Mazda MX-5 Workshop Manual Supplement

ABS

FOREWORD

This is a supplement to the workshop manual shown below. This supplement describes service procedures of new or modified mechanical and/or electrical systems. For service procedures and important safety notices not contained in this supplement, please refer to the previous workshop manual.

Workshop Manual:
Form No.1221-10-89I

All information in this supplement was the latest available at the time of printing, all alternations related to modifications will be notified by Service Bulletin.

Mazda Motor Corporation
HIROSHIMA, JAPAN

APPLICATION:
This manual is applicable to vehicles beginning with the Vehicle Identification Numbers (VIN) shown on the following page.

CONTENTS

Explanations are given only for shaded sections (■).

Volver

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1246-10-90G

VEHICLE IDENTIFICATION NUMBERS (VIN)

JMZ NA18B2 00 100001 ~

GENERAL INFORMATION

IMPORTANT INFORMATION

BASIC ASSUMPTIONS

This workshop manual assumes that you have certain special tools that are necessary for the safe and efficient performance of service operations on Mazda vehicles and that you know how to use them properly. It also assumes that you are familiar with automobile systems and basic service and repair procedures. You should not attempt to use this manual unless these assumptions are correct and you understand the consequences described below.

SAFETY RISK

This manual contains certain notes, warnings, and other precautionary information that you should carefully read and follow to reduce the risk of personal injury to yourself or others and the risk of improper service that may damage the vehicle or render it unsafe. If there is no such information in regard to any specific service method, this does not mean there is no possibility that personal safety or vehicle safety will be jeopardized by the use of incorrect methods or tools.

POSSIBLE LOSS OF WARRANTY

The manufacturer's warranty on Mazda vehicles and engines can be voided if improper service or repairs are performed by persons other than those at an Authorized Mazda Dealer.

WARNING ON LUBRICANTS AND GREASES

Avoid all prolonged and repeated contact with mineral oils, especially used oils. Used oils contaminated during service (e.g., engine sump oils) are more irritating and more likely to cause serious effects, including skin cancer, in the event of gross and prolonged skin contact.

Wash skin thoroughly after work involving oil.
Protective hand cleaners may be of value provided they can be removed from the skin with water. Do not use gasoline, paraffin, or other solvents to remove oil from the skin.

Lubricants and greases may be slightly irritating to the eyes.

Repeated or prolonged skin contact should be avoided by wearing protective clothing. Particular care should be taken with used oils and greases containing lead. Do not allow work clothing to be contaminated with oil. Dry clean or launder such clothing at regular intervals.

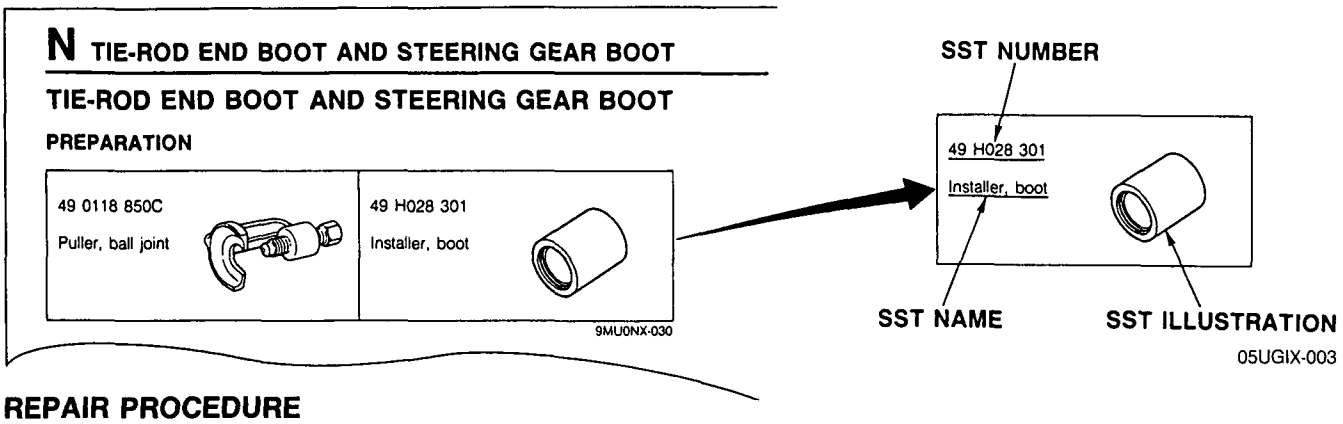
05UGIX-002

HOW TO USE THIS MANUAL

PREPARATION

PREPARATION points out the needed **Special Service Tool (SST)** for the service operation that it preceeds. Gather all necessary **SST** before beginning work.

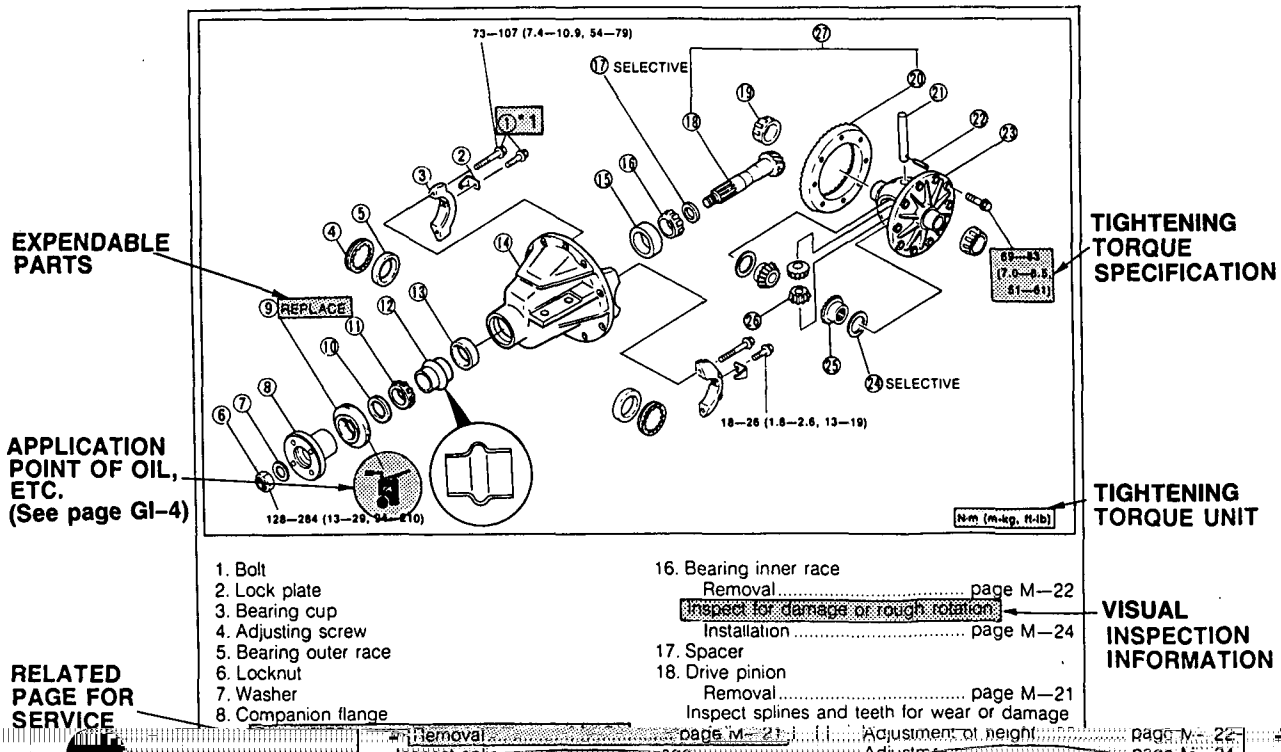
Example:



REPAIR PROCEDURE

1. Most repair operations begin with an overview illustration. It identifies the components, shows how the parts fit together, and describes visual parts inspections. If a damaged or worn part is found, repair or replace it as necessary.
2. Expendable parts, tightening torques, and symbols for oil, grease, and sealant are shown in the overview illustration.
3. Pages related to service procedures are shown under the illustration. Refer to this information when servicing the related part.

Example:



*1: The numbers (① ex.) refer to parts identification and where necessary servicing procedure.
*2: Units are in N·m (m-kg, ft-lb) unless otherwise specified.

SYMBOLS

There are six symbols indicating oil, grease, and sealant. These symbols show the points of applying such materials during service.

Symbol	Meaning	Kind
	Apply oil	New engine oil or gear oil as appropriate
	Apply brake fluid	Only brake fluid
	Apply automatic transmission fluid	Only ATF
	Apply grease	Appropriate grease
	Apply sealant	Appropriate sealant
	Apply petroleum jelly	Only petroleum jelly

95AGIX-002

Note

- **When special oil or grease is needed, this is shown in the illustration.**

NOTES, CAUTIONS, AND WARNINGS

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. **NOTES** give you **added information** that will help you to complete a particular procedure. **CAUTIONS** are given to prevent you from making an error that could **damage the vehicle. WARNINGS** remind you to be especially careful in those areas where carelessness can cause **personal injury.** The following list contains some general WARNINGS you should follow when you work on a vehicle.

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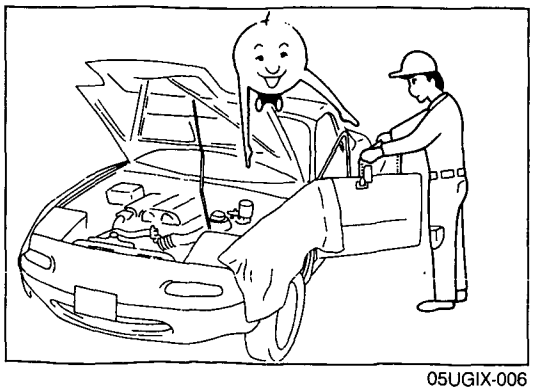

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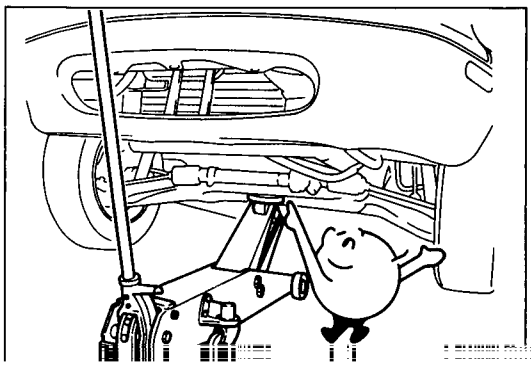
FUNDAMENTAL PROCEDURES

PROTECTION OF VEHICLE

Always be sure to cover fenders, seats, and floor areas before starting work.



A WORD ABOUT SAFETY

The following precautions must be followed when jacking up the vehicle.

1. Block the wheels.
2. Use only the specified jacking positions.
3. Support the vehicle with safety stands.

Start the engine only after making certain the engine compartment is clear of tools and people.

9MUGIX-003

OOLS AND MEASURING

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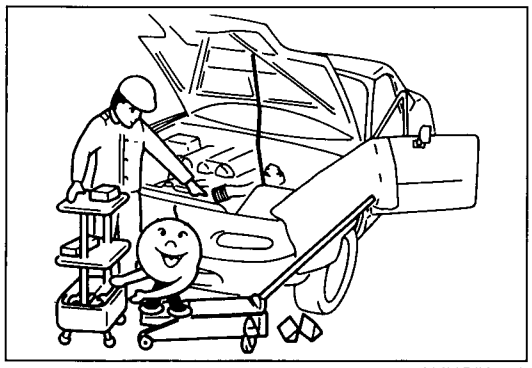

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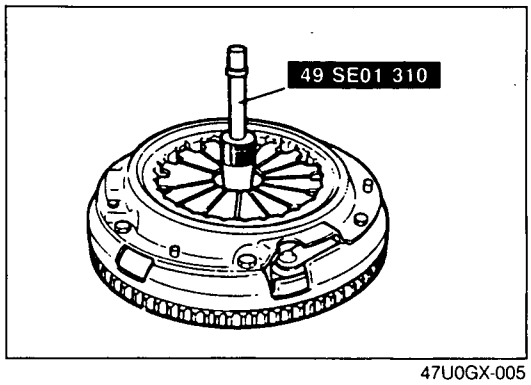
PREPARATION OF T EQUIPMENT

Be sure that all necessa
available before startin

SPECIAL TOOLS

Use special tools wher



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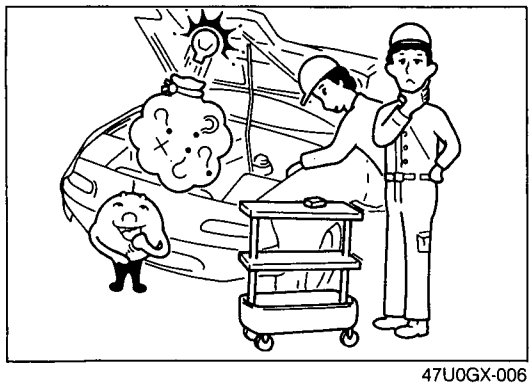
REMOVAL OF PARTS

While correcting a prob
Begin work only after firs
blies must be removed
repair.



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DISASSEMBLY

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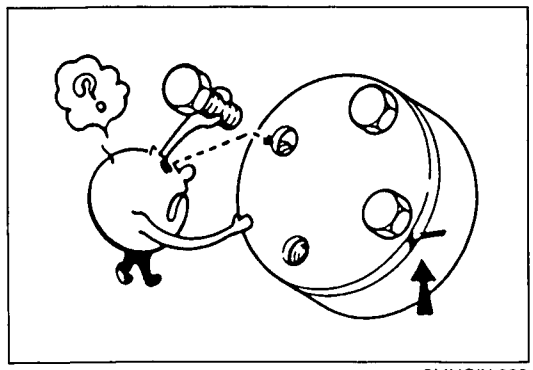

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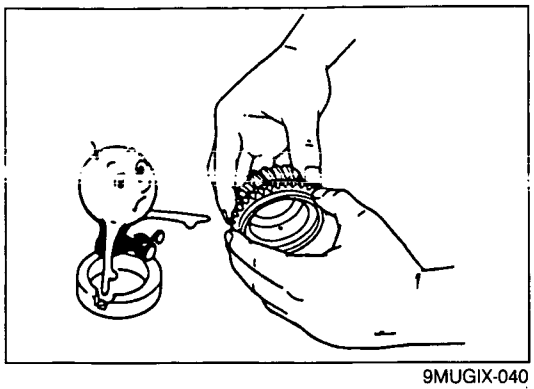
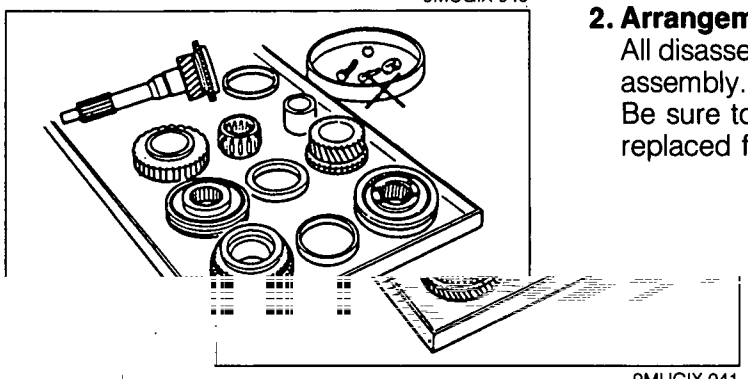


9MUGIX-040

1. Inspection of parts

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



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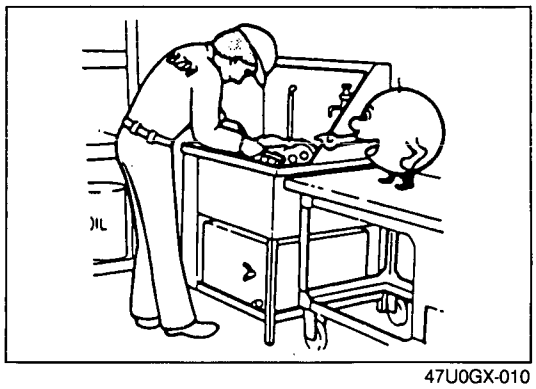
2. Arrangement of parts

All disassembled parts should be carefully arranged for re-assembly.

Be sure to separate or otherwise identify the parts to be replaced from those that will be reused.



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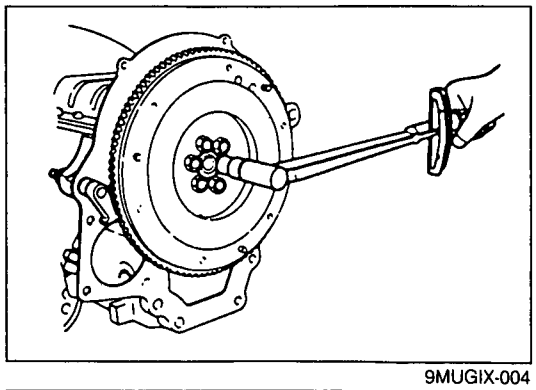
3. Cleaning parts for reuse

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



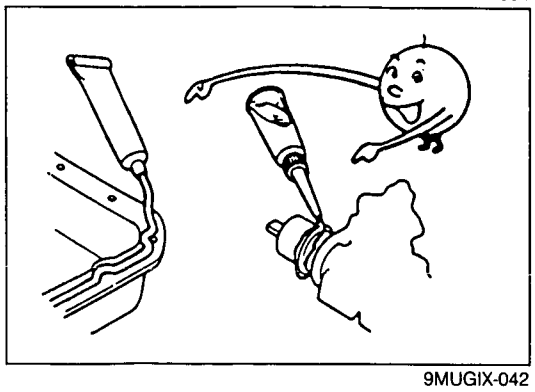
9MUGIX-004

REASSEMBLY

Standard values, such as torques and certain adjustm must be strictly observed in the reassembly of all part Refer to STANDARD BOLT AND NUT TIGHTENING TOF in Section TD for tightening torques not mentioned in the text.

If removed, these parts should be replaced with new

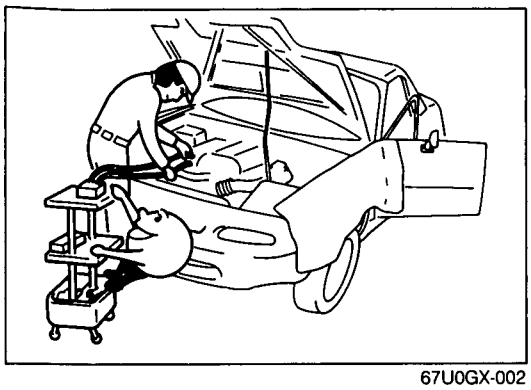
1. Oil seals
2. Gaskets
3. O-rings
4. Lock washers
5. Cotter pins
6. Nylon nuts



9MUGIX-042

Depending on location:

1. Sealant should be applied to gaskets.
2. Oil should be applied to the moving components of
3. Specified oil or grease should be applied at the presc locations (such as oil seals) before reassembly.



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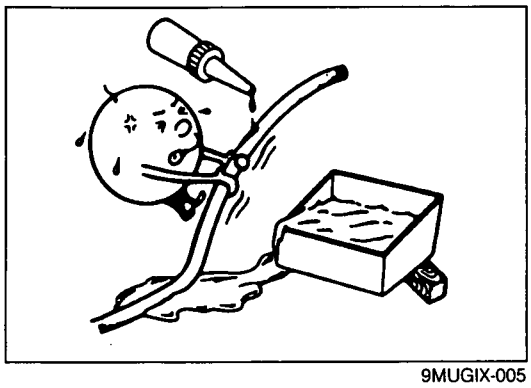


9MUGIX-005

ADJUSTMENTS

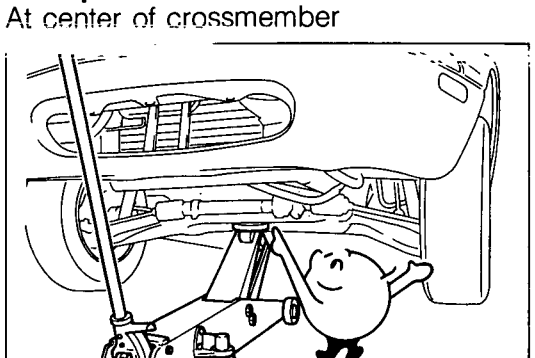
Use suitable gauges and/or testers when making adjustments.

RUBBER PARTS AND TUBING

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

JACK AND SAFETY STAND POSITIONS

FRONT
Jack position:
At center of crossmember



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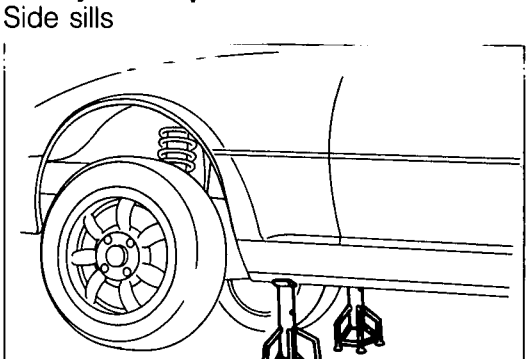
Safety stand positions:
Side sills



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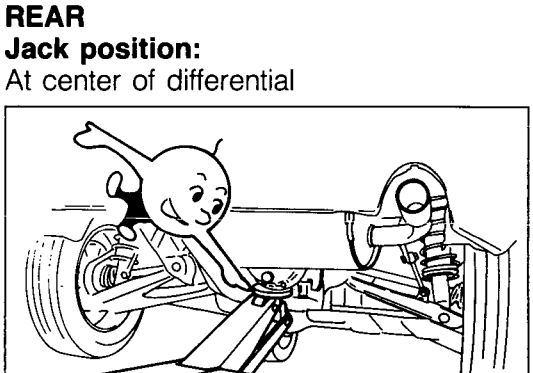
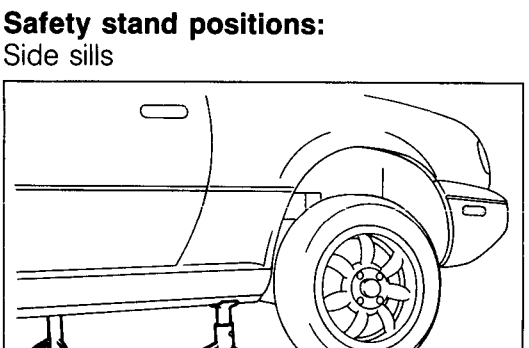
REAR
Jack position:
At center of differential



05UGIX-008

Safety stand positions:
Side sills



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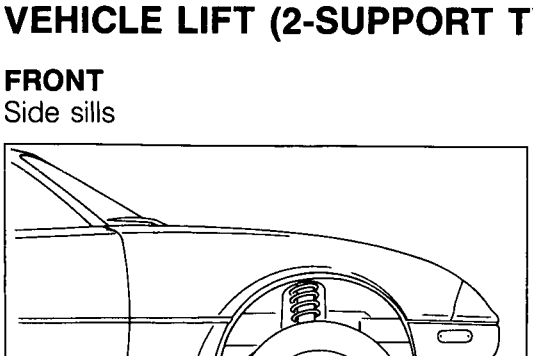
VEHICLE LIFT (2-SUPPORT TYPE) POSITIONS

FRONT
Side sills



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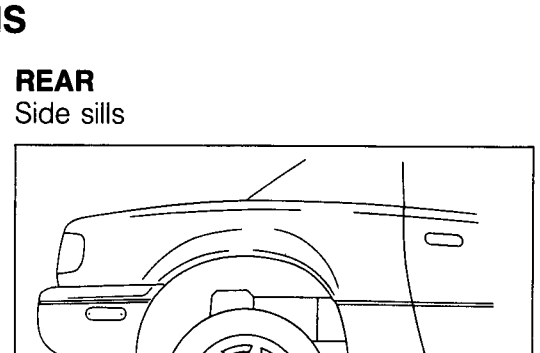
REAR
Side sills



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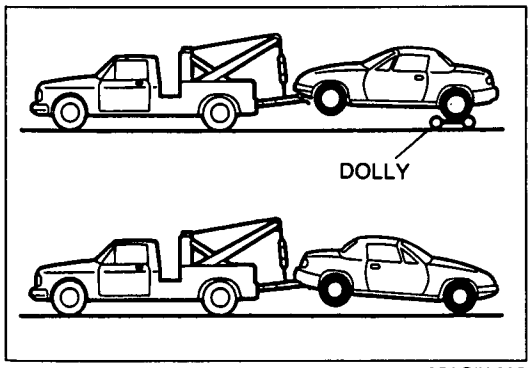

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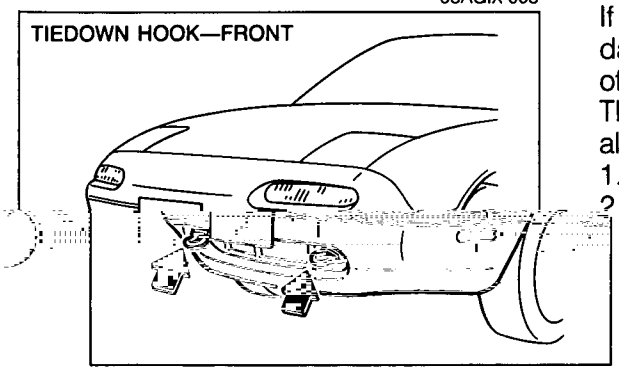
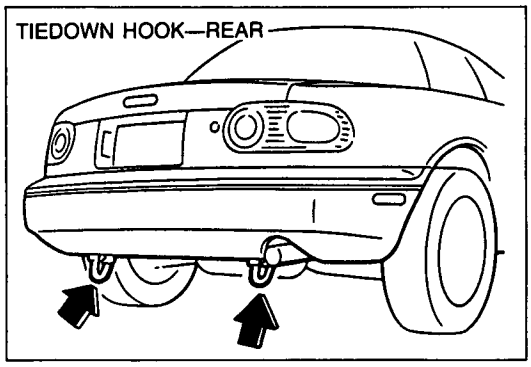




TOWING

Proper towing equipment is necessary to prevent damage to the vehicle during any towing operation.
Laws and regulations applicable to vehicles in tow must always be observed.
As a rule, towed vehicles should be pulled with the driving wheels off the ground.
If towing with the front wheels on the ground, set the front wheels straight ahead and set the ignition switch to OFF.

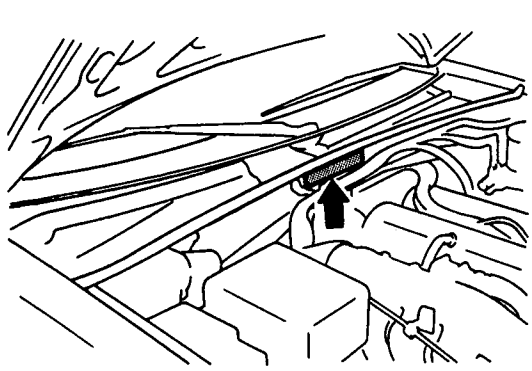
WITH MANUAL TRANSMISSION

If the transmission, rear axle, and steering system are not damaged, the vehicle may be towed on all four wheels. If any of these components is damaged, use a towing dolly.
The following points are important when towing a vehicle with all wheels on the ground.
1. Set the ignition switch in the ACC(I) position.
2. Place the shift lever in Neutral.
3. Release the parking brake.

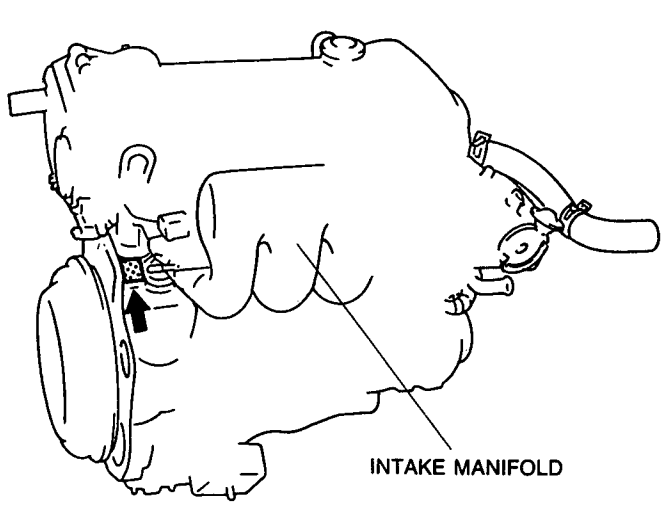
CAUTION
- **The power assists for the brakes and steering are inoperable while the engine is off.**
- **Do not use the tiedown hooks of the vehicle for towing. These hooks are designed ONLY for transport tiedown. If the tiedown hooks are used for towing, the front or rear skirt and bumper will be damaged.**

IDENTIFICATION NUMBER LOCATIONS

VEHICLE IDENTIFICATION NUMBER (VIN)



ENGINE MODEL AND NUMBER



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UNITS

N·m (m-kg or cm-kg, ft-lb or in-lb)	Torque
rpm	Revolutions per minute
A	Ampere(s)
V	Volt(s)
Ω	Ohm(s) (resistance)
kPa (kg/cm^2, psi)	Pressure (usually positive)
mmHg (inHg)	Pressure (usually negative)
W	Watt
liters (US qt, Imp qt)	Volume
mm (in)	Length

89U0GX-006

ABBREVIATIONS

ABDC	After bottom dead center
ABS	Anti-lock brake system
A/C	Air conditioner
ACC	Accessories
ATDC	After top dead center
BBDC	Before bottom dead center
BTDC	Before top dead center
DRL	Daytime running light
ECU	Engine control unit
EGI	Electronic gasoline injection
E/L	Electrical load
EX	Exhaust
IC	Integrated circuit
IN	Intake
INT	Intermittent
ISC	Idle-speed control
LH	Left hand
LSD	Limited-slip differential
M	Motor, electric
MIL	Malfunction indicator lamp
M/T	Manual transmission
OFF	Switch off
ON	Switch on
PCV	Positive crankcase ventilation
PPF	Power plant frame
PRC	Pressure regulator control
P/S	Power steering
P/W	Power window
RH	Right hand
SST	Special service tool
TDC	Top dead center
VRIS	Variable resonance induction system

05EGIX-002

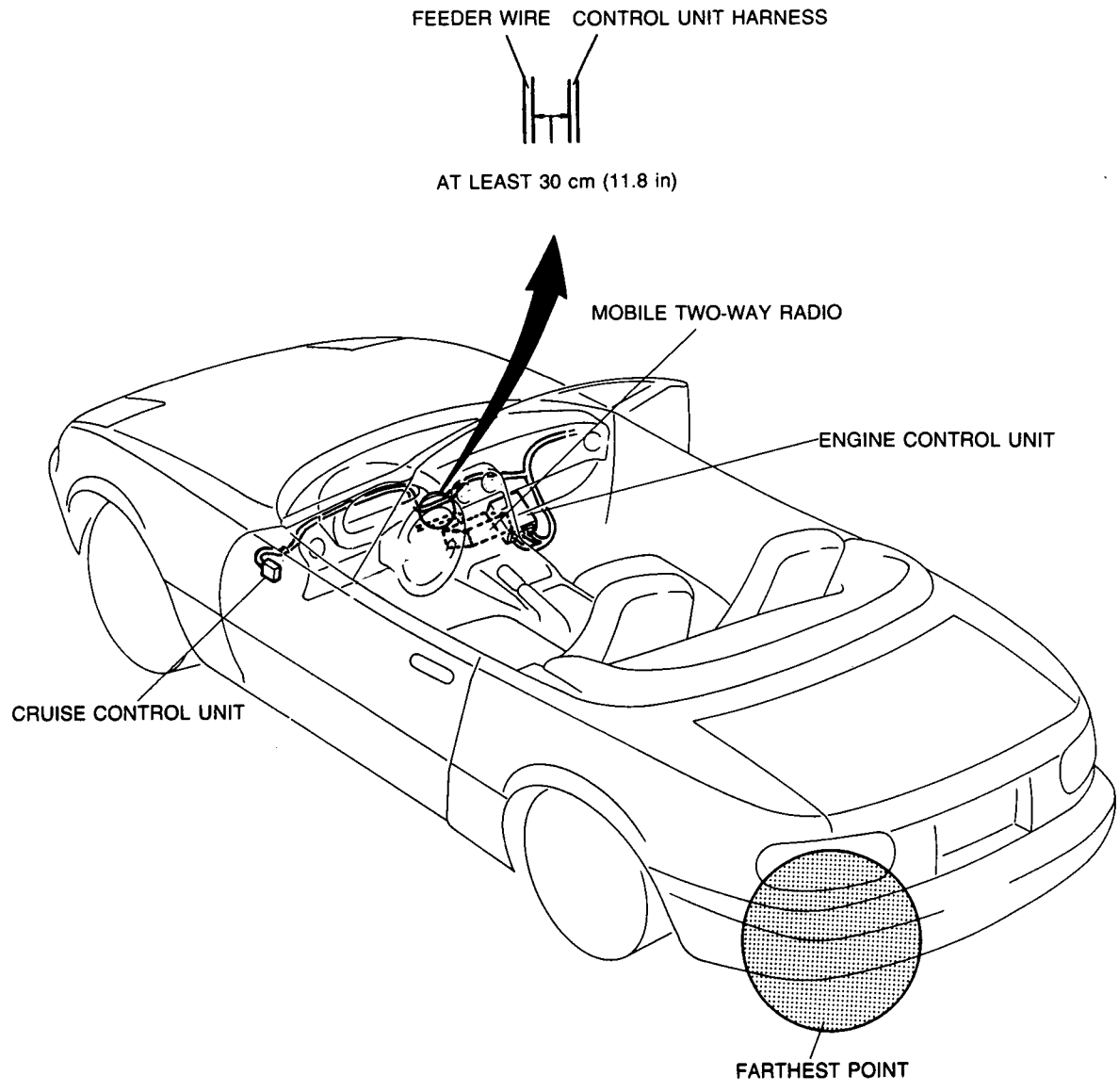
CAUTION

INSTALLATION OF MOBILE TWO-WAY RADIO SYSTEM

If a mobile two-way radio system is installed improperly or if a high-powered type is used, the EGI system and other systems may be affected.

When the vehicle is to be equipped with a mobile two-way radio, observe the following precautions:

1. Install the antenna at the farthest point from control units.
2. Install the antenna feeder as far as possible from the control unit harnesses **(at least 30 cm [11.8 in])**.
3. Ensure that the antenna and feeder are properly adjusted.
4. Do not install a high-powered mobile two-way radio system.



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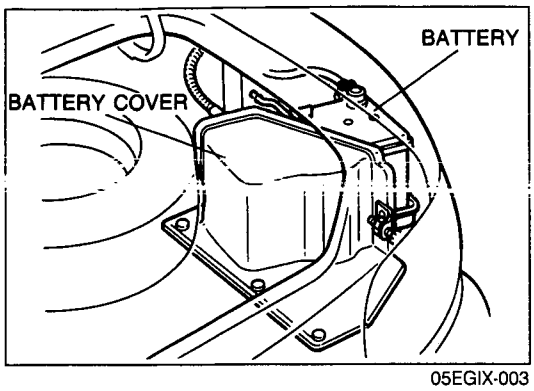
CAUTION



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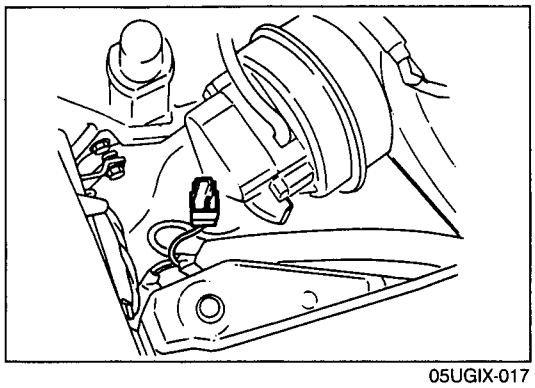

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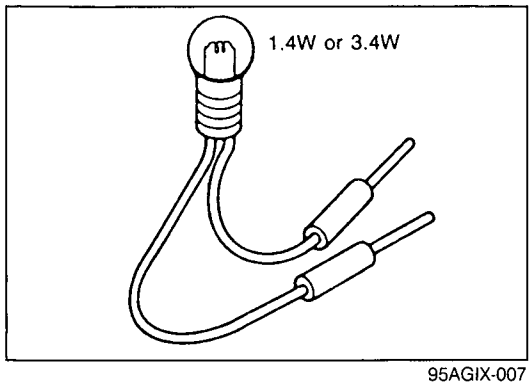
BATTERY

1. The battery is installed in the right rear of the trunk.
2. The battery installed in the MX-5 is unique.
   When a replacement battery is installed, install it with a Mazda genuine battery replacement kit or equivalent.

POWER CONNECTOR IN ENGINE COMPARTMENT

1. When using externally powered test equipment, connect it to the special power connector (Blue: 1-pin) for battery voltage.
2. Do not ground the power connector terminal; the WIPER 20A fuse will be burned.



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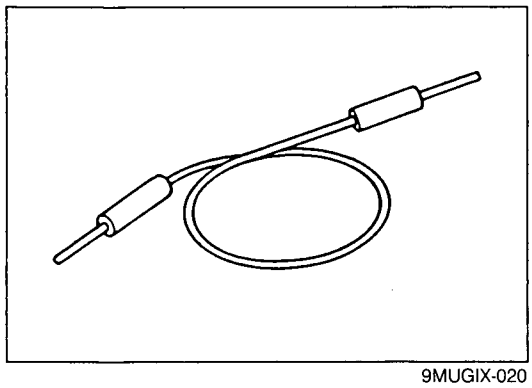

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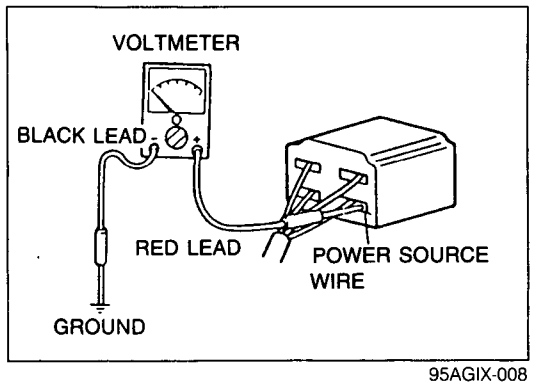

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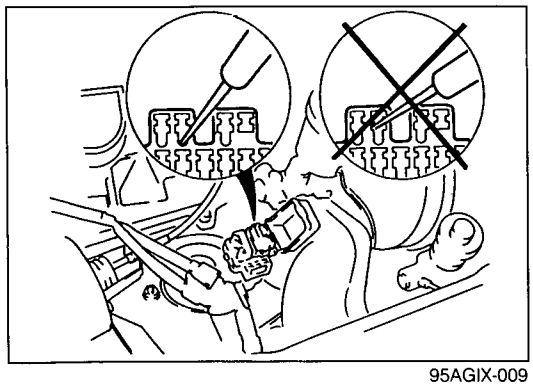

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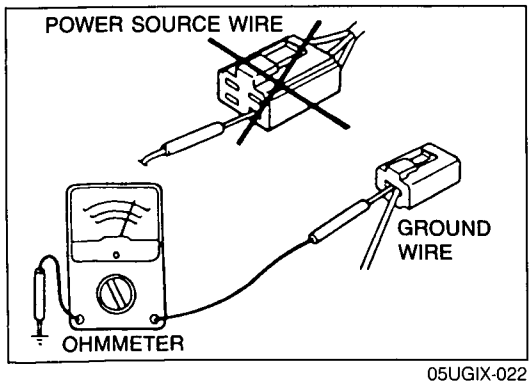


05UGIX-022

ELECTRICAL TROUBLESHOOTING TOOLS

Test Light

The test light, as shown in the figure, uses a 12V bulb. The two leads should be connected to probes.
The test light is used for simple voltage checks and for checking for short circuits.

Caution

- **When checking a control unit, never use a bulb over 3.4W.**

Jumper Wire

The jumper wire is used for testing by shorting across switch terminals and ground connections.

Caution

- **Do not connect a jumper wire from the power source line to a body ground; this may cause burning or other damage to harnesses or electronic components.**

Voltmeter

The DC voltmeter is used to measure circuit voltage. A voltmeter with a range of 15V or more is used by connecting the positive (+) probe (red lead) to the point where voltage is to be measured and the negative (–) probe (black lead) to a body ground.

Diagnosis Connector

Insert the probe into the service hole when connecting a jumper wire or tester to the diagnosis connector.

Caution

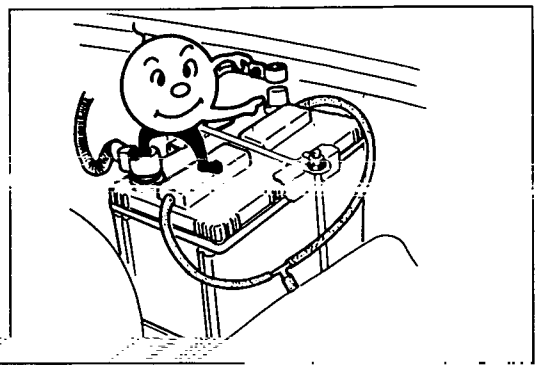
- **Do not insert the wire probe into the diagnosis connector terminal, which may damage the terminal.**

Ohmmeter

The ohmmeter is used to measure the resistance between two points in a circuit, and to check for continuity and short circuits.

Caution

- **Do not attempt to connect the ohmmeter to any circuit to which voltage is applied; this may burn or otherwise damage the ohmmeter.**



05UGIX-023

CAUTION WITH ELECTRICAL PARTS

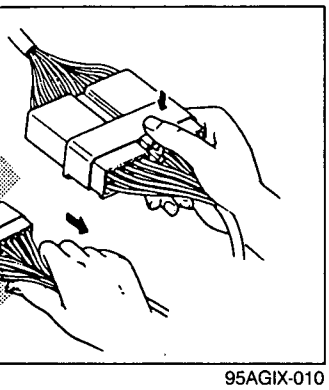
Battery Cable

Before disconnecting connectors or removing electrical parts, disconnect the negative battery cable.

Connectors

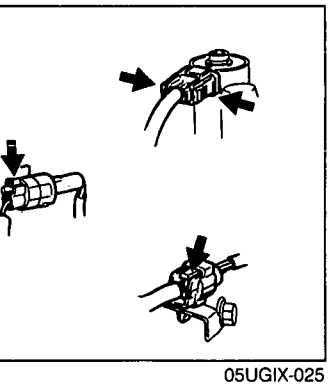
Disconnecting connectors

Never pull on the wiring harness when disconnecting connectors.



95AGIX-010

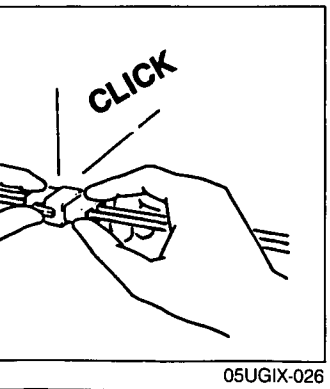
Connectors can be disconnected by pressing or pulling the lock lever as shown.



05UGIX-025

Locking connectors

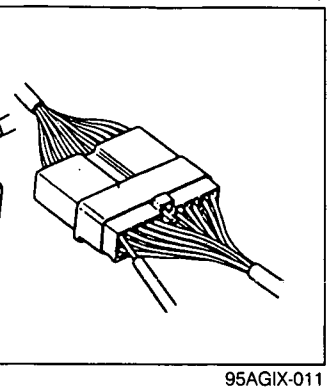
When locking connectors, listen for a click that will indicate they are securely locked.



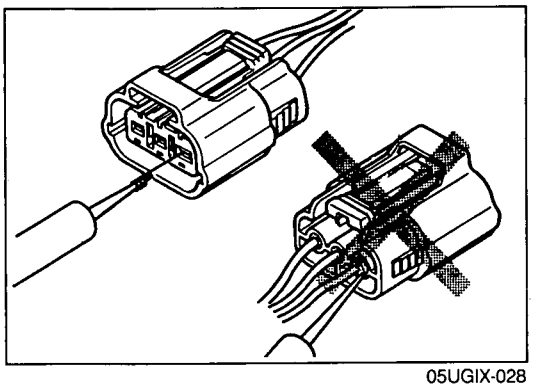
05UGIX-026

Inspection

1. When a tester is used to check for continuity or to measure voltage, insert the tester probe from the wiring harness side.



