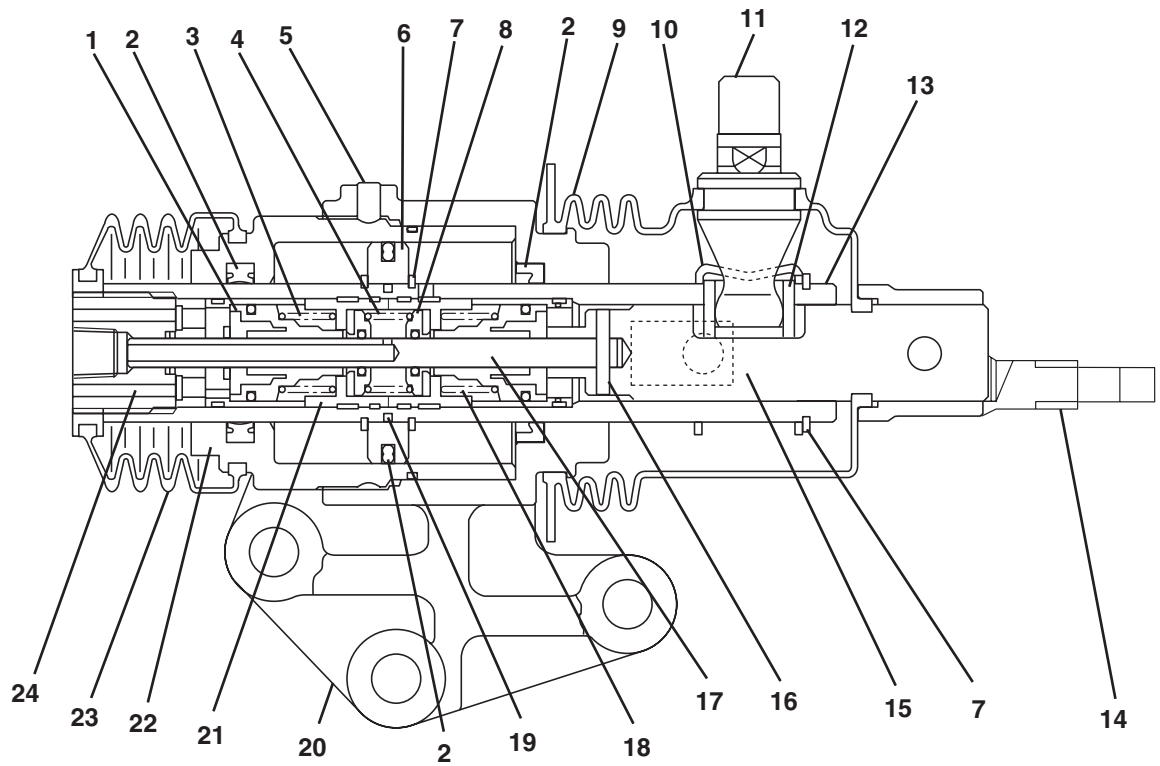
M03060301BEH3002

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Valve seal, piston seal and dust boot:<br>Setting, hardening, wear and deformation | — | — | Replace with new one, if necessary. | Visual check |
| Piston and power shift sub-assembly:<br>Flaws and scratches due to wear in the sliding surface A and B as shown in figure. | A:50 mm {1.969 in.}<br>B:60 mm {2.363 in.} | — | Replace, if there is any flaw and scratch.<br>Remove flaws with a emery paper (No.1000) if it is slightly. | Visual check<br>  |
| Piston cylinder part and valve cylinder part:<br>Flaws and scratches | — | — | Replace, if there is any flaw and scratch.<br>Remove flaws with a emery paper (No.1000) if it is slightly. | Visual check<br>  |
| Fitting groove part for rod seals:<br>Flaws and scratches | — | — | Replace, if necessary. | |
| Mesh filter of the cover:<br>Dirtiness and adhesion of foreign materials | — | — | Clean the parts. | Visual check |
| Other parts:<br>Wear, play and damage | — | — | Replace, if necessary. | Visual check and measure |

# POWER SHIFT (FOR MF06 TRANSMISSION)

## DESCRIPTION

M03060301BEC1003



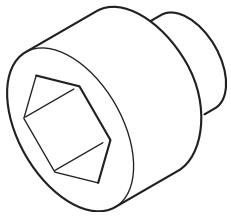
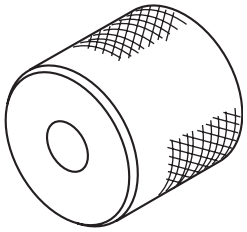
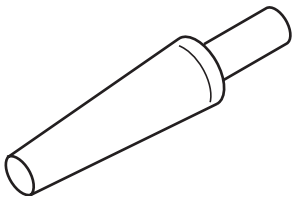
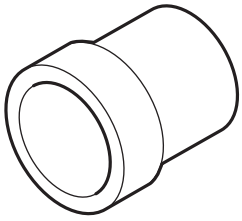

M03060300037

| | | | |
|---|---|---|---|
| 1 | Valve lifter | 13 | Shifter rod |
| 2 | Seal ring | 14 | Gear control lever |
| 3 | Spring "A" | 15 | Actuating rod |
| 4 | Spring "B" | 16 | Straight pin |
| 5 | Set screw | 17 | Pipe |
| 6 | Piston | 18 | Spring "C" |
| 7 | Retainer ring | 19 | O-ring |
| 8 | Valve seal | 20 | Housing |
| 9 | Boot "A" | 21 | Valve seat |
| 10 | Plate | 22 | Cylinder |
| 11 | Striker | 23 | Boot "B" |
| 12 | Guide sleeve | 24 | Connector |

# SPECIAL TOOL

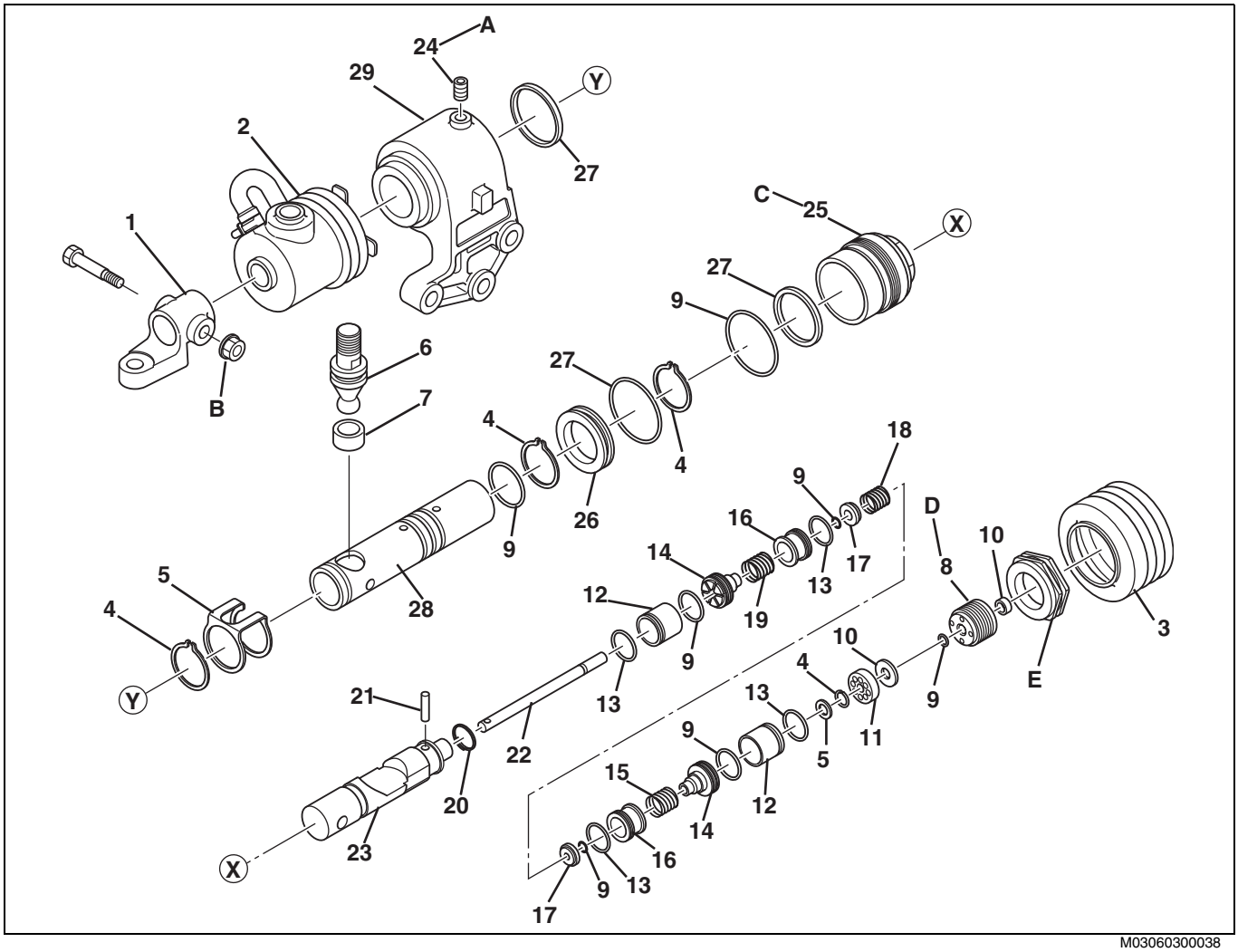
M03060301BEK1003

Prior to starting a power shift overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09622-1200 | SOCKET WRENCH | |
|  | 09665-1370 | INSERT TOOL | |
|  | 09665-1380 | INSERT TOOL | |
|  | 09665-1390 | SLEEVE | |

# COMPONENT LOCATOR

M03060301BED1003




M03060300038

| | | | |
|---|---|---|---|
| 1 | Gear control lever | 16 | Valve seat |
| 2 | Boot "A" | 17 | Valve seal |
| 3 | Boot "B" | 18 | Spring "B" |
| 4 | Retainer ring | 19 | Spring "A" |
| 5 | Plate | 20 | Clamp |
| 6 | Striker | 21 | Straight pin |
| 7 | Guide sleeve | 22 | Pipe |
| 8 | Connector | 23 | Actuating rod |
| 9 | O-ring | 24 | Set screw |
| 10 | Filter | 25 | Cylinder |
| 11 | Collar | 26 | Piston |
| 12 | Tube | 27 | Seal ring |
| 13 | Square ring | 28 | Shifter rod |
| 14 | Valve lifter | 29 | Housing |
| 15 | Spring "C" | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 1.9-3.4 {20-35, 1.5-2.5} | D | 7.8-11.7 {80-120, 5.8-8.6} |
| B | 23.5-26.5 {240-270, 18-19} | E | 58-68 {600-700, 44-50} |
| C | 98-117 {1,000-1,200, 73-86} | | |

# OVERHAUL

M03060301BEH2003

## IMPORTANT POINTS - DISASSEMBLY

**1. CAUTIONS DURING DISASSEMBLY**

(1) In order to maintain airtightness, handle all parts with care and do not forcefully remove any parts.

(2) Remove dirt and dust attached to exterior parts before disassembling them.

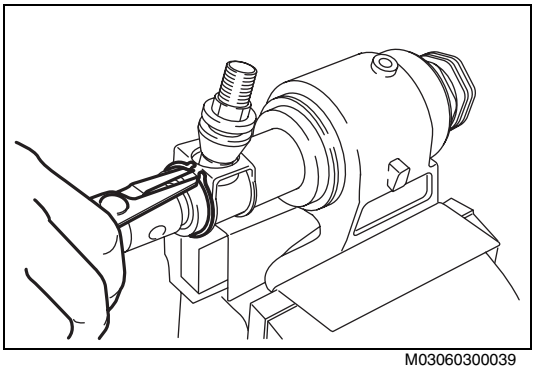
**2. REMOVING THE BOOTS**

(1) Remove the nut and the lever.

(2) Remove boots.

**3. REMOVING THE STRIKER**

(1) Remove the retainer ring, plate, guide sleeve and striker.



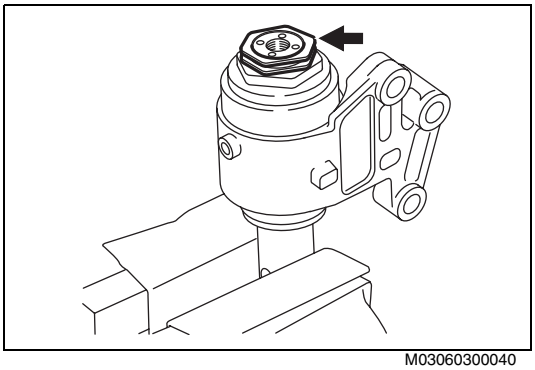
M03060300039

**4. REMOVING THE VALVE ASSEMBLY**

(1) Remove the nut.

**NOTICE:**

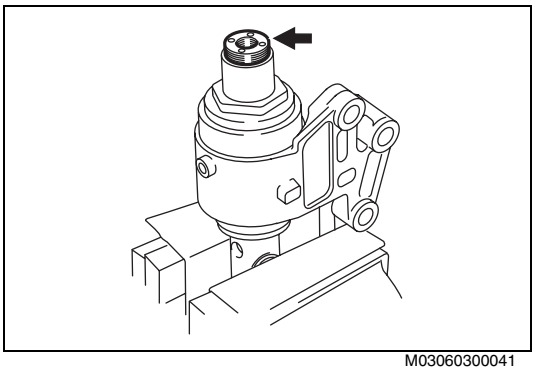
**When working with the shifter rod fixed in place, the guide sleeve should be left installed for greater stability.**



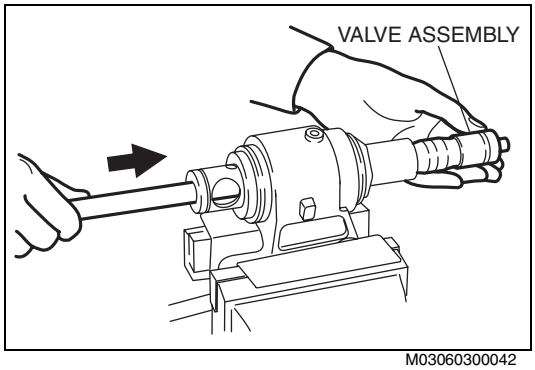
M03060300040

(2) Remove the connector.

(3) Remove the O-ring and filter from the connector.



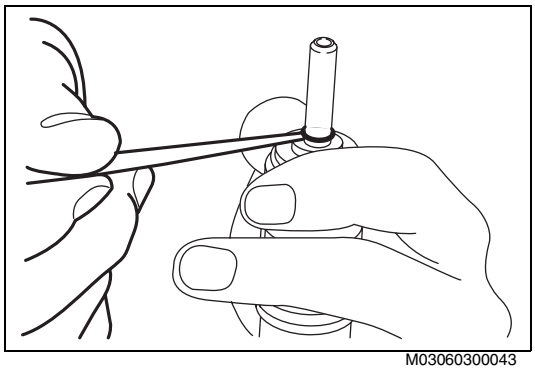
M03060300041



M03060300042

(4) Use a suitable bar or similar tool carefully push out the valve assembly.

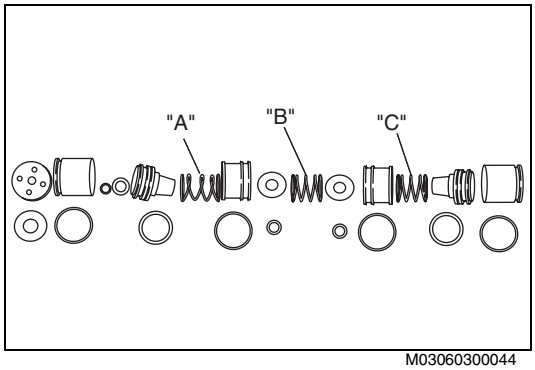
**NOTICE:**
**Avoid excessive force so that the valve seat and square ring are not damaged.**


M03060300043

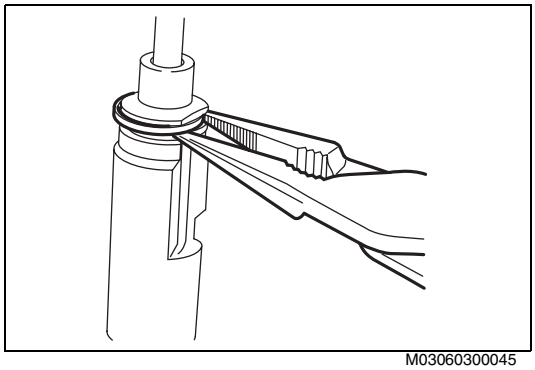
**5. DISASSEMBLING THE VALVE ASSEMBLY**

(1) Remove the collar with attached filter and the tube on one side.
(2) Use a pin or similar tool and remove the retainer ring, and then remove each parts.

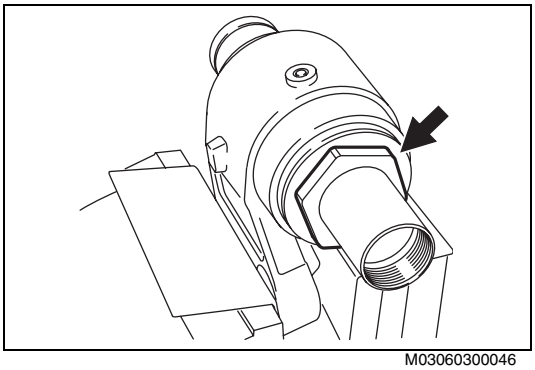
**NOTICE:**
**Keep springs "A","B" and "C" in order so that they are not installed in the wrong positions.**



M03060300044


M03060300045

(3) Remove the clamp. Then pull out the straight pin and disassemble the pipe and actuating rod.


M03060300046

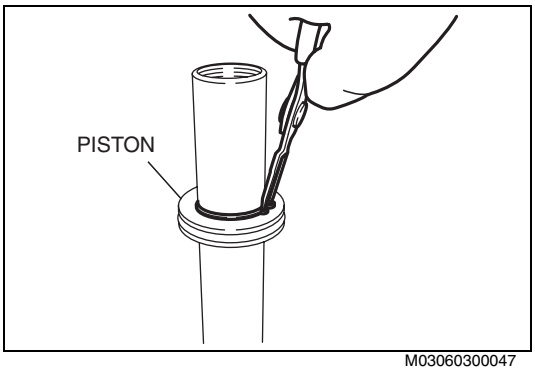
**6. REMOVING THE CYLINDER AND PISTON ASSEMBLY**

(1) Use a hexagonal socket wrench and remove the housing set screw.

(2) Loosen the cylinder threaded part with the special tool provided for that purpose, and remove the cylinder and piston assembly.
**SST: Socket wrench (09622-1200)**

**NOTICE:**
**Loosen the cylinder threaded part carefully because it is fixed with adhesive.**

(3) Remove the O-ring from the cylinder.



M03060300047

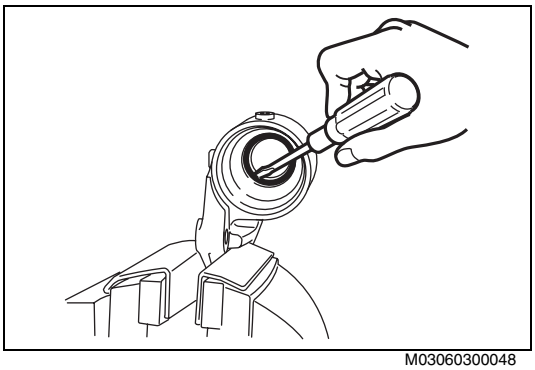
**7. DISASSEMBLING THE PISTON ASSEMBLY**

(1) Remove the retainer ring and the piston with attached seal ring.

(2) Remove the O-ring from the shifter rod and the retainer ring on the opposite side.

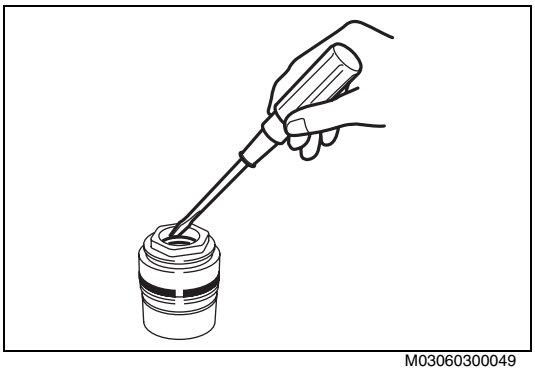
**NOTICE:**
**Be careful not to damage the shifter rod.**

(3) Remove the seal ring from the piston.


M03060300048

**8. REMOVING THE SEAL RING INSIDE THE HOUSING AND CYLINDER**

(1) Remove the plate holding the seal ring inside the housing, and take out the seal ring.


M03060300049

(2) Using a slotted screwdriver or similar tool, remove the seal ring inside the cylinder.

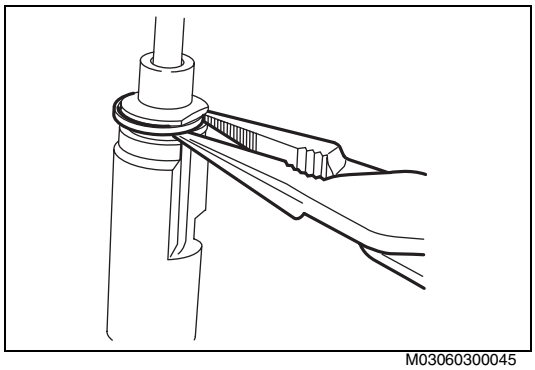
**NOTICE:**
**Be careful not to damage the cylinder.**

## IMPORTANT POINTS - ASSEMBLY

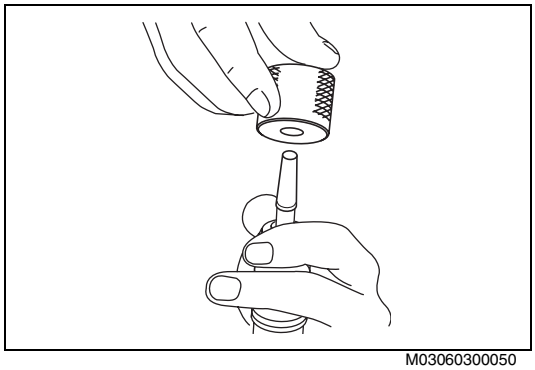
**1. CAUTIONS DURING ASSEMBLY**

(1) To maintain airtightness, handle all parts with care and do not forcefully assembly any parts.
(2) Assemble parts carefully so that dirt and foreign objects do not enter the assembled parts.

**2. ASSEMBLING THE VALVE ASSEMBLY**


M03060300045

(1) Insert the straight pin into the actuating rod and install the pipe.
(2) Install the clamp.
(3) Apply grease (Airmaster Paste) to the new part's O-ring and square ring.
(4) Install O-rings on the valve seal and valve lifter.
(5) Install square ring on the valve seat and tube.

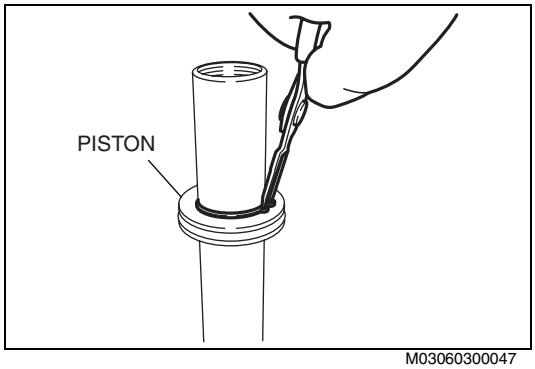

M03060300050

(6) Install the tube, valve lifter, spring, valve seat, and valve seal, and plate on the pipe.
(7) Using the special tool, install a new retainer ring in the pipe groove.
**SST:**
**Insert tool (09665-1370)**
**Insert tool (09665-1380)**

**NOTICE:**
- **Do not deform the retainer ring.**
- **Make sure the retainer ring is securely installed in the groove.**

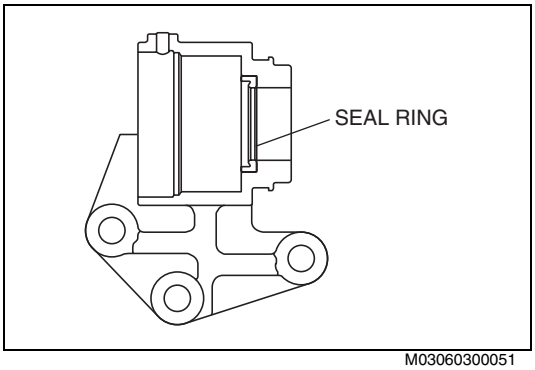
(8) Install the collar with attached filter.

**3. ASSEMBLING THE PISTON ASSEMBLY**



M03060300047

(1) Apply grease (Airmaster Paste) to the new seal ring and piston.
(2) Install a new retainer ring in one side of the shifter rod groove.
(3) Install a new O-ring on the shifter rod.
(4) Insert the piston into the shifter rod and install a new retainer ring in the shifter rod groove on the opposite side.
(5) Measure the retainer ring mating face gap and make sure the retainer ring is securely installed in the shifter rod groove.
**Standard value: Less than 6 mm {0.2362 in.}**

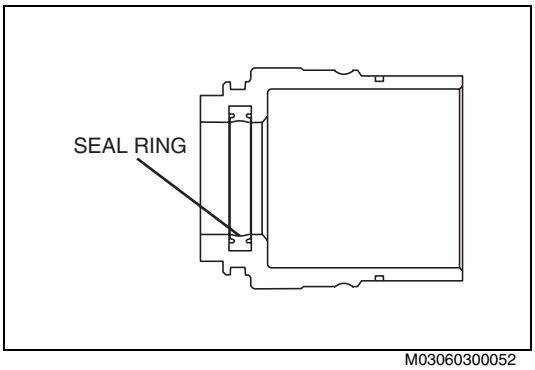


M03060300051

**4. INSTALLING THE SEAL RING INSIDE THE HOUSING AND CYLINDER**

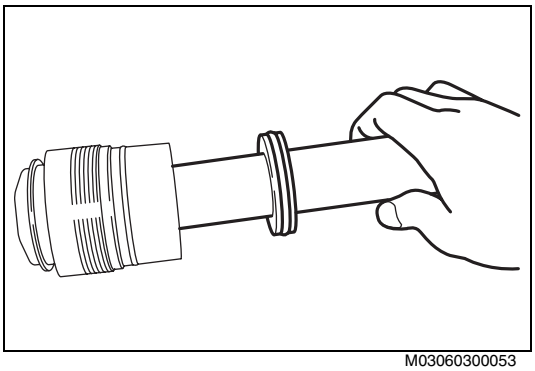
(1) Apply grease (Airmaster Paste) to the new seal ring.
(2) Install the seal ring inside the housing, making sure it is in the right direction.

**NOTICE:**
**If the seal ring is installed in a wrong direction, air will leak out.**



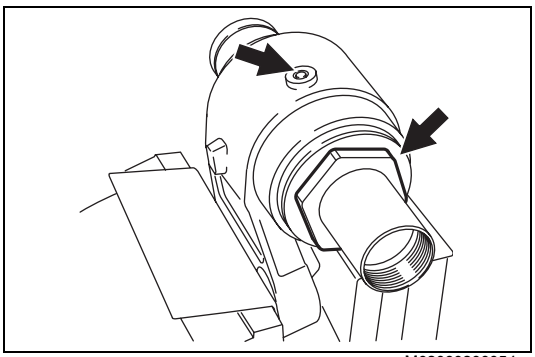
M03060300052

(3) Apply grease (Airmaster Paste) to the new seal ring.
(4) Install the seal ring in the cylinder.


M03060300053

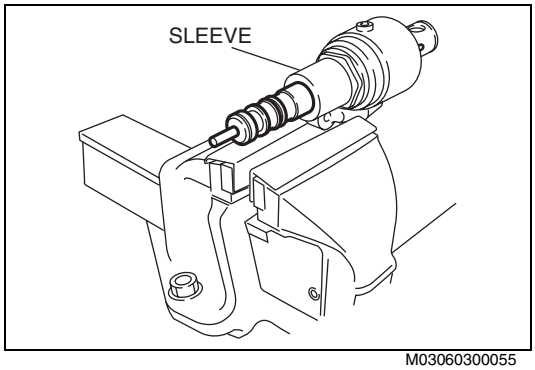
**5. INSTALLING THE CYLINDER AND PISTON ASSEMBLY**

(1) Apply grease (Airmaster Paste) to the new O-ring and install the O-ring on the cylinder.
(2) Assemble the piston assembly on the cylinder.


M03060300054

(3) Apply an adhesive to the cylinder threaded part (LOCTITE 242 or ThreeBond 1401B), and install the cylinder in the housing.
(4) Tighten the cylinder threaded part, using the special tool provided for that purpose.
**SST: Socket wrench (09622-1200)**

(5) Install a new set screw in the housing, using a hexagonal socket wrench.
(6) Caulk two points between the housing and set screw, using a center punch or hammer.



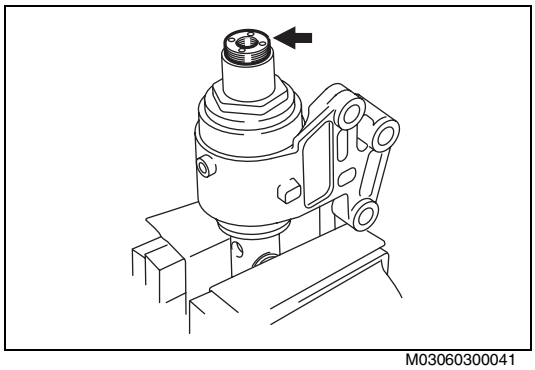
M03060300055

**6. INSTALLING THE VALVE ASSEMBLY**

(1) Apply grease (Airmaster Paste) to the entire interior surface of the piston assembly shifter rod.

(2) Insert the valve assembly, into the shifter rod using the special tool provided for that purpose.
**SST: Sleeve (09665-1390)**

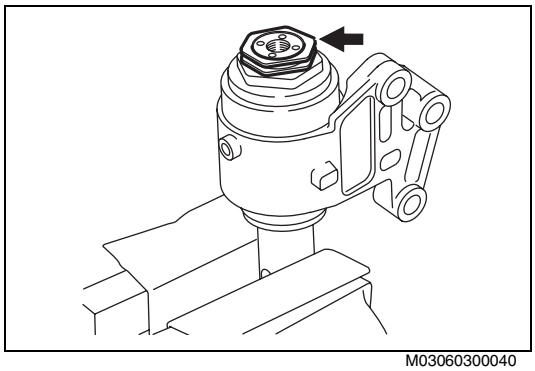
**NOTICE:**
**The special tool must be used because the shifter rod thread will damage the O-ring and square ring.**


M03060300041

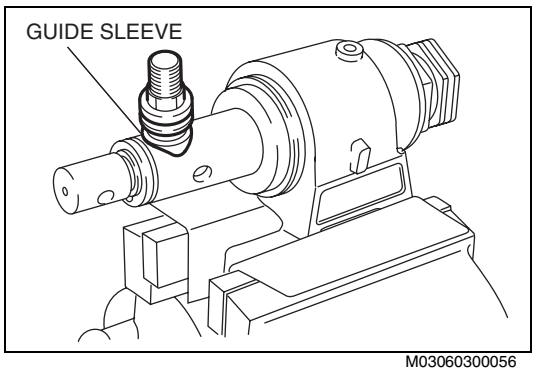
(3) Install a new O-ring and filter on the connector.

(4) Install the connector.

**NOTICE:**
- **The connector tightening torque must be observed to avoid damaging the valve.**
- **When working with the shifter rod fixed in place, the guide sleeve should be left installed for greater stability.**


M03060300040

(5) Install the nut.



M03060300056

**7. INSTALLING THE STRIKER**

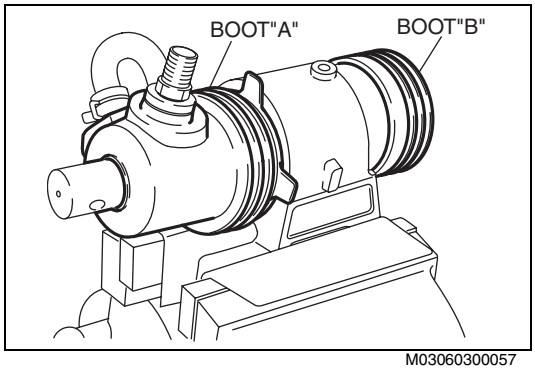
(1) Apply grease (Airmaster Paste) to the guide sleeve, shifter rod, and striker.

(2) Line up the actuating rod flat surface and the shifter rod and guide sleeve installation hole, and then install the guide sleeve and striker.

(3) Install the plate.

(4) Install a new retainer ring in the shifter rod groove.

(5) Measure the retainer ring mating face gap and make sure that retainer ring is securely installed in the shifter rod groove.
**Standard valve: Less than 6 mm {0.2362 in.}**



M03060300057

**8. INSTALLING THE BOOTS**

(1) Install boot "B" over the nut and cylinder groove.

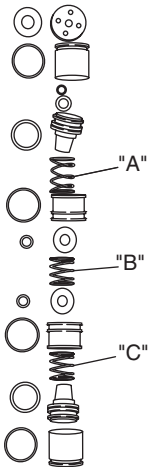
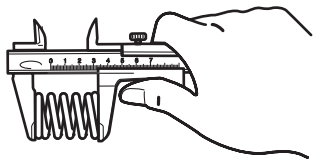
**NOTICE:**
**Install boot "B" so that the drip hole is at the bottom.**

(2) Install boot "A" over the housing, actuating rod, and striker groove.

(3) Install the lever on the actuating rod with a bolt and nut.

# INSPECTION AND REPAIR

M03060301BEH3003

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Spring length**<br>  | **"A":**<br>**41.3 (38.8-43.7) mm**<br>**{1.53-1.72 in.}**<br><br>**"B":**<br>**31.9 (30.0-33.8) mm**<br>**{1.18-1.33 in.}**<br><br>**"C":**<br>**25.0 (23.5-26.5) mm**<br>**{0.92-1.04 in.}** | | **Replace if the standard range is exceeded.** | **Measure**<br>  |
| **Boots wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check** |
| **Filter dirtiness** | **—** | **—** | **Replace, if necessary.** | **Visual check** |

# PROPELLER SHAFT (LF0932)

PP02-001

**PROPELLER SHAFT ASSEMBLY ..... PP02-2**
DATA AND SPECIFICATIONS ..... PP02-2
DESCRIPTION ..... PP02-2
TROUBLESHOOTING ..... PP02-3
SPECIAL TOOL ..... PP02-3
COMPONENT LOCATOR ..... PP02-4
OVERHAUL ..... PP02-6
INSPECTION AND REPAIR ..... PP02-12

# PROPELLER SHAFT ASSEMBLY

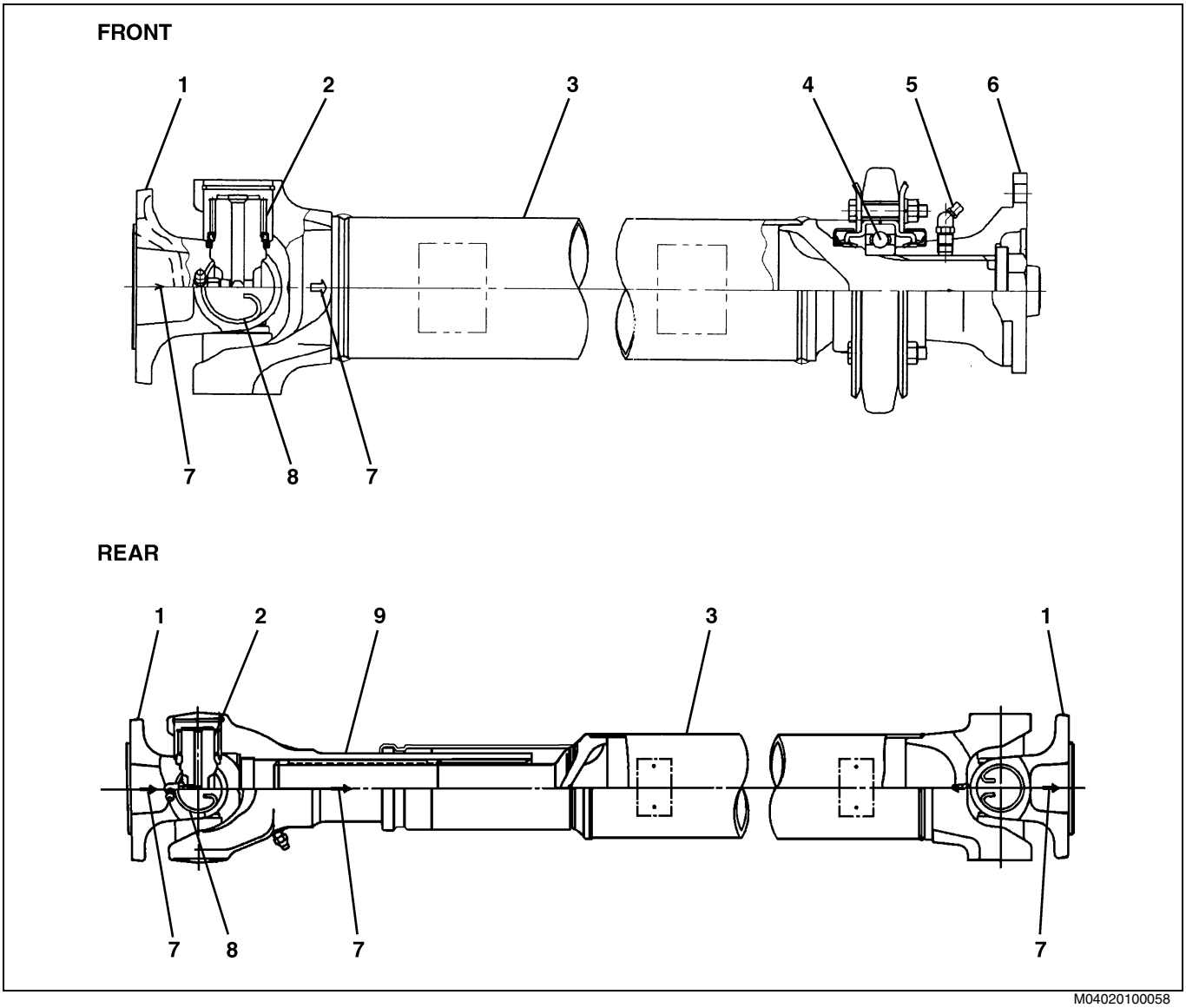
## DATA AND SPECIFICATIONS

M04020102BEI2001

| | |
|---|---|
| **Type** | **Tubular shaft type** |
| **Universal joint** | **All metal, round bearing type with needle roller bearing** |

## DESCRIPTION

M04020102BEC1001




M04020100058

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 6 | Flange |
| 2 | Needle roller bearing | 7 | Phasing arrow |
| 3 | Yoke shaft | 8 | Retainer ring |
| 4 | Center bearing | 9 | Sliding yoke |
| 5 | Lubrication fitting | | |

# TROUBLESHOOTING

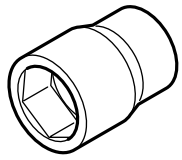
M04020102BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal vibration when driving.** | Looseness of universal joint yoke and flange tightening nuts. | Tighten the nuts. |
| | Looseness of universal joint flange lock nut. | Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely. |
| | Excessively bent propeller shaft. | Replace the shaft. |
| | Worn or damaged universal joint. | Replace the universal joint. |
| | Worn or damaged center bearing. | Replace the bearing. |
| | Worn or damaged center bearing rubber cushion. | Replace the rubber cushion. |
| | Incorrect phasing of the yokes. | Match the phasing arrows correctly. |

# SPECIAL TOOL

M04020102BEK1001

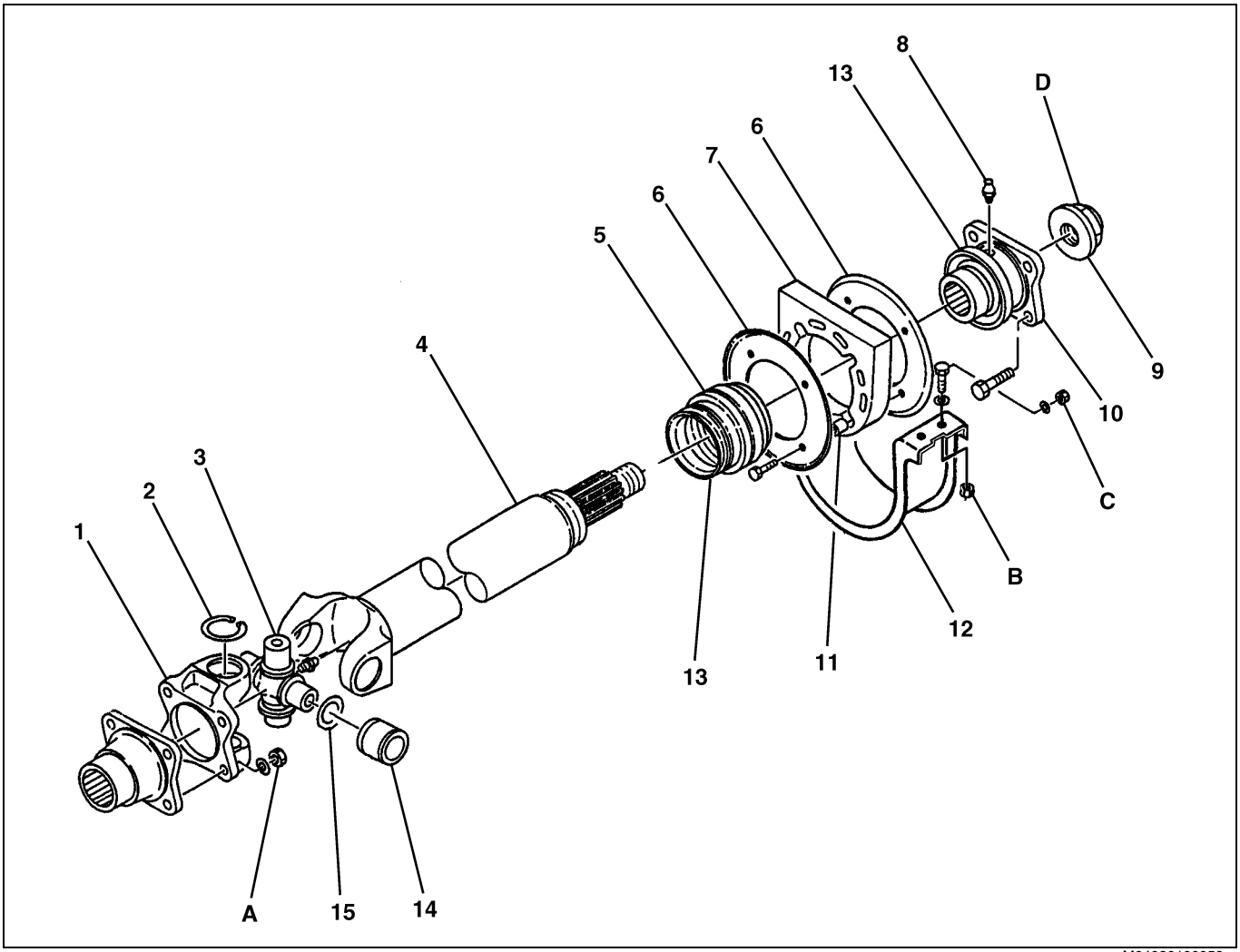
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-4104 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M04020102BED1002

## FRONT



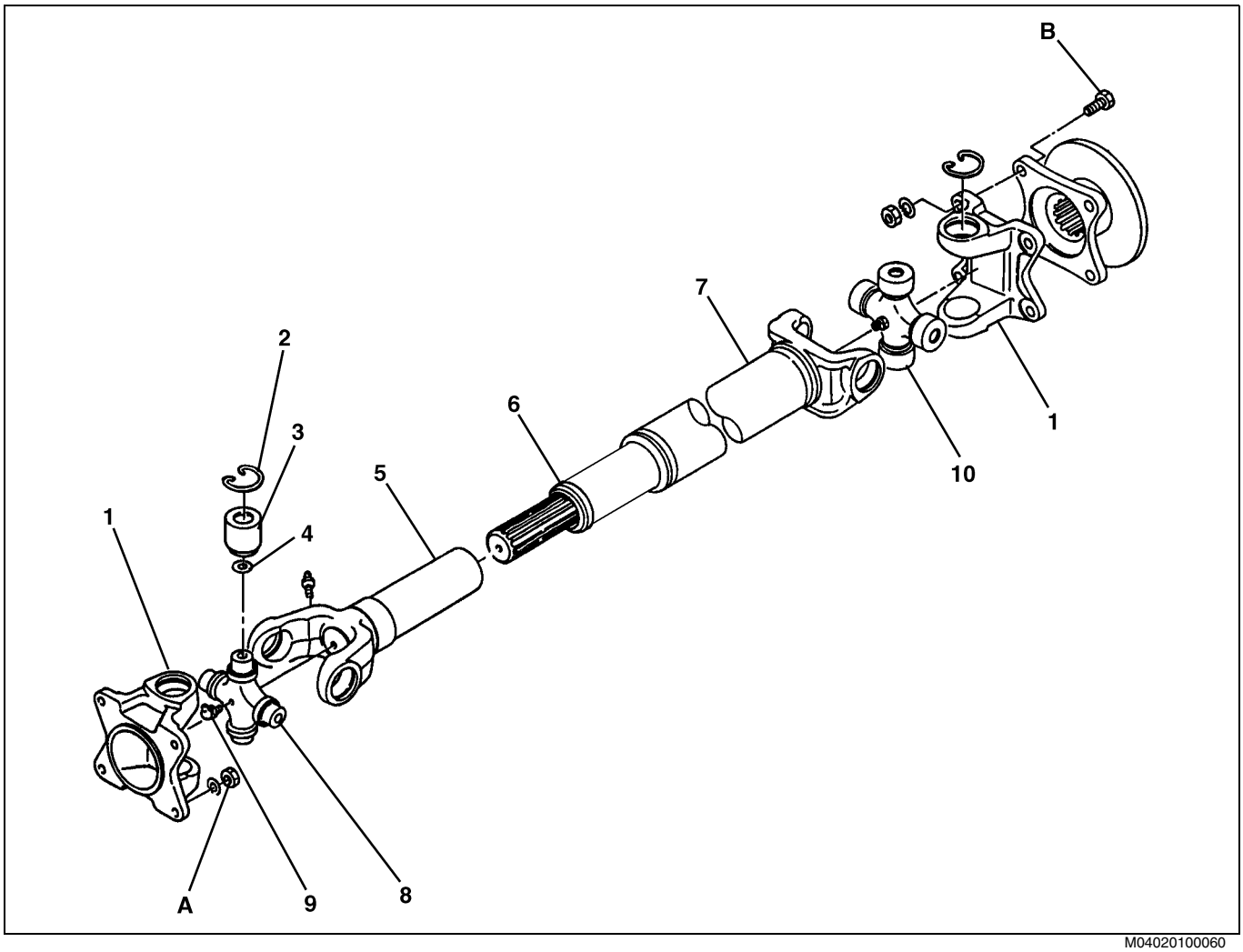

M04020100059

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 9 | Lock nut |
| 2 | Retainer ring | 10 | Flange |
| 3 | Universal joint spider | 11 | Collar |
| 4 | Yoke shaft | 12 | Center bearing holder |
| 5 | Center bearing | 13 | Dust deflector |
| 6 | Center bearing plate | 14 | Needle roller bearing |
| 7 | Center bearing cushion | 15 | Thrust washer |
| 8 | Lubrication fitting | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 61-91 {625-925, 45-66} | C | 22.4-30.6 {228-312, 17-22} |
| B | 41.5-61.5 {425-625, 31-45} | D | 588.4-784.6 {6,000-8,000, 434-578} |

## REAR




M04020100060

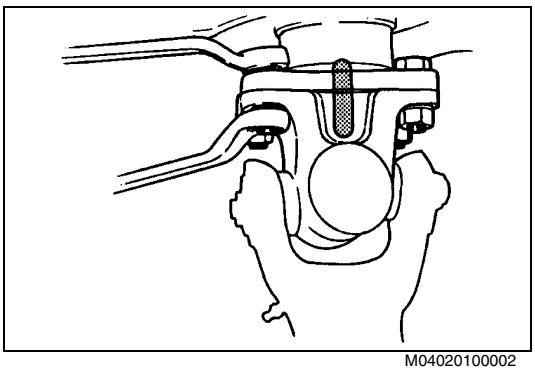
| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 6 | Dust cover seal |
| 2 | Retainer ring | 7 | Yoke shaft |
| 3 | Needle roller bearing | 8 | Universal joint spider |
| 4 | Thrust washer | 9 | Lubrication fitting |
| 5 | Sliding yoke | 10 | Universal joint assembly |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 61-91 {625-925, 45-66} | B | 61-91 {625-925, 45-66} |

# OVERHAUL

M04020102BEH2001


M04020100002

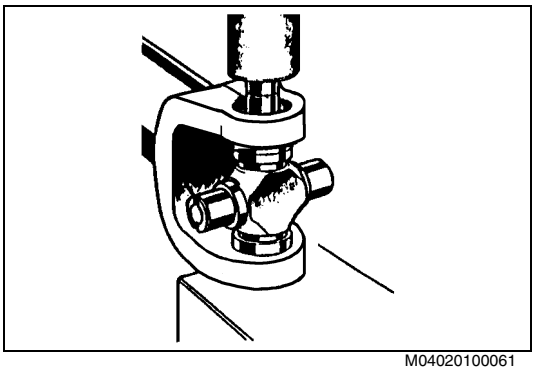
## IMPORTANT POINT - DISMOUNTING

**1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.**

(1) Make aligning marks on the flange and yoke.

(2) Remove the nuts and the bolts.

**NOTICE:**
**Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.**

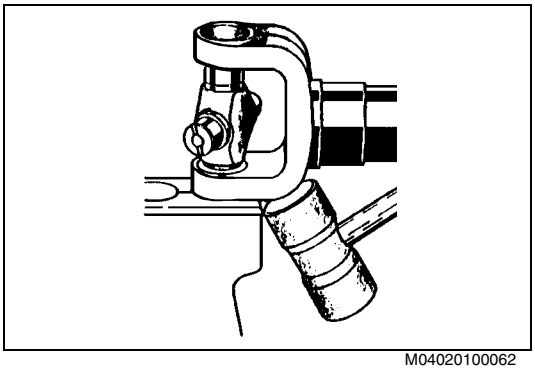

M04020100061

## IMPORTANT POINTS - DISASSEMBLY

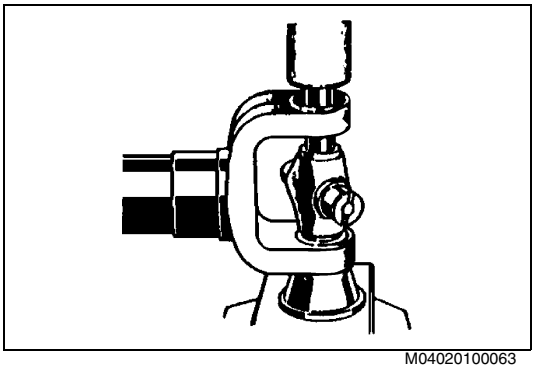
**1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.**

(1) Remove the retainer ring from the yoke.

(2) Position the yoke under the arbor press and push universal joint partially out of the yoke lug. The bearing race will now protrude from the yoke.


M04020100062

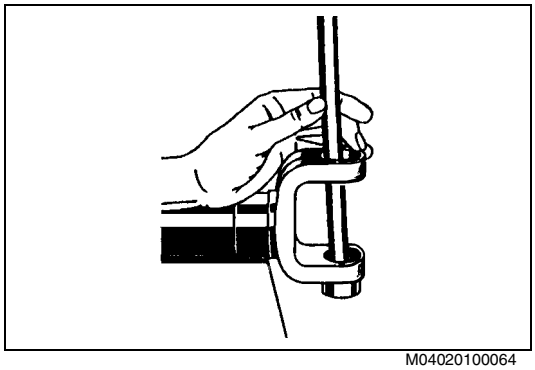
(3) Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise. Tap the yoke in area shown to achieve removal of universal joint bearing.


M04020100063

(4) Place the yoke under an arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.

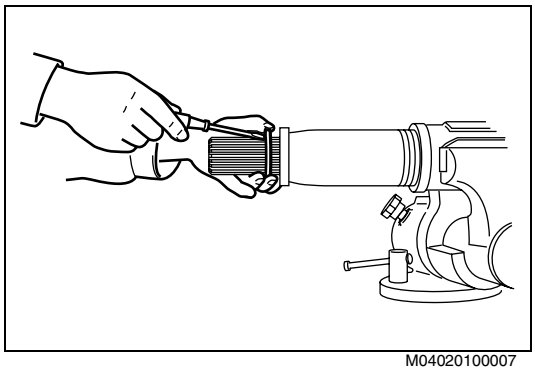
(5) Press the opposite bearing out of the yoke lug.

(6) Remove the spider from the yoke.

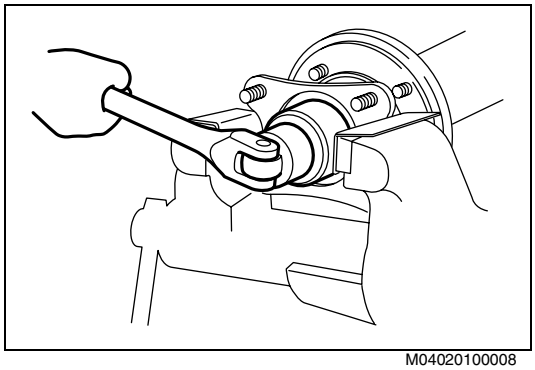

M04020100064

(7) Remove the bearing from the yoke lug.

**NOTICE:**
**Keep the original location of the bearings, thrust washers, spider and retainer rings in mind. These parts have to be replaced in the same position as before disassembly when reassembling.**

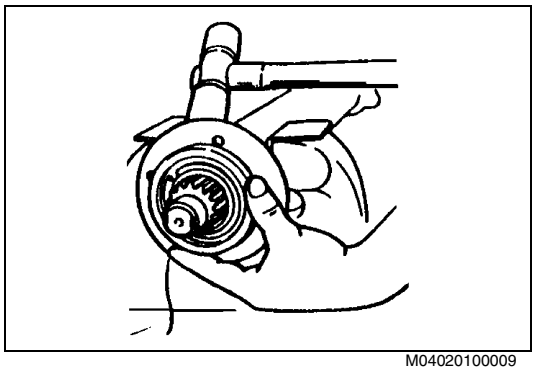

M04020100007

**2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.**
(1) Separate the yoke shaft and sliding yoke.
(2) Remove the dust cover seal from the yoke shaft.

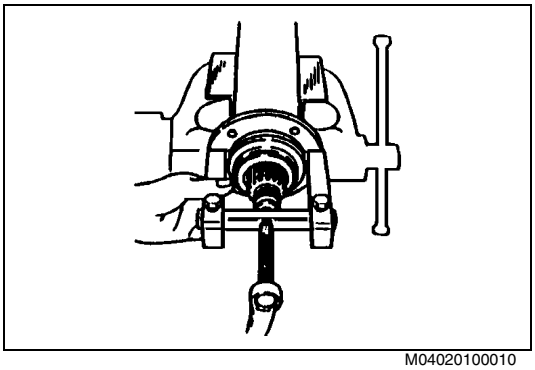

M04020100008

**3. REMOVE THE CENTER BEARING.**
(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
**SST: Socket Wrench (09839-4104)**

(5) Remove the universal joint flange from the shaft.

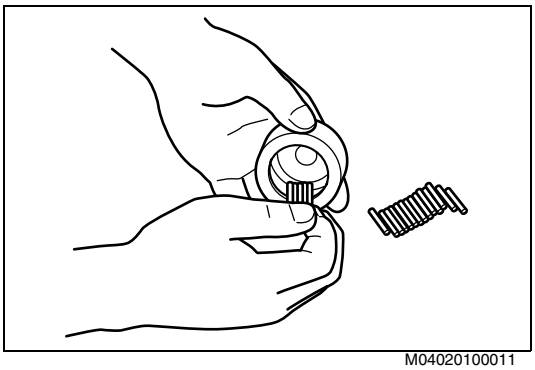

M04020100009

(6) Using a hammer, tap the bearing plate to make a clearance.


M04020100010

(7) Using a commercial puller, remove the center bearing.

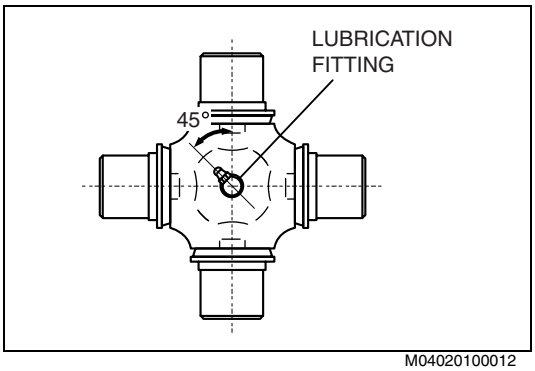
**NOTICE:**
**Be careful not to catch your fingers between bearing plate and dust deflector.**


M04020100011

## IMPORTANT POINTS - ASSEMBLY

**1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.**
(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.
(2) Check each bearing for missing rollers.

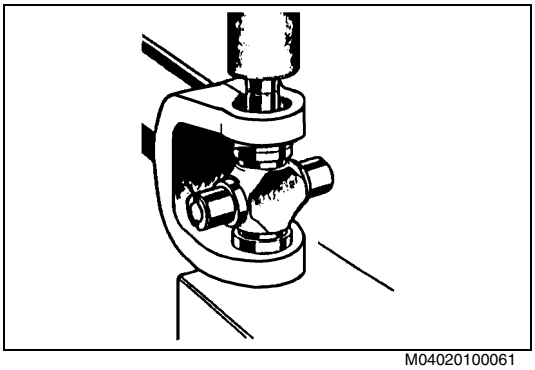
**NOTICE:**
**Remove stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.**



M04020100012

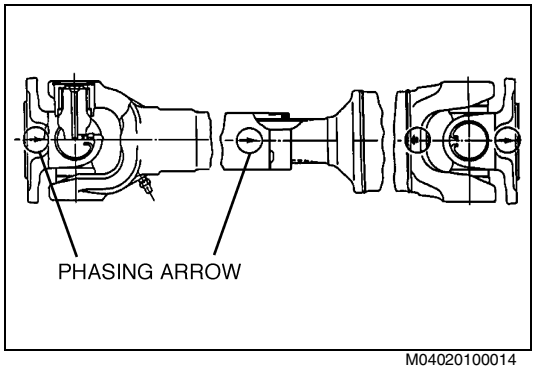
**2. INSTALL THE SPIDERS AND UNIVERSAL JOINT BEARINGS INTO THE YOKES.**
(1) Put the spider into the yoke and then set the universal joint bearings on the yoke.

**NOTICE:**
**When assembling the universal joint spiders to the yokes, position the lubrication fitting so that it faces to the universal joint yoke side as shown in the figure.**


M04020100061

(2) Press the universal joint bearings into the yokes over the spider journal.

**NOTICE:**
**Pay attention not to damage the seal lip of the universal joint bearing when installing.**

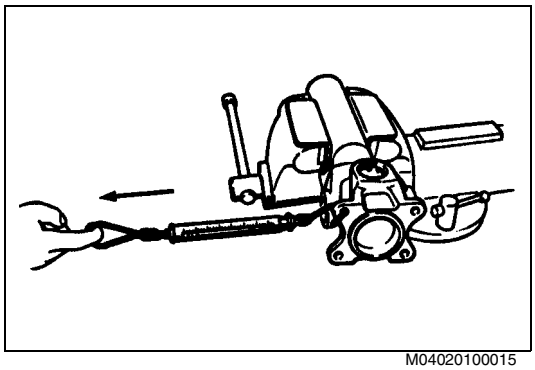


M04020100014

(3) Install the universal joint yokes to the universal joint spider.

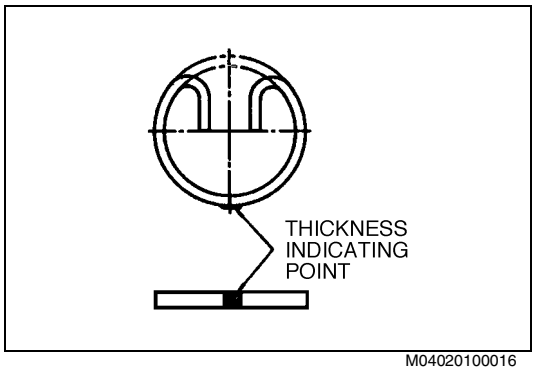
**NOTICE:**

**Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.**


M04020100015

**3. CHECK THE STARTING TORQUE OF THE UNIVERSAL JOINT USING A SPRING BALANCER.**

**Assembly Standard: 1.47-4.9 N·m {15-50 kgf·cm, 13-43 lbf·ft}**



M04020100016

(1) If the measuring value is below the assembly standard, replace the retainer ring with the thicker one.

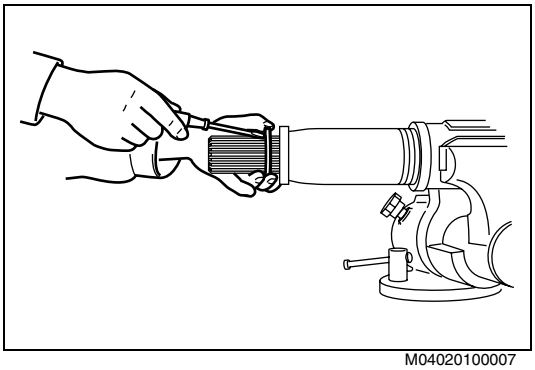
(2) If the measuring value is above the assembly standard, replace the retainer ring with the thinner one.

**NOTICE:**

**Use retainer rings of the same thickness as possible for both ends.**

**Unit: mm {in.}**

| Thickness of retainer ring | Color of thickness indication point |
|---|---|
| 2.22 {0.0874} | White |
| 2.30 {0.0906} | Red |
| 2.38 {0.0937} | Green |

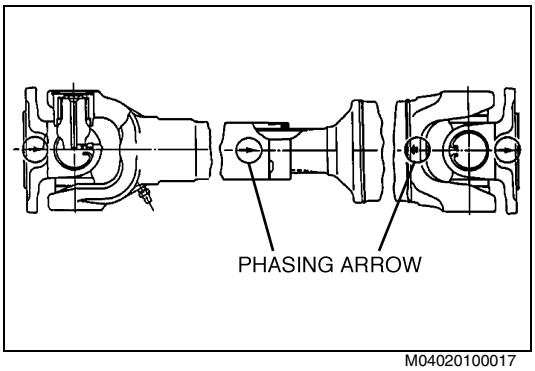

M04020100007

**4. INSTALL THE DUST COVER SEAL.**

(1) Remove the stale grease from the spline of the yoke shaft.

(2) Install the new dust cover seal on the shaft by pushing it in the seal groove.

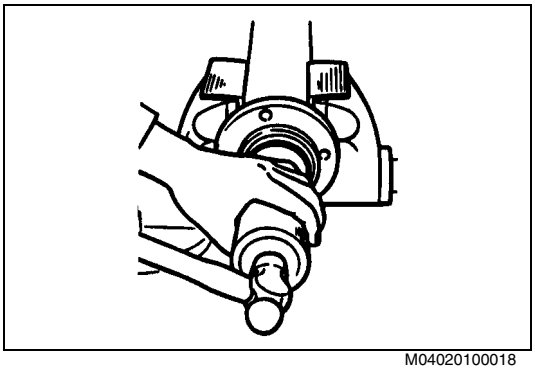
(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the dust cover seal.



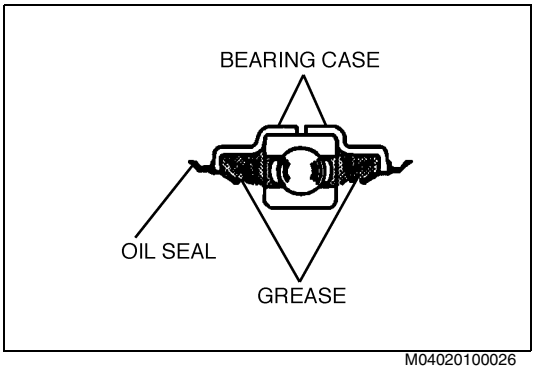
M04020100017

**5. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.**

(1) Align the phasing arrows as show in the figure.


M04020100018

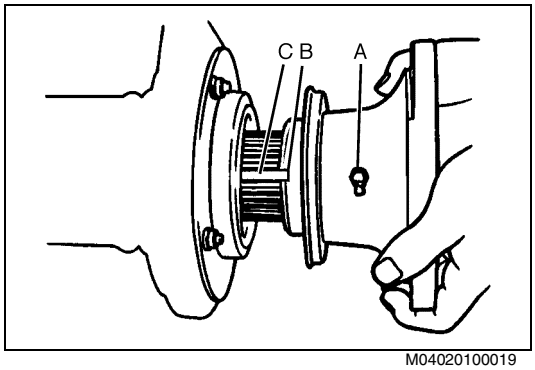
**6. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING.**



M04020100026

**NOTICE:**
**Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.**

**Grease:**
**Refer to owner's manual.**



M04020100019

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to between 80-100°C {176-212°F}.

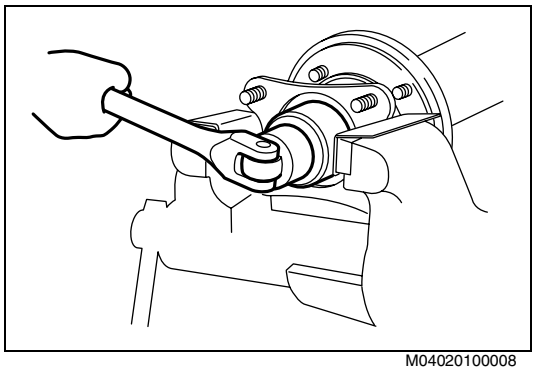
**NOTICE:**
**Do not heat the universal joint flange in excess of 120°C {248°F}.**

**CAUTION:**
**Never touch hot water or oil nor heated universal joint flange with your bare band. This can result in personal injury.**

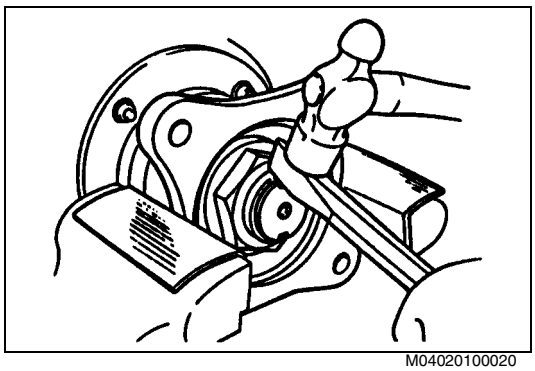
   b. Align lubrication fitting slit and grease passage in line as shown in figure.

- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

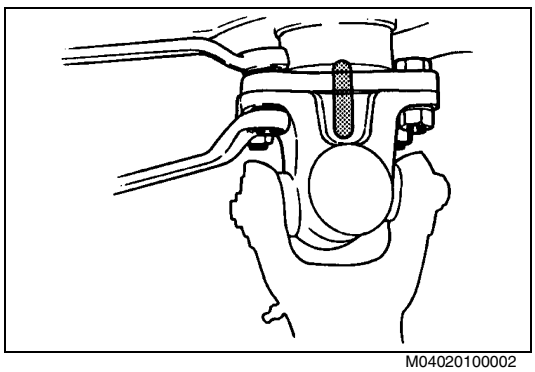
**NOTICE:**
**Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper specified torque.**


M04020100008

   c. Using the special tool, tighten the lock nut.
   **SST: Socket Wrench (09839-4104)**


M04020100020

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


M04020100002

## IMPORTANT POINT - MOUNTING

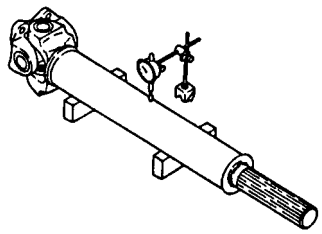
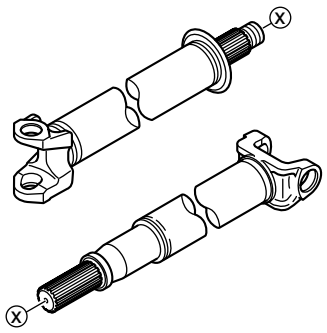
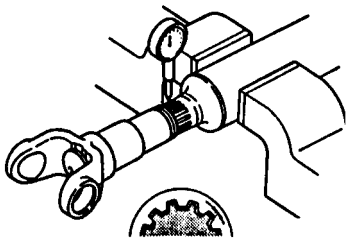
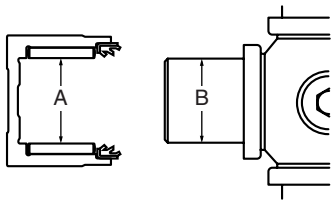
**1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.**
(1) Align the matching marks on the flange and yoke.
(2) Tighten the bolts and nuts.
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

**Grease:**
**Refer to owner's manual.**

# INSPECTION AND REPAIR

M04020102BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Propeller shaft damage and bend | 0-0.5 {0-0.0197} | 1.0 {0.039} | Replace. | Measure  |
| Crack in the welding beads | — | — | Replace, if necessary. | Visual check   |
| Sliding spline damage | — | — | Replace, if necessary. | |
| Sliding spline backlash | At spline 0.062-0.174 {0.0025-0.0068} | 0.25 {0.0098} | Replace. | Measure  |
| Clearance (C) between universal joint spider and needle roller bearing (C = A - B) | 0.024-0.064 {0.0010-0.0025} | 0.1 {0.0039} | Replace needle roller bearing sub-assembly or universal joint spider. | Measure   |

# PROPELLER SHAFT (MC1040)

PP02-002

**PROPELLER SHAFT ASSEMBLY ..... PP02-2**
DATA AND SPECIFICATIONS ..... PP02-2
DESCRIPTION ..... PP02-2
TROUBLESHOOTING ..... PP02-3
SPECIAL TOOL ..... PP02-3
COMPONENT LOCATOR ..... PP02-4
OVERHAUL ..... PP02-6
INSPECTION AND REPAIR ..... PP02-13

# PROPELLER SHAFT ASSEMBLY

## DATA AND SPECIFICATIONS

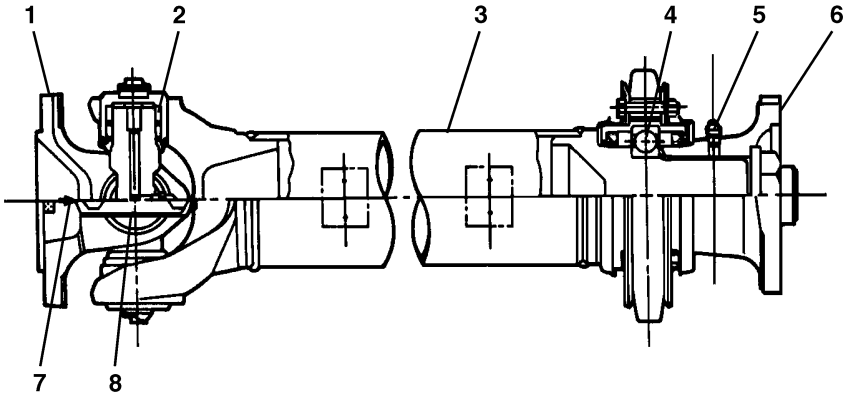
M04020103BEI2001

| | |
|---|---|
| **Type** | **Tubular shaft type** |
| **Universal joint** | **All metal, round bearing type with needle roller bearing** |

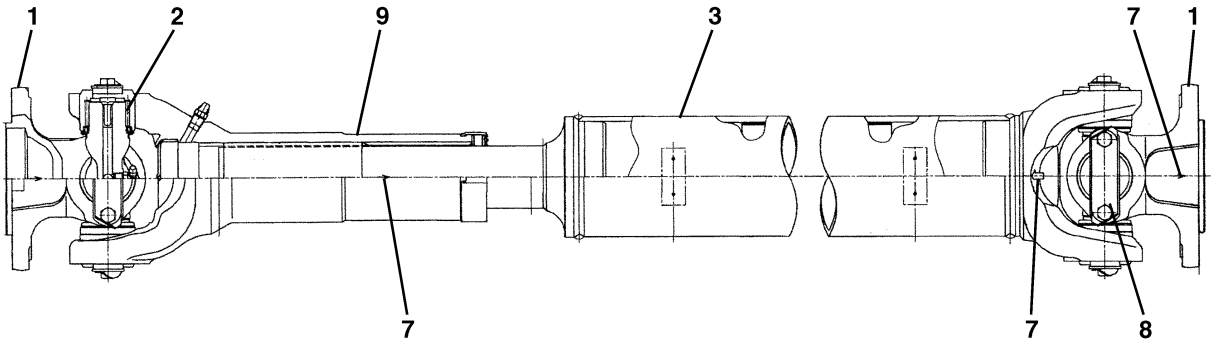
## DESCRIPTION

M04020103BEC1001

**FRONT**




**REAR**




M04020100045

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 6 | Flange |
| 2 | Needle roller bearing | 7 | Phasing arrow |
| 3 | Yoke shaft | 8 | Lock plate |
| 4 | Center bearing | 9 | Sliding yoke |
| 5 | Lubrication fitting | | |

# TROUBLESHOOTING

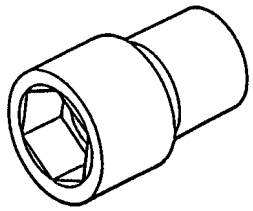
M04020103BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal vibration when driving.** | Looseness of universal joint yoke and flange tightening nuts. | Tighten the nuts. |
| | Looseness of universal joint flange lock nut. | Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely. |
| | Excessively bent propeller shaft. | Replace the shaft. |
| | Worn or damaged universal joint. | Replace the universal joint. |
| | Worn or damaged center bearing. | Replace the bearing. |
| | Worn or damaged center bearing rubber cushion. | Replace the rubber cushion. |
| | Incorrect phasing of the yokes. | Match the phasing arrows correctly. |

# SPECIAL TOOL

M04020103BEK1001

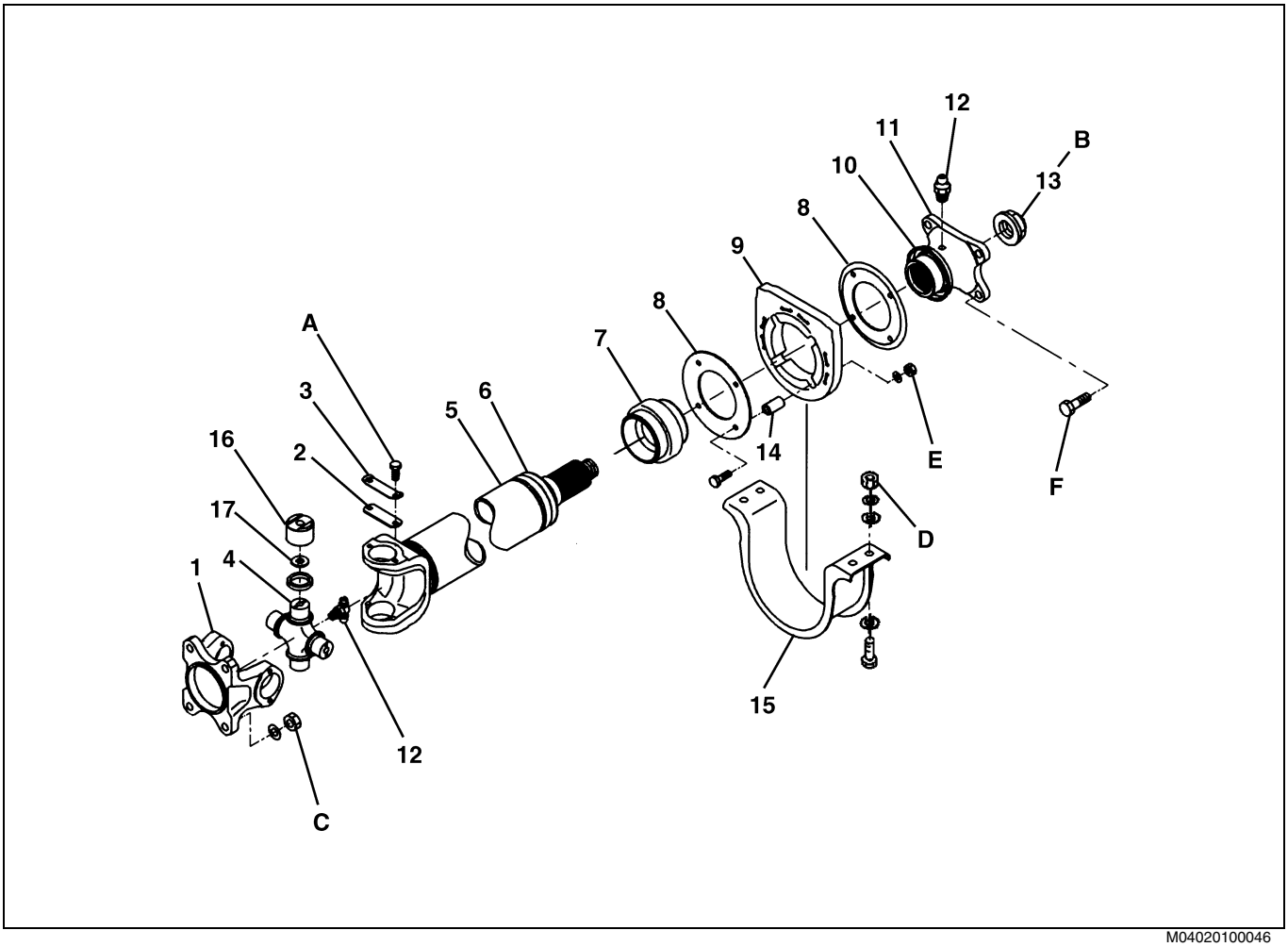
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-4601 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M04020103BED1002

## FRONT



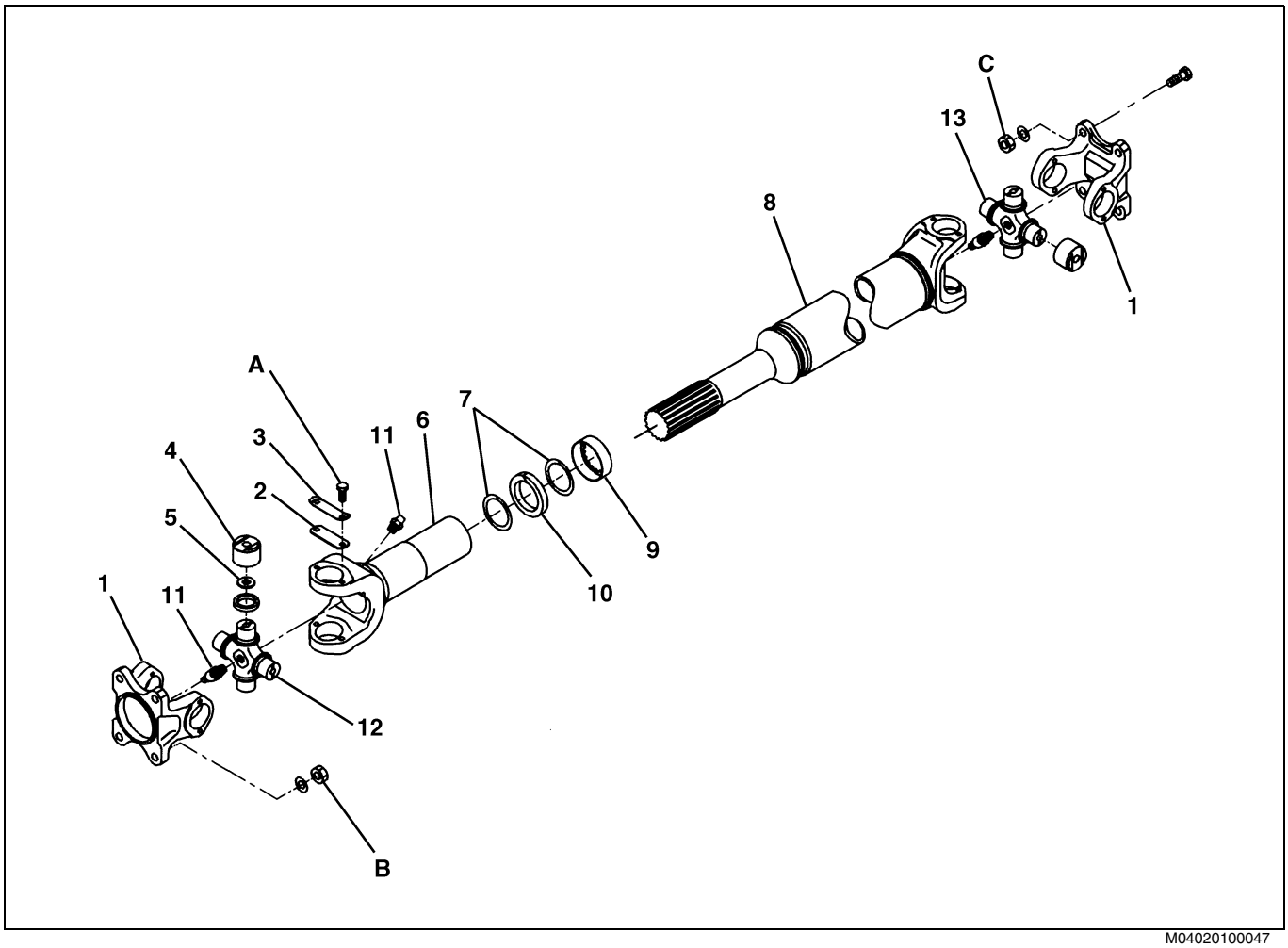

M04020100046

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 10 | Dust deflector |
| 2 | Universal joint cap | 11 | Universal joint flange |
| 3 | Lock plate | 12 | Lubrication fitting |
| 4 | Universal joint spider | 13 | Lock nut |
| 5 | Yoke shaft | 14 | Collar |
| 6 | Dust deflector | 15 | Center bearing holder |
| 7 | Center bearing | 16 | Needle roller bearing |
| 8 | Center bearing plate | 17 | Thrust washer |
| 9 | Center bearing cushion | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 26-31 {260-320, 19-23} | D | 96-144 {980-1,470, 71-105} |
| B | 588.4-784.6 {6,000-8,000, 434-578} | E | 19-25 {190-260, 14-19} |
| C | 128-156 {1,300-1,600, 94-115} | F | 128-156 {1,300-1,600, 94-115} |

## REAR




M04020100047

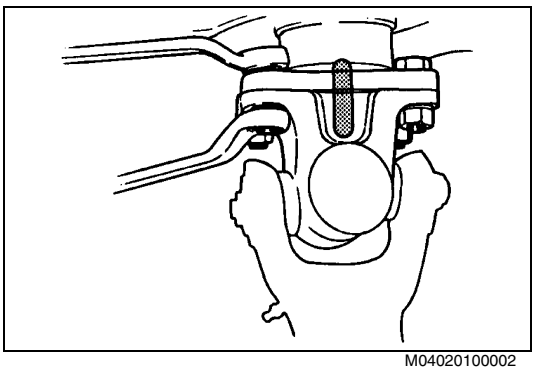
| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 8 | Yoke shaft |
| 2 | Universal joint cap | 9 | Felt ring retainer |
| 3 | Lock plate | 10 | Felt seal |
| 4 | Needle roller bearing | 11 | Lubrication fitting |
| 5 | Thrust washer | 12 | Universal joint spider |
| 6 | Sliding yoke | 13 | Universal joint assembly |
| 7 | Split retainer | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 26-31 {260-320, 19-23} | C | 128-156 {1,300-1,600, 94-115} |
| B | 128-156 {1,300-1,600, 94-115} | | |

# OVERHAUL

M04020103BEH2001



M04020100002

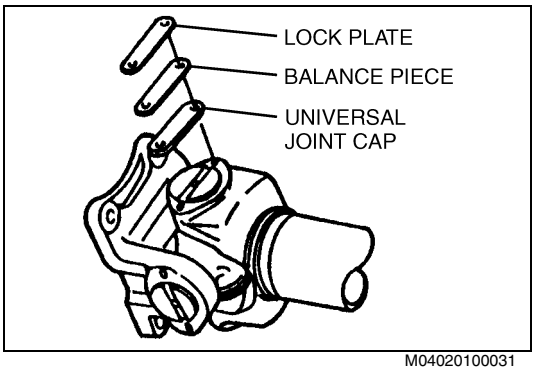
## IMPORTANT POINT - DISMOUNTING

**1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.**

(1) Make aligning marks on the flange and yoke.

(2) Remove the nuts and the bolts.

**NOTICE:**
**Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.**




M04020100031

## IMPORTANT POINTS - DISASSEMBLY

**1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.**

(1) Remove the lock plate.

**NOTICE:**
**For some models, one additional lock plate is installed as an additional balance on one of the bearing.**

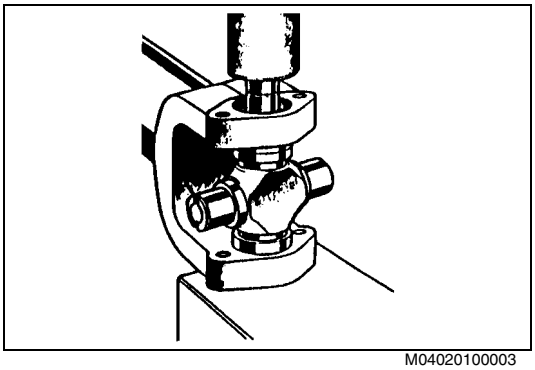
(2) Remove the balance piece, if so equipped.

**NOTICE:**
**Some models are equipped with one, two, or three balance pieces between the lock plate and universal joint cap of one of the bearing.**

(3) Remove the universal joint cap.

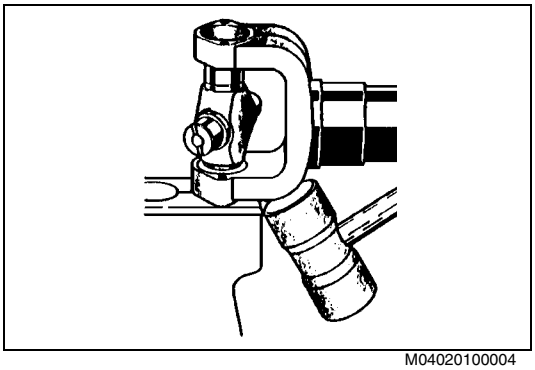
(4) Remove the universal joint bearings and spider from the yoke.

a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
The bearing race will now protrude from the yoke.

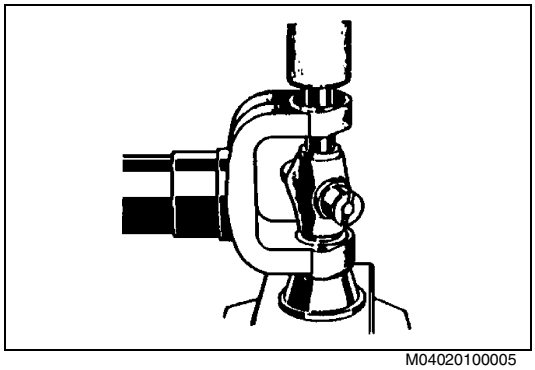


M04020100003

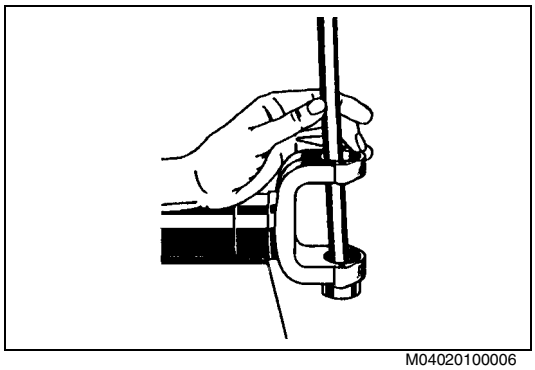
b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
Tap the yoke in area shown to achieve removal of universal joint bearing.



M04020100004

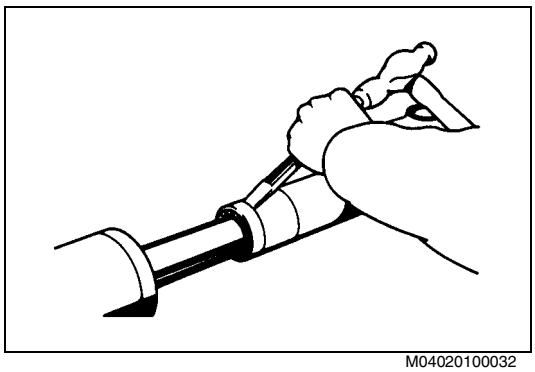

M04020100005

c. Place the yoke under an arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.
d. Press the opposite bearing out of the yoke lug.


M04020100006

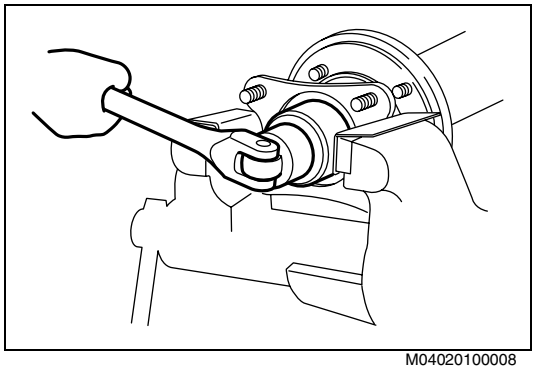
e. Remove the spider from the yoke.
f. Remove the bearing from the yoke lug.

**NOTICE:**
- **Keep the location and number of lock plate or balance piece in mind.**
- **Bolt lengths are different according to the number of balance piece.**

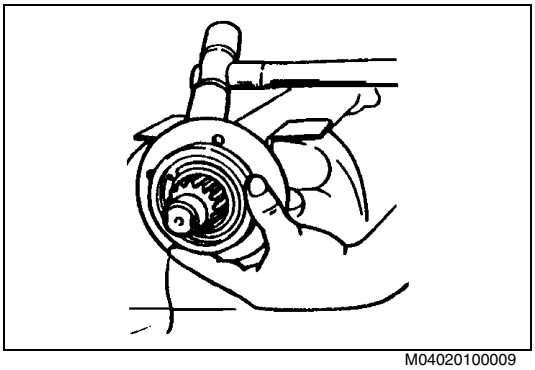

M04020100032

**2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE.**
(1) Uncaulk the felt ring retainer from the groove on the sliding yoke.
(2) Separate the yoke shaft and sliding yoke.
(3) Remove the felt seal, split retainers and felt ring retainer from the yoke shaft.

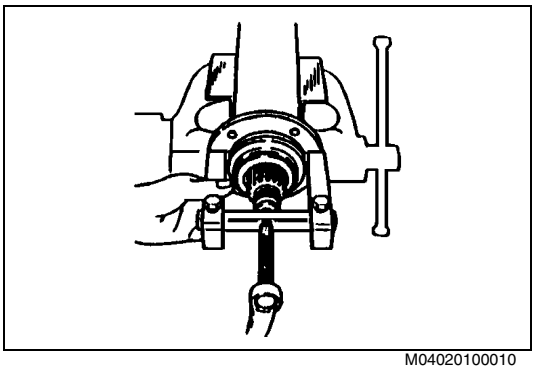
**CAUTION:**
**When uncaulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.**


M04020100008

**3. REMOVE THE CENTER BEARING.**
(1) Place the propeller shaft in a vise.
(2) Uncaulk the lock nut on the shaft.
(3) Make aligning marks on the flange and shaft.
(4) Using the special tool, remove the lock nut.
**SST: Socket Wrench (09839-4601)**
(5) Remove the universal joint flange from the shaft.


M04020100009

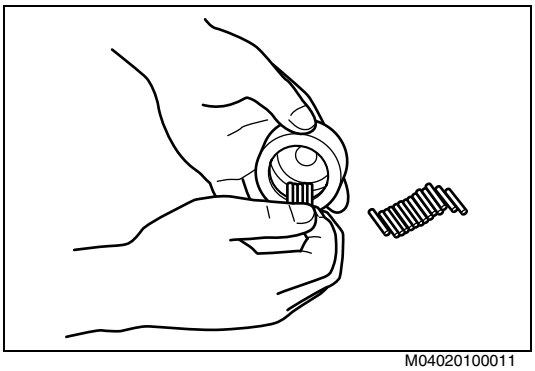
(6) Using a hammer, tap the bearing plate to make a clearance.


M04020100010

(7) Using a commercial puller, remove the center bearing.

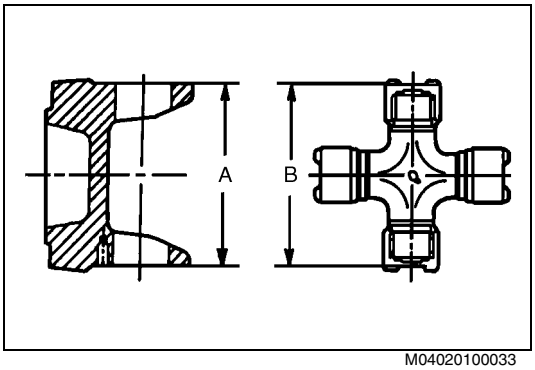
**NOTICE:**
**Be careful not to catch your fingers between bearing plate and dust deflector.**

## IMPORTANT POINTS - ASSEMBLY


M04020100011

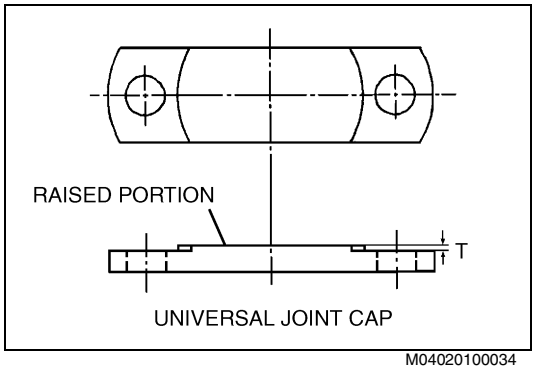
**1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.**
(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.
(2) Check each bearing for missing rollers.

**NOTICE:**
**Remove stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.**



M04020100033

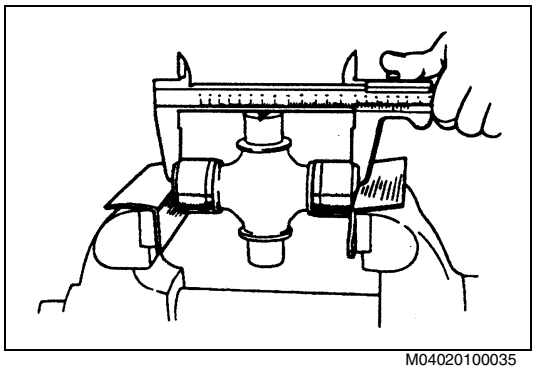
**2. NSTALL THE SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.**
(1) Select a thickness for the raised portion (T) of the universal joint cap so that measurements B is equivalent to measurements A. Use universal joint caps of the same thickness as possible for both ends.



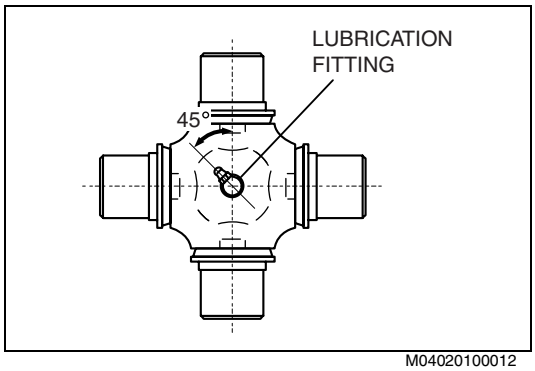
M04020100034

**Universal joint caps are available in following thickness.**
**Unit: mm {in.}**

| Thickness of raised portion (T) of universal joint cap | Color code |
|---|---|
| 0.00 | Silver |
| 0.04 {0.0016} | Yellow |
| 0.08{0.0031} | Black |
| 0.12 {0.0047} | Green |


M04020100035

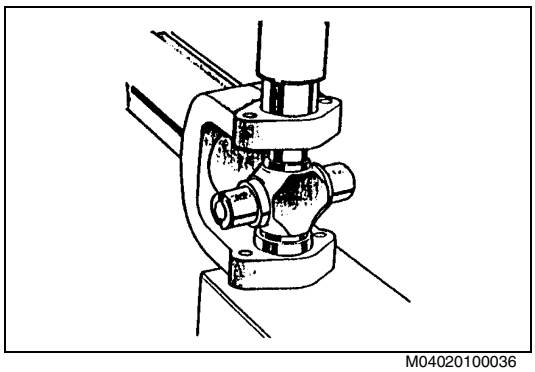
**NOTICE:**
**When measuring dimension "B", clamp the spider with bearings on two journal ends in a vise.**



M04020100012

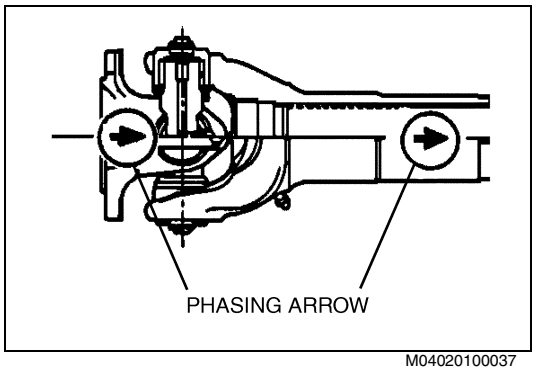
(2) Put the spider into the yoke and then set the universal joint bearings on the yoke.

**NOTICE:**
**When assembling the universal joint spiders to the yokes, position the lubrication fitting so that it is to the inside of the yoke and sliding yoke lugs as shown in figure.**


M04020100036

(3) Press the universal joint bearings into the yokes over the spider journal.

**NOTICE:**
**Pay attention not to damage the seal lip of the universal joint bearing when installing.**



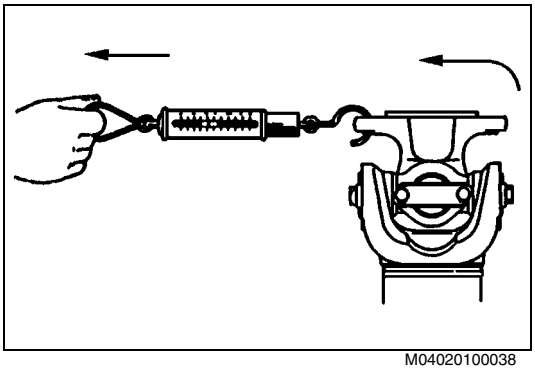
M04020100037

(4) Install the universal joint yokes to the universal joint spider.

**NOTICE:**
**Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.**

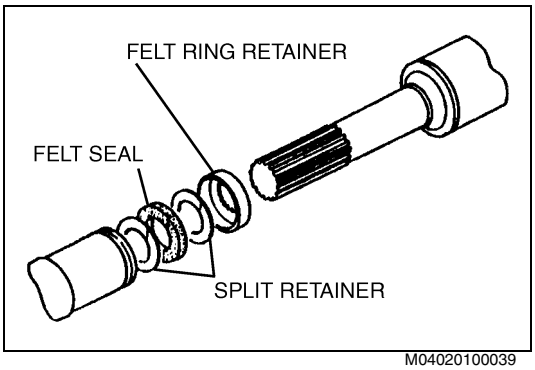
(5) Check the universal joint cap to ensure that it is free of any wear or damage. Insert the universal joint cap into the groove in the needle roller bearing, fit in the lock plate, and tighten the universal joint cap.

**NOTICE:**
**Insert the universal joint cap so that the raised portion faces the needle roller bearing. When inserting the universal joint cap, make sure that the raised portion fits within the bearing bore the universal joint yoke shaft and sliding yoke.**


M04020100038

(6) Check the starting torque of the universal joint using a spring balancer.

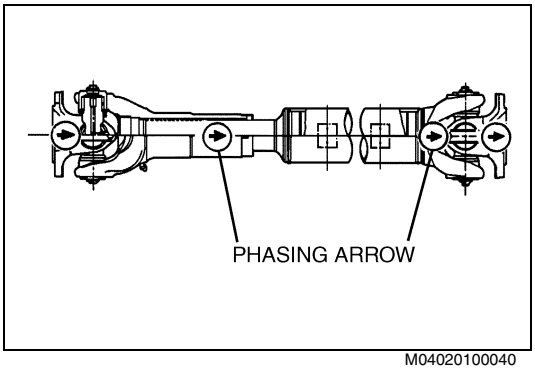
(7) After tightening the universal joint cap, bend the lock plate so that it rests snugly against two sides of the bolt. Make sure that no gaps appear between the lock plate and the bolt. Also, upon fitting the lock plate against the bolt, check the bent portion of the lock plate to make sure there are no cracks or fissures.
**Assembly standard:**
**0.98-3.92 N·m {10-40 kgf·cm, 0.8-2.8 lbf·in}**
a. If the measuring value is below the assembly standard, replace the universal joint cap to a thicker one, then repeat the procedure, starting from step 1.
b. If the measuring value is above the assembly standard, replace the universal joint cap to a thinner one, then repeat the procedure, starting from step 1.



M04020100039

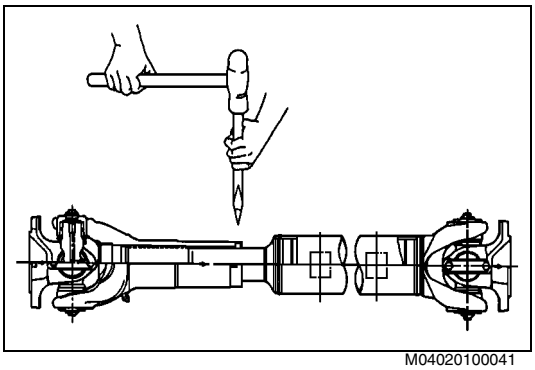
**3. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.**
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new split retainers, felt seal and felt ring retainer on the shaft by pushing it in along the yoke shaft spline.

(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the felt seal.



M04020100040

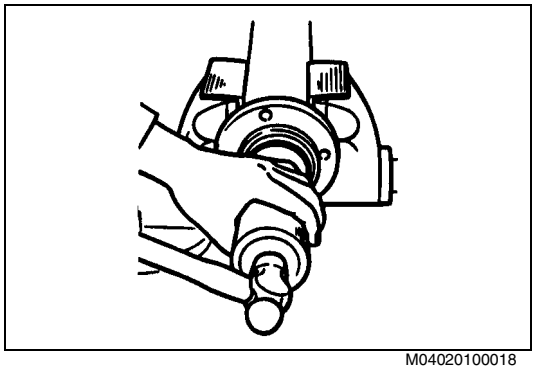
(4) Align the phasing arrows as shown in figure.


M04020100041

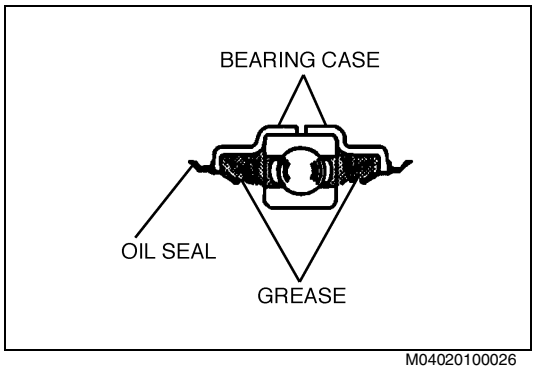
(5) Caulk the felt ring retainer equally at four points on the circumference of the felt ring retainer. Make sure the felt ring retainer is caulked down securely into the groove on the end of the sliding yoke.

**Caulking Width: 10-15 mm {0.394-0.591 in.}**

**CAUTION:**
**When caulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.**


M04020100018

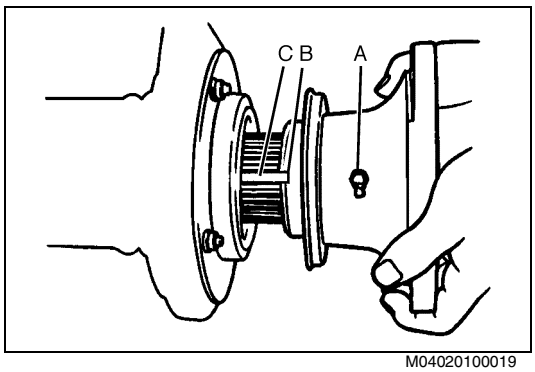
**4. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING ASSEMBLY.**



M04020100026

**NOTICE:**
**Prior to installation of center bearing assembly, remove stale grease and apply fresh grease between the bearing case and the center bearing.**

**Grease:**
**Refer to owner's manual.**



M04020100019

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to between 80-100 °C {176-212 °F}.

**NOTICE:**
**Do not heat the universal joint flange in excess of 120 °C {248 °F}.**

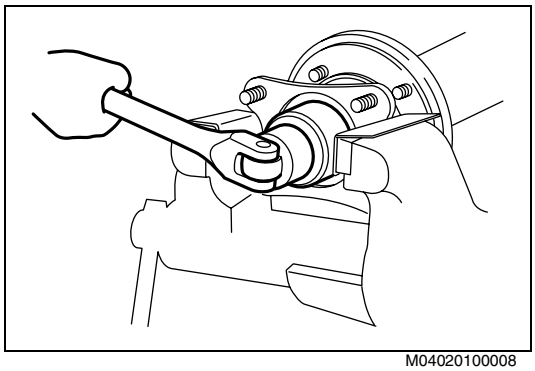
**CAUTION:**
**Never touch hot water or oil and heated universal joint flange with your bare band. This can result personal injury.**

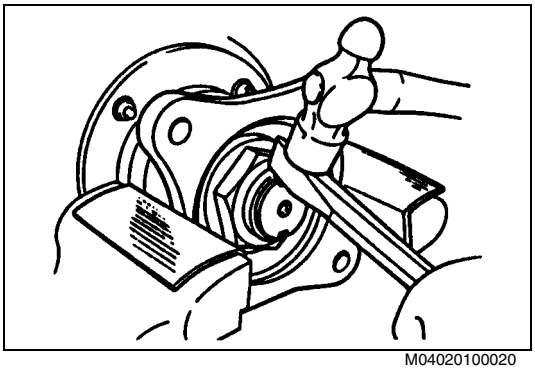
   b. Align lubrication fitting slit and grease passage in line as shown in figure.

- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

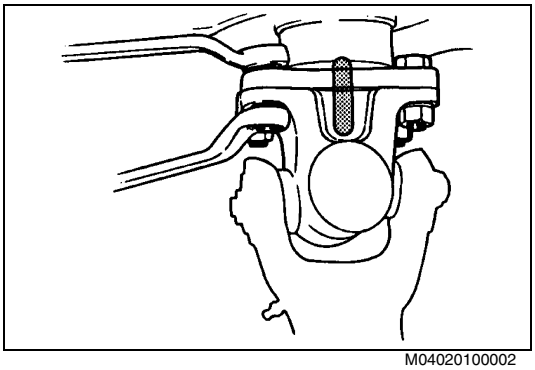
**NOTICE:**
**Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper torque specifications.**

   c. Using the special tool, tighten the lock nut.
   **SST: Socket Wrench (09839-4601)**


M04020100008


M04020100020

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


M04020100002

## IMPORTANT POINT - MOUNTING

**1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.**

(1) Align the matching marks on the flange and yoke.

(2) Tighten the bolts and nuts.

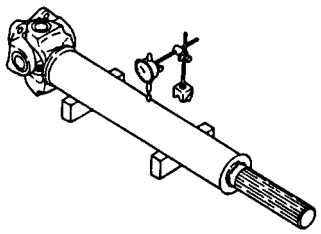
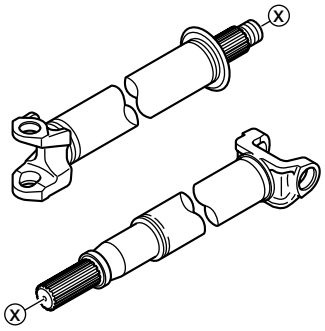
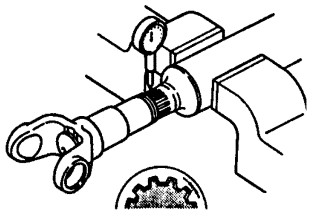
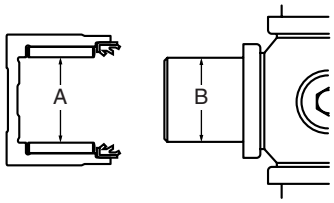
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

**Grease:**
**Refer to owner's manual.**

# INSPECTION AND REPAIR

M04020103BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Propeller shaft damage and bend** | **0-0.5 {0-0.0197}** | **1.0 {0.0393}** | **Replace.** | **Measure**  |
| **Crack in the welding beads** | **—** | **—** | **Replace, if necessary.** | **Visual check**   |
| **Sliding spline damage** | **—** | **—** | **Replace, if necessary.** | |
| **Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 80mm {3.150 in.} from the shaft center.)** | **At spline 0.062-0.174 {0.0025-0.0068}** | **0.25 {0.0098}** | **Replace.** | **Measure**  |
| **Clearance (C) between universal joint spider and needle roller bearing (C = A - B)** | **0.020-0.054 {0.0008-0.0021}** | **0.1 {0.0039}** | **Replace needle roller bearing sub-assembly or universal joint spider.** | **Measure**   |

# PROPELLER SHAFT (HD1050)

PP02-003

**PROPELLER SHAFT ASSEMBLY ..... PP02-2**
DATA AND SPECIFICATIONS ..... PP02-2
DESCRIPTION ..... PP02-3
TROUBLESHOOTING ..... PP02-4
SPECIAL TOOL ..... PP02-4
COMPONENT LOCATOR ..... PP02-5
OVERHAUL ..... PP02-7
INSPECTION AND REPAIR ..... PP02-15

# PROPELLER SHAFT ASSEMBLY

## DATA AND SPECIFICATIONS

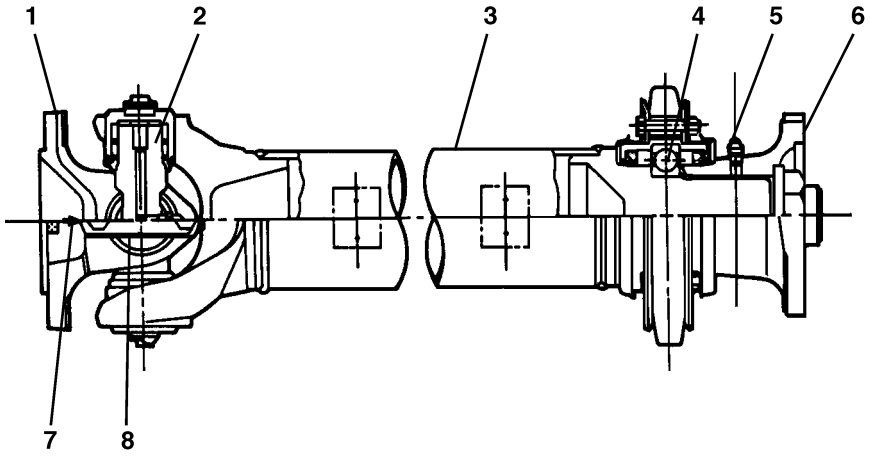
M04020104BEI2001

| | |
|---|---|
| **Type** | **Tubular shaft type (TRANSMISSION TO REAR AXLE)**<br>**Tubeless shaft type [REAR AXLE (FRONT) TO REAR AXLE (REAR)]** |
| **Universal joint** | **All metal, round bearing type with needle roller bearing** |

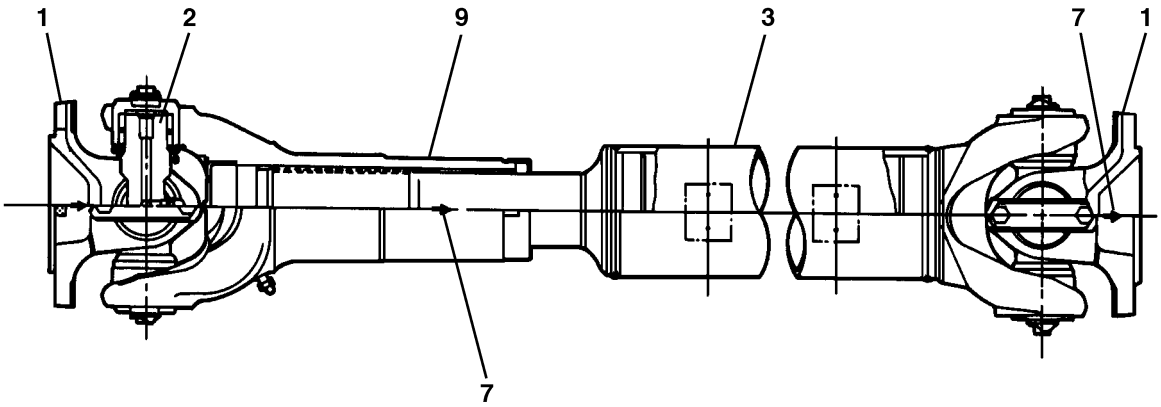
# DESCRIPTION

M04020104BEC1001

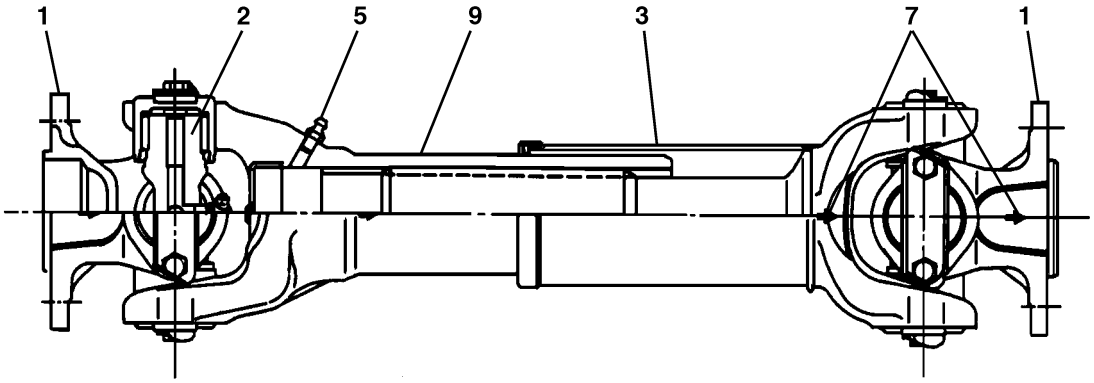
**TRANSMISSION TO REAR AXLE (FRONT)**




**TRANSMISSION TO REAR AXLE (REAR)**




**REAR AXLE (FRONT) TO REAR AXLE (REAR)**




M04020100067

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 6 | Flange |
| 2 | Needle roller bearing | 7 | Phasing arrow |
| 3 | Yoke shaft | 8 | Lock plate |
| 4 | Center bearing | 9 | Sliding yoke |
| 5 | Lubrication fitting | | |

# TROUBLESHOOTING

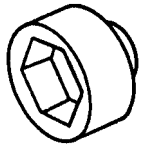
M04020104BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal vibration when driving.** | Looseness of universal joint yoke and flange tightening nuts. | Tighten the nuts. |
| | Looseness of universal joint flange lock nut. | Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut |
| | Excessively bent propeller shaft. | Replace the shaft. |
| | Worn or damaged universal joint | Replace the universal joint. |
| | Worn or damaged center bearing. (If so equipped) | Replace the bearing. |
| | Worn or damaged center bearing rubber cushion. (If so equipped) | Replace the rubber cushion. |
| | Incorrect phasing of the yokes. | Match the phasing arrows correctly. |

# SPECIAL TOOL

M04020104BEK1001

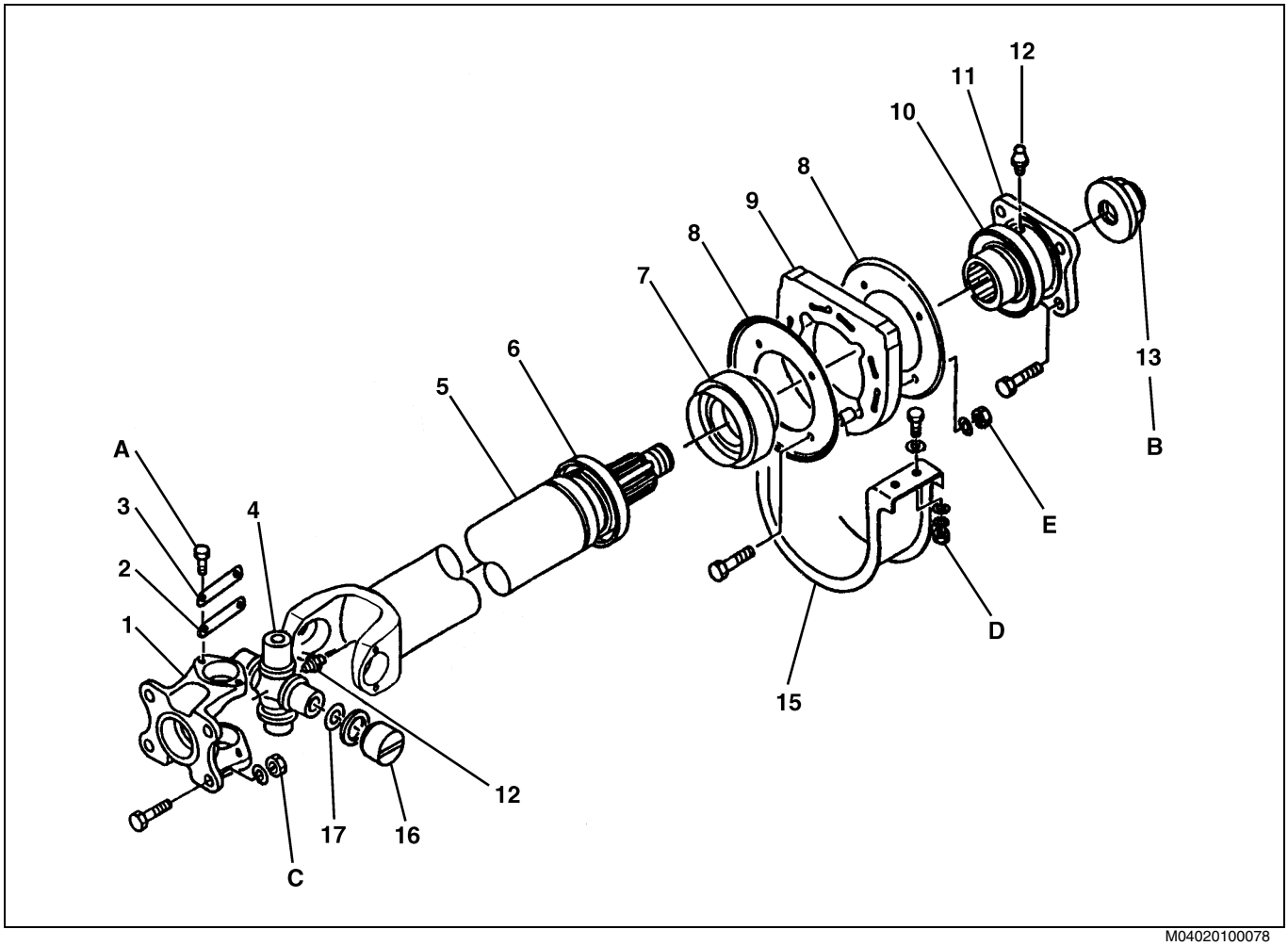
Prior to starting a propeller shaft overhaul, it is necessary to have these special tool. (with center bearing type)

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-6502 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M04020104BED1002

## TRANSMISSION TO REAR AXLE (FRONT)



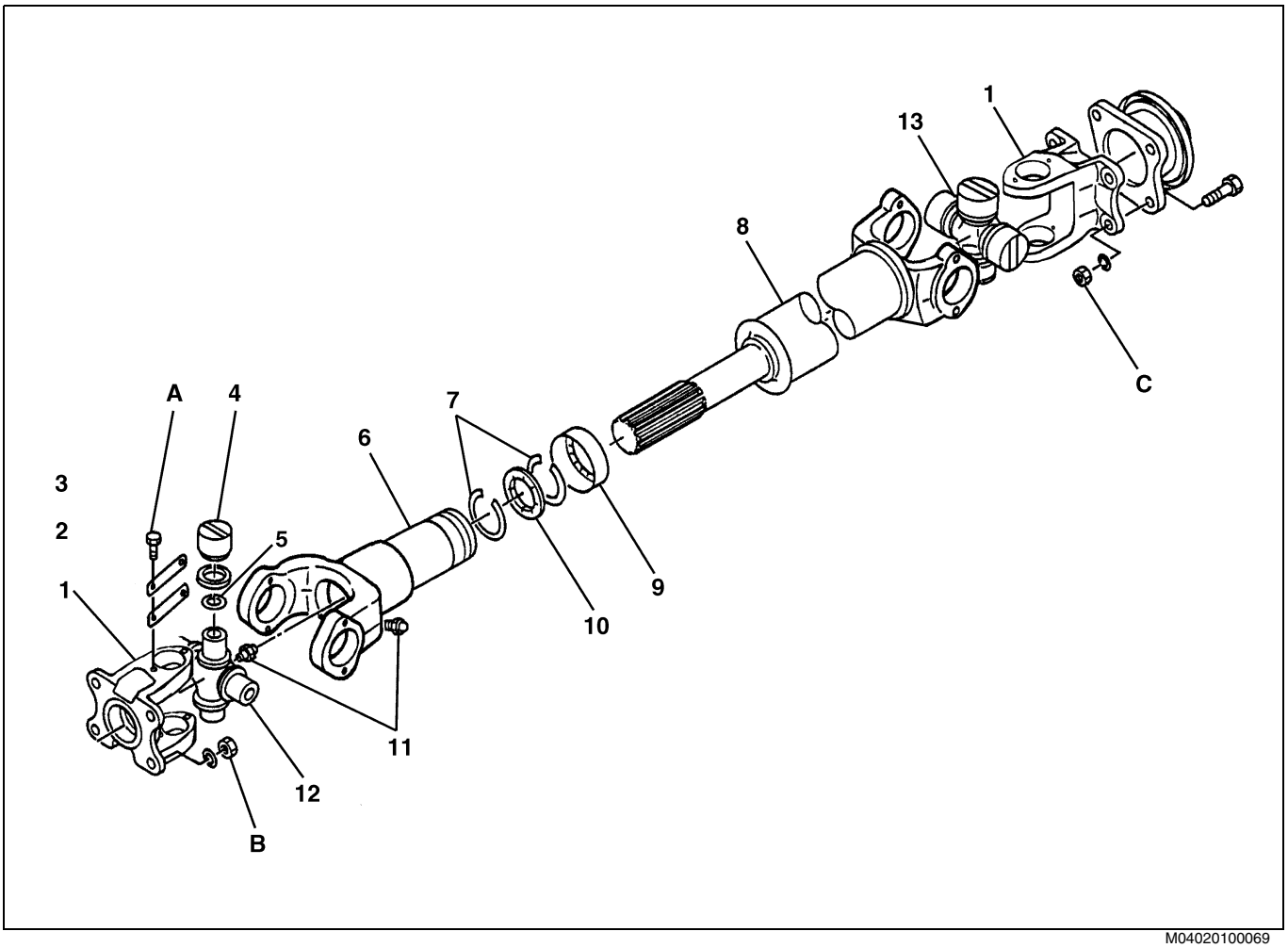

M04020100078

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 10 | Dust deflector |
| 2 | Universal joint cap | 11 | Universal joint flange |
| 3 | Lock plate | 12 | Lubrication fitting |
| 4 | Universal joint spider | 13 | Lock nut |
| 5 | Yoke shaft | 14 | Collar |
| 6 | Dust deflector | 15 | Center bearing holder |
| 7 | Center bearing | 16 | Needle roller bearing |
| 8 | Center bearing plate | 17 | Thrust washer |
| 9 | Center bearing cushion | | |

Tightening torque — Unit: N·m {kgf·cm, lbf·ft}

| | | | |
|---|---|---|---|
| A | 49-61 {500-630, 36-45} | D | 96-144 {980-1,470, 71-105} |
| B | 784-980 {8,000-10,000, 579-723} | E | 19-25 {190-260, 14-19} |
| C | 167-225 {1,700-2,300, 124-166} | | |

## TRANSMISSION TO REAR AXLE (REAR)



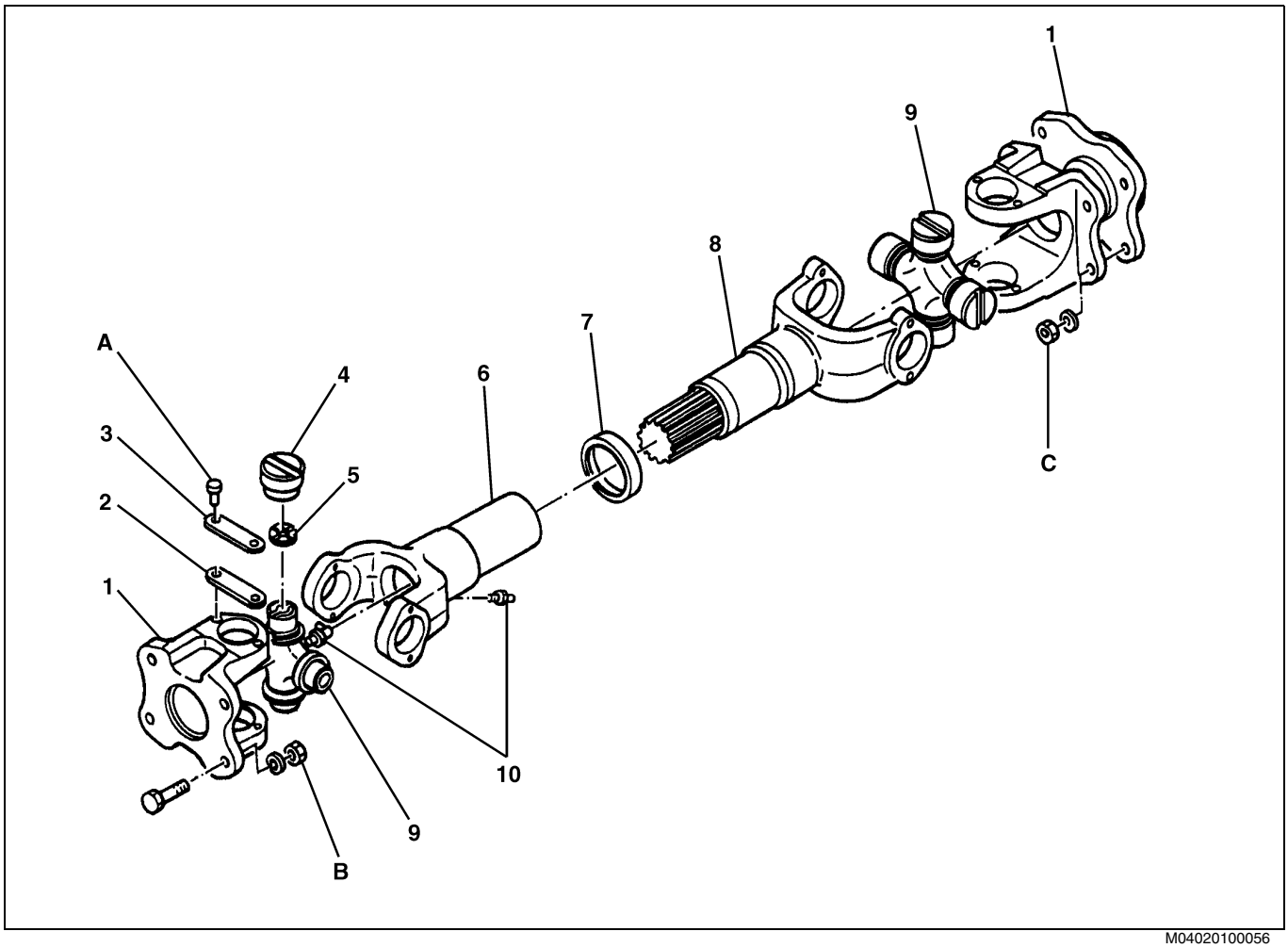

M04020100069

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 8 | Yoke shaft |
| 2 | Universal joint cap | 9 | Felt ring retainer |
| 3 | Lock plate | 10 | Felt seal |
| 4 | Needle roller bearing | 11 | Lubrication fitting |
| 5 | Thrust washer | 12 | Universal joint spider |
| 6 | Sliding yoke | 13 | Universal joint assembly |
| 7 | Split retainer (If so equipped) | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 49-61 {500-630, 36-45} | C | 167-225 {1,700-2,300, 124-166} |
| B | 167-225 {1,700-2,300, 124-166} | | |

## REAR AXLE (FRONT) TO REAR AXLE (REAR)




M04020100056

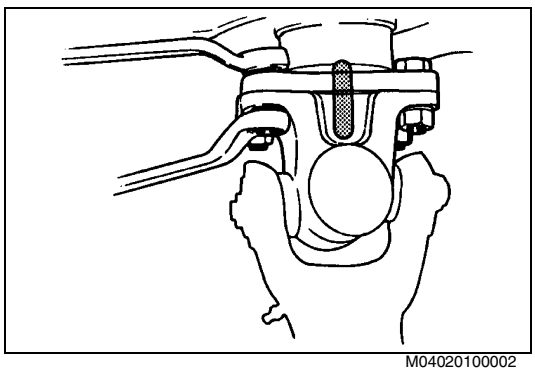
| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 6 | Sliding yoke |
| 2 | Universal joint cap | 7 | Dust seal |
| 3 | Lock plate | 8 | Yoke shaft |
| 4 | Needle roller bearing | 9 | Universal joint spider |
| 5 | Thrust washer | 10 | Lubrication fitting |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 26-31 {260-320, 19-23} | C | 128-156 {1,300-1,600, 94-115} |
| B | 128-156 {1,300-1,600, 94-115} | | |

# OVERHAUL

**M04020104BEH2001**



M04020100002

## IMPORTANT POINT - DISMOUNTING

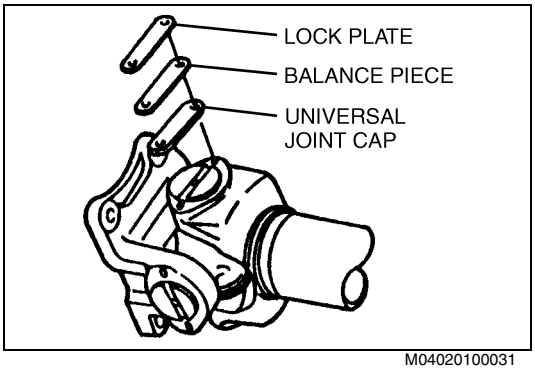
**1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.**

(1) Make aligning marks on the flange and yoke.

(2) Remove the nuts and the bolts.

**NOTICE:**

**Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.**



M04020100031

## IMPORTANT POINTS - DISASSEMBLY

**1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.**

(1) Remove the lock plate.

**NOTICE:**
**For some models, one additional lock plate is installed as an additional balance on one of the bearing.**

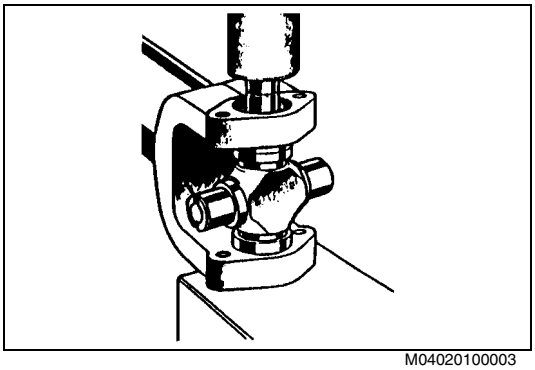
(2) Remove the balance piece, if so equipped.

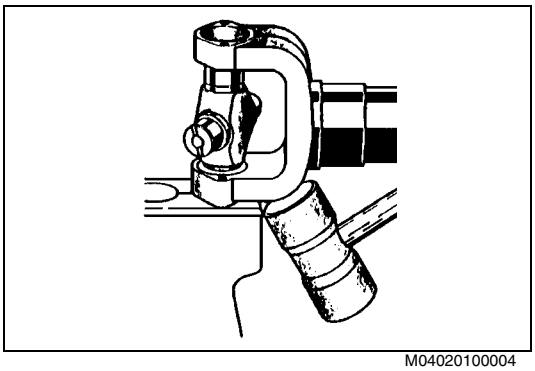
**NOTICE:**
**Some models are equipped with one, two, or three balance pieces between the lock plate and universal joint cap of one of the bearing.**

(3) Remove the universal joint cap.

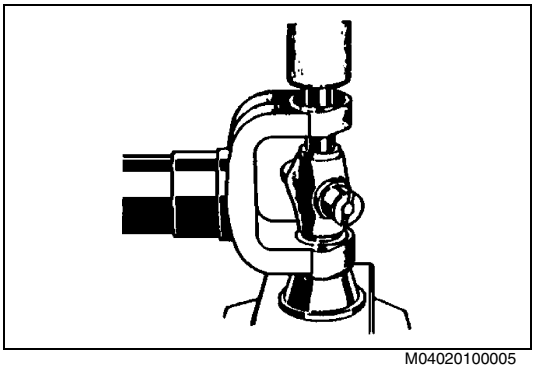
(4) Remove the universal joint bearings and spider from the yoke.

a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
The bearing race will now protrude from the yoke.

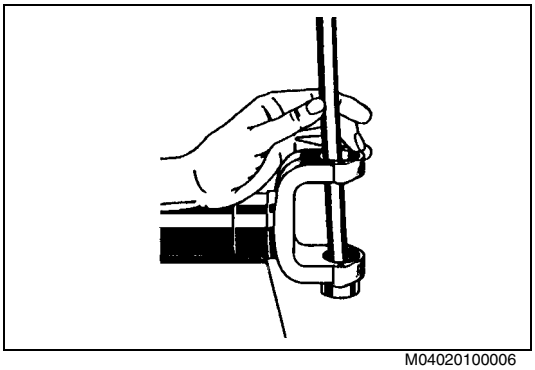

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M04020100004

b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
Tap the yoke in area shown to achieve removal of universal joint bearing.

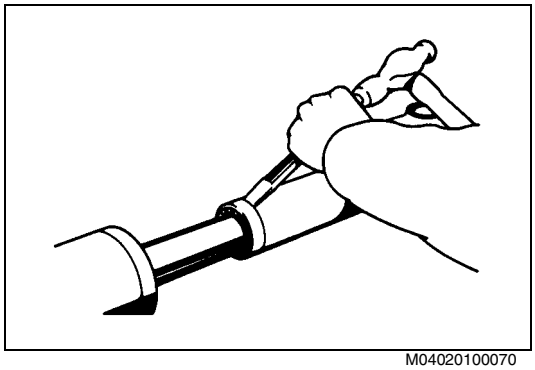

M04020100005

c. Place the yoke under an arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.
d. Press the opposite bearing out of the yoke lug.


M04020100006

e. Remove the spider from the yoke.
f. Remove the bearing from the yoke lug.

**NOTICE:**
- **Keep the location and number of lock plate or balance piece in mind.**
- **Bolt lengths are different according to the number of balance piece.**


M04020100070

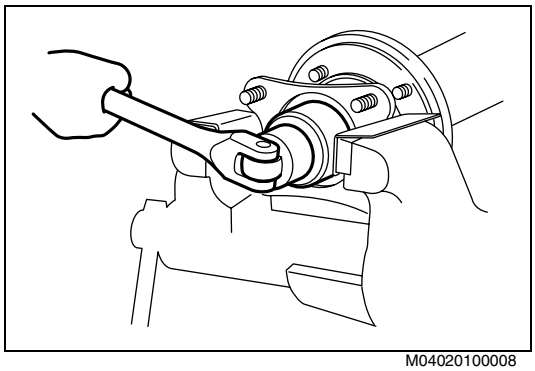
**2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE. [TRANSMISSION TO REAR AXLE (REAR)]**

(1) Knock back the caulking of the felt ring retainer from the groove on the sliding yoke.

(2) Separate the yoke shaft and sliding yoke.

(3) Remove the felt seal, split retainers and felt ring retainer, or dust seal from the yoke shaft.

**CAUTION:**
**When knocking back caulking parts a metal chip may pop on impact. Wear safety glasses to protect your eyes.**


M04020100008

**3. REMOVE THE CENTER BEARING. [TRANSMISSION TO REAR AXLE (FRONT)]**

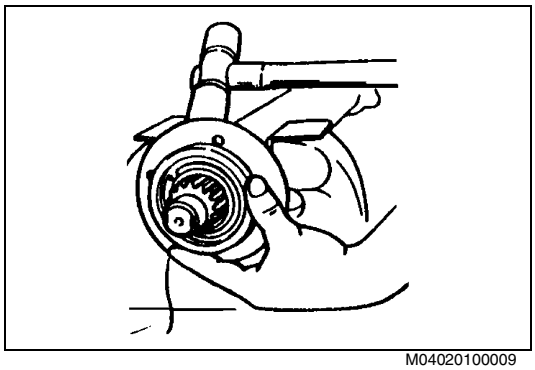
(1) Place the propeller shaft in a vise.

(2) Uncaulk the lock nut on the shaft.

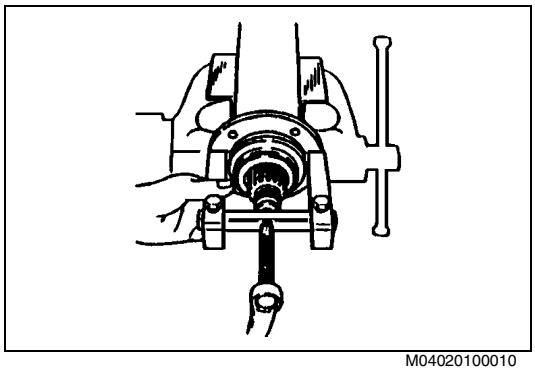
(3) Make aligning marks on the flange and shaft.

(4) Using the special tool, remove the lock nut.
**SST: Socket Wrench (09839-6502)**

(5) Remove the universal joint flange from the shaft.

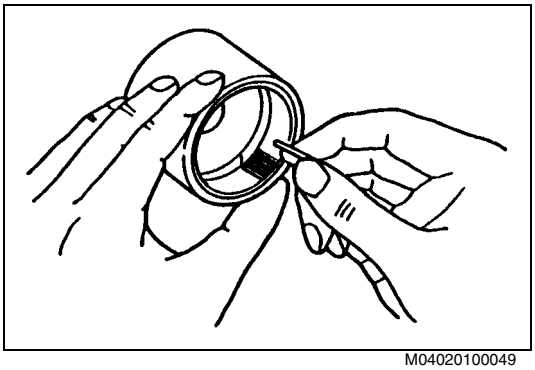

M04020100009

(6) Using a hammer, tap the bearing plate to make a clearance.


M04020100010

(7) Using a commercial puller, remove the center bearing subassembly.

**NOTICE:**
**Be careful not to catch your fingers between bearing plate and dust deflector.**


M04020100049

## IMPORTANT POINTS - ASSEMBLY

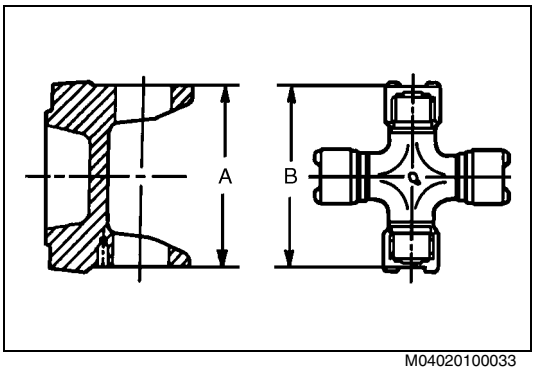
**1. ASSEMBLE THE UNIVERSAL JOINT BEARINGS.**

(1) After the universal joint bearing assemblies are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

**NOTICE:**

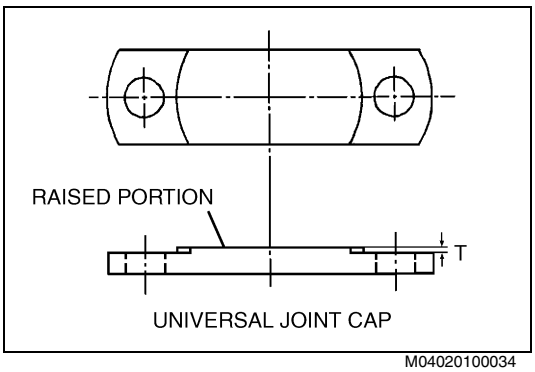
**Remove the stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.**



M04020100033

**2. NSTALL THE SPIDERS AND UNIVERSAL JOINT BEARINGS INTO THE YOKES.**

(1) Select a thickness for the raised portion (T) of the universal joint cap so that measurements B is equivalent to measurements A. Use universal joint caps of the same thickness as possible for both ends.



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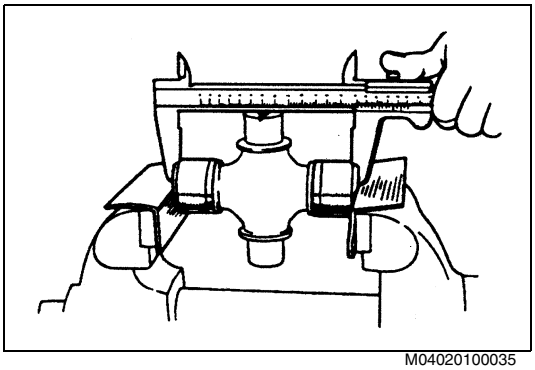
**Universal joint caps are available in following thickness.**

**Unit: mm {in.}**

| Thickness of raised portion (T) of universal joint cap | Color code |
|---|---|
| 0.00 | Silver |
| 0.04 {0.0016} | Yellow |
| 0.08{0.0031} | Black |
| 0.12 {0.0047} | Green |

**NOTICE:**

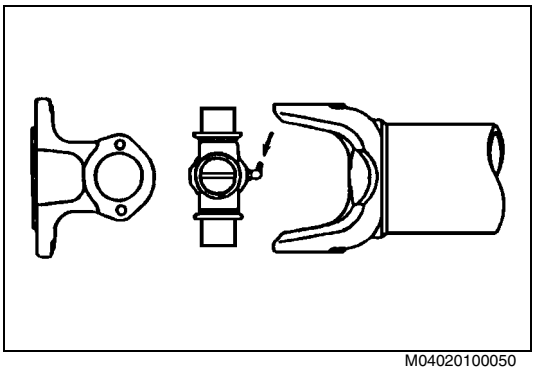
**When measuring dimension "B", clamp the spider with bearings on two journal ends in a vise.**

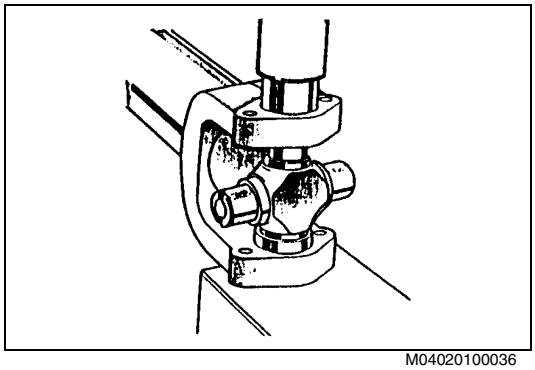

M04020100035

(2) Put the spider into the yoke and then set the universal joint bearings on the yoke.

**NOTICE:**

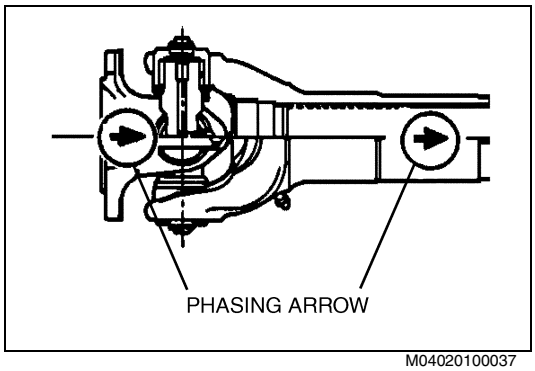
**When assembling the universal joint spiders to the yokes, position the lubrication fitting so that it is to the inside of the yoke and sliding yoke lugs as shown in figure.**


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M04020100036

(3) Press the universal joint bearings into the yokes over the spider journal.

**NOTICE:**
**Pay attention not to damage the seal lip of the universal joint bearing when installing.**



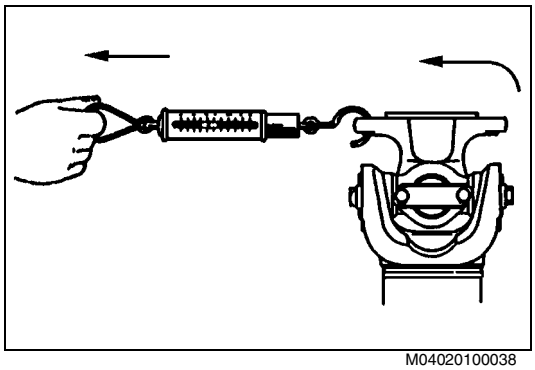
M04020100037

(4) Install the universal joint yokes to the universal joint spider.

**NOTICE:**
**Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.**

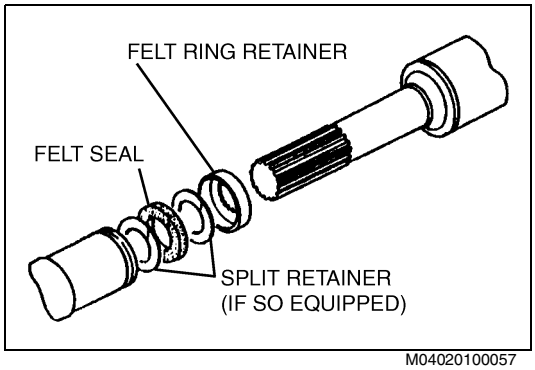
(5) Check the universal joint cap to ensure that it is free of any wear or damage. Insert the universal joint cap into the groove in the needle roller bearing, fit in the lock plate, and tighten the universal joint cap.

**NOTICE:**
**Insert the universal joint cap so that the raised portion faces the needle roller bearing. When inserting the universal joint cap, make sure that the raised portion fits within the bearing opening of the universal joint yoke.**


M04020100038

(6) Check the starting torque of the universal joint using a spring balancer.

(7) After tightening the universal joint cap, bend the lock plate so that it rests snugly against two sides of the bolt. Make sure that no gaps appear between the lock plate and the bolt. Also, upon fitting the lock plate against the bolt, check the bent portion of the lock plate to make sure there are no cracks or fissures.
**Assembly standard:**
**0.98-3.92 N·m {10-40 kgf·cm, 8.7-34.7 lbf·in}**
a. If the measuring value is below the assembly standard, replace the universal joint cap to a thicker one, then repeat the procedure, starting from step 1.
b. If the measuring value is above the assembly standard, replace the universal joint cap to a thinner one, then repeat the procedure, starting from step 1.

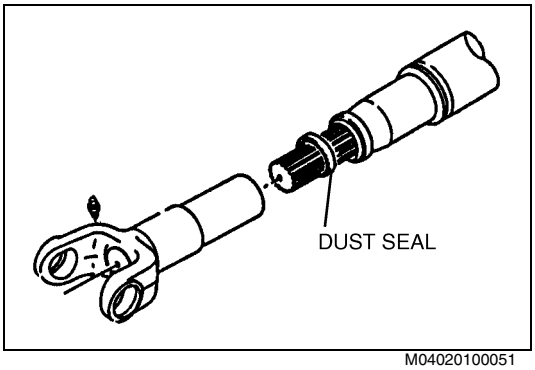


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**3. INSTALL THE SEAL RING AT THE SPLINE. [TRANSMISSION TO REAR AXLE (REAR)]**

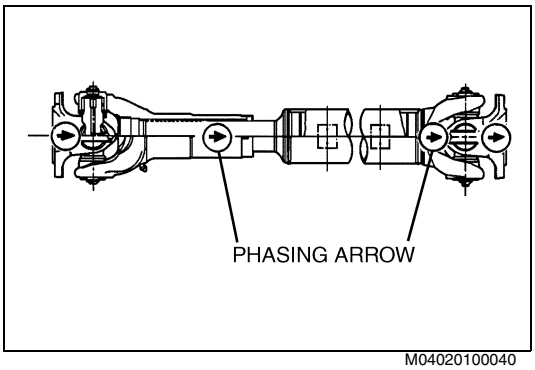
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new split retainers, felt seal and felt ring retainer on the shaft by pushing it in along the yoke shaft spline.

(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the felt ring.



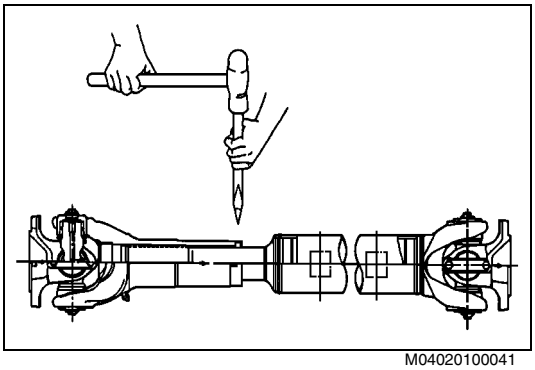
M04020100051

**4. INSTALL THE SEAL RING AT THE SPLINE.**
**[REAR AXLE (FRONT) TO REAR AXLE (REAR)]**
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new dust seal on the shaft by pushing it in the seal groove.
(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the dust seal.



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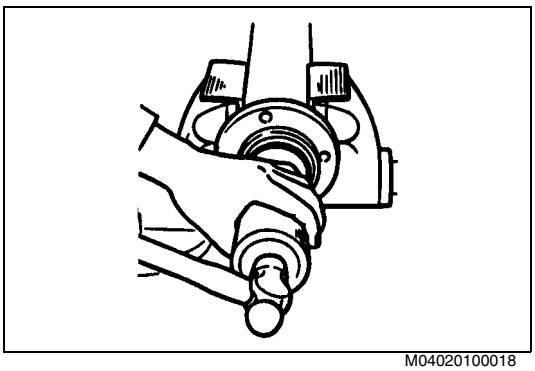
**5. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.**
(1) Align the phasing arrows as shown in figure.


M04020100041

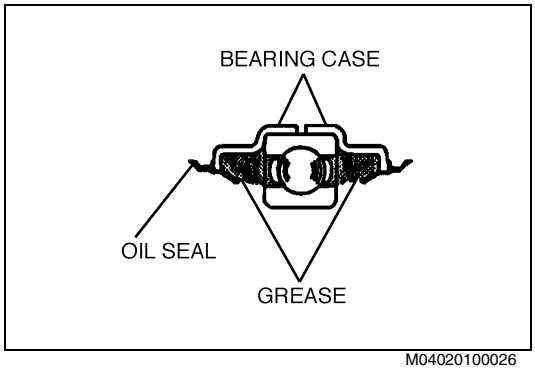
**6. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE.**
**[TRANSMISSION TO REAR AXLE (FRONT)]**
(1) Caulk the felt ring retainer equally at four points on the circumference of the felt ring retainer. Make sure the felt ring retainer is caulked down securely into the groove on the end of the sliding yoke.

**Caulking Width: 10-15 mm {0.394-0.591 in.}**

**CAUTION:**
**When caulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.**


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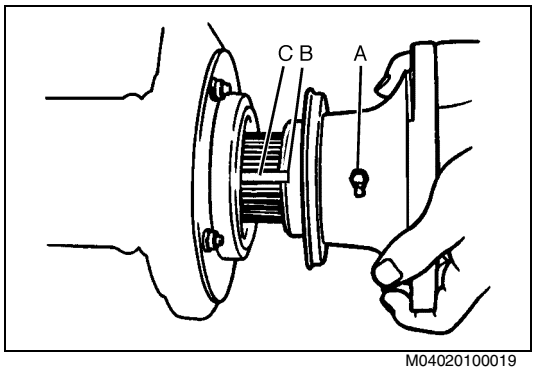
**7. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING ASSEMBLY.**
**[TRANSMISSION TO REAR AXLE (FRONT)]**



M04020100026

**NOTICE:**
**Prior to installation of center bearing assembly, remove the stale grease and apply fresh grease between the bearing case and the center bearing.**

**Grease:**
**Refer to owner's manual.**



M04020100019

(1) Install the universal joint flange yoke.
   a. Prior to installing, heat the universal joint flange ion either water or oil that has been heated to between 80-100 °C {176-212 °F}

**NOTICE:**
**Do not heat the universal joint flange in excess of 120 °C {248 °F}**

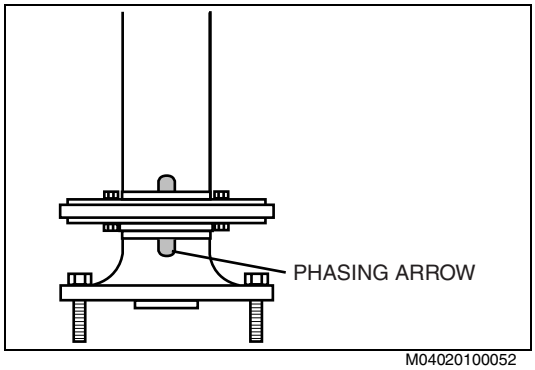
**CAUTION:**
**Never touch hot water or oil and heated universal joint flange with your bare band. This can result personal injury.**

   b. Align lubrication fitting slit and grease passage in line a shown in figure.

- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

**CAUTION:**
**Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper torque specifications.**

   c. Using the special tool, tighten the lock nut.
   **SST: Socket Wrench (09839-6502)**

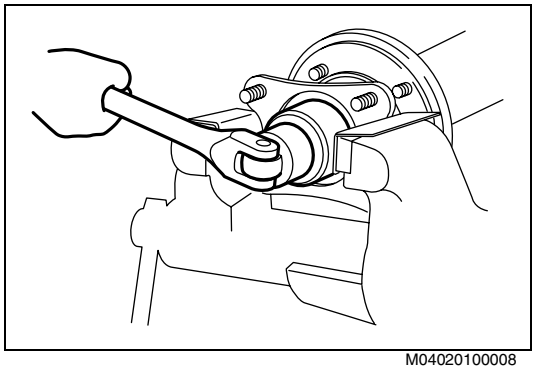


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   d. Prior to mounting heat the universal joint flange in either water or grease that has been heated to between 80-100 °C {176-212 °F}.

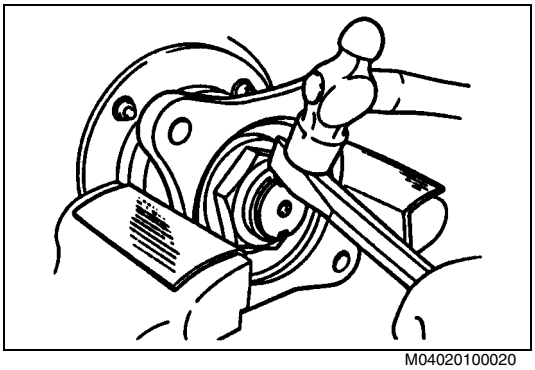
**CAUTION:**
**When heating grease, never allow the temperature to exceed 120 °C {248 °F}.**

   e. Align the phasing arrows on the universal joint flange, yoke shaft and sliding yoke in line as shown in figure.

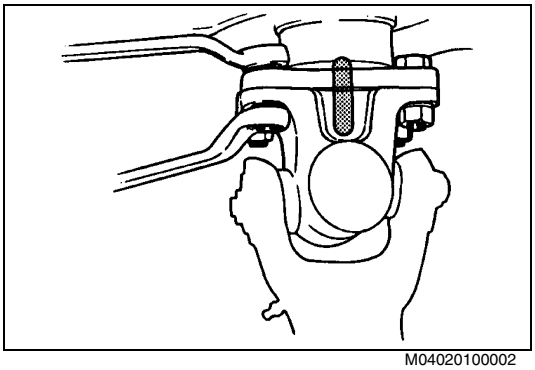

M04020100008

   f. Using the special tool, tighten the lock nut.
   **SST: Socket Wrench (09839-6502)**

   g. Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper torque specifications.


M04020100020

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


M04020100002

## IMPORTANT POINT - MOUNTING

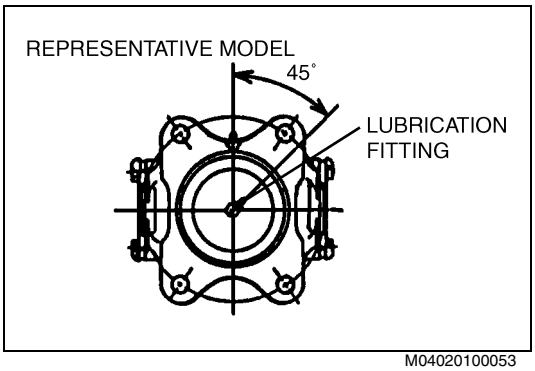
**1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.**

(1) Align the matching marks on the flange and yoke.

(2) Tighten the bolts and nuts.

(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

**Grease:**
**Refer to owner's manual.**



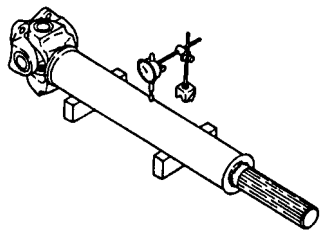
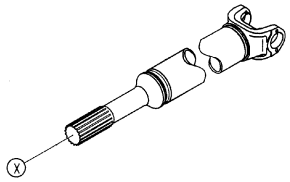
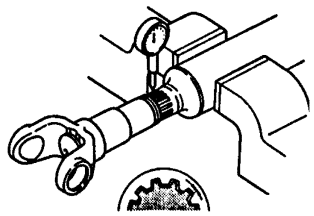
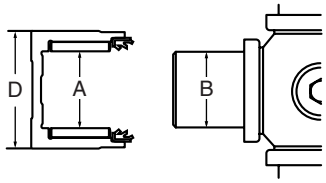
M04020100053

(4) Adjust the direction of the lubrication fitting for the yoke shaft side and sliding yoke side.

# INSPECTION AND REPAIR

M04020104BEH3001

Unit: mm {in.}

| Inspection item | | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|---|
| Propeller shaft damage and bend | | 0-0.5 {0-0.0197} | 1.0 {0.0393} | Replace. | Measure  |
| Crack in the welding beads | | — | — | Replace, if necessary. | Visual check  |
| Sliding spline damage | | — | — | Replace, if necessary. | |
| Sliding spline backlash | Transmission to rear axle | 0.062-0.174 {0.0025-0.0068} | 0.3 {0.0118} | Replace. | Measure  |
| | Rear axle (front) to rear axle (rear) | | 0.3 {0.0118} | | |
| Clearance (C) between universal joint spider and needle roller bearing (C = A - B) | D: 47 {1.85} | 0.020-0.054 {0.0008-0.0021} | 0.1 {0.0039} | Replace needle roller bearing sub-assembly or universal joint spider. | Measure   |
| | D: 50 {1.97} D: 58 {2.28} | 0.25-0.075 {0.0010-0.0029} | | | |

# PROPELLER SHAFT (HE1160)

PP02-004

**PROPELLER SHAFT ASSEMBLY ..... PP02-2**
DATA AND SPECIFICATIONS ..... PP02-2
DESCRIPTION ..... PP02-2
TROUBLESHOOTING ..... PP02-3
SPECIAL TOOL ..... PP02-3
COMPONENT LOCATOR ..... PP02-4
OVERHAUL ..... PP02-7
INSPECTION AND REPAIR ..... PP02-14

# PROPELLER SHAFT ASSEMBLY

## DATA AND SPECIFICATIONS

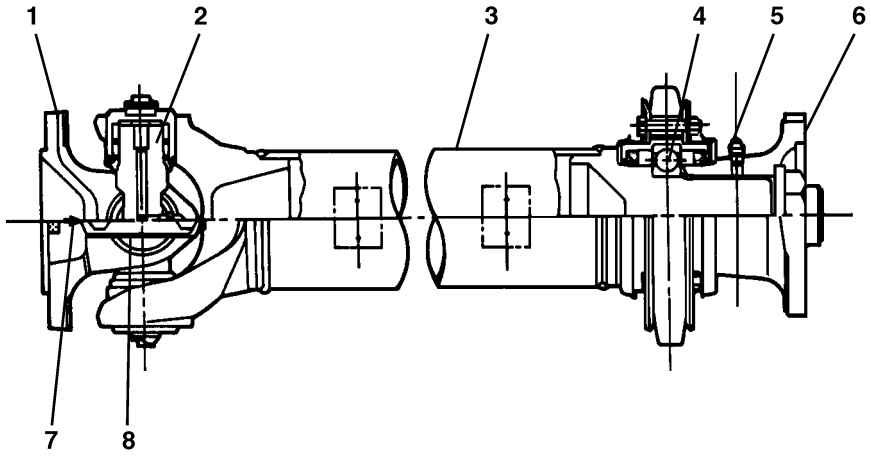
M04020105BEI2001

| | |
|---|---|
| **Type** | **Tubular shaft type (TRANSMISSION TO REAR AXLE)<br>Tubeless shaft type [REAR AXLE (FRONT) TO REAR AXLE (REAR)]** |
| **Universal joint** | **All metal, round bearing type with needle roller bearing** |

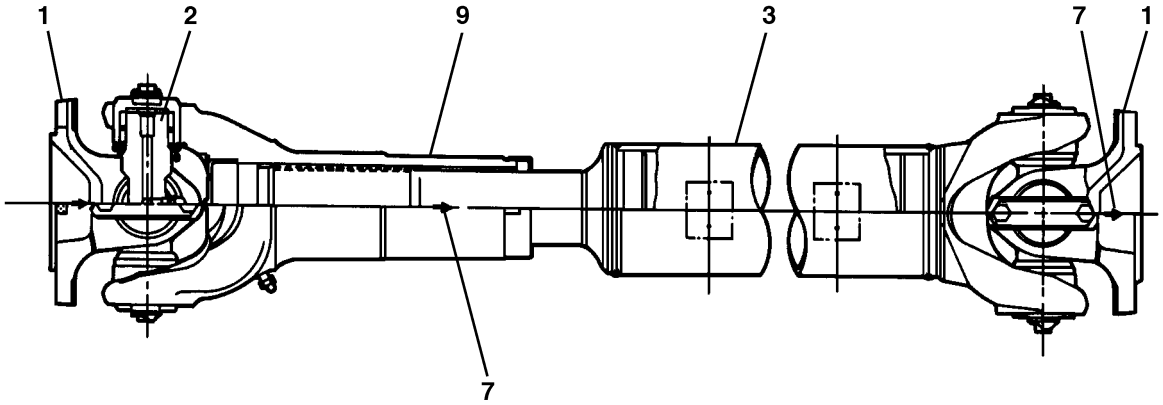
## DESCRIPTION

M04020105C1001

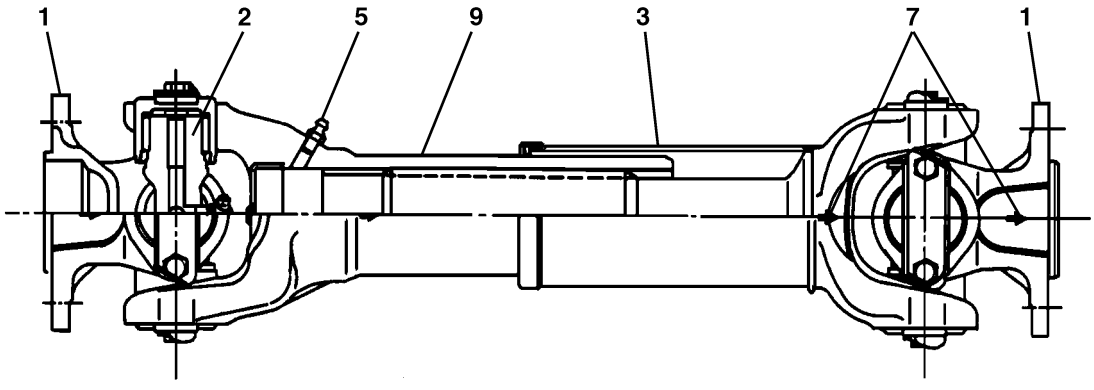
**TRANSMISSION TO REAR AXLE (FRONT)**




**TRANSMISSION TO REAR AXLE (REAR)**




**REAR AXLE (FRONT) TO REAR AXLE (REAR)**




M04020100067

| | | | |
|---|---|---|---|
| **1** | **Universal joint yoke** | **6** | **Flange** |
| **2** | **Needle roller bearing** | **7** | **Phasing arrow** |
| **3** | **Yoke shaft** | **8** | **Lock washer** |
| **4** | **Center bearing** | **9** | **Sliding yoke** |
| **5** | **Lubrication fitting** | | |

# TROUBLESHOOTING

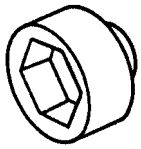
M04020105BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal vibration when driving.** | Looseness of universal joint yoke and flange tightening nuts. | Tighten the nuts. |
| | Looseness of universal joint flange lock nut. | Replace the lock nut with new one, then tighten the lock nut with specified torque and caulk the nut securely. |
| | Excessively bent propeller shaft. | Replace the shaft. |
| | Worn or damaged universal joint | Replace the universal joint. |
| | Worn or damaged center bearing. (If so equipped) | Replace the bearing. |
| | Worn or damaged center bearing rubber cushion. (If so equipped) | Replace the rubber cushion. |
| | Incorrect phasing of the yokes. | Match the phasing arrows correctly. |

# SPECIAL TOOL

M04020105BEK1001

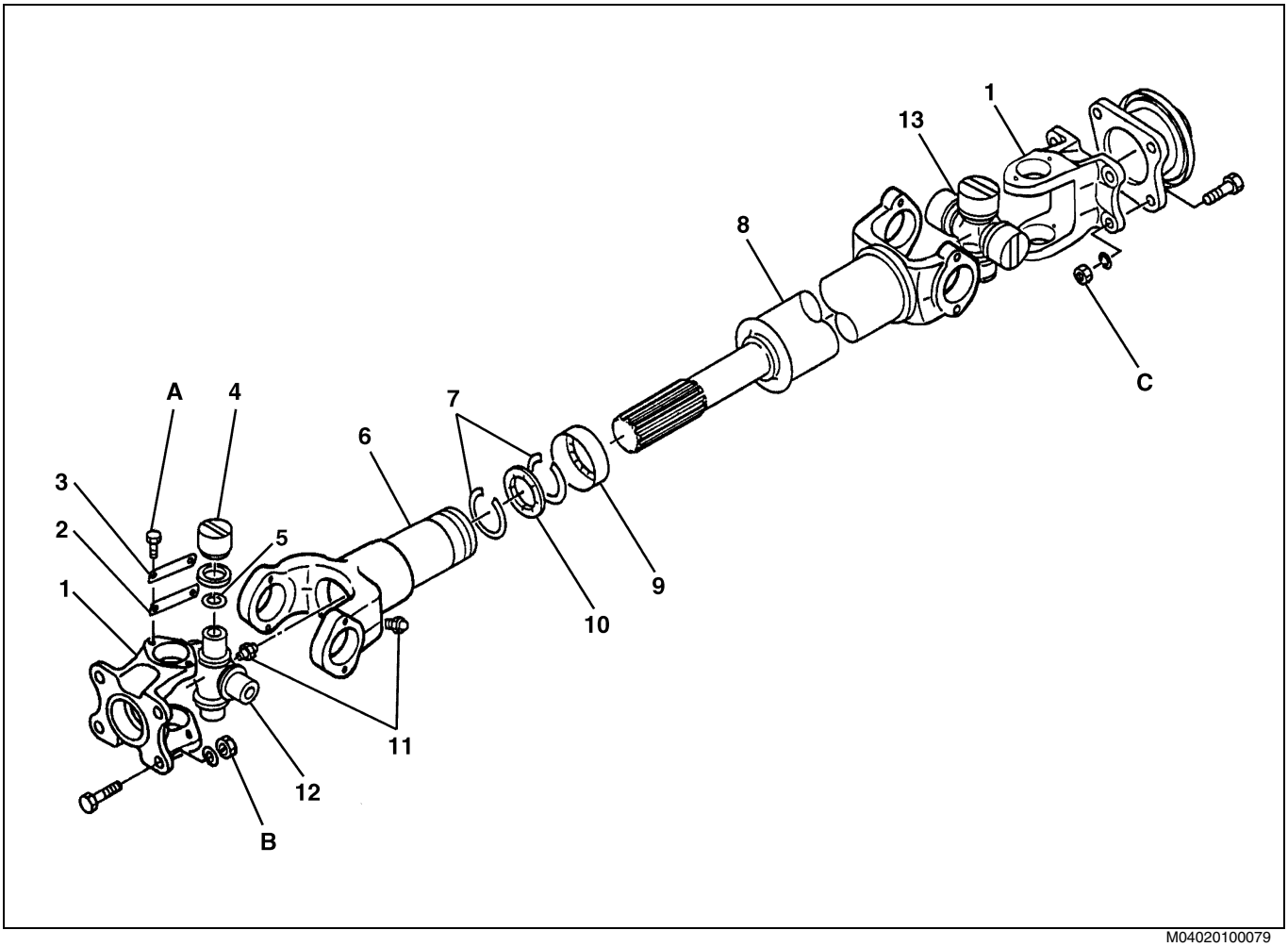
Prior to starting a propeller shaft overhaul, it is necessary to have this special tool. (with center bearing type)

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-6502 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M04020105BED1002

## TRANSMISSION TO REAR AXLE (SINGLE SHAFT TYPE)



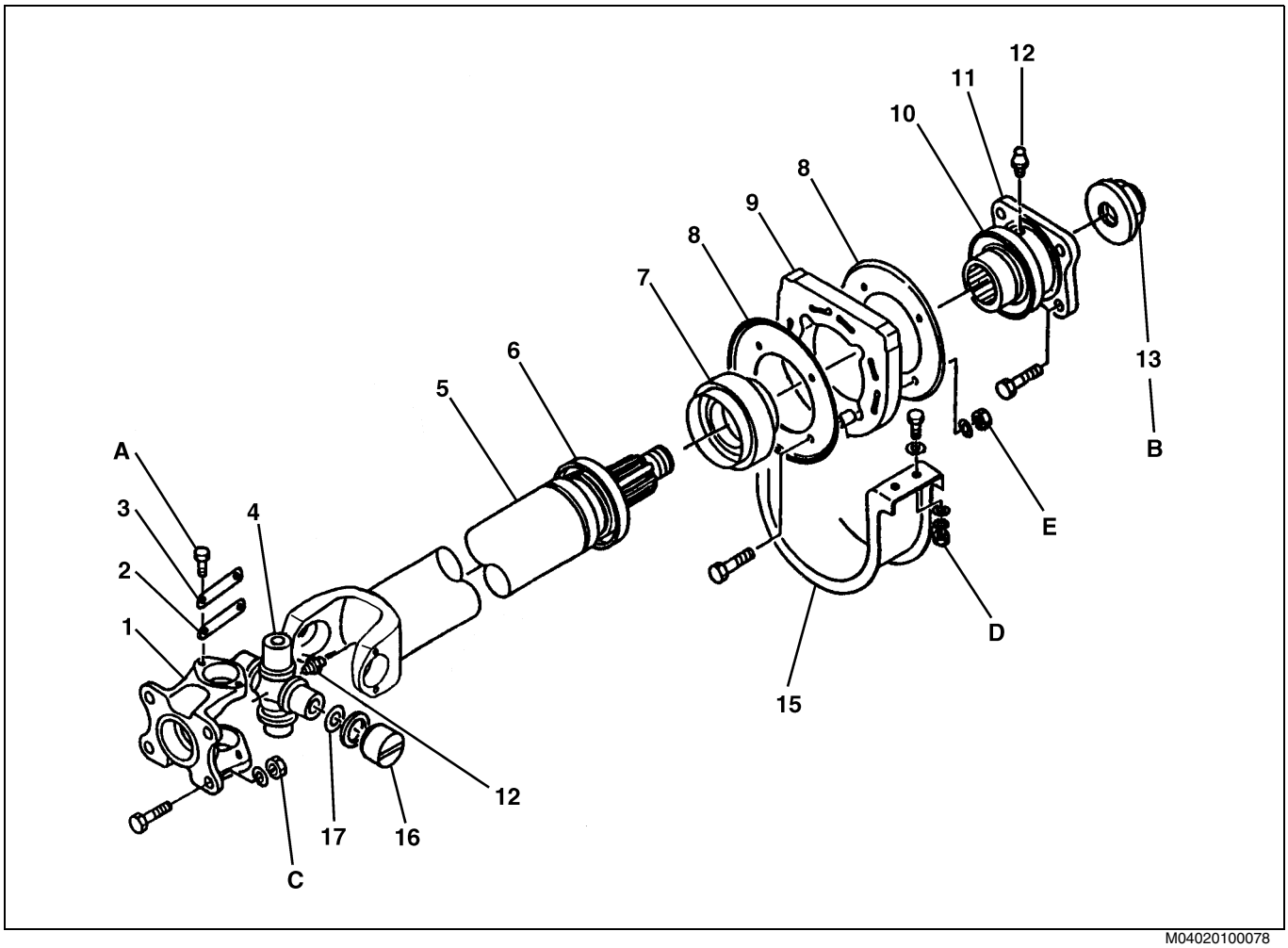

M04020100079

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 8 | Yoke shaft |
| 2 | Universal joint cap | 9 | Felt ring retainer |
| 3 | Lock washer | 10 | Felt seal |
| 4 | Needle roller bearing | 11 | Lubrication fitting |
| 5 | Thrust washer | 12 | Universal joint spider |
| 6 | Sliding yoke | 13 | Universal joint assembly |
| 7 | Split retainer (If so equipped) | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 49-61 {500-630, 36-45} | C | 167-225 {1,700-2,300, 124-166} |
| B | 167-225 {1,700-2,300, 124-166} | | |

## TRANSMISSION TO REAR AXLE (FRONT)



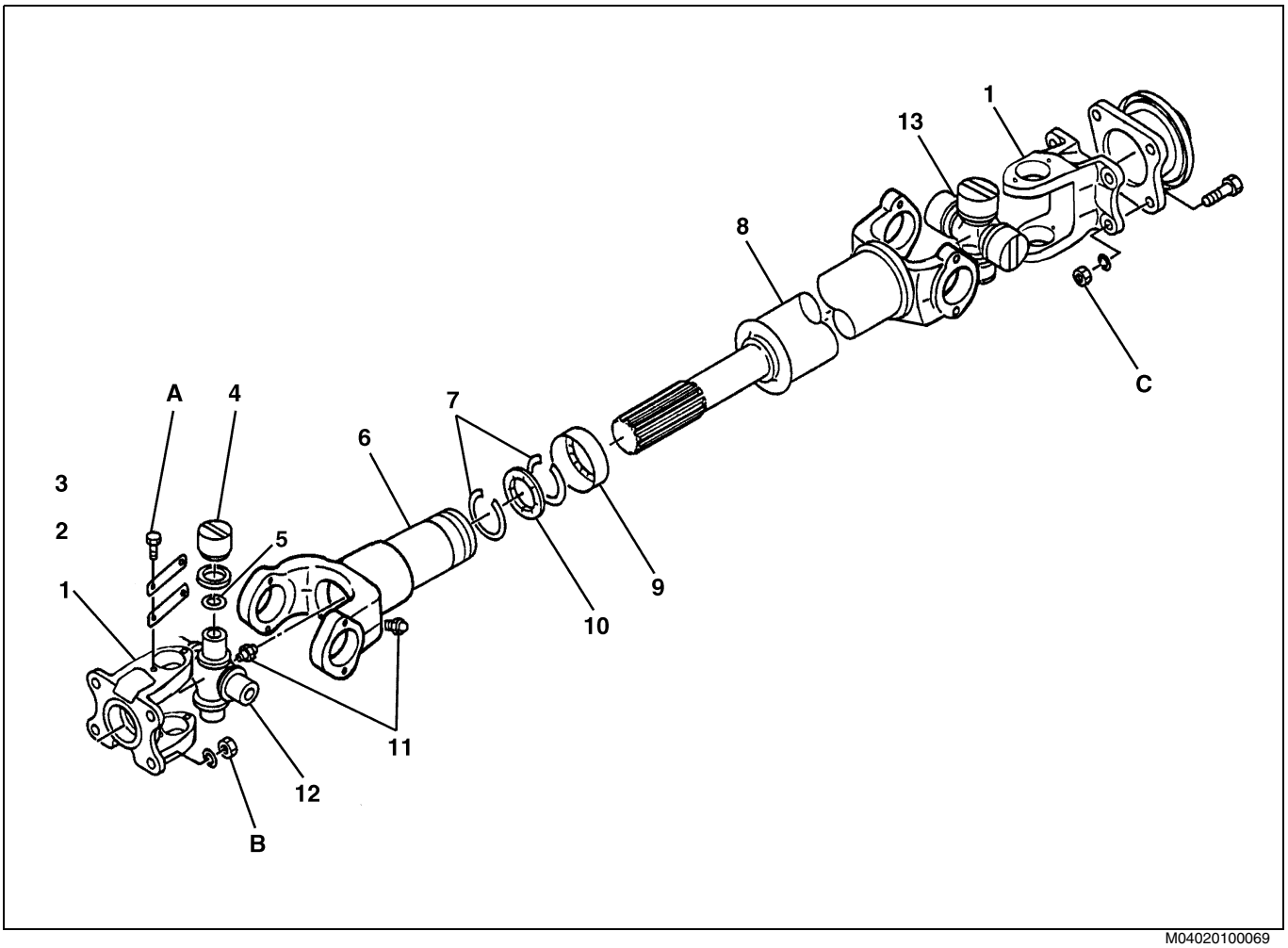

M04020100078

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 10 | Dust deflector |
| 2 | Universal joint cap | 11 | Universal joint flange |
| 3 | Lock washer | 12 | Lubrication fitting |
| 4 | Universal joint spider | 13 | Lock nut |
| 5 | Yoke shaft | 14 | Collar |
| 6 | Dust deflector | 15 | Center bearing holder |
| 7 | Center bearing | 16 | Needle roller bearing |
| 8 | Center bearing plate | 17 | Thrust washer |
| 9 | Center bearing cushion | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 49-61 {500-630, 36-45} | D | 96-144 {980-1,470, 71-105} |
| B | 784-980 {8,000-10,000, 579-723} | E | 19-25 {190-260, 14-19} |
| C | 167-225 {1,700-2,300, 124-166} | | |

## TRANSMISSION TO REAR AXLE (REAR)



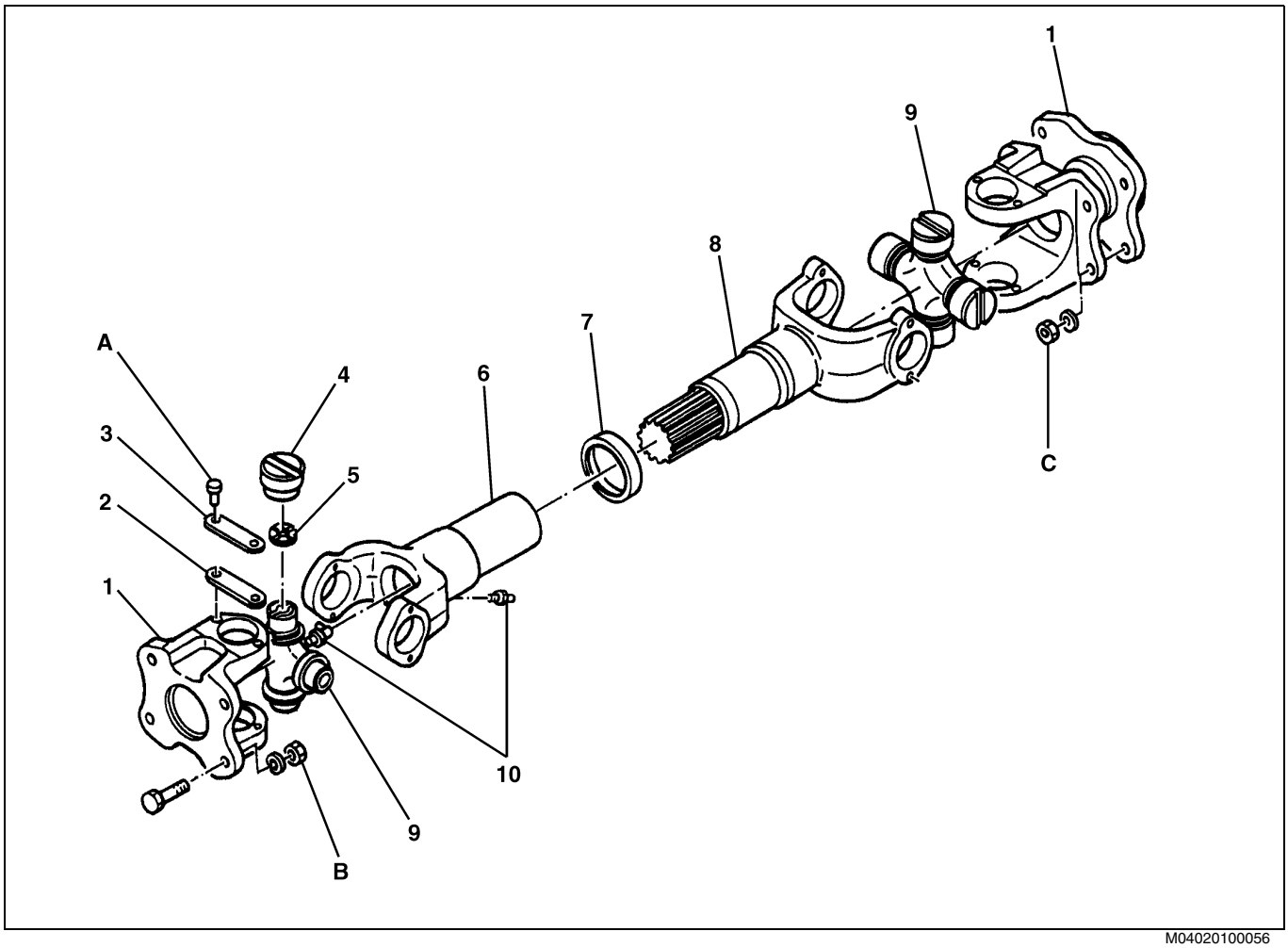

M04020100069

| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 8 | Yoke shaft |
| 2 | Universal joint cap | 9 | Felt ring retainer |
| 3 | Lock washer | 10 | Felt seal |
| 4 | Needle roller bearing | 11 | Lubrication fitting |
| 5 | Thrust washer | 12 | Universal joint spider |
| 6 | Sliding yoke | 13 | Universal joint assembly |
| 7 | Split retainer (If so equipped) | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 49-61 {500-630, 36-45} | C | 167-225 {1,700-2,300, 124-166} |
| B | 167-225 {1,700-2,300, 124-166} | | |

## REAR AXLE, FRONT TO REAR AXLE, REAR




M04020100056

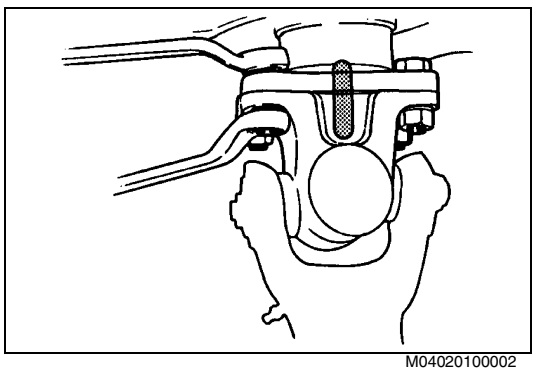
| | | | |
|---|---|---|---|
| 1 | Universal joint yoke | 6 | Sliding yoke |
| 2 | Universal joint cap | 7 | Dust seal |
| 3 | Lock washer | 8 | Yoke shaft |
| 4 | Needle roller bearing | 9 | Universal joint spider |
| 5 | Thrust washer | 10 | Lubrication fitting |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 26-31 {270-310, 20-22} | C | 128-156 {1,300-1,600, 94-115} |
| B | 128-156 {11,300-1,600, 94-115} | | |

# OVERHAUL

**M04020105BEH2001**



M04020100002

## IMPORTANT POINT - DISMOUNTING

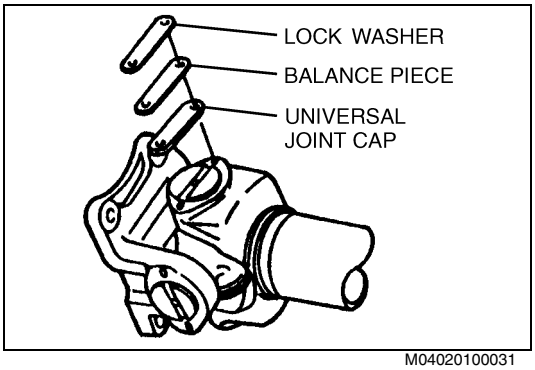
**1. DISCONNECT THE PROPELLER SHAFT FROM THE FLANGE ON ALL THE CONNECTING POINTS.**

(1) Make aligning marks on the flange and yoke.

(2) Remove the nuts and the bolts.

**NOTICE:**

**Park the vehicle on level ground, apply the parking brake and apply wheel stoppers in the front tires or rear tires.**



M04020100031

## IMPORTANT POINTS - DISASSEMBLY

**1. DISASSEMBLE THE UNIVERSAL JOINT ASSEMBLY.**

(1) Remove the lock washer.

**NOTICE:**
**For some models, one additional lock washer is installed as an additional balance on one of the bearing.**

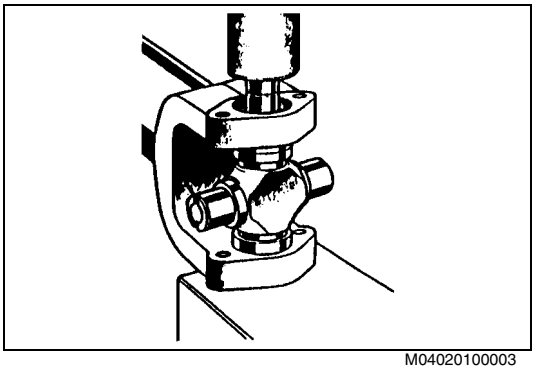
(2) Remove the balance piece, if so equipped.

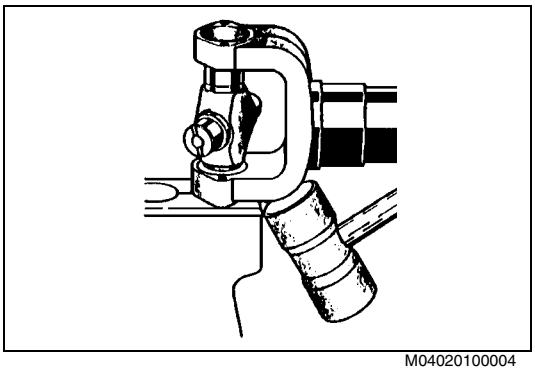
**NOTICE:**
**Some models are equipped with one, two, or three balance pieces between the lock washer and universal joint cap of one of the bearing.**

(3) Remove the universal joint cap.

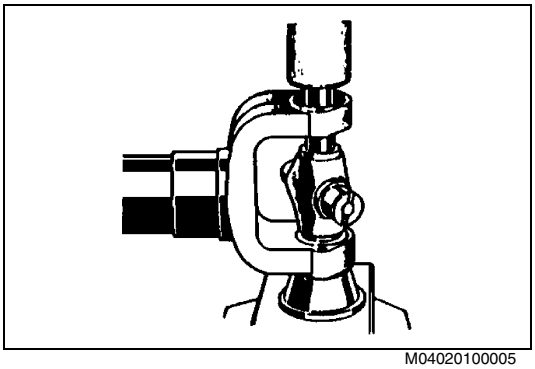
(4) Remove the needle roller bearings and spider from the yoke.

a. Position the yoke under the arbor press and push the universal joint partially out of the yoke lug.
The bearing race will now protrude from the yoke.

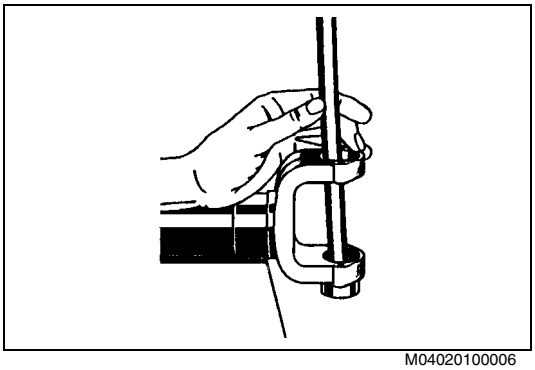

M04020100003


M04020100004

b. Place the propeller shaft assembly in a vise, gripping the protruding bearing with the vise.
Tap the yoke in area shown to achieve removal of universal joint bearing.

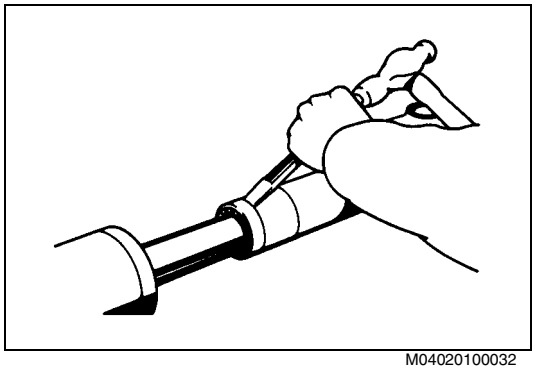

M04020100005

c. Place the yoke under an arbor press with the opposite side of universal joint spider in the up position and place a small push tool on the universal joint spider end.
d. Press the opposite bearing out of the yoke lug.


M04020100006

e. Remove the spider from the yoke.
f. Remove the bearing from the yoke lug.

**NOTICE:**
- **Keep the location and number of lock washer or balance piece in mind.**
- **Bolt lengths are different according to the number of balance piece.**


M04020100032

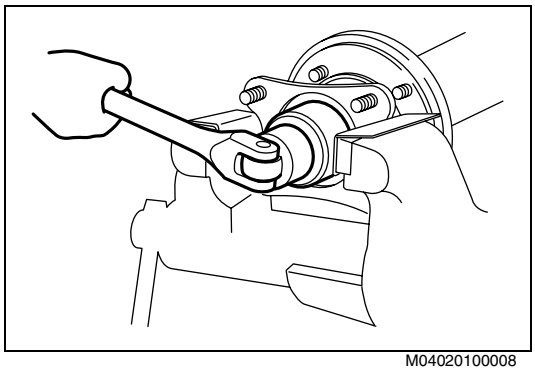
**2. SEPARATE THE YOKE SHAFT AND SLIDING YOKE. [TRANSMISSION TO REAR AXLE (REAR)]**

(1) Uncaulk the felt ring retainer from the groove on the sliding yoke.

(2) Separate the yoke shaft and sliding yoke.

(3) Remove the felt seal, split retainers and felt ring retainer, or dust seal from the yoke shaft.

**CAUTION:**
**When uncaulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.**


M04020100008

**3. REMOVE THE CENTER BEARING. [TRANSMISSION TO REAR AXLE (FRONT)]**

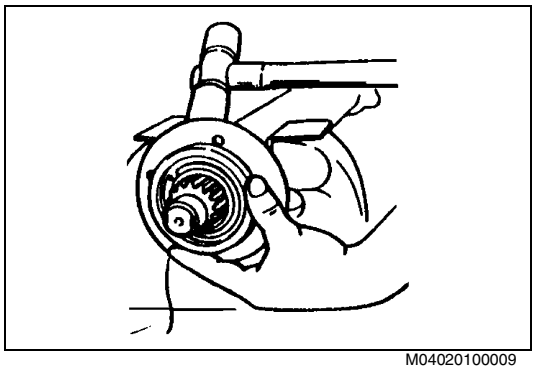
(1) Place the propeller shaft in a vise.

(2) Uncaulk the lock nut on the shaft.

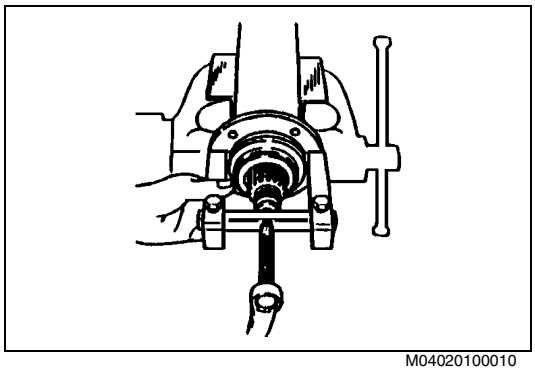
(3) Make aligning marks on the flange and shaft.

(4) Using the special tool, remove the lock nut.
**SST: Socket Wrench (09839-6502)**

(5) Remove the universal joint flange from the shaft.

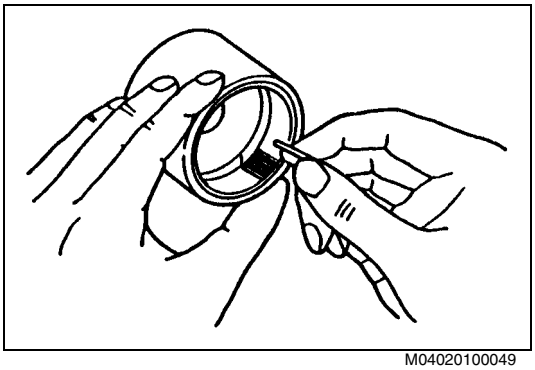

M04020100009

(6) Using a hammer, tap the bearing plate to make a clearance.


M04020100010

(7) Using a commercial puller, remove the center bearing subassembly.

**NOTICE:**
**Be careful not to catch your fingers between bearing plate and dust deflector.**


M04020100049

## IMPORTANT POINTS - ASSEMBLY

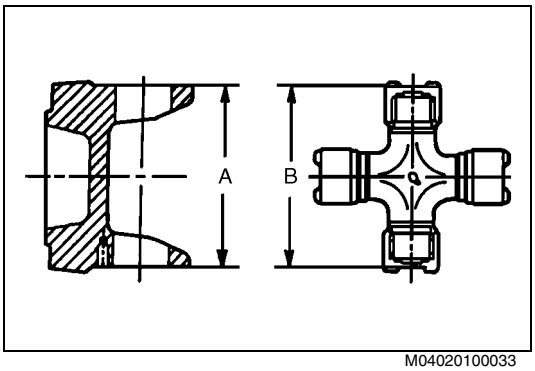
**1. ASSEMBLE THE NEEDLE ROLLER BEARINGS.**

(1) After the needle roller bearings are thoroughly cleaned, apply clean lubricant to the rollers.

(2) Check each bearing for missing rollers.

**NOTICE:**

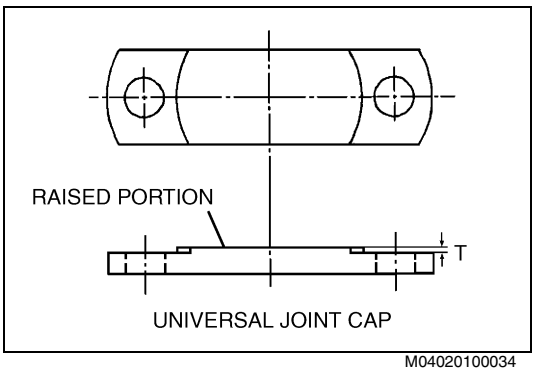
**Remove the stale grease from the bearing cage. Lubricate with grease containing molybdenum disulfide on the needle roller, seal lip and both surfaces of thrust washer.**



M04020100033

**2. NSTALL THE SPIDERS AND NEEDLE ROLLER BEARINGS INTO THE YOKES.**

(1) Select a thickness for the raised portion (T) of the universal joint cap so that measurements B is equivalent to measurement A. Use universal joint caps of the same thickness as possible for both ends.



M04020100034

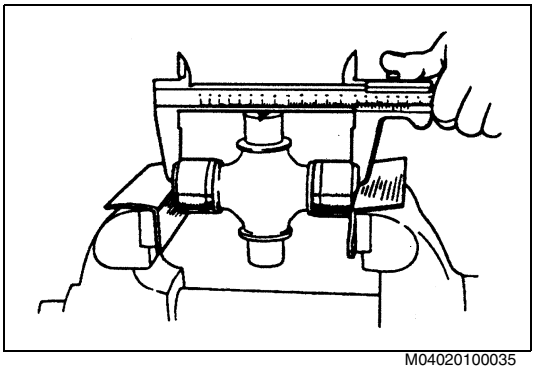
**Universal joint caps are available in following thickness.**

**Unit: mm {in.}**

| Thickness of raised portion (T) of universal joint cap | Color code |
|---|---|
| 0.00 | Silver |
| 0.04 {0.0016} | Yellow |
| 0.08{0.0031} | Black |
| 0.12 {0.0047} | Green |

**NOTICE:**

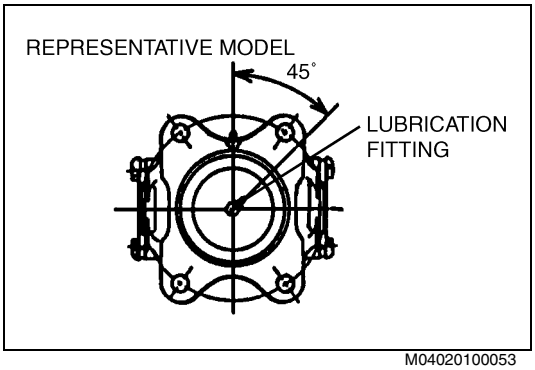
**When measuring dimension "B", clamp the spider with bearings on two journal ends in a vise.**


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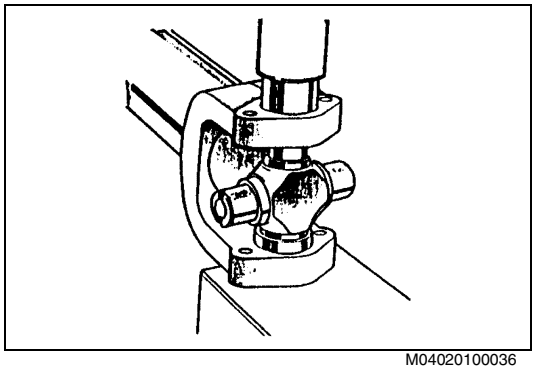
(2) Put the spider into the yoke and then set the universal joint bearings on the yoke.

**NOTICE:**

**When assembling the universal joint spiders to the yokes, position the lubrication fitting so that it is to the inside of the yoke and sliding yoke lugs as shown in figure.**

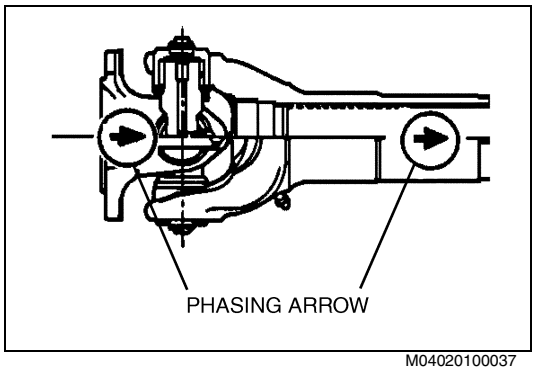


M04020100053


M04020100036

(3) Press the universal joint bearings into the yokes over the spider journal.

**NOTICE:**
**Pay attention not to damage the seal lip of the universal joint bearing when installing.**



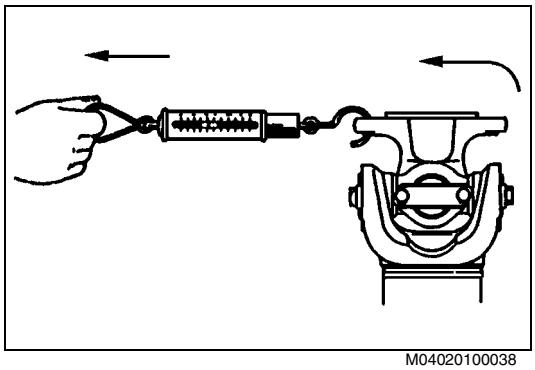
M04020100037

(4) Install the universal joint yokes to the universal joint spider.

**NOTICE:**
**Match the phasing arrows on the universal joint yoke with the phasing arrows on the yoke shaft or sliding yoke.**

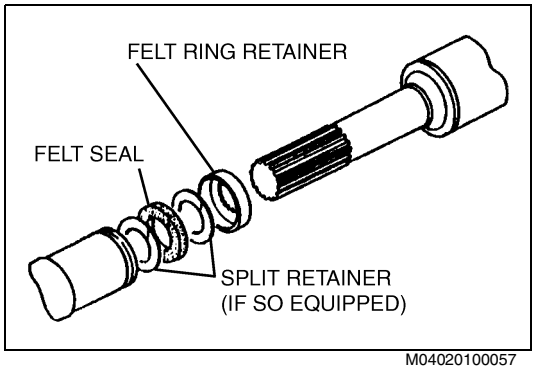
(5) Check the universal joint cap to ensure that it is free of any wear or damage. Insert the universal joint cap into the groove in the needle roller bearing, fit in the lock washer, and tighten the universal joint cap.

**NOTICE:**
**Insert the universal joint cap so that the raised portion faces the needle roller bearing. When inserting the universal joint cap, make sure that the raised portion fits within the bearing bore the universal joint yoke shaft and sliding yoke.**


M04020100038

(6) Check the starting torque of the universal joint using a spring balancer.
**Assembly standard:**
**0.98-4.90 N·m {10-50 kgf·cm, 8.7-43.3 lbf·in}**

(7) After checking the starting torque, bend the lock washer so that it rests snugly against two sides of the bolt. Make sure that no gaps appear between the lock washer and the bolt. Also, upon fitting the lock washer against the bolt, check the bent portion of the lock washer to make sure there are no cracks or fissures.
   a. If the measuring value is below the assembly standard, replace the universal joint cap to a thicker one, then repeat the procedure, starting from step 1.
   b. If the measuring value is above the assembly standard, replace the universal joint cap to a thinner one, then repeat the procedure, starting from step 1.

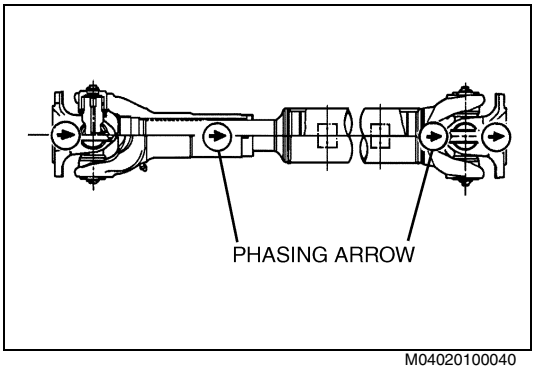


M04020100057

**3. ASSEMBLE THE YOKE SHAFT AND SLIDING YOKE. [TRANSMISSION TO REAR AXLE (REAR)]**

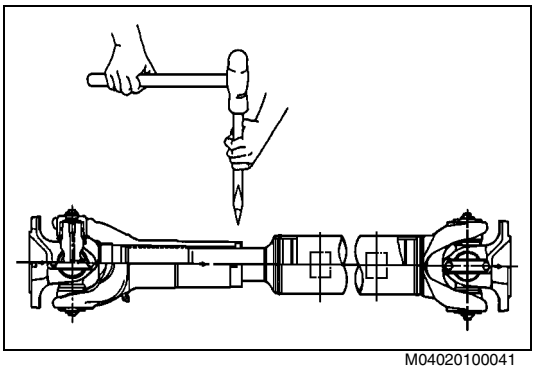
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new split retainers, felt seal and felt ring retainer on the shaft by pushing it in along the yoke shaft spline.

(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the felt ring.



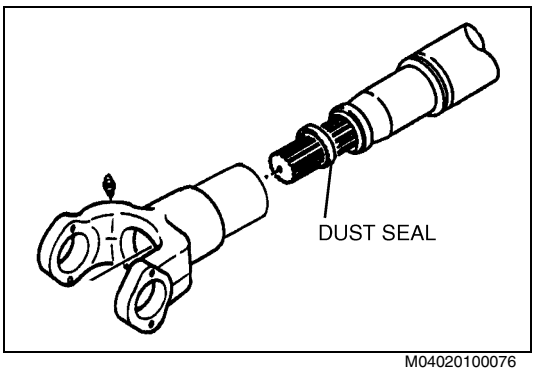
M04020100040

(4) Align the phasing arrows as shown in figure.


M04020100041

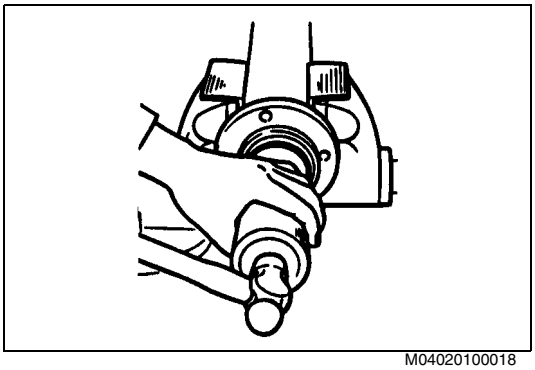
(5) Caulk the felt ring retainer equally at four points on the circumference of the felt ring retainer. Make sure the felt ring retainer is caulked down securely into the groove on the end of the sliding yoke.
**Caulking Width: 10-15 mm {0.394-0.591 in.}**

**CAUTION:**
**When caulking the felt ring retainer, a metal chip may pop on impact. Wear safety glasses to protect your eyes.**

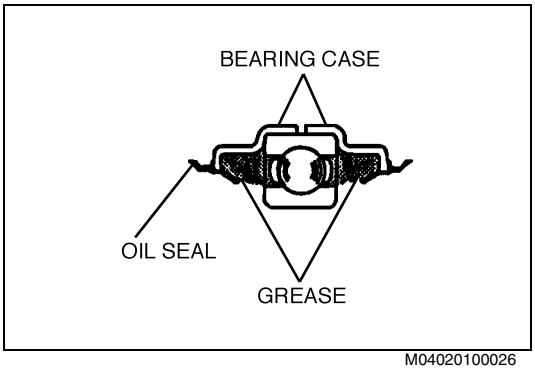


M04020100076

**4. INSTALL THE DUST COVER SEAL.**
**[REAR AXLE (FRONT) TO REAR AXLE (REAR)**
(1) Remove the stale grease from the spline of the yoke shaft.
(2) Install the new dust cover seal on the shaft by pushing it in the dust cover seal groove.
(3) Apply the grease containing molybdenum disulfide on the spline and sliding area of the dust cover seal.


M04020100018

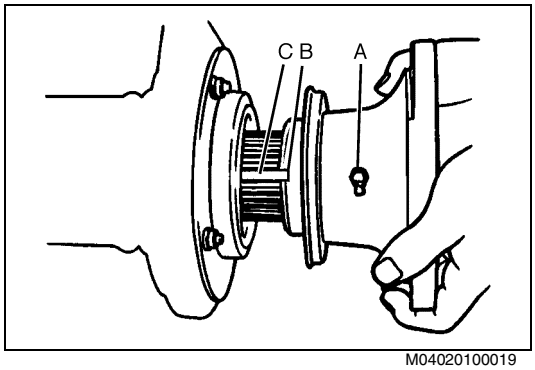
**5. INSTALL THE CENTER BEARING PLATE AND CENTER BEARING.**
**[TRANSMISSION TO REAR AXLE (FRONT)]**



M04020100026

**NOTICE:**
**Prior to installation of center bearing assembly, remove the stale grease and apply fresh grease between the bearing case and the center bearing.**

**Grease:**
**Refer to owner's manual.**



M04020100019

(1) Install the universal joint flange.
   a. Prior to installing, heat the universal joint flange in either water or oil that has been heated to between 80-100 °C {176-212 °F}.

**NOTICE:**
**Do not heat the universal joint flange in excess of 120 °C {248 °F}.**

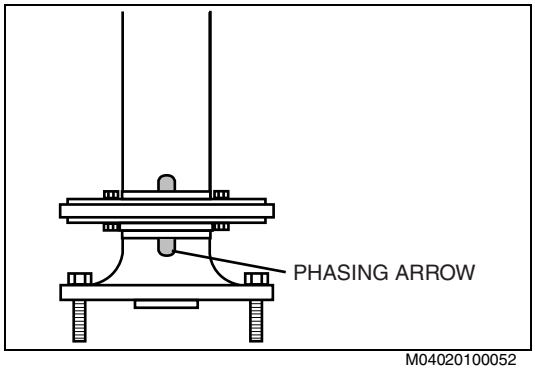
**CAUTION:**
**Never touch hot water or oil and heated universal joint flange with your bare band. This can result personal injury.**

   b. Align lubrication fitting slit and grease passage in line as shown in figure.

- A: Lubrication fitting
- B: Lubrication fitting slit
- C: Grease passage

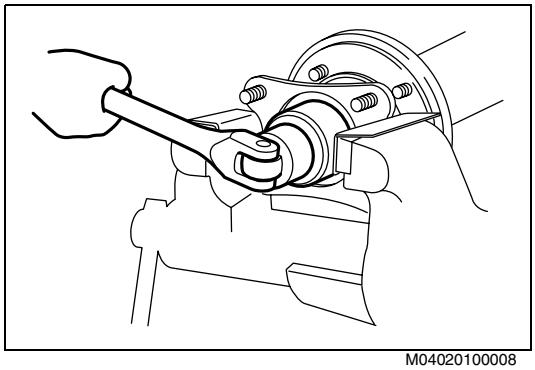
**NOTICE:**
**Following installation, allow the assembly to cool for at least five minutes, prior to tightening to proper torque specifications.**

   c. Using the special tool, tighten the lock nut.
   **SST: Socket Wrench (09839-6502)**

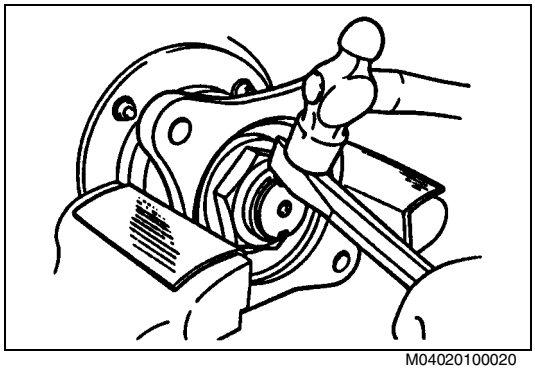


M04020100052

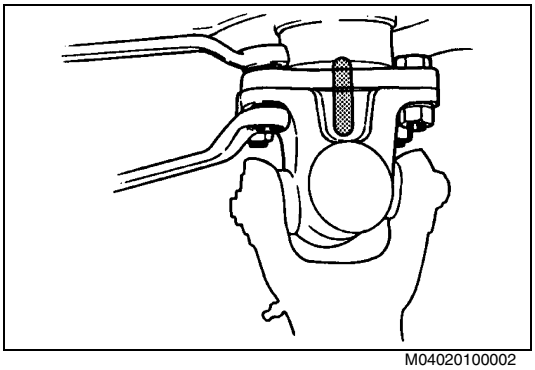
   d. Align the phasing arrows on the universal joint flange, yoke shaft and sliding yoke in line as shown in figure.


M04020100008

   e. Using the special tool, tighten the lock nut.
   **SST: Socket Wrench (09839-6502)**


M04020100020

(2) Caulk the lock nut.
   a. Caulk deeper than 1.5 mm {0.06 in.}
   b. The caulking should fill the groove thoroughly.
   c. The caulking should be done without rift.


M04020100002

## IMPORTANT POINT - MOUNTING

**1. CONNECT THE PROPELLER SHAFT TO THE FLANGE ON ALL OF THE CONNECTING POINTS.**

(1) Align the matching marks on the flange and yoke.

(2) Tighten the bolts and nuts.

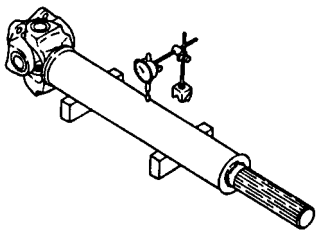
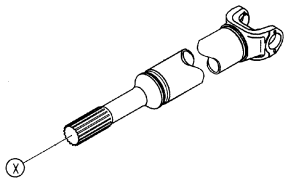
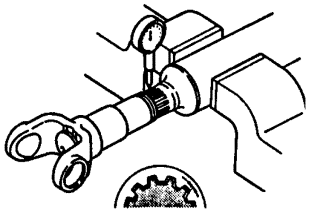
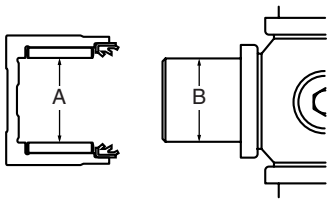
(3) Lubricate the universal joints, sliding spline and center bearing, if so equipped.

**Grease:**
**Refer to owner's manual.**

# INSPECTION AND REPAIR

M04020105BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Propeller shaft damage and bend** | **0-0.5 {0-0.0197}** | **1.0 {0.039}** | **Replace.** | **Measure**  |
| **Crack in the welding beads** | **—** | **—** | **Replace, if necessary.** | **Visual check**   |
| **Sliding spline damage** | **—** | **—** | **Replace, if necessary.** | |
| **Sliding spline backlash (Inspect the spline backlash at sliding yoke lug 80 mm {3.145 in.} from the shaft center.)** | **At spline 0.062-0.174 {0.0025-0.0068}** | **0.3 {0.0118}** | **Replace.** | **Measure**  |
| **Clearance (C) between universal joint spider and needle roller bearing (C = A - B)** | **0.020-0.075 {0.0010-0.0029}** | **0.1 {0.0039}** | **Replace needle roller bearing sub-assembly or universal joint spider.** | **Measure**   |

# DIFFERENTIAL CARRIER (SH13)

DF02-001

**DIFFERENTIAL CARRIER ASSEMBLY (SH13)..... DF02-2**

DATA AND SPECIFICATIONS ..... DF02-2
DESCRIPTION ..... DF02-2
TROUBLESHOOTING ..... DF02-3
SPECIAL TOOL ..... DF02-3
COMPONENT LOCATOR ..... DF02-4
OVERHAUL ..... DF02-6
INSPECTION AND REPAIR ..... DF02-15

# DIFFERENTIAL CARRIER ASSEMBLY (SH13)

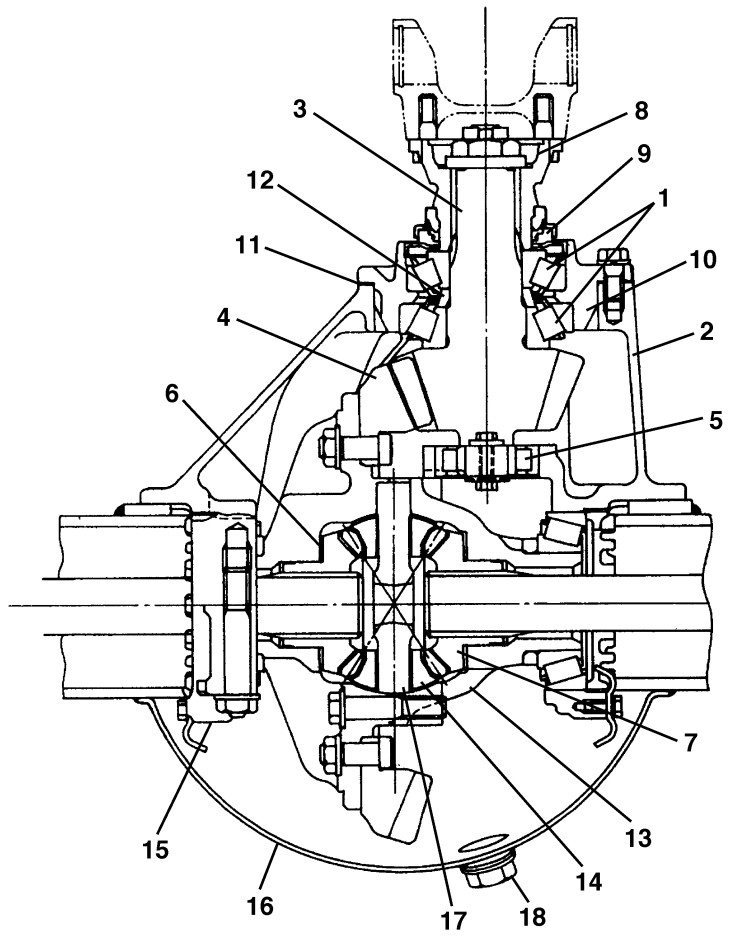
## DATA AND SPECIFICATIONS

M05020101BEI2002

| | |
|---|---|
| **Type** | **Single-reduction, single-speed, by hypoid gearing** |
| **Gear ratios** | **3.900, 4.100, 4.333, 4.625** |
| **Oil capacity** | **3.7 L {0.81 Imp gal. / 0.98 U.S. gal.}** |

## DESCRIPTION

M05020101BEC1002




M05020100001

| | | | |
|---|---|---|---|
| 1 | Taper roller bearing | 10 | Bearing cage |
| 2 | Differential carrier case | 11 | Adjusting shim |
| 3 | Hypoid pinion | 12 | Spacer |
| 4 | Hypoid ring gear | 13 | Differential case |
| 5 | Cylindrical roller bearing | 14 | Differential pinion gear |
| 6 | Thrust washer | 15 | Bearing cap |
| 7 | Differential side gear | 16 | Axle housing |
| 8 | Flange yoke coupling | 17 | Spider |
| 9 | Oil seal | 18 | Oil filler plug |

# TROUBLESHOOTING

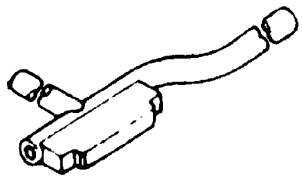
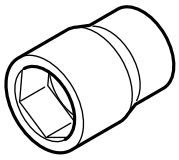
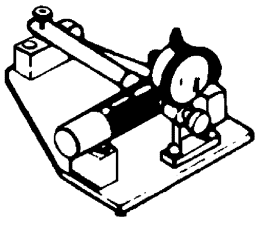
M05020101BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings | Replace bearings. |
| | Worn or damaged differential side bearings | Replace bearings. |
| | Loose pinion bearings | Adjust bearing preload. |
| | Loose differential side bearings | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear | Adjust backlash. |
| | Worn thrust washers | Replace. |
| | Worn differential spider | Replace. |
| | Worn or damaged ring gear and pinion | Replace. |
| | Worn or damaged differential side gears and pinions | Replace. |
| | Loose ring gear bolts | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear | Replace or adjust tooth contact. |
| | Worn pinion spline | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline | Replace. |
| | Worn hub bearings | Replace. |
| | Loose hub bearings | Adjust bearing preload. |
| | Loose differential case tightening bolts | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil | Add oil; check for leakage. |
| | Poor oil quality | Change oil. |
| | Abnormal propeller shaft noise | Refer to Chapter PROPELLER SHAFT. |

# SPECIAL TOOL

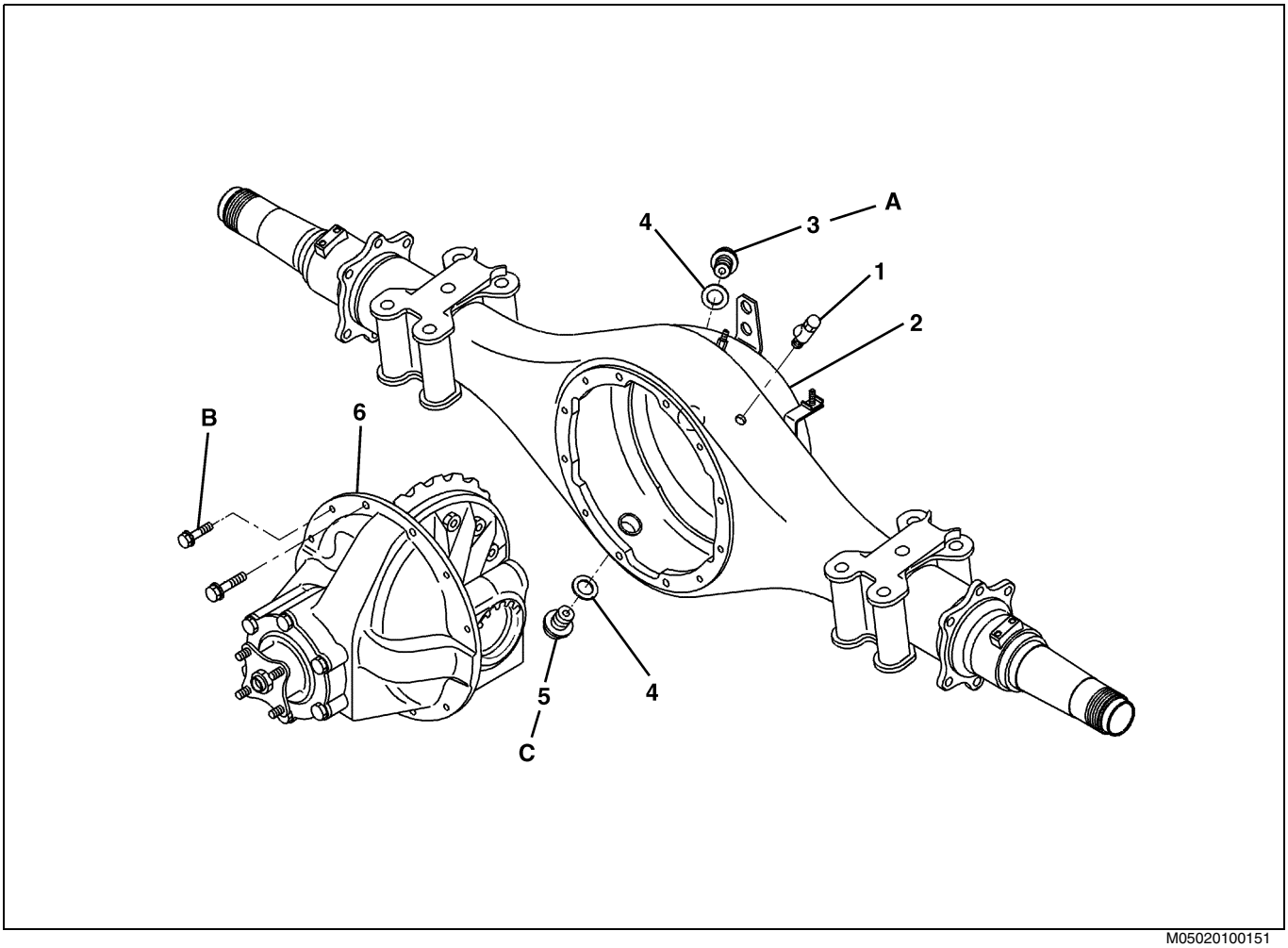
M05020101BEK1001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09665-1150 | ADJUSTER TOOL | |
|  | 09839-4104 | SOCKET WRENCH | |
|  | 09640-1022 | GAUGE ASSEMBLY | |

# COMPONENT LOCATOR

M05020101BED1002

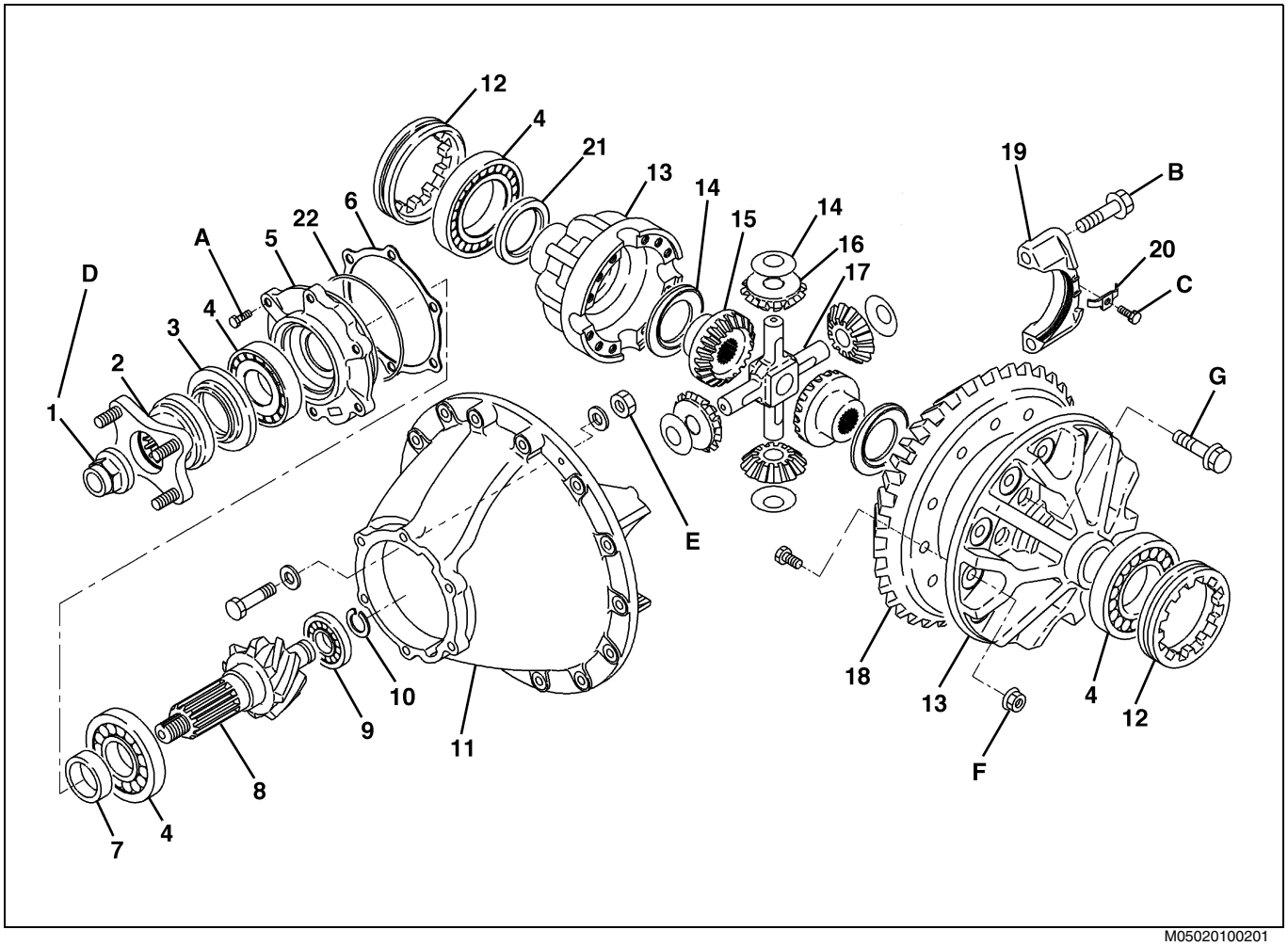



M05020100151

| | | | |
|---|---|---|---|
| 1 | Air breather | 4 | Gasket |
| 2 | Axle housing assembly | 5 | Oil drain plug |
| 3 | Oil filler plug | 6 | Differential carrier assembly |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 78.4-117.6 {800-1,200, 58-86} | C | 78.4-117.6 {800-1,200, 58-86} |
| B | ϕ12 bolt: 84.5-107.5 {860-1,100, 63-79} | | |
| | ϕ14 bolt: 113-147 {1,150-1,500, 83-108} | | |




M05020100201

| | | | |
|---|---|---|---|
| 1 | Lock nut | 12 | Adjusting nut |
| 2 | Flange yoke coupling | 13 | Differential case |
| 3 | Oil seal | 14 | Thrust washer |
| 4 | Taper roller bearing | 15 | Differential side gear |
| 5 | Bearing cage | 16 | Differential pinion gear |
| 6 | Adjusting shim | 17 | Spider |
| 7 | Spacer | 18 | Hypoid ring gear |
| 8 | Hypoid pinion | 19 | Bearing cap |
| 9 | Cylindrical roller bearing | 20 | Lock plate |
| 10 | Retainer ring | 21 | Differential case spacer |
| 11 | Differential carrier case | 22 | O-ring |

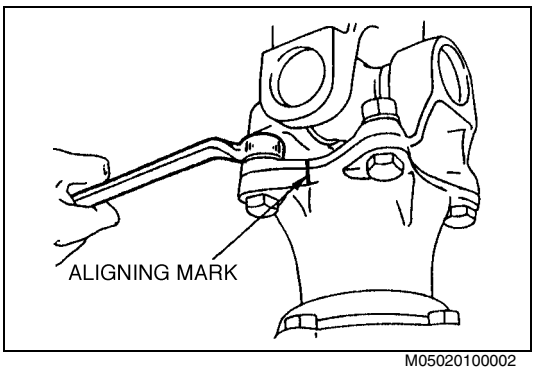
**NOTICE: Installing position of No.21 (differential case spacer)**
**Gear ratio 3.900, 4.100: Hypoid ring gear side (Same as this figure)**
**Gear ratio 4.333, 4.625: Opposite side of hypoid ring gear**

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 63.9-85.3 {650-870, 48-62} | E | 18.7-25.5 {190-260, 14-18} |
| B | 197-225 {2,000-2,300, 145-166} | F | 246-294 {2,500-3,000, 182-216} |
| C | 18.7-25.5 {190-260, 14-18} | G | 246-294 {2,500-3,000, 182-216} |
| D | 374-500 {3,800-5,100, 276-368} | | |

# OVERHAUL

M05020101BEH2002



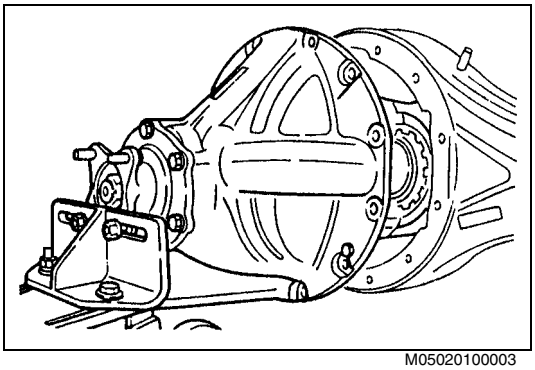
M05020100002

## IMPORTANT POINTS - DISMOUNTING

**1. DISCONNECT THE PROPELLER SHAFT.**

**NOTICE:**

**Make aligning marks before disassembling.**


M05020100003

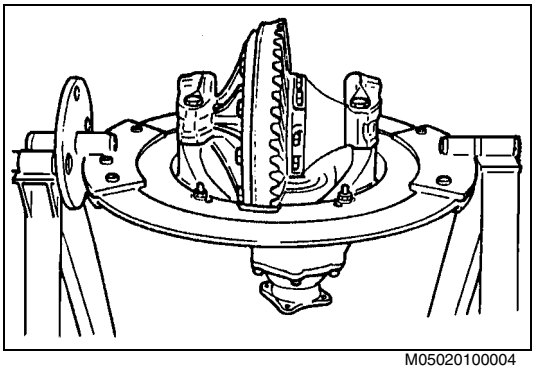
**2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.**

(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.

## IMPORTANT POINTS - DISASSEMBLY

**1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.**

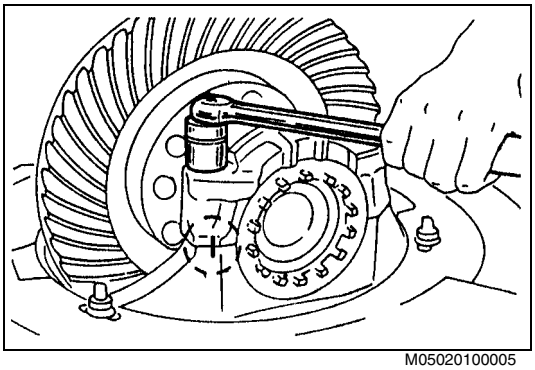

M05020100004

**2. DIFFERENTIAL CASE**

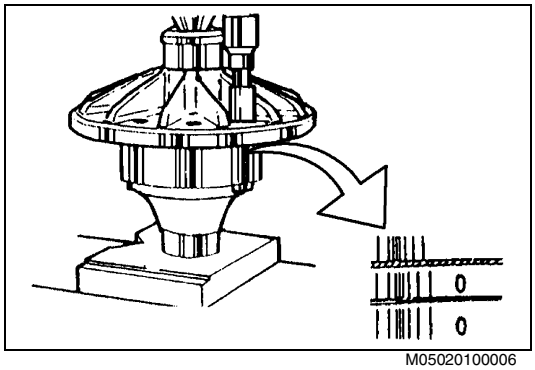
(1) Remove the bearing cap.

**NOTICE:**

**Make aligning marks before disassembling.**


M05020100005

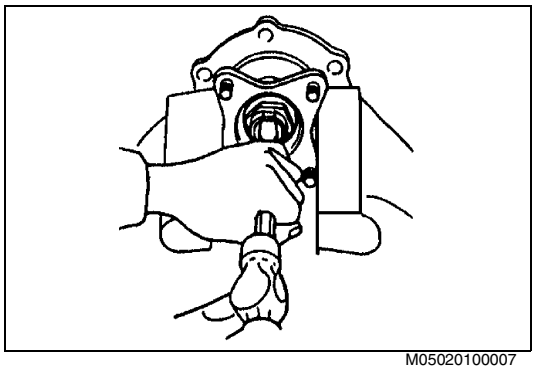
(2) Using a puller, remove the taper roller bearing.



M05020100006

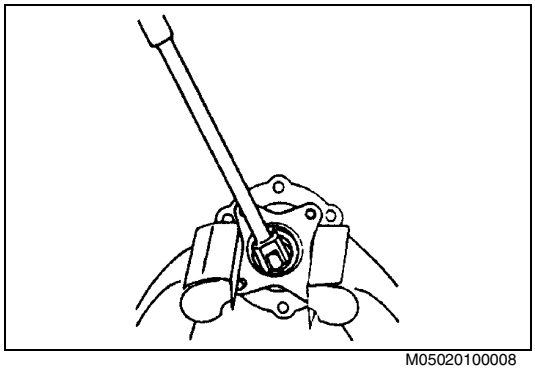
(3) Disassemble the differential case.

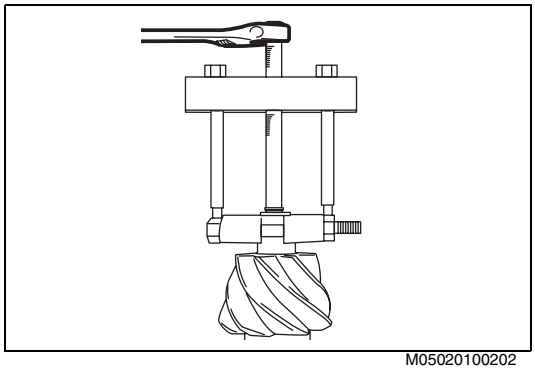
**NOTICE:**
**Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.**


M05020100007

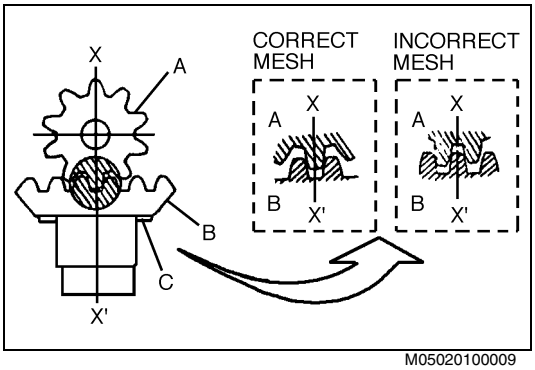
**3. BEARING CAGE**

(1) Uncaulk the lock nut and remove the nut.
**SST: Socket Wrench (09839-4104)**


M05020100008


M05020100202

(2) Using a puller, remove the taper roller bearing and inner race of the cylindrical roller bearing.



M05020100009

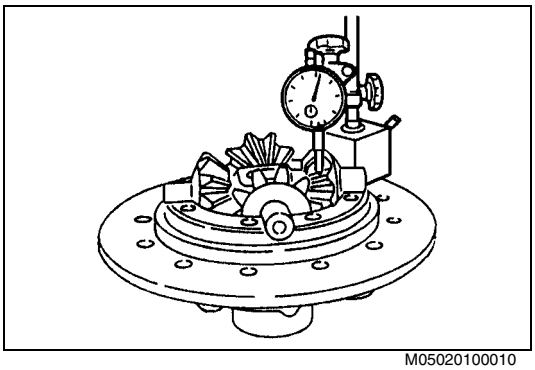
## IMPORTANT POINTS - ASSEMBLY

### 1. DIFFERENTIAL CASE

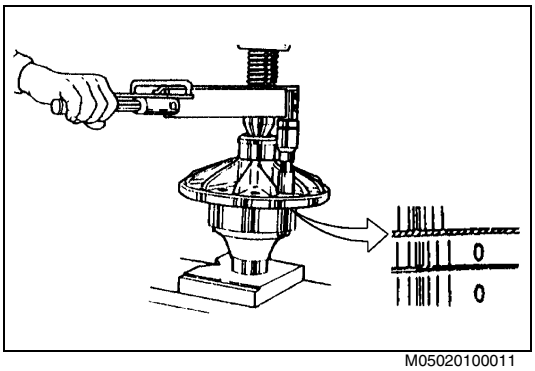
(1) Measure the pinion backlash.

**NOTICE:**
**Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.**

- A: Pinion
- B: Side gear
- C: Thrust washer

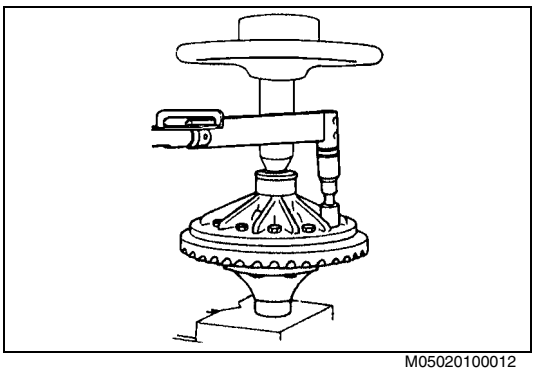

M05020100010

(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
**Assembly standard: 0.20-0.60 mm {0.0079-0.0236 in.}**
**Service Limit: 0.9 mm {0.0354 in.}**


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(3) Assemble the differential case.

**NOTICE:**
- **Align the aligning marks when assembling.**
- **Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads.**


M05020100012

(4) Install the ring gear to the differential case and tighten it with bolts and nuts.

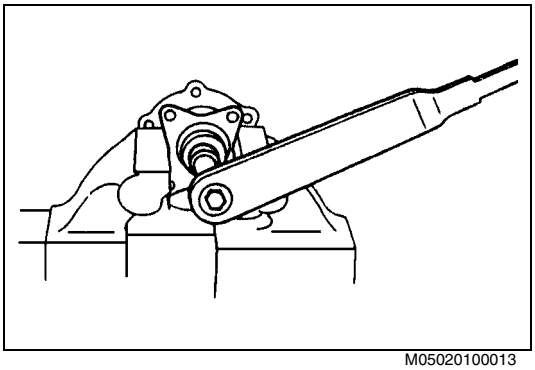
**NOTICE:**
**Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads.**

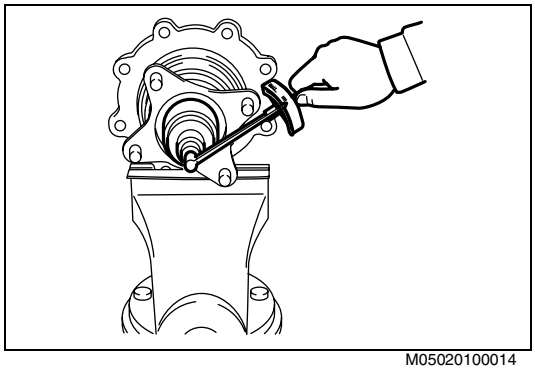
### 2. ADJUSTMENT OF THE PINION BEARING PRELOAD

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

**NOTICE:**
**The oil seal must be installed in the bearing cage after measurement of the preload.**

**SST: Socket Wrench (09839-4104)**


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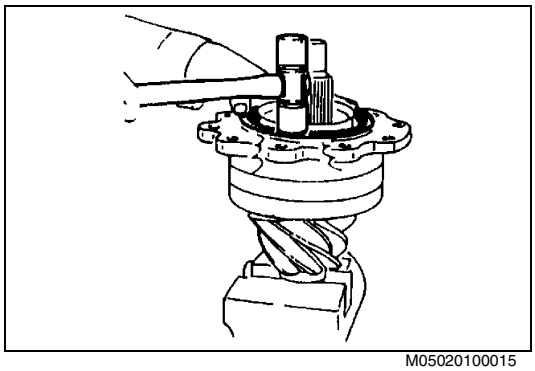
(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

**Assembly Standard: Turning torque**

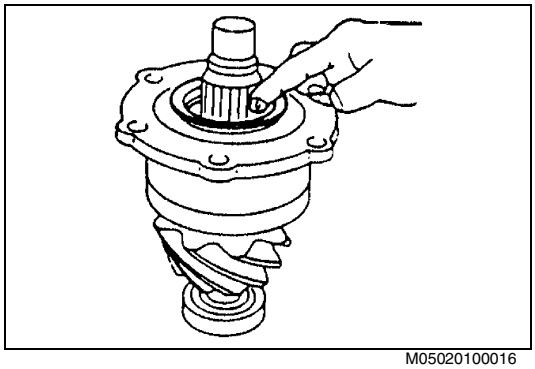
**Unit: N·m {kgf·cm, lbf·ft}**

| New bearing | Re-used bearing |
|---|---|
| 1.97-2.94 {20-30, 1.5-2.1} | 1.48-2.45 {15-25, 1.1-1.8} |

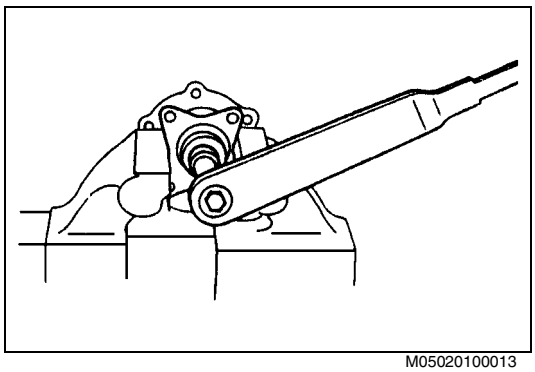
**Adjusting spacer thickness:**
**20 kinds of thicknesses ranging from 13.900 to 14.375 mm {0.5473 to 0.5659 in.} each differing 0.025 mm {0.001 in.}**


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(3) After adjusting the preload, install the new oil seal.

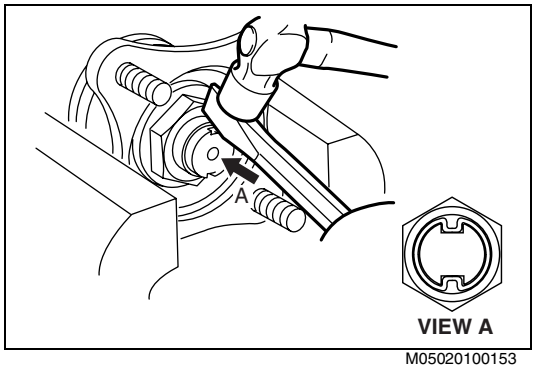

M05020100016

**NOTICE:**
**Apply wheel bearing grease on the oil seal lip part.**


M05020100013

(4) Install the flange yoke coupling and tighten the lock nut.
**SST: Socket Wrench (09839-4104)**

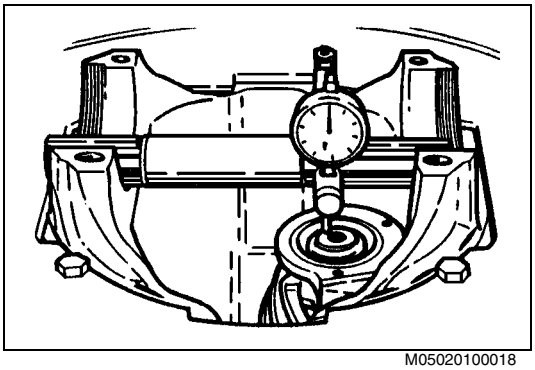
(5) Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.



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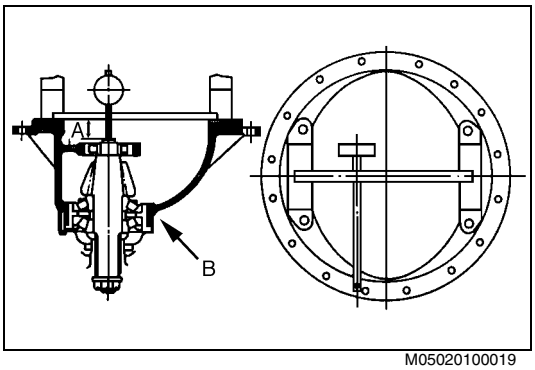
(6) Using a chisel and a hammer, caulk the lock nut.

**NOTICE:**
- **Caulk the nut securely as shown.**
- **Make sure that there is no rift in the caulked position.**


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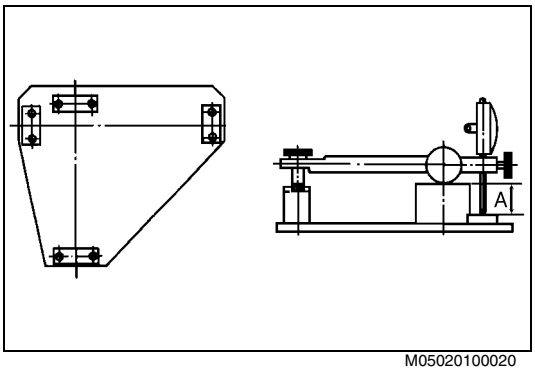
**3. ADJUSTMENT OF PINION FITTING HEIGHT (CONICAL DISTANCE).**

(1) Install the pinion cage assembly and adjust the height with shims.
**SST: Gauge Assembly (09640-1022)**



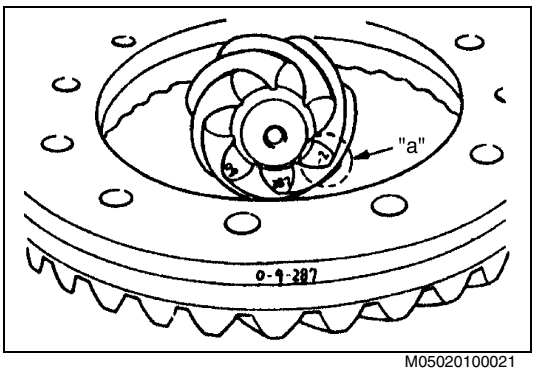
M05020100019

**A: 21.5 mm {0.846 in.}**
**B: Adjusting 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.}**



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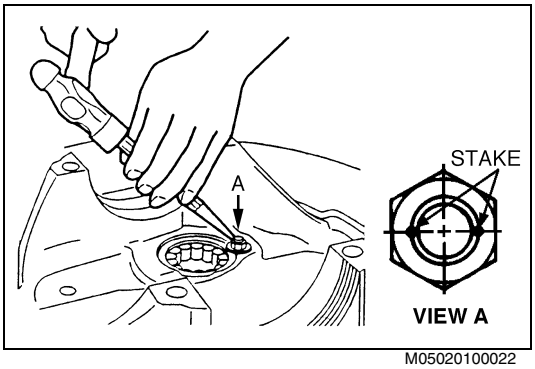
(2) How to use the pinion depth gauge: Set the pinion depth gauge.
**A: 21.5 mm {0.846 in.}**



M05020100021

**EXAMPLE:**
**In a case where the engraved value at the surface of the pinion gear is -20 (-20 means -0.2 mm):**

| Standard pinion height "A" | | | | Measuring part (A') |
|---|---|---|---|---|
| 21.5 mm | – | 0.2 mm | = | 21.3 mm |
| | | The engraved value "a" | | |

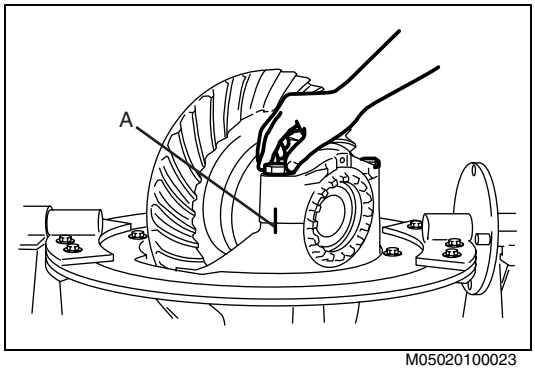


M05020100022

**4. CYLINDRICAL ROLLER BEARING**

(1) Install the cylindrical roller bearing and tighten the lock nut.

**NOTICE:**
- **Apply lock agent (Lock tight) which is equivalent to ThreeBond 1360K on the bolt threads before attaching the lock nut.**
- **When lock agent is not applied, stake the lock nut as shown in the figure.**

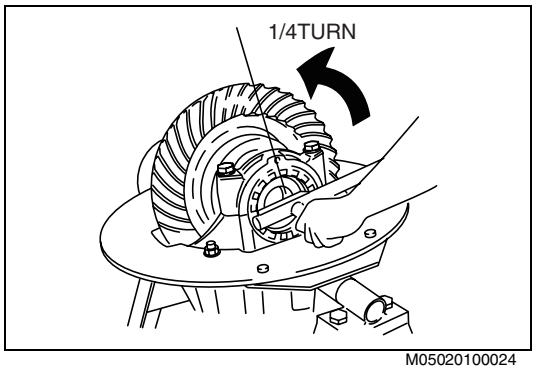


M05020100023

**5. ADJUSTMENT OF HYPOID RING GEAR BACKLASH.**

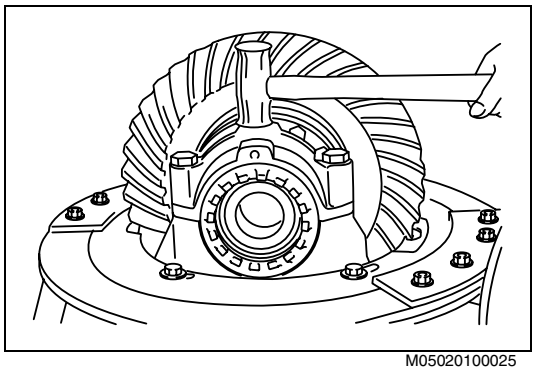
(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

**NOTICE:**
**Align the aligning marks A.**

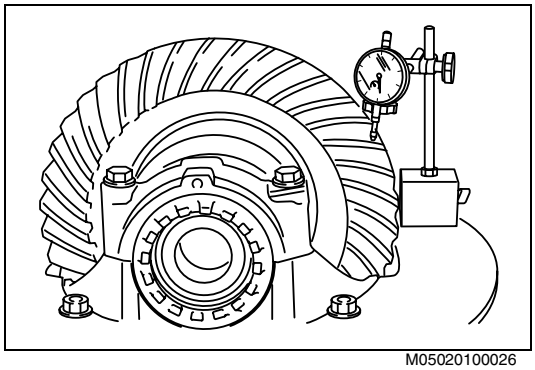


M05020100024

(2) Adjust the preload of the side bearing provisionally.
a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.
**SST: Adjuster Tool (09665-1150)**


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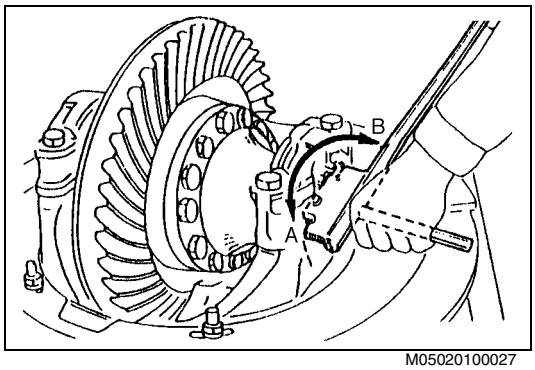
b. Hit the bearing cap with a copper hammer.


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(3) Measure the gear backlash at three or four points on the circumference of the gear.

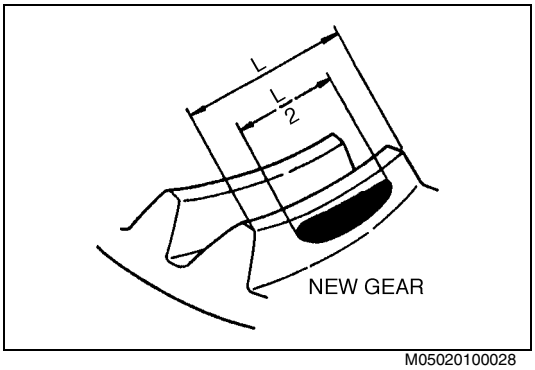
**Assembly standard:** Unit: mm {in.}

| GEAR RATIO | STANDARD |
|---|---|
| 3.900<br>4.333<br>4.625 | 0.25-0.33 {0.0098-0.0130} |
| 4.100 | 0.20-0.28 {0.0078-0.0110} |



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(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: A-Decrease B-Increase
**SST: Adjuster Tool (09665-1150)**



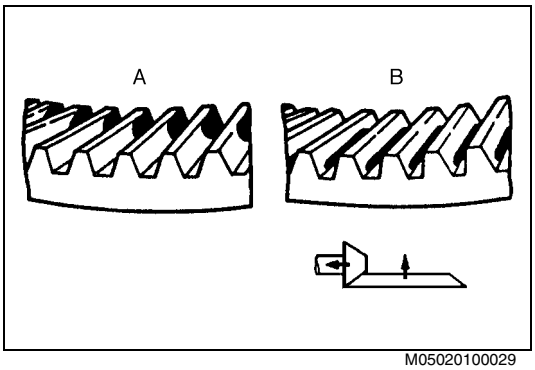
M05020100028

**6. INSPECTION AND ADJUSTMENT OF GEAR MESHING**

(1) Satisfactory gear meshing.

**NOTICE:**

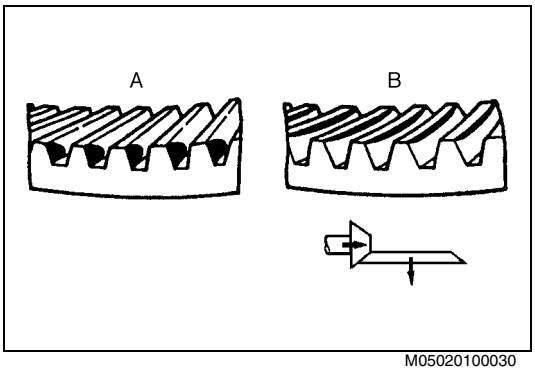
**New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.**



M05020100029

(2) Example of the unsatisfactory engagement
   a. Toe and flank contact

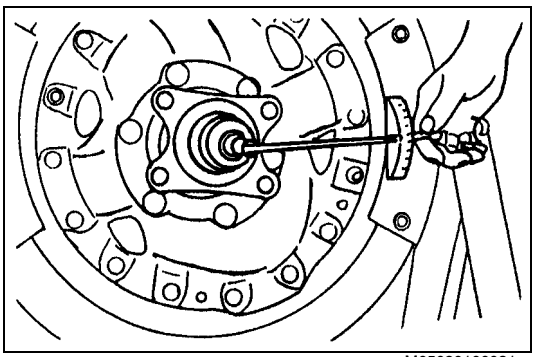
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



M05020100030

   b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


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**7. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING**

(1) Measure and adjust the total preload at the differential carrier bearings, using a torque wrench.

**NOTICE:**

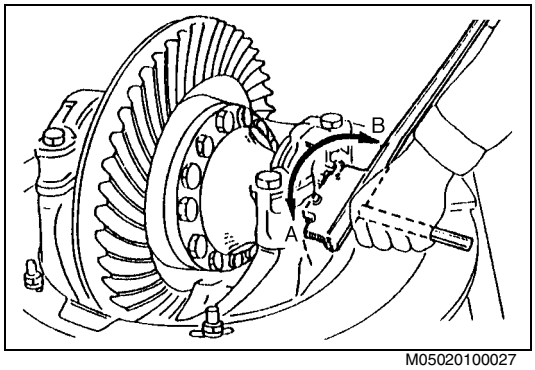
**Total preload = pinion bearing preload (Refer to item 2 in page DC-8) + side bearing preload (Refer to the table below).**

**Assembly standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| Gear ratio | 3.900 | 4.111 | 4.333 | 4.625 |
|---|---|---|---|---|
| New bearing | 0.51-0.75 {5.2-7.6, 0.38-0.54} | 0.48-0.71 {4.9-7.3, 0.35-0.52} | 0.46-0.67 {4.7-6.9, 0.34-0.49} | 0.43-0.63 {4.4-6.4, 0.32-0.46} |
| Re-used bearing | 0.38-0.62 {3.9-6.4, 0.29-0.46} | 0.35-0.59 {3.6-6.1, 0.26-0.44} | 0.34-0.56 {3.5-5.4, 0.24-0.39} | 0.32-0.52 {3.3-5.4, 0.24-0.39} |

**NOTICE:**

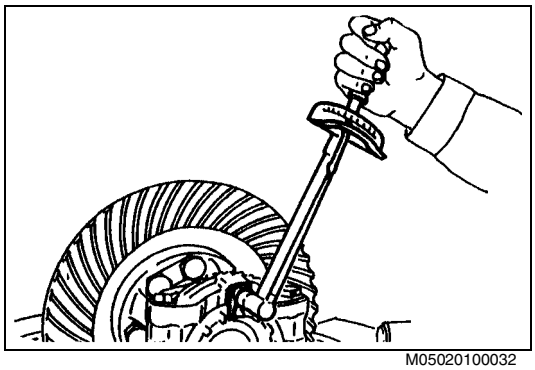
**The gear ratio is indicated on the bearing cage.**



M05020100027

(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise: Decrease preload
- B: Clockwise: Increase preload
  **SST: Adjuster Tool (09665-1150))**


M05020100032

(3) Tighten the bearing cap and install the lock plate.

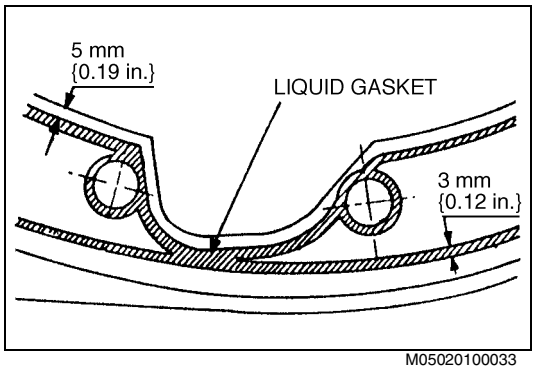
## IMPORTANT POINTS - MOUNTING

**1. MOUNTING**

(1) Apply liquid gasket on the face of the housing flange.

**NOTICE:**

- **The liquid gasket must be ThreeBond #1215 or #1216 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 5 mm {0.19 in.} away from the edge.**

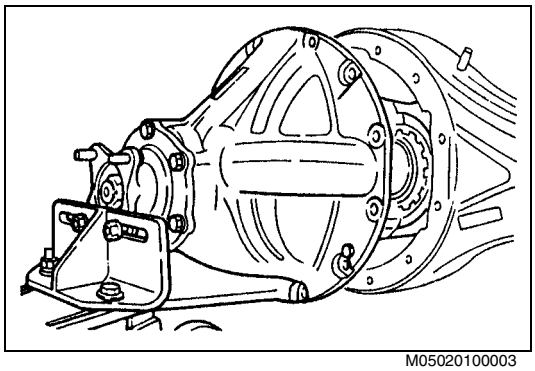


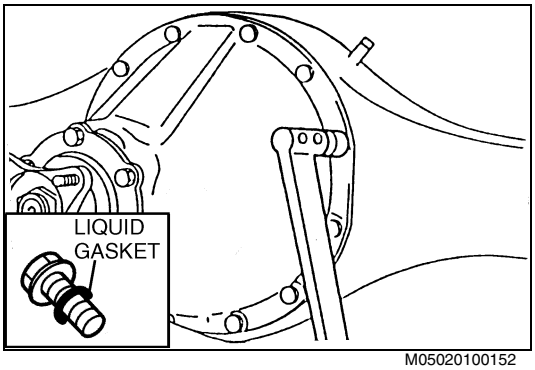
M05020100033

(2) Using a jack, install the differential carrier assembly to the axle housing.

**NOTICE:**

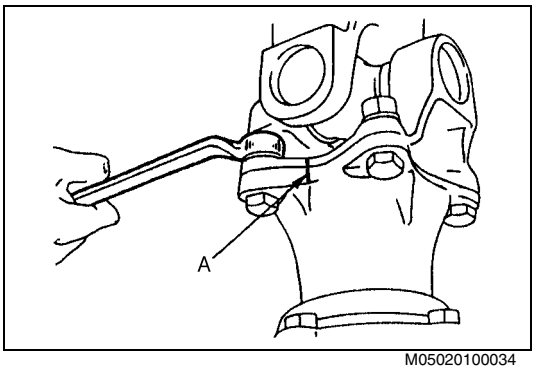
**Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.**


M05020100003



M05020100152

(3) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round bolts, install the bolts and tighten them regularly.



M05020100034

(4) Connect the propeller shaft.

**NOTICE:**
**Align the aligning marks A.**

**Tightening Torque:**
**61-91N·m {623-927 kgf·cm, 45-67 lbf·ft}**

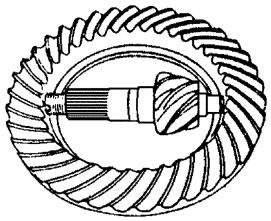
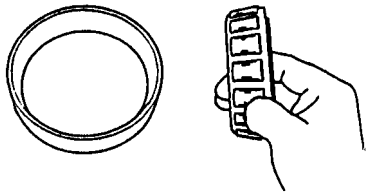
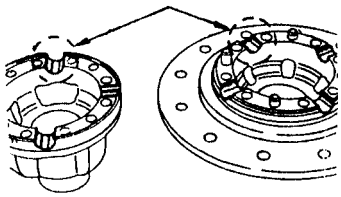
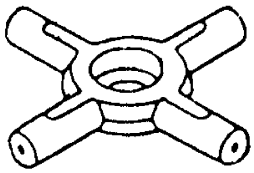
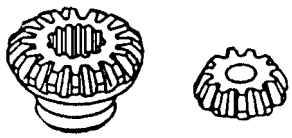
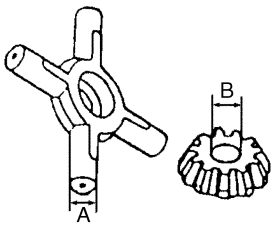
(5) Fill the axle housing with specified gear oil up to the filler plug hole.

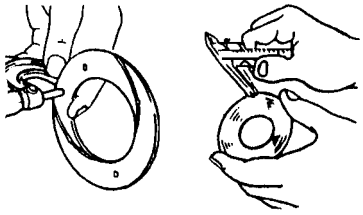
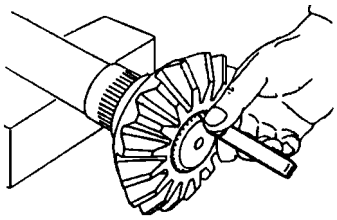
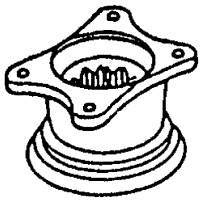
**Gear oil:**
**Refer to the owner's manual**

# INSPECTION AND REPAIR

M05020101BEH3002

Unit: mm {in.}

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Pinion and ring gear: Wear and damage | — | — | Replace, if necessary. | Visual check  |
| Bearing and race: Burns and pitting | — | — | Replace, if necessary. | Visual check  |
| Differential case spider holes: Wear and damage | — | — | Replace, if necessary. | Visual check  |
| Spider: Wear and damage | — | — | Replace, if necessary. | Visual check  |
| Differential side gear and pinion: Wear and damage | — | — | Replace, if necessary. | Visual check  |
| Spider and pinion: Clearance | A:24{0.945} B-A:0.141-0.261 {0.0056-0.0103} | 0.4 {0.016} | Replace. | Measure   |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Thrust washers thickness (Side gear and pinion gear)** | **Side gear: 1.9-2.1 {0.075-0.082}** | **1.7 {0.067}** | **Replace.** | **Measure**  |
| | **Pinion gear: 1.5-1.7 {0.060-0.066}** | **1.3 {0.051}** | | |
| **Differential side gear and axle shaft: Spline backlash** | **0.054-0.148 {0.0021-0.0058}** | **0.5 {0.0196}** | **Replace.** | **Measure**  |
| **Flange coupling: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# DIFFERENTIAL CARRIER (SH14)

DF02-002

**DIFFERENTIAL CARRIER (SH14) ..... DF02-2**
DATA AND SPECIFICATIONS ..... DF02-2
DESCRIPTION ..... DF02-2
TROUBLESHOOTING ..... DF02-3
SPECIAL TOOL ..... DF02-4
COMPONENT LOCATOR ..... DF02-5
OVERHAUL ..... DF02-7
INSPECTION AND REPAIR ..... DF02-17

# DIFFERENTIAL CARRIER (SH14)

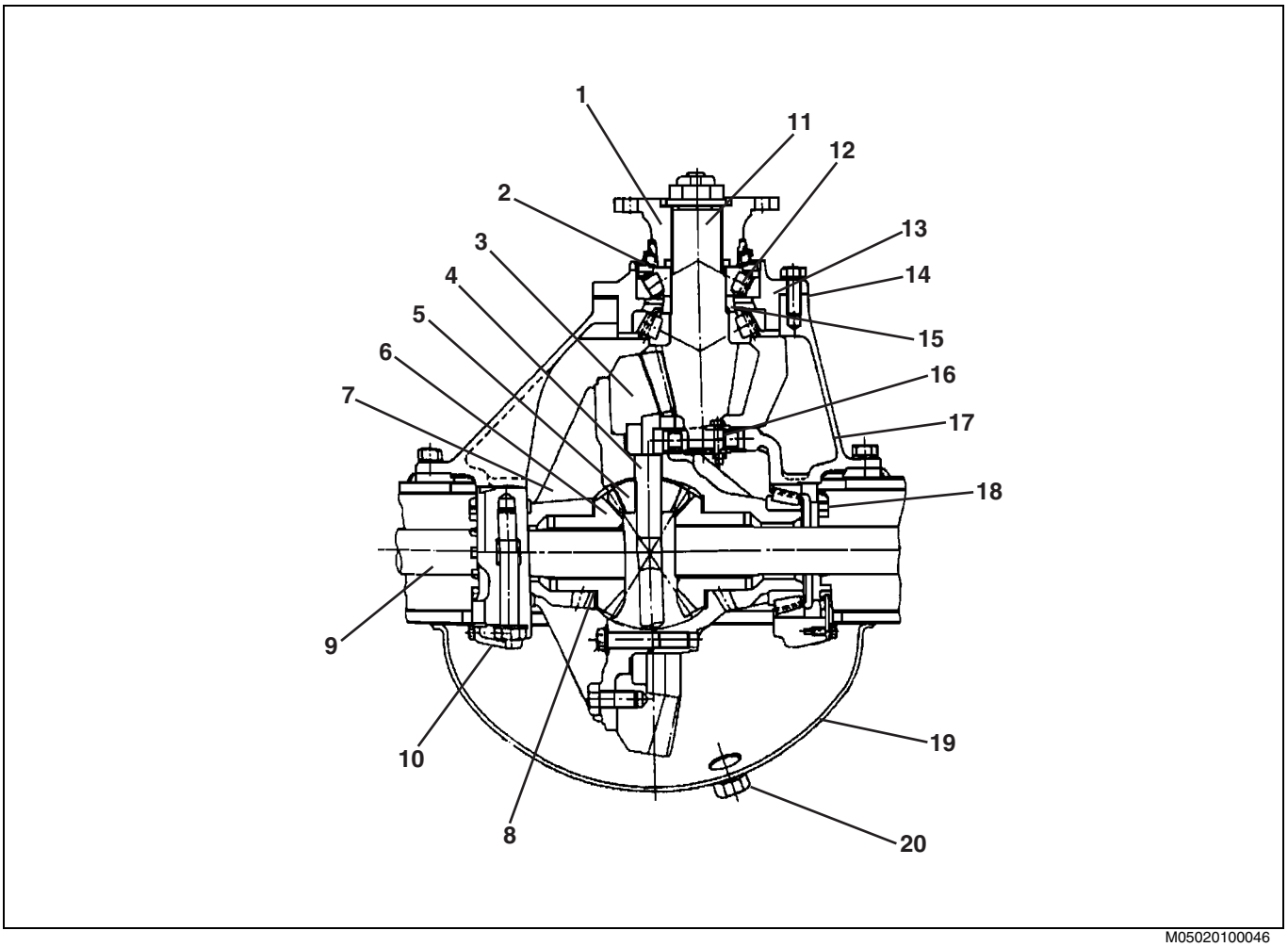
## DATA AND SPECIFICATIONS

M05020102BEI2001

| | |
|---|---|
| Type | Single-reduction, single-speed, by hypoid gearing |
| Gear ratios | 4.875, 5.125 |
| Oil capacity | 5.5 L {1.21 Imp gal. / 1.45 U.S gal.} |

## DESCRIPTION

M05020102BEC1001




M05020100046

| | | | | | |
|---|---|---|---|---|---|
| 1 | Flange yoke coupling | 8 | Thrust washer | 15 | Spacer |
| 2 | Oil seal | 9 | Axle shaft | 16 | Cylindrical roller bearing |
| 3 | Hypoid ring gear | 10 | Bearing cap | 17 | Differential carrier case |
| 4 | Spider | 11 | Hypoid pinion | 18 | Adjusting nut |
| 5 | Differential pinion gear | 12 | Taper roller bearing | 19 | Axle housing |
| 6 | Differential side gear | 13 | Bearing cage | 20 | Oil filler plug |
| 7 | Differential case | 14 | Adjusting shim | | |

# TROUBLESHOOTING

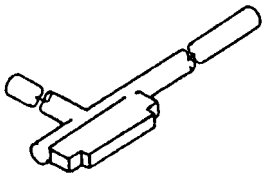
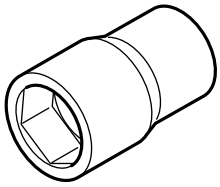
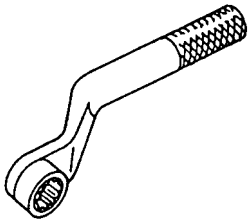
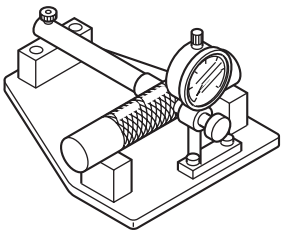
M05020102BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings | Replace bearings. |
| | Worn or damaged differential side bearings | Replace bearings. |
| | Loose pinion bearings | Adjust bearing preload. |
| | Loose differential side bearings | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear | Adjust backlash. |
| | Worn thrust washers | Replace. |
| | Worn differential spider | Replace. |
| | Worn or damaged ring gear and pinion | Replace. |
| | Worn or damaged differential side gears and pinions | Replace. |
| | Loose ring gear bolts | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear | Replace or adjust tooth contact. |
| | Worn pinion spline | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline | Replace. |
| | Worn hub bearings | Replace. |
| | Loose hub bearings | Adjust bearing preload. |
| | Loose differential case tightening bolts | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil | Add oil; check for leakage. |
| | Poor oil quality | Change oil. |
| | Abnormal propeller shaft noise | Refer to chapter PROPELLER SHAFT. |

# SPECIAL TOOL

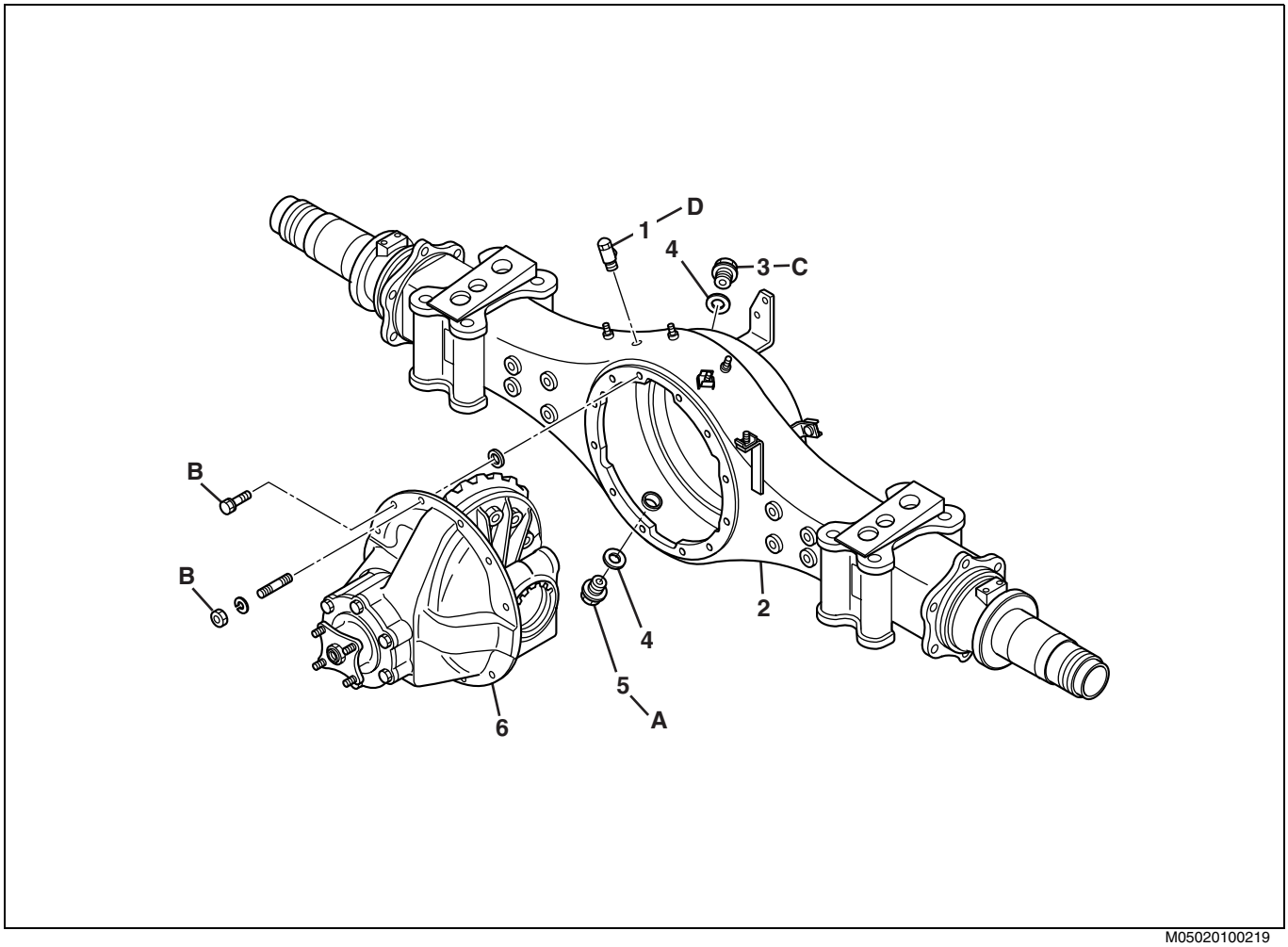
M05020102BEK1001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09665-1040 | ADJUSTER TOOL | |
|  | 09839-4601 | SOCKET WRENCH | |
|  | 09603-1150 | SOCKET WRENCH | |
|  | 09640-1151 | GAUGE ASSEMBLY | |

# COMPONENT LOCATOR

M05020102BED1001

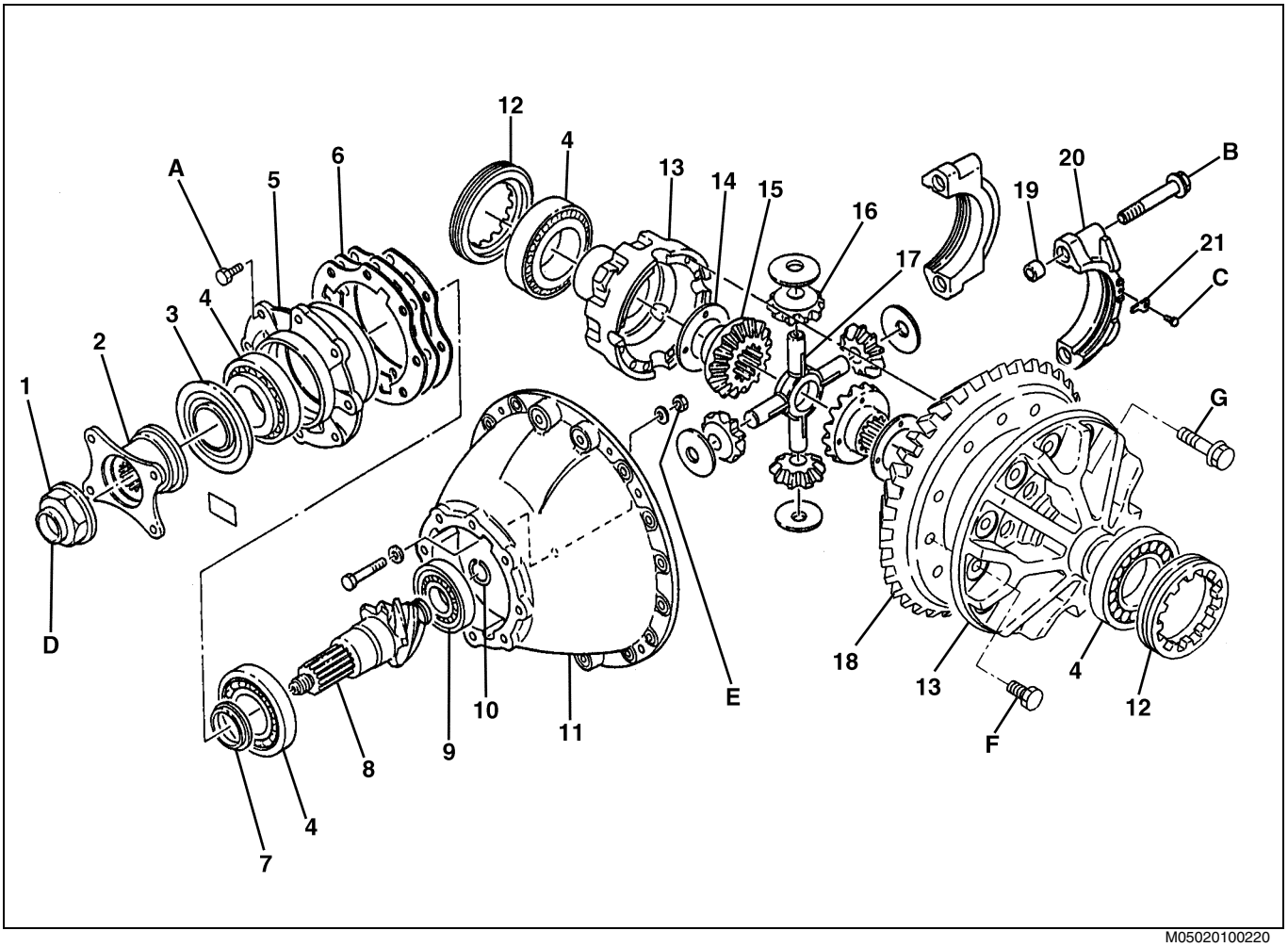



M05020100219

| | | | |
|---|---|---|---|
| 1 | Air breather | 4 | Gasket |
| 2 | Axle housing assembly | 5 | Oil drain plug |
| 3 | Oil filler plug | 6 | Differential carrier assembly |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 39.2-68.6 {400-700, 29-50} | C | 78.4-117.6 {800-1,200, 58-86} |
| B | 113-147 {1,150-1,500, 83-108} | D | 9.8-19.6 {100-200, 7-14} |




M05020100220

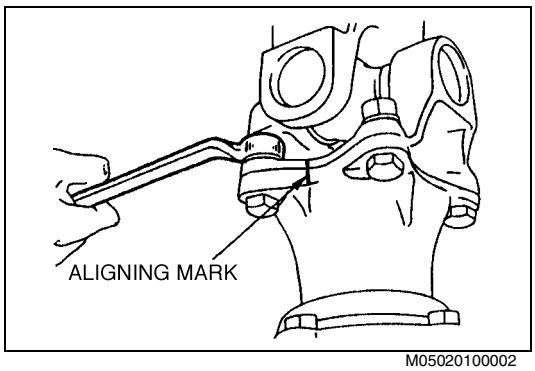
| | | | | | |
|---|---|---|---|---|---|
| 1 | Lock nut | 8 | Hypoid pinion | 15 | Differential side gear |
| 2 | Flange yoke coupling | 9 | Cylindrical roller bearing | 16 | Differential pinion gear |
| 3 | Oil seal | 10 | Retainer ring | 17 | Spider |
| 4 | Taper roller bearing | 11 | Differential carrier case | 18 | Hypoid ring gear |
| 5 | Bearing cage | 12 | Adjusting nut | 19 | Collar |
| 6 | Adjusting shim | 13 | Differential case | 20 | Bearing cap |
| 7 | Spacer | 14 | Thrust washer | 21 | Lock plate |

**Tightening torque** **Unit:N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 108-148 {1,100-1,500, 80-108} | E | 18.7-25.5 {190-260, 14-18} |
| B | 275-353 {2,800-3,600, 203-260} | F | 368-422 {3,700-4,300, 268-311} |
| C | 18.7-25.5 {190-260, 14-18} | G | 167-215 {1,700-2,200, 123-159} |
| D | 589-781 {6,000-8,000, 434-578} | | |

# OVERHAUL

M05020102BEH2001



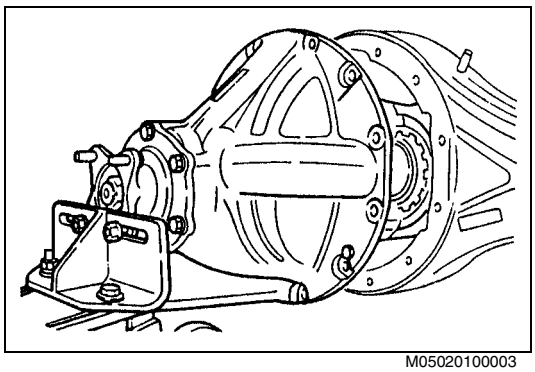
M05020100002

## IMPORTANT POINTS - DISMOUNTING

**1. DISCONNECT THE PROPELLER SHAFT.**

**NOTICE:**

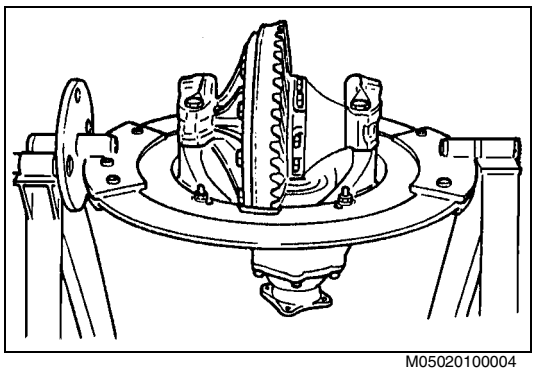
**Make aligning marks before disassembling.**


M05020100003

**2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.**

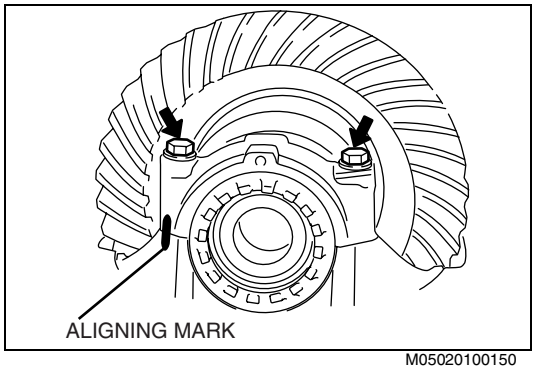
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.


M05020100004

## IMPORTANT POINTS - DISASSEMBLY

**1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.**



M05020100150

**2. DIFFERENTIAL CASE**

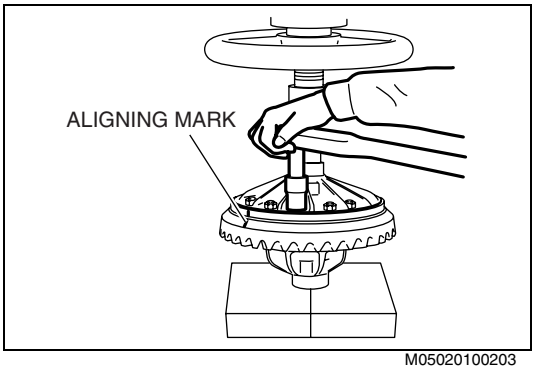
(1) Remove the bearing cap.

**NOTICE:**

**Make aligning marks before disassembling.**

**SST: Socket Wrench (09603-1150)**

(2) Using a puller, remove the taper roller bearing.

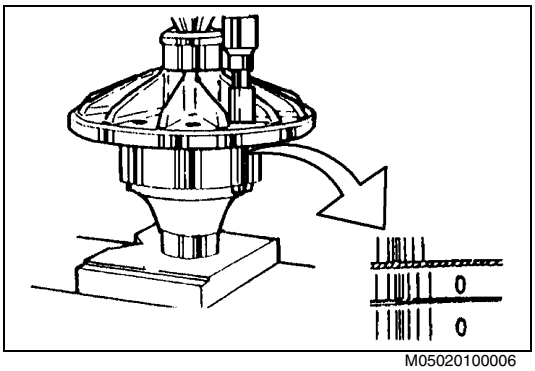


M05020100203

(3) Dismounting the ring gear

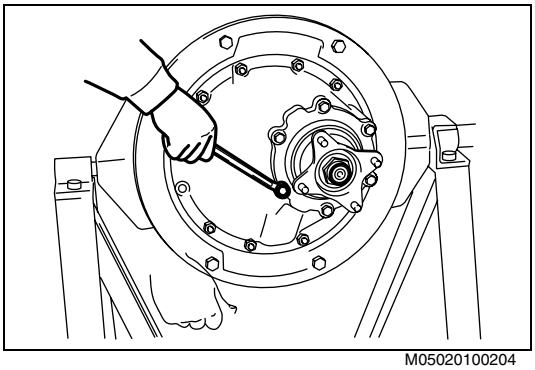
a. Make aligning mark both the differential case and the ring gear.
b. Using press, fix the differential gear assembly.
c. Remove the bolts and then ring gear.

**NOTICE:**
**Be careful not to drop the ring gear.**


M05020100006

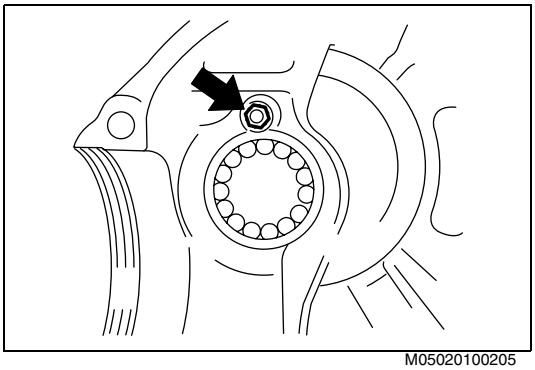
(4) Disassemble the differential case.

**NOTICE:**
**Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.**

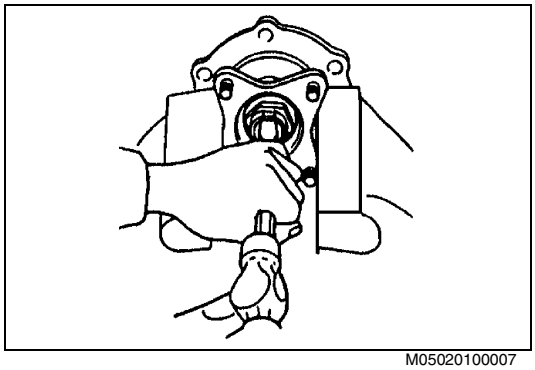

M05020100204

**3. Dismounting the hypoid pinion**

(1) Remove the bolts and then dismount the hypoid pinion and the shims.

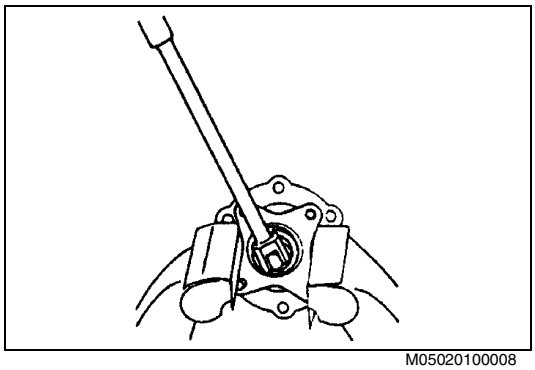

M05020100205

(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


M05020100007

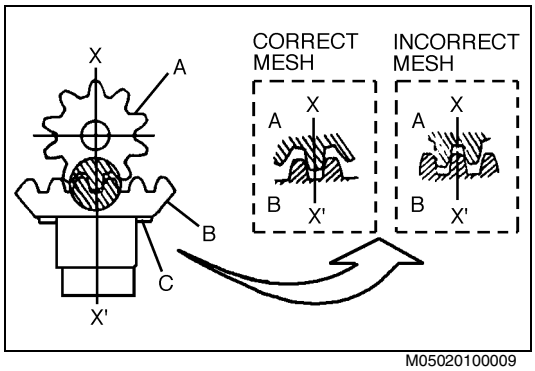
**4. BEARING CAGE**

(1) Uncaulk the lock nut and remove the nut.
**SST: Socket Wrench (09839-4601)**


M05020100008

(2) Using a puller, remove the taper roller bearing outer race.

## IMPORTANT POINTS - ASSEMBLY



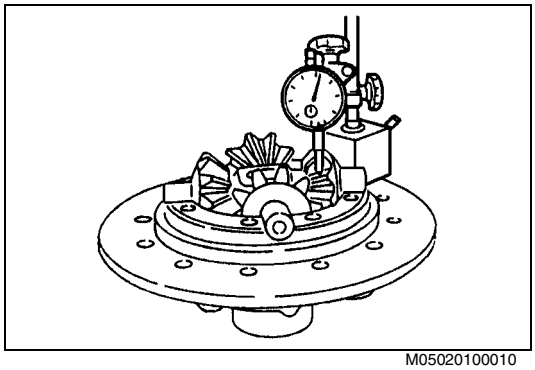
M05020100009

**1. DIFFERENTIAL CASE**

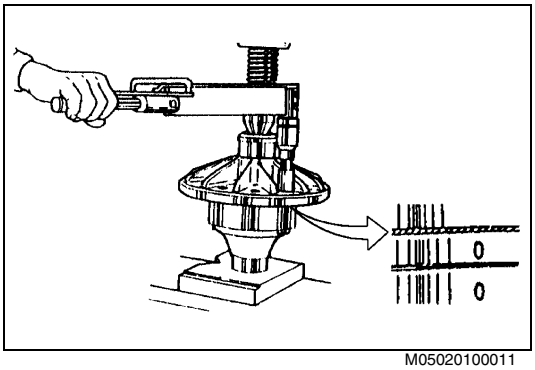
(1) Measure the pinion backlash.

**NOTICE:**
**Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.**

- A: Pinion
- B: Side gear
- C: Thrust washer

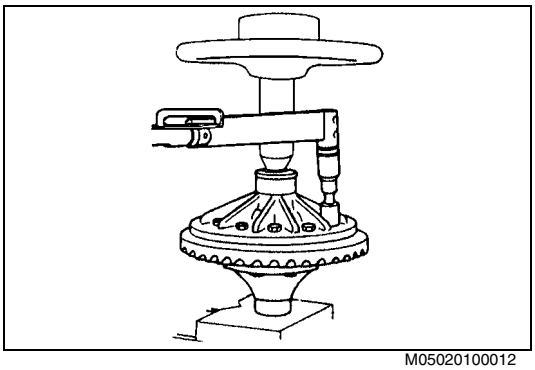

M05020100010

(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
**Assembly Standard:0.20-0.60 mm {0.0079-0.0236 in.}**
**Service Limit:0.9 mm {0.0354 in.}**


M05020100011

(3) Assemble the differential case.

**NOTICE:**
- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

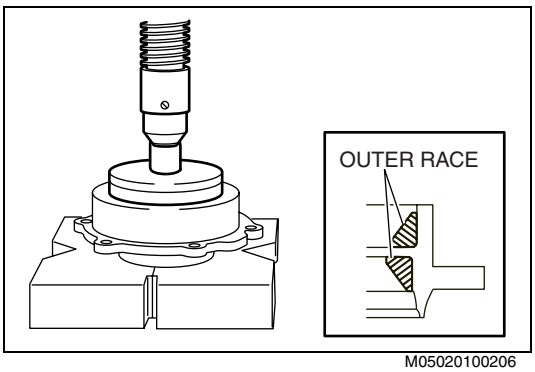

M05020100012

(4) Install the ring gear to the differential case and tighten it with bolts.

**NOTICE:**
**Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

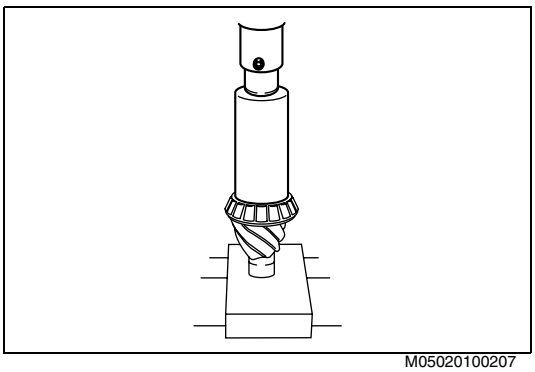
**2. Assembling the hypoid pinion**

(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.

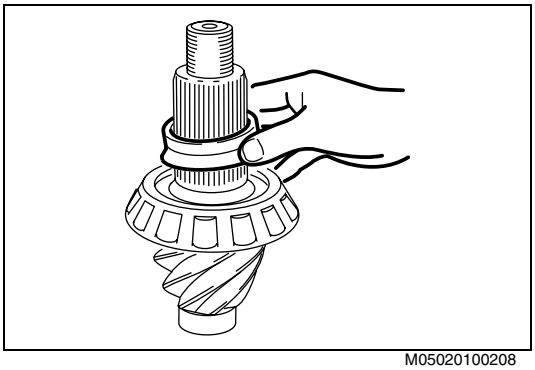


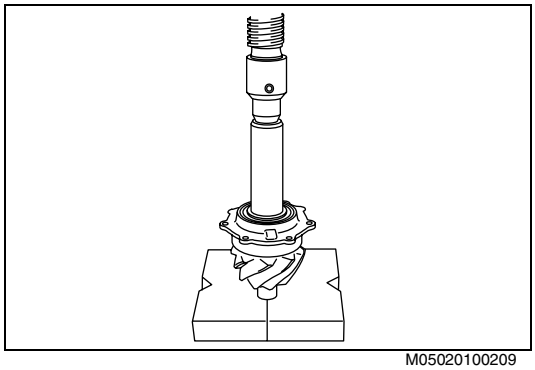
M05020100206

(2) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.

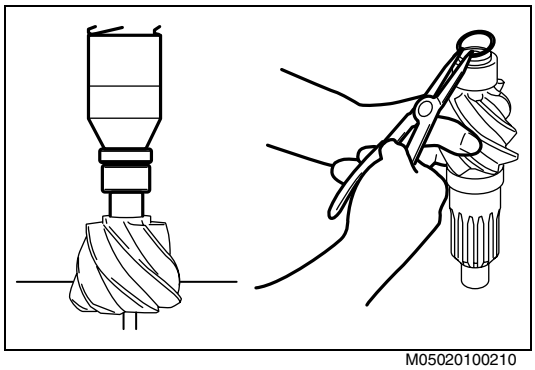

M05020100207

   c. Install the spacer.


M05020100208

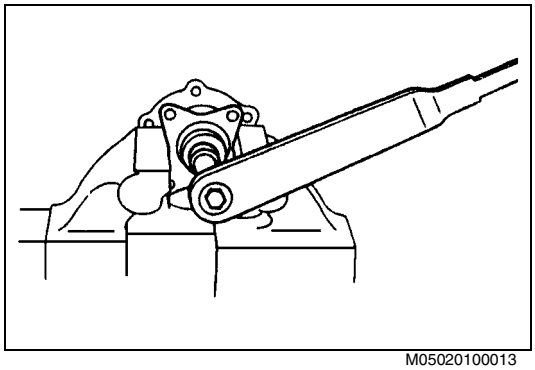

M05020100209

(3) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


M05020100210

(4) Installing the pilot bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**

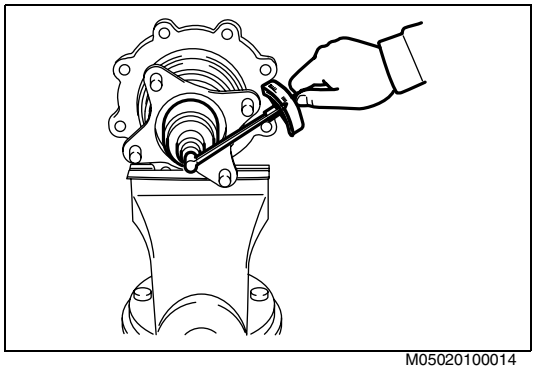

M05020100013

**3. ADJUSTMENT OF THE PINION BEARING PRELOAD**

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

**NOTICE:**
**The oil seal must be installed in the bearing cage after measurement of the preload.**

**SST: Socket Wrench (09839-4601)**

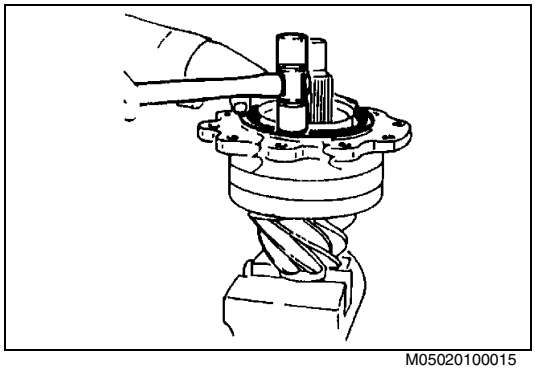

M05020100014

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

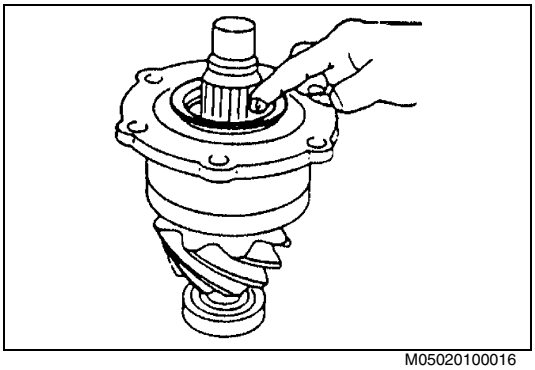
**Assembly Standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| New bearing | Re-used bearing |
|---|---|
| 1.97-2.45 {20-25, 1.5-1.8} | 1.48-1.96 {15-20, 1.1-1.4} |

**Adjusting spacer thickness:**
**17 kinds of thicknesses ranging from 13.975 to 14.375 mm {0.550 to 0.566 in.} each differing 0.025 mm {0.001 in.}**

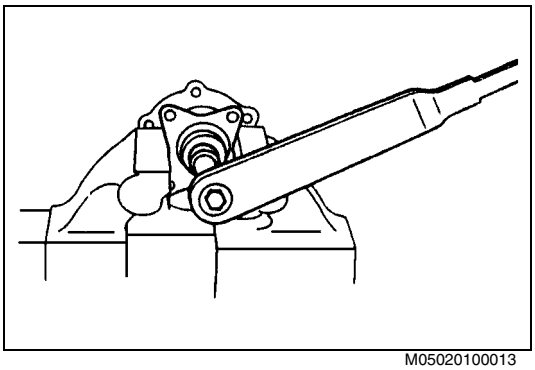

M05020100015

(3) After adjusting the preload, install the new oil seal.



M05020100016

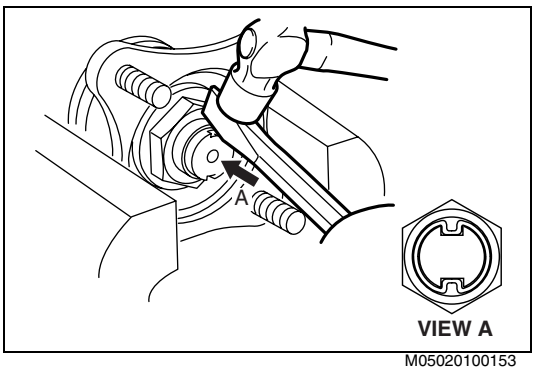
**NOTICE:**
- **Apply wheel bearing grease on the oil seal lip part.**
- **Tap the oil seal in small steps and evenly to prevent it from being at slant position.**



M05020100013

(4) Install the flange yoke coupling and tighten the lock nut.
**SST: Socket Wrench (09839-4601)**

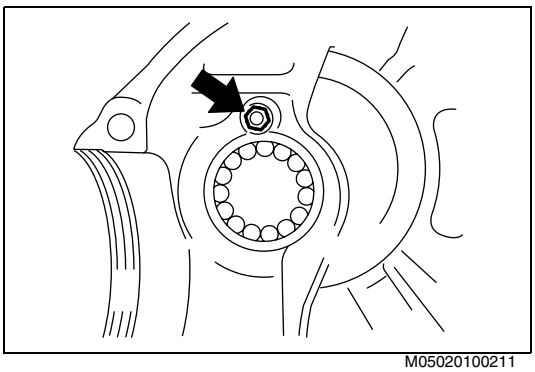
(5) Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.




M05020100153

(6) Caulk the lock nut.

**NOTICE:**
- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**



M05020100211

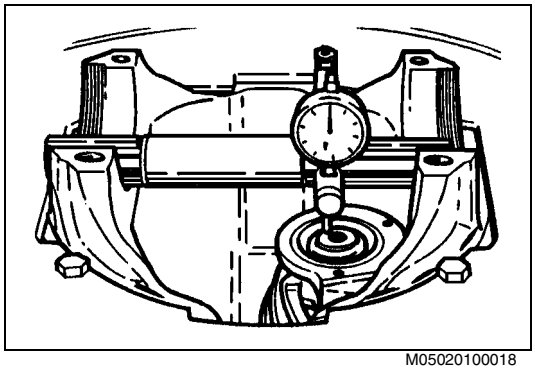
**4. Installing the cylindrical roller bearing outer race**

(1) Apply gear oil to the cylindrical roller bearing outer race.

(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.

**Tightening Torque:**
**18.7-25.5 N·m {191-260 kgf·cm, 14-18 lbf·ft}**

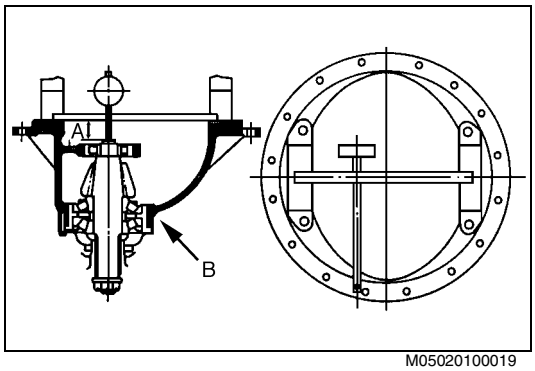
**NOTICE:**
**Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**


M05020100018

**5. ADJUSTMENT OF PINION FITTING HEIGHT (CONICAL DISTANCE).**

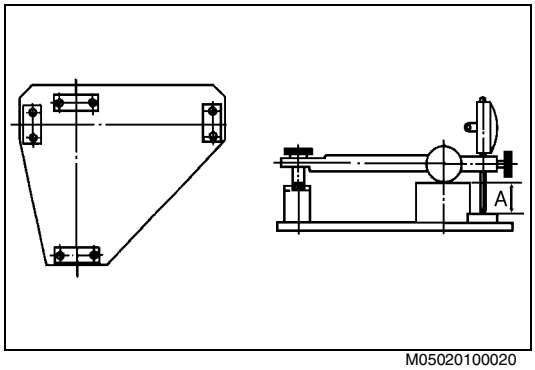
(1) Install the pinion cage assembly and adjust the height with shims.
**SST: Gauge Assembly (09640-1151)**

**NOTICE:**
**Upon completing the adjustment, remove the pinion cage assembly and apply liquid gasket (ThreeBond #1215 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.**



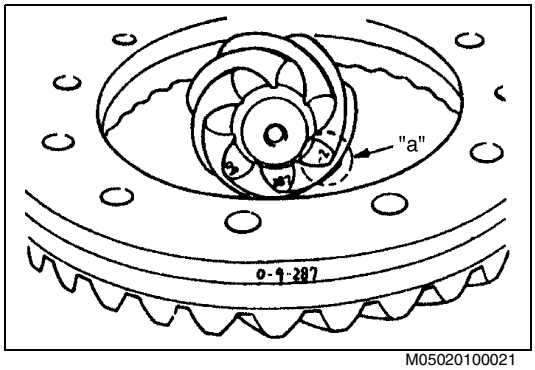
M05020100019

**A: 27 mm {1.063 in.}**
**B: Adjusting 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.}**



M05020100020

(2) How to use the pinion depth gauge: Set the pinion depth gauge.
**A:27 mm {1.063 in.}**

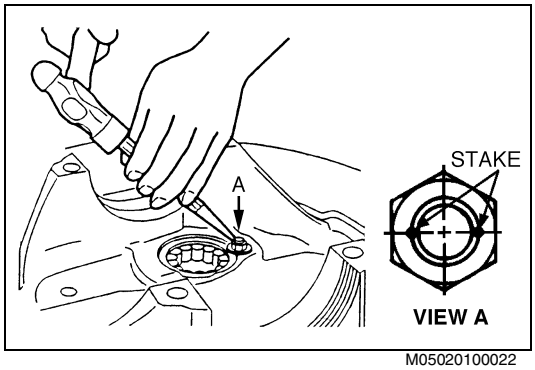


M05020100021

**EXAMPLE:**

**In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):**

| Standard pinion height "A" | | The engraved value "a" | | Measuring part (A') |
|---|---|---|---|---|
| 33.0 mm | – | 0.2 mm | = | 32.8 mm |

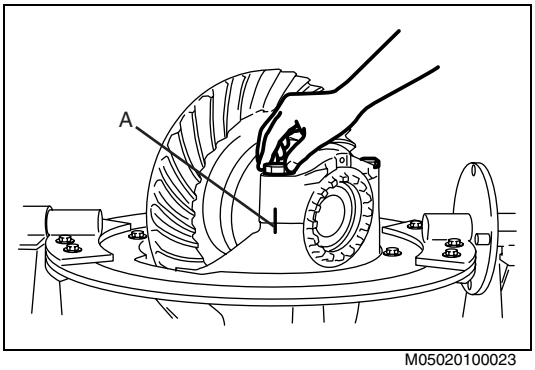


M05020100022

**6. CYLINDRICAL ROLLER BEARING**

(1) Install the cylindrical roller bearing and tighten the lock nut.

**NOTICE:**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the lock nut.**
- **When lock agent is not applied, stake the lock nut as shown in the figure.**

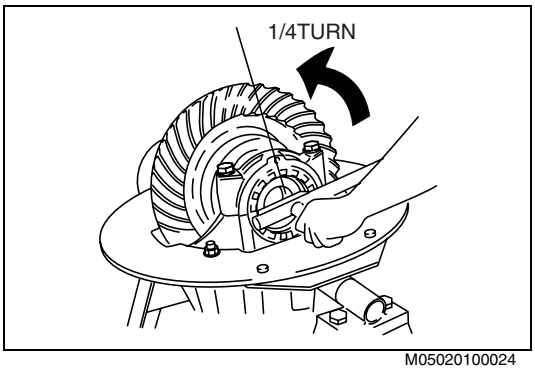


M05020100023

**7. ADJUSTMENT OF HYPOID RING GEAR BACKLASH.**

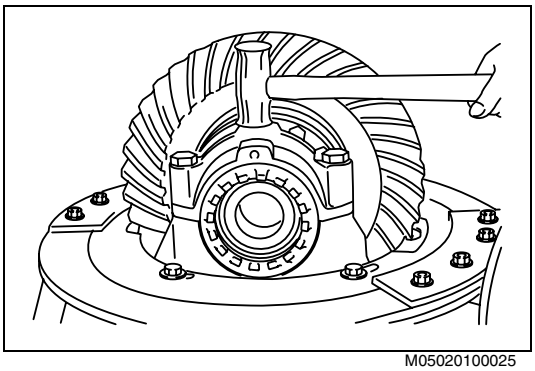
(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

**NOTICE:**
**Align the aligning marks A.**

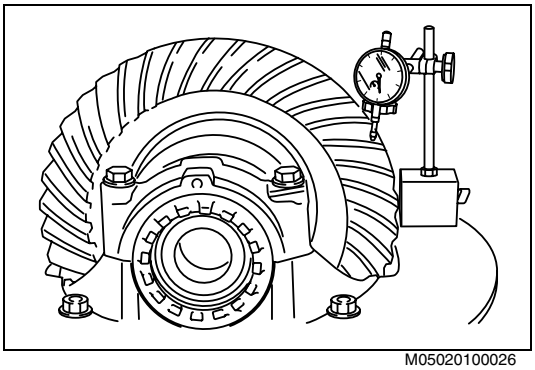


M05020100024

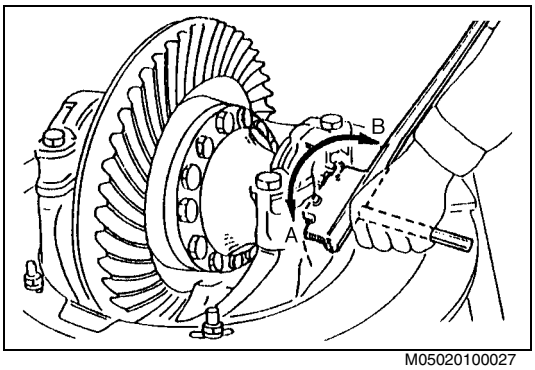
(2) Adjust the preload of the side bearing provisionally.
a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.
**SST: Adjuster Tool (09665-1040)**


M05020100025

b. Hit the bearing cap with a copper hammer.

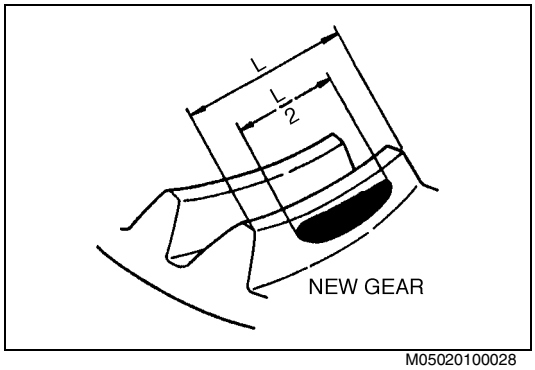

M05020100026

(3) Measure the gear backlash at three or four points on the circumference of the gear.
**Assembly Standard: 0.25-0.33 mm {0.010-0.013 in.}**



M05020100027

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: A-Decrease B-Increase
**SST: Adjuster Tool (09665-1040)**



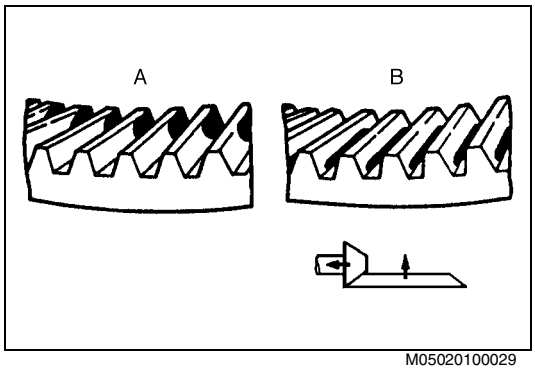
M05020100028

**8. INSPECTION AND ADJUSTMENT OF GEAR MESHING**

(1) Satisfactory gear meshing.

**NOTICE:**

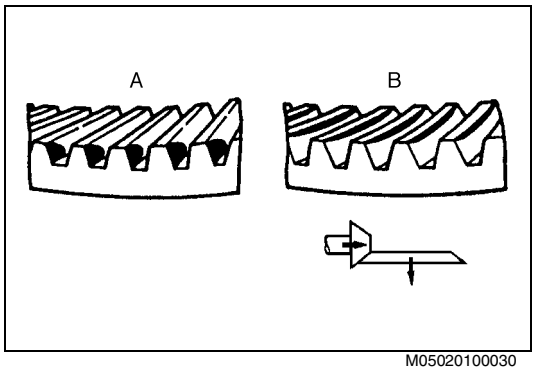
**New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.**



M05020100029

(2) Example of the unsatisfactory engagement
   a. Toe and flank contact

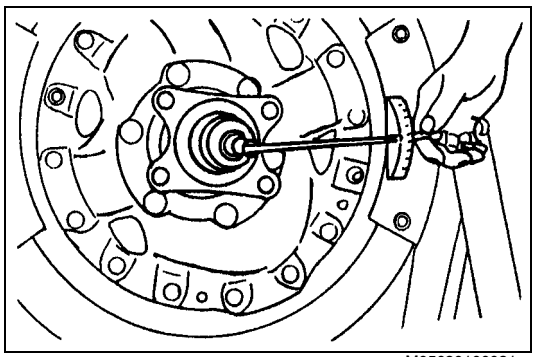
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



M05020100030

   b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


M05020100031

**9. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING**

(1) Measure and adjust the total preload at the differential carrier bearings, using a torque wrench.

**NOTICE:**

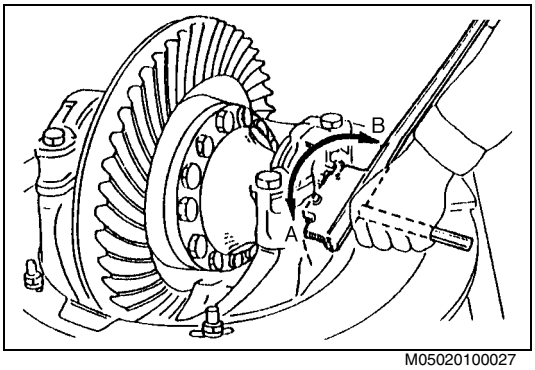
**Total preload = pinion bearing preload (Refer to item 2) + side bearing preload (Refer to the table below).**

**Assembly standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| Gear ratio | 4.875 | 5.125 |
|---|---|---|
| New bearing | 0.41-0.50 {4.2-5.1, 0.30-0.37} | 0.39-0.47 {4.0-4.8, 0.29-0.35} |
| Re-used bearing | 0.31-0.40 {3.1-4.0, 0.23-0.29} | 0.29-0.38 {3.0-3.8, 0.22-0.28} |

**NOTICE:**

**The gear ratio is indicated on the bearing cage.**

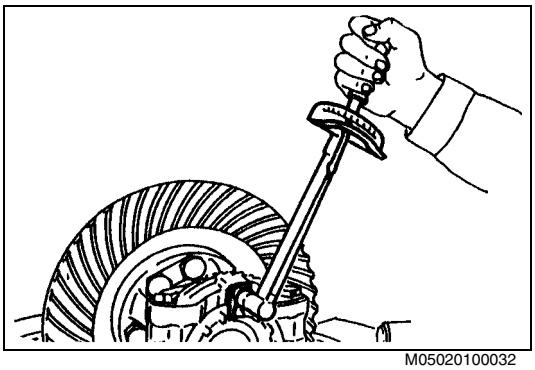


M05020100027

(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise : Decrease preload
- B: Clockwise : Increase preload

**SST: Adjuster Tool (09665-1040))**


M05020100032

(3) Tighten the bearing cap and install the lock plate.

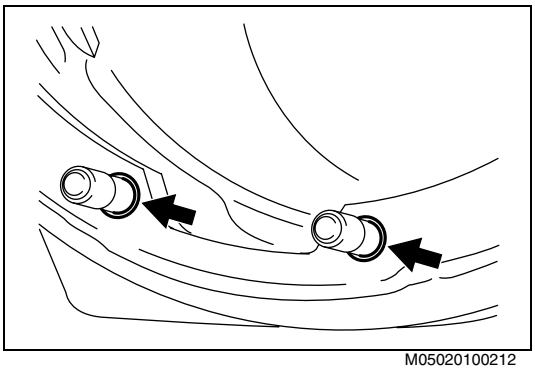
## IMPORTANT POINTS - MOUNTING

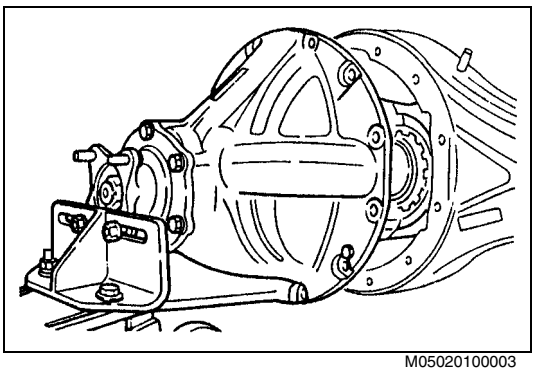
**1. MOUNTING**

(1) Using scraper, remove the rust on the joint surface between the axle housing and the differential carrier assembly.

(2) Install a new O-ring.

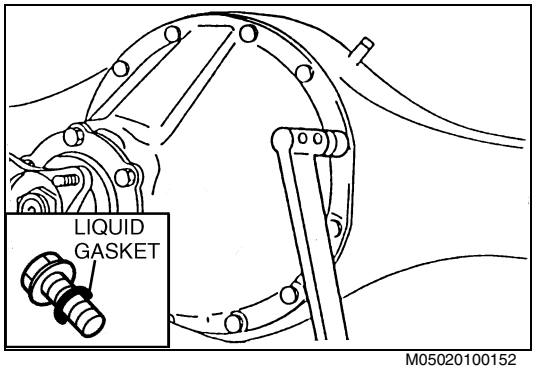
(3) Apply liquid gasket on the face of the housing flange.


M05020100212


M05020100003

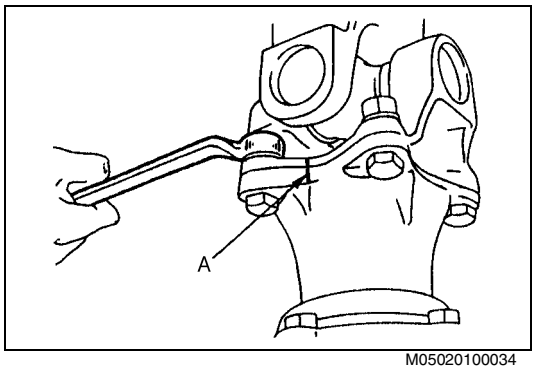
(4) Using a jack, install the differential carrier assembly to the axle housing.

**NOTICE:**
**Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.**



M05020100152

(5) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ14 bolts (10 pieces), install the bolts and tighten them regularly.



M05020100034

(6) Connect the propeller shaft.

**NOTICE:**
**Align the aligning marks A.**

**Tightening Torque:**
**61-91 N·m {623-927 kgf·cm, 45-67 lbf·ft}**

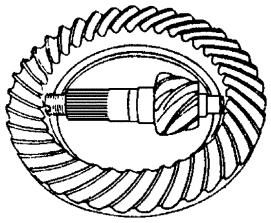
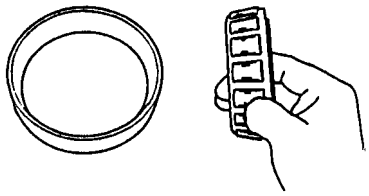
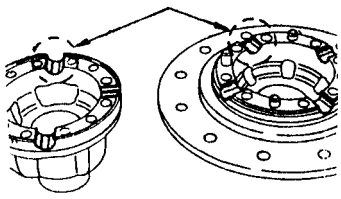
(7) Fill the axle housing with specified gear oil up to the filler plug hole.

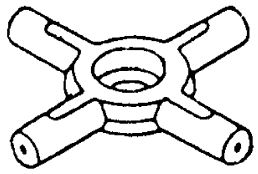
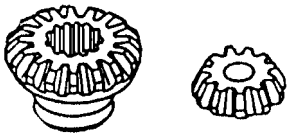
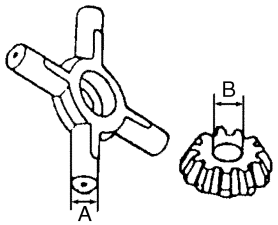
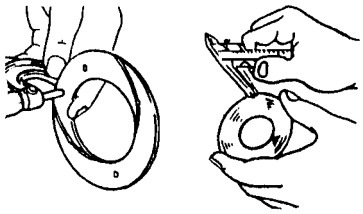
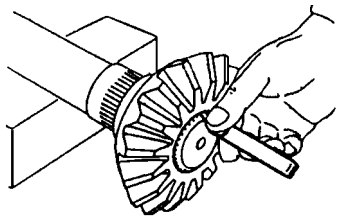
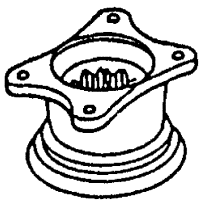
**Gear oil:**
**Refer to owner's manual.**

# INSPECTION AND REPAIR

M05020102BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Pinion and ring gear: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Bearing and race: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Differential case spider holes: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Spider:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Differential side gear and pinion:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Spider and pinion:<br>Clearance | A: 26 {1.024}<br>B-A: 0.140-0.201 {0.0055-0.0079} | 0.4 {0.016} | Replace. | Measure<br>  |
| Thrust washers thickness (Side gear and pinion gear) | Side gear:<br>1.9-2.1 {0.075 – 0.082} | 1.7 {0.067} | Replace. | Measure<br>  |
| | Pinion gear:<br>1.7-1.9 {0.067-0.074} | 1.5 {0.059} | | |
| Differential side gear and axle shaft:<br>Spline backlash | 0.054-0.148 {0.0021-0.0058} | 0.5 {0.0196} | Replace. | Measure<br>  |
| Flange coupling:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |

# DIFFERENTIAL CARRIER (SH16)

DF02-003

**DIFFERENTIAL CARRIER (SH16) ..... DF02-2**
DATA AND SPECIFICATIONS ..... DF02-2
DESCRIPTION ..... DF02-2
TROUBLESHOOTING ..... DF02-3
SPECIAL TOOL ..... DF02-4
COMPONENT LOCATOR ..... DF02-5
OVERHAUL ..... DF02-7
INSPECTION AND REPAIR ..... DF02-17

# DIFFERENTIAL CARRIER (SH16)

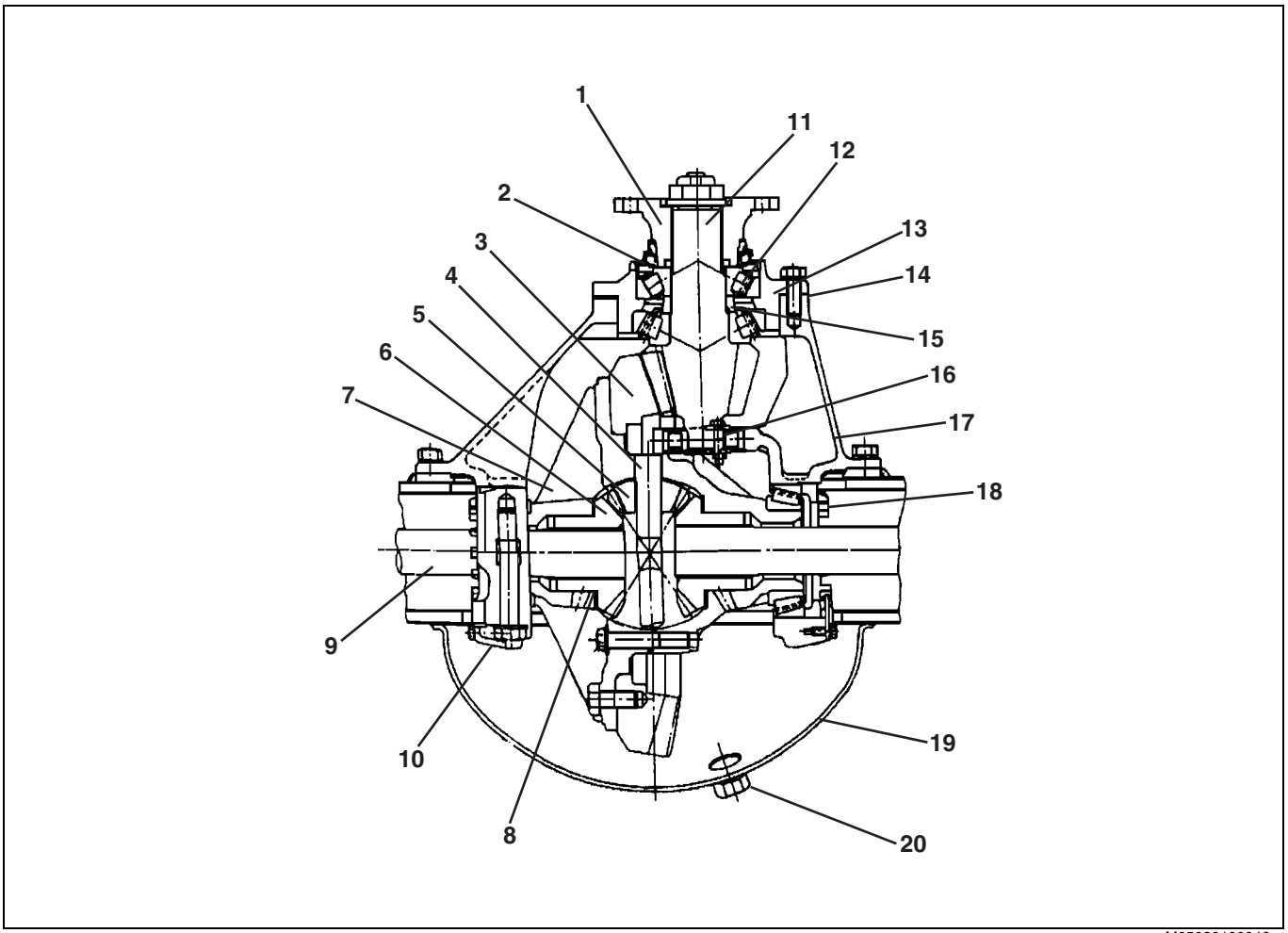
## DATA AND SPECIFICATIONS

M05020103BEI2001

| | |
|---|---|
| Type | Single-reduction, single-speed, by hypoid gearing |
| Gear ratios | 4.300, 4.875, 5.857, 6.428 |
| Oil capacity | 10 L {2.20 Imp gal. / 2.64 U.S gal.} |

## DESCRIPTION

M05020103BEC1001




M05020100046

| | | | | | |
|---|---|---|---|---|---|
| 1 | Flange yoke coupling | 8 | Thrust washer | 15 | Spacer |
| 2 | Oil seal | 9 | Axle shaft | 16 | Cylindrical roller bearing |
| 3 | Hypoid ring gear | 10 | Bearing cap | 17 | Differential carrier case |
| 4 | Spider | 11 | Hypoid pinion | 18 | Adjusting nut |
| 5 | Differential pinion gear | 12 | Taper roller bearing | 19 | Axle housing |
| 6 | Differential side gear | 13 | Bearing cage | 20 | Oil filler plug |
| 7 | Differential case | 14 | Adjusting shim | | |

# TROUBLESHOOTING

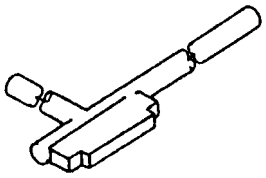
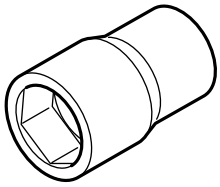
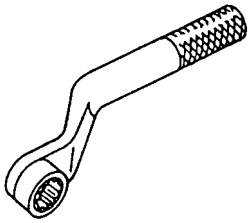
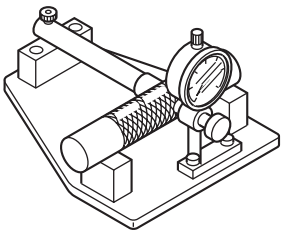
M05020103BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings | Replace bearings. |
| | Worn or damaged differential side bearings | Replace bearings. |
| | Loose pinion bearings | Adjust bearing preload. |
| | Loose differential side bearings | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear | Adjust backlash. |
| | Worn thrust washers | Replace. |
| | Worn differential spider | Replace. |
| | Worn or damaged ring gear and pinion | Replace. |
| | Worn or damaged differential side gears and pinions | Replace. |
| | Loose ring gear bolts | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear | Replace or adjust tooth contact. |
| | Worn pinion spline | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline | Replace. |
| | Worn hub bearings | Replace. |
| | Loose hub bearings | Adjust bearing preload. |
| | Loose differential case tightening bolts | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil | Add oil; check for leakage. |
| | Poor oil quality | Change oil. |
| | Abnormal propeller shaft noise | Refer to chapter PROPELLER SHAFT. |

# SPECIAL TOOL

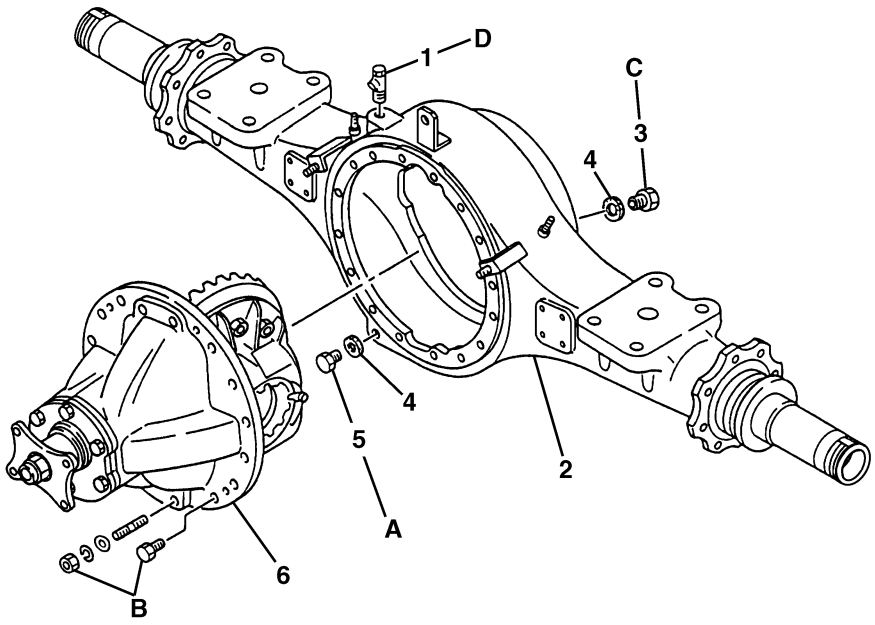
M05020103BEK1001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09665-1040 | ADJUSTER TOOL | |
|  | 09839-4601 | SOCKET WRENCH | |
|  | 09603-1150 | SOCKET WRENCH | |
|  | 09640-1151 | GAUGE ASSEMBLY | |

# COMPONENT LOCATOR

M05020103BED1001

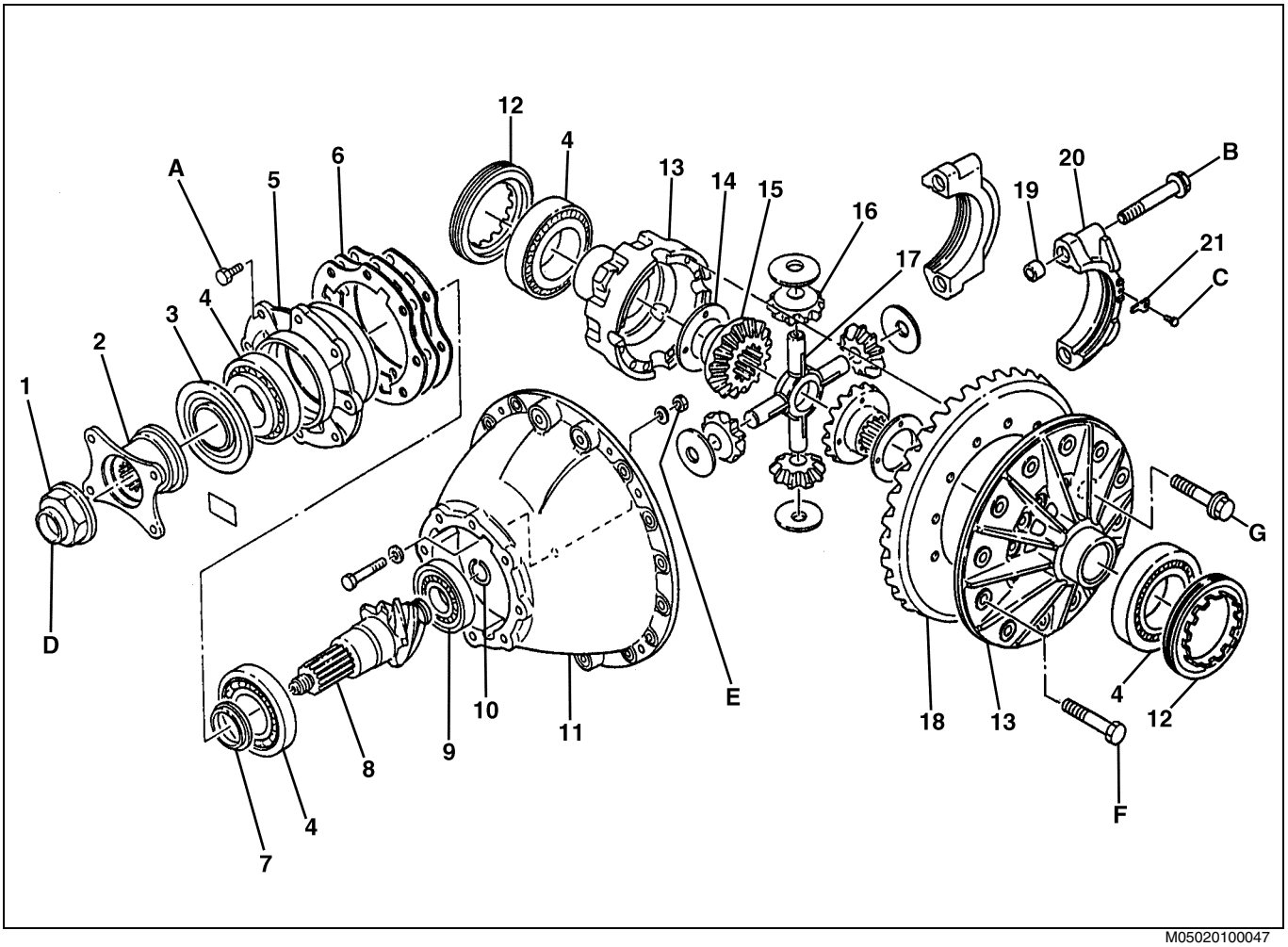



M05020100221

| | | | |
|---|---|---|---|
| 1 | Air breather | 4 | Gasket |
| 2 | Axle housing assembly | 5 | Oil drain plug |
| 3 | Oil filler plug | 6 | Differential carrier assembly |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 39.2-68.6 {400-700, 29-50} | C | 78.4-117.6 {800-1,200, 58-86} |
| B | 113-147 {1,150-1,500, 83-108} | D | 9.8-19.6 {100-200, 7-14} |




M05020100047

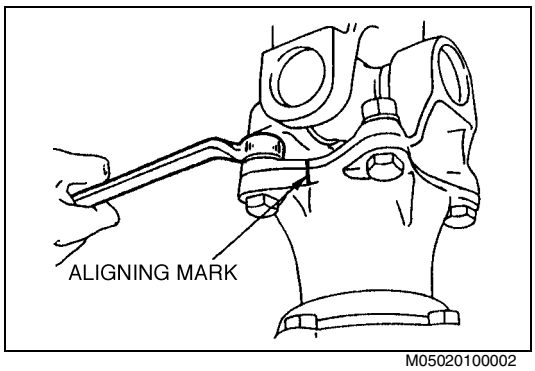
| | | | | | |
|---|---|---|---|---|---|
| 1 | Lock nut | 8 | Hypoid pinion | 15 | Differential side gear |
| 2 | Flange yoke coupling | 9 | Cylindrical roller bearing | 16 | Differential pinion gear |
| 3 | Oil seal | 10 | Retainer ring | 17 | Spider |
| 4 | Taper roller bearing | 11 | Differential carrier case | 18 | Hypoid ring gear |
| 5 | Bearing cage | 12 | Adjusting nut | 19 | Collar |
| 6 | Adjusting shim | 13 | Differential case | 20 | Bearing cap |
| 7 | Spacer | 14 | Thrust washer | 21 | Lock plate |

**Tightening torque** **Unit:N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 113-147 {1,150-1,500, 83-108} | E | 19-25 {190-260, 14-18} |
| B | 277-353 {2,800-3,600, 203-260} | F | 368-422 {3,700-4,300, 268-311} |
| C | 19-25 {190-260, 14-18} | G | 246-294 {2,500-3,000, 181-216} |
| D | 589-781 {6,000-8,000, 434-578} | | |

# OVERHAUL

M05020103BEH2001



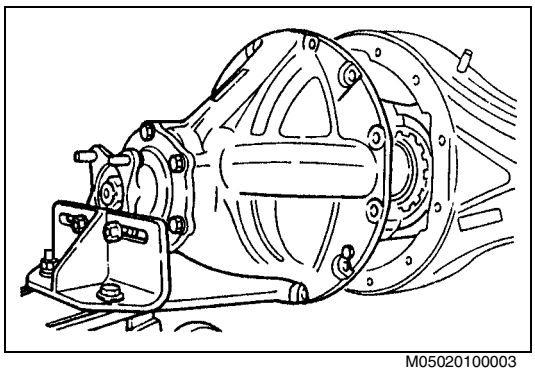
M05020100002

## IMPORTANT POINTS - DISMOUNTING

**1. DISCONNECT THE PROPELLER SHAFT.**

**NOTICE:**

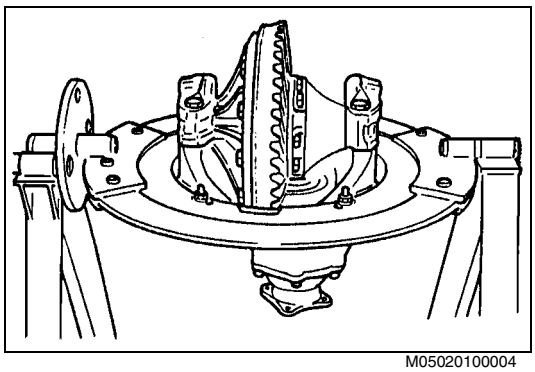
**Make aligning marks before disassembling.**


M05020100003

**2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.**

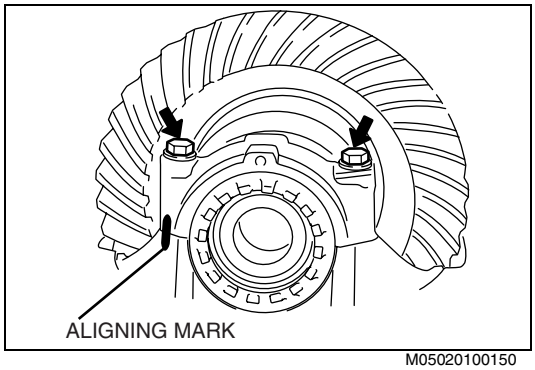
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.


M05020100004

## IMPORTANT POINTS - DISASSEMBLY

**1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.**



M05020100150

**2. DIFFERENTIAL CASE**

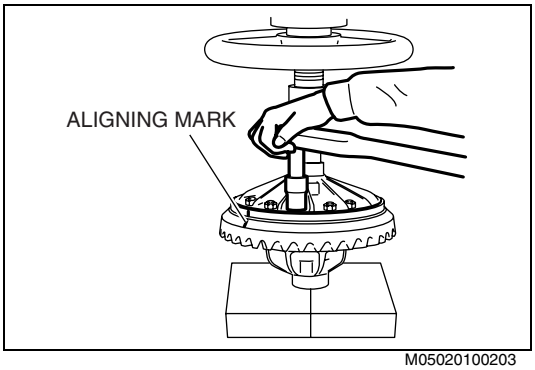
(1) Remove the bearing cap.

**NOTICE:**

**Make aligning marks before disassembling.**

**SST: Socket Wrench (09603-1150)**

(2) Using a puller, remove the taper roller bearing.

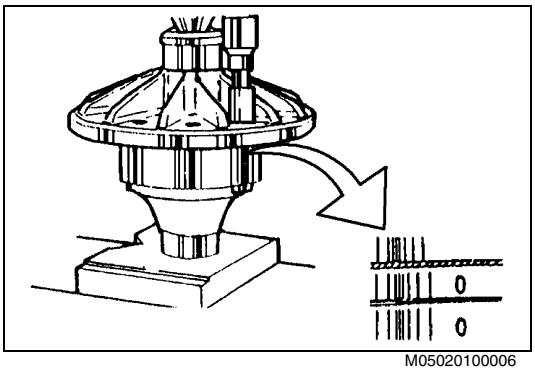


M05020100203

(3) Dismounting the ring gear

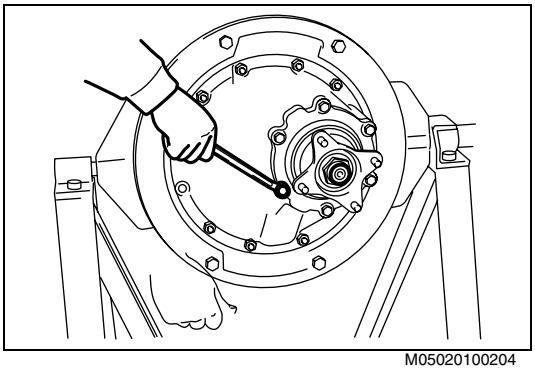
a. Make aligning mark both the differential case and the ring gear.
b. Using press, fix the differential gear assembly.
c. Remove the bolts and then ring gear.

**NOTICE:**
**Be careful not to drop the ring gear.**


M05020100006

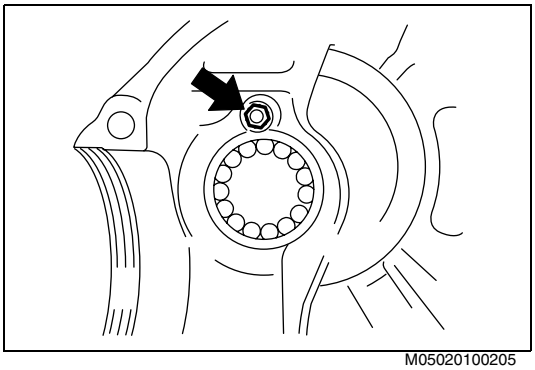
(4) Disassemble the differential case.

**NOTICE:**
**Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts so that the case separates.**

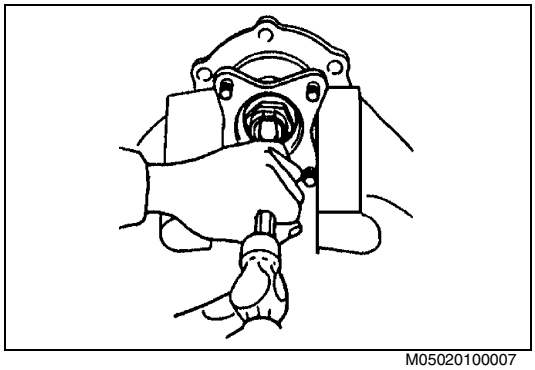

M05020100204

**3. Dismounting the hypoid pinion**

(1) Remove the bolts and then dismount the hypoid pinion and the shims.

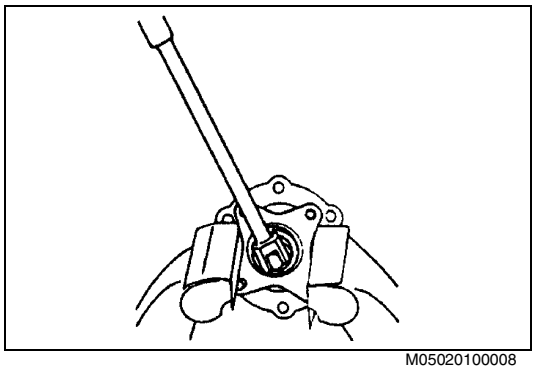

M05020100205

(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


M05020100007

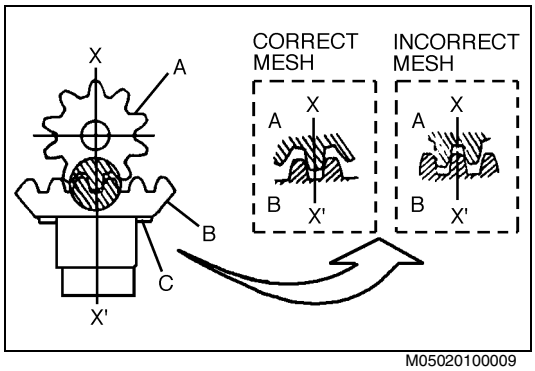
**4. BEARING CAGE**

(1) Uncaulk the lock nut and remove the nut.
**SST: Socket Wrench (09839-4601)**


M05020100008

(2) Using a puller, remove the taper roller bearing outer race.

## IMPORTANT POINTS - ASSEMBLY



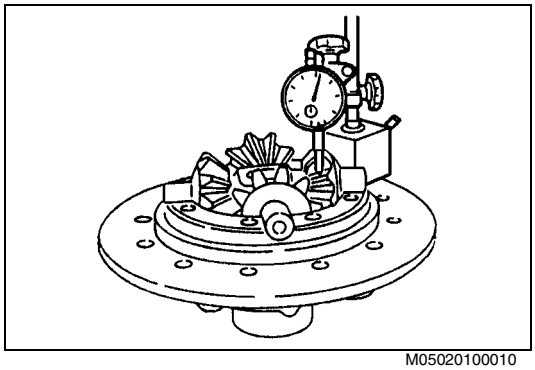
M05020100009

**1. DIFFERENTIAL CASE**

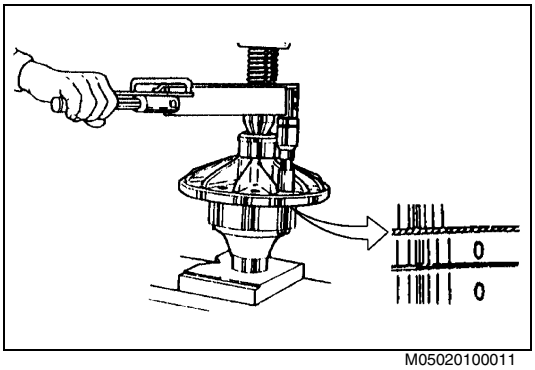
(1) Measure the pinion backlash.

**NOTICE:**
**Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.**

- A: Pinion
- B: Side gear
- C: Thrust washer

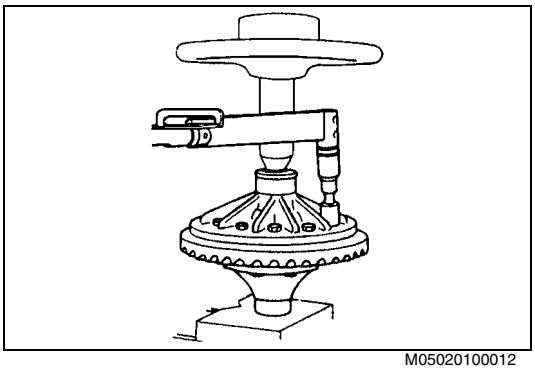

M05020100010

(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
**Assembly Standard:0.20-0.60 mm {0.0079-0.0236 in.}**
**Service Limit:0.9 mm {0.0354 in.}**


M05020100011

(3) Assemble the differential case.

**NOTICE:**
- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

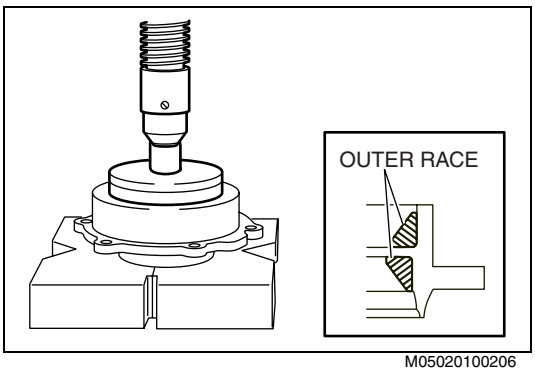

M05020100012

(4) Install the ring gear to the differential case and tighten it with bolts.

**NOTICE:**
**Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**

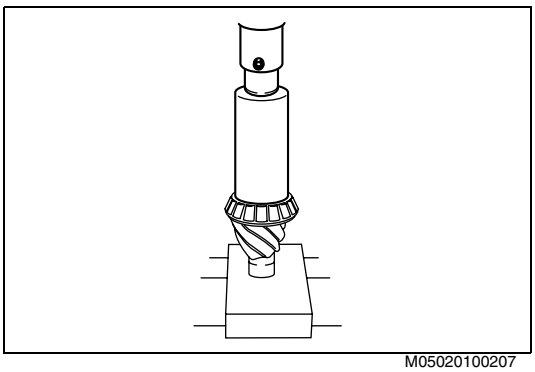
**2. Assembling the hypoid pinion**

(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.

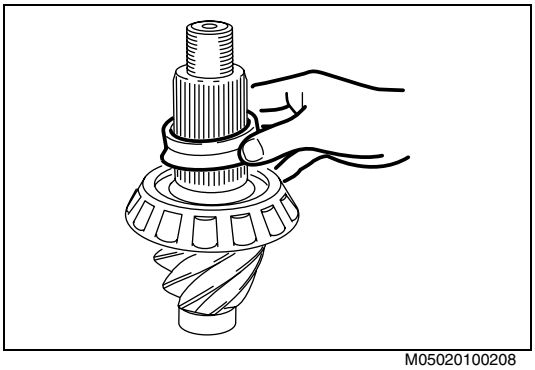


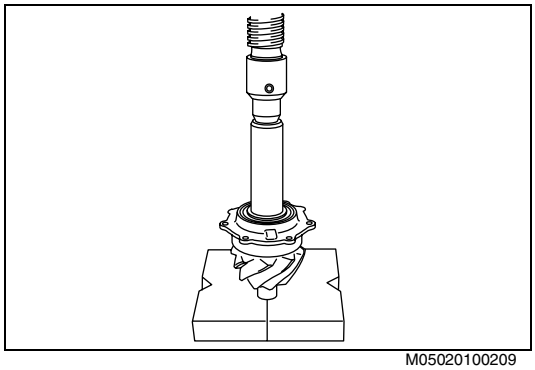
M05020100206

(2) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.

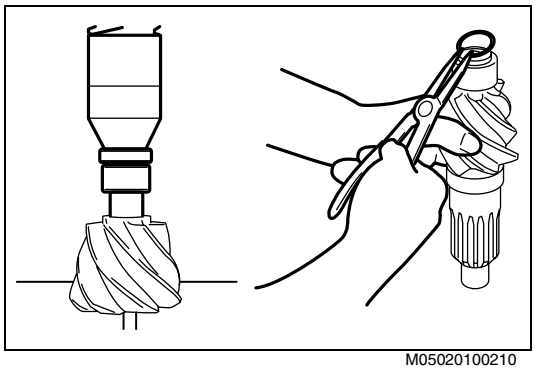

M05020100207

   c. Install the spacer.


M05020100208

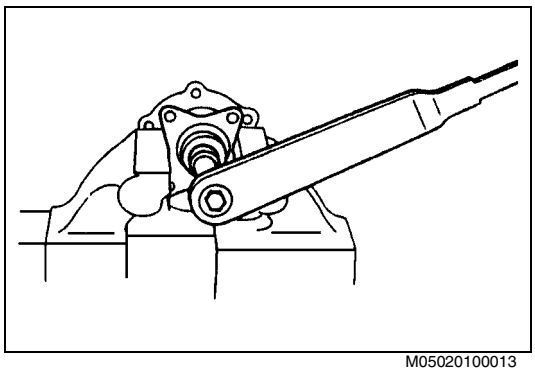

M05020100209

(3) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


M05020100210

(4) Installing the pilot bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**

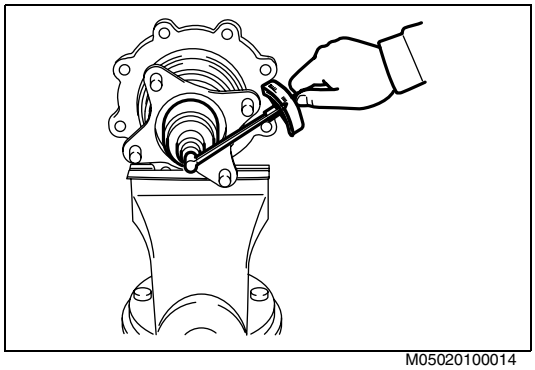

M05020100013

**3. ADJUSTMENT OF THE PINION BEARING PRELOAD**

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

**NOTICE:**
**The oil seal must be installed in the bearing cage after measurement of the preload.**

**SST: Socket Wrench (09839-4601)**

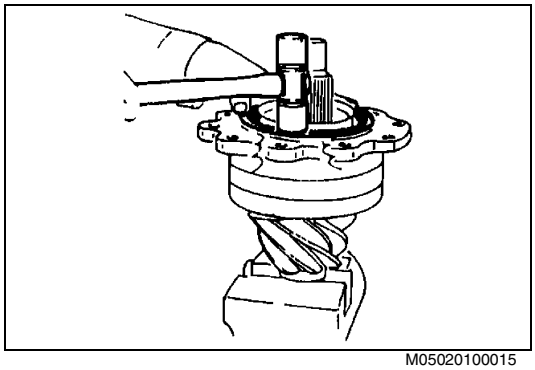

M05020100014

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

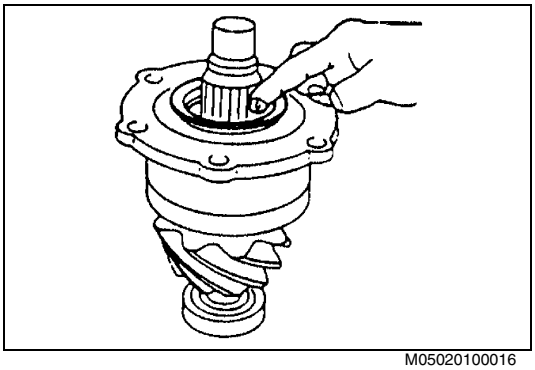
**Assembly Standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| New bearing | Re-used bearing |
|---|---|
| 1.97-2.94 {20-30, 1.5-2.1} | 1.48-2.45 {15-25, 1.1-1.8} |

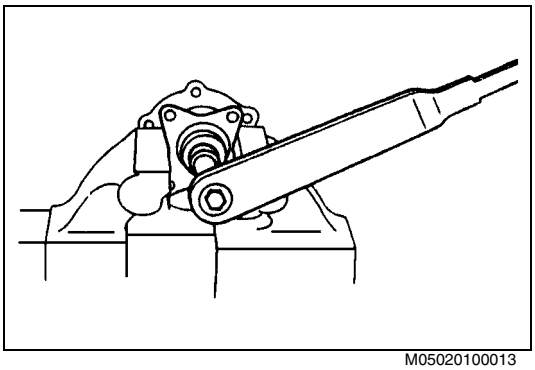
**Adjusting spacer thickness:**
**17 kinds of thicknesses ranging from 17.250 to 17.650 mm {0.679 to 0.694 in.} each differing 0.025 mm {0.001 in.}**


M05020100015

(3) After adjusting the preload, install the new oil seal.

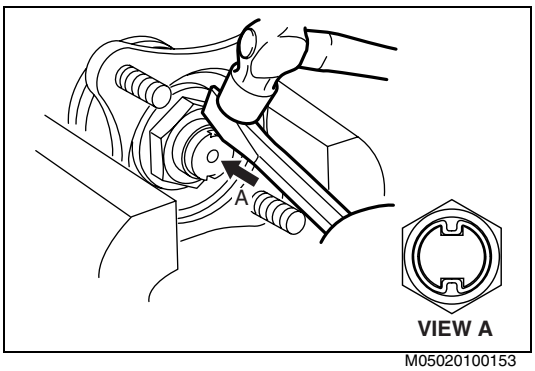

M05020100016

**NOTICE:**
- **Apply wheel bearing grease on the oil seal lip part.**
- **Tap the oil seal in small steps and evenly to prevent it from being at slant position.**


M05020100013

(4) Install the flange yoke coupling and tighten the lock nut.
**SST: Socket Wrench (09839-4601)**

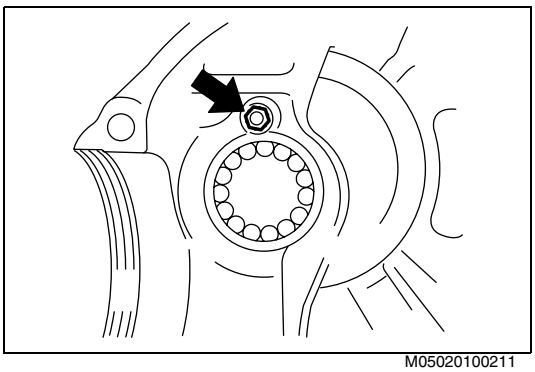
(5) Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.



M05020100153

(6) Caulk the lock nut.

**NOTICE:**
- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**

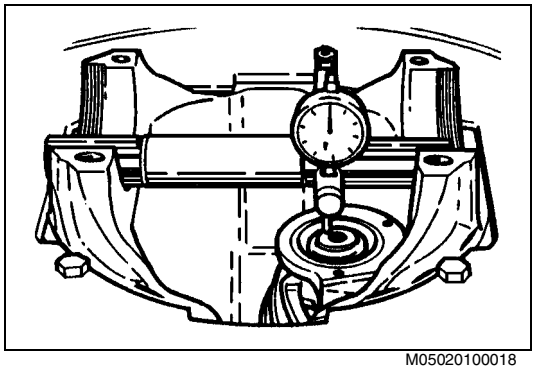

M05020100211

**4. INSTALLING THE CYLINDRICAL ROLLER BEARING OUTER RACE**

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.

**Tightening Torque:**
**19-25 N·m {190-260 kgf·cm, 14-18 lbf·ft}**

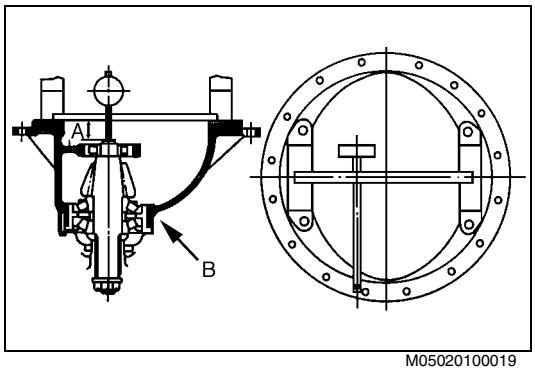
**NOTICE:**
**Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**


M05020100018

**5. ADJUSTMENT OF PINION FITTING HEIGHT (CONICAL DISTANCE).**

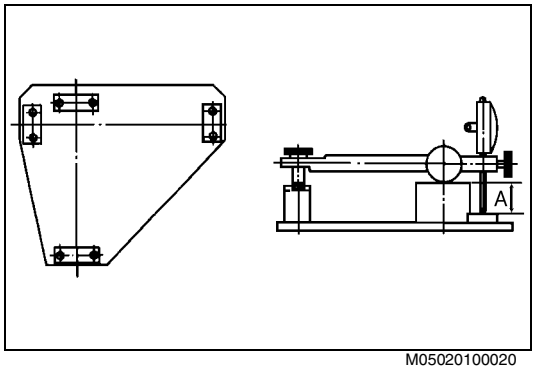
(1) Install the pinion cage assembly and adjust the height with shims.
**SST: Gauge Assembly (09640-1151)**

**NOTICE:**
**Upon completing the adjustment, remove the pinion cage assembly and apply liquid gasket (ThreeBond #1215 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.**



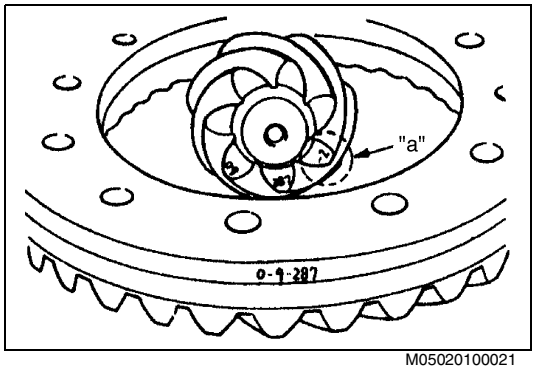
M05020100019

**A: 33 mm {1.299 in.}**
**B: Adjusting 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.}**



M05020100020

(2) How to use the pinion depth gauge: Set the pinion depth gauge.
**A:33 mm {1.299 in.}**



M05020100021

**EXAMPLE:**

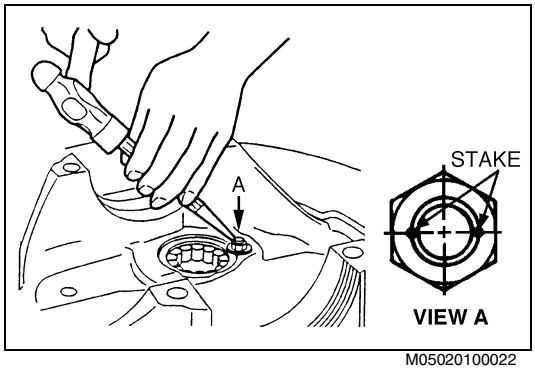
**In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):**

| Standard pinion height "A" | | The engraved value "a" | | Measuring part (A') |
|---|---|---|---|---|
| 33.0 mm | – | 0.2 mm | = | 32.8 mm |

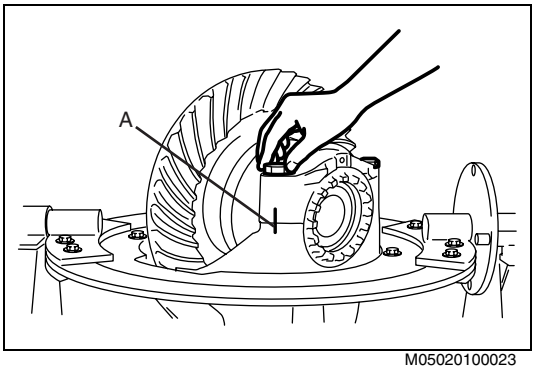
**6. CYLINDRICAL ROLLER BEARING**

(1) Install the cylindrical roller bearing and tighten the lock nut.

**NOTICE:**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the lock nut.**
- **When lock agent is not applied, stake the lock nut as shown in the figure.**



M05020100022

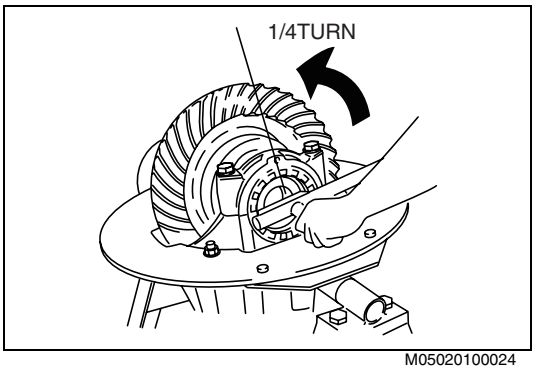


M05020100023

**7. ADJUSTMENT OF HYPOID RING GEAR BACKLASH.**

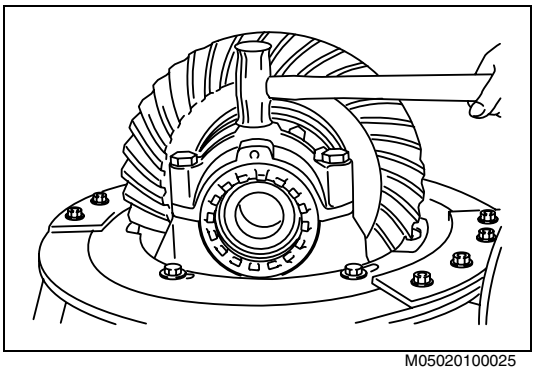
(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

**NOTICE:**
**Align the aligning marks A.**

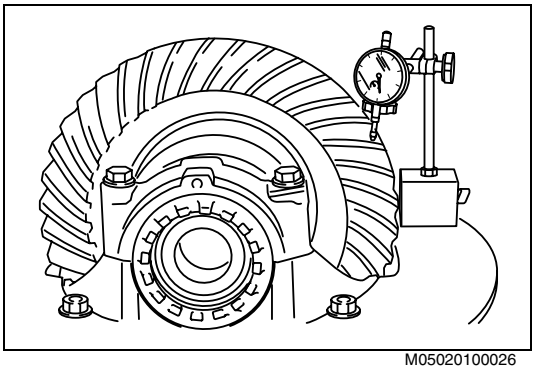


M05020100024

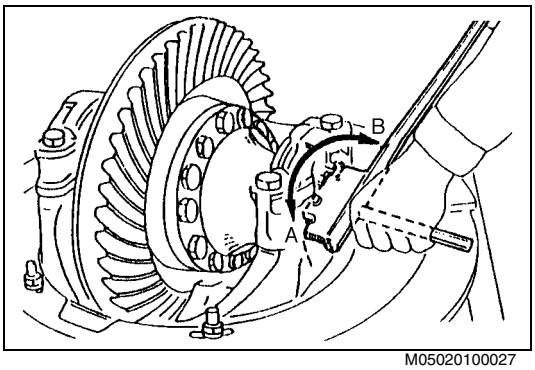
(2) Adjust the preload of the side bearing provisionally.
a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.
**SST: Adjuster Tool (09665-1040)**


M05020100025

b. Hit the bearing cap with a copper hammer.

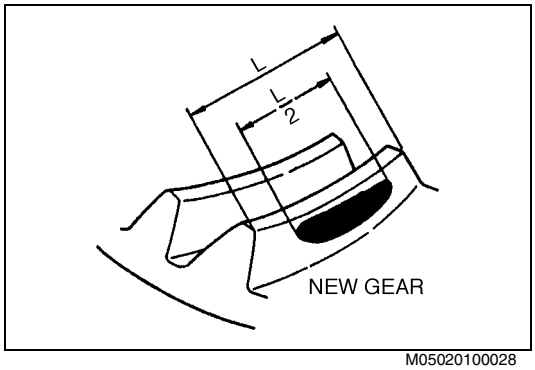

M05020100026

(3) Measure the gear backlash at three or four points on the circumference of the gear.
**Assembly Standard: 0.30-0.41 mm {0.012-0.016 in.}**



M05020100027

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: A-Decrease B-Increase
**SST: Adjuster Tool (09665-1040)**



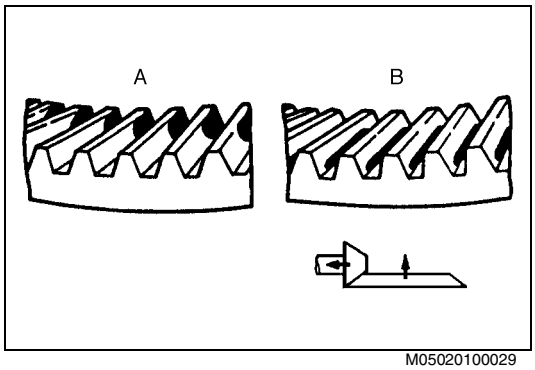
M05020100028

**8. INSPECTION AND ADJUSTMENT OF GEAR MESHING**

(1) Satisfactory gear meshing.

**NOTICE:**

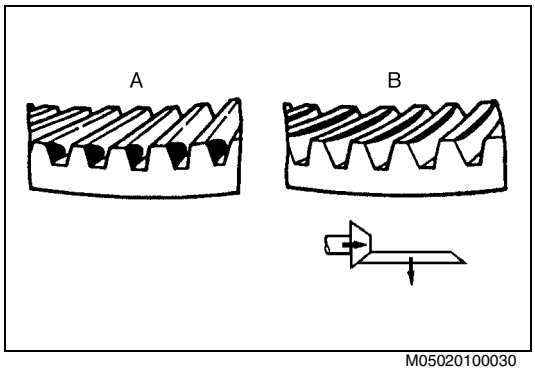
**New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.**



M05020100029

(2) Example of the unsatisfactory engagement
   a. Toe and flank contact

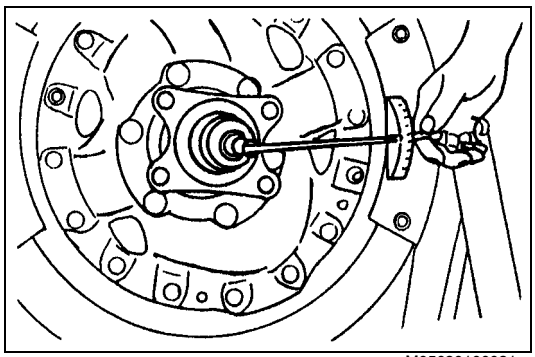
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



M05020100030

   b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


M05020100031

**9. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING**

(1) Measure and adjust the total preload at the differential carrier bearings, using a torque wrench.

**NOTICE:**

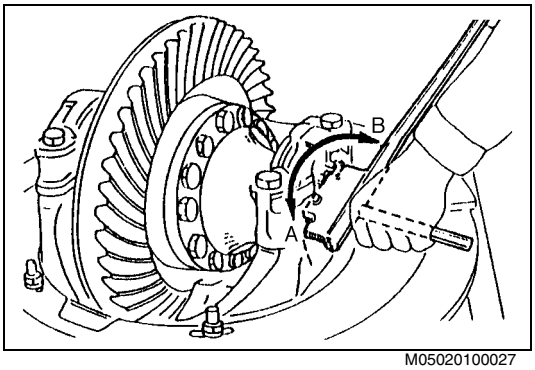
**Total preload = pinion bearing preload (Refer to item 2) + side bearing preload (Refer to the table below).**

**Assembly standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| Gear ratio | 4.300 | 4.875 | 5.857 | 6.428 |
|---|---|---|---|---|
| New bearing | 0.46-0.68 {4.7-6.9, 0.34-0.50} | 0.41-0.60 {4.2-6.1, 0.30-0.44} | 0.34-0.50 {3.5-5.1, 0.25-0.37} | 0.31-0.46 {3.2-4.6, 0.23-0.33} |
| Re-used bearing | 0.35-0.56 {3.5-5.8, 0.26-0.42} | 0.31-0.50 {3.1-5.1, 0.23-0.37} | 0.26-0.41 {2.6-4.2, 0.19-0.30} | 0.23-0.38 {2.4-3.8, 0.17-0.28} |

**NOTICE:**

**The gear ratio is indicated on the bearing cage.**

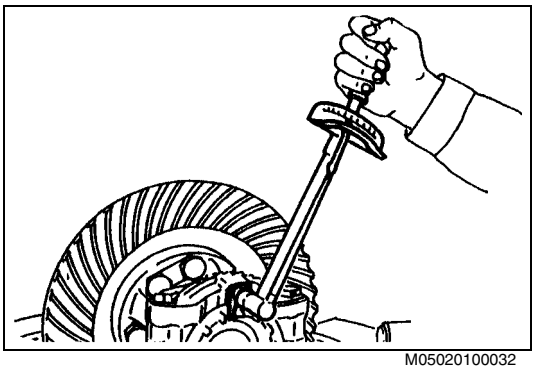


M05020100027

(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise : Decrease preload
- B: Clockwise : Increase preload

**SST: Adjuster Tool (09665-1040))**


M05020100032

(3) Tighten the bearing cap and install the lock plate.

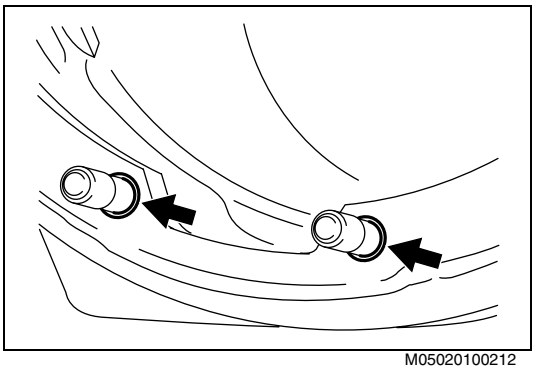
## IMPORTANT POINTS - MOUNTING

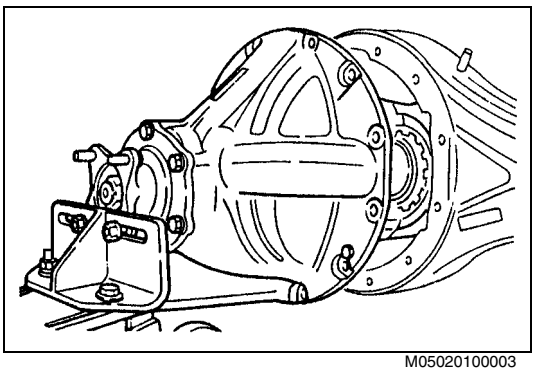
**1. MOUNTING**

(1) Using scraper, remove the rust on the joint surface between the axle housing and the differential carrier assembly.

(2) Install a new O-ring.

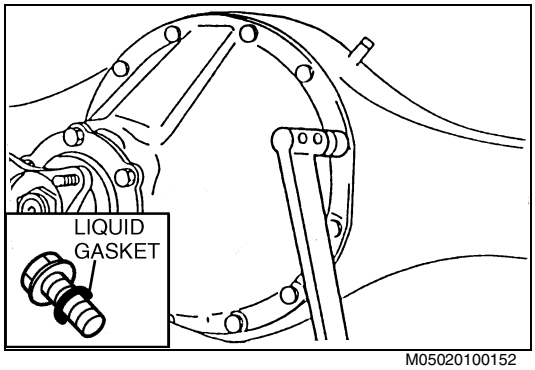
(3) Apply liquid gasket on the face of the housing flange.


M05020100212


M05020100003

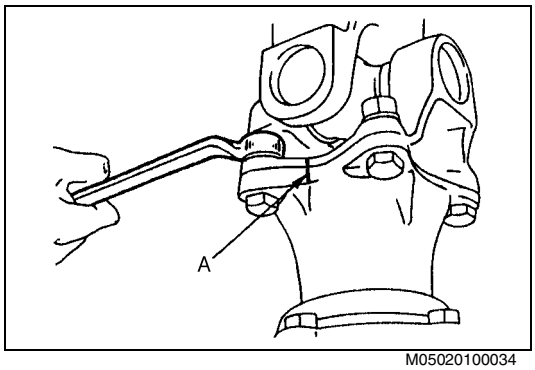
(4) Using a jack, install the differential carrier assembly to the axle housing.

**NOTICE:**
**Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.**



M05020100152

(5) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ14 bolts (12 pieces), install the bolts and tighten them regularly.



M05020100034

(6) Connect the propeller shaft.

**NOTICE:**
**Align the aligning marks A.**

**Tightening Torque:**
**127.4-156.8 N·m {1,300-1,600 kgf·cm, 94-115 lbf·ft}**

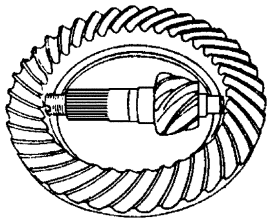
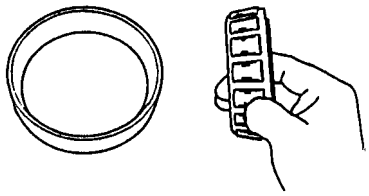
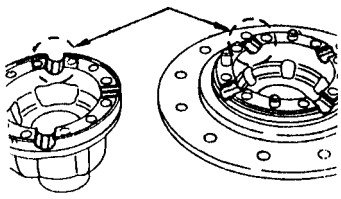
(7) Fill the axle housing with specified gear oil up to the filler plug hole.

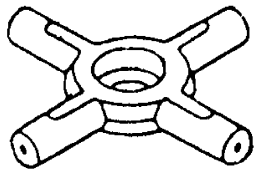
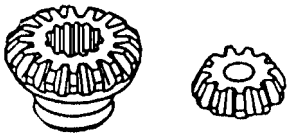
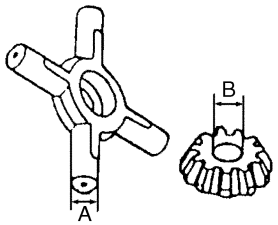
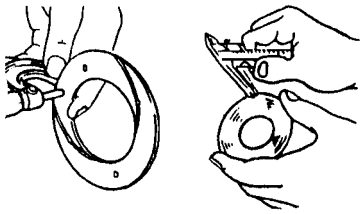
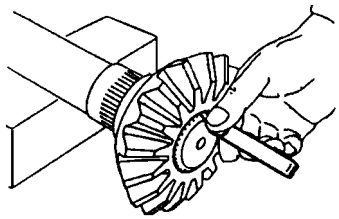
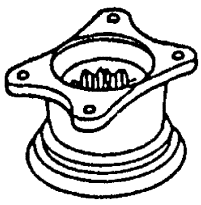
**Gear oil:**
**Refer to owner's manual.**

# INSPECTION AND REPAIR

M05020103BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Pinion and ring gear: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Bearing and race: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Differential case spider holes: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Spider:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Differential side gear and pinion:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Spider and pinion:<br>Clearance | A: 26 {1.024}<br>B-A: 0.140-0.201 {0.0055-0.0079} | 0.4 {0.016} | Replace. | Measure<br>  |
| Thrust washers thickness (Side gear and pinion gear) | Side gear:<br>1.9-2.1 {0.075 – 0.082} | 1.7 {0.067} | Replace. | Measure<br>  |
| | Pinion gear:<br>1.7-1.9 {0.067-0.074} | 1.5 {0.059} | | |
| Differential side gear and axle shaft:<br>Spline backlash | 0.054-0.148 {0.0021-0.0058} | 0.5 {0.0196} | Replace. | Measure<br>  |
| Flange coupling:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |

# DIFFERENTIAL CARRIER (SH17)

DF02-004

**DIFFERENTIAL CARRIER (SH17) ..... DF02-2**
DATA AND SPECIFICATIONS ..... DF02-2
DESCRIPTION ..... DF02-2
TROUBLESHOOTING ..... DF02-3
SPECIAL TOOL ..... DF02-4
COMPONENT LOCATOR ..... DF02-5
OVERHAUL ..... DF02-7
INSPECTION AND REPAIR ..... DF02-17

# DIFFERENTIAL CARRIER (SH17)

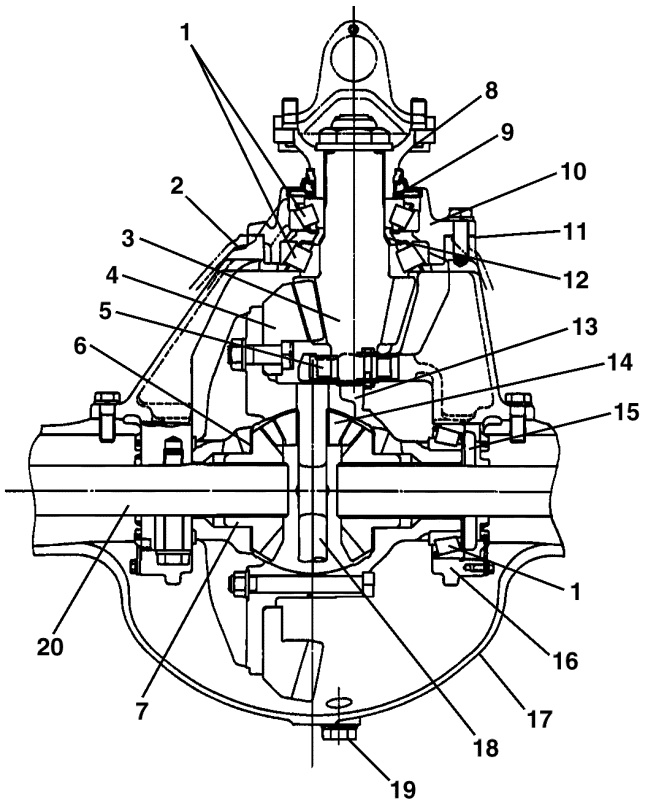
## DATA AND SPECIFICATIONS

M05020104BEI2001

| | |
|---|---|
| Type | Single-reduction, single-speed, by hypoid gearing |
| Gear ratios | 4.100, 4.625, 4.875, 5.250, 5.857 |
| Oil capacity | 11 L {2.42 Imp gal. / 2.91 U.S gal.} |

## DESCRIPTION

M05020104BEC1001




M05020100145

| | | | | | |
|---|---|---|---|---|---|
| 1 | Taper roller bearing | 8 | Flange yoke coupling | 15 | Adjusting nut |
| 2 | Differential carrier case | 9 | Oil seal | 16 | Bearing cap |
| 3 | Hypoid pinion | 10 | Bearing cage | 17 | Axle housing |
| 4 | Hypoid ring gear | 11 | Adjusting shim | 18 | Spider |
| 5 | Cylindrical roller bearing | 12 | Spacer | 19 | Oil filler plug |
| 6 | Thrust washer | 13 | Differential case | 20 | Axle shaft |
| 7 | Differential side gear | 14 | Differential pinion gear | | |

# TROUBLESHOOTING

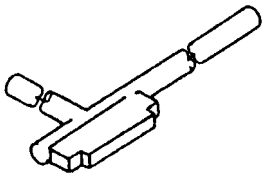
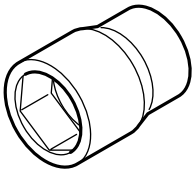
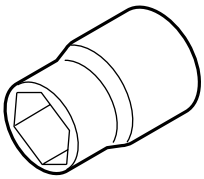
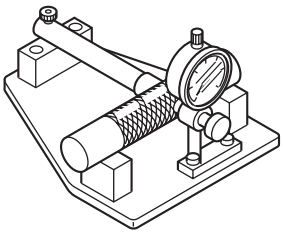
M05020104BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings | Replace bearings. |
| | Worn or damaged differential side bearings | Replace bearings. |
| | Loose pinion bearings | Adjust bearing preload. |
| | Loose differential side bearings | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear | Adjust backlash. |
| | Worn thrust washers | Replace. |
| | Worn differential spider | Replace. |
| | Worn or damaged ring gear and pinion | Replace. |
| | Worn or damaged differential side gears and pinions | Replace. |
| | Loose ring gear bolts | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear | Replace or adjust tooth contact. |
| | Worn pinion spline | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline | Replace. |
| | Worn hub bearings | Replace. |
| | Loose hub bearings | Adjust bearing preload. |
| | Loose differential case tightening bolts | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil | Add oil; check for leakage. |
| | Poor oil quality | Change oil. |
| | Abnormal propeller shaft noise | Refer to chapter PROPELLER SHAFT. |

# SPECIAL TOOL

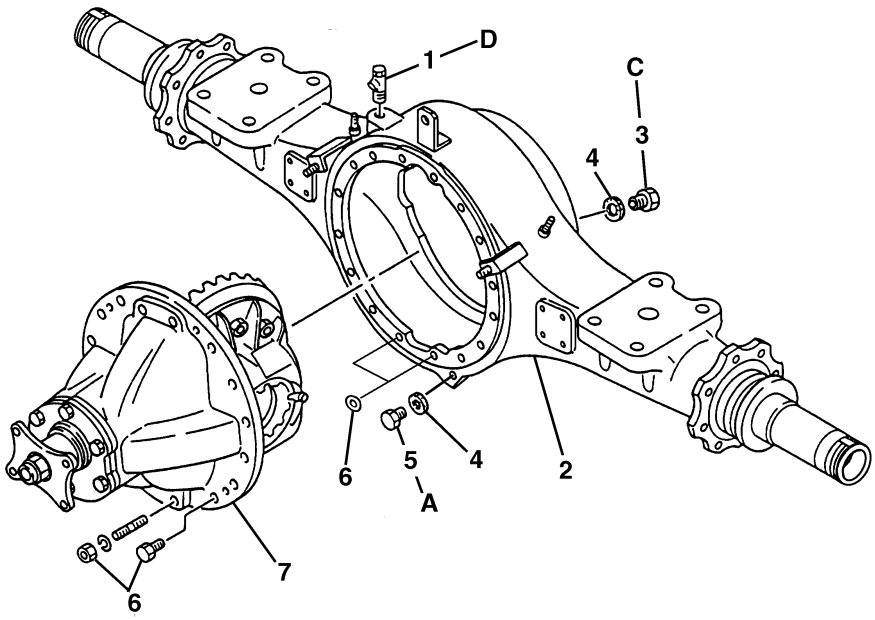
M05020104BEK1001

Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09665-1180 | ADJUSTER TOOL | |
|  | 09839-5501 | SOCKET WRENCH | |
|  | 09839-3003 | SOCKET WRENCH | |
|  | 09640-1210 | GAUGE ASSEMBLY | |

# COMPONENT LOCATOR

M05020104BED1001

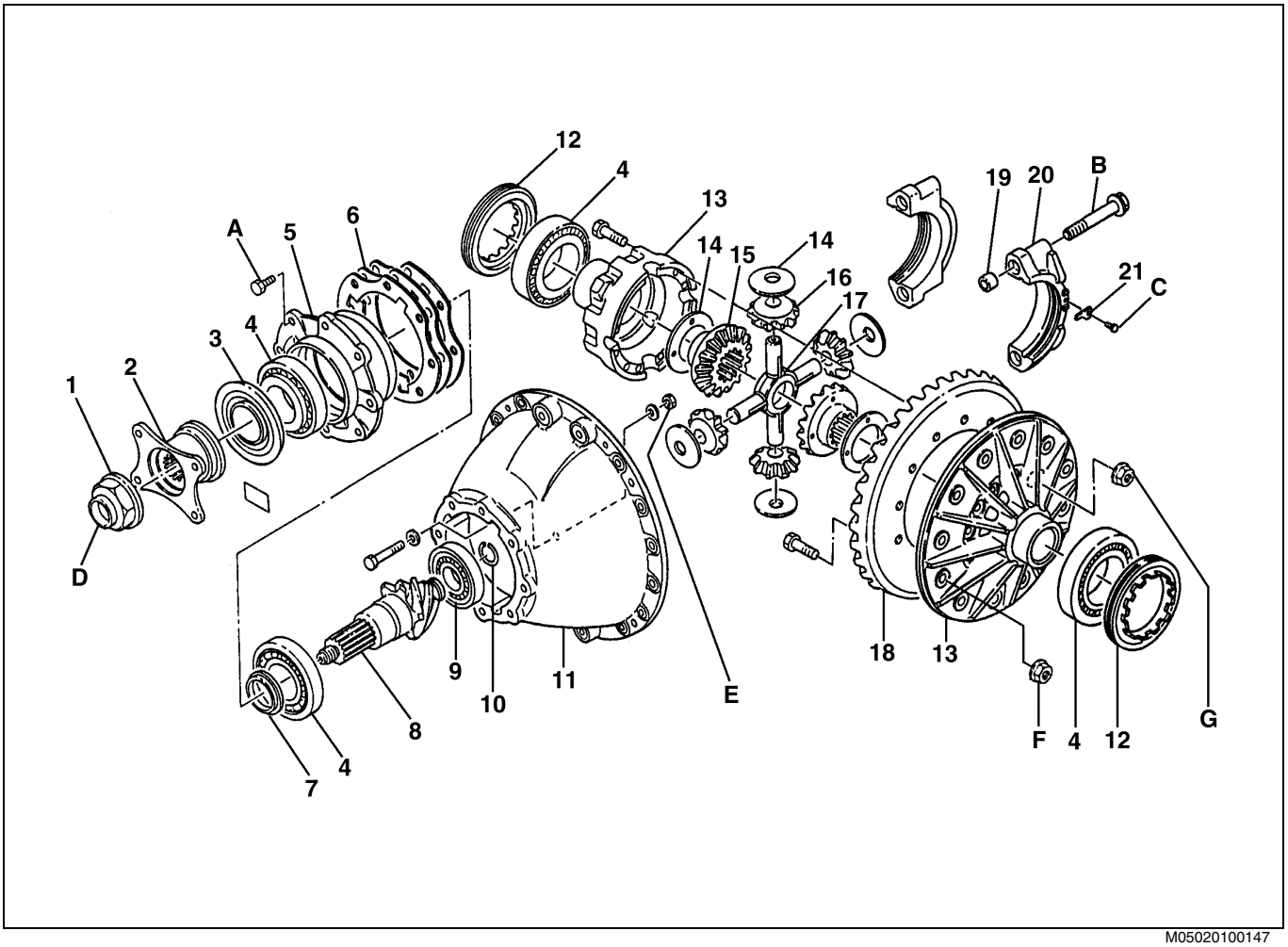



M05020100222

| | | | |
|---|---|---|---|
| 1 | Air breather | 5 | Oil drain plug |
| 2 | Axle housing assembly | 6 | O-ring |
| 3 | Oil filler plug | 7 | Differential carrier assembly |
| 4 | Gasket | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 39.2-68.6 {400-700, 29-50} | C | 78.4-117.6 {800-1,200, 58-86} |
| B | 167-213 {1,700-2,200, 123-159} | D | 9.8-19.6 {100-200, 7-14} |




M05020100147

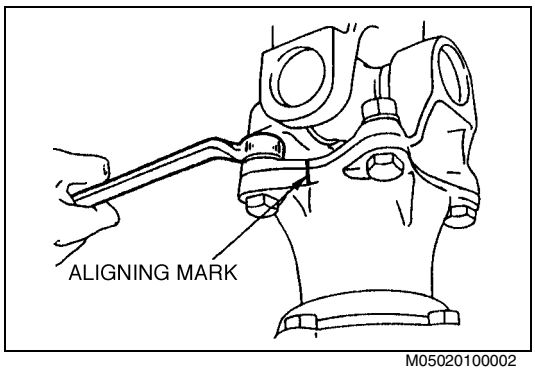
| | | | | | |
|---|---|---|---|---|---|
| 1 | Lock nut | 8 | Hypoid pinion | 15 | Differential side gear |
| 2 | Flange yoke coupling | 9 | Cylindrical roller bearing | 16 | Differential pinion gear |
| 3 | Oil seal | 10 | Retainer ring | 17 | Spider |
| 4 | Taper roller bearing | 11 | Differential carrier case | 18 | Hypoid ring gear |
| 5 | Bearing cage | 12 | Adjusting nut | 19 | Collar |
| 6 | Adjusting shim | 13 | Differential case | 20 | Bearing cap |
| 7 | Spacer | 14 | Thrust washer | 21 | Lock plate |

**Tightening torque** **Unit:N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 167-223 {1,700-2,300, 123-166} | E | 19-25 {190-260, 14-18} |
| B | 372-428 {3,500-4,700, 254-336} | F | 461-559 {4,700-5700, 340-412} |
| C | 19-25 {190-260, 14-18} | G | 246-294 {2,500-3,000, 181-217} |
| D | 589-781 {6,000-8,000, 434-578} | | |

# OVERHAUL

M05020104BEH2001



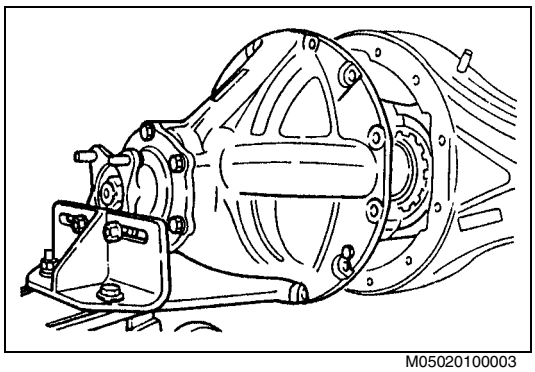
M05020100002

## IMPORTANT POINTS - DISMOUNTING

**1. DISCONNECT THE PROPELLER SHAFT.**

**NOTICE:**

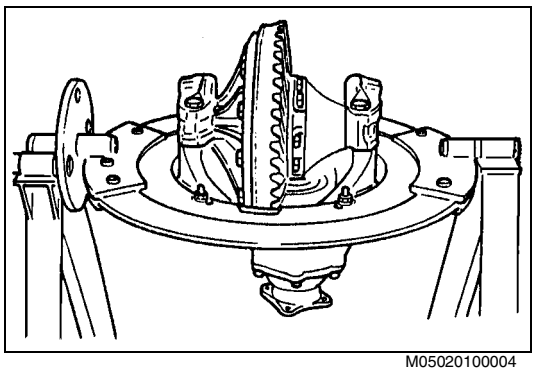
**Make aligning marks before disassembling.**


M05020100003

**2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.**

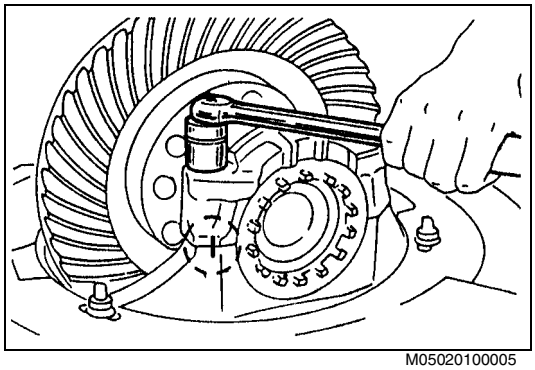
(1) Drain the gear oil and remove the axle shaft.

(2) Using a jack, dismount the differential carrier assembly.


M05020100004

## IMPORTANT POINTS - DISASSEMBLY

**1. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.**


M05020100005

**2. DIFFERENTIAL CASE**

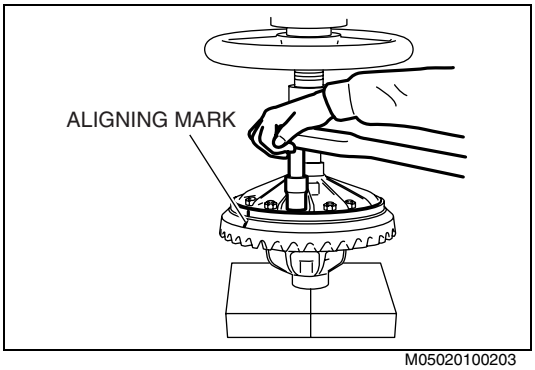
(1) Remove the bearing cap.

**NOTICE:**

**Make aligning marks before disassembling.**

**SST: Socket Wrench (09839-3003)**

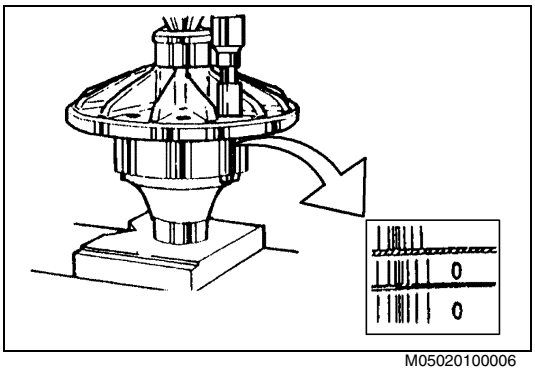
(2) Using a puller, remove the taper roller bearing.



M05020100203

(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts and then ring gear.

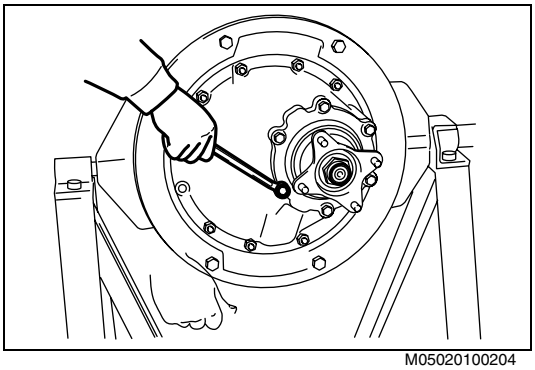
**NOTICE:**
**Be careful not to drop the ring gear.**



M05020100006

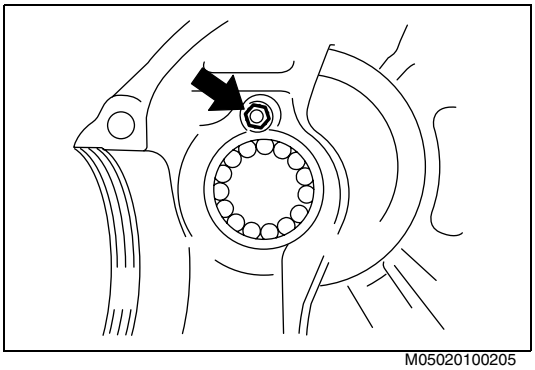
(4) Disassemble the differential case.

**NOTICE:**
**Be sure to check the aligning marks on the differential case before disassembling. Remove the bolts and nuts so that the case separates.**

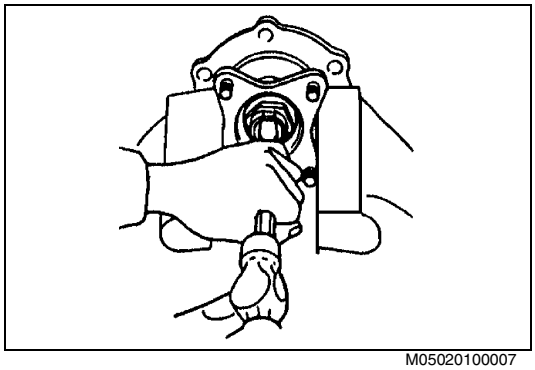

M05020100204

**3. Dismounting the hypoid pinion**

(1) Remove the bolts and then dismount the hypoid pinion and the shims.

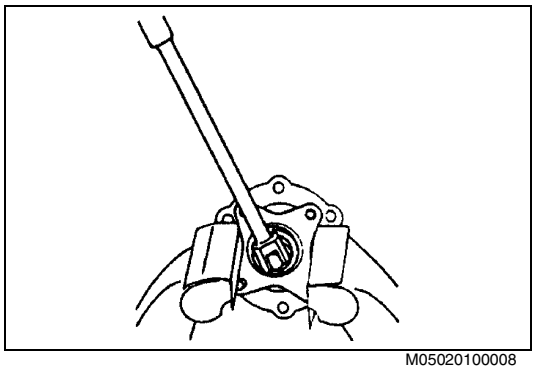

M05020100205

(2) Remove the bolts, nuts, and washers.
(3) Using brass bar and hammer, knock through the cylindrical roller bearing outer race.


M05020100007

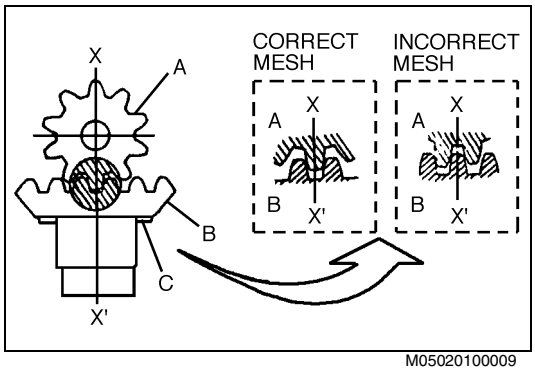
**4. BEARING CAGE**

(1) Uncaulk the lock nut and remove the nut.
**SST: Socket Wrench (09839-5501)**


M05020100008

(2) Using a puller, remove the taper roller bearing outer race.

## IMPORTANT POINTS - ASSEMBLY



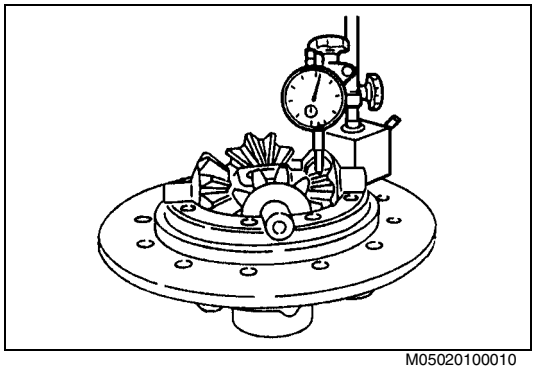
M05020100009

**1. DIFFERENTIAL CASE**

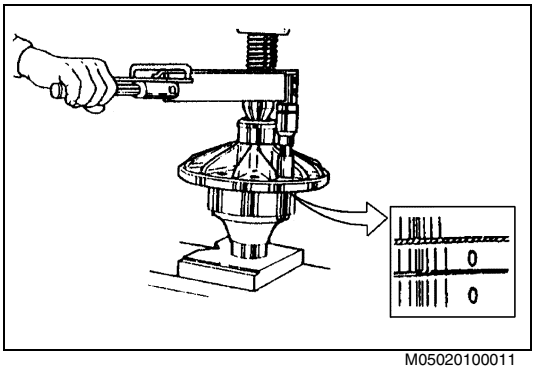
(1) Measure the pinion backlash.

**NOTICE:**
**Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.**

- A:Pinion
- B:Side gear
- C:Thrust washer


M05020100010

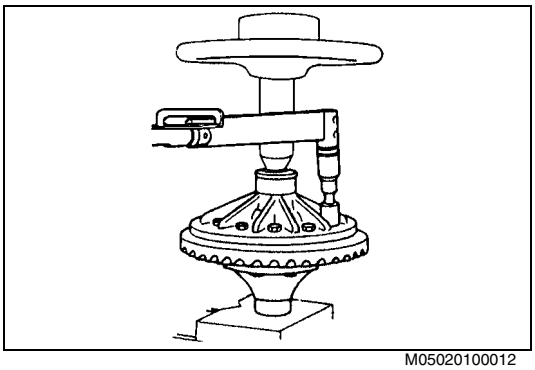
(2) If the backlash is more than service limit, replace the thrust washer for side gear and/or pinion.
**Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}**
**Service Limit: 0.9 mm {0.0354 in.}**



M05020100011

(3) Assemble the differential case.

**NOTICE:**
- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the nuts.**

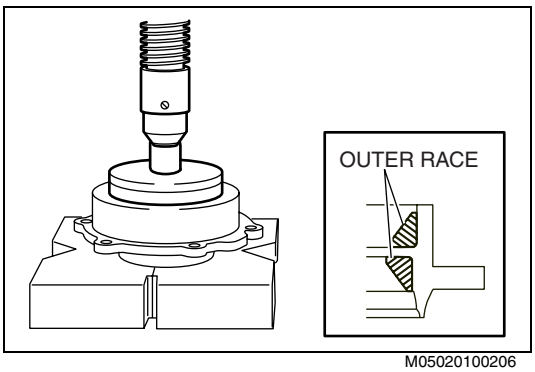

M05020100012

(4) Install the ring gear to the differential case and tighten it with bolts.

**NOTICE:**
**Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the nuts.**

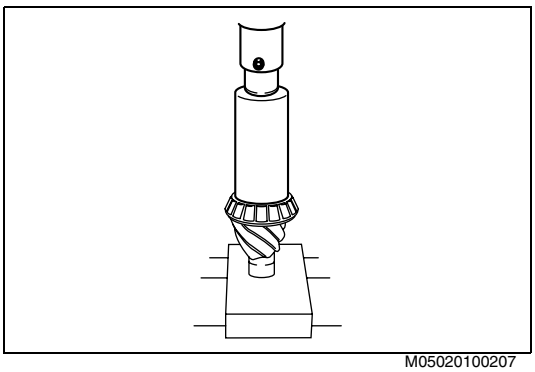
**2. Assembling the hypoid pinion**

(1) Installing the inner and outer taper roller bearing outer race
   a. Apply gear oil to the inner and outer taper roller bearing outer race.
   b. Using wear plates and press, press into the differential cage the inner and outer taper roller bearing outer race.

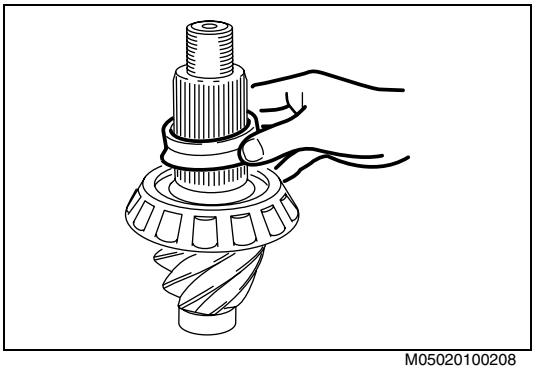


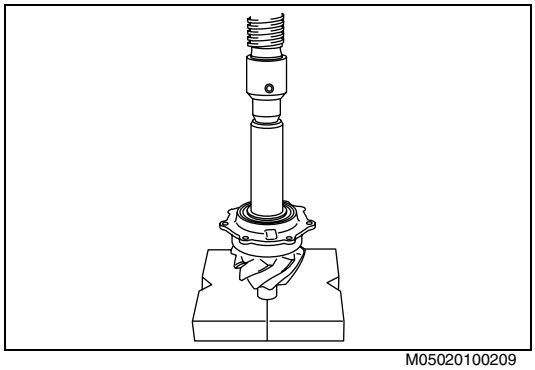
M05020100206

(2) Installing the inner taper roller bearing inner race
   a. Apply gear oil to the inner taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of drive pinion the inner taper roller bearing inner race.

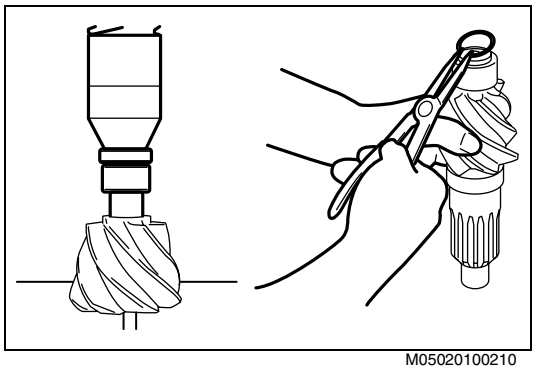

M05020100207

   c. Install the spacer.


M05020100208

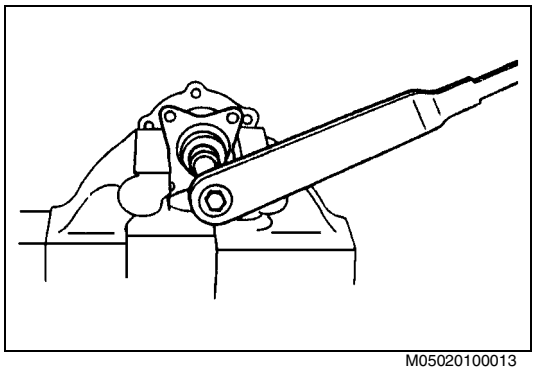

M05020100209

(3) Installing the differential cage and outer taper roller bearing inner race
   a. Apply gear oil to the outer taper roller bearing inner race.
   b. Using wear plates and press, press into the shaft of hypoid pinion the differential cage and outer taper roller bearing inner race.


M05020100210

(4) Installing the pilot bearing inner race
   a. Apply gear oil to the cylindrical roller bearing inner race.
   b. Using press, press the cylindrical roller bearing inner race to the end of the hypoid pinion.
   c. Install a new retainer ring.

**CAUTION:**
**The retainer ring is spring steel and may fly out of the groove during removal. Wear safety glasses during removal.**

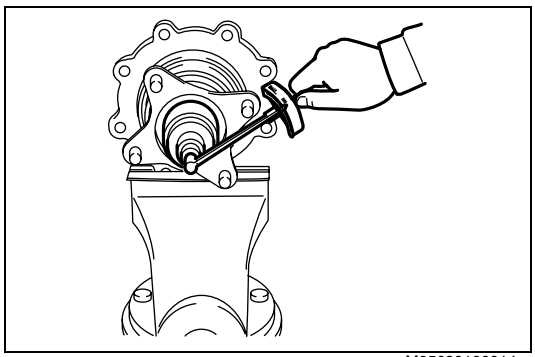

M05020100013

**3. ADJUSTMENT OF THE PINION BEARING PRELOAD**

(1) Assemble the hypoid pinion and bearing cage and then tighten the flange yoke coupling provisionally.

**NOTICE:**
**The oil seal must be installed in the bearing cage after measurement of the preload.**

**SST: Socket Wrench (09839-5501)**

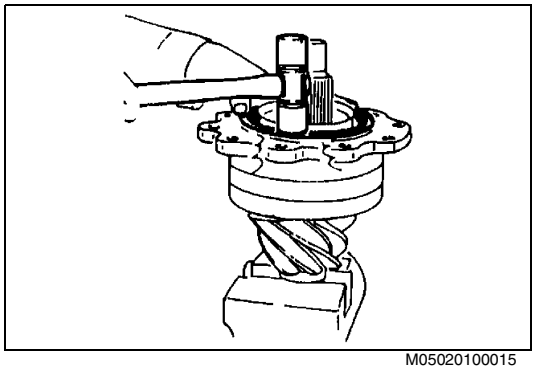

M05020100014

(2) Use a torque wrench to measure the preload of the bearings and if the preload is out of specific value shown below, adjust with spacer.

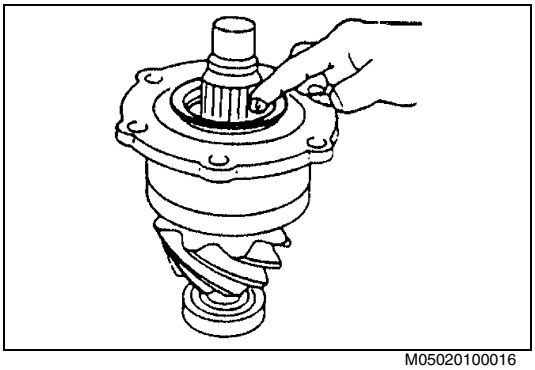
**Assembly Standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| New bearing | Re-used bearing |
|---|---|
| 1.97-2.45 {20-25, 1.5-1.8} | 1.48-1.96 {15-20, 1.1-1.4} |

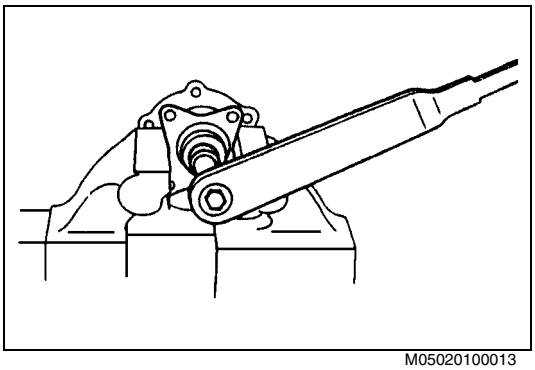
**Adjusting spacer thickness:**
**23 kinds of thicknesses ranging from 16.250 to 16.800 mm {0.640 to 0.661 in.} each differing 0.025 mm {0.001 in.}**


M05020100015

(3) After adjusting the preload, install the new oil seal.

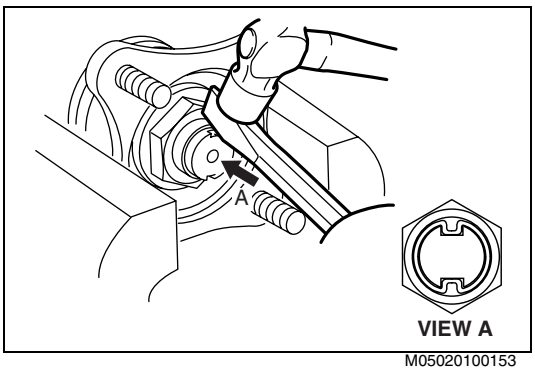

M05020100016

**NOTICE:**
- **Apply wheel bearing grease on the oil seal lip part.**
- **Tap the oil seal in small steps and evenly to prevent it from being at slant position.**


M05020100013

(4) Install the flange yoke coupling and tighten the lock nut.
**SST: Socket Wrench (09839-5501)**

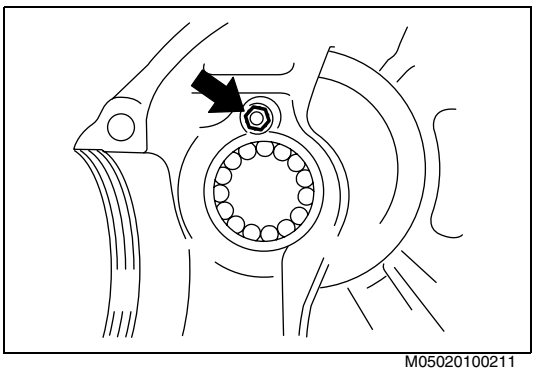
(5) Measure the preload and record it for measuring the total preload at the differential carrier bearings at a later time.



M05020100153

(6) Caulk the lock nut.