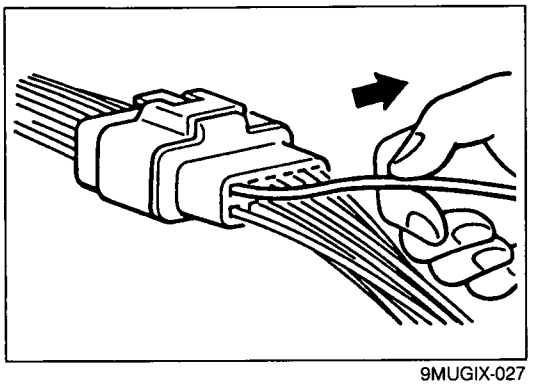
95AGIX-011



05UGIX-028

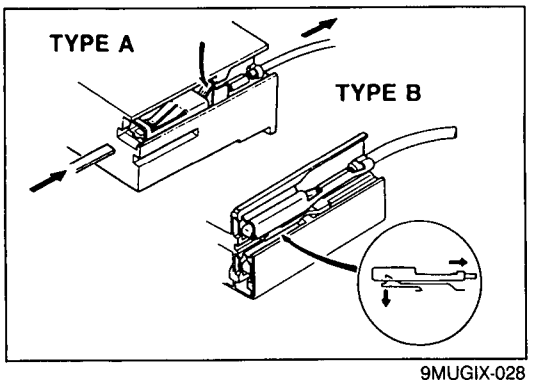
2. Check the terminals of waterproof connectors from the connector side, as they cannot be accessed from the wire harness side.

Caution
- **Use fine wire to prevent damage to the terminal.**
- **Do not damage the terminal when inserting the tester lead.**



9MUGIX-027

Terminals
Inspection
Pull lightly on individual wires to check that they are secured in the terminal.

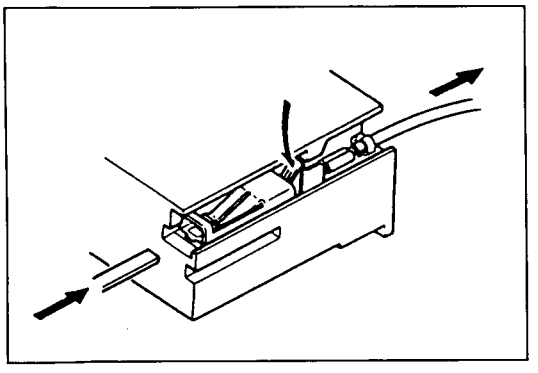


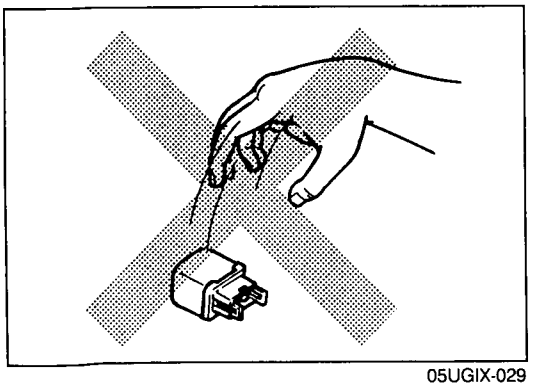
9MUGIX-028

Replacement of terminals
Use the appropriate tools to remove the terminal as shown. When installing the terminal, be sure to insert it until it locks securely.

<Female>
Insert a thin piece of metal from the terminal side of the connector, and then, with the terminal locking tab pressed down, pull the terminal out from the connector.

<Male>
Same as the female type.

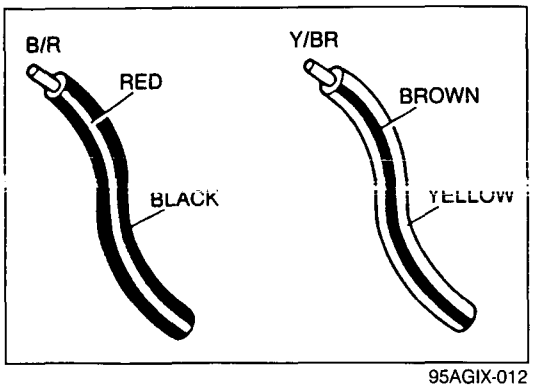




05UGIX-029

Sensors, Switches, and Relays
Handle sensors, switches, and relays carefully. Do not drop them or strike them against other objects.

CAUTION



95AGIX-012

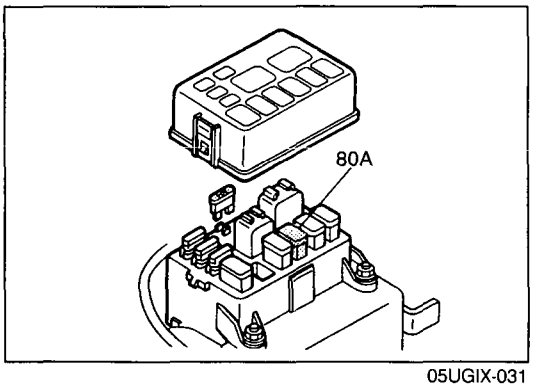
Wiring Harness
Wiring color codes

Two-color wires are indicated by a two-color code symbol. The first letter indicates the base color of the wire and the second the color of the stripe.

CODE	COLOR	CODE	COLOR
B	Black	O	Orange
BR	Brown	P	Pink
G	Green	R	Red
GY	Gray	V	Violet
L	Blue	W	White
LB	Light Blue	Y	Yellow
LG	Light Green	—	—

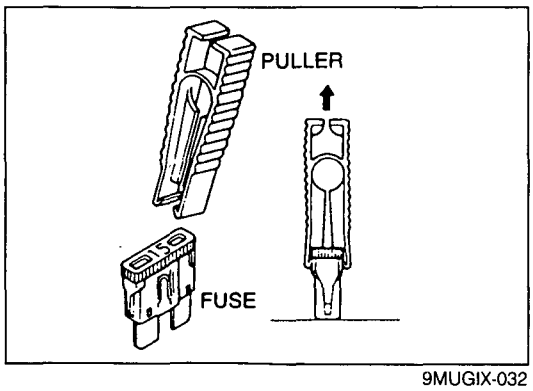
Fuse
Replacement

. When replacing a fuse, be sure to replace it with one of the specified capacity.
If a fuse again fails after it has been replaced, the circuit probably has a short and the wiring should be checked.
. Be sure the negative battery terminal is disconnected before replacing a main fuse (80A).



05UGIX-031

. When replacing a pullout fuse, use the fuse puller supplied in the fuse box cover.



9MUGIX-032

PRE-DELIVERY INSPECTION AND SCHEDULED MAINTENANCE SERVICES

05E0AX-001

PRE-DELIVERY INSPECTION

PRE-DELIVERY INSPECTION TABLE

EXTERIOR

INSPECT and **ADJUST**, if necessary, the following items to specification:

- ☐ Glass, exterior bright metal and paint for damage
- ☐ Convertible top and detachable hard top (if equipped) for damage
- ☐ Wheel lug nuts
  88—118 N·m (9—12 m-kg, 65—87 ft-lb)
- ☐ Tire pressure
- ☐ All weatherstrips for damage or detachment
- ☐ Operation of hood release and lock
- ☐ Operation of fuel lid
- ☐ Door operation and alignment
- ☐ Headlight aiming

INSTALL the following parts:

- ☐ Wheel caps or rings (if equipped)
- ☐ Outside rearview mirror(s)
- ☐ Mast antenna

UNDER HOOD—ENGINE OFF

INSPECT and **ADJUST**, if necessary, the following items to specification:

- ☐ Fuel, coolant and hydraulic lines, fittings, connections and components for leaks
- ☐ Engine oil level
- ☐ Power steering fluid level (if equipped)
- ☐ Brake and clutch master cylinder fluid level
- ☐ Windshield washer reservoir fluid level
- ☐ Radiator coolant level and specific gravity

Protection °C (°F)	Specific gravity at 20°C (68°F)
−16 (3)	1.054
−26 (−15)	1.066
−40 (−40)	1.078

- ☐ Tightness of water hose clamps (including heater hoses)
- ☐ Tightness of battery terminals
- ☐ Drive belt tensions
- ☐ Accelerator cable and linkage for free movement

CLEAN spark plugs

INTERIOR

INSTALL the following parts:

- ☐ Fuse for accessories

CHECK operation of the following items:

- ☐ Seat controls (sliding and reclining)
- ☐ Door locks
- ☐ Seat belts and warning system
- ☐ Ignition switch and steering lock
- ☐ Starter interlock switch (clutch pedal)
- ☐ All lights, including warning and indicator lights
- ☐ Audible warning system
- ☐ Horn, wipers and washer
- ☐ Audio system (if equipped)
- ☐ Cigarette lighter
- ☐ Power windows (if equipped)
- ☐ Heater, defroster and air conditioner at all mode selections (if equipped)

CHECK the following items:

- ☐ Presence of spare fuses
- ☐ Upholstery and interior finish

CHECK and **ADJUST**, if necessary, the following items:

- ☐ Operation and fit of windows
- ☐ Pedal height and free play of brake and clutch pedals

	Pedal height mm (in)	Free play mm (in)
Clutch pedal	175—185 (6.89—7.28) (with carpet)	0.6—3.1 (0.02—0.12)
Brake pedal	171—181 (6.73—7.13) (with carpet)	4—7 (0.16—0.28)

- ☐ Parking brake
  5—7 notches/98 N (10 kg, 22lb)

UNDER HOOD—ENGINE RUNNING AT OPERATING TEMPERATURE

CHECK the following items:

- ☐ Initial ignition timing
  10° ± 1° BTDC (with diagnosis connector TEN and GND terminals connected)
- ☐ Idle speed
  850 ± 50 rpm (with diagnosis connector TEN and GND terminals connected)

ON HOIST

CHECK the following items:

- ☐ Underside fuel, coolant and hydraulic lines, fittings, connections and components for leaks
- ☐ Tires for cuts or bruises
- ☐ Steering linkage, suspension, exhaust system and all underside hardware for looseness or damage
- ☐ Manual transmission oil level
- ☐ Rear axle oil level

ROAD TEST

CHECK the following items:

- ☐ Brake operation
- ☐ Clutch operation
- ☐ Steering control
- ☐ Operation of meters and gauges
- ☐ Squeaks, rattles and unusual noise
- ☐ Overall engine performance
- ☐ Seat belt emergency locking retractors
- ☐ Cruise control system (if equipped)

AFTER ROAD TEST

REMOVE seat and floor mat protective covers

CHECK for necessary owner information materials, tools and spare tire in vehicle

05E0AX-002

SCHEDULED MAINTENANCE SERVICES

MAINTENANCE TABLE

Chart symbols:

I : Inspect, and if necessary correct, clean or replace
A: Adjust
R: Replace or change
T : Tighten

REMARKS

After 80,000 km or 48 months, continue to follow the described maintenance at the recommended intervals.
As for * marked items in this maintenance chart, note the following points.

*1 Major service interval at 12 months/20,000 km (12,000 miles).
Lubrication service based on distance only 10,000 km (6,000 miles) not time.

*2 Adjust or inspect alternator and water pump drive belt, and power steering and air conditioner drive belt if equipped.

*3 Replacement of the timing belt is required at every 100,000 km (60,000 mile). Failure to replace the timing belt may result in damage to the engine.

*4 If the vehicle is operated under any of the following conditions, it is suggested that the engine oil and oil filter be changed more often than the recommended intervals.
a) Driving in dusty conditions.
b) Extended periods of idling or low speed operation.
c) Driving for a prolonged periods in cold temperatures or regularly driving only short distances.

*5 If the vehicle is operated in very dusty or sandy areas, inspect and, if necessary, replace more often than at usual recommended intervals.

*6 This is a full function check of all electrical systems, i.e, all lights, washers (including condition of blades) electric windows, sunroof, horn etc.

*7 Replace every two years.
If there has been continuous hard driving, mountain driving, or if the brakes are used extensively or the vehicle is operated in extremely humid climates, the brake fluid should be changed annually.

95E0AX-001

SCHEDULED MAINTENANCE SERVICES

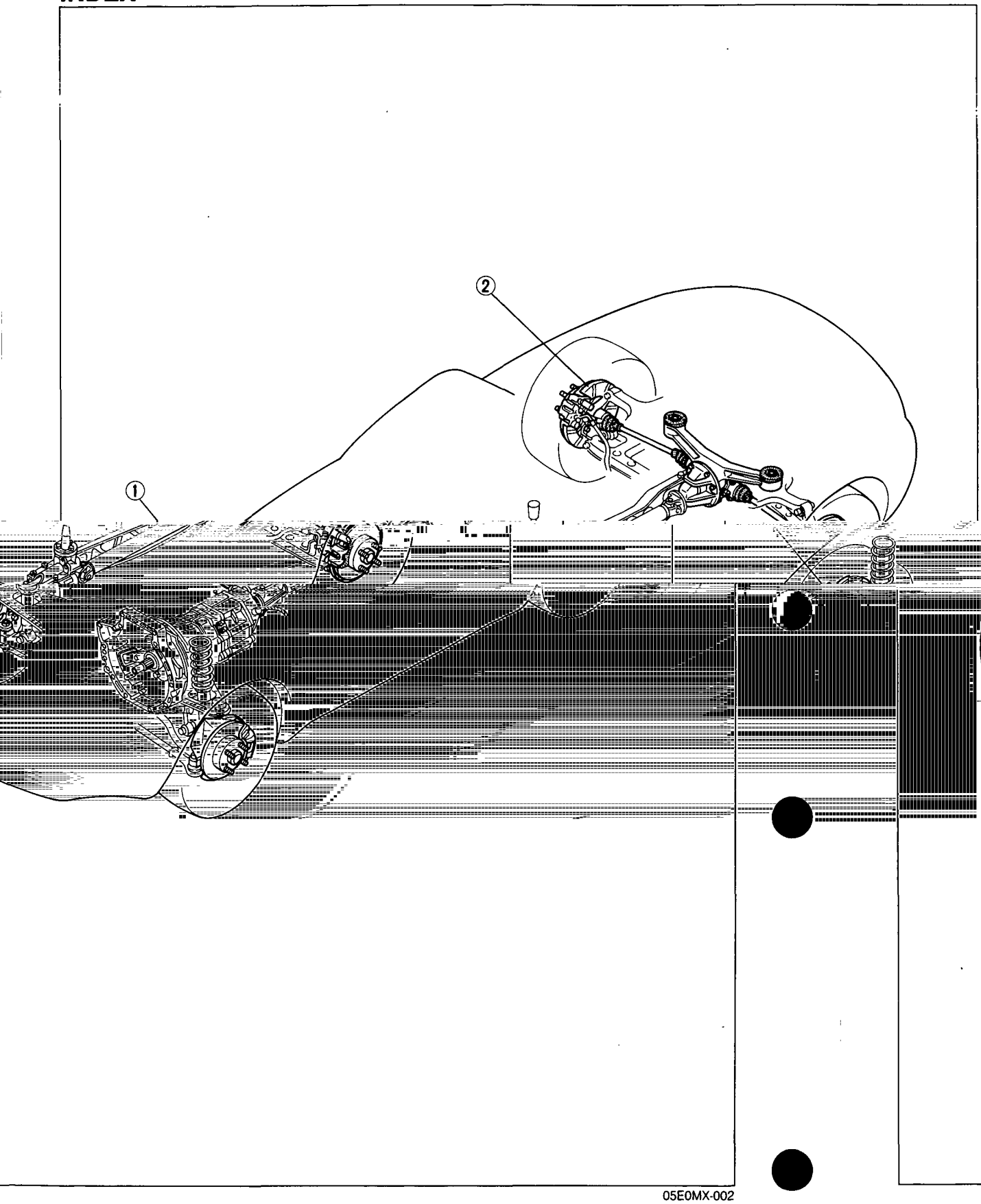
Interval / Maintenance operation	Number of months or km (miles), whichever comes first								
	Months*1	—	6	12	18	24	30	36	42	48
	Kilometers	1,000	10,000	20,000	30,000	40,000	50,000	60,000	70,000	80,000
	(Miles)	(600)	(6,000)	(12,000)	(18,000)	(24,000)	(30,000)	(36,000)	(42,000)	(48,000)
Intake and exhaust manifold nuts (Bolts)		T				T				T
Drive belts*2		A		A		A		A		A
Engine timing belt*3	Replace every 100,000 km (60,000 miles)									
Engine oil*4		R	R	R	R	R	R	R	R	R
Oil filter*4			R	R	R	R	R	R	R	R
Cooling system (Including coolant level adjustment)				I		I		I		I
Engine coolant	Replace every 2 years									
Idle speed				A		A		A		A
Air cleaner element*5						R				R
Fuel filter						R				R
Fuel lines and hoses						I				I
Initial ignition timing						I				I
Spark plugs				A		A		A		A
Spark plugs (Only for sweden)	Adjust every 30,000 km (18,000 mils)									
Throttle sensor				A		A		A		A
Throttle sensor (Only for sweden)	Adjust every 80,000 km (48,000 miles)									
Evaporative system				I		I		I		I
Evaporative system (Only for sweden)	Inspect every 80,000 km (48,000 miles)									
Dashpot				A		A		A		A
Dashpot (Only for sweden)	Adjust every 80,000 km (48,000 miles)									
All electrical system*6			I	I	I	I	I	I	I	I
Headlight alignment				A		A		A		A
Clutch pedal (With cable adjustment)			I	I	I	I	I	I	I	I
Clutch fluid			I	I	I	I	I	I	I	I
Brake lines, hoses and connections				I		I		I		I
Brake pedal			I	I	I	I	I	I	I	I
Brake fluid*7			I	I	I	R	I	I	I	R
Parking brake				A		A		A		A
Power brake unit and hoses				I		I		I		I
Disc brakes				I		I		I		I
Power steering fluid			I	I	I	I	I	I	I	I
Power steering system and hoses				I		I		I		I
Steering and front suspension				I		I		I		I
Manual transmission oil						A				R
Rear axle oil						A				R
Rear suspension ball joints						I				
Wheel bearing grease (If applicable)										A
Bolts, nuts on chassis and body		T		T		T		T		T
Body condition (Visual only)	Inspect annually									
Exhaust system heat shields						I				I
Tyres (Including spare tyres) with inflation pressure adjustment				I		I		I		I
Hinges and catches				A		A		A		A
Underside of vehicle				I		I		I		I
Seat belt				I		I		I		I
Road test				I		I		I		I

05E0AX-003

FRONT AND REAR AXLES

05E0MX-001

INDEX



05E0MX-002

OUTLINE

OUTLINE OF CONSTRUCTION

1. The construction and service procedures are generally the same as for MX-5 models without the ABS.
2. The ABS wheel speed sensors are installed on the knuckles.
3. The ABS sensor rotors for the front wheels are installed on the wheel hubs and those for the rear wheels are installed on the driveshafts.

05E0MX-003

SPECIFICATIONS

Item			Specifications
Front axle	Type		Double-wishbone
	Bearing		Angular ball bearing
	Maximum wheel bearing play mm (in)		0.05 (0.002)
Rear axle	Type		Double-wishbone
	Bearing		Angular ball bearing
	Maximum wheel bearing play mm (in)		0.05 (0.002)
Differential	Type		Standard
	Reduction gear		Hypoid gear
	Reduction ratio		4.300
	Differential gear		Straight-bevel gear
	Ring gear size mm (in)		162.16 (6.384)
	Oil	Grade	API service GL-5
		Viscosity	Above −18°C (0°F): SAE 90 Below −18°C (0°F): SAE 80W
		Capacity liter (US qt, Imp qt)	0.65 (0.69, 0.57)
Driveshaft	Type		Constant velocity (double offset) joint
	Length mm (in)		659.5 (25.965)

05E0MX-004

SUPPLEMENTAL SERVICE INFORMATION

The following points in this section are changed in comparison with Workshop Manual (1221-10-89I).

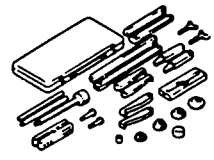
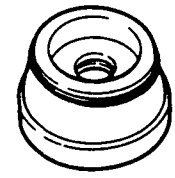
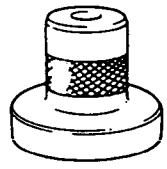
Wheel hub, Steering knuckle
- Removal / Installation
- Disassembly / Assembly

Rear axle
- Removal / Installation

05E0MX-005

FRONT AXLE

PREPARATION
SST

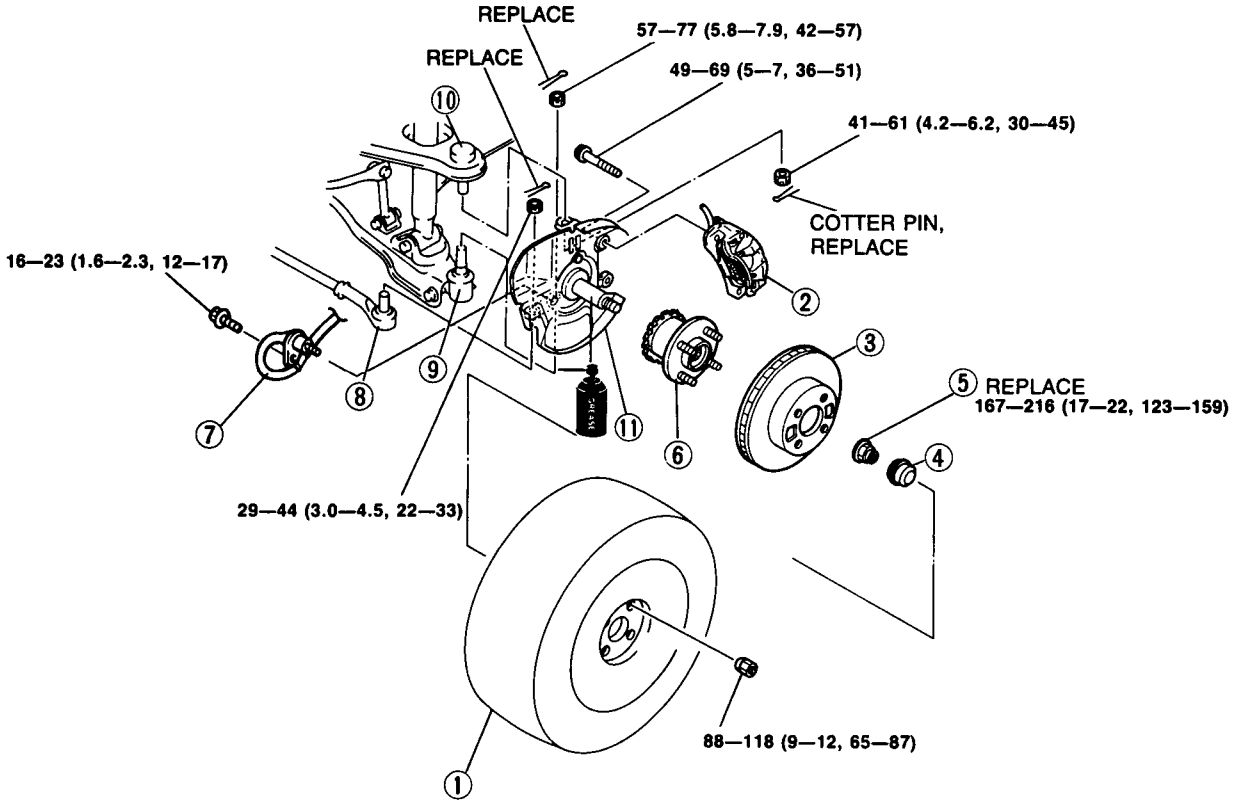
49 0839 425C Puller set, bearing 	For removal of ABS sensor rotor	49 F027 007 Attachment for bearing ϕ72 	For removal of ABS sensor rotor
49 V001 795 Installer, oil seal 	For installation ABS sensor rotor		

05E0MX-006

WHEEL HUB, STEERING KNUCKLE

Removal / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.

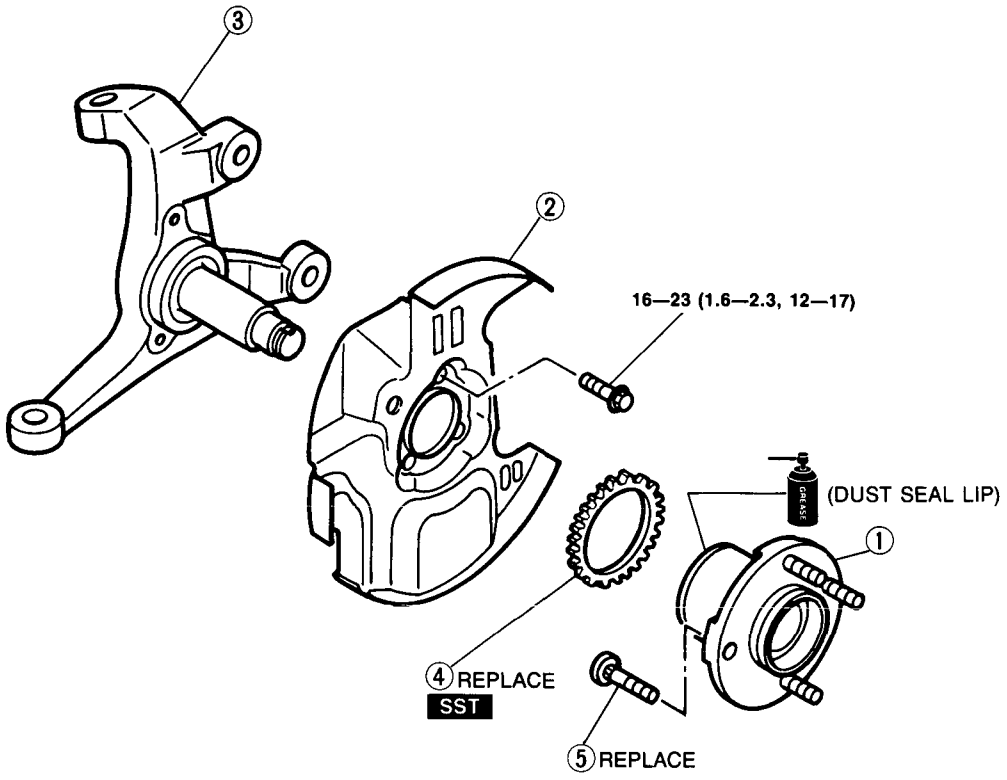


05E0MX-007

1. Front wheel
2. Brake caliper assembly
3. Disc plate
4. Hub cap
5. Locknut
6. Front wheel hub assembly
   Disassembly / Assembly ..... page M–6
7. Wheel speed sensor
   Removal / Inspection / Installation.. Section P
8. Tie-rod end
9. Lower arm ball joint
10. Upper arm ball joint
11. Dust cover and knuckle spindle

Disassembly / Assembly

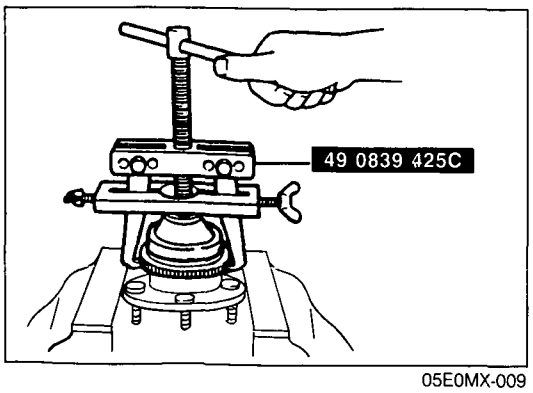
1. Disassemble in the order shown in the figure, referring to **Disassembly Note**.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.



N·m (m-kg, ft-lb)

05E0MX-008

1. Front wheel hub assembly
2. Dust cover
3. Knuckle spindle
4. ABS sensor rotor
   Disassembly Note ..... below
   Assembly Note ..... page M–7
5. Hub bolt



05E0MX-009

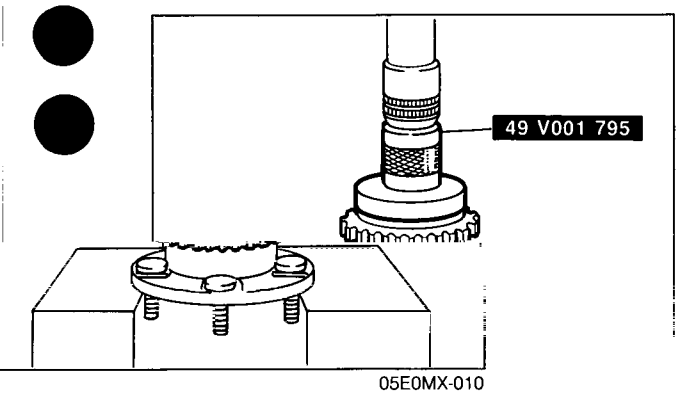
Disassembly note

Note
- **Do not remove the hub bolts unless necessary.**
- **Do not reuse the hub bolts if removed.**

ABS sensor rotor

Remove the ABS sensor rotor with the **SST**.

Note
- **Do not remove the sensor rotor unless necessary.**
- **Do not reuse the sensor rotor if removed.**



05E0MX-010

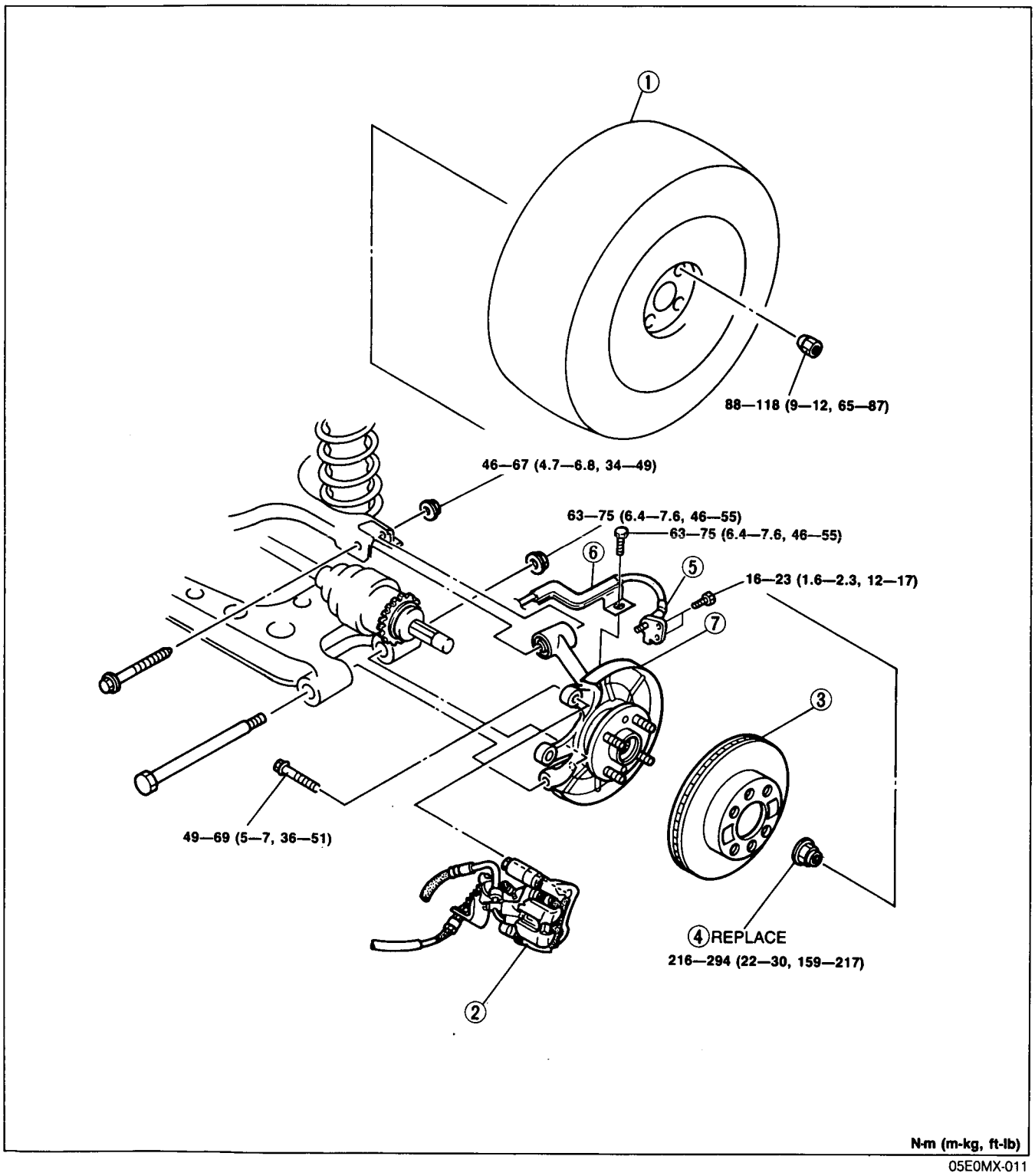
Assembly note
ABS sensor rotor
Install a new sensor rotor with the **SST** and a press.

REAR AXLE

DISC BRAKE TYPE

Removal / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.
3. After installation, adjust the rear wheel alignment.



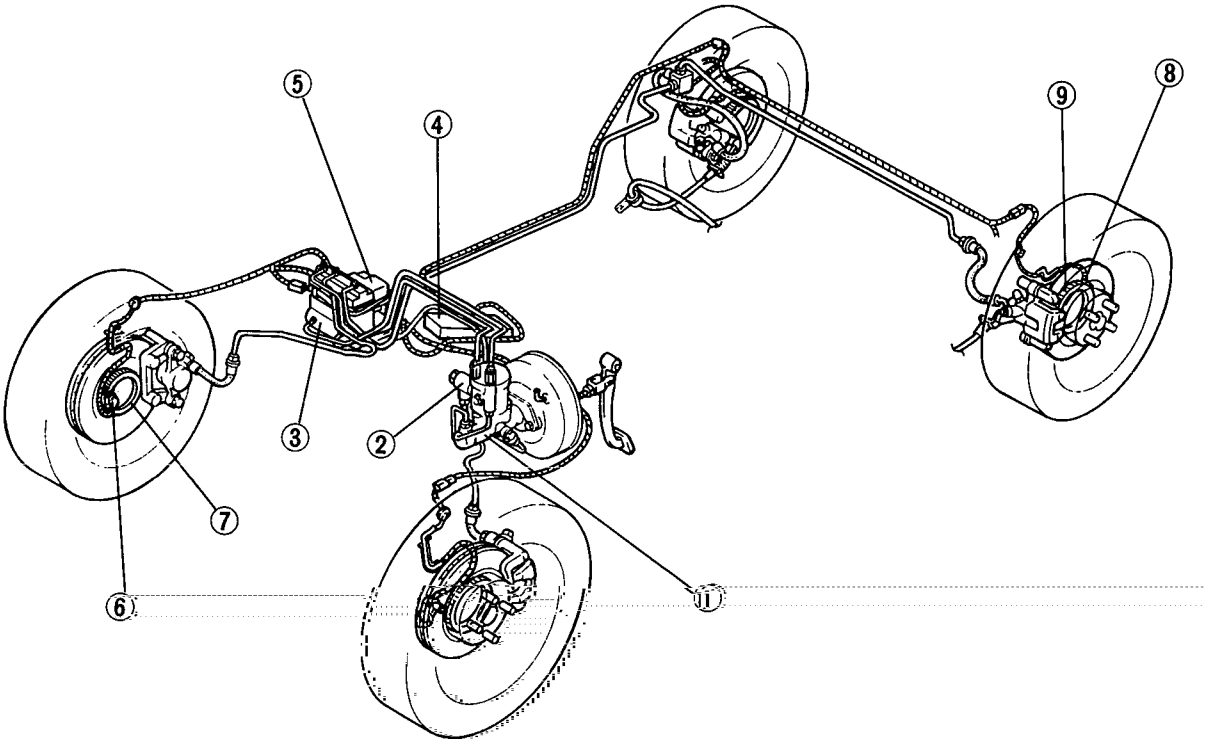
1. Rear wheel
2. Brake caliper assembly
3. Disc plate
4. Locknut
5. ABS wheel speed sensor
   Removal / Inspection / Installation.. Section P
6. Sensor bracket
7. Knuckle, wheel hub, and dust cover

BRAKING SYSTEM

05E0PX-001

INDEX

ANTI-LOCK BRAKE SYSTEM (ABS)



05E0PX-002

OUTLINE

OUTLINE OF CONSTRUCTION

1. The anti-lock brake system (ABS) is installed as an optional safety feature for the brake system.
2. Some parts of the conventional brake system are modified for the use with the ABS.

05E0PX-003

SPECIFICATIONS

Item		Specifications
Brake pedal	Type	Suspended
	Pedal lever	4.1
	Max stroke mm (in)	133 (5.24)
Master cylinder	Type	Tandem (with level sensor)
	Bore mm (in)	22.22 (0.875)
Front disc brake	Type	Disc (ventilated)
	Cylinder bore mm (in)	51.1 (2.01)
	Pad dimensions (area x thickness) mm^2 x mm (in^2 x in)	3,700 x 9.5 (5.73 x 0.37)
	Disc plate dimension (effective diameter x thickness) mm (in)	235 x 18 (9.25 x 0.71)
Rear disc brake	Type	Disc (solid)
	Cylinder bore mm (in)	31.75 (1.25)
	Pad dimensions (area x thickness) mm^2 x mm (in^2 x in)	2,600 x 8.0 (4.03 x 0.31)
	Disc plate dimensions (effective diameter x thickness) mm (in)	231 x 9 (9.09 x 0.35)
Power brake unit	Type	Vacuum multiplier
	Size mm (in)	214 (8)
Braking force control device	Type	Proportioning bypass valve (PBV)
Brake fluid		SAE J1703 or FMVSS 116, DOT-3
Parking brake	Type	Mechanical, two rear brakes
	Operation system	Hand lever

05U0PX-504

ANTI-LOCK BRAKE SYSTEM (ABS)

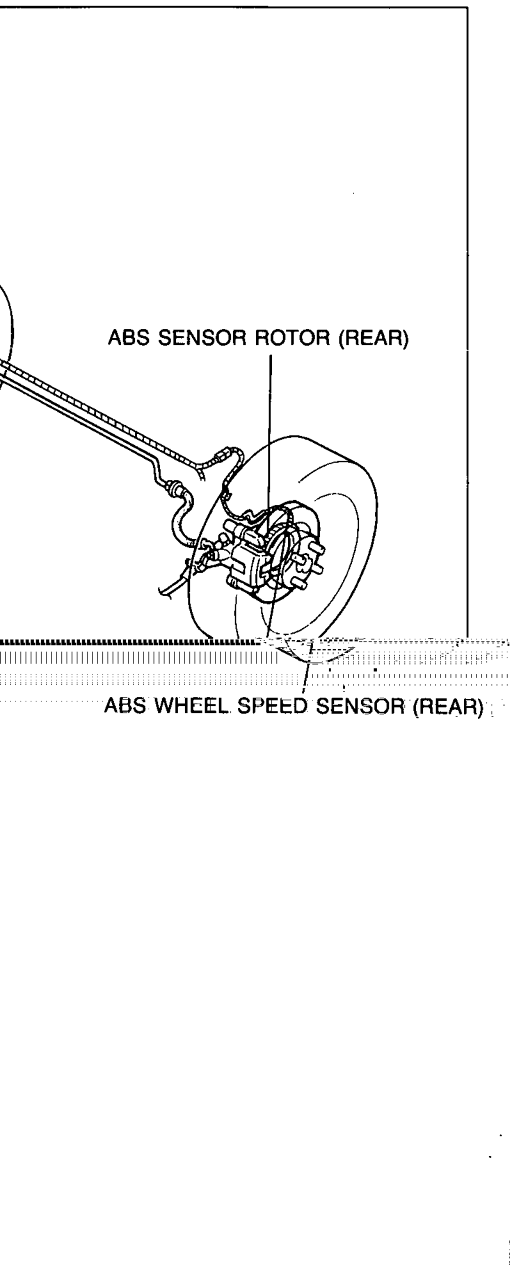
OUTLINE

The ABS is an electronically controlled brake system which controls brake application to maintain directional stability and steerability of the vehicle during braking.
The ABS does this by determining the amount of wheel slippage during sudden braking or during braking

el control, rear axle control (select low
e hydraulic unit, the control unit, and

dralic pressure of both the right
controlling the hydraulic pressure
rake locking.

05E0PX-004



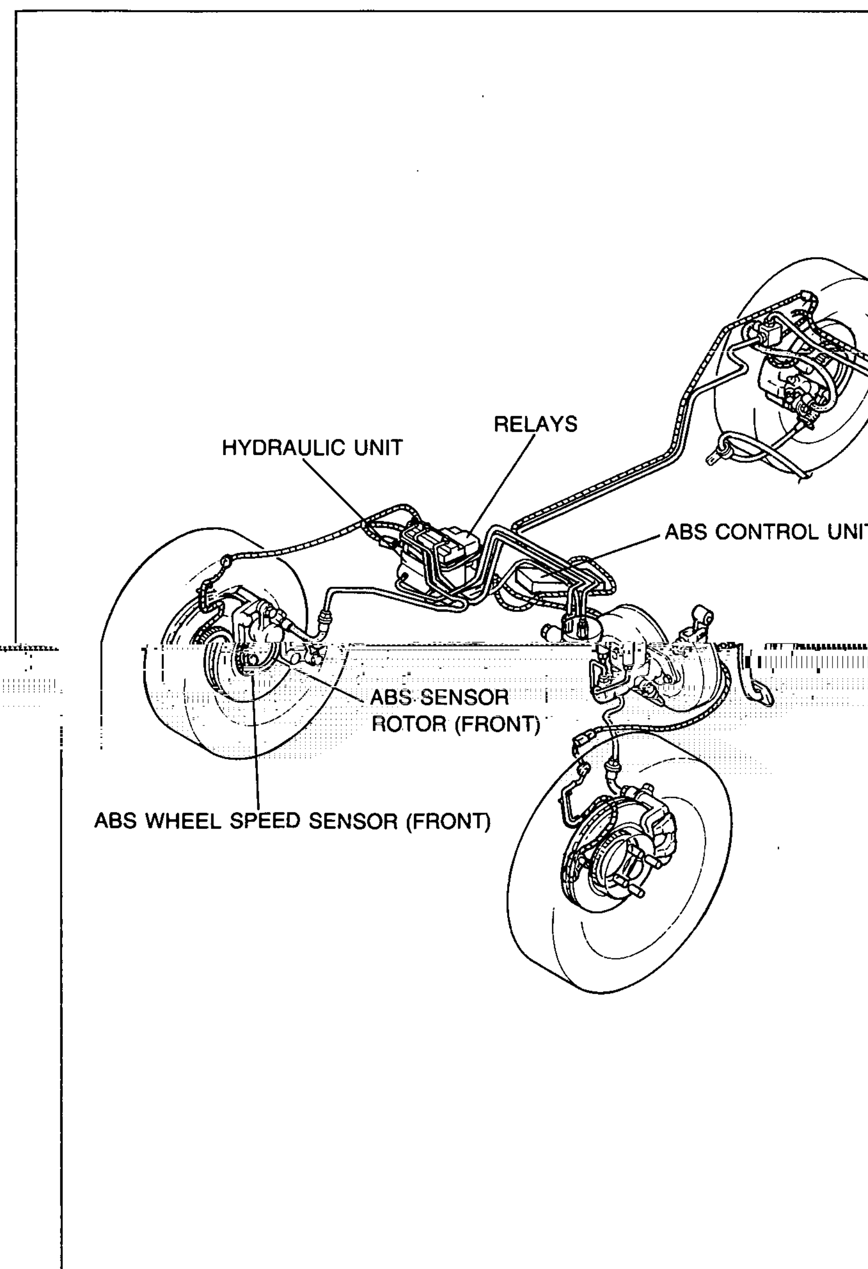
05E0PX-005

computerized ABS control unit. The ABS is an independent front whe
control), four-sensor, 3-channel system. Its basic components are th
the four wheel speed sensors.