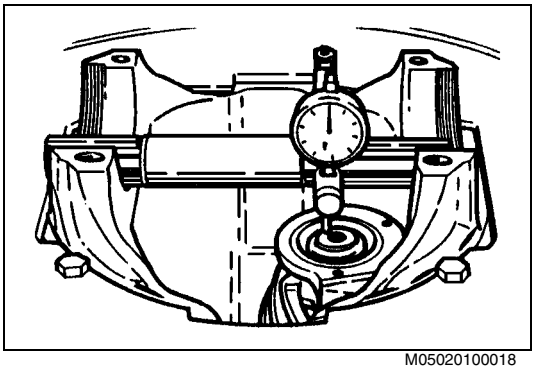
**NOTICE:**
- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**


M05020100211

**4. Installing the cylindrical roller bearing outer race**

(1) Apply gear oil to the cylindrical roller bearing outer race.
(2) Install the cylindrical roller bearing outer race by nuts, bolts, and washers.
**Tightening Torque:**
**18.7-25.5 N·m {191-260 kgf·cm, 14-18 lbf·ft}**

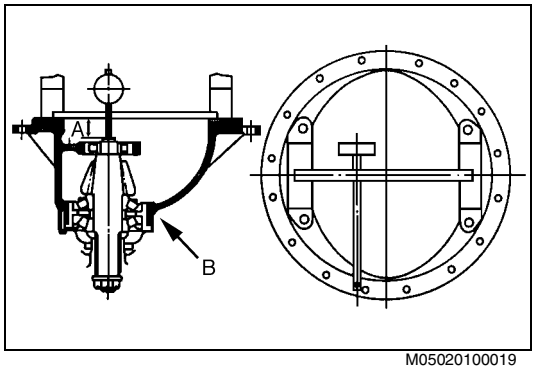
**NOTICE:**
**Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads.**


M05020100018

**5. ADJUSTMENT OF PINION FITTING HEIGHT (CONICAL DISTANCE).**

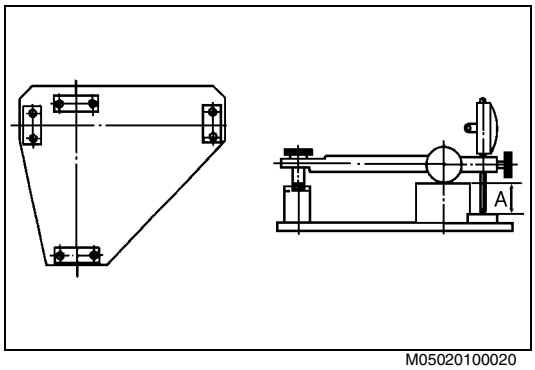
(1) Install the pinion cage assembly and adjust the height with shims.
**SST: Gauge Assembly (09640-1210)**

**NOTICE:**
**Upon completing the adjustment, remove the pinion cage assembly and apply liquid gasket (ThreeBond #1215 or equivalent) on the mounting surfaces of differential carrier case and bearing cage.**



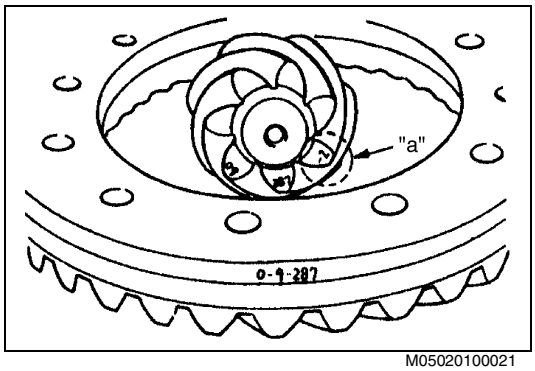
M05020100019

**A: 34 mm {1.339 in.}**
**B: Adjusting 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.}**



M05020100020

(2) How to use the pinion depth gauge: Set the pinion depth gauge.
**A:34 mm {1.339 in.}**

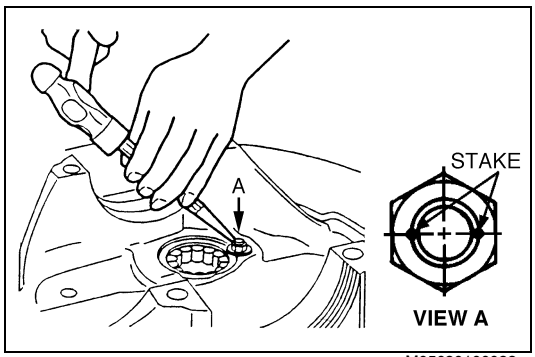


M05020100021

**EXAMPLE:**

**In a case where the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm):**

| Standard pinion height "A" | | The engraved value "a" | | Measuring part (A') |
|---|---|---|---|---|
| 34.0 mm | – | 0.2 mm | = | 33.8 mm |



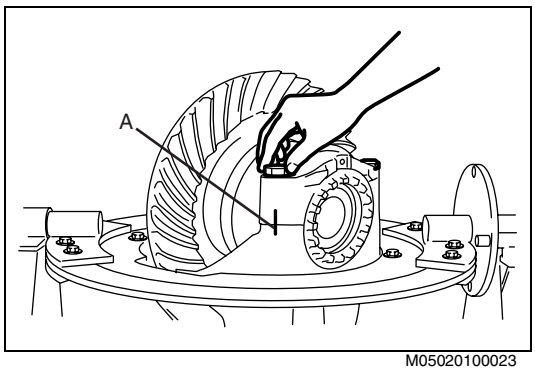
M05020100022

**6. CYLINDRICAL ROLLER BEARING**

(1) Install the cylindrical roller bearing and tighten the lock nut.

**NOTICE:**

- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the lock nut.**
- **When lock agent is not applied, stake the lock nut as shown in the figure.**



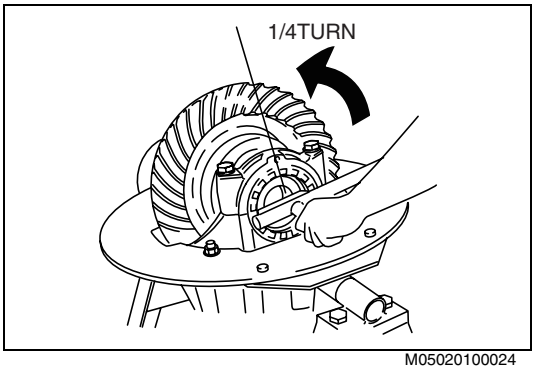
M05020100023

**7. ADJUSTMENT OF HYPOID RING GEAR BACKLASH.**

(1) Set the differential case assembly on the carrier case and install the adjusting nut and bearing cap.

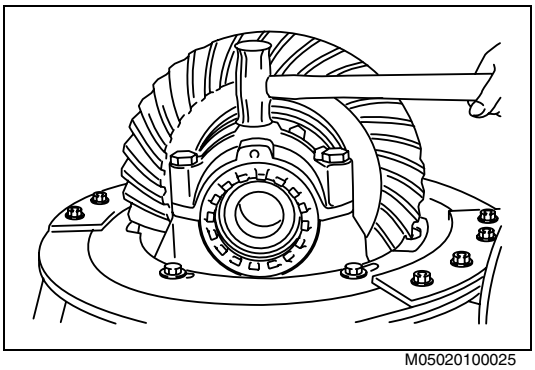
**NOTICE:**

**Align the aligning marks A.**

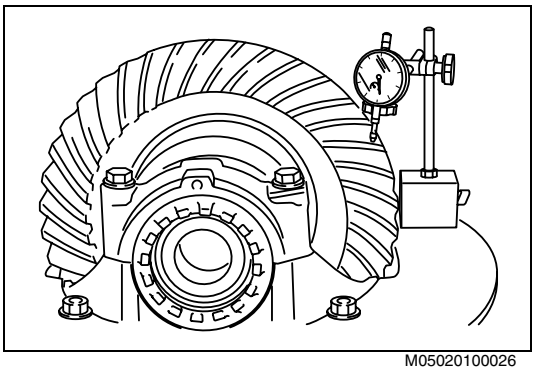


M05020100024

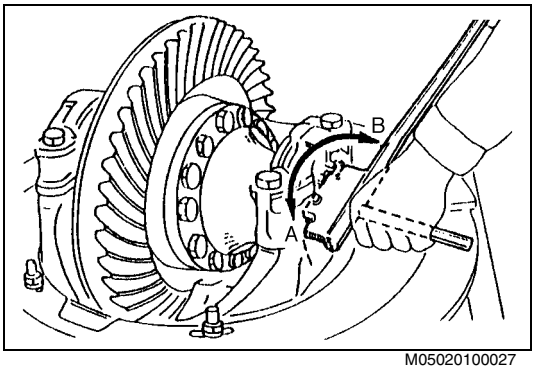
(2) Adjust the preload of the side bearing provisionally.
a. Tighten the adjusting nut fully, then loosen the adjusting nut by 1/4 turn + 1 notch.
**SST: Adjuster Tool (09665-1180)**


M05020100025

b. Hit the bearing cap with a copper hammer.

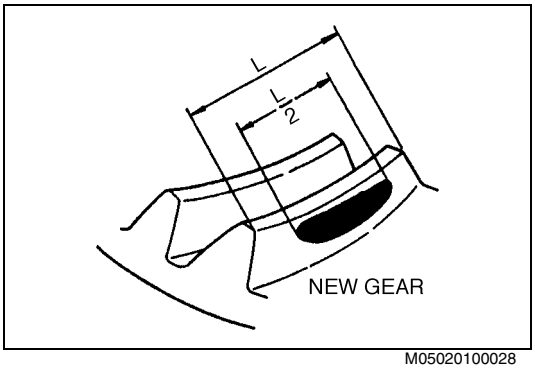

M05020100026

(3) Measure the gear backlash at three or four points on the circumference of the gear.
**Assembly Standard: 0.30-0.41 mm {0.0119-0.0161 in.}**



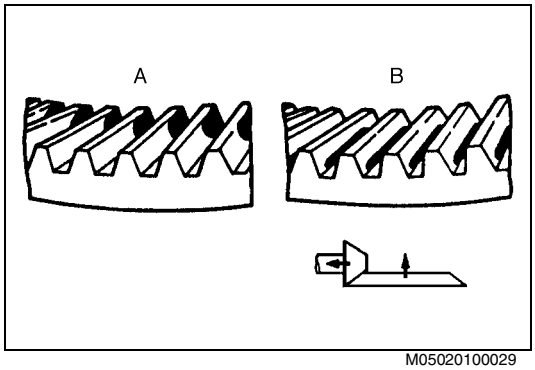
M05020100027

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: A-Decrease B-Increase
**SST: Adjuster Tool (09665-1180)**



M05020100028

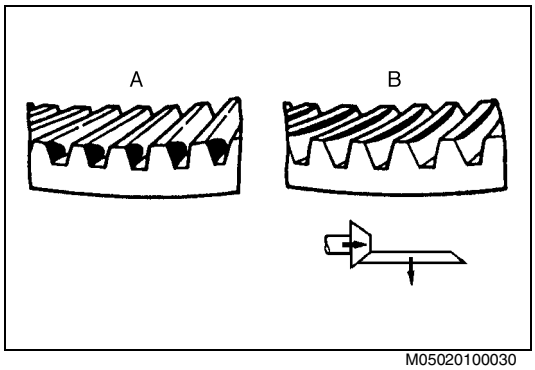
**8. INSPECTION AND ADJUSTMENT OF GEAR MESHING**
(1) Satisfactory gear meshing.
**NOTICE:**
**New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.**



M05020100029

(2) Example of the unsatisfactory engagement
a. Toe and flank contact

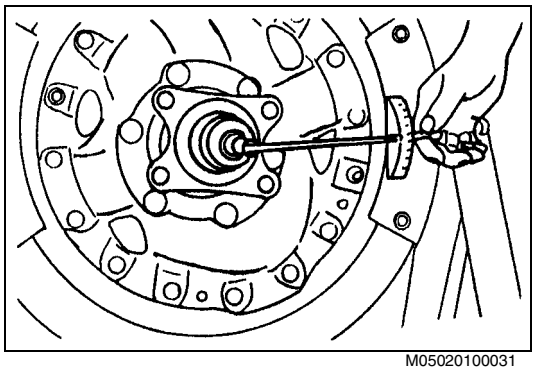
A: Toe contact - Unadjust, replace the pinion and ring gear as a set.
B: Flank contact - Adjust



M05020100030

b. Heel and face contact

A: Heel contact - Unadjust, replace the pinion and ring gear as a set.
B: Face contact - Adjust


M05020100031

**9. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING**

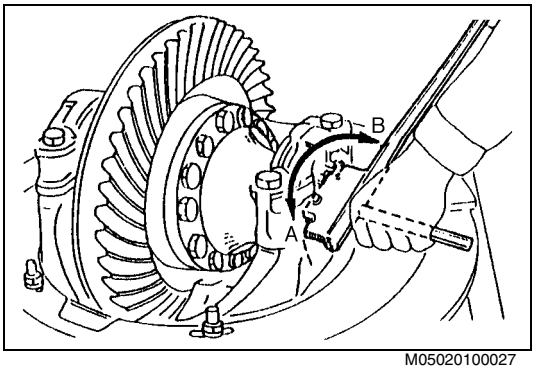
(1) Measure and adjust the total preload at the differential carrier bearings, using a torque wrench.

**NOTICE:**
**Total preload = pinion bearing preload (Refer to item 2) + side bearing preload (Refer to the table below).**

**Assembly standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| Gear ratio | 4.100 | 4.625 | 4.875 | 5.250 | 5.857 |
|---|---|---|---|---|---|
| New bearing | 0.48-0.59 {4.9-6.0, 0.36-0.44} | 0.43-0.52 {4.4-5.4, 0.32-0.39} | 0.41-0.50 {4.2-5.1, 0.30-0.37} | 0.38-0.46 {3.9-4.7, 0.28-0.34} | 0.34-0.41 {3.5-4.2, 0.25-0.30} |
| Re-used bearing | 0.36-0.47 {3.7-4.8, 0.27-0.35} | 0.32-0.42 {3.3-4.3, 0.24-0.31} | 0.31-0.40 {3.1-4.0, 0.23-0.29} | 0.29-0.37 {2.9-3.8, 0.21-0.27} | 0.26-0.33 {2.6-3.4, 0.19-0.24} |

**NOTICE:**
**The gear ratio is indicated on the bearing cage.**

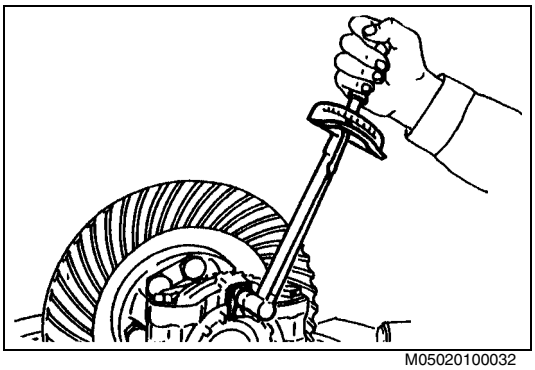


M05020100027

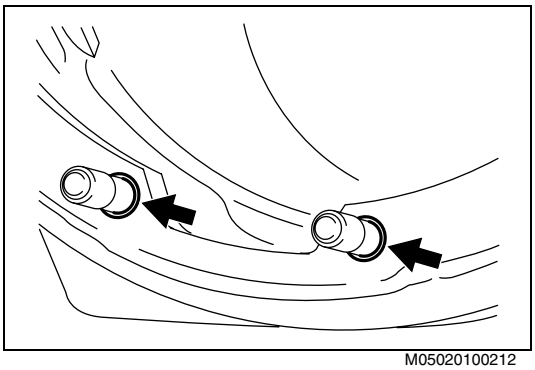
(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise : Decrease preload
- B: Clockwise : Increase preload

**SST: Adjuster Tool (09665-1180)**


M05020100032

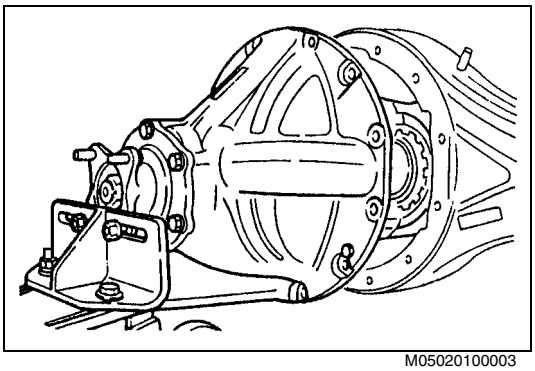
(3) Tighten the bearing cap and install the lock plate.
**SST: Socket Wrench (09839-3003)**


M05020100212

## IMPORTANT POINTS - MOUNTING

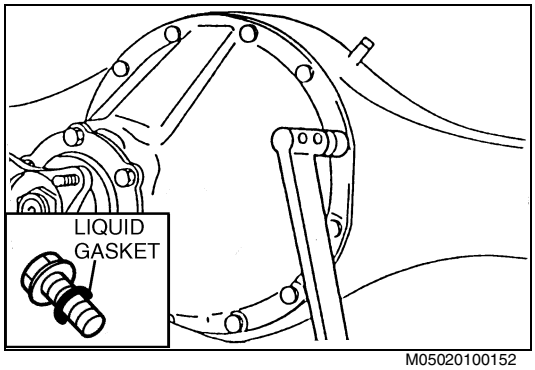
**1. MOUNTING**

(1) Using scraper, remove the rust on the joint surface between the axle housing and the differential carrier assembly.
(2) Install a new O-ring.
(3) Apply liquid gasket on the housing flange.


M05020100003

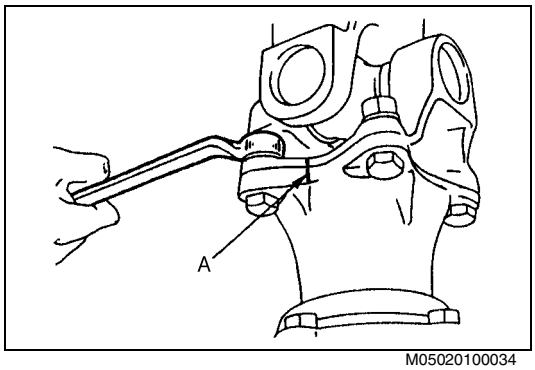
(4) Using a jack, install the differential carrier assembly to the axle housing.

**NOTICE:**
**Place the carrier assembly so that the ring gear teeth faces toward the right-hand side of vehicle.**



M05020100152

(5) After applying the liquid gasket (ThreeBond #1215 or #1216 or equivalent) round ϕ16 bolts (12 pieces), install the bolts and tighten them regularly.



M05020100034

(6) Connect the propeller shaft.

**NOTICE:**
**Align the aligning marks A.**

**Tightening Torque:**
**Model FG:127.4-156.8 N·m {1,300-1,600 kgf·cm, 94-115 lbf·ft}**
**Model FL: 167-225.6 N·m {1,700-2,300 kgf·cm, 123-166 lbf·ft}**

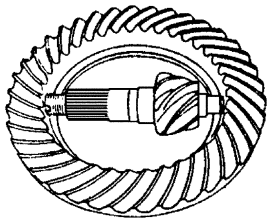
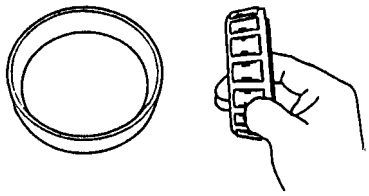
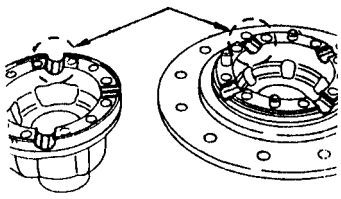
(7) Fill the axle housing with specified gear oil up to the filler plug hole.

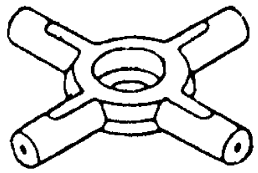
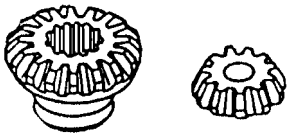
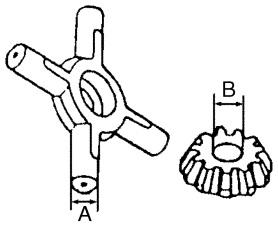
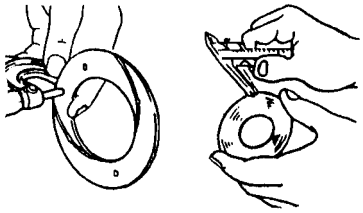
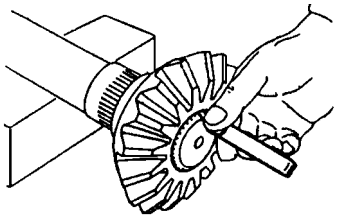
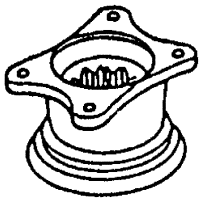
**Gear oil:**
**Refer to the owner's manual.**

# INSPECTION AND REPAIR

M05020104BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Pinion and ring gear: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Bearing and race: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Differential case spider holes: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Spider:<br>Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Differential side gear and pinion:<br>Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Spider and pinion:<br>Clearance** | **A: 32 {1.260}<br>B-A: 0.145-0.190 {0.006-0.007}** | **0.4 {0.016}** | **Replace.** | **Measure**<br>  |
| **Thrust washers thickness (Side gear and pinion gear)** | **Side gear:<br>1.9-2.1 {0.075 – 0.082}** | **1.7 {0.067}** | **Replace.** | **Measure**<br>  |
| | **Pinion gear:<br>1.7-1.9 {0.067-0.074}** | **1.5 {0.059}** | | |
| **Differential side gear and axle shaft:<br>Spline backlash** | **0.054-0.148 {0.0021-0.0058}** | **0.5 {0.0196}** | **Replace.** | **Measure**<br>  |
| **Flange coupling:<br>Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |

# DIFFERENTIAL CARRIER (THD17)

DF02-005

**DIFFERENTIAL CARRIER (THD17)..... DF02-2**

DATA AND SPECIFICATIONS ..... DF02-2
DESCRIPTION ..... DF02-2
TROUBLESHOOTING ..... DF02-5
SPECIAL TOOL ..... DF02-5
COMPONENT LOCATOR ..... DF02-6
OVERHAUL ..... DF02-8
INSPECTION AND REPAIR ..... DF02-24

# DIFFERENTIAL CARRIER (THD17)

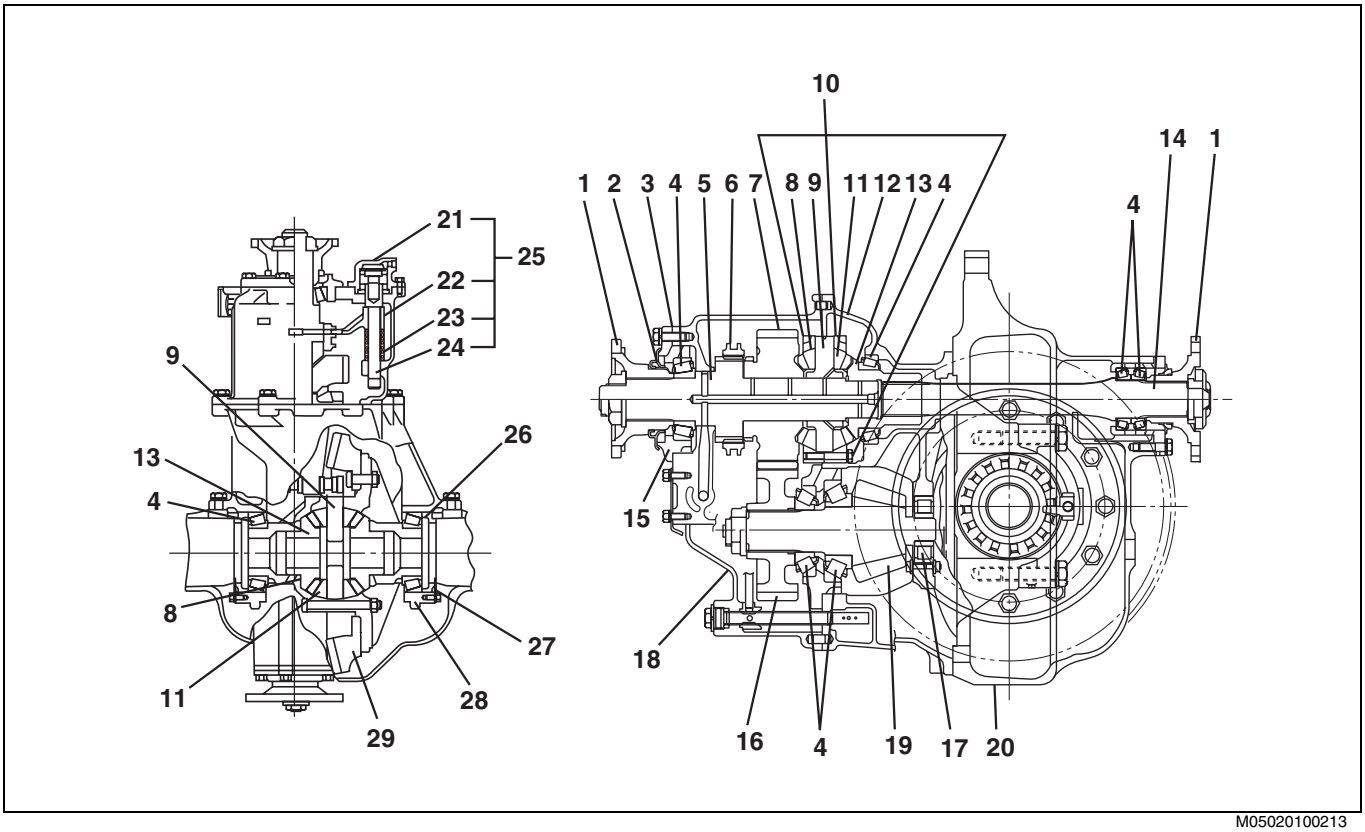
## DATA AND SPECIFICATIONS

M05020110BEI2001

| | THD17 |
|---|---|
| Type | Single-reduction, single-speed, by hypoid gearing with Inter-axle differential and transfer gear, used for the forward axle of tandem drive axles. |
| Gear ratio | 4.875, 5.250, 6.428 |
| Oil capacity | 13 L {3.43 U.S.gal, 2.86 Imp.gal} |

## DESCRIPTION

M05020110BEC1001

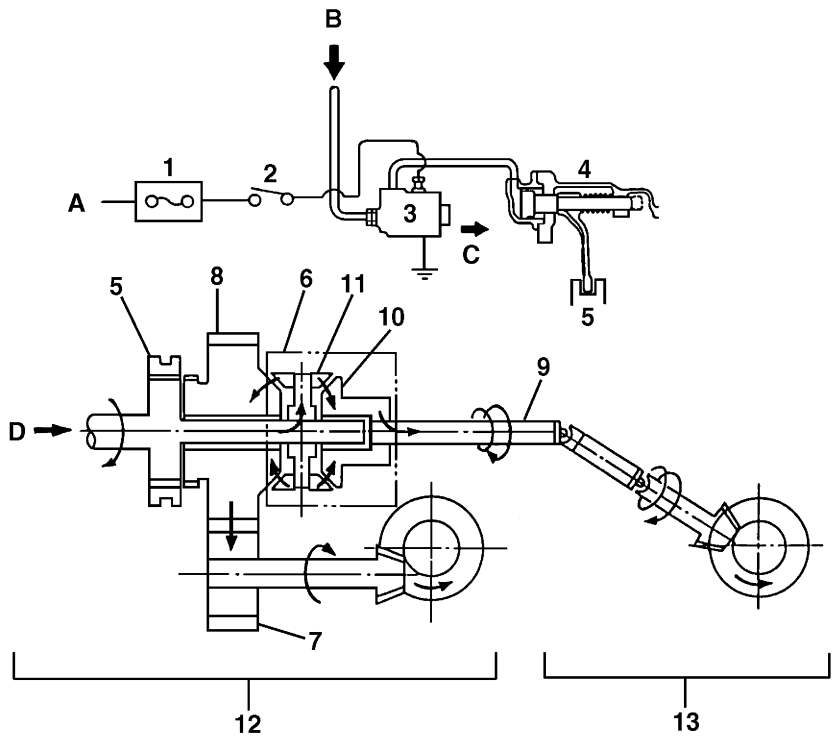



M05020100213

| | | | |
|---|---|---|---|
| 1 | Flange | 16 | Pinion drive gear |
| 2 | Oil seal | 17 | Cylindrical roller bearing |
| 3 | Shim | 18 | Differential carrier cover |
| 4 | Taper roller bearing | 19 | Pinion gear |
| 5 | Drive shaft | 20 | Rear axle housing |
| 6 | Shifter sleeve | 21 | Case cover |
| 7 | Drive gear | 22 | Shift fork |
| 8 | Washer | 23 | Return spring |
| 9 | Spider | 24 | Piston |
| 10 | Inter-axle differential case sub-assembly | 25 | Air shift unit |
| 11 | Differential pinion | 26 | Adjusting nut |
| 12 | Differential carrier | 27 | Lock plate |
| 13 | Side gear | 28 | Bearing cap |
| 14 | Through shaft | 29 | Ring gear |
| 15 | Differential carrier cage | | |

## OPERATION OF INTER-AXLE DIFFERENTIAL GEAR

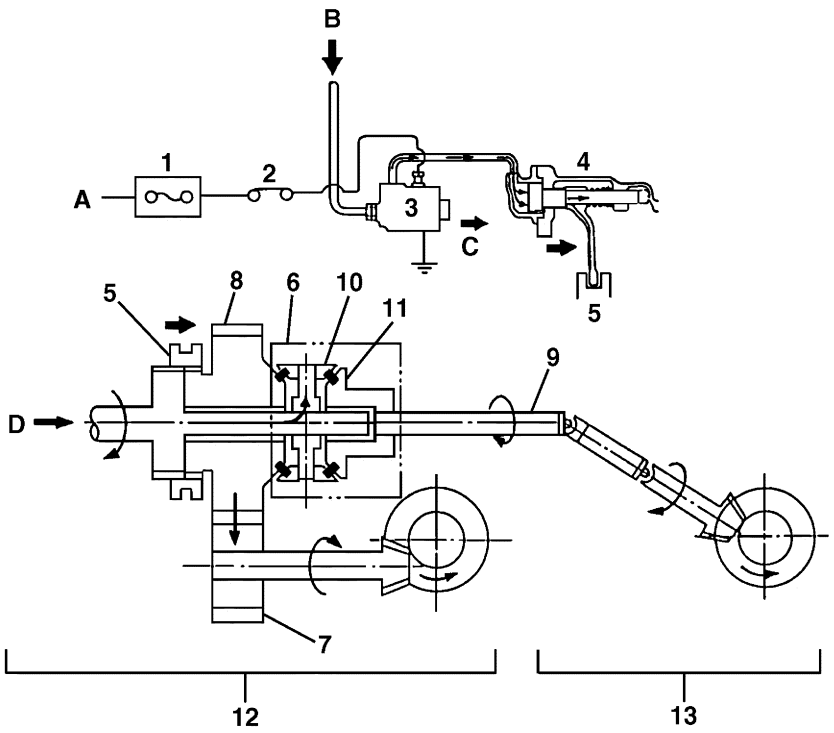
**- Differential (Driving on paved roads) -**




M05020100049

| | | | |
|---|---|---|---|
| 1 | Fuse | 10 | Rearward axle drive gear |
| 2 | Inter-axle differential lock switch | 11 | Inter-axle differential pinion |
| 3 | Magnetic valve | 12 | Forward axle |
| 4 | Air shift unit | 13 | Rearward axle |
| 5 | Shift sleeve | A | From battery |
| 6 | Inter-axle differential gear | B | From air tank |
| 7 | Forward axle drive gear | C | Exhaust |
| 8 | Drive gear | D | From propeller shaft |
| 9 | Through shaft | | |

**- Lock (Driving on bad roads) -**
**NOTICE: Do not operate the switch while the vehicle is moving**




M05020100050

| | | | |
|---|---|---|---|
| 1 | Fuse | 10 | Rearward axle drive gear |
| 2 | Inter-axle differential lock switch | 11 | Inter-axle differential pinion |
| 3 | Magnetic valve | 12 | Forward axle |
| 4 | Air shift unit | 13 | Rearward axle |
| 5 | Shift sleeve | A | From battery |
| 6 | Inter-axle differential gear | B | From air tank |
| 7 | Forward axle drive gear | C | Exhaust |
| 8 | Drive gear | D | From propeller shaft |
| 9 | Through shaft | | |

# TROUBLESHOOTING

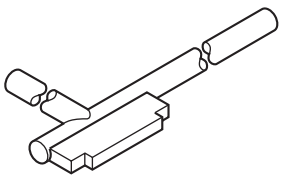
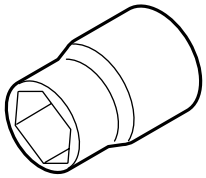
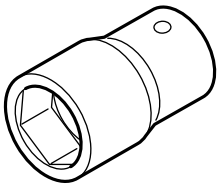
M05020110BEF3001

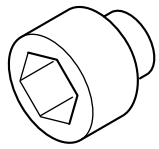
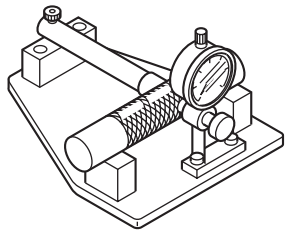
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings | Replace bearings. |
| | Worn or damaged differential side bearings | Replace bearings. |
| | Loose pinion bearings | Adjust bearing preload. |
| | Loose differential side bearings | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear | Adjust backlash. |
| | Worn thrust washers | Replace. |
| | Worn differential spider | Replace. |
| | Worn or damaged ring gear and pinion | Replace. |
| | Worn or damaged differential side gears and pinions | Replace. |
| | Loose ring gear bolts | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear | Replace or adjust tooth contact. |
| | Worn pinion spline | Replace. |
| | Worn or damaged inter-axle differential gear | Replace |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline | Replace. |
| | Worn hub bearings | Replace. |
| | Loose hub bearings | Adjust bearing preload. |
| | Loose differential case tightening bolts | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil | Add oil; check for leakage. |
| | Poor oil quality | Change oil. |
| | Abnormal propeller shaft noise | Refer to chapter PROPELLER SHAFT. |

# SPECIAL TOOL

M05020110BEK1001

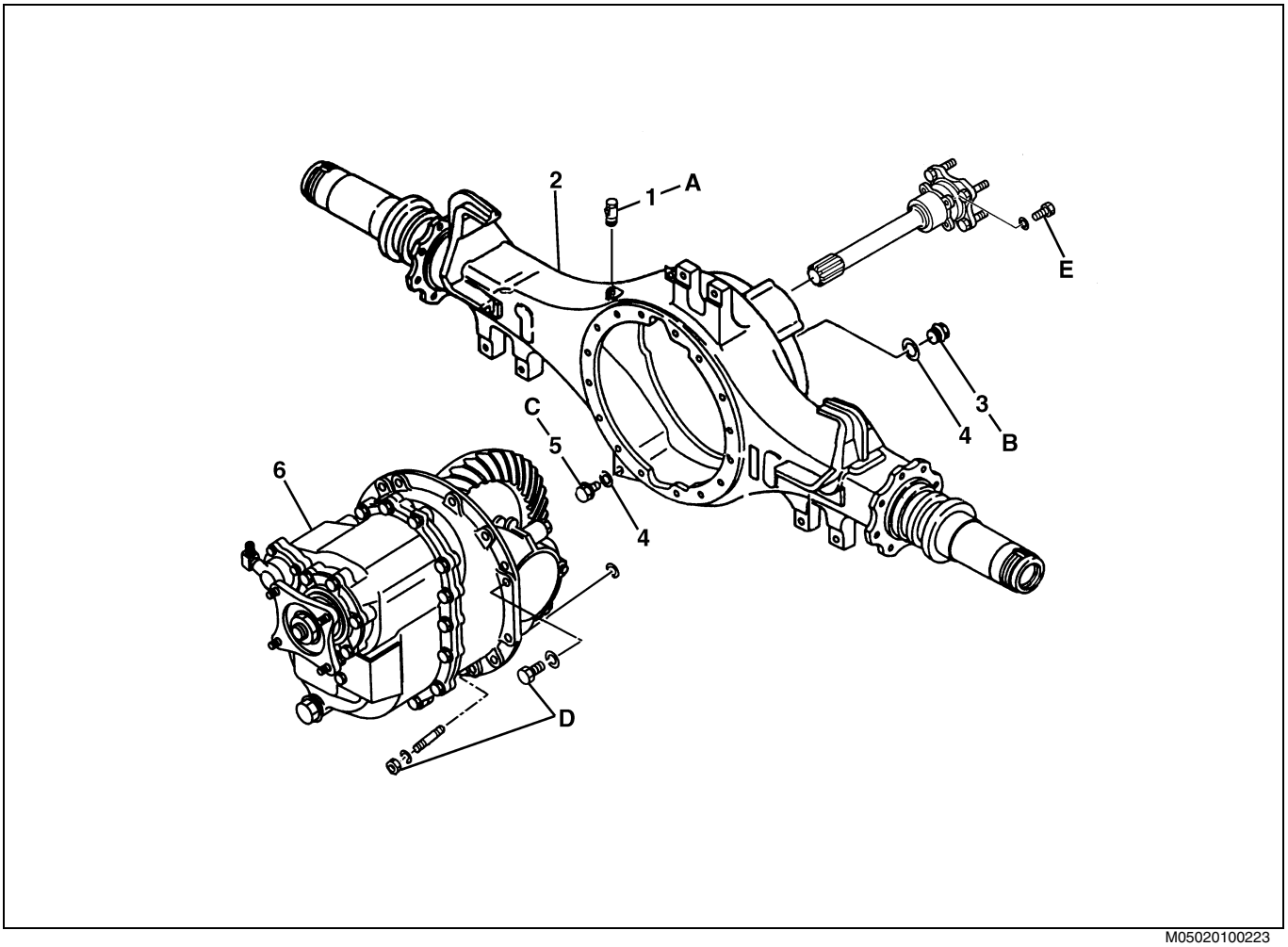
Prior to starting a differential carrier overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09665-1180 | ADJUSTER TOOL | |
|  | 09839-3003 | SOCKET WRENCH | |
|  | 09839-4601 | SOCKET WRENCH | |

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-5501 09839-6502 | SOCKET WRENCH | |
|  | 09640-1210 | GAUGE ASSEMBLY | |

# COMPONENT LOCATOR

M05020110BED1001

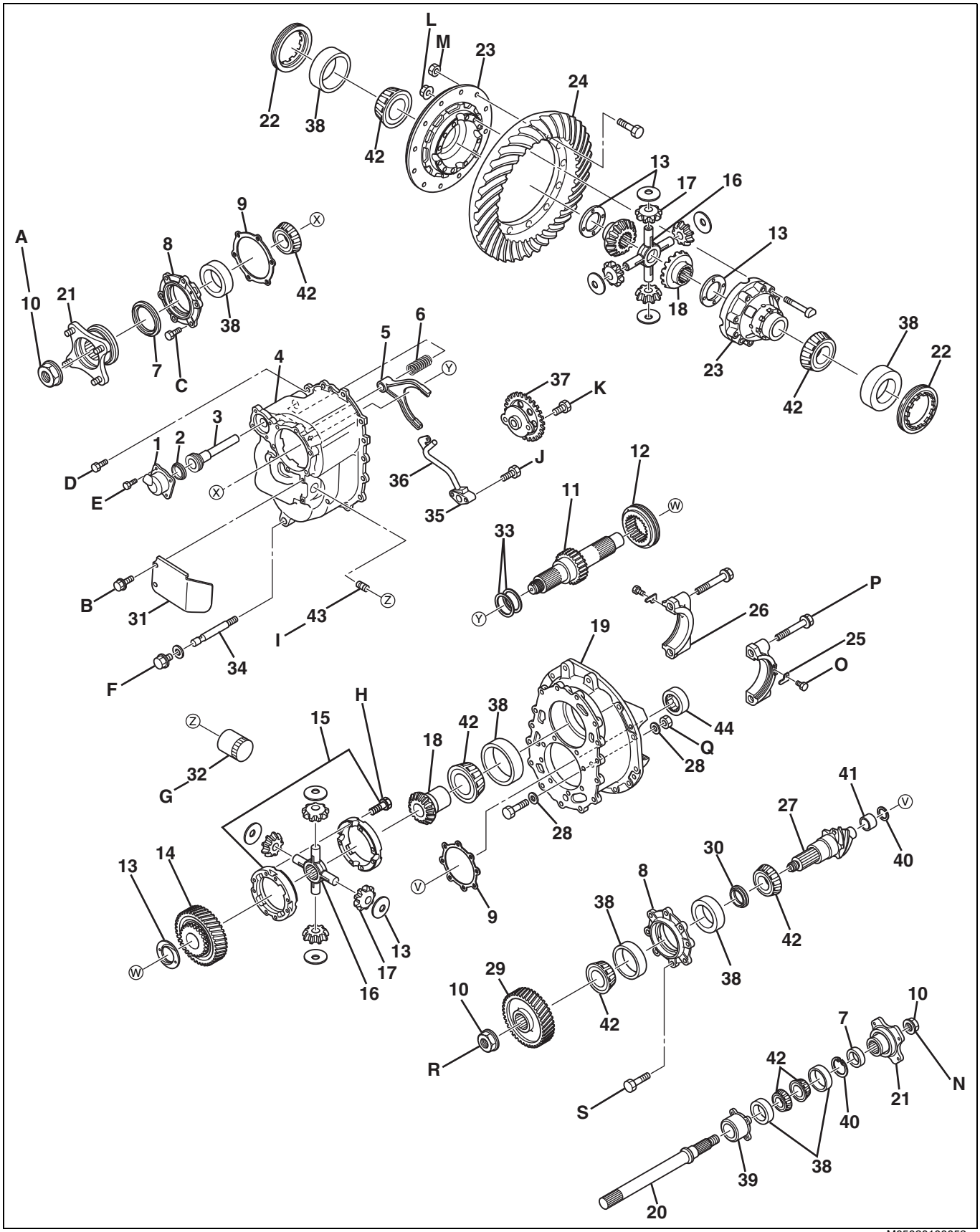



M05020100223

| | | | |
|---|---|---|---|
| 1 | Air breather | 4 | Gasket |
| 2 | Axle housing assembly | 5 | Oil drain plug |
| 3 | Oil filler plug | 6 | Differential carrier assembly |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 9.8-19.6 {100-200, 7-14} | D | 167-213 {1,700-2,200, 123-159} |
| B | 78.4-117.6 {800-1,200, 58-86} | E | 64-84 {650-870, 47-63} |
| C | 39.2-68.6 {400-700, 29-50} | | |


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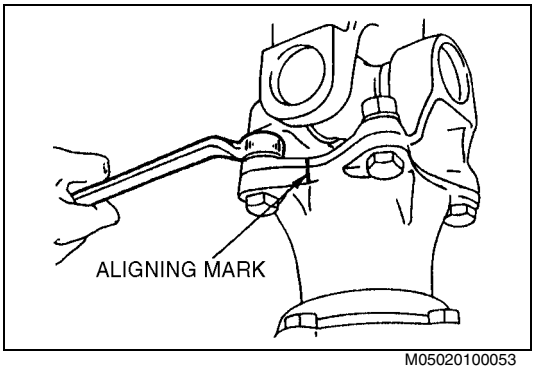
| | | | | | |
|---|---|---|---|---|---|
| 1 | Case cover | 16 | Spider | 32 | Oil filter element set |
| 2 | Piston seal | 17 | Differential pinion | 33 | Seal ring |
| 3 | Piston | 18 | Side gear | 34 | Oil strainer |
| 4 | Differential carrier cover | 19 | Differential carrier | 35 | Elbow |
| 5 | Shift fork | 20 | Through shaft | 36 | Oil pump pipe |
| 6 | Return spring | 21 | Flange | 37 | Oil pump gear |
| 7 | Oil seal | 22 | Adjusting nut | 38 | Taper roller bearing outer race |
| 8 | Differential carrier cage | 23 | Differential gear case | 39 | Bearing cage |
| 9 | Shim | 24 | Ring gear | 40 | Retainer ring |
| 10 | Lock nut | 25 | Lock plate | 41 | Cylindrical roller bearing inner race |
| 11 | Drive shaft | 26 | Bearing cap | | |
| 12 | Shift sleeve | 27 | Pinion gear | 42 | Taper roller bearing inner race |
| 13 | Thrust washer | 28 | Lock washer | 43 | Joint |
| 14 | Drive gear | 29 | Pinion drive gear | 44 | Cylindrical roller bearing outer race |
| 15 | Inter axle differential case sub-assembly | 30 | Spacer | | |
| 31 | Oil filter shield | | | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 589-781 {6,000-8,000, 434-578} | K | 44.5-53.5 {450-550, 33-39} |
| B | 44.5-53.5 {450-550, 33-39} | L | 246-294 {2,500-3,000, 181-216} |
| C | 113-147 {1,100-1,500, 80-108} | M | 461-559 {4,700-5,700, 340-412} |
| D | 113-147 {1,100-1,500, 80-108} | N | 589-781 {6,000-8,000, 434-578} |
| E | 37.5-48.5 {380-500, 28-36} | O | 19-25 {190-260, 14-18} |
| F | 78.5-117.5 {800-1,200, 58-86} | P | 344-456 {3,500-4,700, 254-339} |
| G | 12.0-15.5 {120-160, 9-11} | Q | 19-25 {190-260, 14-18} |
| H | 49-61 {500-630, 37-45} | R | 589-781 {6,000-8,000, 434-578} |
| I | 34.5-43.5 {350-450, 26-32} | S | 167-223 {1,700-2,300, 123-166} |
| J | 44.5-53.5 {450-550, 33-39} | | |

# OVERHAUL

M05020110BEH2001

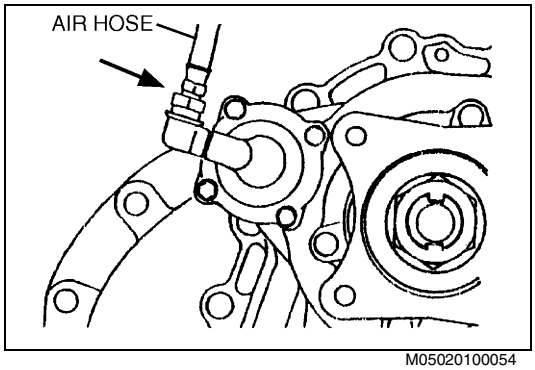


M05020100053

## IMPORTANT POINTS - DISMOUNTING

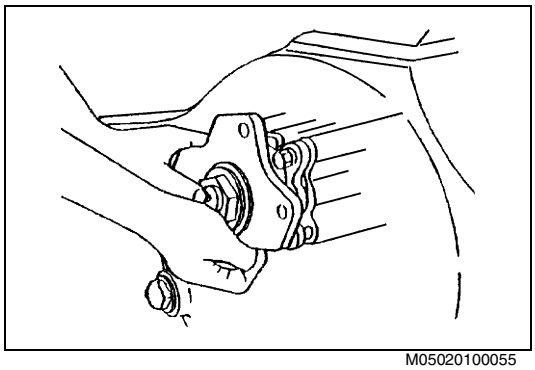
**1. DISCONNECT THE PROPELLER SHAFT.**

**NOTICE:**
**Make aligning marks before disassembling.**

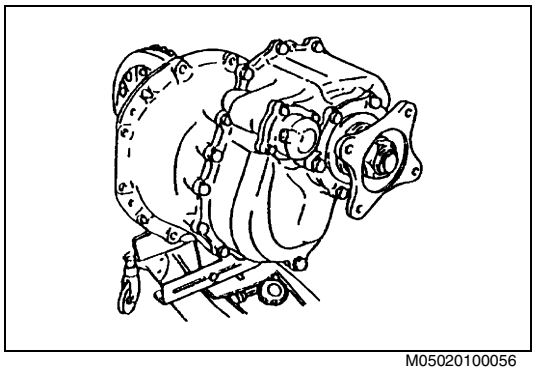


M05020100054

**2. DISMOUNT THE DIFFERENTIAL CARRIER ASSEMBLY.**
(1) Drain the gear oil and remove the axle shaft.
(2) Disconnect the air hose.

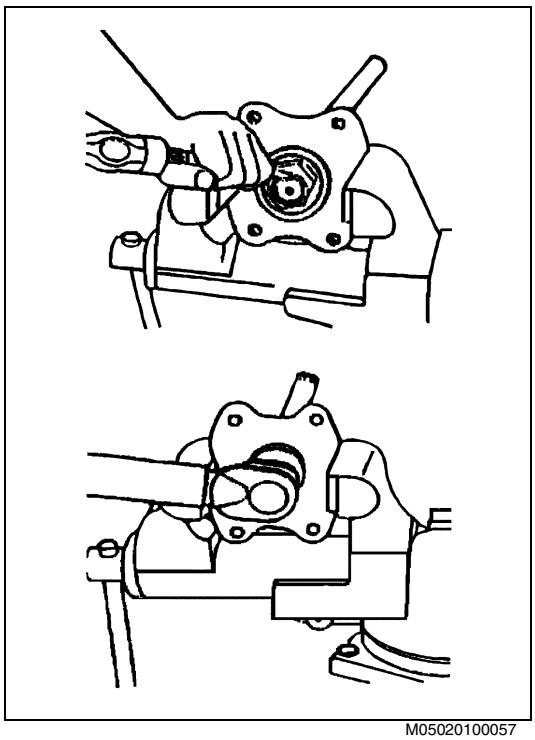

M05020100055

(3) Remove the through shaft.

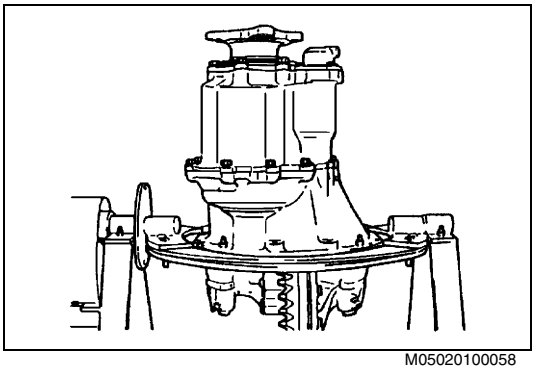

M05020100056

(4) Using a jack, dismount the differential carrier assembly.

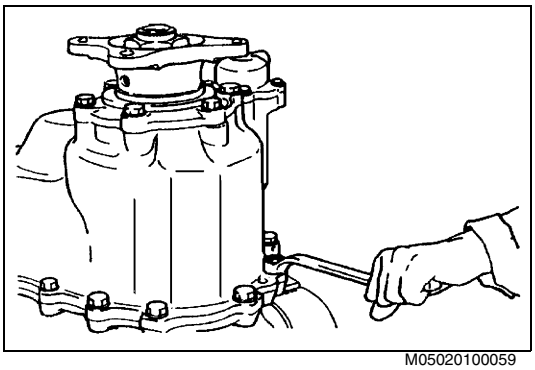
## IMPORTANT POINTS - DISASSEMBLY


M05020100057

**1. THROUGH SHAFT**
(1) Uncaulk the lock nut and remove the nut.
**SST: Socket Wrench (09839-4601)**


M05020100058

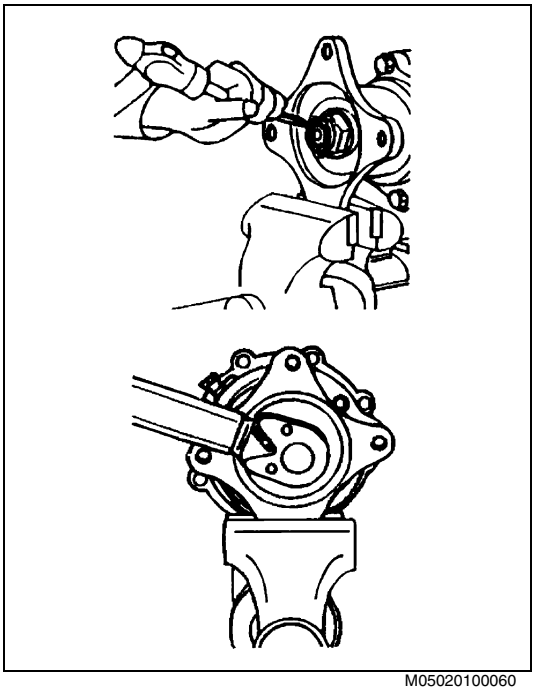
**2. MOUNT THE DIFFERENTIAL CARRIER ASSEMBLY ON A WORK STAND.**


M05020100059

**3. DIFFERENTIAL CARRIER COVER ASSEMBLY**

(1) Loosen the bolts and remove the differential carrier cover assembly from the differential carrier.

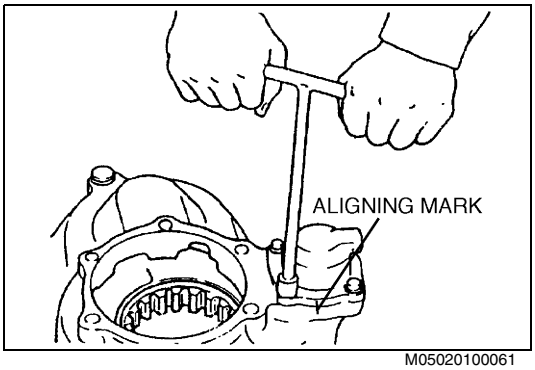
**NOTICE:**
**Lift the assembly vertically with a wire and chain block, and be careful not to drop the drive gear.**


M05020100060

(2) Loosen the bolts and remove the bearing cage with the drive shaft from the carrier cover.

(3) Uncaulk the lock nut, and remove the nut.
**SST: Socket Wrench (09839-6502)**

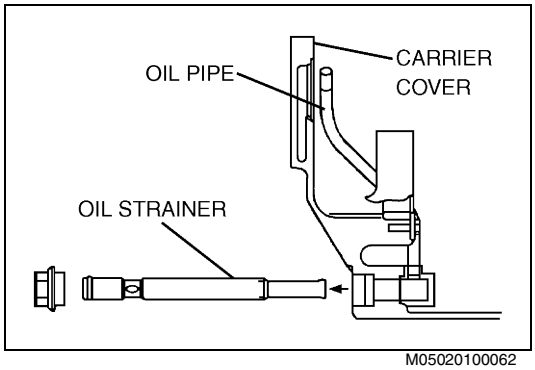
**NOTICE:**
**Be careful not to drop the shift sleeve.**



M05020100061

(4) Loosen the bolts and remove the case cover from the carrier cover, then remove the piston, shift fork and return spring.

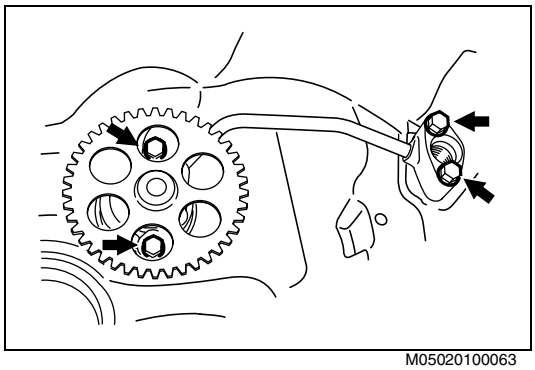
**NOTICE:**
**Before removing the case make aligning mark on the case cover and differential carrier cover.**



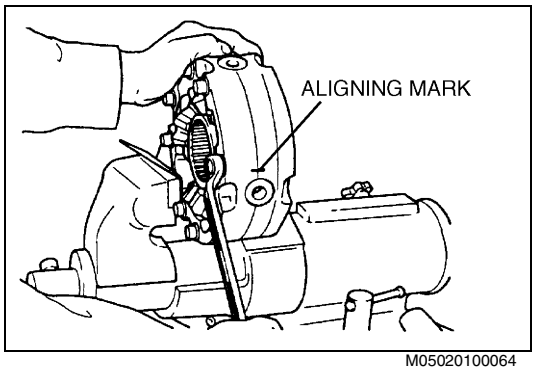
M05020100062

**4. OIL PUMP**

(1) Remove the oil strainer from the carrier cover.


M05020100063

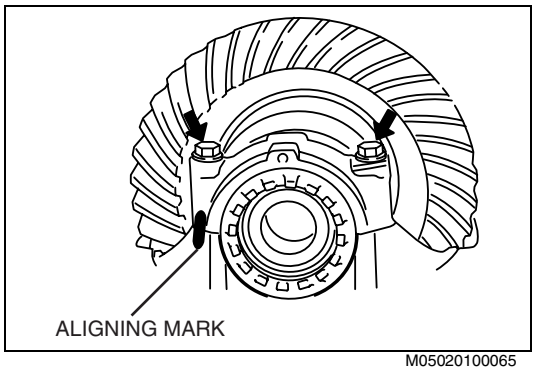
(2) Loosen the bolts and remove the oil pump assembly and the oil pipe from the carrier cover.



M05020100064

**5. INTER-AXLE DIFFERENTIAL GEAR**

(1) Check for the aligning marks for the differential gear case then loosen the bolts and separate it.



M05020100065

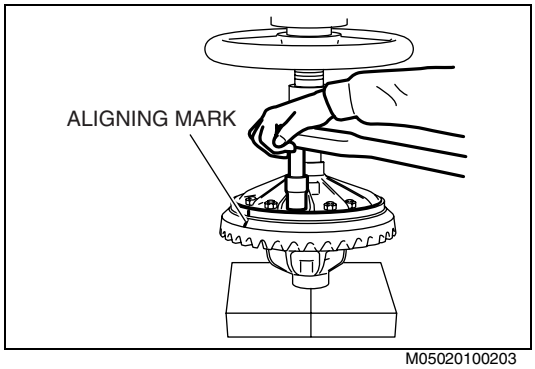
**6. DIFFERENTIAL CARRIER**

(1) Remove the bearing cap, then remove the differential case assembly with a wire and a chain block.

**NOTICE:**
**Make aligning mark before disassembling.**

**SST: Socket Wrench (09839-3003)**

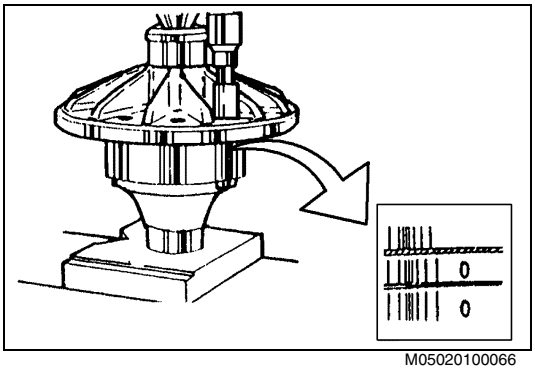
(2) Using a puller, remove the taper roller bearings.



M05020100203

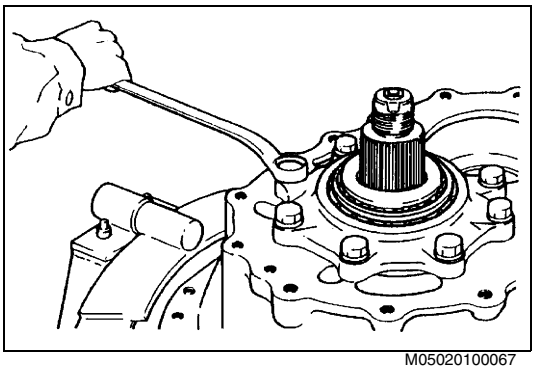
(3) Dismounting the ring gear
   a. Make aligning mark both the differential case and the ring gear.
   b. Using press, fix the differential gear assembly.
   c. Remove the bolts and then ring gear.

**NOTICE:**
**Be careful not to drop the ring gear.**


M05020100066

(4) Disassembly the differential case.

**NOTICE:**
**Be sure to check the matching marks on the differential case before disassembly. Remove the bolts and nuts so that the case separates.**

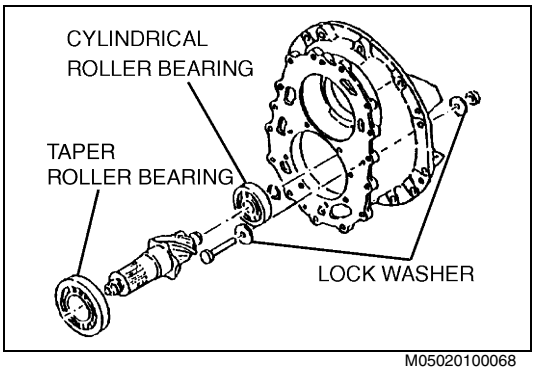

M05020100067

**7. DIFFERENTIAL CARRIER CAGE**

(1) Uncaulk the lock nut and remove the lock nut.
**SST: Socket Wrench (09839-5501)**

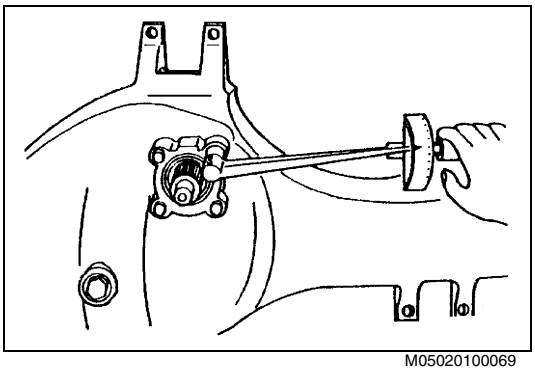
(2) Remove the pinion drive gear.
(3) Loosen the bolts, then remove the pinion assembly.

**NOTICE:**
**Fit the gear and lock nut back to remove the pinion assembly.**



M05020100068

(4) Loosen the bolt and nut then remove the cylindrical roller bearing lock washer.
(5) Using a puller, remove the taper roller bearing inner race and the cylindrical roller bearing inner race.

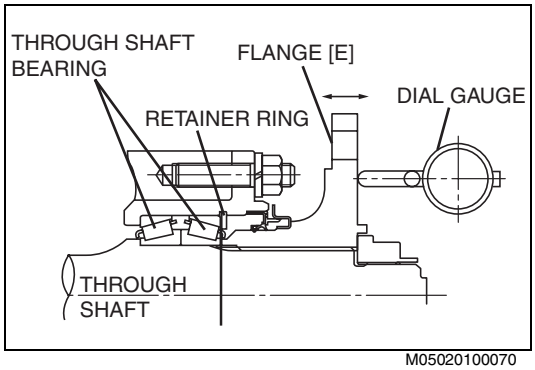

M05020100069

## IMPORTANT POINTS - ASSEMBLY

**1. ADJUSTMENT OF THE THROUGH SHAFT THRUST PLAY**

(1) Install the through shaft with taper roller bearings and outer bearing race then install the retainer ring and bearing cage.

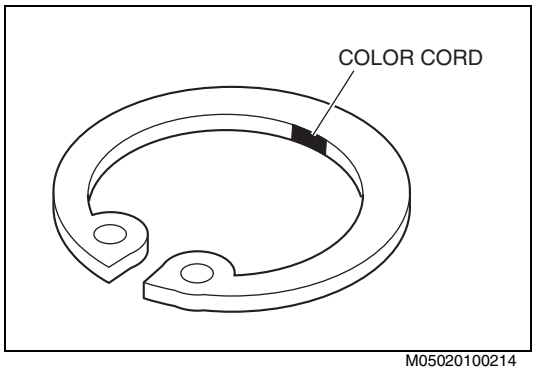
**NOTICE:**
- **During installation, rotate (approx. 30 degrees) the retainer ring to check for proper installation in the groove.**
- **Be sure to use a new retainer ring, and discard the previously installed ring.**
- **Set the oil seal in the bearing cage after measurement of the thrust play.**



M05020100070

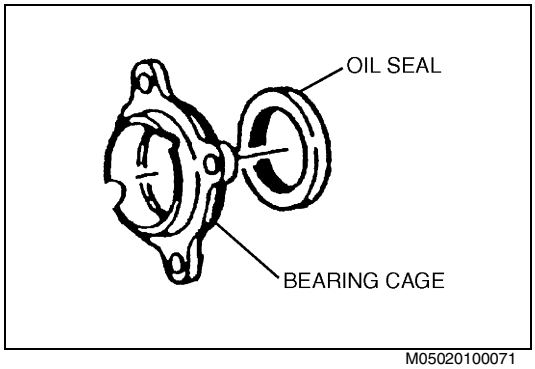
(2) Select a retainer ring with appropriate thickness. Without the oil seal in place, adjust the thrust play between the through shaft bearing and retainer ring. To measure the thrust play, place a dial gauge on the end surface of the flange and move the flange [E].
**Assembly Standard: 0.025-0.125 mm {0.0010-0.0049 in.}**

**NOTICE:**
**Retainer rings are color-coded according to thickness.**



M05020100214

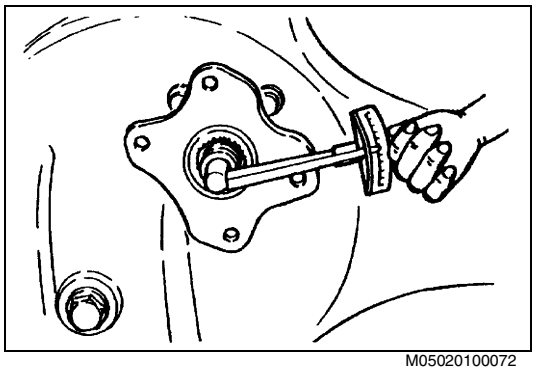
| Thickness of retainer ring | Color cord |
|---|---|
| 2.8 mm {0.110 in.} | Non color |
| 2.9 mm {0.114 in.} | Blue |
| 3.0 mm {0.118 in.} | Yellow |
| 3.1 mm {0.122 in.} | Red |
| 3.2 mm {0.126 in.} | Sky blue |
| 3.3 mm {0.130 in.} | Brown |
| 3.4 mm {0.134 in.} | Green |
| 3.5 mm {0.138 in.} | White |
| 3.6 mm {0.142 in.} | Orange |



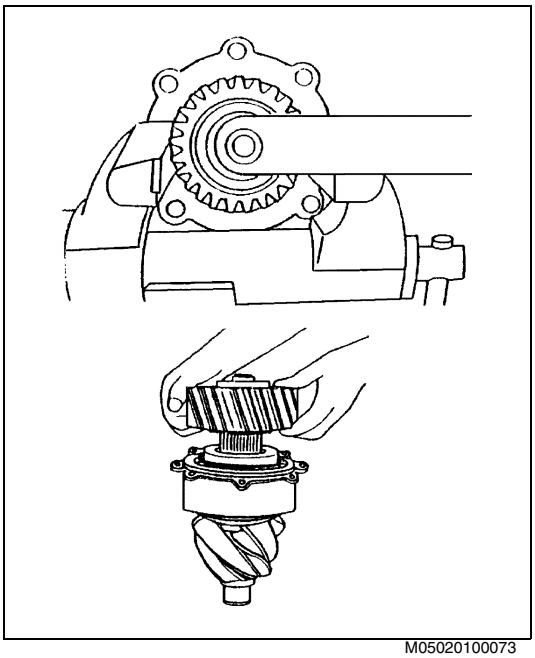
M05020100071

(3) Remove the through shaft assembly from the housing, and remove the flange and the bearing cage from the shaft.
(4) Install the oil seal to the bearing cage.

**NOTICE:**
- **Apply bearing grease on the oil seal lip part.**
- **Before installation of the flange, heat the flange to a temperature between 80-100°C {176-212°F} in hot water or oil. After the flange is installed, leave it for approximately 10 minutes.**
- **Heating parts to a high temperature causes a substantial decrease in strength and durability. Do not heat parts above 120°C {248°F}**


M05020100072

(5) After assembly, tighten it to the specified torque.
**SST: Socket Wrench (09839-4601)**

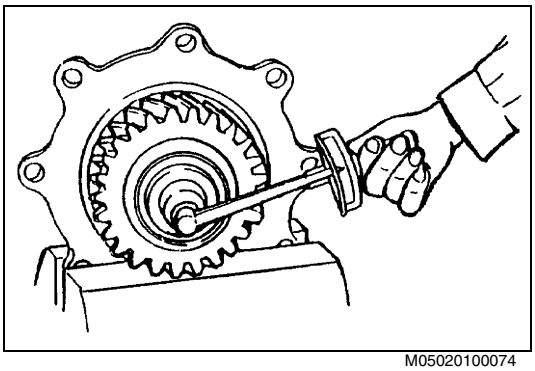

M05020100073

**2. ADJUSTMENT OF THE PINION ASSEMBLY PRELOAD**

(1) Assemble the differential carrier cage and initially tighten the pinion drive gear.

**NOTICE:**
**Apply gear oil to the bearings.**

**SST: Socket Wrench (09839-5501)**

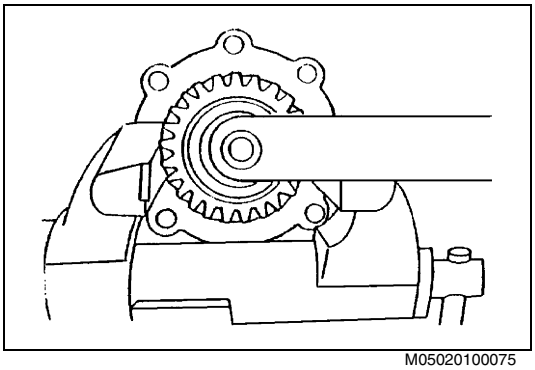

M05020100074

(2) Using the torque wrench, measure the preload of the bearing and if the preload is not within the specific value shown below, adjust with spacer.

**Assembly Standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

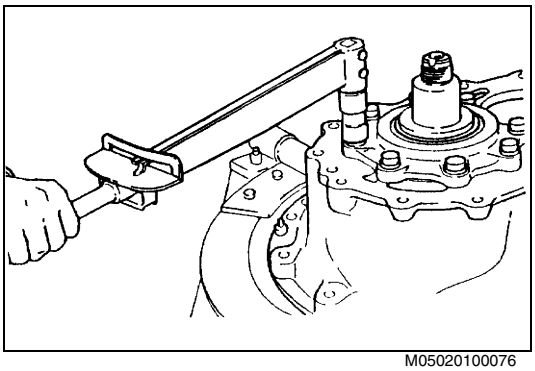
| New bearing | Re-used bearing |
|---|---|
| 2.0-2.4 {20-25, 1.4-1.8} | 1.48-1.96 {15-20, 1.1-1.4} |

**Adjusting spacer thickness:**
**23 kinds of thicknesses ranging from 16.250 to 16.800 mm {0.640 to 0.661 in.} each differing 0.025 mm {0.001 in.}**

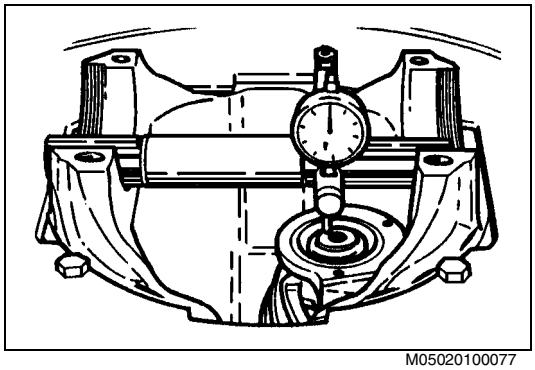

M05020100075

(3) After completing the adjustment, loosen the lock nut.
**SST: Socket Wrench (09839-5501)**

(4) Remove the lock nut and the pinion drive gear.


M05020100076

(5) Install the pinion assembly and tighten the bolts.
(6) Install the pinion drive gear and tighten the lock nut with specified torque.
**SST: Socket Wrench (09839-5501)**


M05020100077

**3. ADJUSTMENT OF PINION FITTING HEIGHT (CONICAL DISTANCE).**

(1) Adjust the pinion fitting height with the shims.

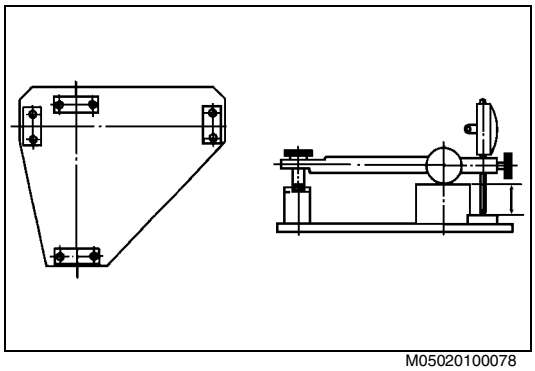
**Standard Pinion Fitting height: 34 mm {1.339 in.}**

**Adjusting shims Thicknesses:**

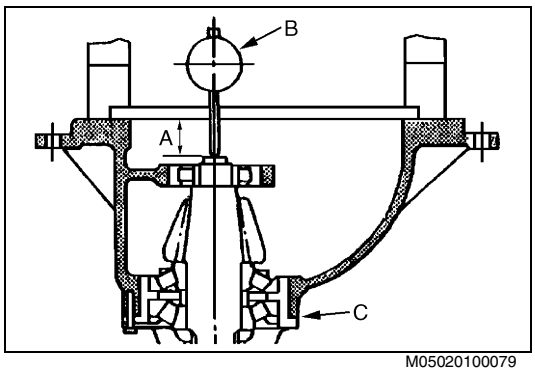
**0.3 mm {0.0118 in.} 0.45 mm {0.0177 in.}**

**0.4 mm {0.0157 in.} 0.50 mm {0.0197 in.}**

**SST: Gauge Assembly (09640-1210)**

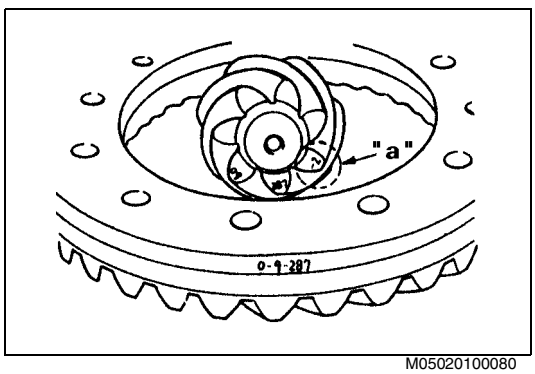

M05020100078

(2) How to use the pinion depth gauge: Set the pinion depth gauge.
**A: 34 mm {1.339 in.}**



M05020100079

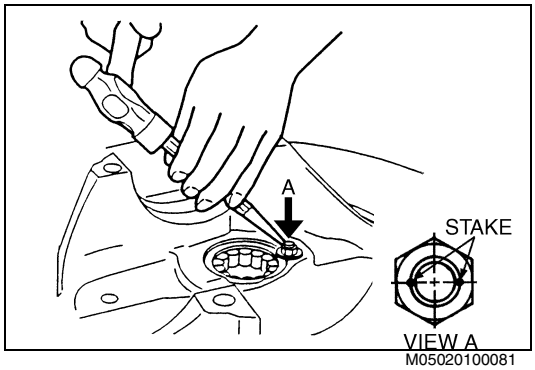
(3) Measure the pinion fitting height (Conical distance); adjust by using the proper shim.
A: Measuring part (Pinion height)
B: Pinion depth gauge
C: Adjusting shim



M05020100080

**EXAMPLE:**
**If the engraved value at the surface of the pinion gear is -2 (-2 means -0.2 mm).**

**The engraved value "a"**
**34 mm - 0.2 mm = 33.8 mm**
**Measuring part (A')**
**Standard pinion height "A"**

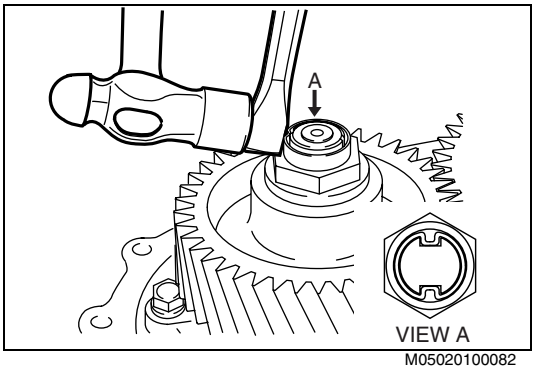


M05020100081

(4) Install the cylindrical roller bearing and tighten the lock nut.

**NOTICE:**

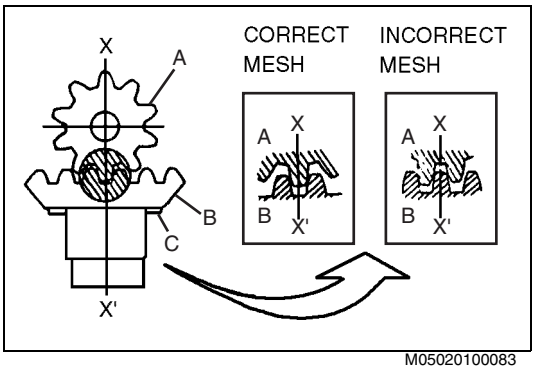
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the lock nut.**
- **When lock agent is not applied, stake the lock nut as shown in the figure.**



M05020100082

(5) Caulk the pinion drive gear lock nut.

**NOTICE:**
- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**



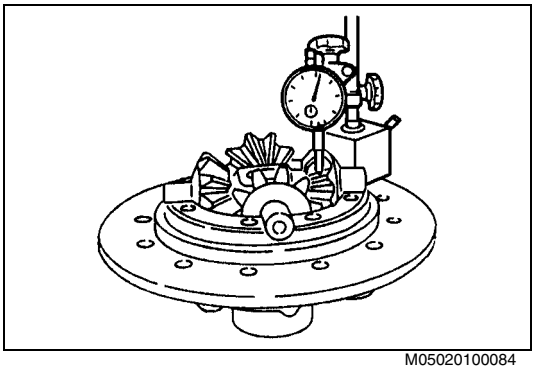
M05020100083

**4. DIFFERENTIAL CASE**

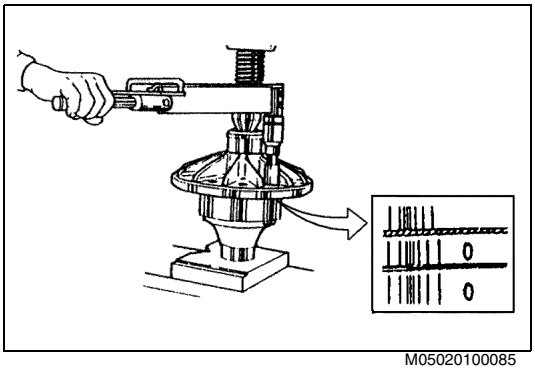
(1) Measure the pinion backlash.

**NOTICE:**
**Be sure to set the chamfered side of the thrust washer for the side gear face to the gear side.**

A: Pinion
B: Side gear
C: Thrust washer

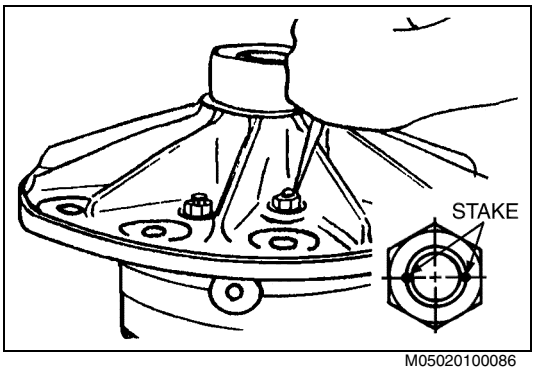

M05020100084

(2) If the backlash is more than service limit, replace the thrust washer for the side gear and/or for the pinion.
**Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}**
**Service Limit: 0.9 mm {0.0354 in.}**


M05020100085

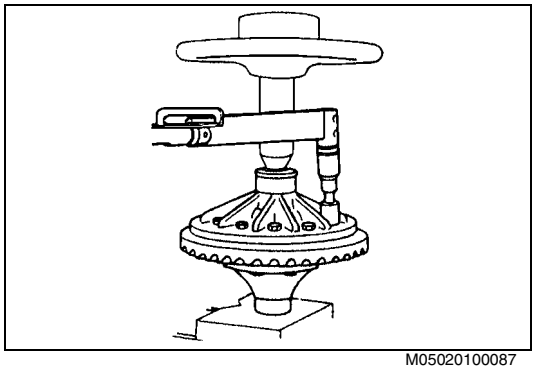
(3) Assemble the differential case.

**NOTICE:**
- **Align the aligning marks when assembling.**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the nuts.**



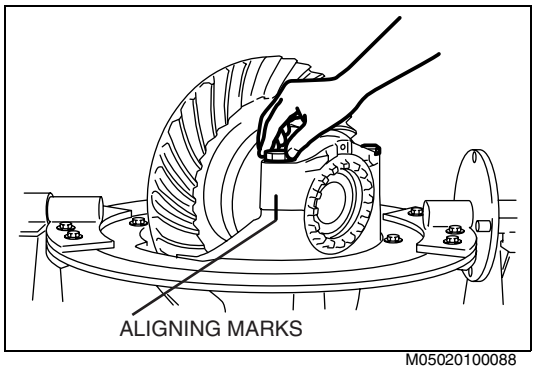
M05020100086

**NOTICE:**
**When lock agent is not applied, stake the lock nut as shown in the figure.**


M05020100087

(4) Install the ring gear to the differential case and tighten the bolts and nuts.

**NOTICE:**
- **Apply lock agent (ThreeBond 1360K or equivalent) on the bolt threads before attaching the nuts.**
- **When lock agent is not applied, stake the nut in the same manner as step 3.**
- **Align the aligning marks when assembling.**

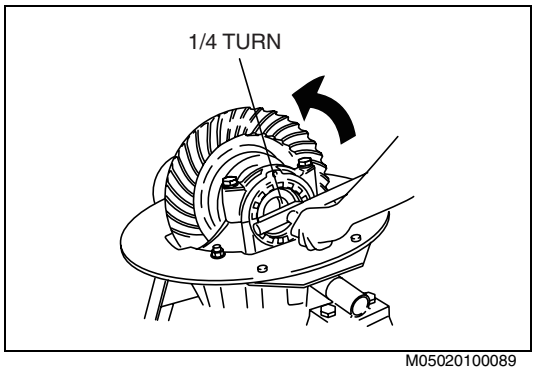


M05020100088

**5. ADJUSTMENT OF PINION DRIVE GEAR AND RING GEAR BACKLASH**

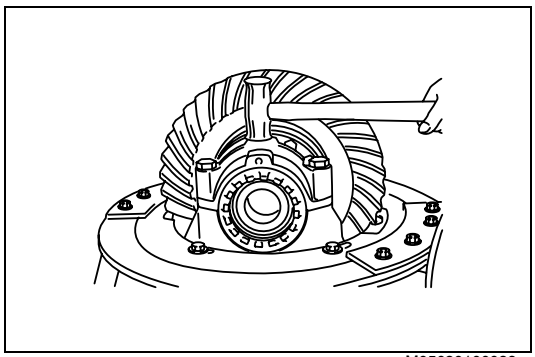
(1) Set the differential case assembly on the differential carrier and install the adjusting nut and bearing cap.

**NOTICE:**
**Align the aligning marks.**

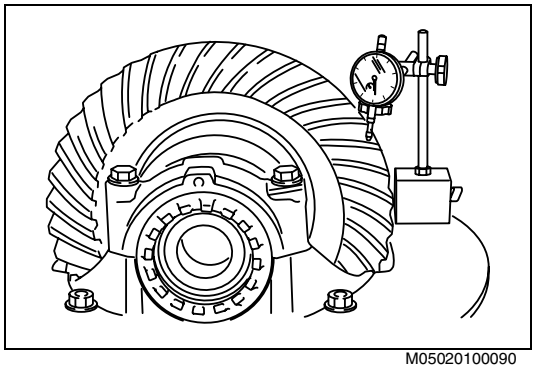


M05020100089

(2) Adjust the preload of the side bearing provisionally.
   a. Tightening the adjusting nut fully then loosen the adjusting nut by 1/4 turn +1 notch.
   **SST: Adjuster Tool (09665-1180)**


M05020100089-

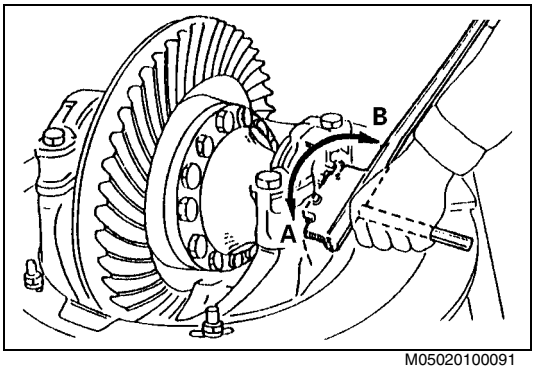
   b. Hit the bearing cap with a copper hammer.


M05020100090

(3) Measure the gear backlash at three or four points on the circumference of the gear.

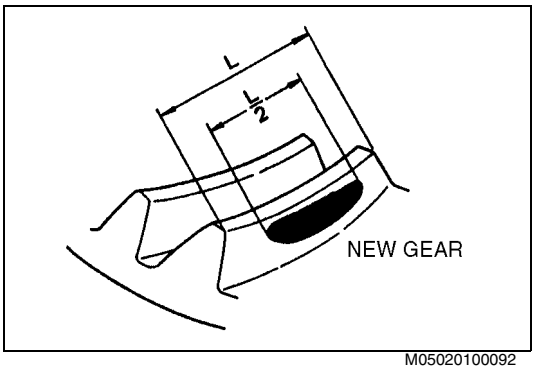
**Assembly standard** Unit: mm {in.}

| Gear ratio | Standard |
|---|---|
| 4.875, 5.250 | 0.30-0.41 {0.0119-0.0161} |
| 6.428 | 0.25-0.33 {0.0098-0.0129} |



M05020100091

(4) Adjust the backlash by turning the adjusting nuts. Turn the both nuts by the same angle.
BACKLASH: A - Decrease B - Increase
**SST: Adjuster Tool (09665-1180)**

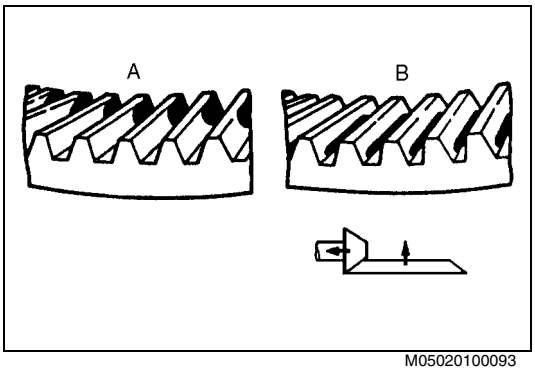


M05020100092

**6. INSPECTION AND ADJUSTMENT OF GEAR MESHING**

(1) Satisfactory gear meshing.

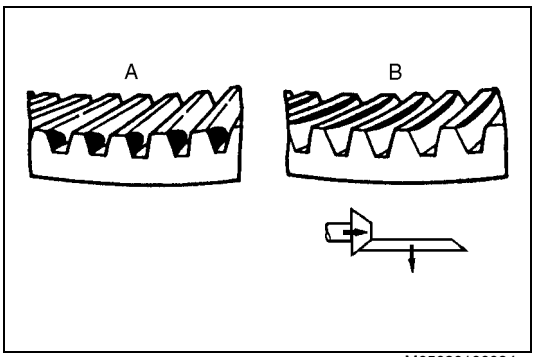
**NOTICE:**
**New gears are marked as shown to indicate proper gear meshing. Make necessary adjustment so that gears mesh corresponds with the factory's mark.**



M05020100093

(2) Example of the unsatisfactory engagement.
a. Toe and flank contact

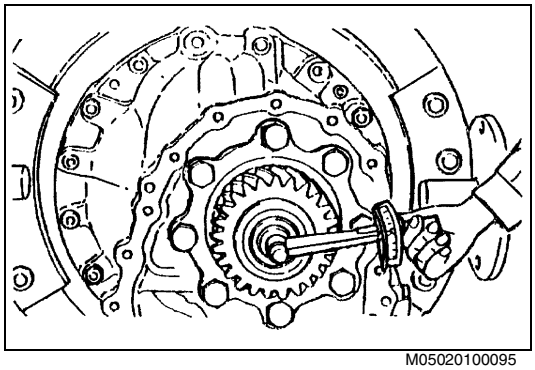
| | |
|---|---|
| A: Toe contact - | Unadjust, replace the pinion and ring gear as a set. |
| B: Flank contact - | Adjust |



M05020100094

b. Heel and face contact.

| | |
|---|---|
| A: Heel contact - | Unadjust, replace the pinion and ring gear as a set. |
| B: Face contact - | Adjust |


M05020100095

**7. MEASUREMENT AND ADJUSTMENT OF THE DIFFERENTIAL CARRIER BEARING AND SIDE BEARING**

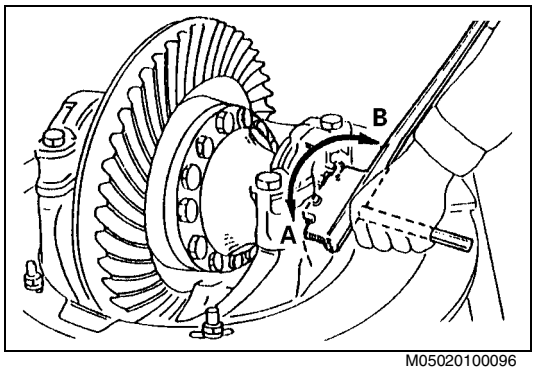
(1) Measure and adjust the total preload at the differential carrier bearings using a torque wrench.

**NOTICE:**
**Total preload = pinion bearing preload (Refer to item 2) + Side bearing preload (Refer to the table below).**

**Assembly standard: Turning torque** Unit: N·m {kgf·cm, lbf·ft}

| Gear ratio | 4.875 | 5.250 | 6.428 |
|---|---|---|---|
| New bearing | 0.41-0.49 {4.2-5.0, 0.31-0.36} | 0.38-0.45 {3.9-4.6, 0.28-0.33} | 0.32-0.37 {3.2-3.8, 0.23-0.27} |
| Re-used bearing | 0.31-0.40 {3.1-4.0, 0.23-0.29} | 0.29-0.37 {2.9-3.8, 0.21-0.27} | 0.23-0.30 {2.4-3.1, 0.17-0.22} |

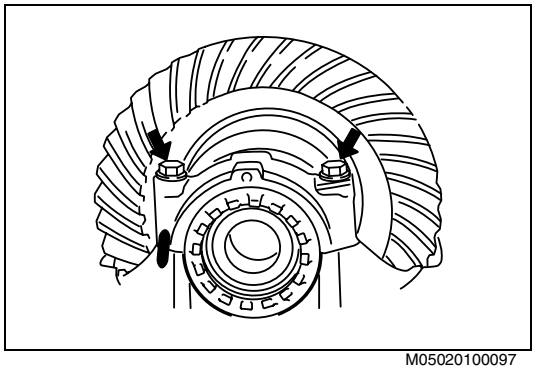
**NOTICE:**
**The gear ratio is indicated on the bearing cage.**



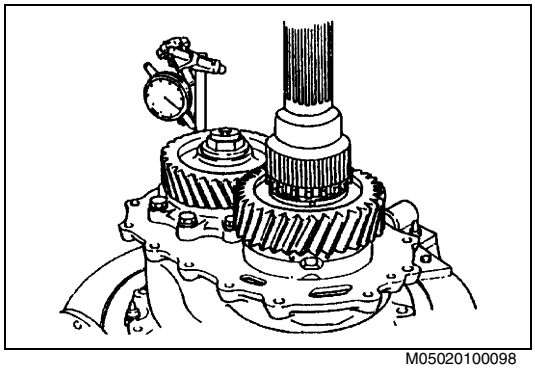
M05020100096

(2) If necessary, adjust the side bearing preload with the adjusting nut.

- A: Counterclockwise : Decrease preload
- B: Clockwise : Increase preload
  **SST: Adjuster Tool (09665-1180)**

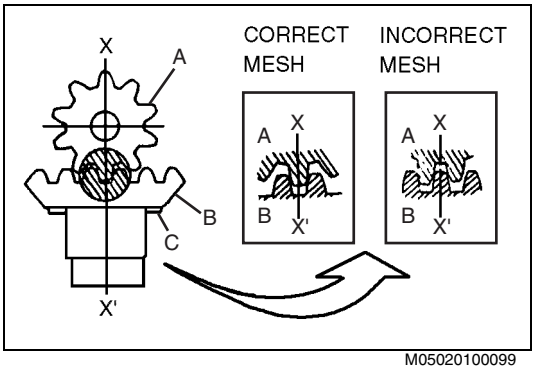

M05020100097

(3) Tighten the bearing cap and install the lock plate.
**SST: Socket Wrench (09839-3003)**


M05020100098

**8. DRIVE GEAR AND PINION DRIVE GEAR**

(1) Measure the drive gear and pinion drive gear backlash.
**Assembly Standard: 0.08-0.16 mm {0.0032-0.0062 in.}**
**Service Limit: 0.4 mm {0.0157 in.}**



M05020100099

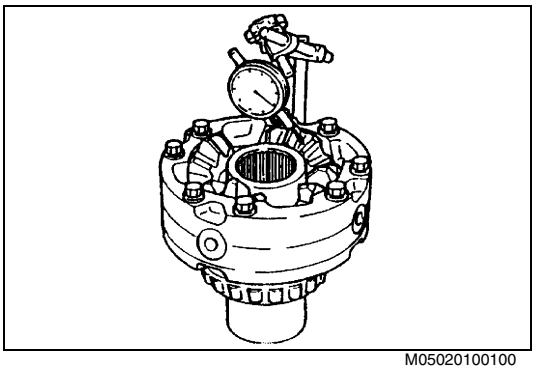
**9. INTER-AXLE DIFFERENTIAL GEAR**

(1) Measure the pinion backlash.

**NOTICE:**

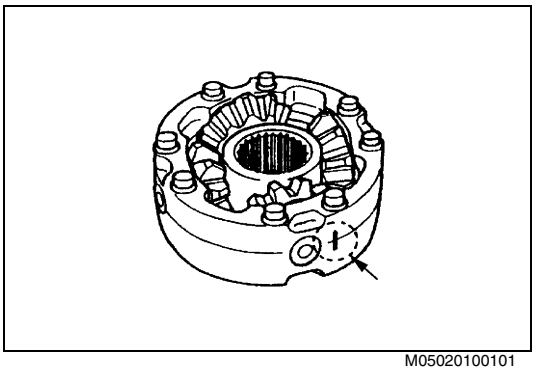
**Apply molybdenum grease to the pinion gear and spider.**

A: Pinion
B: Side gear
C: Thrust washer


M05020100100

(2) If the backlash is more than service limit, replace the thrust washer for the side gear and/or for the pinion.

**Assembly Standard: 0.20-0.60 mm {0.0079-0.0236 in.}**
**Service Limit: 0.9 mm {0.0354 in.}**


M05020100101

(3) Assemble the differential case.

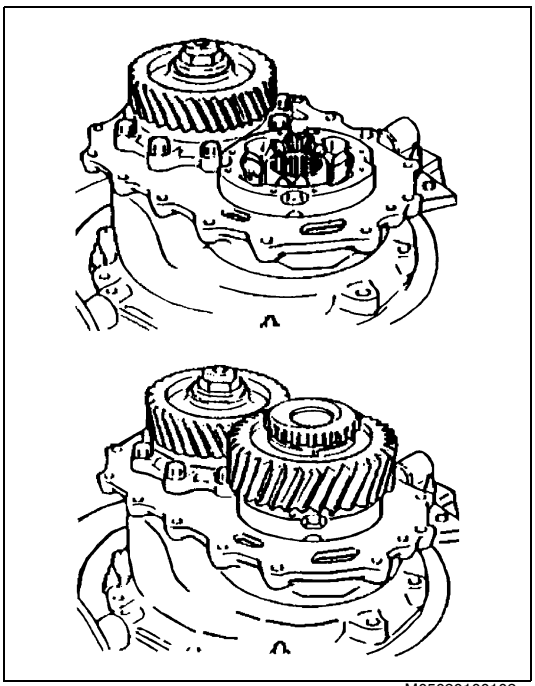
**NOTICE:**

- **Align the aligning marks when assembling.**
- **Apply molybdenum grease on all inner parts.**

(4) Tighten the bolts.

**NOTICE:**

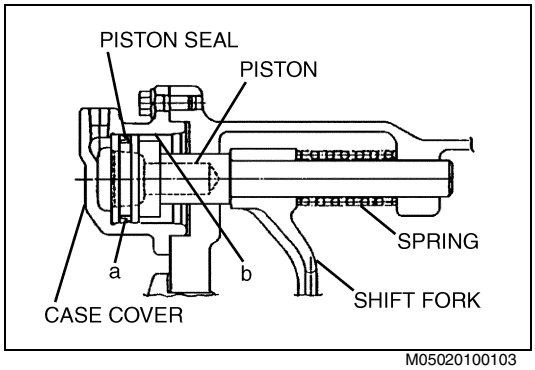
**Apply adhesive (ThreeBond 1360K or equivalent) on the bolt threads.**


M05020100102

(5) Place the inter-axle differential gear and the drive gear as shown in figure.

**NOTICE:**

**The bolts of the differential case should point downward when assembling.**



M05020100103

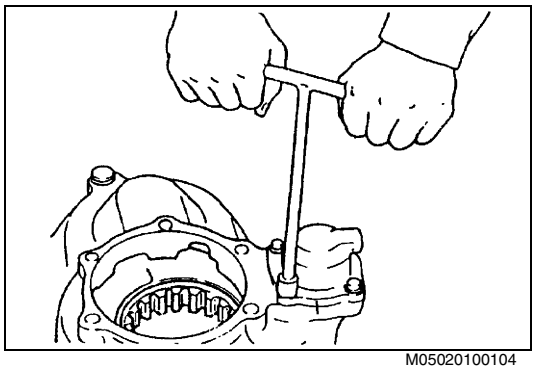
**10. DIFFERENTIAL CARRIER COVER ASSEMBLY**

(1) Set the piston seal as shown in the figure.

(2) Place the spring and the shift fork in the differential carrier cover, then insert the piston.

**NOTICE:**

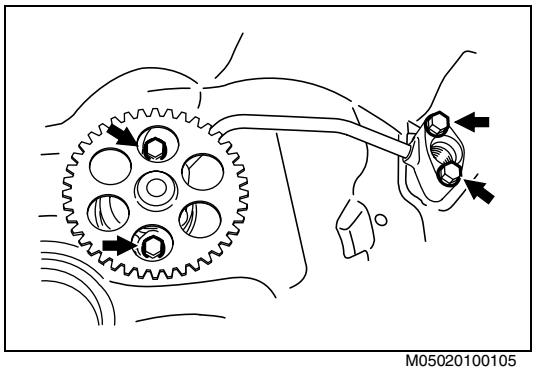
- **Coat the piston seal with silicon grease. (a)**
- **Coat the piston and case cover inner surface with gear oil. (b)**


M05020100104

(3) Install the case cover on the differential carrier cover.

**NOTICE:**

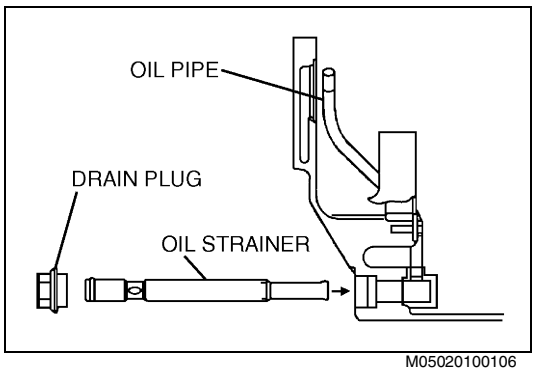
- **Apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surfaces of the case cover and differential carrier cover.**
- **Align the aligning marks on the case cover and the differential carrier cover.**


M05020100105

(4) Install the oil pipe and oil pump assembly to the differential carrier cover.

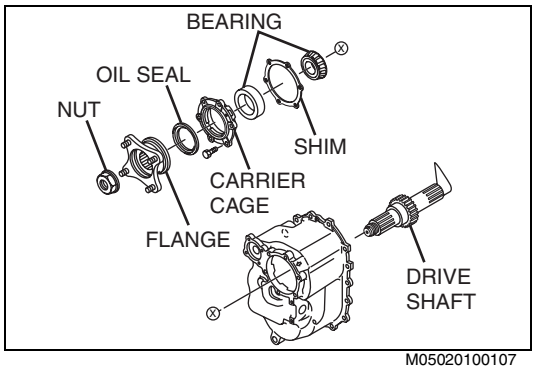
**NOTICE:**

**Be careful not to damage the O-ring when installing the oil pipe.**



M05020100106

(5) Install the oil strainer to the differential carrier cover.



M05020100107

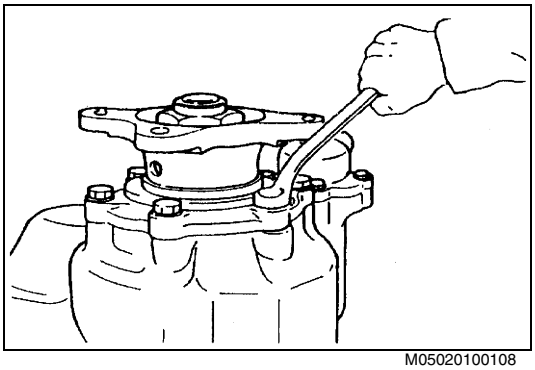
(6) Install the bearing on the drive shaft.

(7) Install the oil seal to the carrier cage and then install the carrier cage with the shim to the drive shaft.

**NOTICE:**

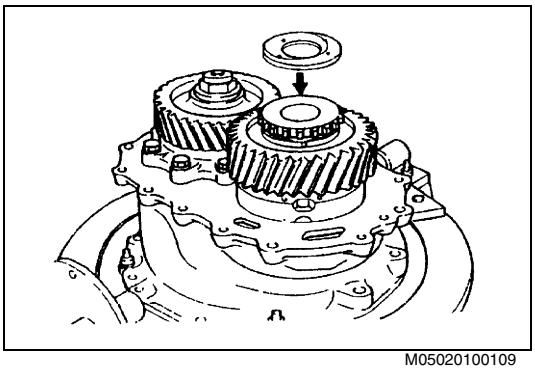
**Apply bearing grease on the oil seal lip parts.**

(8) Install the flange yoke coupling and tighten the nut.
**SST: Socket Wrench (09839-6502)**


M05020100108

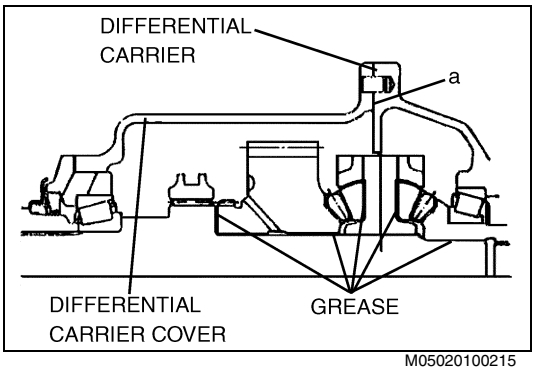
(9) Place the shift sleeve in the shift fork, then install the drive shaft and the carrier cage assembly to the differential carrier cover.

**NOTICE:**
- **Apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surfaces of carrier cage and carrier cover.**
- **Align the spline of the sleeve and the drive shaft.**


M05020100109

(10) Place the thrust washer on the drive gear.

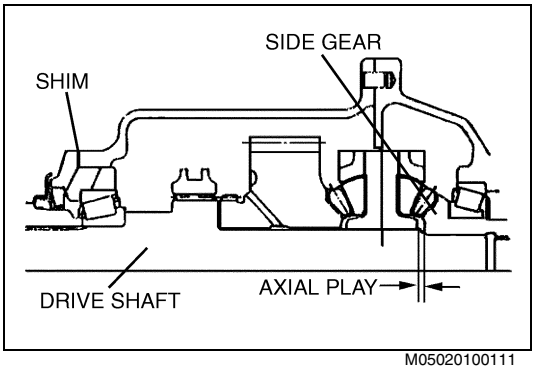
**NOTICE:**
**Apply molybdenum grease to the both sides of the thrust washer.**



M05020100215

(11) Initially install the differential carrier cover assembly to the differential carrier.

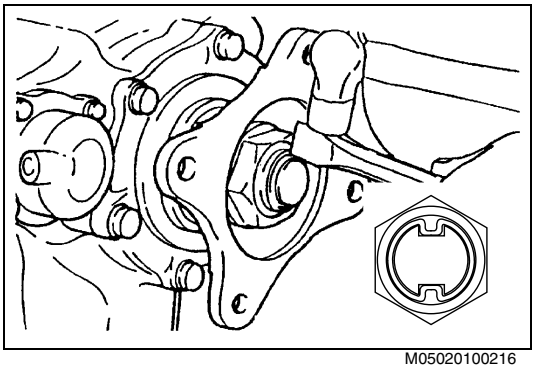
**NOTICE:**
- **Apply molybdenum grease to the sliding surface.**
- **Apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surface of differential carrier cover and differential carrier (a).**



M05020100111

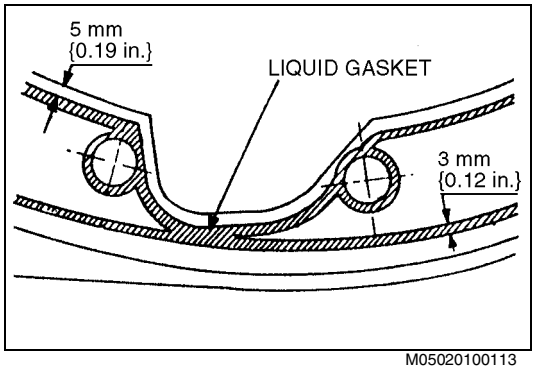
(12) Measure the drive shaft axial play and adjust the side gear and drive shaft axial play with shims.
**Assembly Standard: 0.05-0.10 mm {0.0020-0.0039 in.}**
**Adjusting shims Thicknesses:**
**0.30 mm {0.0118 in.} 0.45 mm {0.0177 in.}**
**0.40 mm {0.0157 in.} 0.50 mm {0.0197 in.}**

**NOTICE:**
**After adjusting shims, apply liquid gasket (ThreeBond #1215 or equivalent) to the facing surface of differential carrier cover and differential carrier cage.**


M05020100216

(13) Caulk the lock nut.

**NOTICE:**
- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**



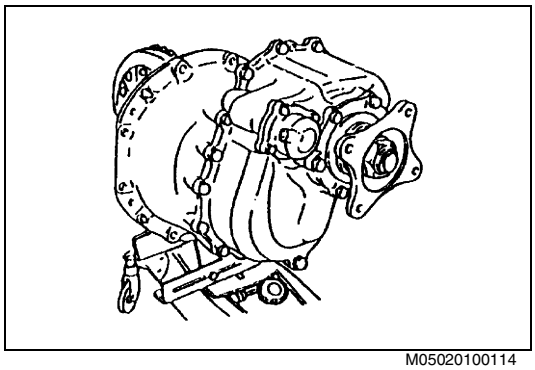
M05020100113

## IMPORTANT POINTS - MOUNTING

**1. DIFFERENTIAL CARRIER ASSEMBLY**

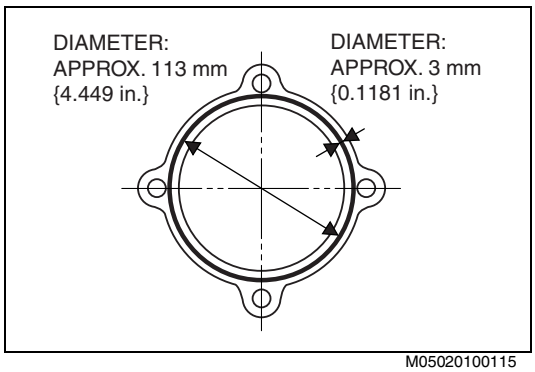
(1) Apply liquid gasket on the face of the housing flange.

**NOTICE:**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**
- **Application should be approximately 3 mm {0.12 in.} width and 5 mm {0.19 in.} away from the edge.**


M05020100114

(2) Using a jack, install the differential carrier assembly to the axle housing.

**NOTICE:**
**Fit the O-ring to the stud bolt.**

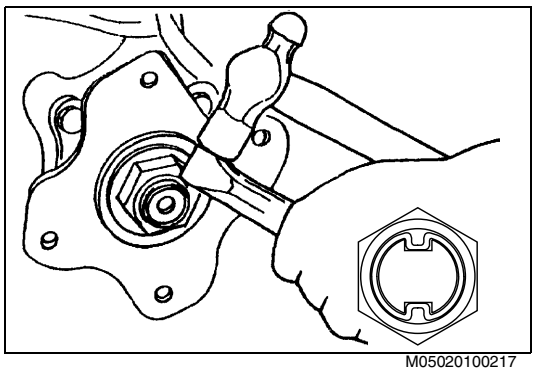


M05020100115

**2. THROUGH SHAFT ASSEMBLY**

(1) Apply liquid gasket on face of the housing flange and insert the through shaft.

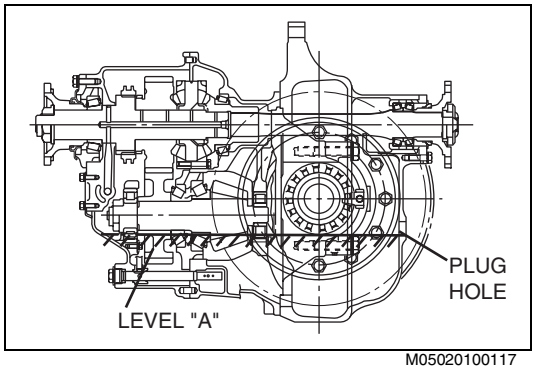
**NOTICE:**
- **The liquid gasket must be ThreeBond #1215 or equivalent.**
- **The liquid gasket should be applied continuously.**


M05020100217

(2) Install the flange yoke coupling and tighten the lock nut.
**SST: Socket Wrench (09839-4601)**

(3) Caulk the lock nut.

**NOTICE:**
- **Caulk the nut securely as shown in the figure.**
- **Make sure that there is no rift in the caulk position.**

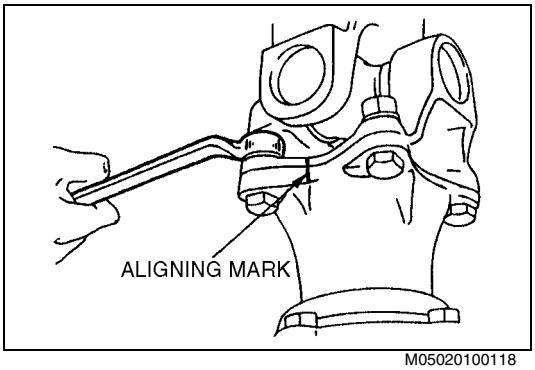


M05020100117

**3. GEAR OIL**

(1) Fill the gear oil using plug hole to level "A" and tighten the plug.

**Gear oil:**
**Refer to the owner's manual.**



M05020100118

**4. PROPELLER SHAFT**

(1) Install the propeller shafts.

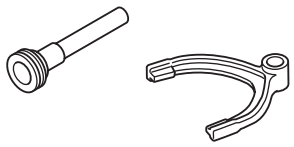
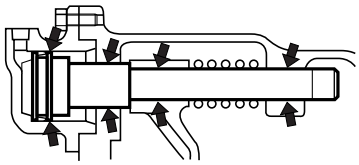
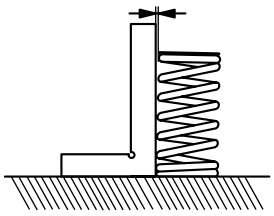
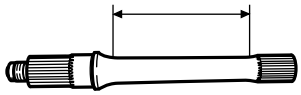
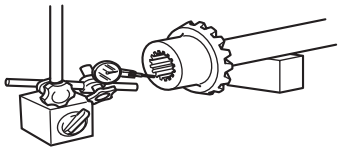
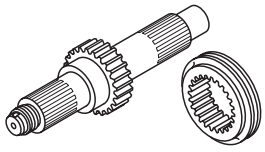
**NOTICE:**
**Align the aligning marks.**

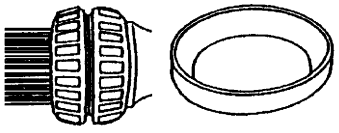
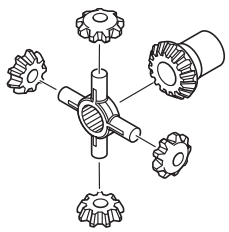
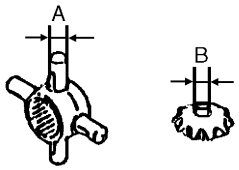
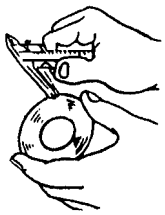
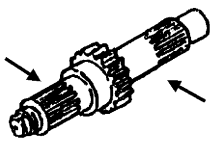
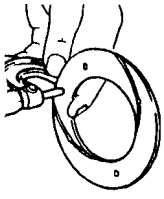
**Tightening Torque:**
**ϕ12 bolt-63.8-85.2 N·m {650-870 kgf·cm, 47-62 lbf·ft}**
**ϕ14 bolt-127.4-156.8- N·m {1,300-1,600 kgf·cm, 94-115 lbf·ft}**
**ϕ16 bolt-166.8-225.4 N·m {1,700-2,300 kgf·cm, 123-166 lbf·ft}**

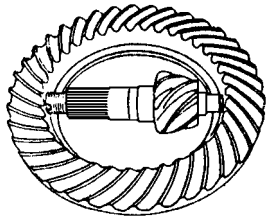
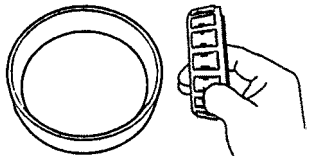
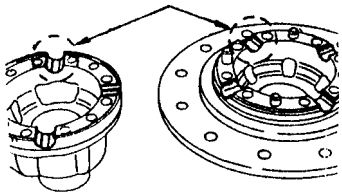
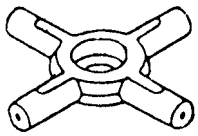
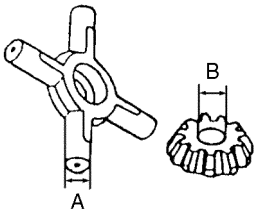
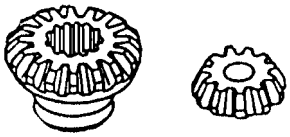
# INSPECTION AND REPAIR

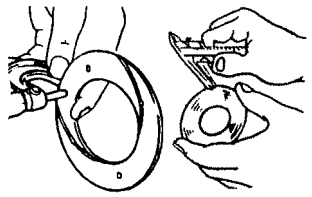
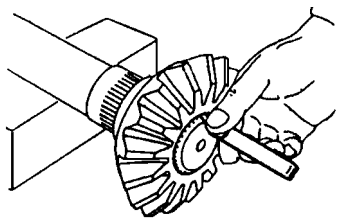
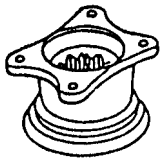
M05020110BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Shift fork and piston: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Shift fork and piston case sliding surface: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Return spring: Squareness** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Through shaft: Bend** | **—** | **0.1 {0.0039}** | **Replace.** | **Measure**  |
| **Inter-axle side gear and through shaft: Spline backlash** | **0.132-0.210 {0.006-0.008}** | **0.5 {0.020}** | **Replace.** | **Measure**  |
| **Drive shaft and shift sleeve: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Through shaft bearing and race:<br>Burns and pitting | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Taper roller bearing:<br>Burns and pitting | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Inter axle differential gear teeth:<br>Wear and damage | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Inter axle differential side gear spline:<br>Wear and damage | — | — | Replace,<br>if necessary. | |
| Inter axle differential spider:<br>Wear and damage | — | — | Replace,<br>if necessary. | |
| Inter axle differential spider and pinion:<br>Clearance | A: 28 {1.102}<br><br>B-A:<br>0.140-0.261<br>{0.006-0.010} | 0.4<br>{0.016} | Replace. | Measure<br>  |
| Inter axle differential thrust washers thickness | 1.7-1.9<br>{0.006-0.010} | 1.3<br>{0.051} | Replace. | Measure<br>  |
| Inter axle differential drive shift sliding surface, spline;<br>Wear and damage | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Drive gear:<br>Wear and damage | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Drive gear:<br>Thrust washer thickness | 1.9-2.1<br>{0.075-0.082} | 1.7<br>{0.067} | Replace. | Measure<br>  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Pinion drive gear: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Cylindrical roller bearing: Burns and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Pinion and ring gear: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Bearing and race: Burns and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Differential case spider holes: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Spider: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Spider and pinion: Clearance** | **A: 32 {1.260}**<br><br>**B-A: 0.145-0.190 {0.0058-0.0074}** | **0.4 {0.016}** | **Replace.** | **Measure**   |
| **Differential side gear and pinion: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Thrust washers thickness** | **Side gear: 1.9-2.1 {0.075-0.082}** | **1.7 {0.067}** | **Replace.** | **Measure**  |
| | **Pinion gear: 1.7-1.9 {0.067-0.074}** | **1.3 {0.051}** | | |
| **Differential side gear and axle shaft: Spline backlash** | **0.054-0.148 {0.0021-0.0058}** | **0.5 {0.020}** | **Replace.** | **Measure**  |
| **Flange coupling spline: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# BRAKE EQUIPMENT (MODELS: WITH AIR OVER HYDRAULIC BRAKE)

BR01-001

**SERVICE BRAKE ASSEMBLY.....BR01-2**
DESCRIPTION ..... BR01-2
DIAGRAM ..... BR01-3
TROUBLESHOOTING ..... BR01-5
AIR BLEEDING ..... BR01-6

# SERVICE BRAKE ASSEMBLY

## DESCRIPTION

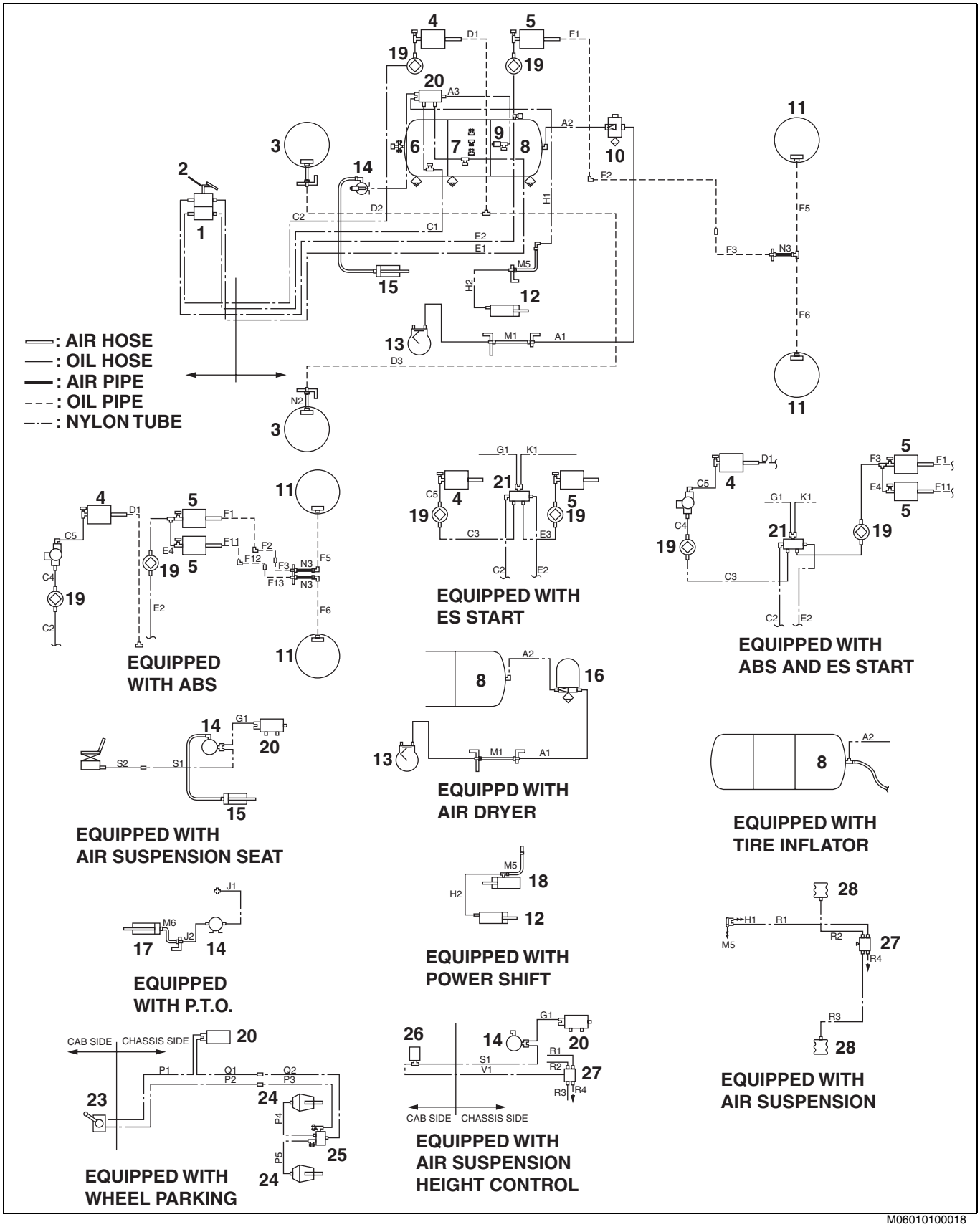
M06010101BEC1001

| | |
|---|---|
| Type of service brake | Air over hydraulic system with drum-shoe type wheel brake. |
| Air charging system | Air charging is from piston type air compressor and air flow is directed and controlled by a pressure regulator, the necessary valves, and lines as required. Pressure sensor and air pressure warning switch are used for indicating the pressure level in the system. |
| Service brake control system | Two independent lines for front and rear wheels with air flow controlled by a brake valve, and each line is separated into air line and hydraulic line by a brake air booster.<br>Stop lamp switch is used to operate the stop lamps. |
| Wheel brake | Drum brake with hydraulic actuated, internally expending two-leading shoes in front and dual two-leading shoes in rear wheels. |

**NOTICE:**
**See "DIAGRAM" of the following page the component parts (Valves, Switches, etc.) used in easy system.**

# DIAGRAM

M06010101BEJ1002




M06010100018

| | | | |
|---|---|---|---|
| 1 | Brake valve | 15 | Exhaust brake |
| 2 | Stop lamp switch | 16 | Air dryer |
| 3 | Wheel brake-Front | 17 | Power take-off |
| 4 | Brake air booster-Front | 18 | Power shift |
| 5 | Brake air booster-Rear | 19 | Quick release valve |
| 6 | Air tank-Front | 20 | Protection valve |
| 7 | Air tank-Rear | 21 | ES start control valve |
| 8 | Air tank-Water separator | 22 | Brake lock valve |
| 9 | Safety valve | 23 | Parking brake control valve |
| 10 | Pressure governor | 24 | Parking brake chamber |
| 11 | Wheel brake-Rear | 25 | Relay valve |
| 12 | Clutch booster | 26 | Height control valve |
| 13 | Air compressor | 27 | Leveling valve |
| 14 | Magnetic valve | 28 | Air spring |

# TROUBLESHOOTING

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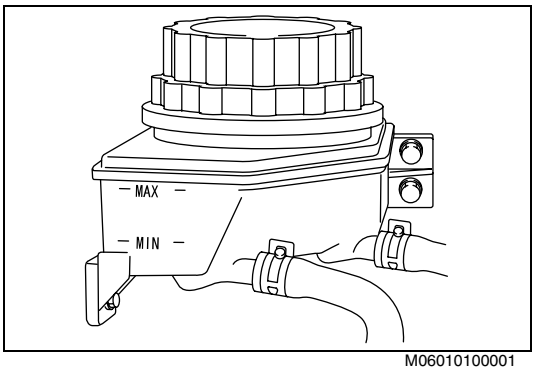
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Not enough braking (Wheel brake and drum)** | Lining is wet with grease or fluid | Replace the lining. |
| | Improper contact of drum and lining | Correct. |
| | Improper lining material or glazed lining | Correct. |
| | Deformation or hardening of drum | Correct or replace. |
| | Excessively worn lining | Replace. |
| | Improper adjustment of shoe | Adjust hold-down nut. |
| **Not enough braking (Control system)** | Leakage of brake fluid from brake system | Tighten further or replace gasket. |
| | Leakage of compressed air from brake system | Tighten further or replace gasket. |
| | Lack of brake fluid | Supply brake fluid. |
| | Lack of compressed air pressure due to excessive use. | Use properly. |
| | Improper operation of air compressor | Repair or replace. |
| | Improper operation of brake valve | Repair or replace. |
| | Improper operation of air booster | Repair or replace. |
| | Clogging of brake system | Replace pipe, hose, etc. |
| | Vapor lock in brake system | Bleed air from brake line. |
| **Brake fluid decreases** | Leakage of brake fluid from brake piping | Tighten further or replace gasket. |
| | Leakage of brake fluid from cylinder | Replace cup. |
| | Leakage of brake fluid from push rod oil seal of air booster. | Replace oil seal. |
| **Unequal or unstable braking** | Lining is wet with grease or fluid | Replace lining. |
| | Defective lining material (Improper combination) | Replace lining. |
| | Non-uniform lining contact | Correct. |
| | Improper adjustment of brake shoe | Adjust. |
| | Non-uniform shoe clearance | Adjust the clearance. |
| | Distorted drums | Correct or replace. |
| | Excessive abrasion of drums | Correct or replace. |
| | Loose hub bearing | Adjust or replace bearing. |
| | Improper or unequal pneumatic pressure of tire | Adjust to proper pneumatic pressure. |
| | Clogging of brake system | Replace pipe, hose, etc. |
| **Brake drags or does not release (Wheel brake and drum)** | Improper adjustment of shoe clearance | Adjust the clearance. |
| | Improper adjustment of brake shoe | Adjust hold-down nut. |
| | Defective shoe return spring | Replace. |
| **Brake drags or does not release (Control system)** | Lack of pedal play | Adjust. |
| | Improper return of brake pedal | Repair or replace. |
| | Improper operation of brake valve | Repair or replace. |
| | Defective check valve of air booster | Replace. |
| | Improper operation of air booster | Repair or replace. |
| | Clogging of brake system | Replace pipe, hose, etc. |

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Brake squeal** | Improper lining material or glazed lining | Replace lining. |
| | Loose lining rivets | Replace or tighten the rivet further. |
| | Lining rivet in contact with drum | Replace lining and rivet. |
| | Deformation or wear of drum | Repair or replace. |
| | Intrusion of foreign matter between drum and lining | Clean the surface of lining or replace |
| | Loose hub bearing | Adjust or replace bearing. |
| **Impossible to bleed air completely.** | Oil hose between air booster and oil reservoir bends and air trapped | Correct the bend of feed pipe and let air out of the oil reservoir. |
| | Improper tightness of joint of brake system. | Tighten further or replace gasket. |

# AIR BLEEDING

M06010101BEH2001

## IMPORTANT POINT - DISMOUNTING



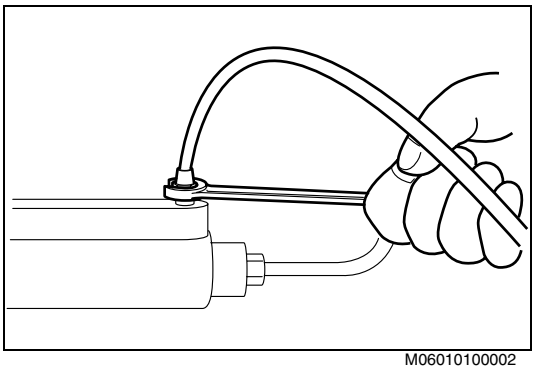
M06010100001

**1. PREPARATION**

(1) Replenish the reservoir with brake fluid up to MAX line.

(2) Start the engine and keep the engine revolution at idling speed during replacing the brake fluid.

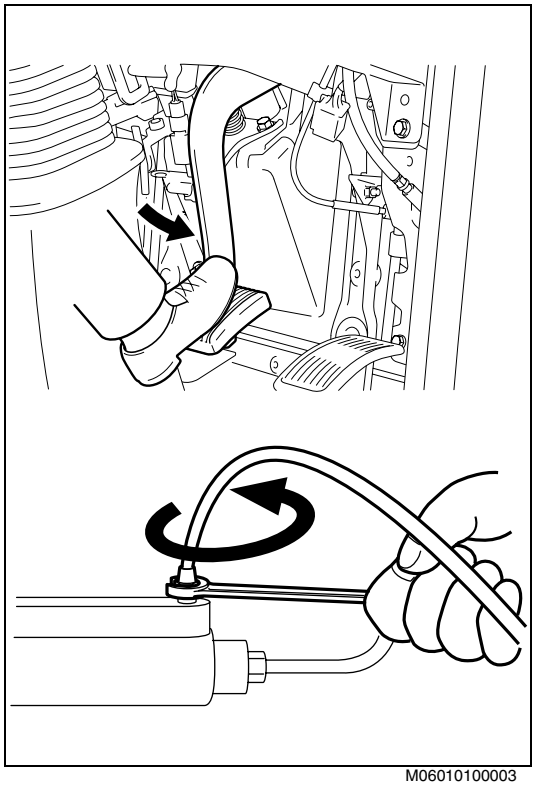
**NOTICE:**
**Always first finish the replacement of either front or rear brake line and then start the replacement of the other.**


M06010100002

**2. AIR BLEEDING OF THE LINE FROM THE RESERVOIR TO THE BRAKE BOOSTER**

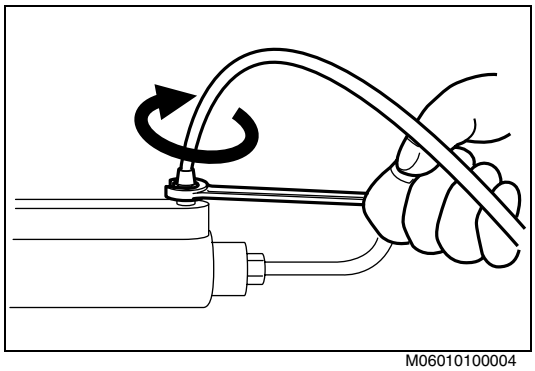
(1) Attach a vinyl tube to the bleeder screw of the brake booster.

**NOTICE:**
**Prepare a container box receiving brake fluid at the end of the vinyl tube.**


M06010100003

(2) While depressing slowly the brake pedal, loosen the bleeder screw and discharge the brake fluid with air or old brake fluid.

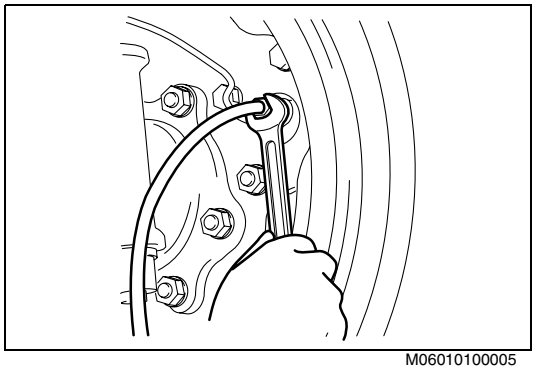
**NOTICE:**
**When replacing the brake fluid, the color of the fluid changes paler. So, observe the color of the fluid passing through the tube.**


M06010100004

(3) While depressing the brake pedal, loosen the bleeder screw and then release the brake pedal.

(4) Repeat the above procedure until no air is observed in the vinyl tube or the replacement of the brake fluid is finished.
**Tightening Torque:**
**For front: 7.0-12.0 N·m {71-122 kgf·cm, 5.2-8.8 lbf·ft}**
**For rear: 6.9-11.8 N·m {70-120 kgf·cm, 5.1-8.6 lbf·ft}**

**NOTICE:**
**Because the quantity of brake fluid will decrease, continue to replenish the reservoir with brake fluid to avoid that the reservoir becomes empty.**


M06010100005

**3. AIR BLEEDING THE LINE FROM THE BRAKE BOOSTER TO THE WHEEL CYLINDER**

(1) Attach the vinyl tube to the bleeder screw of wheel cylinder and carry out the air bleeding or replacement in the same manner as that of the brake booster.

**Tightening Torque:**
**7.5-11.5 N·m {76-117 kgf·cm, 5.5-8.4 lbf·ft}**

**NOTICE:**
**Carry out the air bleeding starting from the wheel cylinder nearest to the brake booster.**

(2) After having finished the air bleeding or replacement, replenish the reservoir with brake fluid up to the MAX line.

# BRAKE EQUIPMENT (MODELS: WITH FULL AIR BRAKE)

BR01-002

**SERVICE BRAKE ASSEMBLY.....BR01-2**
DESCRIPTION ..... BR01-2
DIAGRAM ..... BR01-3
TROUBLESHOOTING ..... BR01-9

# SERVICE BRAKE ASSEMBLY

## DESCRIPTION

M06010102BEC1001

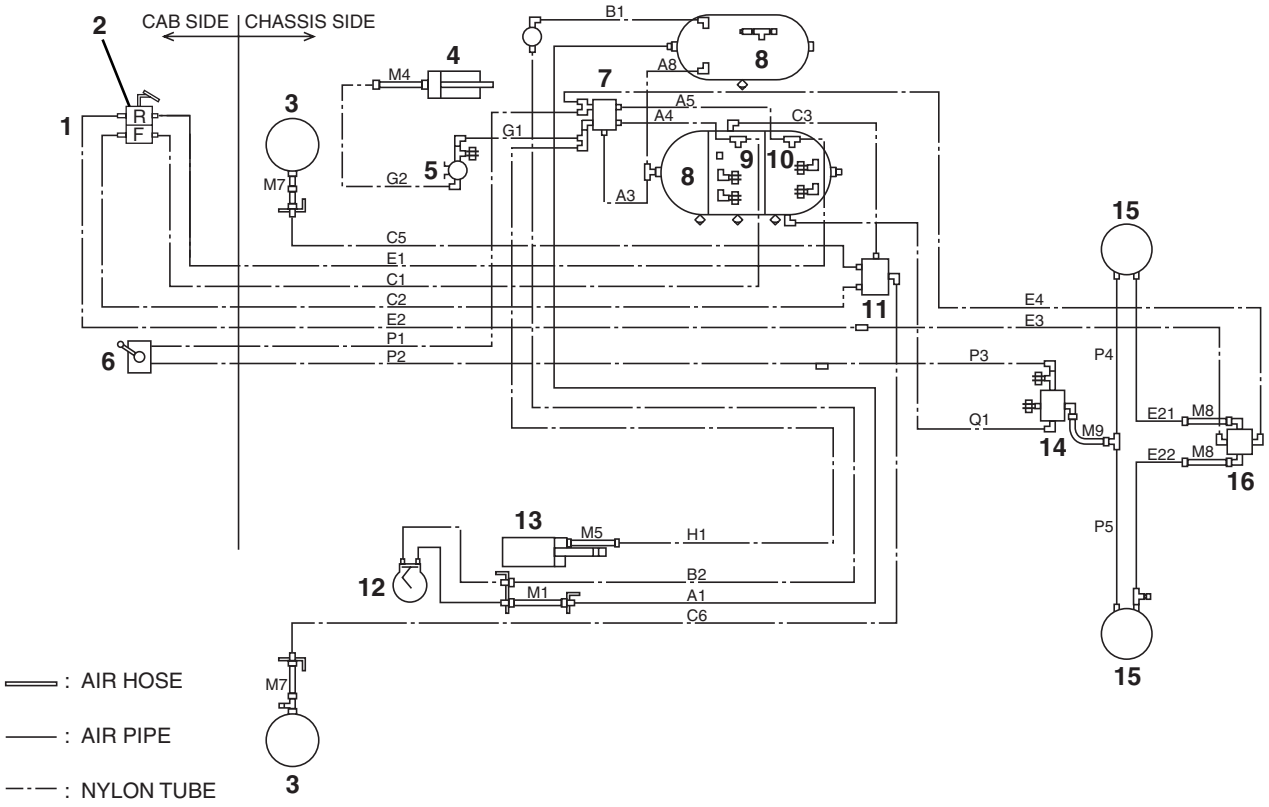
| | |
|---|---|
| Type of service brake | Drum shoe type wheel brake activated by compressed air. |
| Air charging system | Air charging is from piston type air compressor and air flow is directed and controlled by a pressure regulator, the necessary valves, and lines as required.<br>Pressure sensor and air pressure warning switch are used for indicating the pressure level in the system. |
| Service brake control system | Two independent lines for front and rear wheels with air flow controlled by a brake valve, and each line comprises a group of valves and brake chambers (one/wheel).<br>Two stop lamp switches (one/line) are used to operate the stop lamps. |
| Spring brake control system (If so equipped) | Single line for all spring brake chambers or two lines for all spring brake chambers on tractor and for trailer emergency circuit.<br>The line comprises a control valve which controls air flow, the other necessary valve and spring brake chambers.<br>A stop lamp switch is used to turn ON the stop lamps.<br>A parking brake switch is used to turn OFF the warning buzzer and to turn ON the parking brake warning lamp. |
| Trailer brake control system (If so equipped) | Two lines for service and emergency circuits with a control valve which controls air flow and the other necessary valve.<br>A stop lamp switch is used to operate the stop lamps.<br>A trailer brake switch is used to operate the trailer brake indicator lamp. |
| Wheel brake | Drum brake with internally expanding, leading-trailing shoes operation by slack adjuster and cam shaft in all wheels. |

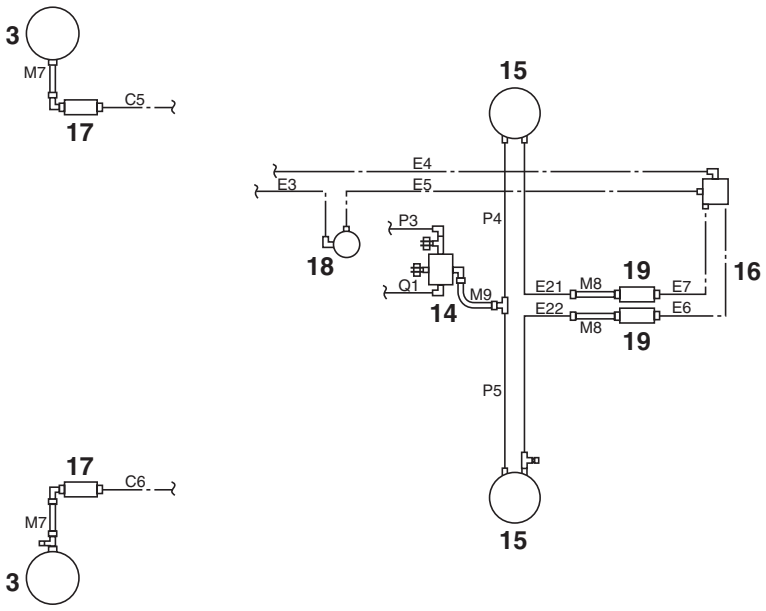
**NOTICE:**
**See "DIAGRAM" of the following page the component parts (Valves, Switches, etc.) used in easy system.**

# DIAGRAM

M06010102BEJ1001

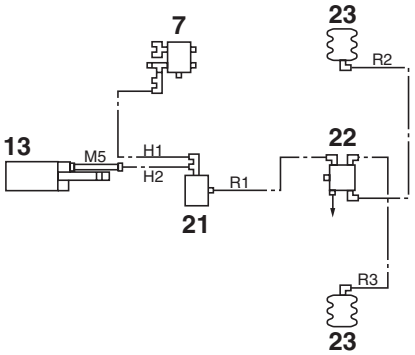
## MODELS: FG, GH



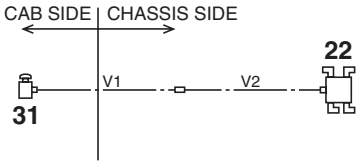




**EQUIPPED WITH ABS**

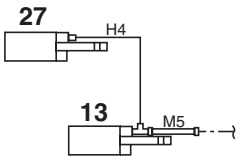
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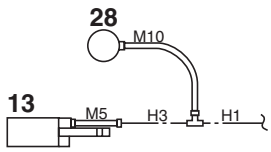

**EQUIPPED WITH AIR SUSPENSION**



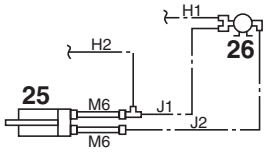

**EQUIPPED WITH AIR SUSPENSION HEIGHT CONTROL**



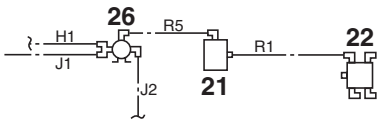

**EQUIPPED WITH TRANSMISSION POWER SHIFT**



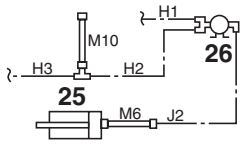

**EQUIPPED WITH EATON FS6109 TRANSMISSION**



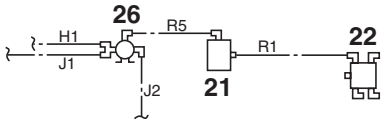

**EQUIPPED WITH TRANSMISSION P. T.O. (MF06 TRANSMISSION)**




**EQUIPPED WITH AIR SUSPENSION AND TRANSMISSION P.T.O. (MF06 TRANSMISSION)**

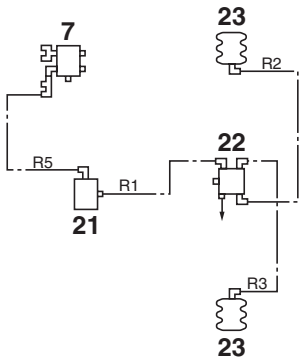



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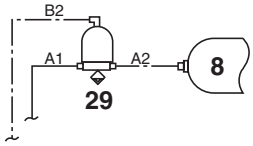



**EQUIPPED WITH AIR SUSPENSION AND TRANSMISSION P.T.O. (EATON FS6109 TRANSMISSION)**

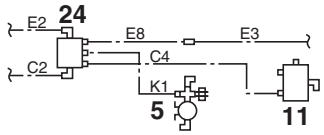
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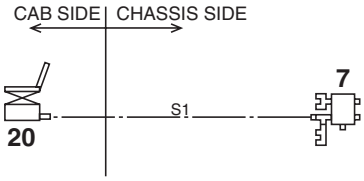

**EQUIPPED WITH AIR SUSPENSION AND AUTOMATIC TRANSMISSION**



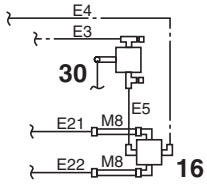

**EQUIPPED WITH AIR DRIER**



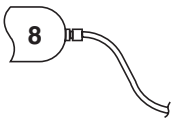

**EQUIPPED WITH ES START**




**EQUIPPED WITH AIR SUSPENSION SEAT**




**EQUIPPED WITH LOAD SENSING VALVE**

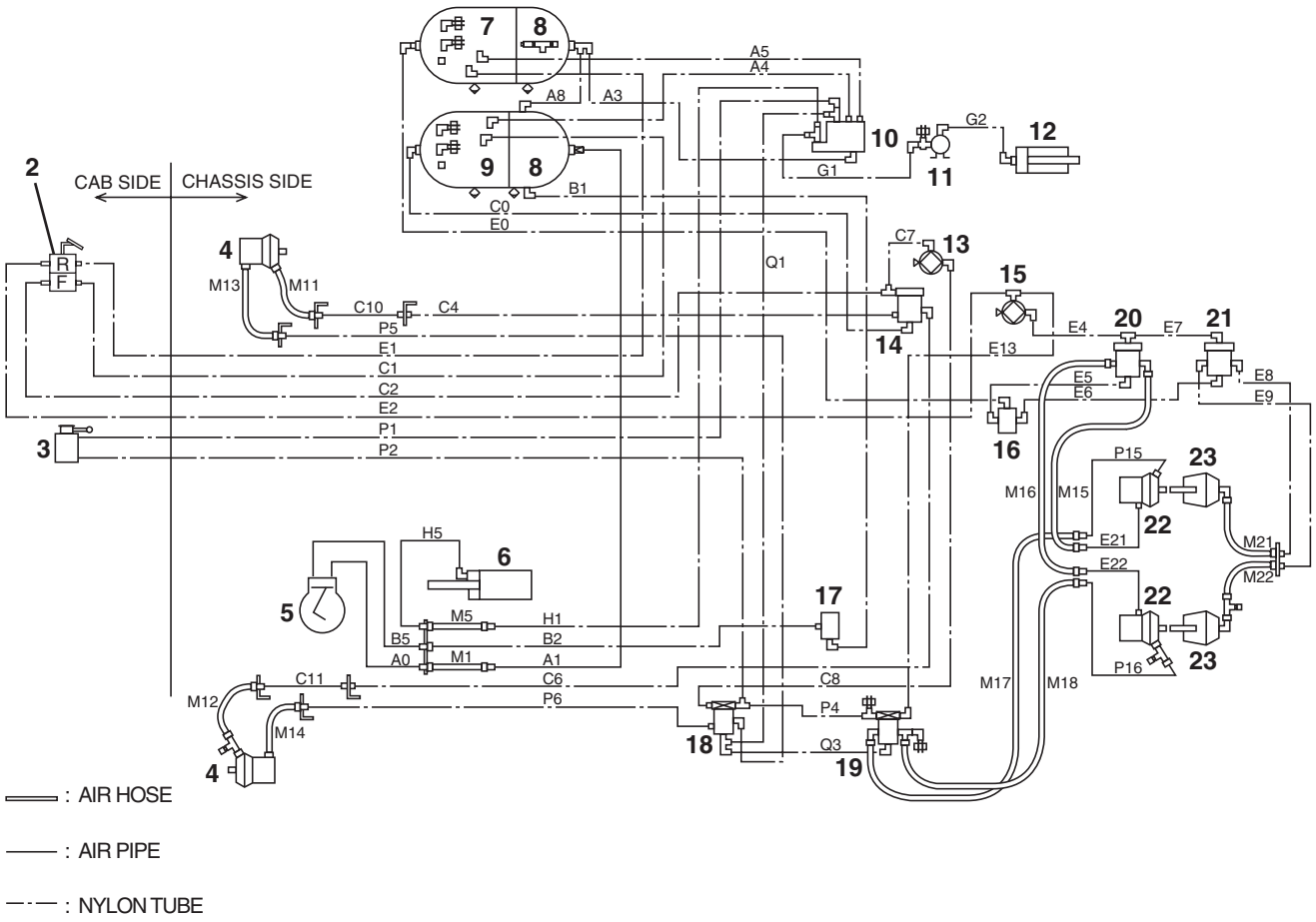


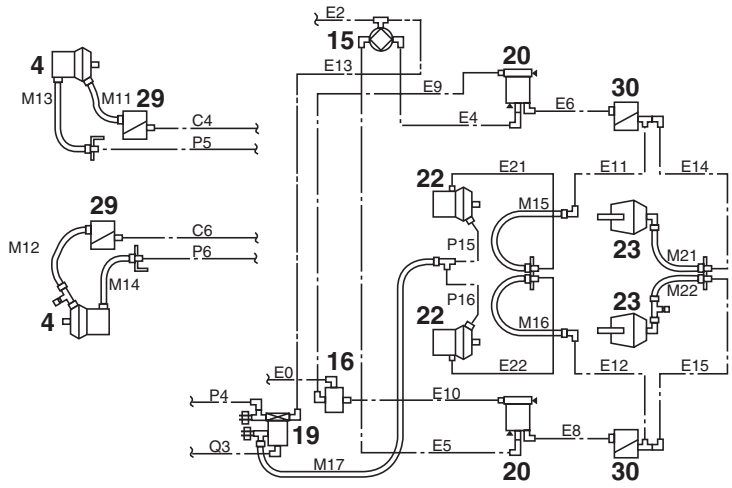

**EQUIPPED WITH TIRE INFLATOR**

M06010100021

| | | | |
|---|---|---|---|
| 1 | Brake valve | 17 | ABS control valve - Front |
| 2 | Stop lamp switch | 18 | Quick release valve |
| 3 | Brake chamber - Front | 19 | ABS control valve - Rear |
| 4 | Exhaust brake | 20 | Air suspension seat |
| 5 | Exhaust brake magnetic valve | 21 | Air suspension protection valve |
| 6 | Parking brake valve | 22 | Leveling valve |
| 7 | 4-way protection valve | 23 | Air spring |
| 8 | Air tank - Water separator | 24 | ES start control valve |
| 9 | Air tank - Front | 25 | Transmission P.T.O. |
| 10 | Air tank - Rear | 26 | P.T.O. magnetic valve |
| 11 | Relay valve - Front | 27 | Transmission power shift |
| 12 | Air compressor | 28 | Range preselection lever |
| 13 | Clutch booster | 29 | Air drier |
| 14 | Relay valve - Wheel parking | 30 | Load sensing valve |
| 15 | Brake chamber - Rear | 31 | Height control valve |
| 16 | Relay valve - Rear | | |

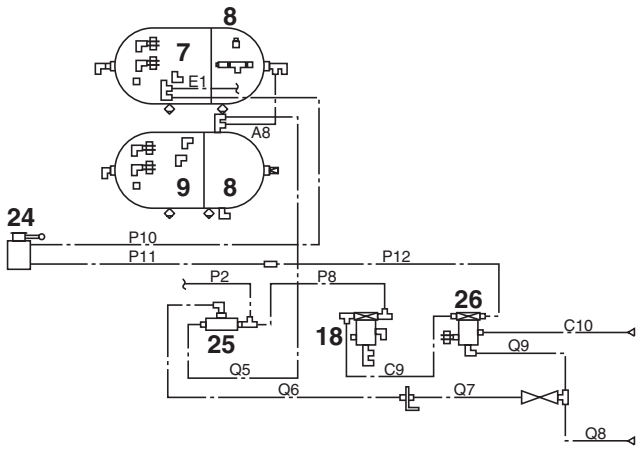
## MODELS: FL, FM



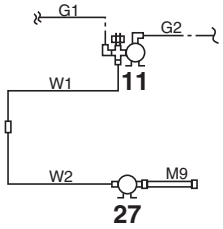




**EQUIPPED WITH ABS**

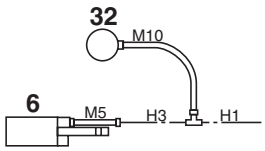
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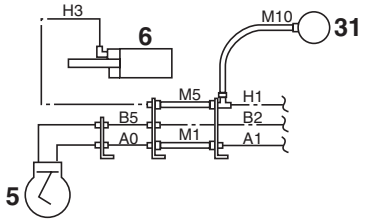

**EQUIPPED WITH TRAILER CONNECTION**



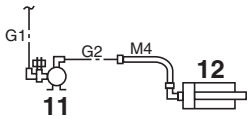

**EQUIPPED WITH INTER-AXLE DIFFERENTIAL LOCK**



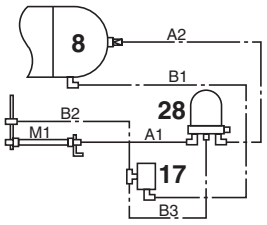

**EQUIPPED WITH EATON FS8209 TRANSMISSION**




**EQUIPPED WITH FULLER RT8908LL TRANSMISSION**

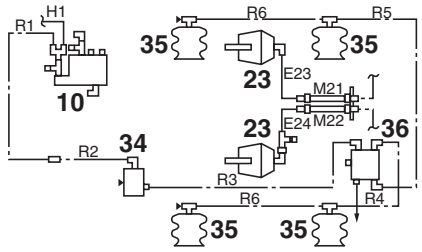



**EQUIPPED WITH EXHAUST BRAKE AND AUTOMATIC TRANSMISSION**

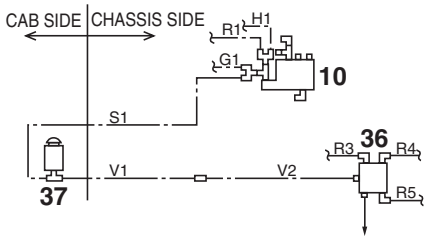



**EQUIPPED WITH AIR DRIER**

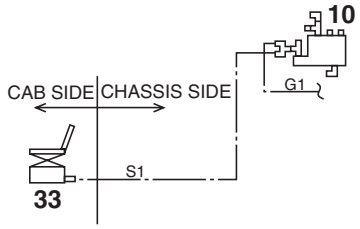
M06010100023



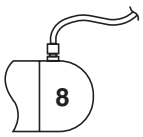

**EQUIPPED WITH AIR SUSPENSION**




**EQUIPPED WITH AIR SUSPENSION HEIGHT CONTROL**




**EQUIPPED WITH AIR SUSPENSION SEAT**




**EQUIPPED WITH TIRE INFLATOR**

M06010100024

| | | | |
|---|---|---|---|
| 1 | Brake valve | 20 | Relay valve - Rear - Front |
| 2 | Stop lamp switch | 21 | Relay valve - Rear - Rear |
| 3 | Parking brake valve | 22 | Spring brake chamber - Rear |
| 4 | Spring brake chamber - Front | 23 | Brake chamber - Rear |
| 5 | Air compressor | 24 | Trailer hand brake valve |
| 6 | Clutch booster | 25 | Cut valve |
| 7 | Air tank - Rear | 26 | Relay valve - Trailer |
| 8 | Air tank - Water separator | 27 | Inter-axle differential lock magnetic valve |
| 9 | Air tank - Front | 28 | Air drier |
| 10 | 4-way protection valve | 29 | ABS control valve - Front |
| 11 | Exhaust brake magnetic valve | 30 | ABS control valve - Rear |
| 12 | Exhaust brake | 31 | Range selector |
| 13 | Quick release valve - Front | 32 | Range preselection lever |
| 14 | Relay valve - Front | 33 | Air suspension seat |
| 15 | Quick release valve - Rear | 34 | Protection valve |
| 16 | Multi joint | 35 | Air spring |
| 17 | Pressure regulator | 36 | Leveling valve |
| 18 | Spring brake valve - Front | 37 | Height control switch |
| 19 | Spring brake valve - Rear | | |

# TROUBLESHOOTING

M06010102BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Not enough braking (Wheel brake and drum)** | Lining is wet with grease or fluid | Replace the lining. |
| | Improper contact of drum and lining | Correct. |
| | Improper lining material or glazed lining | Correct. |
| | Deformation or hardening of drum | Correct or replace. |
| | Excessively worn lining | Replace. |
| **Not enough braking (Control system)** | Leakage of compressed air from brake system | Tighten further or replace gasket. |
| | Lack of compressed air pressure due to excessive use. | Use properly. |
| | Improper operation of air compressor | Repair or replace. |
| | Improper operation of brake valve | Repair or replace. |
| | Improper operation of relay valve and quick release valve | Repair or replace. |
| | Clogging of brake system | Replace pipe, hose, etc. |
| **Unequal or unstable braking** | Lining is wet with grease or fluid | Replace lining. |
| | Defective lining material (Improper combination) | Replace lining. |
| | Non-uniform lining contact | Correct. |
| | Improper adjustment of brake shoe | Adjust. |
| | Non-uniform shoe clearance | Adjust the clearance. |
| | Distorted drums | Correct or replace. |
| | Excessive abrasion of drums | Correct or replace. |
| | Loose hub bearing | Adjust or replace bearing. |
| | Improper or unequal pneumatic pressure of tire | Adjust to proper pneumatic pressure. |
| | Clogging of brake system | Replace pipe, hose, etc. |
| **Brake drags or does not release (Wheel brake and drum)** | Improper adjustment of shoe clearance | Adjust the clearance. |
| | Defective shoe return spring | Replace. |
| **Brake drags or does not release (Control system)** | Lack of pedal play | Adjust. |
| | Improper return of brake pedal | Repair or replace. |
| | Improper operation of brake valve | Repair or replace. |
| | Improper operation of relay valve and quick release valve | Repair or replace. |
| | Clogging of brake system | Replace pipe, hose, etc. |
| **Brake squeal** | Improper lining material or glazed lining | Replace lining. |
| | Loose lining rivets | Replace or tighten the rivet further. |
| | Lining rivet in contact with drum | Replace lining and rivet. |
| | Deformation or wear of drum | Repair or replace. |
| | Intrusion of foreign matter between drum and lining | Clean the surface of lining or replace. |
| | Loose hub bearing | Adjust or replace bearing. |

# SERVICE BRAKE

BR02-001

**PRESSURE GOVERNOR .....BR02-3**
DESCRIPTION ..... BR02-3
INSPECTION ..... BR02-3

**AIR DRYER .....BR02-4**
DATA AND SPECIFICATIONS ..... BR02-4
DESCRIPTION ..... BR02-4
COMPONENT LOCATOR ..... BR02-5
OVERHAUL ..... BR02-6
INSPECTION AND REPAIR ..... BR02-7

**SAFETY VALVE .....BR02-8**
DATA AND SPECIFICATIONS ..... BR02-8
DESCRIPTION ..... BR02-8
INSPECTION AND REPAIR ..... BR02-8

**BRAKE VALVE**
**(MAKER:SANWA SEIKI) .....BR02-9**
DATA AND SPECIFICATIONS ..... BR02-9
DESCRIPTION ..... BR02-9
COMPONENT LOCATOR ..... BR02-10
OVERHAUL ..... BR02-12
INSPECTION AND REPAIR ..... BR02-17

**BRAKE VALVE (WITH ES START).....BR02-19**
DATA AND SPECIFICATIONS ..... BR02-19
DESCRIPTION ..... BR02-19
COMPONENT LOCATOR ..... BR02-20
OVERHAUL ..... BR02-21
INSPECTION AND REPAIR ..... BR02-26

**BRAKE FLUID RESERVOIR.....BR02-28**
DATA AND SPECIFICATIONS ..... BR02-28
DESCRIPTION ..... BR02-28
COMPONENT LOCATOR ..... BR02-29
DISMOUNTING AND MOUNTING ..... BR02-29
INSPECTION AND REPAIR ..... BR02-30

**PROTECTION VALVE .....BR02-31**
DATA AND SPECIFICATIONS ..... BR02-31
DESCRIPTION ..... BR02-31
COMPONENT LOCATOR ..... BR02-32
OVERHAUL ..... BR02-32
INSPECTION AND REPAIR ..... BR02-33

**PROTECTION VALVE**
**(WITH 4-WAY PROTECTION VALVE).....BR02-34**
DATA AND SPECIFICATIONS ..... BR02-34
DESCRIPTION ..... BR02-34
COMPONENT LOCATOR ..... BR02-35
OVERHAUL ..... BR02-36
ADJUSTMENT ..... BR02-36
INSPECTION AND REPAIR ..... BR02-38

**QUICK RELEASE VALVE .....BR02-39**
DATA AND SPECIFICATION ..... BR02-39
DESCRIPTION ..... BR02-39
COMPONENT LOCATOR ..... BR02-40
OVERHAUL ..... BR02-41
INSPECTION AND REPAIR ..... BR02-41

**BRAKE AIR BOOSTER (AIRMASTER)**
**WITHOUT ABS .....BR02-42**
DATA AND SPECIFICATIONS ..... BR02-42
DESCRIPTION ..... BR02-42
SPECIAL TOOL ..... BR02-43
COMPONENT LOCATOR ..... BR02-44
OVERHAUL ..... BR02-45
INSPECTION ..... BR02-49
INSPECTION AND REPAIR ..... BR02-51

**BRAKE AIR BOOSTER (AIRMASTER)**
**WITH ABS .....BR02-52**
DATA AND SPECIFICATIONS ..... BR02-52
DESCRIPTION ..... BR02-52
SPECIAL TOOL ..... BR02-53
COMPONENT LOCATOR ..... BR02-53
OVERHAUL ..... BR02-55
INSPECTION ..... BR02-63
INSPECTION AND REPAIR ..... BR02-65

**RELAY VALVE .....BR02-67**
DATA AND SPECIFICATIONS ..... BR02-67
DESCRIPTION ..... BR02-67
COMPONENT LOCATOR ..... BR02-68
OVERHAUL ..... BR02-69
INSPECTION AND REPAIR ..... BR02-69

**SPRING BRAKE CONTROL VALVE ..... BR02-70**
DATA AND SPECIFICATIONS ..... BR02-70
DESCRIPTION ..... BR02-70
COMPONENT LOCATOR ..... BR02-71
OVERHAUL ..... BR02-72
INSPECTION AND REPAIR ..... BR02-73

**SPRING BRAKE CHAMBER ..... BR02-74**
DATA AND SPECIFICATIONS ..... BR02-74
DESCRIPTION ..... BR02-74
COMPONENT LOCATOR ..... BR02-76
OVERHAUL ..... BR02-77
INSPECTION AND REPAIR ..... BR02-78

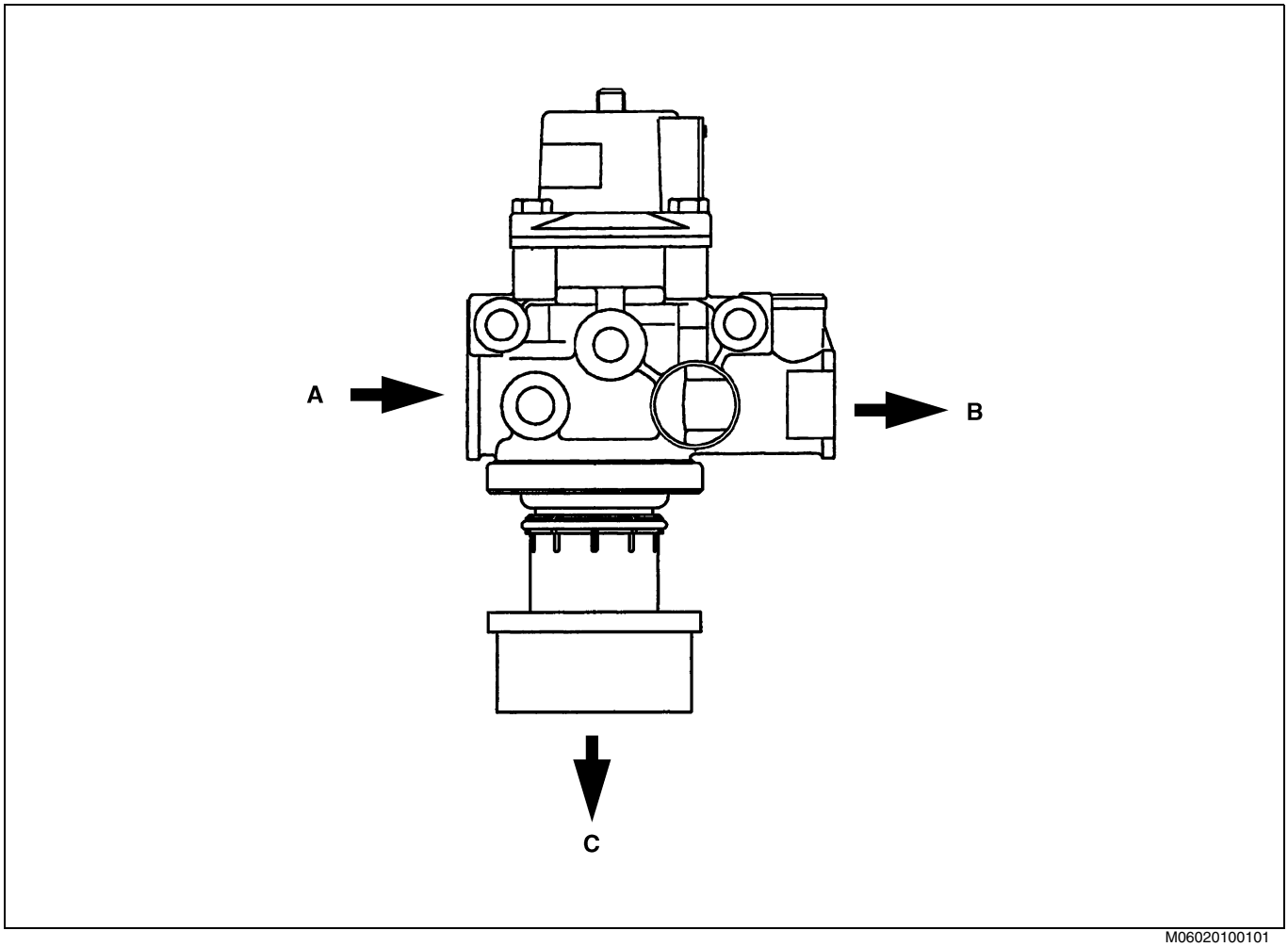
**WHEEL BRAKE (MODEL: FD) ..... BR02-79**
DATA AND SPECIFICATIONS ..... BR02-79
DESCRIPTION ..... BR02-80
SPECIAL TOOL ..... BR02-82
COMPONENT LOCATOR ..... BR02-83
OVERHAUL ..... BR02-87
ADJUSTMENT ..... BR02-91
INSPECTION AND REPAIR ..... BR02-93

**WHEEL BRAKE (MODEL: GD) ..... BR02-95**
DATA AND SPECIFICATIONS ..... BR02-95
DESCRIPTION ..... BR02-96
SPECIAL TOOL ..... BR02-100
COMPONENT LOCATOR ..... BR02-101
OVERHAUL ..... BR02-108
ADJUSTMENT ..... BR02-111
INSPECTION AND REPAIR ..... BR02-113

# PRESSURE GOVERNOR

## DESCRIPTION

M06020101BEC1002




M06020100101

| | | | |
|---|---|---|---|
| A | From air compressor | C | Exhaust |
| B | To reservoir | | |

## INSPECTION

M06020101BEH3001

### IMPORTANT POINTS-INSPECTION

**1. CHECK THE ALL PRESSURES**

| | |
|---|---|
| Cut-off pressure | 890-930 kPa {9.08-9.48 kgf/cm2, 129.15-134.89 lbf/in2} |
| Cut-in pressure | 770-860 kPa {7.85-8.77 kgf/cm2, 111.65-124.74 lbf/in2} |

**NOTICE:**

- **All pressures should be measured when it is connected to air compressor which had achieved operating temperature.**
- **Pressure governor is not necessary to be disassembled. If the above specified value is not obtained, pressure governor should not be disassembled, but be replaced.**

# AIR DRYER

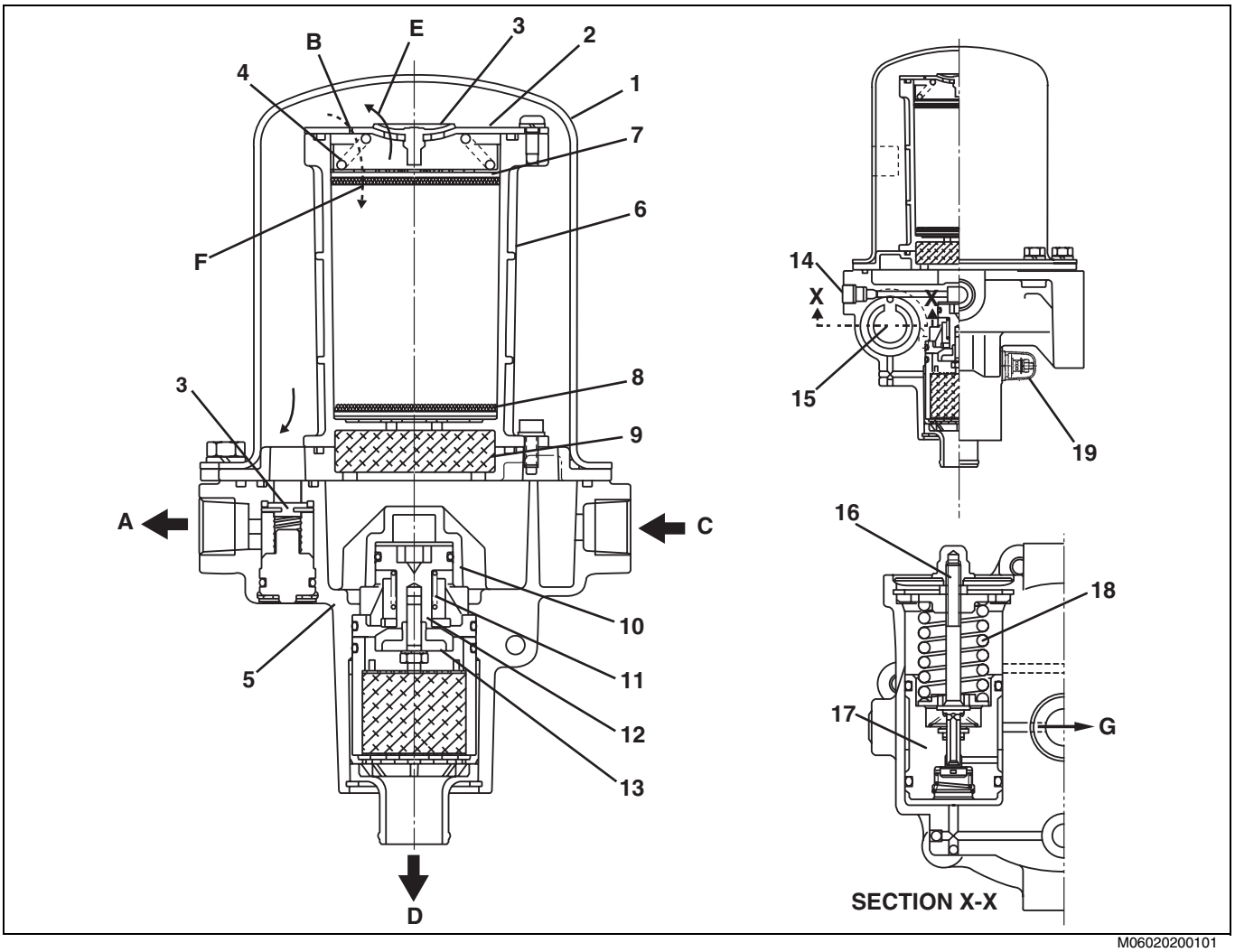
## DATA AND SPECIFICATIONS

M06020201BEI2002

| | |
|---|---|
| Type | Purge tank, desiccant, auto-purge valve. |
| Air and Water discharging time (Reclamation cycle) | Approx. 50 sec. |

## DESCRIPTION

M06020201BEC1002

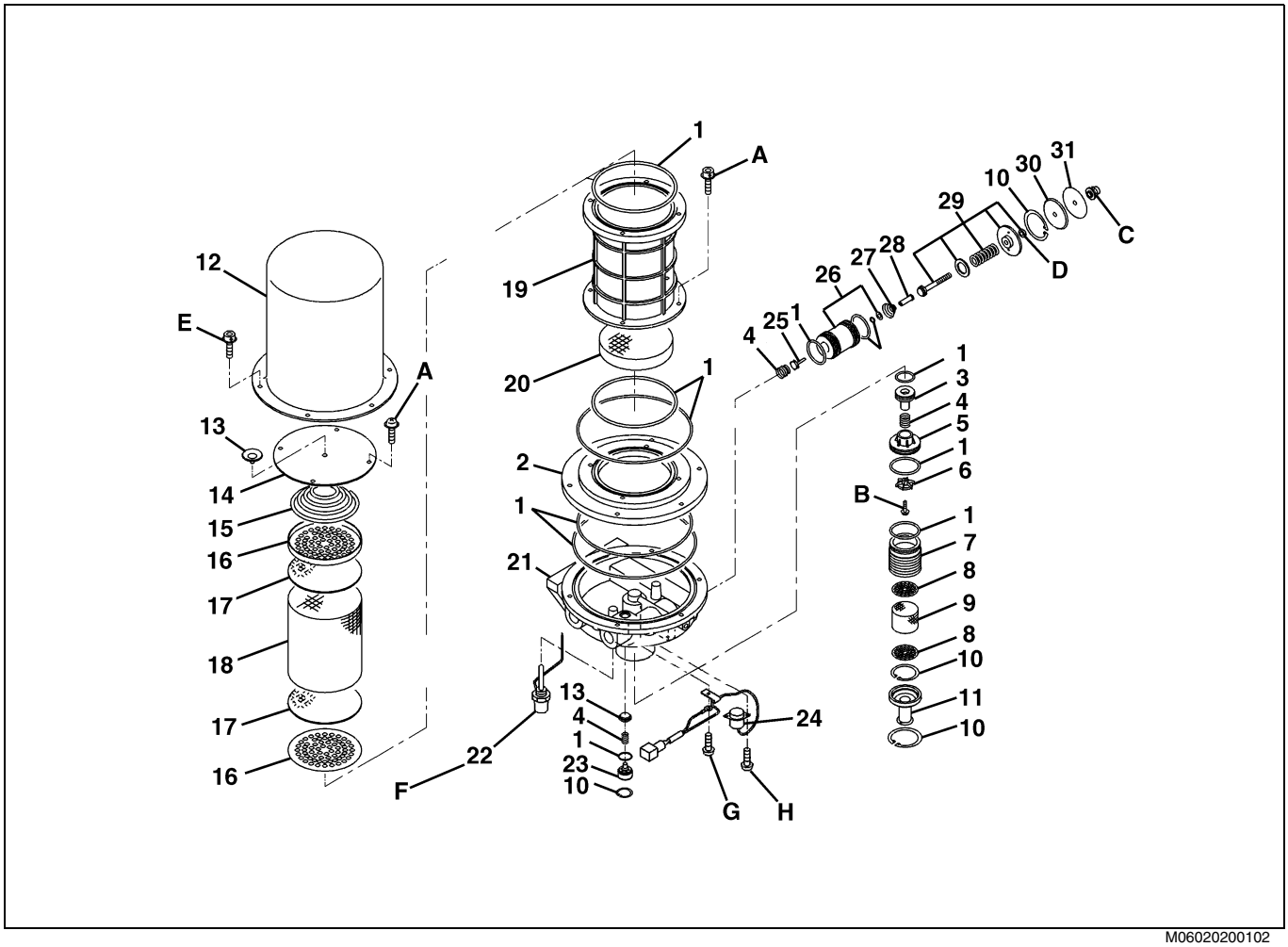



M06020200101

| | | | |
|---|---|---|---|
| 1 | Chamber (Purge tank) | 14 | Plug |
| 2 | Case cover | 15 | Pressure regulator |
| 3 | Check valve | 16 | Adjusting screw |
| 4 | Spring | 17 | Piston |
| 5 | Body | 18 | Piston spring |
| 6 | Desiccant case | 19 | Heater (If so equipped) |
| 7 | Filter | A | Outlet (Dried air to air tank) |
| 8 | Desiccant | B | Orifice |
| 9 | Oil separator filter | C | Inlet (From air compressor) |
| 10 | Valve body | D | Purged air |
| 11 | Valve spring | E | Dehumidification |
| 12 | Piston | F | Reclamation |
| 13 | Purge valve | G | To purge valve |

# COMPONENT LOCATOR

M06020201BED1002




M06020200102

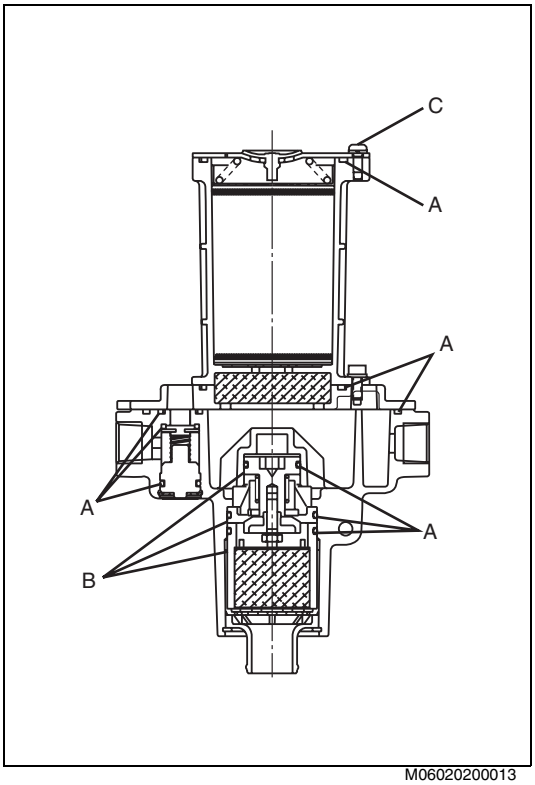
| | | | |
|---|---|---|---|
| 1 | O-ring | 17 | Filter |
| 2 | Plate | 18 | Desiccant |
| 3 | Piston | 19 | Desiccant case |
| 4 | Valve spring | 20 | Oil separator filter |
| 5 | Valve body | 21 | Body |
| 6 | Purge valve | 22 | Heater (If so equipped) |
| 7 | Silencer case | 23 | Valve stopper |
| 8 | Silencer plate | 24 | Thermostat (If so equipped) |
| 9 | Silencer | 25 | Governor valve |
| 10 | Retainer ring | 26 | Piston assembly |
| 11 | Exhaust cover | 27 | Exhaust stem spring |
| 12 | Chamber | 28 | Exhaust stem |
| 13 | Check valve | 29 | Pressure regulator assembly |
| 14 | Case cover | 30 | Valve seat |
| 15 | Set spring | 31 | Plate |
| 16 | Filter plate | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 2.0-3.9 {20-40, 1.5-2.9} | E | 17.7-27.5 {180-280, 13-20} |
| B | 3.9-6.9 {40-70, 2.9-5.0} | F | 19.6-29.4 {200-300, 14-21} |
| C | 4.9-5.9 {50-60, 3.7-4.3} | G | 1.0-1.5 {10-15, 0.7-1.1} |
| D | 6.9-7.8 {71-79, 5.2-5.7} | H | 0.5-1.0 {5-10, 0.4-0.7} |

# OVERHAUL

M06020201BEH2001



M06020200013

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the air dryer, use new O-ring, gasket and seal.

(2) Apply grease (lithium base) to each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

**2. BEFORE TIGHTEN THE BOLT WITH SPECIFIED TIGHTENING TORQUE, TAP ALL OVER THE OUTER SURFACE OF THE DESICCANT CASE WITH A PLASTIC HAMMER.**

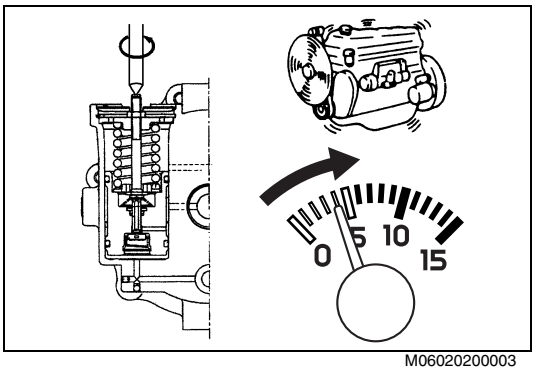
- **C: Bolt**

## IMPORTANT POINTS - MOUNTING

**1. INSPECTION**

(1) Operate the engine and raise the air pressure until the air discharge from the purge valve, then stop the engine.
(The pressure reaches the valve opening pressure of the air pressure regulator).

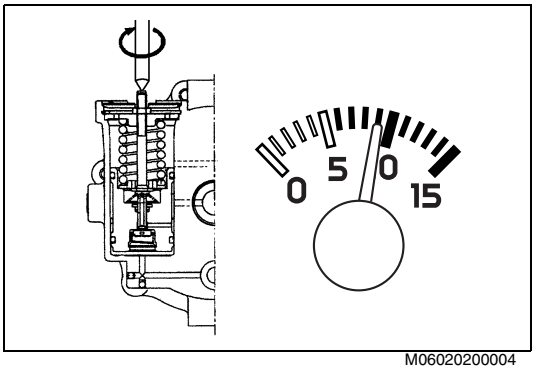
a. Check to see that there is no air leakage from the purge valve.



M06020200003

**2. ADJUSTMENT**

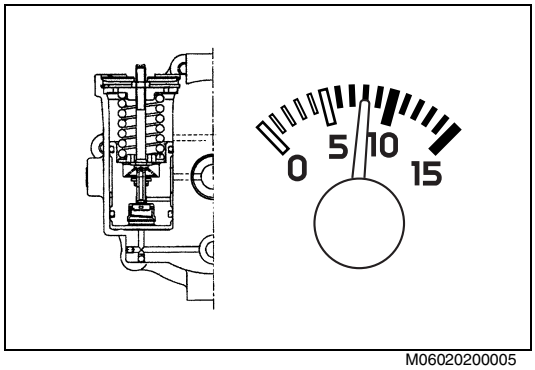
(1) Loosen the adjusting screw until the rod spring tension is released, and start and idle the engine to charge the air for the air tank.



M06020200004

(2) Tighten the adjusting screw gradually till the air pressure gauge indicate valve opening pressure shown below and the air starts to discharge from purge valve.
**Governor valve opening pressure: 880kpa {9.0 kgf/cm$^2$, 128 lbf/in$^2$.}**

(3) Tighten the adjusting screw lock nut.

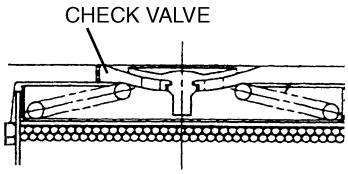
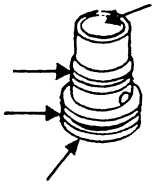
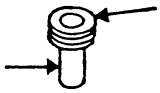
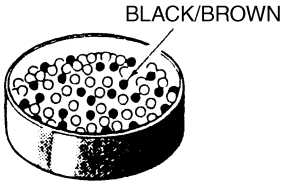


M06020200005

(4) Watch the air pressure gauge needle and see that it stops at the valve closing pressure shown below.
**Governor valve closing pressure: 780 kpa {8.0 kgf/cm$^2$, 114 lbf/in$^2$.}**

# INSPECTION AND REPAIR

M06020201BEH3004

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Check valve and valve seat surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**   |
| **Valve body sliding surface and purge valve seat surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**  |
| **Piston sliding surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**  |
| **Purge valve seat surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**  |
| **Desiccant: Contamination and deterioration** | **—** | **Discolored, more than 1/5 of the quantity.** | **Replace.** | **Visual check**   |

# SAFETY VALVE

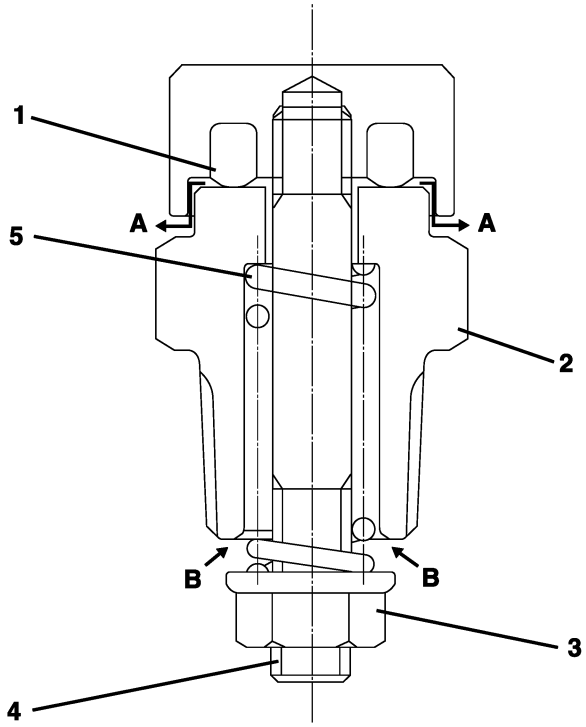
## DATA AND SPECIFICATIONS

M06020501BEI2001

| | |
|---|---|
| Type | Spring type |
| Valve opening pressure | 931.4-970.6 kPa {9.5-9.9 kgf/cm$^2$, 135.2-140.8 lbf/in$^2$.} |

## DESCRIPTION

M06020501BEC1001




M06020500001

| | | | |
|---|---|---|---|
| 1 | Valve | 5 | Compression spring |
| 2 | Body | A | Exhaust |
| 3 | Nut | B | From air tank (Pressure air) |
| 4 | Bolt | | |

## INSPECTION AND REPAIR

M06020501BEH3001

Unit: kPa {kgf/cm$^2$, lbf/in$^2$.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Valve opening pressure | 931.4-970.6 {9.5-9.9, 135.2-140.8} | — | Replace, if necessary. | Measure |

# BRAKE VALVE (MAKER:SANWA SEIKI)

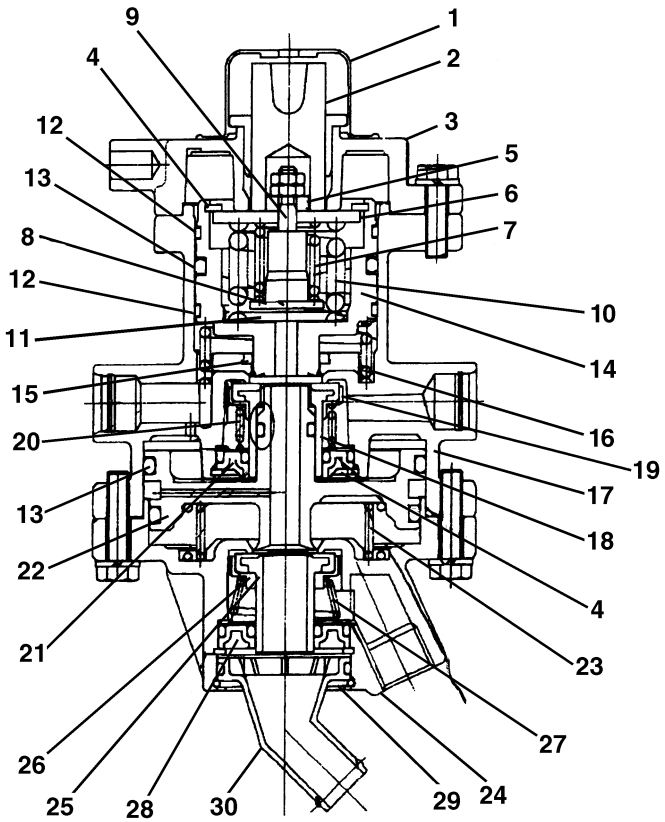
## DATA AND SPECIFICATIONS

M06020601BEI2001

| | |
|---|---|
| **Type** | **Dual pistons and valves with a plunger type pedal** |

## DESCRIPTION

M06020601BEC1002

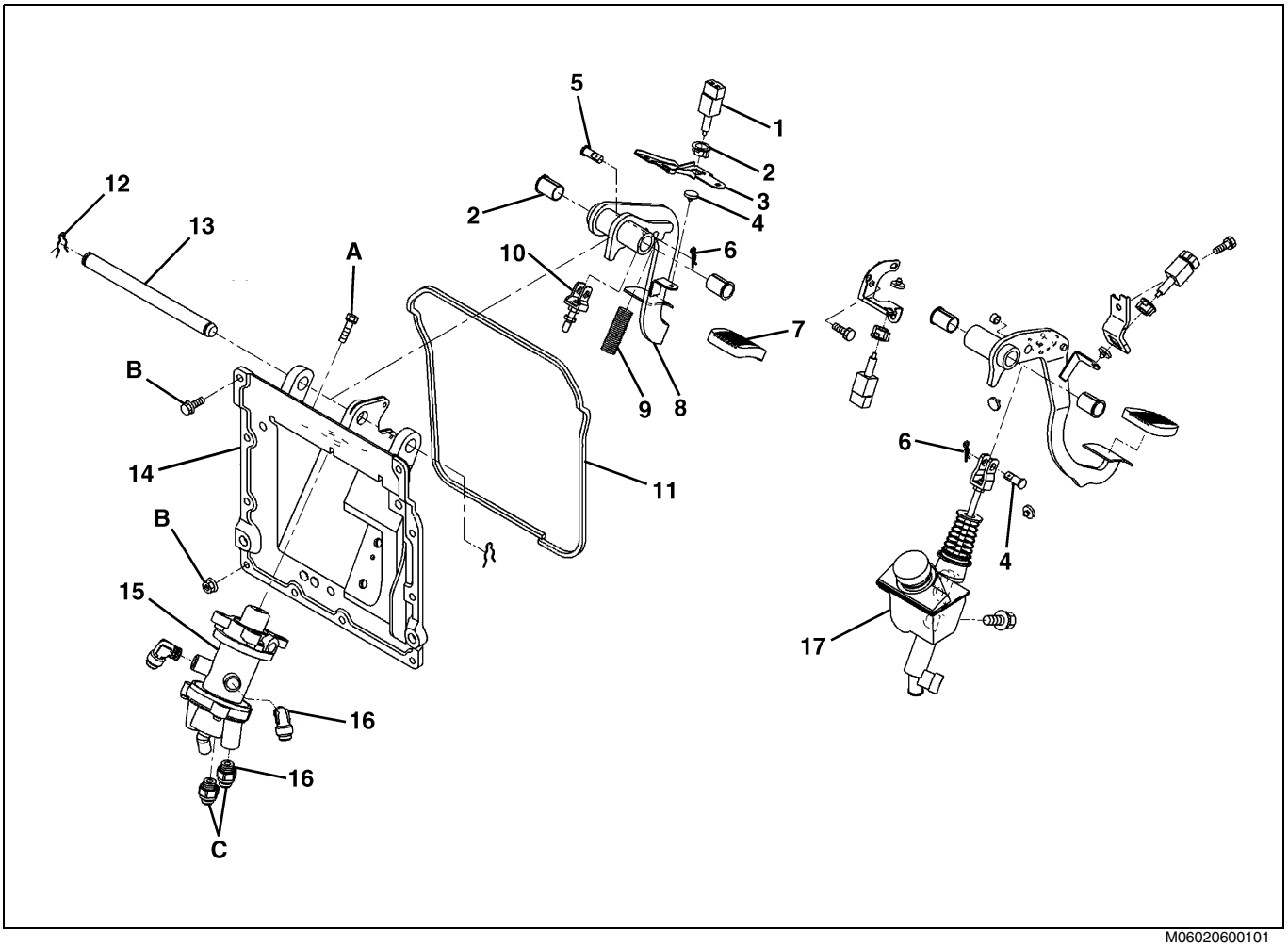



M06020600032

| | | | |
|---|---|---|---|
| 1 | Boot | 16 | Primary piston return spring |
| 2 | Plunger | 17 | Primary valve body |
| 3 | Brake valve cover | 18 | Primary feed valve |
| 4 | Retainer ring | 19 | Retainer |
| 5 | Guide ring | 20 | Primary feed valve return spring |
| 6 | Spring seat | 21 | Primary feed valve retainer |
| 7 | Sub spring | 22 | Secondary piston |
| 8 | Shim | 23 | Secondary piston return spring |
| 9 | Stem | 24 | Secondary valve body |
| 10 | Main spring | 25 | Secondary feed valve |
| 11 | Shim | 26 | Retainer |
| 12 | Guide ring | 27 | Secondary feed valve return spring |
| 13 | O-ring | 28 | Secondary feed valve retainer |
| 14 | Primary piston | 29 | C-ring |
| 15 | Guide | 30 | Exhaust port |

# COMPONENT LOCATOR

M06020601BED1001

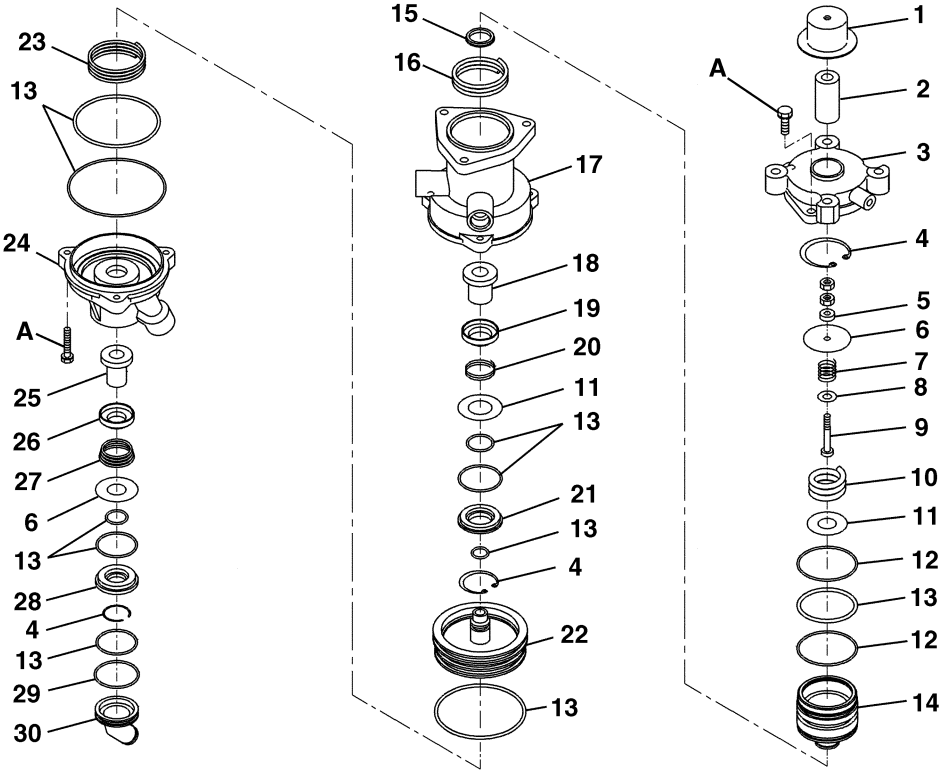



M06020600101

| | | | |
|---|---|---|---|
| 1 | Stop lamp switch | 10 | Push rod |
| 2 | Bushing | 11 | Seal |
| 3 | Bracket | 12 | Clip |
| 4 | Buffer | 13 | Shaft |
| 5 | Pin | 14 | Pedal bracket |
| 6 | R-pin | 15 | Brake valve |
| 7 | Pedal pad | 16 | Connector |
| 8 | Brake pedal | 17 | Clutch master cylinder |
| 9 | Return spring | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 9.5-18.5 {97-188, 7.1-13.5} | C | 24.4-34.4 {250-330, 18-25} |
| B | 18-31 {184-316, 14-22} | | |




M06020600102

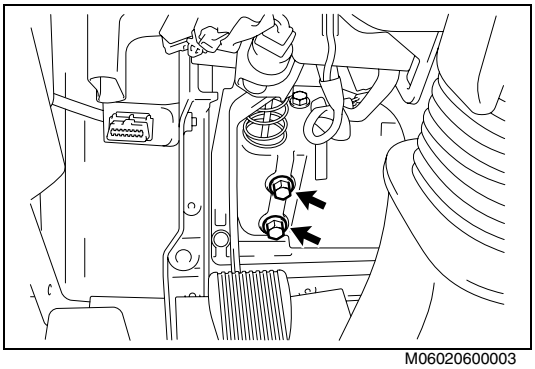
| | | | |
|---|---|---|---|
| 1 | Boot | 16 | Primary piston return spring |
| 2 | Plunger | 17 | Primary valve body |
| 3 | Brake valve cover | 18 | Primary feed valve |
| 4 | Retainer ring | 19 | Retainer |
| 5 | Guide ring | 20 | Primary feed valve return spring |
| 6 | Spring seat | 21 | Primary feed valve retainer |
| 7 | Sub spring | 22 | Secondary piston |
| 8 | Shim | 23 | Secondary piston return spring |
| 9 | Stem | 24 | Secondary valve body |
| 10 | Main spring | 25 | Secondary feed valve |
| 11 | Shim | 26 | Retainer |
| 12 | Guide ring | 27 | Secondary feed valve return spring |
| 13 | O-ring | 28 | Secondary feed valve retainer |
| 14 | Primary piston | 29 | C-ring |
| 15 | Guide | 30 | Exhaust port |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 5.9-7.4 {60-75, 4.3-5.4} | | |

# OVERHAUL

M06020601BEH2002


M06020600003

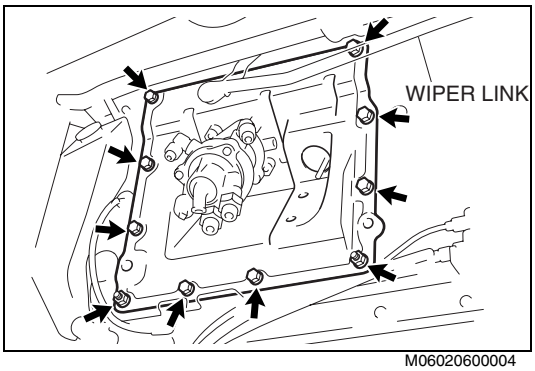
## IMPORTANT POINTS - DISMOUNTING

**1. REMOVE THE CLUTCH MASTER CYLINDER.**

**HINT:**

**Even if without removing the clutch master cylinder, pedal bracket can be removed only to the length of the clutch hose.**

**2. DISCONNECT THE NYLON TUBE.**



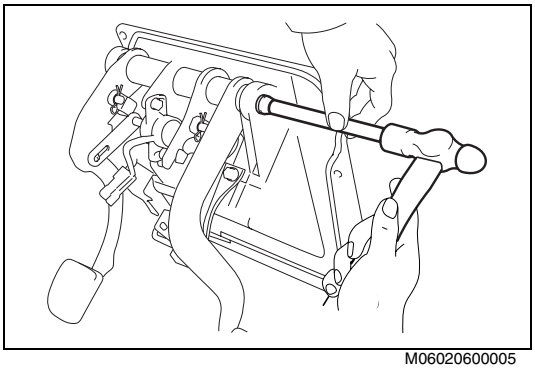
M06020600004

**3. REMOVE THE PEDAL BRACKET ASSEMBLY.**

(1) Loosen the bolt and nut to remove the pedal bracket assembly.

**NOTICE:**

**Before removing the pedal bracket, put the wiper link upward.**

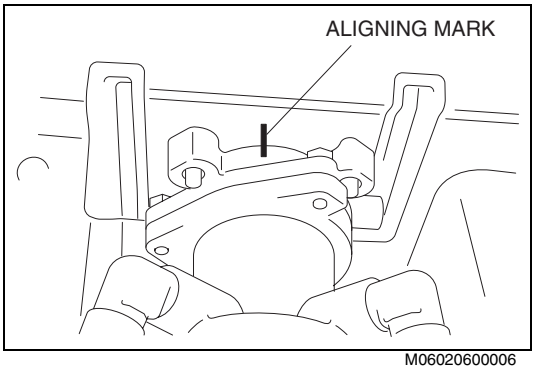

M06020600005

**4. REMOVE THE BRAKE PEDAL.**

(1) Tap the shaft lightly using a brass rod and a hammer, remove the brake pedal from the pedal bracket assembly.

**NOTICE:**

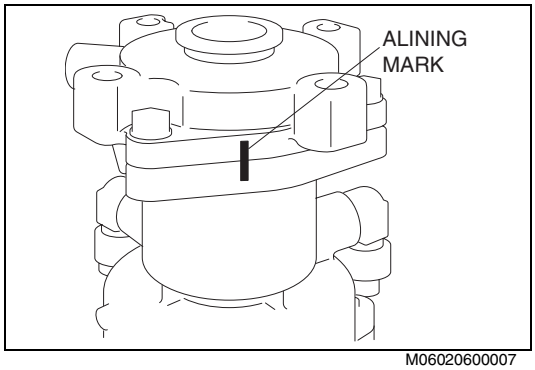
**Do not pull out the shaft because the brake pedal and the clutch pedal are installed by one pedal shaft.**



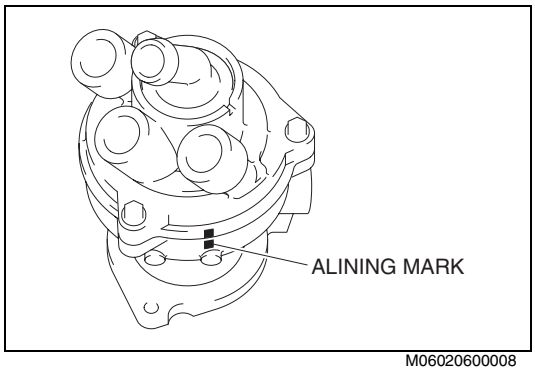
M06020600006

**5. REMOVE THE BRAKE VALVE ASSEMBLY.**

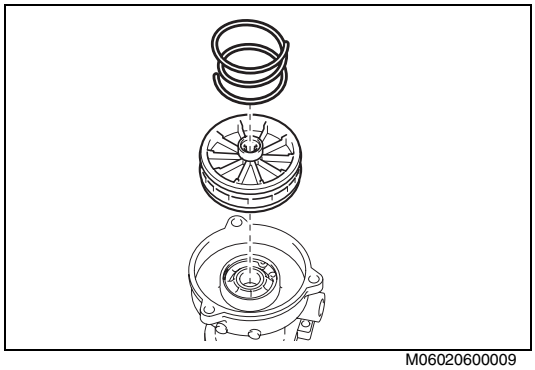
(1) Apply aligning marks on the brake valve assembly and pedal bracket assembly.



M06020600007



M06020600008


M06020600009

## IMPORTANT POINTS - DISASSEMBLY

**NOTICE:**
**Before disassembling the brake valve, apply aligning marks on the brake valve cover, primary valve body and secondary valve body.**

**1. REMOVE THE PRIMARY PISTON ASSEMBLY.**

**2. REMOVE THE SECONDARY VALVE BODY.**

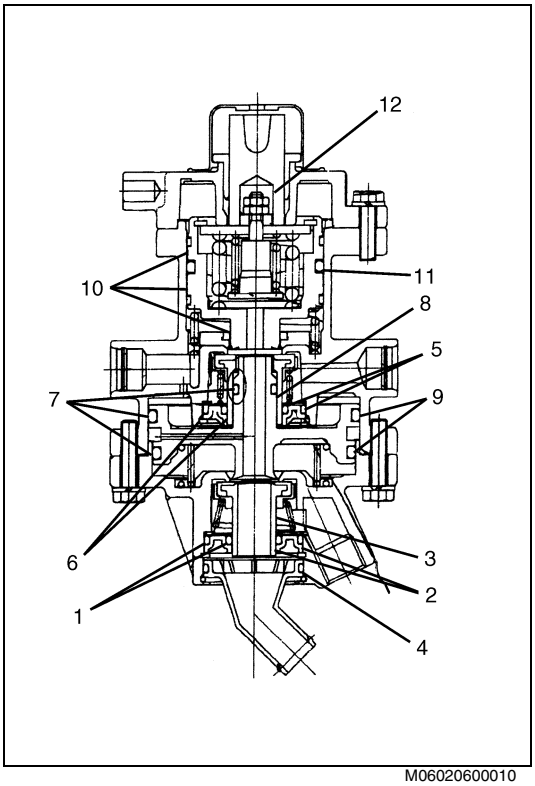
**3. REMOVE THE SECONDARY PISTON.**

**NOTICE:**
**Pull out with hands to prevent the seat part of the secondary piston from being damaged by using a plier etc. If not with hands, secondary piston should not be reused.**

**4. REMOVE THE PRIMARY FEED VALVE.**

**5. REMOVE THE EXHAUST PORT.**

**6. REMOVE THE SECONDARY FEED VALVE**



M06020600010

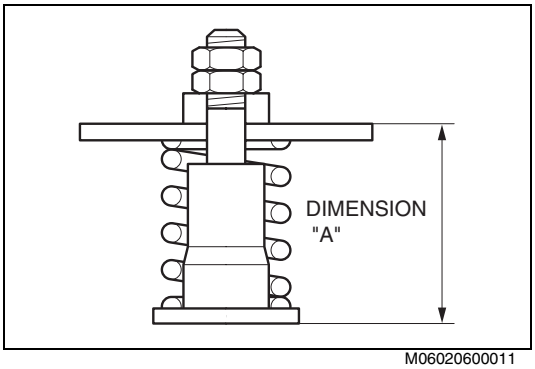
## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When reassembling the brake valve, replace the O-rings and retainer rings with new ones.

(2) Apply adequate amount of silicone grease on the grooves for the O-ring and to the sliding surfaces of the component parts.

1. Secondary feed valve retainer O-ring
2. Secondary feed valve retainer
3. Secondary feed valve
4. Exhaust port O-ring
5. Primary feed valve retainer O-ring
6. Primary feed valve retainer
7. Secondary piston O-ring
8. Secondary piston
9. Primary valve body
10. Primary piston
11. Primary piston O-ring
12. Plunger



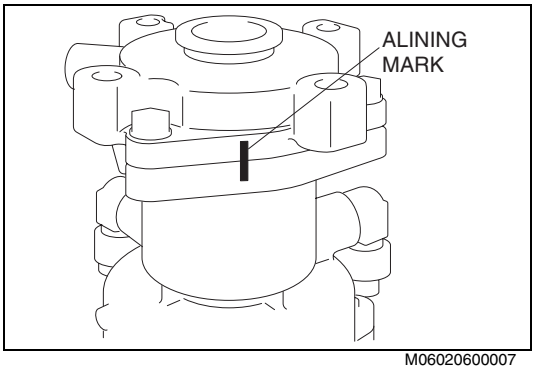
M06020600011

**2. ASSEMBLE THE STEM, SPRING, SPRING SEAT AND SHIM.**

(1) Assemble the sub spring. At this time, adjust dimension "A" and the spring compression "P" by means of the lock nut and the shim.

**NOTICE:**
**In adjusting the spring compression, the axial play of the spring must be removed.**

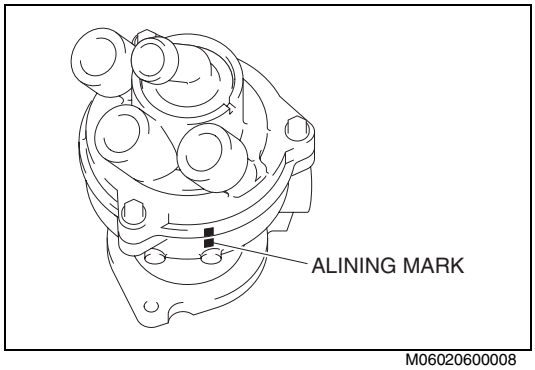
**Dimension "A": 27.15-27.55 mm {1.0689-1.0846 in.}**
**Setting load: 0-9.8 N {0-1 kgf, 0-2.2 lbf}**



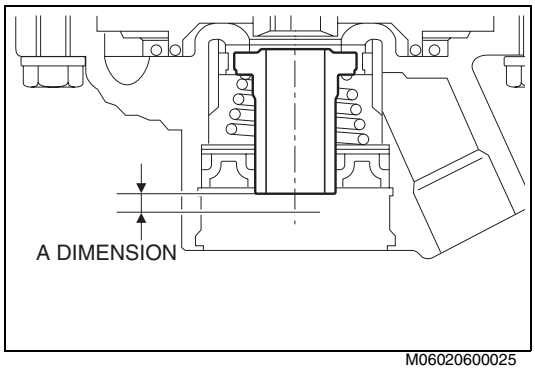
M06020600007

**3. ALIGN THE VALVE COVER AND VALVE BODIES.**

(1) When assemble the brake valve cover, primary body and secondary body, align the marks which were applied at disassembly.



M06020600008



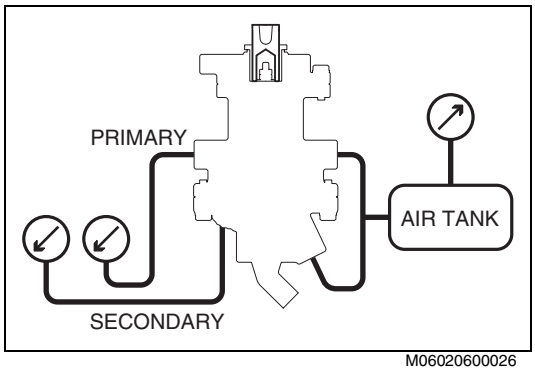
M06020600025

**4. INSPECTION AND ADJUSTMENT**

(1) Brake valve

a. Measure the secondary feed valve stroke (dimension A from starting to release the plunger to completing to fully release the plunger).

**A dimension: 0.6 mm {0.0236 in.} or above**

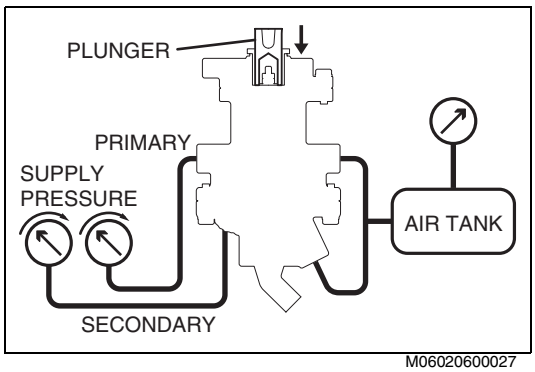


M06020600026

b. Connect the brake valve, nylon tube, air pressure gauge, and air tank as shown in the figure.

c. Set the air tank pressure at 830 kPa {8.5 kgf/cm$^2$, 120.87 lbf/in$^2$}.

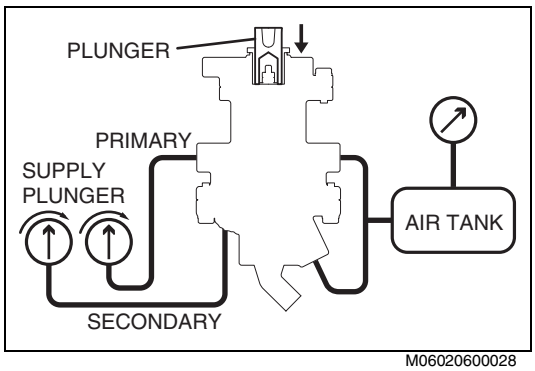
d. Apply soap water to the exhaust port and check to see there is no air leakage.



M06020600027

e. Drive in slowly the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary air pressure gauges start to rise. If the measurements do not match with the standard values, adjust by the shim of the main spring.

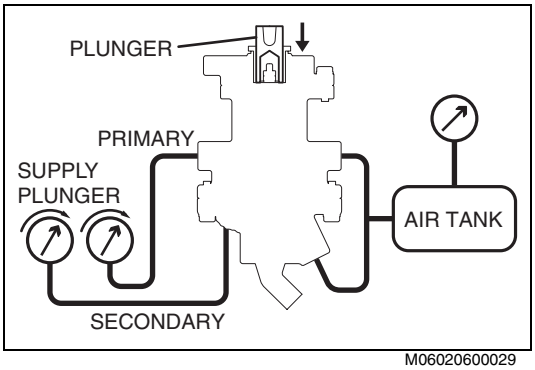
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 1.6-2.4 mm {0.0630-0.0944 in.} |
| Supply pressure | 10-25 kPa {0.1-0.25 kgf/cm$^2$, 1.43-3.55 lbf/in$^2$} |



M06020600028

f. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point immediately before that the primary and secondary pressure increases rapidly (bending point). If the measurements do not match with the standard values, replace each spring.

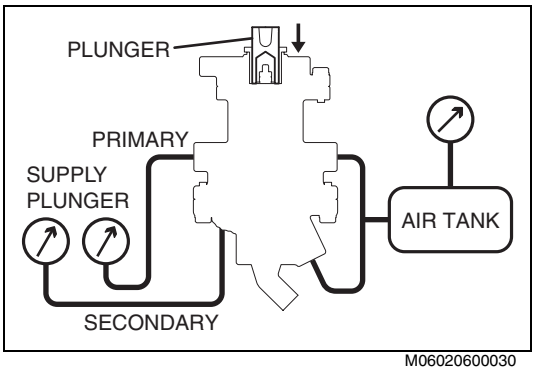
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 4.85-5.95 mm {0.1910-0.2342 in.} |
| Supply pressure | 186 kPa {1.9 kgf/cm$^2$, 27.02 lbf/in$^2$} |



M06020600029

g. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary pressures increase rapidly. If the measurements do not match with the standard values, replace each spring.

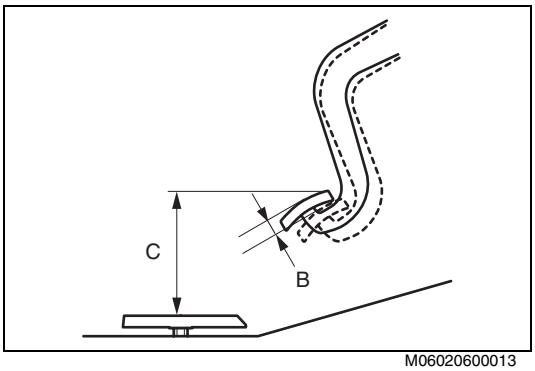
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 7.19-8.51 mm {0.2831-0.3350 in.} |
| Supply pressure | 593 kPa {6.0 kgf/cm$^2$, 85.32 lbf/in$^2$} |



M06020600030

h. Drive in further the plunger. Measure the pedal stepping down angle and supply pressure at the point where the primary and secondary pressure are maximum. If the measurements do not match with the standard values, replace each spring.

| Measurement item | Standard value |
|---|---|
| Plunger stroke | 9.89-11.31 mm {0.3894-0.4452 in.} |
| Supply pressure | 830 kPa {8.5 kgf/cm$^2$, 120.87 lbf/in$^2$} |



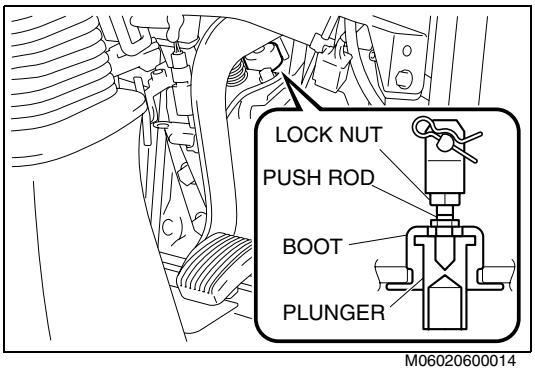
M06020600013

(2) Brake pedal

a. Make sure that the installing height of the brake pedal "C" and the pedal play "B".

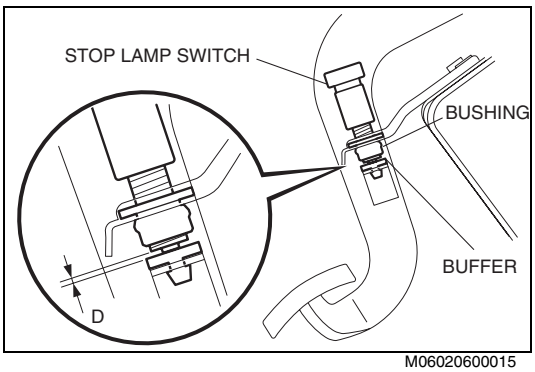
**"B": 2-5 mm {0.0788-0.1968 in.}**

**"C": 149.6-159.6 mm {5.890-6.283 in.}**



M06020600014

b. If the pedal play is out of the standard value, loosen the lock nut and turn the push rod to adjust the pedal play to the standard value.



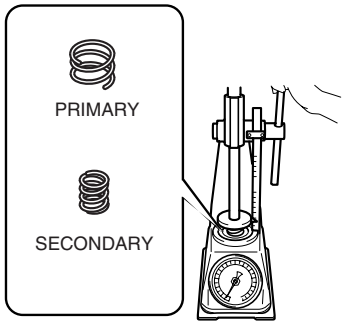
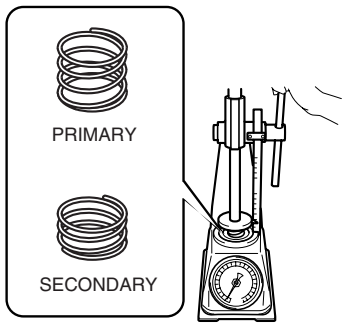
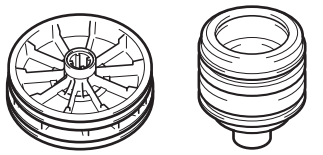
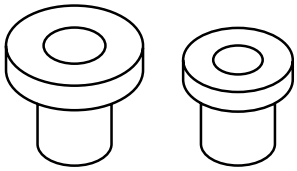
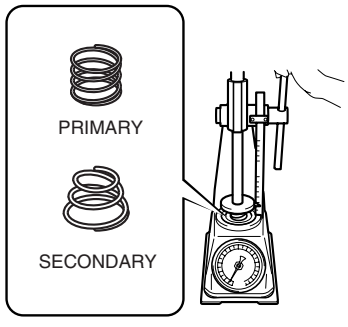
M06020600015

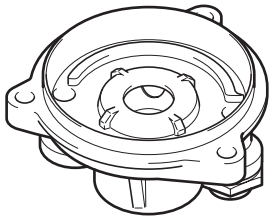
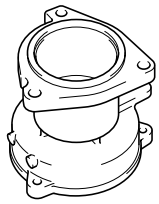
(3) Check the clearance between stop lamp switch and buffer.

**"D": 0.5-1.5 mm {0.0197-0.0590 in.}**

# INSPECTION AND REPAIR

M06020601BEH3001

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Main spring:<br>Free length/<br>setting length/<br>setting load** | **29.4 mm {1.16 in.}/<br>27.6 mm {1.09 in.}/<br>158.0 N<br>{16.1 kgf, 35.99 lbf}** | **28.6 mm<br>{1.13 in.}** | **Replace, if necessary.** | **Visual check and measure**<br>  |
| **Sub spring:<br>Free length/<br>setting length/<br>setting load** | **21.6 mm {0.85 in.}/<br>21.6 mm {0.85 in.}/<br>9.8 N<br>{1.0 kgf, 2.20 lbf}<br>or more** | **20.5 mm<br>{0.81 in.}** | | |
| **Primary and Secondary piston return spring:<br>Free length/<br>setting length/<br>setting load** | **Primary:<br>43.2 mm {1.70 in.}/<br>16.5 mm {0.65 in.}/<br>95.1 N<br>{9.7 kgf, 21.38 lbf}** | **40.5 mm<br>{1.59 in.}** | **Replace, if necessary.** | **Visual check and measure**<br>  |
| | **Secondary:<br>45.8 mm {1.80 in.}/<br>16.0 mm {0.63 in.}/<br>49.0 N<br>{5.0 kgf, 11 lbf}** | **43.2 mm<br>{1.70 in.}** | | |
| **Primary and secondary piston:<br>Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Primary and secondary feed valve:<br>Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Primary and secondary feed valve return spring:<br>Free length/<br>setting length/<br>setting load** | **Primary:<br>21.4 mm {0.84 in.}/<br>12.5 mm {0.49 in.}/<br>52.0 N<br>{5.3 kgf, 11.68 lbf}** | **20.4 mm<br>{0.80 in.}** | **Replace, if necessary.** | **Visual check and measure**<br>  |
| | **Secondary:<br>22.8 mm {0.90 in.}/<br>13.0 mm {0.51 in.}/<br>49.0 N<br>{5.0 kgf, 11.02 lbf}** | **21.8 mm<br>{1.13 in.}** | | |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Secondary valve body: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Primary valve body: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# BRAKE VALVE (WITH ES START)

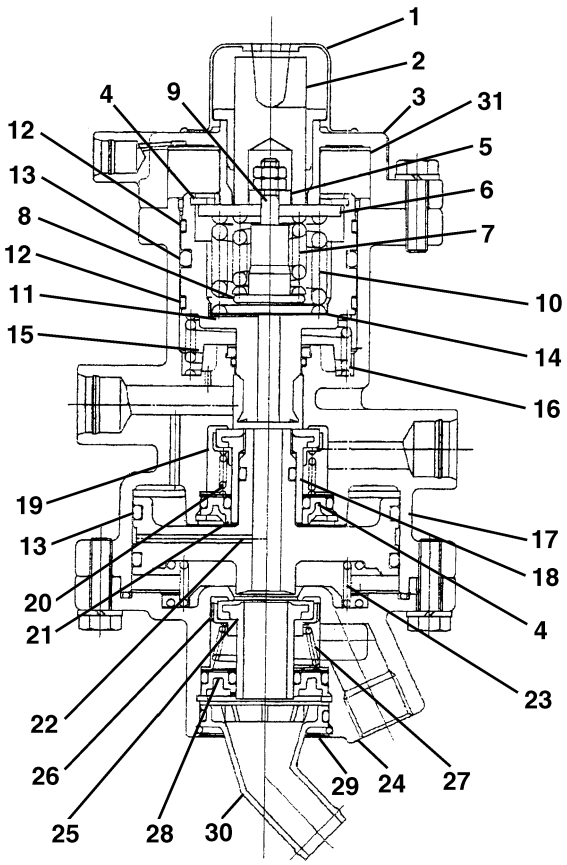
## DATA AND SPECIFICATIONS

M06020601BEI2003

| | |
|---|---|
| **Type** | **Dual pistons and valves with a plunger type pedal** |

## DESCRIPTION

M06020601BEC1004

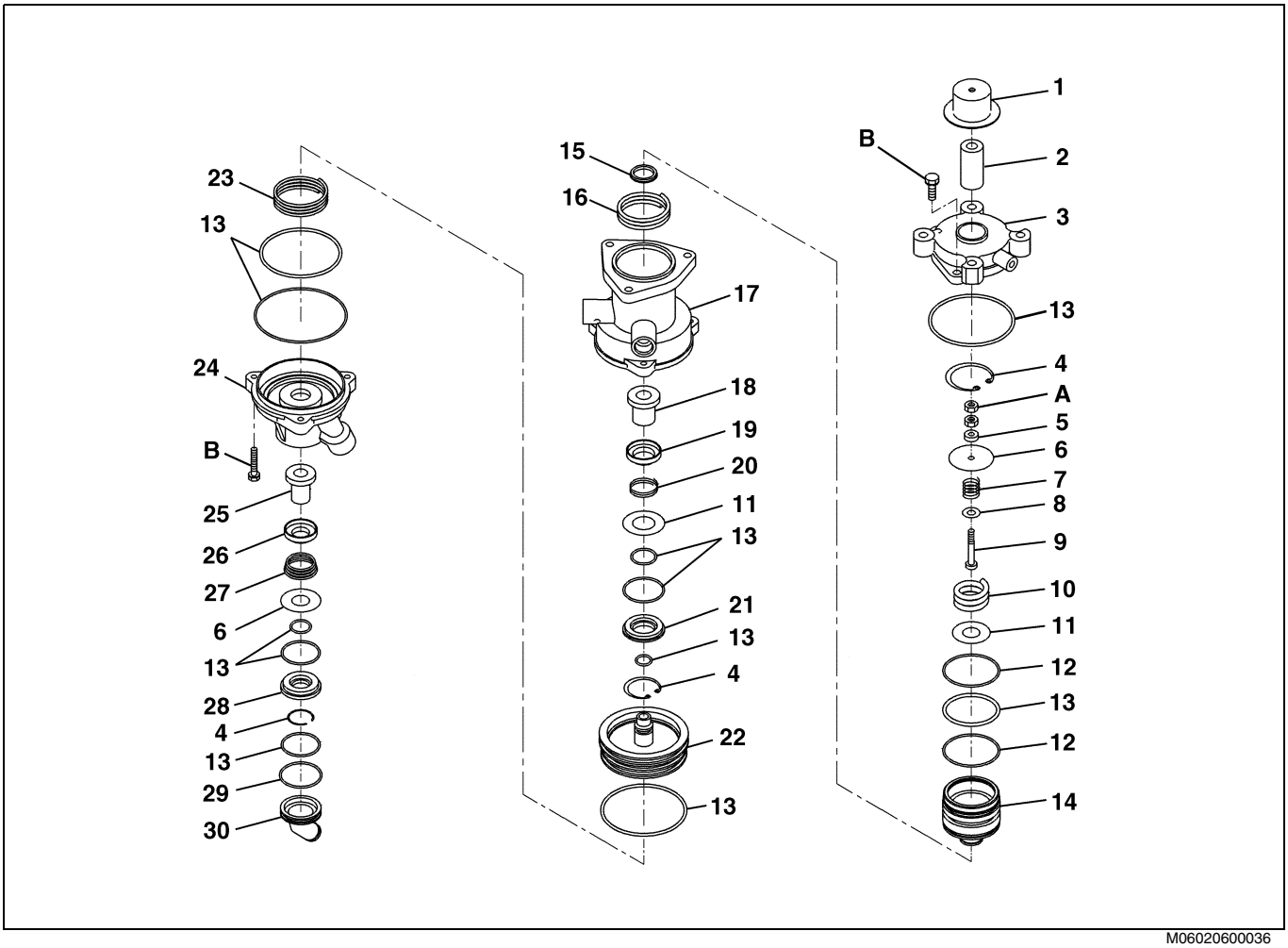



M06020600035

| | | | |
|---|---|---|---|
| 1 | Boot | 16 | Primary piston return spring |
| 2 | Plunger | 17 | Primary valve body |
| 3 | Brake valve cover | 18 | Primary feed valve |
| 4 | Retainer ring | 19 | Retainer |
| 5 | Guide ring | 20 | Primary feed valve return spring |
| 6 | Spring seat | 21 | Primary feed valve retainer |
| 7 | Sub spring | 22 | Secondary piston |
| 8 | Shim | 23 | Secondary piston return spring |
| 9 | Stem | 24 | Secondary valve body |
| 10 | Main spring | 25 | Secondary feed valve |
| 11 | Shim | 26 | Retainer |
| 12 | Guide ring | 27 | Secondary feed valve return spring |
| 13 | O-ring | 28 | Secondary feed valve retainer |
| 14 | Primary piston | 29 | C-ring |
| 15 | Guide | 30 | Exhaust port |

# COMPONENT LOCATOR

M06020601BED1003




M06020600036

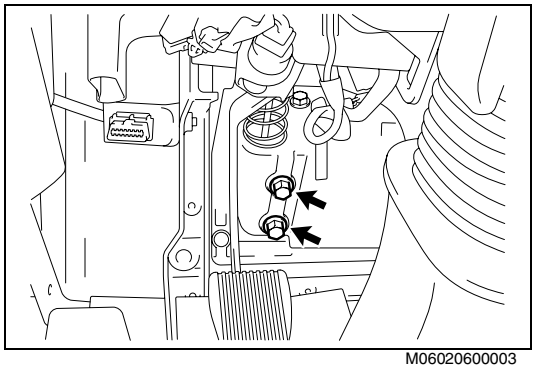
| | | | |
|---|---|---|---|
| 1 | Boot | 16 | Primary piston return spring |
| 2 | Plunger | 17 | Primary valve body |
| 3 | Brake valve cover | 18 | Primary feed valve |
| 4 | Retainer ring | 19 | Retainer |
| 5 | Guide ring | 20 | Primary feed valve return spring |
| 6 | Spring seat | 21 | Primary feed valve retainer |
| 7 | Sub spring | 22 | Secondary piston |
| 8 | Shim | 23 | Secondary piston return spring |
| 9 | Stem | 24 | Secondary valve body |
| 10 | Main spring | 25 | Secondary feed valve |
| 11 | Shim | 26 | Retainer |
| 12 | Guide ring | 27 | Secondary feed valve return spring |
| 13 | O-ring | 28 | Secondary feed valve retainer |
| 14 | Primary piston | 29 | C-ring |
| 15 | Guide | 30 | Exhaust port |

**Tightening torque** **N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 2.9-4.9 {30-50, 2.2-3.6} | B | 5.9-7.4 {60-75, 4.3-5.4} |

# OVERHAUL

M06020601BEH2004


M06020600003

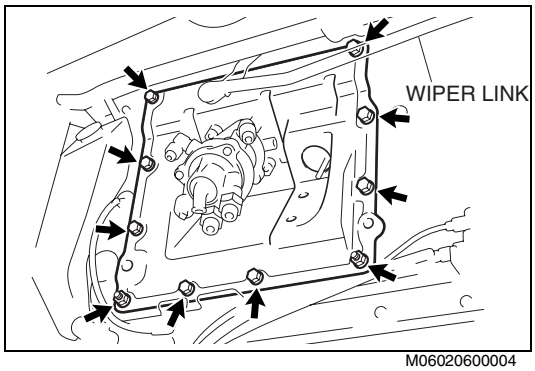
## IMPORTANT POINTS - DISMOUNTING

**1. REMOVE THE CLUTCH MASTER CYLINDER.**

**HINT:**

**Even if without removing the clutch master cylinder, pedal bracket can be removed only to the length of the clutch hose.**

**2. DISCONNECT THE NYLON TUBE.**



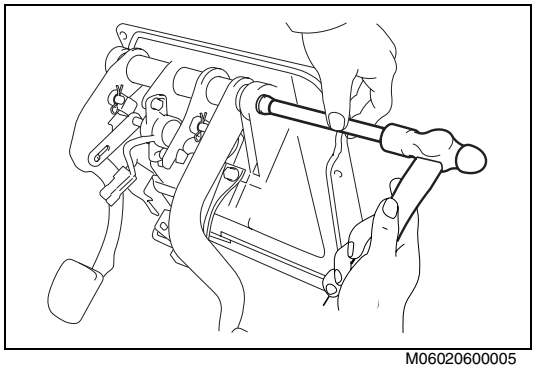
M06020600004

**3. REMOVE THE PEDAL BRACKET ASSEMBLY.**

(1) Loosen the bolt and nut to remove the pedal bracket assembly.

**NOTICE:**

**Before removing the pedal bracket, put the wiper link upward.**

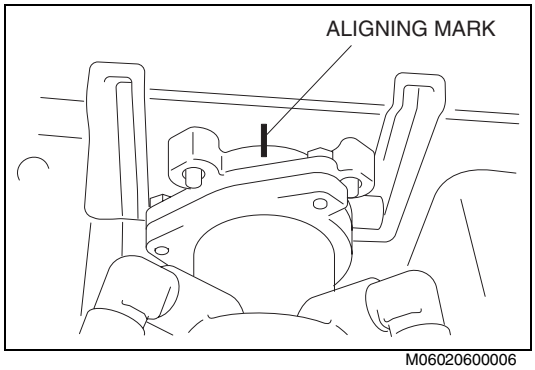

M06020600005

**4. REMOVE THE BRAKE PEDAL.**

(1) Tap the shaft lightly using a brass rod and a hammer, remove the brake pedal from the pedal bracket assembly.

**NOTICE:**

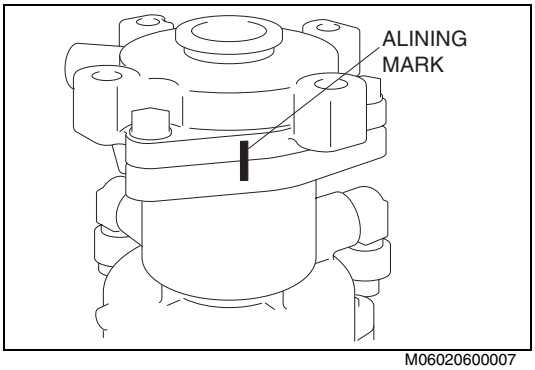
**Do not pull out the shaft because the brake pedal and the clutch pedal are installed by one shaft.**



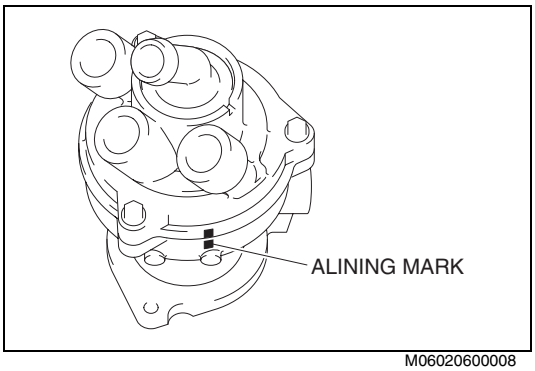
M06020600006

**5. REMOVE THE BRAKE VALVE ASSEMBLY.**

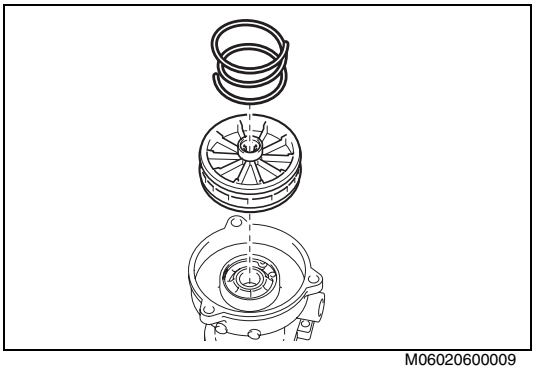
(1) Apply alighning marks on the brake valve assembly and pedal bracket assembly.



M06020600007



M06020600008


M06020600009

## IMPORTANT POINTS - DISASSEMBLY

**NOTICE:**
**Before disassembling the brake valve, apply aligning marks on the brake valve cover, primary valve body and secondary valve body.**

**1. REMOVE THE PRIMARY PISTON ASSEMBLY.**

**2. REMOVE THE SECONDARY VALVE BODY.**

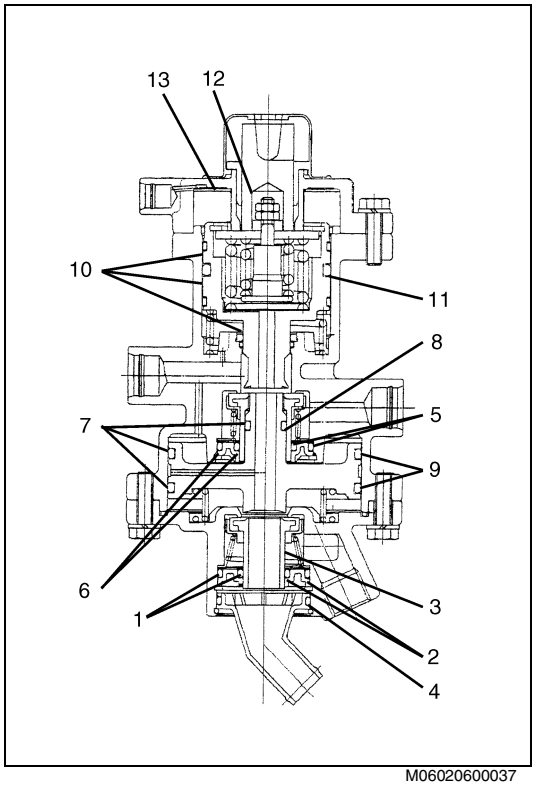
**3. REMOVE THE SECONDARY PISTON.**

**NOTICE:**
**Pull out with hands to prevent the seat part of the secondary piston from being damaged by using a pryer etc. If not with hands, secondary piston should not be reused.**

**4. REMOVE THE PRIMARY FEED VALVE.**

**5. REMOVE THE EXHAUST PORT.**

**6. REMOVE THE SECONDARY FEED VALVE.**



M06020600037

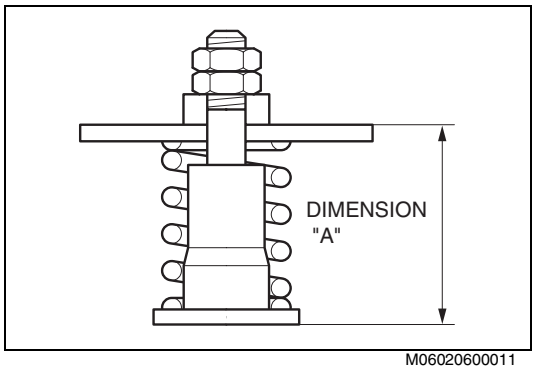
## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When reassembling the brake valve, replace the O-rings and retainer rings with new ones.

(2) Apply adequate amount of silicone grease on the grooves for the O-ring and to the sliding surfaces of the component parts.

1. Secondary feed valve retainer O-ring
2. Secondary feed valve retainer
3. Secondary feed valve
4. Exhaust port O-ring
5. Primary feed valve retainer O-ring
6. Primary feed valve retainer
7. Secondary piston O-ring
8. Secondary piston
9. Primary valve body
10. Primary piston
11. Primary piston O-ring
12. Plunger
13. Piston



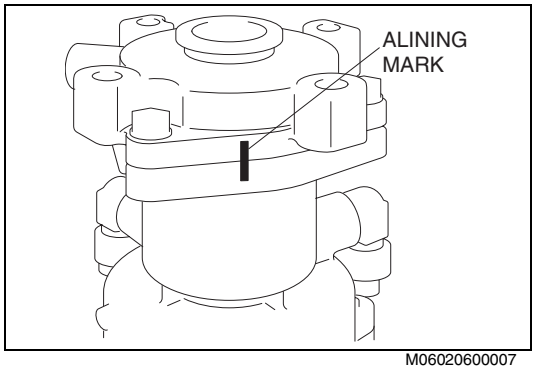
M06020600011

**2. ASSEMBLE THE STEM, SPRING, SPRING SEAT AND SHIM.**

(1) Assemble the sub spring. At this time, adjust dimension "A" and the spring compression "P" by means of the lock nut and the shim.

**NOTICE:**
**In adjusting the spring compression, the axial play of the spring must be removed.**

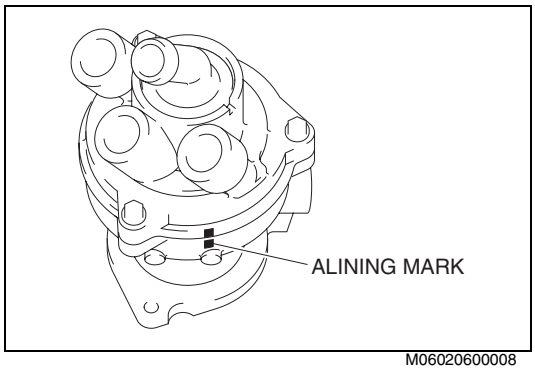
**Dimension "A": 27.15-27.55 mm {1.0689-1.0846 in.}**
**Setting load: 0-9.8 N {0-1 kgf, 0-2.2 lbf}**



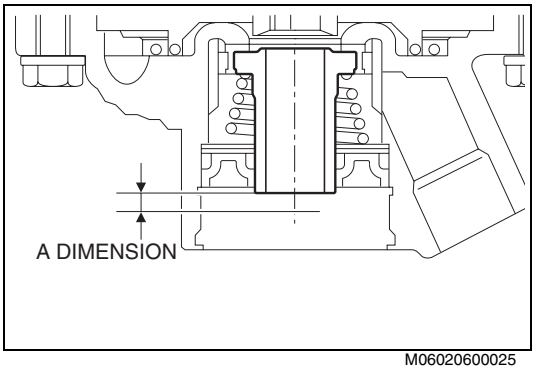
M06020600007

**3. ALIGN THE VALVE COVER AND VALVE BODIES.**

(1) When assemble the brake valve cover, primary body and secondary body, align the marks which were applied at disassembly.



M06020600008



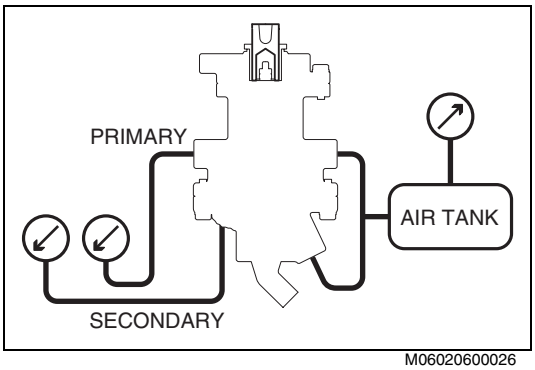
M06020600025

## 4. INSPECTION AND ADJUSTMENT

(1) Brake valve

a. Measure the secondary feed valve stroke (dimension A from starting to release the plunger to completing to fully release the plunger).

**A dimension: 0.6 mm {0.0236 in.} or above**

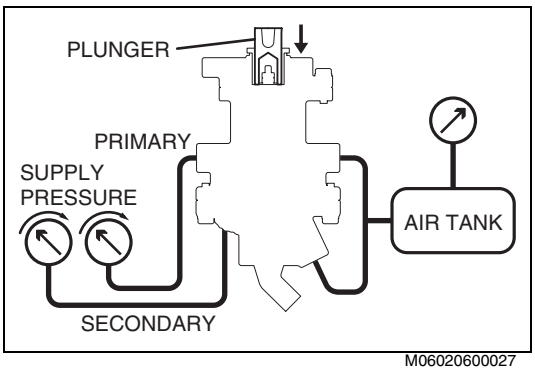


M06020600026

b. Connect the brake valve, nylon tube, air pressure gauge, and air tank as shown in the figure.

c. Set the air tank pressure at 830 kPa {8.5 kgf/cm$^2$, 120.87 lbf/in$^2$}.

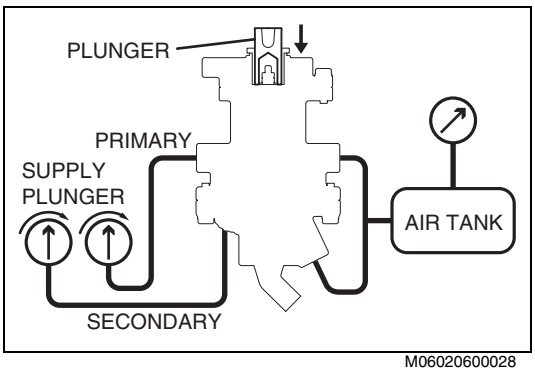
d. Apply soap water to the exhaust port and check to see there is no air leakage.



M06020600027

e. Drive in slowly the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary air pressure gauges start to rise. If the measurements do not match with the standard values, adjust by the shim of the main spring.

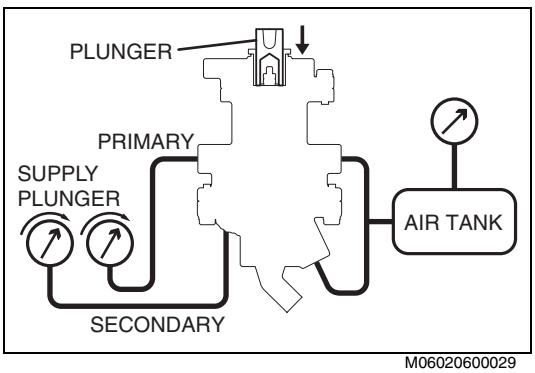
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 1.6-2.4 mm {0.0630-0.0944 in.} |
| Supply pressure | 10-25 kPa {0.1-0.25 kgf/cm$^2$, 1.43-3.55 lbf/in$^2$} |



M06020600028

f. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point immediately before that the primary and secondary pressure increases rapidly (bending point). If the measurements do not match with the standard values, replace each spring.

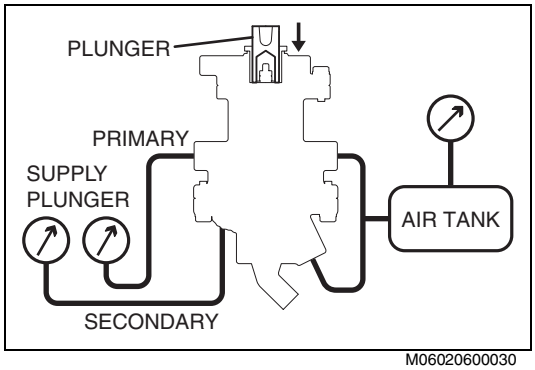
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 4.85-5.95 mm {0.1910-0.2342 in.} |
| Supply pressure | 198 kPa {2.09 kgf/cm$^2$, 28.76 lbf/in$^2$} |



M06020600029

g. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary pressures increase rapidly. If the measurements do not match with the standard values, replace each spring.

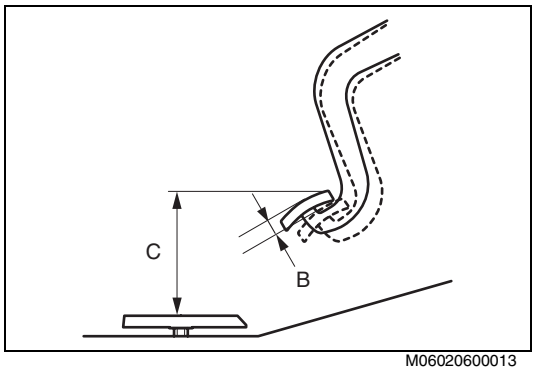
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 7.19-8.51 mm {0.2831-0.3350 in.} |
| Supply pressure | 616 kPa {6.28 kgf/cm$^2$, 89.39 lbf/in$^2$} |



M06020600030

h. Drive in further the plunger. Measure the pedal stepping down angle and supply pressure at the point where the primary and secondary pressure are maximum. If the measurements do not match with the standard values, replace each spring.

| Measurement item | Standard value |
|---|---|
| Plunger stroke | 9.89-11.31 mm {0.3894-0.4452 in.} |
| Supply pressure | 830 kPa {8.5 kgf/cm$^2$, 120.87 lbf/in$^2$} |



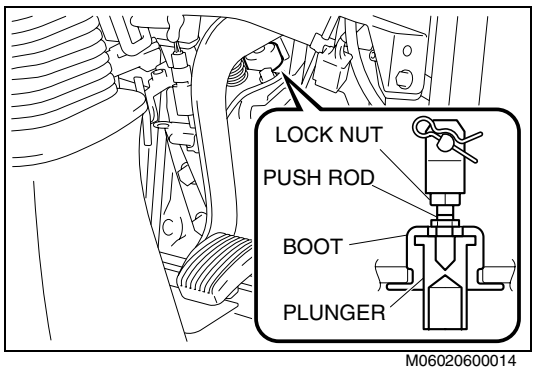
M06020600013

(2) Brake pedal

a. Make sure that the installing height of the brake pedal "C" and the pedal play "B".

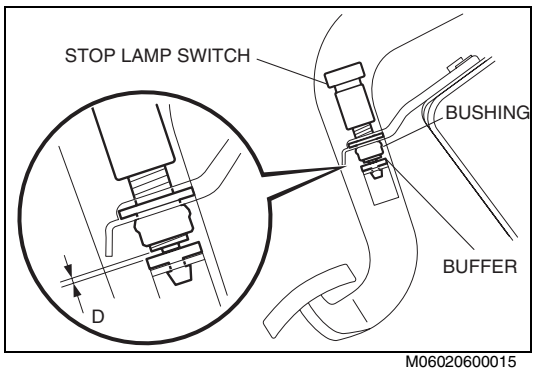
**"B": 2-5 mm {0.0788-0.1968 in.}**

**"C": 149.6-159.6 mm {5.890-6.283 in.}**



M06020600014

b. If the pedal play is out of the standard value, loosen the lock nut and turn the push rod to adjust the pedal play to the standard value.



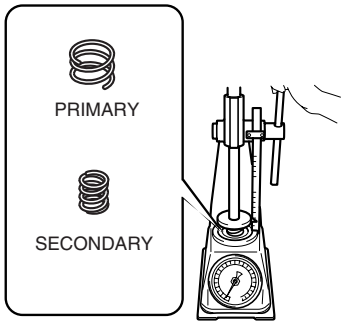
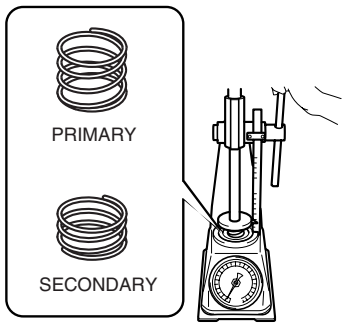
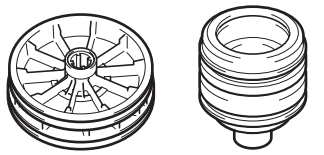
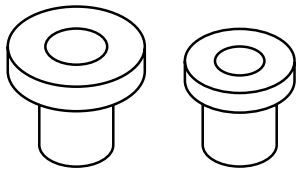
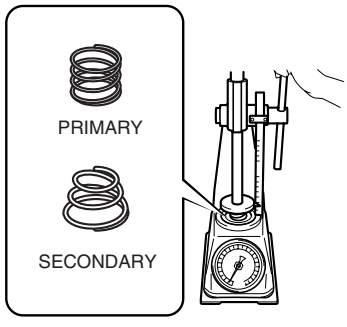
M06020600015

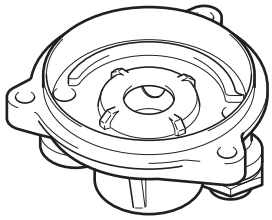
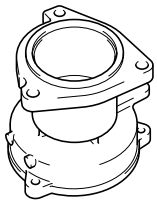
(3) Check the clearance between stop lamp switch and buffer.

**"D": 0.5-1.5 mm {0.0197-0.0590 in.}**

# INSPECTION AND REPAIR

M06020601BEH3003

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Main spring:<br>Free length/<br>setting length/<br>setting load | 29.1 mm {1.15 in.}/<br>27.6 mm {1.09 in.}/<br>147.1 N<br>{15 kgf, 33.07 lbf} | 28.6 mm<br>{1.13 in.} | Replace, if necessary. | Visual check and measure<br>  |
| Sub spring:<br>Free length/<br>setting length/<br>setting load | 21.6 mm {0.85 in.}/<br>19.4 mm {0.76 in.}/<br>457 N<br>{46.6 kgf, 102.7 lbf}<br>or more | 21 mm<br>{0.83 in.} | | |
| Primary and Secondary piston return spring:<br>Free length/<br>setting length/<br>setting load | Primary:<br>43.2 mm {1.70 in.}/<br>16.5 mm {0.65 in.}/<br>95.1 N<br>{9.7 kgf, 21.38 lbf} | 40.5 mm<br>{1.59 in.} | Replace, if necessary. | Visual check and measure<br>  |
| | Secondary:<br>24.5 mm {0.96 in.}/<br>12.0 mm {0.47 in.}/<br>11.8 N<br>{1.2 kgf, 2.6 lbf} | 23.5 mm<br>{0.93 in.} | | |
| Primary and secondary piston:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Primary and secondary feed valve:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Primary and secondary feed valve return spring:<br>Free length/<br>setting length/<br>setting load | Primary:<br>21.4 mm {0.84 in.}/<br>12.5 mm {0.49 in.}/<br>52.0 N<br>{5.3 kgf, 11.68 lbf} | 20.4 mm<br>{0.80 in.} | Replace, if necessary. | Visual check and measure<br>  |
| | Secondary:<br>22.8 mm {0.90 in.}/<br>13.0 mm {0.51 in.}/<br>49.0 N<br>{5.0 kgf, 11.02 lbf} | 21.8 mm<br>{1.13 in.} | | |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Secondary valve body: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Primary valve body: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# BRAKE FLUID RESERVOIR

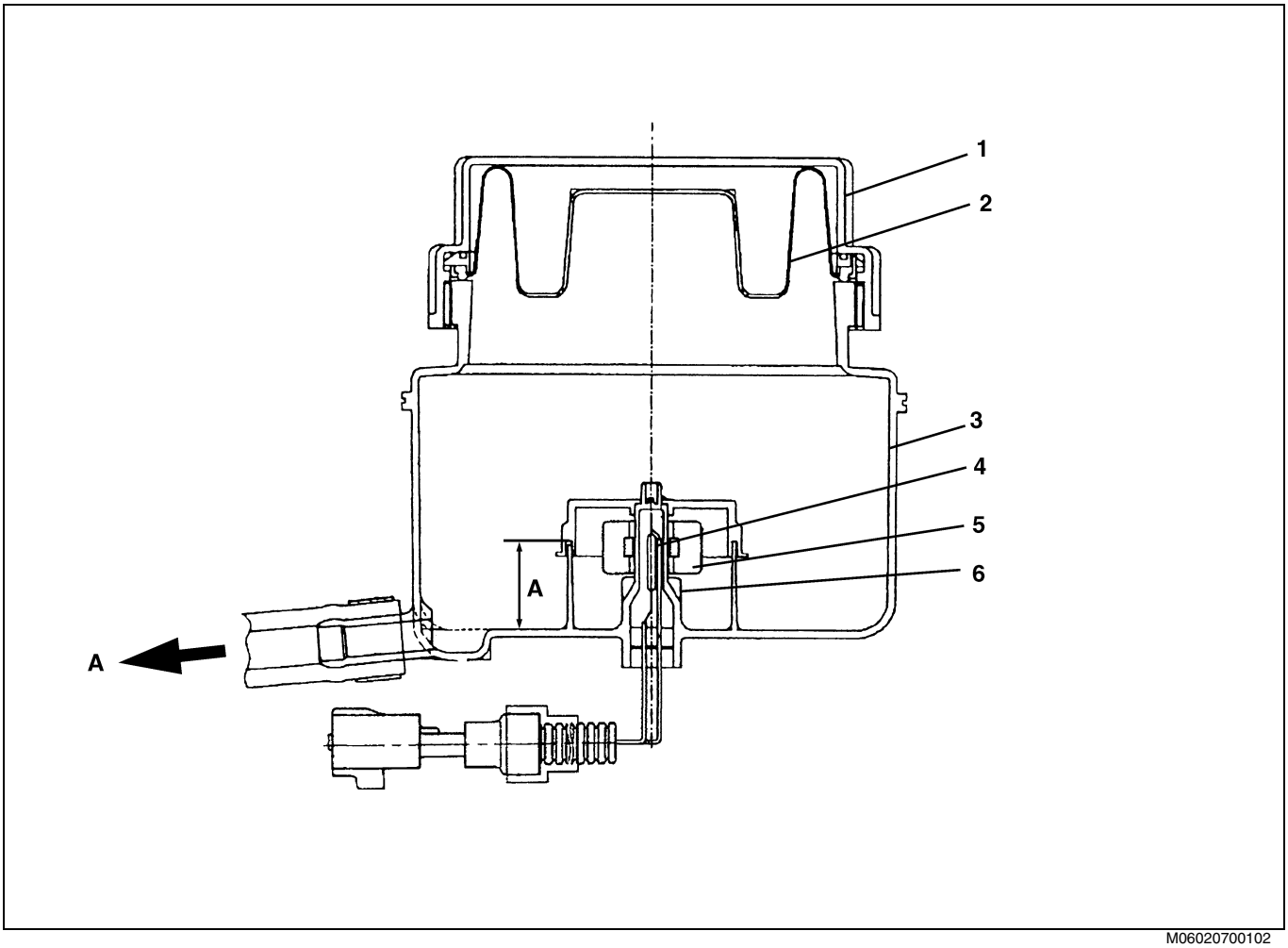
## DATA AND SPECIFICATIONS

M06020701BEI2001

| | |
|---|---|
| Type | Dual chambers for service brake control lines |
| Low fluid level warning switch operating range | Below 18-24 mm {0.709-0.945 in.} (Dimension A) |

## DESCRIPTION

M06020701BEC1002

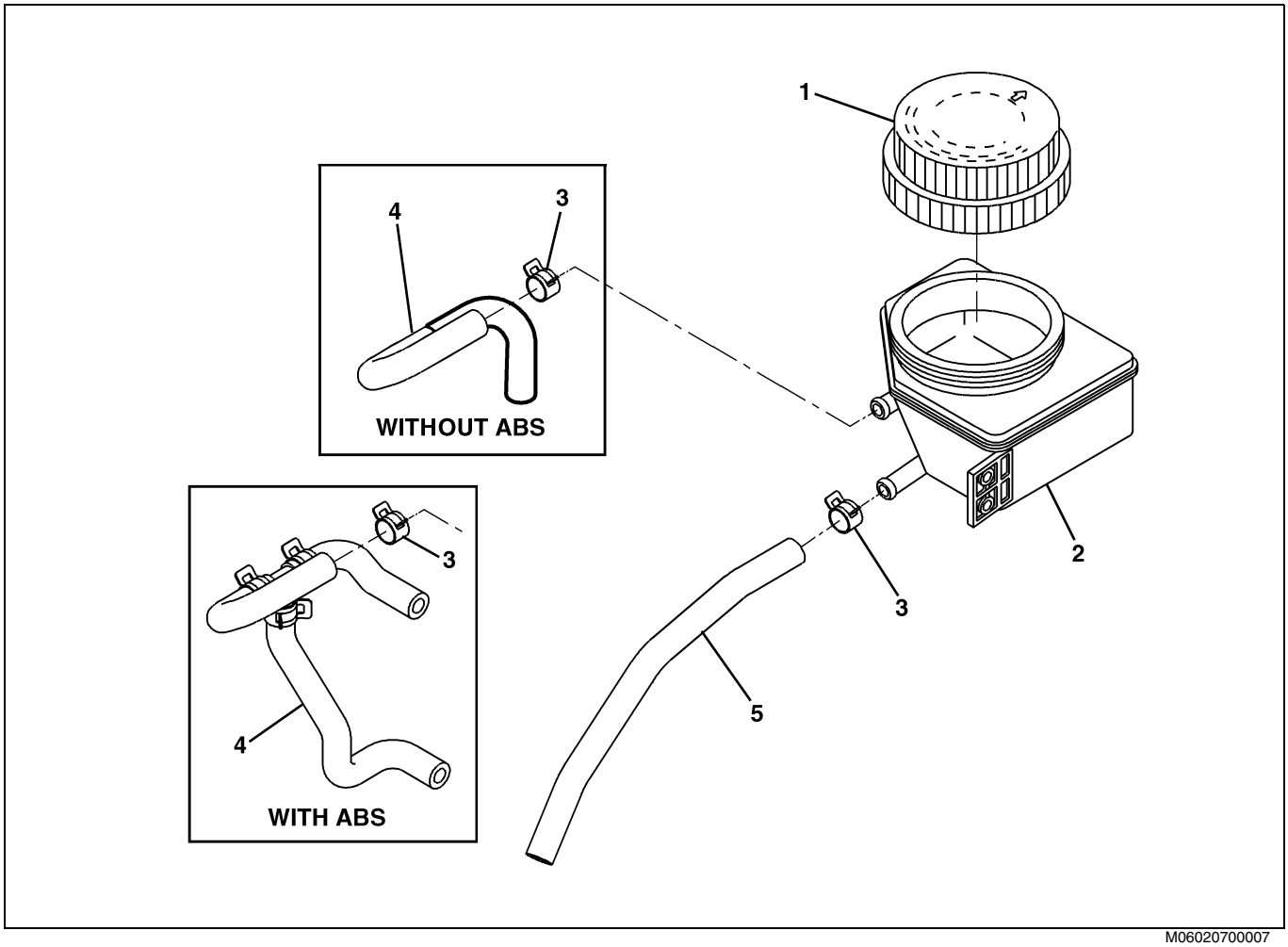



M06020700102

| | | | |
|---|---|---|---|
| 1 | Filler cap | 5 | Float |
| 2 | Diaphragm | 6 | Float stopper |
| 3 | Reservoir | A | To brake air booster |
| 4 | Fluid level warning switch | | |

# COMPONENT LOCATOR

M060207BED1002




M06020700007

| | | | |
|---|---|---|---|
| 1 | Reservoir cap | 4 | Hose |
| 2 | Body | 5 | Tube |
| 3 | Clip | | |

# DISMOUNTING AND MOUNTING

M06020701BEH1001

## IMPORTANT POINT - DISMOUNTING

**1. REMOVAL OF RESERVOIR.**

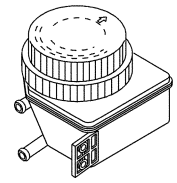
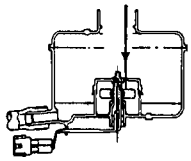
**NOTICE:**

- **Before removing the reservoir, drain the brake fluid from the hydraulic lines.**
- **Place a small pan under the reservoir to receive the brake fluid. Do not let fluid remain on a painted parts. Wash it off immediately.**

# INSPECTION AND REPAIR

M06020701BEH3001

**NOTICE:**
**Brake fluid or isopropyl alcohol should only be used to wash the components.**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Brake fluid reservoir: Cracks, damages and leakage | — | — | Replace, if necessary. | Visual check  |
| Operation of fluid level warning switch | The warning lamp and buzzer should be turned on, when the float is submerged lower than the MIN. level. | — | Replace reservoir assembly, if necessary. | When the reservoir is filled, submerge the float  |

# PROTECTION VALVE

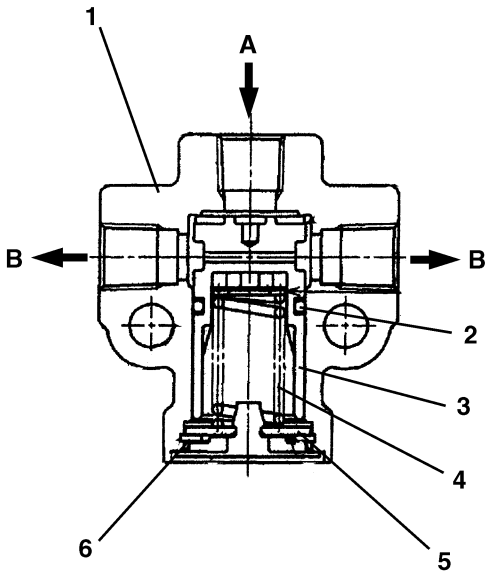
## DATA AND SPECIFICATIONS

M06020801BEI2002

| Type | | Spring type |
|---|---|---|
| Operating pressure | Open | 637 kPa {6.2 kgf/cm$^2$, 88.16 lbf/in.$^2$} |
| | Close | 510 kPa {5.2 kgf/cm$^2$, 73.94 lbf/in.$^2$} |

## DESCRIPTION

M06020801BEC1002

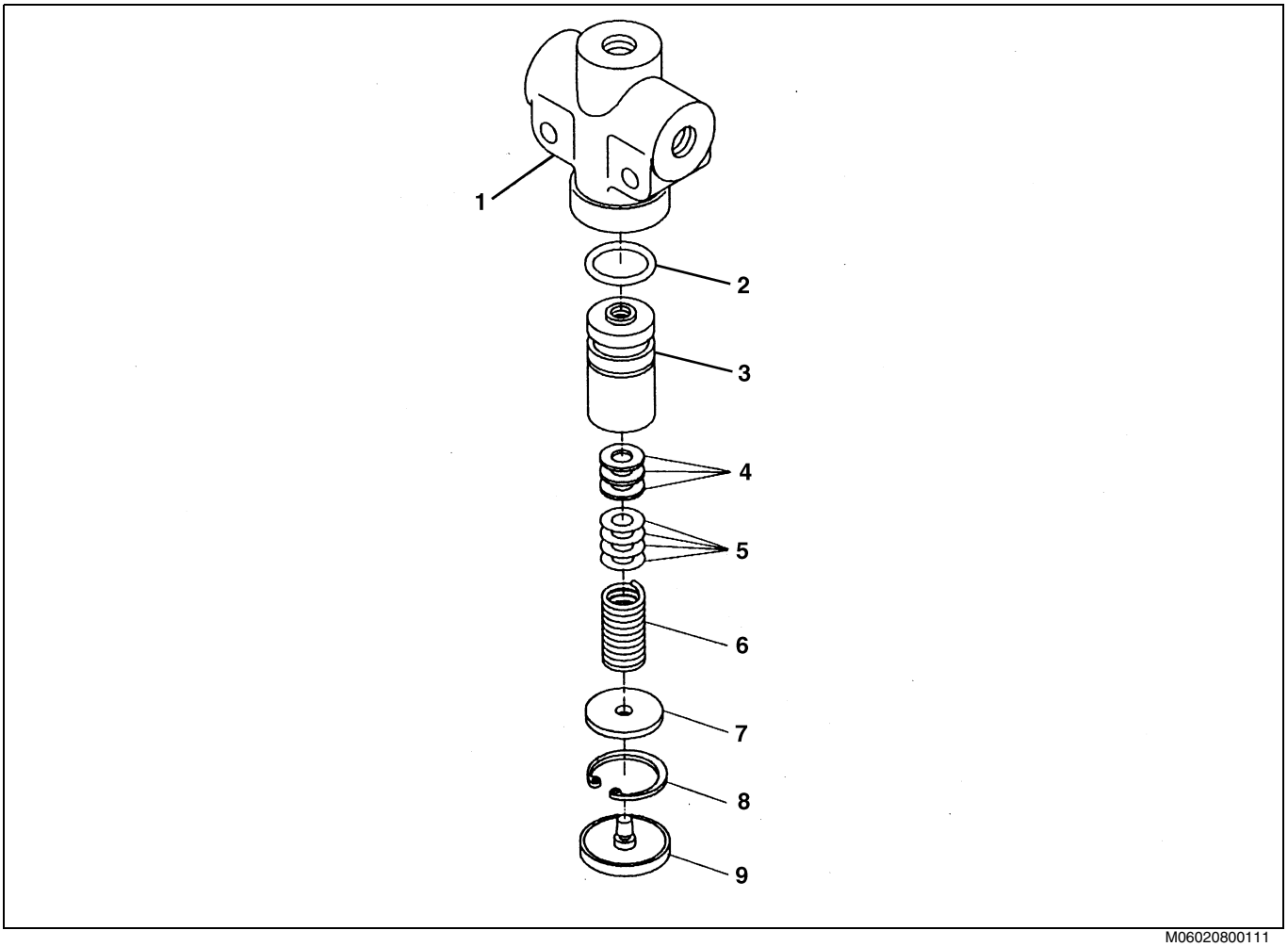



M06020800110

| | | | |
|---|---|---|---|
| 1 | Valve body | 5 | Dust seal plate |
| 2 | O-ring | 6 | Retainer ring |
| 3 | Valve | A | Inlet |
| 4 | Compression spring | B | Outlet |

# COMPONENT LOCATOR

M06020801BED1002

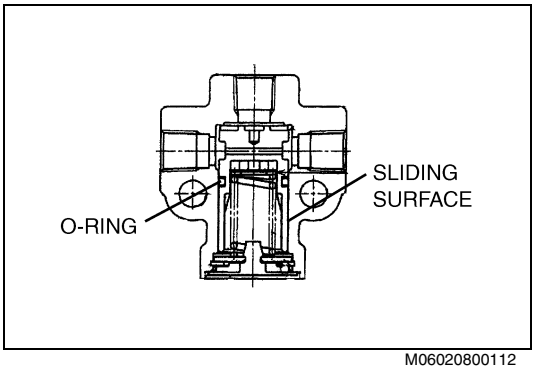



M06020800111

| | | | | | |
|---|---|---|---|---|---|
| 1 | Body | 4 | Spacer | 7 | Dust seal plate |
| 2 | O-ring | 5 | Shim | 8 | Retainer ring |
| 3 | Piston | 6 | Spring | 9 | Dust seal |

# OVERHAUL

M06020801BEH2002




M06020800112

## IMPORTANT POINT - ASSEMBLY

**1. LUBRICATION**

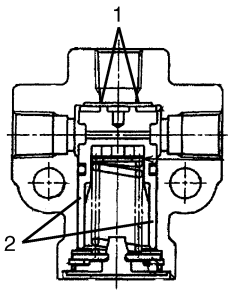
(1) When reassembling the protection valve, replace the O-rings and valve with new ones.

(2) Apply adequate amount of silicone grease to the sliding surface of the component parts.

# INSPECTION AND REPAIR

M06020801BEH3003

Unit: mm {in.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Valve contact surface of Body cap 1: Rust, wear and damage | — | — | Clean or replace, if necessary. | Visual check   |
| Sliding surface of valve body 2: Rust, wear and damage | — | — | Clean or replace, if necessary. | |
| Valve spring: Free length | 60.0 {2.36} | — | Replace. | Measure  |

# PROTECTION VALVE (WITH 4-WAY PROTECTION VALVE)

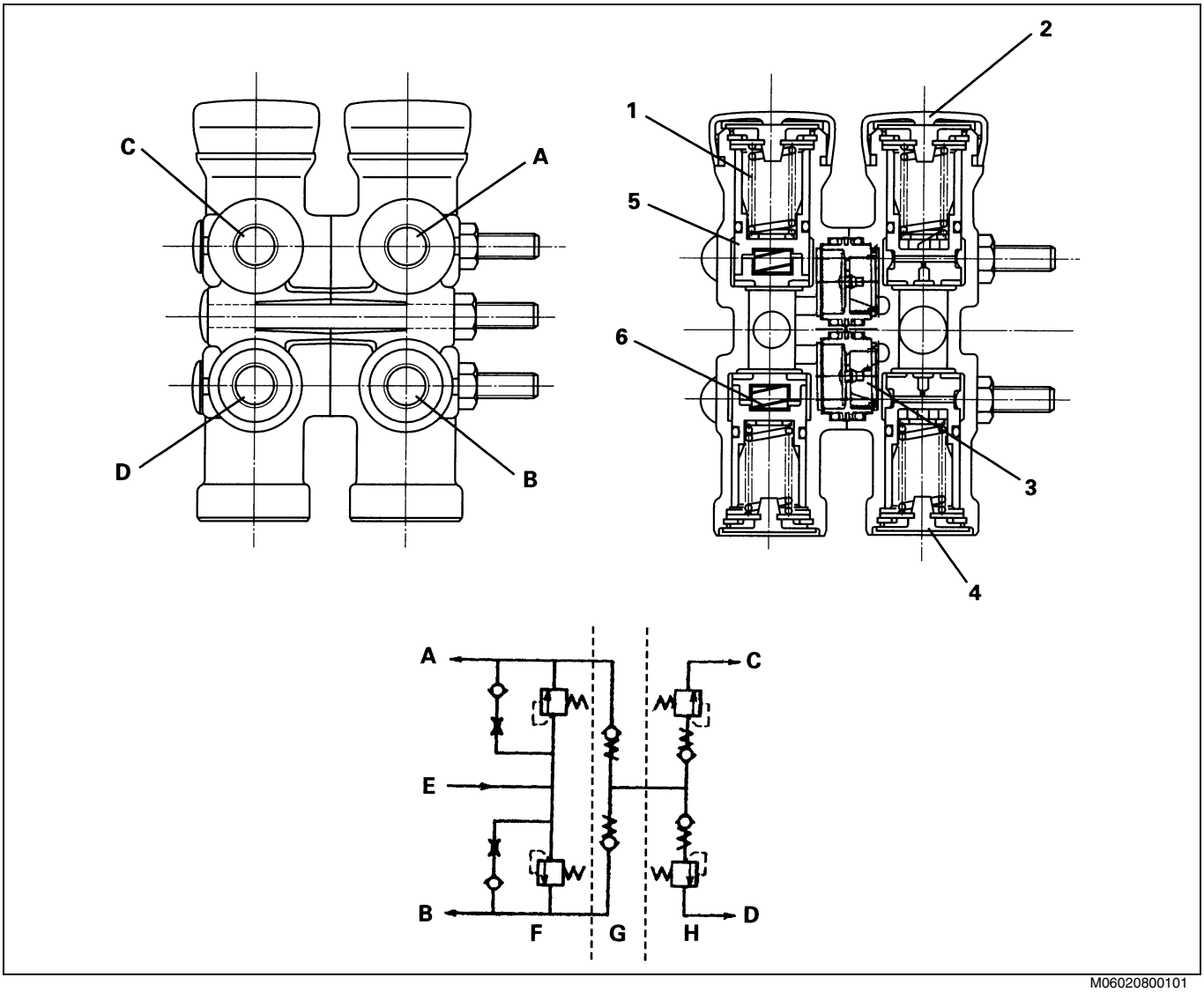
## DATA AND SPECIFICATIONS

M06020801BEI2001

| Type | | | Spring type (4-way protection) |
|---|---|---|---|
| Opening pressure | Open: | Port 21, 22 | 620-660 kpa {6.3-6.7 kgf/cm$^2$, 89.61-95.29 lbf/in$^2$} |
| | | Port 23, 24 | 570-610 kpa {5.8-6.2 kgf/cm$^2$, 82.49-88.18 lbf/in$^2$} |
| | Close: | Port 21, 22 | 440-480 kpa {4.5-4.8 kgf/cm$^2$, 64.01-68.27 lbf/in$^2$} |
| | | Port 23, 24 | 440-480 kpa {4.5-4.8 kgf/cm$^2$, 64.01-68.27 lbf/in$^2$} |

## DESCRIPTION

M06020801BEC1001

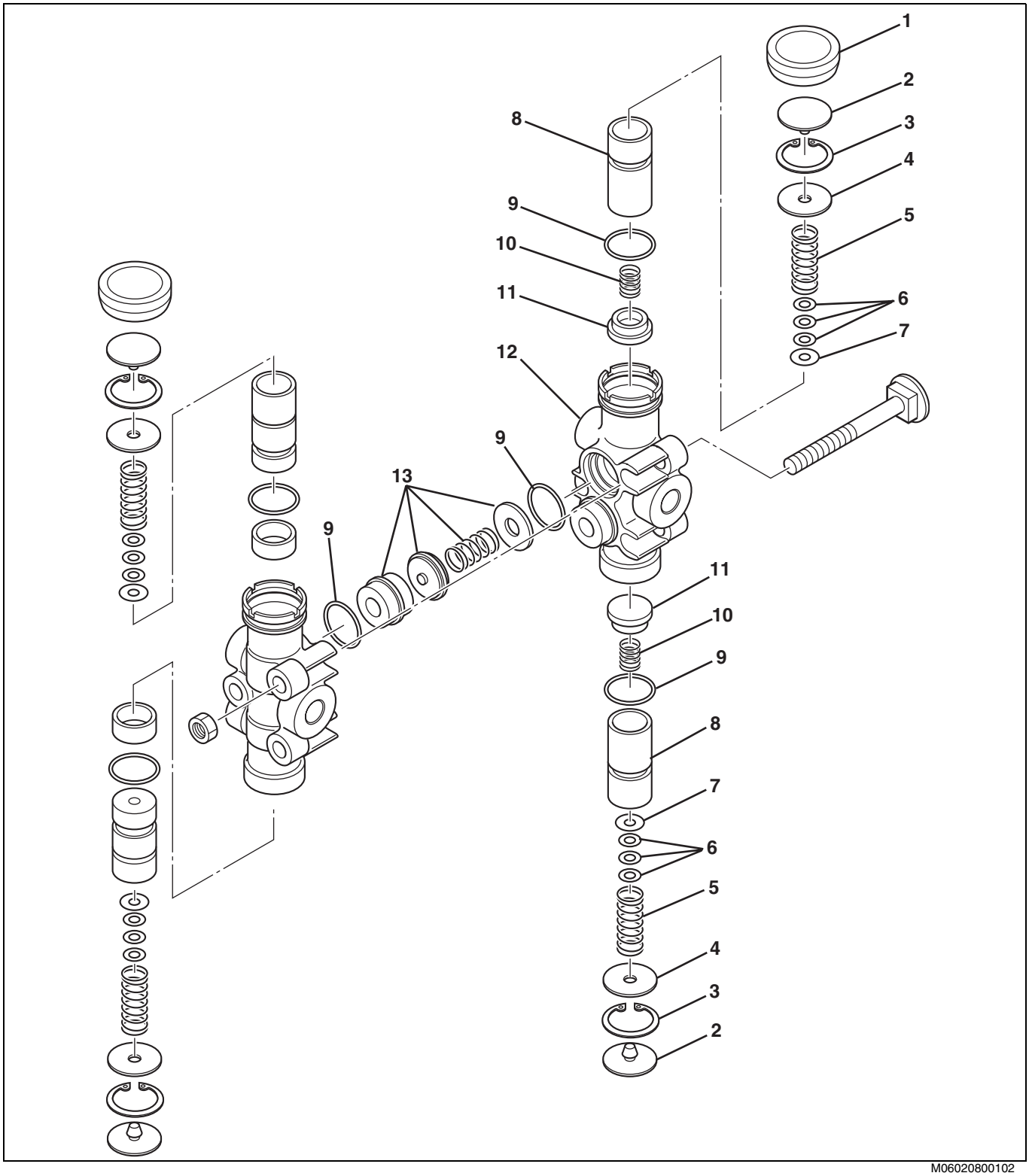



M06020800101

| | | | |
|---|---|---|---|
| 1 | Compression spring | A | Port 21 (Outlet) |
| 2 | Dust cover | B | Port 22 (Outlet) |
| 3 | Check valve | C | Port 23 (Outlet) |
| 4 | Dust seal rubber | D | Port 24 (Outlet) |
| 5 | Piston | E | Inlet port |
| 6 | Valve spring | F | No.1 side |
| | | G | Center check valve |
| | | H | No.2 side |

# COMPONENT LOCATOR

M06020801BED1001

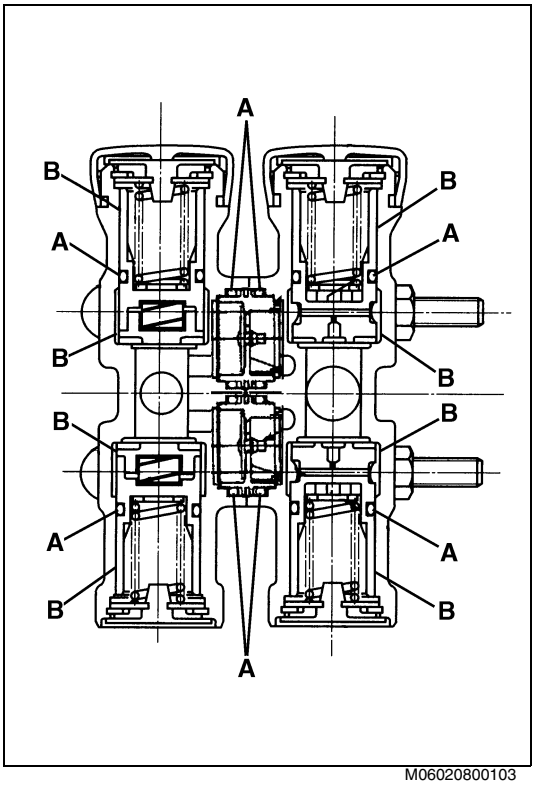



M06020800102

| | | | | | |
|---|---|---|---|---|---|
| 1 | Dust cover | 6 | Shim | 11 | Valve |
| 2 | Dust seal rubber | 7 | Spacer | 12 | Body |
| 3 | Retainer ring | 8 | Piston | 13 | Check valve |
| 4 | Dust seal plate | 9 | O-ring | | |
| 5 | Compression spring | 10 | Valve spring | | |

# OVERHAUL

M06020801BEH2001




M06020800103

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

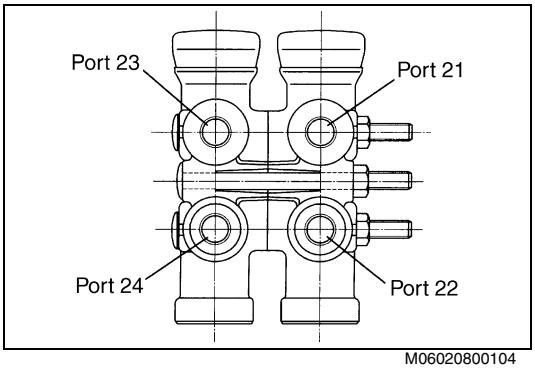
(1) When assembling the protection valve use the new O-rings and valves.

(2) Apply the silicone grease on the each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

# ADJUSTMENT

M06020801BEH3001



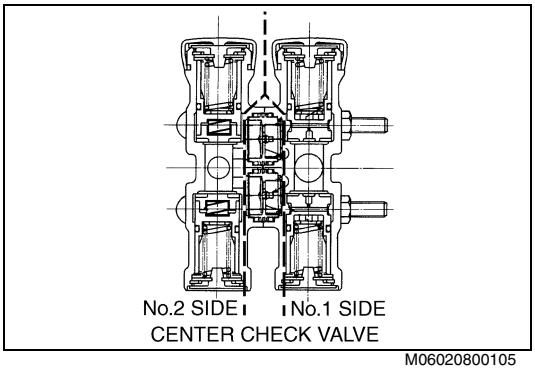

M06020800104

## AIR LEAKAGE

**1. Check valve**

(1) By-pass Check valve at No.1 side.

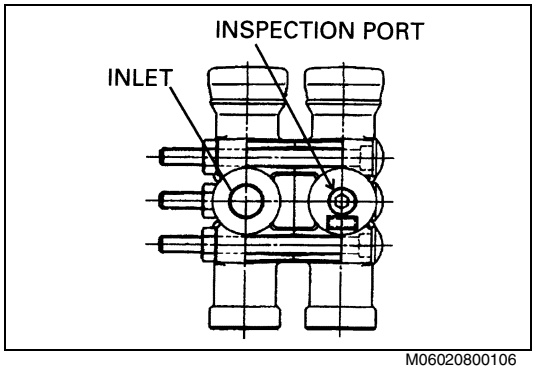
a. Confirm no leakage of air at inlet, No.1, when applying pressure to air under 49 kpa {0.5 kgf/cm$^2$, 7.11 lbf/in$^2$}, 392 kpa {4 kgf/cm$^2$, 56.89 lbf/in$^2$} from outlet No.21 and No.22.




M06020800105

(2) Center check valve

a. Confirm no leakage of air at the outlet No.21 and No.22, when applying pressure to air under 49 kpa {0.5 kgf/cm$^2$, 7.11 lbf/in$^2$}, 880 kpa {9 kgf/cm$^2$, 128 lbf/in$^2$} from the inspection port.



M06020800106

(3) Check valve at No.2 side
a. Confirm no leakage of air at the inspection port, when applying pressure to air under 49 kpa {0.5 kgf/cm$^2$, 7.11 lbf/in$^2$}, 880 kpa {9 kgf/cm$^2$, 128 lbf/in$^2$} at the outlet No.23 and No.24.

**2. Other air tightness**
(1) When applying pressure to air under 0-880 kpa {0-9.0 kgf/cm$^2$, 0-128 lbf/in$^2$}, confirm that any leakage of air should be 0 cm$^3$min.

## PERFORMANCE CHRACTERISTIC

**1. Opening valve pressure**
(1) No.1 side
a. Releasing the compressed air at the outlet port No.23 and No.22 to air, when applying the compressed air at the speed specified below, confirm that air pressure of the compressed air, saturated at the inlet should be of Opening valve pressure, which should be 620-660 kpa {6.3-6.7 kgf/cm$^2$, 89.61-95.29 lbf/in$^2$}.
Charging speed: From 295 kpa {3.0 kgf/cm$^2$, 42.66 lbf/in$^2$} to 490 kpa {5.0 kgf/cm$^2$, 71.10 lbf/in$^2$} within 3-7 seconds.
(2) No.2 side
a. When applying air at charging speed specified below from the inlet side under air pressure "0" at the outlet port No.23 and No.23, confirm that a pressure at the inspection port when it starting to go up at the outlet should be of Opening valve pressure, which should be 570-610 kpa {5.8-6.2 kgf/cm$^2$, 82.49-88.18 lbf/in$^2$}.
Charging speed: From 295 kpa {3.0 kgf/cm$^2$, 42.66 lbf/in$^2$} to 490 kpa {5.0 kgf/cm$^2$, 71.10 lbf/in$^2$} within 8-22 seconds.

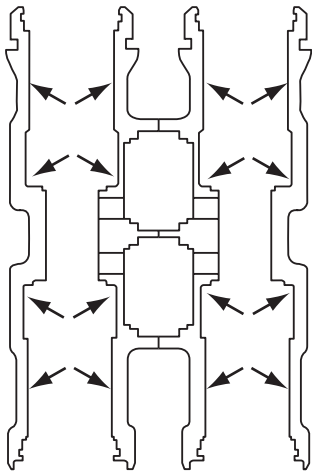
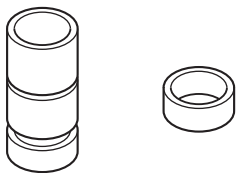
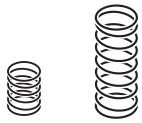
**2. Closing valve pressure**
(1) When discharging air through respective No.1 side and No.2 side inlet under a pressure of 880 kpa {9 kgf/cm$^2$, 128 lbf/in$^2$} at the inlet and the outlet, at discharging speed specified below, confirm that a pressure when the pressures saturated should be of Closing valve pressure, which should be 440-480 kpa {4.5-4.8 kgf/cm$^2$, 64.01-68.27 lbf/in$^2$}.
Discharging speed: From 590 kpa {6.0 kgf/cm$^2$, 85.32 lbf/in$^2$} to 295 kpa {3.0 kgf/cm$^2$, 42.66 lbf/in$^2$} within less than seconds.

**NOTICE:**
**Perform test again by increasing sims, when the respective pressures is low and by decreasing it when high in the above inspection.**

# INSPECTION AND REPAIR

M06020801BEH3002

Unit: mm {in.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Sliding surface and contact surface of body:<br>Wear and damage | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Sliding surface and contact surface of valve seat and piston:<br>Wear and damage | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Conical spring and compression spring:<br>Rust, wear and damage<br>Free length | 1. 0.78 {0.08}<br>2. 158.9 {16.2} | 1. 0.69 {0.07}<br>2. 137.3 {14.0} | Replace. | Visual check<br>  |

# QUICK RELEASE VALVE

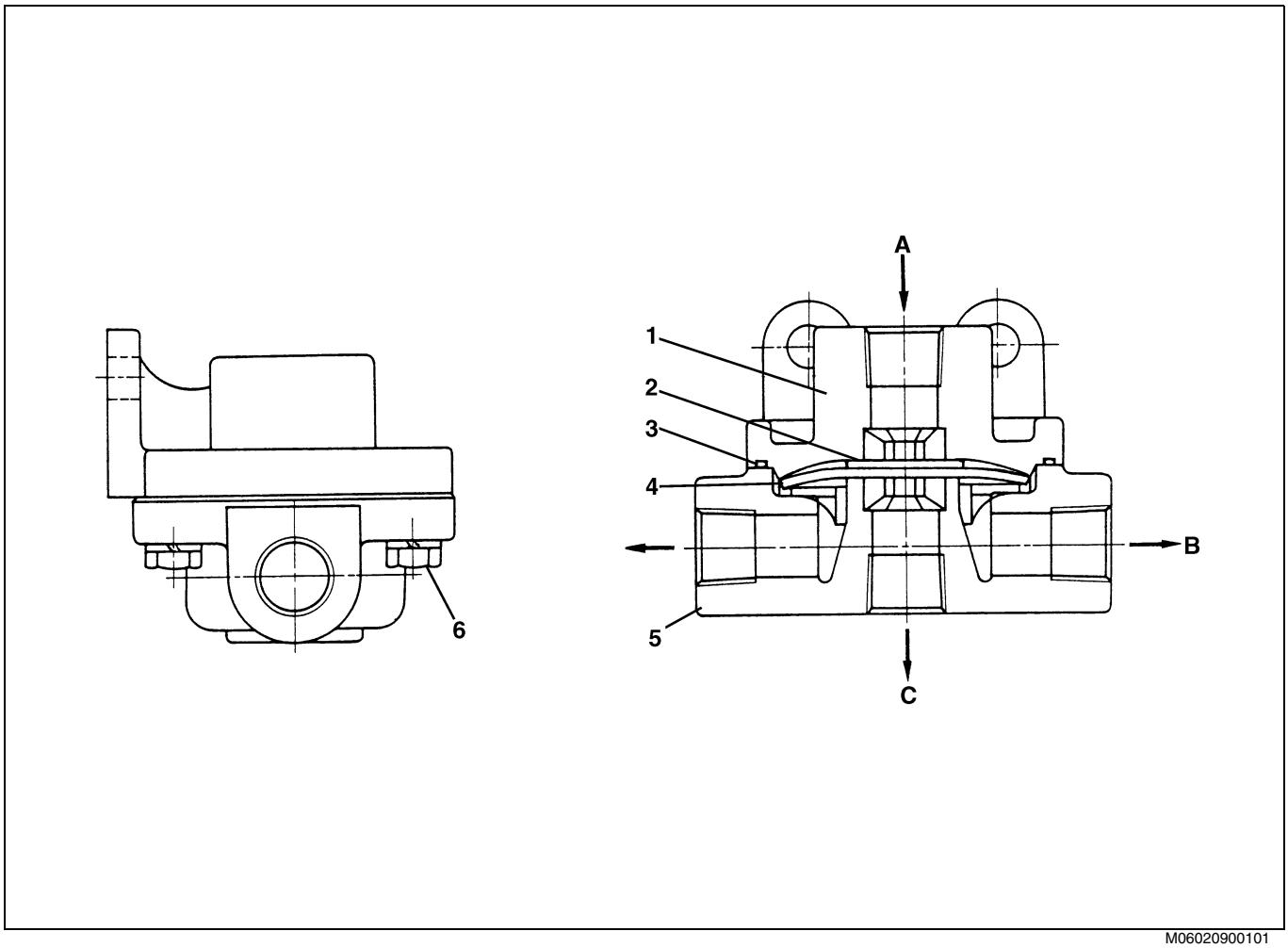
## DATA AND SPECIFICATION

M06020901BEI2001

| | |
|---|---|
| Type | Diaphragm type |

## DESCRIPTION

M06020901BEC1001

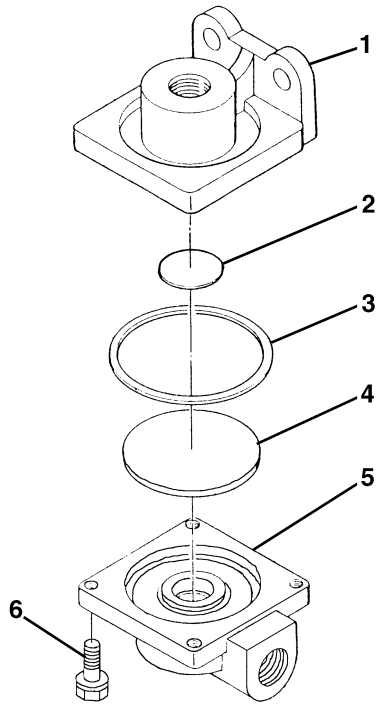



M06020900101

| | | | |
|---|---|---|---|
| 1 | Cover | 6 | Bolt |
| 2 | Filter | A | Inlet |
| 3 | Gasket | B | Outlet |
| 4 | Diaphragm | C | Exhaust |
| 5 | Valve body | | |

# COMPONENT LOCATOR

M06020901BED1001

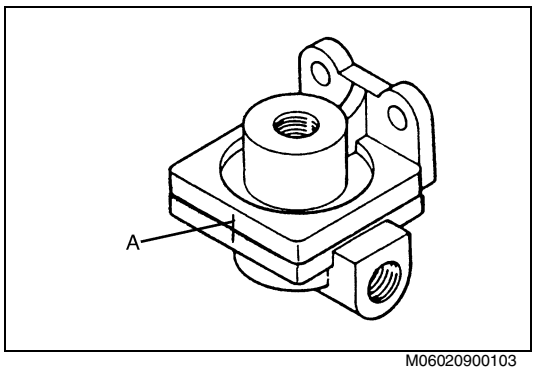



M06020900102

| | | | |
|---|---|---|---|
| 1 | Cover | 4 | Diaphragm |
| 2 | Filter | 5 | Valve body |
| 3 | Gasket | 6 | Bolt |

# OVERHAUL

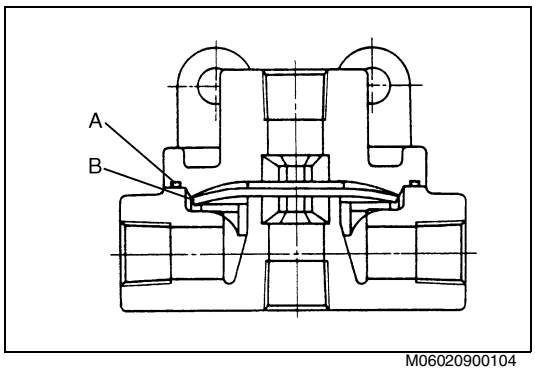
M06020901BEH2001



M06020900103

## IMPORTANT POINTS - DISASSEMBLY

**NOTICE:**
**Before disassemble the relay valve apply the aligning mark "A" for the cover and valve body.**



M06020900104

## IMPORTANT POINTS - ASSEMBLY

**1. Assemble the relay valve**

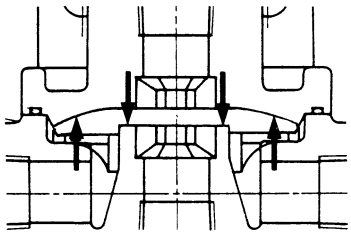
(1) When assembly the relay valve, use the new diaphragm and gasket.

- **A: Gasket**
- **B: Diaphragm**

(2) Coincide the aligning mark "A" which were applied at disassembly.

# INSPECTION AND REPAIR

M06020901BEH3001

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Valve body and cover surface: Rust and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# BRAKE AIR BOOSTER (AIRMASTER) WITHOUT ABS

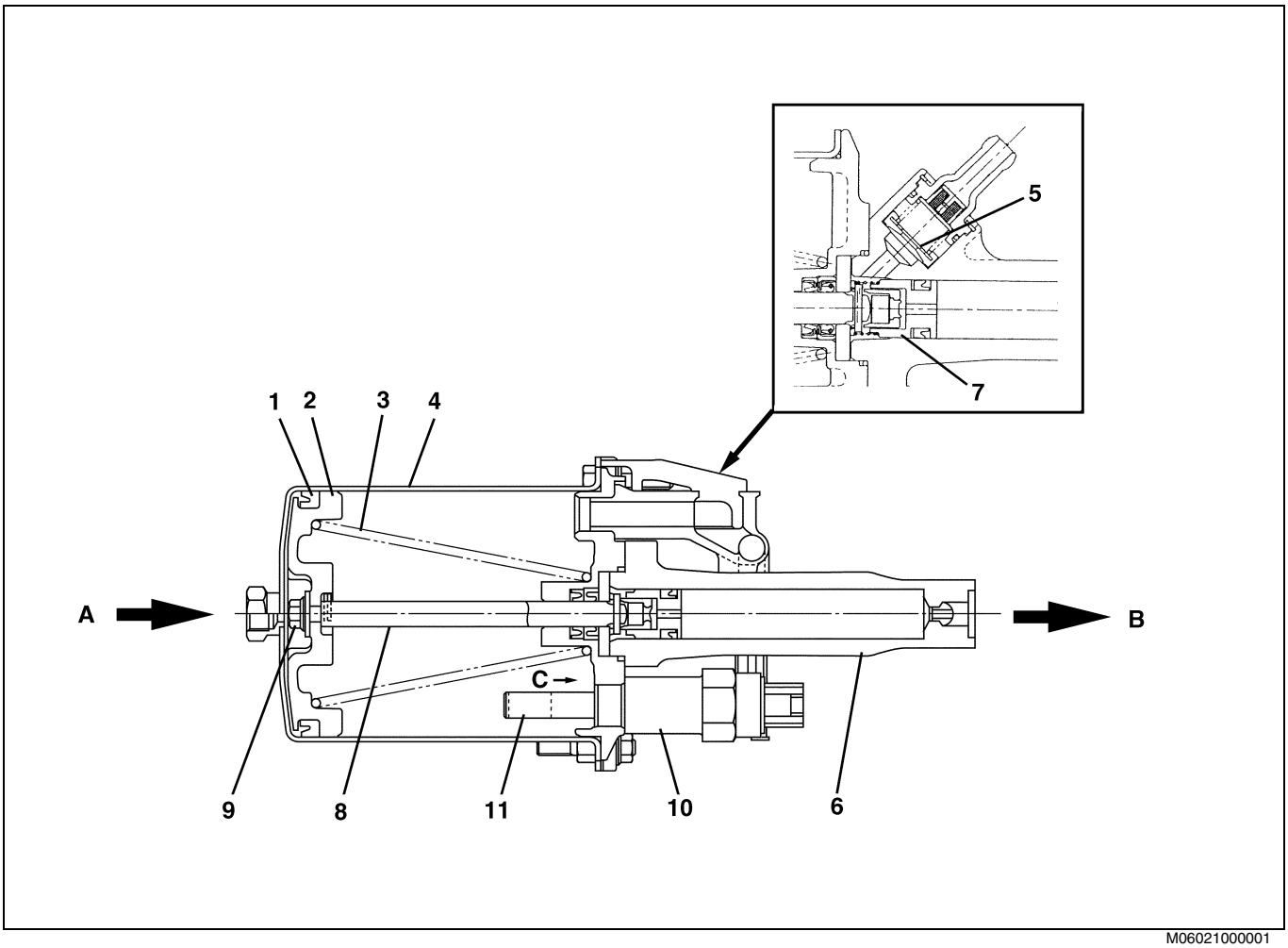
## DATA AND SPECIFICATIONS

M060210BEI2001

| | |
|---|---|
| Type | AIRMASTER (Boosted air controlled by brake valve) |
| Power cylinder diameter | 114.3 mm {4.50 in.} |
| Hydraulic cylinder diameter | 22.2 mm {0.87 in.} |

## DESCRIPTION

M06021001BEC1001



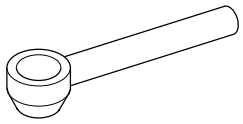
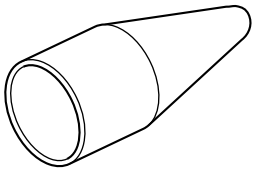
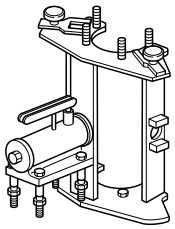
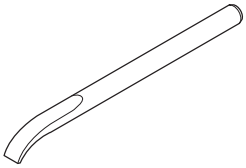
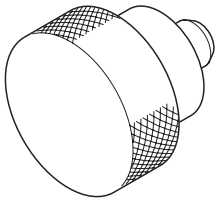
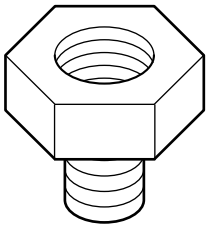

M06021000001

| | | | |
|---|---|---|---|
| 1 | Piston seal | 8 | Push rod |
| 2 | Power piston | 9 | Nut |
| 3 | Return spring | 10 | Stroke warning switch |
| 4 | Power cylinder shell | 11 | Piston stroke detector |
| 5 | Check valve | A | Boost air (From brake valve) |
| 6 | Hydraulic cylinder | B | To wheel cylinder |
| 7 | Hydraulic piston | C | At power piston over stroke |

# SPECIAL TOOL

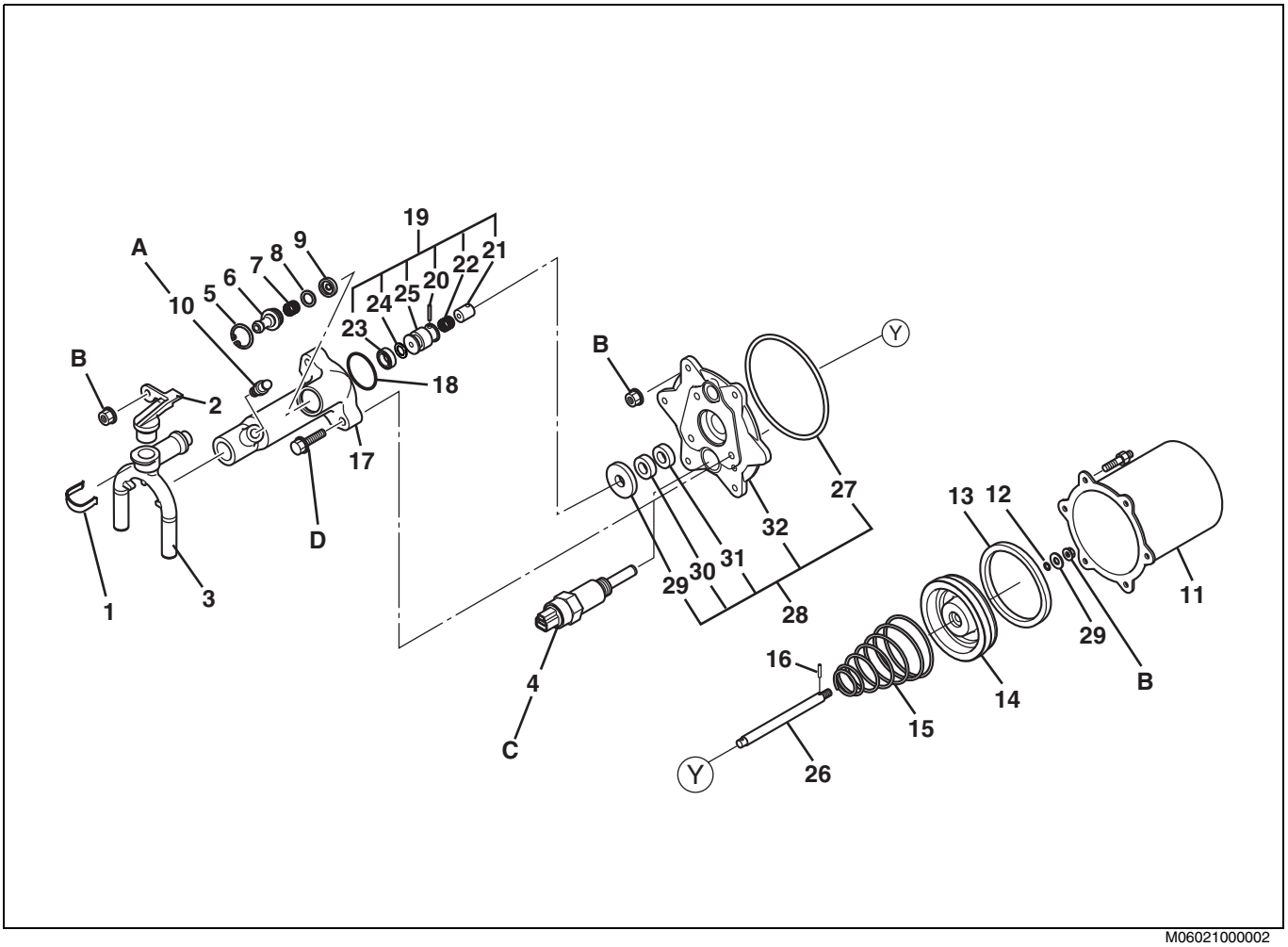
M06021001BEK1001

Prior to starting a brake air booster overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09699-1410 | POWER PISTON HOLDER | |
|  | 09657-2060 | PISTON CUP GUIDE | |
|  | 09630-2340 | STAND | |
|  | 09651-1120 | PULLER | |
|  | 09607-1160 | PRESS FIT BAR | |
|  | 09699-1400 | CONNECTER | |

# COMPONENT LOCATOR

M06021001D1001




M06021000002

| | | | |
|---|---|---|---|
| 1 | Clamp | 17 | Hydraulic cylinder |
| 2 | Holder | 18 | O-ring |
| 3 | Exhaust cover | 19 | Hydraulic piston assembly |
| 4 | Stroke warning switch | 20 | Pin |
| 5 | Retainer ring | 21 | Valve seal |
| 6 | Oil pipe joint | 22 | Hydraulic piston spring |
| 7 | Spring | 23 | Hydraulic piston cup |
| 8 | O-ring | 24 | Back up ring |
| 9 | Check valve | 25 | Hydraulic piston |
| 10 | Air bleeder screw | 26 | Push rod |
| 11 | Power cylinder shell | 27 | O-ring |
| 12 | O-ring | 28 | End plate assembly |
| 13 | Piston seal | 29 | Washer |
| 14 | Power piston | 30 | Oil seal |
| 15 | Return spring | 31 | Oil seal |
| 16 | Push rod pin | 32 | End plate |

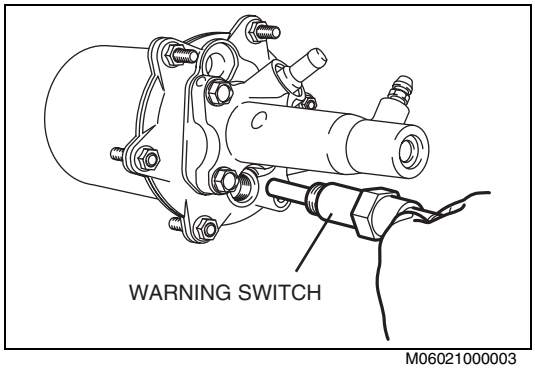
**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 7-12 {70-130, 5.1-9.3} | C | 8-12 {80-120, 5.8-8.6} |
| B | 11-15 {110-160, 8-11} | D | 20-29 {200-300, 15-21} |

# OVERHAUL

M06021001BEH2001

## IMPORTANT POINTS - DISASSEMBLY

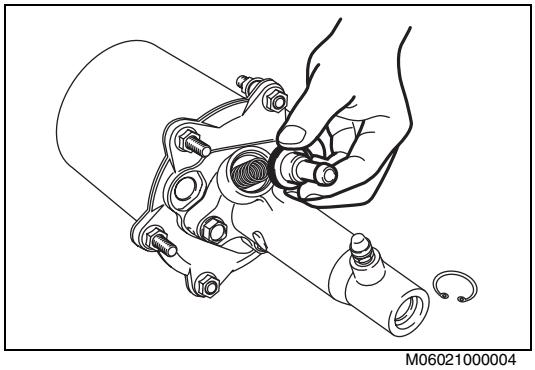


M06021000003

**1. HYDRAULIC CYLINDER AND POWER CYLINDER**

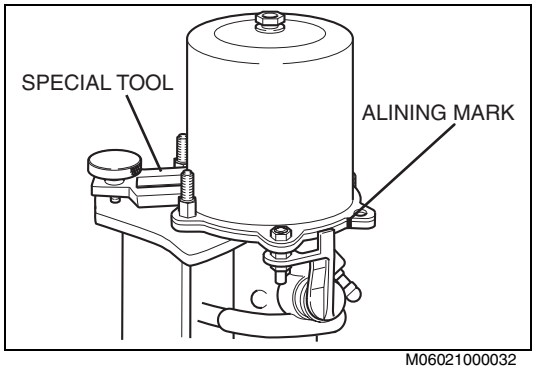
(1) Remove the nut and then remove the clamp, holder, and exhaust cover.

(2) Remove the stroke warning switch.


M06021000004

(3) Remove the retainer ring, oil pipe joint with O-ring, spring and check valve.

(4) Remove the cap and the bleeder screw.

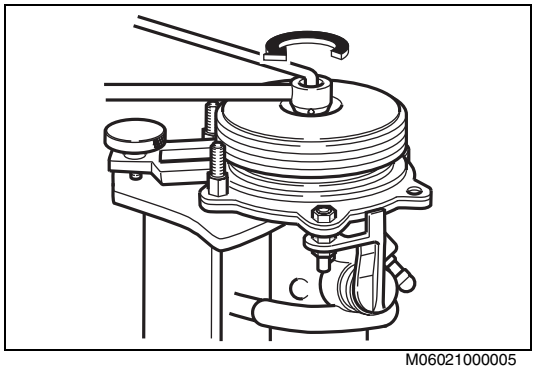


M06021000032

(5) Using the special tool, secure the brake booster.
**SST: Stand (09630-2340)**

**NOTICE:**
**Before disassembling the brake booster, apply aligning mark on the power cylinder shell and end plate.**

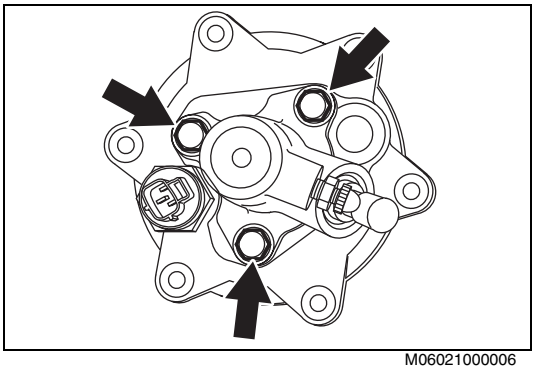
(6) Remove the nuts, then remove the power cylinder shell and O-ring.


M06021000005

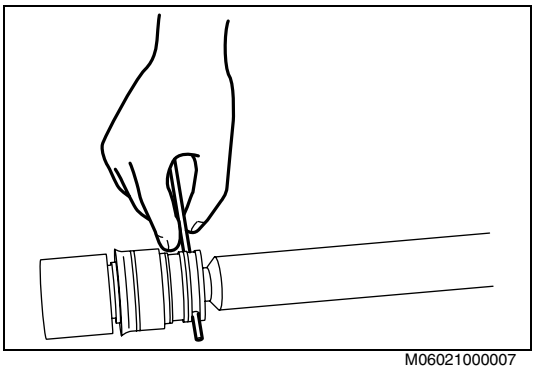
(7) Using the special tool, secure the power piston, then remove the nut.
**SST: Power Piston Holder (09699-1410)**

**NOTICE:**
- **Keep the power piston pushed far enough toward the hydraulic cylinder side while removing the nut. If the power piston is not adequately pushed toward the hydraulic cylinder side, the push rod pin will turn together with the nut.**
- **When removing the nut, take precautions, for there is a spring that will jump out when the nut is removed.**

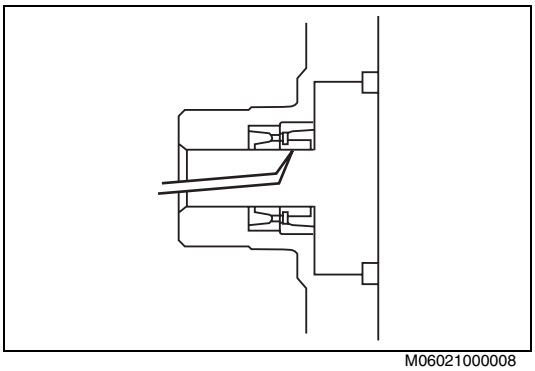
(8) Remove the O-ring, piston seal, power piston and return spring.


M06021000006

(9) Remove the bolts, then remove the hydraulic cylinder and O-ring.


M06021000007

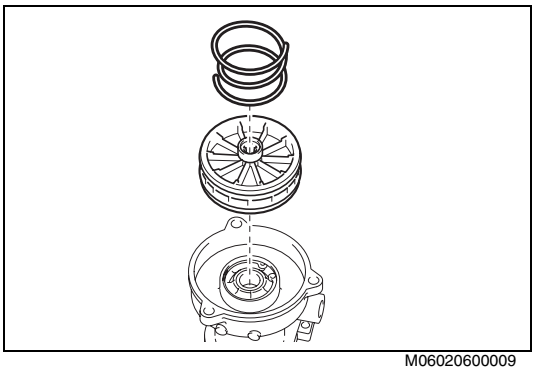
(10) Press and hold down the hydraulic piston spring and remove the pin, and then remove the hydraulic piston assembly.
(11) Remove the push rod, pulling it in the direction away from the push rod threaded part.


M06021000008

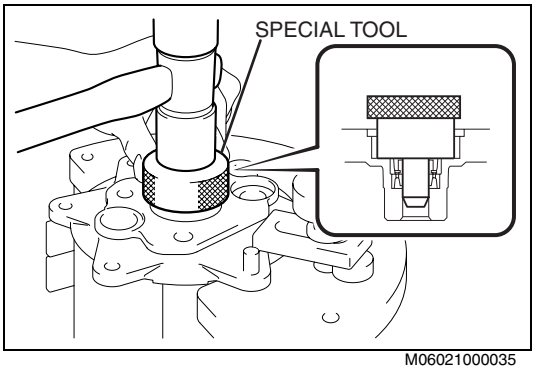
(12) Remove the washer from the end plate.
(13) Using the special tool, remove the oil seal (2 pieces) from the end plate.
**SST: Puller (09651-1120)**

## IMPORTANT POINTS - ASSEMBLY

**1. HYDRAULIC CYLINDER AND POWER CYLINDER**


M06020600009

(1) Using the special tool, secure the end plate.
**SST: Stand (09630-2340)**

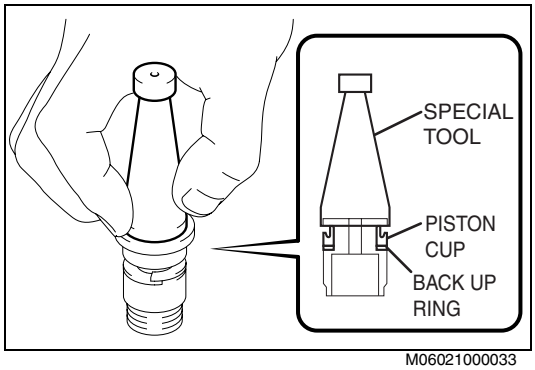


M06021000035

(2) Coat the oil seal and end plate bore with silicone grease. Then using the special tool, press the oil seal on the end plate.
**SST: Press Fit Bar (09607-1160)**

**NOTICE:**
**Make sure the oil seal is inserted in the proper direction.**

(3) Soak the washers in brake fluid and then install the end plate.

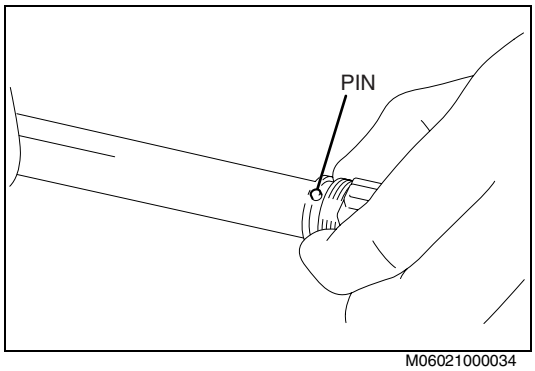


M06021000033

(4) Using the special tool, install the back up ring and hydraulic piston cup to the hydraulic piston.
**SST: Piston Cup Guide (09657-2060)**

**NOTICE:**
- **Install the back up ring and hydraulic piston cup in the correct order and direction.**
- **Make sure the back up ring is not biting into the piston.**

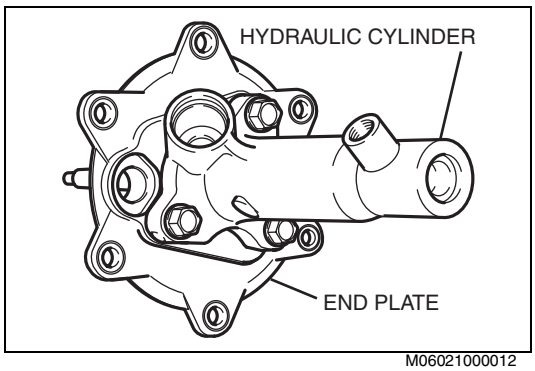
(5) Coat the push rod surfaces and valve seal with silicone grease, then install the push rod to the end plate, installing it in the direction away from the threaded parts.



M06021000034

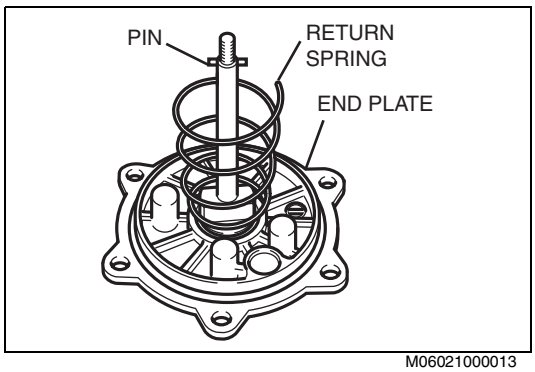
(6) Line up the push rod end pin, the valve seal hole and the hydraulic piston hole, and then insert the pin.

**NOTICE:**
**Make sure that the hydraulic piston spring covers the pin, which is not drawn out from the hydraulic piston.**



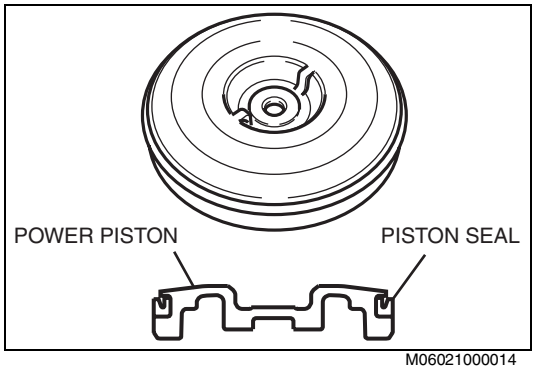
M06021000012

(7) Coat the hydraulic piston assembly exterior surfaces, the hydraulic cylinder inner surfaces and the O-ring with brake fluid.
(8) Install the O-ring on the hydraulic cylinder, then install the hydraulic cylinder on the end plate.
(9) Install the air bleeder screw.



M06021000013

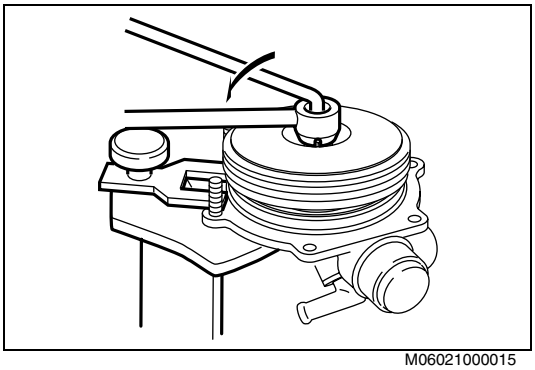
(10) Install the pin in the push rod threaded part hole.
(11) Install the return spring on the end plate.



M06021000014

(12) Coat the piston seal groove of the power piston and piston seal with mineral grease (Air Master Paste or equivalent), and then install the piston seal to the power piston.

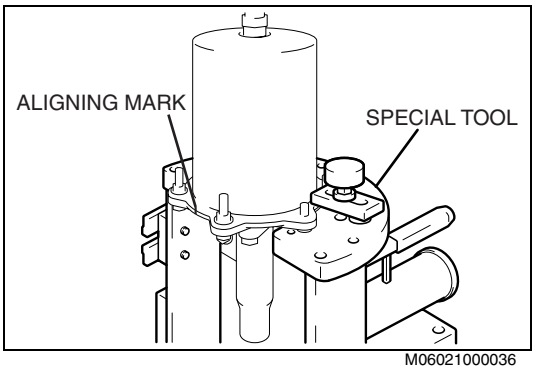
**NOTICE:**
**Make sure the piston seal is installed in the proper direction.**



M06021000015

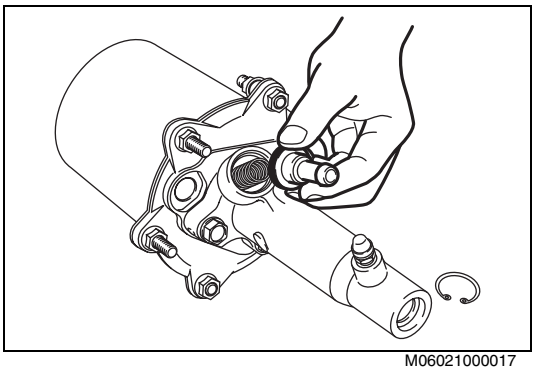
(13) While pressing and holding down the compression spring, install the O-ring and washer in that order, and then secure the hydraulic piston and push rod in place with the nut.
**SST:**
**Power Piston Holder (09699-1410)**
**Stand (09630-2340)**

**NOTICE:**
- **Supply compressed air (about 0.1 MPa) through the hydraulic cylinder discharge opening to prevent the push rod from falling down.**
- **After fastening the nut, caulk the nut and the push rod threaded parts with a punch.**



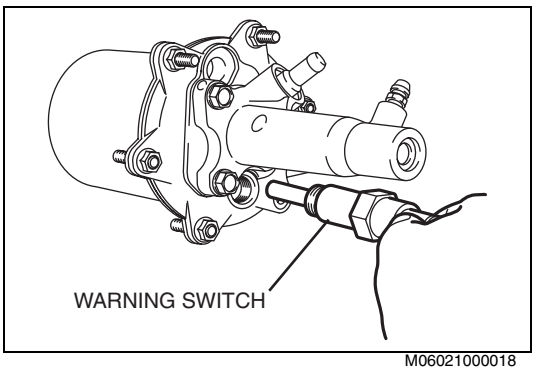

M06021000036

(14) Match the aligning mark, install the power cylinder shell on the end plate.
(15) When assembling the power cylinder shell and end plate, align the mark which were applied at disassembly.



M06021000017

(16) Install the check valve, spring and oil pipe joint with O-ring, then secure the oil pipe joint with the retainer ring.



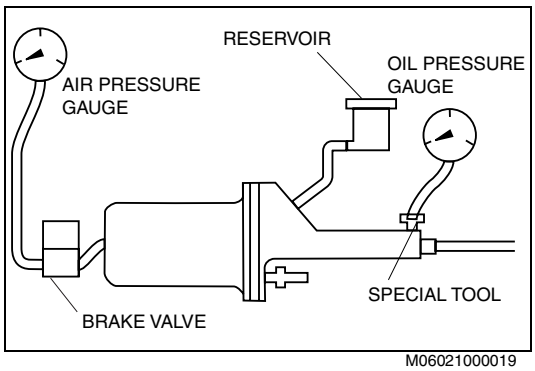

M06021000018

(17) Install the stroke warning switch and tighten it with the specified torque.
(18) Coat the exhaust cover insertion part and the end plate insertion part with silicone grease, and assemble the exhaust cover on the end plate and install the clamp.

# INSPECTION

M06021001BEH3001

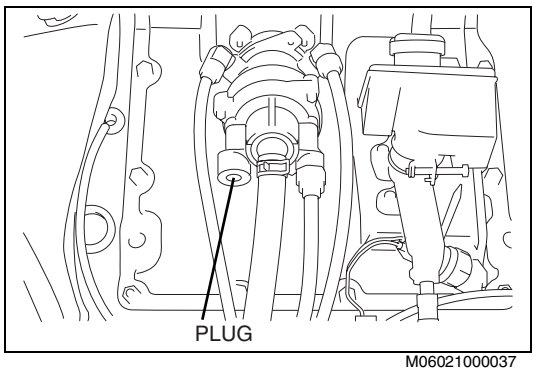
## CHECKING OF BRAKE AIR BOOSTER FUNCTION



M06021000019

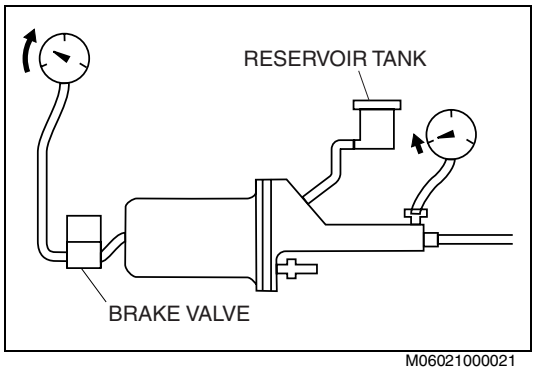
### 1. OPERATION CHECK OF BRAKE BOOSTER

(1) Remove the bleeder screw of hydraulic cylinder and attach an oil pressure gauge scaling 24.5 MPa {250 kgf/cm$^2$, 3.555 lbf/in$^2$} by using a special tool (connecting portion: M12 x 1.5).
**SST: Connector (09699-1400)**



M06021000037

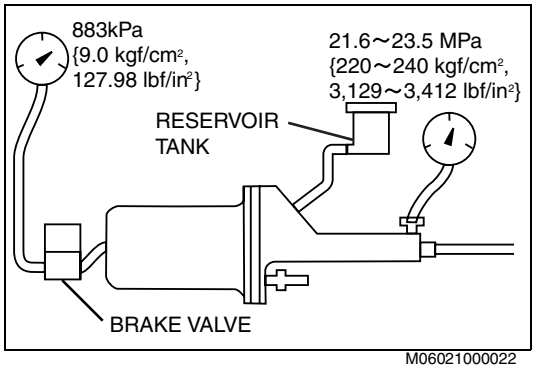
(2) Remove the plug from the brake valve assembly and attach an air pressure gauge to the brake valve assembly.



M06021000021

### 2. TEST OF OPERATION START PRESSURE

(1) Purge the air within the air tank completely and check to see that the air pressure gauge indicates 0.
(2) Depress the brake pedal completely to the floor and hold it down at that position.
(3) Start the engine and increase the air pressure.
(4) Check to see that the oil pressure increases before the air pressure reaches 69kPa {0.7 kgf/cm$^2$, 9.95 lbf/in$^2$}



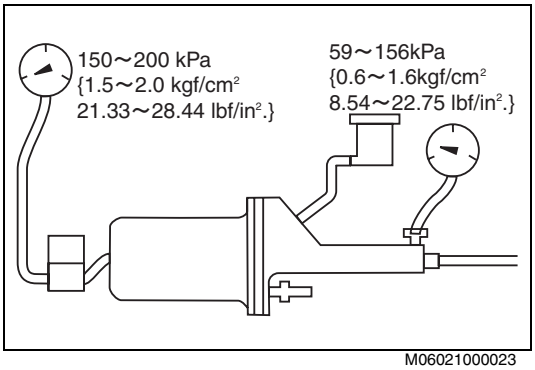
M06021000022

### 3. OPERATION CHECK AT FULL LOAD

(1) Increase the air pressure after the above test.
(2) Depress the brake pedal completely to the floor.
(3) Stop the engine when the air pressure reaches 883kPa {9.0kgf/cm$^2$, 127.98 lbf/in$^2$}.
(4) Check to see that the oil pressure at that moment is between 21.6-23.5MPa {220-240kgf/cm$^2$, 3.129-3.412 lbf/in$^2$}.

### 4. AIR SEALING TEST AT FULL LOAD

(1) Immediately after the above test, check to see for one minute that the air pressure does not drop down.

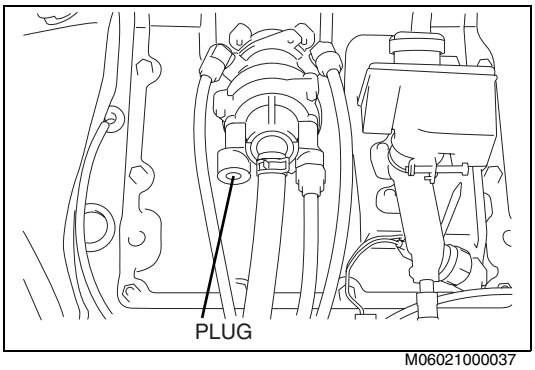


M06021000023

**5. RESIDUAL PRESSURE TEST (CHECK VALVE TEST)**

(1) Replace an oil pressure gauge with one having the scale of 0- 690 kPa {0-7 kgf/cm$^2$, 0-99.54 lbf/in$^2$}.

(2) Depress the brake pedal till the air pressure reaches 150-200 kPa {1.5-2.0 kgf/cm$^2$, 21.33-28.44 lbf/in$^2$} and then release the pedal. Check to see that the oil pressure at that moment is 59-156 kPa {0.6-1.6 kgf/cm$^2$, 8.54-22.75 lbf/in2} in case of the vehicle equipped with drum brake, and 0 in case of the vehicle equipped with disk brake.



M06021000037

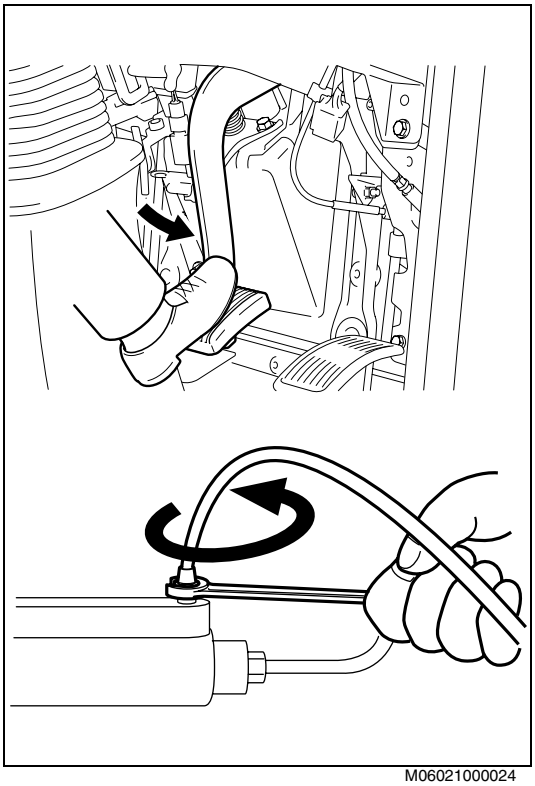
**6. OPERATION AFTER CHECK**

(1) Remove the air pressure gauge from the brake valve assembly.

(2) Apply lock agent (LOCTITE 575 or equivalent) on the threaded portion of the plug.

(3) Install the plug on the brake valve assembly.

(4) Remove the oil pressure gauge and install the bleeder screw of the hydraulic cylinder.


M06021000024

**7. CHECK OF THE STROKE WARNING SWITCH AND WARNING BUZZER**

(1) Attach a vinyl tube to the bleeder screw of hydraulic cylinder.

(2) Depress the brake pedal and loosen the bleeder screw of hydraulic cylinder to allow the fluid flow out.

**NOTICE:**
**Do not have the fluid scattered.**

(3) Check to see if the warning lamp lights up and the warning buzzer beeps.

**NOTICE:**
**Warning buzzer beeps only when the parking brake is released.**

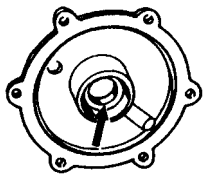
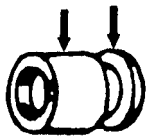
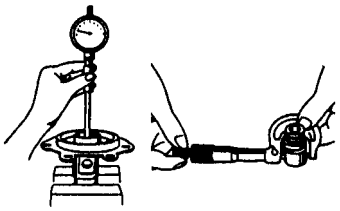
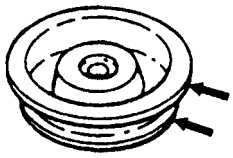
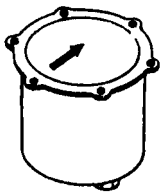
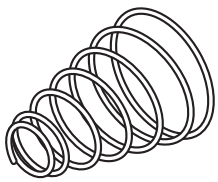
(4) Attach the bleeder screw of hydraulic cylinder.

# INSPECTION AND REPAIR

M06021001BEH3011

**NOTICE:**
**Brake fluid or isopropyl alcohol should only be used to wash the components.**

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Hydraulic cylinder inner surface:<br>Corrosion and wear | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Hydraulic piston:<br>Corrosion and wear | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Hydraulic cylinder and piston:<br>Clearance | 0.07-0.14<br>{0.0028-0.0055} | 0.16<br>{0.0063} | Replace, cylinder and/or piston. | Measure<br>  |
| Power piston:<br>Rust, deformation and wear | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Power cylinder shell:<br>Rust on inner surface and deformation.<br>NOTICE:<br>If the cylinder shell has a deformation in 0.45 mm {0.1772 in.} or more depth, be sure to replace it. | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Return spring:<br>Rust, damage and free length | 161 {6.34} | 154 {6.06} | Replace, if necessary. | Measure and visual check<br>  |

# BRAKE AIR BOOSTER (AIRMASTER) WITH ABS

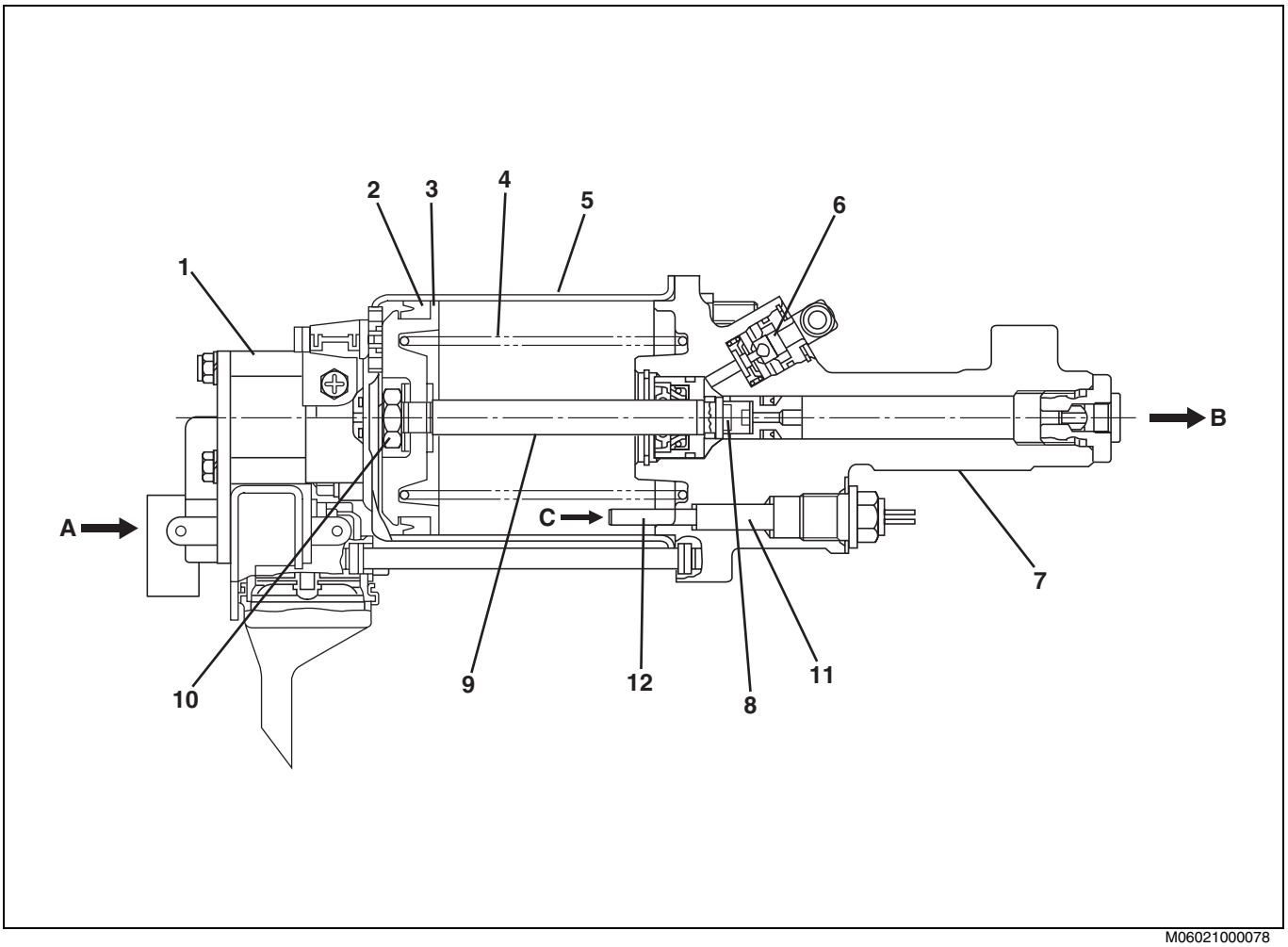
## DATA AND SPECIFICATIONS

M06021001BEI2002

| | |
|---|---|
| Type | AIRMASTER (Boosted air controlled by brake valve) |
| Power cylinder diameter | 92 mm {3.62 in.} |
| Hydraulic cylinder diameter | 17.46 mm {0.69 in.} |

## DESCRIPTION

M06021001BEC1002



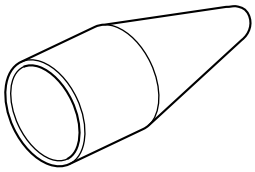
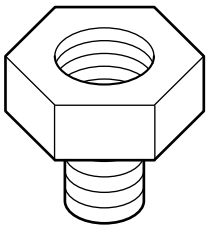

M06021000078

| | | | |
|---|---|---|---|
| 1 | ABS control valve | 9 | Push rod |
| 2 | Piston seal | 10 | Nut |
| 3 | Power piston | 11 | Stroke warning switch |
| 4 | Return spring | 12 | Piston stroke detector |
| 5 | Power cylinder shell | A | Boost air (From brake valve) |
| 6 | Check valve | B | To wheel cylinder |
| 7 | Hydraulic cylinder | C | At power piston over stroke |
| 8 | Hydraulic piston | | |

# SPECIAL TOOL

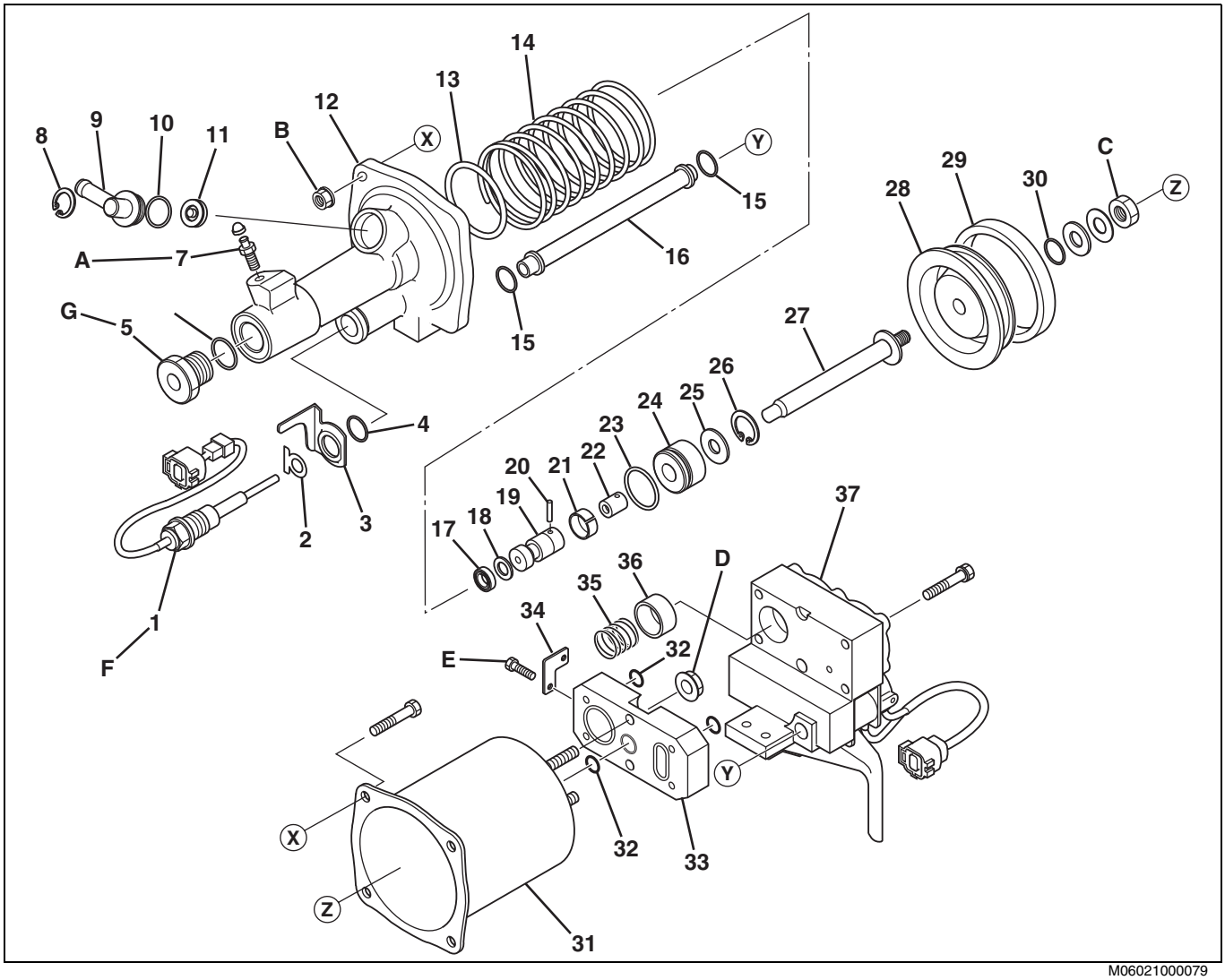
M06021001BEK1002

Prior to starting a brake air booster overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09657-2070 | PISTON CUP GUIDE | |
|  | 09699-1400 | CONNECTER | |

# COMPONENT LOCATOR

M06021001BED1002




M06021000079

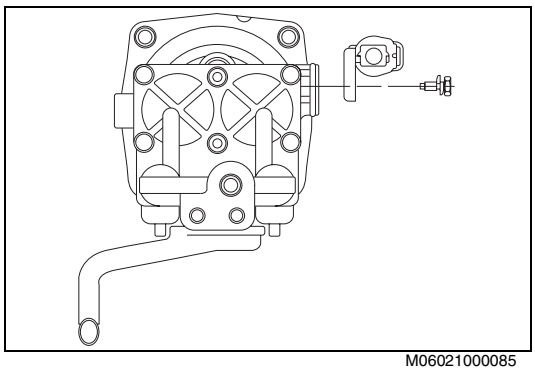
| | | | |
|---|---|---|---|
| 1 | Stroke warning switch | 20 | Pin |
| 2 | Clip | 21 | Band |
| 3 | Bracket | 22 | Valve |
| 4 | O-ring | 23 | O-ring |
| 5 | End plug | 24 | Plug |
| 6 | O-ring | 25 | Oil seal holder |
| 7 | Air bleeder screw | 26 | Retainer ring |
| 8 | Retainer ring | 27 | Piston rod |
| 9 | Oil pipe joint | 28 | Power piston |
| 10 | O-ring | 29 | Piston seal |
| 11 | Check valve | 30 | O-ring |
| 12 | Hydraulic cylinder | 31 | Power cylinder shell |
| 13 | O-ring | 32 | O-ring |
| 14 | Return spring | 33 | Housing |
| 15 | O-ring | 34 | Bracket |
| 16 | Pipe | 35 | Spring |
| 17 | Piston cap | 36 | Return valve |
| 18 | Back up ring | 37 | ABS control valve |
| 19 | Hydraulic piston | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 6.9-11.8 {70-120, 5.1-8.6} | E | 2.9-5.9 {30-60, 2.2-4.3} |
| B | 17.7-26.5 {180-270, 13-19} | F | 3.92-5.88{40-60, 2.9-4.3} |
| C | 19.6-29.4 {200-300, 15-21} | G | 68.6-78.4 {700-800, 51-57} |
| D | 6.9-12.7 {70-130, 5.1-8.6} | | |

# OVERHAUL

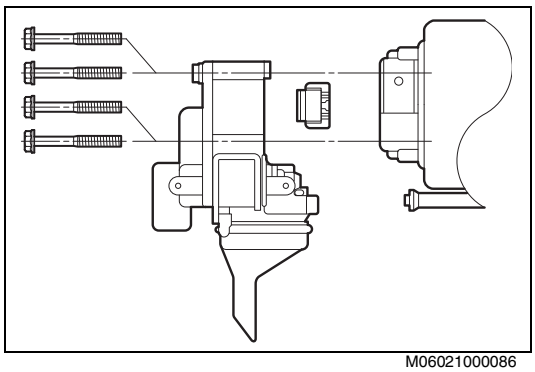
M06021001BEH2002


M06021000085

## IMPORTANT POINTS - DISASSEMBLY

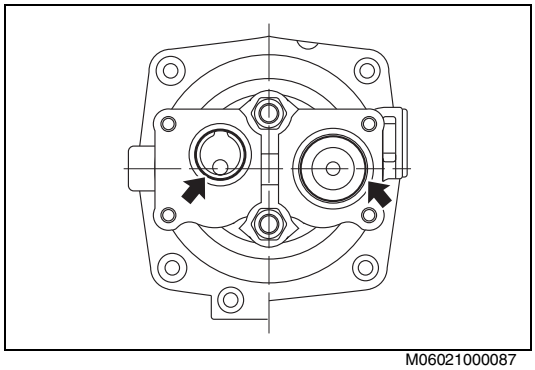
**1. HYDRAULIC CYLINDER AND POWER CYLINDER**

(1) Remove the mounting bolt of ABS control valve connector. Then remove the connector.

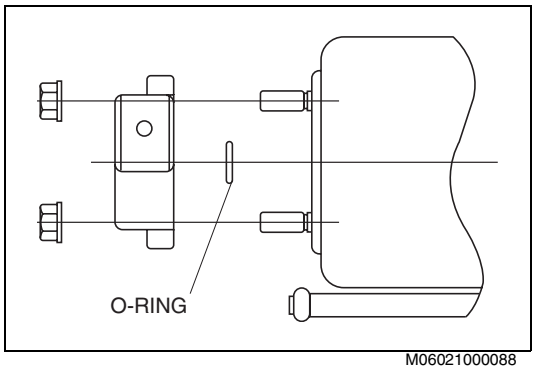

M06021000086

(2) Remove the bolts (4 pieces) and then remove ABS control valve, spring, and return valve.

**NOTICE:**
**Do not disassemble ABS control valve.**

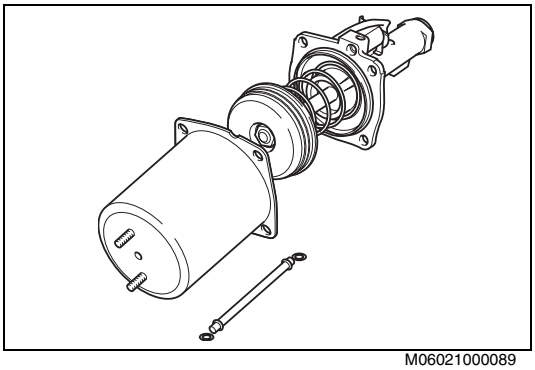

M06021000087

(3) Remove O-ring from the housing.



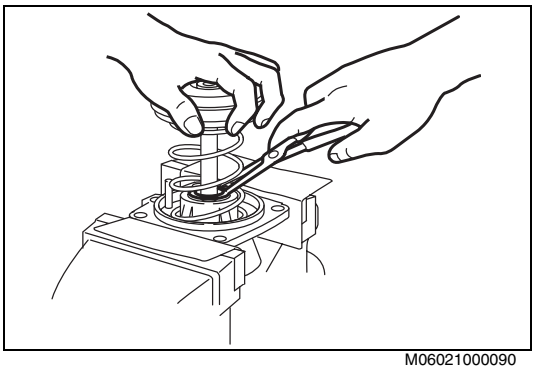
M06021000088

(4) Remove the nuts (2 pieces) and then remove the housing and O-ring from the air cylinder.


M06021000089

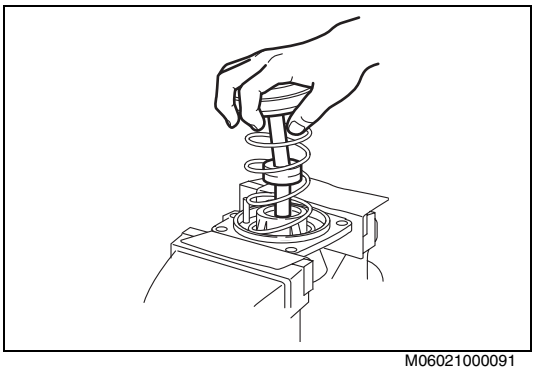
(5) Dismount the oil cylinder in assembly from the air cylinder.

**NOTICE:**
**Be careful not to put any materials other than the lubricants which is specified on the parts on and after this step.**


M06021000090

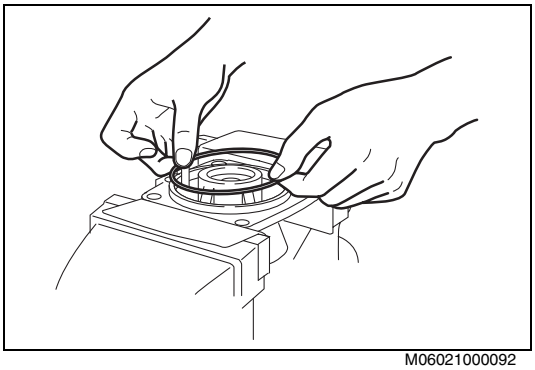
(6) Remove the snap ring from the oil cylinder using a suitable tool while pressing the air piston.

**NOTICE:**
- **Do not put grease in the air cylinder to the parts inside the oil cylinder.**
- **When removing the return spring, hold down the air piston to prevent it from coming out of the oil cylinder.**

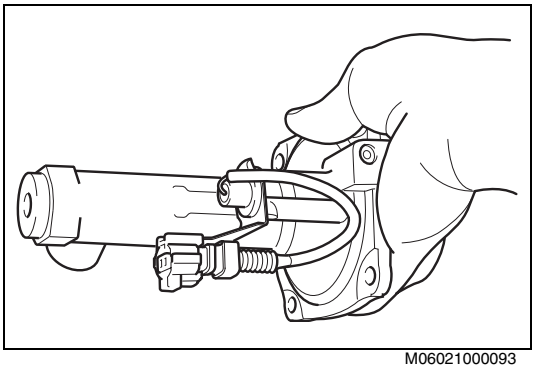

M06021000091

(7) Remove the air piston and return spring from the oil cylinder.

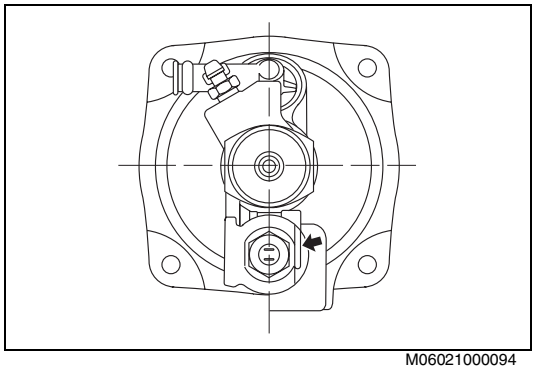
**NOTICE:**
**When removing the plug, pull it out straightforward without twisting it forcibly.**


M06021000092

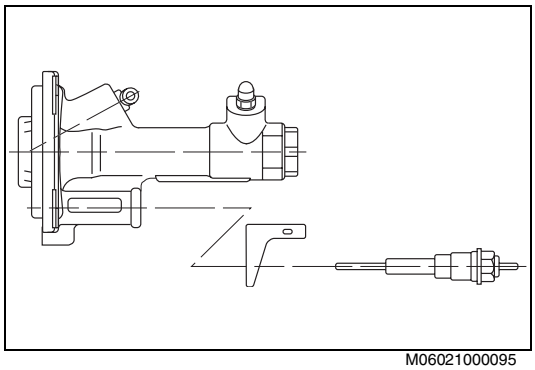
(8) Remove O-ring from the oil cylinder.


M06021000093

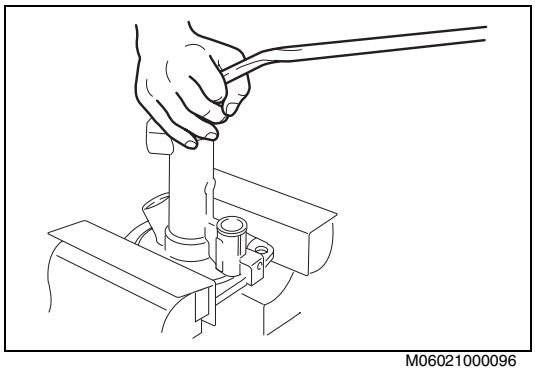
(9) Push the connector lock of the stroke detector switch using a small screwdriver or its equivalent. Then remove the connector from the bracket.


M06021000094

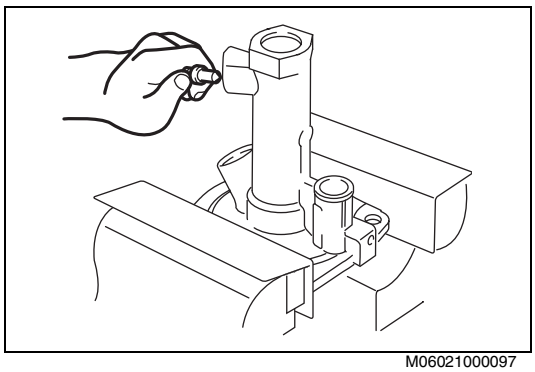
(10) Open the caulking section of the clip.


M06021000095

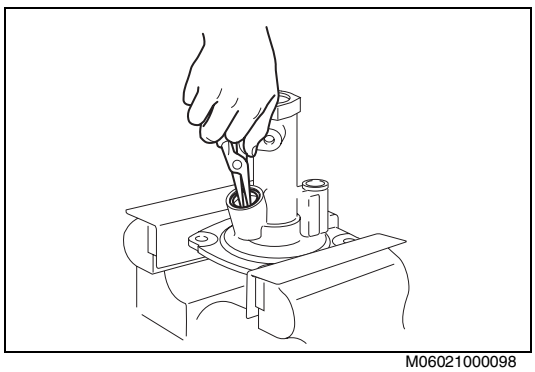
(11) Dismount the stroke detector switch, clip, bracket, and O-ring from the oil cylinder.


M06021000096

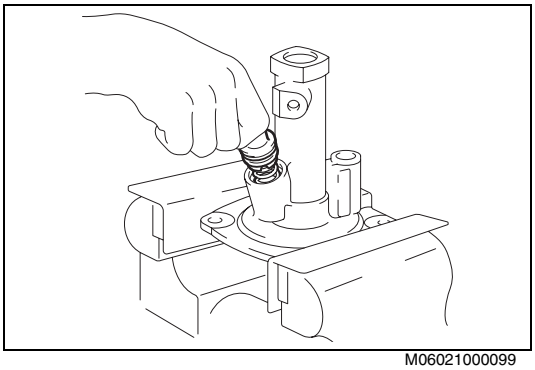
(12) Remove the end cap. Remove the O-ring from the oil cylinder.


M06021000097

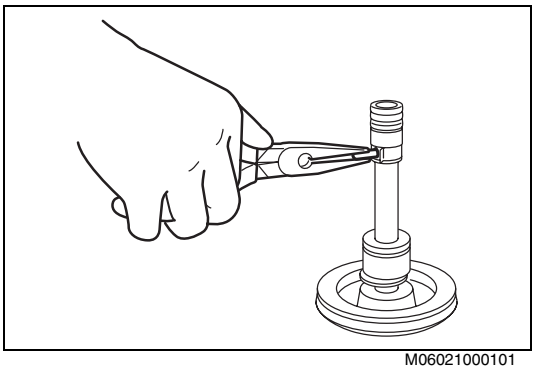
(13) Remove the cap and bleeder screw from the oil cylinder.


M06021000098

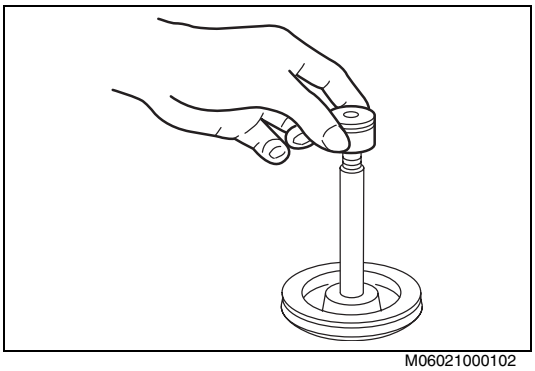
(14) Remove the retainer ring from the oil connector of oil cylinder by using a suitable tool.


M06021000099

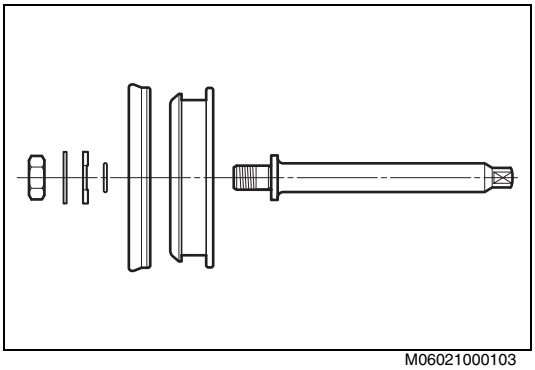
(15) Dismount the oil connector and O-ring from the oil cylinder.


M06021000101

(16) Dismount the check valve from the oil cylinder
(17) Remove the piston pin from the piston rod. Then dismount the band, piston cup, backup ring, hydraulic piston and valve.

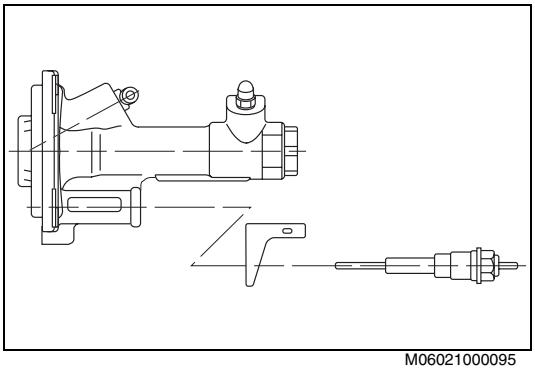

M06021000102

(18) Remove the O-ring, plug and oil seal holder from the piston rod.


M06021000103

(19) Remove the nut of the air piston and dismount the spring washer, plate, O-ring, piston seal, air piston and washer from the piston rod.

**NOTICE:**
**Do not dismount the plate of piston rod.**


M06021000095

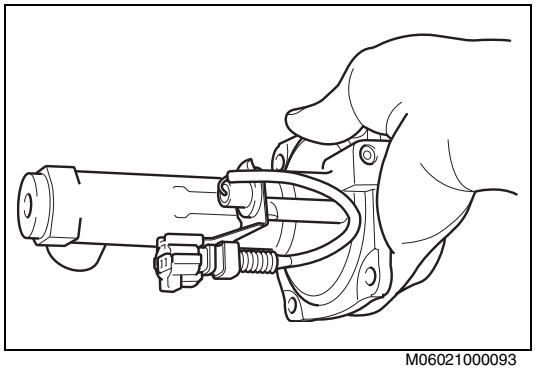
## IMPORTANT POINTS - ASSEMBLY

**1. HYDRAULIC CYLINDER AND POWER CYLINDER**

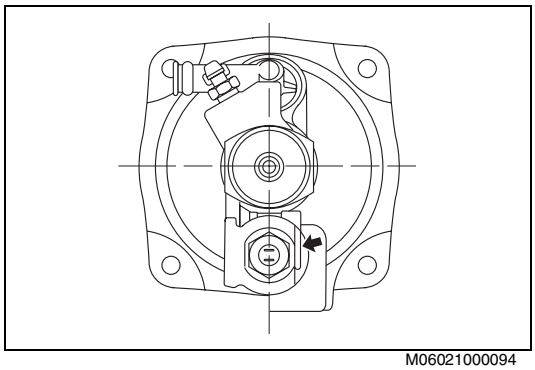
(1) Apply Albania grease to a new O-ring. Install this O-ring, clip, and bracket to the stroke detector switch.

**NOTICE:**
**Be careful to the installing direction of the clip.**

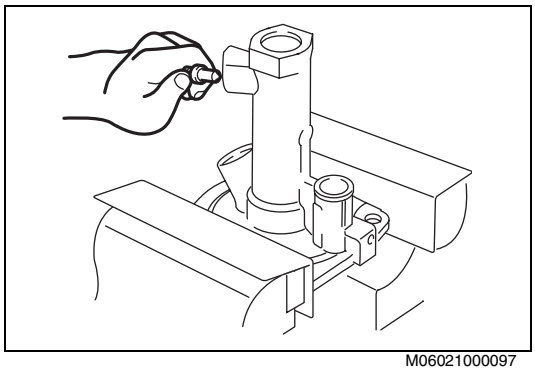
(2) Install the stroke detector switch to the oil cylinder.


M06021000093

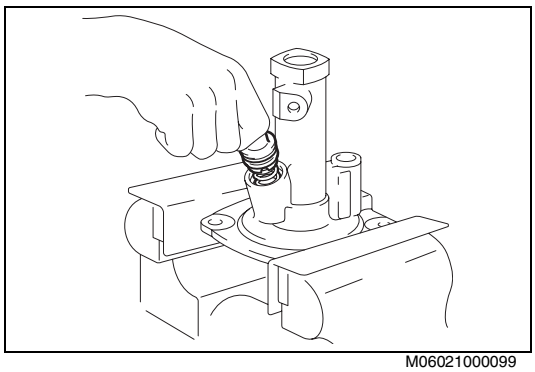
(3) Install the connector of the stroke detector switch to the bracket.


M06021000094

(4) Caulk and fix the clip to the bracket and stroke detector switch.


M06021000097

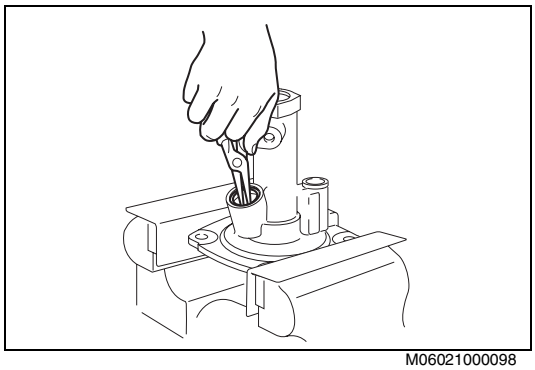
(5) Install the air bleeder screw to the oil cylinder.


M06021000099

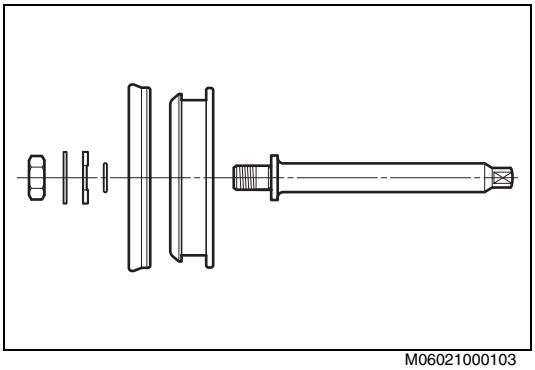
(6) Apply brake and clutch fluid to the check valve and install it to the oil cylinder.

**NOTICE:**
**Install the check valve so that its rubber side is faced to the oil cylinder.**

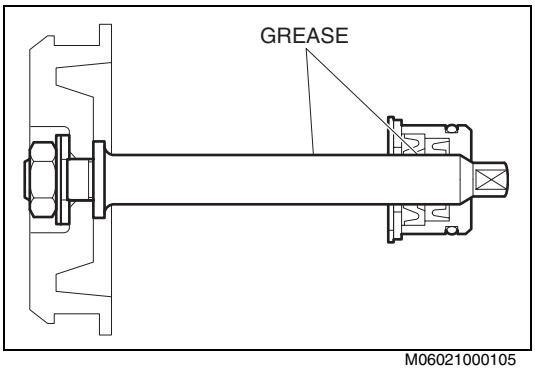
(7) Apply brake and clutch fluid to a new O-ring and install it to the oil connector.
(8) Install the oil connector to the oil cylinder.


M06021000098

(9) Using a suitable tool, install a new snap ring to fix the oil connector.

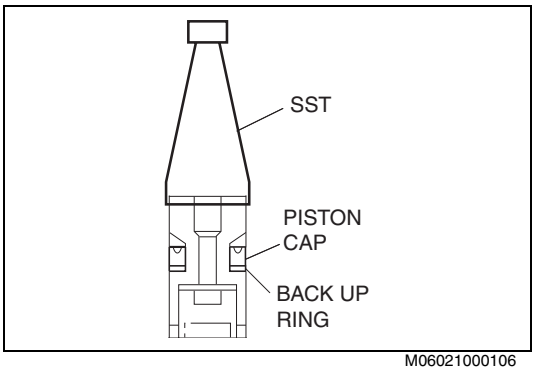

M06021000103

(10) Install to the piston rod the air piston, piston seal, new O-ring, plate and spring washer. Then tighten the nut.
(11) Using punch, caulk two points at 180 degree spacing the nut and the threads of the piston rod.



M06021000105

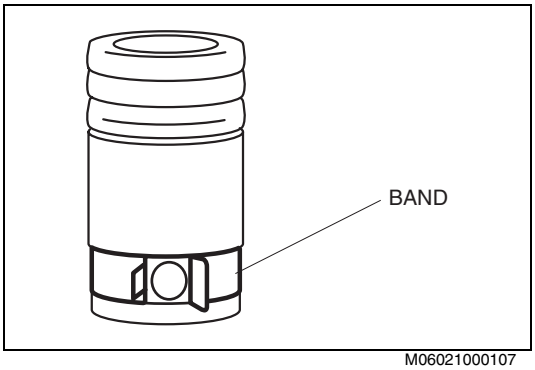
(12) Apply silicone grease to inner surface of a new plug and sliding part of the piston rod. Install to the piston rod a new retainer ring, oil seal holder, plug and O-ring.



M06021000106

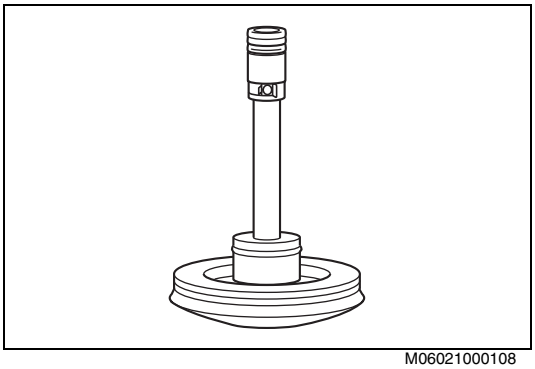
(13) Apply brake and clutch fluid to a new piston cup and backup ring. Install them to the hydraulic piston using special tool.
**SST: PISTON CUP GUIDE (09657-2070)**

**NOTICE:**
- **Be careful to the direction of the hydraulic piston cup and the position of the backup ring.**
- **Do not use other than brake and clutch fluid for assembly.**



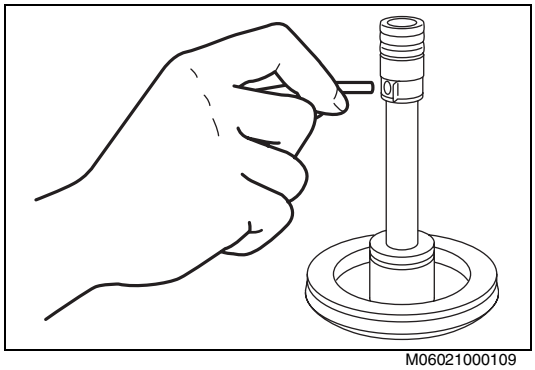
M06021000107

(14) Align the band hole to the pinhole of the hydraulic piston, and assemble them temporarily.

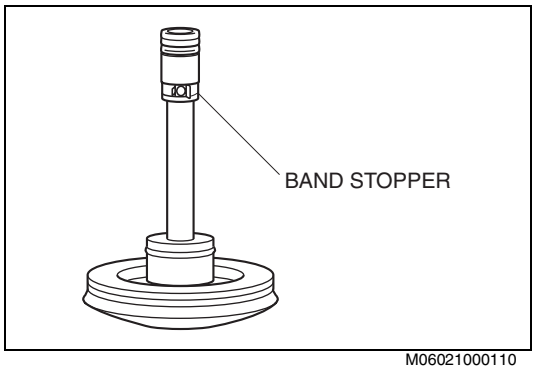

M06021000108

(15) Align the pinhole and install the hydraulic piston and valve to the piston rod.

**NOTICE:**
**If the band hole is opened excessively and deformed, replace it with new one.**

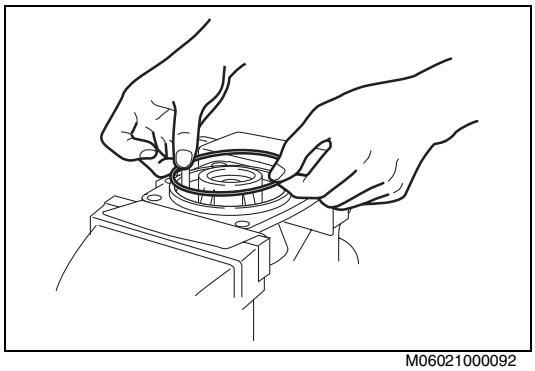

M06021000109

(16) Install the piston pin and assemble it.



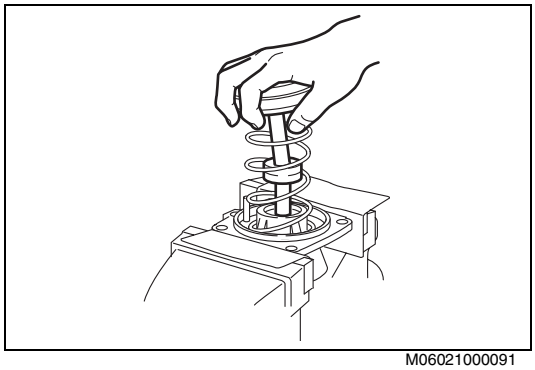
M06021000110

(17) Install the band stopper to the hole of hydraulic piston.


M06021000092

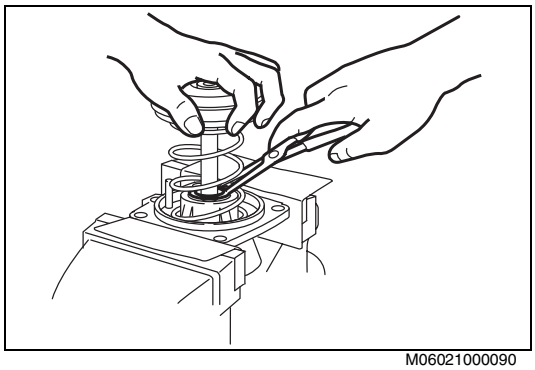
(18) Apply Albania grease No. 2 to a new O-ring and install it to the oil cylinder.

**NOTICE:**
**Do not put grease to the parts inside the oil cylinder. If the grease is put on the parts, replace the parts with new ones.**

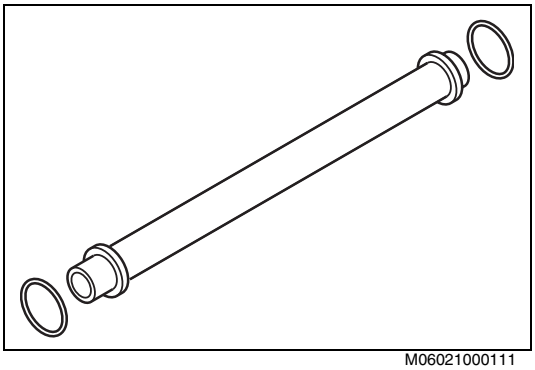

M06021000091

(19) Install the return spring and air piston in assembly to the oil cylinder.

**NOTICE:**
**Install the plug straightforward without pressing it forcibly when mounting it.**

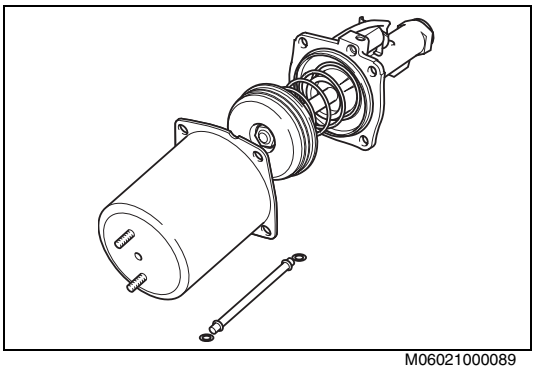

M06021000090

(20) Fix the plug by new retainer ring using a suitable tool.



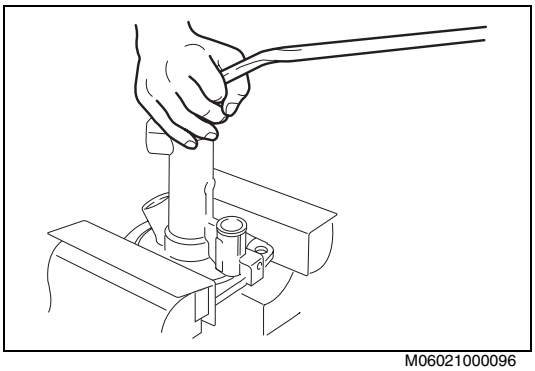
M06021000111

(21) Apply Albania grease No. 2 to new seals and mount them to the ends of the pipe.



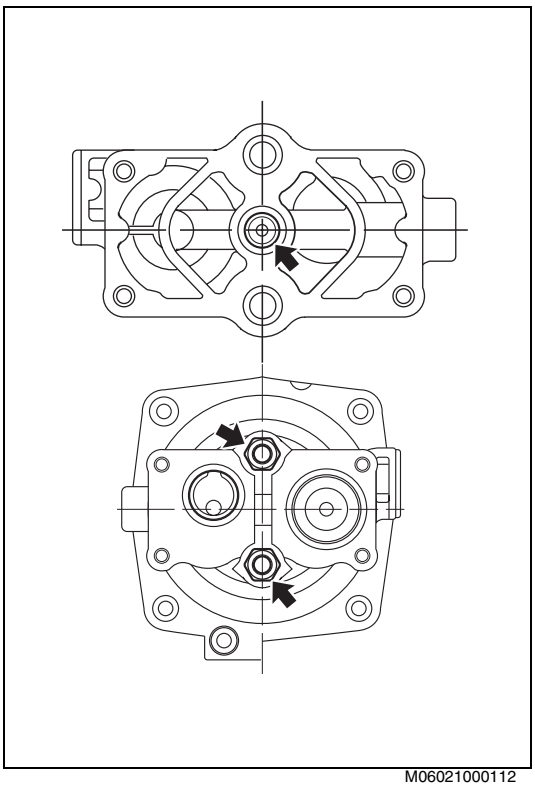
M06021000089

(22) Apply Albania grease No. 2 to the sliding part of the air piston of air cylinder. Mount the air cylinder and pipe to the oil cylinder.



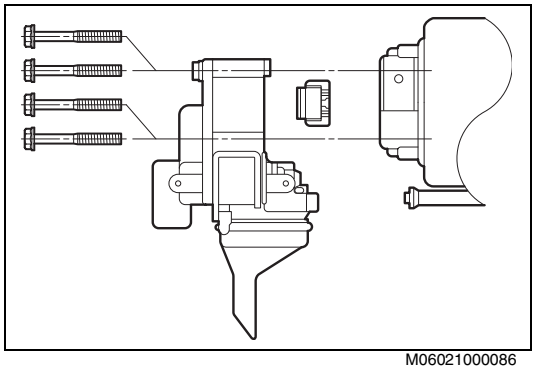
M06021000096

(23) Install a new O-ring to the end cap and mount them to the oil cylinder.



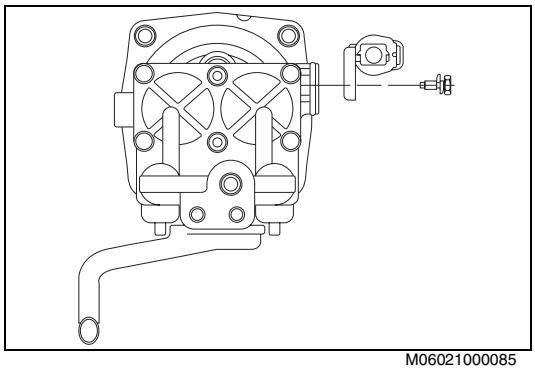
M06021000112

(24) Install a new O-ring to the housing and mount them to the air cylinder by nuts (2 pieces).


M06021000086

(25) Apply Albania grease No. 2 to the sliding part of the return valve and install it to ABS control valve. Then mount the housing. Install new O-rings (2 pieces) to the housing, and mount ABS control valve to the housing by bolts (4 pieces).

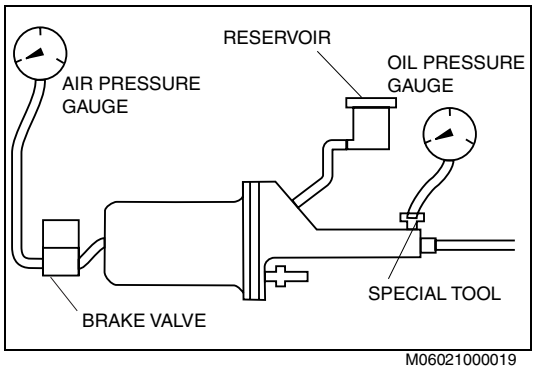
**NOTICE:**
- **Be careful to the mounting direction of return valve.**
- **Do not apply grease to the rubber seat of return valve.**
- **Do not remove the rubber located at the end of the return valve.**


M06021000085

(26) Mount the connector bracket to ABS control valve.

# INSPECTION

M06021001BEH3002



M06021000019

## CHECKING OF BRAKE BOOSTER FUNCTION

For the inspection after assembly, a special tester is available. Use this tester for inspection. For inspection procedure by special tester, refer to "Instruction manual" that has come with the tester. If the tester is not available, follow the instruction below to check oil and air leakage, performance, etc. At the inspection, use brake and clutch fluid as brake fluid. After the assembly, the valve is closed. So, operate the valve several times before inspection.

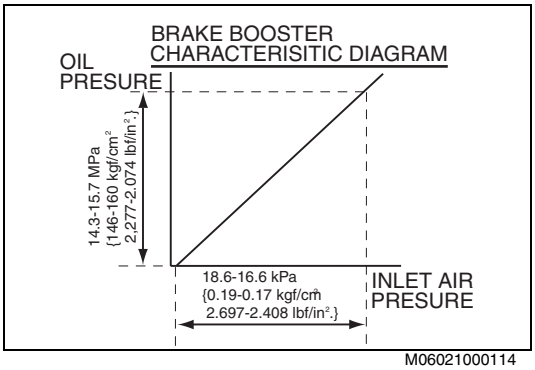
**1. PREPARATION**

(1) Remove the air bleeder of hydraulic cylinder. Using special tool, set an oil pressure gauge of 2.55 MPa {250 kgf/cm$^2$, 3,556 lbf/in$^2$.} scale.
**Connection: M12 x 1.5**
**SST: CONNECTOR (09699-1400)**

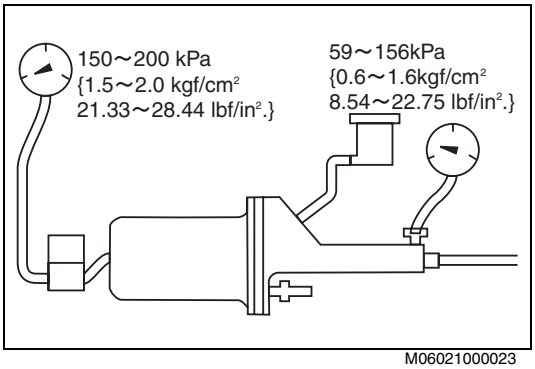
(2) Remove the stop lamp switch of brake valve and set an air pressure gauge.
**Connection: PT 1/4**

**2. TIGHTNESS OF OIL AND AIR**

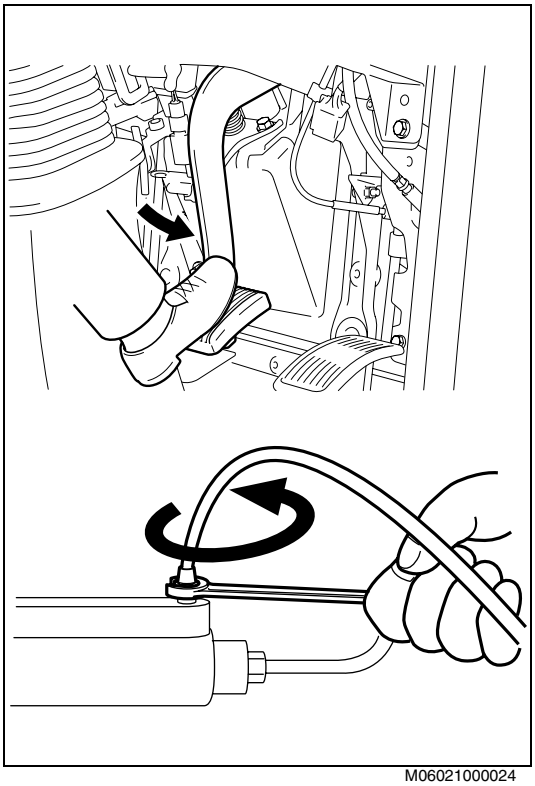
(1) Apply air tank inlet pressure 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} and stop the source pressure. On this condition, check that the oil pressure does not fluctuate for 15 seconds.
(2) Using soap water, check visually that there is no air leakage at the tightened connection.



M06021000114



M06021000023


M06021000024

### 3. OPERATION CHARACTERISTIC

(1) Follow-up control
   a. With the air tank inlet pressure 834 KPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.}, vary the air pressure repeatedly from 0 kPa {0 kgf/cm$^2$, 0 lbf/in$^2$.} to 490 kPa {5.0 kgf/cm$^2$, 71 lbf/in$^2$.} and check that the oil pressure follows up the air pressure smoothly.

(2) Characteristic
   a. With the air tank inlet pressure 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.}, increase the air pressure from 0 kPa {0 kgf/cm$^2$, 0 lbf/in$^2$.} gradually and check that the characteristic meets the brake booster characteristic diagram. When inspecting the brake booster with check valve for residual pressure, make sure to release the residual pressure before inspection.

### 4. RESIDUAL PRESSURE TEST (CHECK VALVE TEST)

(1) Replace the oil pressure gauge with that of 690 kPa {7.0 kgf/cm$^2$, 100 lbf/in$^2$.} scale.

(2) Step the brake pedal until the air pressure drops to 150-200 kPa {1.5-2.0 kgf/cm$^2$, 21.34-28.45 lbf/in$^2$.} and then release the pedal. At this moment, check that the oil pressure is within the range of 78-127 kPa {0.8-1.3 kgf/cm$^2$, 11.38-18.49 lbf/in$^2$.}.

**NOTE:**

- **If the pressure is not attained, replace defective parts; check valve, spring, etc.**

### 5. INSPECTION OF STROKE DETECTOR SWITCH AND WARNING LAMP

(1) Set a vinyl tube to the bleeder of hydraulic cylinder.

(2) Step the brake pedal. Loosen the bleeder of hydraulic cylinder to leak the fluid.

**NOTICE:**

**Do not spill out the brake fluid.**

(3) Check that the warning lamp turns on and the warning buzzer beeps.

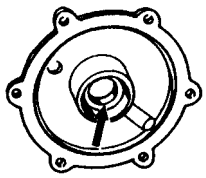
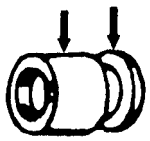
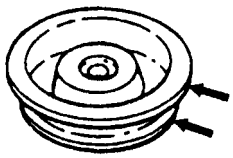
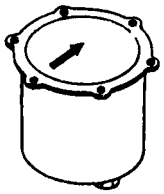
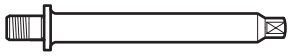
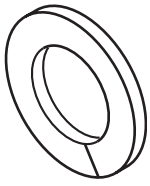
**HINT:**

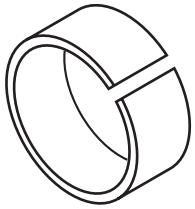
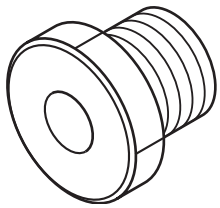
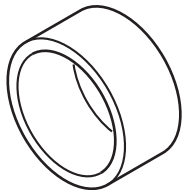
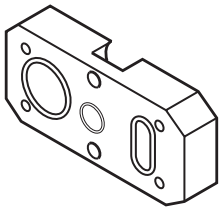
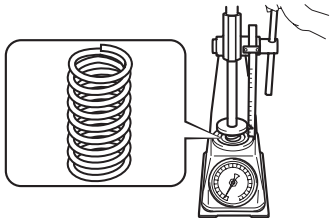
**The warning buzzer does not beep unless the parking brake is released.**

# INSPECTION AND REPAIR

M06021001BEH3012

**NOTICE:**
**Brake fluid or isopropyl alcohol should only be used to wash the components.**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Hydraulic cylinder inner surface:<br>Corrosion and wear | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Hydraulic piston:<br>Corrosion and wear | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Power piston:<br>Rust, deformation and wear | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Power cylinder shell:<br>Rust on inner surface and deformation. | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Piston rod:<br>Rust, deformation and wear | — | — | Clean or replace, if necessary. | Visual check<br>  |
| Back up ring:<br>Rust, deformation and wear | — | — | Replace, if necessary. | Visual check<br>  |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Band:**<br>**Rust, deformation and wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **End plug:**<br>**Rust, deformation and wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Return valve:**<br>**Rust, deformation and wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Housing:**<br>**Rust, deformation and wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Return spring:**<br>**Rust, deformation and wear**<br>**Setting load at specified height.** | | | **Replace, if necessary.** | **Visual check**<br>  |

# RELAY VALVE

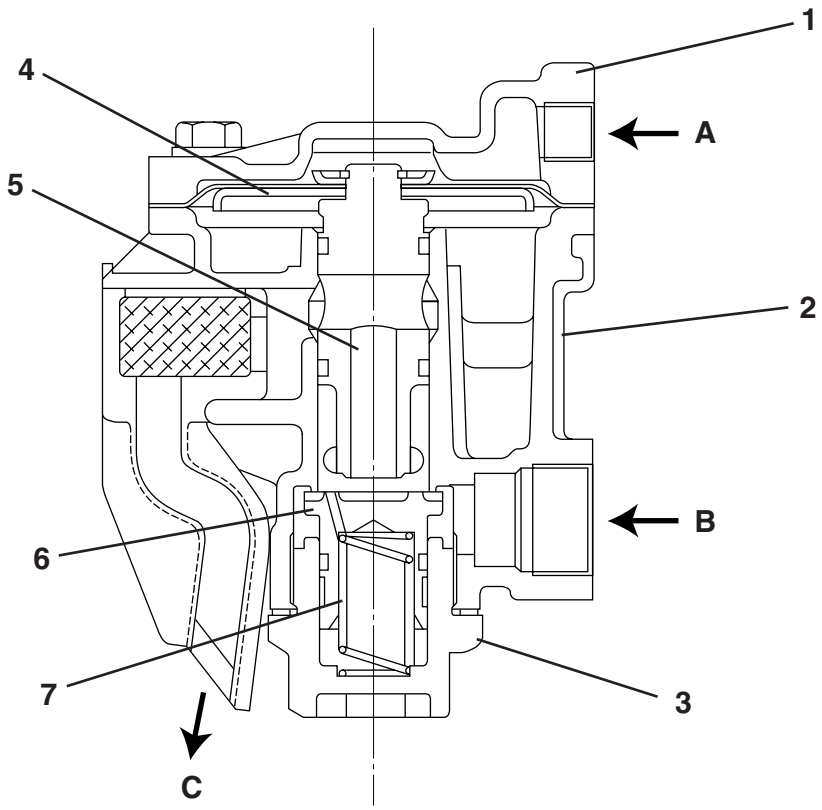
## DATA AND SPECIFICATIONS

M06021301BEI2002

| | |
|---|---|
| **Type** | **Diaphragm type** |
| **Pressure difference between signal and outlet pressure** | **Less than 29 kPa {0.3 kgf/cm$^2$, 4.26 lbf/in$^2$.}** |

## DESCRIPTION

M060213BEC1002

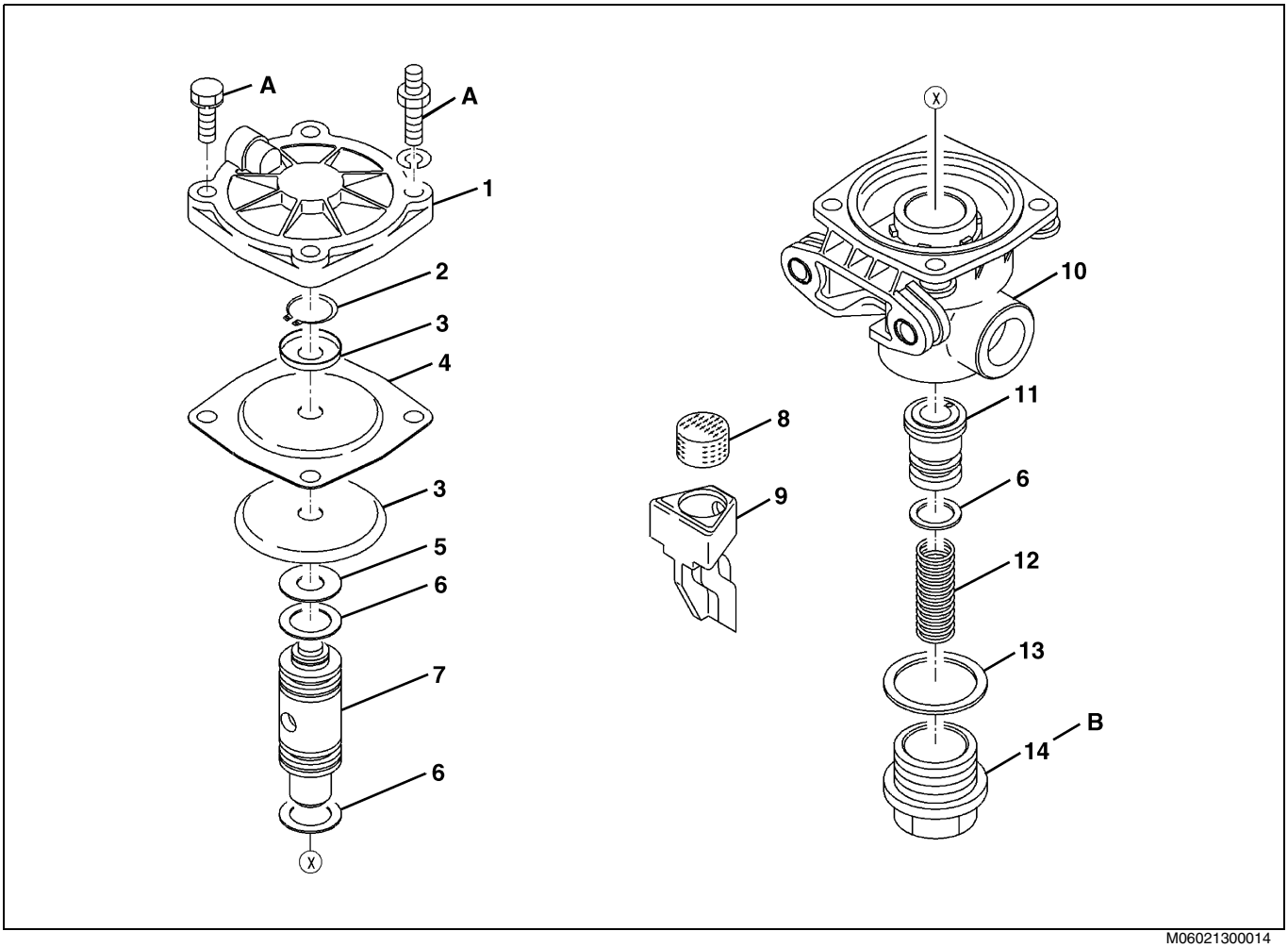



M06021300013

| | | | |
|---|---|---|---|
| 1 | Cover | 6 | Feed valve |
| 2 | Body | 7 | Return spring |
| 3 | Cap | A | Signal air |
| 4 | Diaphragm | B | Inlet air |
| 5 | Exhaust valve | C | Exhaust |

# COMPONENT LOCATOR

M06021301BED1002




M06021300014

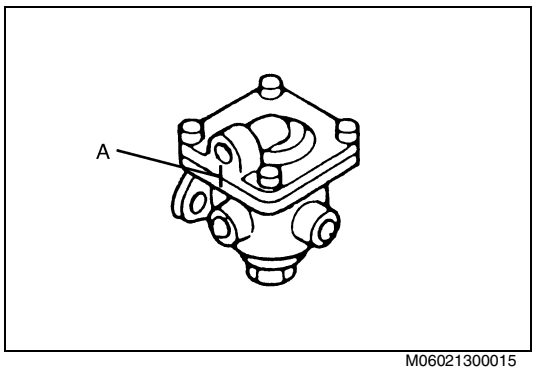
| | | | |
|---|---|---|---|
| 1 | Cover | 8 | Filter |
| 2 | Retainer ring | 9 | Dust cover |
| 3 | Washer | 10 | Body |
| 4 | Diaphragm | 11 | Feed valve |
| 5 | Shim | 12 | Return spring |
| 6 | O-ring | 13 | Gasket |
| 7 | Exhaust valve | 14 | Cap |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 11.8-14.7 {120-150, 9-10} | B | 58.8-78.4 {600-799, 44-57} |

# OVERHAUL

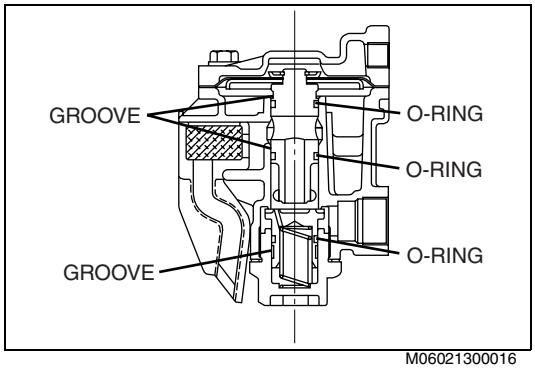
M06021301BEH2002



M06021300015

## IMPORTANT POINT - DISASSEMBLY

**NOTICE:**
**Before disassembling the relay valve, apply the aligning mark A to the cover and body.**



M06021300016

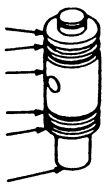
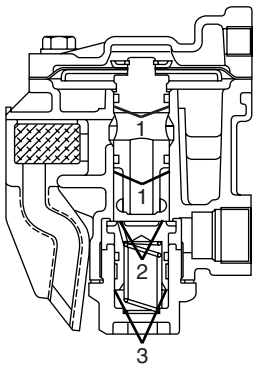
## IMPORTANT POINT - ASSEMBLY

**1. LUBRICATION**
(1) When reassembling the relay valve, replace the O-rings, diaphragm, gasket and feed valve with new ones.
(2) Apply adequate amount of the silicone grease to the O-rings, grease groove and sliding surfaces of the component parts.
(3) When installing the cover to the body, align the aligning marks which were applied at disassembly.

# INSPECTION AND REPAIR

M06021301BEH3002

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Sliding surfaces and valve contact surfaces of exhaust valve: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Valve Body, Sliding surfaces 1 and valve contact surfaces 2: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**   |
| **Cap, Sliding surfaces 3: Wear and damage** | **—** | **—** | **Replace, if necessary.** | |

# SPRING BRAKE CONTROL VALVE

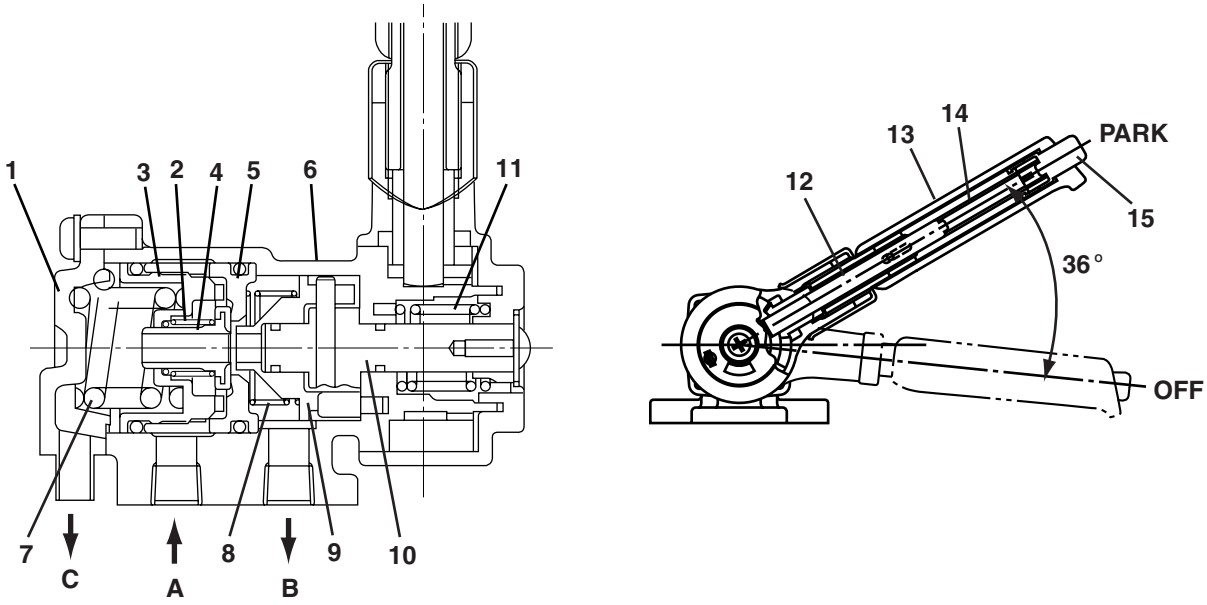
## DATA AND SPECIFICATIONS

M06021201BEI2001

| | |
|---|---|
| **Type** | **Variable pressure control type** |
| **Outlet pressure difference between parking and releasing stroke at a specified lever angle** | **Within 147 kPa {1.5 kgf/cm$^2$, 21.33 lbf/in$^2$.}** |

## DESCRIPTION

M06021201BEC1001

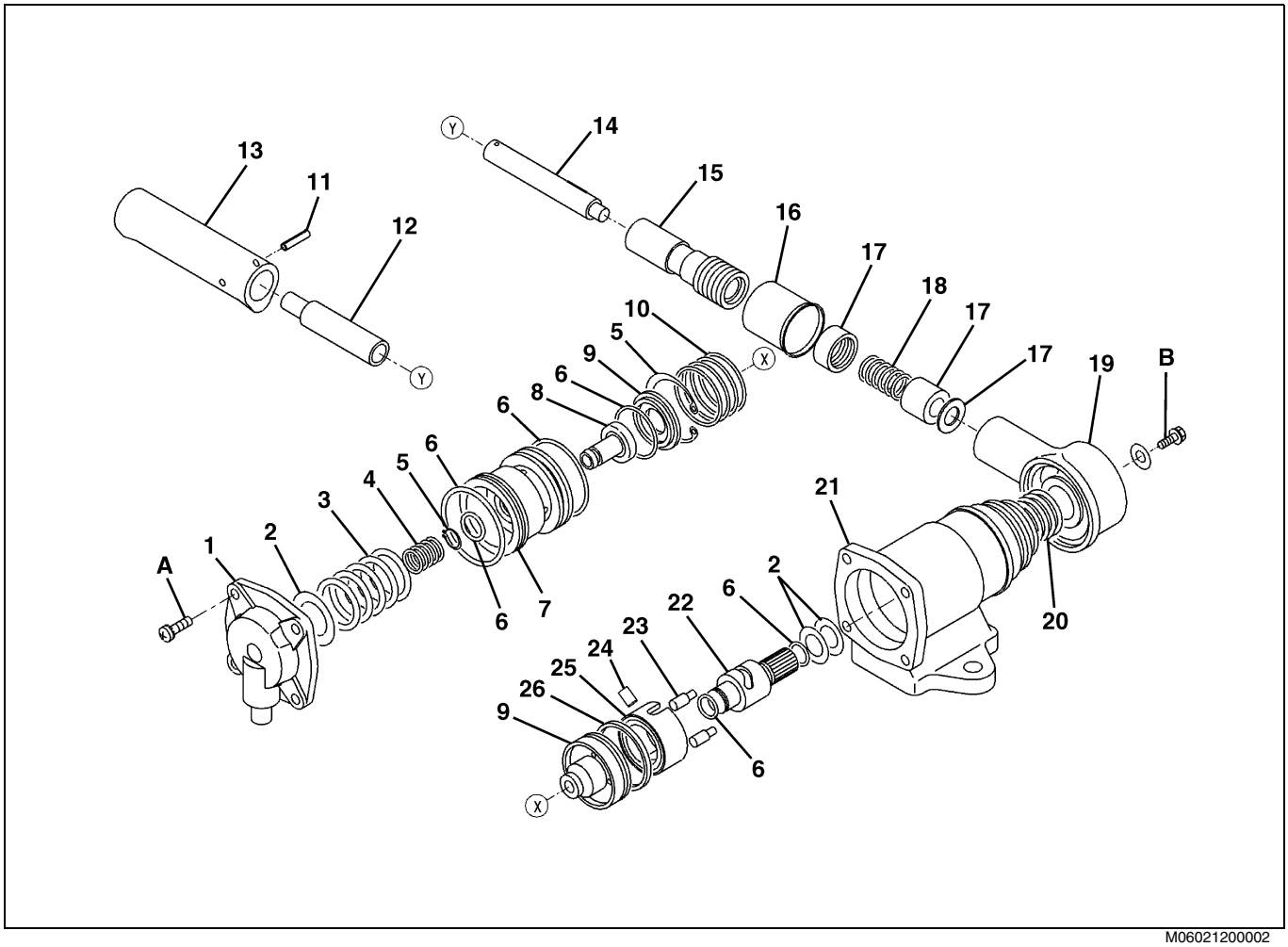



M06021200001

| | | | | | |
|---|---|---|---|---|---|
| 1 | Body cover | 7 | Piston spring | 13 | Grip |
| 2 | Feed valve spring | 8 | Valve seat spring | 14 | Compression spring |
| 3 | Piston | 9 | Cam | 15 | Release rod |
| 4 | Feed valve | 10 | Cam holder | A | Inlet |
| 5 | Valve seat | 11 | Return spring (If so equipped) | B | Outlet |
| 6 | Valve body | 12 | Pull rod | C | Exhaust (PARK) |

# COMPONENT LOCATOR

M06021201BED1001




M06021200002

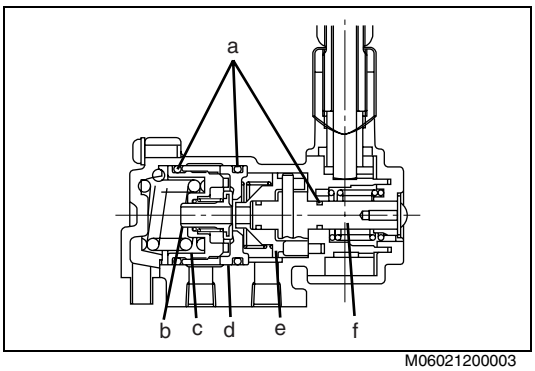
| | | | | | |
|---|---|---|---|---|---|
| 1 | Body cover | 10 | Valve seat spring | 19 | Body cap |
| 2 | Shim | 11 | Lock pin | 20 | Return spring (If so equipped) |
| 3 | Piston spring | 12 | Release rod knob | 21 | Valve body |
| 4 | Feed valve spring | 13 | Grip | 22 | Cam holder |
| 5 | Retainer ring | 14 | Pull rod | 23 | Body pin |
| 6 | O-ring | 15 | Supporter | 24 | Cam holder pin |
| 7 | Piston | 16 | Cover | 25 | Cam |
| 8 | Feed valve | 17 | Stopper | 26 | Piston guide |
| 9 | Valve seat | 18 | Compression spring | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 5.4-7.4 {55-75, 4.0-5.4} | B | 3.4-4.9 {35-50, 2.6-3.6} |

# OVERHAUL

M06021201BEH2001



M06021200003

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the spring brake control valve, replace the feed valve, valve seats and O-rings.

(2) Apply silicone grease to each sliding surface of the assembly parts, O-rings and O-ring grooves.

a. O-ring

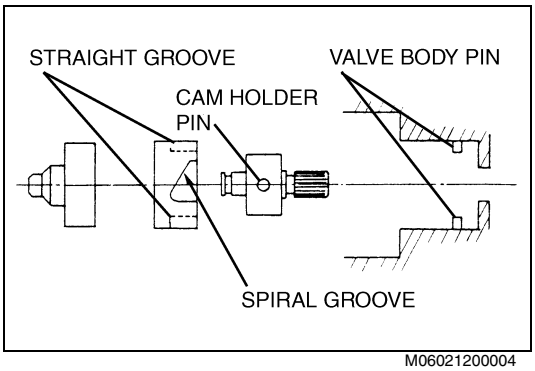
b. Feed valve

c. Piston

d. Valve seat

e. Cam

f. Cam holder

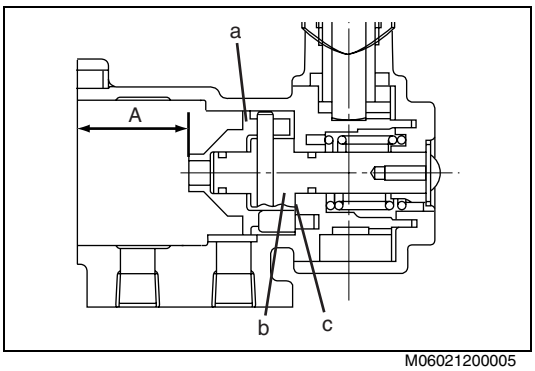


M06021200004

**2. ASSEMBLE THE CAM ASSEMBLY.**

(1) When assembling the cam and cam holder, make sure that the cam holder pin and spiral groove of the cam are aligned.

(2) When installing the cam assembly to the valve body, the valve body pin and straight groove of the cam must be aligned.



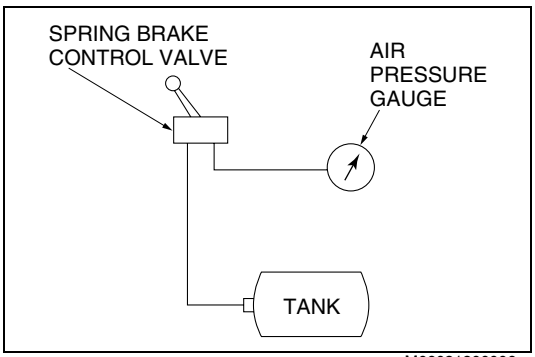
M06021200005

(3) Adjust dimension "A" with the shim.
**Assembly standard: 33.8-34.2 mm {1.331-1.346 in.}**

a. Cam

b. Cam holder

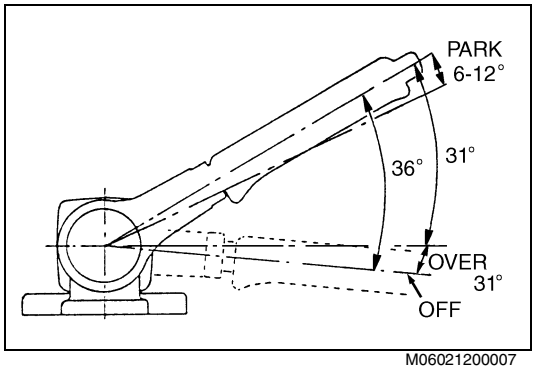
c. Shim



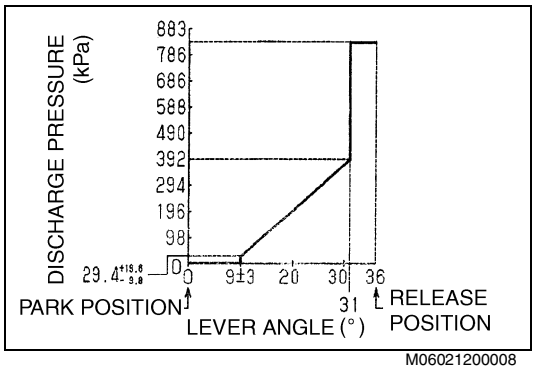
M06021200006

**3. SPRING BRAKE CONTROL VALVE PERFORMANCE TEST**

(1) First, connect the pressure gauge to the outlet line and apply an air pressure of 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} to the inlet line.



M06021200007



M06021200008

(2) Move the spring brake control lever towards the OFF position, gradually and confirm that the air pressure in the outlet line meets the characteristic shown in figure.
**Standard:**

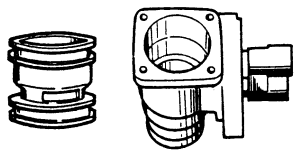
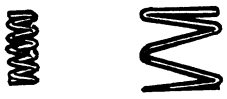
| Lever angle: | Outlet pressure: kPa {kgf/cm$^2$, lbf/in$^2$.} |
|---|---|
| 6-12° | 19.6-49 {0.2-0.5, 2.85-7.11} |
| Over 31° | 686 {7.0, 99.54} |

**NOTICE:**
**The characteristic shown is under the inlet pressure of 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.}**

# INSPECTION AND REPAIR

M06021201BEH3001

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Piston and valve body: Wear and damage | — | — | Replace, if necessary. | Visual check  |
| Cam, pin and cam holder: Wear and damage | — | — | Replace, if necessary. | Visual check  |
| Piston spring: Rust, damage and measure the spring free length | Free Length 27.9 {1.098} | 25.0 {0.984} | Replace, if necessary. | Measure and visual check  |
| Feed valve spring and valve seat spring: Rust and damage | — | — | Replace, if necessary. | Visual check  |

# SPRING BRAKE CHAMBER

## DATA AND SPECIFICATIONS

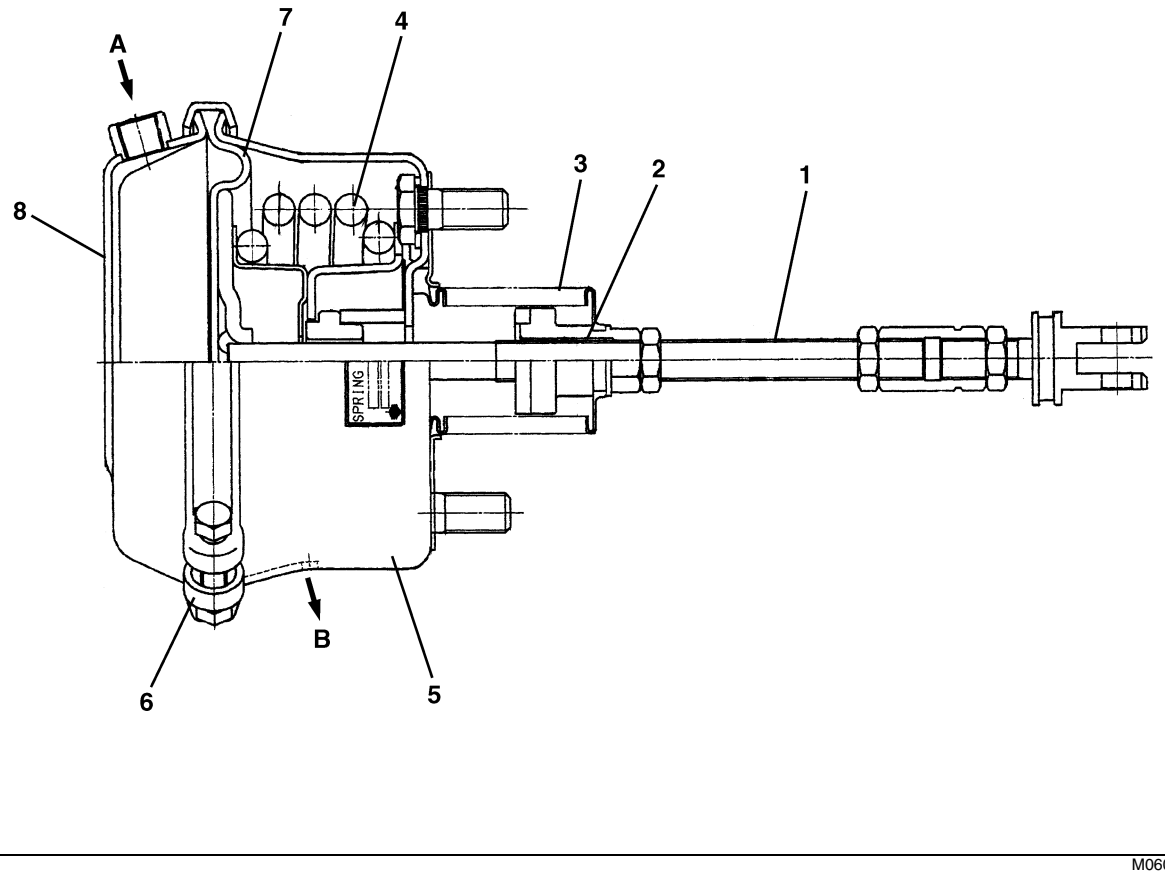
M06021501BEI2003

| | |
|---|---|
| **Type** | **Diaphragm type** |

## DESCRIPTION

M06021501BEC1003

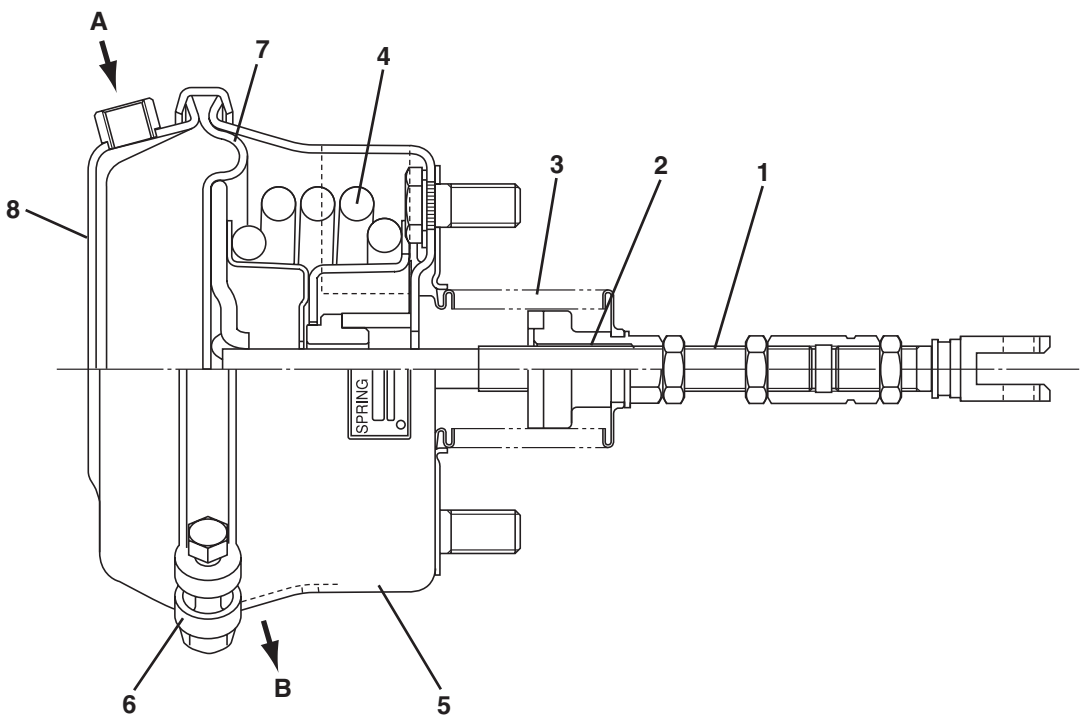
**MODEL: FD**




M06021500036

| | | | |
|---|---|---|---|
| 1 | Push rod | 6 | Clamp |
| 2 | Guide | 7 | Diaphragm |
| 3 | Dust boot | 8 | Pressure plate |
| 4 | Return spring | A | Inlet |
| 5 | Chamber | B | Drain hole |

## MODEL: GD

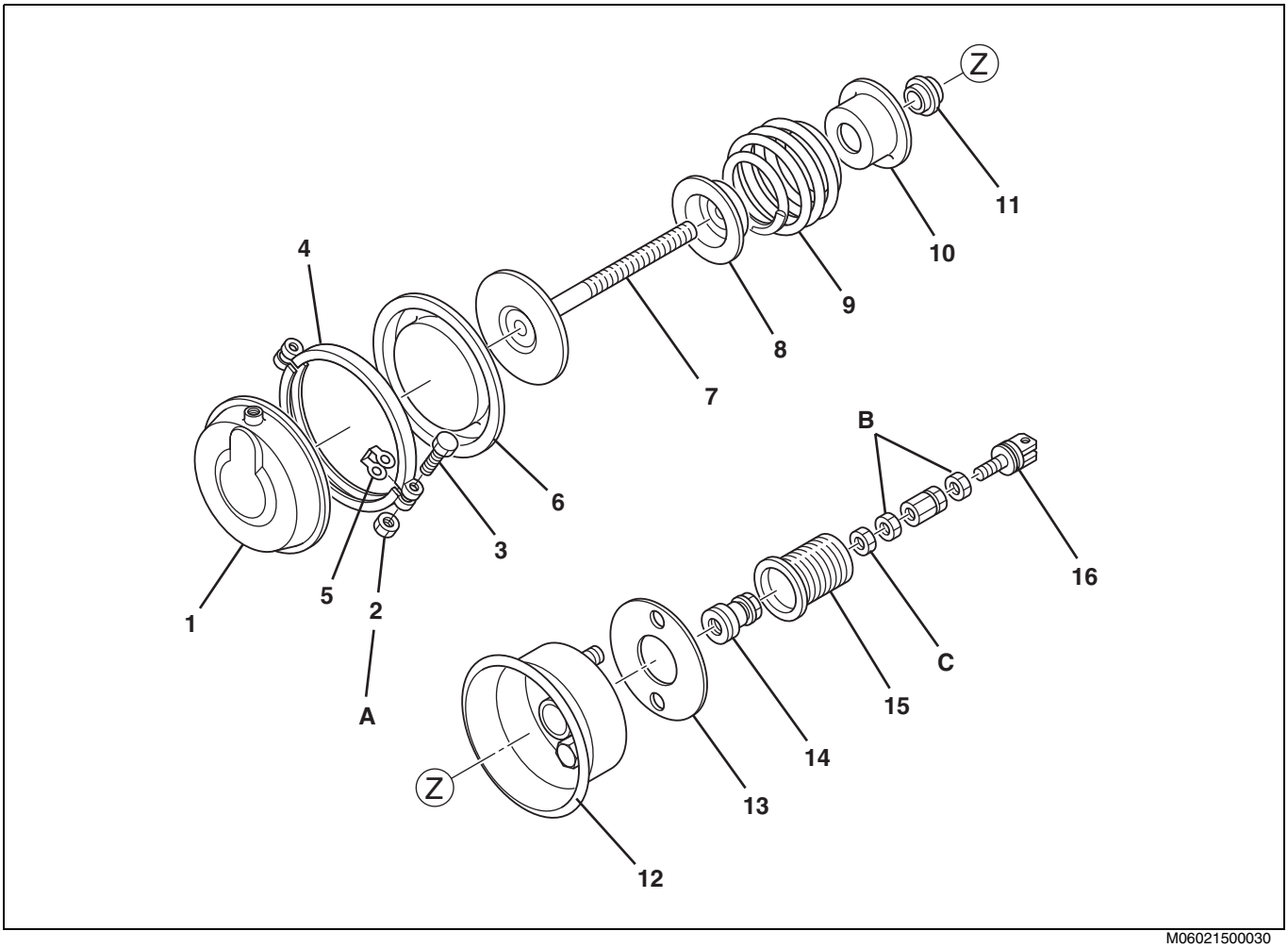



M06021500029

| | | | |
|---|---|---|---|
| 1 | Push rod | 6 | Clamp |
| 2 | Guide | 7 | Diaphragm |
| 3 | Dust boot | 8 | Pressure plate |
| 4 | Return spring | A | Inlet |
| 5 | Chamber | B | Drain hole |

# COMPONENT LOCATOR

M06021501BED1003




M06021500030

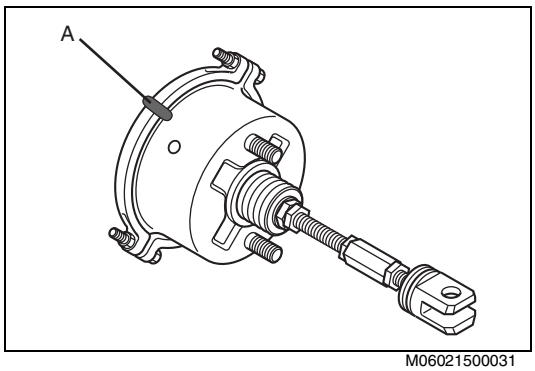
| | | | |
|---|---|---|---|
| 1 | Pressure plate | 9 | Return spring |
| 2 | Clamp nut | 10 | Spring seat |
| 3 | Clamp bolt | 11 | Guide |
| 4 | Clamp | 12 | Chamber |
| 5 | Spacer | 13 | Boot retainer |
| 6 | Diaphragm | 14 | Rod holder |
| 7 | Push rod | 15 | Dust boot |
| 8 | Spring holder | 16 | Clevis |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 26.5-32.3 {270-330, 20-23} | C | 50-68 {510-693, 37-50} |
| B | 50-68 {510-693, 37-50} | | |

# OVERHAUL

M06021501BEH2003



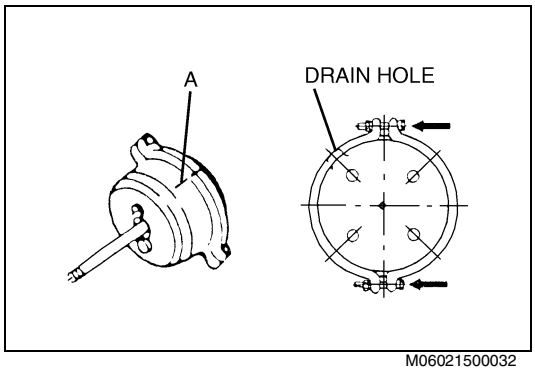
M06021500031

## IMPORTANT POINT - DISMOUNTING

**1. DISMOUNTING OF THE SPRING BRAKE CHAMBER**

(1) Before dismounting, apply an aligning mark A to chamber, clamp and chamber cover.

(2) Apply a position mark R or L to make clear the side where the chamber was installed.



M06021500032

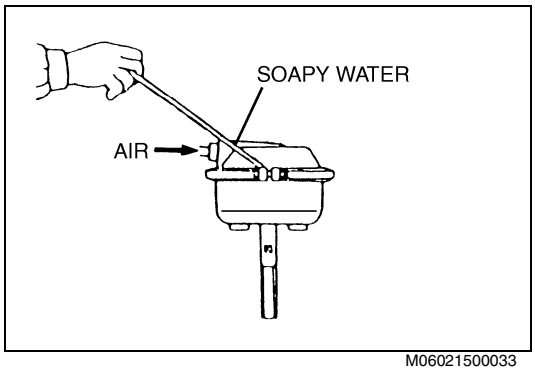
## IMPORTANT POINTS - ASSEMBLY

**1. ASSEMBLING THE SPRING BRAKE CHAMBER**

(1) Replace the diaphragm with new one.

(2) Coincide the aligning mark A of the chamber, clamp and chamber cover.

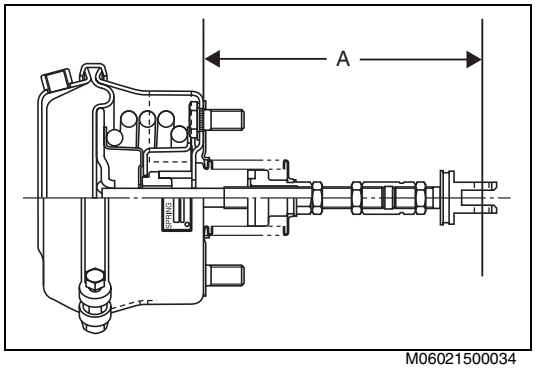
(3) Insert the bolt from opposite side of drain hole and tighten the bolts evenly with nut within specified torque.



M06021500033

**2. CHECKING FOR AIR LEAKAGE**

(1) Apply soapy water for joint part of chamber and charge the compressed air of 835 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} from the inlet port then check the leakage.



M06021500034

**3. INSTALLATION OF CLEVIS.**

(1) Install the clevis to the push rod and adjust the dimension A for specified value.
**Assembly standard: A**
**For model FD: 273.5 mm {10.768 in.}**
**For model GD: 204 mm {8.031 in.}**

## IMPORTANT POINT - MOUNTING

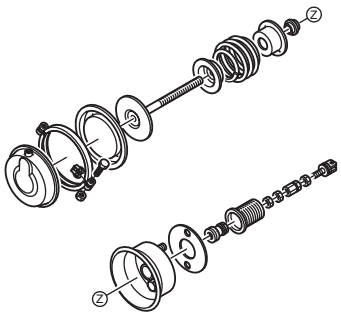
The chamber should be installed for former side.

**NOTICE:**

**See the position mark (R or L) which was applied at dismounting.**

# INSPECTION AND REPAIR

M06021501BEH3003

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Cover, clamp, push rod, compression spring, retainer, dust seal, holder and Chamber: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# WHEEL BRAKE (MODEL: FD)

## DATA AND SPECIFICATIONS

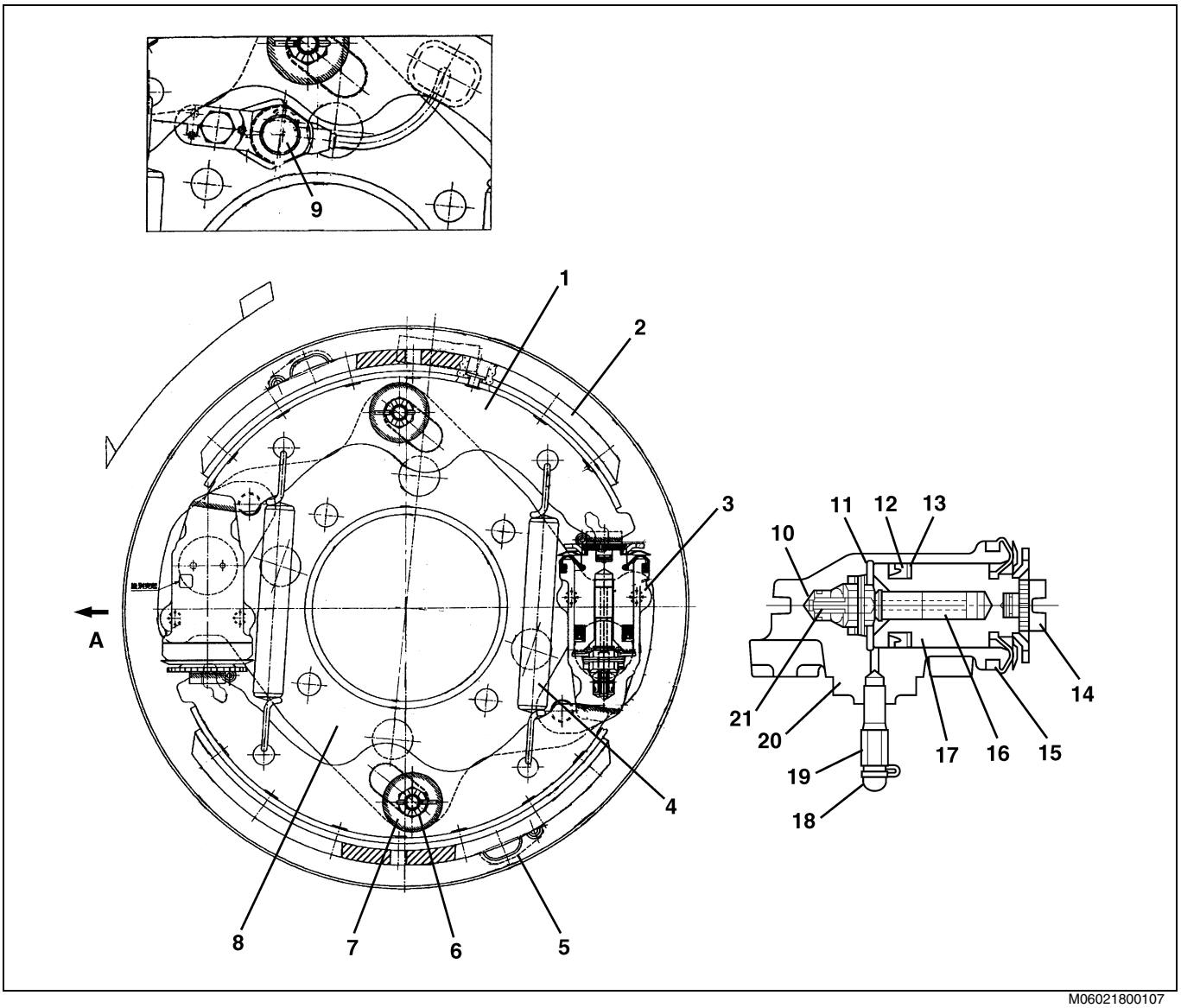
M06021801BEI2001

| | | |
|---|---|---|
| **Type** | | **Drum brake with hydraulically actuated, internally expanding, two-leading shoes in front wheels and dual two-leading shoes in rear wheels.** |
| **Brake drum inside diameter** | | **320.0 mm {12.59 in.} for both front and rear.** |
| **Brake lining (Width x Thickness)** | **Front** | **110 x 13 mm {4.33 x 0.51 in.}** |
| | **Rear** | **145 x 13 mm {5.71 x 0.51 in.}** |
| **Wheel cylinder bore diameter** | **Front** | **36.51 mm {1.437 in.}** |
| | **Rear** | **38.10 mm {1.50 in.}** |

# DESCRIPTION

M06021801BEC1005

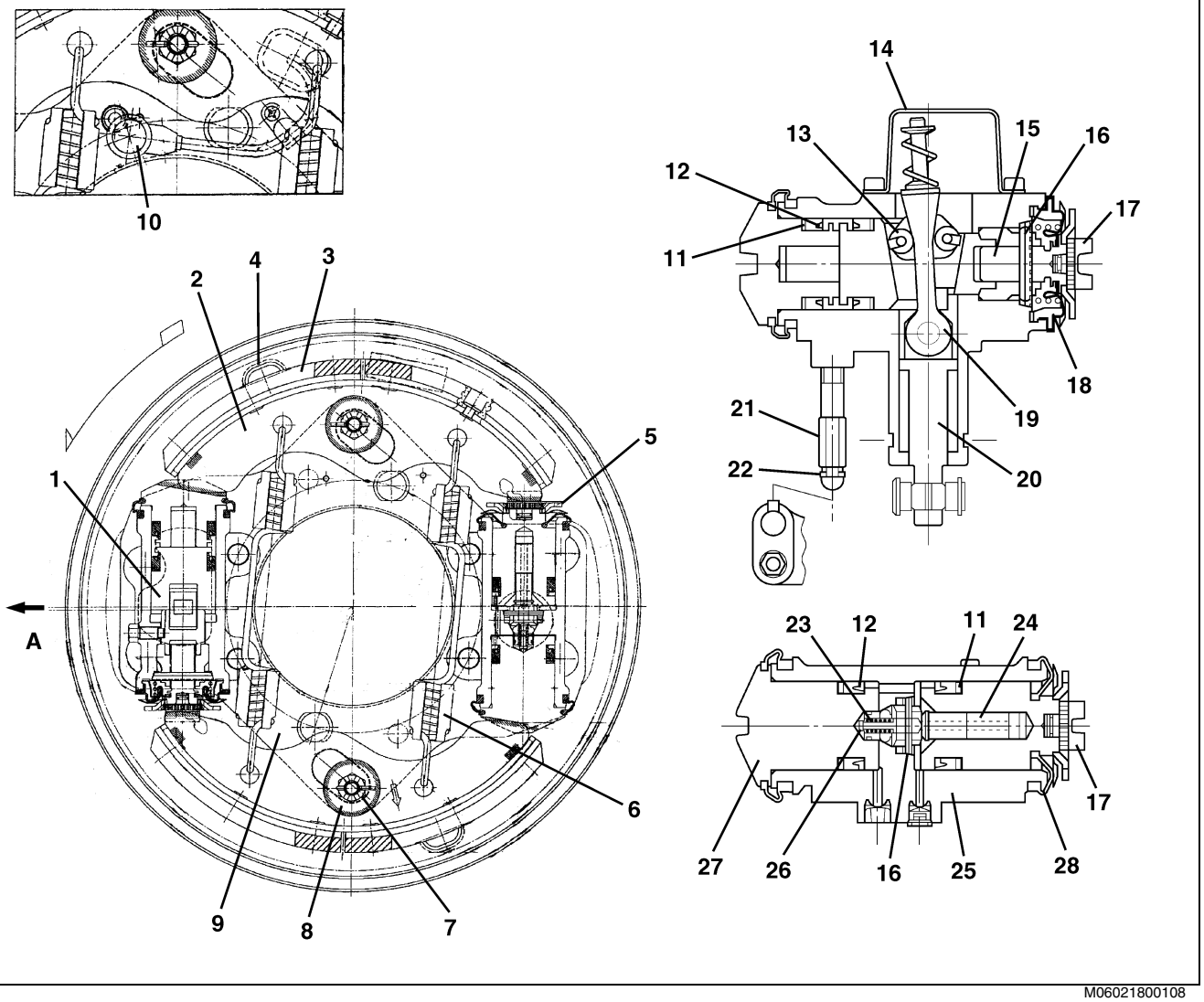
## FRONT




M06021800107

| | | | |
|---|---|---|---|
| 1 | Brake shoe | 12 | Piston cup |
| 2 | Brake lining | 13 | Back up ring |
| 3 | Wheel cylinder assembly | 14 | Piston head |
| 4 | Retracting spring | 15 | Boot |
| 5 | Hole plug | 16 | Adjuster shaft |
| 6 | Shoe hold down nut | 17 | Piston |
| 7 | Shoe hold down washer | 18 | Bleeder cap |
| 8 | Backing plate | 19 | Air bleeder screw |
| 9 | Wheel sensor (If so equipped) | 20 | Wheel cylinder body |
| 10 | Locator | 21 | Locator spring |
| 11 | Drive ring | A | Front |

## REAR



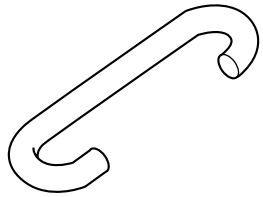
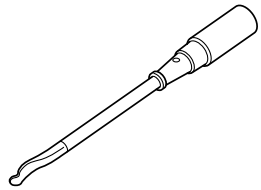
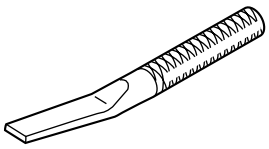

M06021800108

| | | | |
|---|---|---|---|
| 1 | Wheel cylinder assembly | 15 | Adjusting bolt |
| 2 | Brake shoe | 16 | Drive ring |
| 3 | Brake lining | 17 | Piston head |
| 4 | Hole plug | 18 | Boot |
| 5 | Shoe adjusting screw | 19 | Wedge |
| 6 | Shoe retracting spring | 20 | Rod |
| 7 | Shoe hold down nut | 21 | Air bleeder screw |
| 8 | Shoe hold down washer | 22 | Bleeder cap |
| 9 | Backing plate | 23 | Locator spring |
| 10 | Wheel sensor (If so equipped) | 24 | Adjuster shaft |
| 11 | Back up ring | 25 | Wheel cylinder body |
| 12 | Piston cup | 26 | Locator |
| 13 | Roller | 27 | Anchor piston |
| 14 | Wedge cover | A | Front |

# SPECIAL TOOL

M06021801BEK1004

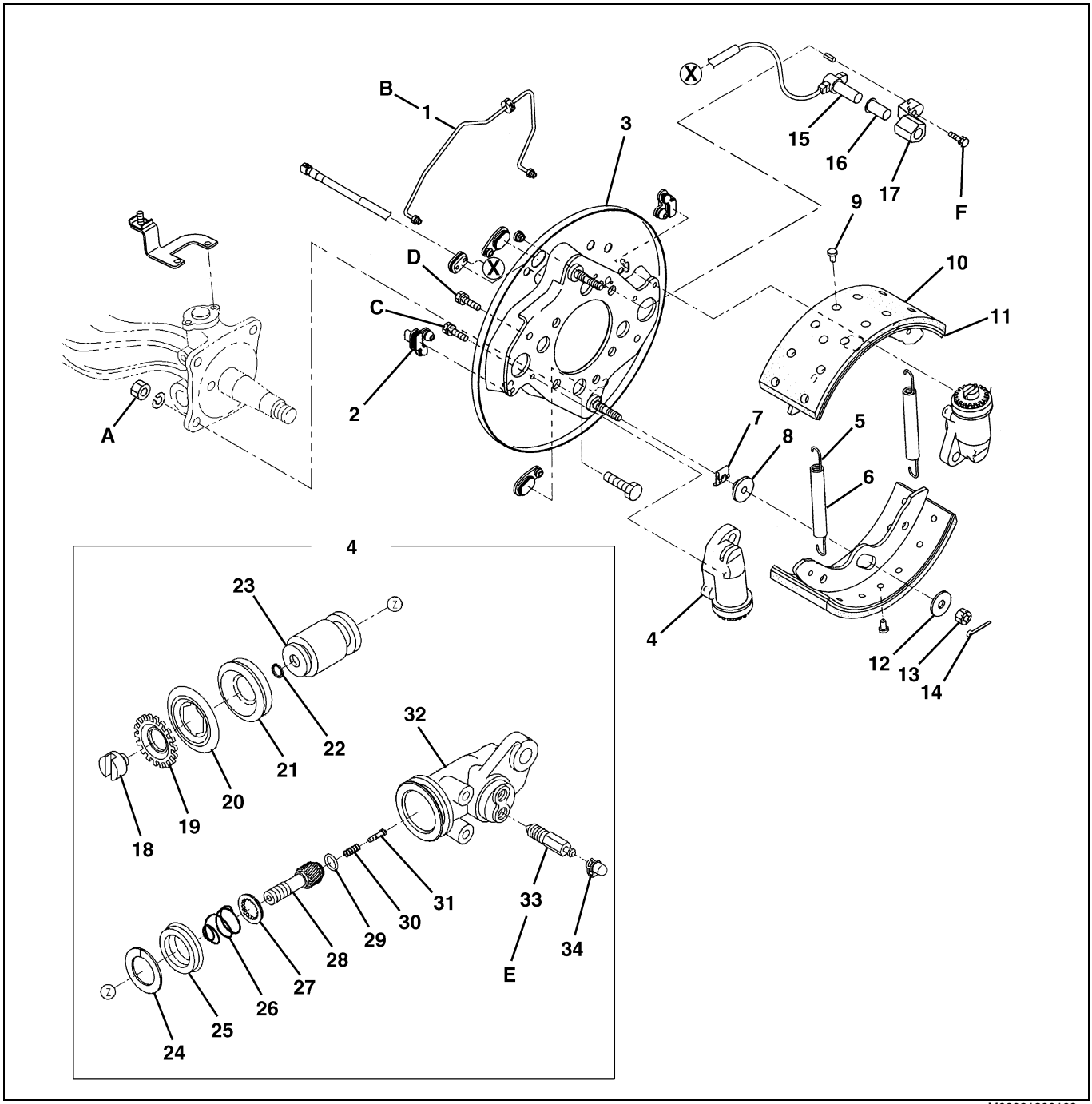
Prior to starting a wheel brake overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09653-1100 | HOOK<br>(USE WITH 09683-1010) | |
|  | 09683-1010 | RETRACTING SPRING PULL BACK TOOL | |
|  | 09665-1250 | BRAKE SHOE ADJUSTING TOOL | |

# COMPONENT LOCATOR

M06021801BED1005

## FRONT



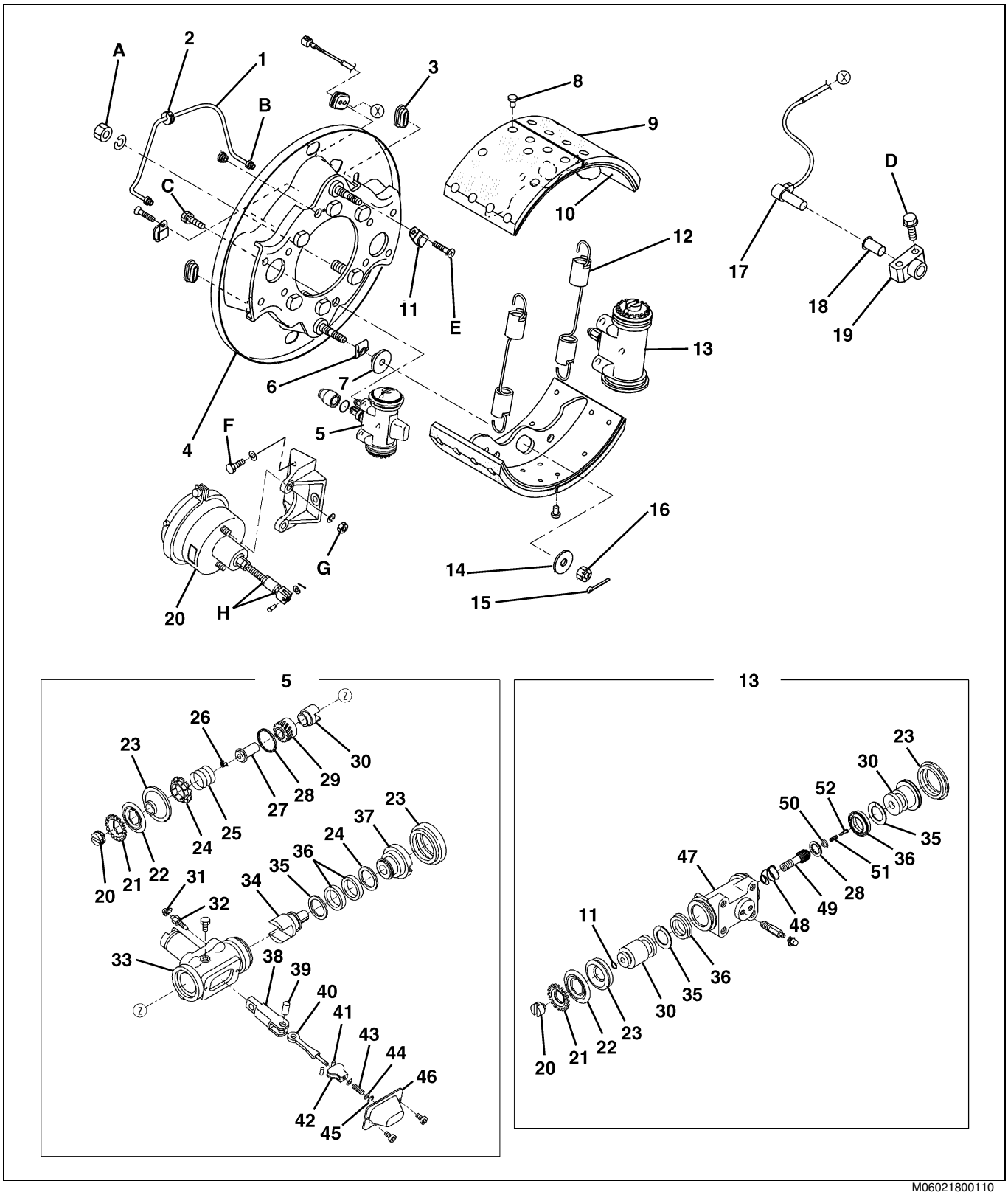

M06021800109

| | | | |
|---|---|---|---|
| 1 | Oil pipe | 18 | Piston head |
| 2 | Hole plug | 19 | Adjuster wheel |
| 3 | Backing plate | 20 | Boot protector |
| 4 | Wheel cylinder assembly | 21 | Boot |
| 5 | Shoe retracting spring | 22 | Clip |
| 6 | Spring cover | 23 | Piston |
| 7 | Adjust spring | 24 | Back up ring |
| 8 | Adjusting nut | 25 | Piston cup |
| 9 | Rivet | 26 | Cone spring |
| 10 | Brake lining | 27 | Drive ring |
| 11 | Brake shoe | 28 | Adjuster shaft |
| 12 | Shoe hold down washer | 29 | O-ring |
| 13 | Shoe hold down nut | 30 | Locator spring |
| 14 | Cotter pin | 31 | Locator |
| 15 | Wheel sensor (If so equipped) | 32 | Wheel cylinder body |
| 16 | Clamping bushing (If so equipped) | 33 | Air bleeder screw |
| 17 | Wheel sensor holder (If so equipped) | 34 | Bleeder cap |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 148-196 {1,500-2000, 109-144} | D | 88.8-120.1 {905-1,225, 66-88} |
| B | 12.7-17.7 {130-180, 10-13} | E | 7.5-11.5 {70-120, 5.1-8.6} |
| C | 16.7-24.5 {170-250, 13-18} | F | 33.8-50.0 {350-510, 25-37} |

## REAR




M06021800110

| | | | |
|---|---|---|---|
| 1 | Oil pipe | 27 | Adjuster screw |
| 2 | Grommet | 28 | Drive ring |
| 3 | Hole plug | 29 | Adjuster sleeve |
| 4 | Backing plate | 30 | Piston |
| 5 | Wheel cylinder assembly (Wheel parking side) | 31 | Bleeder cap |
| 6 | Adjust spring | 32 | Air bleeder screw |
| 7 | Adjusting nut | 33 | Wedge actuator body |
| 8 | Rivet | 34 | Piston |
| 9 | Brake lining | 35 | Back up ring |
| 10 | Brake shoe | 36 | Piston cup |
| 11 | Clip | 37 | Anchor piston |
| 12 | Shoe retracting spring | 38 | Rod |
| 13 | Wheel cylinder assembly | 39 | Pin |
| 14 | Shoe hold down washer | 40 | Wedge |
| 15 | Shoe hold down nut | 41 | Roller |
| 16 | Cotter pin | 42 | Cage |
| 17 | Wheel sensor (If so equipped) | 43 | Cage hold spring |
| 18 | Clamping busing (If so equipped) | 44 | Spring seat |
| 19 | Wheel sensor holder (If so equipped) | 45 | Retainer |
| 20 | Piston head | 46 | Wedge cover |
| 21 | Adjuster wheel | 47 | Wheel cylinder body |
| 22 | Boot protector | 48 | Cone spring |
| 23 | Boot | 49 | Adjuster shaft |
| 24 | Guide plate | 50 | O-ring |
| 25 | Compression spring | 51 | Locator spring |
| 26 | Snap ring | 52 | Locator |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

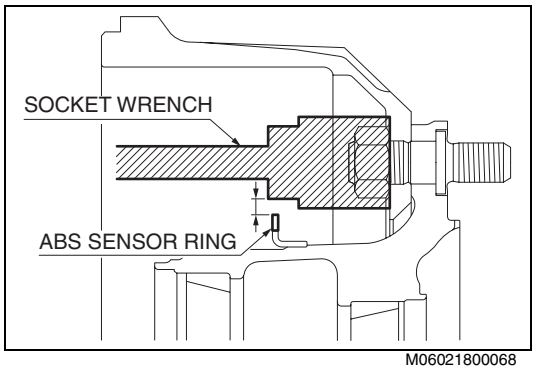
| | | | |
|---|---|---|---|
| A | 148-196 {1,500-2,000, 109-144} | E | 1.3-1.9 {13-19, 1.0-1.4} |
| B | 12.7-17.7 {130-180, 9.4-13} | F | 109-147 {1,112-1,498, 81-108} |
| C | 98.1-137.3 {1,000-1,400, 73-101} | G | 148-196 {1,500-2,000, 109-144} |
| D | 34.5-51.5 {350-520, 25-38} | H | 50-68 {510-693, 37-50} |

# OVERHAUL

M06021801BEH2005

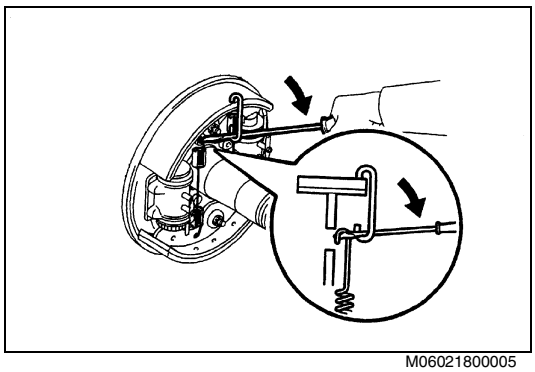
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE TIRE.**
(1) Refer to chapter WHEEL & TIRE.



M06021800068

**2. REMOVE THE BRAKE DRUM.**
**NOTICE:**
**(In case of models equipped with ABS;)**
**When mounting or dismounting the brake drum without removing the sensor ring, be careful not to damage the sensor ring by tools. If tools hit the sensor ring and damage it, ABS operation may be deteriorated.**

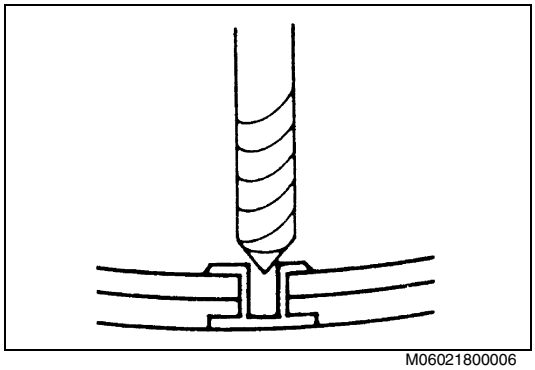

M06021800005

**3. REMOVE THE BRAKE SHOE RETRACTING SPRING.**
(1) Remove the retracting spring by using the special tools.
**SST:**
**Hook (09653-1100)**
**Retracting spring pull back tool (09683-1010)**

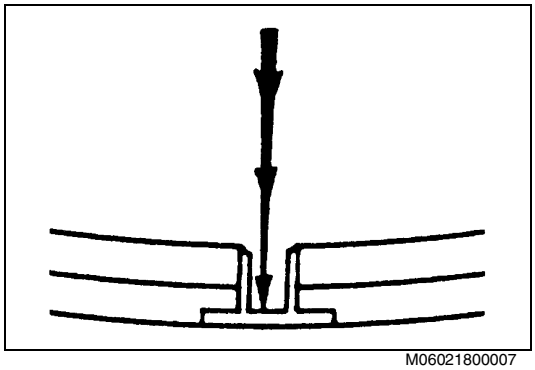
## IMPORTANT POINTS - ASSEMBLY

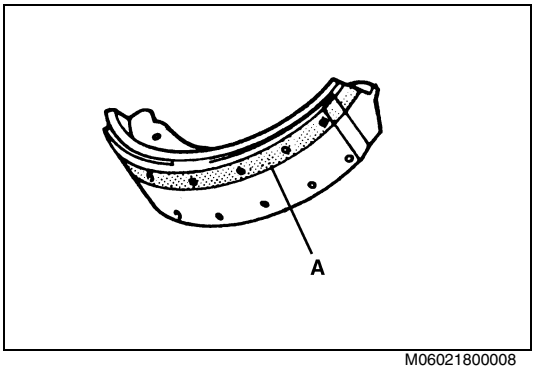
**1. REPLACE THE BRAKE LINING.**
(1) Drill the rivet caulking section with a drill smaller than the rivet diameter.

**NOTICE:**
**At this time, be careful not to scratch the brake shoe.**


M06021800006

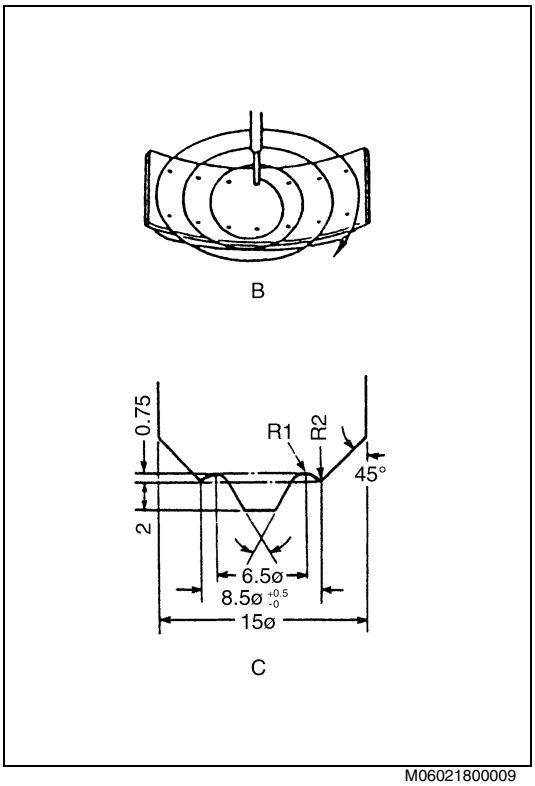
(2) After drilling, remove the remaining portion of the rivet with a fine chisel or a riveting machine.


M06021800007




M06021800008

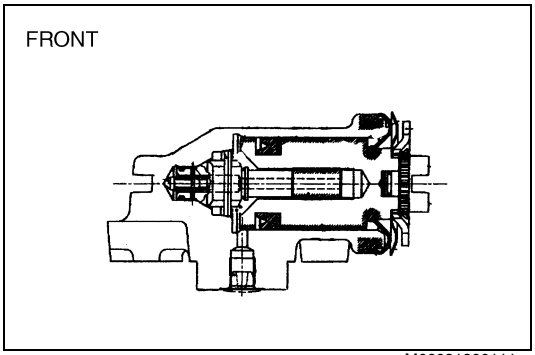
(3) Set the lining with shoe and insert the rivets into all holes, then hold them in place with adhesive tape A.




M06021800009

(4) Caulk the rivets lightly in a circular pattern as shown B; repeat several times to assure proper seating of the lining.
**Recommended configuration of punch: Shown in C.**
**Recommended force of staking the Rivet: 2.4 tons**

(5) Remove adhesive tape.




M06021800111

**2. ASSEMBLE THE WHEEL CYLINDER.**

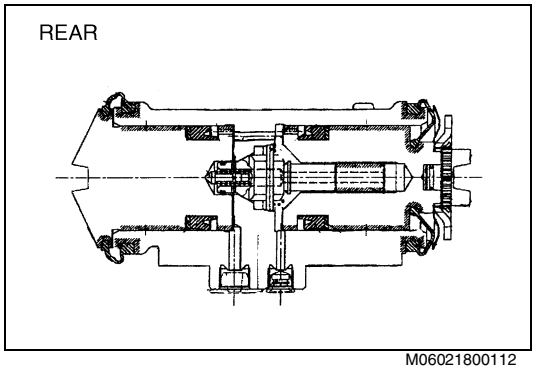
(1) Apply rustproof oil to the internal surface of the cylinder.

**Rustproof oil (CCI NO.20): 04156-1010**

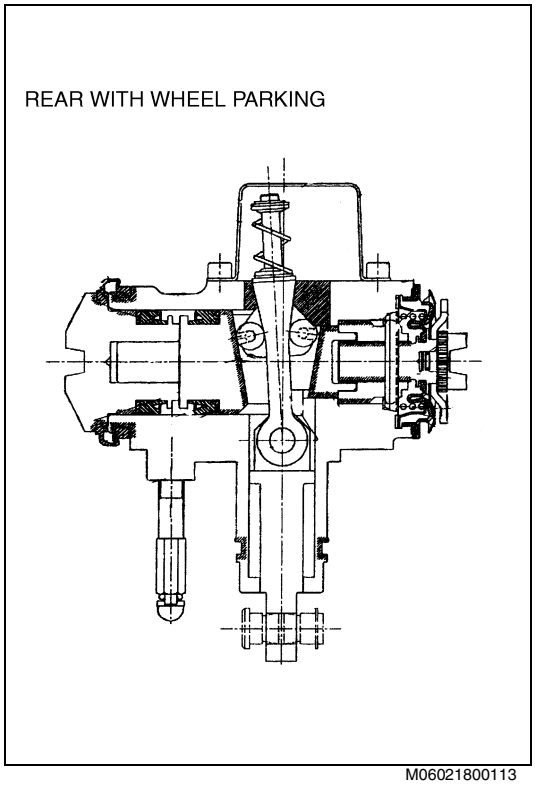
(2) Apply rubber grease to the threads of adjusting bolt, inside of boot, groove for boot, sliding surface of piston.

**Rubber grease (RX-2): 04133-1080**

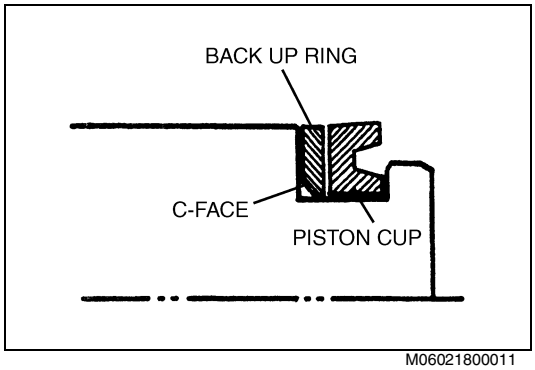
**NOTICE:**
**The parts where the rubber grease shall be applied are shown in figure with arrows and oblique lines.**



M06021800112

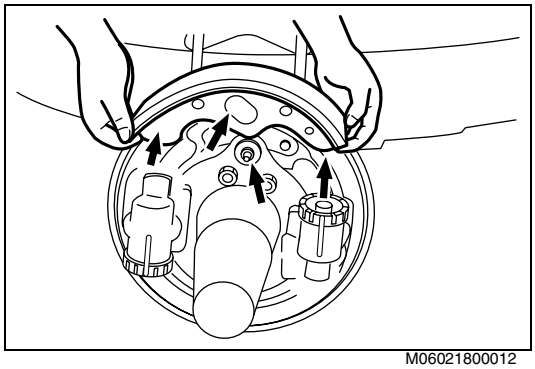


M06021800113



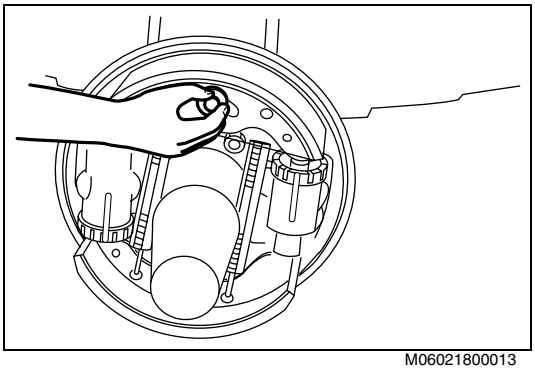
M06021800011

(3) Be sure to install the back up ring with the chamfered face of the ring a way of the cup.


M06021800012

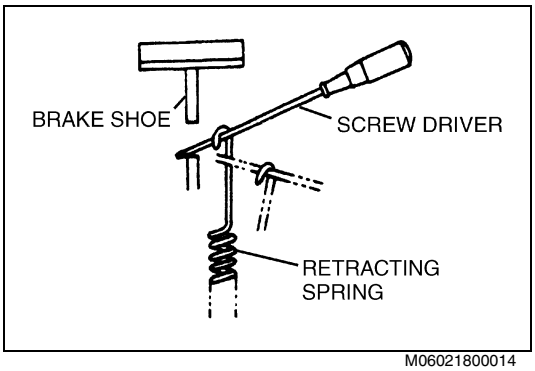
**3. INSTALL THE BRAKE SHOE ASSEMBLY.**

(1) Apply heat-resistant grease to both ends of the shoe web contacting with the piston, and to the top surface of the shoe web contacting the shoe hold washer.


M06021800013

(2) Adjust the clearance between the hold down washer and the shoe.

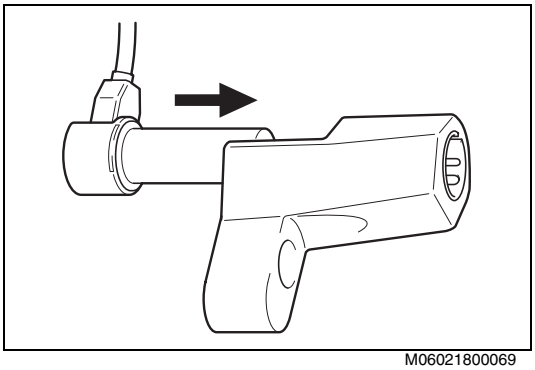
(3) Tighten the slotted nut and back off the nut by 1/3 turn, then secure the nut with the cotter pin.
If the cotter pin cannot be inserted into the hole, loosen the slotted nut (within 1/6 turn) to align it with the bolt hole.



M06021800014

**4. INSTALL THE BRAKE SHOE RETRACTING SPRING.**

(1) Install the retracting spring using a screwdriver. After installing the spring, check that the end of the shoe web is securely set in the groove of the wheel cylinder piston. Also check that the hook of the spring is securely hooked in the hole of the shoe.


M06021800069

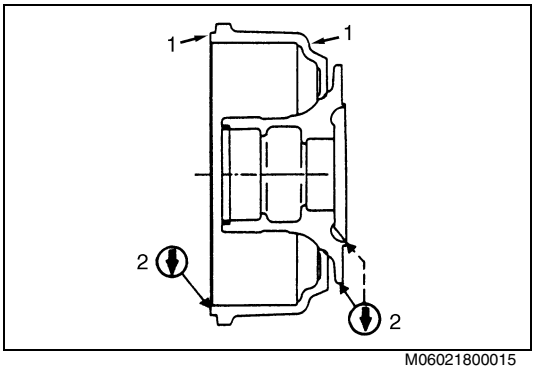
**5. INSTALL THE WHEEL SENSOR.**
**(If so equipped)**

(1) Push in the clamping bushing until the stopper makes contact with the wheel sensor holder.

(2) Push the wheel sensor forcefully into the clamping bussing until you feel that the wheel sensor has contact with the sensor ring.

**NOTICE:**
**When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place using a screwdriver, or the like. Doing so could damage the wheel sensor.**

(3) Arrange the wire harness.



M06021800015

**6. ASSEMBLE THE BRAKE DRUM AND WHEEL HUB.**
**(FRONT WHEEL)**

(1) See the mark located at 1 or 1' on the brake drum as shown in Figure. Install the drum according to NOTICE.

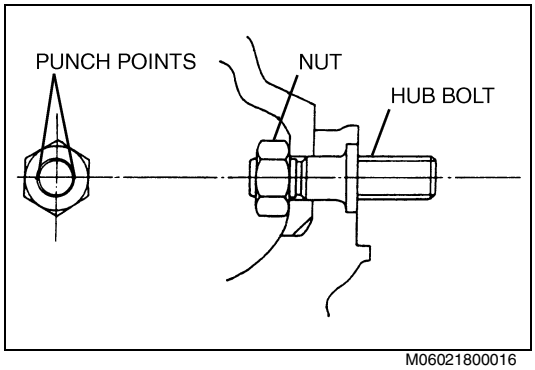
**NOTICE:**

**1. The drums. Number with R or L.**
**With R: Install in right side.**
**With L: Install in left side.**

**2. The drums, with no R or L.**
**New drums: Install in any side.**
**Reused drums: Install in the side originally installed.**

(2) When assembling the brake drum and wheel hub, make sure that their aligning marks are aligned as close to each other as possible.

**NOTICE:**
**Position of marks are located at 2. as shown in the figure. (Broken line shows alternative position).**



M06021800016

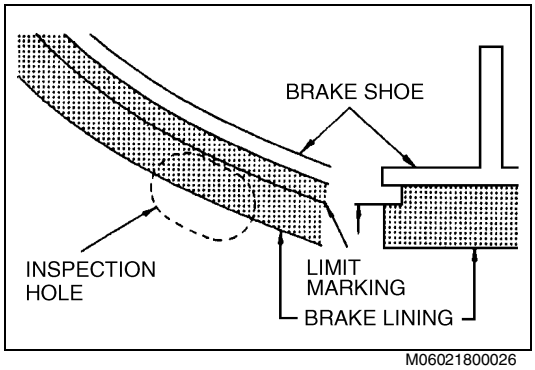
(3) Caulk the hub and nuts as shown in figure, after tightening the brake drum and wheel hub.
**Tightening Torque:**
**393-470 N·m {4,000-4,800 kgf·cm, 290-347 lbf·ft}**

**7. MOUNT THE WHEEL HUB WITH BRAKE DRUM.**
(1) Refer to chapter FRONT AXLE and REAR AXLE.

**8. MOUNT THE TIRE.**
(1) Refer to chapter WHEEL AND TIRE.

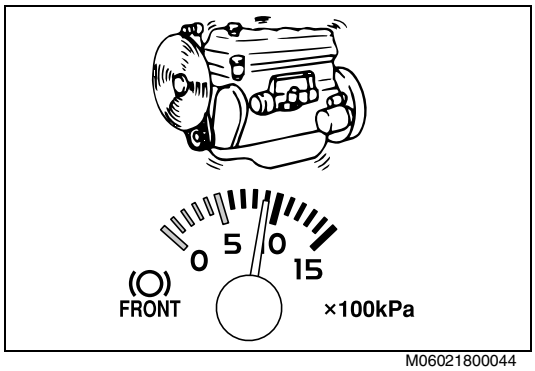
# ADJUSTMENT

M06021801BEH3001



M06021800026

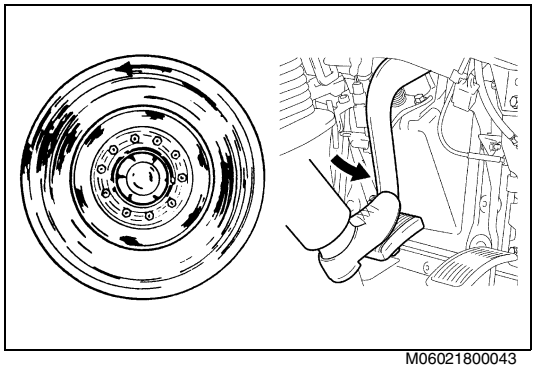
**1. REMAINING THICKNESS OF THE BRAKE LINING**
(1) Check remaining thickness of lining through the inspection hole of the backing plate. If the lining has been worn to the limit marking or if it is foreseen that the lining will be worn to the limit by the time the next inspection is made replace the lining.



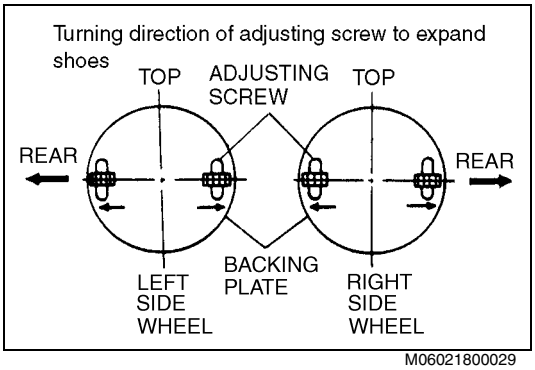
M06021800044

**2. AIR PRESSURE IN THE AIR TANK**
(1) Operate the engine and obtain an air pressure of the 780-880 kPa {8.0-9.0 kgf/cm$^2$, 113-127 lbf/in$^2$.}

**NOTICE:**
**The specified air pressure in the air tank should be maintained when making the adjustment.**

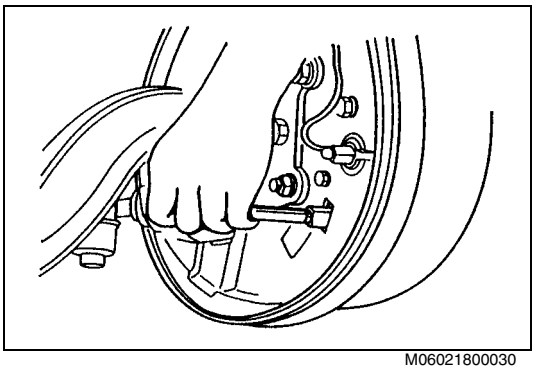

M06021800043

**3. CLEARANCE BETWEEN BRAKE LINING AND BRAKE DRUM**
(1) Lift the wheel to be adjusted off the ground.
(2) While turning the wheel in the forward direction and step on the brake pedal several times to make sure that the brake shoes are correctly positioned.

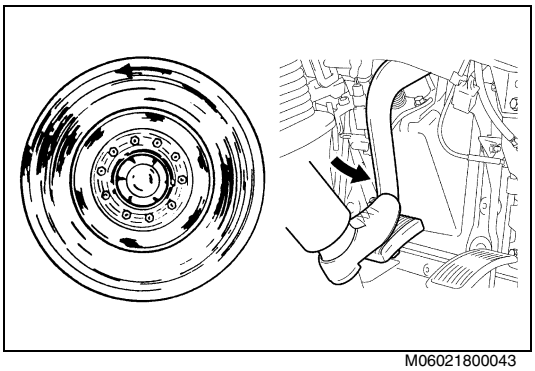


M06021800029

(3) Turn the adjusting screw with an adjusting tool in the arrow direction, (The arrows are marked near the holes on the backing plate), and put the drum into a position as to turn slowly by hand.
**SST: Brake shoe adjusting tool (09665-1250)**


M06021800030

(4) Return the adjusting screw 5-7 notches in the reverse arrow direction.


M06021800043

(5) While turning the wheel by hand in the forward direction, step on the brake pedal several times to make sure that the brake shoes are correctly positioned.

(6) See to it that there is no dragging, when turning the wheel by hand. If there is any dragging, repeat the operation over again from 2.

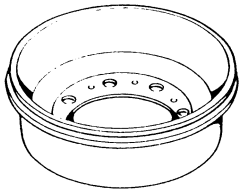
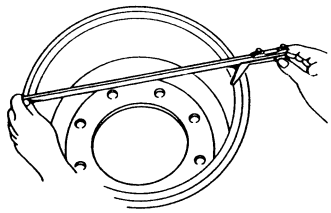
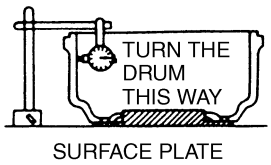
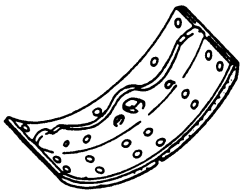
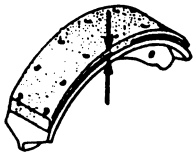
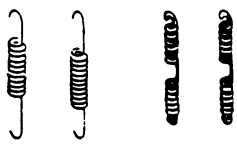
**NOTICE:**
**Using the same procedure as above, adjust the clearance for all wheels.**

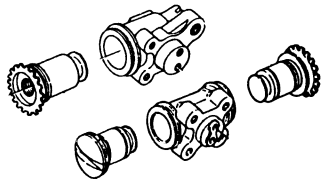
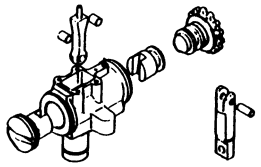
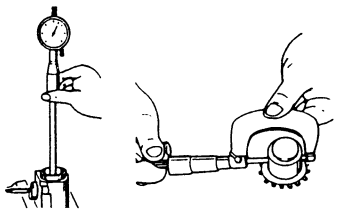
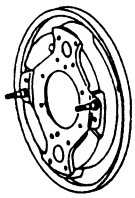
# INSPECTION AND REPAIR

M06021801BEH3015

**NOTICE:**
**Brake fluid or isopropyl alcohol should only be used to wash the wheel cylinder component.**

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Brake drum inner surface: Crack, scoring and/or any other damage | — | — | Regrind or replace, if necessary. | Visual check  |
| Brake drum inner diameter | 320.0 {12.600} | 322.0 {12.677} | Replace. | Measure  |
| Brake drum runout | 0-0.1 {0-0.0039} | 0.2 {0.0079} | Regrind or replace. | Measure   SURFACE PLATE |
| Brake shoe with lining: Crack, wear deformation and/or any other damages | — | — | Re-lining or replace, if necessary. | Visual check  |
| Remaining thickness of brake lining | 13.0 {0.512} | 4.0 {0.1575} | Re-lining. | Measure  |
| Brake shoe retracting spring: Elastic strength distortion and/or any damage | — | — | Replace, if necessary. | Visual check  |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Wheel cylinder and piston: Corrosion and/or any damage** | **—** | **—** | **Clean or replace, if necessary.** | **Visual check**  |
| **Wheel cylinder (For spring brake), Cylinder, Piston, Plunger, Roller, Wedge, Pin and Rod. Corrosion and/or any damage.** | **—** | **—** | **Clean or replace, if necessary.** | **Visual check**  |
| **Clearance between piston and wheel cylinder** | **Front 0.03-0.13 {0.0012-0.0051} Rear 0.08-0.18 {0.0032-0.0070}** | **0.25 {0.0098}** | **Replace** | **Measure**  |
| **Backing plate and stud pins: Deformation, damage and any other abnormality** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# WHEEL BRAKE (MODEL: GD)

## DATA AND SPECIFICATIONS

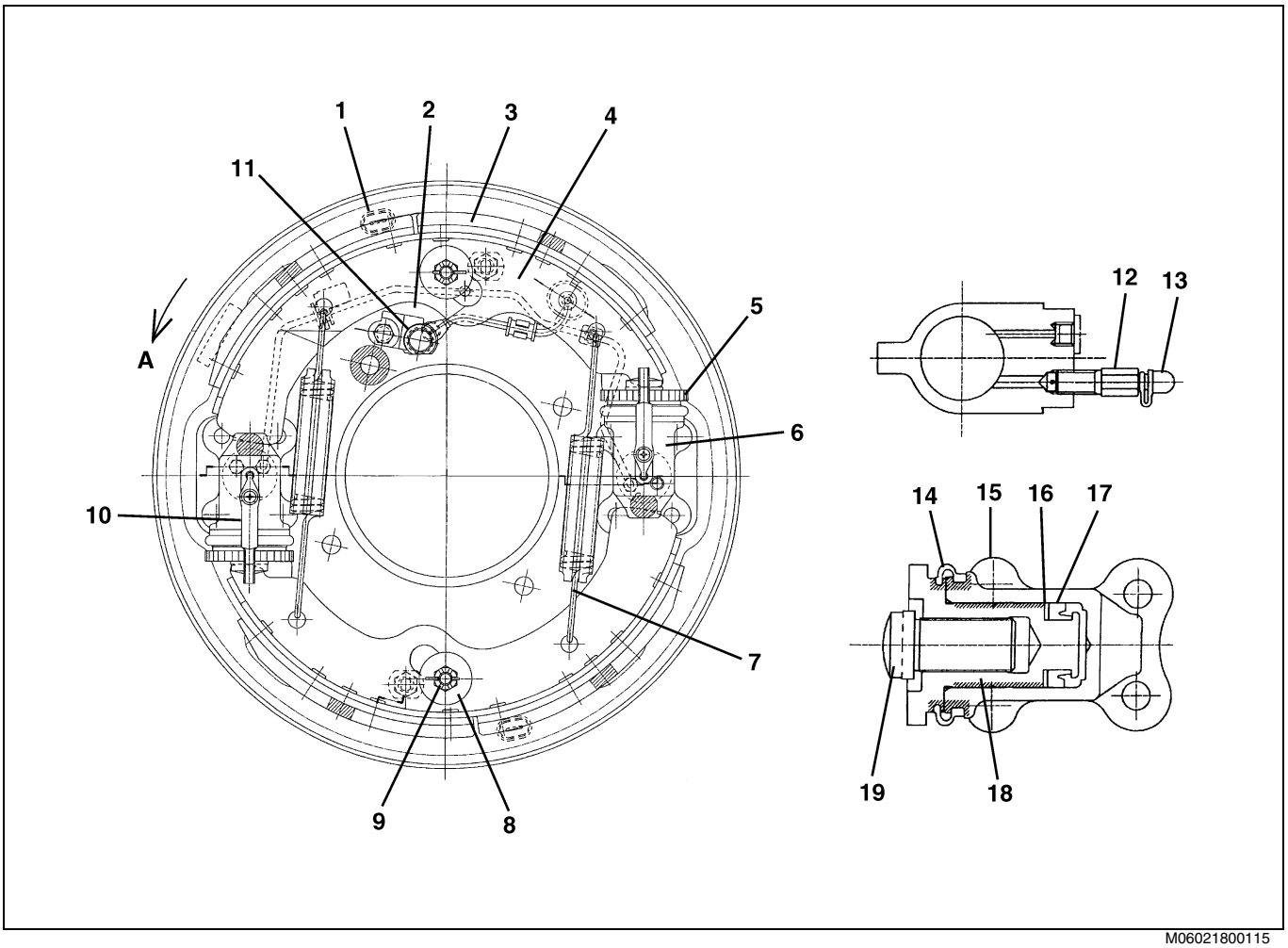
M06021801BEI2002

| | | |
|---|---|---|
| **Type** | | **Drum brake with hydraulically actuated, internally expanding, two-leading shoes in front wheels and dual two-leading shoes in rear wheels.** |
| **Brake drum inside diameter** | | **400 mm {15.75 in.} for both front and rear.** |
| **Brake lining (Width x Thickness)** | **Front** | **120 x 15 mm {4.72 x 0.59 in.}** |
| | **Rear** | **155 x 15 mm {6.10 x 0.59 in.}** |
| **Wheel cylinder bore diameter** | **Front** | **34.93 mm {1.375 in.}** |
| | **Rear** | **38.10 mm {1.50 in.}** |

# DESCRIPTION

M06021801BEC1006

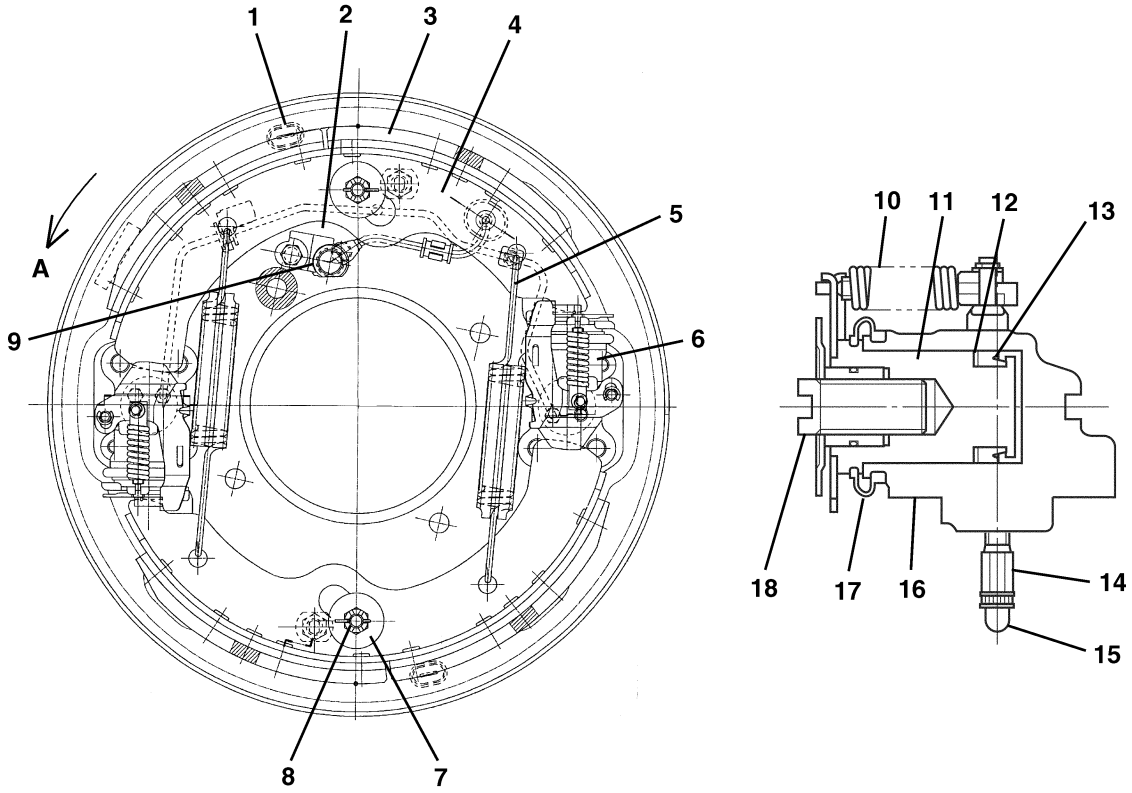
## FRONT




M06021800115

| | | | |
|---|---|---|---|
| 1 | Hole plug | 11 | Wheel sensor (If so equipped) |
| 2 | Backing plate | 12 | Air bleeder screw |
| 3 | Brake lining | 13 | Bleeder cap |
| 4 | Brake shoe | 14 | Boot |
| 5 | Shoe adjusting screw | 15 | Wheel cylinder |
| 6 | Wheel cylinder assembly | 16 | Back up ring |
| 7 | Shoe retracting spring | 17 | Piston cup |
| 8 | Shoe hold down washer | 18 | Piston |
| 9 | Shoe hold down nut | 19 | Adjusting bolt |
| 10 | Adjuster lock spring | A | Forward turning |

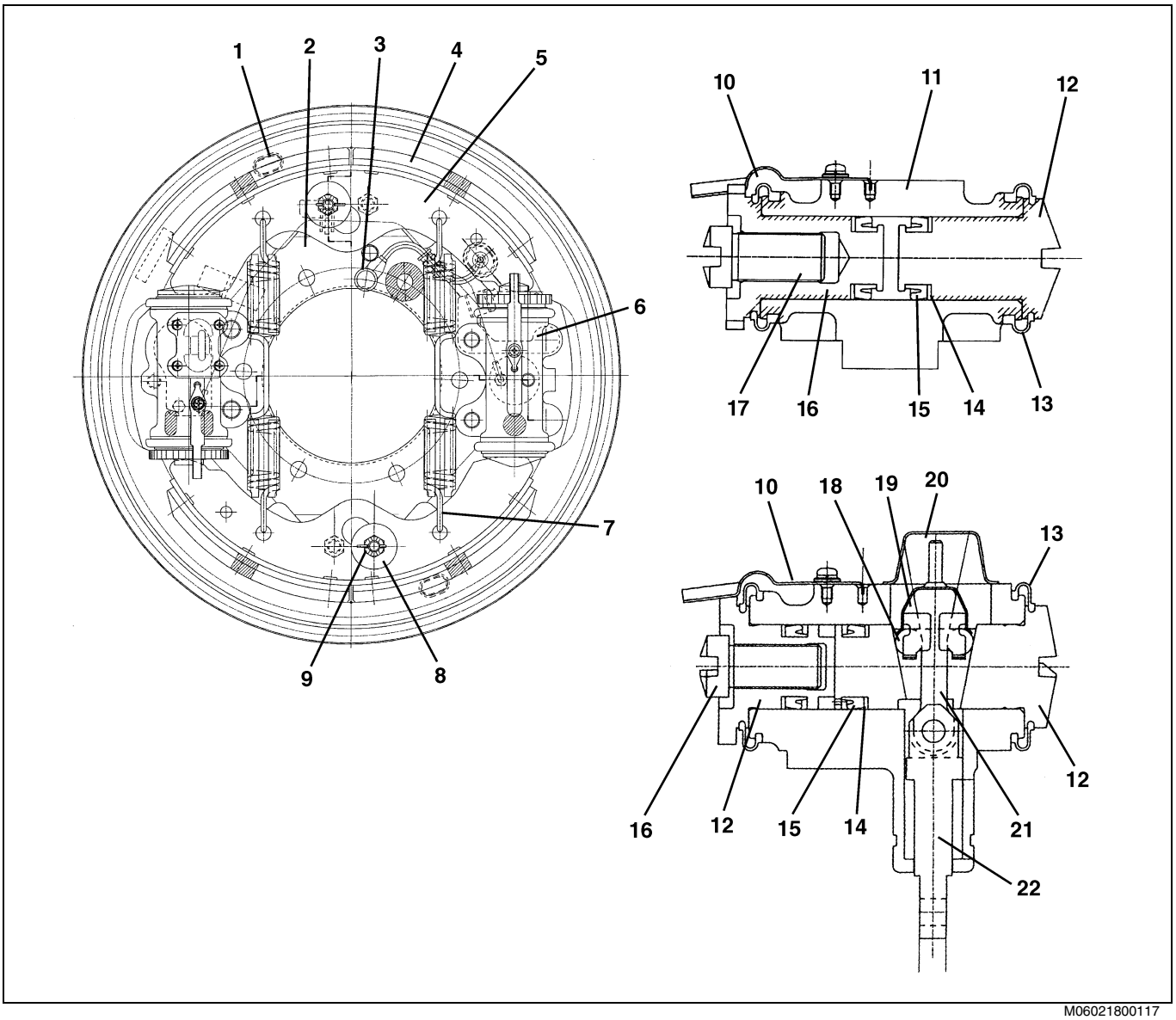
## FRONT (WITH AUTO-ADJUSTER)




M06021800116

| | | | |
|---|---|---|---|
| 1 | Hole plug | 10 | Spring |
| 2 | Backing plate | 11 | Piston |
| 3 | Brake lining | 12 | Back up ring |
| 4 | Brake shoe | 13 | Piston cup |
| 5 | Shoe retracting spring | 14 | Air bleeder screw |
| 6 | Wheel cylinder assembly | 15 | Bleeder cap |
| 7 | Shoe hold down washer | 16 | Wheel cylinder |
| 8 | Shoe hold down nut | 17 | Boot |
| 9 | Wheel sensor (If so equipped) | 18 | Adjusting bolt |

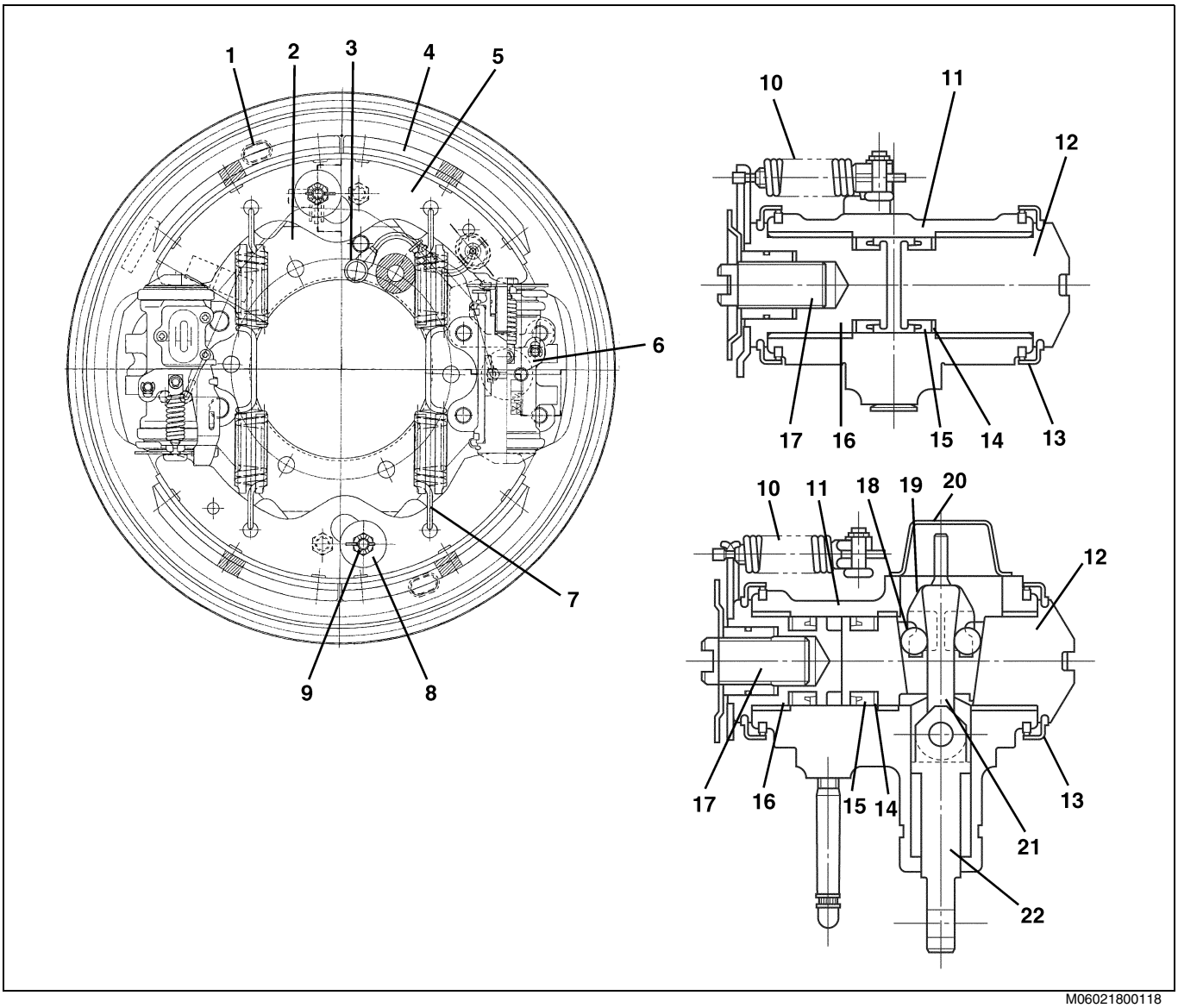
## REAR




M06021800117

| | | | |
|---|---|---|---|
| 1 | Hole plug | 12 | Anchor piston |
| 2 | Backing plate | 13 | Boot |
| 3 | Wheel sensor (If so equipped) | 14 | Back up ring |
| 4 | Brake lining | 15 | Piston cup |
| 5 | Brake shoe | 16 | Piston |
| 6 | Wheel cylinder assembly | 17 | Adjusting bolt |
| 7 | Shoe retracting spring | 18 | Roller |
| 8 | Shoe hold down washer | 19 | Cage |
| 9 | Shoe hold down nut | 20 | Wedge cover |
| 10 | Adjuster lock spring | 21 | Wedge |
| 11 | Wheel cylinder | 22 | Rod |

## REAR (WITH AUTO-ADJUSTER)



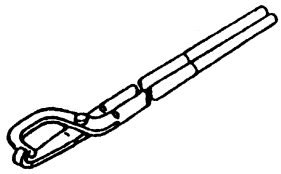
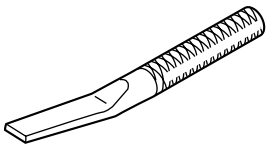

M06021800118

| | | | |
|---|---|---|---|
| 1 | Hole plug | 12 | Anchor piston |
| 2 | Backing plate | 13 | Boot |
| 3 | Wheel sensor (If so equipped) | 14 | Back up ring |
| 4 | Brake lining | 15 | Piston cup |
| 5 | Brake shoe | 16 | Piston |
| 6 | Wheel cylinder assembly | 17 | Adjusting bolt |
| 7 | Shoe retracting spring | 18 | Roller |
| 8 | Shoe hold down washer | 19 | Cage |
| 9 | Shoe hold down nut | 20 | Wedge cover |
| 10 | Spring | 21 | Wedge |
| 11 | Wheel cylinder | 22 | Rod |

# SPECIAL TOOL

M06021801BEK1005

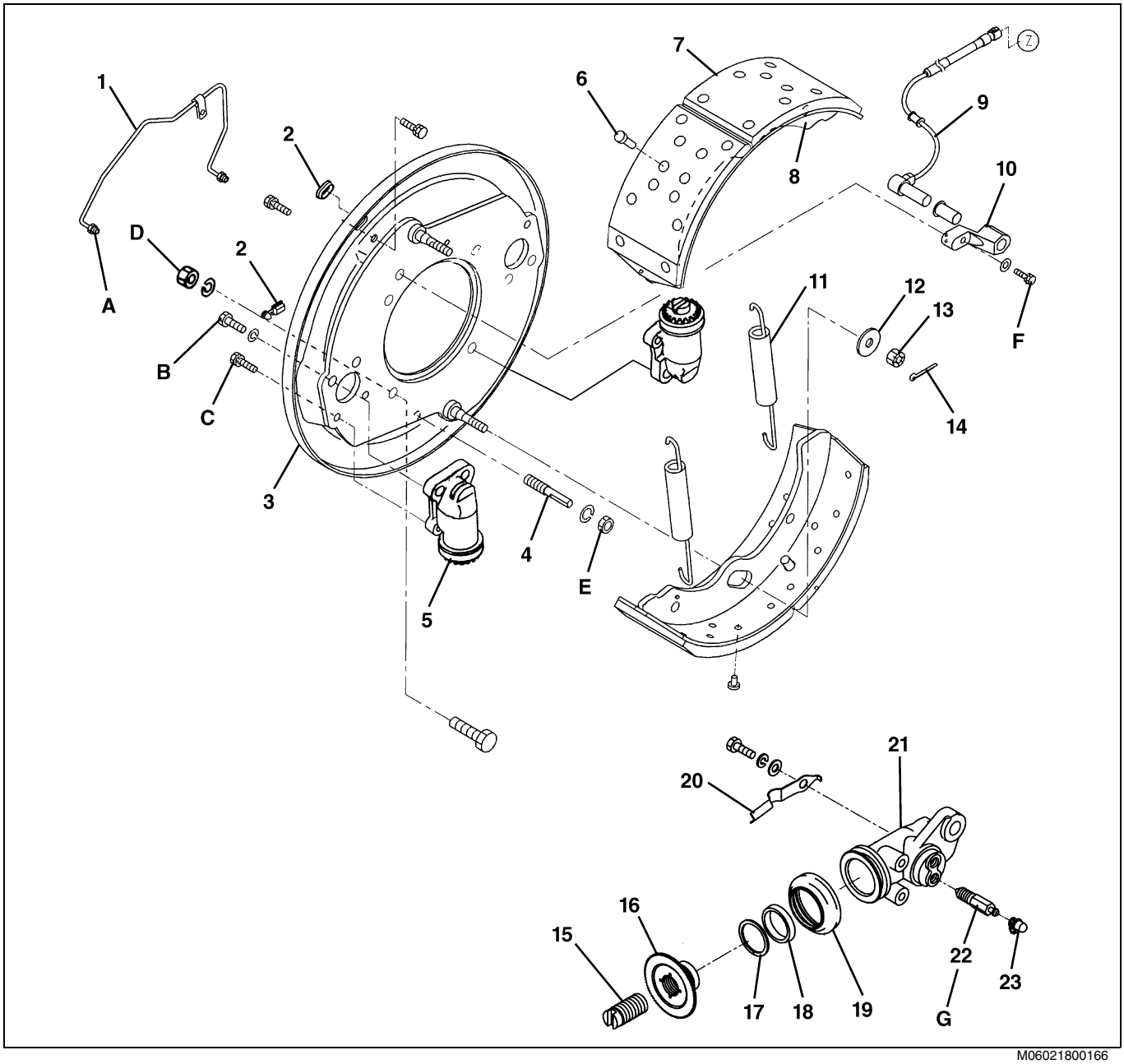
Prior to starting a wheel brake overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09606-1040 | RETRACTING SPRING PULL BACK TOOL | |
|  | 09665-1130 | BRAKE SHOE ADJUSTING TOOL | |

# COMPONENT LOCATOR

M06021801BED1003

## FRONT



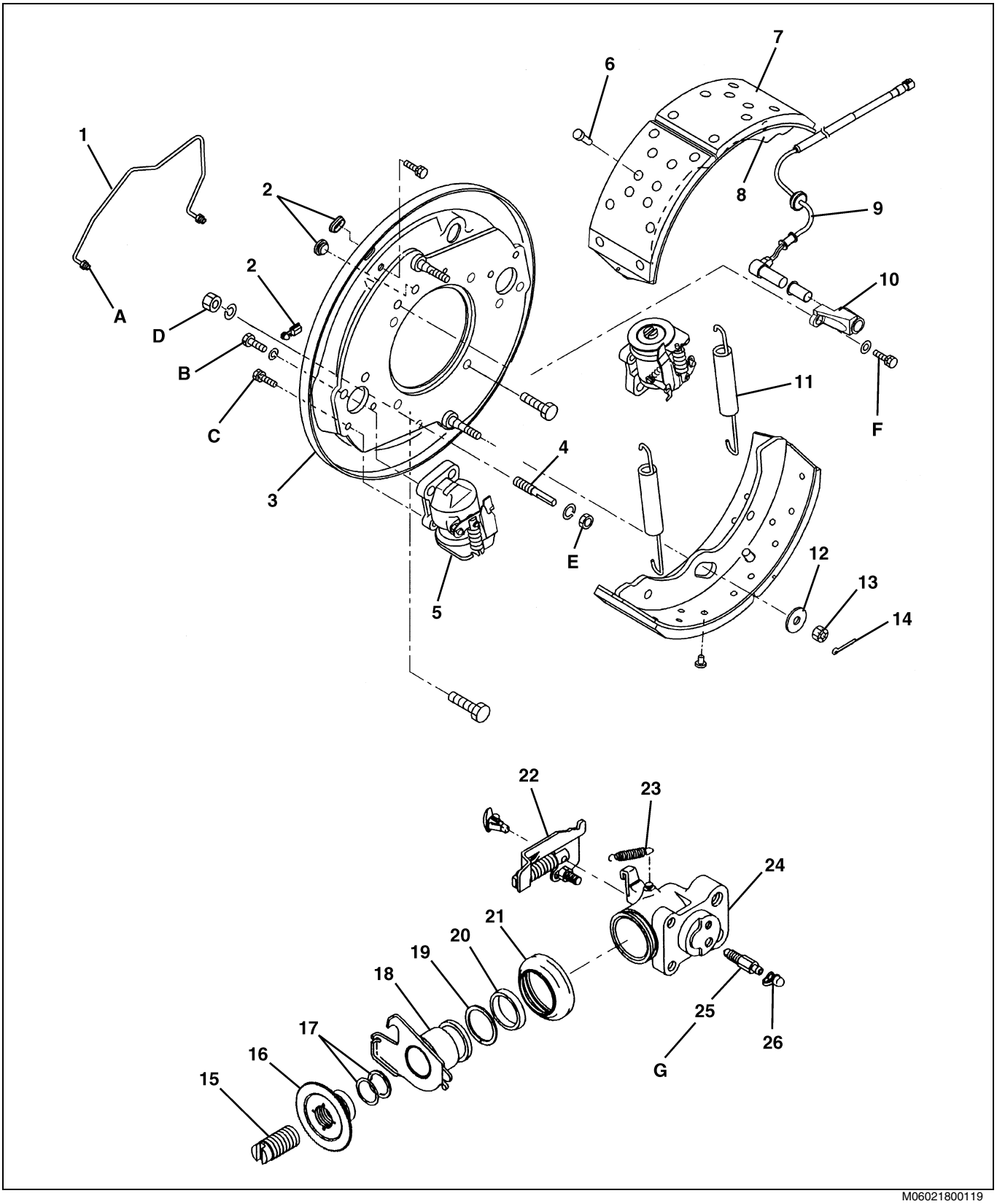

M06021800166

| | | | |
|---|---|---|---|
| 1 | Oil pipe | 13 | Shoe hold down nut |
| 2 | Hole plug | 14 | Cotter pin |
| 3 | Backing plate | 15 | Adjusting bolt |
| 4 | Adjusting bolt | 16 | Wheel cylinder adjuster |
| 5 | Wheel cylinder assembly | 17 | Back up ring |
| 6 | Rivet | 18 | Piston cup |
| 7 | Brake lining | 19 | Boot |
| 8 | Brake shoe | 20 | Shoe adjusting lever |
| 9 | Wheel sensor (If so equipped) | 21 | Wheel cylinder |
| 10 | Wheel sensor holder (If so equipped) | 22 | Air bleeder screw |
| 11 | Shoe retracting spring | 23 | Bleeder cap |
| 12 | Shoe hold down washer | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| **A** | **12.75-17.65 {130-180, 10-13}** | **E** | **25.50-36.28 {260-370, 19-26}** |
| **B** | **ϕ14 bolt: 122.58-166.71 {1,250-1,700, 91-122}** | **F** | **13.73-22.56 {141-229, 11-16}** |
| **C** | **ϕ10 bolt: 37.27-49.03 {380-500, 28-36}** | **G** | **7.5-11.5 {76-117, 5.5-8.4}** |
| **D** | **148-196 {1,500-2,000, 109-144]** | | |

## FRONT (WITH AUTO-ADJUSTER)



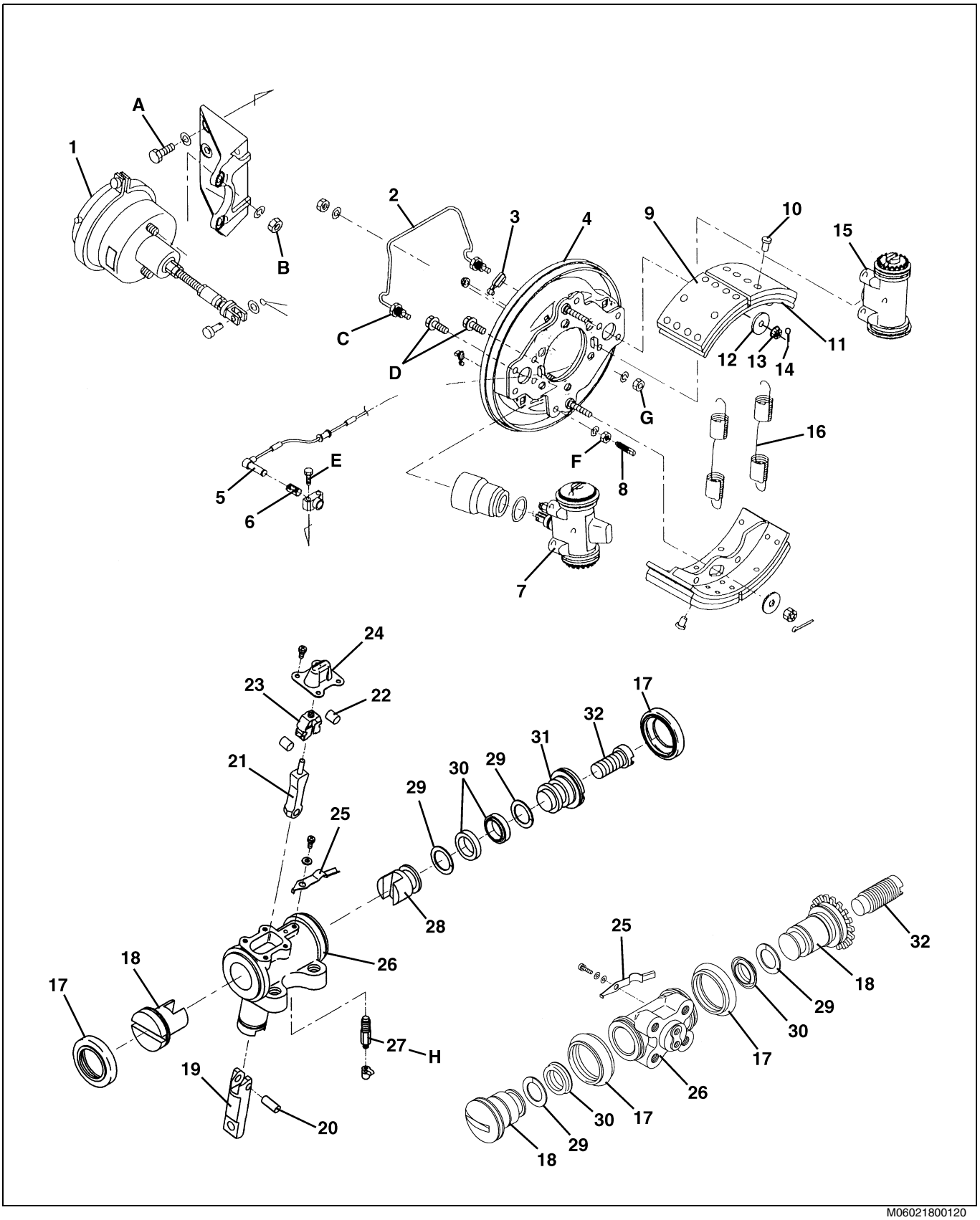

M06021800119

| | | | |
|---|---|---|---|
| 1 | Oil pipe | 14 | Cotter pin |
| 2 | Hole plug | 15 | Adjusting bolt |
| 3 | Backing plate | 16 | Wheel cylinder adjuster |
| 4 | Adjusting bolt | 17 | Spacer |
| 5 | Wheel cylinder assembly | 18 | Piston |
| 6 | Rivet | 19 | Back up ring |
| 7 | Brake lining | 20 | Piston cup |
| 8 | Brake shoe | 21 | Boot |
| 9 | Wheel sensor (If so equipped) | 22 | Shoe adjusting lever |
| 10 | Wheel sensor holder (If so equipped) | 23 | Spring |
| 11 | Shoe retracting spring | 24 | Wheel cylinder |
| 12 | Shoe hold down washer | 25 | Air bleeder screw |
| 13 | Shoe hold down nut | 26 | Bleeder cap |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 12.75-17.65 {130-180, 10-13} | E | 25.50-36.28 {260-370, 19-26} |
| B | ϕ14 bolt: 122.58-166.71 {1,250-1,700, 91-122} | F | 13.73-22.56 {141-229, 11-16} |
| C | ϕ10 bolt: 37.27-49.03 {380-500, 28-36} | G | 7.5-11.5 {76-117, 5.5-8.4} |
| D | 148-196 {1,500-2,000, 109-144] | | |

## REAR



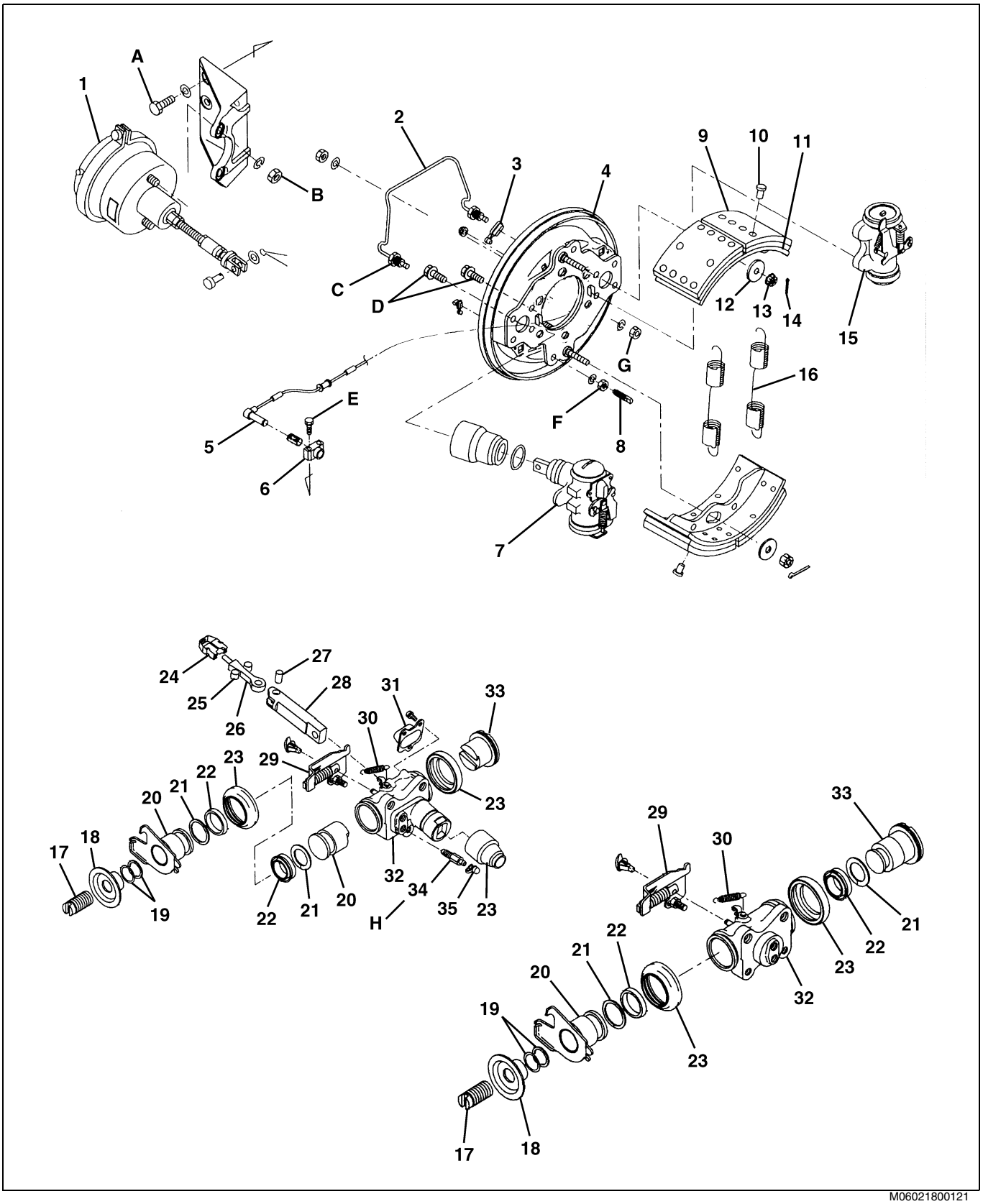

M06021800120

| | | | |
|---|---|---|---|
| 1 | Spring brake chamber | 17 | Boot |
| 2 | Oil pipe | 18 | Piston |
| 3 | Hole plug | 19 | Rod |
| 4 | Backing plate | 20 | Pin |
| 5 | Wheel sensor (If so equipped) | 21 | Wedge |
| 6 | Wheel sensor holder (If so equipped) | 22 | Roller |
| 7 | Wheel cylinder assembly | 23 | Cage |
| 8 | Adjusting bolt | 24 | Wedge cover |
| 9 | Brake lining | 25 | Spring |
| 10 | Rivet | 26 | Cylinder |
| 11 | Brake shoe | 27 | Air bleeder screw |
| 12 | Shoe hold down washer | 28 | Piston |
| 13 | Shoe hold down nut | 29 | Back up ring |
| 14 | Cotter pin | 30 | Piston cup |
| 15 | Wheel cylinder assembly | 31 | Anchor piston |
| 16 | Shoe retracting spring | 32 | Adjusting bolt |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 109-147 {1,110-1,500, 81-108} | E | 34.5-51.5 {350-525, 25-37} |
| B | 148-196 {1,500-2,000, 109-144} | F | 25.50-36.28 {260-370, 19-26} |
| C | 12.75-17.65 {130-180, 10-13} | G | 148-196 {1,500-2,000, 109-144} |
| D | ϕ16 bolt: 186.33-254.97 {1,900-2,600, 137-188}<br>ϕ14 bolt: 122.58-166.71 {1,250-1,700, 91-122}<br>ϕ12 bolt: 79.43-107.87 {810-1,100, 58-79} | H | 7.5-11.5 {76-117, 5.5-8.4} |

## REAR (WITH AUTO-ADJUSTER)




M06021800121

| | | | |
|---|---|---|---|
| 1 | Spring brake chamber | 19 | Spacer |
| 2 | Oil pipe | 20 | Piston |
| 3 | Hole plug | 21 | Back up ring |
| 4 | Backing plate | 22 | Piston cup |
| 5 | Wheel sensor (If so equipped) | 23 | Boot |
| 6 | Wheel sensor holder (If so equipped) | 24 | Cage |
| 7 | Wheel cylinder assembly | 25 | Roller |
| 8 | Adjusting bolt | 26 | Wedge |
| 9 | Brake lining | 27 | Pin |
| 10 | Rivet | 28 | Rod |
| 11 | Brake shoe | 29 | Shoe adjusting lever |
| 12 | Shoe hold down washer | 30 | Spring |
| 13 | Shoe hold down nut | 31 | Wedge cover |
| 14 | Cotter pin | 32 | Cylinder |
| 15 | Wheel cylinder assembly | 33 | Anchor cylinder |
| 16 | Shoe retracting spring | 34 | Air bleeder screw |
| 17 | Adjusting bolt | 35 | Bleeder cap |
| 18 | Wheel cylinder adjuster | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 109-147 {1,110-1,500, 81-108} | E | 34.5-51.5 {350-525, 25-37} |
| B | 148-196 {1,500-2,000, 109-144} | F | 25.50-36.28 {260-370, 19-26} |
| C | 12.75-17.65 {130-180, 10-13} | G | 148-196 {1,500-2,000, 109-144} |
| D | ϕ18 bolt: 186.33-254.97 {1,900-2,600, 137-188} | H | 7.5-11.5 {76-117, 5.5-8.4} |
| | ϕ14 bolt: 122.58-166.71 {1,250-1,700, 91-122} | | |
| | ϕ12 bolt: 79.43-107.87 {810-1,100, 58-79} | | |

# OVERHAUL

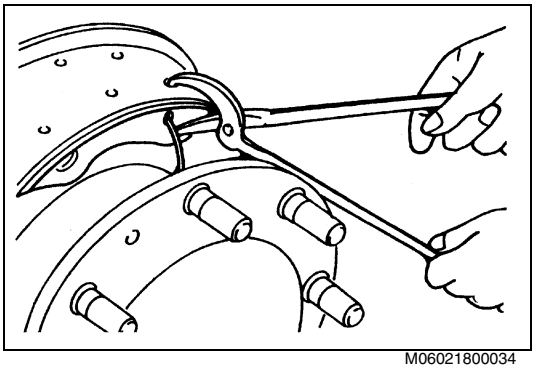
M06021801BEH2006

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF TIRE.**
(1) Refer to chapter WHEEL & TIRE.

**2. REMOVAL OF BRAKE DRUM WITH WHEEL HUB AND WHEEL HUB BEARINGS.**
(1) Refer to chapter FRONT AXLE and REAR AXLE.

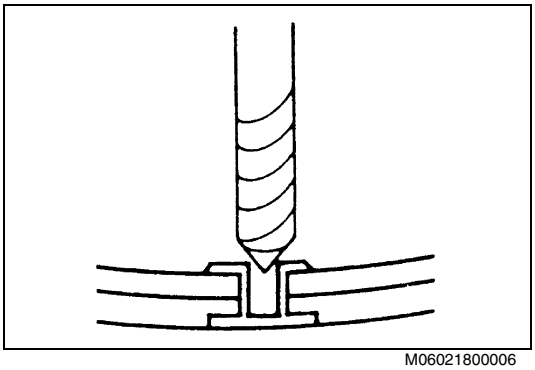
**3. REMOVAL OF BRAKE SHOE RETRACTING SPRING.**
(1) Remove the retracting spring by using the special tools.
**SST: Retracting spring pull back tool (09606-1040)**


M06021800034

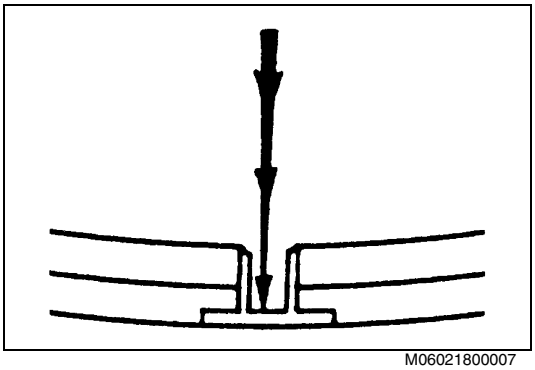
## IMPORTANT POINTS - ASSEMBLY

**1. REPLACEMENT OF THE BRAKE LINING.**
(1) Drill the rivet caulking section with a drill smaller than the rivet diameter.

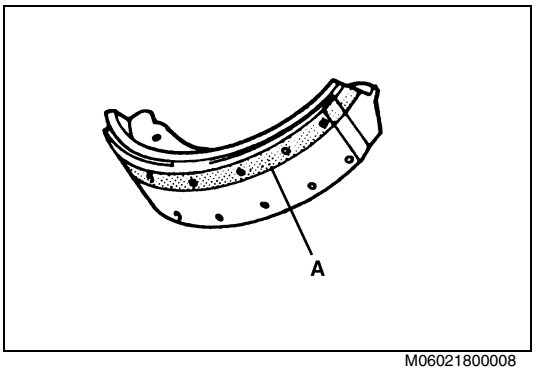
**NOTICE:**
**At this time, be careful not to scratch the brake shoe.**


M06021800006

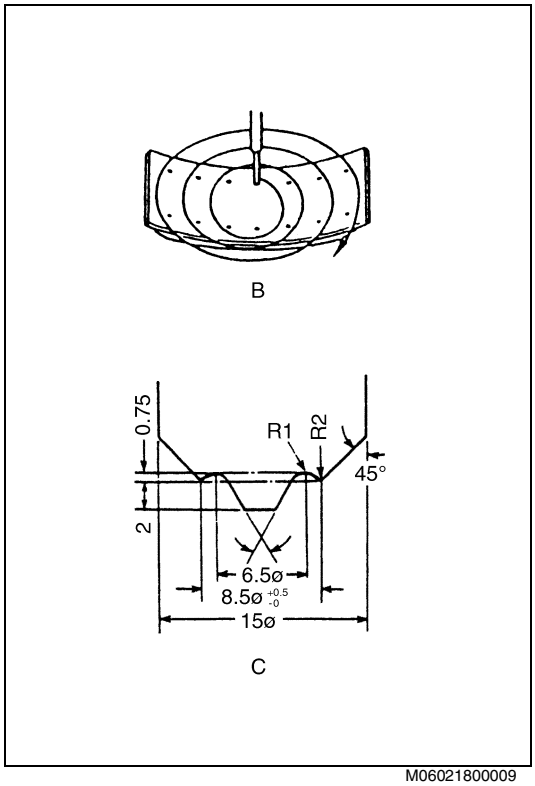
(2) After drilling, remove the remaining portion of the rivet with a fine chisel or a rivetting machine.


M06021800007

(3) Set the lining with shoe and insert the rivets into all holes, then hold them in place with adhesive tape A.



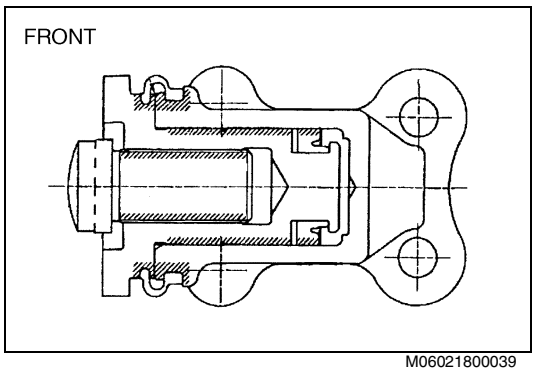
M06021800008



M06021800009

(4) Caulk the rivets lightly in a circular pattern as shown B; repeat several times to assure proper seating of the lining.
**Recommended configuration of punch: Shown in C.**
**Recommended force of staking the Rivet: 2.4 tons**

(5) Remove adhesive tape.



M06021800039

**2. ASSEMBLY OF THE WHEEL CYLINDER.**

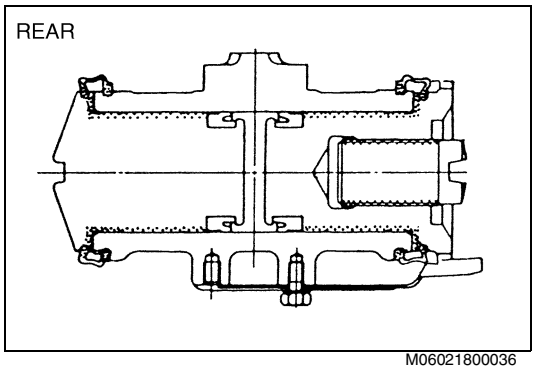
(1) Apply rustproof oil to the internal surface of the cylinder.

**Rustproof oil (CCI No. 20):**
**04156-1010**

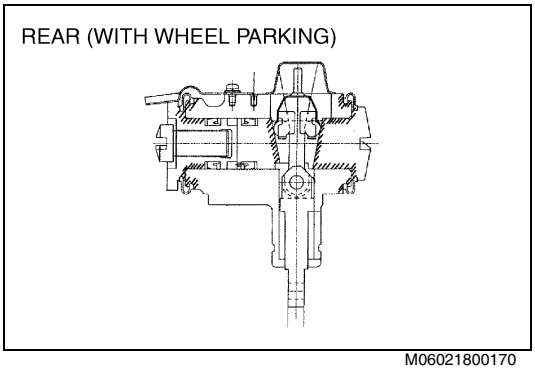
(2) Apply rubber grease to the threads of adjusting bolt, inside of boot, groove for boot, sliding surface of piston.

**Rubber grease (RX-2):**
**04133-1080**

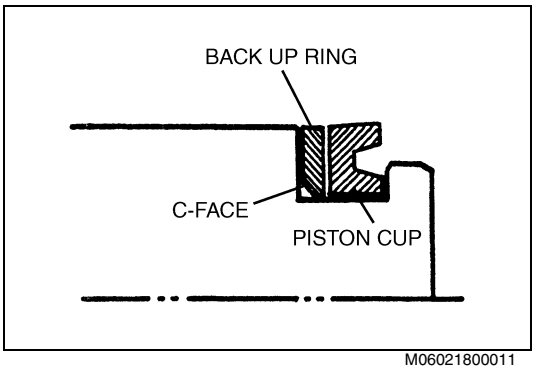
**NOTICE:**
**The parts where the rubber grease shall be applied are shown in figure with oblique lines.**



M06021800036

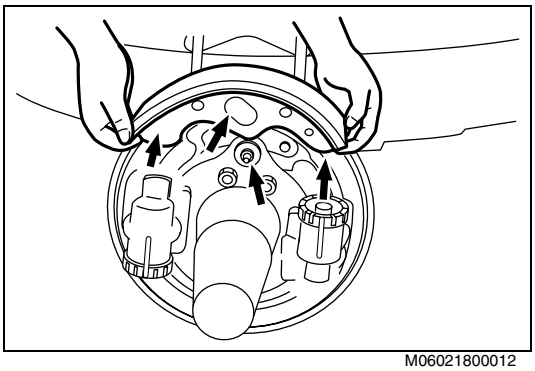


M06021800170



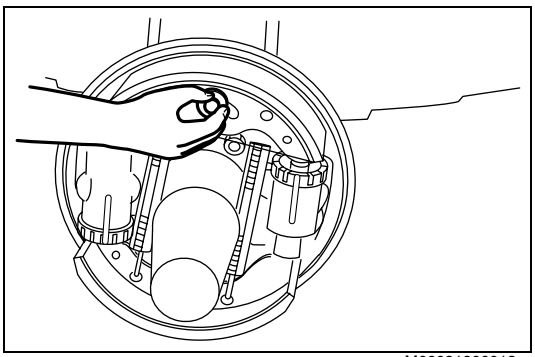
M06021800011

(3) Be sure to install the back up ring with the chamfered face of the ring a way of the cup.

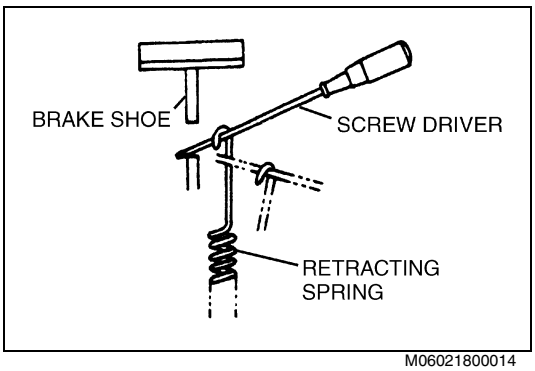

M06021800012

**3. INSTALLATION OF BRAKE SHOE ASSEMBLY.**

(1) Apply heat-resistant grease to both ends of the shoe web contacting with the piston, and to the top surface of the shoe web contacting the shoe hold washer.


M06021800013

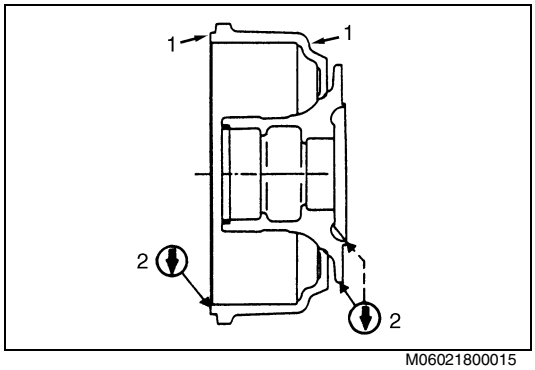
(2) Adjust the clearance between the hold down washer and the shoe.
Tighten the slotted nut and back off the nut by 1/3 turn.
Then secure the nut with the cotter pin.
If the cotter pin cannot be inserted into the hole, loosen the slotted nut (within 1/6 turn) to align it with the bolt hole.



M06021800014

**4. INSTALLATION OF BRAKE SHOE RETRACTING SPRING.**

(1) Install the retracting spring using a screwdriver. After installing the spring, check that the end of the shoe web is securely set in the groove of the wheel cylinder piston. Also check that the hook of the spring is securely hooked in the hole of the shoe.



M06021800015

**5. ASSEMBLY OF THE BRAKE DRUM AND WHEEL HUB. (FRONT WHEEL)**

(1) See the mark located at 1 or 1' on the brake drum as shown in Figure. Install the drum according to NOTE.

**NOTICE:**

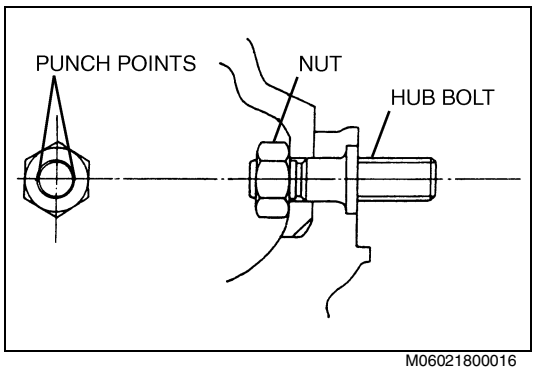
**1. The drums. Number with R or L.**
**With R: Install in right side.**
**With L: Install in left side.**

**2. The drums, with no R or L.**
**New drums: Install in any side.**
**Reused drums: Install in the side originally installed.**

(2) When assembling the brake drum and wheel hub, make sure that their aligning marks are aligned as close to each other as possible.

**NOTICE:**

**Position of marks are located at 2. as shown in the figure. (Broken line shows alternative position).**



M06021800016

(3) Caulk the hub and nuts as shown in figure, after tightening the brake drum and wheel hub.
**Tightening Torque:**
**393-470 N·m {4,000-4,800 kgf·cm, 290-347 lbf·ft}**

**6. MOUNTING OF WHEEL HUB WITH BRAKE DRUM.**

(1) Refer to chapter FRONT AXLE and REAR AXLE.

**7. MOUNTING OF TIRE.**

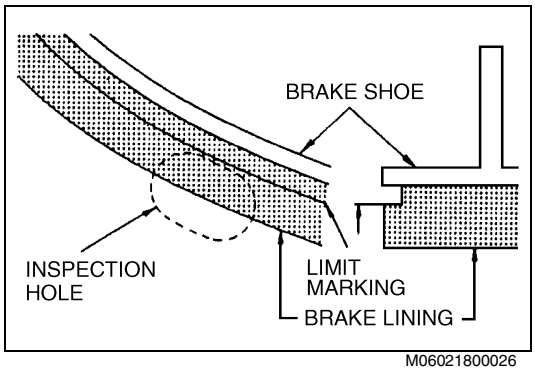
(1) Refer to chapter WHEEL & TIRE.

**8. ADJUSTMENT.**

(1) Finally, adjust the clearance between the brake lining and the brake drum as explained in Section "ADJUSTMENT".

# ADJUSTMENT

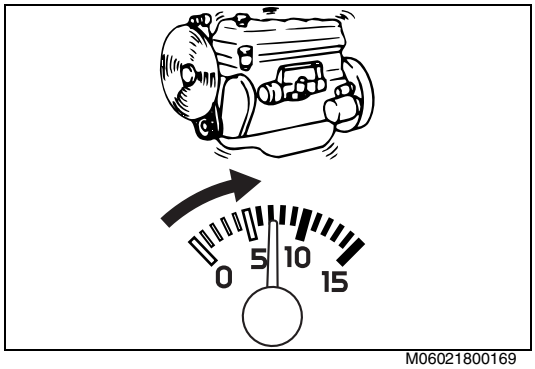
**M06021801BEH3002**



M06021800026

**1. REMAINING THICKNESS OF THE BRAKE LINING.**

(1) Check remaining thickness of lining through the inspection hole of the backing plate. If the lining has been worn to the limit marking or if it is foreseen that the lining will be worn to the limit by the time the next inspection is made replace the lining.



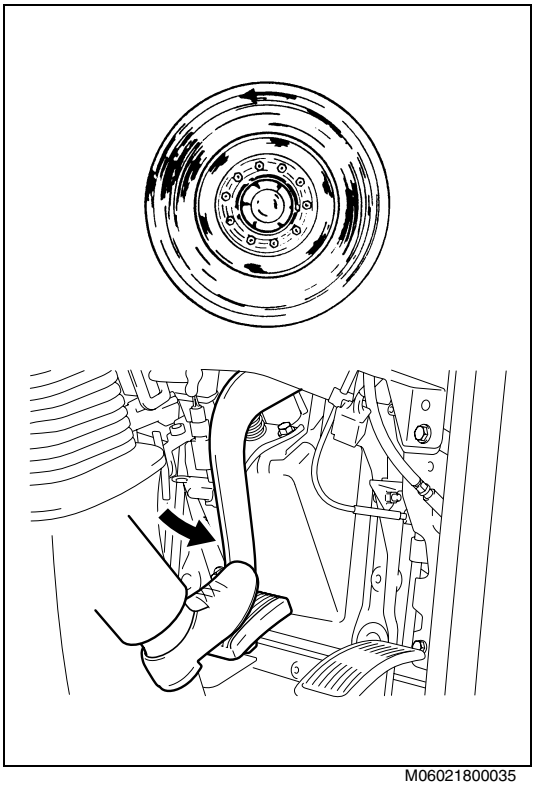
M06021800169

**2. AIR PRESSURE IN THE AIR TANK.**

(1) Operate the engine and obtain an air pressure of the 785-880 kPa {8.0-9.0 kgf/cm$^2$, 114-128 lbf/in$^2$.}

**NOTICE:**

**The specified air pressure in the air tank should be maintained when making the adjustment.**



M06021800035

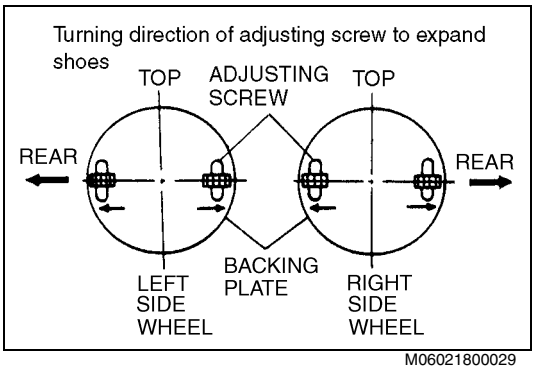
**3. CLEARANCE BETWEEN BRAKE LINING AND BRAKE DRUM.**

(1) Lift the wheel to be adjusted off the ground.

(2) While turning the wheel in the forward direction and step on the brake pedal several times to make sure that the brake shoes are correctly positioned.

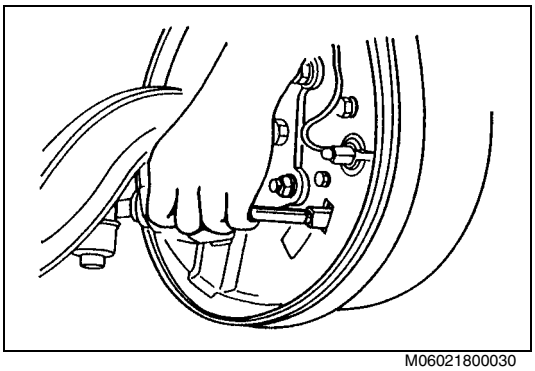
**NOTICE:**

**When adjusting the clearance between brake lining and brake drum, set spring brake control valve to the OFF position.**



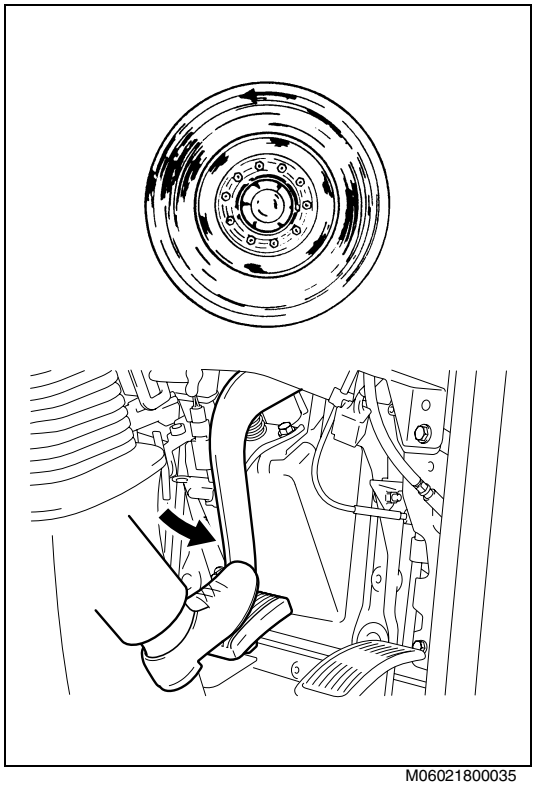

M06021800029

(3) Turn the adjusting screw with an adjusting tool in the arrow direction, (The arrows are marked near the holes on the backing plate), and put the drum into a position as to turn slowly by hand.
**SST: Brake shoe adjusting tool (09665-1130)**



M06021800030

(4) Return the adjusting screw 5-7 notches in the reverse arrow direction.



M06021800035

(5) While turning the wheel by hand in the forward direction, step on the brake pedal several times to make sure that the brake shoes are correctly positioned.

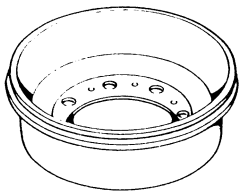
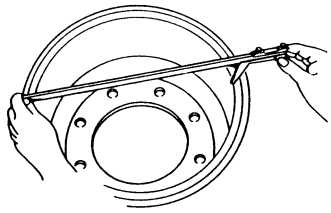
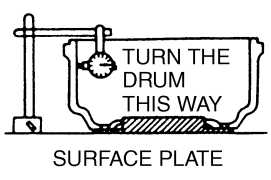
(6) See to it that there is no dragging, when turning the wheel by hand. If there is any dragging, repeat the operation over again from 2.

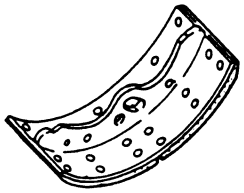
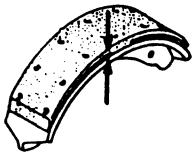
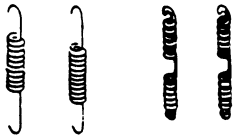
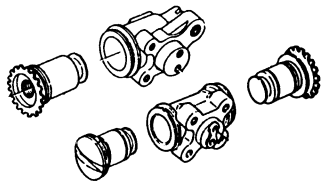
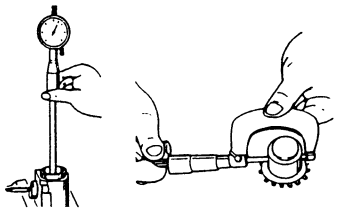
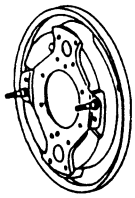
**NOTICE:**
**Using the same procedure as above, adjust the clearance for all wheels.**

# INSPECTION AND REPAIR

M06021801BEH3012

**NOTICE:**
**Brake fluid or isopropyl alcohol should only be used to wash the wheel cylinder component.**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Brake drum inner surface: Crack, scoring and/or any other damage** | **—** | **—** | **Regrind or replace, if necessary.** | **Visual check**  |
| **Brake drum inner diameter** | **400 mm {15.748 in.}** | **403 mm {15.866 in.}** | **Replace.** | **Measure**  |
| **Brake drum runout** | **0-0.1 mm {0-0.0039 in.}** | **0.2 mm {0.0079 in.}** | **Regrind or replace.** | **Measure**   SURFACE PLATE |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Brake shoe with lining: Crack, wear deformation and/or any other damages** | **—** | **—** | **Re-lining or replace, if necessary.** | **Visual check**  |
| **Remaining thickness of brake lining** | **15.0 mm {0.590 in.}** | **5.0 mm {0.197 in.}** | **Re-lining.** | **Measure**  |
| **Brake shoe retracting spring: Elastic strength distortion and/or any damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Wheel cylinder and piston: Corrosion and/or any damage** | **—** | **—** | **Clean or replace, if necessary.** | **Visual check**  |
| **Clearance between piston and wheel cylinder** | **0.03-0.13 mm {0.0012-0.0051 in.}** | **0.25 mm {0.0098 in.}** | **Replace** | **Measure**  |
| **Backing plate and stud pins: Deformation, damage and any other abnormality** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# SERVICE BRAKE

BR02-002

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DATA AND SPECIFICATIONS ..... BR02-3
DESCRIPTION ..... BR02-3
COMPONENT LOCATOR..... BR02-4
OVERHAUL ..... BR02-5
INSPECTION AND REPAIR ..... BR02-6

**AIR DRYER (MODELS: FG, GH [WITHOUT ABS]).....BR02-7**
DATA AND SPECIFICATIONS ..... BR02-7
DESCRIPTION ..... BR02-7
COMPONENT LOCATOR..... BR02-8
OVERHAUL ..... BR02-9
INSPECTION AND REPAIR ..... BR02-10

**AIR DRYER (MODELS: FG, GH [WITH ABS]) .....BR02-11**
DATA AND SPECIFICATIONS ..... BR02-11
DESCRIPTION ..... BR02-12
COMPONENT LOCATOR..... BR02-13
OVERHAUL ..... BR02-14
INSPECTION AND REPAIR ..... BR02-15

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DESCRIPTION ..... BR02-16
COMPONENT LOCATOR..... BR02-17
OVERHAUL ..... BR02-18
INSPECTION AND REPAIR ..... BR02-19

**CHECK VALVE.....BR02-20**
DATA AND SPECIFICATIONS ..... BR02-20
DESCRIPTION ..... BR02-20
COMPONENT LOCATOR..... BR02-21
INSPECTION AND REPAIR ..... BR02-21

**SAFETY VALVE .....BR02-22**
DATA AND SPECIFICATIONS ..... BR02-22
DESCRIPTION ..... BR02-22
INSPECTION AND REPAIR ..... BR02-22

**BRAKE VALVE.....BR02-23**
DATA AND SPECIFICATIONS ..... BR02-23
DESCRIPTION ..... BR02-23
COMPONENT LOCATOR..... BR02-24
OVERHAUL ..... BR02-25
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**PROTECTION VALVE .....BR02-32**
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DESCRIPTION ..... BR02-32
COMPONENT LOCATOR..... BR02-33
OVERHAUL ..... BR02-33
INSPECTION AND REPAIR ..... BR02-34

**PROTECTION VALVE (WITH 4-WAY PROTECTION VALVE).....BR02-35**
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DESCRIPTION ..... BR02-35
COMPONENT LOCATOR..... BR02-36
OVERHAUL ..... BR02-37
ADJUSTMENT..... BR02-37
INSPECTION AND REPAIR ..... BR02-39

**QUICK RELEASE VALVE .....BR02-40**
DATA AND SPECIFICATION..... BR02-40
DESCRIPTION ..... BR02-40
COMPONENT LOCATOR..... BR02-41
OVERHAUL ..... BR02-42
INSPECTION AND REPAIR ..... BR02-42

**SPRING BRAKE CONTROL VALVE .....BR02-43**
DATA AND SPECIFICATIONS ..... BR02-43
DESCRIPTION ..... BR02-43
COMPONENT LOCATOR..... BR02-44
OVERHAUL ..... BR02-45
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**RELAY VALVE (TYPE-A) .....BR02-47**
DATA AND SPECIFICATIONS ..... BR02-47
DESCRIPTON ..... BR02-47
COMPONENT LOCATOR..... BR02-48
OVERHAUL ..... BR02-48
INSPECTION AND REPAIR ..... BR02-49

**RELAY VALVE (TYPE-B)..... BR02-50**
DATA AND SPECIFICATIONS.....BR02-50
DESCRIPTION.....BR02-50
COMPONENT LOCATOR .....BR02-51
OVERHAUL.....BR02-52
INSPECTION AND REPAIR.....BR02-52

**RELAY VALVE**
**(TYPE-C: WITH CHECK VALVE) ..... BR02-53**
DATA AND SPECIFICATIONS.....BR02-53
DESCRIPTION.....BR02-53
COMPONENT LOCATOR .....BR02-54
OVERHAUL.....BR02-55
INSPECTION AND REPAIR.....BR02-56

**SPRING BRAKE CHAMBER**
**(TYPE-A)..... BR02-57**
DATA AND SPECIFICATIONS.....BR02-57
DESCRIPTION.....BR02-58
SPECIAL TOOL.....BR02-59
COMPONENT LOCATOR .....BR02-59
OVERHAUL.....BR02-60
INSPECTION AND REPAIR.....BR02-64

**SPRING BRAKE CHAMBER**
**(TYPE-B)..... BR02-65**
DATA AND SPECIFICATIONS.....BR02-65
DESCRIPTION.....BR02-65
SPECIAL TOOL.....BR02-66
COMPONENT LOCATOR .....BR02-66
OVERHAUL.....BR02-67
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**WHEEL BRAKE..... BR02-71**
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DESCRIPTION.....BR02-72
SPECIAL TOOL.....BR02-77
COMPONENT LOCATOR .....BR02-78
OVERHAUL.....BR02-87
ADJUSTMENT .....BR02-94
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**CUT VALVE..... BR02-99**
DATA AND SPECIFICATIONS.....BR02-99
DESCRIPTION.....BR02-99
COMPONENT LOCATOR .....BR02-100
OVERHAUL.....BR02-101
INSPECTION AND REPAIR.....BR02-101

**WHEEL BRAKE SLACK ADJUSTER**
**(AUTO ADJUSTER)..... BR02-102**
DESCRIPTION.....BR02-102
SPECIAL TOOL.....BR02-103
COMPONENT LOCATOR .....BR02-105
OVERHAUL.....BR02-106
INSPECTION AND REPAIR.....BR02-113

**BRAKE CHAMBER**
**(MODELS: FG, GH) ..... BR02-115**
DATA AND SPECIFICATION .....BR02-115
DESCRIPTION.....BR02-115
COMPONENT LOCATOR .....BR02-116
OVERHAUL.....BR02-116
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**BRAKE CHAMBER**
**(MODELS: FL, FM)..... BR02-118**
DATA AND SPECIFICATION .....BR02-118
DESCRIPTION.....BR02-118
COMPONENT LOCATOR .....BR02-119
OVERHAUL.....BR02-119
INSPECTION AND REPAIR.....BR02-120

**TRAILER HAND BRAKE CONTROL VALVE**
**(MODELS: FM1JKPA, FM2PKPA) ..... BR02-121**
DATA AND SPECIFICATION .....BR02-121
DESCRIPTION.....BR02-121
COMPONENT LOCATOR .....BR02-122
OVERHAUL.....BR02-123
INSPECTION AND REPAIR.....BR02-124

# PRESSURE REGULATOR (MODELS: FG,GH)

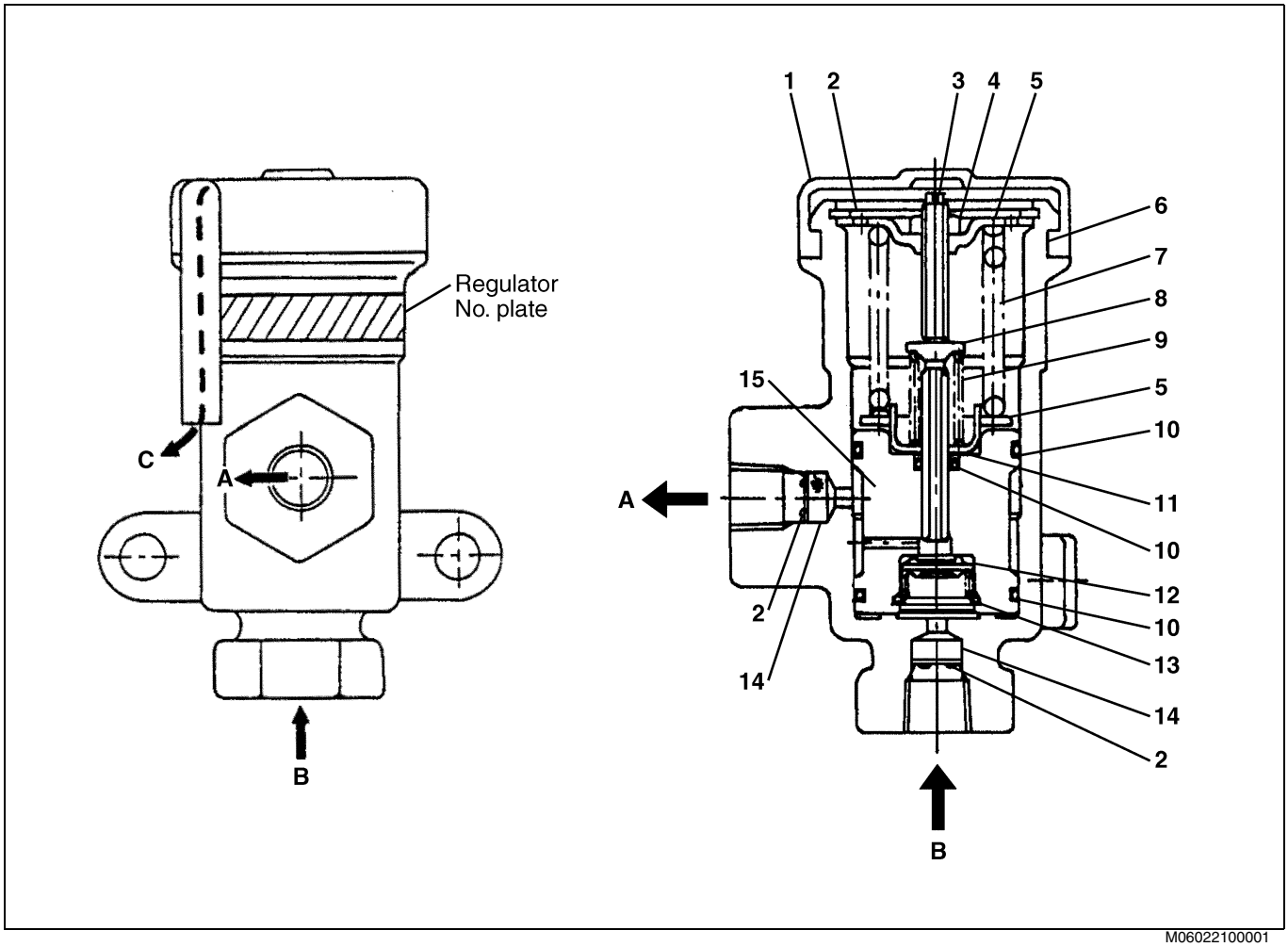
## DATA AND SPECIFICATIONS

M06022101BEI2001

| | |
|---|---|
| **Type** | **Spring type, regulates air pressure together with unloader valve on compressor** |
| **Regulating pressure:<br>Regulator No. 44530-1330** | **780-880 kPa {8.0-9.0 kgf/cm$^2$, 114-128 lbf/in$^2$.}** |

## DESCRIPTION

M06022101BEC1001

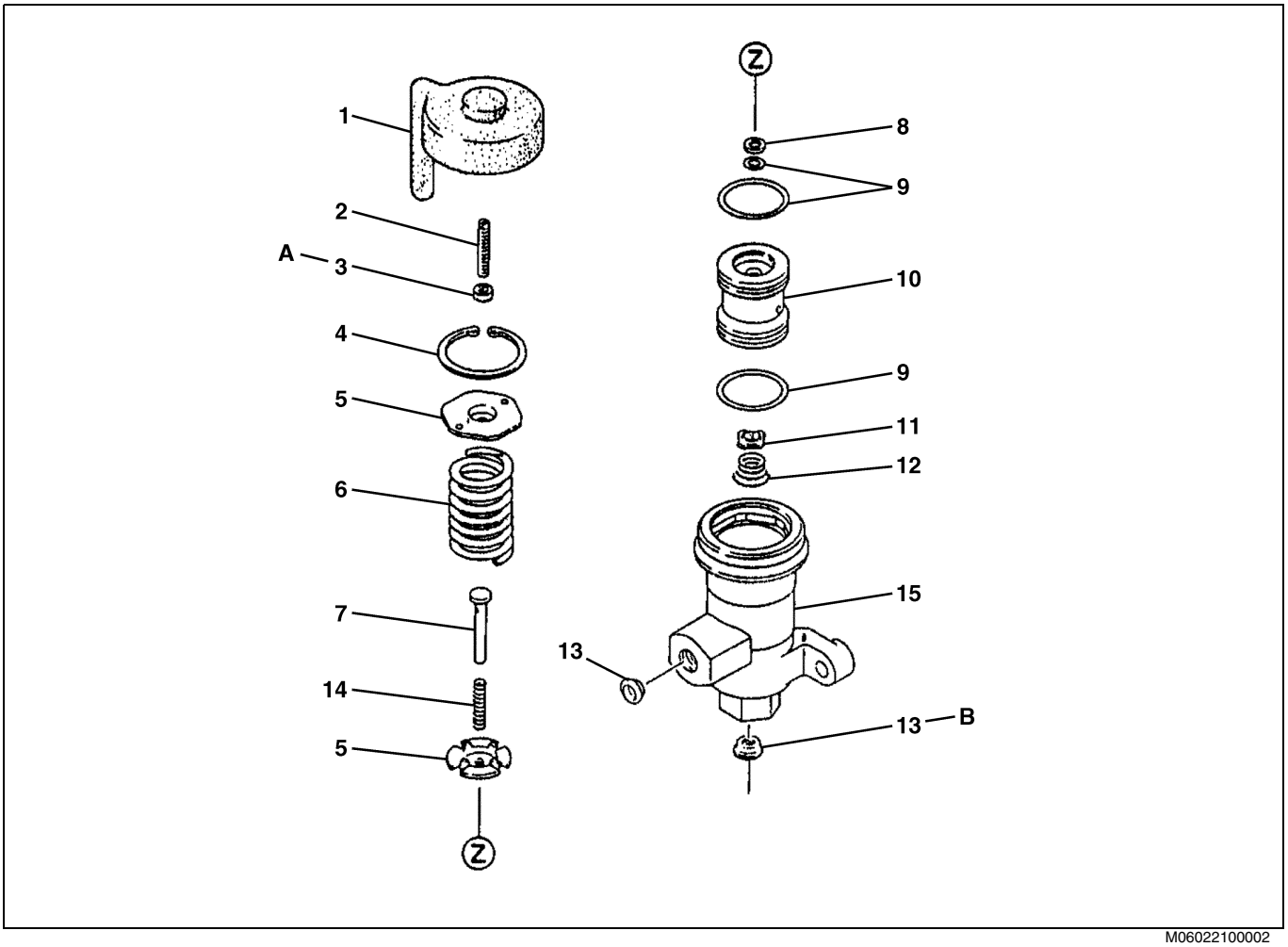



M06022100001

| | | | | | |
|---|---|---|---|---|---|
| 1 | Dust cover | 7 | Main spring | 13 | Valve spring |
| 2 | Retainer ring | 8 | Valve rod | 14 | Filter |
| 3 | Adjusting screw | 9 | Rod spring | 15 | Piston |
| 4 | Lock nut | 10 | O-ring | A | To Unloader valve |
| 5 | Spring seat | 11 | Washer | B | From Air tank |
| 6 | Valve body | 12 | Valve seat | C | Exhaust |

# COMPONENT LOCATOR

M06022101BED1001




M06022100002

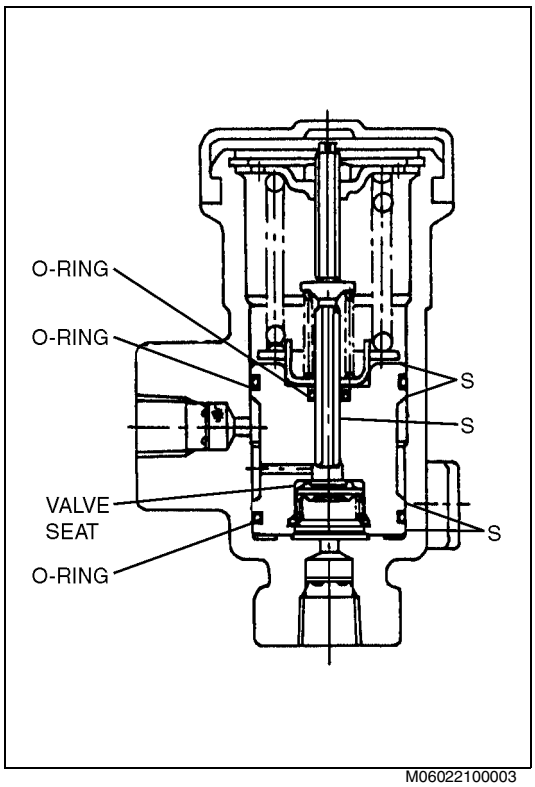
| | | | | | |
|---|---|---|---|---|---|
| 1 | Dust cover | 6 | Main spring | 11 | Valve seat |
| 2 | Adjusting screw | 7 | Valve rod | 12 | Valve spring |
| 3 | Lock nut | 8 | Washer | 13 | Filter |
| 4 | Retainer ring | 9 | O-ring | 14 | Rod spring |
| 5 | Spring seat | 10 | Piston | 15 | Valve body |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 2.4-3.5 {24-36, 1.8-2.6} | B | 0.29-0.49 {3-5, 0.22-0.36} |

# OVERHAUL

M06020101BEH2002



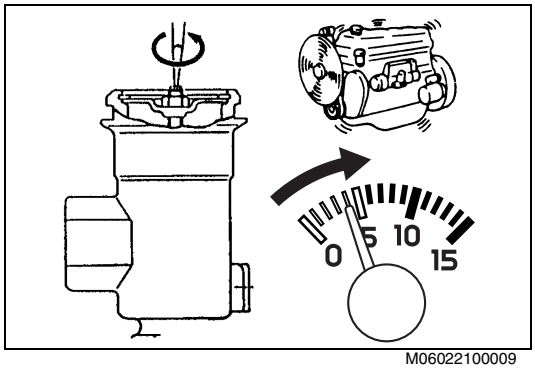

M06022100003

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When reassembling the pressure regulator, replace all rubber parts with new ones.

(2) Apply adequate amount of silicone grease to the O-rings, and sliding surface S of the piston and valve rod.

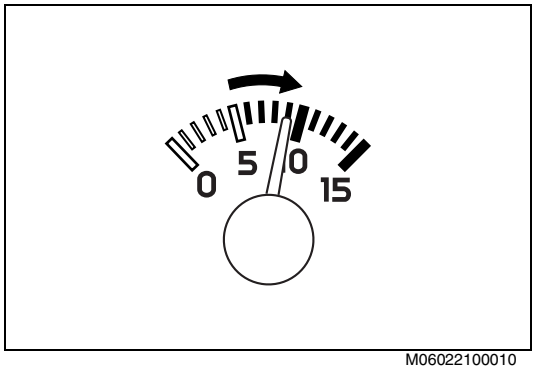



M06022100009

## IMPORTANT POINT - MOUNTING

**1. ADJUSTMENT**

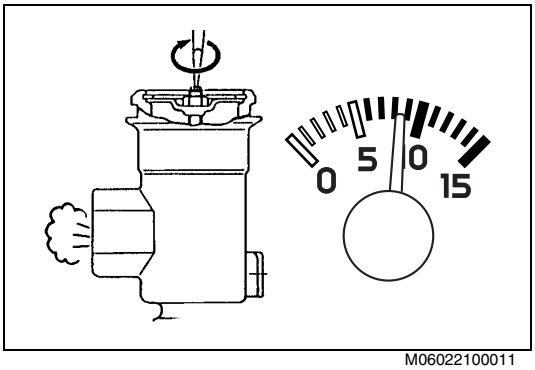
(1) Loosen the adjusting screw until the rod spring tension is released, and start and idle the engine to charge the air for the air tank.




M06022100010

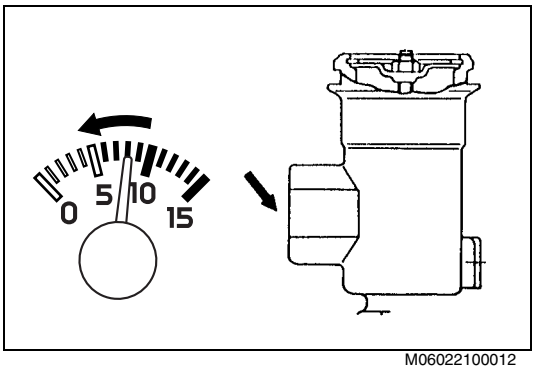
(2) Stop the engine when the gauge indicates valve opening pressure shown below.

| Valve opening pressure | Pressure kPa {kgf/cm$^2$, lbf/in$^2$.} |
|---|---|
| 44530-1330 | 863-902 {8.8-9.2, 125.17-130.85} |



M06022100011

(3) Tighten the adjusting screw gradually till the air starts to leak from the port to the unloader valve side.
(4) Tighten the adjusting screw lock nut.



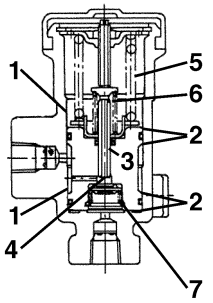
M06022100012

(5) Watch the pressure gauge needle and see that it stops at the valve closing pressure shown below.
(6) Connect the pipe and pressure regulator.

| Valve closing pressure | Pressure kPa {kgf/cm$^2$, lbf/in$^2$.} |
|---|---|
| 44530-1330 | 756-794 {7.7-8.1, 109.52-115.20} |

# INSPECTION AND REPAIR

M06022101BEH3001

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Valve body 1, piston 2 and valve rod 3. Sliding surface: Valve rod 4. Valve contact surface: Wear and any other damages | — | — | Replace, if necessary. | Visual check   |
| Main spring 5. rod spring 6. and valve spring 7: Rust and damage | — | — | Replace, if necessary. | |

# AIR DRYER (MODELS: FG, GH [WITHOUT ABS])

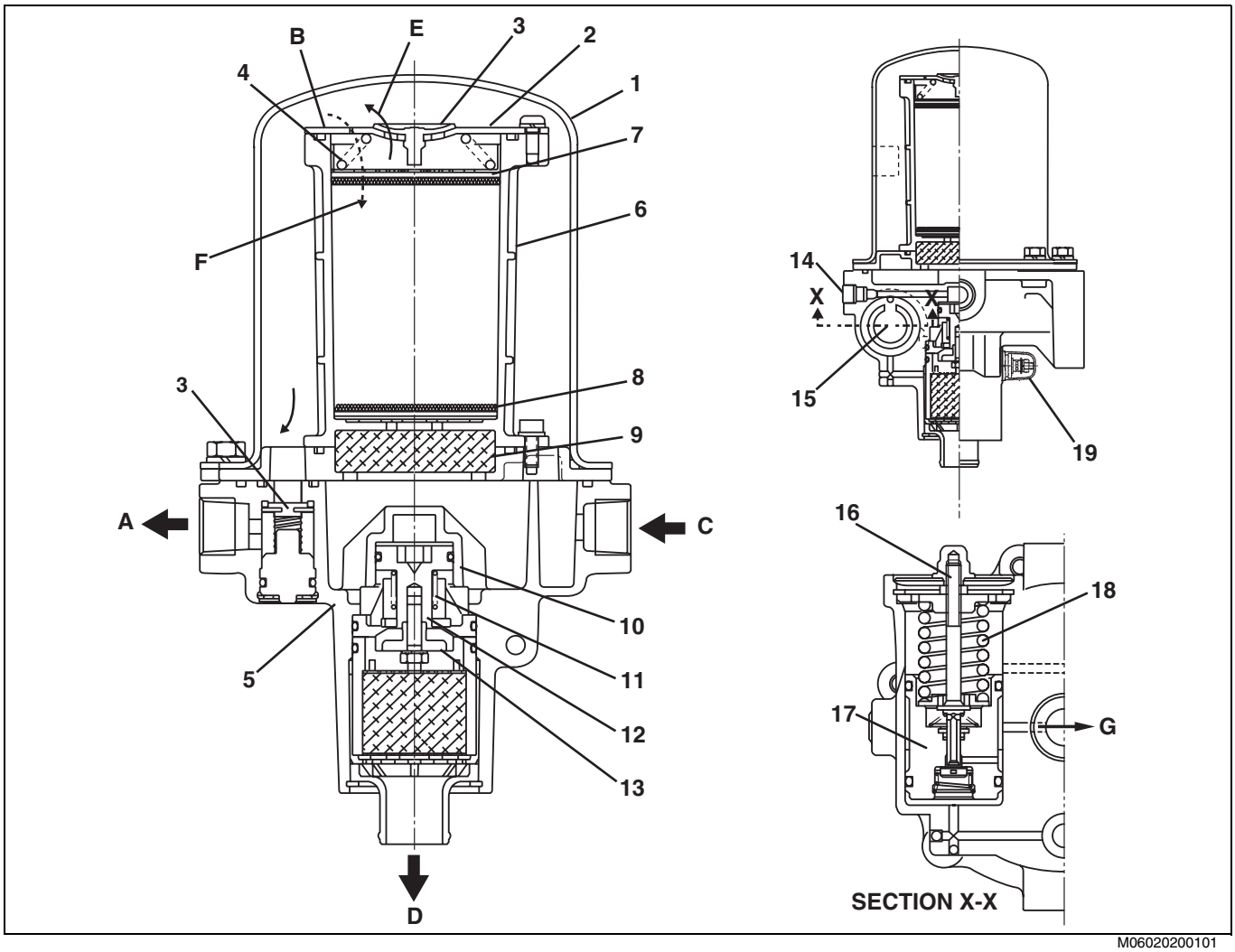
## DATA AND SPECIFICATIONS

M06020201BEI2002

| | |
|---|---|
| Type | Purge tank, desiccant, auto-purge valve. |
| Air and Water discharging time (Reclamation cycle) | Approx. 50 sec. |

## DESCRIPTION

M06020201BEC1005

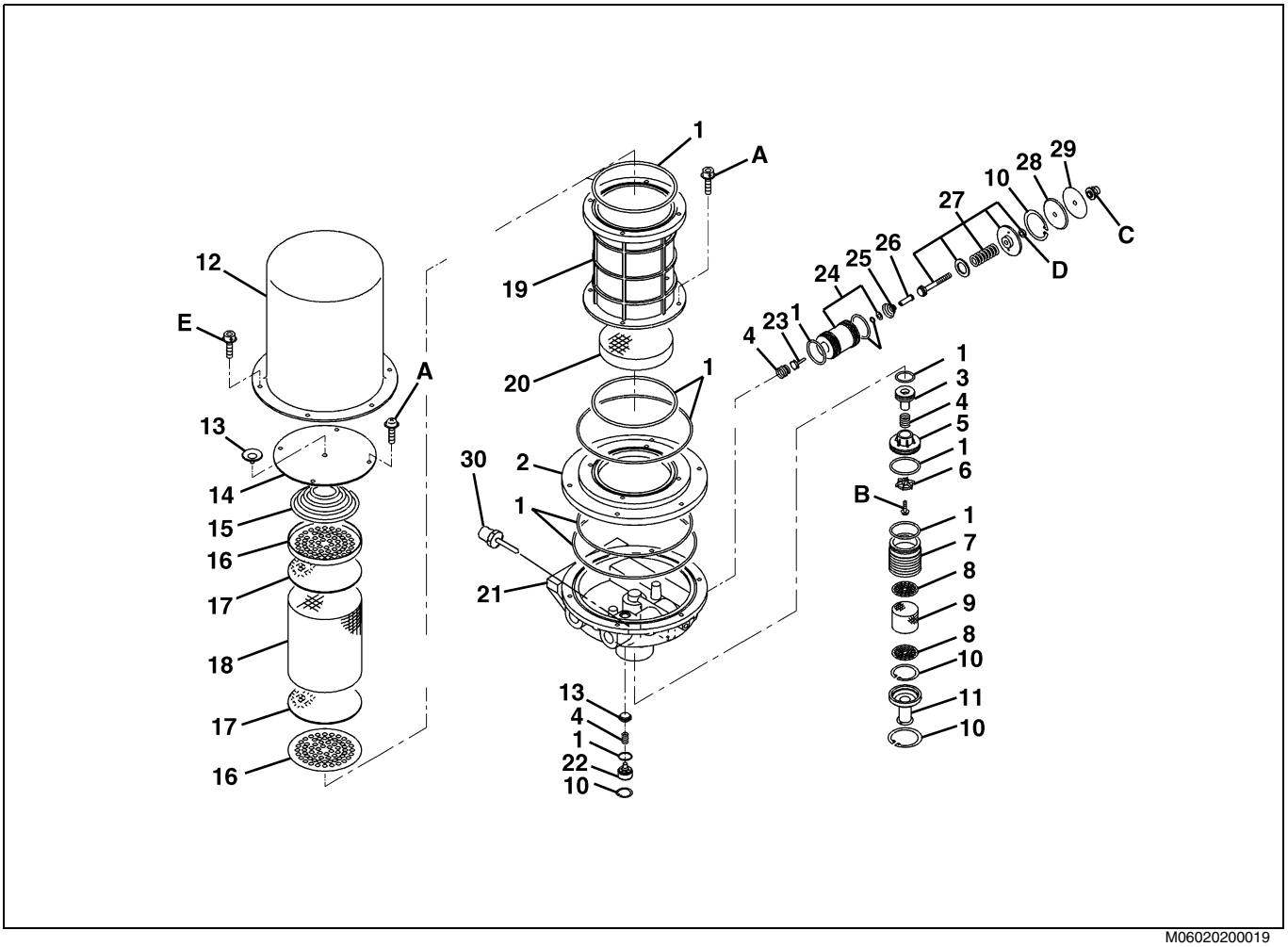



M06020200101

| | | | |
|---|---|---|---|
| 1 | Chamber (Purge tank) | 14 | Plug |
| 2 | Case cover | 15 | Pressure regulator |
| 3 | Check valve | 16 | Adjusting screw |
| 4 | Spring | 17 | Piston |
| 5 | Body | 18 | Piston spring |
| 6 | Desiccant case | 19 | Heater (If so equipped) |
| 7 | Filter | A | Outlet (Dried air to air tank) |
| 8 | Desiccant | B | Orifice |
| 9 | Oil separator filter | C | Inlet (From air compressor) |
| 10 | Valve body | D | Purged air |
| 11 | Valve spring | E | Dehumidification |
| 12 | Piston | F | Reclamation |
| 13 | Purge valve | G | To purge valve |

# COMPONENT LOCATOR

M06020201BED1005




M06020200019

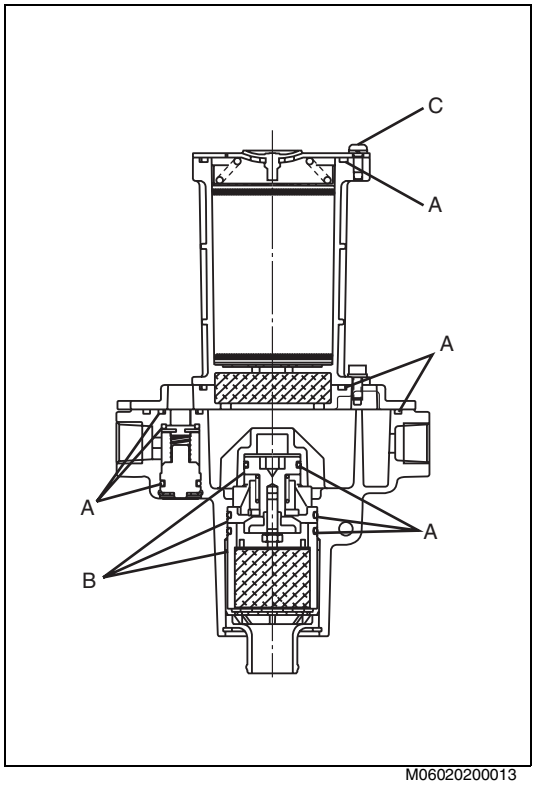
| | | | |
|---|---|---|---|
| 1 | O-ring | 16 | Filter plate |
| 2 | Cover | 17 | Filter |
| 3 | Piston | 18 | Desiccant |
| 4 | Valve spring | 19 | Desiccant case |
| 5 | Valve body | 20 | Oil separator filter |
| 6 | Purge valve | 21 | Body |
| 7 | Silencer case | 22 | Valve stopper |
| 8 | Silencer plate | 23 | Governor valve |
| 9 | Silencer | 24 | Piston assembly |
| 10 | Retainer ring | 25 | Exhaust stem spring |
| 11 | Exhaust cover | 26 | Exhaust stem |
| 12 | Chamber | 27 | Pressure regulator assembly |
| 13 | Check valve | 28 | Valve seat |
| 14 | Case cover | 29 | Plate |
| 15 | Set spring | 30 | Heater (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 2.0-3.9 {20-40, 1.5-2.9} | D | 6.9-7.8 {71-79, 5.2-5.7} |
| B | 3.9-6.9 {40-70, 2.9-5.0} | E | 17.7-27.5 {180-280, 13-20} |
| C | 4.9-5.9 {50-60, 3.7-4.3} | | |

# OVERHAUL

M06020201BEH2001




M06020200013

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the air dryer, use new O-ring, gasket and seal.

(2) Apply grease (lithium base) to each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

**2. BEFORE TIGHTEN THE BOLT WITH SPECIFIED TIGHTENING TORQUE, TAP ALL OVER THE OUTER SURFACE OF THE DESICCANT CASE WITH A PLASTIC HAMMER.**

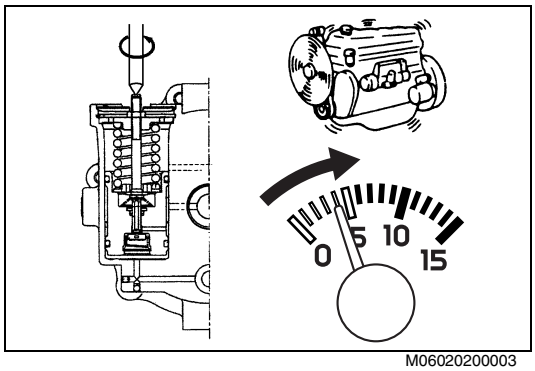
- **C: Bolt**

## IMPORTANT POINTS - MOUNTING

**1. INSPECTION**

(1) Operate the engine and raise the air pressure until the air discharge from the purge valve, then stop the engine.
(The pressure reaches the valve opening pressure of the air pressure regulator).

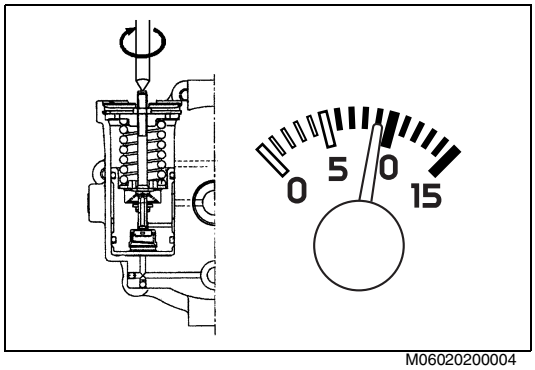
a. Check to see that there is no air leakage from the purge valve.




M06020200003

**2. ADJUSTMENT**

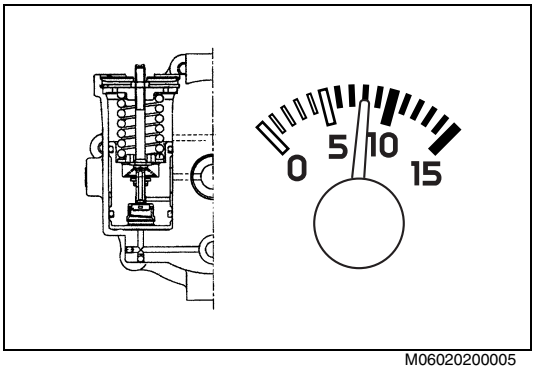
(1) Loosen the adjusting screw until the rod spring tension is released, and start and idle the engine to charge the air for the air tank.




M06020200004

(2) Tighten the adjusting screw gradually till the air pressure gauge indicate valve opening pressure shown below and the air starts to discharge from purge valve.
**Governor valve opening pressure: 880kpa {9.0 kgf/cm$^2$, 128 lbf/in$^2$.}**

(3) Tighten the adjusting screw lock nut.

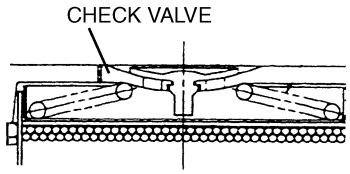
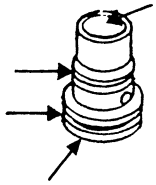
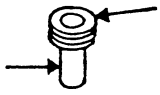
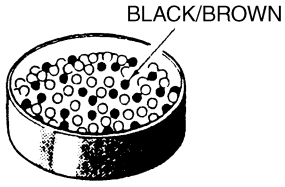


M06020200005

(4) Watch the air pressure gauge needle and see that it stops at the valve closing pressure shown below.
**Governor valve closing pressure: 780 kpa {8.0 kgf/cm$^2$, 114 lbf/in$^2$.}**

# INSPECTION AND REPAIR

M06020201BEH3004

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Check valve and valve seat surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**   |
| **Valve body sliding surface and purge valve seat surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**  |
| **Piston sliding surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**  |
| **Purge valve seat surface: Wear and damage** | **—** | **—** | **Replace, If necessary.** | **Visual check**  |
| **Desiccant: Contamination and deterioration** | **—** | **Discolored, more than 1/5 of the quantity.** | **Replace.** | **Visual check**   |

# AIR DRYER (MODELS: FG, GH [WITH ABS])

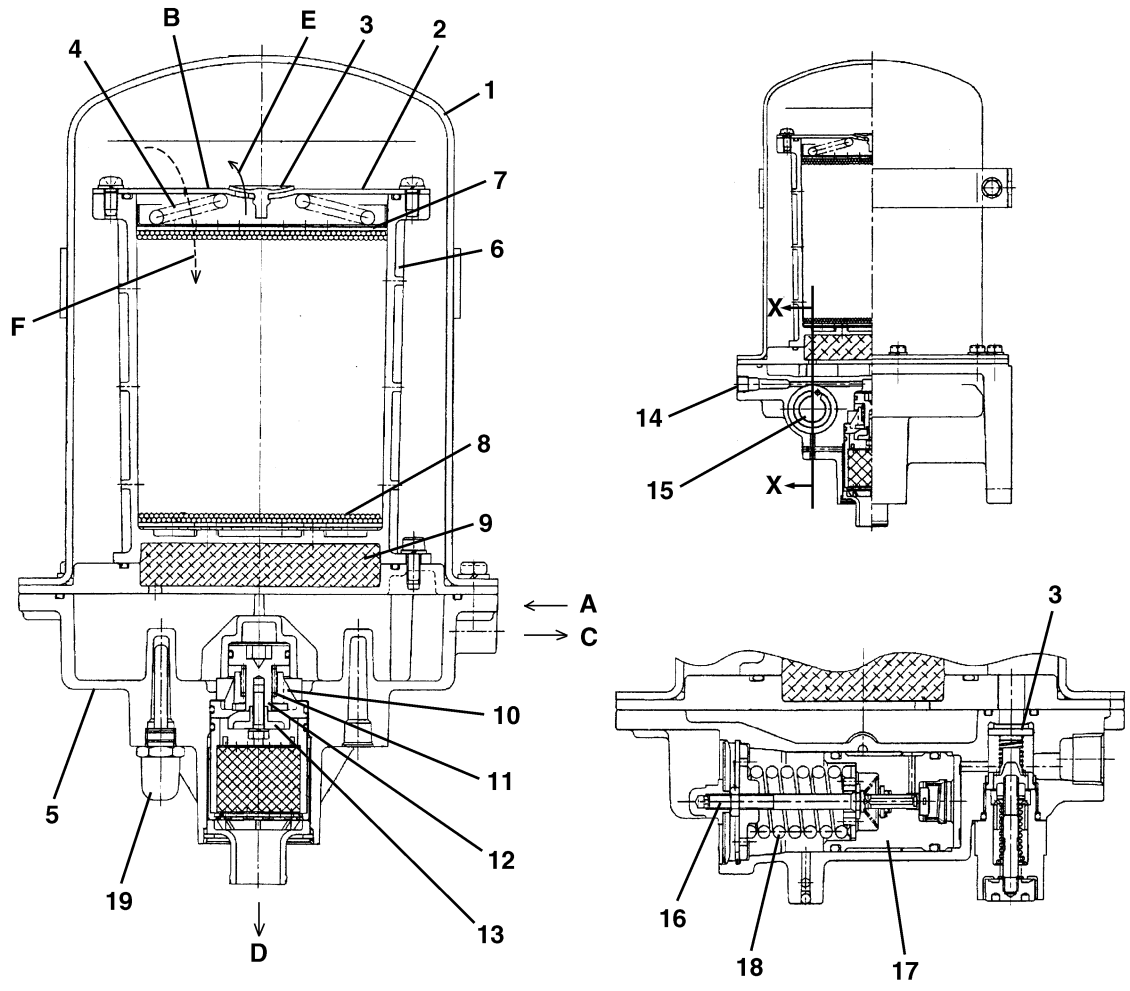
## DATA AND SPECIFICATIONS

M06020201BEI2003

| | |
|---|---|
| **Type** | **Purge tank, desiccant, auto-purge valve.** |
| **Air and Water discharging time (Reclamation cycle)** | **Approx. 50 sec.** |

# DESCRIPTION

M06020201BEC1006

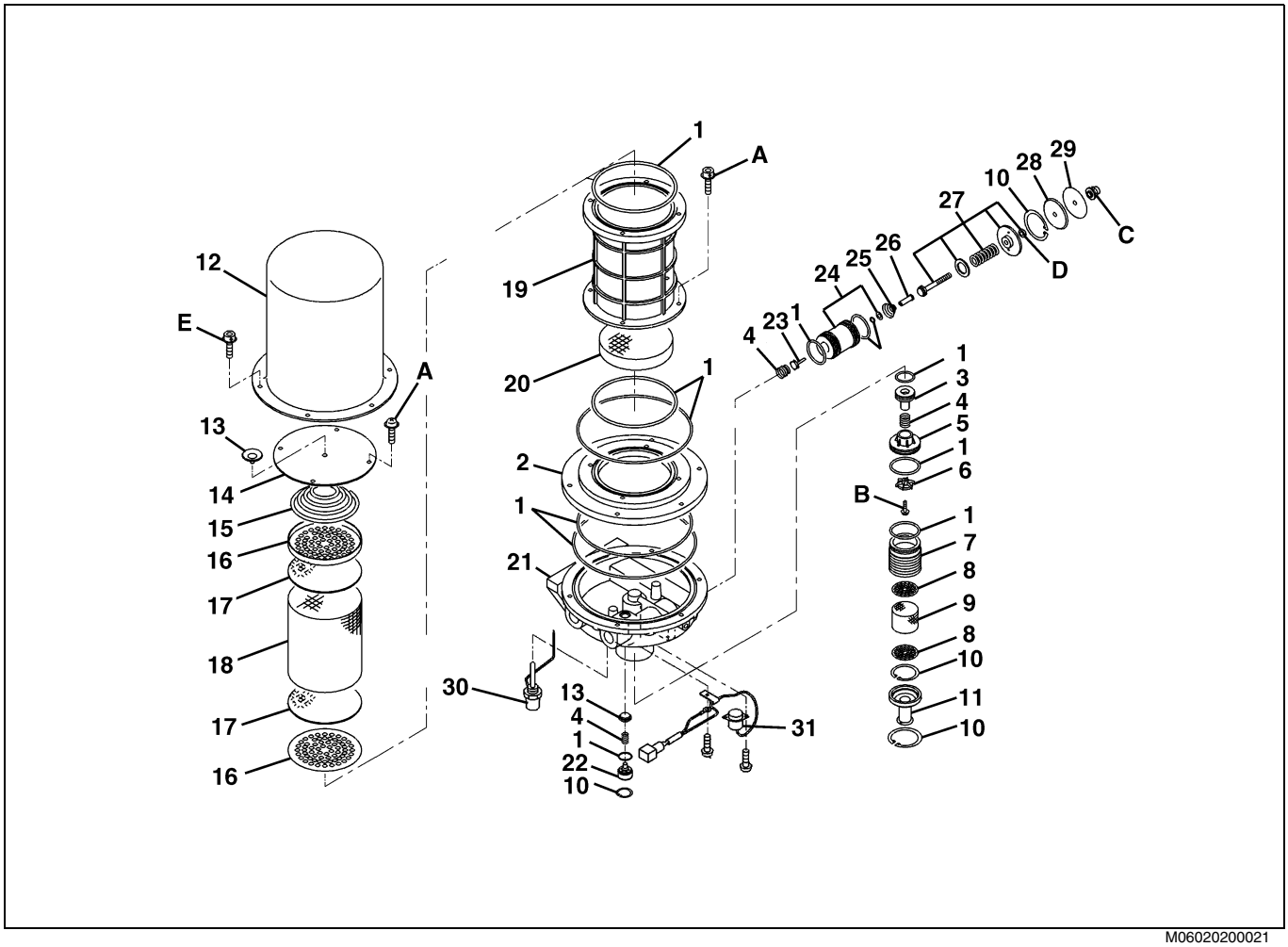



M06020200020

| | | | |
|---|---|---|---|
| 1 | Chamber (Purge tank) | 14 | Plug |
| 2 | Case cover | 15 | Pressure regulator |
| 3 | Check valve | 16 | Adjusting screw |
| 4 | Spring | 17 | Piston |
| 5 | Body | 18 | Piston spring |
| 6 | Desiccant case | 19 | Heater (If so equipped) |
| 7 | Filter | A | Inlet (From air compressor) |
| 8 | Desiccant | B | Orifice |
| 9 | Oil separator filter | C | Outlet (Dried air to air tank) |
| 10 | Valve body | D | Purged air |
| 11 | Valve spring | E | Dehumidification |
| 12 | Piston | F | Reclamation |
| 13 | Purge valve | | |

# COMPONENT LOCATOR

M06020201BED1006




M06020200021

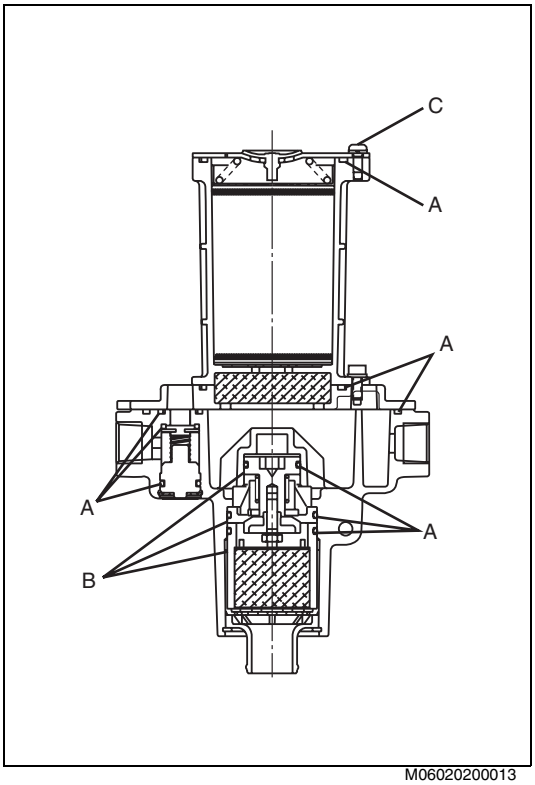
| | | | |
|---|---|---|---|
| 1 | O-ring | 17 | Filter |
| 2 | Cover | 18 | Desiccant |
| 3 | Piston | 19 | Desiccant case |
| 4 | Valve spring | 20 | Oil separator filter |
| 5 | Valve body | 21 | Body |
| 6 | Purge valve | 22 | Valve stopper |
| 7 | Silencer case | 23 | Governor valve |
| 8 | Silencer plate | 24 | Piston assembly |
| 9 | Silencer | 25 | Exhaust stem spring |
| 10 | Retainer ring | 26 | Exhaust stem |
| 11 | Exhaust cover | 27 | Pressure regulator assembly |
| 12 | Chamber | 28 | Valve seat |
| 13 | Check valve | 29 | Plate |
| 14 | Case cover | 30 | Heater |
| 15 | Set spring | 31 | Thermostat |
| 16 | Filter plate | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 3.9-6.9 {40-70, 2.9-5.0} | D | 6.9-7.8 {71-79, 5.2-5.7} |
| B | 3.9-6.9 {40-70, 2.9-5.0} | E | 17.7-27.5 {180-280, 13-20} |
| C | 4.9-5.9 {50-60, 3.7-4.3} | | |

# OVERHAUL

M06020201BEH2002



M06020200013

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the air dryer, use new O-ring, gasket and seal.

(2) Apply grease (lithium base) to each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

**2. BEFORE TIGHTEN THE BOLT WITH SPECIFIED TIGHTENING TORQUE, TAP ALL OVER THE OUTER SURFACE OF THE DESICCANT CASE WITH A PLASTIC HAMMER.**

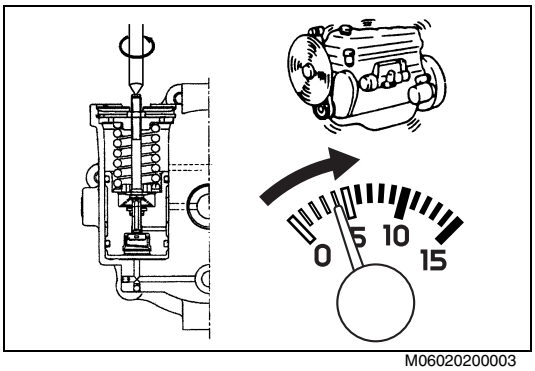
- **C: Bolt**

## IMPORTANT POINTS - MOUNTING

**1. INSPECTION**

(1) Operate the engine and raise the air pressure until the air discharge from the purge valve, then stop the engine.
(The pressure reaches the valve opening pressure of the air pressure regulator).

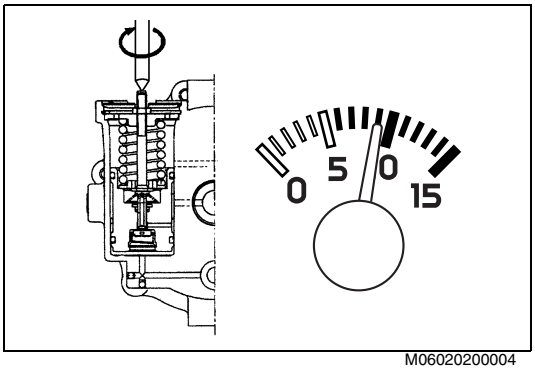
a. Check to see that there is no air leakage from the purge valve.



M06020200003

**2. ADJUSTMENT**

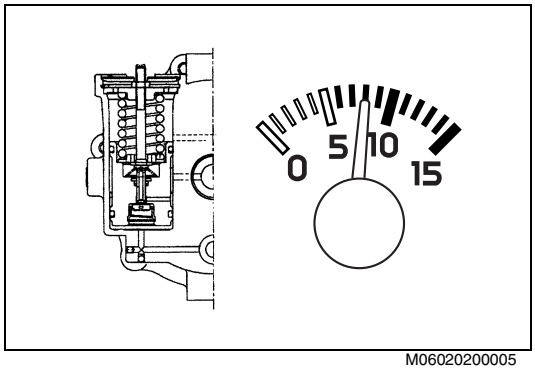
(1) Loosen the adjusting screw until the rod spring tension is released, and start and idle the engine to charge the air for the air tank.



M06020200004

(2) Tighten the adjusting screw gradually till the air pressure gauge indicate valve opening pressure shown below and the air starts to discharge from purge valve.
**Governor valve opening pressure: 880kpa {9.0 kgf/cm$^2$, 128 lbf/in$^2$.}**

(3) Tighten the adjusting screw lock nut.

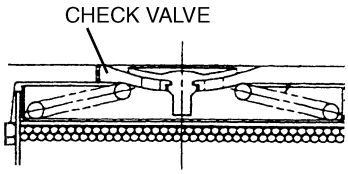
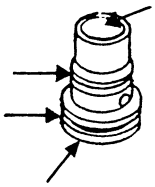
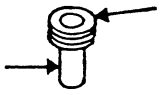
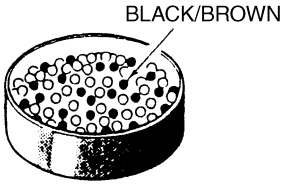


M06020200005

(4) Watch the air pressure gauge needle and see that it stops at the valve closing pressure shown below.
**Governor valve closing pressure: 780 kpa {8.0 kgf/cm$^2$, 114 lbf/in$^2$.}**

# INSPECTION AND REPAIR

M06020201BEH3002

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Check valve and valve seat surface: Wear and damage** | **—** | **—** | **Replace.** | **Visual check**   |
| **Valve body sliding surface and purge valve seat surface: Wear and damage** | **—** | **—** | **Replace.** | **Visual check**  |
| **Piston sliding surface: Wear and damage** | **—** | **—** | **Replace.** | **Visual check**  |
| **Purge valve seat surface: Wear and damage** | **—** | **—** | **Replace.** | **Visual check**  |
| **Desiccant: Contamination and deterioration** | **—** | **Discolored, more than 1/5 of the quantity.** | **Replace.** | **Visual check**   |

# AIR DRYER (MODELS: FL, FM)

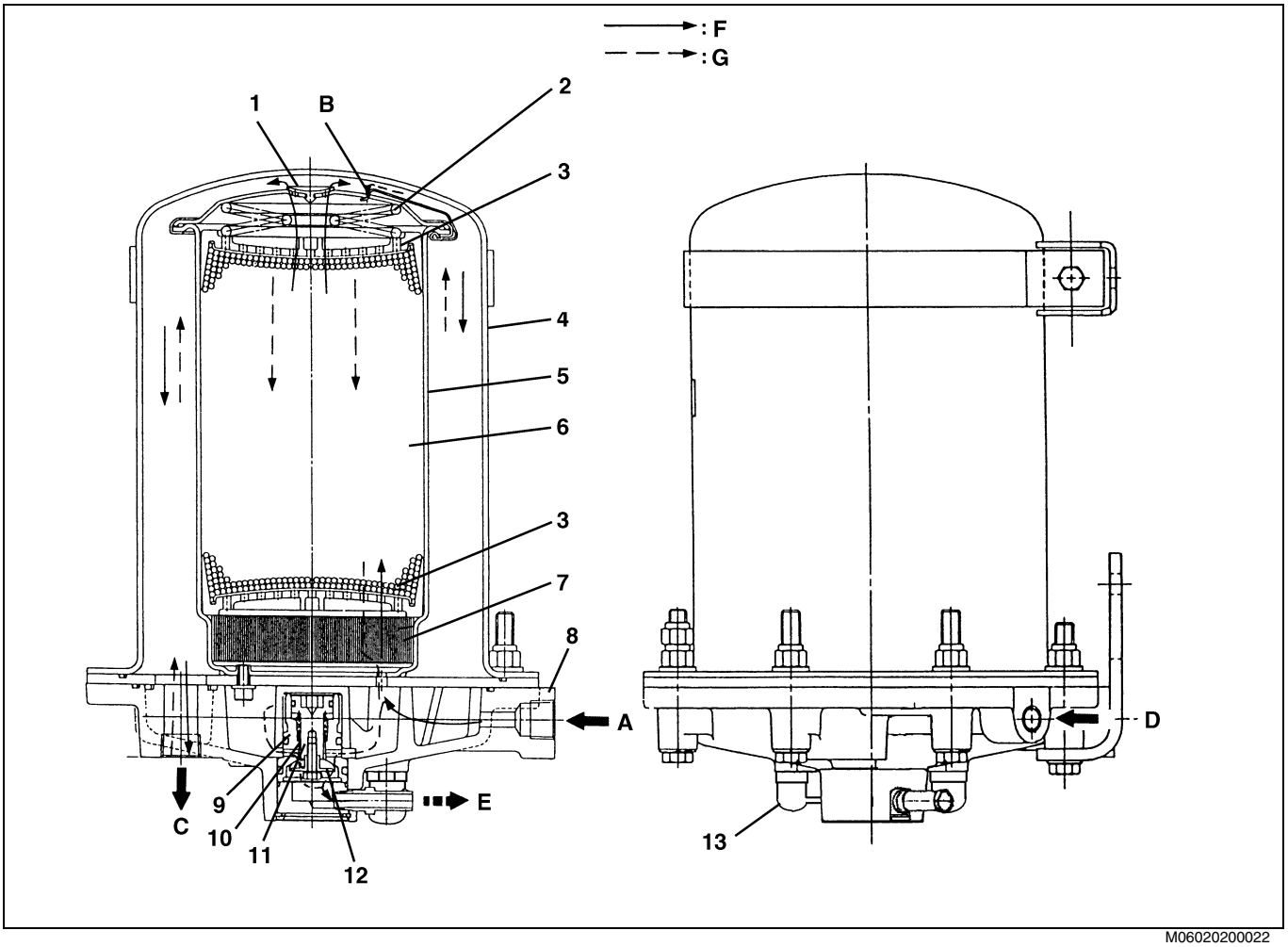
## DATA AND SPECIFICATIONS

M06020201BEI2004

| | |
|---|---|
| Type | Purge tank, desiccant, auto-drain valve. |
| Air and Water discharging time (Reclamation cycle) | Approx. 60 sec. |

## DESCRIPTION

M06020201BEC1004

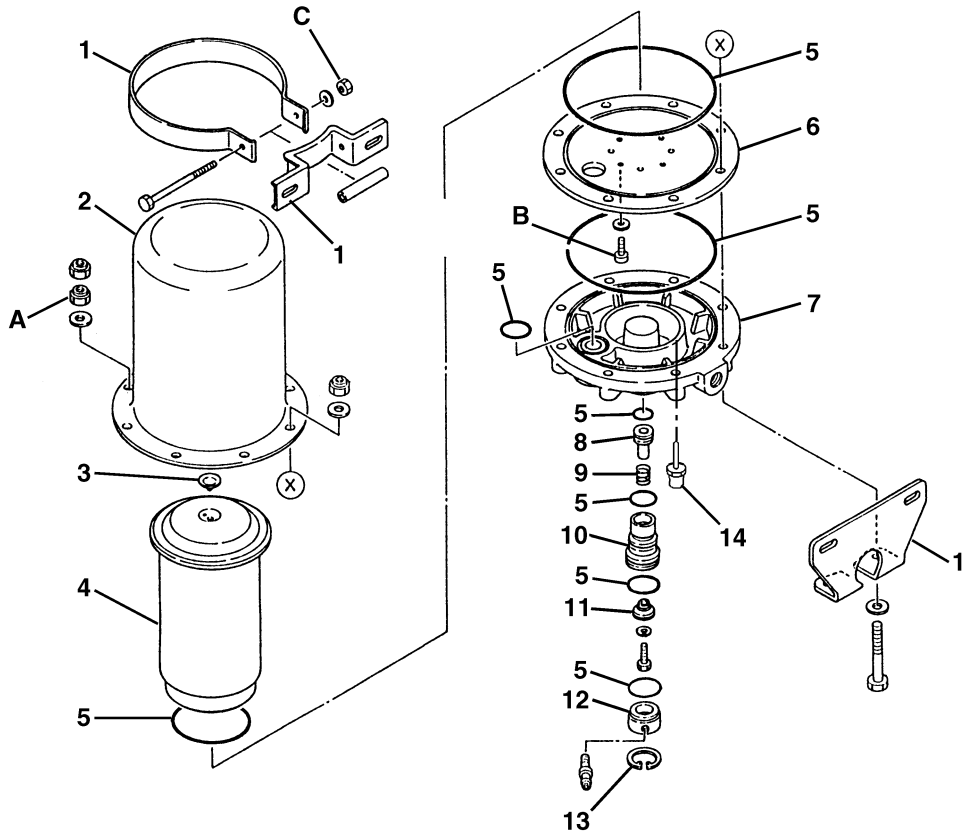



M06020200022

| | | | |
|---|---|---|---|
| 1 | Check valve | 11 | Piston |
| 2 | Spring | 12 | Purge valve |
| 3 | Filter | 13 | Heater (If so equipped) |
| 4 | Chamber (Purge tank) | A | Inlet (from air compressor) |
| 5 | Desiccant case | B | Orifice |
| 6 | Desiccant | C | Outlet (dried air to air tank) |
| 7 | Oil Filter | D | Inlet (from pressure regulator) |
| 8 | Body | E | Purged air |
| 9 | Valve body | F | Dehumidification |
| 10 | Valve spring | G | Reclamation |

# COMPONENT LOCATOR

M06020201BED1007




M06020200023

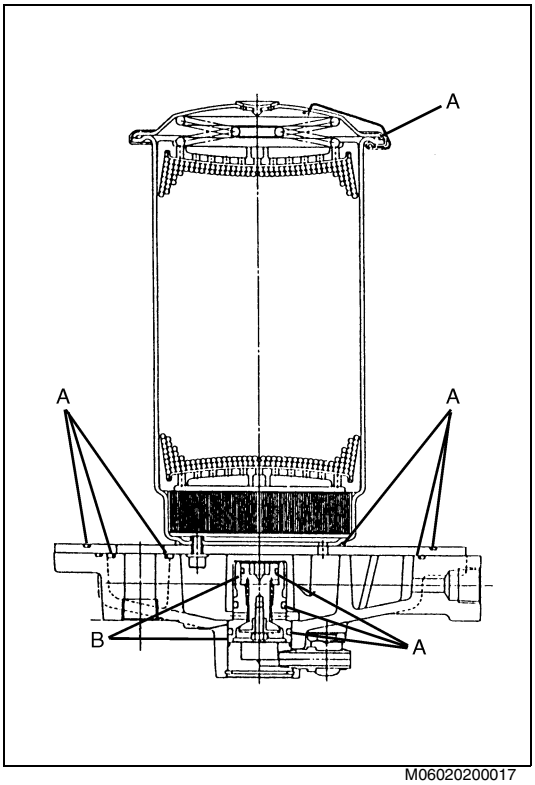
| | | | |
|---|---|---|---|
| 1 | Bracket | 8 | Piston |
| 2 | Chamber (purge tank) | 9 | Valve spring |
| 3 | Check valve | 10 | Valve body |
| 4 | Desiccant case | 11 | Purge valve |
| 5 | O-ring | 12 | Exhaust body |
| 6 | Plate | 13 | Retainer ring |
| 7 | Body | 14 | Heater (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 14.7-22.6 {150-230, 10.9-16.6} | C | 6.9-8.8{70-90, 5.1-6.5} |
| B | 3.9-6.9{40-70, 2.9-5.0} | | |

# OVERHAUL

M06020201H2003



M06020200017

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the air dryer, use new O-ring.

(2) Apply grease (lithium base) to each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

**2. BEFORE CLOSING THE CHAMBER, TAP ALL OVER THE OUTER SURFACE OF THE DESICCANT CASE WITH A PLASTIC HAMMER.**

## IMPORTANT POINTS - MOUNTING

**1. INSPECTION**

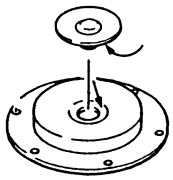
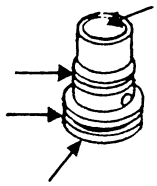
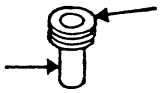
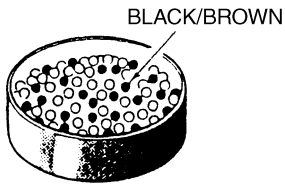
(1) Operate the engine and raise the air pressure until the air compressor stops functioning.
(The pressure reaches the valve opening pressure of the air pressure regulator).

a. Check to see that there is no air leakage from the purge valve while the compressor is functioning.

b. When the compressor stops functioning, check to see that the air is discharged from the purge valve for a period of approx. 60 seconds.

# INSPECTION AND REPAIR

M06020201BEH3003

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Check valve,<br>Valve seat surface:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Valve body,<br>Sliding surface and purge valve seat surface:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Piston,<br>Sliding surface:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Purge valve,<br>Seat surface:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Desiccant:<br>Contamination, Deterioration | — | Discolored, more than 1/5 of the quantity. | Replace. | Visual check<br>  |

# CHECK VALVE

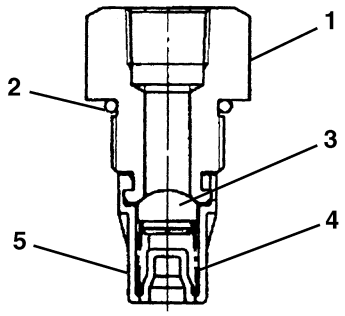
## DATA AND SPECIFICATIONS

M06020201BEI2005

| | |
|---|---|
| Type | Spring type |
| Valve opening pressure | Outlet side pressure 14.7kPa {0.15kgf/cm$^2$, 2.13lbf/in$^2$.} |

## DESCRIPTION

M06020301BEC1002

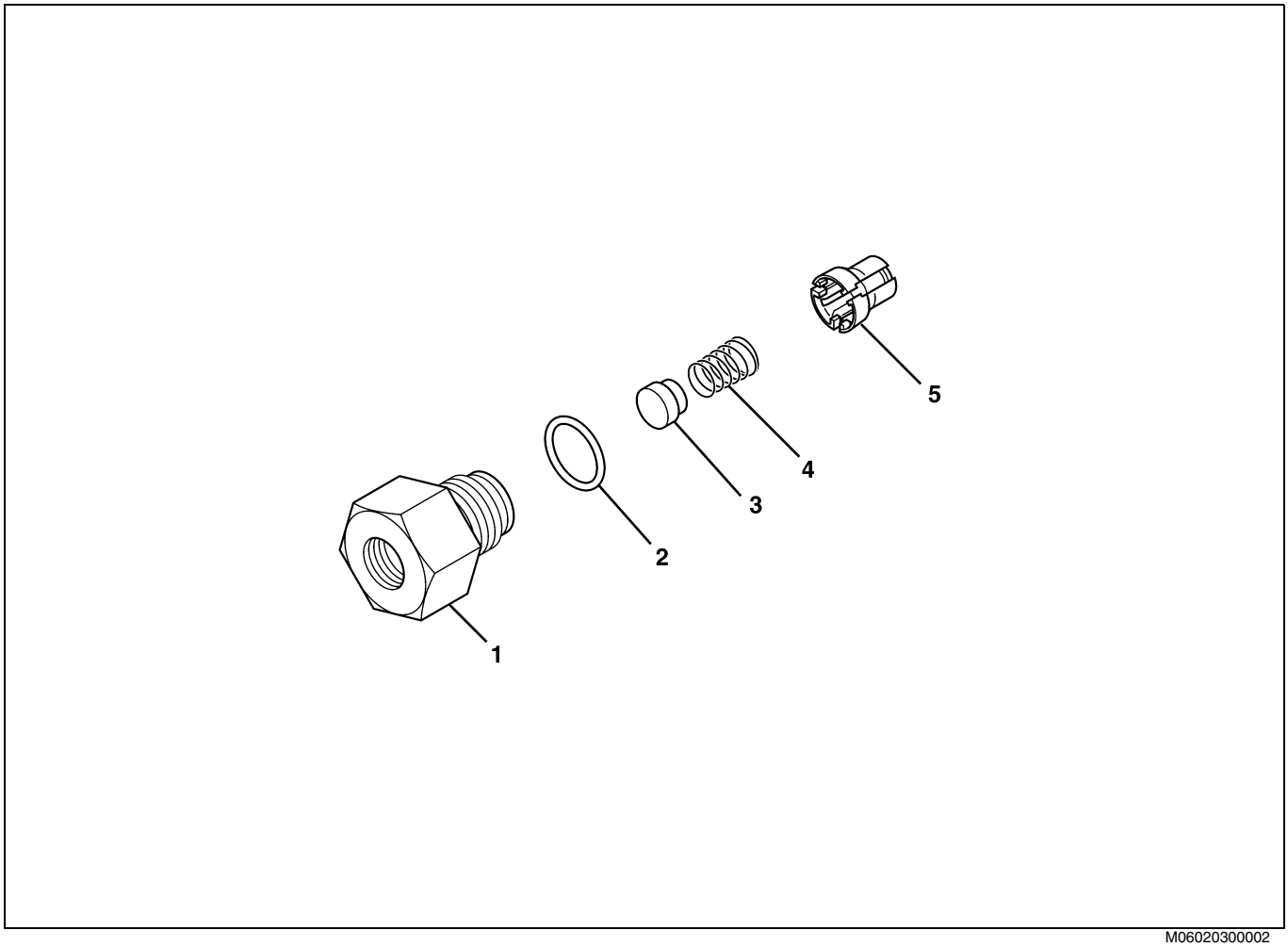



M06020300001

| | | | |
|---|---|---|---|
| 1 | Connector | 4 | Valve spring |
| 2 | O-ring | 5 | Valve holder |
| 3 | Valve | | |

# COMPONENT LOCATOR

M06020301BED1002



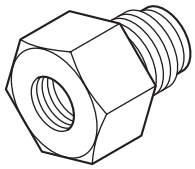
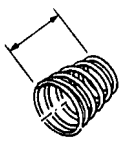

M06020300002

| | | | |
|---|---|---|---|
| 1 | Connector | 4 | Valve spring |
| 2 | O-ring | 5 | Valve holder |
| 3 | Valve | | |

# INSPECTION AND REPAIR

M06020301BEH3002

Unit: mm {in.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Connector:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Valve:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Valve spring:<br>Rust, damage and free length | 19.8 {0.78} | 18 {0.71} | Replace, if necessary. | Measure and visual check<br>  |

# SAFETY VALVE

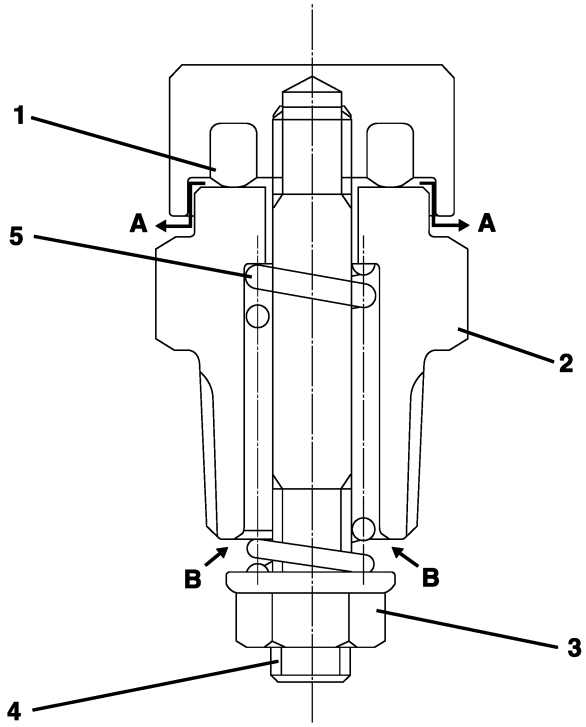
## DATA AND SPECIFICATIONS

M06020501BEI2002

| | |
|---|---|
| Type | Spring type |
| Valve opening pressure | 931.4-970.6 kPa {9.5-9.9 kgf/cm$^2$, 135.2-140.8 lbf/in$^2$.} |

## DESCRIPTION

M06020501BEC1002




M06020500001

| | | | |
|---|---|---|---|
| 1 | Valve | 5 | Compression spring |
| 2 | Body | A | Exhaust |
| 3 | Nut | B | From air tank (Pressure air) |
| 4 | Bolt | | |

## INSPECTION AND REPAIR

M06020501BEH3002

Unit: kPa {kgf/cm$^2$, lbf/in$^2$.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Valve opening pressure | 931.4-970.6 {9.5-9.9, 135.2-140.8} | — | Replace, if necessary. | Measure |

# BRAKE VALVE

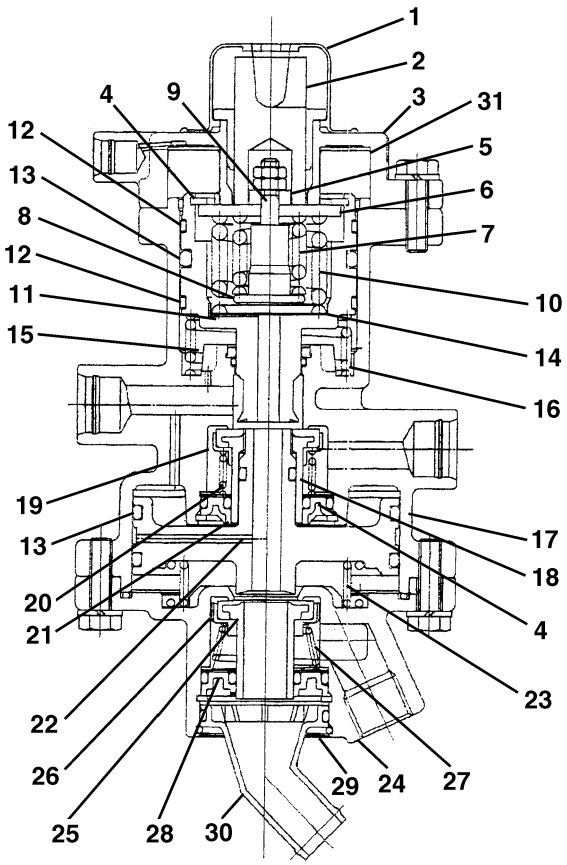
## DATA AND SPECIFICATIONS

M06020601BEI2003

| | |
|---|---|
| Type | Dual pistons and valves with a plunger type pedal |

## DESCRIPTION

M06020601BEC1004

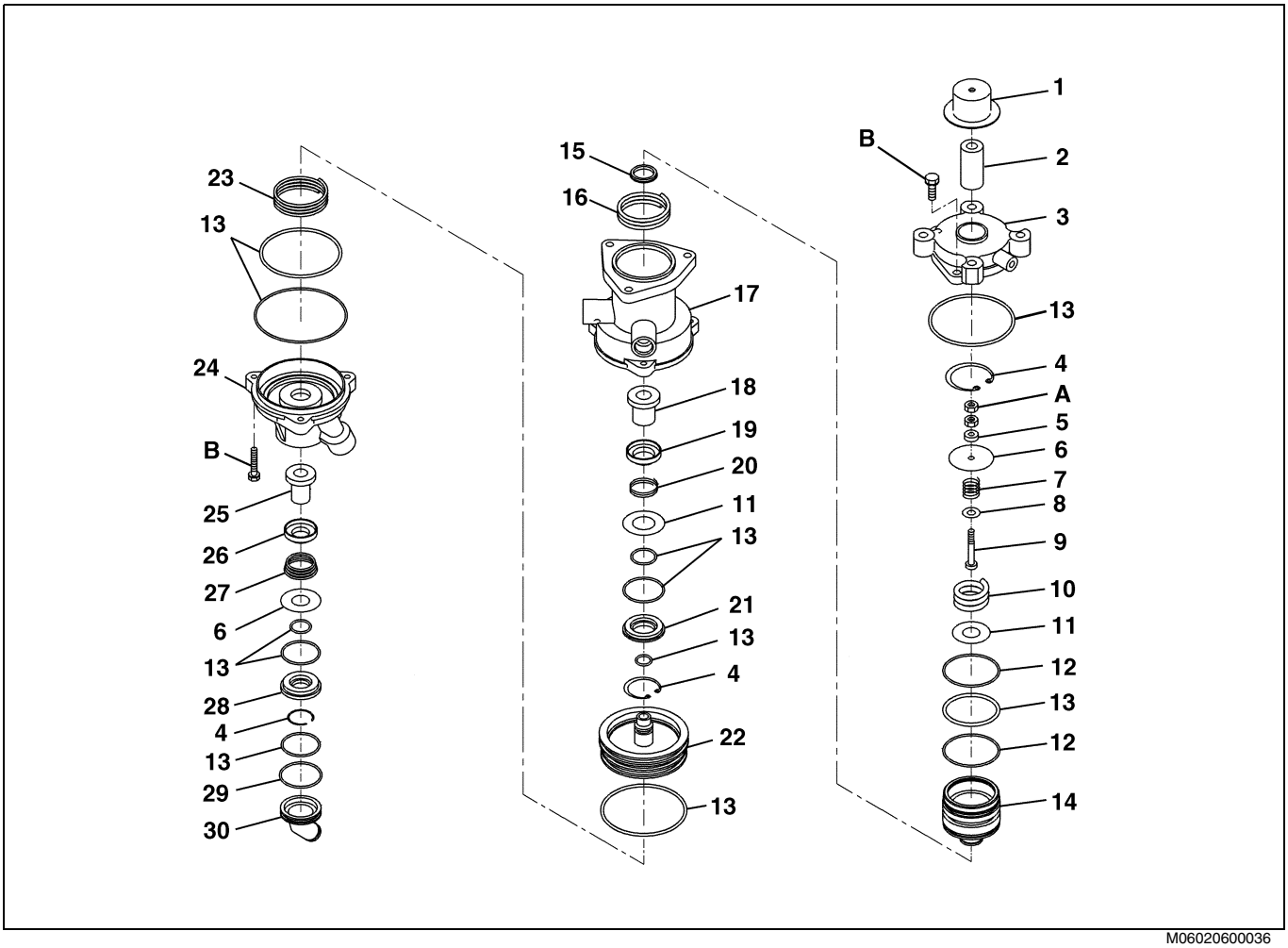



M06020600035

| | | | |
|---|---|---|---|
| 1 | Boot | 16 | Primary piston return spring |
| 2 | Plunger | 17 | Primary valve body |
| 3 | Brake valve cover | 18 | Primary feed valve |
| 4 | Retainer ring | 19 | Retainer |
| 5 | Guide ring | 20 | Primary feed valve return spring |
| 6 | Spring seat | 21 | Primary feed valve retainer |
| 7 | Sub spring | 22 | Secondary piston |
| 8 | Shim | 23 | Secondary piston return spring |
| 9 | Stem | 24 | Secondary valve body |
| 10 | Main spring | 25 | Secondary feed valve |
| 11 | Shim | 26 | Retainer |
| 12 | Guide ring | 27 | Secondary feed valve return spring |
| 13 | O-ring | 28 | Secondary feed valve retainer |
| 14 | Primary piston | 29 | C-ring |
| 15 | Guide | 30 | Exhaust port |

# COMPONENT LOCATOR

M06020601BED1003




M06020600036

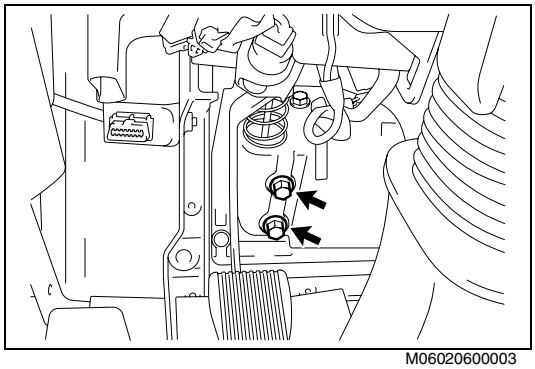
| | | | |
|---|---|---|---|
| 1 | Boot | 16 | Primary piston return spring |
| 2 | Plunger | 17 | Primary valve body |
| 3 | Brake valve cover | 18 | Primary feed valve |
| 4 | Retainer ring | 19 | Retainer |
| 5 | Guide ring | 20 | Primary feed valve return spring |
| 6 | Spring seat | 21 | Primary feed valve retainer |
| 7 | Sub spring | 22 | Secondary piston |
| 8 | Shim | 23 | Secondary piston return spring |
| 9 | Stem | 24 | Secondary valve body |
| 10 | Main spring | 25 | Secondary feed valve |
| 11 | Shim | 26 | Retainer |
| 12 | Guide ring | 27 | Secondary feed valve return spring |
| 13 | O-ring | 28 | Secondary feed valve retainer |
| 14 | Primary piston | 29 | C-ring |
| 15 | Guide | 30 | Exhaust port |

**Tightening torque** **N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 2.9-4.9 {30-50, 2.2-3.6} | B | 5.9-7.4 {60-75, 4.3-5.4} |

# OVERHAUL

M06020601BEH2005


M06020600003

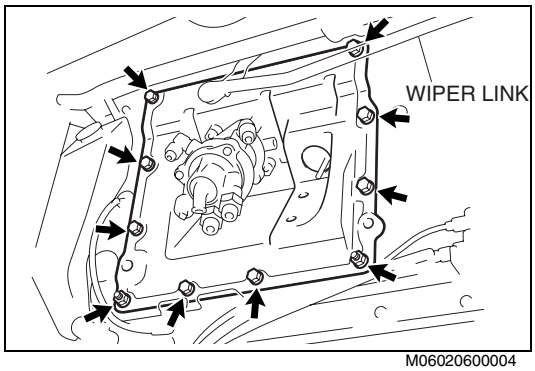
## IMPORTANT POINTS - DISMOUNTING

**1. REMOVE THE CLUTCH MASTER CYLINDER.**

**HINT:**

**Even if without removing the clutch master cylinder, pedal bracket can be removed only to the length of the clutch hose.**

**2. DISCONNECT THE NYLON TUBE.**



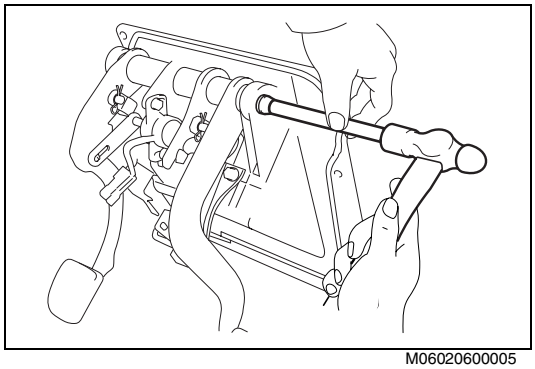
M06020600004

**3. REMOVE THE PEDAL BRACKET ASSEMBLY.**

(1) Loosen the bolt and nut to remove the pedal bracket assembly.

**NOTICE:**

**Before removing the pedal bracket, put the wiper link upward.**

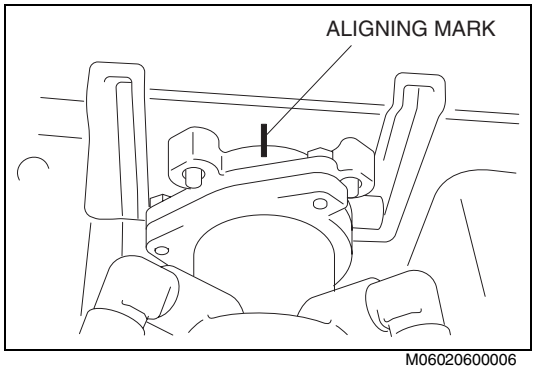

M06020600005

**4. REMOVE THE BRAKE PEDAL.**

(1) Tap the shaft lightly using a brass rod and a hammer, remove the brake pedal from the pedal bracket assembly.

**NOTICE:**

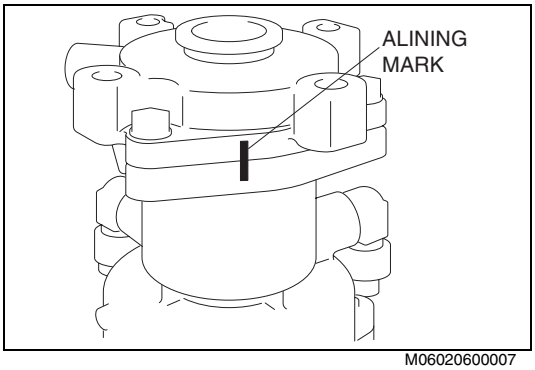
**Do not pull out the shaft because the brake pedal and the clutch pedal are installed by one shaft.**



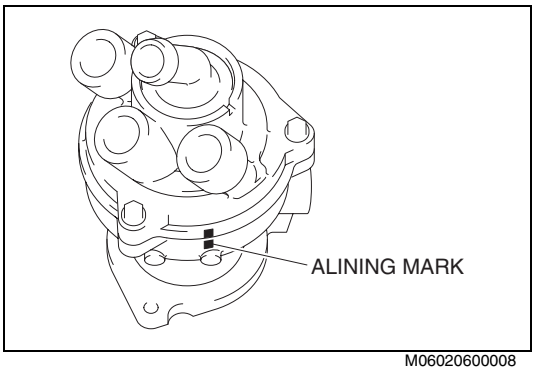
M06020600006

**5. REMOVE THE BRAKE VALVE ASSEMBLY.**

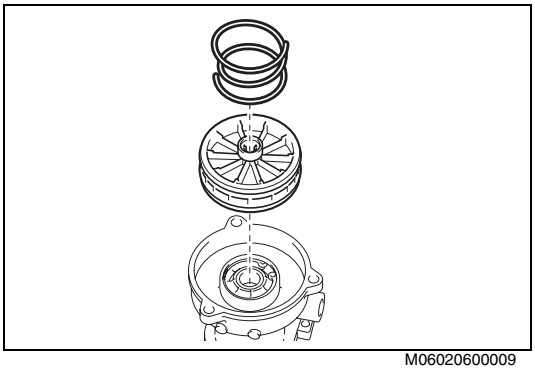
(1) Apply alighning marks on the brake valve assembly and pedal bracket assembly.



M06020600007



M06020600008


M06020600009

## IMPORTANT POINTS - DISASSEMBLY

**NOTICE:**
**Before disassembling the brake valve, apply aligning marks on the brake valve cover, primary valve body and secondary valve body.**

**1. REMOVE THE PRIMARY PISTON ASSEMBLY.**

**2. REMOVE THE SECONDARY VALVE BODY.**

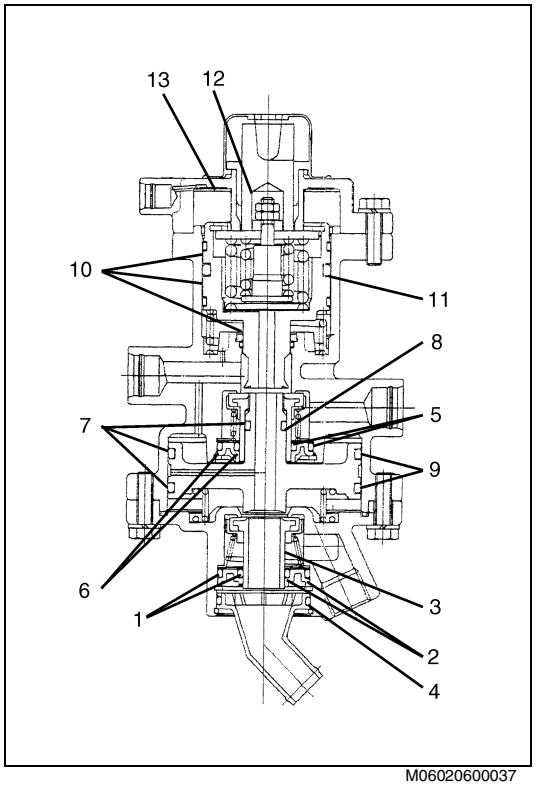
**3. REMOVE THE SECONDARY PISTON.**

**NOTICE:**
**Pull out with hands to prevent the seat part of the secondary piston from being damaged by using a pryer etc. If not with hands, secondary piston should not be reused.**

**4. REMOVE THE PRIMARY FEED VALVE.**

**5. REMOVE THE EXHAUST PORT.**

**6. REMOVE THE SECONDARY FEED VALVE.**



M06020600037

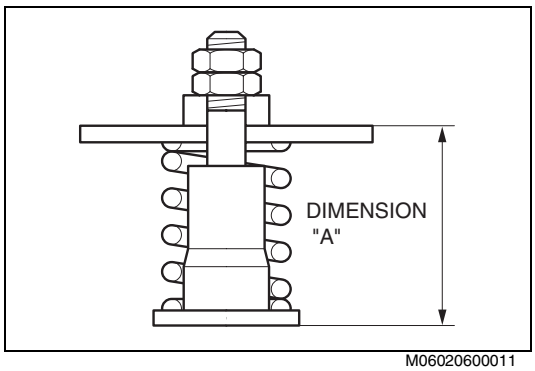
## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When reassembling the brake valve, replace the O-rings and retainer rings with new ones.

(2) Apply adequate amount of silicone grease on the grooves for the O-ring and to the sliding surfaces of the component parts.

1. Secondary feed valve retainer O-ring
2. Secondary feed valve retainer
3. Secondary feed valve
4. Exhaust port O-ring
5. Primary feed valve retainer O-ring
6. Primary feed valve retainer
7. Secondary piston O-ring
8. Secondary piston
9. Primary valve body
10. Primary piston
11. Primary piston O-ring
12. Plunger
13. Piston



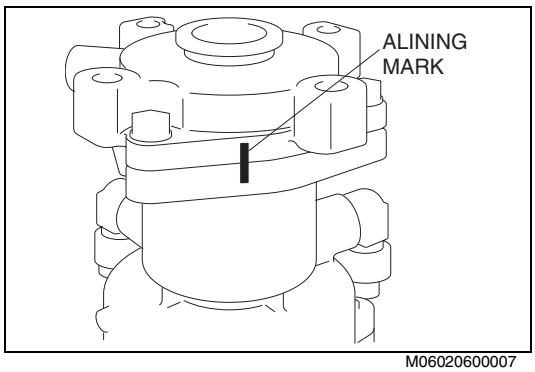
M06020600011

**2. ASSEMBLE THE STEM, SPRING, SPRING SEAT AND SHIM.**

(1) Assemble the sub spring. At this time, adjust dimension "A" and the spring compression "P" by means of the lock nut and the shim.

**NOTICE:**
**In adjusting the spring compression, the axial play of the spring must be removed.**

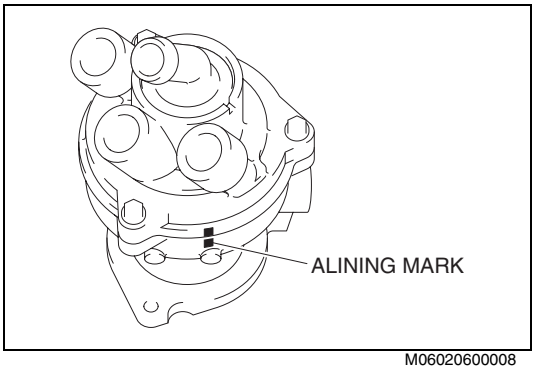
**Dimension "A": 27.15-27.55 mm {1.0689-1.0846 in.}**
**Setting load: 0-9.8 N {0-1 kgf, 0-2.2 lbf}**



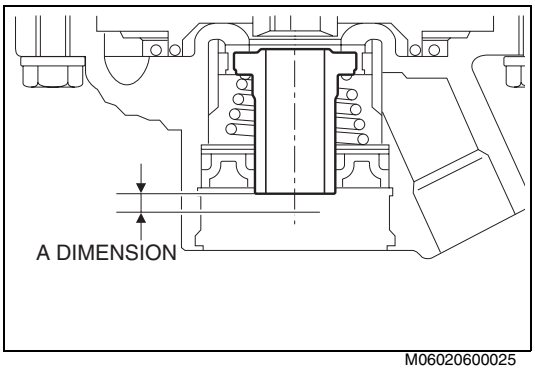
M06020600007

**3. ALIGN THE VALVE COVER AND VALVE BODIES.**

(1) When assemble the brake valve cover, primary body and secondary body, align the marks which were applied at disassembly.



M06020600008



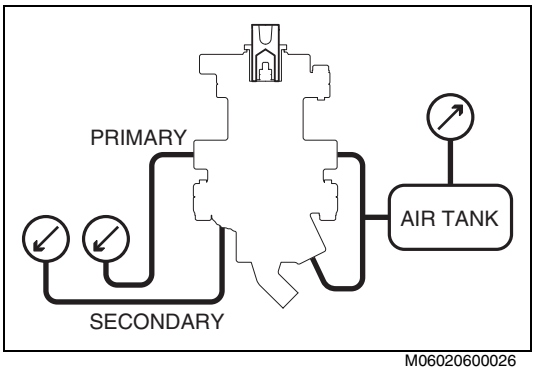
M06020600025

**4. INSPECTION AND ADJUSTMENT**

(1) Brake valve

a. Measure the secondary feed valve stroke (dimension A from starting to release the plunger to completing to fully release the plunger).

**A dimension: 0.6 mm {0.0236 in.} or above**

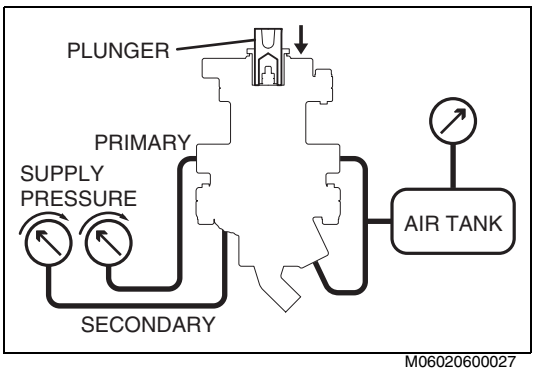


M06020600026

b. Connect the brake valve, nylon tube, air pressure gauge, and air tank as shown in the figure.

c. Set the air tank pressure at 830 kPa {8.5 kgf/cm$^2$, 120.87 lbf/in$^2$}.

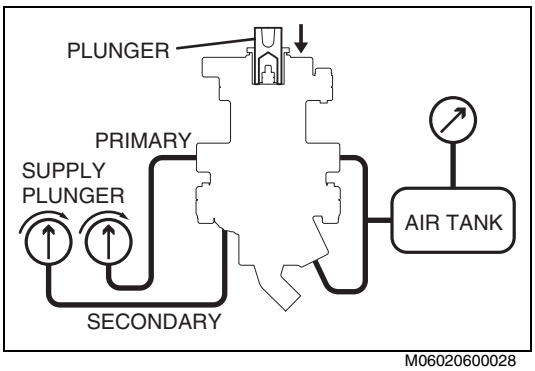
d. Apply soap water to the exhaust port and check to see there is no air leakage.



M06020600027

e. Drive in slowly the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary air pressure gauges start to rise. If the measurements do not match with the standard values, adjust by the shim of the main spring.

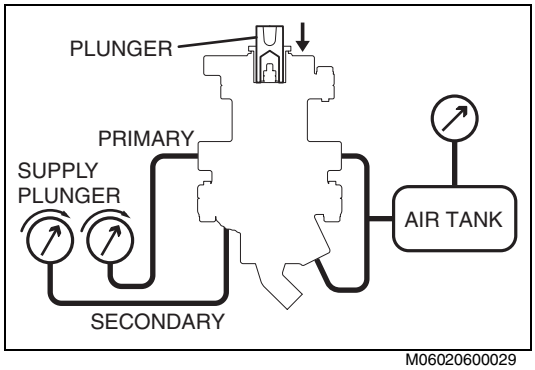
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 1.6-2.4 mm {0.0630-0.0944 in.} |
| Supply pressure | 5-25 kPa {0.05-0.25 kgf/cm$^2$, 0.72-3.55 lbf/in$^2$} |



M06020600028

f. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point immediately before that the primary and secondary pressure increases rapidly (bending point). If the measurements do not match with the standard values, replace each spring.

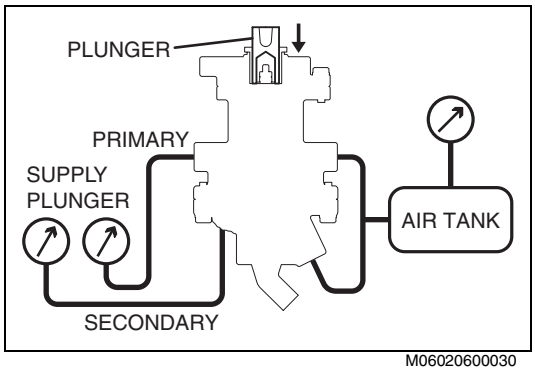
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 4.85-5.95 mm {0.1910-0.2342 in.} |
| Supply pressure | 198 kPa {2.09 kgf/cm$^2$, 28.76 lbf/in$^2$} |



M06020600029

g. Drive in further the plunger. Measure the plunger stroke and supply pressure at the point where the primary and secondary pressures increase rapidly. If the measurements do not match with the standard values, replace each spring.

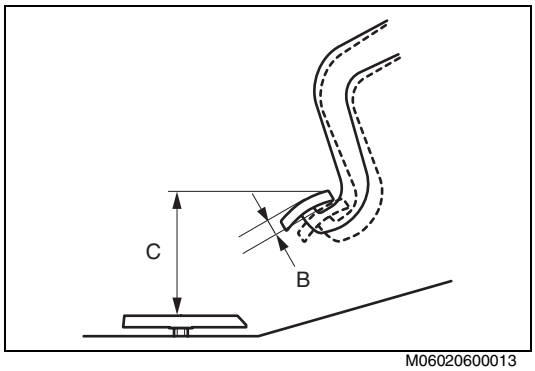
| Measurement item | Standard value |
|---|---|
| Plunger stroke | 7.19-8.51 mm {0.2831-0.3350 in.} |
| Supply pressure | 616 kPa {6.28 kgf/cm$^2$, 89.39 lbf/in$^2$} |



M06020600030

h. Drive in further the plunger. Measure the pedal stepping down angle and supply pressure at the point where the primary and secondary pressure are maximum. If the measurements do not match with the standard values, replace each spring.

| Measurement item | Standard value |
|---|---|
| Plunger stroke | 9.79-11.21 mm {0.3855-0.4413 in.} |
| Supply pressure | 830 kPa {8.5 kgf/cm$^2$, 120.87 lbf/in$^2$} |



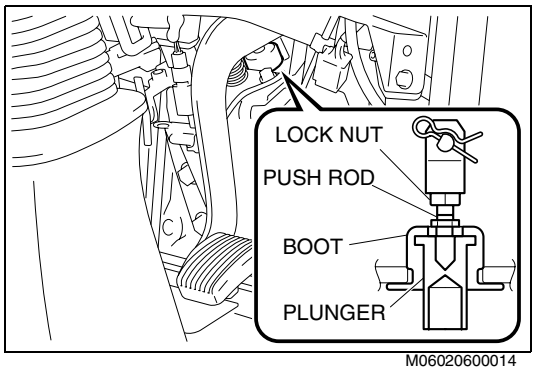
M06020600013

(2) Brake pedal

a. Make sure that the installing height of the brake pedal "C" and the pedal play "B".

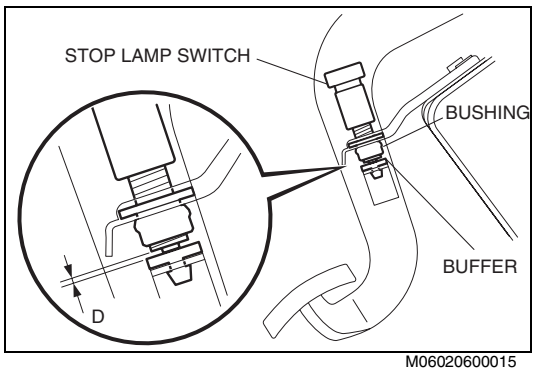
**"B": 2-5 mm {0.0788-0.1968 in.}**

**"C": 149.6-159.6 mm {5.890-6.283 in.}**



M06020600014

b. If the pedal play is out of the standard value, loosen the lock nut and turn the push rod to adjust the pedal play to the standard value.



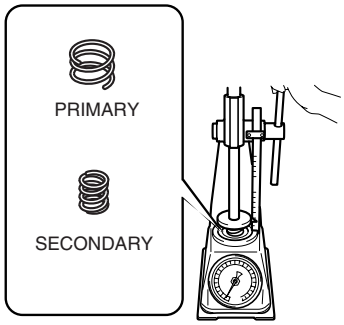
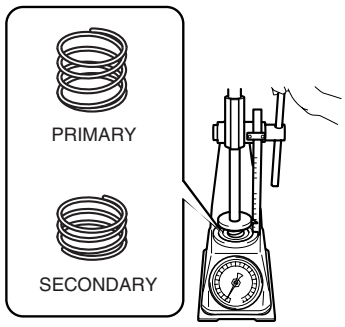
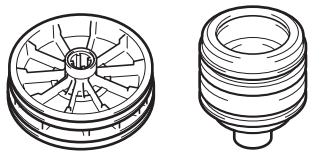
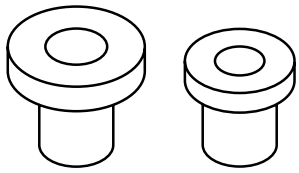
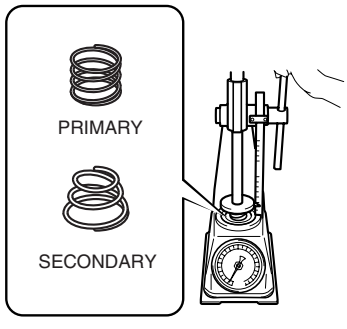
M06020600015

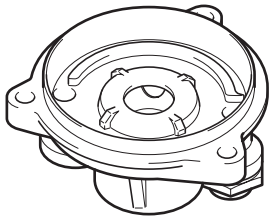
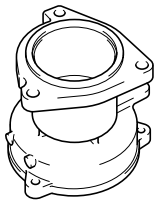
(3) Check the clearance between stop lamp switch and buffer.

**"D": 0.5-1.5 mm {0.0197-0.0590 in.}**

# INSPECTION AND REPAIR

M06020601BEH3003

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Main spring:<br>Free length/<br>setting length/<br>setting load | 29.1 mm {1.15 in.}/<br>27.6 mm {1.09 in.}/<br>147.1 N<br>{15 kgf, 33.07 lbf} | 28.6 mm<br>{1.13 in.} | Replace, if necessary. | Visual check and measure<br>  |
| Sub spring:<br>Free length/<br>setting length/<br>setting load | 21.6 mm {0.85 in.}/<br>19.4 mm {0.76 in.}/<br>457 N<br>{46.6 kgf, 102.7 lbf}<br>or more | 21 mm<br>{0.83 in.} | | |
| Primary and Secondary piston return spring:<br>Free length/<br>setting length/<br>setting load | Primary:<br>43.2 mm {1.70 in.}/<br>16.5 mm {0.65 in.}/<br>95.1 N<br>{9.7 kgf, 21.38 lbf} | 40.5 mm<br>{1.59 in.} | Replace, if necessary. | Visual check and measure<br>  |
| | Secondary:<br>24.5 mm {0.96 in.}/<br>12.0 mm {0.47 in.}/<br>11.8 N<br>{1.2 kgf, 2.6 lbf} | 23.5 mm<br>{0.93 in.} | | |
| Primary and secondary piston:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Primary and secondary feed valve:<br>Wear and damage | — | — | Replace, if necessary. | Visual check<br>  |
| Primary and secondary feed valve return spring:<br>Free length/<br>setting length/<br>setting load | Primary:<br>21.4 mm {0.84 in.}/<br>12.5 mm {0.49 in.}/<br>52.0 N<br>{5.3 kgf, 11.68 lbf} | 20.4 mm<br>{0.80 in.} | Replace, if necessary. | Visual check and measure<br>  |
| | Secondary:<br>22.8 mm {0.90 in.}/<br>13.0 mm {0.51 in.}/<br>49.0 N<br>{5.0 kgf, 11.02 lbf} | 21.8 mm<br>{1.13 in.} | | |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Secondary valve body: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Primary valve body: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# PROTECTION VALVE

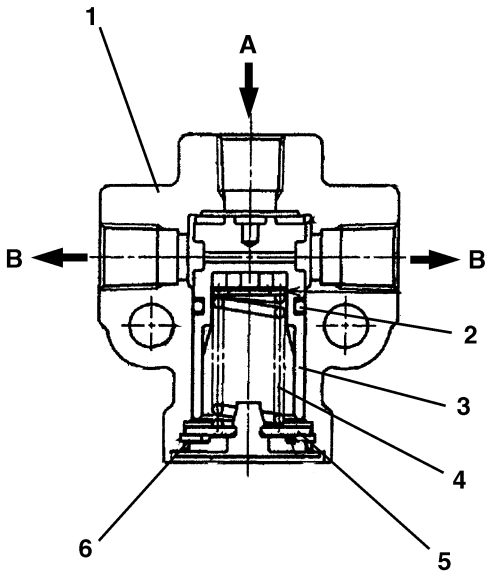
## DATA AND SPECIFICATIONS

M06020801BEI2002

| Type | | Spring type |
|---|---|---|
| Operating pressure | Open | 637 kPa {6.2 kgf/cm$^2$, 88.16 lbf/in.$^2$} |
| | Close | 510 kPa {5.2 kgf/cm$^2$, 73.94 lbf/in.$^2$} |

## DESCRIPTION

M06020801BEC1002

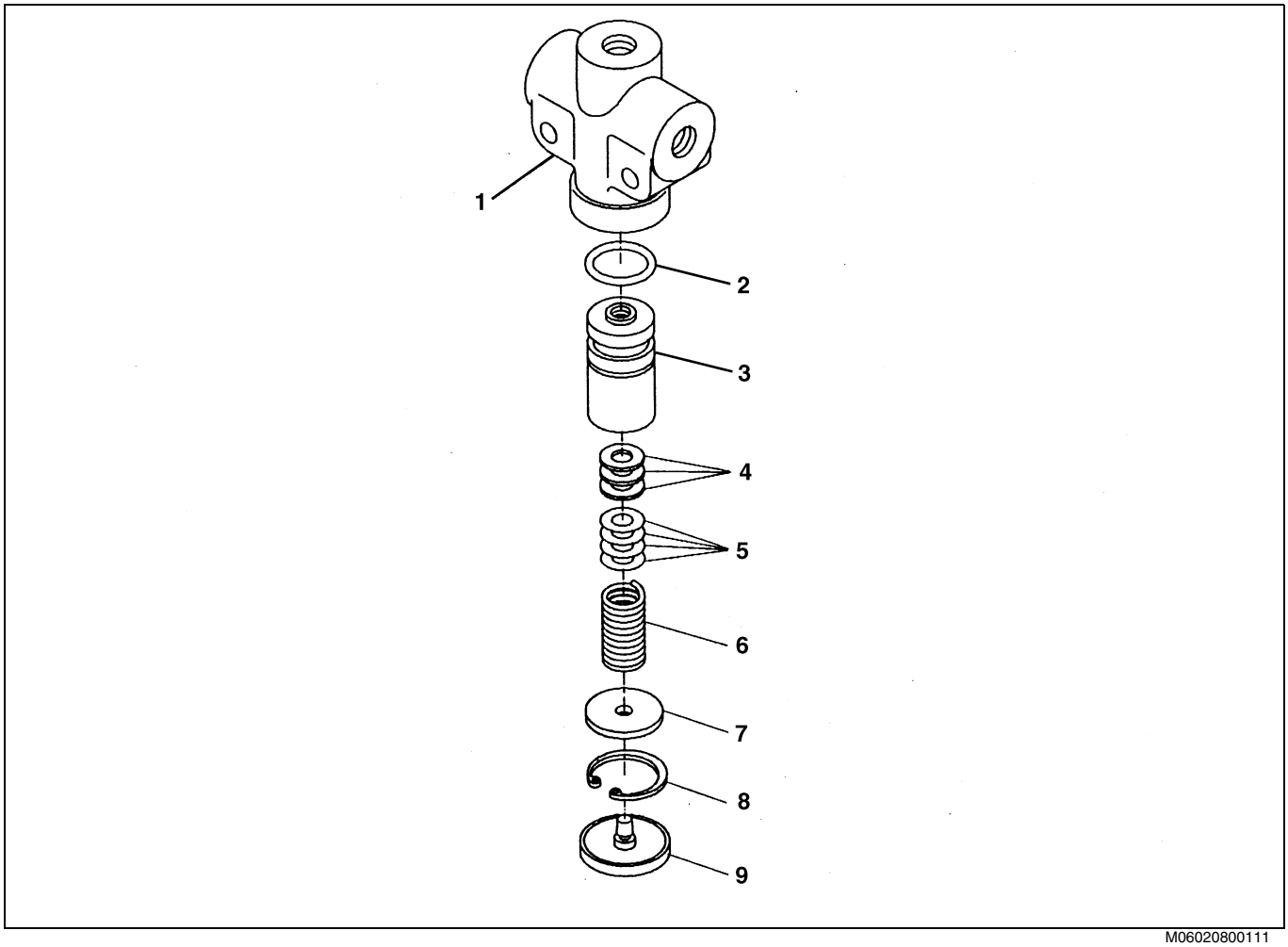



M06020800110

| | | | |
|---|---|---|---|
| 1 | Valve body | 5 | Dust seal plate |
| 2 | O-ring | 6 | Retainer ring |
| 3 | Valve | A | Inlet |
| 4 | Compression spring | B | Outlet |

# COMPONENT LOCATOR

M06020801BED1002

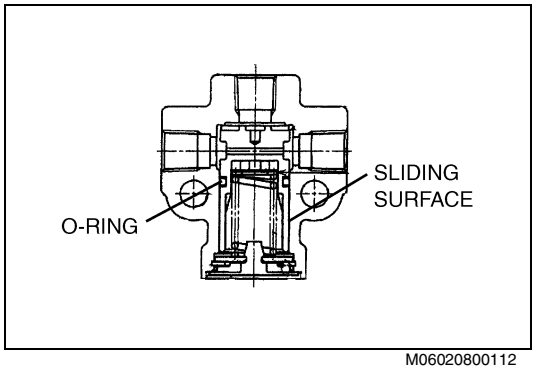



M06020800111

| | | | | | |
|---|---|---|---|---|---|
| 1 | Body | 4 | Spacer | 7 | Dust seal plate |
| 2 | O-ring | 5 | Shim | 8 | Retainer ring |
| 3 | Piston | 6 | Spring | 9 | Dust seal |

# OVERHAUL

M06020801BEH2002




M06020800112

## IMPORTANT POINT - ASSEMBLY

**1. LUBRICATION**

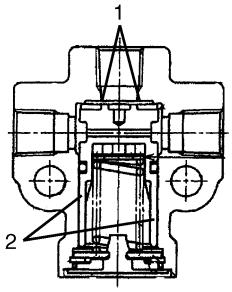
(1) When reassembling the protection valve, replace the O-rings and valve with new ones.

(2) Apply adequate amount of silicone grease to the sliding surface of the component parts.

# INSPECTION AND REPAIR

M06020801BEH3003

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Valve contact surface of Body cap 1: Rust, wear and damage** | **—** | **—** | **Clean or replace, if necessary.** | **Visual check**   |
| **Sliding surface of valve body 2: Rust, wear and damage** | **—** | **—** | **Clean or replace, if necessary.** | |
| **Valve spring: Free length** | **60.0 {2.36}** | **—** | **Replace.** | **Measure**  |

# PROTECTION VALVE (WITH 4-WAY PROTECTION VALVE)

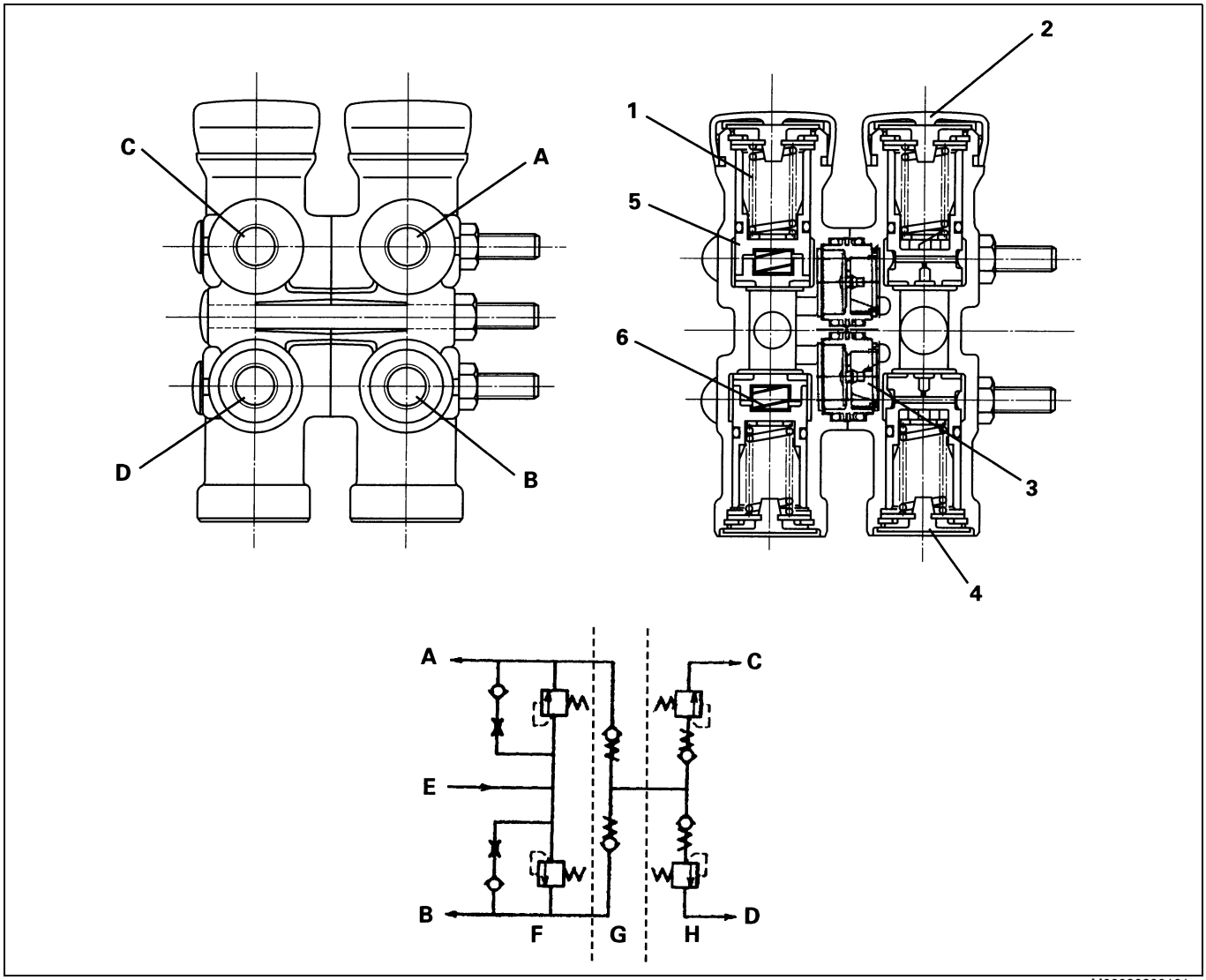
## DATA AND SPECIFICATIONS

M06020801BEI2001

| Type | | | Spring type (4-way protection) |
|---|---|---|---|
| Opening pressure | Open: | Port 21, 22 | 620-660 kpa {6.3-6.7 kgf/cm$^2$, 89.61-95.29 lbf/in$^2$} |
| | | Port 23, 24 | 570-610 kpa {5.8-6.2 kgf/cm$^2$, 82.49-88.18 lbf/in$^2$} |
| | Close: | Port 21, 22 | 440-480 kpa {4.5-4.8 kgf/cm$^2$, 64.01-68.27 lbf/in$^2$} |
| | | Port 23, 24 | 440-480 kpa {4.5-4.8 kgf/cm$^2$, 64.01-68.27 lbf/in$^2$} |

## DESCRIPTION

M06020801BEC1001

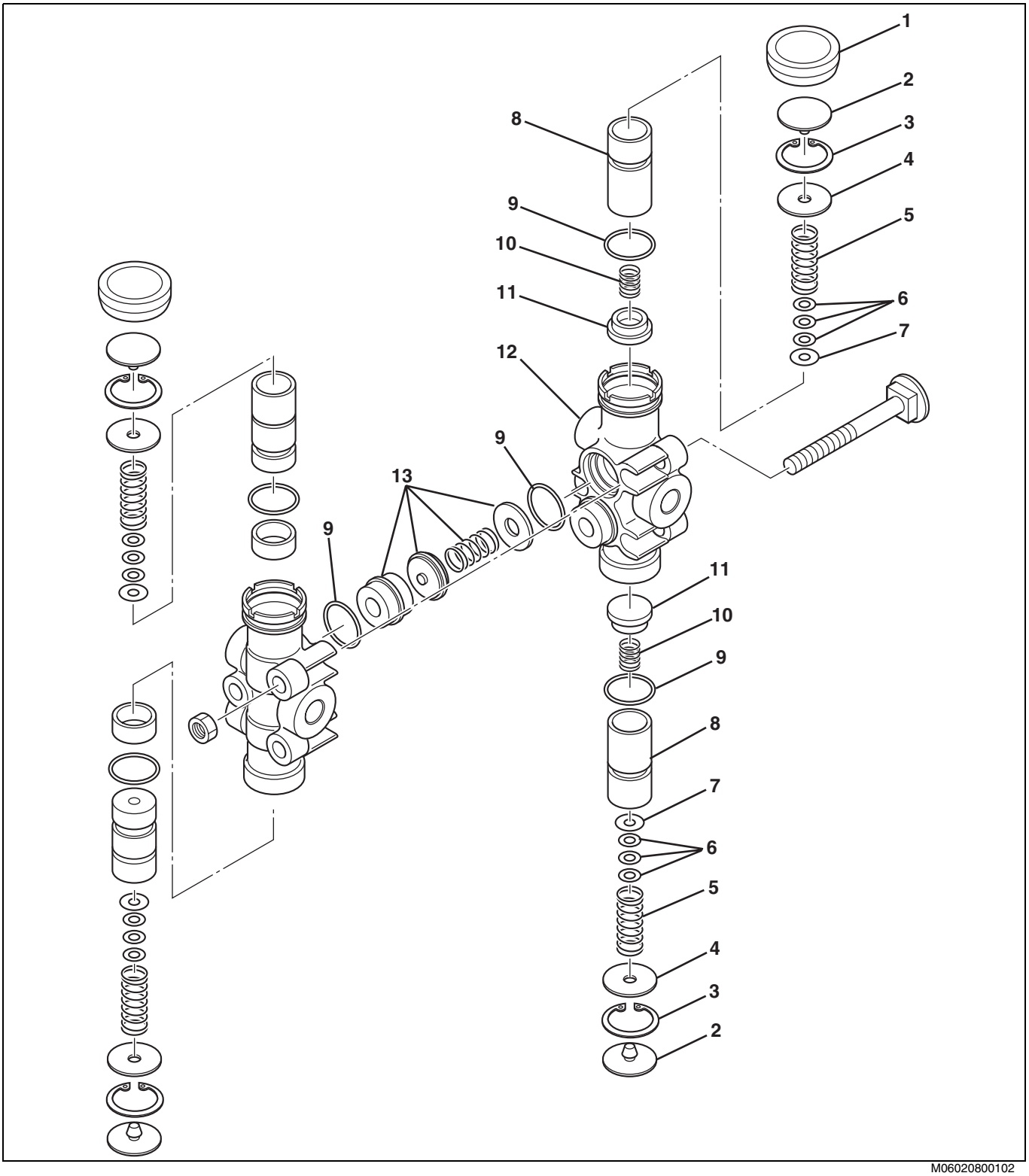



M06020800101

| | | | |
|---|---|---|---|
| 1 | Compression spring | A | Port 21 (Outlet) |
| 2 | Dust cover | B | Port 22 (Outlet) |
| 3 | Check valve | C | Port 23 (Outlet) |
| 4 | Dust seal rubber | D | Port 24 (Outlet) |
| 5 | Piston | E | Inlet port |
| 6 | Valve spring | F | No.1 side |
| | | G | Center check valve |
| | | H | No.2 side |

# COMPONENT LOCATOR

M06020801BED1001

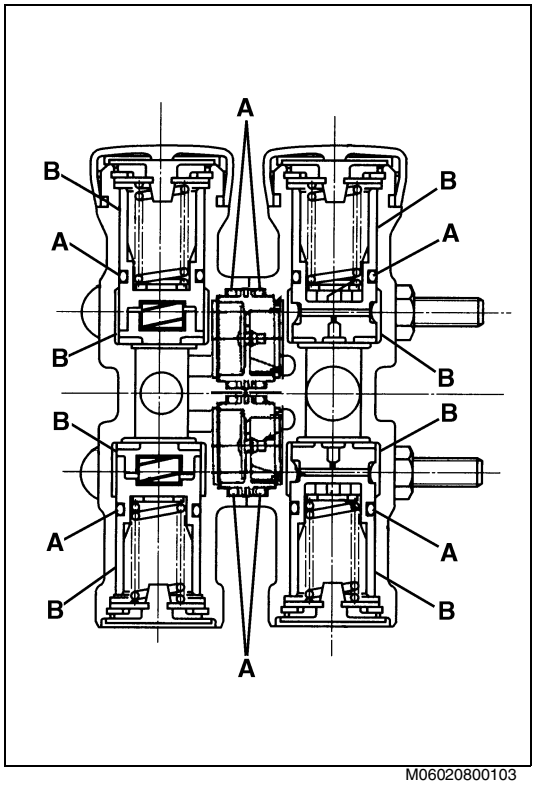



M06020800102

| | | | | | |
|---|---|---|---|---|---|
| 1 | Dust cover | 6 | Shim | 11 | Valve |
| 2 | Dust seal rubber | 7 | Spacer | 12 | Body |
| 3 | Retainer ring | 8 | Piston | 13 | Check valve |
| 4 | Dust seal plate | 9 | O-ring | | |
| 5 | Compression spring | 10 | Valve spring | | |

# OVERHAUL

M06020801BEH2001




M06020800103

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the protection valve use the new O-rings and valves.

(2) Apply the silicone grease on the each sliding surface of the component parts and O-ring groove.

- **A: O-ring**
- **B: Sliding surface**

# ADJUSTMENT

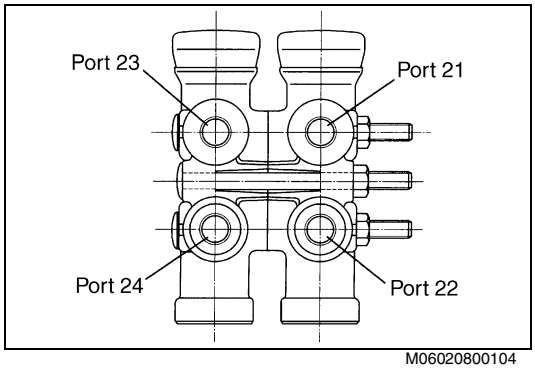
M06020801BEH3001

## AIR LEAKAGE

**1. Check valve**

(1) By-pass Check valve at No.1 side.

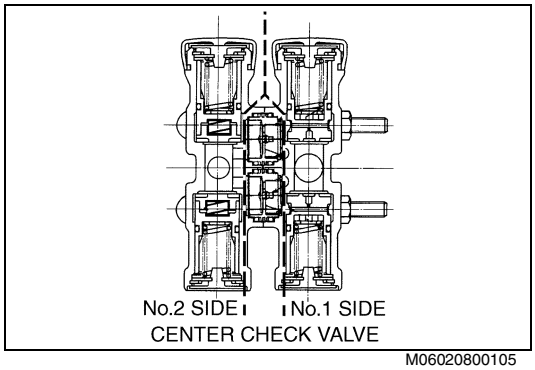
a. Confirm no leakage of air at inlet, No.1, when applying pressure to air under 49 kpa {0.5 kgf/cm$^2$, 7.11 lbf/in$^2$}, 392 kpa {4 kgf/cm$^2$, 56.89 lbf/in$^2$} from outlet No.21 and No.22.



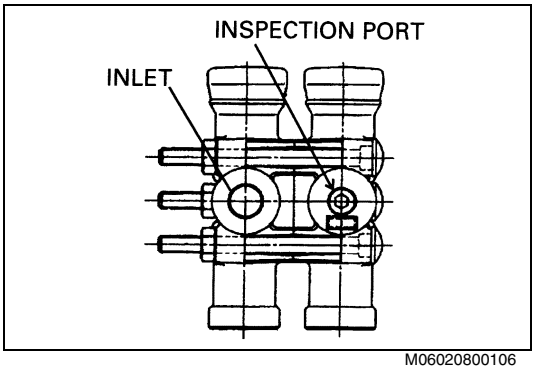

M06020800104

(2) Center check valve

a. Confirm no leakage of air at the outlet No.21 and No.22, when applying pressure to air under 49 kpa {0.5 kgf/cm$^2$, 7.11 lbf/in$^2$}, 880 kpa {9 kgf/cm$^2$, 128 lbf/in$^2$} from the inspection port.




M06020800105



M06020800106

(3) Check valve at No.2 side
a. Confirm no leakage of air at the inspection port, when applying pressure to air under 49 kpa {0.5 kgf/cm$^2$, 7.11 lbf/in$^2$}, 880 kpa {9 kgf/cm$^2$, 128 lbf/in$^2$} at the outlet No.23 and No.24.

**2. Other air tightness**
(1) When applying pressure to air under 0-880 kpa {0-9.0 kgf/cm$^2$, 0-128 lbf/in$^2$}, confirm that any leakage of air should be 0 cm$^3$min.

## PERFORMANCE CHRACTERISTIC

**1. Opening valve pressure**
(1) No.1 side
a. Releasing the compressed air at the outlet port No.23 and No.22 to air, when applying the compressed air at the speed specified below, confirm that air pressure of the compressed air, saturated at the inlet should be of Opening valve pressure, which should be 620-660 kpa {6.3-6.7 kgf/cm$^2$, 89.61-95.29 lbf/in$^2$}.
Charging speed: From 295 kpa {3.0 kgf/cm$^2$, 42.66 lbf/in$^2$} to 490 kpa {5.0 kgf/cm$^2$, 71.10 lbf/in$^2$} within 3-7 seconds.
(2) No.2 side
a. When applying air at charging speed specified below from the inlet side under air pressure "0" at the outlet port No.23 and No.23, confirm that a pressure at the inspection port when it starting to go up at the outlet should be of Opening valve pressure, which should be 570-610 kpa {5.8-6.2 kgf/cm$^2$, 82.49-88.18 lbf/in$^2$}.
Charging speed: From 295 kpa {3.0 kgf/cm$^2$, 42.66 lbf/in$^2$} to 490 kpa {5.0 kgf/cm$^2$, 71.10 lbf/in$^2$} within 8-22 seconds.

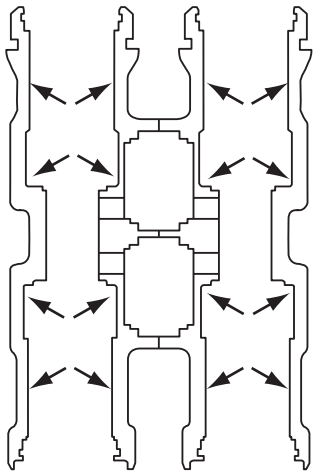
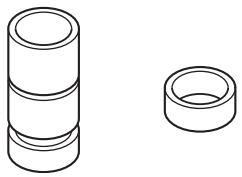
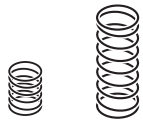
**2. Closing valve pressure**
(1) When discharging air through respective No.1 side and No.2 side inlet under a pressure of 880 kpa {9 kgf/cm$^2$, 128 lbf/in$^2$} at the inlet and the outlet, at discharging speed specified below, confirm that a pressure when the pressures saturated should be of Closing valve pressure, which should be 440-480 kpa {4.5-4.8 kgf/cm$^2$, 64.01-68.27 lbf/in$^2$}.
Discharging speed: From 590 kpa {6.0 kgf/cm$^2$, 85.32 lbf/in$^2$} to 295 kpa {3.0 kgf/cm$^2$, 42.66 lbf/in$^2$} within less than seconds.

**NOTICE:**
**Perform test again by increasing sims, when the respective pressures is low and by decreasing it when high in the above inspection.**

# INSPECTION AND REPAIR

M06020801BEH3002

Unit: mm {in.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Sliding surface and contact surface of body:<br>Wear and damage | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Sliding surface and contact surface of valve seat and piston:<br>Wear and damage | — | — | Replace,<br>if necessary. | Visual check<br>  |
| Conical spring and compression spring:<br>Rust, wear and damage<br>Free length | 1. 0.78 {0.08}<br>2. 158.9 {16.2} | 1. 0.69 {0.07}<br>2. 137.3 {14.0} | Replace. | Visual check<br>  |

# QUICK RELEASE VALVE

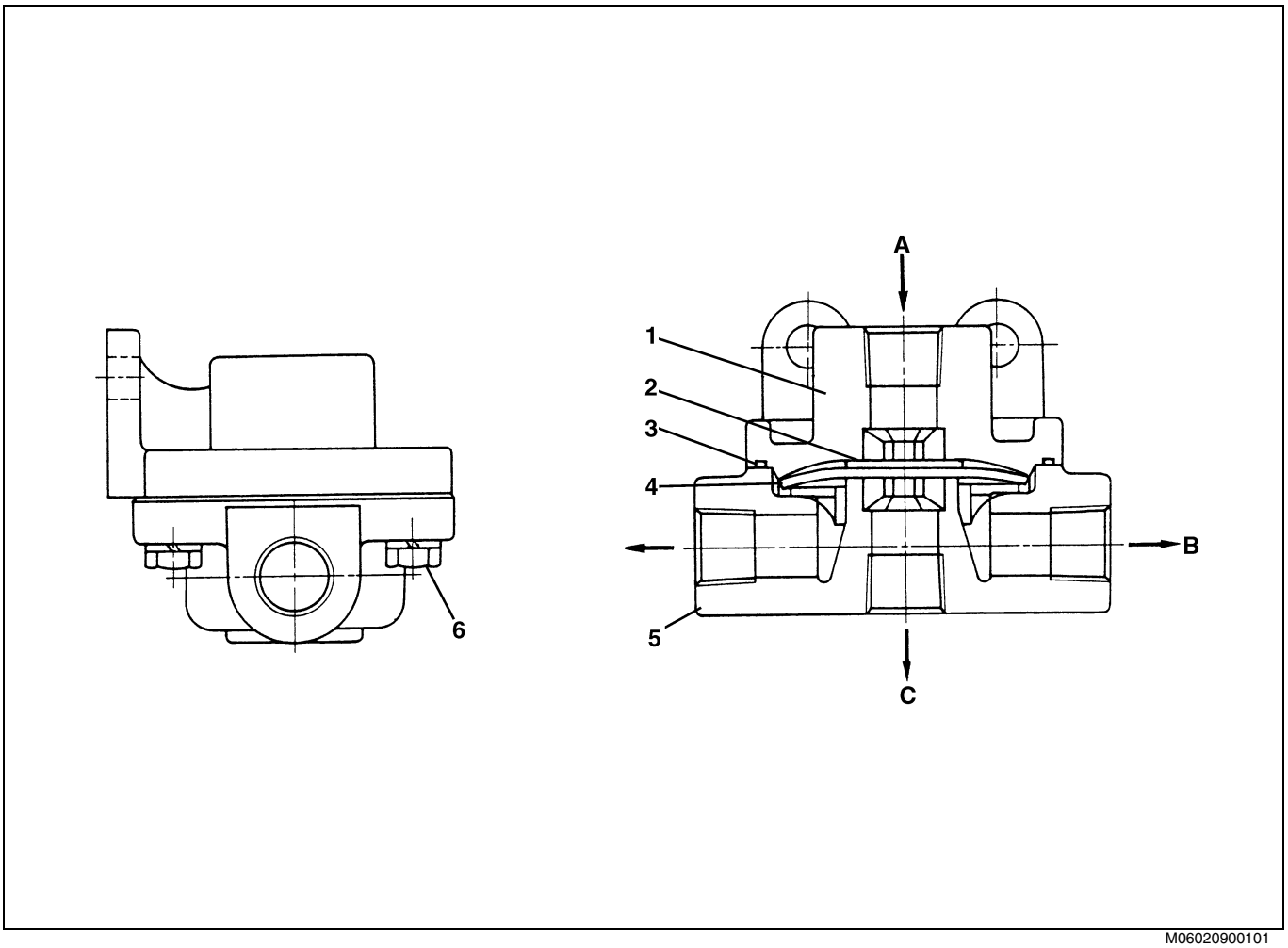
## DATA AND SPECIFICATION

M06020901BEI2001

| | |
|---|---|
| **Type** | **Diaphragm type** |

## DESCRIPTION

M06020901BEC1001

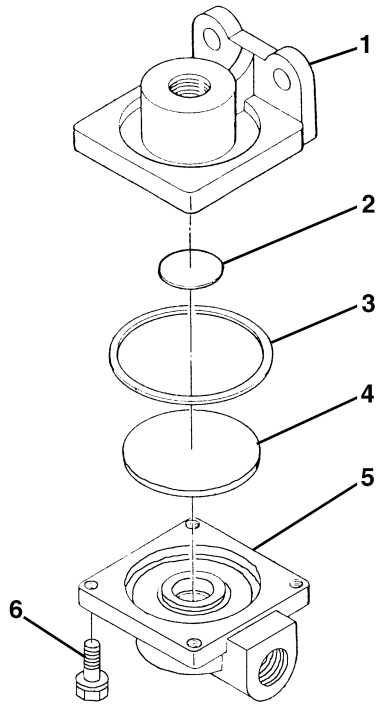



M06020900101

| | | | |
|---|---|---|---|
| 1 | Cover | 6 | Bolt |
| 2 | Filter | A | Inlet |
| 3 | Gasket | B | Outlet |
| 4 | Diaphragm | C | Exhaust |
| 5 | Valve body | | |

# COMPONENT LOCATOR

M06020901BED1001

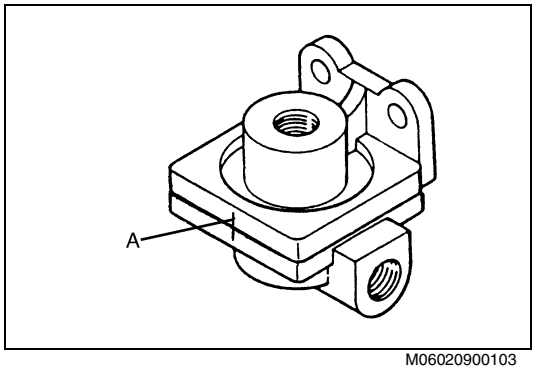



M06020900102

| | | | |
|---|---|---|---|
| 1 | Cover | 4 | Diaphragm |
| 2 | Filter | 5 | Valve body |
| 3 | Gasket | 6 | Bolt |

# OVERHAUL

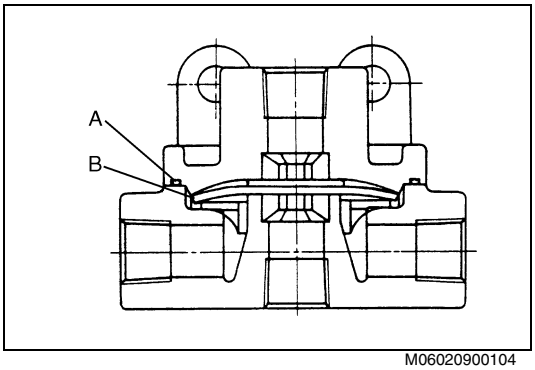
M06020901BEH2001




M06020900103

## IMPORTANT POINTS - DISASSEMBLY

**NOTICE:**
**Before disassemble the relay valve apply the aligning mark "A" for the cover and valve body.**



M06020900104

## IMPORTANT POINTS - ASSEMBLY

**1. Assemble the relay valve**

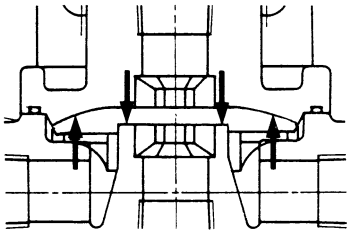
(1) When assembly the relay valve, use the new diaphragm and gasket.

- **A: Gasket**
- **B: Diaphragm**

(2) Coincide the aligning mark "A" which were applied at disassembly.

# INSPECTION AND REPAIR

**M06020901BEH3001**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Valve body and cover surface: Rust and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

# SPRING BRAKE CONTROL VALVE

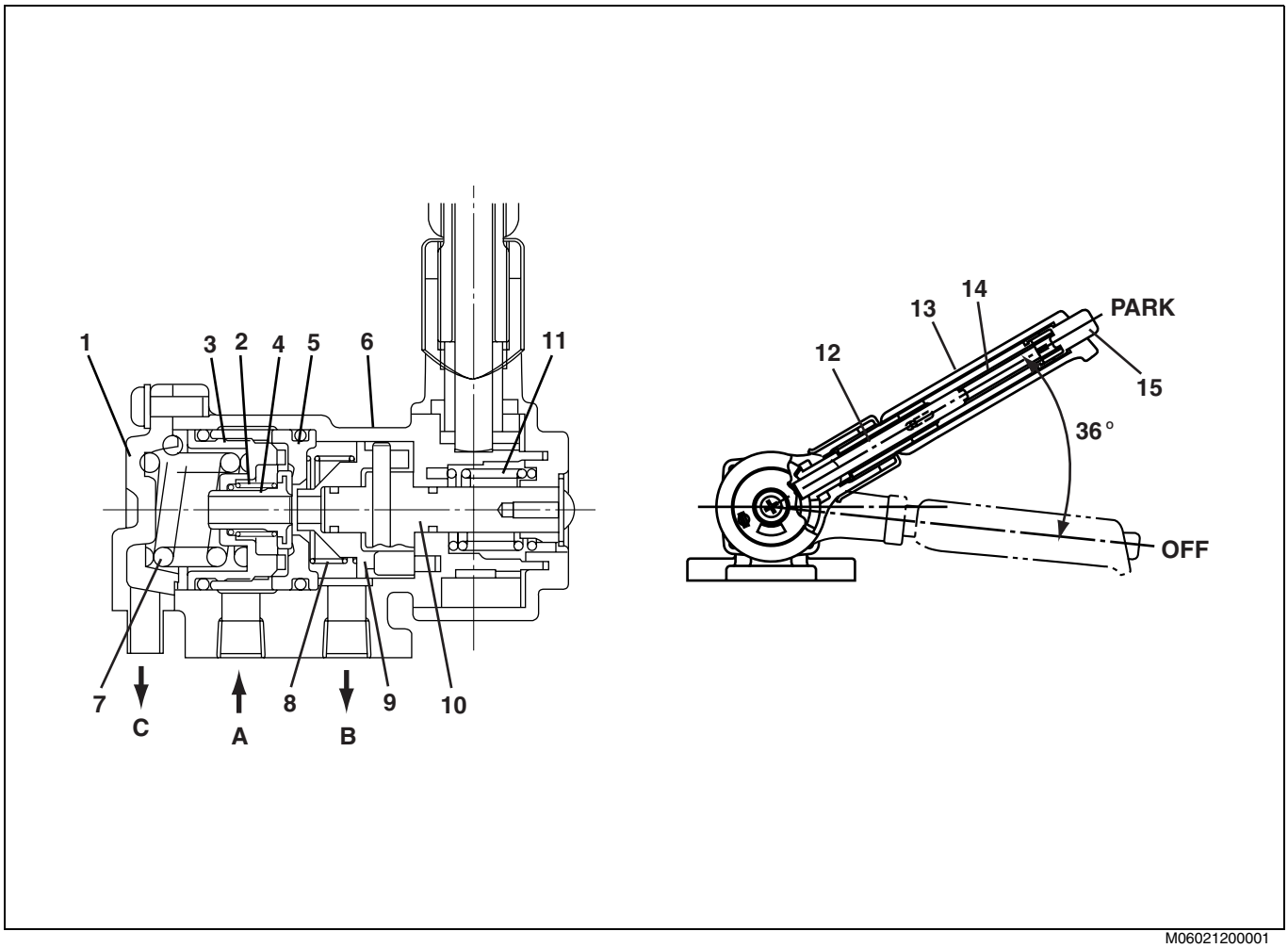
## DATA AND SPECIFICATIONS

M06021201BEI2001

| | |
|---|---|
| **Type** | **Variable pressure control type** |
| **Outlet pressure difference between parking and releasing stroke at a specified lever angle** | **Within 147 kPa {1.5 kgf/cm$^2$, 21.33 lbf/in$^2$.}** |

## DESCRIPTION

M06021201BEC1001

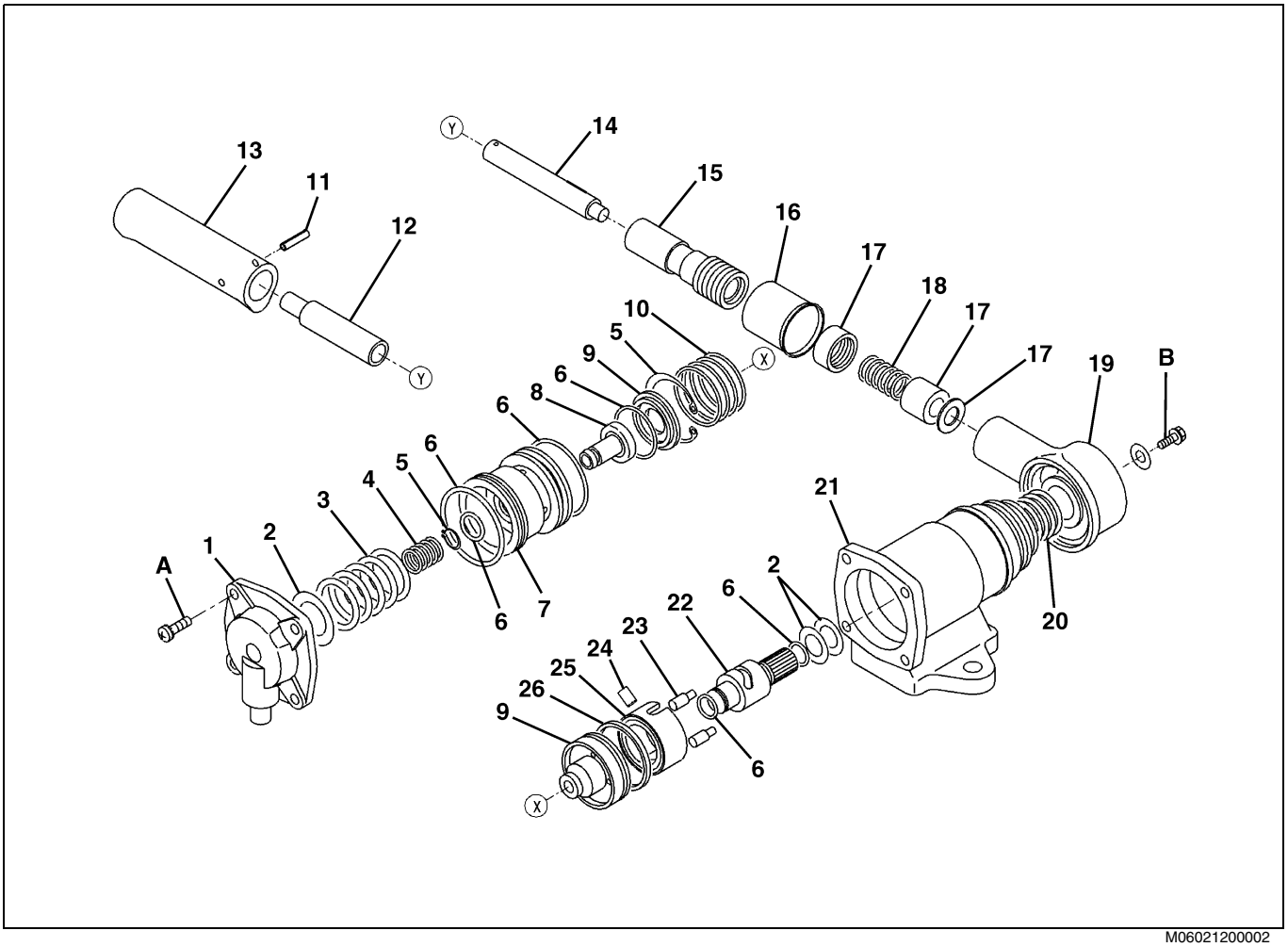



M06021200001

| | | | | | |
|---|---|---|---|---|---|
| 1 | Body cover | 7 | Piston spring | 13 | Grip |
| 2 | Feed valve spring | 8 | Valve seat spring | 14 | Compression spring |
| 3 | Piston | 9 | Cam | 15 | Release rod |
| 4 | Feed valve | 10 | Cam holder | A | Inlet |
| 5 | Valve seat | 11 | Return spring (If so equipped) | B | Outlet |
| 6 | Valve body | 12 | Pull rod | C | Exhaust (PARK) |

# COMPONENT LOCATOR

M06021201BED1001




M06021200002

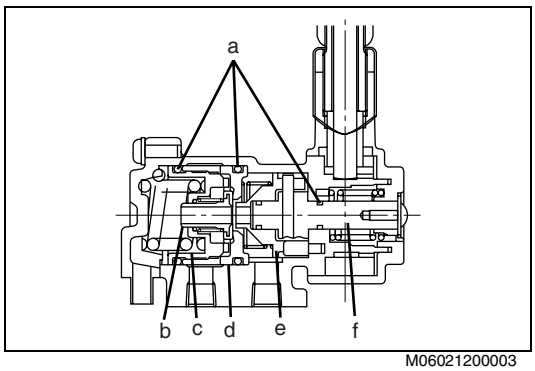
| | | | | | |
|---|---|---|---|---|---|
| 1 | Body cover | 10 | Valve seat spring | 19 | Body cap |
| 2 | Shim | 11 | Lock pin | 20 | Return spring (If so equipped) |
| 3 | Piston spring | 12 | Release rod knob | 21 | Valve body |
| 4 | Feed valve spring | 13 | Grip | 22 | Cam holder |
| 5 | Retainer ring | 14 | Pull rod | 23 | Body pin |
| 6 | O-ring | 15 | Supporter | 24 | Cam holder pin |
| 7 | Piston | 16 | Cover | 25 | Cam |
| 8 | Feed valve | 17 | Stopper | 26 | Piston guide |
| 9 | Valve seat | 18 | Compression spring | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 5.4-7.4 {55-75, 4.0-5.4} | B | 3.4-4.9 {35-50, 2.6-3.6} |

# OVERHAUL

M06021201BEH2001



M06021200003

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the spring brake control valve, replace the feed valve, valve seats and O-rings.

(2) Apply silicone grease to each sliding surface of the assembly parts, O-rings and O-ring grooves.

a. O-ring

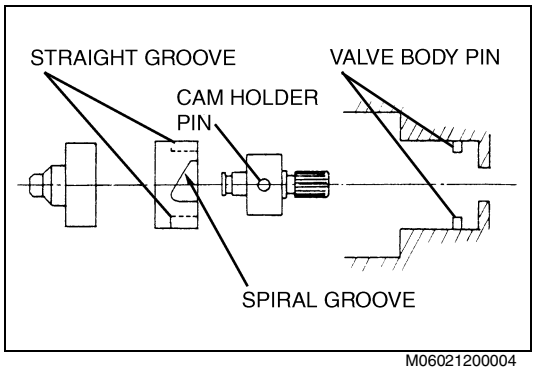
b. Feed valve

c. Piston

d. Valve seat

e. Cam

f. Cam holder

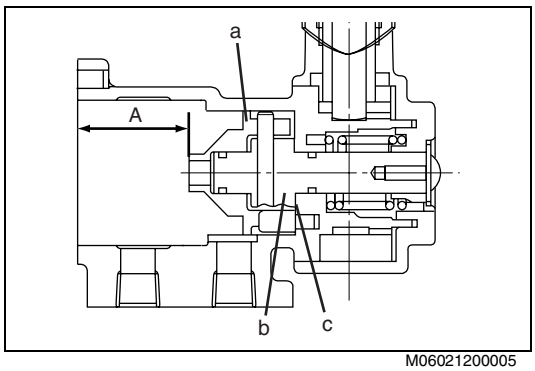


M06021200004

**2. ASSEMBLE THE CAM ASSEMBLY.**

(1) When assembling the cam and cam holder, make sure that the cam holder pin and spiral groove of the cam are aligned.

(2) When installing the cam assembly to the valve body, the valve body pin and straight groove of the cam must be aligned.



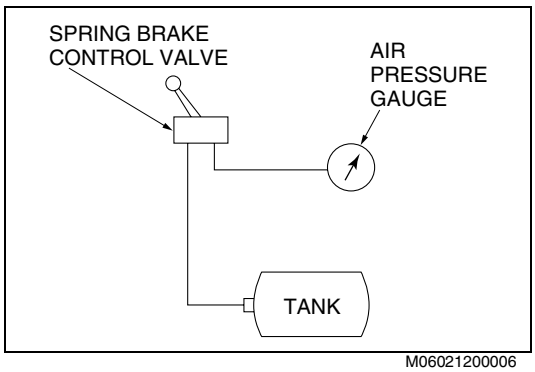
M06021200005

(3) Adjust dimension "A" with the shim.
**Assembly standard: 33.8-34.2 mm {1.331-1.346 in.}**

a. Cam

b. Cam holder

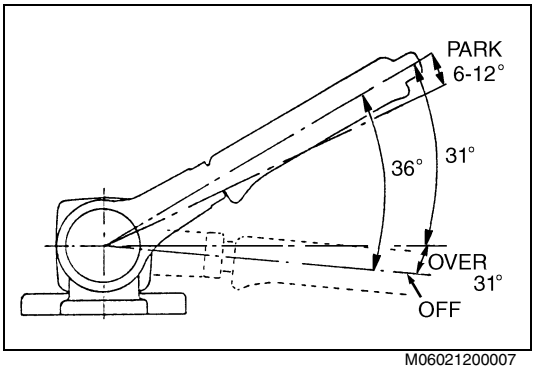
c. Shim



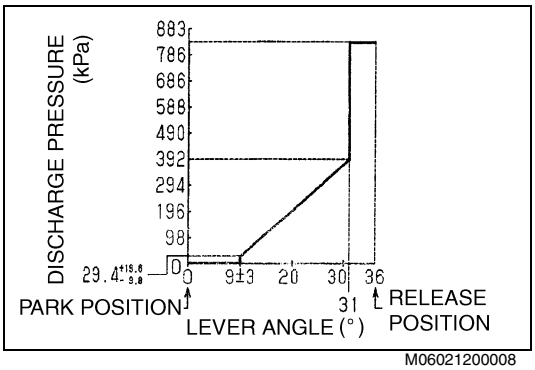
M06021200006

**3. SPRING BRAKE CONTROL VALVE PERFORMANCE TEST**

(1) First, connect the pressure gauge to the outlet line and apply an air pressure of 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} to the inlet line.



M06021200007



M06021200008

(2) Move the spring brake control lever towards the OFF position, gradually and confirm that the air pressure in the outlet line meets the characteristic shown in figure.
**Standard:**

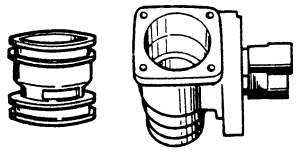
**Lever angle: Outlet pressure: kPa {kgf/cm$^2$, lbf/in$^2$.}**
**6-12° 19.6-49 {0.2-0.5, 2.85-7.11}**
**Over 31° 686 {7.0, 99.54}**

**NOTICE:**
**The characteristic shown is under the inlet pressure of 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.}**

# INSPECTION AND REPAIR

M06021201BEH3001

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Piston and valve body: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Cam, pin and cam holder: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Piston spring: Rust, damage and measure the spring free length** | **Free Length 27.9 {1.098}** | **25.0 {0.984}** | **Replace, if necessary.** | **Measure and visual check**  |
| **Feed valve spring and valve seat spring: Rust and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# RELAY VALVE (TYPE-A)

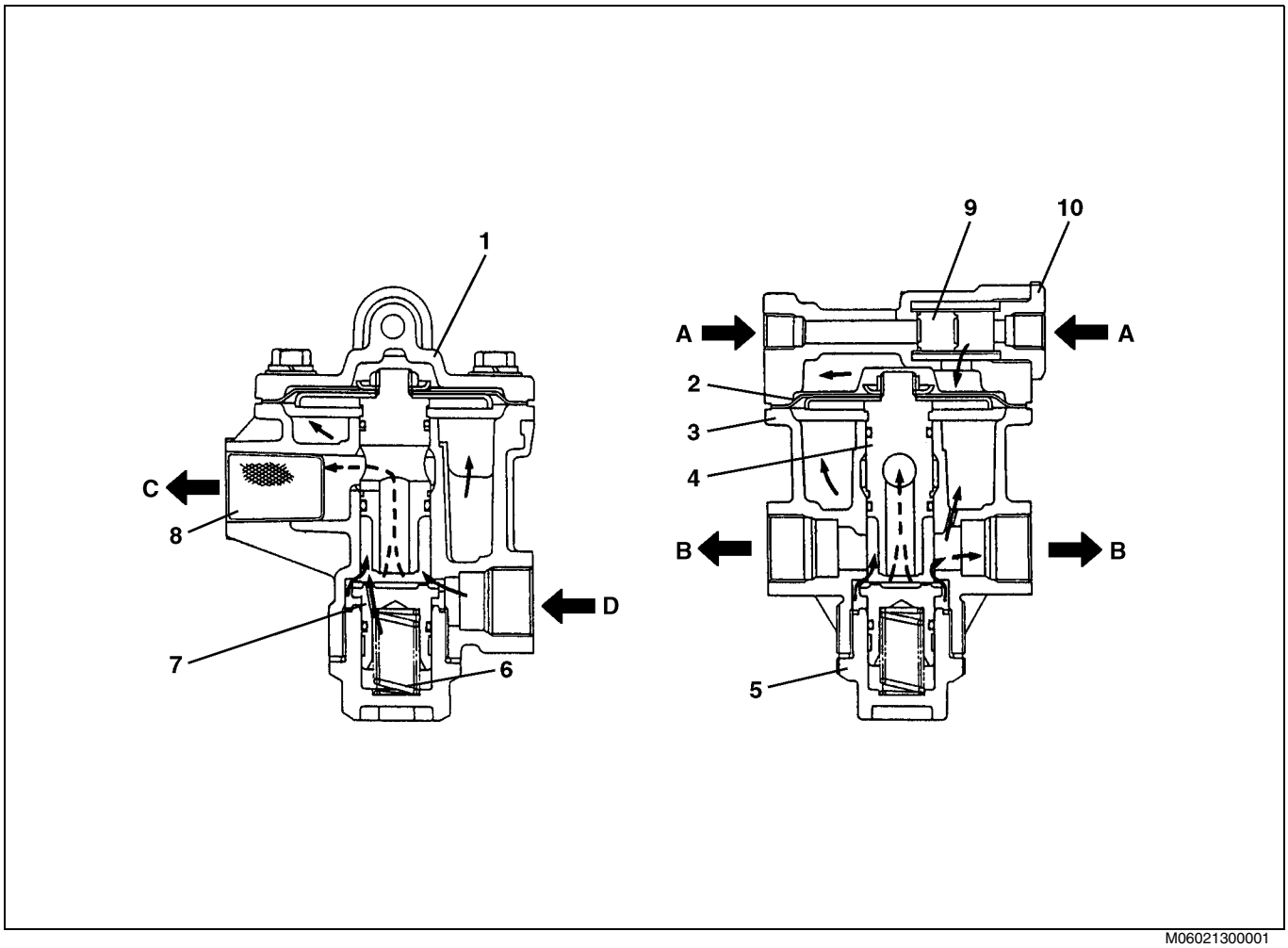
## DATA AND SPECIFICATIONS

M06021301BEI2001

| | |
|---|---|
| Type | Diaphragm type with double check valve combined |
| Pressure difference between signal and outlet pressure | 29.4 kPa {0.3 kgf/cm$^2$, 4.26 lbf/in$^2$.} |

## DESCRIPTON

M06021301BEC1001

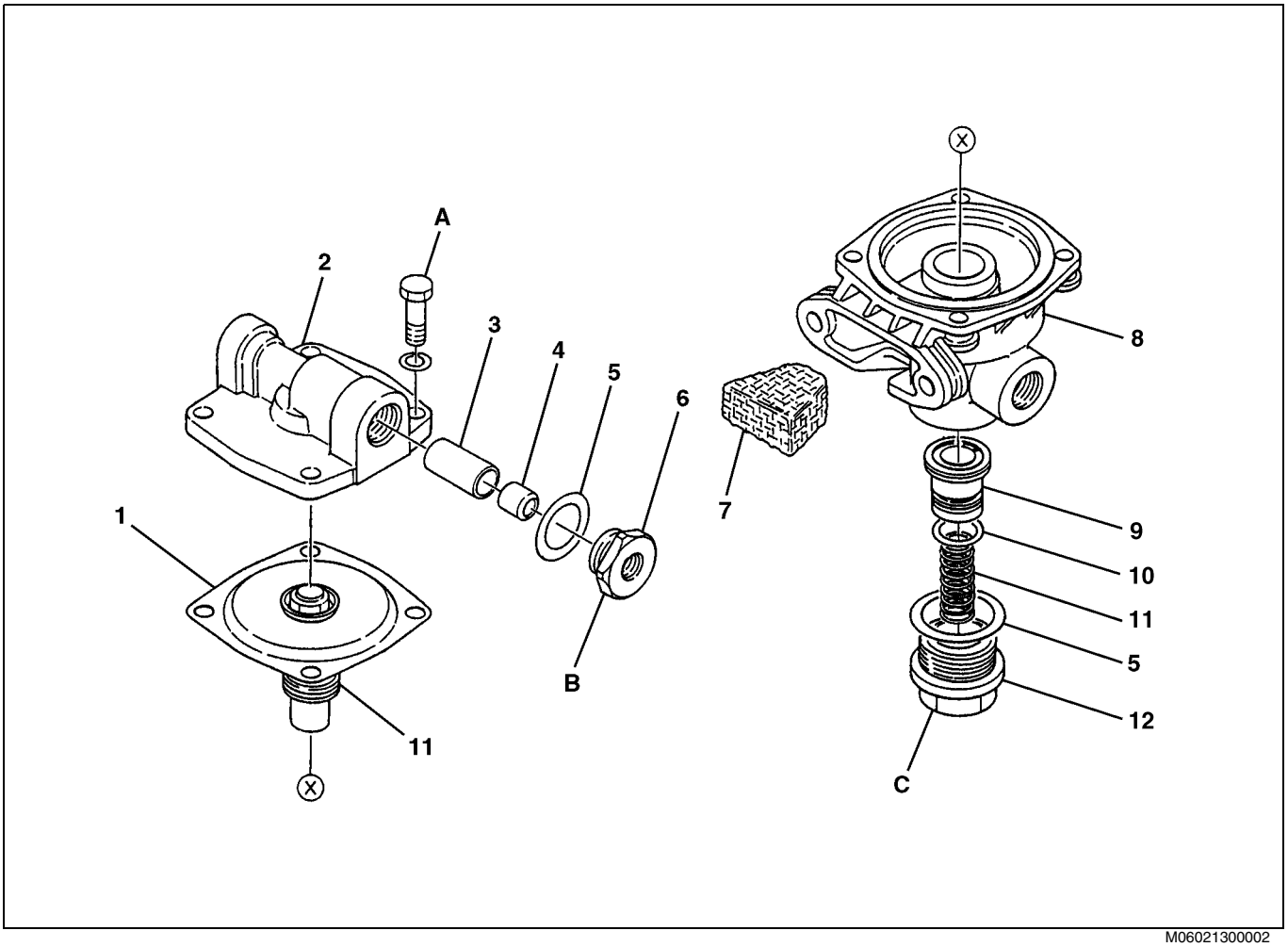



M06021300001

| | | | |
|---|---|---|---|
| 1 | Cover | 8 | Filter |
| 2 | Diaphragm | 9 | Valve |
| 3 | Valve body | 10 | Plug |
| 4 | Valve sub assembly | A | Signal |
| 5 | Valve cap | B | Outlet |
| 6 | Spring | C | Exhaust |
| 7 | Valve | D | Inlet |

# COMPONENT LOCATOR

M06021301BED1001




M06021300002

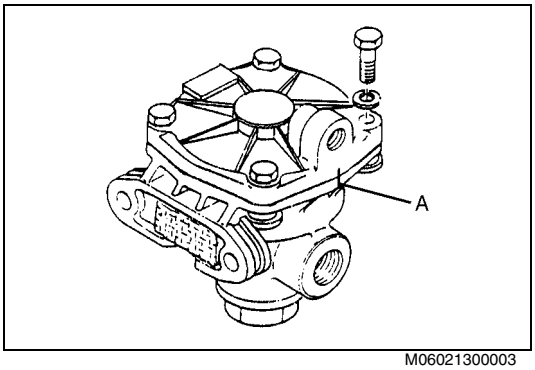
| | | | |
|---|---|---|---|
| 1 | Valve sub assembly | 7 | Filter |
| 2 | Cover | 8 | Valve body |
| 3 | Guide | 9 | Valve |
| 4 | Valve | 10 | O-ring |
| 5 | Gasket | 11 | Spring |
| 6 | Plug | 12 | Valve cap |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 11.8-14.7 {120-150, 9-10} | C | 58.8-78.4 {600-800, 44-57} |
| B | 34.3-44.1 {350-450, 26-32} | | |

# OVERHAUL

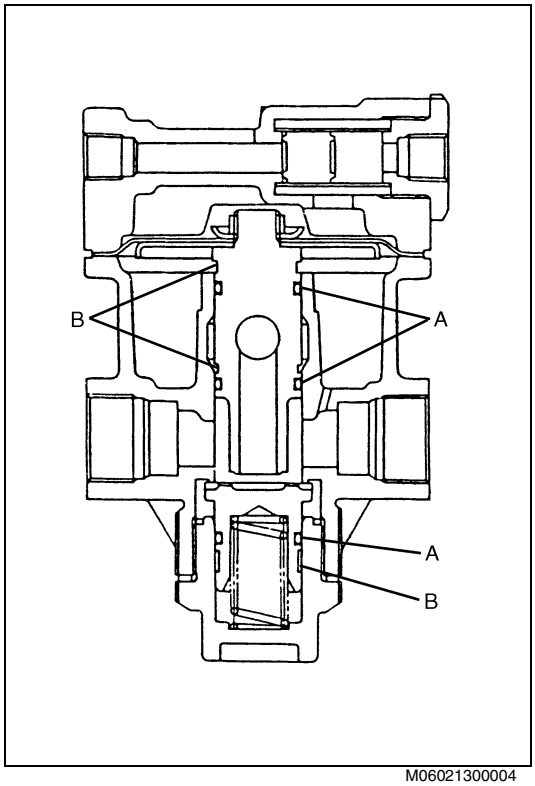
M06021301BEH2001




M06021300003

## IMPORTANT POINT - DISASSEMBLY

**NOTICE:**
**Before disassembling the relay valve, mark the aligning marks "A" on the cover and valve body.**



M06021300004

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

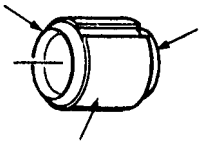
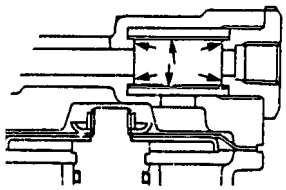
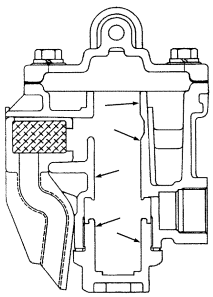
(1) When assembling the relay valve, use new O-rings and valves.

(2) Apply the silicone grease to each sliding surface of the component parts and O-ring groove.
**A: O-ring**
**B: Apply the silicone grease**

(3) When installing the cover to the body, align the aligning marks which were applied at disassembly.

# INSPECTION AND REPAIR

M06021301BEH3001

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Check valve: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Cover, guide and plug: Damage, wear and rust** | — | — | **Clean or Replace, if necessary.** | **Visual check**  |
| **Spring: Rust and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Relay valve body and cap sliding surface: Damage, wear and rust** | — | — | **Clean or Replace, if necessary.** | **Visual check**  |

# RELAY VALVE (TYPE-B)

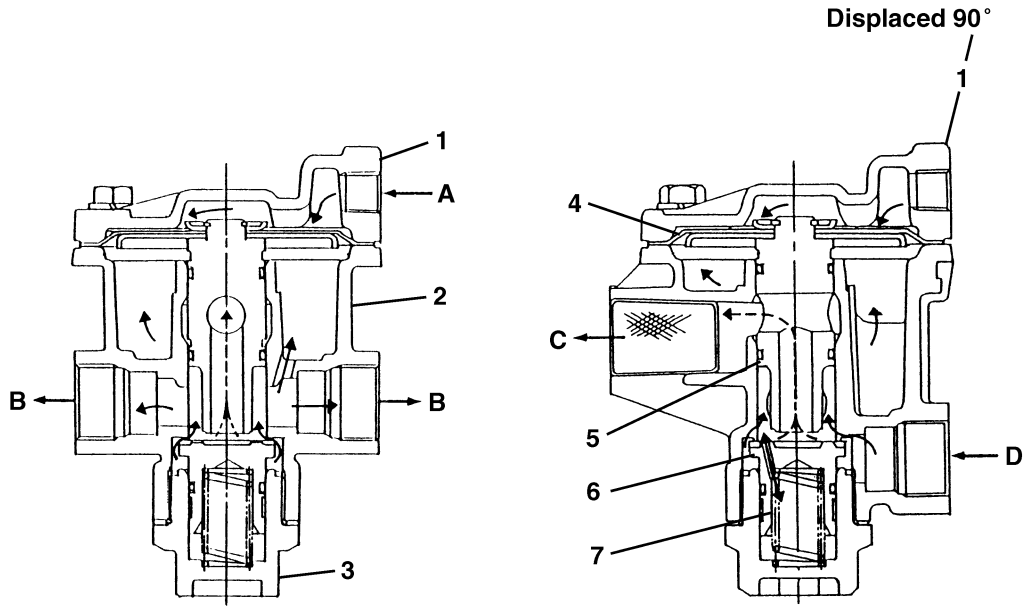
## DATA AND SPECIFICATIONS

M06021301BEI2003

| | |
|---|---|
| **Type** | **Diaphragm type** |
| **Pressure difference between signal and outlet pressure** | **10-29 kPa {0.1-0.3 kgf/cm$^2$, 1.43-4.26 lbf/in$^2$.}** |

## DESCRIPTION

M06021301BEC1003

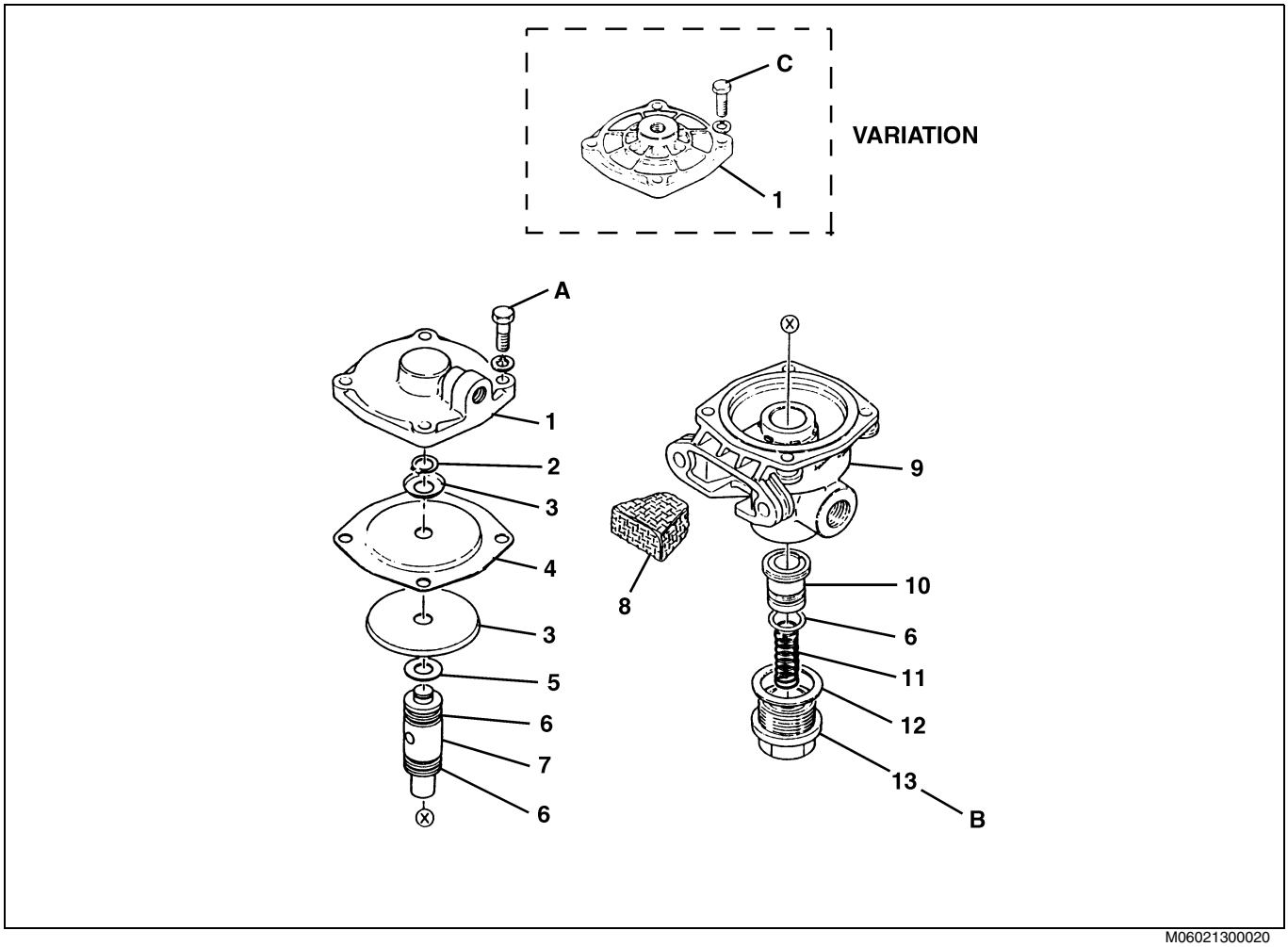



M06021300019

| | | | |
|---|---|---|---|
| 1 | Cover | 7 | Return spring |
| 2 | Body | A | Signal air |
| 3 | Cap | B | Outlet air |
| 4 | Diaphragm | C | Exhaust |
| 5 | Exhaust valve | D | Inlet air |
| 6 | Feed valve | | |

# COMPONENT LOCATOR

M06021301BED1003




M06021300020

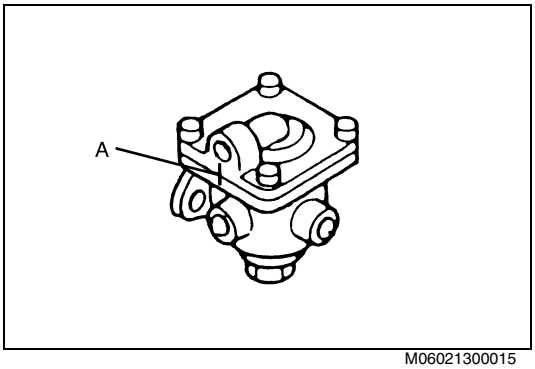
| | | | |
|---|---|---|---|
| 1 | Cover | 8 | Filter |
| 2 | Retainer ring | 9 | Body |
| 3 | Washer | 10 | Feed valve |
| 4 | Diaphragm | 11 | Return spring |
| 5 | Shim | 12 | Gasket |
| 6 | O-ring | 13 | Cap |
| 7 | Exhaust valve | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 11.8-14.7 {120-150, 9-10} | C | 11.8-14.7 {120-150, 9-10} |
| B | 59-78 {600-800, 44-57} | | |

# OVERHAUL

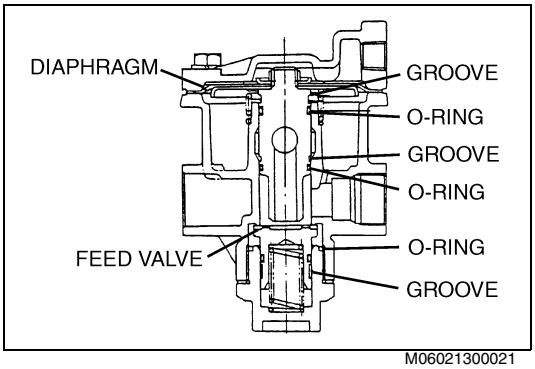
M06021301BEH2003



M06021300015

## IMPORTANT POINT - ASSEMBLY

**NOTICE:**
**Before disassembling the relay valve, apply the aligning mark A to the cover and body.**



M06021300021

## IMPORTANT POINT - ASSEMBLY

**1. LUBRICATION**

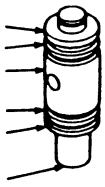
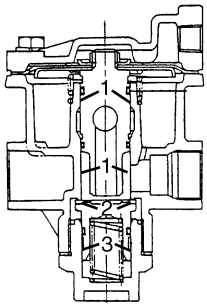
(1) When reassembling the relay valve, replace the O-rings, diaphragm, gasket and feed valve with new ones.

(2) Apply adequate amount of the silicone grease to the O-rings, grease groove and sliding surfaces of the component parts.

(3) When installing the cover to the body, align the aligning marks which were applied at disassembly.

# INSPECTION AND REPAIR

M06021301BEH3003

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Sliding surfaces and valve contact surfaces of exhaust valve: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Valve Body, Sliding surfaces 1 and valve contact surfaces 2: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**   |
| **Cap, Sliding surfaces 3: Wear and damage** | **—** | **—** | **Replace, if necessary.** | |

# RELAY VALVE (TYPE-C: WITH CHECK VALVE)

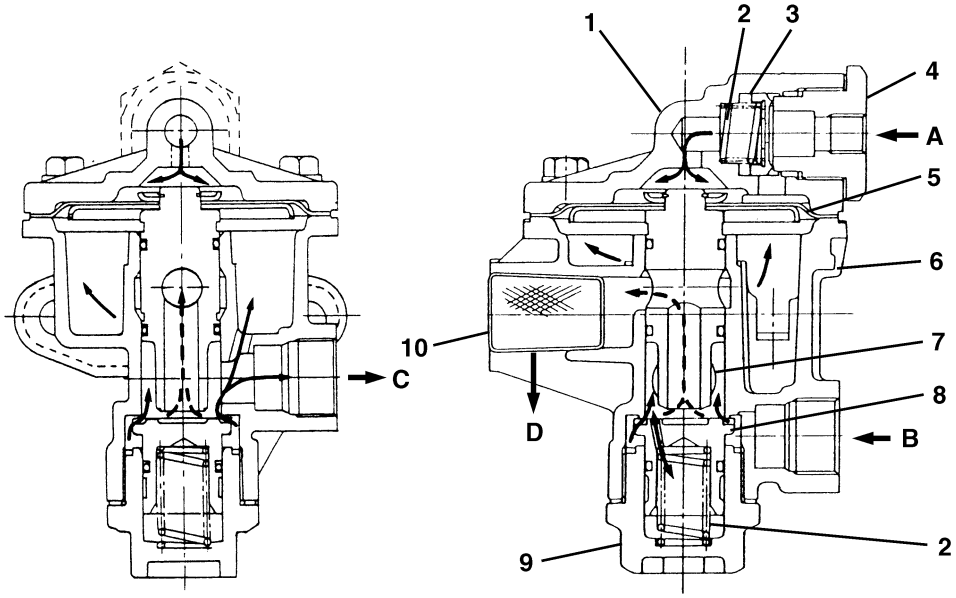
## DATA AND SPECIFICATIONS

M06021302BEI2004

| | |
|---|---|
| **Type** | **Diaphragm type (With a check valve combined)** |
| **Pressure difference between signal and outlet pressure** | **24.5-53.9 kPa {0.25-0.55 kgf/cm$^2$, 3.56-7.82 lbf/in$^2$.}** |

## DESCRIPTION

M06021301BEC1004

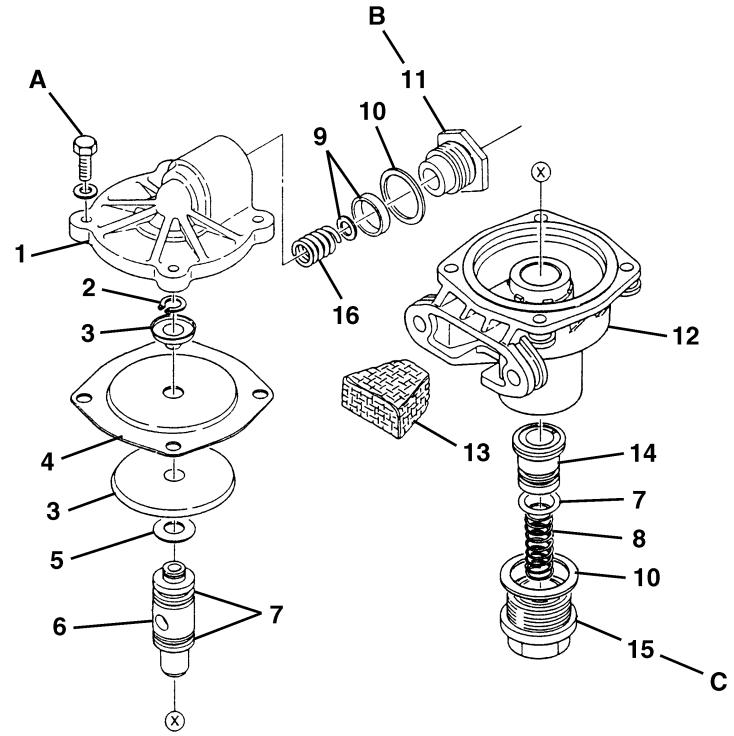



M06021300023

| | | | |
|---|---|---|---|
| **1** | **Cover** | **8** | **Feed valve** |
| **2** | **Spring** | **9** | **Cap** |
| **3** | **Check valve** | **10** | **Filter** |
| **4** | **Plug** | **A** | **Signal (From brake valve)** |
| **5** | **Diaphragm** | **B** | **Inlet (From air tank)** |
| **6** | **Valve body** | **C** | **Outlet (To brake chamber)** |
| **7** | **Exhaust valve** | **D** | **Exhaust** |

# COMPONENT LOCATOR

M06021301BED1004




M06021300024

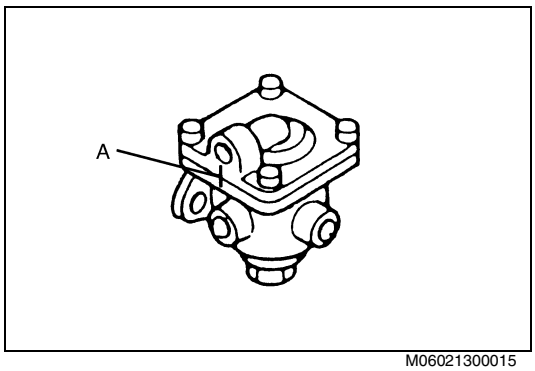
| | | | |
|---|---|---|---|
| 1 | Cover | 9 | Check valve |
| 2 | Retainer ring | 10 | Gasket |
| 3 | Diaphragm washer | 11 | Plug |
| 4 | Diaphragm | 12 | Valve body |
| 5 | Shim | 13 | Filter |
| 6 | Exhaust valve | 14 | Feed valve |
| 7 | O-ring | 15 | Cap |
| 8 | Spring | 16 | Valve spring |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 11.8-14.7 {120-150, 9-10} | C | 59-78 {600-800, 44-57} |
| B | 50-58 {500-600, 37-43} | | |

# OVERHAUL

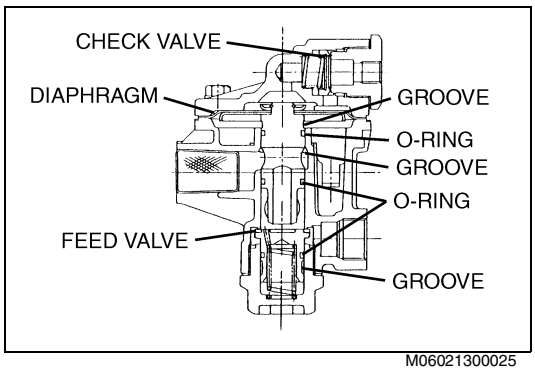
M06021301BEH2004



M06021300015

## IMPORTANT POINT - ASSEMBLY

**NOTICE:**
**Before disassembling the relay valve, apply the aligning mark A to the cover and body.**



M06021300025

## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When reassembling the relay valve, replace the check valve, O-rings, diaphragm, gasket and feed valve with new ones.

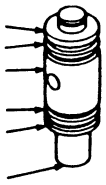
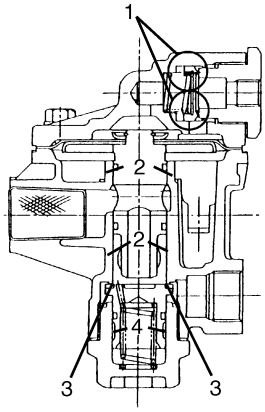
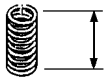
(2) Apply adequate amount of the silicone grease to the O-rings, grease groove and sliding surfaces of the component parts.

(3) When installing the cover to the body, align the aligning marks which were applied at disassembly.

# INSPECTION AND REPAIR

M06021301BEH3004

Unit: mm {in.}

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| Sliding surfaces and valve contact surfaces of exhaust valve: Wear and damage | — | — | Replace, if necessary. | Visual check  |
| Valve contact surface of plug 1: Wear and damage | — | — | Replace, if necessary. | Visual check   |
| Valve body, Sliding surfaces 2, Valve contact surfaces 3: Wear and damage | — | — | Replace, if necessary. | |
| Cap, Sliding surfaces 4: Wear and damage | — | — | Replace, if necessary. | |
| Compression spring: Rust, damage, Free length. | 46.0 {1.81} | — | Replace, if necessary. | Measure and visual check  |
| Valve spring: Rust, damage, Free length. | 31.8 {1.25} | — | Replace, if necessary. | |

# SPRING BRAKE CHAMBER (TYPE-A)

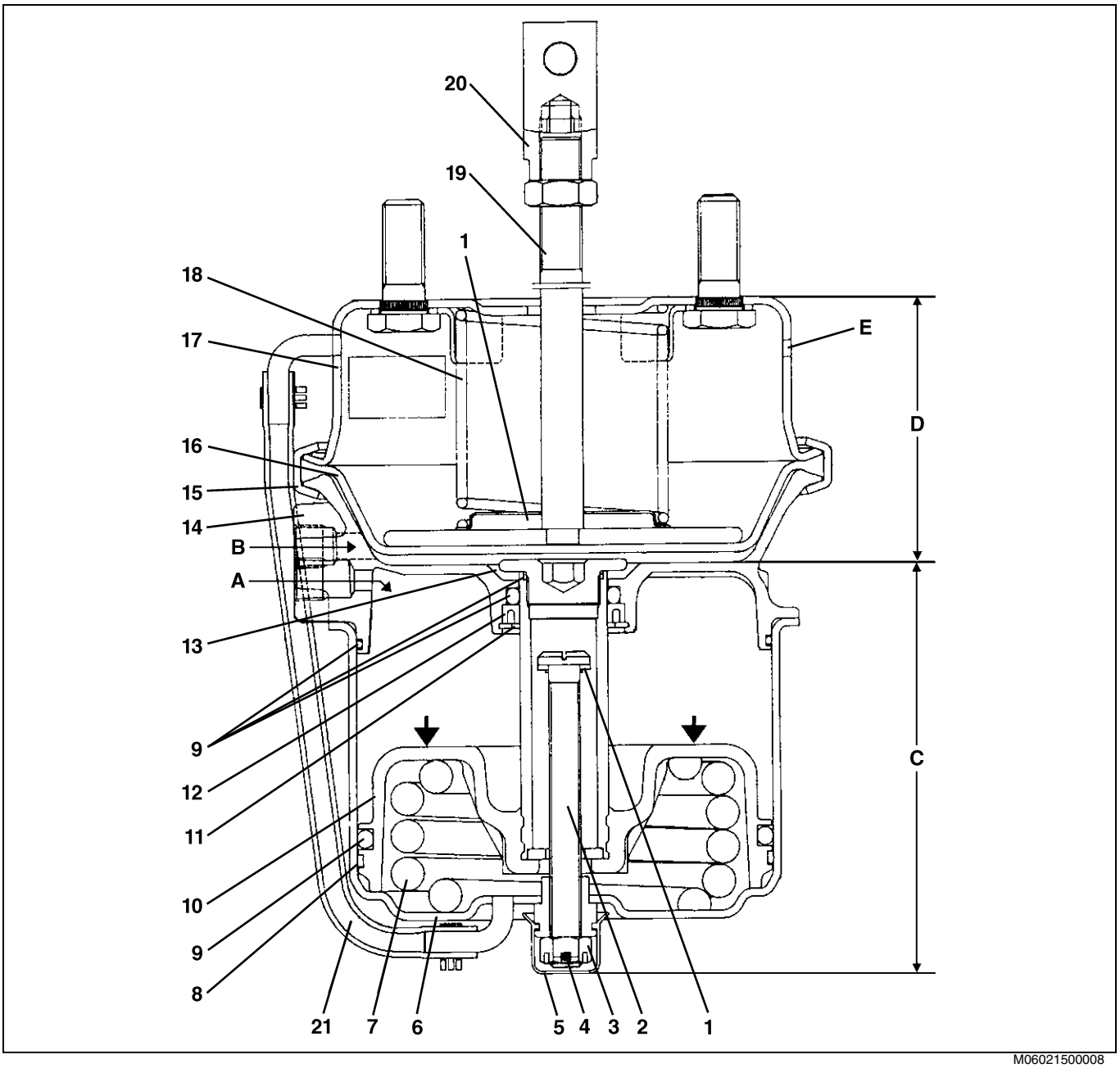
## DATA AND SPECIFICATIONS

M06021501BEI2001

| | |
|---|---|
| **Type** | **Spring and piston type brake chamber combined with diaphragm type chamber with breather tube** |

# DESCRIPTION

M06021501BEC1001



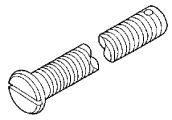

M06021500008

| | | | |
|---|---|---|---|
| 1 | Retainer | 15 | Clamp band |
| 2 | Release bolt | 16 | Diaphragm |
| 3 | Slotted nut | 17 | Service brake chamber |
| 4 | Spring pin | 18 | Compression spring |
| 5 | Dust cover | 19 | Push rod |
| 6 | Spring brake chamber | 20 | Clevis |
| 7 | Spring | 21 | Breather tube |
| 8 | Piston ring | A | Spring brake air port (Emergency and parking) - for releasing air |
| 9 | O-ring | B | Service brake air port (Service) - for braking air |
| 10 | Piston | C | Spring brake portion |
| 11 | Retainer ring | D | Service brake portion |
| 12 | Bushing | E | Drain hole |
| 13 | Piston follower | | |
| 14 | Bulkhead | | |

# SPECIAL TOOL

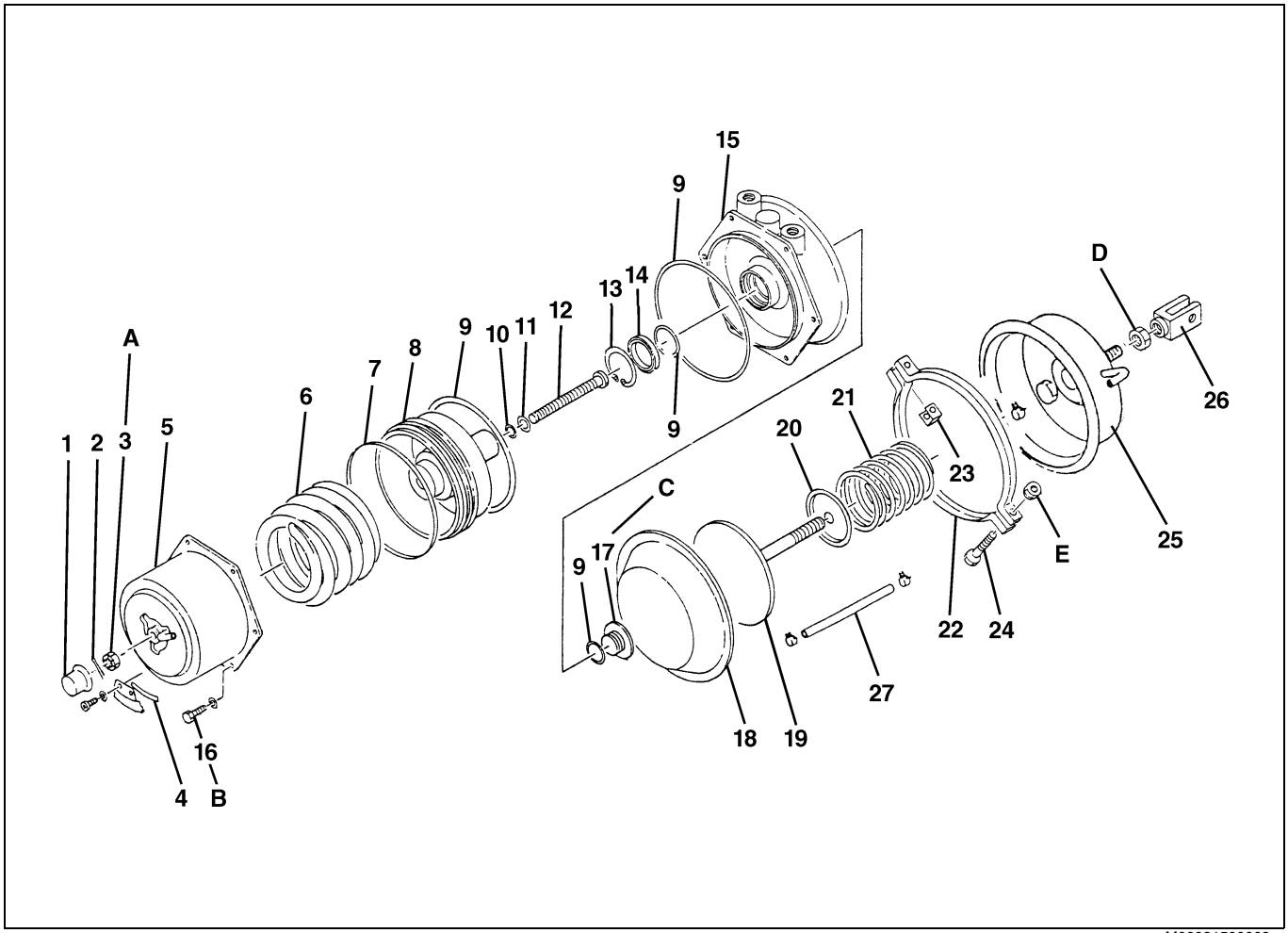
M06021501BEK1001

Prior to starting a spring brake chamber overhaul, it is necessary to have this special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09683-1051 | SPRING BRAKE PISTON RELEASE BOLT | |

# COMPONENT LOCATOR

M06021501BED1001




M06021500009

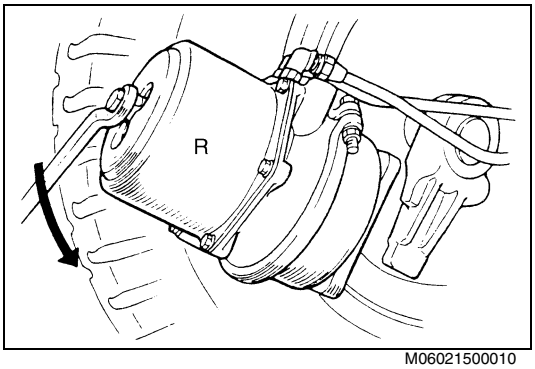
| | | | | | |
|---|---|---|---|---|---|
| 1 | Dust cover | 10 | Retainer | 19 | Push rod |
| 2 | Spring pin | 11 | Plain washer | 20 | Spring retainer |
| 3 | Slotted nut | 12 | Release bolt | 21 | Compression spring |
| 4 | Caution plate | 13 | Retainer ring | 22 | Clamp band |
| 5 | Spring brake chamber | 14 | Bushing | 23 | Spacer |
| 6 | Spring | 15 | Bulkhead | 24 | Clamp band bolt |
| 7 | Piston ring | 16 | Chamber cover bolt | 25 | Service brake chamber |
| 8 | Piston | 17 | Piston follower | 26 | Clevis |
| 9 | O-ring | 18 | Diaphragm | 27 | Breather tube |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 39.0-44.0 {400-450, 29-32} | D | 39.0-49.0 {400-500, 29-36} |
| B | 9.8-17.6 {100-180, 7.3-13.0} | E | 26.5-32.3 {270-330, 20-23} |
| C | 39.0-49.0 {400-500, 29-36} | | |

# OVERHAUL

M06021501BEH2001



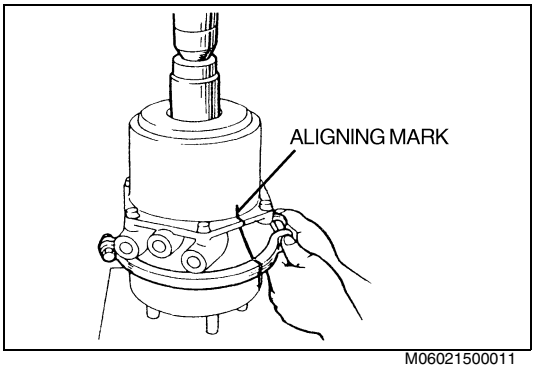
M06021500010

## IMPORTANT POINT - DISMOUNTING

**1. DISMOUNTING THE CHAMBER ASSEMBLY**

(1) Before dismounting the chamber, turn the release bolt counterclockwise to release the spring brake.

(2) Apply a position mark R or L to make clear the side where the chamber was installed.

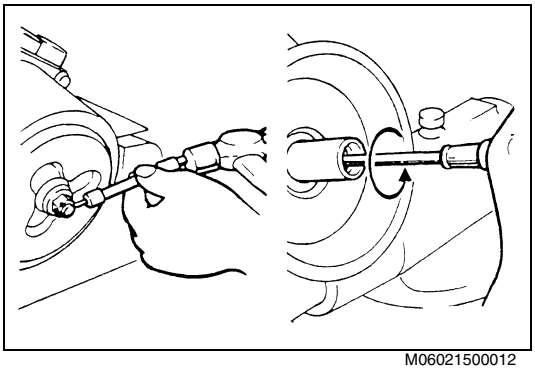


M06021500011

## IMPORTANT POINTS - DISASSEMBLY

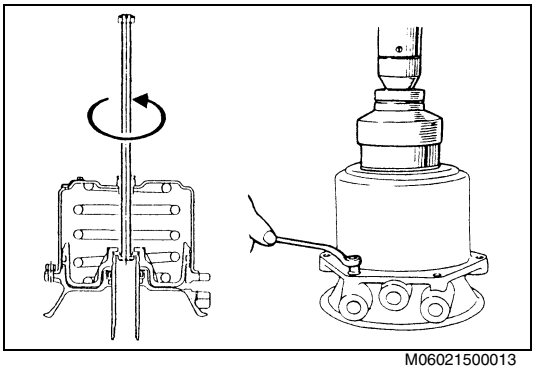
**NOTICE:**

**Before disassembling, put aligning marks to the clamp band, service brake chamber, bulkhead and spring brake chamber.**

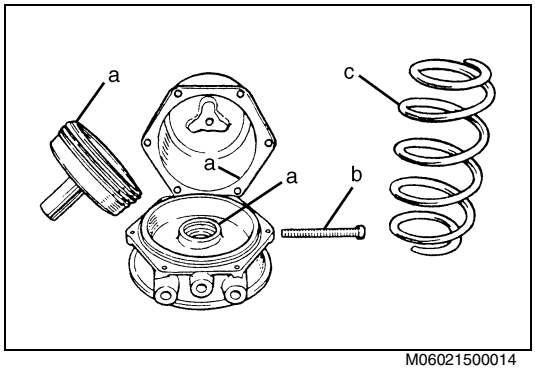

M06021500012

**1. DISASSEMBLING THE SPRING BRAKE CHAMBER**

(1) Remove the piston follower and then remove the dust cover, spring pin and release bolt.


M06021500013

(2) Use a press or special tool to hold the spring in compression then remove the chamber cover bolt.
**SST: Spring brake piston release bolt (09683-1051)**



M06021500014

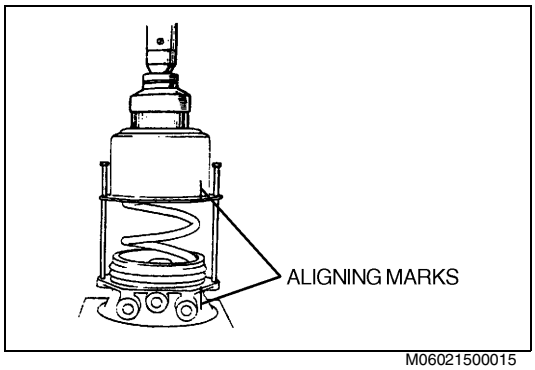
## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the spring brake chamber, replace the piston ring, bushing and O-ring with new ones.

(2) Apply grease or oil to each point.

- a Silicone grease: O-ring, Bushing, Piston ring and Spring brake chamber inner side.
- b Bearing grease: Release bolt
- c Rust preventive oil: Spring

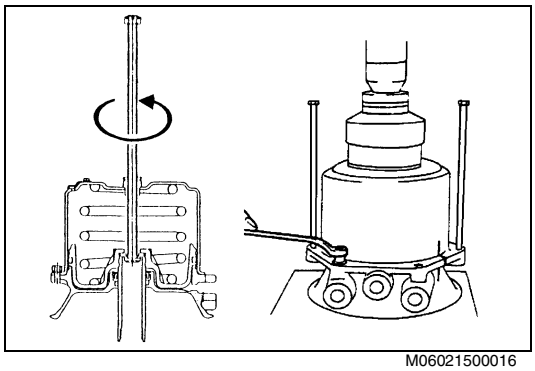


M06021500015

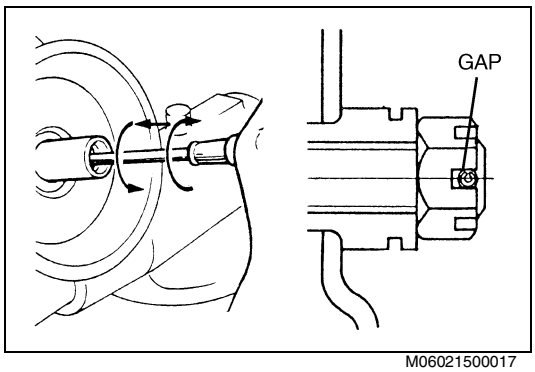
**2. ASSEMBLING THE SPRING BRAKE CHAMBER**

(1) Attach guide bolts to align the holes.

**NOTICE:**
**Align the aligning marks of the spring brake chamber and bulkhead.**


M06021500016

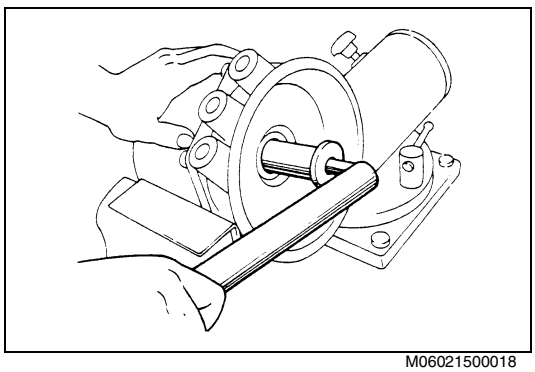
(2) Use a press or special tool to compress the spring then tighten the chamber cover with the bolts.
**SST: Spring brake piston release bolt (09683-1051)**



M06021500017

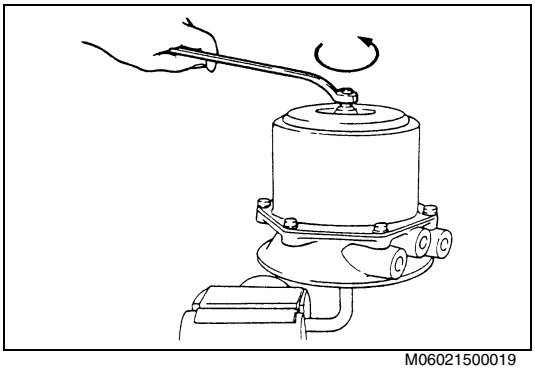
(3) Screw in the release bolt until its head contacts the piston flange, then return the release bolt one or two turns, then install the slotted nut and spring pin.

**NOTICE:**
**The spring pin should be installed as shown in the figure.**


M06021500018

(4) Install the piston follower on the piston.

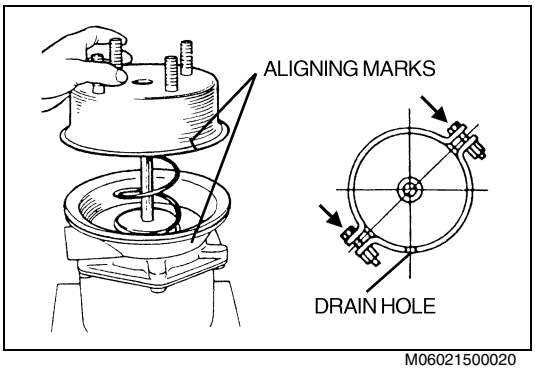
**NOTICE:**
**Apply locking adhesive (LOCTITE 242 or equivalent) to the thread of the piston follower.**


M06021500019

### 3. ASSEMBLING THE SERVICE BRAKE CHAMBER

(1) Turn the release bolt counterclockwise to compress the spring of the spring brake chamber.

**NOTICE:**
**To make turning easy, apply compressed air to the spring brake chamber.**

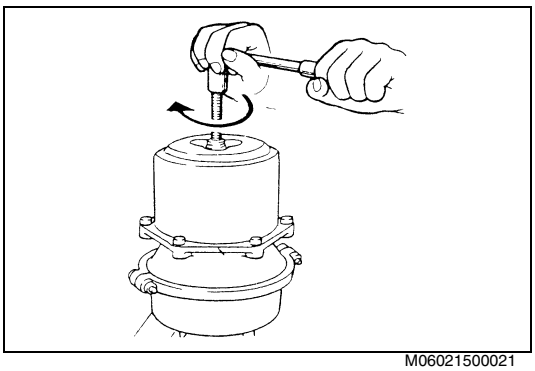


M06021500020

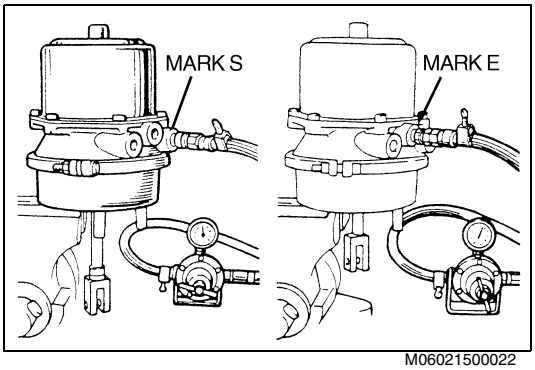
(2) When reassembling the chamber, replace the diaphragm with new one.

**NOTICE:**
**Align the aligning marks of the chamber, clamp band and bulkhead.**

(3) Insert the clamp band bolts from opposite side of drain hole and tighten the bolts evenly with nuts within specified torque.


M06021500021

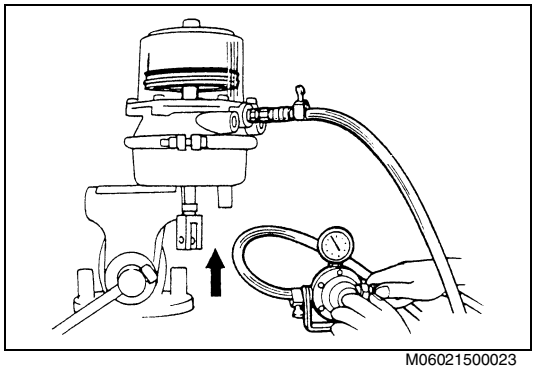
(4) Turn the release bolt clockwise to release the spring of the spring brake chamber.



M06021500022

### 4. INSPECTION FOR AIR LEAKAGE

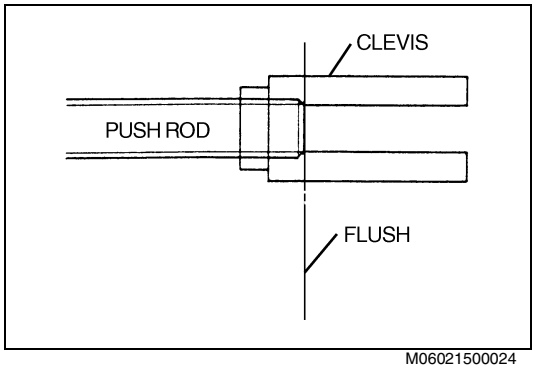
(1) Apply compressed air of 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} to both inlet ports marked E and S, and make sure that there is no air leakage from the joints of the assembly.


M06021500023

**5. INSPECTION FOR PISTON MOVEMENT**

(1) Apply compressed air of 640-830 kPa {6.5-8.5 kgf/cm$^2$, 93-120 lbf/in$^2$.} to the inlet port with mark E gradually and make sure that the push rod is completely returned.

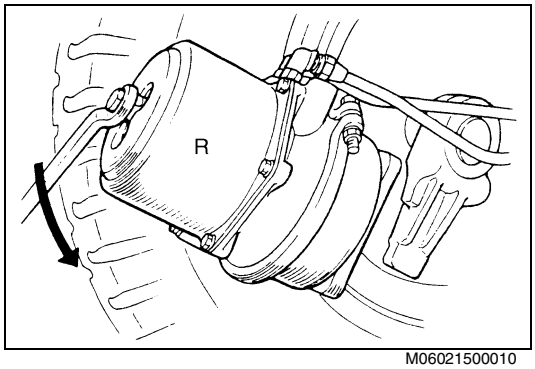
**Piston stroke: 62 mm {2.44 in.}**
**for spring brake chamber parts No.**
**47850-1890/ -1900/ -1971/ -1981/ -2530/ -2540/ -2551/ -2561/ -2570/ -2580/ -2590/ -2600/ -2650/ -2660/ -2670/ -2680/ -2720/ -2730/ -2810/ -2820/ -2830/ -2840/ -2850/ -2860/ -2870/ -2880/ -2890/ -2900/ -2990/ -3000/ -3230/ -3240**



M06021500024

**6. SETTING THE CLEVIS TO PUSH ROD**

(1) Screw the clevis into the push rod until the screw ends of both clevis and push rod are flush.



M06021500010

## IMPORTANT POINT - MOUNTING

**1. INSTALLING THE CHAMBER ASSEMBLY**

(1) Before mounting, turn the release bolt counterclockwise to release the spring brake.

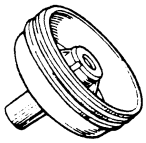
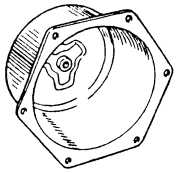
**NOTICE:**

- **Note the position mark R or L on the chamber which mark was applied when dismounting and install it to its former side.**
- **When connecting the clevis with slack adjuster, lubricate clevis pin-hole and clevis pin with sufficient chassis grease.**

(2) After mounting, the release bolt must be set at the specified torque.

# INSPECTION AND REPAIR

M06021501BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Piston:**<br>**Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Chamber:**<br>**Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Spring and compression spring:**<br>**Rust and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |

# SPRING BRAKE CHAMBER (TYPE-B)

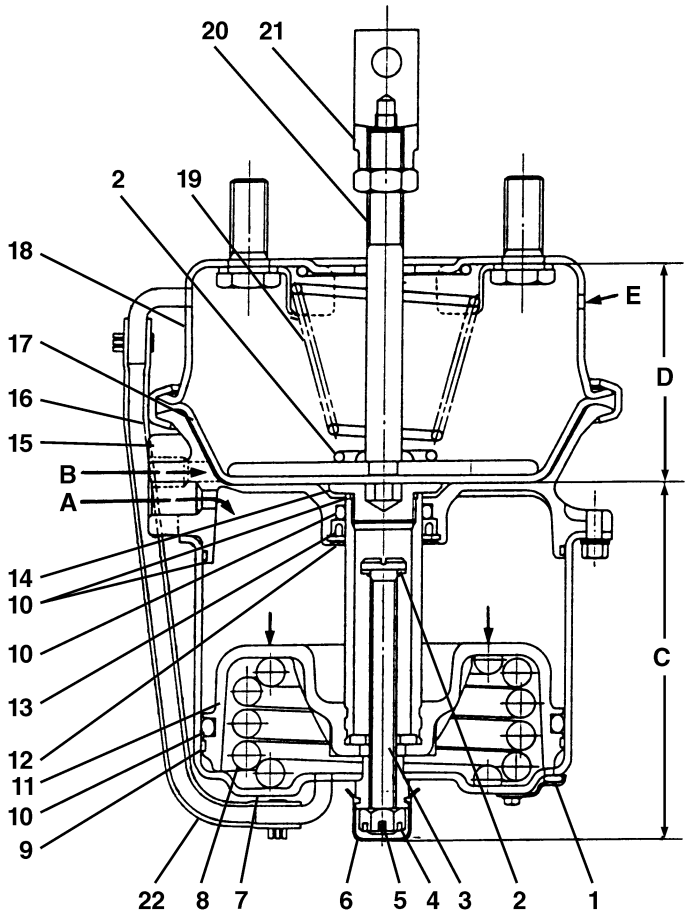
## DATA AND SPECIFICATIONS

M06021501BEI2002

| | |
|---|---|
| **Type** | **Spring and piston type brake chamber combined with diaphragm type chamber with breather tube** |

## DESCRIPTION

M06021501BEC1002



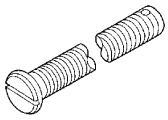

M06021500028

| | | | |
|---|---|---|---|
| 1 | Filter | 15 | Bulkhead |
| 2 | Retainer | 16 | Clamp band |
| 3 | Release bolt | 17 | Diaphragm |
| 4 | Slotted nut | 18 | Service brake chamber |
| 5 | Spring pin | 19 | Compression spring |
| 6 | Dust cover | 20 | Push rod |
| 7 | Spring brake chamber | 21 | Clevis |
| 8 | Spring | 22 | Breather tube |
| 9 | Piston ring | A | Spring brake air port (Emergency and parking) - for releasing air |
| 10 | O-ring | B | Service brake air port (Service) - for braking air |
| 11 | Piston | C | Spring brake portion |
| 12 | Retainer ring | D | Service brake portion |
| 13 | Bushing | E | Drain hole |
| 14 | Piston follower | | |

# SPECIAL TOOL

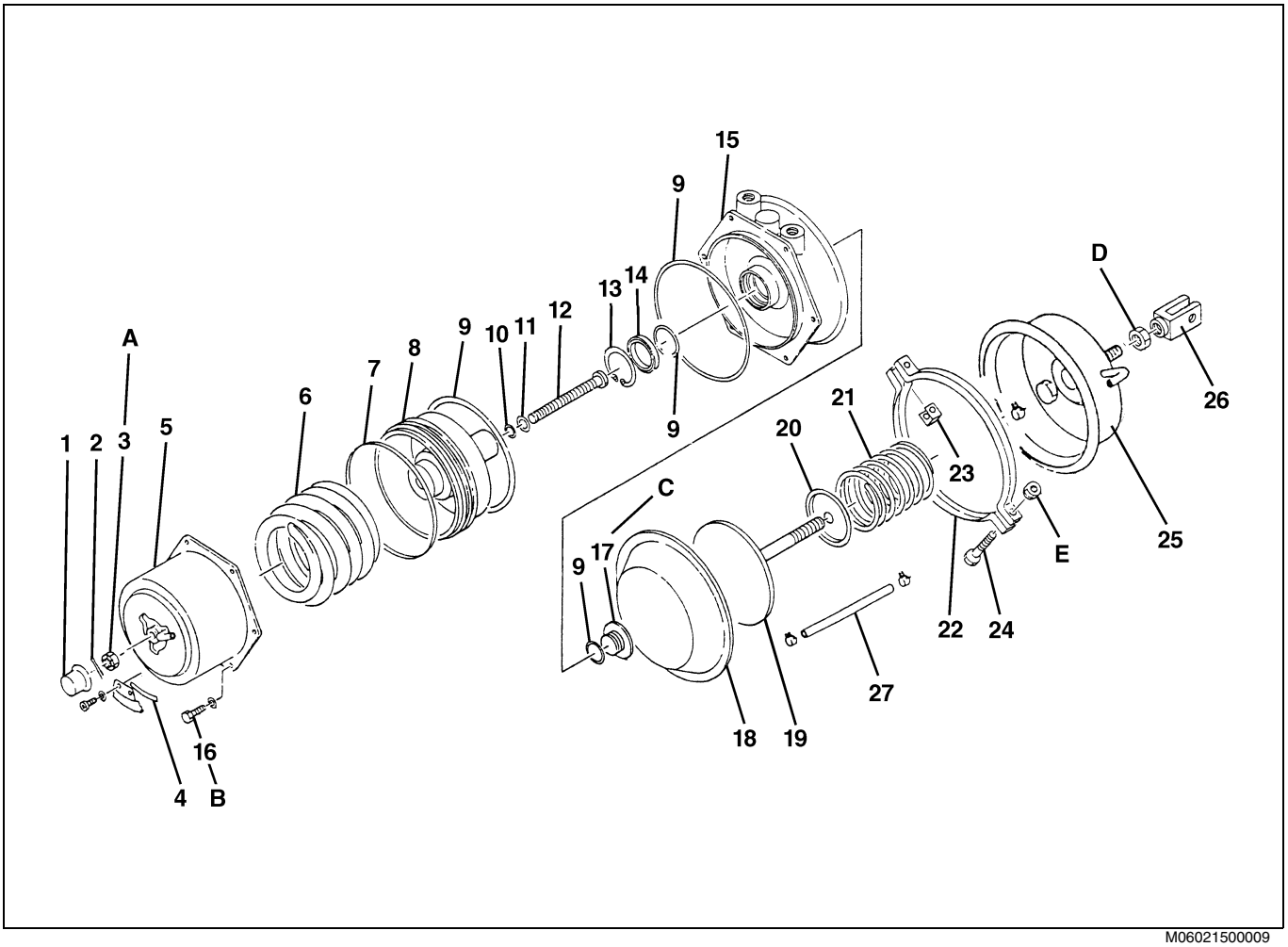
M06021501BEK1002

Prior to starting a spring brake chamber overhaul, it is necessary to have this special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09683-1051 | SPRING BRAKE PISTON RELEASE BOLT | |

# COMPONENT LOCATOR

M06021501BED1002




M06021500009

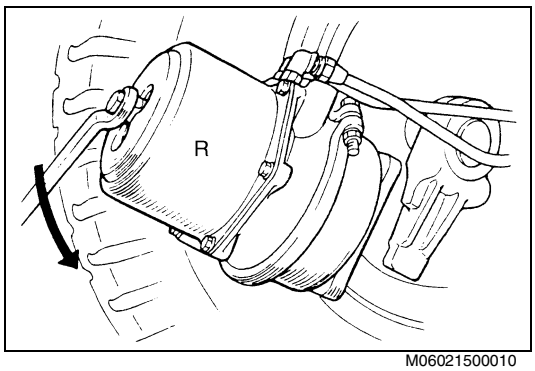
| | | | | | |
|---|---|---|---|---|---|
| 1 | Dust cover | 10 | Retainer | 19 | Push rod |
| 2 | Spring pin | 11 | Plain washer | 20 | Spring retainer |
| 3 | Slotted nut | 12 | Release bolt | 21 | Compression spring |
| 4 | Filter | 13 | Retainer ring | 22 | Clamp band |
| 5 | Spring brake chamber | 14 | Bushing | 23 | Spacer |
| 6 | Spring | 15 | Bulkhead | 24 | Clamp band bolt |
| 7 | Piston ring | 16 | Chamber cover bolt | 25 | Service brake chamber |
| 8 | Piston | 17 | Piston follower | 26 | Clevis |
| 9 | O-ring | 18 | Diaphragm | 27 | Breather tube |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 39.2-44.2 {400-450, 29-32} | D | 39.0-49.0 {400-500, 29-36} |
| B | 9.8-17.6 {100-180, 7.3-13.0} | E | 26.5-32.3 {270-330, 20-23} |
| C | 39.0-49.0 {400-500, 29-36} | | |

# OVERHAUL

M06021501BEH2002



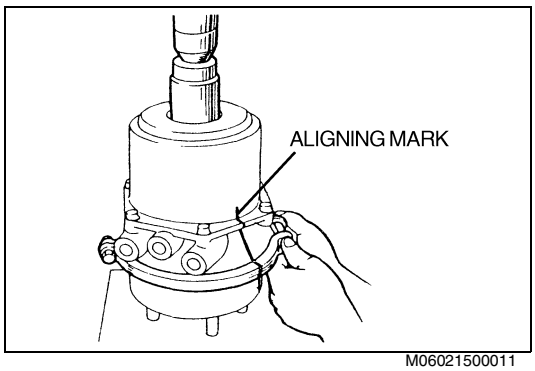
M06021500010

## IMPORTANT POINT - DISMOUNTING

**1. DISMOUNTING THE CHAMBER ASSEMBLY**

(1) Before dismounting the chamber, turn the release bolt counterclockwise to release the spring brake.

(2) Apply a position mark R or L to make clear the side where the chamber was installed.

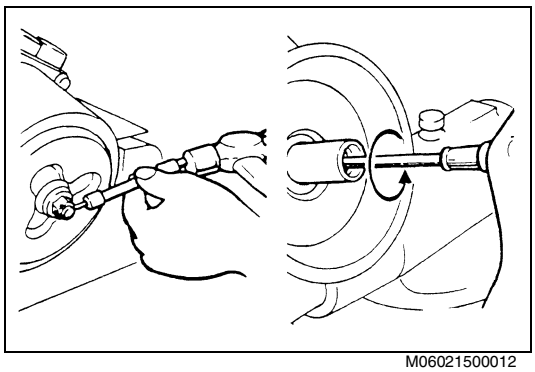


M06021500011

## IMPORTANT POINTS - DISASSEMBLY

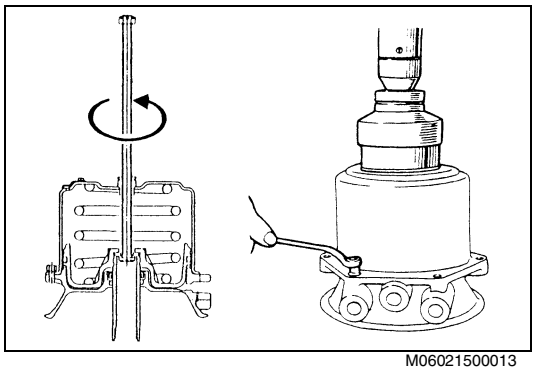
**NOTICE:**

**Before disassembling, put aligning marks to the clamp band, service brake chamber, bulkhead and spring brake chamber.**

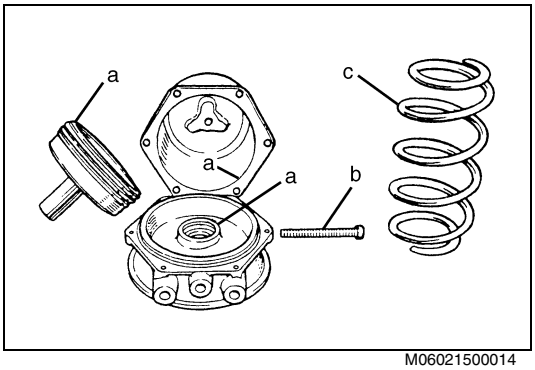

M06021500012

**1. DISASSEMBLING THE SPRING BRAKE CHAMBER**

(1) Remove the piston follower and then remove the dust cover, spring pin and release bolt.


M06021500013

(2) Use a press or special tool to hold the spring in compression then remove the chamber cover bolt.
**SST: Spring brake piston release bolt (09683-1051)**



M06021500014

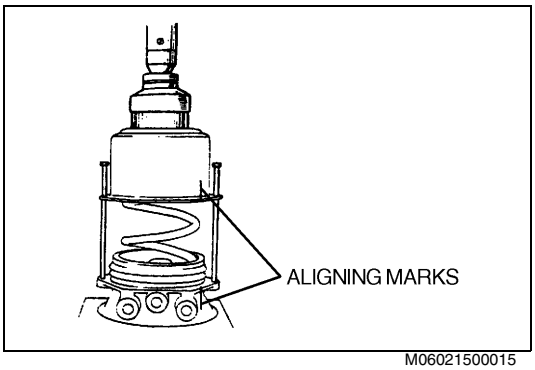
## IMPORTANT POINTS - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the spring brake chamber, replace the piston ring, bushing and O-ring with new ones.

(2) Apply grease or oil to each point.

- a Silicone grease: O-ring, Bushing, Piston ring and Spring brake chamber inner side.
- b Bearing grease: Release bolt
- c Rust preventive oil: Spring

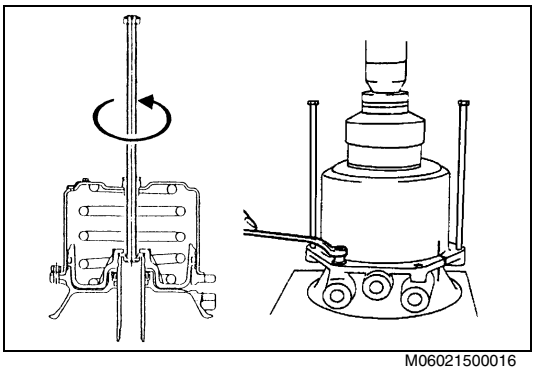


M06021500015

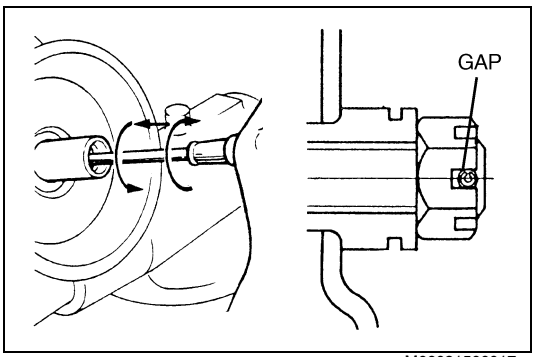
**2. ASSEMBLING THE SPRING BRAKE CHAMBER**

(1) Attach guide bolts to align the holes.

**NOTICE:**
**Align the aligning marks of the spring brake chamber and bulkhead.**


M06021500016

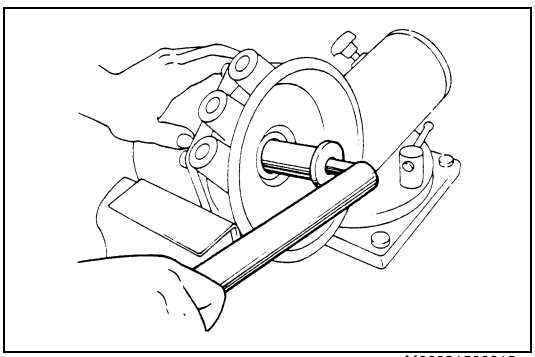
(2) Use a press or special tool to compress the spring then tighten the chamber cover with the bolts.
**SST: Spring brake piston release bolt (09683-1051)**



M06021500017

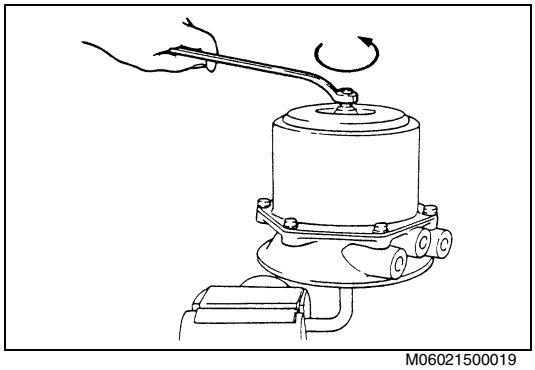
(3) Screw in the release bolt until its head contacts the piston flange, then return the release bolt one or two turns, then install the slotted nut and spring pin.

**NOTICE:**
**The spring pin should be installed as shown in the figure.**


M06021500018

(4) Install the piston follower on the piston.

**NOTICE:**
**Apply locking adhesive (LOCTITE 242 or equivalent) to the thread of the piston follower.**

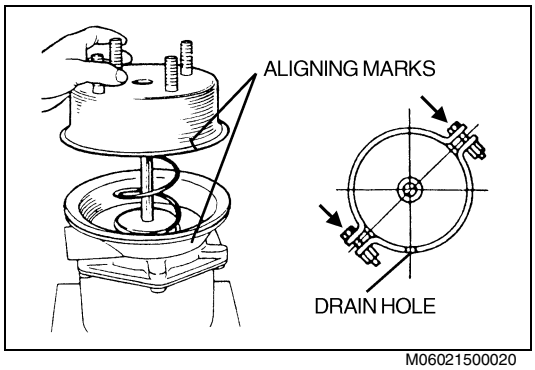


M06021500019

### 3. ASSEMBLING THE SERVICE BRAKE CHAMBER

(1) Turn the release bolt counterclockwise to compress the spring of the spring brake chamber.

**NOTICE:**
**To make turning easy, apply compressed air to the spring brake chamber.**

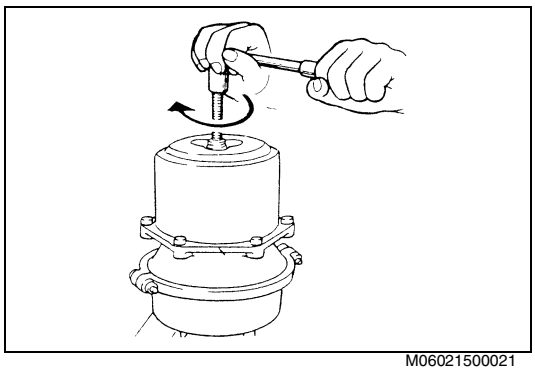



M06021500020

(2) When reassembling the chamber, replace the diaphragm with new one.

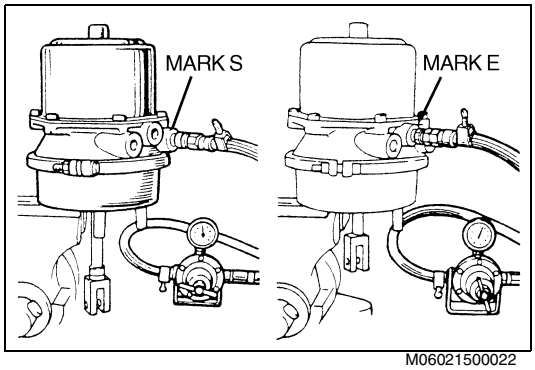
**NOTICE:**
**Align the aligning marks of the chamber, clamp band and bulkhead.**

(3) Insert the clamp band bolts from opposite side of drain hole and tighten the bolts evenly with nuts within specified torque.



M06021500021

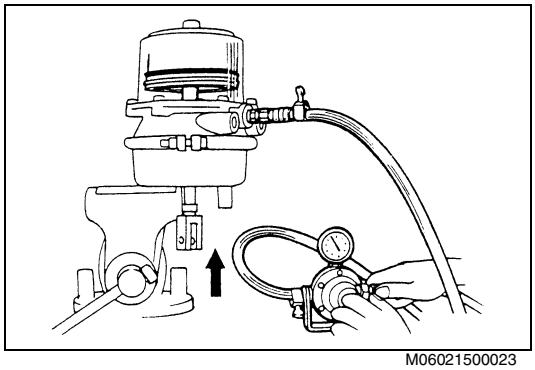
(4) Turn the release bolt clockwise to release the spring of the spring brake chamber.




M06021500022

### 4. INSPECTION FOR AIR LEAKAGE

(1) Apply compressed air of 834 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} to both inlet ports marked E and S, and make sure that there is no air leakage from the joints of the assembly.

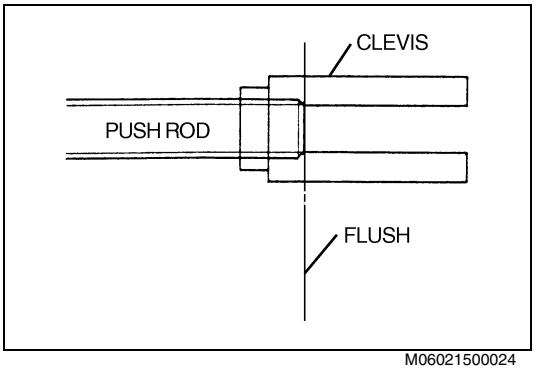


M06021500023

### 5. INSPECTION FOR PISTON MOVEMENT

(1) Apply compressed air of 490 kPa {5.0 kgf/cm$^2$, 71 lbf/in$^2$.} to the inlet port with mark E gradually and make sure that the push rod is completely returned.

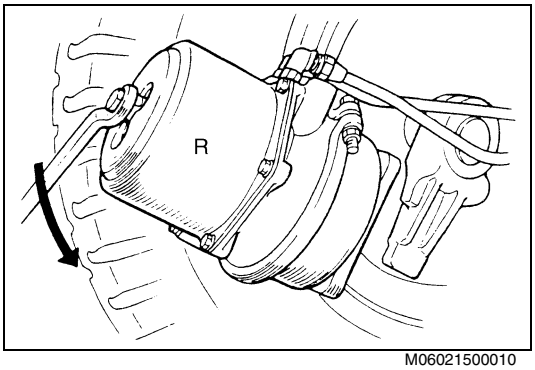
**Piston stroke: 52 mm {2.05 in.}**
**for spring brake chamber parts No.**
**47850-2920/ -2930/ -2940/ -2950/ -3030/ -3040**



M06021500024

**6. SETTING THE CLEVIS TO PUSH ROD**

(1) Screw the clevis into the push rod until the screw ends of both clevis and push rod are flush.



M06021500010

## IMPORTANT POINT - MOUNTING

**1. INSTALLING THE CHAMBER ASSEMBLY**

(1) Before mounting, turn the release bolt counterclockwise to release the spring brake.

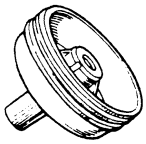
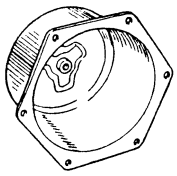
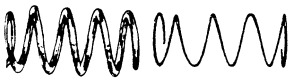
**NOTICE:**

- **Note the position mark R or L on the chamber which mark was applied when dismounting and install it to its former side.**
- **When connecting the clevis with slack adjuster, lubricate clevis pin-hole and clevis pin with sufficient chassis grease.**

(2) After mounting, the release bolt must be set at the specified torque.

# INSPECTION AND REPAIR

**M06021501BEH3002**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Piston:<br>Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Chamber:<br>Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Spring and compression spring:<br>Rust and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |

# WHEEL BRAKE

## DATA AND SPECIFICATIONS

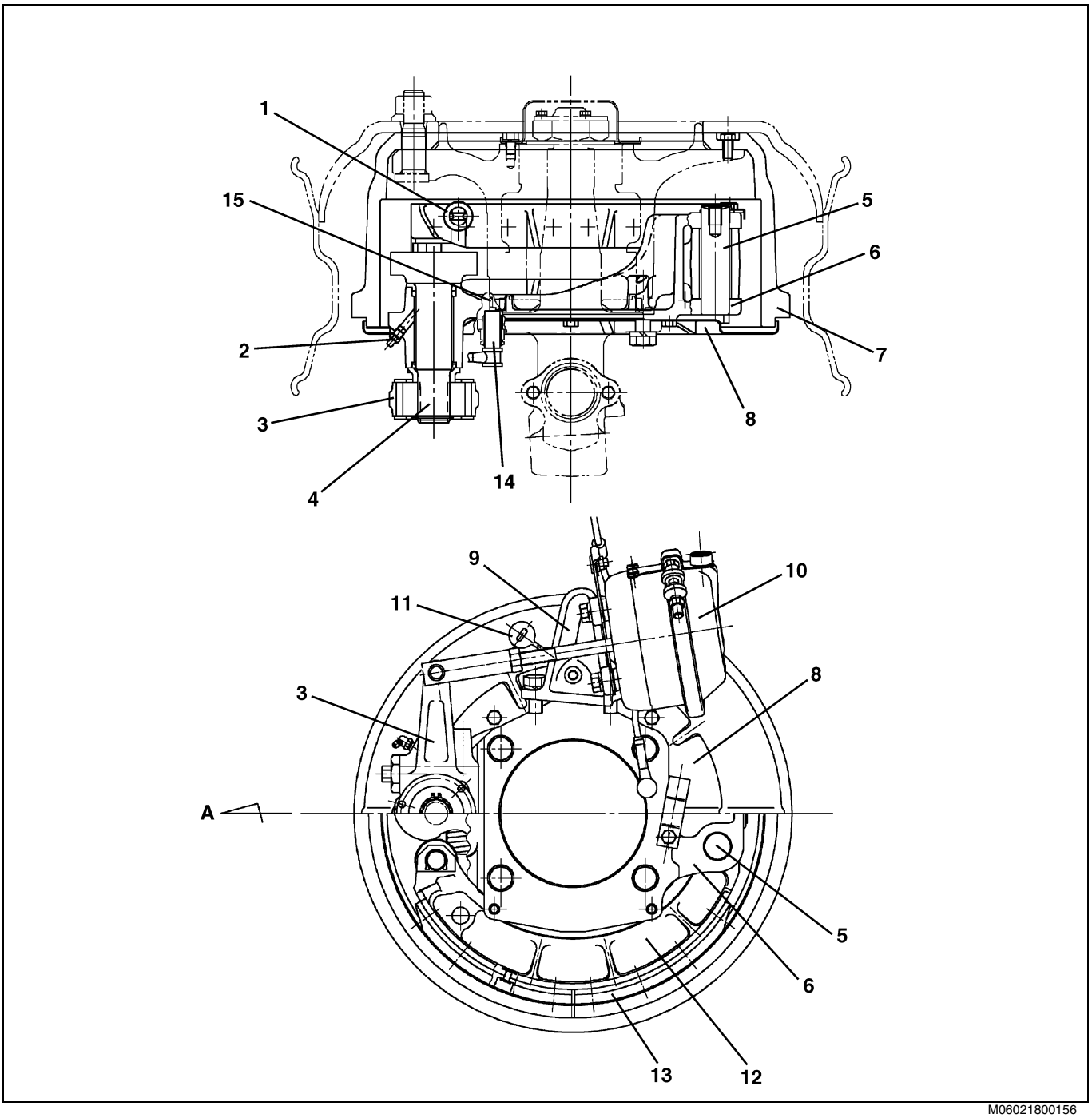
M06020118BEI2004

| | | | |
|---|---|---|---|
| **Type** | | **Drum brake with internally expanding, leading-trailing shoes operating by cam shaft and slack adjuster in all wheels.** | |
| **Brake drum inside diameter** | | | **406.4 mm {16.0 in.} for both front and rear.** |
| **Brake lining Width x Thickness** | **Models: FG, GH** | **Front** | **127 x 15.5 mm {5.0 x 0.61 in.}** |
| | | **Rear** | **203 x 15.5 mm {8.0 x 0.61 in.}** |
| | **Models: FL, FM** | **Front** | **152 x 15.5 mm {6.0 x 0.61 in.}** |
| | | **Rear** | **216 x 15.5 mm {8.5 x 0.61 in.}** |

# DESCRIPTION

M06021801BEC1007

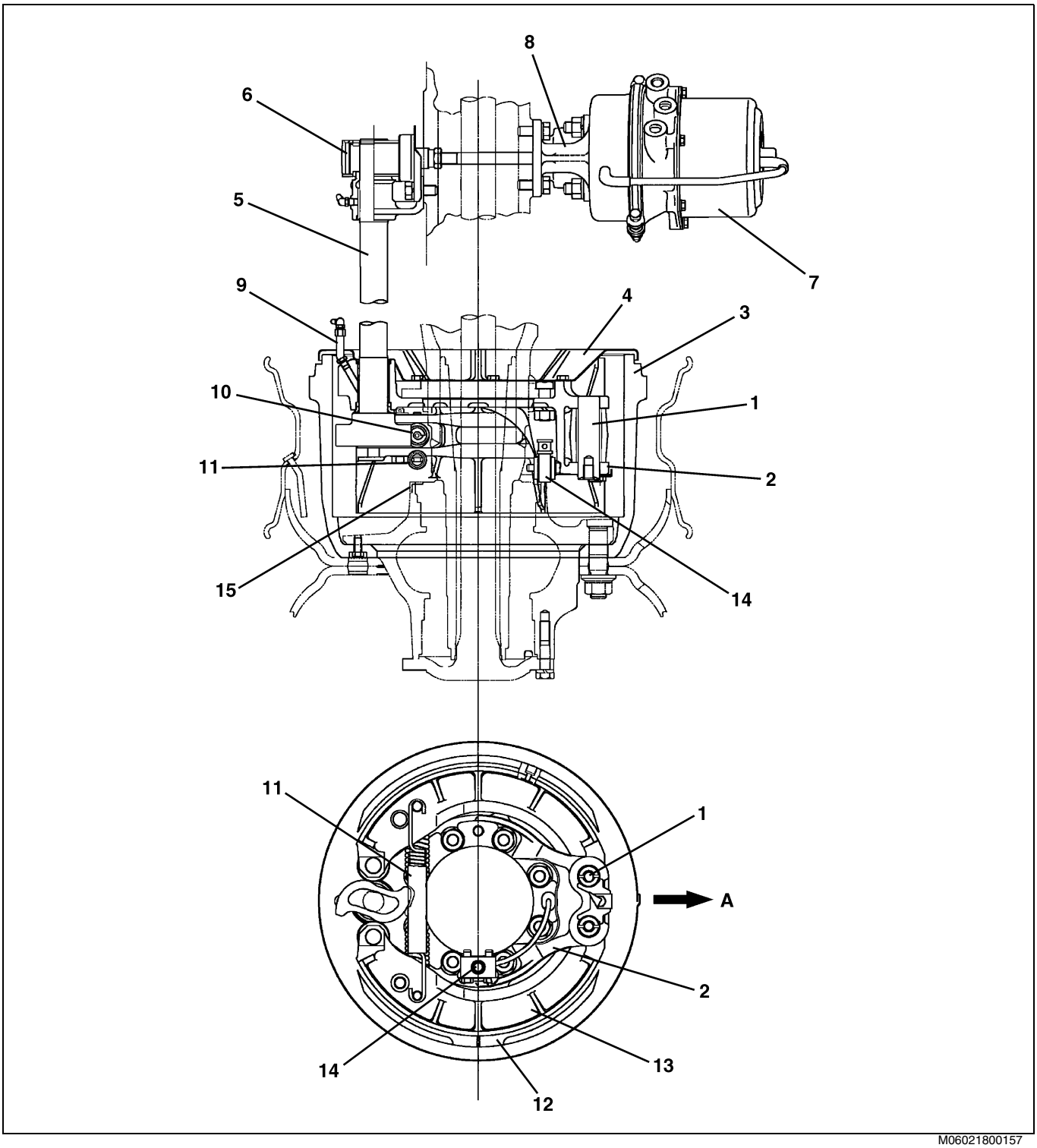
## FRONT (MODELS: FG, GH)




M06021800156

| | | | |
|---|---|---|---|
| 1 | Brake shoe return spring | 9 | Brake chamber bracket |
| 2 | Lubrication fitting | 10 | Brake chamber |
| 3 | Slack adjuster | 11 | Hole plug |
| 4 | Cam shaft | 12 | Brake shoe |
| 5 | Anchor pin | 13 | Brake lining |
| 6 | Brake spider | 14 | Wheel sensor (If so equipped) |
| 7 | Brake drum | 15 | Sensor ring (If so equipped) |
| 8 | Brake drum cover | A | Front |

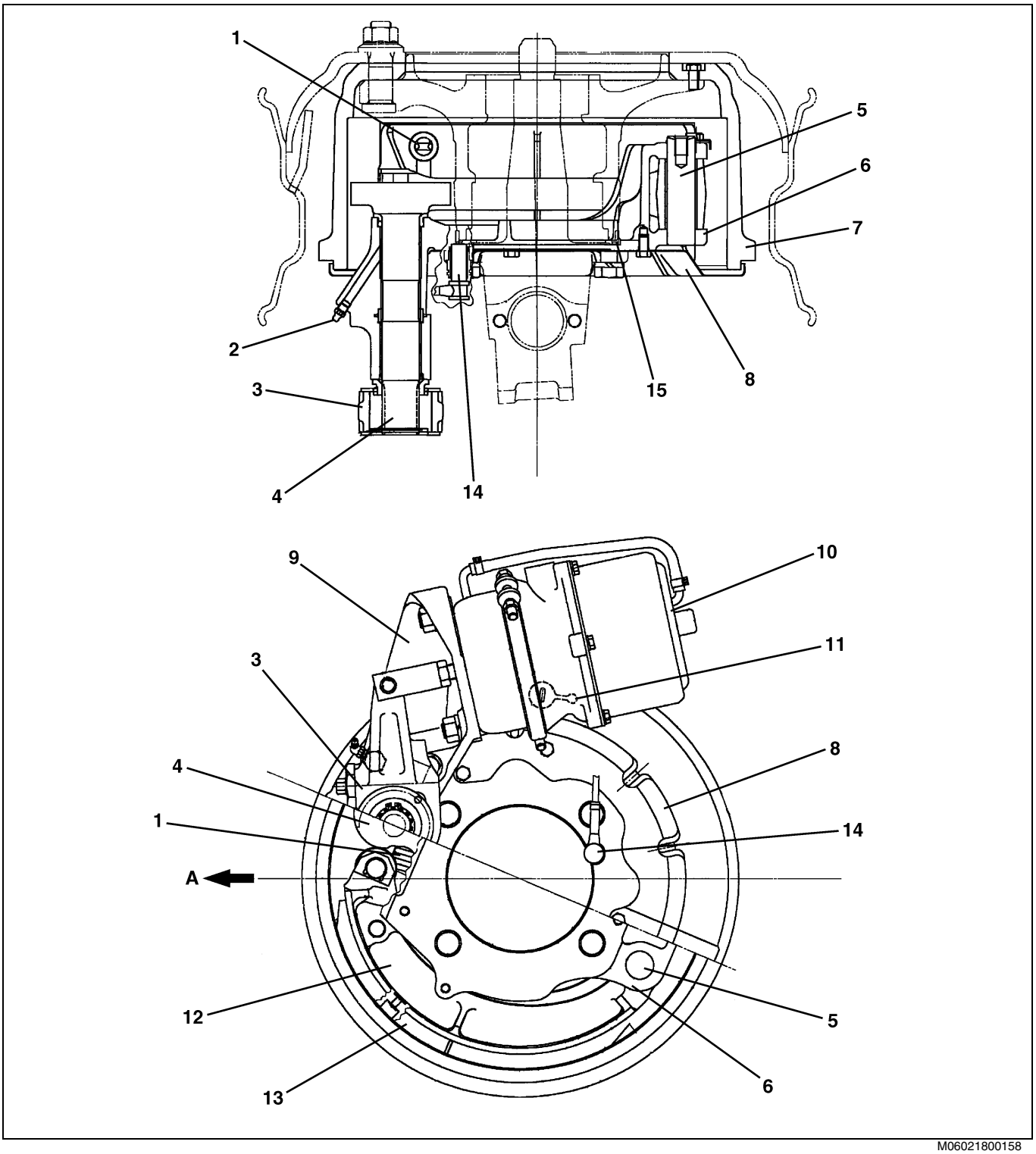
## REAR (MODELS: FG, GH)




M06021800157

| | | | |
|---|---|---|---|
| 1 | Anchor pin | 9 | Lubrication fitting |
| 2 | Brake spider | 10 | Brake shoe return spring (Inner) |
| 3 | Brake drum | 11 | Brake shoe return spring (Outer) |
| 4 | Brake drum cover | 12 | Brake lining |
| 5 | Cam shaft | 13 | Brake shoe |
| 6 | Slack adjuster | 14 | Wheel sensor (If so equipped) |
| 7 | Spring brake chamber | 15 | Sensor ring (If so equipped) |
| 8 | Brake chamber bracket | A | Front |

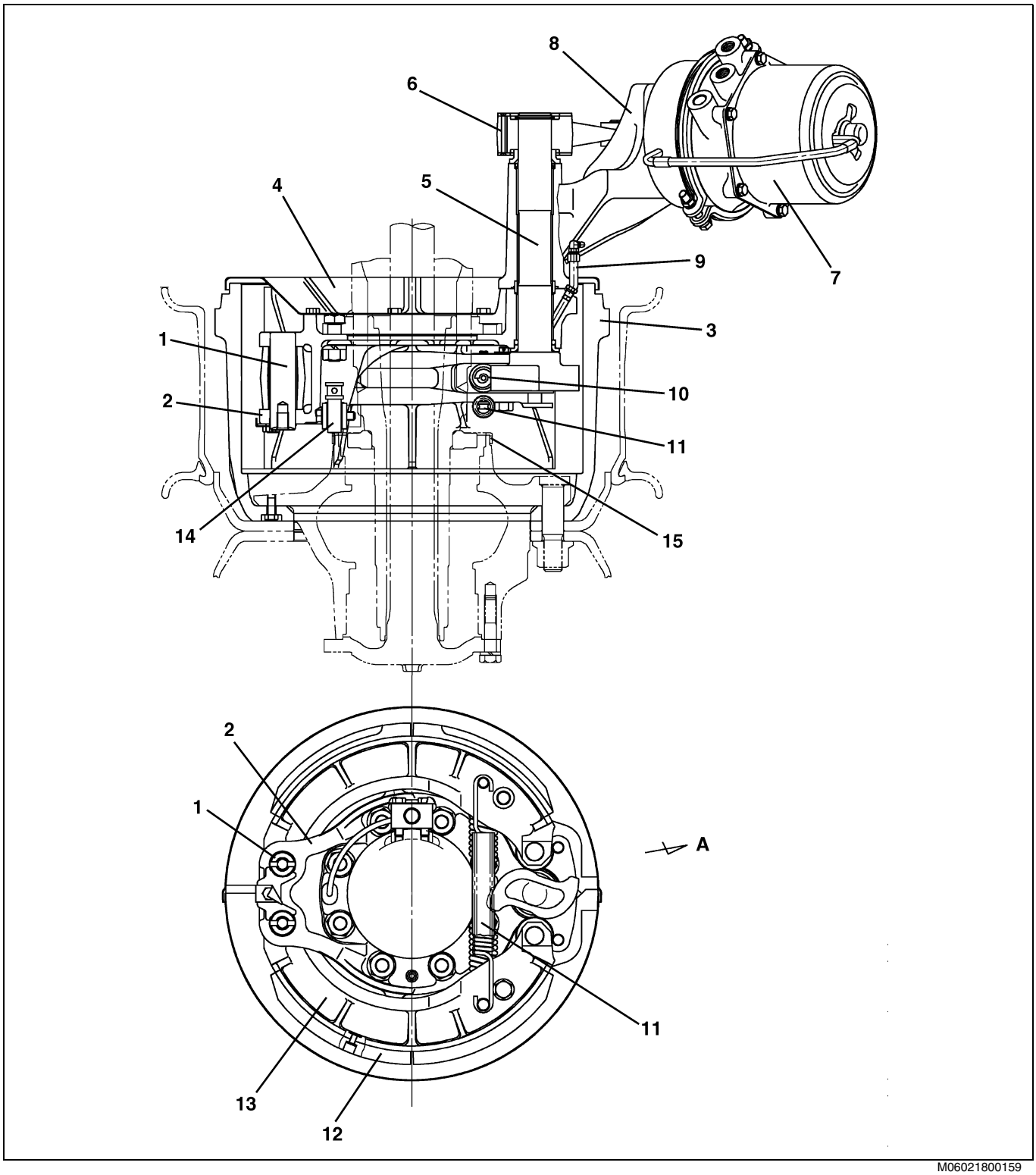
## FRONT (MODELS: FL, FM)




M06021800158

| | | | |
|---|---|---|---|
| 1 | Brake shoe return spring | 9 | Brake chamber bracket |
| 2 | Lubrication fitting | 10 | Spring brake chamber |
| 3 | Slack adjuster | 11 | Hole plug |
| 4 | Cam shaft | 12 | Brake shoe |
| 5 | Anchor pin | 13 | Brake lining |
| 6 | Brake spider | 14 | Wheel sensor (If so equipped) |
| 7 | Brake drum | 15 | Sensor ring (If so equipped) |
| 8 | Brake drum cover | A | Front |

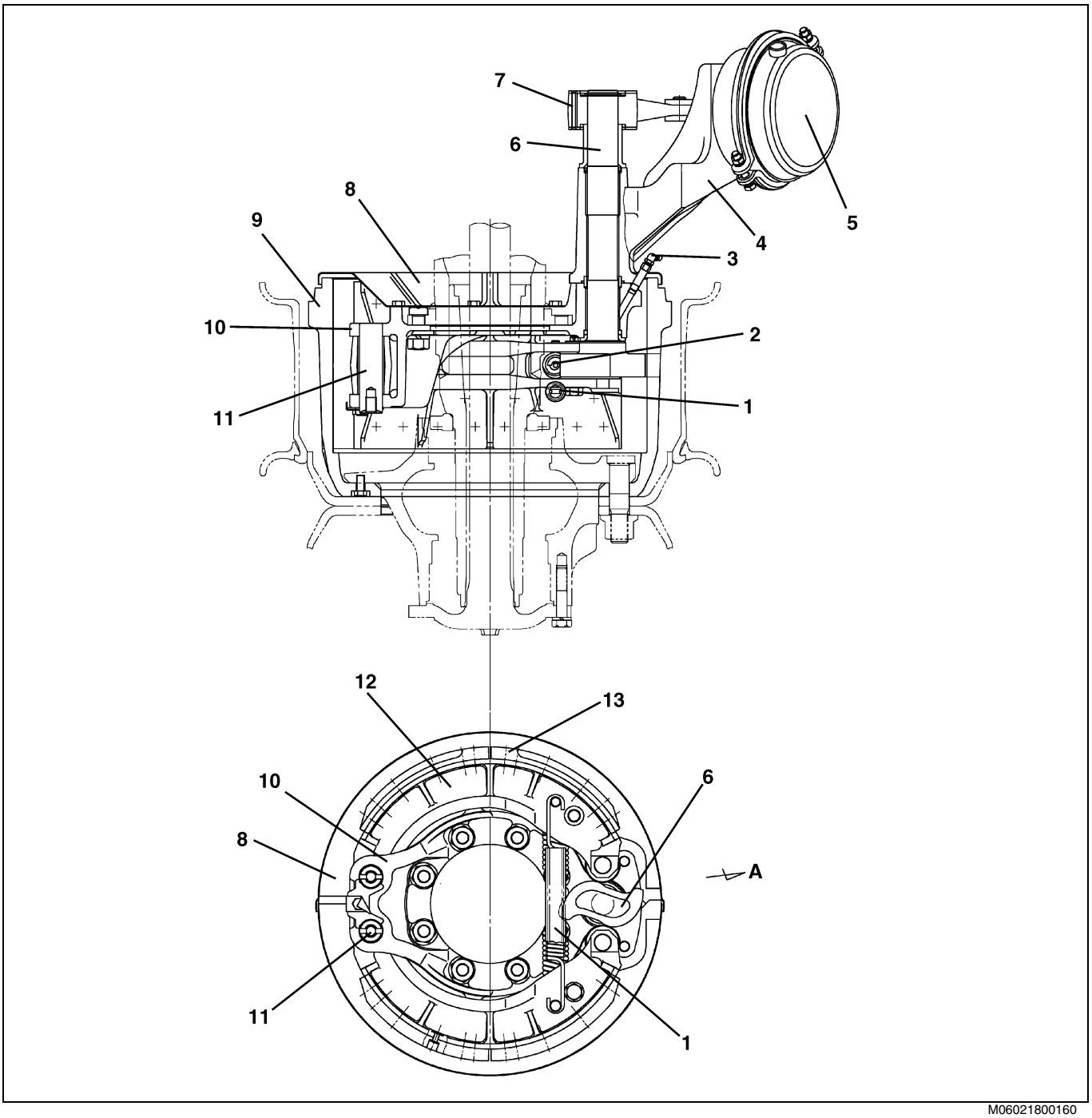
## REAR (Frontward) (MODELS: FL, FM)




M06021800159

| | | | |
|---|---|---|---|
| 1 | Anchor pin | 9 | Lubrication fitting |
| 2 | Brake spider | 10 | Brake shoe return spring (Inner) |
| 3 | Brake drum | 11 | Brake shoe return spring (Outer) |
| 4 | Brake drum cover | 12 | Brake lining |
| 5 | Cam shaft | 13 | Brake shoe |
| 6 | Slack adjuster | 14 | Wheel sensor (If so equipped) |
| 7 | Spring brake chamber | 15 | Sensor ring (If so equipped) |
| 8 | Brake chamber bracket | A | Front |

## REAR (Rearward) (MODELS: FL, FM)



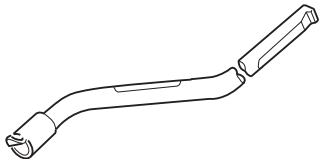
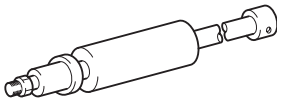
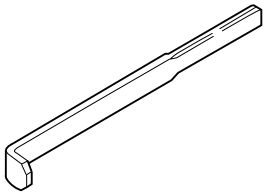

M06021800160

| | | | |
|---|---|---|---|
| 1 | Brake shoe return spring (Outer) | 8 | Brake drum cover |
| 2 | Brake shoe return spring (Inner) | 9 | Brake drum |
| 3 | Lubrication fitting | 10 | Brake spider |
| 4 | Brake chamber bracket | 11 | Anchor pin |
| 5 | Brake chamber | 12 | Brake shoe |
| 6 | Cam shaft | 13 | Brake lining |
| 7 | Slack adjuster | A | Front |

# SPECIAL TOOL

M06021801BEK1006

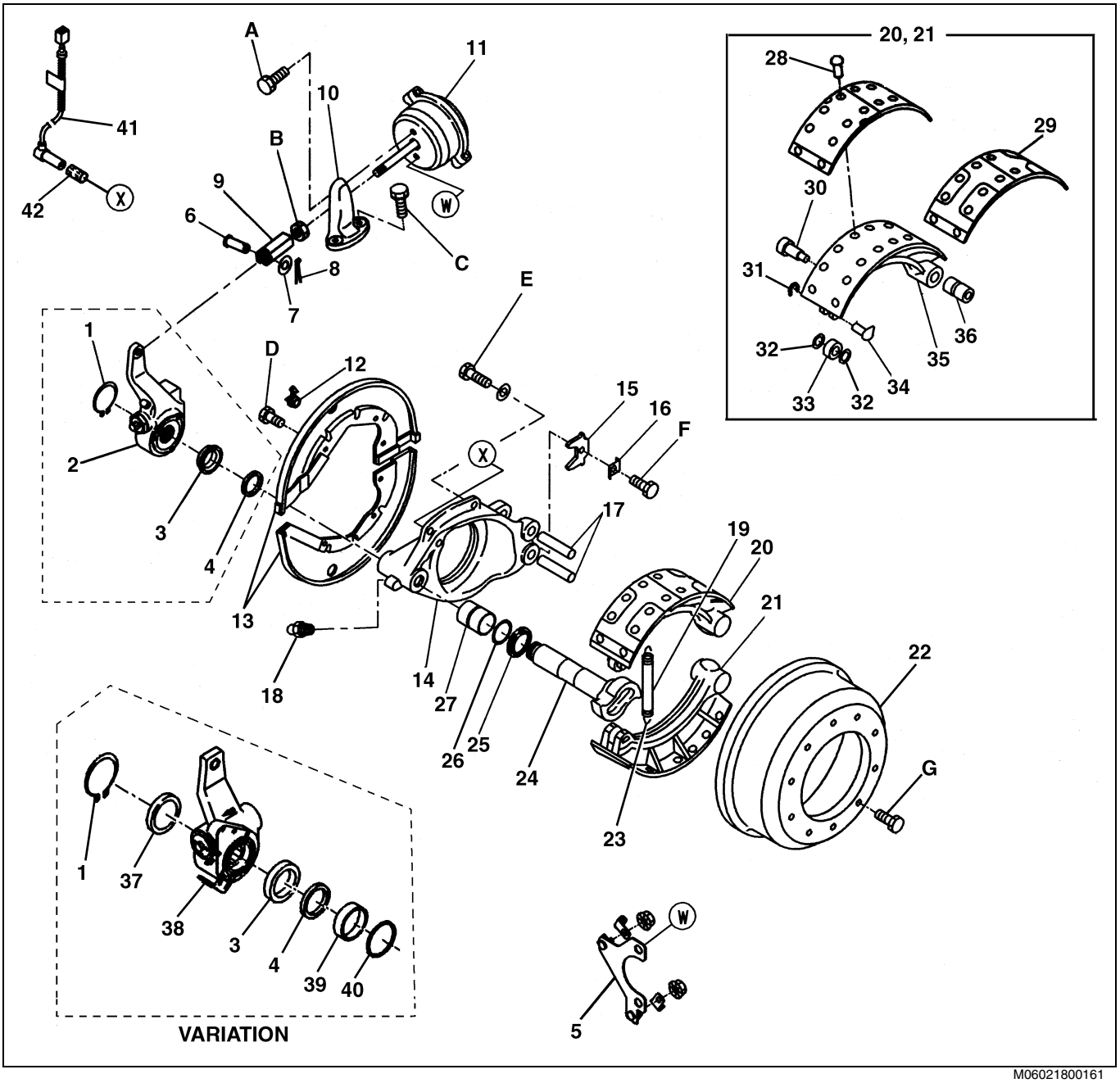
Prior to starting a wheel brake overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09683-1070 | SPRING PULL BACK TOOL | |
|  | 09420-1510 | ANCHOR PIN PULLER | |
|  | 09684-1010 | ANCHOR PIN TOOL | |

# COMPONENT LOCATOR

M06020118BED1007

## FRONT (MODELS: FG, GH)



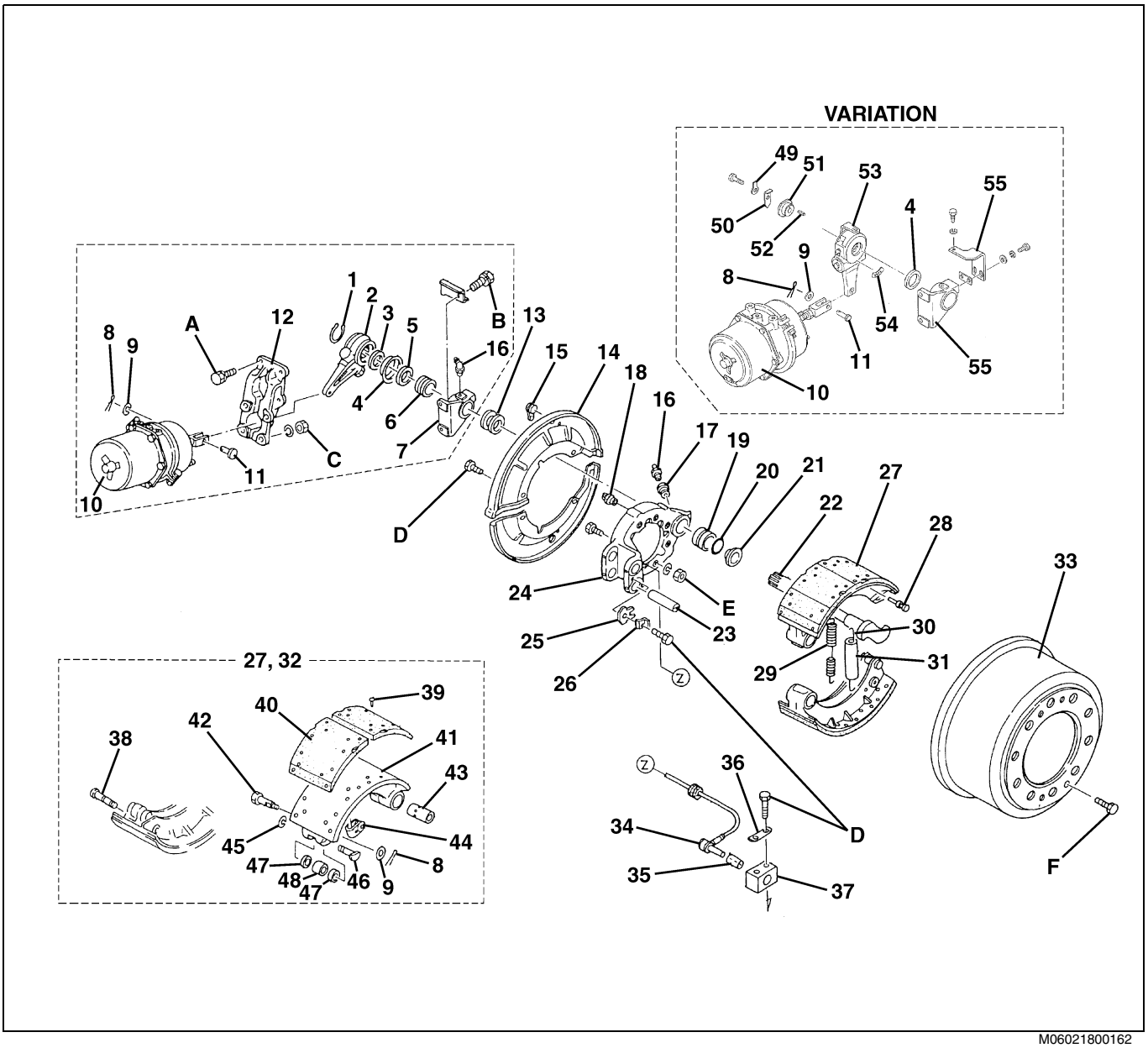

M06021800161

| | | | | | |
|---|---|---|---|---|---|
| 1 | Retainer ring | 15 | Retainer | 29 | Brake lining |
| 2 | Slack adjuster | 16 | Lock plate | 30 | Spring hanger |
| 3 | Collar | 17 | Anchor pin | 31 | Retainer ring |
| 4 | Oil seal | 18 | Lubrication fitting | 32 | Seal |
| 5 | Bracket | 19 | Spring cover | 33 | Roller |
| 6 | Pin | 20 | Brake shoe assembly (Trailing) | 34 | Pin |
| 7 | Washer | 21 | Brake shoe assembly (Leading) | 35 | Brake shoe |
| 8 | Cotter pin | 22 | Brake drum | 36 | Bushing |
| 9 | Clevis | 23 | Brake shoe return spring | 37 | Thrust washer (If so equipped) |
| 10 | Brake chamber bracket | 24 | Cam shaft | 38 | Auto slack adjuster (If so equipped) |
| 11 | Brake chamber | 25 | Collar | 39 | Spacer (If so equipped) |
| 12 | Hole plug | 26 | O-ring | 40 | O-ring (If so equipped) |
| 13 | Brake drum cover | 27 | Bushing | 41 | Wheel sensor (If so equipped) |
| 14 | Brake spider | 28 | Rivet | 42 | Sleeve (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 64-86 {650-870, 47-63} | E | 168-226 {1,710-2,300, 124-166} |
| B | 50-68 {510-690, 36-50} | F | 34.5-51.5 {351-527, 26-38} |
| C | 109-147 {1,100-1,500, 80-108} | G | 20.5-31.5 {200-400, 15-28} |
| D | 34.5-51.5 {351-527, 26-38} | | |

## REAR (MODELS: FG, GH)



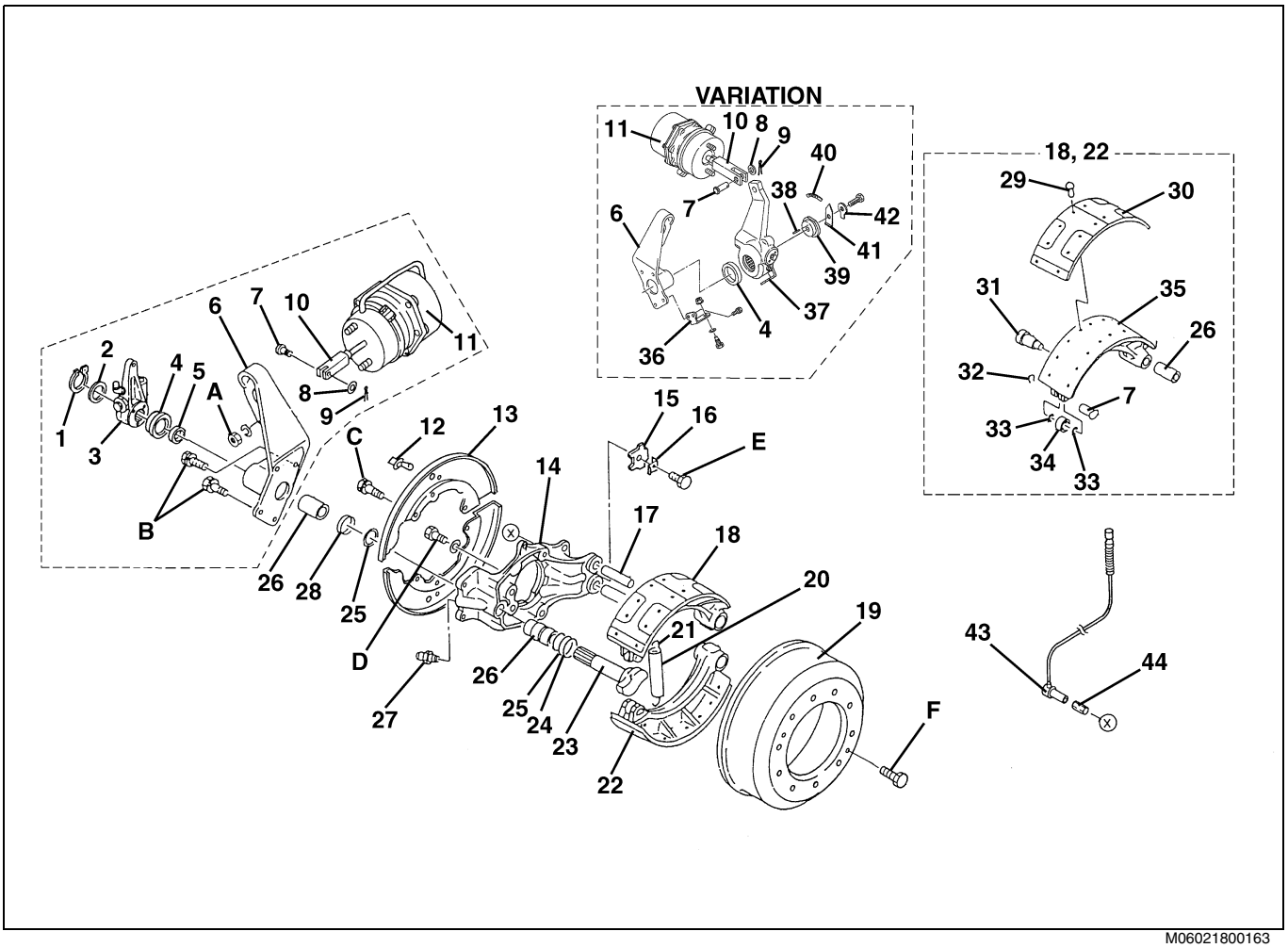

M06021800162

| | | | | | |
|---|---|---|---|---|---|
| 1 | Retainer ring | 20 | O-ring | 39 | Rivet |
| 2 | Slack adjuster | 21 | Collar | 40 | Brake lining |
| 3 | Thrust washer | 22 | Cam shaft | 41 | Brake shoe |
| 4 | Collar | 23 | Anchor pin | 42 | Rivet pin |
| 5 | Oil seal | 24 | Brake spider | 43 | Bushing |
| 6 | Bushing | 25 | Retainer | 44 | Clamp |
| 7 | Bracket | 26 | Lock plate | 45 | Retainer ring |
| 8 | Cotter pin | 27 | Brake shoe assembly (Trailing) | 46 | Pin |
| 9 | Washer | 28 | Spring hanger | 47 | Seal |
| 10 | Spring brake chamber | 29 | Brake shoe return spring (Inner) | 48 | Roller |
| 11 | Pin | 30 | Brake shoe return spring (Outer) | 49 | Lock washer (If so equipped) |
| 12 | Brake chamber bracket | 31 | Spring cover | 50 | Indicator (If so equipped) |
| 13 | Oil seal | 32 | Brake shoe assembly (Leading) | 51 | Spacer (If so equipped) |
| 14 | Brake drum cover | 33 | Brake drum | 52 | Pin (If so equipped) |
| 15 | Hole plug | 34 | Wheel sensor (If so equipped) | 53 | Auto slack adjuster (If so equipped) |
| 16 | Lubrication fitting | 35 | Sleeve (If so equipped) | 54 | Plate (If so equipped) |
| 17 | Joint | 36 | Lock washer (If so equipped) | 55 | Bracket (If so equipped) |
| 18 | Hole plug | 37 | Holder (If so equipped) | | |
| 19 | Bushing | 38 | Spring hanger | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 109-147 {1.100-1.500, 80-108} | D | 34.5-51.5 {351-527, 26-38} |
| B | 110-150 {1,100-1,500, 80-108} | E | 168-225 {1,710-2,300, 124-166} |
| C | 119-225 {1,200-2,300, 81-166} | F | 21-39 {200-400, 15-28} |

## FRONT (MODELS: FL, FM)



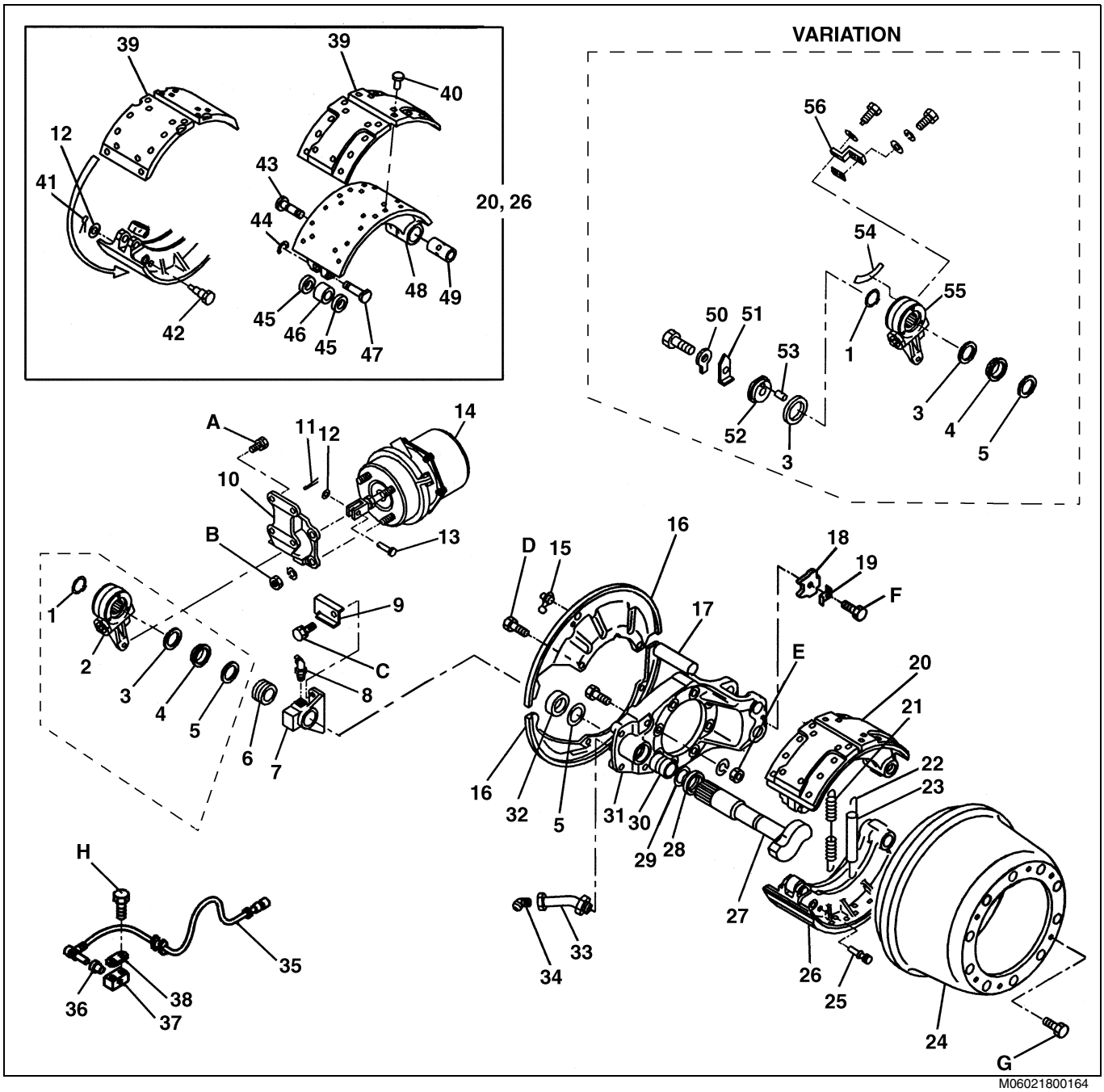

M06021800163

| | | | | | |
|---|---|---|---|---|---|
| 1 | Retainer ring | 16 | Lock plate | 31 | Spring hanger |
| 2 | Thrust washer | 17 | Anchor pin | 32 | Retainer ring |
| 3 | Slack adjuster | 18 | Brake shoe assembly (Trailing) | 33 | Seal |
| 4 | Collar | 19 | Brake drum | 34 | Roller |
| 5 | Oil seal | 20 | Spring cover | 35 | Brake shoe |
| 6 | Brake chamber bracket | 21 | Brake shoe return spring | 36 | Bracket (If so equipped) |
| 7 | Pin | 22 | Brake shoe assembly (Leading) | 37 | Auto slack adjuster (If so equipped) |
| 8 | Washer | 23 | Cam shaft | 38 | Pin (If so equipped) |
| 9 | Cotter pin | 24 | Collar | 39 | Spacer (If so equipped) |
| 10 | Clevis | 25 | O-ring | 40 | Plate (If so equipped) |
| 11 | Spring brake chamber | 26 | Bushing | 41 | Indicator (If so equipped) |
| 12 | Hole plug | 27 | Lubrication fitting | 42 | Lock washer (If so equipped) |
| 13 | Brake drum cover | 28 | Spacer | 43 | Wheel sensor (If so equipped) |
| 14 | Brake spider | 29 | Rivet | 44 | Sleeve (If so equipped) |
| 15 | Retainer | 30 | Brake lining | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 119-225 {1,200-2,300, 87-166} | D | 246-324 {2,500-3,300, 181-238} |
| B | 109-147 {1,100-1,500, 80-108} | E | 34.5-51.5 {351-527, 26-38} |
| C | 34.5-51.5 {351-527, 26-38} | F | 20.5-39.5 {200-400, 15-28} |

## REAR (Frontward) (MODELS: FL, FM)

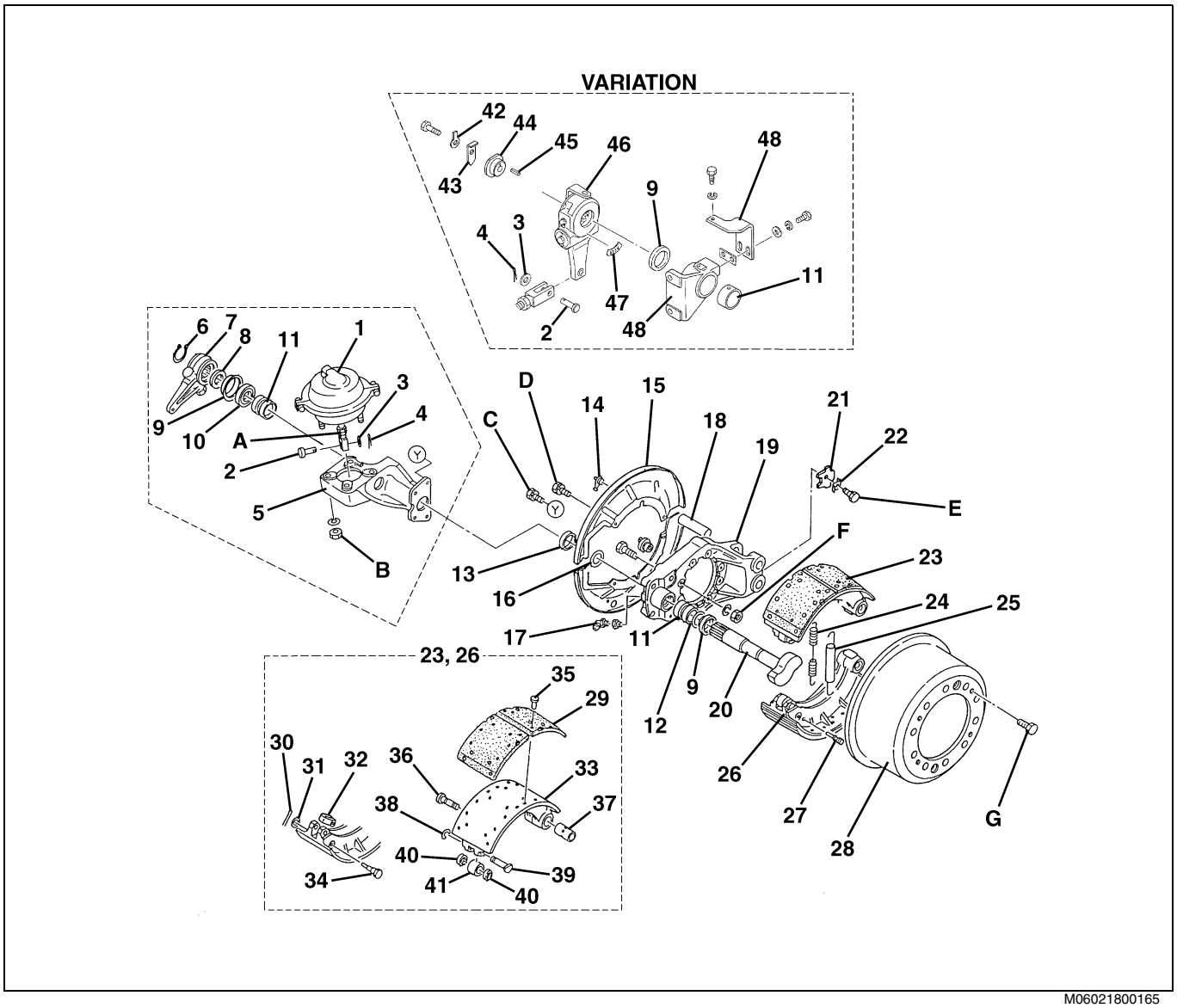


| | | | | | |
|---|---|---|---|---|---|
| 1 | Retainer ring | 20 | Brake shoe assembly (Trailing) | 39 | Brake lining |
| 2 | Slack adjuster | 21 | Brake shoe return spring (Inner) | 40 | O-ring |
| 3 | Thrust washer | 22 | Brake shoe return spring (Outer) | 41 | Cotter pin |
| 4 | Collar | 23 | Spring cover | 42 | Pivot pin |
| 5 | Oil seal | 24 | Brake drum | 43 | Spring hanger |
| 6 | Bushing | 25 | Spring hanger | 44 | Retainer ring |
| 7 | Bracket | 26 | Brake shoe assembly (Leading) | 45 | Seal |
| 8 | Lubrication fitting | 27 | Cam shaft | 46 | Roller |
| 9 | Protector | 28 | Washer | 47 | Pin |
| 10 | Brake chamber bracket | 29 | O-ring | 48 | Brake shoe |
| 11 | Cotter pin | 30 | Bushing | 49 | Bushing |
| 12 | Washer | 31 | Brake spider | 50 | Lock washer (If so equipped) |
| 13 | Pin | 32 | Spacer | 51 | Indicator (If so equipped) |
| 14 | Spring brake chamber | 33 | Connector | 52 | Spacer (If so equipped) |
| 15 | Hole plug | 34 | Lubrication fitting | 53 | Pin (If so equipped) |
| 16 | Brake drum cover | 35 | Wheel sensor (If so equipped) | 54 | Plate (If so equipped) |
| 17 | Anchor pin | 36 | Sleeve (If so equipped) | 55 | Auto slack adjuster (If so equipped) |
| 18 | Retainer | 37 | Holder (If so equipped) | 56 | Bracket (If so equipped) |
| 19 | Lock plate | 38 | Lock washer (If so equipped) | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 109-147 {1,100-1,500, 80-108} | E | 168-226 {1,710-2,300, 124-166} |
| B | 119-225 {1,200-2,300, 81-166} | F | 34.5-51.5 {351-527, 26-38} |
| C | 109-147 {1,100-1,500, 80-108} | G | 21-39 {200-400, 15-28} |
| D | 34.5-51.5 {351-527, 26-38} | H | 21.5-31.5 {220-320, 15-23} |

## REAR (Rearward) (MODELS: FL, FM)




M06021800165

| | | | | | |
|---|---|---|---|---|---|
| 1 | Brake chamber | 17 | Lubrication fitting | 33 | Brake shoe |
| 2 | Pin | 18 | Anchor pin | 34 | Pivot pin |
| 3 | Washer | 19 | Brake spider | 35 | Rivet |
| 4 | Cotter pin | 20 | Cam shaft | 36 | Spring hanger |
| 5 | Brake chamber bracket | 21 | Retainer | 37 | Bushing |
| 6 | Retainer ring | 22 | Lock plate | 38 | Retainer ring |
| 7 | Slack adjuster | 23 | Brake shoe assembly (Leading) | 39 | Pin |
| 8 | Thrust washer | 24 | Brake shoe return spring (Inner) | 40 | Seal |
| 9 | Collar | 25 | Brake shoe return spring (Outer) | 41 | Roller |
| 10 | Oil seal | 26 | Brake shoe assembly (Trailing) | 42 | Lock washer (If so equipped) |
| 11 | Bushing | 27 | Spring hanger | 43 | Indicator (If so equipped) |
| 12 | O-ring | 28 | Brake drum | 44 | Spacer (If so equipped) |
| 13 | Spacer | 29 | Brake lining | 45 | Pin (If so equipped) |
| 14 | Hole plug | 30 | Cotter pin | 46 | Auto slack adjuster (If so equipped) |
| 15 | Brake drum cover | 31 | Washer | 47 | Plate (If so equipped) |
| 16 | O-ring | 32 | Clamp | 48 | Bracket (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 50-68 {510-690, 36-50} | E | 34.5-51.5 {351-527, 26-38} |
| B | 119-225 {1,200-2,300, 81-166} | F | 168-226 {1,710-2,300, 124-166} |
| C | 109-147 {1,100-1,500, 80-108} | G | 20.5-39.5 {200-400, 15-28} |
| D | 34.5-51.5 {351-527, 26-38} | | |

# OVERHAUL

M06020118BEH2007

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF TIRE**

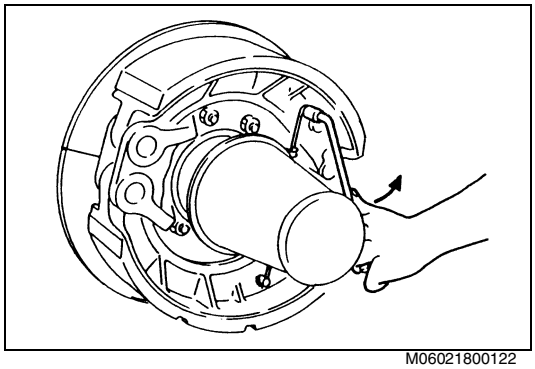
(1) Refer to chapter for WHEEL & TIRE.

**2. REMOVAL OF BRAKE DRUM WITH WHEEL HUB AND WHEEL HUB BEARINGS.**

(1) Refer to chapter FRONT AXLE and REAR AXLE.

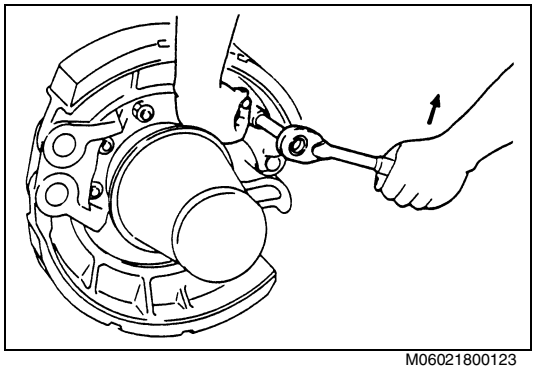
**3. REMOVAL OF BRAKE SHOE RETURN SPRING**

(1) Using the special tool. remove the return spring.
(FRONT WHEEL AND REAR WHEEL - OUTER SPRING).
**SST: Spring pull back tool (09683-1070)**



M06021800122

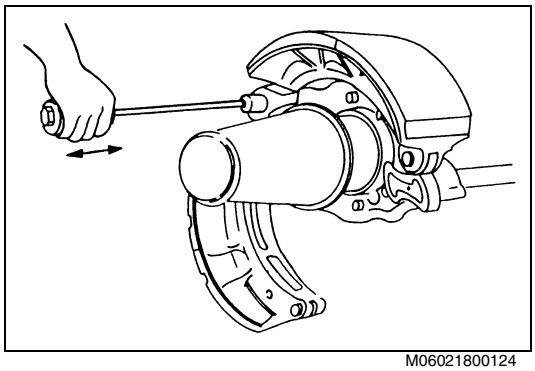
(2) Turn the pivot pin and pull out the spring hanger then remove the return spring, inner (REAR WHEEL).



M06021800123

**4. REMOVAL OF ANCHOR PIN**

(1) Using the special tool, remove the pin and the brake shoe assembly.
**SST: Anchor pin puller (09420-1510)**

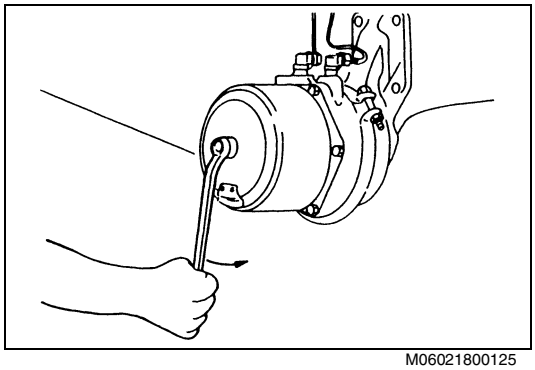


M06021800124

**5. REMOVAL OF CAM SHAFT AND SLACK ADJUSTER**

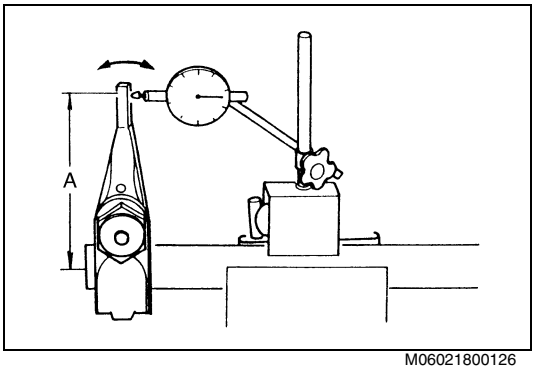
(1) If the vehicle is equipped with spring brake chamber, before removing the cam shaft and slack adjuster, release the spring brake.

**NOTICE:**
**Before removing the slack adjuster and cam shaft, apply a mark to them to make clear the side (Left or Right) where they were installed.**



M06021800125

## IMPORTANT POINTS - ASSEMBLY

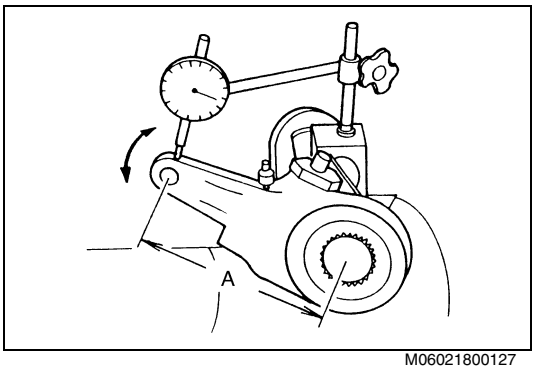


M06021800126

**1. INSPECTION OF SLACK ADJUSTER**

(1) Measure the axial play and if the play exceed the limit, inspect the spline of cam shaft and disassemble the adjuster.

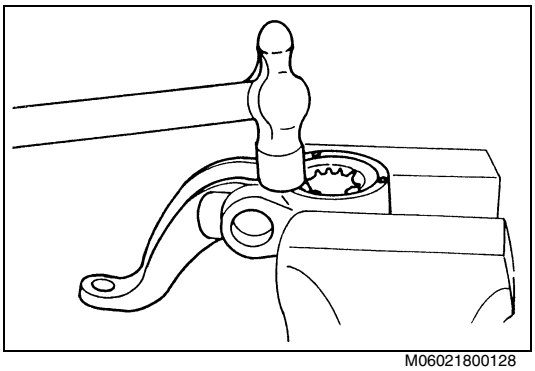
**Dimension A: 150 mm {5.9 in.}**
**Assembly Standard: 1.5 mm {0.06 in.}**
**Service Limit: 3.0 mm {0.12 in.}**



M06021800127

(2) Measure the circumference play and if the play exceed the limit, inspect the spline of cam shaft and disassemble the adjuster.

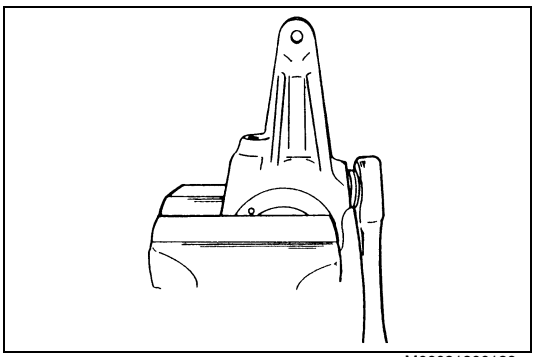
**Dimension A: 150 mm {5.9 in.}**
**Assembly Standard: 3.0 mm {0.12 in.}**
**Service Limit: 10.0 mm {0.39 in.}**


M06021800128

**2. ASSEMBLY OF SLACK ADJUSTER**

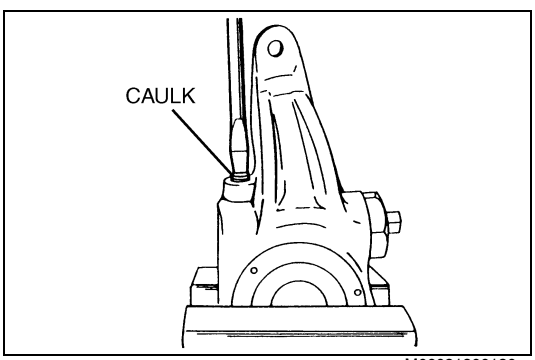
(1) Install the body cover.
(2) Use new rivets and caulk the rivet ends.

**NOTICE:**
**Apply enough chassis grease on the worm gear shaft before installing the cover.**


M06021800129

(3) Tighten the worm gear shaft stopper fully then loose it by 1/12-1/6 turn.

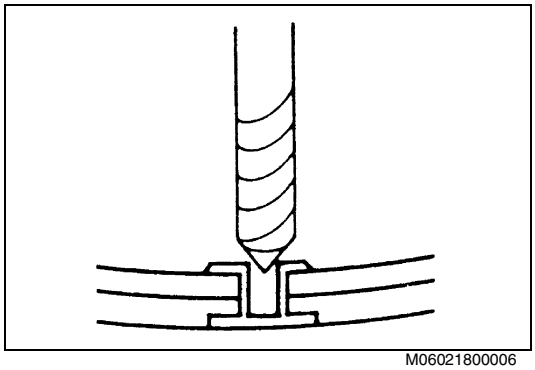
**NOTICE:**
- **Replace the O-ring with new one.**
- **Apply enough chassis grease on the worm gear shaft before installing the worm gear shaft.**



M06021800130

(4) Install the lock ball, spring and plug.
(5) After tighten the plug, caulk it to the body by a punch.

**NOTICE:**
**Apply enough chassis grease on the lock ball and spring.**

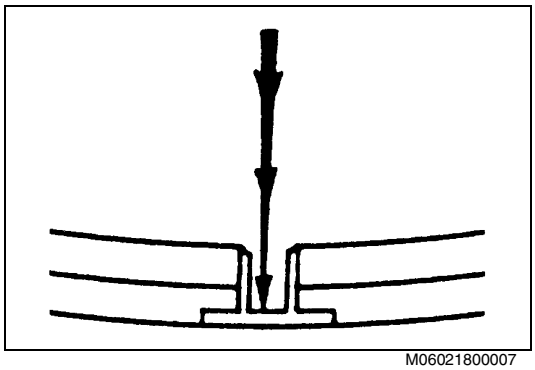

M06021800006

### 3. REPLACEMENT OF BRAKE LINING

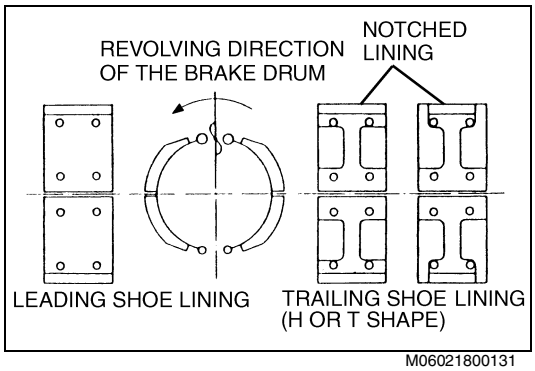
(1) Remove the brake lining from the brake shoe.

a. Drill the rivet caulking section with a drill smaller than the rivet diameter.

**NOTICE:**
**At this time, be careful not to scratch the brake shoe.**


M06021800007

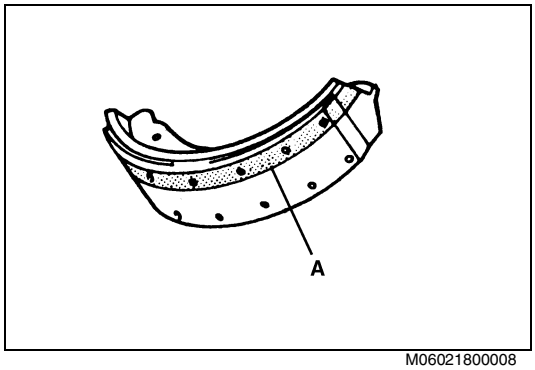
b. After drilling, remove the remaining portion of the rivet with a fine chisel or a riveting machine.