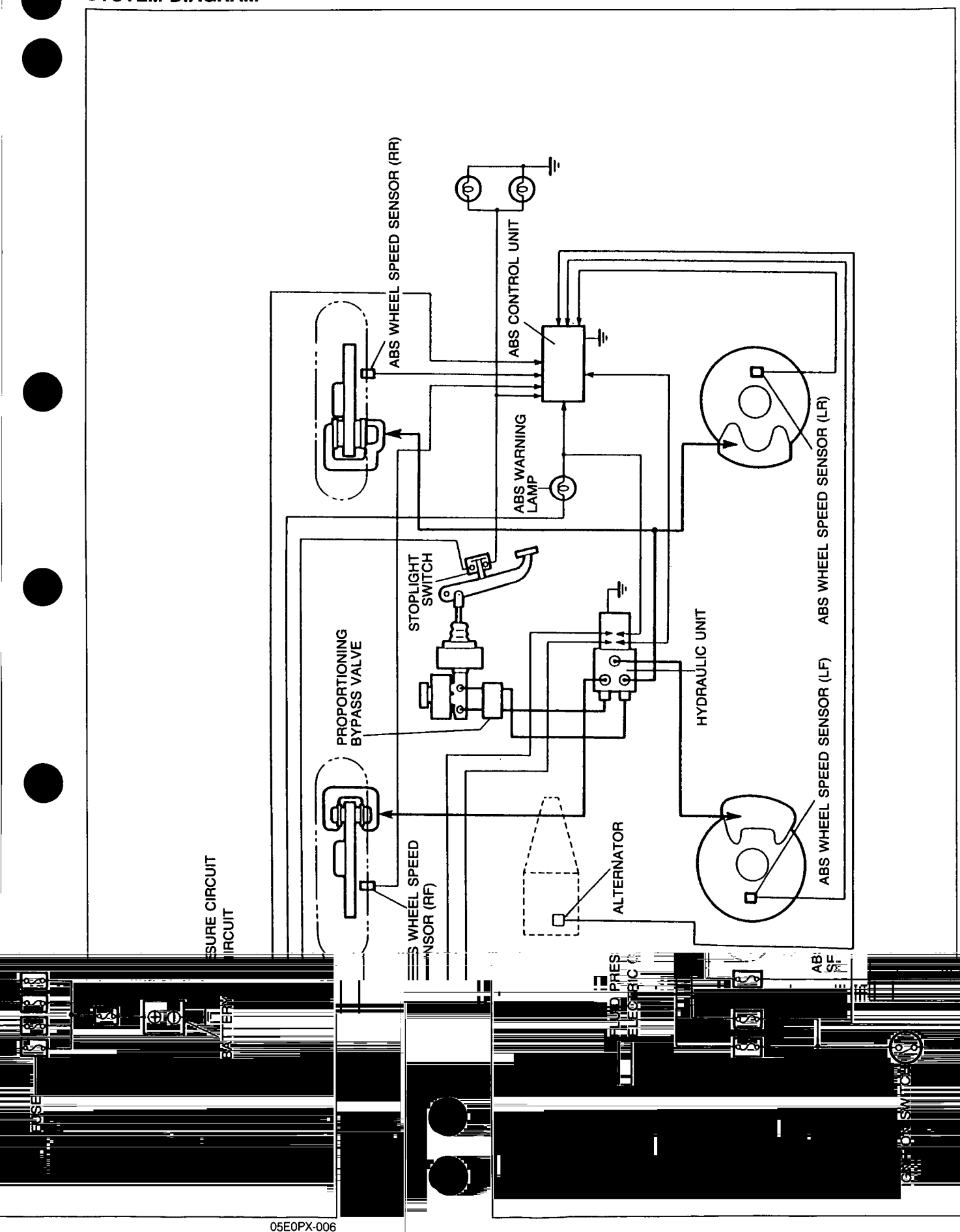
Note

- **Select low control is a method that controls the brake hy and left rear wheels by comparing wheel speeds and then in relation to the side which is in greater danger of the b**

STRUCTURAL VIEW



SYSTEM DIAGRAM

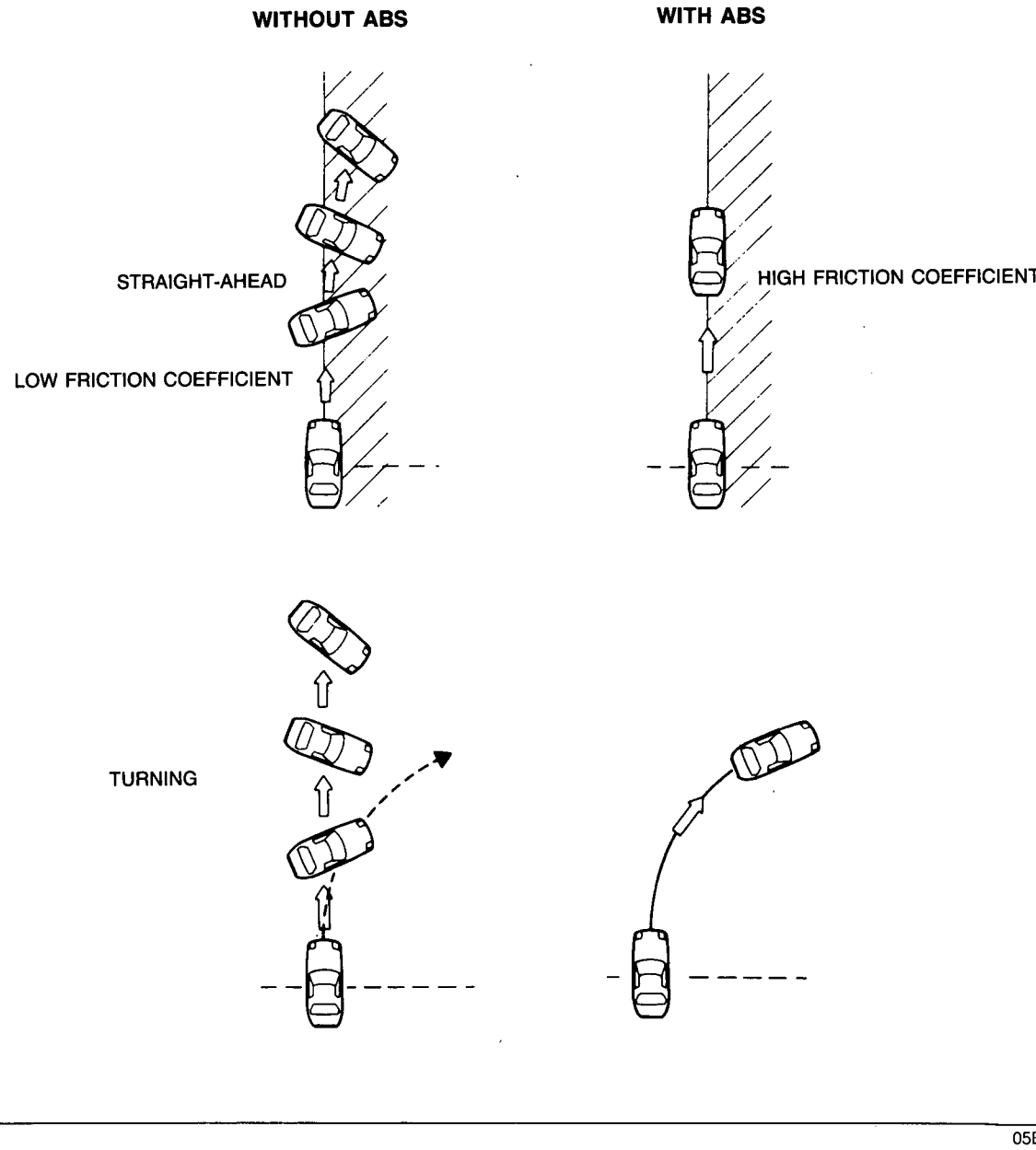


MAJOR COMPONENTS AND FUNCTIONS

Part	Function
Wheel speed sensors	• The speed sensors detect the rotational speed of the wheels and relay this data as electrical signals to the ABS control unit.
ABS control unit	• The ABS control unit receives and computes the signals from the speed sensors, then judges the situation of the wheels and relays signals to the hydraulic unit for control of the hydraulic fluid pressure to prevent wheel lock up during braking. • The basic circuits of the control unit are: 1) Operation circuit 2) Control circuit 3) Fail-safe circuit • In the event of an electrical malfunction of the ABS, the fail-safe function allows the usual braking operations and causes the ABS warning lamp to illuminate.
Hydraulic unit	• The hydraulic unit controls the hydraulic pressure applied to each brake caliper in accordance with signals from the control unit. There are four pressure control operations: 1) Normal 2) Pressure increase 3) Pressure retention 4) Pressure reduction

05E0PX-007

ADVANTAGES OF ANTI-LOCK BRAKE SYSTEM



05E0PX-008

During straight-ahead travel with slippery road surface (low friction coefficient) on one side
Without ABS
When the brakes are applied during straight-ahead travel, the wheels on the slippery surface lock, and the front of the vehicle veers toward the side of the road with the highest friction coefficient, thus causing a spin.
With ABS
Because the braking force is controlled in such a way that the wheels will not lock when the brakes are ap-

PRINCIPLES OF ANTI-LOCK BRAKE SYSTEM

The ABS controls braking force by controlling the brake system hydraulic pressure so that the wheels do not lock during braking. The braking force is controlled based on the slippage ratio determined from the friction coefficient (road surface condition), the wheel speed, and the vehicle speed so that the most effective braking is provided at all times.

Friction coefficient (road surface condition)

When driving on an asphalt road or a snow-covered road surface, the frictional force between the tires and the road is much lower for a snow-covered road than for an asphalt road. The tires, therefore, slip much easier on the snow-covered road surface.
This frictional force condition is expressed as the friction coefficient.

Wheel speed

When the brakes are applied, the wheel rotational speed is reduced as a result of the friction between the tires and the road surface. This actual rotation speed of the wheel is expressed as the wheel speed.

Vehicle speed

When the brakes are applied, the speed of the vehicle is reduced as the wheel speed is reduced. Despite this reduction of wheel speed, however, the vehicle tries to continue moving in the same direction due to its inertial force. This actual vehicle movement is expressed as the vehicle speed.
The control unit therefore uses the wheel speed, not the vehicle speed, as the basis of calculations to control braking.

Slippage ratio

When the brakes are applied, the difference that occurs between the wheel speed and the vehicle speed is called slippage.
This is expressed as the slippage ratio, and is defined by the following formula:

$$\text{Slippage ratio} = \frac{\text{vehicle speed} - \text{wheel speed}}{\text{vehicle speed}} \times 100\ (\%)$$

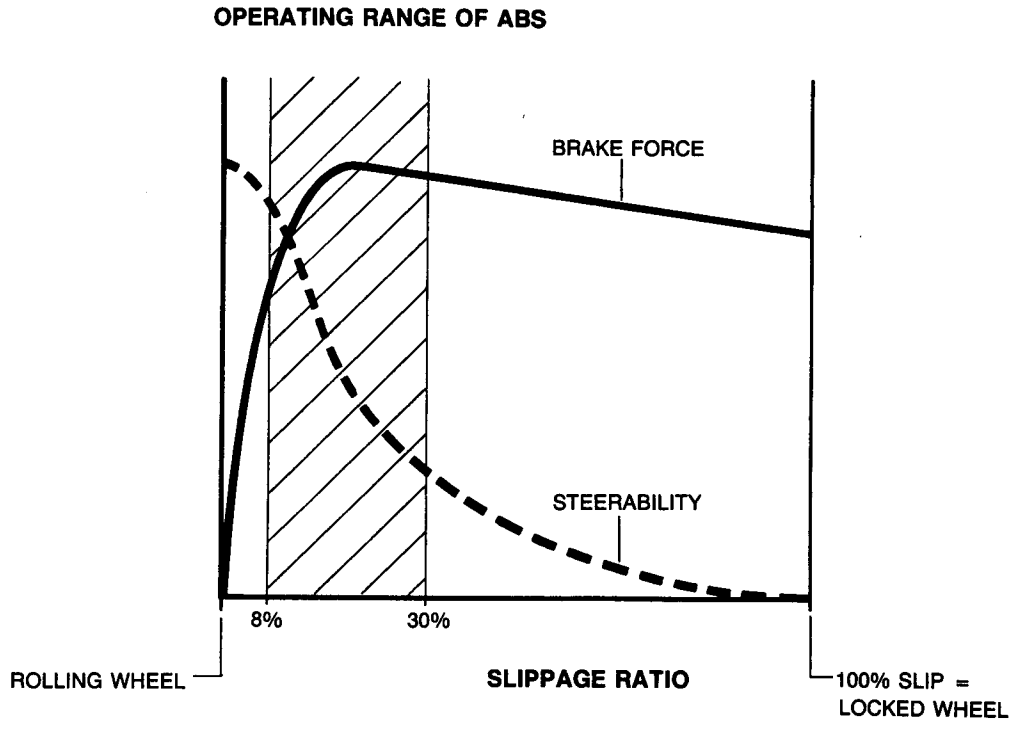
Example:
A vehicle is running on ice at a speed of 10 km/h (6 mph), the brakes are fully applied, and the wheels lock;
The wheels' speed = 0 km/h (0 mph)

$$\text{Slippage ratio} = \frac{10\ (6) - 0}{10\ (6)} \times 100 = 100\%$$

Slippage between tires and road surface is 100%.

05E0PX-009

Braking Characteristics



05E0PX-010

When the brakes are applied, the braking force applied to the road surface increases sharply, reaching a maximum point, after which it decreases.
When the brakes are applied, the wheel speed also decreases.
The wheel speed is less than the vehicle speed, and this causes slippage between the road surface and the tire.
Braking force depends upon the coefficient of slippage between a tire and the road surface.
Braking forces can effectively slow a vehicle when the slippage ratio is in the range of 8%—30%.
Within this range steerability is sufficient to steer the vehicle during full braking application because the tires are still gripping the road surface.

PORT-LESS MASTER CYLINDER

NOT OPERATING

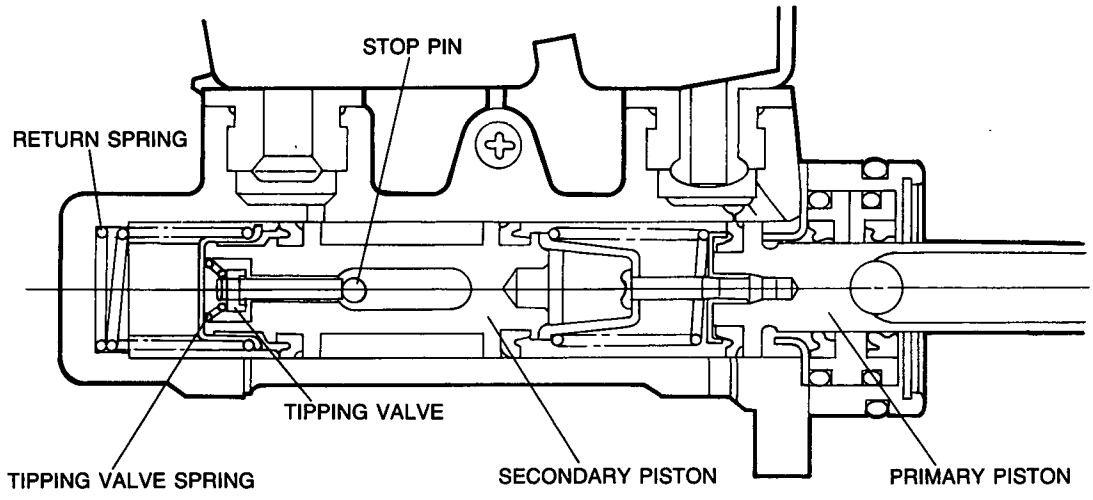


FIGURE ①

OPERATING

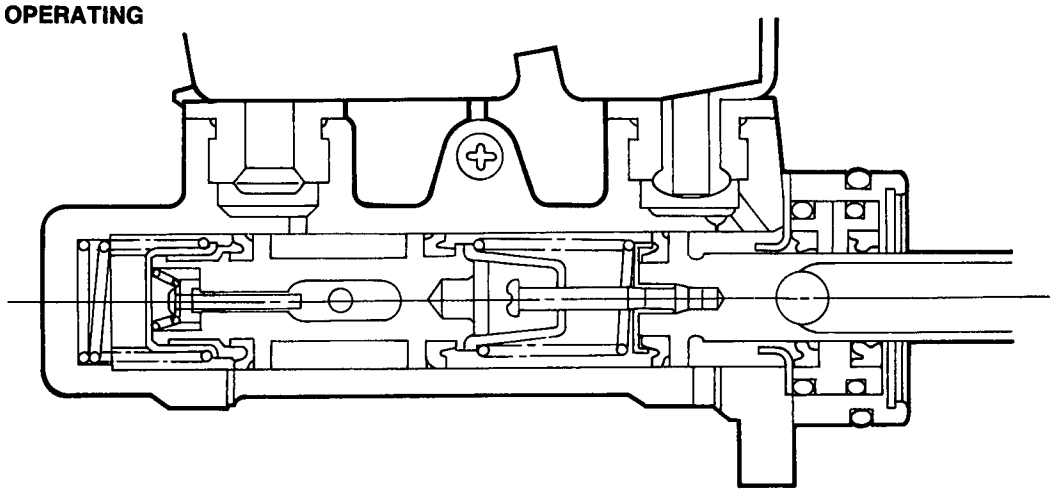


FIGURE ②

05E0PX-012

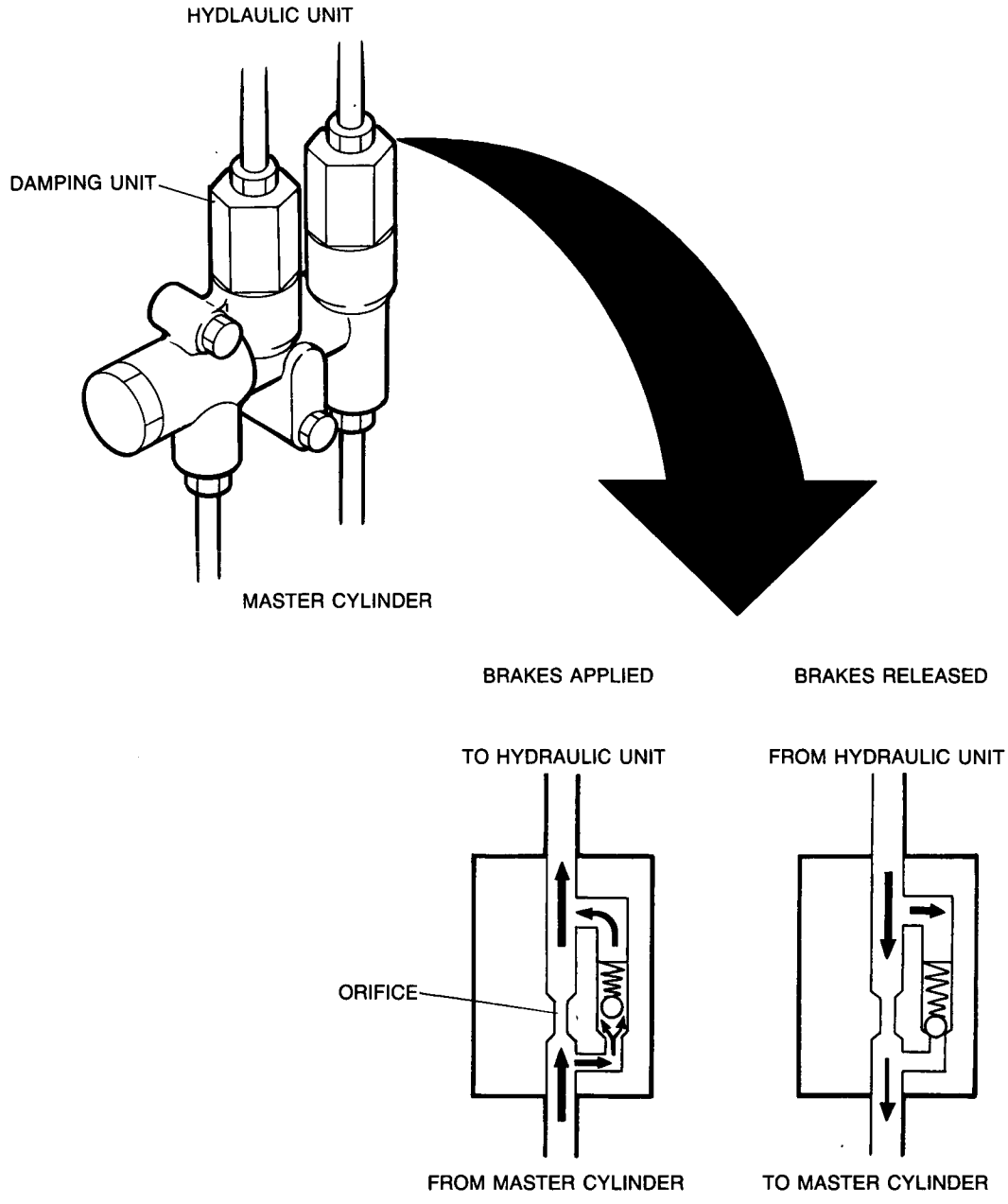
It has been found that when the ABS is operated, the brake fluid pressure causes undue wear to the primary cup of the secondary piston. To avoid this problem, the relief port is abolished, and a tipping valve with a center port is provided in the secondary piston.

When the brake pedal is not pressed, the secondary piston is pressed toward the stop pin by the return spring as shown in Figure ①. At the same time, the tipping valve within the secondary piston is pressed open by the stop pin, providing a return path to the brake fluid reservoir.

When the brake pedal is pressed, the secondary piston is moved away from the stop pin as shown in Figure ②. The tipping valve spring presses the tipping valve against the secondary piston, closing the return path and allowing brake fluid pressure to be generated.

Operation of the primary piston is unchanged.

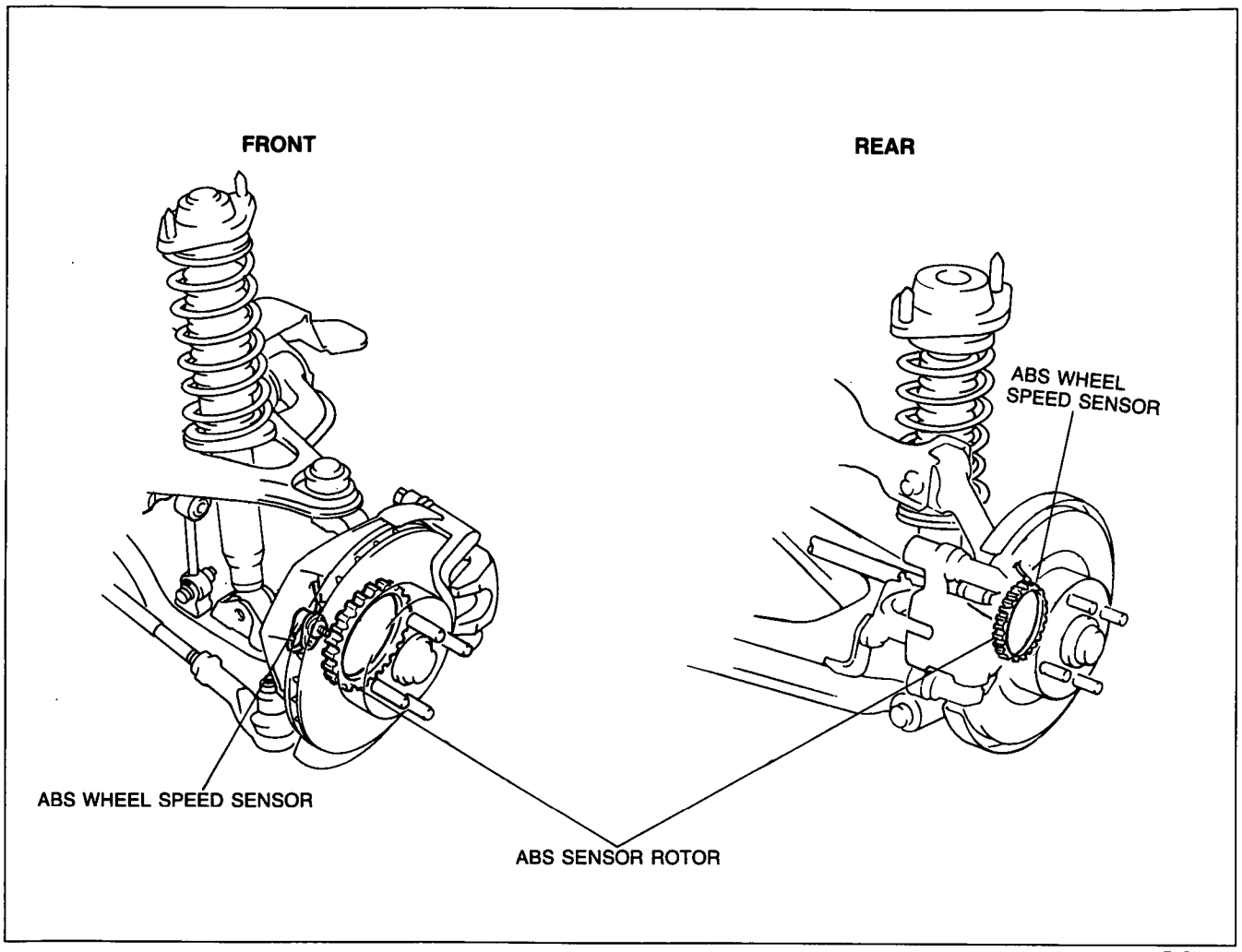
DAMPING UNIT



05E0PX-013

The damping units are installed on the proportioning bypass valve.
When the brakes are applied, the hydraulic pressure from the master cylinder passes through the orifice and check valve, allowing smooth build-up of brake fluid pressure.
When the brakes are released, the hydraulic fluid from the hydraulic unit acts upon the orifice and the check valve, but because the passage of the check valve is closed by the ball, the fluid returns through the orifice only to the master cylinder. Thus, kick back (pulsation) of the brake pedal is limited.

ABS WHEEL SPEED SENSOR

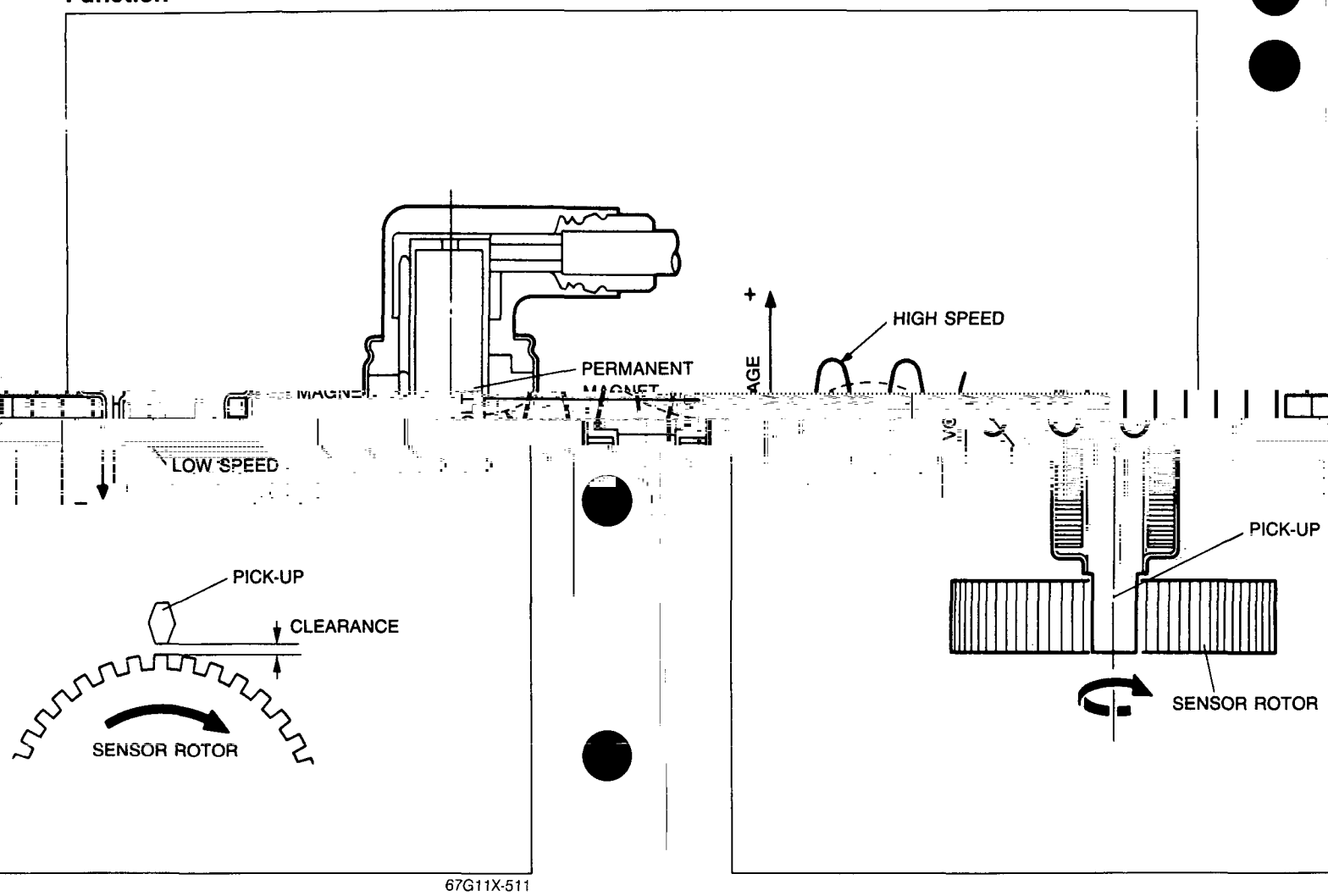


05E0PX-014

Structure

The wheel speed sensors are installed on the knuckles. These produce electrical pulses via rotation of the sensor rotor installed on the wheel hub or the driveshafts.

Function



67G11X-511

ic fields of the wheel speed sensor. This produces
ges. Voltage waves are sent to the control unit as

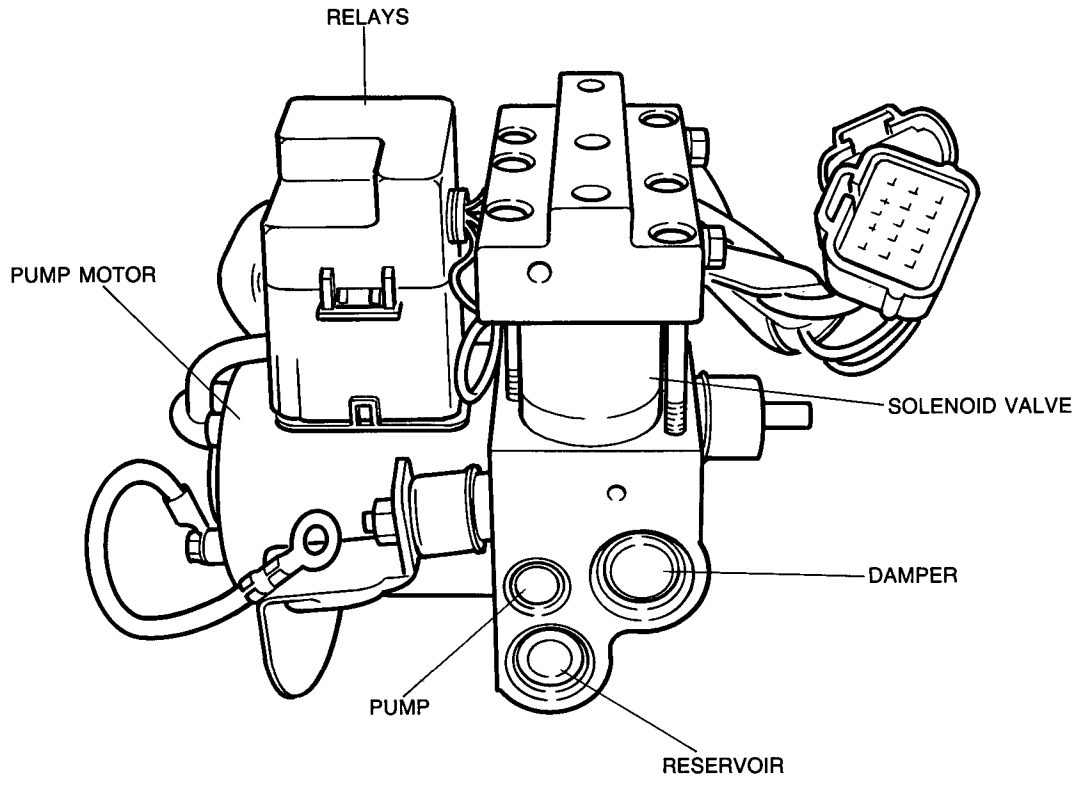
tween the speed sensor pick-up and the sensor rotor.

n.)

The sensor rotor on the wheel hub interrupts the magnet
an AC voltage which changes as the wheel speed char
wheel speed signals.
The sensor is mounted so that there is a small clearance be

Standard clearance: 0.4—1.0mm (0.016—0.039 i

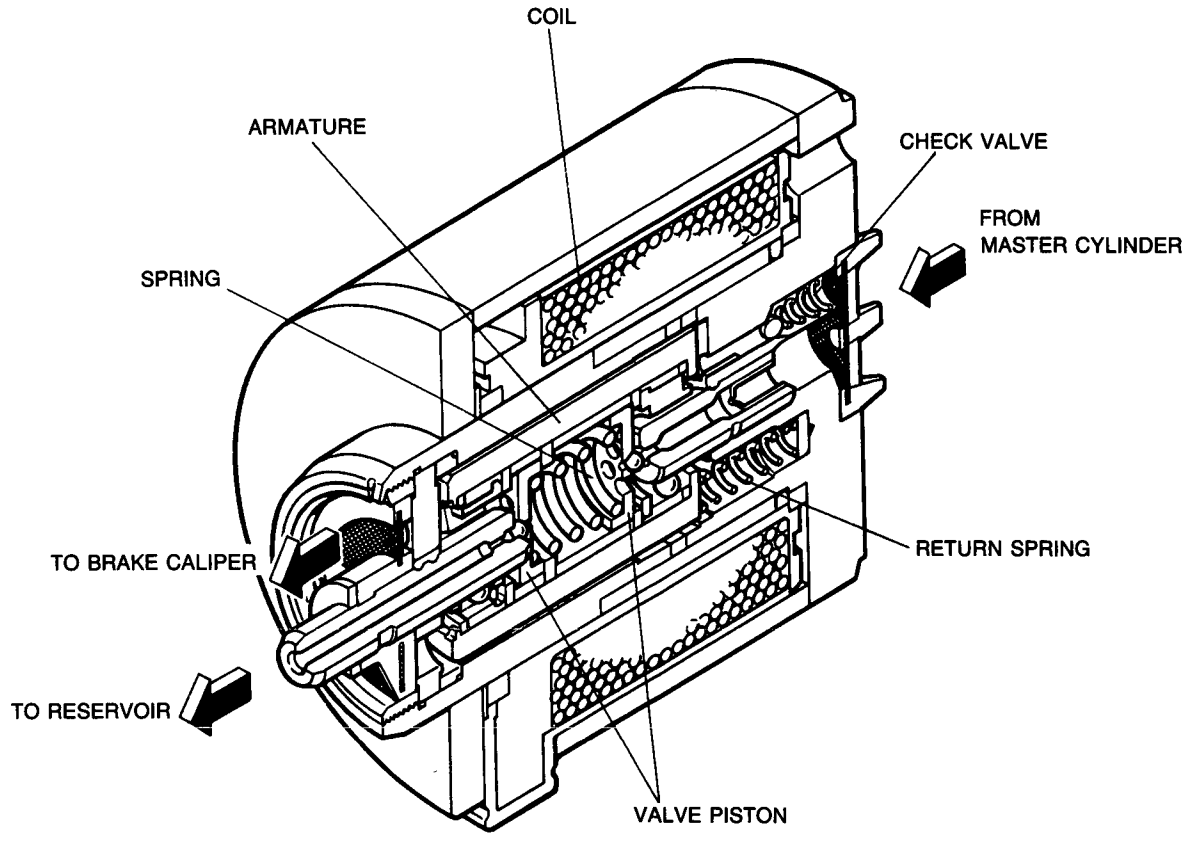
HYDRAULIC UNIT



05E0PX-015

Based on the commands from the ABS control unit, the hydraulic unit controls the hydraulic pressure to the wheels by activating the solenoid valves.
The hydraulic unit has three solenoid valves which operate the 3-channel system.
Two of these valves are for individual front wheel control and the other valve is for pressure regulation of the rear brake circuit.
The hydraulic unit is installed within the engine compartment.

Solenoid Valve



05E0PX-016

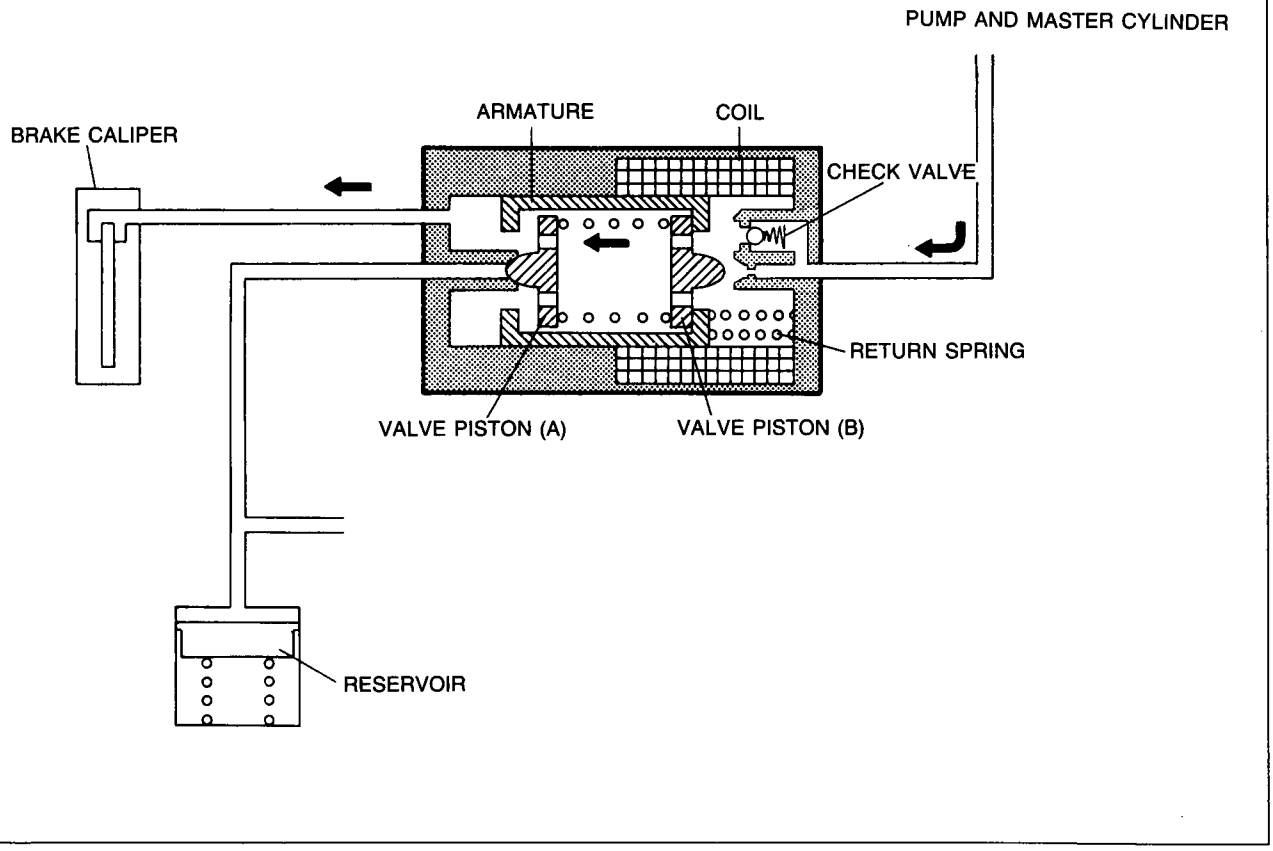
Structure

The main parts of the solenoid valve are the armature, the coil, two valve pistons, the check valve, and the return spring.

The valve pistons within the armature are held outward by the spring.

During ABS operation the valve pistons open or close the fluid passages from the master cylinder or to the reservoir.

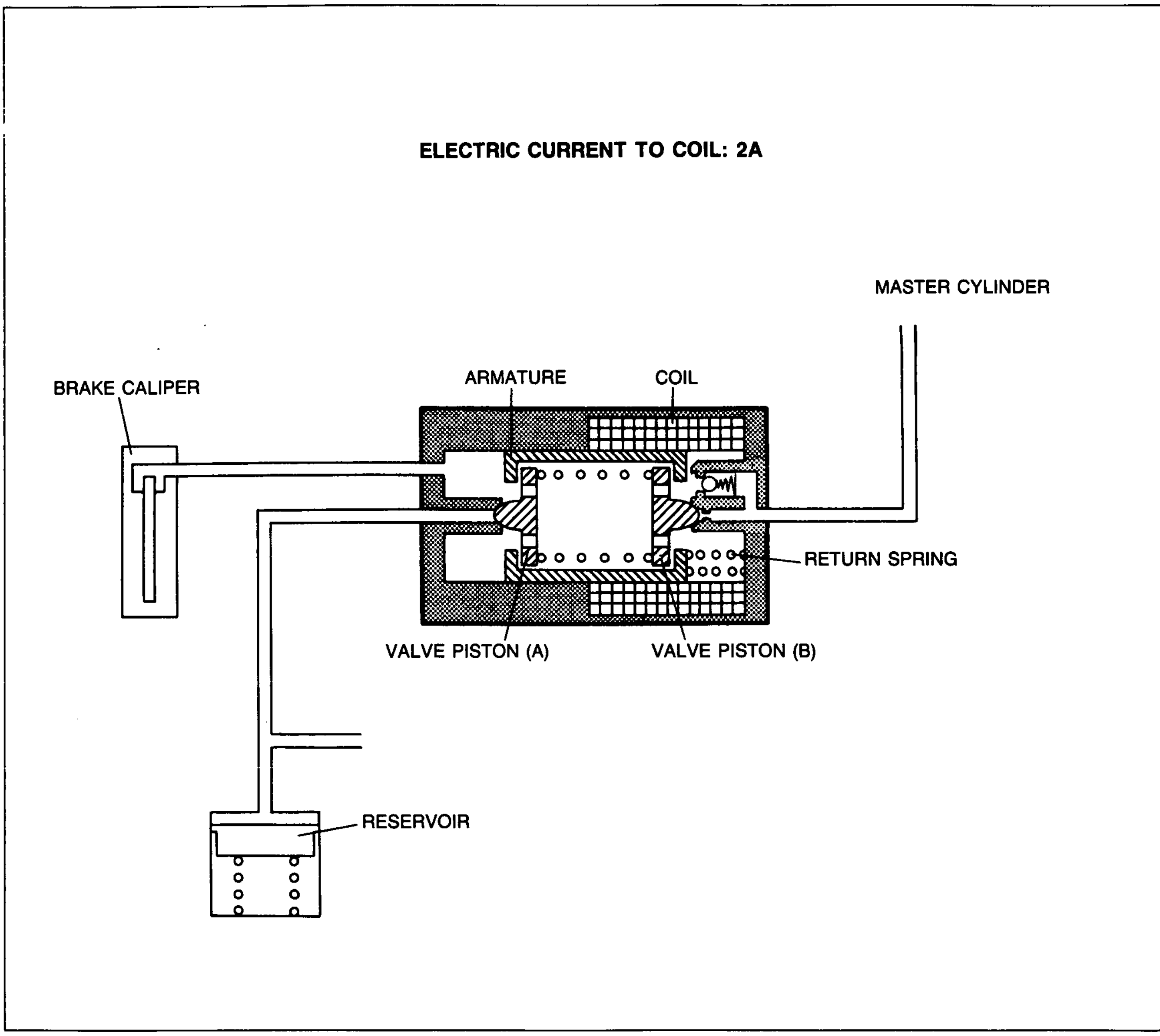
Function
Normal braking and pressure increase



05E0PX-017

During normal braking and pressure increase, there is no current flow in the coil and the armature is held to the left by the return spring.
Because the passage to the reservoir is closed by valve piston (A), the hydraulic pressure from the master cylinder acts upon the brake caliper only.

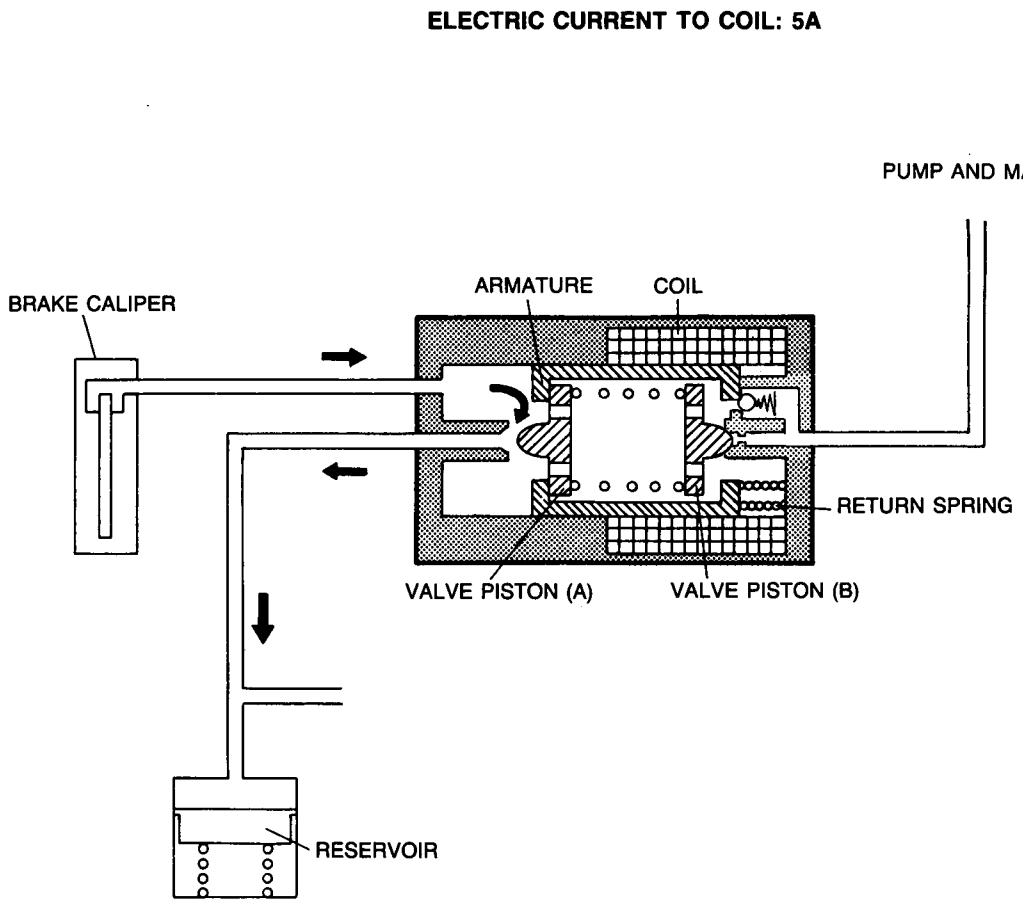
Pressure retention



05E0PX-018

[illegible] return spring, and the armature moves toward the right, stopping at the center of the solenoid valve. [...]assage to the reservoir remains closed by valve piston (A), and the passage from the master cylinder [...]sed by valve piston (B). At this time the hydraulic pressure within the brake caliper is retained.

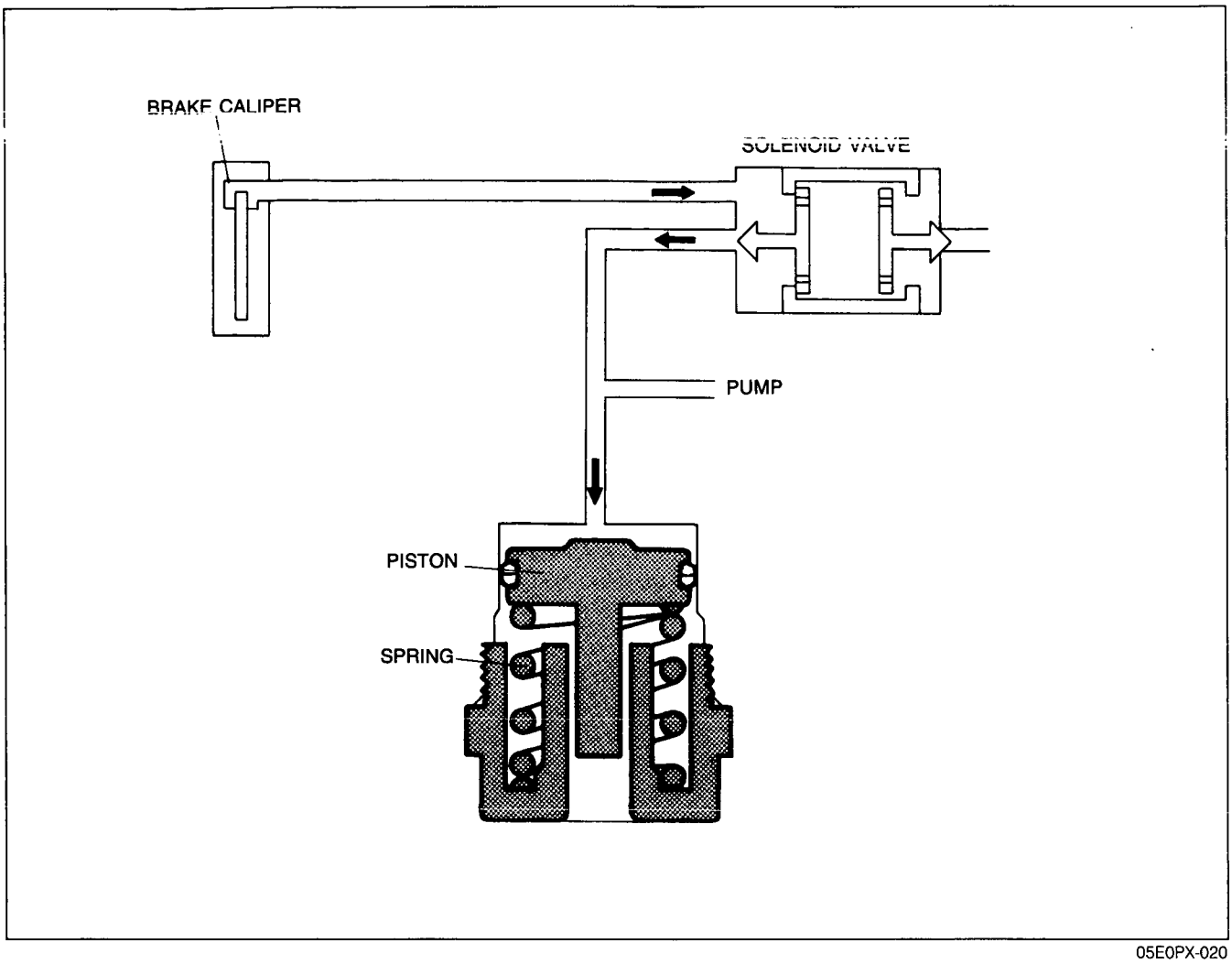
Pressure reduction



05E0PX-019

During pressure reduction, a current of 5A flows to the coil and further attracts the armature. This overcomes more of the force of the return spring, and the armature moves farther to the right than during pressure retention. Valve piston (B) closes and no hydraulic pressure flows from the master cylinder. Valve piston (A) opens, allowing the hydraulic pressure to escape from the brake caliper to the reservoir.

Reservoir

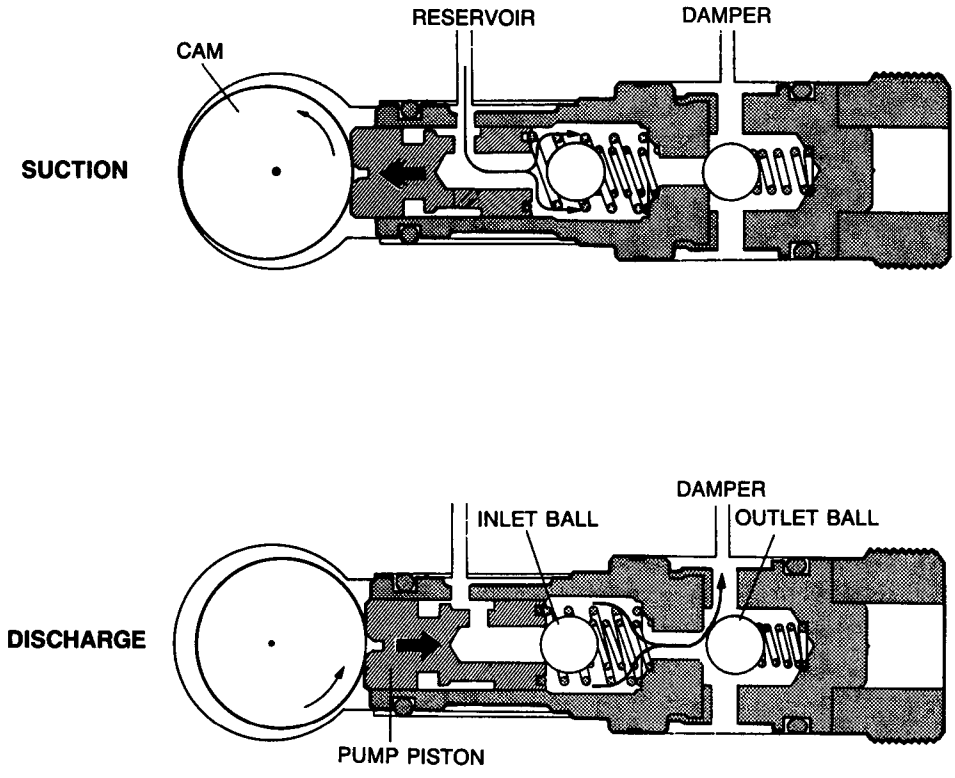


05E0PX-020

Structure
The two main components of the reservoir are the piston and the spring.
The hydraulic pressure within the reservoir when it is filled is approx. **294 kPa (3.0 kg/cm^2, 43 psi)**. There are two reservoirs within the hydraulic unit.

Function
The reservoir temporarily stores the hydraulic pressure which flows from the brake caliper through the solenoid valve during pressure reduction.

Pump



05E0PX-021

Structure

The main components of the pump are the cam, pump piston, inlet and outlet balls, and springs. The pump piston is driven by the pump motor cam.

Function

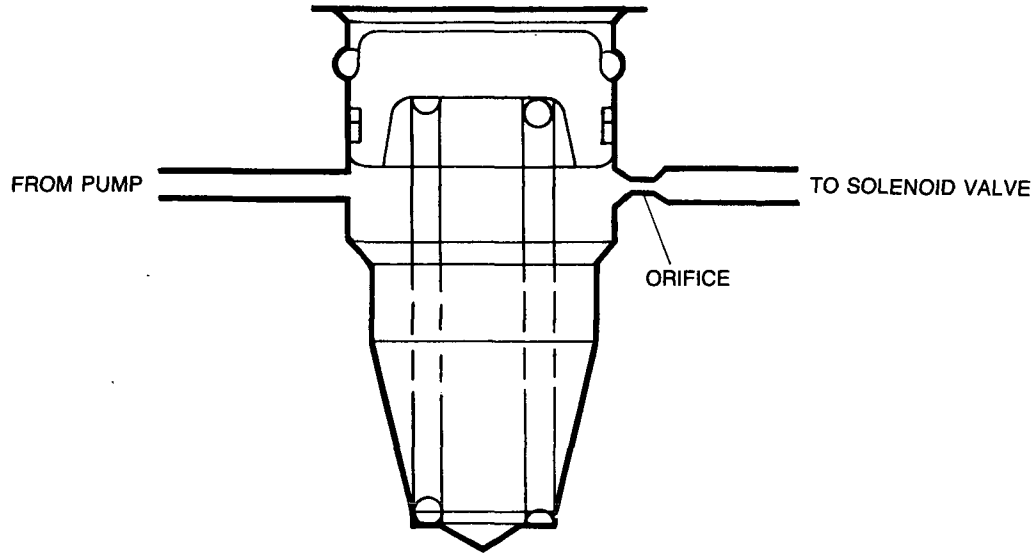
Suction

As the pump motor rotates the cam, it releases the pressure against the pump piston and the spring moves the piston toward the left.
As this happens, the volume of the inlet chamber increases and hydraulic pressure flows in from the reservoir, opening the inlet ball.

Discharge

As the cam presses the pump piston toward the right, the volume of the inlet chamber decreases and the hydraulic pressure in the inlet chamber pushes open the outlet ball and flows to the damper.

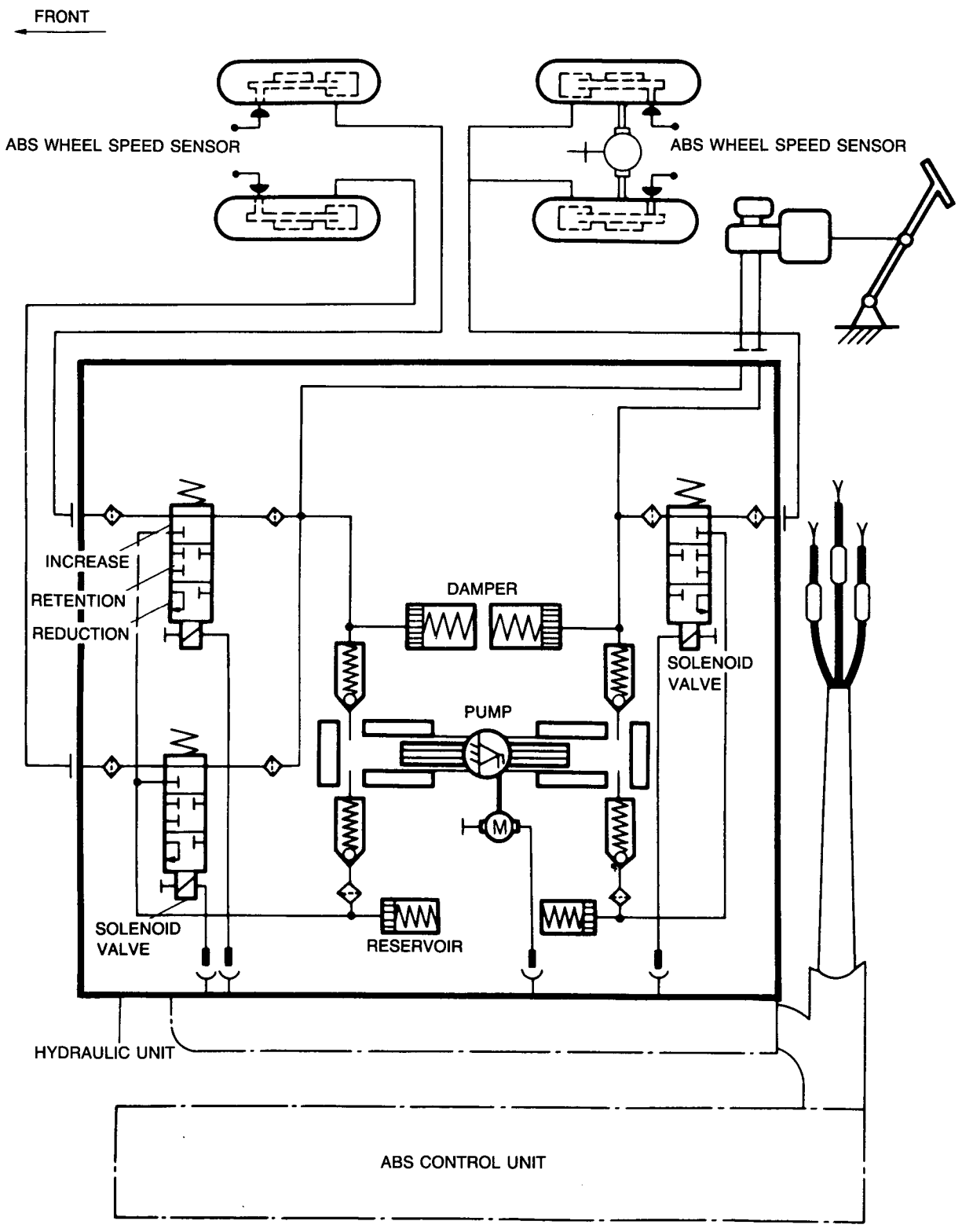
Damper



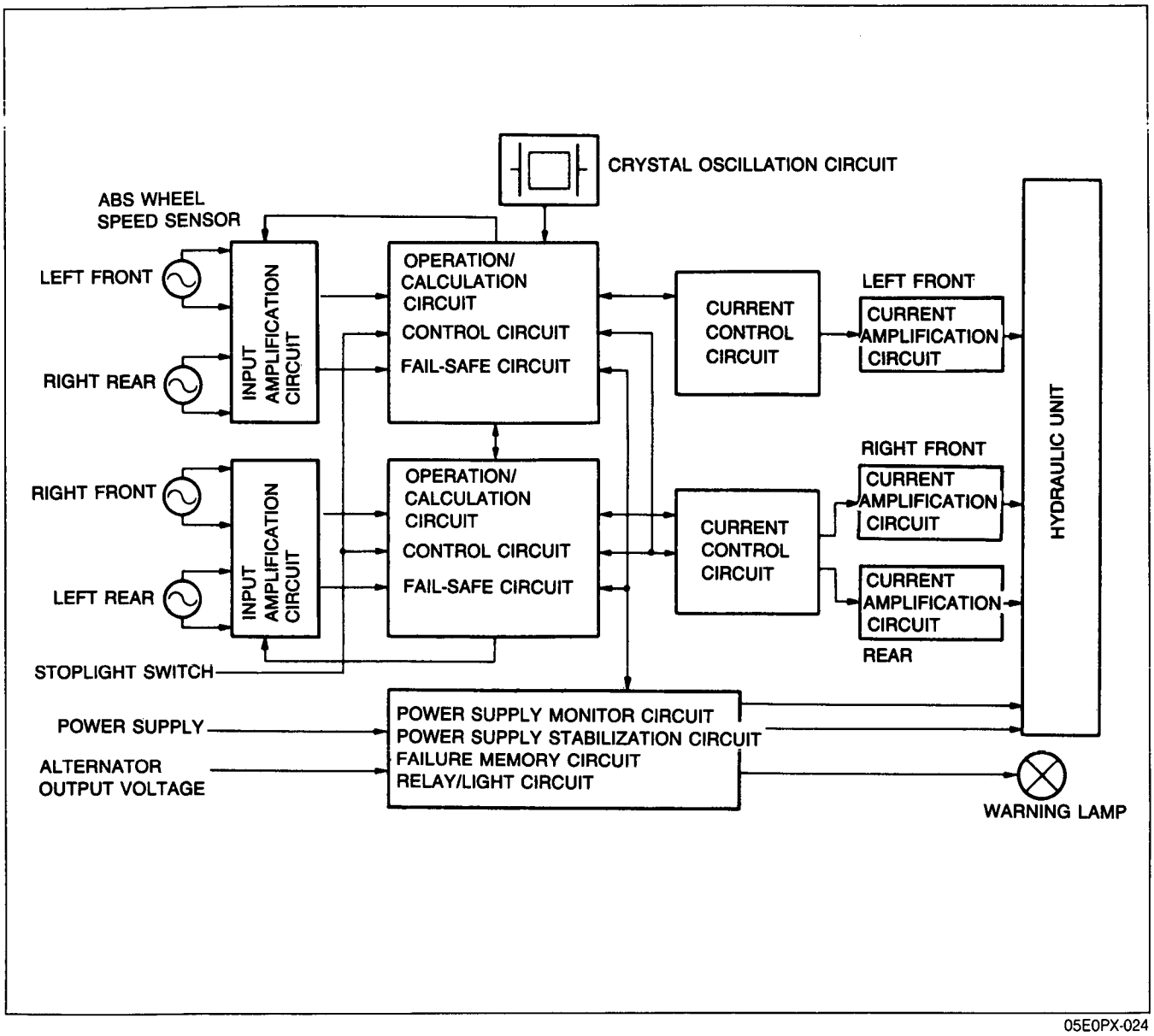
05E0PX-022

The damper prevents transfer of hydraulic pressure from the pump back to the master cylinder and limits pulsation of the brake pedal caused by pressure fluctuations.

Function Diagram



ABS CONTROL UNIT



05E0PX-024

The ABS control unit detects wheel speeds and evaluates the situation of the wheels based on the signals from the speed sensors.

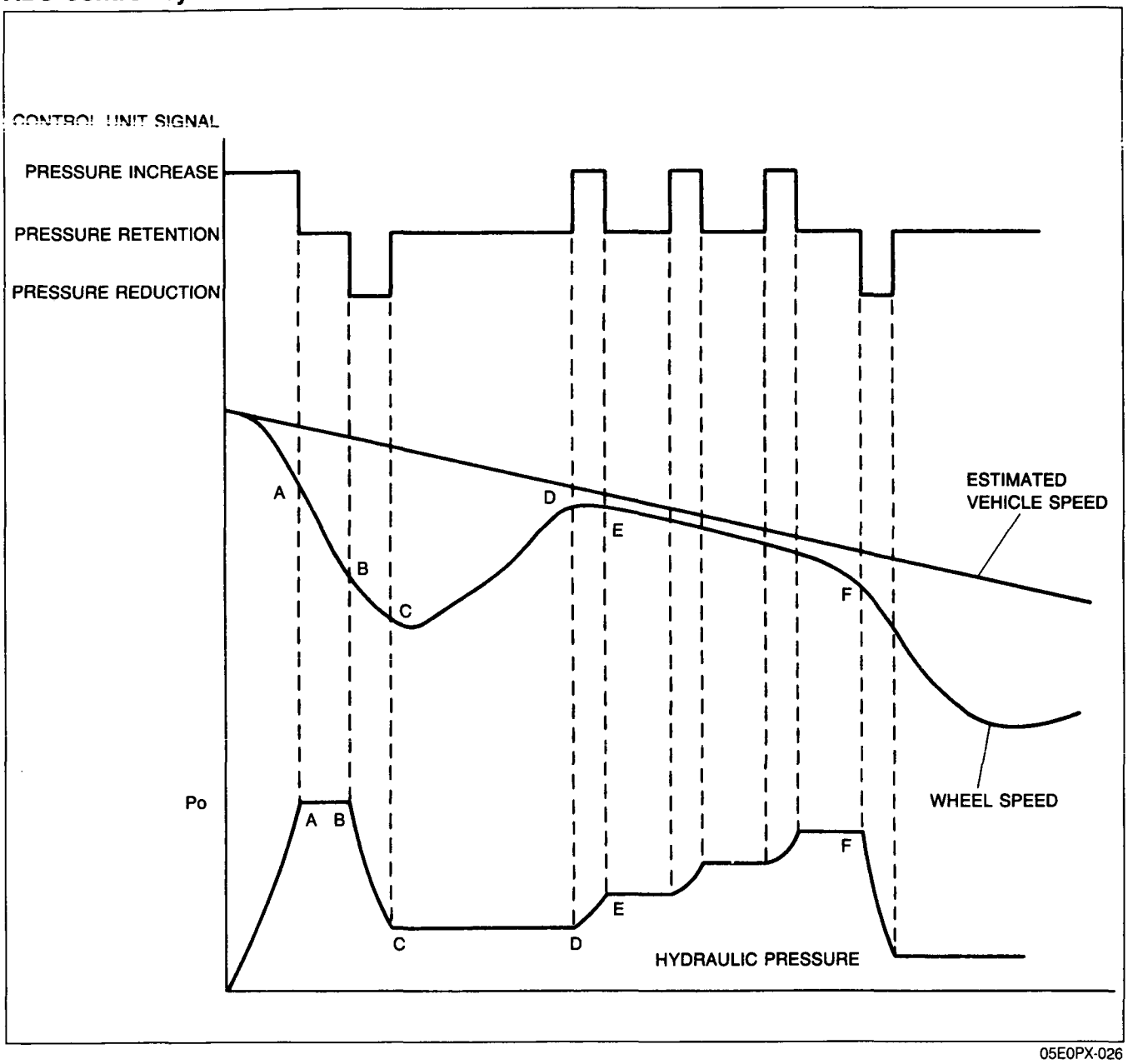
program within the control unit, the control unit then relays signals to the solenoid valves and based on the
otor within the hydraulic unit to control wheel lock-up. the pump m

Circuits and functions

Input amplification	Converts AC voltage from wheel speed sensors to square waves (sine waves) for ABS control unit.
Operation/calculation	Detects wheel speeds from input sine waves and generates wheel increase/decrease speed signals and slippage signals.
Control	Receives signals produced by operation/calculation circuit and generates signals to operate solenoid valves.
Fail-safe	Monitors operation of system. If failure is detected, circuit generates failure-memory, valve relay cut, and warning lamp illumination signals.
Power supply monitor	Monitors battery voltage and power supply stabilization circuit.
Power supply stabilization	Provides stable power supply for ABS control unit.
Failure memory	Memorizes failure conditions if failure is detected.
Relay/light	Acting on signals from fail-safe circuit, stops operation of valve relay, causes warning lamp to illuminate, and shuts off power supply stabilization circuit, thus shutting down entire system.
Current control	Acting on signals from ABS control circuit, selects current signals to be sent to solenoid valves.
Current amplification	Acting on signals from current control circuit, relays correct current to solenoid valves.

05E0PX-025

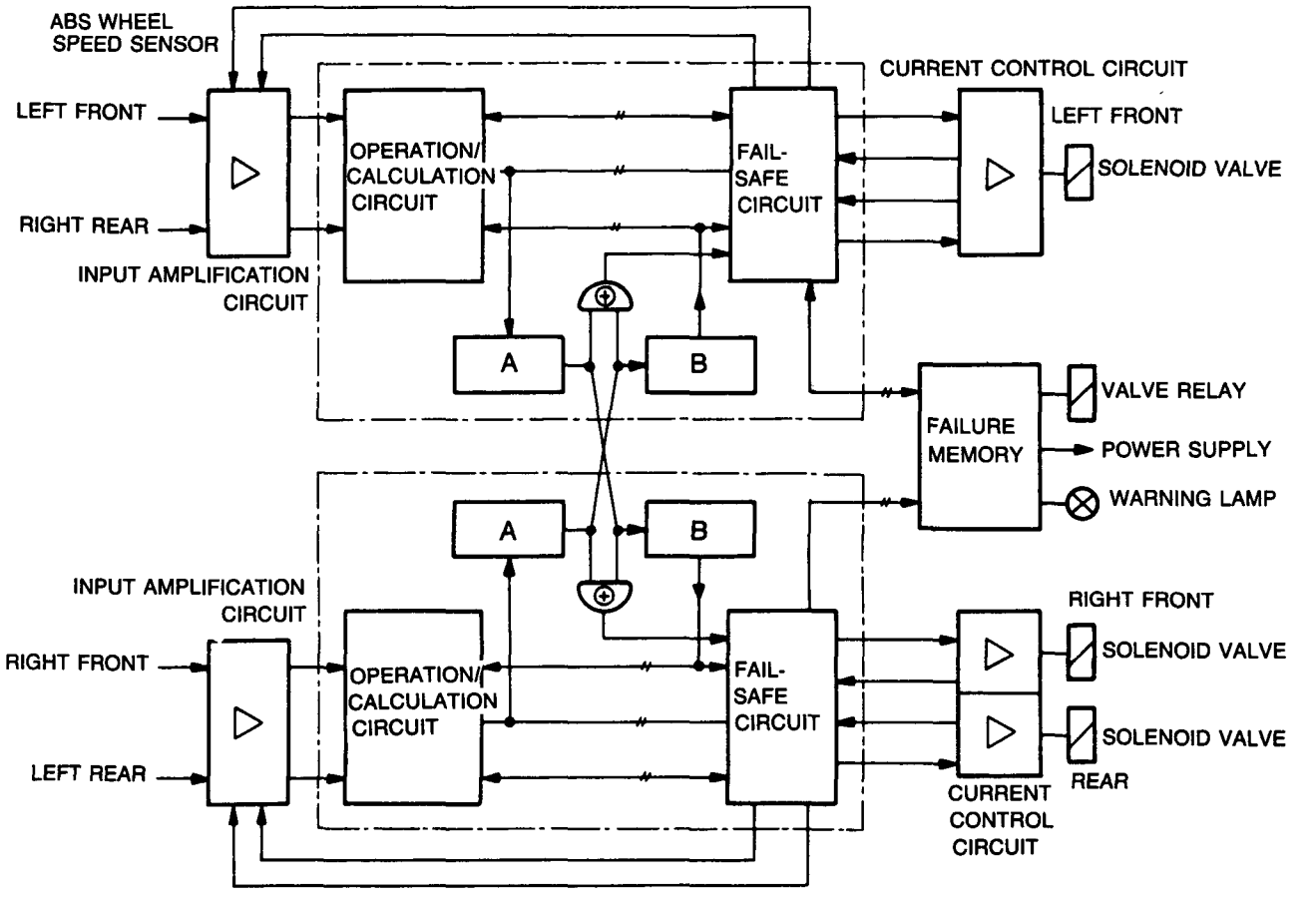
ABS Control Cycle



05E0PX-026

The control unit computes the rotational speed of each individual wheel, based upon signals received from the four wheel speed sensors, and also computes the wheels' deceleration and acceleration, and thereafter projects an estimate of the vehicle speed.
The control logic is explained in a simple manner based on the illustration above.
When the brake pedal is firmly depressed, the speed of the wheel begins to decrease, which is subsequently followed by a tendency toward locking up (point A).
At that point, the ABS control unit, in order to check for wheel lockup, computes the wheel slippage ratio,

Fail-safe System



A: DATA TRANSFER CIRCUIT
B: DATA RECEIVE CIRCUIT

05E0PX-027

The ABS control unit incorporates two circuits which perform the same function so that they can check each other and check for an abnormal conditions in the system.
After the voltage from the speed sensors is converted to sine waves and the wheel speeds are calculated, control signals are output.
These control signals are input to their respective fail-safe circuit, then pass through the data transfer and the data receive circuits, and are input to the other fail-safe circuit. The data from each are then compared. If this comparison indicates an abnormal condition, signals are input to the failure memory circuit from the fail-safe circuit, thus activating the fail-safe system.

Self-diagnosis

The ABS control unit includes a self-diagnostic function which checks for normal operation of the ABS.

Main self-diagnosis	Diagnosis period				Reaction to malfunction	Result
	A	B	C	D		
Fail-safe circuit	○				System shut-down Warning lamp illuminated	Normal braking
Power supply stabilization circuit				○	System shut-down Warning lamp illuminated	Normal braking
Input amplification circuit	○	○	○	○	System shut-down Warning lamp illuminated	Normal braking
Operation/calculation circuit		○	○		System shut-down Warning lamp illuminated	Normal braking
Control circuit		○	○		System shut-down Warning lamp illuminated	Normal braking
Solenoid valves		○		○	System shut-down Warning lamp illuminated	Normal braking
Pump motor		○		○	System shut-down Warning lamp illuminated	Normal braking
Valve relay		○	○		○	System shut-down Warning lamp illuminated	Normal braking
Wheel speed sensors			○	○	○	System shut-down if failure occurs during normal (no ABS operation) driving: Warning lamp illuminated	*Partial control
Battery					○	System shut-down Warning lamp illuminated	Normal braking
Alternator					○	Warning lamp illuminated	ABS available

05E0PX-028

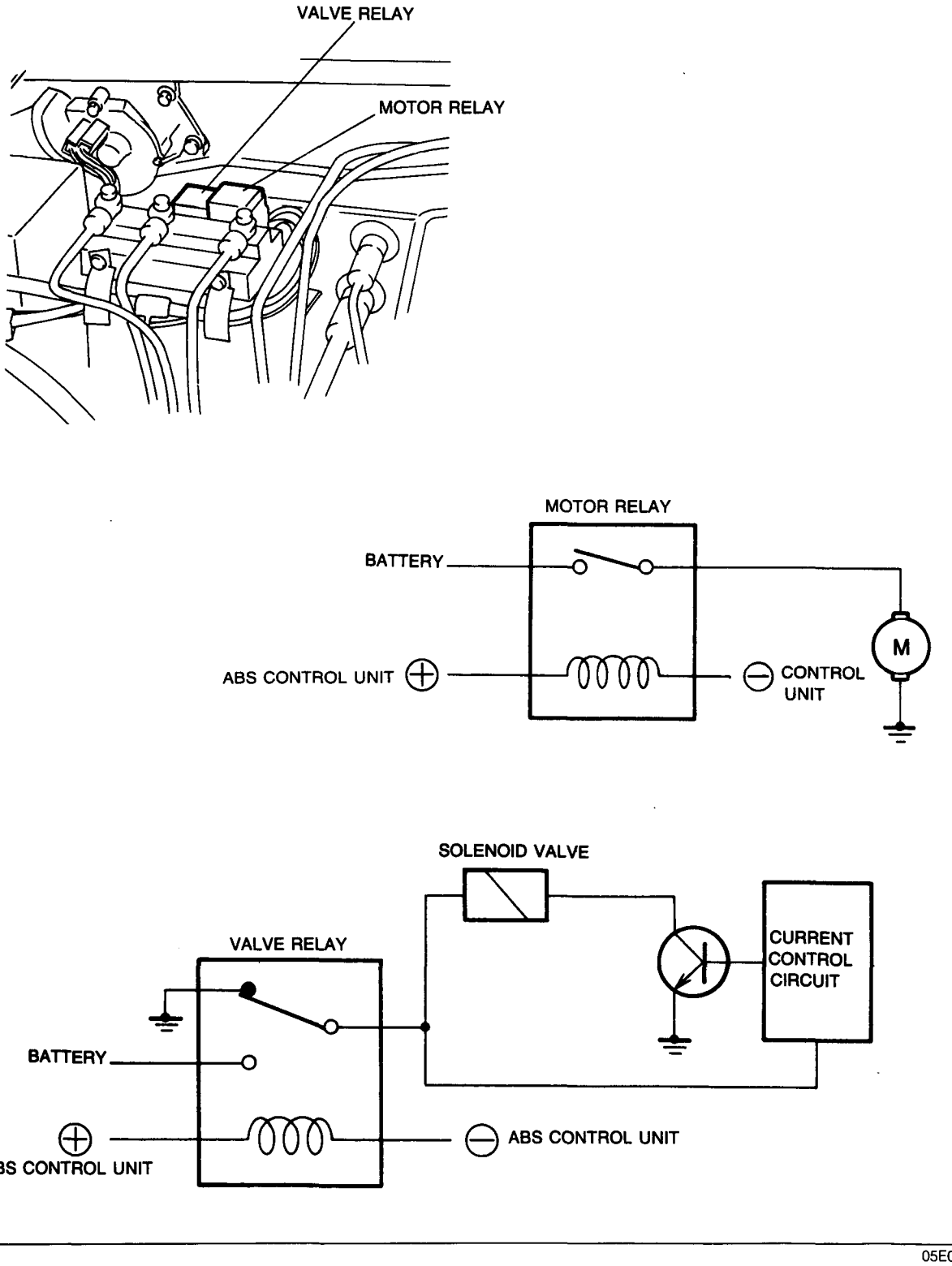
A....Just after starting engine
B....Ignition START position to vehicle speed of 6 km/h (4 mph)
C....Acceleration from idling to vehicle speed of 6 km/h (4 mph)
D....Driving

***Partial control:**
If failure of a sensor occurs during ABS operation, the system is controlled by the remaining sensors until the ABS cycle is completed, then the system is shut-down.

Note

- **The pump motor operates briefly after the vehicle speed reaches approx. 6 km/h (4 mph) for self-diagnosis of the pump motor. The operating sound is heard only momentarily.**

VALVE RELAY AND MOTOR RELAY

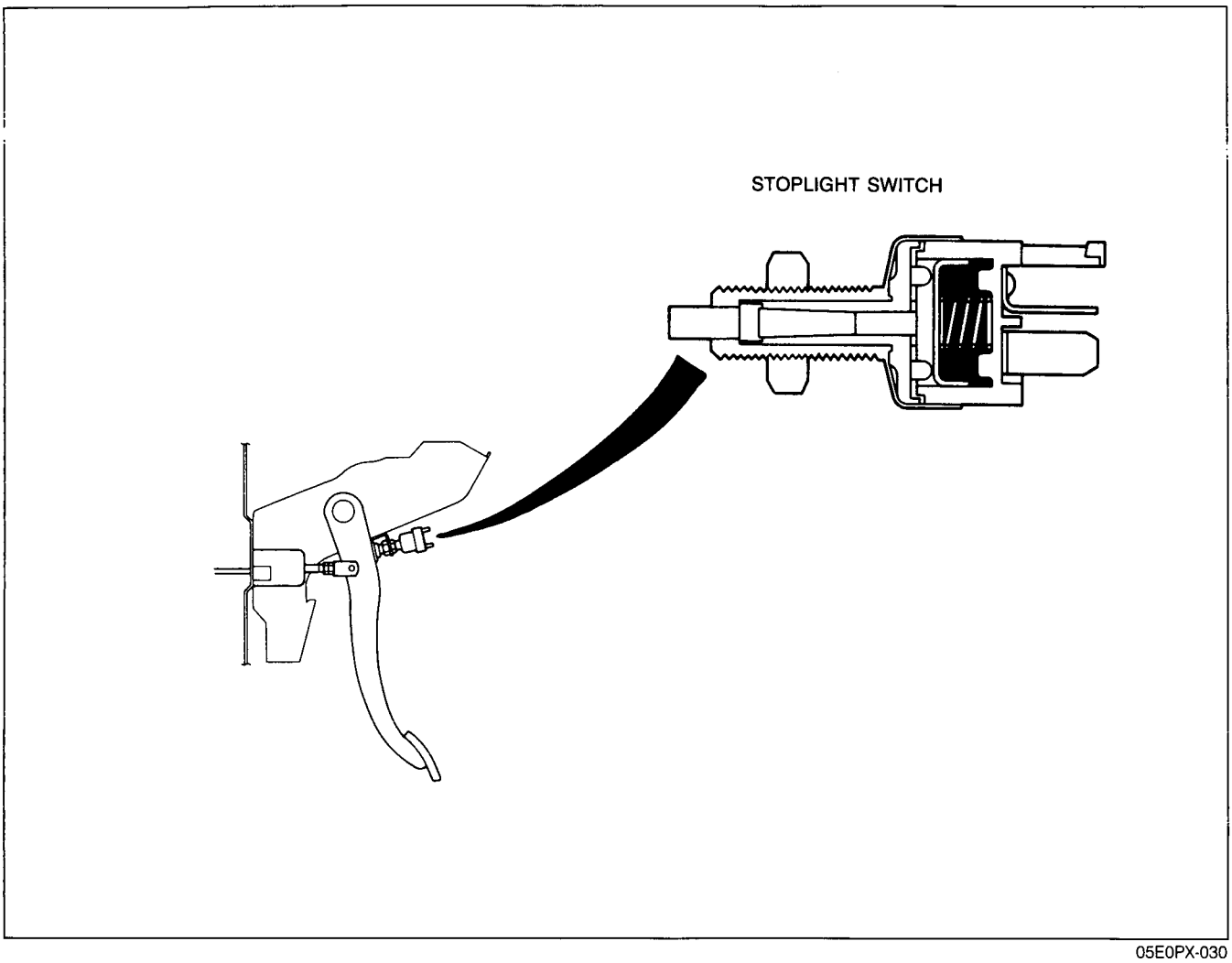


05E0PX-029

Valve relay
The valve relay controls voltage to the solenoid valves.
The valve relay also controls voltage to the current control circuit to switch the transistor ON when ABS is activated.

Motor Relay
The motor relay control voltage to the pump motor.

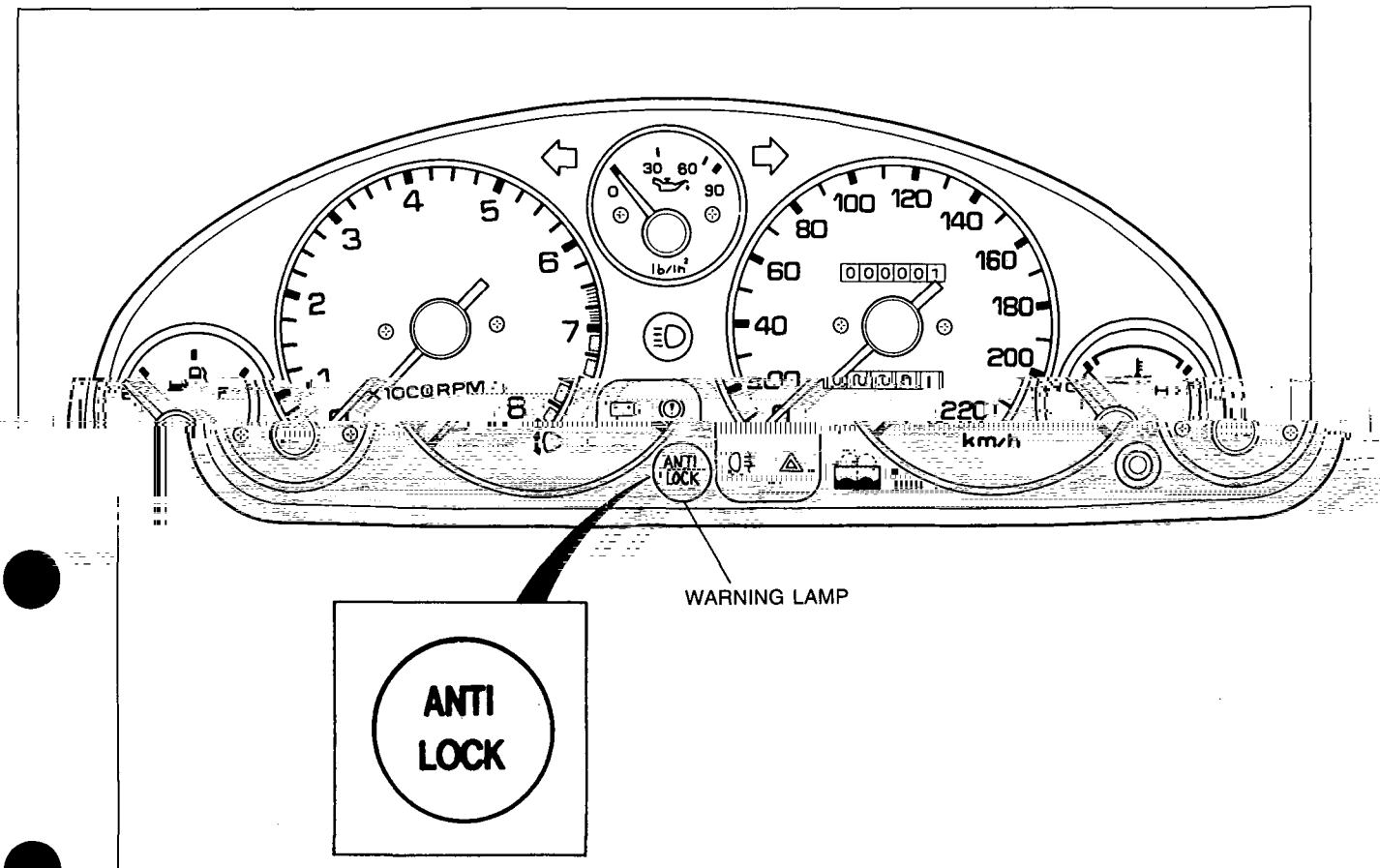
STOPLIGHT SWITCH



05E0PX-030

The stoplight switch sends a "brakes ON" signal to the ABS control unit when the brake pedal is depressed. This prevents unwanted operation of the ABS at times when it is unnecessary, such as when a wheel has stopped due to hydroplaning.