M06021800131

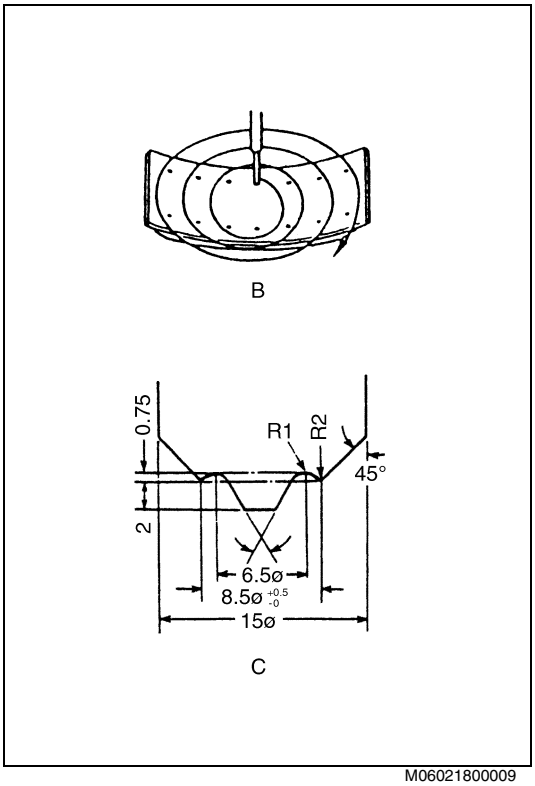
(2) Install the brake lining to the brake shoe.

**NOTICE:**
**If a notched lining is used, the brake shoe and brake lining should be installed as shown in figure.**



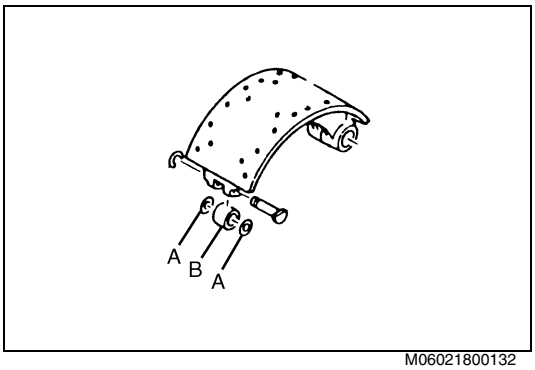
M06021800008

a. Set the lining on the shoe and insert the rivets into all holes, then hold them in place with adhesive tape "A".



M06021800009

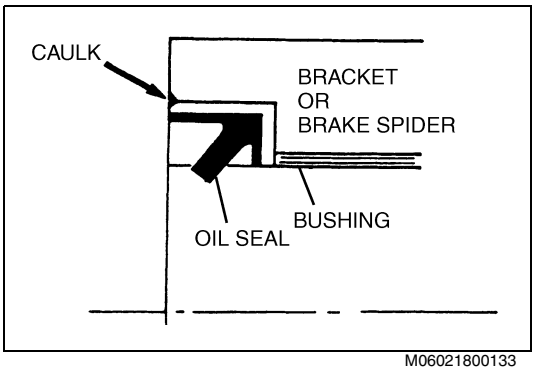
b. Caulk the rivets lightly in a circular pattern as shown in figure "B", repeat several times assure proper seating of the lining.
**Recommended configuration of punch: shown in "C".**
**Recommended force of staking the rivet: 2.4 tons.**
c. Remove adhesive tape.



M06021800132

## IMPORTANT POINTS - ASSEMBLY

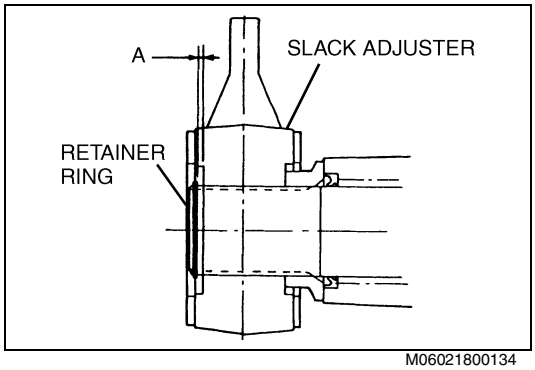
**1. ASSEMBLY OF BRAKE SHOE**
(1) Seals "A" for roller "B" should be replaced with new ones.
(2) Apply adequate amount of heat resistance grease on the roller and seals.



M06021800133

**2. INSTALLATION OF O-RING AND OIL SEAL**
(1) When assembling the wheel brake, replace the O-rings and oil seals with new ones.

**NOTICE:**
- **The lip parts of the seal should always be facing outside.**
- **The seal should be caulked to the bracket (or bracket spider) with a punch.**



M06021800134

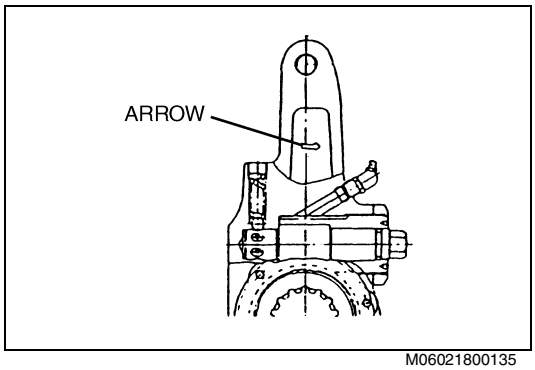
**3. INSTALLATION OF CAM SHAFT AND SLACK ADJUSTER**

(1) Apply adequate amount of chassis grease on the O-ring, oil seal and bushing before installing the cam shaft.

(2) If the clearance "A" between the retainer ring and slack adjuster exceed 2.0 mm {0.078 in.}, install the washer between them.

**NOTICE:**

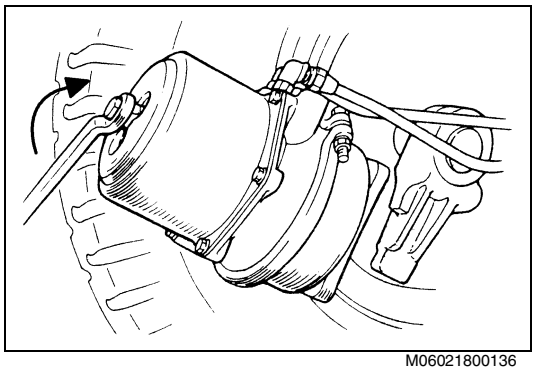
**Install the cam shaft and slack adjuster on the correct side (Left or Right) according to the mark on them which were applied when disassembling.**



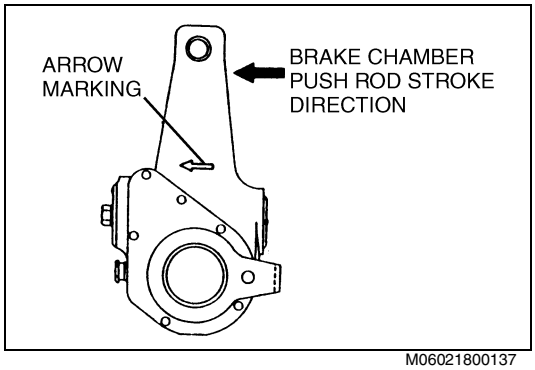
M06021800135

**NOTICE:**

- **Make sure that the slack adjuster is installed, so that the arrow on the adjuster points to the direction of the brake chamber rod stroke as shown in figure.**
- **When connecting the slack adjuster with the brake chamber and/or spring brake chamber, lubricate the clevis pin-hole and the pin with sufficient chassis grease.**


M06021800136

(3) If the vehicle is equipped with a spring brake chamber, after connecting the slack adjuster with the brake chamber push rod, turn the spring brake release bolt clockwise and securely tighten (with mechanical released device).



M06021800137

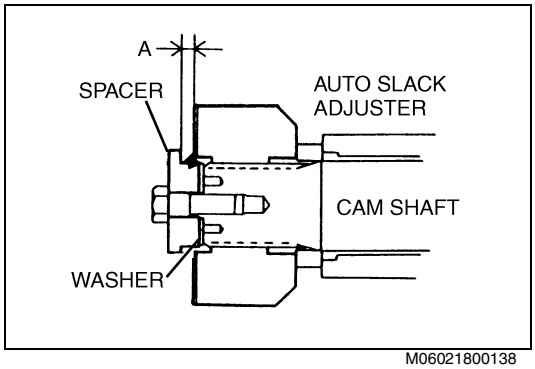
**4. INSTALLATION OF CAM SHAFT AND AUTO SLACK ADJUSTER (If so equipped)**

(1) Apply adequate amount of chassis grease on the O-ring, oil seal and bushing before installing the cam shaft.

(2) Make sure that the auto slack adjuster is installed so that the arrow on the adjuster points in the direction of the brake chamber rod stroke, as shown in figure.

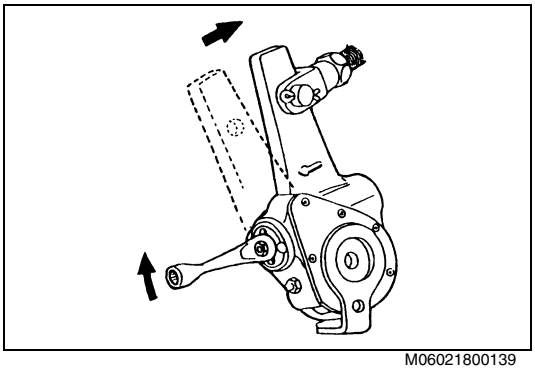
**NOTICE:**

**Install the cam shaft and auto slack adjuster on the correct side (Left or Right) according to the mark which was applied when disassembly.**

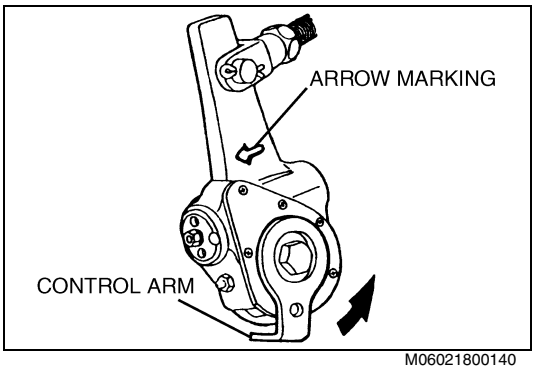


M06021800138

(3) Make sure that clearance "A" between the spacer and auto slack adjuster is 0.5-2.0 mm {0.020-0.078 in.}. Install or remove the washer to maintain the required clearance.

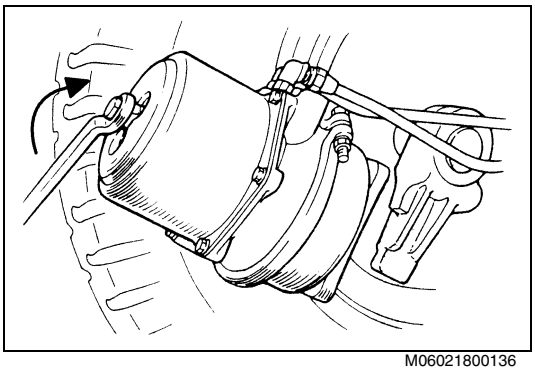

M06021800139

(4) When connection the auto slack adjuster with the brake chamber and/or spring brake chamber, lubricate the clevis pin-hole and pin with sufficient chassis grease.
(5) If the clevis pin-hole and auto slack adjuster pin-hole are misaligned, turn the set screw of auto slack adjuster for clockwise.



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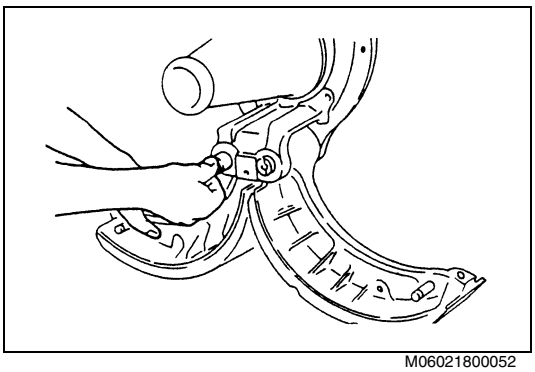
(6) Rotate by hand, the control arm as for as possible in the direction of the arrow on the adjuster point.
(7) Make sure that clearance between set bolt and control arm is correct, and tighten the nut.

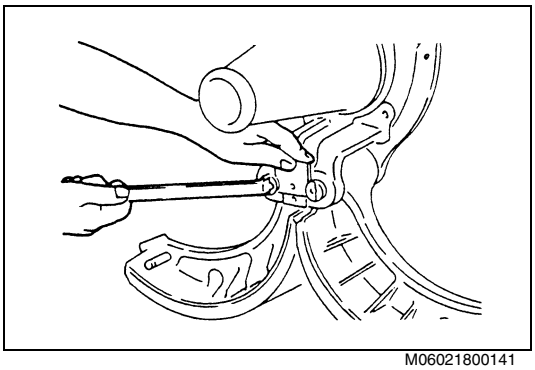

M06021800136

(8) If the spring brake chamber is the equipped, after connecting the auto slack adjuster with the brake chamber push rod, turn the spring brake release bolt for clockwise fully (with mechanical released device).

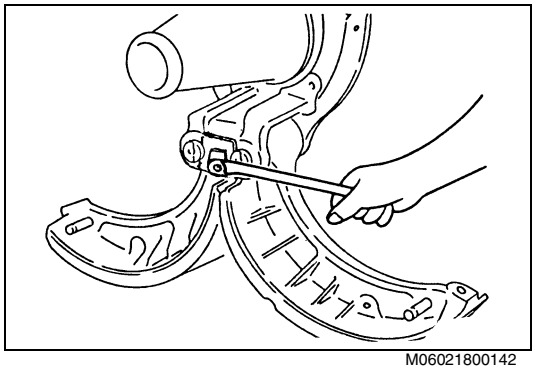
**5. INSTALLATION OF BRAKE SHOE ASSEMBLY**

(1) Apply adequate amount of heat resistance grease on the bushing of the brake shoe.
(2) Set the brake shoe assembly in place, then insert the anchor pins.

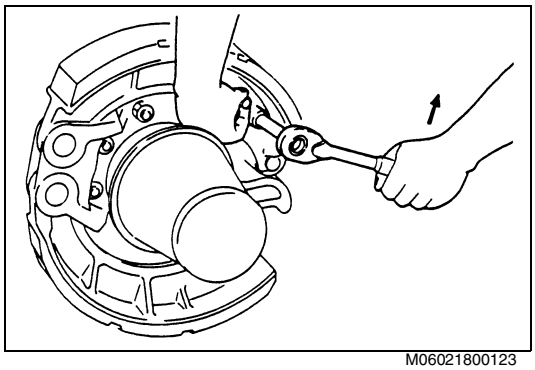

M06021800052


M06021800141

(3) Using the special tool, set the grooves of the two anchor pin parallel and then insert the retainer in the grooves so that the retainer hole and brake spider hole are aligned.
**SST: Anchor pin tool (09684-1010)**


M06021800142

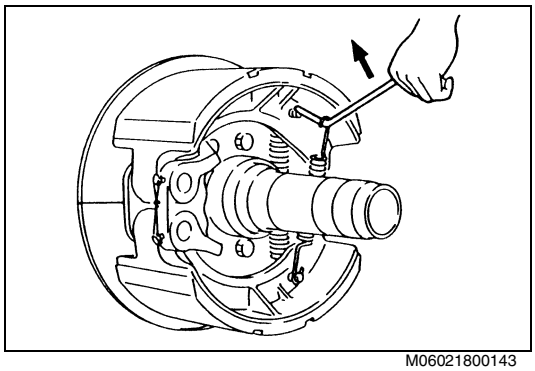
(4) Place the lock plate on the retainer so that its hole is aligned with the lock plate hole, then insert the bolt and tighten it.


M06021800123

**6. INSTALLATION OF BRAKE SHOE RETURN SPRING**

(1) Hook the inner spring to the clamp and turn the pivot pin to align the holes, then insert the spring hanger. (REAR WHEEL)

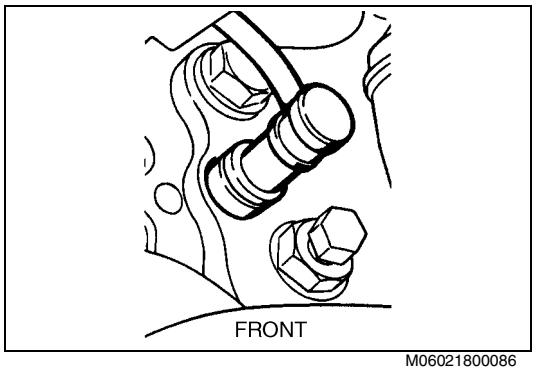
**NOTICE:**
**Painted part of the spring must be placed in the upper side.**


M06021800143

(2) Use the special tool to install the return spring. (FRONT WHEEL, REAR WHEEL - OUTER SPRING).

**NOTICE:**
**The folded part of the spring cover must be placed in the upper side.**

**SST: Spring pull back tool (09683-1070)**

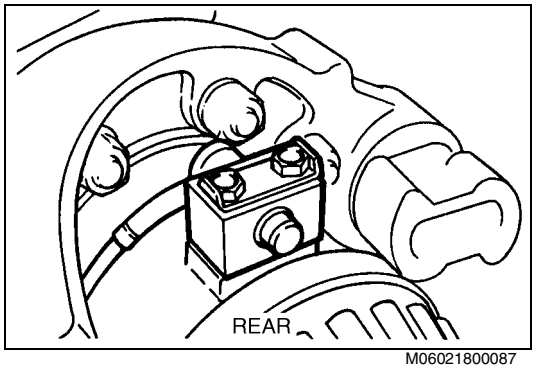


M06021800086

**7. INSTALL THE WHEEL SENSOR**
**(If so equipped)**

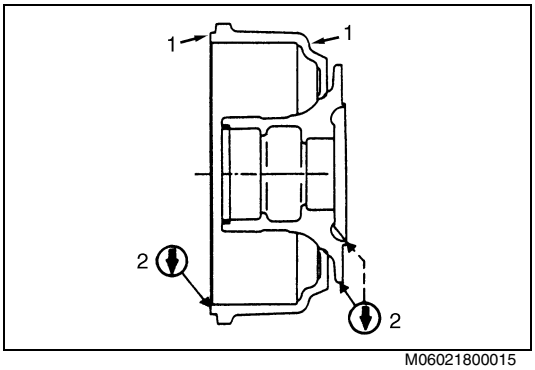
(1) Push in the clamping bushing until the stopper makes contact with the wheel sensor holder.
(2) Push the wheel sensor forcefully into the clamping bushing until you feel that the wheel sensor has contact with the sensor ring.

**NOTICE:**
**When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place using a screwdriver, or the like. Doing so could damage the wheel sensor.**



M06021800087

(3) Arrange the wire harness.



M06021800015

**8. ASSEMBLE THE BRAKE DRUM AND WHEEL HUB (FRONT WHEEL)**

(1) See the mark located at 1 or 1' on the brake drum as shown in figure. Install the drum according to NOTICE.

**NOTICE:**

- **The drums, number with R or L.**
  **With R: Install in right side.**
  **With L: Install in left side.**
- **The drums, with no R or L.**
  **New drums: Install in any side.**
  **Reused drums: Install in the side originally installed.**

(2) When assembling the brake drum and wheel hub, make sure that their aligning marks are aligned as close to each other as possible.

**NOTICE:**

**Position of marks are located at 2 as shown in the figure. (Broken line shows alternative position).**

**9. MOUNTING OF WHEEL HUB WITH BRAKE DRUM**

(1) Refer to chapter FRONT AXLE and REAR AXLE.

**NOTICE:**

1. **Be careful not to push back the wheel sensor too far when mounting the wheel hub and brake drum. Also, make sure they are straight so that you do not bump the tip of the wheel sensor.**
2. **When inserting the outer hub bearing, avoid tapping on it with a hammer as this will expose the wheel sensor to bumps. Insert the outer hub bearing carefully using a lock nut.**

(2) Slowly turn the wheel hub and brake drum and confirm that they move smoothly.

**10. MOUNTING OF TIRE**

(1) Refer to chapter WHEEL & TIRE.

**11. GREASING**

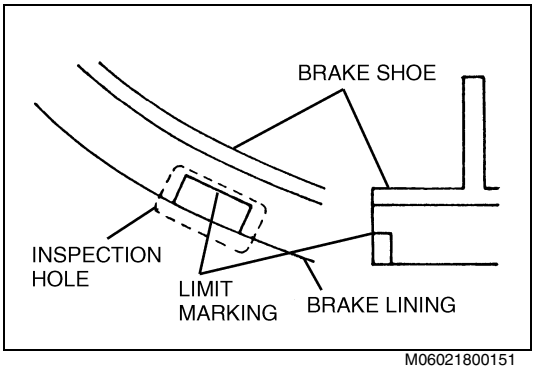
(1) After completion of assembly, lubricate the bushings of the brake spider, cam shaft bracket (REAR WHEEL) and slack adjuster wire with chassis grease from the lubrication fittings.

**12. ADJUSTMENT**

(1) Finally, adjust the brake chamber rod stroke as explained in Section "ADJUSTMENT".

# ADJUSTMENT

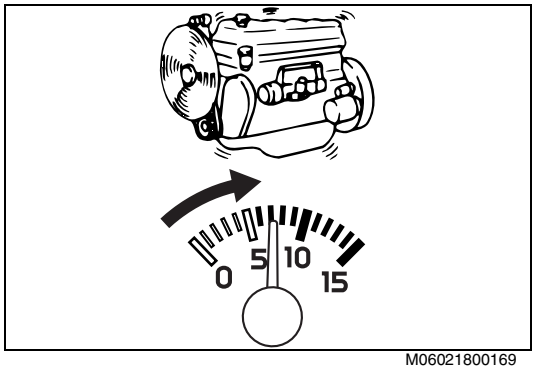
M06021801BEH3004



M06021800151

**1. REMAINING THICKNESS OF THE BRAKE LINING**

(1) Check remaining thickness of lining through the inspection hole of the brake drum cover. If the lining has been worn to the limit marking or if it is foreseen that the lining will be worn to the limit by the time the next inspection is made, replace the lining.



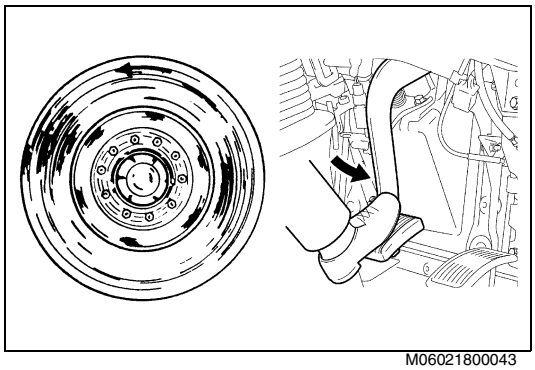
M06021800169

**2. AIR PRESSURE IN THE AIR TANK**

(1) Operate the engine and obtain an air pressure of the 690 kPa {7.0 kgf/cm$^2$, 99.54 lbf/in$^2$.}

**NOTICE:**

**The specified air pressure in the air tank should be maintained when making the adjustment.**


M06021800043

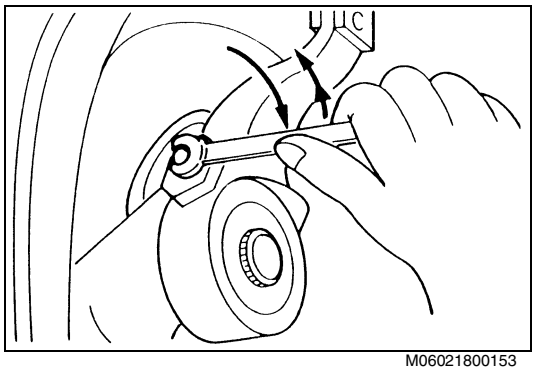
**3. ADJUST THE BRAKE CHAMBER STROKE**

(1) Lift the wheel to be adjusted off the ground.

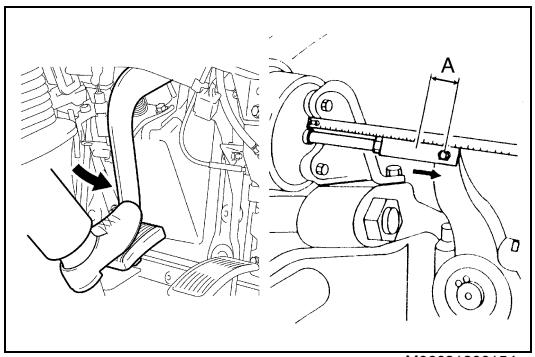
(2) Step on the brake pedal several times while turning the wheel in the forward direction to make sure that the brake shoes are correctly positioned.

**NOTICE:**

**In the case of spring brake chamber, set the spring brake control valve to the "OFF" position.**


M06021800153

(3) Turn the worm gear shaft of the slack adjuster clockwise fully and then turn it back at least two notches.



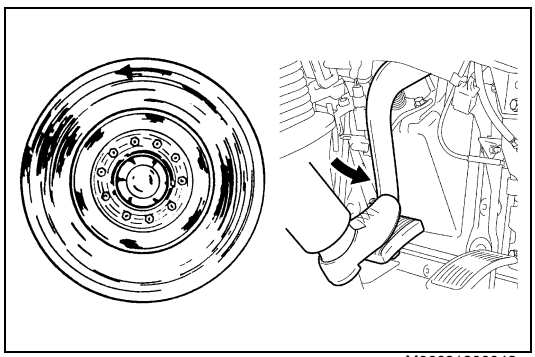
M06021800154

(4) Depress the brake pedal fully and measure the brake chamber push rod stroke "A".

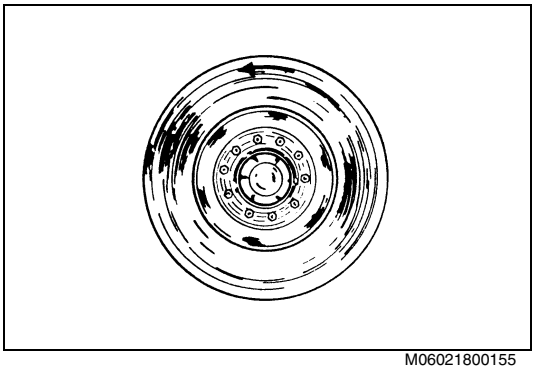
**Assembly standard: 22-30 mm {0.87-1.18 in.}**

**Repair limit: Brake chamber: 40 mm {1.57 in.}**

**Spring brake chamber: 45 mm {1.77 in.}**


M06021800043

(5) While turning the wheel by hand in the forward direction, step on the brake pedal several times to make sure that the brake shoes are correctly positioned.



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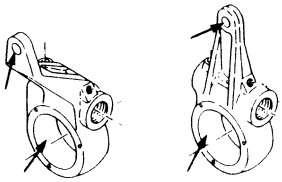
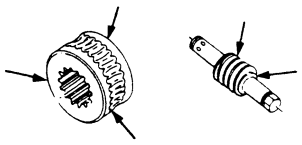
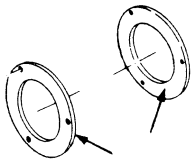
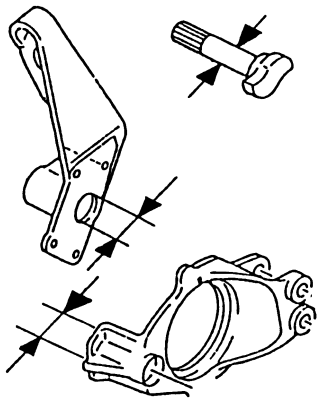
(6) Make sure that there is no dragging, when turning the wheel by hand. If there is any dragging, repeat the operation over again from (2).

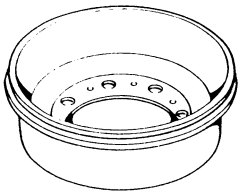
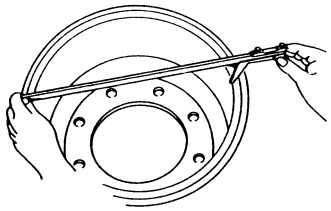
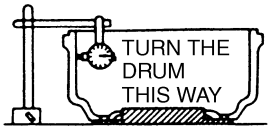
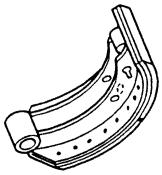
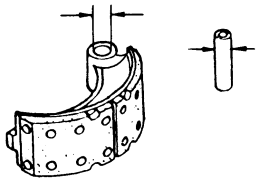
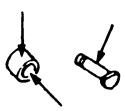
**NOTICE:**
**In accordance with the same procedure as above, adjust the stroke for all wheels.**

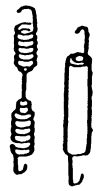
# INSPECTION AND REPAIR

M06020118BEH3016

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Slack adjuster body: Wear and damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Slack adjuster, worm gears: Wear and damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Slack adjuster, body cover: Wear and damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Cam shaft: Diameter.** | **39.8 {1.57}** | **39.5 {1.56)** | **Replace.** | **Measure**  |
| **Clearance between cam shaft and bushing of brake spider, chamber bracket, cam shaft bracket.** | **0.23-0.30 {0.0091-0.0110}** | **0.6 {0.024}** | **Replace bushing and/ or cam shaft.** | |
| **Cam shaft collar and spacer: Wear and damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Brake drum:<br>Cracks and damage.** | **—** | **—** | **Regrind or replace.** | **Visual check**<br>  |
| **Brake drum:<br>Inside diameter.** | **406.4 {16.0}** | **Regrind 409.4 {16.12}<br>Service 410.4 {16.16}** | **Regrind or replace.** | **Visual check**<br>  |
| **Brake drum:<br>Run out.** | **0-0.1 {0-0.0039}** | **0.2 {0.0079}** | **Regrind or replace.** | **Measure**<br>  |
| **Brake shoe assembly:<br>Cracks and damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Brake lining:<br>Thickness.** | **15.5 {0.61}** | **5.5 {0.217}** | **Replace.** | **Visual check**<br>  |
| **Clearance between brake shoe bushing and anchor pin.** | **0.02-0.07 {0.0008-0.0027}** | **0.25 {0.0098}** | **Replace the brake shoe bushing and/or anchor pin.** | **Visual check**<br>  |
| **Brake shoe roller and pin:<br>Wear and damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Brake shoe return spring and spring cover: Damage, Lacking elastic strength distortion.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# CUT VALVE

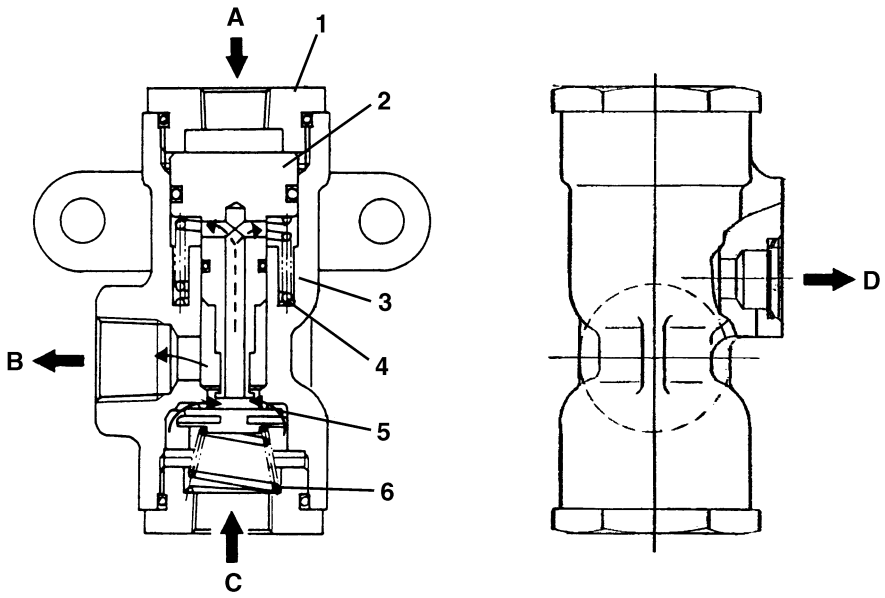
## DATA AND SPECIFICATIONS

M06021401BEI2001

| Type | Spring type |
|---|---|

## DESCRIPTION

M06021401BEC1001

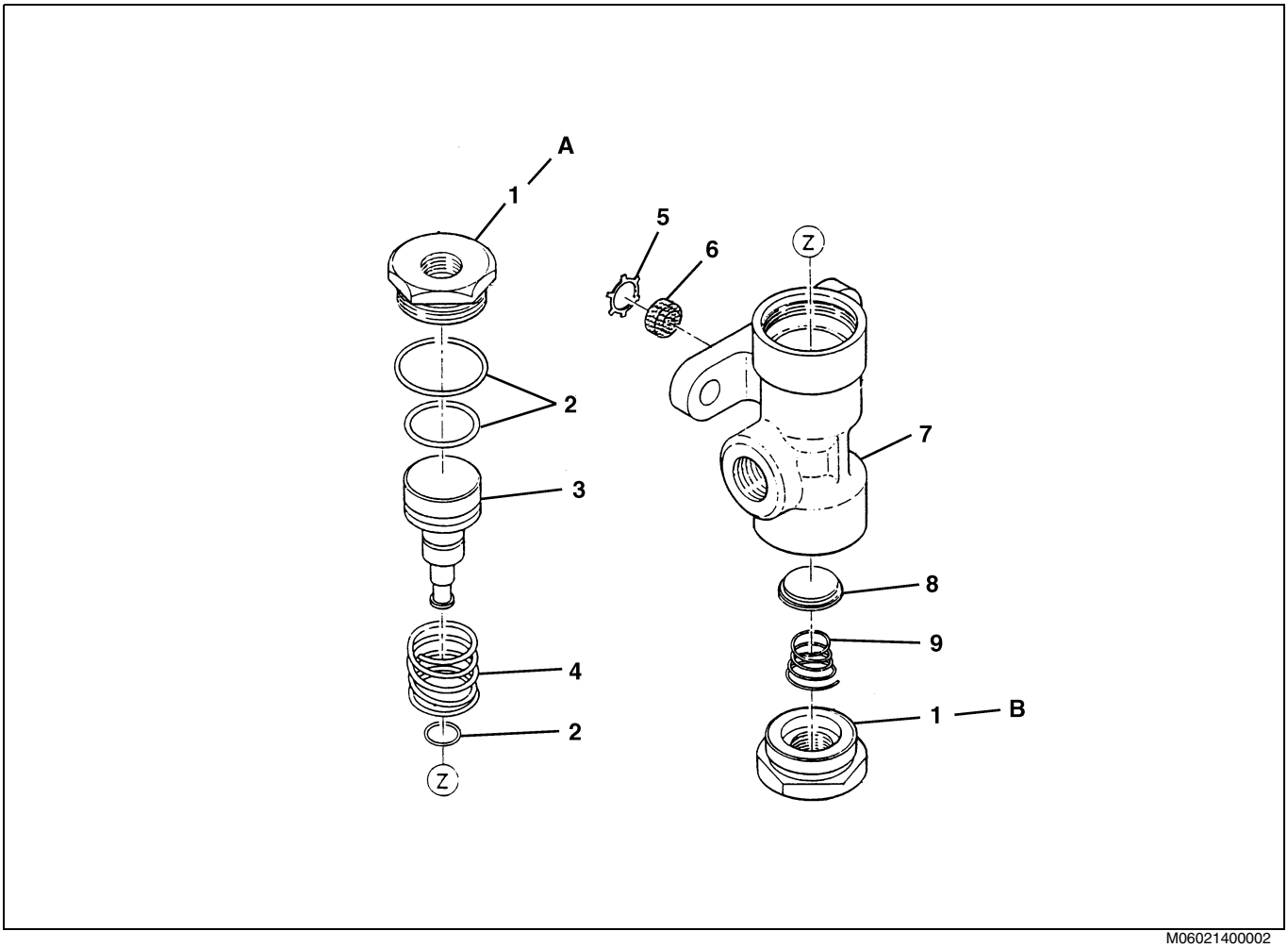



M06021400001

| | | | |
|---|---|---|---|
| 1 | Valve cap | 6 | Conical spring |
| 2 | Piston | A | Signal |
| 3 | Valve body | B | Outlet |
| 4 | Spring | C | Inlet |
| 5 | Valve sub assembly | D | Exhaust |

# COMPONENT LOCATOR

M06021401BED1001




M06021400002

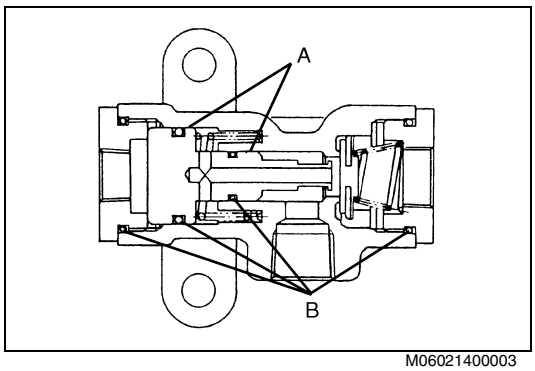
| | | | | | |
|---|---|---|---|---|---|
| 1 | Valve cap | 4 | Spring | 7 | Valve body |
| 2 | O-ring | 5 | Ring retainer | 8 | Valve sub assembly |
| 3 | Piston | 6 | Filter | 9 | Conical spring |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 49.04-58.83 {500-600, 36.2-43.3} | B | 49.04-58.83 {500-600, 36.2-43.3} |

# OVERHAUL

M06021401BEH2001



M06021400003

## IMPORTANT POINT - ASSEMBLY

**1. LUBRICATION**
(1) When assembling the cut valve, use the new O-ring and valve.
(2) Apply the silicone grease to the each sliding surface of the component parts and O-ring groove.

**NOTICE:**
**Check the air leakage from exhaust port, with the piston at the released position.**
**A: Sliding surface**
**B: O-ring**

## PERFORMANCE CHARACTERISTIC

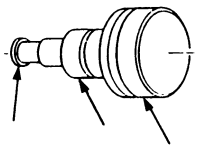
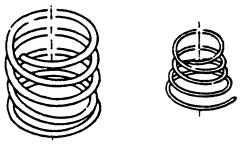
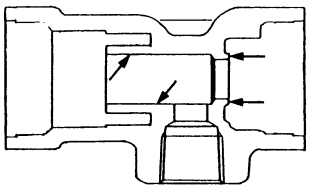
**1. When the inlet pressure is 686 kPa {7.0 kgf/cm$^2$, 99.54 lbf/in$^2$.}, the valve should be opened with the signal pressure of below 343 kPa {3.5 kgf/cm$^2$, 49.77 lbf/in$^2$.} and the valve should be closed with the signal pressure of 197-294 kPa {2.0-3.0 kgf/cm$^2$, 28.44-42.66 lbf/in$^2$.}.**

**2. When the inlet and signal pressure are decreasing at same time, the valve should be closed at pressure of 99-196 kPa {1.0-2.0 kgf/cm$^2$, 14.22-28.44 lbf/in$^2$.}.**

**3. When the inlet and signal pressure are increasing at same time, the valve should be opened with the pressure of 148-245 kPa {1.5-2.5 kgf/cm$^2$, 21.33-35.55 lbf/in$^2$.}.**

# INSPECTION AND REPAIR

M06021401BEH3001

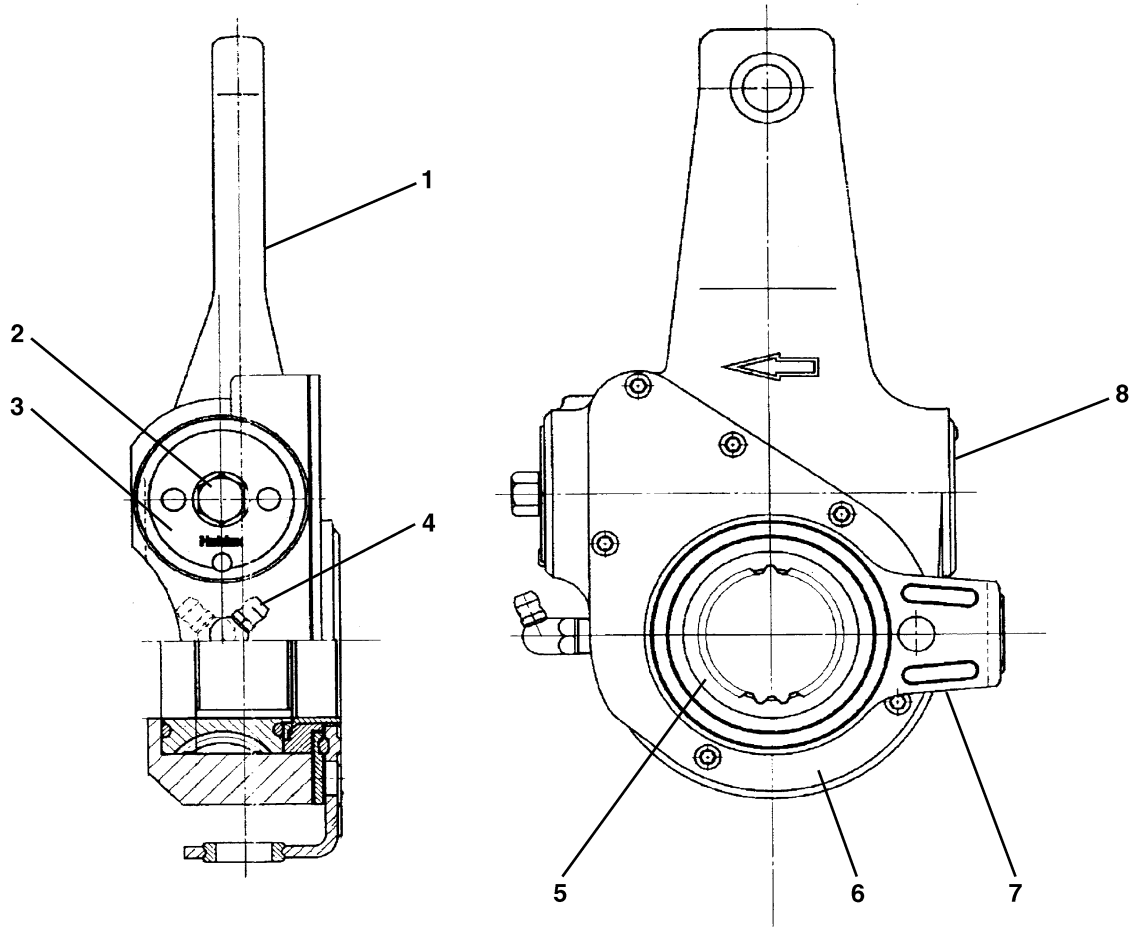
| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Sliding surface and valve contact surface of piston: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Spring: Rust and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Valve body: Sliding surface and contact surface: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# WHEEL BRAKE SLACK ADJUSTER (AUTO ADJUSTER)

## DESCRIPTION

M06021901BEC1001

REPRESENTATIVE TYPE




M06021900001

| | | | |
|---|---|---|---|
| 1 | Body | 5 | Worm gear |
| 2 | Worm shaft | 6 | Holder |
| 3 | Front retainer | 7 | Control arm |
| 4 | Lubrication fitting | 8 | Rear retainer |

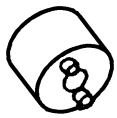
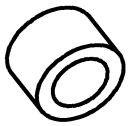
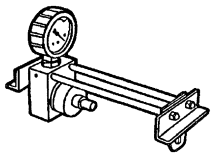
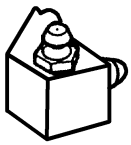
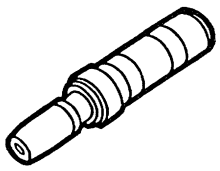
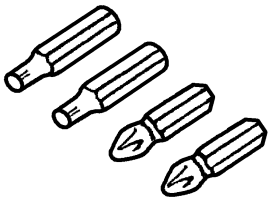
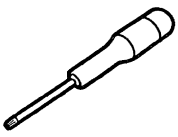
# SPECIAL TOOL

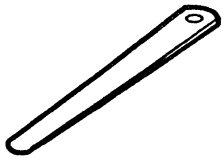
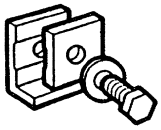
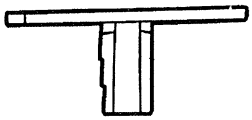
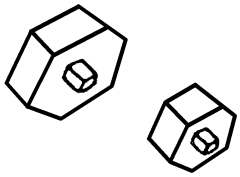
M06021901BEK1001

Prior to starting an auto slack adjuster overhaul, it is necessary to have this special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09630-2350 | SPECIAL PARTS ASSEMBLY | |

## COMPONENTS IN THE SPECIAL PARTS ASSEMBLY

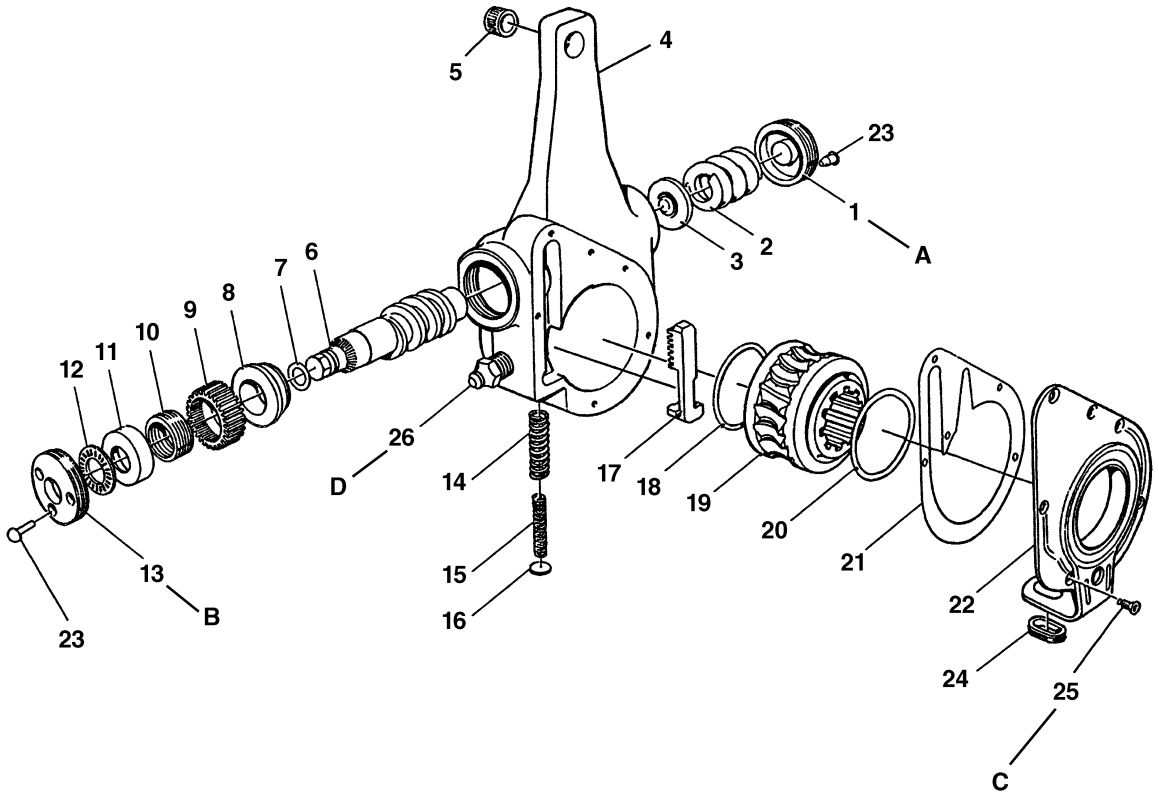
| Illustration | Tool name | Remarks |
|---|---|---|
|  | PEG SPANNER | |
|  | SPACER | |
|  | END LOAD TESTER | |
|  | GREASE TOOL | |
|  | IMPACT SCREWDRIVER | |
|  | DRIVER TIP | |
|  | TORX SCREWDRIVER | |

| Illustration | Tool name | Remarks |
|---|---|---|
|  | MANDREL | |
|  | THICKNESS GAUGE | |
|  | CONTROL ARM BUSH INSTALLATION TOOL | |
|  | UNIVERSAL SPLINE KEY | |
|  | DIAL GAUGE | |
|  | HEXAGONAL WRENCH | |

# COMPONENT LOCATOR

M06021901BED1001

REPRESENTATIVE TYPE




M06021900002

| | | | | | |
|---|---|---|---|---|---|
| 1 | Rear retainer | 10 | Spring | 19 | Worm gear |
| 2 | Spring | 11 | Inner cap | 20 | O-ring |
| 3 | Thrust washer | 12 | Thrust bearing | 21 | Gasket |
| 4 | Body | 13 | Front retainer | 22 | Holder |
| 5 | Bushing | 14 | Spring | 23 | Rivet |
| 6 | Worm shaft | 15 | Spring | 24 | Plug |
| 7 | O-ring | 16 | Plug | 25 | Torx screw |
| 8 | Bearing | 17 | Rack | 26 | Lubrication fitting |
| 9 | Drive gear | 18 | O-ring | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 50 {510, 37} | D | TYPE-A: 47480-1471/ -1791, 47490-1031/ -1181: 3.92-9.81 {40-100, 2.90-7.23} TYPE-B: 47480-1631/ -1641/ -1801/ -1811 9.81-29.4 {100-300, 7.24-21.69} |
| B | 50 {510, 37} | | |
| C | 4 {41, 2.96} | | |

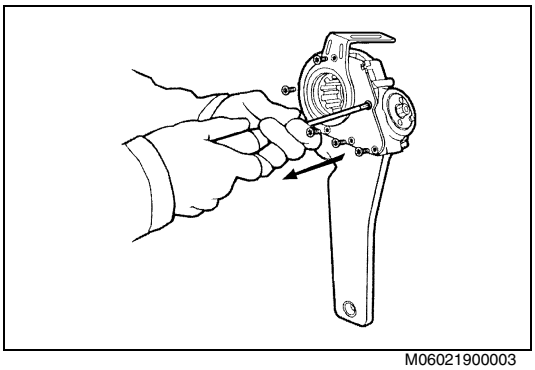
# OVERHAUL

M06021901BEH2001

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVING THE AUTO SLACK ADJUSTER**

(1) Remove the auto slack adjuster from the wheel brake.



M06021900003

**2. DISASSEMBLING OF RACK AND SPRING SECTION**

(1) Remove the six torx screws with the special tool.

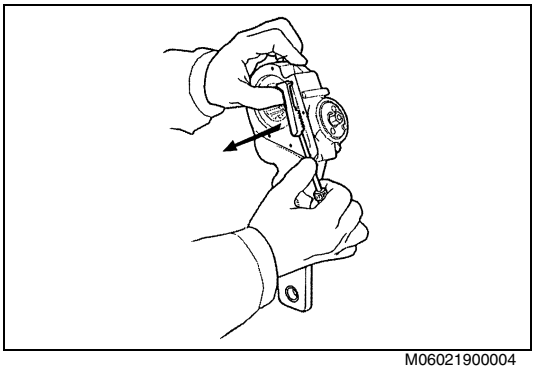
**NOTICE:**

**When the torx screws have been tightened strongly, use the special impact screwdriver and a hammer.**

**SST: Special parts assembly (09630-2350)**

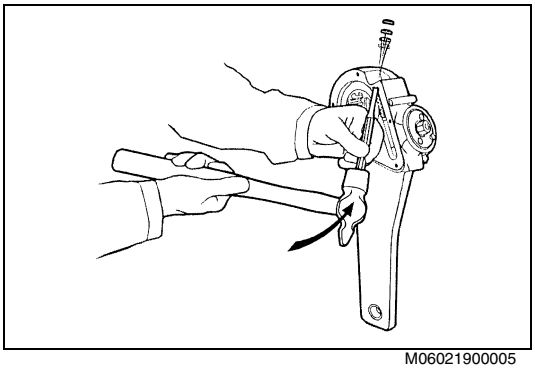
- **Torx screwdriver**
- **Impact screwdriver**

(2) Remove the holder and the gasket.



M06021900004

(3) Remove the rack using a screwdriver.

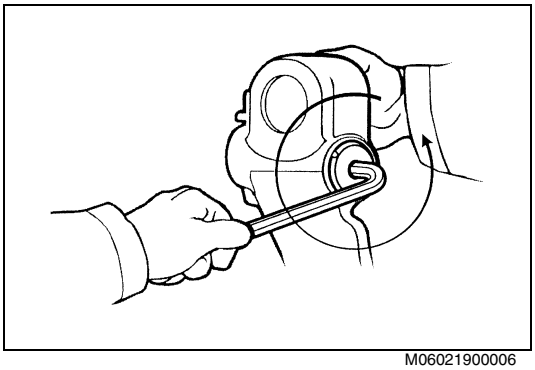


M06021900005

(4) Push and shrink the spring with a screwdriver and bring a tapping rod into contact with the plug.

(5) Remove the plug using a tapping rod and hammer.

(6) Remove the spring.

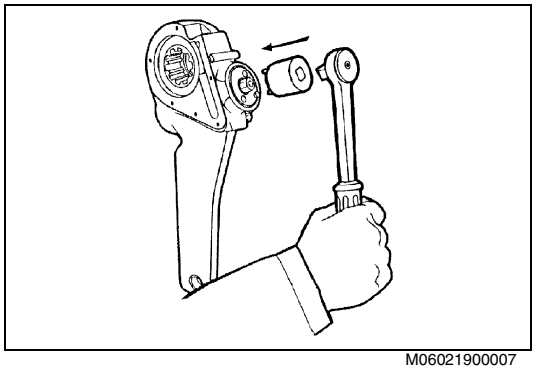


M06021900006

**3. DISASSEMBLING OF WORM SHAFT AND WORM GEAR SECTION**

(1) Loosen the rear retainer in counterclockwise direction with a hexagonal wrench to remove it.

(2) Remove the spring and the thrust washer.

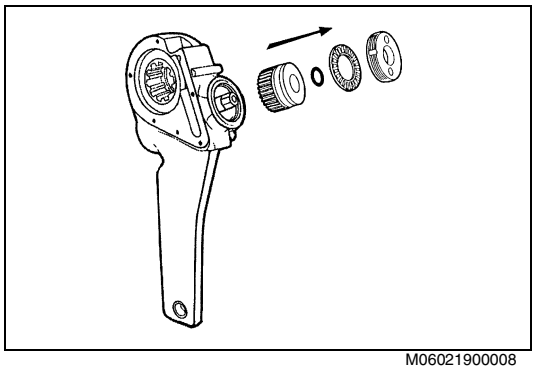

M06021900007

(3) Turn the front retainer in counterclockwise direction using the special tool to remove it.

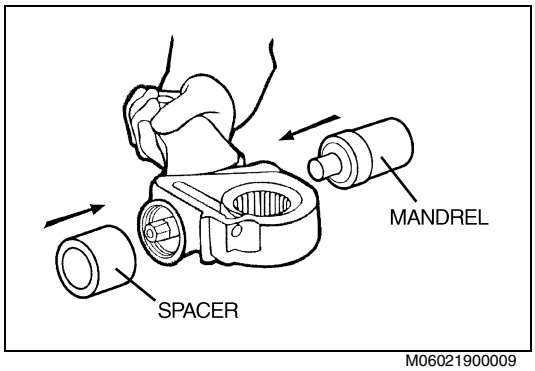
**NOTICE:**
**When the retainer has been tightened strongly, use the special impact screwdriver and a hammer.**

**SST: Special parts assembly (09630-2350)**

- **Peg spanner**
- **Impact screwdriver**


M06021900008

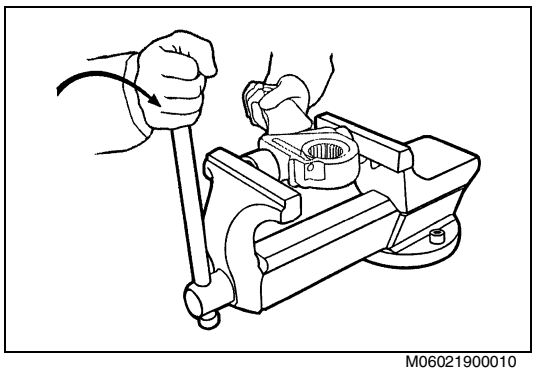
(4) Remove the thrust bearing, the O-ring, the inner cap, the spring and the drive gear.



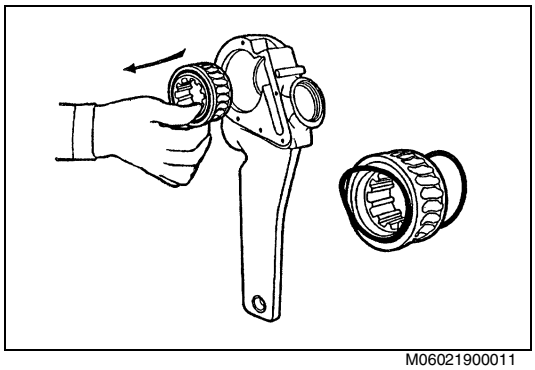
M06021900009

(5) Install the special tool mandrel and the special tool spacer.
**SST: Special parts assembly (09630-2350)**

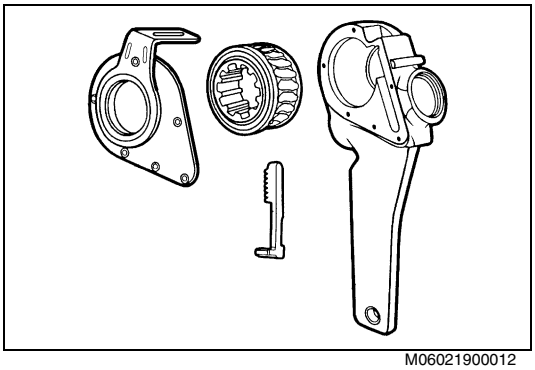
- **Mandrel**
- **Spacer**


M06021900010

(6) Using a vice, turn it slowly until the bearing and the worm shaft are removed.
(7) Remove the bearing and the worm shaft.


M06021900011

(8) Remove the worm gear.
(9) Remove the O-ring from the outer surface of the worm gear.

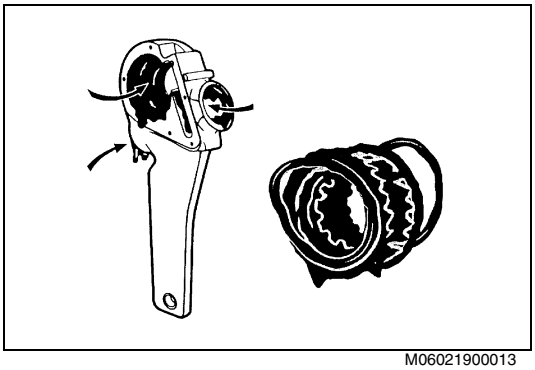

M06021900012

**4. CLEANING OF EACH PART**

(1) Clean each part shown in the figure.

## IMPORTANT POINTS - ASSEMBLY

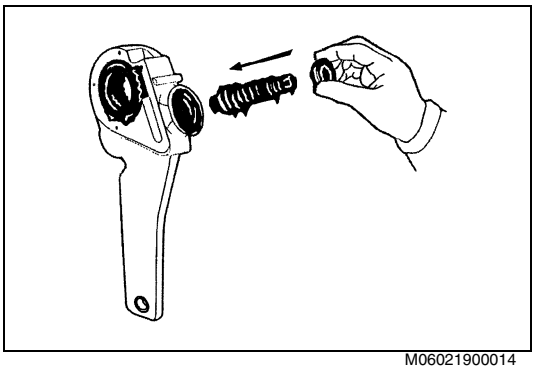
**NOTICE:**
**At the time of assembly, apply a sufficient amount of grease (Alexol RCF2, made by AB Axel Christiernsson or equivalent or LITHIUM/CALCIUM-basis with EP additives viscosity NLG12) to each part.**


M06021900013

**1. ASSEMBLING OF WORM SHAFT AND WORM GEAR SECTION**

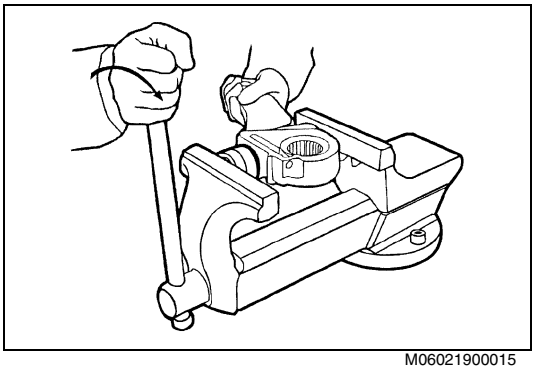
(1) Apply grease (Alexol RCF2, made by AB Axel Christiernsson or equivalent or LITHIUM/CALCIUM-basis with EP additives viscosity NLG12) to the inside of the body and to the entire worm gear.

(2) Install O-rings on both sides of the worm gear and insert the worm gear with the projecting part to the front into the body.


M06021900014

(3) Apply grease (Alexol RCF2, made by AB Axel Christiernsson or equivalent or LITHIUM/CALCIUM-basis with EP additives viscosity NLG12) to the worm shaft and the bearing.

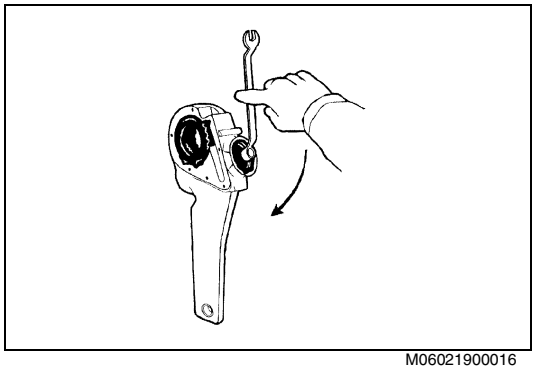
(4) Install them with the hexagonal adjustment part to the front from the front retainer direction all the way to the inside.


M06021900015

(5) Insert the special tool until it comes into contact with the bearing.
**SST: Special parts assembly (09630-2350)**

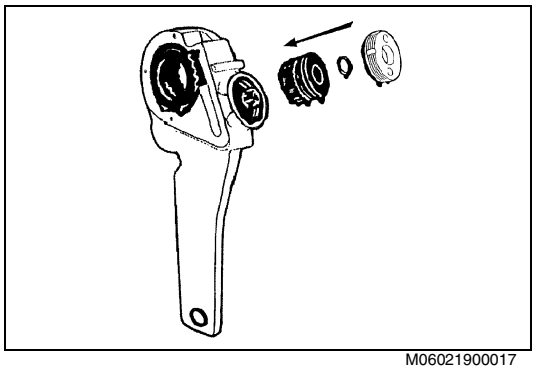
- **Mandrel**

(6) Install the worm shaft and bearing by using a vice to press-fit them completely.

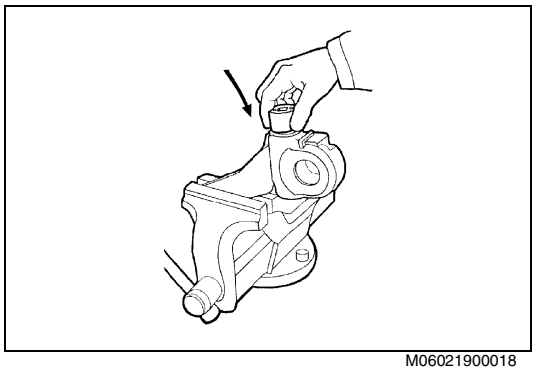

M06021900016

(7) Use a wrench to turn the worm shaft about 22 times, and confirm smooth rotation of the worm shaft and the worm gear.

**NOTICE:**
**The worm gear performs approximately one revolution when the worm shaft is turned 22 times.**


M06021900017

(8) Assemble the inner cap, the spring and the drive gear.
(9) Apply grease (Alexol RCF2, made by AB Axel Christiernsson or equivalent or LITHIUM/CALCIUM-basis with EP additives viscosity NLG12) to the parts assembled in step (7) and to the O-ring, the thrust bearing, and the front retainer. Then install them in sequence from the front retainer direction.


M06021900018

(10) Install the body in a vice and tighten the front retainer using the special tool and a torque wrench.

**NOTICE:**
**Do not use an impact wrench.**

**SST: Special parts assembly (09630-2350)**

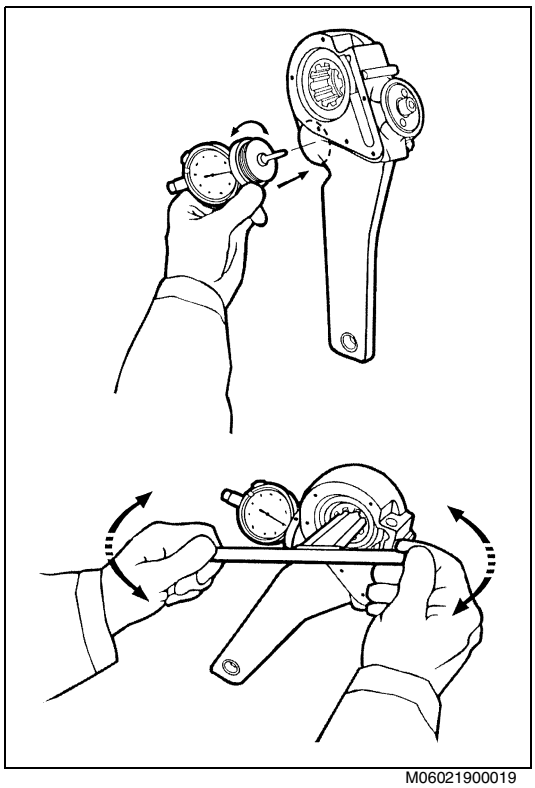
- **Peg spanner**

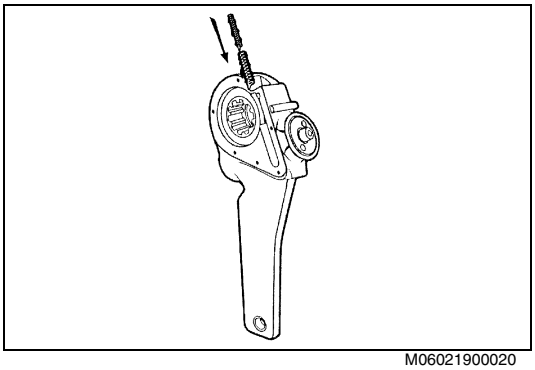
**Tightening Torque:**
**50 N·m {510 kgf·cm, 37 lbf·ft}**

(11) Use a wrench to confirm smooth rotation of worm shaft and worm gear.
(12) Insert the special tool dial gauge into the rear retainer and insert the special tool universal spline key into the worm gear spline section.
**SST: Special parts assembly (09630-2350)**

- **Dial gauge**
- **Universal spline key**

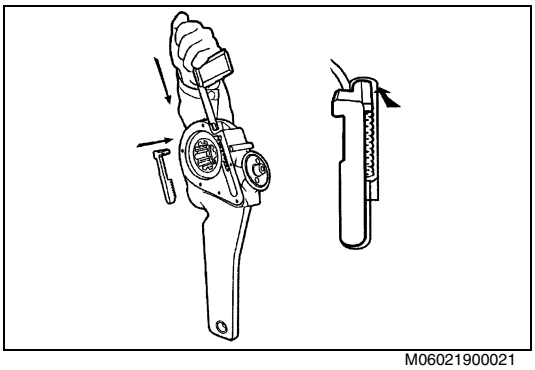
(13) Turn the special tool universal spline key to the left and right and measure the play of the worm shaft indicated by the dial gauge.
**Play: 0.15-0.60 mm {0.0060-0.0236 in.}**
(14) Replace the body if the play is outside the standard range.


M06021900019


M06021900020

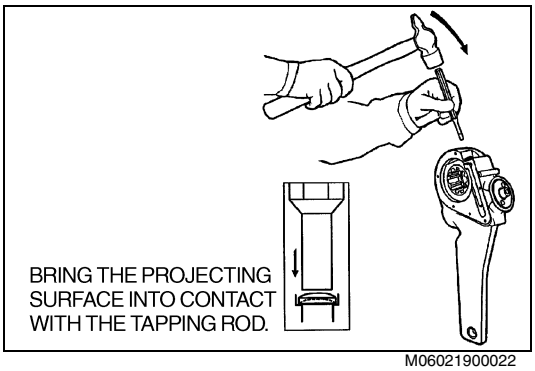
**2. ASSEMBLING OF THE RACK AND SPRING SECTION**

(1) Apply grease (Alexol RCF2, made by AB Axel Christiernsson or equivalent or LITHIUM/CALCIUM-basis with EP additives viscosity NLG12) to the spring and the rack and install them to the body.


M06021900021

(2) Install the rack using the special tool while pushing the spring. Visually confirm that the rack and the spring are fitted as shown in the figure.
**SST: Special parts assembly (09630-2350)**

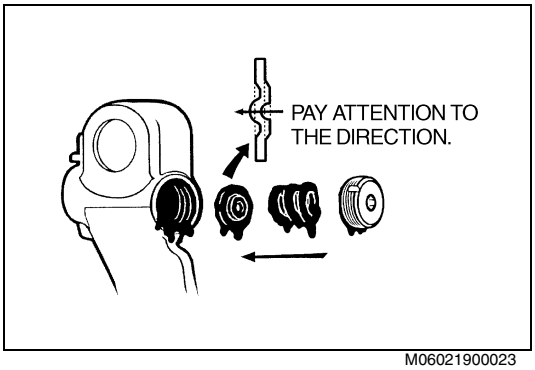
- **Universal spline key**



M06021900022

(3) Use a tapping rod and hammer to close the opening with a new plug.

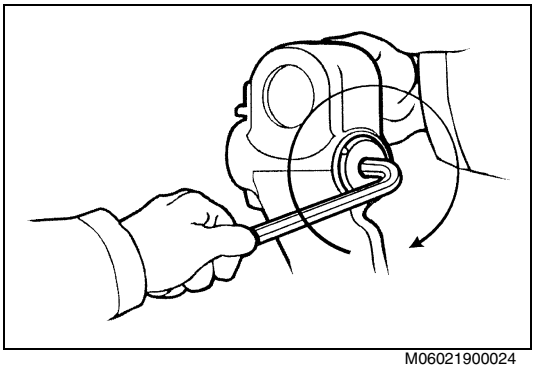
**NOTICE:**
**Pay attention to the direction of the plug.**



M06021900023

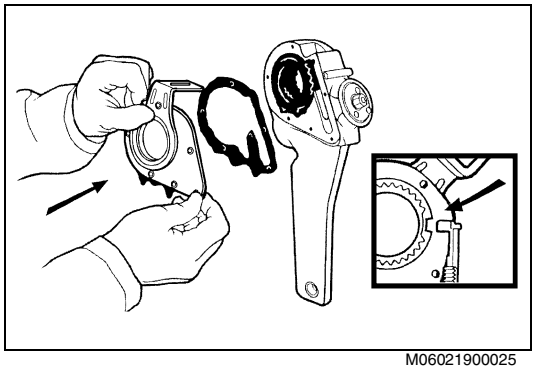
(4) Apply grease (Alexol RCF2, made by AB Axel Christiernsson or equivalent or LITHIUM/CALCIUM-basis with EP additives viscosity NLG12) to the thrust washer, the spring, and the rear retainer and install them.

**NOTICE:**
**Pay attention to the direction of the thrust washer.**


M06021900024

(5) Using an hexagonal wrench, tighten the rear retainer about four turns in the clockwise direction.

**NOTICE:**
**Do not use an impact wrench.**

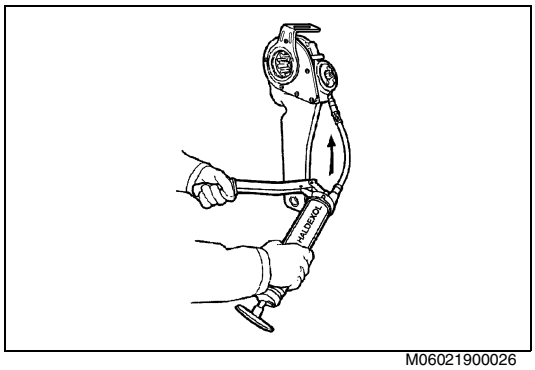

M06021900025

(6) Apply grease (Alexol RCF2, made by AB Axel Christiernsson or equivalent or LITHIUM/CALCIUM-basis with EP additives viscosity NLG12) to the gasket, and then install it together with the holder in the body.

**NOTICE:**
**Confirm that the notch of the holder matches the claw of the rack.**

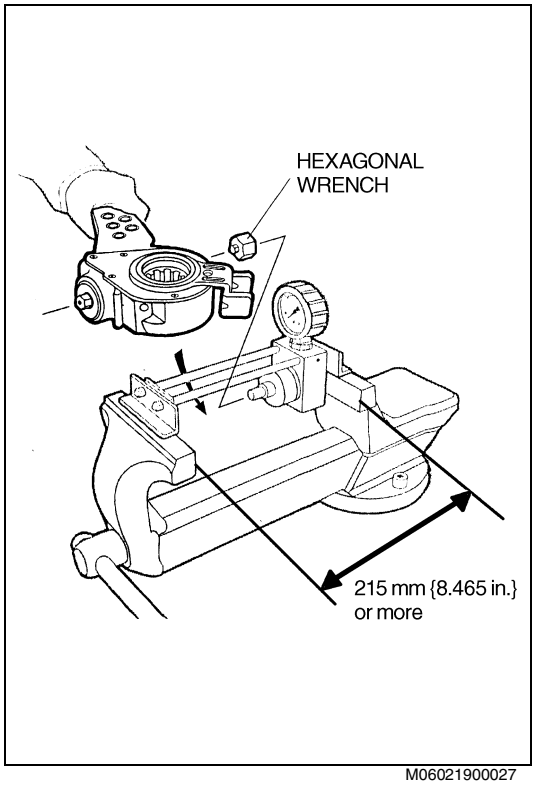
(7) Tighten the torx screws.
**Tightening Torque:**
**4 N·m {41 kgf·cm, 3 lbf·ft}**

(8) Install the lubrication fitting.


M06021900026

**3. GREASE FILLING**

(1) Use a grease gun to apply grease until it escapes through the holder gap.



M06021900027

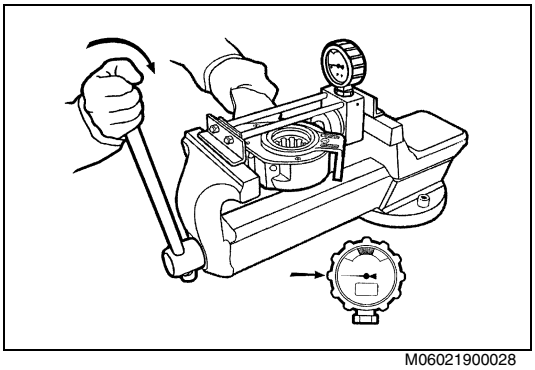
## IMPORTANT POINTS - INSPECTION

**1. INSPECTION OF THE SLACK ADJUSTER ASSEMBLY**

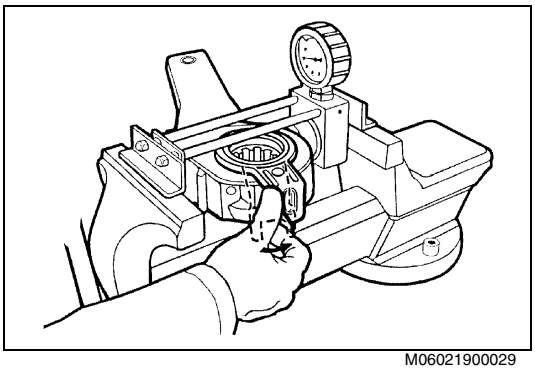
(1) Fix the special tool end load tester to a vice with a width of at least 215 mm {8.465 in.}

(2) Apply the special tool hexagonal wrench to the rear retainer and fix it to the special tool end load tester.
**SST: Special parts assembly (09630-2350)**

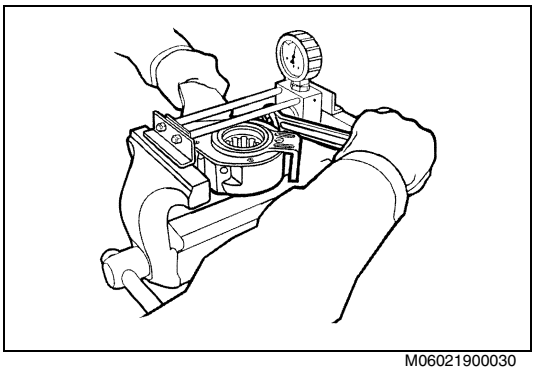
- **End load tester**
- **Hexagonal wrench**


M06021900028

(3) Secure the body, and confirm at this time that the gauge indicator is in the condition shown in the figure.

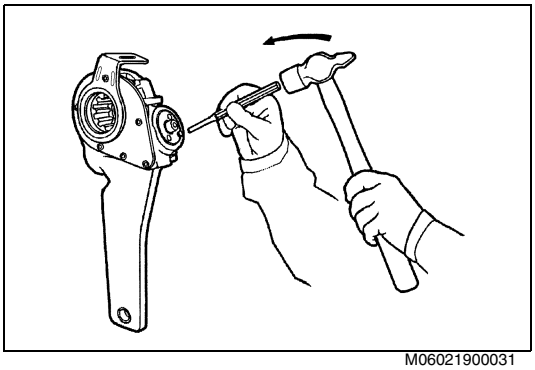

M06021900029

(4) Confirm that the control arm part of the holder can be moved forward and back by hand.
(5) Push the control arm part of the holder with your thumb lightly in the direction of the rear retainer. Turn the vice in clockwise direction and confirm that the control arm part of the holder moves in the direction of the rear retainer within the specified range of the gauge indicator. Or confirm that the control arm of the holder moves lightly.
**Specified value: 3,530-3,730 N {360-380 kgf, 794-837 lbf}**


M06021900030

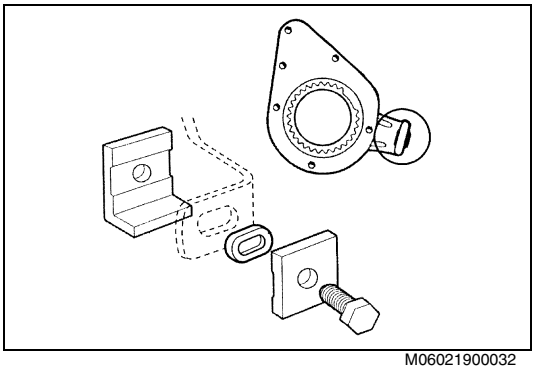
(6) If the control arm part of the holder moves outside the range of 3,530-3,730 N {360-380 kgf, 794-837 lbf} of the gauge indicator, adjust assembly by tightening or loosening the special tool hexagonal wrench with a spanner.
**Under 3,530 N {360 kgf, 794 lbf}: Turn in clockwise direction**
**Over 3,730 N {380 kgf, 837 lbf}: Turn in counterclockwise direction**

(7) For confirmation of correct assembly, again perform the inspection after assembly.


M06021900031

**2. FINISHING THE INSPECTION**
(1) Use a punch and a hammer to drive the rivet into the retainer.
(2) Confirm the inner diameter of the bushing and use a vice to press-fit it into the body.

**NOTICE:**
**Confirm the inner diameter of the bushing as the repair kit contains several types of bushings.**


M06021900032

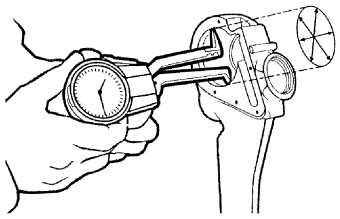
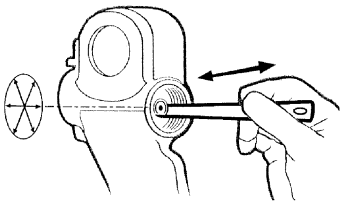
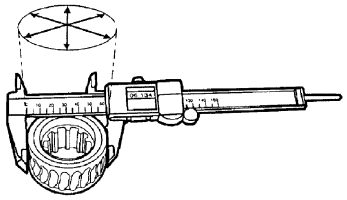
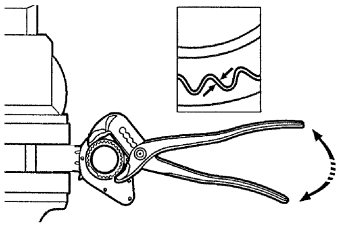
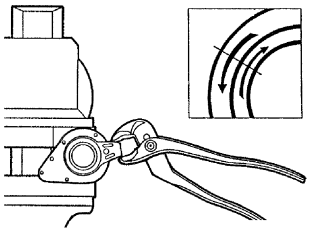
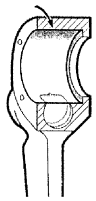
(3) Remove the used plug and use the special tool to install a new plug.
**SST: Special parts assembly (09630-2350)**

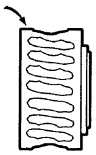
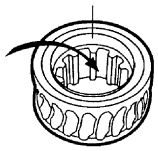
- **Control arm bushing installation tool**

# INSPECTION AND REPAIR

M06021901BEH3001

Unit: mm {in.}

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Inner diameter of the body. | — | 62.20 {2.4488} | Replace. | Measure.  |
| Gap between worm shaft and body (at the time of inspection, a new worm shaft should be uesd) using special thickness gauge | — | 0.25 {0.0098} | Replace the body. | Measure.  |
| Outer diameter of the worm gear. | — | 61.87 {2.4358} | Replace. | Measure.  |
| Holder gear part | — | 0.40 {0.0157} | Replace. | Measure.  |
| Holder gear part:<br>No play | — | — | Replace, if necessary. | Visual check  |
| Body:<br>No traces of scuffing on the inside | — | — | Replace, if necessary. | Visual check  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Worm gear:<br>No uneven wear on the outside** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Worm gear:<br>No damage to the spline part** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |

# BRAKE CHAMBER (MODELS: FG, GH)

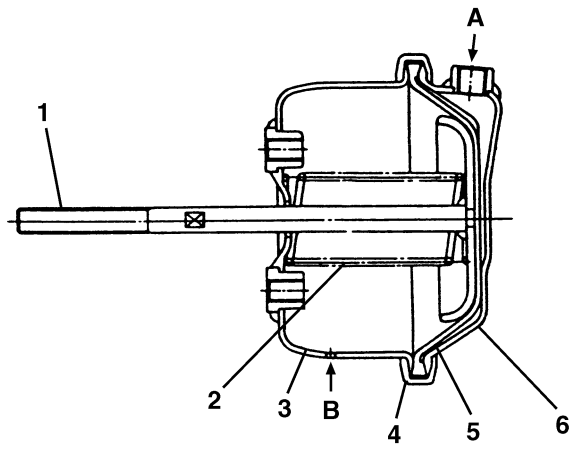
## DATA AND SPECIFICATION

M06021501BEI2004

| | |
|---|---|
| **Type** | **Diaphragm type** |

## DESCRIPTION

M06021501BEC1004

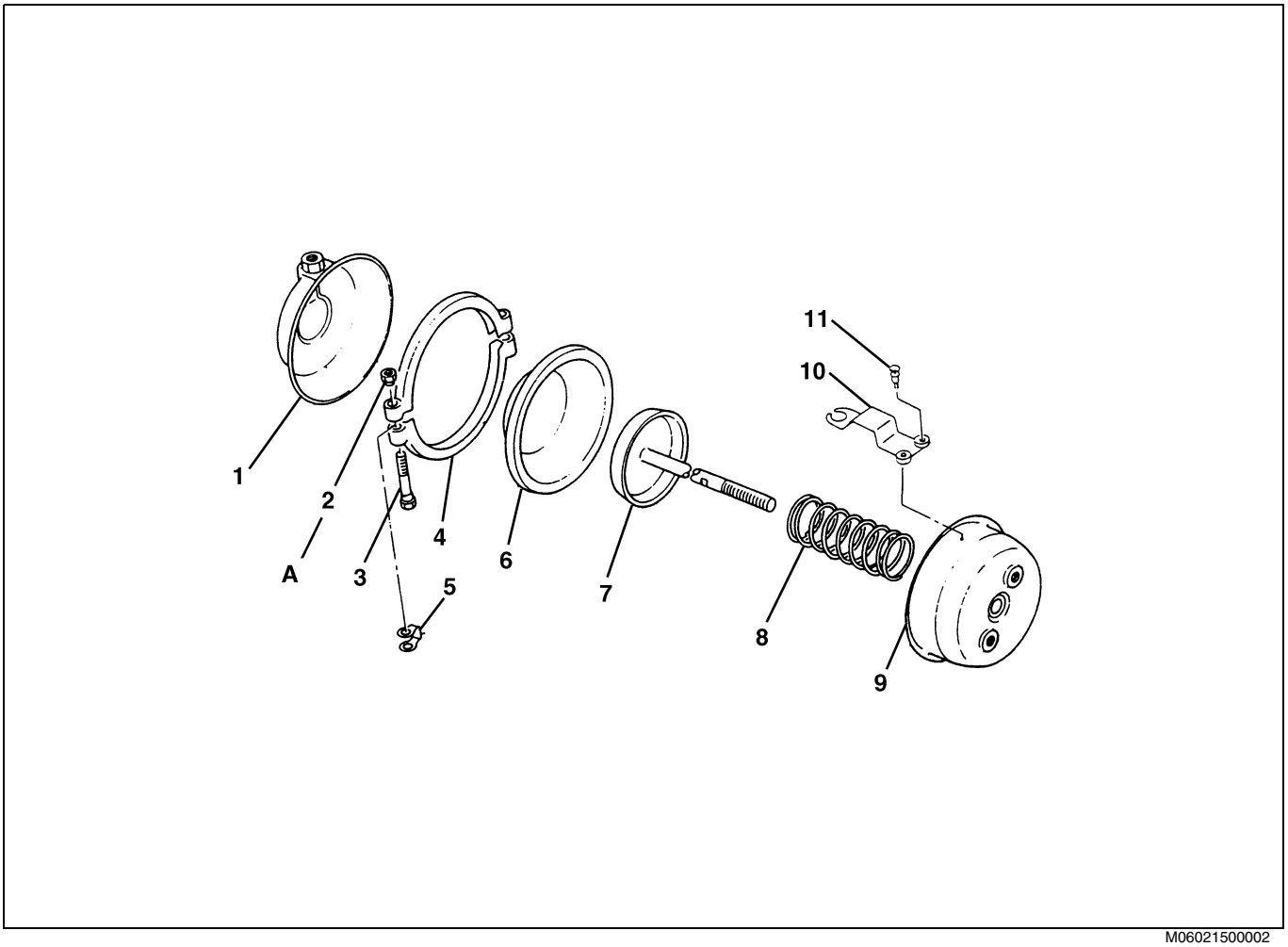



M06021500001

| | | | |
|---|---|---|---|
| **1** | **Push rod** | **5** | **Diaphragm** |
| **2** | **Return spring** | **6** | **Chamber cover** |
| **3** | **Chamber** | **A** | **Inlet** |
| **4** | **Clamp** | **B** | **Drain hole** |

# COMPONENT LOCATOR

M06021501BED1004




M06021500002

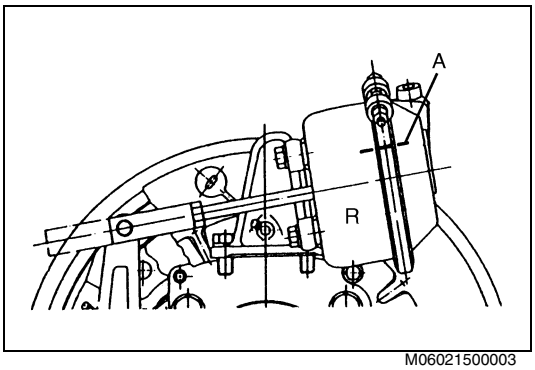
| | | | |
|---|---|---|---|
| 1 | Chamber cover | 7 | Push rod |
| 2 | Clamp nut | 8 | Return spring |
| 3 | Clamp bolt | 9 | Chamber |
| 4 | Clamp | 10 | Holder |
| 5 | Spacer | 11 | Retainer |
| 6 | Diaphragm | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | |
|---|---|---|
| A | 17.7-19.6 {180-200, 13.1-14.4} | |

# OVERHAUL

M06021501BEH2004



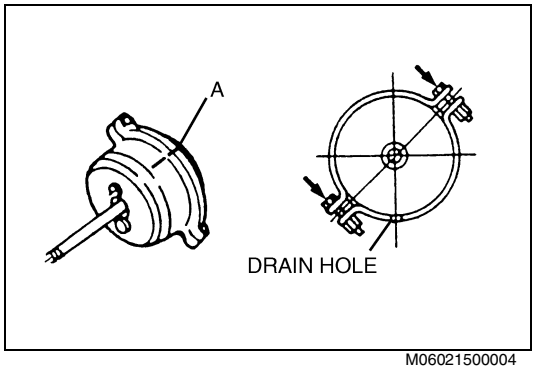

M06021500003

## IMPORTANT POINT - DISMOUNTING

**1. DISMOUNTING OF THE BRAKE CHAMBER**

(1) Before dismounting, apply aligning mark A to the chamber, clamp and chamber cover.

(2) Apply a position mark R or L to identify the side where the chamber was installed.



M06021500004

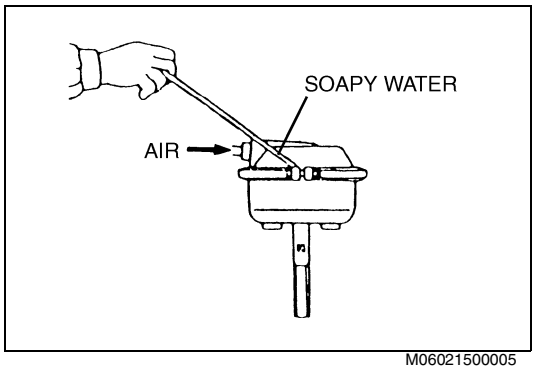
## IMPORTANT POINTS - ASSEMBLY

**1. ASSEMBLING THE BRAKE CHAMBER**

(1) Replace the diaphragm with new one.

(2) Align the aligning mark A of the chamber, clamp and chamber cover.

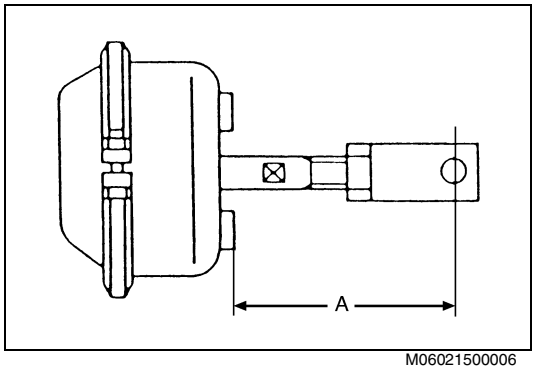
(3) Insert the bolt from opposite side of drain hole and tighten the bolts evenly with nut within the specified torque.



M06021500005

**2. CHECKING FOR AIR LEAKAGE**

(1) Apply soapy water to the chamber as shown and charge with compressed air of 830 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} from the inlet port A then check for leakage.



M06021500006

**3. INSTALLING CLEVIS**

(1) Install the clevis to the push rod and adjust dimension A to the specified value.
**Assembly Standard: 183 mm {7.205 in.}**

## IMPORTANT POINT - MOUNTING

**1. INSTALLING THE BRAKE CHAMBER**

(1) The chamber must be mounted on the side as marked when dismounting.

**NOTICE:**

- **See the position mark (R or L) which was applied when dismounting.**
- **When connecting the clevis with the slack adjuster, lubricate the clevis pin hole and clevis pin with sufficient chassis grease.**

# INSPECTION AND REPAIR

**M06021501BEH3004**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Cover, clamp, push rod, return spring and chamber: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# BRAKE CHAMBER (MODELS: FL, FM)

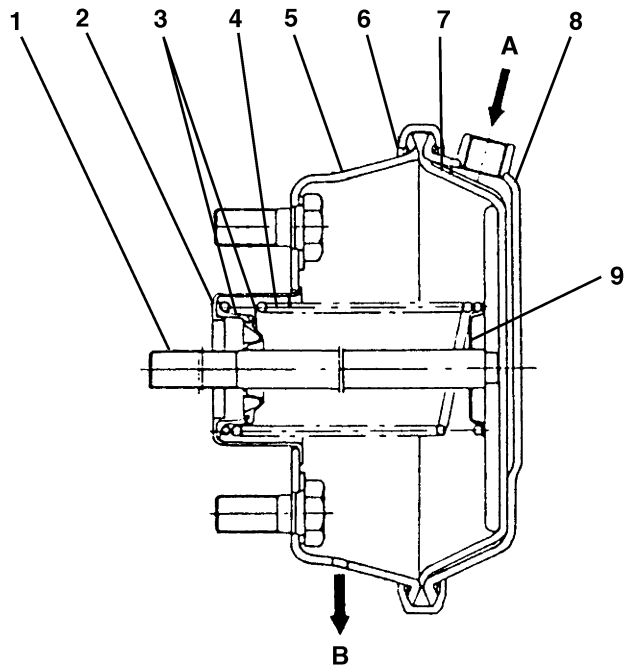
## DATA AND SPECIFICATION

M06021501BEI2005

| | |
|---|---|
| **Type** | **Diaphragm type** |

## DESCRIPTION

M06021501BEC1005

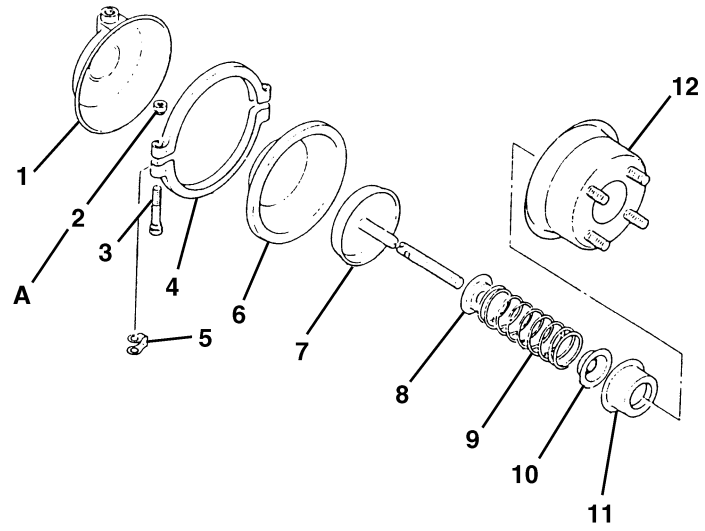



M06021500037

| | | | |
|---|---|---|---|
| 1 | Push rod | 7 | Diaphragm |
| 2 | Holder | 8 | Chamber cover |
| 3 | Dust seal | 9 | Retainer |
| 4 | Return spring | A | Inlet |
| 5 | Chamber | B | Drain hole |
| 6 | Clamp | | |

# COMPONENT LOCATOR

M06021501BED1005




M06021500038

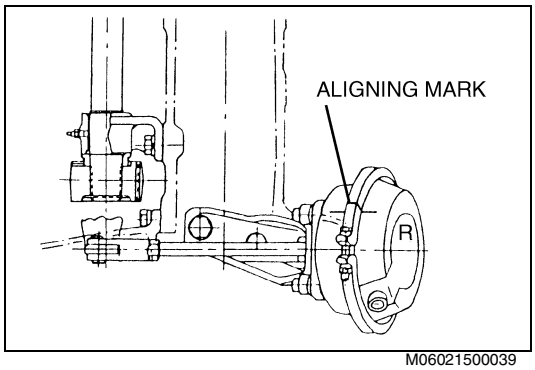
| | | | |
|---|---|---|---|
| 1 | Chamber cover | 7 | Push rod |
| 2 | Clamp nut | 8 | Retainer |
| 3 | Clamp bolt | 9 | Return spring |
| 4 | Clamp | 10 | Dust seal |
| 5 | Spacer | 11 | Holder |
| 6 | Diaphragm | 12 | Chamber |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | |
|---|---|---|
| A | 26.5-32.3 {270-330, 20-23} | |

# OVERHAUL

M06021501BEH2005



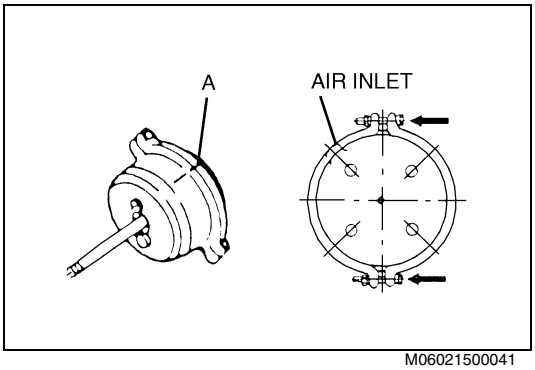

M06021500039

## IMPORTANT POINT - DISMOUNTING

**1. DISMOUNTING OF THE BRAKE CHAMBER**

(1) Before dismounting, apply aligning mark to the chamber, clamp and chamber cover.

(2) Apply a position mark R or L to identify the side where the chamber was installed.

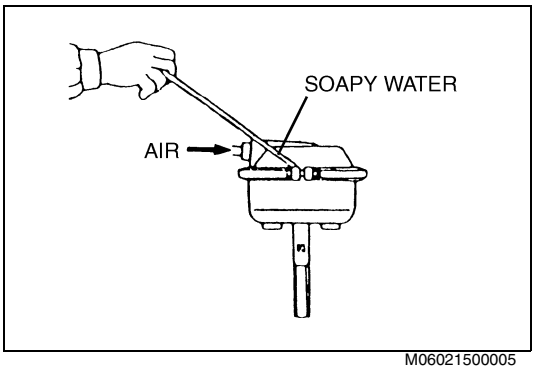


M06021500041

## IMPORTANT POINTS - ASSEMBLY

**1. ASSEMBLING THE BRAKE CHAMBER**

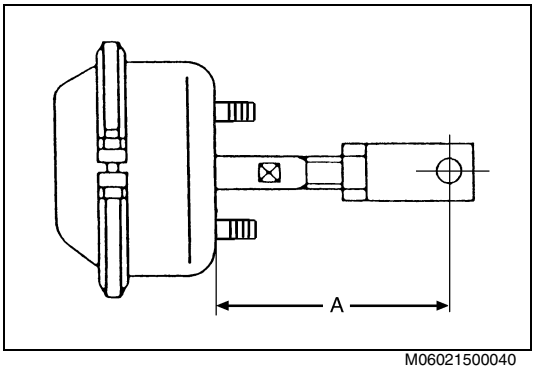
(1) Replace the diaphragm with new one.
(2) Align the aligning mark A of the chamber, clamp and chamber cover.
(3) Insert the bolt from opposite side of drain hole and tighten the bolts evenly with nut within the specified torque.



M06021500005

**2. CHECKING FOR AIR LEAKAGE**

(1) Apply soapy water to the chamber as shown and charge with compressed air of 830 kPa {8.5 kgf/cm$^2$, 121 lbf/in$^2$.} from the inlet port A then check for leakage.



M06021500040

**3. INSTALLING CLEVIS**

(1) Install the clevis to the push rod and adjust dimension A to the specified value.

| | | ID MARK |
|---|---|---|
| **Assembly Standard:** | **85 mm {3.35 in.}** | **-3100/ -3110** |
| | **318 mm {12.52 in.}** | **-3080/ -3090** |
| | **330 mm {12.99 in.}** | **-2910/ -2920** |

## IMPORTANT POINT - MOUNTING

**1. INSTALLING THE BRAKE CHAMBER**

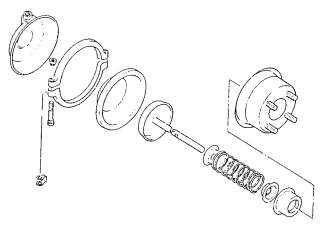
(1) The chamber must be mounted on the side as marked when dismounting.

**NOTICE:**

- **See the position mark (R or L) which was applied when dismounting.**
- **When connecting the clevis with the slack adjuster, lubricate the clevis pin hole and clevis pin with sufficient chassis grease.**

# INSPECTION AND REPAIR

**M06021501BEH3005**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Cover, clamp, push rod, return pring, retainer, dust seal, holder and chamber: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# TRAILER HAND BRAKE CONTROL VALVE (MODELS: FM1JKPA, FM2PKPA)

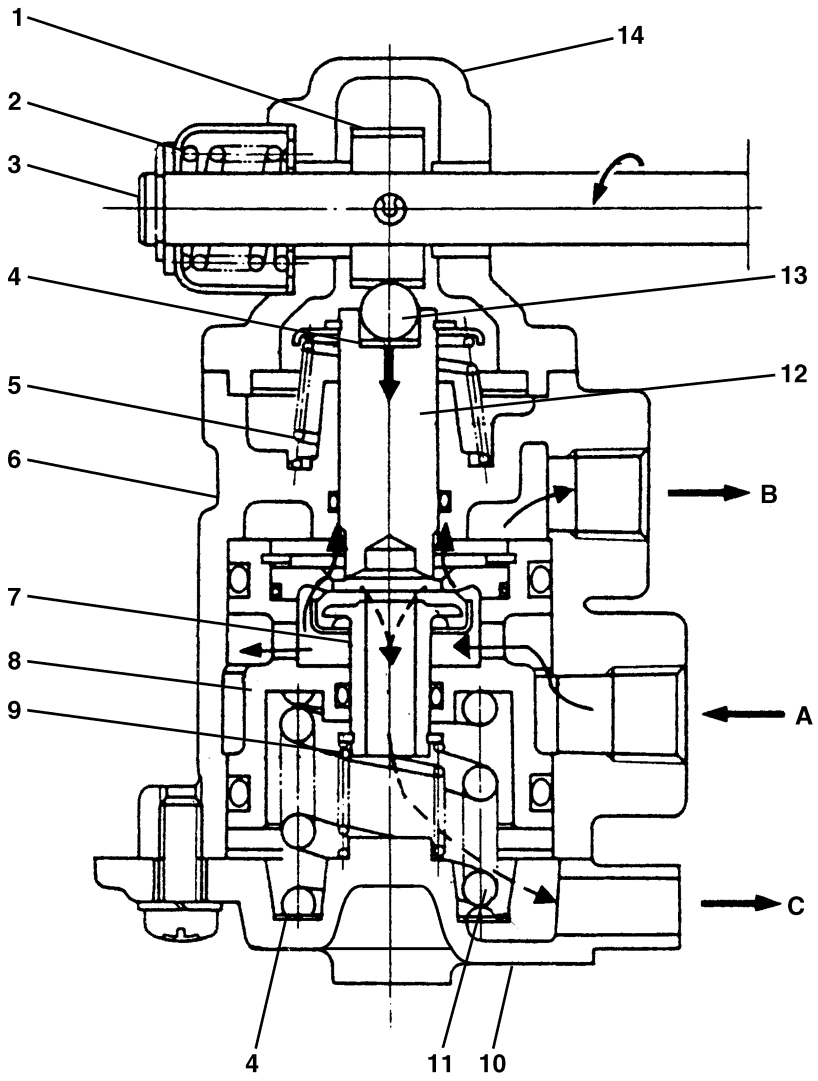
## DATA AND SPECIFICATION

M06021601BEI2001

| | |
|---|---|
| **Type** | **Variable pressure control type** |

## DESCRIPTION

M06021601BEC1001

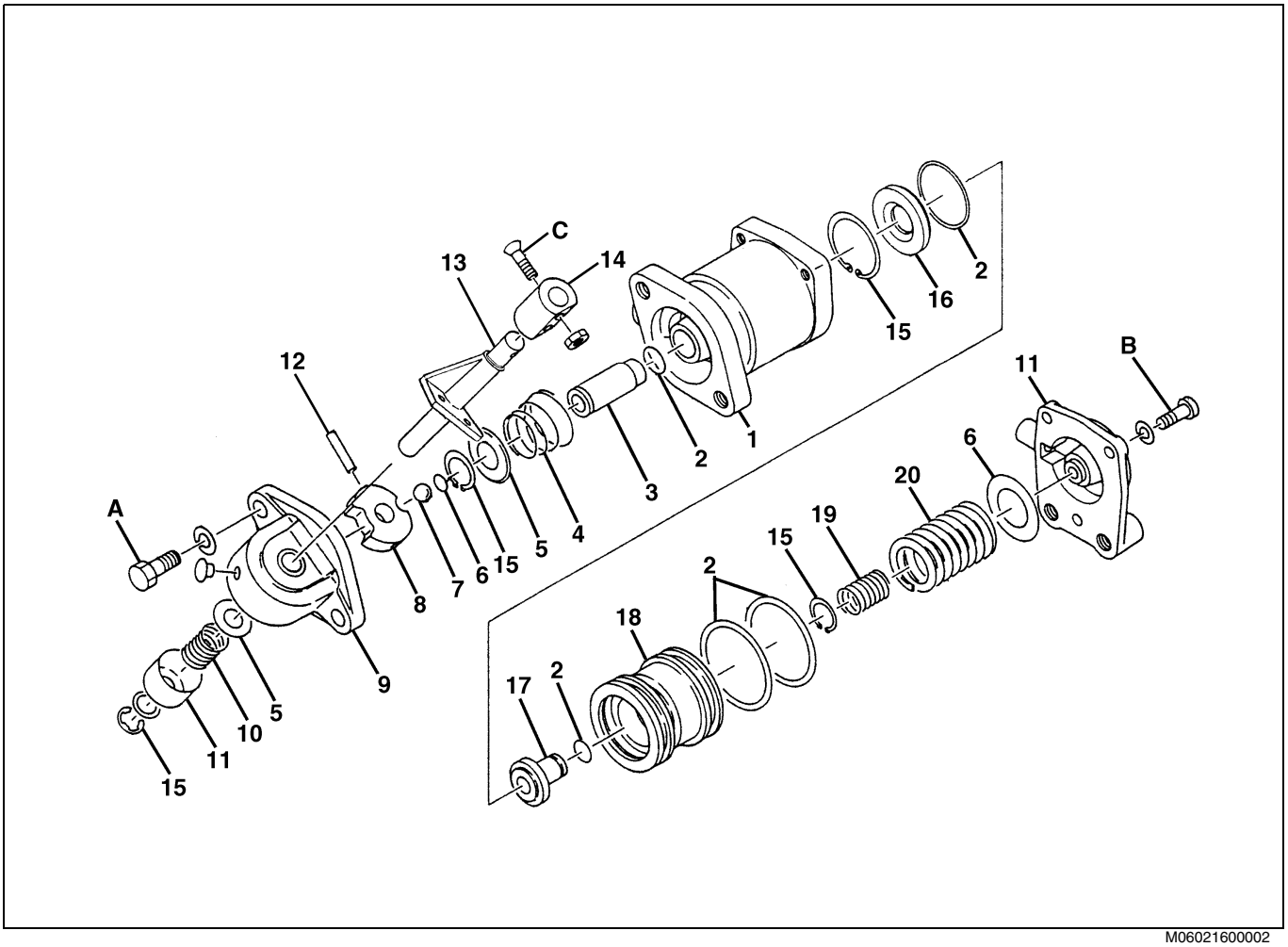



M06021600012

| | | | | | |
|---|---|---|---|---|---|
| 1 | Cam | 7 | Feed valve | 13 | Steel ball |
| 2 | Spring | 8 | Piston | 14 | Holder |
| 3 | Handle | 9 | Inner spring | A | Inlet |
| 4 | Shim | 10 | Cover | B | Outlet |
| 5 | Conical spring | 11 | Outlet spring | C | Exhaust |
| 6 | Valve body | 12 | Exhaust valve | | |

# COMPONENT LOCATOR

M06021601BED1001




M06021600002

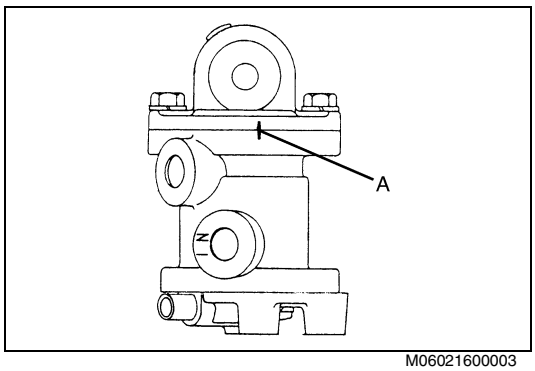
| | | | | | |
|---|---|---|---|---|---|
| 1 | Valve body | 8 | Cam | 15 | Retainer ring |
| 2 | O-ring | 9 | Holder | 16 | Valve seat |
| 3 | Exhaust valve | 10 | Spring | 17 | Feed valve |
| 4 | Conical spring | 11 | Cover | 18 | Piston |
| 5 | Spring seat | 12 | Pin | 19 | Inner spring |
| 6 | Shim | 13 | Handle | 20 | Outer spring |
| 7 | Steel ball | 14 | Connector | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 9.9-19.6 {100-200, 8-14} | B | 5.4-7.3 {55-75, 4.0-5.4} |
| C | 2.5-3.9 {25-40, 1.9-2.8} | | |

# OVERHAUL

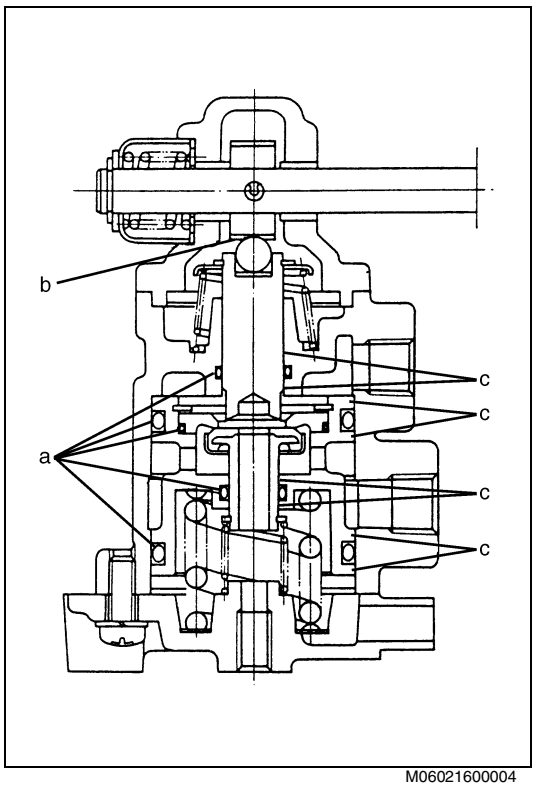
M06021601BEH2001



M06021600003

## IMPORTANT POINT - DISASSEMBLY

Before disassembling the hand brake valve, mark the aligning mark "A" on the holder and valve body.



M06021600004

## IMPORTANT POINT - ASSEMBLY

**1. LUBRICATION**

(1) When assembling the hand brake valve, use new O-ring and feed valve.

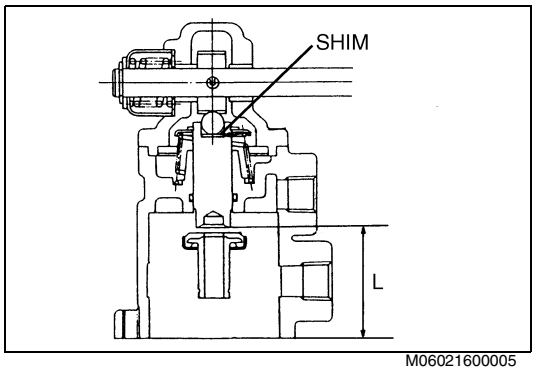
(2) Apply silicone grease to each sliding surface of the component parts and O-ring groove.

a. **O-ring**

b. **Contact of steel ball**

c. **Sliding surface**

(3) Align the aligning mark of the holder and valve body.



M06021600005

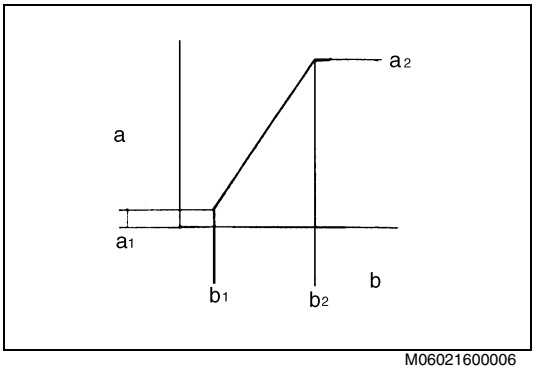
## IMPORTANT POINT - ADJUSTMENT

**1. EXHAUST VALVE FITTING HEIGHT**

(1) Measure the exhaust valve fitting height "L" and adjust it.

**NOTICE:**
**Adjust this dimension with shims.**

**L: 38.3-38.7 mm {1.508-1.523 in.}**



M06021600006

**2. HAND BRAKE VALVE PERFORMANCE CHARACTERISTIC.**

a. **Air pressure at outlet port (kPa {kgf/cm$^2$, lbf/in$^2$})**

b. **Handle turning angle (°)**

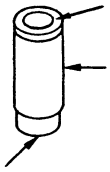
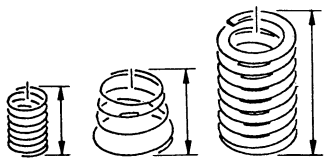
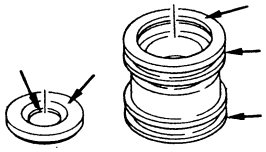
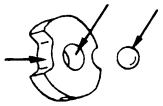
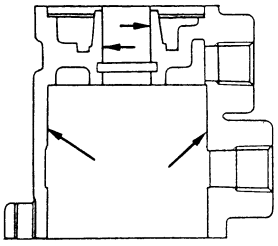
| | | |
|---|---|---|
| **a** | **($a_1$) 19.6-68.6 {0.2-0.7, 2.8-9.9}** | **($a_2$) 460.6-558.6 {4.7-5.7, 66.8-81.0}** |
| **b** | **($b_1$) 7-13** | **($b_2$) 37-43** |

**NOTICE:**
**The characteristic shown in both diagrams are for inlet air pressure of 690 kPa {7.0 kgf/cm$^2$, 99.54 lbf/in$^2$.}**
**The characteristic can be adjusted by changing the shim thickness of the steel ball and of the outer spring.**

# INSPECTION AND REPAIR

M06021601BEH3001

**Unit: mm {in.}**

| Inspection Item | Standard | Limit | Remedy | Inspection Procedure |
|---|---|---|---|---|
| **Sliding surface of exhaust valve: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Spring: Rust and damage Measure the spring dimension.** | **1. 28.5 {1.122}<br>2. 38 {1.496}<br>3. 31 {1.220}** | **27 {1.063}<br>35 {1.377}<br>29 {1.142}** | **Replace, if necessary.** | **Measure and visual check**  |
| **Piston and valve seat: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Cam and steel ball: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Valve body: Rust, wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |

# ABS (ANTI-LOCK BRAKE SYSTEM)

BR03-001

**ABS .....BR03-2**
OVERVIEW ..... BR03-2
COMPOSITION AND OPERATION ..... BR03-3
FUNCTION ..... BR03-6
OVERVIEW AND FUNCTION ..... BR03-7

**FRONT WHEEL BRAKE.....BR03-16**
COMPONENT LOCATOR ..... BR03-16
OVERHAUL ..... BR03-17

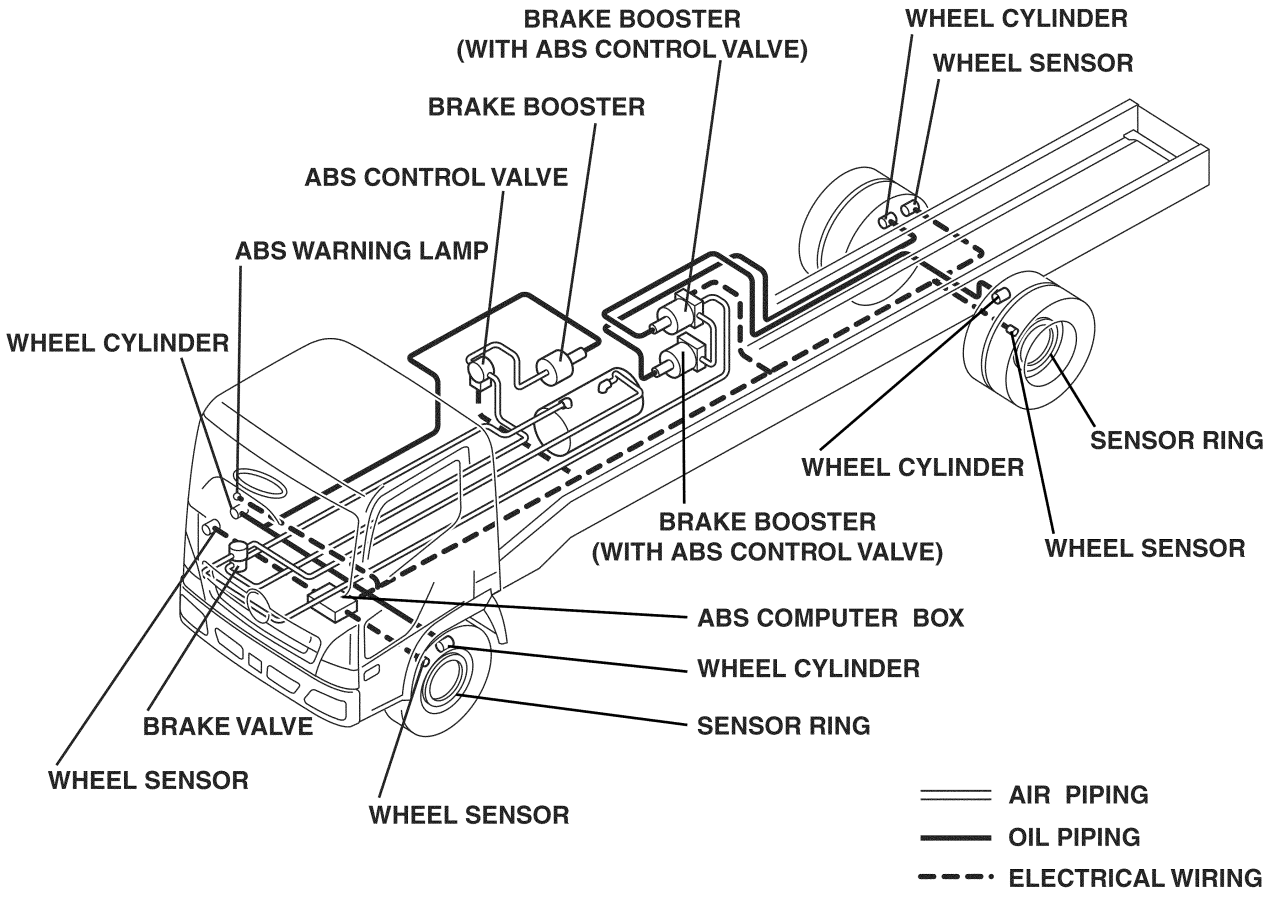
**REAR WHEEL BRAKE.....BR03-20**
COMPONENT LOCATOR ..... BR03-20
OVERHAUL ..... BR03-21

# ABS

## OVERVIEW

M16030101BEC1009

ABS is a system that makes effective use of the friction between the tires and the road surface to maintain vehicle stability while the brakes are being applied and for stopping the vehicle.
Applying the brakes forcefully on a slippery road surface can cause the wheels to be locked, due to excessive braking force. This causes the vehicle to lose a stability because the locked wheels lose resistance in the lateral direction. More specifically, if the front wheels are locked, it becomes impossible to steer the vehicle, and if the rear wheels are locked, the rear of the vehicle may fishtail from side to side.
Also, when wheel-locking occurs, it is not possible to make effective use of friction between the tires and the road surface. This may cause the braking distance to be increased.
ABS uses wheel sensors mounted on the axles to constantly monitor the rotation of the wheels. If any of the wheels is starting to lock up, the ABS computer sends signals to the ABS control valve and immediately adjusts the brake pressure to prevent wheel-locking.
In this way, ABS maintains the stability of the vehicle while stopping by making effective use of the friction between the tires and the road surface.




ABS SYSTEM OVERVIEW DIAGRAM (REPRESENTATIVE MODEL)

M06030100001

# COMPOSITION AND OPERATION

M16030101BEC1010

The ABS system is comprised of the sensor rings mounted on the wheels, the ABS computer, which receives signals from the wheel sensors that monitor the rotational speed of the wheels and outputs control signals to maintain the appropriate braking force; ABS control valves, which increase or decrease the braking force, based on the control signals; the warning lamp, which gives an alarm if the system malfunctions; the piping, wire harnesses, etc., that link together the various units that compose the system.

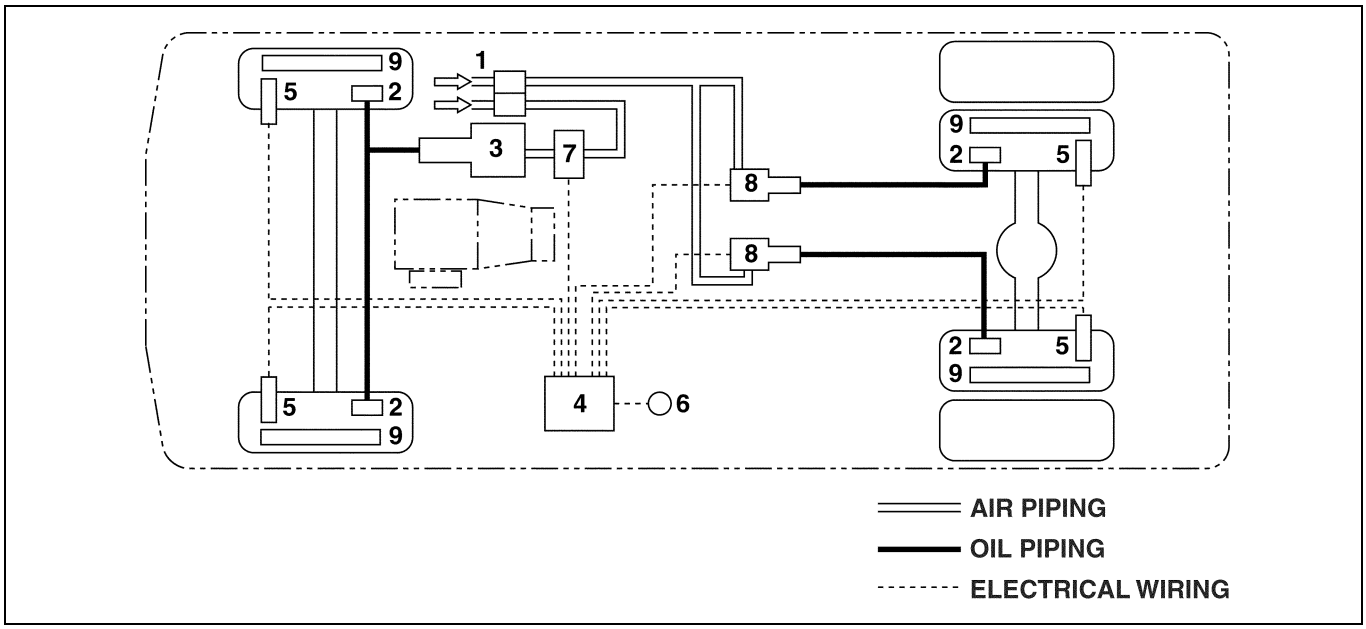
Pulse signals transmitted by the sensor rings mounted on the wheel hubs, rotated together with the wheels, and the wheel sensors mounted near sensor ring on the axles are sent to the ABS computer. The ABS computer then calculates the wheels' rotational speed, acceleration, deceleration, and amount of slippage, based on these signals.

If the limit values for the wheel's deceleration, or slippage ratio are exceeded, the ABS computer immediately transmits signals to the ABS control valves to adjust any excess braking force.

- ABS system operates as following table.

| | FRONT AXLE | REAR AXLE |
|---|---|---|
| **CONTROL SYSTEM** | Control both right and left wheel together | Independently control right and left wheels |

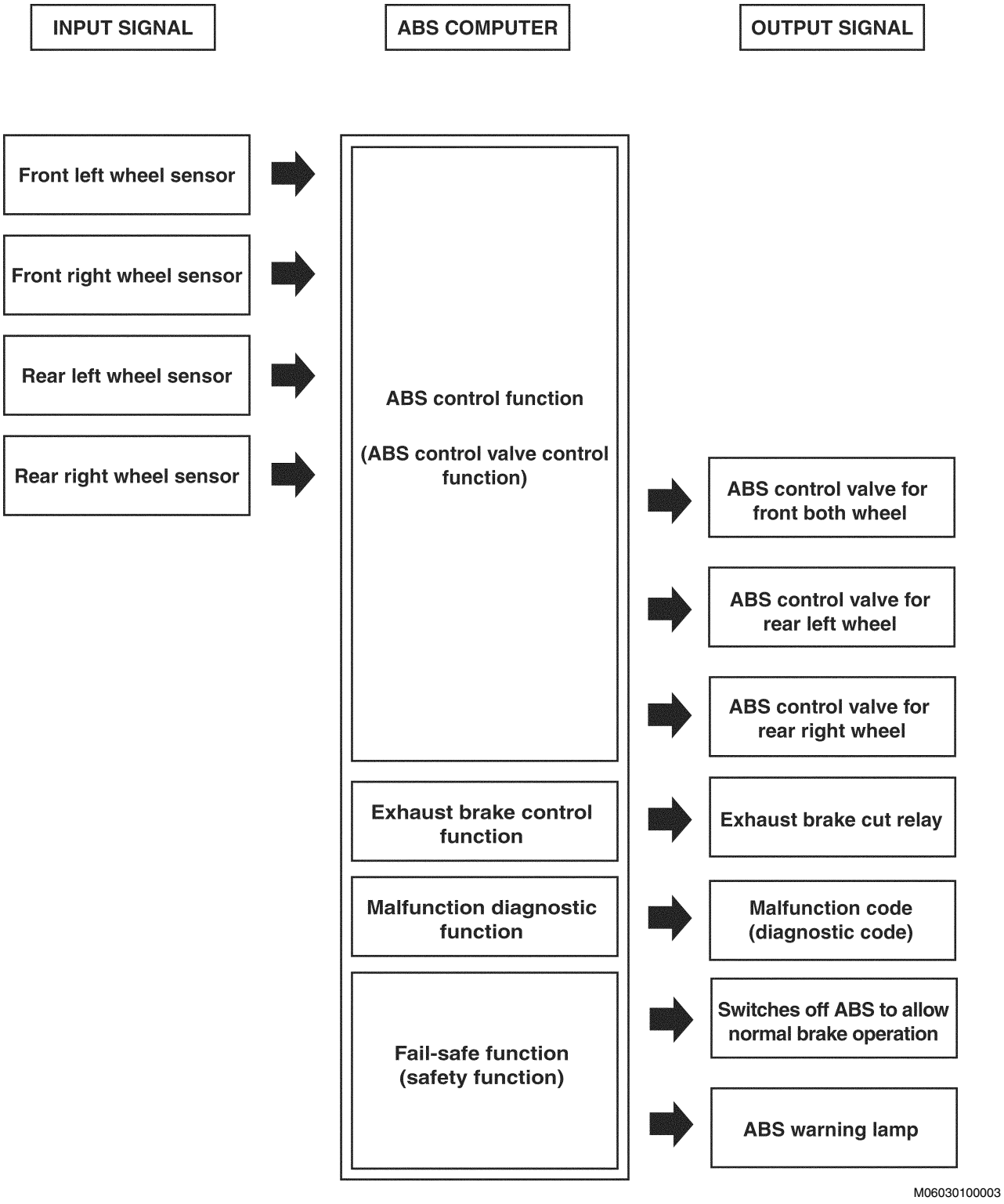
## SYSTEM COMPOSITION DIAGRAM




M06030100002

| | | | |
|---|---|---|---|
| **1** | **Brake valve** | **6** | **ABS warning lamp** |
| **2** | **Wheel cylinder** | **7** | **ABS control valve** |
| **3** | **Brake booster** | **8** | **Brake booster (with ABS control valve)** |
| **4** | **ABS computer** | **9** | **Sensor ring** |
| **5** | **Wheel sensor** | | |

## ABS CONTROL FLOWCHART




M06030100003

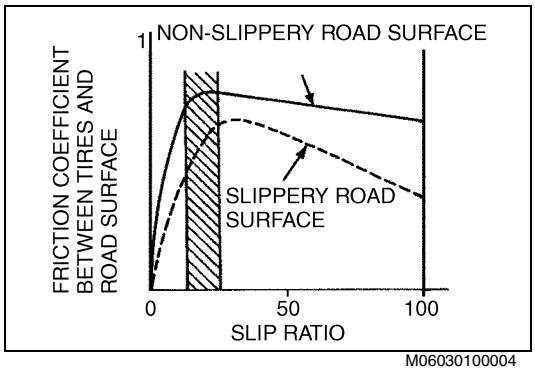
## BASIC PRINCIPLE

Based on its relationship with the slip ratio, which is determined from the wheels' rotational speed and the vehicle's speed, ABS controls the brake force so that it will be most effective.

When the driver applies the brakes, the rotation of the wheels is controlled and the vehicle speed drops. However, the momentum of the vehicle attempts to push it forward further even though the rotation of the wheels is being braked. At this point, slipping will occur if there is a gap between the wheels' rotational speed and the vehicle's speed. The slip ratio is a value that indicates the rate of slippage.

$$\text{Slip ratio} = \frac{\text{Vehicle's speed - Wheel's rotational speed}}{\text{Vehicle's speed}} \times 100\ \%$$

**Slip ratio**
**0 % : No slipping between the wheels and the road surface**
**100 % : Wheels locked**

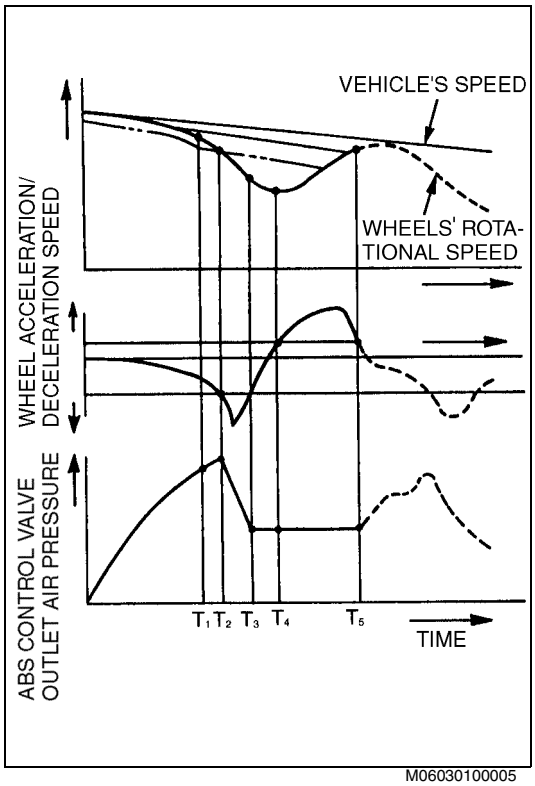


M06030100004

The graph shown at left shows the relationship between the friction coefficient of the tires and of the road surface and the slip ratio.

In an ABS-equipped vehicle, the brake force is controlled to ensure that it is within the range where the friction coefficient is high (shaded portion of the graph) without locking the wheels. This ensures efficient braking performance.

## OPERATION



M06030100005

The ABS control characteristics line graph at left illustrates how the vehicle's speed, the wheels' rotational speed, the wheel acceleration/deceleration, and the air pressure at the ABS control valve outlet change over time after the brakes are applied.

When the brakes are applied, the vehicle's speed and the wheels' rotational speed drop and at the same time, the wheel acceleration/deceleration speed also drops. At point T1, a gap begins to open between the wheels' rotational speed and the vehicle's speed. Passing on point T2, the ABS computer detects that the wheels are beginning to lock and is lowering the outlet air pressure of the ABS control valve to prevent wheel locking from occurring.

At point T3, the wheel acceleration/deceleration speed is starting to return to normal one, and the ABS computer stops lowering the air pressure at the ABS control valve outlet and maintains it at a constant level.

At point T5, the wheels' rotational speed and the vehicle's speed are about the same. The ABS computer detects that the wheels are no longer likely to be locked and increases the air pressure at the ABS control valve outlet.

The above processes is repeated over and over until the vehicle comes to a complete stop.

# FUNCTION

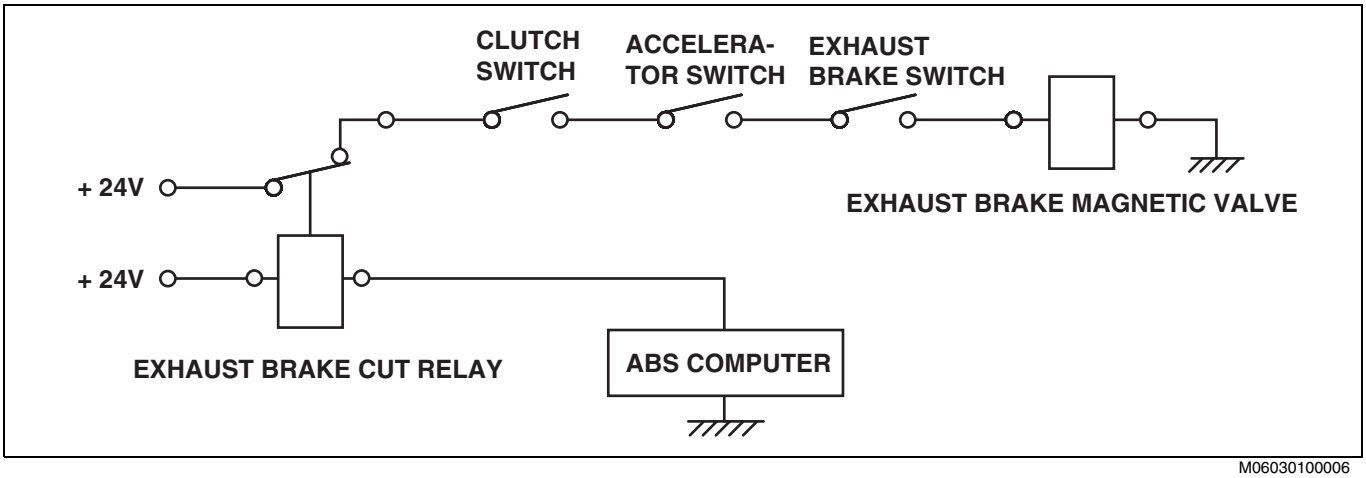
M06030101BEC1011

## FAIL-SAFE FUNCTION

This ABS system is equipped with a fail-safe function that causes the ABS warning lamp on the instrument panel to light and to restore the normal (non-ABS) brake system, should an ABS malfunction occur.
Note that the ABS system consists of two independent circuits. Should a malfunction occur for whatever reason in the electrical circuits, that system's ABS is switched off and the normal brake system is restored while ABS control continued for the other system. This configuration is designed to minimize the effects of any malfunction on ABS function.

## EXHAUST BRAKE CONTROL FUNCTION

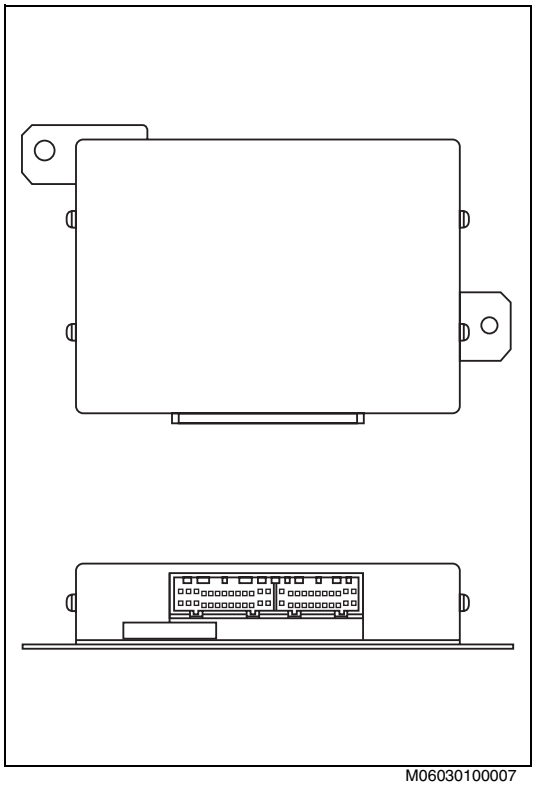
The ABS system of this vehicle is equipped with a function that controls the exhaust brake while ABS is operating.
If the exhaust brake is applied independently or together with the service brake on a road surface with very low friction coefficient, the driving wheels may lock. This ABS system prevents the driven wheels from locking in such cases by automatically releasing the exhaust brake, if necessary, during ABS operation.




M06030100006

# OVERVIEW AND FUNCTION

M06030101BEC1012



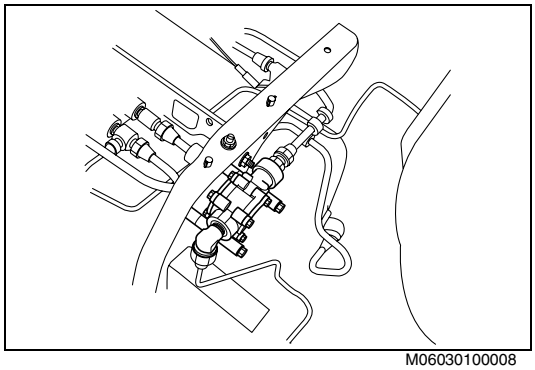
M06030100007

## 1. ABS COMPUTER

Based on pulse signals from the wheel sensors, the ABS computer mounted in the vehicle calculates and evaluates the slip ratio and the acceleration/deceleration speed of the wheels. Based on the results, it sends signals to the various control valves as necessary, causing them to operate and apply the brakes to maintain the slippage of the wheels within the optimal range.

During braking, the air pressure applied to the brake boosters is regulated to prevent the wheels from locking. The brakes are applied so as to maintain the slippage of the wheels within the optimal range.

Regardless of whether the vehicle is stopped or being driven, and whether or not the brakes are being applied, the circuit consisting of the wheel sensors, control valves, ABS computer, and wire harnesses are constantly being checked by the ABS computers' fail-safe circuit. If some sort of malfunction occurs, the fail-safe circuit warns the driver by lighting the ABS warning lamp. At the same time, the ABS system that is experiencing the malfunction is shut off and braking is restored to normal (non-ABS) operation.



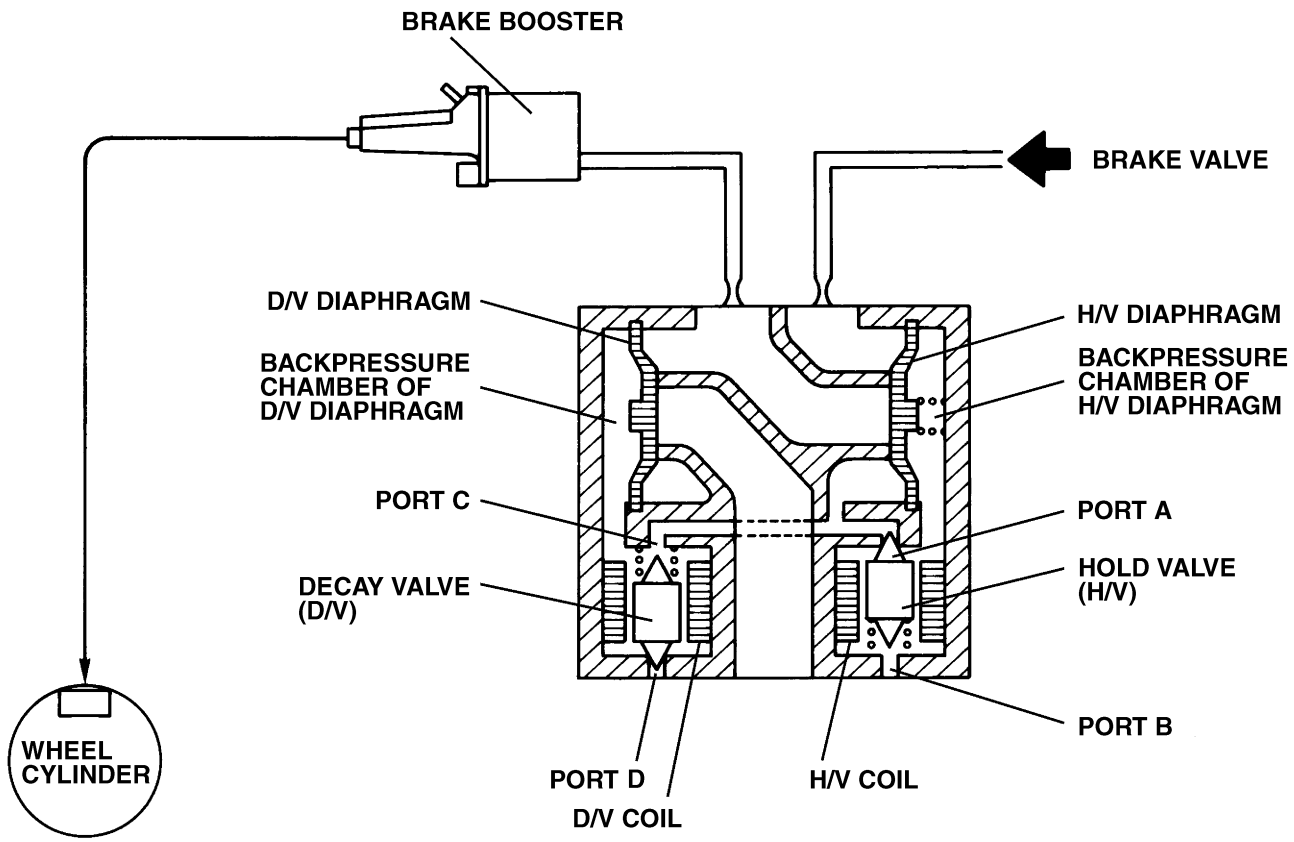
M06030100008

## 2. ABS CONTROL VALVE (FOR FRONT)

(1) Overview

- ABS control valve is located in the brake air circuit between the brake valve and brake booster. This valve is for controlling input air pressure of the brake booster in three mode by holding, depressurizing, or repressurizing the input air pressure of the brake booster according to the instruction signal from the computer.

**ABS CONTROL VALVE**

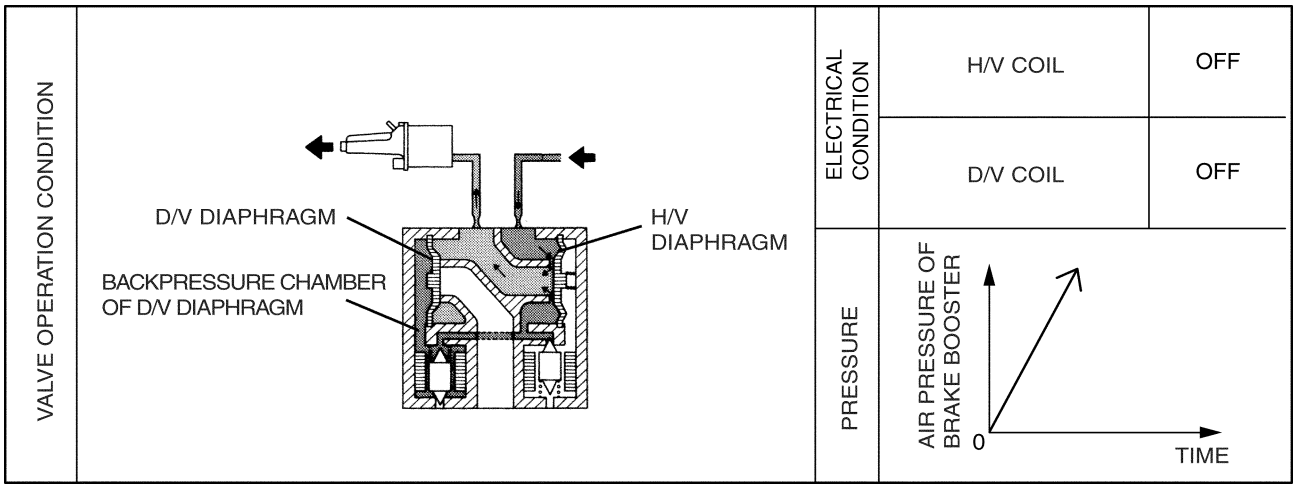



M06030100009

(2) Operation

a. Application of normal brake pressure

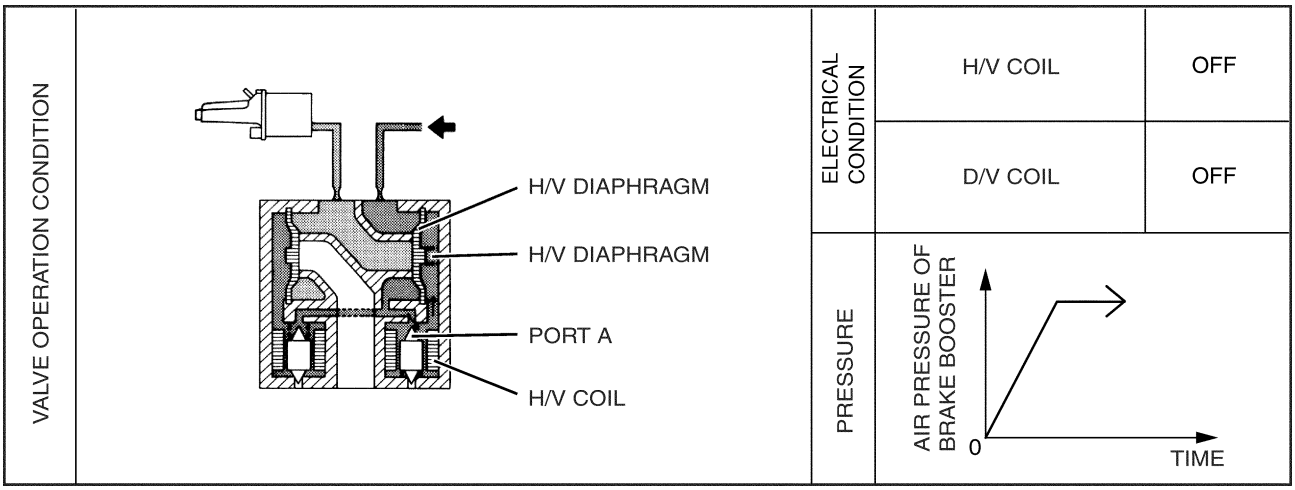
- When the brake valve is depressed, air from the tank pushed open the H/V diaphragm and goes through the backpressure chamber to close the D/V diaphragm. Thus, the air pressure of the brake booster is increased.




M06030100010

b. Pressure holding mode

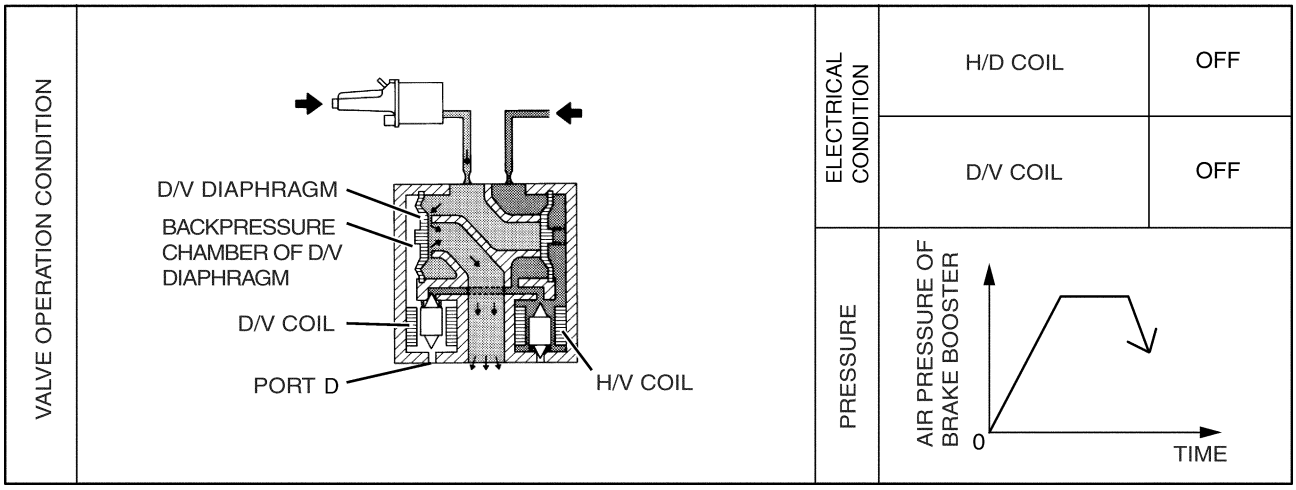
- When the coil for H/V is energized, port A opens and air goes through the backpressure chamber of H/V diaphragm.
- This air pressure in the backpressure chamber keeps H/V diaphragm closed to shut down the air from the brake valve. Thus, the air pressure of the brake booster is increased.




M06030100011

c. Depressurizing mode

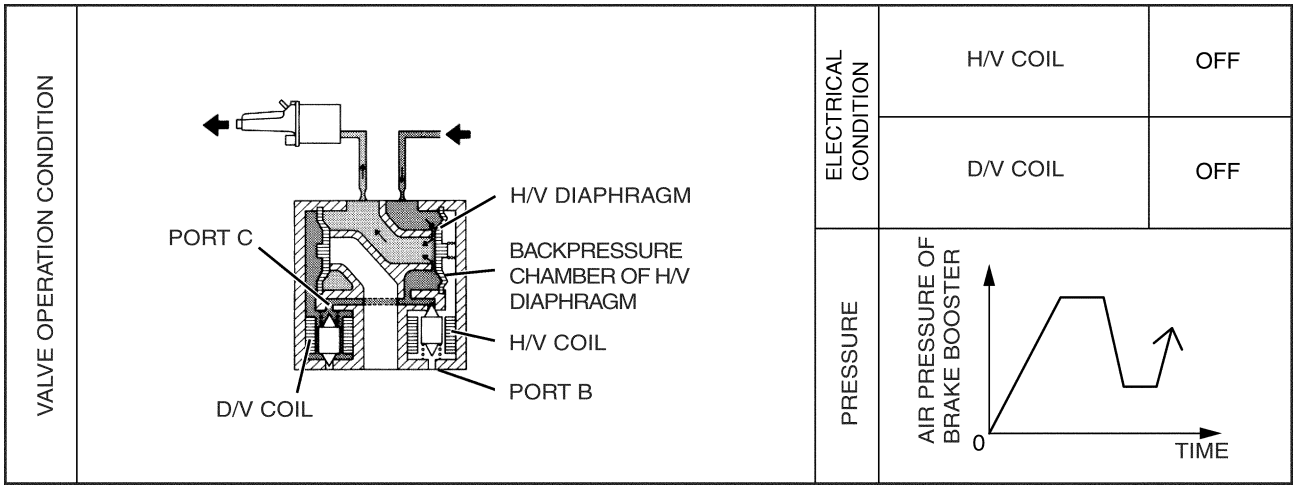
- When D/V coil is energized after turning on H/V coil shuts down the air from the brake valve, port D opens to discharge the air in the backpressure chamber of D/V diaphragm.
- The hold pressure of the brake booster open D/V diaphragm to discharge the air into the atmosphere. Thus, the air pressure of the brake booster is depressurized.



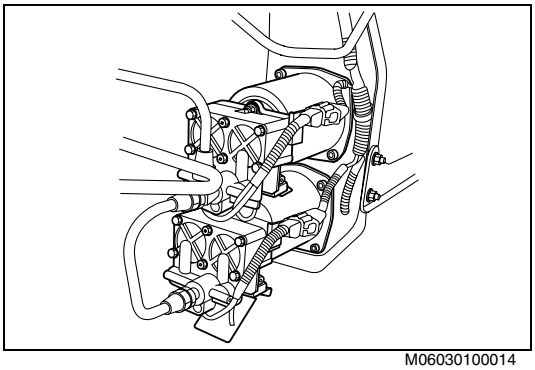

M06030100012

d. Repressurizing mode

- Port C opens when D/V coil is not energized to hold the air pressure of the brake booster.
- Next, turning off H/V coil opens port B to discharge the air in the backpressure chamber of H/V diaphragm. Thus, the air from the brake valve opens H/V diaphragm to repressurize the air pressure of the brake booster.




M06030100013

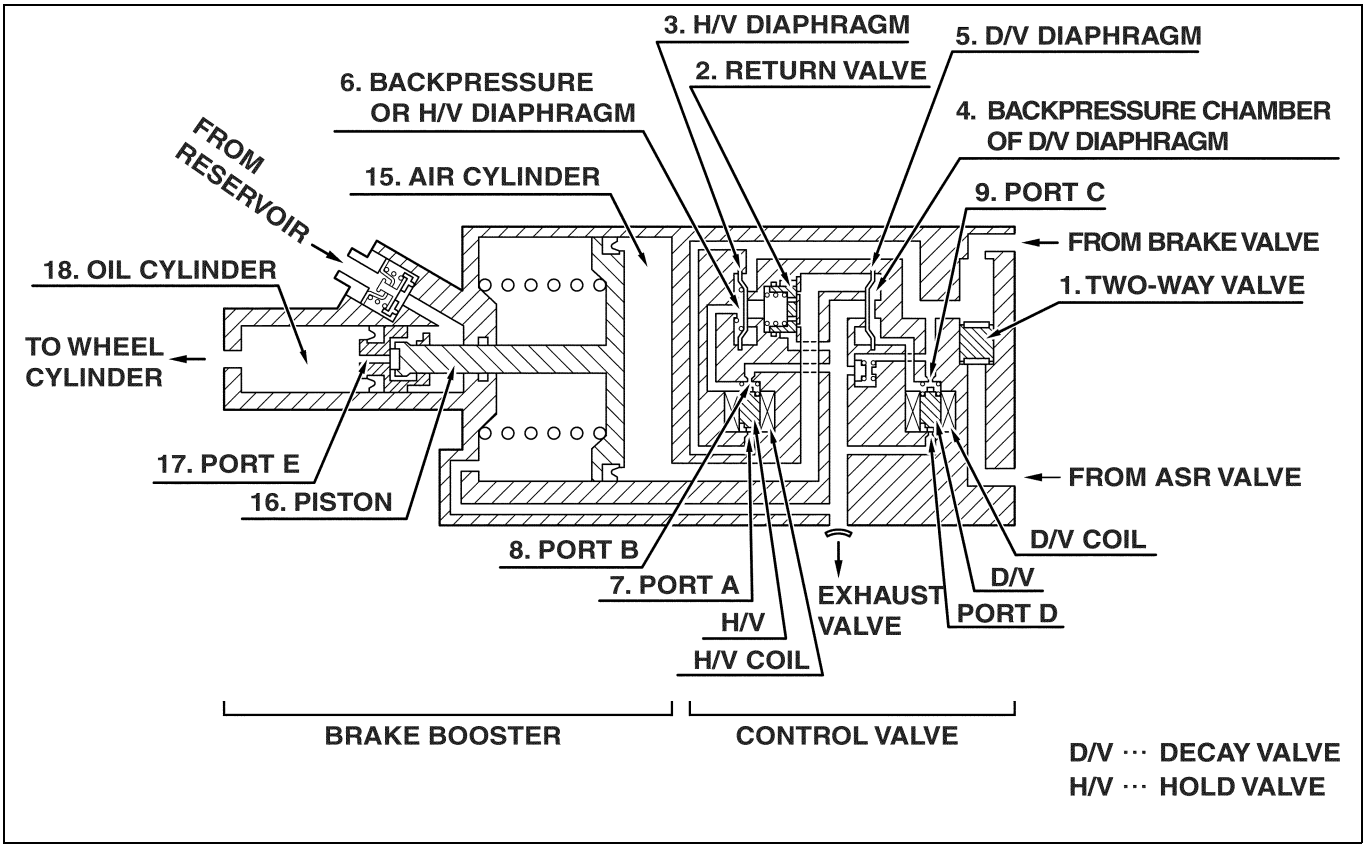


M06030100014

### 3. ABS CONTROL VALVE (FOR REAR)

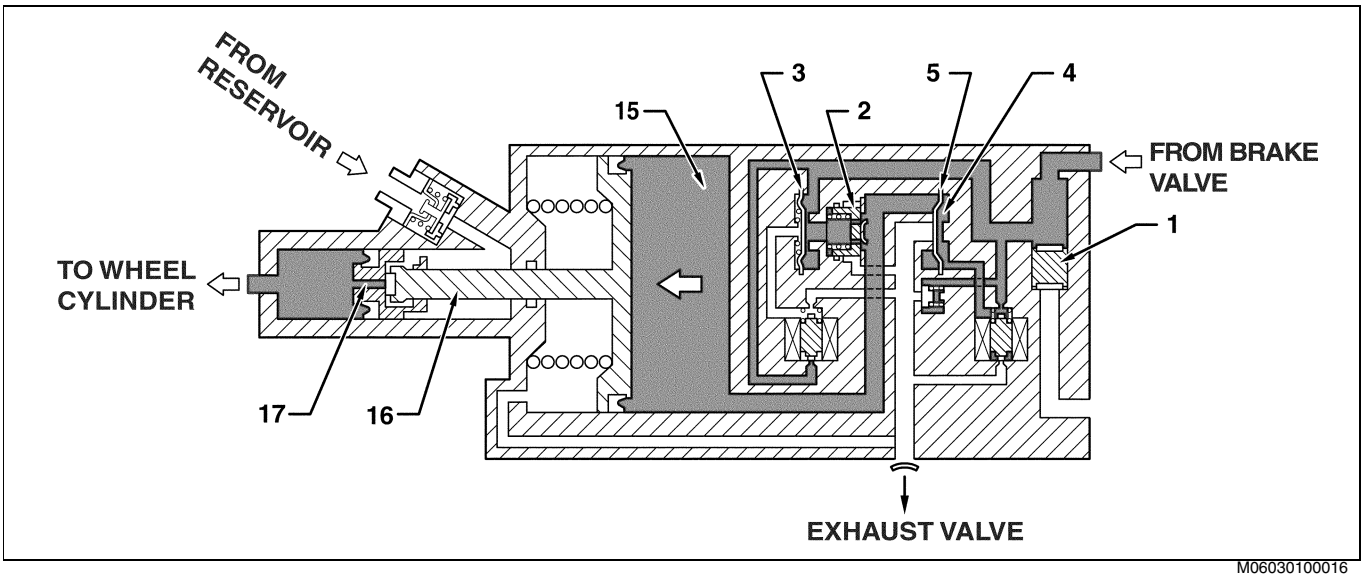
(1) Overview

- Brake booster with ABS control valve is unit incorporating ABS control valve unit and brake booster unit. This ABS control valve unit has the same function as the ABS control valve unit for front.



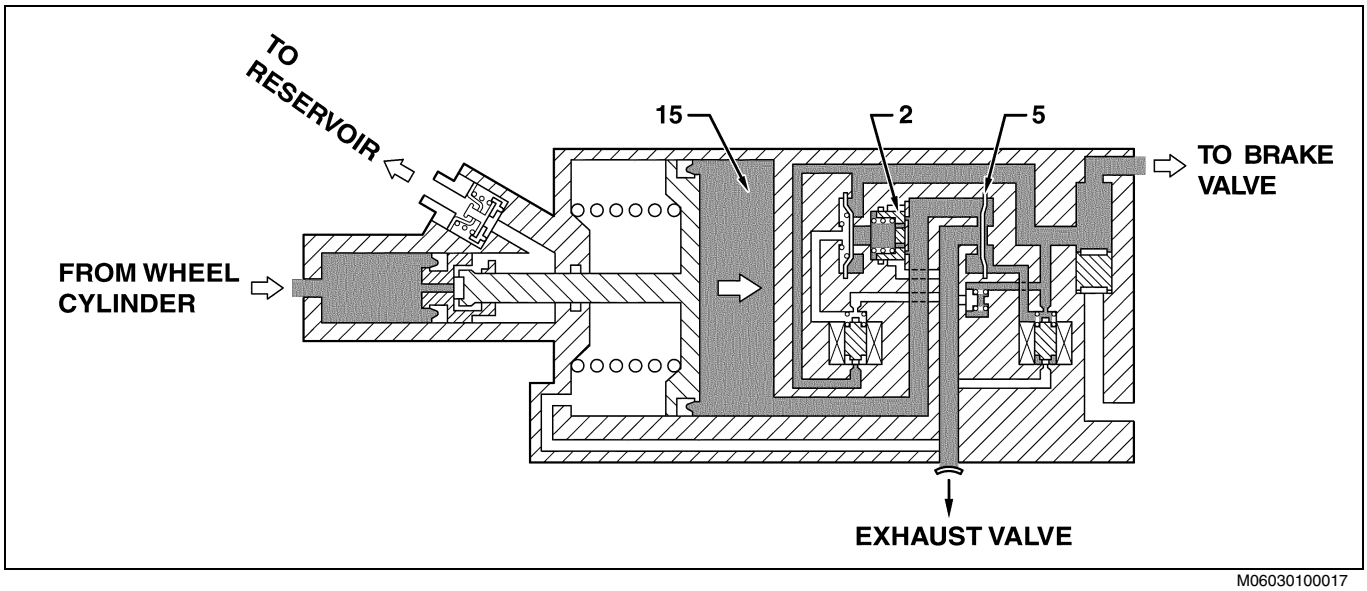

M06030100015

(2) When ABS is not operating (normal brake is operating)
a. When the brake valve is operating



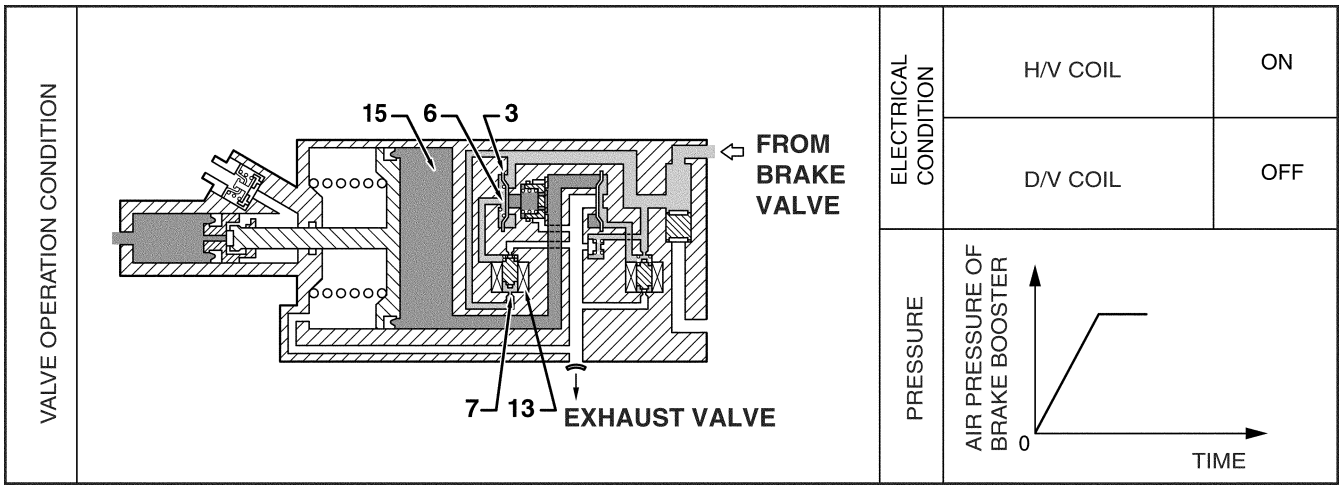

M06030100016

b. When the brake valve is released.



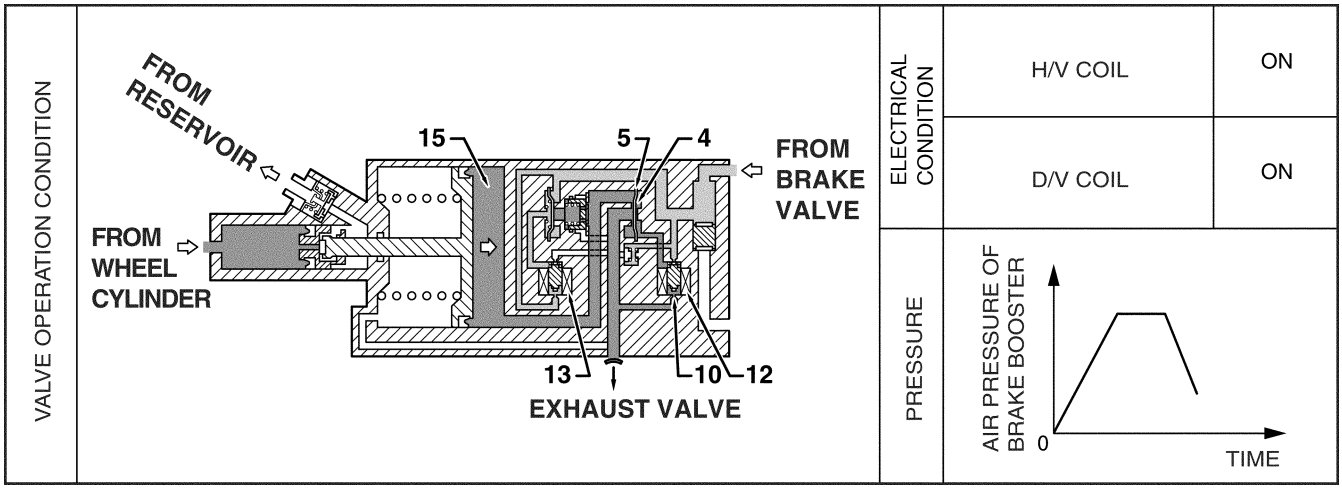

M06030100017

(3) When ABS is operating.
a. Pressure holding mode



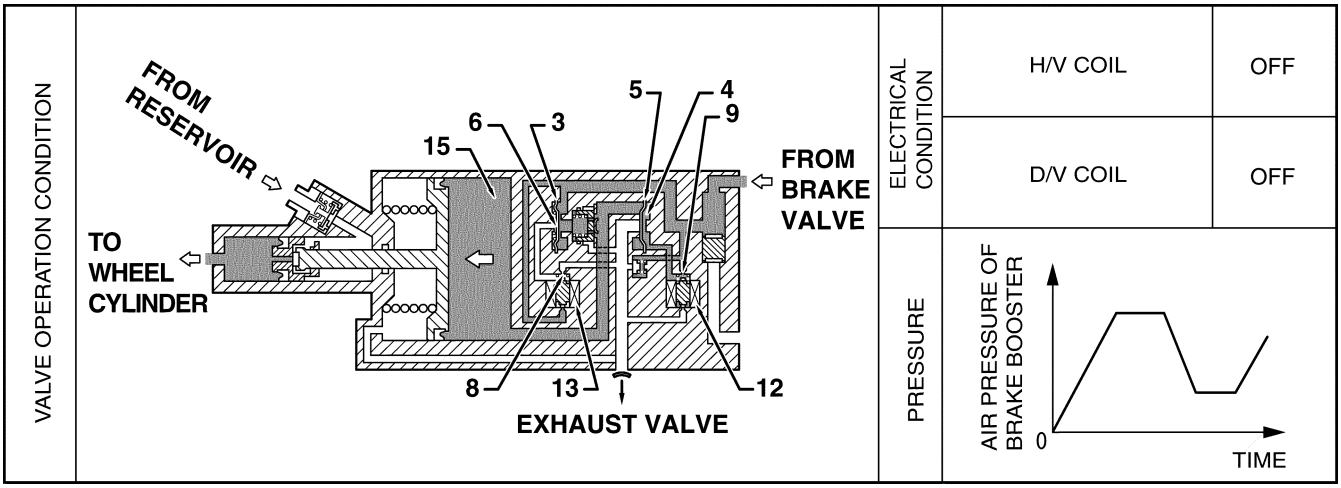

M06030100018

b. Depressurizing mode




M06030100019

c. Repressurizing mode



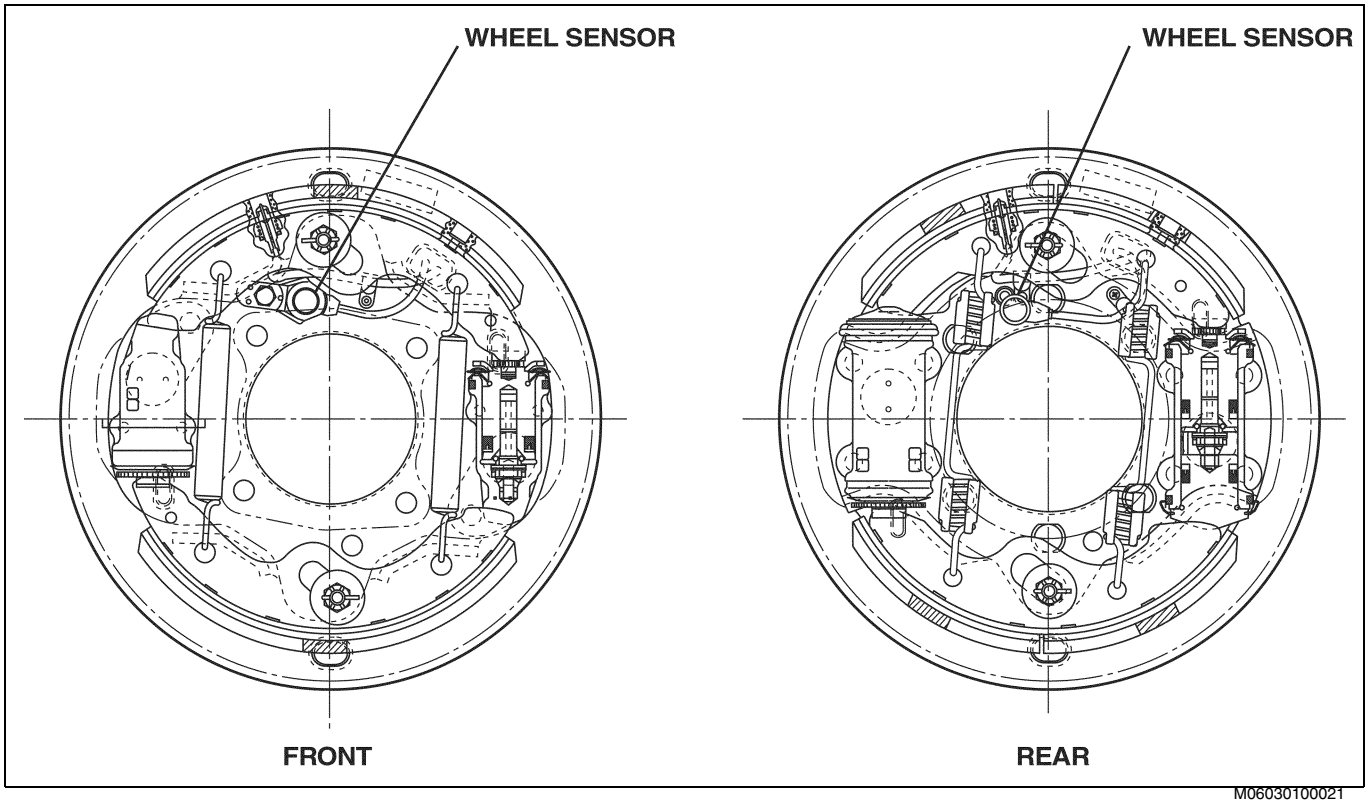

M06030100020

### 4. WHEEL SENSORS

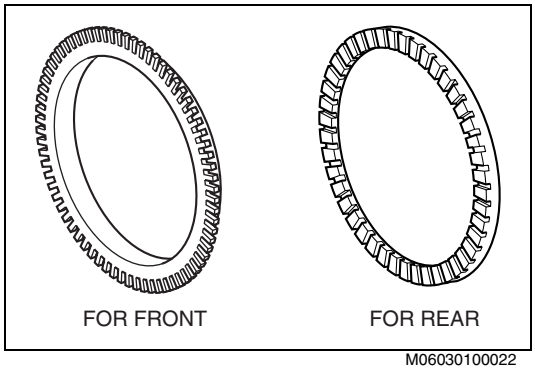
These sensors are mounted, facing the sensor rings on each wheel on the front and rear axles.

The wheel sensors are electromagnet sensors consisting of a permanent magnet core with a coil of wire wrapped around it.

The frequency of the pulse signals generated by magnetic inductance between the sensors and the sensor rings they face is proportional to the rotational speed of the wheels. These pulse signals are sent to the ABS computer and are used to determine the wheels, rotational status.



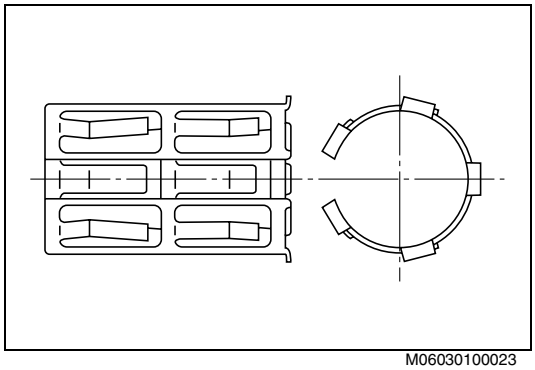

M06030100021




M06030100022

### 5. SENSOR RINGS

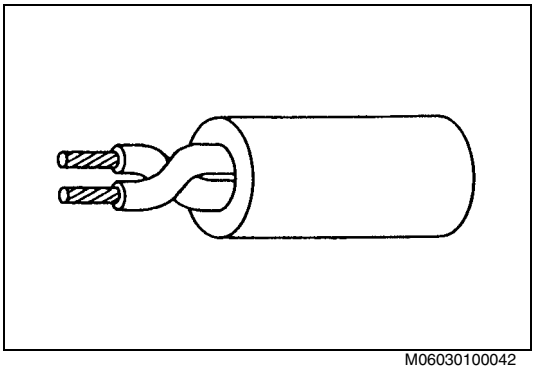
The sensor rings are press-fitted into the insides of the wheel hubs of each wheel on the front and rear axles, and they face the wheel sensors described in the preceding section. The sensor rings are made of a magnetic material, and teeth are cut into the surface which faces the wheel sensor at regular intervals. Also, when the sensor ring performs one complete rotation, the sensor generates pulse signals corresponding to the number of teeth.



M06030100023

### 6. CLAMPING BUSHINGS

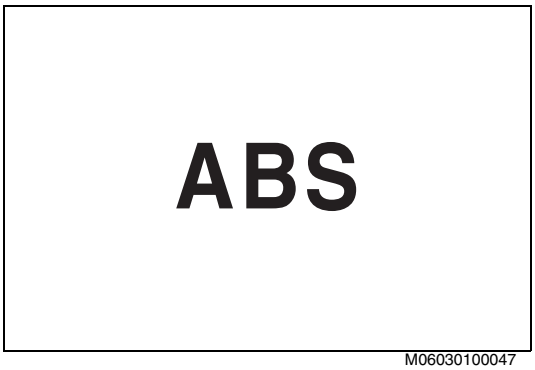
The wheel sensors are held in place through friction by clamping bushings that are inserted into the mounting brackets. If they are assembled properly, the clamping bushings serve to eliminate the need to adjust the clearance between the wheel sensors and sensor rings.



M06030100042

**7. WHEEL SENSOR HARNESSES**

Each wheel sensor wire harness employs a two-conductor twisted wire cable. Its function is to protect the wheel sensor signals, which are vital to the proper operation of the ABS system, from electromagnetic interference. Under no circumstances should any part of the wheel sensor wire harnesses be cut or connected to any other wire.




M06030100047

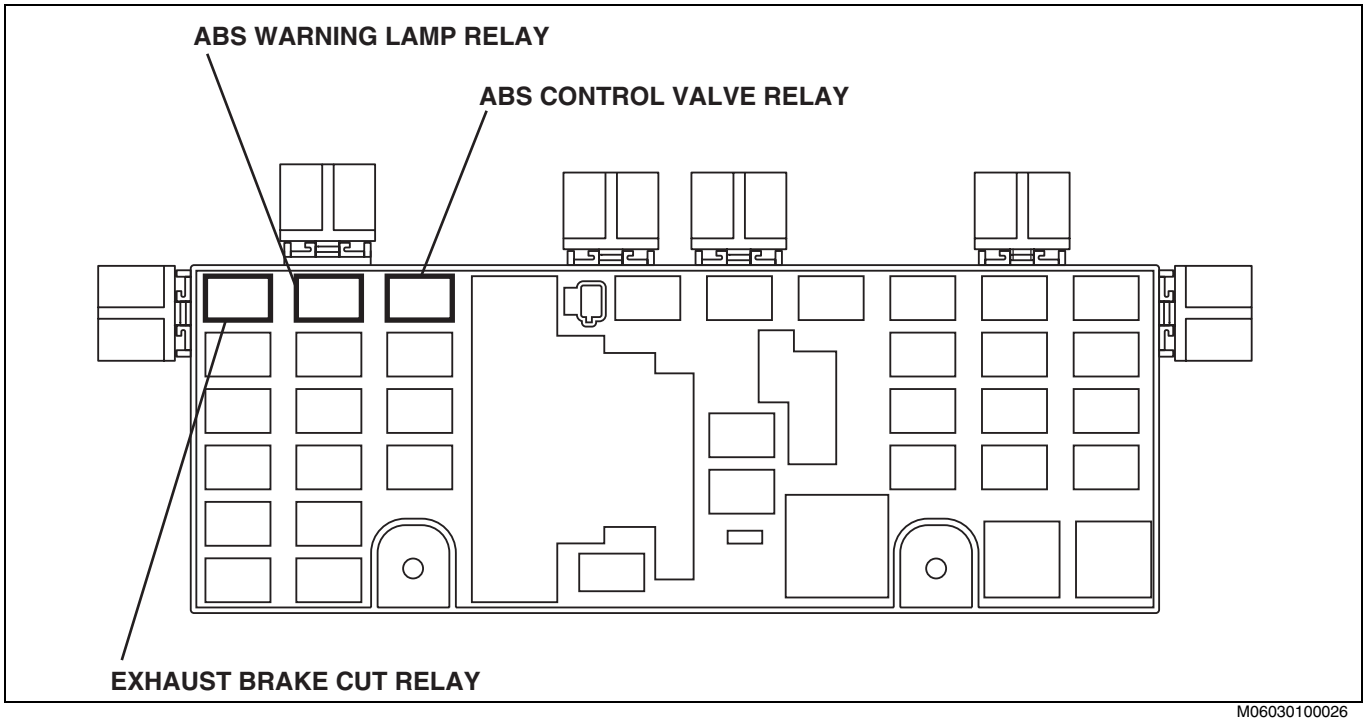
**8. ABS WARNING LAMP**

The status of the ABS system is indicated.

It lights when the starter switch is turned "ON" and automatically goes off when the system functions correctly. If malfunction occurs in the ABS system while the vehicle is being driven, the lamp lights to alert the driver.

**9. RELAY**

- The relays are located in the instrument panel of the assistant seat side.




M06030100026

(1) ABS control valve relay

- This switches supply current to ABS control valve according to the instruction of ABS computer (When the coil of relay is energized, the relay contact closes to flow the current.)

(2) Exhaust brake cut relay

- When this relay is energized during ABS operation, the relay contact opens, the current to the solenoid valve for the exhaust brake is shut down, and the exhaust brake is released.

(3) ABS warning lamp relay

- This is a control relay for ABS warning lamp. When ABS is in normal condition, the relay coil is energized and the contact is kept open. When any abnormality is found in ABS, the energizing current for the coil is shut down to close the contact, and then the warning lamp turns up.

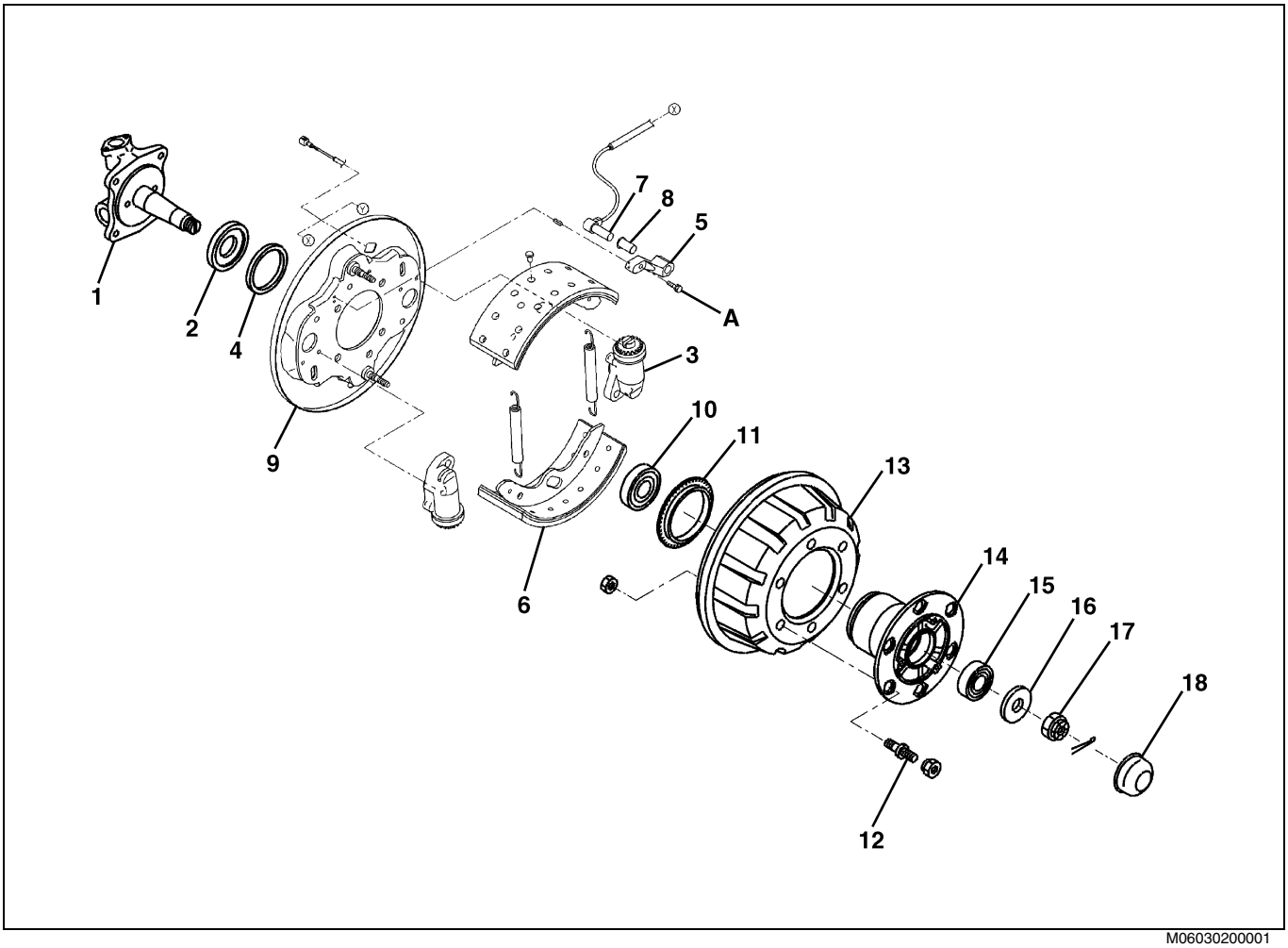
**HINT:**
**The terminal No. (symbol) of each relay is printed on each terminal.**

# FRONT WHEEL BRAKE

## COMPONENT LOCATOR

M06030201BED1003

### FRONT AXLE




M06030200001

| | | | |
|---|---|---|---|
| 1 | Knuckle | 10 | Inner wheel hub bearing |
| 2 | Oil seal guide | 11 | Sensor ring |
| 3 | Wheel cylinder | 12 | Hub bolt |
| 4 | Oil seal | 13 | Brake drum |
| 5 | Holder | 14 | Wheel hub |
| 6 | Brake shoe | 15 | Outer wheel hub bearing |
| 7 | Wheel sensor | 16 | Washer |
| 8 | Clamping bushing | 17 | Wheel hub bearing lock nut |
| 9 | Back plate | 18 | Wheel hub cap |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | |
|---|---|---|
| A | 34.0-50 {345-510, 25-36} | |

# OVERHAUL

M06030201BEH2003

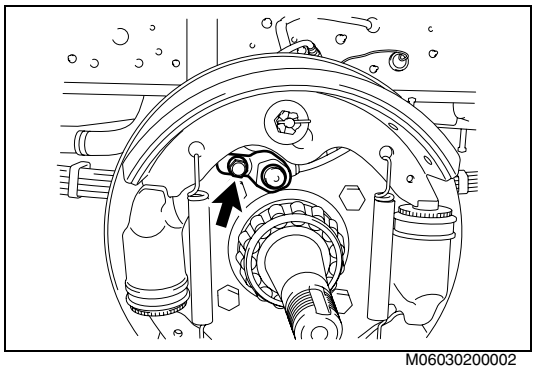
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE WHEEL SENSOR.**

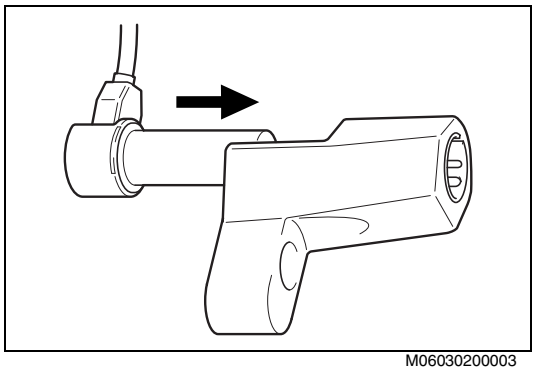
(1) Remove the wheels.
Refer to chapter WHEEL & TIRE.

(2) Remove the wheel hub, hub bearing and brake drum.
Refer to chapter FRONT AXLE.

(3) Loosen the bolt to remove the sensor holder and wheel sensor together from the back plate.



M06030200002



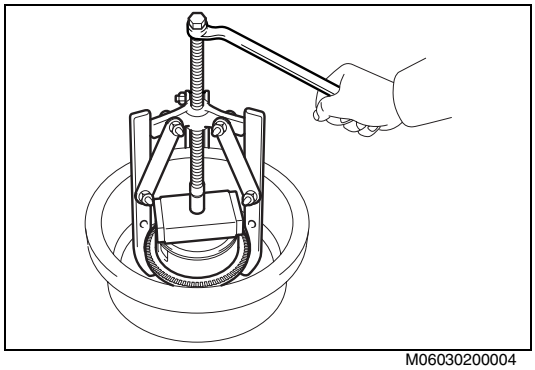
M06030200003

(4) Remove the wheel sensor from the wheel sensor holder.

(5) Remove the clamping bushing from the wheel sensor holder.

**NOTICE:**

**Exposing the wheel sensor to strong bumps could cause interior damage. Never hit the wheel sensor with a hammer or bang it into other parts.**



M06030200004

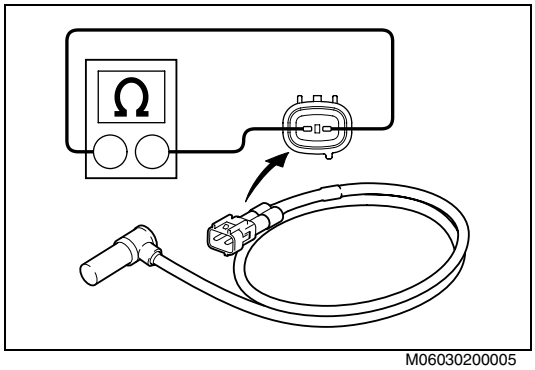
**2. REMOVE THE SENSOR RING.**

(1) Remove the sensor ring from the hub by using 3-point puller.

**NOTICE:**

- **Do not remove the sensor ring unless it is required.**
- **When removing the sensor ring, be careful not to damage the wheel hub.**
- **Do not reuse the removed sensor ring, be sure to replace it with new one.**

## IMPORTANT POINTS - INSPECTION

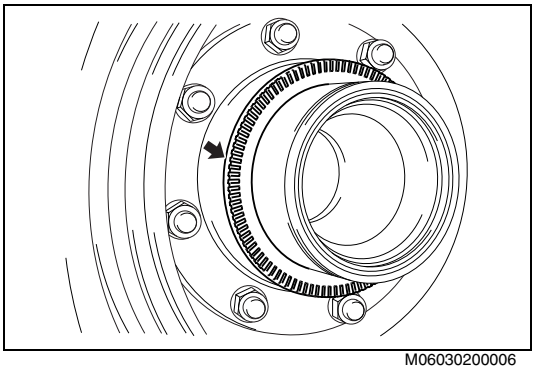



M06030200005

**1. INSPECT THE ONLY WHEEL SENSOR.**

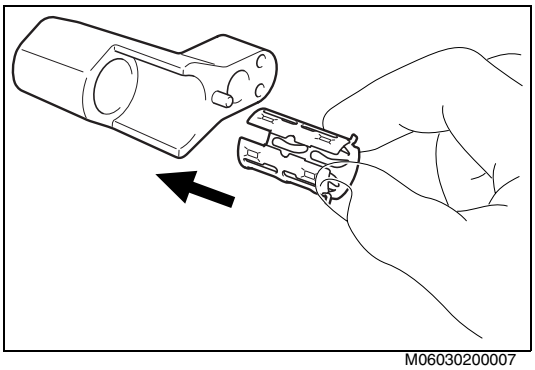
(1) With a tester, measure the resistance of wheel sensor.
**Standard: 1.0-3.0 kΩ**

(2) When the measured value is out of the standard, change the wheel sensor as it might be considered presumably to be abnormal.


M06030200006

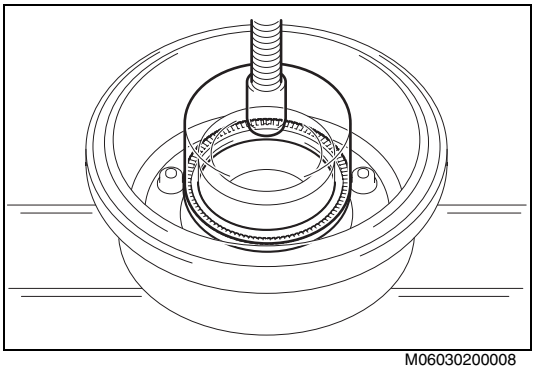
**2. INSPECT THE SENSOR RING.**

(1) Make a visual inspection to check for damage or deformation of the sensor ring, and also to make sure it is not coming loose from the wheel hub.
(2) If any damage or malformation is discovered, replace the sensor ring.
(3) If the sensor ring is coming loose from the wheel hub, use a dolly block and press in it with a press again.


M06030200007

**3. INSPECT THE CLAMPING BUSHING.**

(1) Make sure that wheel sensor is securely fixed.
(2) Change the clamping bushing when it can be pulled off or pushed in with a weak force.

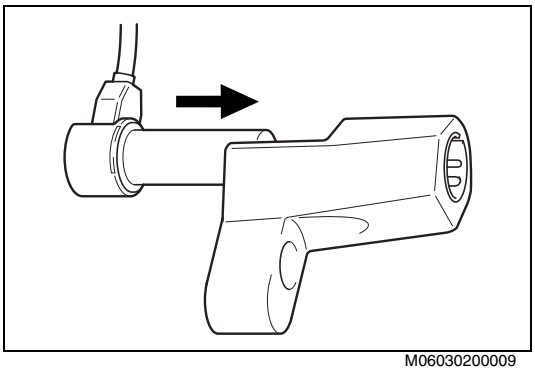

M06030200008

**4. MOUNT THE SENSOR RING.**

(1) Place the sensor ring on the wheel hub and use the dolly block and a press to evenly pressure mount it.

**NOTICE:**
**Warming up the sensor ring with hot water will make it easier to pressure mount it. Do not use a gas burner or the like to warm the sensor ring. Doing so could cause malformation of the sensor ring.**

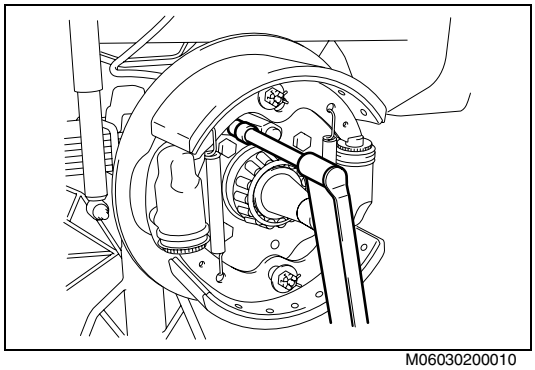
(2) After pressure mounting it, check for flutter of the sensor ring in the axle direction.
**Assembly standard: Less than 0.2 mm {0.0078 in.}**


M06030200009

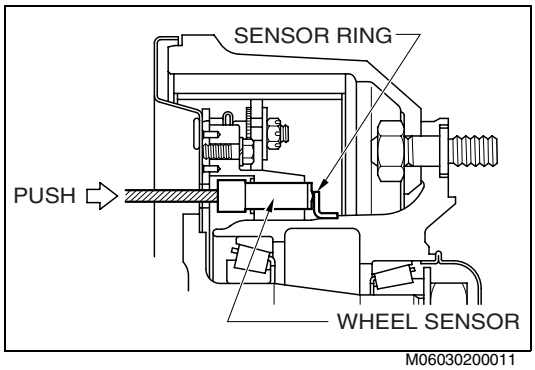
**5. MOUNT THE WHEEL SENSOR.**

(1) Push in the clamping bushing until the stopper makes contact with the wheel sensor holder.
(2) Push the wheel sensor fully in the wheel sensor holder with hands until the wheel sensor makes contact with the clamping bushing.

**NOTICE:**
**When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place with a screwdriver, or the like. Doing so could damage the wheel sensor.**


M06030200010

(3) Install the wheel sensor holder and wheel sensor together to the back plate with bolts.
(4) Mount the wheel hub, hub bearing and brake drum.
Refer to chapter FRONT AXLE.



M06030200011

**6. INSPECT THE WHEEL SENSOR.**
(1) Arrange the wire harness.
(2) With a circuit tester, confirm the output voltage of the wheel sensor (By rotating the tire by one time for 5 seconds)
**Standard: 170-1,999 mV**
**(Range of Alternating Current Voltage)**
(3) In case of out of the standard range at (2), remove the dust cover located on the back plate unit. Then push the wheel sensor by using round end bar until the sensor contacts with the sensor ring.

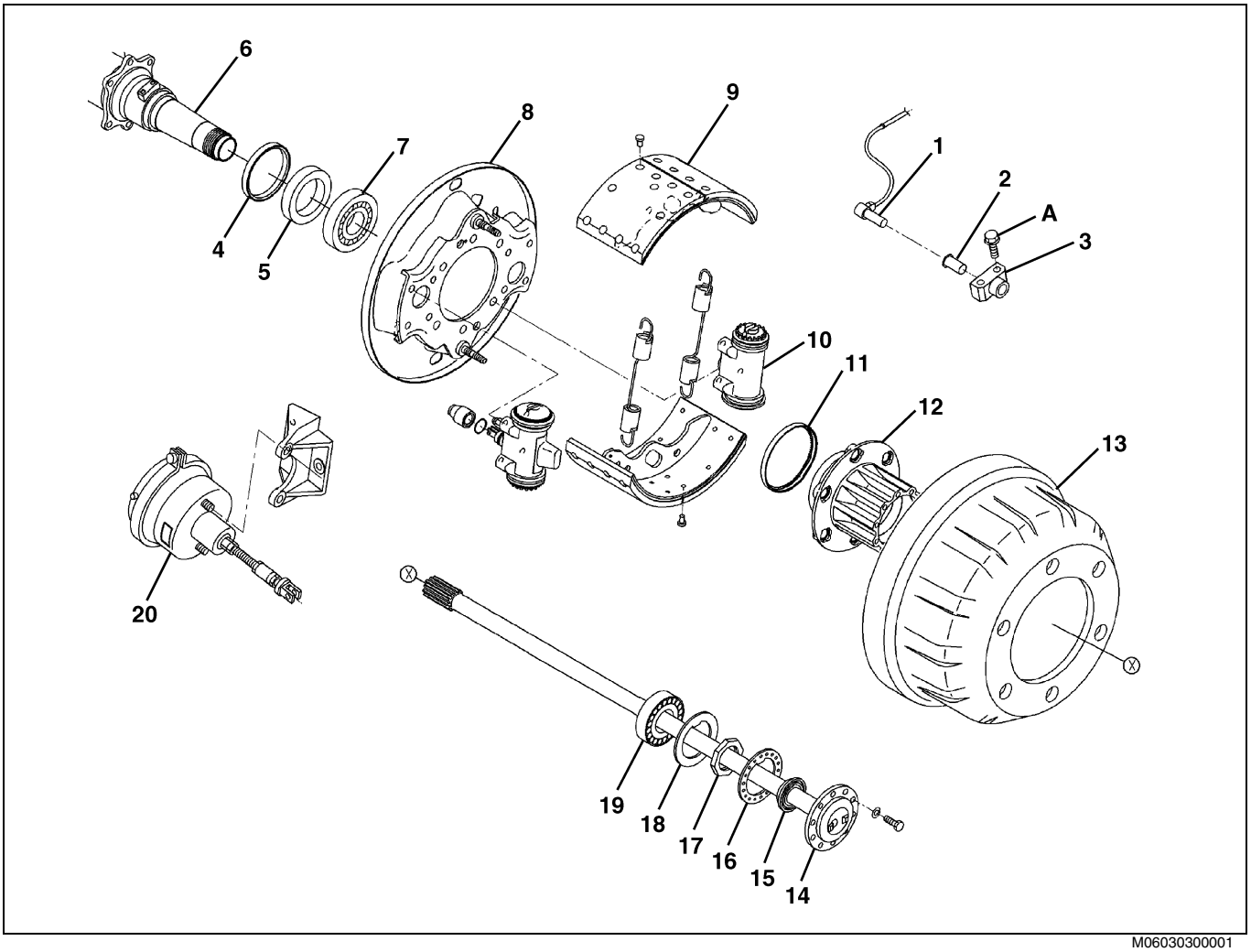
**NOTICE:**
**Do not tap by hammer or turn when pushing the wheel sensor. This may damage the wheel sensor.**

# REAR WHEEL BRAKE

## COMPONENT LOCATOR

M06030301BED1003

### REAR AXLE




M06030300001

| | | | |
|---|---|---|---|
| 1 | Wheel sensor | 11 | Sensor ring |
| 2 | Clamping bushing | 12 | Wheel hub |
| 3 | Wheel sensor holder | 13 | Brake drum |
| 4 | Oil seal collar | 14 | Axle shaft |
| 5 | Oil seal | 15 | Oil seal |
| 6 | Axle housing assembly | 16 | Lock plate |
| 7 | Inner wheel hub bearing | 17 | Lock nut |
| 8 | Back plate | 18 | Washer |
| 9 | Brake shoe | 19 | Outer wheel hub bearing |
| 10 | Wheel cylinder | 20 | Brake chamber |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 35-51 {352-525, 26-37} | | |

# OVERHAUL

M06030301BEH2003

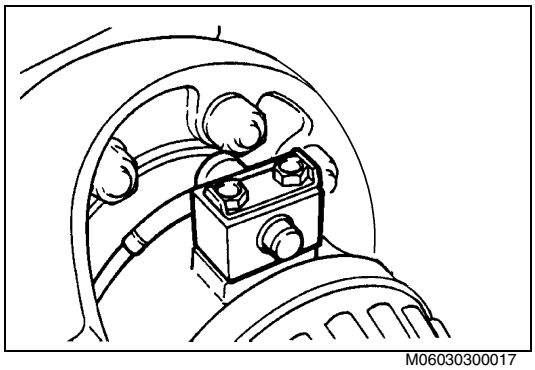
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE WHEEL SENSOR.**

(1) Remove the wheels.
Refer to chapter WHEEL & TIRE.

(2) Remove the wheel hub, hub bearing and brake drum.
Refer to chapter REAR AXLE.

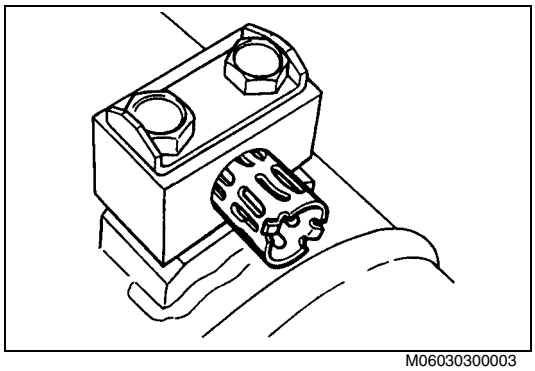
(3) Remove the wheel sensor.


M06030300017

**NOTICE:**

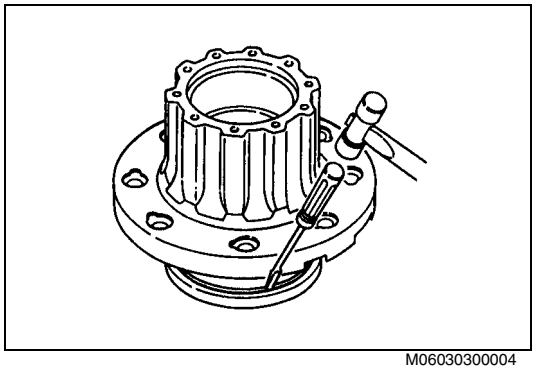
- **Exposing the wheel sensor to strong bumps could cause interior damage. Never hit the wheel sensor with a hammer or bang it into other parts.**
- **Pull out the wheel sensor from the sensor holder by hand.**

(4) Remove the clamping bushing.
Remove the clamping bushing out of the wheel sensor holder.


M06030300003

**2. REMOVE THE SENSOR RING.**

(1) Use a screwdriver or the like to gradually remove the sensor ring by tapping evenly on its outer ring.


M06030300004

**NOTICE:**

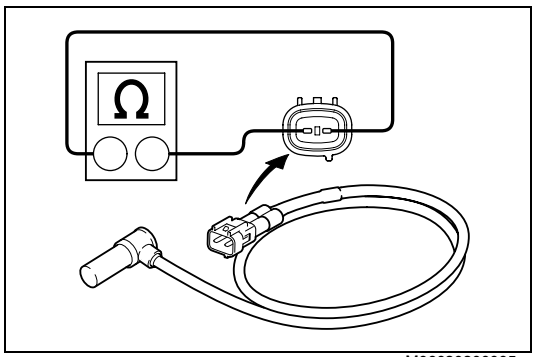
- **Do not remove the sensor ring unless it is required.**
- **When tapping on the sensor ring to remove it, be careful not to scratch the wheel hub.**
- **Do not reuse the removed sensor ring, be sure to replace it with new one.**

## IMPORTANT POINTS - INSPECTION

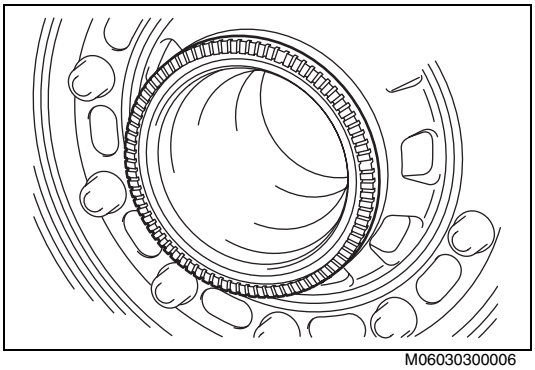
**1. INSPECT THE ONLY WHEEL SENSOR.**

(1) With a tester, measure the resistance of wheel sensor.
**Standard: 1.0-3.0 kΩ**

(2) When the measured value is out of the standard, change the wheel sensor as it might be considered presumably to be abnormal.



M06030300005

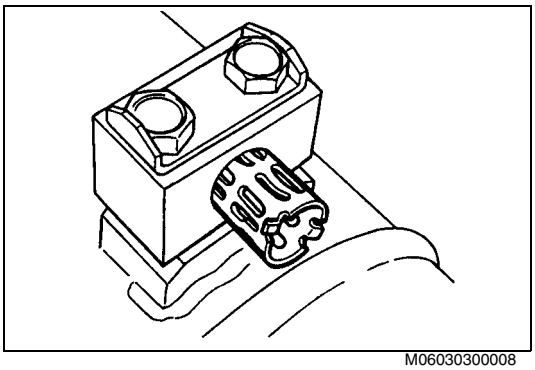

M06030300006

**2. INSPECT THE SENSOR RING.**

(1) Make a visual inspection to check for damage or deformation of the sensor ring, and also to make sure it is not coming loose from the wheel hub.

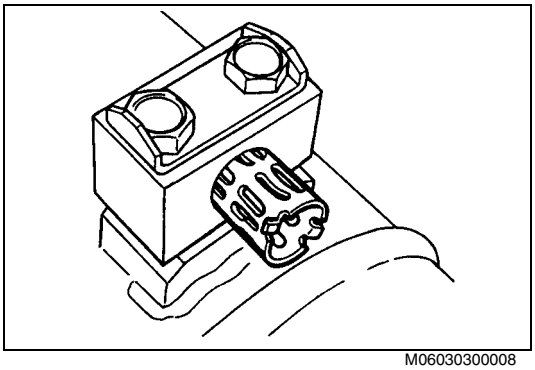
(2) If any damage or malformation is discovered, replace the sensor ring.

(3) If the sensor ring is coming loose from the wheel hub, use a dolly block and a press to pressure mount it again.


M06030300008

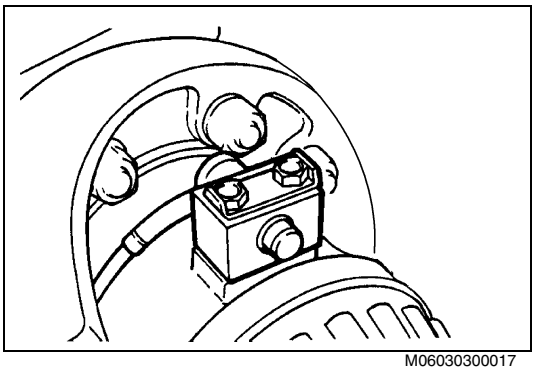
**3. INSPECT THE CLAMPING BUSHING.**

(1) Make sure that wheel sensor is securely fixed.
Change the clamping bushing when it can be pulled off or pushed in with a weak force.


M06030300008

**4. MOUNT THE WHEEL SENSOR**

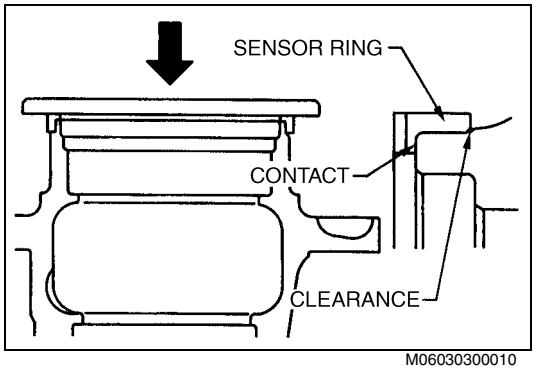
(1) Push in the clamping bushing until the stopper makes contact with the rear axle wheel sensor holder.


M06030300017

(2) Push the wheel sensor fully in the wheel sensor holder with hands until the wheel sensor makes contact with the clamping bushing.

**NOTICE:**
**When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place with a screwdriver, or the like. Doing so could damage the wheel sensor.**

(3) Arrange the wire harness.



M06030300010

**5. MOUNT THE SENSOR RING.**

(1) Place the sensor ring on the wheel hub and use a dolly block and a press to evenly pressure mount it.

**NOTICE:**

**Warming up the sensor ring with hot water will make it easier to pressure mount it. Do not use a gas burner or the like to warm the sensor ring. Doing so could cause malformation of the sensor ring.**

(2) After pressure mounting it, check for flutter of the sensor ring in the axle direction.
**Assembly standard: Less than 0.2 mm {0.0078 in.}**

(3) If the value is still out of the service limit after having performed the above (2), remove the dust cover on the back plate, and push the wheel sensor by using a round end bar until the sensor gets in contact with the sensor ring.

**NOTICE:**

**Do not hammer or twist when pushing the wheel sensor. Otherwise it may damage the wheel sensor.**

**6. MOUNT THE WHEEL HUB, HUB BEARING AND BRAKE DRUM.**

(1) Refer to chapter REAR AXLE.

**NOTICE:**

- **Be careful not to push back the wheel sensor too far when mounting the wheel hub and brake drum. Also, make sure they are straight so that you do not bump the tip of the wheel sensor.**
- **When inserting the outer hub bearing, avoid tapping on it with a hammer as this will expose the wheel sensor to bumps. Insert the outer hub bearing carefully with a lock nut.**

**7. INSPECT THE WHEEL SENSOR.**

(1) Arrange the wire harness.

(2) With a circuit tester, confirm the output voltage of the wheel sensor (By rotating the tire by one time for 5 seconds)
**Standard: 170-1,999 mV**
**(Range of Alternating Current Voltage)**

(3) In case of out of the standard range at (2), remove the dust cover located on the back plate unit. Then push the wheel sensor by using round end bar until the sensor contacts with the sensor ring.

**NOTICE:**

**Do not tap by hammer or turn when pushing the wheel sensor. This may damage the wheel sensor.**

(4) Mount the axle shaft to the wheel hub and tighten the bolt on the axle shaft.
Refer to chapter REAR AXLE.

# ABS (ANTI-LOCK BRAKE SYSTEM) (WABCO MAKE)

BR03-002

**ABS ..... BR03-2**
OVERVIEW ..... BR03-2
COMPOSITION AND OPERATION ..... BR03-3
FUNCTION ..... BR03-7
OVERVIEW AND FUNCTION ..... BR03-8

**FRONT WHEEL BRAKE ..... BR03-13**
COMPONENT LOCATOR ..... BR03-13
OVERHAUL ..... BR03-14
INSPECTION ..... BR03-15

**REAR WHEEL BRAKE ..... BR03-17**
COMPONENT LOCATOR ..... BR03-17
OVERHAUL ..... BR03-18
INSPECTION ..... BR03-19

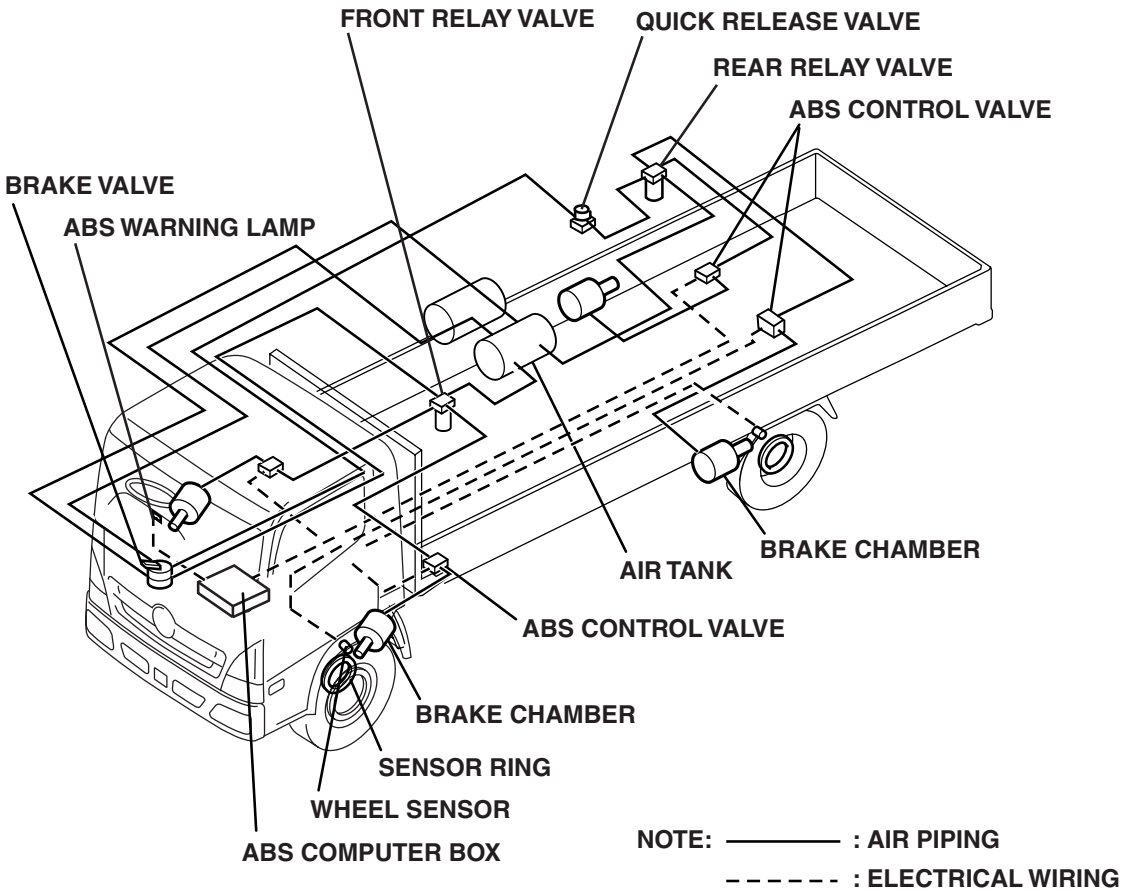
# ABS

## OVERVIEW

M06030102BEC1001

ABS is a system that makes effective use of the friction between the tires and the road surface to maintain vehicle stability while the brakes are being applied and for stopping the vehicle.
Applying the brakes forcefully on a slippery road surface can cause the wheels to be locked, due to excessive braking force. This causes the vehicle to lose a stability because the locked wheels lose resistance in the lateral direction. More specifically, if the front wheels are locked, it becomes impossible to steer the vehicle, and if the rear wheels are locked, the rear of the vehicle may fishtail from side to side.
Also, when wheel-locking occurs, it is not possible to make effective use of friction between the tires and the road surface. This may cause the braking distance to be increased.
ABS uses wheel sensors mounted on the axles to constantly monitor the rotation of the wheels. If any of the wheels is starting to lock up, the ABS computer sends signals to the ABS control valve and immediately adjusts the brake pressure to prevent wheel-locking.
In this way, ABS maintains the stability of the vehicle while stopping by making effective use of the friction between the tires and the road surface.

**REPRESENTATIVE MODEL**




M06030100028

# COMPOSITION AND OPERATION

M16030102BEC1002

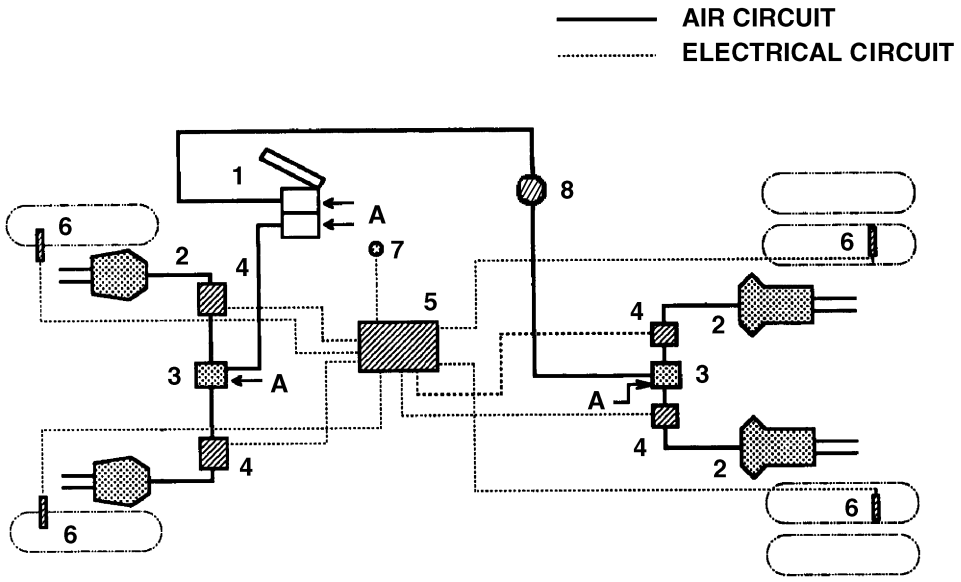
The ABS system is comprised of the sensor rings mounted on the wheels, the ABS computer, which receives signals from the wheel sensors that monitor the rotational speed of the wheels and outputs control signals to maintain the appropriate braking force; ABS control valves, which increase or decrease the braking force, based on the control signals; the warning lamp, which gives an alarm if the system malfunctions; the piping, wire harnesses, etc., that link together the various units that compose the system.

Pulse signals transmitted by the sensor rings mounted on the wheel hubs, rotated together with the wheels, and the wheel sensors mounted near sensor ring on the axles are sent to the ABS computer. The ABS computer then calculates the wheels' rotational speed, acceleration, deceleration, and amount of slippage, based on these signals.

If the limit values for the wheel's deceleration, or slippage ratio are exceeded, the ABS computer immediately transmits signals to the ABS control valves to adjust any excess braking force.

This ABS system controls the four wheels, front, rear, right, and left, independently.

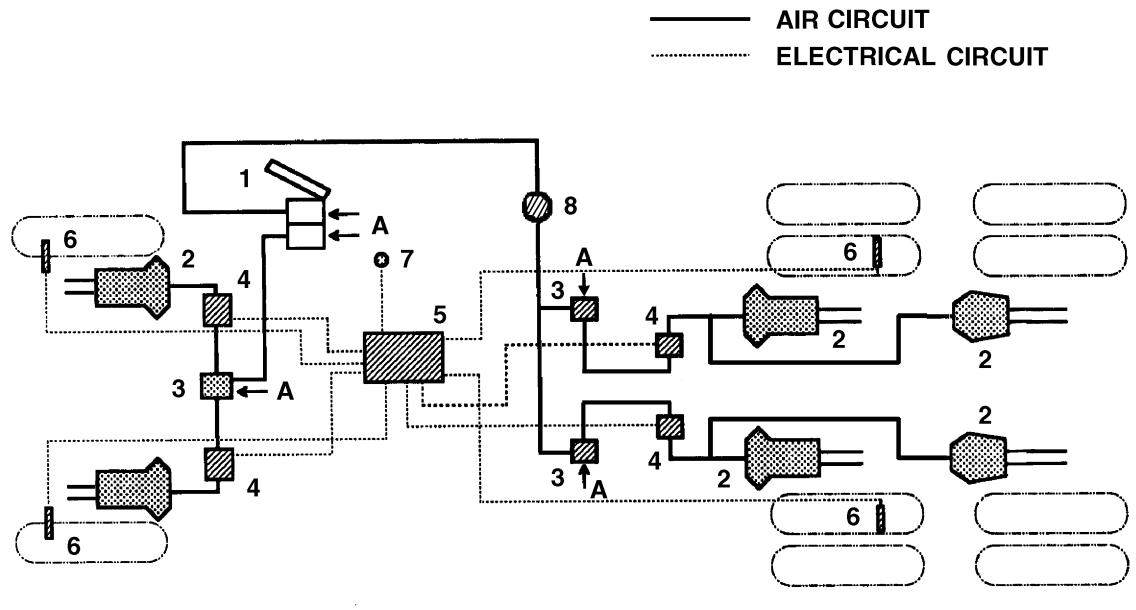
## SYSTEM COMPOSITION DIAGRAM




MODEL: FG, GH

M06030100029

| | | | |
|---|---|---|---|
| 1 | Brake valve | 6 | Wheel sensor |
| 2 | Brake chamber | 7 | ABS warning lamp |
| 3 | Relay valve | 8 | Quick release valve |
| 4 | ABS control valve | A | From air tank |
| 5 | ABS computer | | |

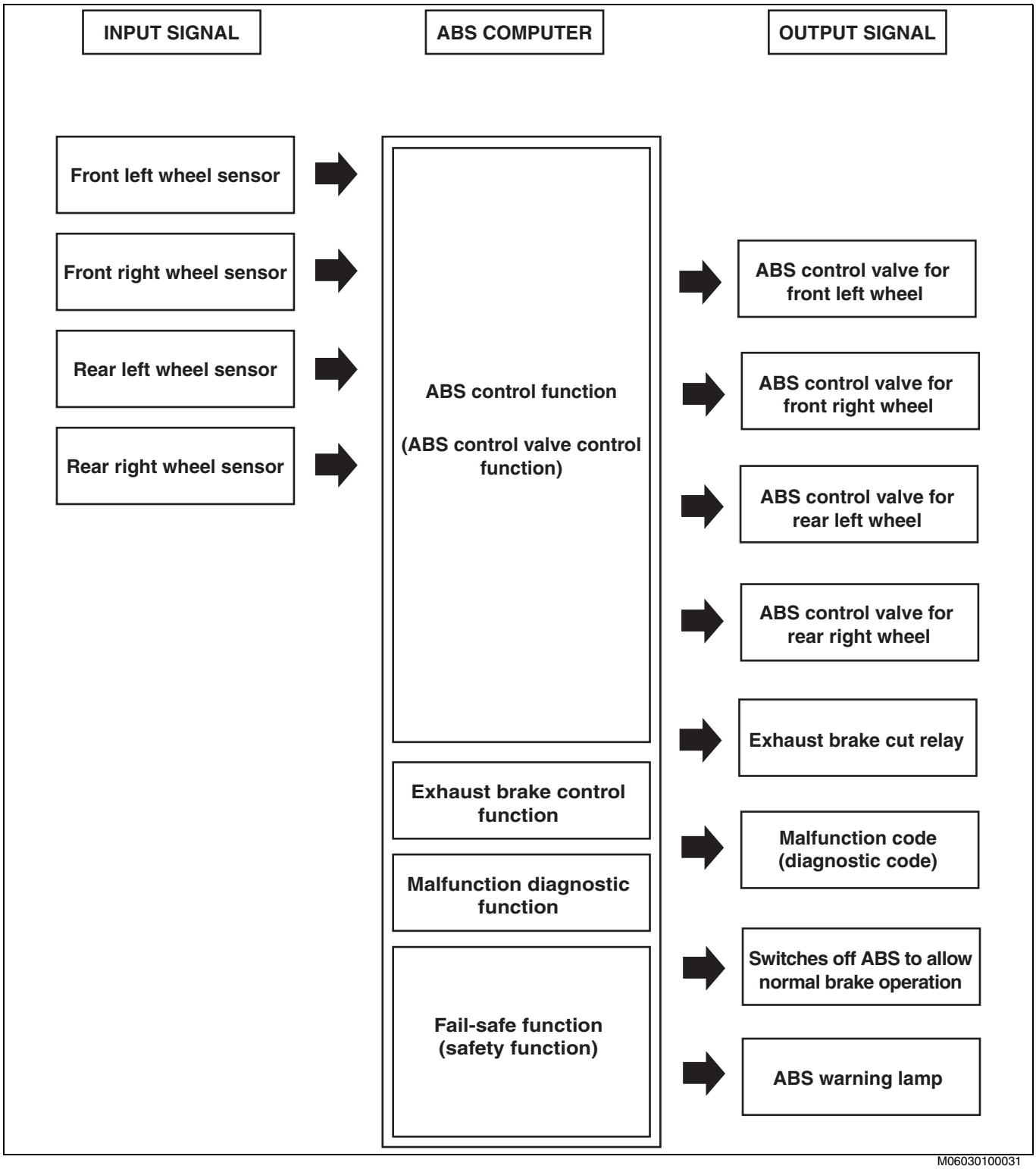



**MODEL: FL, FM**

M06030100030

| | | | |
|---|---|---|---|
| 1 | Brake valve | 6 | Wheel sensor |
| 2 | Brake chamber | 7 | ABS warning lamp |
| 3 | Relay valve | 8 | Quick release valve |
| 4 | ABS control valve | A | From air tank |
| 5 | ABS computer | | |

## ABS CONTROL FLOWCHART




M06030100031

## BASIC PRINCIPLE

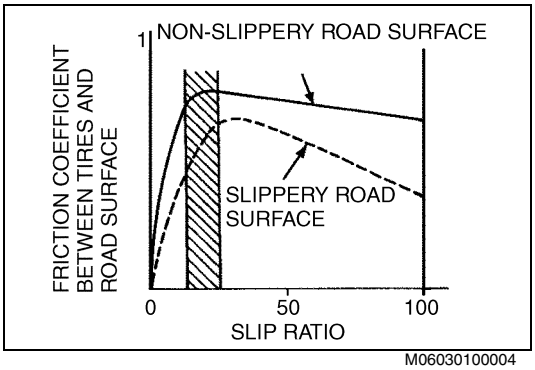
Based on its relationship with the slip ratio, which is determined from the wheels' rotational speed and the vehicle's speed, ABS controls the brake force so that it will be most effective.

When the driver applies the brakes, the rotation of the wheels is controlled and the vehicle speed drops. However, the momentum of the vehicle attempts to push it forward further even though the rotation of the wheels is being braked. At this point, slipping will occur if there is a gap between the wheels' rotational speed and the vehicle's speed. The slip ratio is a value that indicates the rate of slippage.

$$\text{Slip ratio} = \frac{\text{Vehicle's speed - Wheel's rotational speed}}{\text{Vehicle's speed}} \times 100\ \%$$

**Slip ratio 0 % : No slipping between the wheels and the road surface**

**100 % : Wheels locked**

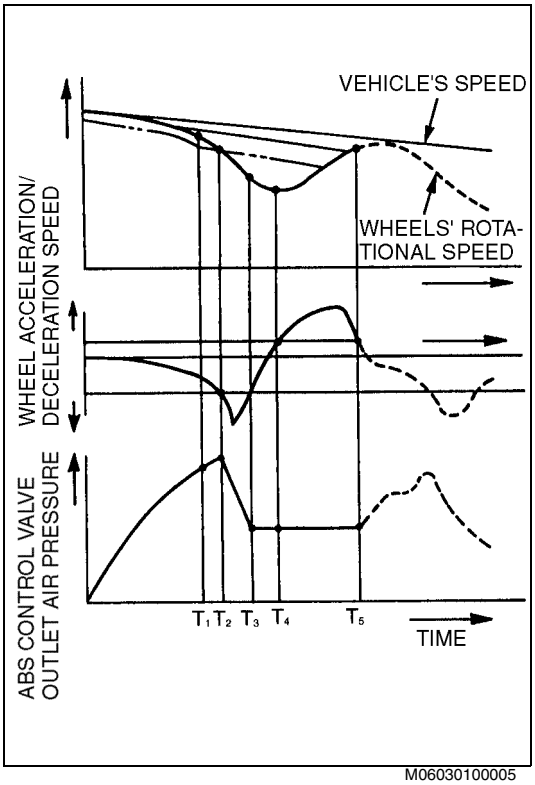



M06030100004

The graph shown at left shows the relationship between the friction coefficient of the tires and of the road surface and the slip ratio.

In an ABS-equipped vehicle, the brake force is controlled to ensure that it is within the range where the friction coefficient is high (shaded portion of the graph) without locking the wheels. This ensures efficient braking performance.

## OPERATION




M06030100005

The ABS control characteristics line graph at left illustrates how the vehicle's speed, the wheels' rotational speed, the wheel acceleration/deceleration, and the air pressure at the ABS control valve outlet change over time after the brakes are applied.

When the brakes are applied, the vehicle's speed and the wheels' rotational speed drop and at the same time, the wheel acceleration/deceleration speed also drops. At point T1, a gap begins to open between the wheels' rotational speed and the vehicle's speed. Passing on point T2, the ABS computer detects that the wheels are beginning to lock and is lowering the outlet air pressure of the ABS control valve to prevent wheel locking from occurring.

At point T3, the wheel acceleration/deceleration speed is starting to return to normal one, and the ABS computer stops lowering the air pressure at the ABS control valve outlet and maintains it at a constant level.

At point T5, the wheels' rotational speed and the vehicle's speed are about the same. The ABS computer detects that the wheels are no longer likely to be locked and increases the air pressure at the ABS control valve outlet.

The above processes is repeated over and over until the vehicle comes to a complete stop.

# FUNCTION

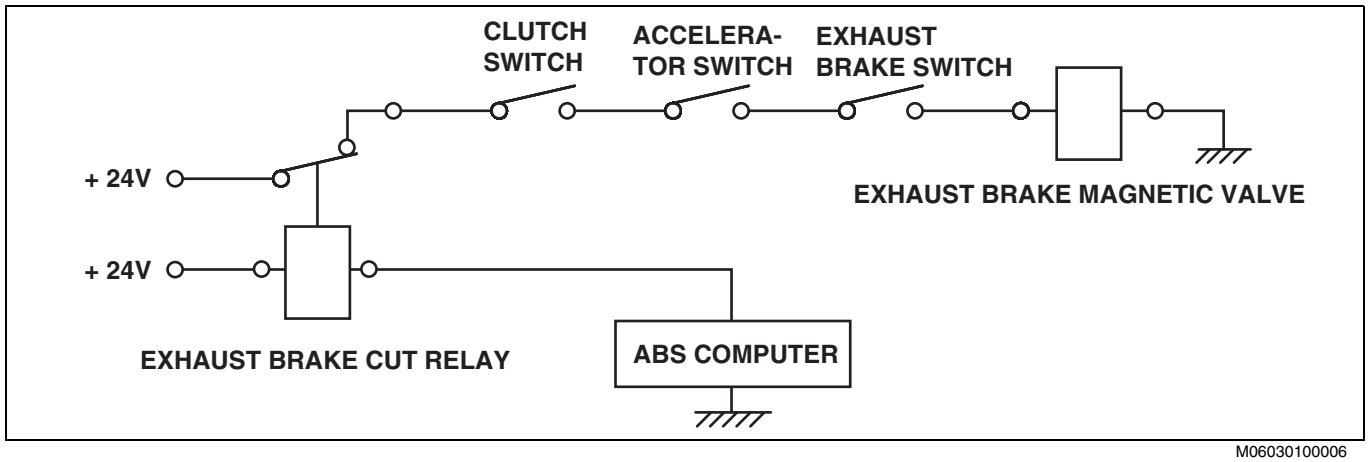
M06030102BEC1003

## FAIL-SAFE FUNCTION

This ABS system is equipped with a fail-safe function that causes the ABS warning lamp on the instrument panel to light and to restore the normal (non-ABS) brake system, should an ABS malfunction occur.
Note that the ABS system consists of two independent circuits. Should a malfunction occur for whatever reason in the electrical circuits, that system's ABS is switched off and the normal brake system is restored while ABS control continued for the other system. This configuration is designed to minimize the effects of any malfunction on ABS function.

## EXHAUST BRAKE CONTROL FUNCTION

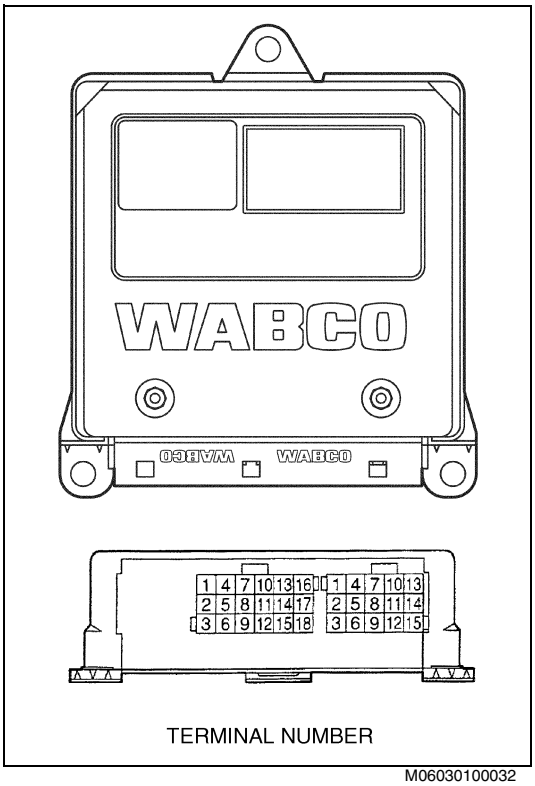
The ABS system of this vehicle is equipped with a function that controls the exhaust brake while ABS is operating.
If the exhaust brake is applied independently or together with the service brake on a road surface with very low friction coefficient, the driving wheels may lock. This ABS system prevents the driven wheels from locking in such cases by automatically releasing the exhaust brake, if necessary, during ABS operation.




M06030100006

# OVERVIEW AND FUNCTION

M06030102BEC1004



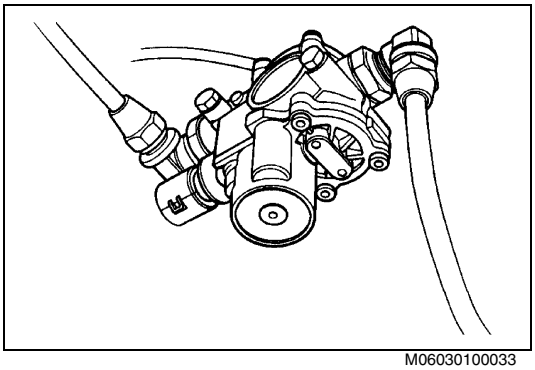

M06030100032

## 1. ABS COMPUTER

Based on pulse signals from the wheel sensors, the ABS computer mounted in the vehicle calculates and evaluates the slip ratio and the acceleration/deceleration speed of the wheels. Based on the results, it sends signals to the various control valves as necessary, causing them to operate and apply the brakes to maintain the slippage of the wheels within the optimal range.

During braking, the air pressure applied to the brake chambers is regulated to prevent the wheels from locking. The brakes are applied so as to maintain the slippage of the wheels within the optimal range.

Regardless of whether the vehicle is stopped or being driven, and whether or not the brakes are being applied, the circuit consisting of the wheel sensors, control valves, ABS computer, and wire harnesses are constantly being checked by the ABS computers' fail-safe circuit. If some sort of malfunction occurs, the fail-safe circuit warns the driver by lighting the ABS warning lamp. At the same time, the ABS system that is experiencing the malfunction is shut off and braking is restored to normal (non-ABS) operation.

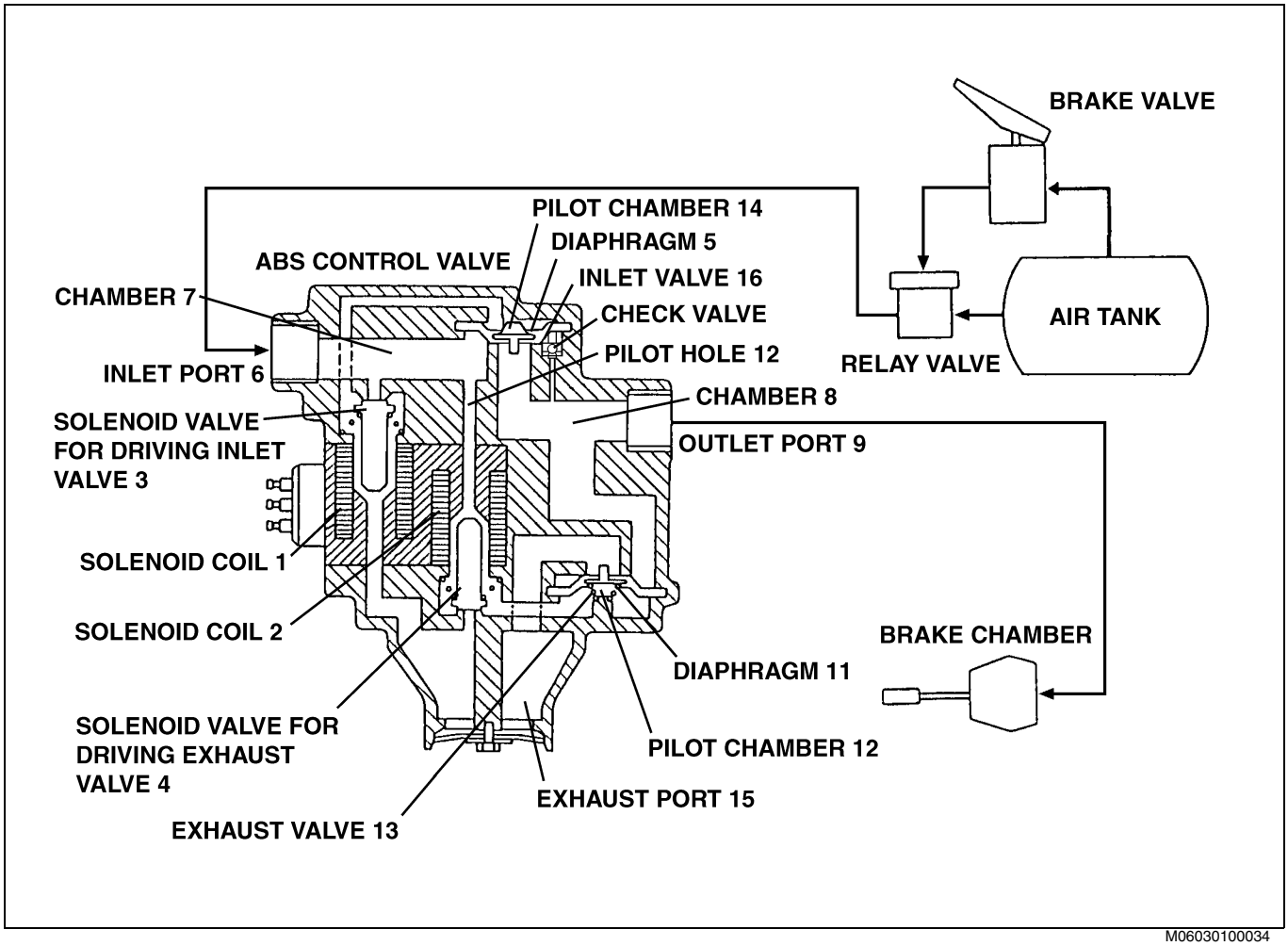


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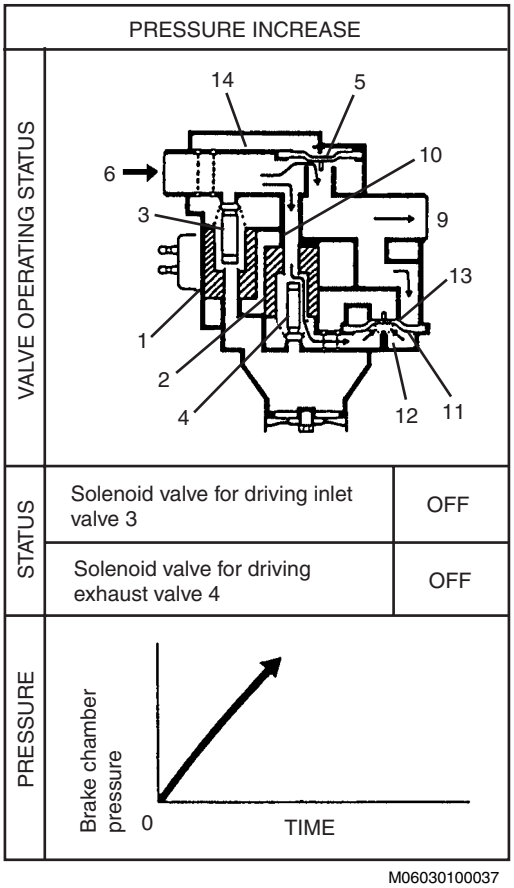
## 2. ABS CONTROL VALVES

(1) Overview

- The ABS control valves are positioned in the brake air circuit between the relay valves and brake chambers. Based on signals from the ABS computer, they adjust the air pressure sent to the brake chambers in one of three modes: pressure increase, pressure reduction, or pressure maintenance.




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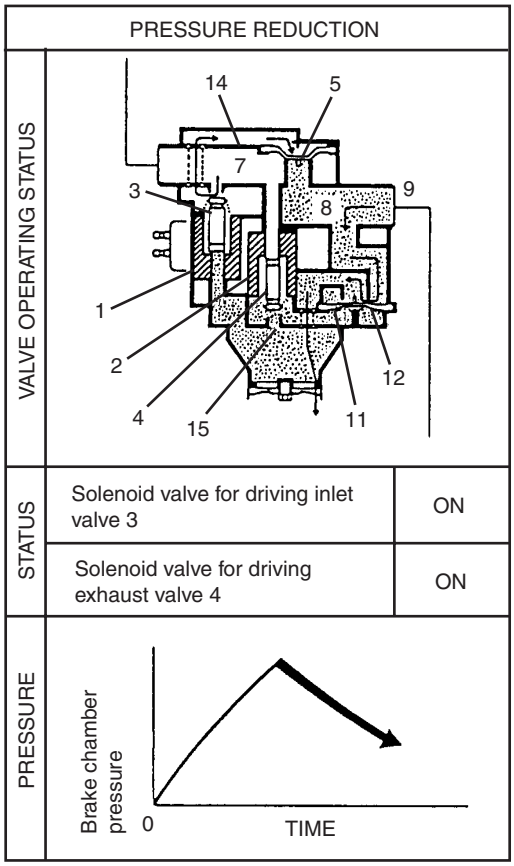



M06030100037

(2) Operation

a. PRESSURE INCREASE MODE

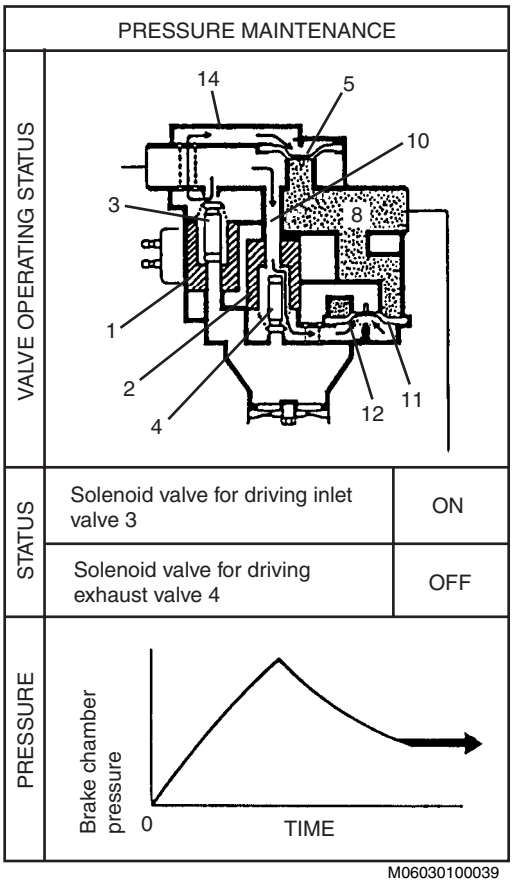
- When the driver steps on the brake pedal, air from the relay valve enters through inlet port (6), pushes open diaphragm (5), passes through outlet port (9), and flows into the brake chamber. At this point, solenoid coil (1) is not energized, so solenoid valve (3) is closed and pilot chamber (14) is open to the atmosphere. Also, solenoid coil (2) is also not energized, so solenoid valve (4) is closed. As a result, air passes through pilot hole (10) and enters pilot chamber (12). It then pushes up diaphragm (11) and closes exhaust valve (13).




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b. PRESSURE REDUCTION MODE

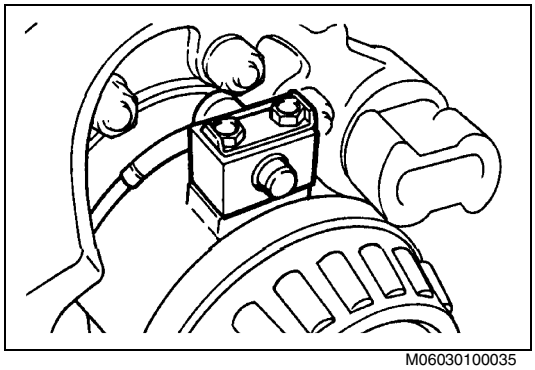
- When solenoid coil (1) is energized, solenoid valve (3) opens and air also flows into pilot chamber (14). It pushes down on diaphragm (5), shutting off chambers (7) and (8). At the same time, solenoid coil (2) is also energized. This causes solenoid valve (4) to open and the operating air from pilot chamber (12) passes through exhaust port (15) and is released into the atmosphere. Consequently, the air from the outlet port (9) side (brake chamber) pushes down on diaphragm (11) and air is released into the atmosphere. This causes the air pressure of the brake chamber to decrease.




M06030100039

c. PRESSURE MAINTENANCE MODE

- When solenoid coil (1) is energized, solenoid valve (3) opens and air flows through chamber (7) and acts on pilot chamber (14). On the other hand, since solenoid coil (2) is not energized, solenoid valve (4) is closed and air flows through pilot hole (10) and acts on pilot chamber (12). This causes diaphragms (5) and (11) to shut off their air passages, and the chamber (8) pressure, that is to say the air acting on the brake chamber, is maintained at the pressure that was current when the switch from the pressure reduction mode to the pressure maintenance mode took place.



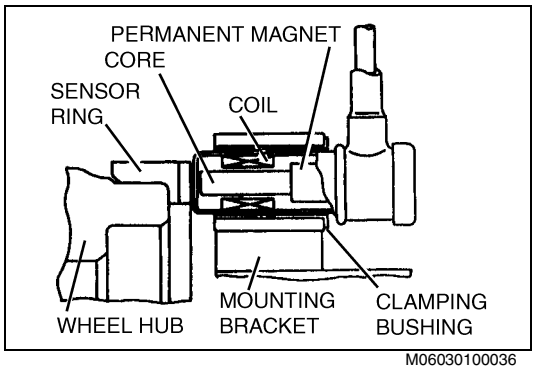
M06030100035

### 3. WHEEL SENSORS

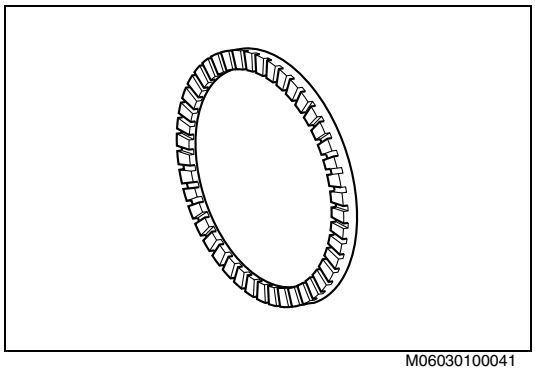
These sensors are mounted, facing the sensor rings on each wheel on the front and rear axles.

The wheel sensors are electromagnet sensors consisting of a permanent magnet core with a coil of wire wrapped around it.

The frequency of the pulse signals generated by magnetic inductance between the sensors and the sensor rings they face is proportional to the rotational speed of the wheels. These pulse signals are sent to the ABS computer and are used to determine the wheels, rotational status.



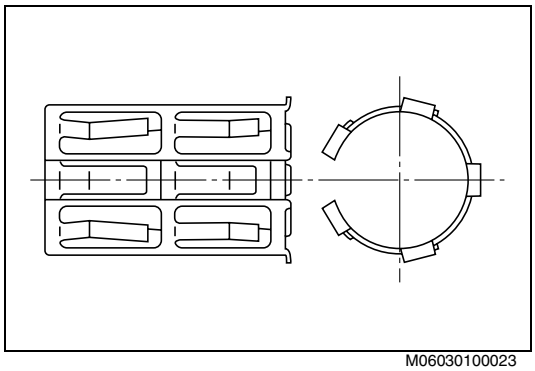

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### 4. SENSOR RINGS

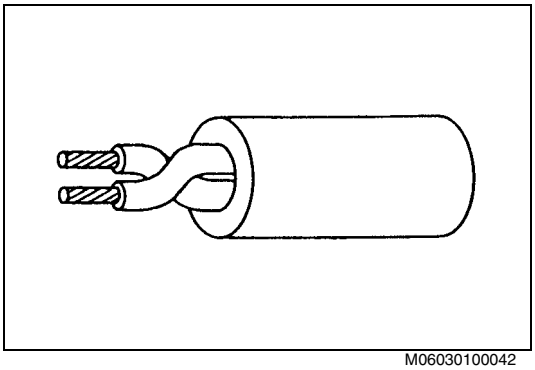
The sensor rings are press-fitted into the insides of the wheel hubs of each wheel on the front and rear axles, and they face the wheel sensors described in the preceding section. The sensor rings are made of a magnetic material, and teeth are cut into the surface which faces the wheel sensor at regular intervals. Also, when the sensor ring performs one complete rotation, the sensor generates pulse signals corresponding to the number of teeth.



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### 5. CLAMPING BUSHINGS

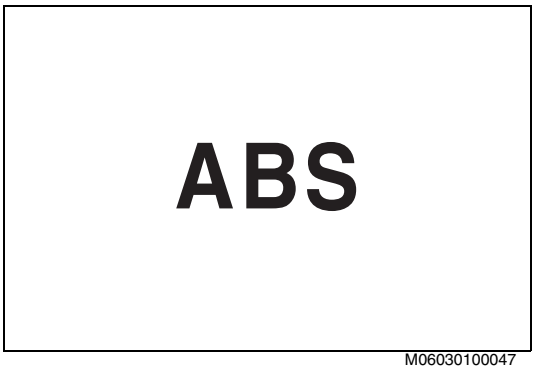
The wheel sensors are held in place through friction by clamping bushings that are inserted into the mounting brackets. If they are assembled properly, the clamping bushings serve to eliminate the need to adjust the clearance between the wheel sensors and sensor rings.



M06030100042

**6. WHEEL SENSOR HARNESSES**

Each wheel sensor wire harness employs a two-conductor twisted wire cable. Its function is to protect the wheel sensor signals, which are vital to the proper operation of the ABS system, from electromagnetic interference. Under no circumstances should any part of the wheel sensor wire harnesses be cut or connected to any other wire.




M06030100047

**7. ABS WARNING LAMP**

The status of the ABS system is indicated.

It lights when the starter switch is turned "ON" and automatically goes off when the system functions correctly.

If malfunction occurs in the ABS system while the vehicle is being driven, the lamp lights to alert the driver.

However, when a defects code is eliminated after repairing it and the starter switch is turned "ON", the lamp will remain lit until the vehicle speed reaches 7-10km/h {11.2 - 16 mile/h}.

Then, note that even when the warning lamp is lit, the ABS system, unaffected by the malfunction, continues to operate. Also, the brake whose ABS system experiences the malfunction is reverted to normal braking operation without ABS.

When a Diagnosis switch is turned "ON", this lamp will goes on and off, which indicates defect code.

**8. EXHAUST BRAKE CUT RELAY**

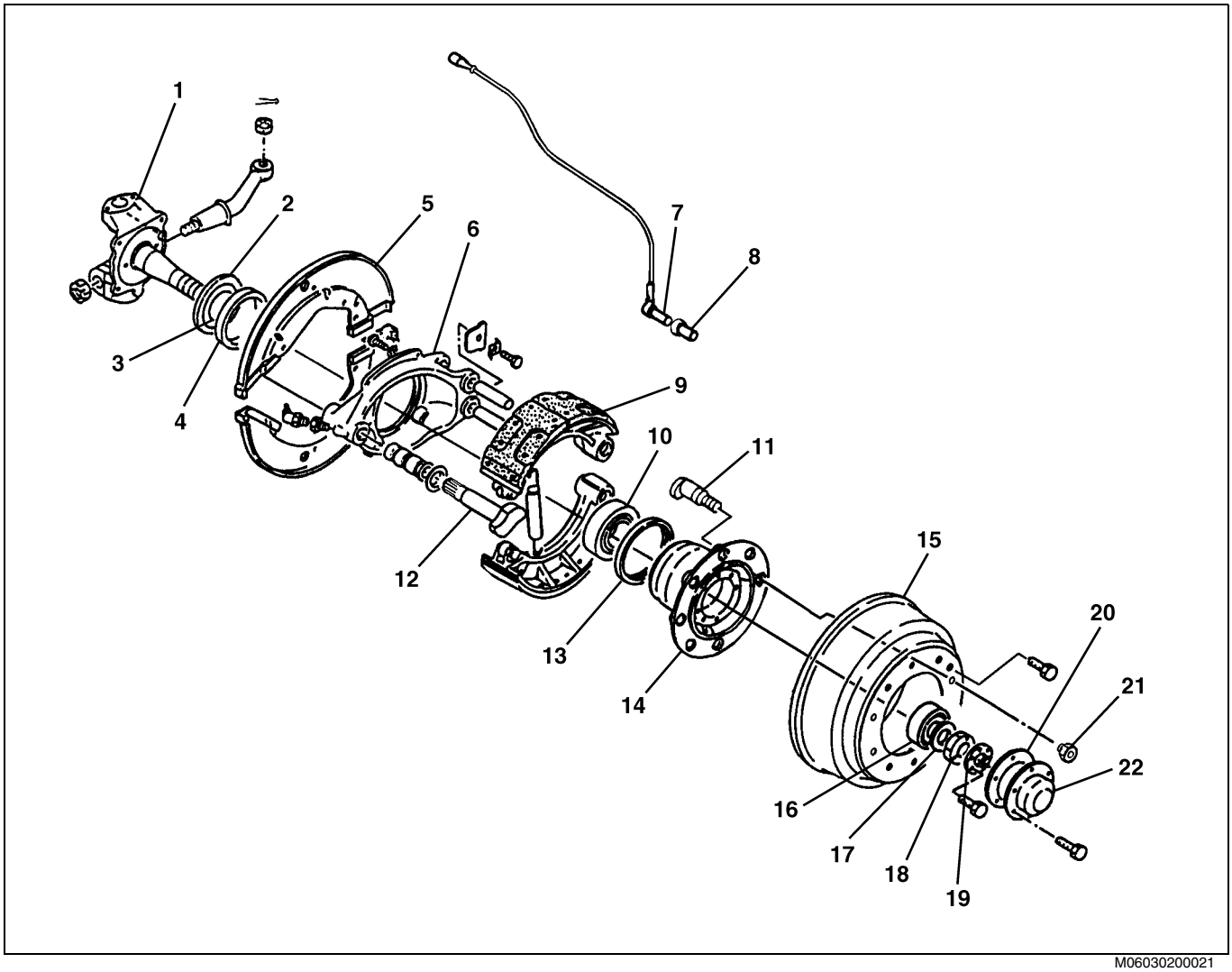
When this relay is energized during ABS operation, the relay contact opens, the current to the solenoid valve for the exhaust brake is shut down, and the exhaust brake is released.

# FRONT WHEEL BRAKE

## COMPONENT LOCATOR

M06030202BED1001

### FRONT AXLE

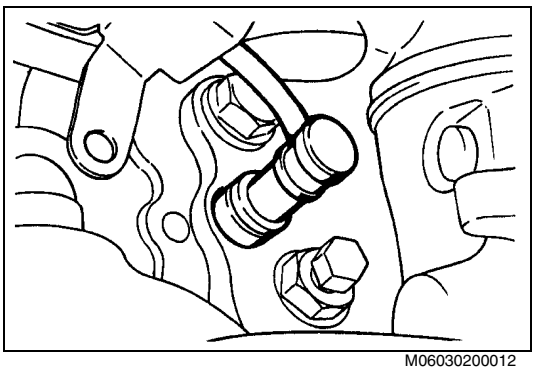



M06030200021

| | | | |
|---|---|---|---|
| 1 | Knuckle | 12 | Cam shaft |
| 2 | Oil seal guide | 13 | Sensor ring |
| 3 | O-ring | 14 | Wheel hub |
| 4 | Oil seal | 15 | Brake drum |
| 5 | Brake drum cover | 16 | Outer wheel hub bearing |
| 6 | Brake spider | 17 | Washer |
| 7 | Wheel sensor | 18 | Wheel hub bearing lock nut |
| 8 | Clamping bushing | 19 | Lock plate |
| 9 | Brake shoe | 20 | Gasket |
| 10 | Inner wheel hub bearing | 21 | Wheel nut |
| 11 | Hub bolt | 22 | Wheel hub cap |

# OVERHAUL

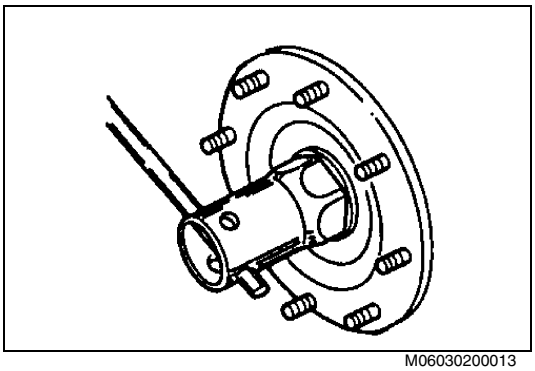
M06030202BEH2001


M06030200012

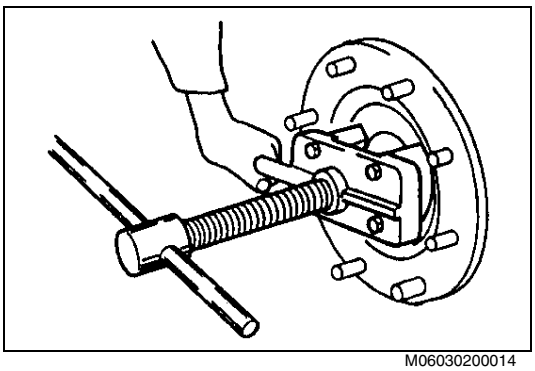
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE WHEEL SENSOR.**
(1) Remove the brake drum cover.
(2) Pull off the wheel sensor.

**NOTICE:**
**Exposing the wheel sensor to strong bumps could cause interior damage. Never hit the wheel sensor with a hammer or bang it into other parts.**

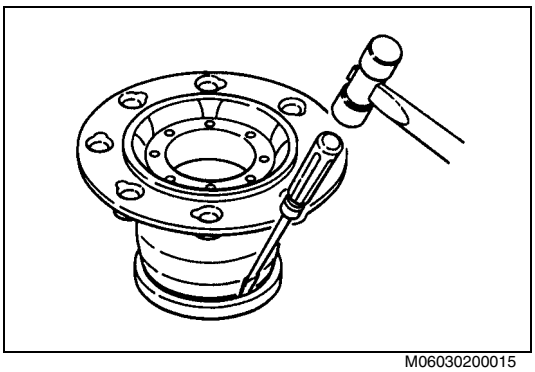

M06030200013

**2. REMOVE THE WHEEL HUB, WHEEL HUB BEARINGS AND BRAKE DRUM.**
(1) Refer to CHAPTER, FRONT AXLE.


M06030200014

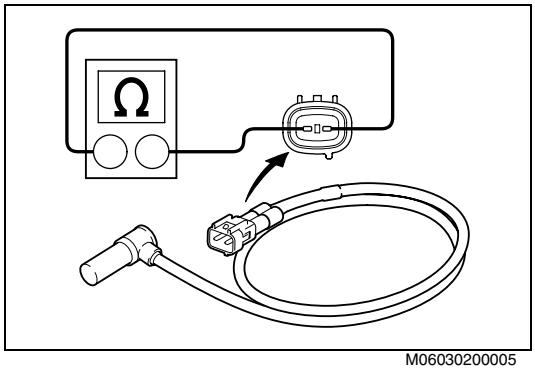
**3. REMOVE THE SENSOR RING**
(1) Use a screwdriver or the like to gradually remove the sensor ring by tapping evenly on its outer ring.

**NOTICE:**
- **When tapping on the sensor ring to remove it, be careful not to scratch the wheel hub.**
- **Do not remove the sensor ring unless it is required.**
- **Do not reuse the removed sensor ring, be sure to replace it with new one.**


M06030200015

# INSPECTION

M06030202BEH3001

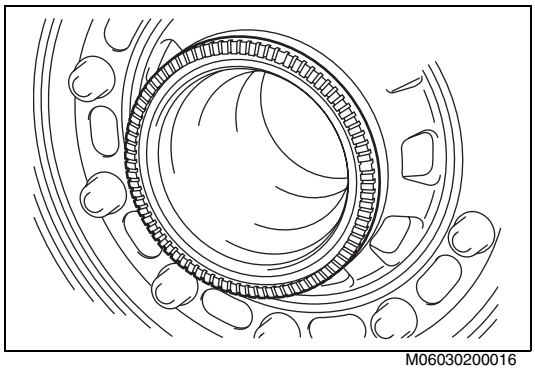


M06030200005

**1. INSPECTION OF ONLY WHEEL SENSOR**

(1) With a tester, measure the resistance of wheel sensor.
**Standard: 1.0-3.0 kΩ**

(2) When the measured value is out of the basic standard, change the wheel sensor as it might be considered presumably to be abnormal.

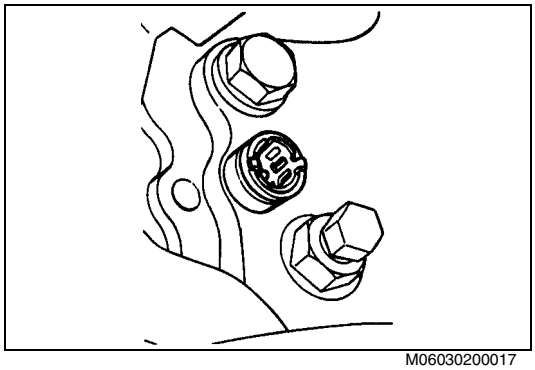

M06030200016

**2. INSPECTION OF THE SENSOR RING.**

(1) Make a visual inspection to check for damage or deformation of the sensor ring, and also to make sure it is not coming loose from the wheel hub.

(2) If any damage or malformation is discovered, replace the sensor ring.

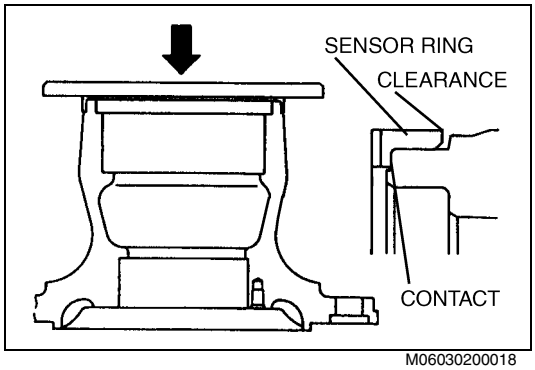
(3) If the sensor ring is coming loose from the wheel hub, use a dolly block and press in it with a press again.


M06030200017

**3. INSPECTION OF THE CLAMPING BUSHING.**

(1) Make sure that wheel sensor is securely fixed.

(2) Change the clamping bushing when it can be pulled off or pushed in with a weak force.



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**4. MOUNTING THE SENSOR RING**

(1) Place the sensor ring on the wheel hub and use the dolly block and a press to evenly pressure mount it.

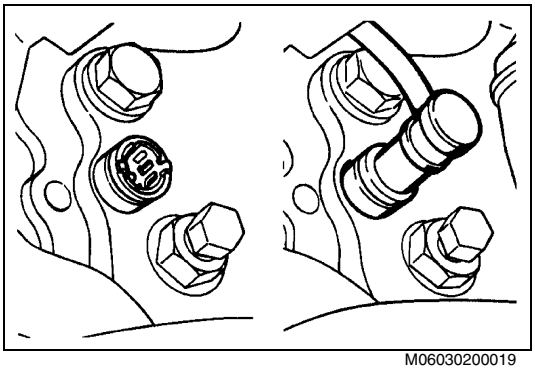
**NOTICE:**
**Warming up the sensor ring with hot water will make it easier to pressure mount it. Do not use a gas burner or the like to warm the sensor ring. Doing so could cause malformation of the sensor ring.**

(2) After pressure mounting it, check for flutter of the sensor ring in the axle direction.
**Assembly standard: Less than 0.2 mm {0.0078 in.}**

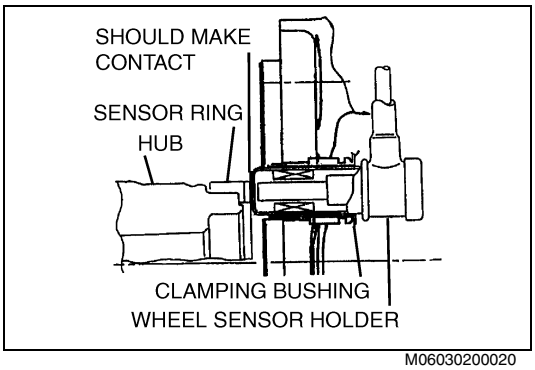
**5. MOUNTING THE WHEEL HUB AND BRAKE DRUM**

(1) Refer to CHAPTER, FRONT AXLE.

**NOTICE:**
**If the wheel sensors are mounted, hammering on the wheel hubs and the like on that axle could cause internal damage to the wheel sensors. Either mount the tire and then tap on the tire or tap on the wheel hub after removing the right and left wheel sensors.**



M06030200019




M06030200020

**6. MOUNTING THE WHEEL SENSOR**

(1) Push in the clamping bushing until the stopper makes contact with the knuckle's wheel sensor holder.

(2) Apply a light coating of chassis grease to the hub of the wheel sensor. Then push it forcefully into the clamping bushing until you feel that the wheel sensor has made contact with the sensor ring.

**NOTICE:**

**When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place with a screwdriver, or the like. Doing so could damage the wheel sensor.**

(3) Slowly turn the wheel hub and brake drum and confirm that they move smoothly.

(4) Mount the drum dust cover.

**7. INSPECT THE WHEEL SENSOR**

(1) Arrange the wire harness.

(2) With a circuit tester, confirm the output voltage of the wheel sensor (By rotating the tire by one time for 5 seconds)

**Standard: 150-1,999 mV**

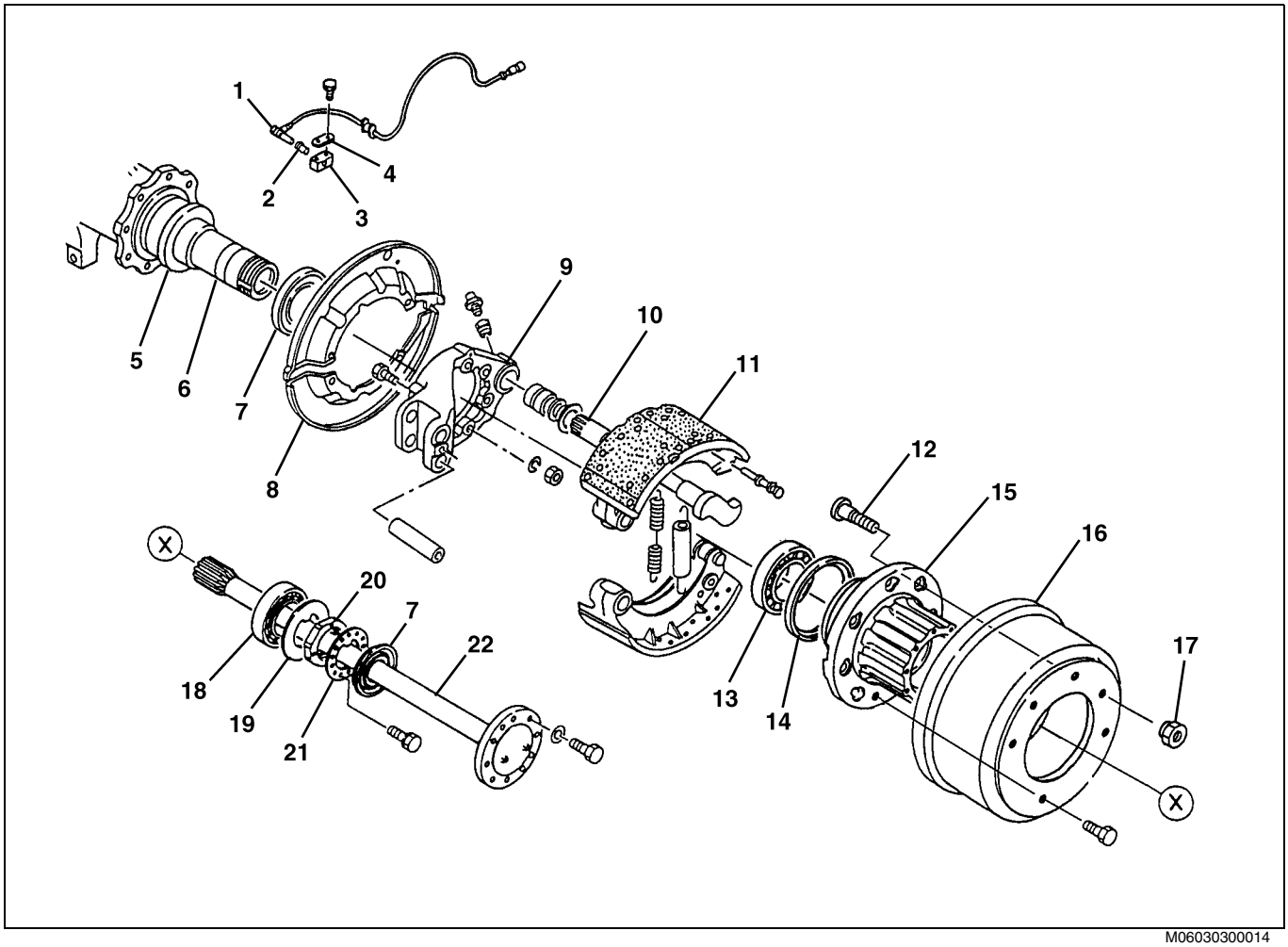
**(Range of Alternating Current Voltage)**

# REAR WHEEL BRAKE

## COMPONENT LOCATOR

M06030302BED1001

### REAR AXLE

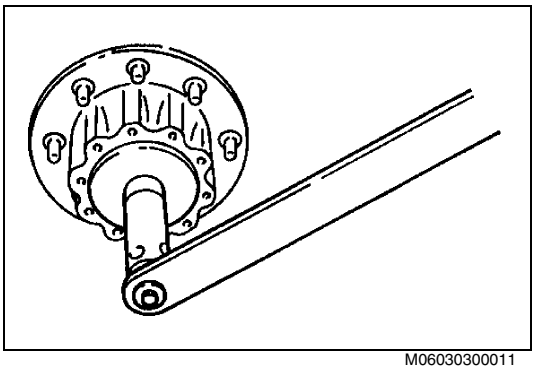



M06030300014

| | | | |
|---|---|---|---|
| 1 | Wheel sensor | 12 | Hub bolt |
| 2 | Clamping bushing | 13 | Inner wheel hub bearing |
| 3 | Wheel sensor holder | 14 | Sensor ring |
| 4 | Lock plate | 15 | Wheel hub |
| 5 | Oil seal collar | 16 | Brake drum |
| 6 | Axle housing assembly | 17 | Wheel nut |
| 7 | Oil seal | 18 | Outer wheel hub bearing |
| 8 | Brake drum cover | 19 | Washer |
| 9 | Brake spider | 20 | Lock nut |
| 10 | Cam shaft | 21 | Lock plate |
| 11 | Brake shoe | 22 | Axle shaft |

# OVERHAUL

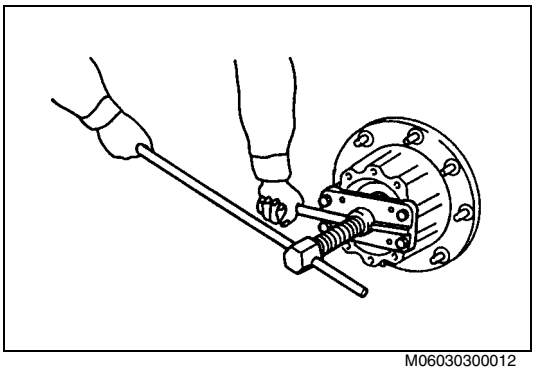
M06030302BEH2001



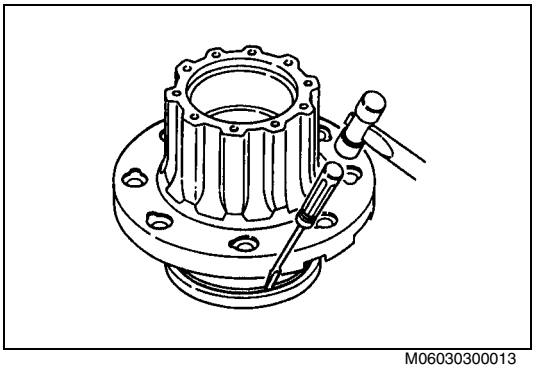
M06030300011

**1. REMOVE THE WHEEL HUB, WHEEL HUB BEARINGS AND BRAKE DRUM.**

(1) Refer to CHAPTER REAR AXLE.



M06030300012



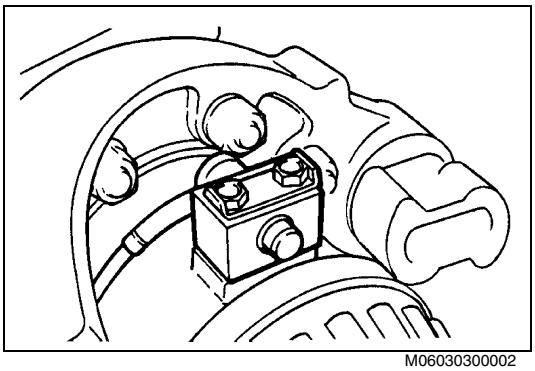
M06030300013

**2. REMOVING THE SENSOR RING**

(1) Use a screwdriver or the like to gradually remove the sensor ring by tapping evenly on its outer ring.

**NOTICE:**

- **When tapping on the sensor ring to remove it, be careful not to scratch the wheel hub.**
- **Do not remove the sensor ring unless it is required.**
- **Do not reuse the removed sensor ring, be sure to replace it with new one.**

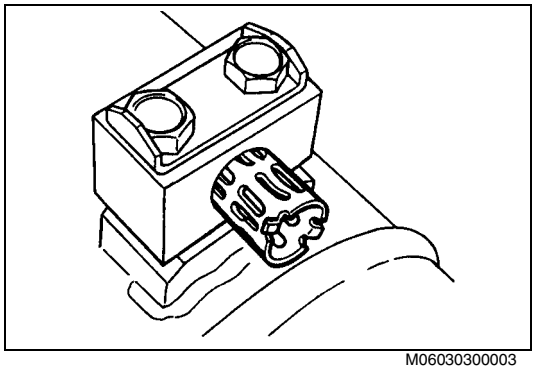


M06030300002

**3. REMOVING THE WHEEL SENSOR**

**NOTICE:**

- **Exposing the wheel sensor to strong bumps could cause interior damage. Never hit the wheel sensor with a hammer or bang it into other parts.**
- **Pull out the wheel sensor from the sensor holder by hand.**

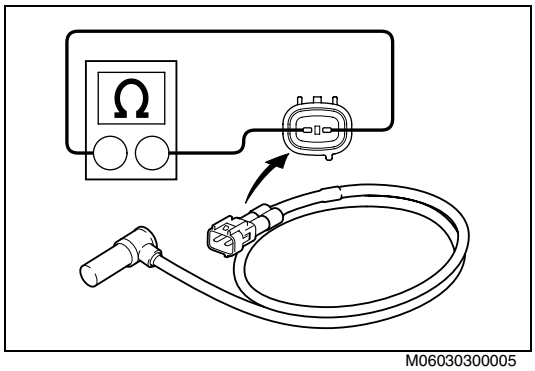

M06030300003

**4. REMOVING THE CLAMPING BUSHING.**

(1) Remove the clamping bushing out of the wheel sensor holder.

# INSPECTION

M06030302BEH3001

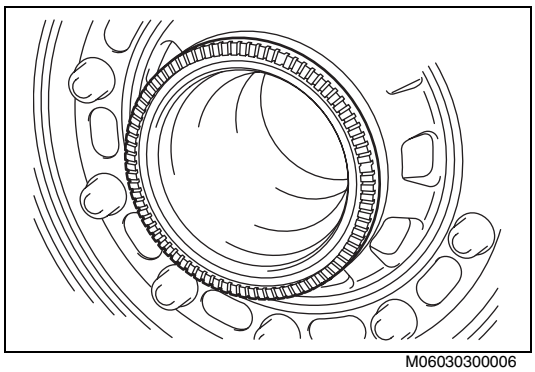


M06030300005

**1. INSPECTION OF ONLY WHEEL SENSOR**

(1) With a tester, measure the resistance of wheel sensor.
**Standard: 1.0-3.0 kΩ**

(2) When the measured value is out of the basic standard, change the wheel sensor as it might be considered presumably to be abnormal.

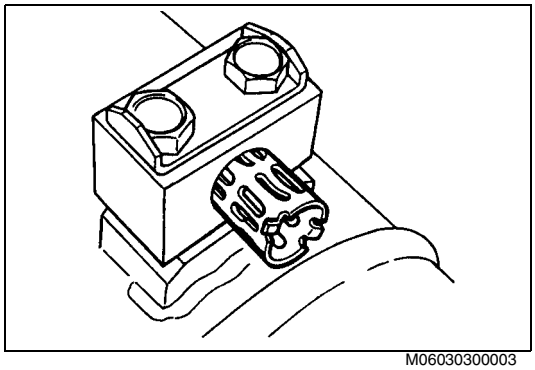

M06030300006

**2. INSPECTION OF THE SENSOR RING.**

(1) Make a visual inspection to check for damage or deformation of the sensor ring, and also to make sure it is not coming loose from the wheel hub.

(2) If any damage or malformation is discovered, replace the sensor ring.

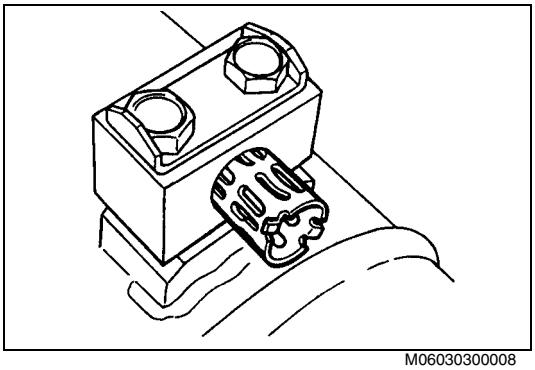
(3) If the sensor ring is coming loose from the wheel hub, use a dolly block and a press to pressure mount it again.


M06030300003

**3. INSPECTION OF THE CLAMPING BUSHING.**

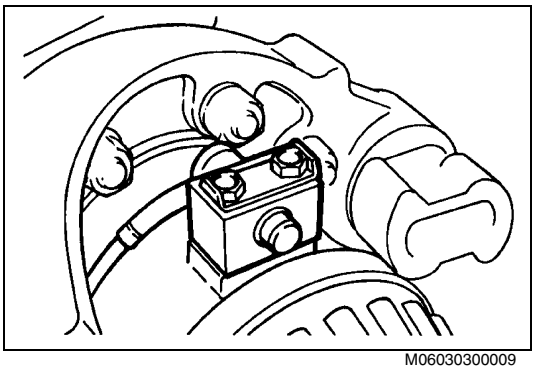
(1) Make sure that the wheel sensor is securely fixed.

(2) Change the clamping bushing when it can be pulled off or pushed in with a weak force.


M06030300008

**4. MOUNTING THE WHEEL SENSOR**

(1) Push in the clamping bushing until the stopper makes contact with the wheel sensor holder.

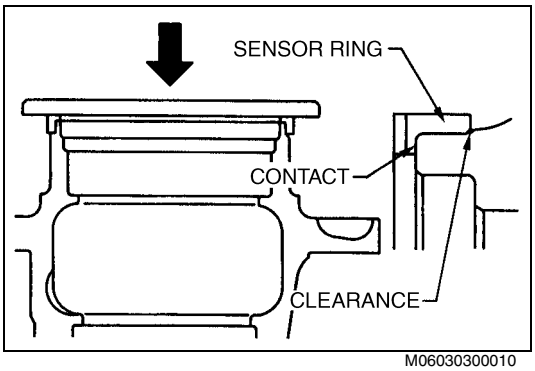

M06030300009

(2) Push the wheel sensor fully in the wheel sensor holder with hands until the wheel sensor makes contact with the clamping bushing.

**NOTICE:**

**When inserting the wheel sensor, do not tap on it with a hammer or attempt to pry it into place using a screwdriver, or the like. Doing so could damage the wheel sensor.**

(3) Arrange the wire harness.



M06030300010

**5. MOUNTING THE SENSOR RING**

(1) Place the sensor ring on the wheel hub and use the dolly block and a press to evenly pressure mount it.

**NOTICE:**

**Warming up the sensor ring with hot water will make it easier to pressure mount it. Do not use a gas burner or the like to warm the sensor ring. Doing so could cause malformation of the sensor ring.**

(2) After pressure mounting it, check for flutter of the sensor ring in the axle direction.
**Assembly standard: Less than 0.2 mm {0.0078 in.}**

**6. MOUNTING THE WHEEL HUB AND BRAKE DRUM**

(1) Refer to CHAPTER REAR AXLE.

**NOTICE:**

- **Be careful not to push back the wheel sensor too far when mounting the wheel hub and brake drum. Also, make sure they are straight so that you do not bump the tip of the wheel sensor.**
- **When inserting the outer hub bearing, avoid tapping on it with a hammer as this will expose the wheel sensor to bumps. Insert the outer hub bearing carefully with a lock nut.**

**7. INSPECT THE WHEEL SENSOR**

(1) Arrange the wire harness.

(2) With a circuit tester, confirm the output voltage of the wheel sensor (By rotating the tire by one time for 5 seconds)
**Standard: 150-1,999 mV**
**(Range of Alternating Current Voltage)**

(3) In case of out of the standard range at 2), remove the dust cover located on the back plate unit. Then push the wheel sensor by using round end bar until the sensor contacts with the sensor ring.

**NOTICE:**

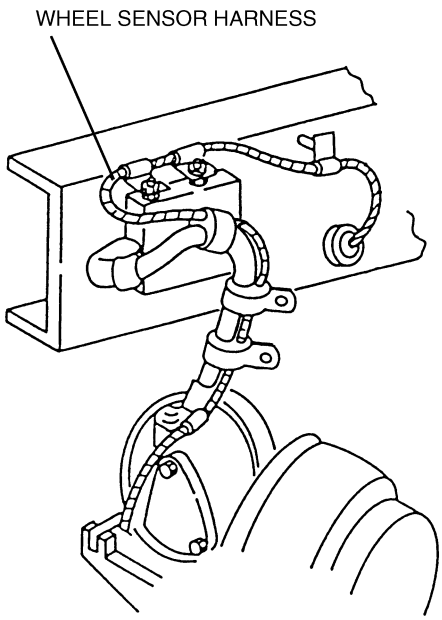
**Do not tap by hammer or turn when pushing the wheel sensor. This may damage the wheel sensor.**

(4) Mount the axle shaft to the wheel hub and tighten the bolt on the axle shaft.
Refer to CHAPTER, REAR AXLE.

**8. ABS WIRE HARNESSES**

(1) Front axle ABS wire harnesses

- The front axle chassis harnesses, particularly the ones that pass over the front axle and extend as far as the wheel sensors, must absorb the movement when the wheels are turned and when the springs move. It is therefore necessary to always maintain an optimal spacing between the clips.
In addition, if there is a large amount of variation in the spacing between the clips, the wheel sensor harnesses can come into contact with tire chains and sustain damage.
The wire harness for the front axle wheel sensor extends directly from the clip on top of the king pin cover to the frame. In particular, make sure that the distance between the clip on top of the king pin cover and the clip on the frame side is as indicated in the diagram below. There are markings on the wheel sensors in cases where the wheel sensor harness clips are in locations where the relative movement is particularly great. These places should be inspected regularly to ensure that the clip positions are still meeting with the same marking.




M06030300015

(2) Rear axle chassis harness

- The rear axle chassis harnesses is arranged so that the left and right wheel sensor harnesses are near each other. Therefore, special care should be taken not to make incorrect connections if the harnesses have been removed for inspection or repairs.
If incorrect connections are made, it will interfere with the functioning of the ABS system. For this reason, caution plates indicating "LEFT" and "RIGHT" are affixed to the harnesses. Be sure to check when connecting the harnesses. (The left harness is on the left side of the vehicle when viewed from the behind and facing toward the front, and the right harness is on the right side of the vehicle.)
The wheel sensor harnesses are arranged along the top of the rear axle housing. Therefore, make sure to allow sufficient harness length between the chassis and the rear axle so that the harnesses can absorb the up-and-down motion of the rear axle.

# ES START (EASY & SMOOTH START SYSTEM)

BR04-001

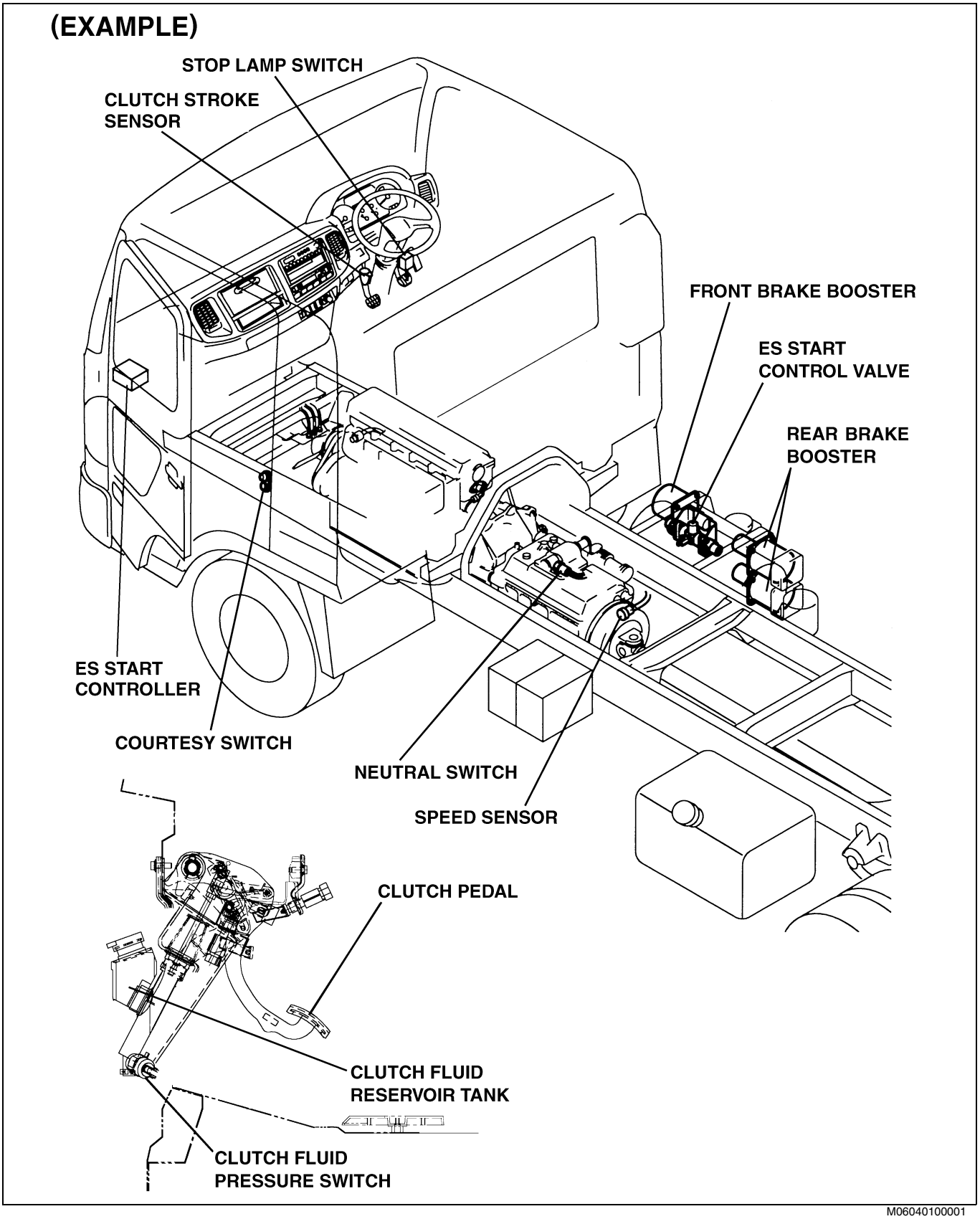
**ES START .....BR04-2**
DESCRIPTION ..... BR04-2
DIAGRAM ..... BR04-3
SPECIAL TOOL ..... BR04-4
ADJUSTMENT ..... BR04-5

**ES START CONTROL VALVE .....BR04-10**
COMPONENT LOCATOR ..... BR04-10
OVERHAUL ..... BR04-11
INSPECTION AND REPAIR ..... BR04-13

# ES START

## DESCRIPTION

M06040101BEC1001

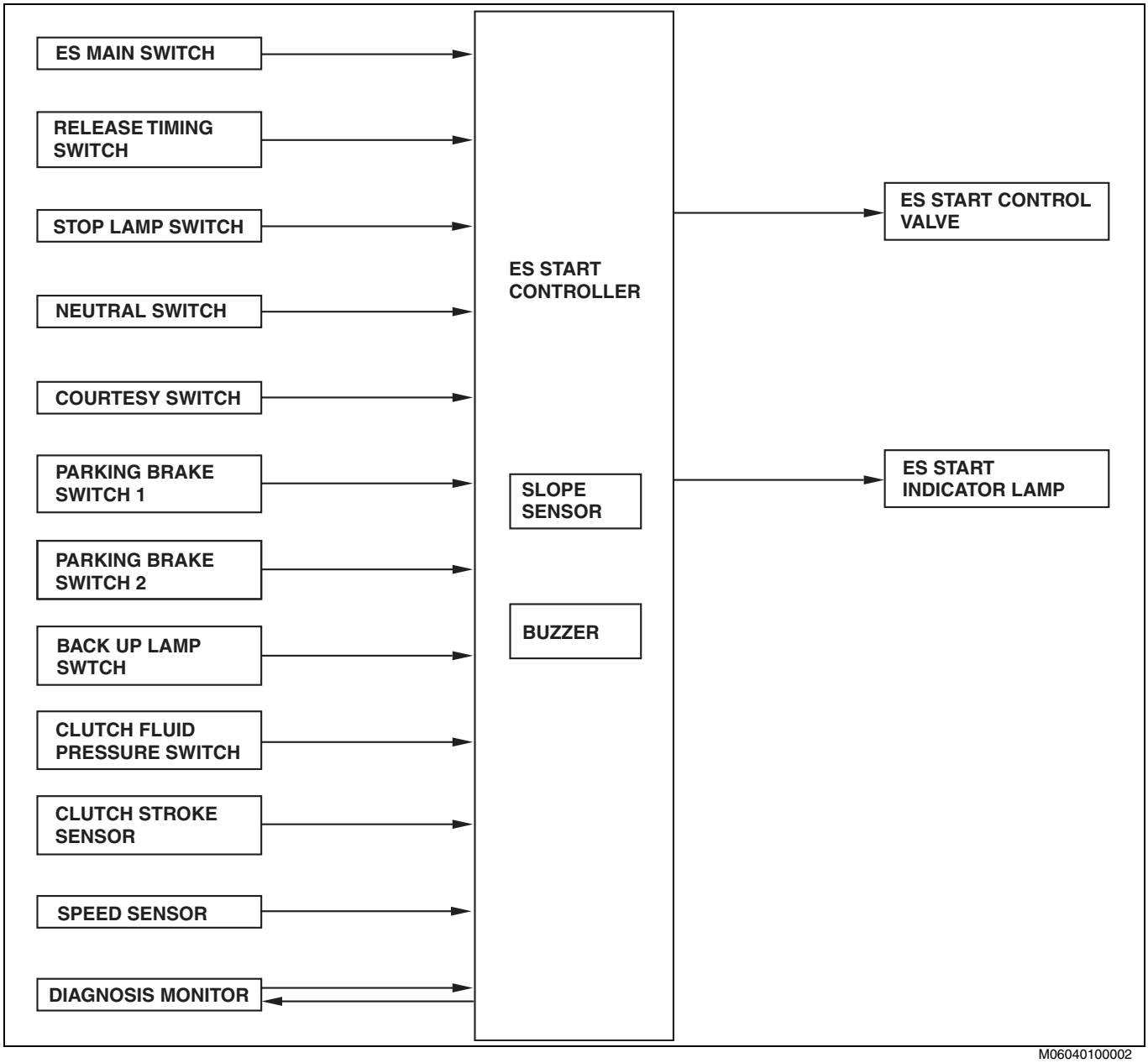



M06040100001

# DIAGRAM

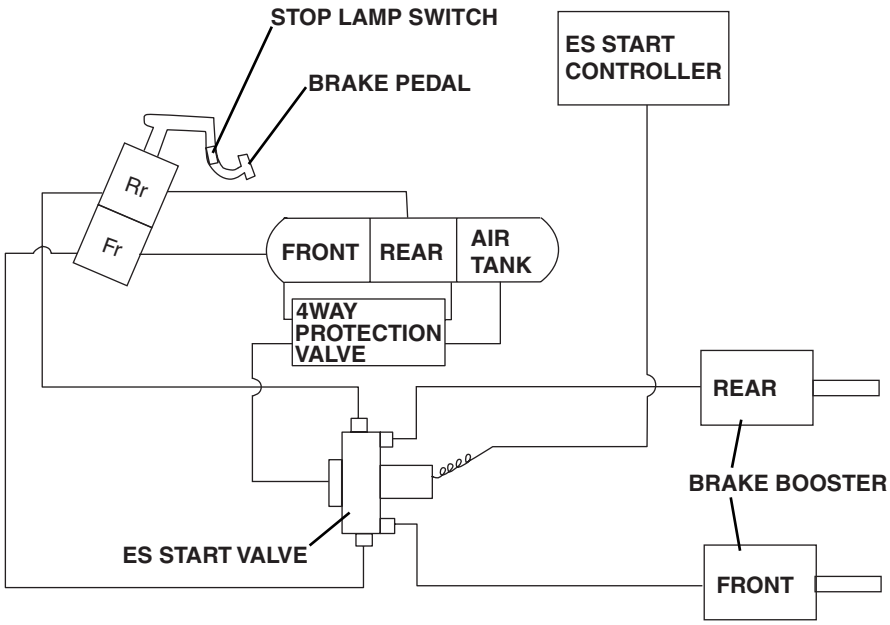
M06040101BEJ1001

## SYSTEM DIAGRAM




M06040100002

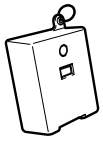
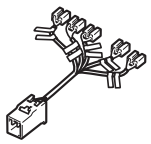
## PIPING DIAGRAM




M06040100003

# SPECIAL TOOL

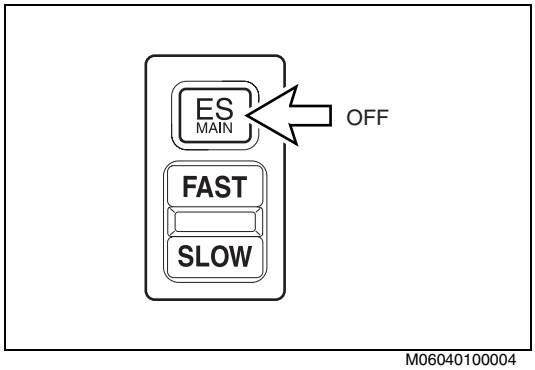
M06040101BEK1001

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09630-1370 | DIAGNOSIS MONITOR | FOR DIAGNOSING AND SETUP OF ES START |
|  | 09630-2300 | SPECIAL WIRING HARNESS FOR INTENSIVE DIAGNOSIS CONNECTOR | FOR CONNECTING DIAGNOSIS MONITOR |

# ADJUSTMENT

M06040101BEH3001

**NOTICE:**
**When replacing the clutch disc, clutch stroke sensor or ES start controller, do the following adjustment.**

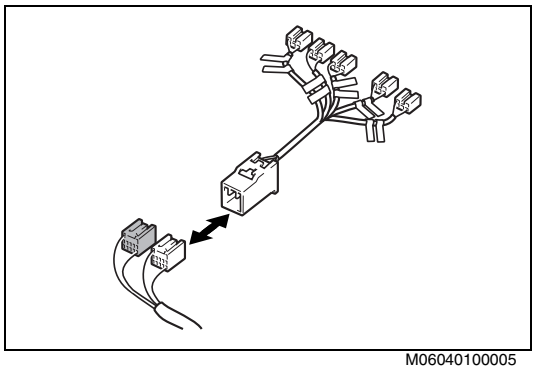


M06040100004

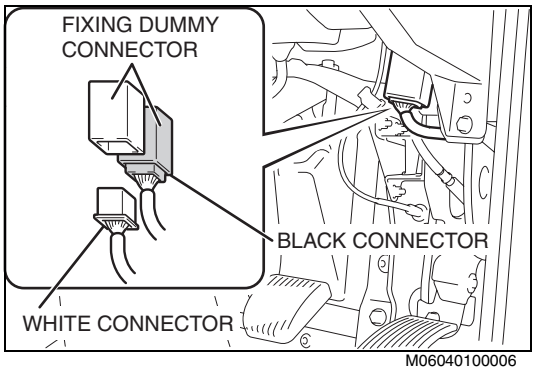
## ADJUSTMENT OF THE CLUTCH STROKE SENSOR.

**1. ADJUSTMENT PROCEDURE BY USING FUNCTION FOR CONFIRMATION OF THE SENSOR CONDITION.**

(1) Set the starter key "ON".
(2) Set the ES main switch "OFF".

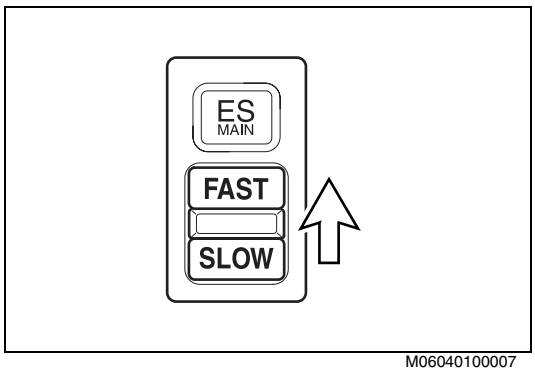

M06040100005

(3) Locate two intensive diagnosis connectors on lower right of the driver's side instrument panel. Connect the special wiring harness to the white connector and diagnosis monitor to the connector tagged by "ES start".
**SST:**
**Special wiring harness for intensive diagnosis connector (09630-2300)**
**Diagnosis monitor (09630-1370)**



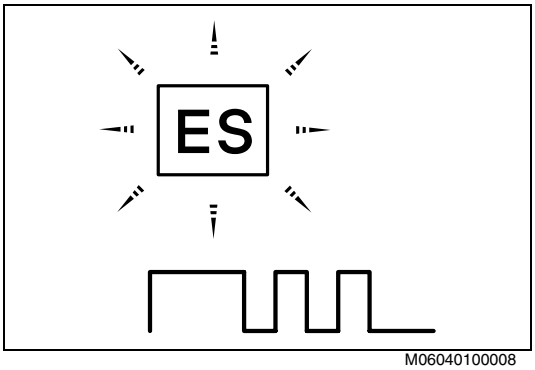
M06040100006

**NOTICE:**
**The intensive diagnosis connector is usually connected to the fixing dummy connector. So, disconnect the connector from the dummy connector and pull it to use. When the connector is not in use, connect it firmly to the fixing dummy connector.**



M06040100007

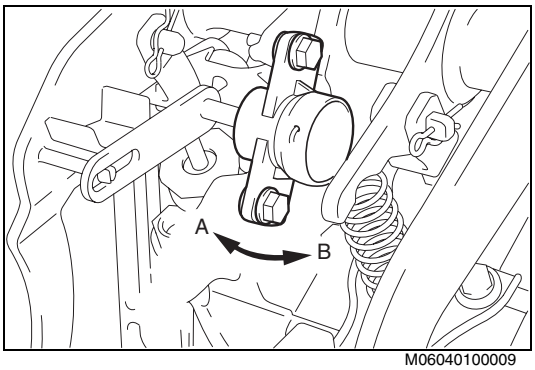
(4) Push "FAST" side of the release timing switch three times.



M06040100008

**HINT:**
**When the sensor status checking function starts by the above-mentioned operation, ES start indicator lamp on the meter panel lights up and buzzer beeps once according to the patterns shown in the figure.**

(5) Diagnose if the adjustment is required or not by the condition of buzzer beeping when the clutch pedal is free.
**The buzzer beeps continuously:**
**Within the range of service limit (adjustment not required)→Go to 3. How to complete.**
**The buzzer does not beep or beeps intermittently:**
**Out of the range of service limit (adjustment required) →Go to 2. Adjustment procedure.**

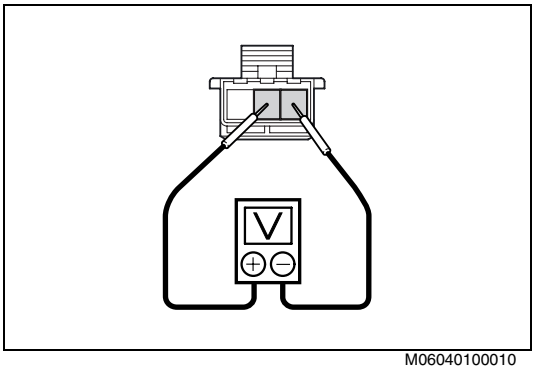


M06040100009

**2. ADJUSTMENT PROCEDURE**
(1) Loosen the clutch stroke sensor fitting bolt to adjust the sensor as shown in the figure.

| Buzzer | Adjusting procedure |
|---|---|
| Beeping intermittently | Turn the sensor to A direction |
| Beeping continuously | Normal condition |
| No beeping | Turn the sensor to B direction |

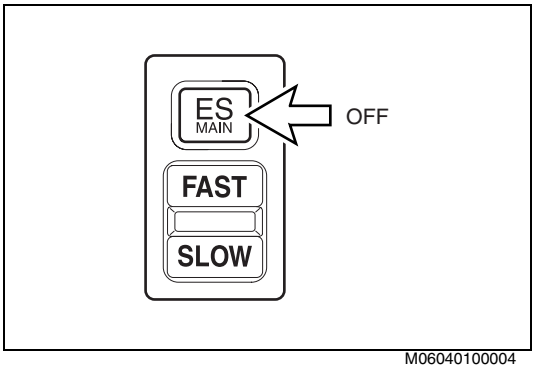
(2) After completing the adjustment, proceed to step 3.



M06040100010

**3. HOW TO COMPLETE**
(1) Tighten the clutch stroke sensor fitting bolt. (Make sure there is no misalignment.)
(2) After using the status checking function, turn the release timing switch to "FAST" side, or ES main switch "ON" before detaching the diagnosis monitor.

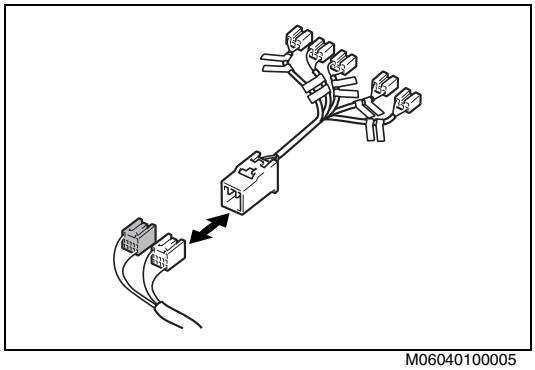
## INITIALIZATION OF RELEASE POSITION



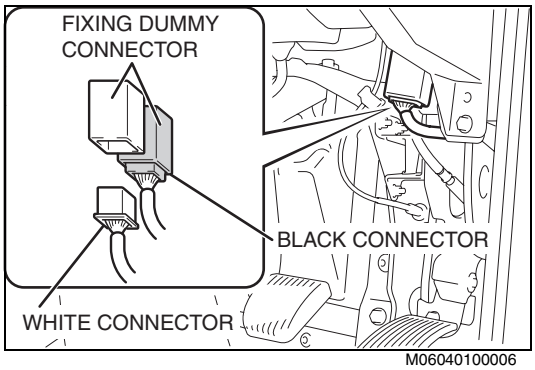
M06040100004

**HINT:**
**This is for memorizing the default value of ES start release position (engaging point of clutch) to ES start controller.**

**1. HOW TO SETUP**
(1) Turn the starter key "ON" and ES main switch "OFF". Then pull the parking brake lever.

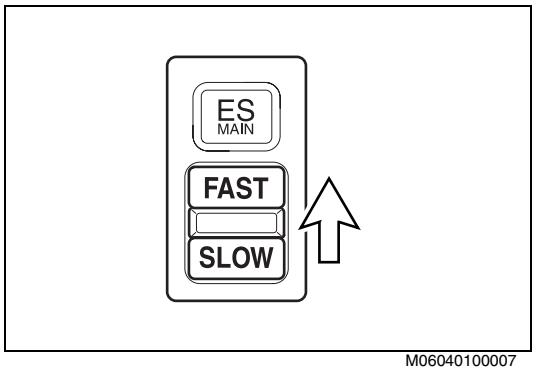

M06040100005

(2) Locate two intensive diagnosis connectors on lower right of the driver's side instrument panel. Connect the special wiring harness to the white connector and diagnosis monitor to the connector tagged by "ES start".
**SST:**
**Special wiring harness for intensive diagnosis connector (09630-2300)**
**Diagnosis monitor (09630-1370)**



M06040100006

**NOTICE:**
**The intensive diagnosis connector is usually connected to the fixing dummy connector. So, disconnect the connector from the dummy connector and pull it to use. When the connector is not in use, connect it firmly to the fixing dummy connector.**



M06040100007

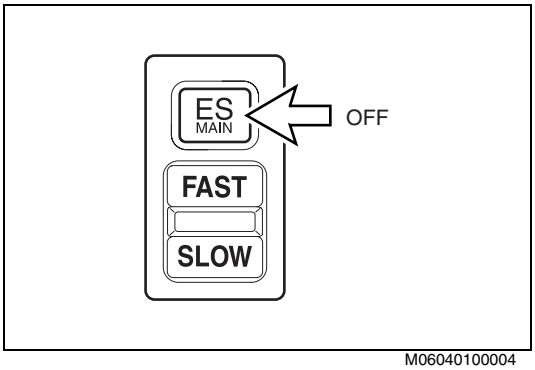
(3) Make sure that the clutch pedal has returned completely and press "FAST" side of the release timing switch for 3 seconds.

**HINT:**
**When the above operation has been completed, the buzzer beeps and the indicator lamp also blinks in exact timing with the buzzer to confirm the startup of the initialization.**

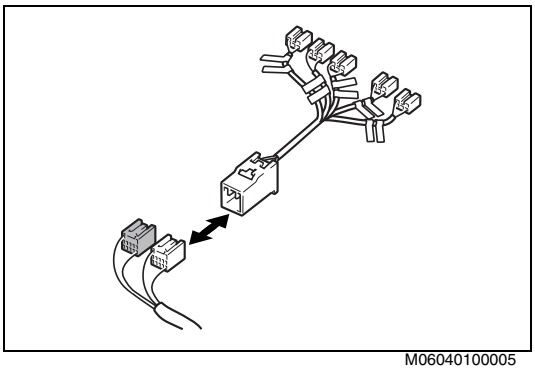
(4) Step the clutch pedal and shift the gear to the second and gradually engage the clutch.
(5) When the engine revolution comes into the condition below, press once more "FAST" side of the release timing switch.
**Models equipped with mechanical governor:**
**Tachometer reading goes down by 50 r/min below the idling revolution.**
**Models equipped with electronic governor or**
**Tachometer reading goes down and then returns.**
(6) The buzzer beeps once and ES start indicator lamp turns off and then the release position is memorized.
(7) After disconnecting the diagnosis monitor, turn the starter switch to "LOCK" position to complete the initialization.

**NOTICE:**
- **To abort the initialization, disconnect the diagnosis monitor.**
- **On the following conditions, the initialization is impossible.**

**1. Failure alarm is alerting.**
**2. ES start is operating.**
**3. Vehicle speed is 0.5 km/h or above.**
**4. Parking brake lever has not been pulled.**
**5. Diagnosis monitor is not connected.**



M06040100004


M06040100005

## 0 POINT ADJUSTMENT OF SLOPE SENSOR

**HINT:**
**This is for memorizing the slope sensor signal when the vehicle is on the level to ES start controller. (For equipped with air suspension models, perform this adjustment at the normal vehicle height position.)**

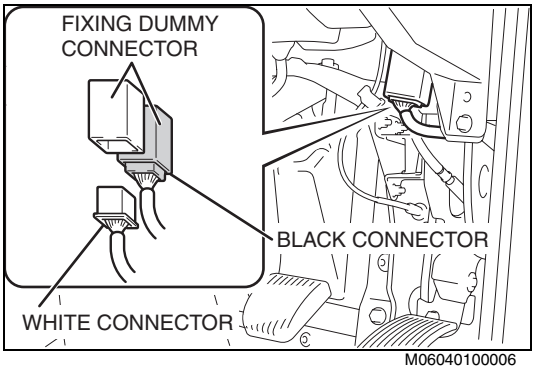
**1. HOW TO SETUP**

(1) Make sure the conditions below.
**Vehicle load: no load**
**Road condition: on the level**

(2) Turn the starter switch "ON" and ES main switch "OFF". Then pull the parking brake lever.

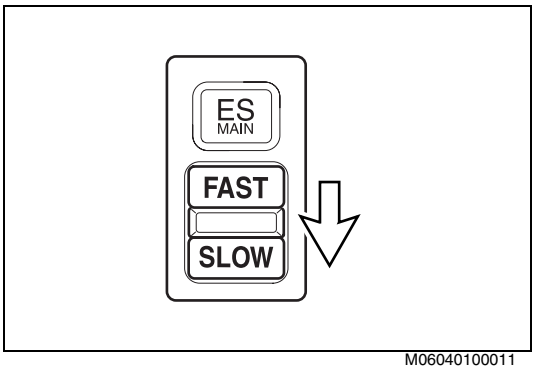
(3) Locate two intensive diagnosis connectors on lower right of the driver's side instrument panel. Connect the special wiring harness to the white connector and diagnosis monitor to the connector tagged by "ES start".

**SST:**
**Special wiring harness for intensive diagnosis connector (09630-2300)**
**Diagnosis monitor (09630-1370)**



M06040100006

**NOTICE:**
**The intensive diagnosis connector is usually connected to the fixing dummy connector. So, disconnect the connector from the dummy connector and pull it to use. When the connector is not in use, connect it firmly to the fixing dummy connector.**



M06040100011

(4) Press "SLOW" side of the release timing switch for 3 seconds.

**HINT:**
**When the above operation has been completed, the buzzer beeps and the indicator lamp also blinks in exact timing with the buzzer to confirm the setup starts. (This condition continues after the switch is released.)**

(5) Press "SLOW" side of the release timing switch again.
(6) The buzzer beeps once and ES start indicator lamp turns off and then the slope sensor output value is memorized.
(7) After disconnecting the diagnosis monitor, turn the starter key to "LOCK" position to complete 0 point adjustment.

**NOTICE:**

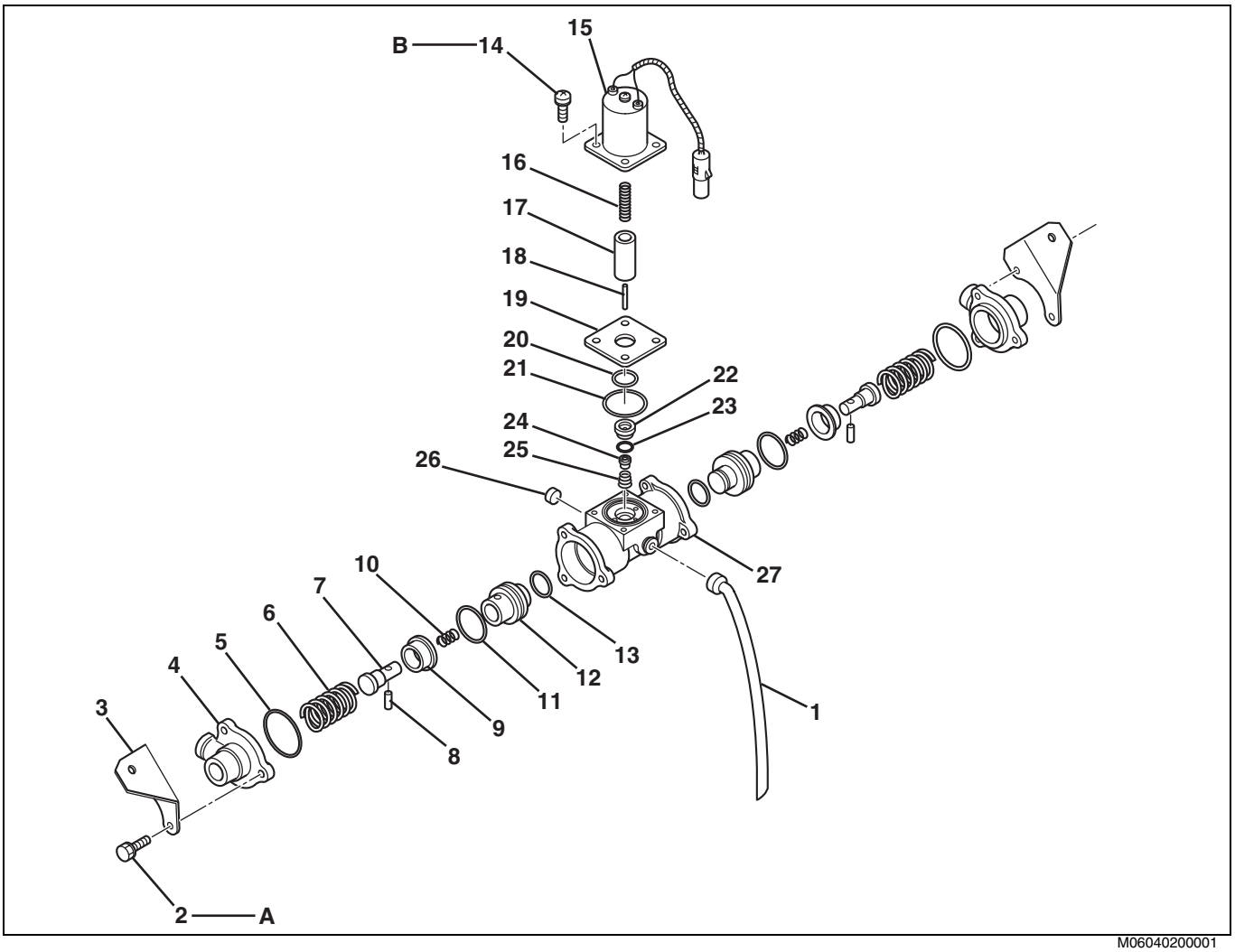
- **0 point adjustment of slope sensor must be done on the level road. (If the adjustment is done on slope road, the sensor does not function properly.)**
- **If startup of 0 point adjustment is impossible, the road condition is not on the level. Move the vehicle to a place on the level.**
- **On the following conditions, 0 point adjustment is impossible.**

1. **Failure alarm is alerting.**
2. **ES start is operating.**
3. **Vehicle speed is 0.5Km/h or above.**
4. **Parking brake lever has not been pulled.**
5. **Diagnosis monitor is not connected.**

# ES START CONTROL VALVE

## COMPONENT LOCATOR

M06040201BED1001




M06040200001

| | | | | | |
|---|---|---|---|---|---|
| 1 | Hose | 10 | Spring | 19 | Coil cover |
| 2 | Bolt | 11 | O-ring | 20 | O-ring |
| 3 | Bracket | 12 | Piston | 21 | O-ring |
| 4 | Cover | 13 | O-ring | 22 | Valve seat |
| 5 | Seal | 14 | Screw | 23 | O-ring |
| 6 | Spring | 15 | Solenoid assembly | 24 | Valve |
| 7 | Inlet valve | 16 | Spring | 25 | Spring |
| 8 | Straight pin | 17 | Plunger | 26 | Filter |
| 9 | Spring seat | 18 | Rod | 27 | Body |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 4.0-6.0 {40-60, 2.9-4.3} | B | 1.3-1.7 {13-17, 0.49-1.22} |

# OVERHAUL

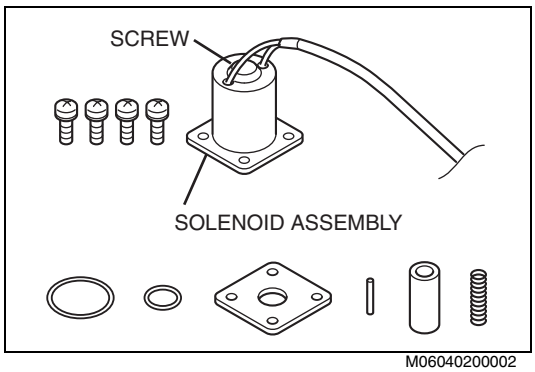
M06040201BEH2001

## IMPORTANT POINTS - DISMOUNTING

**NOTICE:**

- **When dismounting and storing parts, place a cap on all ports so not dirt or dust enters.**
- **Be careful so water, dirt, or dust does not enter inside the harness connector to prevent solenoid short circuits or faulty connections.**

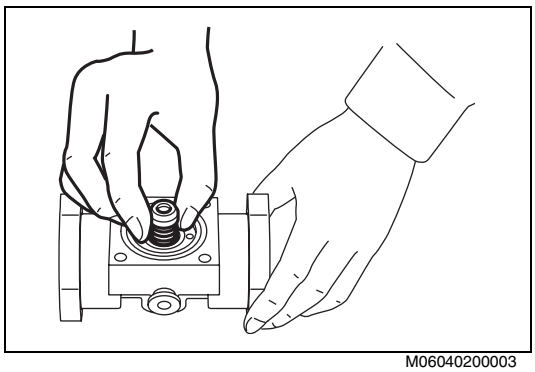
## IMPORTANT POINTS - DISASSEMBLY




M06040200002

**NOTICE:**
**Never loosen the screws in the solenoid assembly. Replace the solenoid assembly if the screws have been loosened.**

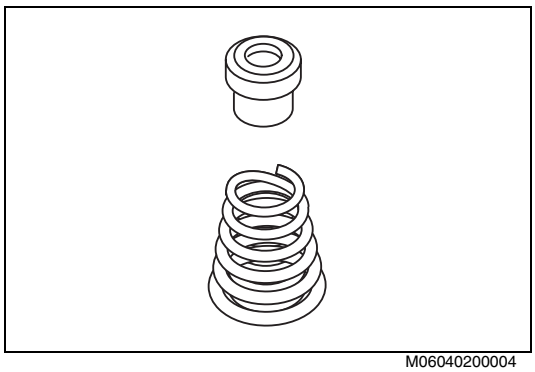
## IMPORTANT POINTS - ASSEMBLY



M06040200003

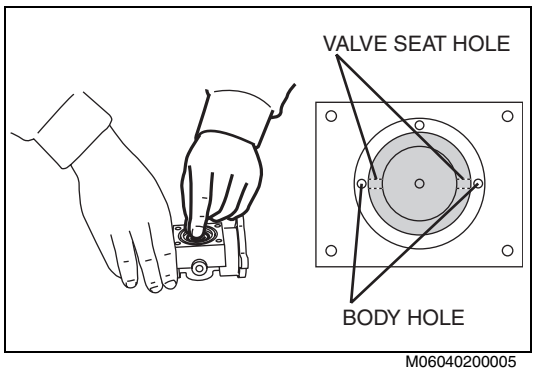
**NOTICE:**
**Apply an adequate amount of grease to each O-ring before assembly.**

1. **Insert the spring in the valve and assemble it in the body.**



M06040200004

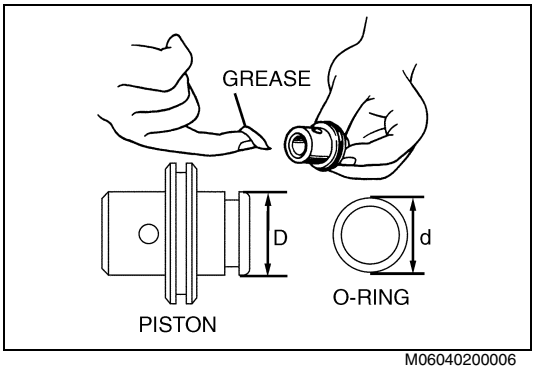
**NOTICE:**
**Assemble the valve and the spring as shown in the figure.**




M06040200005

2. **Align and attach the O-ring in the small diameter space in the valve seat correctly and install it in the body.**

**NOTICE:**
**Align the valve seat holes and body holes to perform the assembly.**

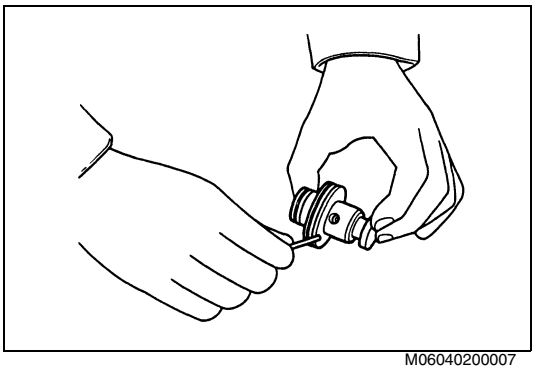


M06040200006

**3. Assemble the O-rings (2 units) in the piston and lubricate the inside diameter of the piston with grease.**

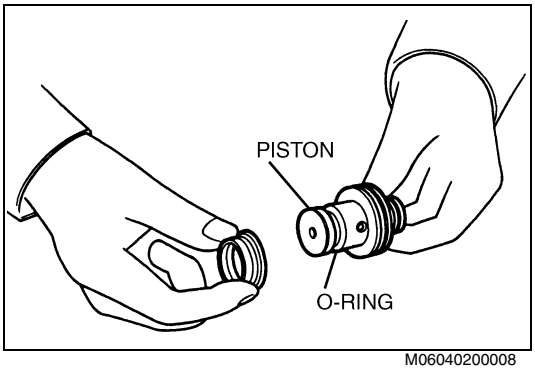
**NOTICE:**
**Verify the diameter of the O-ring (small diameter) because there are multiple settings and then assemble the unit.**

**D dimension = 22 mm {0.87 in.}**
**d dimension = 22 mm {0.87 in.}**


M06040200007

**4. Assemble the spring, piston and inlet valve. Press in the inlet valve and install the straight pin.**

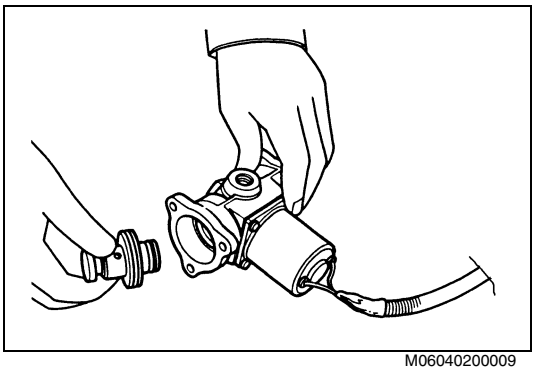
**NOTICE:**
**Align the inlet valve pin hole and piston pin hole and assemble the parts. After the assembly is completed, do not rotate the inlet valve to align the pin holes.**



M06040200008

**5. Position the spring seat collar so it faces the rear side and install the unit.**

**6. Apply grease to the outer surface of the O-ring installed in the piston.**


M06040200009

**7. Apply grease to the inner surface of the body.**

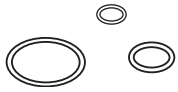
**8. Insert the piston inlet valve assembly in the body.**

**NOTICE:**
**Do not turn the piston when inserting it.**

# INSPECTION AND REPAIR

M06040201BEH3001

**NOTICE:**
**Isopropyl alcohol should only be used to wash the ES start control valve components.**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Valve body inside, piston, valve, valve seat, spring and inlet valve: Wear and damage | — | — | Replace. | Visual check  |
| O-ring: Crack and damage | — | — | Replace. | Visual check  |

# EXHAUST BRAKE

BR05-001

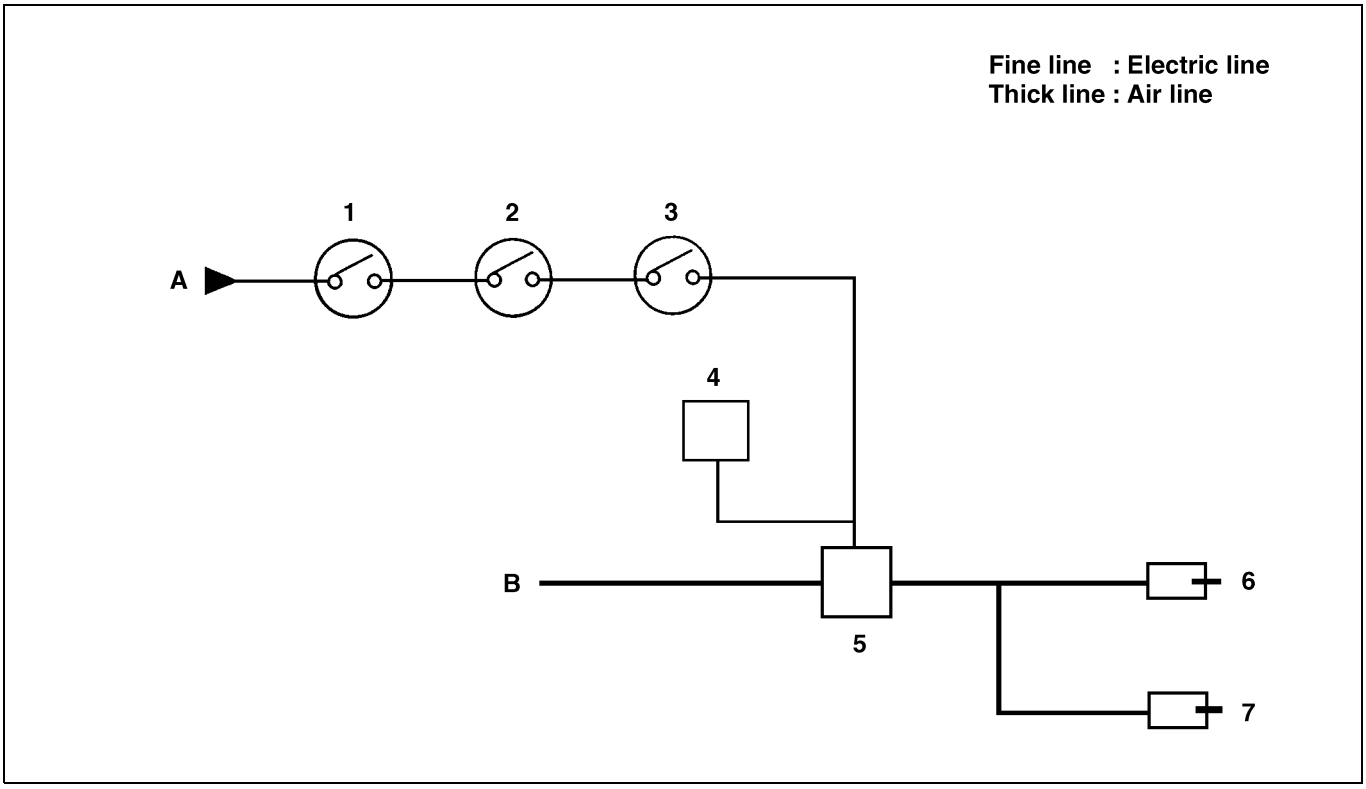
**EXHAUST BRAKE SYSTEM .....BR05-2**
SYSTEM DIAGRAM ..... BR05-2
TROUBLESHOOTING ..... BR05-3
ADJUSTMENT ..... BR05-3

**BRAKE CYLINDER.....BR05-5**
DATA AND SPECIFICATIONS ..... BR05-5
DESCRIPTION ..... BR05-5
COMPONENT LOCATOR ..... BR05-6
OVERHAUL ..... BR05-6
INSPECTION AND REPAIR ..... BR05-7
ADJUSTMENT ..... BR05-8

# EXHAUST BRAKE SYSTEM

## SYSTEM DIAGRAM

M060501BEJ1001




M06050100001

| | | | |
|---|---|---|---|
| 1 | Clutch switch | 6 | Exhaust brake control cylinder |
| 2 | Accelerator switch | 7 | Noise suppressor |
| 3 | Exhaust brake switch | A | From power source |
| 4 | Indicator lamp | B | From air tank |
| 5 | Magnetic valve | | |

**NOTICE:**
**Figure shown above is a typical diagram; refer to Electric Wiring Diagram in the ELECTRICAL EQUIPMENT chapter and Brake Piping Diagram in the SERVICE BRAKE chapter for details.**

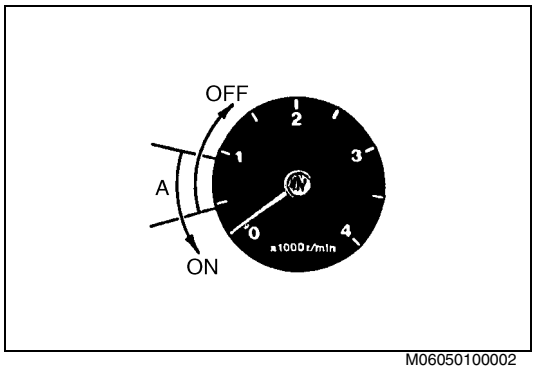
# TROUBLESHOOTING

M060501BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Switch does not work** | Defective contacts | Check and correct. |
| | Open circuit in harness | Check and correct. |
| **Valve does not close** | Valve clogged with carbon | Remove carbon. |
| | Burnt shaft | Check and correct. |

# ADJUSTMENT

M060501BEH3001



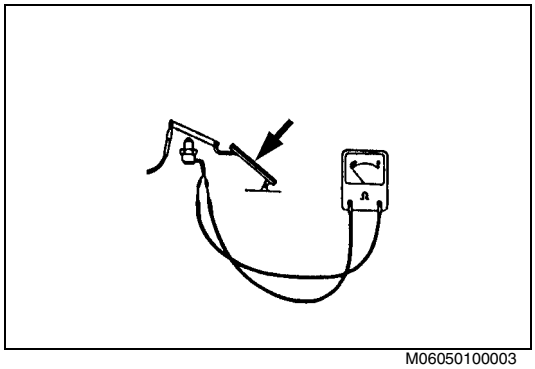
M06050100002

## ACCELERATOR SWITCH ADJUSTMENT

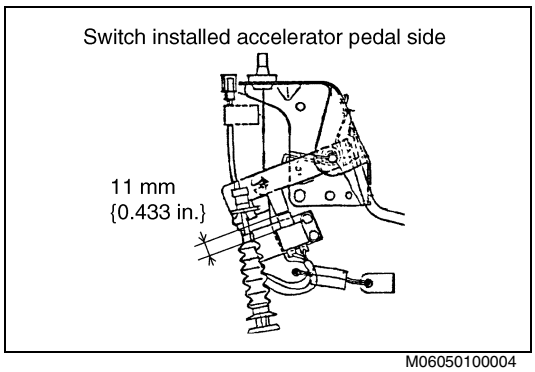
**1. ADJUSTMENT OF THE EXHAUST BRAKE ACCORDING TO THE ENGINE SPEED**

(1) Adjust the engine idling speed by turning the throttle knob.

(2) The accelerator switch should turn on (0 Ω) when the engine speed is lower than the following, and off (∞ Ω) when the engine speed is higher.


M06050100003

**NOTICE:**
**Use the accelerator pedal to change engine speeds.**

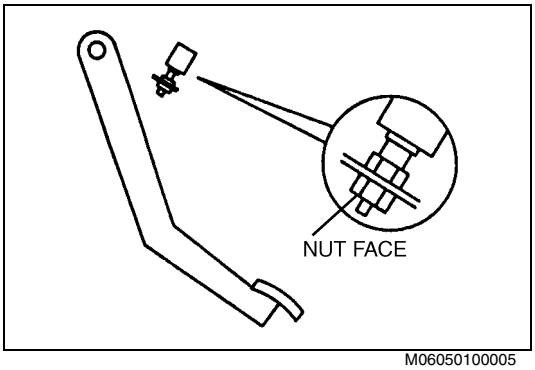


M06050100004

(3) Adjust the accelerator switch position if it is out of position.

**Unit: r/min**

| Engine speed | |
|---|---|
| **Idling speed** | **Accelerator switch turns on or off** |
| **500-550** | **550-700** |



M06050100005

## CLUTCH SWITCH ADJUSTMENT

**1. FIT THE SWITCH SO THAT THE THREAD AND NUT FACE ARE FLUSH.**

# BRAKE CYLINDER

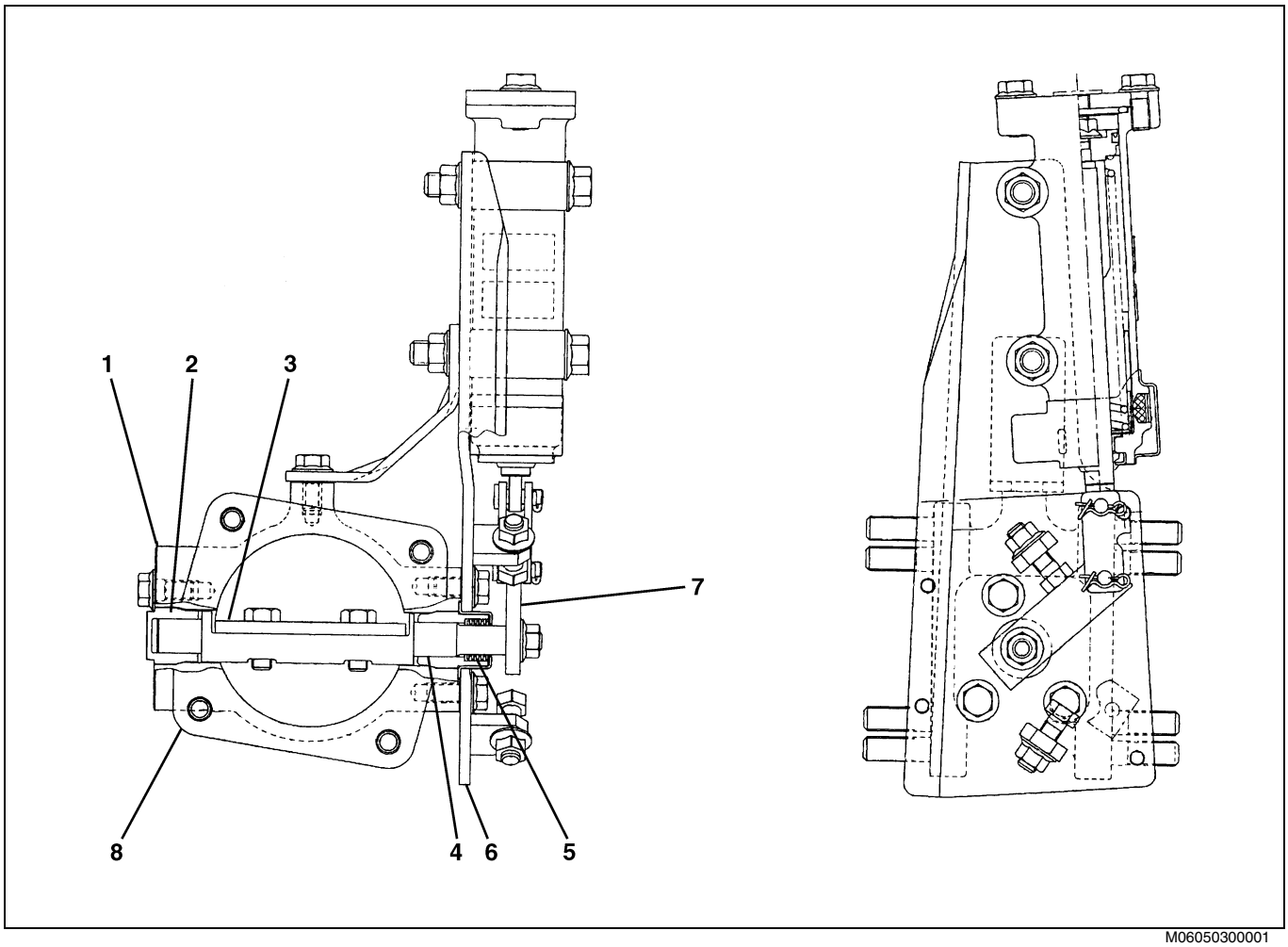
## DATA AND SPECIFICATIONS

M06050301BEI2001

| | |
|---|---|
| Type | Butterfly valve |

## DESCRIPTION

M06050301BEC1001

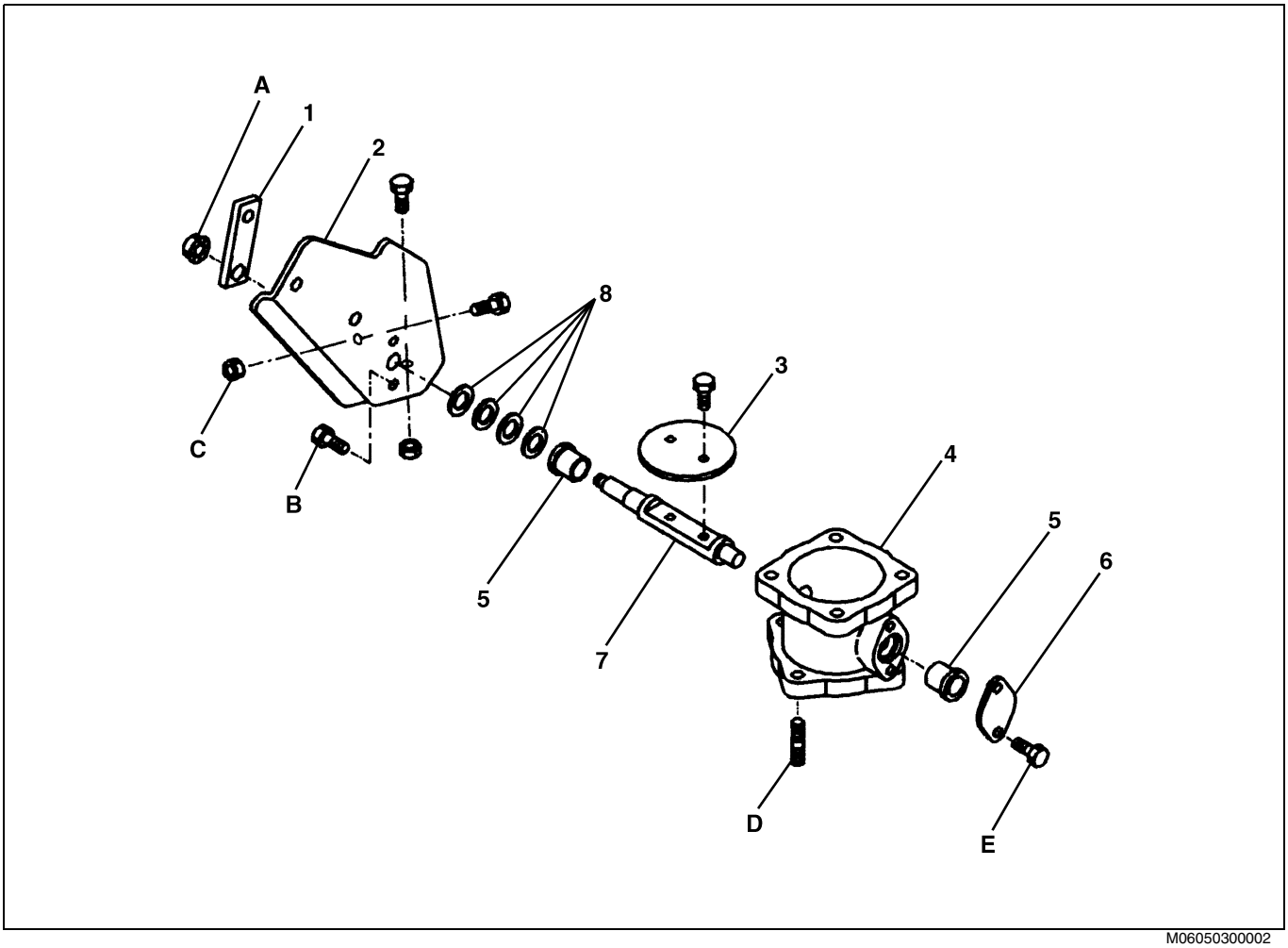



M06050300001

| | | | |
|---|---|---|---|
| 1 | Blind plate | 5 | Seal ring |
| 2 | Bushing | 6 | Plate |
| 3 | Valve | 7 | Lever |
| 4 | Shaft | 8 | Cylinder |

# COMPONENT LOCATOR

M0650301BED1001




M06050300002

| | | | |
|---|---|---|---|
| 1 | Lever | 5 | Bushing |
| 2 | Plate | 6 | Blind plate |
| 3 | Valve | 7 | Shaft |
| 4 | Cylinder | 8 | Seal ring |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

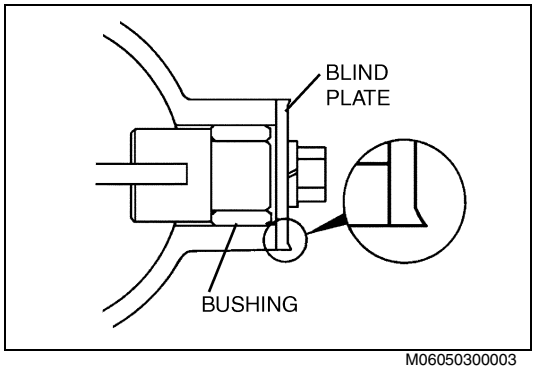
| | | | |
|---|---|---|---|
| A | 10.8-16.7 {120-170, 9-12} | D | 19.6-24.5 {200-240, 15-17} |
| B | 22.6-28.4 {240-280, 18-20} | E | 22.6-28.4 {240-280, 18-20} |
| C | 10.8-16.7 {120-170, 9-12} | | |

# OVERHAUL

M06050301BEH2001

## IMPORTANT POINT - DISMOUNTING

**CAUTION:**
**Do not work on the exhaust brake cylinder while it is still hot. This can result in personal injury.**



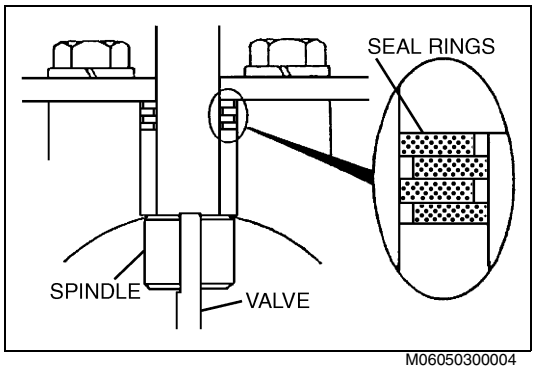
M06050300003

## IMPORTANT POINTS - ASSEMBLY

**1. INSTALLATION OF THE PLATE**

(1) Before assembling the brake cylinder, remove the carbon with a scraper or emery paper (recommended: NO.150) .

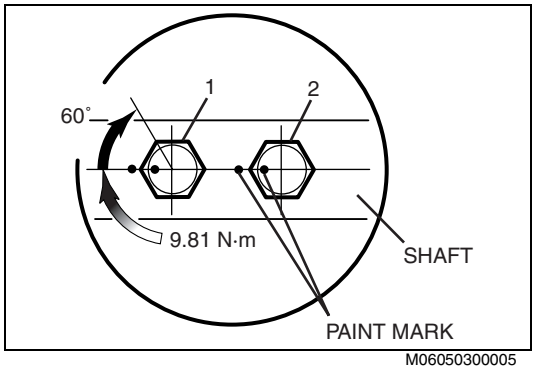
(2) Beveled edge of blind plate is fitted outward as shown in the figure.



M06050300004

**2. INSTALLATION OF THE SEAL RINGS**

(1) The small and large seal rings must be installed alternately as shown in the figure.



M06050300005

**3. INSTALLATION OF THE VALVE**

(1) Apply lithium molybdenum grease to the bolt seat surface and bolt threads.

(2) Tighten the bolts in order shown in the figure to the specified torque below.
**Tightening Torque:**
**9.81 N·m {100 kgf·cm, 7 lbf·ft}**

(3) Mark the bolt heads and shaft in the same direction with paint.

(4) Tighten the bolts 60° (1/6 turn) as in step 2.

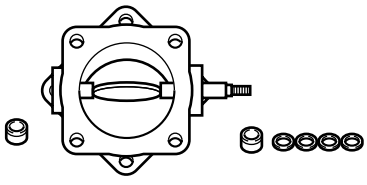
(5) Make sure that the paint marks face the same direction.

**NOTICE:**
**When adding torque, never untighten the nuts, even if they have been overtightened.**

# INSPECTION AND REPAIR

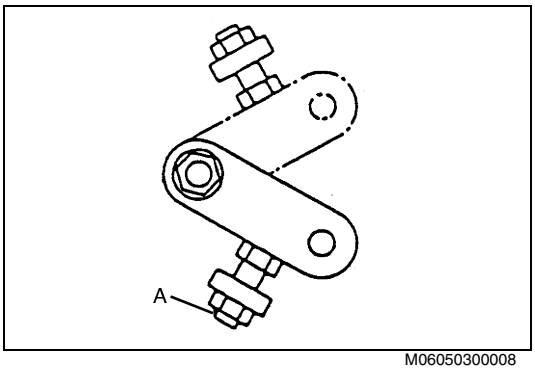
M06050301BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Brake cylinder, bushing and seal ring: Wear, any other damages** | — | — | **Replace, if necessary.** | **Visual check**  |

# ADJUSTMENT

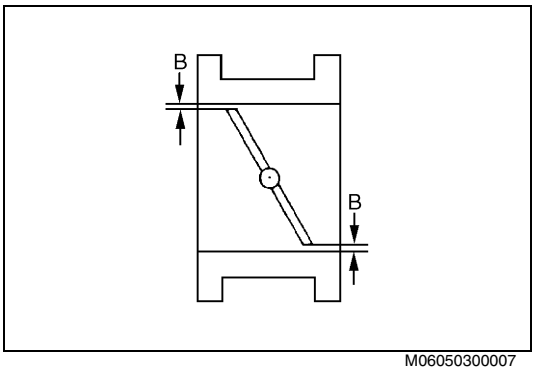
M06050301BEH3002



M06050300008

**1. CLOSE SIDE ADJUSTMENT**

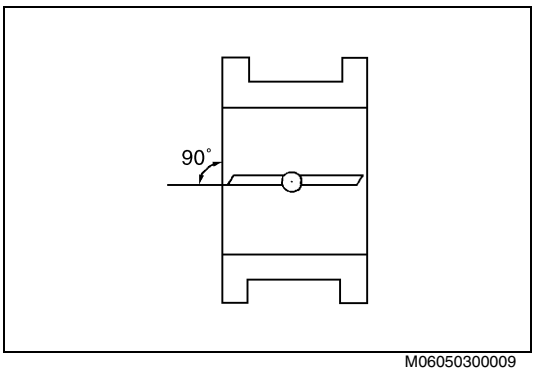
(1) Adjust the clearance between the cylinder and the butterfly valve with the adjusting screw "A".



M06050300007

**Limit: B = 0.1 mm {0.0039 in.}**

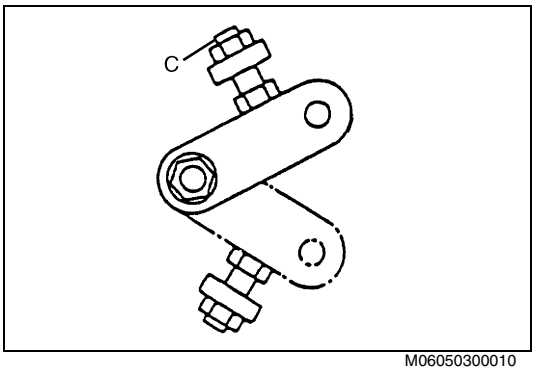
(2) Lock the adjusting screw "A" with a lock nut.



M06050300009

**2. OPEN SIDE ADJUSTMENT**

(1) Set the lever to the open position.
(2) Adjust the butterfly valve may be right angle (90°) to the cylinder with the adjusting screw "C".
(3) Lock the adjusting screw "C" with a lock nut.



M06050300010

# RETARDER BRAKE (ELECTROMAGNETIC RETARDER)

BR06-001

**RETARDER BRAKE ASSEMBLY.....BR06-2**
DATA AND SPECIFICATIONS ..... BR06-2
DIAGRAM ..... BR06-3
DESCRIPTION ..... BR06-4
COMPONENT LOCATOR..... BR06-5
OVERHAUL ..... BR06-7

# RETARDER BRAKE ASSEMBLY

## DATA AND SPECIFICATIONS

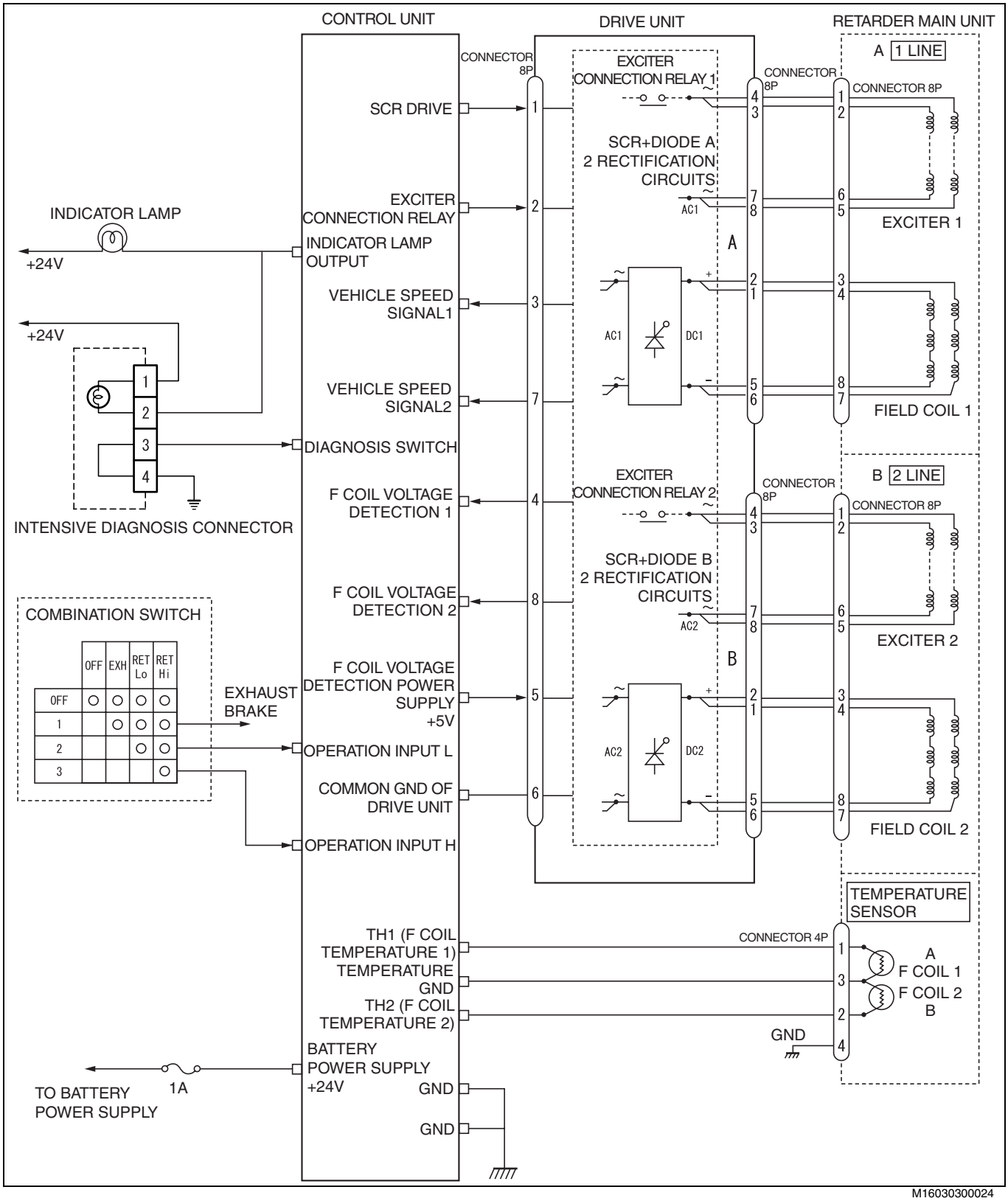
M06060101BEI2001

| | |
|---|---|
| **Retarder type** | **Electromagnetic type** |
| **Brake torque** | **490 N·m {5,000 kgf·cm, 362 lbf·ft}** |
| **Cooling system** | **Air cooling type** |
| **Control system** | **Electronic control system** |
| **Working current** | **Self generating** |

# DIAGRAM

M06060101BEJ1001

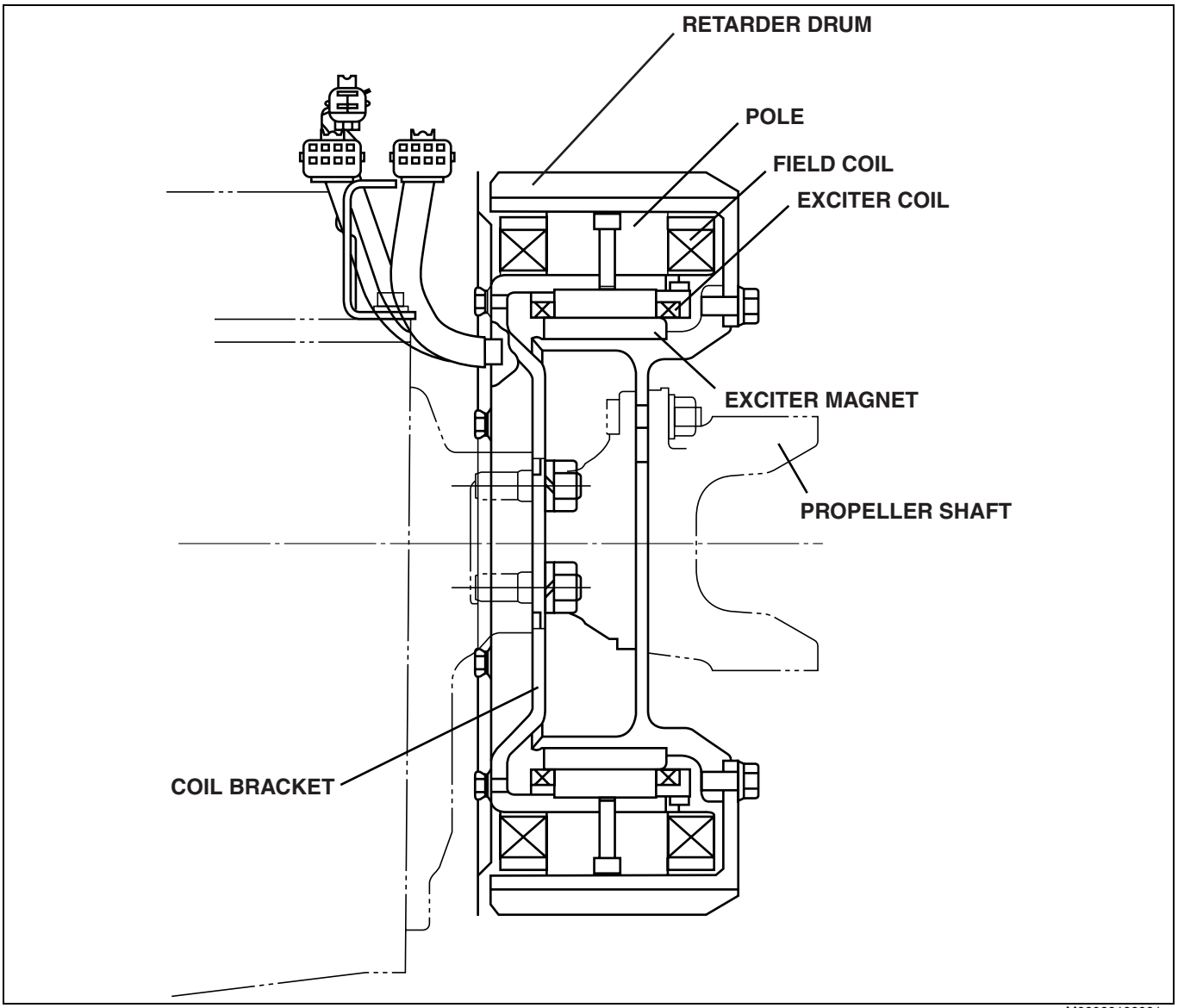
## SYSTEM DIAGRAM




M16030300024

# DESCRIPTION

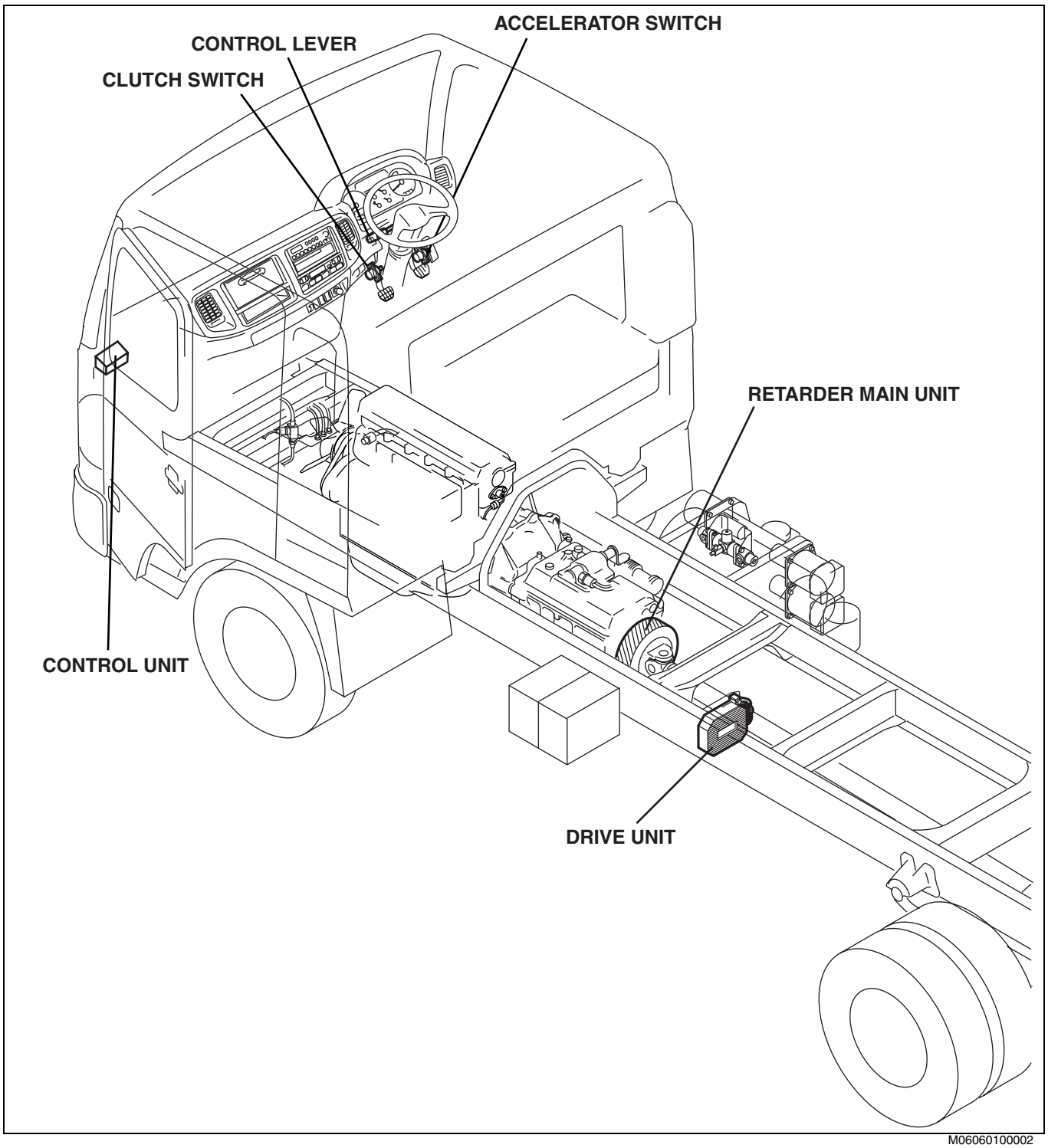
M06060101BEC1001



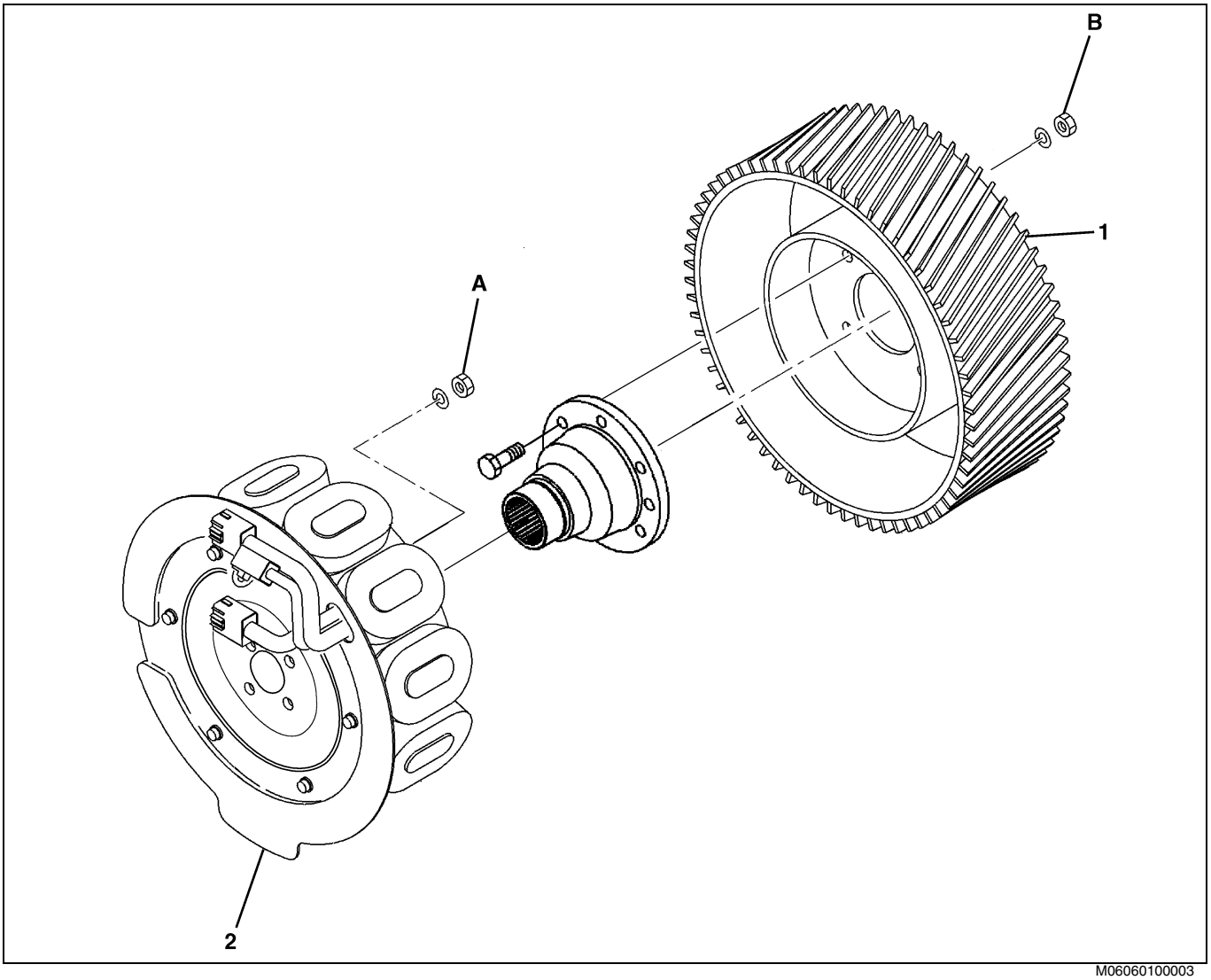

M06060100001

# COMPONENT LOCATOR

M06060101BED1001




M06060100002




M06060100003

| | | | |
|---|---|---|---|
| 1 | Retarder drum | 2 | Retarder coil assembly |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 148-196 {1,500-2,000, 112-148} for FD, GD<br>109-147 {1100-1,500, 82-111} for FG, GH | B | 61-91 {620-930, 46-68} for FD, GD<br>109-147 {1,100-1,500, 82-111} for FG, GH |

# OVERHAUL

M06060101BEH2001

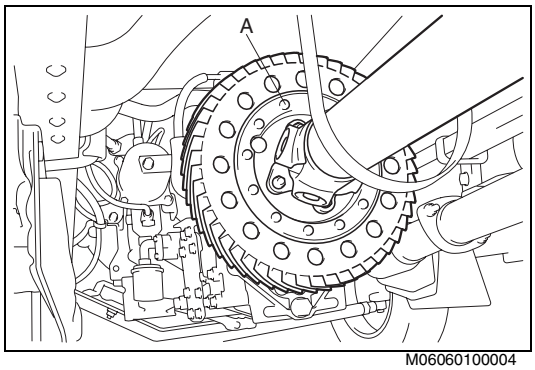
**NOTICE:**
- **The main unit is very hot immediately after operating the retarder. So, cool down enough the unit before starting the work.**
- **If the retarder main unit is foul with mud or sand, cool the unit down to about ambient temperature. And then wash the unit by washer with water or hot water.**

**1. REMOVE THE RETARDER DRUM.**

(1) Block the front wheels.

(2) Models for FD, GD

a. Remove the nut to disconnect the propeller shaft and remove the retarder drum from the transmission.



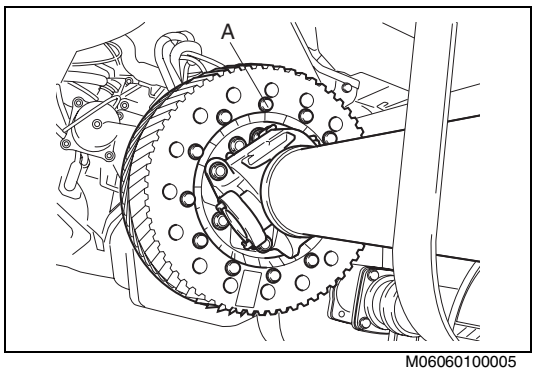
M06060100004

**NOTICE:**
- **Pay attention not to drop or hit the retarder drum.**
- **Do not loosen or remove the fixing bolts (A) of the retarder drum.**
- **Since the propeller shaft and the retarder drum are fixed together in case of FD and GD models, prevent the retarder drum from falling out when dismounting the propeller shaft.**

(3) Models for FG, GH

a. Remove the nut and disconnect the propeller shaft from the transmission.

b. Remove the retarder drum fitting nut and remove the retarder drum from the transmission.



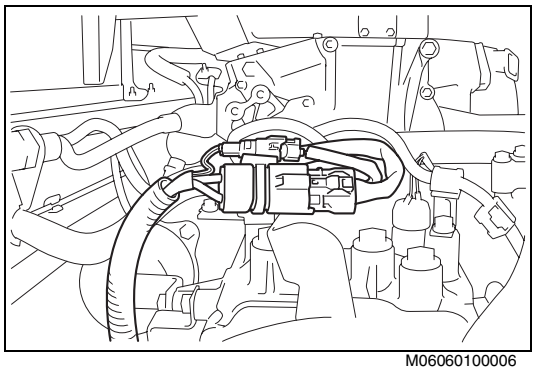
M06060100005

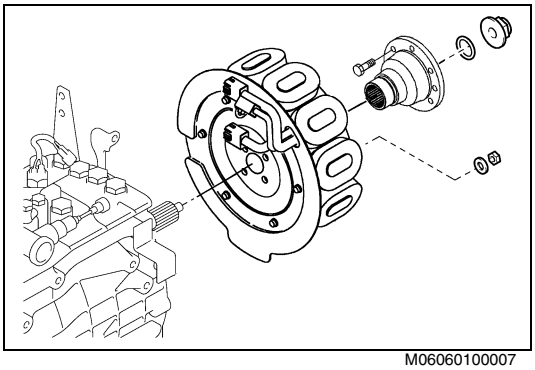
**NOTICE:**
- **Pay attention not to drop or hit the retarder drum.**
- **Do not loosen or remove the fixing bolts (A) of the retarder drum.**

**HINT:**
**Since the propeller shaft and the retarder drum are fixed separately in case of FG and GH models, the propeller shaft can be dismounted separately.**

**2. REMOVE THE RETARDER COIL ASSEMBLY.**

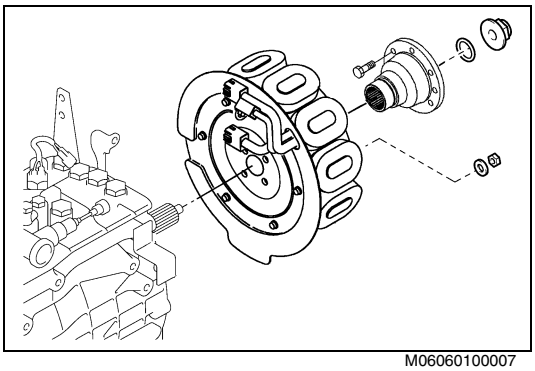
(1) Disconnect each connector for harness of retarder main unit from the holder.


M06060100006


M06060100007

(2) Remove the universal joint flange fitting nut of transmission and remove the universal joint flange from the retarder coil assembly.

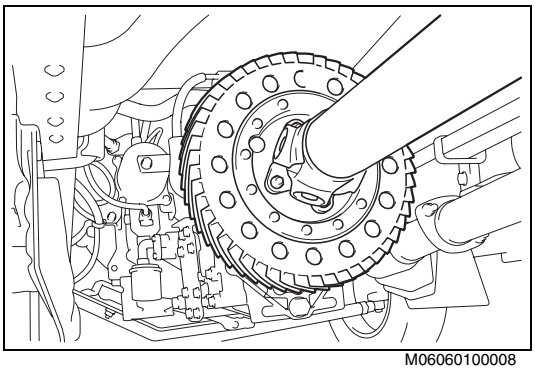
(3) Remove the retarder coil fitting nut and remove the retarder coil assembly from the transmission.


M06060100007

**3. INSTALL THE RETARDER COIL ASSEMBLY.**

(1) After tightening the retarder coil assembly temporarily with fitting nuts (4 pieces), install it to transmission with standard tightening torque.

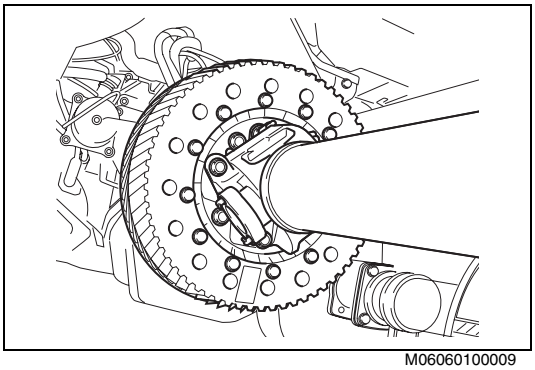
(2) Install the universal joint flange to the transmission output shaft and tighten it with O-ring and nut.


M06060100008

**4. INSTALL THE RETARDER DRUM.**

(1) Models for FD, GD

a. Install the propeller shaft to retarder drum with nuts. (4 pieces).


M06060100009

(2) Models for FG, GH

a. After tightening the retarder drum temporarily with fitting nuts (4 pieces), install it with standard torque.

b. Install the propeller shaft to retarder drum with nuts (4 pieces).

# STEERING EQUIPMENT

SR01-001

**STEERING SYSTEM..... SR01-2**
TROUBLESHOOTING ..... SR01-2

# STEERING SYSTEM

## TROUBLESHOOTING

M07010102BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Hard steering or poor return of steering wheel to center** | Bent steering shaft, sliding shaft or column | Replace parts. |
| | Universal joint oscillates or catches. | Replace universal joint in the assembly. |
| | Column bearing does not revolve or catch. | Replace parts. |
| | Lack of lubrication in steering linkage. | Lubricate. |
| | Wheel alignment is incorrect. | Refer to chapter FRONT AXLE. |
| | Power steering system is faulty. | Refer to chapter POWER STEERING. |
| | Tire air pressure is too low. | Adjust properly. |
| **Steering wheel shimmy** | Steering system linkage is loose. | Tighten properly. |
| | Too much wear or play in steering linkage (spline and ball joints). | Replace parts. |
| | Other front axle problems. | Refer to chapter FRONT AXLE. |
| | Power steering gear badly adjusted. | Refer to chapter POWER STEERING. |
| | The wheels are out of balance. | Balance the wheels. |
| | Wheel wobbles. | Replace wheel. |
| | Tire air pressure is not uniform or sufficient. | Adjust tire pressure. |
| | Distorted disc wheel. | Replace parts. |
| **Abnormal noises** | Lack of lubrication in steering linkage. | Lubricate. |
| | Power steering system is faulty. | Refer to chapter POWER STEERING. |

# STEERING UNIT (MODELS: FD, GD)

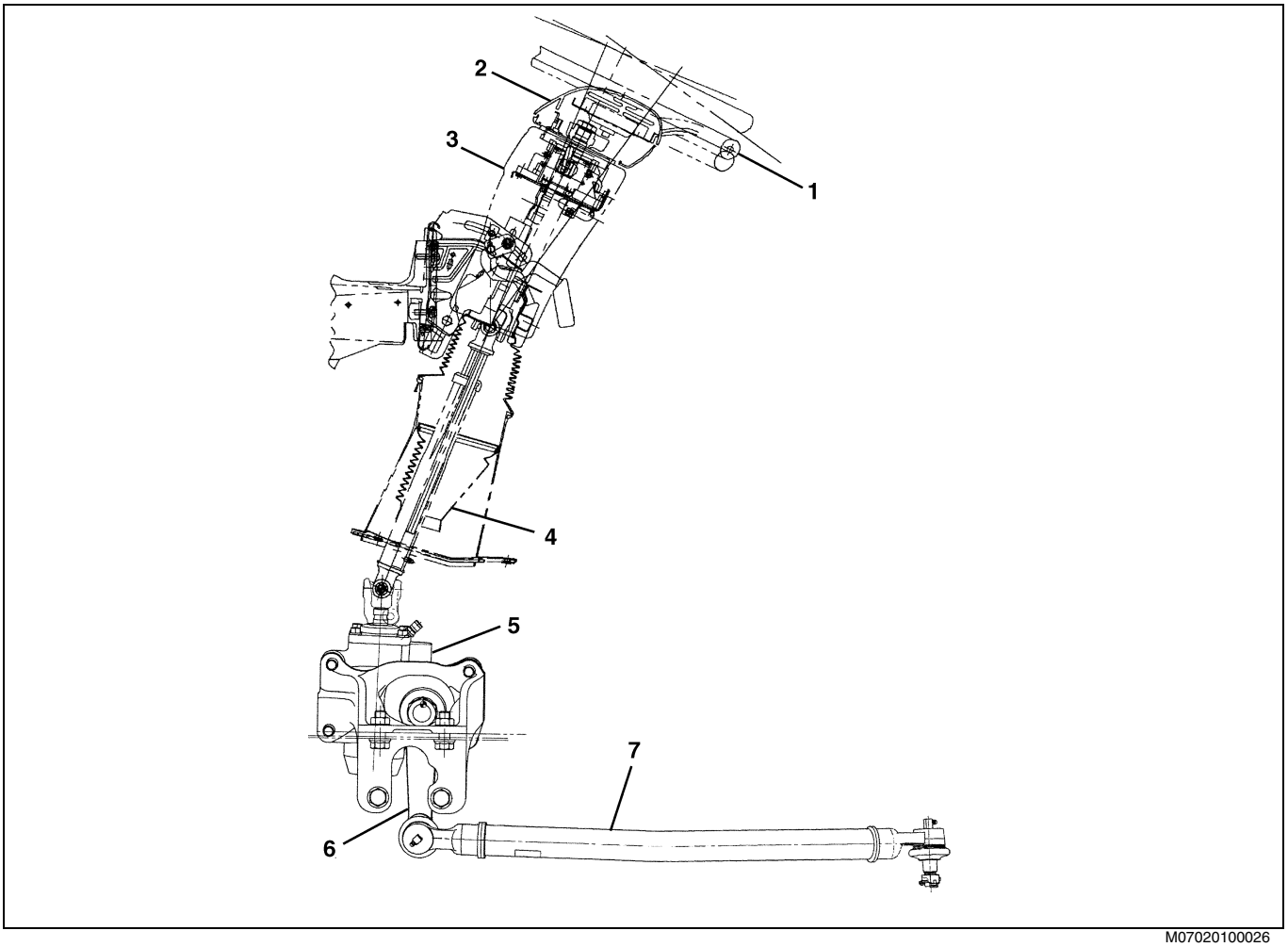
SR02-001

**STEERING LINKAGE ..... SR02-2**
DESCRIPTION ..... SR02-2
COMPONENT LOCATOR ..... SR02-3
SPECIAL TOOL ..... SR02-4
OVERHAUL ..... SR02-4
INSPECTION AND REPAIR ..... SR02-9

# STEERING LINKAGE

## DESCRIPTION

M07020101BEC1001

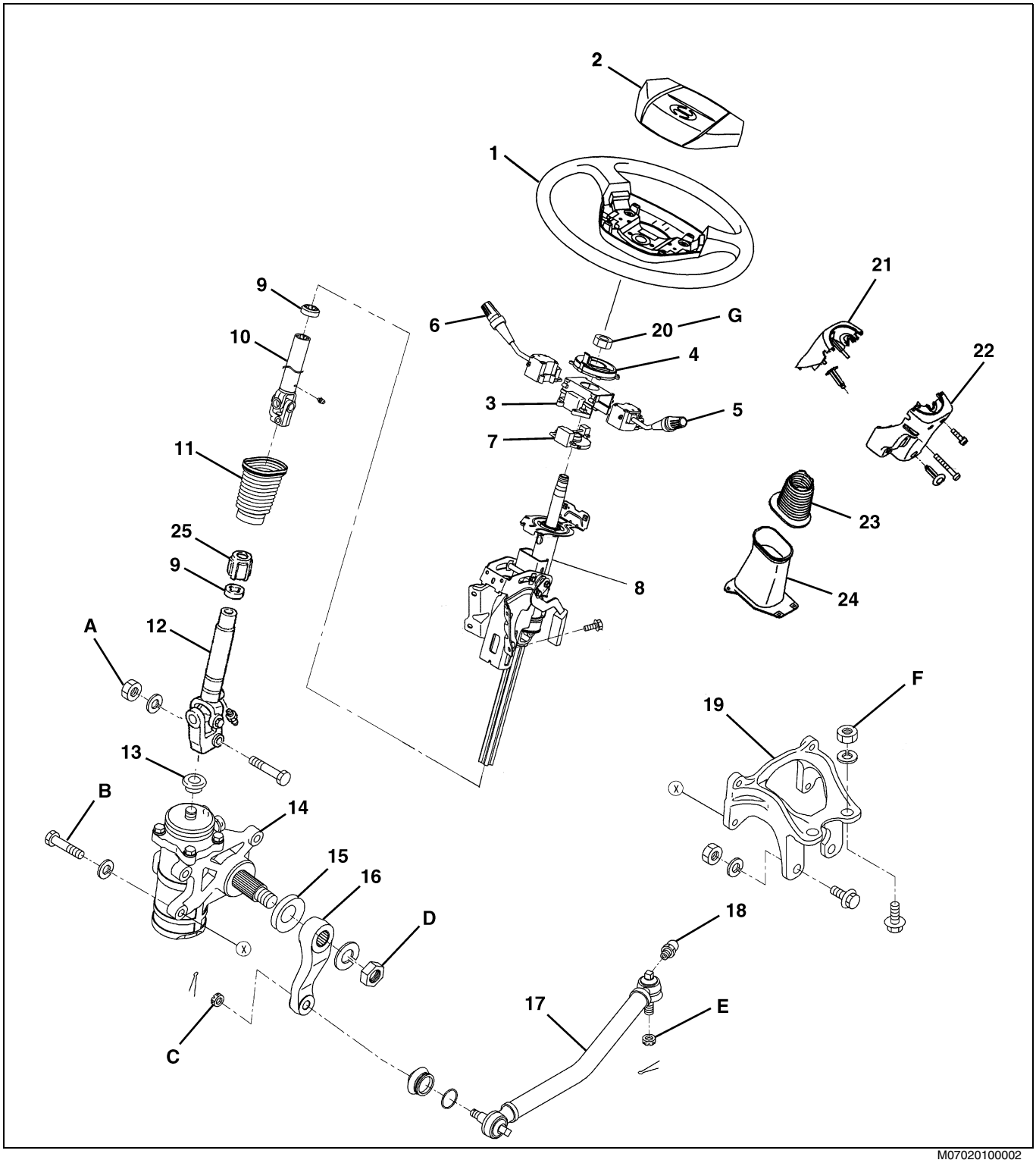



M07020100026

| | | | |
|---|---|---|---|
| 1 | Steering wheel | 5 | Steering gear unit |
| 2 | Horn button | 6 | Pitman arm |
| 3 | Steering column assembly | 7 | Drag link |
| 4 | Dust cover | | |

# COMPONENT LOCATOR

M07020101BED1002




M07020100002

| | | | | | |
|---|---|---|---|---|---|
| 1 | Steering wheel | 10 | Steering shaft universal joint assembly | 19 | Steering gear bracket |
| 2 | Horn button | 11 | Dust cover | 20 | Flange nut |
| 3 | Combination switch | 12 | Sliding yoke | 21 | Column upper cover |
| 4 | Spiral cable | 13 | Steering shaft dust cover | 22 | Column lower cover |
| 5 | Windshield wiper switch | 14 | Steering gear unit | 23 | Column lower boot |
| 6 | Light control switch | 15 | Steering gear dust seal | 24 | Column lower tube |
| 7 | Steering sensor | 16 | Pitman arm | 25 | Pivot bolt |
| 8 | Steering column assembly | 17 | Drag link | | |
| 9 | Dust seal | 18 | Lubrication fitting | | |

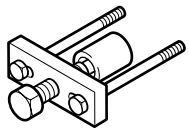
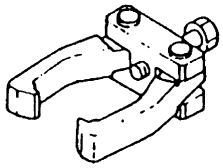
**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| **A** | **48.5-57.5 {500-600, 37-43}** | **E** | **146-244 {1,489-2,488, 108-179}** |
| **B** | **146-224 {1,489-2,284, 108-165}** | **F** | **206-284 {2,100-2,895, 152-209}** |
| **C** | **146-244 {1,489-2,488, 108-179}** | **G** | **48.5-77.5 {500-800, 37-57}** |
| **D** | **341-439 {3,478-4,476, 252-323}** | | |

# SPECIAL TOOL

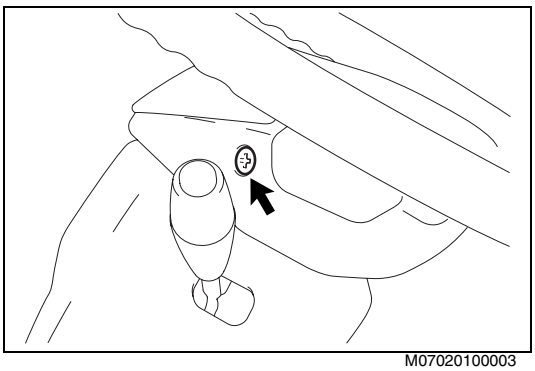
M07020101BEK1001

Prior to starting a steering linkage overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1341 | STEERING WHEEL PULLER | |
|  | 09657-2050 | GUIDE | |
|  | 09650-1260 | PITMAN ARM PULLER | |

# OVERHAUL

M07020101BEH2001



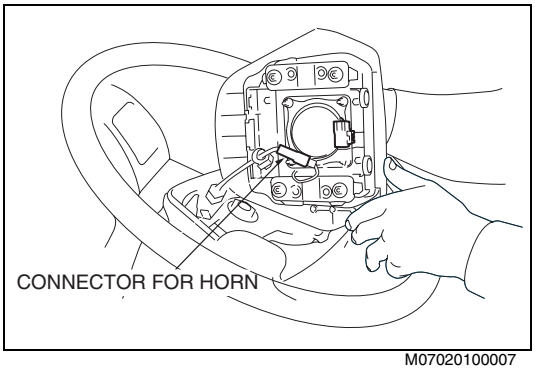
M07020100003

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE STEERING WHEEL.**

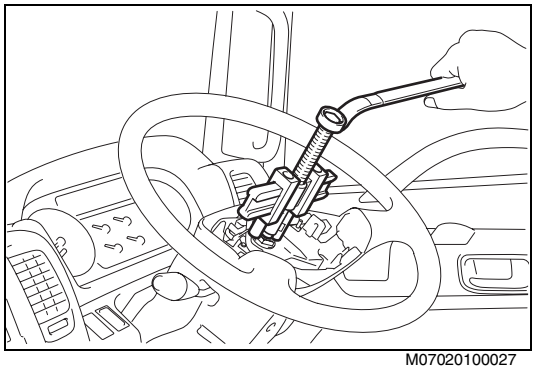
(1) Loosen the torx bolt for fixing the horn button using torx wrench.

(2) Remove the horn button from the steering wheel.




M07020100007

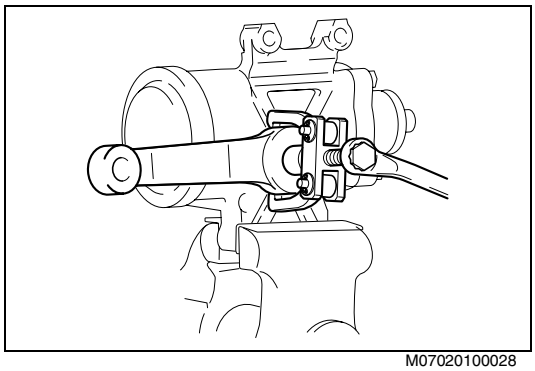
(3) Remove the connector for the horn.


M07020100027

(4) Remove the steering wheel lock nut.
(5) Use the special tool or commercial tool to remove the steering wheel as shown in the figure.
**SST: Steering Wheel Puller (09650-1341)**

**NOTICE:**
- **Before removing the steering wheel from the steering shaft, make aligning marks on both so that they can be assembled in the same position.**
- **Because the puller hole is made of aluminum and it is easily damaged, screw the puller bolt deeply.**

(6) Fix the rotating part of spiral cable with tape etc. to prevent the spiral cable from rotating.

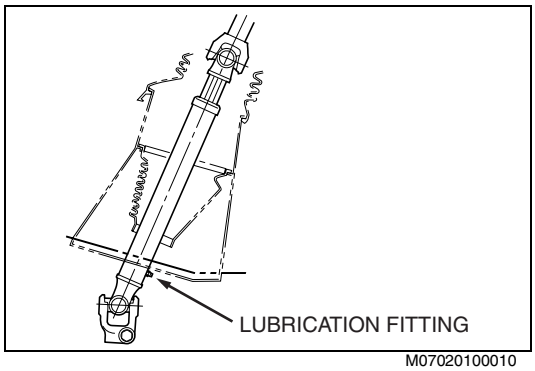

M07020100028

**2. REMOVE THE PITMAN ARM.**
(1) Remove the nut, lock washer and plain washer from the sector shaft.
(2) Using the special tool, remove the pitman arm.
**SST: Pitman Arm Puller (09650-1260)**

## IMPORTANT POINTS - ASSEMBLY

**1. ASSEMBLE THE STEERING SHAFT.**

**2. INSTALL THE DUST COVER.**
(1) The dust cover must be fitted with two bolts facing the relief mark "REAR" rearward. After tightening, make certain that the white paint mark will be faced frontward.

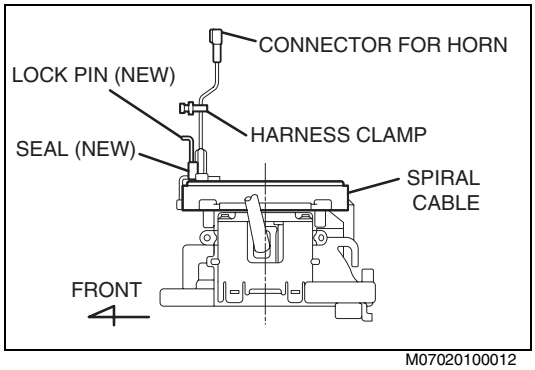


M07020100010

**3. ASSEMBLE THE STEERING SHAFT.**
(1) Before assembling, apply chassis grease to the spline of the sliding yoke, and after assembling also fill grease through lubrication fitting.

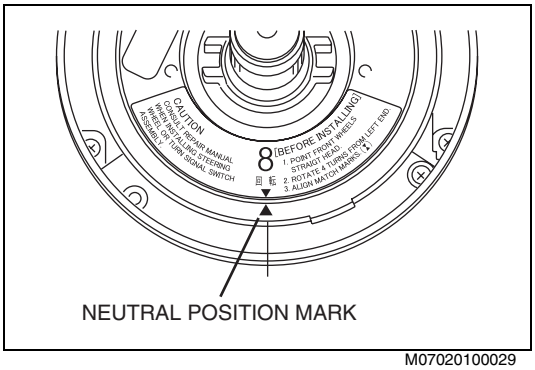
**When replacing parts: 30g (1.1 oz)**
**When replenishing parts: 15g (0.5 oz)**

**NOTICE:**
**When assembling, take care not to damage the steering shaft spline.**



M07020100012

**4. INSTALL THE STEERING WHEEL.**
(1) Set front axles toward rectilinear direction.
(2) When spiral cable is new, make sure that the lock pin is seated in the spiral cable assembly and the seal is not cut. When spiral cable is reused, make sure that the neutral position of the spiral cable does not get out of position.

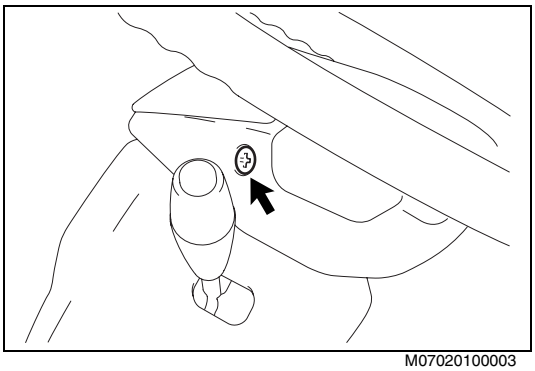



M07020100029

**NOTICE:**
**When there is no lock pin though the spiral cable is new, or when the seal is cut though there is a lock pin, or when the neutral position of the spiral cable gets out of position in reuse, turn the spiral cable counterclockwise lightly. And turn it back clockwise by 4 rotations at the point of beginning of the hard steering. Then match the neutral position marks on the upper side of the spiral cable assembly.**

(3) Pass the spiral cable through the steering wheel opening area and set the steering wheel straight to install it with nut. When the spiral cable is new, remove the lock pin. When it is reused, remove the tape etc. for fixing the rotation of the spiral cable.

(4) Tighten the set screw for fixing the horn button after pushing it in by using a torx wrench.
**Tightening Torque:**
**6.5-13.5 N·m {66-138, 4.8-9.9 kgf·cm}**



M07020100003

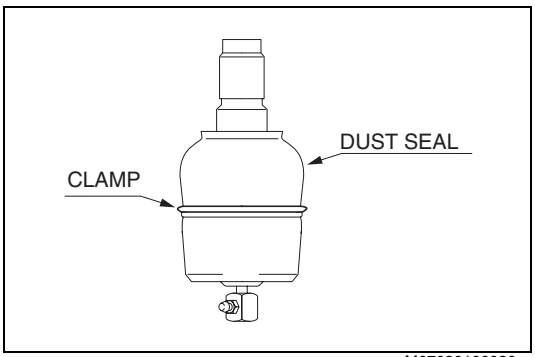
**5. IF NECESSARY, REPLACE THE DRAG LINK DUST SEAL.**

(1) Using a flat blade screwdriver etc., remove the clamp and then remove the dust seal.

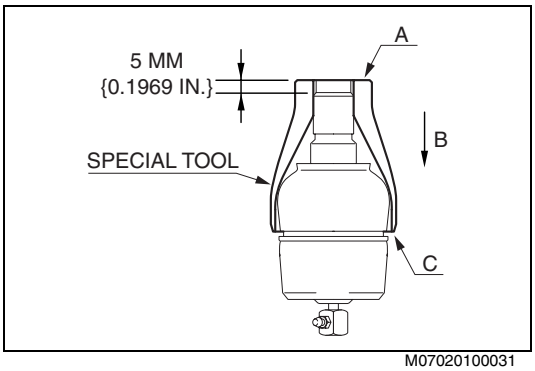
**NOTICE:**
**If dust etc. is adhered to the socket groove, remove it.**

(2) Set up the ball stud vertically to the end.

(3) Apply grease to the dust seal lip part.




M07020100030




M07020100031

(4) Put a dust seal on the end and fit it into the groove. Screw in a clamp mounting special tool so that its end plane A is located 5 mm {0.1969 in.} above the upper end of the ball stud screw. At this moment, make sure that the pointed end of the tool is positioned to the seal groove as the illustration to the left shows.
**SST: Guide (09657-2050)**

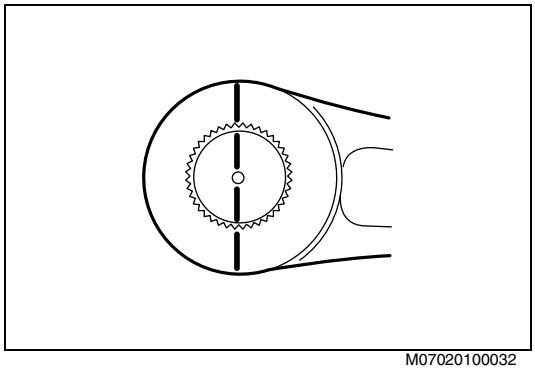
(5) Insert a clamp from A side of the tool and move it to the direction of B down to the plane C. Then drop the clamp slowly into the dust seal groove.

(6) After mounting the clamp, make sure that there is no deformation under torsion or running off the edge of the clamp. If such deformation or running out is found, touch it up by using a flat head screw driver or its equivalent.

**NOTICE:**
- **If the dust seal is damaged or the clamp is deformed, replace them with new one.**
- **Do not reuse the clamp once used.**

(7) After mounting the clamp, fill the lubrication fitting of the drag link ball joint with chassis grease.

**NOTICE:**
**Fill with grease until it flows out from the hole of dust seal.**


M07020100032

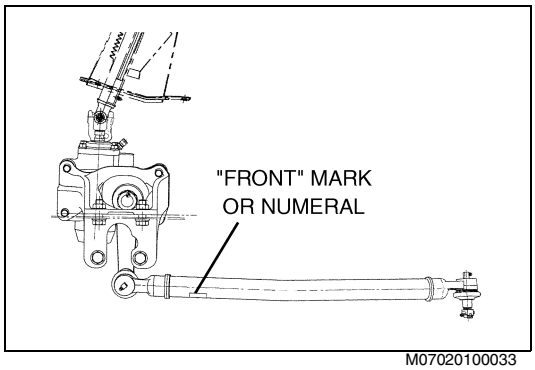
**6. INSTALL THE PITMAN ARM.**

(1) Through the pitman arm, install the plain washer and lock washer to the sector shaft.

(2) Tighten the nut to the specified torque.

**NOTICE:**

**Align the aligning marks.**



M07020100033

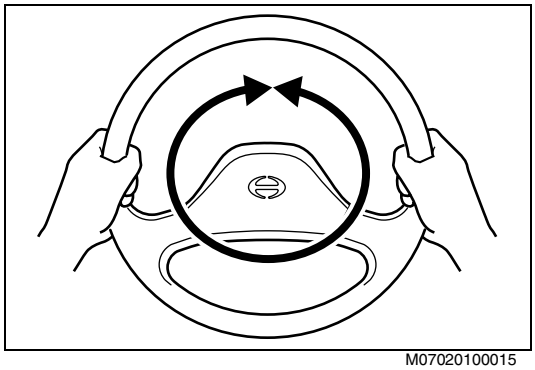
**7. INSTALL THE DRAG LINK.**

(1) Connect the drag link with the pitman arm and with the knuckle arm.

**NOTICE:**

- **At this time, make sure that the arrow "FRONT" or numeral on the drag link is positioned toward the front of vehicle.**
- **When handling the drag link, take care not to damage the dust seal.**

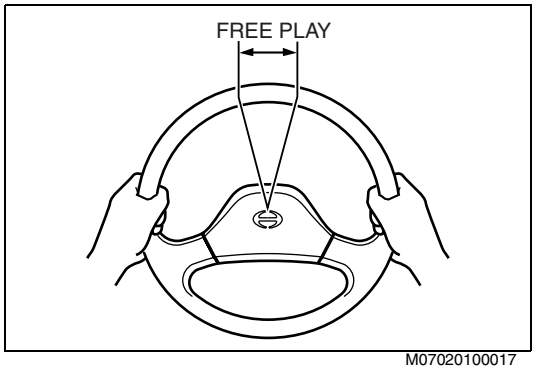
(2) Tighten the slotted nuts of the ball studs at both ends of the link to the specified torque, and then secure the nuts with the cotter pins.


M07020100015

**8. INSPECT THE STEERING SYSTEM FOR OPERATING ABILITY.**

(1) Place the front wheels on turn tables.

(2) Make sure that the steering wheel turns smoothly without any jolts or abnormal resistance when the steering wheel is turned full range.



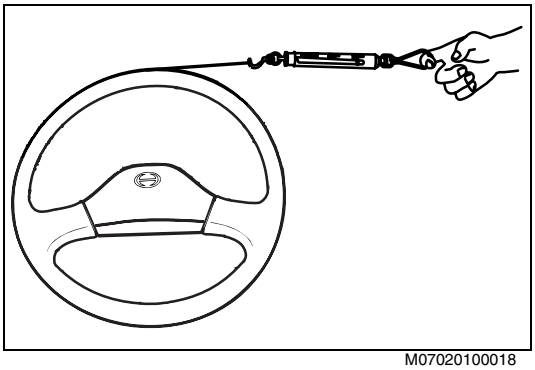
M07020100017

(3) Check the steering wheel free play while engine is idling.
**Wheel Free Play: 15-35 mm {0.591-1.377 in.}**

(4) If wheel free play exceeds 15-35 mm {0.591-1.377 in.}, turn the set screw clockwise to decrease wheel free play and counterclockwise to increase it.

**CAUTION:**

**Excessive steering wheel free play may adversely affect vehicle handling. This can result in personal injury and/or property damage.**

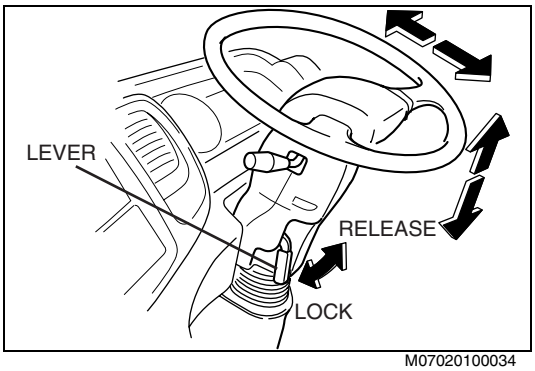


M07020100018

(5) Measure the steering wheel turning force. Use a spring balancer to measure the steering wheel turning force.

**NOTICE:**
**Measure the steering wheel turning force while the engine is idling.**

**Turning force:20 N {2.0 kgf, 4.4 lbf}**




M07020100034

(6) The steering wheel must be locked securely in any position up, down, forward and backward.

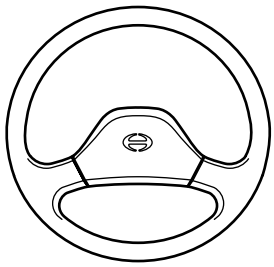
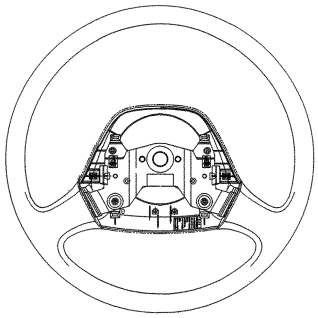
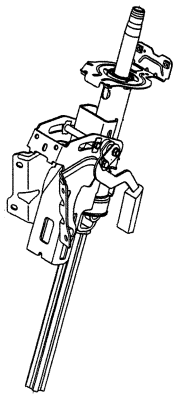
**CAUTION:**
**Before moving the vehicle, tighten the lever securely and try to move the steering wheel up and down, and forward and backward to make sure that it is locked securely. Never try to adjust the steering wheel position while the vehicle is moving. Any adjustment of the steering wheel while driving can cause the driver to lose control, and result in personal injury and/or property damage.**

(7) Check to see that the combination switch is operating properly.

# INSPECTION AND REPAIR

M07020101BEH3002

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Steering wheel: Cracks, distortion and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Steering wheel serration: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Steering column assembly: Bent, oscillation and cracks** | **—** | **—** | **Replace, if necessary** | **Visual check**  |
| **Drag link: Cracks and damage<br>Ball joint: Play<br>Dust seal: Damage** | **—** | **—** | **Replace the whole drag link assembly or replace only dust cover.** | **Visual check**  |

# STEERING UNIT (MODELS: FG, GH, FL, FM)

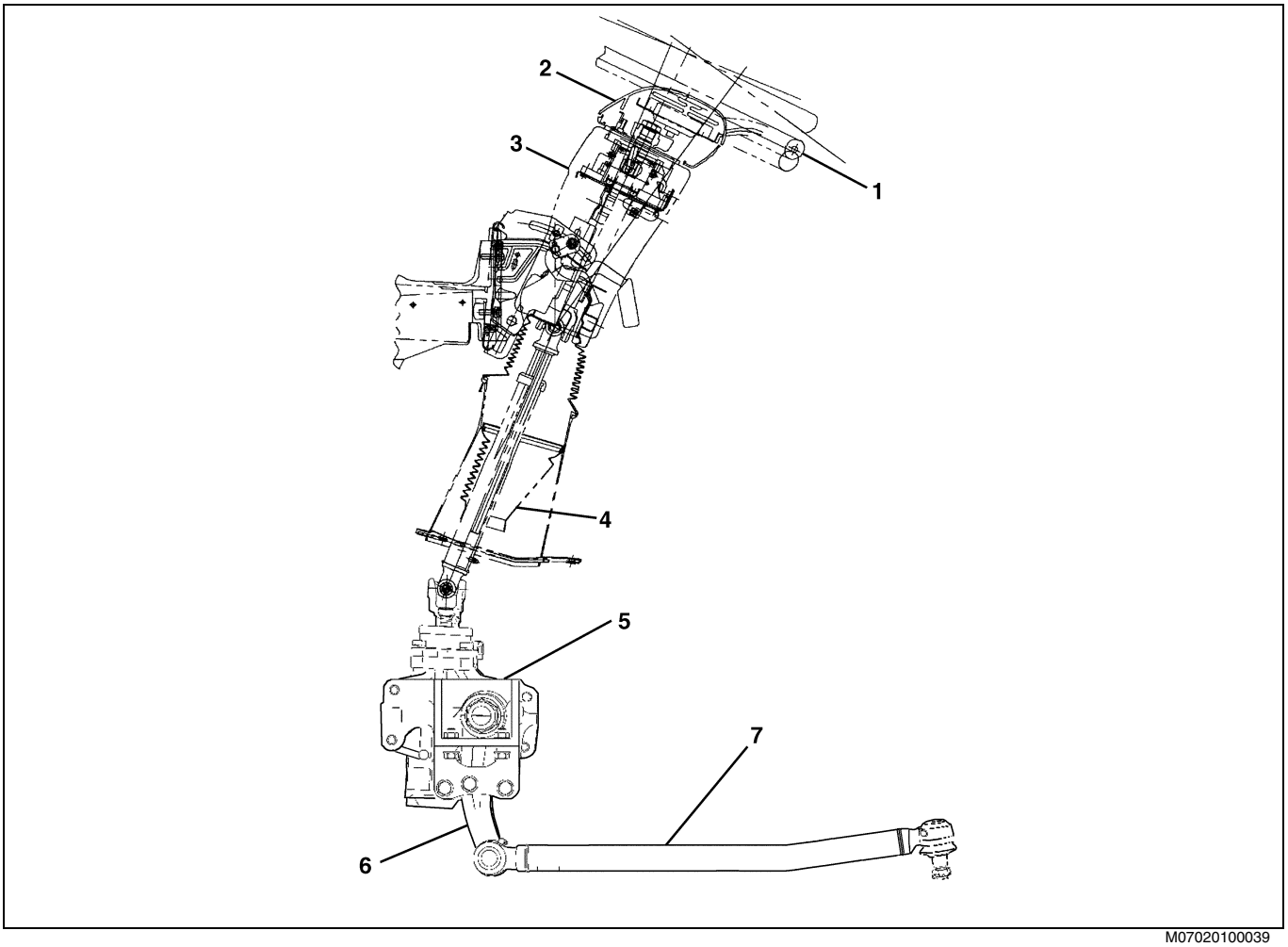
SR02-002

**STEERING LINKAGE ..... SR02-2**
DESCRIPTION ..... SR02-2
COMPONENT LOCATOR ..... SR02-3
SPECIAL TOOL ..... SR02-4
OVERHAUL ..... SR02-4
INSPECTION AND REPAIR ..... SR02-8

# STEERING LINKAGE

## DESCRIPTION

M07020101BEC1001

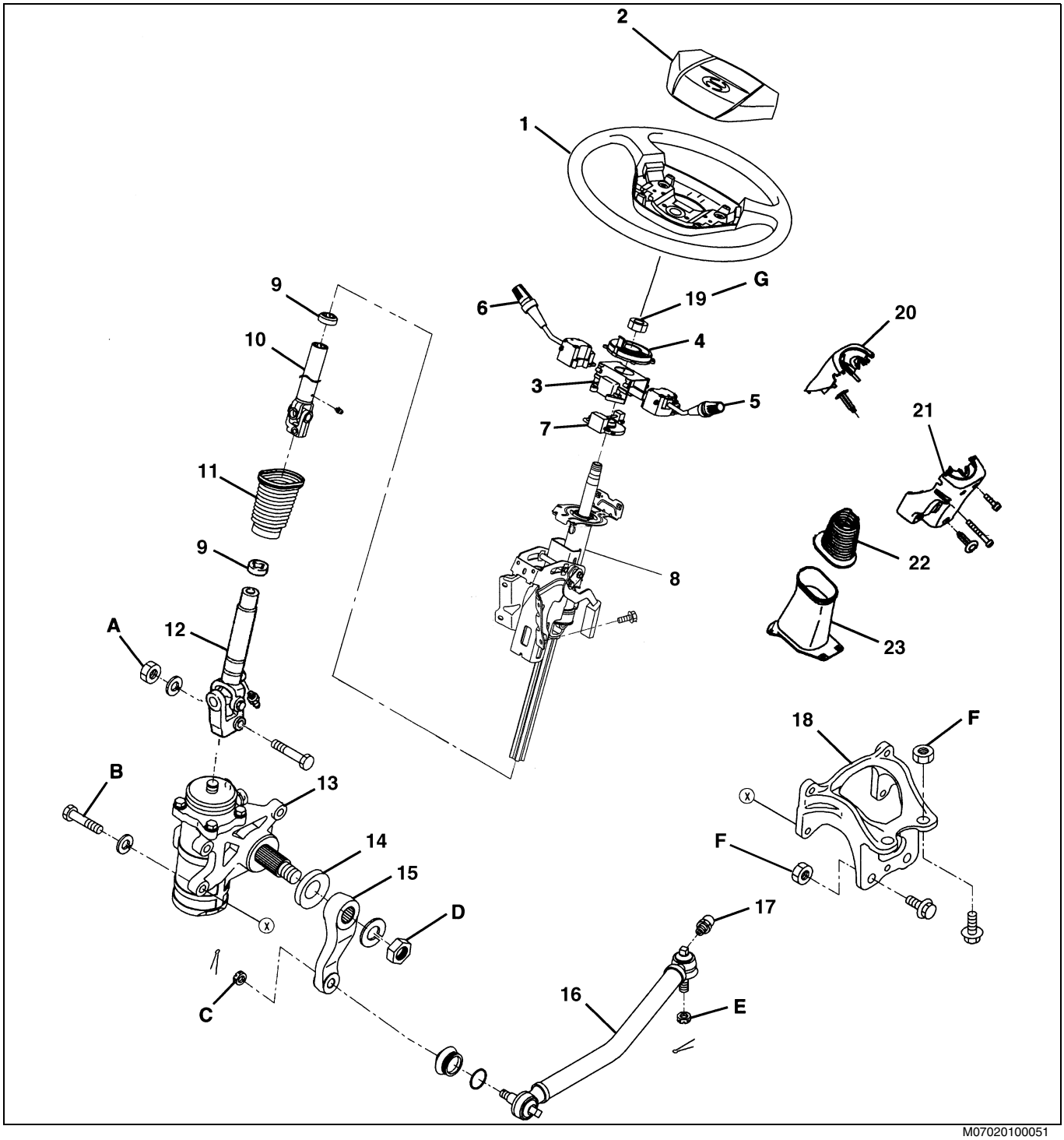



M07020100039

| | | | |
|---|---|---|---|
| 1 | Steering wheel | 5 | Steering gear unit |
| 2 | Horn button | 6 | Pitman arm |
| 3 | Steering column assembly | 7 | Drag link |
| 4 | Dust cover | | |

# COMPONENT LOCATOR

M07020101BED1001




M07020100051

| | | | | | |
|---|---|---|---|---|---|
| 1 | Steering wheel | 9 | Dust seal | 17 | Lubrication fitting |
| 2 | Horn button | 10 | Steering shaft universal joint assembly | 18 | Steering gear bracket |
| 3 | Combination switch | 11 | Dust cover | 19 | Flange nut |
| 4 | Spiral cable | 12 | Sliding yoke | 20 | Column upper cover |
| 5 | Wind shield wiper switch | 13 | Power steering gear unit | 21 | Column lower cover |
| 6 | Light control switch | 14 | Steering gear dust seal | 22 | Column lower boot |
| 7 | Steering sensor | 15 | Pitman arm | 23 | Column lower tube |
| 8 | Steering column assembly | 16 | Drag link | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

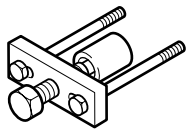
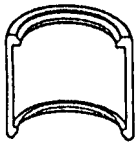
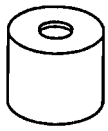
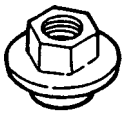
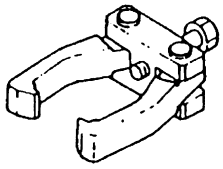
| | | | |
|---|---|---|---|
| **A** | **48.5-57.5 {500-600, 37-43}** | **E** | **146-244 {1,500-2,500, 109-180}** |
| **B** | **277-423 {2,825-4,313, 205-310}** | **F** | **206-284 {2,100-2,895, 152-209}** |
| **C** | **146-244 {1,500-2,500, 109-180}** | **G** | **48.5-77.5 {500-800, 37-57}** |
| **D** | **391-489 {3,988-4,986, 289-360}** | | |

**NOTICE: When retightening the nut F, be sure to apply engine oil to the thread and seat surface or be sure to replace the nut with new one.**

# SPECIAL TOOL

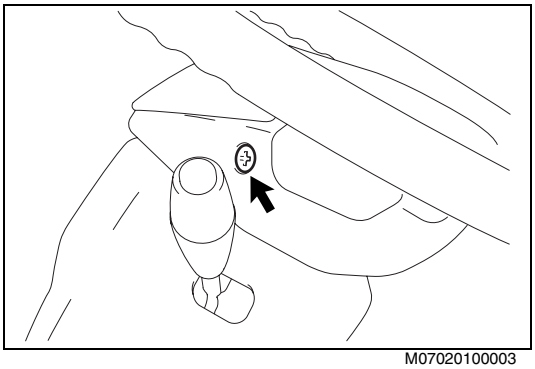
M07020101BEK1001

Prior to starting a steering linkage overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1341 | STEERING WHEEL PULLER | |
|  | 09657-1790 | GUIDE | 2 PIECES |
|  | 09657-1800 | GUIDE | |
|  | 9209-20120 | NUT | |
|  | 09650-1260 | PITMAN ARM PULLER | |

# OVERHAUL

M07020101BEH2001



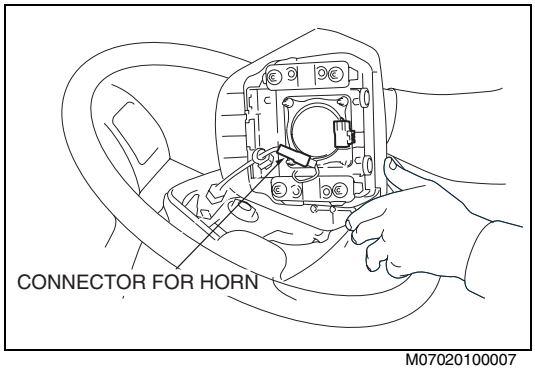
M07020100003

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE STEERING WHEEL.**

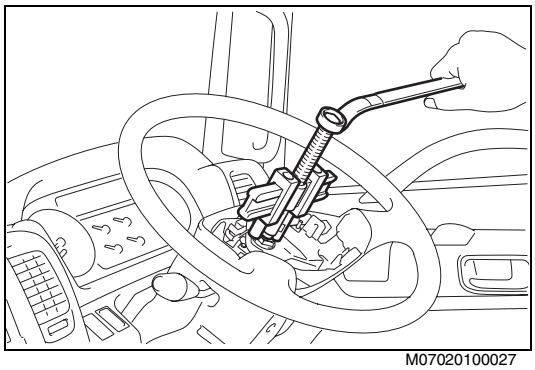
(1) Loosen the torx bolt for fixing the horn button using torx wrench.