ABS WARNING LAMP



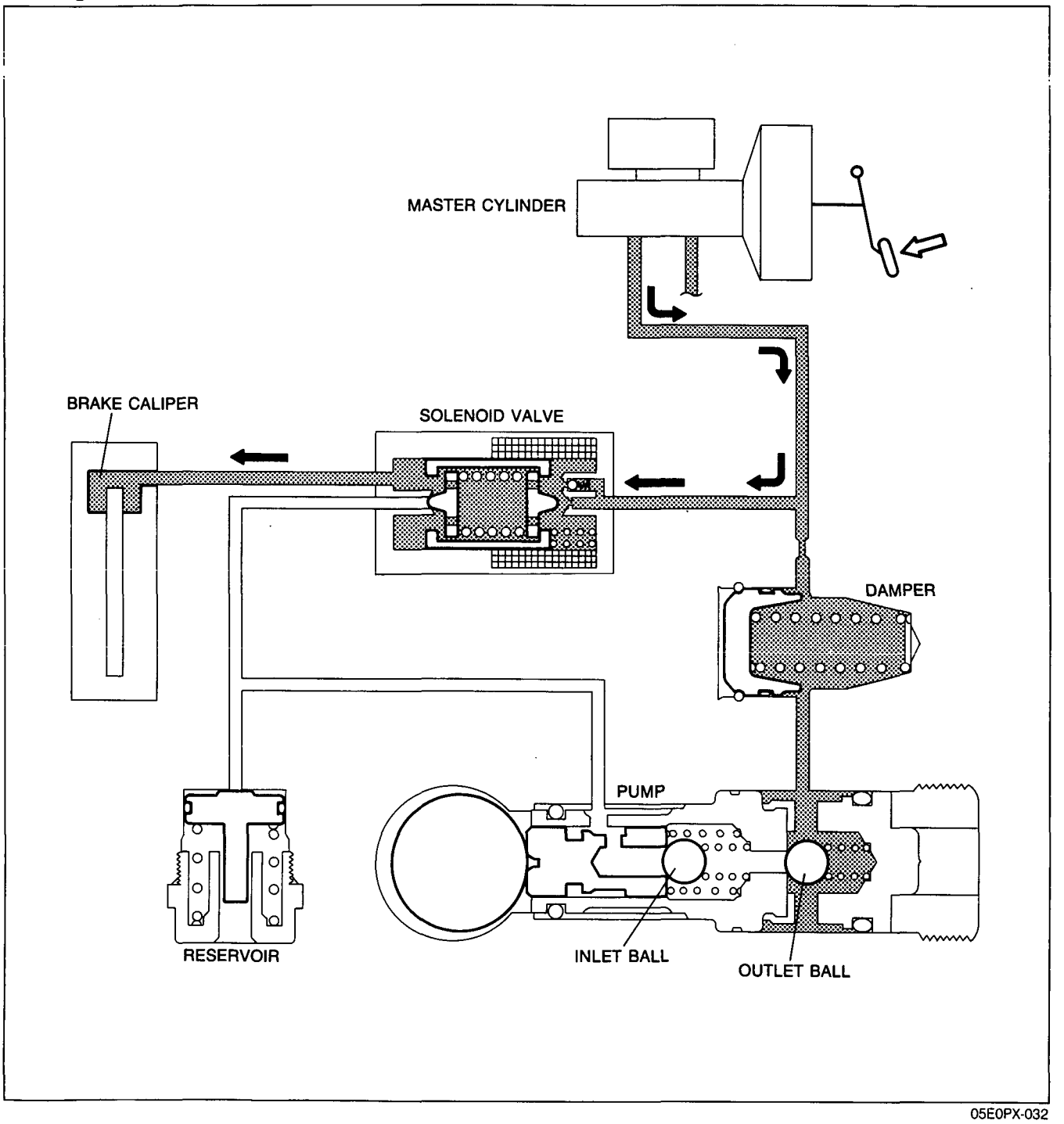
ILUMINATION CYCLE WHEN ABS IS NORMAL

IGN OFF	IGN ON	CRANKING ENGINE RUNNING
	ILLUMINATED	NOT ILLUMINATED

05E0PX-0

The ABS warning lamp is located within the instrument cluster.
If the warning lamp illuminates during driving, it indicates a malfunction in the ABS.

OPERATION OF ABS
Normal Braking
Braking

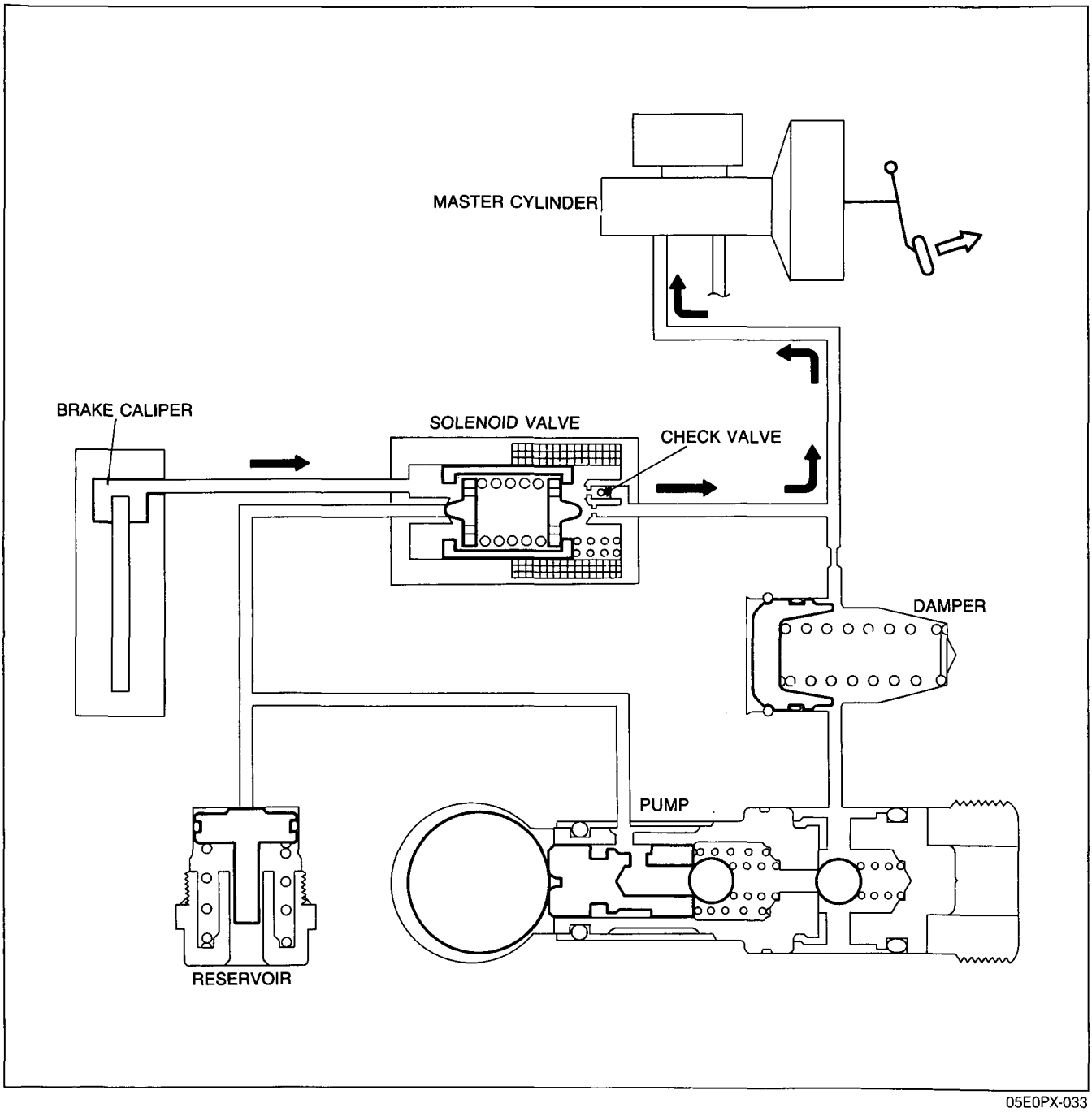


05E0PX-032

When the brake pedal is depressed, the hydraulic pressure from the master cylinder flows to the solenoid valve. During normal braking, because there is no current flow to the solenoid valve, the passage from the master cylinder to the brake caliper is open (the same condition as pressure increase), and the brakes are activated.

The hydraulic pressure which has passed through the damper also reaches the pump but is prevented from flowing through it by the outlet ball.

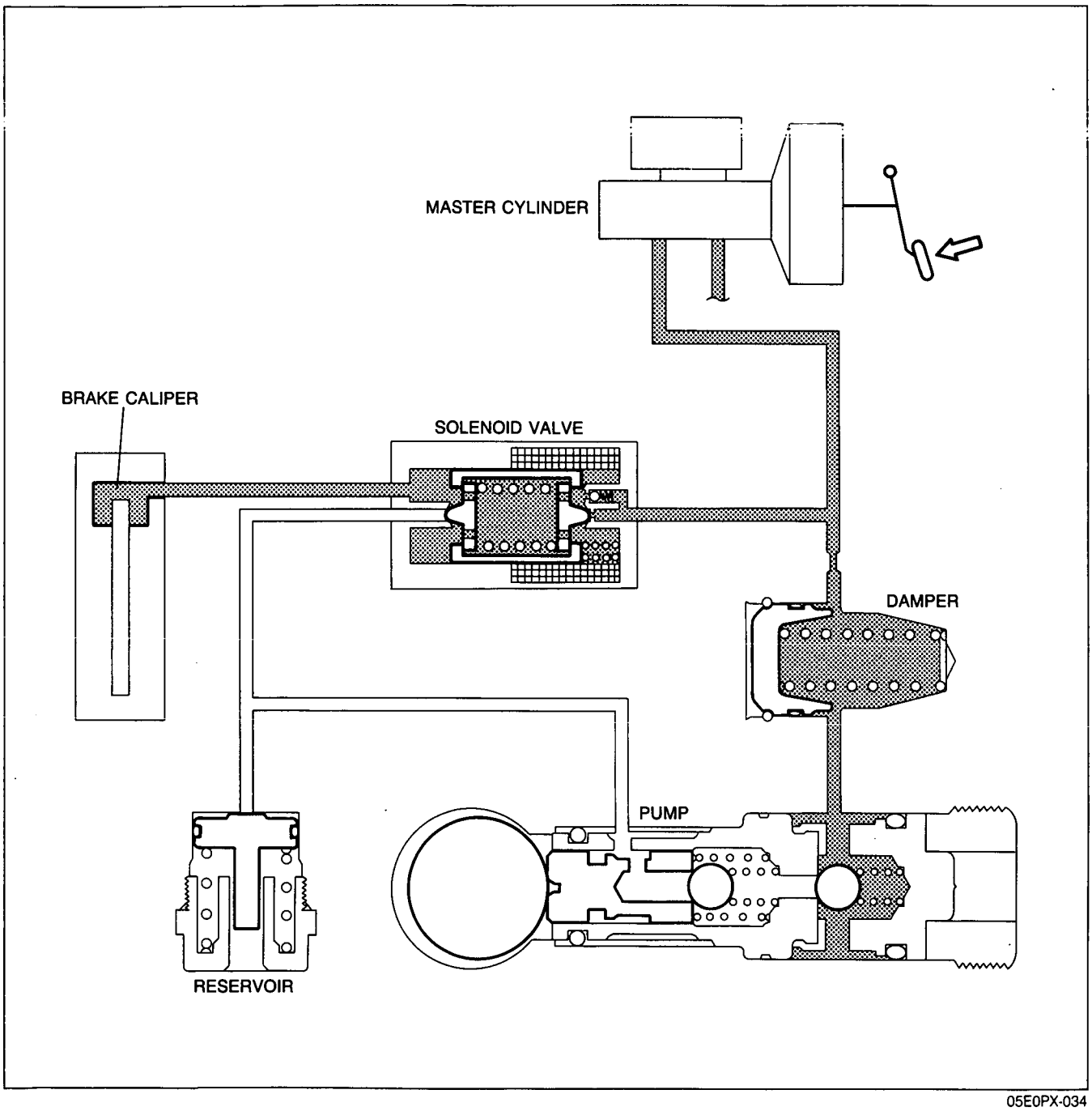
Brakes released



05E0PX-033

When the brake pedal is released, the master cylinder's hydraulic pressure decreases, and the hydraulic pressure from the brake caliper presses the ball of the check valve off its seat and returns to the master cylinder.

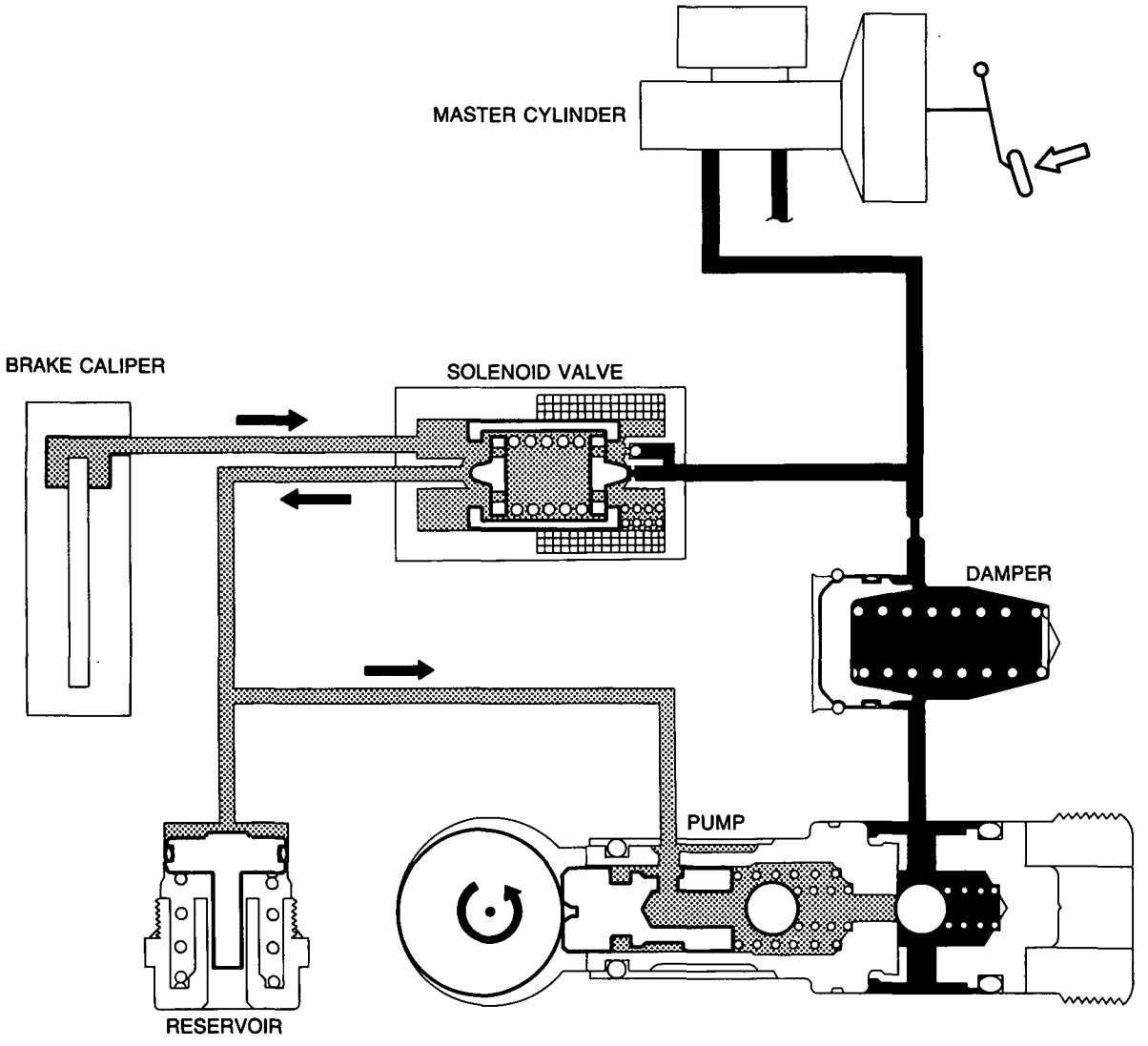
Pressure Retention



05E0PX-034

When a pressure retention signal is relayed from the ABS control unit to the solenoid valve, the solenoid valve closes the passage to the master cylinder reservoir, thereby retaining hydraulic pressure within the brake caliper.

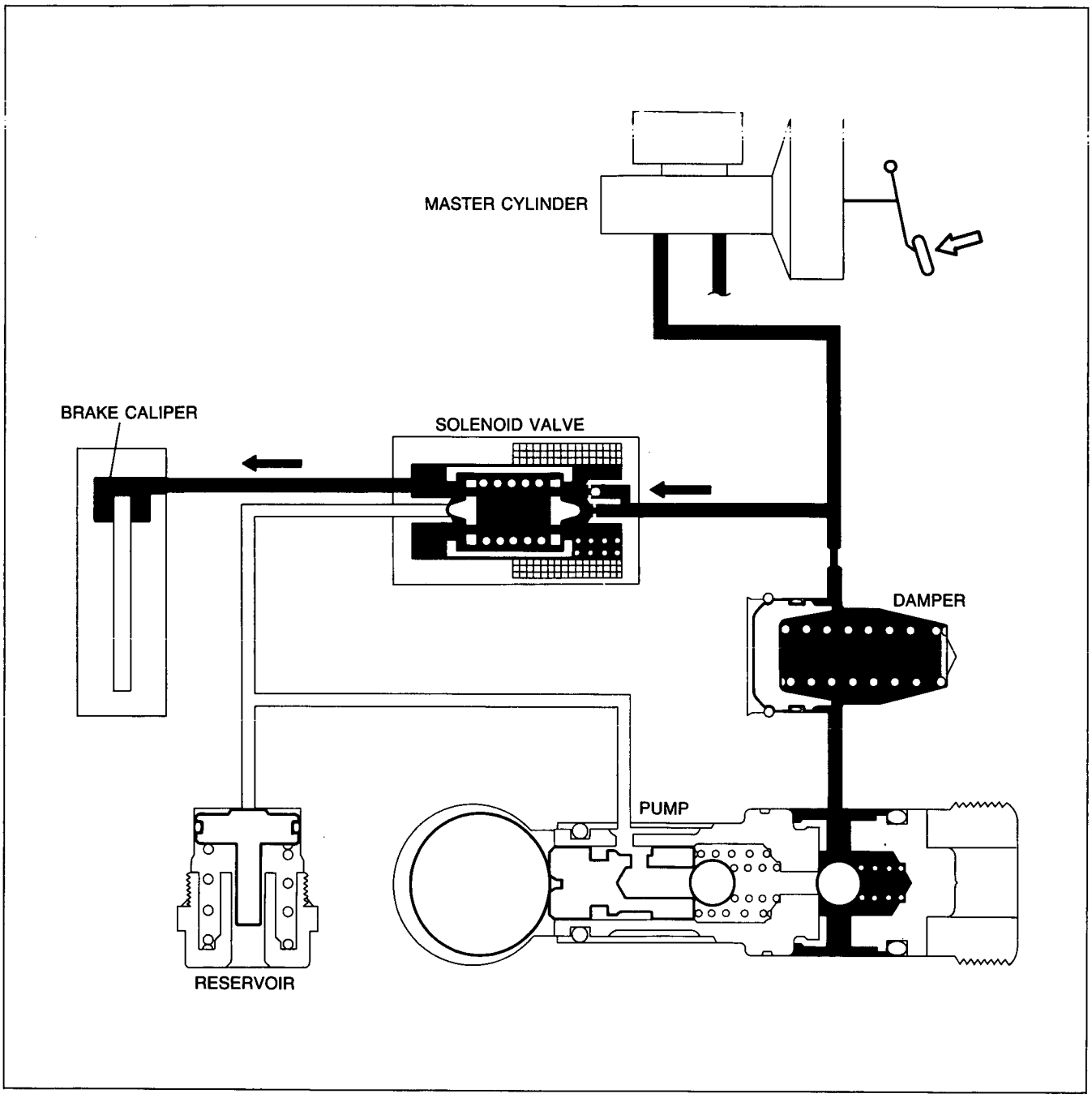
Pressure Reduction



05E0PX-035

When a pressure reduction signal is relayed from the ABS control unit to the solenoid valve, the solenoid valve stops the hydraulic pressure from the master cylinder, and hydraulic pressure is allowed to flow from the brake caliper to the reservoir.
The pressure reduction signal also cause the pump to operate, transfering the hydraulic fluid within the reservoir to the damper.

Pressure Increase



05E0PX-036

When a pressure increase signal is relayed from the ABS control unit, cutting current to the solenoid valve, the solenoid valve opens the passage from the master cylinder to the brake caliper. When this happens, pressurized hydraulic fluid is sent to the brake caliper, thus again raising the hydraulic pressure in the brake caliper.

SUPPLEMENTAL SERVICE INFORMATION

The following points in this section are changed in comparison with Workshop Manual (1221-10-89I).

Master cylinder
- Installation

Proportioning bypass valve
- Replacement

Hydraulic unit
- Removal / Installation

ABS control unit
- Removal / Installation

Relays
- Removal / Inspection / Installation

ABS wheel speed sensor (front)
- Removal / Inspection / Installation

ABS sensor rotor (front)
- Removal / Inspection / Installation

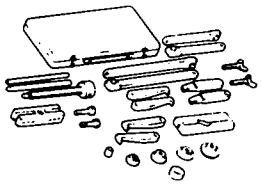
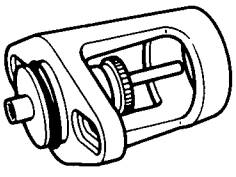
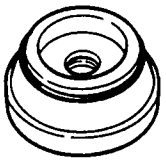
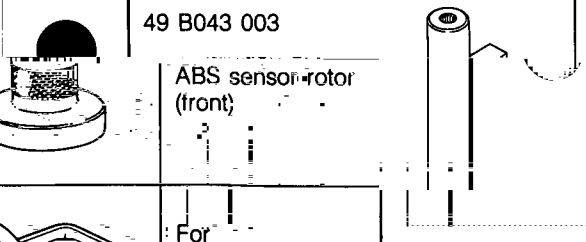
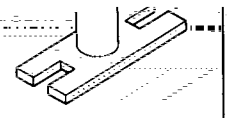
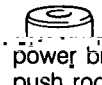
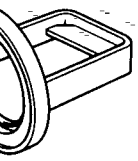
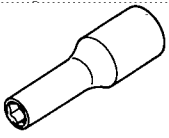
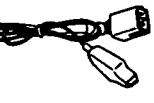
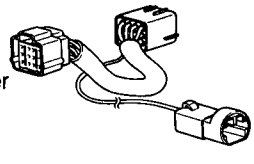
ABS wheel speed sensor (rear)
- Removal / Inspection / Installation

ABS sensor rotor (rear)
- Removal / Inspection / Installation

05E0PX-037

ANTI-LOCK BRAKE SYSTEM (ABS)

PREPARATION
SST

49 0259 770B Wrench, flare unit 	For removal of brake pipe	49 0839 425C Puller set, bearing 	For removal of ABS sensor rotor (front)
49 B043 001 Adjust gauge 	For measurment of master cylinder push rod clearance	49 F027 007 Attachment ϕ72 	For removal of ABS sensor rotor (front)
49 B043 003 ABS sensor rotor (front) 	For adjustment of Lock tool, turning 	49 V001 795 power brake unit push rod 	For installation of Installer, oil seal
 For installation of ABS sensor rot (rear)	49 B043 004 Wrench, socket 	For adjustment of power brake unit push rod	49 H026 101A Installer, sensor rotor 
 For connecting of ABS tester (For UK)	49 N066 001 Harness, adapter 	For connecting of ABS tester	49 H066 003 Harness, adapter 

05E0PX-038

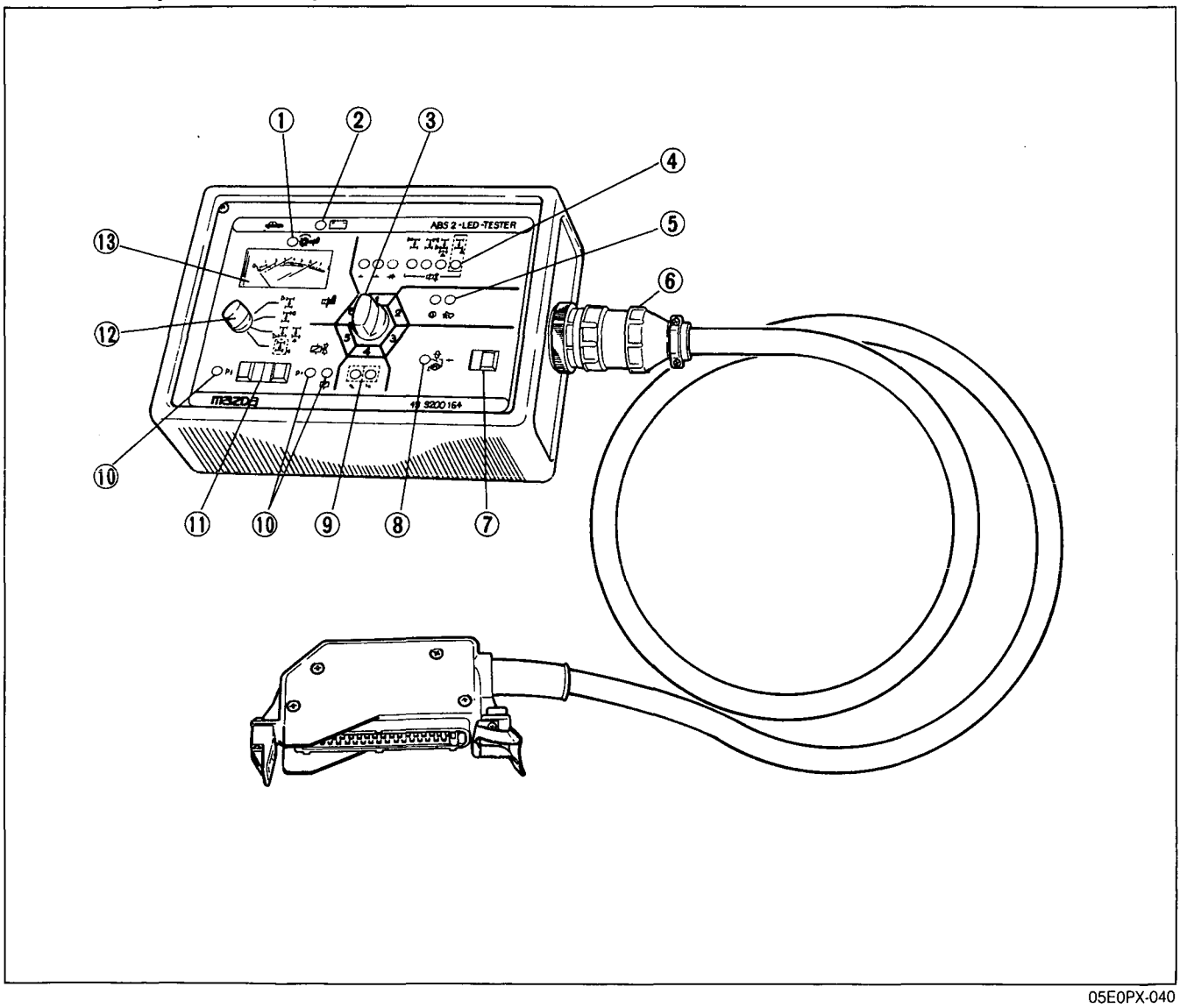
TROUBLESHOOTING GUIDE

Outline

By retaining and reducing the hydraulic fluid pressure in the hydraulic unit, the ABS tester is used to locate the cause of a problem within the anti-lock brake system.
Because there is no way to check the ABS control unit itself, replace the control unit assembly only after first confirming that the other electrical parts are not faulty.

05EUPX-039

ABS Tester (49 9200 164)



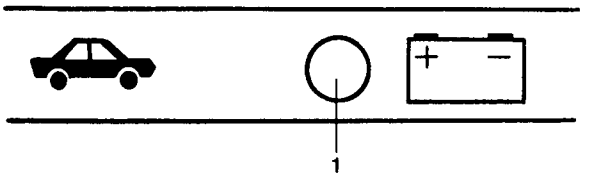
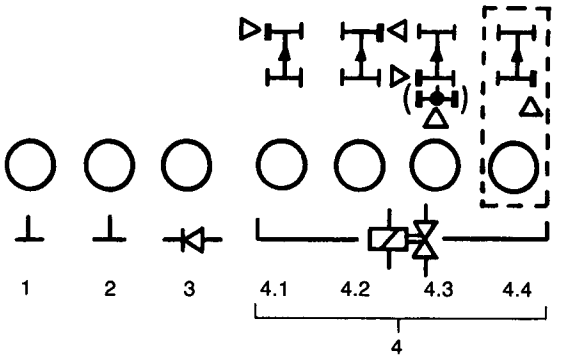
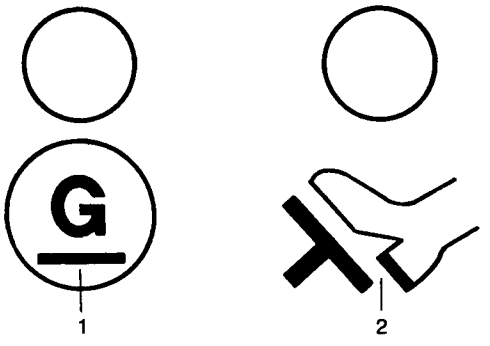
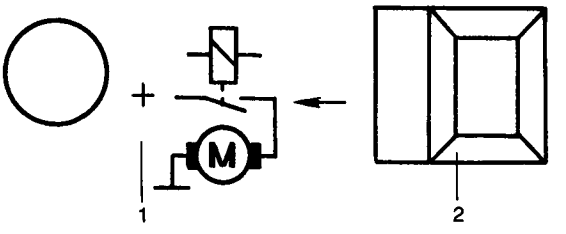
05E0PX-040

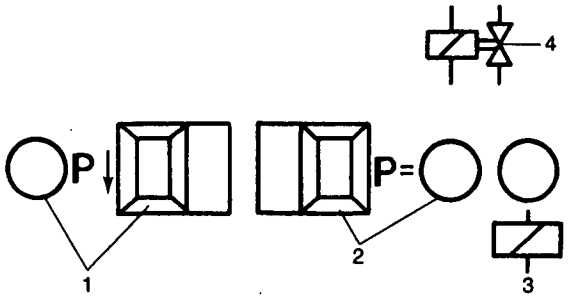
1. LED indicator (1) for wheel speed sensor when program switch set to 6
2. LED indicator (1) for battery voltage
3. Program switch
4. LED indicators (7) for program switch setting 1
5. LED indicators (2) for program switch setting 2
6. Adaptor lead for connection to ABS wiring harness in vehicle
7. Button for motor relay control when program switch set to 3
8. LED indicator (1) for program switch setting 3
9. Not used
10. LED indicators (3) for program switch setting 5
11. Buttons for triggering pressure retention and pressure reduction solenoid valve functions when program switch set to 5
12. Rotary switch for selection of wheels when program switch set to 5 or 6
13. Gauge for program switch setting 6

Note

- **With the exception of wheel speed sensor signals indicated on the gauge, all faults are indicated by LED's.**

Description of symbols

SYMBOL	FUNCTION
	Tester obtains supply voltage from vehicle battery. Supply voltage is monitored during entire testing sequence and at all program switch settings. One LED (1) is constantly illuminated to indicate that the voltage is sufficient.
	**Program switch setting 1** 1 LED indicator for ground connection 1. 2 LED indicator for ground connection 2. 3 LED indicator for diode for warning lamp control. 4 LED indicator for internal resistances of solenoid valves in hydraulic modulator and off position of valve relay. 4.1 LED indicator for left front wheel. 4.2 LED indicator for right front wheel. 4.3 LED indicator for the left rear wheel of vehicle with a 4-channel hydraulic system or for rear axle of vehicle with a 3-channel hydraulic system. 4.4 LED indicator for right rear wheel of vehicles with a 4-channel hydraulic system. The dashed line means that LED must only illuminate if 4-channel hydraulic system is tested.
	**Program switch setting 2** 1 LED indicator for connection to alternator terminal 61 (terminal Ⓓ). 2 LED indicator for connection to brake light switch.
	**Program switch setting 3** 1 LED indicator for motor relay and pump in hydraulic unit. 2 Button for control of motor relay. LED indicator illuminates when button is pushed.

SYMBOL	FUNCTION
	**Program switch setting 5** Functional tests of solenoid valves and valve relay in hydraulic unit. Checking solenoid valve channel assignments: 1 Button and LED indicator for pressure reduction function. LED must illuminate when button depressed. 2 Button and LED indicator for pressure-retention function. LED must illuminate when button depressed. 3 LED indicator for function of valve relay. LED must illuminate while program switch is set to 5. 4 Symbol for solenoid valves

ction switch

am switch is set to 5 or 6, switch is adjusted to tested.

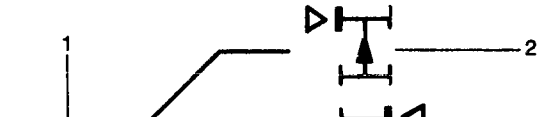
switch for wheel selection.

nt wheel.

ont wheel.

mbol: Left rear wheel of vehicle with 4-channel ic system (program switch setting 5) or 4 wheel sensors (program switch setting 6).
ymbol: Rear axle of vehicle with 3-channel hy- system or 3 wheel speed sensors.

ear wheel of vehicles with 4-channel hydraulic tor or 4 wheel-speed sensors.
ed with 3-channel system.



Wheel sele

When progr wheel to be

1 Rotary

2 Left fro

3 Right fr

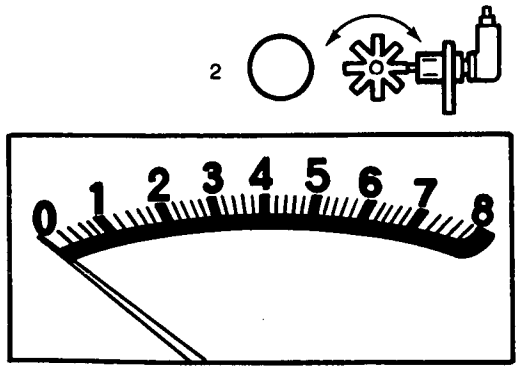
4 Left sy hydrau speed Right s draulic

5 Right re modula Not use

witch setting 6

g wheel speed sensor signal and air gap ween speed sensor and sensor rotor.

dicator for rotation of wheels.
ED illuminates continuously at test speed, ndication is read.



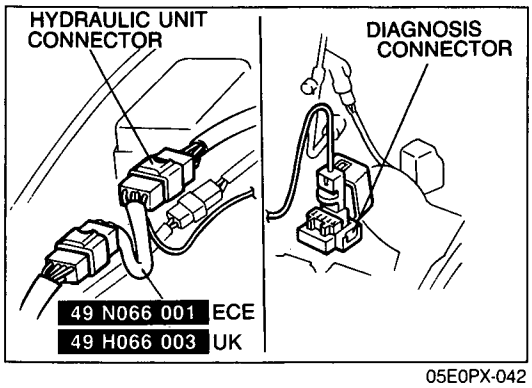
Program s

For checkin change bet

1 Gauge.

2 LED in When L gauge

05E0PX-041

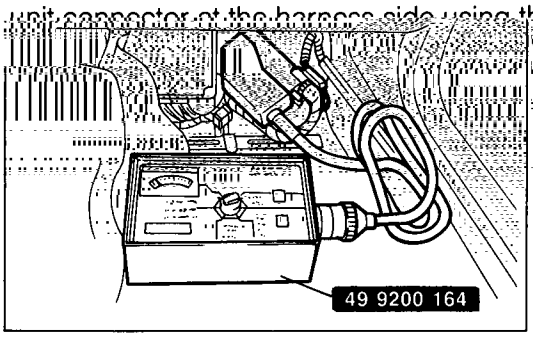


05E0PX-042

Connecting the SST

1. Switch the ignition switch OFF.
2. Connect the **SST** to the hydraulic unit harness connector and the diagnosis connector.
3. Disconnect the control unit connector and connect the **SST** to the control unit connector at the harness side using the adaptor.

Caution
Do not drive with the tester connected.



05E0PX-043

Troubleshooting

	Conditions	Expected test indication	Possible cause if incorrect
G)	Ignition ON	LED [+ −] illuminates continuously.	Battery undercharged. Excessive voltage draw. Fuse blown. Overvoltage protection relay defective. Check lead to ignition lock terminal ⓓ.
mp 3) al s und	Ignition ON	All 7 LED's illuminate to same extent (6 LED's for 3-channel hydraulic system).	LED ⊥ does not illuminate: Check ground terminals for poor connection. LED ⊣◇⊢ does not illuminate: ABS warning lamp defective, diode defective, check valve relay ground connections. LED ⇦✱ does not illuminate: Check corresponding connectors of solenoid valve and leads. All LED's ⇦✱ and LED ⊣◇⊢ do not illuminate: Check valve relay ground connection, valve relay defective. Weak illumination of an LED indicates contact resistance in corresponding current path.

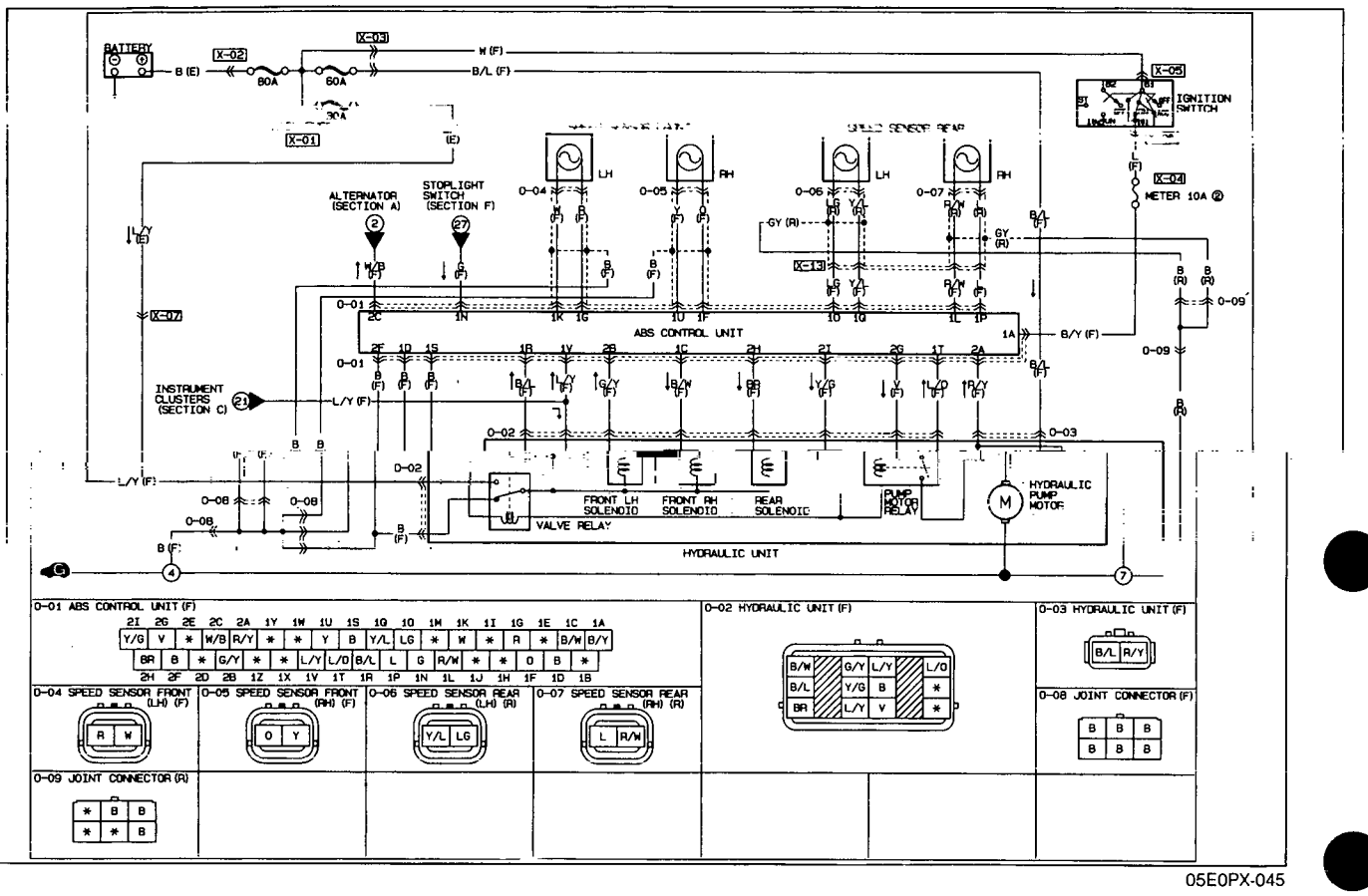
Program switch setting	Test (measure at terminals)
All settings	Power supply (terminals 1D and 2
1	Ground connections (terminal 1S) Diode for warning la (terminals 1V and 2E Solenoid valve interr resistances (terminal 2I, 2H, 1C). Off position and gro connection of valve relay

Program switch setting	Test (measure at terminals)	Conditions	Expected test indication	Possible cause if incorrect
2	Alternator voltage from terminal 61 (terminal 2C)	Ignition ON Start engine	LED (G) illuminates. LED (G) is extinguished when engine starts.	LED is not fully extinguished until after acceleration (test passed). Check lead to the alternator terminal 61. Alternator defective.
	Stoplight switch (terminal 1N)	Ignition ON	LED illuminates.	Check lead to brake light switch. Brake light switch defective. Lead incorrectly connected to brake light switch.
		Depress brake pedal	LED is extinguished.	
3	Motor relay, pump motor in hydraulic unit (terminals 2A and 1T)	Ignition ON, keep button depressed	LED illuminates. Pump motor runs. LED continues to illuminate after releasing button and motor continues to run.	Motor relay defective. Check hydraulic unit ground connection. Pump motor defective.
5	Valve relay functions (terminal 1R)	Ignition ON	LED illuminates.	Valve relay defective.
	Check of solenoid valves in hydraulic unit for proper function and correct connection. **Note** **Carry out testing for each wheel. Keep to the operating sequence.**	Jack up vehicle. Ignition ON. The tested wheel must be capable of rotating freely when turned by hand. Set wheel selection switch to wheel to be tested.		Repeat test with engine running. Brake leads incorrectly connected to hydraulic unit. Current value is not reached (LED **P↓** or **P=** extinguished) because battery is undercharged. Repeat test with engine running. Hydraulic unit defective.
	Pressure retention function	1. Hold button **P=** depressed	LED **P=** illuminates.	
		2. Depress brake pedal	Wheel rotated by hand.	
		3. Release button **P=**	LED **P=** is extinguished, wheel locked.	
	Pressure reduction function	4. Hold button **P↓** depressed	LED **P↓** illuminates wheel rotates by hand.	
		5. Release button **P↓**	LED **P↓** is extinguished, wheel locked.	
		6. Release brake pedal		

Program switch setting	Test (measure at terminals)	Conditions	Expected test indication	Possible cause if incorrect
6	Check of wheel speed sensor for proper function and correct connection. **Note** **Carry out testing for each wheel.** (Left front wheel: terminals 1K and 1G; right front wheel: terminals 1U and 1F; left rear wheel or rear axle: terminals 1O, and 1Q; right rear wheel: terminals 1L and 1P Terminals assignments are vehicle specific)	Jack up vehicle. Ignition ON. The wheel to be tested must rotate freely by hand. When testing driven axle, wheel not being tested must be held. Set wheel selection switch to wheel to be tested.		Wheel speed sensor connector incorrectly connected. Wheel speed sensor wiring open-circuit. Excessive air gap between speed sensor and sensor rotor. Sensor rotor defective or loose. Sensor rotor has wrong number of teeth (vehicle specific). Excessive wheel bearing play.
		Turn wheel by hand until LED above gauge illuminates (speed approx. 1 revolution per second). *Read gauge indication.*	Must meet the following two conditions. 1. Minimum indication: 1.0 or above 2. *Permissible fluctuation:* Fluctuation (max. indication minus min. indication) is the same as or less than max. x 0.25.	

05E0PX-044

Circuit Diagram For ECE



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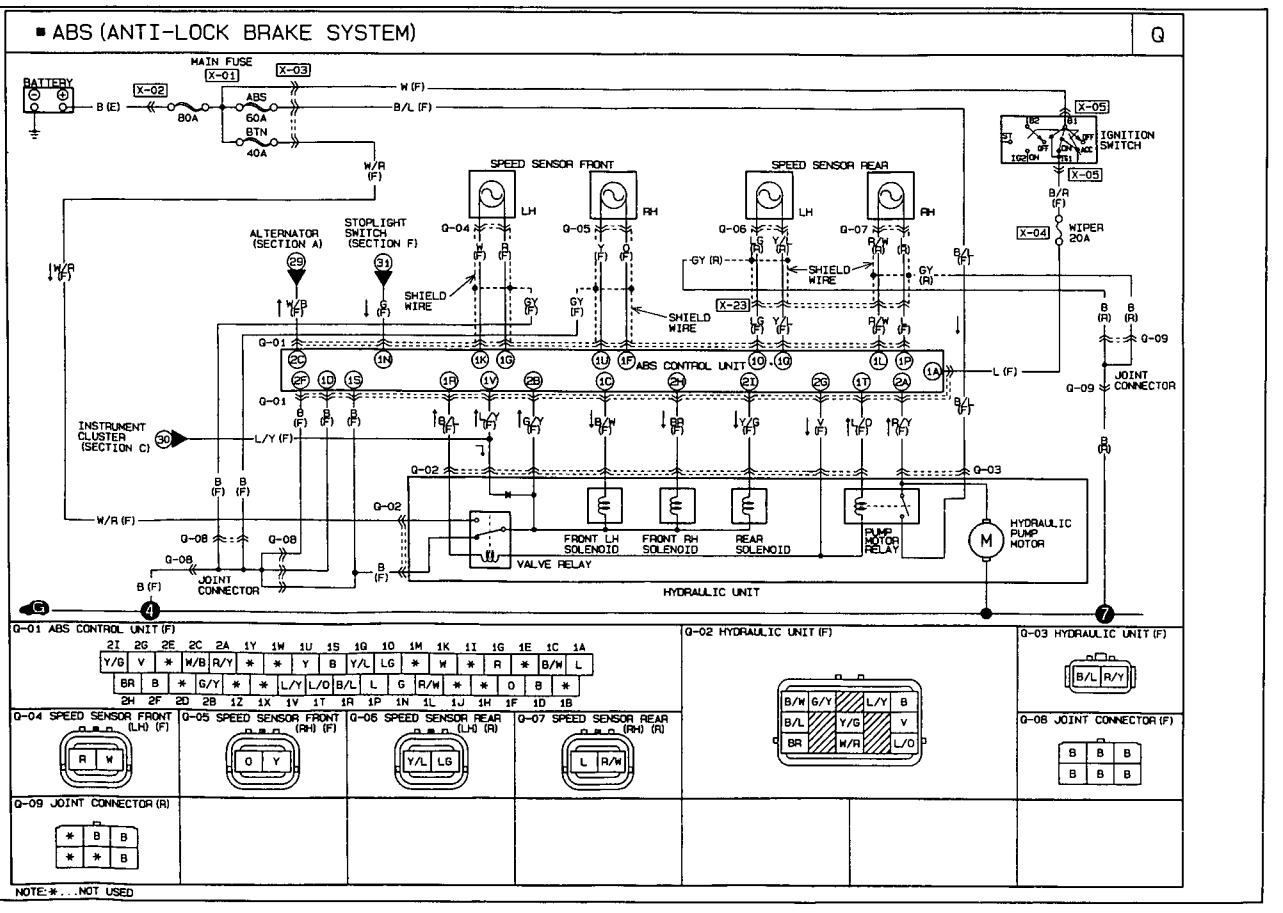
For UK

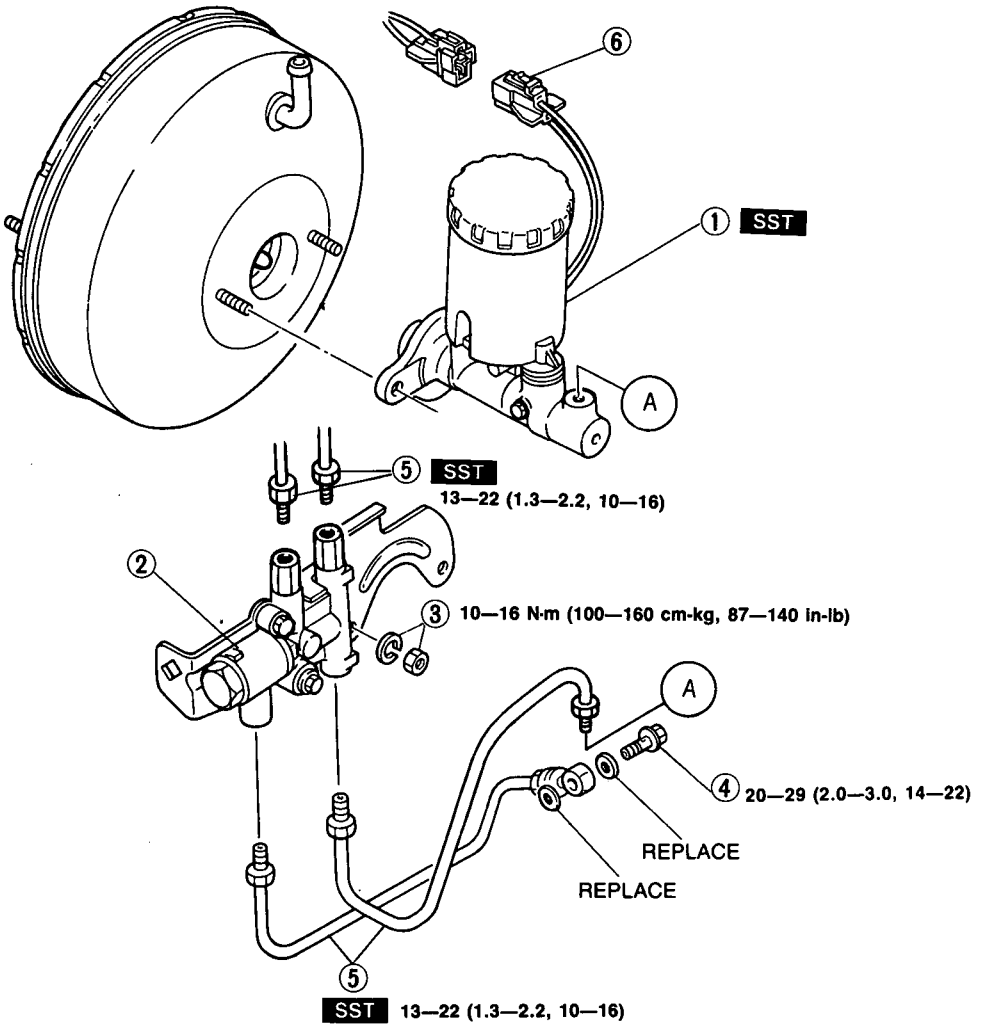


MASTER CYLINDER

Installation

1. Install in the order shown, referring to **Installation Note**.
2. Add brake fluid, bleed the air, and check for fluid leakage.

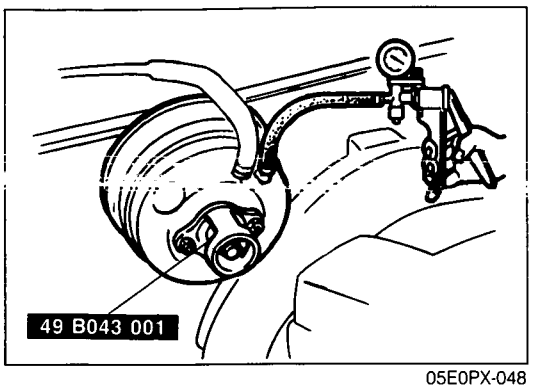
05E0PX-046



N·m (m-kg, ft-lb)

05E0PX-047

1. Reservoir and master cylinder
   Installation note..... page P–46
2. Proportioning bypass valve and braket
3. Nut and washer
4. Connector bolt
5. Brake pipe
6. Fluid level sensor connector



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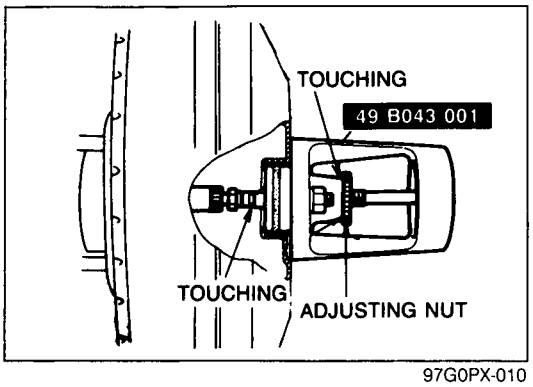

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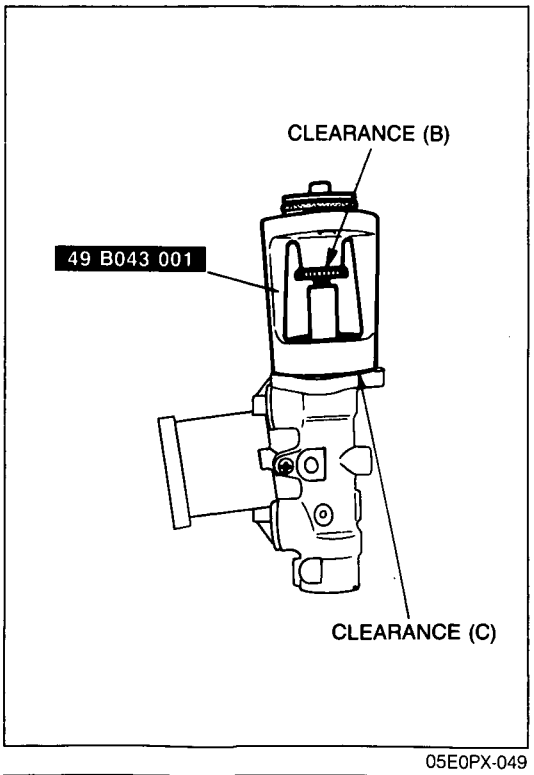

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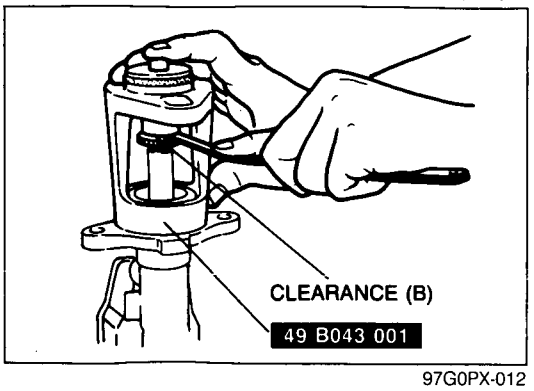


97G0PX-012

Installation note
Master cylinder
Push Rod Clearance
Inspection

Inspect the push rod clearance as follows.

1. Turn the nut of the **SST** clockwise to fully retract the **SST** gauge rod. Attach the **SST** to the power brake unit.

   Tightening torque:
   10—16 N·m (100—160 cm-kg, 87—140 in-lb)

2. Apply **500 mm-Hg (19.7 in-Hg)** vacuum using a vacuum pump.

3. Turn the adjusting nut of the **SST** counterclockwise until the gauge rod just contacts the push rod end of the power brake unit.
   Push lightly on the end of the gauge rod to be sure it is seated. Verify that there is no gap between the adjusting nut and **SST** body.

4. Remove the **SST** from the power brake unit without disturbing the adjusting nut. Set the **SST** onto the master cylinder as shown in the figure.

   Caution
   - **When pushing use only enough pressure to bottom the rod in the piston. If too much pressure is applied a false reading will occur.**

5. Push lightly on the end of the **SST** gauge rod to be sure it is bottomed in the master cylinder piston, and note any clearance between the **SST** body and the adjusting nut (clearance B) or between the body and the master cylinder (clearance C). Adjust the push rod as necessary as outlined in "Adjustment" below.

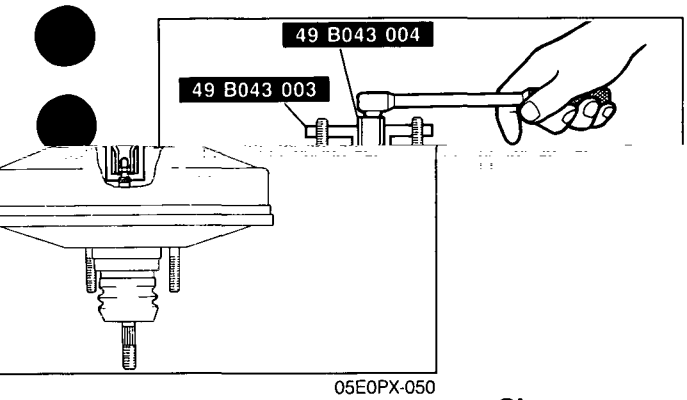
Measurement	Push rod
Clearance at (B)	Too short
Clearance at (C)	Too long
No clearance at (B) or (C)	OK

Adjustment

Note
- **The threads of the push rod are specially designed so that the bolt becomes harder to turn past a certain point to prevent loosening of the bolt. Turn the bolt only within this range when adjusting.**

Clearance at B

1. Push lightly on the end of the **SST** gauge rod, and measure the clearance between the adjusting nut and the **SST** body.

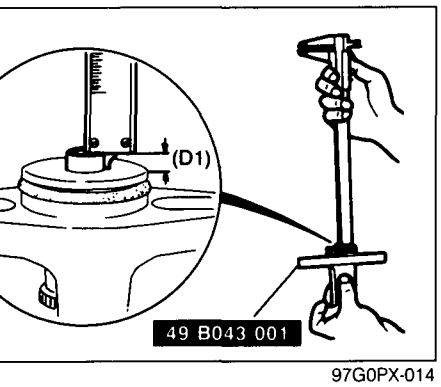


05E0PX-050

2. Using the **SST**, turn the nut to lengthen the power booster push rod an amount equal to the clearance measured at B.

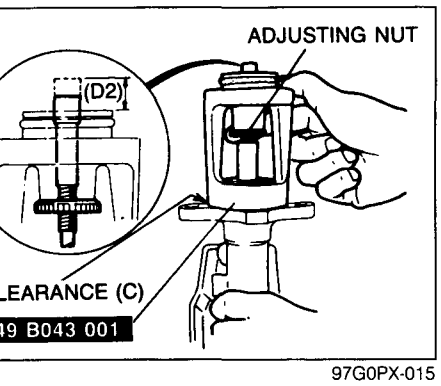
Clearance at C

1. Measure and record height D1 of the gauge rod.



97G0PX-014

2. Turn the adjusting nut until the **SST** body sets squarely on the master cylinder. (Turn only enough for the body to touch.)
3. Measure and record height D2 of the gauge rod.



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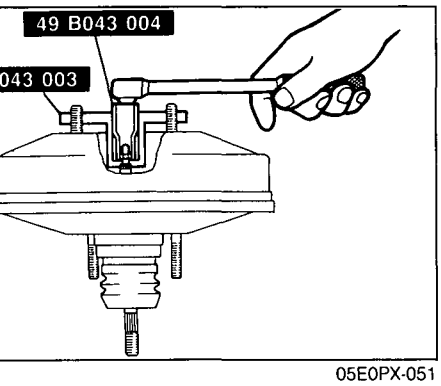
4. Subtract D1 from D2 and using the **SST**, turn the nut to shorten the power booster push rod an amount equal to the difference.



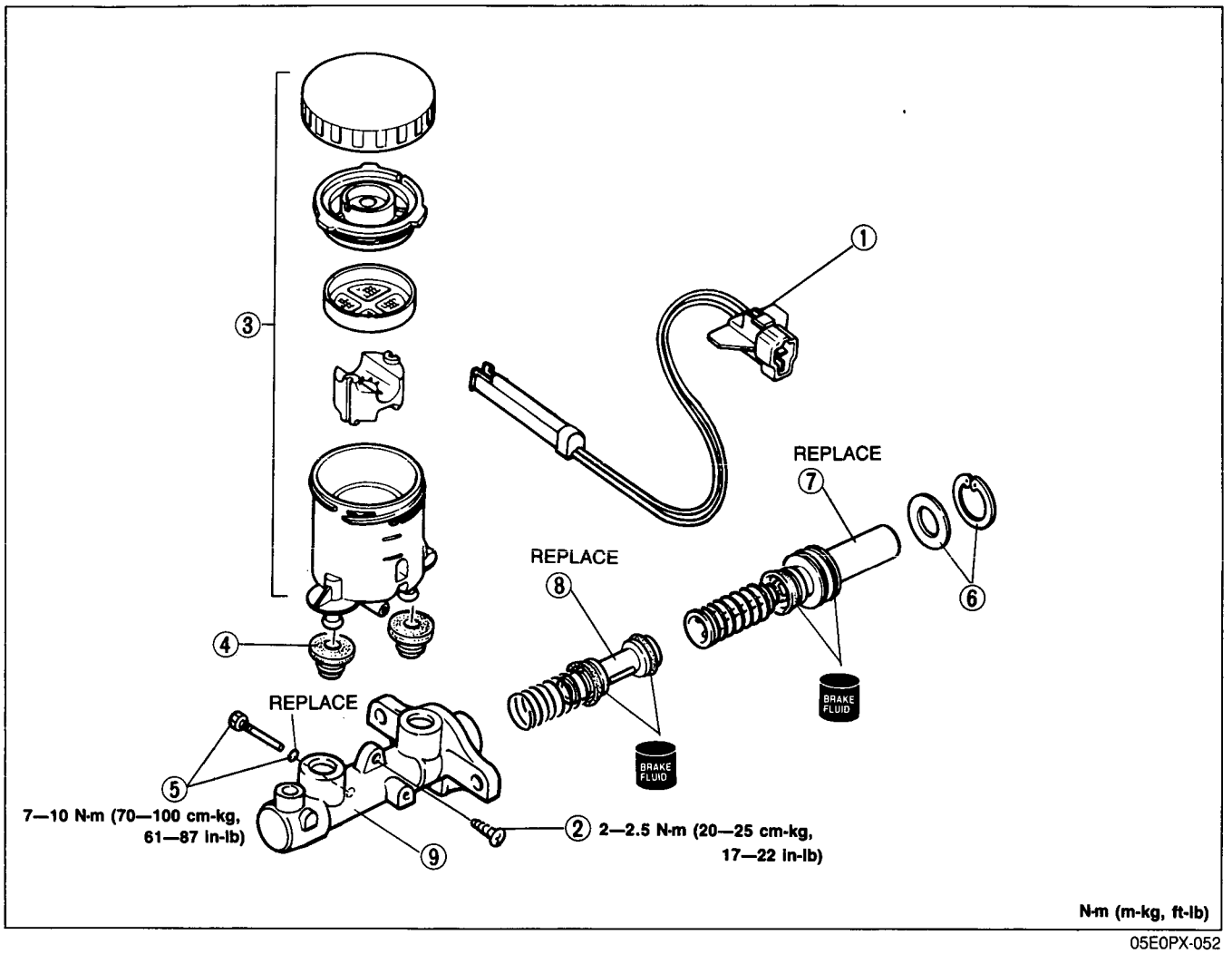
05E0PX-051

Disassembly / Inspection

1. After removing the brake fluid, disassemble in the order shown in the figure.
2. Inspect all parts and repair or replace as necessary.
3. Assemble in the reverse order of disassembly, referring to **Assembly Note**.

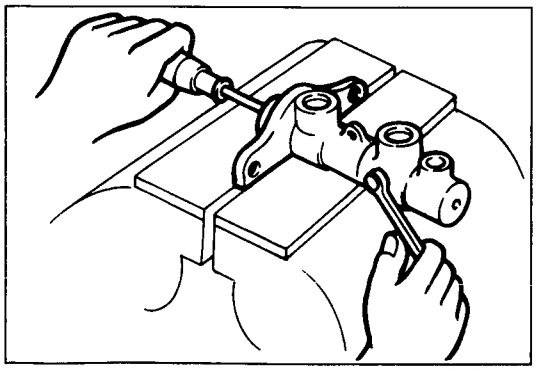
Caution

- **Secure the master cylinder flange in a vise when necessary.**
- **Replace the piston assembly if necessary.**
- **Do not let foreign material enter the cylinder, and do not scratch the inside of the cylinder or the outer surface of the pistons.**



05E0PX-052

1. Fluid level sensor
2. Screw
3. Reservoir assembly
4. Bushings
5. Stop pin and O-ring
   Assembly note..... below
6. Snap ring and spacer
7. Primary piston assembly
8. Secondary piston assembly
9. Cylinder



05E0PX-053

Assembly note

Stop pin

1. Align the hole of the secondary piston and the hole of the cylinder.
2. Insert the stop pin while pushing the secondary piston assembly.

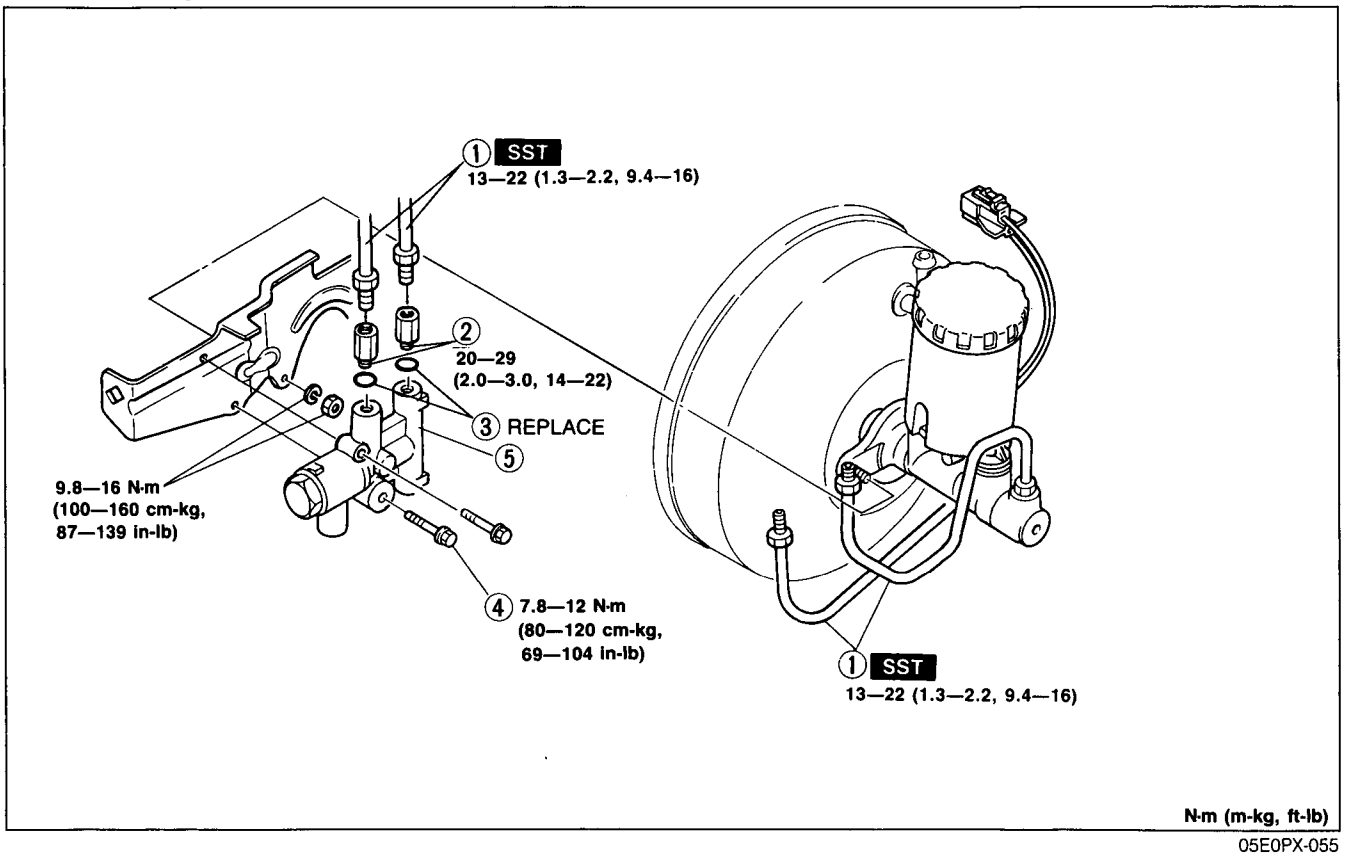
PROPORTIONING BYPASS VALVE

Replacement

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.
3. After installation:
   (1) Add brake fluid and bleed the air.
   (2) Check the brake lines for fluid leakage.

Caution

- **Brake fluid will damage painted surfaces. If it does get on a painted surface, wipe it off immediately.**



05E0PX-055

1. Brake pipe
2. Damping unit
3. O-ring
4. Bolt
5. Proportioning bypass valve

HYDRAULIC UNIT

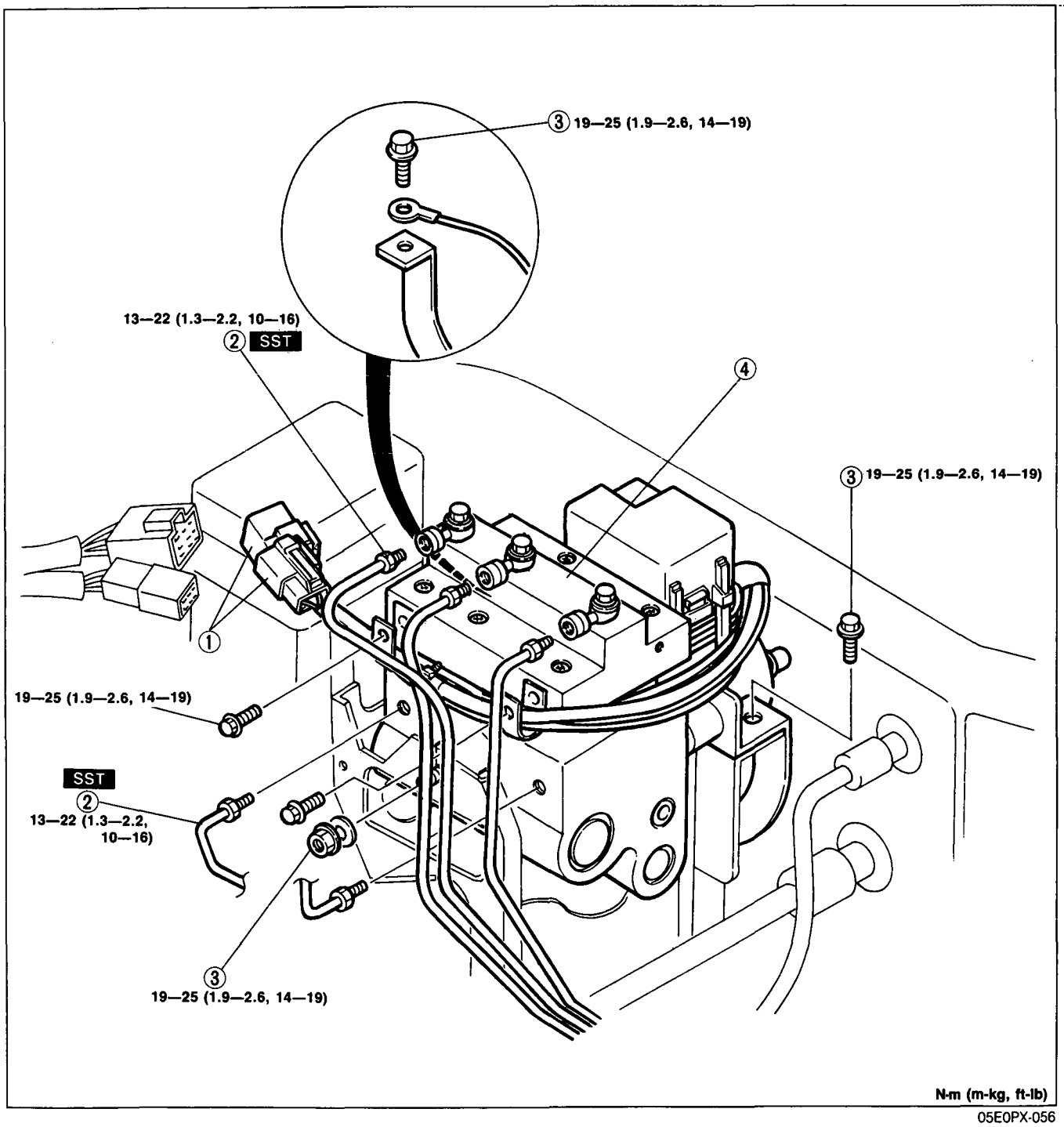
Removal / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure, referring the **Removal Note**.

Caution

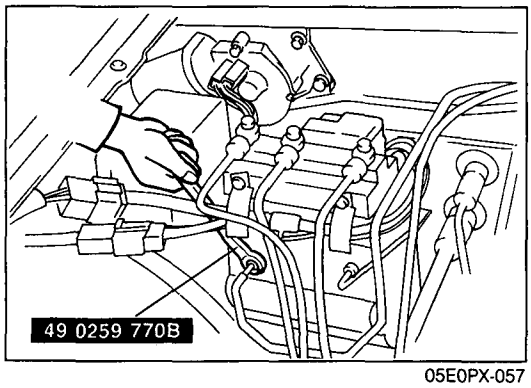
- **The only serviceable parts of the hydraulic unit are the valve relay and the motor relay; if there is a failure of any other part replace the hydraulic unit assembly.**

3. Install in the reverse order of removal, referring the **Installation Note**.
4. Add brake fluid, bleed air, and check for fluid leakage.



05E0PX-056

1. Connectors
2. Brake pipes
   Removal / Installation note..... page P–51
3. Nut, bolts
4. Hydraulic unit



05E0PX-057

Removal / Installation note
Brake pipes

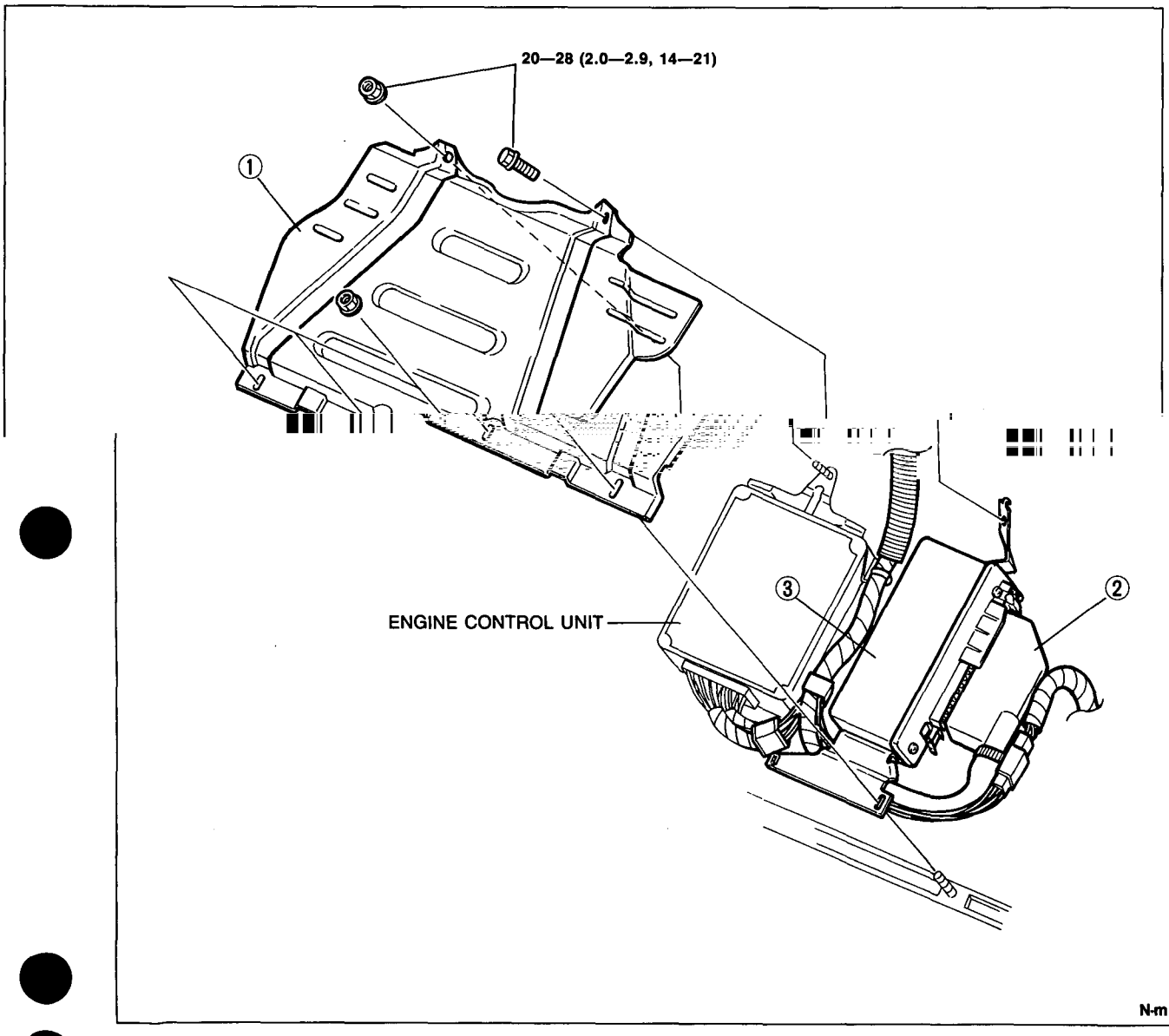
Caution
- **Be careful not to spill the brake fluid onto a painted surface.**

1. Loosen/tighten the brake pipes from/to the hydraulic unit with the **SST**.

ABS CONTROL UNIT

Removal / Installation

1. Disconnect the negative battery cable.
2. Roll back the carpet.
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.



N-m (m-kg, ft

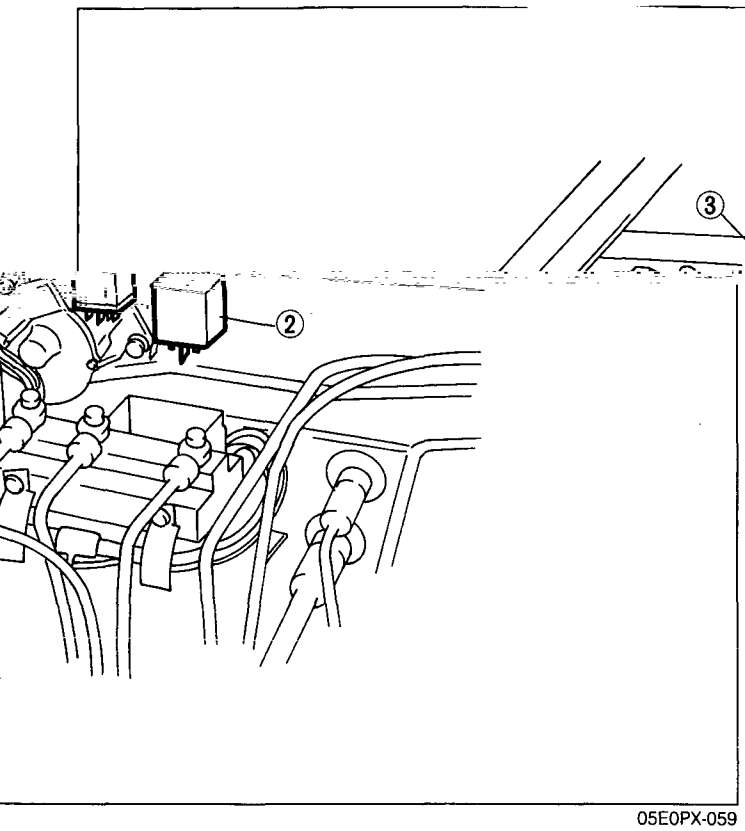
05E0PX

1. Protector
2. Connector
3. ABS control unit

RELAYS

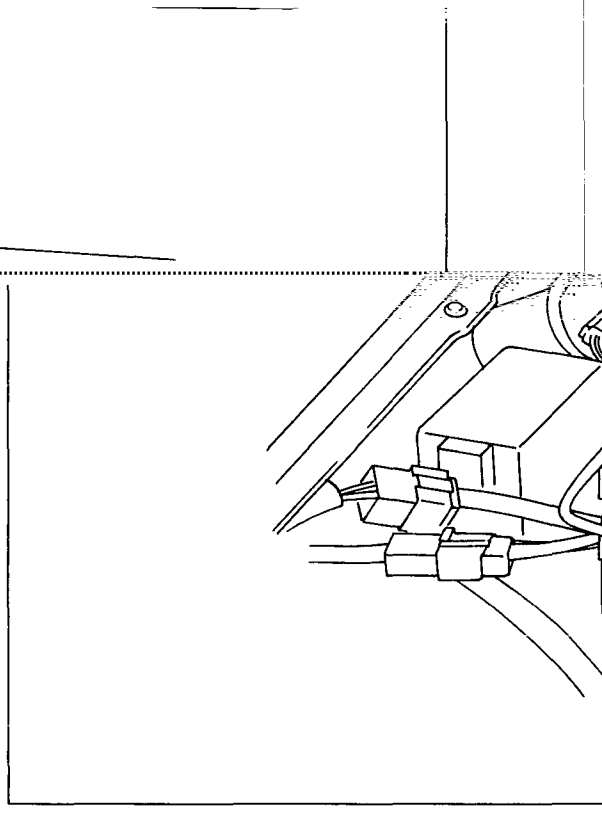
Removal / Inspection / Installation

1. Disconnect the negative battery cable.
2. Remove in the order shown.
3. Inspect all parts and replace as necessary.
4. Install in the reverse order of removal.



05E0PX-059

3. Valve relay
   Inspection ..... page P–53



1. Cover
2. Motor relay
   Inspection ..... be

low

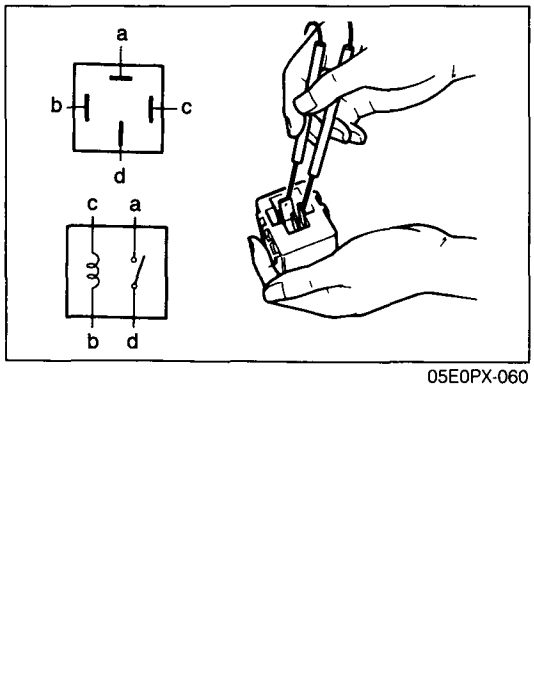
nspection

lotor relay

. Disconnect the negative battery cable.
. Release the motor relay lock from the hydraulic unit and remove the motor relay.
. Connect an ohmmeter and check for continuity at the relay terminals.

Connect to		a	b	c	d
12V	Ground				
—	—		○—○		
c	b	○—			—○

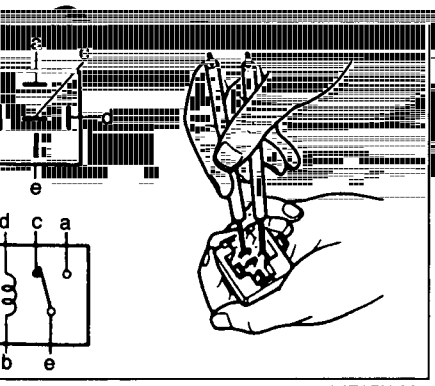
○—○: Indicates continuity



05E0PX-060

. If continuity is not as specified, replace the motor relay.
. If OK, check the wiring harness (Motor relay — Control unit main fuse [ABS 60A]).

09U0PX-049



05E0PX-061

Valve relay

1. Disconnect the negative battery cable.
2. Release the valve relay locks from the hydraulic unit and remove the valve relay.
3. Using an ohmmeter, check continuity of the relay terminals.