(2) Remove the horn button from the steering wheel.



M07020100007

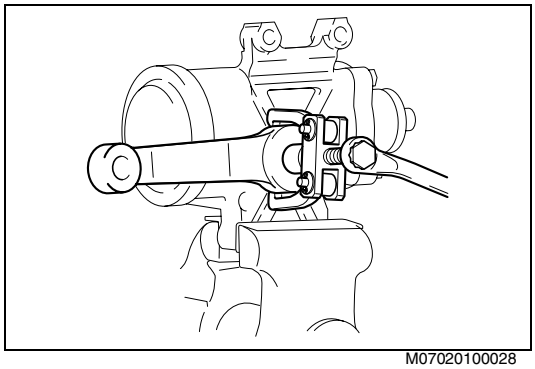
(3) Remove the connector for the horn.


M07020100027

(4) Remove the steering wheel lock nut.
(5) Use the special tool or commercial tool to remove the steering wheel as shown in the figure.
**SST: Steering Wheel Puller (09650-1341)**

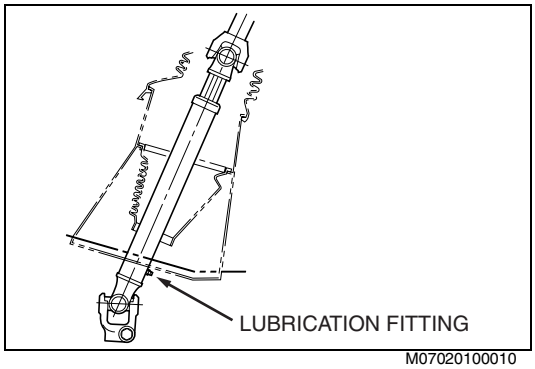
**NOTICE:**
- **Before removing the steering wheel from the steering shaft, make aligning marks on both so that they can be assembled in the same position.**
- **Because the puller hole is made of aluminum and it is easily damaged, screw the puller bolt deeply.**

(6) Fix the rotating part of spiral cable with tape etc. to prevent the spiral cable from rotating.


M07020100028

**2. REMOVE THE PITMAN ARM.**
(1) Remove the nut, lock washer and plain washer from the sector shaft.
(2) Using the special tool, remove the pitman arm.
**SST: Pitman Arm Puller (09650-1260)**

**NOTICE:**
**Do not use wedges or hit with a hammer.**



M07020100010

## IMPORTANT POINTS - ASSEMBLY

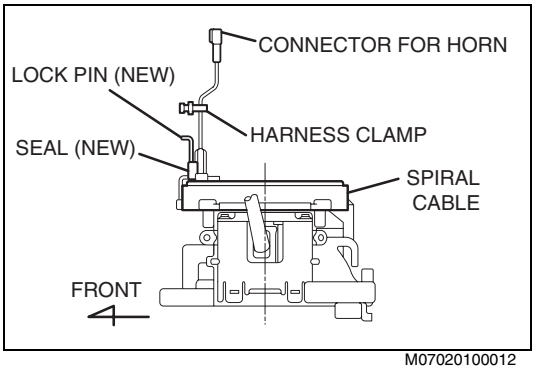
**1. ASSEMBLE THE STEERING SHAFT.**

**2. INSTALL THE DUST COVER.**
(1) The dust cover must be fitted with two bolts facing the relief mark "REAR" rearward. After tightening, make certain that the white paint mark will be faced frontward.

**3. ASSEMBLE THE STEERING SHAFT.**
(1) Before assembling, apply chassis grease to the spline of the sliding yoke, and after assembling also fill grease through lubrication fitting.

**When replacing parts: 30g (1.1 oz)**
**When replenishing parts: 15g (0.5 oz)**

**NOTICE:**
**When assembling, take care not to damage the steering shaft spline.**

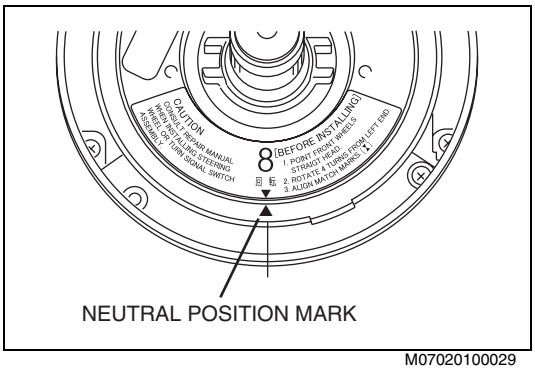


M07020100012

**4. INSTALL THE STEERING WHEEL.**

(1) Set front axles toward rectilinear direction.

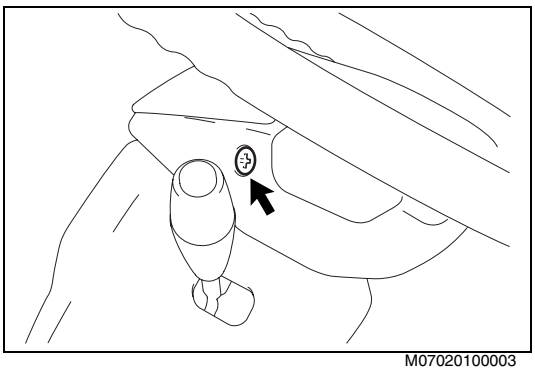
(2) When spiral cable is new, make sure that the lock pin is seated in the spiral cable assembly and the seal is not cut. When spiral cable is reused, make sure that the neutral position of the spiral cable does not get out of position.



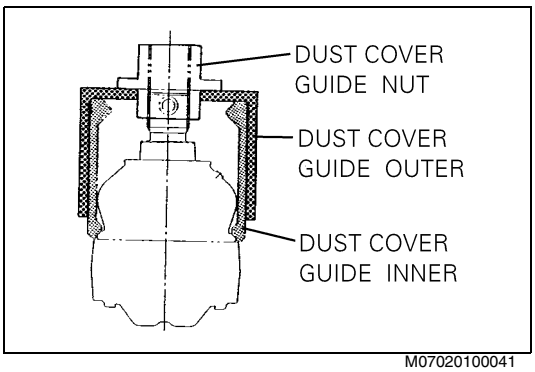
M07020100029

**NOTICE:**
**When there is no lock pin though the spiral cable is new, or when the seal is cut though there is a lock pin, or when the neutral position of the spiral cable gets out of position in reuse, turn the spiral cable counterclockwise lightly. And turn it back clockwise by 4 rotations at the point of beginning of the hard steering. Then match the neutral position marks on the upper side of the spiral cable assembly.**

(3) Pass the spiral cable through the steering wheel opening area and set the steering wheel straight to install it with nut. When the spiral cable is new, remove the lock pin. When it is reused, remove the tape etc. for fixing the rotation of the spiral cable.


M07020100003

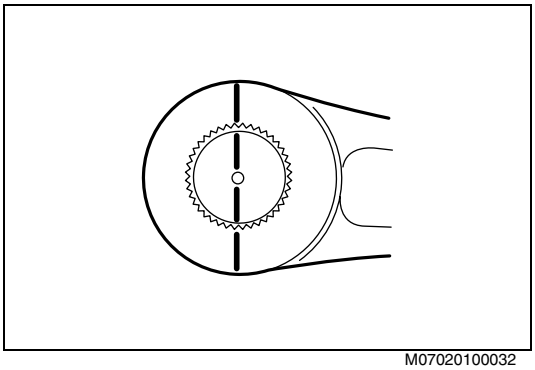
(4) Tighten the set screw for fixing the horn button after pushing it in by using a torx wrench.
**Tightening Torque:**
**6.5-13.5 N·m {66-138, 4.8-9.9 kgf·cm}**



M07020100041

**5. IF NECESSARY, REPLACE THE DUST SEAL OF DRAG LINK AND RELAY ROD.**

(1) Observe the following procedure when changing the dust seal.
a. Pry off the dust seal with a screw driver.
b. Put 6.5 g {0.23 oz} of lithium molybdenum grease in the seal.
c. Use the special tools to install the dust seal onto the socket without damaging it.
**SST:**
**Dust Cover Guide Inner (09657-1790)**
**Dust Cover Guide Outer (09657-1800)**
**Dust Cover Guide Nut (920920-120)**

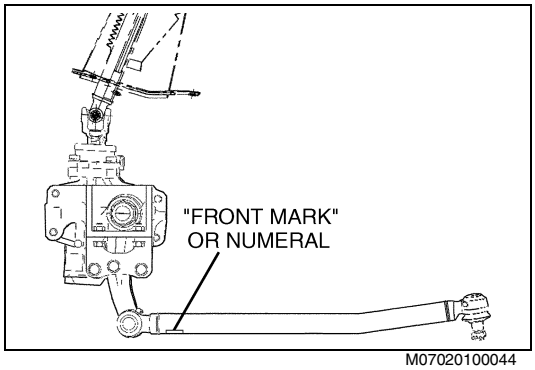

M07020100032

**6. INSTALL THE PITMAN ARM.**

(1) Through the pitman arm, install the plain washer and lock washer to the sector shaft.

(2) Tighten the nut to the specified torque.

**NOTICE:**
**Align the aligning marks.**



M07020100044

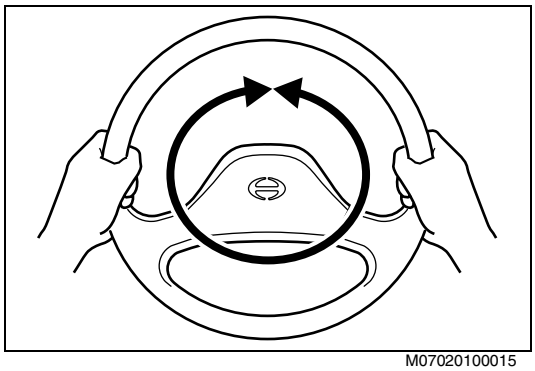
**7. INSTALL THE DRAG LINK.**

(1) Connect the drag link with the pitman arm and with the knuckle arm.

**NOTICE:**

- **At this time, make sure that the arrow "FRONT" or numeral on the drag link is positioned toward the front of vehicle.**
- **When handling the drag link, take care not to damage the dust seal.**

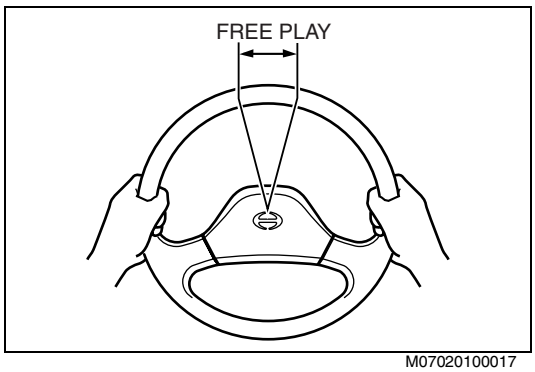
(2) Tighten the slotted nuts of the ball studs at both ends of the link to the specified torque, and then secure the nuts with the cotter pins.


M07020100015

**8. INSPECT THE STEERING SYSTEM FOR OPERATING ABILITY.**

(1) Place the front wheels on turn tables.

(2) Make sure that the steering wheel turns smoothly without any jolts or abnormal resistance when the steering wheel is turned full range.

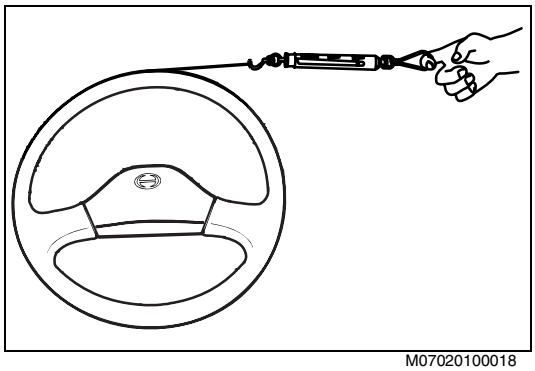


M07020100017

(3) Check the steering wheel free play while engine is idling.
**Wheel Free Play: 15-35 mm {0.591-1.377 in.}**

(4) If wheel free play exceeds 15-35 mm {0.591-1.377 in.}, turn the set screw clockwise to decrease wheel free play and counterclockwise to increase it.

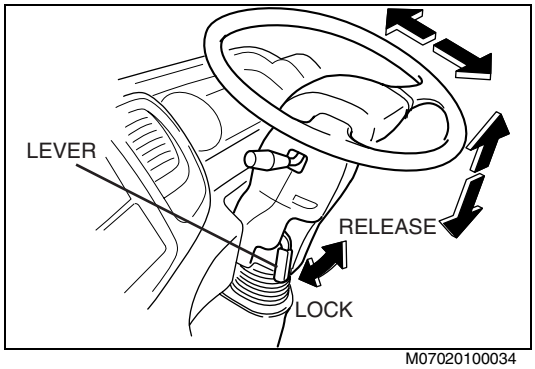
**CAUTION:**
**Excessive steering wheel free play may adversely affect vehicle handling. This can result in personal injury and/or property damage.**


M07020100018

(5) Measure the steering wheel turning force. Use a spring balancer to measure the steering wheel turning force.

**NOTICE:**
**Measure the steering wheel turning force while the engine is idling.**

**Turning force:20 N {2.0 kgf, 4.4 lbf}**



M07020100034

(6) The steering wheel must be locked securely in any position up, down, forward and backward.

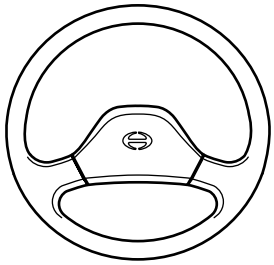
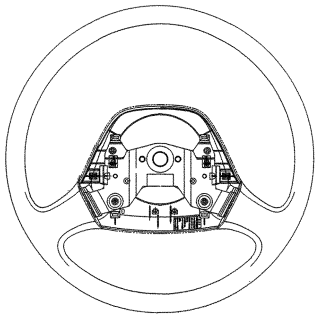
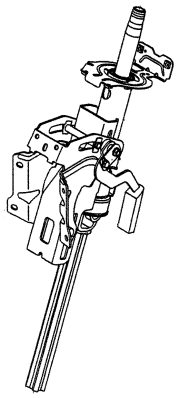
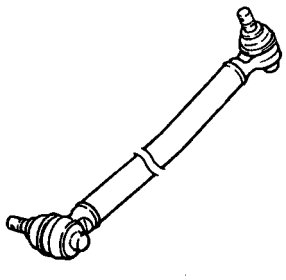
**CAUTION:**
**Before moving the vehicle, tighten the lever securely and try to move the steering wheel up and down, and forward and backward to make sure that it is locked securely. Never try to adjust the steering wheel position while the vehicle is moving. Any adjustment of the steering wheel while driving can cause the driver to lose control, and result in personal injury and/or property damage.**

(7) Check to see that the combination switch is operating properly.

# INSPECTION AND REPAIR

M07020101BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Steering wheel: Cracks, distortion and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Steering wheel serration: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Steering column assembly: Bent, oscillation and cracks** | **—** | **—** | **Replace, if necessary** | **Visual check**  |
| **Drag link: Cracks and damage<br>Ball joint: Play<br>Dust seal: Damage** | **—** | **—** | **Replace the whole drag link assembly or replace only dust cover.** |  |

# POWER STEERING

SR03-001

**POWER STEERING SYSTEM ..... SR03-2**
TROUBLESHOOTING ..... SR03-2
AIR BLEEDING ..... SR03-3
HYDRAULIC TEST ..... SR03-4

**POWER STEERING GEAR UNIT ..... SR03-7**
DATA AND SPECIFICATIONS ..... SR03-7
DESCRIPTION ..... SR03-7
OPERATION ..... SR03-8
SPECIAL TOOL ..... SR03-9
COMPONENT LOCATOR ..... SR03-11
OVERHAUL ..... SR03-12
INSPECTION AND REPAIR ..... SR03-24

**POWER STEERING PUMP (J08C ENGINE) ..... SR03-26**
DATA AND SPECIFICATIONS ..... SR03-26
DESCRIPTION ..... SR03-26
OPERATION ..... SR03-27
COMPONENT LOCATOR ..... SR03-28
OVERHAUL ..... SR03-29
INSPECTION AND REPAIR ..... SR03-32

**OIL RESERVOIR ..... SR03-33**
DESCRIPTION ..... SR03-33
COMPONENT LOCATOR ..... SR03-34
OVERHAUL ..... SR03-34
INSPECTION AND REPAIR ..... SR03-35

# POWER STEERING SYSTEM

## TROUBLESHOOTING

M07030101BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Fluid leakage** | Pump | Replace pump. |
| **Fluid leakage (Gear box)** | Oil seal, O-rings other than those for the seal lock nut and drain plug | Repair oil seal or O-ring. |
| | Seal lock nut, drain plug | Replace lock nut or plug. |
| **Fluid leakage** | Line joints | Replace leaky parts. |
| **Hard steering (Excessive steering effort) (One side is hard)** | Steering gear is faulty | Hydraulic test. Replace piston sub-assembly. |
| **Hard steering (Excessive steering effort) (Both sides are hard)** | Steering gear pump faulty | • Hydraulic test.<br>• Measure pump discharge pressure. Replace pump.<br>• Measure system hydraulic pressure. Replace piston sub-assembly. |
| | Incorrect preload of the sector shaft bearing | Adjust sector shaft preload. |
| **Hard steering (Excessive steering effort) (Hard, when starting to steer)** | Incorrect preload of the sector shaft bearing | Adjust sector shaft preload. |

**NOTICE:**
**Basic inspection items**

- **Fluid level, Fluid cleanliness**
- **Air in fluid**
- **Tire pressure**
- **Front alignment**
- **Steering linkage**
- **Universal joint**

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Pump)**<br>**NOTICE:**<br>**Basic inspection items**<br>• **Fluid level, fluid cleanliness**<br>• **Air mixed in fluid**<br>• **Pump piping**<br>• **Steering linkage** | Air sucked in at input pipe | Repair and bleed air or replace pump. |
| **Abnormal noise** | Gear box | Replace piston sub-assembly. |

**NOTICE:**
**Basic inspection items**

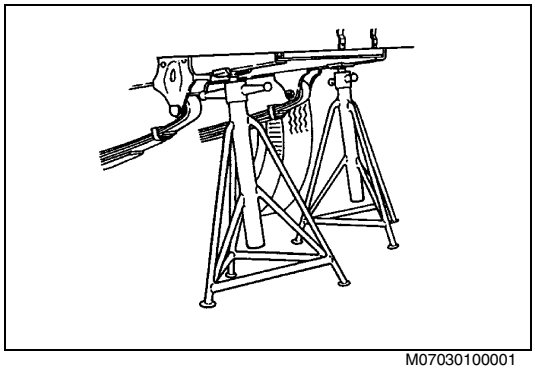
- **Fluid level, fluid cleanliness**
- **Air mixed in fluid**
- **Pump piping**
- **Steering linkage**

# AIR BLEEDING

M07030101BEH2003

**1. FILL THE OIL RESERVOIR WITH POWER STEERING FLUID.**

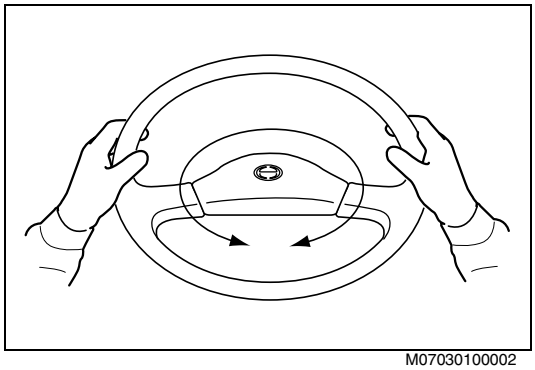
**NOTICE:**
- **Use only specified fluid.**
- **Do not overfill the oil reservoir.**
- **Replace old fluid with new fluid after overhauling power steering gear unit or power steering pump.**
- **Specified fluid....Refer to owner's manual.**



M07030100001

**2. JACK UP THE FRONT AXLE AND SUPPORT THE FRAME WITH STANDS.**

**NOTICE:**
**Block the rear wheels.**

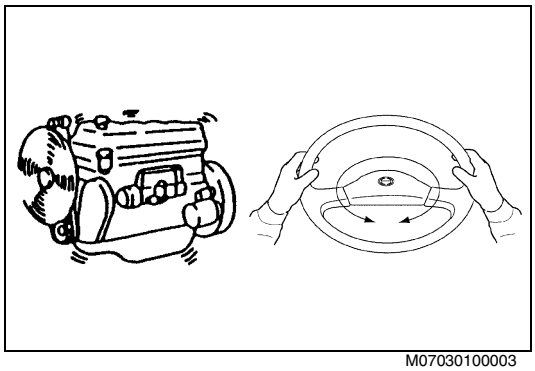


M07030100002

**3. TURN THE STEERING WHEEL FULLY IN BOTH DIRECTIONS SEVERAL TIMES.**

**4. CHECK THE FLUID LEVEL IN THE OIL RESERVOIR.**

(1) Add the fluid, if necessary.

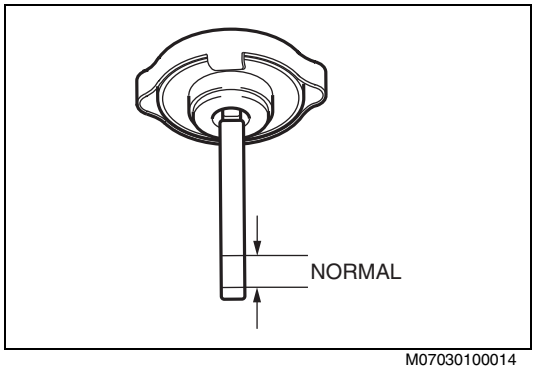


M07030100003

**5. START THE ENGINE AND TURN THE STEERING WHEEL FULLY IN BOTH DIRECTIONS SEVERAL TIMES WITH ENGINE IDLING.**

**NOTICE:**
**The fluid in the oil reservoir should be continuously replenished while air bleeding so that the oil reservoir never become empty.**

**6. RETURN THE STEERING WHEEL TO STRAIGHT AHEAD.**



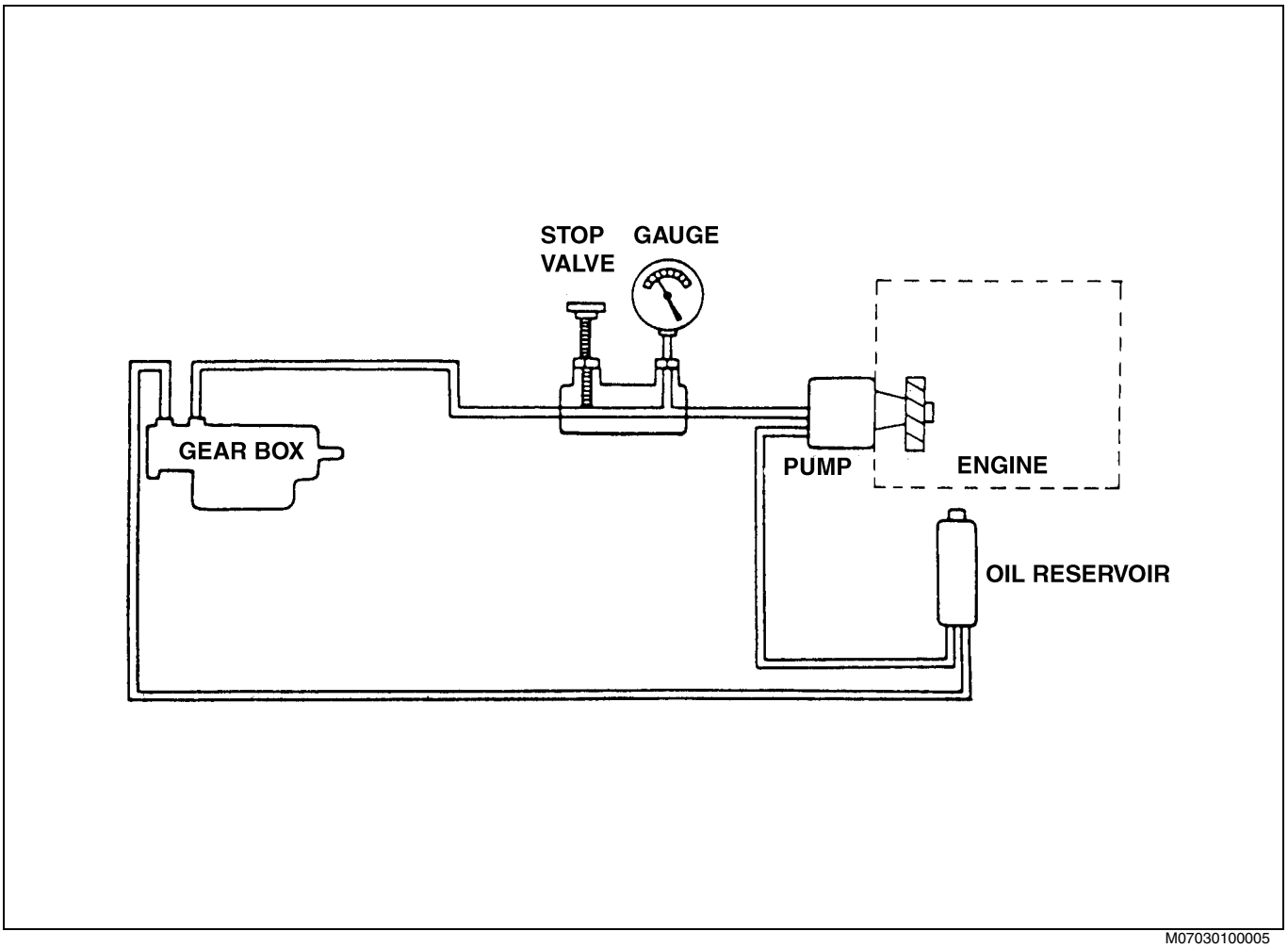

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**7. RECHECK THE FLUID LEVEL WHEN THE ENGINE IS STOPPED.**

(1) If necessary, increase or decrease the power steering fluid to match the between the upper and the lower line.

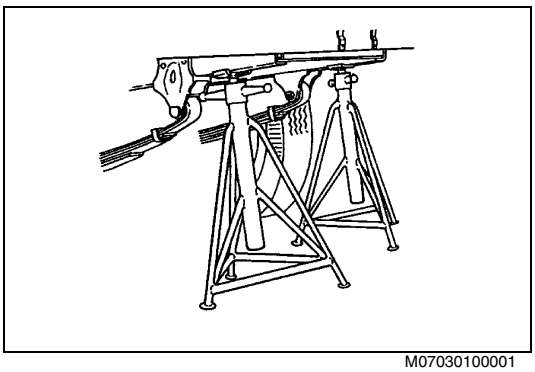
# HYDRAULIC TEST

M07030101BEH3003




M07030100005

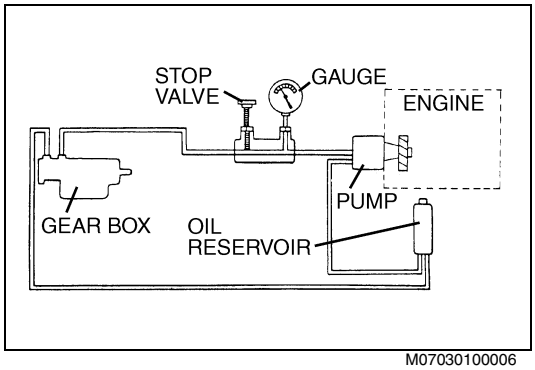
## HYDRAULIC TEST



M07030100001

**1. JACK UP THE FRONT AXLE AND SUPPORT THE FRAME WITH STANDS.**

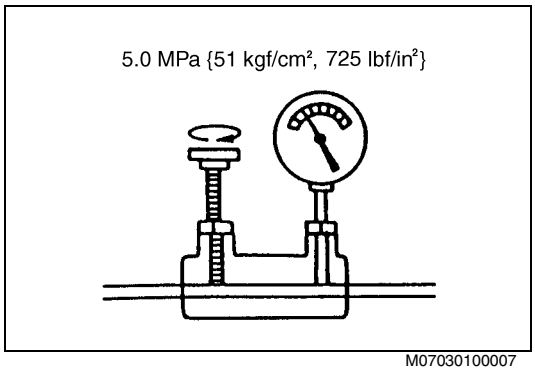
**NOTICE:**
**Block the rear wheels.**



M07030100006

**2. SET THE STOP VALVE AND OIL PRESSURE GAUGE AS SHOWN IN THE FIGURE.**

**NOTICE:**
**After setting the stop valve and oil pressure gauge, perform the air bleeding in the system according to "AIR BLEEDING".**



M07030100007

**3. CHECK THE FLOW CONTROL VALVE OPERATION.**

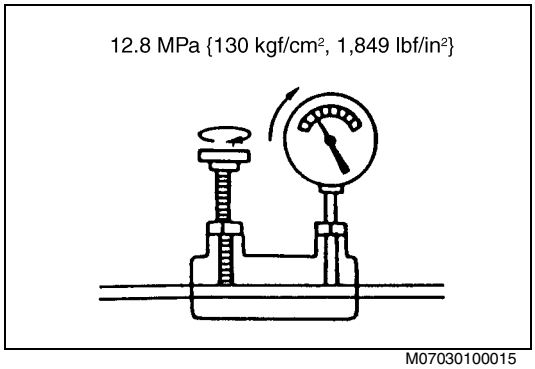
(1) Start the engine and idle then close the stop valve until the fluid pressure is at 5.0 MPa {51 kgf/cm$^2$,725 lbf/in$^2$}.

(2) Run the engine up to 1,500 r/min, then reduce the engine speed suddenly.

**NOTICE:**
**This operation should be repeated more than 5 times.**

(3) Good, if the set pressure of 5.0 MPa {51 kgf/cm$^2$,725 lbf/in$^2$} is recovered immediately.
If the set pressure is not recovered immediately, stop the engine and replace the flow control valve assembly.

(4) Open the stop valve fully.



M07030100015

**4. CHECK THE RELIEF VALVE OPERATION.**

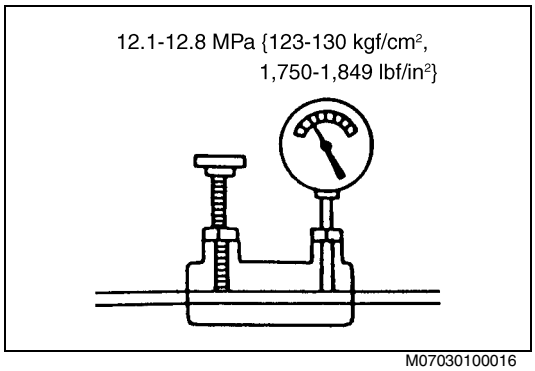
(1) Run the engine up to 2,000 r/min.

(2) Close the stop valve until the fluid pressure is at 12.8 MPa {130 kgf/cm$^2$, 1,849 lbf/in$^2$}.

**NOTICE:**
**Be careful not to exceed 12.8 Mpa {130 kgf/cm$^2$, 1,849 lbf/in$^2$}.**

(3) Good, if the fluid pressure is maintained at 12.1-12.8 MPa {123-130 kgf/cm$^2$, 1,750-1,849 lbf/in$^2$ }

(4) If pressure is higher, stop the engine and replace the flow control valve assembly.



M07030100016

**5. MEASURE THE SYSTEM HYDRAULIC PRESSURE.**

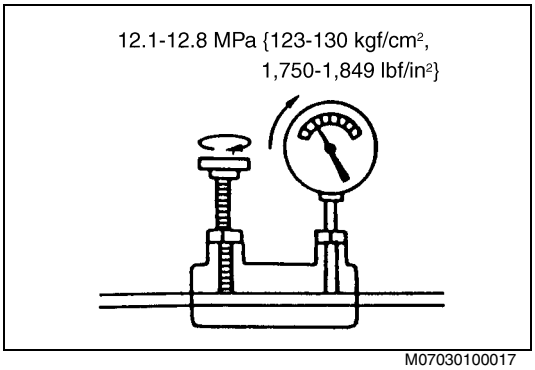
(1) Make sure that the stop valve is fully open.

(2) Start the engine and idle and then turn the steering wheel to a full stop.

(3) Apply a force of approx. 147.1 N {15 kgf, 33 lbf} to the steering wheel and measure the hydraulic pressure.

(4) Repeat the measurement by fully turning the steering wheel in the opposite direction.
**Hydraulic pressure:**
**12.1-12.8 MPa {123-130 kgf/cm$^2$, 1,750-1,849 lbf/in$^2$}**

(5) If the above pressure is not attained, measure the discharge pressure or stop the engine and repair the power steering gear unit.



M07030100017

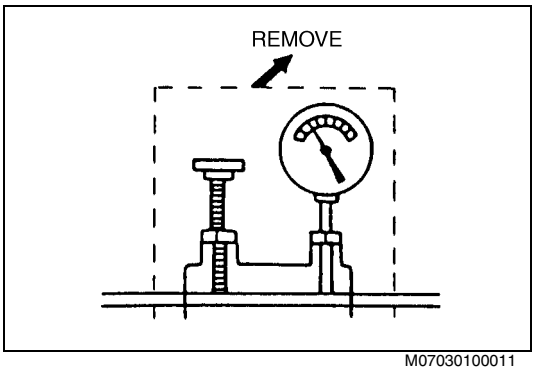
**6. MEASURE THE DISCHARGE PRESSURE.**

(1) Make sure that the stop valve is fully open.

(2) Start the engine and idle and measure the discharge pressure with the stop valve fully close.
**Discharge Pressure:**
**12.1-12.8 MPa {123-130 kgf/cm$^2$, 1,750-1,849 lbf/in$^2$}**

**NOTICE:**
**Do not allow the stop valve to remain closed for more than 15 seconds.**

(3) Open the stop valve fully.



M07030100011

**7. REMOVE THE STOP VALVE AND OIL PRESSURE GAUGE.**

(1) Stop the engine and remove the stop valve and oil pressure gauge.

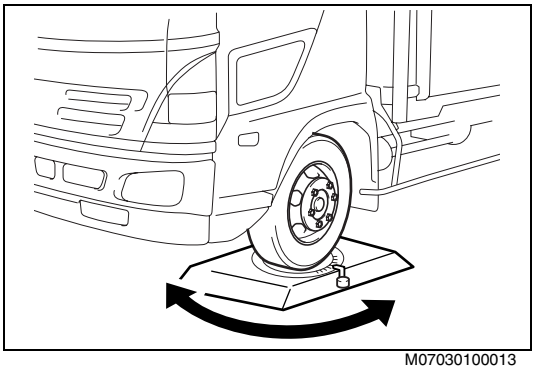
**NOTICE:**
**After removing stop valve and oil pressure gauge, perform the air bleeding in according to "AIR BLEEDING".**

**8. INSPECT THE STEERING SYSTEM FOR OPERATION ABILITY.**

(1) Place the front wheels on turn tables then start the engine and idle.

(2) Check to see that the steering wheel turned smoothly without any jolts or abnormal resistance, when it is turned fully in both directions.

(3) Measure the steering wheel turning force.
**Turning force: Less than 20 N {2 kgf, 4.41 lbf}**


M07030100013

# POWER STEERING GEAR UNIT

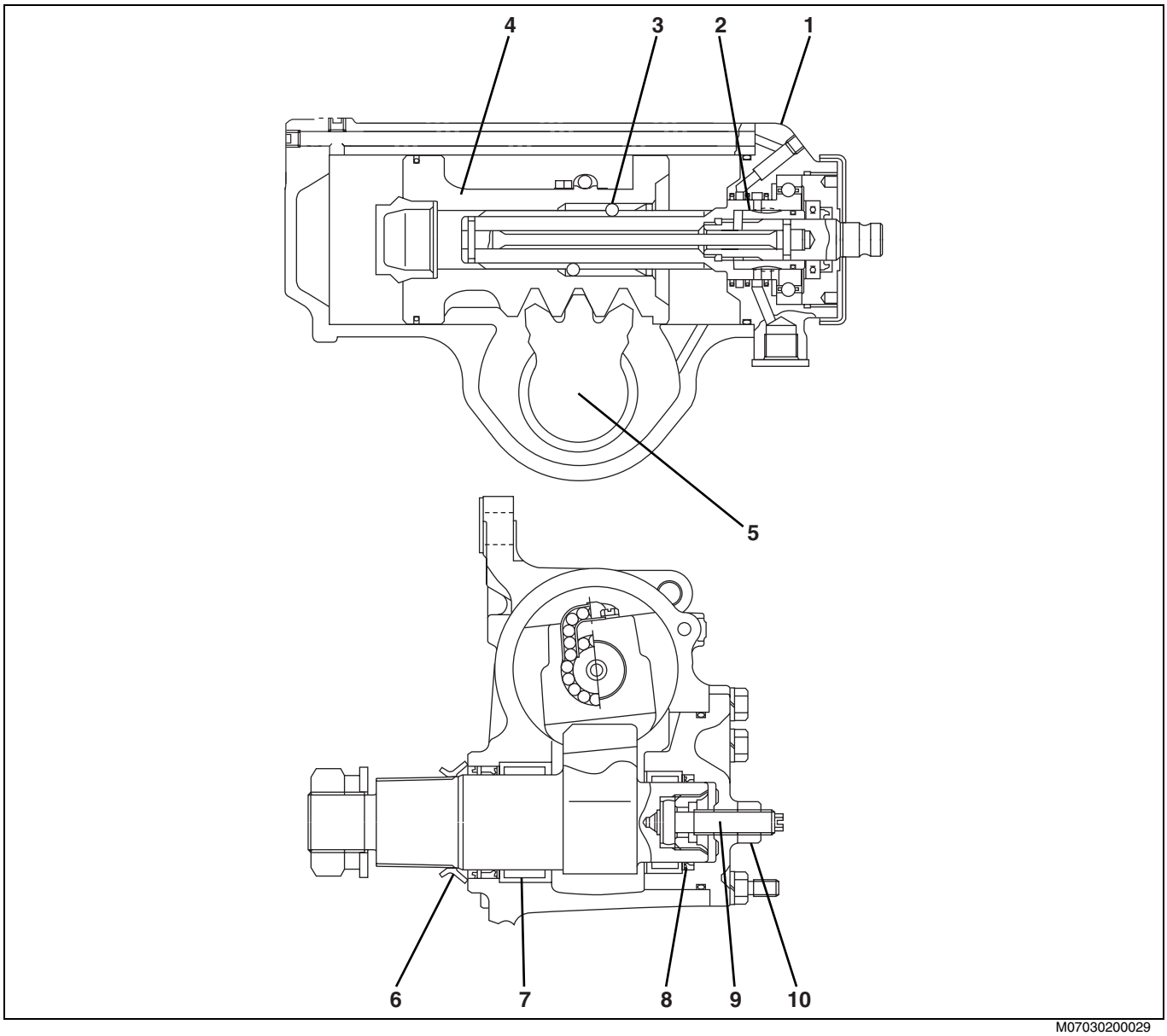
## DATA AND SPECIFICATIONS

M07030201BEI2002

| | |
|---|---|
| **Model** | **Integral type power steering** |
| **Gear ratio** | **20.2 : 1** |
| **Cylinder inside diameter** | **100 mm {3.937 in.}** |

## DESCRIPTION

M07030201BEC1003



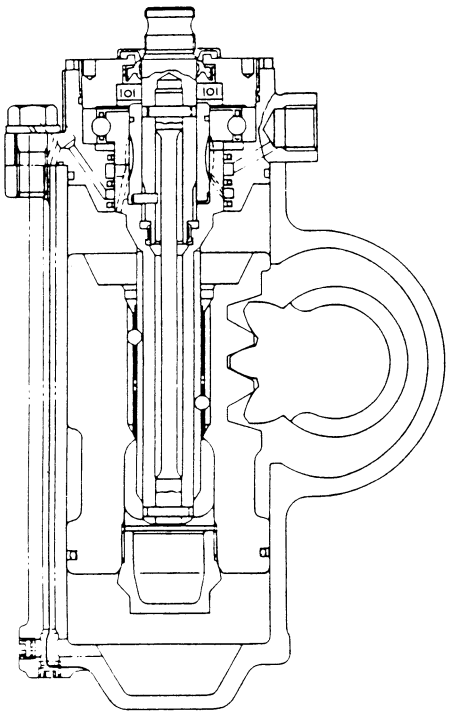

M07030200029

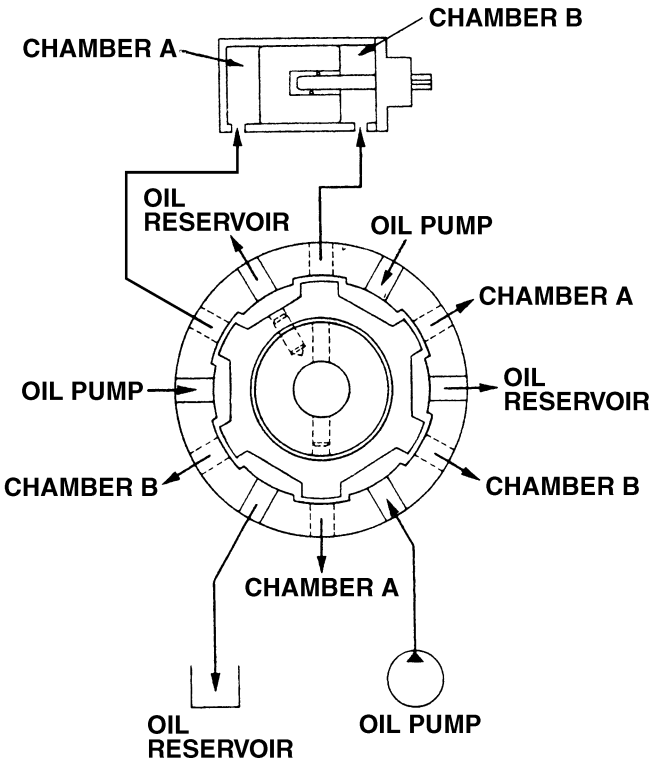
| | | | |
|---|---|---|---|
| 1 | Valve housing assembly | 6 | Dust cover |
| 2 | Worm valve assembly | 7 | Needle roller bearing |
| 3 | Steel ball | 8 | Oil seal |
| 4 | Ball nut assembly | 9 | Adjusting screw |
| 5 | Sector shaft | 10 | Adjusting screw lock nut |

# OPERATION

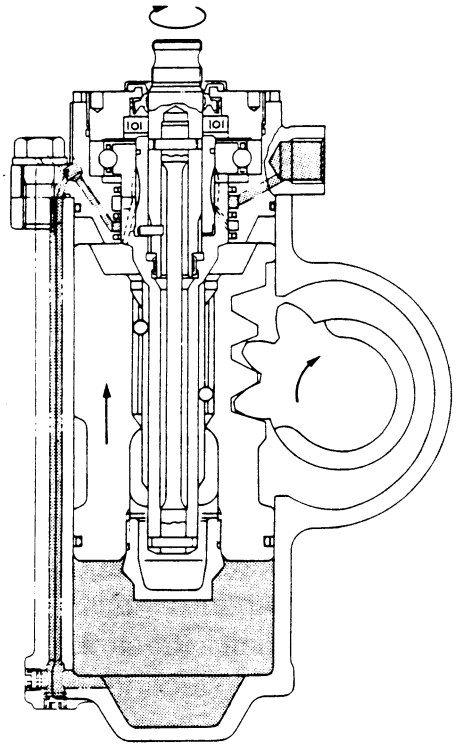
M07030201BEC1004

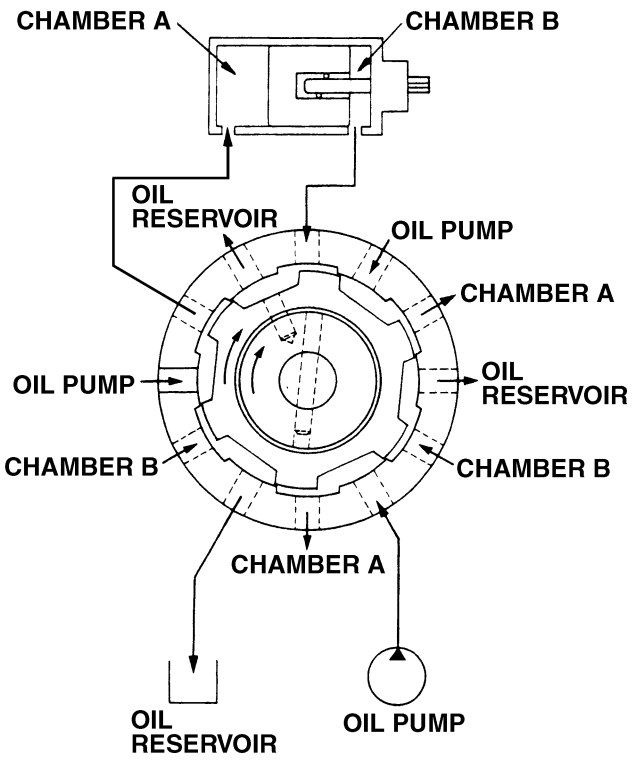
**Neutral position**






**Power steering fluid circuit when turning the vehicle to the right (Left turn is the reverse of the right turn)**





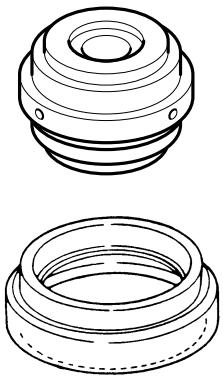
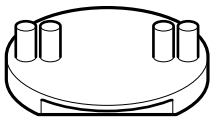
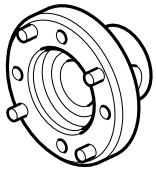
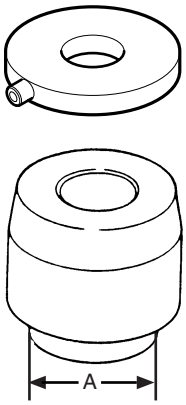
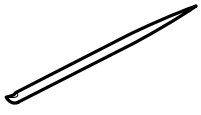
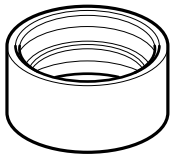

M07030200030

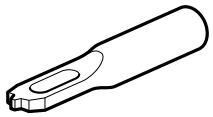
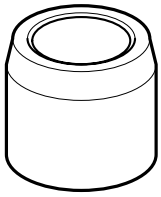
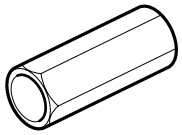
# SPECIAL TOOL

M07030201BEK1002

Prior to starting a power steering gear unit overhaul, it is necessary to have the following special tools.

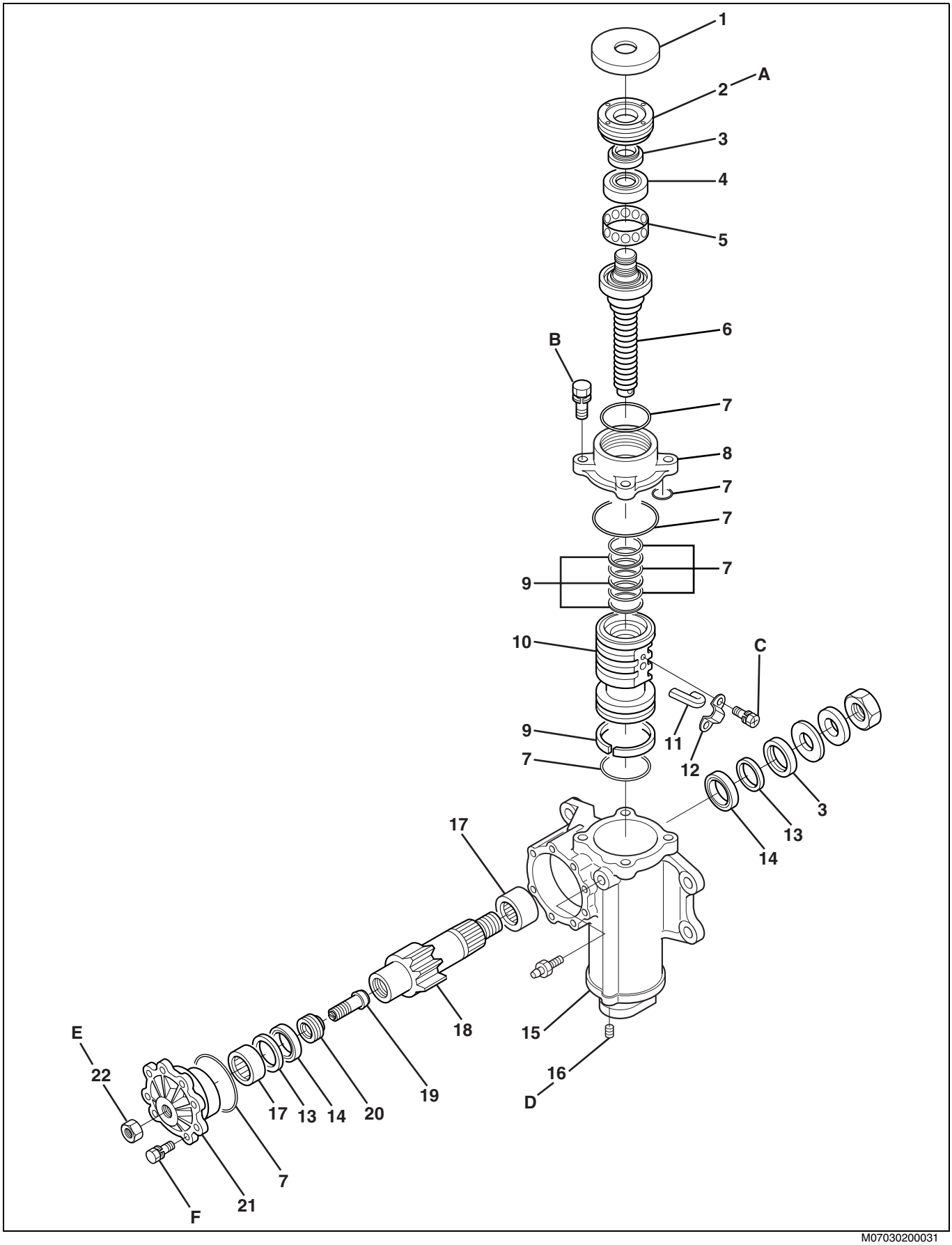
## Tool and accessory set: 09030-4180

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09657-1870 | Tool assembly<br>• For 85 mm {3.346 in.}<br>• For 90-110 mm {3.544-4.330 in.}<br>(Used together with tool assembly) | |
|  | 09659-1400 | Attachment assembly | |
|  | 09603-1560 | Wrench assembly | |
|  | 09657-1860 | Inserter assembly<br>A:<br>For 40 mm {1.575 in.}<br>For 45 mm {1.772 in.}<br>For 48 mm {1.890 in.}<br>For 53 mm {2.087 in.}<br>For 58 mm {2.283 in.}<br>(Used together with inserter assembly) | |
|  | 09659-1410 | Pressfitter | |
|  | 09699-1360 | Needle | |
|  | 09657-1840 | Inserter | |

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09694-1020 | Caulking tool | |
|  | 09657-1850 | Inserter | |
|  | 09712-1130 | Bar | |

# COMPONENT LOCATOR

M07030201BED1002




M07030200031

| | | | |
|---|---|---|---|
| 1 | Dust cover | 12 | Tube clip |
| 2 | Plug and seal assembly | 13 | Back-up ring |
| 3 | Oil seal | 14 | Y-packing |
| 4 | Ball bearing | 15 | Steering body |
| 5 | Bearing cage and steel ball | 16 | Taper plug |
| 6 | Worm shaft assembly | 17 | Needle roller bearing |
| 7 | O-ring | 18 | Sector shaft |
| 8 | Valve housing | 19 | Adjusting screw |
| 9 | Seal ring | 20 | Retainer |
| 10 | Power piston (Ball nut) | 21 | Side cover |
| 11 | Ball tube | 22 | Lock nut |

Tightening torque — Unit: N·m {kgf·cm, lbf·ft}

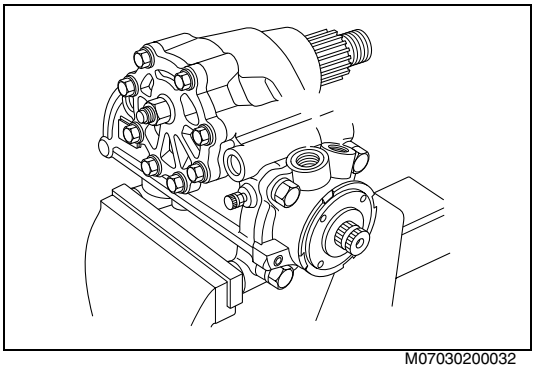
| | | | |
|---|---|---|---|
| A | 226-245 {2,300-2,500, 167-180} | D | 8.9-12.7 {90-130, 6.5-9.4} |
| B | 117.7-127.5 {1,200-1,300, 87-94} | E | 117.7-127.5 {1,200-1,300, 87-94} |
| C | 4.41-5.39 {45-55, 3.2-3.9} | F | 73.6-83.4 {750-850, 55-61} |

# OVERHAUL

M07030201BEH2003

**NOTICE:**
**OBSERVE THE FOLLOWING INSTRUCTIONS BEFORE DISASSEMBLY AND ASSEMBLY.**

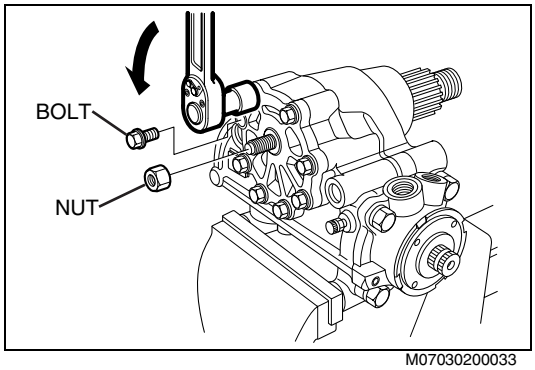
1. **All functional parts should be clean. Blow dirty parts off with dry compressed air, then clean them with volatile metal cleanser. Never use brushes or cloth.**
2. **Handle rubber parts, seals, etc., in clean condition. Any worn part should be replaced immediately.**
   **Volatile metal cleanser may attack rubber parts, so they should never be used. Always use fluid.**
3. **For disassembling and assembling, only use the specified fluid.**
4. **Standard tools can generally be used for assembling and disassembling, although special tools may be required. When using special tools, read the instruction carefully, and never use standard tools in place of special tools.**



M07030200032

## IMPORTANT POINTS - DISASSEMBLY

1. **BEFORE DISASSEMBLY, SECURE THE POWER STEERING IN THE VISE, AND THEN CENTER THE POWER PISTON.**

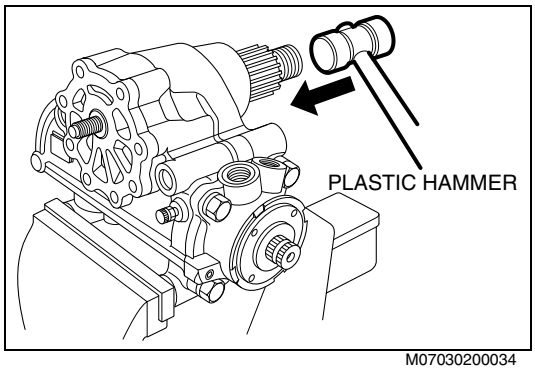


M07030200033

**2. REMOVE THE SIDE COVER ASSEMBLY AND SECTOR SHAFT**

(1) Loosen and remove the nut fixing the adjusting screw to the side cover.

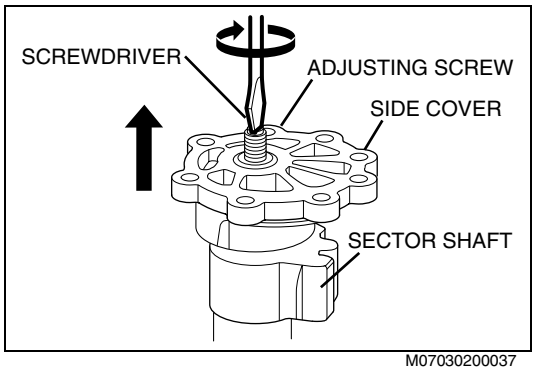
(2) Remove the eight bolts and washers fitting the side cover to the steering body.



M07030200034

(3) Confirm that the power piston is located in the center, and then gently tap the output end of the sector shaft with a plastic (or wooden) hammer to remove the sector shaft assembly and the side cover together from the steering body.

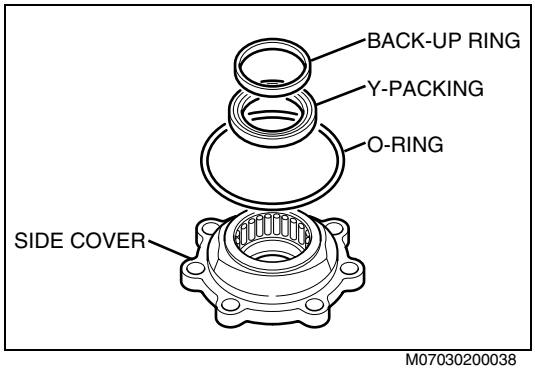
**NOTICE:**
**Never use a steel hammer when removing the sector shaft (as the threads will be damaged).**



M07030200037

(4) Trun the adjusting screw clockwise using a screwdriver to raise and separate the side cover assembly from the sector shaft assembly.

**NOTICE:**
- **Do not secure the sector shaft directly in the vise.**
- **Always use a cloth etc. to protect the sector shaft.**

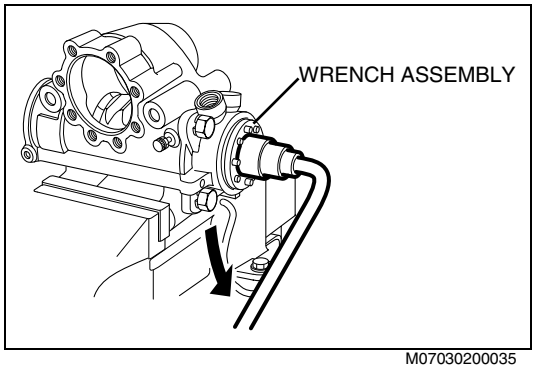


M07030200038

(5) Remove the O-ring from the groove around the outside of the side cover using the special tool. Then remove the Y-packing from behind the needle roller bearing and the back-up ring using the special tool.

**NOTICE:**
**It is not necessary to remove the needle bearing unless it is damaged.**

**SST: Needle (09699-1360)**



M07030200035

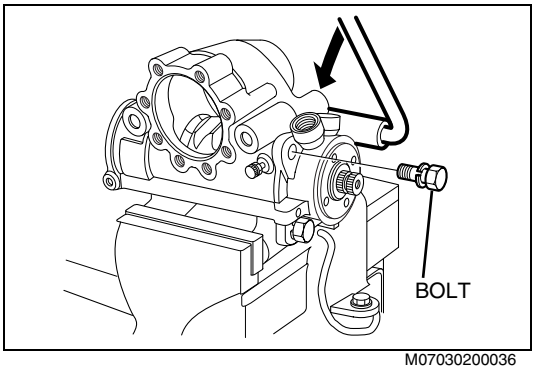
**3. REMOVE THE VALVE HOUSING AND BALL NUT ASSEMBLY**

(1) Remove the dust cover from the valve housing.

(2) Loosen the plug and seal assembly in the valve housing section using the special tool. At this time, only back off the plug and seal assembly 180°. Do not remove it.

**NOTICE:**
**If the plug and seal assembly is removed, the steel balls (bearing) in the valve housing may spring out.**

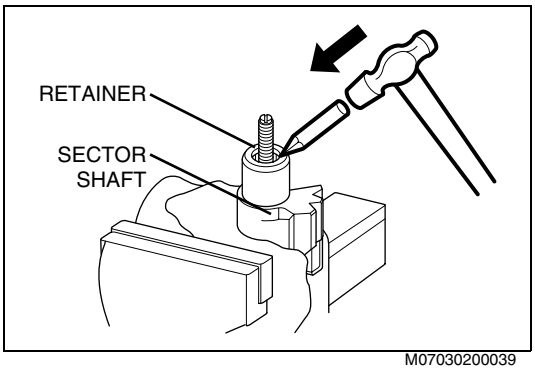
**SST: Wrench assembly (09603-1560)**



M07030200036

(3) Remove the bolts to remove the worm shaft assembly and valve housing asssembly from the steering body.

**NOTICE:**
- **Do not damage the internal surface of the steering body when removing the worm shaft assembly and valve housing assembly.**
- **Do not let the steel balls spring out.**
- **Never damage the power piton.**

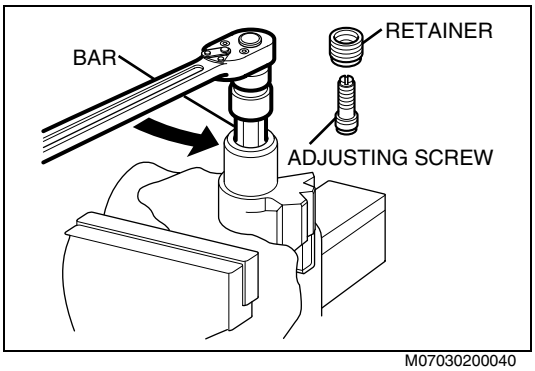


M07030200039

**4. REMOVE THE ADJUSTING SCREW AND SECTOR SHAFT**

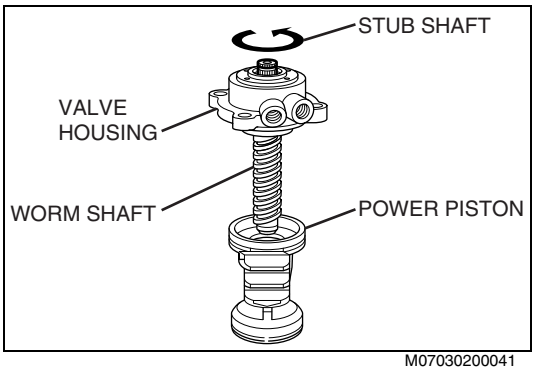
(1) Uncaulk the retainer at two caulked positions.

**NOTICE:**
- **Do not disassemble the sector shaft assembly unless it is damaged.**
- **Do not secure the sector shaft directly in the vise. Always use a cloth etc. to protect the sector shaft.**



M07030200040

(2) Remove the retainer using the special tool. Remove the adjusting screw at the same time.
**SST: Bar (09712-1130)**



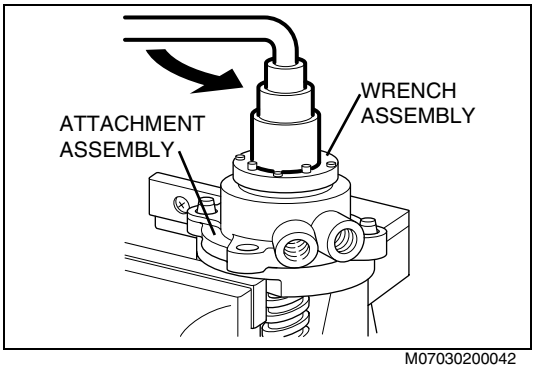
M07030200041

**5. REMOVE THE WORM SHAFT ASSEMBLY, VALVE HOUSING AND POWER PISTON ASSEMBLY.**

(1) Place the assembly on the work bench with the power piston side down. Turn the stub shaft while holding the valve housing, and remove the worm shaft from the power piston.

(2) Let the steel balls assembled in the power piston and ball race of the worm shaft drop into the power piston.

**NOTICE:**
**Do not tilt the piston as it contains the steel balls. Do not lose the steel balls.**

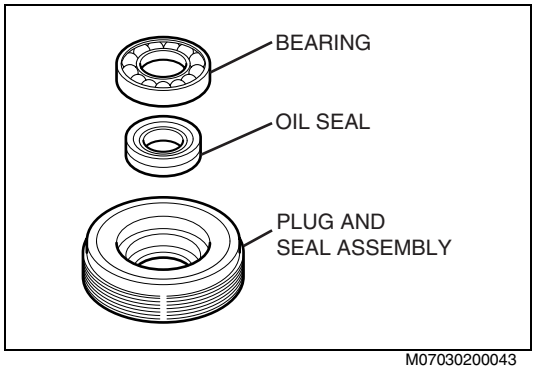


M07030200042

(3) Secure the special tool in the vise.
**SST: Attachment assembly (09659-1400)**

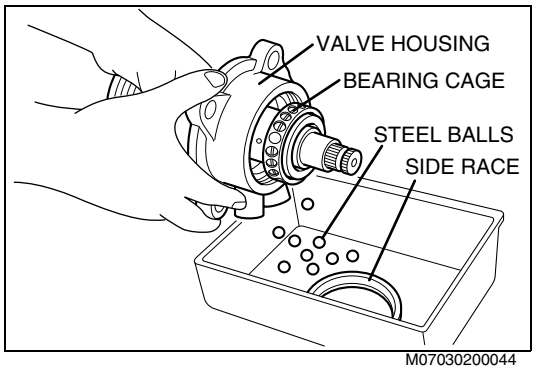
(4) Remove the O-rings fitted on the contact surfaces of the steering body of the valve housing.

(5) Attach the valve housing to the attachment assembly, and remove the previously loosened plug and seal assembly.
**SST: Wrench assembly (09603-1560)**



M07030200043

(6) Remove the ball bearing and oil seal from the plug and seal assembly.



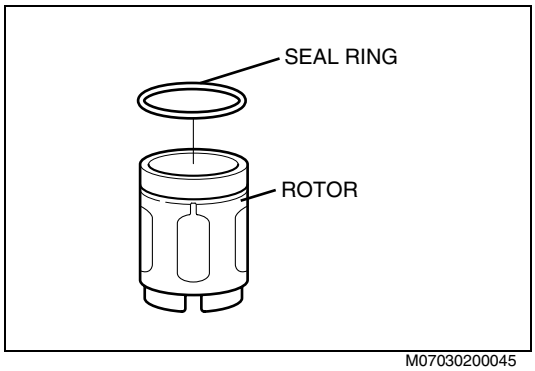
M07030200044

**6. REMOVE THE WORM SHAFT ASSEMBLY AND VALVE HOUSING.**

(1) Prepare a plastic box, etc. Hold the valve housing over the box and remove the worm shaft assembly by pushing it from the power piston side as shown in figure. The side race, steel balls, and bearing cage will come apart and fall into the box.

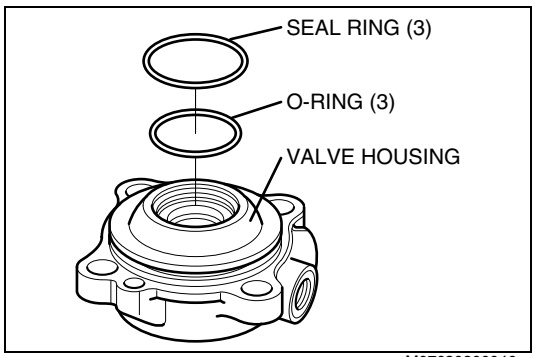
**NOTICE:**
- **Do not lose any steel balls.**
- **If only one side race and/or steel ball is lost, the worm shaft and valve housing assembly must be replaced.**

  **Number of the steel balls: 18 pieces.**



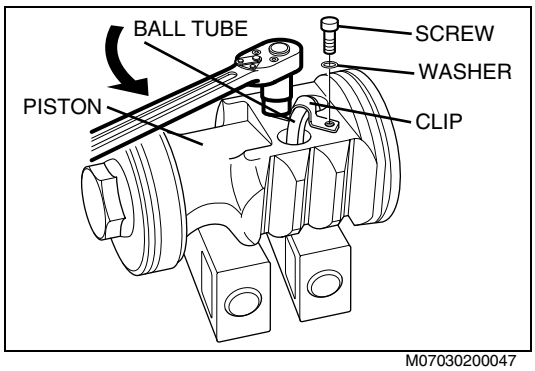
M07030200045

(2) Remove the rotor from the worm shaft assembly, and then remove the seal ring from the rotor using the special tool.
**SST: Needle (09699-1360)**



M07030200046

(3) Remove the three seal rings and three O-rings from the valve housing using the special tool.
**SST: Needle (09699-1360)**



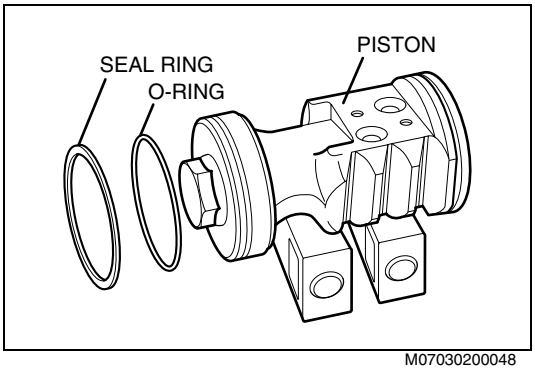
M07030200047

**7. REMOVE THE POWER PISTON.**

(1) Place the piston's steel balls in a separate container.
(2) Loosen the screw of the tube clip securing the ball tube using a wrench. Remove the ball tube from the power piston by pinching it with your fingers and shaking it.

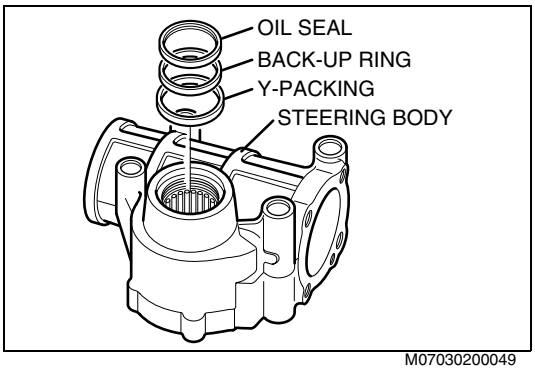
**NOTICE:**
- **Never insert a screwdriver etc, between the ball tube and the piston to pry them apart.**
- **Check for any steel balls remaining in the ball tube.**

  **Number of the steel balls: 32 pieces.**



M07030200048

(3) Remove the seal ring and O-ring from the power piston using the special tool.
**SST: Needle (09699-1360)**

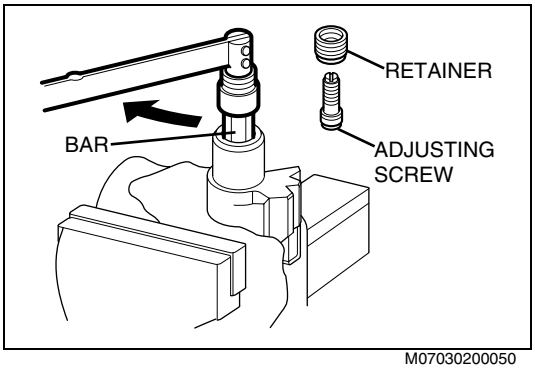


M07030200049

**8. REMOVE THE STEERING BODY.**
(1) Remove the oil seal, back-up ring, and Y-packing from the section of the steering body contacting the sector shaft.

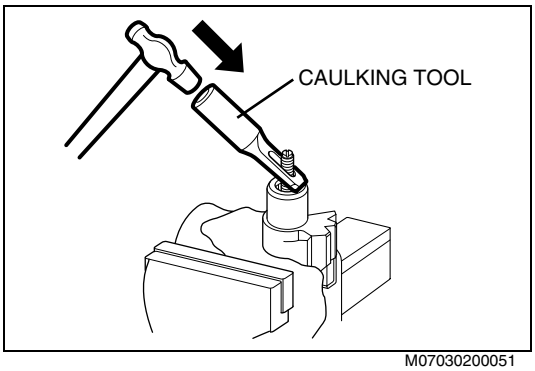
**NOTICE:**
**Do not remove the needle roller bearing and taper plug unless they are damaged.**

## IMPORTANT POINTS - ASSEMBLY



M07030200050

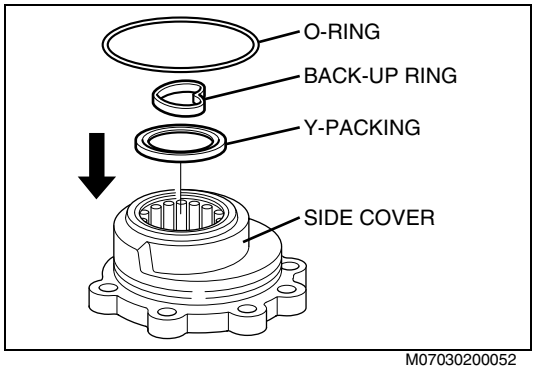
**1. INSTALL THE SECTOR SHAFT.**
(1) Secure the sector shaft in the vise while protecting the geared base of the shaft with a rag.
(2) Fill the assembly with grease through the adjusting screw hole. Then, insert the adjusting screw, and fix the retainer using the special tool.
**SST: Bar (09712-1130)**



M07030200051

**NOTICE:**
**How to tighten the retainer; After fully tightening, back off the retainer 180° and then, after retightening it to 0.04 N·m {0.4 kgf·cm, 0.03 lbf·ft} back it off 20°. Ensure the adjusting screw rotates smoothly.**

(3) After tightening the retainer, securely caulk it at two positions using the special tool.
**SST: Caulking tool (09694-1020)**



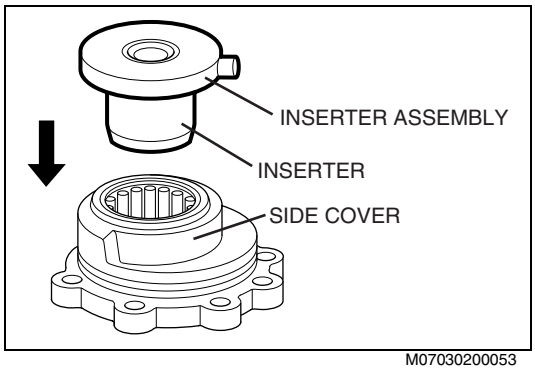
M07030200052

**2. INSTALL THE SIDE COVER.**

(1) Insert the Y-packing and back-up ring in the bottom of the needle roller bearing pressfitted inside the side cover.

**NOTICE:**

- **The back-up ring can be assembled easily if inserted by pinching it with the fingers as shown in figure.**
- **After filling the groove with grease, assemble the Y-packing so that the lip faces to the needle roller bearing side.**



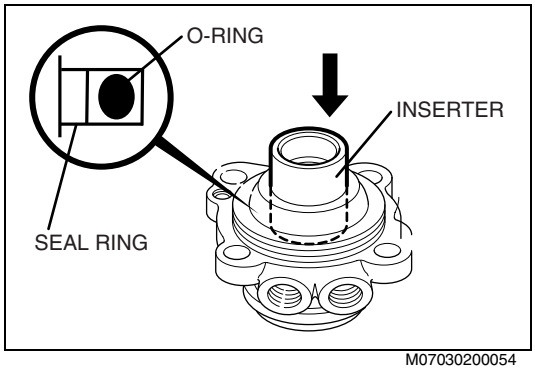
M07030200053

(2) Form the back-up ring using the special tool.
**SST: Inserter assembly (09657-1860)**

**NOTICE:**
**There are five kinds of inserters as below, and install the back-up ring using the inserter for the diameter 48 mm {1.890 in.}.**

**Unit: mm {in.}**

| INSERTER DIAMETER |
|---|
| 40 {1.575} |
| 45 {1.772} |
| 48 {1.890} |
| 53 {2.087} |
| 58 {2.283} |

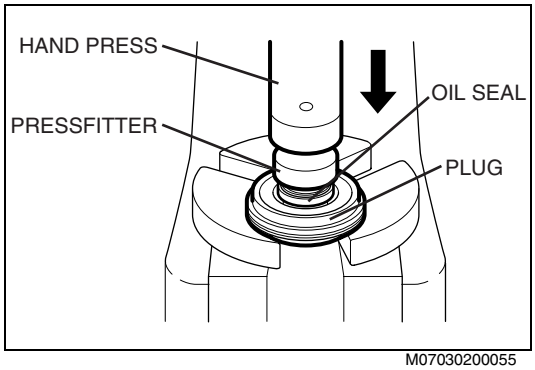


M07030200054

**3. INSTALL THE VALVE HOUSING.**

(1) Insert an O-ring and a seal ring into each of the three narrower grooves of the five grooves in the valve housing.

(2) Then, form the seal ring using the special tool.
**SST: Inserter (09657-1850)**



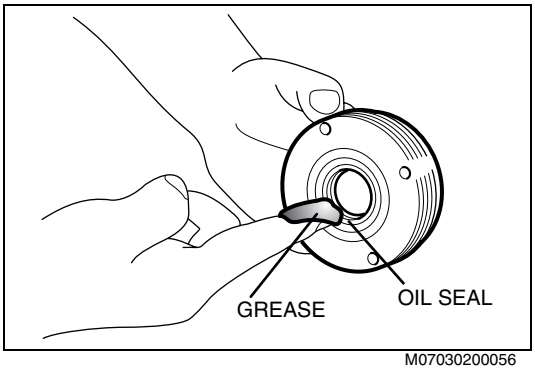
M07030200055

**4. INSTALL THE PLUG AND SEAL ASSEMBLY.**

(1) Press fit the oil seal into the inside of the plug and seal assembly using the special tool.

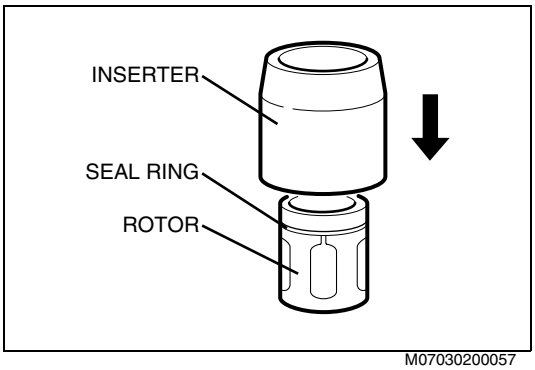
**NOTICE:**
**Always use a hand press when press fitting the oil seal.**

**SST: Pressfitter (09659-1410)**



M07030200056

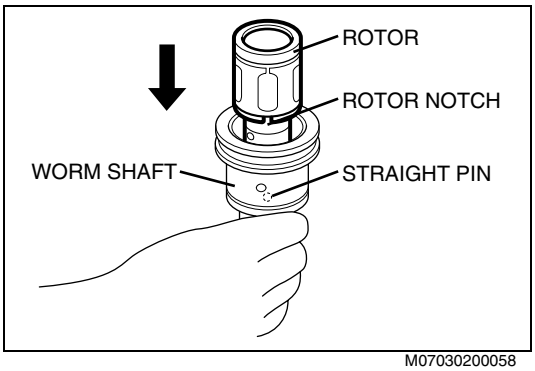
(2) Apply grease to the oil seal and then install the ball bearing.



M07030200057

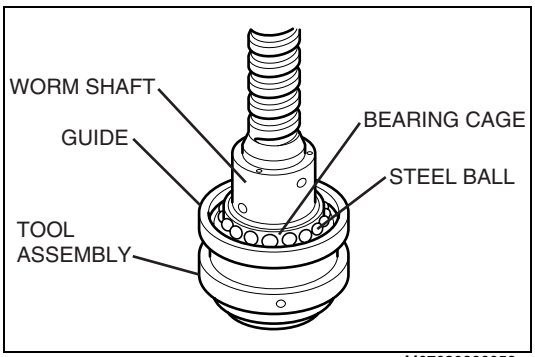
**5. INSTALL THE WORM SHAFT AND THE VALVE HOUSING.**

(1) Form the seal ring using the special tool after assembling the seal ring in the outer groove of the rotor.
**SST: Inserter (09657-1850)**



M07030200058

(2) Insert the rotor between the stub shaft and the worm shaft. At this time, assemble it so that the straight pin in the bottom fits in the rotor notch.



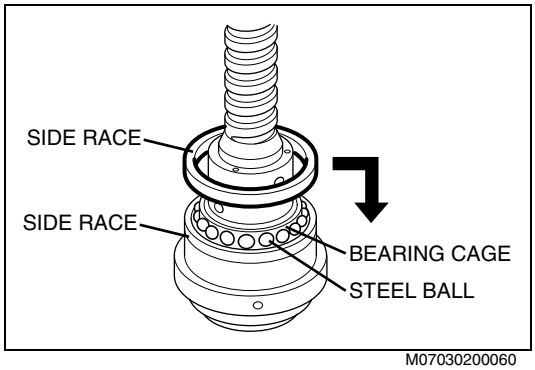
M07030200059

(3) Fit the guide into the special tool and insert the previously assembled worm shaft assembly into the guide with the input side down.
**SST: Tool assembly (09657-1870)**

**NOTICE:**
**There are two kinds of guide as below, and install worm shaft assembly using the guide for power piston diameter 90-110 mm {3.544-4.330 in.}.**

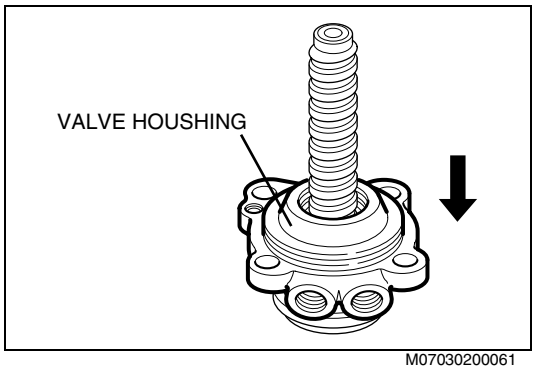
**Unit: mm {in.}**

| POWER PISTON DIAMETER |
|---|
| 85 {3.346} |
| 90-110 {3.544-4.330} |



M07030200060

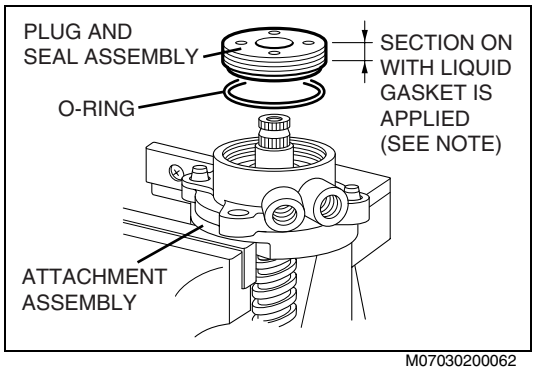
(4) Install the race of bearing side (one side), the bearing cage and the steel balls, and allow the tool assembly to slide down and set the balls in position.
(5) Remove the guide and fit the other side race.



M07030200061

(6) Assemble the valve housing to the worm shaft assembly and previously assembled bearing sub-assembly by inserting it from the worm shaft side.

**NOTICE:**
- **When fitting the valve housing, do not damage the seal ring in the valve housing.**
- **Inserter (09657-1850) can be used to form the seal rings of the valve housing part.**

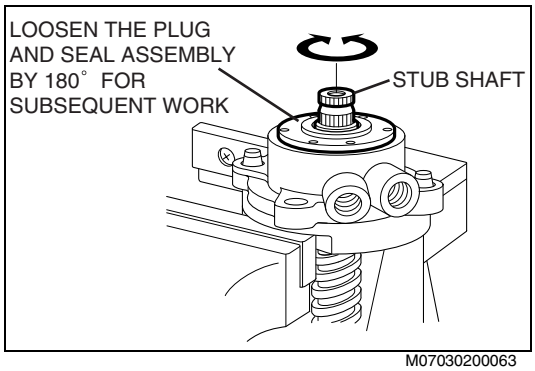


M07030200062

(7) Secure the special tool in the vise.
**SST: Attachment assembly (09659-1400)**

(8) Fit the previously assembled worm shaft assembly and valve housing onto the attachment assembly, place the O-ring in the inner groove of the valve housing, and screw the plug and seal assembly into the valve housing.

**NOTICE:**
- **Apply liquid gasket (equivalent to ThreeBond 1102) to the screw section of the plug and seal assembly.**
- **The O-ring must not be fitted in the thread escape groove of the valve housing.**
- **When assembling the plug and seal assembly, do not let the stub shaft serration damage the oil seal.**

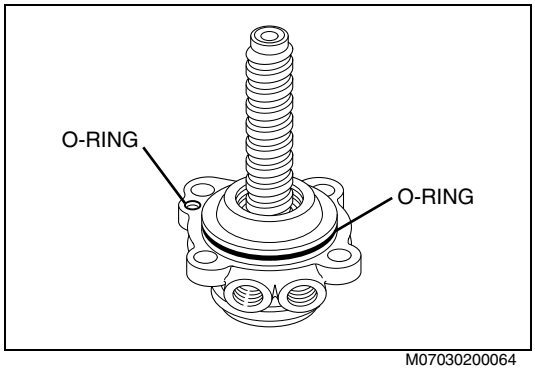


M07030200063

(9) Tighten the plug and seal assembly using the special tool.
**SST: Wrench assembly (09603-1560)**

**NOTICE:**
**Check that the stub shaft rotates soomthly and uniformly while holding the valve housing.**

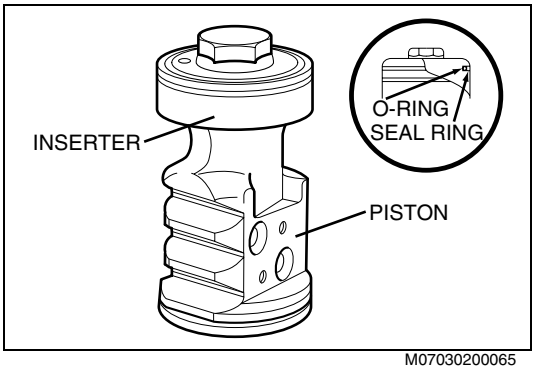
(10) Loosen the plug and seal assembly by approx 180°.



M07030200064

(11) Install O-rings in the groove around the outside of the valve housing, and in the oil port recess.

**NOTICE:**
**Do not twist the O-rings.**



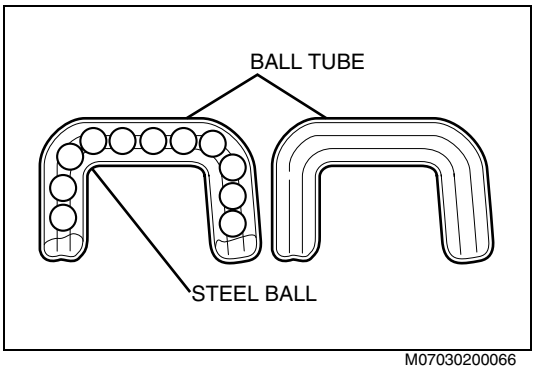
M07030200065

**6. INSTALL THE POWER PISTON.**

(1) Fit the O-ring and seal ring in the groove around the outside of the power piston and form the seal ring using the special tool.

**NOTICE:**
**Do not twist the O-ring or stretch the seal ring.**

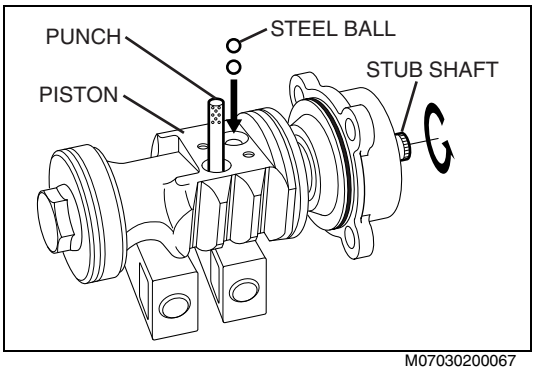
**SST: Inserter (09657-1840)**



M07030200066

(2) Place the power piston on the bench.
(3) Fill the ball tube with grease, lay 10-11 steel balls in the tube, and place the other side of the ball tube on top.

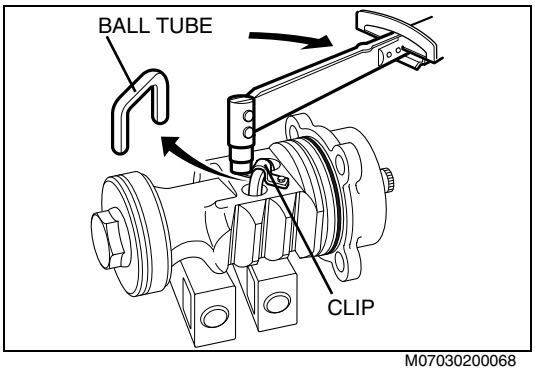
**NOTICE:**
**Never fix the piston in a vise.**



M07030200067

(4) Insert the worm shaft and valve housing assembly in the center hole of the power piston, align the power piston and worm shaft ball races, and drop the remaining steel balls one by one through the piston's ball tube hole.

**NOTICE:**
- **Drop the steel balls while turning the stub shaft to facilitate assembly.**
- **Steel balls sometimes come out of the hole on the other side of the ball tube after a certain number are inserted. Plug the hole with a punch to prevent the steel balls from coming out.**
- **When installing the steel balls, the worm shaft and valve housing assembly must not be drawn out to its extreme position, as the steel balls may drop outside the ball race.**

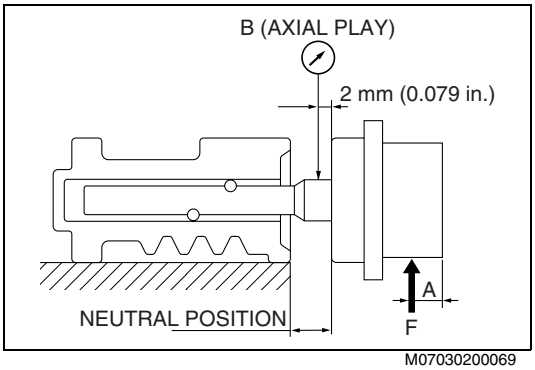


M07030200068

(5) After inserting the steel balls in the power piston, insert the ball tube into the power piston and fix it using the clip, washer, and screw.

**NOTICE:**
**Always push in the ball tube by hand. Never force or strike it. If forced or struck, the ball tube may be deformed, the edge may be nipped, or otherwise damaged, causing malfunctions.**

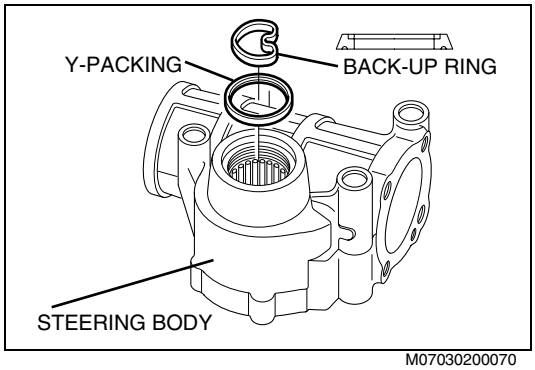
(6) Tighten the screw to the specified torque.



M07030200069

(7) Measure the axial play between the power piston and the worm shaft assembly.

| | |
|---|---|
| **A (point of application)** | **20 mm {0.787 in.}** |
| **F (force)** | **5 kg** |
| **B (axial play)** | **0.5 mm {0.0197 in.} or less** |



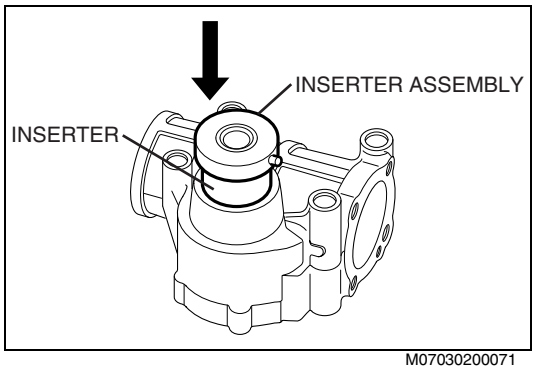
M07030200070

**7. INSTALL THE STEERING BODY.**

(1) Fit the Y-packing and back-up ring in the groove in front of the needle roller bearing (in the hole for the steering body output shaft).

**NOTICE:**

- **Back-up ring installation is facilitated by pinching the ring with the fingers as shown in figure.**
- **After filling the groove with grease, assemble the Y-packing so that the lip faces to the needle roller bearing.**



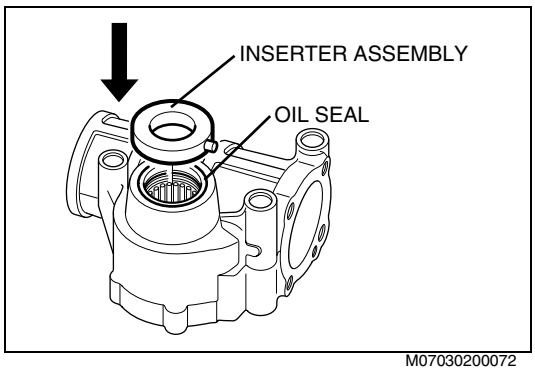
M07030200071

(2) Form the back-up ring using the special tool.
**SST: Inserter assembly (09657-1860)**

**NOTICE:**
**There are five kinds of inserters as below, and install the back-up ring using the inserter for the diameter 58 mm {2.283 in.}.**

**Unit: mm {in.}**

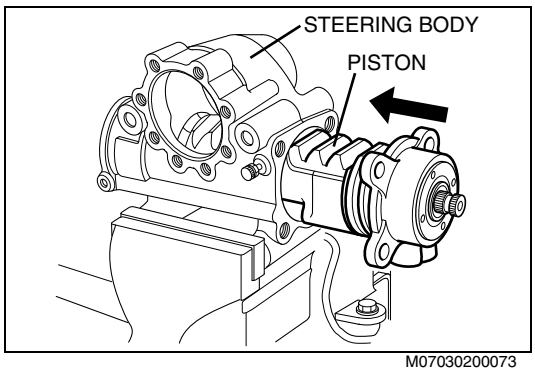
| INSERTER DIAMETER |
|---|
| 40 {1.575} |
| 45 {1.772} |
| 48 {1.890} |
| 53 {2.087} |
| 58 {2.283} |



M07030200072

(3) Press fit the oil seal into the steering body using the special tool.
**SST: Inserter assembly (09657-1860)**

(4) Fill the oil seal with grease.



M07030200073

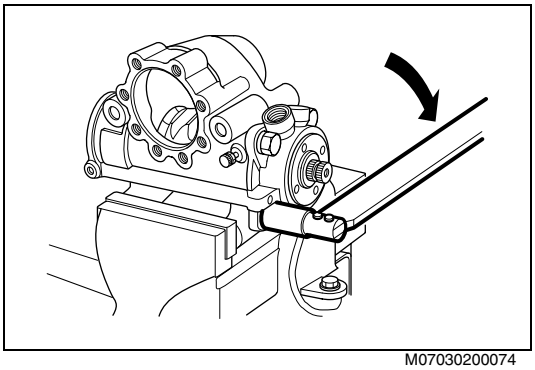
**8. INSTALL THE VALVE HOUSING AND BALL NUT ASSEMBLY.**

(1) Secure the steering body in the vise.

(2) Fit the worm shaft and valve housing assembly by inserting it into the steering body with the power piston gear placed on the side of the sector shaft. Hold the power piton lightly by hand so that it dose not rotate.

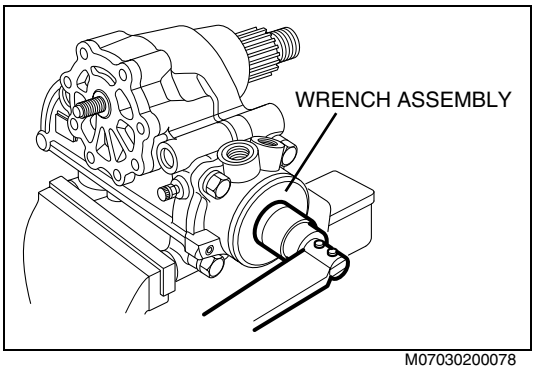
**NOTICE:**

- **When inserting the worm shaft and valve housing assembly, do not damage the piston seal ring.**
- **Be careful that the O-ring dose not fall out.**


M07030200074

(3) Align the steering body and valve housing oil passage holes and tighten the bolt to the specified torque.

**NOTICE:**
**Insert a bar into the bolt hole to align the body and housing oil passage holes. Prevent housing rotation to prevent the O-ring from being cut or dislodged.**

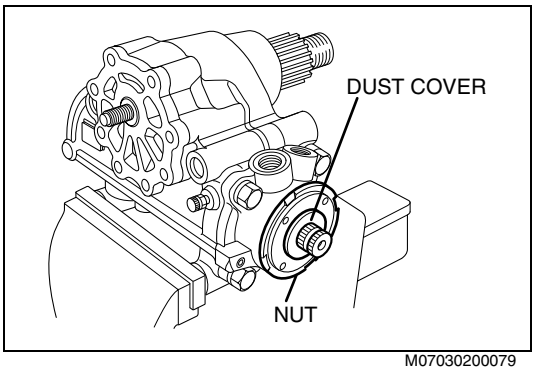


M07030200078

(4) Tighten the plug and seal assembly (which was previously loosened through 180°) to the specified torque using the wrench assembly.
**SST: Wrench assembly (09603-1560)**

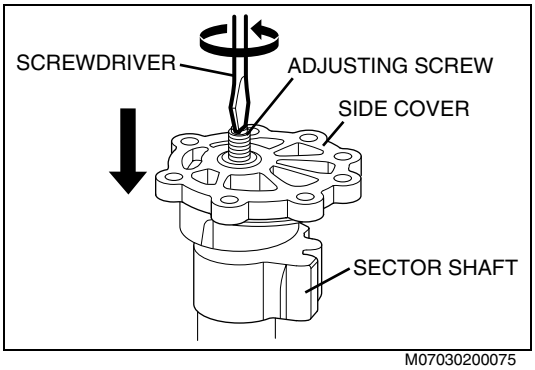
**NOTICE:**
**After applying a thin and uniform coat of liquid gasket to 3-5 whole threads of the screw part of the plug and seal assembly and tightening it with the indicated torque, apply turning stopper punches every 180°.**

**Liquid gasket: Equivalent to ThreeBond 1102**



M07030200079

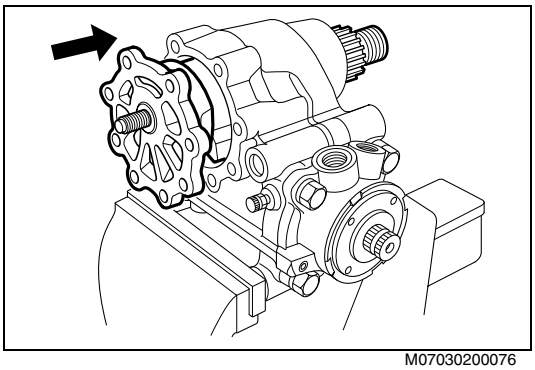
(5) Attach the dust cover to the valve housing.



M07030200075

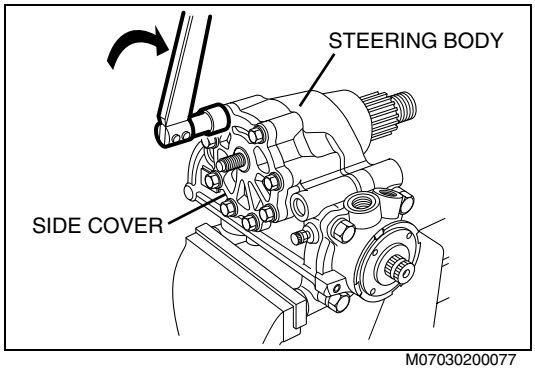
**9. INSTALL THE SIDE COVER ASSEMBLY AND SECTOR SHAFT.**

(1) Assemble the side cover assembly to the sector shaft assembly by aligning the screw hole in the center of the side cover with the adjusting screw and turning the adjusting screw.
Install the O-ring around the outside of the side cover.


M07030200076

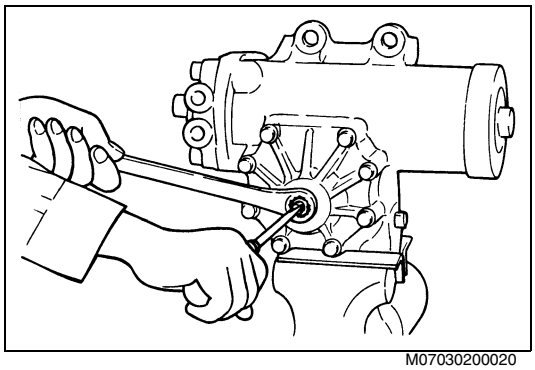
(2) Insert the sector shaft into the steering body so that its gear and the power piston gear engage in the center.

**NOTICE:**
**When inserting the sector shaft, do not let the sector shaft serration damage the lip of the Y-packing. Damage may affect oil tightness.**



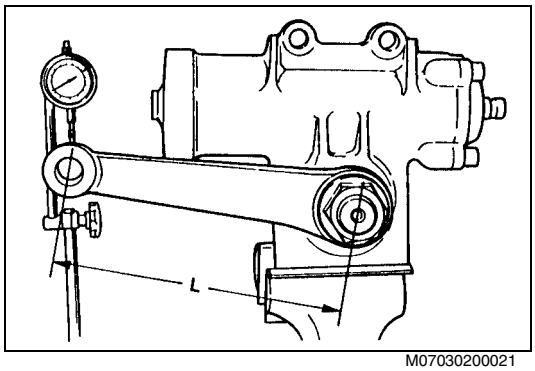
M07030200077

(3) Assemble the side cover to the steering body using the bolts. Tighten them to the specified torque.


M07030200020

**10. MEASURE THE SECTOR SHAFT BACKLASH**

(1) Align the marks on the sector shaft with pitman arm.
(2) Install the pitman arm and tighten the nut finger tight.

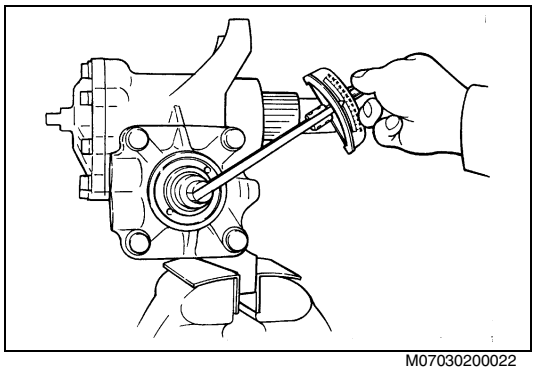


M07030200021

(3) Use a dial gauge to check to see that the sector shaft backlash in neutral position.

| L | Backlash |
|---|---|
| 270 mm {10.63 in.} | 0.05-0.25 mm {0.002-0.009 in.} |

(4) If measurement is not within specification, readjust the backlash with adjusting screw.


M07030200022

**11. INSPECT THE WORM VALVE ASSEMBLY ROTATION CONDITION.**

(1) Check to see that the worm valve assembly rotate smoothly without any shocks, abnormal resistance, noise and drag, when the worm valve assembly rotates full lock in both direction.

**12. TIGHTEN THE PITMAN ARM LOCK NUT.**

# INSPECTION AND REPAIR

M07030201BEH3002

**METALLIC PARTS**

| Inspection item | Location | Remedy |
|---|---|---|
| Steering body | • The internal surface of the cylinder | Repair or replace the steering body if there is evidence of abrasion or stepped wear. Check visually and by touch for any flaws that may affect smooth piston stroke. |
| | • Side cover assembly surface | Repair or replace the steering body if there is evidence of any flaws, rust or gouging that may affect oil tightness (check visually and by touch). |
| | • Y-packing groove in the sector shaft hole | Repair or repalce the steering body if there is evidence of any flaws, rust or gouging that may affect oil tightness (check visually and by touch). |
| Sector shaft | • Gear | Replace the gear if it is severely flawed or worn. Chipped gears must also be repalced. (Check visually and by touch) |
| | • Gear shaft and serrations | Check for cracks using magnetic-particle test equipment and a color penetration test. Replace any cracked parts. |
| | • Needle roller bearing contact surface | Check for wear, flaws or gouging (visually and by touch). Repair or replace if necessary. |
| | • Y-packing contact surface | Repair or replace if any flaws, rust or gouging affecting oil tightness are found (check visually and by touch). |
| | • Adjusting screw | Measure the axial clearance of the adjusting screw with a dial gauge.<br>0.01-0.1 mm is acceptable, but if excessive, the screw must be disassembled for inspection. Also check whether the adjusting screw rotates smoothly. If not, the screw must be disassembled and inspected. |
| Power piston | • Cylinder contact surface | Any wear or abrasion that affects smooth piston stroke must be corrected, or the power piston must be replaced. |
| | • Rack gear | Replace the rack gear if severely flawed, worn or chipped. |
| | • Steel ball race surface | Any wear or flaw that disturbs smooth rotation and movement of steel balls must be corrected, or the race must be replaced. (Visual inspection) |
| | • Seal ring and O-ring | Replace the seal ring or O-ring if any flaws or tears affecting oil tightness are found. |
| Ball tube | • Steel ball rotation surface | Replace the ball tube if any wear, flaws or gouging that affect smooth ball rotation are found on the inside at the tube. |
| | • Tang (end) | Replace the ball tube if any warping, bending, flaws or pits that affect smooth ball rotation are found on the tang. |

| Inspection item | Location | Remedy |
|---|---|---|
| Worm shaft (stub shaft) | • Steel ball race surface | Repair or replace the race if any wear, flaws or pits that affect smooth ball rotation are found. |
| | • Seal ring | Any wear, flaw, or gouge affecting oil tightness must be corrected or the seal ring must be replaced. |
| | • Y-packing contact surface | Any wear, flaw, rust, or gouge which may affect oil tightness must be corrected or the packing must be replaced. |
| | • Thrust bearing (steel ball) contact surface | Check the bearing for wear, flaws or pits if shaft rotation is stiff or uneven. Repair or replace if found. |
| Thrust bearing (steel ball) and bearing cage | • Bearing race and steel ball | Check the bearing for wear, flaws or pits if shaft rotation is stiff or uneven. Repair or replace if found. |
| | • Bearing cage | Replace the cage if any flaws or damage affecting smooth rotation are found. |
| Rotor | • External surface | Repair or replace the rotor if any wear, flaws or gouging affecting smooth rotation are found. |
| | • Chamber | Replace the chamber if any flaws, breaks, or chips affecting steering characteristics are found. |
| | • Seal ring groove | Replace the seal ring if any flaws or tears affecting oil tightness are found. |
| Side cover | • Steering body contact surface | Repair or replace the side cover if any flaws, gouging or rust affecting oil tightness are found. |
| | • Y-packing groove | Repair or replace the side cover if any flaws, gouging or rust affecting oil tightness are found. |
| | • O-ring groove | Repair or replace the side cover if any flaws, gouging or rust affecting oil tightness are found. |
| Plug and seal assembly | • Thrust bearing side race contact surface | Repair or replace the plug and seal assembly if any flaws, rust or gouging affecting uniform tightening are found. |
| | • Y-packing press fitted section | Replace the plug and seal assembly if any flaws, rust or gouging affecting oil tighteness are found. |
| | • O-ring contact surface | Replace the plug and assembly if any flaws, rust or gouging affecting oil tightness are found. |
| Bearings | | Check that the bearing rotates smoothly. Replace the bearing if rotation is stiff or uneven. |

# POWER STEERING PUMP (J08C ENGINE)

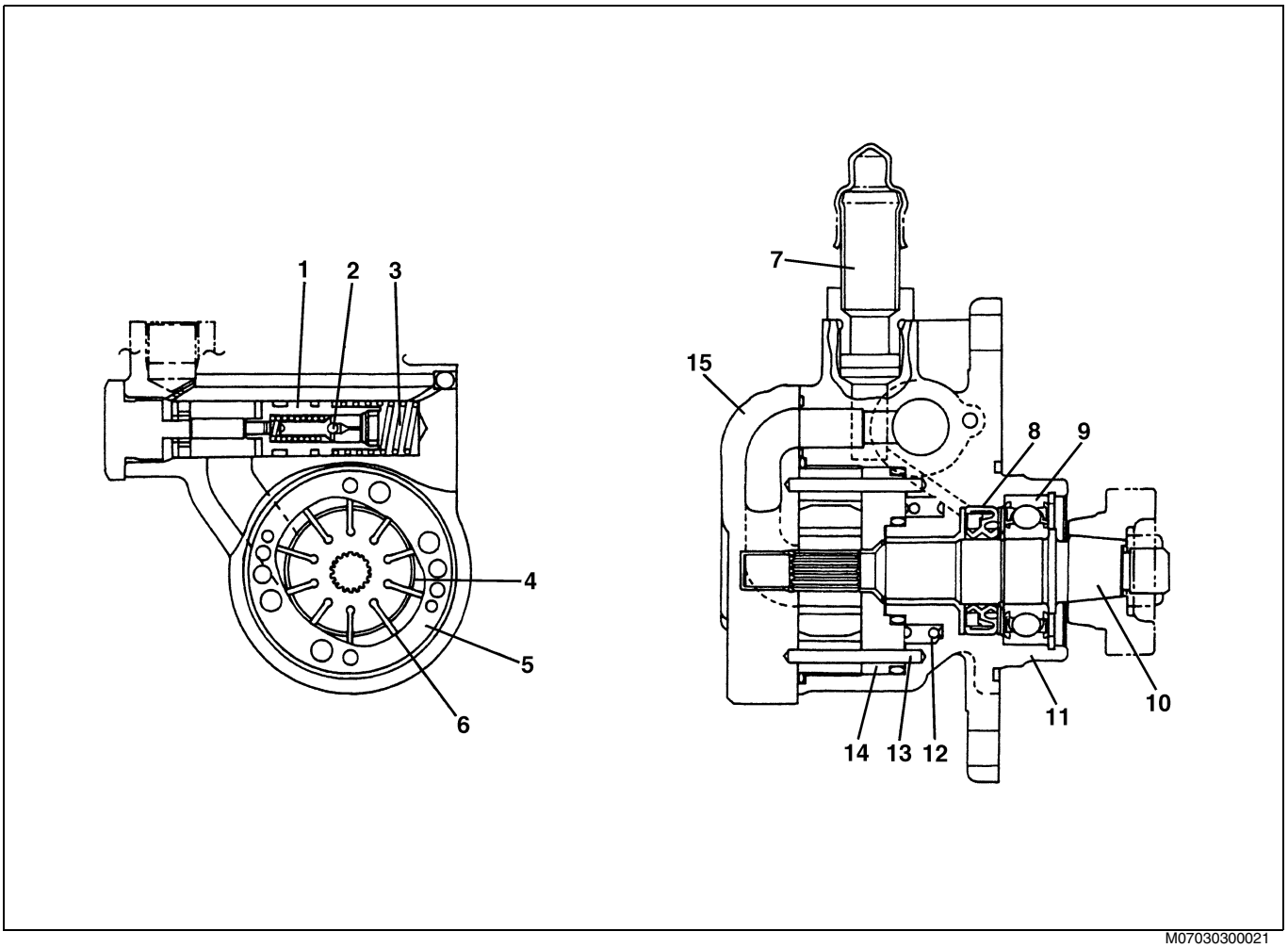
## DATA AND SPECIFICATIONS

M07030302BEI2001

| | |
|---|---|
| Type | Vane type |
| Speed range | 715-5,239 r/min |
| Relief pressure | 12.1-12.8 MPa {123-130 kgf/cm$^2$, 1,750-1,849 lbf/in$^2$} |
| Flow rate | 17.0-20.0 L/min. {4.50-5.28 U.S.gal, 3.74-4.39 Imp.gal} |

## DESCRIPTION

M07030302BEC1001



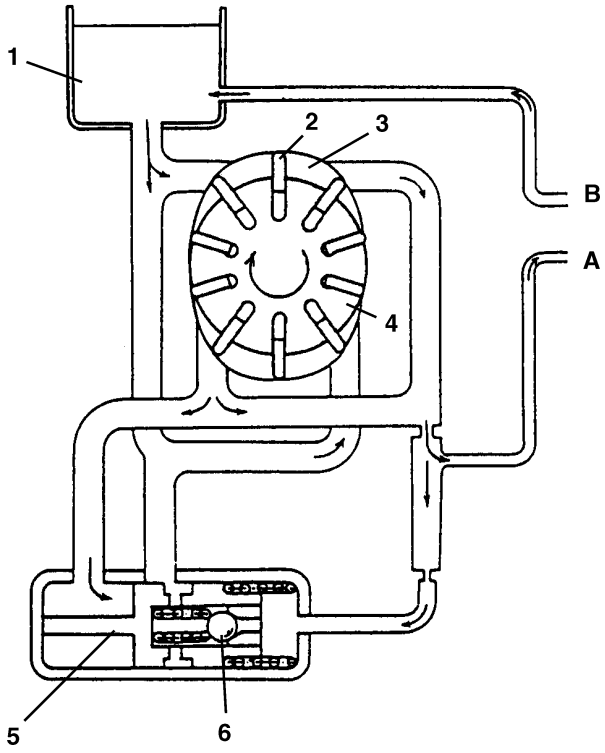

M07030300021

| | | | | | |
|---|---|---|---|---|---|
| 1 | Flow control valve assembly | 6 | Vane | 11 | Pump body sub-assembly |
| 2 | Relief valve | 7 | Suction connector | 12 | Spring |
| 3 | Flow control spring | 8 | Oil seal | 13 | Dowel |
| 4 | Rotor | 9 | Ball bearing | 14 | Side plate |
| 5 | Cam ring | 10 | Pump shaft | 15 | Body cover |

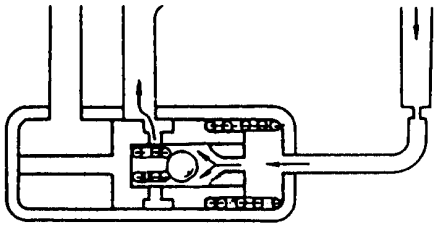
# OPERATION

M07030301BEC1003

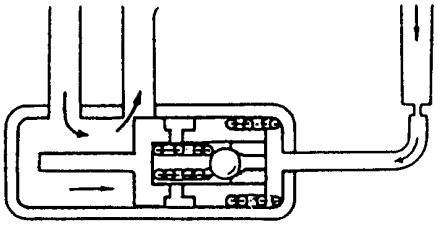
**Neutral (Frow control valve assembly and relief valve are not operating)**




**Relief valve operation**



**Flow control valve operation**

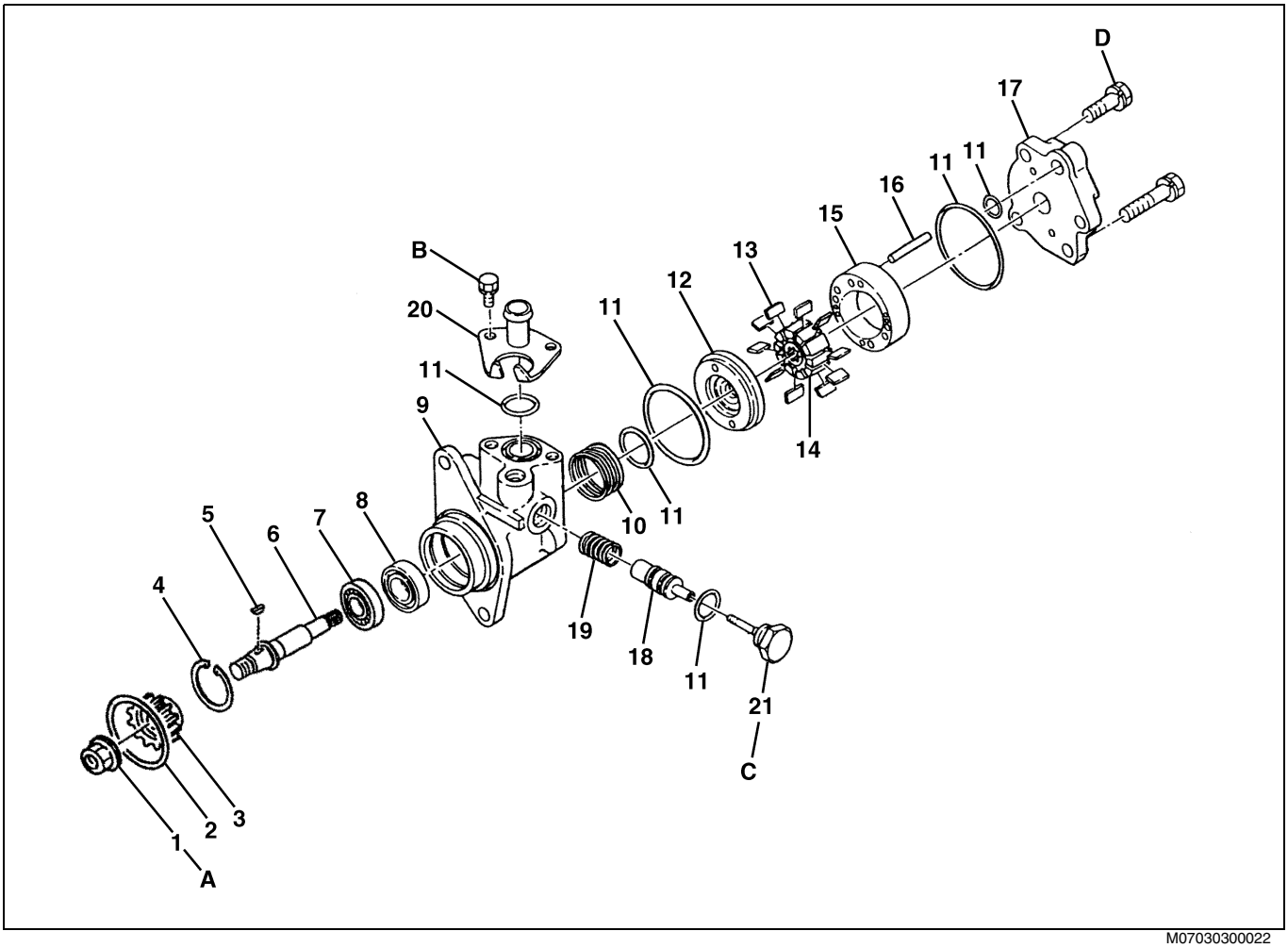


M07030300011

| | | | |
|---|---|---|---|
| 1 | Oil reservoir | 5 | Flow control valve assembly |
| 2 | Vane | 6 | Relief valve |
| 3 | Cam ring | A | To power steering gear unit |
| 4 | Rotor | B | From power steering gear unit |

# COMPONENT LOCATOR

M07030302BED1001




M07030300022

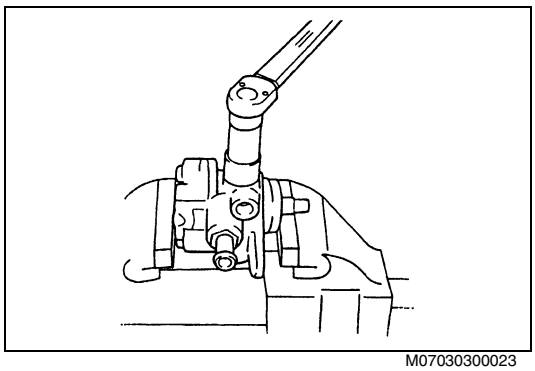
| | | | | | |
|---|---|---|---|---|---|
| 1 | Lock nut | 8 | Oil seal | 15 | Cam ring |
| 2 | O-ring | 9 | Pump body sub-assembly | 16 | Dowel |
| 3 | Drive gear | 10 | Spring | 17 | Body cover |
| 4 | Snap ring | 11 | O-ring | 18 | Flow control valve assembly |
| 5 | Wooduff key | 12 | Side plate | 19 | Flow control spring |
| 6 | Pump shaft | 13 | Vane | 20 | Suction connector |
| 7 | Ball bearing | 14 | Rotor | 21 | Plug |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 99-107 {1,000-1,100 73-79} | C | 49-69 {500-700, 37-50} |
| B | 22-26 {220-260, 16-18} | D | 34-44 {350-450, 26-32} |

# OVERHAUL

M07030302BEH2001


M07030300023

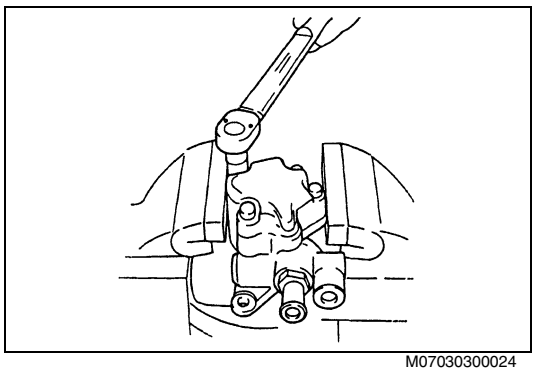
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVE THE FLOW CONTROL VALVE ASSEMBLY**

(1) Remove the plug, flow control valve assembly and spring.

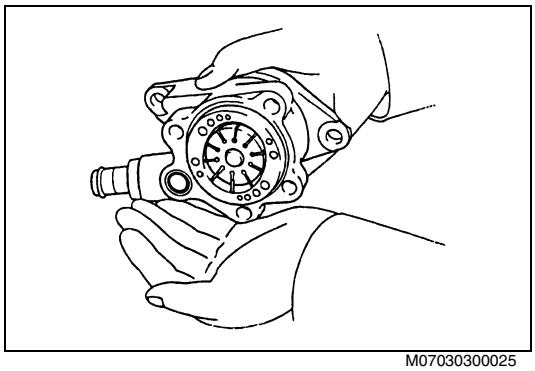
**NOTICE:**

**Be careful not to drop, scratch or nick the flow control valve assembly.**


M07030300024

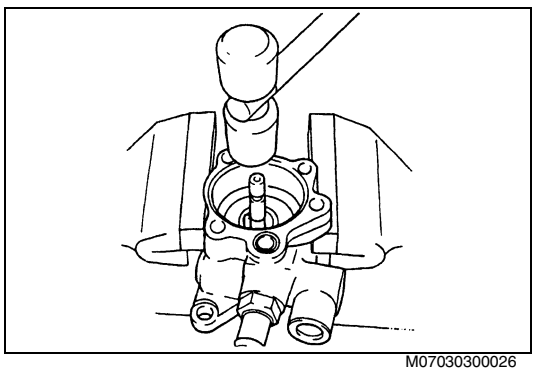
**2. REMOVE THE BODY COVER**

(1) Loosen the four fixing bolts that secure the body cover, then remove the cover.


M07030300025

**3. REMOVE THE VANE PUMP CORE**

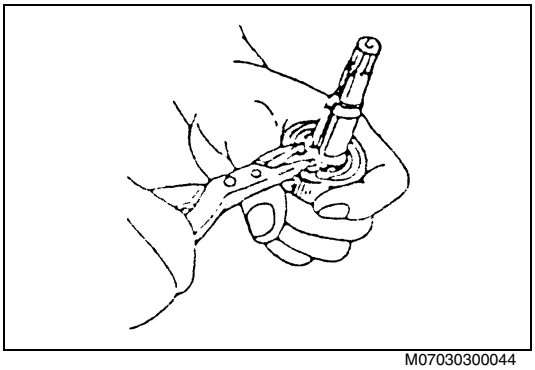
(1) As shown in the figure, face the vane pump core side downward and remove the vane pump core. The vane pump core consists of the cam ring, rotor and vane. Since dimensional checks of these parts have been completed, handle the vane pump core carefully. Remove the side plate and spring.


M07030300026

**4. DISASSEMBLY OF PUMP SHAFT ASSEMBLY**

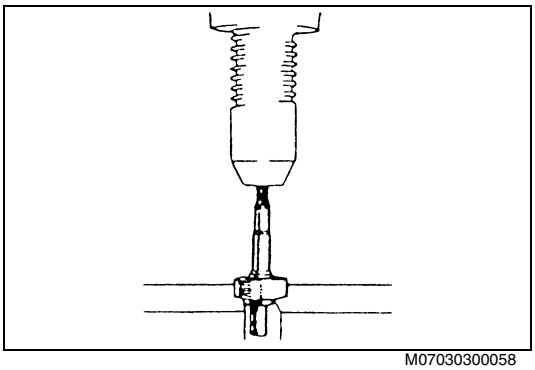
(1) Remove the snap ring from the pump body, and push and remove the spline edge surface of the pump shaft by hand or by using a plastic hammer. Be caresul not to damage the oil seal lip. This process completes disassembly. Carry out inspection.

## REPLACEMENT

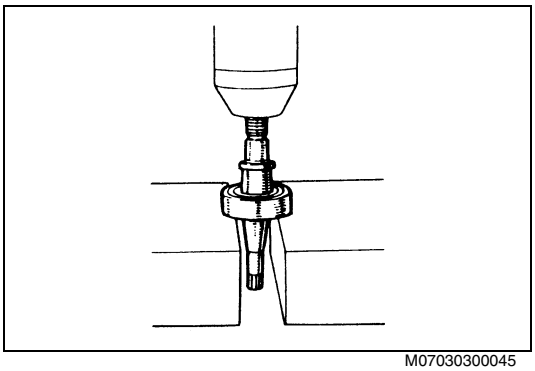

M07030300044

**1. REPLACE THE BALL BEARING, IF NECESSARY.**

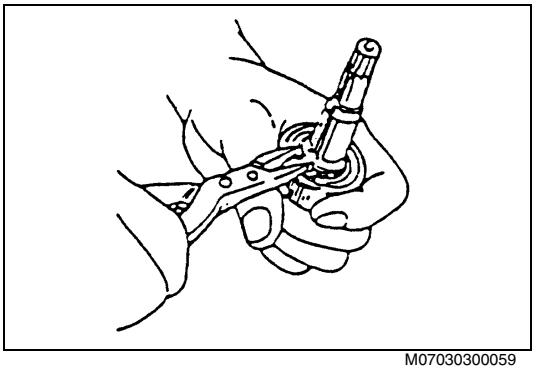
(1) Use a pair of snap ring pliers to remove the retainer ring.


M07030300058

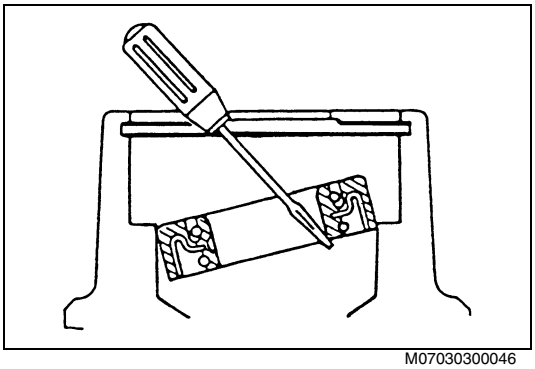
(2) Use a press, press out the ball bearing.


M07030300045

(3) Use a press to press in the ball bearing.


M07030300059

(4) Use a pair of snap ring pliers to install the retainer ring.

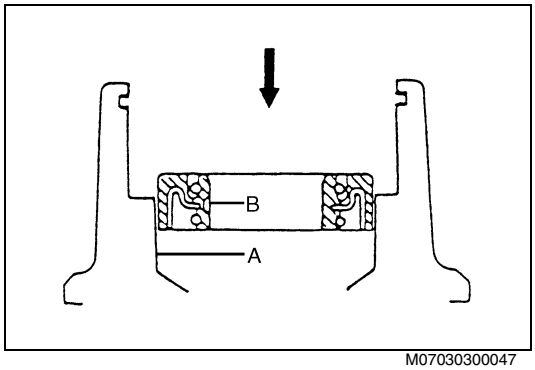

M07030300046

**2. REPLACE THE OIL SEAL, IF NECESSARY.**

(1) Use a screw driver to remove the oil seal.

**NOTICE:**

**Do not scrape or damage the inside of pump body.**

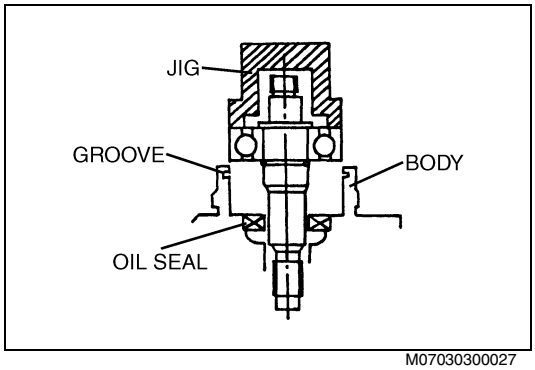


M07030300047

(2) Insert the oil seal as shown in the figure.

**NOTICE:**
**To prevent oil leakage from oil seal due to lip wear, apply lithium base grease to A and B.**

(3) Using a press, press in the oil seal into the pump body.



M07030300027

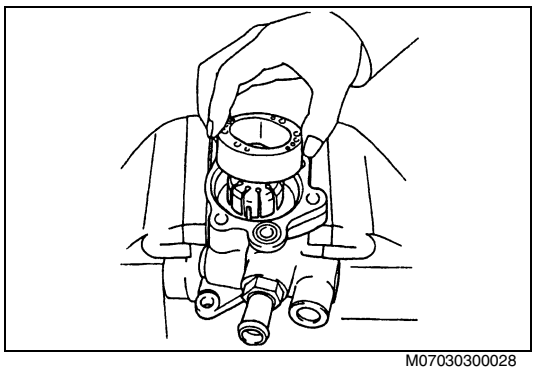
## IMPORTANT POINTS - ASSEMBLY

**1. INSTALL THE PUMP SHAFT**

(1) Apply grease to the oil seal lip.

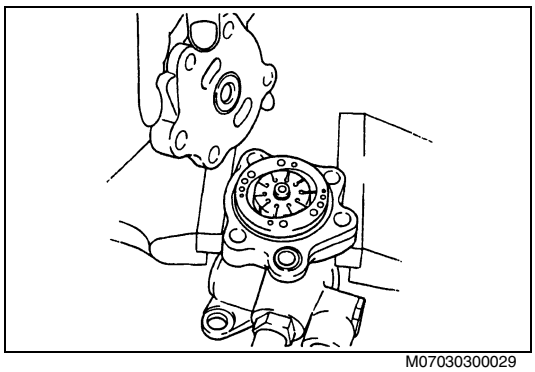
**Recommended: Lithium grease**

(2) Use a jig to install the shaft assembly.
(3) Install the snap ring into the groove completely.


M07030300028

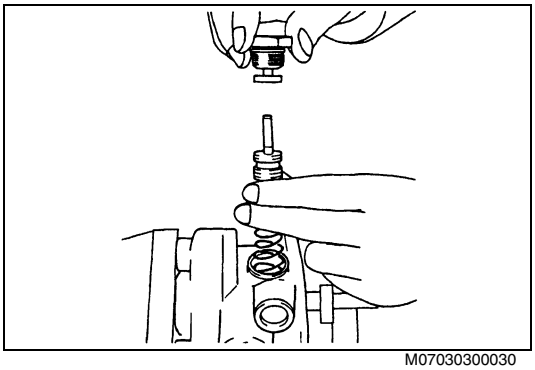
**2. INSTALL THE VANE PUMP CORE**

(1) Press-fit the dowel pin into the pump body, then install in the order: O-ring, spring, side plate, rotor, cam ring, and vane. Install the cam ring so that the oval dowel hole is positioned at the valve side of the body and that the rotation direction is correct. Install the rotor so that the chamfer side of the spline faces the side plate. Install the vane so that the radius edge contacts the inner surface of the cam ring.


M07030300029

**3. INSTALL THE BODY COVER**

(1) Fit the O-ring and the body cover onto the pump body. Align the dowel hole in the cover with the dowel pin, press the cover to the edge surface of the body manually. Temporary tighten the bolts by hand, then retighten to the specified torque.


M07030300030

**4. INSTALL THE FLOW CONTROL VALVE**

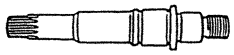
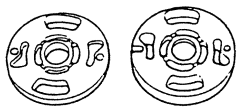
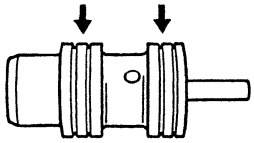
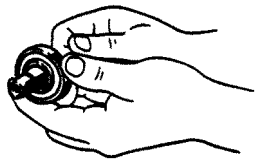
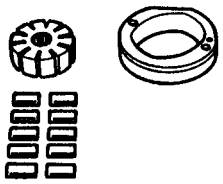
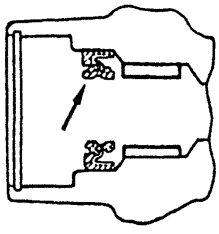
(1) Insert the flow control spring. Install the flow control valve assembly into the body so that the pin side faces the plug side. Tighten the plug.

**5. INSPECT PUMP SHAFT ROTATION CONDITION**

(1) Check to see that the pump shaft rotates smoothly without abnormal noise.

# INSPECTION AND REPAIR

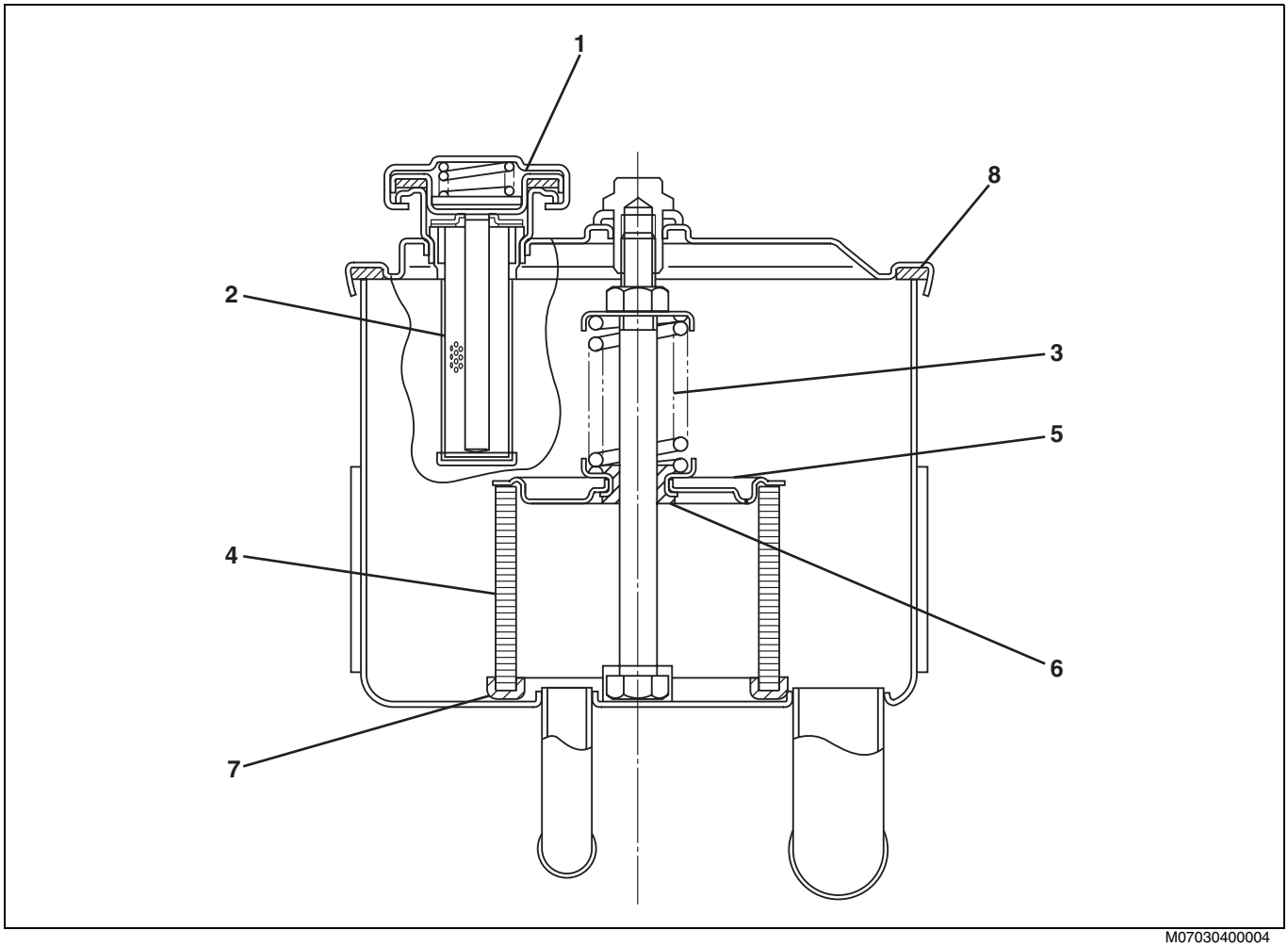
M07030302BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Pump shaft:<br>Damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Side plate:<br>Abrasion and flaw** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Flow control valve assembly:<br>Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Pump shaft bearing:<br>Scratched and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Cam ring inner surface:<br>Rotor surface:<br>Vane surface:<br>Wear, scratches and scoring** | — | — | **Replace the vane pump core, if necessary.** | **Visual check**<br>  |
| **Oil seal:<br>Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |

# OIL RESERVOIR

## DESCRIPTION

M07030401BEC1002

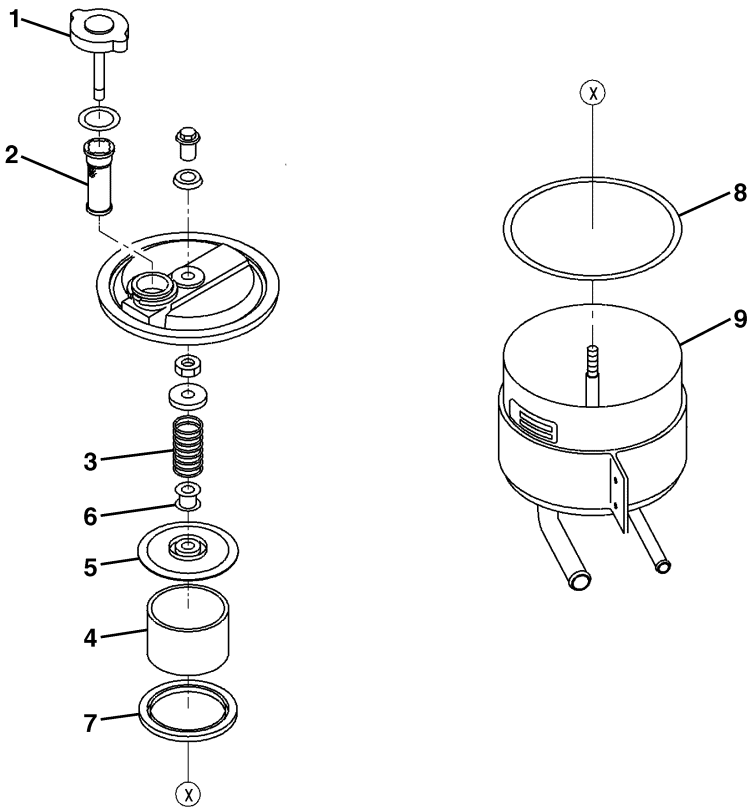



M07030400004

| | | | |
|---|---|---|---|
| 1 | Oil reservoir cap | 5 | Filter cover |
| 2 | Oil strainer | 6 | Filter cover seal |
| 3 | Spring | 7 | Filter seal |
| 4 | Oil filter | 8 | Oil filter gasket |

# COMPONENT LOCATOR

M07030401BED1002




M07030400005

| | | | |
|---|---|---|---|
| 1 | Oil reservoir cap | 6 | Filter cover seal |
| 2 | Oil strainer | 7 | Filter seal |
| 3 | Spring | 8 | Oil filter gasket |
| 4 | Oil filter | 9 | Oil reservoir |
| 5 | Filter cover | | |

# OVERHAUL

M07030401BEH2002

## IMPORTANT POINTS - ASSEMBLY

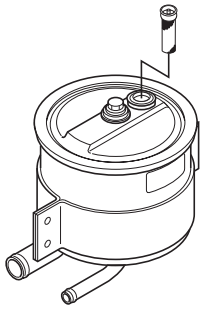
**NOTICE:**

- **Use only compressed air to clean the oil filter.**
- **The oil filter is made of synthetic resin, so never wash it with hot water, solvent or detergent.**
- **Before assembling, clean all the parts.**

# INSPECTION AND REPAIR

M07030401BEH3002

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Oil strainer:<br>Clogged and damage** | **—** | **—** | **Clean or replace, if necessary.** | **Visual check**  |
| **Oil reservoir:<br>Damage** | **—** | **—** | **Replace, if necessary.** | |

# FRONT AXLE (LF366)

AX02-001

**FRONT AXLE (LF366) ..... AX02-2**
DATA AND SPECIFICATIONS ..... AX02-2
DESCRIPTION ..... AX02-3
TROUBLESHOOTING ..... AX02-4
SPECIAL TOOL ..... AX02-5
COMPONENT LOCATOR ..... AX02-7
OVERHAUL ..... AX02-8
INSPECTION AND ADJUSTMENT ..... AX02-13
INSPECTION AND REPAIR ..... AX02-14

# FRONT AXLE (LF366)

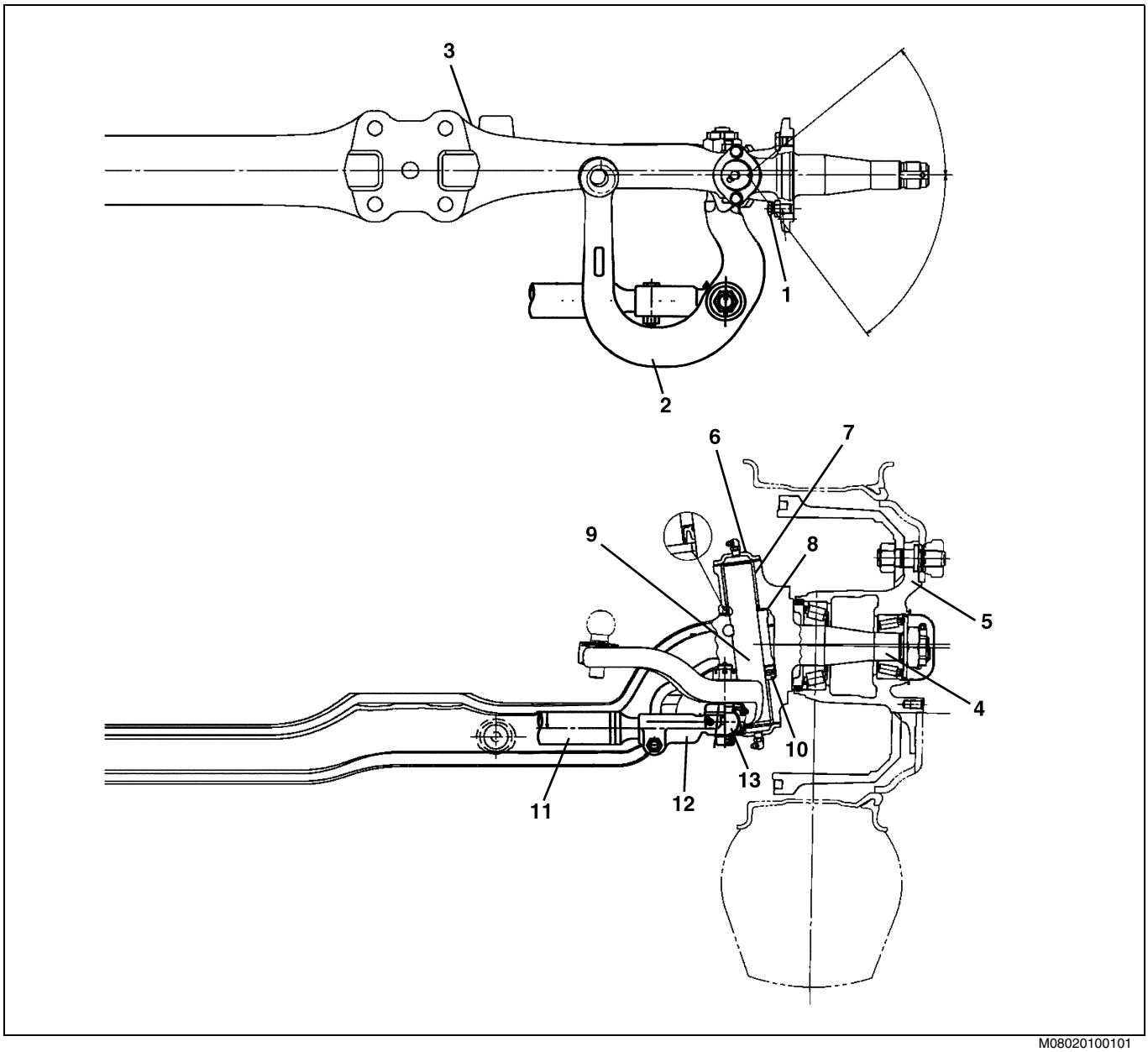
## DATA AND SPECIFICATIONS

M08020103BEI2003

| | | | |
|---|---|---|---|
| Front axle series No. | | | LF366 |
| Axle beam type | | | Reversed Elliot "I" beam |
| Axle beam material | | | As rolled normalized steels |
| Brake drum location | | | Inboard mounted |
| Wheel bearing | | | Two tapered roller bearings |
| Amount of grease in a hub | | | 430 g {15.1 oz} at one wheel |
| King pin thrust bearing | | | Ball bearing |
| Wheel alignment | Camber | | 0°-2° |
| | King pin angle | | 6°-8° |
| | Caster | With power steering | 2° |
| | Toe-in | Diagonal tires | 1-3 mm {0.0394-0.1181 in.} |
| | | Radial tires | 0-2 mm {0-0.0787 in.} |
| Knuckle turning angle | | Inner turn | 50°-53° |
| | | Outer turn | 39° |

# DESCRIPTION

M08020103BEC1002




M08020100101

| | | | |
|---|---|---|---|
| 1 | Stopper bolt | 8 | Thrust washer |
| 2 | Knuckle arm | 9 | King pin |
| 3 | Axle beam | 10 | Thrust bearing |
| 4 | Knuckle | 11 | Tie rod |
| 5 | Wheel hub | 12 | Tie-rod end |
| 6 | King pin cover | 13 | Ball stud |
| 7 | Bushing | | |

# TROUBLESHOOTING

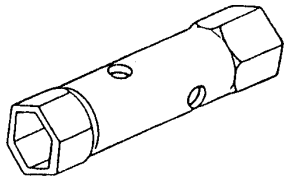
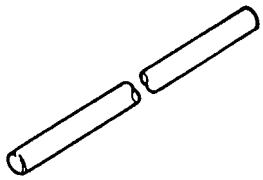
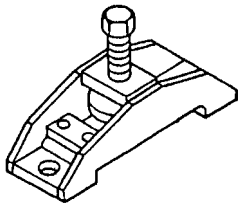
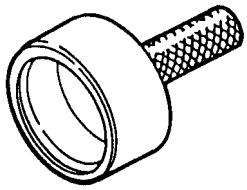
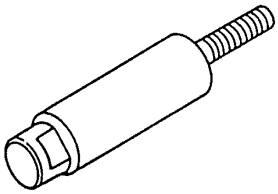
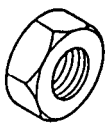
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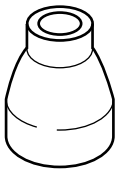
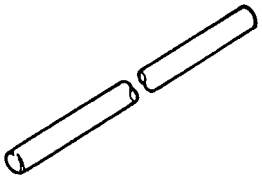
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Hard steering or poor return of steering wheel to center** | Lack of lubrication in steering linkage | Lubricate king pins and ball joints. |
| | Incorrect front wheel alignment (Toe-in angle is incorrect.) | Correct the toe-in. |
| | Incorrect front wheel alignment (Camber, caster of king pin angles are not within specifications.) | Inspect king pin bushings for wear or deflection of knuckles axle beam and tie rod, and replace if necessary. |
| | Worn out or damaged thrust bearing | Replace thrust bearings. |
| | Tire pressure is too low. | Inflate to proper pressure. |
| **Vibration or shimmy** | Incorrect front wheel alignment | Adjust or replace parts if necessary. |
| | Worn out king pin bushing | Replace king pin bushings. |
| | The preload of the wheel bearing is off. | Adjust wheel bearing preload. |
| | Badly worn hub bearings | Replace hub bearings. |
| | Loose tie-rod ends ball joints | Replace all the tie-rod ends. |
| | Loose U-bolt nuts holding the springs to the beams | Tighten the nuts properly. |
| | Loose hub nuts | Tighten the hub nuts properly. |
| | Distorted disc wheels | Replace the disc wheel. |
| | The tires are out of balance. | Balance the tires. |
| | Run-out of the tire and wheel rim | Correct the run-out of the tire and wheel rim. |
| | Tire and wheel are out of balance. | Balance the wheel using a balancing machine. |
| | Tire pressure is not uniform or sufficient. | Adjust the pressure of all tires. |
| | Other faults in the steering system | Refer to the chapter STEERING EQUIPMENT. |
| **Abnormal tire wear** | Incorrect front wheel alignment | Adjust properly or replace parts, if necessary. |
| | Improper tire pressure | Adjust to proper pressure. |
| **Grease leakage from wheel hub** | Worn out oil seal | Replace oil seal. |
| | Hub cap is not seated properly. | Fit the hub cap properly. |
| | Too much grease | Apply only the specified amount of grease. |

# SPECIAL TOOL

M08020103BEK1001

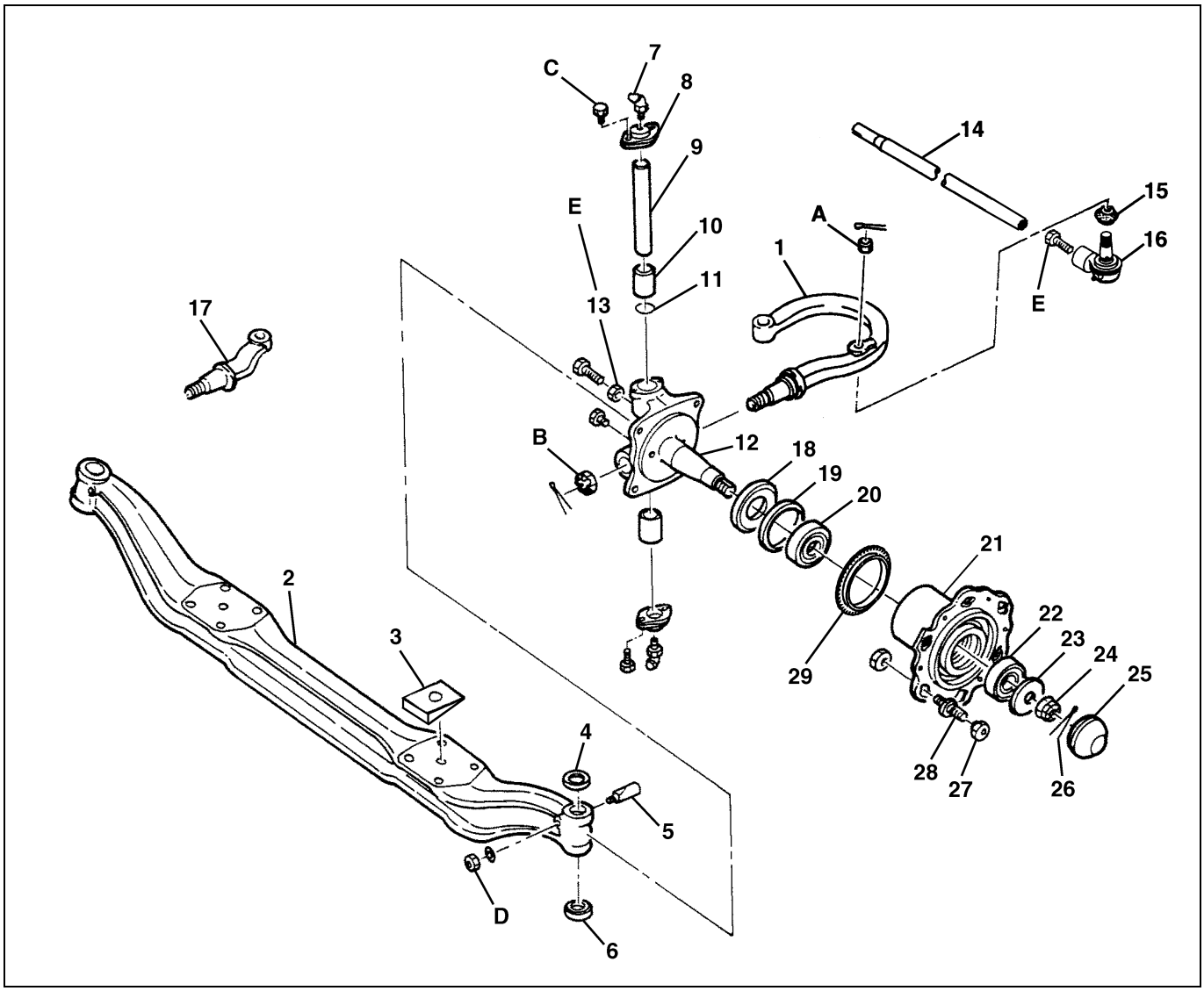
Prior to starting a front axle overhaul, it is necessary to have these special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-5003 | SOCKET WRENCH | |
|  | 09849-2001 | HANDLE | |
|  | 09650-2051 | WHEEL HUB PULLER | |
|  | 09607-1010 | HUB CAP INSTALLER | |
|  | 09657-1131 | KING PIN GUIDE | |
|  | 09654-1080 | PLATE | |
|  | 9201-12100 | NUT | |

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09657-2050 | DUST COVER GUIDE | |
|  | 09712-1080 | BAR | |

# COMPONENT LOCATOR

M08020103BED1003




M08020100113

| | | | |
|---|---|---|---|
| 1 | Knuckle arm | 16 | Tie-rod end assembly |
| 2 | Axle beam | 17 | Tie-rod arm |
| 3 | Caster shim (If so equipped) | 18 | Oil seal guide |
| 4 | Thrust washer | 19 | Oil seal |
| 5 | Lock pin | 20 | Inner wheel hub bearing |
| 6 | Thrust bearing | 21 | Wheel hub |
| 7 | Lubrication fitting | 22 | Outer wheel hub bearing |
| 8 | King pin cover | 23 | Washer |
| 9 | King pin | 24 | Hub bearing lock nut |
| 10 | Bushing | 25 | Hub cap |
| 11 | Oil seal | 26 | Cotter pin |
| 12 | Knuckle | 27 | Wheel nut |
| 13 | Stopper bolt lock nut | 28 | Hub bolt |
| 14 | Tie rod | 29 | ABS sensor ring (If so equipped) |
| 15 | Dust cover | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 146-244 {1,500-2,500, 107-179} | D | 37.5-48.5 {382-494, 27.6-35.7} |
| B | 587-783 {5,949-7,984, 430-577} | E | 150-200 {1,530-2,040, 112-148} |
| C | 19-25 {193-257, 13.9-18.3} | | |

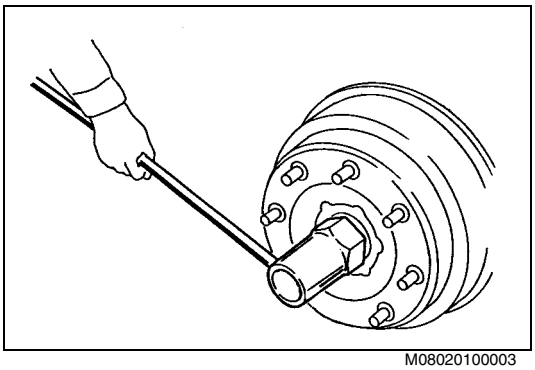
# OVERHAUL

M08020103BEH2002

## IMPORTANT POINTS - DISASSEMBLY

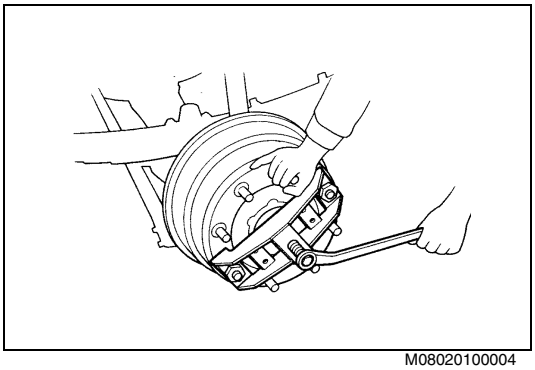
**1. REMOVAL OF THE WHEELS**

(1) Refer to chapter WHEEL AND TIRE.



M08020100003

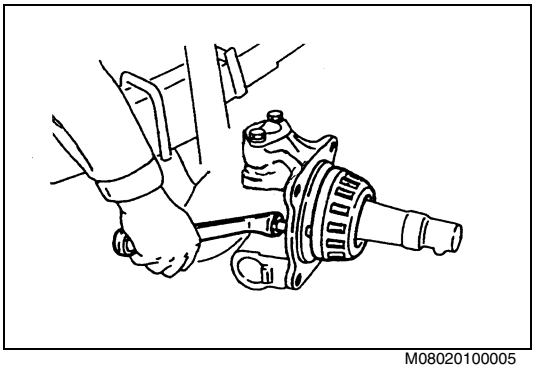
**2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT**
**SST:**
**Socket Wrench (09839-5003)**
**Handle (09849-2001)**



M08020100004

**3. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING**
**SST:**
**Wheel Hub Puller (09650-2051)**
**Handle (09849-2001)**

**NOTICE:**
**Wheel hub assembly is heavy, therefore be careful when handling it.**



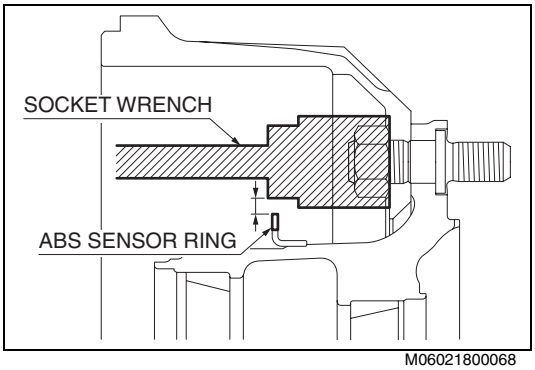
M08020100005

**4. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL GUIDE**

(1) Push out the inner wheel hub bearing and oil seal guide with 2 bolts having same size and thread pitches as of stopper bolt.

**5. REMOVAL OF THE WHEEL BRAKE**

(1) Refer to chapter SERVICE BRAKE.




M06021800068

**6. DISMOUNTING THE WHEEL BOLT**

(1) Remove the nuts.

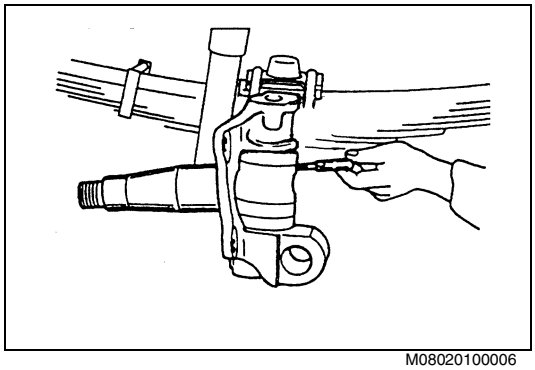
**NOTICE:**

- **Removing the nuts without ABS sensor ring, be careful not to damage the ring by tool.**

(2) Separate the wheel hub and brake drum. (If necessary)
(3) Knock through the wheel bolt using brass bar and hammer.

**NOTICE:**

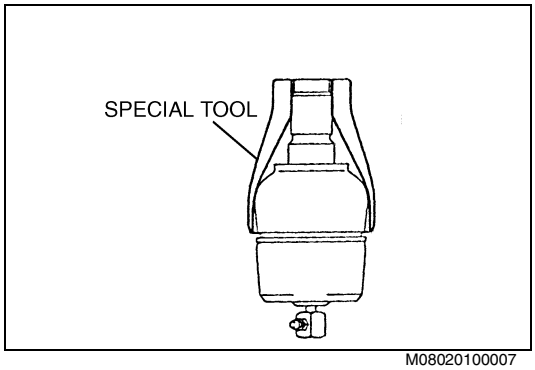
- **Put aligned marks on the wheel hub and brake drum.**


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**7. REMOVAL OF THE LOCK PIN**

(1) To prevent damage to the lock pin threading, loosen the lock pin nut until it is flush with the end of the lock pin, then hammer the nut to loosen the lock pin.

## IMPORTANT POINTS - ASSEMBLY



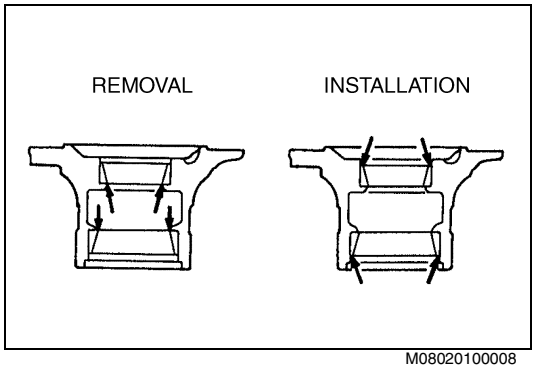
M08020100007

**1. REPLACEMENT OF THE DUST COVER.**

**NOTICE:**

**Apply lithium molybdenum sulfide grease to the inside and lip part of the dust cover.**

**SST: Dust Cover Guide (09657-2050)**

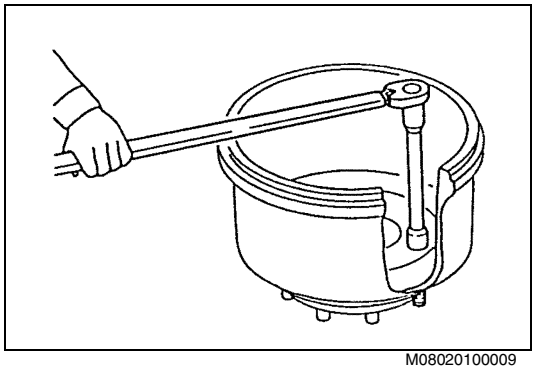


M08020100008

**2. REPLACEMENT OF THE WHEEL HUB BEARING RACE**

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

(2) To install the outer race, use a tapping rod and a hammer, or a press.


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**3. REPLACEMENT OF THE HUB BOLTS**

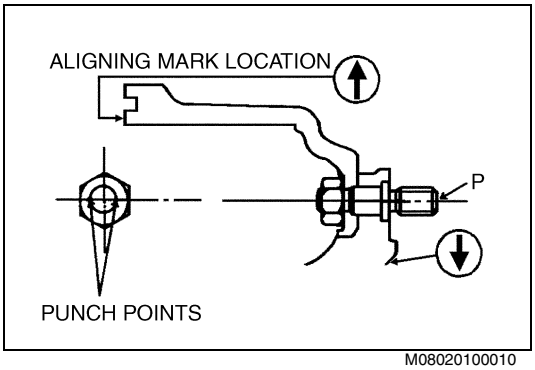
(1) Loosen the hub bolt fitting nuts and remove the hub bolts from the wheel hub.

(2) Install the new hub bolts.

**NOTICE:**

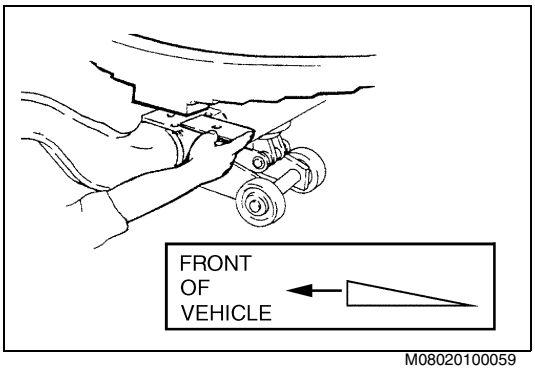
- **The right and left hub bolts differ, so install them according to the chart below.**

| | Marks at "P" | Color |
|---|---|---|
| **RIGHT** | **R** | **Gold** |
| **LEFT** | **L** | **Silver** |



M08020100010

- **After tightening the hub bolts and nuts, caulk each at 2 points with a punch.**
- **If the wheel hub and brake drum are disassembled to replace the hub bolts, reassemble them so that their aligning marks are oriented as closely to each other as possible.**

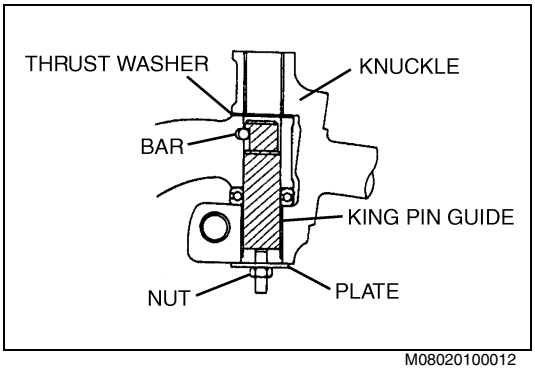


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**4. INSTALLATION OF THE AXLE BEAM**

(1) Secure the axle to the leaf springs with U-bolt.

**NOTICE:**
**Confirm the direction of caster shim.**



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**5. ADJUSTMENT OF THE CLEARANCE BETWEEN THE THRUST WASHER AND KNUCKLE**

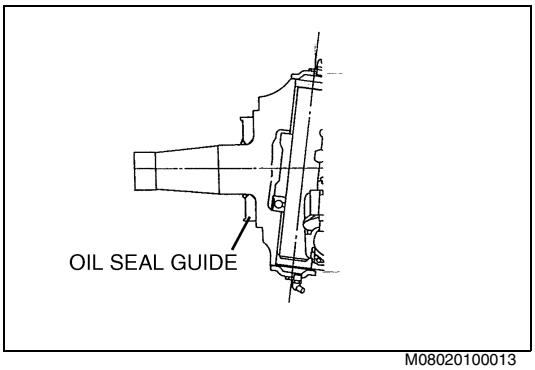
(1) Adjust the clearance with the correct thickness thrust washer.
**Clearance: Assembly Standard Less than 0.1 mm {0.0039 in.}**
**Thickness of Thrust Washer: mm {in.}**

| | | | |
|---|---|---|---|
| **1.9 {0.075}** | **2.0 {0.079}** | **2.1 {0.083}** | **2.2 {0.087}** |
| **2.3 {0.091}** | **2.4 {0.094}** | **2.5 {0.098}** | **2.6 {0.102}** |

**SST:**
**King Pin Guide (09657-1131)**
**Plate (09654-1080)**
**Nut (9201-12100)**
**Bar (09712-1080)**

**6. ASSEMBLY OF THE WHEEL BRAKE**

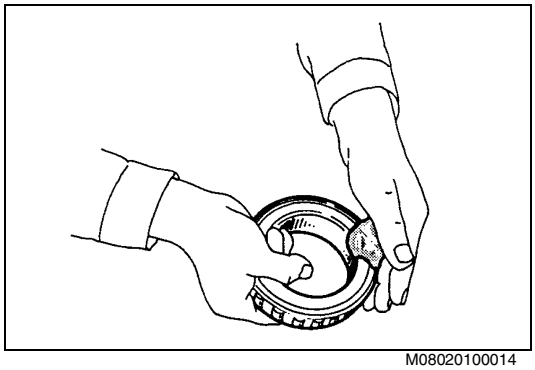
(1) Refer to chapter SERVICE BRAKE.



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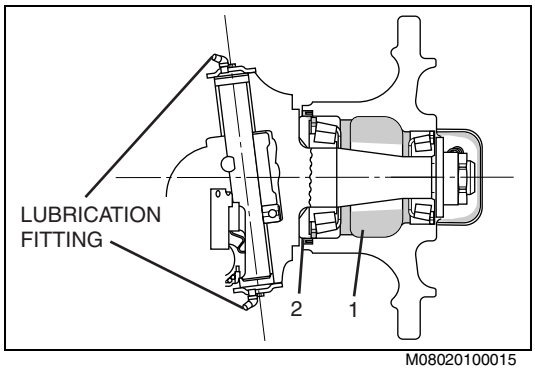
**7. INSTALLATION OF THE OIL SEAL GUIDE**

**NOTICE:**
**If the oil seal guide is warmed up with hot water , it can easily be placed.**


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**8. GREASING**

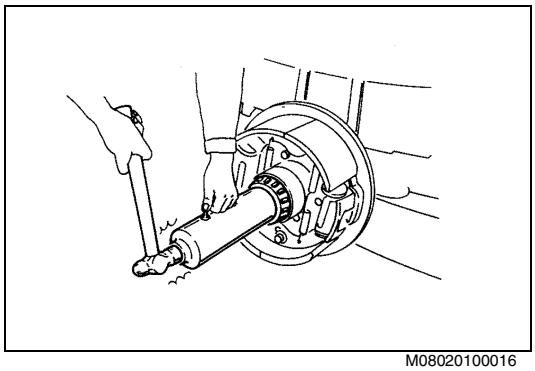
(1) Pack enough the wheel hub bearing grease between the bearing rollers.



M08020100015

(2) Apply wheel hub bearing grease to the wheel hub 1 and lip part 2 of the oil seal.

(3) Lubricate the king pin with chassis grease, using the lubrication fittings located on the two king pin covers.

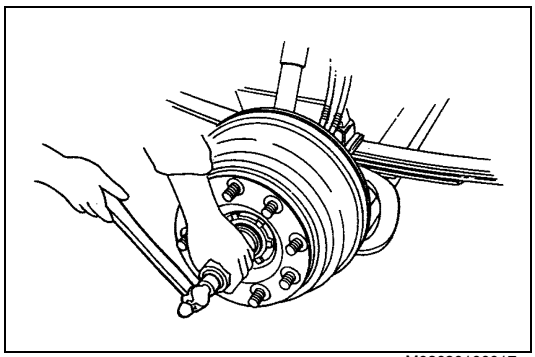

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**9. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY**

(1) Install the inner wheel hub bearing.

**NOTICE:**

- **Using a tool as shown simplifies installation.**

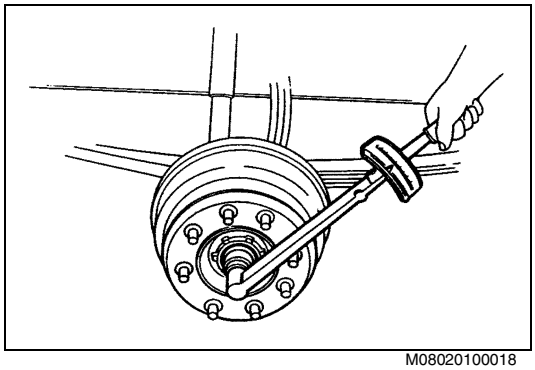

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(2) Install the oil seal in the wheel hub.

(3) Install the wheel hub assembly and the outer wheel hub bearing.

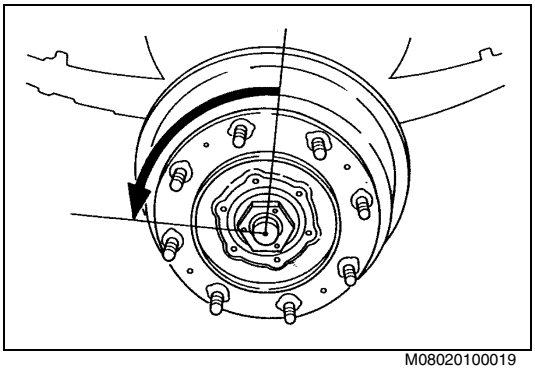
**NOTICE:**

- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**

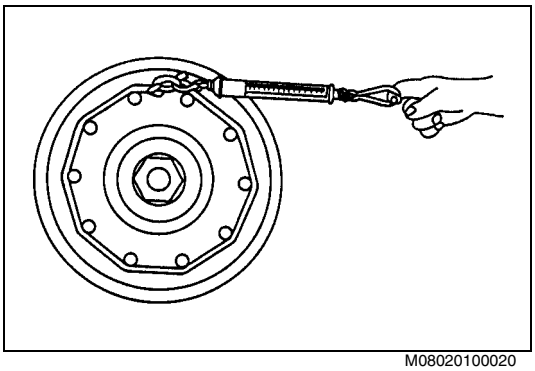

M08020100018

**10. ADJUSTMENT OF THE WHEEL HUB BEARING PRELOAD**

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/6 - 1/4 turn.
**Tightening Torque: 105 N·m {1,100 kgf·cm, 80 lbf·ft}**

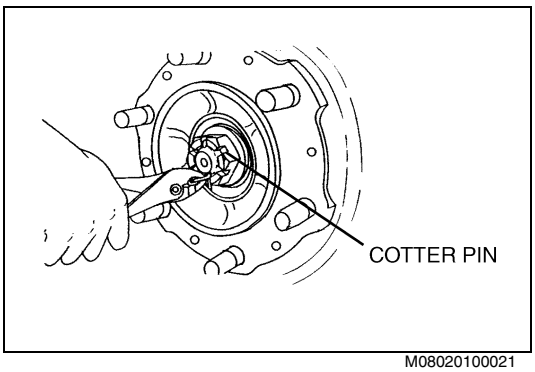

M08020100019

(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


M08020100020

(3) Measure the wheel bearing preload and adjust the preload with the lock nut, if it exceeds or is less than that specified below.

| | |
|---|---|
| **Turning Torque<br>N·m {kgf·cm, lbf·ft}** | **1.97-4.90 {20-50, 1.5-3.6}** |
| **Spring balancer reading<br>N {kgf, lbf}** | **17.6-43.1{1.8-4.4, 4.0-9.7}** |



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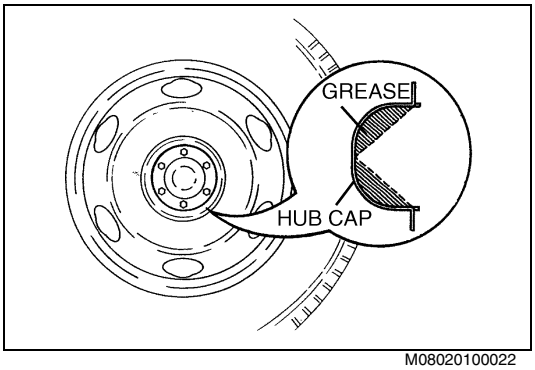
**11. INSTALLATION OF THE COTTER PIN**

**NOTICE:**

**If the holes and the nut groove are not aligned, turn the lock nut within the limits of the wheel hub bearing preload until the hole and groove are aligned.**

**12. INSTALLATION OF THE WHEELS**

(1) Refer to chapter WHEEL & TIRE.



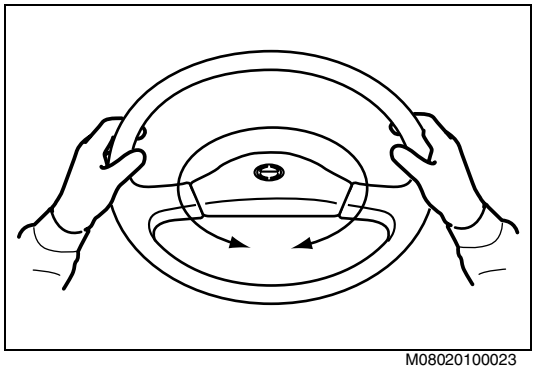
M08020100022

**13. INSTALLATION OF THE HUB CAP**

**NOTICE:**

**Apply silicon based liquid gasket (ThreeBond #1215 or equivalent) to all around the fitting part of the hub cap with the hub, then strike it with special tool.**

**SST: Hub Cap Installer (09607-1010)**



M08020100023

**14. TURN THE STEERING WHEEL TO THE FULL RANGE TO THE RIGHT AND THE LEFT, AND CONFIRM THAT ALL STEERING LINKAGES MOVE FREELY (ESPECIALLY THE BALL JOINTS).**

**15. ADJUSTMENT OF BRAKE SYSTEM AIR BLEEDING AND BRAKE SHOE CLEARANCE**

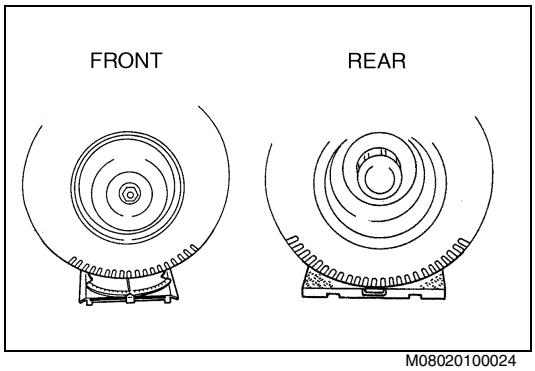
(1) On completion of the front axle overhaul, conduct the followings:

a. Bleed the air from the brake lines according to the section SERVICE BRAKE ASSEMBLY in the BRAKE EQUIPMENT chapter.

b. Adjust the brake shoe clearance according to the section WHEEL BRAKE in the SERVICE BRAKE chapter.

# INSPECTION AND ADJUSTMENT

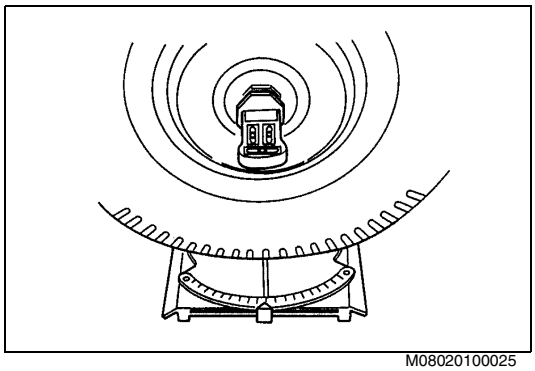
**M08020103BEH3001**




M08020100024

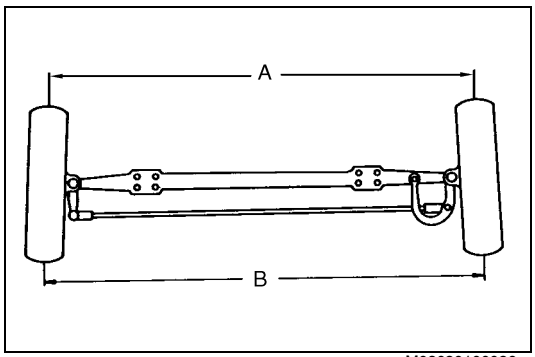
**1. INSPECTION OF THE WHEEL ALIGNMENT**

(1) Park the vehicle on a level surface and check the tire pressure.



M08020100025

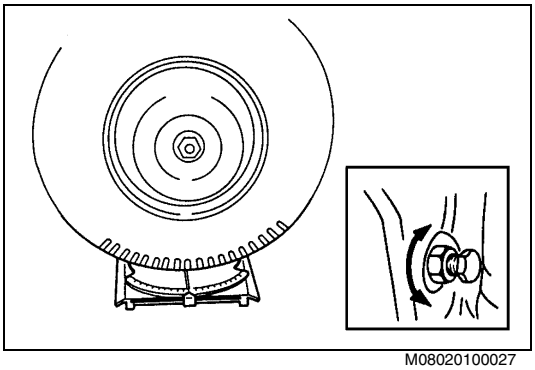
(2) Adjust the king pin inclination, caster, and camber.
Refer to DATA AND SPECIFICATIONS.




M08020100026

(3) Check the toe-in.

- **B - A =Toe-in**


M08020100027

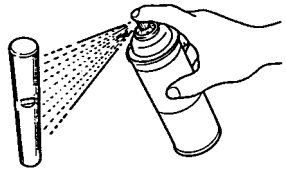
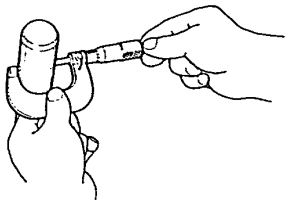
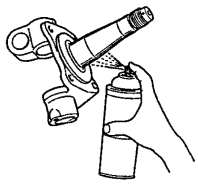
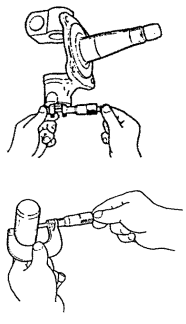
**2. ADJUSTMENT OF THE WHEEL TURNING ANGLE WITH STOPPER BOLT**

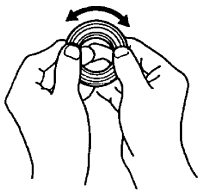
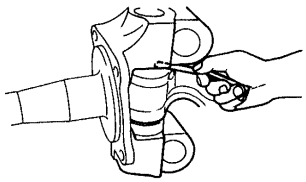
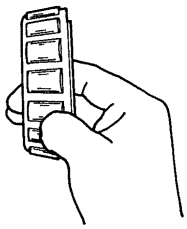
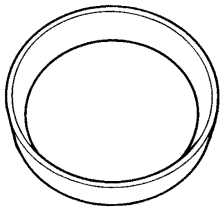
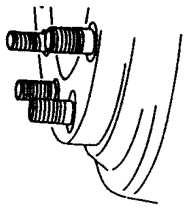
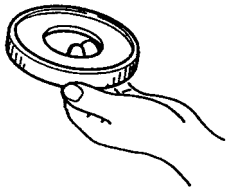
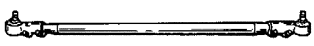
(1) Refer to DATA AND SPECIFICATIONS.

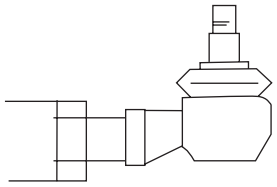
# INSPECTION AND REPAIR

M08020103BEH3003

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **King pin: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Use the magnetic flaw detector or color checking instrument.**  |
| **King pin diameter** | **35 {1.378}** | **34.85 {1.373}** | **Replace.** | **Measure**  |
| **Knuckle: Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Use the magnetic flaw detector or color checking instrument.**  |
| **King pin clearance** | **0.020-0.101 {0.0008-0.0039}** | **0.35 {0.0138}** | **Replace.** | **Measure**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Thrust bearing:<br>Burns and pitting** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Thrust washer wear (Clearance between knuckle and axle beam)** | **—** | **0.5 {0.0197}** | **Replace the thrust washer.** | **Measure**<br>  |
| **Bearing and race:<br>Burns and pitting** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| | | | **Replace, if necessary.** | **Visual check**<br>  |
| **Hub bolts:<br>Threads wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Oil seal guide:<br>Wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Tie rod:<br>Distortion** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Dust cover:<br>Crack** | **—** | **—** | **Replace.** | **Visual check**<br>  |
| **Muddy water in the cover** | **—** | **—** | **Replace the tie-rod end assembly.** | |

# FRONT AXLE (LF458)

AX02-002

**FRONT AXLE (LF458) ..... AX02-2**
DATA AND SPECIFICATIONS ..... AX02-2
DESCRIPTION ..... AX02-3
TROUBLESHOOTING ..... AX02-4
SPECIAL TOOL ..... AX02-5
COMPONENT LOCATOR ..... AX02-7
OVERHAUL ..... AX02-8
INSPECTION AND ADJUSTMENT ..... AX02-13
INSPECTION AND REPAIR ..... AX02-15

# FRONT AXLE (LF458)

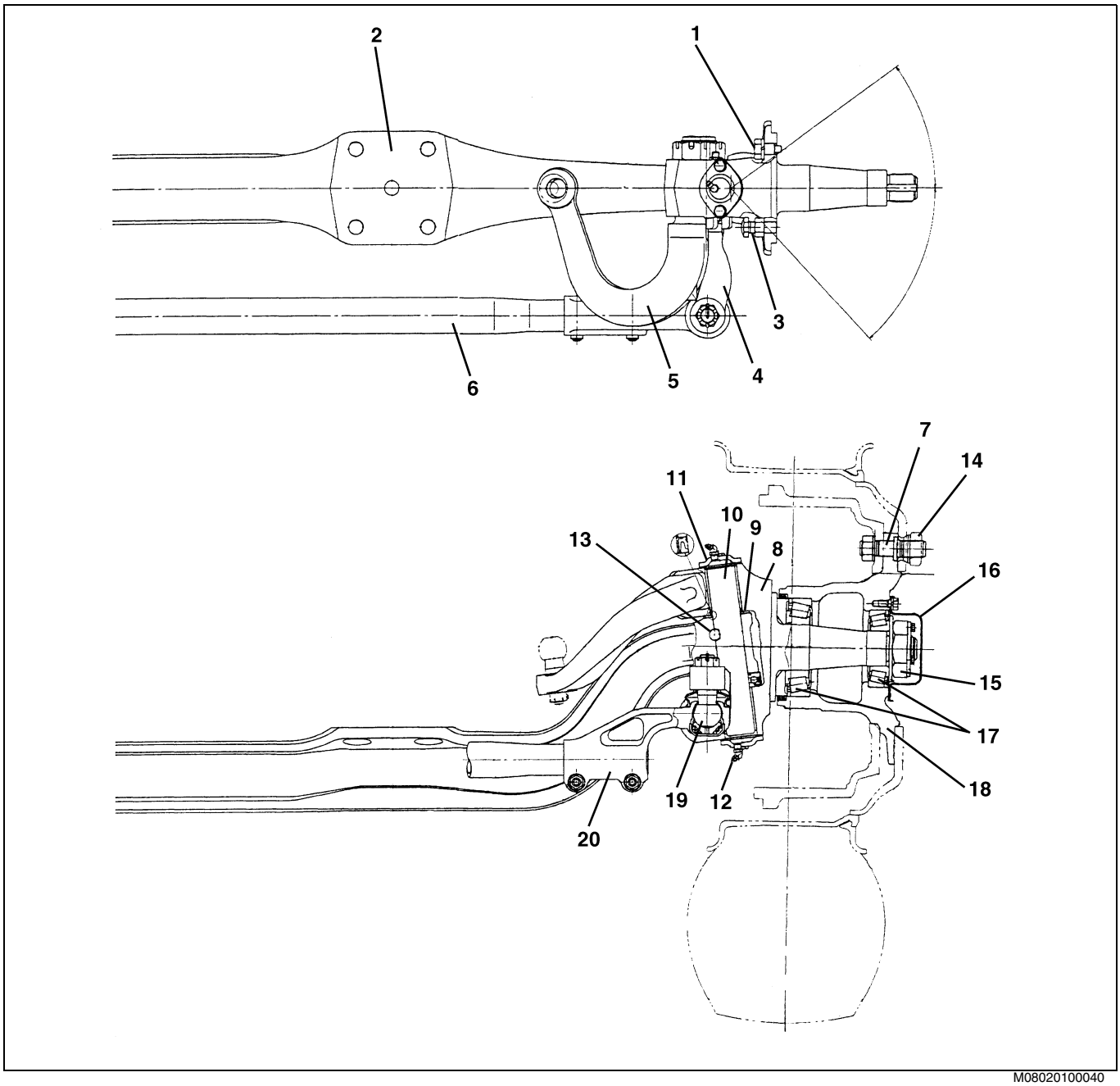
## DATA AND SPECIFICATIONS

M08020105BEI2001

| | | | |
|---|---|---|---|
| Front axle series No. | | | LF458 |
| Axle beam type | | | Reversed Elliot "I" beam |
| Axle beam material | | | Heat-treated carbon steel |
| Wheel bearing | | | Two tapered roller bearings |
| King pin thrust bearing | | | Ball bearing |
| Wheel alignment | Camber | | 0°-2° |
| | King pin angle | | 6°-8° |
| | Caster | | 2° |
| | Toe-in | Diagonal tires | 1-3 mm {0.0394-0.1181 in.} |
| | | Radial tires | 0-2 mm {0-0.0787 in.} |
| Knuckle turning angle | | Inner turn | 42°30'-45°30' |
| | | Outer turn | 35° |
| Amount of grease in a hub | | | 770 g {27.2 oz} at one wheel |

# DESCRIPTION

M08020105BEC1001




M08020100040

| | | | |
|---|---|---|---|
| 1 | Lock pin bolt | 11 | King pin cover |
| 2 | Axle beam | 12 | Lubrication fitting |
| 3 | Stopper bolt | 13 | Lock pin |
| 4 | Tie-rod arm | 14 | Wheel nut |
| 5 | Knuckle arm | 15 | Lock nut |
| 6 | Tie-rod | 16 | Hub cap |
| 7 | Hub bolt | 17 | Wheel hub bearing |
| 8 | Knuckle | 18 | Wheel hub |
| 9 | Thrust washer | 19 | Ball stud |
| 10 | King pin | 20 | Tie-rod end |

# TROUBLESHOOTING

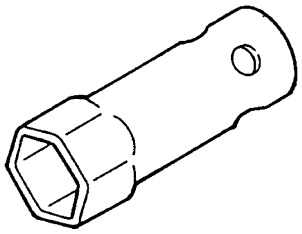
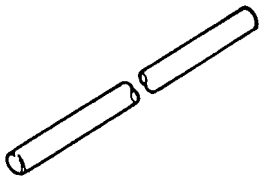
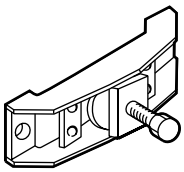
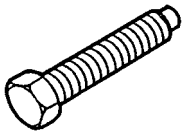
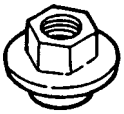
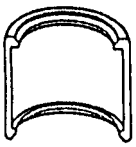
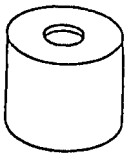
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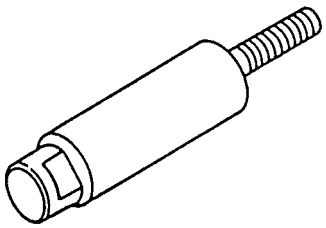
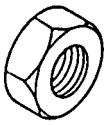
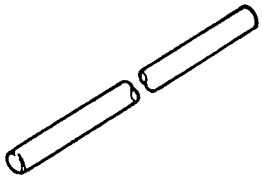
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Hard steering or poor return of steering wheel to center** | Lack of lubrication in steering linkage | Lubricate king pins and ball joints. |
| | Incorrect front wheel alignment (Toe-in angle is incorrect.) | Correct the toe-in. |
| | Incorrect front wheel alignment (Camber, caster of king pin angles are not within specifications.) | Inspect king pin bushings for wear or deflection of knuckles axle beam and tie rod, and replace if necessary. |
| | Worn out or damaged thrust bearing | Replace thrust bearings. |
| | Tire pressure is too low. | Inflate to proper pressure. |
| **Vibration or shimmy** | Incorrect front wheel alignment | Adjust or replace parts if necessary. |
| | Worn out king pin bushing | Replace king pin bushings. |
| | The preload of the wheel bearing is off. | Adjust wheel bearing preload. |
| | Badly worn hub bearings | Replace hub bearings. |
| | Loose tie-rod ends ball joints | Replace all the tie-rod ends. |
| | Loose U-bolt nuts holding the springs to the beams | Tighten the nuts properly. |
| | Loose hub nuts | Tighten the hub nuts properly. |
| | Distorted disc wheels | Replace the disc wheels. |
| | The tires are out of balance. | Balance the tires. |
| | Run-out of the tire and wheel rim | Correct the run-out of the tire and wheel rim. |
| | Tire and wheel are out of balance. | Balance the wheel using a balancing machine. |
| | Tire pressure is not uniform or sufficient. | Adjust the pressure of all tires. |
| | Other faults in the steering system | Refer to the CHAPTER, STEERING EQUIPMENT. |
| **Abnormal tire wear** | Incorrect front wheel alignment | Adjust properly or replace parts, if necessary. |
| | Improper tire pressure | Adjust to proper pressure. |
| **Grease leakage from wheel hub** | Worn out oil seal | Replace oil seal. |
| | Hub cap is not seated properly. | Fit the hub cap properly. |
| | Too much grease | Apply only the specified amount of grease. |

# SPECIAL TOOL

M08020105BEK1001

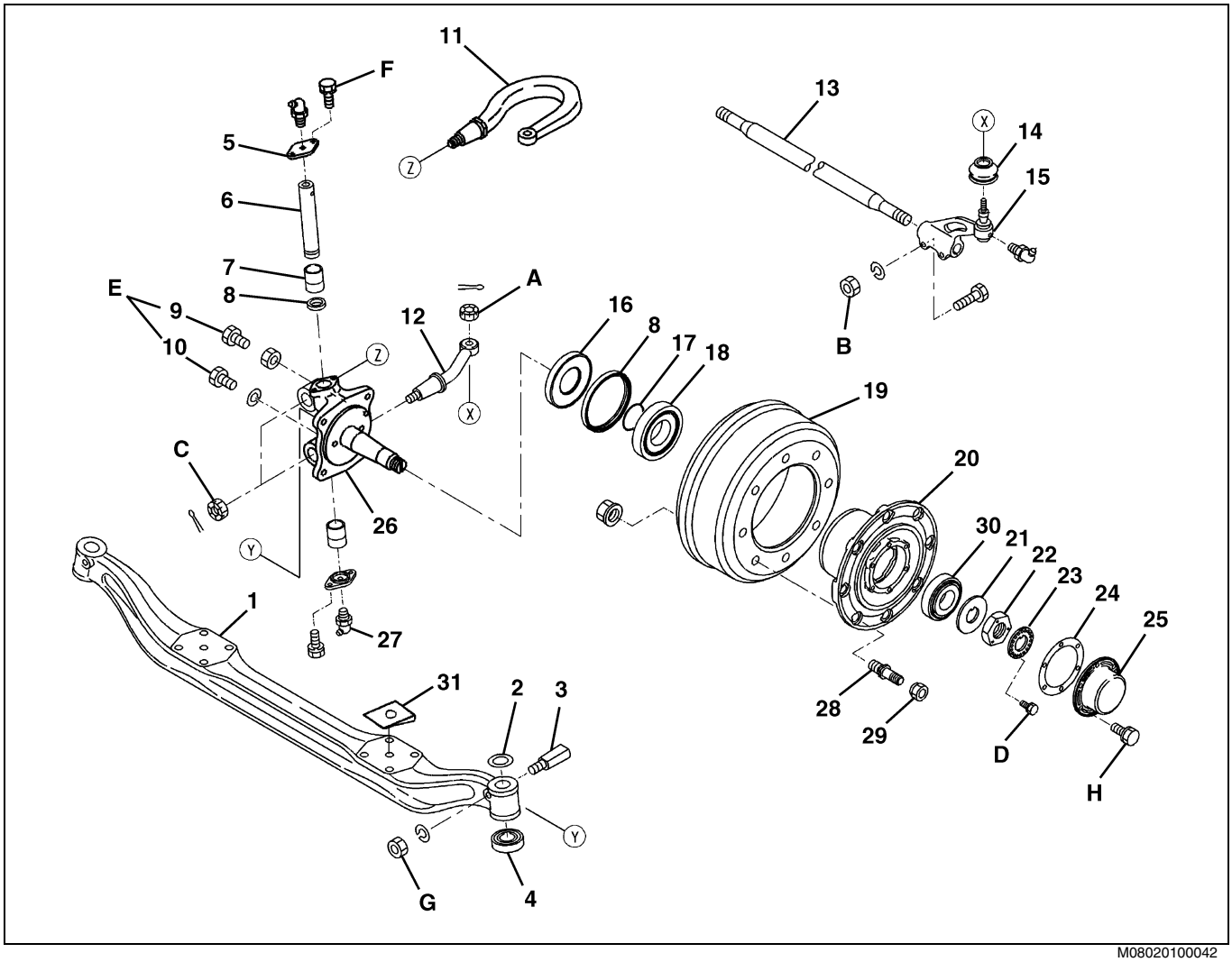
Prior to starting a front axle overhaul, it is necessary to have these special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-7001 | SOCKET WRENCH | |
|  | 09849-2001 | HANDLE | |
|  | 09650-1292 | WHEEL HUB PULLER | |
|  | 09652-1210 | PULLER SCREW | 2 PIECES |
|  | 9209-20120 | DUST COVER GUIDE NUT | |
|  | 09657-1790 | DUST COVER GUIDE (INNER) | 2 PIECES |
|  | 09657-1800 | DUST COVER GUIDE (OUTER) | |

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09657-1320 | KING PIN GUIDE | |
|  | 09654-1080 | PLATE | |
|  | 9201-12100 | NUT | |
|  | 09712-1100 | BAR | |

# COMPONENT LOCATOR

M08020105BED1001




M08020100042

| | | | |
|---|---|---|---|
| 1 | Axle beam | 17 | O-ring |
| 2 | Thrust washer | 18 | Inner wheel hub bearing |
| 3 | Lock pin | 19 | Brake drum |
| 4 | Thrust bearing | 20 | Wheel hub |
| 5 | King pin cover | 21 | Washer |
| 6 | King pin | 22 | Wheel hub bearing lock nut |
| 7 | Bushing | 23 | Lock plate |
| 8 | Oil seal | 24 | Gasket |
| 9 | Stopper bolt | 25 | Wheel hub cap |
| 10 | Lock pin bolt | 26 | Knuckle |
| 11 | Knuckle arm | 27 | Lubrication fitting |
| 12 | Tie-rod arm | 28 | Hub bolt |
| 13 | Tie rod | 29 | Wheel nut |
| 14 | Dust cover | 30 | Outer wheel hub bearing |
| 15 | Tie-rod end assembly | 31 | Caster shim |
| 16 | Oil seal guide | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

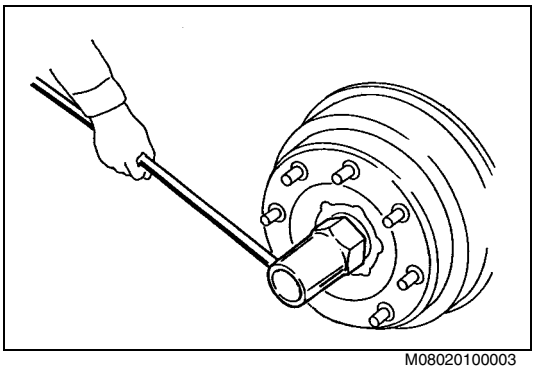
| | | | |
|---|---|---|---|
| A | 146-244 {1,500-2,500, 109-326} | E | 96-144 {1,000-1,500, 73-108} |
| B | 63.5-84.5 {650-860, 47-62} | F | 24.5-33.5 {250-341, 19-24} |
| C | 685-1,175 {7,000-12,000, 507-867} | G | 37.5-48.5 {380-500, 28-36} |
| D | 8.5-10.5 {85-110, 6.2-7.9} | H | 37.5-48.5 {380-500, 28-36} |

# OVERHAUL

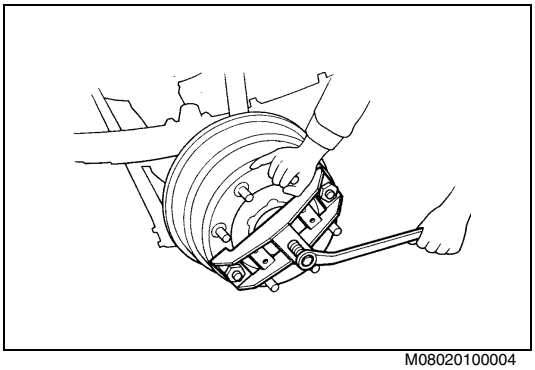
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## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF THE WHEELS**
(1) Refer to chapter WHEEL & TIRE.

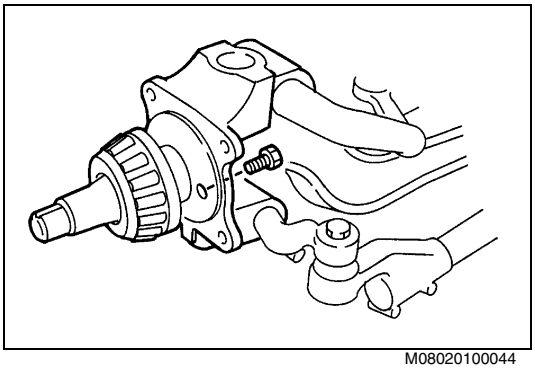

M08020100003

**2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT**
**SST:**
**Socket Wrench (09839-7001)**
**Handle (09849-2001)**


M08020100004

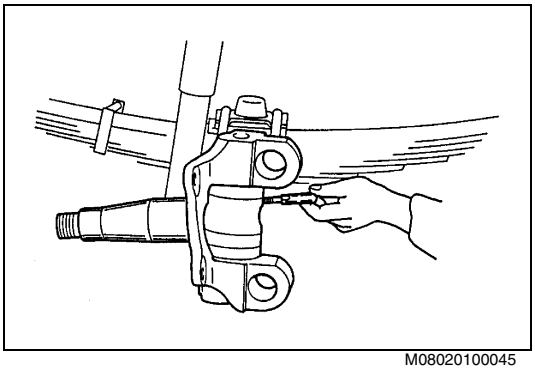
**3. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING**
**SST:**
**Wheel Hub Puller (09650-1292)**
**Handle (09849-2001)**

**NOTICE:**
**Wheel hub assembly is heavy, therefore be careful when handling it.**

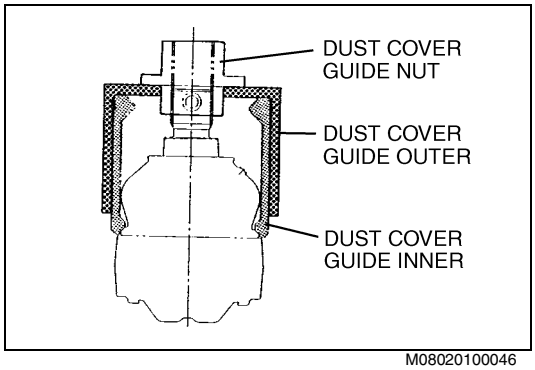

M08020100044

**4. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL GUIDE**
**SST: Screw Puller (09652-1210)**

**5. REMOVAL OF THE WHEEL BRAKE**
(1) Refer to chapter SERVICE BRAKE.


M08020100045

**6. REMOVAL OF THE LOCK PIN**
(1) To prevent damage to the lock pin threading, loosen the lock pin nut until it is flush with the end of the lock pin, then hammer the nut to loosen the lock pin.



M08020100046

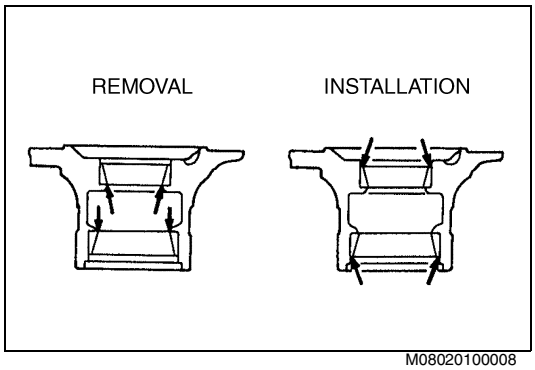
## IMPORTANT POINTS - ASSEMBLY

### 1. REPLACEMENT OF THE DUST COVER

**NOTICE:**

**Apply lithium molybdenum sulfide grease to the inside and lip part of the dust cover.**

**SST:**
**Dust Cover Guide Nut (9209-20120)**
**Dust Cover Guide Inner (09657-1790)**
**Dust Cover Guide Outer (09657-1800)**

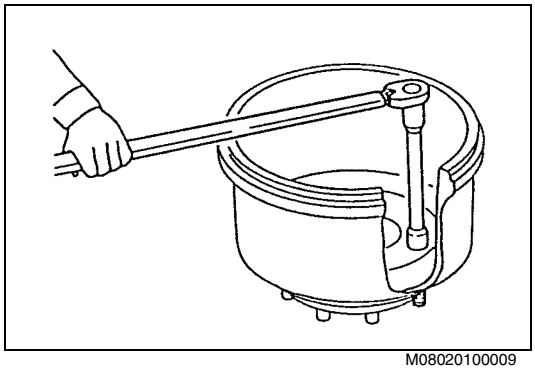


M08020100008

### 2. REPLACEMENT OF THE WHEEL HUB BEARING RACE

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

(2) To install the outer race, use a tapping rod and a hammer, or a press.


M08020100009

### 3. REPLACEMENT OF THE HUB BOLTS

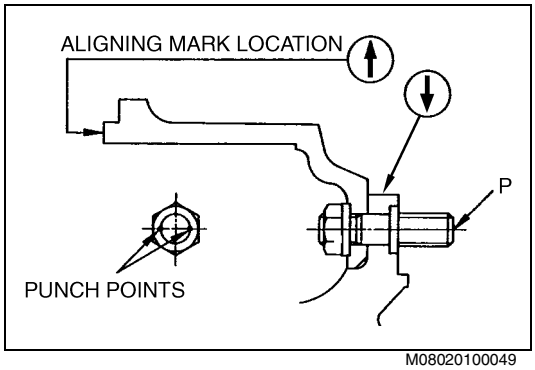
(1) Loosen the hub bolt fitting nuts and remove the hub bolts from the wheel hub.

(2) Install the new hub bolts.

**NOTICE:**

- **The left and right hub bolts differ, so install them according to the chart below.**

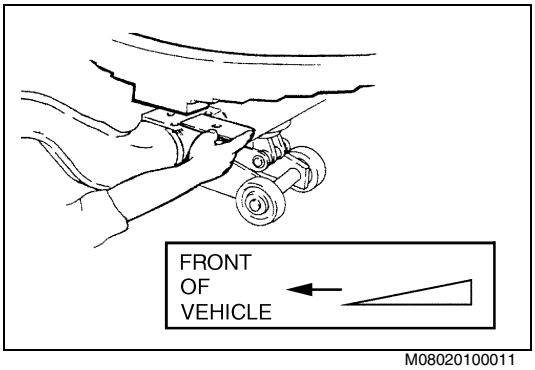
| | Marks at "P" | Color |
|---|---|---|
| **RIGHT** | **R** | **Gold** |
| **LEFT** | **L** | **Silver** |



M08020100049

**NOTICE:**

- **After tightening the hub bolts and nuts, caulk each at 2 points with a punch.**
- **If the wheel hub and brake drum are disassembled to replace the hub bolts, reassemble them so that their aligning marks are oriented as closely to each other as possible.**



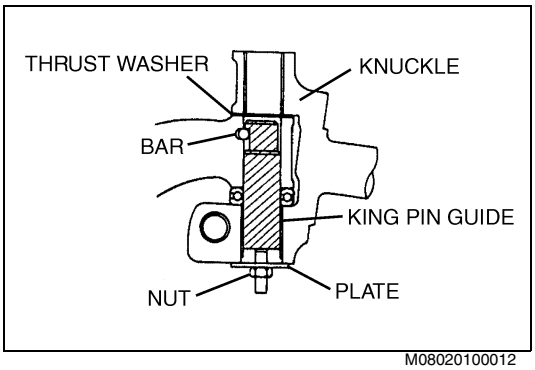
M08020100011

**4. INSTALLATION OF THE AXLE BEAM**

(1) Secure the axle to the leaf springs with "U"bolt.

**NOTICE:**

**Confirm the direction of caster shim.**



M08020100012

**5. ADJUSTMENT OF THE CLEARANCE BETWEEN THE THRUST WASHER AND KNUCKLE.**

(1) Adjust the clearance with the correct thickness thrust washer.

**Clearance:Assembly Standard: Less than 0.1 mm {0.004 in.}**

**Thickness of Thrust Washer: mm {in.}**

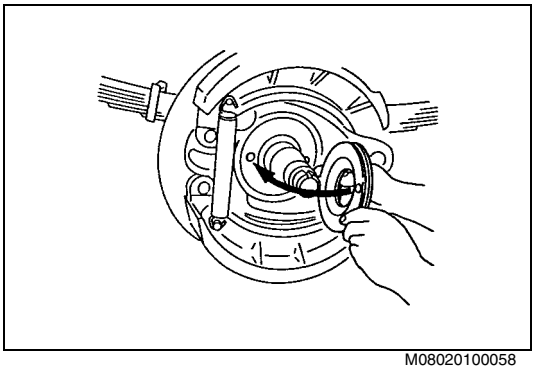
**3.1 {0.122} 3.2 {0.126} 3.3 {0.130} 3.4 {0.134}**
**3.5 {0.138} 3.6 {0.142} 3.7 {0.146} 3.8 {0.150}**

**SST:**

**King Pin Guide (09657-1320)**
**Plate (09654-1080)**
**Nut (9201-12100)**
**Bar (09712-1100)**

**6. ASSEMBLY OF THE WHEEL BRAKE**

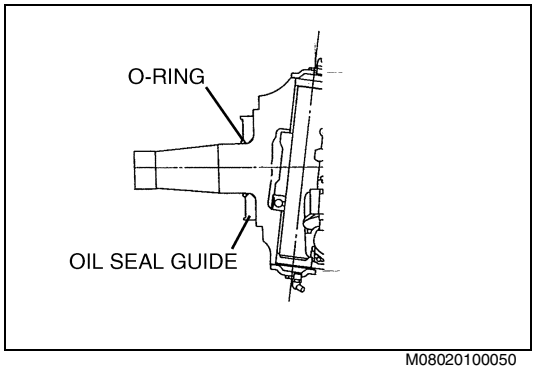
(1) Refer to chapter SERVICE BRAKE.


M08020100058

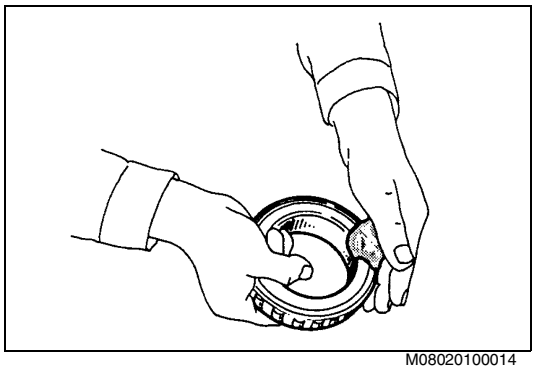
**7. INSTALLATION OF THE OIL SEAL GUIDE**

**NOTICE:**

- **Align the stopper bolt hole of the knuckle and oil seal guide hole.**
- **If oil seal guide is warmed up with hot water, it can easily be installed.**
- **Install the O-ring as shown in the figure.**

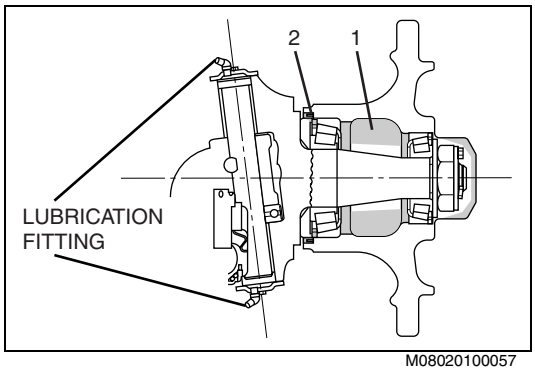


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M08020100014

**8. GREASING**

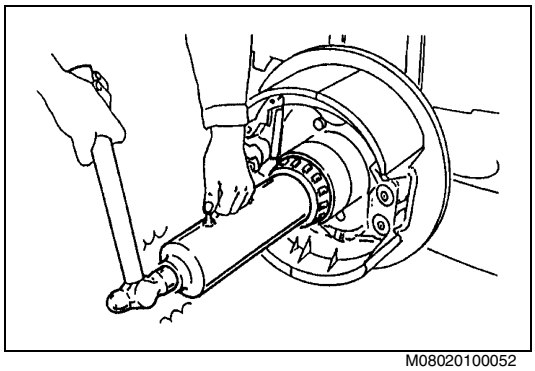
(1) Pack enough the wheel hub bearing grease between the bearing rollers.



M08020100057

(2) Apply wheel hub bearing grease to the wheel hub 1 and lip part 2 of the oil seal and wheel hub cap 3.

(3) Lubricate the king pin with chassis grease, using the lubrication fittings located on the two king pin covers.

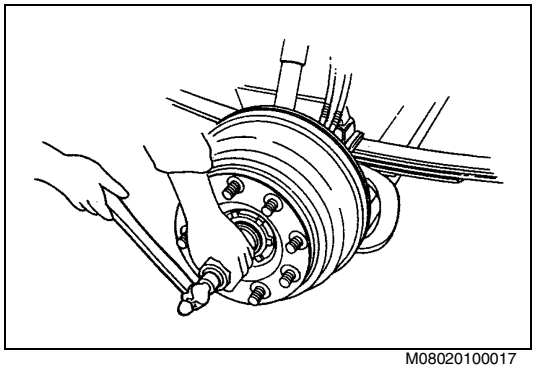

M08020100052

**9. INSTALLATION OF THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY**

(1) Install the inner wheel hub bearing.

**NOTICE:**

**Using a tool as shown, simplifies installation.**

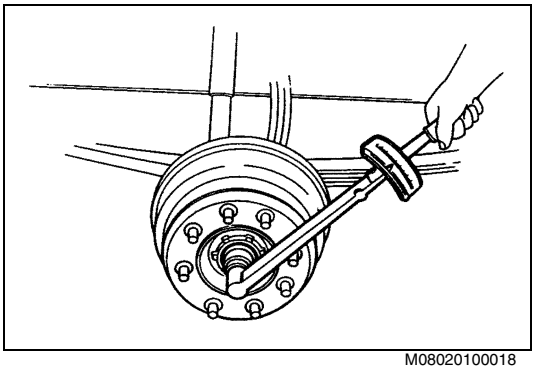

M08020100017

(2) Install the oil seal in the wheel hub.

(3) Install the wheel hub assembly and the outer wheel hub bearing.

**NOTICE:**

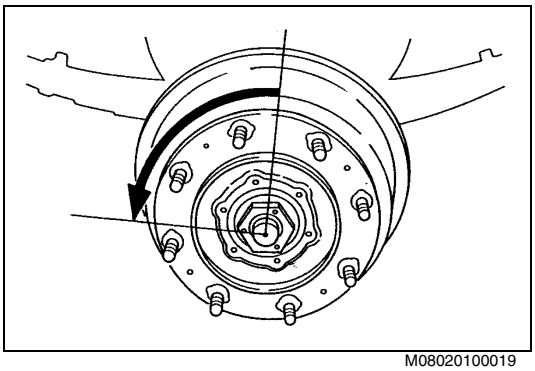
- **Using a tool as shown, simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**

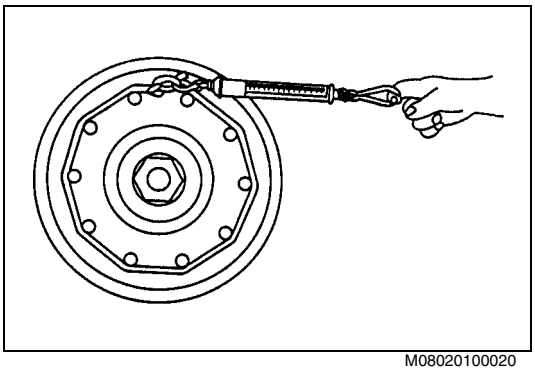

M08020100018

**10. ADJUSTMENT OF THE WHEEL HUB BEARING PRELOAD**

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/6 - 1/4 turn.
**Tightening Torque:**
**340 N·m {3,500 kgf·cm, 253 lbf·ft}**

(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.

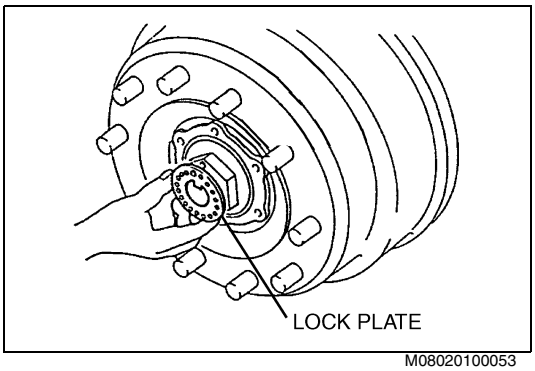

M08020100019


M08020100020

(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, adjust the preload with the lock nut.

**Assembly Standard:**

| | |
|---|---|
| **Turning Torque N·m {kgf·cm, lbf·ft}** | **3.93-6.37 {40-65, 2.9-4.6}** |
| **Spring balancer reading N {kgf, lbf}** | **27.5-44.1 {2.8-4.5, 6.2-9.9}** |



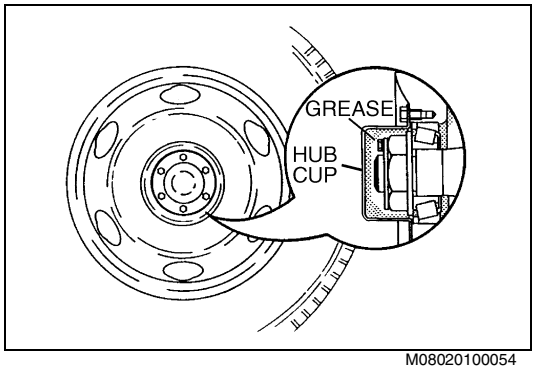
M08020100053

**11. INSTALLATION OF THE LOCK PLATE**

**NOTICE:**
- **If the holes of the plate are not aligned with the screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**

**12. INSTALLATION OF THE WHEELS**

(1) Refer to chapter WHEEL & TIRE.

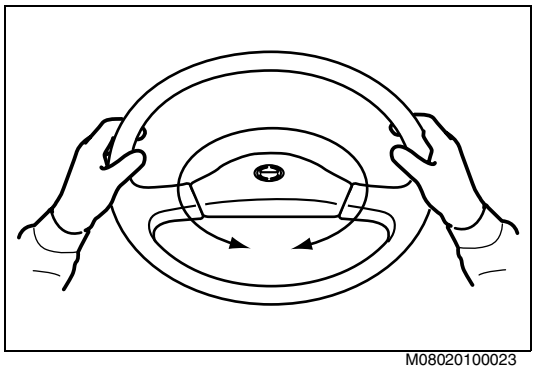


M08020100054

**13. INSTALLATION OF THE HUB CAP**

**NOTICE:**

**Before installing the cap, apply wheel hub bearing grease to the inner surface of the cap.**


M08020100023

**14. TURN THE STEERING WHEEL TO THE FULL RANGE TO THE RIGHT AND THE LEFT, AND CONFIRM THAT ALL STEERING LINKAGES MOVE FREELY(ESPECIALLY THE BALL JOINTS).**

**15. ADJUSTMENT OF THE BRAKE SYSTEM AIR BLEEDING AND THE BRAKE SHOE CLEARANCE**

(1) On completion of the wheel hub and related parts reassembly, conduct the followings:

a. Bleed the air from the brake lines according to the section SERVICE BRAKE ASSEMBLY in the BRAKE EQUIPMENT chapter.

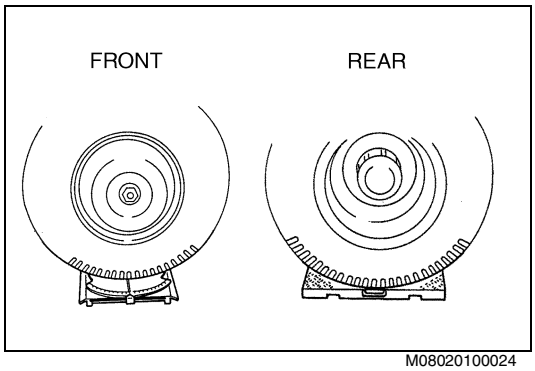
b. Adjust the brake shoe clearance according to the section WHEEL BRAKE in the SERVICE BRAKE chapter.

# INSPECTION AND ADJUSTMENT

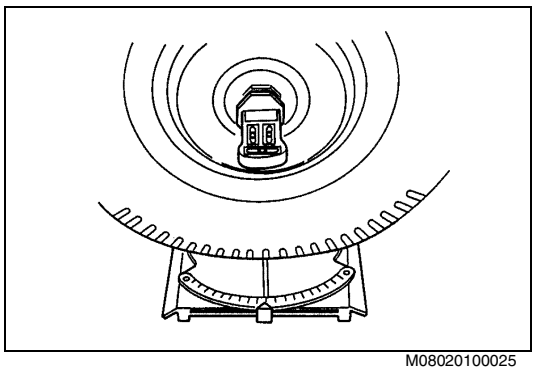
**M08020105BEH3001**

**1. INSPECTION OF THE WHEEL ALIGNMENT**

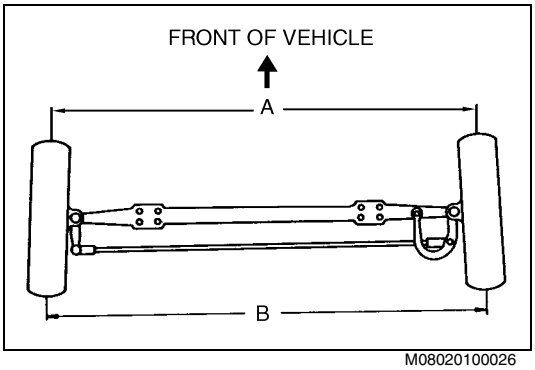
(1) Park the vehicle on a level surface and check the tire pressure.



M08020100024


M08020100025

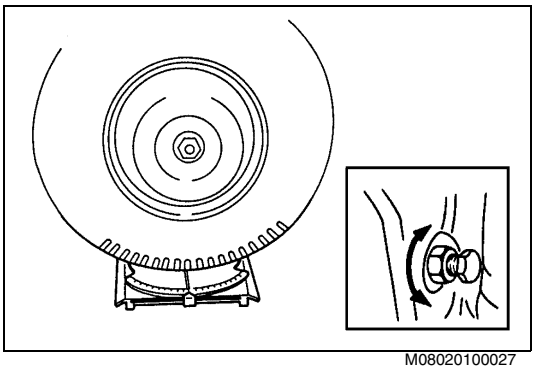
(2) Adjust the king pin inclination, caster, and camber.
Refer to DATA AND SPECIFICATIONS.



M08020100026

(3) Check the toe-in.

- **B - A =Toe-in**


M08020100027

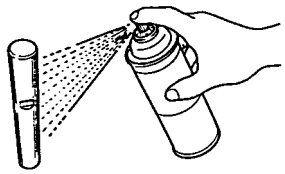
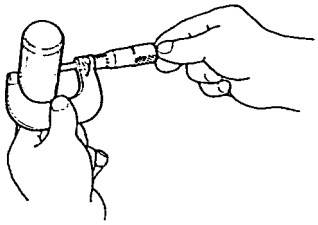
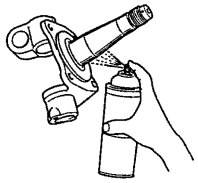
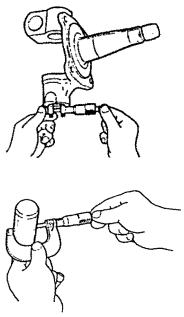
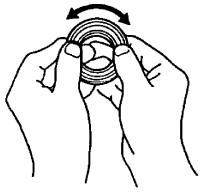
**2. ADJUSTMENT OF THE WHEEL TURNING ANGLE WITH STOPPER BOLT**

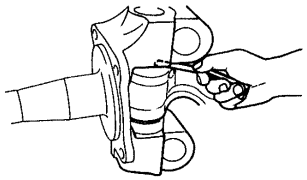
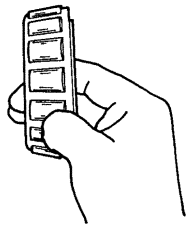
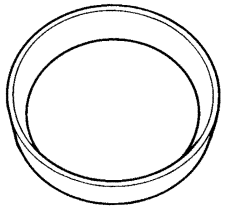
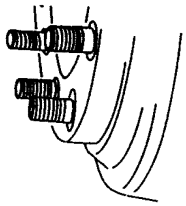
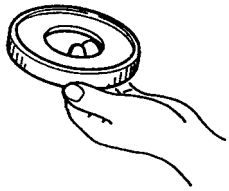
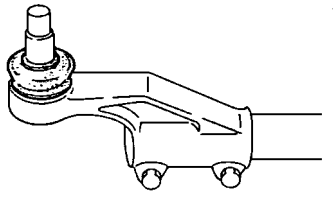
(1) Refer to DATA AND SPECIFICATIONS.

# INSPECTION AND REPAIR

M08020105BEH3002

Unit: mm {in.}

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| King pin:<br>Wear and damage | — | — | Replace, if necessary. | Use the magnetic flaw detector or color checking instrument.<br>  |
| King pin diameter | 40<br>{1.575} | 39.85<br>{1.569} | Replace. | Measure<br>  |
| Knuckle:<br>Wear and damage | — | — | Replace, if necessary. | Use the magnetic flaw detector or color checking instrument.<br>  |
| King pin clearance | 0.060-0.150<br>{0.0024-0.0059} | 0.35<br>{0.0138} | Replace. | Measure<br>  |
| Thrust bearing:<br>Burns and pitting | — | — | Replace, if necessary. | Visual check<br>  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Thrust washer wear (Clearance between knuckle and axle beam)** | **—** | **0.5 {0.0197}** | **Replace, if necessary.** | **Measure**  |
| **Bearing and race: Burns and pitting** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| | | | **Replace, if necessary.** | **Visual check**  |
| **Hub bolts: Threads wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Oil seal guide: Wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Tie rod: Distortion** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Tie-rod end and dust cover: Crack** | **—** | **—** | **Replace.** | **Visual check**  |
| **Muddy water in the cover (Sealed type ball stud)** | **—** | **—** | **Replace the tie-rod end assembly.** | |

# FRONT AXLE (MF67I)

AX02-003

**FRONT AXLE (MF67I) ..... AX02-2**
DATA AND SPECIFICATIONS ..... AX02-2
DESCRIPTION ..... AX02-3
TROUBLESHOOTING ..... AX02-4
SPECIAL TOOL ..... AX02-5
COMPONENT LOCATOR ..... AX02-7
OVERHAUL ..... AX02-8
INSPECTION AND ADJUSTMENT ..... AX02-14
INSPECTION AND REPAIR ..... AX02-15

# FRONT AXLE (MF67I)

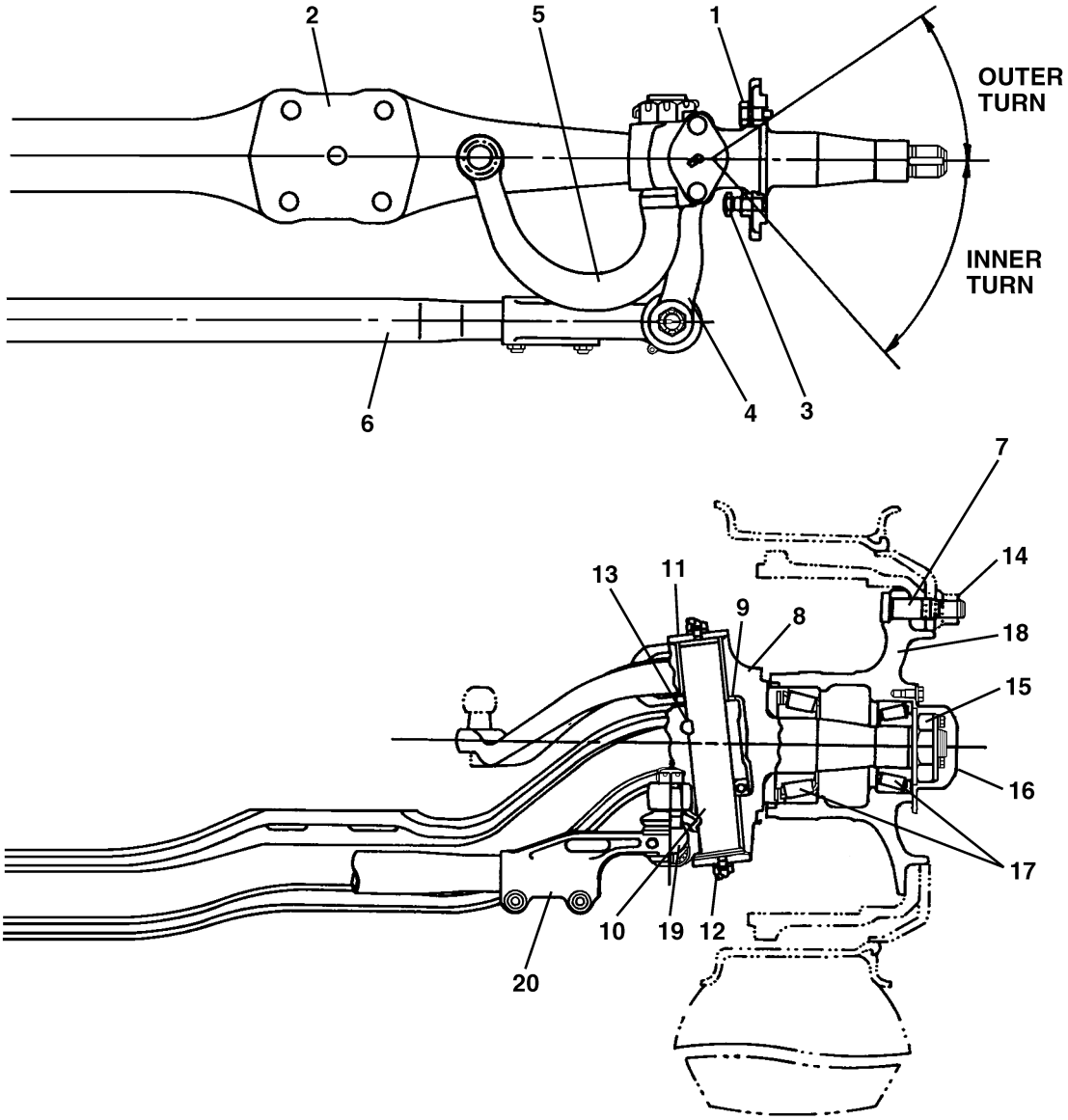
## DATA AND SPECIFICATIONS

M08020114BEI2001

| | | | |
|---|---|---|---|
| **Front axle series No.** | | | **MF67I** |
| **Axle beam type** | | | **Reversed Elliot "I" beam** |
| **Axle beam material** | | | **Chrome molybdenum steel** |
| **Wheel bearing** | | | **Two tapered roller bearings** |
| **King pin thrust bearing** | | | **Ball bearing** |
| **Wheel alignment** | **Camber** | | **0°-2°** |
| | **King pin angle** | | **6°-8°** |
| | **Caster** | | **2°** |
| | **Toe-in** | **Diagonal tires** | **1-3 mm {0.0394-0.1181 in.}** |
| | | **Radial tires** | **0-2 mm {0-0.0787 in.}** |
| **Knuckle turning angle** | | **Inner turn** | **39°30'-42°30'** |
| | | **Outer turn** | **32°** |
| **Amount of grease in a hub** | | | **600 g {21.2 oz} at one wheel** |

# DESCRIPTION

M08020114BEC1001




M08020100115

| | | | |
|---|---|---|---|
| 1 | Lock pin bolt | 11 | King pin cover |
| 2 | Axle beam | 12 | Lubrication fitting |
| 3 | Stopper bolt | 13 | Lock pin |
| 4 | Tie-rod arm | 14 | Wheel nut |
| 5 | Knuckle arm | 15 | Lock nut |
| 6 | Tie-rod | 16 | Hub cap |
| 7 | Hub bolt | 17 | Wheel hub bearing |
| 8 | Knuckle | 18 | Wheel hub |
| 9 | Thrust washer | 19 | Ball stud |
| 10 | King pin | 20 | Tie-rod end |

# TROUBLESHOOTING

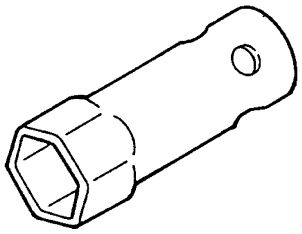
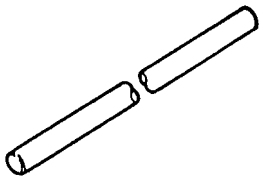
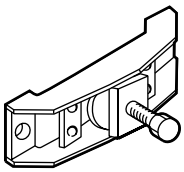
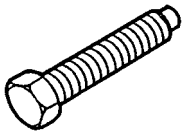
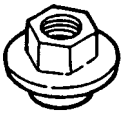
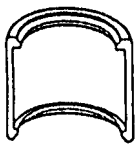
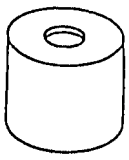
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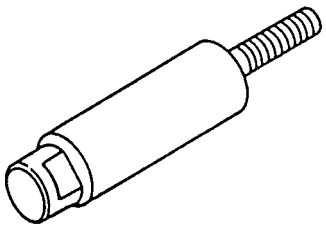
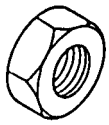
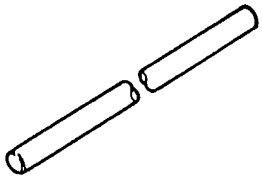
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Hard steering or poor return of steering wheel to center** | Lack of lubrication in steering linkage | Lubricate king pins and ball joints. |
| | Incorrect front wheel alignment (Toe-in angle is incorrect.) | Correct the toe-in. |
| | Incorrect front wheel alignment (Camber, caster of king pin angles are not within specifications.) | Inspect king pin bushings for wear or deflection of knuckles axle beam and tie rod, and replace if necessary. |
| | Worn out or damaged thrust bearing | Replace thrust bearings. |
| | Tire pressure is too low | Inflate to proper pressure. |
| **Vibration or shimmy** | Incorrect front wheel alignment | Adjust or replace parts if necessary. |
| | Worn out king pin bushing | Replace king pin bushings. |
| | The preload of the wheel bearing is off | Adjust wheel bearing preload. |
| | Badly worn hub bearings | Replace hub bearings. |
| | Loose tie-rod ends ball joints | Replace all the tie-rod ends. |
| | Loose U-bolt nuts holding the springs to the beams | Tighten the nuts properly. |
| | Loose hub nuts | Tighten the hub nuts properly. |
| | Distorted disc wheels | Replace the disc wheels. |
| | The tires are out of balance | Balance the tires. |
| | Run-out of the tire and wheel rim | Correct the run-out of the tire and wheel rim. |
| | Tire and wheel are out of balance | Balance the wheel using a balancing machine. |
| | Tire pressure is not uniform or sufficient | Adjust the pressure of all tires. |
| | Other faults in the steering system | Refer to the CHAPTER, STEERING EQUIPMENT. |
| **Abnormal tire wear** | Incorrect front wheel alignment | Adjust properly or replace parts, if necessary. |
| | Improper tire pressure | Adjust to proper pressure. |
| **Grease leakage from wheel hub** | Worn out oil seal | Replace oil seal. |
| | Hub cap bolts are not tightened properly | Tighten the bolts properly. |
| | Too much grease | Apply only the specified amount of grease. |

# SPECIAL TOOL

M08020114BEK1001

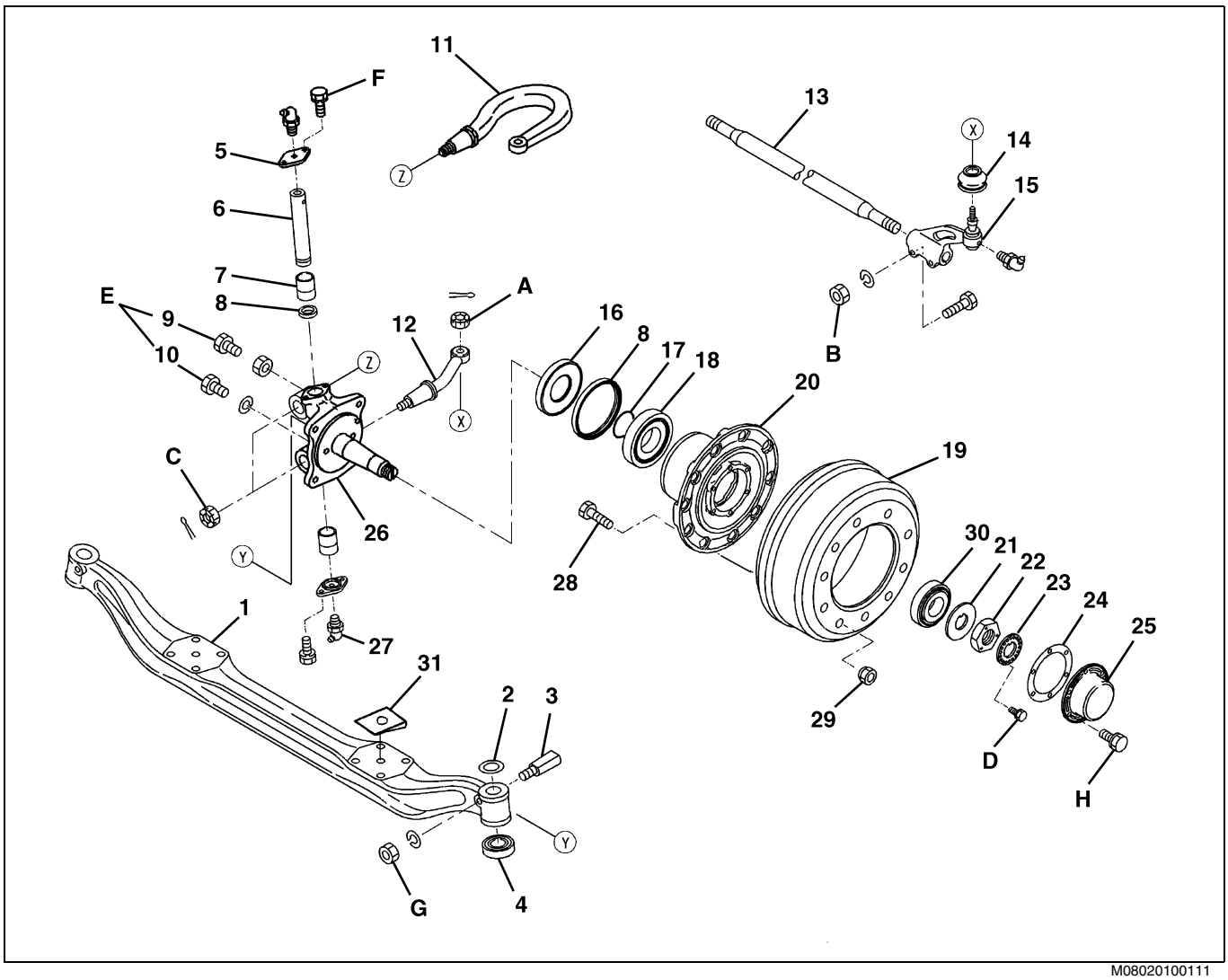
Prior to starting a front axle overhaul, it is necessary to have these special tool.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-7001 | SOCKET WRENCH | |
|  | 09849-2001 | HANDLE | |
|  | 09650-1292 | WHEEL HUB PULLER | |
|  | 09652-1210 | PULLER SCREW | 2 PIECES |
|  | 9209-20120 | DUST COVER GUIDE NUT | |
|  | 09657-1790 | DUST COVER GUIDE (INNER) | 2 PIECES |
|  | 09657-1800 | DUST COVER GUIDE (OUTER) | |

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09657-1320 | KING PIN GUIDE | |
|  | 09654-1080 | PLATE | |
|  | 9201-12100 | NUT | |
|  | 09712-1100 | BAR | |

# COMPONENT LOCATOR

M08020114BED1001




M08020100111

| | | | |
|---|---|---|---|
| 1 | Axle beam | 17 | O-ring |
| 2 | Thrust washer | 18 | Inner wheel hub bearing |
| 3 | Lock pin | 19 | Brake drum |
| 4 | Thrust bearing | 20 | Wheel hub |
| 5 | King pin cover | 21 | Washer |
| 6 | King pin | 22 | Wheel hub bearing lock nut |
| 7 | Bushing | 23 | Lock plate |
| 8 | Oil seal | 24 | Gasket |
| 9 | Stopper bolt | 25 | Wheel hub cap |
| 10 | Lock pin bolt | 26 | Knuckle |
| 11 | Knuckle arm | 27 | Lubrication fitting |
| 12 | Tie-rod arm | 28 | Hub bolt |
| 13 | Tie rod | 29 | Wheel nut |
| 14 | Dust cover | 30 | Outer wheel hub bearing |
| 15 | Tie-rod end assembly | 31 | Caster shim |
| 16 | Oil seal guide | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 147-343 {1,500-3,500, 109-253} | E | 96-144 {1,000-1,500, 73-108} |
| B | 85.5-114.5 {900-1,200, 66-86} | F | 105.5-144.5 {1,100-1,500, 80-108} |
| C | 685-1,175 {7,000-12,000, 507-867} | G | 37.5-48.5 {380-500, 28-36} |
| D | 8.5-10.5 {85-110, 6.2-7.9} | H | 37.5-48.5 {380-500, 28-36} |

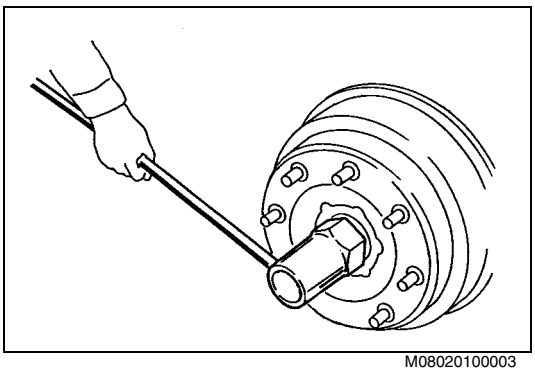
# OVERHAUL

M08020114BEH2001

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF THE WHEELS**
(1) Refer to chapter WHEEL & TIRE.

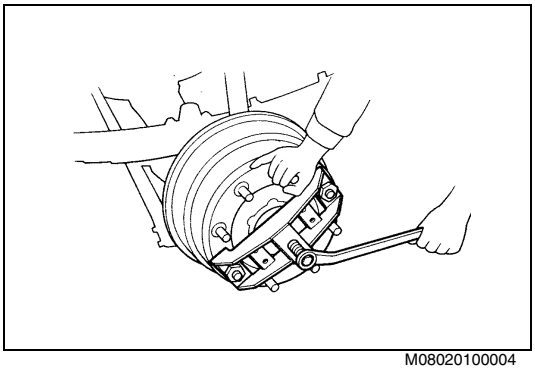
**2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT**
**SST:**
**Socket Wrench (09839-7001)**
**Handle (09849-2001)**



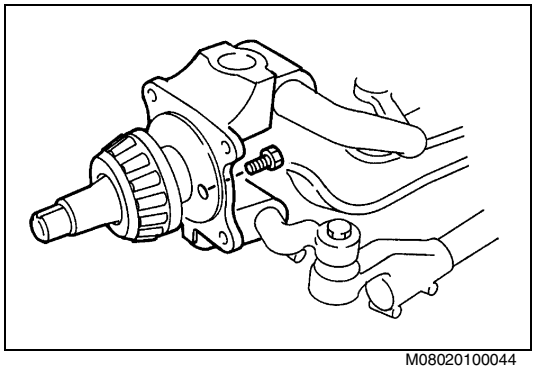
M08020100003

**3. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING**
**SST:**
**Wheel Hub Puller (09650-1292)**
**Handle (09849-2001)**

**NOTICE:**
**Wheel hub assembly is heavy, therefore be careful when handling it.**

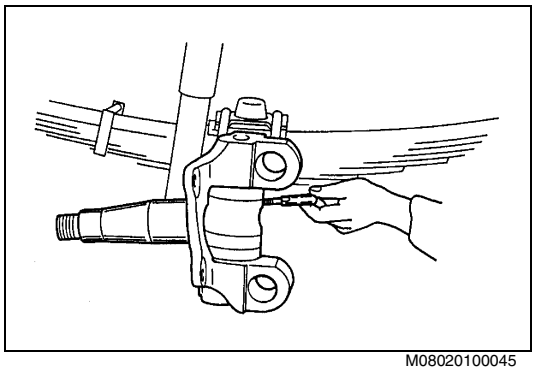


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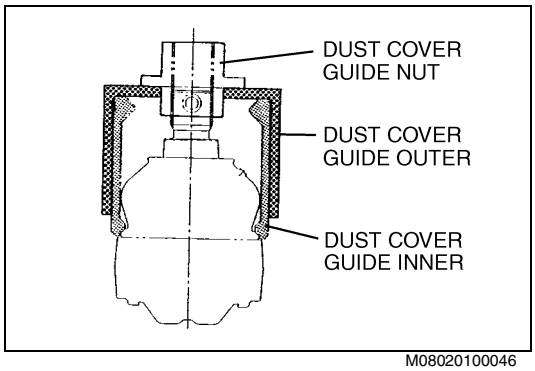
**4. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL GUIDE**
**SST: Screw Puller (09652-1210)**

**5. REMOVAL OF THE WHEEL BRAKE**
(1) Refer to chapter SERVICE BRAKE.


M08020100045

**6. REMOVAL OF THE LOCK PIN**
(1) To prevent damage to the lock pin threading, loosen the lock pin nut until it is flush with the end of the lock pin, then hammer the nut to loosen the lock pin.

## IMPORTANT POINTS - ASSEMBLY

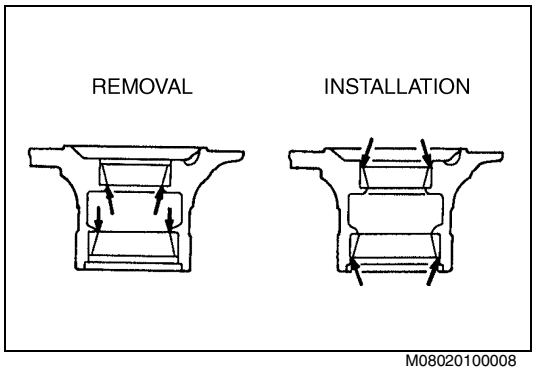


M08020100046

**1. REPLACEMENT OF THE DUST COVER**

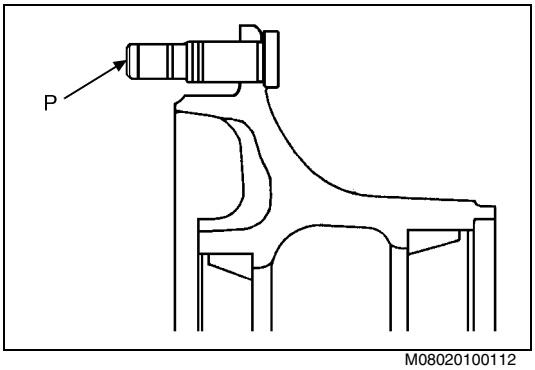
**NOTICE:**
**Apply lithium molybdenum sulfide grease to the inside and lip part of the dust cover.**

**SST:**
**Dust Cover Guide Nut (9209-20120)**
**Dust Cover Guide Inner (09657-1790)**
**Dust Cover Guide Outer (09657-1800)**



M08020100008

**2. REPLACEMENT OF THE WHEEL HUB BEARING RACE**
(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.
(2) To install the outer race, use a tapping rod and a hammer, or a press.



M08020100112

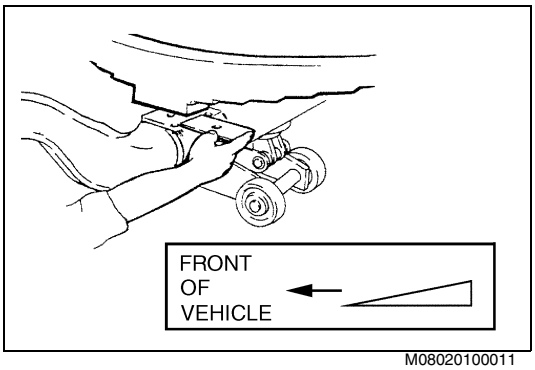
### 3. REPLACEMENT OF THE HUB BOLTS

(1) Remove the hub bolts from the wheel hub.
(2) Install the new hub bolts.

**NOTICE:**

- **The right and left hub bolts differ, so install them according to the chart below.**

| | Marks at "P" | Color |
|---|---|---|
| **RIGHT** | **R** | **Gold** |
| **LEFT** | **L** | **Silver** |



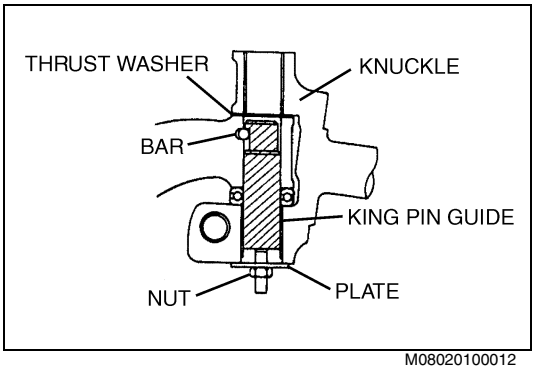
M08020100011

### 4. INSTALLATION OF THE AXLE BEAM

(1) Secure the axle to the leaf springs with U-bolts.

**NOTICE:**

**Confirm the direction of caster shim.**



M08020100012

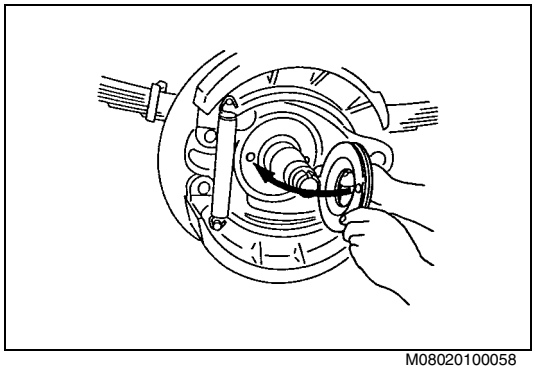
### 5. ADJUSTMENT OF THE CLEARANCE BETWEEN THE THRUST WASHER AND KNUCKLE

(1) Adjust the clearance with the correct thickness thrust washer.
**Assembly Standard: Less than 0.1 mm {0.004 in.}**
**Thickness of Thrust Washer: mm {in.}**
**3.2 {0.126} 3.3 {0.130} 3.4 {0.134} 3.5 {0.138}**
**3.6 {0.142} 3.7 {0.146} 3.8 {0.150}**

**SST:**
**King Pin Guide (09657-1320)**
**Plate (09654-1080)**
**Nut (9201-12100)**
**Bar (09712-1100)**

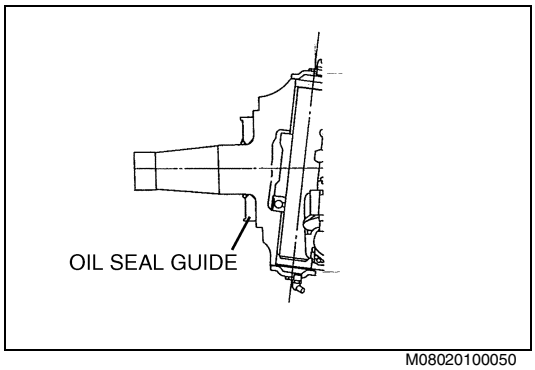
### 6. ASSEMBLY OF THE WHEEL BRAKE

(1) Refer to chapter SERVICE BRAKE.

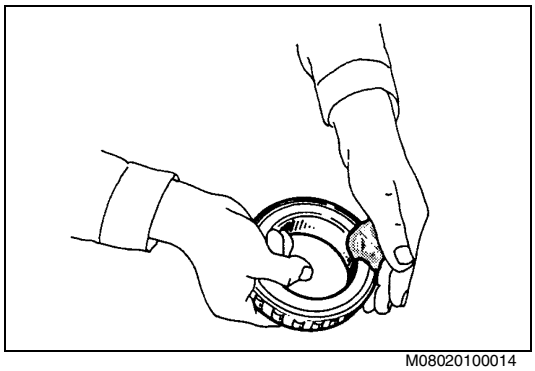

M08020100058

**7. INSTALLATION OF THE OIL SEAL GUIDE**

**NOTICE:**
- **Align the stopper bolt hole of the knuckle and oil seal guide hole.**
- **If oil seal guide is warmed up with hot water, it can easily be installed.**
- **Install the O-ring as shown in the figure.**

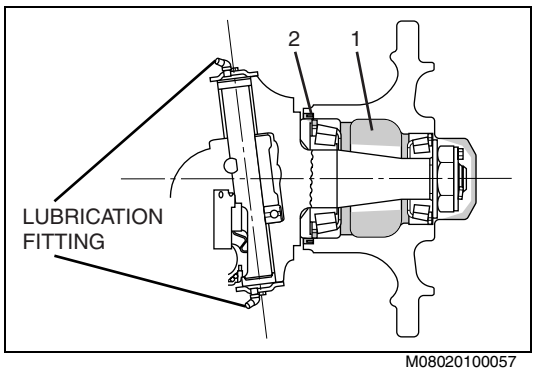


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**8. GREASING**

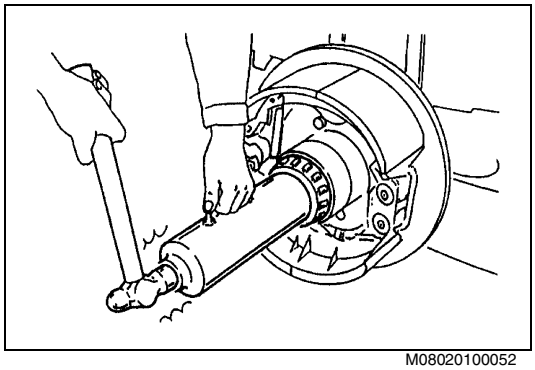
(1) Pack enough the wheel hub bearing grease between the bearing rollers.



M08020100057

(2) Apply wheel hub bearing grease to the wheel hub 1 and lip part 2 of the oil seal and wheel hub cap 3.

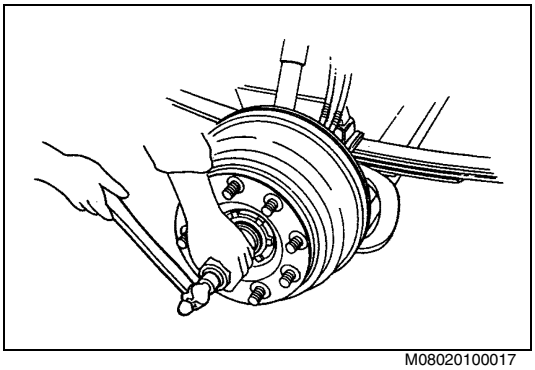
(3) Lubricate the king pin with chassis grease, using the lubrication fittings located on the two king pin covers.


M08020100052

**9. INSTALLATION OF THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY**

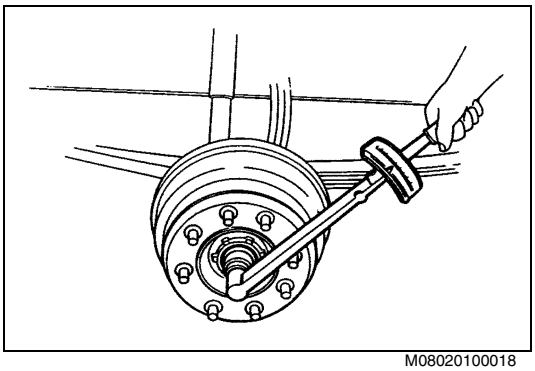
(1) Install the inner wheel hub bearing.

**NOTICE:**
**Using a tool as shown, simplifies installation.**


M08020100017

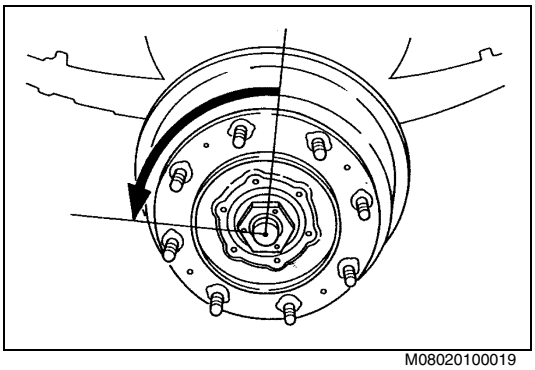
(2) Install the oil seal in the wheel hub.
(3) Install the wheel hub assembly and the outer wheel hub bearing.

**NOTICE:**
- **Using a tool as shown, simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


M08020100018

**10. ADJUSTMENT OF THE WHEEL HUB BEARING PRELOAD**

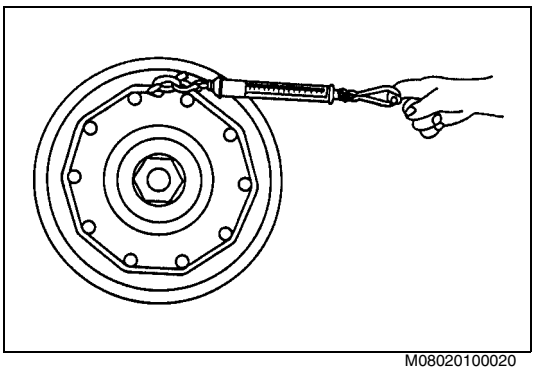
(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/6 - 1/4 turn.
**Tightening Torque:**
**340 N·m {3,500 kgf·cm, 253 lbf·ft}**

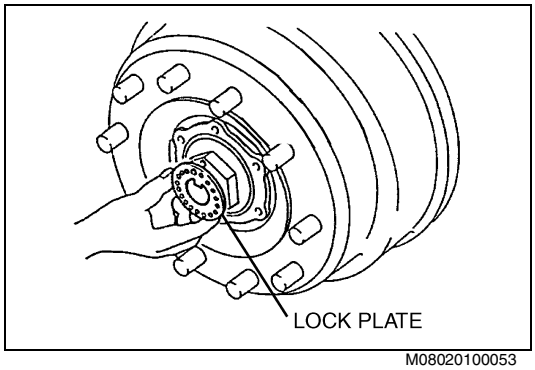

M08020100019

(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.
(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, and adjust the preload with the lock nut.

**Assembly Standard:**

| | |
|---|---|
| **Turning Torque N·m {kgf·cm, lbf·ft}** | **3.93-6.37 {40-65, 2.9-4.6}** |
| **Spring balancer reading N {kgf, lbf}** | **27.5-44.1 {2.8-4.5, 6.2-9.9}** |


M08020100020



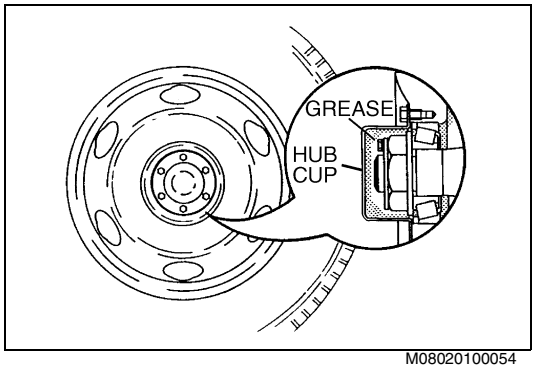
M08020100053

**11. INSTALLATION OF THE LOCK PLATE**

**NOTICE:**
- **If the holes of the plate are not aligned with the screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**

**12. INSTALLATION OF THE WHEELS**

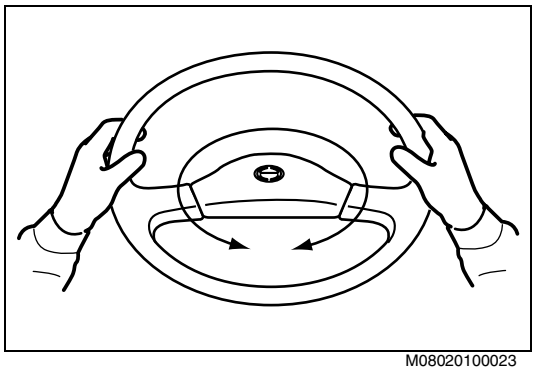
(1) Refer to chapter WHEEL & TIRE.



M08020100054

**13. INSTALLATION OF THE HUB CAP**

**NOTICE:**
**Before installing the cap, apply wheel hub bearing grease to the inner surface of the cap.**


M08020100023

**14. TURN THE STEERING WHEEL TO THE FULL RANGE TO THE RIGHT AND THE LEFT, AND CONFIRM THAT ALL STEERING LINKAGES MOVE FREELY(ESPECIALLY THE BALL JOINTS).**

**15. ADJUSTMENT OF THE BRAKE SYSTEM AIR BLEEDING AND THE BRAKE SHOE CLEARANCE**

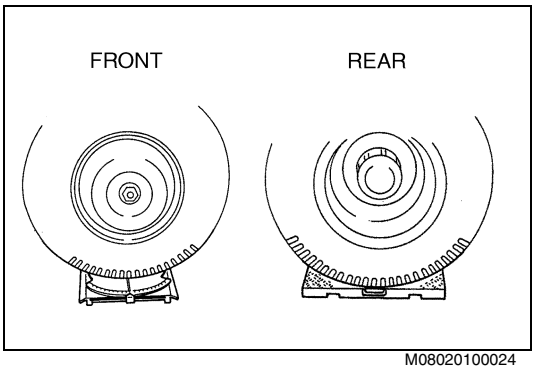
(1) On completion of the wheel hub and related parts reassembly, conduct the followings:

a. Bleed the air from the brake lines according to the section SERVICE BRAKE ASSEMBLY in the BRAKE EQUIPMENT chapter.

b. Adjust the brake shoe clearance according to the section WHEEL BRAKE in the SERVICE BRAKE chapter.

# INSPECTION AND ADJUSTMENT

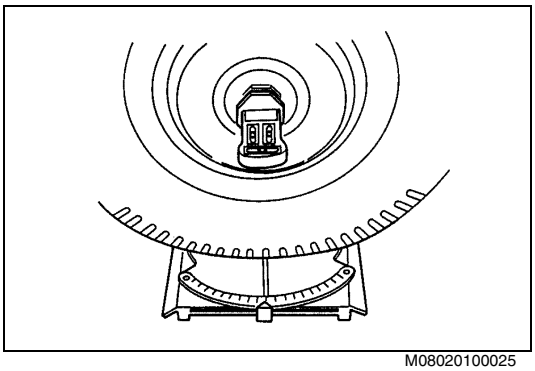
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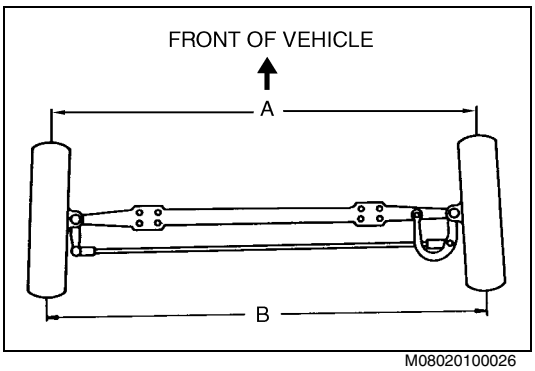
M08020100024

**1. INSPECTION OF THE WHEEL ALIGNMENT**

(1) Park the vehicle on a level surface and check the tire pressure.


M08020100025

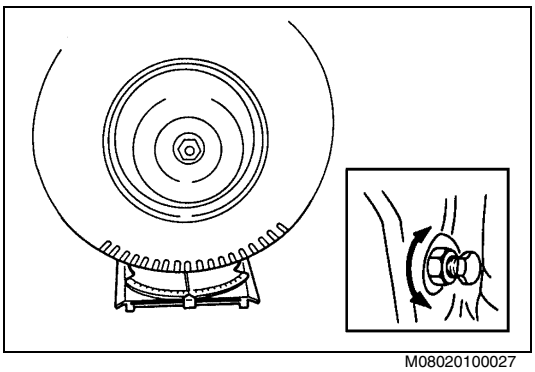
(2) Adjust the king pin inclination, caster, and camber.
Refer to DATA AND SPECIFICATIONS.



M08020100026

(3) Check the toe-in.

- **B - A =Toe-in**


M08020100027

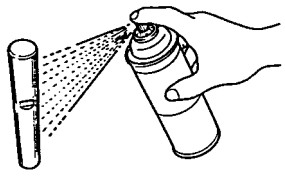
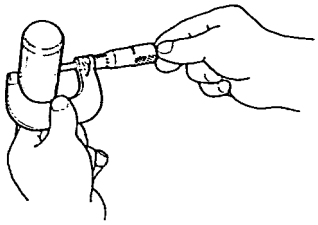
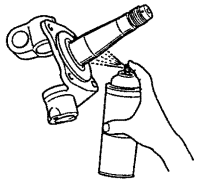
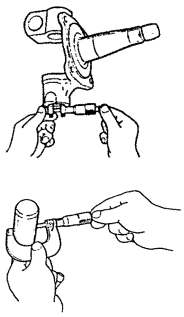
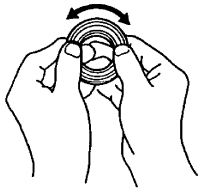
**2. ADJUSTMENT OF THE WHEEL TURNING ANGLE WITH STOPPER BOLT**

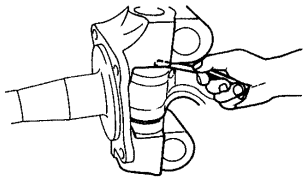
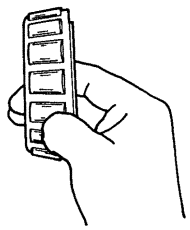
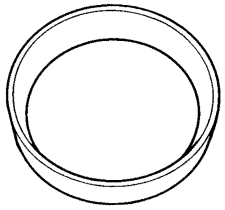
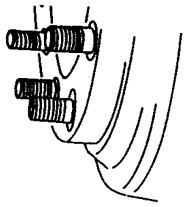
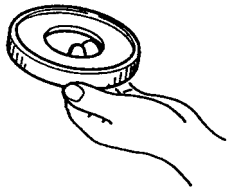
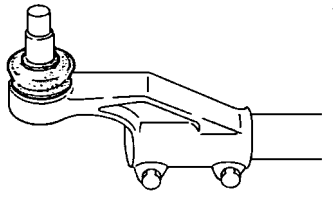
(1) Refer to DATA AND SPECIFICATIONS.

# INSPECTION AND REPAIR

M08020114BEH3002

Unit: mm {in.}

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| King pin:<br>Wear and damage | — | — | Replace, if necessary. | Use the magnetic flaw detector or color checking instrument.<br>  |
| King pin diameter | 50<br>{1.969} | 49.85<br>{1.9626} | Replace. | Measure<br>  |
| Knuckle:<br>Wear and damage | — | — | Replace, if necessary. | Use the magnetic flaw detector or color checking instrument.<br>  |
| King pin clearance | 0.025-0.08<br>{0.0010-0.0031} | 0.35<br>{0.0138} | Replace. | Measure<br>  |
| Thrust bearing:<br>Burns and pitting | — | — | Replace, if necessary. | Visual check<br>  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Thrust washer wear (Clearance between knuckle and axle beam)** | **—** | **0.5 {0.0197}** | **Replace, if necessary.** | **Measure**  |
| **Bearing and race: Burns and pitting** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| | | | **Replace, if necessary.** | **Visual check**  |
| **Hub bolts: Threads wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Oil seal guide: Wear** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Tie rod: Distortion** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Tie-rod end and dust cover: Crack** | **—** | **—** | **Replace.** | **Visual check**  |
| **Muddy water in the cover (Sealed type ball stud)** | **—** | **—** | **Replace the tie-rod end assembly.** | |

# REAR AXLE (DIFFERENTIAL GEAR SERIES: SH13) AX03-001

**REAR AXLE**
**(DIFFERENTIAL GEAR SERIES: SH13).. AX03-2**
DATA AND SPECIFICATIONS ..... AX03-2
DESCRIPTION ..... AX03-2
TROUBLESHOOTING ..... AX03-3
SPECIAL TOOL ..... AX03-4
COMPONENT LOCATOR ..... AX03-5
OVERHAUL ..... AX03-6
INSPECTION AND REPAIR ..... AX03-10

# REAR AXLE (DIFFERENTIAL GEAR SERIES: SH13)

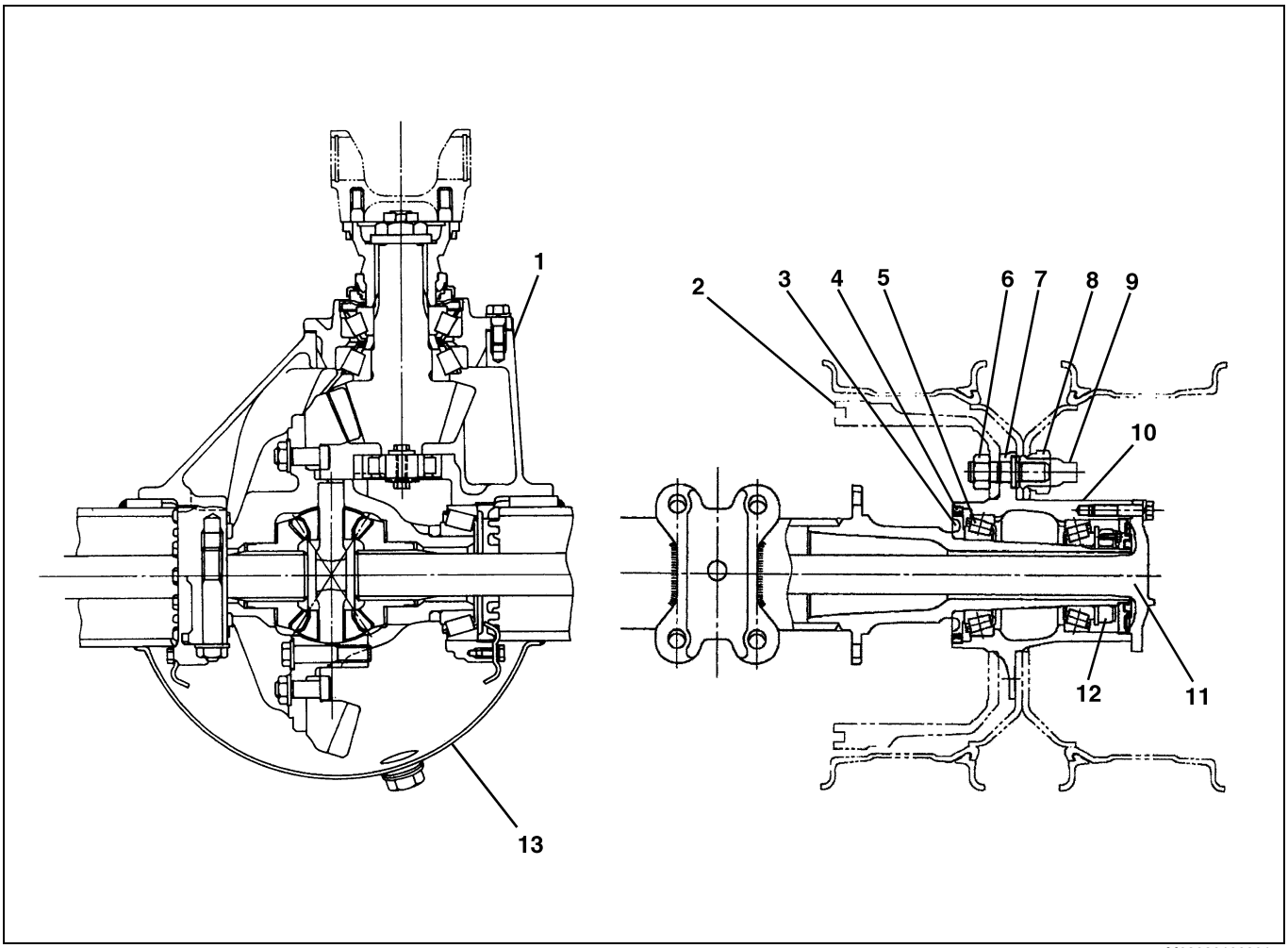
## DATA AND SPECIFICATIONS

M08030101BEI2001

| | |
|---|---|
| Type | Full-floating axle shaft |
| Housing | Banjo type, with extension tubes welded on both ends |
| Type of drive | Hotchkiss drive |

## DESCRIPTION

M08030101BEC1001




M08030100001

| | | | |
|---|---|---|---|
| 1 | Differential carrier assembly | 8 | Outer wheel nut |
| 2 | Brake drum | 9 | Inner wheel nut |
| 3 | Oil seal collar | 10 | Wheel hub |
| 4 | Oil seal | 11 | Axle shaft |
| 5 | Wheel hub bearing | 12 | Lock nut |
| 6 | Hub bolt fitting nut | 13 | Axle housing |
| 7 | Hub bolt | | |

# TROUBLESHOOTING

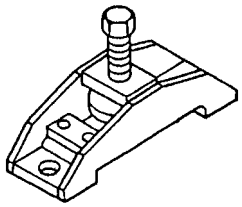
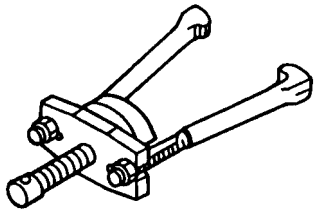
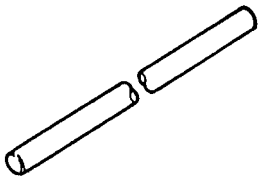
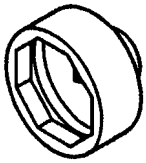
M08030101BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings. | Replace bearings. |
| | Worn or damaged differential side bearings. | Replace bearings. |
| | Loose pinion bearings. | Adjust bearings preload. |
| | Loose differential side bearings. | Adjust bearings preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear. | Adjust backlash. |
| | Worn thrust washers. | Replace. |
| | Worn differential spider. | Replace. |
| | Worn or damaged ring gear and pinion. | Replace. |
| | Worn or damaged differential side gears and pinions. | Replace. |
| | Loose ring gear tightening bolts. | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear. | Replace or adjust tooth contact. |
| | Worn pinion spline. | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline. | Replace. |
| | Worn hub bearings. | Replace. |
| | Loose hub bearings. | Adjust bearing preload. |
| | Loose differential case tightening bolts. | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil. | Add oil; check for leakage. |
| | Poor oil quality. | Change oil. |
| | Abnormal noise of propeller shaft. | Refer to Chapter PROPELLER SHAFT. |

# SPECIAL TOOL

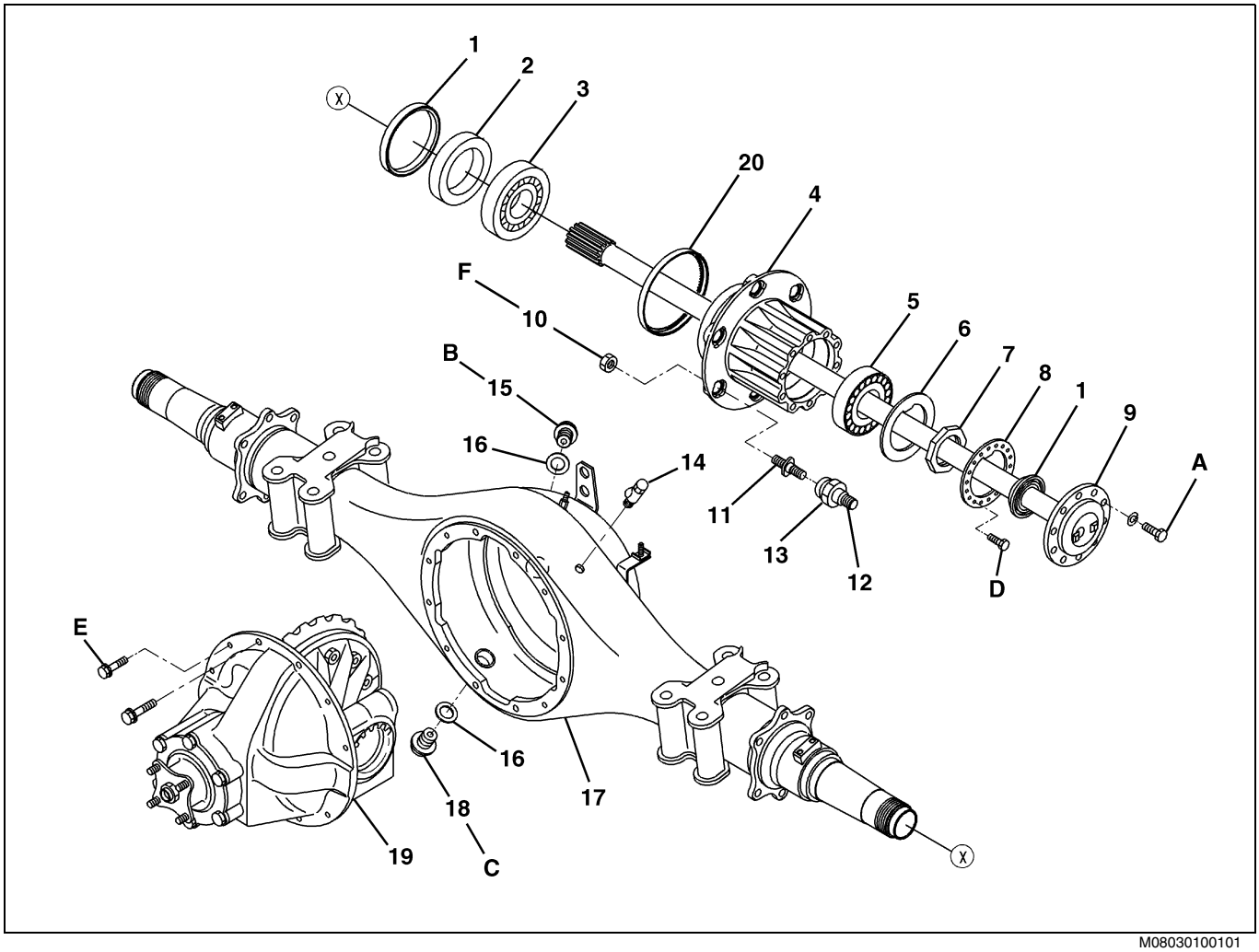
M08030101BEK1001

Prior to starting a rear axle overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-2051 | WHEEL HUB PULLER | |
|  | 09650-2090 | HUB BEARING PULLER | |
|  | 09849-1601<br>09849-2001 | HANDLE | |
|  | 09839-9401 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M08030101BED1002




M08030100101

| | | | |
|---|---|---|---|
| 1 | Oil seal | 11 | Hub bolt |
| 2 | Oil seal collar | 12 | Inner wheel nut |
| 3 | Inner wheel hub bearing | 13 | Outer wheel nut |
| 4 | Wheel hub | 14 | Air breather |
| 5 | Outer wheel hub bearing | 15 | Oil filler plug |
| 6 | Lock washer | 16 | Gasket |
| 7 | Lock nut | 17 | Axle housing assembly |
| 8 | Lock plate | 18 | Oil drain plug |
| 9 | Axle shaft | 19 | Differential carrier assembly |
| 10 | Hub bolt fitting nut | 20 | ABS sensor ring (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

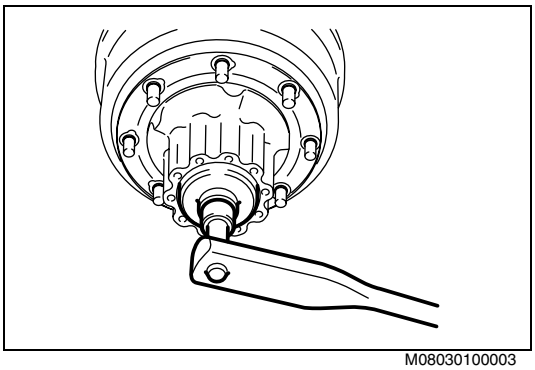
| | | | |
|---|---|---|---|
| A | 84.5-107.5 {862-1,097, 63-79} | E | ϕ12 bolt: 84.5-107.5 {862-1,097, 63-79} |
| B | 78.4-117.6 {800-1,200, 58-86} | | ϕ14 bolt: 113-147 {1,152-1,499, 83-108} |
| C | 78.4-117.6 {800-1,200, 58-86} | F | 392-470 {4,000-4,800, 290-347} |
| D | 8.33-10.79 {85-110, 6.2-8.0} | | |

# OVERHAUL

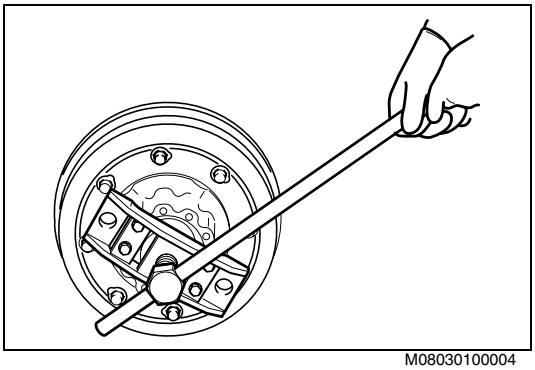
M08030101BEH2002

## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF THE WHEELS.**
(1) Refer to chapter WHEEL & TIRE.

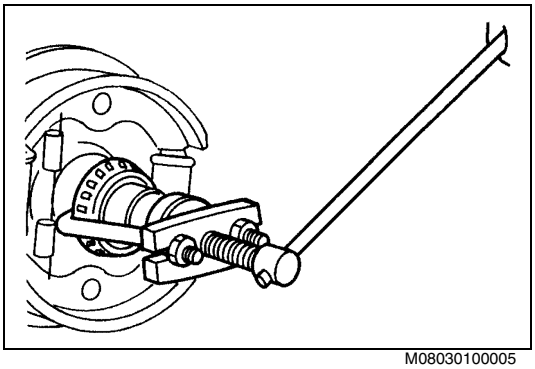

M08030100003

**2. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT.**
**SST: Socket Wrench (09839-9401)**


M08030100004

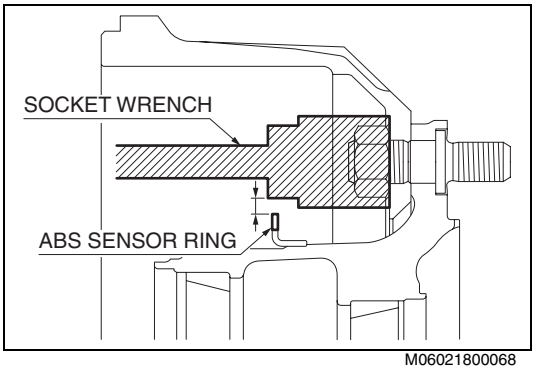
**3. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING.**
**SST:**
**Wheel Hub Puller (09650-2051)**
**Handle (09849-1601)**
**Handle (09849-2001)**

**NOTICE:**
**The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100005

**4. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL COLLAR.**
**SST:**
**Hub Bearing Puller (09650-2090)**
**Handle (09849-1601)**
**Handle (09849-2001)**

**5. REMOVAL OF THE WHEEL BRAKE**
(1) Refer to chapter SERVICE BRAKE.



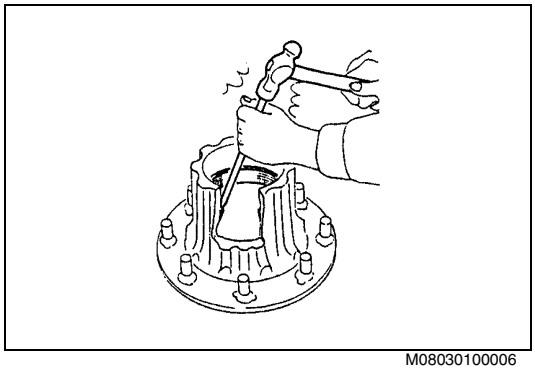
M06021800068

**6. DISMOUNTING THE WHEEL BOLT**
(1) Remove the nuts.

**NOTICE:**
- **Removing the nuts without ABS sensor ring, be careful not to damage the ring by tool.**

(2) Separate the wheel hub and brake drum. (If necessary)
(3) Knock through the wheel bolt using brass bar and hammer.

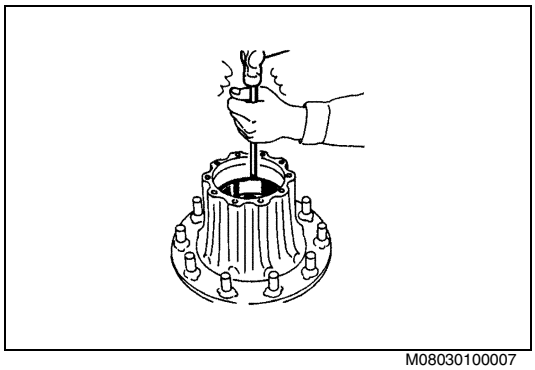
**NOTICE:**
- **Put aligned marks on the wheel hub and brake drum.**


M08030100006

## IMPORTANT POINTS - ASSEMBLY

**1. REPLACEMENT OF THE WHEEL HUB BEARING RACE.**

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

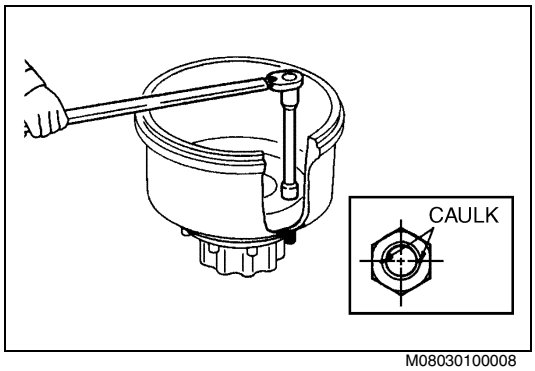

M08030100007

(2) Using a tapping rod and a hammer or a press, install the outer race.

**2. REPLACEMENT OF THE HUB BOLTS**

**NOTICE:**

**Caulk the lock nuts at two points after tightening to the specified torque.**



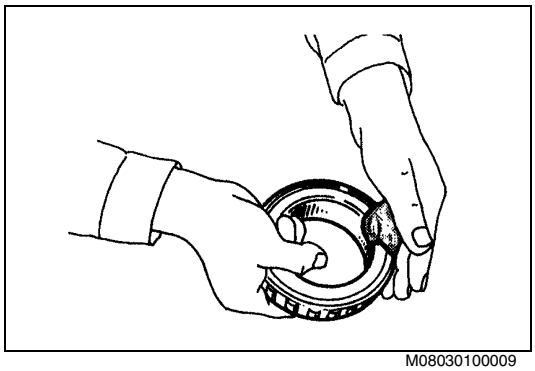
M08030100008

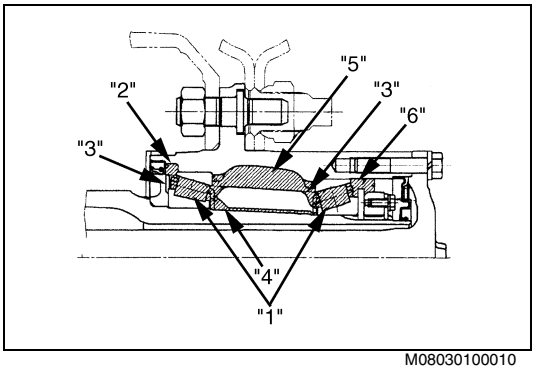
**3. GREASING.**

(1) Pack sufficient amount of wheel hub bearing grease between the bearing rollers.

**NOTICE:**

**"1": Fill the grease to spaces among the inner race, rollers and retainer to the extent that there is not any vacancy remained.**

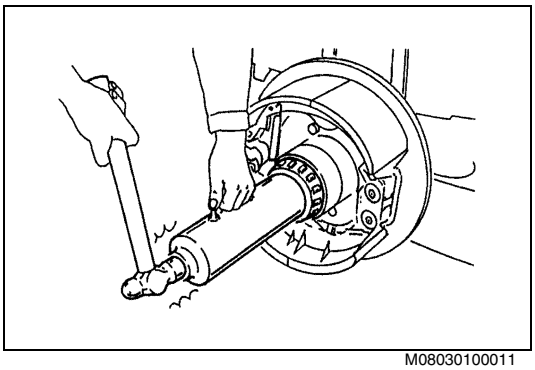

M08030100009



M08030100010

(2) Apply wheel hub bearing grease to wheel hub.

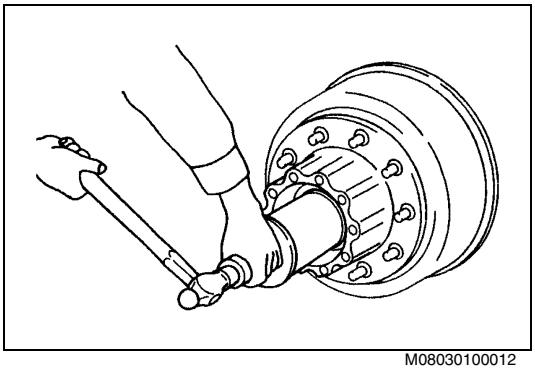
**NOTICE:**
- **"2": Fill the grease between the oil seal and inner bearing, and at this time some grease may flow out to the oil seal.**
- **"3": The grease has to ooze out to the extent that the retainer is buried.**
- **"4": After pressing in the inner race of the inner bearing, apply the grease to the end of race circumferentially with the width of 15 mm {0.591 in}.**
- **"5": When filling the grease to this space, do it up to the line which connects between the small diameter sides edges of 2 bearings.**
- **"6": Fill the grease up the half depth of the lock nut.**


M08030100011

**4. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY.**

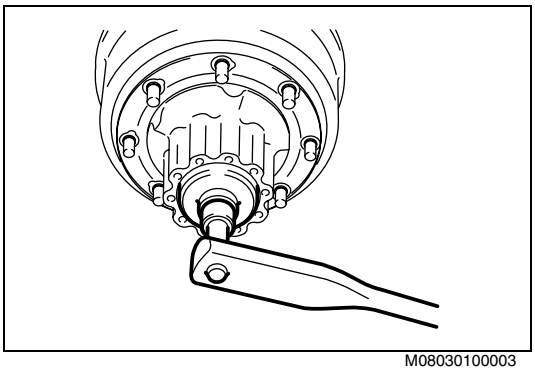
(1) Install the oil seal and the inner wheel hub bearing.

**NOTICE:**
- **If the collar is warmed up with hot water, it can easily be installed.**


M08030100012

(2) Install the wheel hub assembly and the outer wheel hub bearing.

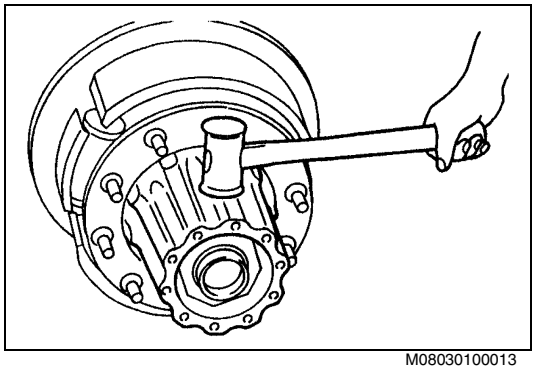
**NOTICE:**
- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100003

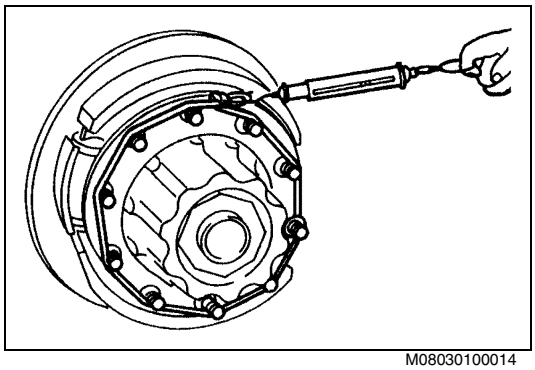
**5. ADJUSTMENT-OF THE WHEEL HUB BEARING PRELOAD.**

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/3 - 1/4 turn.
**SST: Socket Wrench (09839-9401)**

**Tightening Torque:**
**588-882 N·m {6,000-9,000 kgf·cm, 434-650 lbf·ft}**

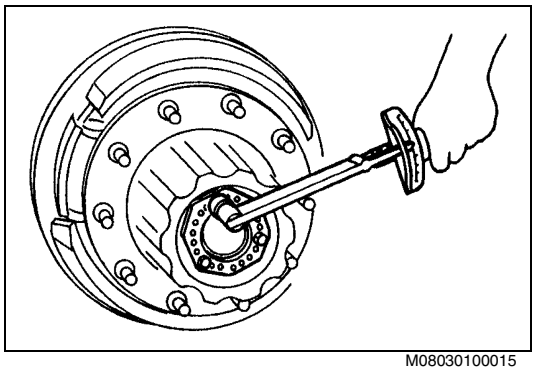

M08030100013

(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


M08030100014

(3) Measure the wheel bearing preload and adjust the preload with the lock nut, if it exceeds or is less than that specified below.

| | |
|---|---|
| **Turning Torque<br>N·m {kgf·cm, lbf·ft}** | **3.9-5.9<br>{40-60, 2.9-4.3}** |
| **Spring balancer reading<br>N {kgf, lbf}** | **35.3-51.9<br>{3.6-5.3, 8.0-11.6}** |


M08030100015

**6. INSTALLATION OF THE LOCK PLATE**

(1) Install the lock plate to the lock nut.

**NOTICE:**

- **If the holes of the plate are not aligned with screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**

**7. BRAKE SYSTEM AIR BLEEDING AND BRAKE SHOE CLEARANCE ADJUSTMENT.**

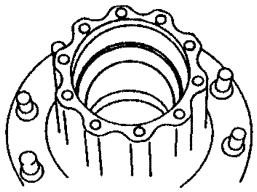
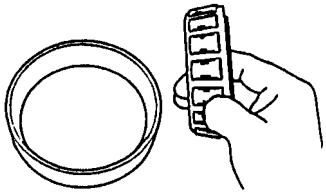
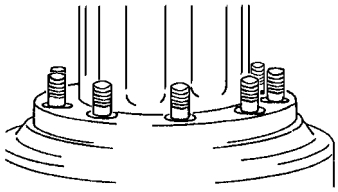
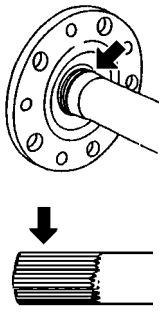
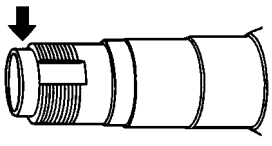
(1) On completion of the wheel hub and related parts reassembly, conduct the followings.

(2) Bleed the air from the brake lines according to the section SERVICE BRAKE ASSEMBLY in the chapter BRAKE EQUIPMENT.

(3) Adjust the brake shoe clearance according to the section WHEEL BRAKE in the chapter SERVICE BRAKE.

# INSPECTION AND REPAIR

M08030101BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Wheel hub bearing race: Burns, pitting and cracks** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Wheel hub bearings: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Hub bolt: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Oil seal collar: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Axle shaft spline: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Axle tube: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

# REAR AXLE (DIFFERENTIAL GEAR SERIES: SH14) AX03-002

**REAR AXLE**
**(DIFFERENTIAL GEAR SERIES: SH14).. AX03-2**
DATA AND SPECIFICATIONS ..... AX03-2
DESCRIPTION ..... AX03-2
TROUBLESHOOTING ..... AX03-3
SPECIAL TOOL ..... AX03-4
COMPONENT LOCATOR ..... AX03-5
OVERHAUL ..... AX03-6
INSPECTION AND REPAIR ..... AX03-10

# REAR AXLE (DIFFERENTIAL GEAR SERIES: SH14)

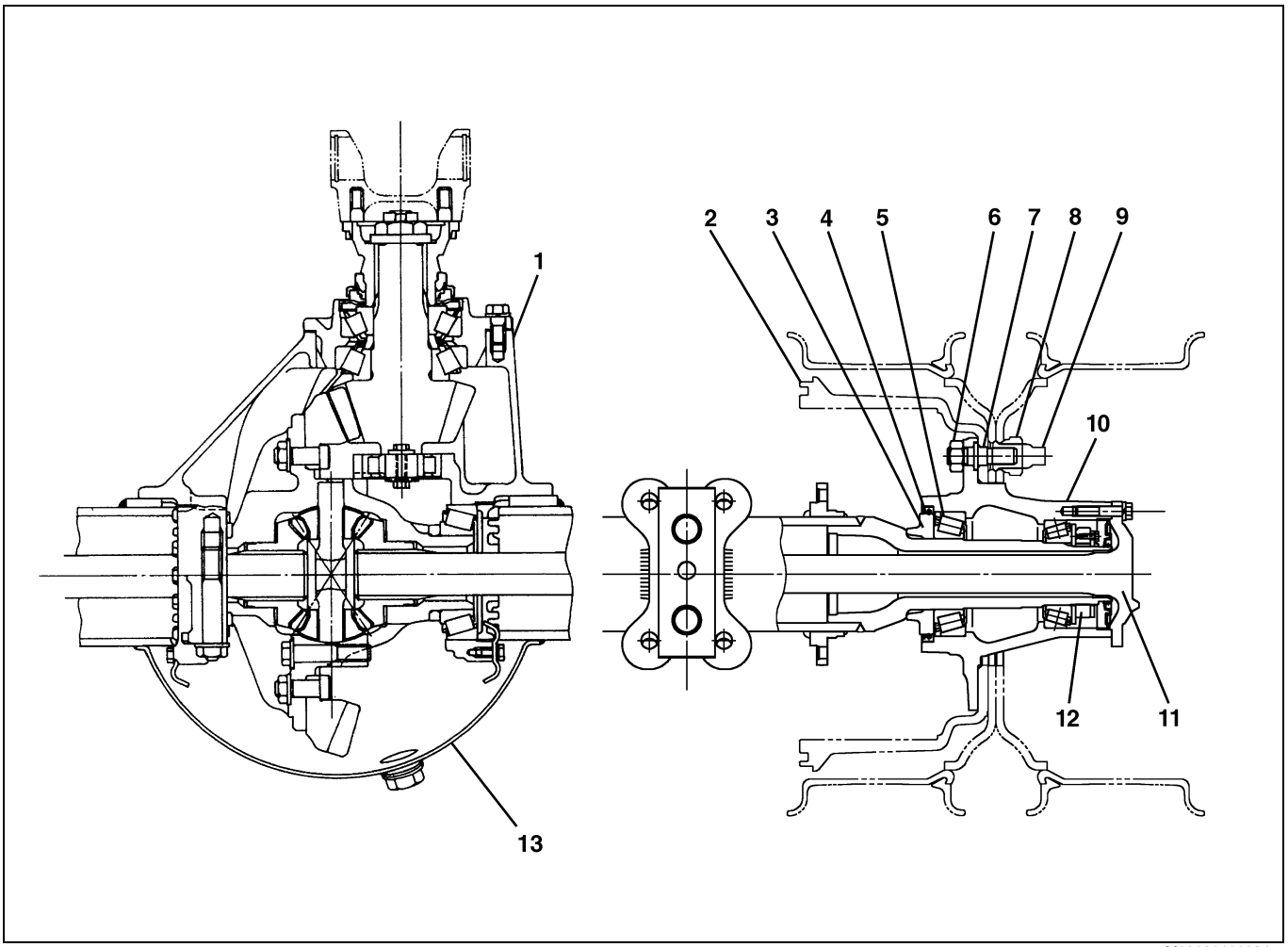
## DATA AND SPECIFICATIONS

M08030101BEI2001

| | |
|---|---|
| **Type** | **Full-floating axle shaft** |
| **Housing** | **Banjo type, with extension tubes welded on both ends** |
| **Type of drive** | **Hotchkiss drive** |

## DESCRIPTION

M08030101BEC1001




M08030100034

| | | | |
|---|---|---|---|
| **1** | **Differential carrier assembly** | **8** | **Outer wheel nut** |
| **2** | **Brake drum** | **9** | **Inner wheel nut** |
| **3** | **Oil seal collar** | **10** | **Wheel hub** |
| **4** | **Oil seal** | **11** | **Axle shaft** |
| **5** | **Wheel hub bearing** | **12** | **Lock nut** |
| **6** | **Hub bolt fitting nut** | **13** | **Axle housing** |
| **7** | **Hub bolt** | | |

# TROUBLESHOOTING

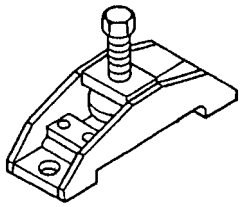
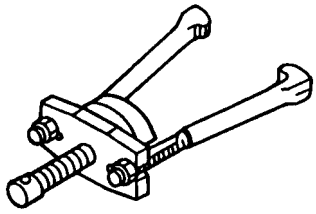
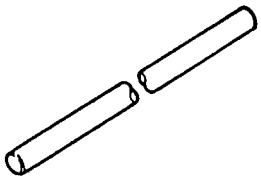
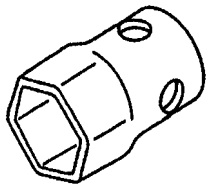
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| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings. | Replace bearings. |
| | Worn or damaged differential side bearings. | Replace bearings. |
| | Loose pinion bearings. | Adjust bearings preload. |
| | Loose differential side bearings. | Adjust bearings preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear. | Adjust backlash. |
| | Worn thrust washers. | Replace. |
| | Worn differential spider. | Replace. |
| | Worn or damaged ring gear and pinion. | Replace. |
| | Worn or damaged differential side gears and pinions. | Replace. |
| | Loose ring gear tightening bolts. | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear. | Replace or adjust tooth contact. |
| | Worn pinion spline. | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline. | Replace. |
| | Worn hub bearings. | Replace. |
| | Loose hub bearings. | Adjust bearing preload. |
| | Loose differential case tightening bolts. | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil. | Add oil; check for leakage. |
| | Poor oil quality. | Change oil. |
| | Abnormal noise of propeller shaft. | Refer to Chapter PROPELLER SHAFT. |

# SPECIAL TOOL

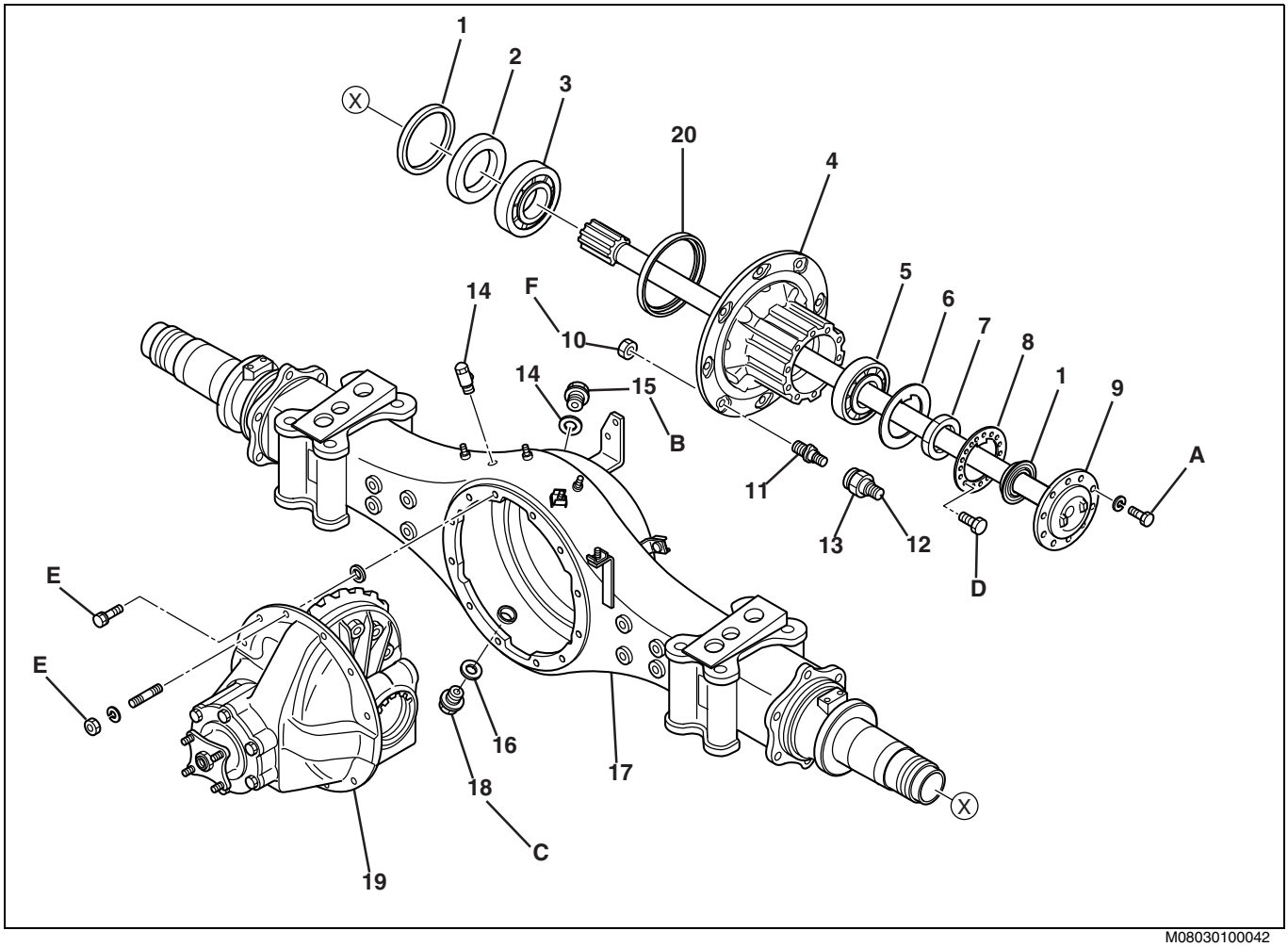
M08030101BEK1001

Prior to starting a rear axle overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1292 | WHEEL HUB PULLER | |
|  | 09650-2090 | HUB BEARING PULLER | |
|  | 09849-1601<br>09849-2001 | HANDLE | |
|  | 09603-1210 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M08030101BED1002




M08030100042

| | | | |
|---|---|---|---|
| 1 | Oil seal | 11 | Hub bolt |
| 2 | Oil seal collar | 12 | Inner wheel nut |
| 3 | Inner wheel hub bearing | 13 | Outer wheel nut |
| 4 | Wheel hub | 14 | Air breather |
| 5 | Outer wheel hub bearing | 15 | Oil filler plug |
| 6 | Lock washer | 16 | Gasket |
| 7 | Lock nut | 17 | Axle housing assembly |
| 8 | Lock plate | 18 | Oil drain plug |
| 9 | Axle shaft | 19 | Differential carrier assembly |
| 10 | Hub bolt fitting nut | 20 | ABS sensor ring (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

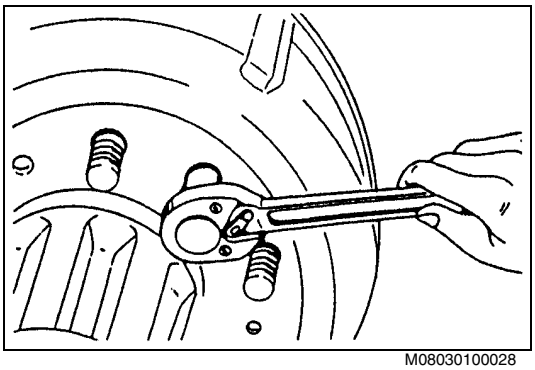
| | | | |
|---|---|---|---|
| A | 84.5-107.5 {862-1,097, 63-79} | D | 8.33-10.79 {85-110, 6.2-8.0} |
| B | 78.4-117.6 {800-1,200, 58-86} | E | 113-147 {1,152-1,499, 83-108} |
| C | 39.2-68.6 {400-700, 29-50} | F | 392-470 {4,000-4,800, 290-347} |

# OVERHAUL

M08030101BEH2002

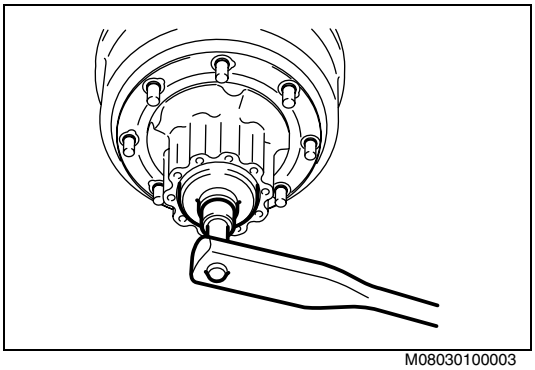
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF THE WHEELS.**
(1) Refer to chapter WHEEL & TIRE.

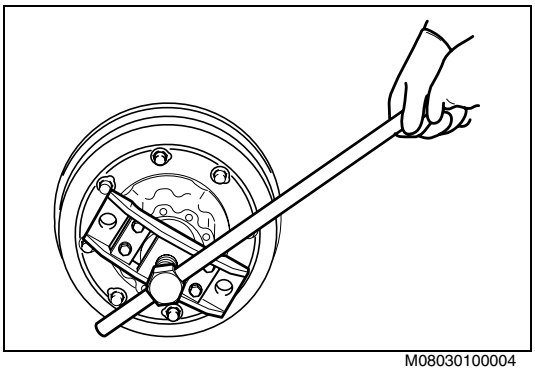

M08030100028

**2. REMOVAL OF THE BRAKE DRUMS**
(1) Loosen the drum set screws and remove the brake drums.

**NOTICE:**
- **If the drum does not easily come out, screw the set screws into the drum removing hole.**
- **Brake drum is heavy, therefore be careful when handling it.**

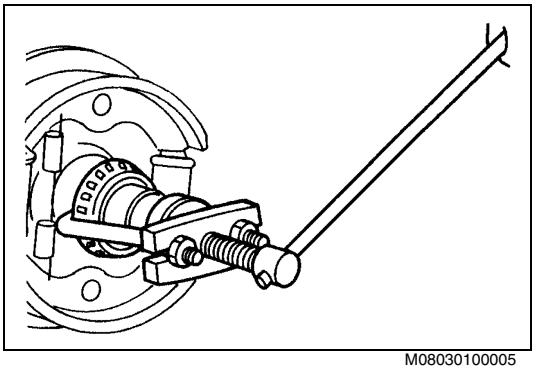

M08030100003

**3. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT.**
**SST: Socket Wrench (09603-1210)**


M08030100004

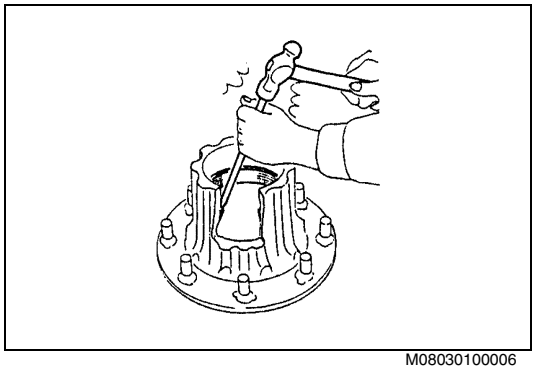
**4. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING.**
**SST:**
**Wheel Hub Puller (09650-1291)**
**Handle (09849-1601)**
**Handle (09849-2001)**

**NOTICE:**
**The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100005

**5. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL COLLAR.**
**SST:**
**Hub Bearing Puller (09650-2090)**
**Handle (09849-1601)**
**Handle (09849-2001)**

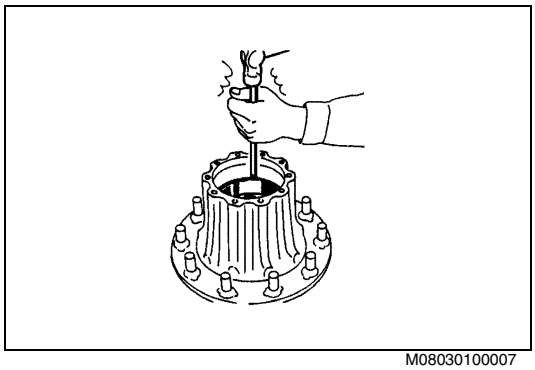
**6. REMOVAL OF THE WHEEL BRAKE**
(1) Refer to chapter SERVICE BRAKE.


M08030100006

## IMPORTANT POINTS - ASSEMBLY

**1. REPLACEMENT OF THE WHEEL HUB BEARING RACE.**

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

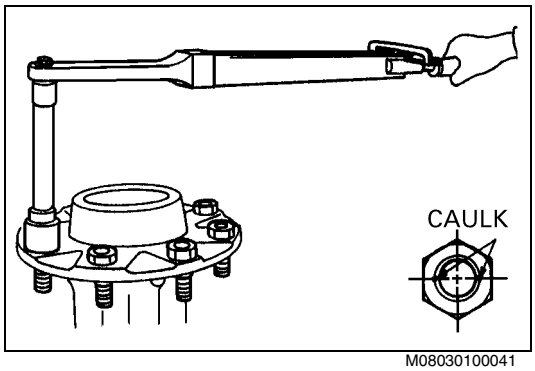

M08030100007

(2) Using a tapping rod and a hammer or a press, install the outer race.

**2. REPLACEMENT OF THE HUB BOLTS**

**NOTICE:**

**Caulk the lock nuts at two points after tightening to the specified torque.**



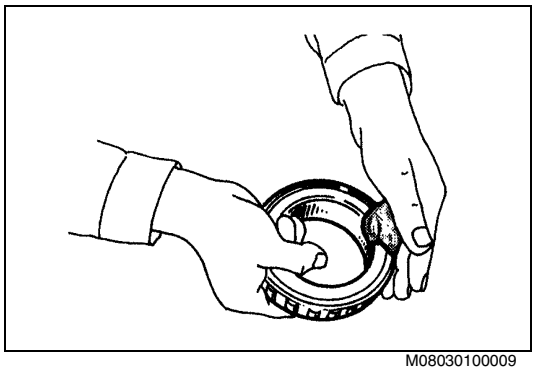
M08030100041

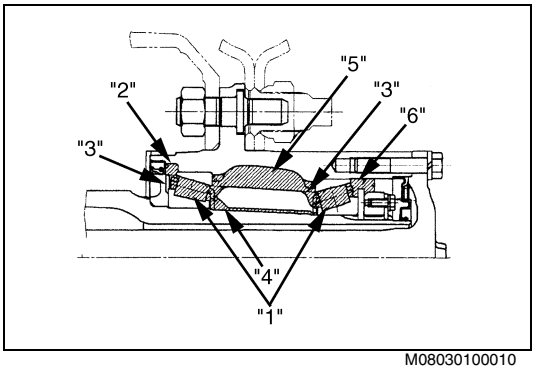
**3. GREASING.**

(1) Pack sufficient amount of wheel hub bearing grease between the bearing rollers.

**NOTICE:**

**"1": Fill the grease to spaces among the inner race, rollers and retainer to the extent that there is not any vacancy remained.**

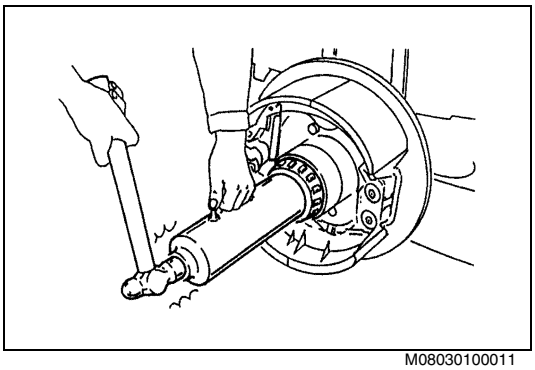

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M08030100010

(2) Apply wheel hub bearing grease to wheel hub.

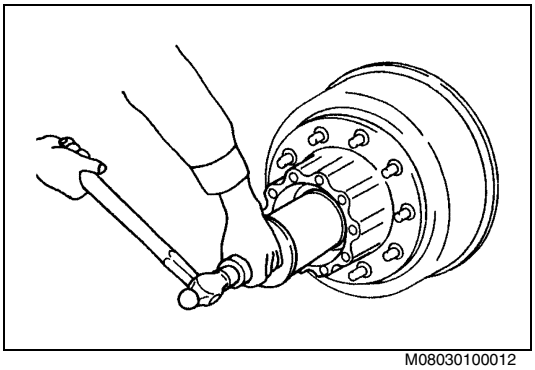
**NOTICE:**
- **"2": Fill the grease between the oil seal and inner bearing, and at this time some grease may flow out to the oil seal.**
- **"3": The grease has to ooze out to the extent that the retainer is buried.**
- **"4": After pressing in the inner race of the inner bearing, apply the grease to the end of race circumferentially with the width of 15 mm {0.591 in}.**
- **"5": When filling the grease to this space, do it up to the line which connects between the small diameter sides edges of 2 bearings.**
- **"6": Fill the grease up the half depth of the lock nut.**


M08030100011

**4. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY.**

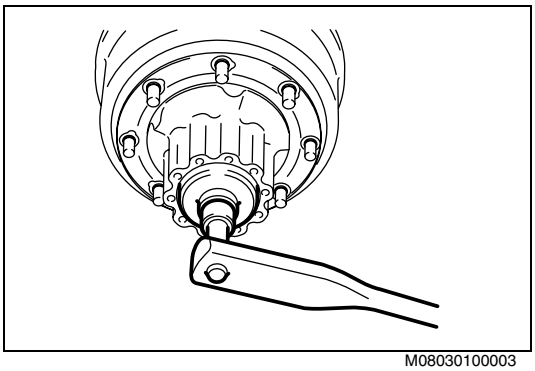
(1) Install the oil seal and the inner wheel hub bearing.

**NOTICE:**
- **If the collar is warmed up with hot water, it can easily be installed.**


M08030100012

(2) Install the wheel hub assembly and the outer wheel hub bearing.

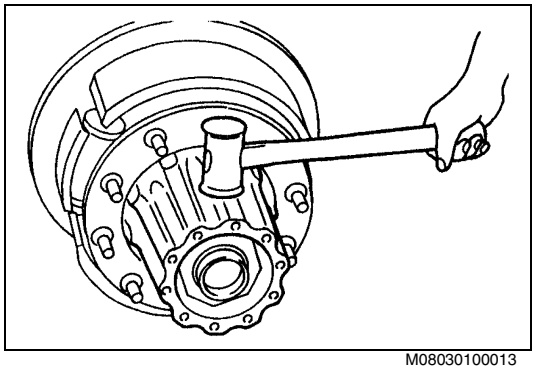
**NOTICE:**
- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100003

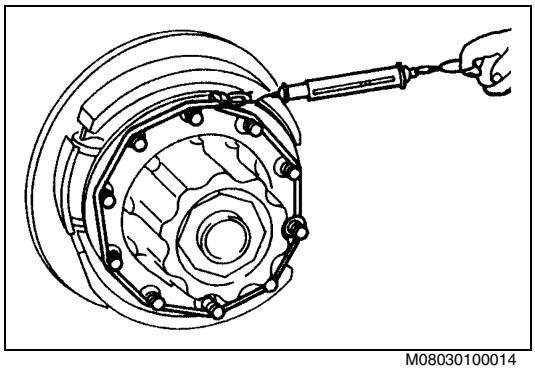
**5. ADJUSTMENT-OF THE WHEEL HUB BEARING PRELOAD.**

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/3 - 1/4 turn.
**SST: Socket Wrench (09603-1210)**

**Tightening Torque:**
**588-882 N·m {6,000-9,000 kgf·cm, 434-650 lbf·ft}**

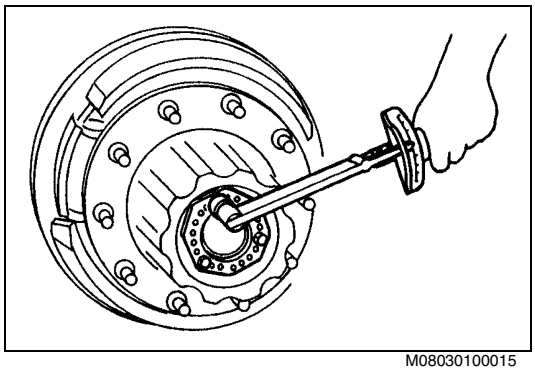

M08030100013

(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


M08030100014

(3) Measure the wheel bearing preload and adjust the preload with the lock nut, if it exceeds or is less than that specified below.

| | |
|---|---|
| **Turning Torque<br>N·m {kgf·cm, lbf·ft}** | **4.9-8.9<br>{50-90, 3.6-6.5}** |
| **Spring balancer reading<br>N {kgf, lbf}** | **35.3-61.7<br>{3.6-6.3, 8.0-13.8}** |

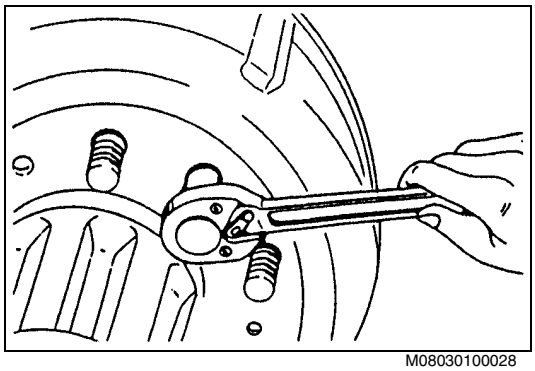

M08030100015

**6. INSTALLATION OF THE LOCK PLATE**

(1) Install the lock plate to the lock nut.

**NOTICE:**

- **If the holes of the plate are not aligned with screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**


M08030100028

**7. INSTALLATION OF THE BRAKE DRUM**

(1) Install the brake drums and tighten the drum set screws.

**8. INSTALLATION OF THE WHEELS**

(1) Refer to chapter WHEEL & TIRE.

**9. BRAKE SYSTEM AIR BLEEDING AND BRAKE SHOE CLEARANCE ADJUSTMENT.**

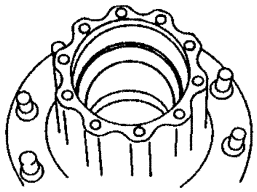
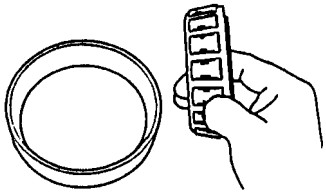
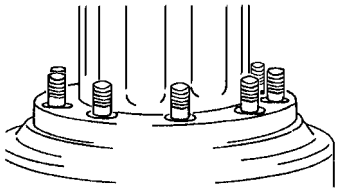
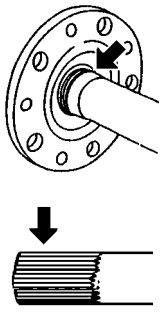
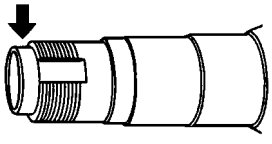
(1) On completion of the wheel hub and related parts reassembly, conduct the followings.

(2) Bleed the air from the brake lines according to the section SERVICE BRAKE ASSEMBLY in the chapter BRAKE EQUIPMENT.

(3) Adjust the brake shoe clearance according to the section WHEEL BRAKE in the chapter SERVICE BRAKE.

# INSPECTION AND REPAIR

M08030101BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Wheel hub bearing race: Burns, pitting and cracks** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Wheel hub bearings: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Hub bolt: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Oil seal collar: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Axle shaft spline: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Axle tube: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

# REAR AXLE (DIFFERENTIAL GEAR TYPE: SH16)

AX03-003

**REAR AXLE**
**(DIFFERENTIAL GEAR TYPE: SH16) ..... AX03-2**
DATA AND SPECIFICATION..... AX03-2
DESCRIPTION ..... AX03-2
TROUBLESHOOTING..... AX03-3
SPECIAL TOOL..... AX03-4
COMPONENT LOCATOR..... AX03-5
OVERHAUL ..... AX03-6
INSPECTION AND REPAIR ..... AX03-10

# REAR AXLE (DIFFERENTIAL GEAR TYPE: SH16)

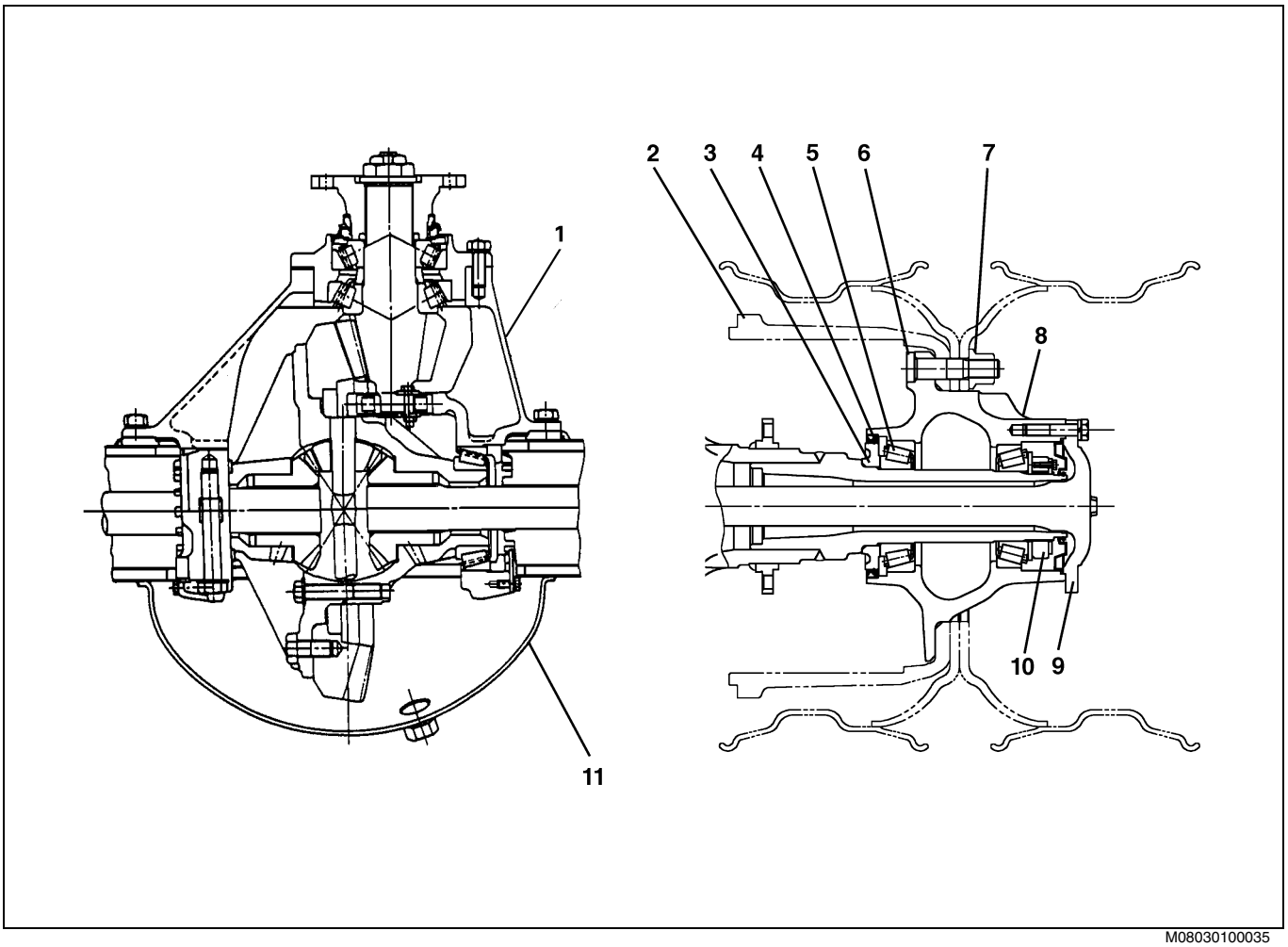
## DATA AND SPECIFICATION

M08030101BEI2001

| | |
|---|---|
| Type | Full-floating axle shaft |
| Housing | Banjo type, with extension tubes welded on both ends |
| Type of drive | Hotchkiss drive |

## DESCRIPTION

M08030101BEC1001




M08030100035

| | | | |
|---|---|---|---|
| 1 | Differential carrier assembly | 7 | Wheel nut |
| 2 | Brake drum | 8 | Wheel hub |
| 3 | Oil seal collar | 9 | Axle shaft |
| 4 | Oil seal | 10 | Lock nut |
| 5 | Wheel hub bearing | 11 | Axle housing |
| 6 | Hub bolt | | |

# TROUBLESHOOTING

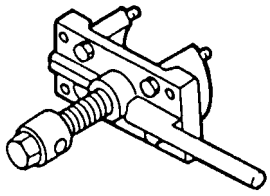
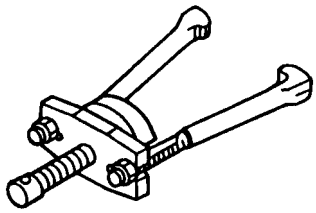
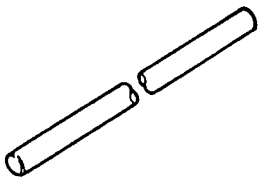
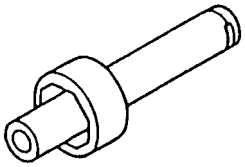
M08030101BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings. | Replace bearings. |
| | Worn or damaged differential side bearings. | Replace bearings. |
| | Loose pinion bearings. | Adjust bearing preload. |
| | Loose differential side bearings. | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear. | Adjust backlash. |
| | Worn thrust washers. | Replace. |
| | Worn differential spider. | Replace. |
| | Worn or damaged ring gear and pinion. | Replace. |
| | Worn or damaged differential side gears and pinions. | Replace. |
| | Loose ring gear tightening bolts. | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear. | Replace or adjust tooth contact. |
| | Worn pinion spline. | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline. | Replace. |
| | Worn hub bearings. | Replace. |
| | Loose hub bearings. | Adjust bearing preload. |
| | Loose differential case tightening bolts. | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil. | Add oil; check for leakage. |
| | Poor oil quality. | Change oil. |
| | Abnormal noise of propeller shaft. | Refer to chapter PROPELLER SHAFT. |

# SPECIAL TOOL

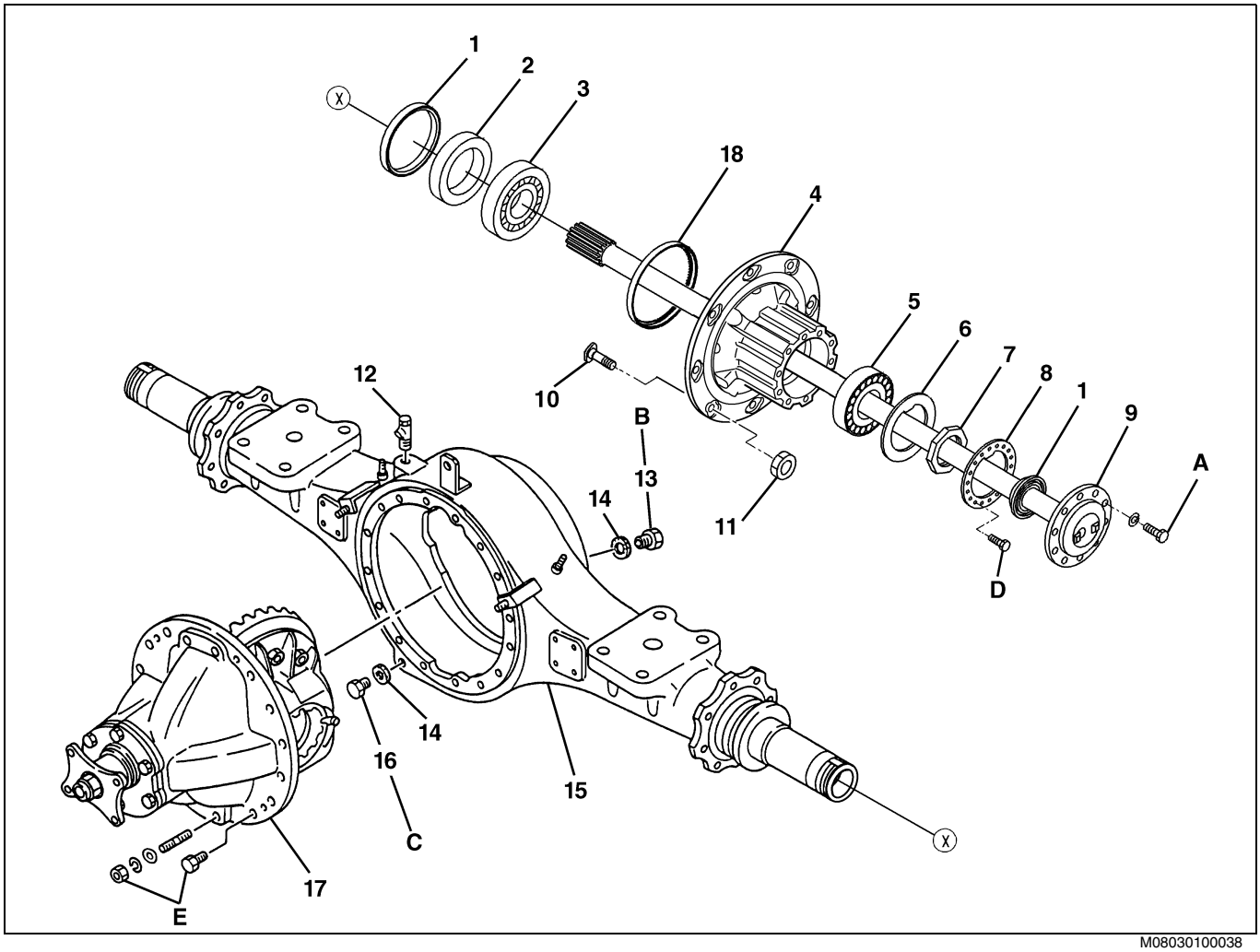
M08030101BEK1001

Prior to starting a rear axle overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1790 | WHEEL HUB PULLER | |
|  | 09650-1310 | HUB BEARING PULLER | |
|  | 09849-1601<br>09849-2001 | HANDLE | |
|  | 09603-1360 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M08030101BED1001




M08030100038

| | | | |
|---|---|---|---|
| 1 | Oil seal | 10 | Hub bolt |
| 2 | Oil seal collar | 11 | Wheel nut |
| 3 | Inner wheel hub bearing | 12 | Air breather |
| 4 | Wheel hub | 13 | Oil filler plug |
| 5 | Outer wheel hub bearing | 14 | Gasket |
| 6 | Lock washer | 15 | Axle housing assembly |
| 7 | Lock nut | 16 | Oil drain plug |
| 8 | Lock plate | 17 | Differential carrier assembly |
| 9 | Axle shaft | 18 | ABS sensor ring (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 148-192 {1,510-1,960, 109-141} | D | 8.33-10.79 {85-110, 6.2-8.0} |
| B | 78.4-117.6 {800-1,200, 58-86} | E | 113-147 {1,150-1,500, 83-108} |
| C | 39.2-68.6 {400-700, 29-50} | | |

# OVERHAUL

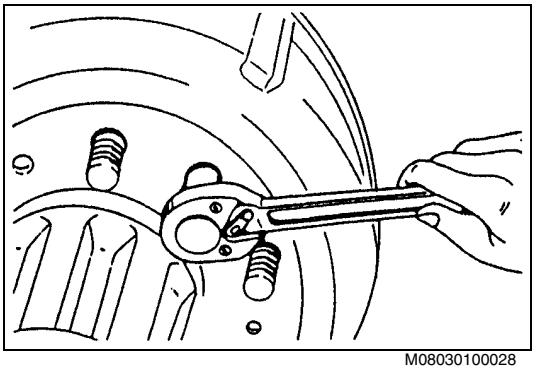
M08030101BEH2001

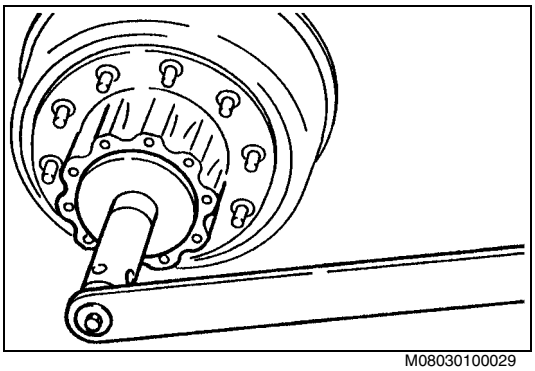
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF THE WHEELS**
(1) Refer to chapter WHEEL & TIRE.

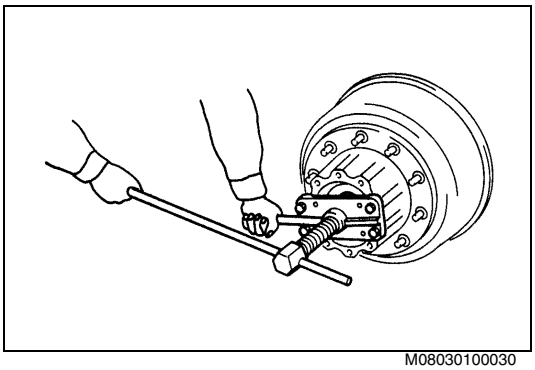
**2. REMOVAL OF THE BRAKE DRUMS**
(1) Loosen the drum set screws and remove the brake drums.

**NOTICE:**
- **If the drum does not easily come out, screw the set screws into the drum removing hole.**
- **Brake drum is heavy, therefore be careful when handling it.**


M08030100028

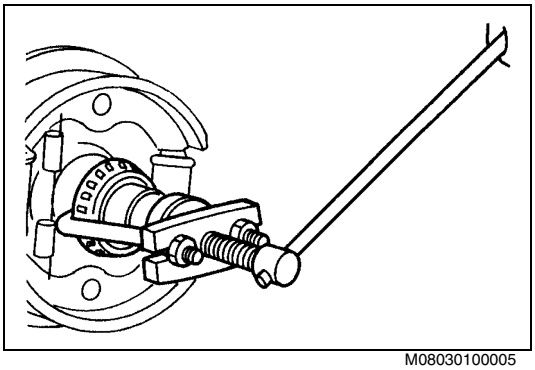

M08030100029

**3. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT**
**SST:**
**Socket Wrench (09603-1360)**
**Handle (09849-1601)**
**Handle (09849-2001)**


M08030100030

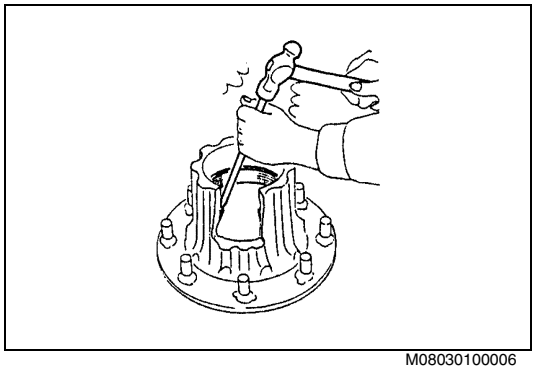
**4. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING**
**SST:**
**Wheel Hub Puller (09650-1790)**
**Handle (09849-1601)**
**Handle (09849-2001)**

**NOTICE:**
**The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100005

**5. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL COLLAR**
**SST:**
**Hub Bearing Puller (09650-1310)**
**Handle (09849-1601)**
**Handle (09849-2001)**

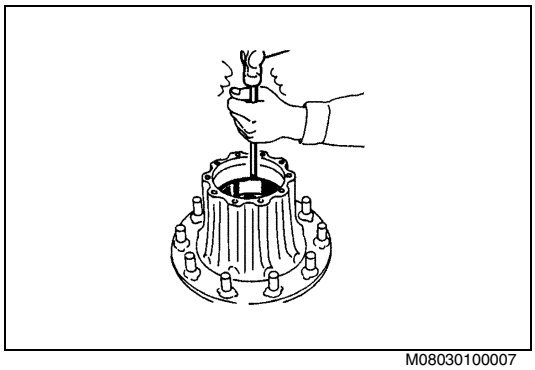
**6. REMOVAL OF THE WHEEL BRAKE**
(1) Refer to chapter SERVICE BRAKE.


M08030100006

## IMPORTANT POINTS - ASSEMBLY

**1. REPLACEMENT OF THE WHEEL HUB BEARING RACE**

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

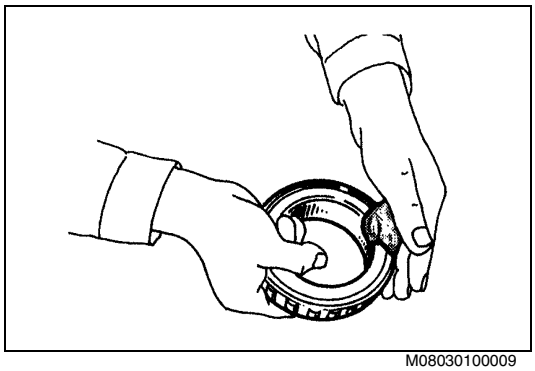

M08030100007

(2) Using a tapping rod and a hammer or a press, install the outer race.

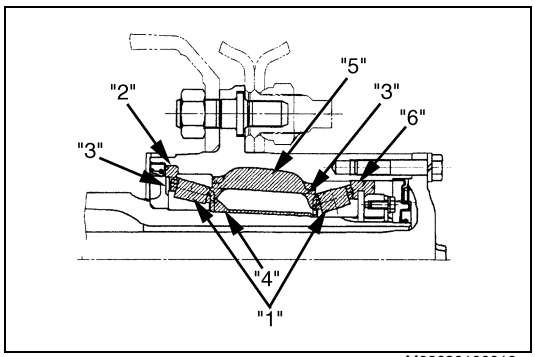
**2. GREASING**

(1) Pack sufficient amount of wheel hub bearing grease between the bearing rollers.

**NOTICE:**
**"1": Fill the grease to spaces among the inner race, rollers and retainer to the extent that there is not any vacancy remained.**

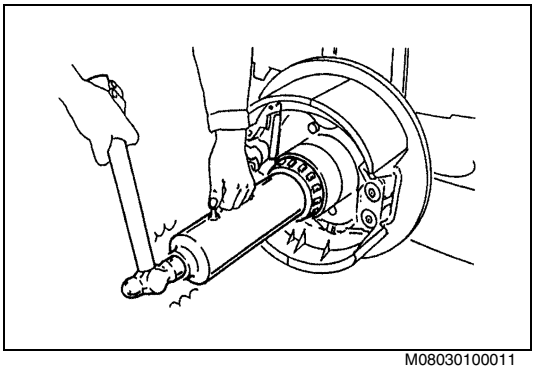

M08030100009

(2) Apply wheel hub bearing grease to wheel hub.



M08030100010

**NOTICE:**
- **"2": Fill the grease between the oil seal and inner bearing, and at this time some grease may flow out to the oil seal.**
- **"3": The grease has to ooze out to the extent that the retainer is buried.**
- **"4": After pressing in the inner race of the inner bearing, apply the grease to the end of race circumferentially with the width of 15 mm {0.591 in}.**
- **"5": When filling the grease to this space, do it up to the line which connects between the small diameter sides edges of 2 bearings.**
- **"6": Fill the grease up the half depth of the lock nut.**

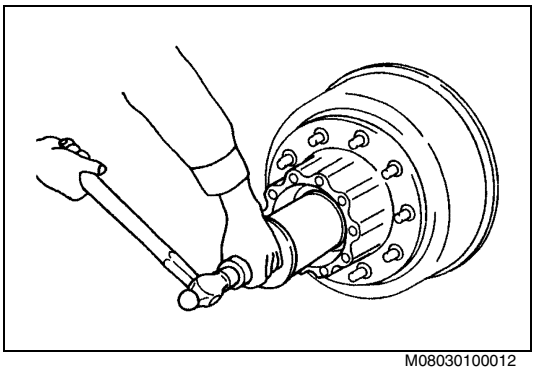

M08030100011

**3. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY**

(1) Install the oil seal and the inner wheel hub bearing.

**NOTICE:**

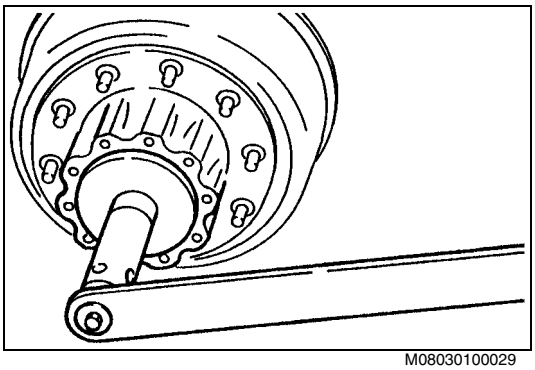
- **If the collar is warmed up with hot water, it can easily be installed.**


M08030100012

(2) Install the wheel hub assembly and the outer wheel hub bearing.

**NOTICE:**

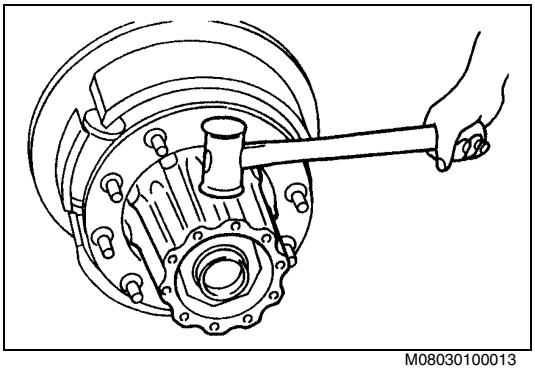
- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100029

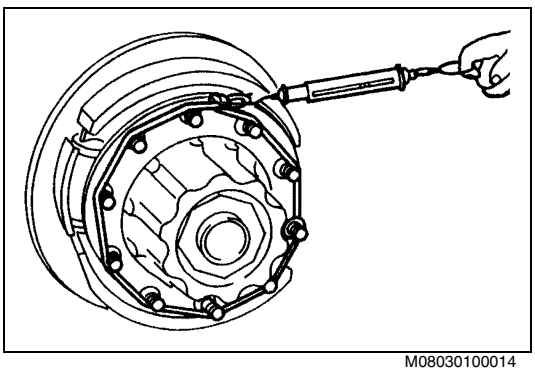
**4. ADJUSTMENT-OF THE WHEEL HUB BEARING PRELOAD**

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/3 - 1/4 turn.
**SST: Socket Wrench (09603-1360)**

**Tightening Torque:**
**588-1,176 N·m {6,000-12,000 kgf·cm, 434-867 lbf·ft}**


M08030100013

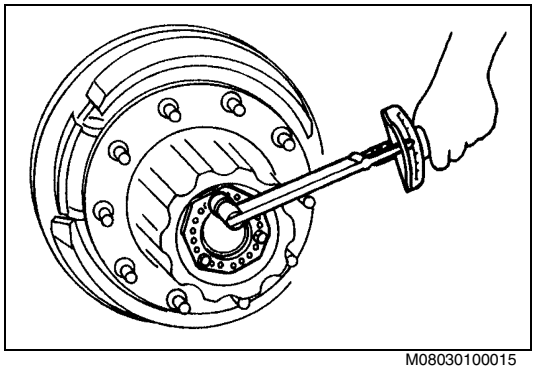
(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


M08030100014

(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, adjust the preload with the lock nut.

**Assembly standard:**

| | |
|---|---|
| **Turning Torque<br>N·m {kgf·cm, lbf·ft}** | **4.9-8.9<br>{50-90, 3.7-6.5}** |
| **Spring balancer reading<br>N {kgf, lbf}** | **29.5-51.9<br>{3.0-5.3, 6.7-11.6}** |

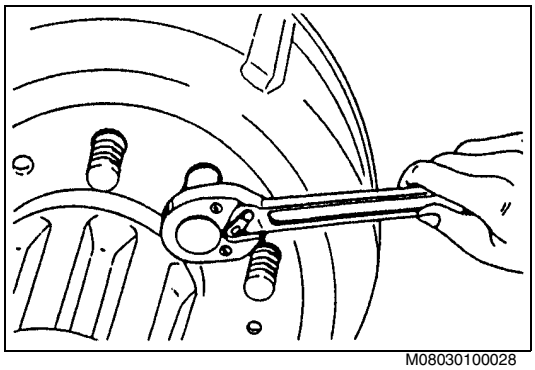

M08030100015

**5. INSTALLATION OF THE LOCK PLATE**

(1) Install the lock plate to the lock nut.

**NOTICE:**

- **If the holes of the plate are not aligned with screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**


M08030100028

**6. INSTALLATION OF THE BRAKE DRUM**

(1) Install the brake drums and tighten the drum set screws.

**7. INSTALLATION OF THE WHEELS**

(1) Refer to chapter WHEEL & TIRE.

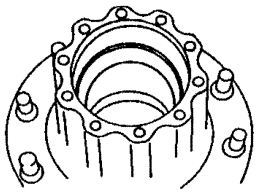
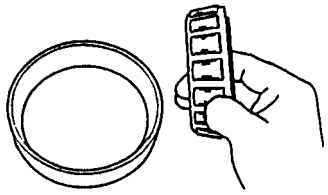
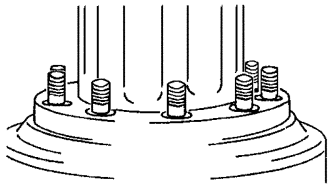
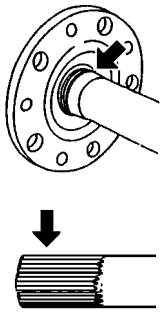
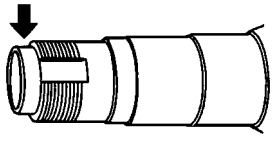
**8. BRAKE SYSTEM AIR BLEEDING AND BRAKE SHOE CLEARANCE ADJUSTMENT.**

(1) On completion of the wheel hub and related parts reassembly, conduct the followings.

a. Adjust the brake chamber rod stroke according to the section WHEEL BRAKE ADJUSTMENT in the chapter SERVICE BRAKE.

# INSPECTION AND REPAIR

M08030101BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Wheel hub bearing race: Burns, pitting and cracks** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Wheel hub bearings: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Hub bolt: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Oil seal collar: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Axle shaft spline: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Axle tube: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

# REAR AXLE (DIFFERENTIAL GEAR TYPE: SH17)

AX03-004

**REAR AXLE**
**(DIFFERENTIAL GEAR TYPE: SH17) ..... AX03-2**
DATA AND SPECIFICATION..... AX03-2
DESCRIPTION ..... AX03-2
TROUBLESHOOTING..... AX03-3
SPECIAL TOOL..... AX03-4
COMPONENT LOCATOR..... AX03-5
OVERHAUL ..... AX03-6
INSPECTION AND REPAIR ..... AX03-9

# REAR AXLE (DIFFERENTIAL GEAR TYPE: SH17)

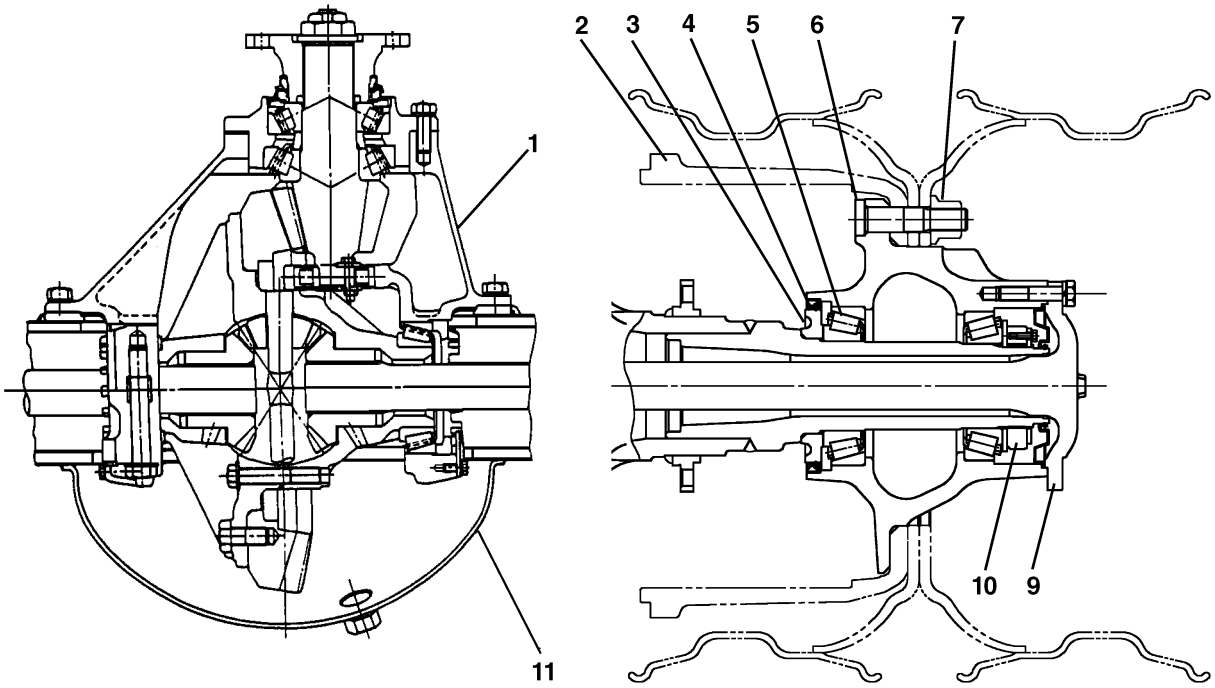
## DATA AND SPECIFICATION

M08030104BEI2001

| | |
|---|---|
| **Type** | **Full-floating axle shaft** |
| **Housing** | **Banjo type, with extension tubes welded on both ends** |
| **Type of drive** | **Hotchkiss drive** |

## DESCRIPTION

M08030104BEC1001




M08030100036

| | | | |
|---|---|---|---|
| 1 | Differential carrier assembly | 7 | Wheel nut |
| 2 | Brake drum | 8 | Wheel hub |
| 3 | Oil seal collar | 9 | Axle shaft |
| 4 | Oil seal | 10 | Lock nut |
| 5 | Wheel hub bearing | 11 | Axle housing |
| 6 | Hub bolt | | |

# TROUBLESHOOTING

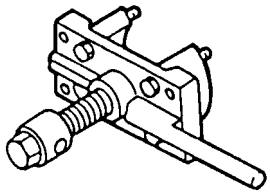
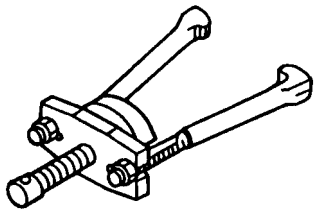
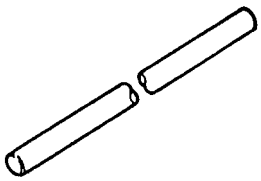
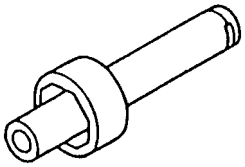
M08030104BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings. | Replace bearings. |
| | Worn or damaged differential side bearings. | Replace bearings. |
| | Loose pinion bearings. | Adjust bearing preload. |
| | Loose differential side bearings. | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear. | Adjust backlash. |
| | Worn thrust washers. | Replace. |
| | Worn differential spider. | Replace. |
| | Worn or damaged ring gear and pinion. | Replace. |
| | Worn or damaged differential side gears and pinions. | Replace. |
| | Loose ring gear tightening bolts. | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear. | Replace or adjust tooth contact. |
| | Worn pinion spline. | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline. | Replace. |
| | Worn hub bearings. | Replace. |
| | Loose hub bearings. | Adjust bearing preload. |
| | Loose differential case tightening bolts. | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil. | Add oil; check for leakage. |
| | Poor oil quality. | Change oil. |
| | Abnormal noise of propeller shaft. | Refer to chapter PROPELLER SHAFT. |

# SPECIAL TOOL

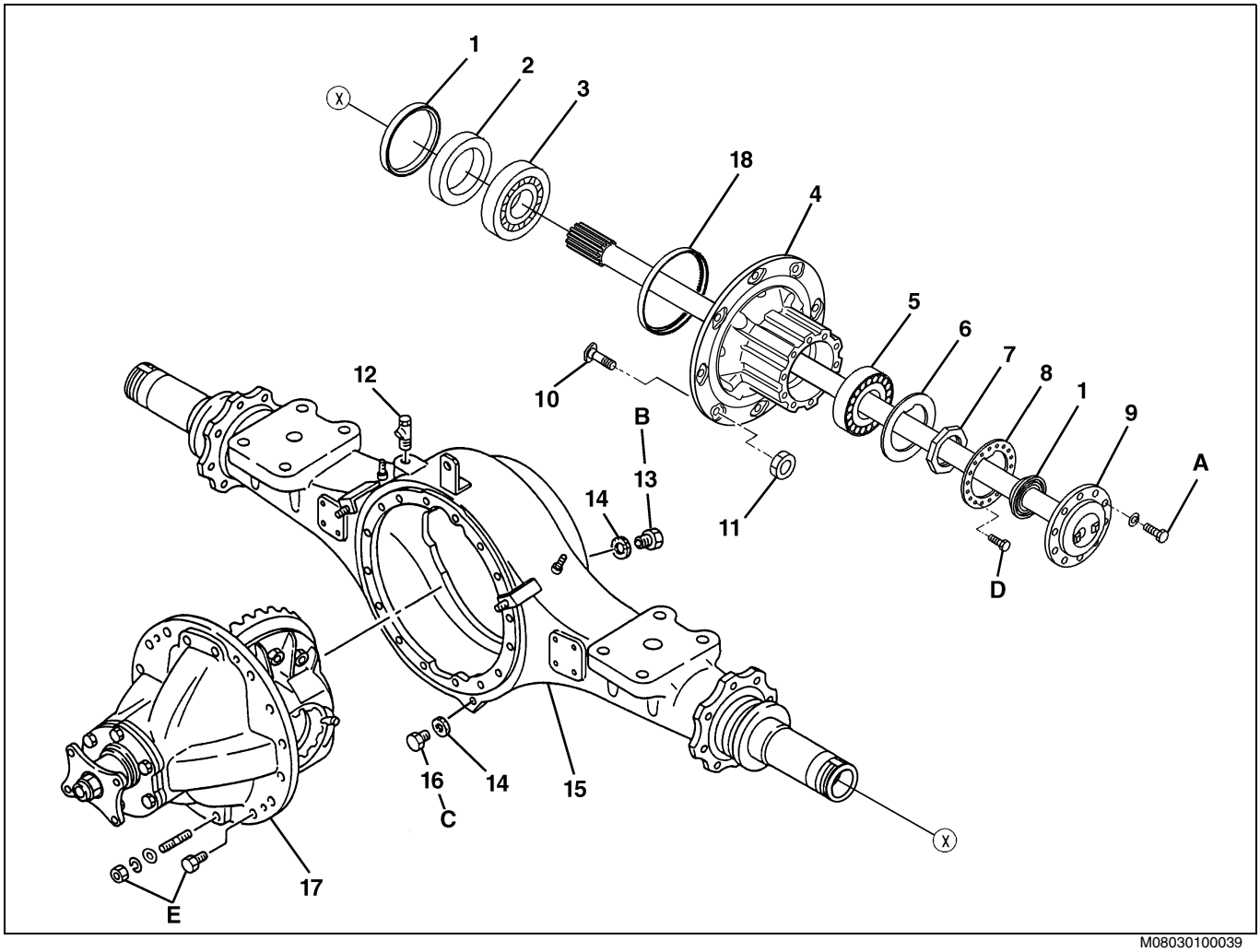
M08030104BEK1001

Prior to starting a rear axle overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1790 | WHEEL HUB PULLER | |
|  | 09650-1310 | HUB BEARING PULLER | |
|  | 09849-1601<br>09849-2001 | HANDLE | |
|  | 09603-1360 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M08030104BED1001




M08030100039

| | | | |
|---|---|---|---|
| 1 | Oil seal | 10 | Hub bolt |
| 2 | Oil seal collar | 11 | Inner wheel nut |
| 3 | Inner wheel hub bearing | 12 | Air breather |
| 4 | Wheel hub | 13 | Oil filler plug |
| 5 | Outer wheel hub bearing | 14 | Gasket |
| 6 | Lock washer | 15 | Axle housing assembly |
| 7 | Lock nut | 16 | Oil drain plug |
| 8 | Lock plate | 17 | Differential carrier assembly |
| 9 | Axle shaft | 18 | ABS sensor ring (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

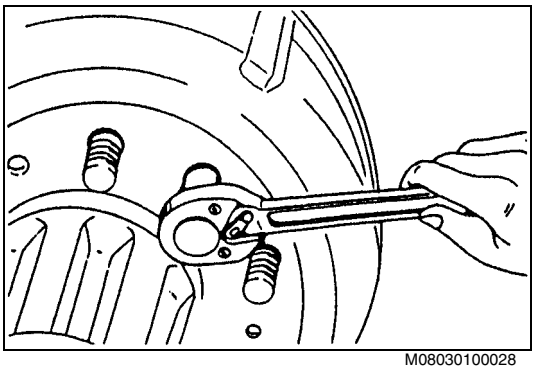
| | | | |
|---|---|---|---|
| A | 148-192 {1,500-2,000, 109-144} | D | 8.33-10.79 {85-110, 6.2-8.0} |
| B | 78.4-117.6 {800-1,200, 58-86} | E | 167-213 {1,700-2,200, 123-159} |
| C | 39.2-68.6 {400-700, 29-50} | | |

# OVERHAUL

MM08030104BEH2001

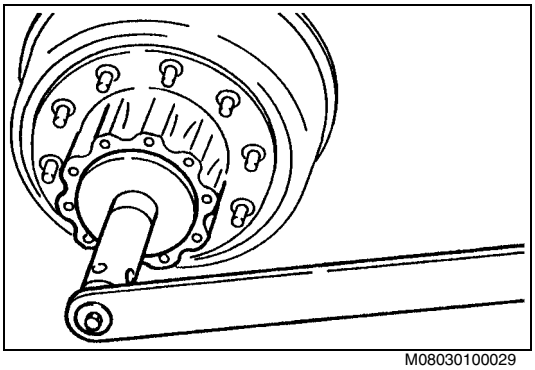
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF THE WHEELS**
(1) Refer to chapter WHEEL & TIRE.

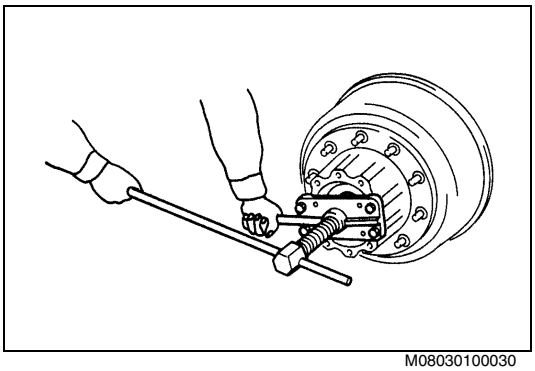

M08030100028

**2. REMOVAL OF THE BRAKE DRUMS**
(1) Loosen the drum set screws and remove the brake drums.

**NOTICE:**
- **If the drum does not easily come out, screw the set screws into the drum removing hole.**
- **Brake drum is heavy, therefore be careful when handling it.**

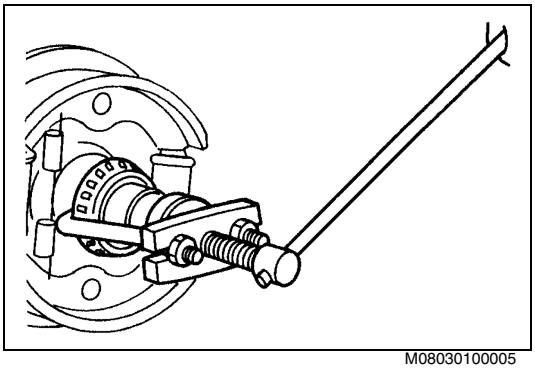

M08030100029

**3. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT**
**SST:**
**Socket Wrench (09603-1360)**
**Handle (09849-1601)**
**Handle (09849-2001)**


M08030100030

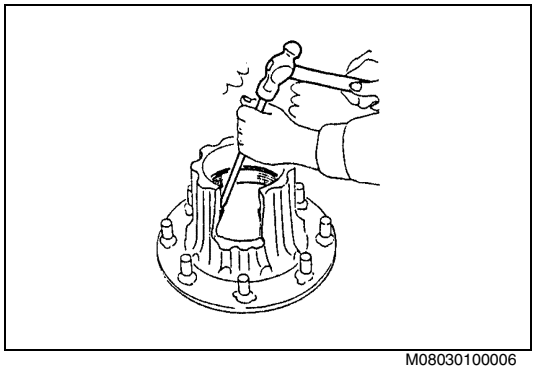
**4. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING**
**SST:**
**Wheel Hub Puller (09650-1790)**
**Handle (09849-1601)**
**Handle (09849-2001)**

**NOTICE:**
**The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100005

**5. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL COLLAR**
**SST:**
**Hub Bearing Puller (09650-1310)**
**Handle (09849-1601)**
**Handle (09849-2001)**

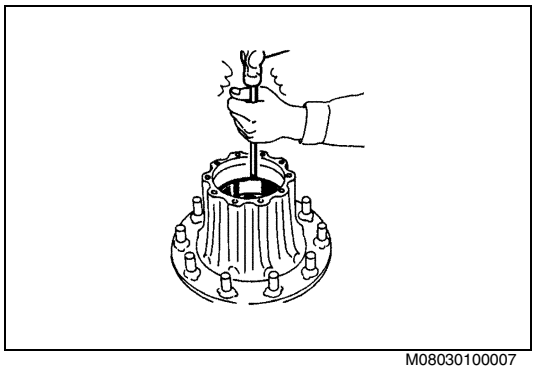
**6. REMOVAL OF THE WHEEL BRAKE**
(1) Refer to chapter SERVICE BRAKE.


M08030100006

## IMPORTANT POINTS - ASSEMBLY

**1. REPLACEMENT OF THE WHEEL HUB BEARING RACE**

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

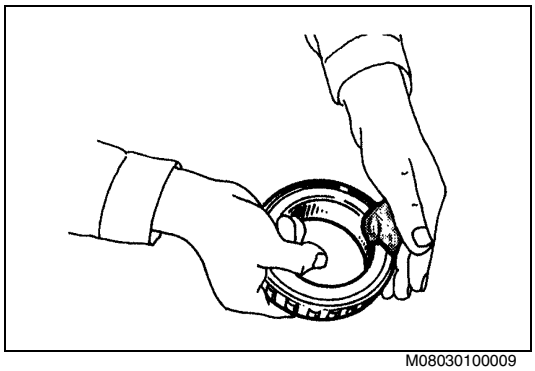

M08030100007

(2) Using a tapping rod and a hammer or a press, install the outer race.

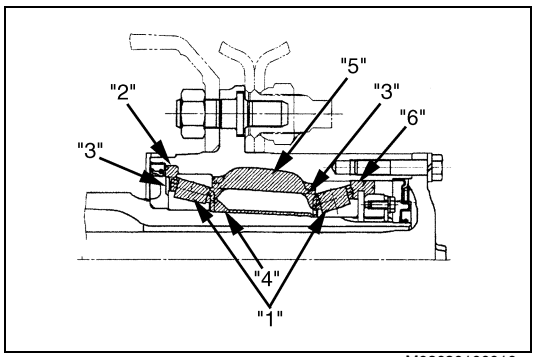
**2. GREASING**

(1) Pack sufficient amount of wheel hub bearing grease between the bearing rollers.

**NOTICE:**
**"1": Fill the grease to spaces among the inner race, rollers and retainer to the extent that there is not any vacancy remained.**

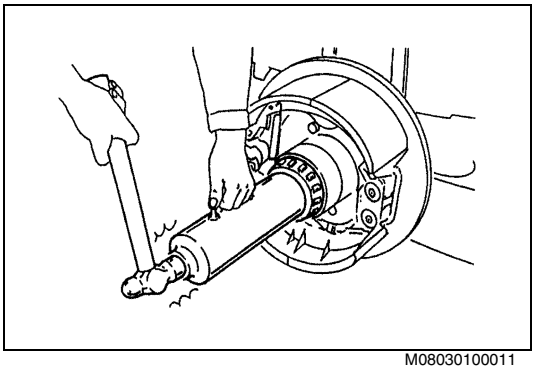

M08030100009

(2) Apply wheel hub bearing grease to wheel hub.



M08030100010

**NOTICE:**
- **"2": Fill the grease between the oil seal and inner bearing, and at this time some grease may flow out to the oil seal.**
- **"3": The grease has to ooze out to the extent that the retainer is buried.**
- **"4": After pressing in the inner race of the inner bearing, apply the grease to the end of race circumferentially with the width of 15 mm {0.591 in}.**
- **"5": When filling the grease to this space, do it up to the line which connects between the small diameter sides edges of 2 bearings.**
- **"6": Fill the grease up the half depth of the lock nut.**

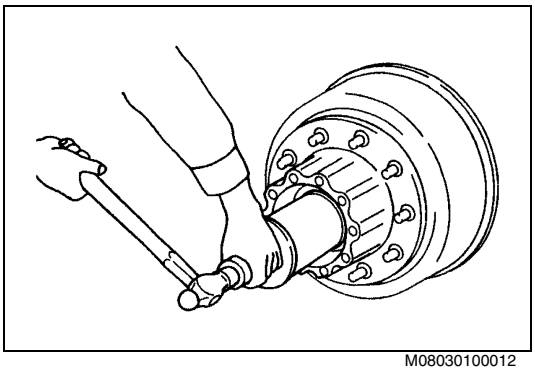

M08030100011

**3. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY**

(1) Install the oil seal and the inner wheel hub bearing.

**NOTICE:**

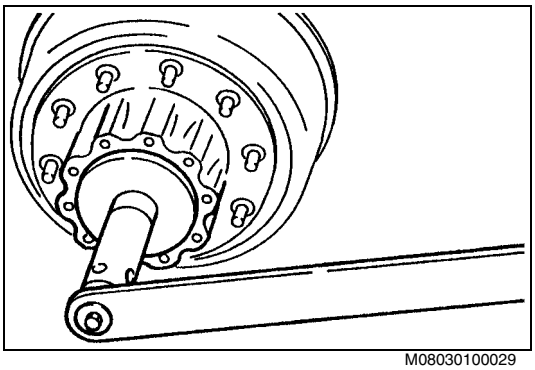
- **If the collar is warmed up with hot water, it can easily be installed.**


M08030100012

(2) Install the wheel hub assembly and the outer wheel hub bearing.

**NOTICE:**

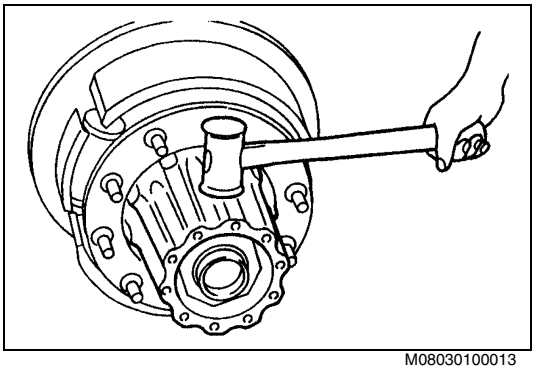
- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100029

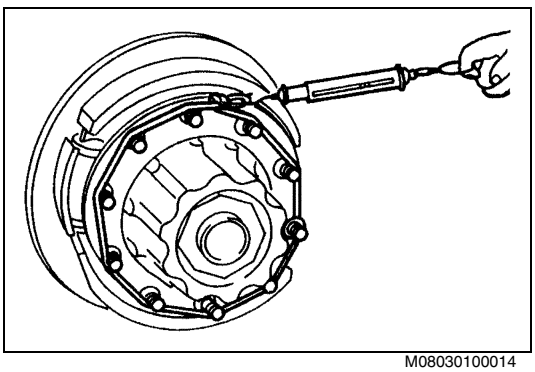
**4. ADJUSTMENT-OF THE WHEEL HUB BEARING PRELOAD**

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/3 - 1/4 turn.
**SST: Socket Wrench (09603-1360)**

**Tightening Torque:**
**588-1,176 N·m {6,000-12,000 kgf·cm, 434-868 lbf·ft}**


M08030100013

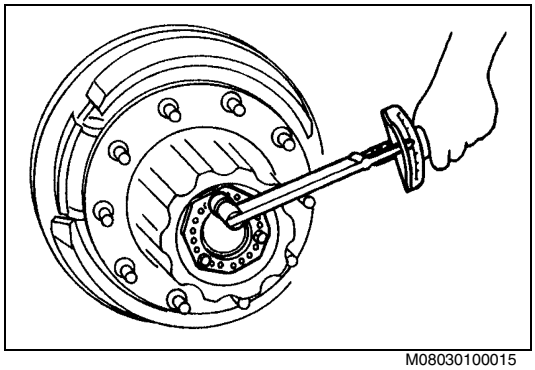
(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


M08030100014

(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, adjust the preload with the lock nut.

**Assembly standard:**

| | |
|---|---|
| **Turning Torque N·m {kgf·cm, lbf·ft}** | **4.9-8.9 {50-90, 3.7-6.5}** |
| **Spring balancer reading N {kgf, lbf}** | **29.5-51.9 {3.0-5.3, 6.7-11.6}** |

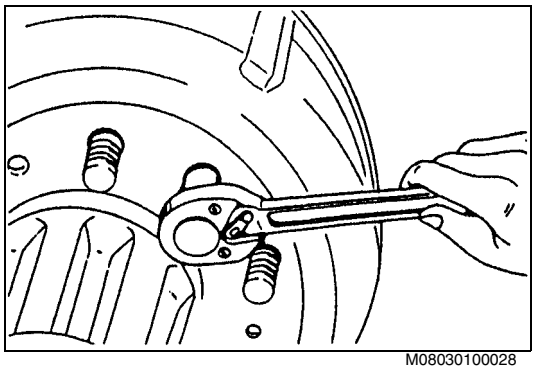

M08030100015

**5. INSTALLATION OF THE LOCK PLATE**

(1) Install the lock plate to the lock nut.

**NOTICE:**

- **If the holes of the plate are not aligned with screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**


M08030100028

**6. INSTALLATION OF THE BRAKE DRUM**

(1) Install the brake drums and tighten the drum set screws.

**7. INSTALLATION OF THE WHEELS**

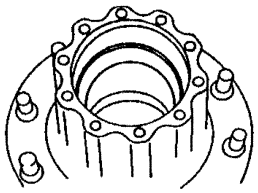
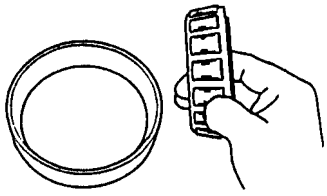
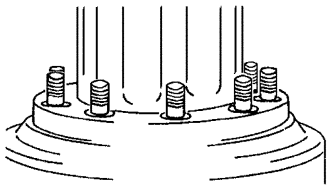
(1) Refer to chapter WHEEL & TIRE.

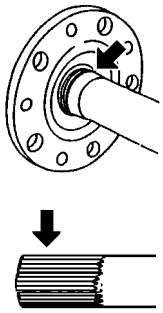
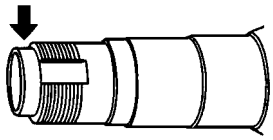
**8. BRAKE SYSTEM AIR BLEEDING AND BRAKE SHOE CLEARANCE ADJUSTMENT**

(1) On completion of the wheel hub and related parts reassembly, conduct the followings.
   a. Adjust the brake chamber rod stroke according to the section WHEEL ADJUSTMENT in the chapter SERVICE BRAKE.

# INSPECTION AND REPAIR

**M08030104BEH3001**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Wheel hub bearing race: Burns, pitting and cracks** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Wheel hub bearings: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Hub bolt: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Oil seal collar:**<br>**Wear and damage** | — | — | **Replace,**<br>**if necessary.** | **Visual check**<br>  |
| **Axle shaft spline:**<br>**Wear and damage** | — | — | **Replace,**<br>**if necessary.** | **Visual check**<br>  |
| **Axle tube:**<br>**Wear and damage** | — | — | **Replace,**<br>**if necessary.** | **Visual check**<br>  |

# REAR AXLE (DIFFERENTIAL GEAR TYPE: THD17) AX03-005

**REAR AXLE**
**(DIFFERENTIAL GEAR TYPE: THD17) ... AX03-2**
DATA AND SPECIFICATION ..... AX03-2
DESCRIPTION ..... AX03-2
TROUBLESHOOTING ..... AX03-3
SPECIAL TOOL ..... AX03-4
COMPONENT LOCATOR ..... AX03-5
OVERHAUL ..... AX03-6
INSPECTION AND REPAIR ..... AX03-9

# REAR AXLE (DIFFERENTIAL GEAR TYPE: THD17)

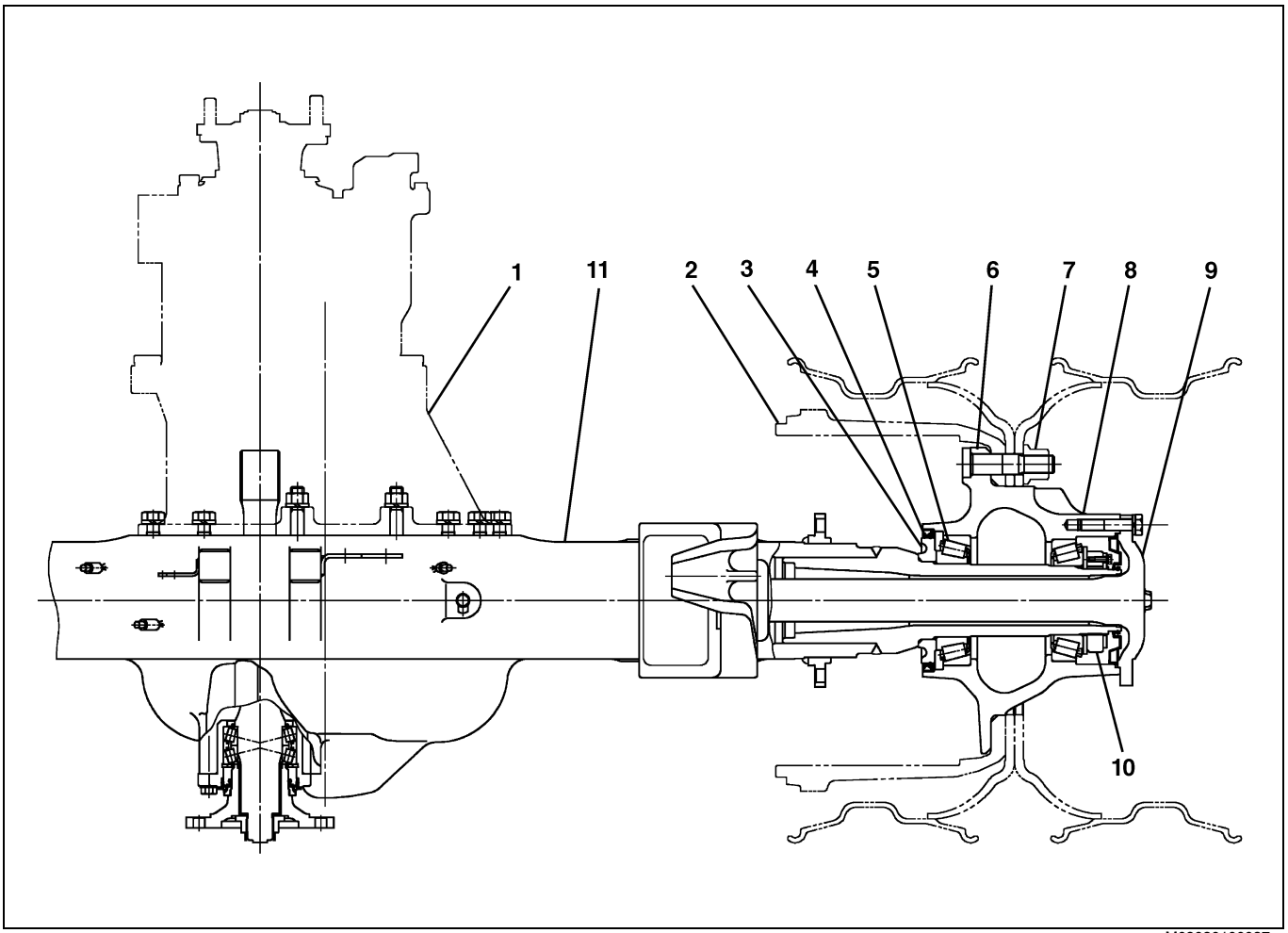
## DATA AND SPECIFICATION

M08030110BEI2001

| | |
|---|---|
| Type | Full-floating axle shaft |
| Housing | Banjo type, with extension tubes welded on both ends |
| Type of drive | Torque rod drive |

## DESCRIPTION

M08030110BEC1001




M08030100037

| | | | |
|---|---|---|---|
| 1 | Differential carrier assembly | 7 | Wheel nut |
| 2 | Brake drum | 8 | Wheel hub |
| 3 | Oil seal collar | 9 | Axle shaft |
| 4 | Oil seal | 10 | Lock nut |
| 5 | Wheel hub bearing | 11 | Axle housing |
| 6 | Hub bolt | | |

# TROUBLESHOOTING

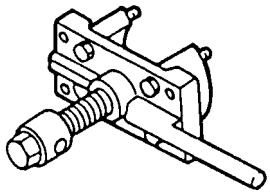
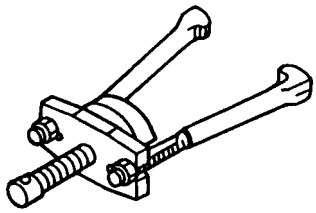
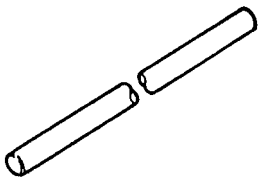
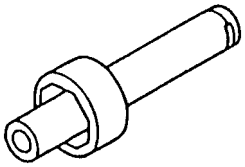
M08030110BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal noise (Bearing system)** | Worn or damaged pinion bearings. | Replace bearings. |
| | Worn or damaged differential side bearings. | Replace bearings. |
| | Loose pinion bearings. | Adjust bearing preload. |
| | Loose differential side bearings. | Adjust bearing preload. |
| **Abnormal noise (Gear system)** | Inadequate backlash on ring gear and pinion gear. | Adjust backlash. |
| | Worn thrust washers. | Replace. |
| | Worn differential spider. | Replace. |
| | Worn or damaged ring gear and pinion. | Replace. |
| | Worn or damaged differential side gears and pinions. | Replace. |
| | Loose ring gear tightening bolts. | Tighten bolts. |
| | Inadequate tooth contact of ring gear and pinion gear. | Replace or adjust tooth contact. |
| | Worn pinion spline. | Replace. |
| **Abnormal noise (Rear axle system)** | Worn rear axle shaft spline. | Replace. |
| | Worn hub bearings. | Replace. |
| | Loose hub bearings. | Adjust bearing preload. |
| | Loose differential case tightening bolts. | Tighten bolts. |
| **Abnormal noise (Oil system, etc.)** | Insufficient oil. | Add oil; check for leakage. |
| | Poor oil quality. | Change oil. |
| | Abnormal noise of propeller shaft. | Refer to chapter PROPELLER SHAFT. |

# SPECIAL TOOL

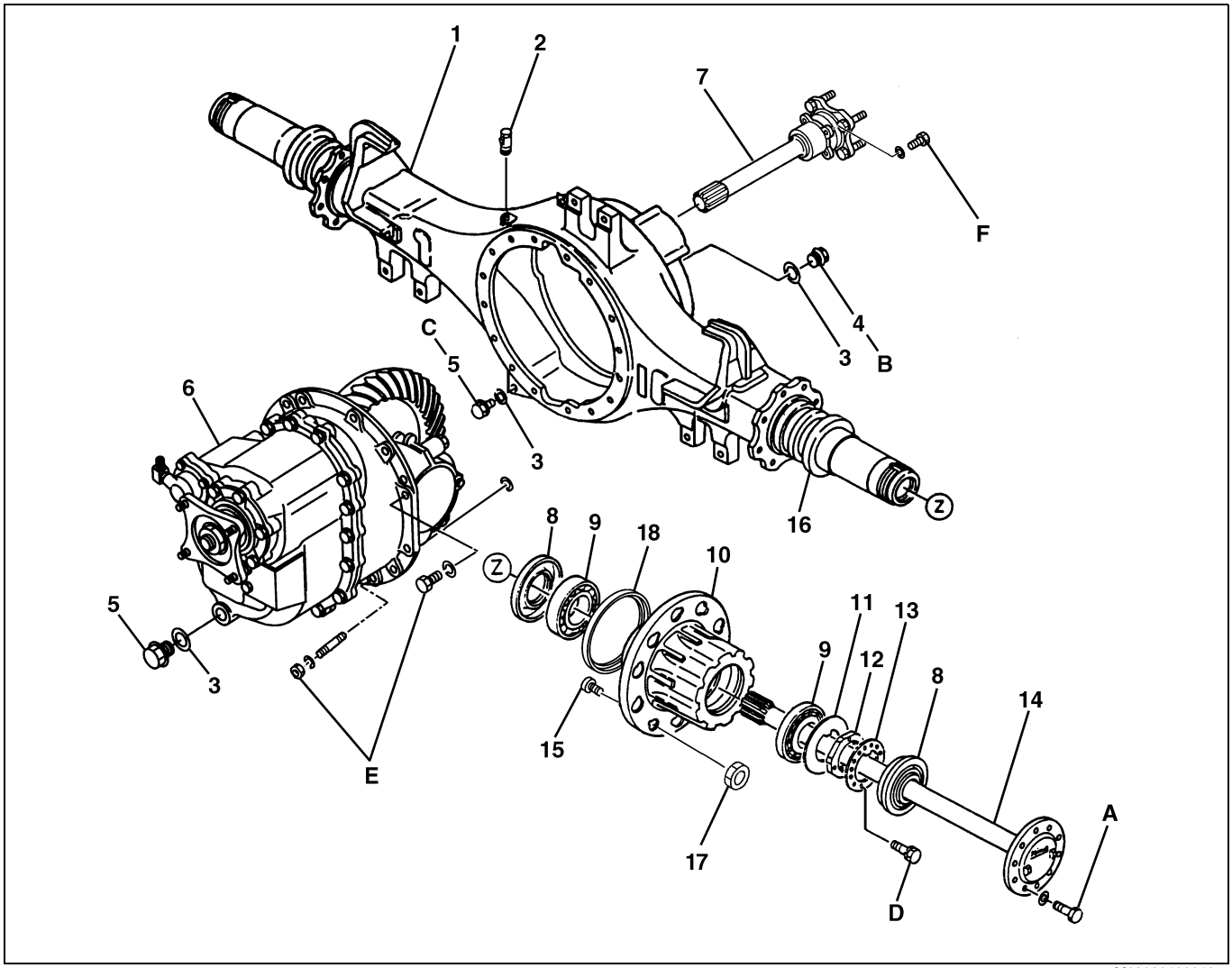
M08030110BEK1001

Prior to starting a rear axle overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09650-1790 | WHEEL HUB PULLER | |
|  | 09650-1310 | HUB BEARING PULLER | |
|  | 09849-1601<br>09849-2001 | HANDLE | |
|  | 09603-1360 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M08030110BED1001




M08030100040

| | | | | | |
|---|---|---|---|---|---|
| 1 | Axle housing assembly | 7 | Through shaft assembly | 13 | Lock plate |
| 2 | Air breather | 8 | Oil seal | 14 | Axle shaft |
| 3 | Gasket | 9 | Wheel hub bearing | 15 | Hub bolt |
| 4 | Oil filler plug | 10 | Wheel hub | 16 | Oil seal collar |
| 5 | Oil drain plug | 11 | Lock washer | 17 | Wheel nut |
| 6 | Differential carrier assembly | 12 | Lock nut | 18 | ABS sensor ring (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

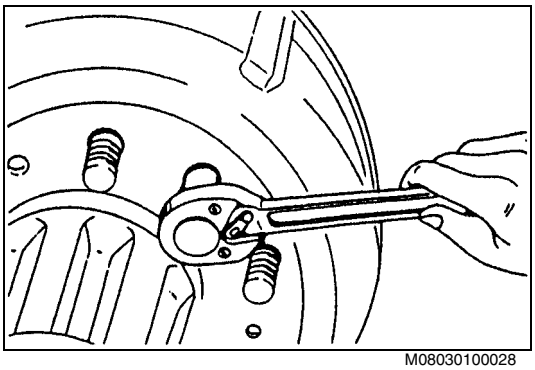
| | | | |
|---|---|---|---|
| A | 148-192 {1,500-2,000, 109-144} | D | 8.33-10.79 {85-110, 6.2-8.0} |
| B | 78.4-117.6 {800-1,200, 58-86} | E | 167-213 {1,700-2,200, 123-159} |
| C | 39.2-68.6 {400-700, 29-50} | F | 64-84 {650-870, 47-63} |

# OVERHAUL

M08030110BEH2001

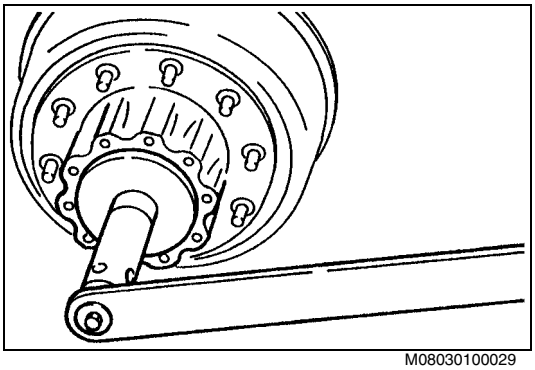
## IMPORTANT POINTS - DISASSEMBLY

**1. REMOVAL OF THE WHEELS**
(1) Refer to chapter WHEEL & TIRE.

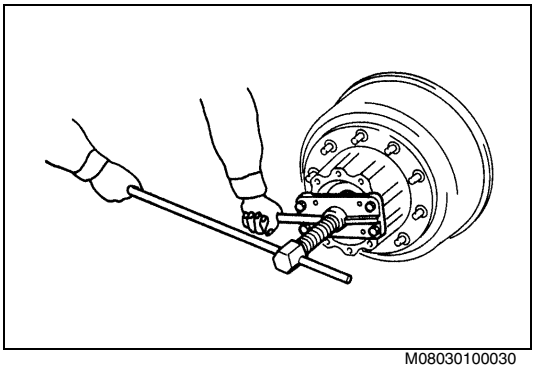

M08030100028

**2. REMOVAL OF THE BRAKE DRUMS**
(1) Loosen the drum set screws and remove the brake drums.

**NOTICE:**
- **If the drum does not easily come out, screw the set screws into the drum removing hole.**
- **Brake drum is heavy, therefore be careful when handling it.**

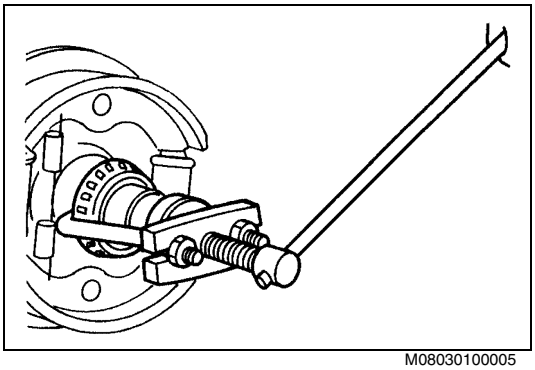

M08030100029

**3. REMOVAL OF THE WHEEL HUB BEARING LOCK NUT**
**SST:**
**Socket Wrench (09603-1360)**
**Handle (09849-1601)**
**Handle (09849-2001)**


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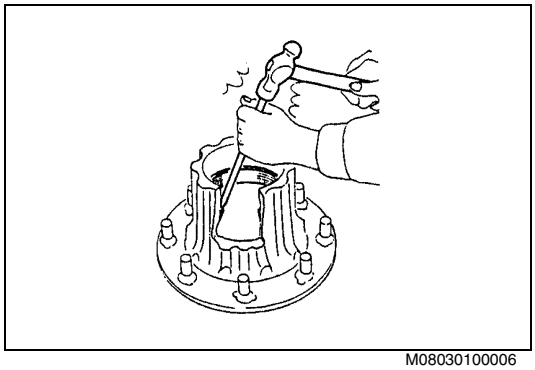
**4. REMOVAL OF THE WHEEL HUB AND THE OUTER WHEEL HUB BEARING**
**SST:**
**Wheel Hub Puller (09650-1790)**
**Handle (09849-1601)**
**Handle (09849-2001)**

**NOTICE:**
**The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100005

**5. REMOVAL OF THE INNER WHEEL HUB BEARING TOGETHER WITH OIL SEAL COLLAR**
**SST:**
**Hub Bearing Puller (09650-1310)**
**Handle (09849-1601)**
**Handle (09849-2001)**

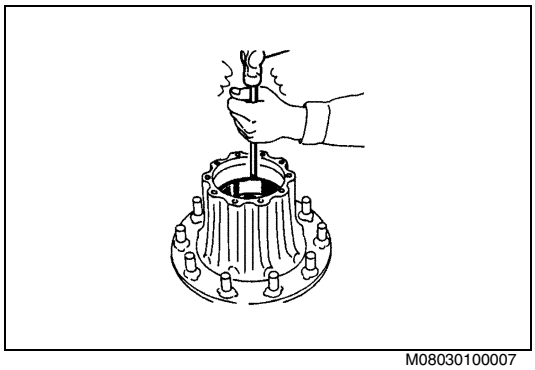
**6. REMOVAL OF THE WHEEL BRAKE**
(1) Refer to chapter SERVICE BRAKE.


M08030100006

## IMPORTANT POINTS - ASSEMBLY

**1. REPLACEMENT OF THE WHEEL HUB BEARING RACE**

(1) Remove the outer race of bearing by striking the race lightly and evenly through the 4 access holes in the wheel hub, using a tapping rod.

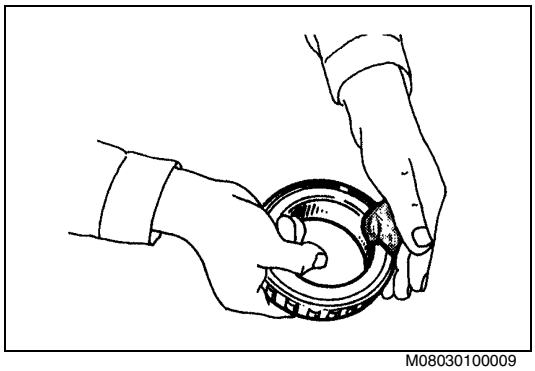

M08030100007

(2) Using a tapping rod and a hammer or a press, install the outer race.

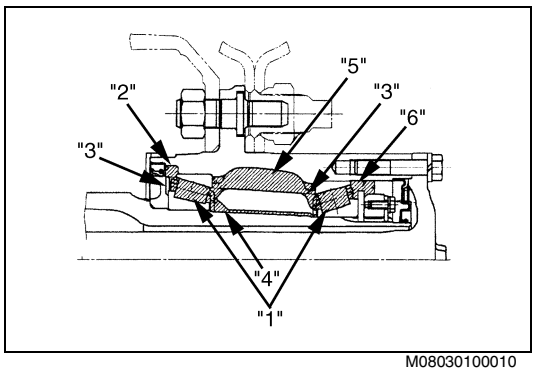
**2. GREASING**

(1) Pack sufficient amount of wheel hub bearing grease between the bearing rollers.

**NOTICE:**
**"1": Fill the grease to spaces among the inner race, rollers and retainer to the extent that there is not any vacancy remained.**

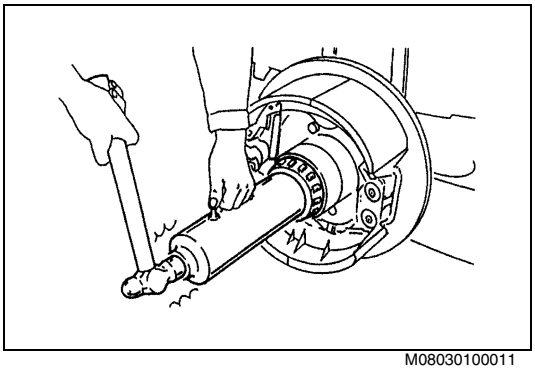

M08030100009

(2) Apply wheel hub bearing grease to wheel hub.



M08030100010

**NOTICE:**
- **"2": Fill the grease between the oil seal and inner bearing, and at this time some grease may flow out to the oil seal.**
- **"3": The grease has to ooze out to the extent that the retainer is buried.**
- **"4": After pressing in the inner race of the inner bearing, apply the grease to the end of race circumferentially with the width of 15 mm {0.591 in}.**
- **"5": When filling the grease to this space, do it up to the line which connects between the small diameter sides edges of 2 bearings.**
- **"6": Fill the grease up the half depth of the lock nut.**

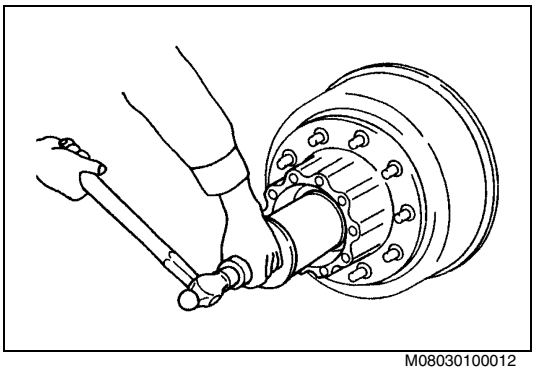

M08030100011

**3. INSTALLATION OF THE OIL SEAL, THE WHEEL HUB BEARINGS AND WHEEL HUB ASSEMBLY**

(1) Install the oil seal and the inner wheel hub bearing.

**NOTICE:**

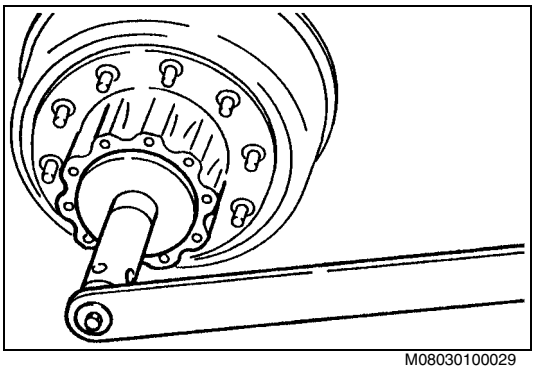
- **If the collar is warmed up with hot water, it can easily be installed.**


M08030100012

(2) Install the wheel hub assembly and the outer wheel hub bearing.

**NOTICE:**

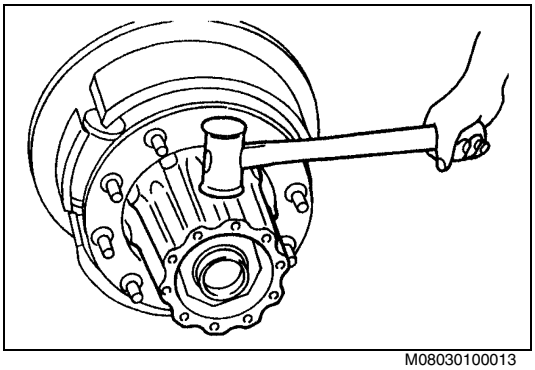
- **Using a tool as shown simplifies installation.**
- **The wheel hub assembly is heavy, therefore be careful when handling it.**


M08030100029

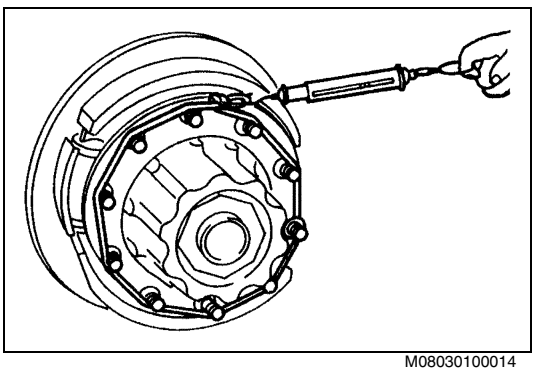
**4. ADJUSTMENT-OF THE WHEEL HUB BEARING PRELOAD**

(1) Tighten the wheel hub bearing lock nut with the specified torque then loosen the nut by 1/3 - 1/4 turn.
**SST: Socket Wrench (09603-1360)**

**Tightening Torque:**
**588-1,176 N·m {6,000-12,000 kgf·cm, 434-868 lbf·ft}**


M08030100013

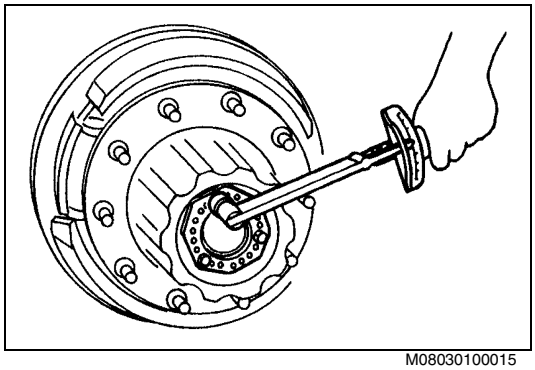
(2) Strike the wheel hub with a copper hammer to properly seat the wheel hub.


M08030100014

(3) Measure the wheel bearing preload. If it exceeds or it is less than the standard value shown below, adjust the preload with the lock nut.

**Assembly standard:**

| | |
|---|---|
| **Turning Torque<br>N·m {kgf·cm, lbf·ft}** | **4.9-8.9<br>{50-90, 3.7-6.5}** |
| **Spring balancer reading<br>N {kgf, lbf}** | **29.5-51.9<br>{3.0-5.3, 6.7-11.6}** |

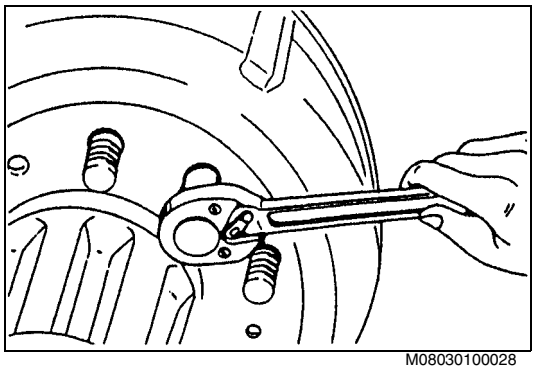

M08030100015

**5. INSTALLATION OF THE LOCK PLATE**

(1) Install the lock plate to the lock nut.

**NOTICE:**

- **If the holes of the plate are not aligned with screw holes of the nut, turn over the plate.**
- **If alignment is still unattainable, turn the lock nut further within the limits of wheel hub bearing preload.**


M08030100028

**6. INSTALLATION OF THE BRAKE DRUM**

(1) Install the brake drums and tighten the drum set screws.

**7. INSTALLATION OF THE WHEELS**

(1) Refer to chapter WHEEL & TIRE.

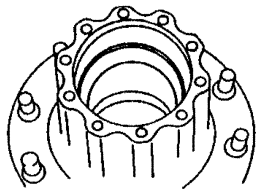
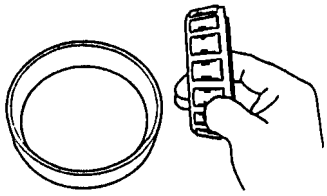
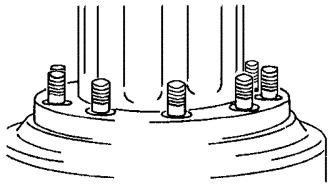
**8. BRAKE SYSTEM AIR BLEEDING AND BRAKE SHOE CLEARANCE ADJUSTMENT.**

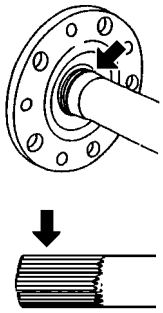
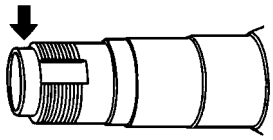
(1) On completion of the wheel hub and related parts reassembly, conduct the followings.

a. Adjust the brake chamber rod stroke according to the section WHEEL BRAKE ADJUSTMENT in the chapter SERVICE BRAKE.