Connect to		a	b	c	d	e
12V	Ground					
—	—		○	○—○	○	○
b	d	○				○

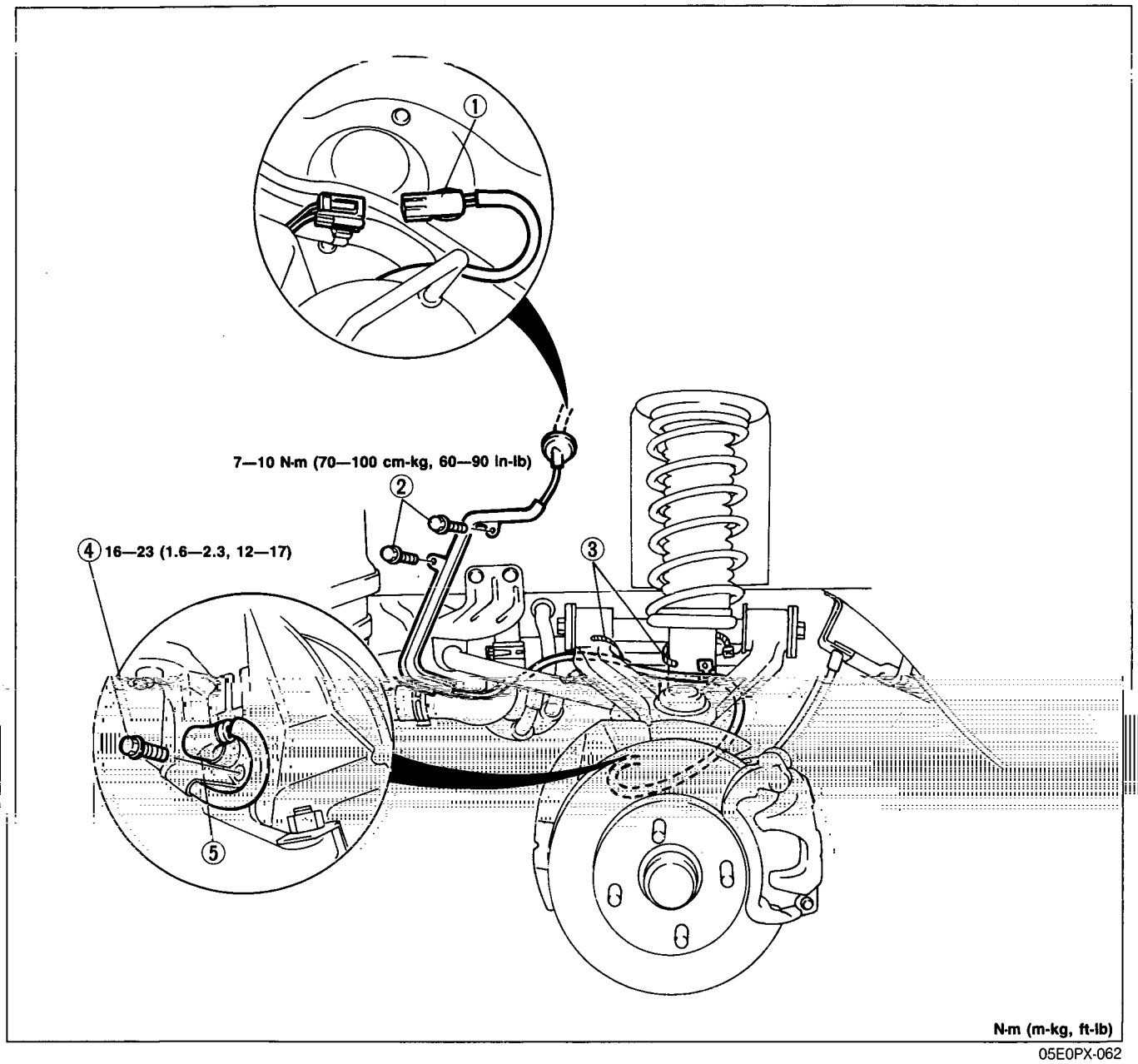
○—○: Indicates continuity

4. If continuity is not as specified, replace the valve relay.

ABS WHEEL SPEED SENSOR (FRONT)

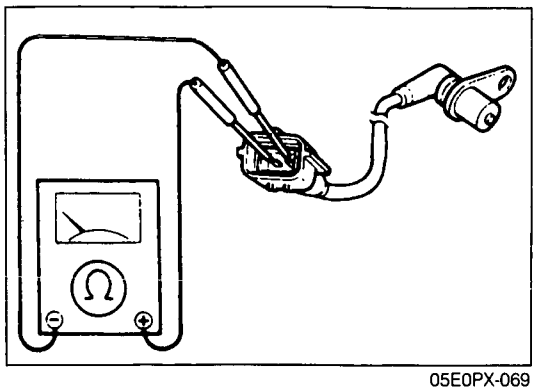
Removal / Inspection / Installation

1. Remove in the order shown in the figure.
2. Install in the reverse order of removal.



05E0PX-062

1. Connector
2. Bolts
3. Band
4. Bolt
5. ABS wheel speed sensor
   Inspection..... below



05E0PX-069

Inspection

ABS wheel speed sensor

1. Measure resistance between terminals of the wheel speed sensor.

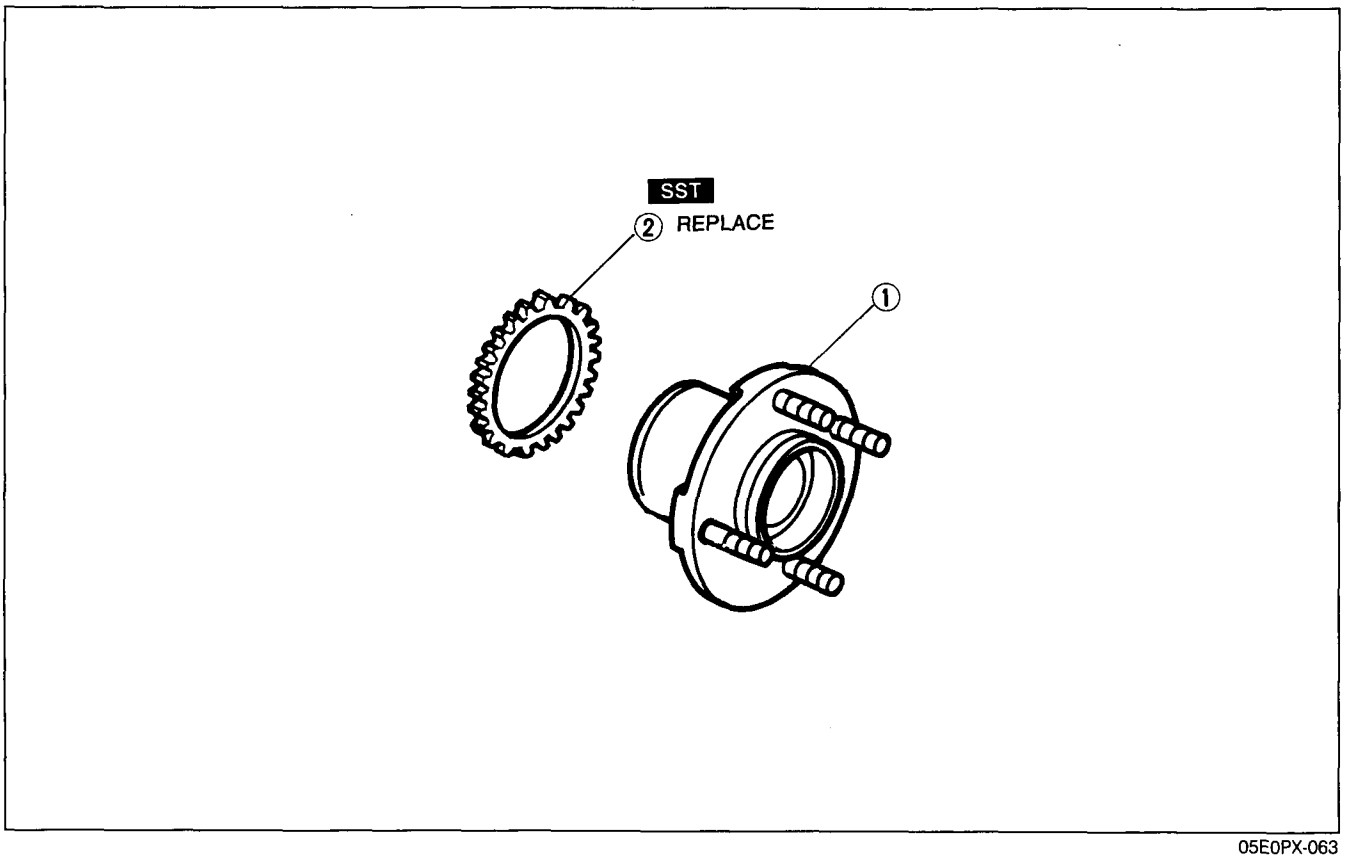
   Resistance: 1.1 kΩ ± 0.1 kΩ

2. If not as specified, replace the wheel speed sensor.

ABS SENSOR ROTOR (FRONT)

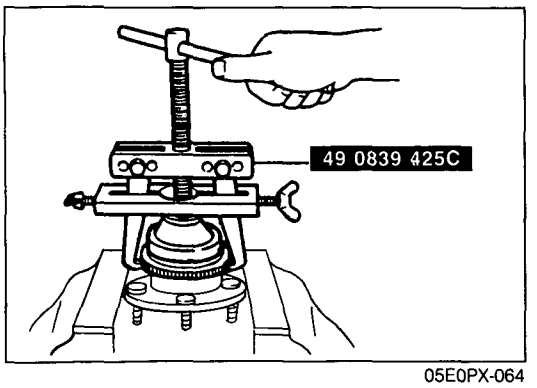
Removal / Inspection / Installation

1. Inspect the ABS sensor rotor for missing and damaged teeth.
2. Remove in the order shown in the figure, referring to **Removal Note**.
3. Install in the reverse order of removal, referring to **Installation Note**.

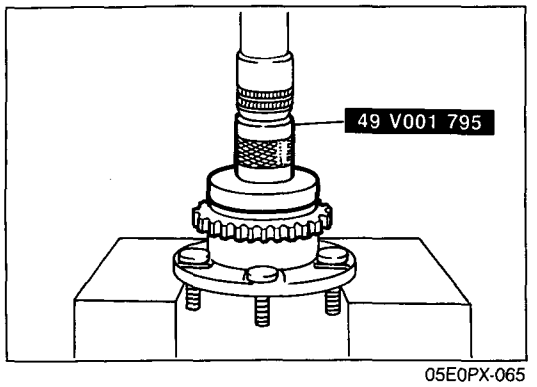


05E0PX-063

1. Wheel hub
   Removal / Installation ..... section M
2. ABS sensor rotor
   Removal note ..... below
   Installation note ..... below



05E0PX-064



05E0PX-065

Removal note
ABS sensor rotor

1. Remove the sensor rotor from the wheel hub with the **SST**.

Installation note
ABS sensor rotor

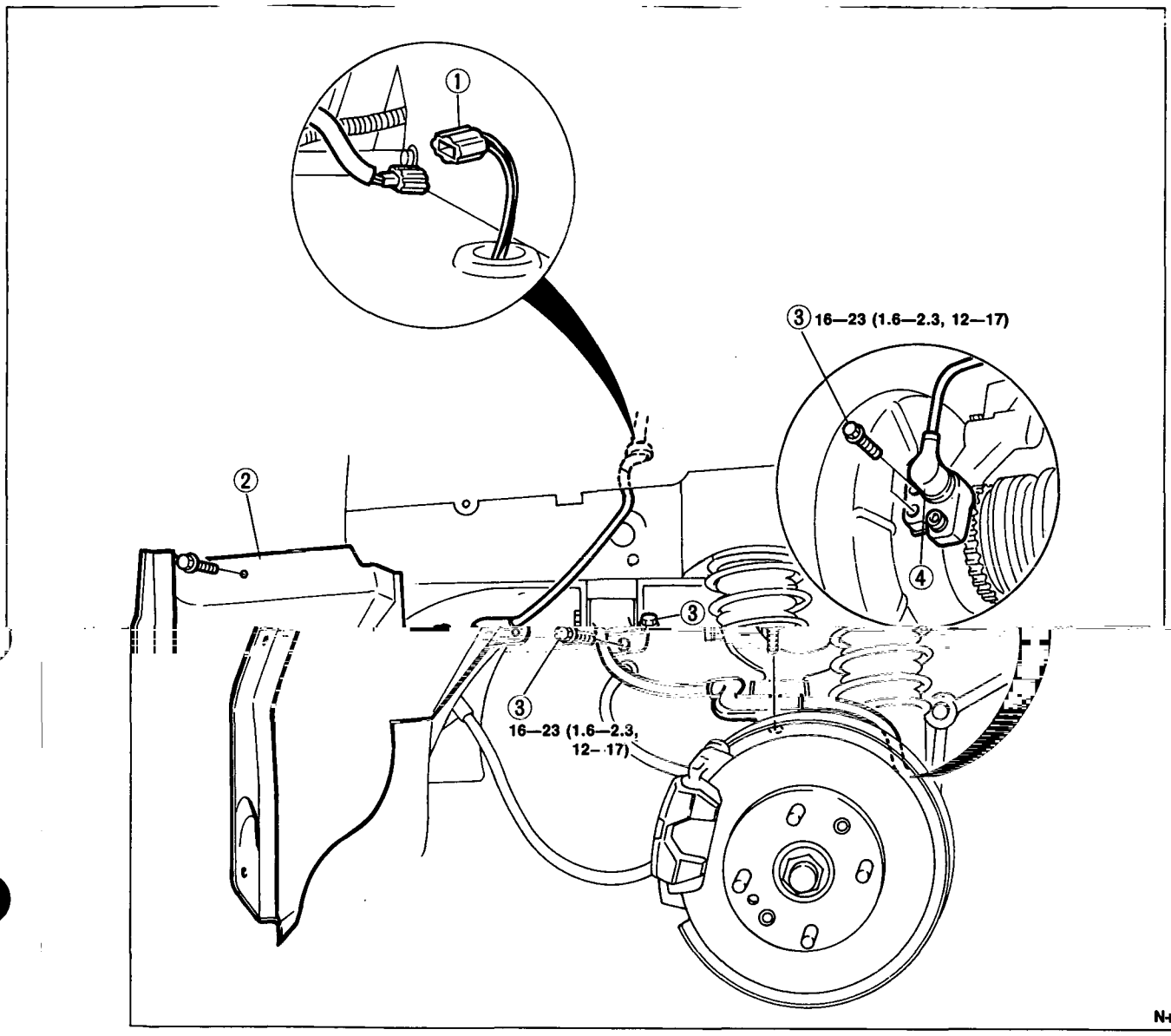
Caution
- **Install the rotor with chamfered edge toward the wheel hub.**

1. Press a new sensor rotor onto the wheel hub with the **SST**.

ABS WHEEL SPEED SENSOR (REAR)

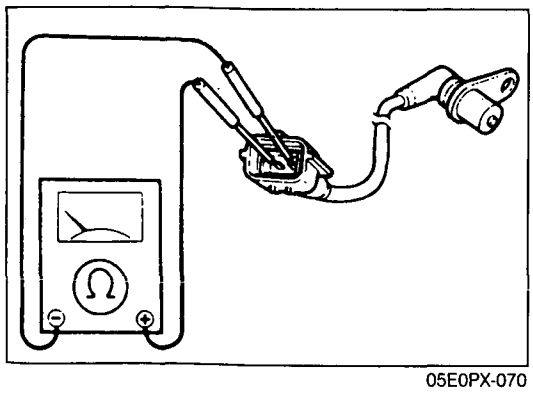
Removal / Installation

1. Remove the filler pipe protector (left side).
2. Remove the spare tire (right side)
3. Remove in the order shown in the figure.
4. Install in the reverse order of removal.



1. Connector
2. Mud guard
3. Bolts
4. ABS wheel speed sensor

Inspection..... belo



05E0PX-070

Inspection

ABS wheel speed sensor

1. Measure resistance between terminals of the wheel spee sensor.

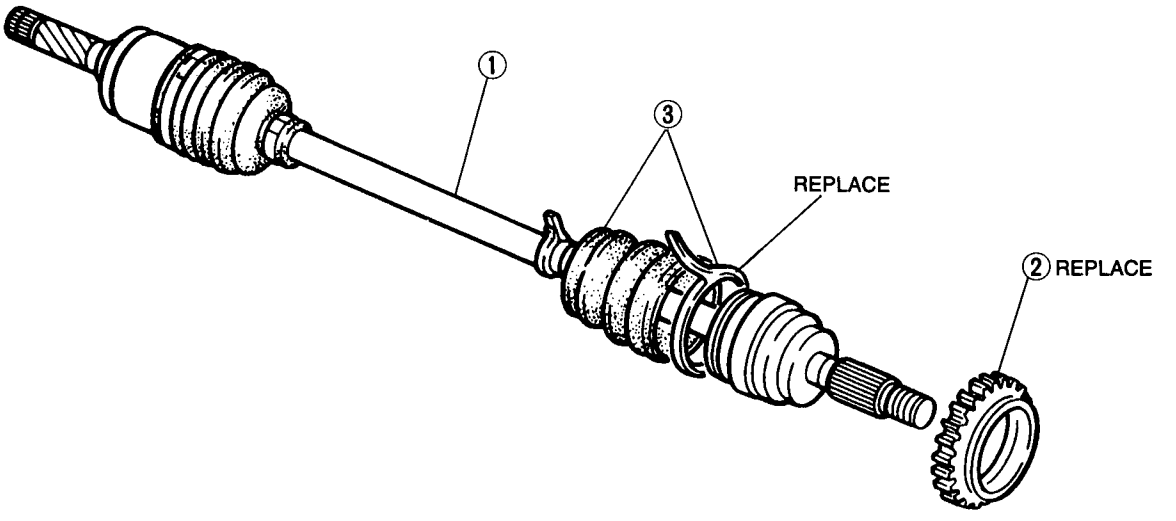
   Resistance: 1.1 kΩ ± 0.1 kΩ

2. If not as specified, replace the wheel speed sensor.

ABS SENSOR ROTOR (REAR)

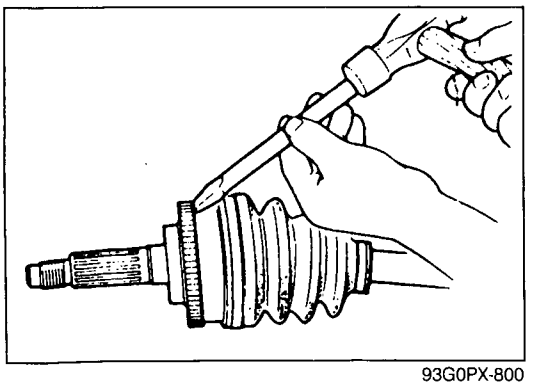
Removal / Inspection

1. Inspect the ABS sensor rotor for missing and damaged teeth.
2. Remove in the order shown in the figure, referring to **Removal Note**.



05E0PX-067

1. Driveshaft
2. Sensor rotor
   Removal note ..... below
3. Boot band and boot



93G0PX-800

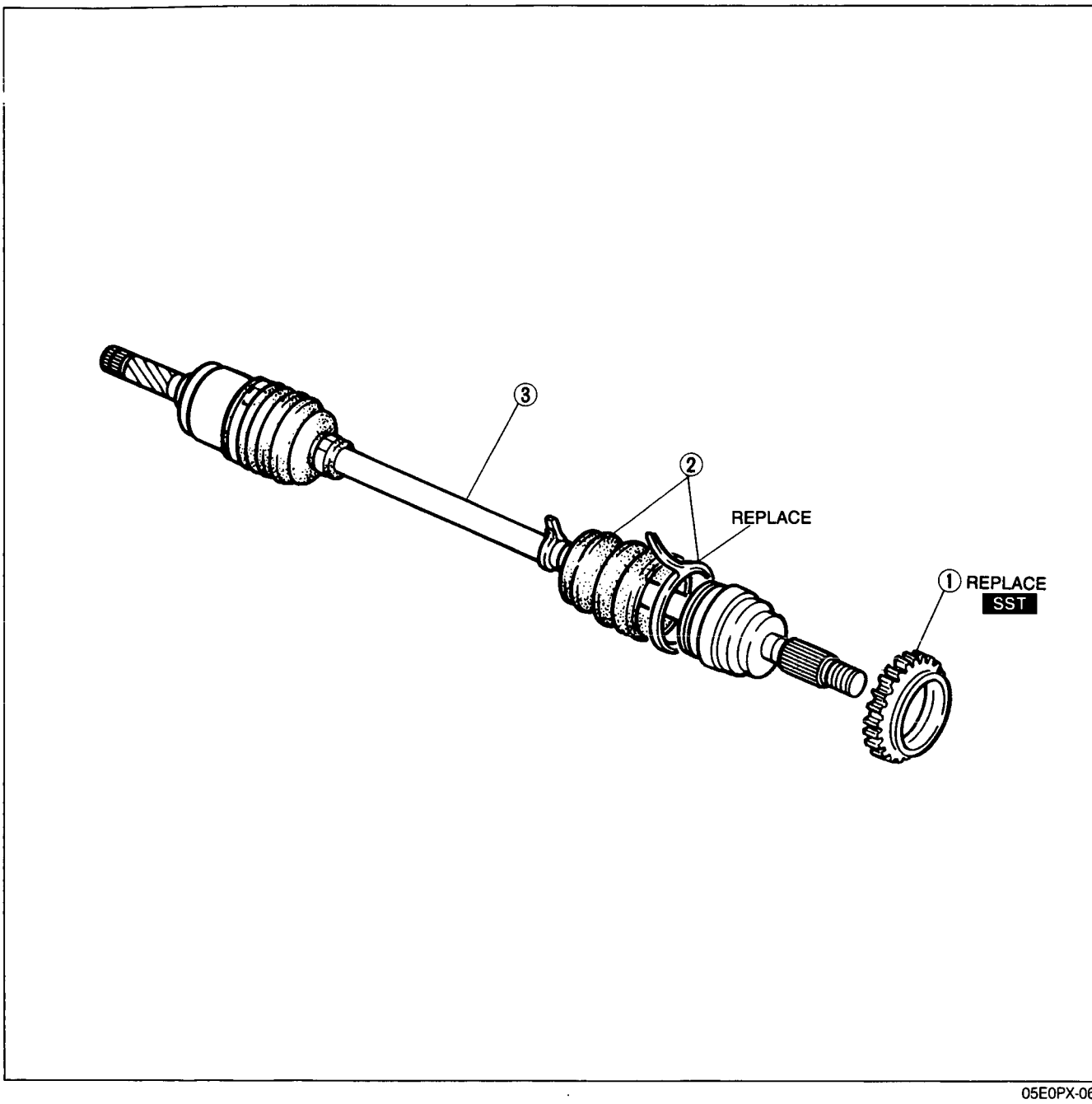
Removal note
Sensor rotor

1. Tap the sensor rotor off the driveshaft with a chisel.

Caution
- **Do not reuse the sensor rotor.**

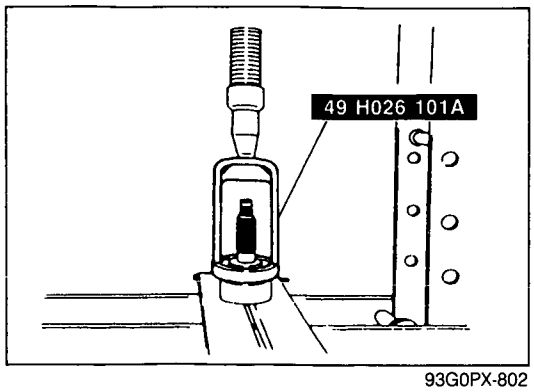
Installation

1. Install in the order shown in the figure, referring to **Installation Note**.



05E0PX-06

1. Sensor rotor
   Installation note ..... below
2. Boot and boot band
3. Driveshaft



93G0PX-802

Installation note

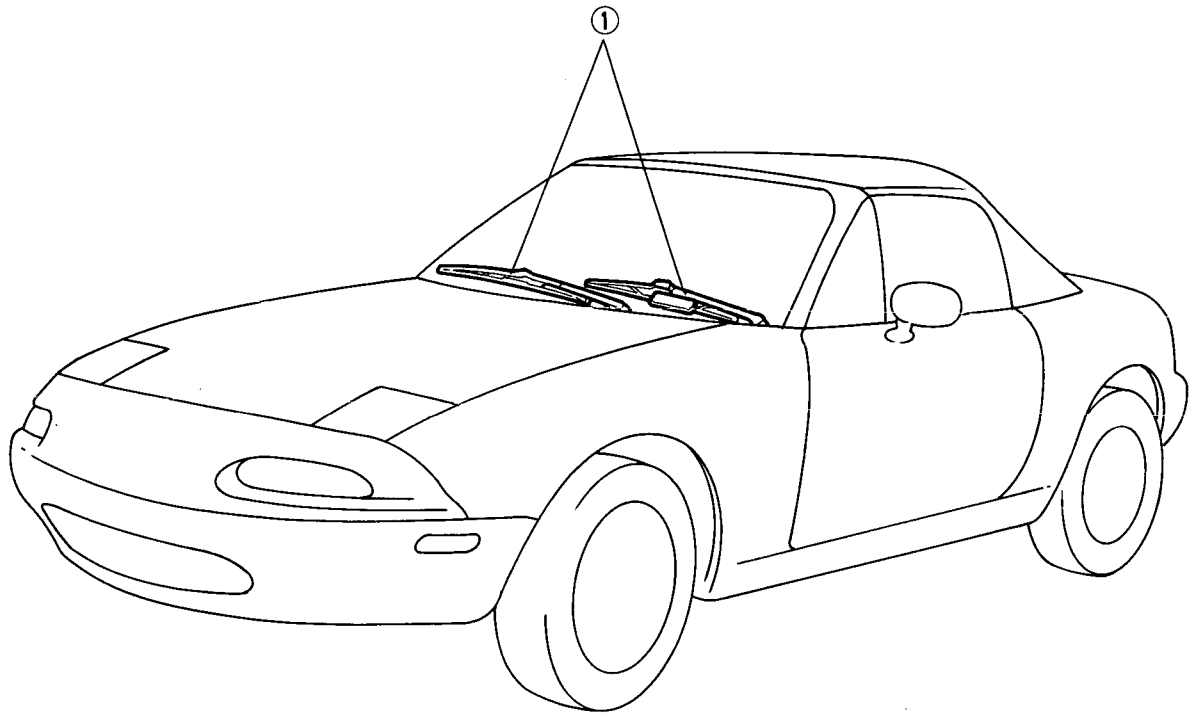
ABS sensor rotor

1. Set a new sensor rotor on the driveshaft and press it on wit
   the **SST**.

BODY

05E0SX-001

INDEX



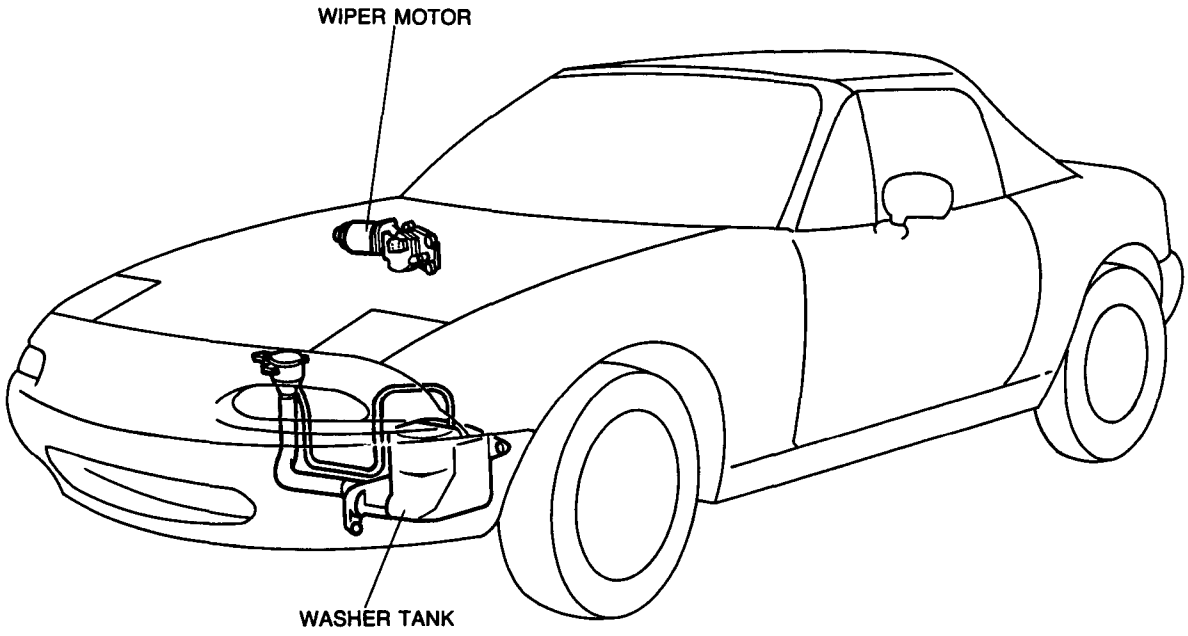
05E0SX-002

1. Windshield wiper and washer
   Removal / Installation ..... page S–4

OUTLINE

OUTLINE OF CONSTRUCTION

The washer tank and wiper motor are changed.



05E0SX-003

SUPPLEMENTAL SERVICE INFORMATION

The following point in this section is changed MX-5 Workshop Manual (1221-10-89I).

Washer tank
- Removal / Installation procedure

Wiper motor
- Removal / Installation procedure

05E0SX-004

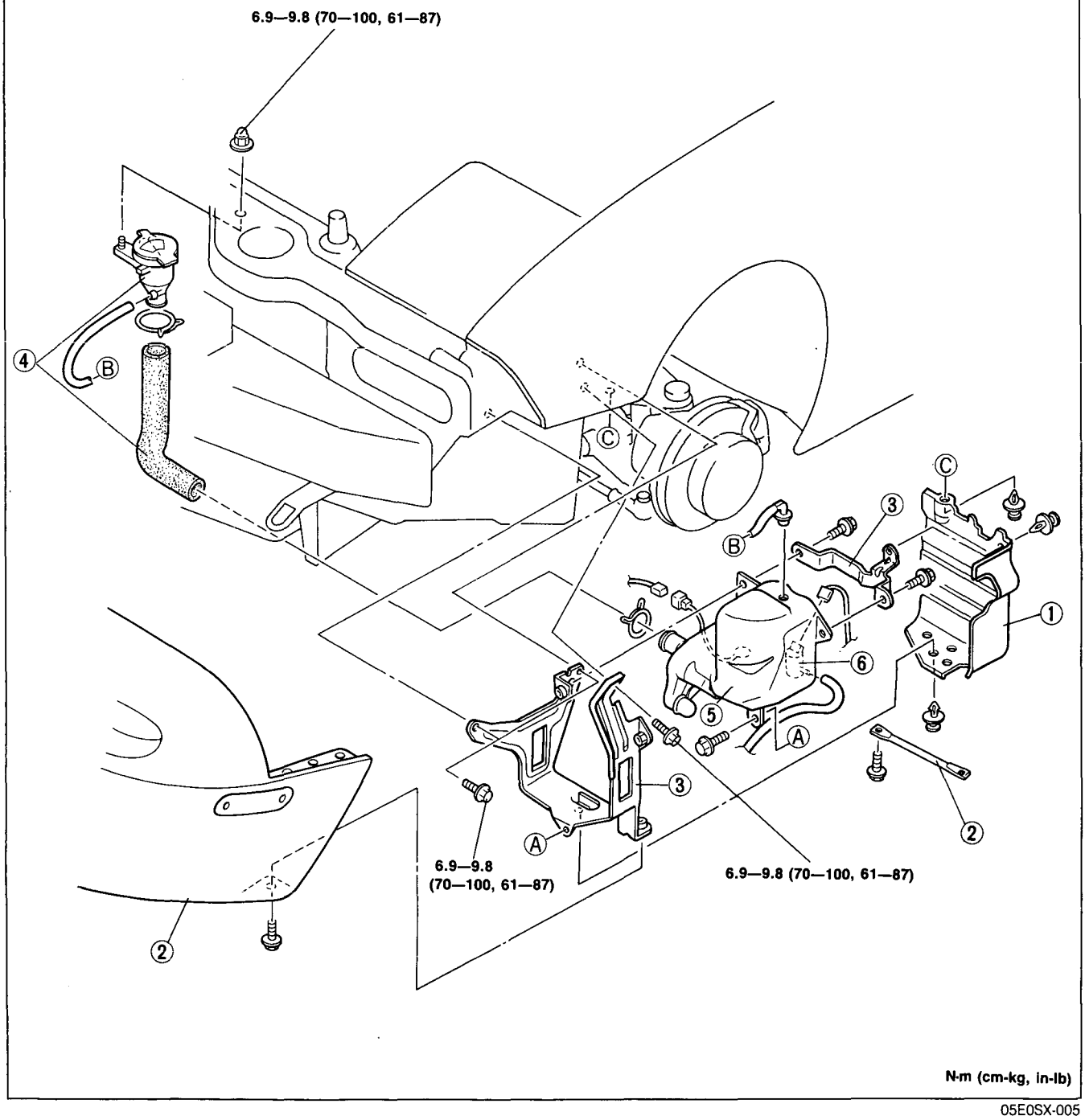
WINDSHIELD WIPER AND WASHER

COMPONENTS

Removal / Installation

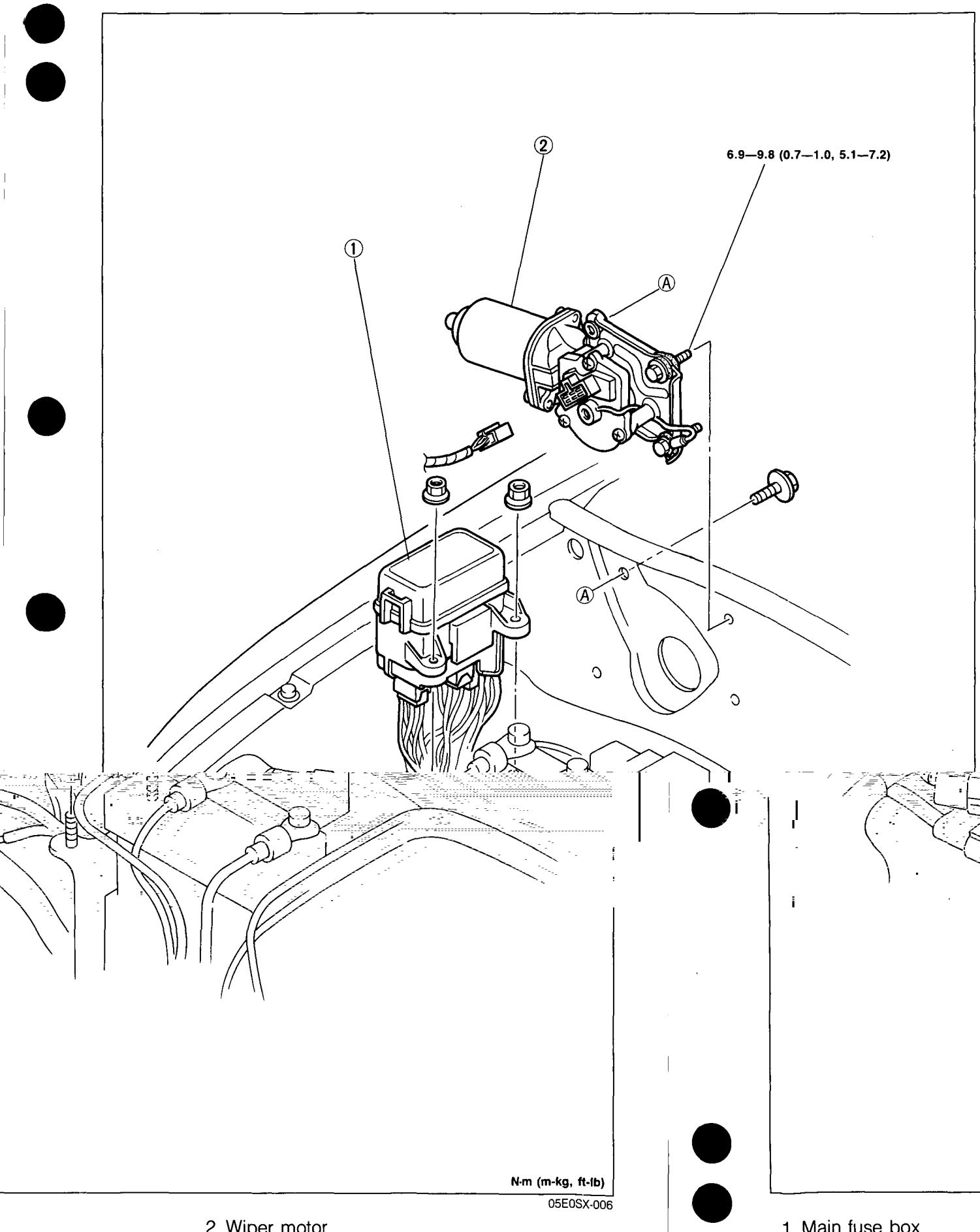
1. Disconnect the negative battery cable.
2. Remove in the order shown in the figure.
3. Install in the reverse order of removal.

WITH ABS



05E0SX-005

1. Washer tank cover
2. Front bumper and bracket
3. Tank bracket
4. Washer tank hose
5. Washer tank
6. Washer motor



2. Wiper motor

1. Main fuse box

BODY ELECTRICAL SYSTEM

05E0TX-001

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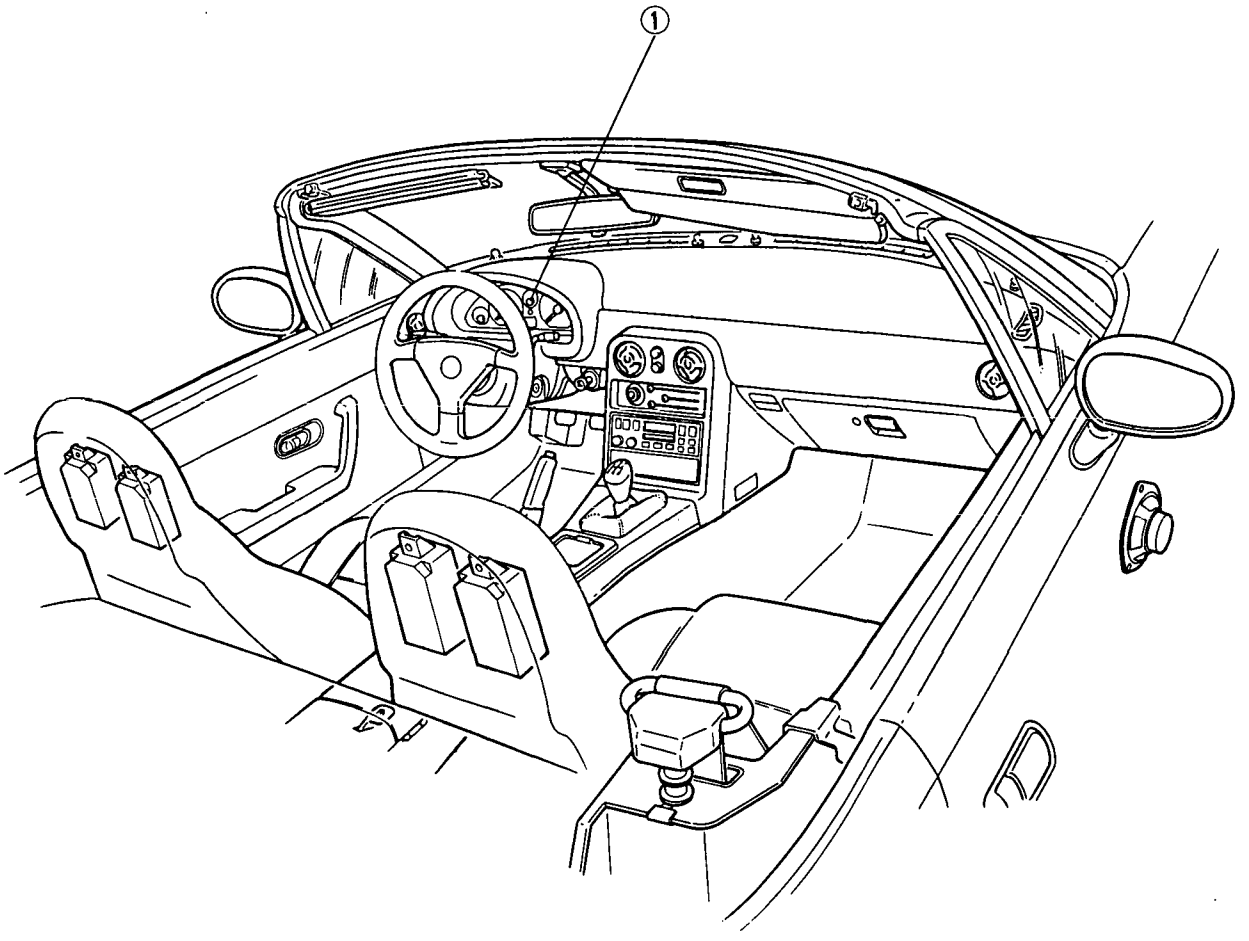


05E0TX-002

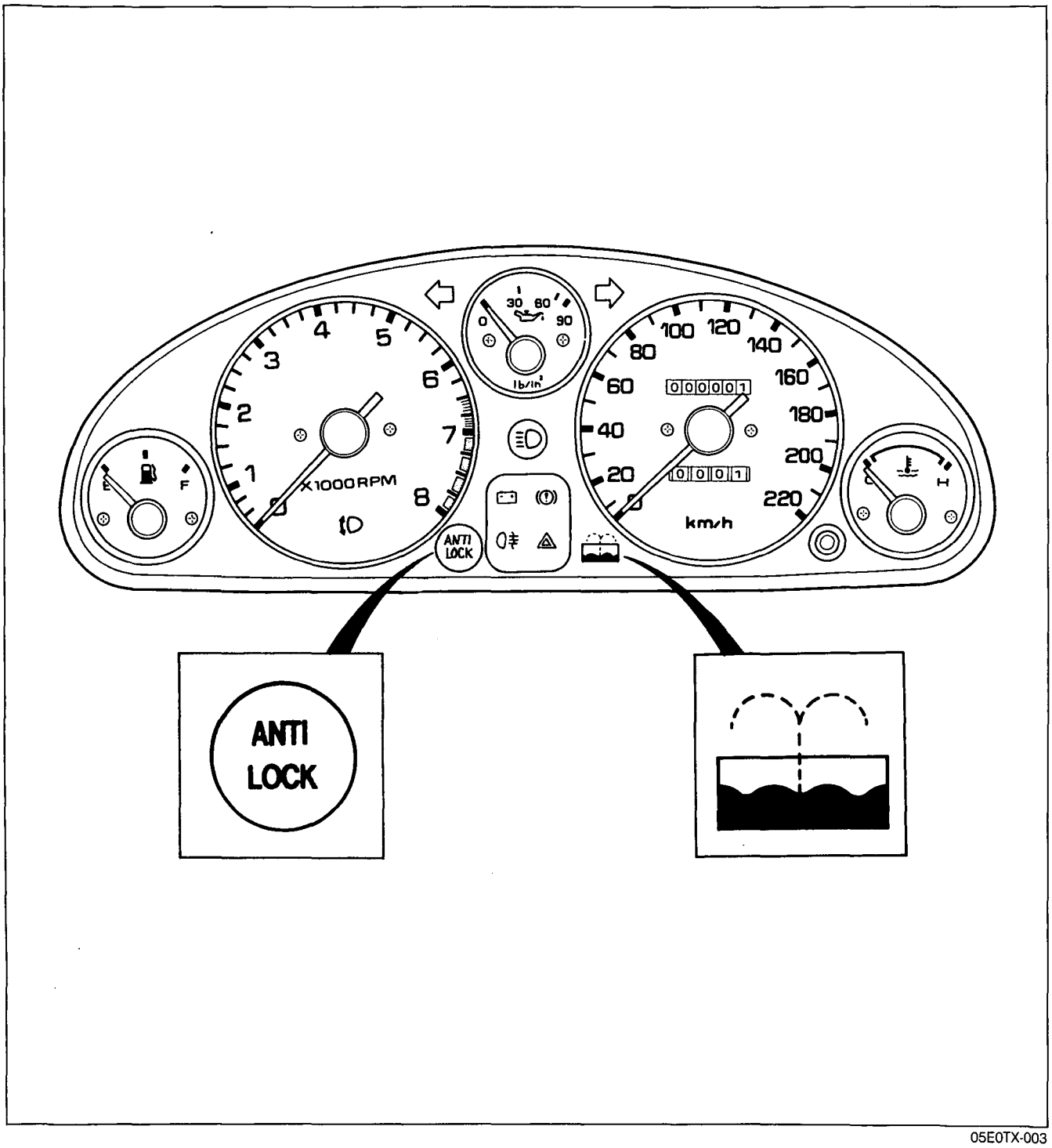
1. Instrument cluster
   Inspection ..... page T–4

OUTLINE

OUTLINE OF CONSTRUCTION

The Anti-lock warning lamp and the washer fluid level indicator lamp are newly equipped in the instrument cluster.

INSTRUMENT CLUSTER



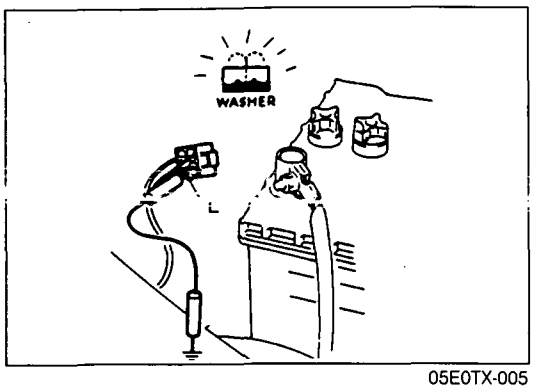
05E0TX-003

SUPPLEMENTAL SERVICE INFORMATION

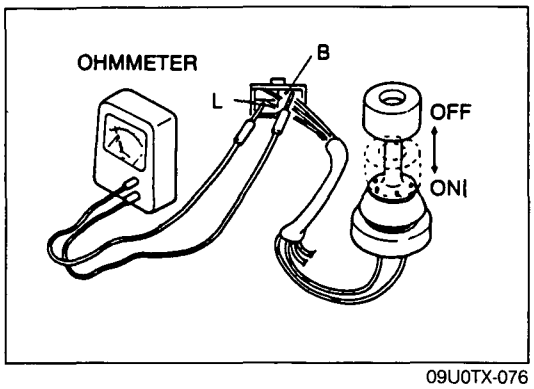
The following point in this section is changed MX-5 Workshop Manual (1221-10-89I).

Instrument cluster

- Inspection



05E0TX-005



09U0TX-076

INSTRUMENT CLUSTER

INSPECTION

Washer Fluid Level Indicator

1. Disconnect the connector from the washer fluid level sensor.
2. Jump terminal-wire (L) (harness side) to a body ground.
3. Start the engine and check that the WASHER indicator illuminates.
4. If there is no illumination, check the bulb, wiring harness, and sensor. Replace or repair as necessary.

Washer Fluid Level Sensor

1. Connect the sensor connector (sensor side) to an ohmmeter.
2. Move the sensor float up and down.
3. Verify that there is continuity when the float is at the lowest point.

TECHNICAL DATA

05ETDX-001

A. MEASUREMENTS

Item			Measurements
Overall length		mm (in)	3,948 (155.4)
Overall width		mm (in)	1,676 (65.9)
Overall height		mm (in)	1,224 (48.2)
Wheelbase		mm (in)	2,266 (89.2)
Tread	Front	mm (in)	1,410 (55.5)
	Rear	mm (in)	1,428 (56.2)

B. ENGINE

Item \ Engine			B6 DOHC
Type			Gasoline, 4-cycle
Cylinder arrangement and number			In-line, 4-cylinders
Combustion chamber			Pentroof
Valve system			DOHC, belt-driven 16 valves
Bore x Stroke		mm (in)	78.0 x 83.6 (3.07 x 3.29)
Total piston displacement		cc (cu in)	1,597 (97.42)
Compression ratio			9.4
Compression pressure kPa (kg/cm^2, psi)-rpm	Standard		1,324 (13.5, 192)-300
	Minimum		932 (9.5, 135)-300
	Maximum difference between each cylinder		196 (2.0, 28)
Valve timing	IN	Open BTDC	5°
		Close ABDC	51°
	EX	Open BBDC	53°
		Close ATDC	15°
Valve clearance		IN	0: Maintenance-free
	mm (in)	EX	0: Maintenance-free
Cylinder head			
Height		mm (in)	133.8—134.0 (5.268—5.276)
Distortion		mm (in)	0.15 (0.006) max.
Grinding		mm (in)	0.20 (0.008) max.
Cylinder head-to-HLA clearance		Standard	0.025—0.066 (0.0010—0.0026)
	mm (in)	Maximum	0.18 (0.0071)
Valve and valve guide			
Valve head diameter		IN	30.9—31.1 (1.217—1.224)
	mm (in)	EX	26.1—26.3 (1.028—1.035)
Valve head margin thickness		IN	1.0 (0.039)
	mm (in)	EX	1.0 (0.039)
Valve face angle		IN	45°
		EX	45°
Valve length mm (in)	IN	Standard	105.29 (4.1452)
		Minimum	104.79 (4.1256)
	EX	Standard	105.39 (4.1492)
		Minimum	104.89 (4.1295)
Valve stem diameter		IN	5.970—5.985 (0.2350—0.2356)
	mm (in)	EX	5.965—5.980 (0.2348—0.2354)
Guide inner diameter		mm (in)	6.01—6.03 (0.2366—0.2374)

Item			Engine	B6 DOHC
Seat contact width			mm (in)	0.8—1.4 (0.031—0.055)
Seat sinking			mm (in)	Standard: 43.5 (1.713) / Maximum: 45.0 (1.772)
Valve spring				
Free length	mm (in)	IN	Standard	48.0 (1.890)
			Minimum	47.0 (1.850)
		EX	Standard	48.3 (1.902)
			Minimum	47.3 (1.862)
Out-of-square			mm (in)	IN: 1.68 (0.0661) max. / EX: 1.69 (0.0665) max.
Setting load/height			N (kg, lb)/mm (in)	IN: 217—246 (22.1—25.1, 48.6—55.2)/40.0 (1.575) / EX: 174—196 (17.7—20.0, 38.9—44.0)/40.0 (1.575)
Camshaft				
Cam height	mm (in)	IN	Standard	40.888 (1.6098)
			Minimum	40.688 (1.6019)
		EX	Standard	40.889 (1.6098)
			Minimum	40.689 (1.6019)
Journal diameter			mm (in)	Standard (No.1—No.5): 25.940—25.965 (1.0213—1.0222) / Out-of-round: 0.05 (0.002) max.
Camshaft bearing oil clearance			mm (in)	Standard (No.1—No.5): 0.035—0.081 (0.0014—0.0032) / Maximum: 0.15 (0.006)
Camshaft runout			mm (in)	0.03 (0.0012) max.
Camshaft end-play			mm (in)	Standard: 0.07—0.19 (0.0028—0.0075) / Maximum: 0.20 (0.008)
Cylinder block				
Height			mm (in)	221.5 (8.720)
Distortion			mm (in)	0.15 (0.006) max.
Grinding			mm (in)	0.20 (0.008) max.
Cylinder bore diameter			mm (in)	Standard size: 78.006—78.013 (3.0711—3.0714) / 0.25 (0.010) oversize: 78.256—78.263 (3.0809—3.0812) / 0.50 (0.020) oversize: 78.506—78.513 (3.0908—3.0911)
Cylinder bore taper and out-of-round			mm (in)	0.019 (0.0007) max.
Piston				
Piston diameter Measured at 90° to pin bore axis and 16.5mm (0.650 in) below oil ring groove			mm (in)	Standard size: 77.954—77.974 (3.0690—3.0698) / 0.25 (0.010) oversize: 78.211—78.217 (3.0792—3.0794) / 0.50 (0.020) oversize: 78.461—78.467 (3.0890—3.0892)
Piston-to-cylinder clearance			mm (in)	Standard: 0.039—0.052 (0.0015—0.0020) / Maximum: 0.15 (0.006)
Piston ring				
Thickness			mm (in)	Top: 1.465—1.480 (0.0577—0.0583) / Second: 1.47—1.49 (0.0579—0.0587)
End gap (Measured in cylinder)			mm (in)	Top: 0.15—0.30 (0.006—0.012) / Second: 0.15—0.30 (0.006—0.012) / Oil (rail): 0.20—0.70 (0.008—0.028) / Maximum: 1.0 (0.039)
Ring groove width in piston			mm (in)	Top: 1.520—1.535 (0.0598—0.0604) / Second: 1.52—1.54 (0.0598—0.0606) / Oil: 4.02—4.04 (0.1583—0.1591)
Piston ring-to-ring groove clearance			mm (in)	Top: 0.04—0.07 (0.0016—0.0028) / Second: 0.03—0.07 (0.0012—0.0028) / Maximum: 0.15 (0.006)
Piston pin				
Diameter			mm (in)	19.987—19.993 (0.7869—0.7871)
Piston-to-piston pin clearance			mm (in)	−0.005—0.016 (−0.0002—0.0005)
Connecting rod bush-to-piston pin clearance			mm (in)	0.010—0.027 (0.0004—0.0011)

Item \ Engine			B6 DOHC
Connecting rod and connecting rod bearing			
Length (Center to center) mm (in)			132.85—132.95 (5.230—5.234)
Bending mm (in)			0.075 (0.0030) max./50 (1.97)
Small end bore (Bush inner diameter) mm (in)			20.003—20.014 (0.7875—0.7880)
Big end bore mm (in)			48.000—48.016 (1.8898—1.8904)
Big end width mm (in)			21.838—21.890 (0.8598—0.8618)
Connecting rod side clearance mm (in)		Standard	0.110—0.262 (0.0043—0.0103)
		Maximum	0.30 (0.012)
Crankshaft			
Crankshaft runout mm (in)			0.04 (0.0016) max.
Main journal diameter mm (in)	Standard size	Standard	49.938—49.956 (1.9661—1.9668)
		Minimum	49.904 (1.9647)
	0.25 (0.010) undersize	Standard	49.704—49.708 (1.9568—1.9570)
		Minimum	49.652 (1.9548)
	0.50 (0.020) undersize	Standard	49.454—49.458 (1.9470—1.9472)
		Minimum	49.402 (1.9450)
	0.75 (0.030) undersize	Standard	49.204—49.208 (1.9372—1.9373)
		Minimum	49.152 (1.9351)
Main journal taper and out-of-round mm (in)			0.05 (0.0020) max.
Crankpin diameter mm (in)	Standard size	Standard	44.940—44.956 (1.7693—1.7699)
		Minimum	44.908 (1.7680)
	0.25 (0.010) undersize	Standard	44.690—44.706 (1.7594—1.7601)
		Minimum	44.658 (1.7582)
	0.50 (0.020) undersize	Standard	44.440—44.456 (1.7496—1.7502)
		Minimum	44.408 (1.7483)
	0.75 (0.030) undersize	Standard	44.190—44.206 (1.7398—1.7404)
		Minimum	44.158 (1.7385)
Crankpin taper and out-of-round mm (in)			0.05 (0.0020) max.
Main bearing			
Main journal bearing oil clearance mm (in)		Standard	0.018—0.036 (0.0007—0.0014)
		Maximum	0.10 (0.004)
Available undersize bearing mm (in)			0.25 (0.010), 0.50 (0.020), 0.75 (0.030)
Crankpin bearing			
Crankpin bearing oil clearance mm (in)		Standard	0.028—0.068 (0.0011—0.0027)
		Maximum	0.10 (0.004)
Available undersize bearing mm (in)			0.25 (0.010), 0.50 (0.020), 0.75 (0.030)
Thrust bearing			
Crankshaft end play mm (in)		Standard	0.080—0.282 (0.0031—0.0111)
		Maximum	0.30 (0.012)
Bearing width mm (in)	Standard size		2.500—2.550 (0.0984—0.1004)
	0.25 (0.010) oversize		2.625—2.675 (0.1033—0.1053)
	0.50 (0.020) oversize		2.750—2.800 (0.1083—0.1102)
	0.75 (0.030) oversize		2.875—2.925 (0.1132—0.1152)
Timing belt			
Belt deflection mm (in)/98 N (10 kg, 22 lb)			9.0—11.5 (0.35—0.45)

D. LUBRICATION SYSTEM

Item \ Engine			B6 DOHC
Lubricating method			Force-fed
Oil pump			
Type			Trochoid gear
Relief pressure kPa (kg/cm², psi)			343—441 (3.5—4.5, 50—64)
Oil pressure kPa (kg/cm², psi)		1,000 rpm	196—294 (2.0—3.0, 28—43)
		3,000 rpm	294—392 (3.0—4.0, 43—57)

Item	Engine	B6 DOHC
Inner rotor tooth tip to outer rotor clearance mm (in)	Standard	0.02—0.16 (0.0008—0.0063)
	Maximum	0.20 (0.0079)
Outer rotor to body clearance mm (in)	Standard	0.09—0.18 (0.0035—0.0071)
	Maximum	0.22 (0.0087)
Side clearance mm (in)	Standard	0.03—0.11 (0.0012—0.0043)
	Maximum	0.14 (0.0055)
Oil filter		
Type		Full-flow, paper element
Relief pressure differential kPa (kg/cm², psi)		78—118 (0.8—1.2, 11—17)
Engine oil		
Capacity liters (US qt, Imp qt)	Total (dry engine)	3.6 (3.8, 3.2)
	Oil pan	3.2 (3.4, 2.8)
	Oil filter	0.17 (0.18, 0.15)
Grade		API Service SF or SG
Viscosity number	Above 30°C (86°F)	SAE 40
	0°C—40°C (32°F—104°F)	SAE 30
	−10°C—20°C (14°F—68°F)	SAE 20W-20
	Above −10°C (14°F)	SAE 20W-40 or 20W-50
	−25°C—30°C (−13°F—86°F)	SAE 10W-30
	Above −25°C (−13°F)	SAE 10W-40 or 10W-50
	Below 0°C (32°F)	SAE 5W-30
	Below −20°C (−4°F)	SAE 5W-20

E. COOLING SYSTEM

Item	Engine	B6 DOHC
Cooling method		Water-cooled, forced circulation
Water pump		
Type		Centrifugal, V-belt driven
Impeller diameter mm (in)		75 (2.95)
Number of impeller blades		6
Speed ratio		1 : 1.05
Water seal type		Unified mechanical seal
Thermostat		
Type		Wax
Opening temperature °C (°F)		80.5—83.5 (177—182)
Full-open temperature °C (°F)		95 (203)
Full-open lift mm (in)		8.5 (0.33) min.
Radiator		
Type		Corrugated fin
Cap valve opening pressure kPa (kg/cm², psi)		74—103 (0.75—1.05, 11—15)
Cooling circuit checking pressure kPa (kg/cm², psi)		103 (1.05, 15)
Cooling fan		
Type		Electric
Number of blades		5
Outer diameter mm (in)		320 (12.6)
Switching temperature OFF → ON °C (°F)		97 (207)
Capacity W-V		70-12
Current A		5.3—6.5
Coolant		
Capacity liters (US qt, Imp qt)		6.0 (6.3, 5.3)

Item \ Engine		B6 DOHC		
	Coolant protection	Volume percentage %		Specific gravity at 20°C (68°F)
		Water	Coolant	
Antifreeze solution	Above −16°C (3°F)	65	35	1.054
	Above −26°C (−15°F)	55	45	1.066
	Above −40°C (−40°F)	45	55	1.078

F. FUEL AND EMISSION CONTROL SYSTEMS

Item			Specification
Idle speed	rpm		850 ± 50*
Ignition timing	BTDC		10° ± 1°*
Throttle body			
Type			Horizontal draft
Throat diameter	mm (in)		55 (2.2)
Dashpot			
Adjustment speed	rpm		2,500 ± 150
Airflow meter			
Resistance Ω	E_2 ↔ Vs	Fully closed	200—600
		Fully open	20—1,000
	E_2 ↔ Vc		200—400
	E_2 ↔ THA_A (Intake air thermosensor)	−20°C (−4°F)	13,600—18,400
		20°C (68°F)	2,210—2,690
		60°C (140°F)	493—667
	E_1 ↔ Fc	Fully closed	∞
		Fully open	0
Fuel pump			
Type			Impeller (in-tank)
Output pressure	kPa (kg/cm², psi)		441—589 (4.5—6.0, 64—85)
Fuel filter			
Type	Low-pressure side		Nylon element
	High-pressure side		Paper element
Pressure regulator			
Type			Diaphragm
Regulating pressure	kPa (kg/cm², psi)		265—314 (2.7—3.2, 38—46)
Injector			
Type			High-ohmic
Type of drive			Voltage
Resistance	Ω		12—16 (at 20°C, 68°F)
ISC valve (Solenoid valve [Idle speed control])			
Solenoid resistance	Ω		11—13 (at 20°C, 68°F)
Circuit opening relay			
Resistance	Ω	STA — E_1	21—43
		B — Fc	109—226
		B — F_P	∞
Solenoid valve (Purge control)			
Solenoid resistance	Ω		23—27 (at 20°C, 68°F)
Crank angle sensor			
Type			Optical pickup
Water thermosensor			
Resistance	kΩ	−20°C (−4°F)	14.6—17.8
		20°C (68°F)	2.2—2.7
		80°C (176°F)	0.29—0.35
Air valve			
Opening temperature	°C (°F)		Below 40 (104)
Fuel tank			
Capacity	liters (US gal, Imp gal)		45 (11.9, 9.9)

*....TEN terminal in diagnosis connector grounded.

Item	Specification
Air cleaner	
Element type	Oil permeated
Accelerator cable	
Free play mm (in)	1—3 (0.039—0.118)
Fuel	
Specification	Unleaded regular (RON 90 or higher)

G. ENGINE ELECTRICAL SYSTEM

Item \ Engine			B6 DOHC
Battery	Voltage V		12, Negative ground
	Type and capacity (5-hour rate)		S46A24L(S) (32Ah) Maintenance-free
Dark current*	mA		20.0
Alternator	Type		A.C.
	Output V-A		12-60
	Regulator type		Transistorized (built-in IC regulator)
	Regulated voltage		14.1—14.7
	Brush length mm (in)	Standard	21.5 (0.85)
		Minimum	8 (0.31)
	Drive belt tension mm (in)	New	8—9 (0.31—0.35)
		Used	9—10 (0.35—0.39)
Starter	Type		Conventional
	Output V-kW		12-0.95 (Others)
	Brush length mm (in)	Standard	17.0 (0.67)
		Minimum	11.5 (0.45)
Ignition system	Type		Electronic spark advance (ESA)
	Spark advance control		Engine control unit controls sparks advance
Ignition timing	BTDC		10° ± 1° (Test connector grounded)
Ignition coil	Type		Molded
	Primary coil winding kΩ		0.78—0.94
	Secondary coil winding kΩ		11.2—15.2
Spark plug	Type		NGK: BKR5E-11 (Standard), BKR6E-11, BKR7E-11 / Nippon Denso: K16PR-U11, K20PR-U11 (Standard), K22PR-U11
	Plug gap mm (in)		1.0—1.1 (0.039—0.043)
	Firing order		1—3—4—2

* Dark current is the constant flow of current while the ignition switch is OFF.
(i.e. engine control unit, audio etc.)

H. CLUTCH

Item \ Engine		B6 DOHC
Clutch control		Hydraulic
Clutch pedal		
Type		Suspended
Pedal ratio		6.13
Full stroke mm (in)		120 (4.72)
Height (with carpet) mm (in)		175—185 (6.89—7.28)
Free play mm (in)		0.6—3.1 (0.02—0.12)
Distance to carpet when clutch fully disengaged mm (in)	Minimum	68 (2.68)
Flywheel		
Runout limit mm (in)		0.2 (0.008)
Clutch disc		
Type		Single dry plate

Item	Engine	B6 DOHC
Runout limit	mm (in)	0.7 (0.028)
Wear limit	mm (in)	0.3 (0.012) from rivet head
Outer diameter	mm (in)	200 (7.87)
Inner diameter	mm (in)	130 (5.12)
Facing thickness mm (in)	Flywheel side	3.5 (0.14)
	Pressure plate side	3.5 (0.14)
Clutch cover		
Type		Diaphragm spring
Set load	N (kg, lb)	4,022 (410, 902)

J. MANUAL TRANSMISSION

Item	Transmission		M-type (M5M-D)
Gear ratio	1st		3.136
	2nd		1.888
	3rd		1.330
	4th		1.000
	5th		0.814
	Reverse		3.758
Oil capacity	liters (US qt, Imp qt)		2.0 (2.1, 1.8)
Mainshaft	Runout mm (in)	Maximun	0.03 (0.0012)
	Clearance between mainshaft and gear (or bush) mm (in)	Wear limit	0.15 (0.006)
Reverse	Clearance between reverse idle gear bushing	Wear limit	0.15 (0.006)

mm (in)		
between shift tch sleeve mm (in)	Wear limit	0.5 (0.020)
between shift nd control lever mm (in)	Wear limit	0.8 (0.031)
between r ring and	Standard	1.5 (0.059)
	Wear limit	0.8 (0.032)

ree length	mm (in)	75 (2.953)
ree length	mm (in)	22.5 (0.886)
ree length	mm (in)	22.5 (0.886)
ree length	mm (in)	17.0 (0.669)
bove 10°C (50°F)		API Service GL-4 or GL-5 SAE 80W-90
ll seasons		API Service GL-4 or GL-5 SAE 75W-90

Idle gear	and shaft
Shift fork and rod	Clearance fork and cl
	Clearance rod gate ar
Synchronizer ring	Clearance synchroniz side of ge
Shift rod (5th/Reverse) spring	F
Detent ball spring (1st/2nd)	F
Detent ball spring (3rd/4th)	F
Detent ball spring (5th/Reverse)	F
Oil grade and viscosity	A
	A

SHAFT

Item		Specification
n-out	mm (in)	0.4 (0.016)

L. PROPELLER

Max. permissible ru

M. FRONT AND REAR AXLES

Item \ Transmission				M5M-D	
Front axle	Type			Double-wishbone	
	Bearing			Angular ball bearing	
	Wheel bearing play mm (in)	Maximum		0.05 (0.002)	
Rear axle	Type			Double-wishbone	
	Bearing			Angular ball bearing	
	Wheel bearing play mm (in)	Maximum		0.05 (0.002)	
Differential	Type			Standard	Viscous L.S.D.
	Reduction gear			Hypoid gear	
	Reduction ratio			4.300	
	Differential gear			Straight-bevel gear	
	Ring gear size mm (in)			162.16 (6.38)	
	Oil	Grade		API service GL-5	
		Viscosity		Above −18°C (0°F): SAE 90 Below −18°C (0°F): SAE 80W	
		Capacity liters (Us qt, Imp qt)		0.65 (0.69, 0.57)	
	Drive pinion preload (without oil seal) N·m (cm-kg, in-lb)			0.3—0.7 (3—7, 2.6—6.1)	
	Backlash mm (in)	Side gear and pinion gear		0—0.1 (0—0.004)	
		Final gear		0.09—0.11 (0.0035—0.0043)	
	Length (Pilot section to pilot section) mm (in)			150.20 $^{+0}_{-0.72}$ (5.913 $^{+0}_{-0.028}$)	

Viscous L.S.D.: Viscous Limited Slip Differential

N. STEERING SYSTEM

Item \ Type		Manual steering	Power steering
Steering wheel			
Outer diameter	mm (in)	370 (14.6)	
Free play	mm (in)	0—30 (0—1.18)	
Wheel effort	N (kg, lb)	4.9—29.4 (0.5—3.0, 1.1—6.6)	23.5—35.3 (2.4—3.6, 5.3—8.0)
Lock-to-lock	turns	3.36	2.8
Steering Shaft			
Shaft type		Collapsible, non-tilt	
Joint type		2-cross-joint	
Power steering system			
Power assist type		Engine speed sensing	
Gear type		Rack-and-pinion	
Gear ratio		∞ (infinite)	
Rack stroke	mm (in)	121.0 (4.76)	
Power steering fluid		ATF DEXRON-II or M-III	
Fluid capacity	liter (Us qt, Imp qt)	0.8 (0.85, 0.70)	
Fluid pressure	kPa (kg/cm², psi)	7,603—8,339 (77.5—85.0, 1,102—1,209)	

P. BRAKING SYSTEM

Item			Specifications
Brake pedal	Height (with carpet)	mm (in)	171—181 (6.73—7.13)
	Free play	mm (in)	4—7 (0.16—0.28)
	Reserve travel (without carpet, clearance when pedal is depressed at 589 N (60 kg, 132 lb))	mm (in)	95 (3.74)
Master cylinder	Type		Tandem
	Bore	mm (in)	22.22 (0.87)
	Fluid type		SAEJ1703 or FMVSS116, DOT-3

Item			Specifications
Front brake (Disc)	Type		Disc
	Thickness of pad mm (in)	Standard	9.5 (0.37)
		Limit	1.0 (0.04)
	Thickness of disc plate mm (in)	Standard	18.0 (0.71)
		Limit	16.0 (0.63)
	Disc plate runout	mm (in)	0.1 (0.004) max.
	Wheel cylinder bore	mm (in)	51.1 (2.01)
Rear brake (Disc)	Type		DISC
	Thickness of pad mm (in)	Standard	8.0 (0.31)
		Limit	1.0 (0.04)
	Thickness of disc plate mm (in)	Standard	9 (0.35)
		Limit	7 (0.28)
	Wheel cylinder bore	mm (in)	31.75 (1.25)
Parking brake	Lever notches [Pulled at 98 N (10 kg, 22 lb)]		5—7
Power brake unit	Type		Single diaphragm
	Diameter	mm (in)	214 (8.0)
	Push rod-to-piston clearance	mm (in)	When vacuum applied to the unit is approx. 500 mmHg (19.7 inHg) 0.1—0.4mm (0.004—0.015 in)
	Fluid pressure per treading force	kPa (kg/cm², psi)/N (kg, lb)	1,079—1,177 (11—12, 156—171)/196 (20, 44) at 0 mmHg (0 inHg) min. 5,199—5,494 (53—56, 754—796)/196 (20, 44) at 500 mmHg (19.7 inHg) min.
Rear wheel hydraulic control system	Type		PBV
	Bend portion (Rear brake pressure)	kPa (kg/cm², psi)	2,943 (30, 427)

Q. WHEELS AND TIRES

Item \ Type			Standard	Temporary spare
Wheel	Size		14 x 5 1/2-JJ	14 x 4T
	Offset	mm (in)	45 (1.77)	
	Pitch circle diameter	mm (in)	100 (3.94)	
	Material		Steel or aluminum alloy	Steel
Tire	Size		185/60R14 82H	T115/70D14
	Air pressure	kPa (kg/cm², psi)	179 (1.8, 26)	415 (4.2, 60)
Wheel and tire	Runout limit mm (in)	Horizontal	2.0 (0.079)	
		Vertical	1.5 (0.059)	
	Maximum unbalance (at rim edge)	g (oz)	10 (0.35)	

R. SUSPENSION

Item			Specifications
Front suspension			
Type			Double-wishbone
Stabilizer	Type		Torsion bar
	Diameter	mm (in)	19 (0.75)
Shock absorbers			Cylindrical double-acting, low-pressure gas charged
Coil springs	Identification color		Red
	Wire diameter	mm (in)	10.8 (0.43)
	Coil inner diameter	mm (in)	83 (3.27)
	Free length	mm (in)	282.5 (11.12)
	Coil number		5.91

Item			Specifications
Rear suspension			
Type			Double-wishbone
Stabilizer	Type		Torsion bar
	Diameter	mm (in)	12 (0.47)
Shock absorbers			Cylindrical double-acting, low-pressure gas charged
Coil springs	Identification color		Blue
	Wire diameter	mm (in)	10.1 (0.40)
	Coil inner diameter	mm (in)	83 (3.27)
	Free length	mm (in)	339.5 (13.37)
	Coil number		7.68
Wheel alignment			
Front wheel alignment (Unladed*1)	Total toe-in	mm (in)	3 ± 3 (0.12 ± 0.12)
		degree	0°18' ± 18'
	Maximum steering angle	Inner	37°23' ± 2°
		Outer	32°32' ± 2°
	Camber angle		0°24' ± 45'*2
	Caster angle		4°26' ± 45'*3
	King pin angle		11°20'
Rear wheel alignment (Unladed*1)	Total toe-in	mm (in)	3 ± 3 (0.12 ± 0.12)
		degree	0°18' ± 18'
	Camber angle		−0°43' ± 30'*2

*1 Fuel tank full, radiator coolant and engine oil at specified level, and spare tire, jack, and tools in designated position
*2 Difference between left and right must not exceed 1°.
*3 Difference between left and right must not exceed 1°30'.

T. BODY ELECTRICAL SYSTEM

Item	Wattage (Bulb trade number)
Instrument cluster lamps	
Beam	3.4
Turn (LH and RH)	3.4
Illumination	3.4
Brake	1.4
Charge	1.4
Hazard	1.4
Rear fog	1.4
Retractor	1.4
Anti lock	1.4
Washer	1.4
Exterior lights	
Headlights	60/55
Front turn signal	21
Side turn signal lights	5
License plate lights	5
Rear turn signal lights	21
Stop/taillights	21/5
Back-up lights	21
High-mount stoplight	18.4
Interior lamps	5
Illumination lamps	
Ash tray	3.4
Heater control switch panel	1.4
Hazard switch	1.4

STANDARD BOLT AND NUT TIGHTENING TORQUE

Diameter mm (in)	Pitch mm (in)	4T			6T			8T		
		N·m	m-kg	ft-lb	N·m	m-kg	ft-lb	N·m	m-kg	ft-lb
6 (0.236)	1 (0.039)	4.2—6.2	0.43—0.63	3.1—4.6	6.9—9.8	0.7—1.0	5.0—7.2	7.8—11.8	0.8—1.2	5.8—8.8
8 (0.315)	1.25 (0.049)	9.8—14.7	1.0—1.5	7.2—10.8	16—23	1.6—2.3	12—17	18—26	1.8—2.7	13—20
10 (0.394)	1.25 (0.049)	20—28	2.0—2.9	14—21	31—40	3.2—4.7	23—34	36—54	3.7—5.5	27—40
12 (0.472)	1.5 (0.059)	34—50	3.5—5.1	25—37	55—80	5.6—8.2	41—59	63—93	6.4—9.5	46—69
14 (0.551)	1.5 (0.059)	—	—	—	75—103	7.7—10.5	56—76	102—137	10—14	75—101
16 (0.630)	1.5 (0.059)	—	—	—	116—157	12—16	85—116	156—211	16—22	115—156
18 (0.709)	1.5 (0.059)	—	—	—	167—225	17—23	123—166	221—299	23—31	163—221
20 (0.787)	1.5 (0.059)	—	—	—	231—314	24—32	171—231	308—417	31—43	227—307
22 (0.866)	1.5 (0.059)	—	—	—	314—423	32—43	231—312	417—564	43—58	307—416
24 (0.945)	1.5 (0.059)	—	—	—	475—546	41—56	298—403	536—726	55—74	396—536

SPECIAL TOOLS

05ESTX-001

dicate the degree of importance of each tool.

ble for performing operations satisfactorily, easily, safely, and
ervice shops have these tools.

ools ranked A, but all service shops should have them to per-

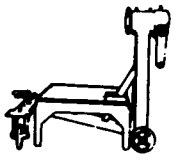
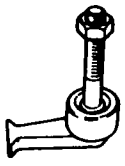
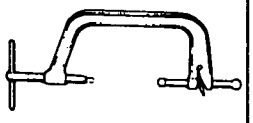
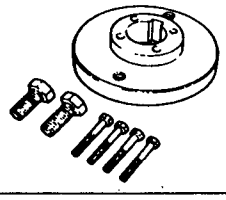
of several tools, check the List in the Parts Catalogue
t duplicated in other sets you may already have. If they
er only those new tools that are needed.

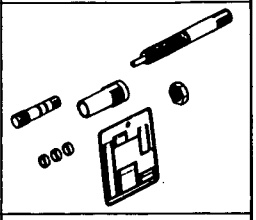
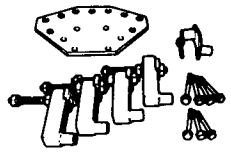
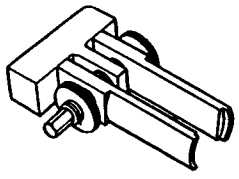
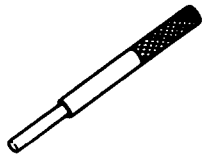
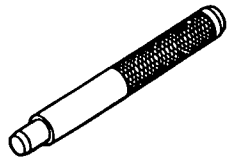
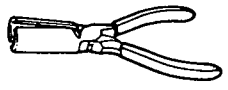
05USTX-002

The letters A and B in the priority column in
A.....Indispensable
The tools ranked A in this list are indispensab
efficiently. It is, therefore, advisable that all s
B.....Selective
The tools ranked B are not as necessary as to
form repairs more easily and efficiently.

Note
- **When ordering tool sets that consist to make sure that some tools are no are, instead of ordering the set, ord**

ENGINE

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0107 680A Engine stand	A	
49 E301 060 Brake, ring gear	A	
49 0636 100A Arm, valve spring lifter	A	
49 B011 102 Lock tool, crankshaft	A	
49 S120 710 Holder, coupling flange	A	
49 9200 145 Adapter set, radiater cap tester	A	
49 G014 001 Wrench, oil filtter	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 L012 0A0 Installer set, valve seal & valve guide	A	
49 L010 1A0 Hanger set, engine stand	A	
49 B012 0A2 Pivot	A	
49 B012 005 Remover & installer, valve guide	A	
49 0221 061A Remover & installer, piston pin	B	
49 S120 170 Remover, valve seal	A	
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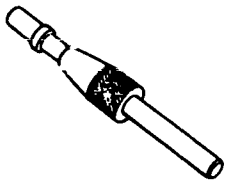
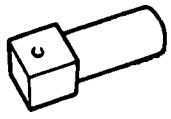
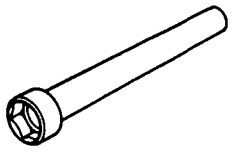
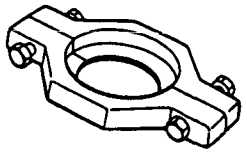
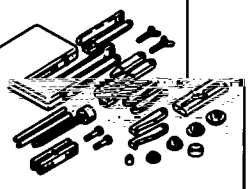
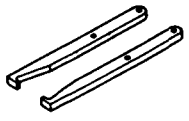
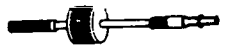
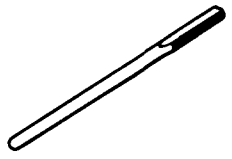
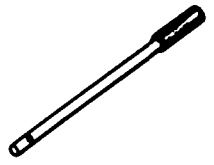
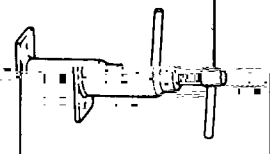
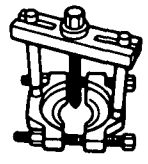
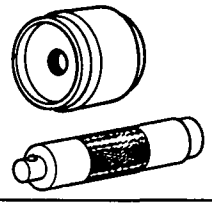
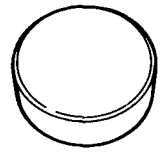
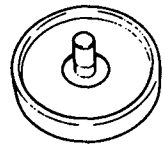
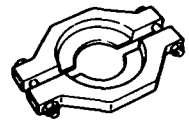
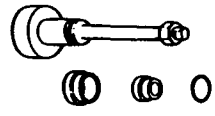
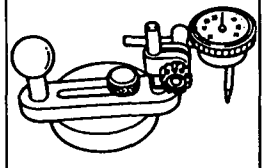
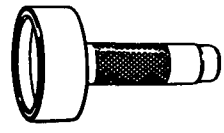
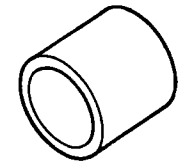
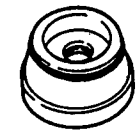
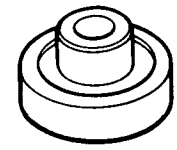
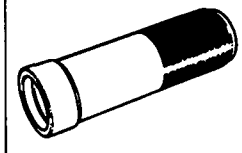
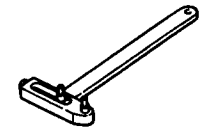
CLUTCH AND MANUAL TRANSMISSION

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 SE01 310 Centering tool, clutch disc	A	
49 0259 440 Holder, mainshaft	A	
49 1243 465A Wrench, main-shaft locknut	A	
49 0636 145 Puller, fan pulley boss	A	
49 0839 425C Puller set, bearing	A	
49 H017 101 Hook	A	
49 0180 321A Installer, main drive gear bearing	A	

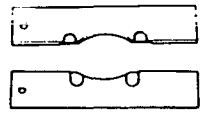
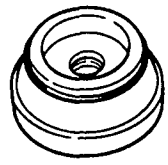
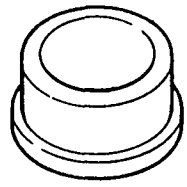
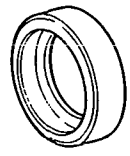
TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 1285 071 Puller, bearing	A	
49 0187 451A Guide, interlock pin assembly	B	
49 0862 350 Guide, shift fork assembly	B	
49 0500 330 Installer, bearing	A	
49 0305 430 Pusher, main drive shaft	A	
49 0710 520 Puller, bearing	A	
49 B025 0A0 Installer, dust seal	A	

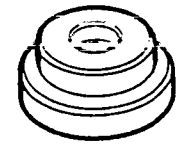
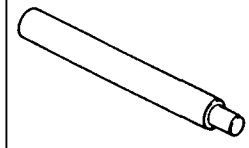
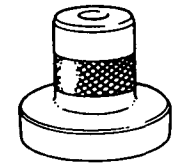
DIFFERENTIAL

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 N027 001 Gauge block	A	
49 N034 213 Installer, rubber bush	A	
49 M005 561 Hanger, *diff. carrier*	A	
49 H027 002 Remover, bearing	A	
49 8531 565 Pinion model	A	
49 0727 570 Gauge body, pinion height	A	
49 B001 795 Installer, oil seal	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 U027 003 Installer, oil seal	A	
49 F027 005 Attachment ϕ62	A	
49 H033 101 Remover, bearing	A	
49 F401 331 Body	A	
49 F401 336B Attachment B	A	
49 F401 337A Attachment C	A	
49 0259 720 Adjustment wrench, side bearing	B	

FRONT AND REAR AXLES

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 F026 103 Puller, wheel hub	A	
49 F027 007 Attachment ϕ72	A	
49 F027 009 Attachment ϕ68 & ϕ77	A	
49 G033 107 Installer, dust cover	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 G030 727 Attachment A	A	
49 G033 102 Handle	A	
49 V001 795 Installer, oil seal	A	
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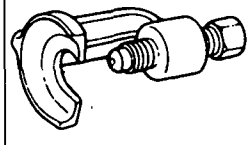
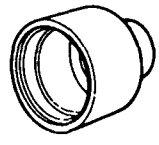
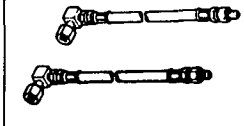
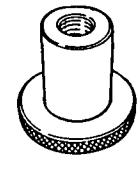
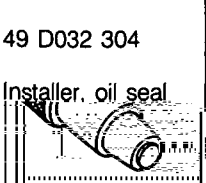
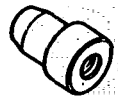
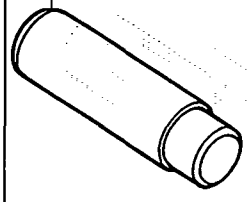
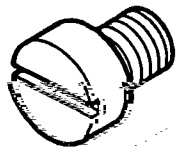
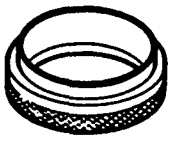
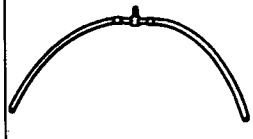
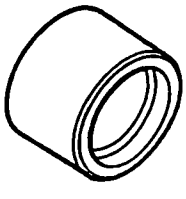
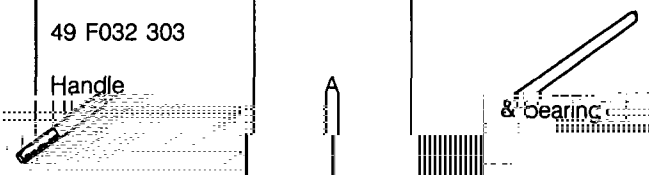
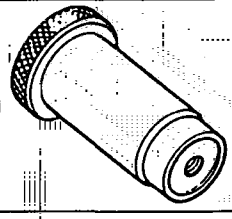
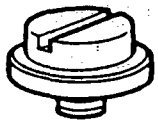
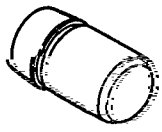
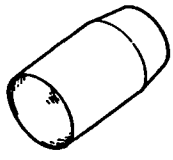
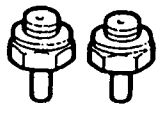
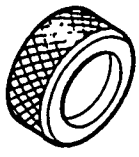
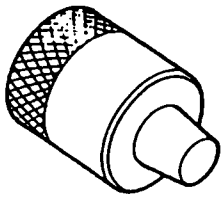
STEERING SYSTEM

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0118 850C Puller, ball joint	A	
49 1243 785 Installer, dust boot	A	
49 B032 302 Adapter	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 1232 670A Gauge set, power steering	A	
49 H002 671 Adapter	A	
49 B001 605 Caster camber gauge adapter	A	

STEERING SYSTEM (CONT'D)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 D032 304 Installer, oil seal	A	
49 D032 301 Installer body, oil seal & bearing	A	
49 D032 302 Attachment	A	
49 N032 302 Guide, oil seal	A	
49 N032 304 Protector, oil seal	A	
49 G032 319 Adapter	A	
49 D032 313 Seal ring former	A	
49 D032 305 Remover, oil seal & bearing	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 F032 303 Handle	A	
49 N032 303 Remover body, backup ring & oil seal	A	
49 D032 307 Remover, oil seal & bearing	A	
49 D032 303 Attachment	A	
49 N032 301 Protector body, oil seal	A	
49 N032 305 Protector, backup ring & oil seal	A	
49 G032 317 Hose	A	
49 D032 306 Support block	A	

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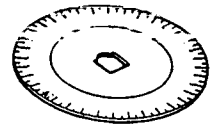
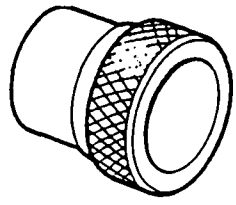
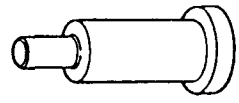
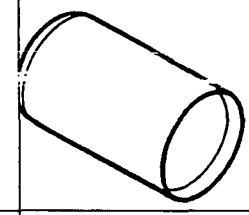
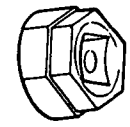
STEERING SYSTEM (CONT'D)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 D032 316 Protractor	A	
49 D032 315 Seal ring former & guide	A	
49 B032 305 Holder, power steering pump	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 D032 310 Protector, pinion shaft	A	
49 H032 321A Hexagon wrench	A	
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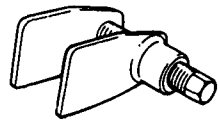
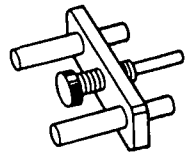
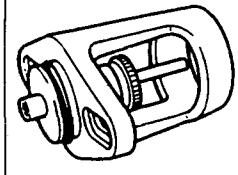
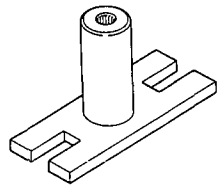
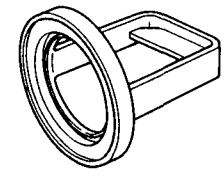
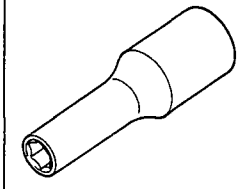
BRAKING SYSTEM

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0221 600C Expand tool, disc brake	B	
49 F043 001 Adjust gauge	A	
49 B043 001 Adjust gauge (ABS)	A	
49 B043 003 Lock tool, turning (ABS)	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0259 770B Wrench, flare nut	A	
49 H026 101A Installer, sensor rotor (rear)	A	
49 B043 004 Wrench, socket (ABS)	A	
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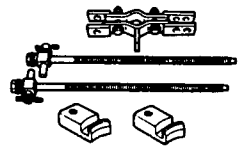
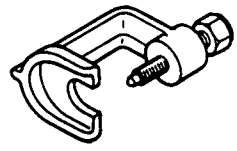
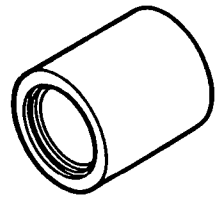
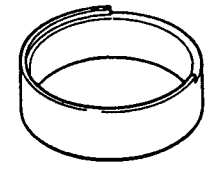
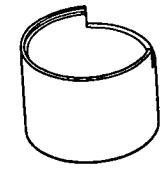
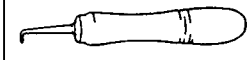
FRONT AND REAR SUSPENSIONS

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 G034 1A0 Compressor, coil spring	A	
49 0180 510B Preload, attachment	B	
49 N028 201 Support block	A	
49 B034 201 Support block	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0727 575 Puller, ball joint	A	
49 H028 301 Installer, dust boot	A	
49 0208 701A Air out tool, boot	B	
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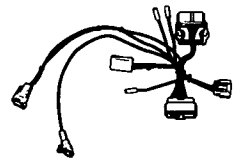
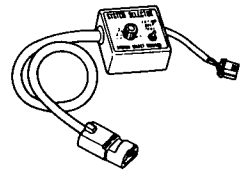
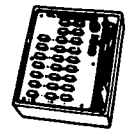
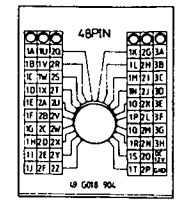
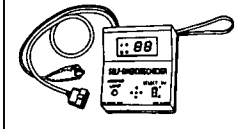
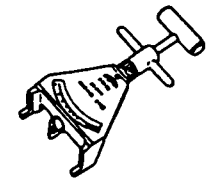
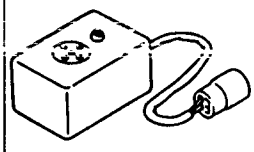
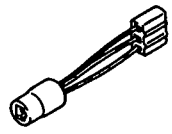
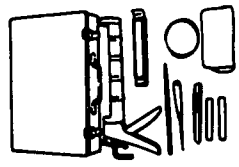
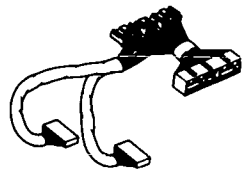
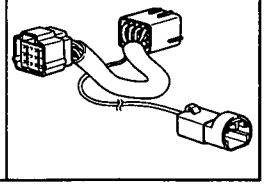
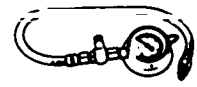
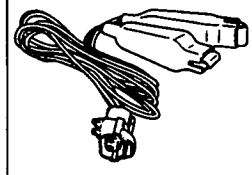
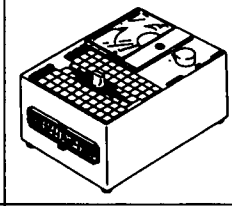
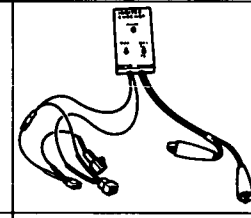
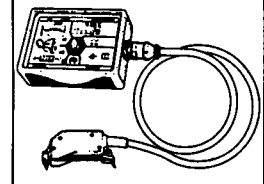
CHECKERS AND OTHER EQUIPMENT

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 N018 001 Adapter harness (Igniter checker)	A	
49 B019 9A0 System selector	A	
49 0839 285 Checker, fuel and thermometer	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 G018 904 Sheet (Engine signal monitor)	A	
49 H018 9A1 Self-diagnosis checker	A	
49 9200 020 Tension gauge, V-ribbed belt	B	

CHECKERS AND OTHER EQUIPMENT (CONT'D)

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0200 165 Tester, throttle sensor	A	
49 9200 166 Adapter, throttle sensor	A	
49 0305 870A Tool set, window	A	
49 G018 903 Adapter harness (Engine signal monitor)	A	
49 G050 1A0 Remover, sealant	A	
49 N066 001 Harness, adapter (For ECE)	A	

TOOL NUMBER & DESCRIPTION	PRIORITY	ILLUSTRATION
49 0187 280 Gauge, oil pressure	A	
49 L018 901 Injector checker	A	
49 9200 162 Engine signal monitor	A	
49 F018 002 Igniter checker	A	
49 9200 164 ABS tester	A	
49 H066 003 Harness, adapter (For UK)	A	

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