# INSPECTION AND REPAIR

M08030110BEH3001

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Wheel hub bearing race: Burns, pitting and cracks** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Wheel hub bearings: Burns and pitting** | — | — | **Replace, if necessary.** | **Visual check**  |
| **Hub bolt: Wear and damage** | — | — | **Replace, if necessary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Oil seal collar:**<br>**Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Axle shaft spline:**<br>**Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Axle tube:**<br>**Wear and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |

# WHEEL & TIRE

AX04-001

**WHEEL AND TIRE ..... AX04-2**
DATA AND SPECIFICATIONS ..... AX04-2
DESCRIPTION ..... AX04-8
TROUBLESHOOTING ..... AX04-12
SPECIAL TOOL ..... AX04-15
PRECAUTIONS ..... AX04-16
INSPECTION ..... AX04-17
INSPECTION AND REPAIR ..... AX04-18

**SAE, JIS, DIN AND ISO TYPE WHEEL ..... AX04-19**
OVERHAUL ..... AX04-19

**SPOKE WHEEL AND ADAPTER TYPE WHEEL ..... AX04-24**
OVERHAUL ..... AX04-24

# WHEEL AND TIRE

## DATA AND SPECIFICATIONS

M08040101BEI2002

**The figures given in the table are based on the recommendation by European Tire and Rim Technical Organization. (E.T.R.T.O.)**

***(1). Tire radius given is dynamic effective radius for dual tires, for single tire, deduct 1.0 mm {0.039 in.} from the figure given.**

***(2). The rims with mark (•) are standard and others may be used.**

***(3). The max. air pressure and max. load refer to the recommendation by Japan Automobile Tire Manufacturers' Association. (J.A.T.M.A.)**

***(4). The tire is certified by ECE.**

***(5). Some vehicle specifications are not applicable to the following table. Refer to the Owner's Manual for details.**

**1. Diagonal tires**

| Tire size | Max. air press. kPa {kgf/cm$^2$, lbf/in.$^2$} | Allowable max. load kg {lb} | | Tire radius mm {in.} | *(2) Applicable rim size |
|---|---|---|---|---|---|
| | | Single | Dual | | |
| *(3) 7.00-16-6PR | 325 {3.25, 47} | 880 {1,940} | 840 {1,852} | *(1) 368 {14.49} | • 16 x 5.50F SDC |
| *(3) 7.00-16-10PR | 500 {5.00, 73} | 1,130 {2,491} | 1,075 {2,370} | | • 16 x 5.50F SDC |
| 7.00-16-12PR | 600 {6.12, 87} | 1,285 {2,833} | 1,250 {2,756} | 373 {14.69} | • 16 x 5.50F SDC |
| 7.50-16-12PR | 650 {6.63, 94} | 1,450 {3,197} | 1,400 {3,086} | 389 {15.31} | • 16 x 6.00GS SDC |
| *(3) 7.50-16-14PR | 650 {6.50, 94} | 1,510 {3,329} | 1,440 {3,175} | 383 {15.08} | |
| 7.50-20-10PR | 550 {5.61, 80} | 1,550 {3,417} | 1,500 {3,307} | 451 {17.76} | • 20 x 6.00S |
| 7.50-20-12PR | 675 {6.88, 98} | 1,800 {3,968} | 1,750 {3,858} | | |
| 8.25-16-14PR | 650 {6.63, 94} | 1,800 {3,968} | 1,700 {3,747} | 404 {15.91} | • 16 x 6.40H 16 x 6.00S SDC 16 X 6.00GS |
| *(3) 8.25-16-14PR | 575 {5.75, 83.4} | 1,710 {3,770} | 1,630 {3,593} | *(1) 404 {15.91} | • 16 x 6.00GS |
| 8.25-20-12PR | 600 {6.12, 87} | 1,900 {4,188} | 1,800 {3,968} | 468 {18.43} | • 20 x 6.50T |
| 8.25-20-14PR | 675 {6.88, 98} | 2,060 {4,541} | 1,950 {4,299} | | • 20 x 6.50T 20 x 6.00S |
| 9.00-20-12PR | 625 {6.37, 91} | 2,240 {4,938} | 2,060 {4,541} | 488 {19.21} | • 20 x 7.00T 20 x 6.50T |
| 9.00-20-14PR | 700 {7.14, 102} | 2,500 {5,511} | 2,300 {5,071} | | 20 x 6.50T 20 x 7.00T 20 x 7.50V |
| *(3) 10.00-20-12PR | 575 {5.75, 83} | 2,450 {5,401} | 2,210 {4,482} | *(1) 506 {19.92} | • 20 x 7.50V |

| Tire size | Max. air press. kPa {kgf/cm$^2$, lbf/in.$^2$} | Allowable max. load kg {lb} | | Tire radius mm {in.} | *(2) Applicable rim size |
|---|---|---|---|---|---|
| | | Single | Dual | | |
| 10.00-20-14PR | 650 {6.63, 94} | 2,650 {5,842} | 2,430 {5,357} | 507 {19.96} | 20 x 7.00T<br>20 x 7.50T |
| 10.00-20-16PR | 750 {7.65, 109} | 3,000 {6,614} | 2,725 {6,007} | | 20 x 7.00T<br>20 x 7.50V<br>20 x 8.00T |
| *(3) 11.00-20-12PR | 575 {5.75, 83} | 2,585 {5,699} | 2,435 {5,368} | *(1) 520 {20.47} | • 20 x 8.00V |
| 11.00-20-14PR | 675 {6.88, 98} | 3,000 {6,614} | 2,725 {6,007} | 521 {20.51} | 20 x 7.50V |
| 11.00-20-16PR | 725 {7.39, 105} | 3,250 {7,165} | 2,900 {6,393} | | 20 x 7.50V<br>20 x 8.50V |
| *(3) 12.00-20-14PR | 575 {5.75, 83} | 2,900 {6,393} | 2,760 {6,085} | *(1) 539 {21.22} | • 20 x 8.50V |
| 12.00-20-16PR | 675 {6.88, 98} | 3,350 {7,385} | 3,000 {6,613} | 540 {21.26} | 20 x 8.00V |
| 12.00-20-18PR | 775 {7.90, 112} | 3,750 {8,267} | 3,250 {7,165} | | 20 x 9.00V |
| 12.00-24-16PR | 675 {6.88, 98} | 3,650 {8,047} | 3,250 {7,165} | 589 {23.19} | • 24 x 8.50V<br>24 x 8.00V<br>24 x 9.00V |
| 12.00-24-18PR | 775 {7.90, 112} | 4,000 {8,818} | 3,650 {8,047} | | |
| *(3) 14.00-24-20PR | 675 {6.75, 98} | 4,990 {11,001} | 4,755 {10,483} | *(1) 642 {25.28} | • 24 x 10.00WI<br>24 x 9.00V |

**2. Radial tires (with tube)**

| Tire size | Max. air press. kPa {kgf/cm$^2$, lbf/in.$^2$} | Allowable max. load kg {lb} | | Tire radius mm {in.} | *(2) Applicable rim size |
|---|---|---|---|---|---|
| | | Single | Dual | | |
| *(3) 7.00R-16-8PR | 450 {4.5, 65} | 1,025 {2,259} | 980 {2,160} | *(1) 373 {14.69} | • 16 x 5.50F SDC |
| *(3) 7.00R-16-10PR | 525 {5.25, 76} | 1,130 {2,491} | 1,075 {2,369} | | • 16 x 5.50F SDC |
| *(3) 7.00R-16-12PR | 600 {6.00, 87} | 1,230 {2,711} | 1,170 {2,579} | | • 16 x 5.50F SDC |
| 7.50R-16-12PR | 625 {6.37, 91} | 1,450 {3,197} | 1,400 {3,086} | 390 {15.35} | 16 x 6.00GS |
| *(3) 7.50R-16-14PR | 700 {7.00, 102} | 1,510 {3,328} | 1,440 {3,174} | *(1) 387 {15.24} | • 16 x 6.00GS SDC |
| 7.50R-20-12PR | 675 {6.88, 98} | 1,800 {3,968} | 1,750 {3,858} | 451 {17.76} | • 20 x 6.00S 20 x 6.50T |
| 8.25R-16-14PR | 675 {6.88, 98} | 1,800 {3,968} | 1,700 {3,748} | 418 {16.46} | • 16 x 6.00GS |
| 8.25R-20-14PR | 675 {6.88, 98} | 2,060 {4,541} | 1,950 {4,299} | 467 {18.39} | • 20 x 6.50T 20 x 7.00T |
| 9.00R-20-12PR | 725 {7.39, 105} | 2,336 {5,150} | 2,050 {4,520} | 491 {19.29} | 20 x 7.00T |
| 9.00R-20-14PR | 725 {7.39, 105} | 2,500 {5,511} | 2,300 {5,071} | 494 {19.45} | • 20 x 7.00T 20 x 6.50T 20 x 7.50V |
| 10.00R-20-14PR | 725 {7.39, 105} | 2,650 {5,842} | 2,430 {5,357} | 508 {20.00} | • 20 x 7.50V 20 x 6.50T 20 x 7.00T 20 x 8.00V |
| 10.00R-20-16PR | 800 {8.16, 116} | 3,000 {6,614} | 2,725 {6,007} | 511 {20.12} | • 20 x 7.50V 20 x 7.00T |
| 11.00R-20-14PR | 725 {7.39, 105} | 3,000 {6,614} | 2,725 {6,007} | 523 {20.59} | • 20 x 8.00V 20 x 7.50V 20 x 8.50V |
| 11.00R-20-16PR | 800 {8.16, 116} | 3,250 {7,165} | 2,900 {6,393} | 525 {20.67} | • 20 x 8.00V 20 x 7.50V 20 x 8.50V |
| 12.00R-20-16PR | 750 {7.65, 109} | 3,350 {7,385} | 3,000 {6,613} | 542 {21.34} | • 20 x 8.50V 20 x 9.00V |
| 12.00R-20-18PR | 850 {8.67, 123} | 3,750 {8,267} | 3,250 {7,165} | 545 {21.46} | • 20 x 8.50V 20 x 8.50 |
| 14.00R-20-18PR | 700 {7.14, 102} | 4,500 {9,921} | 4,125 {9,094} | 601 {23.66} | 20 x 10.00V 20 x 10.00W |

**3. Radial tires (Tubeless)**

| Tire size | Max. air press. kPa {kgf/cm$^2$, lbf/in.$^2$} | Allowable max. load kg {lb} | | Tire radius mm {in.} | *(2) Applicable rim size |
|---|---|---|---|---|---|
| | | Single | Dual | | |
| 205/75R17.5 122/120 | 675 {6.88, 81} | 1,500 {3,307} | 1,400 {3,086} | 366 {14.41} | • 17.5 x 6.00<br>17.5 x 5.25<br>17.5 x 6.75 |
| 215/75R17.5 | 817.87 {8.34, 118.6} | 2,180 {4,806} | 2,060 {4,542} | — | 17.5 x 6.00<br>17.5 x 6.75 |
| *(3) 225/80R17.5-14PR | 700 {7.00, 102} | 1,550 {3,417} | 1,500 {3,307} | *(1) 389 {15.31} | • 17.5 x 6.75<br>17.5 x 6.00 |
| *(3) 225/90R17.5-14PR | 700 {7.00, 102} | 1,750 {3,858} | 1,650 {3,638} | *(1) 410 {16.14} | • 17.5 x 6.75<br>17.5 x 6.00 |
| *(4) 225/90R17.5 -128/126 | 720 {7.34, 104} | 1,800 {3,968} | 1,700 {3,748} | *(1) 410 {16.14} | • 17.5 x 6.00 |
| 255/70R22.5 | 800 {8.16, 116} | 2,500 {5,511} | 2,300 {5,071} | 452 {17.80} | • 22.5 x 7.50 |
| 235/70R22.5 | 900 {9.18, 131} | 2,360 {5,202} | 2,180 {4,806} | 439 {17.28} | • 22.5 x 6.75 |
| 235/70R17.5 | 725 {7.39, 105} | 1,900 {4,189} | 1,800 {3,968} | 387 {15.24} | 17.5 x 6.75 |
| 235/75R17.5 | 725 {7.39, 105} | 1,900 {4,189} | 1,800 {3,968} | 372 {14.65} | 17.5 x 6.75 |
| 255/70R22.5 | 900 {9.18, 131} | 2,725 {6,007} | 2,500 {5,511} | 452 {17.80} | • 22.5 x 7.50<br>22.5 x 6.75<br>22.5 x 8.25 |
| 275/70R22.5 | 900 {9.18, 131} | 3,150 {6,944} | 2,900 {6,393} | 465 {18.31} | • 22.5 x 8.25<br>22.5 x 7.50 |
| 275/80R22.5 | 809.05 {8.25, 117.3} | 3,000 {6,613} | 2,725 {6,007} | 490 {19.29} | • 22.5 x 8.25<br>22.5 x 7.50 |
| 275/80R22.5 -149/146J | 850 {8.67, 123} | 3,250 {7,165} | 3,000 {6,614} | 491 {19.33} | • 22.5 x 7.50 |
| 295/70R22.5 | 882.60 {9.00, 128.0} | 3,450 {7,605} | 3,150 {6,944} | 467 {18.39} | • 22.5 x 9.00<br>22.5 x 8.25 |
| 295/80R22.5 | 800 {8.16, 116} | 3,350 {7,385} | 3,000 {6,614} | 507 {19.96} | • 22.5 x 8.25 |
| 315/80R22.5 | 825 {8.41, 120} | 3,750 {8,267} | 3,350 {7,385} | 523 {20.59} | • 22.5 x 9.00 |
| 8R17.5 117/116 | 600 {6.12, 87} | 1,285 {2,833} | 1,250 {2,756} | 381 {15.00} | • 17.5 x 5.25<br>• 17.5 x 6.00<br>17.5 x 6.75 |
| *(3) 8.5R17.5-12PR | 625 {6.25, 91} | 1,450 {3,196} | 1,400 {3,086} | *(1) 389 {15.31} | • 17.5 x 6.00<br>16 x 6.00GS SDC |
| *(3) 9R22.5-14PR | 725 {7.25, 105} | 2,030 {4,475} | 1,930 {4,255} | *(1) 470 {18.50} | • 22.5 x 6.75<br>22.5 x 6.00 |

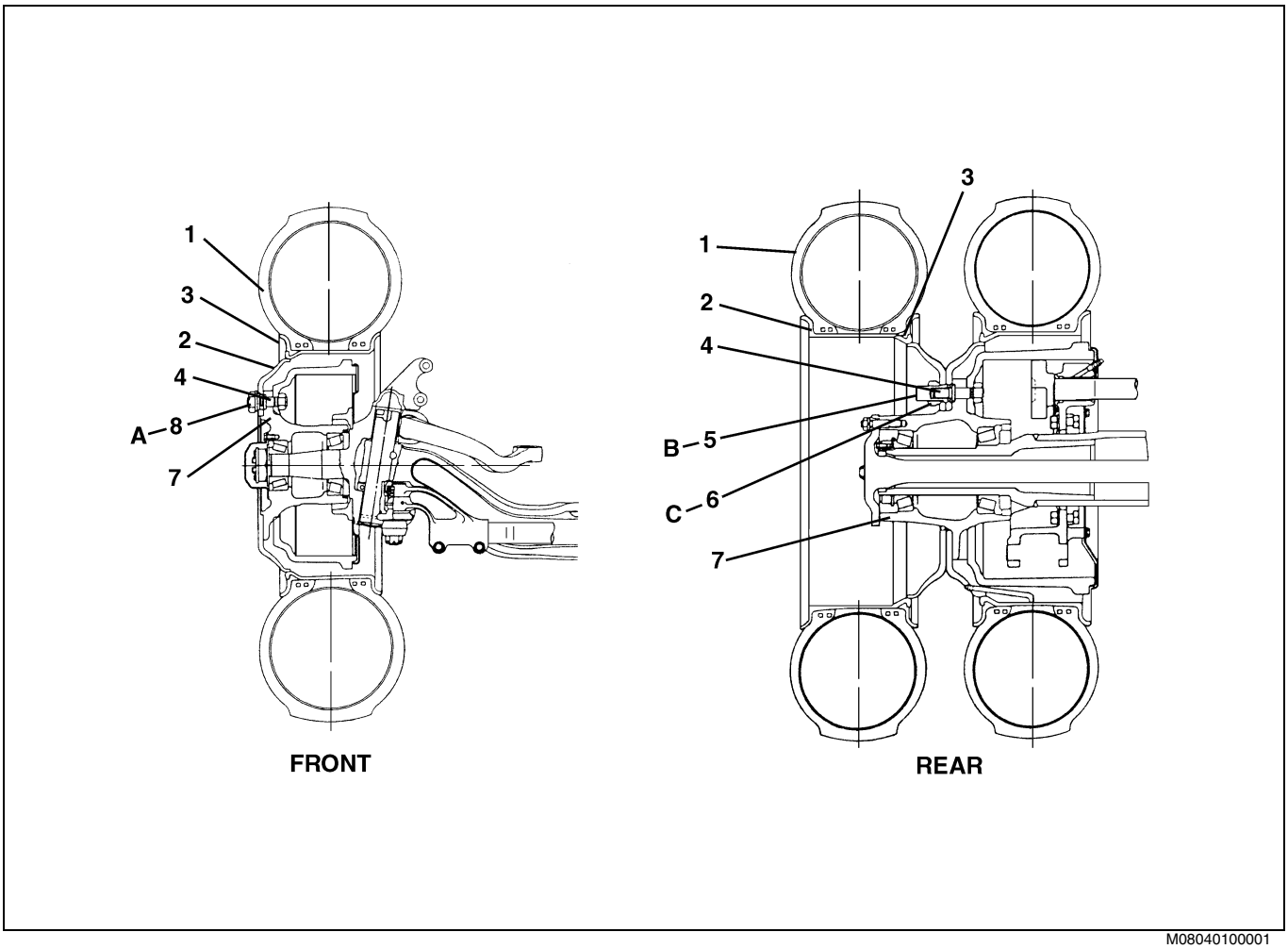
| Tire size | Max. air press. kPa {kgf/cm$^2$, lbf/in.$^2$} | Allowable max. load kg {lb} | | Tire radius mm {in.} | *(2) Applicable rim size |
|---|---|---|---|---|---|
| | | Single | Dual | | |
| 9.5R-17.5-14PR | 671.76 {6.85, 97.4} | 1,700 {3,748} | 1,600 {3,527} | 408 {16.06} | • 17.5 x 6.00<br>17.5 x 6.75 |
| 9.5R-17.5 129/127 | 671.76 {6.85, 97.4} | 1,700 {3,748} | 1,600 {3,527} | 408 {16.06} | • 17.5 x 6.00<br>17.5 x 6.75 |
| *(3) 10R22.5-14PR | 725 {7.25, 105} | 2,415 {5,324} | 2,300 {5,071} | *(1) 492 {19.37} | • 22.5 x 7.50<br>22.5 x 6.75 |
| *(3) 11R22.5-14PR | 700 {7.00, 102} | 2,725 {6,007} | 2,500 {5,511} | *(1) 508 {20.0} | • 22.5 x 8.25<br>22.5 x 7.50 |
| *(3) 11R22.5-16PR | 800 {8.00, 116} | 3,000 {6,614} | 2,725 {6,007} | *(1) 508 {20.0} | • 22.5 x 8.25<br>22.5 x 7.50 |
| *(3) 12R22.5-14PR | 725 {7.25, 105} | 3,000 {6,614} | 2,725 {6,007} | *(1) 523 {20.59} | • 22.5 x 9.00<br>22.5 x 7.50<br>22.5 x 8.25 |
| *(3) 12R22.5-16PR | 800 {8.00, 116} | 3,250 {7,165} | 2,900 {6,393} | *(1) 523 {20.59} | • 22.5 x 9.00<br>22.5 x 8.25 |
| 12R22.5-152/148 | 850 {8.67, 123} | 3,550 {7,826} | 3,150 {6,944} | 526 {20.71} | • 22.5 x 8.25 |

**4. Off the road tires**

| Tire size | Max. air press. kPa {kgf/cm$^2$, lbf/in.$^2$} | Allowable max. load kg {lb} | Tire radius mm {in.} | *(2) Applicable rim size |
|---|---|---|---|---|
| | | Single | | |
| *(3) 7.50-20-12PR | 525 {5.25, 76} | 1,600 {3,527} | *(1) 447 {17.60} | • 6.00S |
| *(3) 8.25-20-12PR | 525 {5.25, 76} | 1,890 {4,167} | *(1) 465 {18.31} | • 6.50T<br>6.00S |
| *(3) 8.25-20-14PR | 600 {6.00, 87} | 2.045 {4,508} | | |
| *(3) 9.00-20-12PR | 475 {4.75, 69} | 2,120 {4,674} | *(1) 485 {19.09} | • 7.00T<br>6.50T |
| *(3) 9.00-20-14PR | 550 {5.50, 80} | 2,310 {5,093} | | |
| *(3) 10.00-20-14PR | 500 {5.00, 73} | 2.470 {5,445} | *(1) 500 {19.69} | • 7.50V<br>7.00T<br>8.00V |
| *(3) 11.00-20-14PR | 475 {4.75, 69} | 2.605 {5,743} | *(1) 513 {20.20} | • 8.00V<br>7.50V<br>8.50V |
| *(3) 12.00-20-14PR | 425 {4.25, 62} | 2,795 {6,162} | *(1) 532 {20.94} | • 8.50V<br>8.00V<br>9.00V |
| *(3) 12.00-20-16PR | 500 {5.00, 73} | 3,075 {6,779} | | |
| *(3) 12.00-20-18PR | 550 {5.50, 80} | 3,250 {7,165} | | |
| *(3) 12.00-24-16PR | 500 {5.00, 73} | 3,460 {7,628} | *(1) 582 {22.91} | • 8.50V<br>8.00V<br>9.00V |
| *(3) 13.00-24-18PR | 500 {5.00, 73} | 4,000 {8,818} | *(1) 606 {23.86} | • 9.00V<br>8.50V |
| *(3) 14.00-20-16PR | 425 {4.25, 62} | 3,850 {8,488} | *(1) 584 {22.99} | • 10.00WI<br>9.00V |
| *(3) 14.00-24-16PR | 425 {4.25, 62} | 4,295 {9,469} | *(1) 635 {25.00} | • 10.00WI<br>9.00V |
| *(3) 14.00-24-20PR | 525 {5.25, 76} | 4,865 {10,725} | | |
| *(3) 14.00-24-24PR | 650 {6.50, 94} | 5,510 {12,147} | | |

# DESCRIPTION

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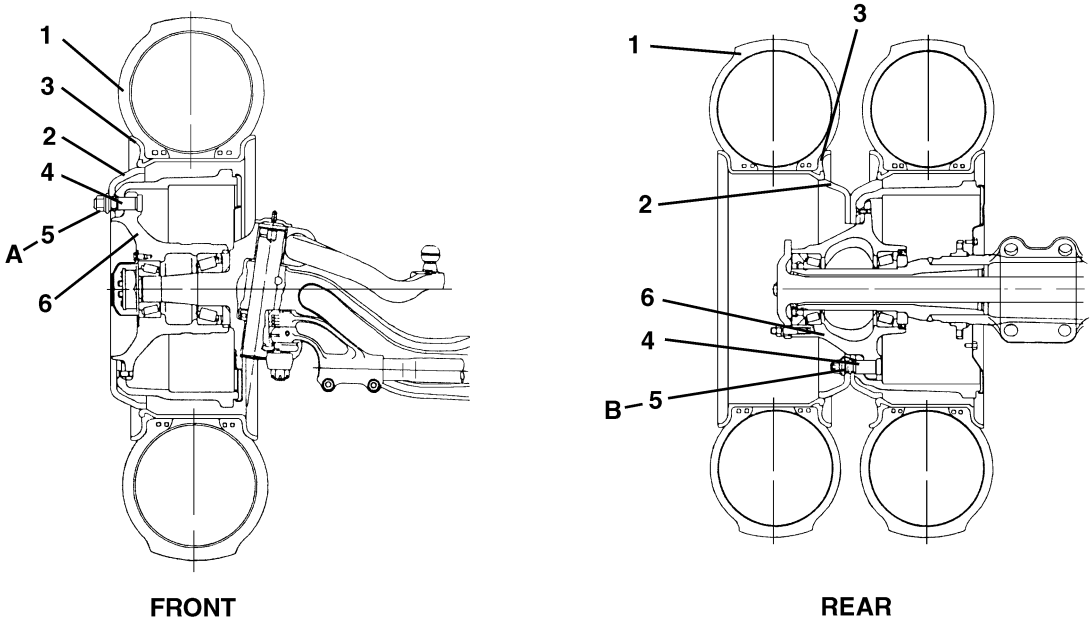



M08040100001

**SAE AND JIS TYPE**

| | | | |
|---|---|---|---|
| 1 | Tire | 5 | Inner wheel nut |
| 2 | Disc wheel | 6 | Outer wheel nut |
| 3 | Side ring | 7 | Hub |
| 4 | Hub bolt | 8 | Wheel nut |

| | Hub bolt diameter mm {in.} | Tightening torque N·m {kgf·cm, lbf·ft} |
|---|---|---|
| A | 20 {0.787} | 392.27-470.71 {4,000-4,800, 290-347} |
| | 18 {0.709} | 235.36-294.19 {2,400-3,000, 174-216} |
| B, C | 20 {0.787} | 392.27-470.71 {4,000-4,800, 290-347} |
| | 18 {0.709} | 235.36-294.19 {2,400-3,000, 174-216} |

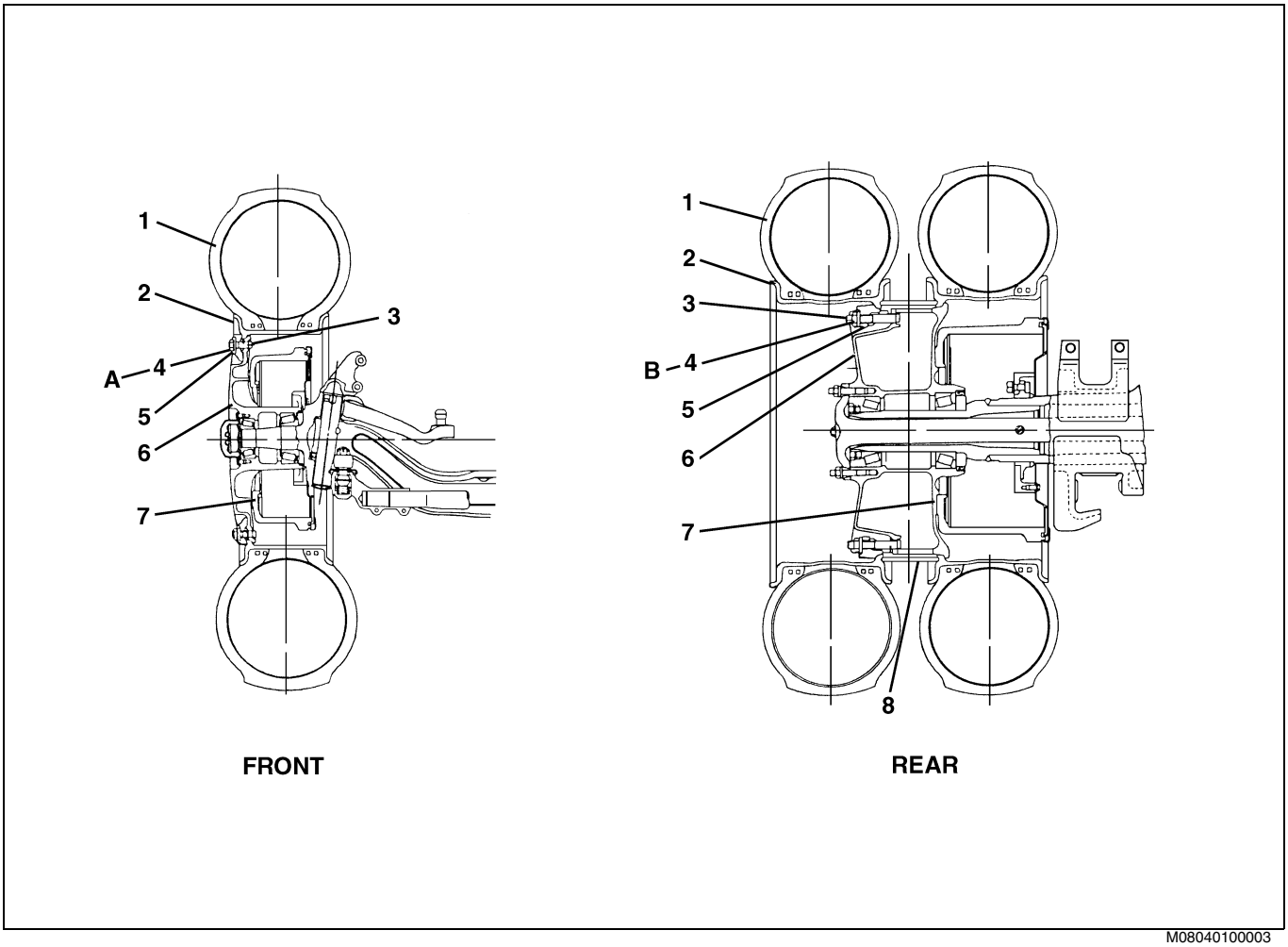



M08040100002

**DIN AND JIS TYPE**

| | | | |
|---|---|---|---|
| 1 | Tire | 4 | Hub bolt |
| 2 | Disc wheel | 5 | Wheel nut |
| 3 | Side ring | 6 | Hub |

| | Type | Tightening torque N·m {kgf·cm, lbf·ft} |
|---|---|---|
| A | DIN | 490.34-588.39 {5,000-6,000, 362-433} |
| | ISO | 490-539 {5,000-5,500, 362-397} |
| B | DIN | 490.34-588.39 {5,000-6,000, 362-433} |
| | ISO | 490-539 {5,000-5,500, 362-397} |

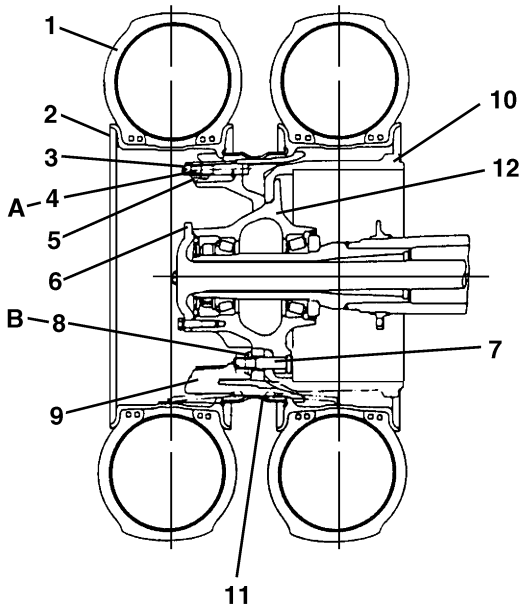



M08040100003

**SPOKE WHEEL TYPE**

| | | | |
|---|---|---|---|
| 1 | Tire | 5 | Clamp |
| 2 | Rim | 6 | Spoke wheel |
| 3 | Clamp bolt | 7 | Brake drum |
| 4 | Clamp nut | 8 | Band spacer |

| | Tightening torque N·m {kgf·cm, lbf·ft} |
|---|---|
| A | 264.78-294.19 {2,700-3,000, 196-216} |
| B | 264.78-294.19 {2,700-3,000, 196-216} |

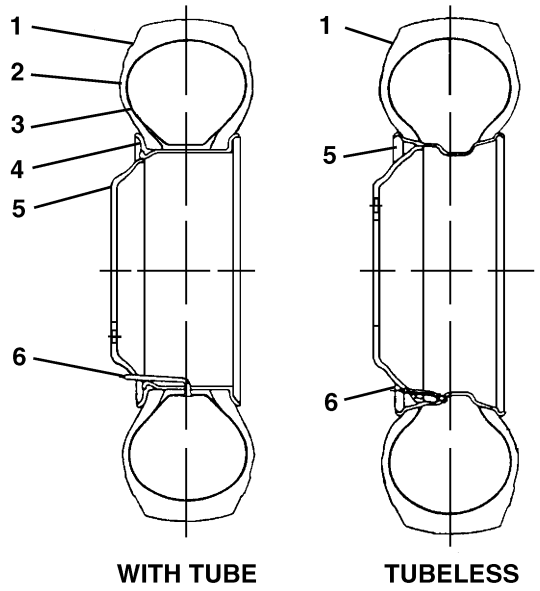



M08040100004

**ADAPTER TYPE SPOKE WHEEL (Only for rear)**

| | | | |
|---|---|---|---|
| 1 | Tire | 7 | Hub bolt |
| 2 | Rim | 8 | Hub nut |
| 3 | Clamp bolt | 9 | Adapter |
| 4 | Clamp nut | 10 | Brake drum |
| 5 | Clamp | 11 | Band spacer |
| 6 | Axle shaft | 12 | Hub |

| | Tightening torque N·m {kgf·cm, lbf·ft} |
|---|---|
| A | 294.20-323.61 {3,000-3,300, 217-238} |
| B | 490.34-588.39 {5,000-6,000, 362-433} |




M08040100005

**WHEEL AND TIRE**

| | | | |
|---|---|---|---|
| **1** | **Tire** | **4** | **Side ring** |
| **2** | **Tube** | **5** | **Disc wheel** |
| **3** | **Flap** | **6** | **Valve** |

# TROUBLESHOOTING

**M08040101BEF3001**

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Excessive wear on edges of tread** | Under inflated tires | Properly inflate with the recommended pressure. |
| | Vehicle overloading | Correct as required by Factory spec. |
| | High speed cornering | Correct as required by Factory spec. |
| | Incorrect wheel alignment | Set to the correct specifications. |
| **Tires show excessive wear in center of tread** | Tires overinflated | Properly inflate with the recommended pressure. |
| **Excessive tire wear** | Improper tire pressure | Properly inflate with the recommended pressure. |
| | Incorrect tire wheel usage | Install the correct tire wheel combination. |
| | Bent wheel | Repair or replace. |
| | Front end out of alignment | Align front end. |
| | Loose, worn or damaged steering linkage, joints, suspension components, bushing or ball joints | Inspect, repair or replace as required |

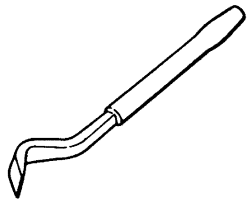
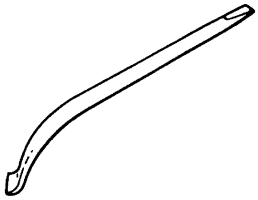
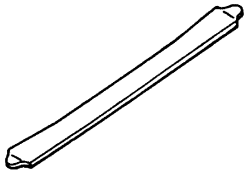
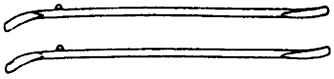
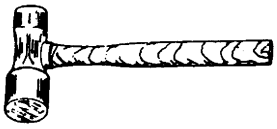
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Wheel hopping (vehicle vibration and rough steering) (Disc wheels)** | Rocks or debris wedged between dual disc wheels | Remove the rocks and the debris. |
| | Out-of-balance tire and/or hub and drum | Determine the out-of-balance component and balance or replace. |
| | Improper positioning of the side ring split | Reassemble with ring split, opposite (180 degrees) to the valve opening to improve the balance. |
| **Wheel hopping (vehicle vibration and rough steering) (Vehicle)** | Loose or worn drive line or suspension | Identify the location of vibration carefully. Then repair or replace the loose or worn parts. (Refer to PROPELLER SHAFT for vehicle vibration.) |
| **Wobbling (vehicle vibration and rough steering) (Disc wheels)** | Bent or distorted due to the overloading or improper handling | Replace the wheel. |
| | Loose mountings, damaged studs, wheel nuts, enlarged stud holes, worn or broken hub face, or foreign material on mounting surfaces | Replace worn or damaged parts. Clean mounting surfaces. |
| **Wobbling (vehicle vibration and rough steering) (Vehicle)** | Improper alignment | Have vehicle aligned. |
| | Loose, worn or broken suspension parts | Repair or replace. |
| **Cracked or broken wheel discs (cracks develop in the wheel disc from hand hole to hand hole, from hand hole to rim, or from hand hole to stud hole.)** | Metal fatigue resulting from overloading | Replace wheel. |
| **Damaged hub bolt holes (hub bolt holes become worn, elongated or deformed, metal builds up around hub bolt hole edges, cracks develop from hub bolt hole to hub bolt hole.)** | Loose wheel mounting | • Replace wheel and check the installation of correct hub bolt and nuts.<br>• Check the cracked or broken hub bolt-replace.<br>• Check the worn hub face-replace.<br>• Check the broken or cracked hub-replace.<br>• Clean mounting surfaces (Retorque the wheel nuts periodically.)<br>• Rust streaks fanning out from hub bolts holes: indicates that the wheel nuts are or have been loose. |
| **Tire slippage on rim (Disc wheels)** | Improper storage or operating conditions | Correct as required. |
| | Poor maintenance | Follow the proper maintenance procedures. |
| | Rust, corrosion or bead seating | Correct as required. |
| | Loss of pressure | Follow the proper maintenance procedures. |
| **Tire mounting difficulties (Wheel rims)** | Mismatched tire and rim sizes | Correct as required. |
| | Defective or mismatched rings for the rim | Correct as required. |
| | Tires overinflated | Properly inflate with the recommended pressure. |
| | Corrosion and dirt | Correct as required. |

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Loose inner wheel** | Excessive hub bolt standout from the mounting face of hub allowing the wheel nut to bottom out | Replace with the proper length hub bolt. |
| | Improper torque | Follow the recommended torque procedure. |
| | Wrong inner nut | Use correct inner nuts. |
| **Broken hub bolts** | Loose wheel nuts | Replace the hub bolt and follow the proper torque procedures. |
| | Overloading | Replace the hub bolt. |
| **Stripped threads** | Excessive clamp load | Replace hub bolt and follow the proper torque procedures. |
| **Rust streaks from hub bolt holes** | Loose wheel nuts | Check complete assembly, replace damaged parts and follow the proper torque procedures. |
| **Damaged inner or outer wheel nuts** | Loose wheel assembly | Replace wheel nuts. Check the proper torque procedures. |
| **Frozen inner or outer wheel nuts** | Corrosion or damage | Replace wheel nuts and hub bolts. |

# SPECIAL TOOL

M08040101BEK1001

Prior to starting a wheel and tire overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09672-1010 | LEVER | |
|  | 09672-1020 | LEVER | |
|  | 09672-1040 | LEVER | |
|  | 09609-1210 | LEVER | |
|  | 09609-1220 | RUBBER HUMMER | |

# PRECAUTIONS

M08040101BEC1002

**CAUTION:**
**Failure to comply with the following procedures may result in faulty positioning of the tire and/or rim parts, and can cause the assembly to burst with a explosive force sufficient to cause serious physical injury or death.**

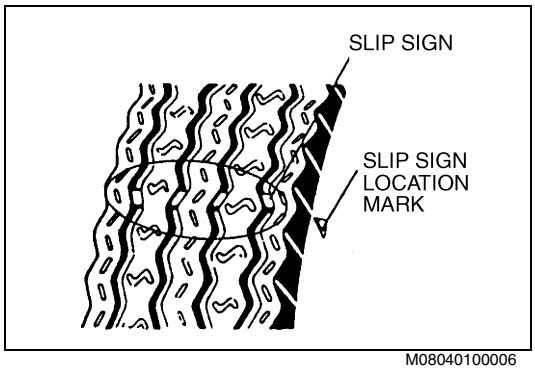
**1. DEFLATION AND DISASSEMBLY**
(1) Always check the tire/rim assembly for the proper components seating prior to the removal from the vehicle.
(2) Always deflate the tire by removing the valve core prior to removing the wheel from vehicle or disassembling of the components.
(3) Never position your body in front of the rim during deflation.
(4) Always follow the assembly and disassembly procedures outlined in this instruction manual and obtain safety literature from the Authorities.
(5) Never use a steel hammer to assemble or disassemble the rim components. Use a lead, brass, or plastic type mallet.

**2. RIM INSPECTION**
(1) Always select the proper tire size and construction to match the rim or wheel rating and size.
(2) Never use damaged, worn, or corroded rims, wheels, or mounting hardware.
(3) Always clean and repaint lightly rusted rims.
(4) Never use a rim or wheel component you cannot identify.

**3. ASSEMBLY AND INFLATION**
(1) Always perform the double check to see that the removable rings are properly seated before inflating.
(2) Always inflate the tire in a safety cage or use a portable lock ring guard. Use a clip-on type air chuck with a remote valve so that you can stand clear during the tire inflation.
(3) Never attempt to seat the rings while the tire is totally or partially inflated.
(4) Never re-inflate or add inflation pressure to a tire that has been run flat or seriously under inflated without removing and checking for ring seating and rim damage.
(5) Tire pressure should be checked while cold. Do not bleed air from tires while hot. This will result in an under inflated condition. Under inflated tires build up excessive heat due to overdeflection that may result in sudden tire deterioration, causing severe handling problems.
(6) Never use an assembly with excessive side ring play, wide gaps between ring ends, or butting ring ends.
(7) Never hammer on the components of an inflated or partially inflated assembly.

# INSPECTION

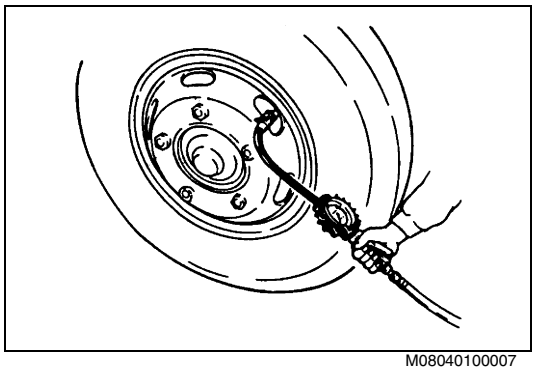
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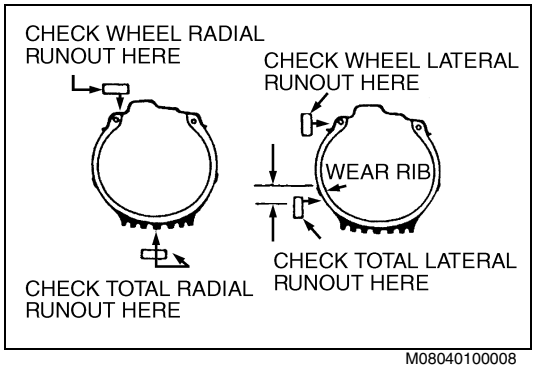
M08040100006

## 1. GENERAL INSPECTION

(1) Check the tire tread wear (groove depth) and tire damage. If the slip sign on the tire tread comes out, replace the tire.
**Groove depth (Remaining groove)**
**General running: 1.6 mm {0.063 in.}**
**High-speed running: 3.2 mm {0.126 in.}**


M08040100007

(2) Check the air pressure.
If improper, inflate the tire to the proper pressure as previously described in this chapter.



M08040100008

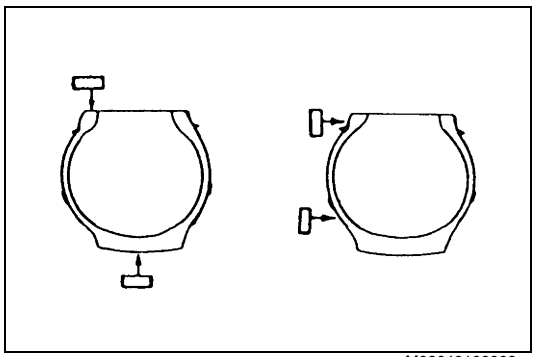
## 2. CHECK RUNOUT IN THE TIRE AND WHEEL RIM.

**NOTICE:**
**Eliminate any flat spots in the tire by driving the vehicle a little.**

(1) Jack up the vehicle and the check the runout in the tire and wheel rim.

**Unit: mm {in.}**

| | Tire | Wheel rim |
|---|---|---|
| **Lateral runout** | **Less than 2.5 {0.098}** | **Less than 1.8 {0.071}** |
| **Radial runout** | **Less than 2.5 {0.098}** | **Less than 1.8 {0.071}** |


M08040100009

(2) If the wheel rim does not conform to the runout limits, try re-mounting the wheel in a different position.
(3) If the wheel rim is still not within 1.8 mm {0.072 in.} of runout, then replace it with a new rim.
(4) If the tire does not conform to runout standards, reinstall it in different position on the rim.

## 3. WHEEL AND TIRE BALANCING.

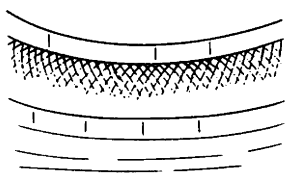
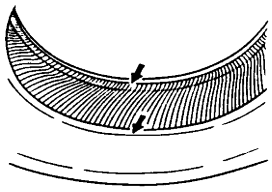
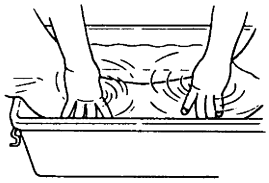
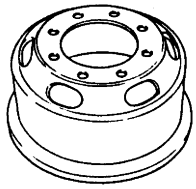
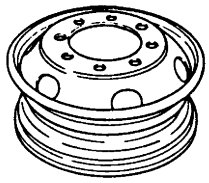
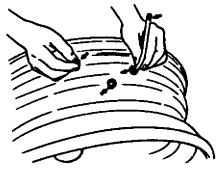
(1) Driving with a rim or tire that is unbalanced may cause the vehicle and steering wheel to shimmy, and will produce an abnormal tire wear.
In this situation, we recommend that you should balance the wheels.

- Static balancing
  This is relatively effective when operating at low speeds; however, if operating at high speeds, dynamic balancing is recommended.
- Dynamic balancing
  Please balance the wheels, using a balancing machine.

# INSPECTION AND REPAIR

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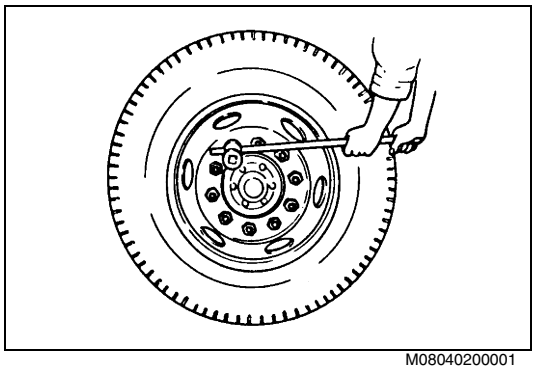
Unit: mm {in.}

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Tire:<br>Damage, foreign matter, etc. | — | — | Replace, if necessary. | Visual check<br>  |
| Tubeless tire:<br>Damage | — | — | Replace, if necessary. | Visual check<br>  |
| Tube:<br>Air leakage | — | — | Replace, if necessary. | Visual check<br>  |
| Wheel (With tube):<br>Cracks and deformation | — | — | Replace, if necessary. | Visual check<br>  |
| Wheel (Tubeless tire):<br>Cracks and deformation | — | — | Replace, if necessary. | Visual check<br>  |
| Rim (Tubeless tire):<br>Damage | — | — | Replace, if necessary. | Visual check<br>  |
| Pipe, nut and O-ring of the valve (tubeless tire):<br>Damage | — | — | Replace, if necessary. | Visual check<br>  |

# SAE, JIS, DIN AND ISO TYPE WHEEL

## OVERHAUL

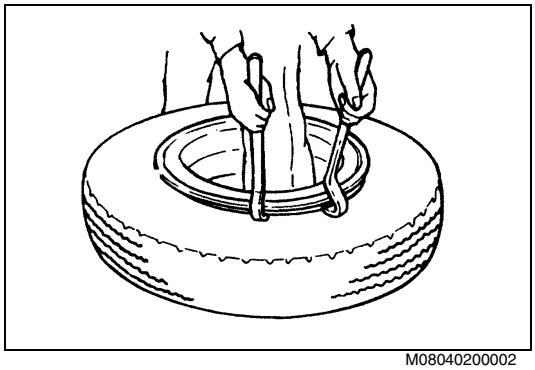
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### IMPORTANT POINT– REMOVAL

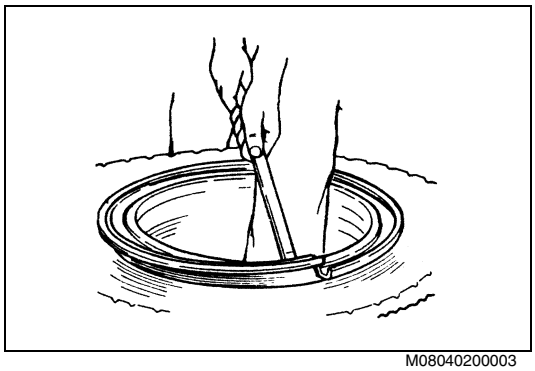
**1. REMOVE THE WHEEL AND TIRE.**
(1) Loosen the wheel nuts, but do not remove them.
(2) Raise the vehicle until the tire clear the floor.
(3) Remove the wheel nuts and tire from the hub and drum.
On dual tires, the inner wheel nuts will also have to be removed for the inner tire to be removed.

**NOTICE:**
- **Be sure to apply the wheel stoppers in the front or rear tires.**
- **The wheel nuts on the right side of the vehicle have right hand threads, and those on the left side have left hand threads.**

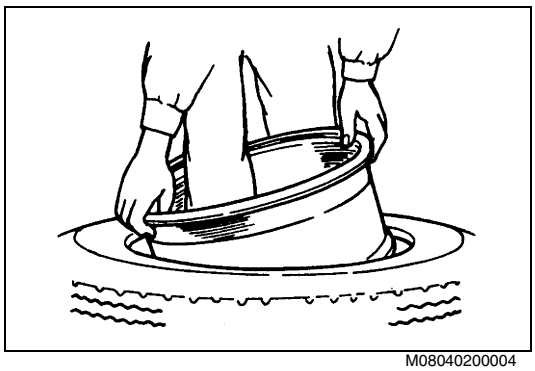

M08040200002

### IMPORTANT POINT - DISASSEMBLY

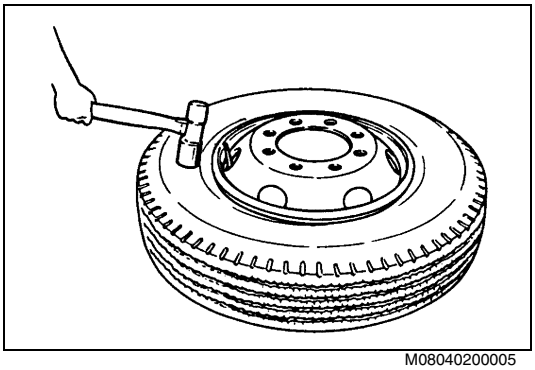
**1. DISASSEMBLE THE WHEEL AND TIRE (WITH TUBE).**
(1) Place the wheel and tire on the floor with side ring up.
(2) Make certain that the tire is completely deflated with the valve core removed.
(3) With the special tools, insert the hooked end between the side ring and side wall of the tire and pry the bead loose from the side ring with a downward pressure on the tools.
(4) Continue prying progressively around the tire until the bead is completely freed from side ring.


M08040200003

(5) With the special tool, pry the side ring from its groove in the rim by prying progressively around the tire until the ring is freed.
**SST: Lever (09672-1040)**


M08040200004

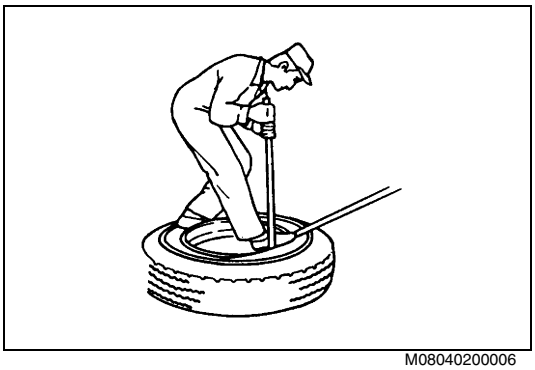
(6) Turn the assembly over and unseat the second tire bead from the rim. Lift the rim from the tire.
Remove the tube and flap, if any, from the tire.


M08040200005

**2. DISASSEMBLE THE WHEEL AND TIRE (TUBELESS).**

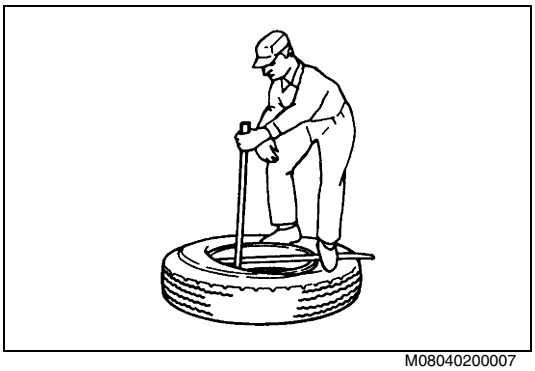
(1) Make certain the tire completely deflated with the valve core removed.

(2) With the tire lying flat, loosen both beads with the special tool or by standing on the tire with your heels close to the rim.
**SST: Rubber hammer (09609-1220)**

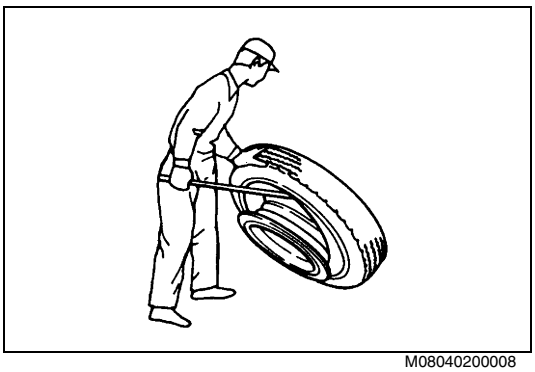

M08040200006

(3) With the wide side of the rim down, lubricate the top bead.

(4) With the stops toward the rim, insert the spoon ends of the special tools about 250 mm {10 in.} apart. Holding the bead in the well with one foot, pull one tool towards the center of the rim.
**SST: Lever (09609-1210)**


M08040200007

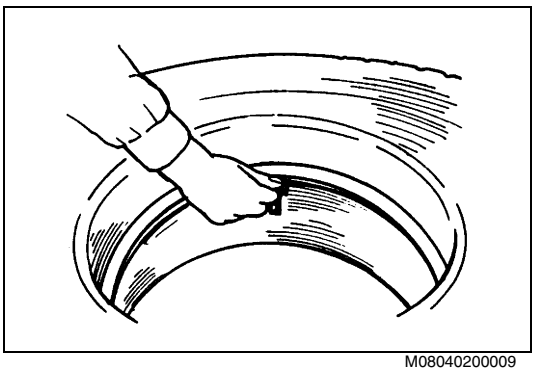
(5) Hold the tool in position with one foot and pull the second tool toward the center of the rim. Progressively work the bead off the rim, taking additional bites with the tools as necessary.


M08040200008

(6) Stand the assembly in a vertical position.
Lubricate the second bead.

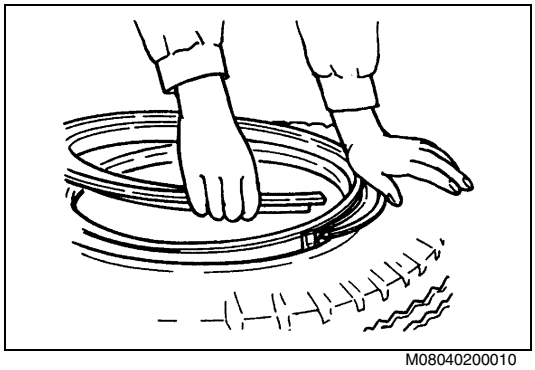
(7) At the top of the assembly, insert the straight end of the tool between the bead and back the flange of the rim at about 45 degrees angle.
Turn the tool so that it is perpendicular to the rim. Pry the second bead off.

## IMPORTANT POINTS – ASSEMBLY

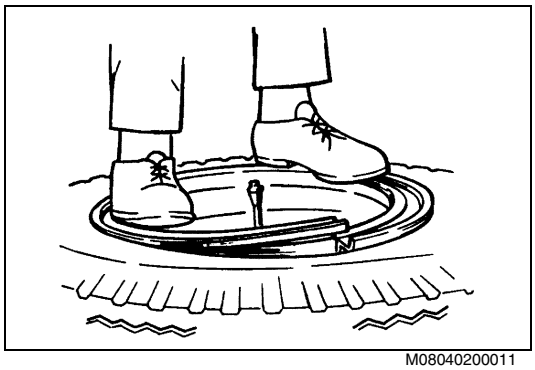

M08040200009

**1. ASSEMBLY THE WHEEL AND TIRE (WITH TUBE).**

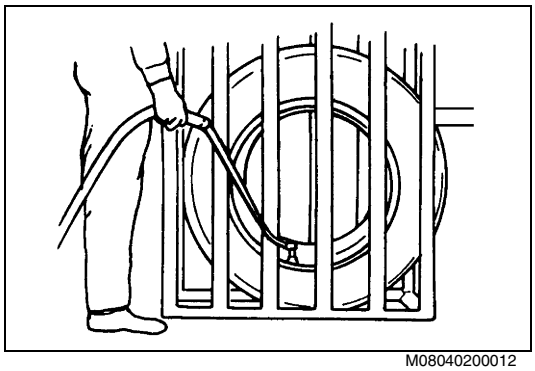
(1) Insert the tube and the flap into the tire and partially inflate to round out the tube. Apply the rubber lubricant to the inside and outside surfaces of both beads and to that portion of the tube and flap that appears between the beads. Lay the rim flat on the floor with the valve slot up. Align the valve with the rim valve slot, and place the tire onto the rim, and insert the valve through the valve slot.


M08040200010

(2) Place the side-ring on the rim base so that the ring split is opposite to the valve stem. Place the leading end of the ring into the groove in the rim as shown.


M08040200011

(3) Starting at the valve side progressively walk the side-ring into place. Check to ensure that the ring is fully seated in the groove.


M08040200012

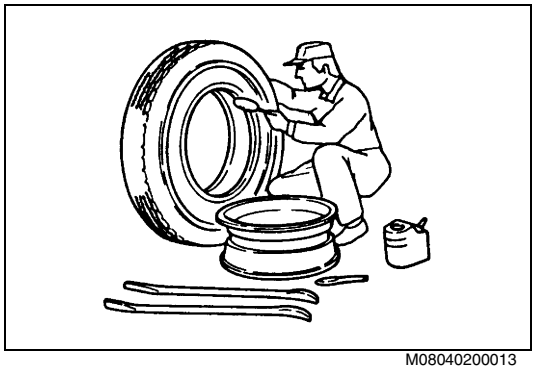
(4) Place the tire assembly in a safety cage and inflate the tire as previously described in this chapter. Again check the side-ring, tapping lightly with a mallet to ensure the proper engagement. Check to see that the beads are properly seated. Completely deflate the tire to prevent the tube from the buckling. Reinflate according to the recommended pressure, and check the tire assembly.

**2. ASSEMBLY THE WHEEL AND TIRE (TUBELESS).**

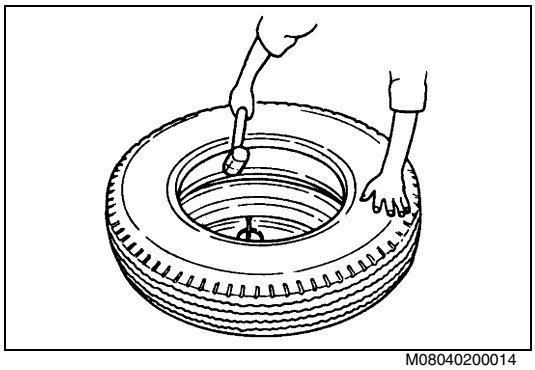
(1) Be sure that the right valve is used and is properly installed in the rim.
**Valve nut tightening torque: 12.7 N·m {130 kgf·cm, 9.4 lbf·ft}**

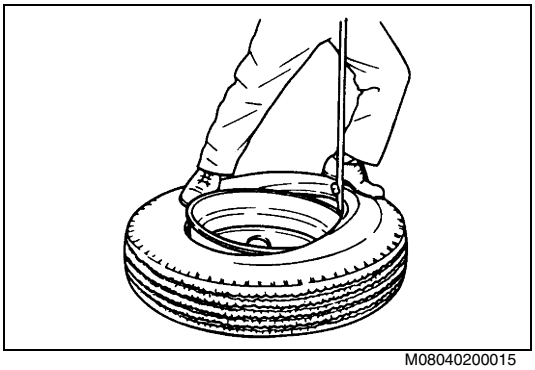
(2) Inspect the rim to ensure that the bead seats are clean and smooth.

(3) Place the rim on the floor with the wide side down and lubricate the first bead of the tire and upper bead seat of the rim.

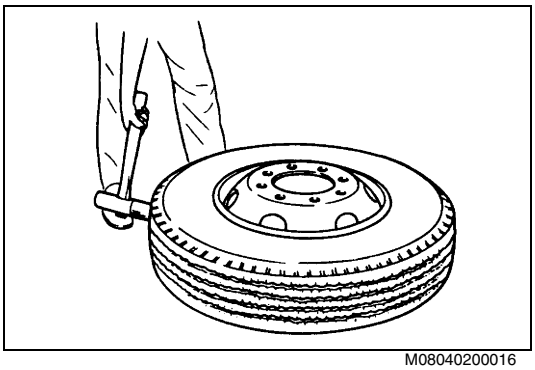

M08040200013

(4) Push the first bead into the well of the rim and onto the rim as far as possible.
With the special tool, hammer the first bead so that the bead gets over the rim flange.
**SST: Rubber hammer (09609-1220)**


M08040200014


M08040200015

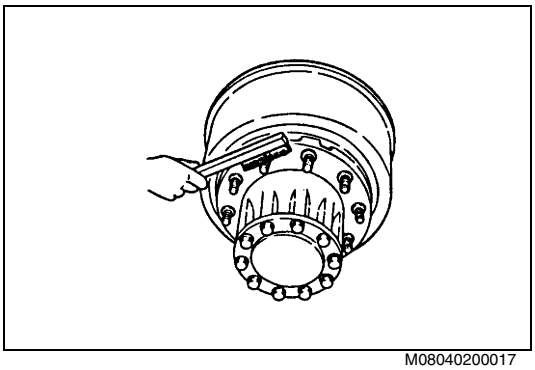
(5) Insert the lever between the rim flange and the tire bead and then raise the lever so that the bead gets over the rim flange.
**SST: Lever (09609-1210)**


M08040200016

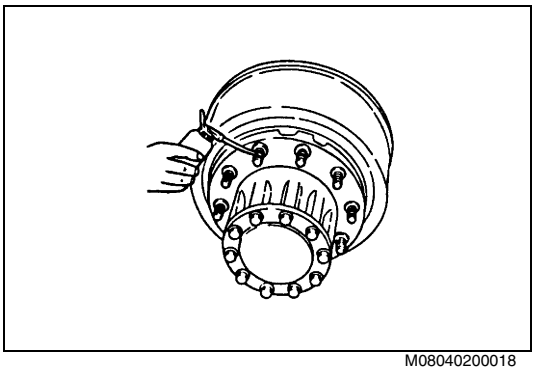
(6) With the special tool, hammer the tire tread so that the bead and the rim will be seated.
**SST: Rubber hammer (09609-1220)**

(7) Inflate the tire as described in this chapter, making certain that all the safety precautions are followed. Check for the leakage.

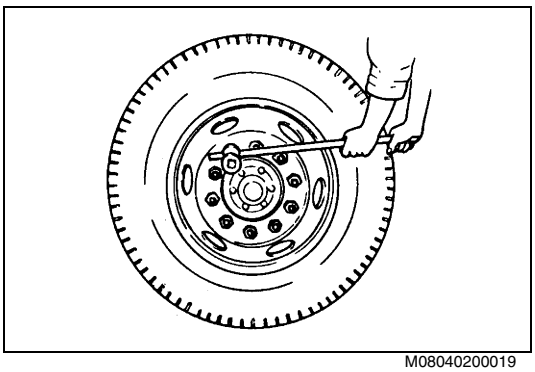
## IMPORTANT POINT – INSTALLATION


M08040200017

**1. INSTALL THE WHEEL AND TIRE.**
(1) Be sure to check all parts and replace any parts that are overly worn or damaged. Clean and remove any foreign matter from hub bolts, wheel nuts and wheel side is contacting with the brake drum.

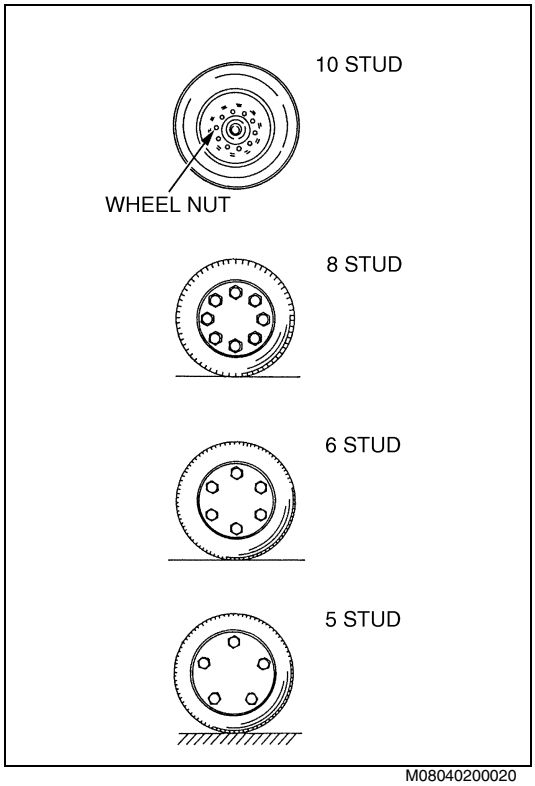

M08040200018

(2) Apply lubricant (engine oil or grease) to the thread part of the hub bolts and wheel nuts.


M08040200019

(3) Rotate the wheel if necessary and check to see that the hub bolts are in the center of the wheel's hub bolt holes, then tighten the wheel nuts lightly.

**NOTICE:**
**The wheel nuts on the right side of the vehicle have right hand threads, and those on the left side have left hand threads.**



M08040200020

(4) Using a wheel nut wrench, tighten the wheel nuts in accordance with specified torque using diagonal method.

| | | Tightening torque N·m {kgf·cm, lbf·ft} |
|---|---|---|
| DIN type | | 490.34-588.39 {5,000-6,000, 362-434} |
| SAE and JIS type | 10 stud | 392.27-470.71 {4,000-4,800, 290-347} |
| | 8 stud | |
| | 6 stud | |
| | 5 stud | 235.36-294.19 {2,400-3,000, 174-217} |
| ISO type | | 490-539 {5,000-5,500, 362-497} |

**NOTICE:**
**Tighten the wheel nuts with several repetitions in the tightening order so as to reach the proper torque evenly and gradually.**

**CAUTION:**
**The specified torque should be referred to the torque tightening wheel nuts. Tightening it with incorrect can cause the wheel to come off while driving. This can result in physical injury and/or property damage due to the loss of vehicle control.**
**When the vehicle, wheels, or wheel nuts are new, the wheel nuts should be checked and tightened with specified torque at 50-100 km {30-60 miles} since they may not be well tightened. The tightening torque should be checked with the proper torque wrench.**

**2. THE FOLLOWING ORDER AND INSTRUCTIONS ARE NECESSARY FOR INSTALLING THE DUAL TIRES.**

(1) Installation procedures for the inner wheel nuts are the same as in 1. through 4. above.
(2) Installation procedures for the outer wheel nuts are the same as above.
(3) When only the outer wheel is replaced, first tighten all the inner wheel nuts to the specified torque. Then mount the outer wheel and tighten all the outer wheel nuts to the specified torque.

**NOTICE:**
- **Install the dual rear wheels with their valve stems positioned at 180 degrees apart to facilitate inflation.**
- **Tighten all the inner nuts and outer nuts according to the above-mentioned procedures.**

**3. WHEEL AND TIRE BALANCING**

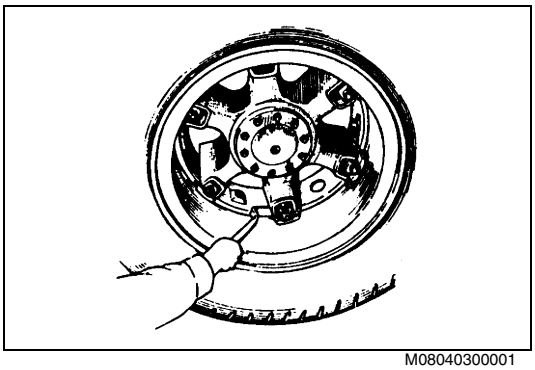
(1) Driving with a rim or tire that is unbalanced may cause the vehicle and steering wheel to shimmy, and will produce an abnormal tire wear.
In this situation, we recommend that you should balance the wheels.

- Static balancing
  This is relatively effective when operating at low speeds; however, if operating at high speeds, dynamic balancing is recommended.
- Dynamic balancing
  Please balance the wheels, using a balancing machine.

# SPOKE WHEEL AND ADAPTER TYPE WHEEL

## OVERHAUL

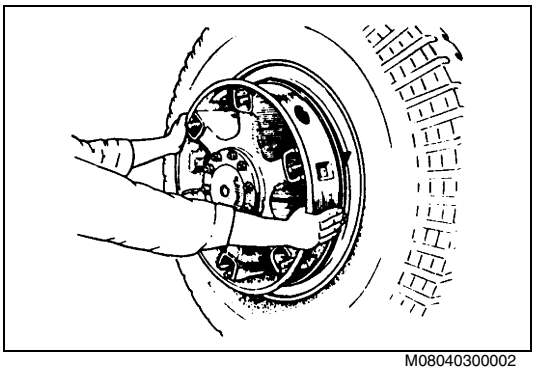
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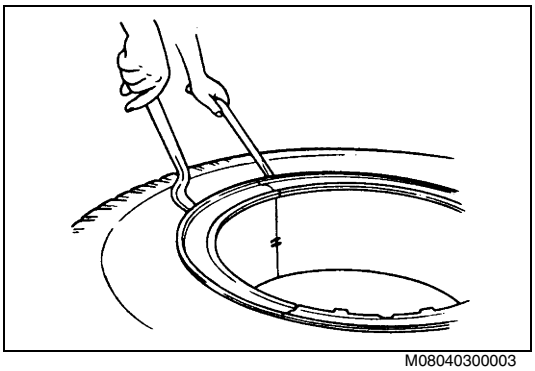
### IMPORTANT POINT – REMOVAL

**1. REMOVAL OF THE RIM AND TIRE.**
(1) Loosen the clamp nuts, but do not remove them completely.
(2) Raise the vehicle until the tire clear from floor.
(3) Remove the clamp nuts and then use the special tool to pry off the clamps.
**SST: Lever (09672–1010)**

**NOTICE:**
**Block the wheels.**

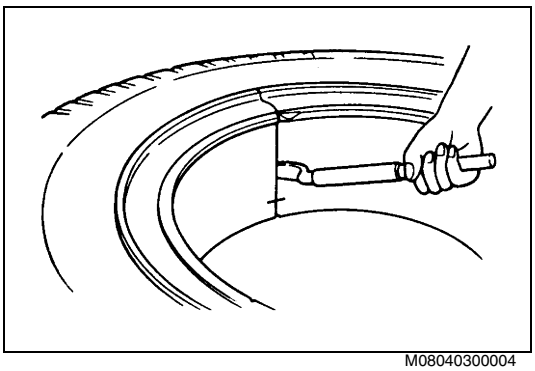

M08040300002

(4) On the dual tires, the band spacer will also have to be removed and then remove the inner wheel.


M08040300003

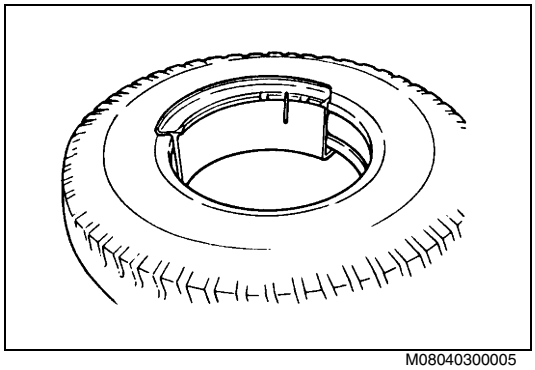
### IMPORTANT POINT – DISASSEMBLY

**1. DISASSEMBLE THE RIM AND TIRE.**
(1) Place the wheel on the floor with valve side up.
(2) Make sure the tire is completely deflated with the valve core removed.
(3) With the special tools, insert the hooked end between the rim and side wall of tire and pry the bead loose from the rim with a downward pressure on the special tools.
**SST: Lever (09672–1010, 09672–1020)**


M08040300004

(4) Continue prying progressively around the tire until the bead is completely freed from the rim.
(5) Make a matching marks on the segments.
(6) Place the special tool in the rim joint groove and pry the rim segments apart.
**SST: Lever (09672–1010)**

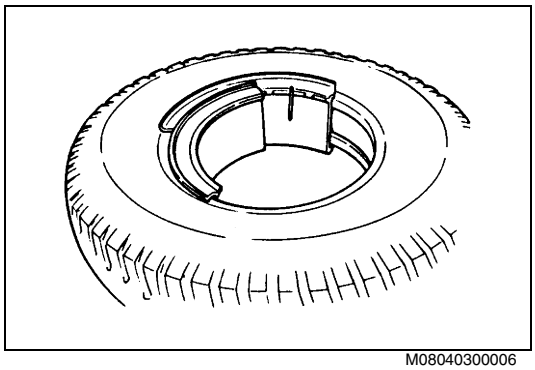
(7) Remove the rim segments.


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## IMPORTANT POINT – ASSEMBLY

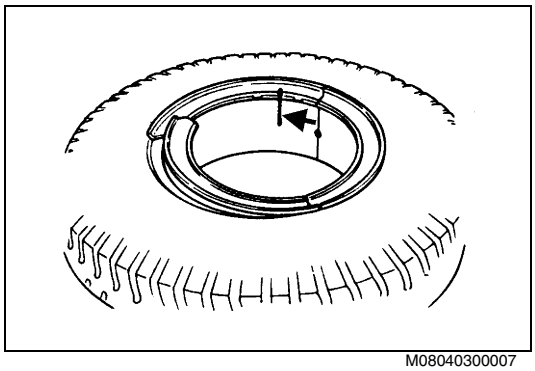
**1. ASSEMBLE THE RIM AND TIRE.**

(1) Clean the rim segments and check for damages, if there is any damage, repair or replace.
(2) Fit the tube and flap in the tire.
(3) Place the segment with valve hole in the tire.
The valve must point upwards.

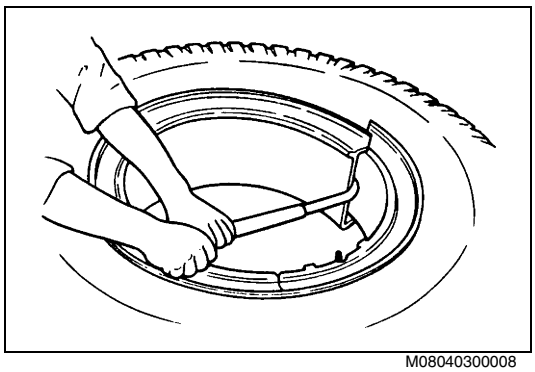

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(4) Place the other segment on the first one as shown in the figure.

**NOTICE:**
**Align the matching marks on the segments.**


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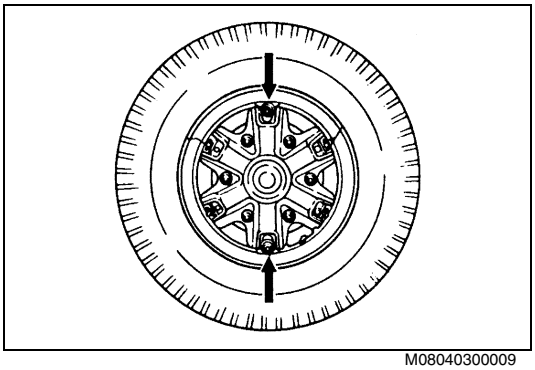
(5) Place the other segment together with the first one.
Fit the segment so that the valve lies against the side of the hole marked with an arrow.


M08040300008

(6) With the special tool, pry the segments to fit the last segment in position.
**SST: Lever (09672–1020)**

**NOTICE:**
**Do not pull upwards.**

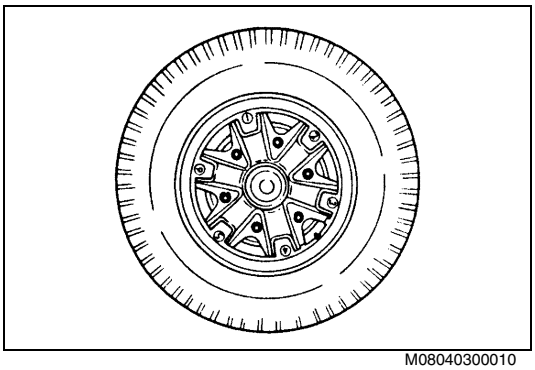
(7) Install the valve core and then inflate the tire as previously described in this chapter, making sure that all the safety precautions are followed. Check for the leakage.


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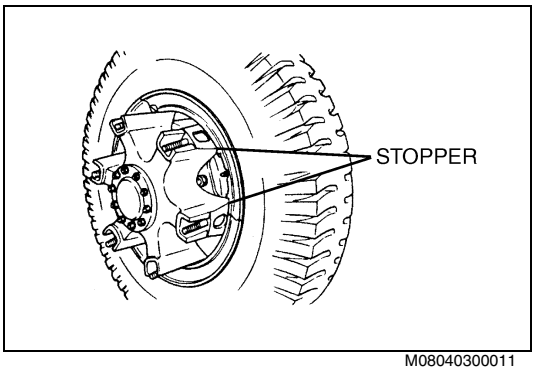
## IMPORTANT POINTS – INSTALLATION

**1. INSTALL THE SINGLE WHEEL.**

(1) Clean the spoke ends, rim edges, clamps and nuts.
(2) Lubricate the clamp bolts.
(3) Install the wheel over the spoke ends so that the valve and rim stopper are between two spokes.
(4) Install two clamps and nuts on opposite sides of the rim as indicated by arrows on the drawing.
Tighten the nuts lightly.


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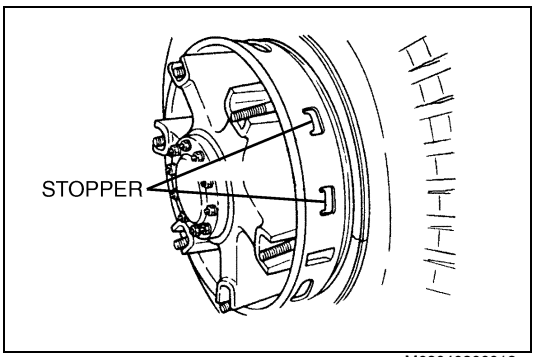
(5) Install the remaining clamps and nuts.
Tighten the nuts in sequence round the rim edge to sufficient torque as described in this chapter.
(6) Check and retighten the nuts after driving the vehicle in a distance.



M08040300011

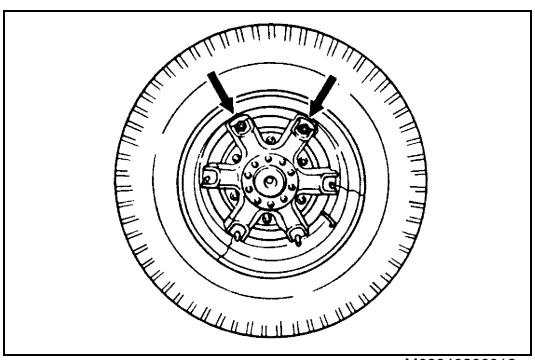
**2. INSTALL THE DUAL WHEEL.**

(1) Clean the spoke ends, rim edge, band spacer, clamps and nuts.
(2) Lubricate the clamp bolts.
(3) Install the inner wheel so that the valve and rim stopper are between two spokes.

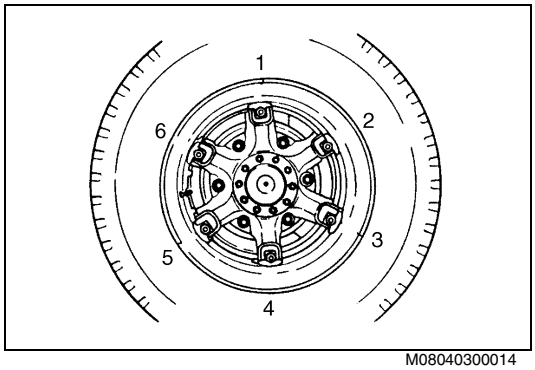


M08040300012

(4) Install the band spacer over the spokes so that it is tightened up against the inner wheel rim.
The band spacer stopper must be between two spokes. Make sure that the band spacer stopper does not cover the inner wheel valve.


M08040300013

(5) Install the outer wheel and press it tight against the band spacer. Make sure that the rim stopper and valve are between two spokes and diagonally to the inner wheel valve.
Install two top clamps and nuts as indicated by the arrows on the drawing and tighten the nuts lightly.



M08040300014

(6) Install the remaining clamps and nuts.
(7) Tighten the nuts in sequence round the rim edge to sufficient torque as previously described in this chapter.
(8) Check and retighten the nuts after driving the vehicle in a distance.

**3. WHEEL AND TIRE BALANCING**

(1) Driving with a rim or tire that is unbalanced may cause the vehicle and steering wheel to shimmy, and will produce an abnormal tire wear.
In this situation, we recommend that you should balance the wheels.

- Static balancing
This is relatively effective when operating at low speeds; however, if operating at high speeds, dynamic balancing is recommended.
- Dynamic balancing
Please balance the wheels, using a balancing machine.

# SUSPENSION (MODELS: FD, GD)

SU02-001

**LEAF SUSPENSION ASSEMBLY ..... SU02-2**
DATA AND SPECIFICATIONS ..... SU02-2
DESCRIPTION ..... SU02-4
TROUBLESHOOTING ..... SU02-5
SPECIAL TOOL ..... SU02-5
COMPONENT LOCATOR ..... SU02-6
OVERHAUL ..... SU02-9
INSPECTION AND REPAIR ..... SU02-14

# LEAF SUSPENSION ASSEMBLY

## DATA AND SPECIFICATIONS

M09020101BEI2003

### MODEL: FD

**FRONT SUSPENSION**

| | | | | |
|---|---|---|---|---|
| Type | | Semi-elliptic leaf springs with shock absorber | | |
| Dimensions of leaf springs: | Span | 1,300 mm {51.181 in.} | | |
| | Width | 70 mm {2.760 in.} | | |
| | Thickness of leaves | Multi leaf spring | Taper leaf spring | |
| | | 10 mm {0.394 in.} | 18.5 mm {0.728 in.} | 18.5 mm {0.728 in.} |
| | | 11 mm {0.433 in.} | 19.8 mm {0.780 in.} | 19.8 mm {0.780 in.} |
| | | | 14.0 mm {0.551 in.} | 16.2 mm {0.638 in.} |
| Shock absorbers: | Type | Single acting | Double acting | |
| | Stroke | 255 mm {10.039 in.} | 255 mm {10.039 in.} | |
| | Min. length | 359 mm {14.134 in.} | 359 mm {14.134 in.} | |
| | Max. length | 614 mm {24.173 in.} | 614 mm {24.173 in.} | |

**REAR SUSPENSION**

| | | |
|---|---|---|
| Type | Semi-elliptic main and auxiliary leaf springs | |
| Dimensions of main leaf springs: | Span | 1,300 mm {51.181 in.} |
| | Width | 70 mm {2.760 in.} |
| | Thickness of leaves | 11 mm {0.433 in.} |
| Dimensions of auxiliary leaf springs: | Span | 900 mm {35.433 in.} |
| | Width | 70 mm {2.760 in.} |
| | Thickness of leaves | 9 mm {0.354 in.} |
| | | 10 mm {0.394 in.} |

## MODEL: GD

### FRONT SUSPENSION

| | | | | |
|---|---|---|---|---|
| **Type** | | **Semi-elliptic leaf springs with shock absorber** | | |
| **Dimensions of leaf springs:** | **Span** | **1,300 mm {51.181 in.}** | | |
| | **Width** | **70 mm {2.760 in.}** | | |
| | **Thickness of leaves** | **Multi leaf spring** | **Taper leaf spring** | |
| | | **10 mm {0.394 in.}** | **18.5 mm {0.728 in.}** | **18.5 mm {0.728 in.}** |
| | | **11 mm {0.433 in.}** | **19.8 mm {0.780 in.}** | **19.8 mm {0.780 in.}** |
| | | | **14.0 mm {0.551 in.}** | **16.2 mm {0.638 in.}** |
| **Shock absorbers:** | **Type** | **Single acting** | **Double acting** | |
| | **Stroke** | **255 mm {10.039 in.}** | **255 mm {10.039 in.}** | |
| | **Min. length** | **359 mm {14.134 in.}** | **359 mm {14.134 in.}** | |
| | **Max. length** | **614 mm {24.173 in.}** | **614 mm {24.173 in.}** | |
| **Stabilizer:** | | **Torsion bar** | **Torsion bar** | |

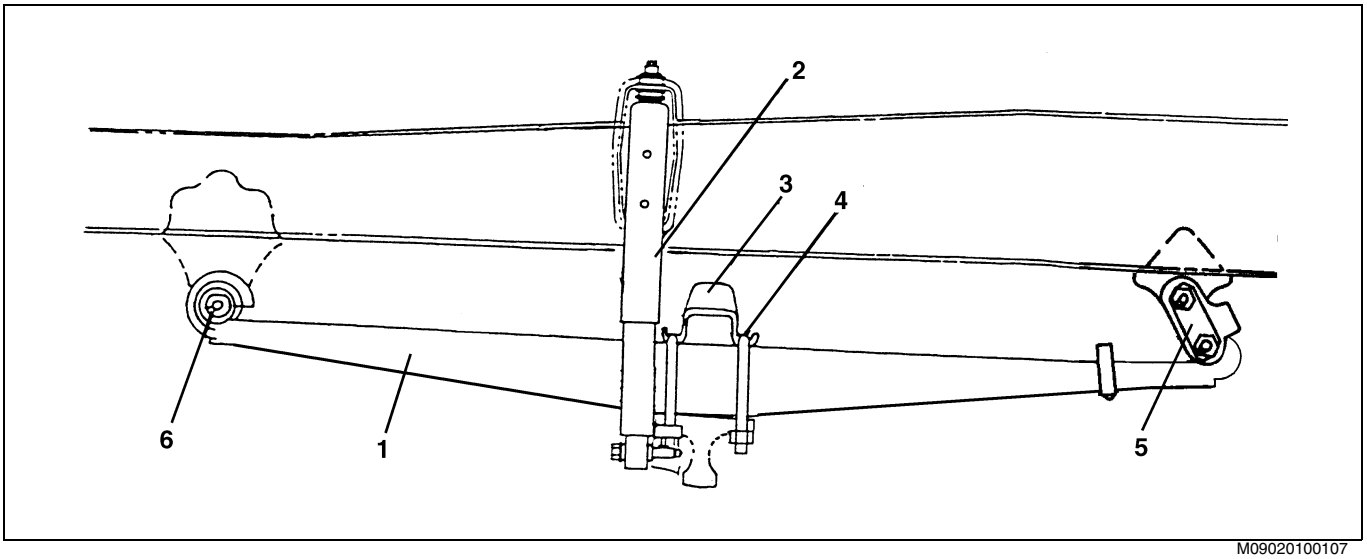
### REAR SUSPENSION

| | | |
|---|---|---|
| **Type** | **Semi-elliptic main and auxiliary leaf springs** | |
| **Dimensions of main leaf springs:** | **Span** | **1,300 mm {51.181 in.}** |
| | **Width** | **70 mm {2.760 in.}** |
| | **Thickness of leaves** | **11 mm {0.433 in.}** |
| | | **10 mm {0.394 in.}** |
| **Dimensions of auxiliary leaf springs:** | **Span** | **900 mm {35.433 in.}** |
| | **Width** | **70 mm {2.760 in.}** |
| | **Thickness of leaves** | **10 mm {0.394 in.}** |

# DESCRIPTION

M09020101BEC1002

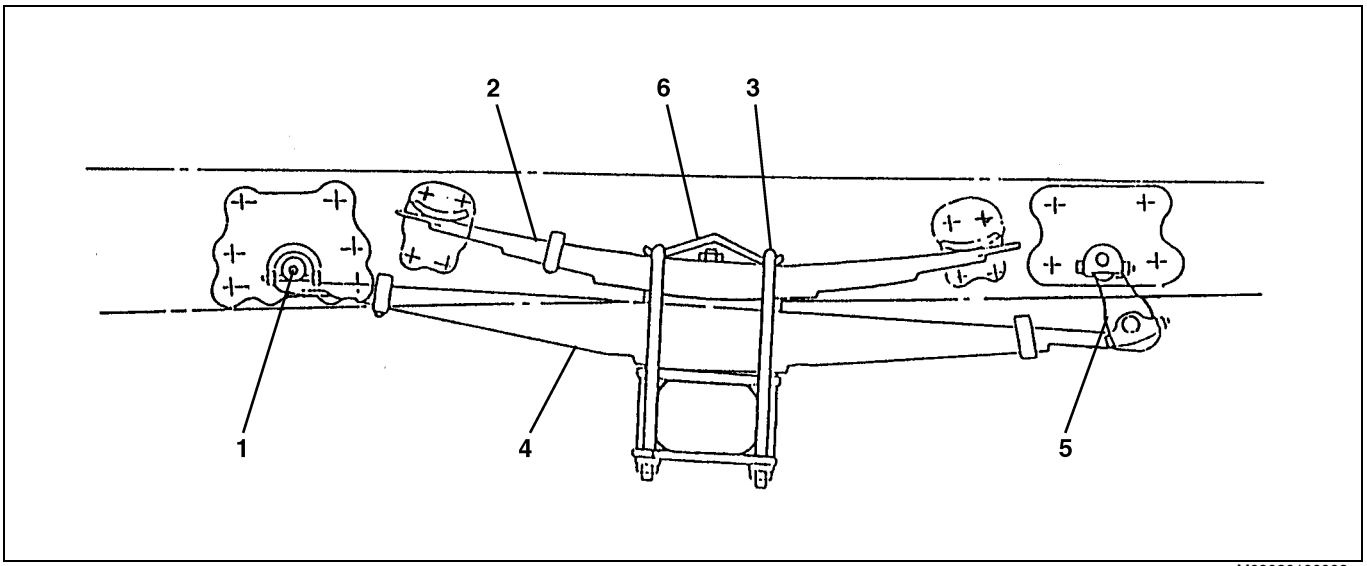
## FRONT SUSPENSION




M09020100107

| | | | |
|---|---|---|---|
| 1 | Leaf spring assembly | 4 | U-bolt |
| 2 | Shock absorber | 5 | Shackle |
| 3 | Spring bumper | 6 | Spring pin |

## REAR SUSPENSION




M09020100002

| | | | |
|---|---|---|---|
| 1 | Spring pin | 4 | Main leaf spring assembly |
| 2 | Auxiliary leaf spring assembly | 5 | Shackle |
| 3 | U-bolt | 6 | Spring bumper |

# TROUBLESHOOTING

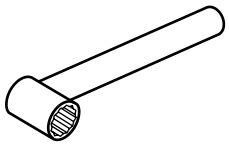
M09020101BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Rough ride** | Broken leaves | Replace the leaves. Check the load capacity rating. |
| | Cracked or damaged | Replace the leaves. Check the load capacity rating. |
| | Overloading | Decrease the load. |
| **Heavy sway** | Inoperative shock absorber | Replace the shock absorber. |
| **Leaves broken at the center bolt hole** | Loosen U-bolts | Replace the leaves and tighten the U-bolts to specified torque. |
| **Squeaking of the leaves** | Friction between the leaves | Replace the silencers and/or apply chassis grease between leaves. |

# SPECIAL TOOL

M09020101BEK1001

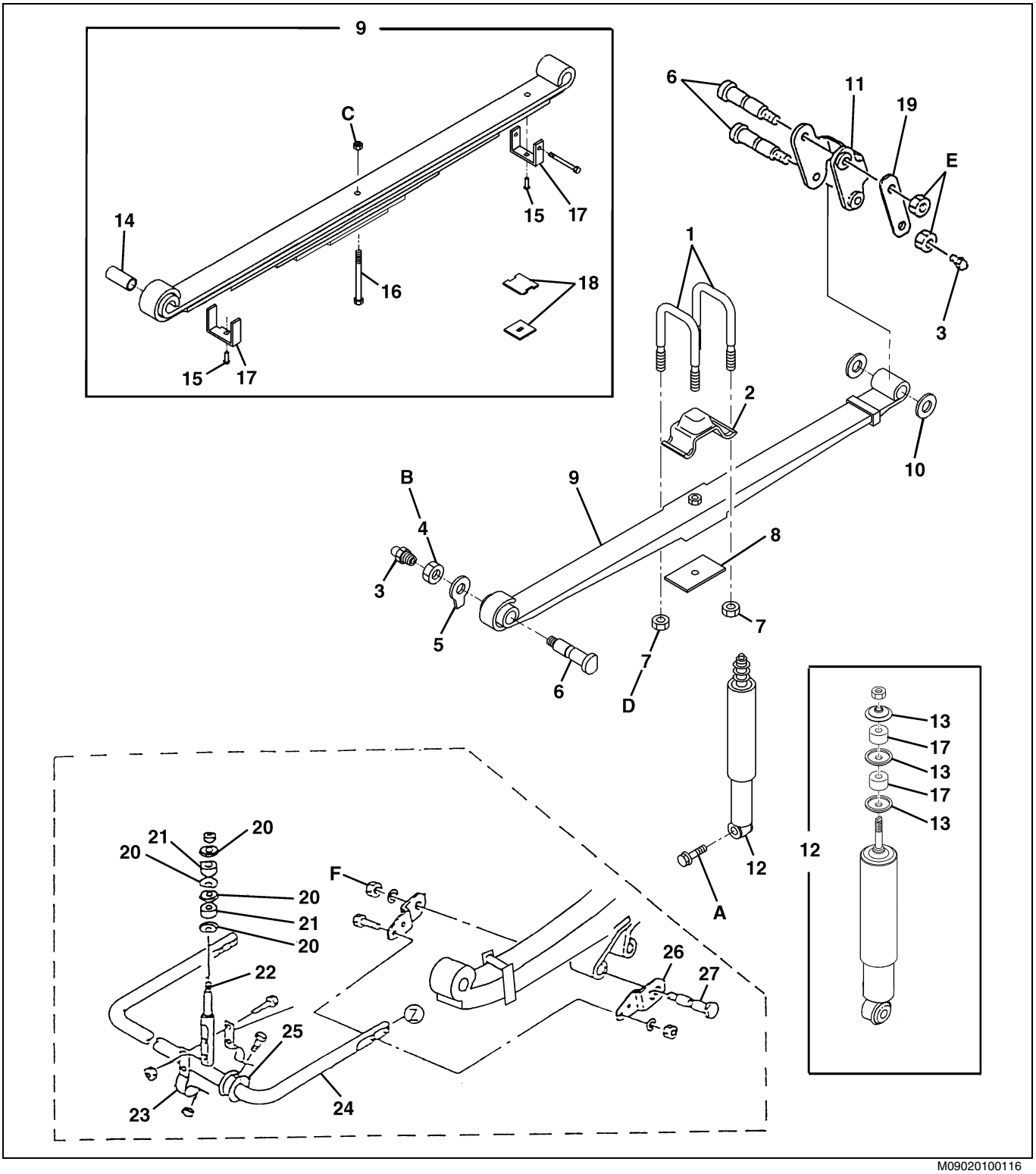
Prior to starting a suspension overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09839-2204 | SOCKET WRENCH | FOR FRONT U-BOLT |
|  | 09603-1160 | SOCKET WRENCH | FOR REAR U-BOLT |

# COMPONENT LOCATOR

M09020101BED1002

## FRONT SUSPENSION



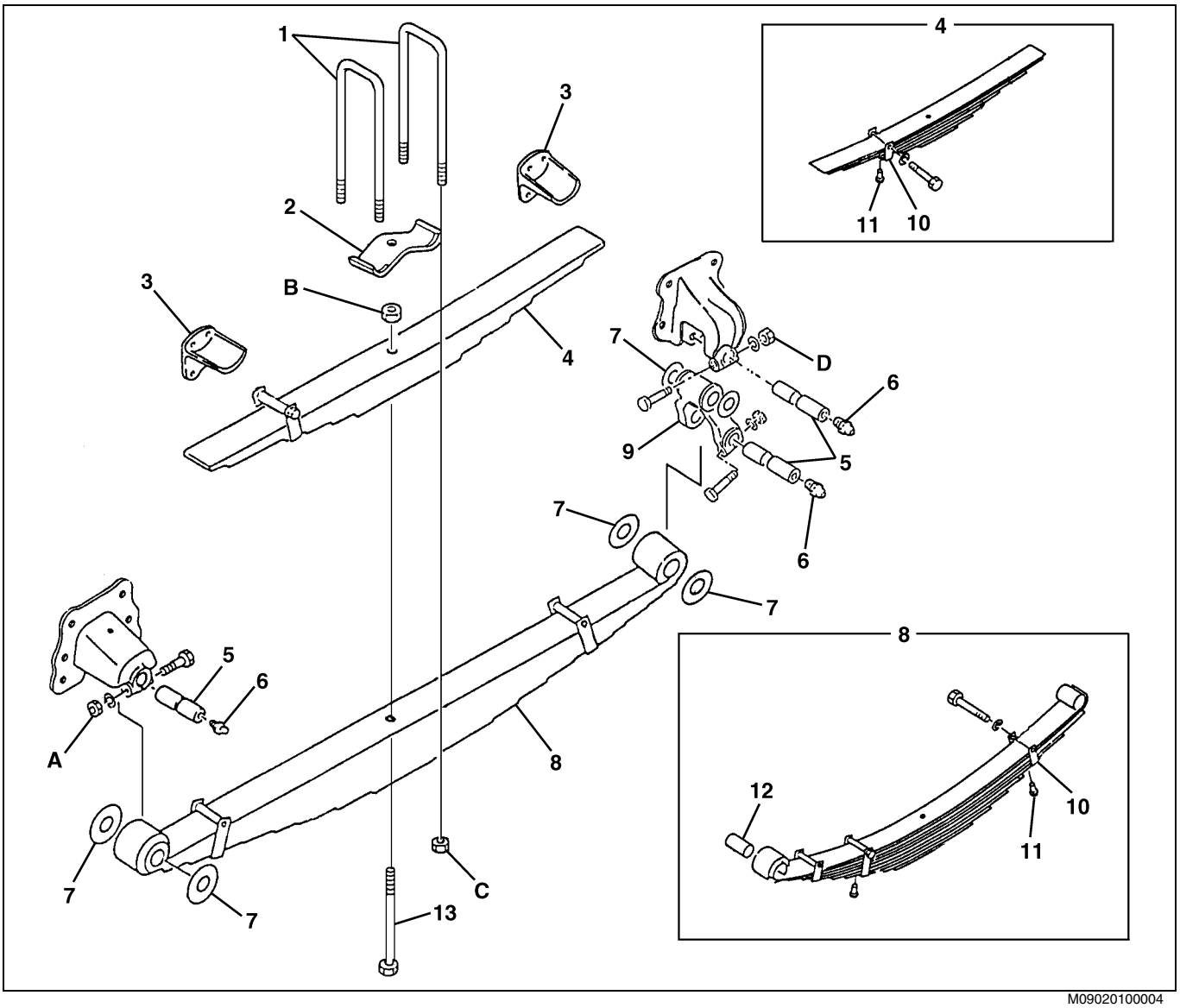

M09020100116

| | | | |
|---|---|---|---|
| 1 | U-bolt | 15 | Rivet |
| 2 | Spring bumper | 16 | Center bolt |
| 3 | Lubrication fitting | 17 | Clip |
| 4 | Lock nut | 18 | Silencer |
| 5 | Lock washer | 19 | Lock plate |
| 6 | Spring pin | 20 | Cushion washer (If so equipped) |
| 7 | U-bolt nut | 21 | Cushion washer (If so equipped) |
| 8 | Spacer (Driver's seat side) | 22 | Stabilizer link rod (If so equipped) |
| 9 | Leaf spring assembly | 23 | Holder (If so equipped) |
| 10 | Thrust washer | 24 | Stabilizer (If so equipped) |
| 11 | Shackle | 25 | Rubber bushing (If so equipped) |
| 12 | Shock absorber | 26 | Stabilizer lever (If so equipped) |
| 13 | Cushion washer | 27 | Stabilizer link pin (If so equipped) |
| 14 | Bushing | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | FD: 76-114 {775-1,162, 57-84}<br>GD: 73-109 {745-1,110, 55-81} | D | FD: 200-280 {2,040-2,855, 148-206}<br>GD: 290-410 {2,960-4,180, 218-307} |
| B | 64-93 {653-948, 48-68} | E | 64-93 {653-948, 48-68} |
| C | 85-108 {870-1,100, 63-79} | F | 64-93 {653-948, 48-68} |

## REAR SUSPENSION




M09020100004

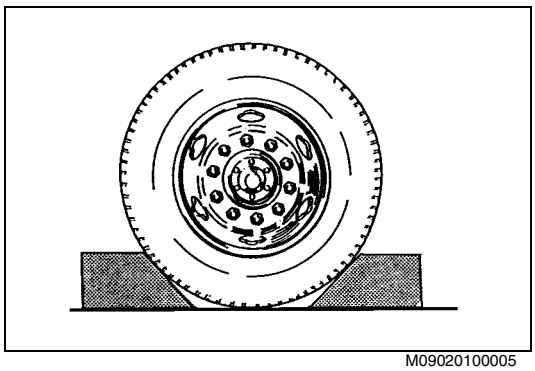
| | | | |
|---|---|---|---|
| 1 | U-bolt | 8 | Main leaf spring assembly |
| 2 | Spring pad | 9 | Shackle |
| 3 | Slide seat | 10 | Clip |
| 4 | Auxiliary leaf spring assembly | 11 | Rivet |
| 5 | Spring pin | 12 | Bushing |
| 6 | Lubrication fitting | 13 | Center bolt |
| 7 | Thrust washer | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 73-109 {745-1,111, 54-80} | C | 265-315 {2,703-3,212, 196-232} |
| B | 85-108 {870-1,100, 63-79} | D | 73-109 {745-1,111, 54-80} |

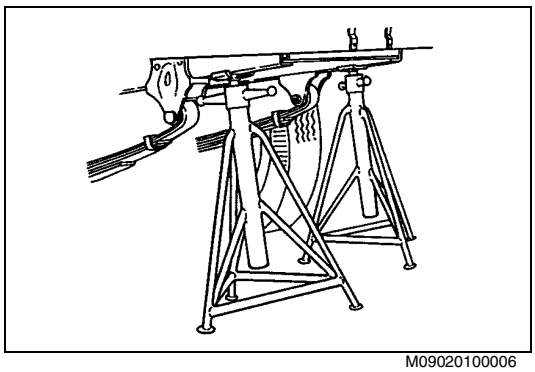
# OVERHAUL

M09020101BEH2002

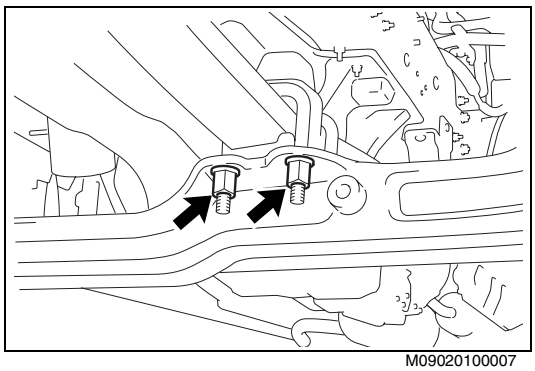

M09020100005

## IMPORTANT POINTS - DISMOUNTING

**1. SUPPORT OF THE FRAME WITH STANDS**
(1) Park the vehicle on level ground.
(2) Be sure to block the wheels before dismounting.


M09020100006

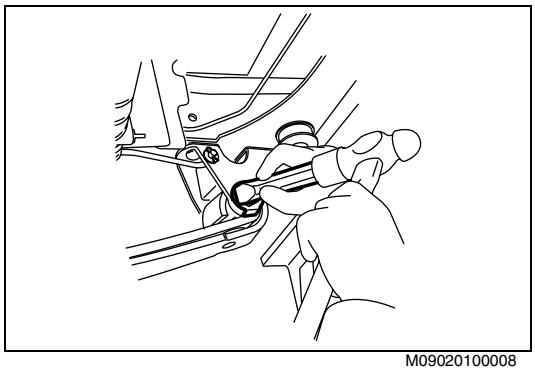
(3) Jack up the axle, and support the frame with stands.
(4) Remove the tires.


M09020100007

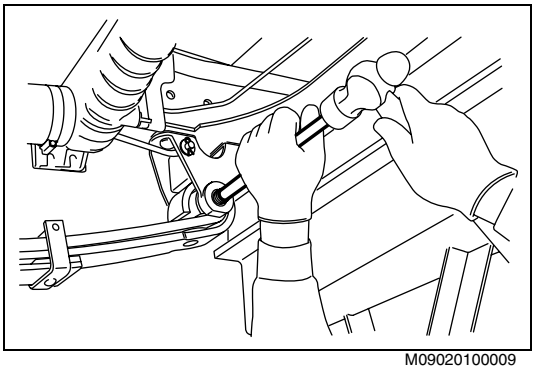
**2. REMOVAL OF THE U-BOLT**
(1) Remove the shock absorber. (Front suspension only)
(2) Support the axle with a floor jack.
(3) Remove the U-bolt mounting nuts.

**NOTICE:**
**When cutting off the U-bolts (Due to rusted threads) with a torch, never direct the flame toward the leaves or allow sparks to come in contact with the leaves.**

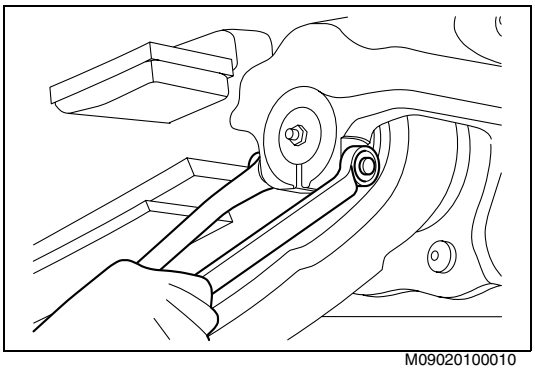
**SST:**
**Socket Wrench for Front U-bolt (09839-2204)**
**Socket Wrench for Rear U-bolt (09603-1160)**


M09020100008

**3. REMOVAL OF THE SPRING PIN (FRONT SUSPENSION)**
(1) Remove the lubrication fitting.
(2) Uncaulk the nut with a chisel, then loosen the nut.

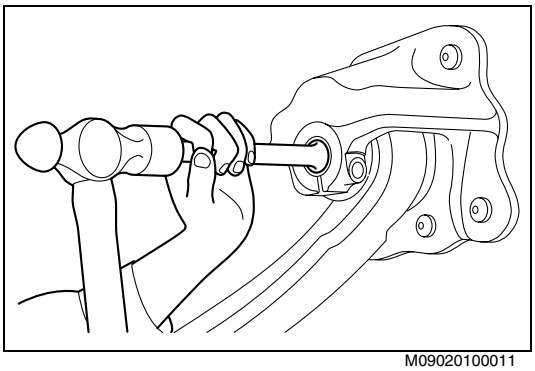

M09020100009

(3) Use a brass rod to remove the spring pins from the shackle and spring bracket.


M09020100010

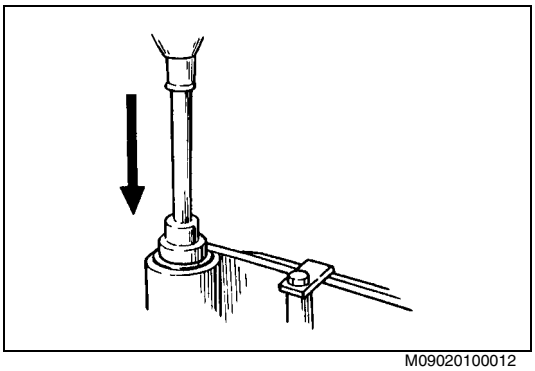
**4. REMOVAL OF THE SPRING PIN (REAR SUSPENSION)**

(1) Remove the lubrication fitting and spring pin lock bolt.


M09020100011

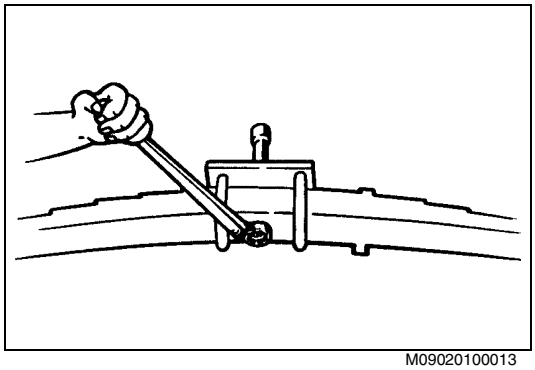
(2) Use a brass rod to remove the spring pins from the shackle and spring bracket.

## IMPORTANT POINTS - DISASSEMBLY


M09020100012

**1. REPLACEMENT OF THE EYE BUSHING**

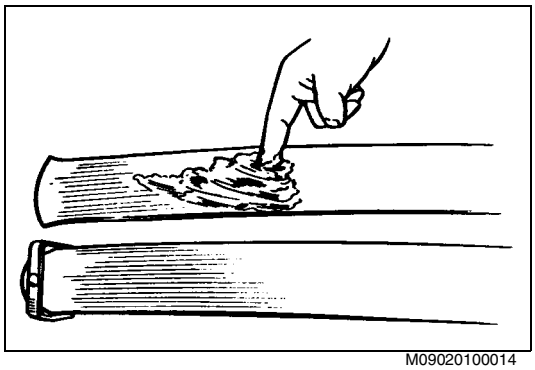
(1) Use a suitable tool to press out the old eye bushing.
(2) Use a suitable tool to press in the new eye bushing.


M09020100013

**2. DISASSEMBLY OF THE LEAF SPRING**

**CAUTION:**
**When removing the center bolt lock nut, the spring leaves may jump. Care should be taken to avoid possible personal injury.**

(1) Remove the clip bolts.
(2) Use a vise or an arbor press to hold the leaf spring near the center bolt.
(3) Remove the center bolt.
(4) Loosen a vise or an arbor press slowly, and separate the leaves.

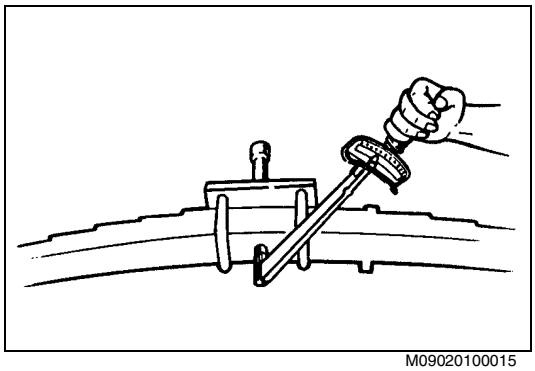

M09020100014

## IMPORTANT POINTS - ASSEMBLY

**1. ASSEMBLY OF THE LEAF SPRING**

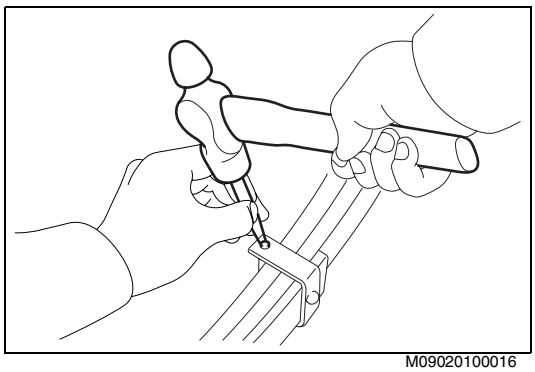
**CAUTION:**
**When clamping the spring leaves, they may jump. Care should be taken to avoid possible personal injury.**

(1) Apply coating on the leaf after removing rust, and apply chassis grease on both surfaces at leaves.


M09020100015

(2) Align the leaf holes and silencers (Front suspension only), then secure the leaves with a vise or an arbor press.
(3) Insert the center bolt and tighten the lock nut.

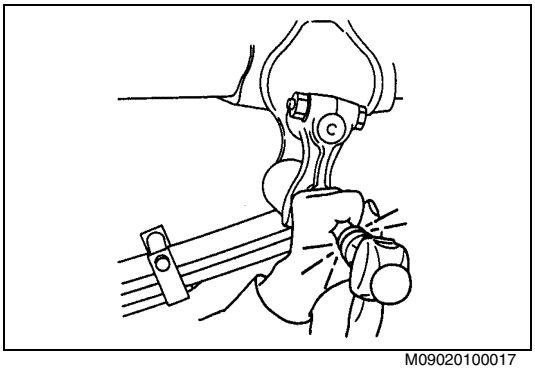
**NOTICE:**
**When reassembling the leaf spring, replace the center bolt with a new one.**


M09020100016

(4) Tighten the clip bolts.

**NOTICE:**
**When tightening the clip bolts, use a new clip bolts.**

(5) Use a punch to peen the thread of the clip bolts.


M09020100017

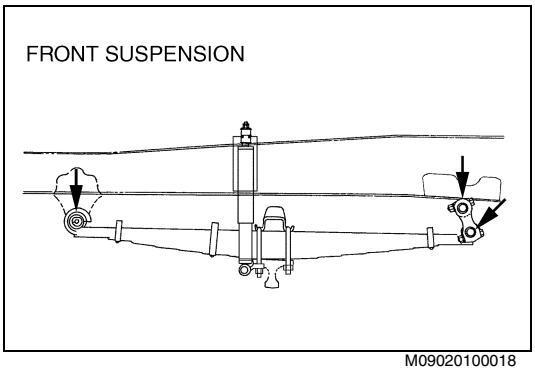
## IMPORTANT POINTS - MOUNTING

**1. INSTALLATION OF THE SPRING PIN**

(1) Use a copper hammer to install the spring pin with thrust washers.

**NOTICE:**
**Apply chassis grease on the surface of the eye bushing and spring pin before installing.**

(2) Install the spring pin lock bolt and nut.
(3) Install and secure the lock nut.

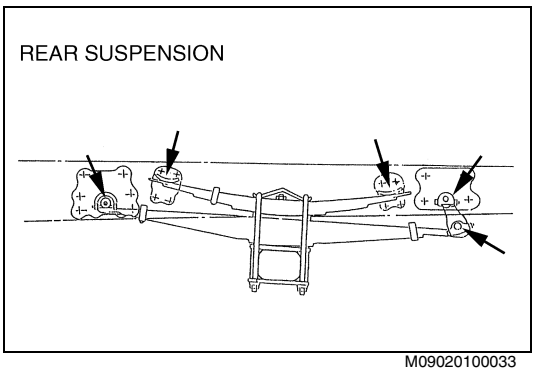


M09020100018

**2. LUBRICATION**

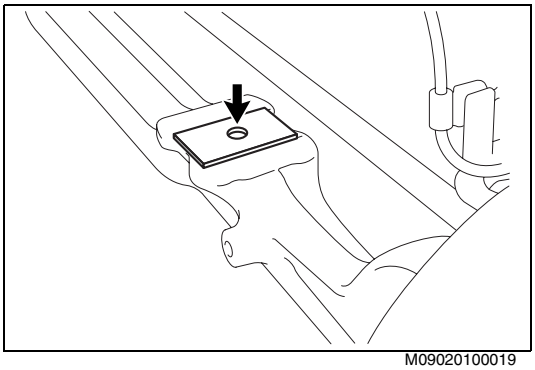
(1) Lubricate the following parts with chassis grease.

1. Spring pins



M09020100033

2. Auxiliary spring slide seats

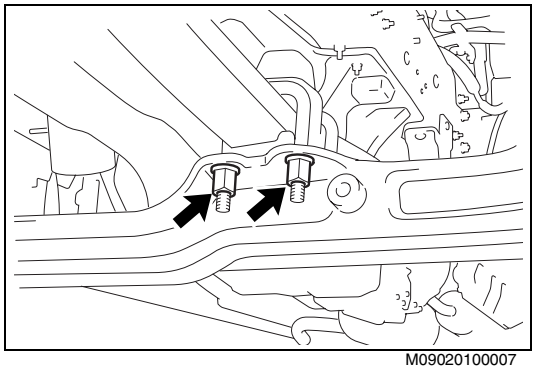

M09020100019

**3. INSTALLATION OF THE U-BOLT**

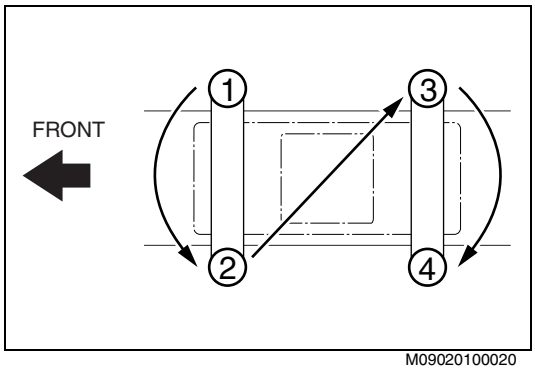
(1) Put the spacer on the front axle I-beam part of the driver's seat side. (For front suspension)

(2) Lift the axle using a jack and align the hole of the leaf spring center bolt and the hole of the axle I-beam.

**NOTICE:**
**Axle and suspension assembly are heavy, therefore be careful when handling them.**


M09020100007

(3) Put the spring pads on the leaf springs.
(4) Set the U-bolts so that they catch the spring pads and tighten the U-bolt nuts temporarily.



M09020100020

(5) Using the special tool, tighten the U-bolt nuts (4 pieces) alternately right and left and equally.
After repeating this operation 3 to 5 times, tighten the nuts to the specified torque.

**SST:**
**Socket Wrench for Front U-bolt (09839-2204)**
**Socket Wrench for Rear U-bolt (09603-1160)**

**4. ADJUSTMENT OF THE SUSPENSION AFTER ASSEMBLING**
(1) If the vehicle inclination is observed after assembling suspension, correct it by inserting the following spacer between the spring and the axle.

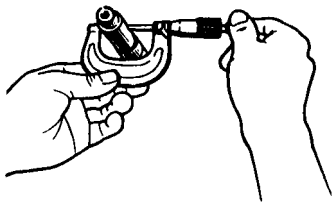
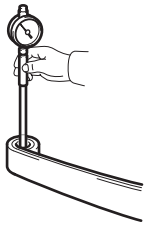
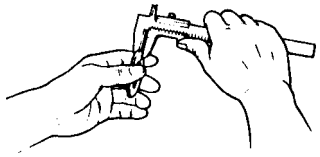
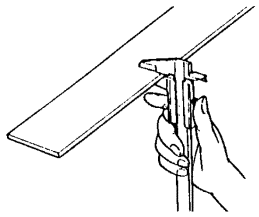
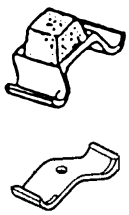
**Spacer:**

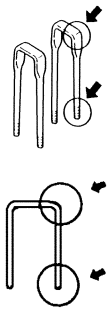
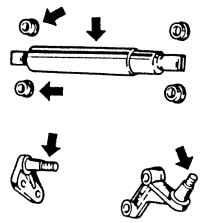
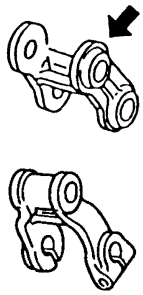
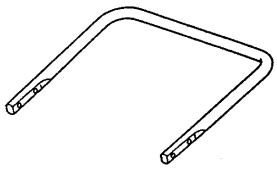
| | Part No. | Thickness (mm) |
|---|---|---|
| **Front suspension** | **9004-85526** | **4.5** |
| **Rear suspension** | **9004-85184** | **6.0** |

# INSPECTION AND REPAIR

M09020101BEH3002

Unit: mm {in.}

| Inspection item | | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|---|
| Spring pin: Outside diameter | Front | 25 {0.984} | 24.7 {0.9724} | Replace. | Measure  |
| | Rear | 30 {1.181} | 29.7 {1.1693} | | |
| Clearance between spring pin and eye bushing | | 0.125 {0.0049} | 0.5 {0.0197} | Replace the pin and/or bushing. | Measure  |
| Thrust washer: Wear | | 3.0 {0.118} | 2.5 {0.0984} | Replace. | Measure  |
| Leaf: Damage and wear | | — | More than 15% | Replace. | Measure  |
| Silencer: Wear | | 3.0 {0.118} | 1.0 {0.0394} | Replace, if necessary. | Measure  |
| Spring bumper: Damage and wear | | — | — | Replace, if necessary. | Visual check  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **U-Bolt:<br>Damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Shock absorber:<br>Operation, oil leak and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Cushion:<br>Damage and wear** | — | — | | |
| **Shock absorber pin and bracket:<br>Damage and wear** | — | — | | |
| **Shackle:<br>Damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Stabilizer Bar:<br>Damage<br>(If so equipped)** | | | **Replace, if necessary.** | **Visual check**<br>  |
| **Stabilizer Sleeve:<br>Wear<br>(If so equipped)** | | | | |
| **Stabilizer Bushing:<br>Wear<br>(If so equipped)** | | | | |

# SUSPENSION (MODELS: FG, GH)

SU02-002

**SUSPENSION ASSEMBLY..... SU02-2**
DATA AND SPECIFICATIONS ..... SU02-2
DESCRIPTION ..... SU02-3
TROUBLESHOOTING ..... SU02-4
SPECIAL TOOL ..... SU02-4
COMPONENT LOCATOR..... SU02-5
OVERHAUL ..... SU02-8
INSPECTION AND REPAIR ..... SU02-13

# SUSPENSION ASSEMBLY

## DATA AND SPECIFICATIONS

M09020101BEI2004

**FRONT SUSPENSION**

| | | | | | |
|---|---|---|---|---|---|
| Type | Semi-elliptic leaf springs with shock absorber | | | | |
| Dimensions of leaf springs: | Span | 1,470 mm {57.87 in.} | | | |
| | Width | 80 mm {3.15 in.} | | | |
| | Thickness of leaves | Multi leaf spring | | Taper leaf spring | |
| | | 13 mm {0.51 in.} | 13 mm {0.512 in.} | 19.5 mm {0.768 in.} | 21 mm {0.827 in.} |
| | | — | 12 mm {0.472 in.} | | |
| Shock absorbers: | Type | Single acting | | Double acting | |
| | Stroke | 260 mm {10.23 in.} | | 259 mm {0.197 in.} | |
| | Min. length | 390 mm {15.35 in.} | | 391 mm {15.394 in.} | |
| | Max. length | 650 mm {25.59 in.} | | 650 mm {25.591 in.} | |
| Stabilizer (If so equipped) | | — | | Torsion bar | |

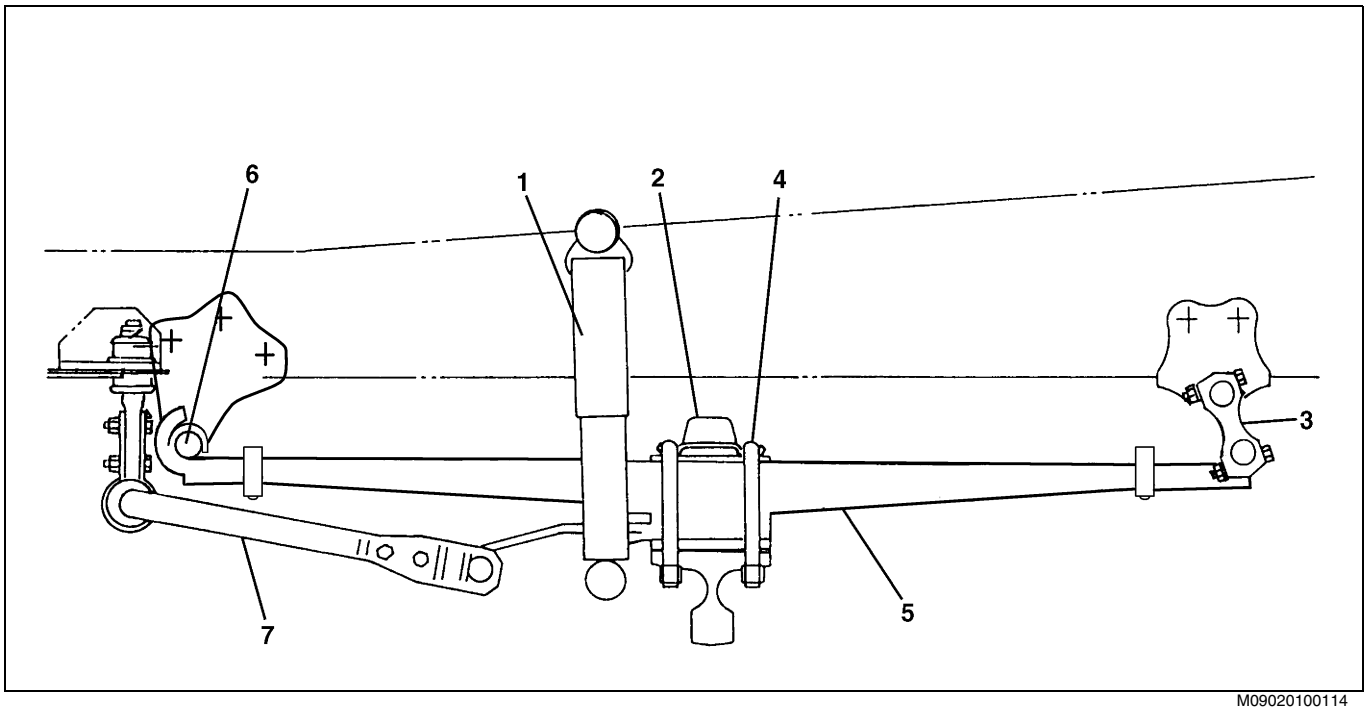
**REAR SUSPENSION**

| | | |
|---|---|---|
| Type | Semi-elliptic main and auxiliary leaf springs | |
| Dimensions of main leaf springs: | Span | 1,400 mm {55.12 in.} |
| | Width | 90 mm {3.54 in.} |
| | Thickness of leaves | 12 mm {0.47 in.} |
| Dimensions of auxiliary leaf springs: | Span | 1,000 mm {39.37 in.} |
| | Width | 90 mm {3.54 in.} |
| | Thickness of leaves | 11 mm {0.43 in.} |
| | | 12 mm {0.47 in.} |

# DESCRIPTION

M09020101BEC1003

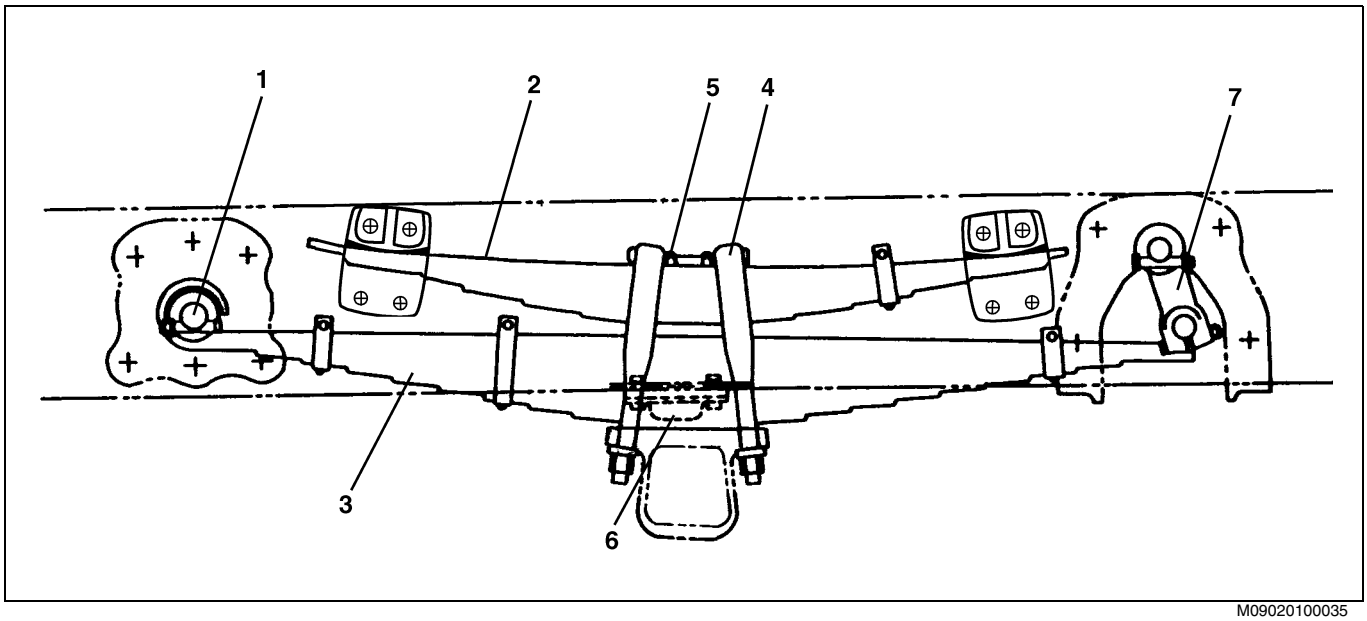
## FRONT SUSPENSION




M09020100114

| | | | |
|---|---|---|---|
| 1 | Shock absorber | 5 | Leaf spring assembly |
| 2 | Spring bumper | 6 | Spring pin |
| 3 | Shackle | 7 | Stabilizer (If so equipped) |
| 4 | U-bolt | | |

## REAR SUSPENSION




M09020100035

| | | | |
|---|---|---|---|
| 1 | Spring pin | 5 | Spring pad |
| 2 | Auxiliary leaf spring assembly | 6 | Spring bumper |
| 3 | Main leaf spring assembly | 7 | Shackle |
| 4 | U-bolt | | |

# TROUBLESHOOTING

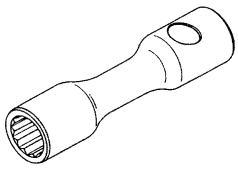
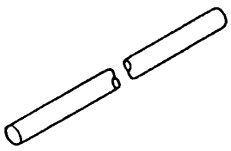
M09020101BEF3002

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Rough ride** | Broken leaves | Replace the leaves. Check the load capacity rating. |
| | Cracked or damaged | Replace the leaves. Check the load capacity rating. |
| | Overloading | Decrease the load. |
| **Heavy sway** | Inoperative shock absorber | Replace the shock absorber. |
| **Leaves broken at the center bolt hole** | Loosen U-bolts | Tighten to specified torque. |
| **Squeaking of the leaves** | Friction between the leaves | Replace the silencers and/or apply chassis grease between leaves. |

# SPECIAL TOOL

M09020101BEK1002

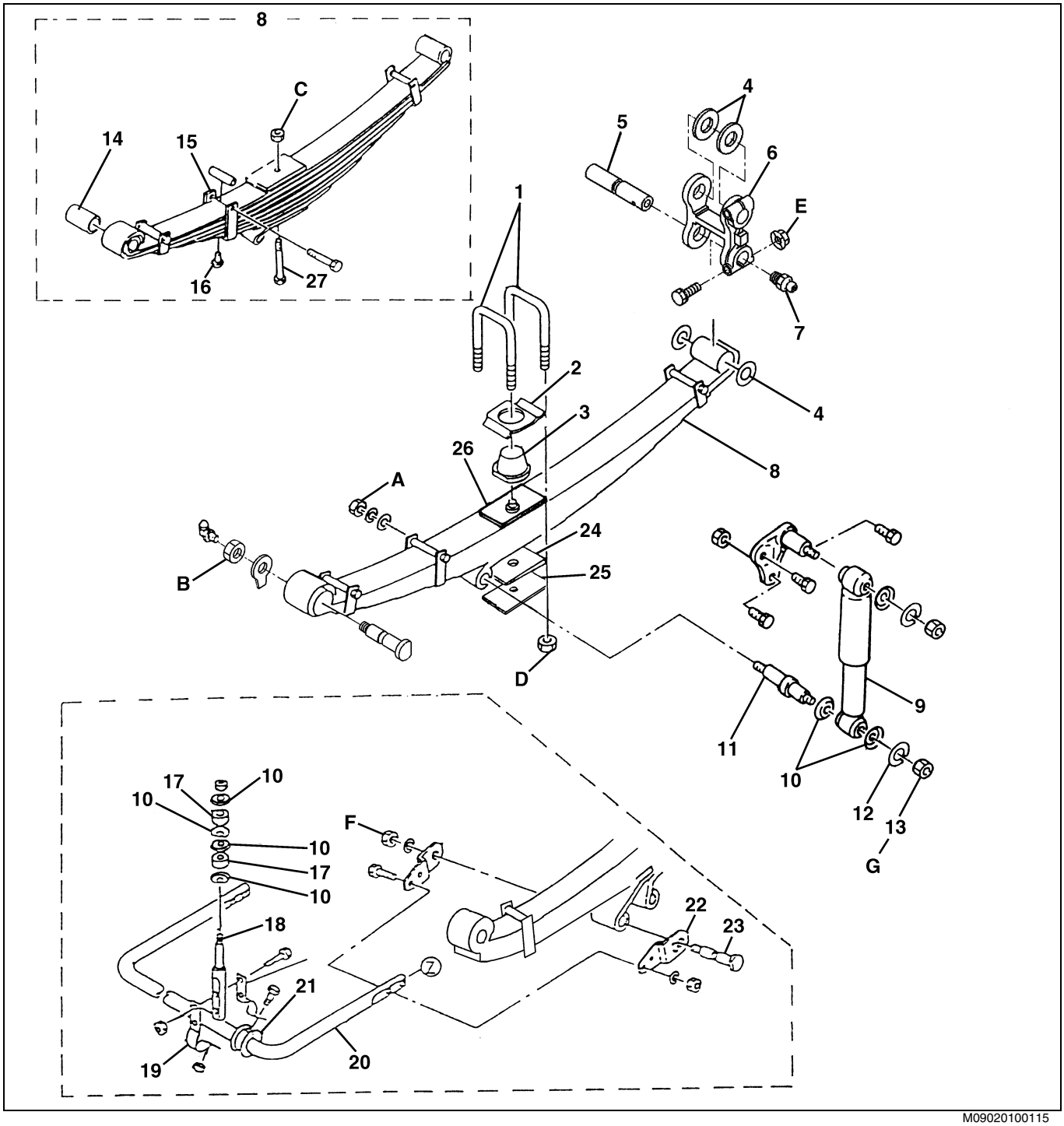
Prior to starting a suspension overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09603-1160 | SOCKET WRENCH | FOR FRONT U-BOLT |
|  | 09839-3202<br>09839-3203 | SOCKET WRENCH | FOR REAR U-BOLT |
|  | 09841-2560 | BAR | FOR REAR U-BOLT |

# COMPONENT LOCATOR

M09020101BED1003

## FRONT SUSPENSION



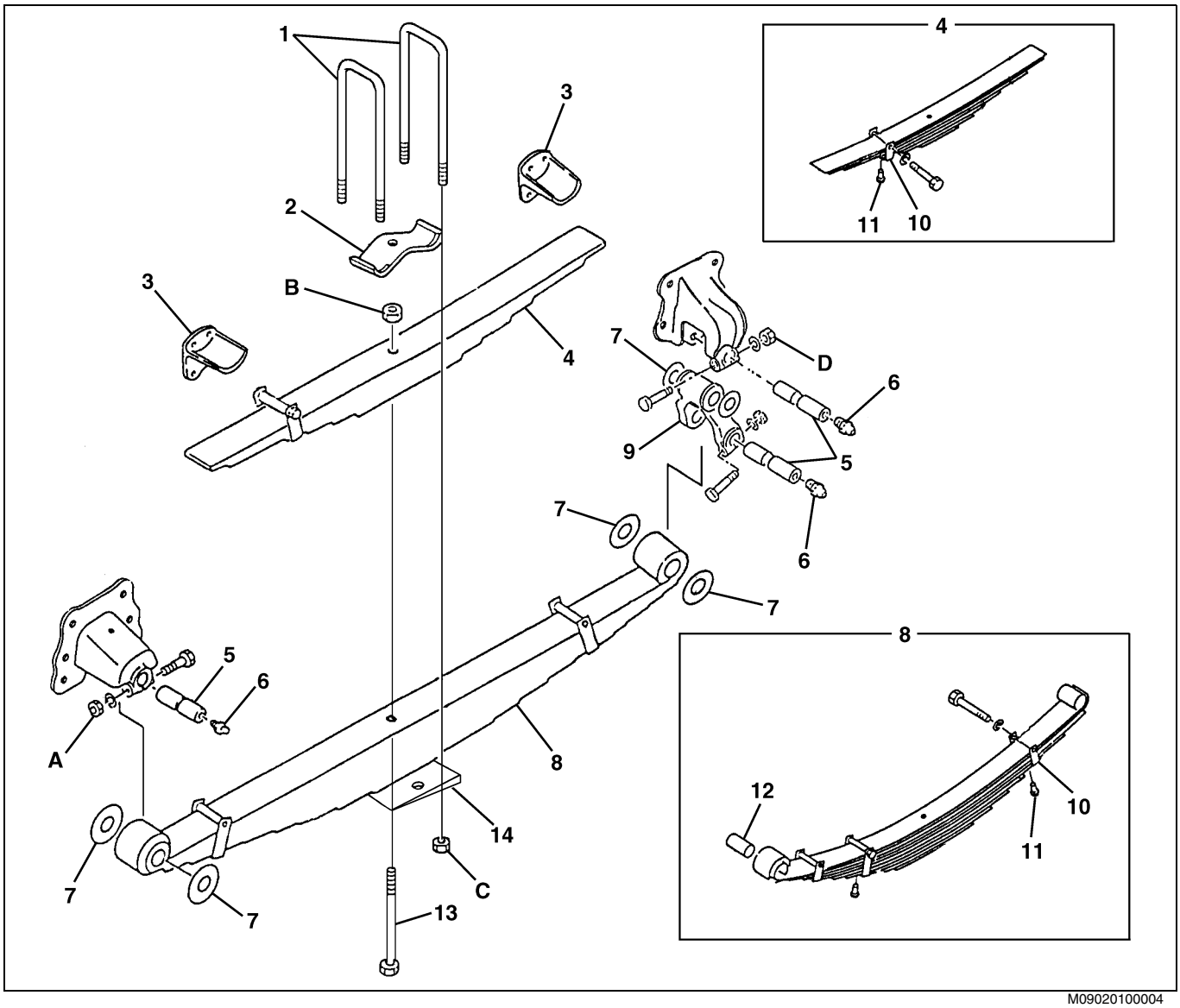

M09020100115

| | | | |
|---|---|---|---|
| 1 | U-bolt | 15 | Clip |
| 2 | Spring pad | 16 | Rivet |
| 3 | Spring bumper | 17 | Cushion washer (If so equipped) |
| 4 | Thrust washer | 18 | Stabilizer link rod (If so equipped) |
| 5 | Spring pin | 19 | Holder (If so equipped) |
| 6 | Shackle | 20 | Stabilizer (If so equipped) |
| 7 | Lubrication fitting | 21 | Rubber bushing (If so equipped) |
| 8 | Leaf spring assembly | 22 | Stabilizer lever (If so equipped) |
| 9 | Shock absorber | 23 | Stabilizer link pin (If so equipped) |
| 10 | Cushion washer | 24 | Caster shim |
| 11 | Shock absorber pin | 25 | Spacer |
| 12 | Lock washer | 26 | Spacer |
| 13 | Nut | 27 | Center bolt |
| 14 | Bushing | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 236-324 {2,406-3,303, 174-238} | E | 73-109 {745-1,111, 54-80} |
| B | 64-93 {653-948, 48-68} | F | 236-324 {2,406-3,303, 174-238} |
| C | 85-108 {870-1,100, 63-79} | G | 167-225 {1,700-2,300, 123-165} (Taper leaf spring) |
| D | 390-440 {3,977-4,486, 288-324} | G | 236-324 {2,406-3,303, 174-238} (Multi leaf spring) |

## REAR SUSPENSION




M09020100004

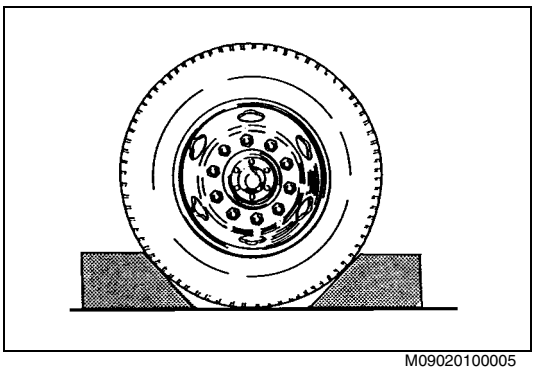
| | | | |
|---|---|---|---|
| 1 | U-bolt | 8 | Main leaf spring assembly |
| 2 | Spring pad | 9 | Shackle |
| 3 | Slide seat | 10 | Clip |
| 4 | Auxiliary leaf spring assembly | 11 | Rivet |
| 5 | Spring pin | 12 | Bushing |
| 6 | Lubrication fitting | 13 | Center bolt |
| 7 | Thrust washer | 14 | Wedge |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 73-109 {745-1,111, 54-80} | C | 640-740 {6,530-7,550, 472-545} |
| B | 226-284 {2,300-2,900, 167-209} | D | 73-109 {745-1,111, 54-80} |

# OVERHAUL

M09020101BEH2003

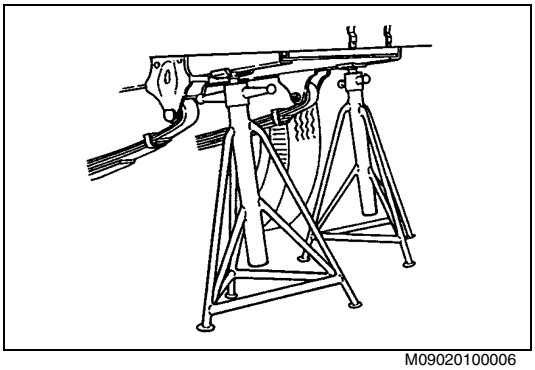

M09020100005

## IMPORTANT POINTS - DISMOUNTING

**1. SUPPORT OF THE FRAME WITH STANDS**

(1) Park the vehicle on level ground.

(2) Be sure to block the wheels before dismounting.


M09020100006

(3) Jack up the axle, and support the frame with stands.

(4) Remove the tires.

**2. REMOVAL OF THE U-BOLT**

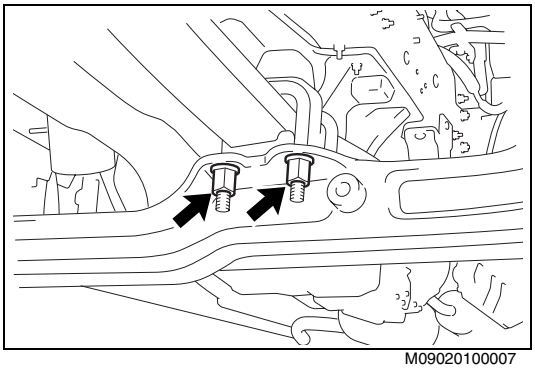
(1) Remove the shock absorber. (Front suspension only)

(2) Support the axle with a floor jack.

(3) Remove the U-bolt mounting nuts.

**NOTICE:**

**When cutting off the U-bolts (Due to rusted threads) with a torch, never direct the flame toward the leaves or allow sparks to come in contact with the leaves.**

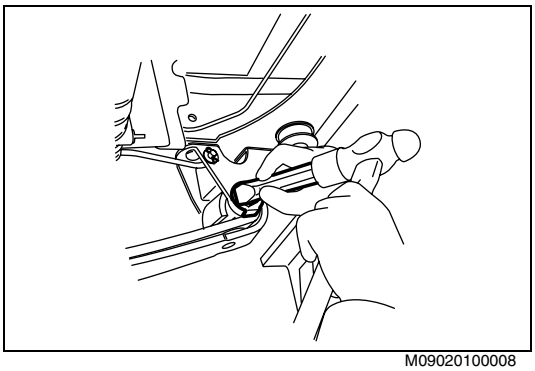

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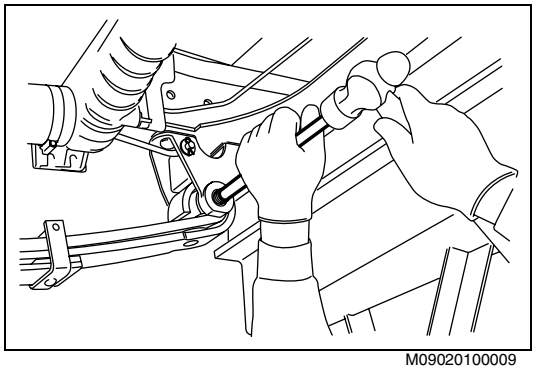
**SST:**
**Socket Wrench for Front U-bolt (09603-1160)**
**Socket Wrench for Rear U-bolt (09839-3202)**
**Socket Wrench for Rear U-bolt (09839-3203)**
**Bar (09841-2560)**

**3. REMOVAL OF THE SPRING PIN (FRONT SIDE SPRING)**

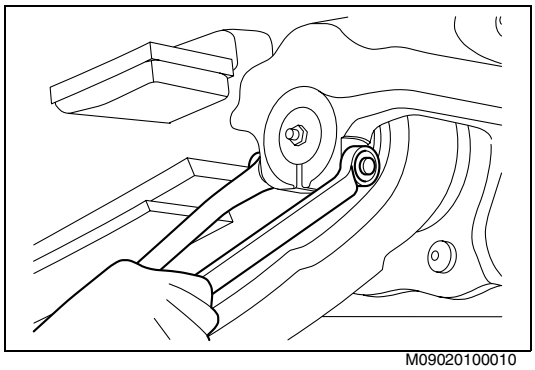
(1) Remove the lubrication fitting.

(2) Uncaulk the nut with a chisel, then loosen the nut. (Front side of spring)

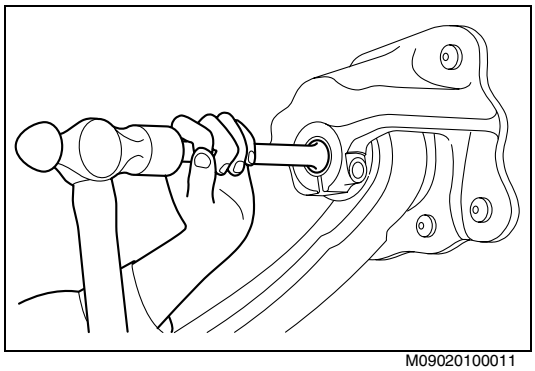

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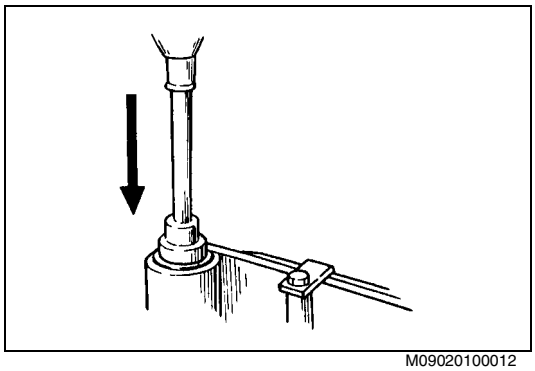
(3) Remove the spring pin lock bolt. (Rear side of spring)
(4) Use a brass rod to remove the spring pins from the shackle and spring bracket.


M09020100010

**4. REMOVAL OF THE SPRING PIN (REAR SUSPENSION)**
(1) Remove the lubrication fitting and spring pin lock bolt.

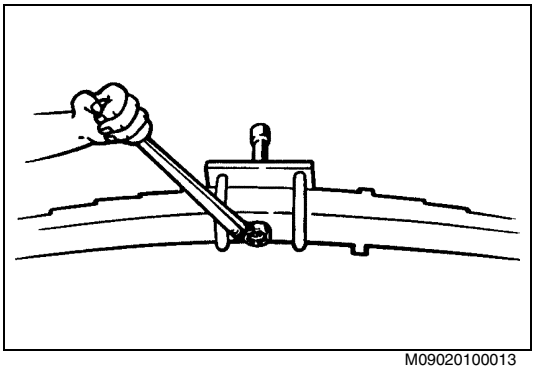

M09020100011

(2) Use a brass rod to remove the spring pins from the shackle and spring bracket.


M09020100012

## IMPORTANT POINTS - DISASSEMBLY

**1. REPLACEMENT OF THE EYE BUSHING**
(1) Use a suitable tool to press out the old eye bushing.
(2) Use a suitable tool to press in the new eye bushing.

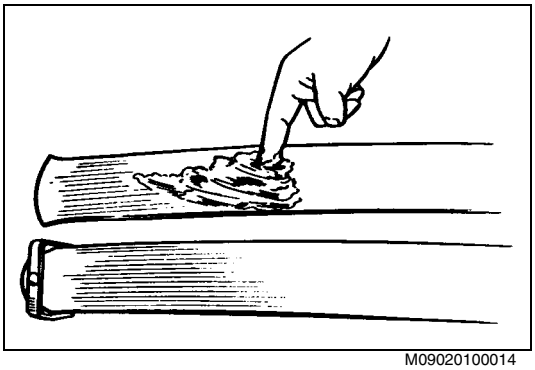

M09020100013

**2. DISASSEMBLY OF THE LEAF SPRING**

**CAUTION:**
**When removing the center bolt lock nut, the spring leaves may jump. Care should be taken to avoid possible personal injury.**

(1) Remove the clip bolts.
(2) Use a vise or an arbor press to hold the leaf spring near the center bolt.
(3) Remove the center bolt.
(4) Loosen a vise or an arbor press slowly, and separate the leaves.

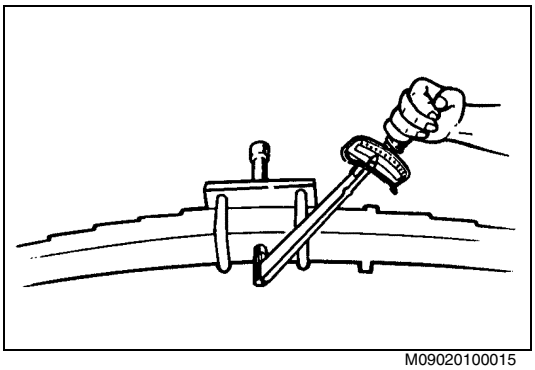
## IMPORTANT POINTS - ASSEMBLY


M09020100014

**1. ASSEMBLY OF THE LEAF SPRING**

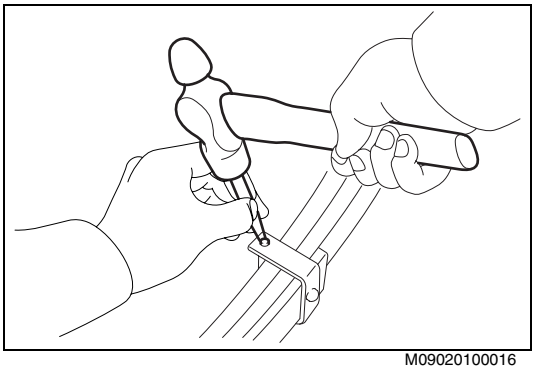
**CAUTION:**
**When clamping the spring leaves, they may jump. Care should be taken to avoid possible personal injury.**

(1) Apply coating on the leaf after removing rust, and apply chassis grease on both surface at leaves.


M09020100015

(2) Align the leaf holes and secure the leaves with a vise or an arbor press.
(3) Insert the center bolt and tighten the lock nut.

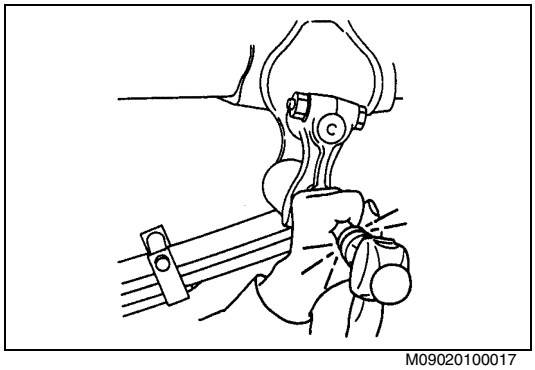
**NOTICE:**
**When reassembling the leaf spring, replace the center bolt with a new one.**


M09020100016

(4) Tighten the clip bolts.

**NOTICE:**
**When tightening the clip bolts, use a new clip bolts.**

(5) Use a punch to peen the thread of the clip bolts.


M09020100017

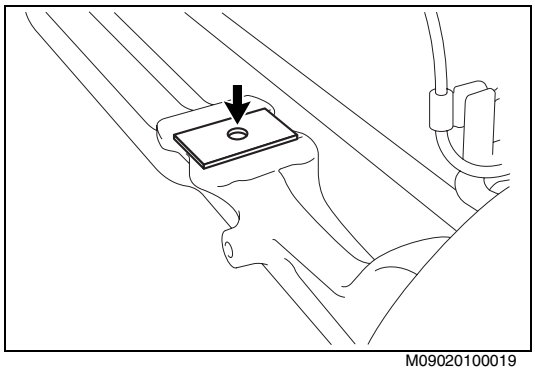
## IMPORTANT POINTS - MOUNTING

**1. INSTALLATION OF THE SPRING PIN**

(1) Use a copper hammer to install the spring pin with thrust washers.

**NOTICE:**
**Apply chassis grease on the surface of the eye bushing and spring pin before installing.**

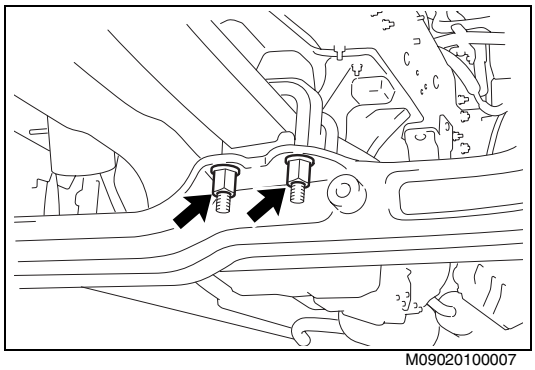
(2) Install the spring pin lock bolt and nut.
(3) Install secure the lock nut.


M09020100019

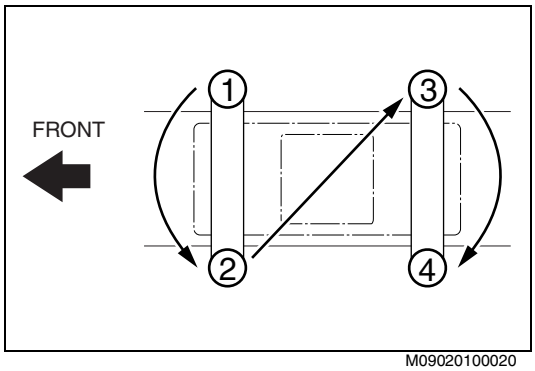
**2. INSTALLATION OF THE U-BOLT**

(1) Put the spacer on the front axle I-beam part of the driver's seat side. (For front suspension)
(2) Lift the axle using a jack and align the hole of the leaf spring center bolt and the hole of the axle I-beam.

**NOTICE:**
**Axle and suspension assembly are heavy, therefore be careful when handling them.**


M09020100007

(3) Put the spring pads on the leaf springs.
(4) Set the U-bolts so that they catch the spring pads and tighten the U-bolt nuts temporarily.



M09020100020

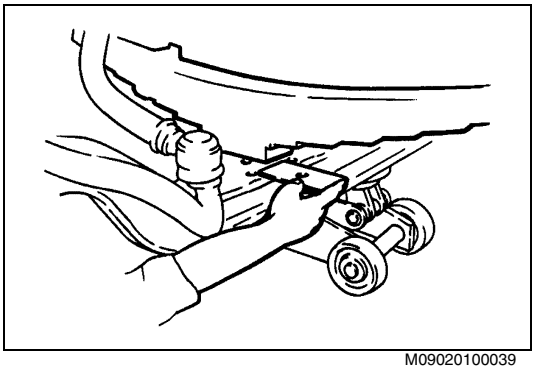
(5) Using the special tool, tighten the U-bolt nuts (4 pieces) alternately right and left and equally.
After repeating this operation 3 to 5 times, tighten the nuts to the specified torque.
**SST:**
**Socket Wrench for Front U-bolt (09603-1160)**
**Socket Wrench for Rear U-bolt (09839-3202)**
**Socket Wrench for Rear U-bolt (09839-3203)**
**Bar (09841-2560)**

**3. ADJUSTMENT OF THE SUSPENSION AFTER ASSEMBLING**

(1) If the vehicle inclination is observed after assembling suspension, correct it by inserting the following spacer between the spring and the axle.

**Spacer:**

| | Part No. | Thickness (mm) |
|---|---|---|
| **Front suspension** | **9004-85349** | **4.5** |
| **Rear suspension** | **9004-85125** | **6.0** |

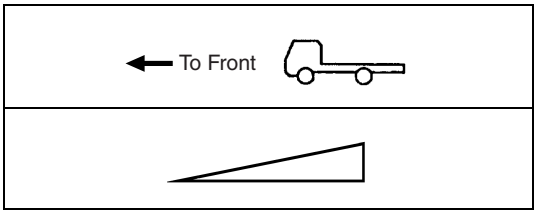


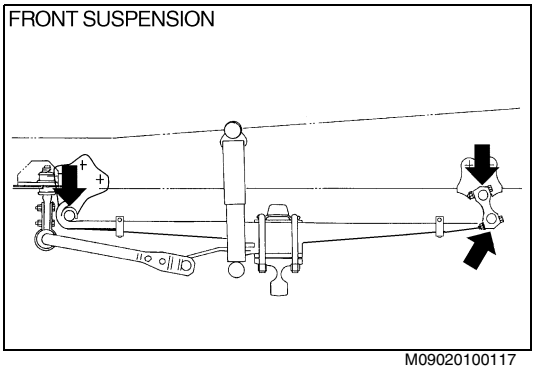
M09020100039

(2) Place the caster shim between the spring seat and leaf spring.

**NOTICE:**

**When installing the caster shim, the thick end should face the rear of the vehicle.**



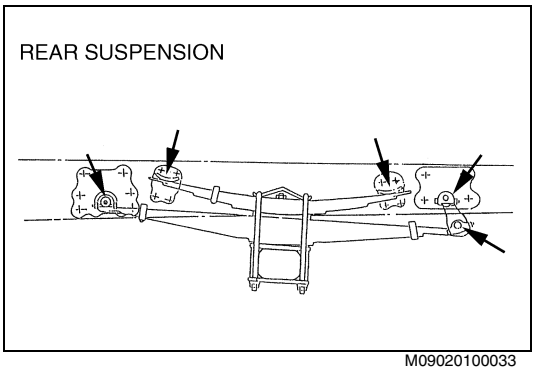




M09020100117

**4. LUBRICATION**

(1) Lubricate the following parts with chassis grease.

a. Spring pins



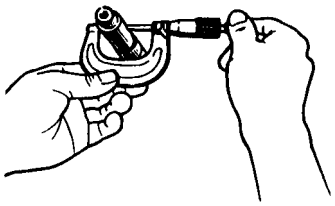
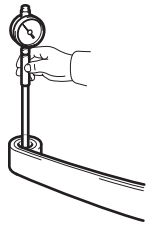
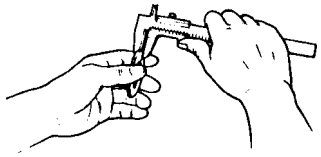
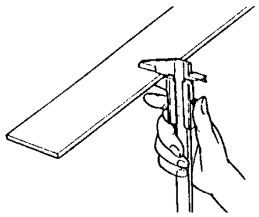
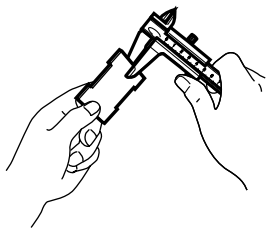
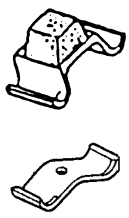

M09020100033

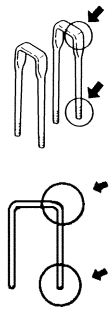
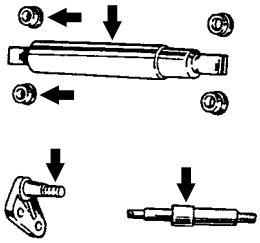
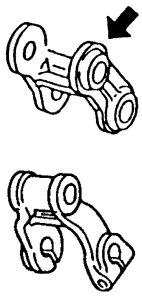
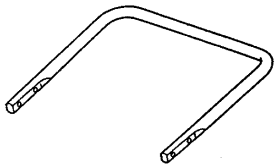
b. Auxiliary spring slide seats

# INSPECTION AND REPAIR

M09020101BEH3003

Unit: mm {in.}

| Inspection item | | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|---|
| Spring pin: Outside diameter | Front | 30 {1.181} | 29.7 {1.170} | Replace. | Measure  |
| | Rear | 30 {1.181} | 29.7 {1.170} | | |
| Clearance between spring pin and eye bushing | | 0.020-0.125 {0.0008-0.0049} | 0.5 {0.0196} | Replace the pin and/or bushing. | Measure  |
| Thrust washer: Wear | Front | Pivot side 3.0 {0.118} | 2.5 {0.0984} | Replace. | Measure  |
| | | Shackle side 4.0 {0.157} | 3.5 {0.138} | | |
| | Rear | Pivot side 2.0 {0.079} | 1.5 {0.059} | | |
| | | Shackle side 4.0 {0.157} | 3.5 {0.138} | | |
| Leaf: Damage and wear | | — | More than 15% | Replace. | Measure  |
| Silencer: Wear | | 3.0 {0.118} | 1.0 {0.0394} | Replace, if necessary. | Measure  |
| Spring bumper: Damage and wear | | — | — | Replace, if necessary. | Visual check  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **U-Bolt:<br>Damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Shock absorber:<br>Operation, oil leak and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Cushion:<br>Damage and wear** | — | — | | |
| **Shock absorber pin and bracket:<br>Damage and wear** | — | — | | |
| **Shackle:<br>Damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Stabilizer Bar:<br>Damage<br>(If so equipped)** | | | **Replace, if necessary.** | **Visual check**<br>  |
| **Stabilizer Sleeve:<br>Wear<br>(If so equipped)** | | | | |
| **Stabilizer Bushing:<br>Wear<br>(If so equipped)** | | | | |

# SUSPENSION (MODELS: FL, FM)

SU02-003

**LEAF SUSPENSION ASSEMBLY ..... SU02-2**
DATA AND SPECIFICATIONS ..... SU02-2
DESCRIPTION ..... SU02-3
TROUBLESHOOTING ..... SU02-4
SPECIAL TOOL ..... SU02-4
COMPONENT LOCATOR ..... SU02-5
OVERHAUL ..... SU02-7
INSPECTION AND REPAIR ..... SU02-14

# LEAF SUSPENSION ASSEMBLY

## DATA AND SPECIFICATIONS

M09020102BEI2001

**FRONT SUSPENSION**

| | | | |
|---|---|---|---|
| **Type** | **Semi-elliptic leaf springs with shock absorber** | | |
| **Dimensions of leaf springs:** | **Span** | **1,470 mm {57.874 in.}** | |
| | **Width** | **80 mm {3.15 in.}** | |
| | **Thickness of leaves** | **Multi leaf spring** | **Taper leaf spring** |
| | | **10 mm {0.394 in.}** | **19.5 mm {0.768 in.}** |
| | | **12 mm {0.472 in.}** | |
| | | **13 mm {0.512 in.}** | |
| **Shock absorbers:** | **Type** | **Single acting** | **Double acting** |
| | **Stroke** | **252 mm {9.921 in.}** | **249 mm {9.803 in.}** |
| | **Min. length** | **382 mm {15.039 in.}** | **381 mm {15.000 in.}** |
| | **Max. length** | **634 mm {24.961 in.}** | **630 mm {24.803 in.}** |

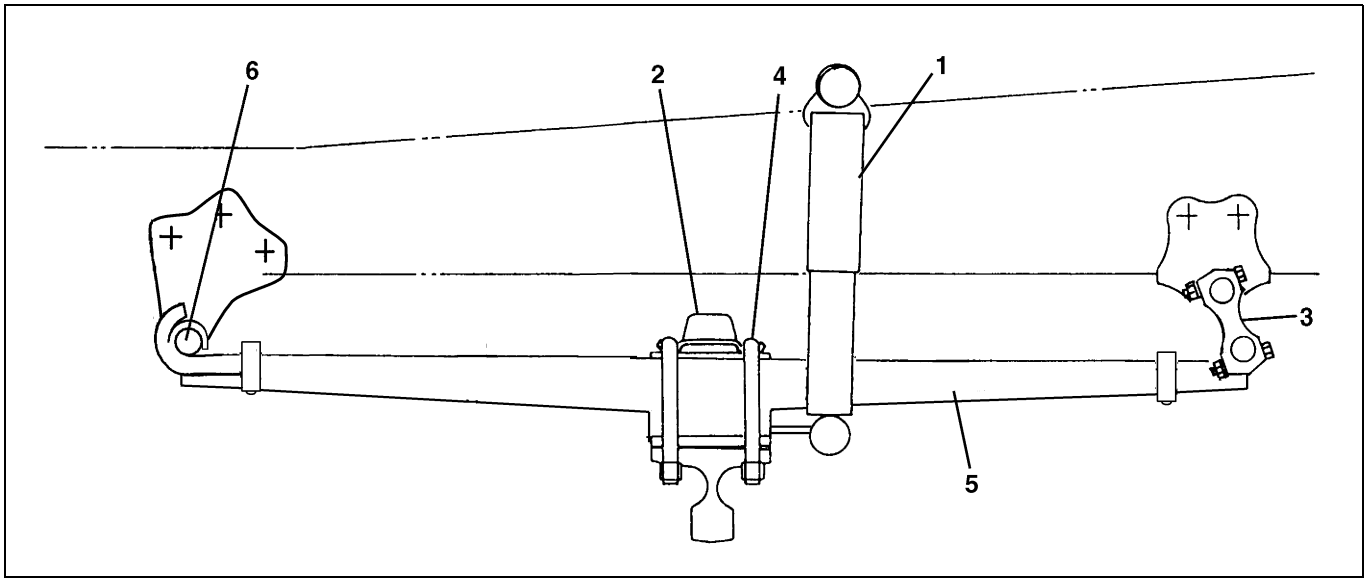
**REAR SUSPENSION**

| | | |
|---|---|---|
| **Type** | **Semi-elliptic leaf springs with torque rods** | |
| **Dimensions of main leaf springs:** | **Span** | **1,300 mm {51.181 in.}** |
| | **Width** | **90 mm {3.543 in.}** |
| | **Thickness of leaves** | **16 mm {0.63 in.}** |
| | | **18 mm {0.71 in.}** |

# DESCRIPTION

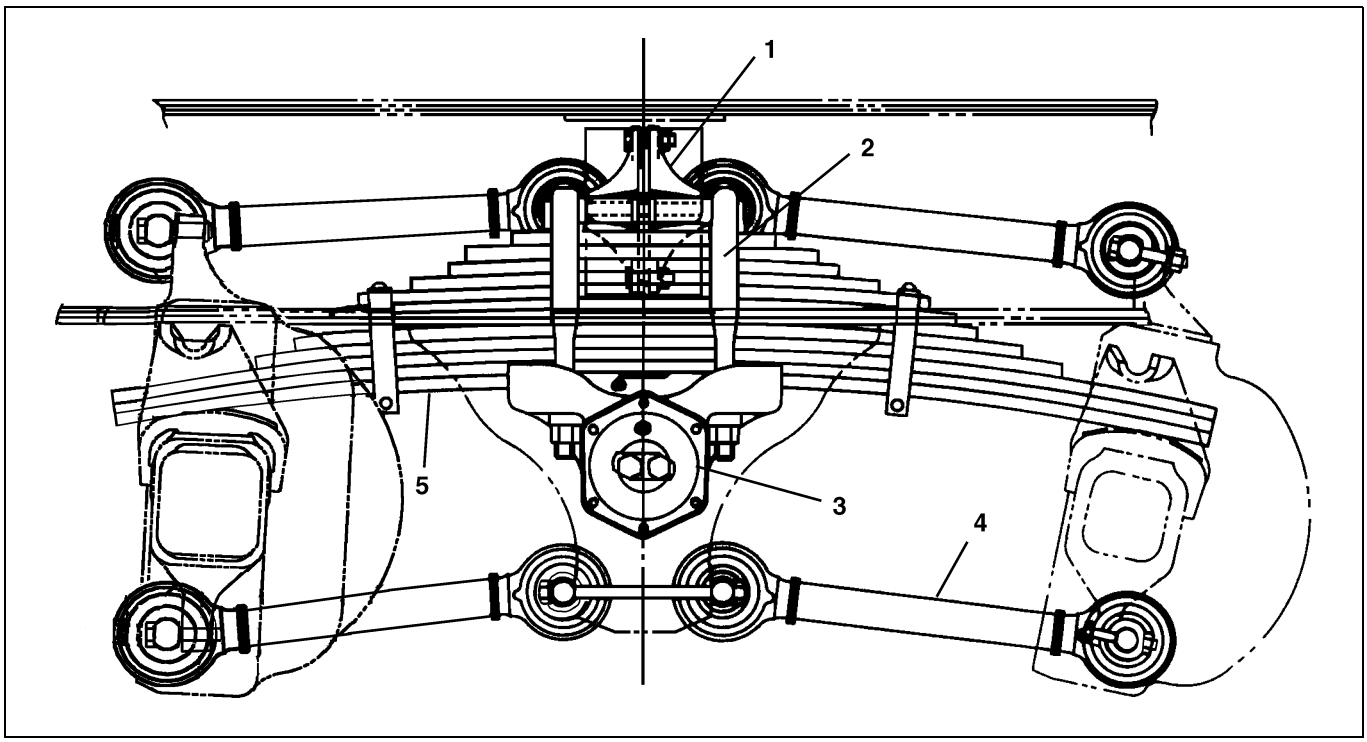
M09020102BEC1001

## FRONT SUSPENSION




| | | | |
|---|---|---|---|
| 1 | Shock absorber | 4 | U-bolt |
| 2 | Spring bumper | 5 | Leaf spring assembly |
| 3 | Shackle | 6 | Spring pin |

## REAR SUSPENSION




| | | | |
|---|---|---|---|
| 1 | Torque rod bracket | 4 | Torque rod |
| 2 | U-bolt | 5 | Leaf spring assembly |
| 3 | Trunnion assembly | | |

# TROUBLESHOOTING

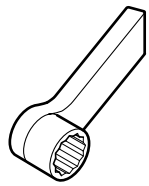
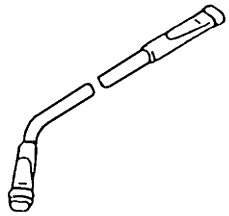
M09020102BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Rough ride** | Broken leaves | Replace the leaves. Check the load capacity rating. |
| | Cracked or damaged | Replace the leaves. Check the load capacity rating. |
| | Overloading | Decrease the load. |
| **Heavy sway** | Inoperative shock absorber | Replace the shock absorber. |
| **Leaves broken at the center bolt hole** | Loosen U-bolts | Tighten to specified torque. |
| **Squeaking of the leaves** | Friction between the leaves | Replace the silencers and/or apply chassis grease between leaves. |

# SPECIAL TOOL

M09020102BEK1001

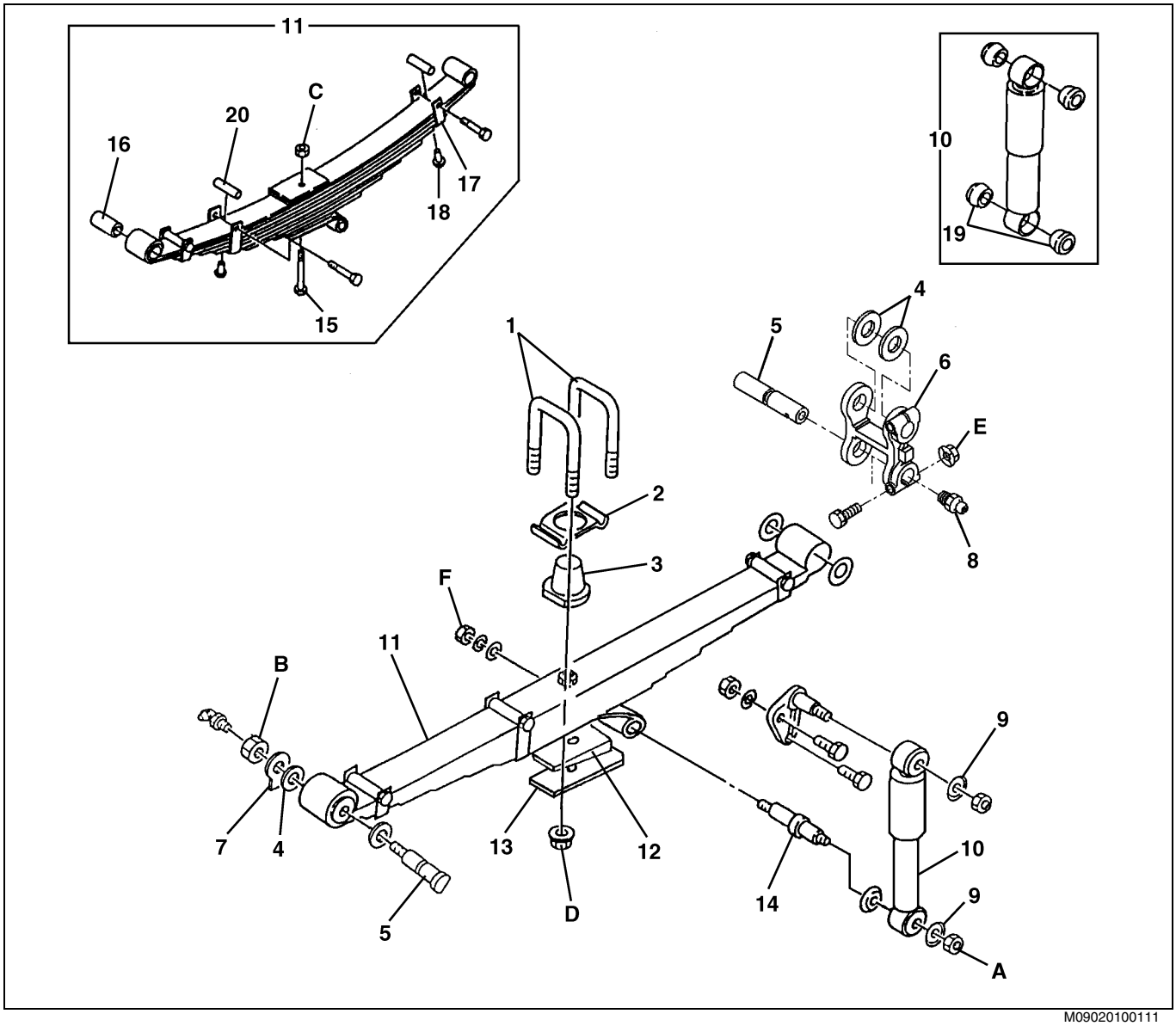
Prior to starting a suspension overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09603-1160 | SOCKET WRENCH | FOR FRONT U-BOLT |
|  | 09603-1010 | SOCKET WRENCH | FOR REAR U-BOLT |
|  | 09404-1060 | HANDLE | |

# COMPONENT LOCATOR

M09020102BED1001

## FRONT SUSPENSION



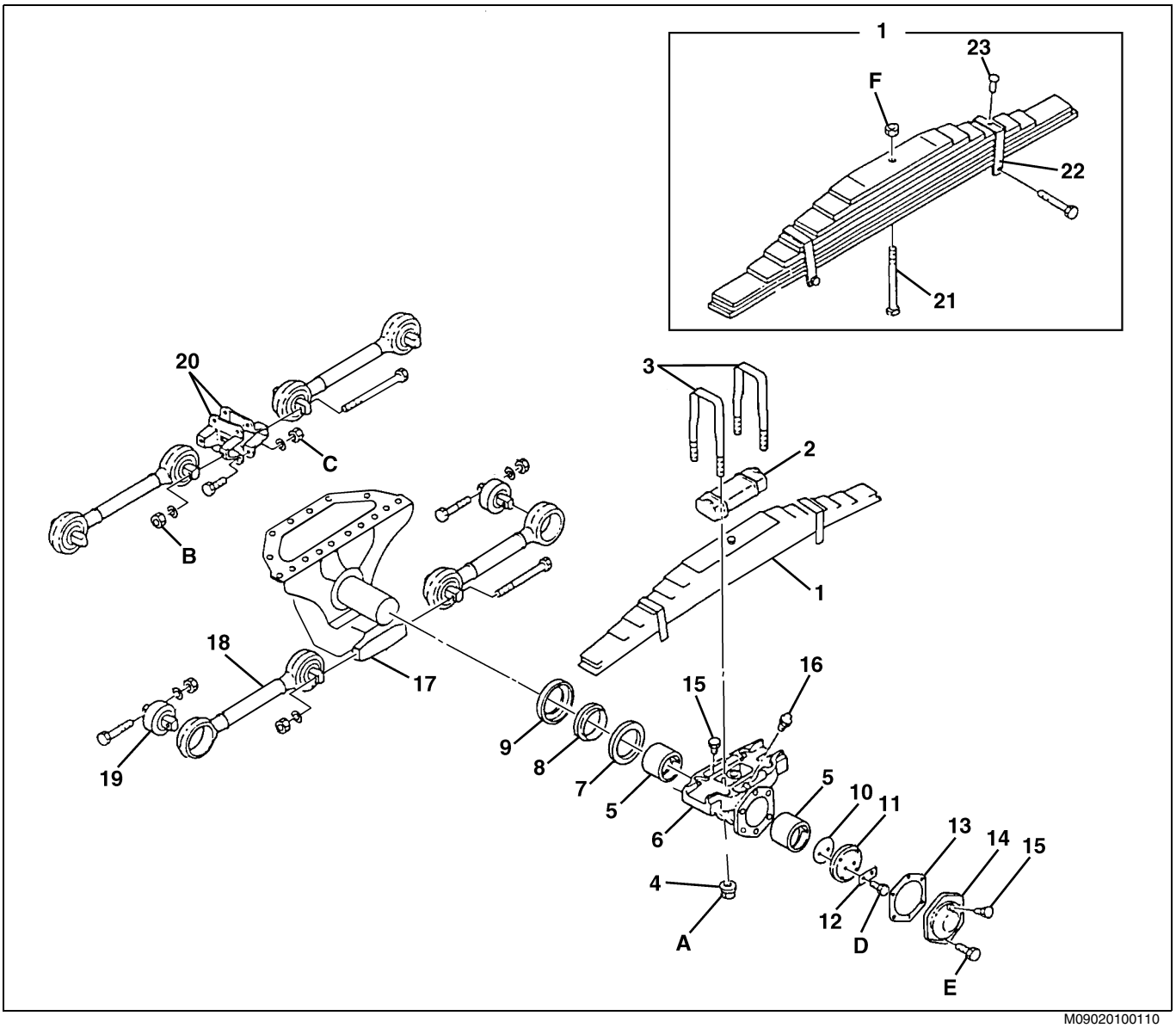

M09020100111

| | | | |
|---|---|---|---|
| 1 | U-bolt | 11 | Leaf spring assembly |
| 2 | Spring pad | 12 | Caster shim |
| 3 | Spring bumper | 13 | Spacer (If so equipped) |
| 4 | Thrust washer | 14 | Shock absorber pin |
| 5 | Spring pin | 15 | Center bolt |
| 6 | Shackle | 16 | Bushing |
| 7 | Lock plate | 17 | Clip |
| 8 | Lubrication fitting | 18 | Rivet |
| 9 | Cushion washer | 19 | Cushion |
| 10 | Shock absorber | 20 | Collar |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 167-225 {1,700-2,300, 125-168} | D | 390-440 {3,977-4,486, 288-324} |
| B | 64-93 {653-948, 48-68} | E | 73-109 {745-1,111, 54-80} |
| C | 85-108 {870-1,100, 63-79} | F | 236-324 {2,406-3,303, 174-238} |

## REAR SUSPENSION




M09020100110

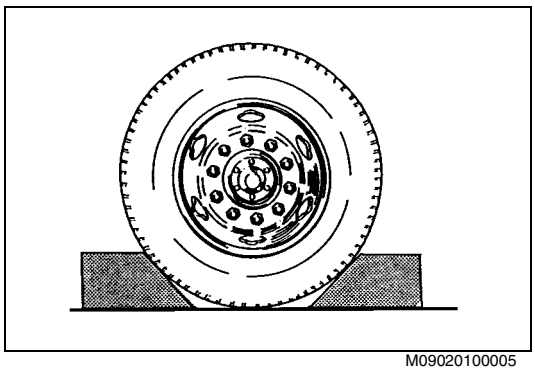
| | | | | | |
|---|---|---|---|---|---|
| 1 | Leaf spring assembly | 9 | Dust shield | 17 | Trunnion bracket |
| 2 | Spring pad | 10 | Shim | 18 | Torque rod |
| 3 | U-bolt | 11 | Clamp plate | 19 | Rubber bushing |
| 4 | Nut | 12 | Lock plate | 20 | Torque rod bracket |
| 5 | Bushing | 13 | Trunnion gasket | 21 | Center bolt |
| 6 | Trunnion seat | 14 | Trunnion cover | 22 | Clip |
| 7 | Oil-seal | 15 | Breather valve | 23 | Rivet |
| 8 | Trunnion collar | 16 | Lubrication fitting | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 782-978 {7,975-9,972, 577-721} | D | 341-459 {3,478-4,680, 254-339} |
| B | 236-324 {2,407-3,303, 174-238} | E | 37-49 {378-499, 28-36} |
| C | 170-230 {1,734-2,345, 126-169} | F | 226-284 {2,300-2,900, 167-209} |

# OVERHAUL

M09020102BEH2001



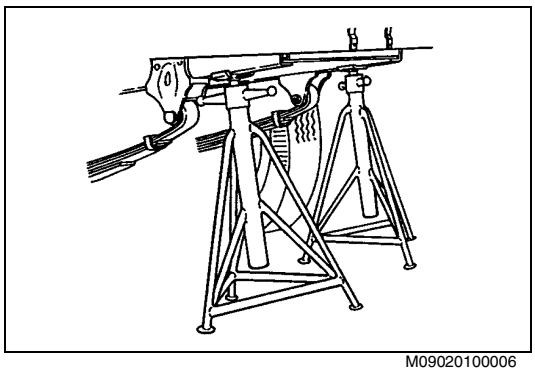
M09020100005

## IMPORTANT POINTS - DISMOUNTING

**1. SUPPORT OF THE FRAME WITH STANDS**

(1) Park the vehicle on level ground.

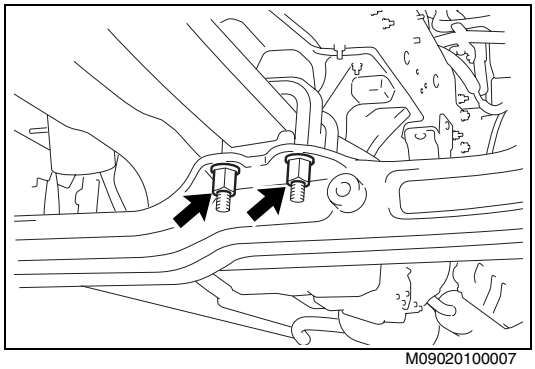
(2) Be sure to block the wheels before dismounting.



M09020100006

(3) Jack up the axle, and support the frame with stands.

(4) Remove the tires.



M09020100007

**2. REMOVAL OF THE U-BOLT**

(1) Remove the shock absorber. (Front suspension only)

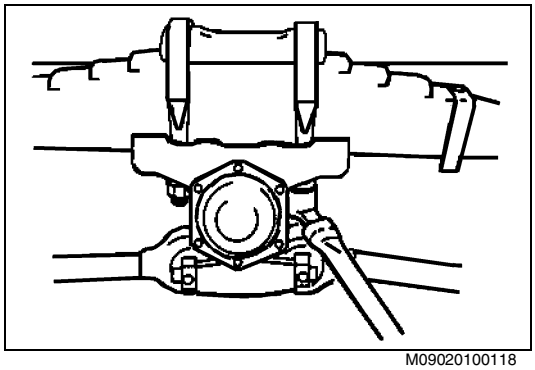
(2) Support the axle with a floor jack.

(3) Remove the U-bolt mounting nuts.

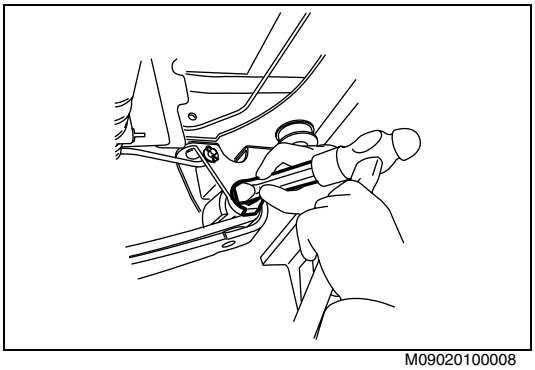
**NOTICE:**

**When cutting off the U-bolts (Due to rusted threads) with a torch, never direct the flame toward the leaves or allow sparks to come in contact with the leaves.**

**SST: Socket Wrench for Front U-bolt (09603-1160)**
**Socket Wrench for Rear U-bolt (09603-1010)**
**Handle (09404-1060)**

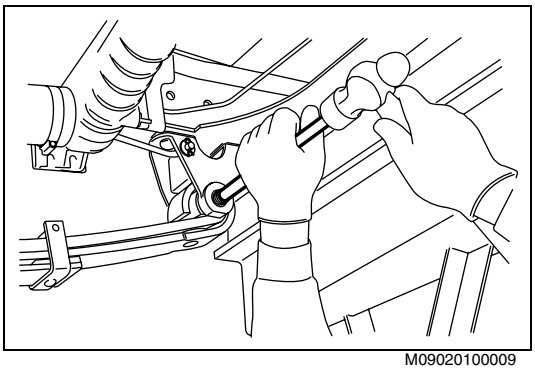


M09020100118

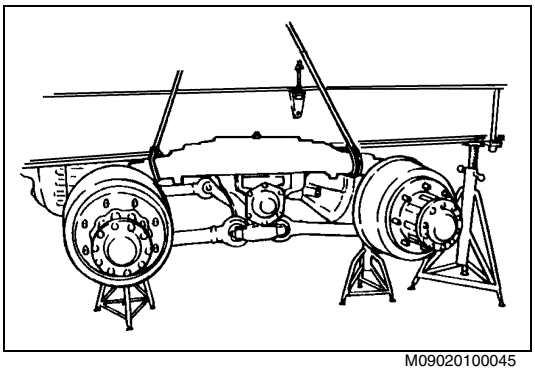

M09020100008

**3. REMOVAL OF THE SPRING PIN (FRONT SUSPENSION)**

(1) Remove the lubrication fitting.
(2) Uncaulk the nut with a chisel, then loosen the nut. (Front side of spring)

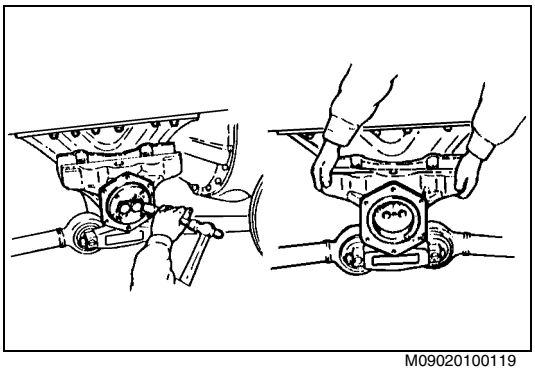

M09020100009

(3) Remove the spring pin lock bolt. (Rear side of spring)
(4) Use a brass rod to remove the spring pins from the shackle and spring bracket.


M09020100045

**4. REMOVAL OF THE LEAF SPRING FROM THE TRUNNION SEAT.**

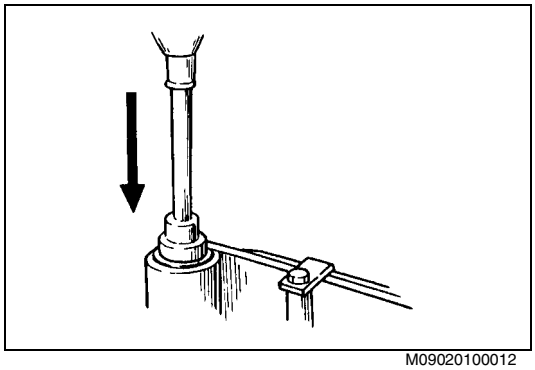
(1) Remove the leaf spring from the trunnion seat.


M09020100119

**5. REMOVE OF THE TRUNNION SEAT**

(1) Remove the trunnion shaft cover.
(2) Uncaulk the lock plate of the clamp plate bolts with a chisel, then remove the bolts, lock plate, clamp plate and shims.
(3) Remove the trunnion seat from trunnion shaft.

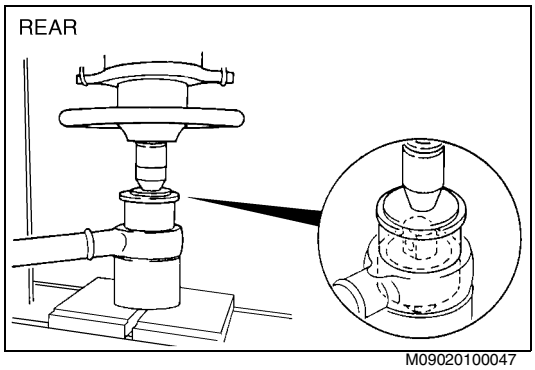
**CAUTION:**
**Since the trunnion seat is too heavy, be careful not to drop it on your feet.**


M09020100012

## IMPORTANT POINTS - DISASSEMBLY

**1. REPLACEMENT OF THE EYE BUSHING**

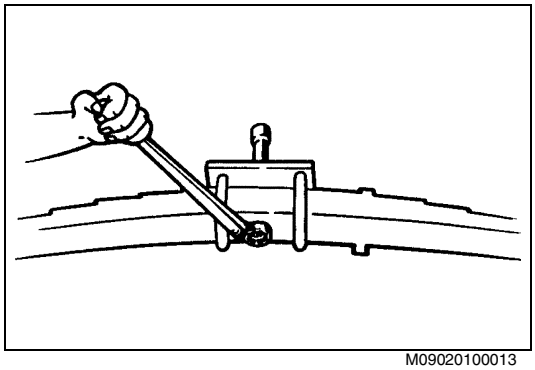
(1) Use a suitable tool to press out the old eye bushing.
(2) Use a suitable tool to press in the new eye bushing.



M09020100047

**2. REPLACEMENT OF THE RUBBER BUSHING**

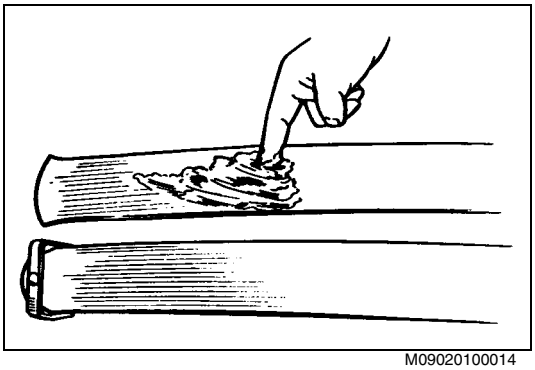
(1) Use a commercial tool to press out the old tubber bushing.
(2) Use a commercial tool to press in the new rubber bushing.


M09020100013

**3. DISASSEMBLY OF THE LEAF SPRING**

**CAUTION:**
**When removing the center bolt lock nut, the spring leaves may jump. Care should be taken to avoid possible personal injury.**

(1) Remove the clip bolts.
(2) Use a vise or an arbor press to hold the leaf spring near the center bolt.
(3) Remove the center bolt.
(4) Loosen a vise or an arbor press slowly, and separate the leaves.

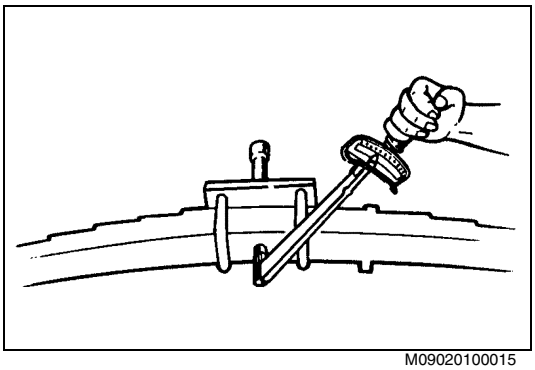

M09020100014

## IMPORTANT POINTS - ASSEMBLY

### 1. ASSEMBLY OF THE LEAF SPRING

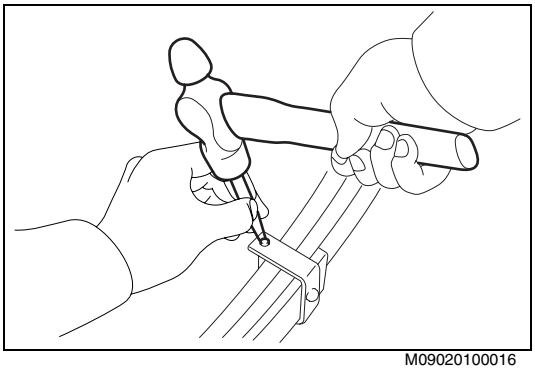
**CAUTION:**
**When clamping the spring leaves, they may jump. Care should be taken to avoid possible personal injury.**

(1) Apply coating on the leaf after removing rust, and apply chassis grease on both surfaces at leaves.


M09020100015

(2) Align the leaf holes and silencers (Front suspension only), then secure the leaves with a vise or an arbor press.
(3) Insert the center bolt and tighten the lock nut.

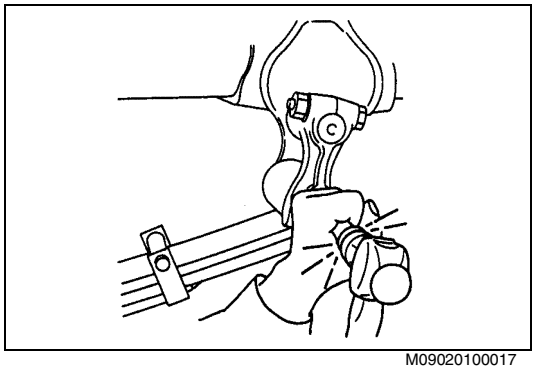
**NOTICE:**
**When reassembling the leaf spring, replace the center bolt with a new one.**


M09020100016

(4) Tighten the clip bolts.

**NOTICE:**
**When tightening the clip bolts, use a new clip bolts.**

(5) Use a punch to peen the thread of the clip bolts.


M09020100017

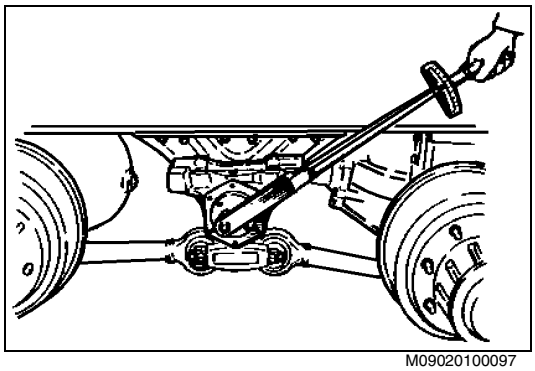
## IMPORTANT POINTS - MOUNTING

**1. INSTALLATION OF THE SPRING PIN**

(1) Use a copper hammer to install the spring pin with thrust washers.

**NOTICE:**
**Apply chassis grease on the surface of the eye bushing and spring pin before installing.**

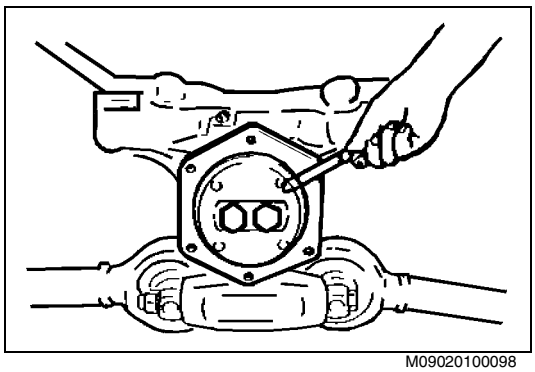
(2) Install the spring pin lock bolt and nut.
(3) Install secure the lock nut.


M09020100097

**2. INSPECT THE CLEARANCE BETWEEN THE CLAMP PLATE AND THE TRUNNION SEAT.**

**NOTICE:**
- **Replace the oil seal and trunnion gasket with new ones.**
- **Apply chassis grease to lip of the oil seal and the inside of the bushing.**
- **Insert two trunnion seat bolts before installing the trunnion seat on the trunnion shaft.**

(1) Install the trunnion seat to the trunnion shaft.
(2) Set the shim and clamp plate and tighten the bolts with the lock plate.

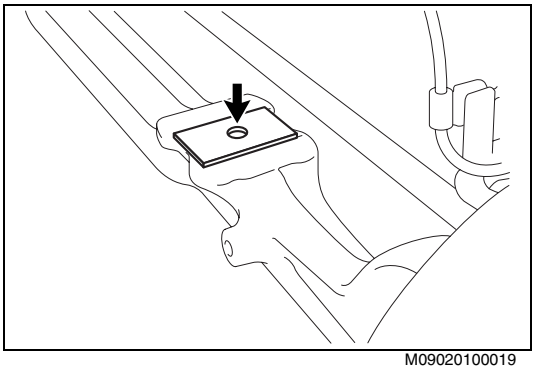

M09020100098

(3) Inspect the clearance between the clamp plate and trunnion seat.
**Standard clearance: 0.05-0.1 mm {0.0020-0.0039 in.}**
**Service limit: 0.4 mm {0.0157 in.}**

**NOTICE:**
**If the standard clearance is not correct, adjust the clearance by decreasing or increasing the shim.**

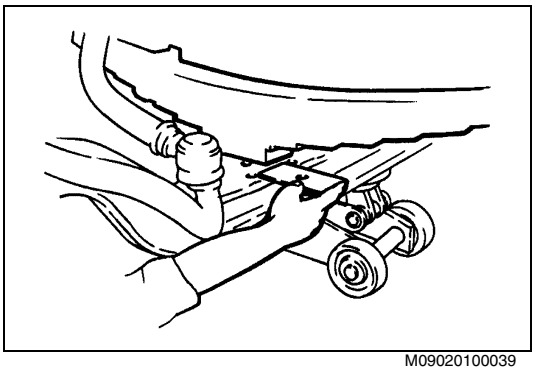
**The following shims are available.**
**0.30 mm {0.0118 in.}, 0.40 mm {0.0157 in.},**
**0.45 mm {0.0177 in.}, 0.50 mm {0.0197 in.}.**

(4) Lock the clamp plate bolts with the lock plate.


M09020100019

**3. INSTALLATION OF THE U-BOT**

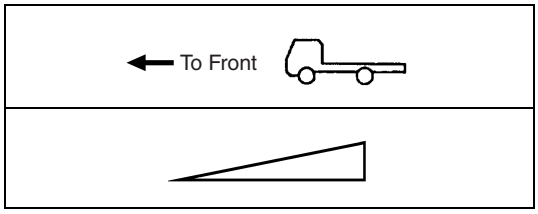
(1) Put the spacer on the front axle I-beam part of the driver's seat side. (For front suspension)


M09020100039

(2) Place the caster shim between the spring seat and leaf spring.

**NOTICE:**

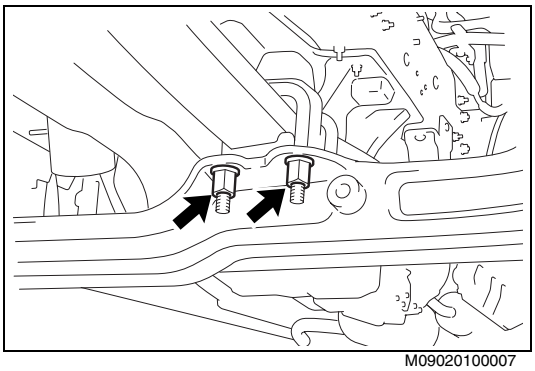
**When installing the caster shim, the thick end should face the rear of the vehicle.**




(3) Lift the axle using a jack and align the hole of the leaf spring center bolt and the hole of the axle I-beam.

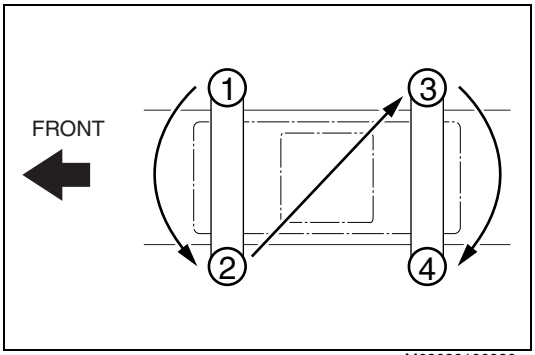
**NOTICE:**

**Axle and suspension assembly are heavy, therefore be careful when handing them.**


M09020100007

(4) Put the spring pads on the leaf springs.

(5) Set the U-bolt so that they catch the spring pads and tighten the U-bolt nuts temporarily.



M09020100020

(6) Using the special tool, tighten the U-bolt nuts (4 pieces) alternately right and left and equally.
After repeating this operation 3 to 5 times, tighten the nuts to the specified torque.

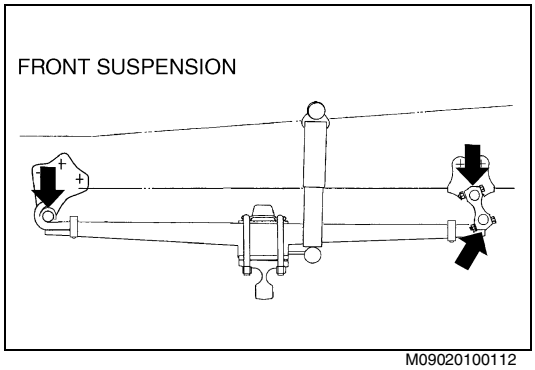
**SST: Socket Wrench for Front U-bolt (09603-1160)**
**Socket Wrench for Rear U-bolt (09603-1010)**
**Handle (09404-1060)**

**4. ADJUSTMENT OF THE SUSPENSION AFTER ASSEMBLING**

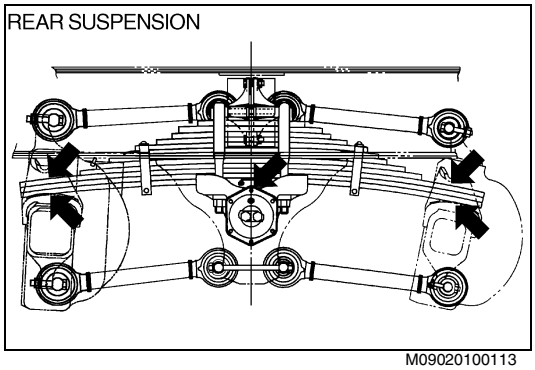
(1) If the vehicle inclination is observed after assembling suspension, correct it by inserting the following spacer between the spring and the axle.

**Spacer:**

| | Part No. | Thickness (mm) |
|---|---|---|
| **Front suspension** | **9004-85349** | **4.5** |



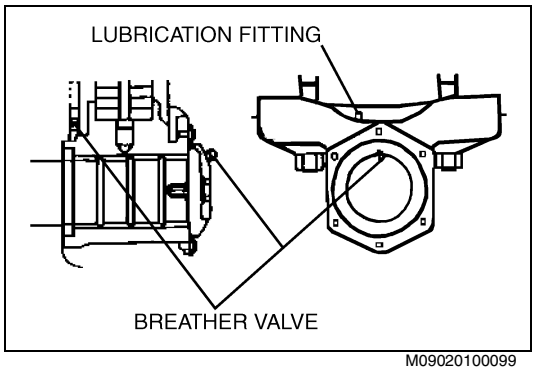

M09020100112




M09020100113

**5. LUBRICATION**

(1) Lubricate the following parts with chassis grease.
- a. Spring pins
- b. Spring surface of the spring and axle housing
- c. Trunnion shaft




M09020100099

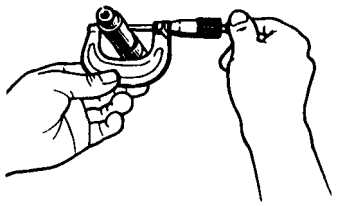
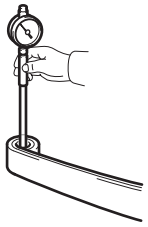
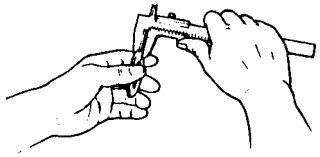
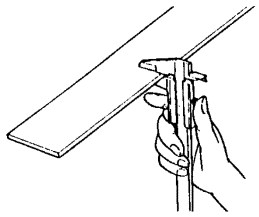
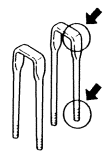
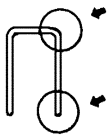
**NOTICE:**

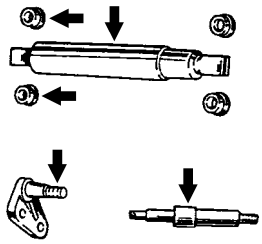
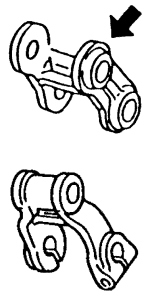
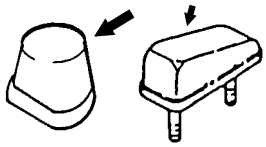
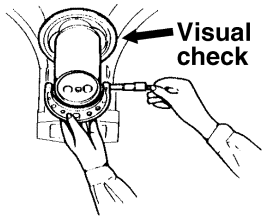
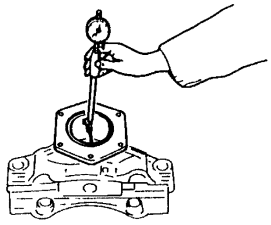
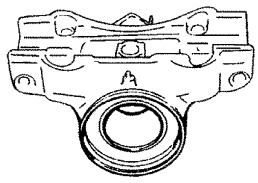
**Use the lubrication fitting to chassis grease the trunnion shaft, until the grease flows out from the breather valve of trunnion seat and trunnion cover.**

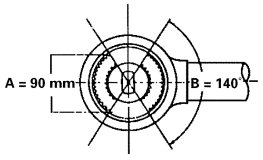
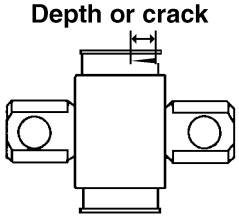
# INSPECTION AND REPAIR

M09020102BEH3001

Unit: mm {in.}

| Inspection item | | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|---|
| Spring pin: Outside diameter. | Front | 30 {1.181} | 29.7 {1.170} | Replace. | Measure  |
| Clearance between spring pin and eye bushing | | 0.02-0.125 {0.0008-0.0049} | 0.5 {0.0196} | Replace the pin and/or bushing. | Measure  |
| Thrust washer: Wear. | | Pivot side 3.0 {0.118} | 2.5 {0.0984} | Replace. | Measure  |
| | | Shackle side 4.0 {0.157} | 3.5 {0.138} | | |
| Leaf: Damage and wear. | | — | More than 15% | Replace. | Measure  |
| Silencer: Wear. | | 3.0 {0.118} | 1.0 {0.0040} | Replace, if necessary. | Measure  |
| U-Bolt: Damage. | | — | — | Replace, if necessary. | Visual check   |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Shock absorber: Operation, oil leak and damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Cushion: Damage and wear** | **—** | **—** | | |
| **Shock absorber pin and bracket: Damage and wear.** | **—** | **—** | | |
| **Shackle: Damage.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Spring bumper: Damage and wear.** | **—** | **—** | **Replace, if necessary.** | **Visual check**  |
| **Trunnion shaft outside diameter.** | **100 {3.937}** | **—** | **Replace, if necessary.** | **Measure**   |
| **Clearance between trunnion shaft and bushing.** | **0.26-0.43 {0.0103-0.0169}** | **0.7 {0.0275}** | **Replace, if nec-essary.** | |
| **Dust shield: Damage.** | **—** | **—** | **Replace, if nec-essary.** |  |
| **Trunnion oil seal: Damage.** | **—** | **—** | **Replace, if nec-essary.** | **Visual check**  |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Rubber bushing:<br>Damage and crack.** | **—** | **15<br>{0.59}** | **In case cracks have developed on the rubber circumference in the range (A or B) shown in figure, replace the torque rod bushing.** | **Measure and Visual check**<br>  <br>**Depth or crack**<br>  |

# SUSPENSION (HENDRICKSON HAS 200, HAS 230)

SU02-004

**SUSPENSION ASSEMBLY..... SU02-2**
DATA AND SPECIFICATIONS ..... SU02-2
DESCRIPTION ..... SU02-2
TROUBLESHOOTING ..... SU02-3
SPECIAL TOOL ..... SU02-3
COMPONENT LOCATOR..... SU02-4
OVERHAUL ..... SU02-5
INSPECTION AND REPAIR ..... SU02-10

# SUSPENSION ASSEMBLY

## DATA AND SPECIFICATIONS

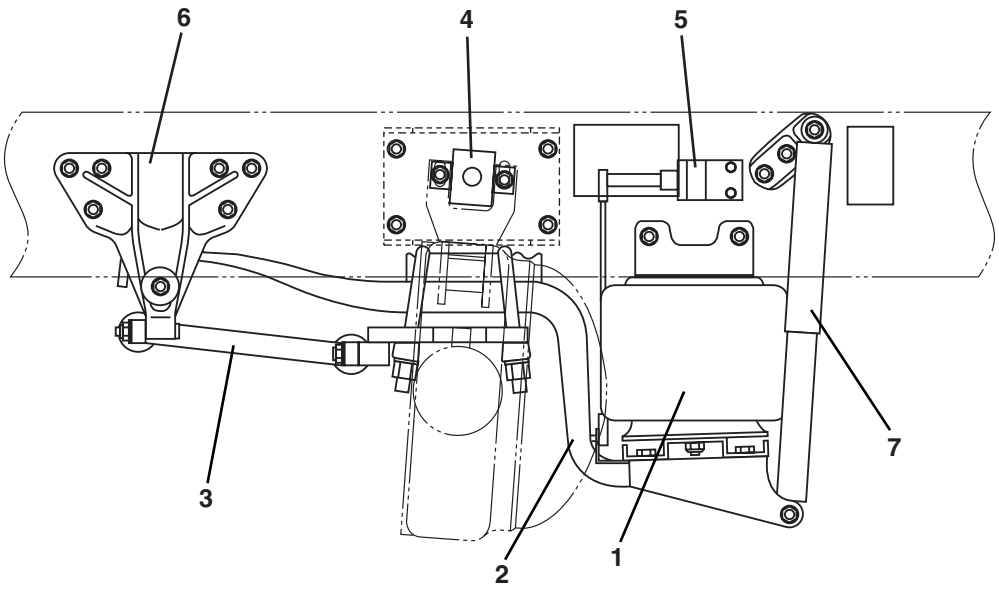
M09020104BEI2001

| MODEL | FD, GD | FG, GH, FL, FM |
|---|---|---|
| TYPE | HENDRICKSON HAS 200 | HENDRICKSON HAS 230 |

## DESCRIPTION

M09020104BEC1001

**MODEL: FD, GD, FG, GH**




M09020100061

| | | | |
|---|---|---|---|
| 1 | Air spring | 5 | Height control valve |
| 2 | Main support member | 6 | Frame hanger |
| 3 | Torque rod | 7 | Shock absorber |
| 4 | Transverse rod | | |

**Rear axle, frontward and rearward for FL, FM models are same as this figure.**

# TROUBLESHOOTING

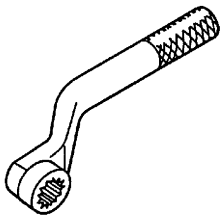
M09020104BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Abnormal sound occurs from the spring while driving.** | Eccentric wear of the shock absorber fitting pin | Replace the pin and/or rubber bushing. |
| | Wear and deflection of the rebound roller | Remove the rebound roller and/or rebound bolt spacer. |
| **Uncomfortably (Rolling and pitching)** | Deflection and damage of the bushings of the torque rod and the transverse rod | Replace the bushings. |
| | Faulty of the shock absorber | Replace the shock absorber. |
| | Faulty of the leveling valve | Repair the leveling valve. |
| **Vibration of the steering wheel, and the car shake** | Deflection of the bushing in the torque rod and the transverse rod | Replace the bushings. |
| | Looseness of the torque rod and the transverse rod bracket bolt | Replace the lock nut and tighten with the specified torque. |
| **Vehicle height is not adjusted correctly.** | Faulty of the leveling valve | Repair the parts. |

# SPECIAL TOOL

M09020104BEK1001

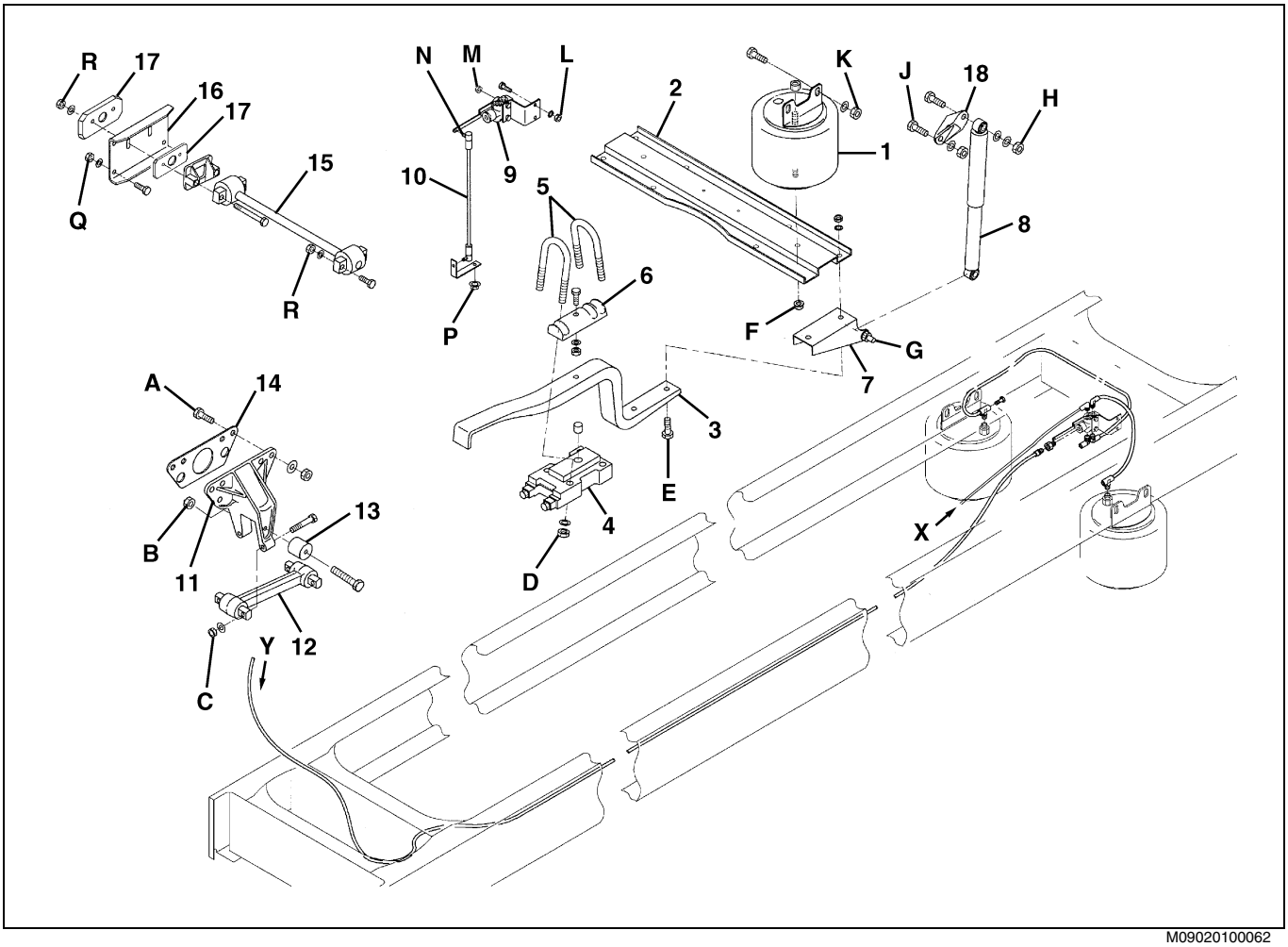
Prior to starting a suspension overhaul, it is necessary to have these special tools.

| Illustration | Part number | Tool name | Remarks |
|---|---|---|---|
|  | 09603-1160 | SOCKET WRENCH | |

# COMPONENT LOCATOR

M09020104BED1001

## MODEL: FD, GD, FG, GH




M09020100062

| | | | |
|---|---|---|---|
| 1 | Air spring | 11 | Frame hanger |
| 2 | Cross channel | 12 | Torque rod |
| 3 | Main support member | 13 | Rebound roller |
| 4 | Spring seat | 14 | Back plate |
| 5 | U-bolt | 15 | Transverse rod |
| 6 | Top pad | 16 | Channel reinforcement |
| 7 | Lower shock absorber bracket | 17 | Back up plate |
| 8 | Shock absorber | 18 | Upper shock absorber bracket |
| 9 | Height control valve | X | From air tank |
| 10 | Threaded extension rod | Y | From height control valve |

**Rear axle, frontward and rearward for FL, FM models are same as this figure.**

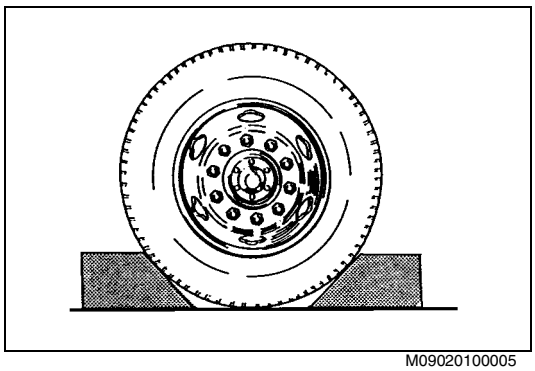
**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 435-508 {4,440-5,180, 320-375} | J | 237-305 {2,420-3,110, 175-225} |
| B | 68-95 {695-965, 50-70} | K | 237-305 {2,420-3,110, 175-225} |
| C | 203-278 {2,070-2,835, 150-205} | L | 41-61 {420-620, 30-45} |
| D | FD, GD: 350-430 {3,570-4,380, 270-315} | M | 27-40 {275-405, 20-33} |
| | FG, GH, FL, FM: 545-610 {5,560-6,220, 400-450} | N | 11-17 {115-170, 8-12} |
| E | 355-435 {3,620-4,435, 260-320} | P | 27-40 {275-405, 20-33} |
| F | 27-40 {275-405, 20-33} | Q | 237-305 {2,420-3,110, 175-225} |
| G | 68-95 {695-965, 50-70} | R | 203-280 {2,070-2,835, 150-205} |
| H | 68-95 {695-965, 50-70} | | |

# OVERHAUL

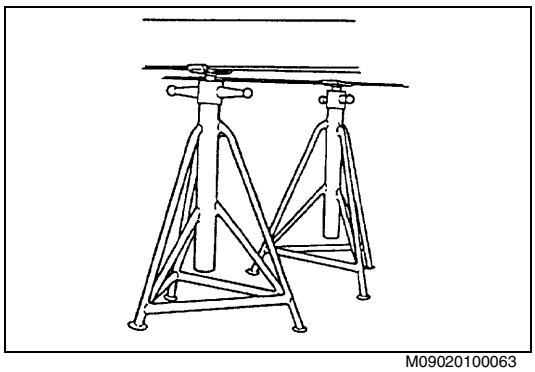
M09020104BEH2001

## IMPORTANT POINTS - DISASSEMBLY



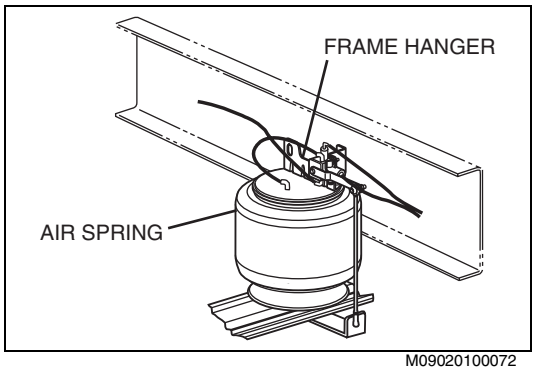
M09020100005

**1. SUPPORT THE FRAME WITH THE STAND.**
(1) Park the vehicle on the level ground.
(2) Be sure to block the wheels before dismounting.



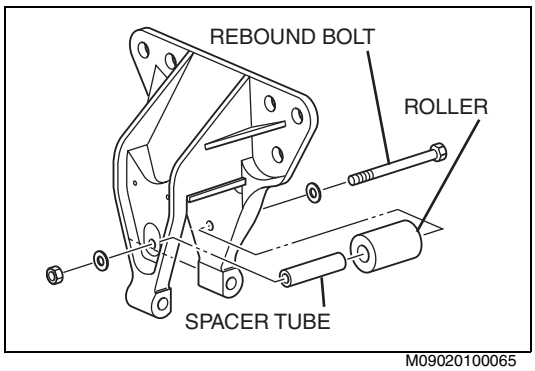
M09020100063

(3) Jack up the axle, and support the frame with the stand.



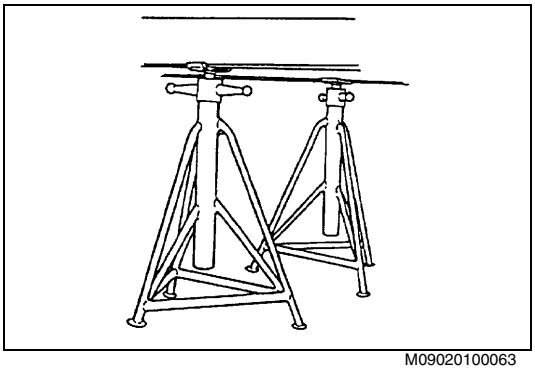

M09020100072

**2. REMOVAL OF MAIN SUPPORT MEMBERS**
(1) Release air pressure from the air springs.
(2) Remove the height control valve link from the valve by removing the nut and the lock washer.

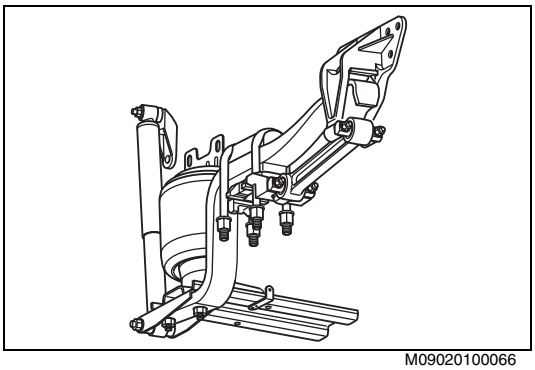



M09020100065

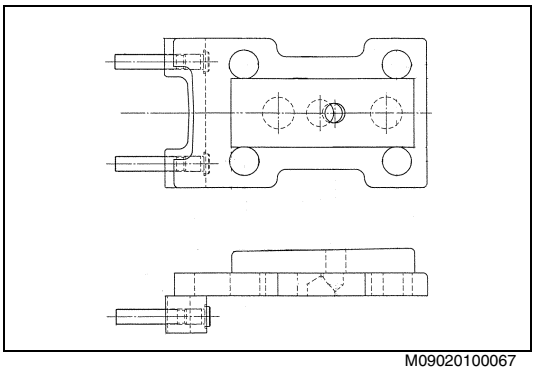
(3) Remove the rebound bolts, lock nuts, washers, spacer tube, and rebound roller from the frame hanger.


M09020100063

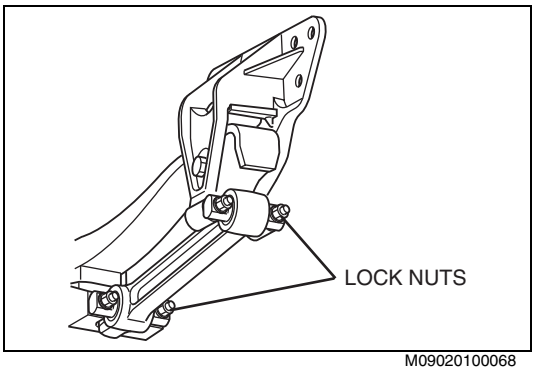
(4) Raise the rear of frame, high enough to remove the load from main support member.


M09020100066

(5) Remove the U-bolt lock nuts and washers.
(6) Remove the U-bolts, bottom cap, and top pad.
(7) Remove both the lock nuts and washers which connect the cross channel to both the main support members.
(8) Lift cross channel off the main support member with jacks.
(9) Remove the main support member assembly.

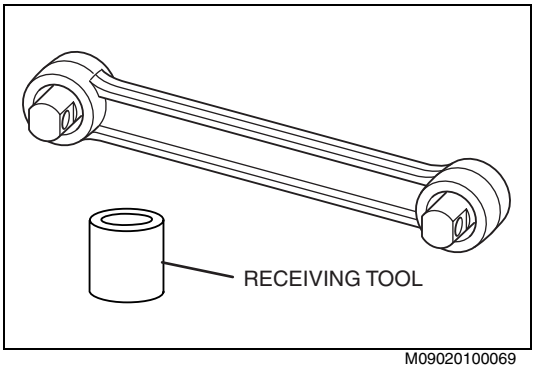

M09020100067

**3. REPLACEMENT OF THE SPRING SEAT**
(1) Remove the spring seat.



M09020100068

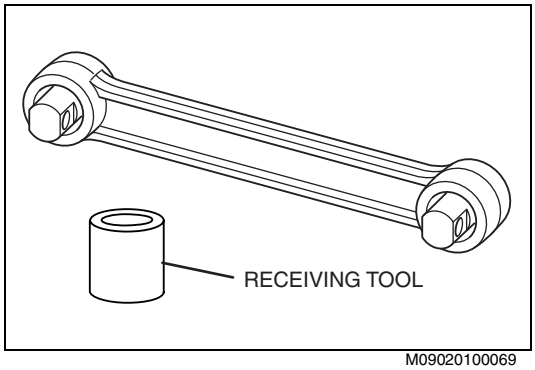
**4. REPLACEMENT OF THE TORQUE ROD BUSHINGS**
(1) Remove the straddle mount bar pin lock nuts and washers at the axle end of the torque rod.
(2) Loosen the rebound bolt lock nut in the frame hanger.
(3) Remove the straddle mount bar pin lock nuts, bolts, and washers at the frame hanger ends of the torque rod.



M09020100069

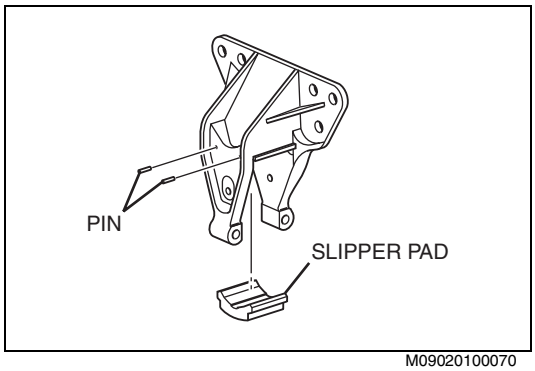
(4) Push out oil bushings. Use a vertical shop press with a capacity of at least 10 tons. Steel tube receiving tool is required. These bushings are not cartridge type bushings. They do not have outer metals. Support the torque rod end on receiving tool with the end tube of torque rod centered on tool. Push directly on the bushing straddle mount bar pin until the bushing clears the torque rod end tube.

**CAUTION:**
**Be sure the torque rod is securely supported on the press bed for safety.**
**Do not use heat or cutting torch to remove the bushings from the torque rod. The use of heat will adversely affect a strength of the torque rod.**



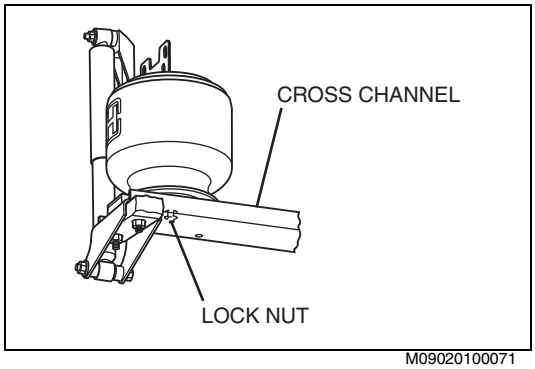
M09020100069

(5) Clean and inspect the torque rod ends, removing any nick with emery cloth.
(6) Lubricate the torque rod ends and the new rubber bushings with a vegetable base oil (cooking oil or lard). Do not use a petroleum or soap base lubricant.
(7) Press in new bushings. Support the torque rod end on receiving tool with end tube of torque rod centered on receiving tool. Straddle mount bar pin bushing must have mounting flats positioned zero degrees to shank of torque rod as shown in the figure. Press directly straddle mount bar pin of bushing. Bushing must be centered within torque rod end tubes. When pressing in new bushings, overshoot desired final position by approximately 3/16 and press bushing again from opposite side to center bushing within torque rod end.



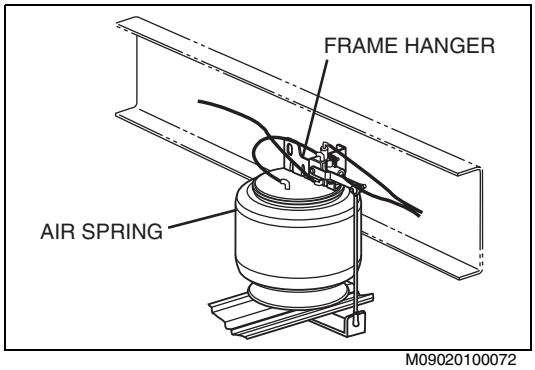
M09020100070

**5. REPLACEMENT OF THE FRAME HANGER SLIPPER PADS**
(1) In most cases removal of the rebound roller and spacer may be required to disassemble the slipper pad. Remove the rebound bolt lock nut, washer bolt rebound roller and spacer.
(2) Procure the slipper pad locally from Hendrickson's Agent.



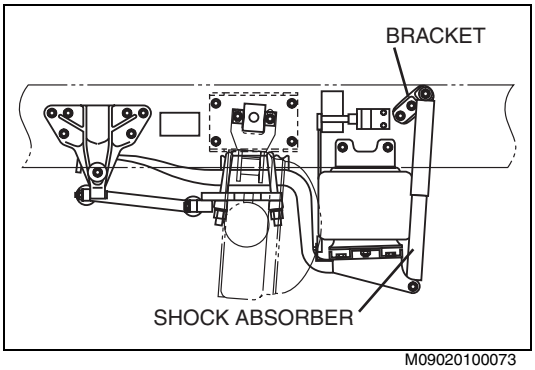
M09020100071

**6. REMOVAL OF CROSS CHANNEL**
(1) Remove the lock nuts and washers which connect the air spring to cross channel.
(2) Raise the cross channel by using jack if required.



M09020100072

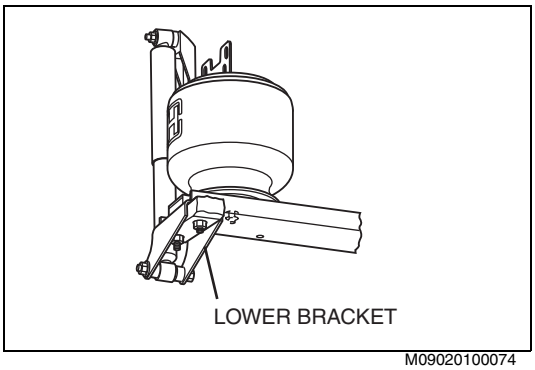
**7. REMOVAL OF AIR SPRING**
(1) Remove the air line to the air spring seat.
(2) Remove the brass air fittings from the air spring.
(3) Remove the lock nuts and washers which connect the air spring to the upper air spring frame hanger.
(4) Remove the air spring.
(5) Remove the air spring frame hanger.



M09020100073

**8. REMOVAL OF SHOCK ABSORBER FRAME HANGER BRACKET**

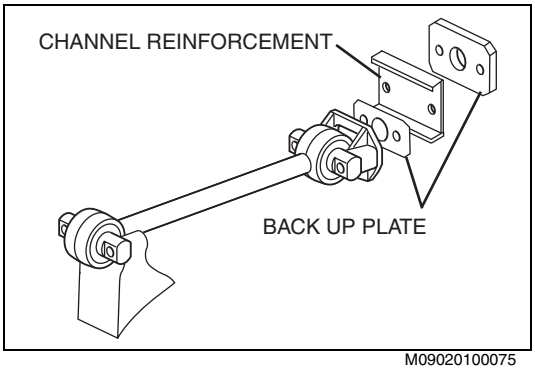
(1) Remove the lock nuts and washers at both ends of the shock absorber.
(2) Remove the shock absorber completely from the chassis.
(3) Remove the lock nuts and washers which connect the shock absorber bracket to the frame.
(4) Remove the shock absorber bracket.



M09020100074

**9. REMOVAL OF SHOCK ABSORBER LOWER BRACKET**

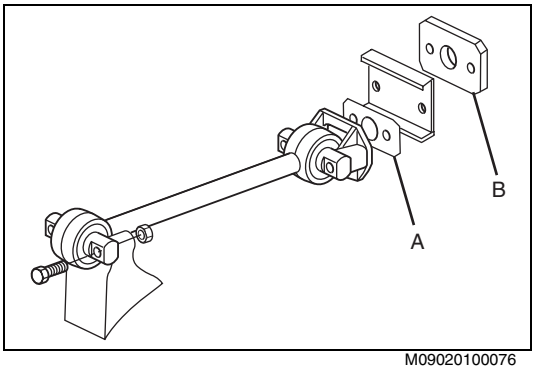
(1) Remove the shock absorber completely from the chassis.
(2) Remove the lock nuts and washers which connect the cross channel to the main support member.
(3) Remove the shock absorber lower bracket by sliding the bracket to rear.



M09020100075

**10. REMOVAL OF TRANSVERSE ROD**

(1) Remove the lock nuts and washers which connect the transverse rod to the frame.
(2) Remove the lock nuts and washers which connect to the axle bracket.
(3) Use Owatonna Tool Company's tool set to remove and install the torque rod bushings. Follow their instructions.



M09020100076

## IMPORTANT POINTS - ASSEMBLY

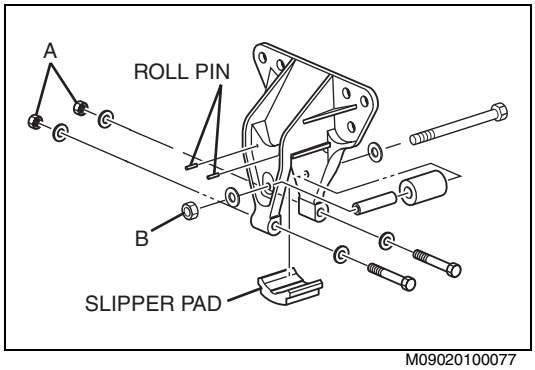
**1. INSTALLATION OF TRANSVERSE ROD**

(1) Assemble the washer and lock nut to the bolt. Tighten the lock nut to specified torque.
(2) Install the back up plates.

**Thickness:**

**A: 3 mm {0.119 in.}**
**B: 10 mm {0.394 in.}**

(3) Position the straddle mount end of torque rod at the transverse rod to the frame, tighten the lock nuts to specified torque.



M09020100077

**2. INSTALLATION OF FRAME HANGER**

(1) Install new slipper pad.
(2) Raise the main support member to secure slipper pad in place.
(3) Drive new roll pin in place with punch until flush with the front of frame hanger.
(4) Tighten fasteners to specified torque.

**3. CHECK THE AIR LEAKAGE.**

(1) Apply soapy water for each joint of air line and charge the compressed air of 780 kPa {8.0 kgf/cm$^2$, 110 lbf/in.$^2$} then check the leakage.

**4. ADJUSTMENT OF THE VEHICLE HEIGHT**

**NOTICE:**

- **Adjustment should be done only after assembling.**
- **Adjustment should be done with the air pressure of 71-86 kPa {7.0-8.5 kgf/cm$^2$, 99-120 lbf/in.$^2$}, keeping on supplying the air while rotating the engine at the idle speed.**

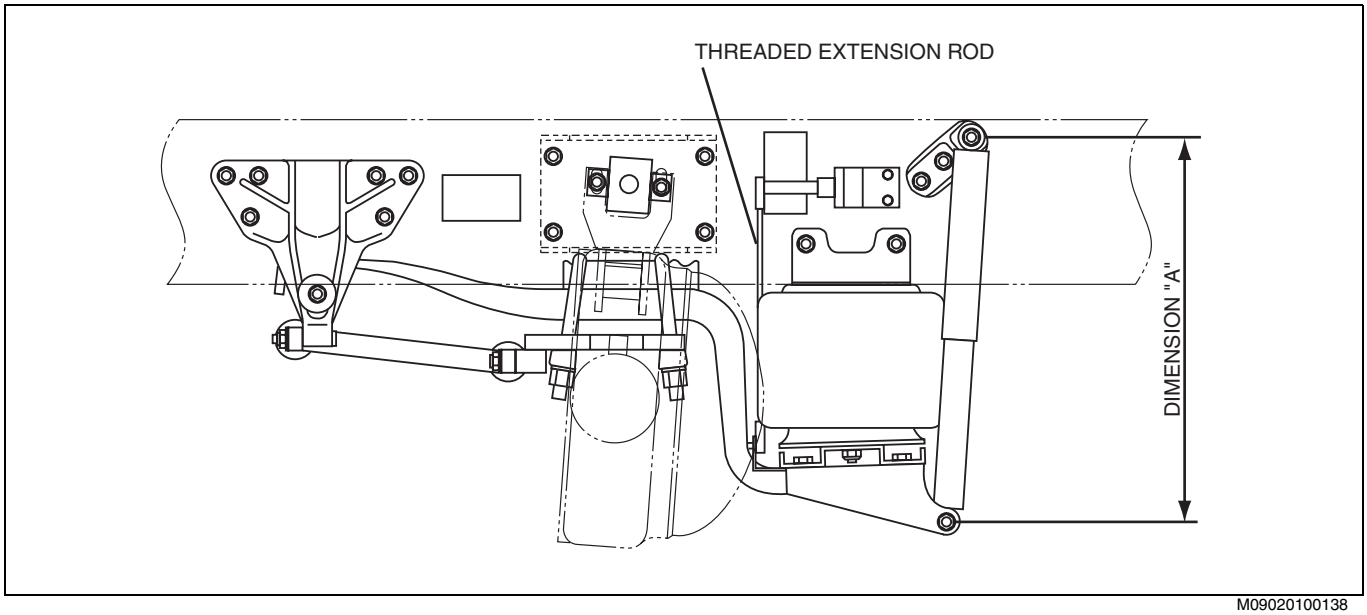
(1) Measure the shock absorber length between upper and lower pins.

**Assembly standard:** Unit: mm{in.}

| Model | Dimension "A" |
|---|---|
| FD | 508.6{20.02} |
| GD | 575.4{22.65} |
| FG, GH | 583.6{22.98} |
| FL | *RF: 619.3{24.38}, *RR: 620.6{24.43} |
| FM | *RF: 617.4{24.31}, *RR: 612.0{24.09} |

*** "RF": Rear axle, frontward, "RR": Rear axle, rearward**

(2) If the shock absorber length is not the assembly standard, adjust the extension rod length, so that the shock absorber length is the assembly standard.

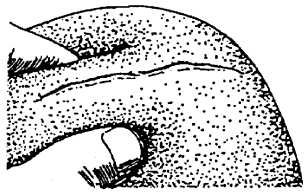
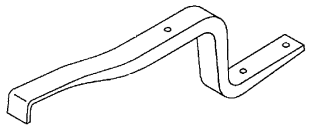
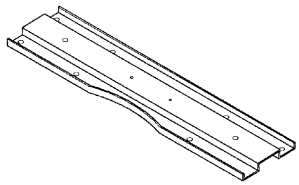
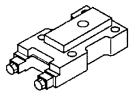
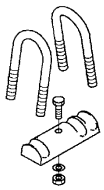
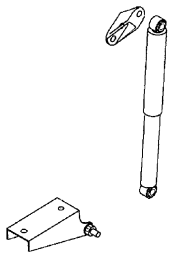
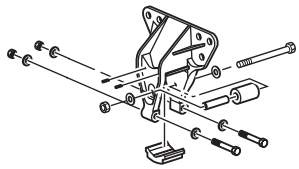


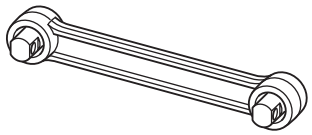
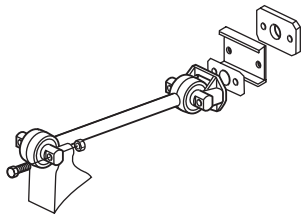
M09020100138

# INSPECTION AND REPAIR

M09020104BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Air spring:<br>Wear, damage and crack** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Main support member:<br>Crack and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Cross channel:<br>Crack and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Spring seat:<br>Wear, damage and crack** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **U-Bolt:<br>Damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Pad:<br>Wear, damage and crack** | — | — | | |
| **Shock absorber:<br>Operation, oil leak and damage** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Upper and lower brackets:<br>Crack and damage** | — | — | | |
| **Rebound roller:<br>Wear, damage and crack** | — | — | **Replace, if necessary.** | **Visual check**<br>  |
| **Slipper pad:<br>Wear, damage and crack** | — | — | | |

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| **Torque rod:<br>Crack and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Torque rod bushings:<br>Wear, damage and crack** | **—** | **—** | | |
| **Transverse rod:<br>Crack and damage** | **—** | **—** | **Replace, if necessary.** | **Visual check**<br>  |
| **Transverse rod bushings:<br>Wear, damage and crack** | **—** | **—** | | |
| **Channel reinforcement:<br>Crack and damage** | **—** | **—** | | |
| **Back up plate:<br>Crack and damage** | **—** | **—** | | |

# CHASSIS FRAME

FC02-001

**CHASSIS FRAME ..... FC02-2**
TROUBLESHOOTING ..... FC02-2
REPAIR ..... FC02-2
INSPECTION AND REPAIR ..... FC02-7

# CHASSIS FRAME

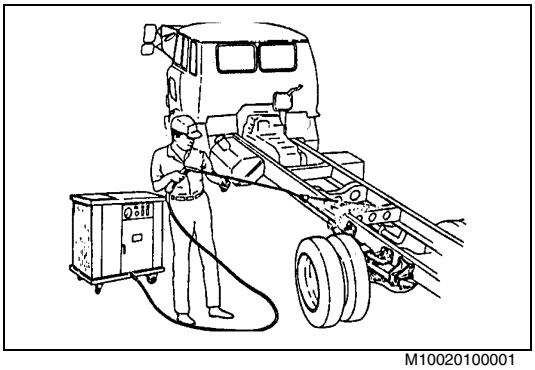
## TROUBLESHOOTING

M10020101BEF3001

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Frame distortion (Vehicle inclination)** | Flattening or breakage of springs on one side | Replace spring |
| | Incorrect mounting (Attachment of heavy weight on one side of the vehicle) | Correct mounting |
| **Bent frame** | Overloading or concentrated weight on rear end of frame | • Correct load<br>• Correct with frame correction device |
| **Frame cracking or rivets breaking** | Wrong body mounting | Correct mounting |
| | Overloading | • Improvement of the usage<br>• Reinforce with stiffener |

## REPAIR

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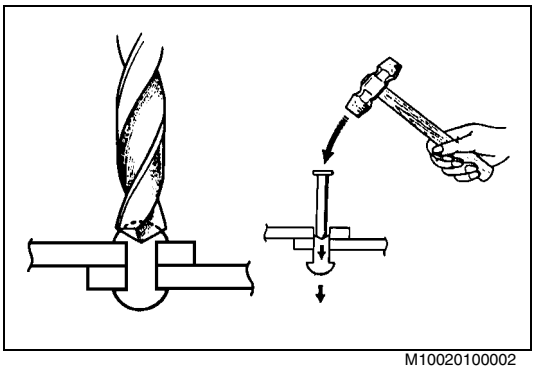
M10020100001

**1. REPLACEMENT OF LOOSENED RIVETS**

(1) Clean the frame.

**NOTICE:**

**While inspecting or repairing, stop the vehicle engine and block the wheels. When cleaning with a steam cleaner, use safety goggles.**

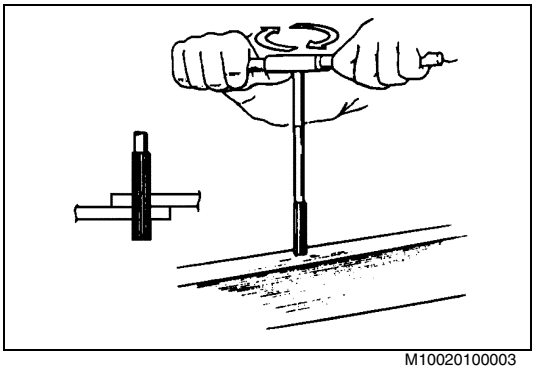


M10020100002

(2) Drill out the head of the loosened rivets with a drill or grind.

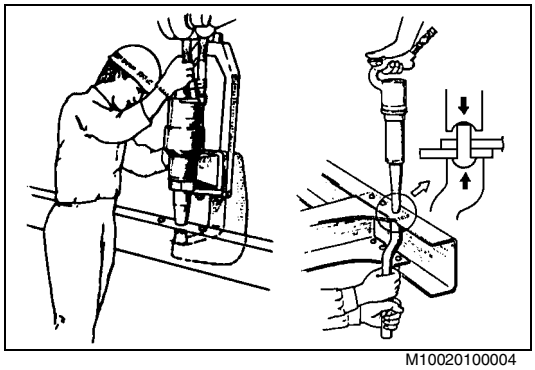
**NOTICE:**

**When drilling, do not use the gloves. They can get caught up in the drill.**



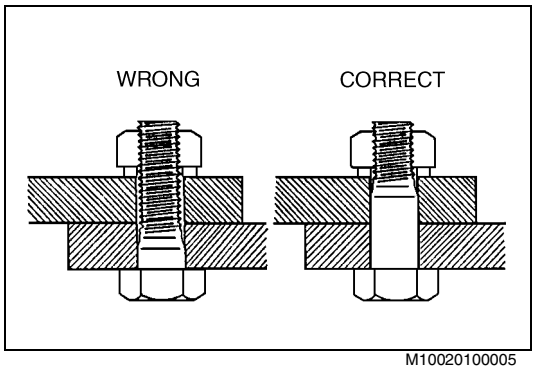
M10020100003

(3) Ream out the hole with a reamer.


M10020100004

(4) Rivet with proper force, using a pneumatic riveter.

| Rivet | Rivet hole | |
|---|---|---|
| ϕ10mm {ϕ0.39in.} | Standard: | ϕ11mm {ϕ0.43in.} |
| | Repair limit: | ϕ11.5mm {ϕ0.45in.} |
| ϕ11mm {ϕ0.43in.} | Standard: | ϕ12mm {ϕ0.47in.} |
| | Repair limit: | ϕ12.5mm {ϕ0.49in.} |
| ϕ13mm {ϕ0.51in.} | Standard: | ϕ14mm {ϕ0.55in.} |
| | Repair limit: | ϕ14.5mm {ϕ0.57in.} |
| ϕ16mm {ϕ0.63in.} | Standard: | ϕ17mm {ϕ0.67in.} |
| | Repair limit: | ϕ17.5mm {ϕ0.69in.} |

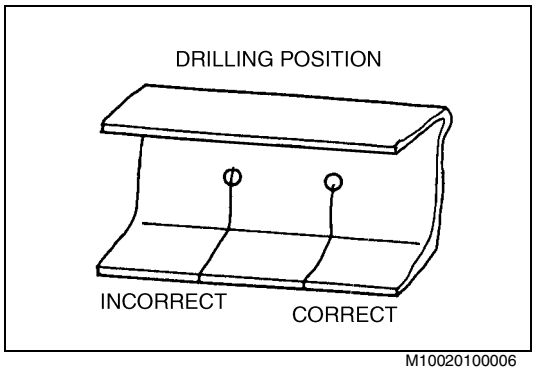


M10020100005

(5) If it is impossible to tighten with rivets, finish the rivet hole with a reamer and tighten with reamer bolts.

**NOTICE:**
**The tensile strength of the bolts material of the bolts must be above 686 MPa {70kgf/mm$^2$, 99,562 lbf/in.$^2$}**

**Tightening Torque:**
**10 mm {0.39 in.} Bolt: 37.27-49.03 N·m {380-500 kgf·cm, 28-36 lbf·ft}**
**12 mm {0.47 in.} Bolt: 63.74-85.32 N·m {650-870 kgf·cm, 47-62 lbf·ft}**
**14 mm {0.55 in.} Bolt: 107.88-147.09 N·m {1,100-1,500 kgf·cm, 80-108 lbf·ft}**
**16 mm {0.63 in.} Bolt: 166.72-225.55 N·m {1,700-2,300 kgf·cm, 123-166 lbf·ft}**
**18 mm {0.71 in.} Bolt: 245.17-323.61 N·m {2,500-3,300 kgf·cm, 181-238 lbf·ft}**
**20 mm {0.79 in.} Bolt: 343.24-460.91 N·m {3,500-4,700 kgf·cm, 254-339 lbf·ft}**
**22 mm {0.87 in.} Bolt: 470.72-627.62 N·m {4,800-6,400 kgf·cm, 348-462 lbf·ft}**

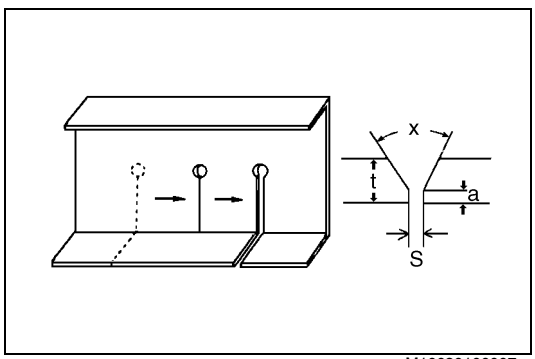


M10020100006

**1. REPAIRING OF FRAME CRACKS**

(1) Perform the procedure for preventing the enlargement of cracks.

**NOTICE:**
**Do not make drill holes on the frame flanges except when repairing the cracks.**

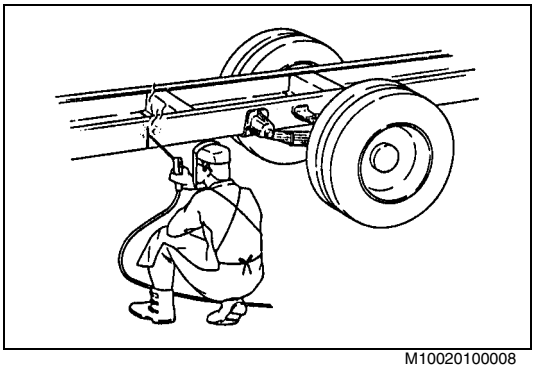


M10020100007

(2) Make the V-shape groove with a grinder along the frame crack according the following table.

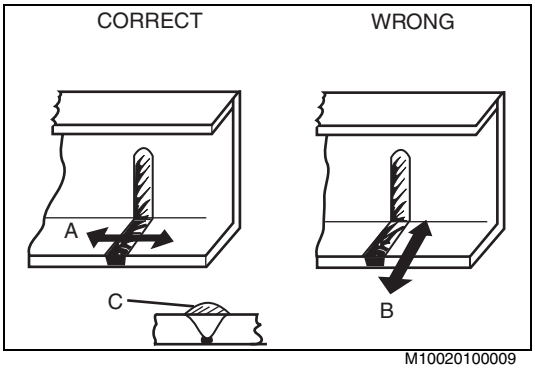
Unit: mm {in.}

| t | x° | s | a |
|---|---|---|---|
| 4.5 {0.18} | 90 | 1.0 {0.039} | 0 |
| 6 {0.24} | 70 | 1.0 {0.039} | 0 |
| 7 {0.28} | 70 | 1.5 {0.059} | 1 {0.039} |
| 8 {0.31} | 70 | 1.5 {0.059} | 1 {0.039} |
| 9 {0.35} | 70 | 1.5 {0.059} | 1 {0.039} |
| 10 {0.39} | 60 | 1.5 {0.059} | 1 {0.039} |
| 12 {0.47} | 60 | 1.5 {0.059} | 1 {0.039} |
| 16 {0.63} | 60 | 2.0 {0.079} | 1 {0.039} |


M10020100008

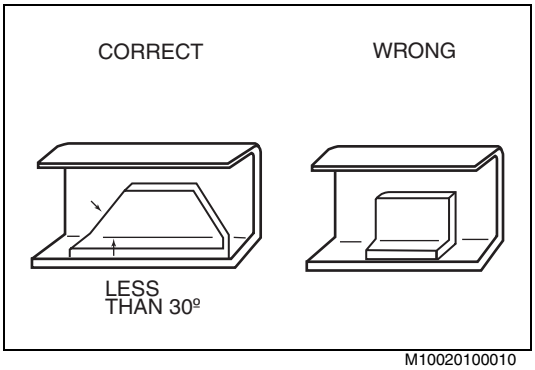
(3) Use an electric welder.
**Refer to page FC02-7 for WELDING CONDITION (WHEN WELDING ROD IS USED).**

**CAUTION:**
- **Disconnect the negative battery ground cable before using arc welding equipment.**
- **While welding, make sure that there are no flammable materials such as oil, rags, etc. around. As welded parts becomes extremely hot and sparks are present, make sure that there are no items such as harnesses, tubes, pipes, suspension component, etc. which may be damaged.**
- **If material is allowed to sputter onto the spring leaf during welding its strength will be significantly diminished. It should therefore be covered with a protective sheet. Also, for the same reason, the spring leaf should never be used as a ground for arc welding.**
- **When arc welding, ventilate or wear antitoxic mask for noxious gas.**
- **To prevent burns, electric shock and gas poisoning during arc welding, wear a helmet, apron, antitoxin mask, safety goggles, arm coverings, leg covering, safety boots and gloves.**



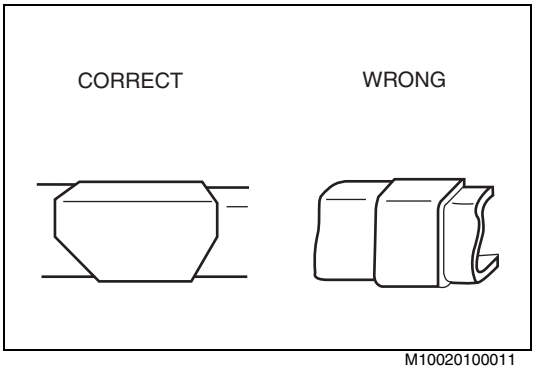
M10020100009

(4) After welding, shake the grinder crosswise the bead line A, along direction B, to polish the welded area as illustrated in C.
Grind and polish the bead line A so that the frame surface becomes even.

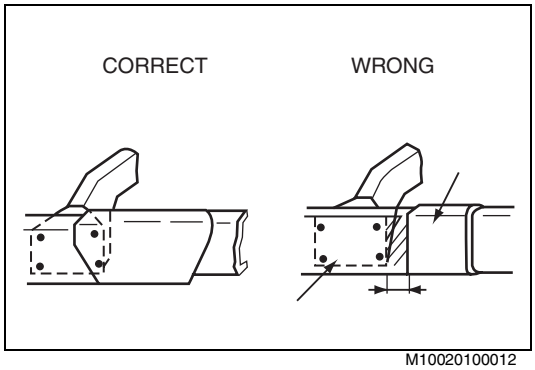


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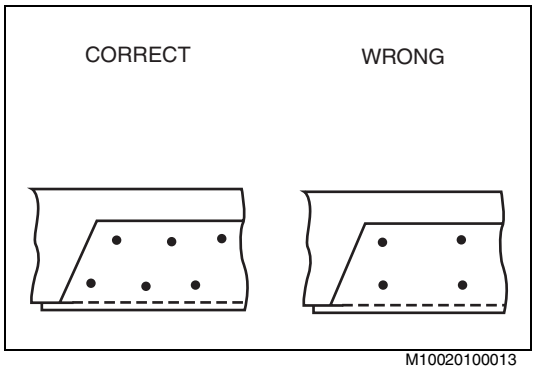
(5) Reinforcement patching method.
Patch-plate with ends squared off rather than tapered can cause damage.
The patching plate thickness should be the same as the frame.



M10020100011

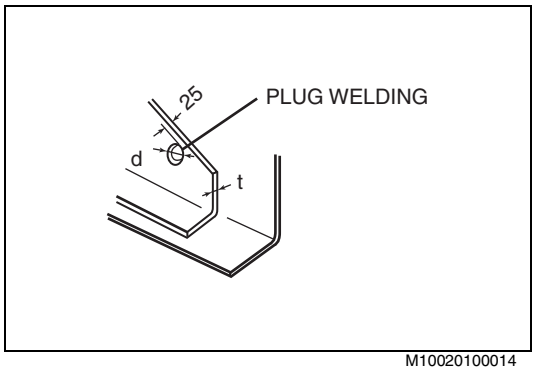


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M10020100013

(6) Be sure to fasten the bolts at the hole locations of ups and downs (use rivets or perform the plug welding).

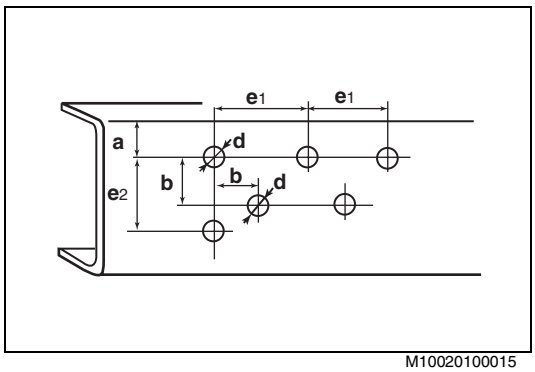


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(7) Diameter of plug welding hole.

**NOTICE:**
**Prohibit plug welding on the flange.**

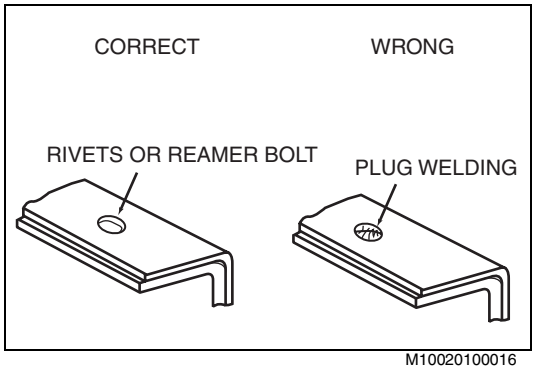
| t | dϕ |
|---|---|
| 3.2 | 15 |
| 4.5 | 15 |
| 6 | 18 |



M10020100015

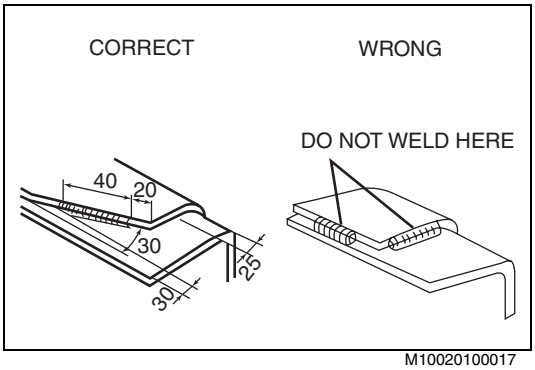
(8) Interval of the holes

**a ≥50+d/2**
**b≥ 3d**
**e1e2≥701+a**
**dϕ: 20 or less**

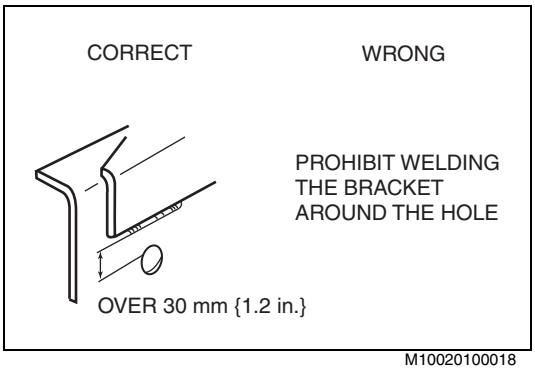


M10020100016

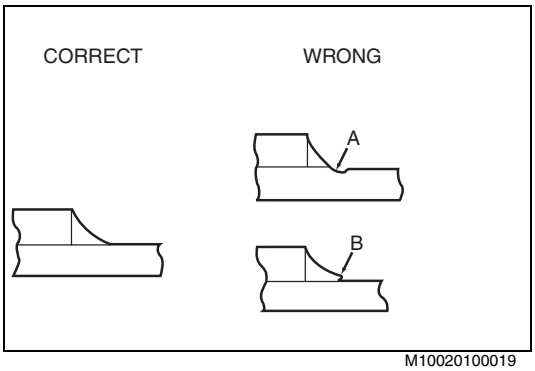
(9) Method of fixing on the flange.



M10020100017



M10020100018



M10020100019

(10) Method of welding on the flange.

(11) In welding, be sure that there is no undercut A or the overlap B of the bead and a pin hole.

**NOTICE:**
**An experienced professional welder should always perform the welding since a poor welding job on the frame can cause damage.**

## WELDING CONDITION (WHEN WELDING ROD IS USED)

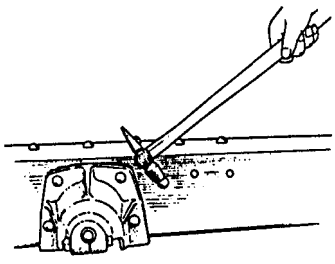
| | | Electric current (Unit: A) | | | | | |
|---|---|---|---|---|---|---|---|
| | Rod dia ϕ | 3.2 mm {0.126 in.} | | 4mm {0.157 in.} | | 5 mm {0.197 in.} | |
| | Welding position | Flat | Vertical overhead | Flat | Vertical overhead | Flat | Vertical overhead |
| Mechanical property of weld metal & rod | Weld Metal (Hot roll plate) Tensile strength; 441 MPa {45 kgf/mm$^2$, 64.004 lbf/in.$^2$} Welding Rod Tensile strength; 422 MPa {43 kgf/mm$^2$, 61.160 lbf/in.$^2$} Illuminate type (JIS D4301 AWS E6019) Coated electrode | 80-130 | 60-110 | 120-180 | 100-150 | 170-250 | 130-200 |
| | Weld Metal (Hot roll plate) Tensile strength; 539 MPa {55 kgf/mm$^2$, 78.228 lbf/in.$^2$} Welding Rod Tensile strength; 490 MPa {50 kgf/mm$^2$, 71.116 lbf/in.$^2$} Illuminate type (JIS D4301 AWS E6019) Coated electrode | 90-140 | 80-130 | 141-190 | 110-160 | 180-250 | — |

**NOTICE:**
- **Diameter of welding rod ϕ3.2 mm {0.126 in.} or ϕ4 mm {0.157 in.} - plate thinner than 5 mm {0.197 in.}**
- **Diameter of welding rod ϕ4 mm {0.157 in.} or ϕ5 mm {0.197 in.} - plate thicker than 6 mm {0.236 in.}**

# INSPECTION AND REPAIR

M10020101BEH3001

**Unit: mm {in.}**

| Inspection item | Standard | Limit | Remedy | Inspection procedure |
|---|---|---|---|---|
| Looseness of the rivets | — | — | Replace the rivet, if necessary. |  |
| Frame cracking | — | — | Repair the frame. | |

# CAB

CA02-001

**CAB ASSEMBLY .....CA02-2**
DATA AND SPECIFICATIONS ..... CA02-2
TROUBLESHOOTING ..... CA02-3
DISMOUNTING AND MOUNTING ..... CA02-5

**CAB MOUNTING PARTS.....CA02-8**
COMPONENT LOCATOR..... CA02-8
OVERHAUL ..... CA02-11

**CAB TILT MECHAMISM (MODELS WITH DOUBLE CAB).....CA02-14**
COMPONENT LOCATOR..... CA02-14
TROUBLESHOOTING ..... CA02-16

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COMPONENT LOCATOR..... CA02-19
OVERHAUL ..... CA02-20

**TILT PUMP (MODELS WITH DOUBLE CAB).....CA02-22**
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**SEAT .....CA02-34**
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COMPONENT LOCATOR..... CA02-41
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COMPONENT LOCATOR..... CA02-43
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COMPONENT LOCATOR..... CA02-46
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# CAB ASSEMBLY

## DATA AND SPECIFICATIONS

M11020101BEI2002

**CAB**

| | Except for double cab | Double cab |
|---|---|---|
| Type | All steel welded construction, safety glass fitted to all windows | |
| Tilt system | Torsion bar | Oil jack |
| Tilt angle | 44° ("Over-tilt" position: 50°) | 39° |

**TILT PUMP (If so equipped)**

| | | | |
|---|---|---|---|
| PUMP | Type | | Single plunger type |
| | Relief valve pressure | | 34.3-37.2 MPa {350-380 kgf/cm$^2$, 4,977-5,404 lbf/in$^2$.} |
| | Discharge pressure and discharge quantity | Rating pressure | 19.6 MPa {200 kgf/cm$^2$, 2,844 lbf/in$^2$.} |
| | | Electric drive | 460 cm$^3$/min. |
| | | Manual operate | 17 cm$^3$/30 stroke or more |
| MOTOR | Type | | Compound winding type |
| | Nominal output | | 0.3kW |
| | Voltage | | 24V |
| | Rotating | | Clockwise (seen from output shaft) |
| | Ground type | | Body earth |

**TILT CYLINDER (If so equipped)**

| | | |
|---|---|---|
| Type | | Double action type |
| Max. length | | 630.2-633.1 mm {24.8-24.9 in.} |
| Min. length | | 387.6-389.2 mm {15.2-15.3 in.} |
| Max stroke | | 241.9-244.4 mm {9.5-9.6 in.} |
| Output | Extension | 39,700 N {4,050 kgf, 8,925 lbf} or more |
| | Retraction | 17,000 N {1,730 kgf, 3,822 lbf} or more |

# TROUBLESHOOTING

M11020101BEF3002

## CAB TILT (EXCEPT FOR DOUBLE CAB)

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Cab does not tilt up.** | Cab mounting hook does not release. | Inspection of cab mounting hook mechanism. |
| | Safety rod does not release. | Inspection of safety rod mechanism. |
| | Damaged torsion bar | Replace torsion bar. |
| **Cab tilting is difficult.** | Heavy items in or attached to cab | Adjustment of shim for anchor lever or removal of the heavy items. |
| | Tilt up force is weak. | Adjustment of shim for anchor lever. |
| | | Replace torsion bar. |
| **Cab does not lock to cab mounting member.** | Mounting hook does not operate. | Adjustment of mounting hook mechanism. |
| | Cab mounting cushion is not correctly installed. | Correct installation of cab mounting. |

*As for cab tilt troubleshooting for models with double cab, refer to section "CAB TILT MECHANISM".

## DOOR

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Door does not close properly.** | Door is not adjusted | Adjust door installing. |
| | Striker is not adjusted | Adjustment of shim for door lock striker |
| | Damaged door lock | Replace door lock. |
| **Door does not lock by inside lock knob.** | Deformation of rod | Replace rod. |
| | Rod is disconnected | Connect rod. |
| | Damaged door lock | Replace door lock. |
| **Door does not lock by key.** | Rod is disconnected | Connect rod. |
| | Damaged door lock | Replace door lock. |
| | Damaged lock cylinder | Replace lock cylinder. |
| **Door does not open by outside handle.** | Outside handle push rod is not adjusted. | Adjust push rod. |
| | Damaged door lock | Replace door lock. |
| **Door does not open by inside handle.** | Inside handle is not installed properly. | Install inside handle properly. |
| | Deformation of rod | Replace rod. |
| | Rod is disconnected. | Connect rod. |
| | Damaged door lock | Replace door lock. |
| **Inside handle does not return to its normal position.** | Interference between rods. | Replace rod. |
| | Inside handle is not installed properly. | Adjust inside handle. |
| | Return spring is damaged. | Replace inside handle. |
| **Door window goes down while driving.** | Window is not in the glass holder. | Repair. |
| | Regulator is damaged. | Replace regulator. |
| **Regulator makes abnormal noise while driving.** | Window sill weather strip is installed improperly. | Install properly or replace clips. |

## BLOWER

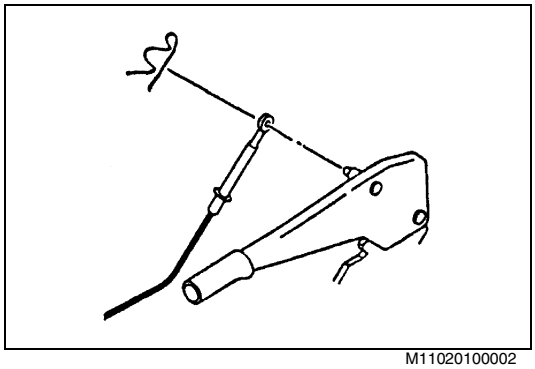
| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Malfunction of blower when power is ON.** | Blown fuse | Change fuse or check for short circuit. |
| | Malfunction in heater relay | Inspect relay. |
| | Malfunction of heater blower switch | Inspect power switch. |
| | Malfunction of register | Check register. |
| | Blower motor malfunction | Replace motor. |
| | Damaged electrical wiring or poor grounding | Repair as necessary. |

# DISMOUNTING AND MOUNTING

M11020101BEH1001

**1. BEFORE DISMOUNT THE CAB**

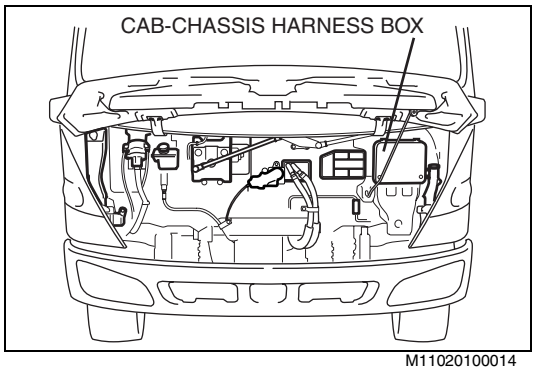
- Be sure to block the front wheels.
- Disconnect the battery cable from the battery ground terminal.
- Drain engine coolant, clutch fluid and refrigerant of the air conditioner.



M11020100002

**2. CAB INSIDE**

(1) Remove the parking brake cable retainer spring and pin.

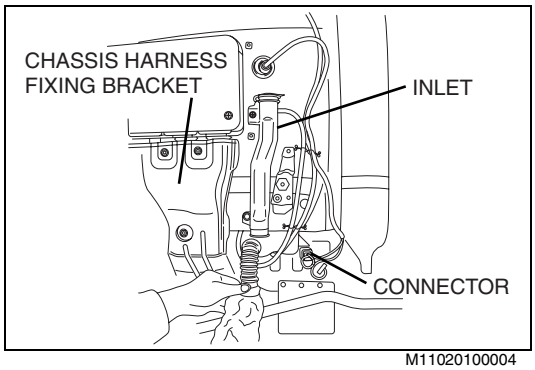



M11020100014

**3. CAB FRONT SIDE**

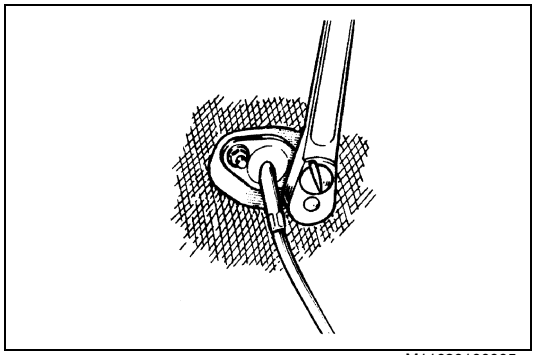
(1) Remove the front bumper and open the front panel.

(2) Remove the cab-chassis harness box lid and disconnect all the connectors of the harness connected to the cab and chassis.




M11020100004

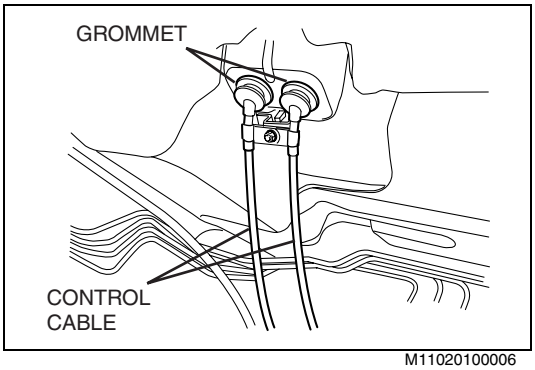
(3) Disconnect the inlet hose from washer tank.



M11020100005

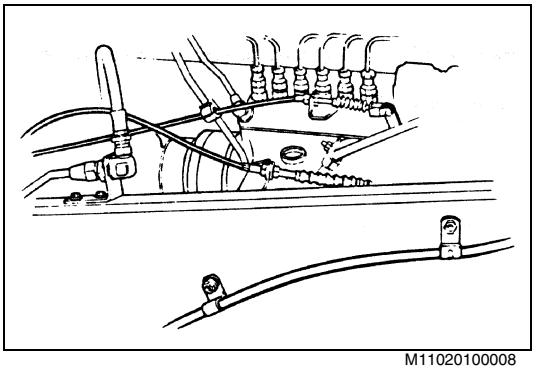
**4. AFTER TILTING THE CAB**

(1) Disconnect the parking brake cable and transmission control cables.



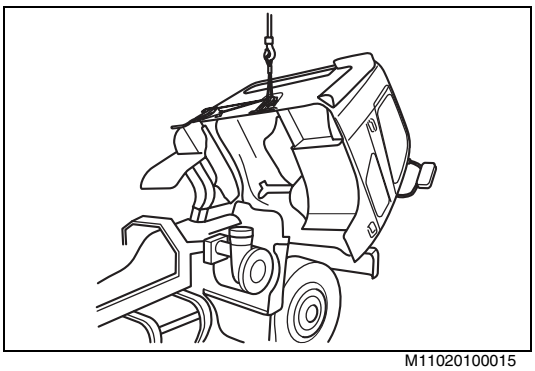
M11020100006

(2) Remove the harness clips located under the floor of the cab. Disconnect the air brake hoses and clutch hose.
(3) Remove the engine control cable and engine stop cable with clips. Remove the cab stopper release cable.


M11020100008

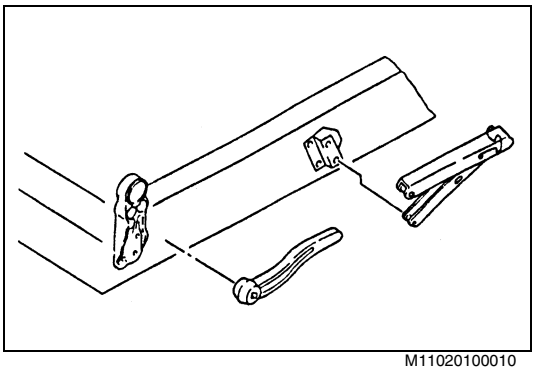
**5. REMOVE ANCHOR LEVER**
(1) Raise the cab to OVER-TILT position.
Refer to CAB TILT OPERATING TENSION ADJUSTMENT (1) OVER-TILT.
Suspend the cab with crane or hoist as shown in figure.

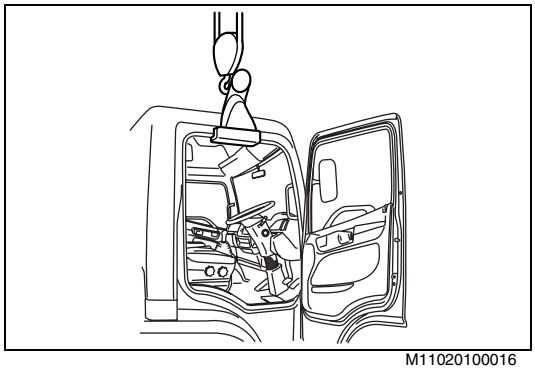
**NOTICE:**
**Do not raise cab excessively, because the cab will fall forward.**


M11020100015

(2) Remove the set screws of the anchor lever, and pull out the anchor levers.
Remove the cab stopper stay.
Slowly lower the cab with crane or hoist.

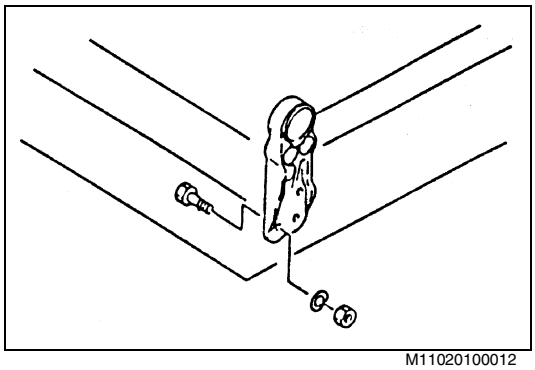
**CAUTION:**
**Never go under the cab when lowering the cab. It is very dangerous.**


M11020100010

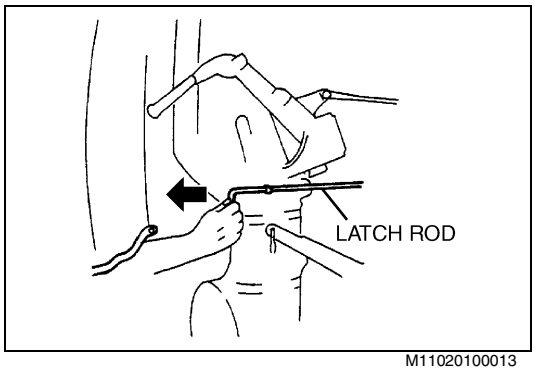

M11020100016

**6. DISMOUNTING CAB ASSEMBLY**

(1) Open the doors and hook the hooks of the cab lifting device.


M11020100012

(2) Initially raise the cab so that most of its weight is borne by the lifting device, then remove the bolts of the tilt hinge brackets.



M11020100013

(3) Pull the cab tilt latch rod and lift the cab slowly.

**NOTICE:**
**Make sure that all of connecting parts are disconnected.**

(4) Set the cab on a cab stand.

**7. CAB MOUNTING**

(1) Pay attention to the points below, and mount in the reverse order of dismounting.

1. Steering sliding shaft inserting
2. Anchor lever fitting position
3. Damage or interference of harness wire, cable and hose

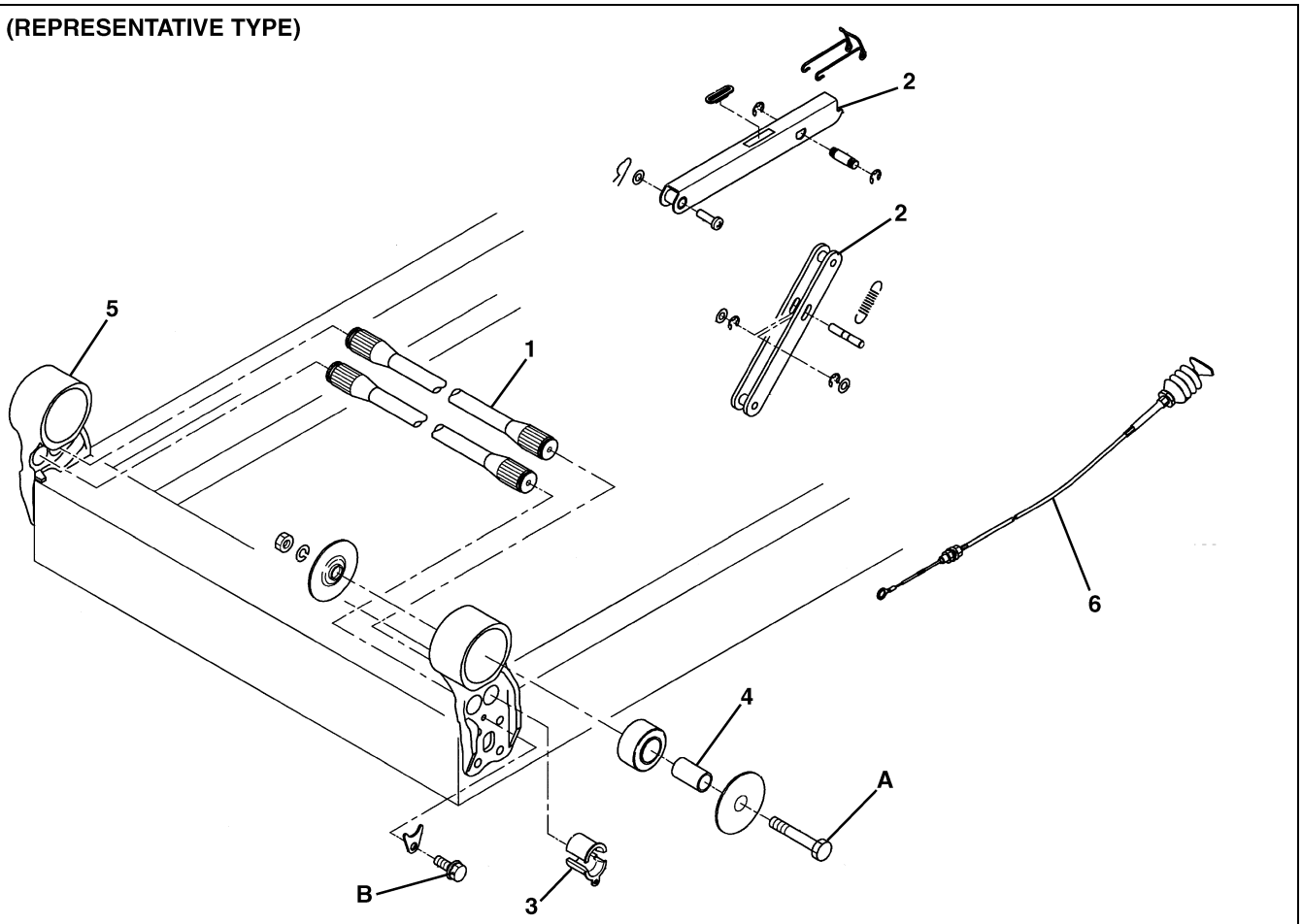
# CAB MOUNTING PARTS

## COMPONENT LOCATOR

M11020201BED1002

### FRONT SIDE

(REPRESENTATIVE TYPE)




M11020200023

| | | | |
|---|---|---|---|
| 1 | Torsion bar (If so equipped) | 4 | Collar |
| 2 | Cab stopper stay (If so equipped) | 5 | Tilt hinge bracket |
| 3 | Fitting collar (If so equipped) | 6 | Cab stopper release cable (If so equipped) |

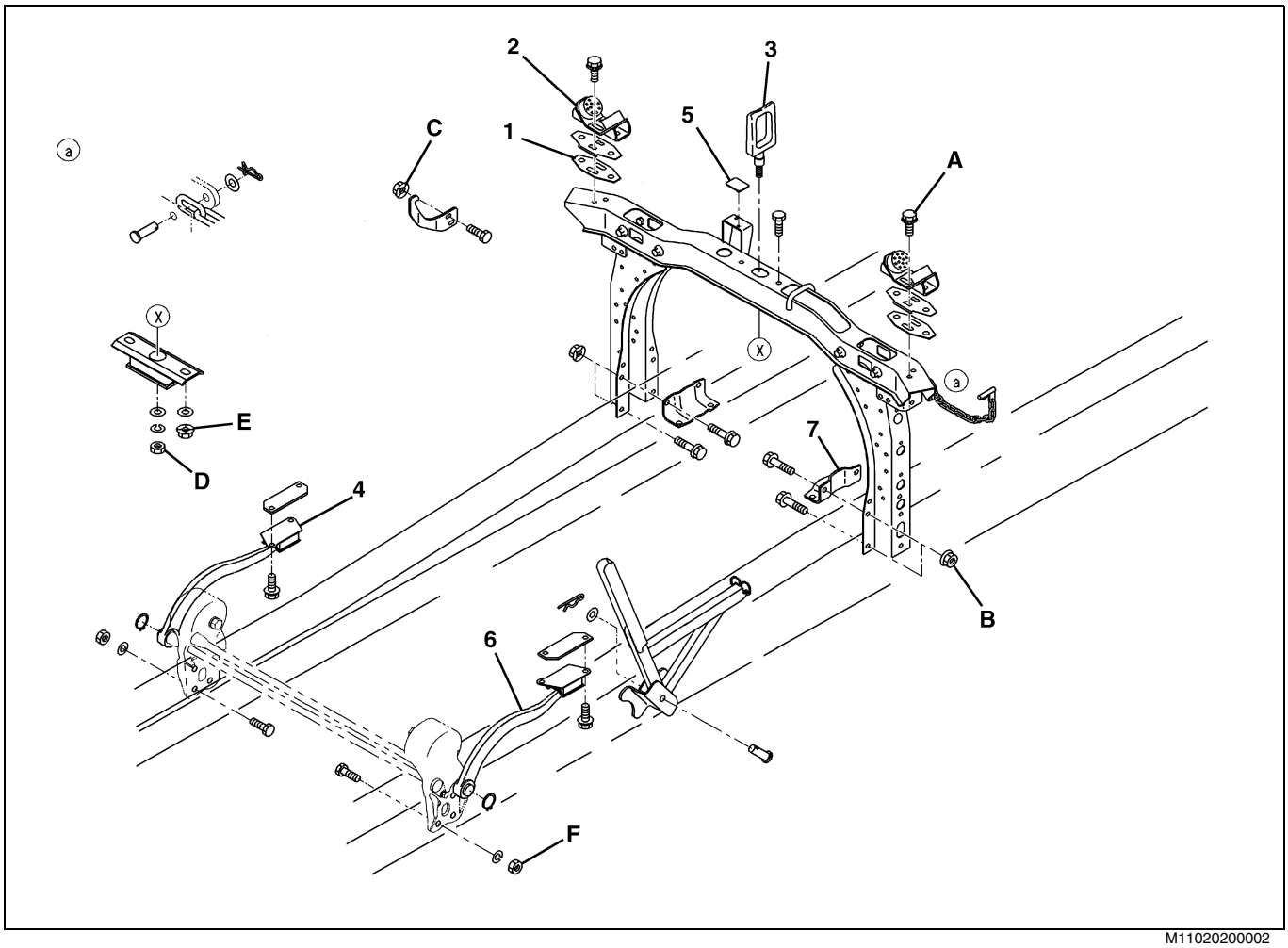
**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 156-244 {1,590-2,488, 115-180} | B | 34.5-51.5 {352-525, 26-37} |

**NOTICE:**
**Tighten the bolts to the following torque unless otherwise specified.**

| | Bolt diameter (mm) | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|
| HEXAGON SPOTTED PORTION | N·m | 18-26 | 34.5-51.5 | 61.0-91.0 | 96.0-144.0 | 152.0-228.0 |
| | kgf·cm | 184-265 | 352-525 | 622-927 | 979-1,468 | 1,550-2,325 |
| | lbf·ft | 13-19 | 26-37 | 45-67 | 71-106 | 112-168 |
| FLANGED SPOTTED PORTION | N·m | 21.5-31.5 | 41.5-61.5 | 73.0-108.0 | 144.0-216.0 | 228.0-342.0 |
| | kgf·cm | 220-321 | 423-627 | 745-1,100 | 1,468-2,202 | 2,325-3,487 |
| | lbf·ft | 16-23 | 31-45 | 54-80 | 106-159 | 168-252 |

## REAR SIDE (EXCEPT FOR DOUBLE CAB)




M11020200002

| | | | |
|---|---|---|---|
| 1 | Adjusting shim | 5 | Rebound rubber |
| 2 | Cab mounting cushion | 6 | Anchor lever |
| 3 | Eye bolt | 7 | Bracket |
| 4 | Stopper | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

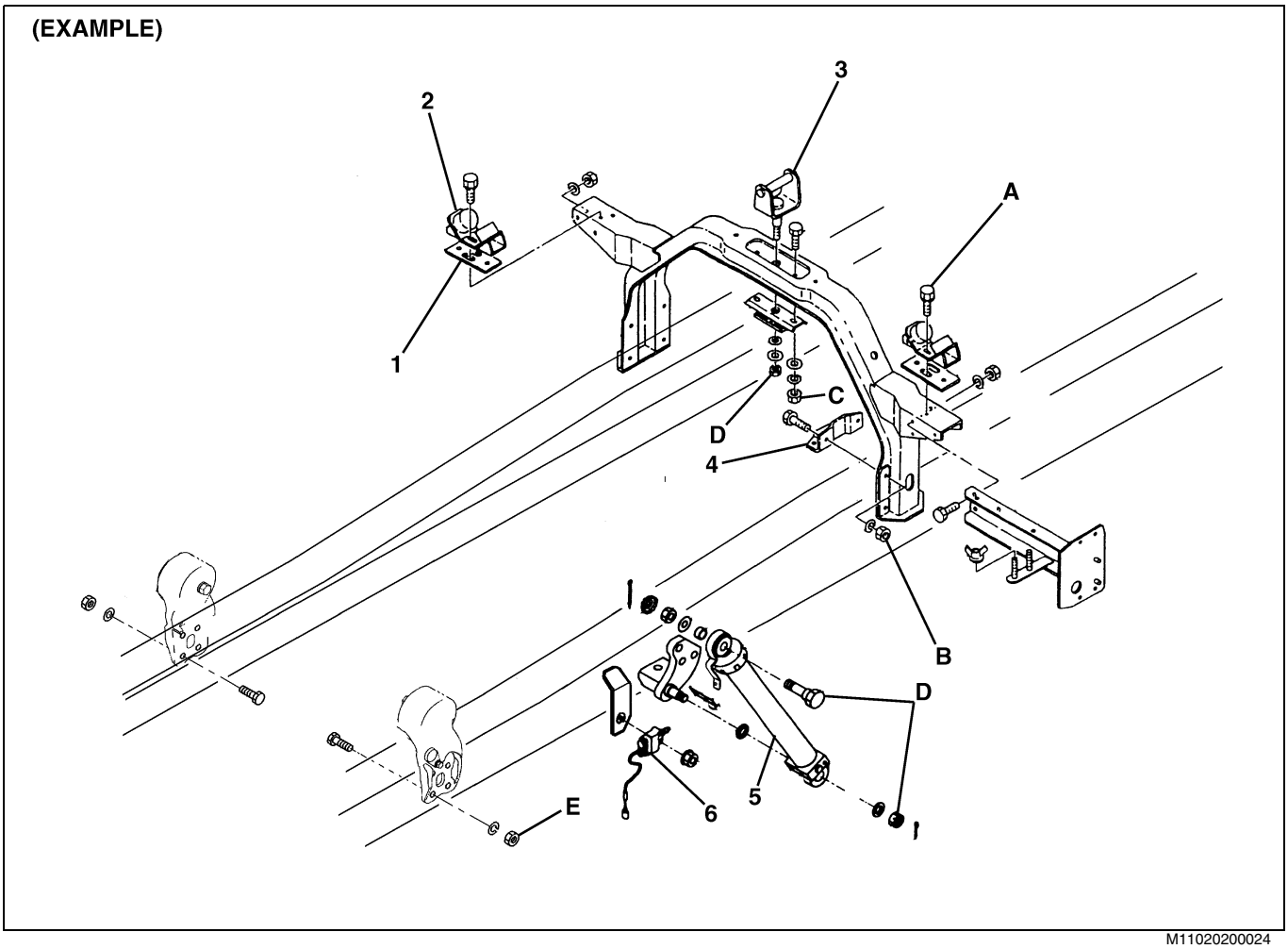
| | | | |
|---|---|---|---|
| A | 34.5-51.5 {352-525, 26-37} | D | 110-150 {1,122-1,529, 82-110} |
| B | Standard cab: 55-82 {561-836, 41-60} | E | 34.5-51.5 {352-525, 26-37} |
| | Wide cab: 96-144 {979-1,468, 71-106} | F | Standard cab: 150-180 {1,530-1,835, 111-133} |
| C | 55.0-82.0 {561-836, 41-60} | | Wide cab: 200-300 {2,040-3,059, 148-221} |

**NOTICE:**
**Tighten the bolts to the following torque unless otherwise specified.**

| | Bolt diameter (mm) | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|
| HEXAGON SPOTTED PORTION | N·m | 18-26 | 34.5-51.5 | 61.0-91.0 | 96.0-144.0 | 152.0-228.0 |
| | kgf·cm | 184-265 | 352-525 | 622-927 | 979-1,468 | 1,550-2,325 |
| | lbf·ft | 13-19 | 26-37 | 45-67 | 71-106 | 112-168 |
| FLANGED SPOTTED PORTION | N·m | 21.5-31.5 | 41.5-61.5 | 73.0-108.0 | 144.0-216.0 | 228.0-342.0 |
| | kgf·cm | 220-321 | 423-627 | 745-1,100 | 1,468-2,202 | 2,325-3,487 |
| | lbf·ft | 16-23 | 31-45 | 54-80 | 106-159 | 168-252 |

## REAR SIDE (DOUBLE CAB)

(EXAMPLE)




M11020200024

| | | | |
|---|---|---|---|
| 1 | Adjusting shim | 4 | Bracket |
| 2 | Cab mounting cushion | 5 | Tilt cylinder |
| 3 | Stopper pin | 6 | Cab stopper switch |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

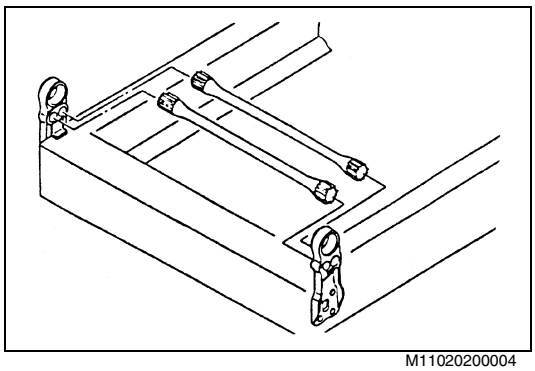
| | | | |
|---|---|---|---|
| A | 34.5-51.5 {352-525, 26-37} | D | 110-150 {1,122-1,529, 82-110} |
| B | 96-144 {979-1,468, 71-106} | E | Standard cab: 150-180 {1,530-1,835, 111-133} |
| C | 34.5-51.5 {352-525, 26-37} | | Wide cab: 200-300 {2,040-3,059, 148-221} |

**NOTICE:**
**Tighten the bolts to the following torque unless otherwise specified.**

| | Bolt diameter (mm) | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|
| HEXAGON SPOTTED PORTION | N·m | 18-26 | 34.5-51.5 | 61.0-91.0 | 96.0-144.0 | 152.0-228.0 |
| | kgf·cm | 184-265 | 352-525 | 622-927 | 979-1,468 | 1,550-2,325 |
| | lbf·ft | 13-19 | 26-37 | 45-67 | 71-106 | 112-168 |
| FLANGED SPOTTED PORTION | N·m | 21.5-31.5 | 41.5-61.5 | 73.0-108.0 | 144.0-216.0 | 228.0-342.0 |
| | kgf·cm | 220-321 | 423-627 | 745-1,100 | 1,468-2,202 | 2,325-3,487 |
| | lbf·ft | 16-23 | 31-45 | 54-80 | 106-159 | 168-252 |

# OVERHAUL

M11020201BEH2003


M11020200004

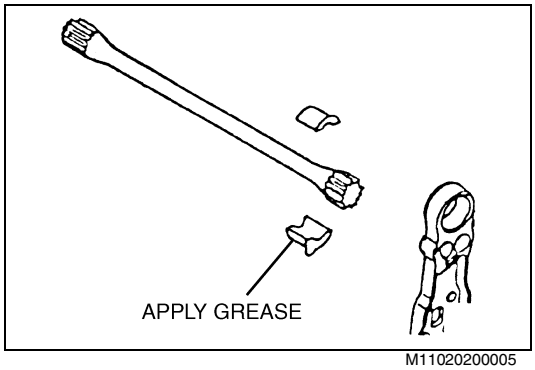
## EXCEPT FOR DOUBLE CAB

**1. TORSION BAR INSPECTION**

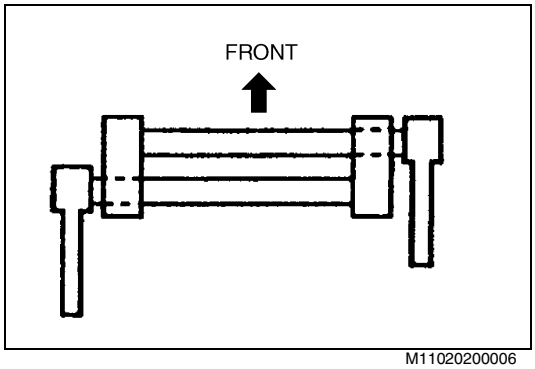
(1) Visually inspect the torsion bars for rust.
If it is severely rusted, replace torsion bars.

**NOTICE:**

- **A rusted torsion bar may be broken while tilting, and it will be very dangerous.**
- **Visually inspect the fitting collars for wear or fatigue.**
- **If it is slight wear or fatigue, replace the collars.**



M11020200005



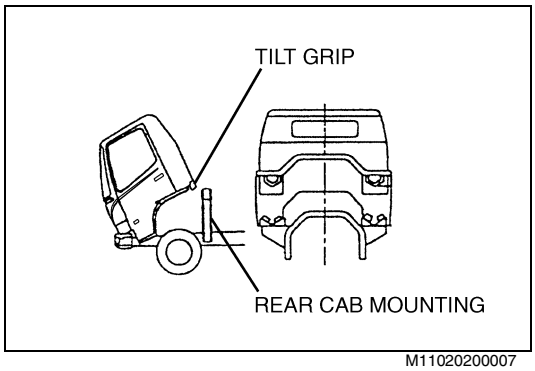
M11020200006

**2. TORSION BAR INSTALLING**

(1) Check the marks on the torsion bars, then install them as shown in figure.

**NOTICE:**

- **Be sure to install the levers in their correct positions.**
- **If the cab is raised with the torsion bars improperly installed, the torsion bars will drastically lose strength, and then it must be replaced with new ones.**

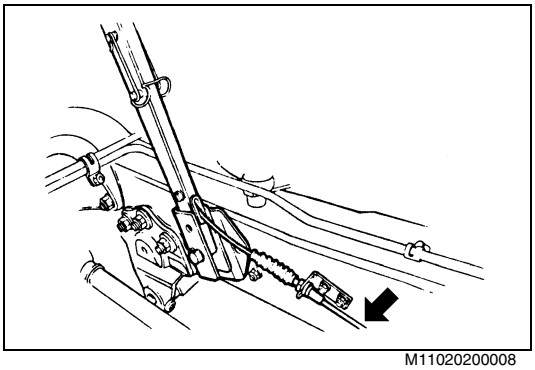


M11020200007

**3. STANDARD CAB TILT OPERATING TENSION**

(1) Tilt the cab several times, without lifting by hand, to determine the average rise of the cab.

| UP | DOWN |
|---|---|
| **255 N {26 kgf, 57 lbf} or less** | **510 N {52 kgf, 114.6 lbf} or less** |

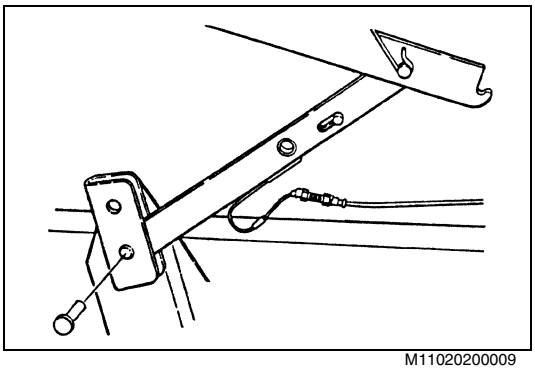

M11020200008

**4. CAB TILT OPERATING TENSION ADJUSTMENT**

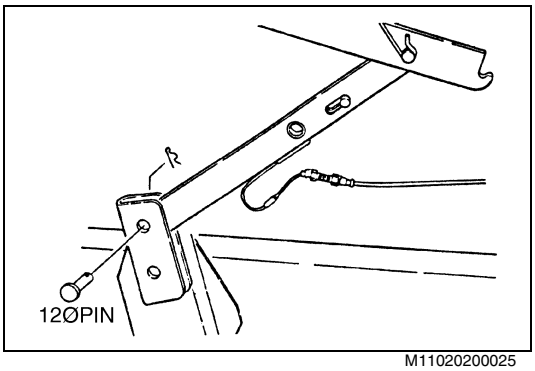
(1) OVER-TILT

a. Remove the radiator grille.

b. Tilt up the cab and remove the cab stopper release cable from the brackets.


M11020200009

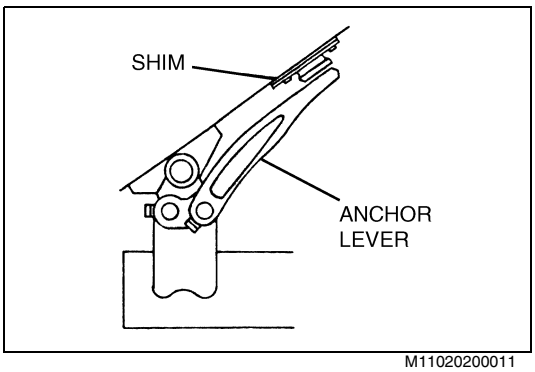
c. Pull out the pin at the lower part of cab stopper stay bracket.



M11020200025

d. Align the hole on the cab stopper stay with the hole for OVER-TILT at the upper part of the cab stopper stay bracket and insert 12 mm {0.47 in.} pin.
Use a cotter pin so that the pin does not come out.

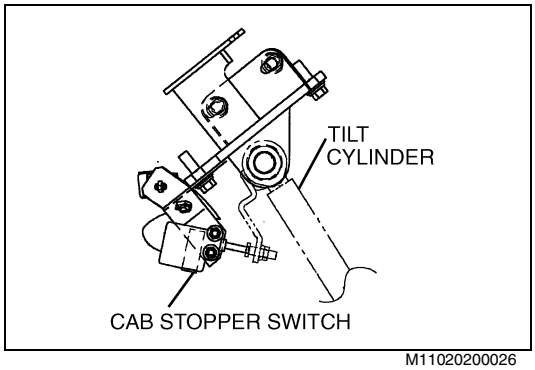
**CAUTION:**
**Make sure that the cab stopper pin is locked. If it is not properly locked, the cab may fall.**



M11020200011

(2) ADJUSTING SHIM INSTALLING

a. Adjust the cab tilt operating tension by increasing or decreasing the number of shims when cab tilt up to OVER-TILT position.
For each 6 mm {0.24 in.} thick shim added, the cab tilt up effort by hand will be reduced about 49N {5 kgf, 11 lbf}.
However, do not add more than 4 shims (Maximum 4 shims).
When more than 5 shims are needed, or the torsion bar sage, replace the torsion bar.
If the clearance between the stopper rubber and the anchor lever is too narrow to insert the spacers, tilt the cab for 3-5 times to obtain the clearance.



M11020200026

## DOUBLE CAB

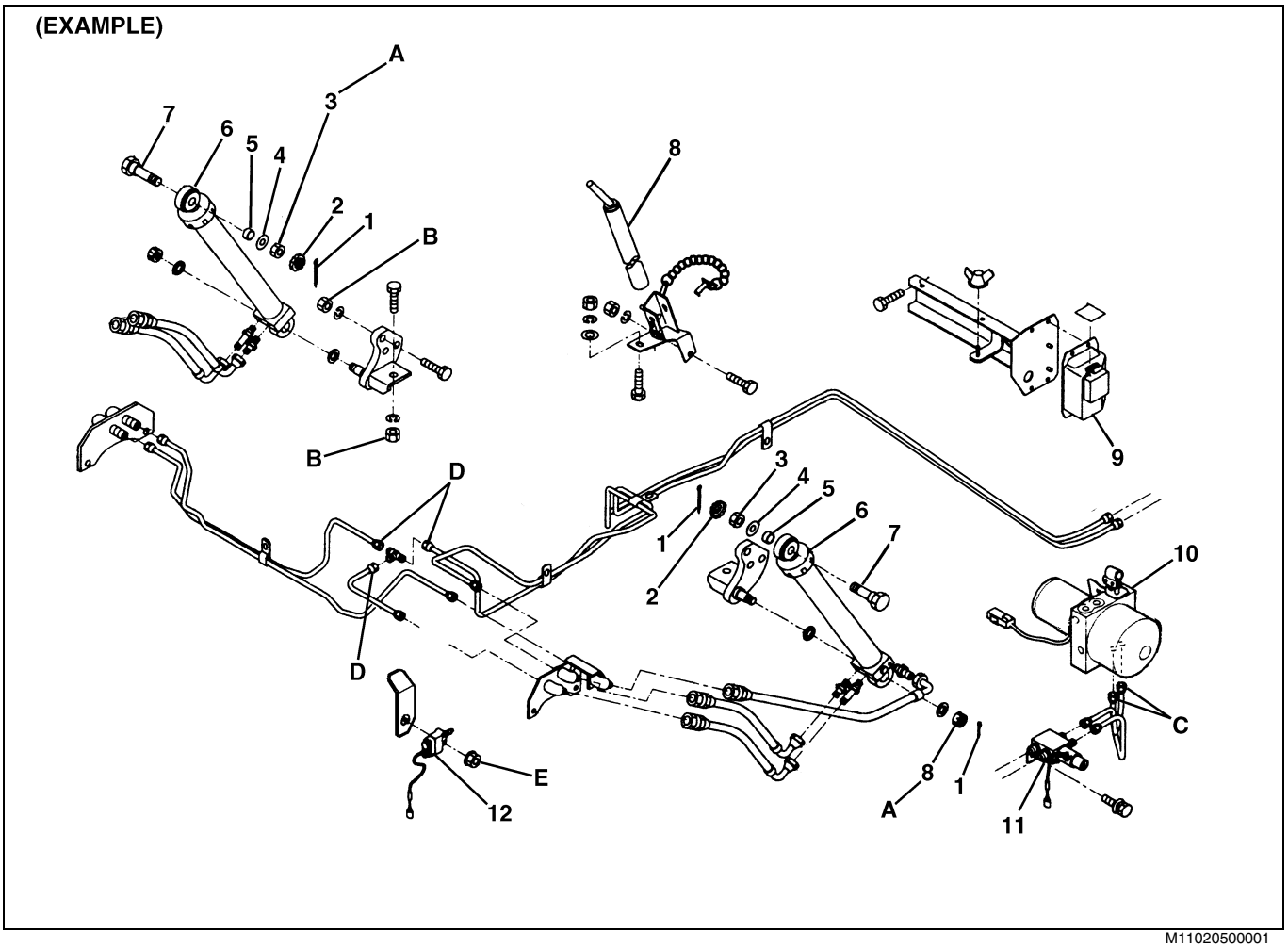
### 1. CAB STOPPER SWITCH ADJUSTMENT

(1) The bolt has to be adjusted so that the limit switch functions, namely cab tilting stops, at the position that the safety support can be completely stood up.

# CAB TILT MECHAMISM (MODELS WITH DOUBLE CAB)

## COMPONENT LOCATOR

M11020501BED1001




M11020500001

| | | | |
|---|---|---|---|
| 1 | Cotter pin | 7 | Pin |
| 2 | Slotted adjusting lock cap | 8 | Safety support |
| 3 | Nut | 9 | Tilt switch |
| 4 | Washer | 10 | Tilt pump |
| 5 | Collar | 11 | Solenoid valve |
| 6 | Tilt cylinder | 12 | Cab stopper switch |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 110-150 {1,100-1,500, 80-108} | D | 24.5-31.3 {250-319, 18-23} |
| B | 170-230 {1,734-2,345, 125-169} | E | 5.7-7.7 {58-78, 4.2-5.6} |
| C | 20-30 {204-305, 15-22} | | |

**NOTICE:**
**Tighten the bolts to the following torque unless otherwise specified.**

| | Bolt diameter (mm) | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|
| HEXAGON SPOTTED PORTION | N·m | 18-26 | 34.5-51.5 | 61.0-91.0 | 96.0-144.0 | 152.0-228.0 |
| | kgf·cm | 184-265 | 352-525 | 622-927 | 979-1,468 | 1,550-2,325 |
| | lbf·ft | 13-19 | 26-37 | 45-67 | 71-106 | 112-168 |
| FLANGED SPOTTED PORTION | N·m | 21.5-31.5 | 41.5-61.5 | 73.0-108.0 | 144.0-216.0 | 228.0-342.0 |
| | kgf·cm | 220-321 | 423-627 | 745-1,100 | 1,468-2,202 | 2,325-3,487 |
| | lbf·ft | 16-23 | 31-45 | 54-80 | 106-159 | 168-252 |

# TROUBLESHOOTING

M11020501BEF3001

(A) The cab fails to tilt (fail to rise).

| Trouble (Check points) | Possible Causes | Remedy |
|---|---|---|
| (1) The motor runs but fails to raise the cab. — (1) The cab scarcely moves. — (1) Low motor noise | (i) Air is drawn into the pump. | Check the oil level. |
| | (ii) Poor sealing in pump and valve | Disassemble and check (replace the O-ring, etc.) |
| (1) The motor runs but fails to raise the cab. — (1) The cab scarcely moves. — (2) High motor noise — (1) | (i) Crushed or clogged pipe | Replace with a new part. |
| | (ii) Clogged cylinder orifice | Disassemble and check. |
| | (iii) Other troubles in the pump, cylinder and solenoid valve | Check. |
| (1) The motor runs but fails to raise the cab. — (1) The cab scarcely moves. — (2) High motor noise — (2) Abnormally heavy load | (i) Excessive weight imposed on the cab | Check. |
| | (ii) Clinging snow and ice | Check. |
| | (iii) Seizure of the tilt hinge and pin etc. | Check. |
| (1) The motor runs but fails to raise the cab. — (2) The cab tilting begins but stops halfway or near the point where the lock is released. | (i) The same as in (1)–(1)–(2)–(2). | |
| | (ii) Excessively low setting of the pump relief pressure | Check and adjust the relief pressure. |
| | (iii) Pump abnormalities (Pressure fails to reach the relief level.) | Disassemble and check (piston assembly or check valve). |
| | (iv) The cab lock fails to be released. | Check the cab lock. |
| | (v) Excessive lateral projection of the cab lock | Check the horizontal sliding of the cab.<br>Check the vehicle horizontality (Particularly check the left side running on the curb etc.).<br>Grease the pin. |
| (1) The motor runs but fails to raise the cab. — (3) The cab stops halfway (tilted halfway) | (i) Excessive oil feeding | Check the oil level. |
| | (ii) Poor oil feeding (air drawn-in). | Adjust the cap position. |
| | (iii) Others (Cylinder bites, bend, contact, etc.) | Add oil,bleed air. Check, disassemble and repair. |
| (2) The motor fails to run. — (1) The buzzer fails to sound. — (1) The cab lock switch fails to function. | Blown fuse and poor contact in the connector: | Check the circuit or replace the fuse. |
| | (i) Poor installation adjustment | Adjust the switch. |
| | (ii) Part failure | Replace the switch. |
| (2) The motor fails to run. — (1) The buzzer fails to sound. — (2) The cab stopper switch fails to function. | (i) Poor installation adjustment | Adjust the switch. |
| | (ii) Parts failure | Replace the switch. |
| (2) The motor fails to run. — (2) Battery depleted (the starter fails) | | Check and charge the battery. |
| (2) The motor fails to run. — (3) The power relay produces no operating noise. — (1) Voltage not applied to the (+) side of the operating switch terminal. | The motor terminal relay actuated (Motor overheated) | Resume the operation after allowing to stand for 30 minutes (to cool). |
| | Thermal relay failure | Check and adjust the motor. |
| (2) The motor fails to run. — (3) The power relay produces no operating noise. — (2) Pressing the operating switch fails to apply voltage to the relay exciting circuit (+) side. | Operation switch failure | Replace the switch. |
| | Relay failure | Replace the relay. |
| (2) The motor fails to run. — (4) Abnormally hot motor — The motor is overheated. | Motor thermal relay actuated. | Resume the operation after allowing to stand for 30 minutes (to cool). |

M11020500002

(B) The fails to tilt (fails to lower)

| Trouble (Check points) | Possible causes | Remedy |
|---|---|---|
| (1) The motor runs but fails to lower the cab. — (1) The cab scarcely moves. — (1) Low motor noise | (i) The same as in (A)–(1)–(1)–(1) (ii) | |
| (1) The motor runs but fails to lower the cab. — (1) The cab scarcely moves. — (2) High motor noise | (i) Inversely installed piping. Normal "rise" is assured.<br>(ii) The same as in (A)–(1)–(1)–(2)–(2) | Correct the piping. |
| (1) The motor runs but fails to lower the cab. — (2) The cab stops halfway. — (1) The cab stopper is actuated. | (iii) Other troubles in the pump, cylinder and solenoid valve<br>(i) Poor stroke of the mechanical stopper | Check.<br>Adjust the stroke. |
| (2) The motor fails to run. | (i) The same as in (A)–(2)–(1)~(4) | |
| (2) The motor fails to run. | (i) The cab lock switch actuated (locked when the cab is raised). | Restore the cab lock to lock-standby position. |

(C) The cab sags after being tilted.

| Trouble (Check points) | Possible causes | Remedy |
|---|---|---|
| (1) Releasing the operation switch makes the cab to sag visibly. | (i) Simultaneous occurrence of:<br>(Cylinder..... Check valve failure)<br>(Pump..... Switch valve failure) | Replace the O-ring in the cylinder check valve or the pilot and the pump switch valve. |
| (1) Releasing the operation switch makes the cab to sag visibly. | (ii) Air is drawn in: | Bleed air out of the cylinder piping. |
| (1) Releasing the operation switch makes the cab to sag visibly. | (iii) Cylinder malfunction:<br>• Defective check valve seal<br>• Defective pilot piston<br>• Defective piston seal | Disassemble and check the cylinder and inpipe cylinder. |
| (2) The cab sags when allowed to stand for a long time (at 50°). | (i)The same as in (1) | Check and repair. |

M11020500003

(D) Other abnormalities

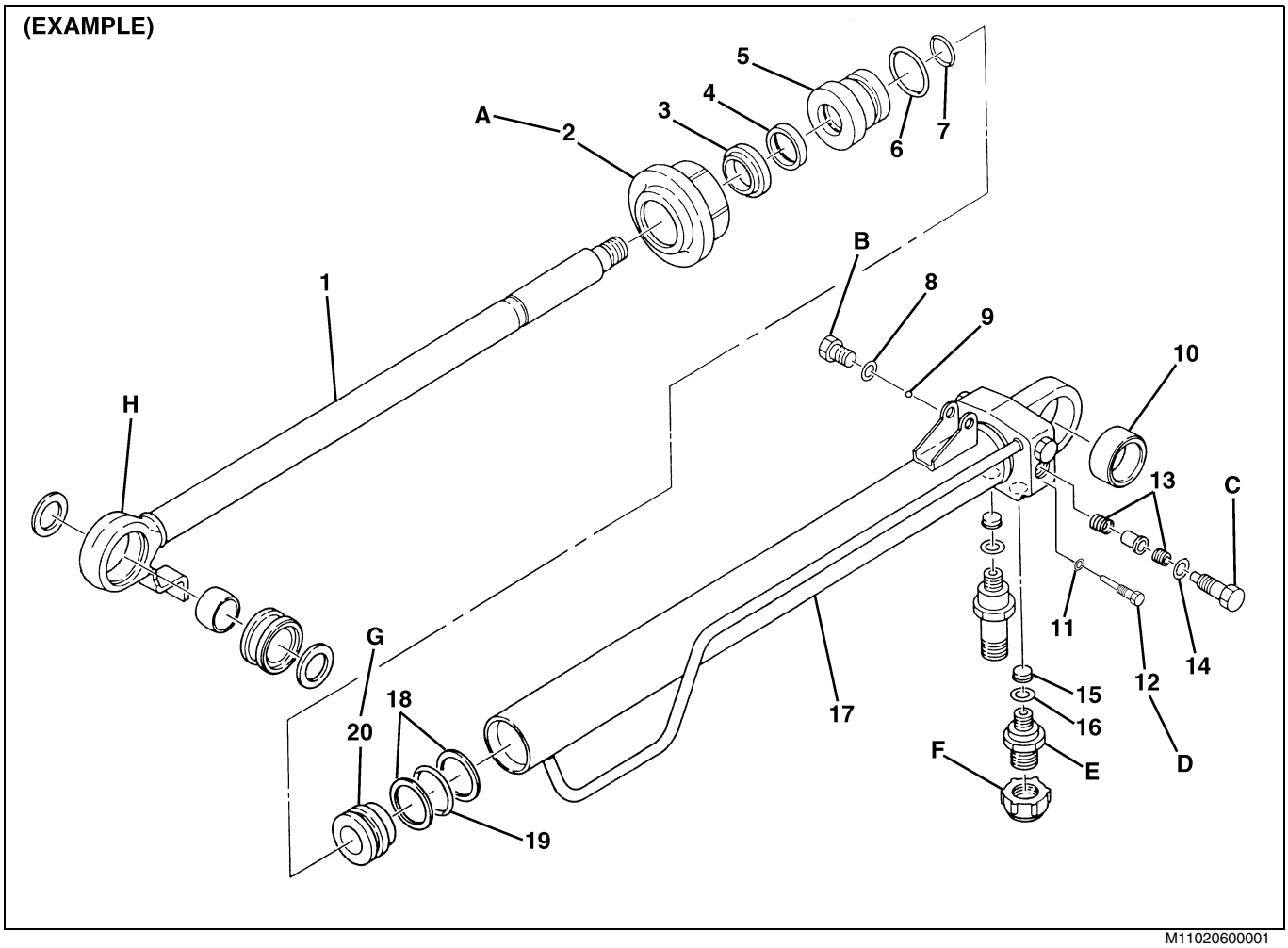
| Trouble (Check points) | Possible causes | Remedy |
|---|---|---|
| (1) Tilting speed differs from normal rate. — (1) Long "raising" time | (i) The same as in (A)–(1)–(1)–(2)–(2) and(A)–(1)–(2) | |
| | (ii) Drop of battery voltage | Check and charge the battery. |
| | (iii) Motor performance deteriorated. | Charge and adjust the battery. |
| | (iv) Increased resistance due to oil of irrelevant type (low temperature, high viscosity, etc.) | Check and adjust the motor. |
| (1) Tilting speed differs from normal rate. — (2) Short "lowering" time | (i) Poor sealing in the cylinder, check valve, or piston | Disassemble and inspect the cylinder. |
| (2) Oil leak — (1) Pipe hose joints | (i) Poor fitting of pipes and joints | Retighten or replace the pipe. |
| | (ii) Impairment of the hose and the O-ring | Replace the O-ring. |
| (2) Oil leak — (2) Cylinder | (i) Defects in the U-cup sealing, end tube and the O-ring | Replace the seal (U cup). |
| | (ii) Impairment of the outer cylinder O-ring | Replace the cylinder body and assembly. |
| (2) Oil leak — (3) Pump or motor | (i) Impairment of the O-ring (pump) and the oil seal (motor) | Replace the O-ring (pump) and the oil seal (motor). |
| (3) The buzzer does not stop sounding. | (i) Poor adjustment or failure of the switches (cab stopper or cab lock) | Inspect and adjust. |
| | (ii) Cab lock failure | Inspect the cab lock and replace with a new part. |
| | (iii) Cab stopper failure | Inspect and adjust. |
| (4) The cab tilts but the buzzer does not sound. | (i) Bad contact in the terminal | Inspect the connector. |
| | (ii) Defective buzzer | Replace the buzzer. |
| (5) Abnormal noise — (1) Noise from the under-carriage beneath the cab front | (i) Play in the cylinder pin | Inspect, repair or replace. |
| (5) Abnormal noise — (2) Noise from the panel in the cab rear | (i) Slapping of the cab lock pin due to damaged rubber piece | Inspect, repair or replace. |
| | (ii) Cab lock failure (the cab lock was applied with the cab being tilted) | Restore the cab lock to the normal position (lift and release). |

M11020500004

# TILT CYLINDER (MODELS WITH DOUBLE CAB)

## COMPONENT LOCATOR

M11020601BED1001




M11020600001

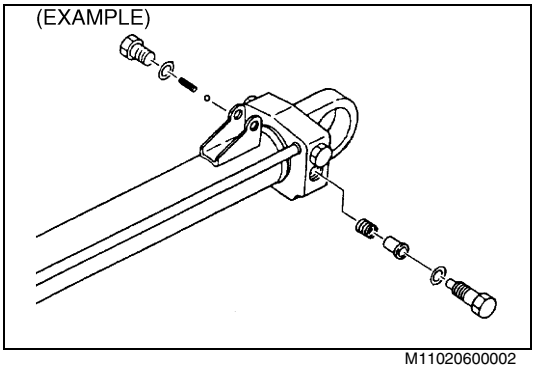
| | | | | | |
|---|---|---|---|---|---|
| 1 | Piston rod | 8 | O-ring | 15 | Filter |
| 2 | Stop ring | 9 | Check valve ball | 16 | O-ring |
| 3 | Dust seal | 10 | Bearing | 17 | Cylinder |
| 4 | Oil seal ring | 11 | O-ring | 18 | Oil seal ring |
| 5 | Tube end | 12 | Plug | 19 | O-ring |
| 6 | O-ring | 13 | Spring | 20 | Piston |
| 7 | O-ring | 14 | O-ring | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 176.4-215.7 {1,800-2,200, 130-158} | E | 17.7-26.5 {180-270, 14-19} |
| B | 17.7-26.5 {180-270, 14-19} | F | 1.0-2.0 {10-20, 0.8-1.4} |
| C | 17.7-26.5 {180-270, 14-19} | G | 44.1-58.9 {450-600, 33-43} |
| D | 1.97-2.35 {20-24, 1.5-1.7} | H | 44.1-58.9 {450-600, 33-43} |

# OVERHAUL

M11020601BEH2001

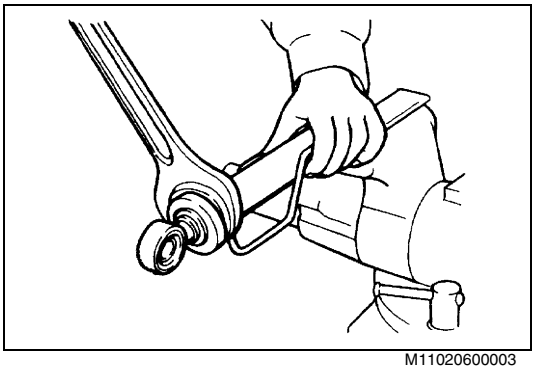


M11020600002

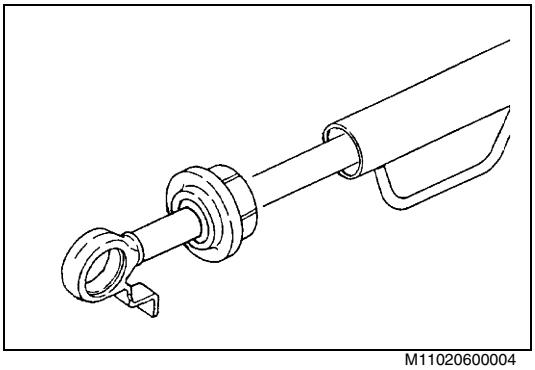
## IMPORTANT POINT - DISASSEMBLY

**1. TILT CYLINDER**

(1) Remove the check valve.


M11020600003

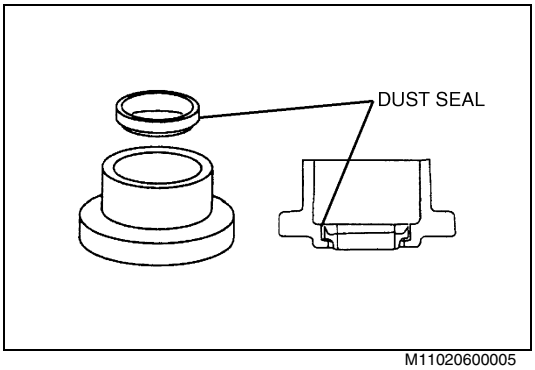
(2) Loosen the stop ring.


M11020600004

(3) Pull out the piston rod assembly.

**NOTICE:**

**Take care not to damage the piston rod, and remove the rod over an oil pan, as oil will leak out.**



M11020600005

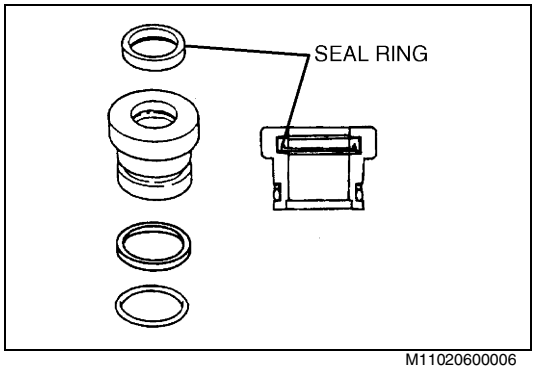
## IMPORTANT POINTS - ASSEMBLY

**1. TILT CYLINDER STOP RING**

(1) Use a press to install the dust seal into the stop ring.

**NOTICE:**

**Before assembling the dust seal, fill the inside with lithium grease. Afterward, apply lithium grease to O-rings and seal rings.**



M11020600006

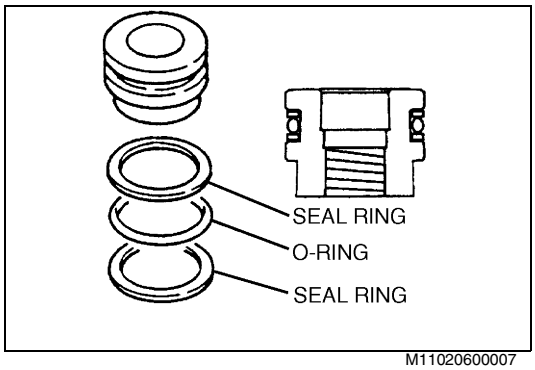
**2. TILT CYLINDER TUBE END**

(1) Assemble the seal ring and O-rings to the tube end.

**NOTICE:**

**Pay attention to the seal ring direction.**

**When assembling the seal ring, use the new one.**



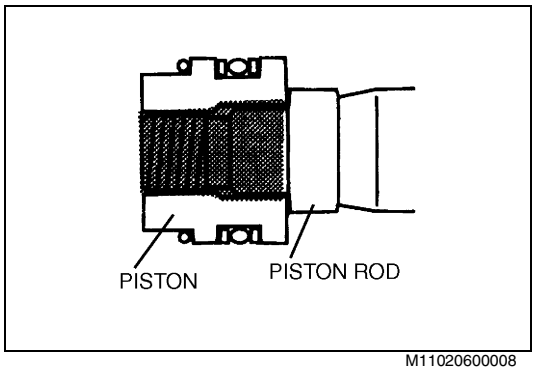
M11020600007

**3. TILT CYLINDER PISTON**

(1) Assemble seal rings and O-ring to piston.

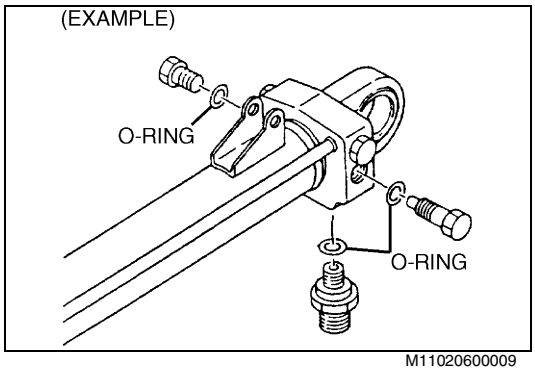
**NOTICE:**

**When assembling the seal rings and O-ring, use the new ones.**



M11020600008

(2) Apply adhesive (ThreeBond No.1374 or equivalent) between the piston and the piston rod.



M11020600009

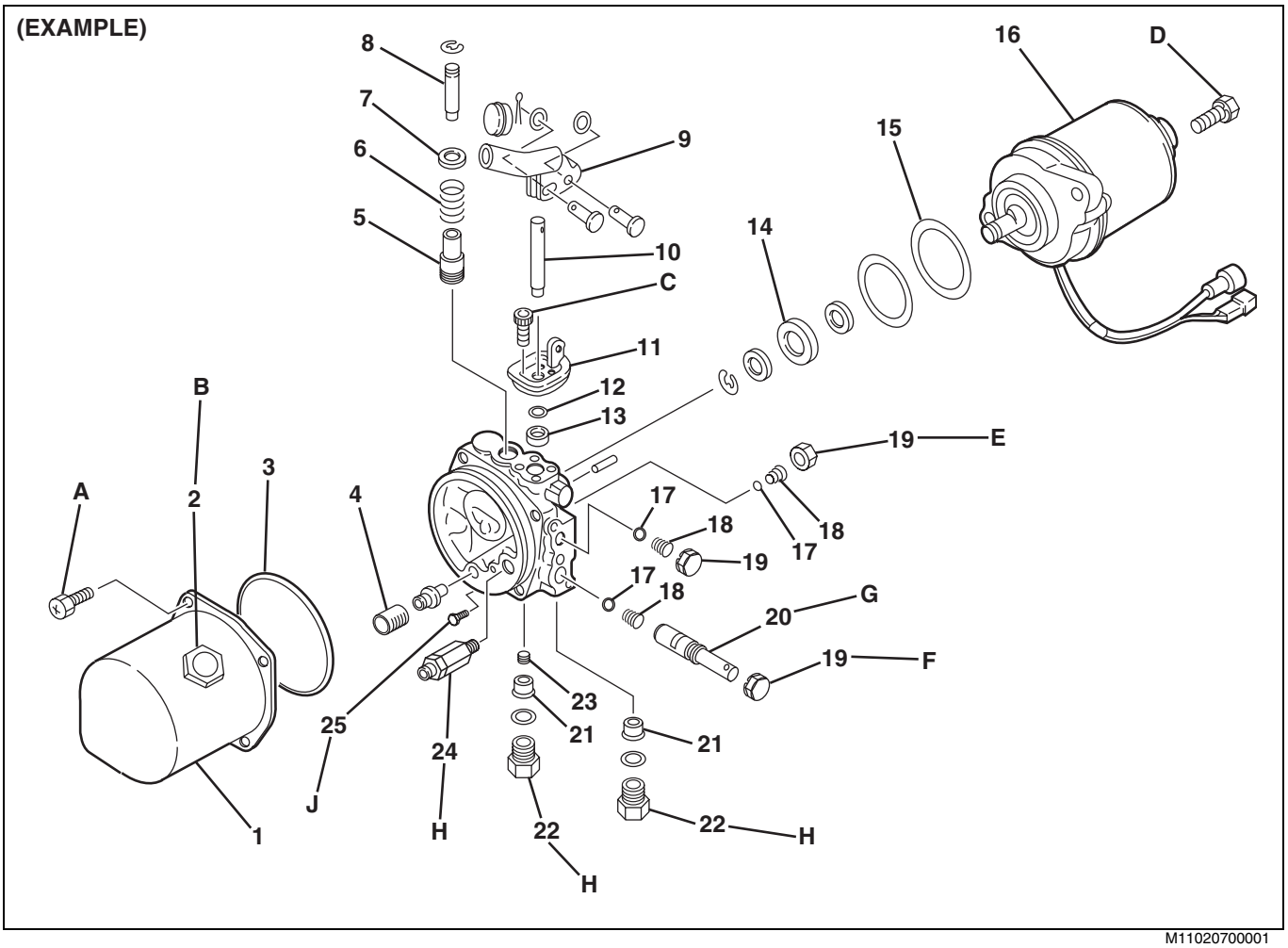
**4. CHECK VALVE**

(1) Apply lithium grease to the O-rings.

# TILT PUMP (MODELS WITH DOUBLE CAB)

## COMPONENT LOCATOR

M11020701BED1001




M11020700001

| | | | | | |
|---|---|---|---|---|---|
| 1 | Reservoir tank | 10 | Piston | 19 | Plug |
| 2 | Filler cap | 11 | Case | 20 | Plug |
| 3 | O-ring | 12 | Back up ring | 21 | Filter |
| 4 | Filter | 13 | Gasket | 22 | Plug |
| 5 | Pump cylinder | 14 | Bearing | 23 | Plug |
| 6 | Spring | 15 | O-ring | 24 | Relief valve |
| 7 | Plain washer | 16 | Tilt motor | 25 | Select lever lock bolt |
| 8 | Piston | 17 | Check valve ball | | |
| 9 | Manual pump lever | 18 | Spring | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 2.4-3.4 {25-35, 1.9-2.5} | F | 19.6-29.4 {200-300, 15-21} |
| B | 44.2-54.0 {450-550, 32-39} | G | 7.8-10.8 {80-110, 5.7-7.9} |
| C | 4.9-6.9 {50-70, 3.7-5.0} | H | 0.98-1.48 {10-15, 0.72-1.09} |
| D | 7.4-9.8 {76-100, 5.5-7.2} | I | 11.8-19.6 {120-200, 8.7-14.4} |
| E | 11.7-14.7 {120-150, 9-10} | J | 4.9-6.9 {50-70, 3.7-5.0} |

# OVERHAUL

M11020701BEH2001

## IMPORTANT POINT - DISMOUNTING

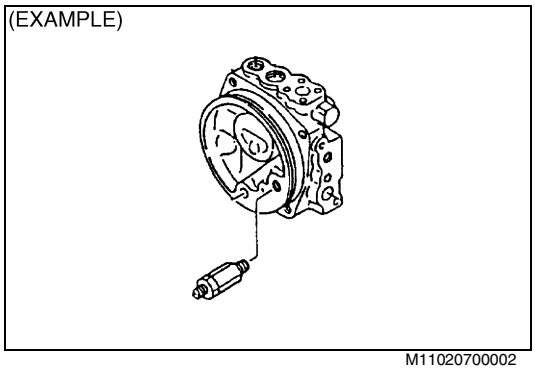
**1. TILT PUMP**

(1) Disconnect the oil pipes between the pump and the cylinder at the pump side.

**NOTICE:**

- **Before disconnection of the pipes, clean the connection parts.**
- **Seal the removed pump and the pipe connector parts with tape etc.**

## IMPORTANT POINTS - DISASSEMBLY




M11020700002

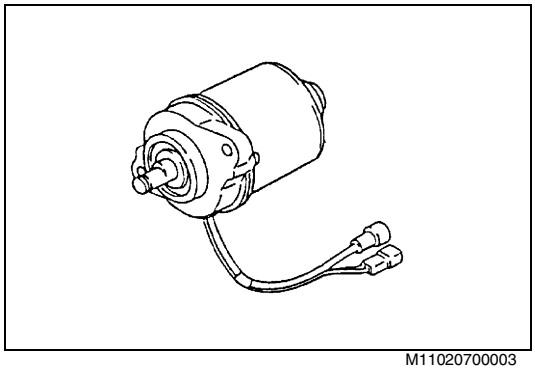
**1. RELIEF VALVE**

(1) Never disassemble the relief valve when removing it.

**NOTICE:**

**Adjust the valve opening pressure of relief valve to the specified value.**

**VALVE OPENING PRESSURE:**
**34.3 MPa {350 kgf/cm$^2$, 4,978 lbf/in.$^2$}**



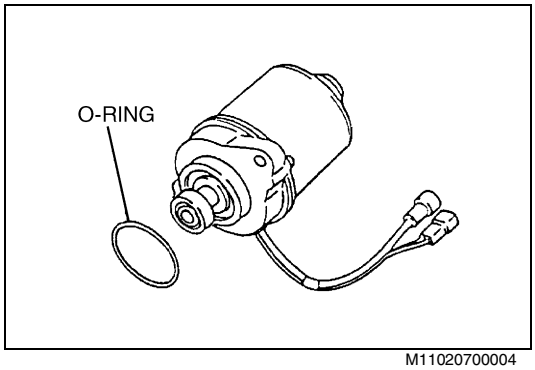
M11020700003

**2. TILT MOTOR**

(1) Never open the tilt motor cover.

If the motor is faulty, replace the motor assembly.

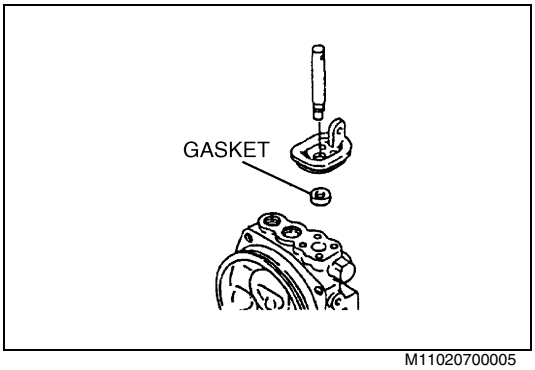
## IMOPORTANT POINTS - ASSEMBLY




M11020700004

**1. TILT MOTOR**

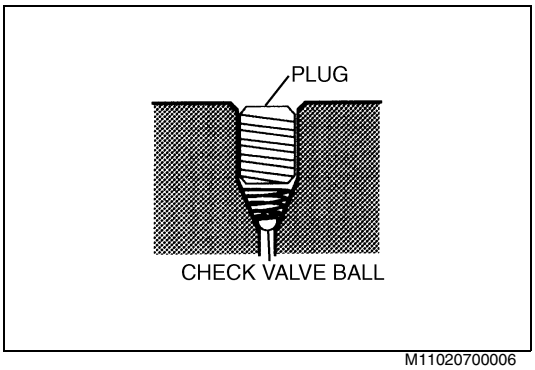
(1) Apply lithium grease to the O-ring.



M11020700005

**2. MANUAL TILT PUMP**

(1) Apply lithium grease to the gasket.



M11020700006

**3. CHECK VALVES**

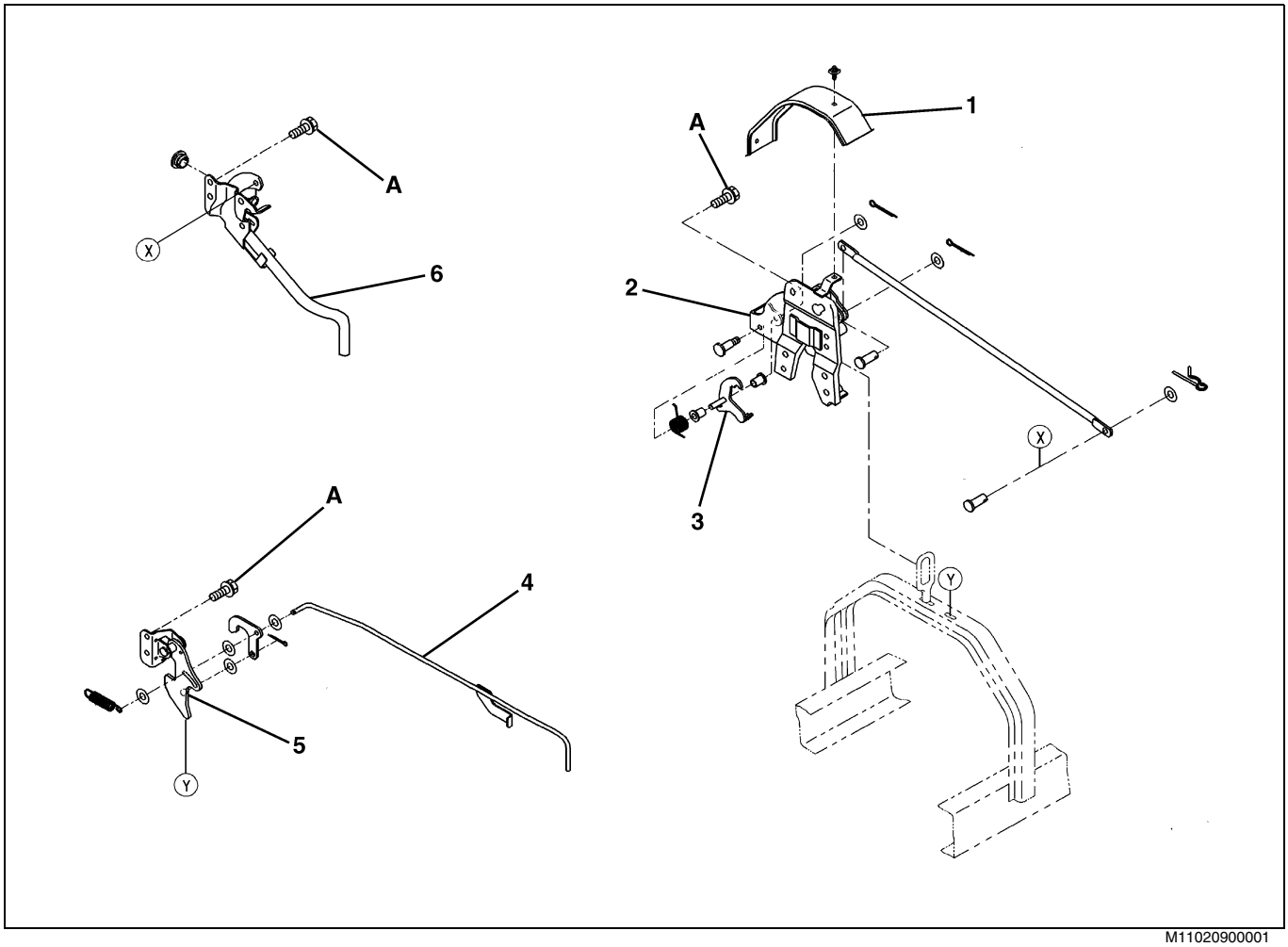
(1) Coat the plug with seal tape when installing the check valves.

# CAB LOCK MECHANISM

## COMPONENT LOCATOR

M11020901BED1001

### EXCEPT FOR DOUBLE CAB




M11020900001

| | | | |
|---|---|---|---|
| 1 | Dust cover | 4 | Tilt latch rod |
| 2 | Cab lock | 5 | Tilt latch |
| 3 | Release latch | 6 | Cab lock lever |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | |
|---|---|---|
| A | 34.5-51.5 {352-525, 26-37} | |

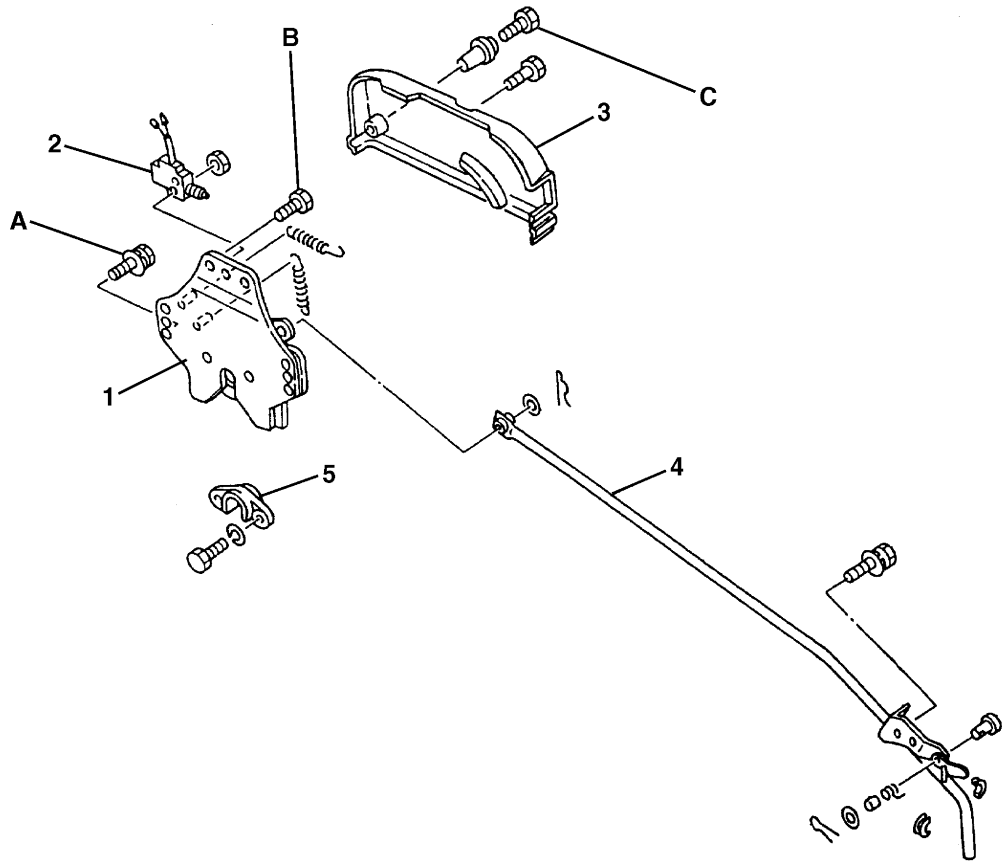
**NOTICE:**

- **Apply chassis grease between moving parts.**
- **Tighten the bolts to the following torque unless otherwise specified.**

| | Bolt diameter (mm) | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|
| HEXAGON SPOTTED PORTION | N·m | 18-26 | 34.5-51.5 | 61.0-91.0 | 96.0-144.0 | 152.0-228.0 |
| | kgf·cm | 184-265 | 352-525 | 622-927 | 979-1,468 | 1,550-2,325 |
| | lbf·ft | 13-19 | 26-37 | 45-67 | 71-106 | 112-168 |
| FLANGED SPOTTED PORTION | N·m | 21.5-31.5 | 41.5-61.5 | 73.0-108.0 | 144.0-216.0 | 228.0-342.0 |
| | kgf·cm | 220-321 | 423-627 | 745-1,100 | 1,468-2,202 | 2,325-3,487 |
| | lbf·ft | 16-23 | 31-45 | 54-80 | 106-159 | 168-252 |

## DOUBLE CAB

(EXAMPLE)




M11020900002

| | | | |
|---|---|---|---|
| 1 | Cab lock | 4 | Cab lock rod |
| 2 | Cab lock switch | 5 | Stopper |
| 3 | Dust cover | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 34.5-51.5 {352-525, 26-37} | D | 5.0-13.0 {51-132, 3.7-9.5} |
| B | 5.7-7.7 {58-78, 4.2-5.6} | | |

**NOTICE:**
- **Apply chassis grease between moving parts.**
- **Tighten the bolts to the following torque unless otherwise specified.**

| | Bolt diameter (mm) | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|
| HEXAGON SPOTTED PORTION | N·m | 18-26 | 34.5-51.5 | 61.0-91.0 | 96.0-144.0 | 152.0-228.0 |
| | kgf·cm | 184-265 | 352-525 | 622-927 | 979-1,468 | 1,550-2,325 |
| | lbf·ft | 13-19 | 26-37 | 45-67 | 71-106 | 112-168 |
| FLANGED SPOTTED PORTION | N·m | 21.5-31.5 | 41.5-61.5 | 73.0-108.0 | 144.0-216.0 | 228.0-342.0 |
| | kgf·cm | 220-321 | 423-627 | 745-1,100 | 1,468-2,202 | 2,325-3,487 |
| | lbf·ft | 16-23 | 31-45 | 54-80 | 106-159 | 168-252 |

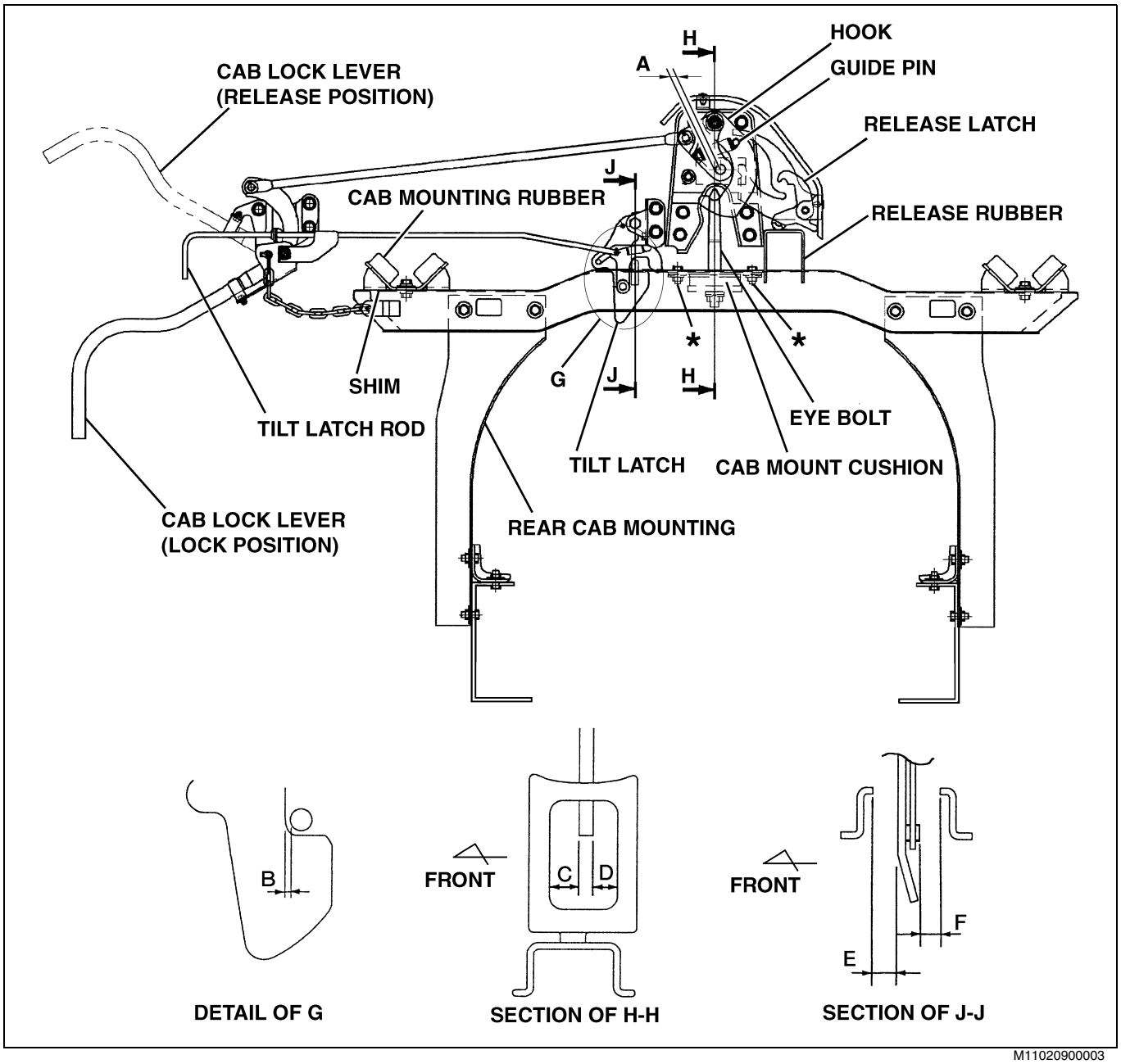
# OVERHAUL

M11020901BEH2001

## EXCEPT FOR DOUBLE CAB

**1. CAB LOCK MECHANISM ADJUSTMENT**

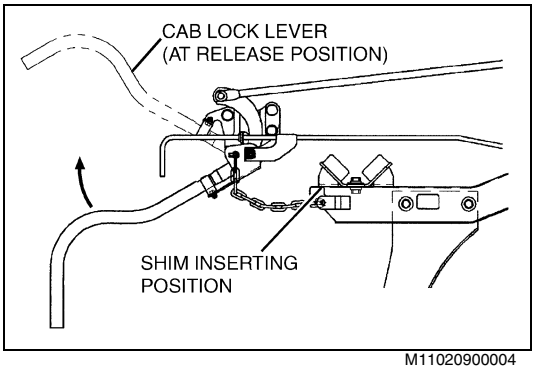
(1) Adjust dimension A, B, C, D, E and F as follows:




M11020900003

**Unit: mm {in.}**

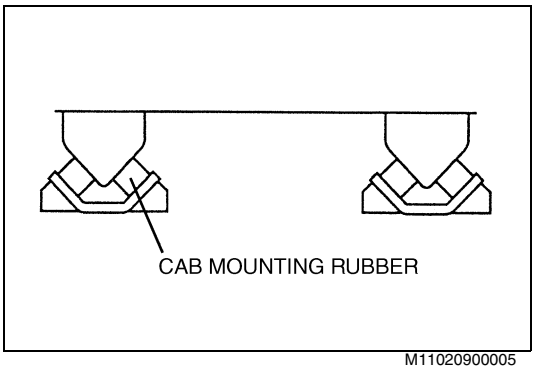
| Position | Related parts | Dimensions |
|---|---|---|
| A: Eye bolt, crank pin off set | * Mark bolts | 9-13 {0.36-0.51} |
| B: Tilt latch, pin clearance | Tilt latch adjusting bolt | 3-6 {0.12-0.23} |
| C: Hook, eye bolt clearance | Mounting member attaching bolt | 12-22 {0.48-0.86} |
| D: Hook, eye bolt clearance | Mounting member attaching bolt | 20-30 {0.79-1.18} |
| E: Mounting member, tilt latch clearance | Mounting member attaching bolt | 20-22 {0.79-0.86} |
| F: Mounting member, tilt latch clearance | Mounting member attaching bolt | 9-11 {0.36-0.43} |



M11020900004

**2. CAB LOCK LEVER OPERATING RESISTANCE ADJUSTMENT**

(1) Adjust the mounting cushion shims to bring the operating tension of the lock lever to 166-266 N {17-27 kgf, 38-59 lbf.}. If the cab is not directly aligned, the operating resistance of the lock lever increases. In this case, correct the cab mounting cushions.

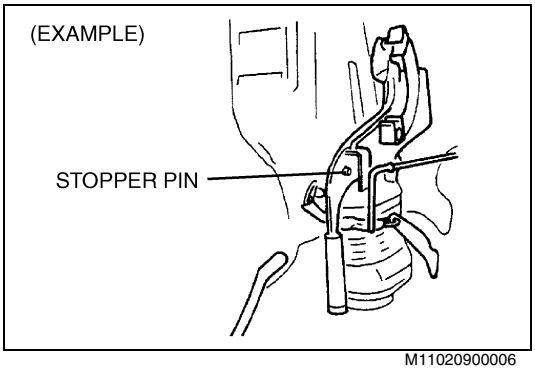


M11020900005

**3. CAB MOUNTING CUSHION ADJUSTMENT**

(1) If the cab shifts sideways, loosen the mounting rubber attaching bolts and adjust the mounting rubbers so that there is no clearance there.

**NOTICE:**
**Replace cab mounting rubbers which are hardened or deformed.**

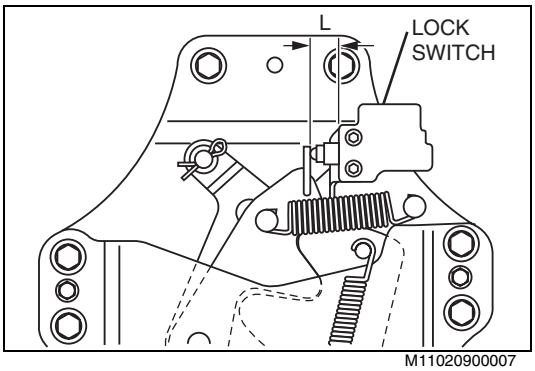


M11020900006

**4. INSPECTION**

(1) Operate the cab lock lever, and confirm that each part operates smoothly, that the hook and eye bolt fit in the lock position, and that the stopper pin is securely inserted.

**CAUTION:**
**If the stopper pin is not inserted securely in place while driving, external shock such as road bumps or collision may cause a tilting of the cab. This can result in personal injury and/or property damage. If the stopper pin is lost, immediately install a new stopper pin. Make sure that the hook engages with the eye bolt securely.**

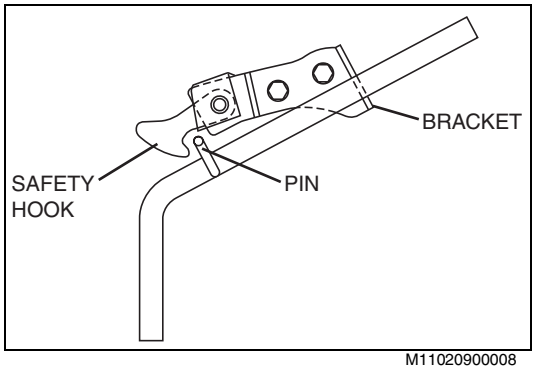


M11020900007

## DOUBLE CAB

**1. CAB LOCK SWITCH ADJUSTMENT**

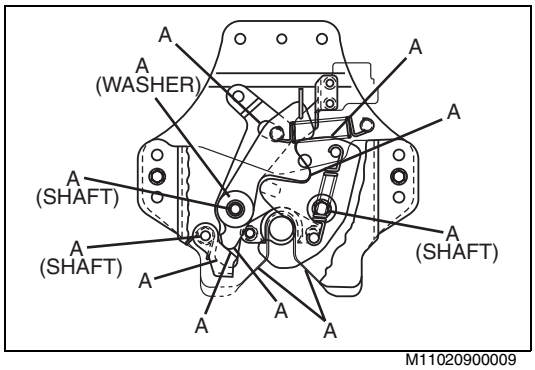
(1) Adjust the dimension L in the elongated hole of the switch, when the cab is locked position.
Tighten the installing nuts to the specified torque.
**Dimension L: 19-21 mm {0.748-0.826 in.}**



M11020900008

**2. SAFETY HOOK ADJUSTMENT**

(1) The lock position of the safety hook shall be adjusted so that the cab lock switch can not become "ON" with the safety hook and the pin in a free play state.



M11020900009

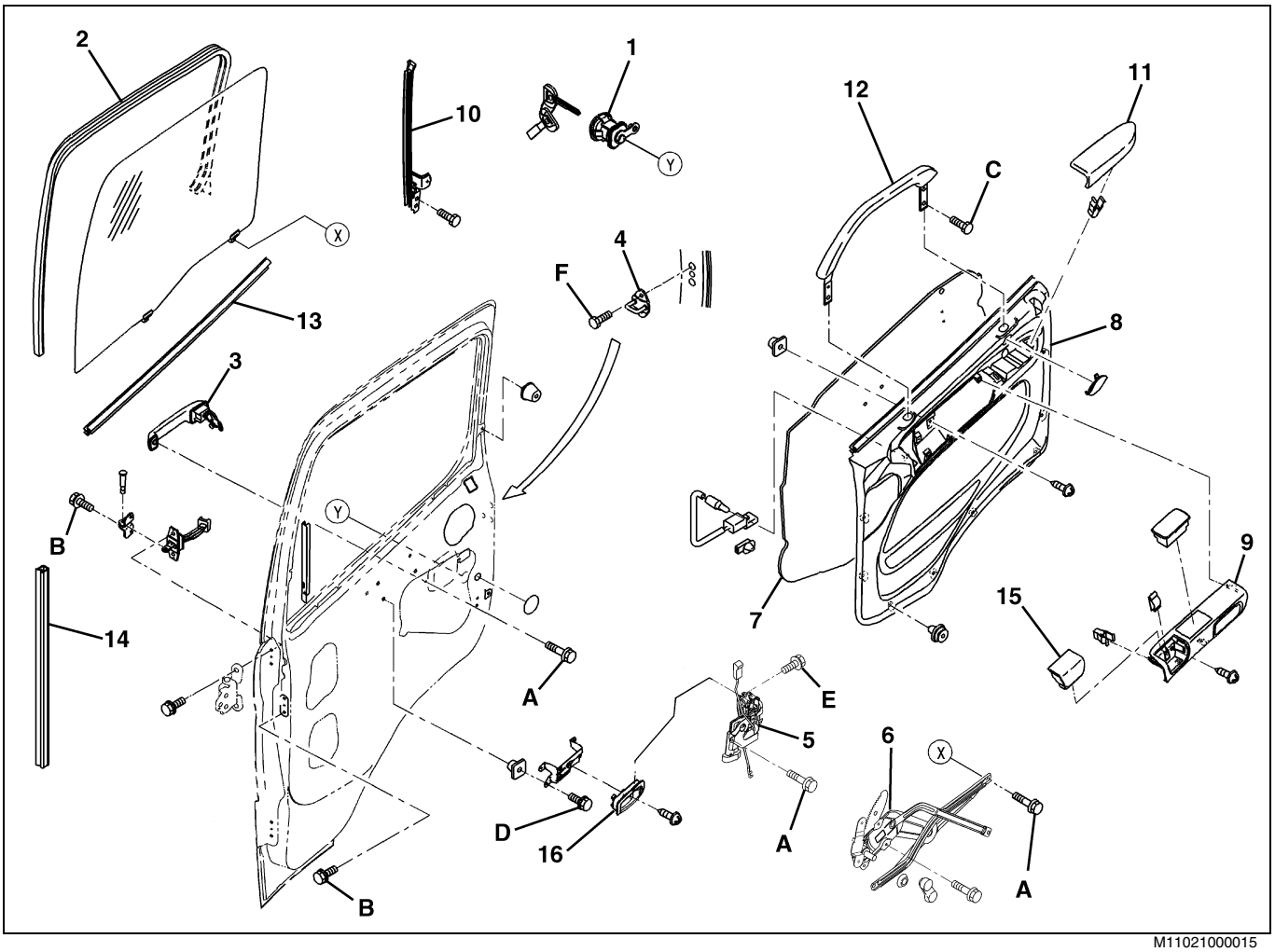
**3. LUBRICATION**

(1) Apply chassis grease to "A" position.

# DOOR

## COMPONENT LOCATOR

M11021001BED1001




M11021000015

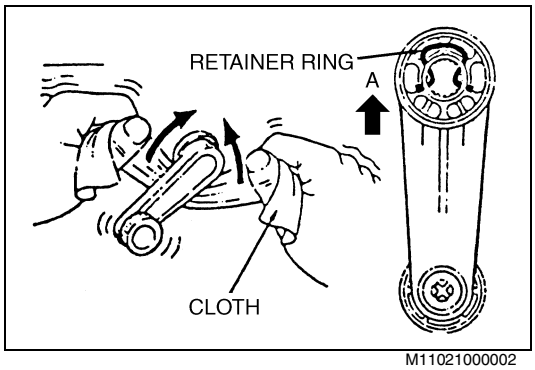
| | | | |
|---|---|---|---|
| 1 | Lock cylinder | 9 | Inside upper trim |
| 2 | Weather strip | 10 | Door frame |
| 3 | Outside handle | 11 | Armrest |
| 4 | Striker | 12 | Door assist grip |
| 5 | Door lock | 13 | Outer oscillate-proof |
| 6 | Regulator | 14 | Glass run weather strip |
| 7 | Inside hole cover | 15 | Ashtray |
| 8 | Inside trim | 16 | Inside handle case |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 4.4-6.6 {45-67, 3.3-4.8} | D | 2.0-3.0 {20-30, 1.5-2.1} |
| B | 7.2-10.8 {74-110, 5.4-7.9} | E | 7.2-10.8 {74-110, 5.4-7.9} |
| C | 10.8-20.2 {110-206, 8.0-14.8} | F | 18-26 {184-264, 13.3-19.0} |

# OVERHAUL

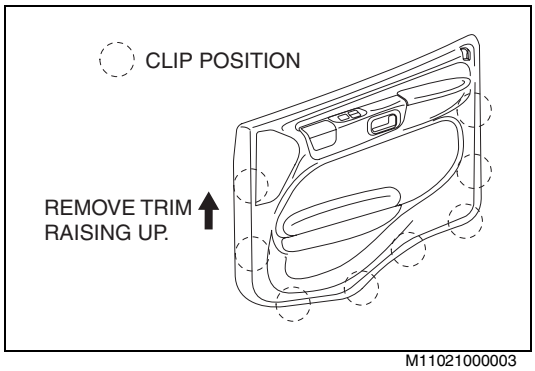
M11021001BEH2001



M11021000002

**1. REMOVE REGULATOR HANDLE.**

(1) Use a piece of cloth to catch the two ends of the retainer ring and pull the cloth back and forth as shown, to remove the ring.

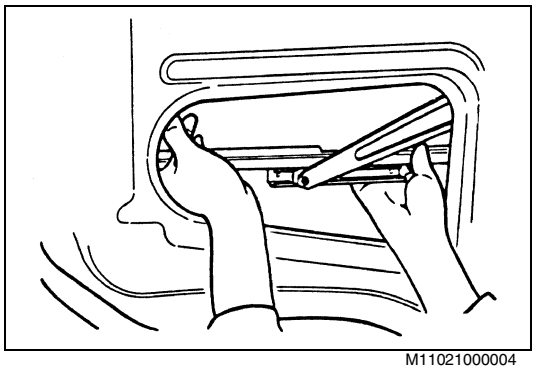


M11021000003

**2. REMOVE INSIDE TRIM.**

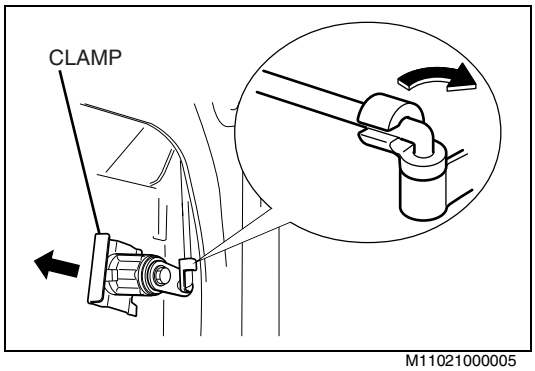
(1) Remove the parts below in the listed.
(Refer to the DOOR COMPONENT LOCATOR)
   a. Ashtray
   b. Armrest
   c. Inside upper trim
   d. Inside handle case

(2) Pull off the inside trim.


M11021000004

**3. REMOVE WINDOW.**

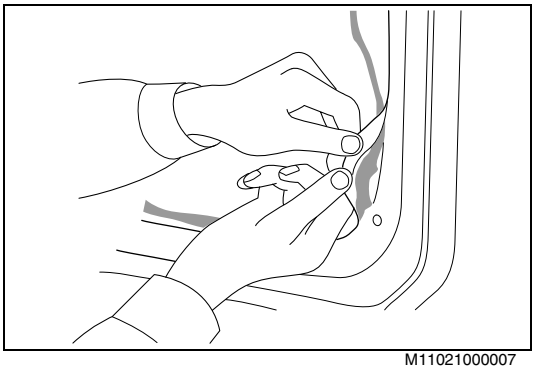
(1) Disconnect regulator from window channel.



M11021000005

**4. REMOVE DOOR LOCK.**

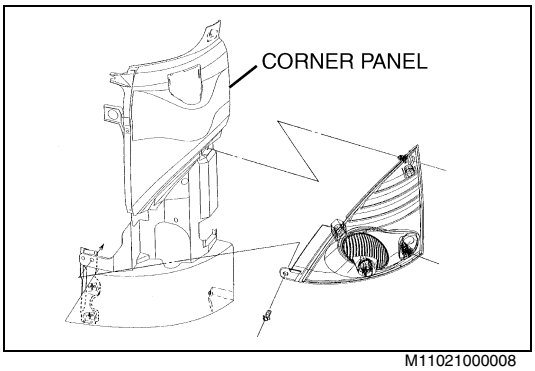
(1) Disconnect the lock cylinder from the door lock.
(2) Remove the lock cylinder.
(3) Remove the door lock with rods.


M11021000007

**5. SERVICE HOLE COVER AND REGULATOR INSTALLING**

(1) Stick butyl rubber tape along lower tangent line of the drain hole of the door.

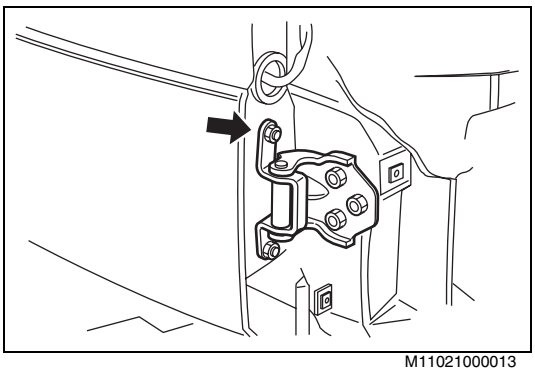
(2) Insert the regulator handle with retainer ring into the regulator.



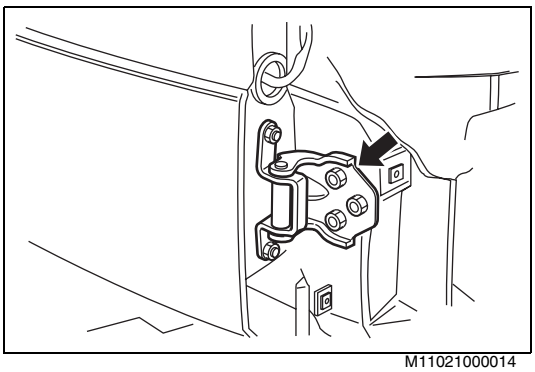
M11021000008

**6. DOOR HINGE ADJUSTMENT**

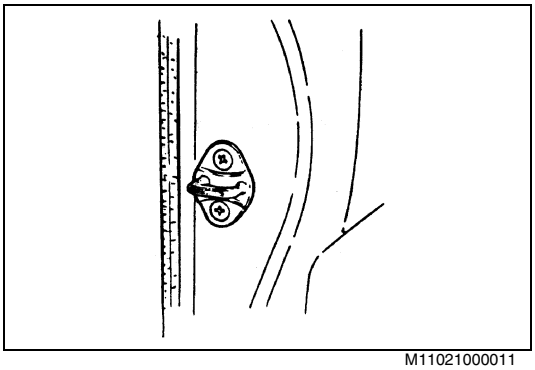
(1) Remove the corner panel.


M11021000013

(2) Make vertical and horizontal adjustments by loosening the hinge bolts on the door.


M11021000014

(3) Make depth adjustments by loosening the hinge bolts on the body.

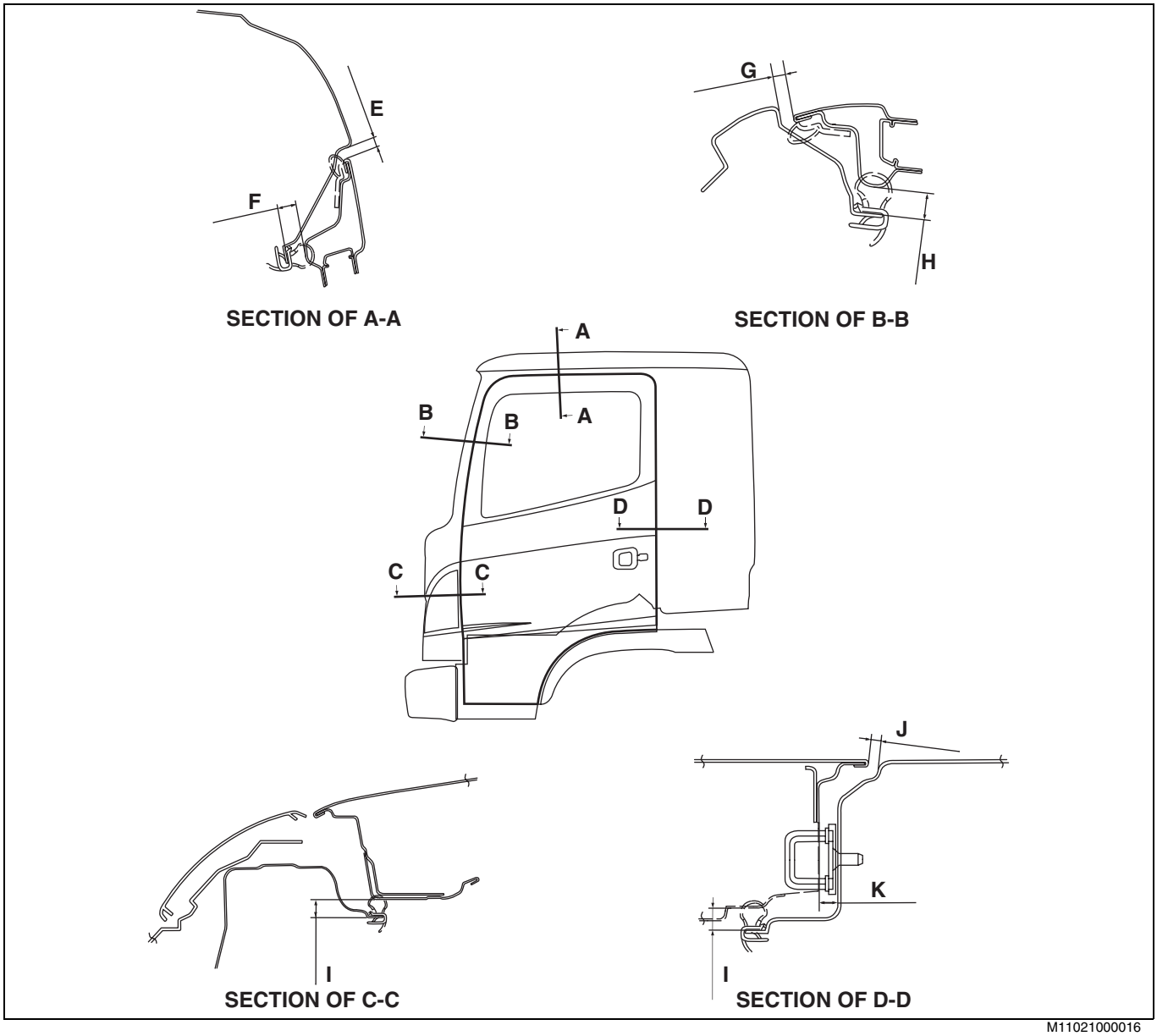

M11021000011

**7. STRIKER ADJUSTMENT**

(1) Check the engagement between the door lock and the striker. Make the top and bottom contact even.

(2) Perform adjustment so that the outside of the door and the outside of the rear quarter panel are flush with each other. After adjustment, properly tighten the bolts.

**NOTICE:**
**When adjusting the door in the vertical direction, do not force in into alignment by using the door lock striker.**




M11021000016

**CLEARANCES BETWEEN BODY AND DOOR** **Unit: mm {in.}**

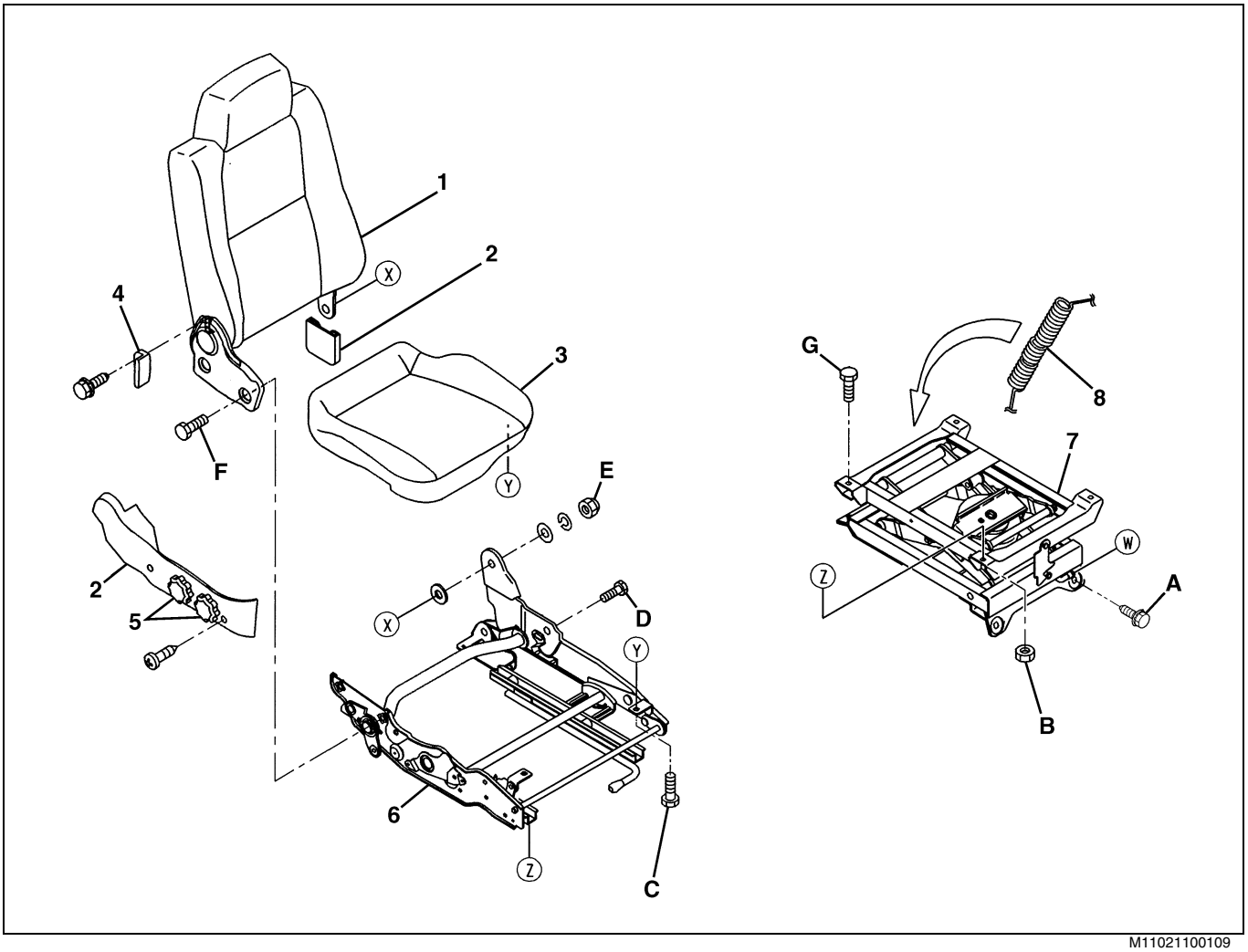
| | | | |
|---|---|---|---|
| **E** | **6.0-9.0 {0.24-0.35}** | **I** | **14.4-18.4 {0.57-0.72}** |
| **F** | **12.5-16.5 {0.50-0.64}** | **J** | **6.0-9.0 {0.24-0.35}** |
| **G** | **6.0-9.0 {0.24-0.35}** | **K** | **11.3-15.3 {0.45-0.60}** |
| **H** | **12.5-16.5 {0.50-0.64}** | | |

# SEAT

## COMPONENT LOCATOR

M11021101BED1003

### DRIVER'S SEAT



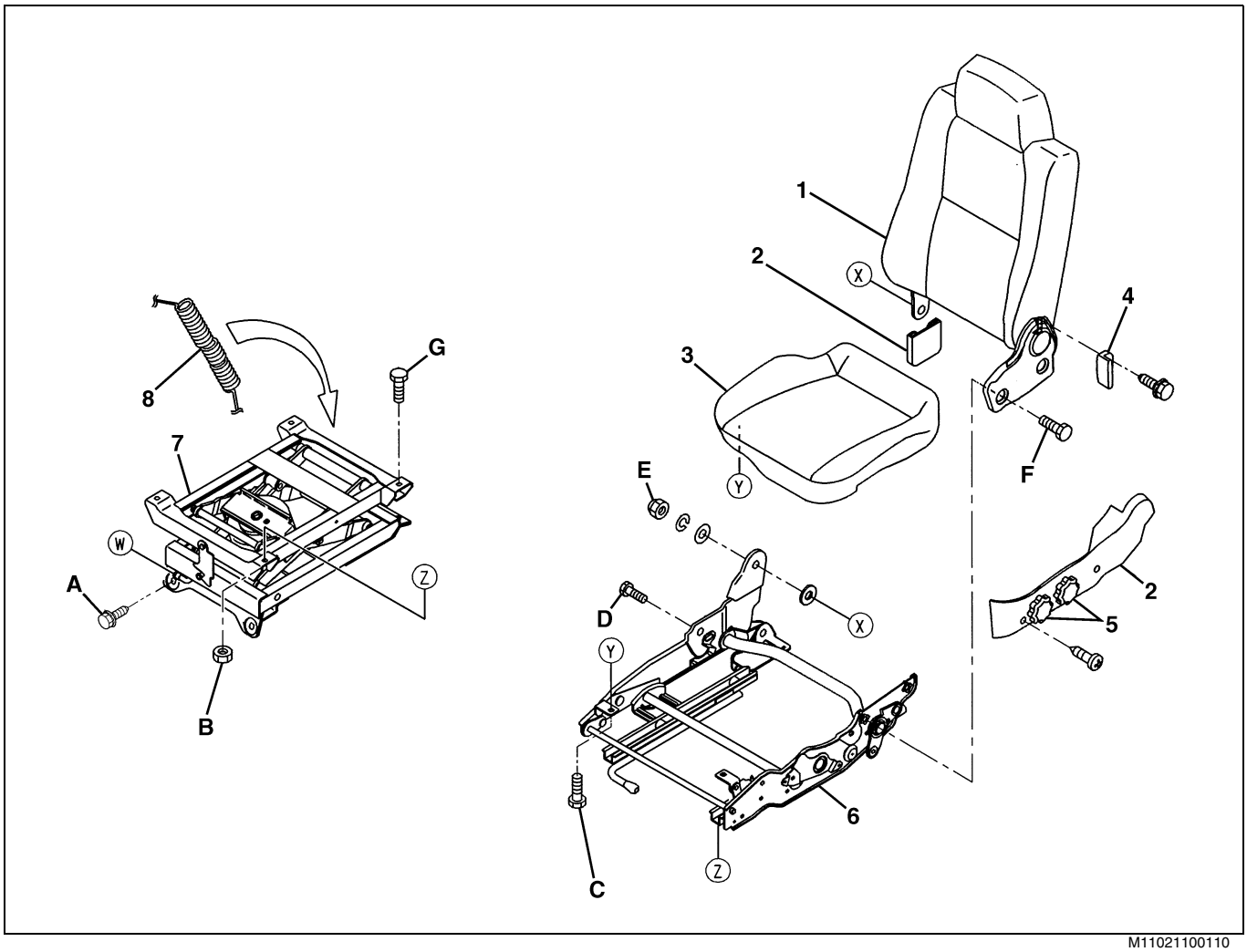

M11021100109

| | | | |
|---|---|---|---|
| 1 | Seat back | 5 | Seat tilt adjuster handle |
| 2 | Seat back cover | 6 | Seat adjuster (If so equipped) |
| 3 | Seat cushion | 7 | Seat suspension (If so equipped) |
| 4 | Seat reclining knob | 8 | Wire (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 17.5-32.5 {179-331, 13-23} | E | 11.8-14.7 {120-150, 9-11} |
| B | 27.1-41.0 {280-420, 20-30} | F | 40.1-53.9 {410-550, 30-40} |
| C | 20.5-34.3 {210-350, 15-25} | G | 40.1-53.9 {410-550, 30-40} |
| D | 20.5-34.3 {210-350, 15-25} | | |

## ASSISTANT'S SEAT



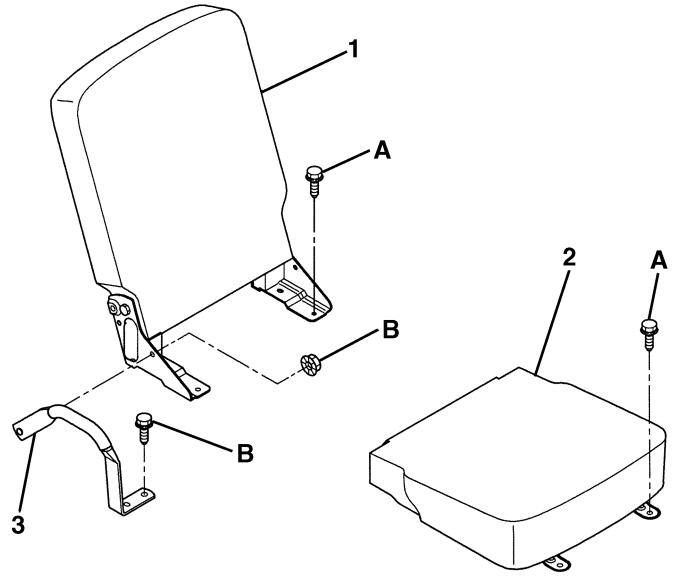

M11021100110

| | | | |
|---|---|---|---|
| 1 | Seat back | 5 | Seat tilt adjuster handle |
| 2 | Seat back cover | 6 | Seat adjuster (If so equipped) |
| 3 | Seat cushion | 7 | Seat suspension (If so equipped) |
| 4 | Seat reclining knob | 8 | Wire (If so equipped) |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 17.5-32.5 {179-331, 13-23} | E | 11.8-14.7 {120-150, 9-11} |
| B | 27.1-41.0 {280-420, 20-30} | F | 40.1-53.9 {410-550, 30-40} |
| C | 20.5-34.3 {210-350, 15-25} | G | 40.1-53.9 {410-550, 30-40} |
| D | 20.5-34.3 {210-350, 15-25} | | |

## CENTER SEAT



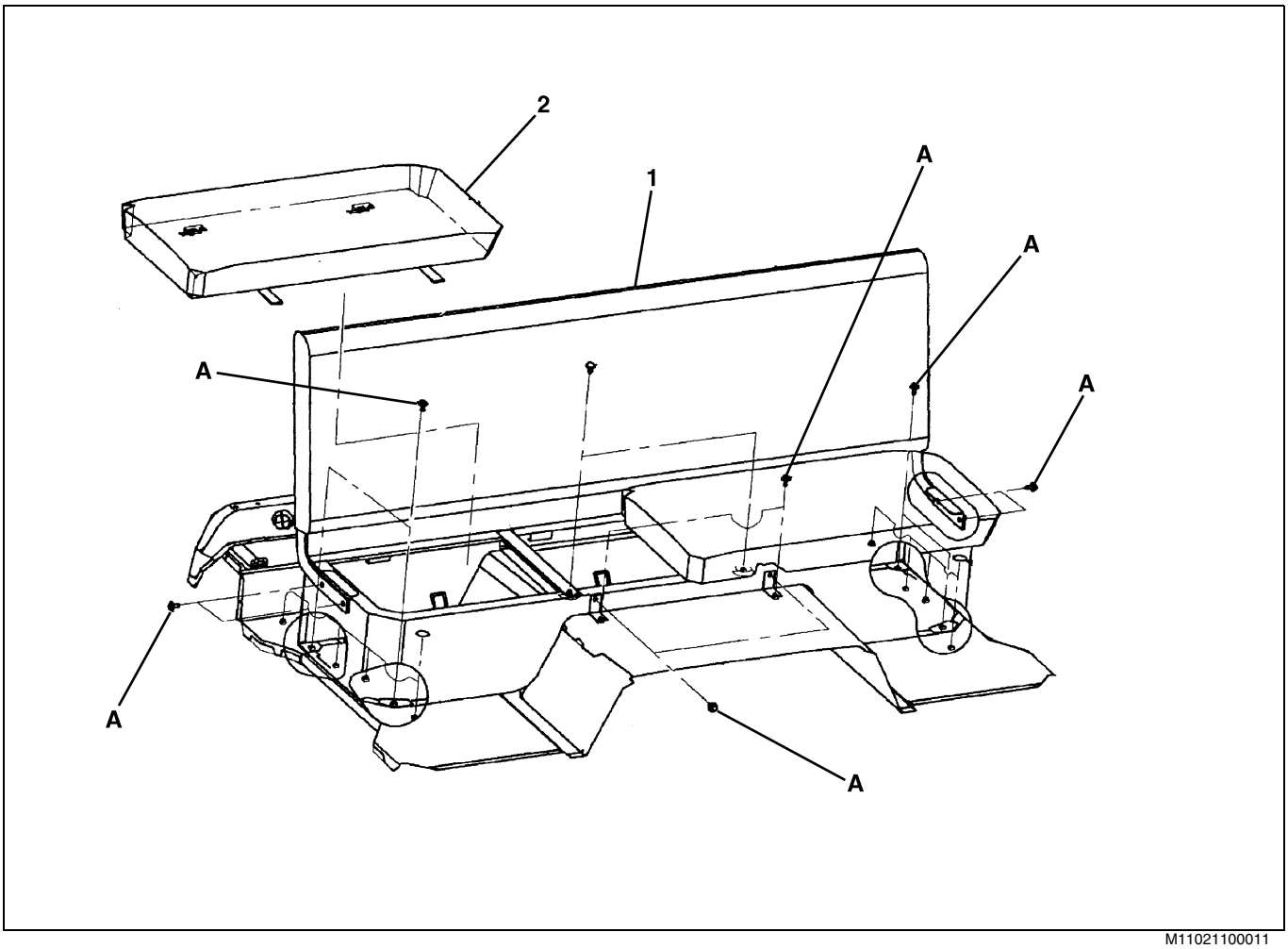

M11021100003

| | | | |
|---|---|---|---|
| 1 | Seat back | 3 | Center grip |
| 2 | Cushion | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 17.5-32.5 {179-331, 13-23} | B | 14.5-32.5 {148-331, 11-23} |

## REAR SEAT (IF SO EQUIPPED)

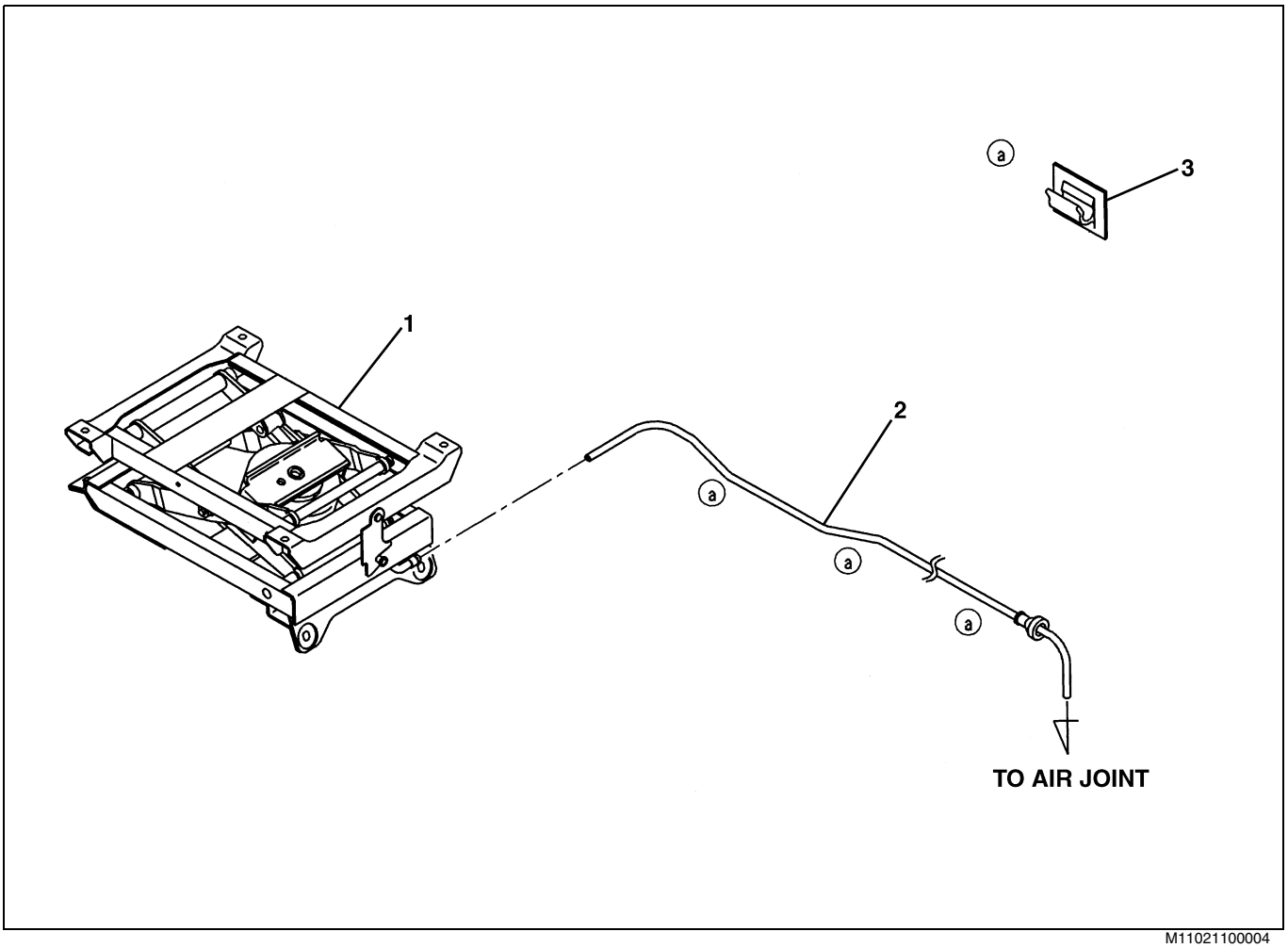



| | |
|---|---|
| 1 Seat back | 2 Cushion |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | |
|---|---|
| A 17.5-32.5 {179-331, 13-23} | |

## AIR SUSPENSION SEAT (IF SO EQUIPPED)

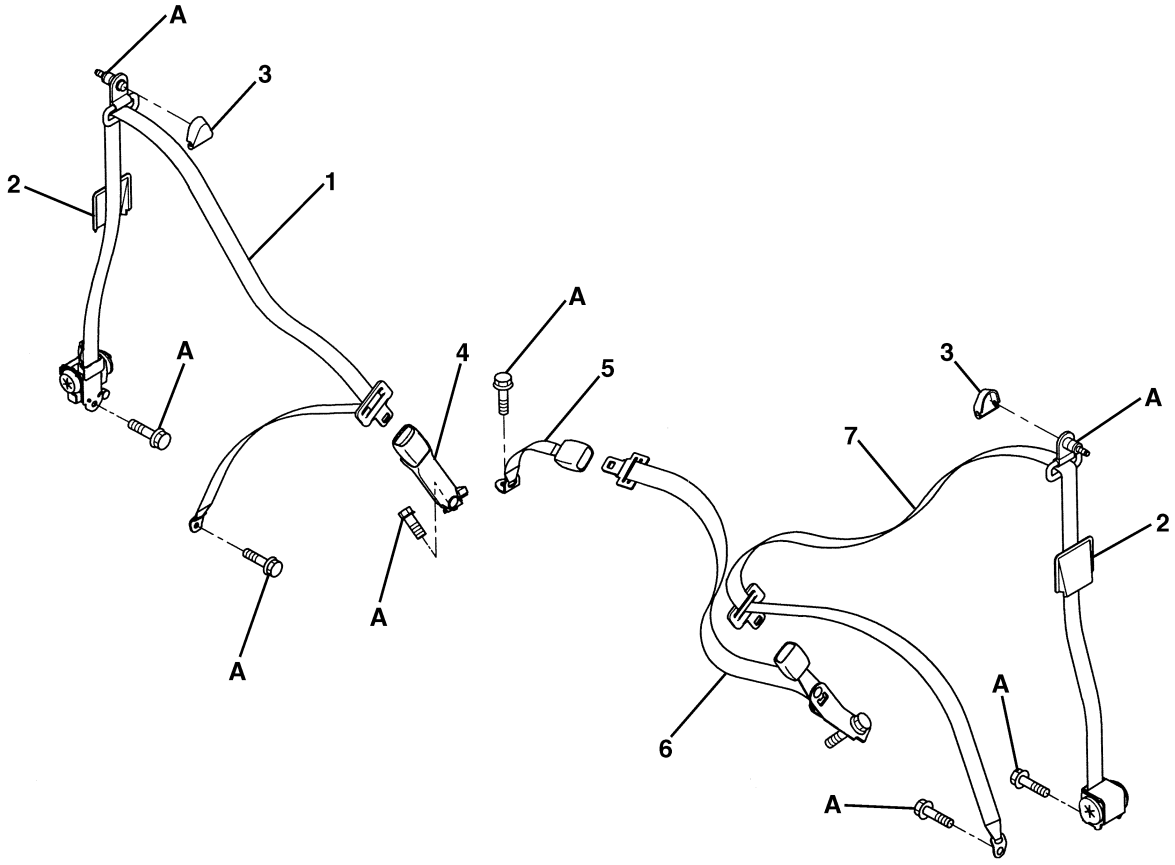



M11021100004

| | | | |
|---|---|---|---|
| 1 | Seat suspension | 3 | Clip |
| 2 | Air hose | | |

## SEAT BELT (FRONT)

(REPRESENTATIVE TYPE)



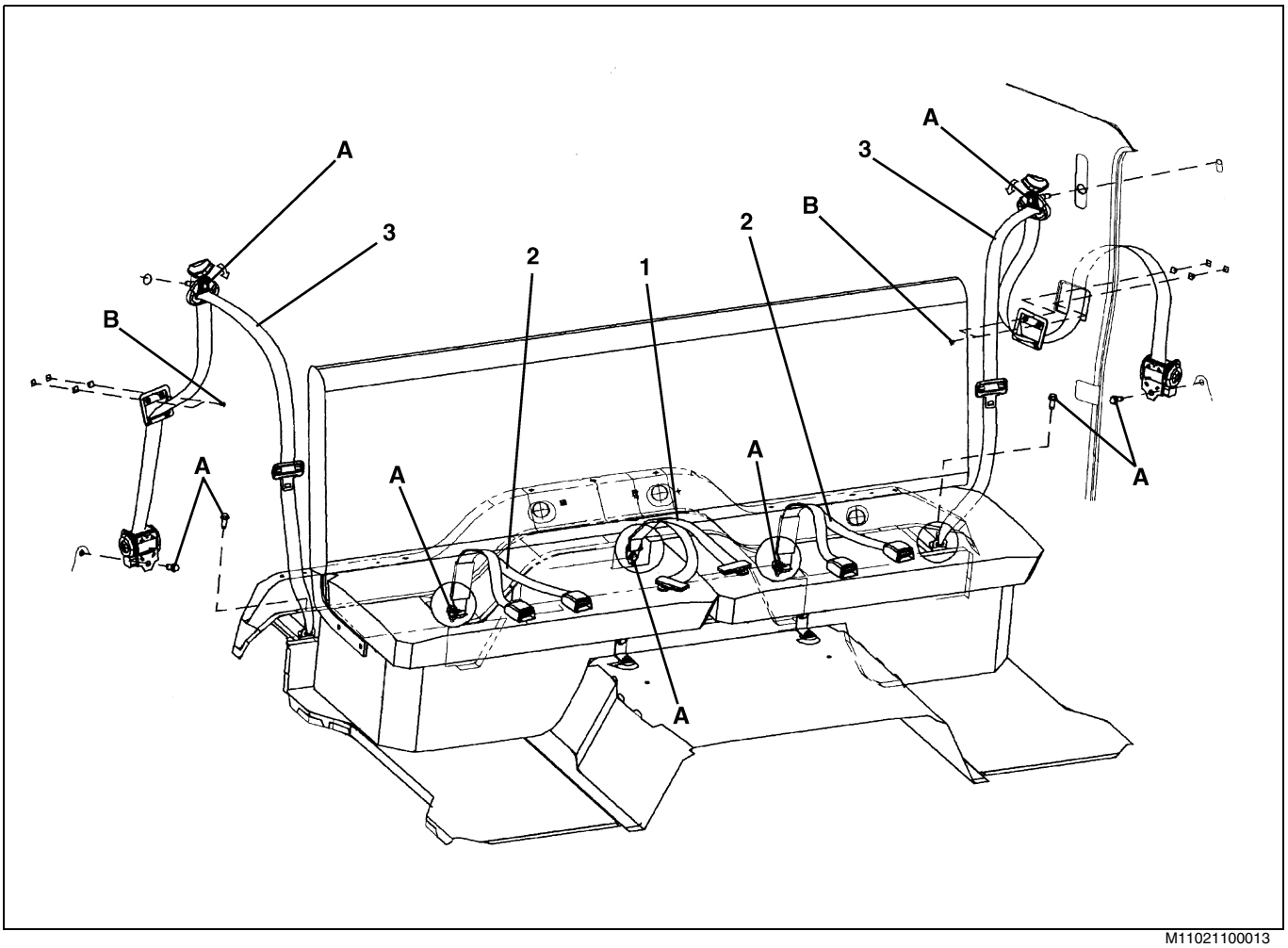

M11021100012

| | | | |
|---|---|---|---|
| 1 | Outer seat belt (Driver's seat) | 5 | Center seat belt |
| 2 | Seat belt guide | 6 | Inner seat belt (Assistant's seat) |
| 3 | Seat belt cover | 7 | Outer seat belt (Assistant's seat) |
| 4 | Inner seat belt (Driver's seat) | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 29-55 {296-560, 22-40} | | |

## SEAT BELT (REAR)




M11021100013

| | | | |
|---|---|---|---|
| 1 | Center seat belt | 3 | Outside seat belt |
| 2 | Middle seat belt | | |

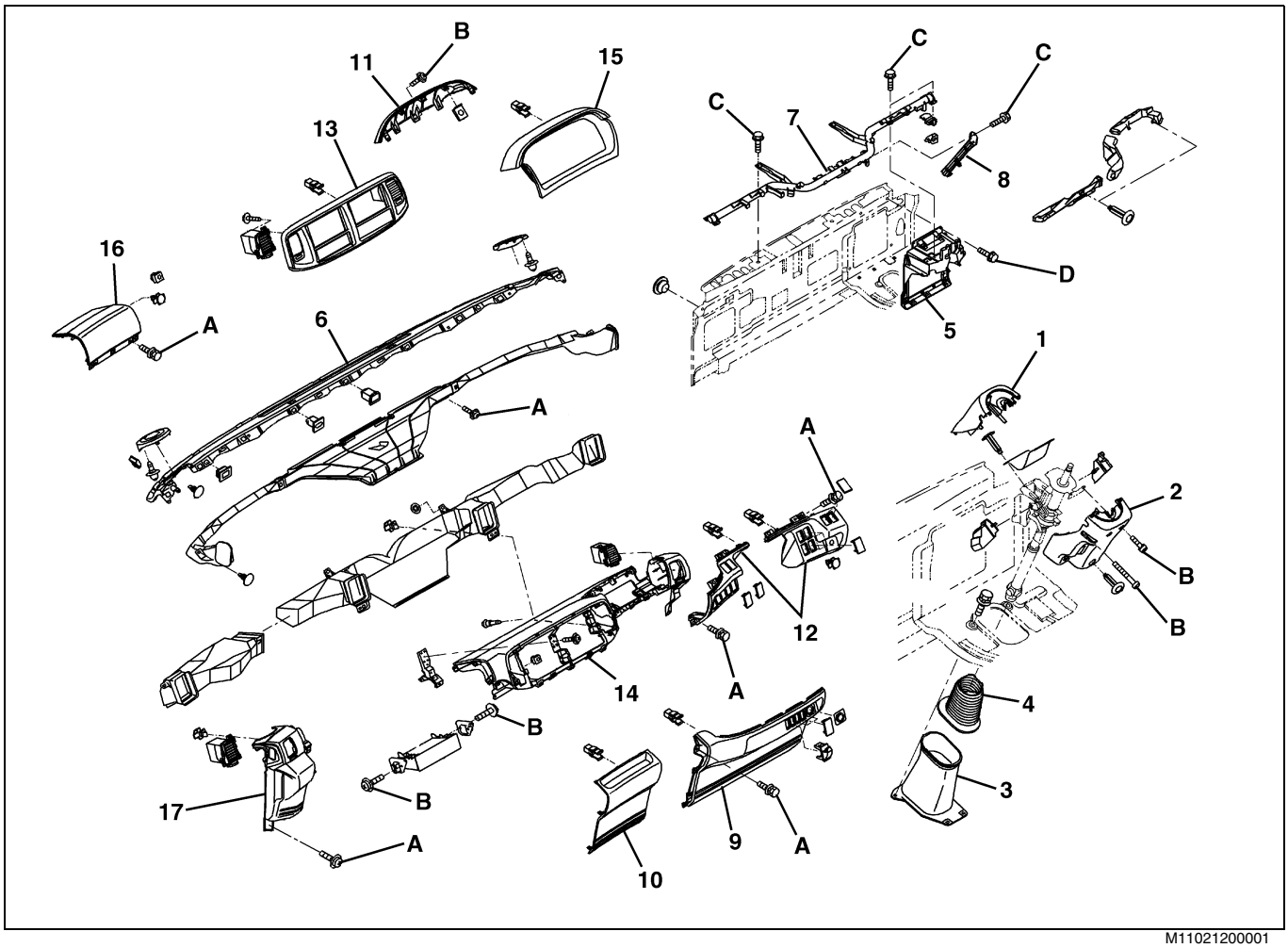
**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 29-55 {296-560, 22-40} | B | 4.5-10.5 {46-107, 3.3-7.7} |

# INSTRUMENT PANEL

## COMPONENT LOCATOR

M11021201BED1001




M11021200001

| | | | |
|---|---|---|---|
| 1 | Steering column upper cover | 10 | Lower left cover |
| 2 | Steering column lower cover | 11 | Panel upper cover |
| 3 | Steering column lower tube | 12 | Switch board panel |
| 4 | Steering column lower boots | 13 | Cluster finish panel |
| 5 | Pedal bracket support | 14 | Cluster housing |
| 6 | Upper panel | 15 | Cluster bezel |
| 7 | Instrument panel cross member | 16 | Upper left cover |
| 8 | Gusset | 17 | Side cover |
| 9 | Lower center cover | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

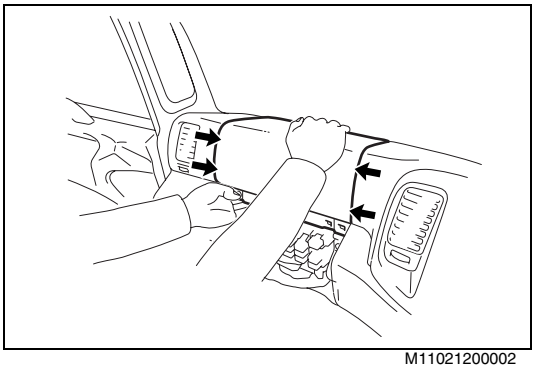
| | | | |
|---|---|---|---|
| A | 2.8-3.2 {29-32, 2.1-2.3} | C | 7.5-16.5 {77-168, 5.6-12.1} |
| B | 1.5-2.5 {16-25, 1.2-1.8} | D | 9.5-16.5 {96-168, 7.0-12.1} |

# DISMOUNTING AND MOUNTING

M11021201BEH1001

**1. BEFORE REMOVE THE INSTRUMENT PANEL.**

(1) Disconnect the battery cable from the battery ground terminal.



M11021200002

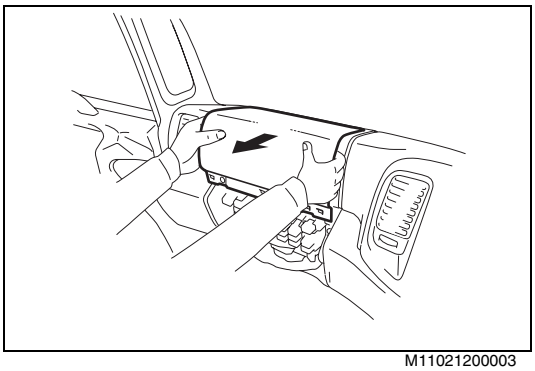
**2. REMOVE THE UPPER LEFT COVER.**

(1) Remove the lower bolt on the upper left cover.

(2) Pull the upper left cover toward you, remove the 4 clips of this side.

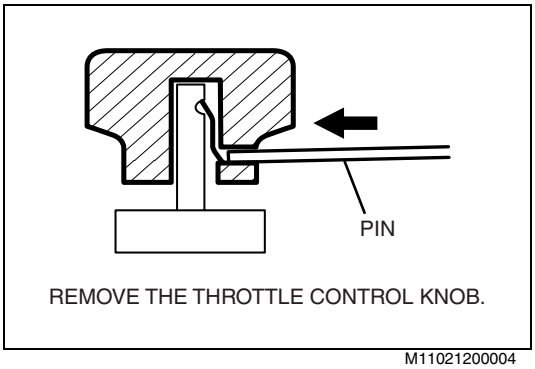
**CAUTION:**

- **When pulling the upper left cover, be careful not to damage the clips.**
- **Be sure to remove the 4 clips of this side previously because pulling out the upper left cover at one time may damage it.**



M11021200003

(3) Pull the upper left cover straight with both hands to remove the inner clip and remove the upper left cover.




REMOVE THE THROTTLE CONTROL KNOB.

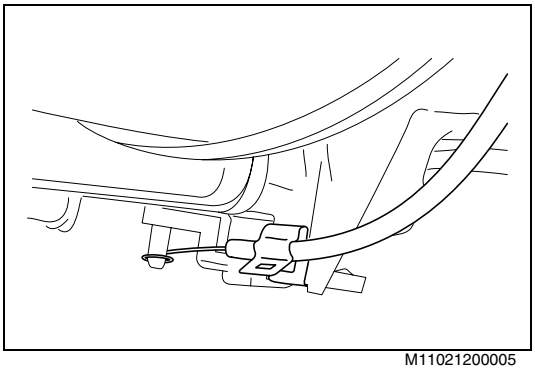
M11021200004

**3. REMOVE THE SWITCH BOARD PANEL.**

(1) Remove the throttle control knob.

(2) Remove the wire of the front lid opener.

(3) Remove the bolt and pull out the switch board panel.



M11021200005

**4. REMOVE THE INSTRUMENT PANEL CLUSTER.**

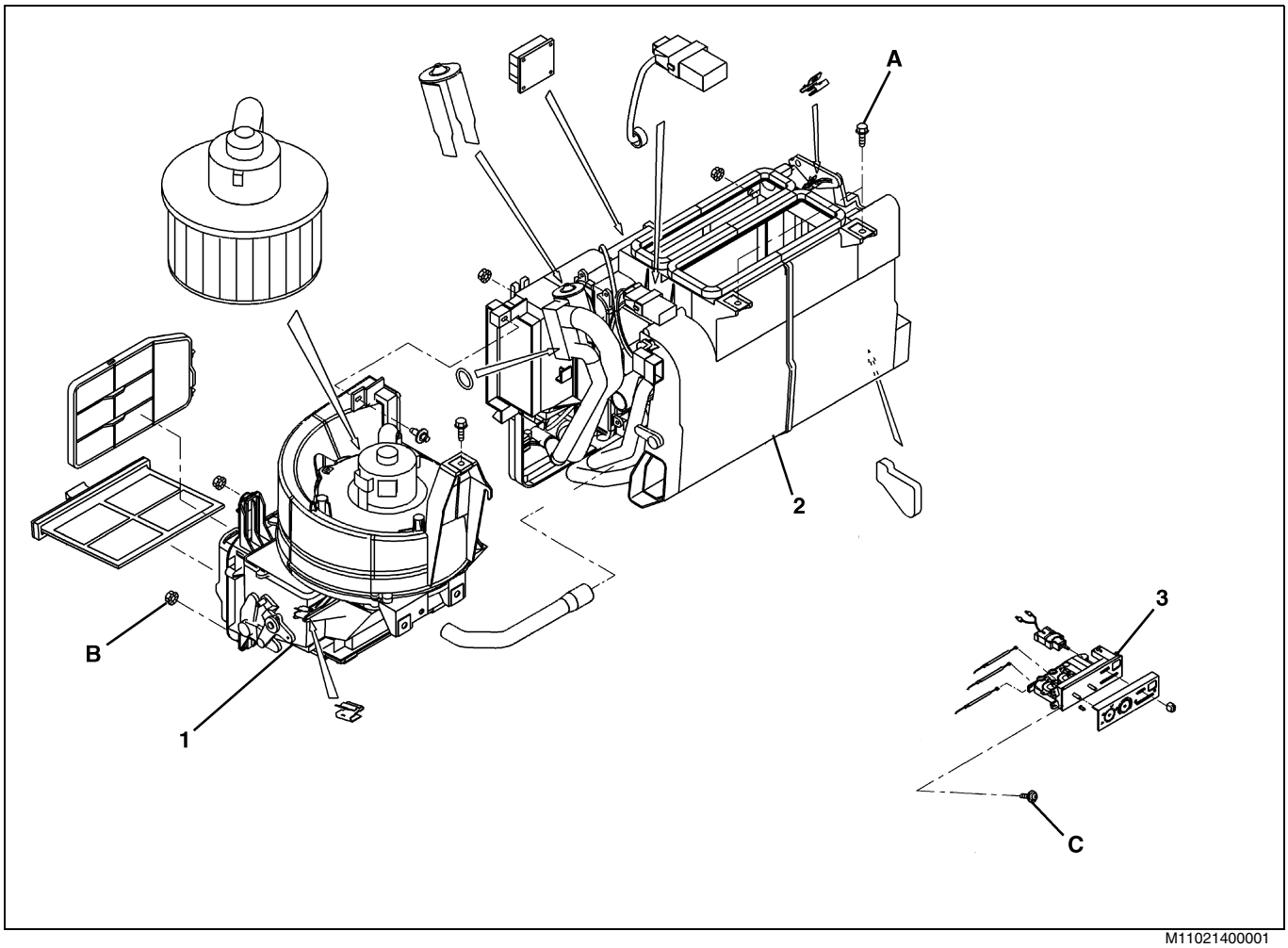
(1) Remove the cable of the blower part.

(2) Loosen the bolt to remove the instrument panel cluster.

# HEATER AND AIR CONDITIONER

## COMPONENT LOCATOR

M11021301BED1001




M11021400001

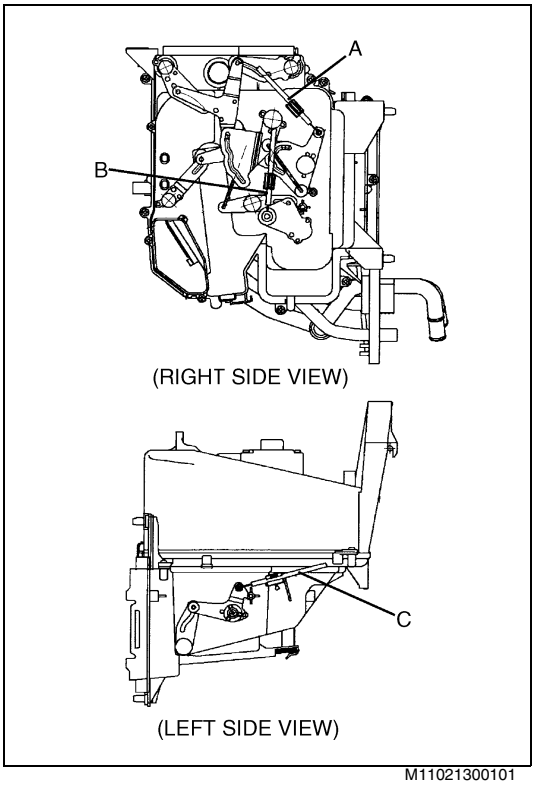
| | | | |
|---|---|---|---|
| 1 | Blower assembly | 3 | Control panel assembly |
| 2 | Air conditioner assembly | | |

**Tightening torque** **Unit: N·m {kgf·cm, lbf·ft}**

| | | | |
|---|---|---|---|
| A | 3.9-4.9 {40-50, 2.9-3.6} | C | 1.4-2.4 {14-24, 1.0-1.7} |
| B | 3.9-4.9 {40-50, 2.9-3.6} | | |

# DISMOUNTING AND MOUNTING

M11021301BEH1001



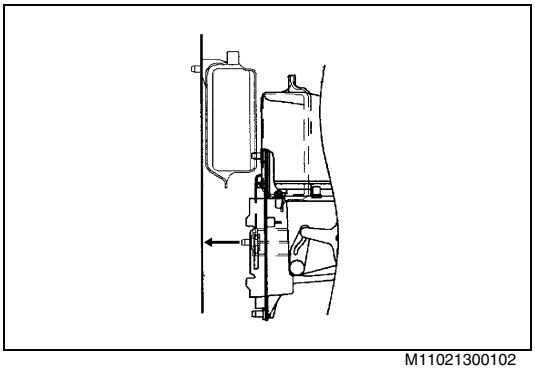

M11021300101

## IMPORTANT POINTS - MOUNTING

**NOTICE:**

- **Should not bend the Inner cable when cable route.**
- **Set the cable at pulled state and make sure the link to boss. Set position is as forrows.**

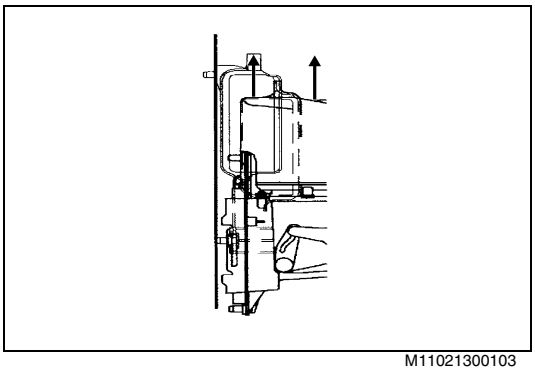
| Cable | Color | Position |
|---|---|---|
| A: Mode switch | GRAY | FACE |
| B: Temperature control | BLACK | MAX COOL |
| C: Inside and outside air switch | NATURAL | INSIDE |



M11021300102

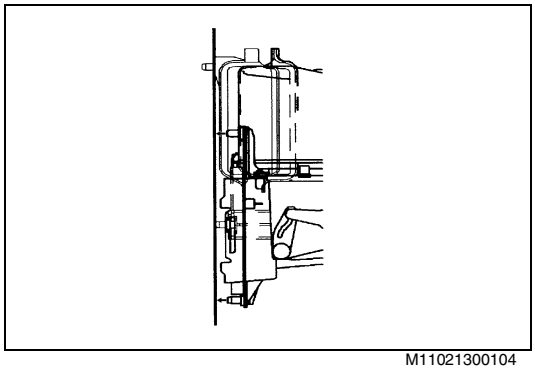
**1. MOUNTING BLOWER ASSEMBLY.**

(1) Blower assembly lower than installation hole, 15 mm and hold to dash panel.



M11021300103

(2) Blower assembly lift 15 mm.



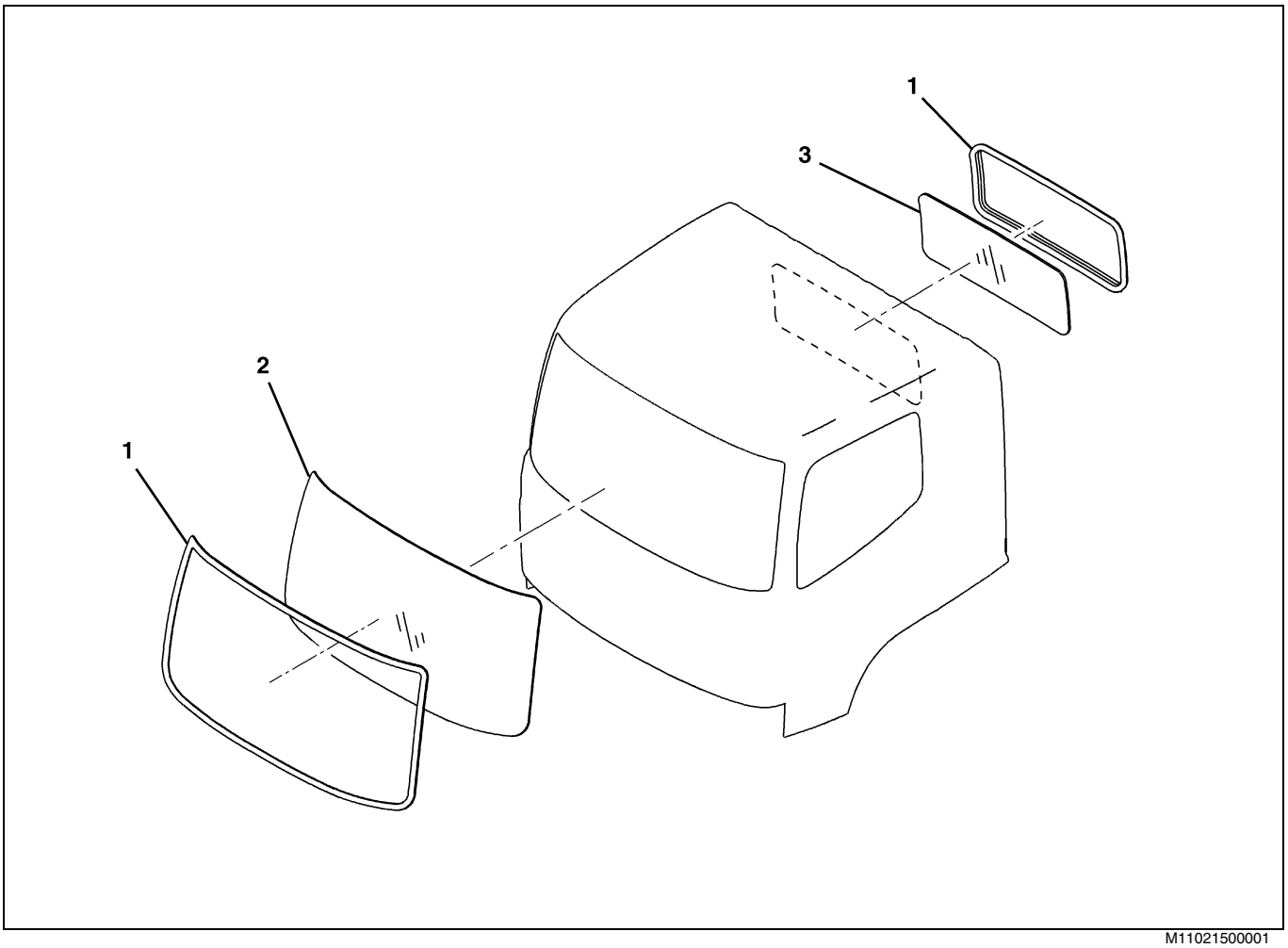
M11021300104

(3) Blower assembly shift to vehicle front way and fit with installation hole.

# WINDSHIELD

## COMPONENT LOCATOR

M11021501BED1001




M11021500001

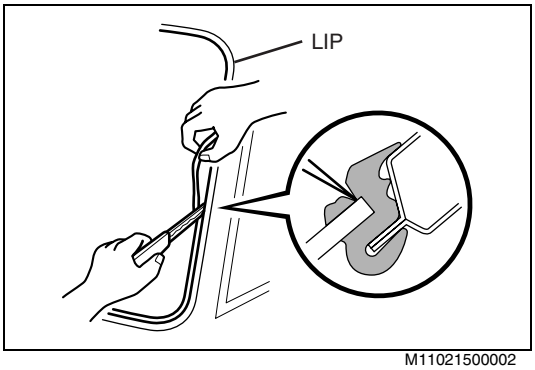
| | | | |
|---|---|---|---|
| 1 | Weatherstrip | 3 | Back wind |
| 2 | Windshield glass | | |

## REPLACEMENT

M11021501BEH1001

**1. BEFORE REPLACE THE WINDSHIELD.**

(1) Remove the windshield wiper.

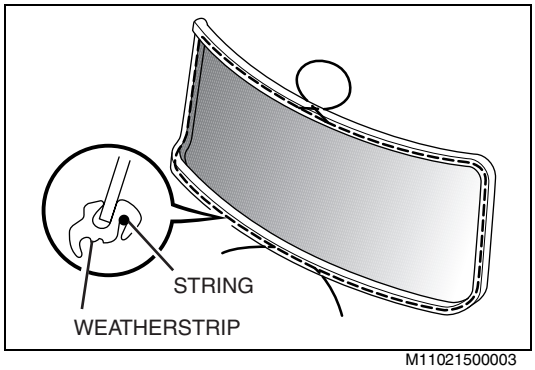



M11021500002

**2. REMOVE THE WINDSHIELD.**

(1) Cut the lip of the weatherstrip with a knife.

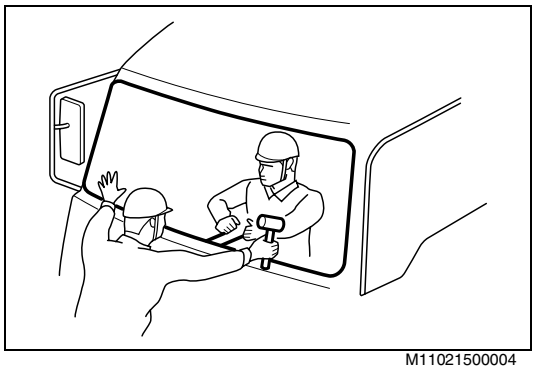
(2) The windshield is heavy so remove it using at least two persons.



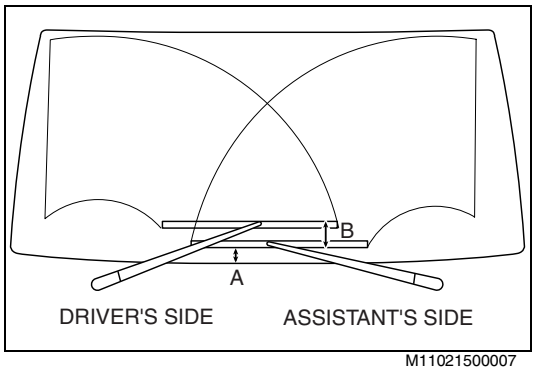
M11021500003

**3. MOUNTING THE WINDSHIELD.**

(1) Clean the weatherstrip, mounting flange of cab and contact surface of the window.
(2) Repair any wavy area at the mounting flange as necessary.
(3) Insert the working string as shown in the figure.


M11021500004

(4) Pull the working string from the interior of the cab, and gradually install the lip of the weatherstrip on the mounting flange.
(5) During this operation, knock the glass from outside. Use soapy water as necessary.
(6) After install the glass properly, knock the glass from inside and outside.



M11021500007

**4. INSTALL THE WINDSHIELD WIPER.**

(1) Install the wiper arm.

**Assembly standard:** Unit: mm {in.}

| Driver's side clearance (A) | Assistant's side clearance (B) |
|---|---|
| 30-50 {1.2-1.9} | 70-90 {2.8-3.5} |

# ELECTRICAL EQUIPMEMT

EL01-001

**ELECTRICAL PARTS ..... EL01-2**
DATA AND SPECIFICATIONS ..... EL01-2
COMPONENT LOCATOR ..... EL01-3
TROUBLESHOOTING ..... EL01-10
GENERAL INSTRUCTION ..... EL01-11
HANDLING PRECAUTION ..... EL01-15
INSPECTION ..... EL01-16
INSPECTION AND ADJUSTMENT ..... EL01-36
SPEEDOMETER
CONVERSION RATE LIST ..... EL01-39

# ELECTRICAL PARTS

## DATA AND SPECIFICATIONS

M12010101BEI2001

### ELECTRICAL SYSTEM

| | |
|---|---|
| Voltage | Direct current 24 volts |
| Ground | Negative (-) ground |

### BULB WATTAGE RATING

| | |
|---|---|
| Head lamp | 75/70W |
| Fog lamp (If so equipped) | 70W |
| Clearance lamp | 5W |
| Front turn signal lamp | 21W |
| Front side turn signal lamp | 12W |
| Dome lamp | 10W |
| Rear turn signal lamp | 25W |
| Stop/tail lamp | 22/5W |
| Back up lamp | 21W |
| License plate lamp | 5W |
| Roof marker lamp | 5W |

### GAUGE TYPE

| | |
|---|---|
| Fuel | Coil type |
| Coolant temperature | Coil type |
| Tachometer | Coil type |
| Speedometer | Coil type |
| Air pressure | Coil type |

# COMPONENT LOCATOR

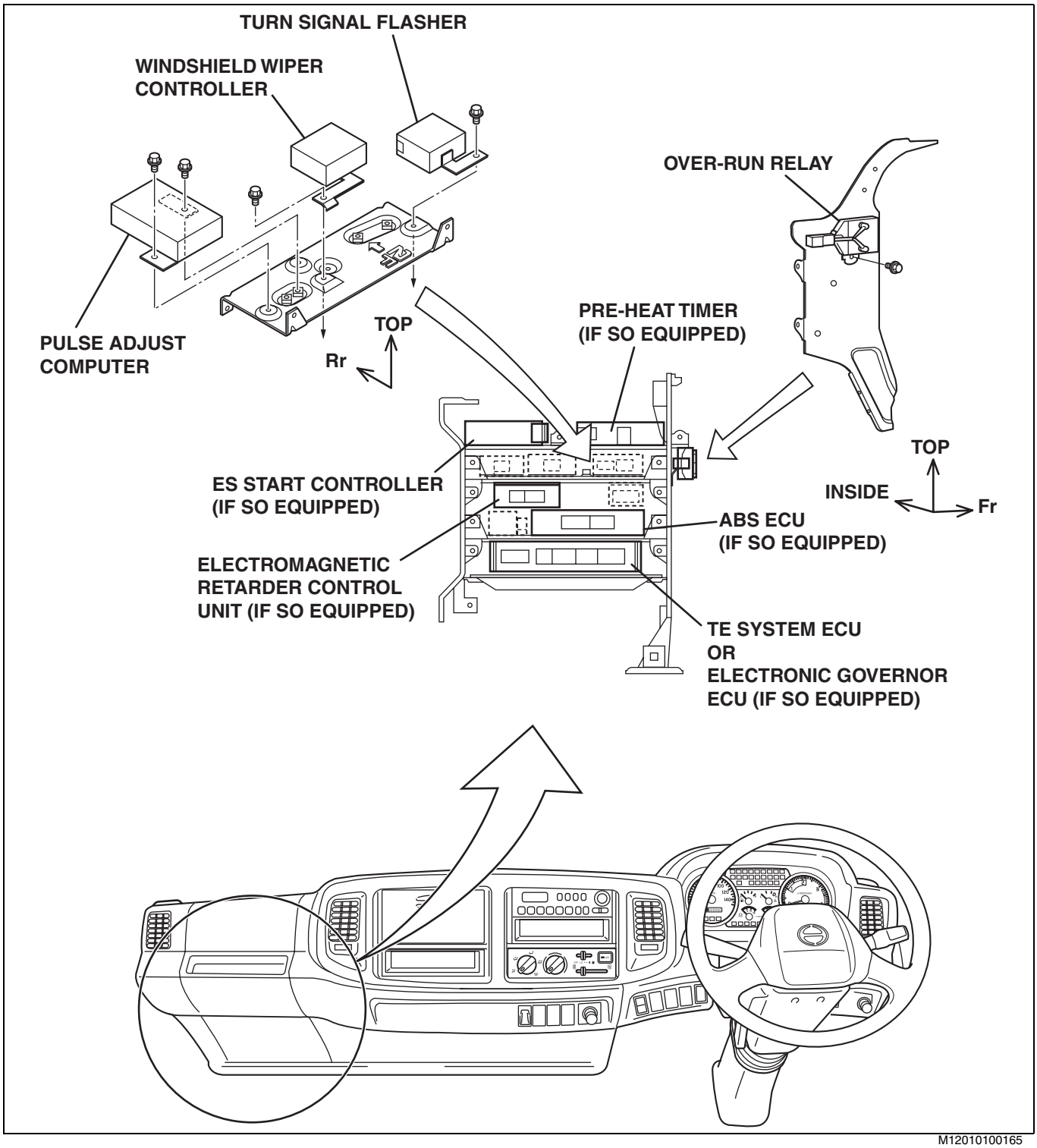
M12010101BED1001

## PARTS INSTALLED POSITION

| PARTS | INSTALLED POSITION | PARTS | INSTALLED POSITION |
|---|---|---|---|
| HEAD LAMP RELAY (HIGH,LOW) | RELAY PANEL | EXHAUST BRAKE CUT RELAY (FOR ABS) (IF SO EQUIPPED) | RELAY PANEL |
| POWER RELAY No.1,2,3,4 | | CAB TILT UP RELAY (IF SO EQUIPPED) | |
| TAIL LAMP RELAY No.1,2 | | CAB TILT DOWN RELAY (IF SO EQUIPPED) | |
| LAMP CHECK RELAY | | TRANSMISSION P.T.O. RELAY (IF SO EQUIPPED) | |
| ACTUATOR POWER RELAY | | LO-HI INDICATOR LAMP RELAY (IF SO EQUIPPED) | |
| ENGINE STOP MOTOR RELAY | | REAR POWER WINDOW RELAY (IF SO EQUIPPED) | |
| STOP LAMP RELAY | | DC-DC CONVERTER (FOR SPARE POWER SOURCE) | INSTRUMENT PANEL CENTER |
| FOG LAMP RELAY (IF SO EQUIPPED) | | DC-DC CONVERTER (MODELS EQUIPPED WITH HEAD LAMP LEVELING CONTROL SWITCH) | |
| HORN RELAY | | | |
| HEATER RELAY | | DOOR LOCK CONTROLLER (IF SO EQUIPPED) | |
| AIR CONDITIONER RELAY (IF SO EQUIPPED) | | POWER MIRROR RELAY (IF SO EQUIPPED) | |
| AIR CONDITIONER CONDENSER RELAY (IF SO EQUIPPED) | | TURN SIGNAL FLASHER | ECU RACK |
| AUTOMATIC TRANSMISSION NEUTRAL RELAY (IF SO EQUIPPED) | | OVER-RUN RELAY | |
| EXHAUST BRAKE CUT RELAY (FOR AUTOMATIC TRANSMISSION ) (IF SO EQUIPPED) | | WINDSHIELD WIPER CONTROLLER | |
| AUTOMATIC TRANSMISSION BACK-UP LAMP RELAY (IF SO EQUIPPED) | | PULSE ADJUST COMPUTER | |
| POWER ACCESSORY RELAY | | ABS ECU (IF SO EQUIPPED) | |
| ECU MAIN RELAY | | ES START CONTROLLER (IF SO EQUIPPED) | |
| ABS WARNING LAMP RELAY (IF SO EQUIPPED) | | TE SYSTEM ECU | |
| ABS CONTROL VALVE RELAY (IF SO EQUIPPED) | | PRE-HEAT TIMER (IF SO EQUIPPED) | |
| | | ELECTROMAGNETIC RETARDER CONTROL UNIT (IF SO EQUIPPED) | |

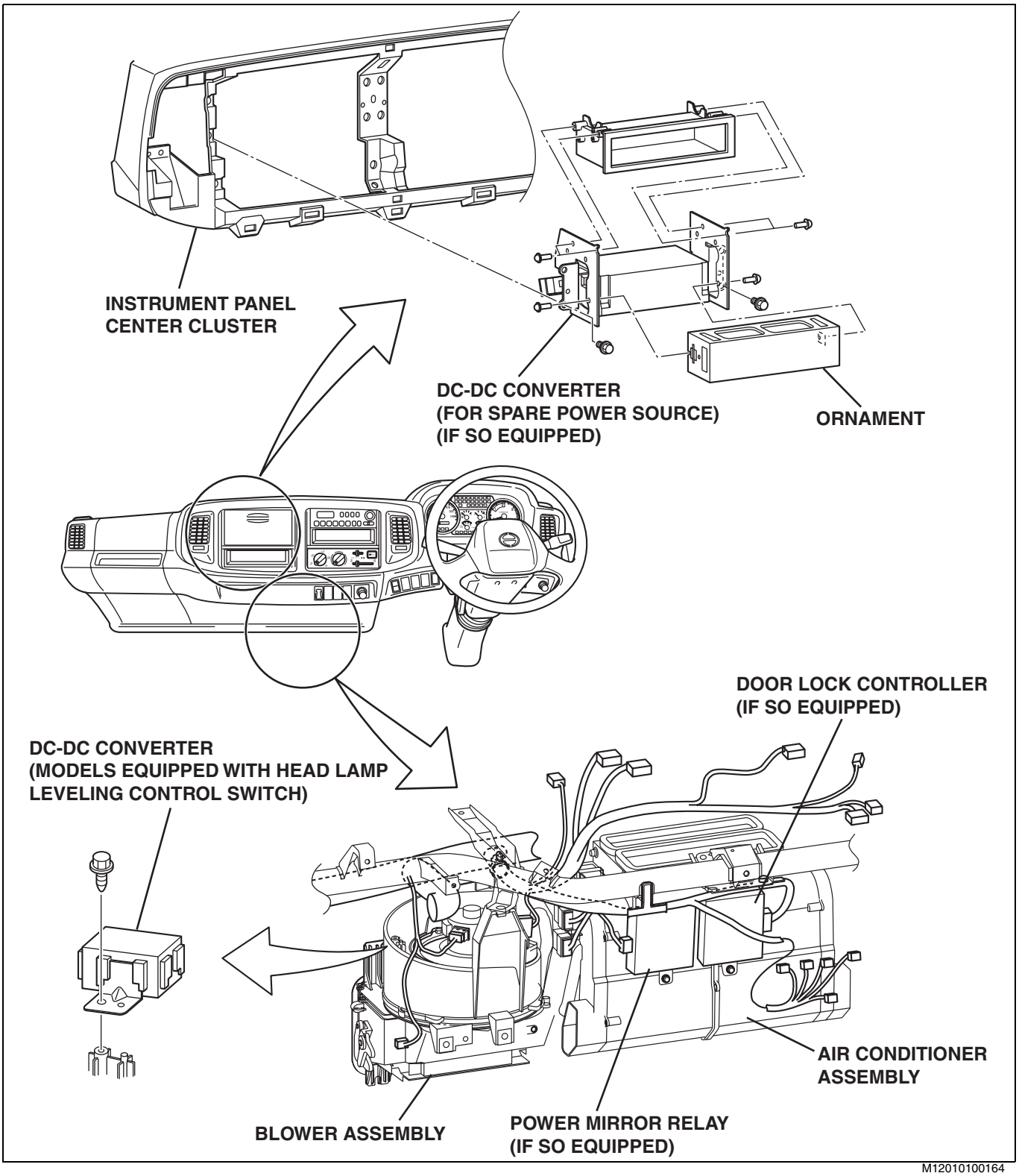
| PARTS | INSTALLED POSITION | PARTS | INSTALLED POSITION |
|---|---|---|---|
| ENGINE STOP ELECTRIC MOTOR | FRONT PANEL | STARTER RELAY | REAR CAB MOUNTING |
| WINDSHIELD WIPER MOTOR | | PRE-HEATER RELAY (IF SO EQUIPPED) | |
| WINDSHIELD WASHER MOTOR (WASHER JAR) | | FUSIBLE LINK | |
| ACCELERATOR PEDAL SWITCH | PEDAL BRACKET | CAB TILT LOCK SWITCH (IF SO EQUIPPED) | |
| CLUTCH PEDAL SWITCH | | CAB TILT STOPPER SWITCH (IF SO EQUIPPED) | CAB TILT CYLINDER |
| CLUTCH STROKE SENSOR (IF SO EQUIPPED) | | BRAKE STROKE WARNING SWITCH | BRAKE AIR BOOSTER |
| STOP LAMP SWITCH | | FUEL GAUGE SENDER UNIT | FUEL TANK |
| COOLANT TEMPERATURE GAUGE SENDER UNIT | ENGINE | NEUTRAL SWITCH | TRANSMIS-SION |
| OIL PRESSURE SWITCH | | BACK-UP LAMP SWITCH | |
| REVOLUTION SENSOR | | | |

## ECU RACK



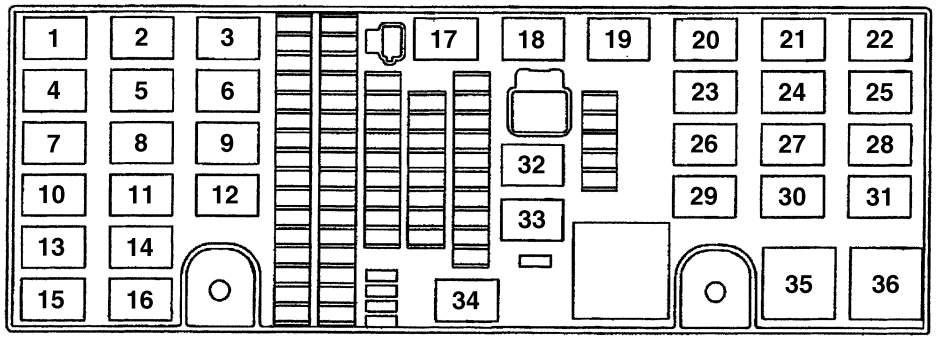

M12010100165

## INSTRUMENT PANEL




M12010100164

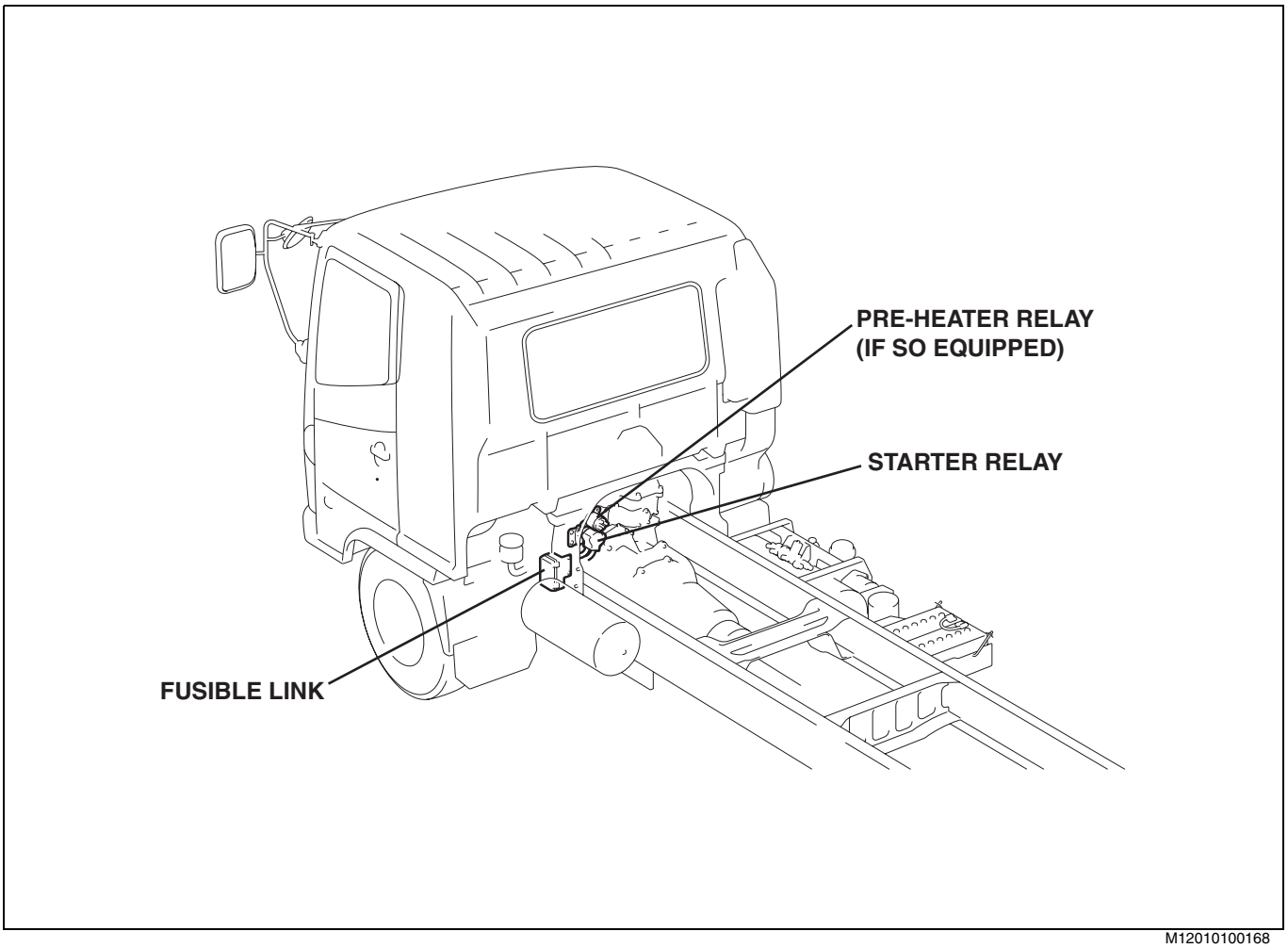
## RELAY PANEL




M12010100107

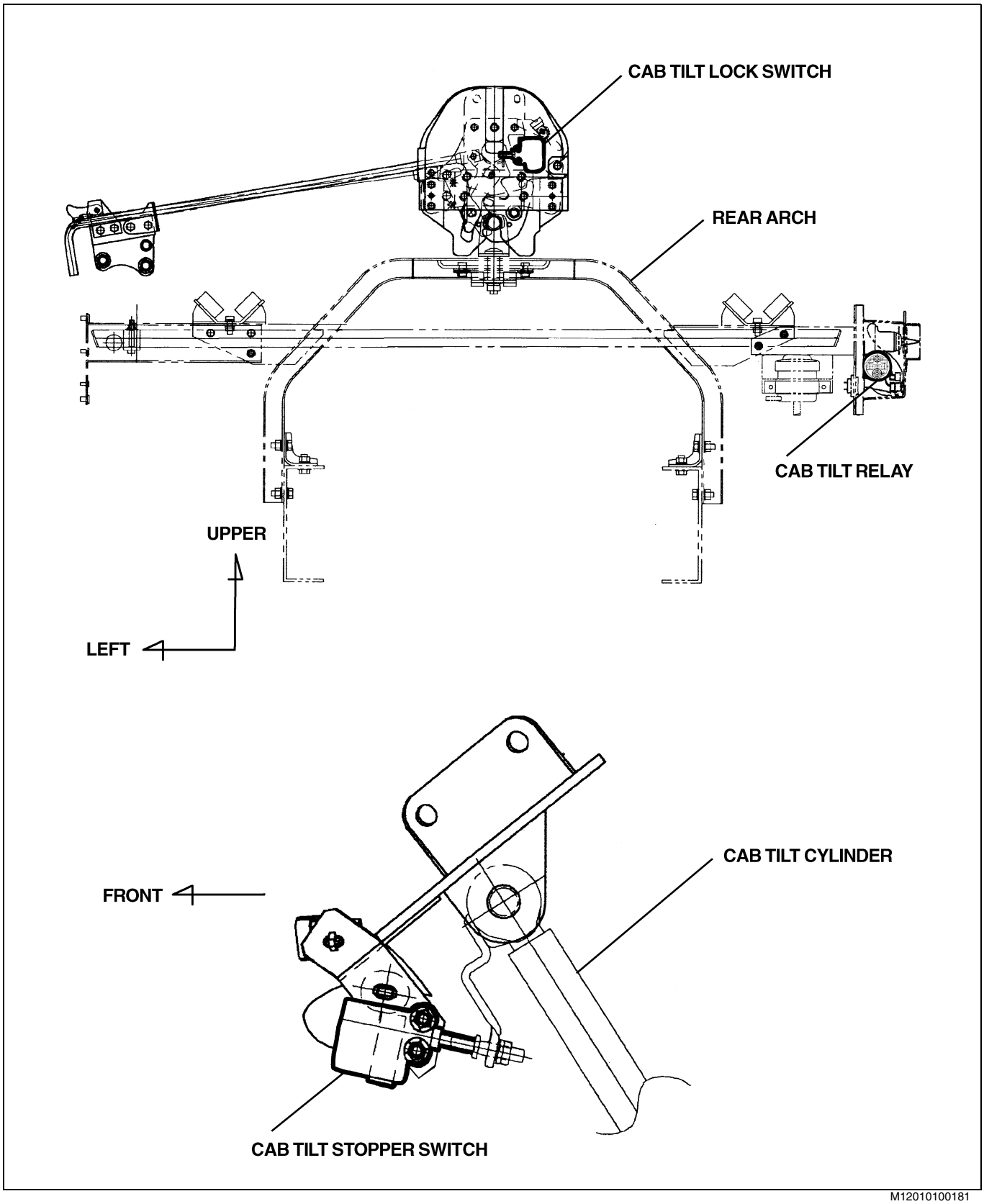
| | | | | | |
|---|---|---|---|---|---|
| 1 | Exhaust brake cut relay (For ABS) (If so equipped) | 13 | Transmission P.T.O. relay (If so equipped) | 25 | Heater relay |
| 2 | ABS warning lamp relay (If so equipped) | 14 | Lo-Hi indicator lamp relay (If so equipped) | 26 | Disengaged |
| 3 | ABS control valve relay (If so equipped) | 15 | Rear power window relay (If so equipped) | 27 | Lamp check relay |
| 4 | Automatic transmission neutral relay (If so equipped) | 16 | Disengaged | 28 | Horn relay |
| 5 | Exhaust brake cut relay (For automatic transmission) (If so equipped) | 17 | Power relay No.1 | 29 | Fog lamp relay (If so equipped) |
| 6 | Automatic transmission back-up lamp relay (If so equipped) | 18 | Power relay No.3 | 30 | Head lamp relay (Low) |
| 7 | Disengaged | 19 | Power relay No.2 | 31 | Head lamp relay (High) |
| 8 | Disengaged | 20 | Power relay No.4 | 32 | Tail lamp relay No.1 |
| 9 | Disengaged | 21 | Power accessory relay | 33 | Tail lamp relay No.2 |
| 10 | Cab tilt down relay (If so equipped) | 22 | ECU main relay | 34 | Actuator power relay |
| 11 | Cab tilt up relay (If so equipped) | 23 | Air conditioner relay (If so equipped) | 35 | Engine stop motor relay |
| 12 | Disengaged | 24 | Air conditioner condenser relay (If so equipped) | 36 | Stop lamp relay |

## REAR CAB MOUNTING




M12010100168

## REAR CAB MOUNTING (DOUBLE CAB ONLY)




M12010100181

# TROUBLESHOOTING

M12010113BEF3001

## STARTING SYSTEM

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Engine does not operate (Starter switch)** | Poor contact condition | Clean or replace contacts. |
| **Engine does not operate (Battery)** | Open circuit in harness | Check and correct. |
| | Short circuit between electrodes | Replace battery. |
| | Poor contact condition of battery terminal | Clean or retighten. |
| **Engine does not operate (Engine oil)** | Improper viscosity oil | Change oil. |
| **Engine does not operate (Starter relay)** | Defective or poor contact of starter relay | Repair or replace. |
| **Engine does not operate (Starter)** | Starter does not operate | Repair or replace. Refer to chapter STARTER. |

## HEAD LAMP CIRCUIT

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Head lamp does not turn on (Head lamp)** | Bulb burned out | Replace bulb. |
| | Not grounded | Check the grounding. |
| **Head lamp does not turn on (Fuse)** | Fuse burned out | Replace fuse. |
| **Head lamp does not turn on (Head lamp relay)** | Defective relay | Replace relay. |
| **Head lamp does not turn on (Lighting switch)** | Broken wire between relay and switch | Repair wire. |
| | Defective switch | Replace switch. |

## TURN SIGNAL CIRCUIT

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Turn signal does not work (Turn signal lamp)** | Bulb burned out | Replace bulb. |
| | Broken wire | Repair wire. |
| **Turn signal does not work (Fuse)** | Fuse burned out | Replace fuse. |
| **Turn signal does not work (Turn signal flasher)** | Not grounded | Check the grounding. |
| | Defective flasher | Replace flasher. |
| **Turn signal does not work (Turn signal switch)** | Broken wire between fuse and switch | Repair wire. |
| | Defective switch | Replace switch. |

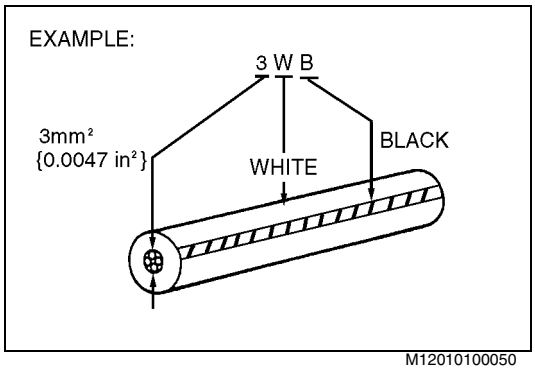
## TAIL AND LICENSE PLATE LAMP CIRCUIT

| Symptom | Possible cause | Remedy/Prevention |
|---|---|---|
| **Tail and license plate lamp does not turn on (Lamp)** | Bulb burned out | Replace bulb. |
| | Not grounded | Check the grounding. |
| **Tail and license plate lamp does not turn on (Fuse)** | Fuse burned out | Replace fuse. |
| **Tail and license plate lamp does not turn on (Tail lamp relay)** | Defective relay | Replace relay |
| **Tail and license plate lamp does not turn on (Lighting switch)** | Broken wire between fuse and switch | Replace wire. |
| | Defective switch | Replace switch. |

# GENERAL INSTRUCTION

M12010101BEC1001

**CAUTION:**
**Be sure to disconnect the ground cable before servicing the electrical circuits except for testing on-vehicle.**



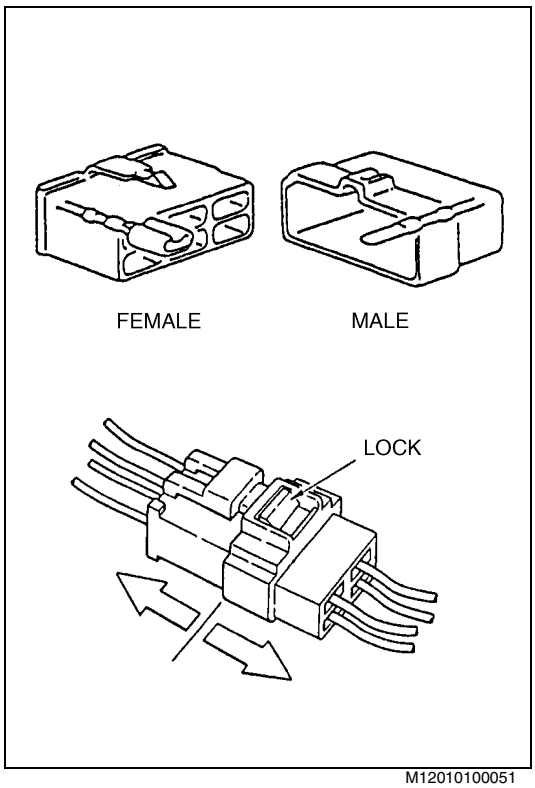
M12010100050

## 1. WIRING CODE

(1) Wiring colors are indicated by a code.

| | | | |
|---|---|---|---|
| B | : Black | Lg | : Light green |
| Br | : Brown | R | : Red |
| G | : Green | W | : White |
| L | : Blue | Y | : Yellow |

(2) The first letter indicates the ground wire color and second letter indicated the strip color.
(3) Arabic numerals indicates the cross sectional area of wire.
**Example: 3 indicates 3 $mm^2$ {0.0047 $in^2$}**

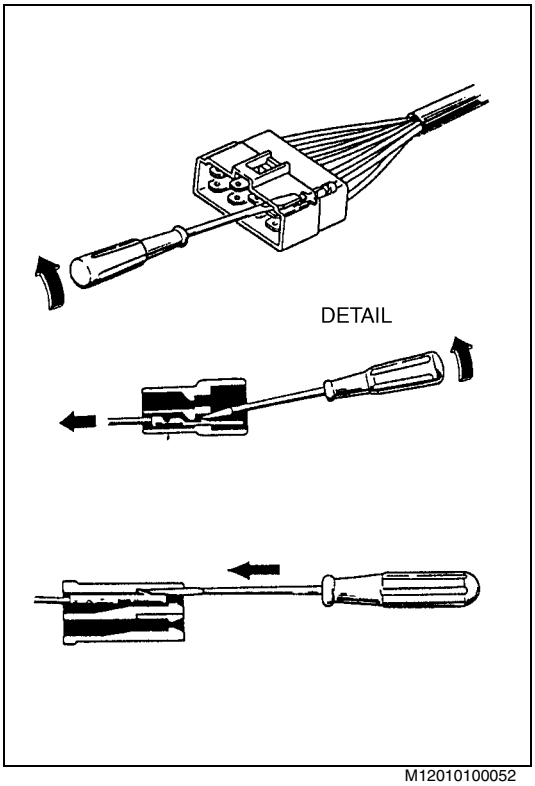


M12010100051

## 2. CONNECTOR

(1) The connector consists of the male and female connectors.
Male and female connectors are classified according to the shape of the terminals in the connector.
Male and female connectors are provided with a lock, so that they can not be separated easily.
To separate the connectors, unlock the lock, then hold one connector with one hand and the other one with the other hand, and pull each other.

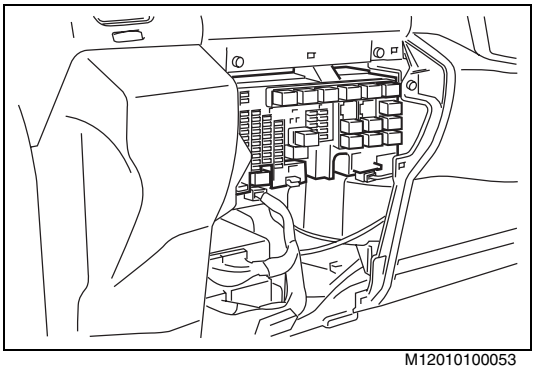
**NOTICE:**
**When the connector is disconnected by pulling the wires, the connection between the terminals and the wires will be damaged.**



M12010100052

(2) Removing the terminal from the connector.
   a. Insert a miniature screwdriver or a terminal puller between terminal and connector, and unlock the lock between terminal and connector.
   b. When the lock has been released, pull the wire to remove the terminal.

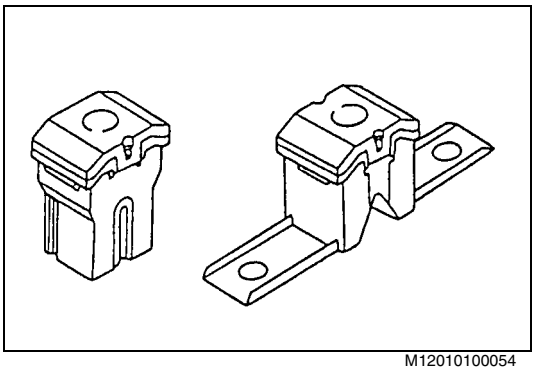
(3) Installing the terminal in the connector.
   a. Insert the terminal into the connector until it clicks.
   b. Pull the wire to confirm correct lock engagement.


M12010100053

**3. FUSE**

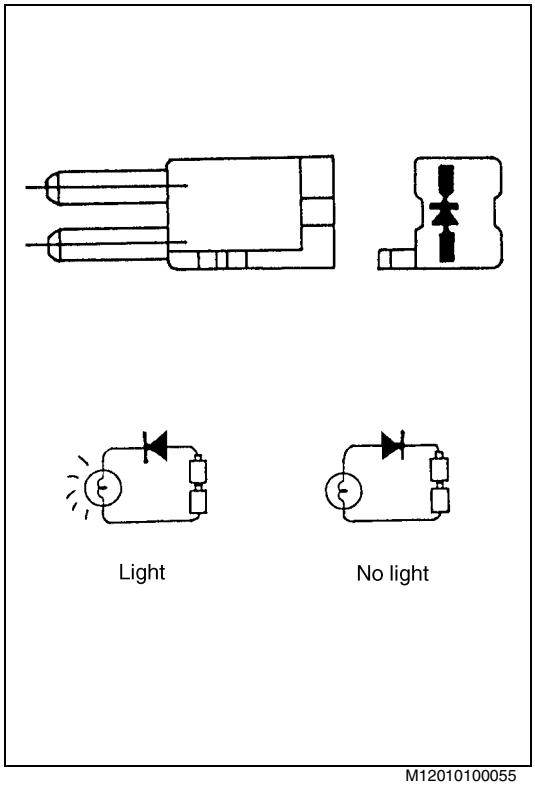
(1) The power supply must be switched off for fuse replacement.
Use a proper amperage fuse.

**NOTICE:**
**Wire burning may be caused when a fuse with an excessively large current capacity is used.**
**If the fuse should blow frequently, investigate the cause and correct it.**


M12010100054

**4. FUSIBLE LINK**

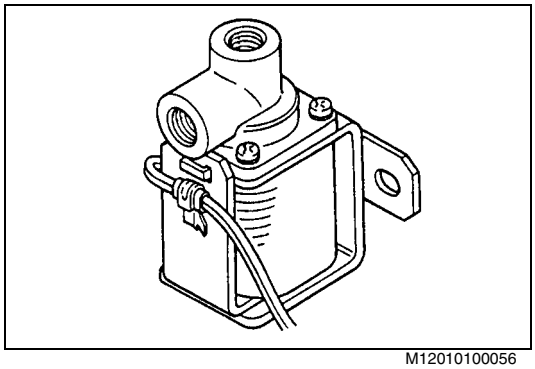
(1) The cause of an overload current should be determined and corrected before a melted fusible link is replaced.
A melted fusible link can be determined swollen or melted insulation of the link.



M12010100055

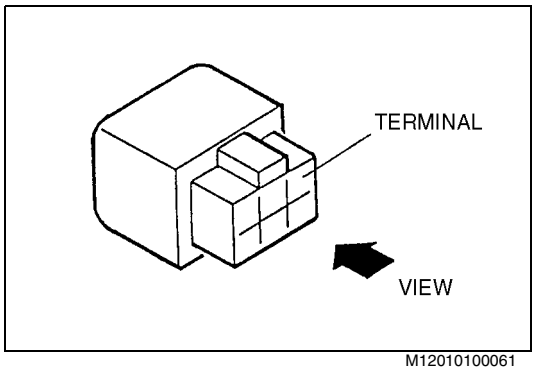
**5. DIODE**

(1) Diode allows the flow of electric current in only one direction.


M12010100056

**6. SOLENOID VALVE**

(1) Solenoid valve controls the current of compressed air by electric. Check the continuity between terminals. If there is no continuity, replace the solenoid valve.

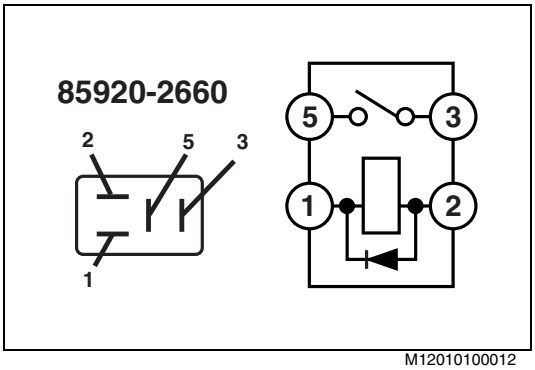


M12010100061

## RELAY (TYPE, NAME AND INSPECTION)

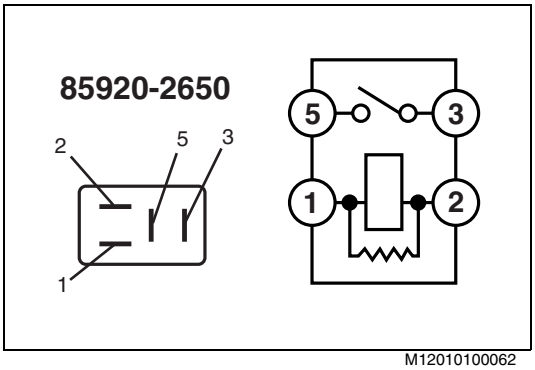
TYPE-1: Head lamp relay (High, low)
Fog lamp relay (If so equipped)
Horn relay
Tail lamp relay No.1, 2
Air conditioner relay (If so equipped)
Air conditioner condenser relay
(If so equipped)
Heater relay
ECU main relay
ABS control valve relay (If so equipped)
Automatic transmission neutral relay
(If so equipped)
Exhaust brake cut relay (For automatic transmission)
(If so equipped)
Automatic transmission back-up lamp relay
(If so equipped)
Cab tilt up relay (If so equipped)
Cab tilt down relay (If so equipped)
Rear power window relay (If so equipped)
Transmission P.T.O. relay (If so equipped)

TYPE-2: Power relay No.1, 2, 3, 4
Power accessory relay
Lamp check relay
TYPE-3: Stop lamp relay
TYPE-4: Engine stop motor relay
TYPE-5: Actuator power relay
TYPE-6: Exhaust brake cut relay (For ABS) (If so equipped)
ABS warning lamp relay (If so equipped)
Lo-Hi indicator lamp relay (If so equipped)



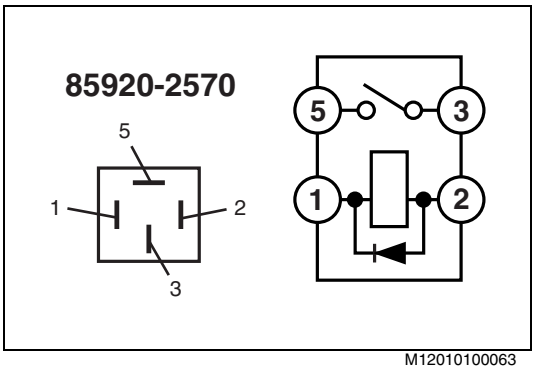
M12010100012

**1. TYPE-1 INSPECTION**
(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.
(2) Under normal condition, terminals 3 and 5 switch on.



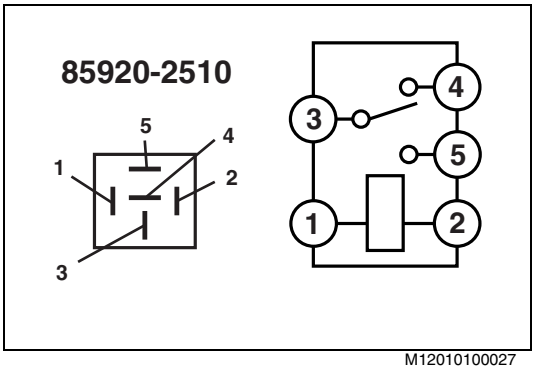
M12010100062

**2. TYPE-2 INSPECTION**
(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.
(2) Under normal condition, terminals 3 and 5 switch on.



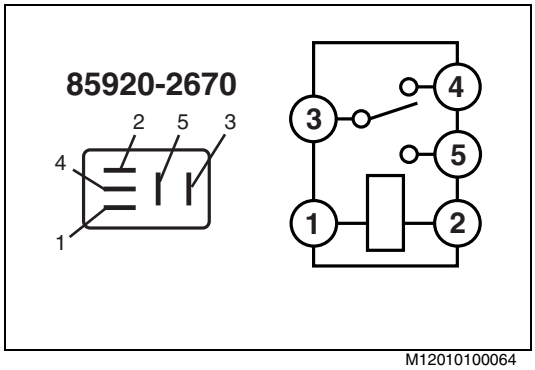
M12010100063

**3. TYPE-3 INSPECTION**
(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.
(2) Under normal condition, terminals 3 and 5 switch on.



M12010100027

**4. TYPE-4 INSPECTION**
(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.
(2) Under normal condition, relay switches the continuity from terminals 3 and 4 to 3 and 5.

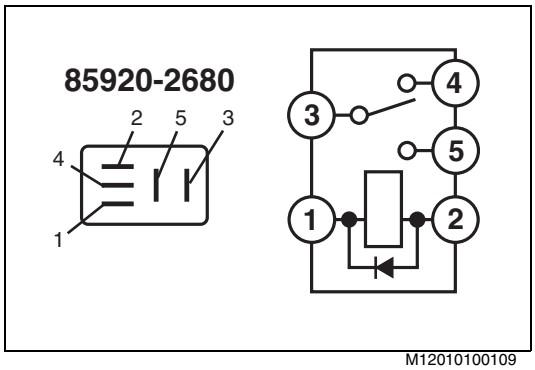


M12010100064

**5. TYPE-5 INSPECTION**

(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, relay switches the continuity from terminals 3 and 4 to 3 and 5.



M12010100109

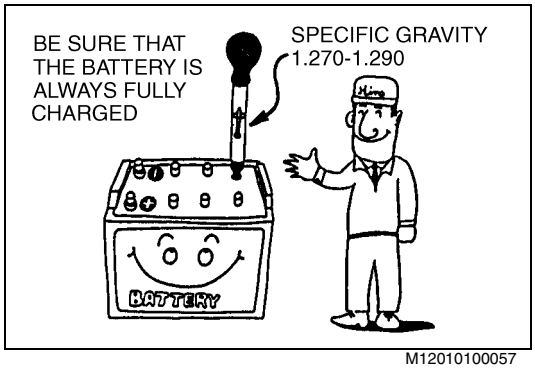
**6. TYPE-6 INSPECTION**

(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, relay switches the continuity from terminals 3 and 4 to 3 and 5.

# HANDLING PRECAUTION

M12010113BEC1002



M12010100057

## BATTERY

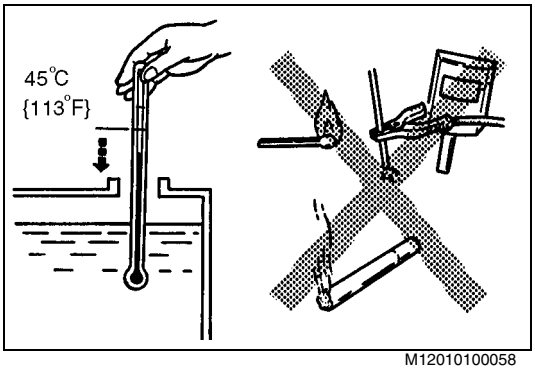
**1. CONVERSION FORMULA FOR SPECIFIC GRAVITY**

(1) The specific gravity of the electrolyte changes according to the temperature of the electrolyte itself, therefore a temperature of 20°C {68°C} is used as reference temperature.
Consequently, if the temperature is not 20°C when the specific gravity is measured, it is necessary to convent the measured value to value calculated under the following conversion formula at 20°C.
**Temperature conversion formula: S20=St+0.0007(t-20)**

(2) Where,

- "S20" is the specific gravity at 20°C (Reference temperature)
- "St" is the specific gravity at the measuring temperature
- "t" is the temperature during measurement
- "0.0007" is the temperature coefficient of the electrolyte

**NOTICE:**
**As a rough guide, if the temperature of the electrolyte rises or falls by 15°C (59°F), the specific gravity of the electrolyte will vary by about 0.01.**



M12010100058

**2. BATTERY CHARGING**

- Be careful of the following points.

(1) While the battery is being charged, ensure that the temperature of the electrolyte does not rise above 45°C {113°F}.
(2) While the battery is being charged, be particularly careful to keep it away from sources of fire.
(3) The amount of electrolyte must be within the specified level.
**Specific gravity when battery is fully charged:**
**1.270-1.290 at 20°C {68°F}**

**3. CLEANING THE BATTERY**

- If the terminals at the top of the battery are dirty, clean them with cold water or lukewarm water.
- Apply a light coating of grease to the terminals to prevent them from rusting so as to prevent faulty contact.

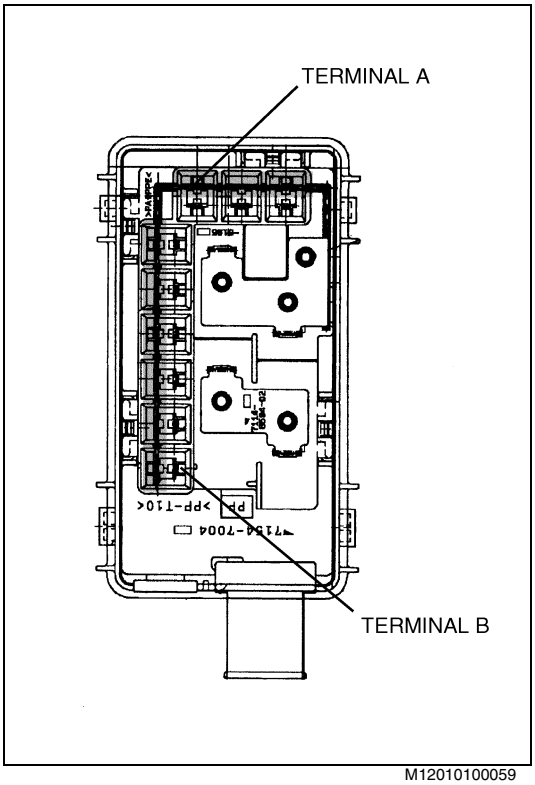
**4. CONNECTING THE BATTERY CABLES**

- Clamp the cables securely to prevent improper contact between the cables and the battery terminals.
- Be very careful not to connect the (+) and (-) leads in reverse. (Because this may cause damage to the equipment and batteries)

# INSPECTION

M12010101BEH3001

## POWER SUPPLY CIRCUIT

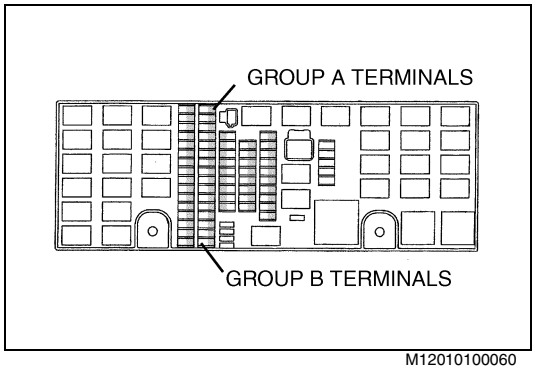


M12010100059

**1. FUSIBLE LINK BLOCK INSPECTION**

(1) Check the voltage between fusible link block terminal A and chassis body ground.
(2) Under normal condition, the voltage is about 24V.
(3) If it is not correct, check the battery cable, wiring harness, etc.

- Battery cable (Open circuit, loosen connection, etc.)
- Wiring harness (Open circuit, etc.)
- Battery (Discharged)



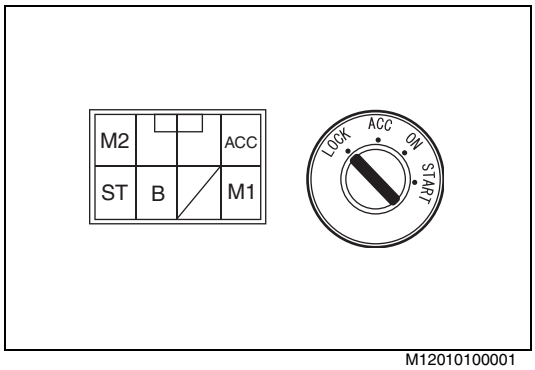
M12010100060

**2. FUSE BLOCK INSPECTION**

(1) Check the voltage between group A terminals of fuse block and cab body ground.
(2) Under normal condition, the voltage is about 24V.
(3) If it is not correct, check the circuit from battery to fuse.

- Coupler connection between cab harness and chassis harness
- Coupler connection of each electrical parts
- Cab harness and chassis harness
  (Open circuit, against short, etc.)
- Fusible link burn out

**NOTICE:**
**Group A terminals: From battery**
**Group B terminals: To each electrical parts**



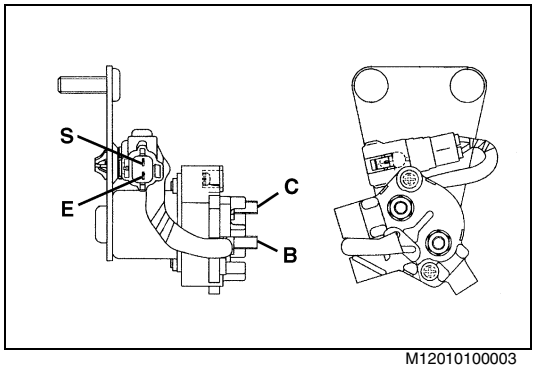
M12010100001

## ENGINE STARTING CIRCUIT

**1. STARTER SWITCH INSPECTION**

(1) Check the continuity between terminals.

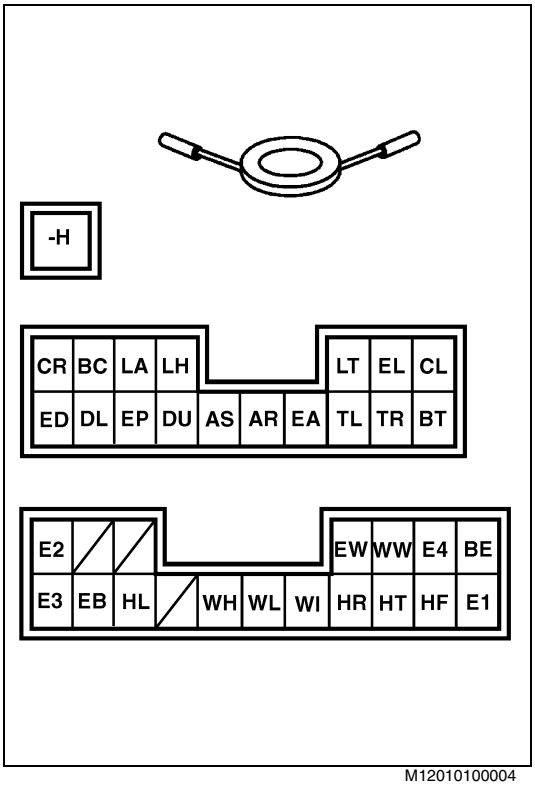
| Terminals / Switch position | B | ACC | M2 | M1 | ST |
|---|---|---|---|---|---|
| LOCK | | | | | |
| ACC | ○ | ○ | | | |
| ON | ○ | ○ | ○ | ○ | |
| ST | ○ | | ○ | ○ | ○ |



M12010100003

**2. STARTER RELAY INSPECTION**

(1) Apply voltage to terminals;
24V to terminal S,
Ground to terminal E.
(2) Under normal condition, terminals C and B switch on.



M12010100004

# HEAD LAMP CIRCUIT

## 1. COMBINATION SWITCH INSPECTION

(1) Check the continuity between terminals.

**Lighting (ON, OFF):**

| Switch position \ Terminals | EL | LT | LH |
|---|---|---|---|
| OFF | | | |
| TAIL | ○—— | ——○ | |
| TAIL AND HEAD | ○—— | ——○ | ——○ |

**Lighting (HIGH, LOW):**

| Switch position \ Terminals | ED | DL | DU | EP |
|---|---|---|---|---|
| PASSING | ○—— | ——○ | ○—— | ——○ |
| LOW BEAM | ○—— | ——○ | | |
| HIGH BEAM | ○—— | ———— | ——○ | |

**Turn signal:**

| Switch position \ Terminals | BT | TL | TR |
|---|---|---|---|
| LEFT | ○—— | ——○ | |
| OFF | | | |
| RIGHT | ○—— | ———— | ——○ |

**Hazard warning:**

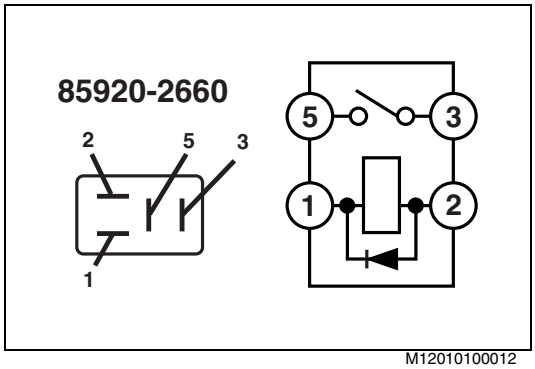
| Switch position \ Terminals | HF | HL | HR | HT |
|---|---|---|---|---|
| OFF | | | | |
| ON | ○—— | ——○ | ——○ | ——○ |

**Exhaust brake and electromagnetic retarder:**

| Switch position \ Terminals | EB | E1 | E3 | BE | E2 |
|---|---|---|---|---|---|
| OFF | | | | | |
| Ⅰ | ○—— | ——○ | | | |
| ↕ | ○—— | ——○ | | | |
| Ⅱ | ○—— | ——○ | | ○—— | ——○ |
| ↕ | ○—— | ——○ | | ○—— | ——○ |
| Ⅲ | ○—— | ——○ | ——○ | ○—— | ——○ |

**Windshield wiper and washer:**

| Switch position \ Terminals | WW | EW | WI | WL | WH |
|---|---|---|---|---|---|
| OFF | | | | | |
| WIPER: INT | | ○—○ | | | |
| MEDIUM | | ○— | | ○ | |
| HIGH | | ○— | | ○ | ○ |
| WASHER: ON | ○ | ○ | | | |



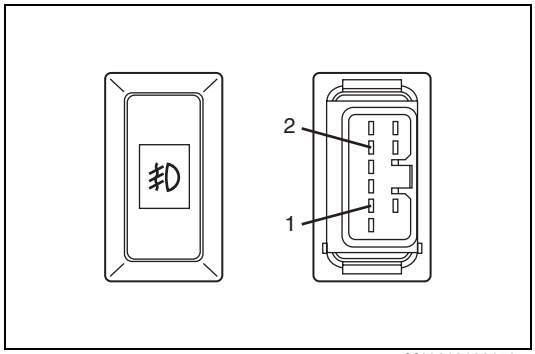
M12010100012

**2. HEAD LAMP RELAY INSPECTION**

(1) Apply voltage terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, terminals 3 and 5 switches on.

## FOG LAMP CIRCUIT (IF SO EQUIPPED)

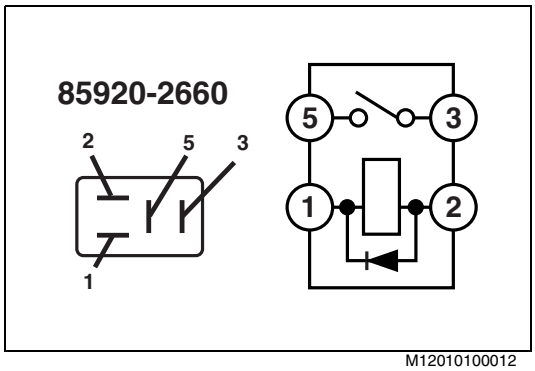


M12010100159

**1. FOG LAMP SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Switch position \ Terminals | 1 | 2 |
|---|---|---|
| OFF | | |
| ON | ○ | ○ |

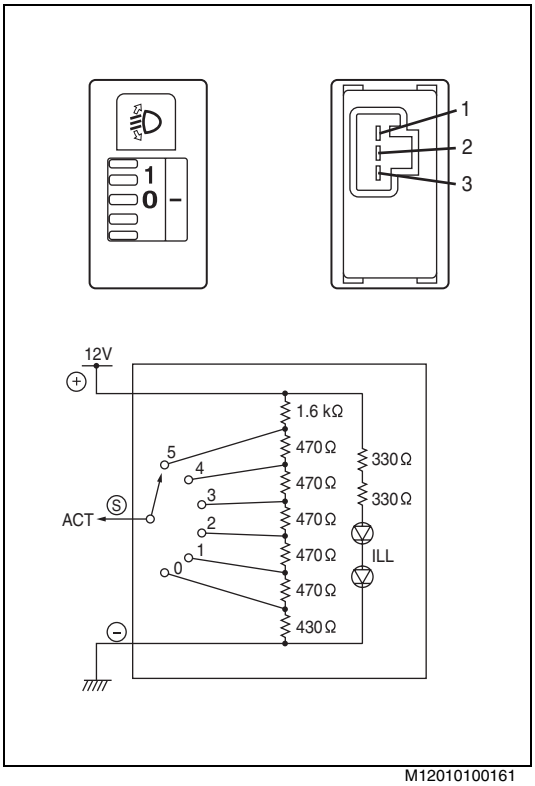


M12010100012

**2. FOG LAMP RELAY INSPECTION**

(1) Apply voltage terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, terminals 3 and 5 switches on.




M12010100161

## HEAD LAMP CONTROL CIRCUIT (IF SO EQUIPPED)

**1. HEAD LAMP LEVELING CONTROL SWITCH INSPECTION**

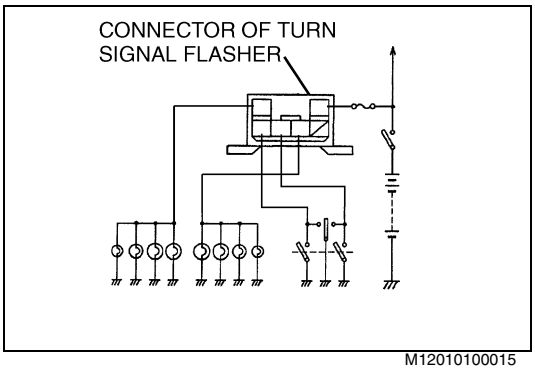
(1) Measure resistance between terminals.

**Between No.1 and No.3 terminals**

| Switch position | Resistance |
|---|---|
| 0 | 1.60 kΩ |
| 1 | 2.07 kΩ |
| 2 | 2.54 kΩ |
| 3 | 3.01 kΩ |
| 4 | 3.48 kΩ |
| 5 | 3.95 kΩ |

**Between No.1 and No.2 terminals**

| Resistance |
|---|
| 4.38kΩ |




M12010100015

## TURN SIGNAL, HAZARD, CLEARANCE, TAIL AND LICENSE PLATE LAMP CIRCUIT

**1. TURN SIGNAL FLASHER INSPECTION**

(1) Wire the turn signal flasher, bulbs, battery and fuse as shown in figure.

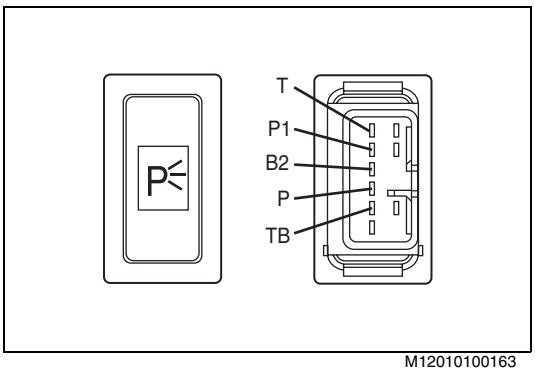
(2) Under normal condition, bulbs turn on and off.

**NOTICE:**

**Take care quantity of installing bulbs.**

**TURN SIGNAL:** **21W x 2 pcs,12W x 1 pcs, LED x 1pcs**

**HAZARD WARNING:** **21W x 4 pcs, 12W x 2 pcs, LED x 2 pcs**

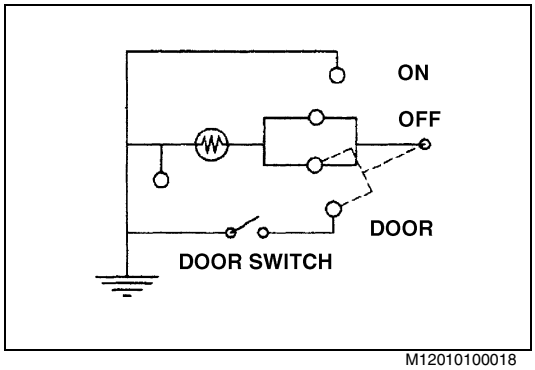



M12010100163

**2. PARKING LAMP SWITCH INSPECTION (IF SO EQUIPPED)**

(1) Check the continuity between terminals.

| Terminals / Switch position | T | P | B2 | TB | P1 |
|---|---|---|---|---|---|
| OFF | ○—○ | | | | |
| ON | | ○—○ | | ○—○ | |

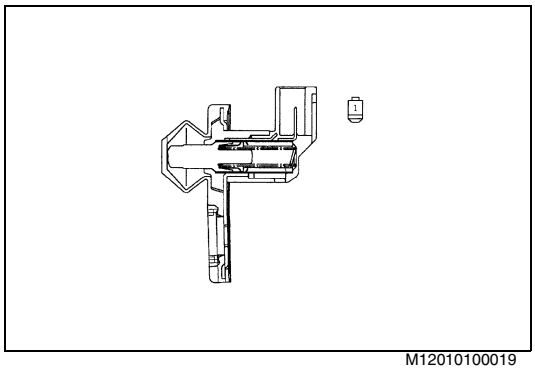


M12010100018

## DOME LAMP CIRCUIT

**1. DOME LAMP INSPECTION**

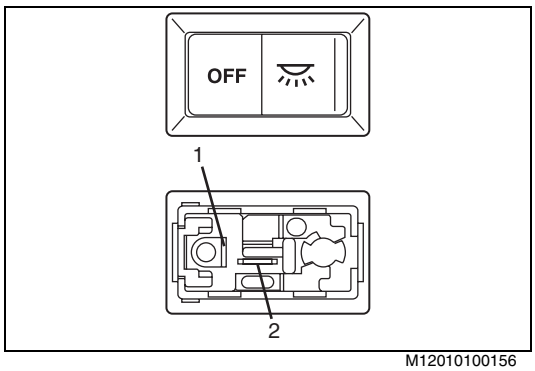
(1) Apply voltage to terminals and check the bulbs lighting.


M12010100019

**2. COURTESY SWITCH INSPECTION**

(1) Check the continuity between terminal and body ground.

| | Between terminals |
|---|---|
| PUSH | No continuity |
| FREE | Continuity |



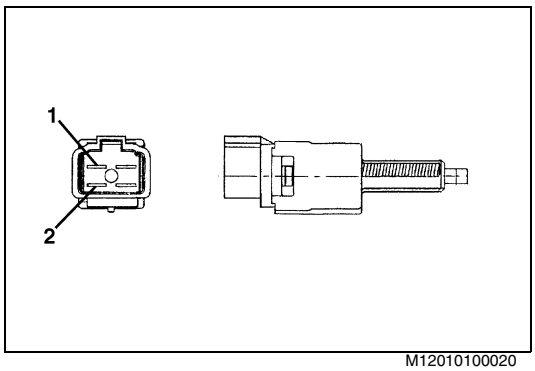
M12010100156

## FLUORESCENT LAMP CIRCUIT

**1. FLUORESCENT LAMP SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Terminals / Switch position | 1 | 2 |
|---|---|---|
| OFF | | |
| ON | ○ | ○ |



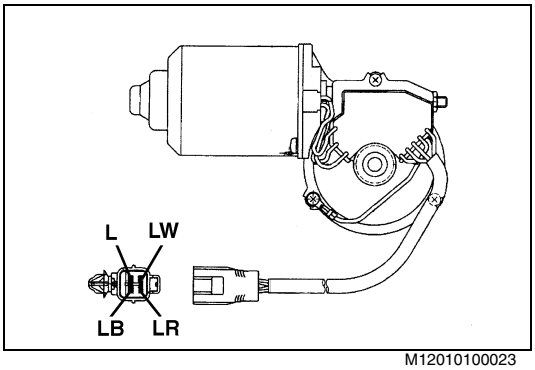
M12010100020

## STOP LAMP CIRCUIT

**1. STOP LAMP SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Terminals / Switch position | 1 | 2 |
|---|---|---|
| PUSH | | |
| FREE | ○ | ○ |



M12010100023

## WINDSHIELD WIPER CIRCUIT

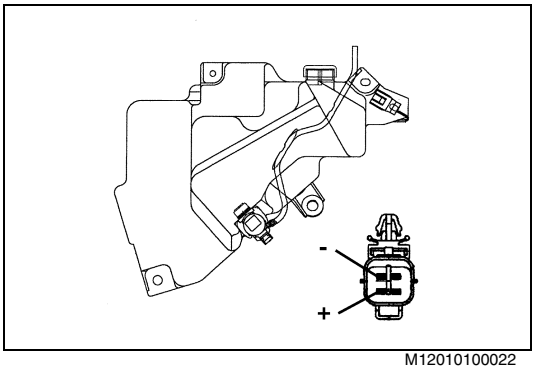
**1. WIPER MOTOR INSPECTION**

(1) Apply 24V to terminals, the motor operates as below.

**NOTICE:**

**Connect a 10A fuse between the terminal and the 24V power source. If the fuse is burned out or the motor does not operate, replace the motor.**

| Terminals / Switch position | LW | LB | L | LR |
|---|---|---|---|---|
| OFF | ○ | ○ | | |
| LOW | ○ | | ○ | |
| HIGH | | | ○ | ○ |



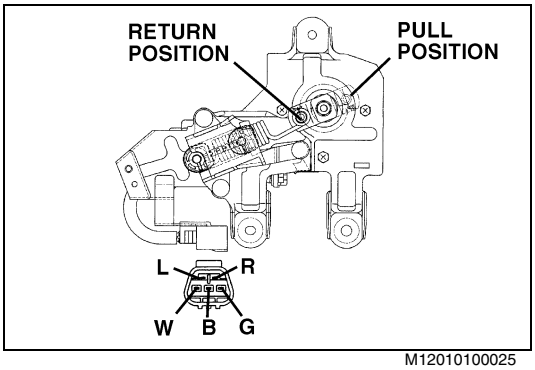
M12010100022

**2. WASHER PUMP INSPECTION**

(1) Check the continuity between terminals of the motor.
If no continuity, replace jar and pump assembly.

**NOTICE:**

**Do not apply voltage to the pump motor for operational with an empty jar, or the motor will be damaged.**



M12010100025

## ENGINE STOP CIRCUIT

**1. ENGINE STOP ELECTRIC MOTOR INSPECTION**

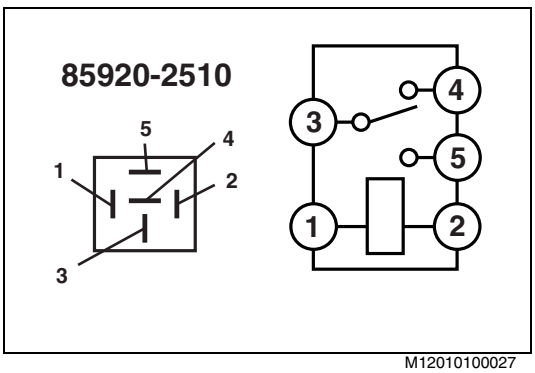
(1) Apply 24V to terminals as shown in the chart.

(2) Under normal condition, it should be operated as below

| Terminals / Switch position | + | – |
|---|---|---|
| PULL | G | W |
| RETURN | G | B |

**NOTICE:**

**Connect a 10A fuse between the terminal and the 24V power source. If the fuse is burned out or the motor does not operate, replace the motor.**

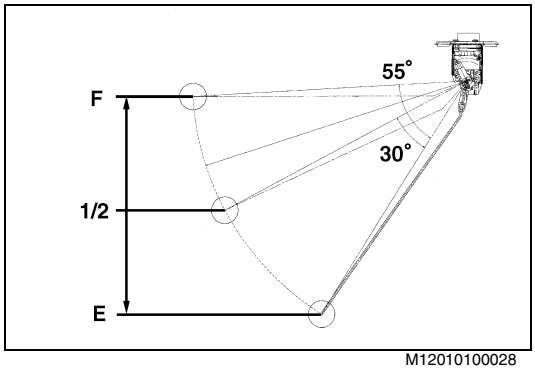


M12010100027

**2. ENGINE STOP RELAY**

(1) Apply voltage terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, relay switches the continuity from terminals 3 and 4 to 3 and 5.



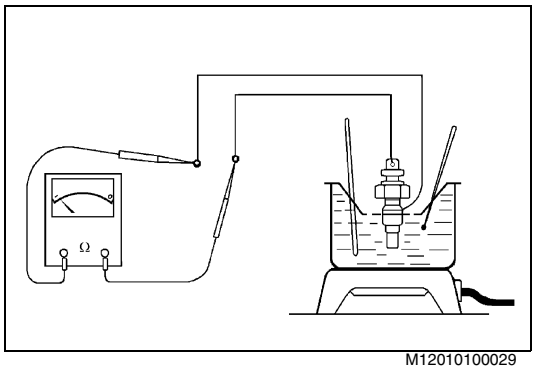
M12010100028

## GAUGE, METER AND WARNING CIRCUIT

### 1. FUEL GAUGE SENDER UNIT INSPECTION

(1) Measure resistance between terminals.

| Float position | F | 1/2 | E |
|---|---|---|---|
| Resistance: Ω | 0-1.2 | 29.5-32.5 | 146.5-153.5 |

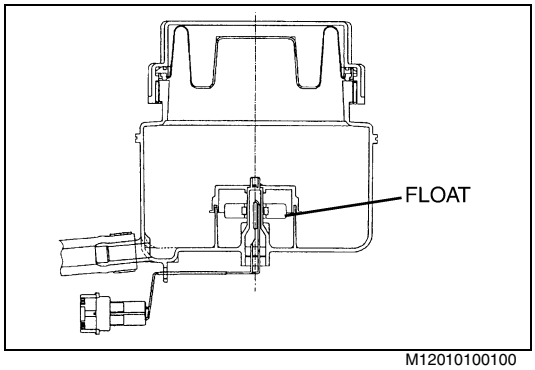


M12010100029

### 2. COOLANT TEMPERATURE GAUGE SENDER UNIT INSPECTION

(1) Warm up the sender gauge and measure the resistance between the terminal and the body ground.

| Temperature | 75°C {167°F} | 100°C {212°F} |
|---|---|---|
| Resistance:Ω | 79-92 | 35.5-42.5 |

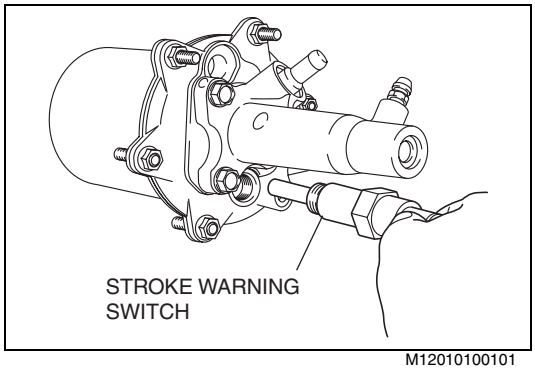


M12010100100

### 3. BRAKE FLUID LEVEL SWITCH INSPECTION

(1) Check the continuity between terminals.

| | Between terminals |
|---|---|
| Float position UP | No continuity |
| Float position DOWN | Continuity |



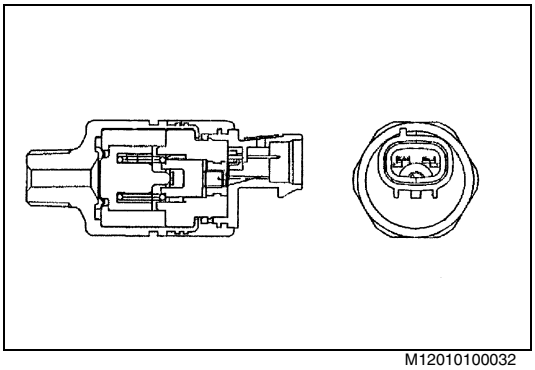
M12010100101

### 4. BRAKE STROKE WARNING SWITCH (Installed at the service brake air booster) INSPECTION

(1) Check the continuity between terminals.

| | Between terminals |
|---|---|
| PUSH | Continuity |
| FREE | No continuity |

**NOTICE:**
**When the head of the detector is depressed, the warning lamp goes on to indicate brake shoe needs adjustment or lining replacement.**

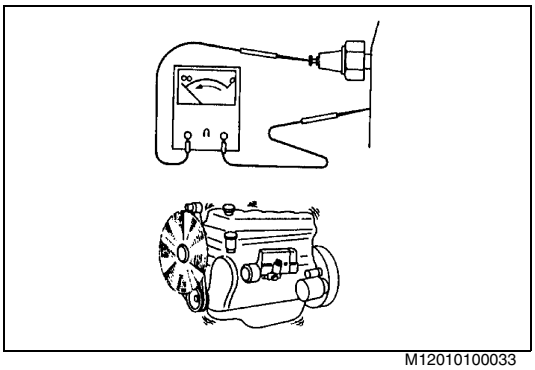


M12010100032

### 5. AIR PRESSURE SWITCH INSPECTION

(1) Apply air pressure.
(2) Check the continuity between terminal and body ground.

| | Between terminals |
|---|---|
| Less than 588.4 kPa {6.0 kgf/cm$^2$ 85.3 lbf/in$^2$} | Continuity |
| More than 588.4 kPa {6.0 kgf/cm$^2$ 85.3 lbf/in$^2$} | No continuity |

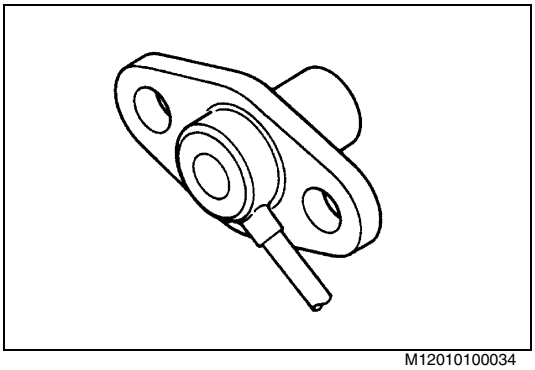


M12010100033

### 6. OIL PRESSURE SWITCH INSPECTION

(1) Start engine and disconnect the coupler.
(2) Check the continuity between terminal and engine ground.

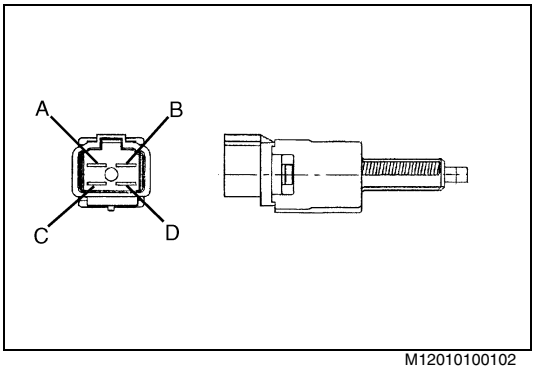
| | Terminal | Engine ground |
|---|---|---|
| Engine stop | ○ | ○ |
| Engine running | | |



M12010100034

### 7. REVOLUTION SENSOR INSPECTION

(1) Check the continuity between terminals.
If the revolution sensor is normal, there will be continuity between the terminals.



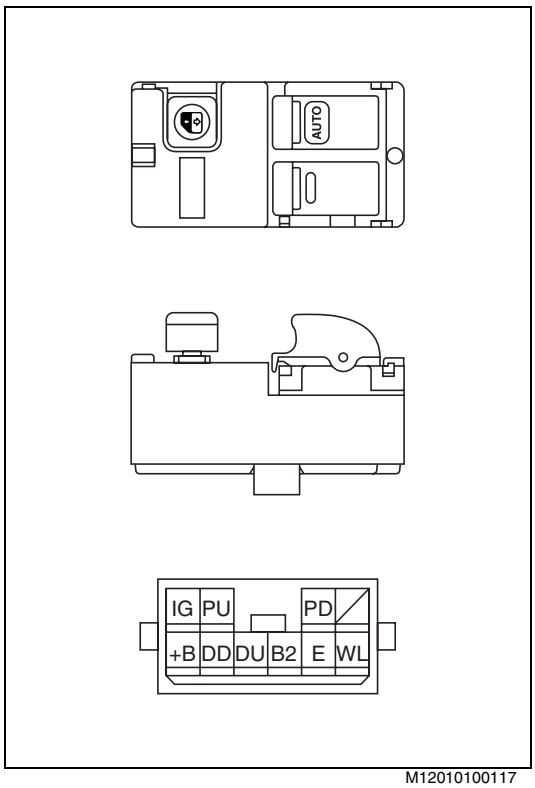

M12010100102

### 8. PARKING BRAKE SWITCH INSPECTION

(1) Check the continuity between terminals.

| Terminals / Switch position | A | B | C | D |
|---|---|---|---|---|
| PUSH | ○ | | ○ | |
| FREE | | ○ | | ○ |

## POWER WINDOW CIRCUIT (IF SO EQUIPPED)




M12010100117

**1. DRIVER'S SIDE SWITCH INSPECTION (FOR FRONT WINDOW)**

(1) Check the continuity between terminals.

**DRIVER'S SIDE:**

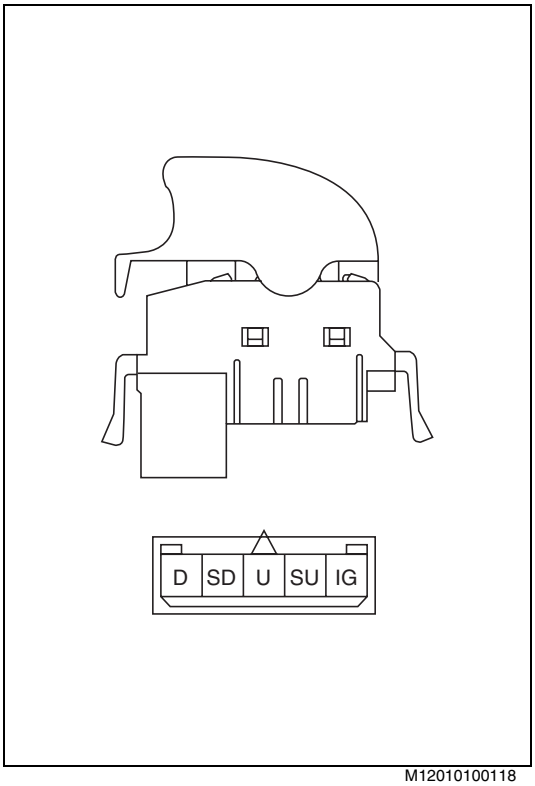
| Terminals / Switch position | +B | DU | DD | E |
|---|---|---|---|---|
| AUTO CLOSE | ○—— | ——○ | ○—— | ——○ |
| CLOSE | ○—— | ——○ | ○—— | ——○ |
| ↕ | ×—— | | | ——× |
| OFF | | ○—— | | ——○ |
| | | | ○—— | ——○ |
| ↕ | ×—— | | | ——× |
| OPEN | ○—— | | ——○ | |
| | | ○—— | ——○ | |
| AUTO OPEN | ○—— | | ——○ | |
| | | ○—— | ——○ | |

**ASSISTANT'S SIDE: LOCK SWITCH OFF POSITION**

| Terminals / Switch position | +B | PU | PD | E | WL |
|---|---|---|---|---|---|
| CLOSE | ○—— | ——○ | | ○—— | ——○ |
| | | | ○—— | ——○ | |
| ↕ | ×—— | | | ——× | |
| OFF | | ○—— | | ○—— | ——○ |
| | | | ○—— | ——○ | |
| ↕ | ×—— | | | ——× | |
| OPEN | ○—— | | ——○ | ○—— | ——○ |
| | | ○—— | | ——○ | |

**ASSISTANT'S SIDE: LOCK SWITCH ON POSITION**

| Terminals / Switch position | +B | PU | PD | E | WL |
|---|---|---|---|---|---|
| CLOSE | ○—— | ——○ | | ×—— | ——× |
| ↕ | ×—— | | | ——× | |
| OFF | | ○—— | ——○ | ×—— | ——× |
| ↕ | ×—— | | | ——× | |
| OPEN | ○—— | | ——○ | ×—— | ——× |

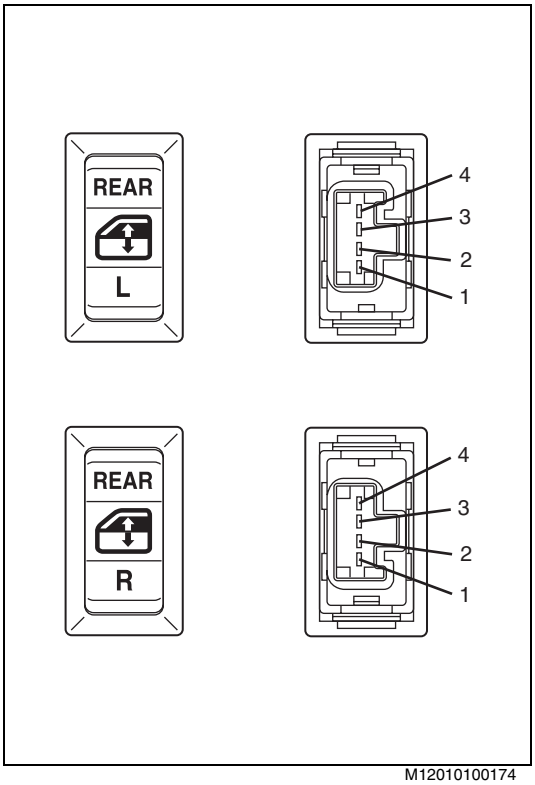



M12010100118

**2. ASSISTANT'S SIDE SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Switch position \ Terminals | SU | U | IG | D | SD |
|---|---|---|---|---|---|
| CLOSE | | ○—○ | | ○—○ | |
| ↕ | ×—× | | | | |
| OFF | ○—○ | | | ○—○ | |
| ↕ | | | ×—× | | |
| OPEN | ○—○ | | ○—○ | | |

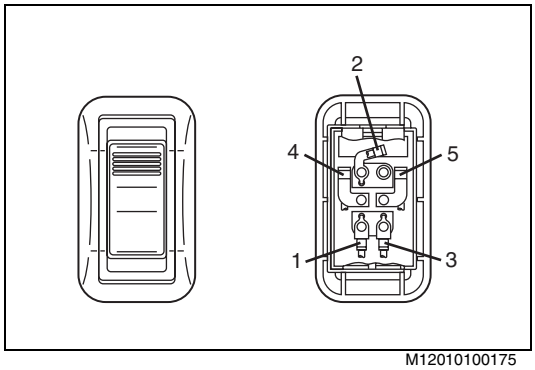



M12010100174

**3. DRIVER'S SIDE SWITCH INSPECTION (FOR REAR WINDOW)**

(1) Check the continuity between terminals.

| Switch position \ Terminals | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CLOSE | ○—○ | | ○—○ | |
| ↕ | ×—× | | | |
| OFF | ○—○ | ○—○ | | |
| ↕ | ×—× | | | |
| OPEN | ○—○ | ○—○ | ○—○ | |

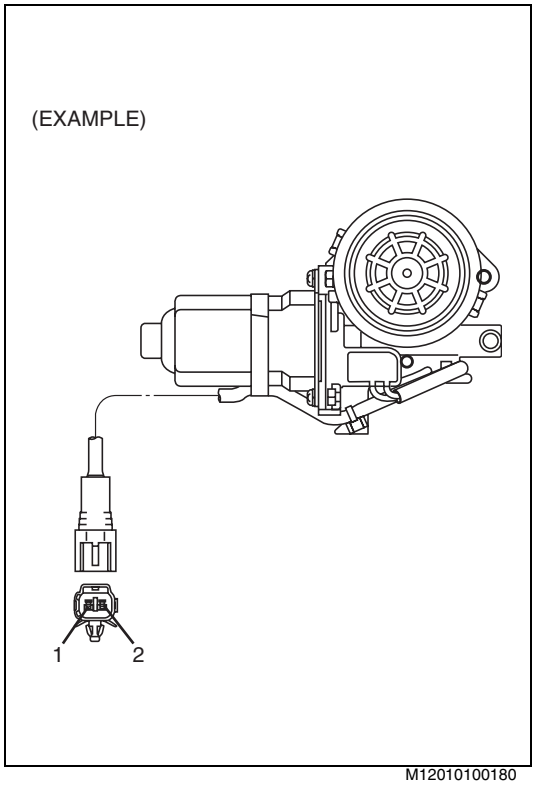


M12010100175

**4. REAR SEAT SIDE SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Switch position \ Terminals | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| CLOSE | ○ | | | ○ | |
| | | | ○ | | ○ |
| ↕ | × | × | | | |
| OFF | | ○ | | ○ | |
| | | | ○ | | ○ |
| ↕ | × | | × | | |
| OPEN | ○ | ○ | | ○ | |
| | | | | | ○ |



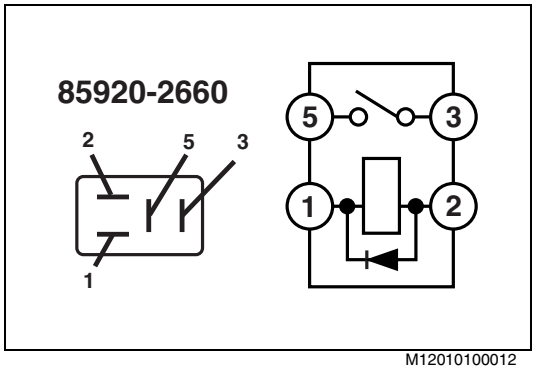
M12010100180

**5. POWER WINDOW MOTOR INSPECTION**

(1) Check the continuity between terminals. If there is no continuity, replace the motor.

(2) Apply 24V to terminals, inspect the motor operation as below.

| Direction of rotation (View from out put shaft) \ Terminals | 1 | 2 |
|---|---|---|
| CLOCKWISE | + | − |
| COUNTERCLOCKWISE | − | + |

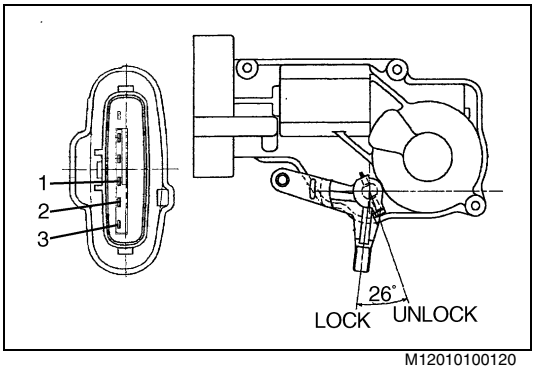


M12010100012

**6. REAR POWER WINDOW RELAY INSPECTION**

(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, terminals 3 and 5 switch on.



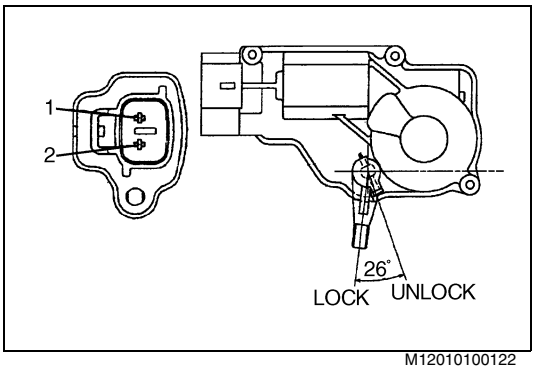
M12010100120

# POWER DOOR LOCK CIRCUIT (IF SO EQUIPPED)

**1. DRIVER'S SIDE DOOR LOCK SWITCH INSPECTION**

(1) Check the continuity between terminals. If there is no continuity, replace the switch.

| Terminals / Lever position | 1 | 2 | 3 |
|---|---|---|---|
| LOCK | ○ | | ○ |
| UNLOCK | | ○ | ○ |

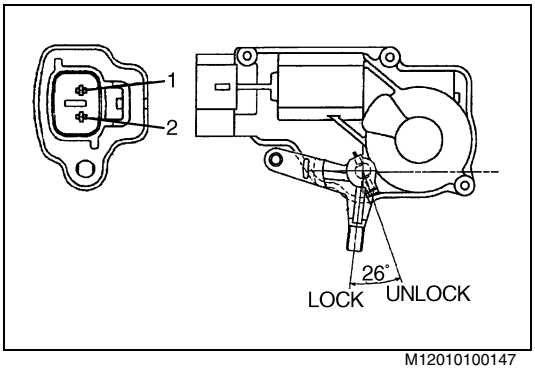


M12010100122

**2. ASSISTANT'S SIDE AND REAR LEFT SIDE DOOR LOCK ACTUATOR INSPECTION**

(1) Check the continuity between terminals. If there is no continuity, replace the actuator.

| Terminals / Lever position | 1 | 2 |
|---|---|---|
| LOCK | + | − |
| UNLOCK | − | + |

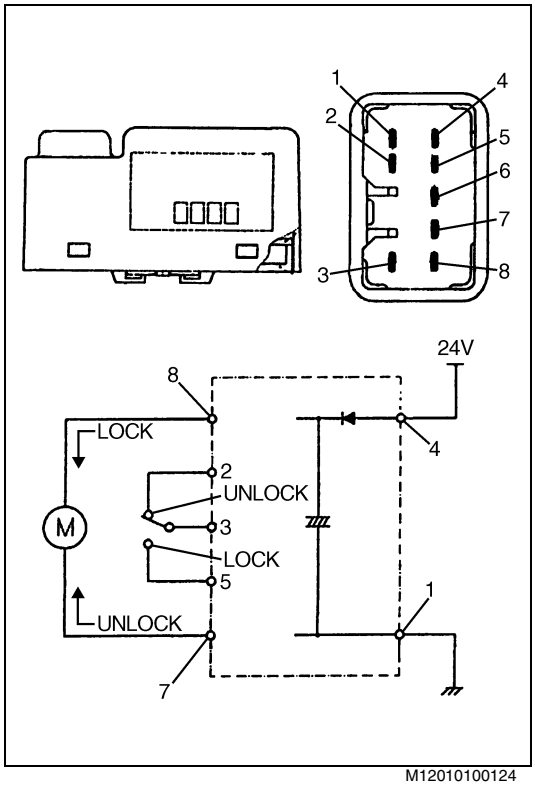


M12010100147

**3. REAR RIGHT SIDE DOOR LOCK ACTUATOR INSPECTION**

(1) Check the continuity between terminals. If there is no continuity, replace the actuator.

| Terminals / Lever position | 1 | 2 |
|---|---|---|
| LOCK | − | + |
| UNLOCK | + | − |

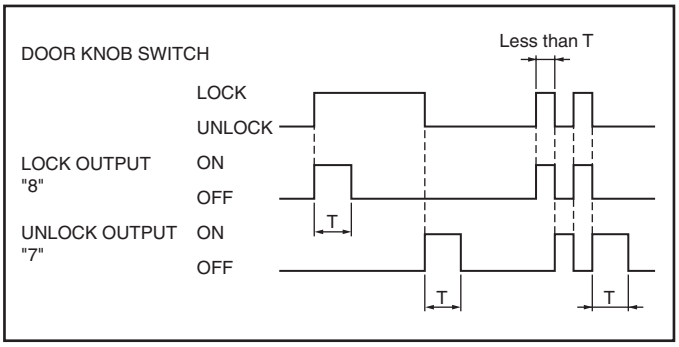


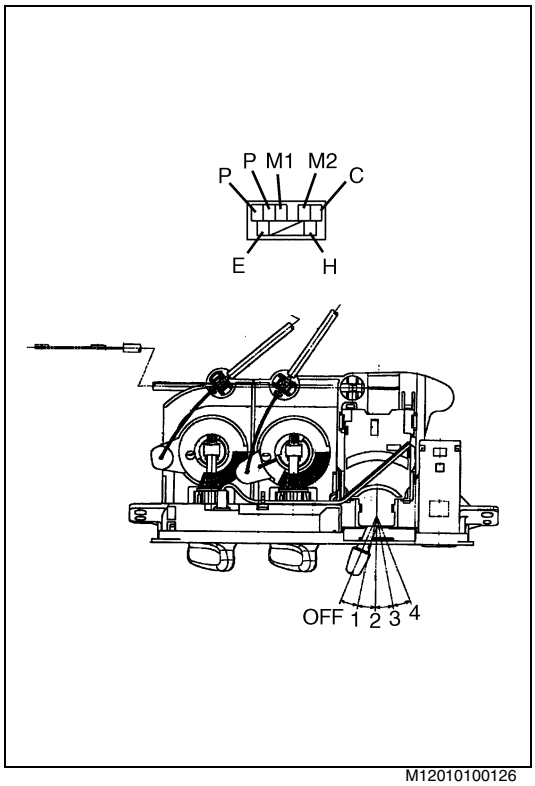

M12010100124

**4. DOOR LOCK CONTROLLER INSPECTION**

(1) Wire the door lock controller as shown in the figure.

(2) Check the function.



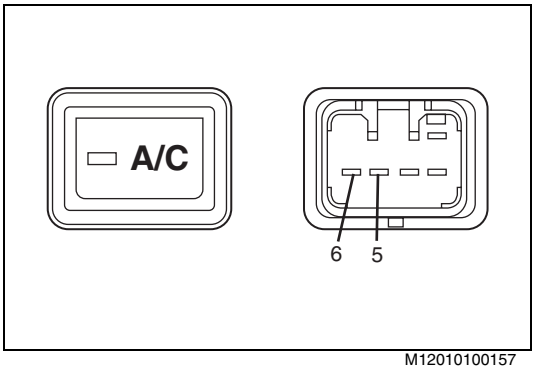

M12010100126

## HEATER AND COOLER CIRCUIT

**1. BLOWER SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Terminals / Switch position | E | C | M1 | M2 | H | P | P |
|---|---|---|---|---|---|---|---|
| OFF | | | | | | LAMP | |
| 1 | ○ | ○ | | | | | |
| 2 | ○ | ○ | ○ | | | | |
| 3 | ○ | ○ | | ○ | | | |
| 4 | ○ | ○ | | | ○ | | |

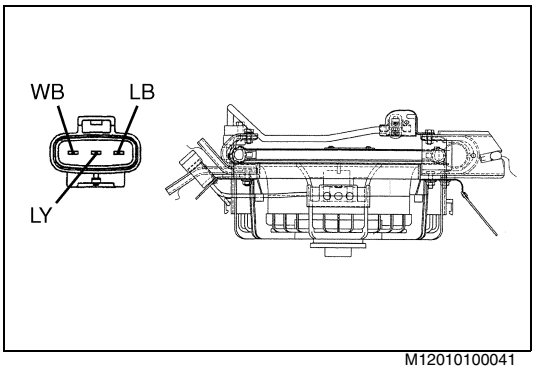


M12010100157

**2. COOLER CONTROL SWITCH**

(1) Check the continuity between terminals.

| Terminals / Switch position | 5 | 6 |
|---|---|---|
| OFF | | |
| ON | ○ | ○ |

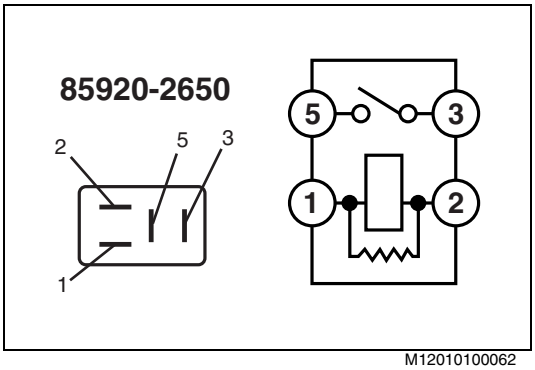


M12010100041

**3. CONDENSER ASSEMBLY INSPECTION**

(1) Check continuity between terminals.

| Terminal / Switch position | LB | WB | LY |
|---|---|---|---|
| OFF | | | |
| LO | ○ | ○ | |
| HIGH | ○ | | ○ |

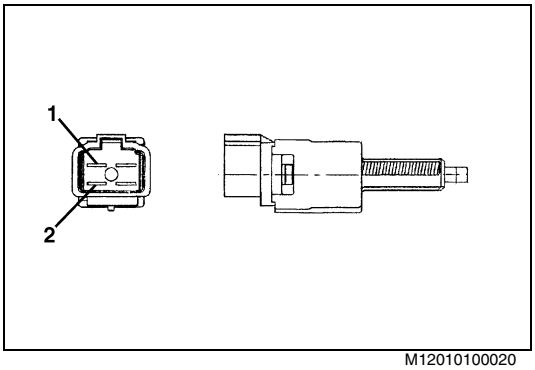


M12010100062

**4. POWER RELAY No.2 INSPECTION**

(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, terminals 3 and 5 switch on.



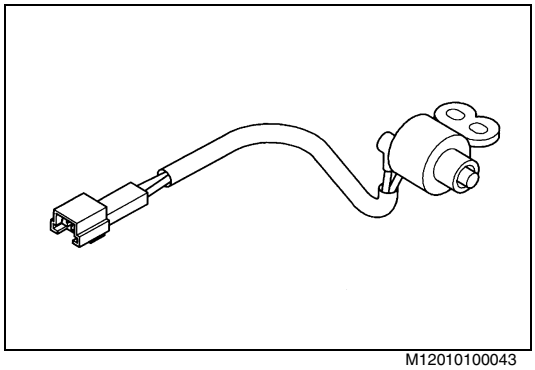
M12010100020

## EXHAUST BRAKE CIRCUIT

**1. CLUTCH PEDAL SWITCH INSPECTION**

(1) Check the continuity between terminals.

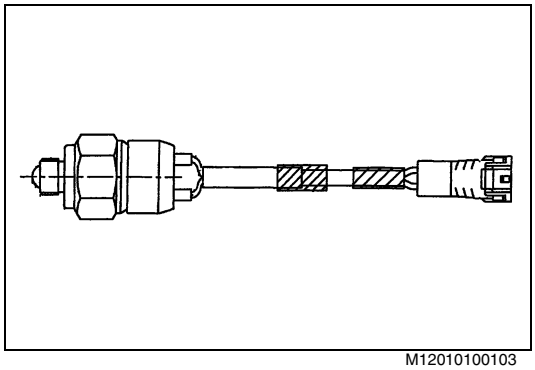
| Terminals / Switch position | 1 | 2 |
|---|---|---|
| PUSH | | |
| FREE | ○ | ○ |


M12010100043

**2. ACCELERATOR PEDAL SWITCH INSPECTION**

(1) Check the continuity between terminals.

| | Between terminals |
|---|---|
| PUSH | Continuity |
| FREE | No continuity |

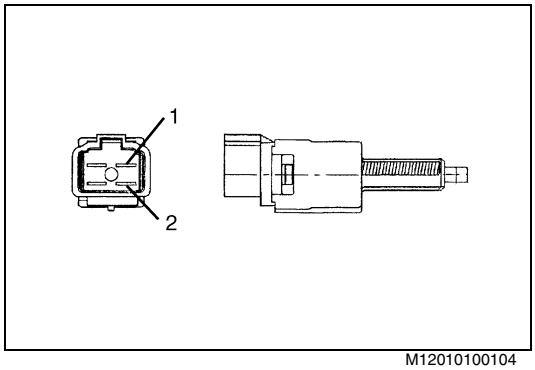

M12010100103

## BACK UP LAMP CIRCUIT

**1. BACK UP LAMP SWITCH INSPECTION**

(1) Check the continuity between terminals.

| | Between terminals |
|---|---|
| PUSH | Continuity |
| FREE | No continuity |



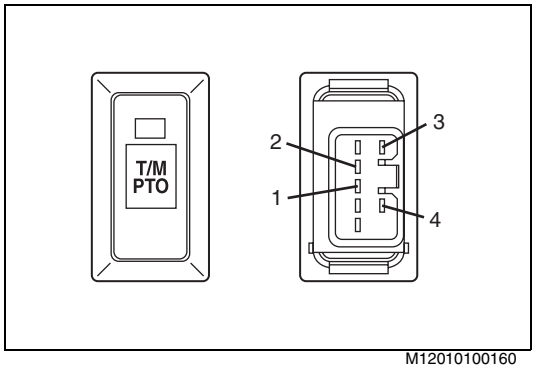
M12010100104

## POWER TAKE-OFF CIRCUIT (IF SO EQUIPPED)

**1. CLUTCH PEDAL SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Terminals / Switch position | 1 | 2 |
|---|---|---|
| PUSH | | |
| FREE | ○ | ○ |

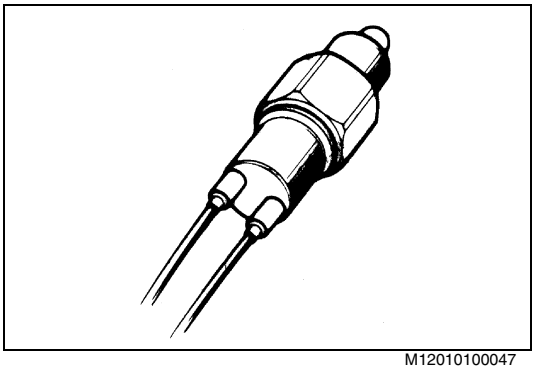


M12010100160

**2. TRANSMISSION P.T.O. SWITCH INSPECTION**

(1) Check the continuity between terminals.

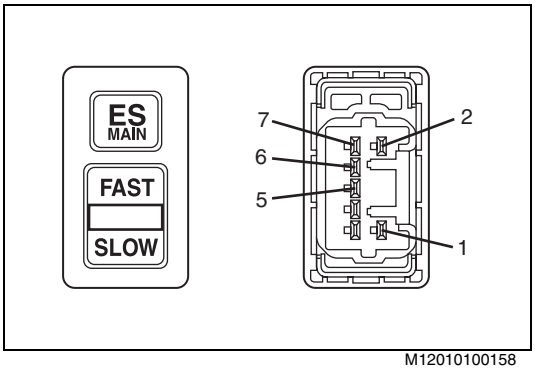
| Terminal / Switch position | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| OFF | | | ∩ | |
| ON | ○ | ○ | | |


M12010100047

**3. P.T.O. POSITION SWITCH INSPECTION**

(1) Check the continuity between terminals.

| | Between terminals |
|---|---|
| PUSH | Continuity |
| FREE | No continuity |



M12010100158

## ES START CIRCUIT (IF SO EQUIPPED)

**1. ES MAIN SWITCH INSPECTION**

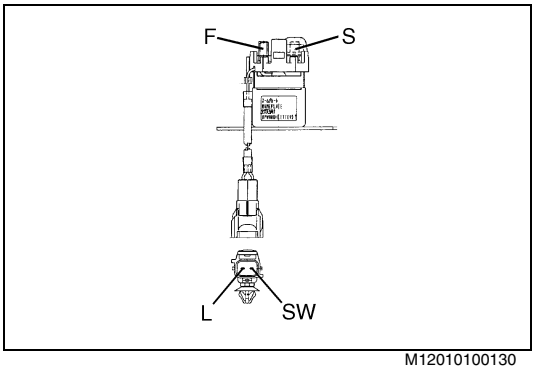
(1) Check the continuity between terminals.

| Terminals / Switch position | 5 | 6 | 7 |
|---|---|---|---|
| OFF | ○ | ○ | |
| ON | ○ | | ○ |

**2. RELEASE TIMING SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Terminals / Switch position | 5 | 1 | 2 |
|---|---|---|---|
| FAST | ○ | ○ | |
| SLOW | ○ | | ○ |



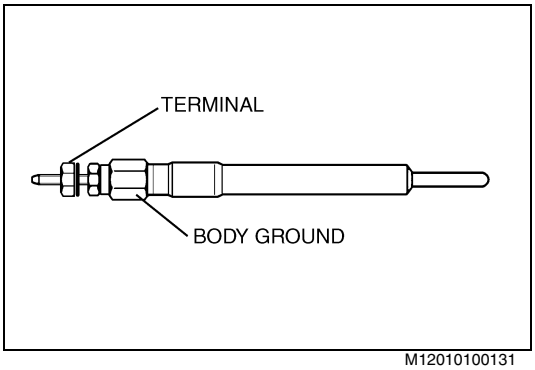
M12010100130

## PRE-HEATING CIRCUIT (IF SO EQUIPPED)

**1. PRE-HEAT RELAY INSPECTION**

(1) Apply voltage to terminals;
24V to terminal SW,
Ground to terminal L.

(2) Under normal condition, terminals S and F switch on.

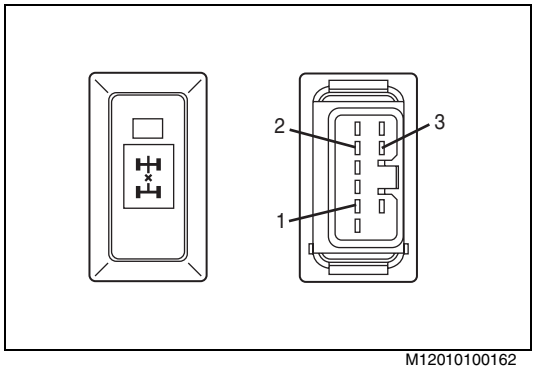


M12010100131

**2. GLOW PLUG INSPECTION**

(1) Check continuity between terminal and body ground.

(2) Under normal condition, the terminal and body ground is continuity.



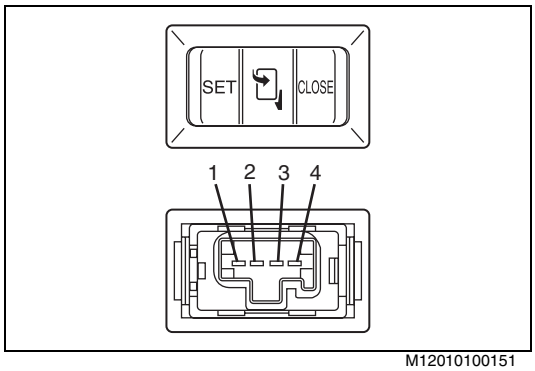
M12010100162

## INTER-AXLE DIFFERENTIAL LOCK CIRCUIT (IF SO EQUIPPED)

**1. INTER-AXLE DIFFERENTIAL LOCK**

(1) Check the continuity between terminals.

| Switch position \ Terminal | 1 | 2 | 3 |
|---|---|---|---|
| OFF | | | |
| ON | ○ | ○ | ○ ○ |



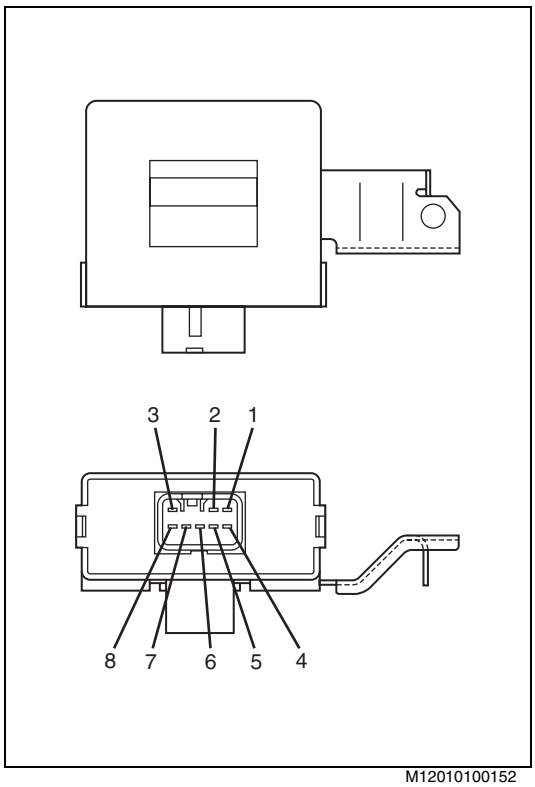
M12010100151

## POWER MIRROR CIRCUIT (IF SO EQUIPPED)

**1. POWER MIRROR SWITCH INSPECTION**

(1) Check the continuity between terminals.

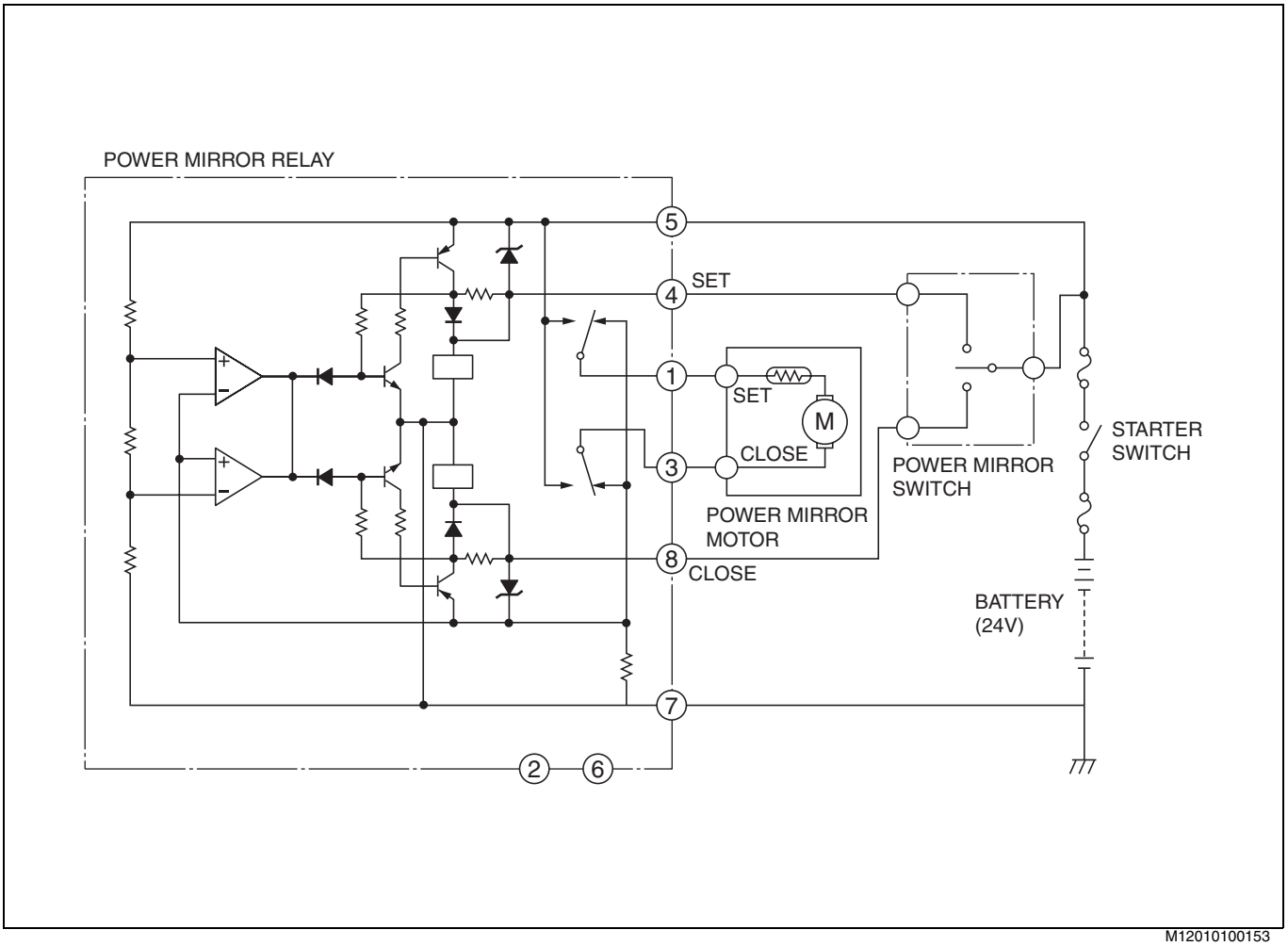
| Lever position \ Terminals | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| CLOSE | ○ | ○ | ○ | ○ |
| ↕ | × | | | × |
| OFF | ○ | ○ | | |
| ↕ | × | | | × |
| SET | | ○ | | ○ |



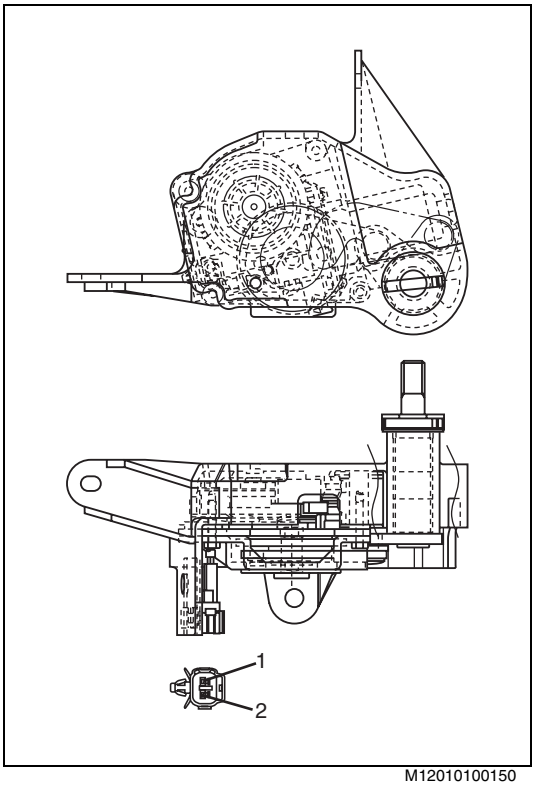
M12010100152

**2. POWER MIRROR RELAY INSPECTION**

(1) Check the function as shown below the wiring diagram.




M12010100153

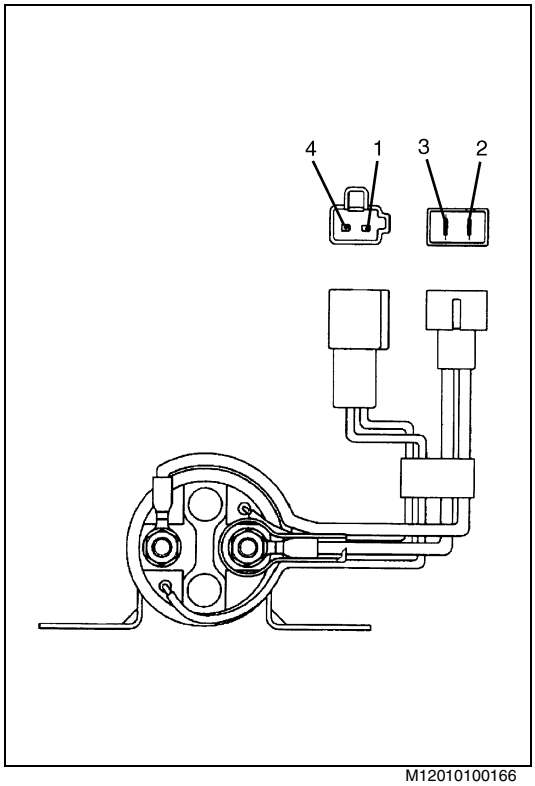



M12010100150

**3. POWER MIRROR MOTOR INSPECTION**

(1) Check the continuity between terminals.

| Terminals / Direction of rotation (View from out put shaft) | 1 | 2 |
|---|---|---|
| COUNTERCLOCKWISE | + | − |
| CLOCKWISE | − | + |

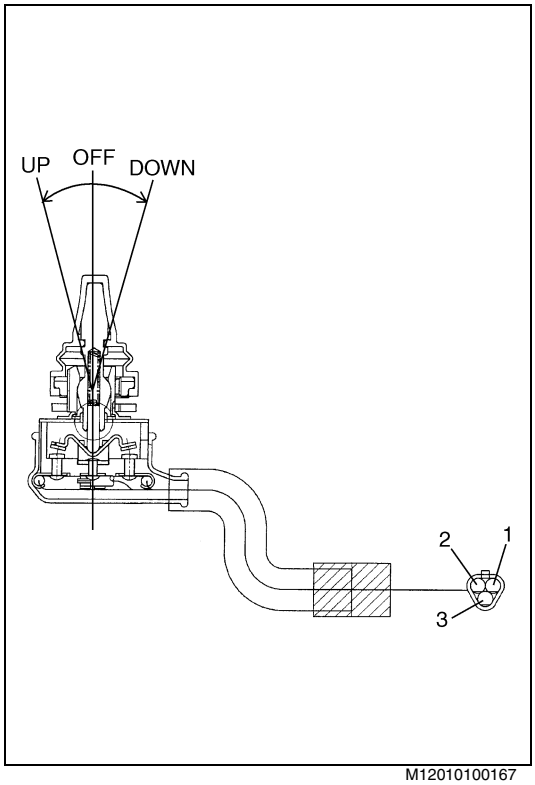


M12010100166

## CAB TILT CIRCUIT (IF SO EQUIPPED)

### 1. CAB TILT RELAY INSPECTION

(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 4.
(2) Under normal condition, terminals 2 and 3 switch on.

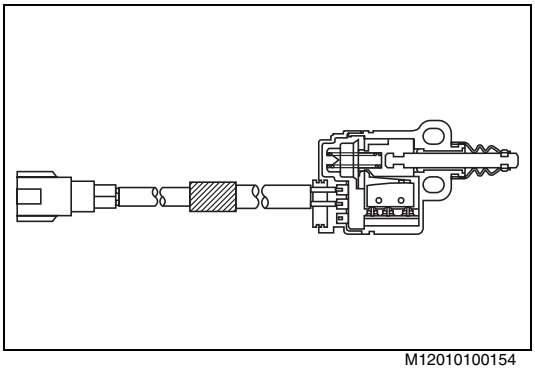


M12010100167

### 2. CAB TILT SWITCH INSPECTION

(1) Check the continuity between terminals.

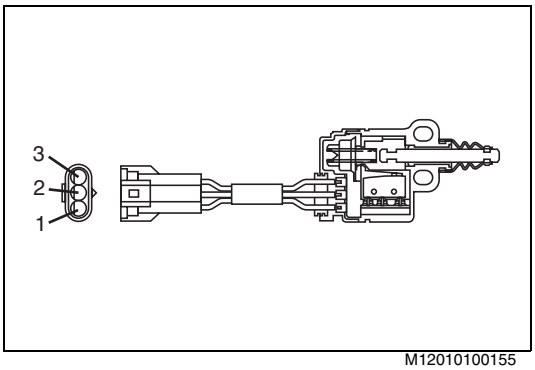
| Terminals / Position | 1 | 2 | 3 |
|---|---|---|---|
| UP | ○ | ○ | |
| OFF | | | |
| DOWN | | ○ | ○ |


M12010100154

**3. CAB TILT STOPPER SWITCH INSPECTION**

(1) Check the continuity between terminals.

| | Between terminals |
|---|---|
| PUSH | No continuity |
| FREE | Continuity |

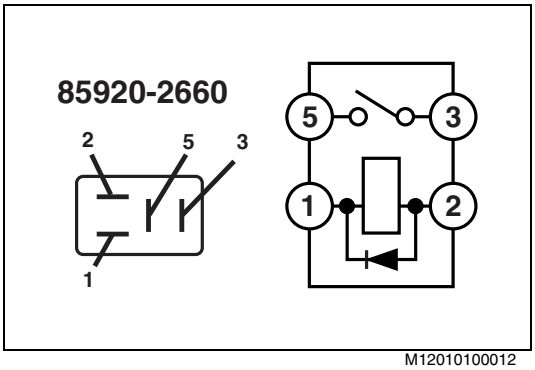


M12010100155

**4. CAB TILT LOCK SWITCH INSPECTION**

(1) Check the continuity between terminals.

| Terminals / Switch position | 1 | 2 | 3 |
|---|---|---|---|
| PUSH | ○ | | ○ |
| FREE | | ○ | ○ |



M12010100012

**5. CAB TILT UP RELAY AND CAB TILT DOWN RELAY INSPECTION**

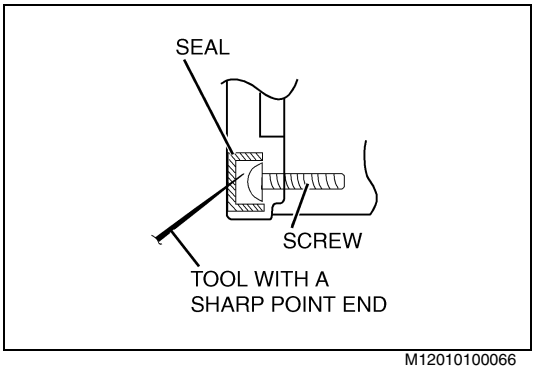
(1) Apply voltage to terminals;
24V to terminal 1,
Ground to terminal 2.

(2) Under normal condition, terminals 3 and 5 switch on.

# INSPECTION AND ADJUSTMENT

M12010113BEH3002

## ADJUSTMENT OF PULSE ADJUST COMPUTER



M12010100066

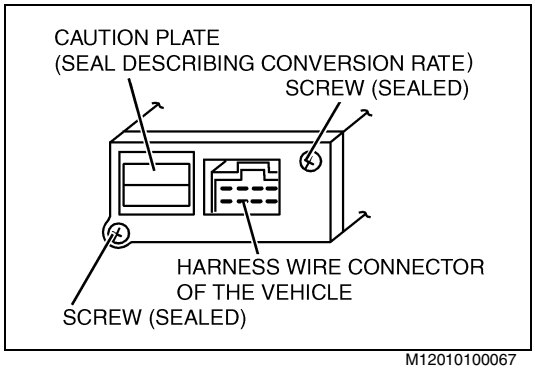
**HINT:**

**This is a device that enables a fine-tuning of compensating ratio of speedometer without modifying the speedometer driven gear of the transmission.**

**1. CONNECTING INPUT TOOL**

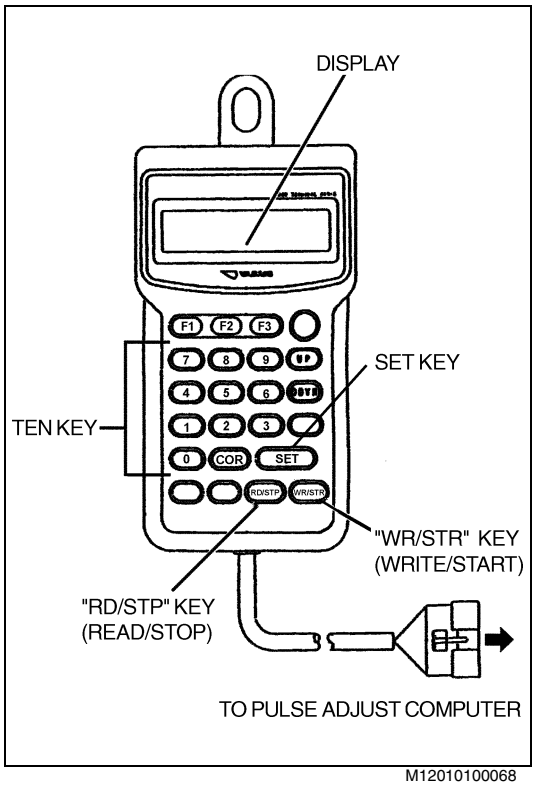
(1) Remove the instrument panel cover of assistant seat side in the cabin.

(2) Remove the seal around the screws by using a tool with a sharp point end.




M12010100067

(3) Remove the screws and then the cover of pulse adjust computer.
(4) If you disconnected the wire harness connector of the vehicle when removing the cover of pulse adjust computer, connect again the wire harness connector.
(5) Connect the input tool connector.
**SST: Input tool (09630-2400)**




M12010100068

**2. THE METHOD OF WRITING IN OR READING OUT THE CONVERSION RATE**

**NOTICE:**
**The vehicle condition at writing in or reading out: Starter switch is turned on.**

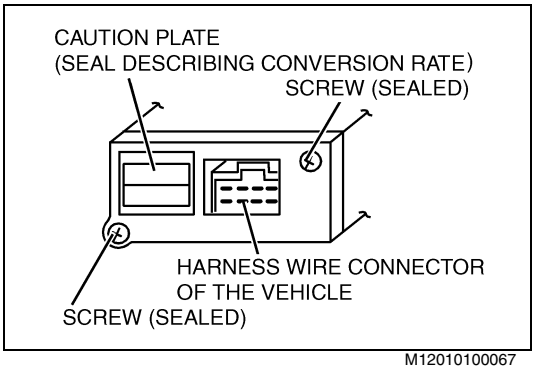
(1) Reading out the conversion rate.
  a. The "RD/STP" key is pushed.
  b. Reading out the conversion rate correctly, "GOOD" is indicated and buzzer is rung for three seconds, then the conversion rate which is written in the pulse adjust computer is indicated.
  (Reading out it incorrectly, "bad 0" is indicated and buzzer is rung. In this case, put the connector again.)
  c. It becomes a condition of writing the conversion rate when the set key is pushed after reading out the conversion rate.

**HINT:**
**Refer to operation manual which belongs to input tool for details.**

(2) Writing in the conversion rate.
  a. While the condition of inputting the conversion rate (" *.****" indication), the conversion rate is inputted to push the ten key or [UP] [DOWN] key.
  If the conversion rate is inputted, omit a decimal point.
  EX.) When you want to input the conversion rate "1.8210", push the ten key as "18210" and the set key.

**NOTICE:**
**Refer to the following "Pulse conversion rate table".**

  b. If the set key is pushed, the input value is decided.
  When it is inputted correctly, the buzzer is rung and the display becomes the same condition before inputting with ten key.
  c. The "WR/STR" key is pushed.
  Writing in the conversion rate correctly, "GOOD" is indicated and buzzer is rung for three seconds, then the conversion rate which is contained an error and which was actually written in the pulse converter is indicated.
  Writing in it incorrectly, "bad 0" is indicated and buzzer is rung.
  In this case, write in it correctly again.



M12010100067

**3. DISCONNECTING INPUT TOOL**

(1) Turn the starter switch to "LOCK" position.
(2) Disconnect the input tool connector and mount the cover of pulse adjust computer.
(3) Apply new seal (83179-1140) on the screws to seal them.
(4) Write conversion rate on a new caution plate (conversion rate record seal (76588-3800) and stick it on the place.
(5) Mount the instrument panel cover of assistant seat side.

# SPEEDOMETER CONVERSION RATE LIST

M12010113BEI3001

## LF05,06,LH05,LX06 TRANSMISSION SERIES (Except Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *3.363* | *3.636* | *3.900* | *4.100* | *4.300* | *4.333* | *4.555* | *4.625* |
| *225/60R17.5* | 0.349 | 1.370 | 1.267 | 1.181 | 1.123 | 1.071 | 1.063 | 1.011 | 0.996 |
| *215/70R17.5* | 0.364 | 1.428 | 1.321 | 1.232 | 1.172 | 1.117 | 1.109 | 1.055 | 1.039 |
| *195/80R17.5* | 0.367 | 1.440 | 1.332 | 1.242 | 1.181 | 1.126 | 1.118 | 1.063 | 1.047 |
| *205/80R17.5* | 0.374 | 1.468 | 1.357 | 1.266 | 1.204 | 1.148 | 1.139 | 1.084 | 1.067 |
| *235/70R17.5* | 0.376 | 1.476 | 1.365 | 1.272 | 1.210 | 1.154 | 1.145 | 1.089 | 1.073 |
| *7.50-16* | 0.383 | 1.503 | 1.390 | 1.296 | 1.233 | 1.175 | 1.166 | 1.110 | 1.093 |
| *7.50R16* | 0.387 | 1.519 | 1.405 | 1.310 | 1.246 | 1.188 | 1.179 | 1.121 | 1.104 |
| *235/75R17.5* | 0.387 | 1.519 | 1.405 | 1.310 | 1.246 | 1.188 | 1.179 | 1.121 | 1.104 |
| *225/80R17.5* | 0.389 | 1.527 | 1.412 | 1.316 | 1.252 | 1.194 | 1.185 | 1.127 | 1.110 |
| *225/70R19.5* | 0.395 | 1.550 | 1.434 | 1.337 | 1.271 | 1.212 | 1.203 | 1.144 | 1.127 |
| *8.25-16* | 0.404 | 1.586 | 1.466 | 1.367 | 1.300 | 1.240 | 1.230 | 1.170 | 1.153 |
| *245/70R19.5* | 0.407 | 1.597 | 1.477 | 1.377 | 1.310 | 1.249 | 1.240 | 1.179 | 1.161 |
| *8.25R16* | 0.409 | 1.605 | 1.485 | 1.384 | 1.317 | 1.255 | 1.246 | 1.185 | 1.167 |
| *9.5R17.5* | 0.409 | 1.605 | 1.485 | 1.384 | 1.317 | 1.255 | 1.246 | 1.185 | 1.167 |
| *225/90R17.5* | 0.410 | 1.609 | 1.488 | 1.387 | 1.320 | 1.258 | 1.249 | 1.188 | 1.170 |
| *9.00-16* | 0.420 | | 1.525 | 1.421 | 1.352 | 1.289 | 1.279 | 1.217 | 1.198 |
| *265/70R19.5* | 0.421 | | 1.528 | 1.425 | 1.355 | 1.292 | 1.282 | 1.220 | 1.201 |
| *7.50-18* | 0.423 | | 1.535 | 1.431 | 1.362 | 1.298 | 1.288 | 1.226 | 1.207 |
| *7.50R18* | 0.426 | | 1.546 | 1.442 | 1.371 | 1.307 | 1.297 | 1.234 | 1.216 |
| *9R19.5* | 0.433 | | 1.572 | 1.465 | 1.394 | 1.329 | 1.319 | 1.255 | 1.236 |
| *265/60R22.5* | 0.438 | | 1.590 | 1.482 | 1.410 | 1.344 | 1.334 | 1.269 | 1.250 |
| *235/70R22.5* | 0.440 | | 1.597 | 1.489 | 1.416 | 1.350 | 1.340 | 1.275 | 1.256 |
| *7.50-20* | 0.448 | | 1.626 | 1.516 | 1.442 | 1.375 | 1.365 | 1.298 | 1.278 |
| *285/60R22.5* | 0.450 | | 1.633 | 1.523 | 1.449 | 1.381 | 1.371 | 1.304 | 1.284 |
| *7.50R20* | 0.452 | | 1.641 | 1.530 | 1.455 | 1.387 | 1.377 | 1.310 | 1.290 |
| *255/70R22.5* | 0.453 | | 1.644 | 1.533 | 1.458 | 1.390 | 1.380 | 1.312 | 1.293 |
| *275/70R22.5* | 0.465 | | | 1.574 | 1.497 | 1.427 | 1.416 | 1.347 | 1.327 |
| *11/70R22.5* | 0.468 | | | 1.584 | 1.506 | 1.436 | 1.425 | 1.356 | 1.335 |
| *8.25-20* | 0.468 | | | 1.584 | 1.506 | 1.436 | 1.425 | 1.356 | 1.335 |
| *8.25R20* | 0.470 | | | 1.591 | 1.513 | 1.443 | 1.432 | 1.362 | 1.341 |
| *9R22.5* | 0.470 | | | 1.591 | 1.513 | 1.443 | 1.432 | 1.362 | 1.341 |
| *265/75R22.5* | 0.474 | | | 1.604 | 1.526 | 1.455 | 1.444 | 1.373 | 1.353 |
| *295/70R22.5* | 0.479 | | | | 1.542 | 1.470 | 1.459 | 1.388 | 1.367 |
| *9.00-20* | 0.490 | | | | 1.577 | 1.504 | 1.492 | 1.420 | 1.398 |
| *275/80R22.5* | 0.491 | | | | 1.581 | 1.507 | 1.496 | 1.423 | 1.401 |
| *9.00R20* | 0.492 | | | | 1.584 | 1.510 | 1.499 | 1.426 | 1.404 |
| *10R22.5* | 0.492 | | | | 1.584 | 1.510 | 1.499 | 1.426 | 1.404 |
| *295/75R22.5* | 0.493 | | | | 1.587 | 1.513 | 1.502 | 1.428 | 1.407 |
| *295/80R22.5* | 0.505 | | | | 1.626 | 1.550 | 1.538 | 1.463 | 1.441 |
| *10.00-20* | 0.506 | | | | 1.629 | 1.553 | 1.541 | 1.466 | 1.444 |
| *11.1-20* | 0.506 | | | | 1.629 | 1.553 | 1.541 | 1.466 | 1.444 |
| *10.00R20* | 0.508 | | | | 1.635 | 1.559 | 1.547 | 1.472 | 1.450 |
| *11.1R20* | 0.508 | | | | 1.635 | 1.559 | 1.547 | 1.472 | 1.450 |
| *11R22.5* | 0.508 | | | | 1.635 | 1.559 | 1.547 | 1.472 | 1.450 |
| *11.00-20* | 0.520 | | | | 1.674 | 1.596 | 1.584 | 1.507 | 1.484 |
| *315/80R22.5* | 0.520 | | | | 1.674 | 1.596 | 1.584 | 1.507 | 1.484 |
| *11.00R20* | 0.523 | | | | 1.684 | 1.605 | 1.593 | 1.515 | 1.492 |
| *12R22.5* | 0.523 | | | | 1.684 | 1.605 | 1.593 | 1.515 | 1.492 |

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| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 4.875 | 5.125 | 5.142 | 5.250 | 5.285 | 5.428 | 5.571 | 5.857 |
| 225/60R17.5 | 0.349 | 0.945 | 0.899 | 0.896 | | | | | |
| 215/70R17.5 | 0.364 | 0.985 | 0.937 | 0.934 | 0.915 | 0.909 | 0.885 | | |
| 195/80R17.5 | 0.367 | 0.993 | 0.945 | 0.942 | 0.922 | 0.916 | 0.892 | | |
| 205/80R17.5 | 0.374 | 1.012 | 0.963 | 0.960 | 0.940 | 0.934 | 0.909 | 0.886 | |
| 235/70R17.5 | 0.376 | 1.018 | 0.968 | 0.965 | 0.945 | 0.939 | 0.914 | 0.891 | |
| 7.50-16 | 0.383 | 1.037 | 0.986 | 0.983 | 0.963 | 0.956 | 0.931 | 0.907 | |
| 7.50R16 | 0.387 | 1.048 | 0.996 | 0.993 | 0.973 | 0.966 | 0.941 | 0.917 | |
| 235/75R17.5 | 0.387 | 1.048 | 0.996 | 0.993 | 0.973 | 0.966 | 0.941 | 0.917 | |
| 225/80R17.5 | 0.389 | 1.053 | 1.002 | 0.998 | 0.978 | 0.971 | 0.946 | 0.921 | |
| 225/70R19.5 | 0.395 | 1.069 | 1.017 | 1.014 | 0.993 | 0.986 | 0.960 | 0.936 | 0.890 |
| 8.25-16 | 0.404 | 1.094 | 1.040 | 1.037 | 1.015 | 1.009 | 0.982 | 0.957 | 0.910 |
| 245/70R19.5 | 0.407 | 1.102 | 1.048 | 1.044 | 1.023 | 1.016 | 0.989 | 0.964 | 0.917 |
| 8.25R16 | 0.409 | 1.107 | 1.053 | 1.050 | 1.028 | 1.021 | 0.994 | 0.969 | 0.921 |
| 9.5R17.5 | 0.409 | 1.107 | 1.053 | 1.050 | 1.028 | 1.021 | 0.994 | 0.969 | 0.921 |
| 225/90R17.5 | 0.410 | 1.110 | 1.056 | 1.052 | 1.031 | 1.024 | 0.997 | 0.971 | 0.924 |
| 9.00-16 | 0.420 | 1.137 | 1.081 | 1.078 | 1.056 | 1.049 | 1.021 | 0.995 | 0.946 |
| 265/70R19.5 | 0.421 | 1.140 | 1.084 | 1.080 | 1.058 | 1.051 | 1.023 | 0.997 | 0.948 |
| 7.50-18 | 0.423 | 1.145 | 1.089 | 1.086 | 1.063 | 1.056 | 1.028 | 1.002 | 0.953 |
| 7.50R18 | 0.426 | 1.153 | 1.097 | 1.093 | 1.071 | 1.064 | 1.036 | 1.009 | 0.960 |
| 9R19.5 | 0.433 | 1.172 | 1.115 | 1.111 | 1.088 | 1.081 | 1.053 | 1.026 | 0.976 |
| 265/60R22.5 | 0.438 | 1.186 | 1.128 | 1.124 | 1.101 | 1.094 | 1.065 | 1.037 | 0.987 |
| 235/70R22.5 | 0.440 | 1.191 | 1.133 | 1.129 | 1.106 | 1.099 | 1.070 | 1.042 | 0.991 |
| 7.50-20 | 0.448 | 1.213 | 1.154 | 1.150 | 1.126 | 1.119 | 1.089 | 1.061 | 1.009 |
| 285/60R22.5 | 0.450 | 1.218 | 1.159 | 1.155 | 1.131 | 1.124 | 1.094 | 1.066 | 1.014 |
| 7.50R20 | 0.452 | 1.224 | 1.164 | 1.160 | 1.136 | 1.129 | 1.099 | 1.071 | 1.018 |
| 255/70R22.5 | 0.453 | 1.226 | 1.166 | 1.163 | 1.139 | 1.131 | 1.101 | 1.073 | 1.021 |
| 275/70R22.5 | 0.465 | 1.259 | 1.197 | 1.193 | 1.169 | 1.161 | 1.131 | 1.101 | 1.048 |
| 11/70R22.5 | 0.468 | 1.267 | 1.205 | 1.201 | 1.176 | 1.169 | 1.138 | 1.109 | 1.054 |
| 8.25-20 | 0.468 | 1.267 | 1.205 | 1.201 | 1.176 | 1.169 | 1.138 | 1.109 | 1.054 |
| 8.25R20 | 0.470 | 1.272 | 1.210 | 1.206 | 1.181 | 1.174 | 1.143 | 1.113 | 1.059 |
| 9R22.5 | 0.470 | 1.272 | 1.210 | 1.206 | 1.181 | 1.174 | 1.143 | 1.113 | 1.059 |
| 265/75R22.5 | 0.474 | 1.283 | 1.221 | 1.217 | 1.191 | 1.184 | 1.152 | 1.123 | 1.068 |
| 295/70R22.5 | 0.479 | 1.297 | 1.233 | 1.229 | 1.204 | 1.196 | 1.165 | 1.135 | 1.079 |
| 9.00-20 | 0.490 | 1.327 | 1.262 | 1.258 | 1.232 | 1.224 | 1.191 | 1.161 | 1.104 |
| 275/80R22.5 | 0.491 | 1.329 | 1.264 | 1.260 | 1.234 | 1.226 | 1.194 | 1.163 | 1.106 |
| 9.00R20 | 0.492 | 1.332 | 1.267 | 1.263 | 1.237 | 1.229 | 1.196 | 1.165 | 1.109 |
| 10R22.5 | 0.492 | 1.332 | 1.267 | 1.263 | 1.237 | 1.229 | 1.196 | 1.165 | 1.109 |
| 295/75R22.5 | 0.493 | 1.335 | 1.269 | 1.265 | 1.239 | 1.231 | 1.199 | 1.168 | 1.111 |
| 295/80R22.5 | 0.505 | 1.367 | 1.300 | 1.296 | 1.269 | 1.261 | 1.228 | 1.196 | 1.138 |
| 10.00-20 | 0.506 | 1.370 | 1.303 | 1.299 | 1.272 | 1.264 | 1.230 | 1.199 | 1.140 |
| 11.1-20 | 0.506 | 1.370 | 1.303 | 1.299 | 1.272 | 1.264 | 1.230 | 1.199 | 1.140 |
| 10.00R20 | 0.508 | 1.375 | 1.308 | 1.304 | 1.277 | 1.269 | 1.235 | 1.203 | 1.145 |
| 11.1R20 | 0.508 | 1.375 | 1.308 | 1.304 | 1.277 | 1.269 | 1.235 | 1.203 | 1.145 |
| 11R22.5 | 0.508 | 1.375 | 1.308 | 1.304 | 1.277 | 1.269 | 1.235 | 1.203 | 1.145 |
| 11.00-20 | 0.520 | 1.408 | 1.339 | 1.335 | 1.307 | 1.298 | 1.264 | 1.232 | 1.172 |
| 315/80R22.5 | 0.520 | 1.408 | 1.339 | 1.335 | 1.307 | 1.298 | 1.264 | 1.232 | 1.172 |
| 11.00R20 | 0.523 | 1.416 | 1.347 | 1.342 | 1.315 | 1.306 | 1.272 | 1.239 | 1.178 |
| 12R22.5 | 0.523 | 1.416 | 1.347 | 1.342 | 1.315 | 1.306 | 1.272 | 1.239 | 1.178 |

M12010100070

| | | REAR AXLE GEAR RATIO | | | | | |
|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 6.142 | 6.285 | 6.428 | 6.571 | 6.833 | 7.166 |
| 225/60R17.5 | 0.349 | | | | | | |
| 215/70R17.5 | 0.364 | | | | | | |
| 195/80R17.5 | 0.367 | | | | | | |
| 205/80R17.5 | 0.374 | | | | | | |
| 235/70R17.5 | 0.376 | | | | | | |
| 7.50-16 | 0.383 | | | | | | |
| 7.50R16 | 0.387 | | | | | | |
| 235/75R17.5 | 0.387 | | | | | | |
| 225/80R17.5 | 0.389 | | | | | | |
| 225/70R19.5 | 0.395 | | | | | | |
| 8.25-16 | 0.404 | | | | | | |
| 245/70R19.5 | 0.407 | | | | | | |
| 8.25R16 | 0.409 | | | | | | |
| 9.5R17.5 | 0.409 | | | | | | |
| 225/90R17.5 | 0.410 | | | | | | |
| 9.00-16 | 0.420 | 0.902 | 0.882 | | | | |
| 265/70R19.5 | 0.421 | 0.904 | 0.884 | | | | |
| 7.50-18 | 0.423 | 0.909 | 0.888 | | | | |
| 7.50R18 | 0.426 | 0.915 | 0.894 | | | | |
| 9R19.5 | 0.433 | 0.930 | 0.909 | 0.889 | | | |
| 265/60R22.5 | 0.438 | 0.941 | 0.920 | 0.899 | | | |
| 235/70R22.5 | 0.440 | 0.945 | 0.924 | 0.903 | 0.884 | | |
| 7.50-20 | 0.448 | 0.962 | 0.941 | 0.920 | 0.900 | | |
| 285/60R22.5 | 0.450 | 0.967 | 0.945 | 0.924 | 0.904 | | |
| 7.50R20 | 0.452 | 0.971 | 0.949 | 0.928 | 0.908 | | |
| 255/70R22.5 | 0.453 | 0.973 | 0.951 | 0.930 | 0.910 | | |
| 275/70R22.5 | 0.465 | 0.999 | 0.976 | 0.955 | 0.934 | 0.898 | |
| 11/70R22.5 | 0.468 | 1.005 | 0.983 | 0.961 | 0.940 | 0.904 | |
| 8.25-20 | 0.468 | 1.005 | 0.983 | 0.961 | 0.940 | 0.904 | |
| 8.25R20 | 0.470 | 1.010 | 0.987 | 0.965 | 0.944 | 0.908 | |
| 9R22.5 | 0.470 | 1.010 | 0.987 | 0.965 | 0.944 | 0.908 | |
| 265/75R22.5 | 0.474 | 1.018 | 0.995 | 0.973 | 0.952 | 0.915 | |
| 295/70R22.5 | 0.479 | 1.029 | 1.006 | 0.983 | 0.962 | 0.925 | 0.882 |
| 9.00-20 | 0.490 | 1.053 | 1.029 | 1.006 | 0.984 | 0.946 | 0.902 |
| 275/80R22.5 | 0.491 | 1.055 | 1.031 | 1.008 | 0.986 | 0.948 | 0.904 |
| 9.00R20 | 0.492 | 1.057 | 1.033 | 1.010 | 0.988 | 0.950 | 0.906 |
| 10R22.5 | 0.492 | 1.057 | 1.033 | 1.010 | 0.988 | 0.950 | 0.906 |
| 295/75R22.5 | 0.493 | 1.059 | 1.035 | 1.012 | 0.990 | 0.952 | 0.908 |
| 295/80R22.5 | 0.505 | 1.085 | 1.060 | 1.037 | 1.014 | 0.975 | 0.930 |
| 10.00-20 | 0.506 | 1.087 | 1.062 | 1.039 | 1.016 | 0.977 | 0.932 |
| 11.1-20 | 0.506 | 1.087 | 1.062 | 1.039 | 1.016 | 0.977 | 0.932 |
| 10.00R20 | 0.508 | 1.091 | 1.067 | 1.043 | 1.020 | 0.981 | 0.935 |
| 11.1R20 | 0.508 | 1.091 | 1.067 | 1.043 | 1.020 | 0.981 | 0.935 |
| 11R22.5 | 0.508 | 1.091 | 1.067 | 1.043 | 1.020 | 0.981 | 0.935 |
| 11.00-20 | 0.520 | 1.117 | 1.092 | 1.068 | 1.044 | 1.004 | 0.958 |
| 315/80R22.5 | 0.520 | 1.117 | 1.092 | 1.068 | 1.044 | 1.004 | 0.958 |
| 11.00R20 | 0.523 | 1.124 | 1.098 | 1.074 | 1.050 | 1.010 | 0.963 |
| 12R22.5 | 0.523 | 1.124 | 1.098 | 1.074 | 1.050 | 1.010 | 0.963 |

M12010100071

## LF05,06,LH05,LX06 TRANSMISSION SERIES (For Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *3.363* | *3.636* | *3.900* | *4.100* | *4.300* | *4.333* | *4.555* | *4.625* |
| *225/60R17.5* | 0.349 | 1.342 | 1.241 | 1.157 | 1.100 | 1.049 | 1.041 | 0.990 | 0.975 |
| *215/70R17.5* | 0.364 | 1.399 | 1.294 | 1.207 | 1.148 | 1.094 | 1.086 | 1.033 | 1.017 |
| *195/80R17.5* | 0.367 | 1.411 | 1.305 | 1.217 | 1.157 | 1.103 | 1.095 | 1.042 | 1.026 |
| *205/80R17.5* | 0.374 | 1.438 | 1.330 | 1.240 | 1.179 | 1.124 | 1.116 | 1.061 | 1.045 |
| *235/70R17.5* | 0.376 | 1.445 | 1.337 | 1.246 | 1.186 | 1.130 | 1.122 | 1.067 | 1.051 |
| *7.50-16* | 0.383 | 1.472 | 1.362 | 1.270 | 1.208 | 1.151 | 1.143 | 1.087 | 1.070 |
| *7.50R16* | 0.387 | 1.488 | 1.376 | 1.283 | 1.220 | 1.163 | 1.155 | 1.098 | 1.082 |
| *235/75R17.5* | 0.387 | 1.488 | 1.376 | 1.283 | 1.220 | 1.163 | 1.155 | 1.098 | 1.082 |
| *225/80R17.5* | 0.389 | 1.495 | 1.383 | 1.289 | 1.227 | 1.169 | 1.161 | 1.104 | 1.087 |
| *225/70R19.5* | 0.395 | 1.519 | 1.404 | 1.309 | 1.245 | 1.188 | 1.178 | 1.121 | 1.104 |
| *8.25-16* | 0.404 | 1.553 | 1.436 | 1.339 | 1.274 | 1.215 | 1.205 | 1.147 | 1.129 |
| *245/70R19.5* | 0.407 | 1.565 | 1.447 | 1.349 | 1.283 | 1.224 | 1.214 | 1.155 | 1.138 |
| *8.25R16* | 0.409 | 1.572 | 1.454 | 1.356 | 1.290 | 1.230 | 1.220 | 1.161 | 1.143 |
| *9.5R17.5* | 0.409 | 1.572 | 1.454 | 1.356 | 1.290 | 1.230 | 1.220 | 1.161 | 1.143 |
| *225/90R17.5* | 0.410 | 1.576 | 1.458 | 1.359 | 1.293 | 1.233 | 1.223 | 1.164 | 1.146 |
| *9.00-16* | 0.420 | | 1.493 | 1.392 | 1.324 | 1.263 | 1.253 | 1.192 | 1.174 |
| *265/70R19.5* | 0.421 | | 1.497 | 1.396 | 1.327 | 1.266 | 1.256 | 1.195 | 1.177 |
| *7.50-18* | 0.423 | | 1.504 | 1.402 | 1.334 | 1.272 | 1.262 | 1.201 | 1.182 |
| *7.50R18* | 0.426 | | 1.515 | 1.412 | 1.343 | 1.281 | 1.271 | 1.209 | 1.191 |
| *9R19.5* | 0.433 | | 1.540 | 1.435 | 1.365 | 1.302 | 1.292 | 1.229 | 1.210 |
| *265/60R22.5* | 0.438 | | 1.557 | 1.452 | 1.381 | 1.317 | 1.307 | 1.243 | 1.224 |
| *235/70R22.5* | 0.440 | | 1.565 | 1.459 | 1.387 | 1.323 | 1.313 | 1.249 | 1.230 |
| *7.50-20* | 0.448 | | 1.593 | 1.485 | 1.413 | 1.347 | 1.337 | 1.271 | 1.252 |
| *285/60R22.5* | 0.450 | | 1.600 | 1.492 | 1.419 | 1.353 | 1.343 | 1.277 | 1.258 |
| *7.50R20* | 0.452 | | 1.607 | 1.498 | 1.425 | 1.359 | 1.349 | 1.283 | 1.263 |
| *255/70R22.5* | 0.453 | | 1.611 | 1.502 | 1.428 | 1.362 | 1.352 | 1.286 | 1.266 |
| *275/70R22.5* | 0.465 | | | 1.541 | 1.466 | 1.398 | 1.387 | 1.320 | 1.300 |
| *11/70R22.5* | 0.468 | | | 1.551 | 1.476 | 1.407 | 1.396 | 1.328 | 1.308 |
| *8.25-20* | 0.468 | | | 1.551 | 1.476 | 1.407 | 1.396 | 1.328 | 1.308 |
| *8.25R20* | 0.470 | | | 1.558 | 1.482 | 1.413 | 1.402 | 1.334 | 1.314 |
| *9R22.5* | 0.470 | | | 1.558 | 1.482 | 1.413 | 1.402 | 1.334 | 1.314 |
| *265/75R22.5* | 0.474 | | | 1.571 | 1.495 | 1.425 | 1.414 | 1.345 | 1.325 |
| *295/70R22.5* | 0.479 | | | | 1.510 | 1.440 | 1.429 | 1.360 | 1.339 |
| *9.00-20* | 0.490 | | | | 1.545 | 1.473 | 1.462 | 1.391 | 1.370 |
| *275/80R22.5* | 0.491 | | | | 1.548 | 1.476 | 1.465 | 1.394 | 1.372 |
| *9.00R20* | 0.492 | | | | 1.551 | 1.479 | 1.468 | 1.396 | 1.375 |
| *10R22.5* | 0.492 | | | | 1.551 | 1.479 | 1.468 | 1.396 | 1.375 |
| *295/75R22.5* | 0.493 | | | | 1.555 | 1.482 | 1.471 | 1.399 | 1.378 |
| *295/80R22.5* | 0.505 | | | | 1.592 | 1.518 | 1.507 | 1.433 | 1.412 |
| *10.00-20* | 0.506 | | | | 1.596 | 1.521 | 1.510 | 1.436 | 1.414 |
| *11.1-20* | 0.506 | | | | 1.596 | 1.521 | 1.510 | 1.436 | 1.414 |
| *10.00R20* | 0.508 | | | | 1.602 | 1.527 | 1.516 | 1.442 | 1.420 |
| *11.1R20* | 0.508 | | | | 1.602 | 1.527 | 1.516 | 1.442 | 1.420 |
| *11R22.5* | 0.508 | | | | 1.602 | 1.527 | 1.516 | 1.442 | 1.420 |
| *11.00-20* | 0.520 | | | | 1.640 | 1.563 | 1.552 | 1.476 | 1.454 |
| *315/80R22.5* | 0.520 | | | | 1.640 | 1.563 | 1.552 | 1.476 | 1.454 |
| *11.00R20* | 0.523 | | | | 1.649 | 1.573 | 1.561 | 1.484 | 1.462 |
| *12R22.5* | 0.523 | | | | 1.649 | 1.573 | 1.561 | 1.484 | 1.462 |

M12010100251

| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *4.875* | *5.125* | *5.142* | *5.250* | *5.285* | *5.428* | *5.571* | *5.857* |
| *225/60R17.5* | 0.349 | 0.925 | 0.880 | 0.877 | | | | | |
| *215/70R17.5* | 0.364 | 0.965 | 0.918 | 0.915 | 0.896 | 0.890 | 0.867 | | |
| *195/80R17.5* | 0.367 | 0.973 | 0.926 | 0.923 | 0.904 | 0.898 | 0.874 | | |
| *205/80R17.5* | 0.374 | 0.992 | 0.943 | 0.940 | 0.921 | 0.915 | 0.891 | 0.868 | |
| *235/70R17.5* | 0.376 | 0.997 | 0.948 | 0.945 | 0.926 | 0.920 | 0.895 | 0.872 | |
| *7.50-16* | 0.383 | 1.016 | 0.966 | 0.963 | 0.943 | 0.937 | 0.912 | 0.889 | |
| *7.50R16* | 0.387 | 1.026 | 0.976 | 0.973 | 0.953 | 0.947 | 0.922 | 0.898 | |
| *235/75R17.5* | 0.387 | 1.026 | 0.976 | 0.973 | 0.953 | 0.947 | 0.922 | 0.898 | |
| *225/80R17.5* | 0.389 | 1.031 | 0.981 | 0.978 | 0.958 | 0.951 | 0.926 | 0.903 | |
| *225/70R19.5* | 0.395 | 1.047 | 0.996 | 0.993 | 0.973 | 0.966 | 0.941 | 0.916 | 0.872 |
| *8.25-16* | 0.404 | 1.071 | 1.019 | 1.016 | 0.995 | 0.988 | 0.962 | 0.937 | 0.892 |
| *245/70R19.5* | 0.407 | 1.079 | 1.027 | 1.023 | 1.002 | 0.995 | 0.969 | 0.944 | 0.898 |
| *8.25R16* | 0.409 | 1.085 | 1.032 | 1.028 | 1.007 | 1.000 | 0.974 | 0.949 | 0.903 |
| *9.5R17.5* | 0.409 | 1.085 | 1.032 | 1.028 | 1.007 | 1.000 | 0.974 | 0.949 | 0.903 |
| *225/90R17.5* | 0.410 | 1.087 | 1.034 | 1.031 | 1.009 | 1.003 | 0.976 | 0.951 | 0.905 |
| *9.00-16* | 0.420 | 1.114 | 1.059 | 1.056 | 1.034 | 1.027 | 1.000 | 0.975 | 0.927 |
| *265/70R19.5* | 0.421 | 1.116 | 1.062 | 1.058 | 1.037 | 1.030 | 1.003 | 0.977 | 0.929 |
| *7.50-18* | 0.423 | 1.122 | 1.067 | 1.063 | 1.042 | 1.035 | 1.007 | 0.981 | 0.934 |
| *7.50R18* | 0.426 | 1.130 | 1.075 | 1.071 | 1.049 | 1.042 | 1.014 | 0.988 | 0.940 |
| *9R19.5* | 0.433 | 1.148 | 1.092 | 1.089 | 1.066 | 1.059 | 1.031 | 1.005 | 0.956 |
| *265/60R22.5* | 0.438 | 1.161 | 1.105 | 1.101 | 1.078 | 1.071 | 1.043 | 1.016 | 0.967 |
| *235/70R22.5* | 0.440 | 1.167 | 1.110 | 1.106 | 1.083 | 1.076 | 1.048 | 1.021 | 0.971 |
| *7.50-20* | 0.448 | 1.188 | 1.130 | 1.126 | 1.103 | 1.096 | 1.067 | 1.040 | 0.989 |
| *285/60R22.5* | 0.450 | 1.193 | 1.135 | 1.131 | 1.108 | 1.101 | 1.072 | 1.044 | 0.993 |
| *7.50R20* | 0.452 | 1.199 | 1.140 | 1.136 | 1.113 | 1.106 | 1.076 | 1.049 | 0.998 |
| *255/70R22.5* | 0.453 | 1.201 | 1.143 | 1.139 | 1.115 | 1.108 | 1.079 | 1.051 | 1.000 |
| *275/70R22.5* | 0.465 | 1.233 | 1.173 | 1.169 | 1.145 | 1.137 | 1.107 | 1.079 | 1.026 |
| *11/70R22.5* | 0.468 | 1.241 | 1.180 | 1.177 | 1.152 | 1.145 | 1.115 | 1.086 | 1.033 |
| *8.25-20* | 0.468 | 1.241 | 1.180 | 1.177 | 1.152 | 1.145 | 1.115 | 1.086 | 1.033 |
| *8.25R20* | 0.470 | 1.246 | 1.186 | 1.182 | 1.157 | 1.150 | 1.119 | 1.091 | 1.037 |
| *9R22.5* | 0.470 | 1.246 | 1.186 | 1.182 | 1.157 | 1.150 | 1.119 | 1.091 | 1.037 |
| *265/75R22.5* | 0.474 | 1.257 | 1.196 | 1.192 | 1.167 | 1.159 | 1.129 | 1.100 | 1.046 |
| *295/70R22.5* | 0.479 | 1.270 | 1.208 | 1.204 | 1.179 | 1.172 | 1.141 | 1.111 | 1.057 |
| *9.00-20* | 0.490 | 1.299 | 1.236 | 1.232 | 1.207 | 1.199 | 1.167 | 1.137 | 1.081 |
| *275/80R22.5* | 0.491 | 1.302 | 1.239 | 1.234 | 1.209 | 1.201 | 1.169 | 1.139 | 1.084 |
| *9.00R20* | 0.492 | 1.305 | 1.241 | 1.237 | 1.211 | 1.203 | 1.172 | 1.142 | 1.086 |
| *10R22.5* | 0.492 | 1.305 | 1.241 | 1.237 | 1.211 | 1.203 | 1.172 | 1.142 | 1.086 |
| *295/75R22.5* | 0.493 | 1.307 | 1.244 | 1.239 | 1.214 | 1.206 | 1.174 | 1.144 | 1.088 |
| *295/80R22.5* | 0.505 | 1.339 | 1.274 | 1.270 | 1.244 | 1.235 | 1.203 | 1.172 | 1.115 |
| *10.00-20* | 0.506 | 1.342 | 1.276 | 1.272 | 1.246 | 1.238 | 1.205 | 1.174 | 1.117 |
| *11.1-20* | 0.506 | 1.342 | 1.276 | 1.272 | 1.246 | 1.238 | 1.205 | 1.174 | 1.117 |
| *10.00R20* | 0.508 | 1.347 | 1.281 | 1.277 | 1.251 | 1.243 | 1.210 | 1.179 | 1.121 |
| *11.1R20* | 0.508 | 1.347 | 1.281 | 1.277 | 1.251 | 1.243 | 1.210 | 1.179 | 1.121 |
| *11R22.5* | 0.508 | 1.347 | 1.281 | 1.277 | 1.251 | 1.243 | 1.210 | 1.179 | 1.121 |
| *11.00-20* | 0.520 | 1.379 | 1.312 | 1.307 | 1.280 | 1.272 | 1.238 | 1.207 | 1.148 |
| *315/80R22.5* | 0.520 | 1.379 | 1.312 | 1.307 | 1.280 | 1.272 | 1.238 | 1.207 | 1.148 |
| *11.00R20* | 0.523 | 1.387 | 1.319 | 1.315 | 1.288 | 1.279 | 1.246 | 1.214 | 1.154 |
| *12R22.5* | 0.523 | 1.387 | 1.319 | 1.315 | 1.288 | 1.279 | 1.246 | 1.214 | 1.154 |

M12010100252

| | | REAR AXLE GEAR RATIO | | | | | |
|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 6.142 | 6.285 | 6.428 | 6.571 | 6.833 | 7.166 |
| 225/60R17.5 | 0.349 | | | | | | |
| 215/70R17.5 | 0.364 | | | | | | |
| 195/80R17.5 | 0.367 | | | | | | |
| 205/80R17.5 | 0.374 | | | | | | |
| 235/70R17.5 | 0.376 | | | | | | |
| 7.50-16 | 0.383 | | | | | | |
| 7.50R16 | 0.387 | | | | | | |
| 235/75R17.5 | 0.387 | | | | | | |
| 225/80R17.5 | 0.389 | | | | | | |
| 225/70R19.5 | 0.395 | | | | | | |
| 8.25-16 | 0.404 | | | | | | |
| 245/70R19.5 | 0.407 | | | | | | |
| 8.25R16 | 0.409 | | | | | | |
| 9.5R17.5 | 0.409 | | | | | | |
| 225/90R17.5 | 0.410 | | | | | | |
| 9.00-16 | 0.420 | 0.884 | 0.864 | | | | |
| 265/70R19.5 | 0.421 | 0.886 | 0.866 | | | | |
| 7.50-18 | 0.423 | 0.890 | 0.870 | | | | |
| 7.50R18 | 0.426 | 0.897 | 0.876 | | | | |
| 9R19.5 | 0.433 | 0.911 | 0.891 | 0.871 | | | |
| 265/60R22.5 | 0.438 | 0.922 | 0.901 | 0.881 | | | |
| 235/70R22.5 | 0.440 | 0.926 | 0.905 | 0.885 | 0.865 | | |
| 7.50-20 | 0.448 | 0.943 | 0.921 | 0.901 | 0.881 | | |
| 285/60R22.5 | 0.450 | 0.947 | 0.925 | 0.905 | 0.885 | | |
| 7.50R20 | 0.452 | 0.951 | 0.930 | 0.909 | 0.889 | | |
| 255/70R22.5 | 0.453 | 0.953 | 0.932 | 0.911 | 0.891 | | |
| 275/70R22.5 | 0.465 | 0.979 | 0.956 | 0.935 | 0.915 | 0.880 | |
| 11/70R22.5 | 0.468 | 0.985 | 0.963 | 0.941 | 0.921 | 0.885 | |
| 8.25-20 | 0.468 | 0.985 | 0.963 | 0.941 | 0.921 | 0.885 | |
| 8.25R20 | 0.470 | 0.989 | 0.967 | 0.945 | 0.925 | 0.889 | |
| 9R22.5 | 0.470 | 0.989 | 0.967 | 0.945 | 0.925 | 0.889 | |
| 265/75R22.5 | 0.474 | 0.998 | 0.975 | 0.953 | 0.932 | 0.897 | |
| 295/70R22.5 | 0.479 | 1.008 | 0.985 | 0.963 | 0.942 | 0.906 | 0.864 |
| 9.00-20 | 0.490 | 1.031 | 1.008 | 0.985 | 0.964 | 0.927 | 0.884 |
| 275/80R22.5 | 0.491 | 1.033 | 1.010 | 0.987 | 0.966 | 0.929 | 0.886 |
| 9.00R20 | 0.492 | 1.035 | 1.012 | 0.989 | 0.968 | 0.931 | 0.887 |
| 10R22.5 | 0.492 | 1.035 | 1.012 | 0.989 | 0.968 | 0.931 | 0.887 |
| 295/75R22.5 | 0.493 | 1.038 | 1.014 | 0.991 | 0.970 | 0.933 | 0.889 |
| 295/80R22.5 | 0.505 | 1.063 | 1.039 | 1.016 | 0.993 | 0.955 | 0.911 |
| 10.00-20 | 0.506 | 1.065 | 1.041 | 1.018 | 0.995 | 0.957 | 0.913 |
| 11.1-20 | 0.506 | 1.065 | 1.041 | 1.018 | 0.995 | 0.957 | 0.913 |
| 10.00R20 | 0.508 | 1.069 | 1.045 | 1.022 | 0.999 | 0.961 | 0.916 |
| 11.1R20 | 0.508 | 1.069 | 1.045 | 1.022 | 0.999 | 0.961 | 0.916 |
| 11R22.5 | 0.508 | 1.069 | 1.045 | 1.022 | 0.999 | 0.961 | 0.916 |
| 11.00-20 | 0.520 | 1.094 | 1.070 | 1.046 | 1.023 | 0.984 | 0.938 |
| 315/80R22.5 | 0.520 | 1.094 | 1.070 | 1.046 | 1.023 | 0.984 | 0.938 |
| 11.00R20 | 0.523 | 1.101 | 1.076 | 1.052 | 1.029 | 0.989 | 0.943 |
| 12R22.5 | 0.523 | 1.101 | 1.076 | 1.052 | 1.029 | 0.989 | 0.943 |

M12010100253

## LJ06, MF06 TRANSMISSION SERIES (Except Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *3.363* | *3.636* | *3.900* | *4.100* | *4.300* | *4.333* | *4.555* | *4.625* |
| *225/60R17.5* | 0.349 | 1.112 | 1.029 | 0.959 | 0.912 | 0.870 | 0.863 | 0.821 | 0.808 |
| *215/70R17.5* | 0.364 | 1.160 | 1.073 | 1.000 | 0.951 | 0.907 | 0.900 | 0.856 | 0.843 |
| *195/80R17.5* | 0.367 | 1.169 | 1.082 | 1.008 | 0.959 | 0.914 | 0.908 | 0.863 | 0.850 |
| *205/80R17.5* | 0.374 | 1.192 | 1.102 | 1.028 | 0.977 | 0.932 | 0.925 | 0.880 | 0.866 |
| *235/70R17.5* | 0.376 | 1.198 | 1.108 | 1.033 | 0.983 | 0.937 | 0.930 | 0.884 | 0.871 |
| *7.50-16* | 0.383 | 1.220 | 1.129 | 1.052 | 1.001 | 0.954 | 0.947 | 0.901 | 0.887 |
| *7.50R16* | 0.387 | 1.233 | 1.141 | 1.063 | 1.011 | 0.964 | 0.957 | 0.910 | 0.897 |
| *235/75R17.5* | 0.387 | 1.233 | 1.141 | 1.063 | 1.011 | 0.964 | 0.957 | 0.910 | 0.897 |
| *225/80R17.5* | 0.389 | 1.240 | 1.146 | 1.069 | 1.017 | 0.969 | 0.962 | 0.915 | 0.901 |
| *225/70R19.5* | 0.395 | 1.259 | 1.164 | 1.085 | 1.032 | 0.984 | 0.977 | 0.929 | 0.915 |
| *8.25-16* | 0.404 | 1.287 | 1.191 | 1.110 | 1.056 | 1.007 | 0.999 | 0.950 | 0.936 |
| *245/70R19.5* | 0.407 | 1.297 | 1.200 | 1.118 | 1.064 | 1.014 | 1.006 | 0.957 | 0.943 |
| *8.25R16* | 0.409 | 1.303 | 1.205 | 1.124 | 1.069 | 1.019 | 1.011 | 0.962 | 0.948 |
| *9.5R17.5* | 0.409 | 1.303 | 1.205 | 1.124 | 1.069 | 1.019 | 1.011 | 0.962 | 0.948 |
| *225/90R17.5* | 0.410 | 1.307 | 1.208 | 1.127 | 1.072 | 1.022 | 1.014 | 0.964 | 0.950 |
| *9.00-16* | 0.420 | | 1.238 | 1.154 | 1.098 | 1.047 | 1.039 | 0.988 | 0.973 |
| *265/70R19.5* | 0.421 | | 1.241 | 1.157 | 1.100 | 1.049 | 1.041 | 0.990 | 0.975 |
| *7.50-18* | 0.423 | | 1.247 | 1.162 | 1.106 | 1.054 | 1.046 | 0.995 | 0.980 |
| *7.50R18* | 0.426 | | 1.256 | 1.171 | 1.113 | 1.062 | 1.054 | 1.002 | 0.987 |
| *9R19.5* | 0.433 | | 1.276 | 1.190 | 1.132 | 1.079 | 1.071 | 1.019 | 1.003 |
| *265/60R22.5* | 0.438 | | 1.291 | 1.204 | 1.145 | 1.092 | 1.083 | 1.030 | 1.015 |
| *235/70R22.5* | 0.440 | | 1.297 | 1.209 | 1.150 | 1.097 | 1.088 | 1.035 | 1.019 |
| *7.50-20* | 0.448 | | 1.320 | 1.231 | 1.171 | 1.116 | 1.108 | 1.054 | 1.038 |
| *285/60R22.5* | 0.450 | | 1.326 | 1.237 | 1.176 | 1.121 | 1.113 | 1.059 | 1.043 |
| *7.50R20* | 0.452 | | 1.332 | 1.242 | 1.181 | 1.126 | 1.118 | 1.063 | 1.047 |
| *255/70R22.5* | 0.453 | | 1.335 | 1.245 | 1.184 | 1.129 | 1.120 | 1.066 | 1.050 |
| *275/70R22.5* | 0.465 | | | 1.278 | 1.215 | 1.159 | 1.150 | 1.094 | 1.077 |
| *11/70R22.5* | 0.468 | | | 1.286 | 1.223 | 1.166 | 1.157 | 1.101 | 1.084 |
| *8.25-20* | 0.468 | | | 1.286 | 1.223 | 1.166 | 1.157 | 1.101 | 1.084 |
| *8.25R20* | 0.470 | | | 1.291 | 1.228 | 1.171 | 1.162 | 1.106 | 1.089 |
| *9R22.5* | 0.470 | | | 1.291 | 1.228 | 1.171 | 1.162 | 1.106 | 1.089 |
| *265/75R22.5* | 0.474 | | | 1.302 | 1.239 | 1.181 | 1.172 | 1.115 | 1.098 |
| *295/70R22.5* | 0.479 | | | | 1.252 | 1.194 | 1.185 | 1.127 | 1.110 |
| *9.00-20* | 0.490 | | | | 1.281 | 1.221 | 1.212 | 1.153 | 1.135 |
| *275/80R22.5* | 0.491 | | | | 1.283 | 1.224 | 1.214 | 1.155 | 1.138 |
| *9.00R20* | 0.492 | | | | 1.286 | 1.226 | 1.217 | 1.157 | 1.140 |
| *10R22.5* | 0.492 | | | | 1.286 | 1.226 | 1.217 | 1.157 | 1.140 |
| *295/75R22.5* | 0.493 | | | | 1.289 | 1.229 | 1.219 | 1.160 | 1.142 |
| *295/80R22.5* | 0.505 | | | | 1.320 | 1.259 | 1.249 | 1.188 | 1.170 |
| *10.00-20* | 0.506 | | | | 1.323 | 1.261 | 1.251 | 1.190 | 1.172 |
| *11.1-20* | 0.506 | | | | 1.323 | 1.261 | 1.251 | 1.190 | 1.172 |
| *10.00R20* | 0.508 | | | | 1.328 | 1.266 | 1.256 | 1.195 | 1.177 |
| *11.1R20* | 0.508 | | | | 1.328 | 1.266 | 1.256 | 1.195 | 1.177 |
| *11R22.5* | 0.508 | | | | 1.328 | 1.266 | 1.256 | 1.195 | 1.177 |
| *11.00-20* | 0.520 | | | | 1.359 | 1.296 | 1.286 | 1.223 | 1.205 |
| *315/80R22.5* | 0.520 | | | | 1.359 | 1.296 | 1.286 | 1.223 | 1.205 |
| *11.00R20* | 0.523 | | | | 1.367 | 1.303 | 1.294 | 1.230 | 1.212 |
| *12R22.5* | 0.523 | | | | 1.367 | 1.303 | 1.294 | 1.230 | 1.212 |

M12010100072

| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *4.875* | *5.125* | *5.142* | *5.250* | *5.285* | *5.428* | *5.571* | *5.857* |
| *225/60R17.5* | 0.349 | 0.767 | 0.730 | 0.727 | | | | | |
| *215/70R17.5* | 0.364 | 0.800 | 0.761 | 0.758 | 0.743 | 0.738 | 0.718 | | |
| *195/80R17.5* | 0.367 | 0.807 | 0.767 | 0.765 | 0.749 | 0.744 | 0.724 | | |
| *205/80R17.5* | 0.374 | 0.822 | 0.782 | 0.779 | 0.763 | 0.758 | 0.738 | 0.719 | |
| *235/70R17.5* | 0.376 | 0.826 | 0.786 | 0.783 | 0.767 | 0.762 | 0.742 | 0.723 | |
| *7.50-16* | 0.383 | 0.842 | 0.801 | 0.798 | 0.782 | 0.776 | 0.756 | 0.737 | |
| *7.50R16* | 0.387 | 0.851 | 0.809 | 0.806 | 0.790 | 0.785 | 0.764 | 0.744 | |
| *235/75R17.5* | 0.387 | 0.851 | 0.809 | 0.806 | 0.790 | 0.785 | 0.764 | 0.744 | |
| *225/80R17.5* | 0.389 | 0.855 | 0.813 | 0.811 | 0.794 | 0.789 | 0.768 | 0.748 | |
| *225/70R19.5* | 0.395 | 0.868 | 0.826 | 0.823 | 0.806 | 0.801 | 0.780 | 0.760 | 0.723 |
| *8.25-16* | 0.404 | 0.888 | 0.845 | 0.842 | 0.824 | 0.819 | 0.797 | 0.777 | 0.739 |
| *245/70R19.5* | 0.407 | 0.895 | 0.851 | 0.848 | 0.831 | 0.825 | 0.803 | 0.783 | 0.744 |
| *8.25R16* | 0.409 | 0.899 | 0.855 | 0.852 | 0.835 | 0.829 | 0.807 | 0.787 | 0.748 |
| *9.5R17.5* | 0.409 | 0.899 | 0.855 | 0.852 | 0.835 | 0.829 | 0.807 | 0.787 | 0.748 |
| *225/90R17.5* | 0.410 | 0.901 | 0.857 | 0.854 | 0.837 | 0.831 | 0.809 | 0.788 | 0.750 |
| *9.00-16* | 0.420 | 0.923 | 0.878 | 0.875 | 0.857 | 0.851 | 0.829 | 0.808 | 0.768 |
| *265/70R19.5* | 0.421 | 0.925 | 0.880 | 0.877 | 0.859 | 0.854 | 0.831 | 0.810 | 0.770 |
| *7.50-18* | 0.423 | 0.930 | 0.884 | 0.881 | 0.863 | 0.858 | 0.835 | 0.814 | 0.774 |
| *7.50R18* | 0.426 | 0.936 | 0.891 | 0.888 | 0.869 | 0.864 | 0.841 | 0.819 | 0.779 |
| *9R19.5* | 0.433 | 0.952 | 0.905 | 0.902 | 0.884 | 0.878 | 0.855 | 0.833 | 0.792 |
| *265/60R22.5* | 0.438 | 0.963 | 0.916 | 0.913 | 0.894 | 0.888 | 0.865 | 0.842 | 0.801 |
| *235/70R22.5* | 0.440 | 0.967 | 0.920 | 0.917 | 0.898 | 0.892 | 0.869 | 0.846 | 0.805 |
| *7.50-20* | 0.448 | 0.985 | 0.937 | 0.934 | 0.914 | 0.908 | 0.884 | 0.862 | 0.820 |
| *285/60R22.5* | 0.450 | 0.989 | 0.941 | 0.938 | 0.918 | 0.912 | 0.888 | 0.865 | 0.823 |
| *7.50R20* | 0.452 | 0.993 | 0.945 | 0.942 | 0.922 | 0.916 | 0.892 | 0.869 | 0.827 |
| *255/70R22.5* | 0.453 | 0.996 | 0.947 | 0.944 | 0.925 | 0.918 | 0.894 | 0.871 | 0.829 |
| *275/70R22.5* | 0.465 | 1.022 | 0.972 | 0.969 | 0.949 | 0.943 | 0.918 | 0.894 | 0.851 |
| *11/70R22.5* | 0.468 | 1.029 | 0.978 | 0.975 | 0.955 | 0.949 | 0.924 | 0.900 | 0.856 |
| *8.25-20* | 0.468 | 1.029 | 0.978 | 0.975 | 0.955 | 0.949 | 0.924 | 0.900 | 0.856 |
| *8.25R20* | 0.470 | 1.033 | 0.983 | 0.979 | 0.959 | 0.953 | 0.928 | 0.904 | 0.860 |
| *9R22.5* | 0.470 | 1.033 | 0.983 | 0.979 | 0.959 | 0.953 | 0.928 | 0.904 | 0.860 |
| *265/75R22.5* | 0.474 | 1.042 | 0.991 | 0.988 | 0.967 | 0.961 | 0.936 | 0.912 | 0.867 |
| *295/70R22.5* | 0.479 | 1.053 | 1.001 | 0.998 | 0.978 | 0.971 | 0.946 | 0.921 | 0.876 |
| *9.00-20* | 0.490 | 1.077 | 1.025 | 1.021 | 1.000 | 0.993 | 0.967 | 0.942 | 0.896 |
| *275/80R22.5* | 0.491 | 1.079 | 1.027 | 1.023 | 1.002 | 0.995 | 0.969 | 0.944 | 0.898 |
| *9.00R20* | 0.492 | 1.081 | 1.029 | 1.025 | 1.004 | 0.998 | 0.971 | 0.946 | 0.900 |
| *10R22.5* | 0.492 | 1.081 | 1.029 | 1.025 | 1.004 | 0.998 | 0.971 | 0.946 | 0.900 |
| *295/75R22.5* | 0.493 | 1.084 | 1.031 | 1.027 | 1.006 | 1.000 | 0.973 | 0.948 | 0.902 |
| *295/80R22.5* | 0.505 | 1.110 | 1.056 | 1.052 | 1.031 | 1.024 | 0.997 | 0.971 | 0.924 |
| *10.00-20* | 0.506 | 1.112 | 1.058 | 1.054 | 1.033 | 1.026 | 0.999 | 0.973 | 0.926 |
| *11.1-20* | 0.506 | 1.112 | 1.058 | 1.054 | 1.033 | 1.026 | 0.999 | 0.973 | 0.926 |
| *10.00R20* | 0.508 | 1.117 | 1.062 | 1.059 | 1.037 | 1.030 | 1.003 | 0.977 | 0.929 |
| *11.1R20* | 0.508 | 1.117 | 1.062 | 1.059 | 1.037 | 1.030 | 1.003 | 0.977 | 0.929 |
| *11R22.5* | 0.508 | 1.117 | 1.062 | 1.059 | 1.037 | 1.030 | 1.003 | 0.977 | 0.929 |
| *11.00-20* | 0.520 | 1.143 | 1.087 | 1.084 | 1.061 | 1.054 | 1.027 | 1.000 | 0.951 |
| *315/80R22.5* | 0.520 | 1.143 | 1.087 | 1.084 | 1.061 | 1.054 | 1.027 | 1.000 | 0.951 |
| *11.00R20* | 0.523 | 1.150 | 1.094 | 1.090 | 1.067 | 1.060 | 1.032 | 1.006 | 0.957 |
| *12R22.5* | 0.523 | 1.150 | 1.094 | 1.090 | 1.067 | 1.060 | 1.032 | 1.006 | 0.957 |

M12010100073

| | | REAR AXLE GEAR RATIO | | | | | |
|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 6.142 | 6.285 | 6.428 | 6.571 | 6.833 | 7.166 |
| 225/60R17.5 | 0.349 | | | | | | |
| 215/70R17.5 | 0.364 | | | | | | |
| 195/80R17.5 | 0.367 | | | | | | |
| 205/80R17.5 | 0.374 | | | | | | |
| 235/70R17.5 | 0.376 | | | | | | |
| 7.50-16 | 0.383 | | | | | | |
| 7.50R16 | 0.387 | | | | | | |
| 235/75R17.5 | 0.387 | | | | | | |
| 225/80R17.5 | 0.389 | | | | | | |
| 225/70R19.5 | 0.395 | | | | | | |
| 8.25-16 | 0.404 | | | | | | |
| 245/70R19.5 | 0.407 | | | | | | |
| 8.25R16 | 0.409 | | | | | | |
| 9.5R17.5 | 0.409 | | | | | | |
| 225/90R17.5 | 0.410 | | | | | | |
| 9.00-16 | 0.420 | 0.733 | 0.716 | | | | |
| 265/70R19.5 | 0.421 | 0.734 | 0.718 | | | | |
| 7.50-18 | 0.423 | 0.738 | 0.721 | | | | |
| 7.50R18 | 0.426 | 0.743 | 0.726 | | | | |
| 9R19.5 | 0.433 | 0.755 | 0.738 | 0.722 | | | |
| 265/60R22.5 | 0.438 | 0.764 | 0.747 | 0.730 | | | |
| 235/70R22.5 | 0.440 | 0.768 | 0.750 | 0.733 | 0.717 | | |
| 7.50-20 | 0.448 | 0.781 | 0.764 | 0.747 | 0.730 | | |
| 285/60R22.5 | 0.450 | 0.785 | 0.767 | 0.750 | 0.734 | | |
| 7.50R20 | 0.452 | 0.788 | 0.771 | 0.753 | 0.737 | | |
| 255/70R22.5 | 0.453 | 0.790 | 0.772 | 0.755 | 0.739 | | |
| 275/70R22.5 | 0.465 | 0.811 | 0.793 | 0.775 | 0.758 | 0.729 | |
| 11/70R22.5 | 0.468 | 0.816 | 0.798 | 0.780 | 0.763 | 0.734 | |
| 8.25-20 | 0.468 | 0.816 | 0.798 | 0.780 | 0.763 | 0.734 | |
| 8.25R20 | 0.470 | 0.820 | 0.801 | 0.783 | 0.766 | 0.737 | |
| 9R22.5 | 0.470 | 0.820 | 0.801 | 0.783 | 0.766 | 0.737 | |
| 265/75R22.5 | 0.474 | 0.827 | 0.808 | 0.790 | 0.773 | 0.743 | |
| 295/70R22.5 | 0.479 | 0.836 | 0.817 | 0.798 | 0.781 | 0.751 | 0.716 |
| 9.00-20 | 0.490 | 0.855 | 0.835 | 0.817 | 0.799 | 0.768 | 0.733 |
| 275/80R22.5 | 0.491 | 0.857 | 0.837 | 0.818 | 0.801 | 0.770 | 0.734 |
| 9.00R20 | 0.492 | 0.858 | 0.839 | 0.820 | 0.802 | 0.771 | 0.736 |
| 10R22.5 | 0.492 | 0.858 | 0.839 | 0.820 | 0.802 | 0.771 | 0.736 |
| 295/75R22.5 | 0.493 | 0.860 | 0.840 | 0.822 | 0.804 | 0.773 | 0.737 |
| 295/80R22.5 | 0.505 | 0.881 | 0.861 | 0.842 | 0.823 | 0.792 | 0.755 |
| 10.00-20 | 0.506 | 0.883 | 0.863 | 0.843 | 0.825 | 0.793 | 0.757 |
| 11.1-20 | 0.506 | 0.883 | 0.863 | 0.843 | 0.825 | 0.793 | 0.757 |
| 10.00R20 | 0.508 | 0.886 | 0.866 | 0.847 | 0.828 | 0.797 | 0.759 |
| 11.1R20 | 0.508 | 0.886 | 0.866 | 0.847 | 0.828 | 0.797 | 0.759 |
| 11R22.5 | 0.508 | 0.886 | 0.866 | 0.847 | 0.828 | 0.797 | 0.759 |
| 11.00-20 | 0.520 | 0.907 | 0.886 | 0.867 | 0.848 | 0.815 | 0.777 |
| 315/80R22.5 | 0.520 | 0.907 | 0.886 | 0.867 | 0.848 | 0.815 | 0.777 |
| 11.00R20 | 0.523 | 0.912 | 0.892 | 0.872 | 0.853 | 0.820 | 0.782 |
| 12R22.5 | 0.523 | 0.912 | 0.892 | 0.872 | 0.853 | 0.820 | 0.782 |

M12010100074

## LJ06, MF06 TRANSMISSION SERIES (For Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *3.363* | *3.636* | *3.900* | *4.100* | *4.300* | *4.333* | *4.555* | *4.625* |
| *225/60R17.5* | 0.349 | 1.089 | 1.008 | 0.939 | 0.893 | 0.852 | 0.845 | 0.804 | 0.792 |
| *215/70R17.5* | 0.364 | 1.136 | 1.051 | 0.980 | 0.932 | 0.888 | 0.882 | 0.839 | 0.826 |
| *195/80R17.5* | 0.367 | 1.146 | 1.060 | 0.988 | 0.940 | 0.896 | 0.889 | 0.846 | 0.833 |
| *205/80R17.5* | 0.374 | 1.167 | 1.080 | 1.007 | 0.957 | 0.913 | 0.906 | 0.862 | 0.849 |
| *235/70R17.5* | 0.376 | 1.174 | 1.086 | 1.012 | 0.963 | 0.918 | 0.911 | 0.866 | 0.853 |
| *7.50-16* | 0.383 | 1.196 | 1.106 | 1.031 | 0.981 | 0.935 | 0.928 | 0.883 | 0.869 |
| *7.50R16* | 0.387 | 1.208 | 1.117 | 1.042 | 0.991 | 0.945 | 0.937 | 0.892 | 0.878 |
| *235/75R17.5* | 0.387 | 1.208 | 1.117 | 1.042 | 0.991 | 0.945 | 0.937 | 0.892 | 0.878 |
| *225/80R17.5* | 0.389 | 1.214 | 1.123 | 1.047 | 0.996 | 0.950 | 0.942 | 0.896 | 0.883 |
| *225/70R19.5* | 0.395 | 1.233 | 1.140 | 1.063 | 1.011 | 0.964 | 0.957 | 0.910 | 0.896 |
| *8.25-16* | 0.404 | 1.261 | 1.166 | 1.087 | 1.034 | 0.986 | 0.979 | 0.931 | 0.917 |
| *245/70R19.5* | 0.407 | 1.270 | 1.175 | 1.095 | 1.042 | 0.994 | 0.986 | 0.938 | 0.924 |
| *8.25R16* | 0.409 | 1.277 | 1.181 | 1.101 | 1.047 | 0.998 | 0.991 | 0.942 | 0.928 |
| *9.5R17.5* | 0.409 | 1.277 | 1.181 | 1.101 | 1.047 | 0.998 | 0.991 | 0.942 | 0.928 |
| *225/90R17.5* | 0.410 | 1.280 | 1.184 | 1.104 | 1.050 | 1.001 | 0.993 | 0.945 | 0.930 |
| *9.00-16* | 0.420 | | 1.213 | 1.130 | 1.075 | 1.025 | 1.017 | 0.968 | 0.953 |
| *265/70R19.5* | 0.421 | | 1.215 | 1.133 | 1.078 | 1.028 | 1.020 | 0.970 | 0.955 |
| *7.50-18* | 0.423 | | 1.221 | 1.139 | 1.083 | 1.033 | 1.025 | 0.975 | 0.960 |
| *7.50R18* | 0.426 | | 1.230 | 1.147 | 1.091 | 1.040 | 1.032 | 0.982 | 0.967 |
| *9R19.5* | 0.433 | | 1.250 | 1.165 | 1.109 | 1.057 | 1.049 | 0.998 | 0.983 |
| *265/60R22.5* | 0.438 | | 1.265 | 1.179 | 1.121 | 1.069 | 1.061 | 1.009 | 0.994 |
| *235/70R22.5* | 0.440 | | 1.270 | 1.184 | 1.127 | 1.074 | 1.066 | 1.014 | 0.999 |
| *7.50-20* | 0.448 | | 1.293 | 1.206 | 1.147 | 1.094 | 1.085 | 1.032 | 1.017 |
| *285/60R22.5* | 0.450 | | 1.299 | 1.211 | 1.152 | 1.099 | 1.090 | 1.037 | 1.021 |
| *7.50R20* | 0.452 | | 1.305 | 1.217 | 1.157 | 1.103 | 1.095 | 1.042 | 1.026 |
| *255/70R22.5* | 0.453 | | 1.308 | 1.219 | 1.160 | 1.106 | 1.097 | 1.044 | 1.028 |
| *275/70R22.5* | 0.465 | | | 1.252 | 1.191 | 1.135 | 1.127 | 1.072 | 1.055 |
| *11/70R22.5* | 0.468 | | | 1.260 | 1.198 | 1.142 | 1.134 | 1.079 | 1.062 |
| *8.25-20* | 0.468 | | | 1.260 | 1.198 | 1.142 | 1.134 | 1.079 | 1.062 |
| *8.25R20* | 0.470 | | | 1.265 | 1.203 | 1.147 | 1.139 | 1.083 | 1.067 |
| *9R22.5* | 0.470 | | | 1.265 | 1.203 | 1.147 | 1.139 | 1.083 | 1.067 |
| *265/75R22.5* | 0.474 | | | 1.276 | 1.214 | 1.157 | 1.148 | 1.092 | 1.076 |
| *295/70R22.5* | 0.479 | | | | 1.226 | 1.169 | 1.160 | 1.104 | 1.087 |
| *9.00-20* | 0.490 | | | | 1.255 | 1.196 | 1.187 | 1.129 | 1.112 |
| *275/80R22.5* | 0.491 | | | | 1.257 | 1.199 | 1.190 | 1.132 | 1.114 |
| *9.00R20* | 0.492 | | | | 1.260 | 1.201 | 1.192 | 1.134 | 1.117 |
| *10R22.5* | 0.492 | | | | 1.260 | 1.201 | 1.192 | 1.134 | 1.117 |
| *295/75R22.5* | 0.493 | | | | 1.262 | 1.204 | 1.194 | 1.136 | 1.119 |
| *295/80R22.5* | 0.505 | | | | 1.293 | 1.233 | 1.223 | 1.164 | 1.146 |
| *10.00-20* | 0.506 | | | | 1.296 | 1.235 | 1.226 | 1.166 | 1.148 |
| *11.1-20* | 0.506 | | | | 1.296 | 1.235 | 1.226 | 1.166 | 1.148 |
| *10.00R20* | 0.508 | | | | 1.301 | 1.240 | 1.231 | 1.171 | 1.153 |
| *11.1R20* | 0.508 | | | | 1.301 | 1.240 | 1.231 | 1.171 | 1.153 |
| *11R22.5* | 0.508 | | | | 1.301 | 1.240 | 1.231 | 1.171 | 1.153 |
| *11.00-20* | 0.520 | | | | 1.331 | 1.269 | 1.260 | 1.198 | 1.180 |
| *315/80R22.5* | 0.520 | | | | 1.331 | 1.269 | 1.260 | 1.198 | 1.180 |
| *11.00R20* | 0.523 | | | | 1.339 | 1.277 | 1.267 | 1.205 | 1.187 |
| *12R22.5* | 0.523 | | | | 1.339 | 1.277 | 1.267 | 1.205 | 1.187 |

M12010100254

| | | REAR AXLE GEAR RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *4.875* | *5.125* | *5.142* | *5.250* | *5.285* | *5.428* | *5.571* | *5.857* |
| *225/60R17.5* | 0.349 | 0.751 | 0.715 | 0.712 | | | | | |
| *215/70R17.5* | 0.364 | 0.784 | 0.745 | 0.743 | 0.728 | 0.723 | 0.704 | | |
| *195/80R17.5* | 0.367 | 0.790 | 0.752 | 0.749 | 0.734 | 0.729 | 0.710 | | |
| *205/80R17.5* | 0.374 | 0.805 | 0.766 | 0.763 | 0.748 | 0.743 | 0.723 | 0.705 | |
| *235/70R17.5* | 0.376 | 0.809 | 0.770 | 0.767 | 0.752 | 0.747 | 0.727 | 0.708 | |
| *7.50-16* | 0.383 | 0.825 | 0.784 | 0.782 | 0.766 | 0.761 | 0.741 | 0.721 | |
| *7.50R16* | 0.387 | 0.833 | 0.793 | 0.790 | 0.774 | 0.769 | 0.748 | 0.729 | |
| *235/75R17.5* | 0.387 | 0.833 | 0.793 | 0.790 | 0.774 | 0.769 | 0.748 | 0.729 | |
| *225/80R17.5* | 0.389 | 0.837 | 0.797 | 0.794 | 0.778 | 0.772 | 0.752 | 0.733 | |
| *225/70R19.5* | 0.395 | 0.850 | 0.809 | 0.806 | 0.790 | 0.784 | 0.764 | 0.744 | 0.708 |
| *8.25-16* | 0.404 | 0.870 | 0.827 | 0.825 | 0.808 | 0.802 | 0.781 | 0.761 | 0.724 |
| *245/70R19.5* | 0.407 | 0.876 | 0.834 | 0.831 | 0.814 | 0.808 | 0.787 | 0.767 | 0.729 |
| *8.25R16* | 0.409 | 0.881 | 0.838 | 0.835 | 0.818 | 0.812 | 0.791 | 0.771 | 0.733 |
| *9.5R17.5* | 0.409 | 0.881 | 0.838 | 0.835 | 0.818 | 0.812 | 0.791 | 0.771 | 0.733 |
| *225/90R17.5* | 0.410 | 0.883 | 0.840 | 0.837 | 0.820 | 0.814 | 0.793 | 0.772 | 0.735 |
| *9.00-16* | 0.420 | 0.904 | 0.860 | 0.857 | 0.840 | 0.834 | 0.812 | 0.791 | 0.753 |
| *265/70R19.5* | 0.421 | 0.906 | 0.862 | 0.859 | 0.842 | 0.836 | 0.814 | 0.793 | 0.754 |
| *7.50-18* | 0.423 | 0.911 | 0.866 | 0.863 | 0.846 | 0.840 | 0.818 | 0.797 | 0.758 |
| *7.50R18* | 0.426 | 0.917 | 0.872 | 0.870 | 0.852 | 0.846 | 0.824 | 0.803 | 0.763 |
| *9R19.5* | 0.433 | 0.932 | 0.887 | 0.884 | 0.866 | 0.860 | 0.837 | 0.816 | 0.776 |
| *265/60R22.5* | 0.438 | 0.943 | 0.897 | 0.894 | 0.876 | 0.870 | 0.847 | 0.825 | 0.785 |
| *235/70R22.5* | 0.440 | 0.947 | 0.901 | 0.898 | 0.880 | 0.874 | 0.851 | 0.829 | 0.788 |
| *7.50-20* | 0.448 | 0.965 | 0.918 | 0.914 | 0.896 | 0.890 | 0.866 | 0.844 | 0.803 |
| *285/60R22.5* | 0.450 | 0.969 | 0.922 | 0.919 | 0.900 | 0.894 | 0.870 | 0.848 | 0.806 |
| *7.50R20* | 0.452 | 0.973 | 0.926 | 0.923 | 0.904 | 0.898 | 0.874 | 0.852 | 0.810 |
| *255/70R22.5* | 0.453 | 0.975 | 0.928 | 0.925 | 0.906 | 0.900 | 0.876 | 0.853 | 0.812 |
| *275/70R22.5* | 0.465 | 1.001 | 0.952 | 0.949 | 0.930 | 0.924 | 0.899 | 0.876 | 0.833 |
| *11/70R22.5* | 0.468 | 1.008 | 0.959 | 0.955 | 0.936 | 0.929 | 0.905 | 0.882 | 0.839 |
| *8.25-20* | 0.468 | 1.008 | 0.959 | 0.955 | 0.936 | 0.929 | 0.905 | 0.882 | 0.839 |
| *8.25R20* | 0.470 | 1.012 | 0.963 | 0.959 | 0.940 | 0.933 | 0.909 | 0.885 | 0.842 |
| *9R22.5* | 0.470 | 1.012 | 0.963 | 0.959 | 0.940 | 0.933 | 0.909 | 0.885 | 0.842 |
| *265/75R22.5* | 0.474 | 1.021 | 0.971 | 0.968 | 0.948 | 0.941 | 0.917 | 0.893 | 0.849 |
| *295/70R22.5* | 0.479 | 1.031 | 0.981 | 0.978 | 0.958 | 0.951 | 0.926 | 0.902 | 0.858 |
| *9.00-20* | 0.490 | 1.055 | 1.004 | 1.000 | 0.980 | 0.973 | 0.948 | 0.923 | 0.878 |
| *275/80R22.5* | 0.491 | 1.057 | 1.006 | 1.002 | 0.982 | 0.975 | 0.949 | 0.925 | 0.880 |
| *9.00R20* | 0.492 | 1.059 | 1.008 | 1.004 | 0.984 | 0.977 | 0.951 | 0.927 | 0.882 |
| *10R22.5* | 0.492 | 1.059 | 1.008 | 1.004 | 0.984 | 0.977 | 0.951 | 0.927 | 0.882 |
| *295/75R22.5* | 0.493 | 1.062 | 1.010 | 1.006 | 0.986 | 0.979 | 0.953 | 0.929 | 0.883 |
| *295/80R22.5* | 0.505 | 1.087 | 1.034 | 1.031 | 1.010 | 1.003 | 0.977 | 0.951 | 0.905 |
| *10.00-20* | 0.506 | 1.090 | 1.036 | 1.033 | 1.012 | 1.005 | 0.978 | 0.953 | 0.907 |
| *11.1-20* | 0.506 | 1.090 | 1.036 | 1.033 | 1.012 | 1.005 | 0.978 | 0.953 | 0.907 |
| *10.00R20* | 0.508 | 1.094 | 1.040 | 1.037 | 1.016 | 1.009 | 0.982 | 0.957 | 0.910 |
| *11.1R20* | 0.508 | 1.094 | 1.040 | 1.037 | 1.016 | 1.009 | 0.982 | 0.957 | 0.910 |
| *11R22.5* | 0.508 | 1.094 | 1.040 | 1.037 | 1.016 | 1.009 | 0.982 | 0.957 | 0.910 |
| *11.00-20* | 0.520 | 1.120 | 1.065 | 1.062 | 1.040 | 1.033 | 1.006 | 0.980 | 0.932 |
| *315/80R22.5* | 0.520 | 1.120 | 1.065 | 1.062 | 1.040 | 1.033 | 1.006 | 0.980 | 0.932 |
| *11.00R20* | 0.523 | 1.126 | 1.071 | 1.068 | 1.046 | 1.039 | 1.011 | 0.985 | 0.937 |
| *12R22.5* | 0.523 | 1.126 | 1.071 | 1.068 | 1.046 | 1.039 | 1.011 | 0.985 | 0.937 |

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| | | REAR AXLE GEAR RATIO | | | | | |
|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 6.142 | 6.285 | 6.428 | 6.571 | 6.833 | 7.166 |
| 225/60R17.5 | 0.349 | | | | | | |
| 215/70R17.5 | 0.364 | | | | | | |
| 195/80R17.5 | 0.367 | | | | | | |
| 205/80R17.5 | 0.374 | | | | | | |
| 235/70R17.5 | 0.376 | | | | | | |
| 7.50-16 | 0.383 | | | | | | |
| 7.50R16 | 0.387 | | | | | | |
| 235/75R17.5 | 0.387 | | | | | | |
| 225/80R17.5 | 0.389 | | | | | | |
| 225/70R19.5 | 0.395 | | | | | | |
| 8.25-16 | 0.404 | | | | | | |
| 245/70R19.5 | 0.407 | | | | | | |
| 8.25R16 | 0.409 | | | | | | |
| 9.5R17.5 | 0.409 | | | | | | |
| 225/90R17.5 | 0.410 | | | | | | |
| 9.00-16 | 0.420 | 0.718 | 0.701 | | | | |
| 265/70R19.5 | 0.421 | 0.719 | 0.703 | | | | |
| 7.50-18 | 0.423 | 0.723 | 0.706 | | | | |
| 7.50R18 | 0.426 | 0.728 | 0.711 | | | | |
| 9R19.5 | 0.433 | 0.740 | 0.723 | 0.707 | | | |
| 265/60R22.5 | 0.438 | 0.748 | 0.731 | 0.715 | | | |
| 235/70R22.5 | 0.440 | 0.752 | 0.735 | 0.718 | 0.703 | | |
| 7.50-20 | 0.448 | 0.766 | 0.748 | 0.731 | 0.716 | | |
| 285/60R22.5 | 0.450 | 0.769 | 0.751 | 0.735 | 0.719 | | |
| 7.50R20 | 0.452 | 0.772 | 0.755 | 0.738 | 0.722 | | |
| 255/70R22.5 | 0.453 | 0.774 | 0.756 | 0.740 | 0.723 | | |
| 275/70R22.5 | 0.465 | 0.795 | 0.776 | 0.759 | 0.743 | 0.714 | |
| 11/70R22.5 | 0.468 | 0.800 | 0.782 | 0.764 | 0.747 | 0.719 | |
| 8.25-20 | 0.468 | 0.800 | 0.782 | 0.764 | 0.747 | 0.719 | |
| 8.25R20 | 0.470 | 0.803 | 0.785 | 0.767 | 0.751 | 0.722 | |
| 9R22.5 | 0.470 | 0.803 | 0.785 | 0.767 | 0.751 | 0.722 | |
| 265/75R22.5 | 0.474 | 0.810 | 0.792 | 0.774 | 0.757 | 0.728 | |
| 295/70R22.5 | 0.479 | 0.819 | 0.800 | 0.782 | 0.765 | 0.736 | 0.701 |
| 9.00-20 | 0.490 | 0.837 | 0.818 | 0.800 | 0.783 | 0.753 | 0.718 |
| 275/80R22.5 | 0.491 | 0.839 | 0.820 | 0.802 | 0.784 | 0.754 | 0.719 |
| 9.00R20 | 0.492 | 0.841 | 0.822 | 0.803 | 0.786 | 0.756 | 0.721 |
| 10R22.5 | 0.492 | 0.841 | 0.822 | 0.803 | 0.786 | 0.756 | 0.721 |
| 295/75R22.5 | 0.493 | 0.842 | 0.823 | 0.805 | 0.787 | 0.757 | 0.722 |
| 295/80R22.5 | 0.505 | 0.863 | 0.843 | 0.825 | 0.807 | 0.776 | 0.740 |
| 10.00-20 | 0.506 | 0.865 | 0.845 | 0.826 | 0.808 | 0.777 | 0.741 |
| 11.1-20 | 0.506 | 0.865 | 0.845 | 0.826 | 0.808 | 0.777 | 0.741 |
| 10.00R20 | 0.508 | 0.868 | 0.848 | 0.829 | 0.811 | 0.780 | 0.744 |
| 11.1R20 | 0.508 | 0.868 | 0.848 | 0.829 | 0.811 | 0.780 | 0.744 |
| 11R22.5 | 0.508 | 0.868 | 0.848 | 0.829 | 0.811 | 0.780 | 0.744 |
| 11.00-20 | 0.520 | 0.889 | 0.868 | 0.849 | 0.831 | 0.799 | 0.762 |
| 315/80R22.5 | 0.520 | 0.889 | 0.868 | 0.849 | 0.831 | 0.799 | 0.762 |
| 11.00R20 | 0.523 | 0.894 | 0.873 | 0.854 | 0.835 | 0.803 | 0.766 |
| 12R22.5 | 0.523 | 0.894 | 0.873 | 0.854 | 0.835 | 0.803 | 0.766 |

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## HK06 TRANSMISSION SERIES (Except Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | *3.636* | *3.900* | *4.100* | *4.300* | *4.333* | *4.555* | *4.625* | *4.875* | *5.250* |
| *215/70R17.5* | *0.364* | 1.073 | 1.000 | 0.951 | 0.907 | 0.900 | 0.856 | 0.843 | 0.800 | |
| *195/80R17.5* | *0.367* | 1.082 | 1.008 | 0.959 | 0.914 | 0.908 | 0.863 | 0.850 | 0.807 | |
| *205/80R17.5* | *0.374* | 1.102 | 1.028 | 0.977 | 0.932 | 0.925 | 0.880 | 0.866 | 0.822 | 0.763 |
| *235/70R17.5* | *0.376* | 1.108 | 1.033 | 0.983 | 0.937 | 0.930 | 0.884 | 0.871 | 0.826 | 0.767 |
| *7.50-16* | *0.383* | 1.129 | 1.052 | 1.001 | 0.954 | 0.947 | 0.901 | 0.887 | 0.842 | 0.782 |
| *7.50R16* | *0.387* | 1.141 | 1.063 | 1.011 | 0.964 | 0.957 | 0.910 | 0.897 | 0.851 | 0.790 |
| *225/80R17.5* | *0.389* | 1.146 | 1.069 | 1.017 | 0.969 | 0.962 | 0.915 | 0.901 | 0.855 | 0.794 |
| *225/70R19.5* | *0.395* | 1.164 | 1.085 | 1.032 | 0.984 | 0.977 | 0.929 | 0.915 | 0.868 | 0.806 |
| *8.25-16* | *0.404* | 1.191 | 1.110 | 1.056 | 1.007 | 0.999 | 0.950 | 0.936 | 0.888 | 0.824 |
| *245/70R19.5* | *0.407* | 1.200 | 1.118 | 1.064 | 1.014 | 1.006 | 0.957 | 0.943 | 0.895 | 0.831 |
| *8.25R16* | *0.409* | 1.205 | 1.124 | 1.069 | 1.019 | 1.011 | 0.962 | 0.948 | 0.899 | 0.835 |
| *225/90R17.5* | *0.410* | 1.208 | 1.127 | 1.072 | 1.022 | 1.014 | 0.964 | 0.950 | 0.901 | 0.837 |
| *9.00-16* | *0.420* | 1.238 | 1.154 | 1.098 | 1.047 | 1.039 | 0.988 | 0.973 | 0.923 | 0.857 |
| *265/70R19.5* | *0.421* | 1.241 | 1.157 | 1.100 | 1.049 | 1.041 | 0.990 | 0.975 | 0.925 | 0.859 |
| *7.50-18* | *0.423* | 1.247 | 1.162 | 1.106 | 1.054 | 1.046 | 0.995 | 0.980 | 0.930 | 0.863 |
| *7.50R18* | *0.426* | 1.256 | 1.171 | 1.113 | 1.062 | 1.054 | 1.002 | 0.987 | 0.936 | 0.869 |
| *265/60R22.5* | *0.438* | 1.291 | 1.204 | 1.145 | 1.092 | 1.083 | 1.030 | 1.015 | 0.963 | 0.894 |
| *235/70R22.5* | *0.440* | 1.297 | 1.209 | 1.150 | 1.097 | 1.088 | 1.035 | 1.019 | 0.967 | 0.898 |
| *7.50-20* | *0.448* | 1.320 | 1.231 | 1.171 | 1.116 | 1.108 | 1.054 | 1.038 | 0.985 | 0.914 |
| *285/60R22.5* | *0.450* | | 1.237 | 1.176 | 1.121 | 1.113 | 1.059 | 1.043 | 0.989 | 0.918 |
| *7.50R20* | *0.452* | | 1.242 | 1.181 | 1.126 | 1.118 | 1.063 | 1.047 | 0.993 | 0.922 |
| *255/70R22.5* | *0.453* | | 1.245 | 1.184 | 1.129 | 1.120 | 1.066 | 1.050 | 0.996 | 0.925 |
| *275/70R22.5* | *0.465* | | 1.278 | 1.215 | 1.159 | 1.150 | 1.094 | 1.077 | 1.022 | 0.949 |
| *11/70R22.5* | *0.468* | | 1.286 | 1.223 | 1.166 | 1.157 | 1.101 | 1.084 | 1.029 | 0.955 |
| *8.25-20* | *0.468* | | 1.286 | 1.223 | 1.166 | 1.157 | 1.101 | 1.084 | 1.029 | 0.955 |
| *8.25R20* | *0.470* | | 1.291 | 1.228 | 1.171 | 1.162 | 1.106 | 1.089 | 1.033 | 0.959 |
| *9R22.5* | *0.470* | | 1.291 | 1.228 | 1.171 | 1.162 | 1.106 | 1.089 | 1.033 | 0.959 |
| *295/70R22.5* | *0.479* | | 1.316 | 1.252 | 1.194 | 1.185 | 1.127 | 1.110 | 1.053 | 0.978 |
| *9.00-20* | *0.490* | | | 1.281 | 1.221 | 1.212 | 1.153 | 1.135 | 1.077 | 1.000 |
| *275/80R22.5* | *0.491* | | | 1.283 | 1.224 | 1.214 | 1.155 | 1.138 | 1.079 | 1.002 |
| *10R22.5* | *0.492* | | | 1.286 | 1.226 | 1.217 | 1.157 | 1.140 | 1.081 | 1.004 |
| *9.00R20* | *0.492* | | | 1.286 | 1.226 | 1.217 | 1.157 | 1.140 | 1.081 | 1.004 |
| *295/75R22.5* | *0.493* | | | 1.289 | 1.229 | 1.219 | 1.160 | 1.142 | 1.084 | 1.006 |
| *295/80R22.5* | *0.505* | | | | 1.259 | 1.249 | 1.188 | 1.170 | 1.110 | 1.031 |
| *10.00-20* | *0.506* | | | | 1.261 | 1.251 | 1.190 | 1.172 | 1.112 | 1.033 |
| *11.1-20* | *0.506* | | | | 1.261 | 1.251 | 1.190 | 1.172 | 1.112 | 1.033 |
| *10.00R20* | *0.508* | | | | 1.266 | 1.256 | 1.195 | 1.177 | 1.117 | 1.037 |
| *11.1R20* | *0.508* | | | | 1.266 | 1.256 | 1.195 | 1.177 | 1.117 | 1.037 |
| *11R22.5* | *0.508* | | | | 1.266 | 1.256 | 1.195 | 1.177 | 1.117 | 1.037 |
| *11.00-20* | *0.520* | | | | 1.296 | 1.286 | 1.223 | 1.205 | 1.143 | 1.061 |
| *315/80R22.5* | *0.520* | | | | 1.296 | 1.286 | 1.223 | 1.205 | 1.143 | 1.061 |
| *11.00R20* | *0.523* | | | | 1.303 | 1.294 | 1.230 | 1.212 | 1.150 | 1.067 |
| *12R22.5* | *0.523* | | | | 1.303 | 1.294 | 1.230 | 1.212 | 1.150 | 1.067 |
| *12.00-20* | *0.539* | | | | | | 1.268 | 1.249 | 1.185 | 1.100 |
| *12.00R20* | *0.542* | | | | | | 1.275 | 1.256 | 1.191 | 1.106 |
| *12.00-24* | *0.593* | | | | | | | | 1.304 | 1.210 |
| *12.00R24* | *0.594* | | | | | | | | 1.306 | 1.212 |

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| | | REAR AXLE GEAR RATIO | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 5.285 | 5.428 | 5.857 | 6.142 | 6.428 | 6.833 | 7.166 |
| 215/70R17.5 | 0.364 | | | | | | | |
| 195/80R17.5 | 0.367 | | | | | | | |
| 205/80R17.5 | 0.374 | 0.758 | | | | | | |
| 235/70R17.5 | 0.376 | 0.762 | | | | | | |
| 7.50-16 | 0.383 | 0.776 | 0.756 | | | | | |
| 7.50R16 | 0.387 | 0.785 | 0.764 | | | | | |
| 225/80R17.5 | 0.389 | 0.789 | 0.768 | | | | | |
| 225/70R19.5 | 0.395 | 0.801 | 0.780 | | | | | |
| 8.25-16 | 0.404 | 0.819 | 0.797 | | | | | |
| 245/70R19.5 | 0.407 | 0.825 | 0.803 | | | | | |
| 8.25R16 | 0.409 | 0.829 | 0.807 | | | | | |
| 225/90R17.5 | 0.410 | 0.831 | 0.809 | 0.750 | | | | |
| 9.00-16 | 0.420 | 0.851 | 0.829 | 0.768 | | | | |
| 265/70R19.5 | 0.421 | 0.854 | 0.831 | 0.770 | | | | |
| 7.50-18 | 0.423 | 0.858 | 0.835 | 0.774 | | | | |
| 7.50R18 | 0.426 | 0.864 | 0.841 | 0.779 | | | | |
| 265/60R22.5 | 0.438 | 0.888 | 0.865 | 0.801 | 0.764 | | | |
| 235/70R22.5 | 0.440 | 0.892 | 0.869 | 0.805 | 0.768 | | | |
| 7.50-20 | 0.446 | 0.908 | 0.884 | 0.820 | 0.781 | | | |
| 285/60R22.5 | 0.450 | 0.912 | 0.888 | 0.823 | 0.785 | 0.750 | | |
| 7.50R20 | 0.452 | 0.916 | 0.892 | 0.827 | 0.788 | 0.753 | | |
| 255/70R22.5 | 0.453 | 0.918 | 0.894 | 0.829 | 0.790 | 0.755 | | |
| 275/70R22.5 | 0.465 | 0.943 | 0.918 | 0.851 | 0.811 | 0.775 | | |
| 11/70R22.5 | 0.468 | 0.949 | 0.924 | 0.856 | 0.816 | 0.780 | | |
| 8.25-20 | 0.468 | 0.949 | 0.924 | 0.856 | 0.816 | 0.780 | | |
| 8.25R20 | 0.470 | 0.953 | 0.928 | 0.860 | 0.820 | 0.783 | | |
| 9R22.5 | 0.470 | 0.953 | 0.928 | 0.860 | 0.820 | 0.783 | | |
| 295/70R22.5 | 0.479 | 0.971 | 0.946 | 0.876 | 0.836 | 0.798 | 0.751 | |
| 9.00-20 | 0.490 | 0.993 | 0.967 | 0.896 | 0.855 | 0.817 | 0.768 | |
| 275/80R22.5 | 0.491 | 0.995 | 0.969 | 0.898 | 0.857 | 0.818 | 0.770 | |
| 10R22.5 | 0.492 | 0.998 | 0.971 | 0.900 | 0.858 | 0.820 | 0.771 | |
| 9.00R20 | 0.492 | 0.998 | 0.971 | 0.900 | 0.858 | 0.820 | 0.771 | |
| 295/75R22.5 | 0.493 | 1.000 | 0.973 | 0.902 | 0.860 | 0.822 | 0.773 | |
| 295/80R22.5 | 0.505 | 1.024 | 0.997 | 0.924 | 0.881 | 0.842 | 0.792 | 0.755 |
| 10.00-20 | 0.506 | 1.026 | 0.999 | 0.926 | 0.883 | 0.843 | 0.793 | 0.757 |
| 11.1-20 | 0.506 | 1.026 | 0.999 | 0.926 | 0.883 | 0.843 | 0.793 | 0.757 |
| 10.00R20 | 0.508 | 1.030 | 1.003 | 0.929 | 0.886 | 0.847 | 0.797 | 0.759 |
| 11.1R20 | 0.508 | 1.030 | 1.003 | 0.929 | 0.886 | 0.847 | 0.797 | 0.759 |
| 11R22.5 | 0.508 | 1.030 | 1.003 | 0.929 | 0.886 | 0.847 | 0.797 | 0.759 |
| 11.00-20 | 0.520 | 1.054 | 1.027 | 0.951 | 0.907 | 0.867 | 0.815 | 0.777 |
| 315/80R22.5 | 0.520 | 1.054 | 1.027 | 0.951 | 0.907 | 0.867 | 0.815 | 0.777 |
| 11.00R20 | 0.523 | 1.060 | 1.032 | 0.957 | 0.912 | 0.872 | 0.820 | 0.782 |
| 12R22.5 | 0.523 | 1.060 | 1.032 | 0.957 | 0.912 | 0.872 | 0.820 | 0.782 |
| 12.00-20 | 0.539 | 1.093 | 1.064 | 0.986 | 0.940 | 0.898 | 0.845 | 0.806 |
| 12.00R20 | 0.542 | 1.099 | 1.070 | 0.992 | 0.946 | 0.903 | 0.850 | 0.810 |
| 12.00-24 | 0.593 | 1.202 | 1.171 | 1.085 | 1.035 | 0.989 | 0.930 | 0.887 |
| 12.00R24 | 0.594 | 1.204 | 1.173 | 1.087 | 1.036 | 0.990 | 0.931 | 0.888 |

M12010100076

## ZF TRANSMISSION (Except Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 3.636 | 3.727 | 3.900 | 4.100 | 4.300 | 4.333 | 4.555 | 4.625 | 4.875 |
| 7.50-16 | 0.383 | 0.678 | 0.681 | 0.632 | 0.601 | 0.573 | 0.569 | 0.541 | 0.533 | 0.506 |
| 7.50R16 | 0.387 | 0.685 | 0.668 | 0.639 | 0.608 | 0.579 | 0.575 | 0.547 | 0.538 | 0.511 |
| 235/75R17.5 | 0.387 | 0.685 | 0.668 | 0.639 | 0.608 | 0.579 | 0.575 | 0.547 | 0.538 | 0.511 |
| 225/80R17.5 | 0.389 | 0.689 | 0.672 | 0.642 | 0.611 | 0.582 | 0.578 | 0.550 | 0.541 | 0.513 |
| 225/70R19.5 | 0.395 | 0.699 | 0.682 | 0.652 | 0.620 | 0.591 | 0.587 | 0.558 | 0.550 | 0.521 |
| 8.25-16 | 0.404 | 0.715 | 0.698 | 0.667 | 0.634 | 0.605 | 0.600 | 0.571 | 0.562 | 0.533 |
| 245/70R19.5 | 0.407 | 0.721 | 0.703 | 0.672 | 0.639 | 0.609 | 0.605 | 0.575 | 0.566 | 0.537 |
| 8.25R16 | 0.409 | 0.724 | 0.706 | 0.675 | 0.642 | 0.612 | 0.608 | 0.578 | 0.569 | 0.540 |
| 9.5R17.5 | 0.409 | 0.724 | 0.706 | 0.675 | 0.642 | 0.612 | 0.608 | 0.578 | 0.569 | 0.540 |
| 225/90R17.5 | 0.410 | 0.726 | 0.708 | 0.677 | 0.644 | 0.614 | 0.609 | 0.579 | 0.571 | 0.541 |
| 9.00-16 | 0.420 | 0.744 | 0.725 | 0.693 | 0.659 | 0.629 | 0.624 | 0.593 | 0.584 | 0.554 |
| 265/70R19.5 | 0.421 | 0.745 | 0.727 | 0.695 | 0.661 | 0.630 | 0.625 | 0.595 | 0.586 | 0.556 |
| 7.50-18 | 0.423 | 0.749 | 0.731 | 0.698 | 0.664 | 0.633 | 0.628 | 0.598 | 0.589 | 0.558 |
| 7.50R18 | 0.426 | 0.754 | 0.736 | 0.703 | 0.669 | 0.638 | 0.633 | 0.602 | 0.593 | 0.562 |
| 9R19.5 | 0.433 | 0.767 | 0.748 | 0.715 | 0.680 | 0.648 | 0.643 | 0.612 | 0.603 | 0.572 |
| 265/60R22.5 | 0.438 | 0.775 | 0.756 | 0.723 | 0.688 | 0.656 | 0.651 | 0.619 | 0.610 | 0.578 |
| 235/70R22.5 | 0.440 | 0.779 | 0.760 | 0.726 | 0.691 | 0.659 | 0.654 | 0.622 | 0.612 | 0.581 |
| 7.50-20 | 0.448 | 0.793 | 0.774 | 0.739 | 0.703 | 0.671 | 0.665 | 0.633 | 0.623 | 0.591 |
| 285/60R22.5 | 0.450 | 0.797 | 0.777 | 0.743 | 0.706 | 0.674 | 0.668 | 0.636 | 0.626 | 0.594 |
| 7.50R20 | 0.452 | 0.800 | 0.781 | 0.746 | 0.710 | 0.677 | 0.671 | 0.639 | 0.629 | 0.597 |
| 255/70R22.5 | 0.453 | 0.802 | 0.782 | 0.748 | 0.711 | 0.678 | 0.673 | 0.640 | 0.630 | 0.598 |
| 275/70R22.5 | 0.465 | | | 0.768 | 0.730 | 0.696 | 0.691 | 0.657 | 0.647 | 0.614 |
| 11/70R22.5 | 0.468 | | | 0.772 | 0.735 | 0.701 | 0.695 | 0.661 | 0.651 | 0.618 |

M12010100077

| | | REAR AXLE GEAR RATIO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 3.636 | 3.727 | 3.900 | 4.100 | 4.300 | 4.333 | 4.555 | 4.625 | 4.875 |
| 8.25-20 | 0.468 | | | 0.772 | 0.735 | 0.701 | 0.695 | 0.661 | 0.651 | 0.618 |
| 8.25R20 | 0.470 | | | 0.776 | 0.738 | 0.704 | 0.698 | 0.664 | 0.654 | 0.621 |
| 9R22.5 | 0.470 | | | 0.776 | 0.738 | 0.704 | 0.698 | 0.664 | 0.654 | 0.621 |
| 265/75R22.5 | 0.474 | | | | 0.744 | 0.710 | 0.704 | 0.670 | 0.660 | 0.626 |
| 295/70R22.5 | 0.479 | | | | 0.752 | 0.717 | 0.712 | 0.677 | 0.667 | 0.632 |
| 9.00-20 | 0.490 | | | | 0.769 | 0.734 | 0.728 | 0.692 | 0.682 | 0.647 |
| 275/80R22.5 | 0.491 | | | | 0.771 | 0.735 | 0.729 | 0.694 | 0.683 | 0.648 |
| 9.00R20 | 0.492 | | | | 0.772 | 0.737 | 0.731 | 0.695 | 0.685 | 0.650 |
| 10R22.5 | 0.492 | | | | 0.772 | 0.737 | 0.731 | 0.695 | 0.685 | 0.650 |
| 295/75R22.5 | 0.493 | | | | 0.774 | 0.738 | 0.732 | 0.697 | 0.686 | 0.651 |
| 295/80R22.5 | 0.505 | | | | | 0.756 | 0.750 | 0.714 | 0.703 | 0.667 |
| 10.00-20 | 0.506 | | | | | 0.757 | 0.752 | 0.715 | 0.704 | 0.668 |
| 11.1-20 | 0.506 | | | | | 0.757 | 0.752 | 0.715 | 0.704 | 0.668 |
| 10.00R20 | 0.508 | | | | | 0.760 | 0.755 | 0.718 | 0.707 | 0.671 |
| 11.1R20 | 0.508 | | | | | 0.760 | 0.755 | 0.718 | 0.707 | 0.671 |
| 11R22.5 | 0.508 | | | | | 0.760 | 0.755 | 0.718 | 0.707 | 0.671 |
| 11.00-20 | 0.520 | | | | | 0.778 | 0.773 | 0.735 | 0.724 | 0.687 |
| 315/80R22.5 | 0.520 | | | | | 0.778 | 0.773 | 0.735 | 0.724 | 0.687 |
| 11.00R20 | 0.523 | | | | | 0.783 | 0.777 | 0.739 | 0.728 | 0.691 |
| 12R22.5 | 0.523 | | | | | 0.783 | 0.777 | 0.739 | 0.728 | 0.691 |
| 12.00-20 | 0.539 | | | | | | | 0.762 | 0.750 | 0.712 |
| 12.00R20 | 0.542 | | | | | | | 0.766 | 0.754 | 0.716 |
| 12.00-24 | 0.593 | | | | | | | | | 0.783 |
| 12.00R24 | 0.594 | | | | | | | | | 0.784 |

M12010100078

| | | REAR AXLE GEAR RATIO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 5.125 | 5.250 | 5.285 | 5.428 | 5.857 | 6.142 | 6.428 | 6.833 | 7.166 |
| 7.50-16 | 0.383 | 0.481 | 0.469 | 0.466 | 0.454 | | | | | |
| 7.50R16 | 0.387 | 0.486 | 0.474 | 0.471 | 0.459 | | | | | |
| 235/75R17.5 | 0.387 | 0.486 | 0.474 | 0.471 | 0.459 | | | | | |
| 225/80R17.5 | 0.389 | 0.488 | 0.477 | 0.474 | 0.461 | | | | | |
| 225/70R19.5 | 0.395 | 0.496 | 0.484 | 0.481 | 0.468 | | | | | |
| 8.25-16 | 0.404 | 0.507 | 0.495 | 0.492 | 0.479 | | | | | |
| 245/70R19.5 | 0.407 | 0.511 | 0.499 | 0.496 | 0.482 | | | | | |
| 8.25R16 | 0.409 | 0.514 | 0.501 | 0.498 | 0.485 | | | | | |
| 9.5R17.5 | 0.409 | 0.514 | 0.501 | 0.498 | 0.485 | | | | | |
| 225/90R17.5 | 0.410 | 0.515 | 0.503 | 0.499 | 0.486 | | | | | |
| 9.00-16 | 0.420 | 0.527 | 0.515 | 0.511 | 0.498 | 0.461 | | | | |
| 265/70R19.5 | 0.421 | 0.529 | 0.516 | 0.513 | 0.499 | 0.463 | | | | |
| 7.50-18 | 0.423 | 0.531 | 0.518 | 0.515 | 0.501 | 0.465 | | | | |
| 7.50R18 | 0.426 | 0.535 | 0.522 | 0.519 | 0.505 | 0.468 | 0.446 | | | |
| 9R19.5 | 0.433 | 0.544 | 0.531 | 0.527 | 0.513 | 0.476 | 0.454 | | | |
| 265/60R22.5 | 0.438 | 0.550 | 0.537 | 0.533 | 0.519 | 0.481 | 0.459 | | | |
| 235/70R22.5 | 0.440 | 0.553 | 0.539 | 0.536 | 0.522 | 0.483 | 0.461 | | | |
| 7.50-20 | 0.448 | 0.563 | 0.549 | 0.546 | 0.531 | 0.492 | 0.469 | | | |
| 285/60R22.5 | 0.450 | 0.565 | 0.552 | 0.548 | 0.534 | 0.494 | 0.471 | | | |
| 7.50R20 | 0.452 | 0.568 | 0.554 | 0.550 | 0.536 | 0.497 | 0.474 | | | |
| 255/70R22.5 | 0.453 | 0.569 | 0.555 | 0.552 | 0.537 | 0.498 | 0.475 | | | |
| 275/70R22.5 | 0.465 | 0.584 | 0.570 | 0.566 | 0.551 | 0.511 | 0.487 | 0.465 | | |
| 11/70R22.5 | 0.468 | 0.588 | 0.574 | 0.570 | 0.555 | 0.514 | 0.490 | 0.468 | | |

M12010100079

| | | REAR AXLE GEAR RATIO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 5.125 | 5.250 | 5.285 | 5.428 | 5.857 | 6.142 | 6.428 | 6.833 | 7.166 |
| 8.25-20 | 0.468 | 0.588 | 0.574 | 0.570 | 0.555 | 0.514 | 0.490 | 0.468 | | |
| 8.25R20 | 0.470 | 0.590 | 0.576 | 0.572 | 0.557 | 0.516 | 0.492 | 0.470 | | |
| 9R22.5 | 0.470 | 0.590 | 0.576 | 0.572 | 0.557 | 0.516 | 0.492 | 0.470 | | |
| 265/75R22.5 | 0.474 | 0.595 | 0.581 | 0.577 | 0.562 | 0.521 | 0.497 | 0.474 | | |
| 295/70R22.5 | 0.479 | 0.602 | 0.587 | 0.583 | 0.568 | 0.526 | 0.502 | 0.479 | | |
| 9.00-20 | 0.490 | 0.615 | 0.601 | 0.597 | 0.581 | 0.538 | 0.513 | 0.491 | 0.461 | |
| 275/80R22.5 | 0.491 | 0.617 | 0.602 | 0.598 | 0.582 | 0.539 | 0.514 | 0.492 | 0.462 | |
| 9.00R20 | 0.492 | 0.618 | 0.603 | 0.599 | 0.583 | 0.541 | 0.515 | 0.493 | 0.463 | |
| 10R22.5 | 0.492 | 0.618 | 0.603 | 0.599 | 0.583 | 0.541 | 0.515 | 0.493 | 0.463 | |
| 295/75R22.5 | 0.493 | 0.619 | 0.604 | 0.600 | 0.585 | 0.542 | 0.517 | 0.494 | 0.464 | |
| 295/80R22.5 | 0.505 | 0.634 | 0.619 | 0.615 | 0.599 | 0.555 | 0.529 | 0.506 | 0.476 | |
| 10.00-20 | 0.506 | 0.635 | 0.620 | 0.616 | 0.600 | 0.556 | 0.530 | 0.507 | 0.476 | |
| 11.1-20 | 0.506 | 0.635 | 0.620 | 0.616 | 0.600 | 0.556 | 0.530 | 0.507 | 0.476 | |
| 10.00R20 | 0.508 | 0.638 | 0.623 | 0.619 | 0.602 | 0.558 | 0.532 | 0.509 | 0.478 | |
| 11.1R20 | 0.508 | 0.638 | 0.623 | 0.619 | 0.602 | 0.558 | 0.532 | 0.509 | 0.478 | |
| 11R22.5 | 0.508 | 0.638 | 0.623 | 0.619 | 0.602 | 0.558 | 0.532 | 0.509 | 0.478 | |
| 11.00-20 | 0.520 | 0.653 | 0.637 | 0.633 | 0.617 | 0.571 | 0.545 | 0.521 | 0.490 | 0.467 |
| 315/80R22.5 | 0.520 | 0.653 | 0.637 | 0.633 | 0.617 | 0.571 | 0.545 | 0.521 | 0.490 | 0.467 |
| 11.00R20 | 0.523 | 0.657 | 0.641 | 0.637 | 0.620 | 0.575 | 0.548 | 0.524 | 0.493 | 0.470 |
| 12R22.5 | 0.523 | 0.657 | 0.641 | 0.637 | 0.620 | 0.575 | 0.548 | 0.524 | 0.493 | 0.470 |
| 12.00-20 | 0.539 | 0.677 | 0.661 | 0.656 | 0.639 | 0.592 | 0.565 | 0.540 | 0.508 | 0.484 |
| 12.00R20 | 0.542 | 0.681 | 0.664 | 0.660 | 0.643 | 0.596 | 0.568 | 0.543 | 0.510 | 0.487 |
| 12.00-24 | 0.593 | 0.745 | 0.727 | 0.722 | 0.703 | 0.652 | 0.621 | 0.594 | 0.559 | 0.533 |
| 12.00R24 | 0.594 | 0.746 | 0.728 | 0.723 | 0.704 | 0.653 | 0.622 | 0.595 | 0.559 | 0.533 |

M12010100080

## EATON T/M (Except Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 3.636 | 3.727 | 3.900 | 4.100 | 4.300 | 4.333 | 4.555 | 4.625 | 4.875 | 5.125 | 5.250 | 5.285 |
| 7.50-16 | 0.383 | 1.024 | 0.999 | 0.955 | 0.908 | 0.866 | 0.859 | 0.817 | 0.805 | 0.764 | 0.726 | 0.709 | 0.704 |
| 7.50R16 | 0.387 | 1.035 | 1.010 | 0.965 | 0.918 | 0.875 | 0.868 | 0.826 | 0.813 | 0.772 | 0.734 | 0.717 | 0.712 |
| 235/75R17.5 | 0.387 | 1.035 | 1.010 | 0.965 | 0.918 | 0.875 | 0.868 | 0.826 | 0.813 | 0.772 | 0.734 | 0.717 | 0.712 |
| 225/80R17.5 | 0.389 | 1.040 | 1.015 | 0.970 | 0.922 | 0.880 | 0.873 | 0.830 | 0.818 | 0.776 | 0.738 | 0.720 | 0.716 |
| 225/70R19.5 | 0.395 | 1.056 | 1.031 | 0.985 | 0.937 | 0.893 | 0.886 | 0.843 | 0.830 | 0.788 | 0.749 | 0.731 | 0.727 |
| 8.25-16 | 0.404 | 1.080 | 1.054 | 1.007 | 0.958 | 0.913 | 0.907 | 0.862 | 0.849 | 0.806 | 0.766 | 0.748 | 0.743 |
| 245/70R19.5 | 0.407 | 1.088 | 1.062 | 1.015 | 0.965 | 0.920 | 0.913 | 0.869 | 0.856 | 0.812 | 0.772 | 0.754 | 0.749 |
| 8.25R16 | 0.409 | 1.094 | 1.067 | 1.020 | 0.970 | 0.925 | 0.918 | 0.873 | 0.860 | 0.816 | 0.776 | 0.757 | 0.752 |
| 9.5R17.5 | 0.409 | 1.094 | 1.067 | 1.020 | 0.970 | 0.925 | 0.918 | 0.873 | 0.860 | 0.816 | 0.776 | 0.757 | 0.752 |
| 225/90R17.5 | 0.410 | 1.096 | 1.070 | 1.022 | 0.972 | 0.927 | 0.920 | 0.875 | 0.862 | 0.819 | 0.778 | 0.759 | 0.754 |
| 9.00-16 | 0.420 | 1.123 | 1.096 | 1.047 | 0.996 | 0.950 | 0.942 | 0.896 | 0.883 | 0.838 | 0.797 | 0.778 | 0.773 |
| 265/70R19.5 | 0.421 | 1.126 | 1.098 | 1.050 | 0.998 | 0.952 | 0.945 | 0.899 | 0.885 | 0.840 | 0.799 | 0.780 | 0.774 |
| 7.50-18 | 0.423 | 1.131 | 1.104 | 1.055 | 1.003 | 0.956 | 0.949 | 0.903 | 0.689 | 0.844 | 0.802 | 0.783 | 0.778 |
| 7.50R18 | 0.426 | 1.139 | 1.111 | 1.062 | 1.010 | 0.963 | 0.956 | 0.909 | 0.896 | 0.850 | 0.808 | 0.789 | 0.784 |
| 9R19.5 | 0.433 | 1.158 | 1.130 | 1.080 | 1.027 | 0.979 | 0.972 | 0.924 | 0.910 | 0.864 | 0.821 | 0.802 | 0.797 |
| 265/60R22.5 | 0.438 | 1.171 | 1.143 | 1.092 | 1.039 | 0.990 | 0.983 | 0.935 | 0.921 | 0.874 | 0.831 | 0.811 | 0.806 |
| 235/70R22.5 | 0.440 | 1.177 | 1.148 | 1.097 | 1.043 | 0.995 | 0.987 | 0.939 | 0.925 | 0.878 | 0.835 | 0.815 | 0.809 |
| 7.50-20 | 0.448 | 1.198 | 1.169 | 1.117 | 1.062 | 1.013 | 1.005 | 0.956 | 0.942 | 0.893 | 0.850 | 0.830 | 0.824 |
| 285/60R22.5 | 0.450 | 1.203 | 1.174 | 1.122 | 1.067 | 1.018 | 1.010 | 0.961 | 0.946 | 0.897 | 0.854 | 0.833 | 0.828 |
| 7.50R20 | 0.452 | 1.209 | 1.179 | 1.127 | 1.072 | 1.022 | 1.014 | 0.965 | 0.950 | 0.901 | 0.857 | 0.837 | 0.831 |
| 255/70R22.5 | 0.453 | 1.211 | 1.182 | 1.129 | 1.074 | 1.024 | 1.017 | 0.967 | 0.952 | 0.903 | 0.859 | 0.839 | 0.833 |
| 275/70R22.5 | 0.465 | | | 1.159 | 1.103 | 1.051 | 1.043 | 0.993 | 0.978 | 0.927 | 0.882 | 0.861 | 0.855 |
| 11/70R22.5 | 0.468 | | | 1.167 | 1.110 | 1.058 | 1.050 | 0.999 | 0.984 | 0.933 | 0.888 | 0.867 | 0.861 |
| 8.25-20 | 0.468 | | | 1.167 | 1.110 | 1.058 | 1.050 | 0.999 | 0.984 | 0.933 | 0.888 | 0.867 | 0.861 |
| 8.25R20 | 0.470 | | | 1.172 | 1.115 | 1.063 | 1.055 | 1.003 | 0.988 | 0.937 | 0.892 | 0.870 | 0.865 |
| 9R22.5 | 0.470 | | | 1.172 | 1.115 | 1.063 | 1.055 | 1.003 | 0.988 | 0.937 | 0.892 | 0.870 | 0.865 |
| 265/75R22.5 | 0.474 | | | | 1.124 | 1.072 | 1.064 | 1.012 | 0.998 | 0.945 | 0.899 | 0.878 | 0.872 |
| 295/70R22.5 | 0.479 | | | | 1.136 | 1.083 | 1.075 | 1.022 | 1.007 | 0.955 | 0.909 | 0.887 | 0.881 |
| 9.00-20 | 0.490 | | | | 1.162 | 1.108 | 1.100 | 1.046 | 1.030 | 0.977 | 0.930 | 0.907 | 0.901 |
| 275/80R22.5 | 0.491 | | | | 1.164 | 1.110 | 1.102 | 1.048 | 1.032 | 0.979 | 0.931 | 0.909 | 0.903 |
| 9.00R20 | 0.492 | | | | 1.167 | 1.113 | 1.104 | 1.050 | 1.034 | 0.981 | 0.933 | 0.911 | 0.905 |
| 10R22.5 | 0.492 | | | | 1.167 | 1.113 | 1.104 | 1.050 | 1.034 | 0.981 | 0.933 | 0.911 | 0.905 |
| 295/75R22.5 | 0.493 | | | | 1.169 | 1.115 | 1.106 | 1.052 | 1.036 | 0.983 | 0.935 | 0.913 | 0.907 |
| 295/80R22.5 | 0.505 | | | | | 1.142 | 1.133 | 1.078 | 1.062 | 1.007 | 0.958 | 0.935 | 0.929 |
| 10.00-20 | 0.506 | | | | | 1.144 | 1.136 | 1.080 | 1.064 | 1.009 | 0.960 | 0.937 | 0.931 |
| 11.1-20 | 0.506 | | | | | 1.144 | 1.136 | 1.080 | 1.064 | 1.009 | 0.960 | 0.937 | 0.931 |
| 10.00R20 | 0.508 | | | | | 1.149 | 1.140 | 1.084 | 1.068 | 1.013 | 0.964 | 0.941 | 0.935 |
| 11.1R20 | 0.508 | | | | | 1.149 | 1.140 | 1.084 | 1.068 | 1.013 | 0.964 | 0.941 | 0.935 |
| 11R22.5 | 0.508 | | | | | 1.149 | 1.140 | 1.084 | 1.068 | 1.013 | 0.964 | 0.941 | 0.935 |
| 11.00-20 | 0.520 | | | | | 1.176 | 1.167 | 1.110 | 1.093 | 1.037 | 0.987 | 0.963 | 0.957 |
| 315/80R22.5 | 0.520 | | | | | 1.176 | 1.167 | 1.110 | 1.093 | 1.037 | 0.987 | 0.963 | 0.957 |
| 11.00R20 | 0.523 | | | | | 1.183 | 1.174 | 1.116 | 1.100 | 1.043 | 0.992 | 0.969 | 0.962 |
| 12R22.5 | 0.523 | | | | | 1.183 | 1.174 | 1.116 | 1.100 | 1.043 | 0.992 | 0.969 | 0.962 |
| 12.00-20 | 0.539 | | | | | | | 1.151 | 1.133 | 1.075 | 1.023 | 0.998 | 0.992 |
| 12.00R20 | 0.542 | | | | | | | 1.157 | 1.140 | 1.081 | 1.028 | 1.004 | 0.997 |
| 12.00-24 | 0.593 | | | | | | | | | 1.183 | 1.125 | 1.098 | 1.091 |
| 12.00R24 | 0.594 | | | | | | | | | 1.185 | 1.127 | 1.100 | 1.093 |

M12010100081

| | | REAR AXLE GEAR RATIO | | | | | |
|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 5.428 | 5.857 | 6.142 | 6.428 | 6.833 | 7.166 |
| 7.50-16 | 0.383 | 0.686 | | | | | |
| 7.50R16 | 0.387 | 0.693 | | | | | |
| 235/75R17.5 | 0.387 | 0.693 | | | | | |
| 225/80R17.5 | 0.389 | 0.697 | | | | | |
| 225/70R19.5 | 0.395 | 0.707 | | | | | |
| 8.25-16 | 0.404 | 0.724 | | | | | |
| 245/70R19.5 | 0.407 | 0.729 | | | | | |
| 8.25R16 | 0.409 | 0.733 | | | | | |
| 9.5R17.5 | 0.409 | 0.733 | | | | | |
| 225/90R17.5 | 0.410 | 0.734 | | | | | |
| 9.00-16 | 0.420 | 0.752 | 0.697 | | | | |
| 265/70R19.5 | 0.421 | 0.754 | 0.699 | | | | |
| 7.50-18 | 0.423 | 0.758 | 0.702 | | | | |
| 7.50R18 | 0.426 | 0.763 | 0.707 | 0.674 | | | |
| 9R19.5 | 0.433 | 0.776 | 0.719 | 0.685 | | | |
| 265/60R22.5 | 0.438 | 0.784 | 0.727 | 0.693 | | | |
| 235/70R22.5 | 0.440 | 0.788 | 0.730 | 0.696 | | | |
| 7.50-20 | 0.448 | 0.802 | 0.744 | 0.709 | | | |
| 285/60R22.5 | 0.450 | 0.806 | 0.747 | 0.712 | | | |
| 7.50R20 | 0.452 | 0.810 | 0.750 | 0.715 | | | |
| 255/70R22.5 | 0.453 | 0.811 | 0.752 | 0.717 | | | |
| 275/70R22.5 | 0.465 | 0.833 | 0.772 | 0.736 | 0.703 | | |
| 11/70R22.5 | 0.468 | 0.838 | 0.777 | 0.741 | 0.708 | | |
| 8.25-20 | 0.468 | 0.838 | 0.777 | 0.741 | 0.708 | | |
| 8.25R20 | 0.470 | 0.842 | 0.780 | 0.744 | 0.711 | | |
| 9R22.5 | 0.470 | 0.842 | 0.780 | 0.744 | 0.711 | | |
| 265/75R22.5 | 0.474 | 0.849 | 0.787 | 0.750 | 0.717 | | |
| 295/70R22.5 | 0.479 | 0.858 | 0.795 | 0.758 | 0.724 | | |
| 9.00-20 | 0.490 | 0.878 | 0.813 | 0.776 | 0.741 | 0.697 | |
| 275/80R22.5 | 0.491 | 0.879 | 0.815 | 0.777 | 0.743 | 0.699 | |
| 9.00R20 | 0.492 | 0.881 | 0.817 | 0.779 | 0.744 | 0.700 | |
| 10R22.5 | 0.492 | 0.881 | 0.817 | 0.779 | 0.744 | 0.700 | |
| 295/75R22.5 | 0.493 | 0.883 | 0.818 | 0.780 | 0.746 | 0.701 | |
| 295/80R22.5 | 0.505 | 0.905 | 0.838 | 0.799 | 0.764 | 0.718 | |
| 10.00-20 | 0.506 | 0.906 | 0.840 | 0.801 | 0.765 | 0.720 | |
| 11.1-20 | 0.506 | 0.906 | 0.840 | 0.801 | 0.765 | 0.720 | |
| 10.00R20 | 0.508 | 0.910 | 0.843 | 0.804 | 0.768 | 0.723 | |
| 11.1R20 | 0.508 | 0.910 | 0.843 | 0.804 | 0.768 | 0.723 | |
| 11R22.5 | 0.508 | 0.910 | 0.843 | 0.804 | 0.768 | 0.723 | |
| 11.00-20 | 0.520 | 0.931 | 0.863 | 0.823 | 0.786 | 0.740 | 0.705 |
| 315/80R22.5 | 0.520 | 0.931 | 0.863 | 0.823 | 0.786 | 0.740 | 0.705 |
| 11.00R20 | 0.523 | 0.937 | 0.868 | 0.828 | 0.791 | 0.744 | 0.709 |
| 12R22.5 | 0.523 | 0.937 | 0.868 | 0.828 | 0.791 | 0.744 | 0.709 |
| 12.00-20 | 0.539 | 0.965 | 0.895 | 0.853 | 0.815 | 0.767 | 0.731 |
| 12.00R20 | 0.542 | 0.971 | 0.900 | 0.858 | 0.820 | 0.771 | 0.735 |
| 12.00-24 | 0.593 | 1.062 | 0.984 | 0.939 | 0.897 | 0.844 | 0.805 |
| 12.00R24 | 0.594 | 1.064 | 0.986 | 0.940 | 0.898 | 0.845 | 0.806 |

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## EATON T/M (For Australia)

| | | REAR AXLE GEAR RATIO | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 3.636 | 3.727 | 3.900 | 4.100 | 4.300 | 4.333 | 4.555 | 4.625 | 4.875 | 5.125 | 5.250 | 5.285 |
| 7.50-16 | 0.383 | 1.003 | 0.979 | 0.935 | 0.890 | 0.848 | 0.842 | 0.801 | 0.789 | 0.748 | 0.712 | 0.695 | 0.690 |
| 7.50R16 | 0.387 | 1.014 | 0.989 | 0.945 | 0.899 | 0.857 | 0.851 | 0.809 | 0.797 | 0.756 | 0.719 | 0.702 | 0.697 |
| 235/75R17.5 | 0.387 | 1.014 | 0.989 | 0.945 | 0.899 | 0.857 | 0.851 | 0.809 | 0.797 | 0.756 | 0.719 | 0.702 | 0.697 |
| 225/80R17.5 | 0.389 | 1.019 | 0.994 | 0.950 | 0.904 | 0.862 | 0.855 | 0.813 | 0.801 | 0.760 | 0.723 | 0.706 | 0.701 |
| 225/70R19.5 | 0.395 | 1.035 | 1.009 | 0.965 | 0.918 | 0.875 | 0.868 | 0.826 | 0.813 | 0.772 | 0.734 | 0.716 | 0.712 |
| 8.25-16 | 0.404 | 1.058 | 1.032 | 0.987 | 0.939 | 0.895 | 0.888 | 0.846 | 0.832 | 0.789 | 0.751 | 0.733 | 0.728 |
| 245/70R19.5 | 0.407 | 1.066 | 1.040 | 0.994 | 0.945 | 0.901 | 0.895 | 0.851 | 0.838 | 0.795 | 0.756 | 0.738 | 0.733 |
| 8.25R16 | 0.409 | 1.071 | 1.045 | 0.999 | 0.950 | 0.906 | 0.899 | 0.855 | 0.842 | 0.799 | 0.760 | 0.742 | 0.737 |
| 9.5R17.5 | 0.409 | 1.071 | 1.045 | 0.999 | 0.950 | 0.906 | 0.899 | 0.855 | 0.842 | 0.799 | 0.760 | 0.742 | 0.737 |
| 225/90R17.5 | 0.410 | 1.074 | 1.048 | 1.001 | 0.952 | 0.908 | 0.901 | 0.857 | 0.844 | 0.801 | 0.762 | 0.744 | 0.739 |
| 9.00-16 | 0.420 | 1.100 | 1.073 | 1.026 | 0.976 | 0.930 | 0.923 | 0.878 | 0.865 | 0.821 | 0.780 | 0.762 | 0.757 |
| 265/70R19.5 | 0.421 | 1.103 | 1.078 | 1.028 | 0.978 | 0.933 | 0.925 | 0.880 | 0.867 | 0.822 | 0.782 | 0.764 | 0.759 |
| 7.50-18 | 0.423 | 1.108 | 1.081 | 1.033 | 0.983 | 0.937 | 0.930 | 0.884 | 0.871 | 0.826 | 0.786 | 0.767 | 0.762 |
| 7.50R18 | 0.426 | 1.116 | 1.089 | 1.040 | 0.990 | 0.944 | 0.936 | 0.891 | 0.877 | 0.832 | 0.792 | 0.773 | 0.768 |
| 9R19.5 | 0.433 | 1.134 | 1.107 | 1.058 | 1.006 | 0.959 | 0.952 | 0.905 | 0.892 | 0.846 | 0.805 | 0.785 | 0.780 |
| 265/60R22.5 | 0.438 | 1.147 | 1.119 | 1.070 | 1.018 | 0.970 | 0.963 | 0.916 | 0.902 | 0.856 | 0.814 | 0.795 | 0.789 |
| 235/70R22.5 | 0.440 | 1.153 | 1.125 | 1.075 | 1.022 | 0.975 | 0.967 | 0.920 | 0.906 | 0.860 | 0.818 | 0.798 | 0.793 |
| 7.50-20 | 0.448 | 1.174 | 1.145 | 1.094 | 1.041 | 0.992 | 0.985 | 0.937 | 0.923 | 0.875 | 0.833 | 0.813 | 0.807 |
| 285/60R22.5 | 0.450 | 1.179 | 1.150 | 1.099 | 1.045 | 0.997 | 0.989 | 0.941 | 0.927 | 0.879 | 0.836 | 0.816 | 0.811 |
| 7.50R20 | 0.452 | 1.184 | 1.155 | 1.104 | 1.050 | 1.001 | 0.994 | 0.945 | 0.931 | 0.883 | 0.840 | 0.820 | 0.815 |
| 255/70R22.5 | 0.453 | 1.187 | 1.158 | 1.106 | 1.052 | 1.003 | 0.996 | 0.947 | 0.933 | 0.885 | 0.842 | 0.822 | 0.816 |
| 275/70R22.5 | 0.465 | | | 1.136 | 1.080 | 1.030 | 1.022 | 0.972 | 0.958 | 0.908 | 0.864 | 0.844 | 0.838 |
| 11/70R22.5 | 0.468 | | | 1.143 | 1.087 | 1.037 | 1.029 | 0.979 | 0.964 | 0.914 | 0.870 | 0.849 | 0.843 |
| 8.25-20 | 0.468 | | | 1.143 | 1.087 | 1.037 | 1.029 | 0.979 | 0.964 | 0.914 | 0.870 | 0.849 | 0.843 |
| 8.25R20 | 0.470 | | | 1.148 | 1.092 | 1.041 | 1.033 | 0.983 | 0.968 | 0.918 | 0.873 | 0.853 | 0.847 |
| 9R22.5 | 0.470 | | | 1.148 | 1.092 | 1.041 | 1.033 | 0.983 | 0.968 | 0.918 | 0.873 | 0.853 | 0.847 |
| 265/75R22.5 | 0.474 | | | | 1.101 | 1.050 | 1.042 | 0.991 | 0.976 | 0.926 | 0.881 | 0.860 | 0.854 |
| 295/70R22.5 | 0.479 | | | | 1.113 | 1.061 | 1.053 | 1.002 | 0.986 | 0.936 | 0.890 | 0.869 | 0.863 |
| 9.00-20 | 0.490 | | | | 1.138 | 1.085 | 1.077 | 1.025 | 1.009 | 0.957 | 0.911 | 0.889 | 0.883 |
| 275/80R22.5 | 0.491 | | | | 1.141 | 1.088 | 1.079 | 1.027 | 1.011 | 0.959 | 0.912 | 0.891 | 0.885 |
| 9.00R20 | 0.492 | | | | 1.143 | 1.090 | 1.082 | 1.029 | 1.013 | 0.961 | 0.914 | 0.893 | 0.887 |
| 10R22.5 | 0.492 | | | | 1.143 | 1.090 | 1.082 | 1.029 | 1.013 | 0.961 | 0.914 | 0.893 | 0.887 |
| 295/75R22.5 | 0.493 | | | | 1.145 | 1.092 | 1.084 | 1.031 | 1.015 | 0.963 | 0.916 | 0.894 | 0.888 |
| 295/80R22.5 | 0.505 | | | | | 1.119 | 1.110 | 1.056 | 1.040 | 0.987 | 0.939 | 0.916 | 0.910 |
| 10.00-20 | 0.506 | | | | | 1.121 | 1.112 | 1.058 | 1.042 | 0.989 | 0.940 | 0.918 | 0.912 |
| 11.1-20 | 0.506 | | | | | 1.121 | 1.112 | 1.058 | 1.042 | 0.989 | 0.940 | 0.918 | 0.912 |
| 10.00R20 | 0.508 | | | | | 1.125 | 1.117 | 1.062 | 1.046 | 0.993 | 0.944 | 0.922 | 0.915 |
| 11.1R20 | 0.508 | | | | | 1.125 | 1.117 | 1.062 | 1.046 | 0.993 | 0.944 | 0.922 | 0.915 |
| 11R22.5 | 0.508 | | | | | 1.125 | 1.117 | 1.062 | 1.046 | 0.993 | 0.944 | 0.922 | 0.915 |
| 11.00-20 | 0.520 | | | | | 1.152 | 1.143 | 1.087 | 1.071 | 1.016 | 0.966 | 0.943 | 0.937 |
| 315/80R22.5 | 0.520 | | | | | 1.152 | 1.143 | 1.087 | 1.071 | 1.016 | 0.966 | 0.943 | 0.937 |
| 11.00R20 | 0.523 | | | | | 1.159 | 1.150 | 1.094 | 1.077 | 1.022 | 0.972 | 0.949 | 0.943 |
| 12R22.5 | 0.523 | | | | | 1.159 | 1.150 | 1.094 | 1.077 | 1.022 | 0.972 | 0.949 | 0.943 |
| 12.00-20 | 0.539 | | | | | | | 1.127 | 1.110 | 1.053 | 1.002 | 0.978 | 0.971 |
| 12.00R20 | 0.542 | | | | | | | 1.133 | 1.116 | 1.059 | 1.007 | 0.983 | 0.977 |
| 12.00-24 | 0.593 | | | | | | | | | 1.159 | 1.102 | 1.076 | 1.069 |
| 12.00R24 | 0.594 | | | | | | | | | 1.181 | 1.104 | 1.078 | 1.071 |

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| | | REAR AXLE GEAR RATIO | | | | | |
|---|---|---|---|---|---|---|---|
| TIRE SIZE | RADIUS | 5.428 | 5.857 | 6.142 | 6.428 | 6.833 | 7.166 |
| 7.50-16 | 0.383 | 0.672 | | | | | |
| 7.50R16 | 0.387 | 0.679 | | | | | |
| 235/75R17.5 | 0.387 | 0.679 | | | | | |
| 225/80R17.5 | 0.389 | 0.682 | | | | | |
| 225/70R19.5 | 0.395 | 0.693 | | | | | |
| 8.25-16 | 0.404 | 0.709 | | | | | |
| 245/70R19.5 | 0.407 | 0.714 | | | | | |
| 8.25R16 | 0.409 | 0.718 | | | | | |
| 9.5R17.5 | 0.409 | 0.718 | | | | | |
| 225/90R17.5 | 0.410 | 0.719 | | | | | |
| 9.00-16 | 0.420 | 0.737 | 0.683 | | | | |
| 265/70R19.5 | 0.421 | 0.739 | 0.684 | | | | |
| 7.50-18 | 0.423 | 0.742 | 0.688 | | | | |
| 7.50R18 | 0.426 | 0.747 | 0.693 | 0.660 | | | |
| 9R19.5 | 0.433 | 0.760 | 0.704 | 0.671 | | | |
| 265/60R22.5 | 0.438 | 0.768 | 0.712 | 0.679 | | | |
| 235/70R22.5 | 0.440 | 0.772 | 0.715 | 0.682 | | | |
| 7.50-20 | 0.448 | 0.786 | 0.728 | 0.695 | | | |
| 285/60R22.5 | 0.450 | 0.790 | 0.732 | 0.698 | | | |
| 7.50R20 | 0.452 | 0.793 | 0.735 | 0.701 | | | |
| 255/70R22.5 | 0.453 | 0.795 | 0.737 | 0.702 | | | |
| 275/70R22.5 | 0.465 | 0.816 | 0.756 | 0.721 | 0.689 | | |
| 11/70R22.5 | 0.468 | 0.821 | 0.761 | 0.726 | 0.693 | | |
| 8.25-20 | 0.468 | 0.821 | 0.761 | 0.726 | 0.693 | | |
| 8.25R20 | 0.470 | 0.825 | 0.764 | 0.729 | 0.696 | | |
| 9R22.5 | 0.470 | 0.825 | 0.764 | 0.729 | 0.696 | | |
| 265/75R22.5 | 0.474 | 0.832 | 0.771 | 0.735 | 0.702 | | |
| 295/70R22.5 | 0.479 | 0.840 | 0.779 | 0.743 | 0.710 | | |
| 9.00-20 | 0.490 | 0.860 | 0.797 | 0.760 | 0.726 | 0.683 | |
| 275/80R22.5 | 0.491 | 0.862 | 0.798 | 0.761 | 0.727 | 0.684 | |
| 9.00R20 | 0.492 | 0.863 | 0.800 | 0.763 | 0.729 | 0.686 | |
| 10R22.5 | 0.492 | 0.863 | 0.800 | 0.763 | 0.729 | 0.686 | |
| 295/75R22.5 | 0.493 | 0.865 | 0.802 | 0.764 | 0.730 | 0.687 | |
| 295/80R22.5 | 0.505 | 0.886 | 0.821 | 0.783 | 0.748 | 0.704 | |
| 10.00-20 | 0.506 | 0.888 | 0.823 | 0.785 | 0.750 | 0.705 | |
| 11.1-20 | 0.506 | 0.888 | 0.823 | 0.785 | 0.750 | 0.705 | |
| 10.00R20 | 0.508 | 0.891 | 0.826 | 0.788 | 0.753 | 0.708 | |
| 11.1R20 | 0.508 | 0.891 | 0.826 | 0.788 | 0.753 | 0.708 | |
| 11R22.5 | 0.508 | 0.891 | 0.826 | 0.788 | 0.753 | 0.708 | |
| 11.00-20 | 0.520 | 0.912 | 0.846 | 0.806 | 0.770 | 0.725 | 0.691 |
| 315/80R22.5 | 0.520 | 0.912 | 0.846 | 0.806 | 0.770 | 0.725 | 0.691 |
| 11.00R20 | 0.523 | 0.918 | 0.850 | 0.811 | 0.775 | 0.729 | 0.695 |
| 12R22.5 | 0.523 | 0.918 | 0.850 | 0.811 | 0.775 | 0.729 | 0.696 |
| 12.00-20 | 0.539 | 0.946 | 0.876 | 0.836 | 0.799 | 0.751 | 0.716 |
| 12.00R20 | 0.542 | 0.951 | 0.881 | 0.840 | 0.803 | 0.755 | 0.720 |
| 12.00-24 | 0.593 | 1.041 | 0.964 | 0.920 | 0.879 | 0.827 | 0.788 |
| 12.00R24 | 0.594 | 1.042 | 0.966 | 0.921 | 0.880 | 0.828 | 0.789 |

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## ALLISON ATM (For Australia)

| | | REAR AXLE GEAR RATIO |
|---|---|---|
| TIRE SIZE | RADIUS | 6.428 |
| 275/70R22.5 | 0.465 | 1.847 |
| 275/80R22.5 | 0.492 | 1.954 |
| 295/80R22.5 | 0.505 | 2.005 |
| 11R22.5 | 0.508 | 2.017 |

M12010100257

# ELECTRIC WIRE

EL02-001

**DIAGRAM..... EL02-2**
HOW TO USE THIS CHAPTER.....EL02-2
SPECIFICATION SYMBOL LIST .....EL02-4
DIAGRAM .....EL02-16
WIRE TO WIRE CONNECTOR .....EL02-88

# DIAGRAM

## HOW TO USE THIS CHAPTER

M12020101BEJ1001

- In this chapter, "specification symbols" are used as prefix of each wiring diagram in order to specify the circuits that are different in accordance with the models and specifications. For further detail on how to use this chapter, refer to "1. Description of specification symbol list" and "2. Description of wiring diagram".

1. Description of specification symbol list

| a | | b | c | d | e |
|---|---|---|---|---|---|
| Circuit name | | Specification symbol | Specifications | Remarks | Page |
| A | METER CIRCUIT (CAB SIDE) | □ | Common to all models | ○ | EL02-16 |
| | | ⊠ | Except for models with P11C engine | ○ | |
| | | ⊟ | Models with P11C engine | | |
| | | △ | Models equipped with air over hydraulic brake (without brake-lock) | ○ | |
| | | ⧋ | Models equipped with air over hydraulic brake (with brake-lock) | | |
| | | ▽ | Models equipped with center parking brake | ○ | |
| | | ⌁ | Models equipped with wheel parking brake | | |
| | | ⊖ | Models equipped with brake-lock (as option) | | |
| | | ▭ | Models equipped with mechanical governor | ○ | |
| | | ⊠ | Models for Australia and New Zealand | | |
| | | ✡ | For tractor models | | |

M12020100104

a. Circuit name
Designates the circuit names on the wiring diagram.

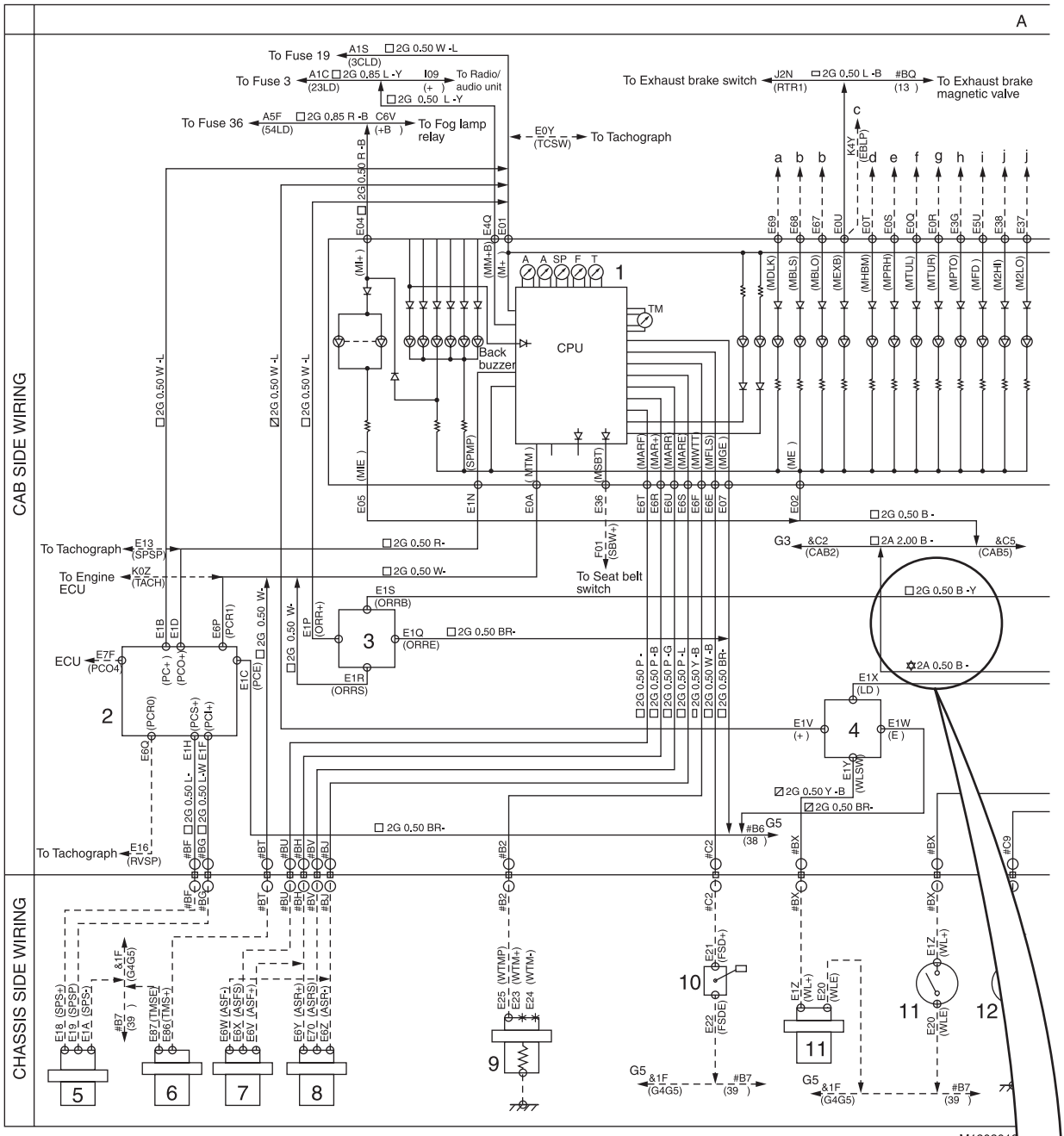
b. Specification symbol
This is the symbol of the specification listed on the "Specifications" column. On the wiring diagram, this symbol is prefixed to all the wiring type mark (example: 2G 0.50 W-L).
Each wiring is installed only on the vehicles of the specifications that the relevant specification symbol designates.

c. Specifications
Describes the contents of specifications that each specification symbol designates. All the wirings are classified according to the specifications listed here.

d. Remarks
"O" means that this is the wiring common to all the models on this manual. Model name means that this is the wiring relating only to that model. The blank means that this is the wiring not relating to the models covered by this manual.

e. Page
Indicates the page where the relevant wiring diagram is found.

2. Description of wiring diagram




This is the circuit name.

**A. METER CIRCUIT (CAB SIDE)**

1. Combination meter
2. Pulse adjust computer
3. Over revolution detector
4. Coolant level warning relay
5. Speed sensor
6. Tachometer sensor
7. Front air gauge sensor
8. Rear air gauge sensor
9. Coolant temperature gauge sender unit
10. Fuel gauge sender unit
11. Coolant level warning switch
12. Oil pressure warning switch
13. Warning buzzer
14. Center parking brake switch
15. Trailer hand brake switch
16. Brake-lock short-circuit connector
17. Warning lamp check relay
18. Low oil pressure warning switch
19. Brake adjust warning switch
20. Brake fluid level warning switch
21. Spring brake switch
22. Buzzer cancel switch

This is name of the parts on the diagram and the number corresponds to that on the diagram.

Specification symbol (□,✡,etc.)

Each wiring is installed to the vehicles relevant to the specification that the specification symbol designates.

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# SPECIFICATION SYMBOL LIST

M12020101BEJ1002

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| A | METER CIRCUIT (CAB SIDE) | □ | Common to all models | O | EL02-16 |
| | | ⊠ | Except for models with P11C engine | O | |
| | | ⊟ | Models with P11C engine | | |
| | | △ | Models equipped with air over hydraulic brake (without brake-lock) | O | |
| | | ⧋ | Models equipped with air over hydraulic brake (with brake-lock) | | |
| | | ▽ | Models equipped with center parking brake | | |
| | | ⌒ | Models equipped with wheel parking brake | O | |
| | | ⊖ | Models equipped with brake-lock (as option) | | |
| | | ▭ | Models equipped with mechanical governor | O | |
| | | ⊠ | Models for Australia and New Zealand | O | |
| | | ✡ | For tractor models | | |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| B | METER CIRCUIT (CHASSIS SIDE 1) | □ | Common to all models | ○ | EL02-20 |
| | | ◪ | Models with automatic transmission | ○ | |
| | | ⋈ | For tractor models | | |
| | | ⊖ | Models equipped with air over hydraulic brake | ○ | |
| | | ⊕ | Models without air tank for auxiliary equipment | ○ | |
| | | ⊠ | Models with one pointer type air pressure gauge | | |
| | | △△ | Models with two pointers type air pressure gauge | ○ | |
| | | ✡ | Models with air tank for auxiliary equipment | ○ | |
| | | △ | Models for Australia | ○ | |
| | | ⧋ | Except for models for Australia | ○ | |
| | | ⊗ | Models equipped with air over hydraulic brake (with ABS) | ○ | |
| | | ▽ | Models FG, GH, FL, FM, SG (with air over hydraulic brake and ABS) | | |
| | | ○ | Models FT, GT (without ABS) | | |
| | | ◍ | Models FT, GT (with ABS) | | |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| C | METER CIRCUIT (CHASSIS SIDE 2) | □ | Common to all models | O | EL02-22 |
| | | ⊟ | Model FC3J | | |
| | | ◪ | Models with J08C engine | | |
| | | ⌁ | Models FT, GT (except for tractor models) | | |
| | | ◐ | Models FT, GT (for tractor models) | | |
| | | △ | Models with J08C-TI engine | O | |
| | | ⊕ | Model FC4J | | |
| | | ⊠ | Models with P11C engine | | |
| | | ○ | Except for models with P11C engine | O | |
| D | POWER SUPPLY CIRCUIT | □ | Common to all models | O | EL02-24 |
| | | ◪ | Models equipped with power mirror | O | |
| | | ⊟ | Models equipped with electromagnetic retarder | O | |
| | | △ | Models equipped with electronic governor | O | |
| | | ⏃ | Models with transfer or automatic transmission | O | |
| | | ⋈ | Models equipped with P.T.O. | O | |
| | | ⊞ | Models equipped with P11C engine (with intake air heater) | | |
| | | ⊠ | Models equipped with P11C engine (without intake air heater) | | |
| | | ⊕ | For double cab models | O | |
| E | HOUR METER CIRCUIT | ◪ | Models equipped with hour meter | | EL02-26 |
| F | EXHAUST BRAKE CIRCUIT (EXCEPT FOR MODELS WITH AUTOMATIC TRANSMISSION AND ALL MODELS WITH P11C ENGINE) | ◪ | Models with manual transmission | O | EL02-27 |
| | | △ | Models without ABS | O | |
| | | ⊕ | Models equipped with ABS | O | |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| G | EXHAUST BRAKE CIRCUIT (MODELS WITH AUTOMATIC TRANSMISSION) |  | Models with automatic transmission | ○ | EL02-28 |
| | |  | Models without ABS | ○ | |
| | |  | Models equipped with ABS | ○ | |
| H | EXHAUST BRAKE CIRCUIT (MODELS WITH P11C ENGINE) |  | Models with P11C engine | | EL02-29 |
| | |  | Models equipped with TE system | | |
| | |  | Models equipped with ABS | | |
| I | TACHOGRAPH CIRCUIT |  | Common to all models | ○ | EL02-30 |
| J | HEAD LAMP, FRONT FOG LAMP AND REAR COMBINATION LAMP CIRCUIT (CAB SIDE) |  | Common to all models | ○ | EL02-32 |
| | |  | Models equipped with halogen head lamps | ○ | |
| | |  | Models equipped with rear fog lamp | | |
| | |  | Models equipped with discharge head lamps | | |
| | |  | Models without parking lamp | ○ | |
| | |  | Models equipped with parking lamp (for tractor models) | | |
| | |  | Models equipped with parking lamp (except for tractor models) | ○ | |
| | |  | For tractor models | | |
| | |  | Except for tractor models | ○ | |
| | |  | Models equipped with wheel parking brake for Hong Kong | | |
| | |  | Models equipped with parking lamp (as option) | ○ | |
| K | REAR FOG LAMP CIRCUIT (CAB SIDE) |  | Models equipped with rear fog lamp | | EL02-33 |
| L | MARKER LAMP CIRCUIT (CAB SIDE) |  | Models equipped with roof marker lamp | ○ | EL02-33 |
| | |  | Models equipped with front side marker lamp | | |
| | |  | Models equipped with rear fog lamp | | |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| M | HEAD LAMP, FRONT FOG LAMP AND REAR COMBINATION LAMP CIRCUIT (CHASSIS SIDE) | □ | Common to all models | O | EL02-34 |
| | | ⊠ | For full-tractor models | | |
| | | ◪ | Except for models FT, GT tractors | O | |
| | | ○ | Models for mixer models | O | |
| | | ⊟ | Models FT, GT | | |
| | | △ | For tractor models | | |
| N | REAR FOG LAMP CIRCUIT (CHASSIS SIDE) | ⧋ | Models equipped with rear fog lamp (except for models FT,GT) | | EL02-35 |
| | | ⋈ | Models equipped with rear fog lamp (models FT,GT) | | |
| O | MARKER LAMP CIRCUIT (CHASSIS SIDE) | – | – | – | EL02-35 |
| P | TURN SIGNAL AND HAZARD LAMP CIRCUIT | □ | Common to all models | O | EL02-36 |
| | | ⊟ | For tractor models | | |
| | | ◪ | Except for tractor models | O | |
| | | △ | For left-hand drive models with power window | | |
| | | ⋈ | Models without power window | O | |
| | | ⧋ | For right-hand drive models with power window | O | |
| | | ⊠ | For full-tractor models | | |
| | | ▽ | Except for models FT, GT tractors | O | |
| | | ⊗ | Models for mixer models | O | |
| | | ○ | Models FT, GT | | |
| Q | SPOT LAMP CIRCUIT | ⊟ | For tractor models | | EL02-38 |
| R | HEAD LAMP CONTROL CIRCUIT | ◪ | Models equipped with head lamp beam level control switch | O | EL02-39 |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| S | BACK-UP LAMP CIRCUIT (MODELS WITH MANUAL TRANSMISSION) |  | For tractor models (with two back-up lamps) | | EL02-40 |
| | |  | With one back-up lamp | O | |
| | |  | With two back-up lamps | O | |
| | |  | For full-tractor models | | |
| | |  | For tractor models | | |
| | |  | Models FT, GT | | |
| | |  | Except models FT, GT | O | |
| | |  | Models for mixer models | O | |
| | |  | Models for Hong Kong | | |
| | |  | Except for models for Hong Kong | O | |
| T | BACK-UP LAMP CIRCUIT (MODELS WITH AUTO-MATIC TRANSMISSION) |  | Models with automatic transmission | O | EL02-41 |
| U | ROOM LAMP CIRCUIT |  | With two room lamps | O | EL02-42 |
| | |  | Models equipped with fluorescent lamp | O | |
| | |  | For double cab models | O | |
| | |  | With one room lamp | | |
| V | WIPER AND WASHER CIRCUIT |  | Common to all models | O | EL02-44 |
| W | POWER MIRROR CIRCUIT |  | Models equipped with power mirror | O | EL02-45 |
| X | HORN CIRCUIT |  | Common to all models | O | EL02-45 |
| Y | CIGARETTE LIGHTER CIRCUIT |  | Common to all models | O | EL02-45 |
| Z | SEAT BELT WARNING LAMP CIRCUIT |  | Models equipped with seat belt warning lamp | O | EL02-46 |
| AA | POWER DOOR LOCK CIR-CUIT (FOR RIGHT-HAND DRIVE VEHICLE) |  | Models equipped with power door lock | O | EL02-46 |
| | |  | For double cab models | O | |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| AB | POWER DOOR LOCK CIRCUIT (FOR LEFT-HAND DRIVE VEHICLE) | ⊠ | Models equipped with power door lock | | EL02-47 |
| AC | POWER WINDOW CIRCUIT (FOR RIGHT-HAND DRIVE VEHICLE) | ⊠ | Models equipped with power window | O | EL02-48 |
| | | △△ | For double cab models | O | |
| AD | POWER WINDOW CIRCUIT (FOR LEFT-HAND DRIVE VEHICLE) | ⊠ | Models equipped with power window | | EL02-49 |
| AE | RADIO/AUDIO CIRCUIT | □ | Common to all models | O | EL02-50 |
| AF | DST-1 CIRCUIT | ⊠ | Models equipped with ABS (Models FC, FD, GD, FT, GT) | O | EL02-51 |
| | | ⊟ | Models equipped with ABS (Models FG, GH, FL, FM, SG) | O | |
| AG | HEATER AND MANUAL AIR CONDITIONER CIRCUIT | □ | Common to all models | O | EL02-52 |
| AH | SPARE POWER SOURCE CIRCUIT | □ | Common to all models | O | EL02-54 |
| | | ○ | All models equipped with 12V spare power source | O | |
| | | ⊟ | For tractor models | | |
| | | ⊠ | Except for tractor models | O | |
| | | ⊕ | Models equipped with 12V power source (for tractor models) | | |
| | | ⊖ | Models equipped with 12V power source (except for tractor models) | O | |
| | | ⚠ | For semi-tractor models | | |
| | | ⊠ | For full-tractor models | | |
| AI | 12V SPARE POWER SOURCE CIRCUIT | ○ | All models equipped with 12V spare power source | O | EL02-55 |
| | | ⊕ | Models equipped with 12V spare power source (for tractor models) | | |
| | | ⊖ | Models equipped with 12V spare power source (except for tractor models) | O | |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| AJ | GROUND CIRCUIT | □ | Common to all models | ○ | EL02-56 |
| | | ⊠ | Except for FT tractor | ○ | |
| | | ⊟ | Models FT, GT | | |
| | | △ | For tractor models | | |
| | | ⧋ | Models equipped with ES start, electromagnetic retarder, or transfer | ○ | |
| | | ⋈ | Models equipped with automatic transmission and ABS | ○ | |
| AK | ENGINE STARTING CIRCUIT (MODELS WITH MANUAL TRANSMISSION) | ⊠ | Except for models with P11C engine | ○ | EL02-58 |
| | | ⊠ | Models equipped with sub-starter switch | ○ | |
| AL | ENGINE STARTING CIRCUIT (MODELS WITH AUTOMATIC TRANSMISSION) | ⊟ | Models with automatic transmission | ○ | EL02-59 |
| AM | ENGINE STARTING CIRCUIT (MODELS WITH P11C ENGINE) | ○ | Models equipped with 3kW intake air heater | | EL02-60 |
| | | ⊗ | Models without intake air heater | | |
| | | △ | All models with P11C engine | | |
| AN | PRE-HEATER CIRCUIT (MODELS WITH MANUAL TRANSMISSION AND J-SERIES ENGINE) | ⊠ | Models equipped with pre-heater | ○ | EL02-61 |
| AO | PRE-HEATER CIRCUIT (MODELS WITH AUTOMATIC TRANSMISSION) | ⊠ | Models equipped with pre-heater | ○ | EL02-62 |
| AP | PRE-HEATER CIRCUIT (MODELS WITH P11C ENGINE) | △ | Models equipped with intake air heater | | EL02-63 |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| AQ | CHARGING CIRCUIT | □ | Common to all models | O | EL02-63 |
| | | ⋈ | Models with P11C engine (with intake air heater) | | |
| | | ▽ | Models with P11C engine (without intake air heater) | | |
| | | ⊞ | Model FC3J | | |
| | | ○ | Model FC4J | | |
| | | ⊠ | Models with J08C engine | | |
| | | △ | Models with J08C-TI engine | O | |
| AR | TE SYSTEM (TICS) CIRCUIT | ⊿ | Models equipped with mechanical governor | O | EL02-64 |
| | | ⩚ | Models with P11C engine | | |
| | | ▽ | Except for model FC | O | |
| | | ⊗ | Model FC | | |
| AS | TE SYSTEM (ELECTRONIC GOVERNOR) CIRCUIT | ⊿ | Models equipped with electronic governor | O | EL02-66 |
| | | ⊟ | Models with automatic transmission | O | |
| | | △ | Models with manual transmission | O | |
| AT | TE SYSTEM (ELECTRONIC GOVERNOR) POWER TAKE-OFF CIRCUIT | ⊿ | Except for models with EATON FS6109/8209 transmission | O | EL02-68 |
| | | ⊟ | Models with manual transmission | O | |
| | | △ | Models with automatic transmission | O | |
| | | ⩚ | Models with EATON FS6109/8209 transmission | O | |
| AU | ENGINE STOP CIRCUIT (FOR RIGHT-HAND DRIVE VEHICLE) | ⊿ | Except for models equipped with electronic governor | O | EL02-69 |
| AV | ENGINE STOP CIRCUIT (FOR LEFT-HAND DRIVE VEHICLE) | ⊿ | Except for models equipped with electronic governor | | EL02-69 |

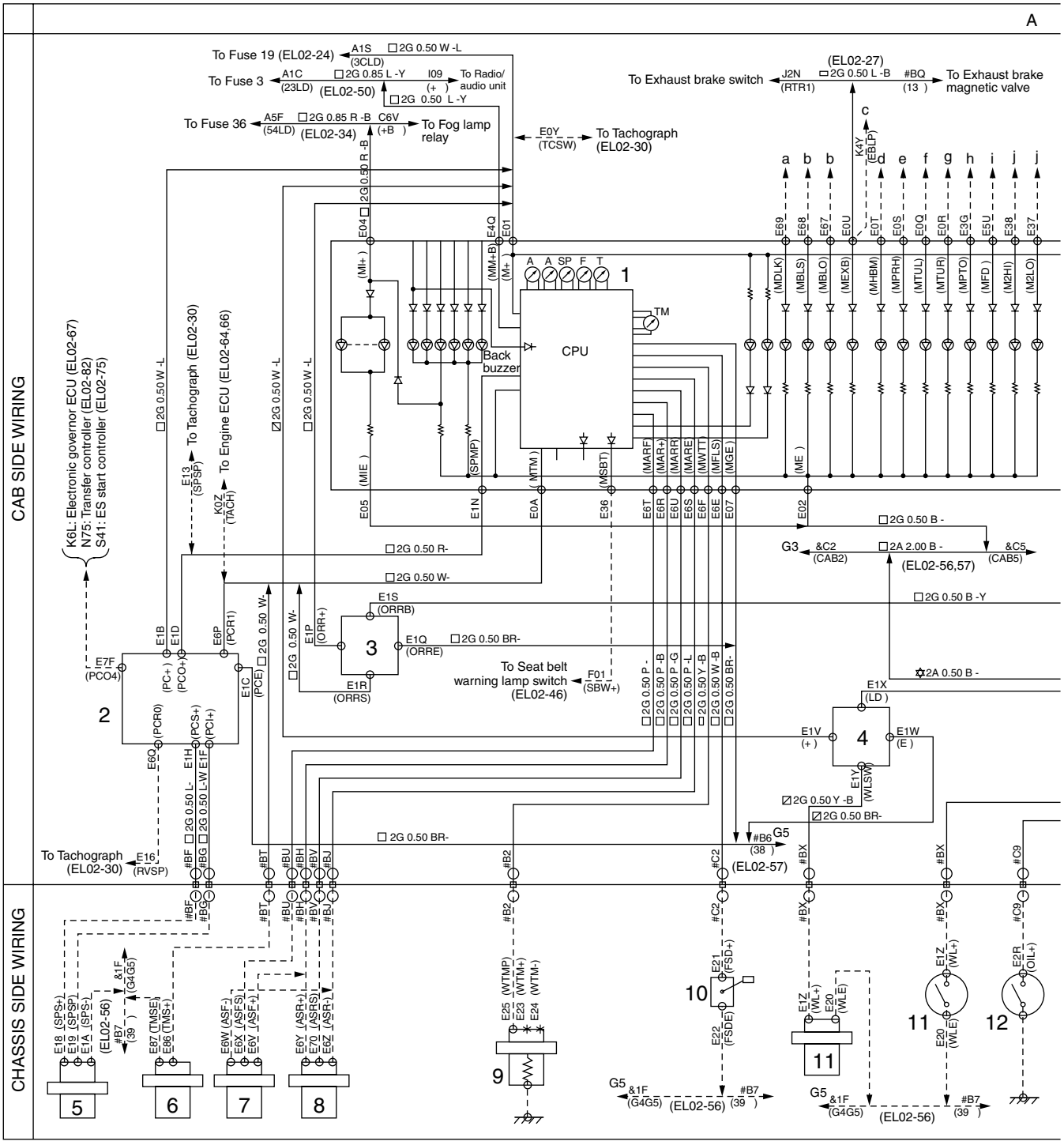
| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| AW | ABS CIRCUIT (MODELS FC, FD, GD, FT, GT) | ⊠ | All models equipped with ABS | ○ | EL02-70 |
| | | ⊟ | Models FT, GT | | |
| | | △ | Except for models FT, GT | ○ | |
| | | ⧋ | Models equipped with exhaust brake | ○ | |
| AX | ABS CIRCUIT (MODELS FG, GH, FL, FM, SG) | ⊠ | All models equipped with ABS | ○ | EL02-72 |
| | | ⊟ | Models equipped with full air brake | ○ | |
| | | △ | Models equipped with air over hydraulic brake | | |
| | | ⧋ | Models with manual transmission and exhaust brake (for right-hand drive vehicle) | ○ | |
| | | ⋈ | Models with automatic transmission and exhaust brake (for right-hand drive vehicle) | ○ | |
| | | △△ | Models with manual transmission and exhaust brake (for left-hand drive vehicle) | | |
| AY | ES START SYSTEM CIRCUIT | ⊠ | All models equipped with ES start system | ○ | EL02-74 |
| | | ⊟ | Models equipped with center parking brake | | |
| | | △ | Models equipped with wheel parking brake | ○ | |
| | | ⧋ | Models equipped with electronic governor | ○ | |
| | | ⋈ | Models FT, GT | | |
| | | ▽ | Models with J08C, J08C-TI engine (with pre-heater) | ○ | |
| | | ○ | Models with P11C engine | | |
| | | ⌒ | Except for models equipped with electronic governor and models FT, GT | ○ | |
| | | ▭ | Models with J08C, J08C-TI engine (without pre-heater) | ○ | |
| | | □ | Models with two back-up lamps or tractor models | ○ | |
| | | ⊠ | With one back-up lamp | ○ | |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| AZ | BRAKE-LOCK CIRCUIT (MODELS EQUIPPED WITH CENTER PARKING BRAKE) | ⊠ | Models equipped with brake-lock | | EL02-76 |
| BA | BRAKE-LOCK CIRCUIT (MODELS EQUIPPED WITH WHEEL PARKING BRAKE) | ⊟ | Models equipped with brake-lock | | EL02-77 |
| BB | ELECTROMAGNETIC RETARDER CIRCUIT | ⊠ | Models equipped with electromagnetic retarder | O | EL02-78 |
| BC | INTER-AXLE DIFFERENTIAL LOCK CIRCUIT | ⊠ | Model FM | O | EL02-79 |
| | | ⊟ | For tractor models | | |
| | | △ | Except for tractor models | O | |
| BD | AUTOMATIC TRANSMISSION CIRCUIT | ⊠ | Models with automatic transmission | O | EL02-80 |
| BE | TRANSFER CONTROL CIRCUIT | ⊠ | Models FT, GT | | EL02-82 |
| BF | TRANSMISSION P.T.O. CONTROL CIRCUIT (EXCEPT FOR MODELS WITH EATON FS6109/8209 TRANSMISSION) | ⊠ | Models equipped with transmission P.T.O. | O | EL02-83 |
| | | △ | For dump models | O | |
| BG | TRANSMISSION P.T.O. CONTROL CIRCUIT (MODELS WITH EATON FS6109/8209 TRANSMISSION) | ⊟ | Models equipped with transmission P.T.O. | O | EL02-83 |
| | | ⚠ | For dump models | O | |
| BH | CAB TILT CIRCUIT (MODELS FOR DOUBLE CAB) | ⊠ | For double cab models | O | EL02-84 |
| BI | TRAILER CONNECTOR CIRCUIT | ⊠ | For tractor models | | EL02-85 |

| Circuit name | | Specification symbol | Specifications | Remarks | Page |
|---|---|---|---|---|---|
| BJ | AIR DRIER CIRCUIT | ○ | Models equipped with manual transmission (the drier is mounted on the left of the chassis) | ○ | EL02-85 |
| | | ▽ | Models equipped with manual transmission (the drier is mounted on the right of the chassis) | ○ | |
| | | ⊞ | Models equipped with automatic transmission (the drier is mounted on the left of the chassis) | ○ | |
| | | ⊠ | Models equipped with automatic transmission (the drier is mounted on the right of the chassis) | ○ | |
| BK | TRANSMISSION CONTROL CIRCUIT (MODELS WITH EATON FS6109/8209 TRANSMISSION) | ◹ | All models with EATON FS6109/8209 transmission | ○ | EL02-86 |
| | | ⊟ | For tractor models | | |
| | | △ | Except for tractor models | ○ | |
| BL | TRANSMISSION CONTROL CIRCUIT (MODELS WITH ZF 9S109 TRANSMISSION) | ◮ | All models with ZF 9S109 transmission | | EL02-86 |
| | | ⋈ | For tractor models | | |
| | | ▽ | Except for tractor models | | |
| BM | DIAGNOSIS MONITOR CIRCUIT | ◹ | Models equipped with electronic governor | ○ | EL02-87 |
| | | △ | Models equipped with ABS | ○ | |
| | | ◮ | Models equipped with ES start system | ○ | |
| | | ⋈ | Models equipped with electromagnetic retarder | ○ | |

# DIAGRAM

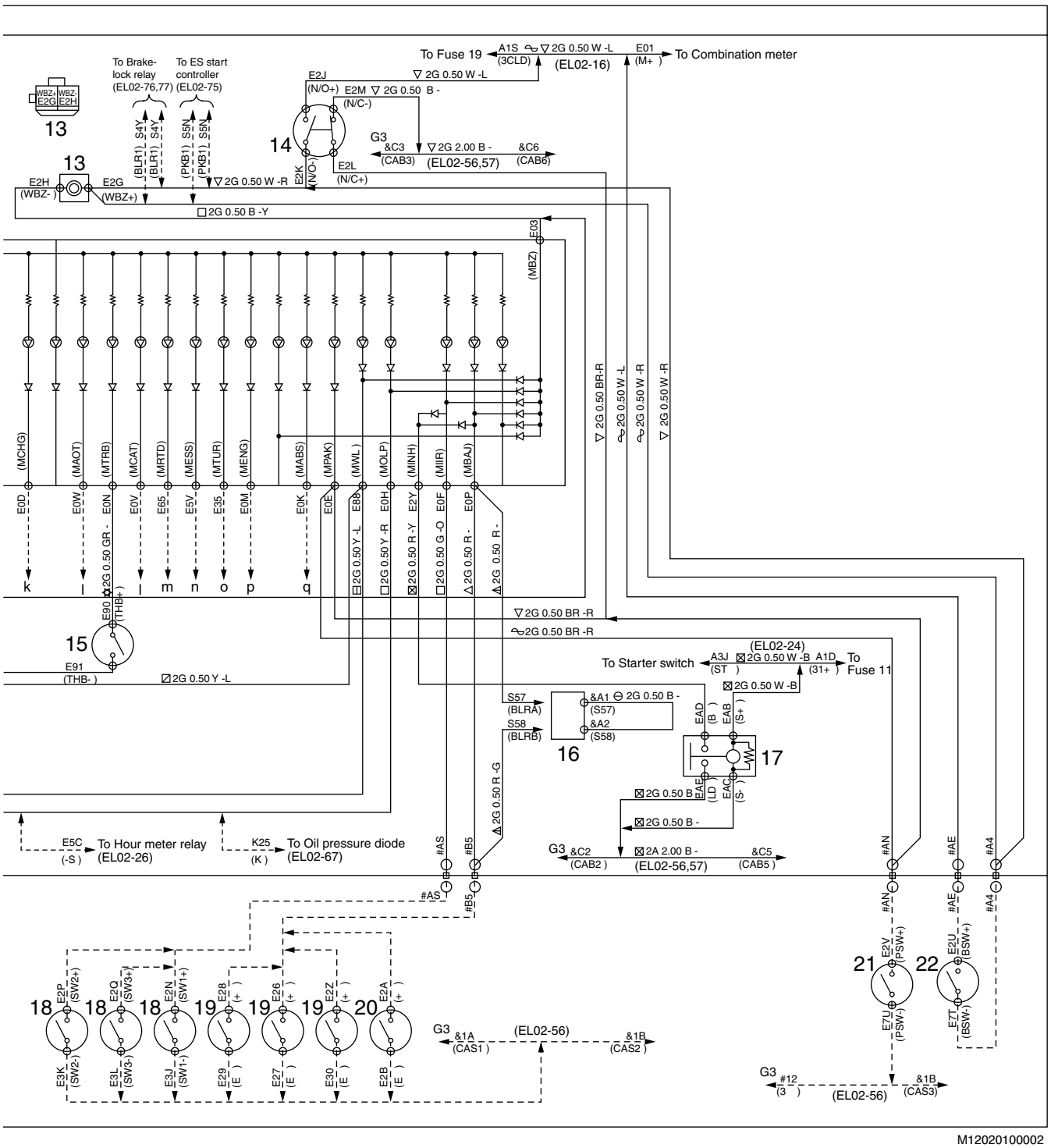
M12020101BEJ1003




M12020100001

**A. METER CIRCUIT (CAB SIDE)**

1. Combination meter
2. Pulse adjust computer
3. Over revolution detector
4. Coolant level warning relay
5. Speed sensor
6. Tachometer sensor
7. Front air gauge sensor
8. Rear air gauge sensor
9. Coolant temperature gauge sender unit
10. Fuel gauge sender unit
11. Coolant level warning switch
12. Oil pressure warning switch
13. Warning buzzer
14. Center parking brake switch
15. Trailer hand brake switch
16. Brake-lock short-circuit connector
17. Warning lamp check relay
18. Low oil pressure warning switch
19. Brake adjust warning switch
20. Brake fluid level warning switch
21. Spring brake switch
22. Buzzer cancel switch



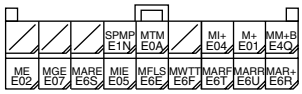

M12020100002

a. To Inter-axle differential lock switch (EL02-79)
b. To Brake-lock relay (EL02-76,77)
c. To Engine ECU (EL02-17)
d. To Head lamp (LH) (EL02-32,34)
e. To Pre-heat timer (EL02-61 to 63)
f. To Flasher unit (EL02-36)
g. To Flasher unit (EL02-36)
h. To Transmission P.T.O. diode (EL02-83)
i. To Transfer controller (EL02-82)
j. To Transfer circuit (Models FT, GT) (EL02-82)
To Transmission control circuit
(Models equipped with EATON FS6109/8209 and ZF 9S109 transmission) (EL02-86)
k. To Alternator (EL02-63)
l. To Automatic transmission ECU (EL02-80)
m. To Electromagnetic retarder control unit (EL02-78)
n. To ES start controller (EL02-74)
o. To TICS ECU
(Models equipped with P11C engine) (EL02-64)
p. To Engine ECU (EL02-64,66)
q. To ABS ECU (EL02-71,72)

CAB SIDE WIRING




1




1



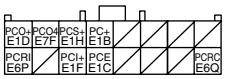

1
(For Automatic transmission)




1




1
(For Manual transmission)



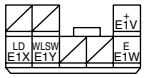

2

CHASSIS SIDE WIRING

M12020100003




3




4



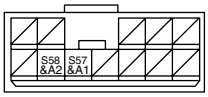

14




15

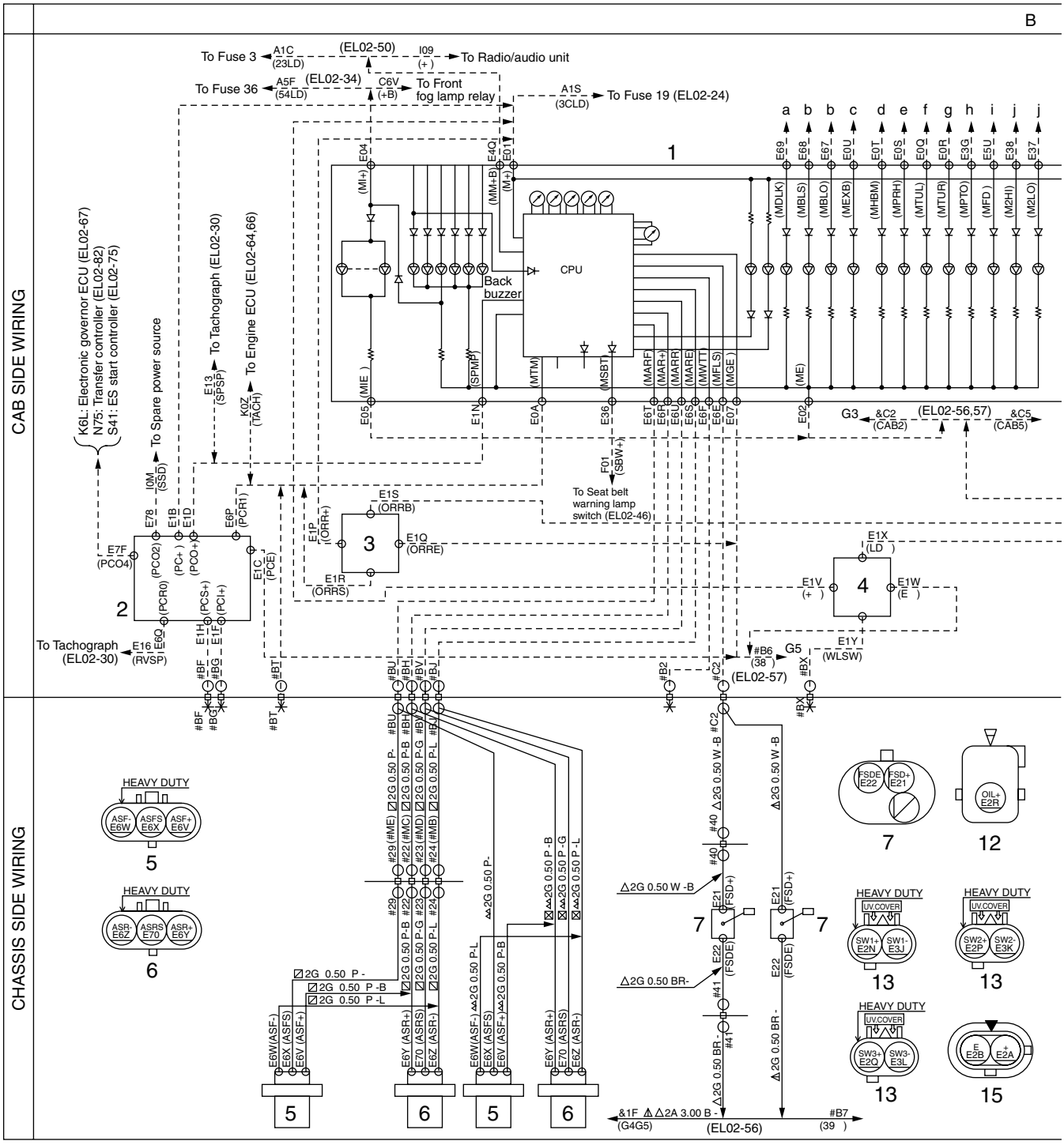



16
(With brake-lock control)




16
(Without brake-lock control)

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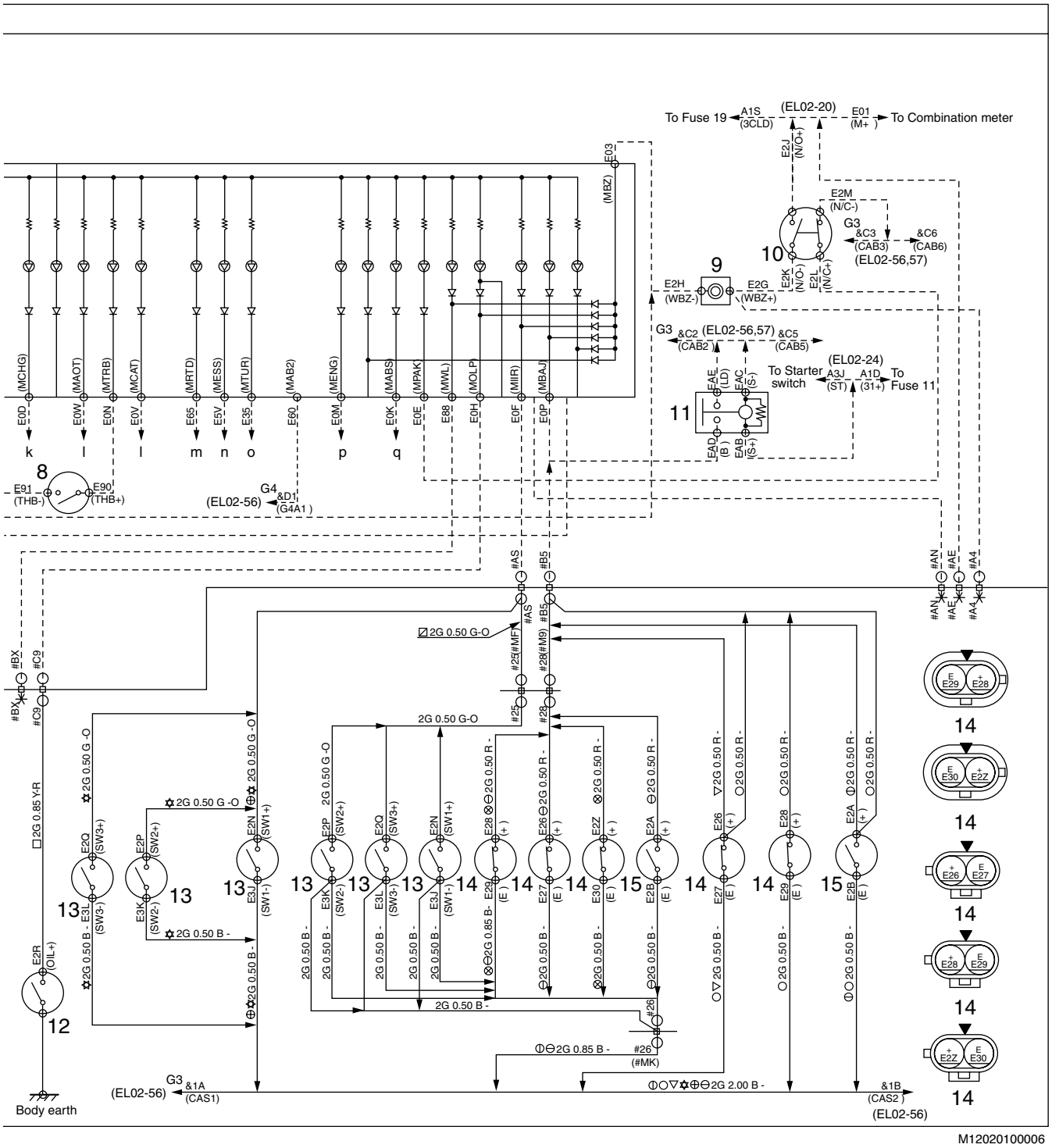



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**B. METER CIRCUIT (CHASSIS SIDE 1)**

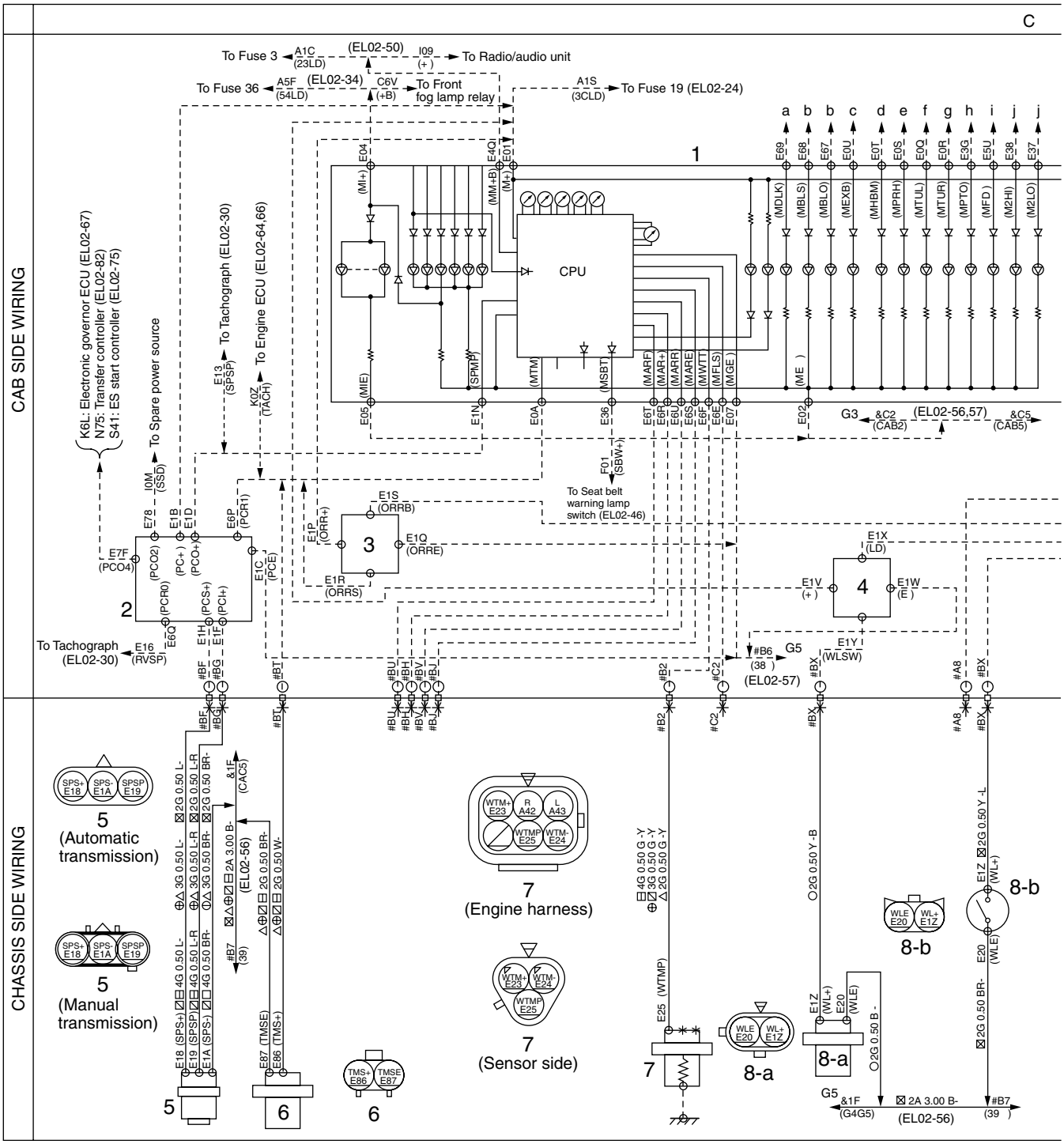
1. Combination meter
2. Pulse adjust computer
3. Over revolution detector
4. Coolant level warning relay
5. Front air gauge sensor
6. Rear air gauge sensor
7. Fuel gauge sender unit
8. Trailer hand brake switch
9. Warning buzzer
10. Center parking brake switch
11. Warning lamp check relay
12. Oil pressure warning switch
13. Low oil pressure warning switch
14. Brake adjust warning switch
15. Brake fluid level warning switch

a. To Inter-axle differential lock switch (EL02-79)
b. To Brake-lock relay (EL02-76,77)
c. To Engine ECU (EL02-17)
d. To Head lamp (LH) (EL02-32,34)
e. To Pre-heat timer (EL02-61 to 63)
f. To Flasher unit (EL02-36)
g. To Flasher unit (EL02-36)




M12020100006

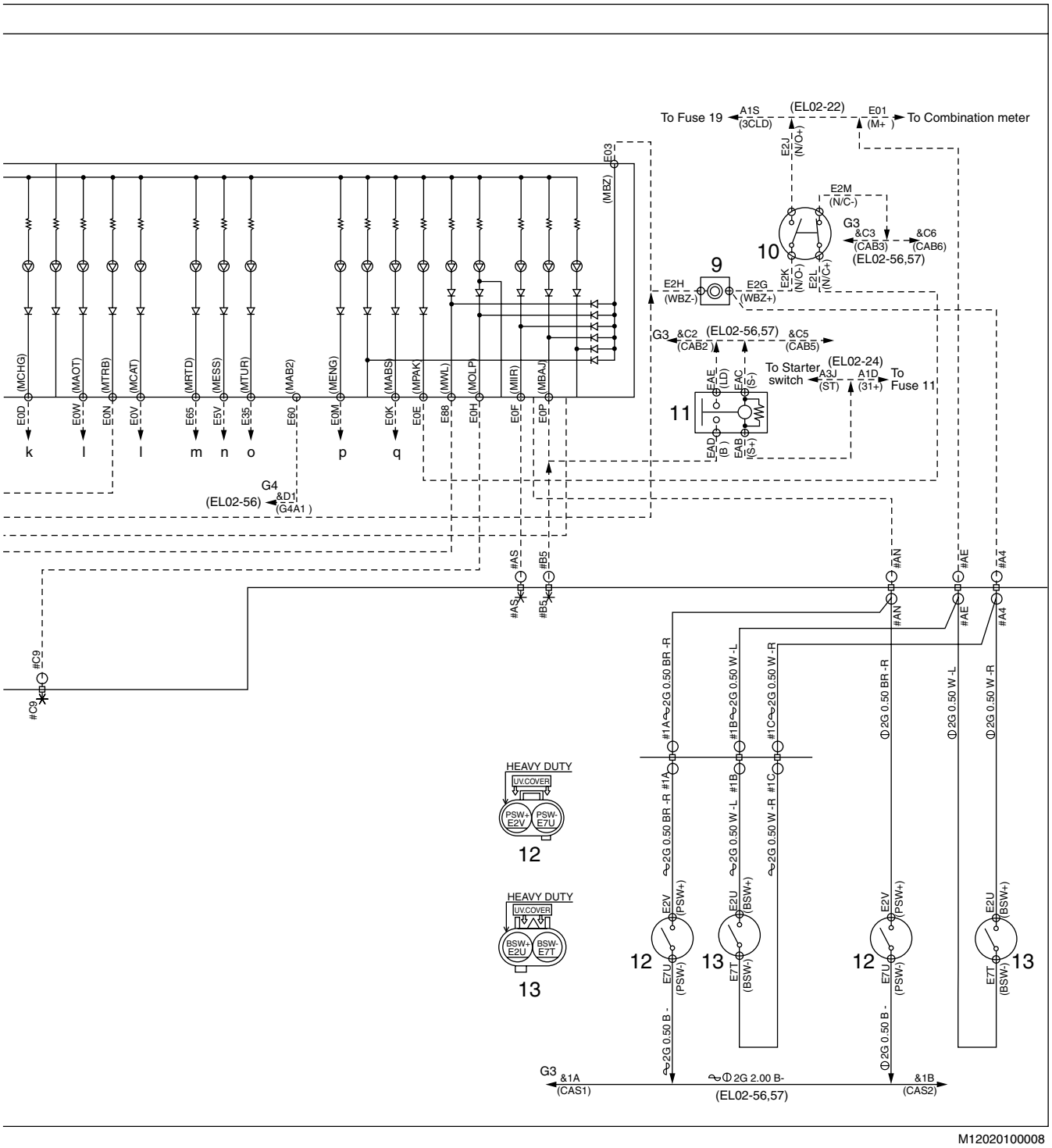
h. To Transmission P.T.O. diode (EL02-83)
i. To Transfer controller (EL02-82)
j. To Transfer circuit (Models FT, GT) (EL02-82)
To Transmission control circuit
(Models equipped with EATON FS6109/8209 and ZF 9S109 transmission) (EL02-86)
k. To Alternator (EL02-63)
l. To Automatic transmission ECU (EL02-80)
m. To Electromagnetic retarder control unit (EL02-78)
n. To ES start controller (EL02-74)
o. To TICS ECU
(Models equipped with P11C engine) (EL02-64)
p. To Engine ECU (EL02-64,66)
q. To ABS ECU (EL02-71,72)




**C. METER CIRCUIT (CHASSIS SIDE 2)**

1. Combination meter
2. Pulse adjust computer
3. Over revolution detector
4. Coolant level warning relay
5. Speed sensor
6. Tachometer sensor
7. Coolant temperature gauge sender unit
8. Coolant level warning switch
9. Warning buzzer
10. Center parking brake switch
11. Warning lamp check relay
12. Spring brake switch
13. Buzzer cancel switch

a. To Inter-axle differential lock switch (EL02-79)
b. To Brake-lock relay (EL02-76,77)
c. To Engine ECU (EL02-17)
d. To Head lamp (LH) (EL02-32,34)
e. To Pre-heat timer (EL02-61 to 63)
f. To Flasher unit (EL02-36)
g. To Flasher unit (EL02-36)
h. To Transmission P.T.O. diode (EL02-83)




M12020100008

i. To Transfer controller (EL02-82)

j. To Transfer circuit (Models FT, GT) (EL02-82)
To Transmission control circuit
(Models equipped with EATON FS6109/8209 and ZF 9S109 transmission) (EL02-86)

k. To Alternator (EL02-63)

l. To Automatic transmission ECU (EL02-80)

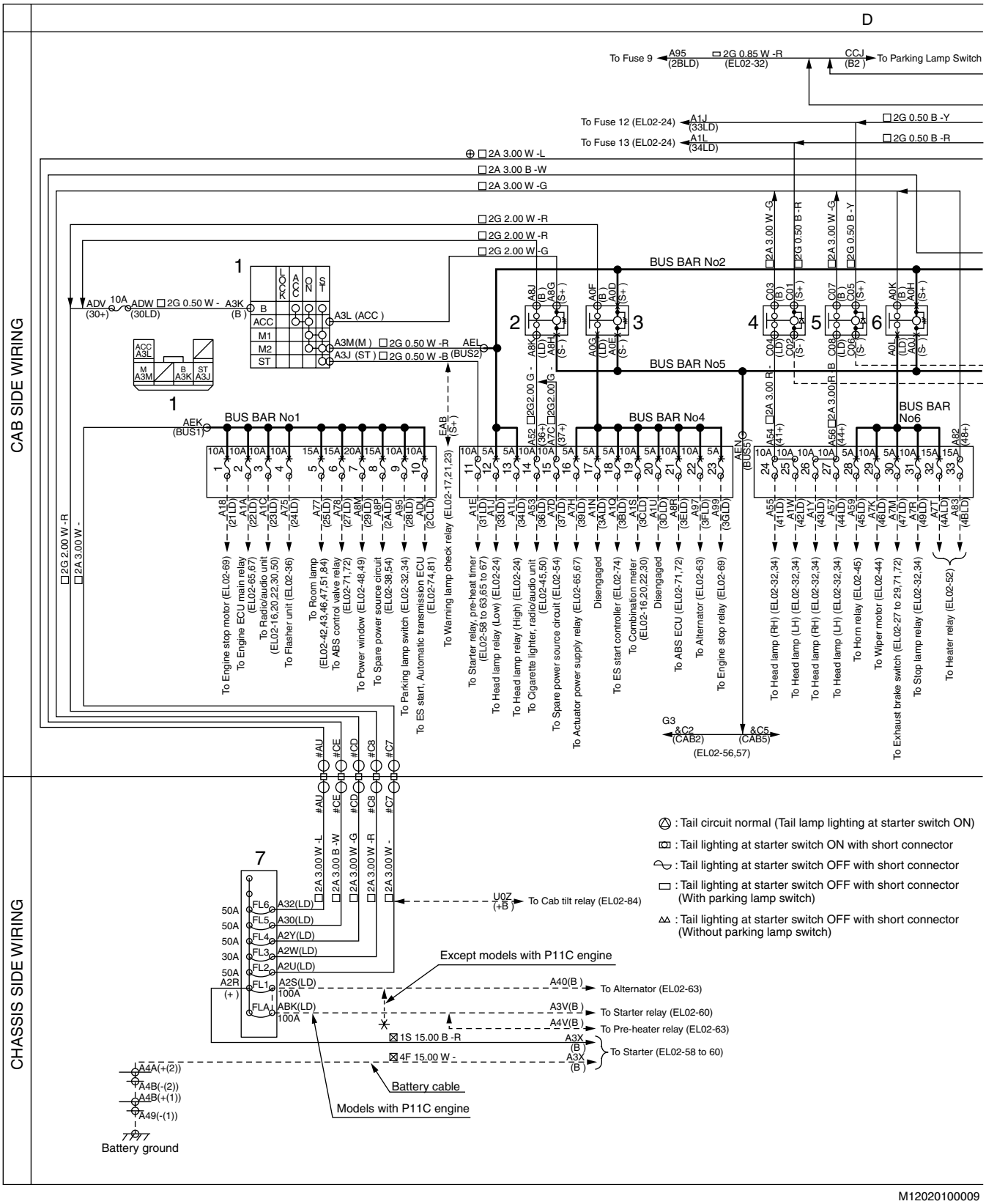
m. To Electromagnetic retarder control unit (EL02-78)

n. To ES start controller (EL02-74)

o. To TICS ECU
(Models equipped with P11C engine) (EL02-64)

p. To Engine ECU (EL02-64,66)

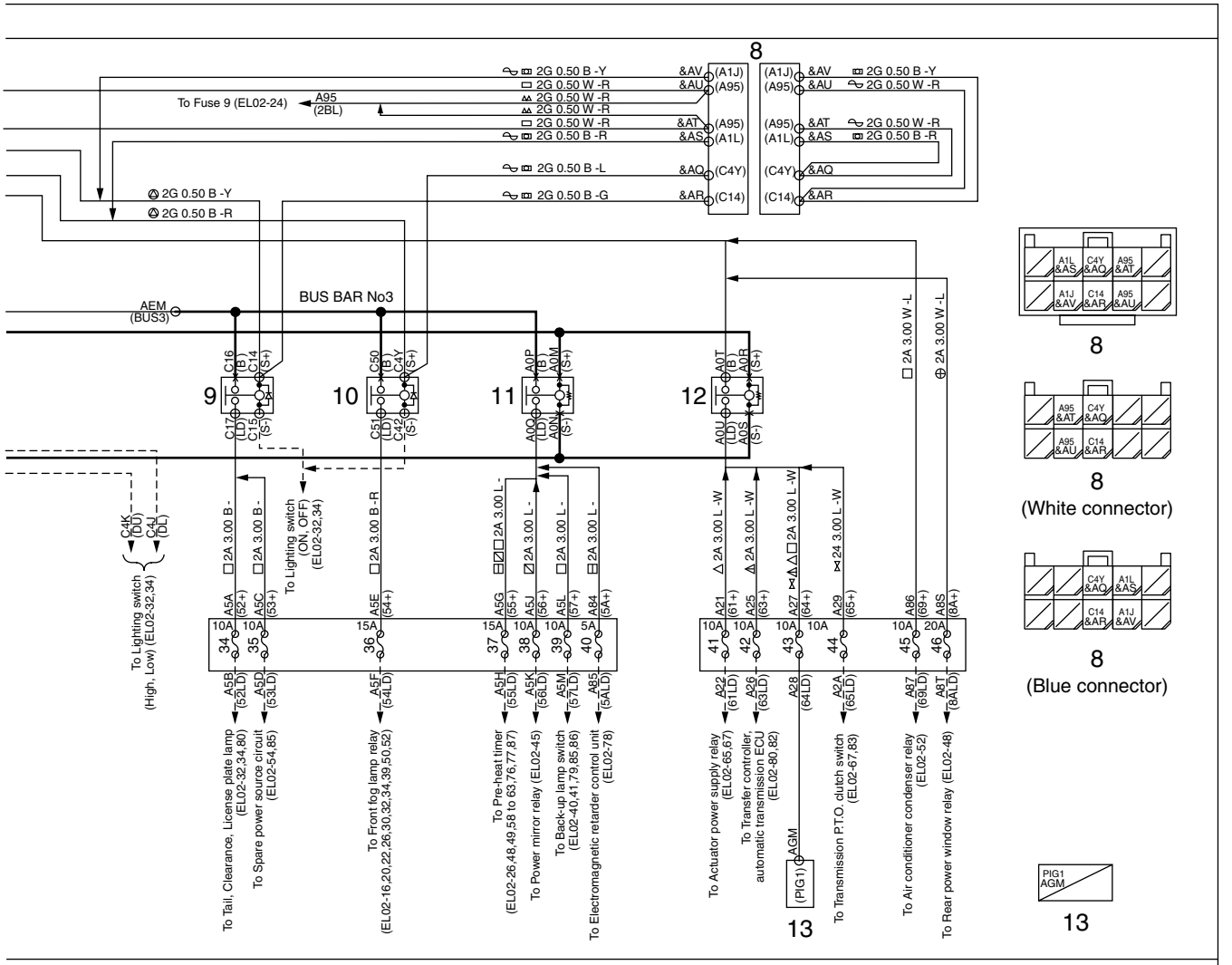
q. To ABS ECU (EL02-71,72)

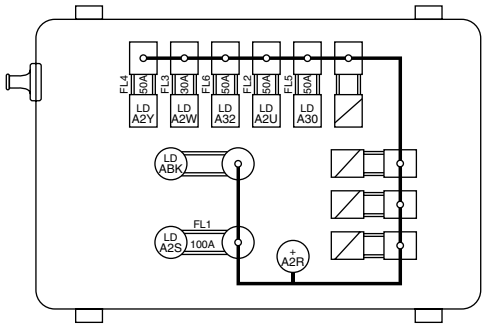



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**D. POWER SUPPLY CIRCUIT**

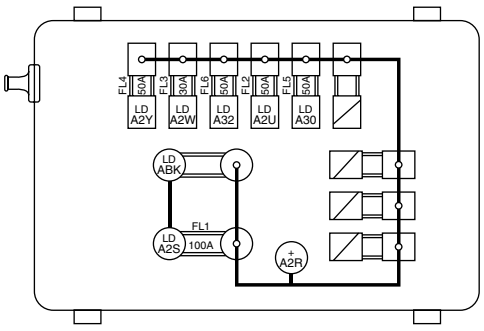
1. Starter switch
2. Power accessory relay
3. Power relay No.1
4. Head lamp relay (High)
5. Head lamp relay (Low)
6. Power relay No.2
7. Fusible link block 1
8. Short connector (If so equipped)
9. Tail lamp relay No.1
10. Tail lamp relay No.2
11. Power relay No.3
12. Power relay No.4
13. Spare power source connector




7

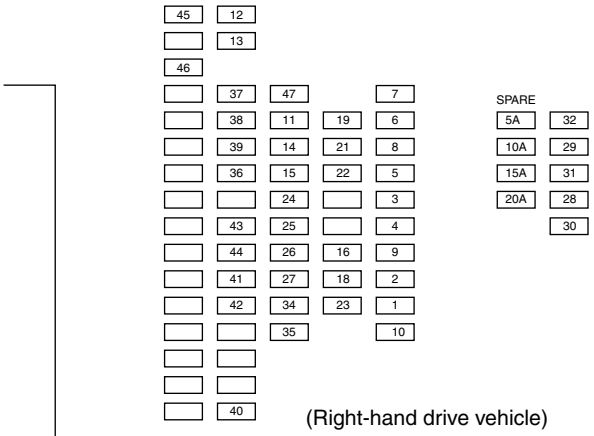
(Except P11C engine with 80A alternator)



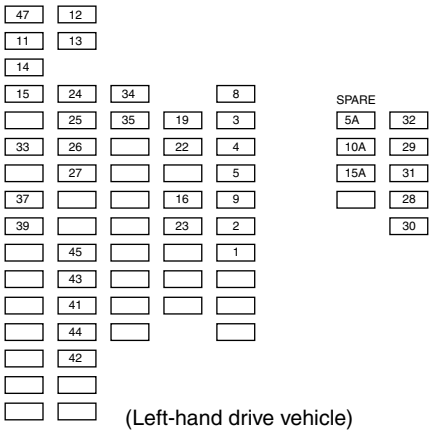

7

(For P11C engine with 80A alternator)

FUSE LAYOUT

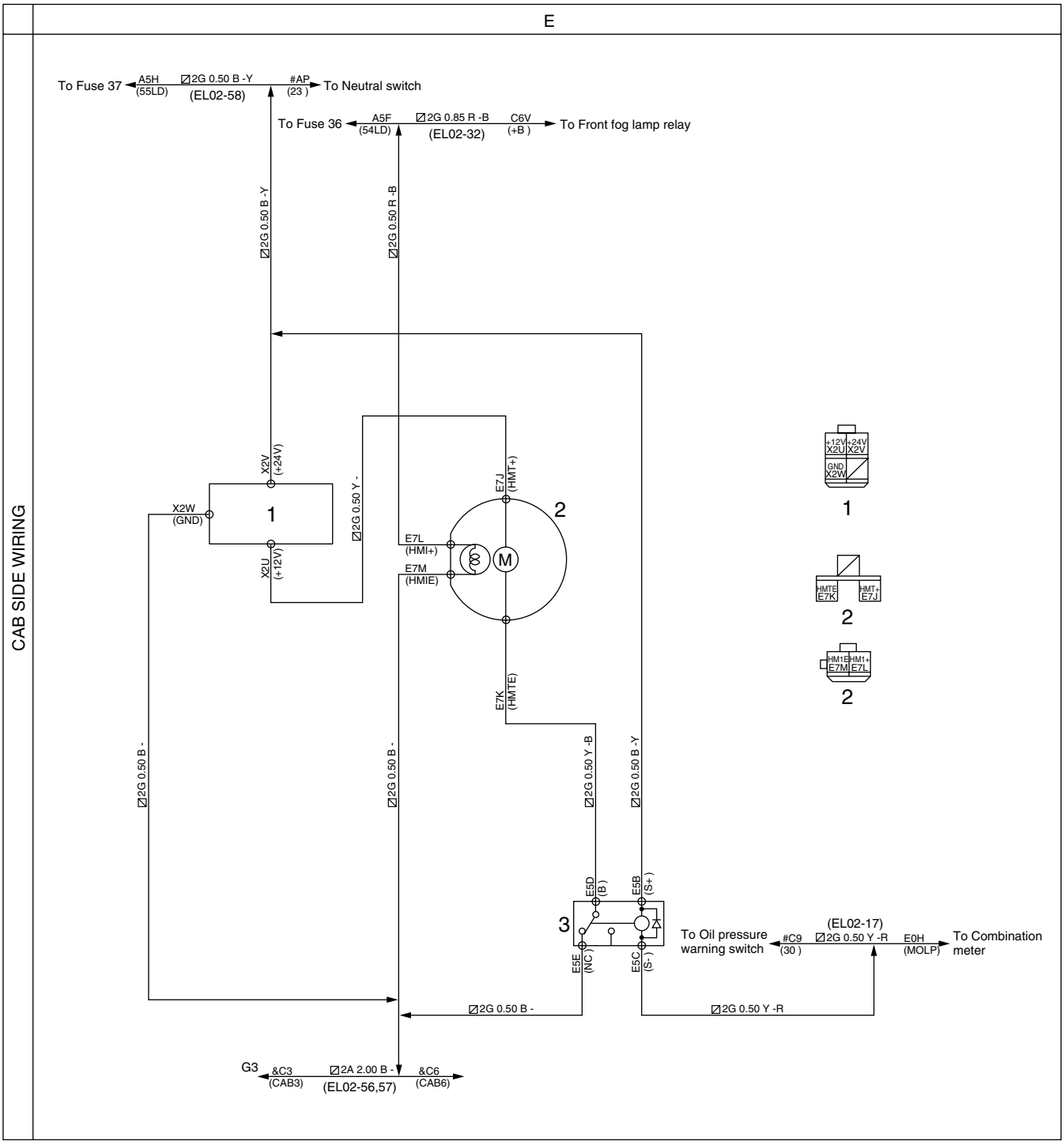



(Right-hand drive vehicle)




(Left-hand drive vehicle)

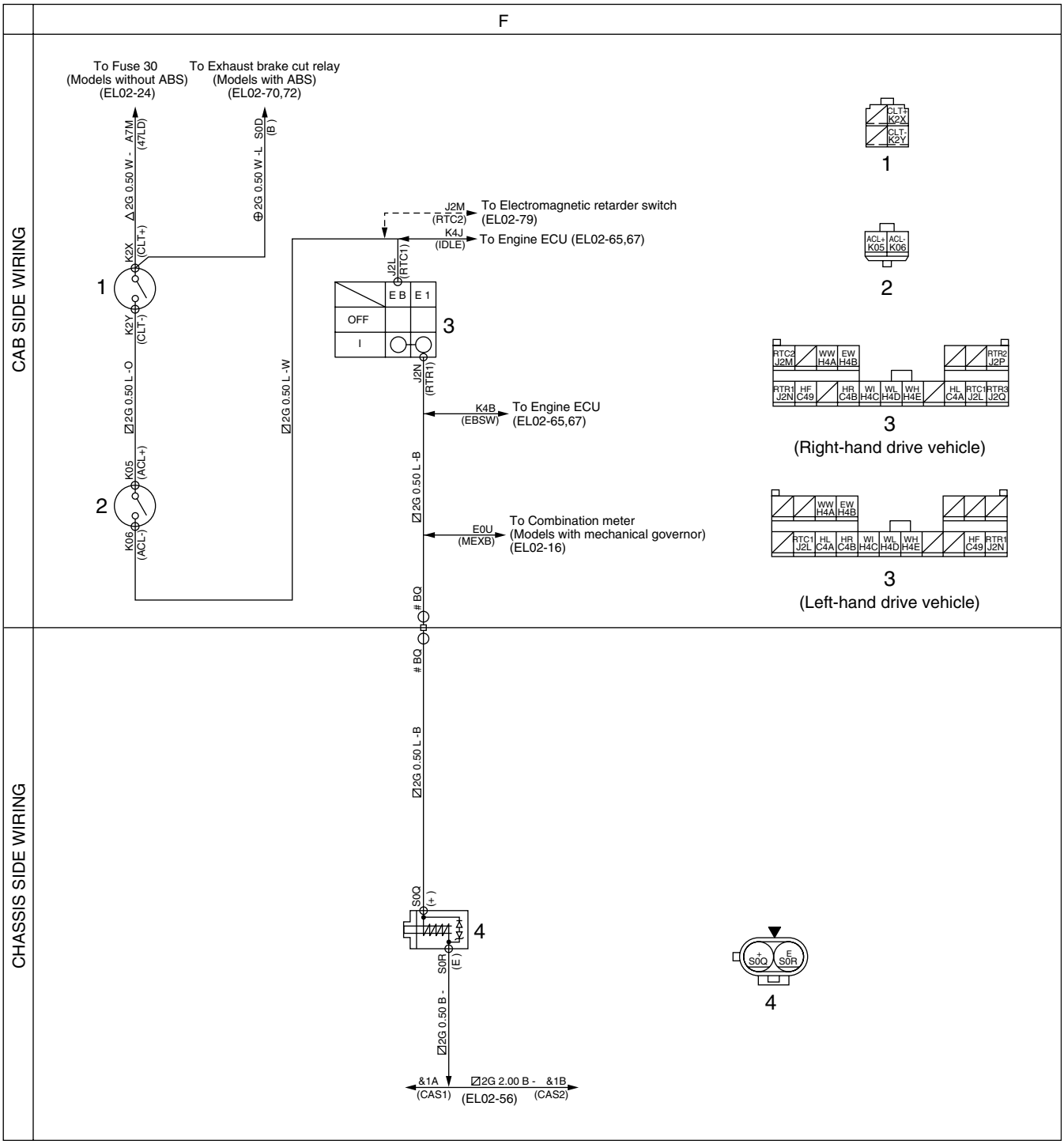
M12020100010




M12020100011

**E. HOUR METER CIRCUIT**

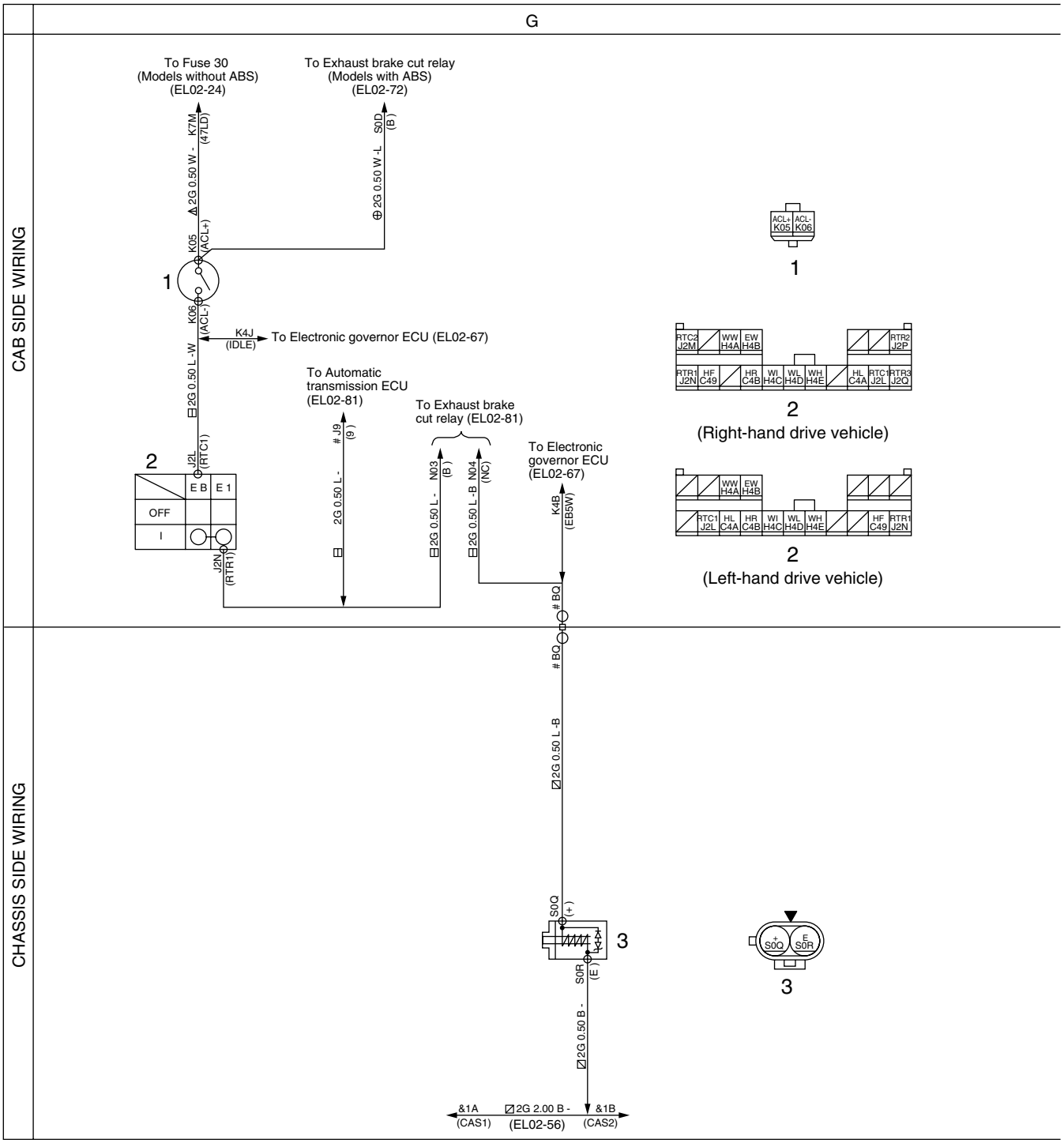
1. DC-DC converter
2. Hour meter
3. Hour meter relay




M12020100012

**F. EXHAUST BRAKE CIRCUIT**
**(EXCEPT FOR MODELS WITH AUTOMATIC TRANSMISSION AND ALL MODELS OF P11C ENGINE)**

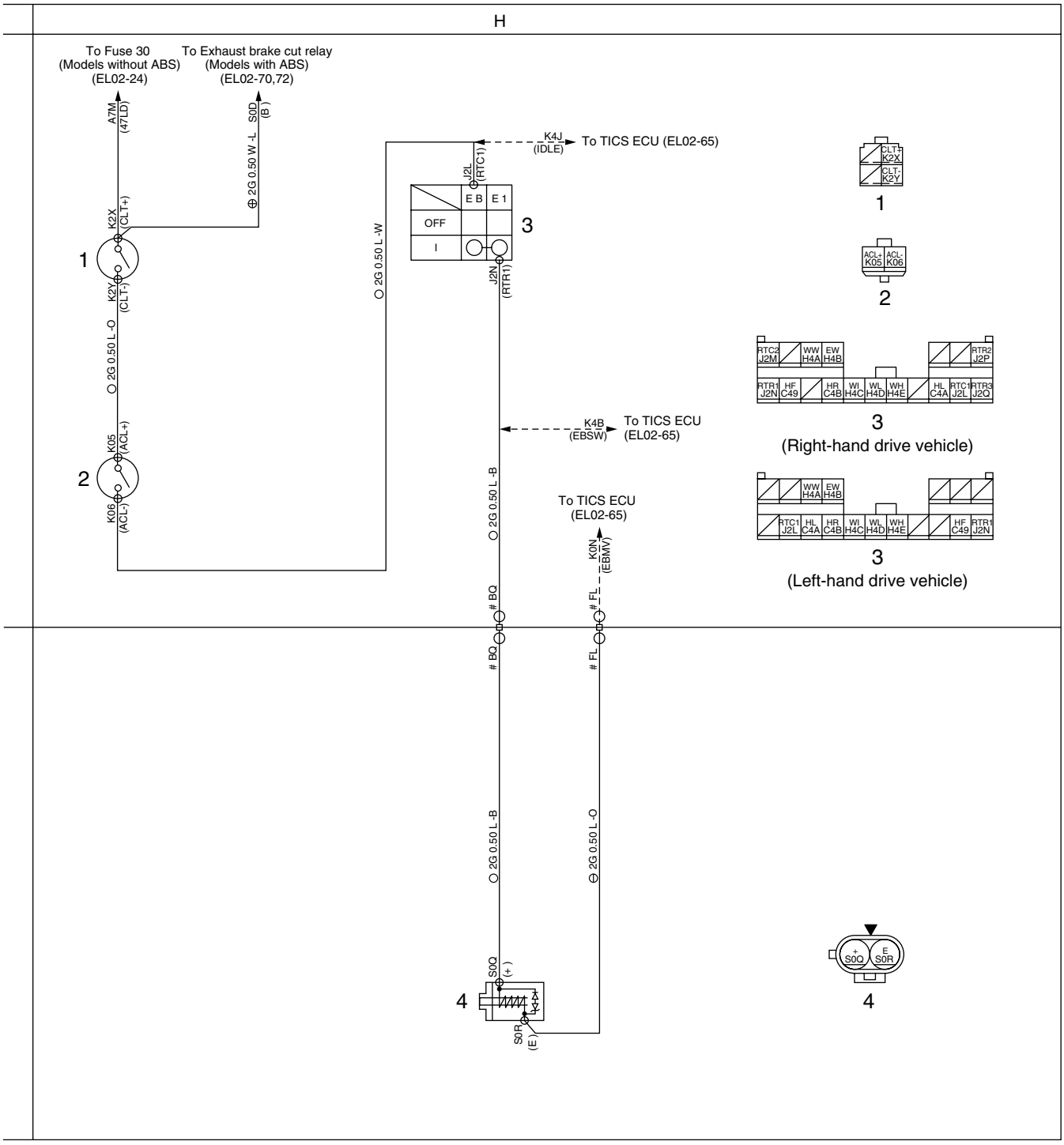
1. Clutch pedal switch
2. Accelerator pedal switch
3. Exhaust brake switch
4. Exhaust brake magnetic valve




M12020100013

**G. EXHAUST BRAKE CIRCUIT (MODELS WITH AUTOMATIC TRANSMISSION)**

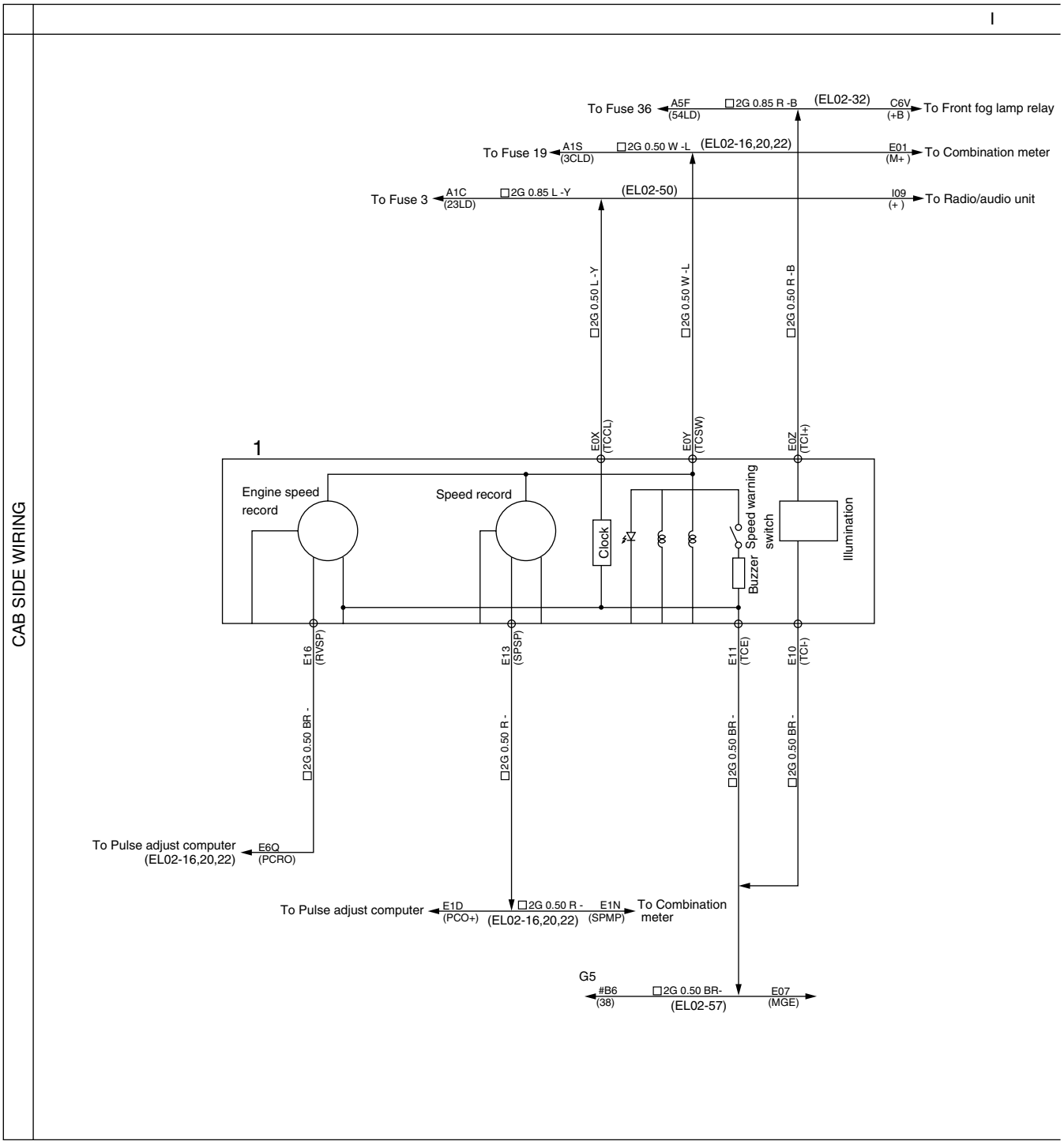
1. Accelerator pedal switch
2. Exhaust brake switch
3. Exhaust brake magnetic valve




M12020100014

**H. EXHAUST BRAKE CIRCUIT (MODELS WITH P11C ENGINE)**

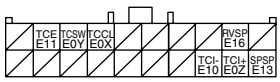
1. Clutch pedal switch
2. Accelerator pedal switch
3. Exhaust brake switch
4. Exhaust brake magnetic valve




M12020100015

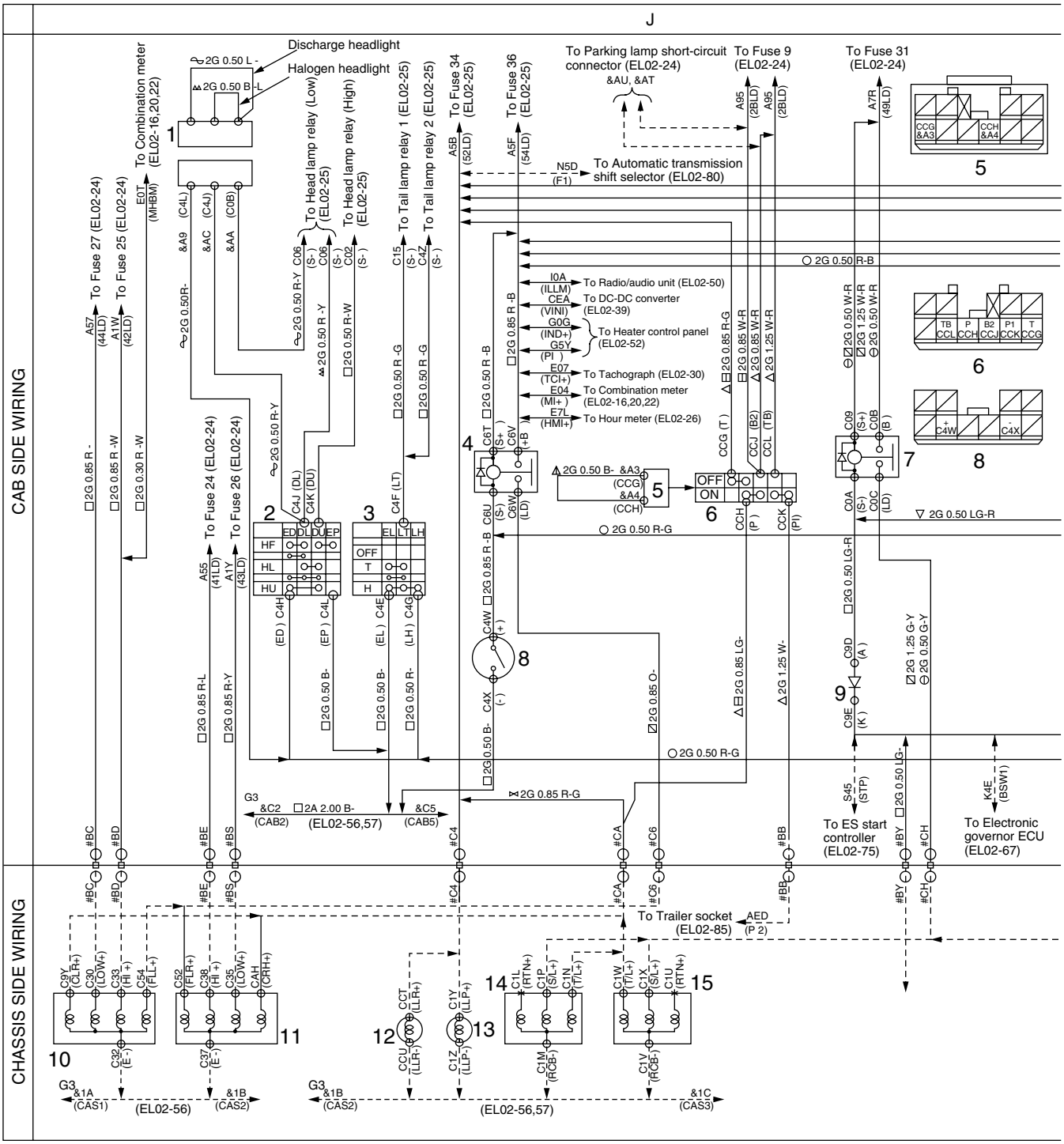
**I. TACHOGRAPH CIRCUIT**

1. Electric tachograph




1

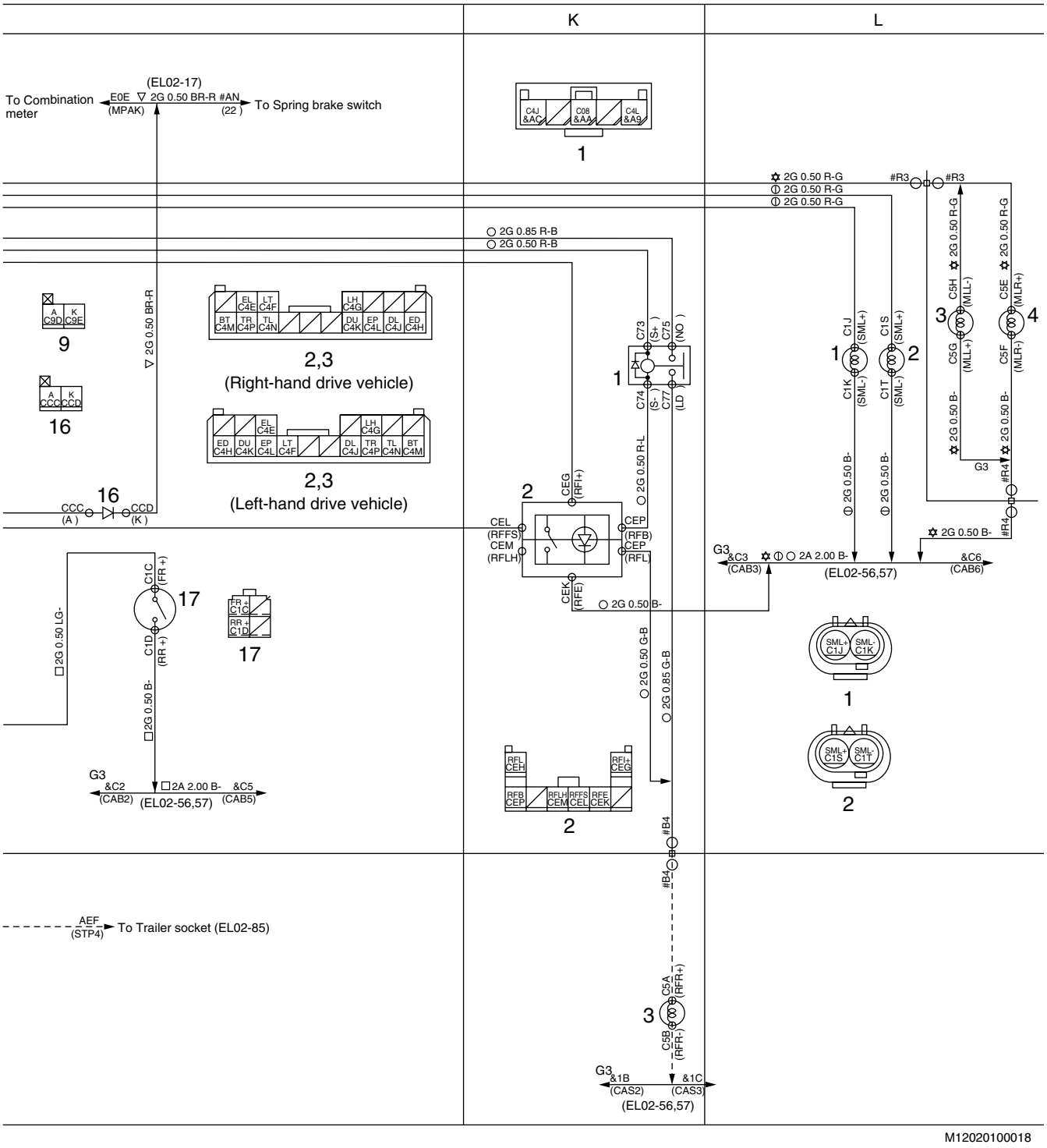
M12020100016




M12020100017

**J. HEAD LAMP, FRONT FOG LAMP AND REAR COMBINATION LAMP CIRCUIT (CAB SIDE)**

1. Head lamp short-circuit connector
2. Lighting switch (High, Low)
3. Lighting switch (ON, OFF)
4. Front fog lamp relay
5. Parking lamp short-circuit connector (Models without parking lamp)
6. Parking lamp switch
7. Stop lamp relay
8. Front fog lamp switch
9. Diode 2 (Models for Hong Kong)
10. Head lamp (LH)
11. Head lamp (RH)
12. License plate lamp (RH)
13. License plate lamp (LH)
14. Rear combination lamp (LH)
15. Rear combination lamp (RH)
16. Diode 1 (Models for Hong Kong)
17. Stop lamp switch



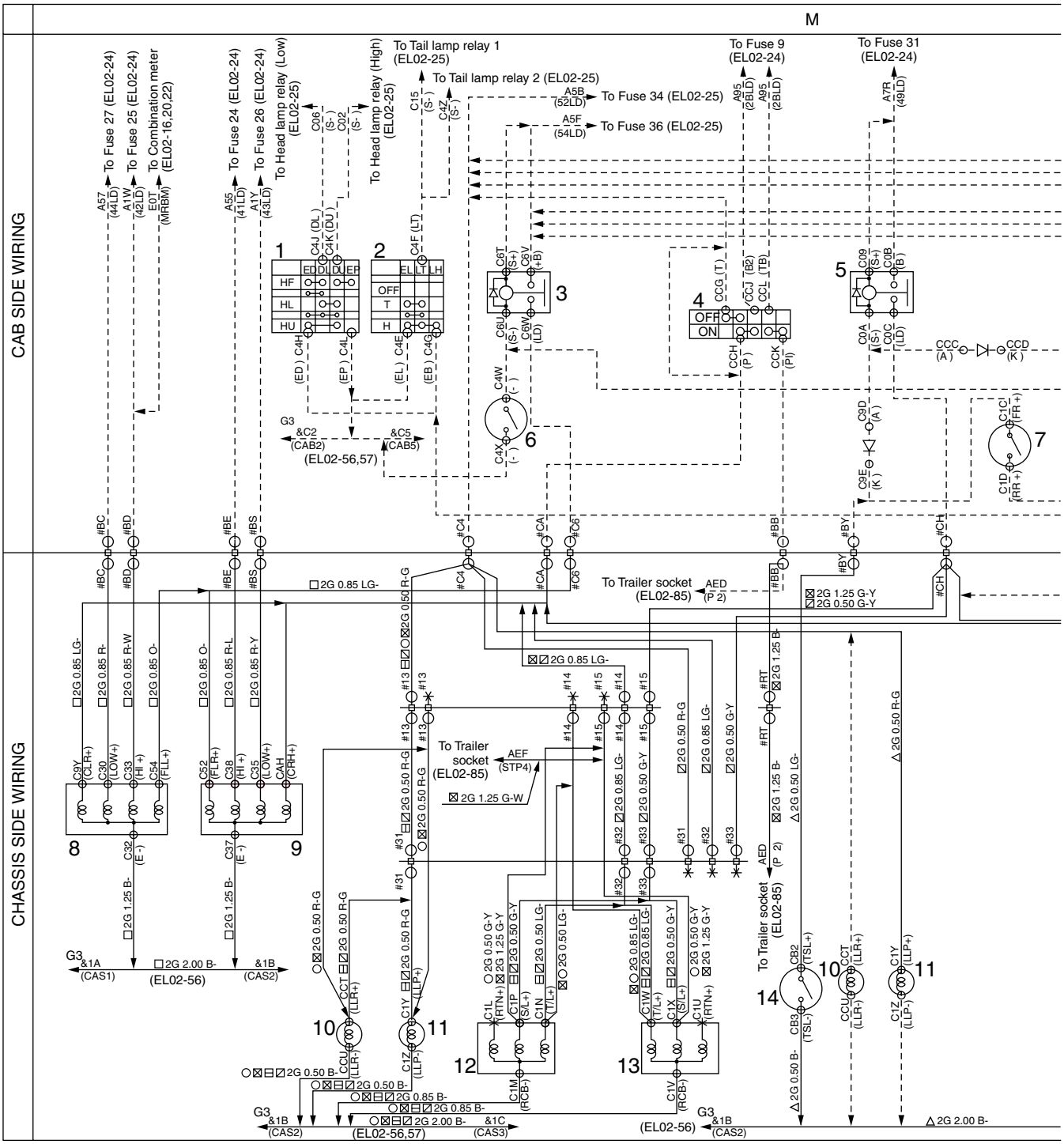

M12020100018

**K. REAR FOG LAMP CIRCUIT (CAB SIDE)**

1. Rear fog lamp relay
2. Rear fog lamp switch
3. Rear fog lamp

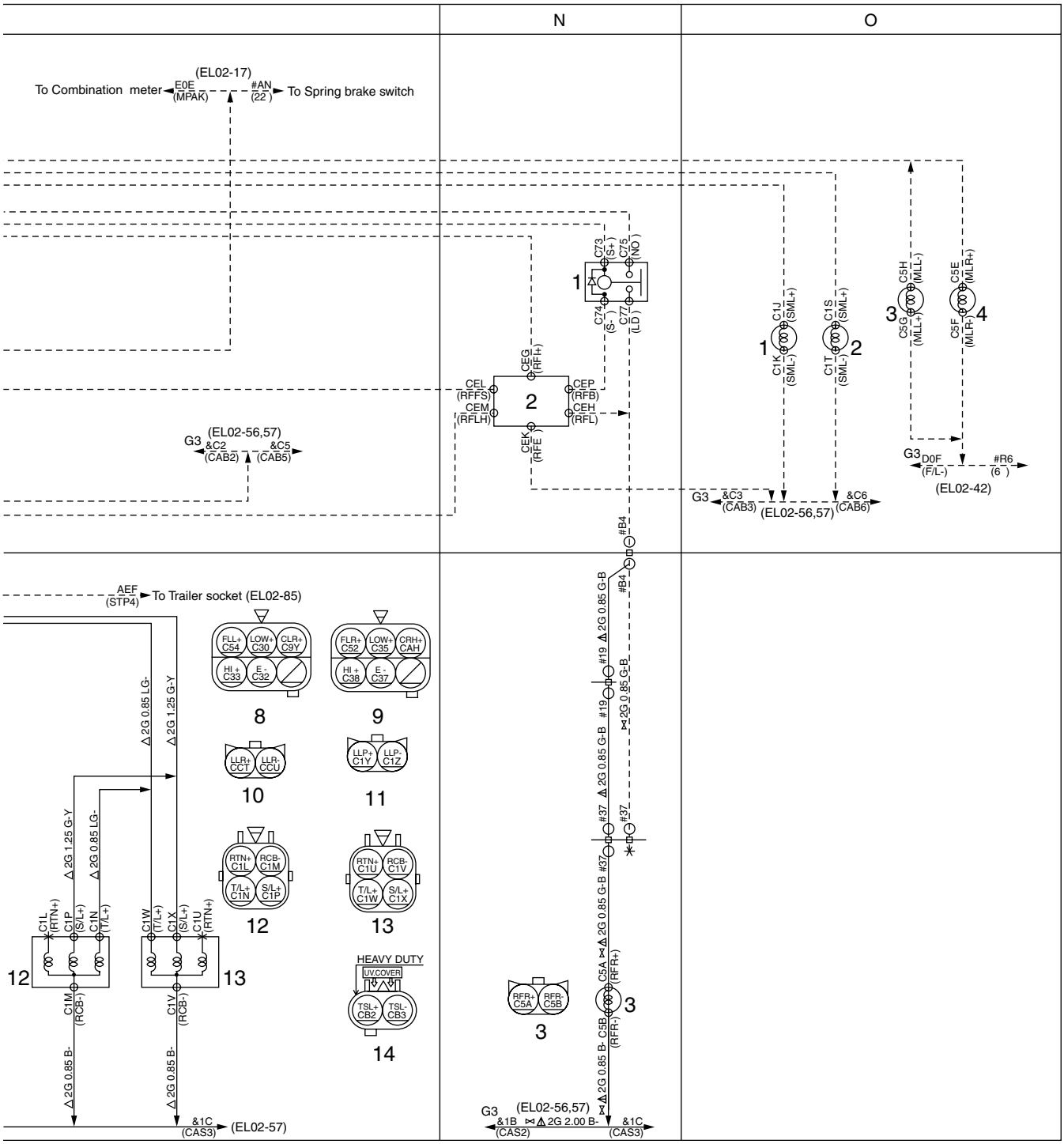
**L. MARKER LAMP CIRCUIT (CAB SIDE)**

1. Side marker lamp (LH)
2. Side marker lamp (RH)
3. Roof marker lamp (LH)
4. Roof marker lamp (RH)




**M. HEAD LAMP, FRONT FOG LAMP AND REAR COMBINATION LAMP CIRCUIT (CHASSIS SIDE)**

1. Lighting switch (High, Low)
2. Lighting switch (ON, OFF)
3. Front fog lamp relay
4. Parking lamp switch
5. Stop lamp relay
6. Front fog lamp switch
7. Stop lamp switch
8. Head lamp (LH)
9. Head lamp (RH)
10. License plate lamp (RH)
11. License plate lamp (LH)
12. Rear combination lamp (LH)
13. Rear combination lamp (RH)
14. Trailer stop lamp switch



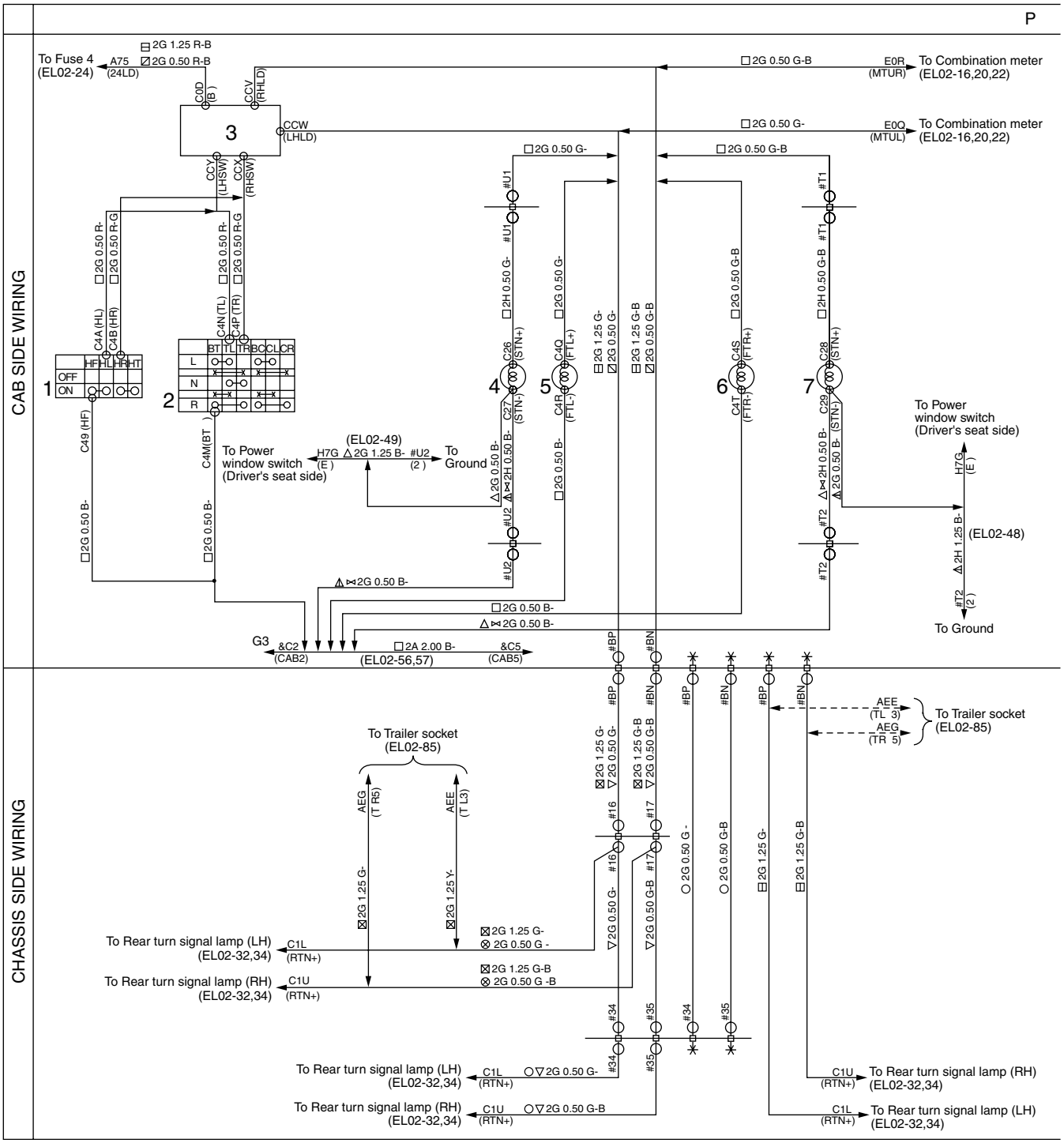

M12020100020

**N. REAR FOG LAMP CIRCUIT (CHASSIS SIDE)**

1. Rear fog lamp relay
2. Rear fog lamp switch
3. Rear fog lamp

**O. MARKER LAMP CIRCUIT (CHASSIS SIDE)**

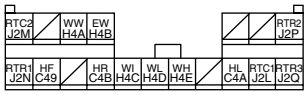
1. Side marker lamp (LH)
2. Side marker lamp (RH)
3. Roof marker lamp (LH)
4. Roof marker lamp (RH)



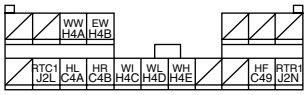

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**P. TURN SIGNAL AND HAZARD LAMP CIRCUIT**

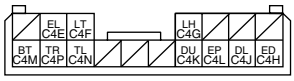
1. Hazard lamp switch
2. Turn signal lamp switch
3. Flasher unit
4. Side turn signal lamp (LH)
5. Front turn signal lamp (LH)
6. Front turn signal lamp (RH)
7. Side turn signal lamp (RH)



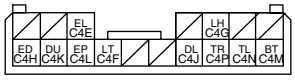

1
(Right-hand drive vehicle)



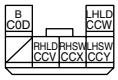

1
(Left-hand drive vehicle)



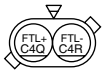

2
(Right-hand drive vehicle)



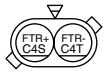

2
(Left-hand drive vehicle)




3

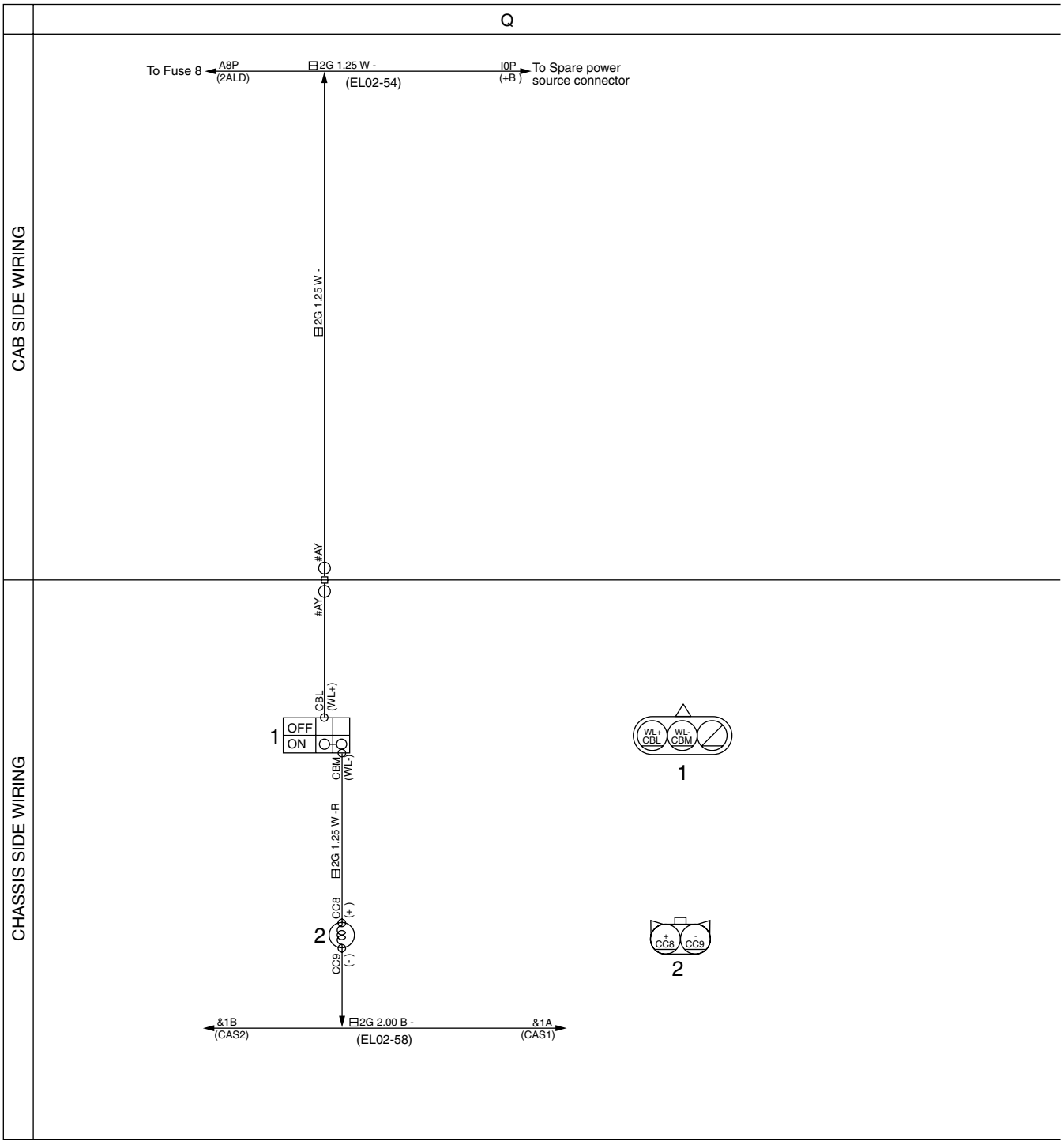



5




6

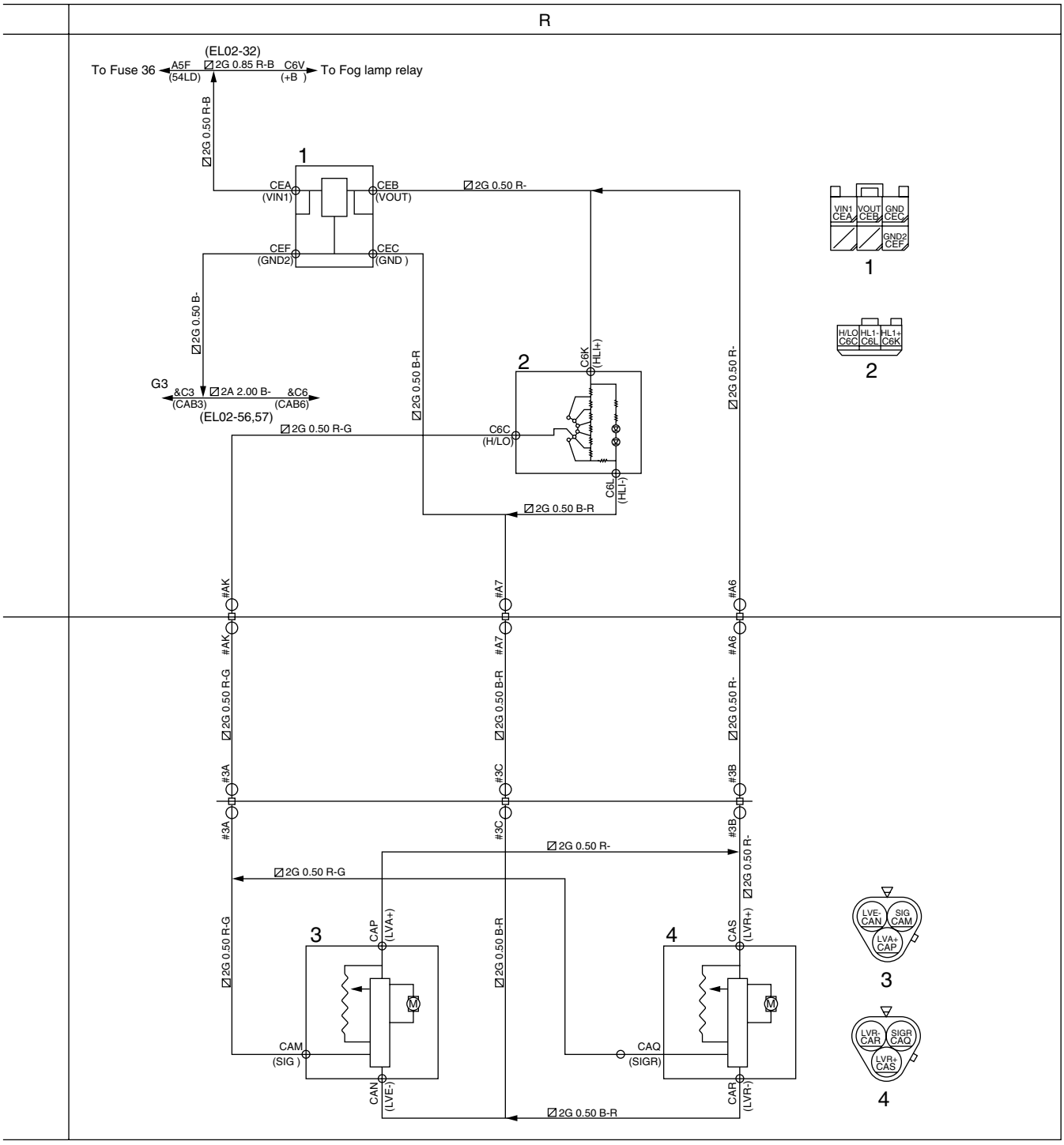
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**Q. SPOT LAMP CIRCUIT**

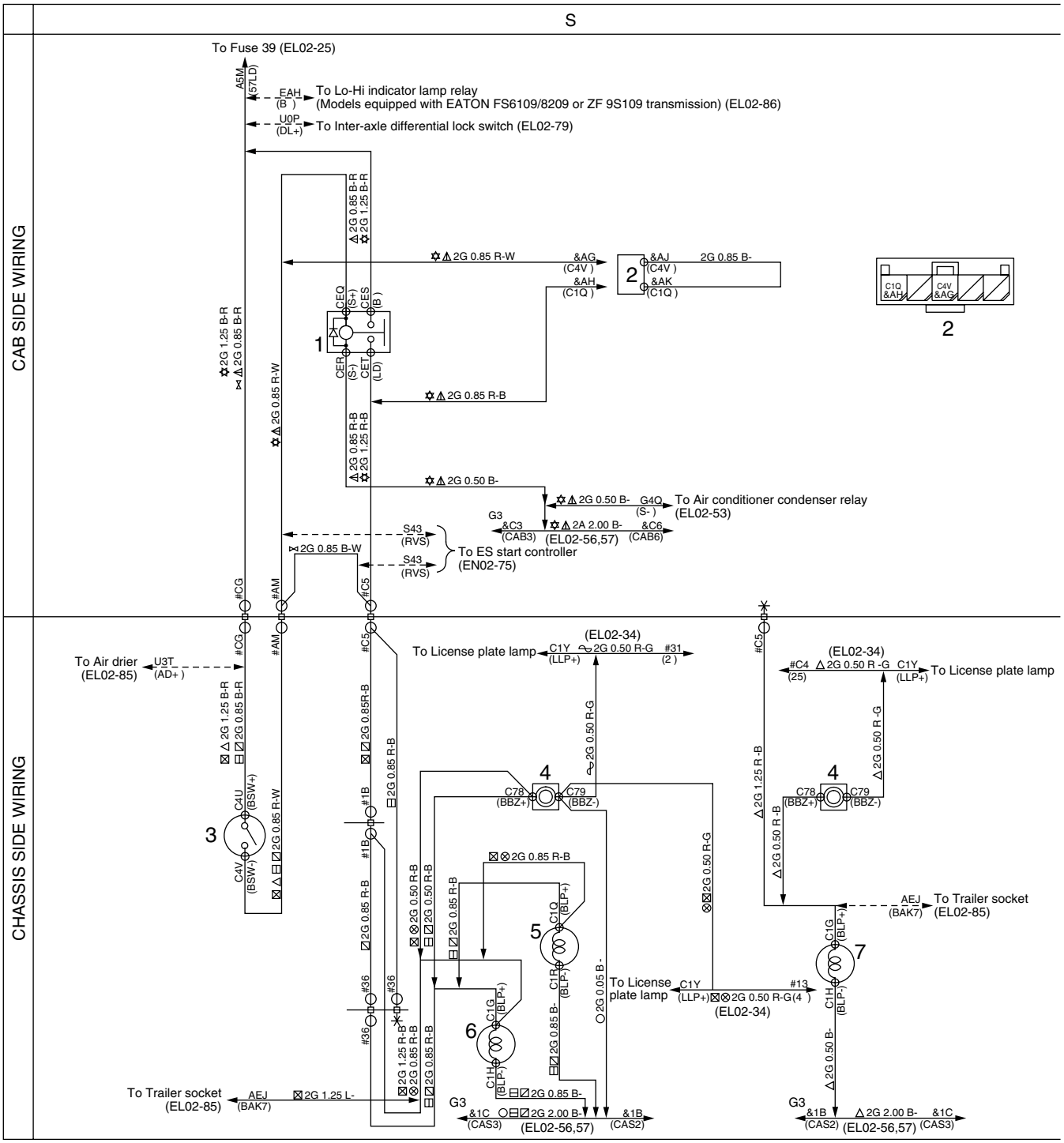
1. Spot lamp switch
2. Spot lamp




M12020100024

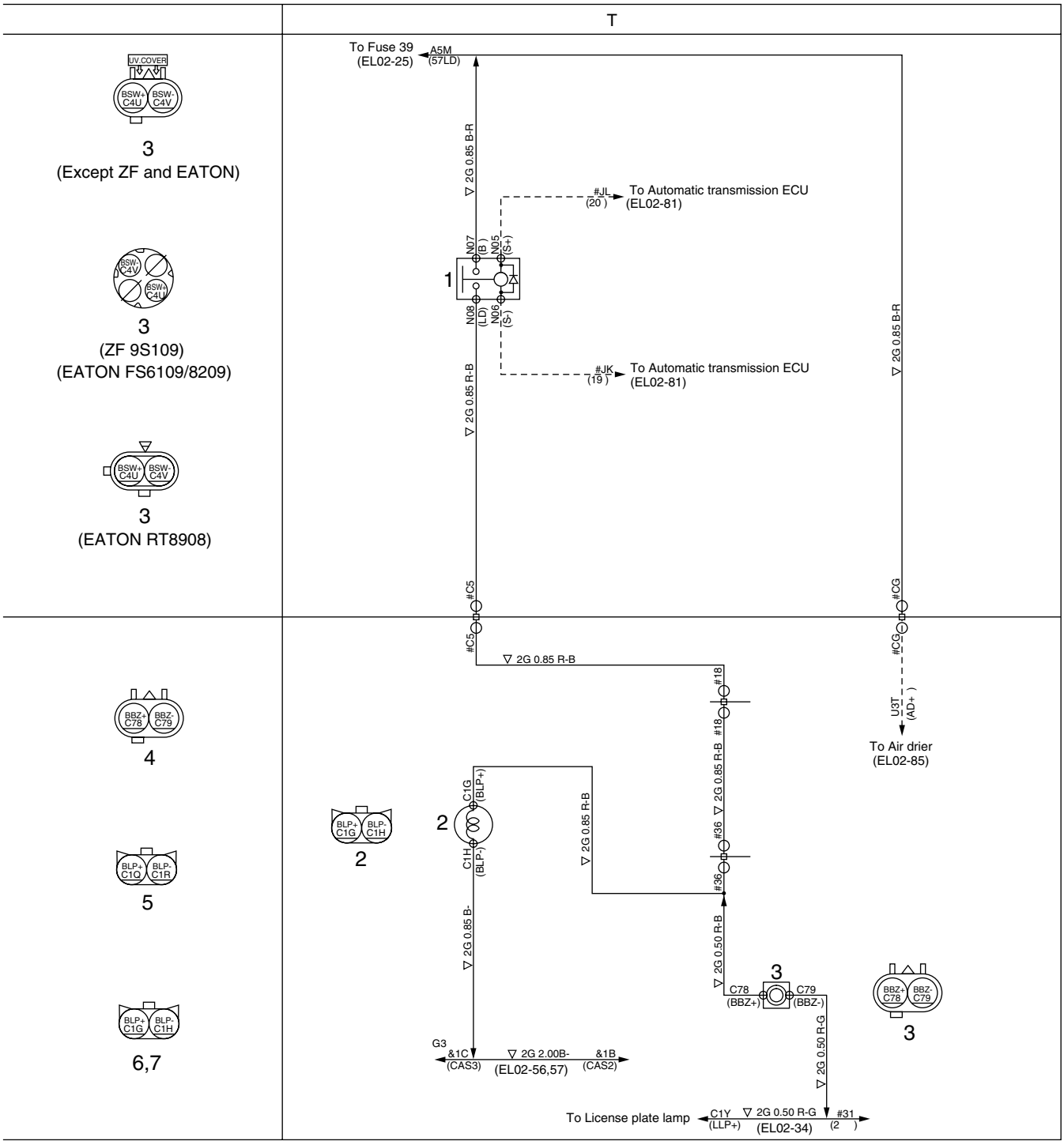
**R. HEAD LAMP CONTROL CIRCUIT**

1. DC-DC converter
2. Head lamp leveling control switch
3. Head lamp leveling actuator (LH)
4. Head lamp leveling actuator (RH)




**S. BACK-UP LAMP CIRCUIT (MODELS WITH MANUAL TRANSMISSION)**

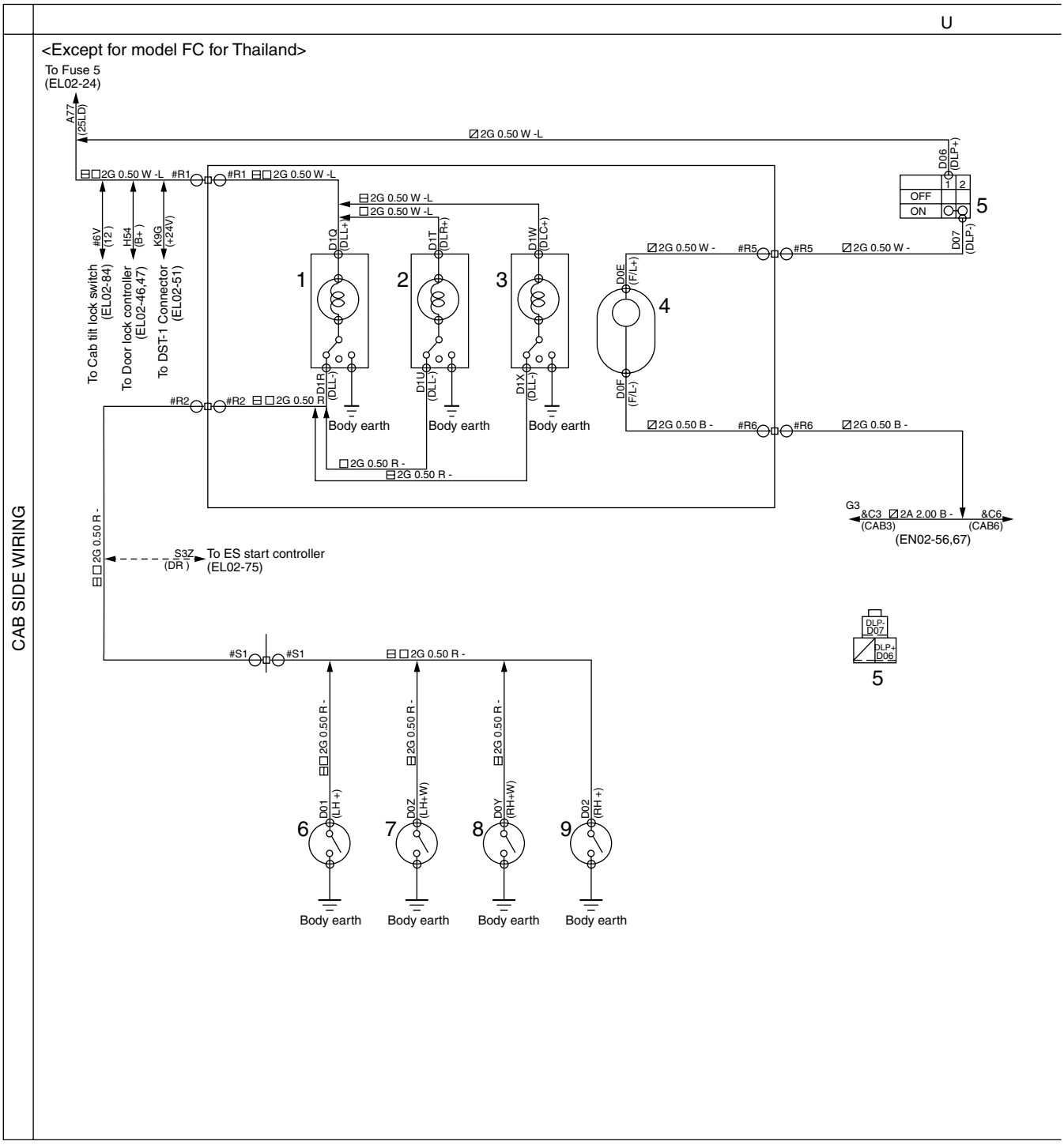
1. Back-up lamp relay
2. Back-up lamp short-circuit connector
3. Back-up lamp switch
4. Back-up buzzer
5. Back-up lamp (RH)
6. Back-up lamp (LH)
7. Back-up lamp




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**T. BACK-UP LAMP CIRCUIT (MODELS WITH AUTOMATIC TRANSMISSION)**

1. Back-up lamp relay
2. Back-up lamp
3. Back-up buzzer

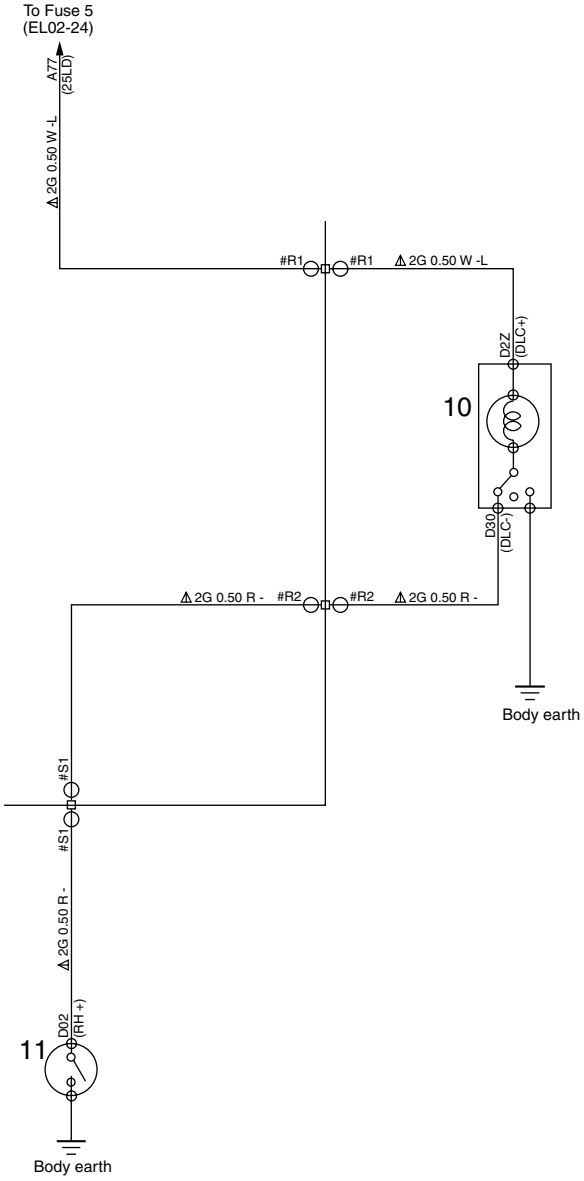



M12020100027

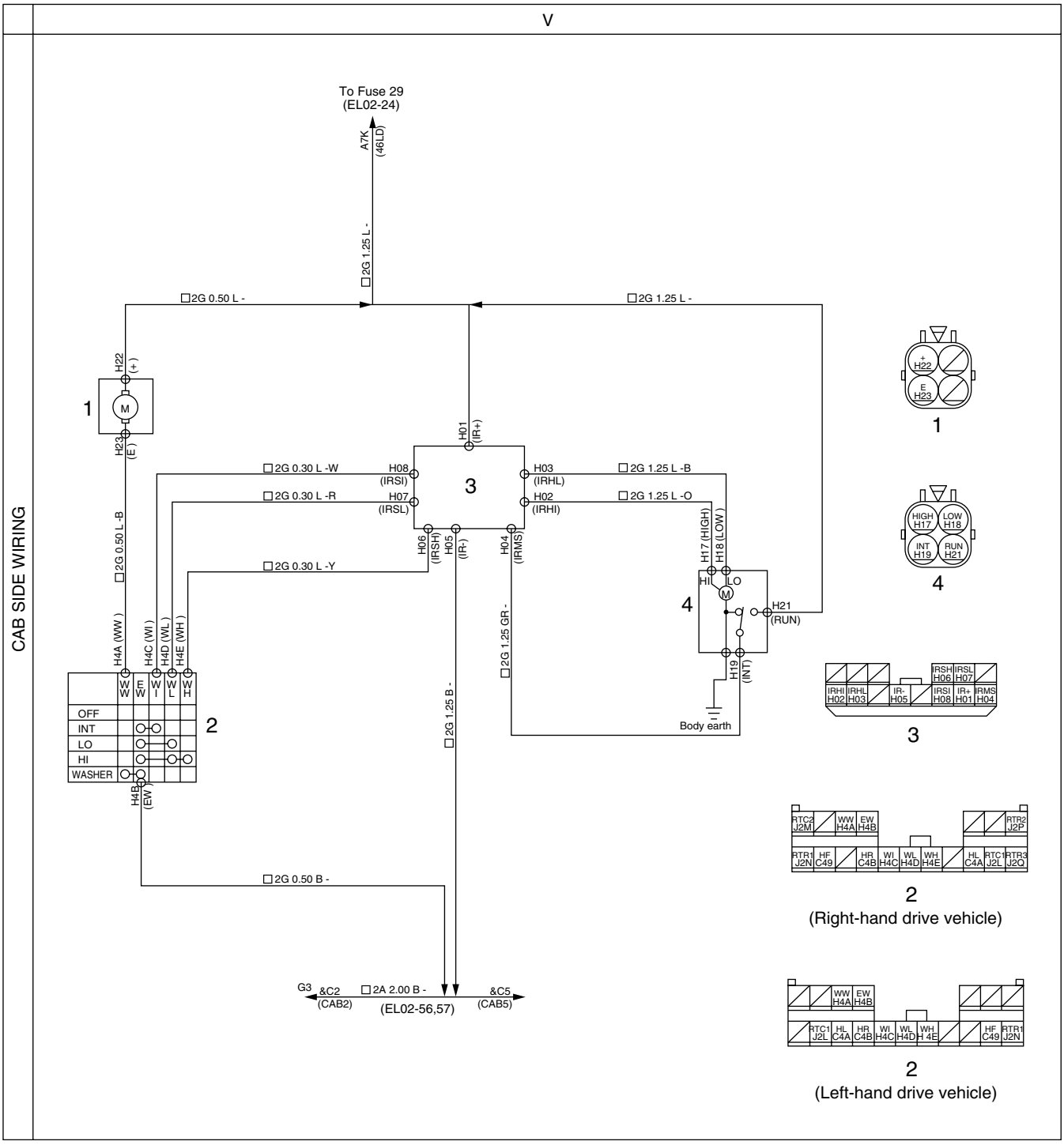
**U. ROOM LAMP CIRCUIT**

1. Front room lamp (LH)
2. Front room lamp (RH)
3. Rear room lamp
4. Fluorescent lamp
5. Fluorescent lamp switch
6. Front courtesy switch (LH)
7. Rear courtesy switch (LH)
8. Rear courtesy switch (RH)
9. Front courtesy switch (RH)
10. Center room lamp
11. Courtesy switch

<Model FC for Thailand>



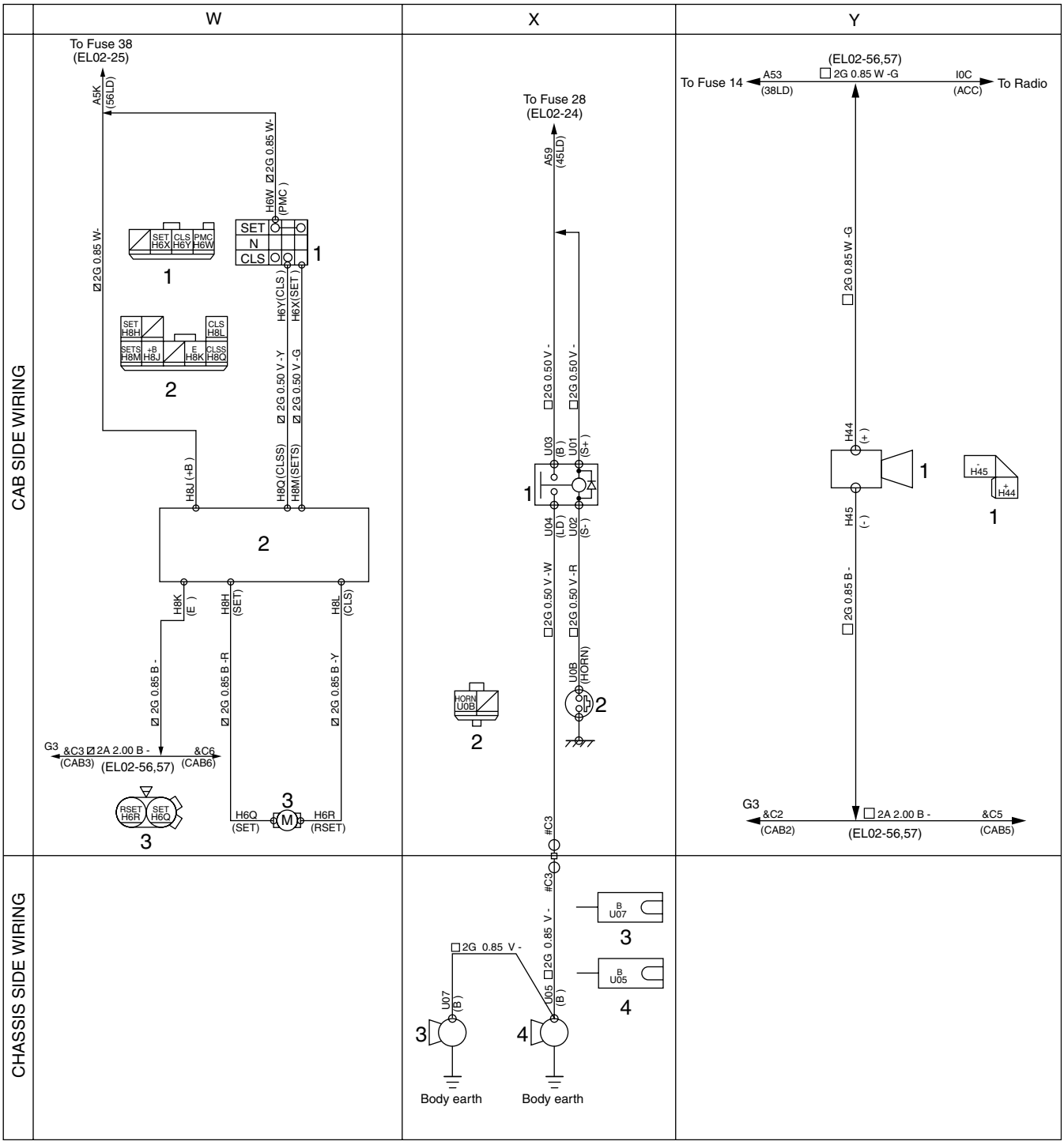

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M12020100029

**V. WIPER AND WASHER CIRCUIT**

1. Washer motor
2. Wiper switch
3. Intermittent wiper relay
4. Wiper motor




M12020100030

**W. POWER MIRROR CIRCUIT**

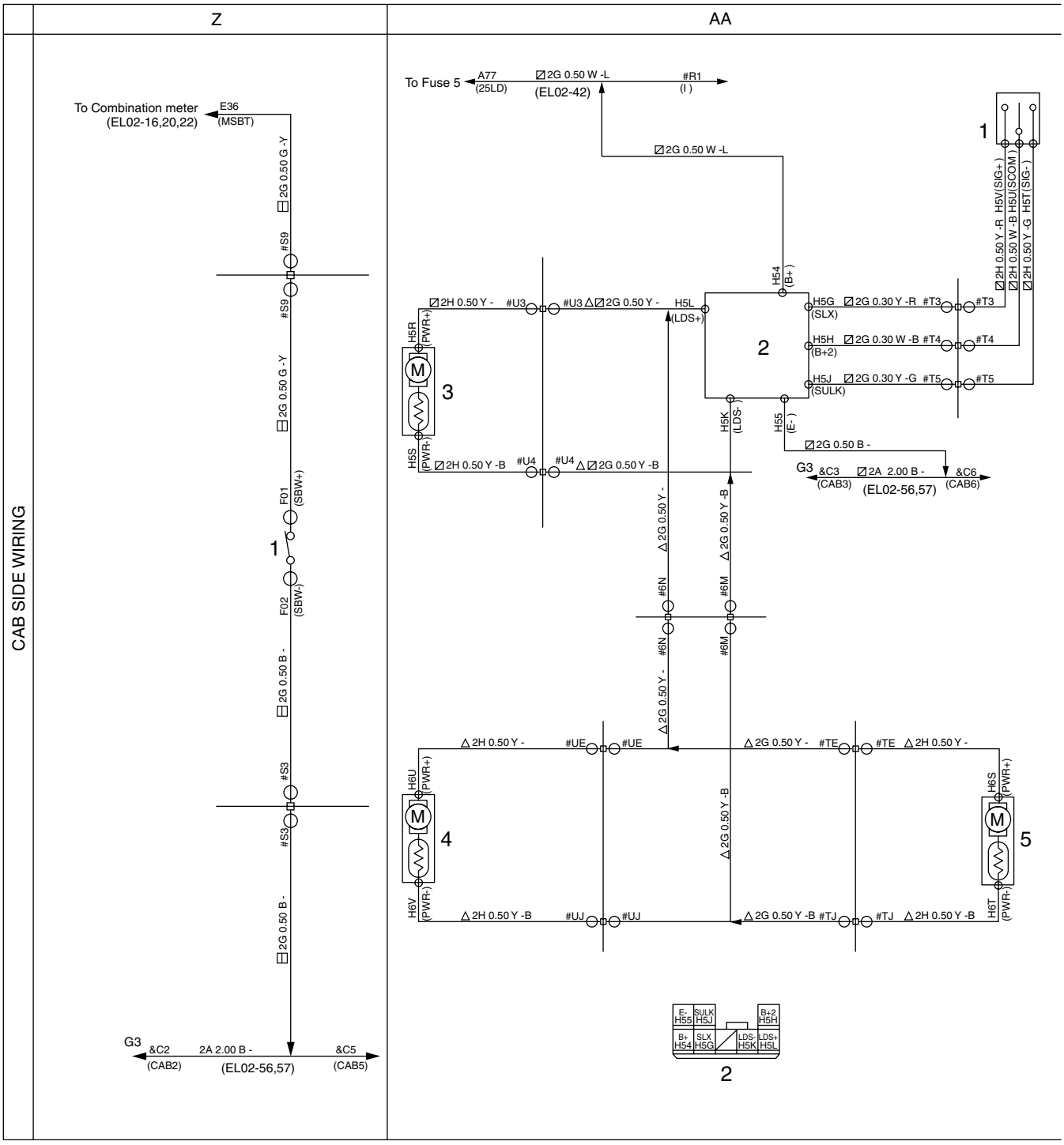
1. Power mirror switch
2. Power mirror relay
3. Power mirror motor

**X. HORN CIRCUIT**

1. Horn relay
2. Horn switch
3. Horn (Low)
4. Horn (High)

**Y. CIGARETTE LIGHTER CIRCUIT**

1. Cigarette lighter




M12020100031

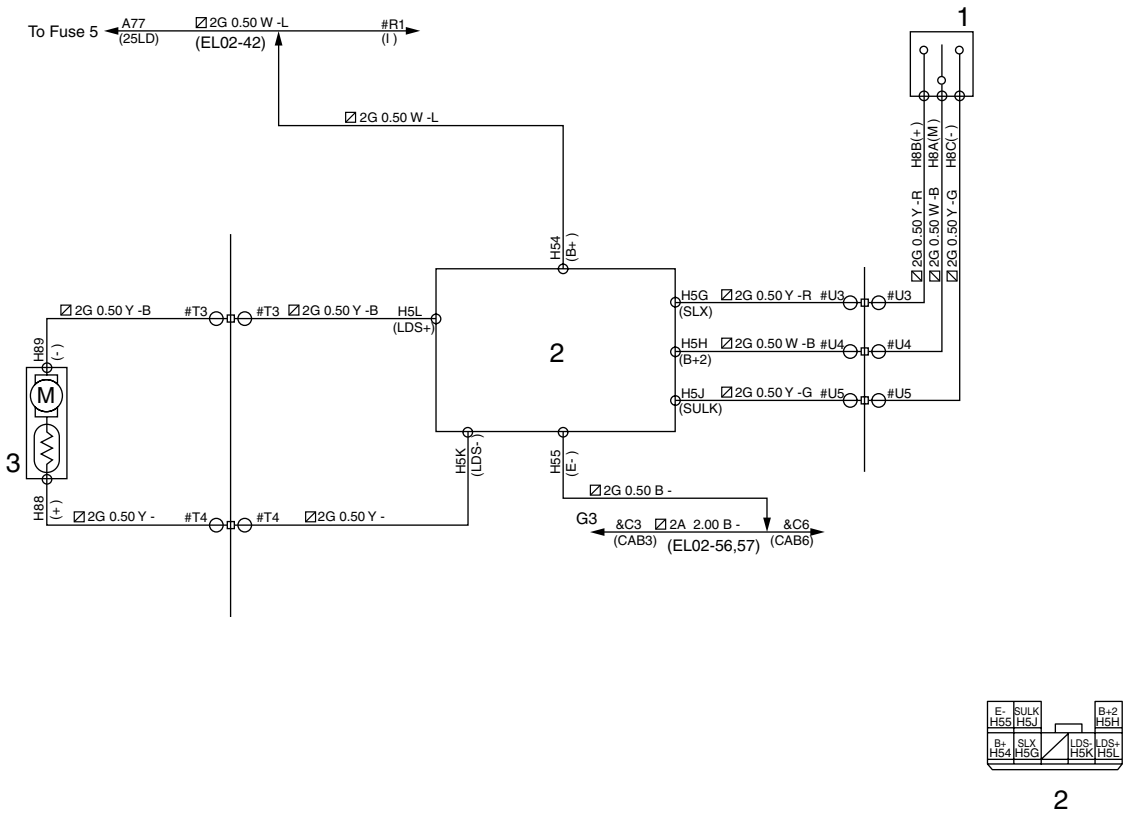
**Z. SEAT BELT WARNING LAMP CIRCUIT**

1. Seat belt warning lamp switch

**AA. POWER DOOR LOCK CIRCUIT (FOR RIGHT-HAND DRIVE VEHICLE)**

1. Door lock switch (Driver's seat side)
2. Door lock controller
3. Door lock actuator (Assistant's seat side)
4. Rear door lock actuator (LH)
5. Rear door lock actuator (RH)

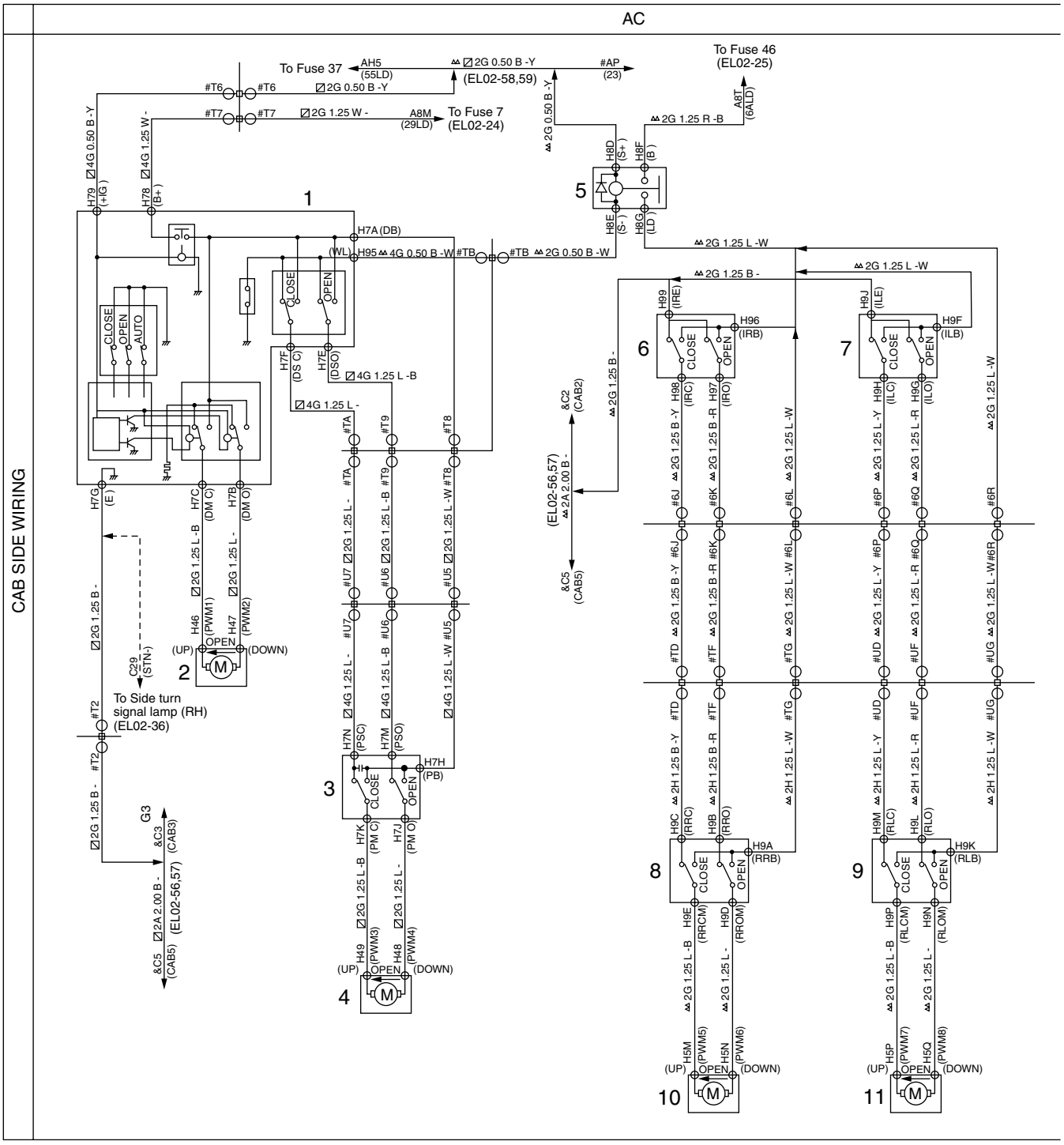
AB




M12020100032

**AB. POWER DOOR LOCK CIRCUIT (FOR LEFT-HAND DRIVE VEHICLE)**

1. Door lock switch (Driver's seat side)
2. Door lock controller
3. Door lock actuator (Assistant's seat side)

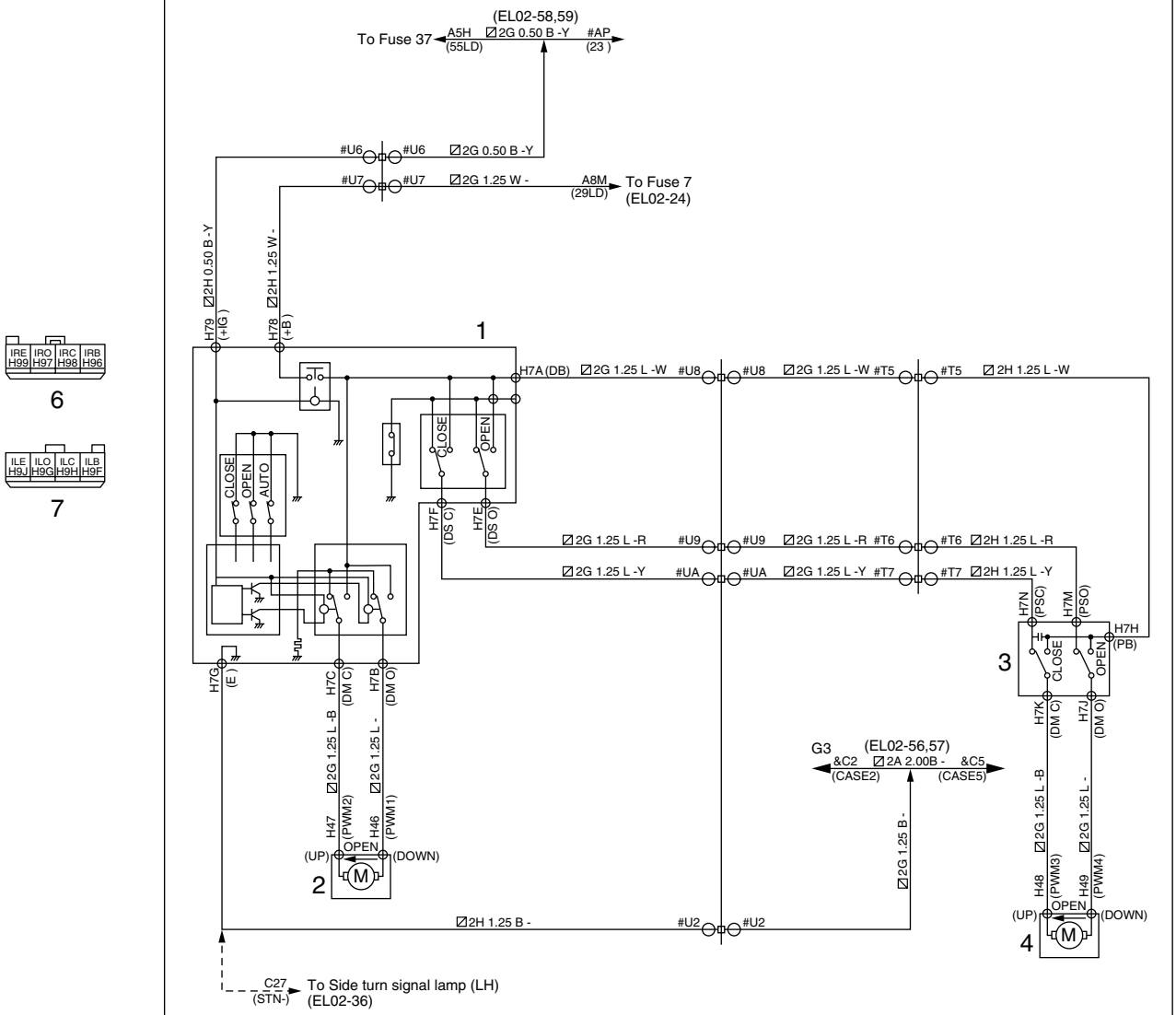



M12020100033

**AC. POWER WINDOW CIRCUIT (FOR RIGHT-HAND DRIVE VEHICLE)**

1. Power window switch (Driver's seat side)
2. Power window motor (Driver's seat side)
3. Power window switch (Assistant's seat side)
4. Power window motor (Assistant's seat side)
5. Rear power window relay
6. Rear power window switch (RH) (Driver's seat side)
7. Rear power window switch (LH) (Driver's seat side)
8. Rear power window switch (RH) (Rear seat side)
9. Rear power window switch (LH) (Rear seat side)
10. Rear power window motor (RH)
11. Rear power window motor (LH)

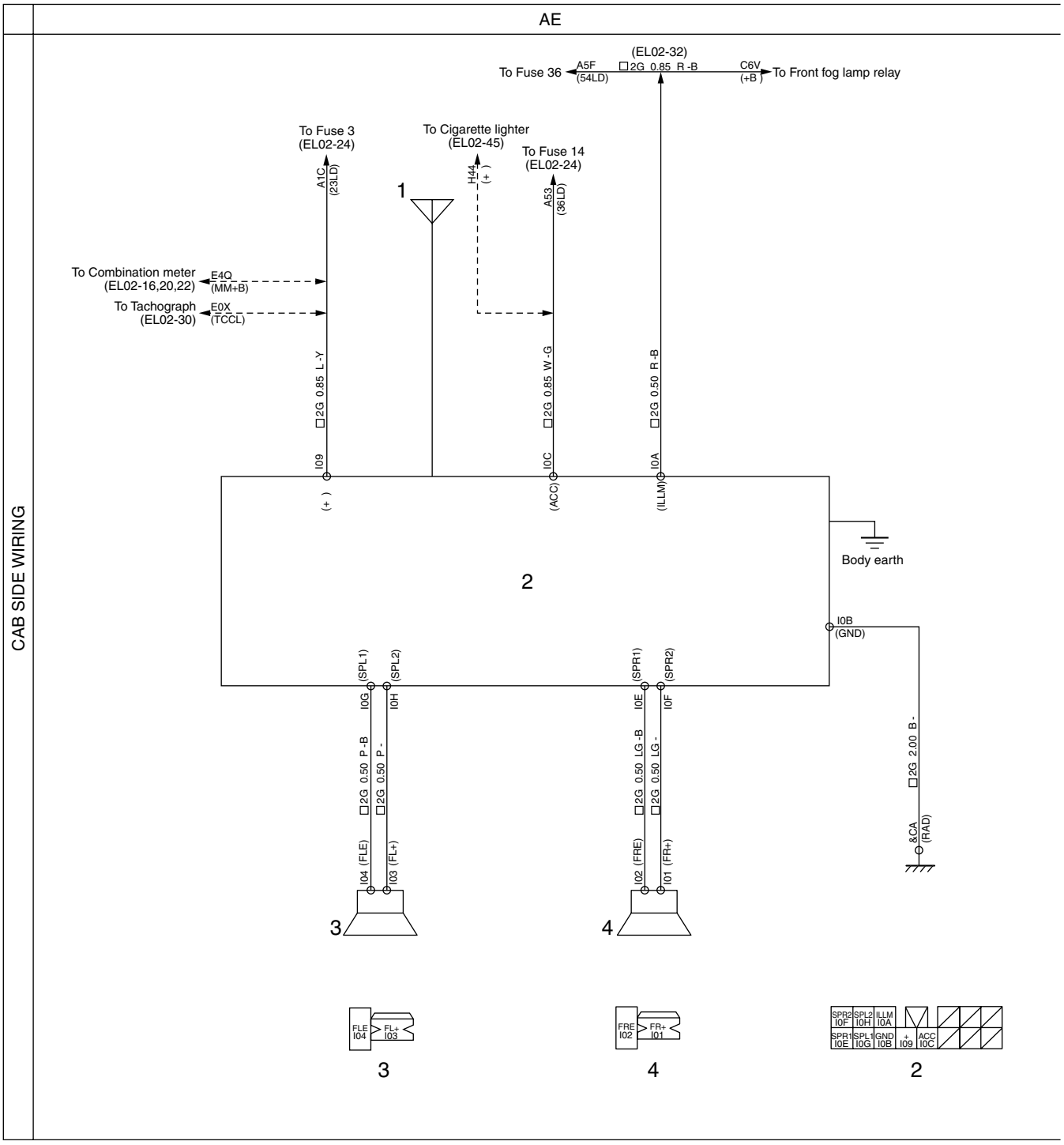
AD




M12020100034

**AD. POWER WINDOW CIRCUIT (FOR LEFT-HAND DRIVE VEHICLE)**

1. Power window switch (Driver's seat side)
2. Power window motor (Driver's seat side)
3. Power window switch (Assistant's seat side)
4. Power window motor (Assistant's seat side)

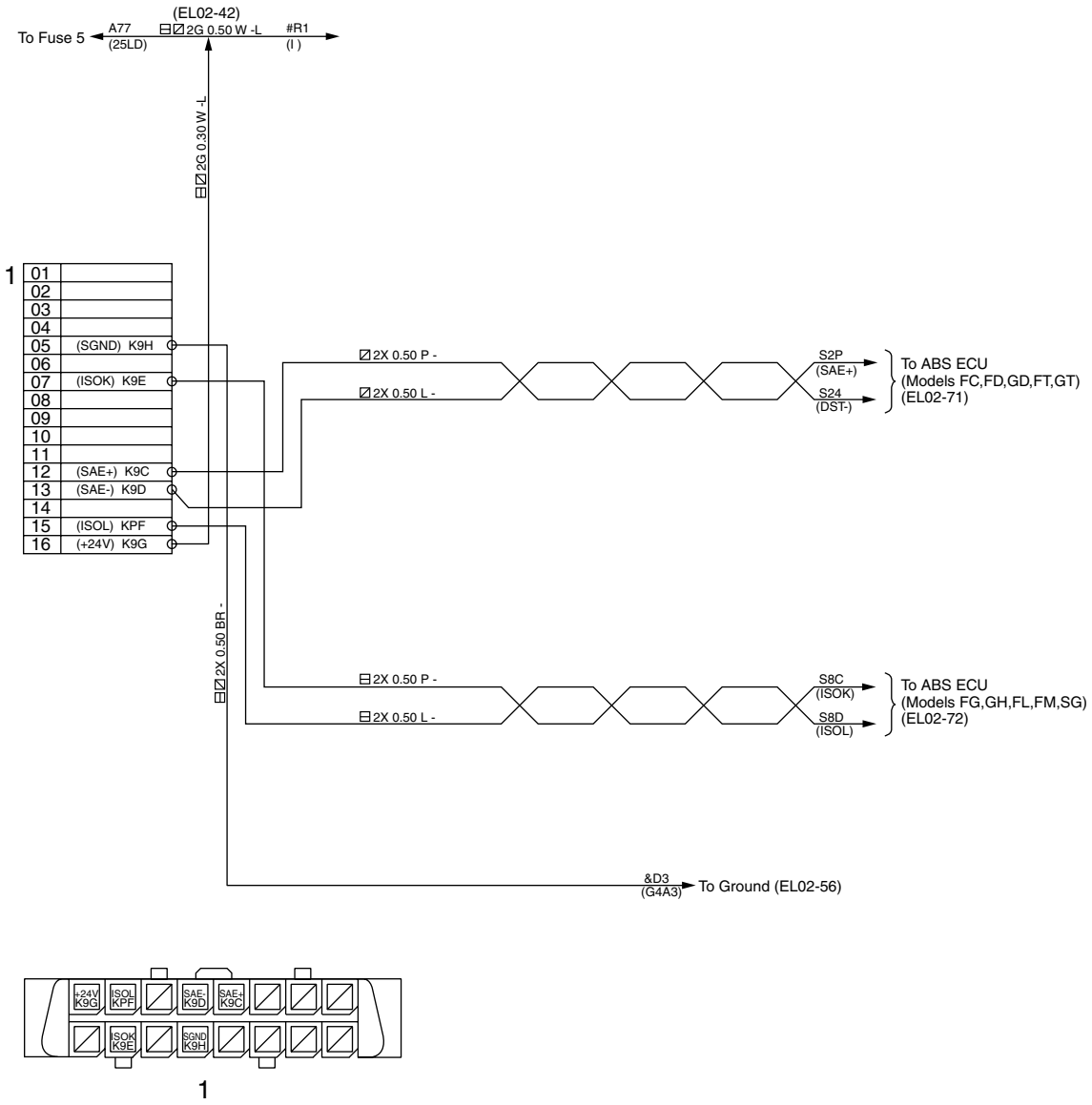



M12020100035

**AE. RADIO/AUDIO CIRCUIT**

1. Antenna
2. Radio/audio unit
3. Front speaker (LH)
4. Front speaker (RH)

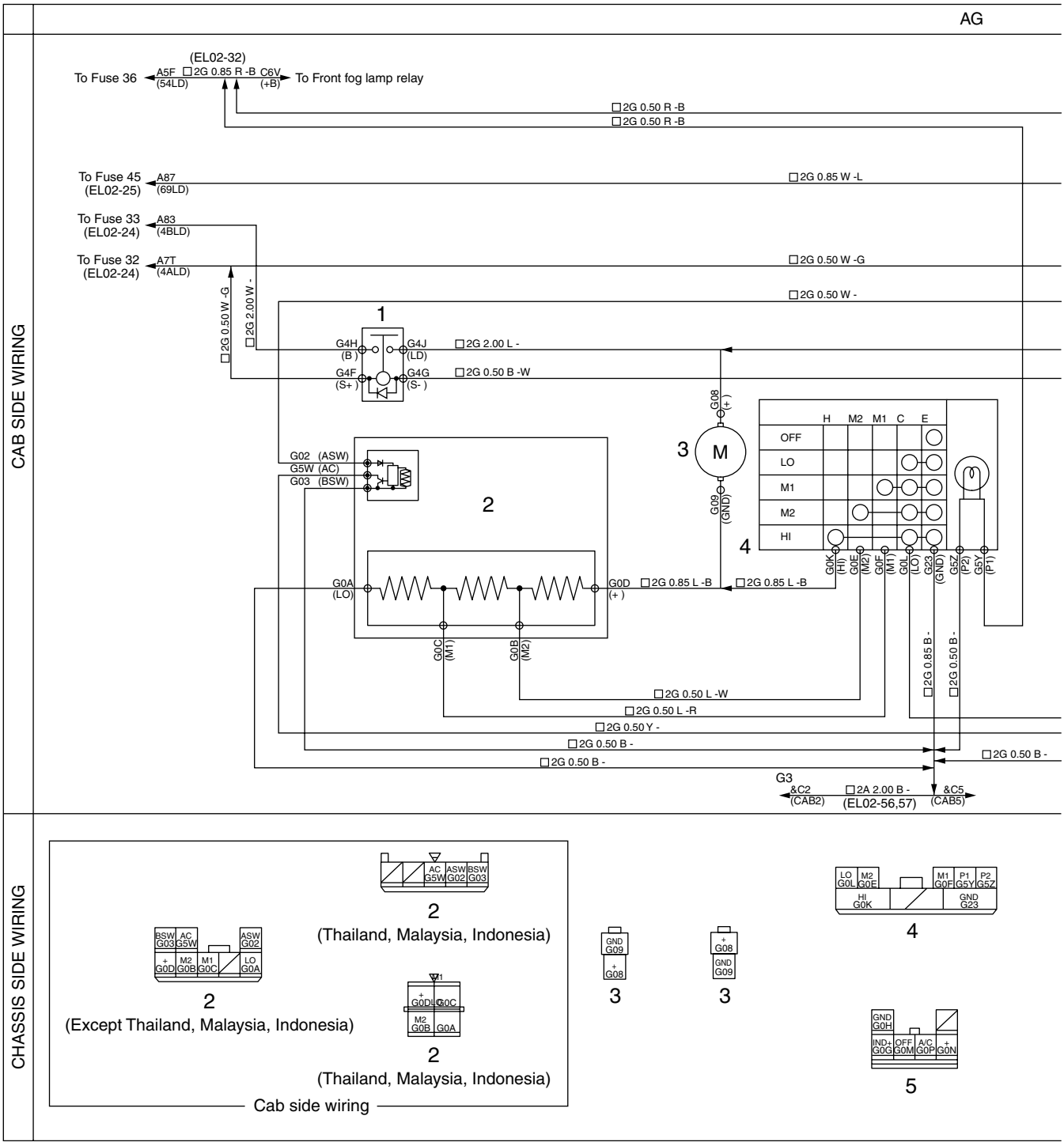
AF




M12020100036

**AF. DST-1 CIRCUIT**

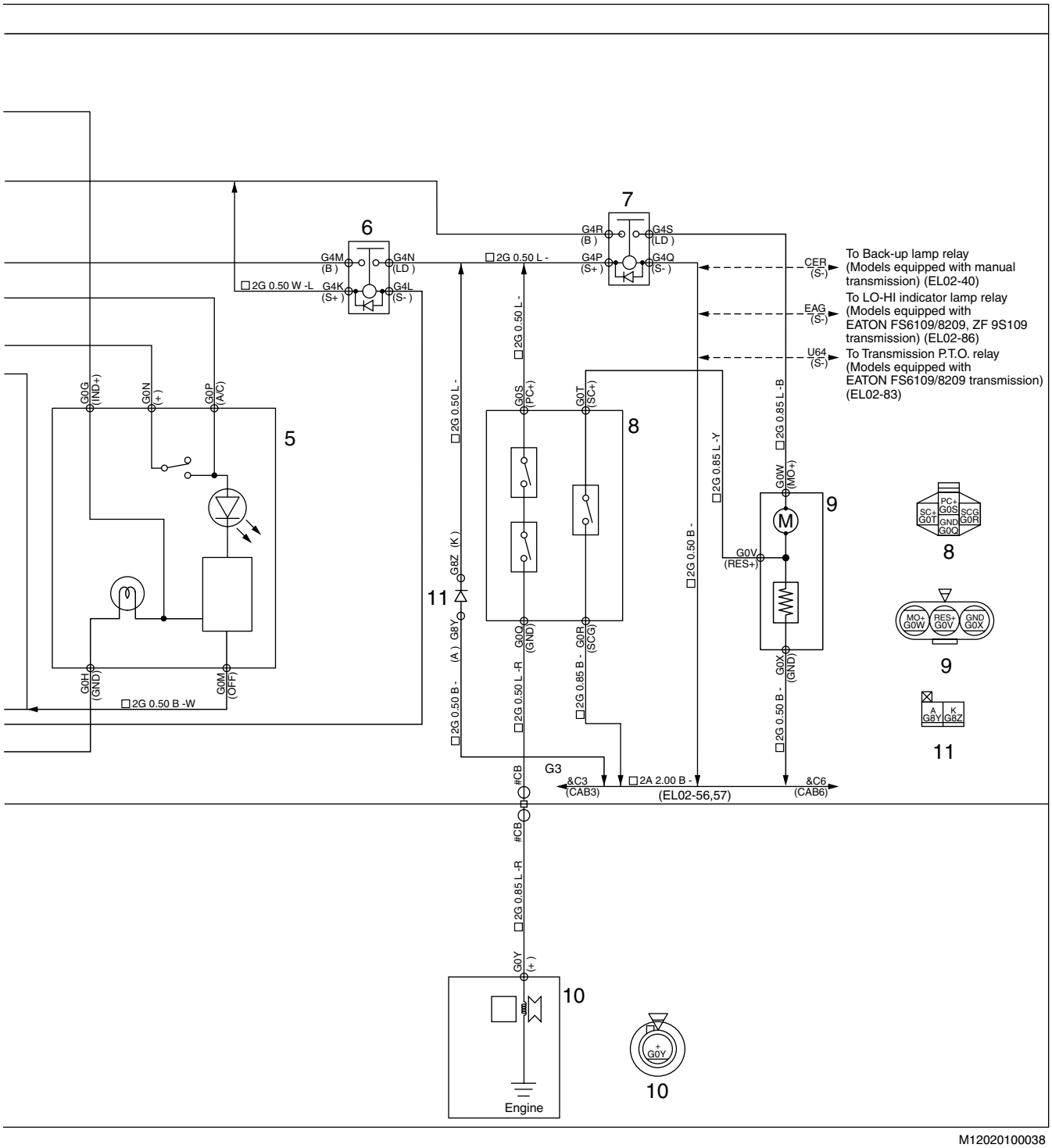
1. DST-1 connector



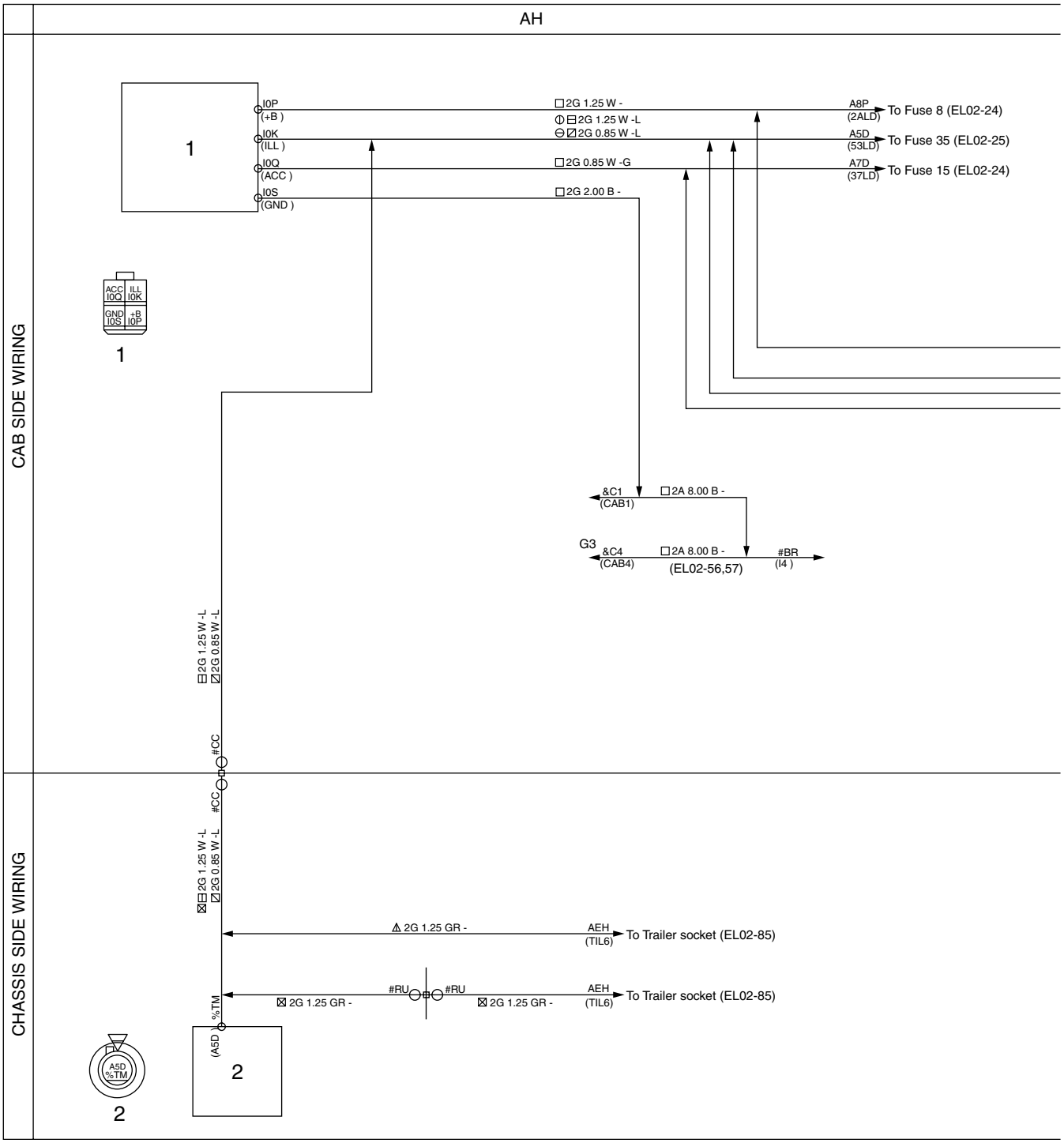

M12020100037

**AG. HEATER AND MANUAL AIR CONDITIONER CIRCUIT**

1. Heater relay
2. Heater and cooler unit
3. Blower motor
4. Heater blower switch
5. Air conditioner switch
6. Air conditioner relay
7. Air conditioner condenser relay
8. High-Low pressure cut switch
9. Air conditioner condenser
10. Compressor
11. Diode



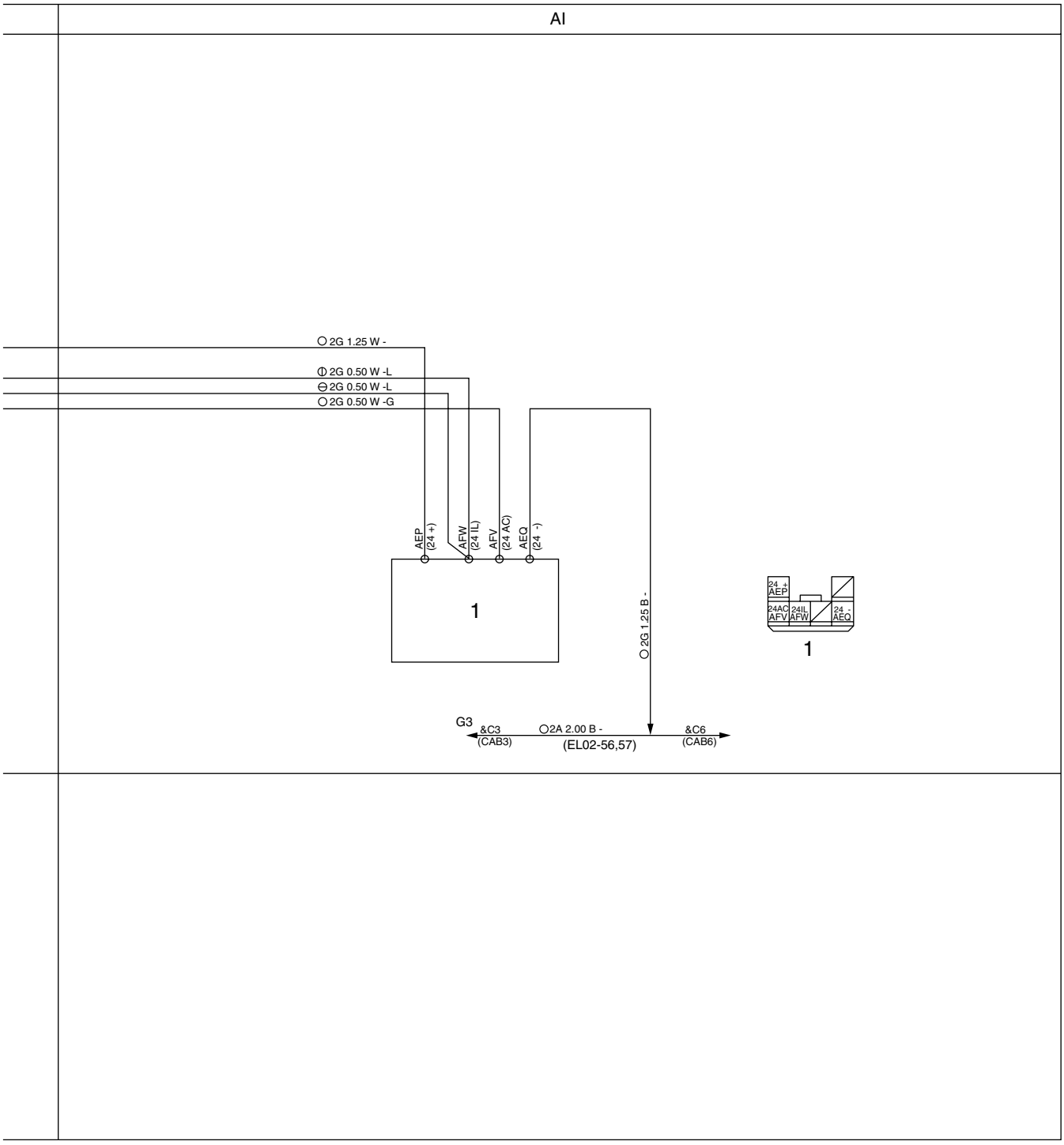

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M12020100039

**AH. SPARE POWER SOURCE CIRCUIT**

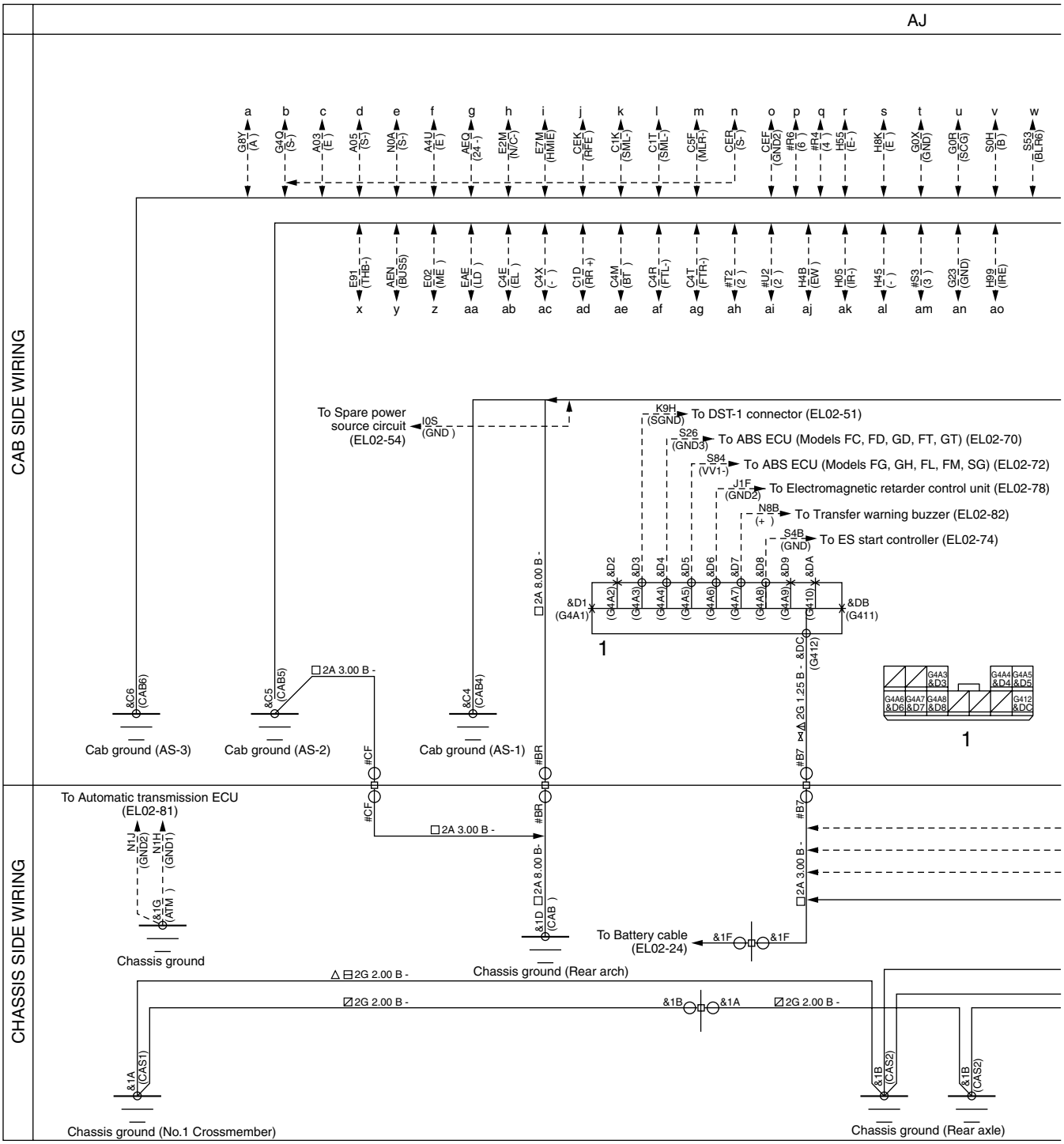
1. Spare power source connector
2. Spare power source connector




M12020100040

**AI. 12V SPARE POWER SOURCE CIRCUIT**

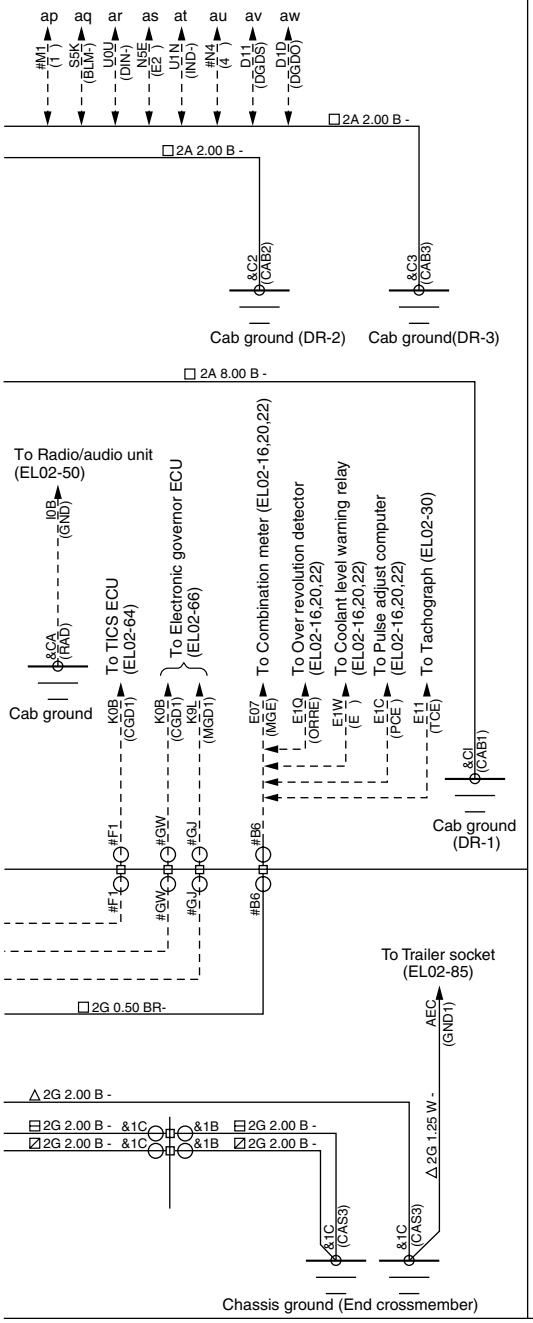
1 DC-DC converter




M12020100041

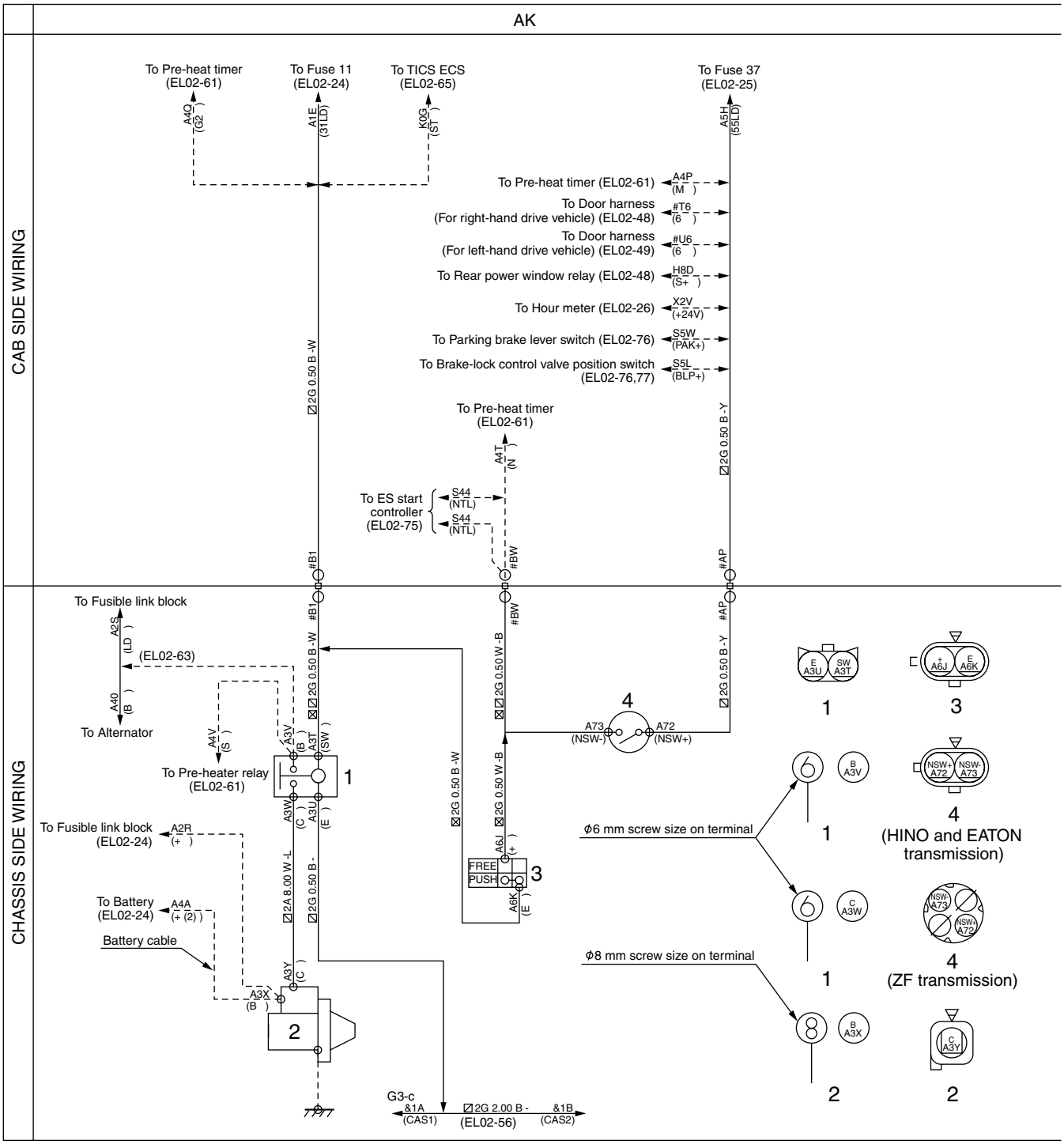
## AJ. GROUND CIRCUIT

1. Cab-chassis harness connector




a. To Air conditioner diode (EL02-53)
b. To Air conditioner condenser relay (EL02-53)
c. To Engine stop electric motor (EL02-69)
d. To Engine stop relay (EL02-69)
e. To Automatic transmission neutral relay (EL02-59)
f. To Pre-heat timer (EL02-61)
g. To DC-DC converter (For 12V spare power source circuit) (EL02-55)
h. To Center parking brake switch (EL02-17,21,23)
i. To Hour meter (EL02-26)
j. To Rear fog lamp switch (EL02-33,35)
k. To Side marker lamp (LH) (EL02-33,35)
l. To Side marker lamp (RH) (EL02-33,35)
m. To Roof marker lamp (EL02-33,35)
n. To Back-up lamp relay
(Models equipped with manual transmission) (EL02-40)
o. To DC-DC converter (For head lamp control circuit) (EL02-39)
p. To Fluorescent lamp (EL02-42)
q. To Roof marker lamp (EL02-33)
r. To Door lock controller (EL02-46,47)
s. To Power mirror relay (EL02-45)
t. To Air conditioner condenser (EL02-53)
u. To Air conditioner high-low pressure cut switch (EL02-53)
v. To ABS warning lamp relay (Models FC, FD, GD, FT, GT) (EL02-70)
w. To Brake-lock relay (EL02-76,77)
x. To Trailer hand brake switch (EL02-16,20)
y. To Power relay (EL02-24)
z. To Combination meter (EL02-16,20,22)
aa. To Warning lamp check relay (EL02-17,21,23)
ab. To Lighting switch (ON, OFF) (EL02-32,34)
ac. To Front fog lamp switch (EL02-32,34)
ad. To Stop lamp switch (EL02-33,35)
ae. To Turn signal lamp switch (EL02-36)
af. To Front turn signal lamp (LH) (EL02-36)
ag. To Front turn signal lamp (RH) (EL02-36)
ah. To Power window switch (For right-hand drive vehicle) (EL02-48)
ai. To Power window switch (For left-hand drive vehicle) (EL02-49)
aj. To Wiper switch (EL02-44)
ak. To Intermittent wiper relay (EL02-44)
al. To Cigarette lighter (EL02-45)
am. To Seat belt warning lamp switch (EL02-47)
an. To Heater blower switch (EL02-52)
ao. To Rear power window switch (EL02-48)
ap. To Brake-lock pressure switch (EL02-76,77)
aq. To Brake-lock control valve (EL02-76,77)
ar. To Inter-axle differential lock switch (EL02-79)
as. To Automatic transmission shift selector (EL02-80)
at. To Transmission P.T.O. switch (EL02-83)
au. To Transmission P.T.O. magnetic valve (EL02-83)
av. To Diagnosis connector (White) (EL02-87)
aw. To Diagnosis connector (Black) (EL02-87)

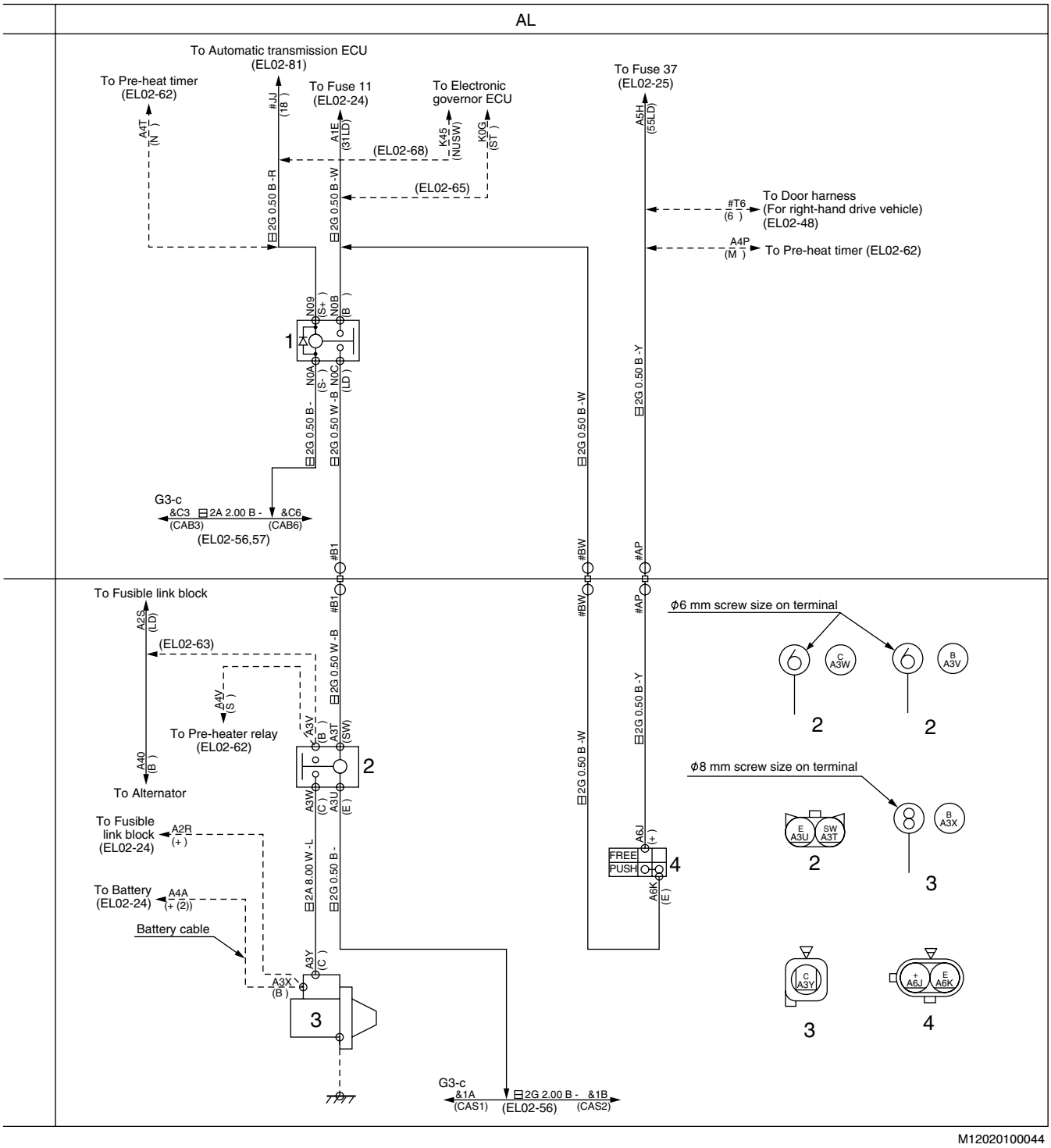
M12020100042




M12020100043

**AK. ENGINE STARTING CIRCUIT (MODELS WITH MANUAL TRANSMISSION)**

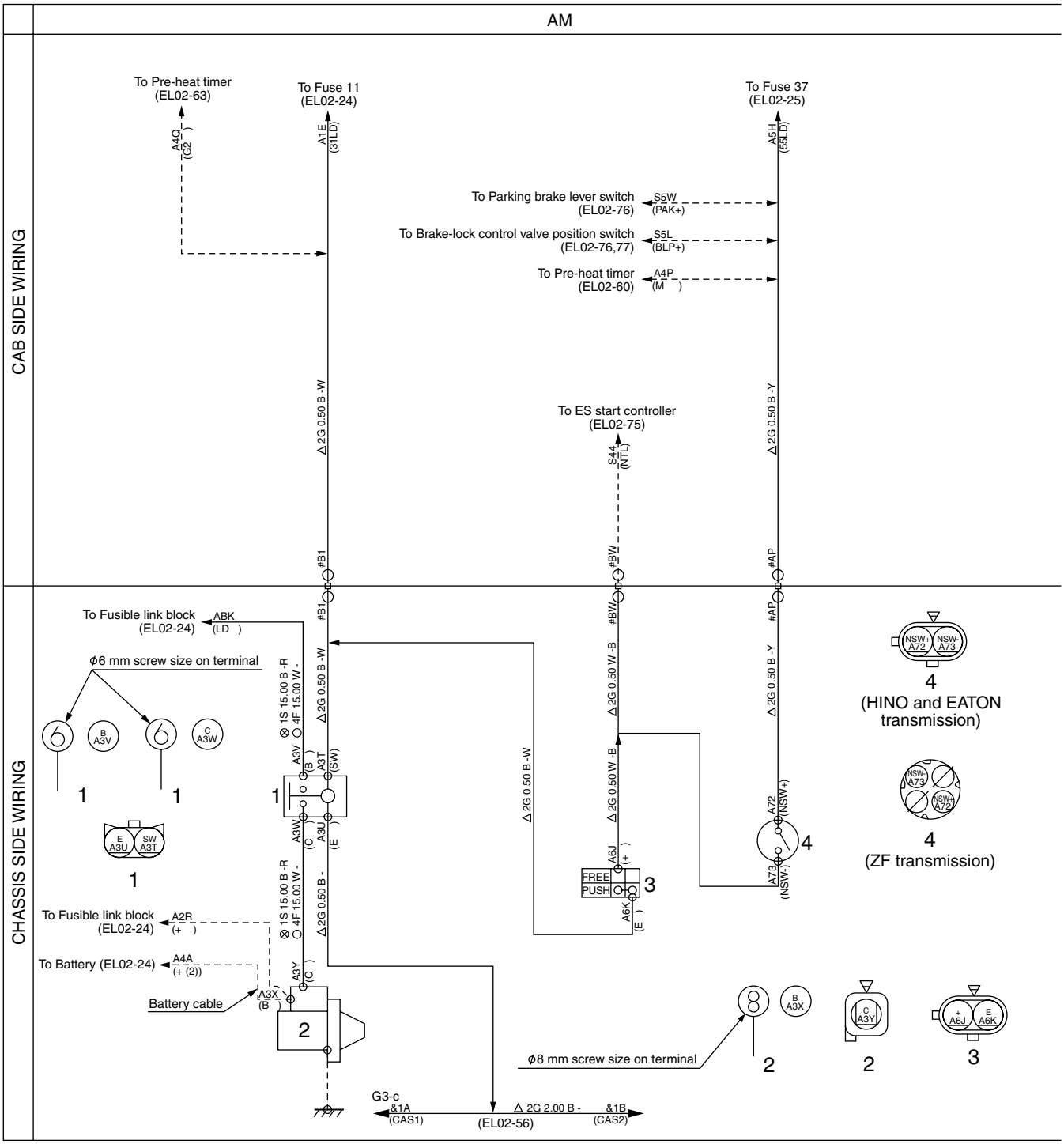
1. Starter relay
2. Starter
3. Sub-starter switch
4. Neutral switch




M12020100044

**AL. ENGINE STARTING CIRCUIT (MODELS WITH AUTOMATIC TRANSMISSION)**

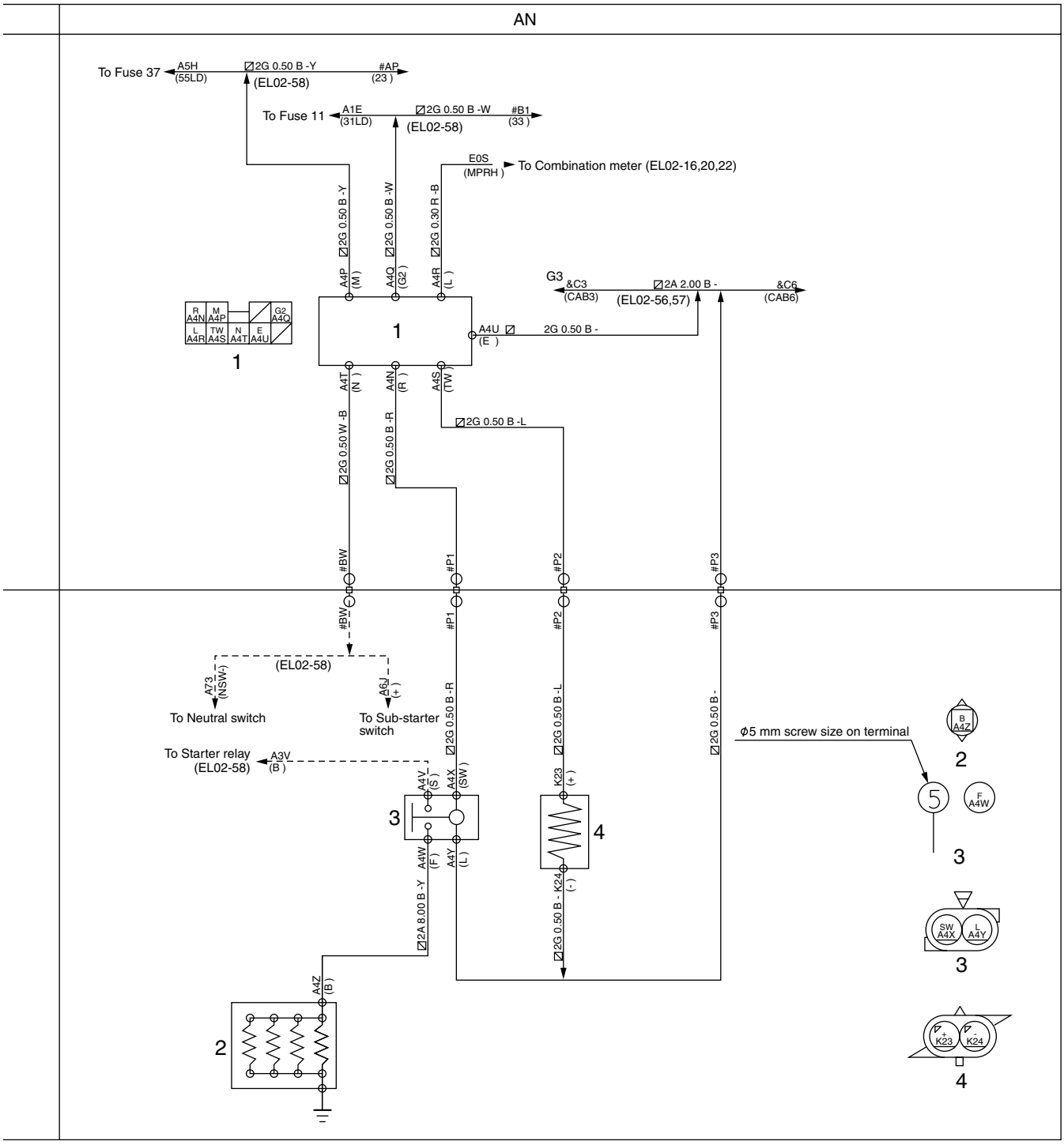
1. Automatic transmission neutral relay
2. Starter relay
3. Starter
4. Sub-starter switch




M12020100045

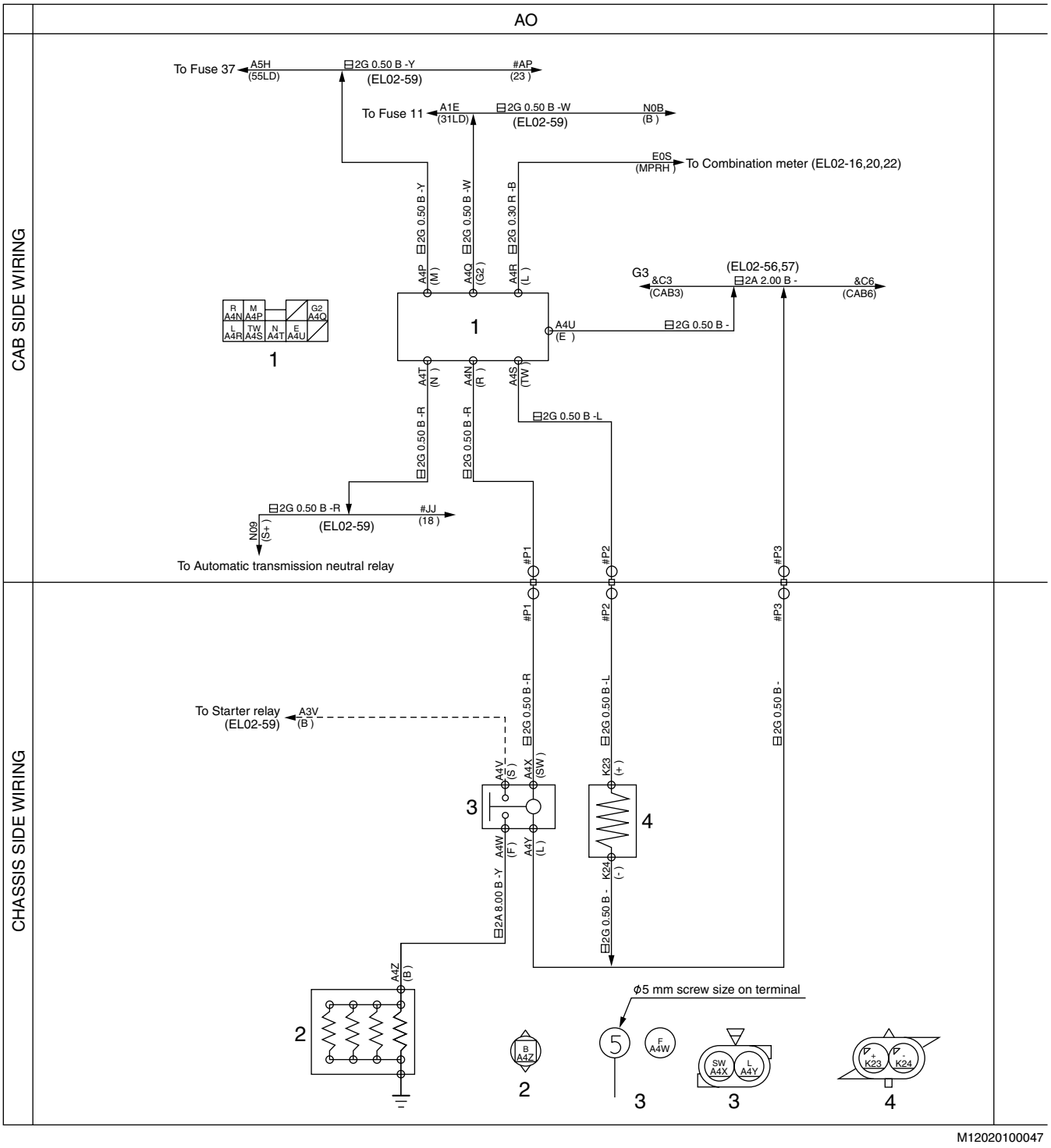
**AM. ENGINE STARTING CIRCUIT (MODELS WITH P11C ENGINE)**

1. Starter relay
2. Starter
3. Sub-starter switch
4. Neutral switch




**AN. PRE-HEATER CIRCUIT (MODELS WITH MANUAL TRANSMISSION)**

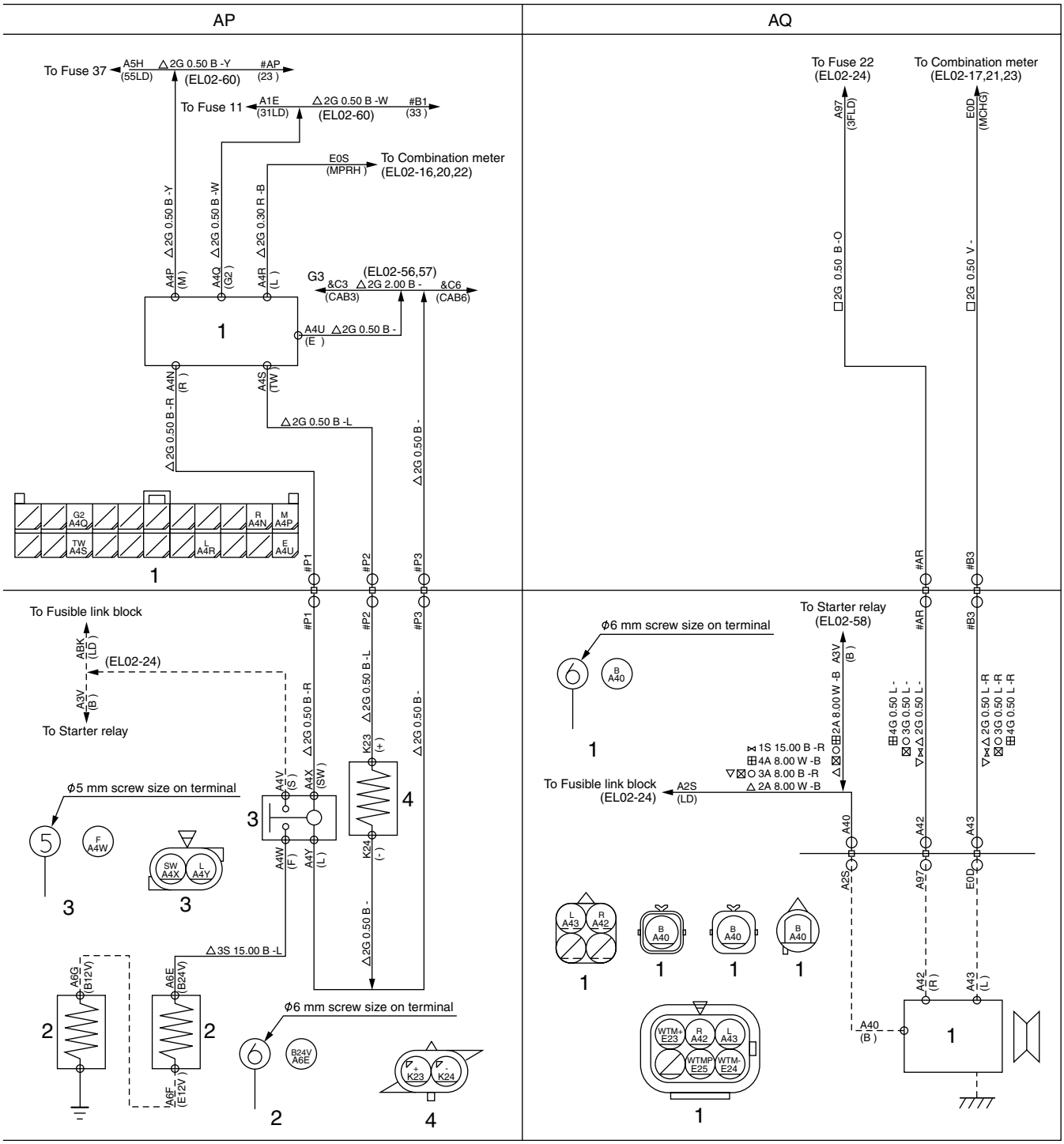
1. Pre-heat timer
2. Grow plug
3. Pre-heater relay
4. Coolant temperature sensor




M12020100047

**AO. PRE-HEATER CIRCUIT (MODELS WITH AUTOMATIC TRANSMISSION)**

1. Pre-heat timer
2. Grow plug
3. Pre-heater relay
4. Coolant temperature sensor



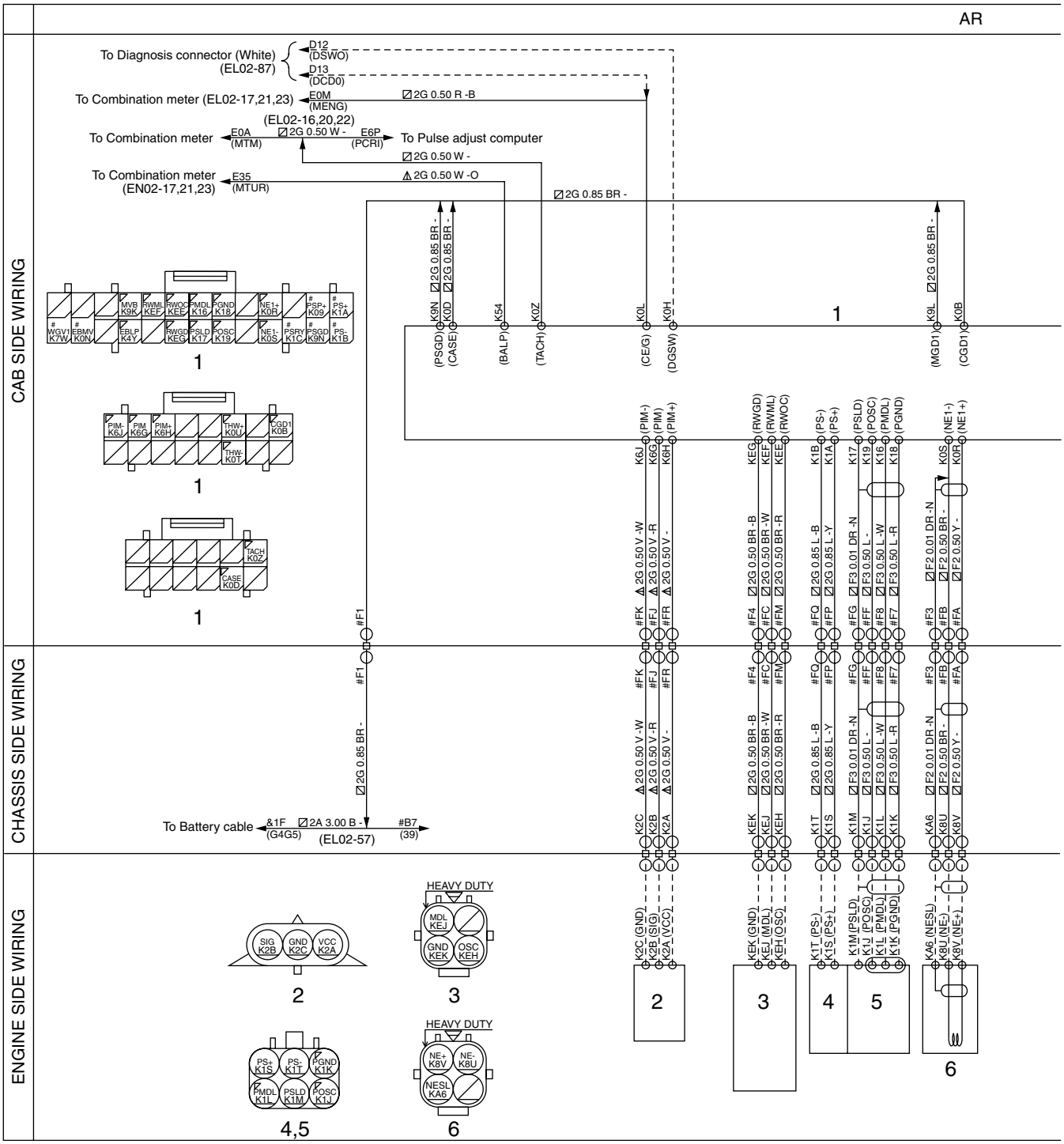

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**AP. PRE-HEATER CIRCUIT (MODELS WITH P11C ENGINE)**

1. Pre-heat timer
2. Intake air heater
3. Pre-heater relay
4. Coolant temperature sensor

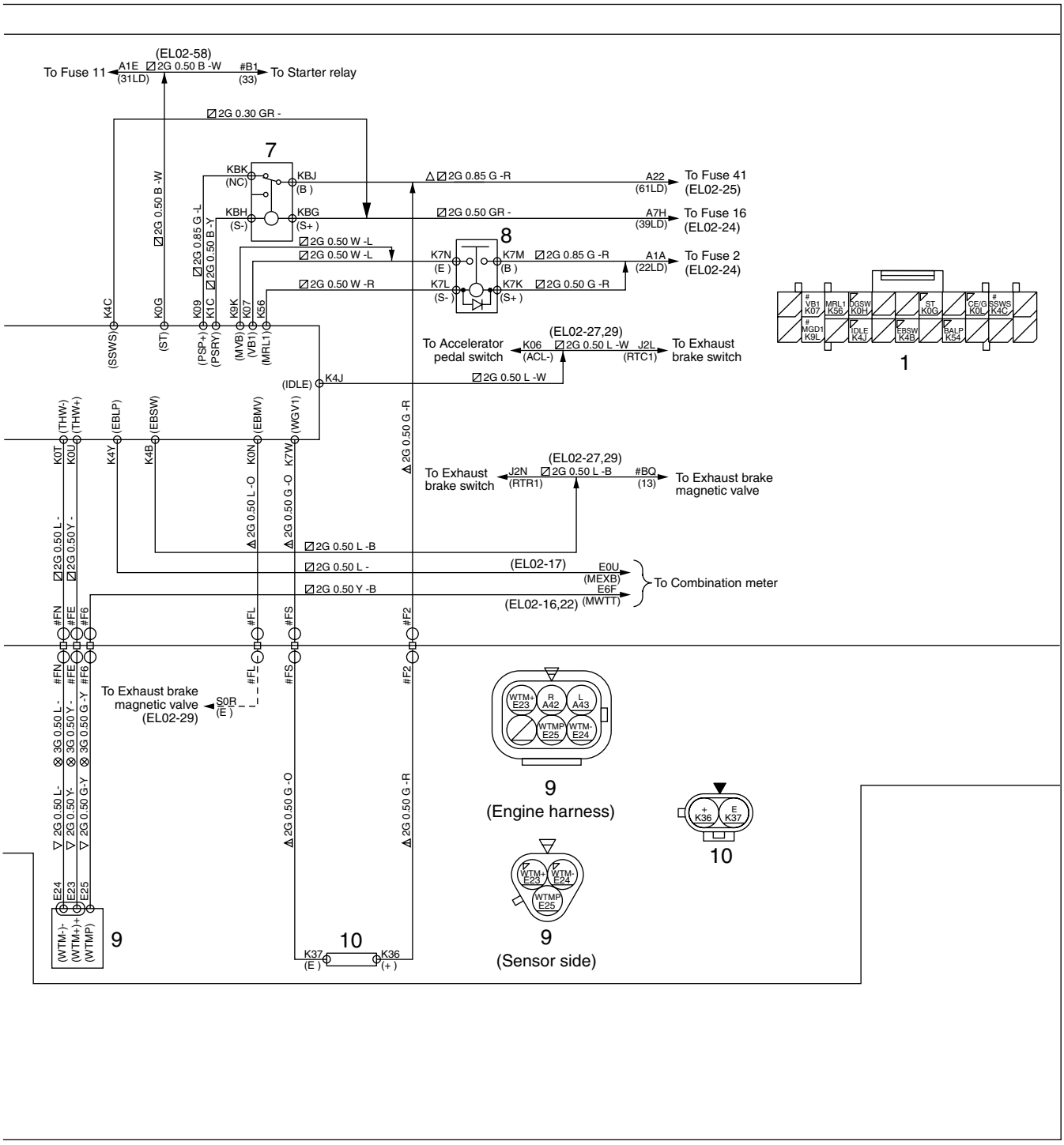
**AQ. CHARGING CIRCUIT**

1. Alternator

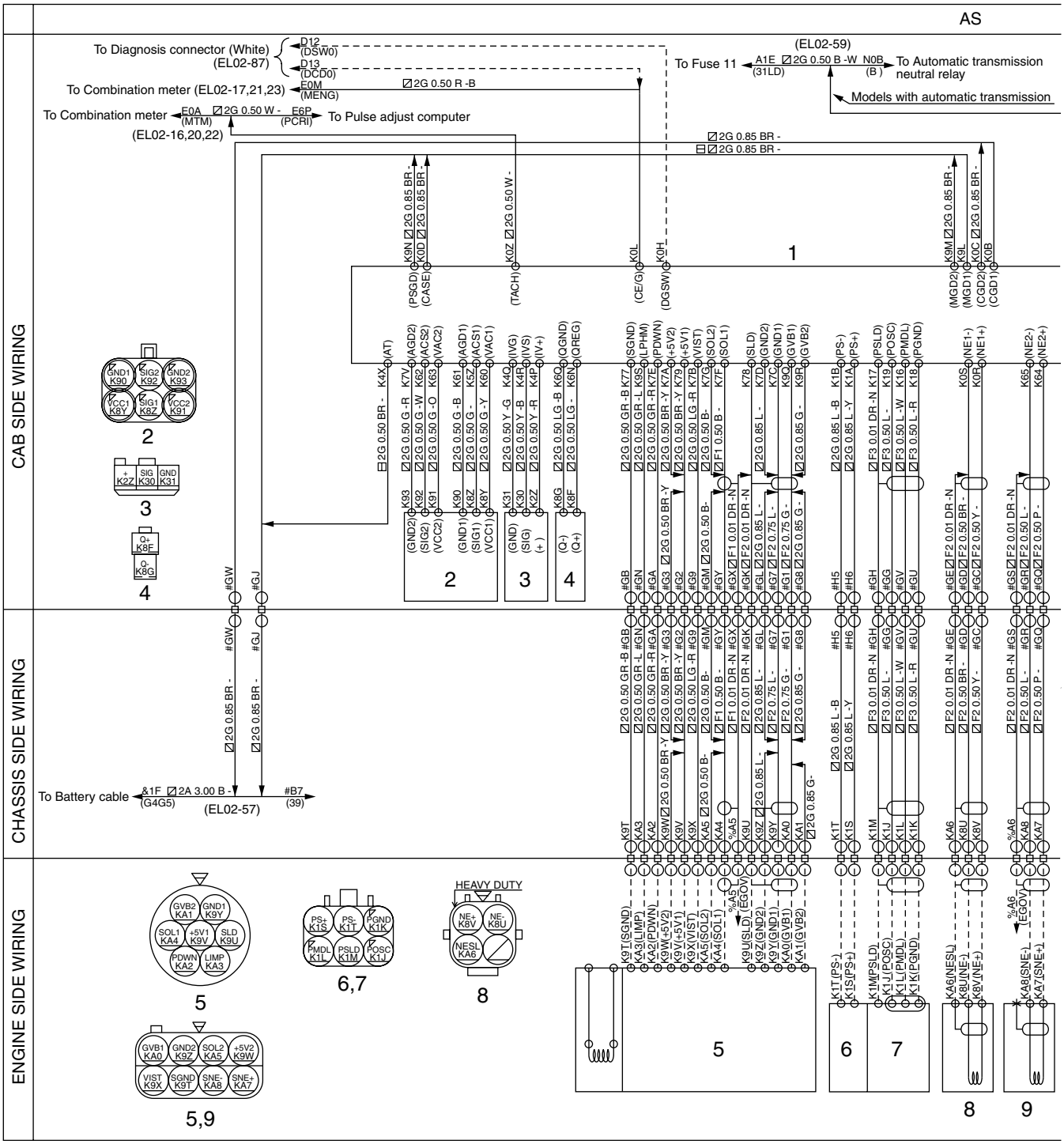



**AR. TE SYSTEM (TICS) CIRCUIT**

1. TICS ECU
2. Boost pressure sensor
3. Rack sensor
4. Pre-stroke actuator
5. Pre-stroke sensor
6. Engine revolution sensor
7. Actuator power supply relay
8. ECU main relay
9. Coolant temperature sensor
10. Waste gate control magnetic valve

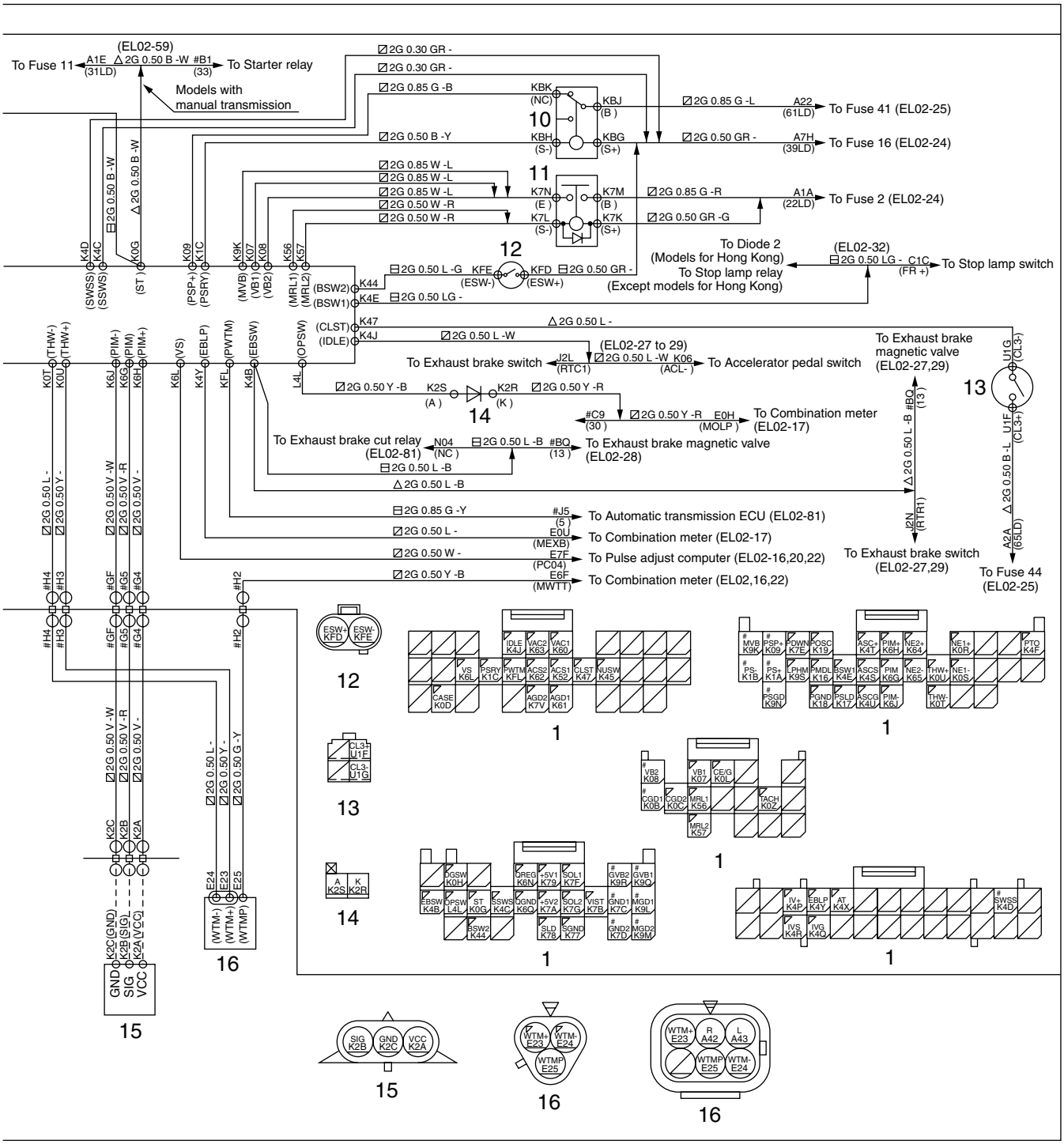



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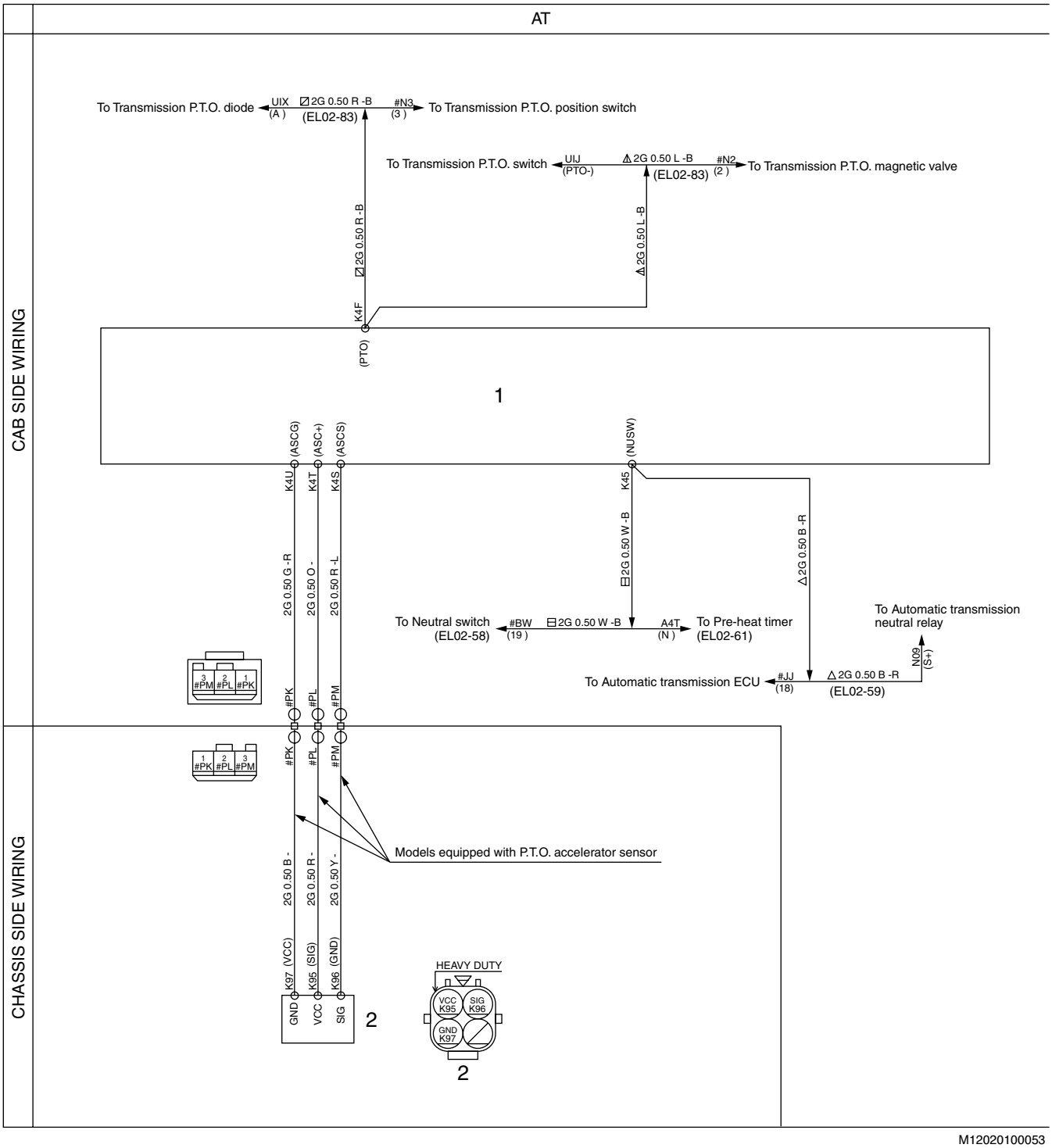



**AS. TE SYSTEM (ELECTRONIC GOVERNOR) CIRCUIT**

1. Electronic governor ECU
2. Accelerator pedal stroke sensor
3. Idle controller
4. Q-Adjustment register
5. Rack sensor
6. Pre-stroke actuator
7. Pre-stroke sensor
8. Engine revolution sensor (main)
9. Engine revolution sensor (sub)
10. Actuator power supply relay
11. ECU main relay
12. Brake switch
13. Clutch pedal switch
14. Oil pressure diode
15. Boost pressure sensor
16. Coolant temperature sensor



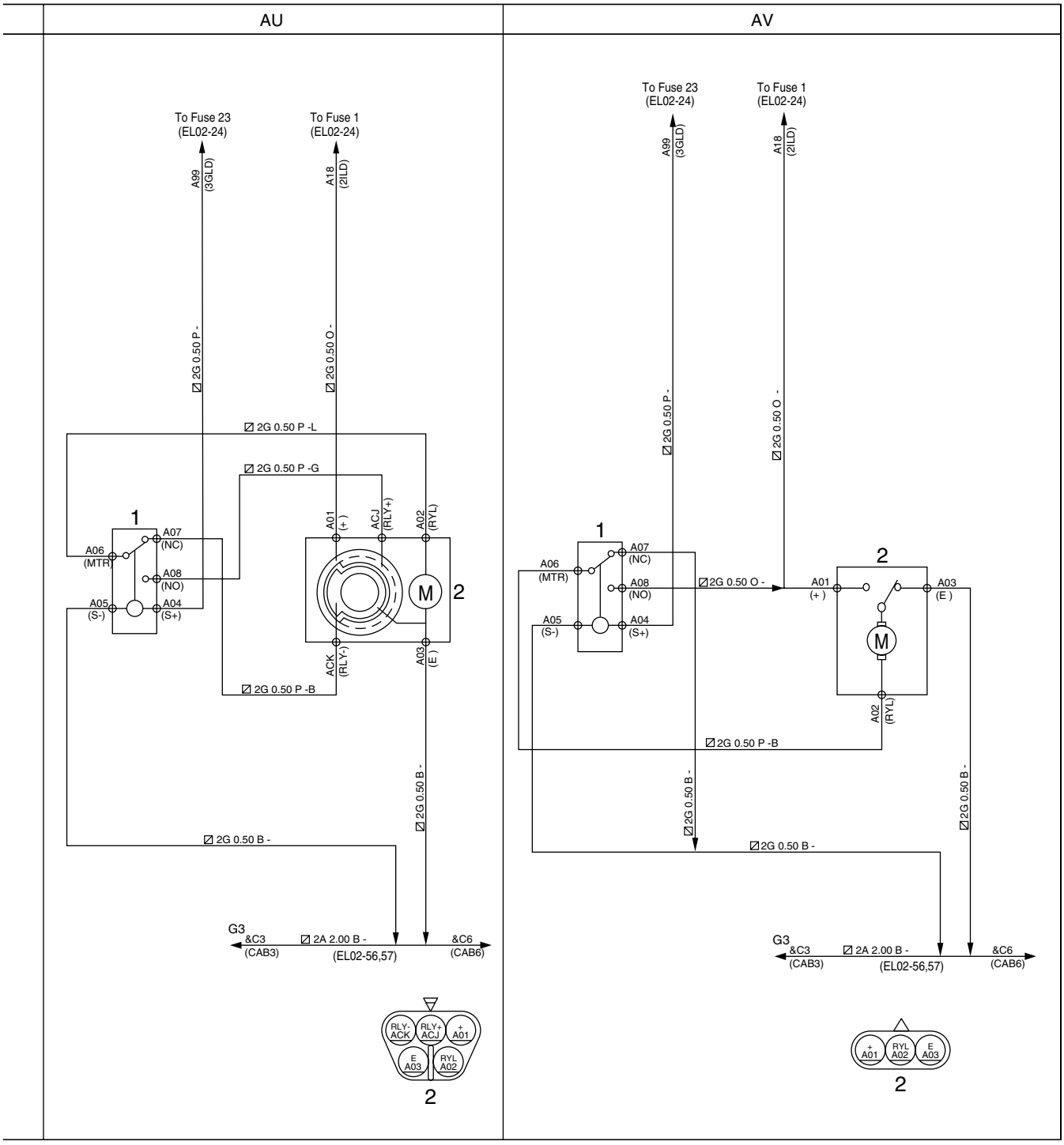

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**AT. TE SYSTEM (ELECTRONIC GOVERNOR) POWER TAKE-OFF CIRCUIT**

1. Electronic governor ECU



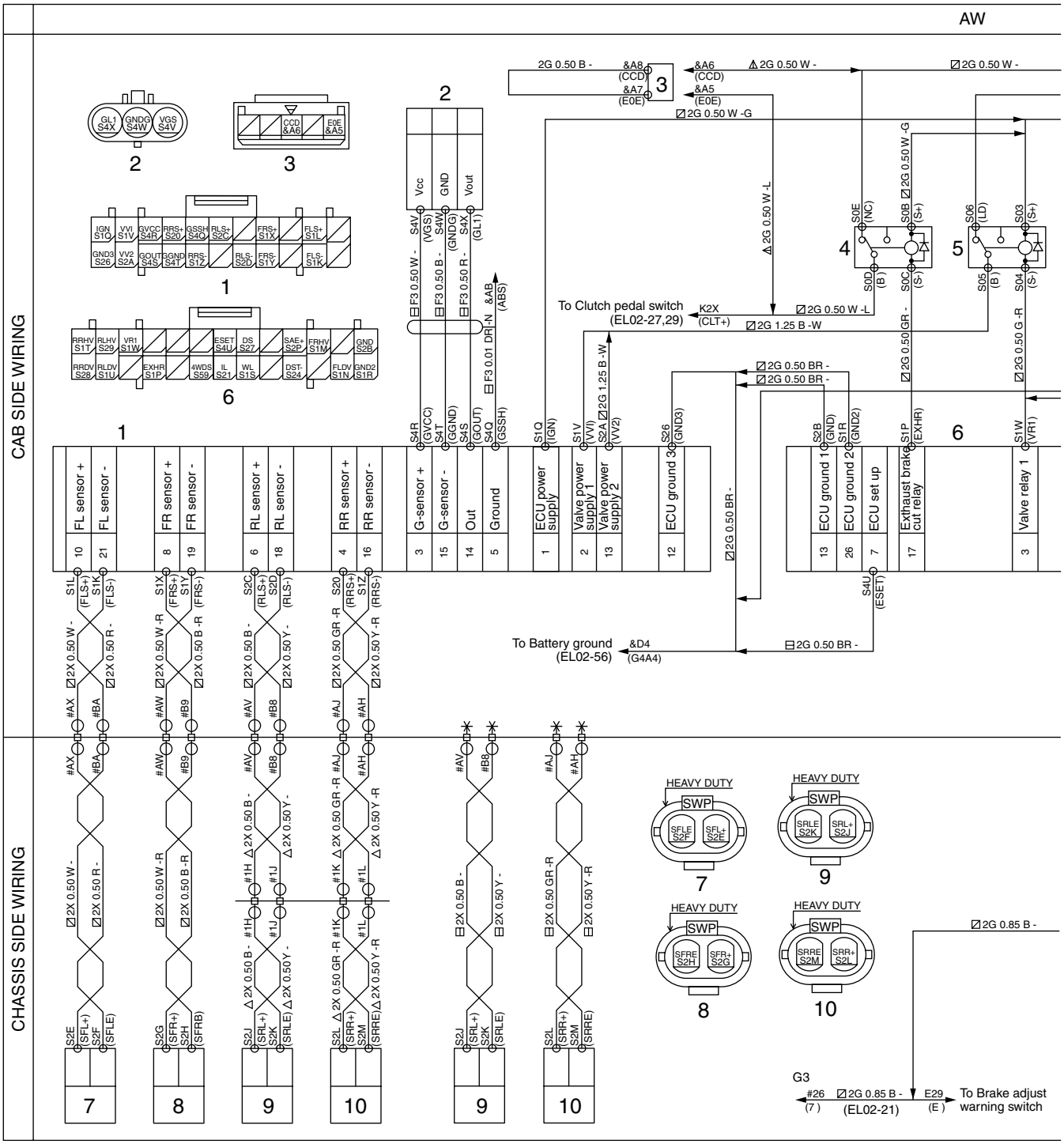

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**AU. ENGINE STOP CIRCUIT (FOR RIGHT-HAND DRIVE VEHICLE)**

1. Engine stop relay
2. Engine stop electric motor

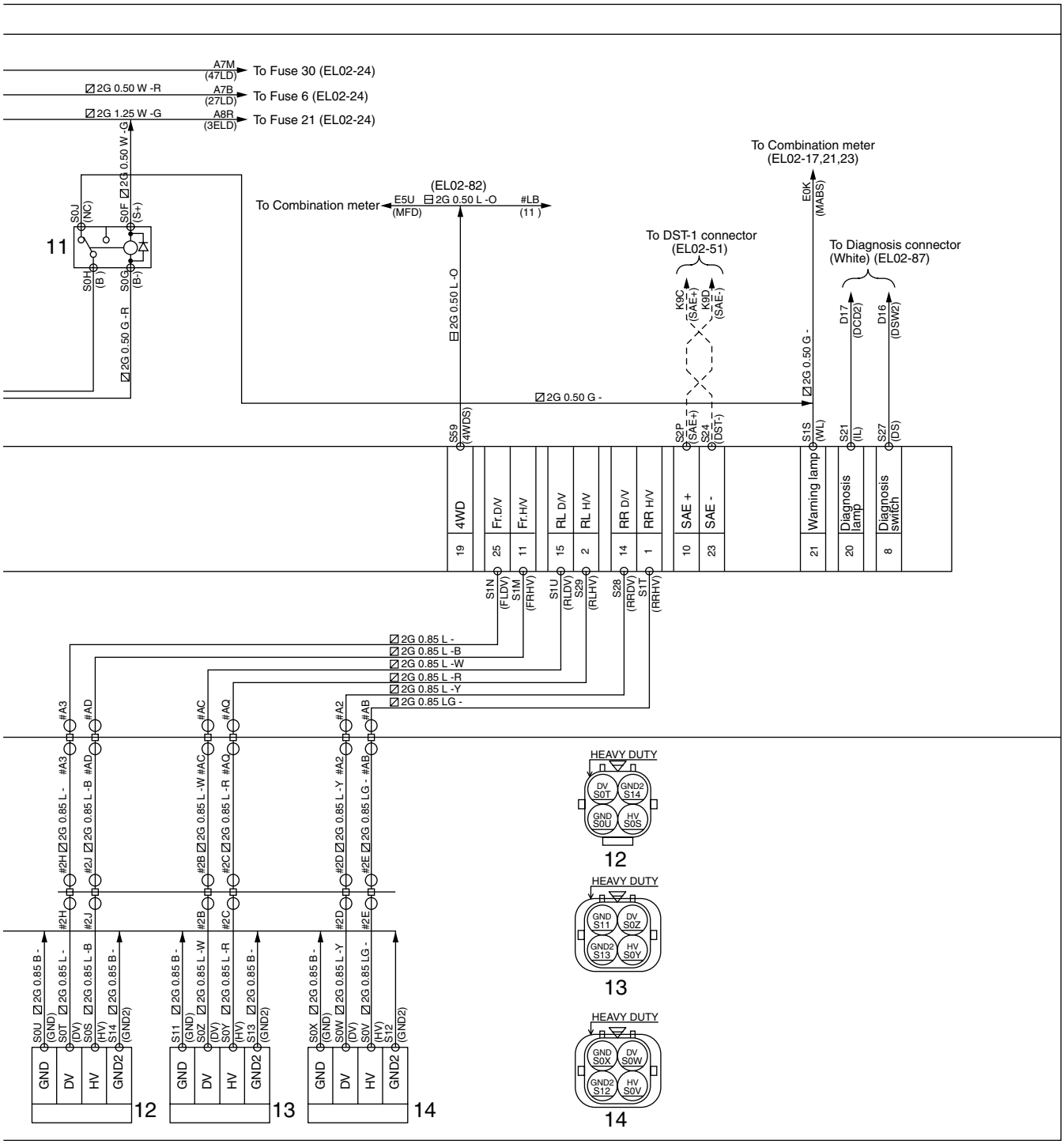
**AV. ENGINE STOP CIRCUIT (FOR LEFT-HAND DRIVE VEHICLE)**

1. Engine stop relay
2. Engine stop electric motor

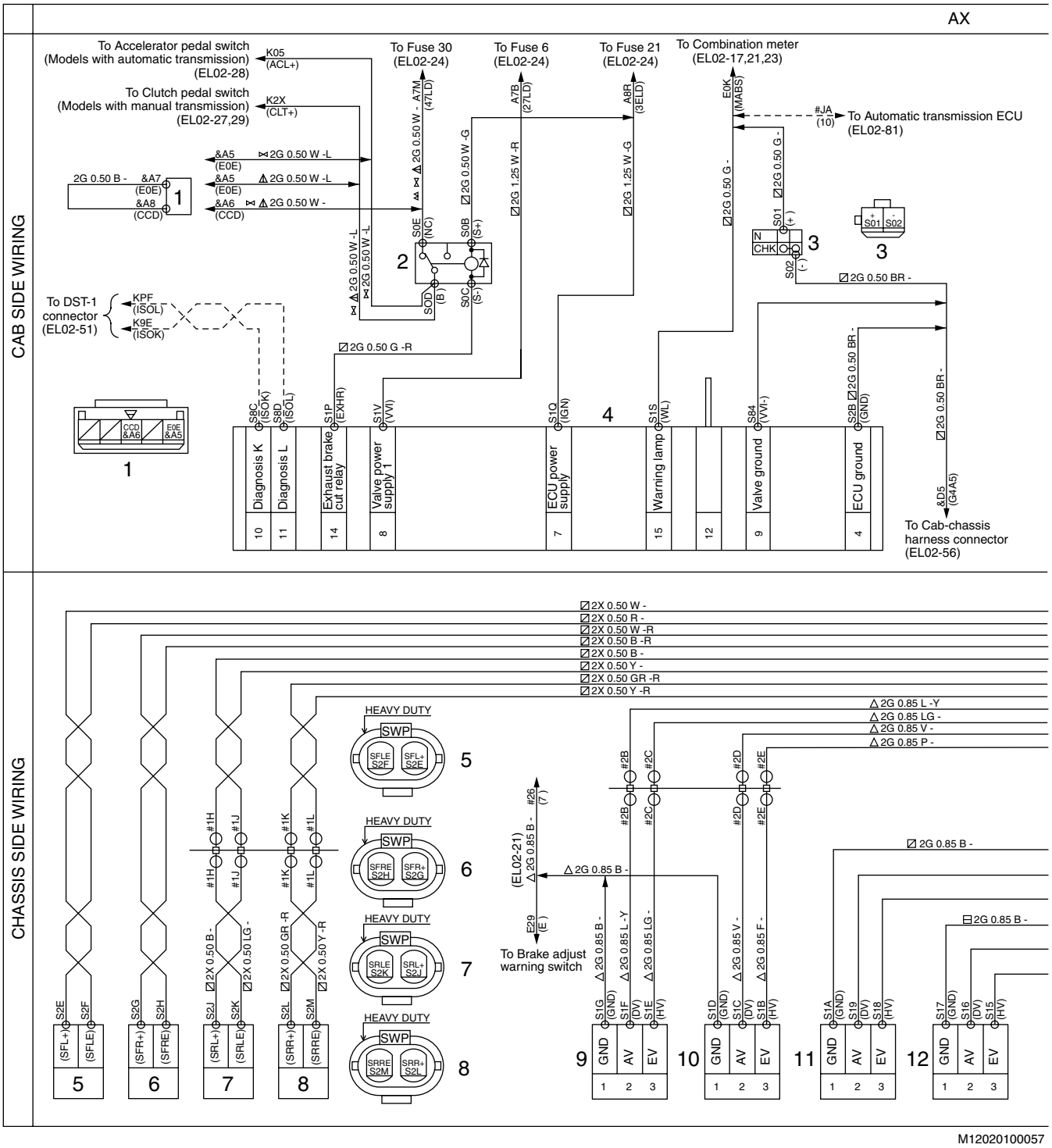



**AW. ABS CIRCUIT (MODELS FC, FD, GD, FT, GT)**

1. ABS ECU No.1
2. G-sensor
3. ABS short-circuit connector
4. Exhaust brake cut relay
5. ABS control valve relay
6. ABS ECU No.2
7. Wheel sensor (FrLH)
8. Wheel sensor (FrRH)
9. Wheel sensor (RrLH)
10. Wheel sensor (RrRH)
11. ABS warning lamp relay
12. Modulator (Fr)
13. Modulator (RrLH)
14. Modulator (RrRH)



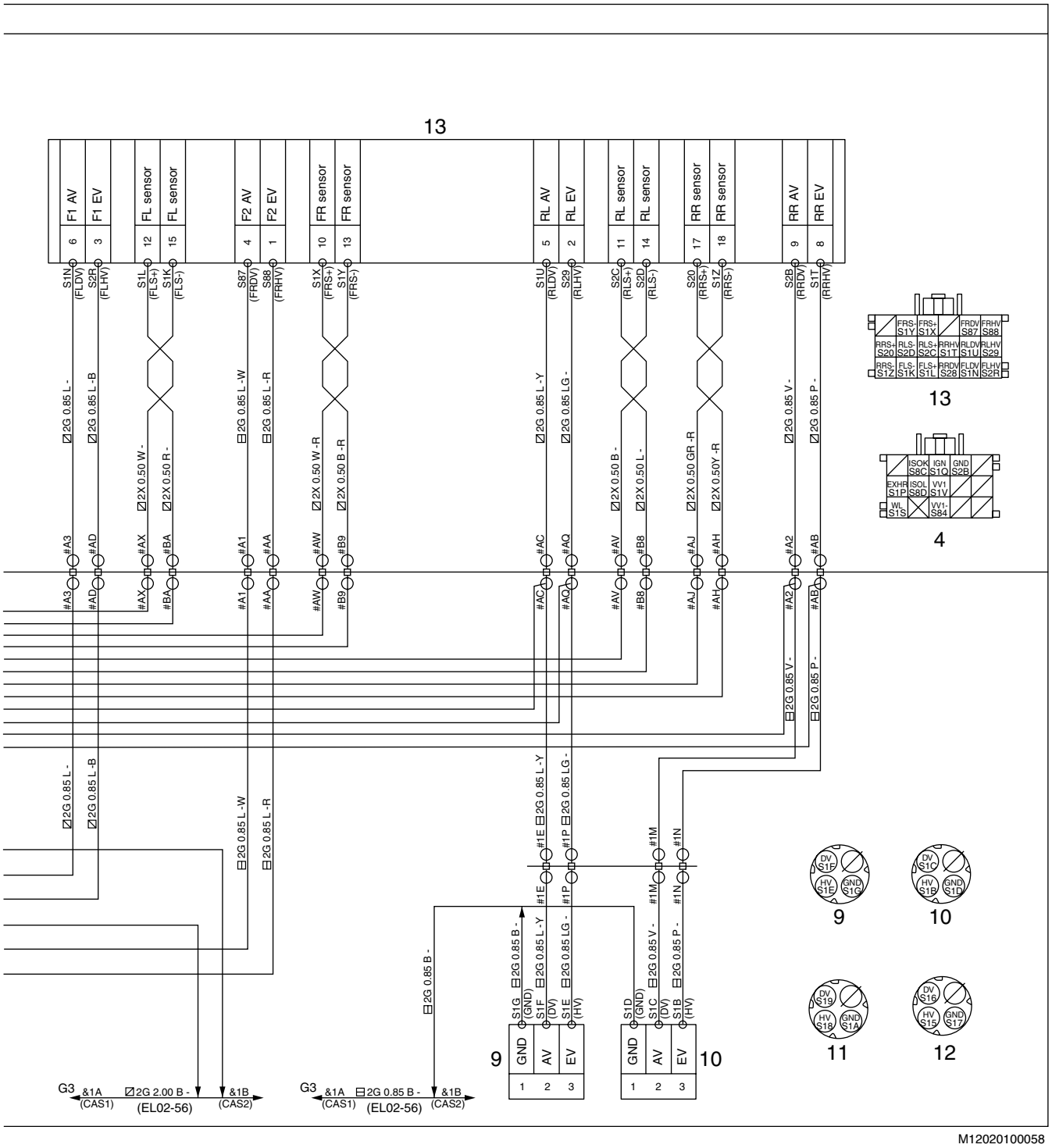

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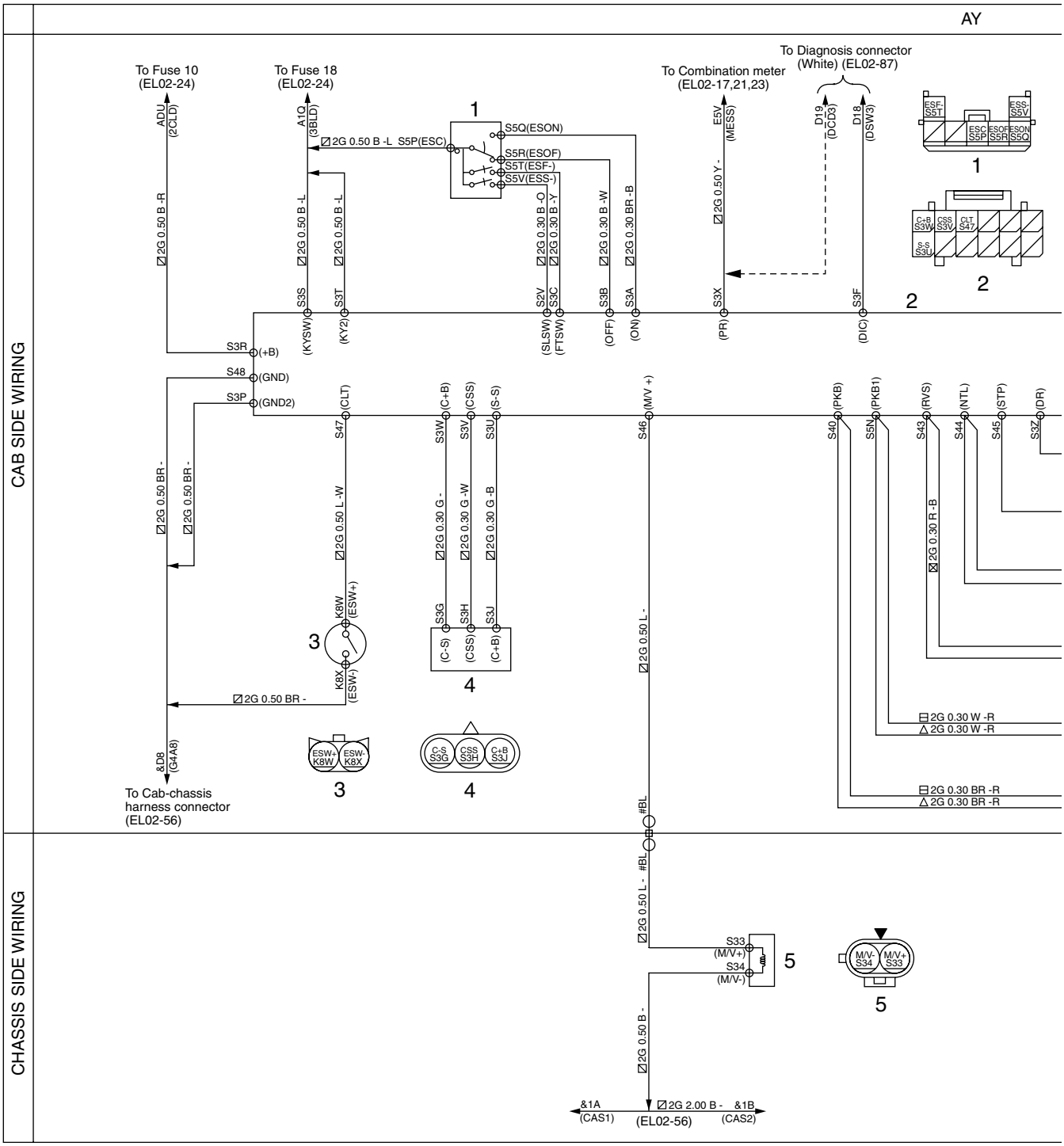

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**AX. ABS CIRCUIT (MODELS FG, GH, FL, FM, SG)**

1. ABS short-circuit connector
2. Exhaust brake cut relay
3. ABS diagnosis switch
4. ABS ECU No.1
5. Wheel sensor (FrLH)
6. Wheel sensor (FrRH)
7. Wheel sensor (RrLH)
8. Wheel sensor (RrRH)
9. Modulator (RrLH)
10. Modulator (RrRH)
11. Modulator (FrLH)
12. Modulator (FrRH)
13. ABS ECU No.2



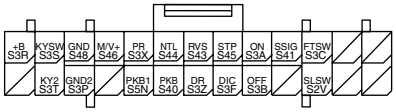

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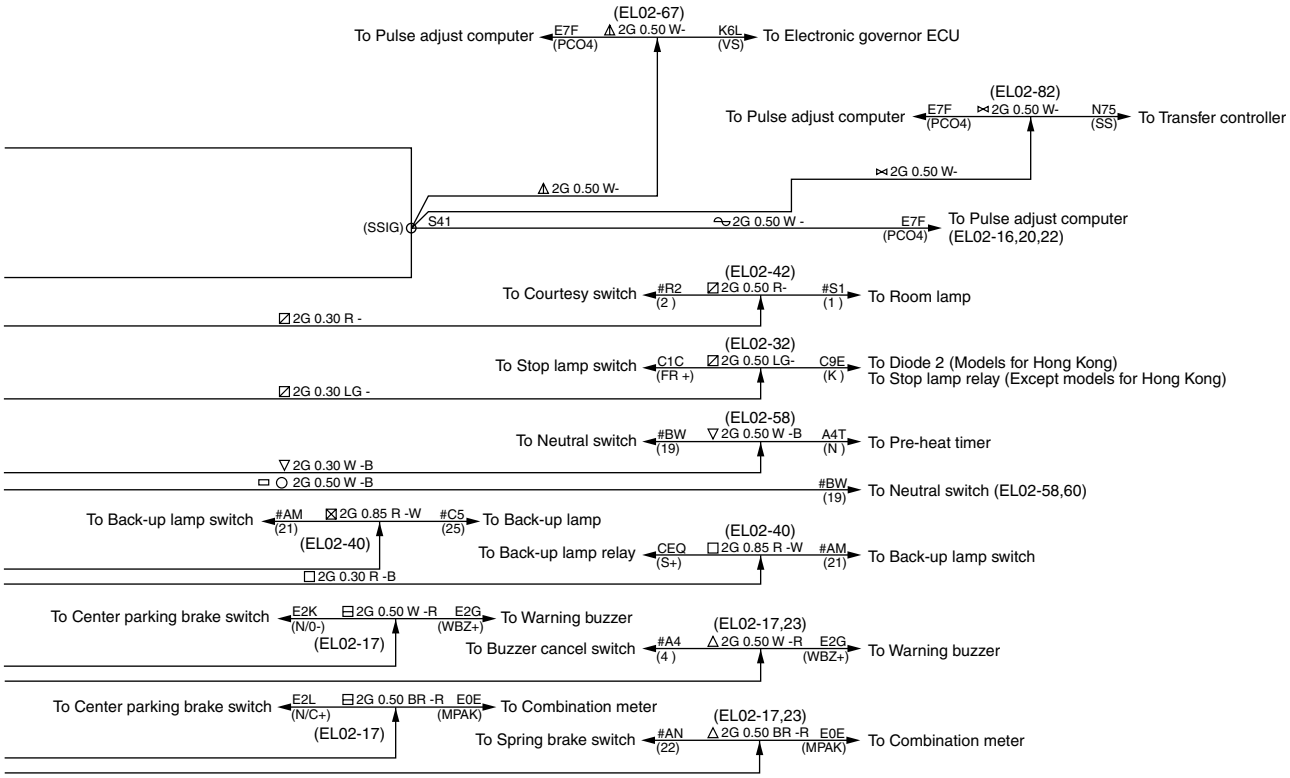



M12020100059

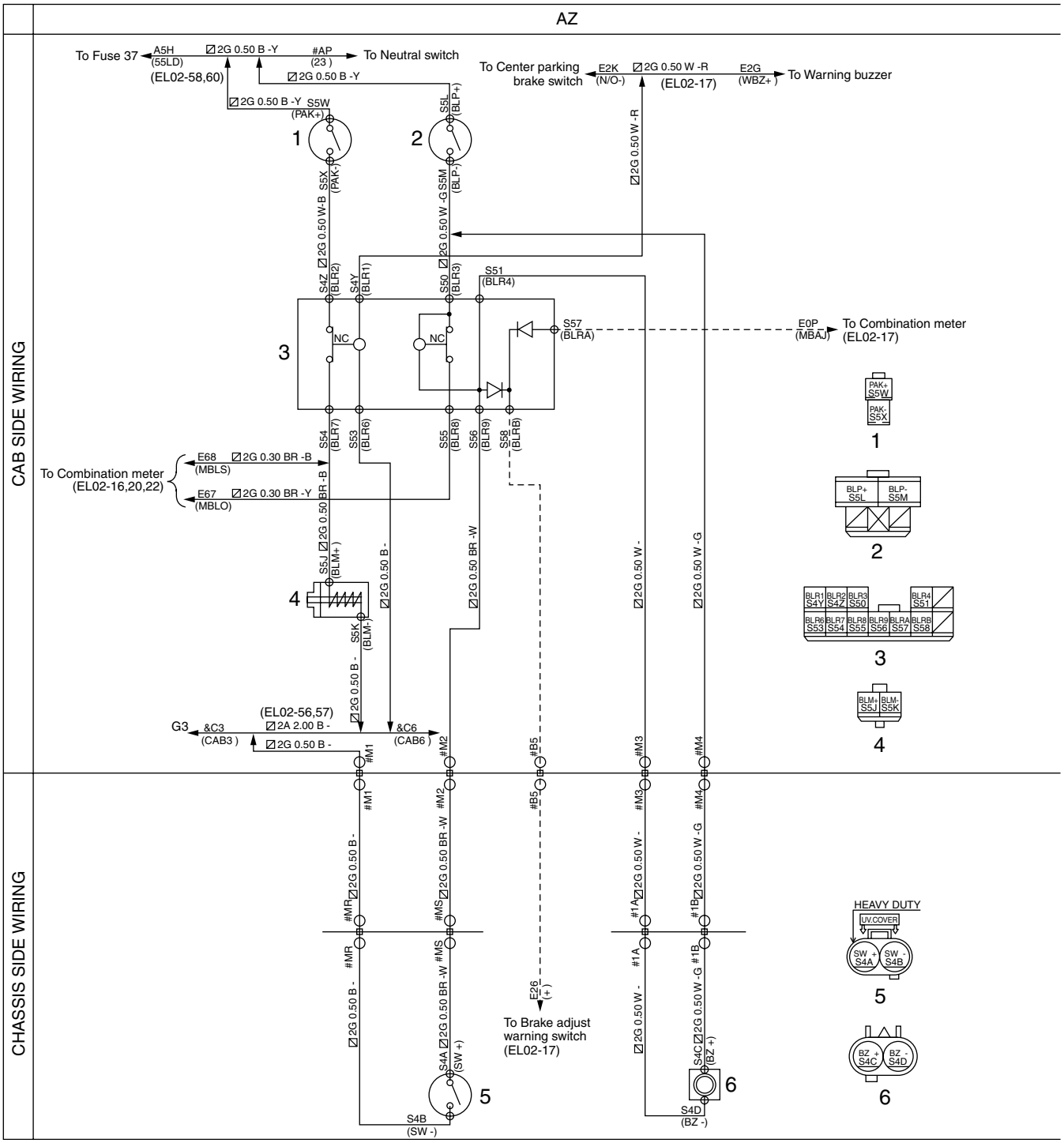
**AY. ES START SYSTEM CIRCUIT**

1. ES main switch
2. ES start controller
3. Clutch fluid pressure switch
4. Clutch pedal stroke sensor
5. ES start control valve



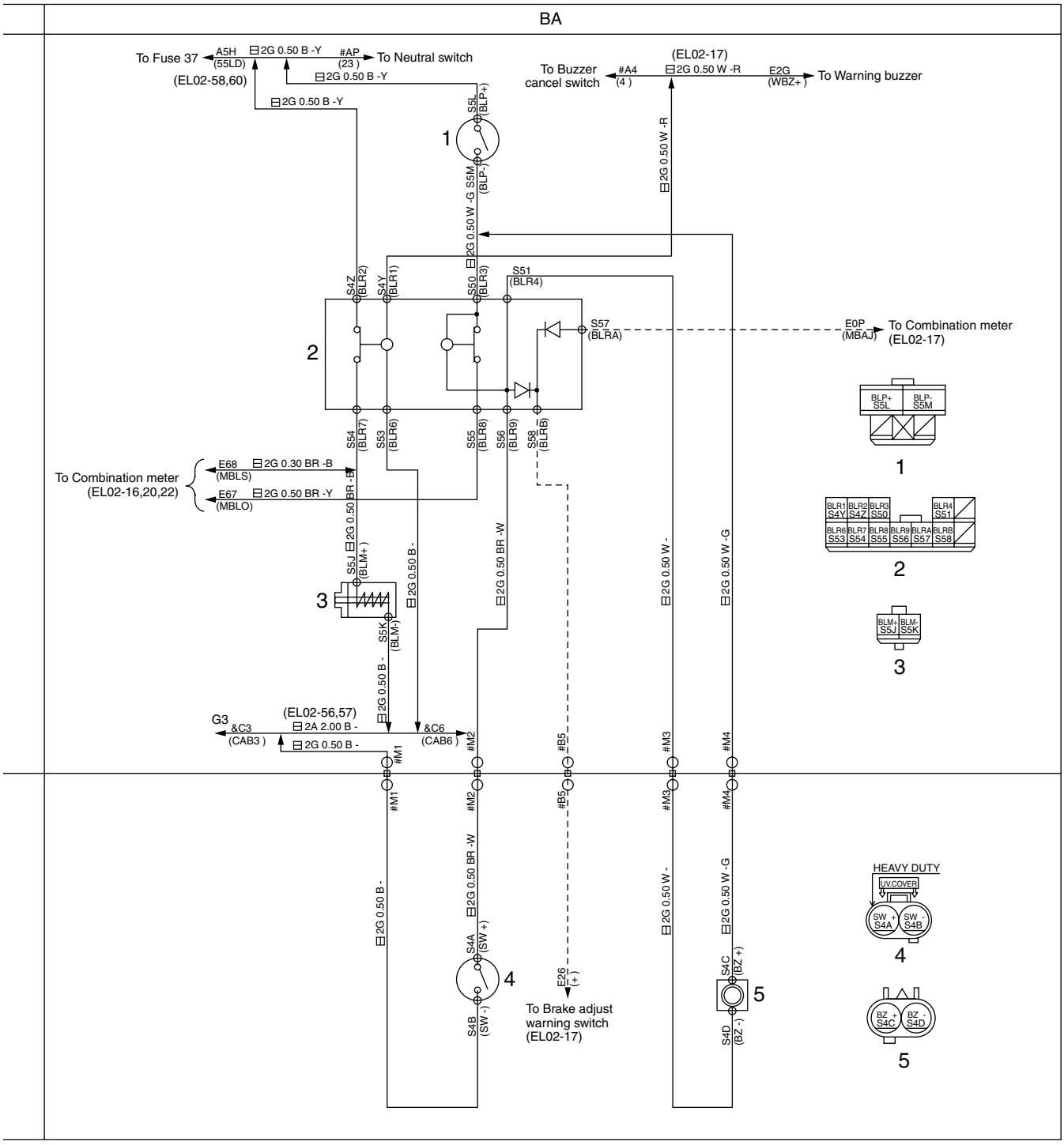

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**AZ. BRAKE-LOCK CIRCUIT (MODELS EQUIPPED WITH CENTER PARKING BRAKE)**

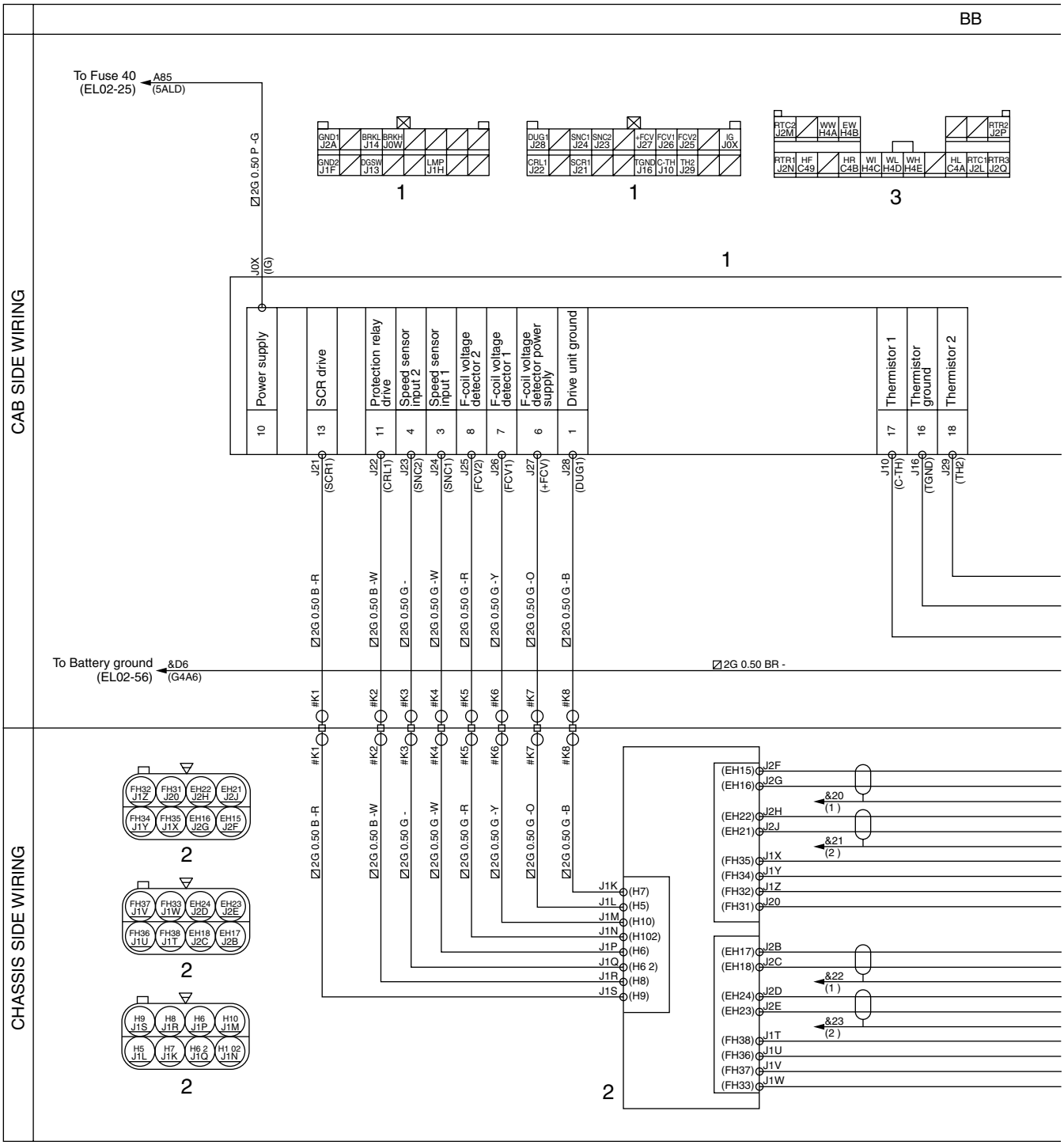
1. Parking brake lever switch
2. Brake-lock control valve position switch
3. Brake-lock relay
4. Brake-lock control magnetic valve
5. Brake-lock pressure switch
6. Brake-lock warning buzzer




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**BA. BRAKE-LOCK CIRCUIT (MODELS EQUIPPED WITH WHEEL PARKING BRAKE)**

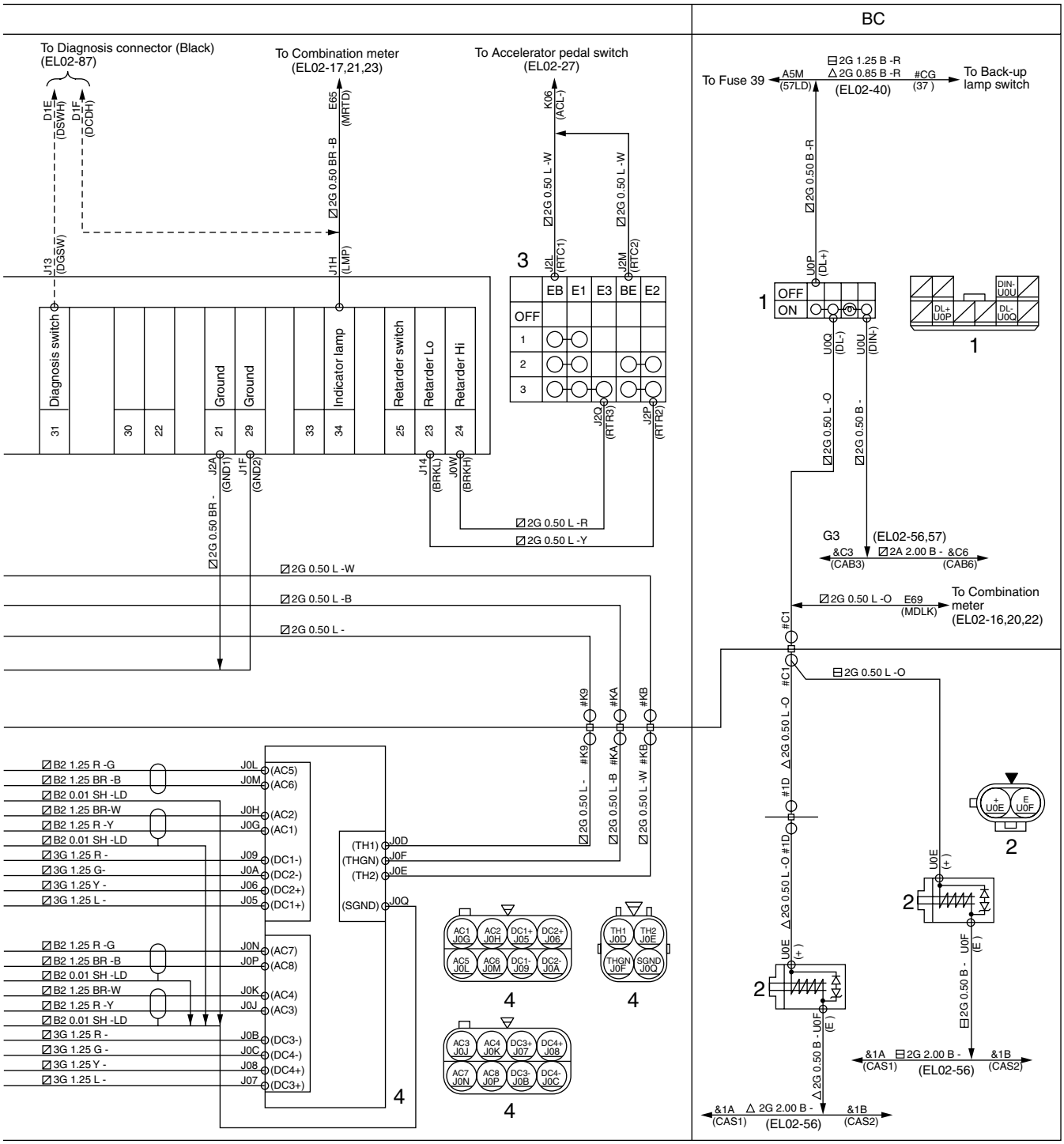
1. Brake-lock control valve position switch
2. Brake-lock relay
3. Brake-lock control magnetic valve
4. Brake-lock pressure switch
5. Brake-lock warning buzzer




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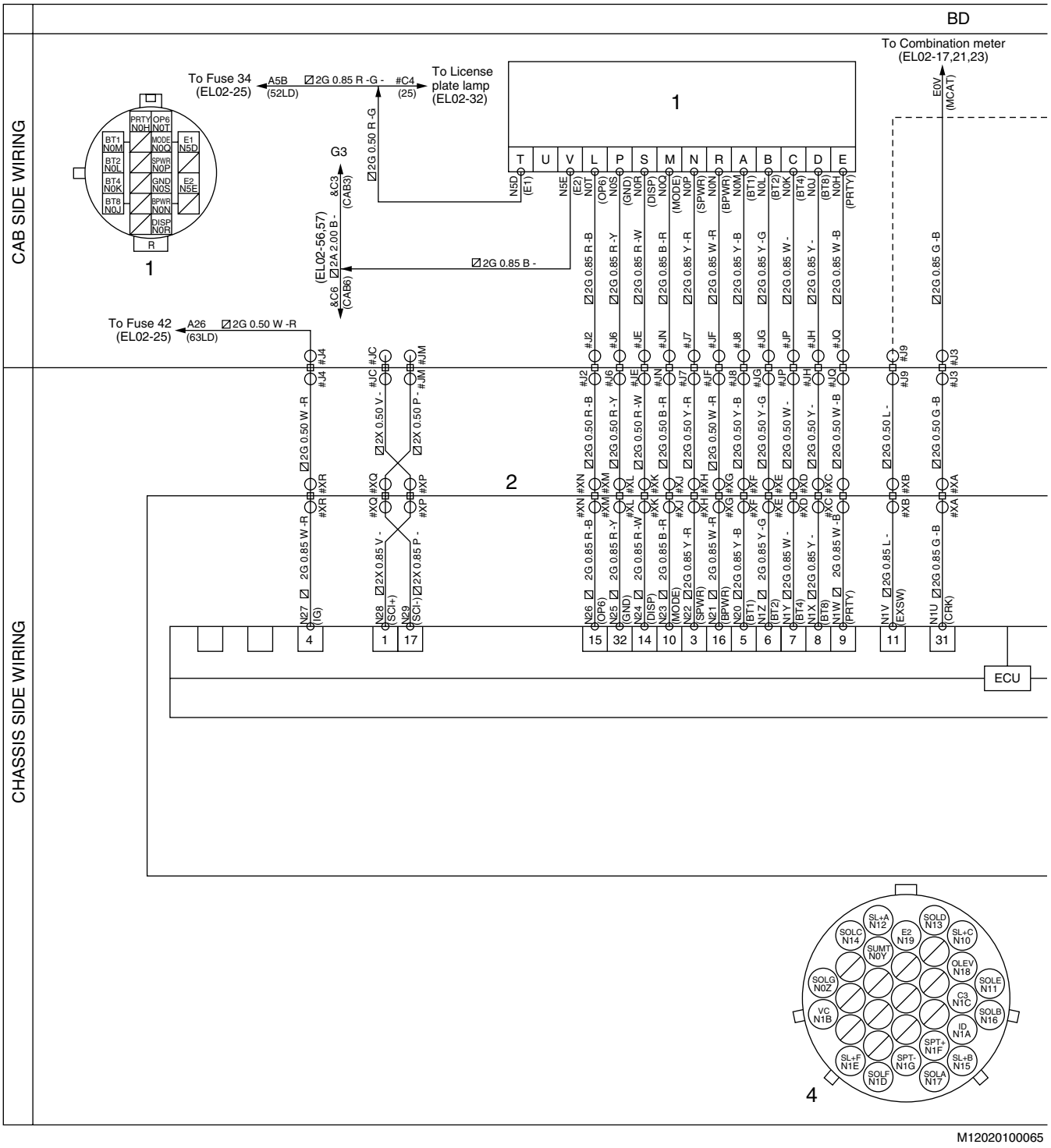
**BB. ELECTROMAGNETIC RETARDER CIRCUIT**

1. Electromagnetic retarder control unit
2. Electromagnetic retarder drive unit
3. Electromagnetic retarder switch
4. Electromagnetic retarder main unit




**BC. INTER-AXLE DIFFERENTIAL LOCK CIRCUIT**

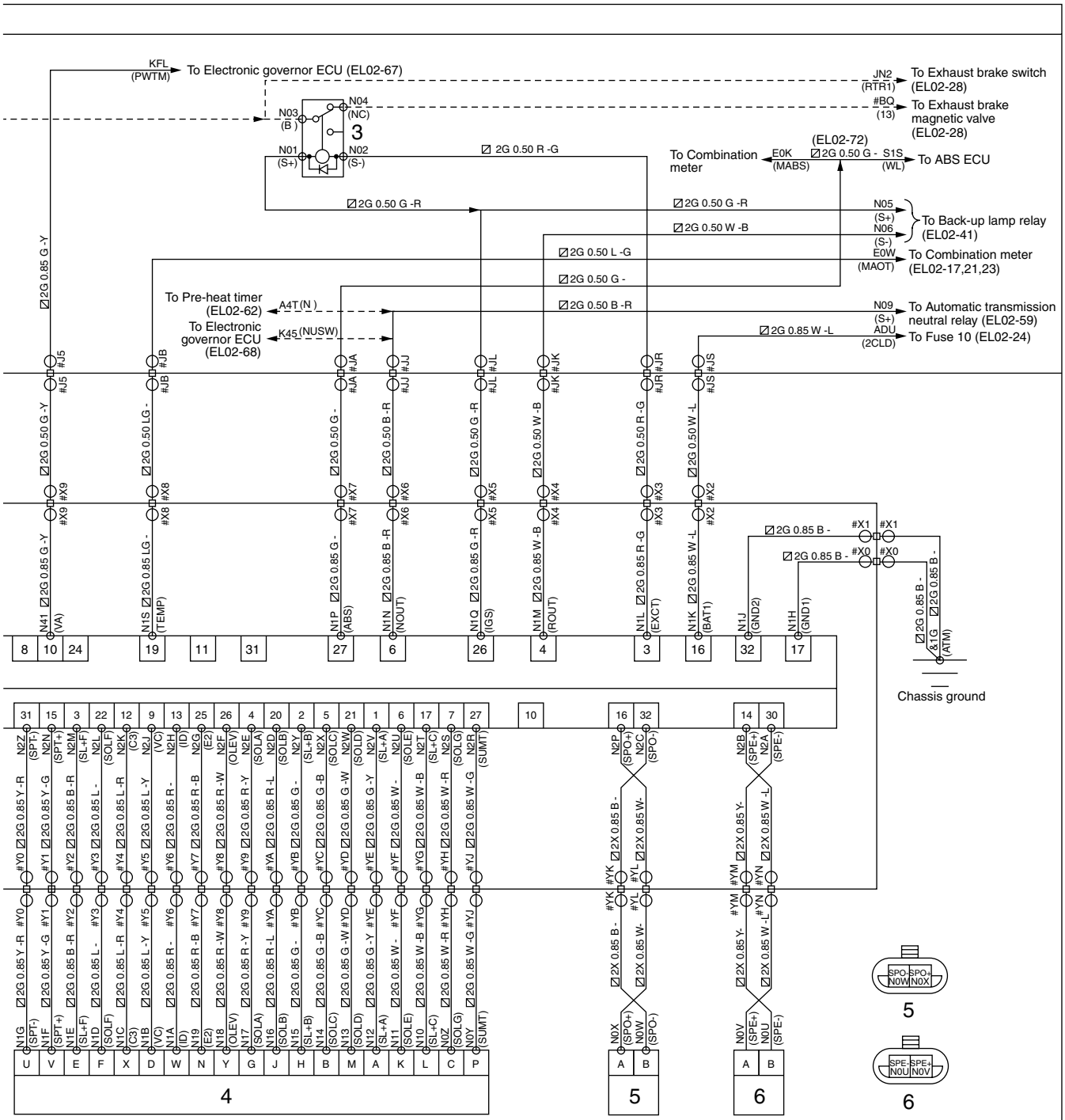
1. Differential lock switch
2. Differential lock magnetic valve



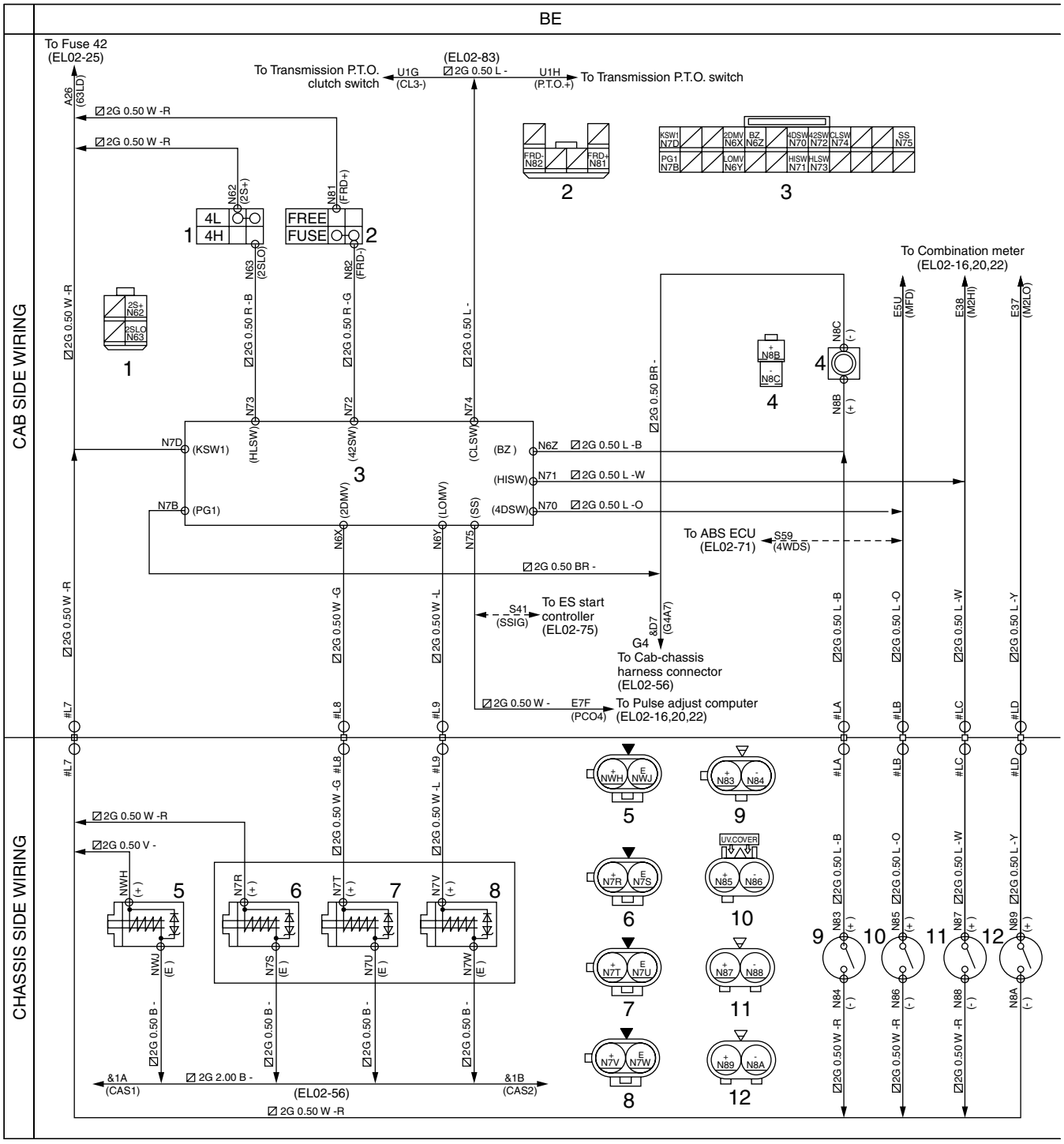

M12020100065

**BD. AUTOMATIC TRANSMISSION CIRCUIT**

1. Automatic transmission shift selector
2. Automatic transmission ECU
3. Exhaust brake cut relay
4. Automatic transmission main unit
5. Output speed sensor
6. Engine revolution sensor



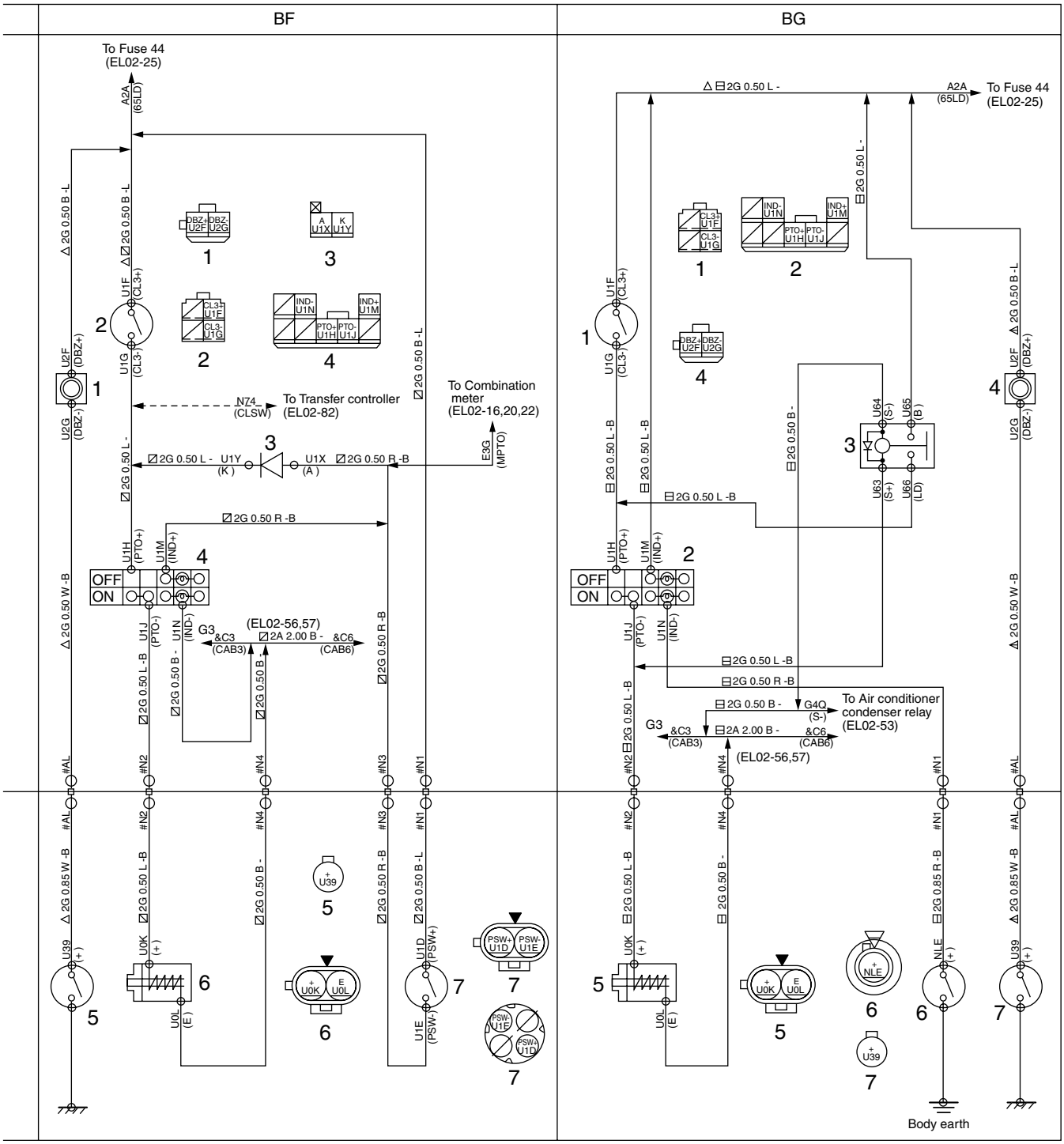

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**BE. TRANSFER CONTROL CIRCUIT**

1. Transfer Low-High selector switch
2. 4WD selector switch
3. Transfer controller
4. Transfer warning buzzer
5. Low position magnetic valve
6. Transfer control magnetic valve
7. 4WD/2WD magnetic valve
8. Transfer Low-High magnetic valve
9. Neutral switch
10. 4WD position switch
11. High position switch
12. Low position switch

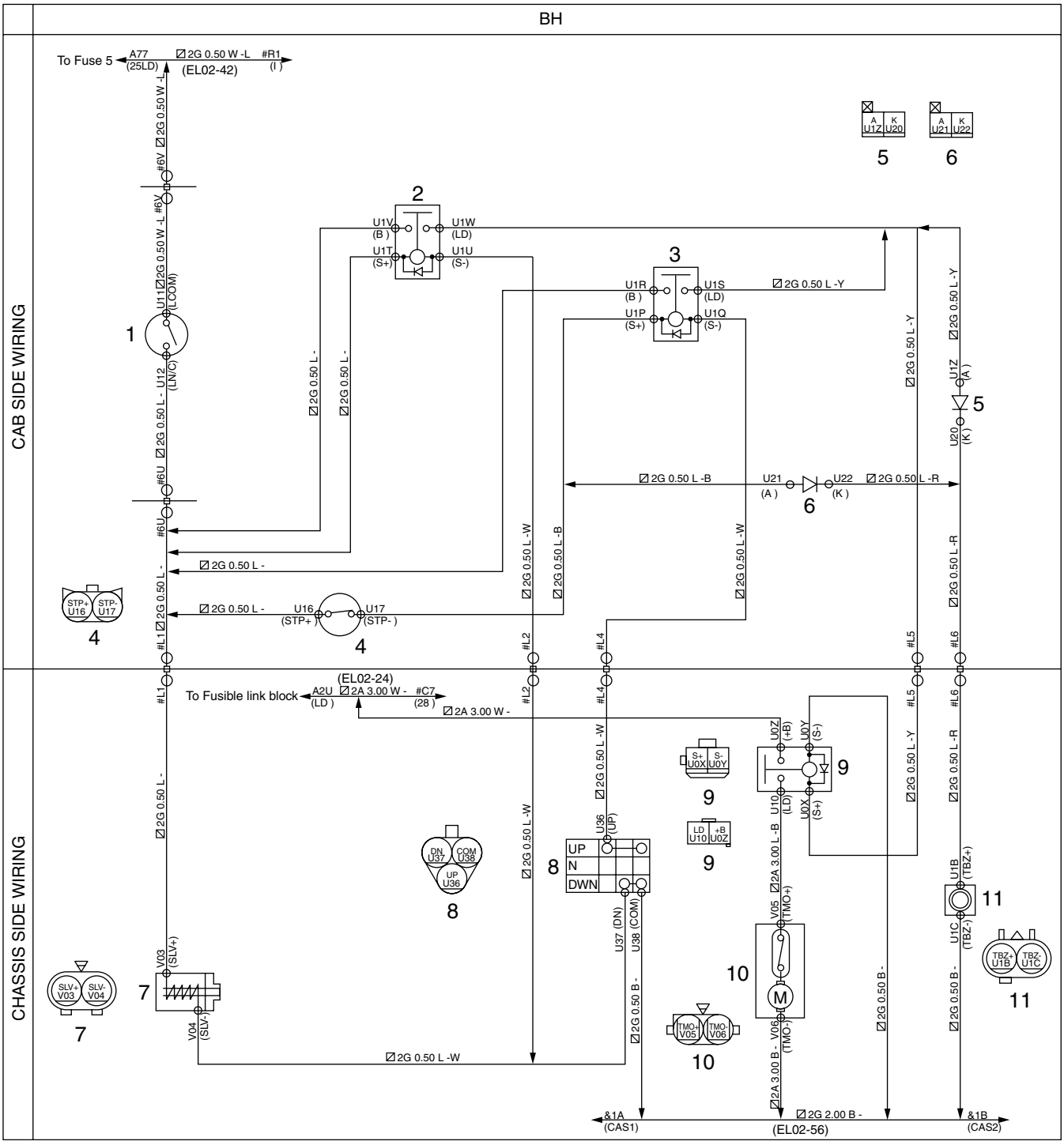



**BF. TRANSMISSION P.T.O. CONTROL CIRCUIT (EXCEPT FOR MODELS WITH EATON FS6109/8209 TRANSMISSION)**

1. Dump warning buzzer
2. Clutch pedal switch
3. P.T.O. diode
4. Transmission P.T.O. switch
5. Dump up switch
6. P.T.O. magnetic valve
7. P.T.O. position switch

**BG. TRANSMISSION P.T.O. CONTROL CIRCUIT (MODELS WITH EATON FS6109/8209 TRANSMISSION)**

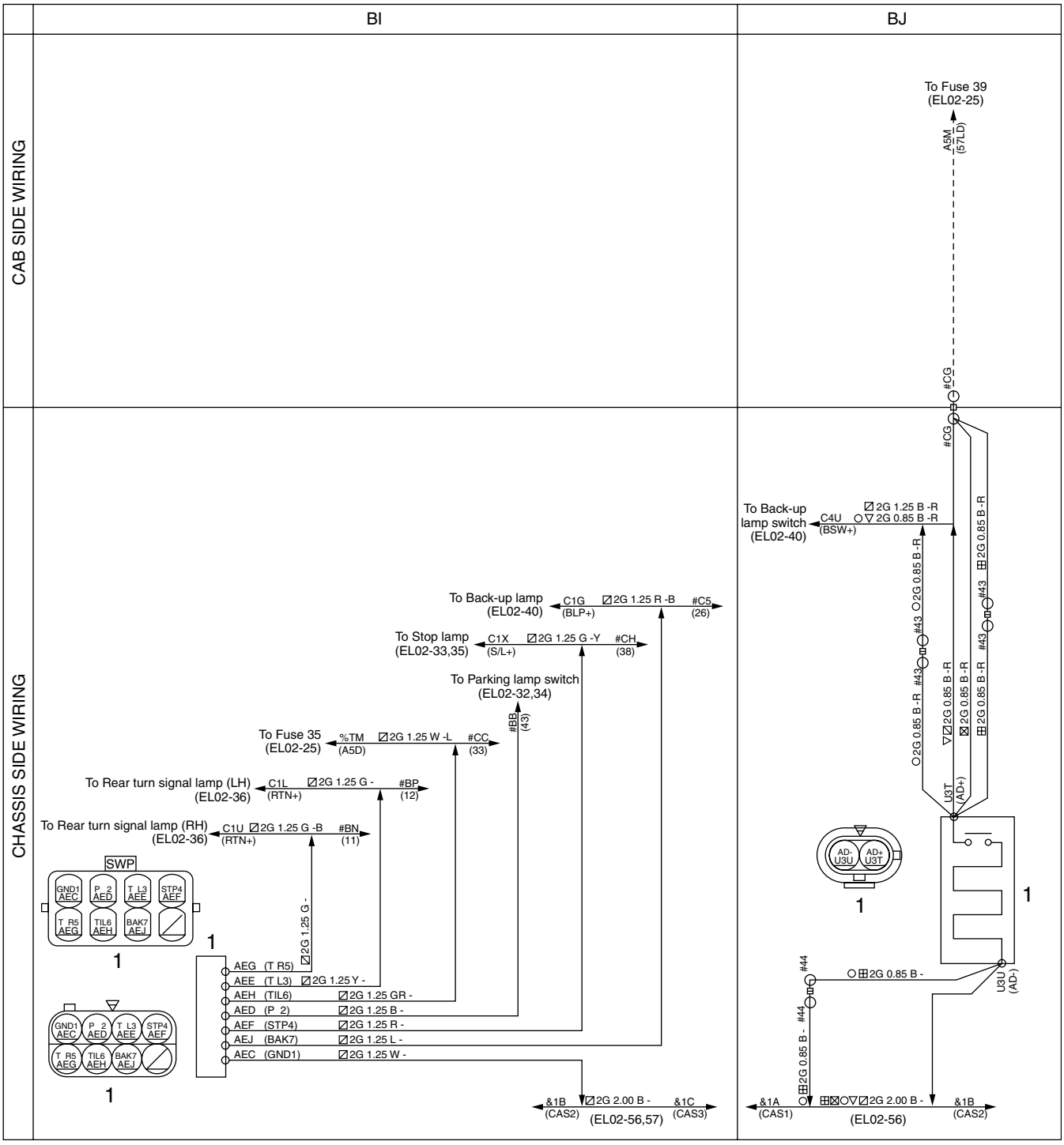
1. Clutch pedal switch
2. Transmission P.T.O. switch
3. P.T.O. relay
4. Dump warning buzzer
5. P.T.O. magnetic valve
6. Transmission P.T.O. switch
7. Dump up switch




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**BH. CAB TILT CIRCUIT (MODELS FOR DOUBLE CAB)**

1. Cab tilt lock switch
2. Cab tilt down relay
3. Cab tilt up relay
4. Cab tilt stopper switch
5. Cab tilt diode No.1
6. Cab tilt diode No.2
7. Cab tilt magnetic valve
8. Cab tilt switch
9. Cab tilt relay
10. Cab tilt motor
11. Cab tilt warning buzzer



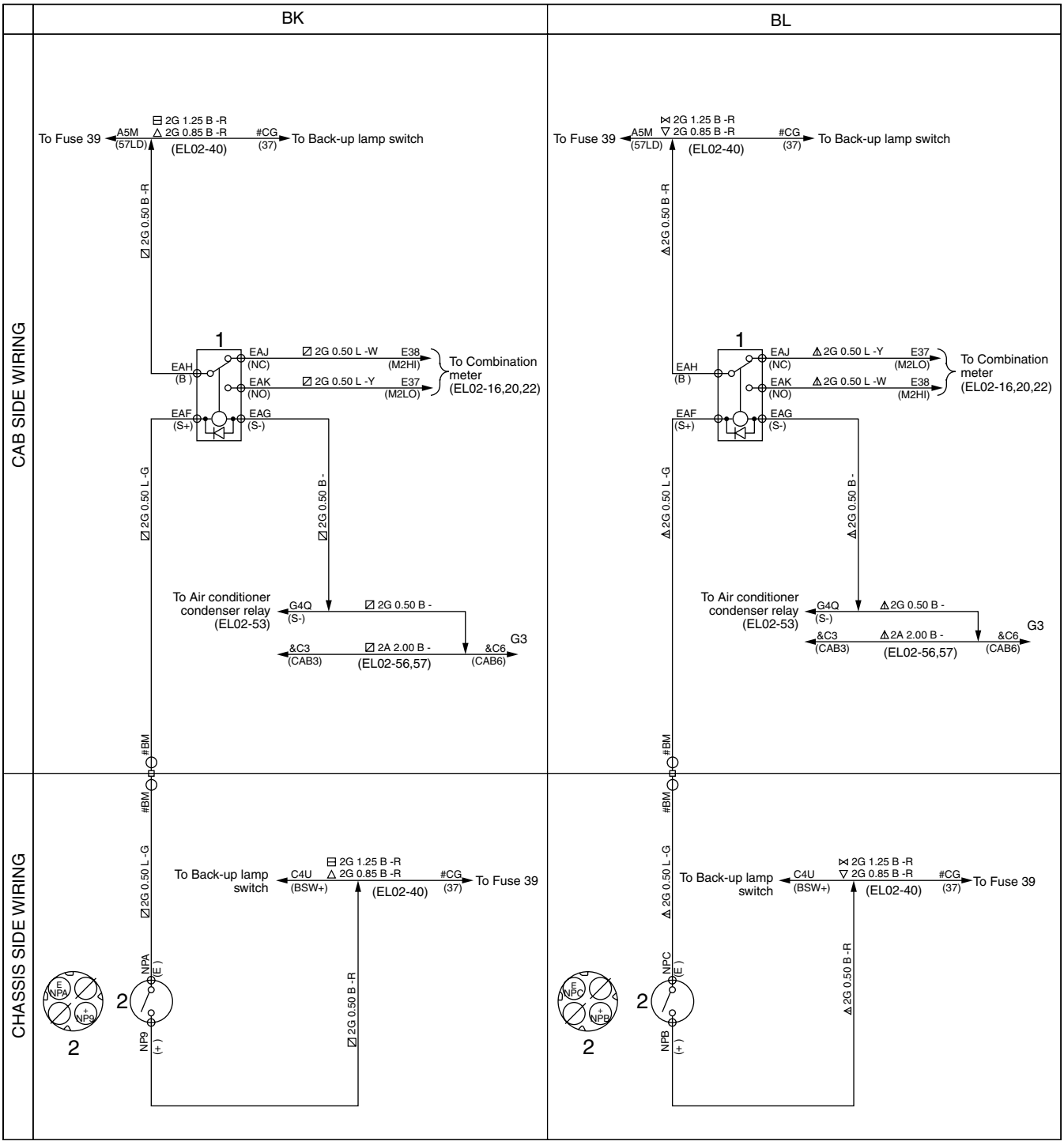

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**BI. TRAILER CONNECTOR CIRCUIT**

1. Trailer socket

**BJ. AIR DRIER CIRCUIT**

1. Air drier



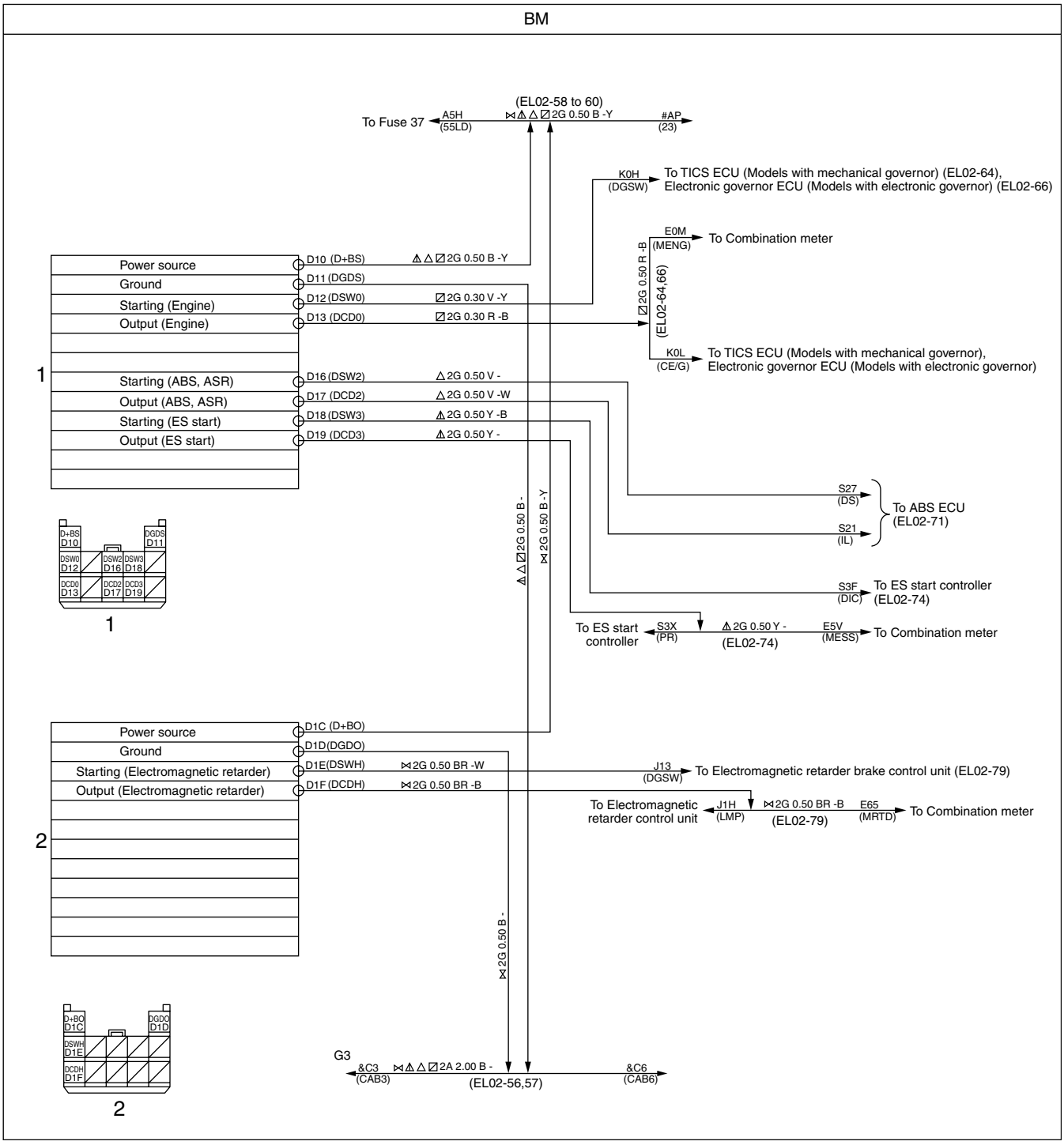

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**BK. TRANSMISSION CONTROL CIRCUIT (MODELS WITH EATON FS6109/8209 TRANSMISSION)**

1. LO-HI indicator lamp relay
2. Range LO switch

**BL. TRANSMISSION CONTROL CIRCUIT (MODELS WITH ZF 9S109 TRANSMISSION)**

1. LO-HI indicator lamp relay
2. Range LO switch




M12020100072

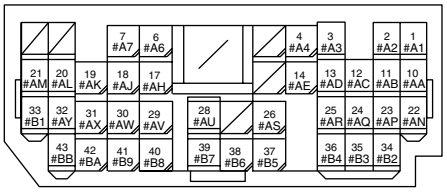
**BM. DIAGNOSIS MONITOR CIRCUIT**

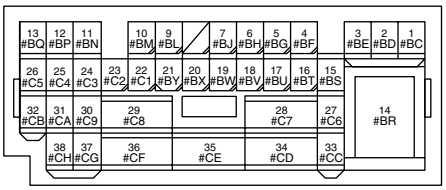
1. Diagnosis connector (White)
2. Diagnosis connector (Black)

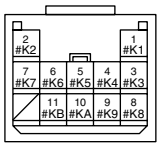
# WIRE TO WIRE CONNECTOR

M12020101BEJ1004

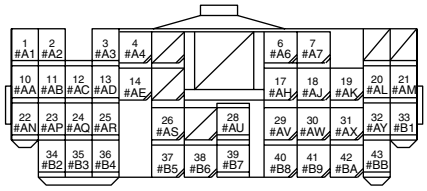
CAB HARNESS

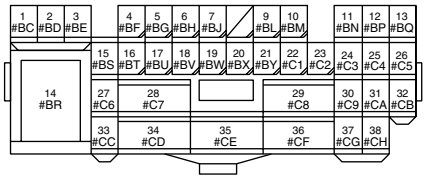


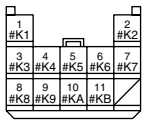



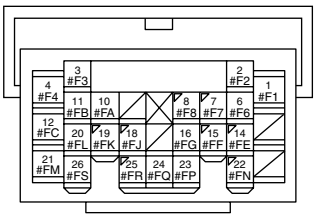

CHASSIS HARNESS

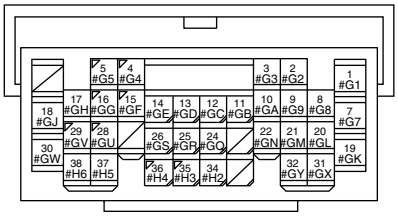


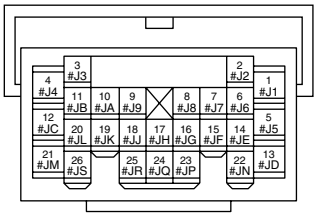



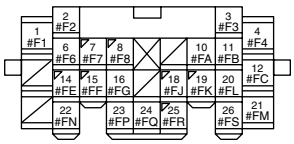



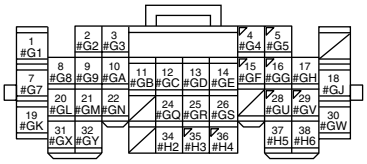

M12020100106

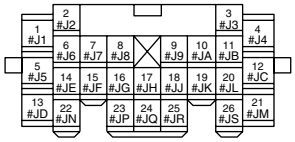


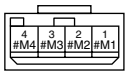



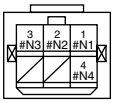



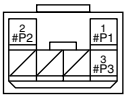



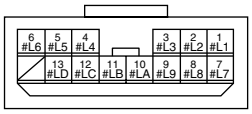

M12020100107

CAB HARNESS



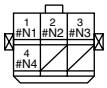



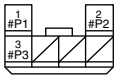



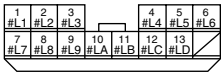




CHASSIS HARNESS



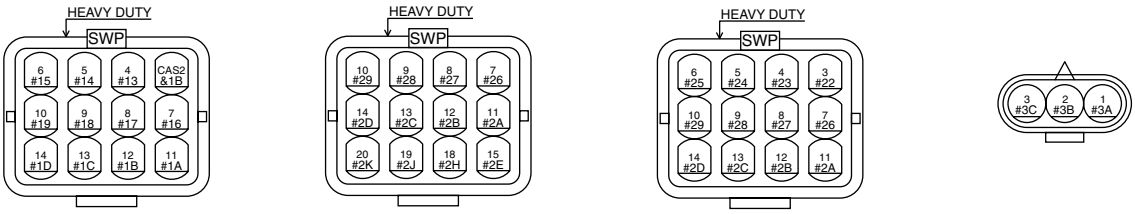



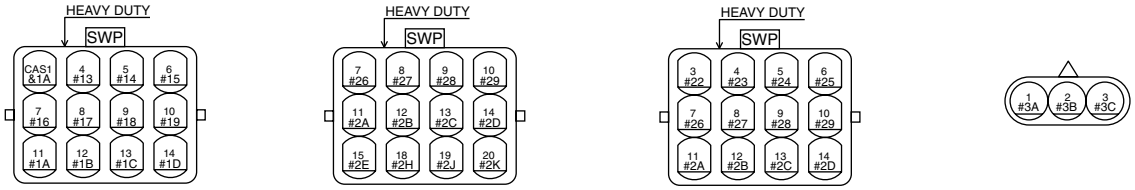




M12020100108

CHASSIS HARNESS

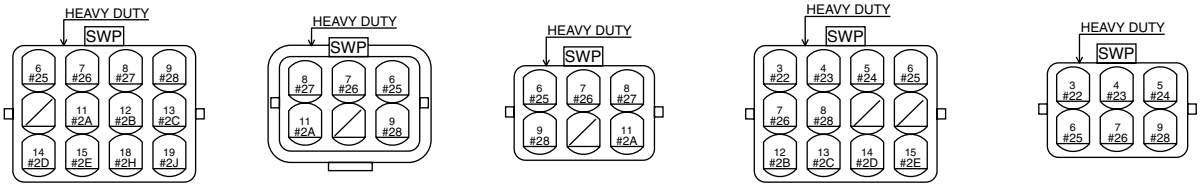



FRONT HARNESS

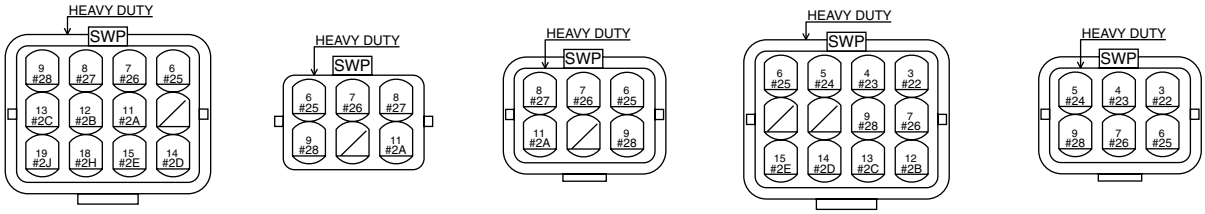



M12020100109

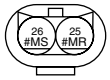
CHASSIS HARNESS




FRONT HARNESS




M12020100110

| | |
|---|---|
| FRONT HARNESS |  |
| AUTOMATIC TRANSMISSION HARNESS |  |

M12020100111

# BRAKE CONTROL (ABS: AKEBONO BRAKE MAKE)

DN03-001

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# ANTI-LOCK BRAKE

## INSPECTION

## (ABS SYSTEM OPERATION AND FAILURE DIAGNOSTICS)

M16030101BEF2001

### ABS SYSTEM REGULAR INSPECTION

Inspect the operation of the ABS system once per year in accordance with the procedure below.

### OPERATION STATUS INSPECTION

Refer to the section below "OPERATION STATUS INSPECTION" for information on the inspection procedure. If this inspection reveals any malfunctions, be sure to carry out next inspection.

### OPERATION STATUS INSPECTION

**1. PREPARATION BEFORE INSPECTION**

(1) With the vehicle stopped, step on the brake pedal and check for air leakage from the ABS control valves. If air leaking from the pipe connectors is found by applying soapy water, or the like, correct the problem by tightening the connectors or take a similar corrective action. Also, if air is leaking from the ABS control valve body, replace the ABS control valve.

(2) Release the brake pedal and inspect the exhaust status of the ABS control valves.
The above inspection should be carried out on all ABS control valves.

**2. ABS OPERATION STATUS INSPECTION IN TEST DRIVE**

**NOTICE:**

**When inspecting the ABS operation status in a test drive, exercise caution with regard to the following points.**

- **Use a large, safe area for the test.**
- **Conduct the test with nothing loaded on the vehicle.**
- **Apply white tape, or the like, to the sides of the front and rear wheels to enable you to determine the wheel's rotational status.**

(1) Turn the starter switch "ON". Confirm that the ABS warning lamp lights and then goes off.

(2) Start driving the vehicle and, accelerate to a speed of vehicle to 20 - 30 km/h {12.4 - 18.6 mile/h}, then apply the brakes hard. Confirm that none of the wheels are locked.

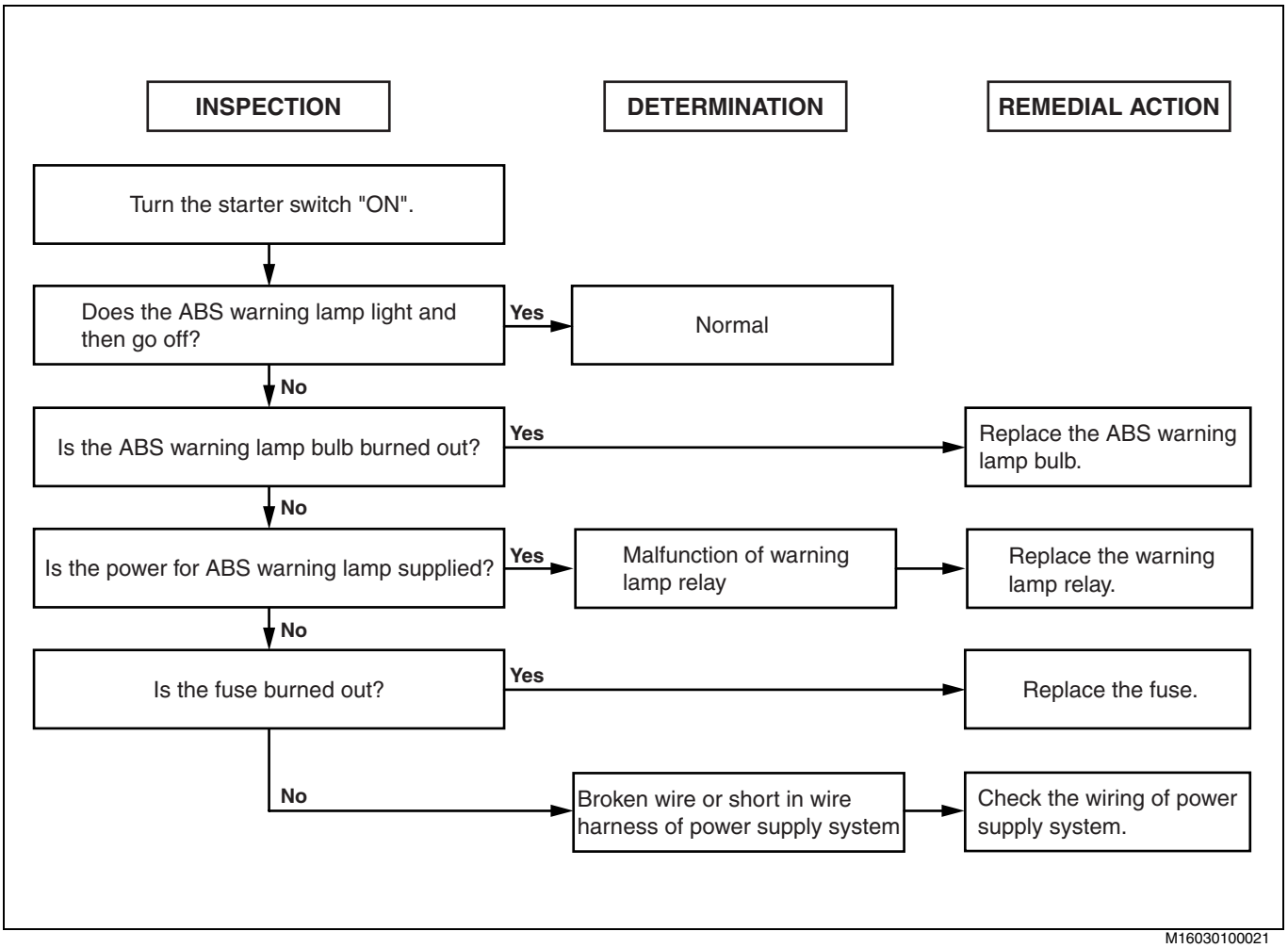
## FAILURE DIAGNOSTICS BASED ON ILLUMINATION OF WARNING LAMPS

| LIT LAMP | CAUSE OF MALFUNCTION | FAIL-SAFE FUNCTION |
|---|---|---|
| ABS warning lamp (Lamp lights while driving vehicle.) | POWER SUPPLY RELATED<br>• Fuse burned out<br>• Wire harness connector disconnected<br>• Bad contact with wire harness<br>• Wire broken in wire harness<br>• Low battery voltage | Entire ABS system becomes non-functional. (Brakes of all wheels return to normal braking operation.) |
| | WHEEL SENSOR RELATED<br>• Sensor clearance too wide<br>• Bad sensor unit<br>• Broken wire in wire harness<br>• Wire harness connector disconnected or bad contact. | ABS becomes nonfunctional on wheels in the system where sensor malfunctioned, and those wheels return to normal braking operation. |
| | ABS CONTROL VALVE RELATED<br>• Wire broken or short circuit in solenoid coil<br>• Broken wire in wire harness of ABS control valve, wire harness connector disconnected, bad contact | ABS becomes non-functional on wheel in the system where ABS control valve malfunctioned, and those wheel return to normal braking operation. |
| | COMPUTER<br>• Internal malfunction in computer | ABS becomes non-functional on wheel in the system controlled by faulty computer, and those wheels return to normal braking operation. |

**NOTICE:**
**The ABS warning lamp may remain lit if the ABS system experiences a temporary malfunction and then recovers. Should this occur, reset it by turn "LOCK" the starter switch temporarily while the vehicle is stopped.**

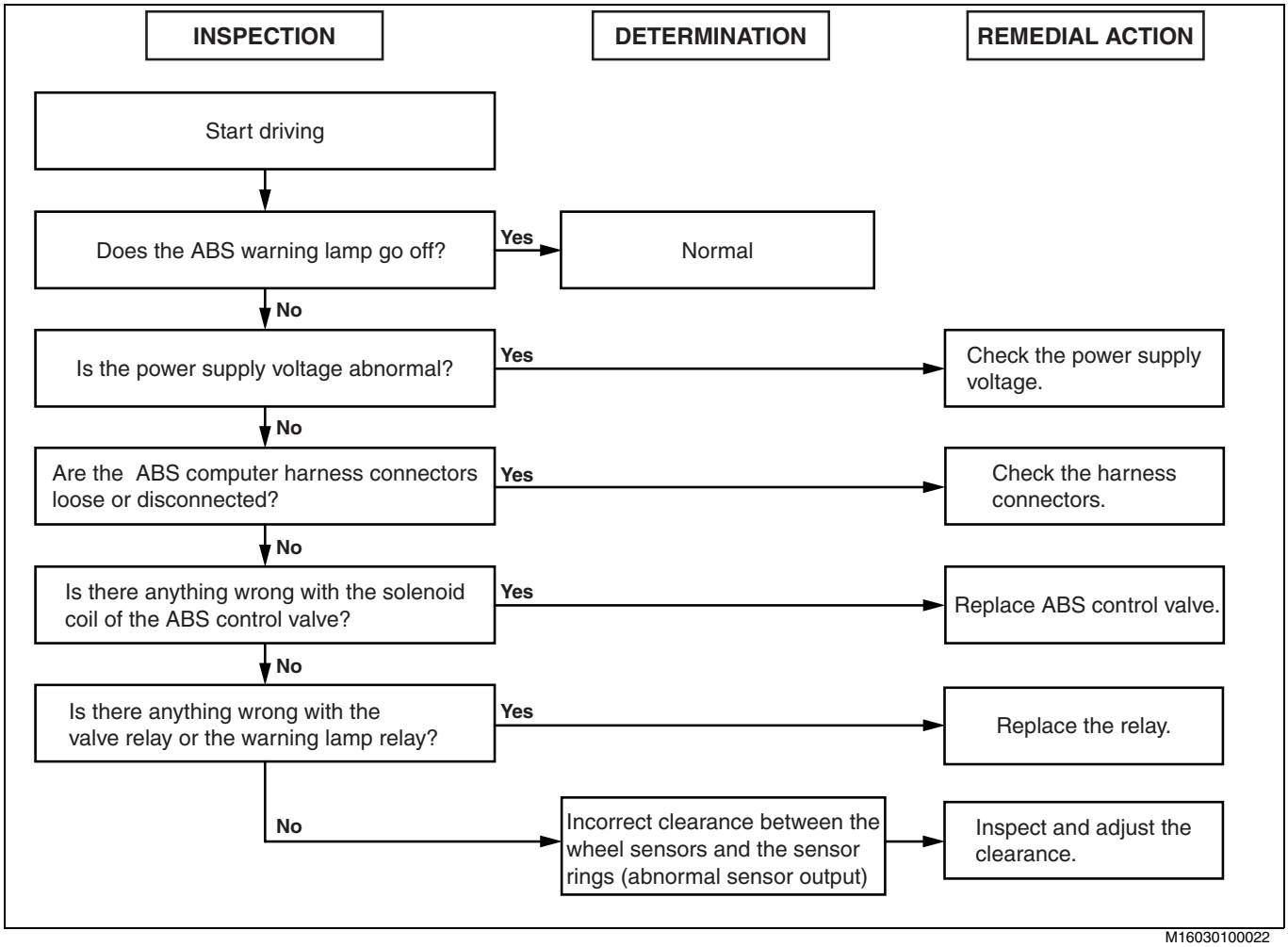
## ABS SYSTEM FAILURE DIAGNOSTICS FLOWCHART

### 1. WHEN THE ENGINE IS STARTED UP



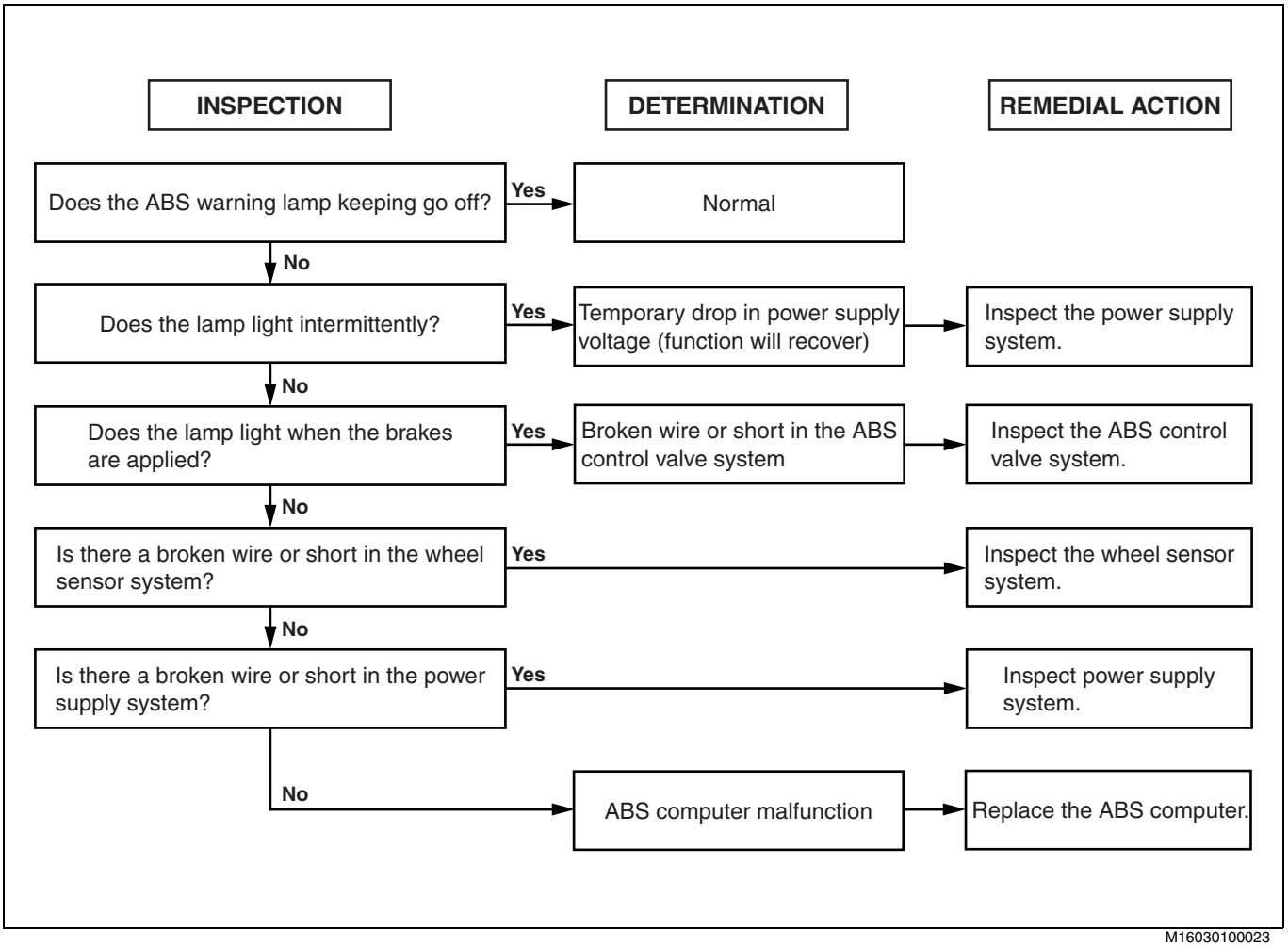

M16030100021

**2. WHEN STARTING TO DRIVE**




M16030100022

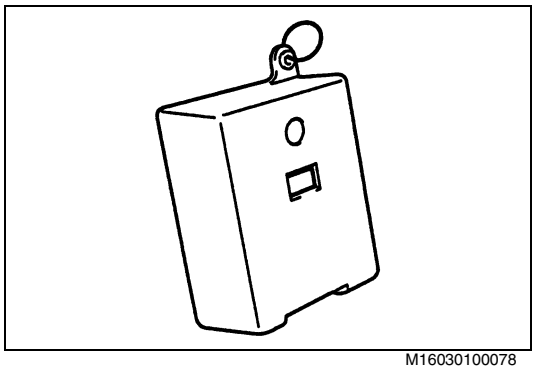
### 3. WHILE DRIVING AND BRAKING




M16030100023

# DIAGNOSIS USING THE DIAGNOSIS MONITOR

M16030101BEF2043

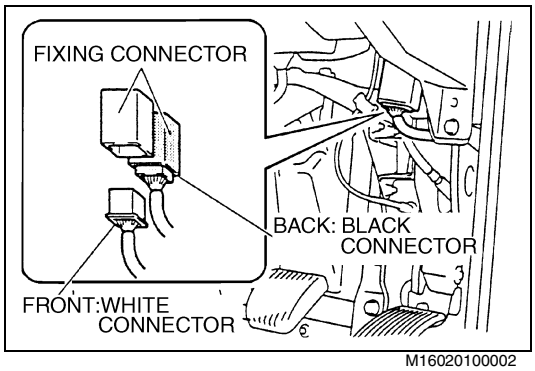


M16030100078

**1. CONNECT THE DIAGNOSIS MONITOR.**
**SST: Diagnosis monitor (09630-1370)**

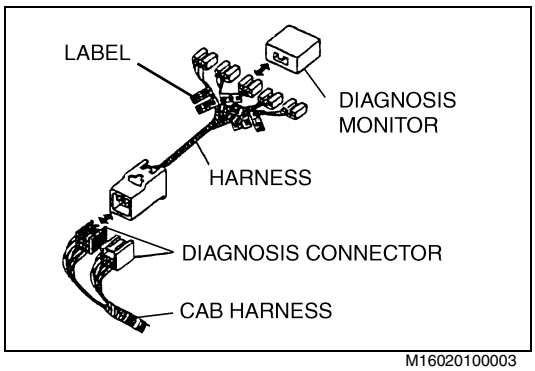
**NOTICE:**
**Trouble diagnosis can be performed using the diagnosis monitor. The malfunction codes are indicated by sound and light.**

(1) Turn the starter switch to the "ON".




M16020100002

(2) Connect the harness to the diagnosis connector.
**SST: Harness (09630-2300)**




M16020100003

(3) Connect the diagnosis monitor to the connector which tagged a "STD: ABS/ASR" label.

**2. READ OUT THE MALFUNCTION CODE.**

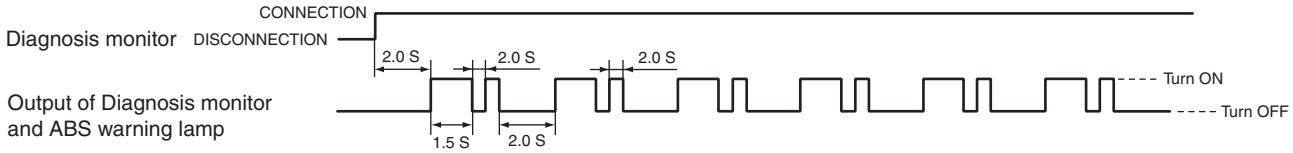
(1) Check the diagnosis monitor or ABS warning lamp flashes on and off to inform the malfunction codes.

(2) Read out the malfunction codes and write down the malfunction codes that are displayed.

**NOTICE:**

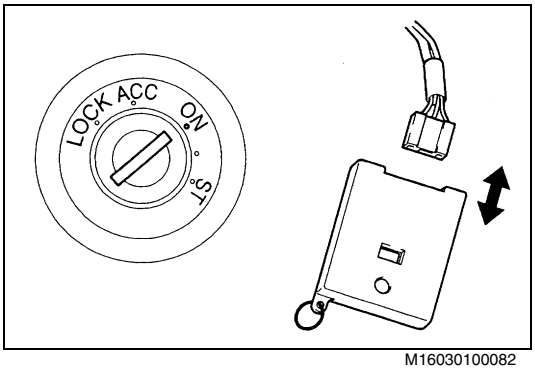
**Malfunction codes are displayed, starting from the lowest and progressing upward, with no distinction between present and past malfunction codes.**

MALFUNCTION CODE DISPLAY PATTERN




OUTPUT CODE 6: Abnormal signal of the wheel sensor, LH on front axle

M16030100081




M16030100082

**3. ERASE THE MALFUNCTION CODE MEMORY.**

(1) Disconnect the diagnosis monitor with the starter switch set to "ON".

**NOTICE:**

**In case of disconnecting with the starter switch set to "LOCK", the malfunction code memory will not be erased. Always disconnect the diagnosis monitor with the starter switch set to ON.**

(2) Wait 5 seconds and connect the diagnosis monitor.

(3) This time, only the present malfunction codes are displayed.

(4) Compare the two sets of codes you get to determine which are the present codes and which are the past one's.

# TABLE OF TROUBLE CORD

M16030101BEF2002

| OUTPUT CODE | MALFUNCTION CONTENTS | CORRESPONDING TERMNAL NUMBER OF ABS COMPUTER (CONNECTOR PIN NO.) |
|---|---|---|
| 1 | Normal function of system | — |
| 2 | Abnormality of ABS computer internal | — |
| 3 | Abnormality of ABS computer power supply voltage | 22 pin connector-1st |
| 4 | Wrong sensor ring or wrong tire size | — |
| 6 | Abnormal signal of the wheel sensor, LH on front axle | — |
| 7 | Abnormal signal of the wheel sensor, RH on front axle | — |
| 8 | Abnormal signal of the wheel sensor, LH on rear axle | — |
| 9 | Abnormal signal of the wheel sensor, RH on rear axle | — |
| 11 | Abnormality of the wheel sensor, LH on front axle | 22 pin connector-10th, 21th |
| 12 | Abnormality of the wheel sensor, RH on front axle | 22 pin connector-8th, 19th |
| 13 | Abnormality of the wheel sensor, LH on rear axle | 22 pin connector-6th, 18th |
| 14 | Abnormality of the wheel sensor, RH on rear axle | 22 pin connector-4th, 16th |
| 17 | Abnormality of ABS control valve, on front axle | 26 pin connector-25th, 11th |
| 18 | Abnormality of ABS control valve, LH on rear axle | 26 pin connector-15th, 2nd |
| 19 | Abnormality of ABS control valve, RH on rear axle | 26 pin connector-14th, 1st |
| 21 or 22 | Abnormality of ABS control valve relay power supply or abnormality of ABS control valve relay | 22 pin connector-2nd, 13th<br>26 pin connector-3rd |
| 23 | Leakage of ABS control valve power supply | — |
| 24 | Abnormality on exhaust brake cut relay | — |
| 29 | Wrong ABS computer | — |

# ABNORMALITY OF ABS COMPUTER INTERNAL

# (DIAGNOSIS CODE 2)

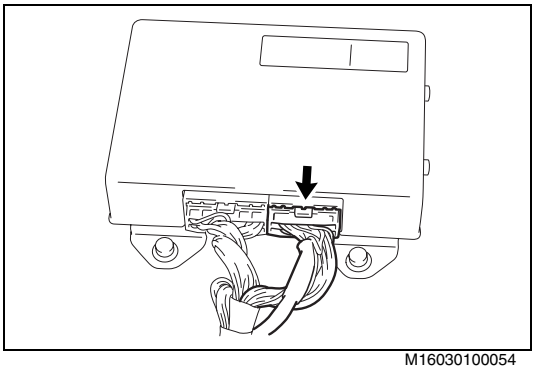
M16030101BEF2003

If this code is output frequently, replace ABS computer. (The computer cannot be disassembled, so do not disassemble it.)
If the ABS computer operates normally again by the starter switch "ON" to "LOCK", it is a temporary malfunction caused by harness or connectors.
Check the fitting of ABS computer connector and ground.

# ABNORMALITY OF ABS COMPUTER

# POWER SUPPLY VOLTAGE (DIAGNOSIS CODE 3)

M16030101BEF2004

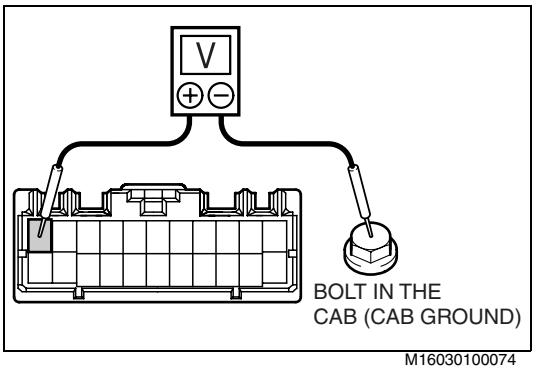


M16030100054

**1. CHECK THE VOLTAGE OF COMPUTER POWER SUPPLY.**

(1) Set the starter switch to "LOCK".

(2) Disconnect the 22 pin connectors of ABS computer.




M16030100074

(3) Start the engine and measure the voltage between 1st terminal of 22 pin connectors (Chassis harness side) and the bolt in the cab (Ground).
**Standard: 22-28V**

NG

- Under standard:
  Check the fitting condition of 22 pin connectors and fuse (ABS 2)
- Over the battery and alternator.

OK

Abnormality of ABS computer

(4) Stop the engine and set the starter switch to "LOCK".

# WRONG SENSOR RING OR WRONG TIRE SIZE

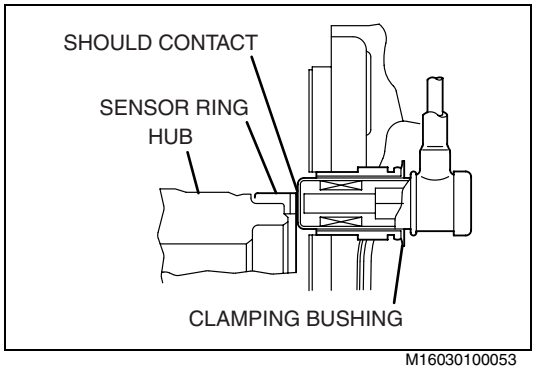
# (DIAGNOSIS CODE 4)

M16030101BEF2005

If this code is output, check whether the specified sensor ring and tire is installed or not. If it is wrong, replace the sensor ring and tire. (When the tire is worn excessively, this code can be output.)

# ABNORMAL SIGNAL OF THE WHEEL SENSOR (DIAGNOSIS CODE 6 TO 9)

M16030101BEF2006



M16030100053

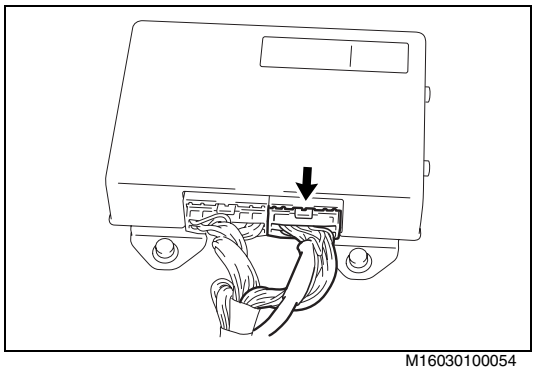
**1. CHECK THE WHEEL SENSOR.**

(1) Push the wheel sensor using a round end bar until the sensor contacts with the sensor ring.

(2) Check the damage of wheel sensor, holding status of sensor holder and play of wheel hub bearing.
Refer to CHAPTER ABS, SECTION FRONT AXLE and REAR AXLE.

# ABNORMARITY OF THE WHEEL SENSOR, LH ON FRONT AXLE (DIAGNOSIS CODE 11)

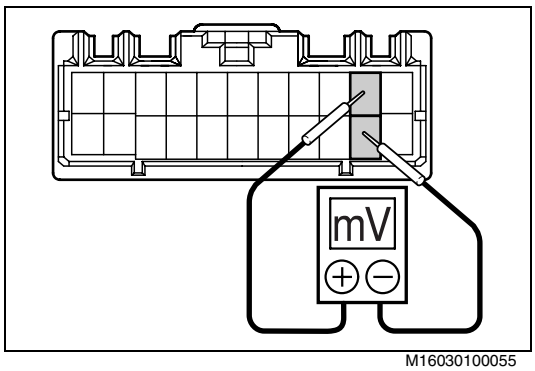
M16030101BEF2007


M16030100054

**1. CHECK THE VOLTAGE OF THE WHEEL SENSOR.**

(1) Set the starter switch to "LOCK".

(2) Disconnect the 22 pin connectors of ABS computer.



M16030100055

(3) Measure the voltage between 10th and 21th terminals of 22 pin connectors (Chassis harness side), measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 170-1,999 mV**

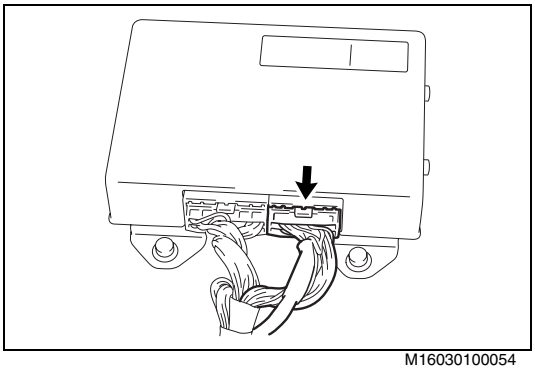
NG → Abnormality of harness or wheel sensor

OK

- Temporary malfunction because of abnormality of harness connector
- Abnormality of ABS computer

# ABNORMARITY OF THE WHEEL SENSOR, RH ON FRONT AXLE (DIAGNOSIS CODE 12)

M16030101BEF2008

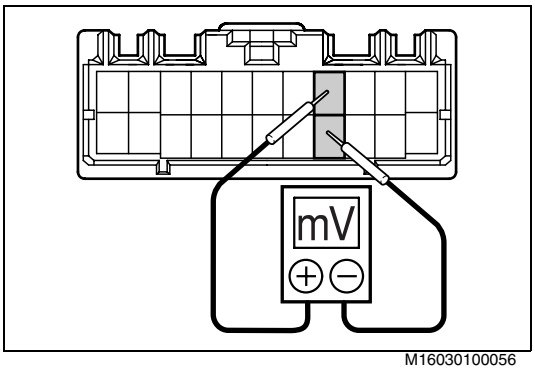


M16030100054

**1. CHECK THE VOLTAGE OF THE WHEEL SENSOR.**

(1) Set the starter switch to "LOCK".

(2) Disconnect the 22 pin connectors of ABS computer.




M16030100056

(3) Measure the voltage between 8th and 19th terminals of 22 pin connectors (Chassis harness side), measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 170-1,999 mV**

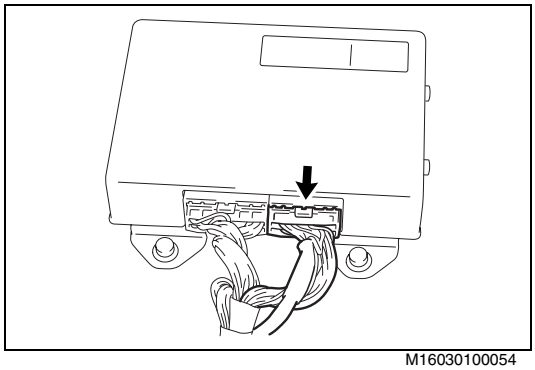
NG → Abnormality of harness or wheel sensor

OK

- Temporary malfunction because of abnormality of harness connector
- Abnormality of ABS computer

# ABNORMARITY OF THE WHEEL SENSOR, LH ON REAR AXLE (DIAGNOSIS CODE 13)

M16030101BEF2009

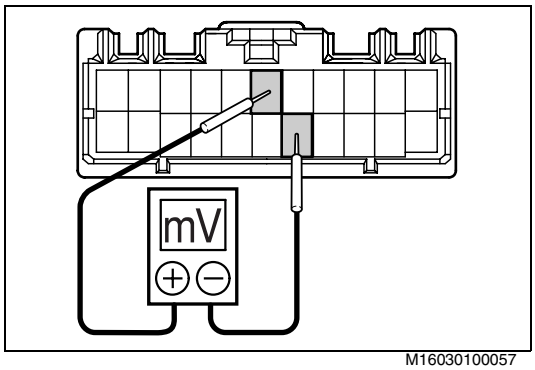


M16030100054

**1. CHECK THE VOLTAGE OF THE WHEEL SENSOR.**

(1) Set the starter switch to "LOCK".

(2) Disconnect the 22 pin connectors of ABS computer.




M16030100057

(3) Measure the voltage between 6th and 18th terminals of 22 pin connectors (Chassis harness side), measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 170-1,999 mV**

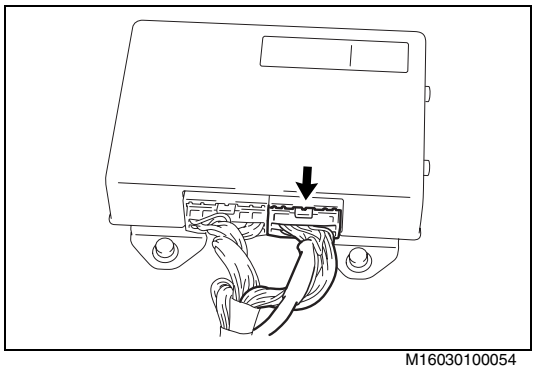
NG → Abnormality of harness or wheel sensor

OK

- Temporary malfunction because of abnormality of harness connector
- Abnormality of ABS computer

# ABNORMARITY OF THE WHEEL SENSOR, RH ON REAR AXLE (DIAGNOSIS CODE 14)

M16030101BEF2010

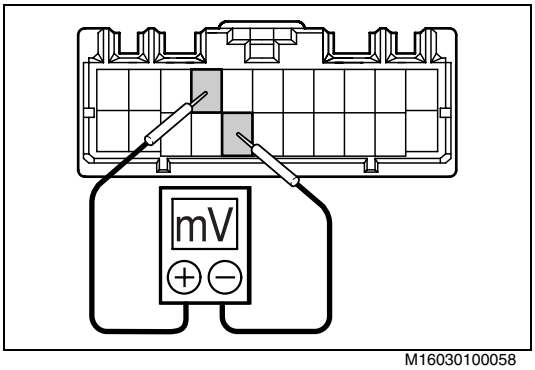


M16030100054

**1. CHECK THE VOLTAGE OF THE WHEEL SENSOR.**

(1) Set the starter switch to "LOCK".

(2) Disconnect the 22 pin connectors of ABS computer.



M16030100058

(3) Measure the voltage between 4th and 16th terminals of 22 pin connectors (Chassis harness side), measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 170-1,999 mV**

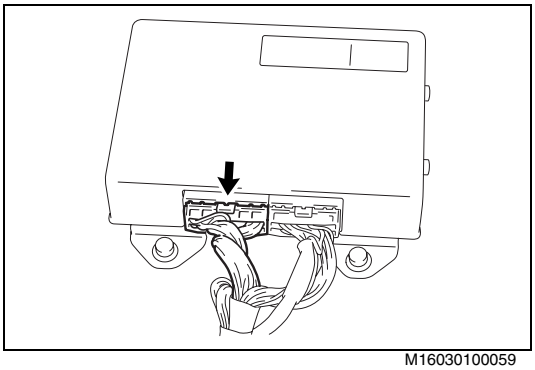
NG → Abnormality of harness or wheel sensor

OK

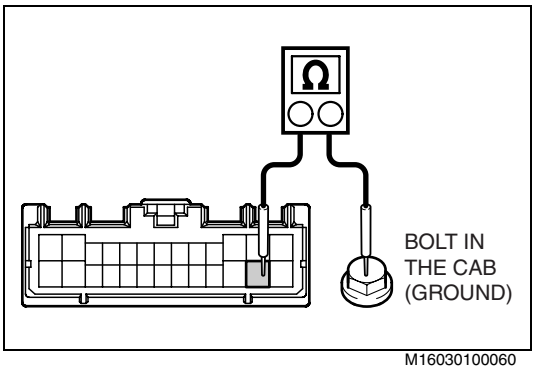
- Temporary malfunction because of abnormality of harness connector
- Abnormality of ABS computer

# ABNORMALITY OF ABS CONTROL VALVE, ON FRONT AXLE (DIAGNOSIS CODE 17)

M16030101BEF2011


M16030100059

**1. CHECK THE RESISTANCE BETWEEN TERMINAL AND GROUND.**
(1) Set the starter switch to "LOCK".
(2) Disconnect the 26 pin connectors of ABS computer.

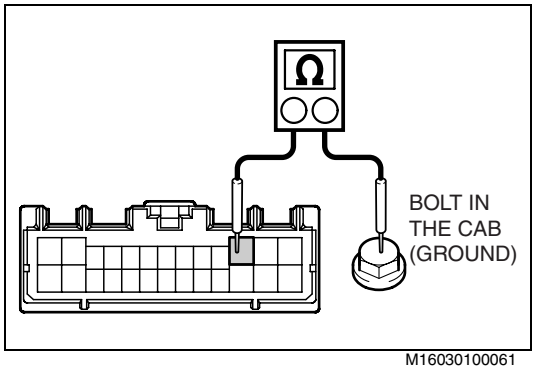


M16030100060

(3) Measure the resistance between 25th terminal (Chassis harness side) and the bolt in the cab (Ground).
**Standard: 9-25 Ω**

NG → Proceed to 3.

OK



M16030100061

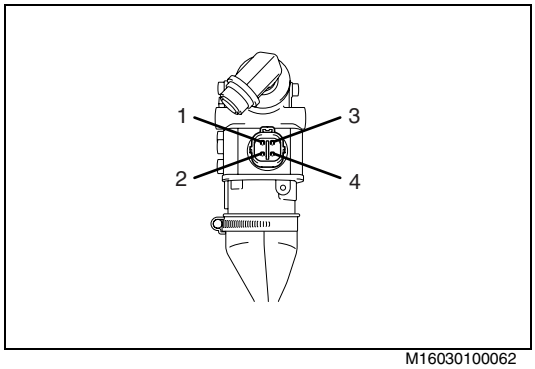
**2. CHECK THE RESISTANCE BETWEEN TERMINAL AND GROUND.**

(1) Measure the resistance between 11th terminal (Chassis harness side) and the bolt in the cab (Ground).
**Standard: 9-25 Ω**

NG → Proceed to 3.

OK →

- Temporary malfunction because of abnormality of harness or abnormality of connectors
- Abnormality of ABS computer



M16030100062

**3. CHECK THE RESISTANCE OF THE ABS CONTROL VALVE.**

(1) Disconnect the connector of ABS control valve.
(2) Measure the resistance between 1st-2nd terminals and 3rd-4th terminals (Control valve side).
**Standard:**

| Terminals | Resistance |
|---|---|
| **Between 1st-2nd** | **9-25 Ω** |
| **Between 3rd-4th** | **9-25 Ω** |

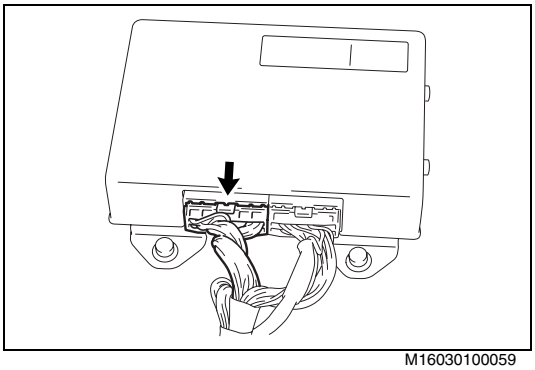
NG → Abnormality of control valve

OK →

Abnormality of harness

# ABNORMALITY OF ABS CONTROL VALVE, LH ON REAR AXLE (DIAGNOSIS CODE 18)

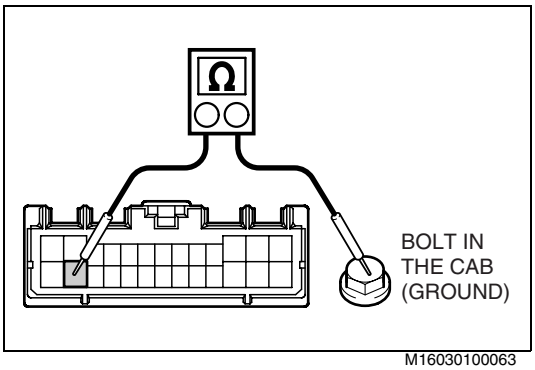
M16030101BEF2012



M16030100059

**1. CHECK THE RESISTANCE BETWEEN TERMINAL AND GROUND.**

(1) Set the starter switch to "LOCK".
(2) Disconnect the 26 pin connectors of ABS computer.




M16030100063

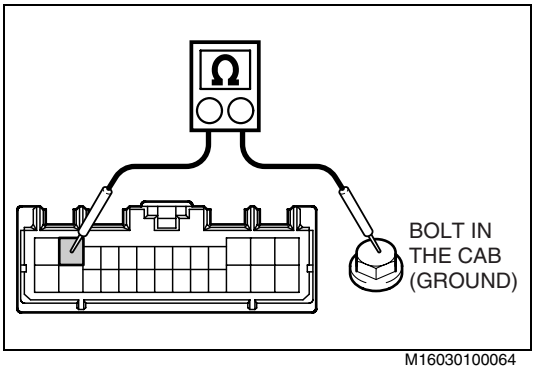
(3) Measure the resistance between 15th terminal (Chassis harness side) and the bolt in the cab (Ground).
**Standard: 9-25 Ω**

NG → Proceed to 3.

OK

**2. CHECK THE RESISTANCE BETWEEN TERMINAL AND GROUND.**

(1) Measure the resistance between 2nd terminal (Chassis harness side) and the bolt in the cab (Ground).
**Standard: 9-25 Ω**

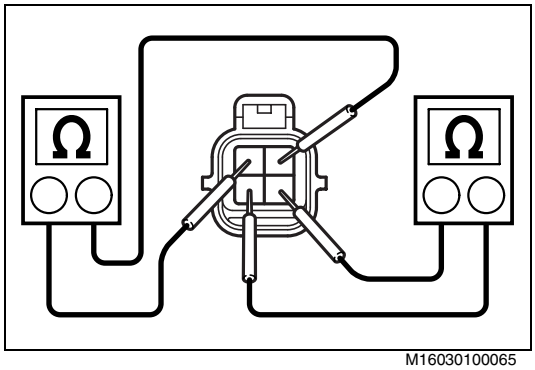



M16030100064

NG → Proceed to 3.

OK

- Temporary malfunction because of abnormality of harness or abnormality of connectors
- Abnormality of ABS computer



M16030100065

**3. CHECK THE RESISTANCE OF THE ABS CONTROL VALVE.**

(1) Disconnect the connector of ABS control valve.

(2) Measure the resistance between 1st-2nd terminals and 3rd-4th terminals (control valve side).
**Standard:**

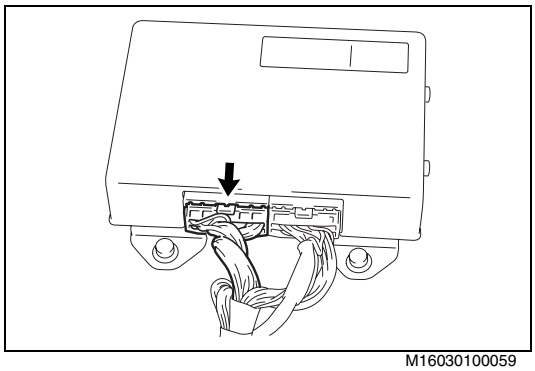
| Terminals | Resistance |
|---|---|
| **Between 1st-2nd** | **9-25 Ω** |
| **Between 3rd-4th** | **9-25 Ω** |

NG → Abnormality of control valve

OK → Abnormality of harness

# ABNORMALITY OF ABS CONTROL VALVE, RH ON REAR AXLE (DIAGNOSIS CODE 19)

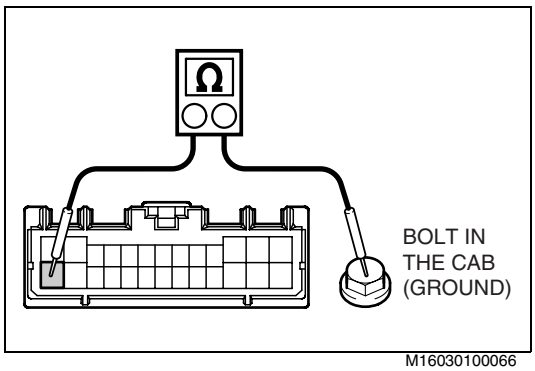
M16030101BEF2013


M16030100059

**1. CHECK THE RESISTANCE BETWEEN TERMINAL AND GROUND.**

(1) Set the starter switch to "LOCK".

(2) Disconnect the 26 pin connectors of ABS computer.

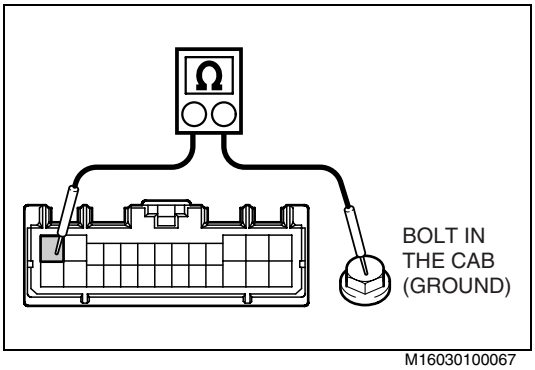


M16030100066

(3) Measure the resistance between 14th pin connectors (Chassis harness side) and the bolt in the cab (Ground).
**Standard: 9-25 Ω**

NG → Proceed to 3.

OK



M16030100067

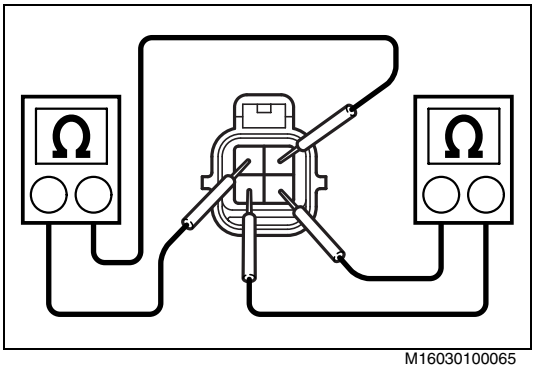
**2. CHECK THE RESISTANCE BETWEEN TERMINAL AND GROUND.**

(1) Measure the resistance between 1st pin connectors (Chassis harness side) and the bolt in the cab (Ground).
**Standard: 9-25 Ω**

NG → Proceed to 3.

OK →

- Temporary malfunction because of abnormality of harness or abnormality of connectors
- Abnormality of ABS computer


M16030100065

**3. CHECK THE RESISTANCE OF THE ABS CONTROL VALVE.**

(1) Disconnect the connector of ABS control valve.
(2) Measure the resistance between 1st-2nd terminals and 3rd-4th terminals (control valve side).
**Standard:**

| Terminals | Resistance |
|---|---|
| **Between 1st-2nd** | **9-25 Ω** |
| **Between 3rd-4th** | **9-25 Ω** |

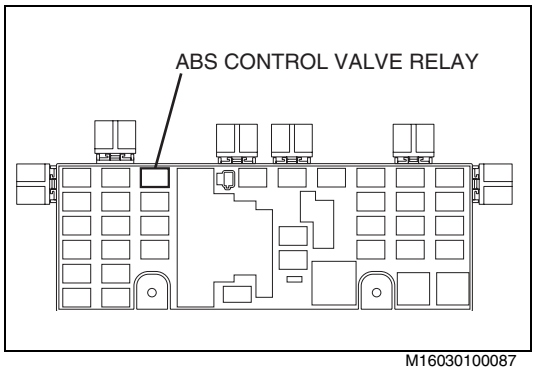
NG → Abnormality of control valve

OK →

Abnormality of harness

# ABNORMALITY OF ABS CONTROL VALVE RELAY POWER SUPPLY OR ABNORMALITY OF ABS CONTROL VALVE RELAY (DIAGNOSIS CODE 21 OR 22)

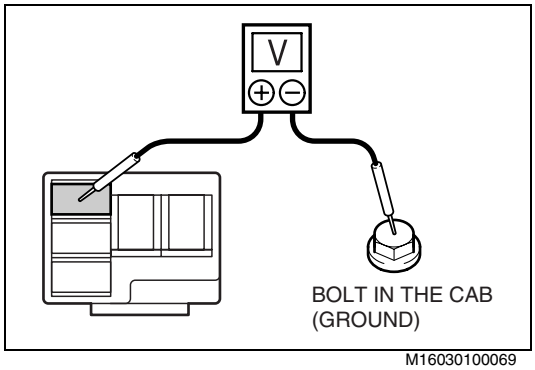
M16030101BEF2014



M16030100087

**1. CHECK THE VOLTAGE BETWEEN TERMINAL AND GROUND.**

(1) Set the starter switch to "LOCK".
(2) Remove the ABS control valve relay.
(3) Set the starter switch "ON" (The engine is stopped).



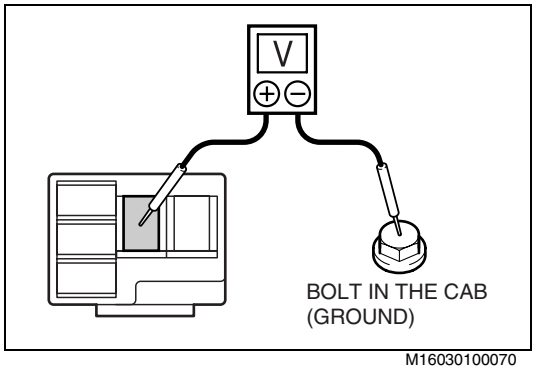
M16030100069

(4) Measure the voltage between 1st terminal of valve relay socket (Relay block side) and the bolt in the cab (Ground).
**Standard: 22-28 V**

NG

- Burn out Fuse
- Harness disconnection

OK



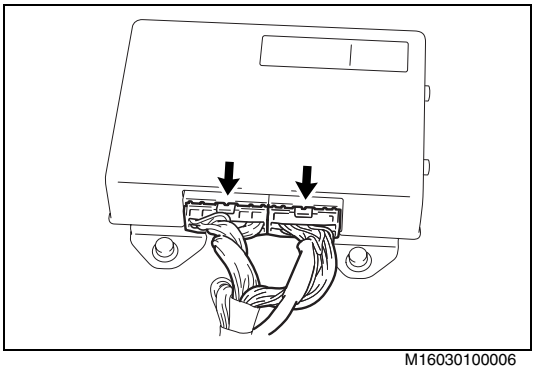
M16030100070

(5) Measure the voltage between 5th terminal of valve relay socket (Relay block side) and the bolt in the cab (Ground).
**Standard: 22-28 V**

NG

- Burn out Fuse
- Harness disconnection

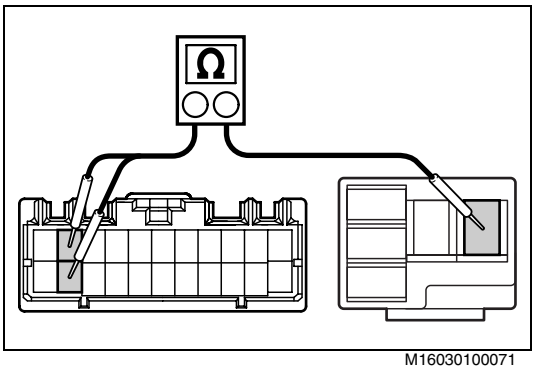
OK


M16030100006

**2. CHECK THE CONTINUITY BETWEEN TERMINALS.**

(1) Set the starter switch to "LOCK".

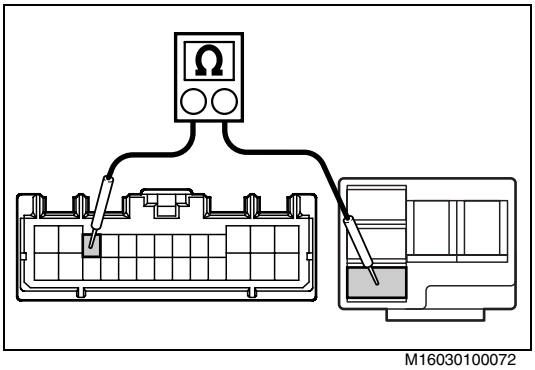
(2) Disconnect the 22 pin and 26 pin connectors of ABS computer.


M16030100071

(3) Check the continuity between 2nd terminal of 22 pin connectors and 3rd terminal of valve relay socket, 13th terminal of 22 pin and 3rd terminal of valve relay (Chassis harness side, Relay block side).
**Standard: Continuity**

NG → Harness disconnection

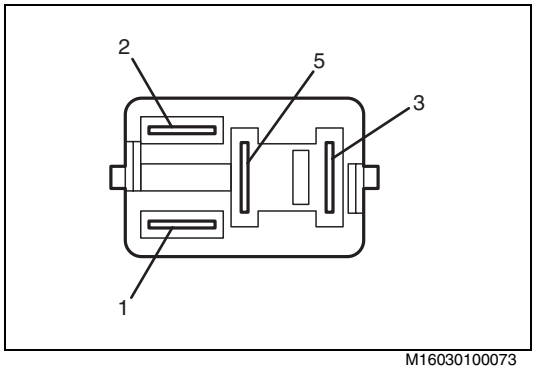
OK


M16030100072

(4) Check the continuity between 3rd terminal of 26 pin connectors and 2nd terminal of valve relay socket (Chassis harness side, Relay block side).
**Standard: Continuity**

NG → Harness disconnection

OK



M16030100073

**3. CHECK THE CONTINUITY AND INSULATION OF ABS CONTROL VALVE RELAY.**

(1) According to the table below, check the continuity between terminals

**Standard:**

| | Between 3-5 |
|---|---|
| Turning on electricity under 24 V to 1-2 | Continuity |
| No electricity to 1-2 | Insulation |

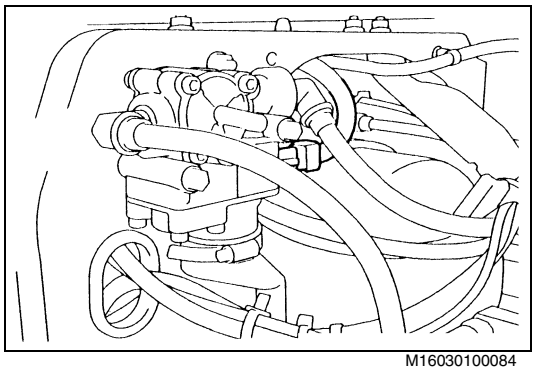
NG → Abnormality of ABS control valve relay

OK

Abnormality of ABS computer

# LEAKAGE OF ABS CONTROL VALVE POWER SUPPLY (DIAGNOSIS CODE 23)

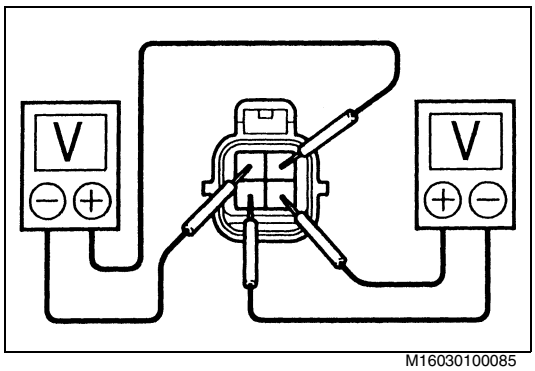
M16030101BEF2041


M16030100084

**1. CHECK THE VOLTAGE OF THE ABS CONTROL VALVE FOR FRONT WHEEL.**

(1) Set the starter switch to "LOCK".

(2) Disconnect the connector of ABS control valve for front axle.



M16030100085

(3) Measure the voltage between 1st-2nd terminals, 3rd-4th terminals (Chassis harness side).

**Standard: 1V or less**

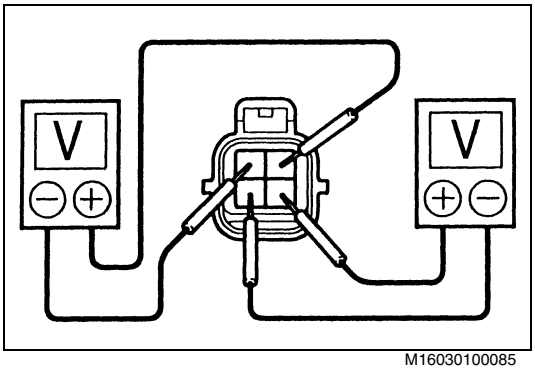
NG

- Temporary malfunction because of abnormality of harness connector
- Abnormality of ABS computer

OK

**2. CHECK THE VOLTAGE OF THE ABS CONTROL VALVE FOR LH ON REAR AXLE.**

(1) Set the starter switch to "LOCK".
(2) Disconnect the connector of ABS control valve for LH on rear axle.
(3) Measure the voltage between 1st-2nd terminals, 3rd-4th terminals (Chassis harness side).
**Standard: 1V or less**



M16030100085

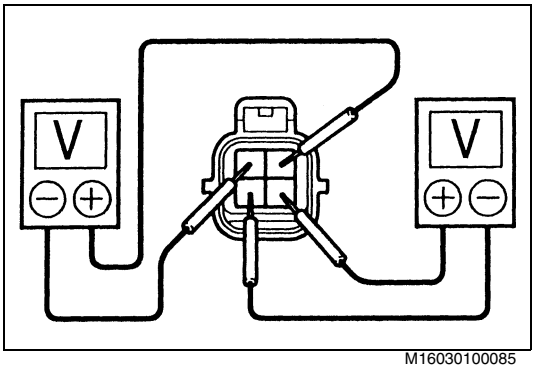
NG

OK

- Temporary malfunction because of abnormality of harness connector
- Abnormality of ABS computer

**3. CHECK THE VOLTAGE OF THE ABS CONTROL VALVE FOR RH ON THE REAR AXLE.**

(1) Set the starter switch to "LOCK".
(2) Disconnect the connector of ABS control valve for RH on rear axle.
(3) Measure the voltage between 1st-2nd terminals, 3rd-4th terminals (Chassis harness side).
**Standard: 1V or less**



M16030100085

NG

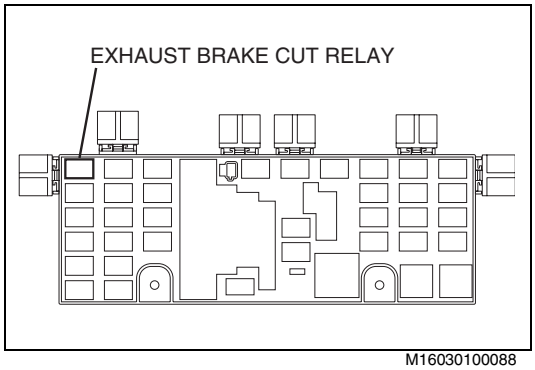
OK

- Temporary malfunction because of abnormality of harness connector
- Abnormality of ABS computer

Delete the past failure and check again by diagnosis monitor.

# ABNORMALITY ON THE EXHAUST BRAKE CUT RELAY (DIAGNOSIS CODE 24)

M16030101BEF2042

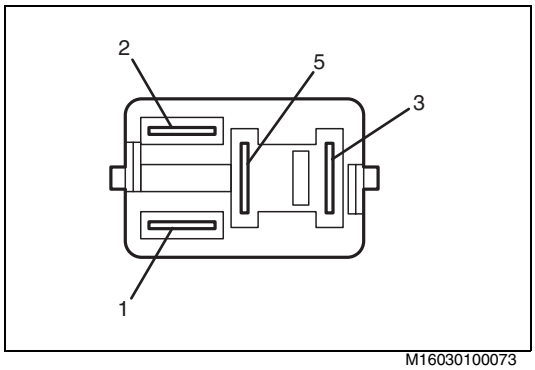


M16030100088

**1. CHECK THE CONTINUITY AND INSULATION OF EXHAUST BRAKE CUT RELAY.**

(1) Set the starter switch to "LOCK".

(2) Remove the exhaust brake cut relay.



M16030100073

(3) According to the table below, check the continuity between terminals

**Standard:**

| | Between 3-5 |
|---|---|
| Turning on electricity under 24 V to 1-2 | Continuity |
| No electricity to 1-2 | Insulation |

NG → Abnormality of exhaust brake cut relay

OK

- Abnormality of harness
- Abnormality of ABS computer

# WRONG ABS COMPUTER (DIAGNOSIS CODE 29)

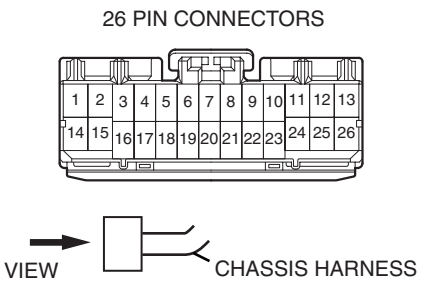
M16030101BEF2044

If this code is output, check the parts number of ABS computer.

# ABS COMPUTER CHASSIS SIDE

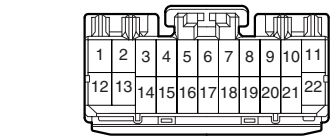
# CONNECTOR PIN ASSIGNMENT

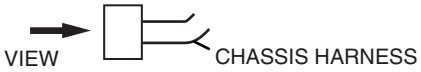
M16030101BEF2015




| No. | SIGNAL | CONNECTING DESTINETION | No. | SIGNAL | CONNECTING DESTINETION |
|---|---|---|---|---|---|
| 1 | RRHV | ABS control valve for rear right wheel | 14 | RRDV | ABS control valve for rear right wheel |
| 2 | RLHV | ABS control valve for rear left wheel | 15 | RLDV | ABS control valve for rear left wheel |
| 3 | VR1 | ABS valve relay and ABS warning lamp relay | 16 | — | — |
| 4 | — | — | 17 | EXBR | Exhaust brake cut relay |
| 5 | — | — | 18 | — | — |
| 6 | — | — | 19 | — | — |
| 7 | ESET | Battery ground | 20 | IL | For diagnosis monitor |
| 8 | DS | For diagnosis monitor | 21 | WL | ABS warning lamp |
| 9 | — | — | 22 | — | — |
| 10 | — | — | 23 | — | — |
| 11 | FRHV | ABS control valve for front wheel | 24 | — | — |
| 12 | — | — | 25 | FLDV | ABS control valve for front wheel |
| 13 | GND | Computer ground 1 | 26 | GND2 | Computer ground 2 |

22 PIN CONNECTORS




| No. | SIGNAL | CONNECTING DESTINETION | No. | SIGNAL | CONNECTING DESTINETION |
|---|---|---|---|---|---|
| 1 | IGN | ABS Computer power supply (Fuse) | 12 | GND3 | Computer ground 3 |
| 2 | VV1 | ABS control valve relay | 13 | VV2 | ABS control valve relay |
| 3 | — | — | 14 | — | — |
| 4 | RRS+ | Wheel sensor for rear right wheel | 15 | — | — |
| 5 | — | — | 16 | RRS- | Wheel sensor for rear right wheel |
| 6 | RLS+ | Wheel sensor for rear left wheel | 17 | — | — |
| 7 | — | — | 18 | RLS- | Wheel sensor for rear left wheel |
| 8 | FRS+ | Wheel sensor for front right wheel | 19 | FRS- | Wheel sensor for front right wheel |
| 9 | — | — | 20 | — | — |
| 10 | FLS+ | Wheel sensor for front left wheel | 21 | FLS- | Wheel sensor for front left wheel |
| 11 | — | — | 22 | — | — |

# BRAKE CONTROL (ABS: WABCO MAKE)

DN03-002

**ANTI-LOCK BRAKE .....DN03-2**
INSPECTION (ABS SYSTEM OPERATION AND FAILURE DIAGNOSTICS) .....DN03-2
TABLE OF TROUBLE CODE.....DN03-7
ABNORMALITY OF ABS CONTORO VALVE, RH ON FRONT AXLE (DIAGNOSIS CODE 2-1) .....DN03-8
ABNORMALITY OF ABS CONTOROL VALVE, LH ON FRONT AXLE (DIAGNOSIS CODE 2-2) .....DN03-9
ABNORMALITY OF ABS CONTROL VALVE, RH ON REAR AXLE (DIAGNOSIS CODE 2-3).....DN03-11
ABNORMALITY OF ABS CONTROL VALVE, LH ON REAR AXLE (DIAGNOSIS CODE 2-4).....DN03-12
EXCESSIVE AIR GAP OF WHEEL SENSOR, RH ON FRONT AXLE (DIAGNOSIS CODE 3-1) .....DN03-14
EXCESSIVE AIR GAP OF WHEEL SENSOR, LH ON FRONT AXLE (DIAGNOSIS CODE 3-2) .....DN03-14
EXCESSIVE AIR GAP OF WHEEL SENSOR, RH ON REAR AXLE (DIGNOSIS CODE 3-3) .....DN03-15
EXCESSIVE AIR GAP OF WHEEL SENSOR, LH ON REAR AXLE (DIAGNOSIS CODE 3-4).....DN03-15
SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, RH ON FRONT AXLE (DIAGNOSIS CODE 4-1) .....DN03-16
SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, LH ON FRONT AXLE (DIAGNOSIS CODE 4-2) .....DN03-16
SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, RH ON REAR AXLE (DIAGNOSIS CODE 4-3) .....DN03-17
SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, LH ON REAR AXLE (DIAGNOSIS CODE 4-4) .....DN03-18
ABNORMAL SIGNAL OF THE WHEEL SENSOR, RH ON FRONT AXLE (DIAGNOSIS CODE 5-1) .....DN03-18
ABNORMAL SIGNAL OF THE WHEEL SENSOR, LH ON FRONT AXLE (DIAGNOSIS CODE 5-2) .....DN03-18
ABNORMAL SIGNAL OF THE WHEEL SENSOR, RH ON REAR AXLE (DIAGNOSIS CODE 5-3) ...DN03-19
ABNORMAL SIGNAL OF THE WHEEL SENSOR, LH ON REAR AXLE (DIAGNOSIS CODE 5-4) ...DN03-19
ABNORMALITY IN SENSOR RING, RH ON FRONT AXLE (DIAGNOSIS CODE 6-1).....DN03-19
ABNORMALITY IN SENSOR RING, LH ON FRONT AXLE (DIAGNOSIS CODE 6-2).....DN03-19
ABNORMALITY IN SENSOR RING, RH ON REAR AXLE (DIAGNOSIS CODE 6-3).....DN03-19
ABNORMALITY IN SENSOR RING, LH ON REAR AXLE (DIAGNOSIS CODE 6-4).....DN03-19
ABNORMAL SIGNAL OF THE WHEEL SENSOR (DIAGNOSIS CODE 7-1) .....DN03-20
ABNORMALITY ON THE EXHAUST BRAKE CUT RELAY (DIAGNOSIS CODE 7-3).....DN03-20
ABNORMALITY ON ABS WARNING LAMP (DIAGNOSIS CODE 7-4) .....DN03-20
ABNORMALITY OF GROUND HARNESS (DIAGNOSIS CODE 8-5) .....DN03-21

# ANTI-LOCK BRAKE

## INSPECTION (ABS SYSTEM OPERATION AND FAILURE DIAGNOSTICS)

M16030101BEF2016

### ABS SYSTEM REGULAR INSPECTION

Inspect the operation of the ABS system once per year in accordance with the procedure below.

### OPERATION STATUS INSPECTION

Refer to the section below "OPERATION STATUS INSPECTION" for information on the inspection procedure. If this inspection reveals any malfunctions, be sure to carry out next inspection.

### OPERATION STATUS INSPECTION

**1. PREPARATION BEFORE INSPECTION**

(1) With the vehicle stopped, step on the brake pedal and check for air leakage from the ABS control valves. If air leaking from the pipe connectors is found by applying soapy water, or the like, correct the problem by tightening the connectors or take a similar corrective action. Also, if air is leaking from the ABS control valve body, replace the ABS control valve.

(2) Release the brake pedal and inspect the exhaust status of the ABS control valves.
The above inspection should be carried out on all ABS control valves.

**2. ABS OPERATION STATUS INSPECTION IN TEST DRIVE**

**NOTICE:**

**When inspecting the ABS operation status in a test drive, exercise caution with regard to the following points.**

- **Use a large, safe area for the test.**
- **Conduct the test with nothing loaded on the vehicle.**
- **Apply white tape, or the like, to the sides of the front and rear wheels to enable you to determine the wheel's rotational status.**

(1) Turn the starter switch "ON". Confirm that the ABS warning lamp lights and then goes off.

(2) Start driving the vehicle and, accelerate to a speed of vehicle to 20 - 30 km/h {12.4 - 18.6 mile/h}, then apply the brakes hard. Confirm that none of the wheels are locked.

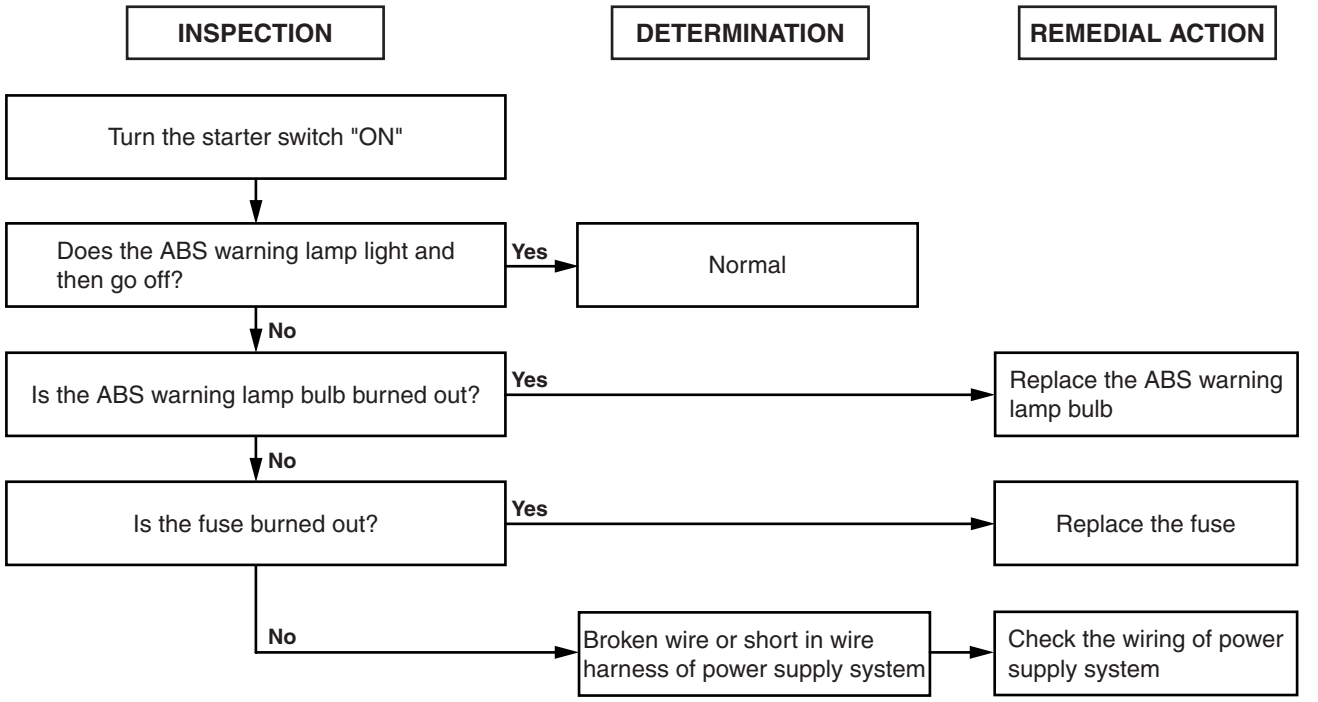
## FAILURE DIAGNOSTICS BASED ILLUMINATION OF WARNING LAMPS

| LIT LAMP | CAUSE OF MALFUNCTION | FAIL-SAFE FUNCTION |
|---|---|---|
| ABS warning lamp (Lamp lights while driving vehicle.) | POWER SUPPLY RELATED<br>• Fuse burned out<br>• Wire harness connector disconnected<br>• Bad contact with wire harness<br>• Wire broken in wire harness<br>• Low battery voltage | Entire ABS system becomes non-functional. (Brakes of all wheels return to normal braking operation.) |
| | WHEEL SENSOR RELATED<br>• Sensor clearance too wide<br>• Bad sensor unit<br>• Broken wire in wire harness<br>• Wire harness connector disconnected or bad contact. | ABS becomes non-functional on wheels in the system where sensor malfunctioned, and those wheels return to normal braking operation. |
| | ABS CONTROL VALVE RELATED<br>• Wire broken or short circuit in solenoid coil<br>• Broken wire in wire harness of ABS control valve, wire harness connector disconnected, bad contact | ABS becomes non-functional on wheel in the system where ABS control valve malfunctioned, and those wheel return to normal braking operation. |
| | COMPUTER<br>• Internal malfunction in computer | ABS becomes non-functional on wheel in the system controlled by faulty computer, and those wheels return to normal braking operation. |

**NOTICE:**
**The ABS warning lamp may remain lit if the ABS system experiences a temporary malfunction and then recovers. Should this occur, reset it by turn "LOCK" the starter switch temporarily while the vehicle is stopped. Then start driving the vehicle. If the lamp goes off when a speed of vehicle exceeds 7 km/h {4.3 mile/h}, ABS is working normally.**

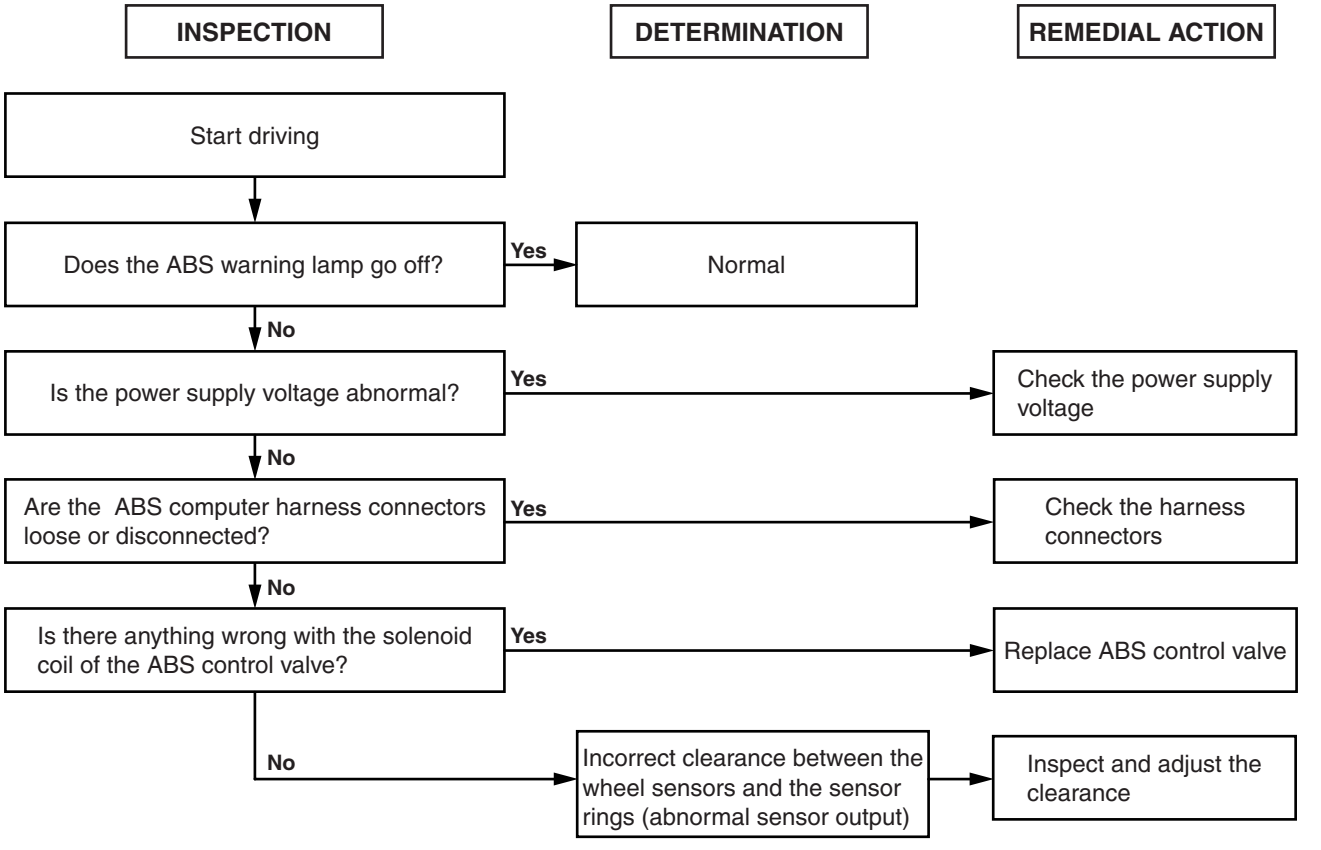
## ABS SYSTEM FAILURE DIAGNOSTICS FLOWCHART

### 1. WHEN THE ENGINE IS STARTED UP



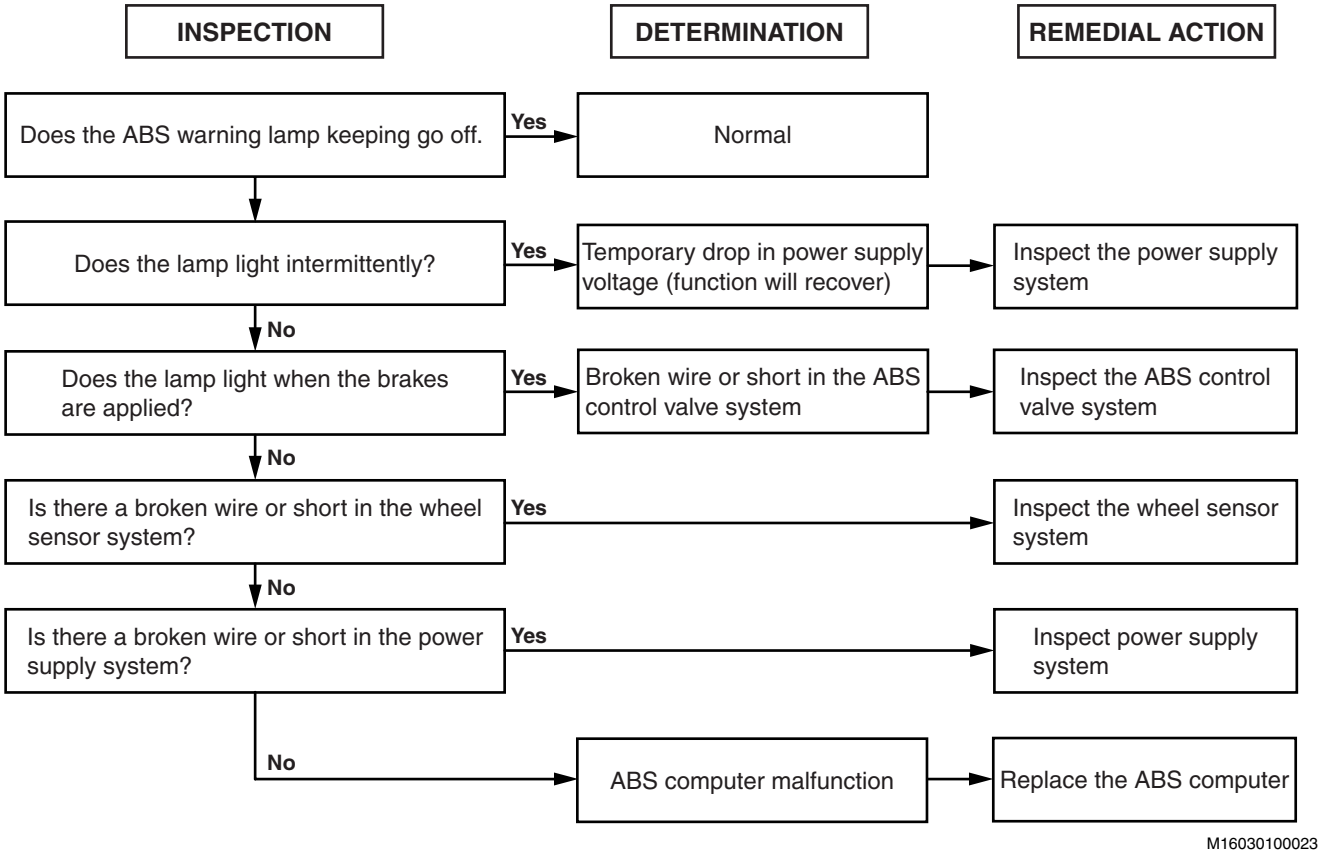

M16030100024

### 2. WHEN STARTING TO DRIVE




M16030100025

**3. WHILE DRIVING AND BRAKING**



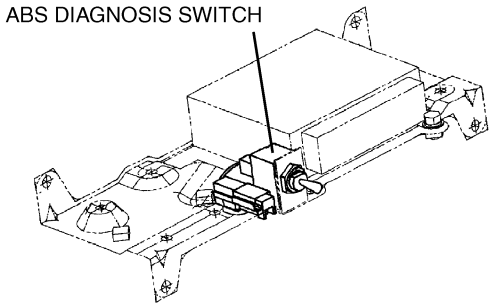

M16030100023

## TROUBLE DIAGNOSIS BY MALFUNCTION DIAGNOSING FUNCTION OF ABS COMPUTER

ABS system memorizes all malfunction contents occurred so far in the computer. By turning "ON" the diagnosis switch, by which is changed to diagnosis mode, ABS warning lamp flashes on and off to advise the trouble contents.

## DIAGNOSIS SWITCH OF ABS SYSTEM

It is positioned at the side of ABS computer in the instrument panel of assistant seat front side.
By switching the starter key "ON" and falling to "ON" side this ABS diagnosis switch, which is led to the diagnosis mode, the ABS warning lamp flashes on and off to inform the trouble codes.

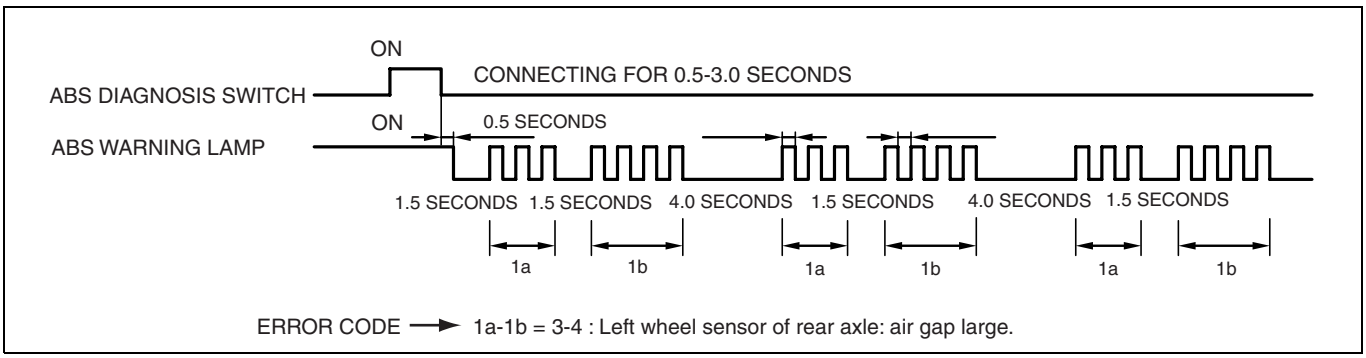



M16030100051

**NOTICE:**
**ABS diagnosis switch reverts automatically to "OFF" position.**

## MALFUNCTION DIAGNOSIS WHEN PRESENTLY HAVING TROUBLES

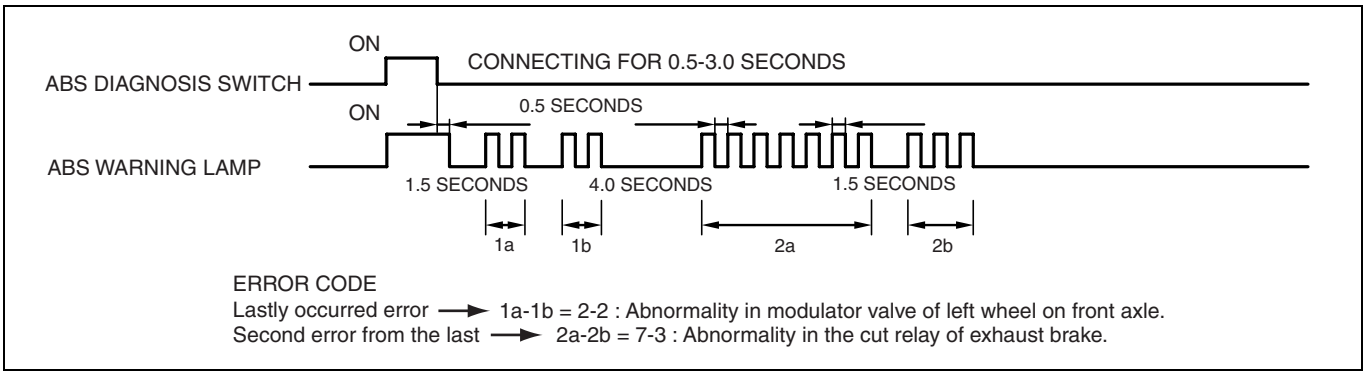
It indicates repeatedly "an current occurring trouble". When having more than two troubles, the latest trouble is displayed. Confirm the trouble contents together with a "TABLE OF TROUBLE CODE, in the page DN03-7.
When switching the starter switch "OFF", or detecting the driving speed with the wheel sensor, trouble indication will be finished.




M16030100026

## WHEN PRESENTLY NOT HAVING TROUBLE

The last four troubles occurred will be indicated in the order from the last one.
Even when more than four troubles are occurred, only latest four troubles will be indicated without showing other prior one before the latest four ones.
Once the trouble contents are finished to be indicated, it will finish automatically.

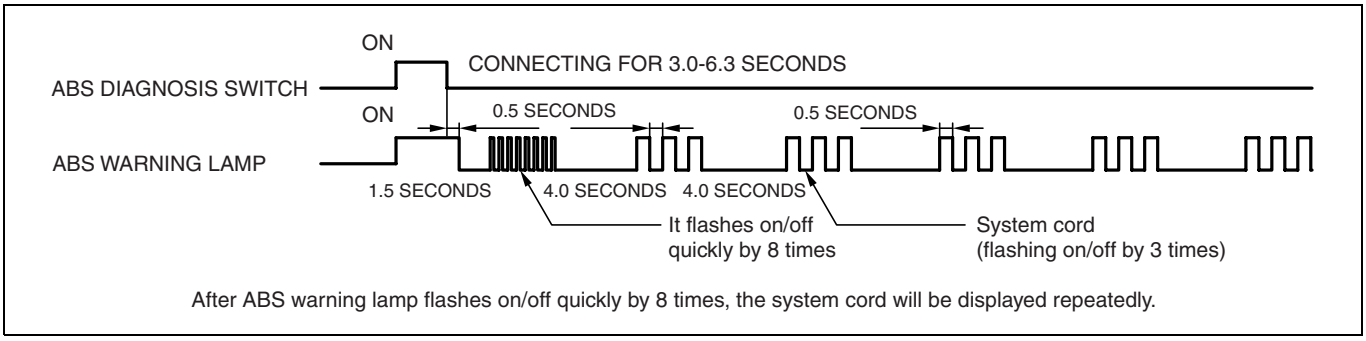



M16030100027

## ELIMINATION OF PAST TROUBLE HISTORY

Once fallen to "ON" side the ABS diagnosis switch, by which trouble memories will be eliminated.
And just after ABS warning lamp flashes on/off by 8 times, the ABS system cord will be displayed repeatedly at interval of 4 seconds and will light on/off consecutively.
When the starter switch is turned "OFF" once and turned "ON", ABS warning lamp will go on and off when the driving speed reaches to 7-10 km/h {4.3-6.2 mile/h.}.

**NOTICE:**
**Past trouble history can not be eliminated when having trouble.**




M16030100028

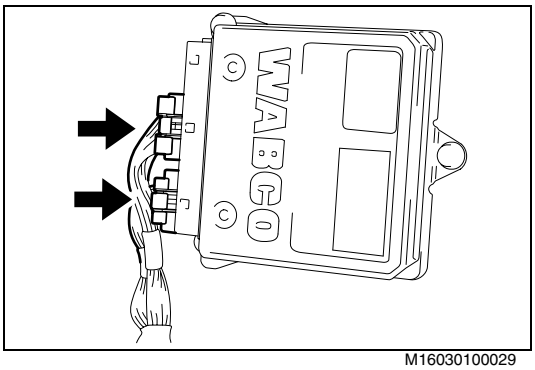
# TABLE OF TROUBLE CODE

M16030101BEF2017

| OUTPUT CODE | | MALFUNCTION CONTENTS | CORRESPONDING TERMNAL NUMBER OF ABS COMPUTER (CONNECTOR PIN NO.) |
|---|---|---|---|
| a | b | | |
| 1 | 1 | Normal function of system | |
| 2 | 1 | Abnormality of ABS control valve, RH on front axle | 18 pin connector-1st, 4th |
| 2 | 2 | Abnormality of ABS control valve, LH on front axle | 18 pin connector-3rd, 6th |
| 2 | 3 | Abnormality of ABS control valve, RH on rear axle | 18 pin connector-8th, 9th |
| 2 | 4 | Abnormality of ABS control valve, LH on rear axle | 18 pin connector-2nd, 5th |
| 3 | 1 | Excessive air gap of wheel sensor, RH on front axle | 18 pin connector-10th, 13th |
| 3 | 2 | Excessive air gap of wheel sensor, LH on front axle | 18 pin connector-15th, 12th |
| 3 | 3 | Excessive air gap of wheel sensor, RH on rear axle | 18 pin connector-17th, 18th |
| 3 | 4 | Excessive air gap of wheel sensor, LH on rear axle | 18 pin connector-11th, 14th |
| 4 | 1 | Short-circuit and wiring disconnection of wheel sensor, RH on front axel | 18 pin connector-10th, 13th |
| 4 | 2 | Short-circuit and wiring disconnection of wheel sensor,LH on front axle | 18 pin connector-15th, 12th |
| 4 | 3 | Short-circuit and wiring disconnection of wheel sensor,RH on rear axle | 18 pin connector-17th, 18th |
| 4 | 4 | Short-circuit and wiring disconnection of wheel sensor, LH on rear axle | 18 pin connector-11th, 14th |
| 5 | 1 | Abnormal signal of the wheel sensor, RH on front axle | 18 pin connector-10th, 13th |
| 5 | 2 | Abnormal signal of the wheel sensor, LH on front axle | 18 pin connector-15th, 12th |
| 5 | 3 | Abnormal signal of the wheel sensor, RH on rear axle | 18 pin connector-17th, 18th |
| 5 | 4 | Abnormal signal of the wheel sensor, LH on rear axle | 18 pin connector-11th, 14th |
| 6 | 1 | Abnormality in sensor ring, RH on front axle | 18 pin connector-10th, 13th |
| 6 | 2 | Abnormality in sensor ring, LH on front axle | 18 pin connector-15th, 12th |
| 6 | 3 | Abnormality in sensor ring, RH on rear axle | 18 pin connector-17th, 18th |
| 6 | 4 | Abnormality in sensor ring, LH on rear axle | 18 pin connector-11th, 14th |
| 7 | 1 | Abnormal signal of the wheel sensor | 18 pin connector-10th, 11th, 12th, 13th, 14th, 15th, 17th, 18th |
| 7 | 3 | Abnormality on the exhaust brake cut-relay | 15 pin connector-14th |
| 7 | 4 | Abnormality on ABS warning lamp | 15 pin connector-15th |
| 8 | 1 | Abnormality of power supply (Low voltage) | 15 pin connector-8th |
| 8 | 2 | Abnormality of power supply (High voltage) | 15 pin connector-8th |
| 8 | 5 | Abnormality of ground harness | 15 pin connector-4th, 9th |

# ABNORMALITY OF ABS CONTOROL VALVE, RH ON FRONT AXLE (DIAGNOSIS CODE 2-1)

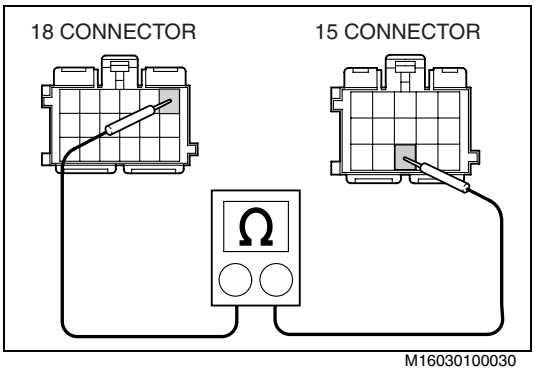
M16030101BEF2045



M16030100029

**1. CHECK THE RESISRANCE BETWEEN TERMINALS.**

(1) By switching the starter key "LOCK" position, remove off 15 and 18 pin connectors of ABS computer.

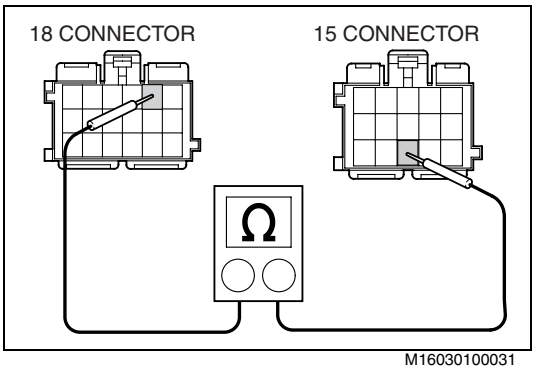


M16030100030

(2) Measure the resistance between 1st terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20Ω**

NG → Proceed to (3)

OK → Computer abnormality

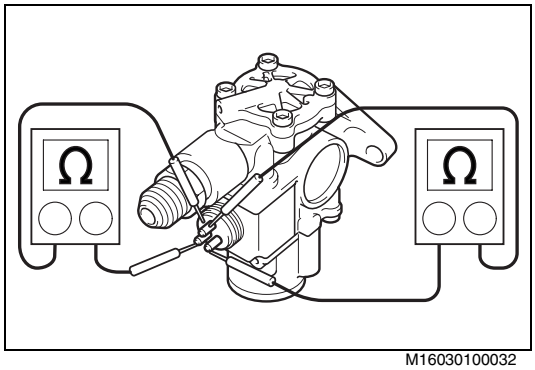


M16030100031

(3) Measure the resistance between 4th terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20Ω**

NG → Proceed to (4)

OK → Computer abnormality



M16030100032

(4) By removing off the harness of control valve, measure the resistances between 1-2nd terminals and between 1-3rd terminals.
**Standard: 11.1-19.2Ω**

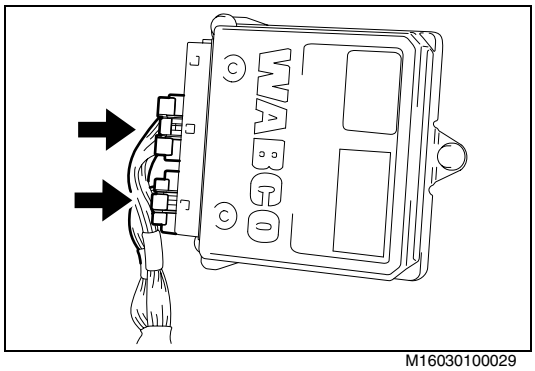
NG → Abnormality of the control valve.

OK

Abnormality of the harness.

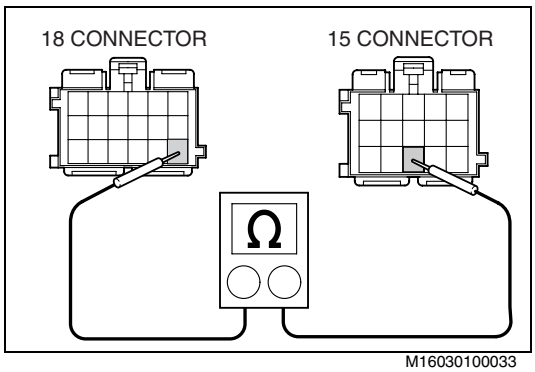
# ABNORMALITY OF ABS CONTOROL VALVE, LH ON FRONT AXLE (DIAGNOSIS CODE 2-2)

M16030101BEF2046



M16030100029

**1. CHECK THE RESISRANCE BETWEEN TERMINALS.**
(1) By switching the starter key "LOCK" position, remove off 15 and 18 pin connectors of ABS computer.



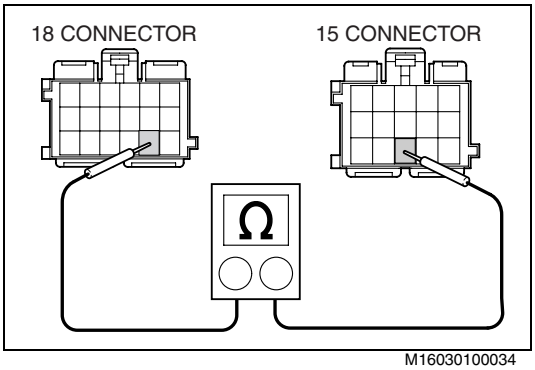
M16030100033

(2) Measure the resistance between 3rd terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20Ω**

NG → Proceed to (3)

OK

Computer abnormality

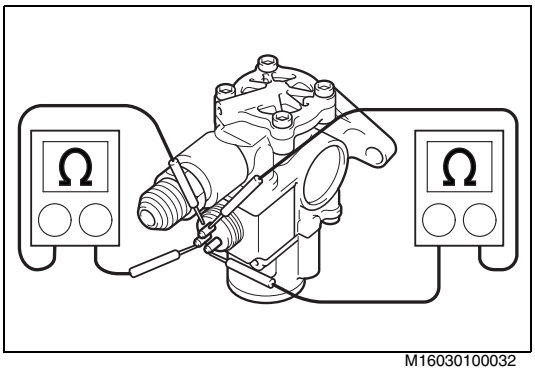


M16030100034

(3) Measure the resistance between 6th terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20Ω**

NG → Proceed to (4)

OK → Computer abnormality



M16030100032

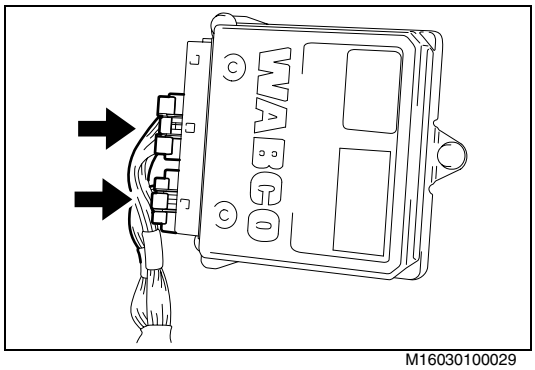
(4) By removing off the harness of control valve, measure the resistances between 1-2nd terminals and between 1-3rd terminals.
**Standard: 11.1-19.2Ω**

NG → Abnormality of the control valve.

OK → Abnormality of the harness.

# ABNORMALITY OF ABS CONTROL VALVE, RH ON REAR AXLE (DIAGNOSIS CODE 2-3)

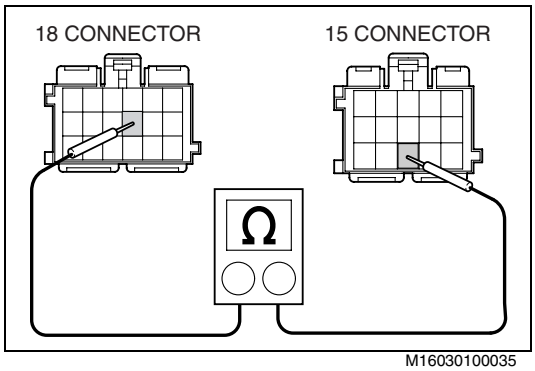
M16030101BEF2019



M16030100029

**1. CHECK THE REASISTANCE BETWEEN TERMINALS.**

(1) By switching the starter key "LOCK" position, remove off 15 and 18 pin connectors of ABS computer.

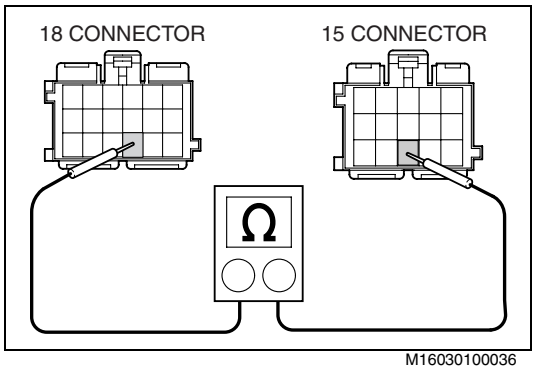


M16030100035

(2) Measure the resistance between 8th terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20** Ω

NG → Proceed to (3)

OK → Computer abnormality

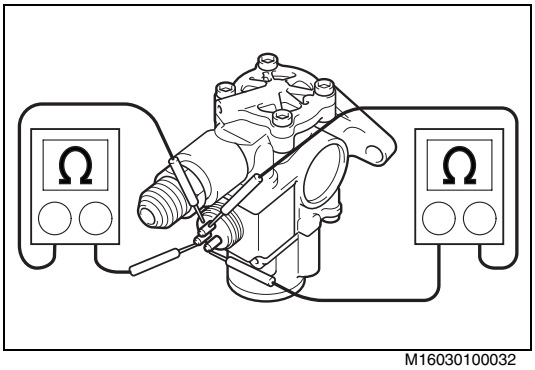


M16030100036

(3) Measure the resistance between 9th terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20** Ω

NG → Proceed to (4)

OK → Computer abnormality



M16030100032

(4) By removing off the harness of control valve, measure the resistances between 1-2nd terminal and between 1-3rd terminal.
**Standard: 11.1-19.2 Ω**

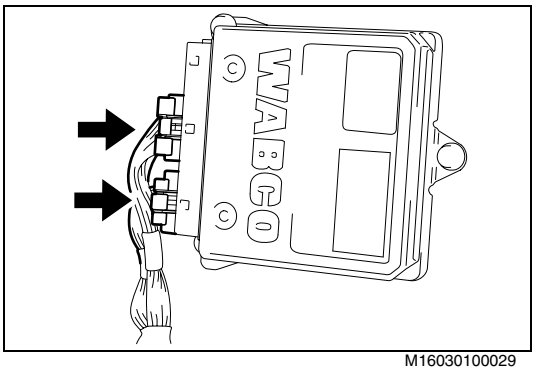
NG → Abnormality of the control valve.

OK

Abnormality of the harness.

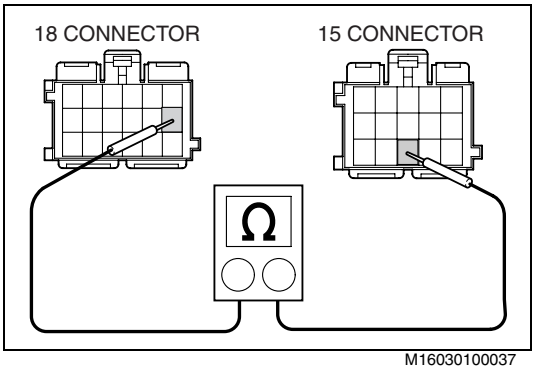
# ABNORMALITY OF ABS CONTROL VALVE, LH ON REAR AXLE (DIAGNOSIS CODE 2-4)

M16030101BEF2020



M16030100029

**1. CHECK THE RESISTANCE BETWEEN TERMINALS.**
(1) By switching the starter key "LOCK" position, remove off 15 and 18 pin connectors of ABS computer.



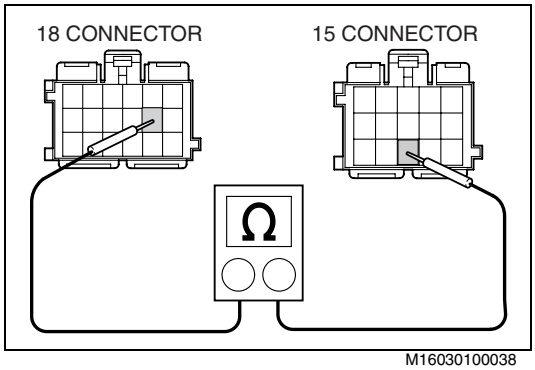
M16030100037

(2) Measure the resistance between 2nd terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20 Ω**

NG → Proceed to (3)

OK

Computer abnormality

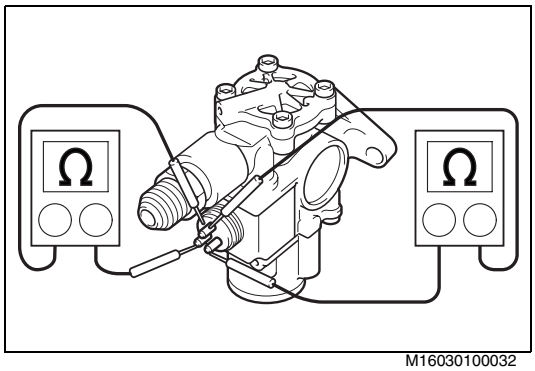


M16030100038

(3) Measure the resistance between 5th terminal of 18 pin connectors and 9th one of 15 ones.
**Standard: 10-20** Ω

NG → Proceed to (4)

OK → Computer abnormality



M16030100032

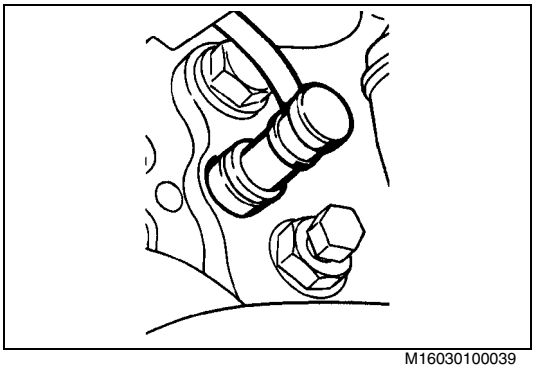
(4) By removing off the harness of control valve, measure the resistances between 1-2nd terminal and between 1-3rd terminal.
**Standard: 11.9-19.2** Ω

NG → Abnormality of the control valve.

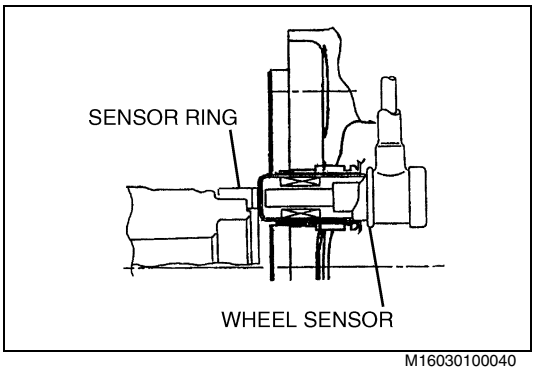
OK → Abnormality of the harness.

# EXCESSIVE AIR GAP OF WHEEL SENSOR, RH ON FRONT AXLE (DIAGNOSIS CODE 3-1)

M16030101BEF2021



M16030100039



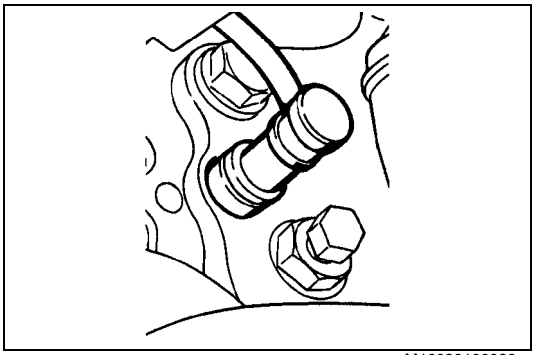

M16030100040

**1. CHECK THE AIR GAP OF WHEEL SENSOR.**

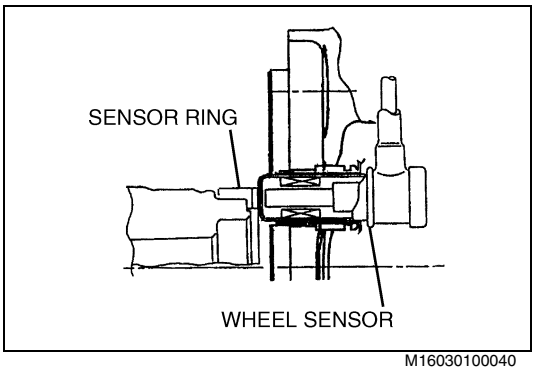
(1) Insert a wheel sensor till it touches to the sensor ring.
(2) Make sure that the tire size is correct.

# EXCESSIVE AIR GAP OF WHEEL SENSOR, LH ON FRONT AXLE (DIAGNOSIS CODE 3-2)

M16030101BEF2022



M16030100039



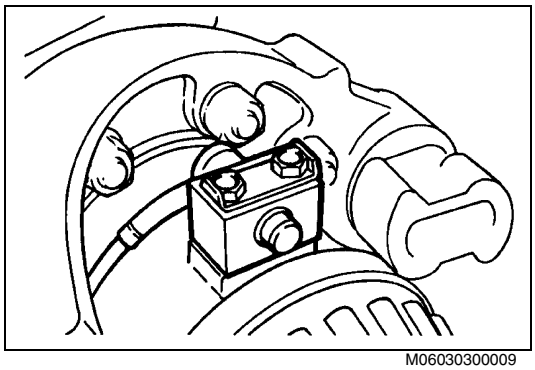

M16030100040

**1. CHECK THE AIR GAP OF WHEEL SENSOR.**

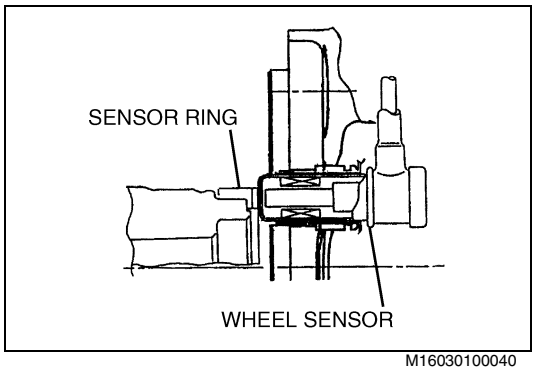
(1) Insert a wheel sensor till it touches to the sensor ring.
(2) Make sure that the tire size is correct.

# EXCESSIVE AIR GAP OF WHEEL SENSOR, RH ON REAR AXLE (DIGNOSIS CODE 3-3)

M16030101BEF2047



M06030300009



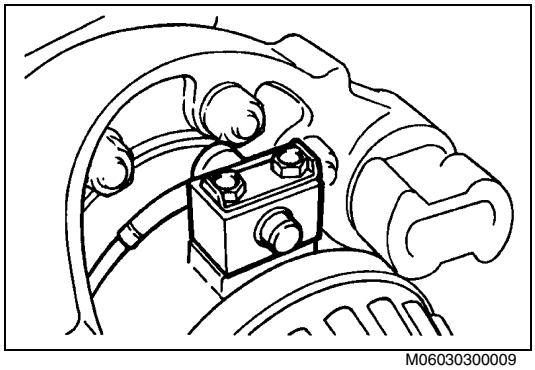

M16030100040

**1. CHECK THE AIR GAP OF WHEEL SENSOR.**

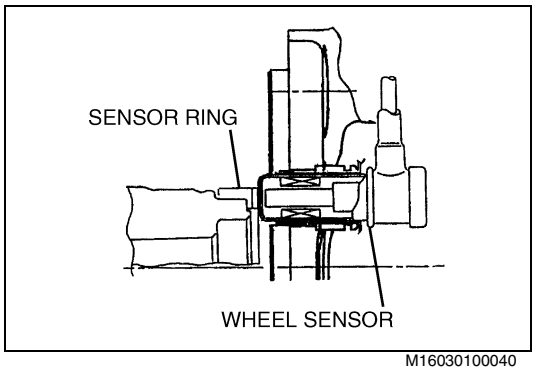
(1) Refer to SECTION REAR WHEEL BRAKE.

# EXCESSIVE AIR GAP OF WHEEL SENSOR, LH ON REAR AXLE (DIAGNOSIS CODE 3-4)

M16030101BEF2024



M06030300009



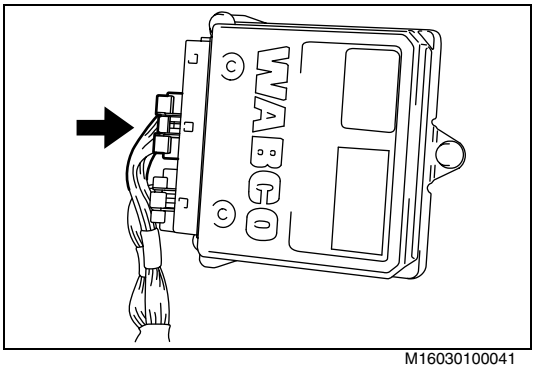

M16030100040

**1. CHECK THE AIR GAP OF WHEEL SENSOR.**

(1) Refer to SECTION REAR WHEEL BRAKE.

# SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, RH ON FRONT AXLE (DIAGNOSIS CODE 4-1)

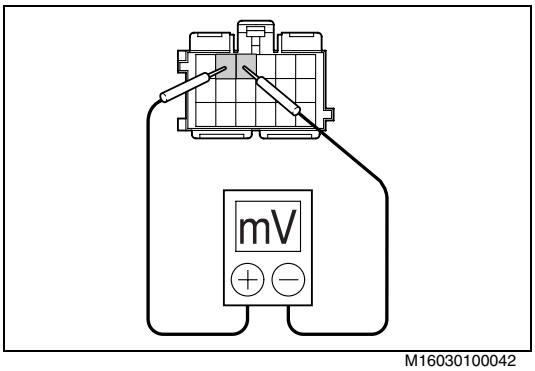
M16030101BEF2025



M16030100041

**1. CHECK THE VOLTAGE BETWEEN TERMINALS.**

(1) By switching the starter key "LOCK" position, remove off 18 pin connectors of ABS computer.



M16030100042

(2) Connecting the tester between 10th and 13th terminals of 18 pin connectors, measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 150-1,999 mV (Range of Alternating Current Voltage)**

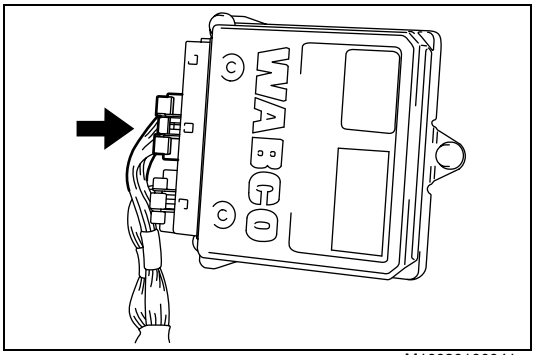
NG → Abnormality of the harness or wheel sensor.

OK

Computer abnormality.

# SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, LH ON FRONT AXLE (DIAGNOSIS CODE 4-2)

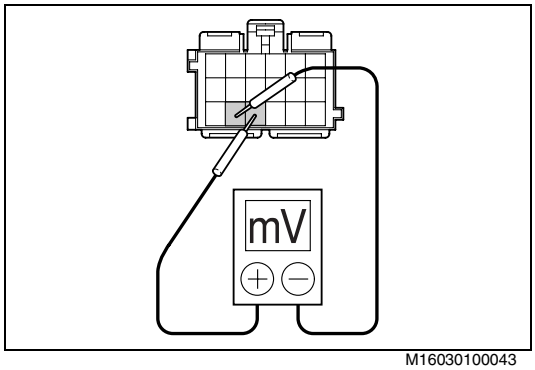
M16030101BEF2026



M16030100041

**1. CHECK THE VOLTAGE BETWEEN TERMINALS.**

(1) By switching the starter key "LOCK" position, remove off 18 pin connectors of ABS computer.



M16030100043

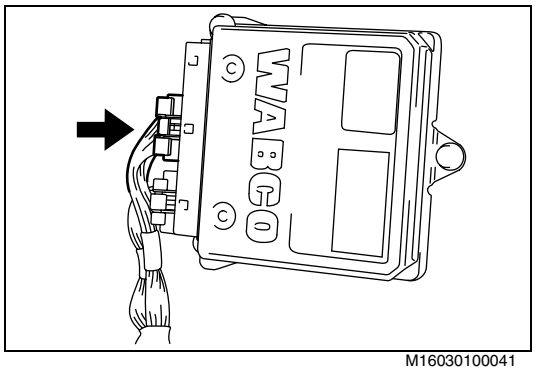
(2) Connecting the tester between 12th and 15th terminals of 18 pin connectors, measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 150-1,999 mV (Range of Alternating Current Voltage)**

NG → Abnormality of the harness or wheel sensor.

OK → Computer abnormality.

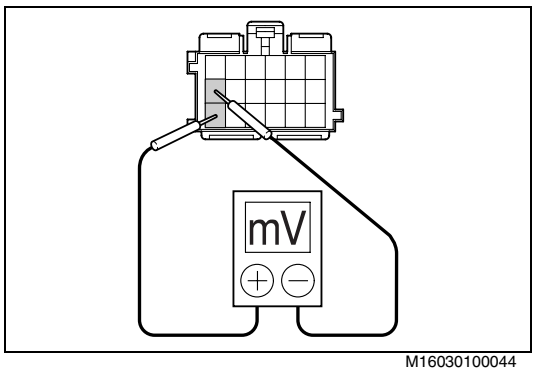
# SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, RH ON REAR AXLE (DIAGNOSIS CODE 4-3)

M16030101BEF2027



M16030100041

**1. CHECK THE VOLTAGE BETWEEN TERMINALS.**
(1) By switching the starter key "LOCK" position, remove off 18 pin connectors of ABS computer.



M16030100044

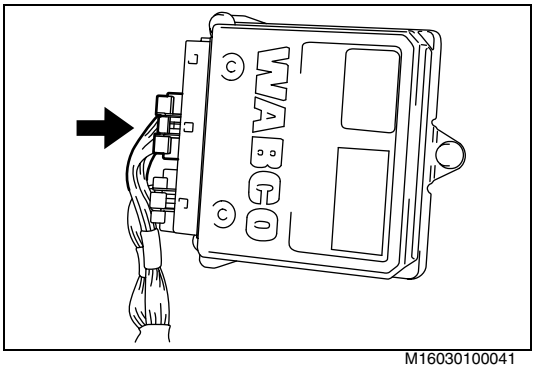
(2) Connecting the tester between 18th and 17th terminals of 18 pin connectors, measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 150-1,999 mV (Range of Alternating Current Voltage)**

NG → Abnormality of the harness or wheel sensor.

OK → Computer abnormality.

# SHORT-CIRCUIT AND WIRING DISCONNECTION OF WHEEL SENSOR, LH ON REAR AXLE (DIAGNOSIS CODE 4-4)

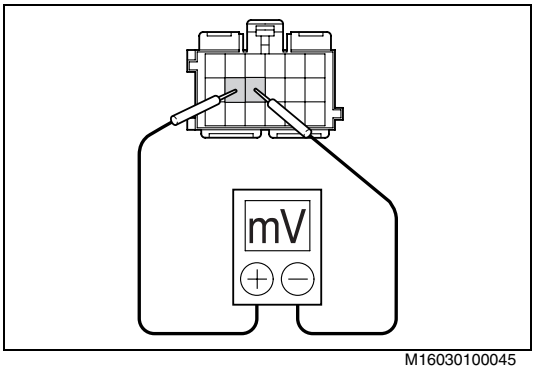
M16030101BEF2028



M16030100041

**1. CHECK THE VOLTAGE BETWEEN TERMINALS.**

(1) By switching the starter key "LOCK" position, remove off 18 pin connectors of ABS computer.



M16030100045

(2) Connecting the tester between 14th and 11th terminals of 18 pin connectors, measure it's voltage by rotating the tire by one time for 5 seconds.
**Standard: 150-1,999 mV (Range of Alternating Current Voltage)**

NG → Abnormality of the harness or wheel sensor.

OK → Computer abnormality.

# ABNORMAL SIGNAL OF THE WHEEL SENSOR, RH ON FRONT AXLE (DIAGNOSIS CODE 5-1)

M16030101BEF2029

**1. CHECK THE WHEEL SENSOR.**

(1) Inspect the harness and the connectors of wheel sensor.
(2) Inspect the installed status and also damage, breakage of wheel sensor.

# ABNORMAL SIGNAL OF THE WHEEL SENSOR, LH ON FRONT AXLE (DIAGNOSIS CODE 5-2)

M16030101BEF2030

**1. CHECK THE WHEEL SENSOR.**

(1) Inspect the harness and the connectors of wheel sensor.
(2) Inspect the installed status and also damage, breakage of wheel sensor.

## ABNORMAL SIGNAL OF THE WHEEL SENSOR, RH ON REAR AXLE (DIAGNOSIS CODE 5-3)

M16030101BEF2031

**1. CHECK THE WHEEL SENSOR.**
(1) Inspect the harness and the connectors of wheel sensor.
(2) Inspect the installed status and also damage, breakage of wheel sensor.

## ABNORMAL SIGNAL OF THE WHEEL SENSOR, LH ON REAR AXLE (DIAGNOSIS CODE 5-4)

M16030101BEF2032

**1. CHECK THE WHEEL SENSOR.**
(1) Inspect the harness and the connectors of wheel sensor.
(2) Inspect the installed status and also damage, breakage of wheel sensor.

## ABNORMALITY IN SENSOR RING, RH ON FRONT AXLE (DIAGNOSIS CODE 6-1)

M16030101BEF2033

**1. CHECK THE SENSOR RING.**
(1) Inspect on damage of the sensor ring, installing status of the sensor holder and the play of wheel hub bearing.

## ABNORMALITY IN SENSOR RING, LH ON FRONT AXLE (DIAGNOSIS CODE 6-2)

M16030101BEF2034

**1. CHECK THE SENSOR RING.**
(1) Inspect on damage of the sensor ring, installing status of the sensor holder and the play of wheel hub bearing.

## ABNORMALITY IN SENSOR RING, RH ON REAR AXLE (DIAGNOSIS CODE 6-3)

M16030101BEF2035

**1. CHECK THE SENSOR RING.**
(1) Inspect on damage of the sensor ring, installing status of the sensor holder and the play of wheel hub bearing.

## ABNORMALITY IN SENSOR RING, LH ON REAR AXLE (DIAGNOSIS CODE 6-4)

M16030101BEF2036

**1. CHECK THE SENSOR RING.**
(1) Inspect on damage of the sensor ring, installing status of the sensor holder and the play of wheel hub bearing.

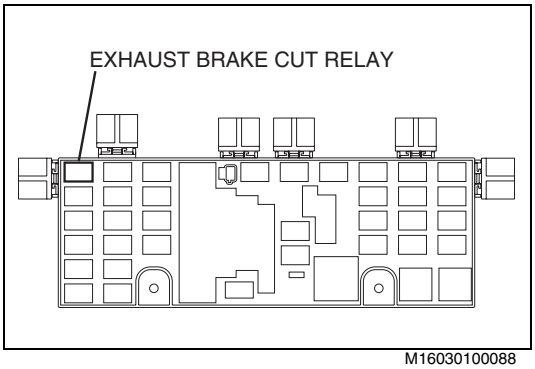
# ABNORMAL SIGNAL OF THE WHEEL SENSOR (DIAGNOSIS CODE 7-1)

M16030101BEF2037

1. **Refer to DIAGNOSIS CODE 5-1 to 5-4.**

# ABNORMALITY ON THE EXHAUST BRAKE CUT RELAY (DIAGNOSIS CODE 7-3)

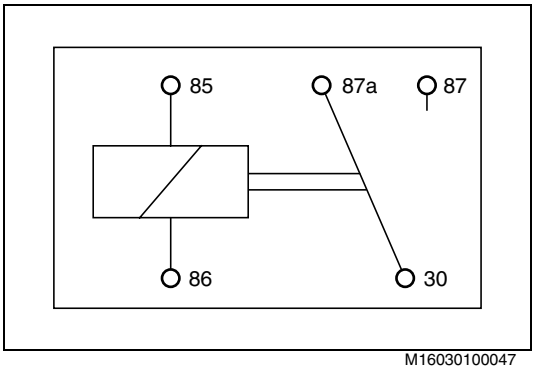
M16030101BEF2049




M16030100088

1. **CHECK THE CONTINUITY INSULATION BETWEEN EACH TERMINALS OF THE RELAY.**

(1) By switching the starter key "LOCK", remove the exhaust brake cut relay.




M16030100047

(2) According to the table below, inspect the continuity insulation between each terminals of the relay.

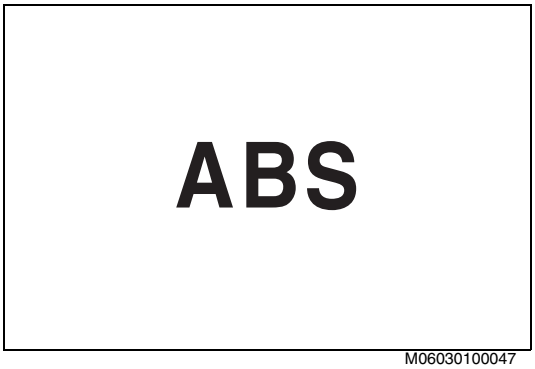
| | **Between 30-87** | **Between 30-87a** |
|---|---|---|
| Turning on electricity under 24V to 85-86. | Continuity | Insulation |
| No electricity to 85-86. | Insulation | Continuity |

NG → Abnormality of the harness.

OK → Abnormality at the exhaust brake cut-relay.

# ABNORMALITY ON ABS WARNING LAMP (DIAGNOSIS CODE 7-4)

M16030101BEF2050




M06030100047

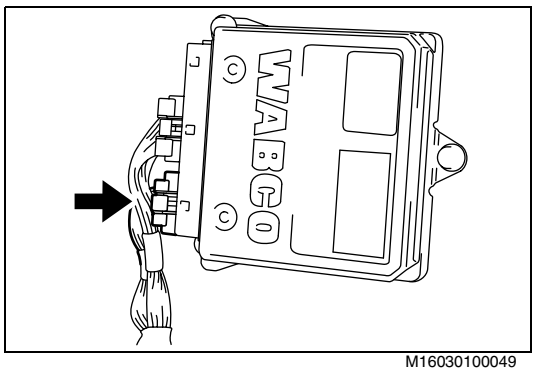
1. **CHECK THE ABS WARNING LAMP.**

(1) Make sure that it lights when the starter key is turned "ON" and goes off after some moments.

(2) Change the bulb when it does not light.

# ABNORMALITY OF GROUND HARNESS (DIAGNOSIS CODE 8-5)

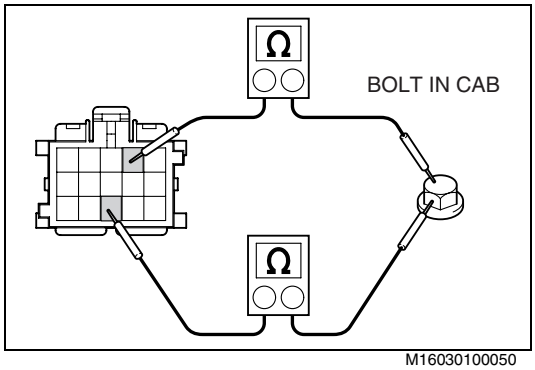
M16030101BEF2051




M16030100049

**1. CHECK THE CONTINUITY BETWEEN TERMINALS AND THE BOLT IN THE CAB.**

(1) By switching the starter key "LOCK" position, remove off 15 pin connectors of ABS computer.




M16030100050

(2) Make sure that the continuity exists between 4th, 9th terminals of 15 pin connectors and the bolt in the cab.
**Standard: Continuity**

NG

Abnormality of the harness.

OK

Computer abnormality.

# BRAKE CONTROL (ES START)

DN03-003

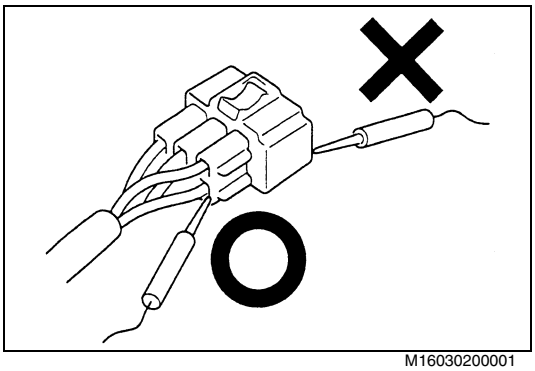
**ES START (EASY & SMOOTH START) SYSTEM ..... DN03-2**

HANDLING PRECAUTIONS ..... DN03-2
SYSTEM DIAGRAM ..... DN03-3
ARRANGEMENT OF CONNECTOR PIN ..... DN03-4
PRE-INSPECTION ..... DN03-5
TROUBLESHOOTING ..... DN03-7
FAILURE DIAGNOSIS BY USING DIAGNOSIS MONITOR ..... DN03-11
HOW TO DELETE THE DIAGNOSIS CODE 8 ..... DN03-12
HOW TO DELETE THE DIAGNOSIS CODE 12 ..... DN03-13
HOW TO DELETE THE DIAGNOSIS CODE 13 ..... DN03-14
DAMAGE ANALYSIS BY DIAGNOSIS CODE ..... DN03-15
POWER MALFUNCTION (NO DIAGNOSIS CODE) ..... DN03-16
POWER SUPPLY VOLTAGE MALFUNCTION (DIAGNOSIS CODE 2) ..... DN03-18
CLUTCH STROKE SENSOR SYSTEM DAMAGE (DIAGNOSIS CODE 3) ..... DN03-19
SPEED SENSOR SYSTEM DAMAGE (DIAGNOSIS CODE 4) ..... DN03-21
ES START CONTROL VALVE DAMAGE (DIAGNOSIS CODE 7) ..... DN03-22
CLUTCH FLUID PRESSURE SWITCH DAMAGE (DIAGNOSIS CODE 8) ..... DN03-24
CLUTCH STROKE SENSOR POWER SYSTEM MALFUNCTION (DIAGNOSIS CODE 9) ..... DN03-26
NEUTRAL SWITCH AND BACK-UP LAMP SWITCH MALFUNCTION (DIAGNOSIS CODE 11) ..... DN03-27
NEUTRAL SWITCH SYSTEM OR SPEED SENSOR SYSTEM MALFUNCTION (DIAGNOSIS CODE 12) ..... DN03-29
STOP LAMP SWITCH DAMAGE (DIAGNOSIS CODE 13) ..... DN03-31
ES START CONTROLLER MALFUNCTION (DIAGNOSIS CODE 16) ..... DN03-32
ES MAIN SWITCH DAMAGE (DIAGNOSIS CODE 18) ..... DN03-33
ES START RELEASE TIMING SWITCH (DIAGNOSIS CODE 21) ..... DN03-35

# ES START (EASY & SMOOTH START) SYSTEM

## HANDLING PRECAUTIONS

M16030201BEF2001



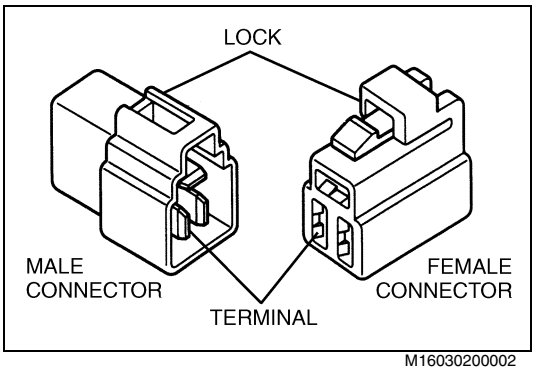
M16030200001

### 1. ABOUT CONNECTORS

(1) Before performing the inspection operation, make sure that all connectors are connected securely.

(2) Do not contact the tester bar to the connection surface of the connector. This may cause terminal damage or a short-circuit.

(3) All connectors in the connector diagram are observed from the contact surfaces. However, the tester bar is put from the rear side.

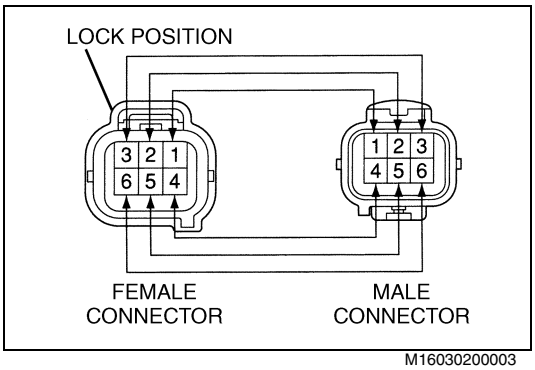



M16030200002

(4) The connector is displayed from the view of the mating surface when the connector lock is positioned above.

**Reference**

- **Female connector: The terminal is female.**
- **Male connector: The terminal is male.**




M16030200003

(5) As for the terminal numbers of the connecor, the first terminal is located on the top right terminal of the male connector and the top left tereminal of the female connector.
**Reference:**
**When viewed from the mating surface, the terminal numbers of both connectors are located symmetrically (reversed horizontally).**

(6) When disconnecting the connectors, be sure to position the starter switch "LOCK".

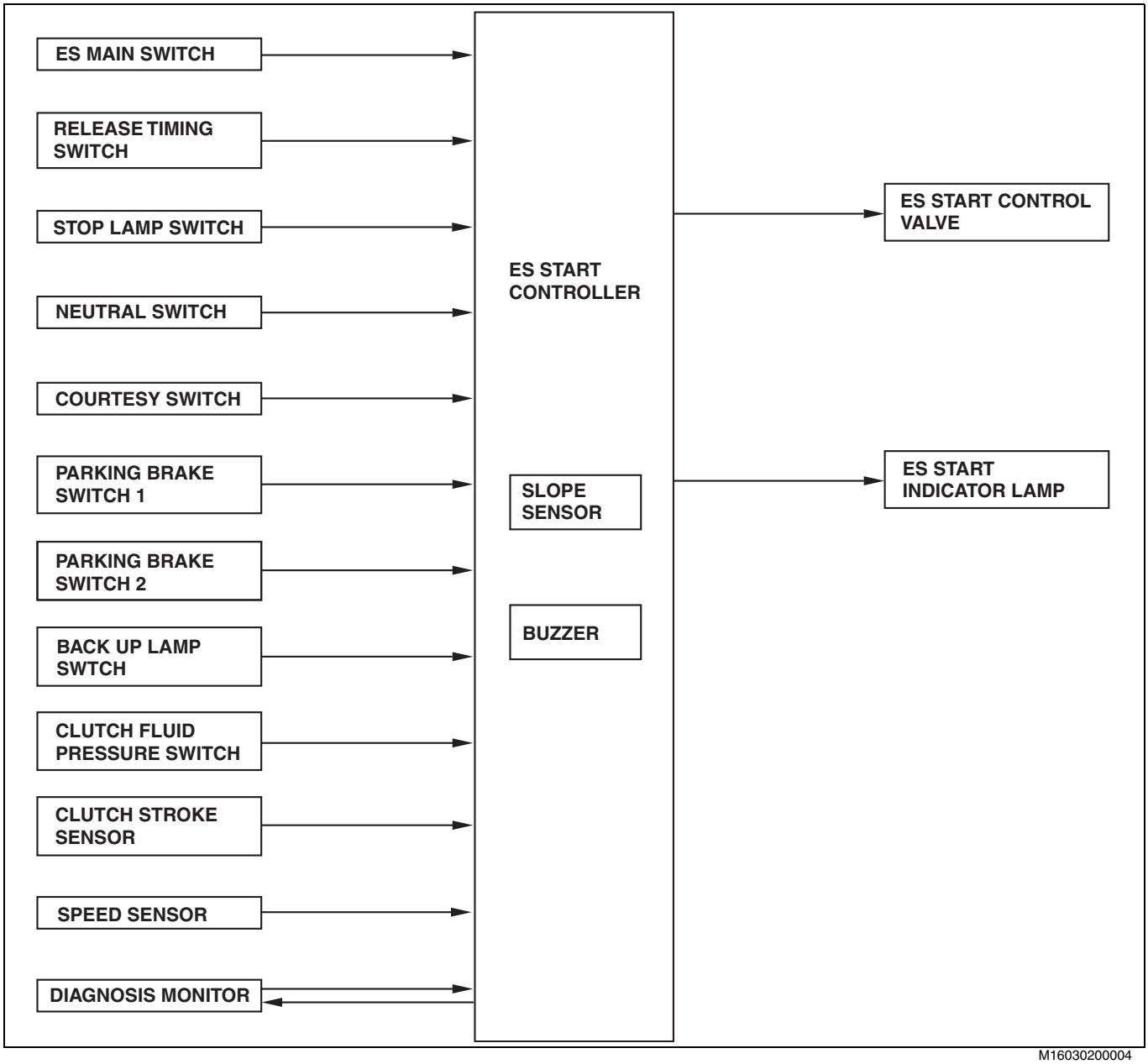
### 2. ABOUT DIAGNOSIS MONITOR

(1) Erase the previous damage data after they have been recorded, then perform the damage diagnosis again and confirm the current damage.

(2) After the damage analysis is completed, delete the previous damage data.

# SYSTEM DIAGRAM

M16030201BEF2002



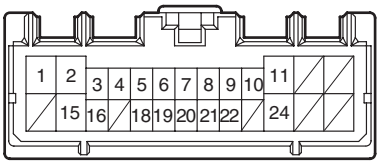

M16030200004

# ARRANGEMENT OF CONNECTOR PIN

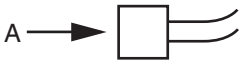
M16030201BEF2019

## ES START CONTROLLER

26-PIN CONNECTOR



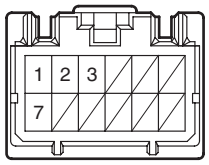

VIEW A



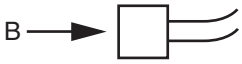

CAB SIDE HARNESS

| No. | CODE | SIGNAL | No. | CODE | SIGNAL |
|---|---|---|---|---|---|
| 1 | +B | Power | 14 | — | — |
| 2 | KYSW | Starter switch | 15 | KY2 | Starter switch |
| 3 | GND | System ground | 16 | GND2 | System ground 2 |
| 4 | M/V+ | ES start control valve output | 17 | — | — |
| 5 | PR | ES start warning lamp | 18 | PKB1 | Parking brake switch No.2 |
| 6 | NTL | Neutral switch | 19 | PKB | Parking brake switch No.1 |
| 7 | RVS | Back-up lamp switch | 20 | DR | Courtesy switch |
| 8 | STP | Stop lamp switch | 21 | DIC | Diagnosis monitor input |
| 9 | ON | ES main switch "ON" | 22 | OFF | ES main switch "OFF" |
| 10 | SSIG | Speed sensor signal | 23 | — | — |
| 11 | FTSW | Release timing switch "FAST" | 24 | SLSW | Release timing switch "SLOW" |
| 12 | — | — | 25 | — | — |
| 13 | — | — | 26 | — | — |

12-PIN CONNECTOR




VIEW B



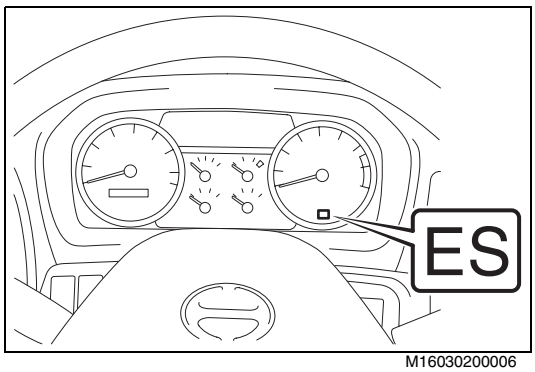

CAB SIDE HARNESS

| No. | CODE | SIGNAL | No. | CODE | SIGNAL |
|---|---|---|---|---|---|
| 1 | C+B | Clutch stroke sensor power | 7 | S-S | Clutch stroke sensor ground |
| 2 | CSS | Clutch stroke sensor signal | 8 | — | — |
| 3 | CLT | Clutch fluid pressure switch | 9 | — | — |
| 4 | — | — | 10 | — | — |
| 5 | — | — | 11 | — | — |
| 6 | — | — | 12 | — | — |

M16030200005

# PRE-INSPECTION

M16030201BEF2003



M16030200006

**1. CHECKING DISPLAY CODES OF ES INDICATOR LAMP**

(1) ES start controller alerts by beeping the warning buzzer and lighting or blinking the indicator lamp to classify the alarms when malfunctions or failures occur.

**NOTICE:**
**When a failure alarm is displayed, perform the failure diagnosis by using diagnosis function.**

| Display and warning item | | Indicator lamp | Warning buzzer | Warning content | Treatment |
|---|---|---|---|---|---|
| Under "ON" condition of starter switch, check if the lamp lights or not | | Lighting for one second | Beeping once | — | — |
| Operation | ES start is operating | Lighting | Beeping once | — | — |
| | ES start is released | Lighting off | No beeping | — | — |
| Warning | Failure alarm | Blinking | Beeping continuously | Defects of signal switches or sensors | Perform failure diagnosis by diagnosis function. |
| | Non-adjustment alarm | Blinking | No beeping | Initialization is not completed. | Initialize. |
| Caution to mis-operation | Quitting seat alarm | Lighting | Beeping continuously | Door (either driver's side or assistant's side) opens when ES start is operating | Pull parking brake lever. |
| | Starter switch OFF alarm | Lighting off | Beeping continuously | Starter switch is set to "LOCK" when ES start is operating during neutral position. | Pull parking brake lever or set main switch to "OFF". |
| | Vehicle moving alarm | Lighting | Beeping continuously | Vehicle moves when ES start is operating. | Pull parking brake lever or step brake pedal |
| | Operation time information | Lighting | Operation time from 1 to 9 minutes<br>1 minute has passed: beeping once<br>2 minutes have passed: beeping two times<br>9 minutes have passed: beeping nine times<br>Operation time 10 minutes or more: Beeping continuously | Displaying every minute ES start operation time | Release ES start. |

M16030200057

- Check the battery voltage.
  Reference value: More than 20V
- Check that the ES start controller connectors are connected correctly.
- Check the fuse.
- Check that the speed sensor connector is connected correctly.
- Check that the ES start valve connector is connected correctly.
- Check that the clutch hydraulic switch connector is connected correctly.
- Check that the clutch stroke sensor connector is connected correctly.
- Check that the back-up lamp switch connector is connected correctly.
- Check that the neutral switch connector is connected correctly.

# TROUBLESHOOTING

M16030201BEF2004

**THE ES START OPERATION FAILS.**

**1 Is there an operation malfunction?**
- The starter switch is in either the [LOCK] or [ACC] position.
- The ON/OFF switch is in the [OFF] position.
- The brake pedal is released.
- The parking brake lever is pulled back.
- Going forward downhill.
- Going in reverse uphill.

An operation malfunction occurred.
→ Correct the operation.

An operation malfunction did not occur.

**2 Set the starter key to [ON] and check the main power.**

**3 Check if a warning is occurred.**
A warning occurred.
→ Refer to table of warning

A warning did not occur.

**4 Check the stop lamp switch.**

**5 Check the parking brake switch.**

**6 Check the speed sensor.**

**7 Check the clutch stroke sensor.**

**8 Check the air piping.**

**9 Check the ES start control valve.**

**10 The ES start controller is damaged.**

M16030200058

**THE ES START IS NOT CANCELED.**
**(THE CANCEL OPERATION IS PERFORMED BY THE STARTING OPERATION.)**

1 **Check if there was an operation malfunction.**
- The gear shift lever is in neutral.
- The start operation is not performed correctly.

An operation malfunction occurred.
→ Correct the operation.

An operation malfunction did not occur.

2 **Check if a warning is occurred.**
A warning occurred.
→ Refer to table of warning

A warning did not occur.

3 **Check the neutral switch and the back-up lamp switch.**

4 **Check the clutch stroke sensor.**

5 **Check the air piping.**

6 **Check the ES start control valve.**

7 **The ES start controller is damaged.**

M16030200059

**THE ES START IS NOT CANCELED.**
**(THE CANCEL OPERATION IS PERFORMED BY THE PARKING BRAKE.)**

1 **Check if there was an operation malfunction.**
- The parking brake must not be pulled back.

An operation malfunction occurred.
→ Correct the operation.

An operation malfunction did not occur.

2 **Check if a warning is occurred.**
A warning occurred.
→ Refer to table of warning

A warning did not occur.

3 **Check the parking brake switch.**

4 **Check the air piping.**

5 **Check the ES start control valve.**

6 **The ES start controller is damaged.**

M16030200060

**THE ES START IS NOT CANCELED.**
**(THE CANCEL OPERATION IS PERFORMED BY THE ES MAIN SWITCH.)**

1 **Check if there was an operation malfunction.**
- The main switch is not set to [OFF] .

An operation malfunction occurred.
→ Correct the operation.

An operation malfunction did not occur.

2 **Check if a warning is occurred.**
A warning occurred.
→ Refer to table of warning

A warning did not occur.

3 **The ES start controller is damaged.**

M16030200061

**THE INITIAL SETTING OF THE CANCEL POSITION CANNOT BE PERFORMED.**

1 **Check if an operation malfunction occurred.**
An operation malfunction occurred.
→ Correct the operation.

An operation malfunction did not occur.

2 **Check if the following conditions are not satisfied.**
- The ES start operation is currently being performed.
- The 0-point adjustment is being performed.
- The cancel position is being adjusted.

3 **Check if a warning is occurred.**
A warning occurred.
→ Refer to table of warning

A warning did not occur.

4 **Check the parking brake switch.**

5 **Check the neutral switch and the back-up lamp switch.**

6 **Check the clutch stroke sensor.**

7 **The ES start controller is damaged.**

M16030200062

**THE 0-POINT ADJUSTMENT OF THE SLOPE SENSOR CANNOT BE PERFORMED.**

**1 Check if an operation malfunction occurred.**
An operation malfunction occurred.
→ Correct the operation.

An operation malfunction did not occur.

**2 Check if the following conditions are not satisfied.**
- The ES start operation is currently being performed.
- The initial setting of the cancel position is being performed.
- The cancel position is being adjusted.

**3 Check if a warning is occurred.**
A warning occurred.
→ Refer to table of warning

A warning did not occur.

**4 Check the parking brake switch.**

**5 The ES start controller is damaged.**

M16030200063

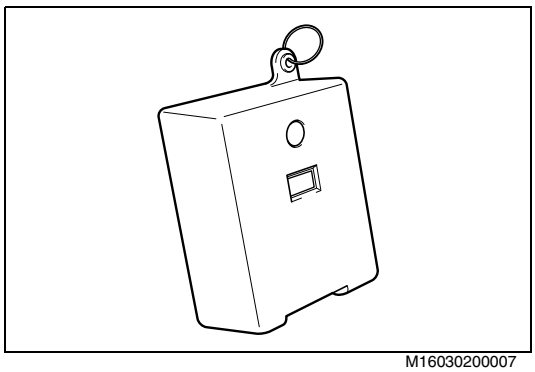
**THE BRAKE IS NOT RELEASED WHEN THE CANCELLATION IS PERFORMED. (OR VEHICLE SLIDES DOWN.)**

**Adjust the release timing.**

M16030200064

# FAILURE DIAGNOSIS BY USING DIAGNOSIS MONITOR

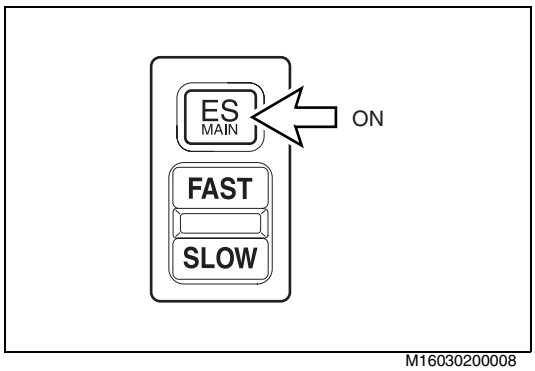
M16030201BEF2020



M16030200007

**1. FAILURE DIAGNOSIS BY USING DIAGNOSIS MONITOR**

(1) Diagnosis monitor alerts the failure location with sound and light by being connected to the special diagnosis connector of ES start system.

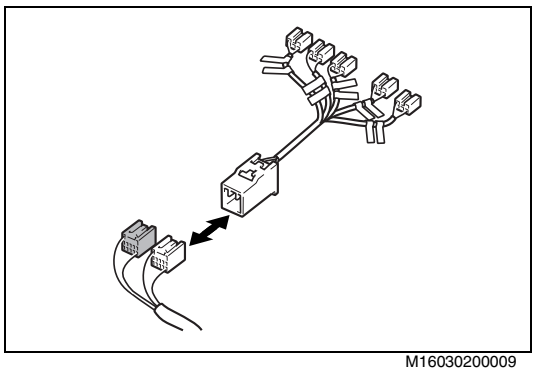



M16030200008

**2. CONNECTION OF THE DIAGNOSIS MONITOR**

(1) Set the ES main switch to [ON].

(2) Set the starter switch to [ON].



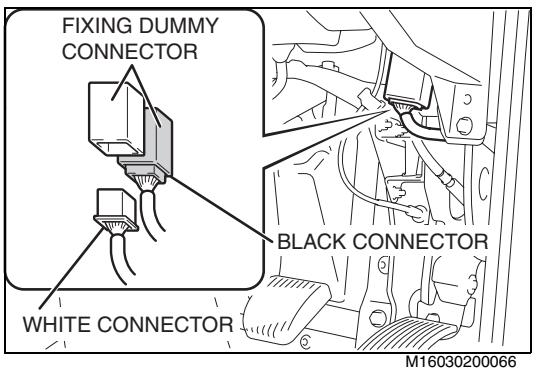
M16030200009

(3) Locate two intensive diagnosis connectors on lower right of the driver's side instrument panel. Connect the special wiring harness to the white connector and diagnosis monitor to the connector tagged by "ES start".

**SST:**

**Special wiring harness for intensive diagnosis connector (09630-2300)**

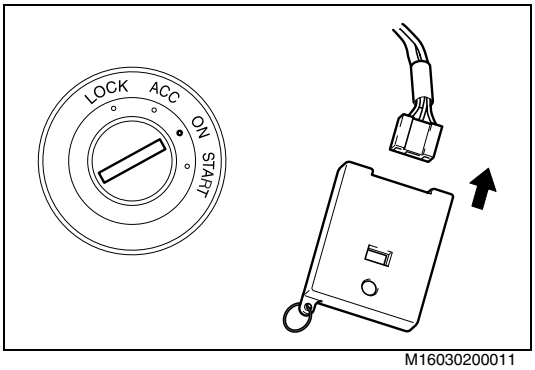
**Diagnosis monitor (09630-1370)**




M16030200066

**NOTICE:**

**The intensive diagnosis connector is usually connected to the fixing dummy connector. So, disconnect the connector from the dummy connector and pull it to use. When the connector is not in use, connect it firmly to the fixing dummy connecor.**



M16030200011

**3. DISPLAYING THE FAILURE CODE**

(1) Because the failure codes are output repeatedly in ascending order of failure codes without distinguishing present and past failures, delete the past failure by referring "4. Deleting the past failures".

**HINT:**
**If there are no failure codes, the system outputs "Diagnosis code 1".**

**4. DELETING THE PAST FAILURES**

**NOTICE:**
**Regarding the diagnosis codes 8, 12 and 13, the way of deleting the past codes is different. Refer to the individual way of deleting.**

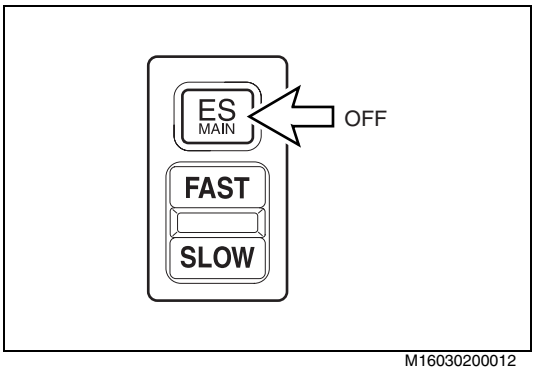
(1) Record the first diagnosis code output.
(2) Disconnect the diagnosis monitor while keeping the starter key at "ON" position.

**NOTICE:**
**If the starter key is set to "LOCK" position, the past failures cannot be deleted. Make sure to keep the key at "ON" position.**

(3) Wait for several seconds. Then connect the diagnosis monitor to output the present failure.

# HOW TO DELETE THE DIAGNOSIS CODE 8

M16030201BEF2021



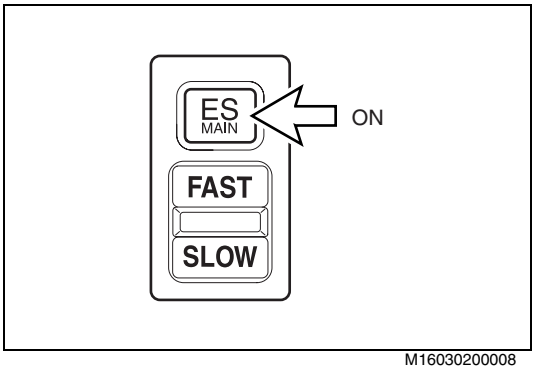
M16030200012

**1. DELETING PROCEDURE**

(1) Turn the starter switch to "ON" position and ES main switch "OFF".

(2) After having repaired the failure, step and release the clutch pedal for more than three times to make the controller recognize the ON/OFF of hydraulic switch.

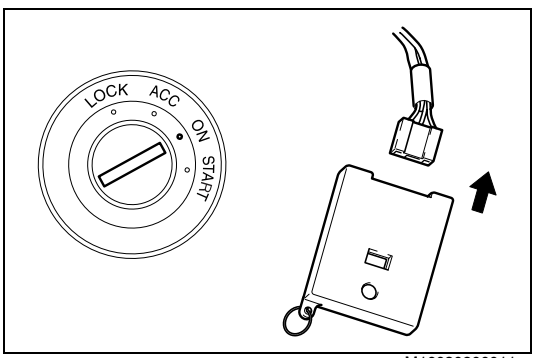
**HINT:**
**Until the controller recognizes the ON/OFF of hydraulic switch, the diagnosis code cannot be deleted.**



M16030200008

(3) Turn ES main switch "ON".

(4) Connect the diagnosis monitor and check that the diagnosis code 8 is output.



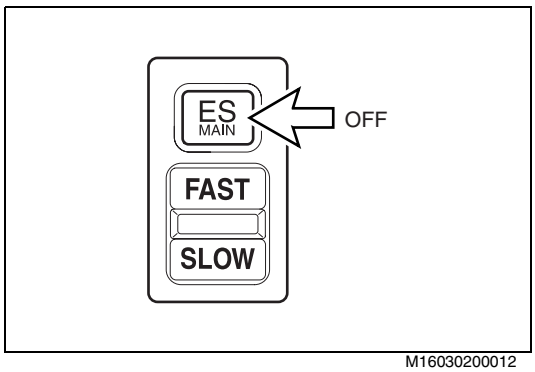
M16030200011

(5) Disconnect the diagnosis monitor while keeping the starter switch at "ON" position.

(6) Wait for several seconds. Then connect the diagnosis monitor to check that the diagnosis code 8 has been deleted.

# HOW TO DELETE THE DIAGNOSIS CODE 12

M16030201BEF2022



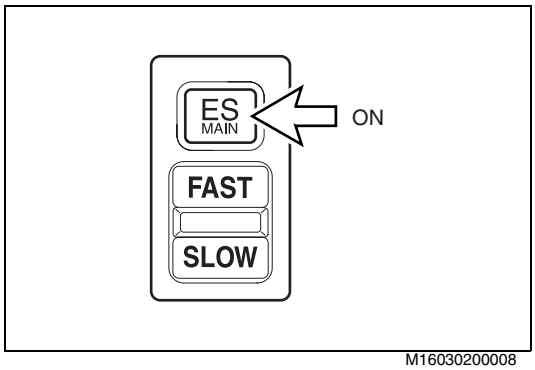
M16030200012

**1. DELETING PROCEDURE**

(1) Turn the starter switch to "ON" position and ES main switch "OFF".

(2) After having repaired the failure, engage and disengage the transmission for more than three times to make the controller recognize the ON/OFF of neutral switch.

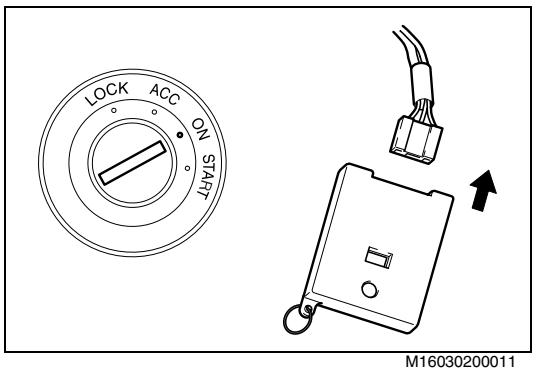
**HINT:**
**Until the controller recognizes the ON/OFF of neutral switch, the diagnosis code cannot be deleted.**



M16030200008

(3) Turn ES main switch "ON".

(4) Connect the diagnosis monitor and check that the diagnosis code 12 is output.



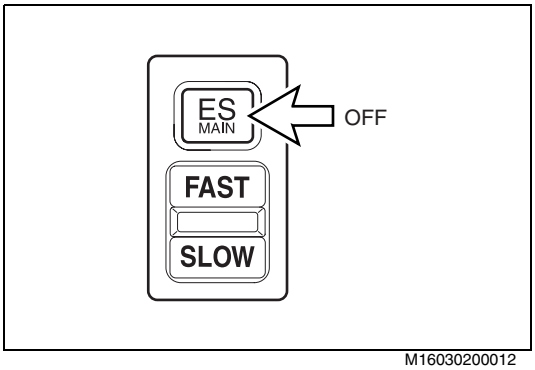
M16030200011

(5) Disconnect the diagnosis monitor while keeping the starter key at "ON" position.

(6) Wait for several seconds. Then connect the diagnosis monitor to check that the diagnosis code 12 has been deleted.

# HOW TO DELETE THE DIAGNOSIS CODE 13

M16030201BEF2023



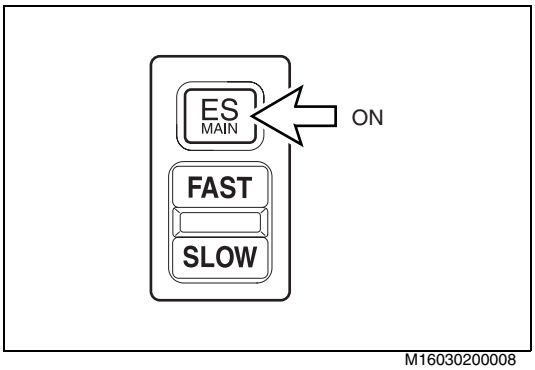
M16030200012

**1. DELETING PROCEDURE**

(1) Turn the stater switch to "ON" position and ES main switch "OFF".

(2) After having repaired the failure, step and release the brake pedal for more than three times to make the controller recognize the ON/OFF of stop lamp switch.

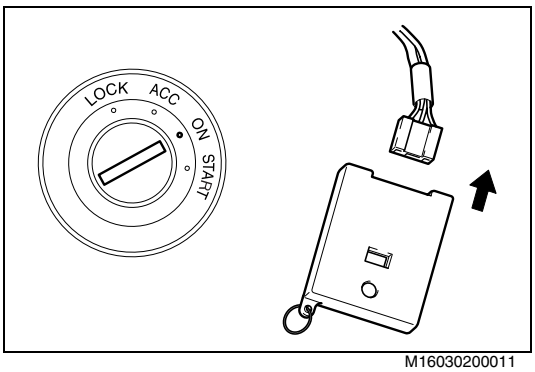
**HINT:**
**Until the controller recognizes the ON/OFF of stop lamp switch, the diagnosis code cannot be deleted.**



M16030200008

(3) Turn ES main switch "ON".

(4) Connect the diagnosis monitor and check that the diagnosis code 13 is output.

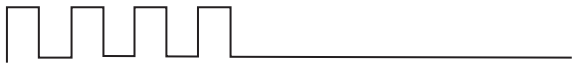
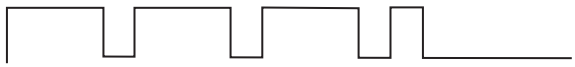
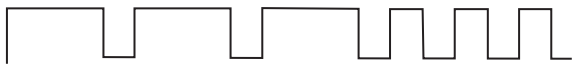
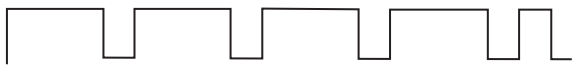


M16030200011

(5) Disconnect the diagnosis monitor while keeping the starter key at "ON" position.

(6) Wait for several seconds. Then connect the diagnosis monitor to check that the diagnosis code 13 has been deleted.

## DIAGNOSIS CODE TABLE

| Diagnosis code No. | Inspection item | Diagnosis monitor and indicator lamp output |
|---|---|---|
| 1 | Normal |  |
| 2 | Power harness voltage malfunction |  |
| 3 | Clutch stroke sensor system damage (disconnection, short-circuit) |  |
| 4 | Speed sensor system damage |  |
| 7 | ES start control valve damage |  |
| 8 | Clutch fluid pressure switch system damage |  |
| 9 | Clutch stroke sensor power system malfunction |  |
| 11 | Neutral switch and back up lamp switch malfunction |  |
| 12 | Neutral switch system or speed sensor system malfunction |  |
| 13 | Stop lamp switch damage |  |
| 16 | ES start controller malfunction |  |
| 18 | ES main switch damage |  |
| 21 | Release timing position switch damage |  |

# DAMAGE ANALYSIS BY DIAGNOSIS CODE

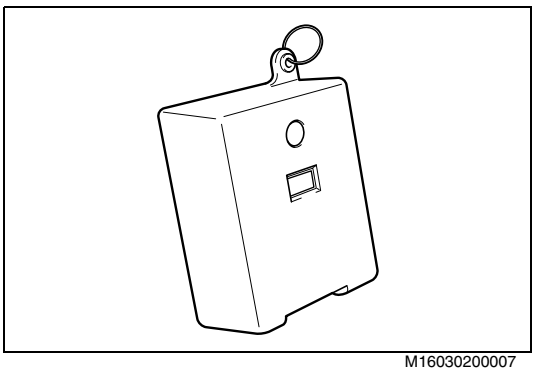
M16030201BEF2005

**NOTICE:**

1. **When replacing the clutch hydraulic switch, always initialize the brake releasing position.**
2. **When replacing the clutch stroke sensor, always initialize the brake releasing position.**
3. **When replacing ES start controller, always initialize the brake releasing position and perform 0 point adjustment of slope sensor.**

# POWER MALFUNCTION (NO DIAGNOSIS CODE)

M16030201BEF2006



M16030200007

**1. MEASURE THE VOLTAGE BETWEEN TERMINALS.**

(1) Set the starter switch to [LOCK] and remove the 26-pin connector of the ES start controller.

(2) Set the starter switch [ON] and measure the voltage between the terminal 2 and 3 and the terminal 15 and 16 of the 26-pin connector (harness side).
**Standard value: More than 20 V**

NG

OK

- Less than 20 V: Go to the item 3.
- 0 V: Go to the item 4.

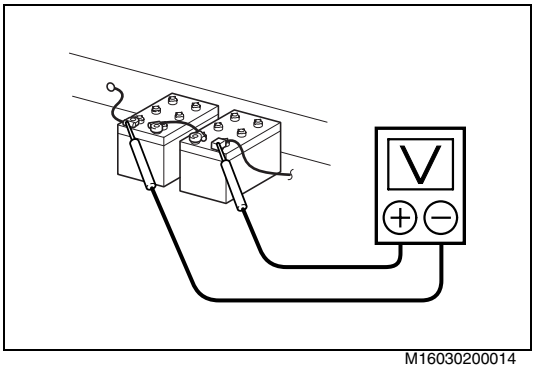
**2. CHECK THE OPERATION OF THE ES START SYSTEM.**
**Standard: Normal operation**

NG

OK

ES start controller malfunction

ES start controller connector contact failure, faulty harness contact failure




M16030200014

**3. MEASURE THE VOLTAGE OF BATTERY.**

(1) Measure the voltage between the (+) terminal and the (-) terminal of the battery.
**Standard value: More than 20 V**

NG

OK

Battery malfunction

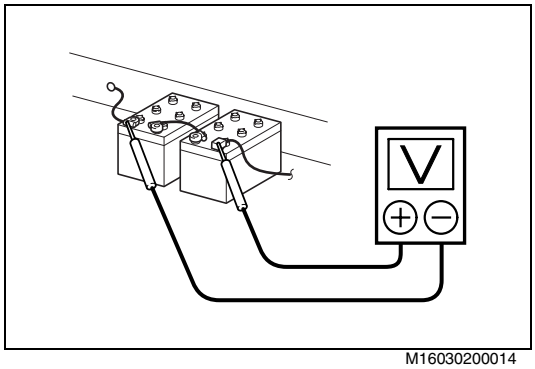
Power supply harness contact failure or disconnection

**4. CHECK THE ES START FUSE.**

(1) Check the ES start fuse in the fuse block.
**Standard: Not melting**

NG → Go to the item 6.

OK



M16030200014

**5. MEASURE THE VOLTAGE OF BATTERY.**

(1) Measure the voltage between the (+) terminal and the (-) terminal of the battery.
**Standard value: More than 20 V**

NG → Battery malfunction

OK

Power supply harness contact failure or disconnection

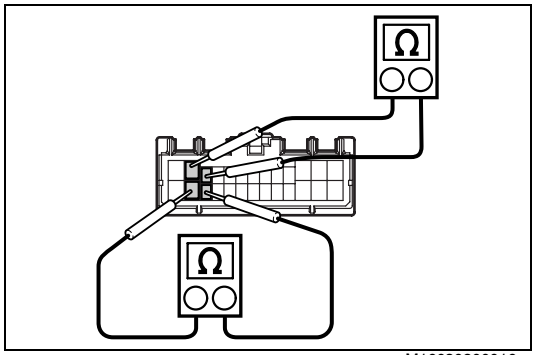
**6. RECHECK THE ES START FUSE.**

(1) Set the starter switch to [LOCK], replace the fuse and set the starter switch [ON].
**Standard: Not melting**

NG → Go to the item 7.

OK

Normal



M16030200016

**7. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Set the starter switch to [LOCK], remove the 26-pin connector of the ES start controller and check the conductiviry between the terminal 2 and 3 and the terminal 15 and 16 of the 26-pin connector (harness side).
**Standard: No conductivity**

NG → Short-circuit in the harness

OK

**8. RECHECK THE OPERATION OF THE ES START SYSTEM.**
**Standard: Normal operation**

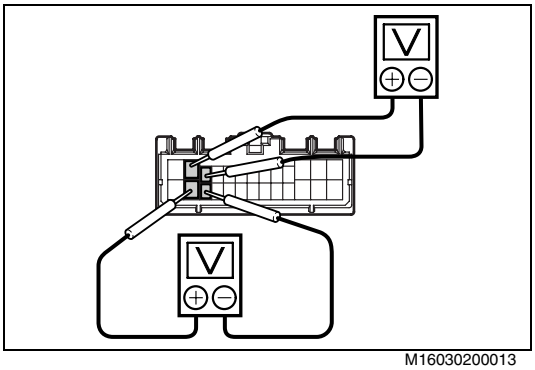
NG → ES start controller malfunction

OK

ES start controller connector contact failure, faulty harness contact failure

# POWER SUPPLY VOLTAGE MALFUNCTION (DIAGNOSIS CODE 2)

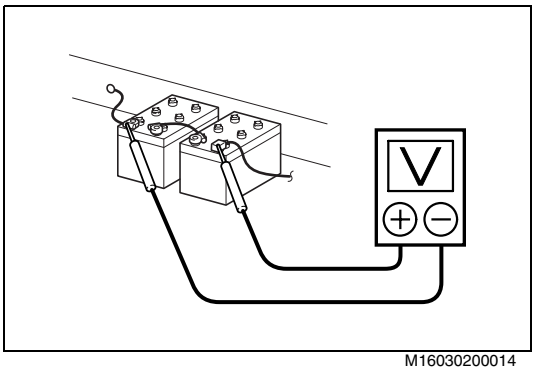
M16030201BEF2007


M16030200013

**1. MEASURE THE VOLTAGE BETWEEN TERMINALS.**
(1) Set the starter switch to [LOCK] and remove the 26-pin connector of the ES start controller.
(2) Measure the voltage between the terminal 2 and 3 and the terminal 15 and 16 of the 26-pin connector (harness side.)
**Standard value: More than 20 V**

NG → Go to the item 3.

OK

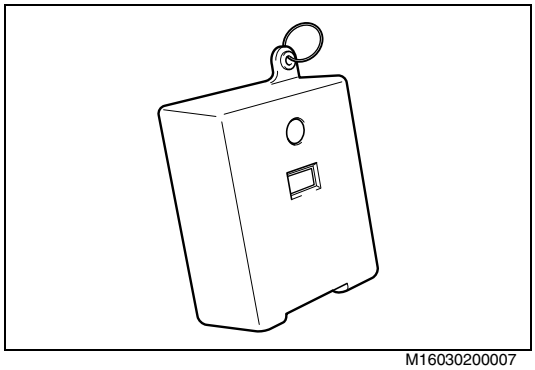

M16030200014

**2. MEASURE THE VOLTAGE OF BATTERY.**
(1) Measure the voltage between the (+) terminal and (-) terminal of the battery.
**Standard value: More than 20 V**

NG → Battery malfunction

OK

Power supply harness contact failure or disconnection


M16030200007

**3. CHECK THE DIAGNOSIS CODE.**

(1) Erase the diagnosis monitor memory and confirm the diagnosis code by diagnosis functions again.
**Standard: Diagnosis code: 1**

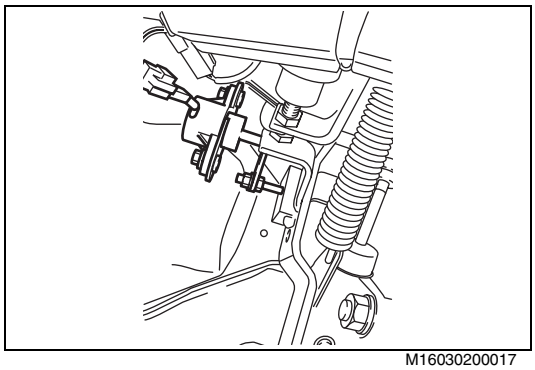
NG → ES start controller malfunction

OK

- Harness contact failure
- Charging system malfunction

# CLUTCH STROKE SENSOR SYSTEM DAMAGE (DIAGNOSIS CODE 3)

M16030201BEF2008


M16030200017

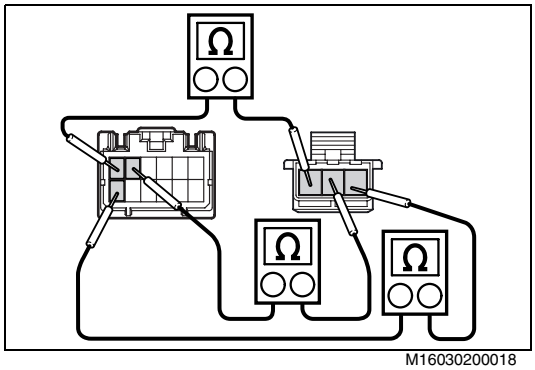
**1. CHECK THE CLUTCH STROKE SENSOR.**

(1) Check the installation location of the clutch stroke sensor.
**Standard: Correct installation**

NG → Install the sensor correctly.

OK

(2) Measure the voltage of the set position.
**Standard voltage: 0.28-0.77 V**

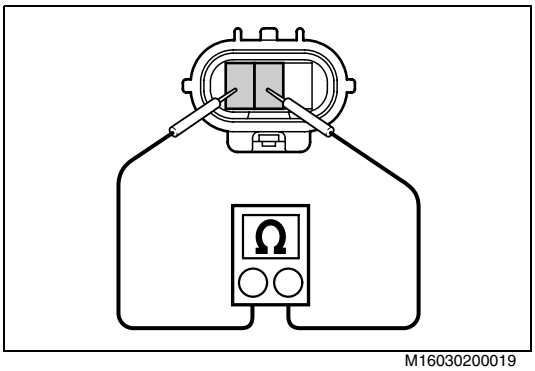

M16030200018

**2. CHECK THE CONDUCTIVITY BETWEEN THE TERMINALS.**

(1) Remove the 12-pin connector of the ES start controller and clutch stroke sensor connector and check the conductivity between the terminal 1 and 1, the terminal 2 and 2 and the terminal 7 and 3 of both connectors (harness side).
**Standard: Conductivity**

NG → Harness disconnection

OK



M16030200019

**3. MEASURE THE RESISTANCE BETWEEN TERMINALS.**

(1) Measure the resistance between the terminal 2 and 3 of the connector (sensor side).
**Standard value:**
**When pressing the clutch pedal: Approx. 2 kΩ**
**When releasing the clutch pedal: Approx. 700 Ω**

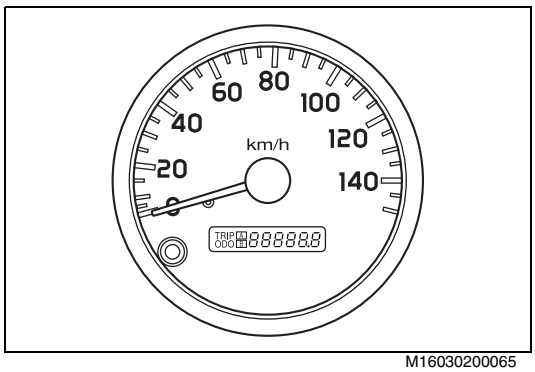
NG → Clutch stroke sensor damage

OK

Go to diagnosis code 9.

# SPEED SENSOR SYSTEM DAMAGE (DIAGNOSIS CODE 4)

M16030201BEF2009



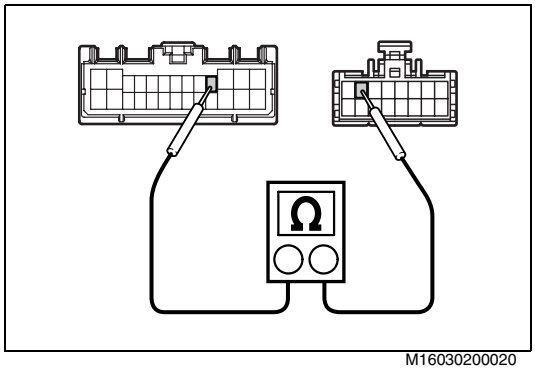
M16030200065

**1. CHECK THE SPEEDOMETER OPERATION.**

(1) Check if the speedometer operates correctly when driving.
**Standard: Normal operation**

NG → Speed sensor or pulse adjust computer malfunction

OK



M16030200020

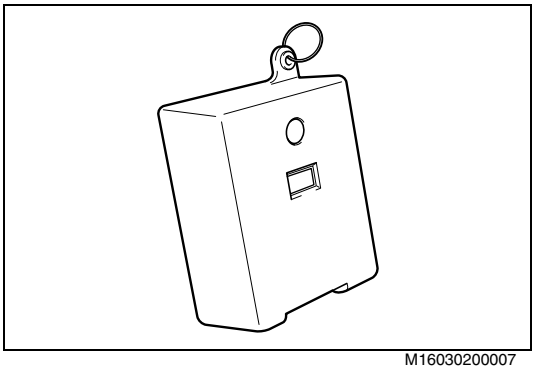
**2. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Remove the 26-pin connector of the ES start controller and pulse adjust computer connector and check the conductivity between the terminal 10 and 2 of both connectors (harness side).
**Standard: Conductivity**

NG → Harness disconnection

OK

Go to the item 3 after checking the pulse adjust computer.


M16030200007

**3. CHECKING THE DIAGNOSIS CODE**

(1) After having restored the connector and deleted the past failures, drive the vehicle at 30 km/h or above for more than two minutes. Then output again the diagnosis code. (This is because vibrations are necessary for slope sensor output. Inspection by circuit tester has no meaning.)
**Standard: Diagnosis code: 4**

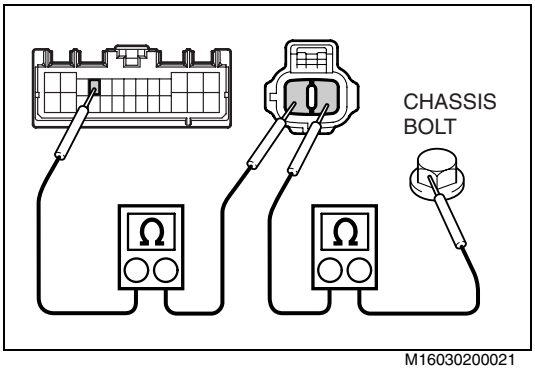
NG → Connector or harness contact failure

OK

ES start controller malfunction

# ES START CONTROL VALVE DAMAGE (DIAGNOSIS CODE 7)

M16030201BEF2010



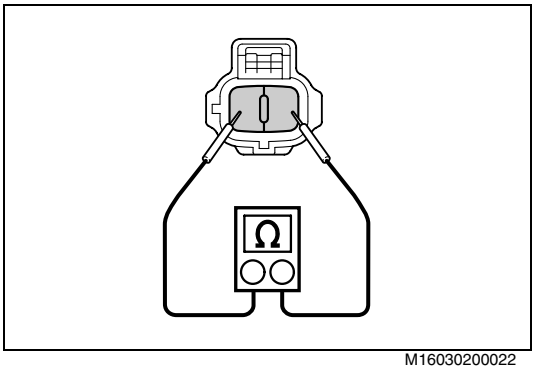
M16030200021

**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Remove the 26-pin connector of the ES start controller and the ES start control valve connector. Check the conductivity between terminal 4 and terminal 1 and the chassis ground and terminal 2 (harness side).
**Standard: Conductivity**

NG → Harness disconnection

OK

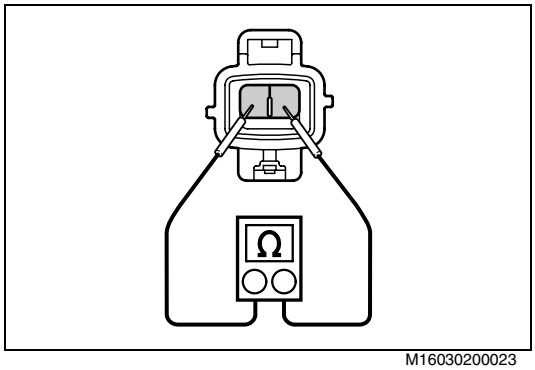

M16030200022

**2. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Check the conductivity between terminal 1 and terminal 2 of the ES start valve connector (harness side).
**Standard: No conductivity**

NG → Short-circuit in the harness

OK

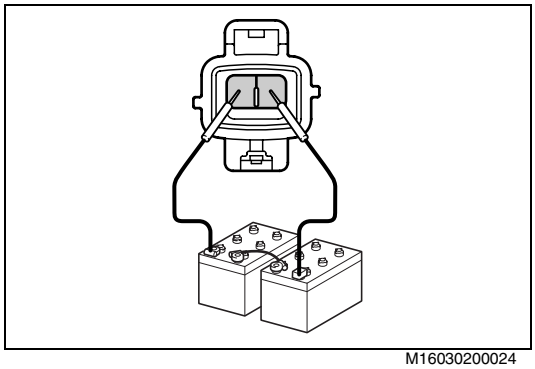

M16030200023

**3. MEASURE THE RESISTANCE BETWEEN TERMINALS.**

(1) Measure the resistance between terminal 1 and terminal 2 of the connector (part side).
**Standard value: 30-45 Ω**

NG → ES start control valve malfunction

OK

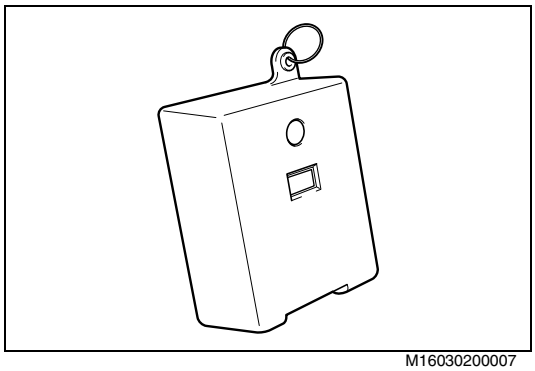

M16030200024

**4. CHECK THE ES START VALVE OPERATION.**

(1) Apply the power voltage and check the ES start control valve operation.
**Standard: Normal operation**

NG → ES start control valve malfunction

OK


M16030200007

**5. RECHECK THE DIAGNOSIS CODE.**

(1) Erase the diagnosis code and output the diagnosis code again.
**Standard: Diagnosis code: 7**

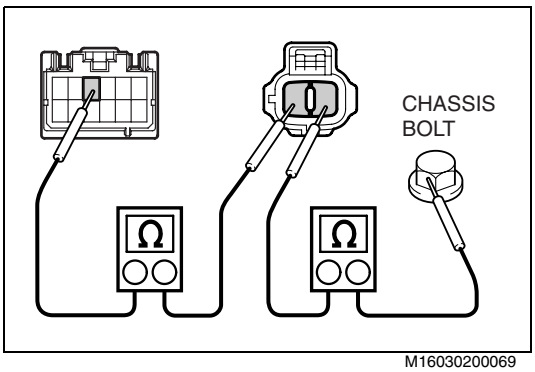
NG → Faulty contact in harness or connector

OK

ES start controller malfunction

# CLUTCH FLUID PRESSURE SWITCH DAMAGE (DIAGNOSIS CODE 8)

M16030201BEF2011



M16030200069

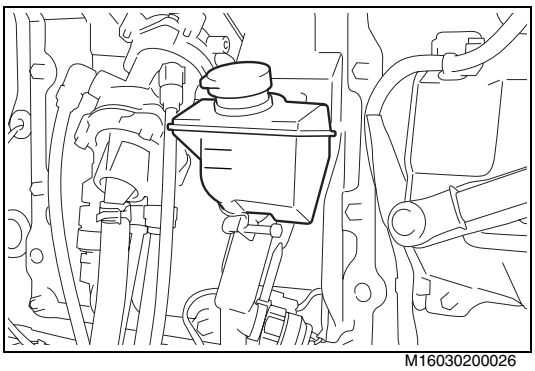
**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Remove the 12-pin connector of the ES start controller and clutch fluid pressure switch connector and check the conductivity between the terminal 3 and the terminal 1 and the chassis ground and the terminal 2 (harness side).

**Standard: Conductivity**

NG → Harness disconnection

OK


M16030200026

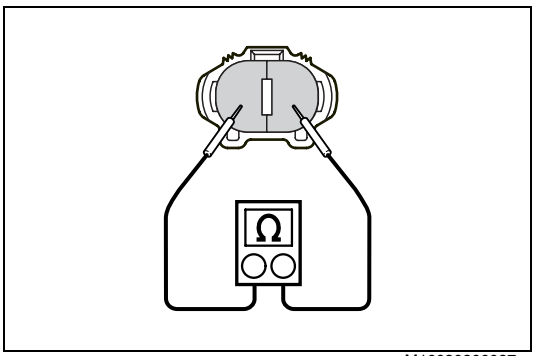
**2. CHECK THE CLUTCH FLUID.**

(1) Check if the clutch fluid level is between L and H of the reservoir tank.

**Standard: Between L and H**

NG → Supply the clutch fluid.

OK


M16030200027

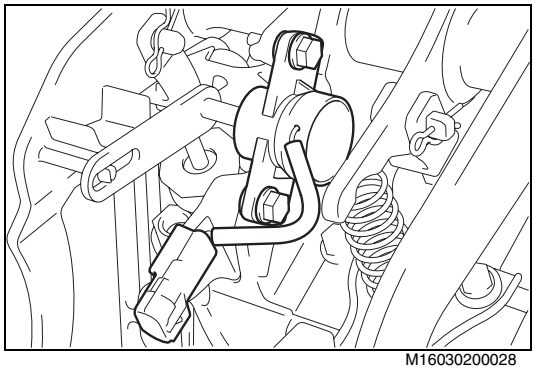
**3. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Check the conductivity between the terminal 1 and 2 of the clutch fluid pressure switch (switch side).

**Standard: When pressing the clutch pedal: Conductivity**
**When releasing the clutch pedal: No conductivity**

NG → Clutch fluid pressure switch malfunction

OK


M16030200028

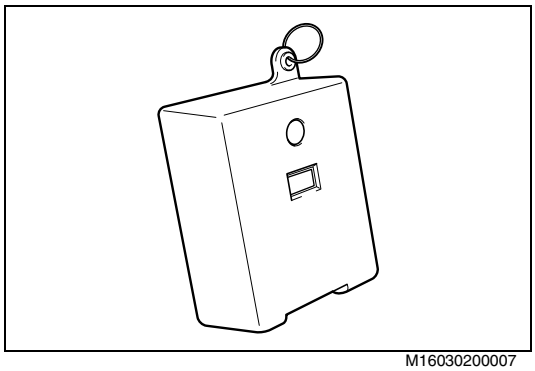
**4. CHECK THE CLUTCH STROKE SENSOR.**

(1) Check the installation location of the clutch stroke sensor.
**Standard: Correct installation**

NG → Install the sensor correctly.

OK

(2) Measure the voltage of the set position.
**Standard voltage: 0.28-0.77 V**


M16030200007

**5. RECHECK THE DIAGNOSIS CODE.**

(1) Erase the diagnosis code. Press the clutch pedal a few times and output the diagnosis code again.

**NOTICE:**
**The way of deleting the past failure is different to others.**

**Refer to the section of the "How to delete the diagnosis code 8".**
**Standard: Diagnosis code: 8**

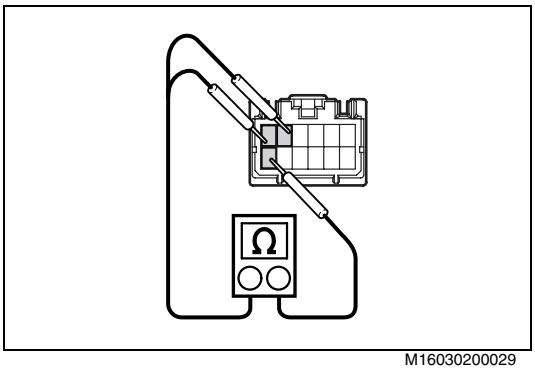
NG → Faulty contact in connector or harness

OK

Clutch fluid pressure switch malfunction

# CLUTCH STROKE SENSOR POWER SYSTEM MALFUNCTION (DIAGNOSIS CODE 9)

M16030201BEF2012



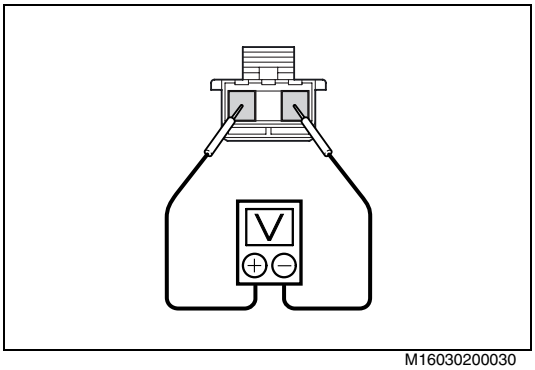
M16030200029

**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Remove the 12-pin connector of the ES start controller. Check the conductivity between terminals 1 and 7 and terminals 2 and 7 of the ES start controller connector (harness side).
**Standard: No conductivity**

NG → Short-circuit in the harness

OK



M16030200030

**2. MEASURE THE VOLTAGE BETWEEN TERMINALS.**

(1) After having restored the ES start controller connector, remove the clutch stroke sensor connector and set the starter switch [ON]. Measure the voltage between the terminals 1 and 3 of the clutch stroke sensor connector (harness side).

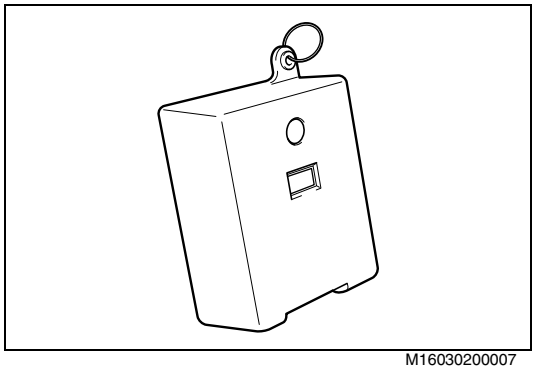
**NOTICE:**
**Be careful not to make a short-circuit.**

**Standard value: 4-6V**

NG → Go to the item 3.

OK

Clutch stroke sensor malfunction


M16030200007

**3. RECHECK THE DIAGNOSIS CODE.**
(1) Erase the diagnosis code. Output the diagnosis code again.
**Standard: Diagnosis code: 9**

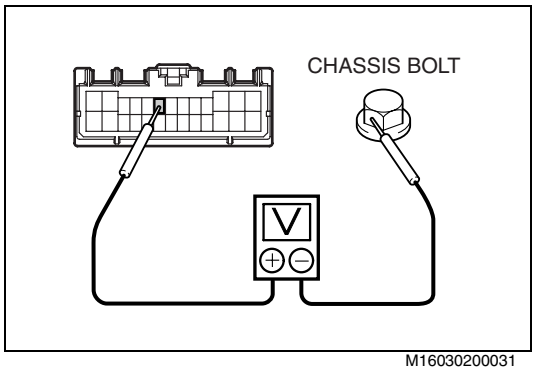
NG → Connector or harness contact failure.

OK

ES start controller malfunction

# NEUTRAL SWITCH AND BACK-UP LAMP SWITCH MALFUNCTION (DIAGNOSIS CODE 11)

M16030201BEF2013

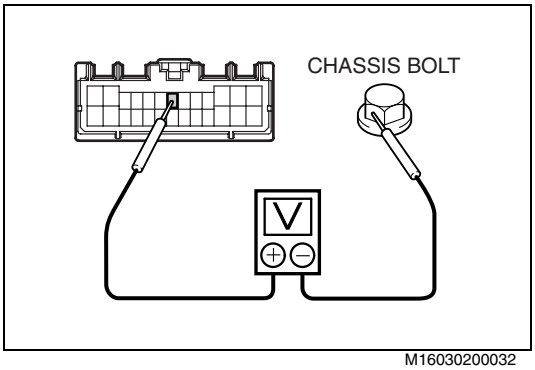


M16030200031

**1. MEASURE THE VOLTAGE BETWEEN TERMINALS.**
(1) Remove the 26-pin connector of ES start controller and set the starter switch to [ON]. Measure the voltage between the harness connector terminal 6 and the chassis ground.
**Standard value:**
**When the transmission is in gear: Less than 1 V**
**When the transmission is in neutral: More than 20 V**

NG → Neutral switch malfunction, disconnection or installation error

OK



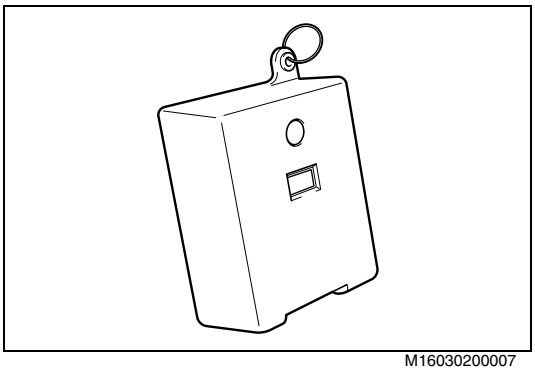
M16030200032

**2. MEASURE THE VOLTAGE BETWEEN TERMINALS.**

(1) Measure the voltage between the harness connector terminal 7 and the chassis ground.
**Standard value:**
**When the transmission is in reverse: More than 20 V**
**When the transmission is in other position: Less than 1 V**

NG → Back-up lamp switch malfunction, disconnection or installation error

OK


M16030200007

**3. RECHECK THE DIAGNOSIS CODE.**

(1) Erase the diagnosis code. Shift into reverse and output the diagnosis code again.
**Standard: Diagnosis code: 11**

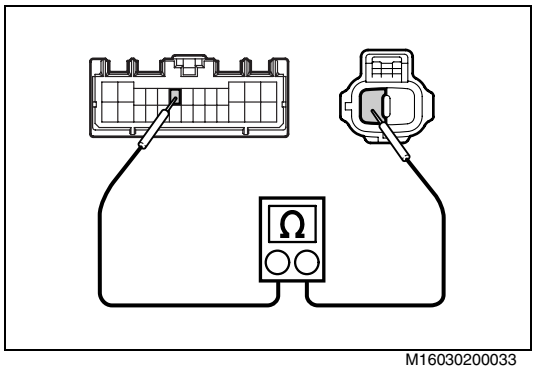
NG → Connector or harness contact failure.

OK

ES start controller malfunction

# NEUTRAL SWITCH SYSTEM OR SPEED SENSOR SYSTEM MALFUNCTION (DIAGNOSIS CODE 12)

M16030201BEF2014



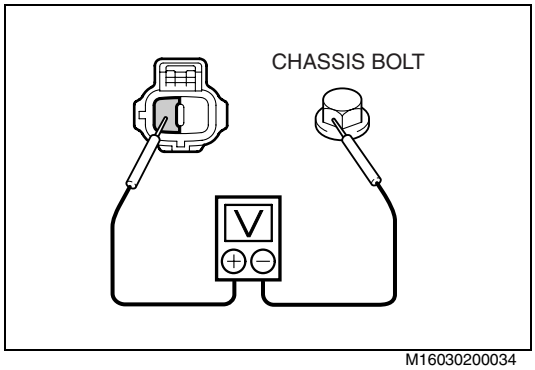
M16030200033

**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Remove the 26-pin connector of the ES start controller and the neutral switch connector. Check the conductivity between terminal 6 and terminal 1 of both connectors (harness side).
**Standard: Conductivity**

NG → Harness disconnection

OK



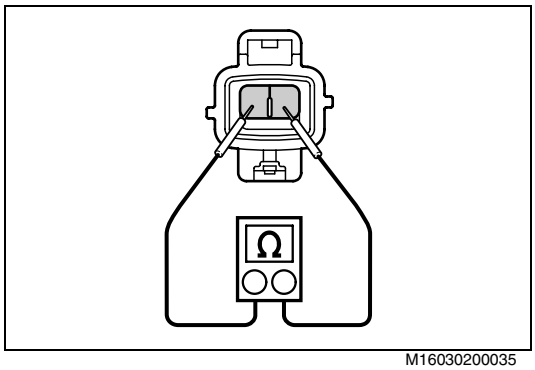
M16030200034

**2. MEASURE THE VOLTAGE BETWEEN TERMINALS.**

(1) Restore the ES start controller connector and set the starter switch to [ON]. Measure the voltage between the neutral switch connector terminal 1 and the chassis ground.
**Standard value: More than 20 V**

NG → Harness or power supply malfunction

OK



M16030200035

**3. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

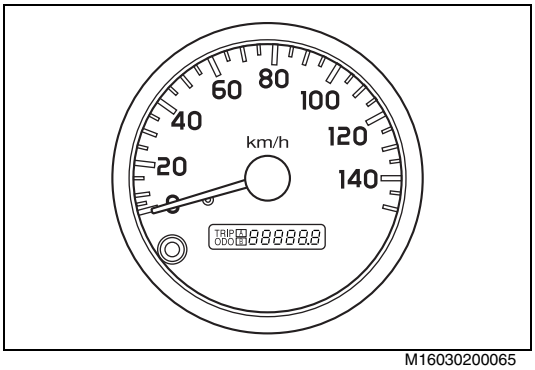
(1) Check the conductivity between connector terminal 1 and 2 of the part side.

**NOTICE:**
**Check that the switch does not change within the motion range of the shift lever.**

**Standard :**
**When the transmission is in gear: No conductivity**
**When the transmission is in neutral: Conductivity**

NG → Neutral switch malfunction

OK



M16030200065

**4. CHECK THE SPEEDOMETER OPERATION.**

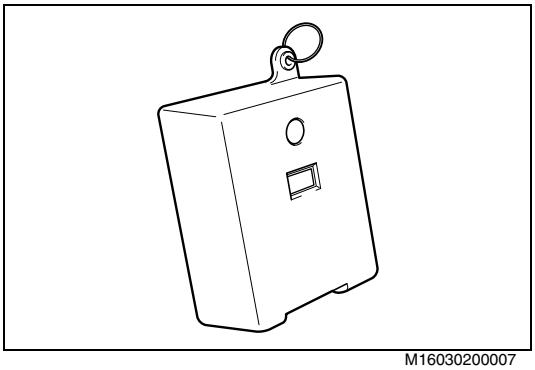
(1) Check if the speedometer operates correctly when driving.
**Standard: Normal operation**

NG

OK

Go to the item 5 after checking the speed sensor and pulse adjust computer.

Go to the item 5 after checking the pulse adjust computer.


M16030200007

**5. RECHECK THE DIAGNOSIS CODE.**

(1) Erase the diagnosis code. Accelerate and decelerate from 0 to 50 km/h more than 10 times. Output the diagnosis code again.

**NOTICE:**
**The way of deleting the past failure is different to others.**

Refer to the section of the "How to delete the diagnosis code 12".
**Standard: Diagnosis code: 12**

NG

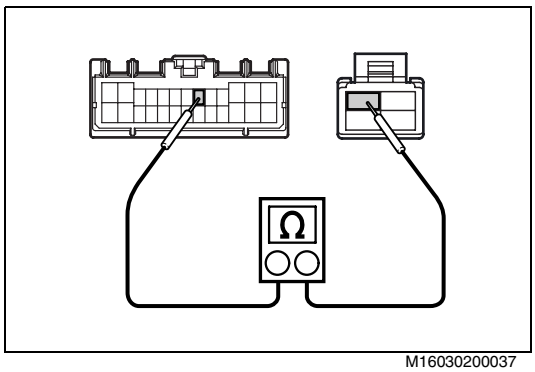
OK

Connector or harness contact failure

ES start controller malfunction

# STOP LAMP SWITCH DAMAGE (DIAGNOSIS CODE 13)

M16030201BEF2015



M16030200037

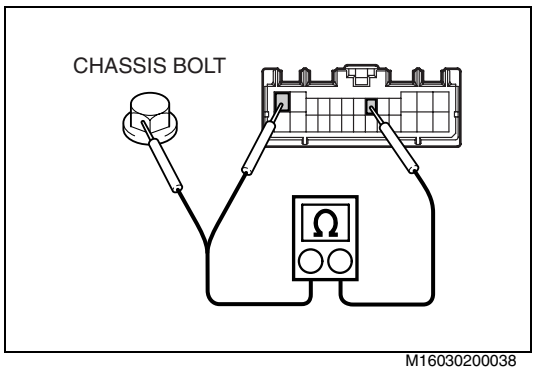
**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

(1) Set the starter switch to [LOCK], remove the 26-pin connector of the ES start controller and the connector of the stop lamp switch.

(2) Check the conductivity between the terminal 8 and 1 of both connectors (harness side).
**Standard: Conductivity**

NG → Harness contact failure or disconnection

OK



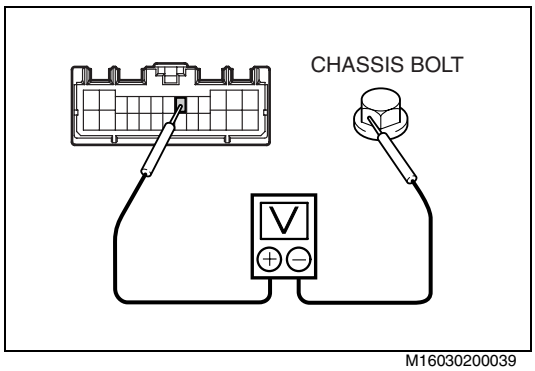
M16030200038

**2. CHECK A SHORT-CIRCUIT BETWEEN TERMINALS.**

(1) Check if the harness connectors between terminal 8 and terminal 1 of 26-pin connector (harness side) and between terminal 8 and chassis ground cause a short-circuit.
**Standard: No conductivity**

NG → Short-circuit in the harness

OK



M16030200039

**3. CHECK THE VOLTAGE OF TERMINALS.**

(1) Restore the connector and set the starter switch to "ON" and measure the voltage between No.8 terminal of 26-pin connector of ES start controller and chassis ground.
**Standard value:**
**When stepping brake pedal: Less than 1V**
**When releasing brake pedal: More than 18V**

NG → Go to the item 4.

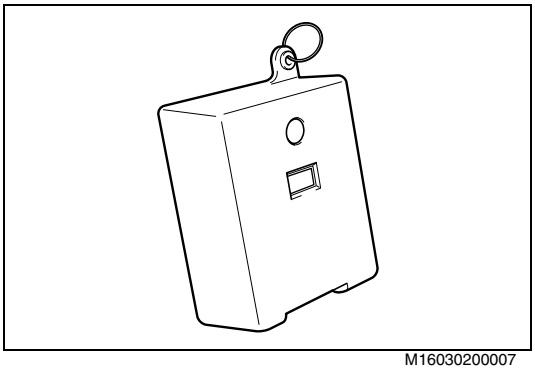
OK

Go to the item 5.

**4. CHECK THE STOP LAMP SWITCH.**
(1) Check the stop lamp switch.

NG → Stop lamp switch malfunction

OK


M16030200007

**5. RECHECK THE DIAGNOSIS CODE.**
(1) Erase the diagnosis code. Repeat for more than five times in succession the acceleration from 0 km/h to 50 km/h or above and the deceleration from 50 km/h to 0 km/h. Output the diagnosis code again.

**NOTICE:**
**The way of deleting the past failure is different to others.**

Refer to the section of the "How to delete the diagnosis code 13".
**Standard: Diagnosis code: 13**

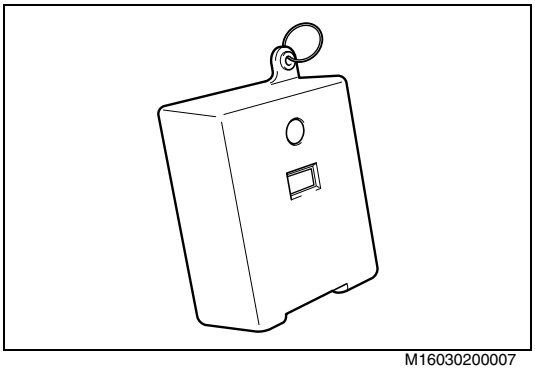
NG → Connector or harness contact failure

OK

ES start controller malfunction

# ES START CONTROLLER MALFUNCTION (DIAGNOSIS CODE 16)

M16030201BEF2016


M16030200007

**1. CHECK THE DIAGNOSIS CODE.**
(1) Erase the diagnosis code and output the diagnosis code again.
**Standard: Diagnosis code: 1**

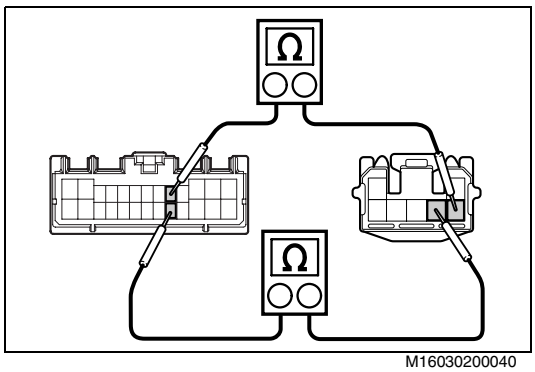
NG → ES start controller malfunction

OK

Normal

# ES MAIN SWITCH DAMAGE (DIAGNOSIS CODE 18)

M16030201BEF2017


M16030200040

**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

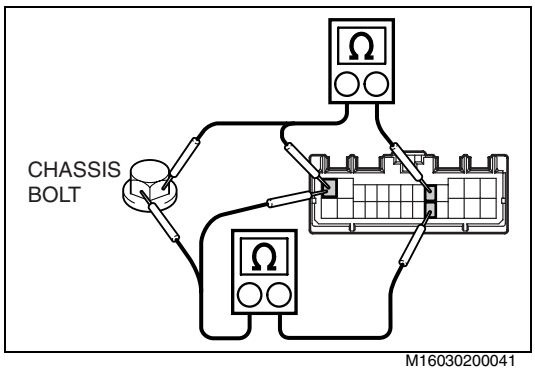
(1) Set the starter switch to [LOCK], and remove the 26-pin connector of ES start controller and the connector of ES main switch.

(2) Check the conductivity between terminal 9 and terminal 7 and between terminal 22 and terminal 6 of both connectors (harness side).

**Standard: Conductivity**

NG → Harness disconnection

OK



M16030200041

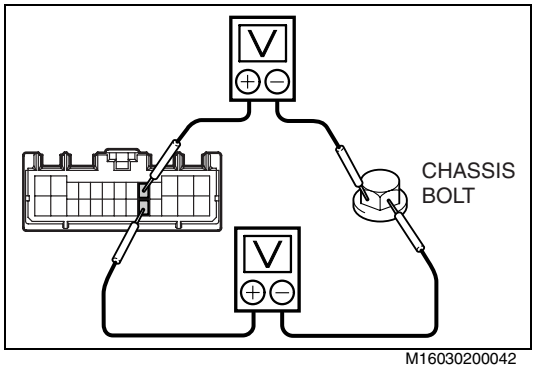
**2. CHECK A SHORT-CIRCUIT BETWEEN TERMINALS.**

(1) Check a short-circuit of harness connector between terminal 9 and terminal 1 of 26-pin connector, between terminal 9 and chassis ground, between terminal 22 and terminal 1 and between terminal 22 and chassis ground.

**Standard: No conductivity**

NG → Short-circuit in the harness

OK



M16030200042

**3. MEASURE THE VOLTAGE BETWEEN TERMINALS.**

(1) Set the starter switch to [ON] and measure the voltage between the terminal 9 of the 26-pin connector and chassis ground and between the terminal 22 and chassis ground.

**Standard value:**
**When main switch is [ON]:**
**Between terminal 9 and chassis ground: More than 20V**
**Between terminal 22 and chassis ground: Less than 1V**
**When main switch is [OFF]:**
**Between terminal 9 and chassis ground: Less than 1V**
**Between terminal 22 and chassis ground: More than 20V**

NG → Go to the item 4.

OK

Go to the item 5.

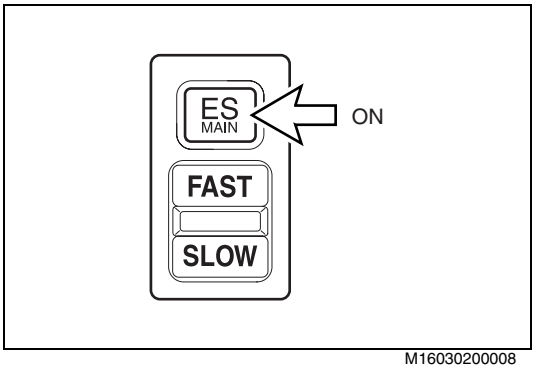
**4. CHECK THE ES MAIN SWITCH.**

(1) Check the ES main switch.
**Standard: Normal**

NG

ES main switch malfunction

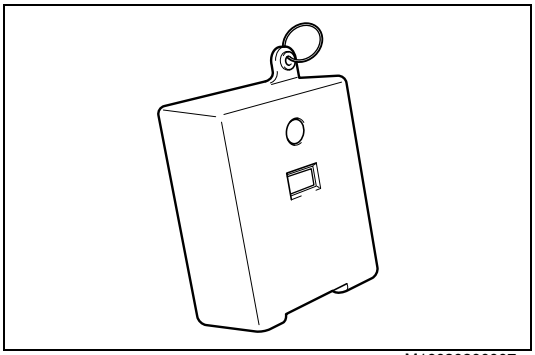
OK



M16030200008

**5. RECHECK THE DIAGNOSIS CODE.**

(1) Erase the diagnosis code and set the ES main switch to [ON].


M16030200007

(2) More than 10 seconds later, output the diagnosis code again.
**Standard: Diagnosis code: 18**

NG

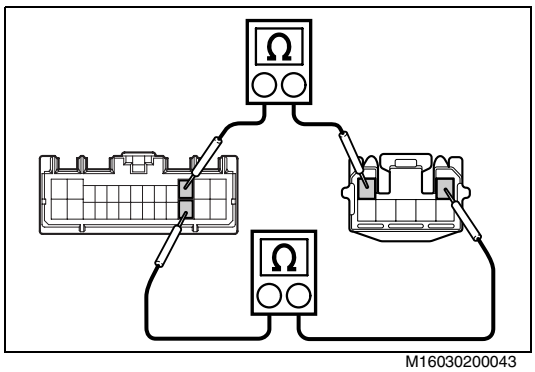
Connector or harness contact failure

OK

ES start controller malfunction

# ES START RELEASE TIMING SWITCH (DIAGNOSIS CODE 21)

M16030201BEF2018


M16030200043

**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS.**

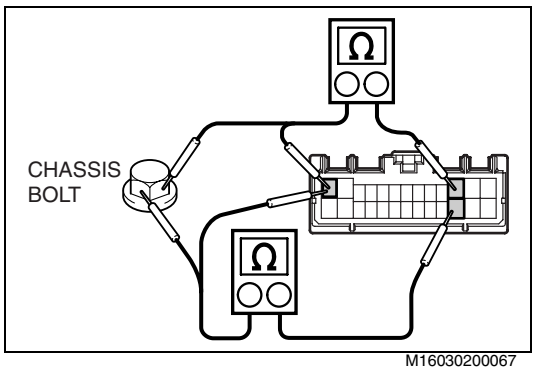
(1) Set the starter switch to [LOCK] and disconnect the connector of 26-pin connector of ES start controller and the connector of release timing switch.

(2) Check the conductivity between the terminal 11 and terminal 1 and between terminal 24 and terminal 2 of both connectors (harness side).

**Standard: Conductivity**

NG → Harness disconnection

OK



M16030200067

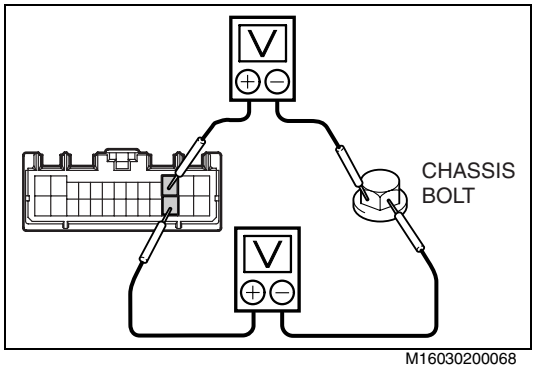
**2. CHECK A SHORT-CIRCUIT BETWEEN TERMINALS.**

(1) Check a short-circuit of harness connector between terminal 11 and terminal 1 of 26-pin connector, between terminal 11 and chassis ground, between terminal 24 and terminal 1 and between terminal 24 and chassis ground.

**Standard: No conductivity**

NG → Short-circuit in the harness

OK



M16030200068

**3. MEASURE THE VOLTAGE BETWEEN TERMINALS.**

(1) Set the starter switch to [ON] and measure the voltage between the terminal 11 of the 26-pin connector and chassis ground and between the terminal 24 and chassis ground.

**Standard value:**
**When release timing switch is [FAST]:**
**Between terminal 11 and chassis ground: More than 20V**
**Between terminal 24 pand chassis ground: Less than 1V**
**When release timing switch is [SLOW]:**
**Between terminal 11 and chassis ground: Less than 1V**
**Between terminal 24 and chassis ground: More than 20V**

NG → Go to the item 4.

OK

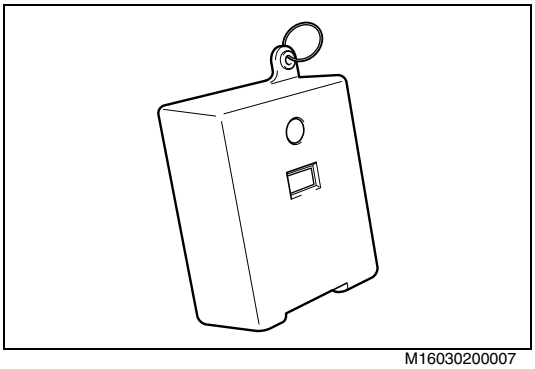
Go to the item 5.

**4. CHECK THE RELEASE TIMING SWITCH.**

(1) Check the release timing switch.
**Standard: Normal**

NG → Release timing switch malfunction

OK



M16030200007

**5. RECHECKING THE DIAGNOSIS CODE**

(1) Delete the past failures. Press for more than three seconds "FAST" and "SLOW" side each of the release timing switch. Then output again the diagnosis code.
**Standard: Diagnosis code: 21**

NG → Connector or harness contact failure

OK

ES start controller malfunction

# BRAKE CONTROL (ELECTROMAGNETIC RETARDER)

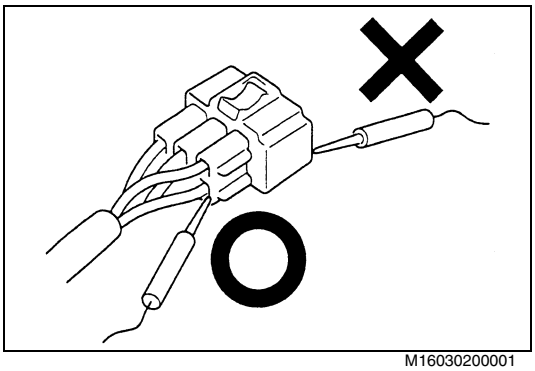
DN03-004

**ELECTROMAGNETIC RETARDER ..... DN03-2**
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SYSTEM DIAGRAM ..... DN03-3
ARRANGEMENT OF CONNECTOR PIN IN CONTROL UNIT ..... DN03-4
PRE-INSPECTION ..... DN03-5
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FAILURE OF THE CONTROL UNIT (DIAGNOSIS CODE 7) ..... DN03-15

# ELECTROMAGNETIC RETARDER

## HANDLING PRECAUTIONS

M16030301BEC1001



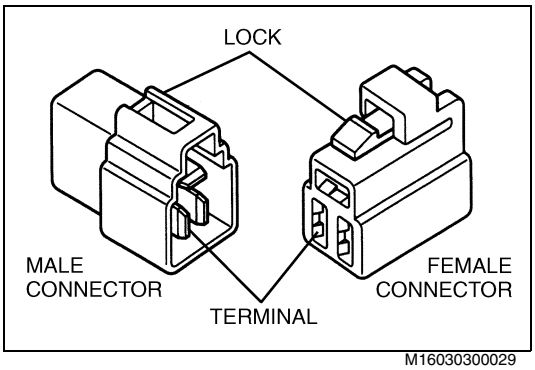
M16030200001

### 1. ABOUT CONNECTORS

(1) Before performing the inspection operation, make sure that all connectors are connected securely.

(2) Do not contact the tester bar to the connection surface of the connector. This may cause terminal damage or a short-circuit.

(3) All connectors in the connector diagram are observed from the contact surfaces. However, the tester bar is put from the rear side.

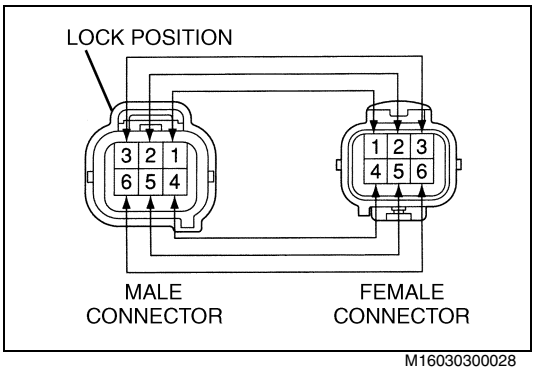



M16030300029

(4) The connector is displayed from the view of the mating surface when the connector lock is positioned above.

**Reference**

- **Female connector:** **The terminal is female.**
- **Male connector:** **The terminal is male.**




M16030300028

(5) As for the terminal numbers of the connector, the first terminal is located on the top right terminal of the male connector and the top left terminal of the female connector.
**Reference:**
**When viewed from the mating surface, the terminal numbers of both connectors are located symmetrically (reversed horizontally).**

(6) When disconnecting the connector, be sure to set the starter switch to "LOCK".

### 2. ABOUT DIAGNOSIS MONITOR

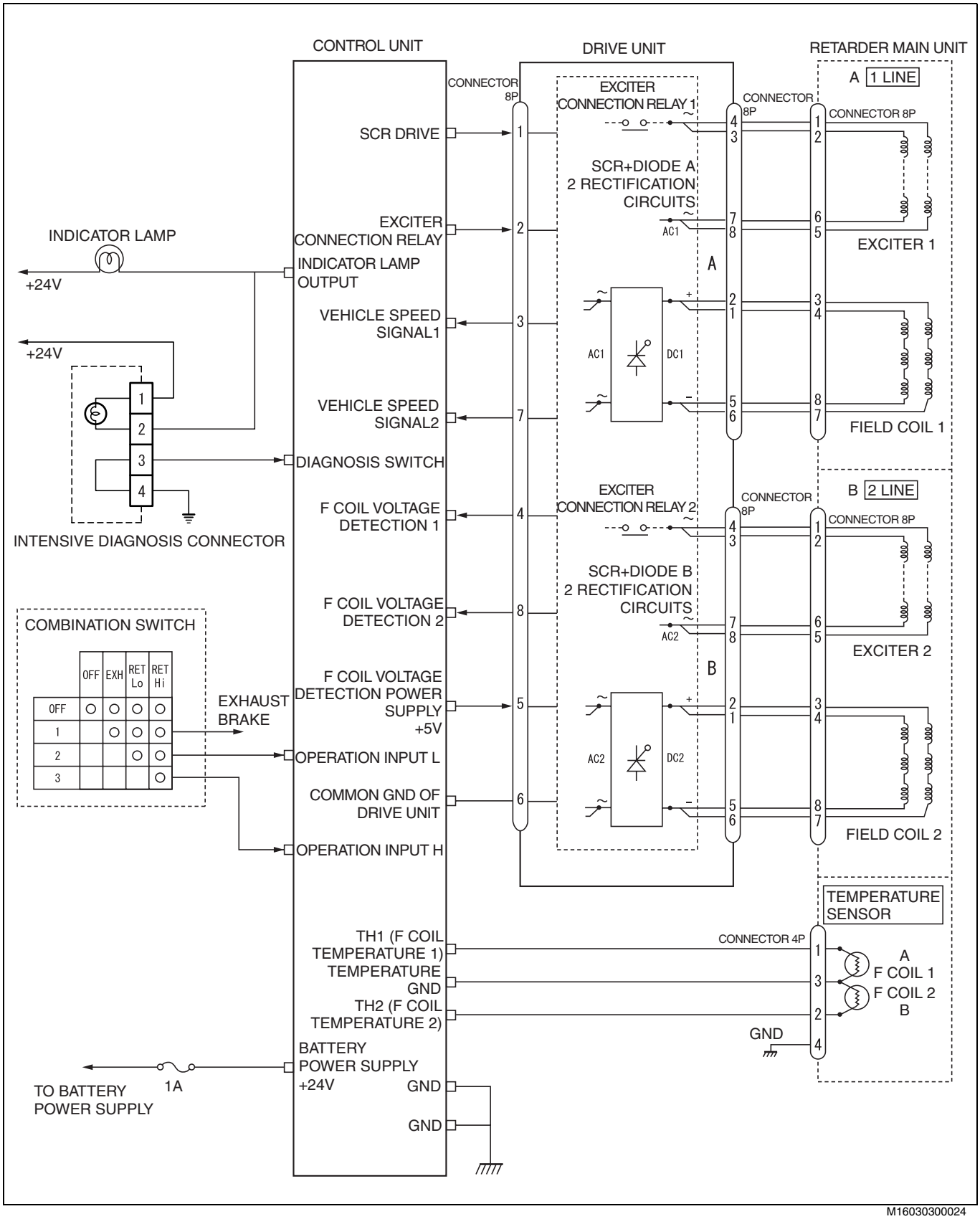
(1) Erase the previous damage data after they have been recorded, then perform the damage diagnosis again and confirm the current damage.

(2) After the damage analysis is completed, delete the previous damage data.

(3) If a failure that makes the indicator lamp blink occurs, make sure to delete the past failure after repair has been completed. Otherwise the indicator lamp does not stop blinking even if the failure does not exist.

# SYSTEM DIAGRAM

M16030301BEJ1001

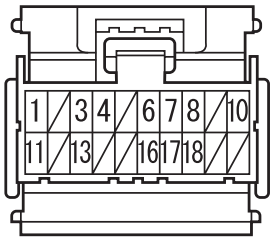



M16030300024

# ARRANGEMENT OF CONNECTOR PIN IN CONTROL UNIT

M16030301BEF2001

20-PIN CONNECTOR



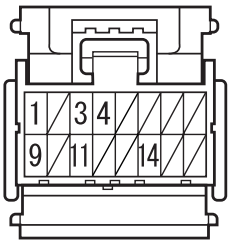

VIEW A



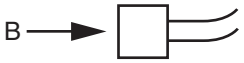

CAB SIDE HARNESS

| No. | SIGNAL | No. | SIGNAL |
|---|---|---|---|
| 1 | Common ground of drive unit | 11 | Exciter connection relay |
| 2 | — | 12 | — |
| 3 | Vehicle speed sensor 1 | 13 | SCR drive |
| 4 | Vehicle speed sensor 2 | 14 | — |
| 5 | — | 15 | — |
| 6 | F coil voltage detection power supply | 16 | Temperature ground |
| 7 | F coil voltage detection 1 | 17 | F coil temperature 1 |
| 8 | F coil voltage detection 2 | 18 | F coil temperature 2 |
| 9 | — | 19 | — |
| 10 | Battery power supply | 20 | — |

16-PIN CONNECTOR




VIEW B




CAB SIDE HARNESS

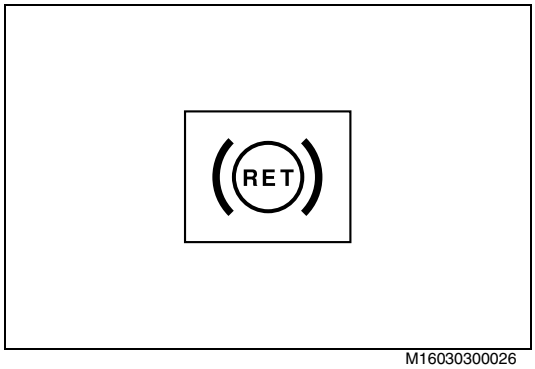
| No. | SIGNAL | No. | SIGNAL |
|---|---|---|---|
| 1 | Ground | 9 | Ground |
| 2 | — | 10 | — |
| 3 | Operation input L | 11 | Diagnosis switch |
| 4 | Operation input H | 12 | — |
| 5 | — | 13 | — |
| 6 | — | 14 | Indicator lamp |
| 7 | — | 15 | — |
| 8 | — | 16 | — |

M16030300025

# PRE-INSPECTION

M16030301BEH3001

## CHECKING SYSTEM STATUS



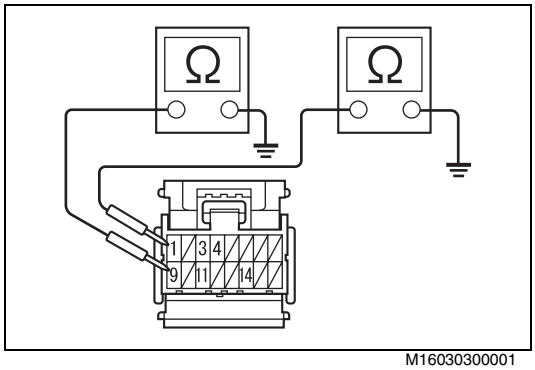
M16030300026

1. **Check the indicator lamp on the instrument panel (When operating the retarder).**

| INDICATOR LAMP CONDITION | SYSTEM STATUS |
|---|---|
| LIGHTING | Normal (But the indicator lamp does not turn on at the vehicle speed 10 km/h or below because the retarder does not operate then.) |
| LIGHTING OFF | Failure (Check the operation because faulty operation may turn the indicator lamp off. The indicator lamp does not turn on at the vehicle speed 10 km/h or below because the retarder does not operate then.) |
| BLINKING | Failure (The operation is not cancelled by turning "OFF" the retarder control lever.) |

2. **Check the battery voltage.**
   **Standard value: More than 20V**
3. **Check the fuse.**
4. **Check that the connector of control unit is connected correctly.**
5. **Check that the connector of drive unit is connected correctly.**
6. **Check that the connector of retarder main unit is connected correctly.**
7. **Check that the connector of clutch switch is connected correctly.**
8. **Check that the connector of accelerator switch is connected correctly.**

## INSPECTION OF THE INPUT AND OUTPUT OF THE CONTROL UNIT



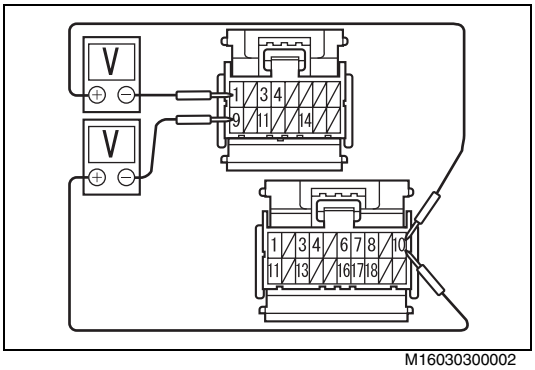
M16030300001

1. **CHECK THE CONDUCTIVITY OF HARNESS.**

(1) Set the starter switch to "LOCK" position. Disconnect 16-pin connector of the control unit and check the conductivity between terminal No.1 of the connector (harness side) and chassis ground, terminal No.9 of the connector (harness side) and chassis ground.
**Standard: Conductivity**

NG → Replace the harness.

OK



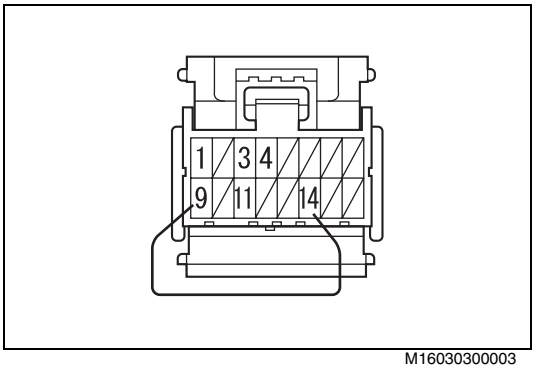
M16030300002

**2. INSPECT THE VOLTAGE OF CONTROL UNIT.**

(1) Disconnect 20-pin connector and 16-pin connector of control unit. Set the starter switch "ON" and measure the voltage between the terminal No.10 of 20-pin connector (harness side) and the terminal No.1 of 16-pin connector (harness side) and between the terminal No.10 of 20-pin connector (harness side) and terminal No.9 of 16-pin connector (harness side).
**Standard value: More than 20V**

NG → Replace the fuse.

OK



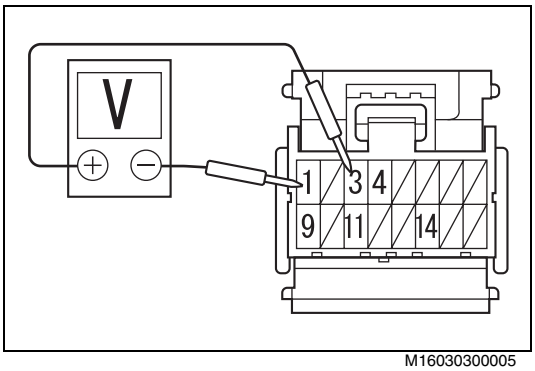
M16030300003

**3. INSPECT THE INDICATOR LAMP CIRCUIT.**

(1) Disconnect 16-pin connector of control unit. Connect the harness to the terminal No.14 of connector (harness side) and to the terminal No.9. Set the starter switch to "ON" and check that the indicator lamp turns on.
**Standard: Lighting**

NG → Replace the fuse.

OK



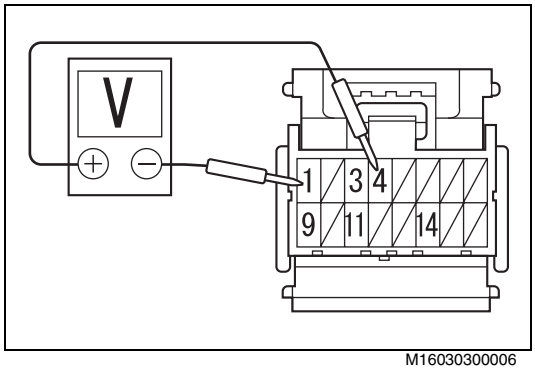
M16030300005

**4. INSPECT THE RETARDER CONTROL LEVER CIRCUIT**

(1) Disconnect the 16-pin connector of the control unit. Set the starter switch "ON" and set the retarder control lever at the second (LOW) without stepping the clutch and accelerator pedals. At this moment, measure the voltage between No.1 and No.3 terminals of the connector (harness side).
**Standard value: More than 20V**

NG → Check the clutch switch, accelerator switch and retarder control lever.

OK



M16030300006

**5. INSPECT THE RETARDER CONTROL LEVER CIRCUIT.**

(1) Disconnect the 16-pin connector of the control unit. Set the starter switch "ON" and set the retarder control lever at the third (HIGH) without stepping the clutch and accelerator pedals. At this moment, measure the voltage between No.1 and No.4 terminals of the connector (harness side).
**Standard value: More than 20V**

NG

OK

Check the clutch switch, accelerator switch and retarder control lever.

## INSPECTION OF FUSE

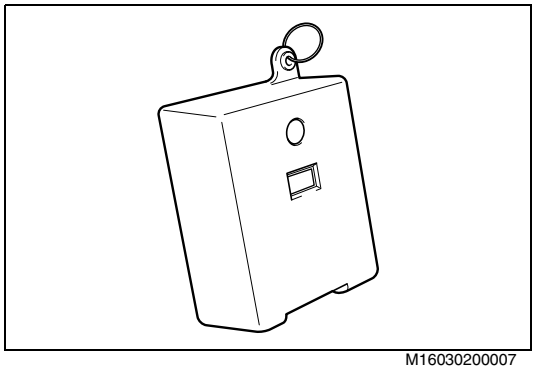
**1. REMOVE THE LOWER COVER OF THE ASSISTANT SEAT SIDE. CHECK THE FUSE FOR ELECTROMAGNETIC RETARDER. IF IT IS BLOWN OUT, REPLACE IT WITH NEW ONE.**

**2. REMOVE THE LOWER COVER OF THE ASSISTANT SEAT SIDE. CHECK THE FUSE FOR POWER SUPPLY. IF IT IS BLOWN OUT, REPLACE IT WITH NEW ONE.**

# FAILURE DIAGNOSIS BY USING DIAGNOSIS MONITOR

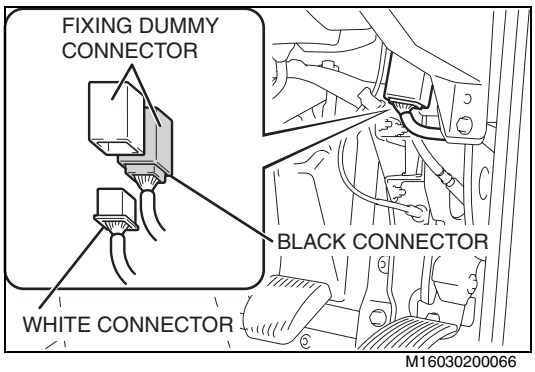
M16030301BEF2002

The electromagnetic retarder stores the history of failures and its contents up to the present in its computer. Connecting the diagnosis monitor to the special connector can monitor the failure contents.


M16030200007

**1. DIAGNOSIS MONITOR**

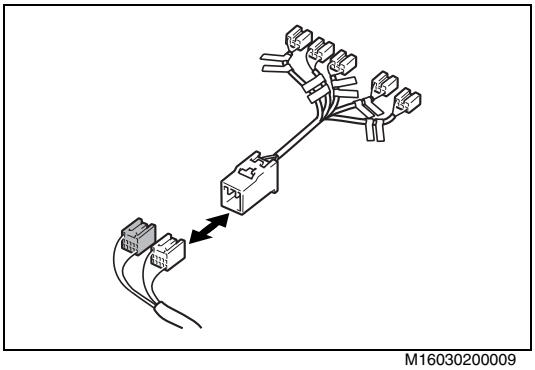
(1) Diagnosis monitor alerts the failure location with sound and light by being connected to the special diagnosis connector of electromagnetic retarder.
**SST: Diagnosis monitor (09630-1370)**



M16030200066

**2. CONNECT THE DIAGNOSIS MONITOR.**

(1) Locate two intensive diagnosis connectors on lower right of the instrument panel. Connect the special wiring harness to the black connector and diagnosis monitor to the connector tagged by "electromagnetic retarder".
**SST: Special wiring harness for intensive diagnosis connector (09630-2300)**



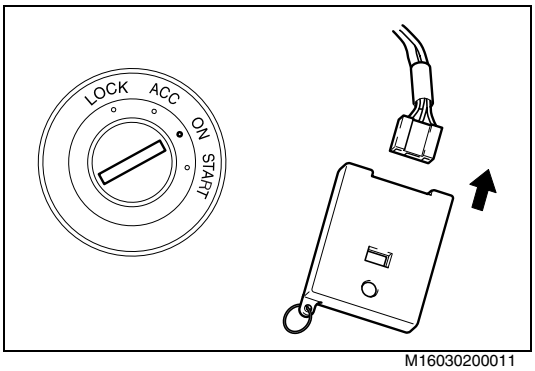
M16030200009

**NOTICE:**
**The intensive diagnosis connector is usually connected to the fixing dummy connector. So, disconnect the connector from the dummy connector and pull it to use. When the connector is not in use, connect it firmly to the fixing dummy connector.**

(2) Set the starter switch to "ON".

**3. DISPLAYING THE FAILURE CODE**

(1) The failure codes are output repeatedly in ascending order of failure codes without distinguishing present and past failures.




M16030200011

**4. DELETE THE PAST FAILURES**

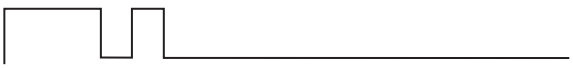
(1) Record the first diagnosis code output.
(2) Disconnect the diagnosis monitor while keeping the starter switch at "ON" position.

**NOTICE:**
**If the starter switch is set to "LOCK" position, the past failures cannot be deleted. Make sure to keep the switch at "ON" position.**

(3) Wait for several seconds. Then connect the diagnosis monitor to output the present failure.

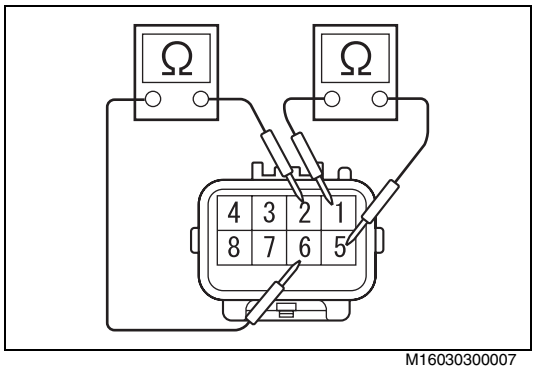
# DIAGNOSIS CODE TABLE

M16030301BEF2003

| Diagnosis code No. | Inspection item | Diagnosis monitor and indicator lamp output |
|---|---|---|
| 1 | Normalcy of the system |  |
| 2 | Malfunction of the exciter unit in the main unit |  |
| 3 | Malfunction of the field coil (F coil) unit in the main unit |  |
| 4 | Malfunction of the temperature sensor unit in the main unit |  |
| 6 | Failure of the drive unit |  |
| 7 | Failure of the control unit |  |

# MALFUNCTION OF THE EXCITER UNIT IN THE MAIN UNIT (DIAGNOSIS CODE 2)

M16030301BEF2004



M16030300007

**1. MEASURE THE RESISTANCE BETWEEN THE TERMINALS OF THE RETARDER MAIN UNIT.**

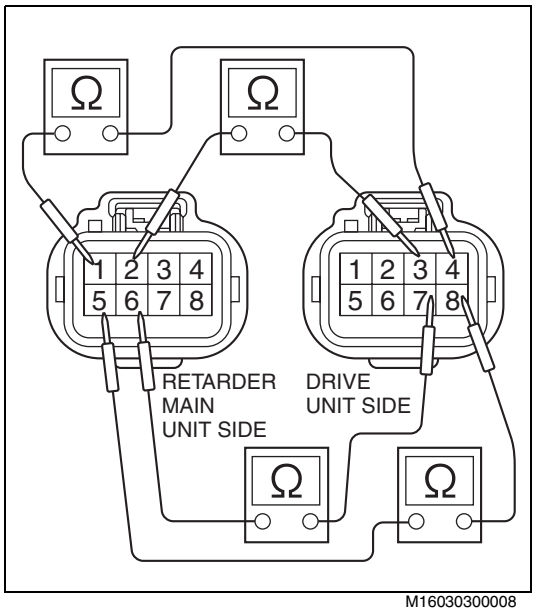
(1) Set the starter switch to "LOCK" position. Disconnect 8-pin connectors of both A line and B line of the retarder main unit.

(2) Measure the resistance between terminals No.1 and No.5, terminals No.2 and No.6 of each connector.
**Standard value: 1.11Ω (At 20°C {68°F})**

NG

OK

Replace the retarder main unit (Except for retarder drum)



M16030300008

**2. CHECK THE CONDUCTIVITY OF HARNESS.**

(1) Disconnect 8-pin connectors (black) of A line and B line of the retarder main unit and drive unit and measure the conductivity between each terminal for the exciter of the connector (harness side).

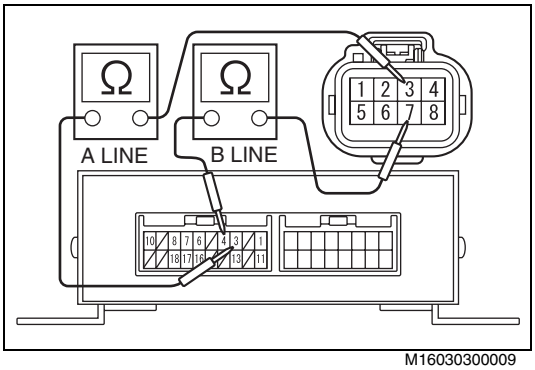
| RETARDER MAIN UNIT | DRIVE UNIT |
|---|---|
| TERMINAL NO.5 | TERMINAL NO.8 |
| TERMINAL NO.6 | TERMINAL NO.7 |
| TERMINAL NO.1 | TERMINAL NO.4 |
| TERMINAL NO.2 | TERMINAL NO.3 |

**Standard: Conductivity**

NG

OK

Replace the harness.



M16030300009

**3. CHECK THE CONDUCTIVITY OF THE HARNESS.**

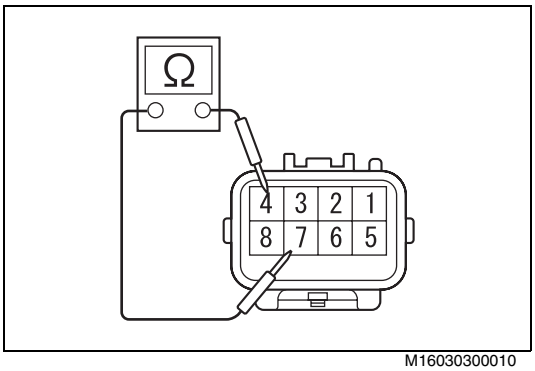
(1) Disconnect 8-pin connectors (gray) of control unit line of drive unit and 20-pin connector of control unit. Check the conductivity between the terminals for vehicle speed sensor signal of connector (harness side).

| | DRIVE UNIT | CONTROL UNIT |
|---|---|---|
| A LINE | TERMINAL NO.3 | TERMINAL NO.3 |
| B LINE | TERMINAL NO.7 | TERMINAL NO.4 |

**Standard: Conductivity**

NG → Replace the harness.

OK



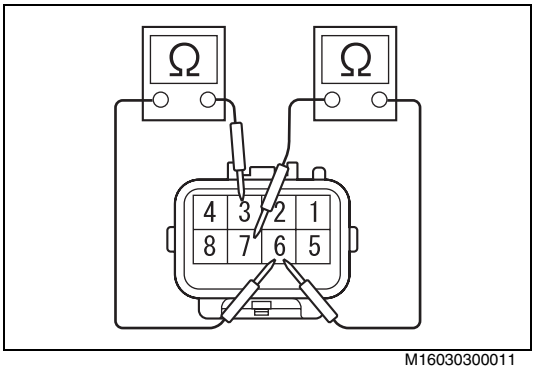
M16030300010

**4. MEASURE THE RESISTANCE OF THE DRIVE UNIT**

(1) Disconnect 8-pin connectors (black) of both the retarder main unit A line and B line of the drive unit. Set the starter switch to "ON". Set the retarder control lever at "LOW". Then measure the resistance between the terminals No.7 and No.4 of the primary of vehicle speed sensor signal insulation transformer of the connector (parts side).
**Standard value: 80-83 kΩ (At 20°C {68°F})**

NG → Replace the drive unit.

OK



M16030300011

**5. MEASURE THE RESISTANCE OF THE DRIVE UNIT.**

(1) Disconnect 8-pin connectors (black) of both the retarder main unit A line and B line of the drive unit, and 8-pin connectors (gray) of control unit line. Measure the resistance between the terminals No.3 and No.6 of the drive unit side of control unit line connector (gray) and between the terminals No.7 and No.6.
**Standard value: 180-200 Ω (At 20°C {68°F})**

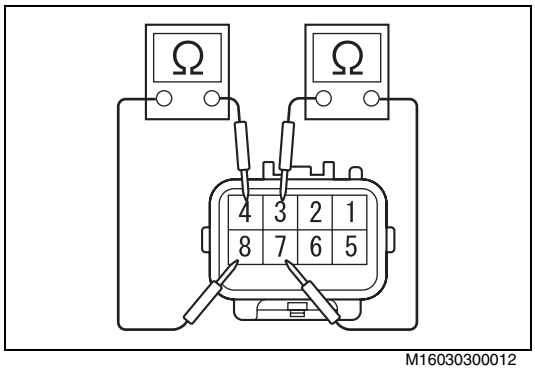
NG → Replace the drive unit.

OK

Replace the control unit.

# MALFUNCTION OF THE FIELD COIL (F COIL) UNIT IN THE MAIN UNIT (DIAGNOSIS CODE 3)

M16030301BEF2005



M16030300012

**1. MEASURE THE RESISTANCE BETWEEN THE TERMINALS OF THE RETARDER MAIN UNIT.**

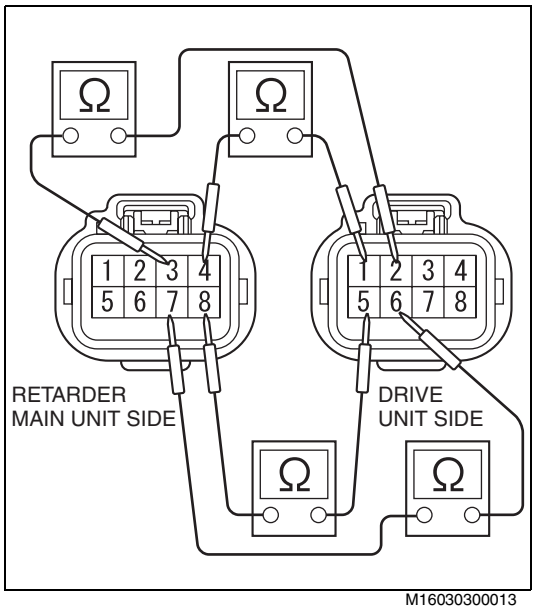
(1) Set the starter switch to "LOCK" position. Disconnect 8-pin connectors of both A line and B line of the retarder main unit.

(2) Measure the resistance between terminals No.7 and No.3, terminals No.8 and No.4 of each connector.
**Standard value: 2.8 Ω (At 20°C {68°F})**

NG

OK

Replace the retarder main unit (Except for retarder drum).



M16030300013

**2. CHECK THE CONDUCTIVITY OF HARNESS.**

(1) Disconnect 8-pin connectors (black) of A line and B line of the retarder main unit and drive unit and measure the conductivity between each terminal for the field coil of the connector (harness side)

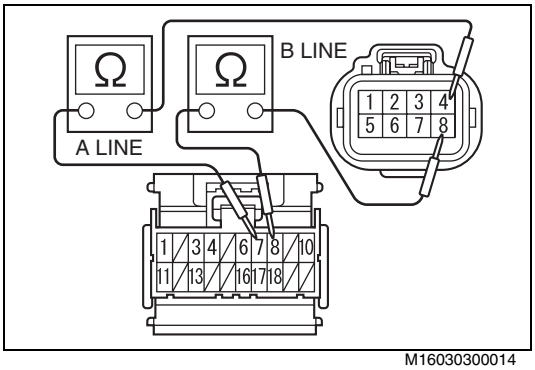
| RETARDER MAIN UNIT | DRIVE UNIT |
|---|---|
| TERMINAL NO.7 | TERMINAL NO.6 |
| TERMINAL NO.8 | TERMINAL NO.5 |
| TERMINAL NO.3 | TERMINAL NO.2 |
| TERMINAL NO.4 | TERMINAL NO.1 |

**Standard: Conductivity**

NG

OK

Replace the harness.



M16030300014

**3. CHECK THE CONDUCTIVITY OF THE HARNESS.**

(1) Disconnect 8-pin connectors (gray) of control unit line of drive unit and 20-pin connector of control unit. Check the conductivity between the terminals for F coil voltage detection power supply (following table) of connector (harness side).

| | DRIVE UNIT | CONTROL UNIT |
|---|---|---|
| A LINE | TERMINAL NO.4 | TERMINAL NO.7 |
| B LINE | TERMINAL NO.8 | TERMINAL NO.8 |

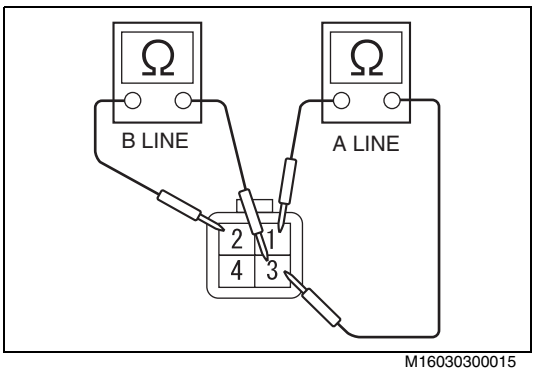
**Standard: Conductivity**

NG → Replace the harness.

OK → Replace the drive unit.

# MALFUNCTION OF THE TEMPERATURE SENSOR UNIT IN THE MAIN UNIT (DIAGNOSIS CODE 4)

M16030301BEF2006



M16030300015

**1. MEASURE THE RESISTANCE BETWEEN THE TERMINALS OF RETARDER MAIN UNIT.**

(1) Set the starter switch to "LOCK" position. Disconnect each connector of the temperature sensor of the retarder main unit side.

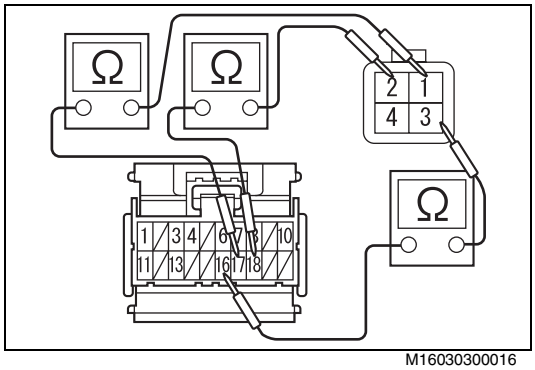
(2) Measure the resistance between terminals of each connector.

| | | |
|---|---|---|
| A LINE | TERMINAL NO.1 | TERMINAL NO.3 |
| B LINE | TERMINAL NO.2 | TERMINAL NO.3 |

**Standard value: 50-300 kΩ (At 20°C {68°F})**

NG → Replace the retarder main unit (Except for retarder drum).

OK



M16030300016

**2. CHECK THE CONDUCTIVITY OF THE HARNESS.**

(1) Disconnect the connectors of temperature sensor of retarder main unit and 20-pin connector of control unit. Measure the conductivity between the terminals of connector (harness side).

| TEMPERATURE SENSOR | CONTROL UNIT |
|---|---|
| TERMINAL NO.1 | TERMINAL NO.17 |
| TERMINAL NO.2 | TERMINAL NO.18 |
| TERMINAL NO.3 | TERMINAL NO.16 |

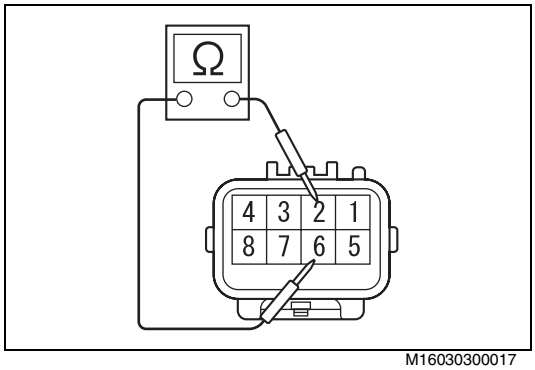
**Reference: Conductivity**

NG → Replace the harness.

OK → Perform the damage analysis of "MALFUNCTION OF THE EXCITER UNIT IN THE MAIN UNIT (DIAGNOSIS CODE 2)" and "MALFUNCTION OF THE FIELD COIL (F COIL) UNIT IN THE MAIN UNIT (DIAGNOSIS CODE 3)"

# FAILURE OF THE DRIVE UNIT (DIAGNOSIS CODE 6)

M16030301BEF2007



M16030300017

**1. MEASURE THE RESISTANCE BETWEEN TERMINALS OF DRIVE UNIT.**

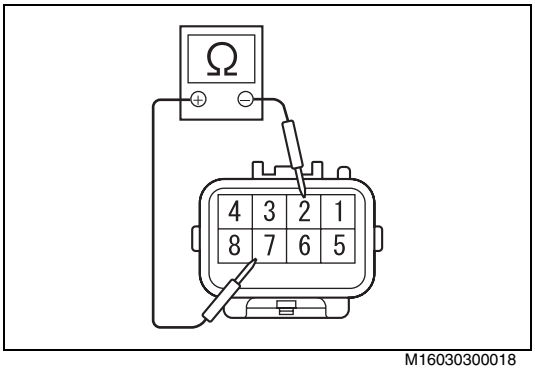
(1) Set the starter switch to "LOCK" and disconnect 8-pin connector (gray) of control unit line of the drive unit.

(2) Measure the resistance between the terminals No.2 and No.6 of the drive unit.

**Reference value: Approx. 180 Ω (At 20°C {68°F})**

NG → Replace the drive unit.

OK



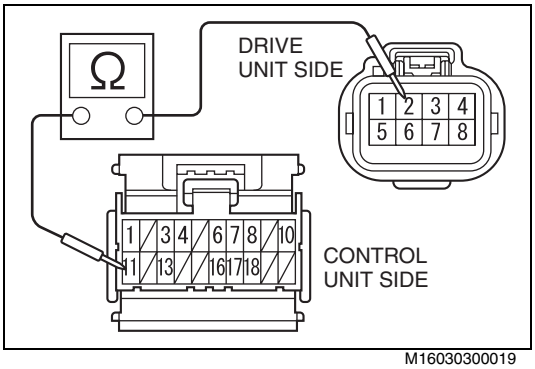
M16030300018

**2. INSPECT THE DRIVE UNIT.**

(1) Disconnect 8-pin connectors (black) of A line and B line of the retarder main unit of the drive unit and check the conductivity between the terminals No.2 and No.7 of drive unit side connector.
**Standard: No conductivity**

NG → Replace drive unit.

OK



M16030300019

**3. CHECK THE CONDUCTIVITY OF THE HARNESS.**

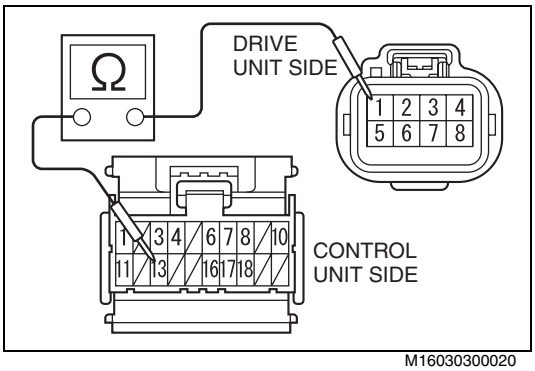
(1) Disconnect 8-pin connectors (gray) of control unit line of drive unit and 20-pin connector of control unit. Check the conductivity between the terminals for vehicle speed sensor signal of connector (harness side).

| DRIVE UNIT | CONTROL UNIT |
|---|---|
| TERMINAL NO.2 | TERMINAL NO.11 |

**Standard: Conductivity**

NG → Replace the harness.

OK



M16030300020

**4. CHECK THE CONDUCTIVITY OF THE HARNESS.**

(1) Disconnect 8-pin connectors (gray) of control unit line of drive unit and 20-pin connector of control unit. Measure the conductivity between the terminals for SCR drive signal of connector (harness side).

| DRIVE UNIT | CONTROL UNIT |
|---|---|
| TERMINAL NO.1 | TERMINAL NO.13 |

**Standard: Conductivity**

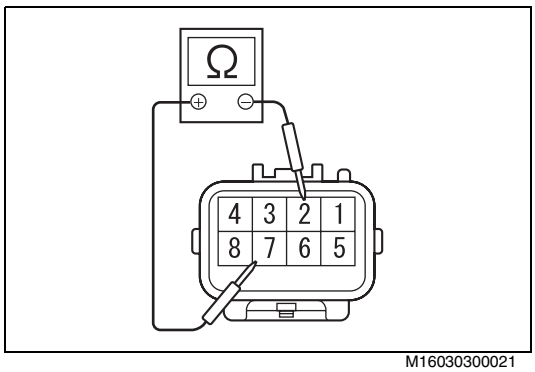
NG → Replace the harness.

OK

Replace the control unit.

# FAILURE OF THE CONTROL UNIT (DIAGNOSIS CODE 7)

M16030301BEF2008



M16030300021

**1. CHECK THE CONDUCTIVITY BETWEEN TERMINALS OF DRIVE UNIT.**

(1) Set the starter switch to "LOCK" and disconnect 8-pin connector (black) of retarder main unit A line and B line of the drive unit.

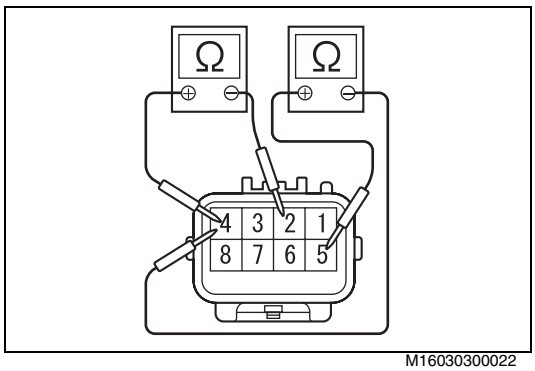
(2) Check the conductivity between terminals No.2 and No.7 of connector (parts side).

**Standard: No conductivity**

NG

OK

Replace the drive unit.



M16030300022

**2. INSPECT THE DRIVE UNIT.**

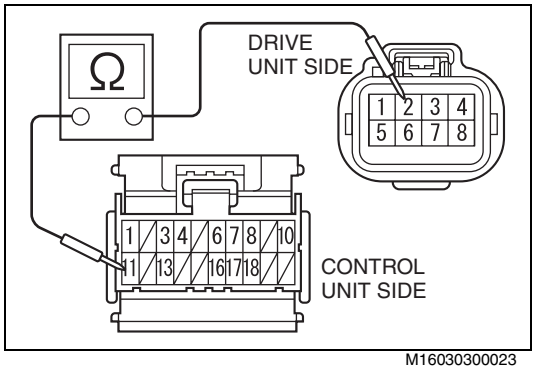
(1) Disconnect 8-pin connectors (black) of A line and B line of the retarder main unit of the drive unit and check the conductivity between the terminals No.4 and No.2, No.4 and No.5 of connector (parts side).

**Standard: No conductivity**

NG

OK

Replace drive unit.



M16030300023

**3. CHECK THE CONDUCTIVITY OF THE HARNESS.**

(1) Disconnect 8-pin connectors (gray) of control unit line of drive unit and 20-pin connector of control unit. Check the conductivity between the terminals for drive signal of exciter connection relay of connector (harness side).

| DRIVE UNIT | CONTROL UNIT |
|---|---|
| TERMINAL NO.2 | TERMINAL NO.11 |

**Standard: Conductivity**

NG

OK

Replace the harness.

Replace the control unit.

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