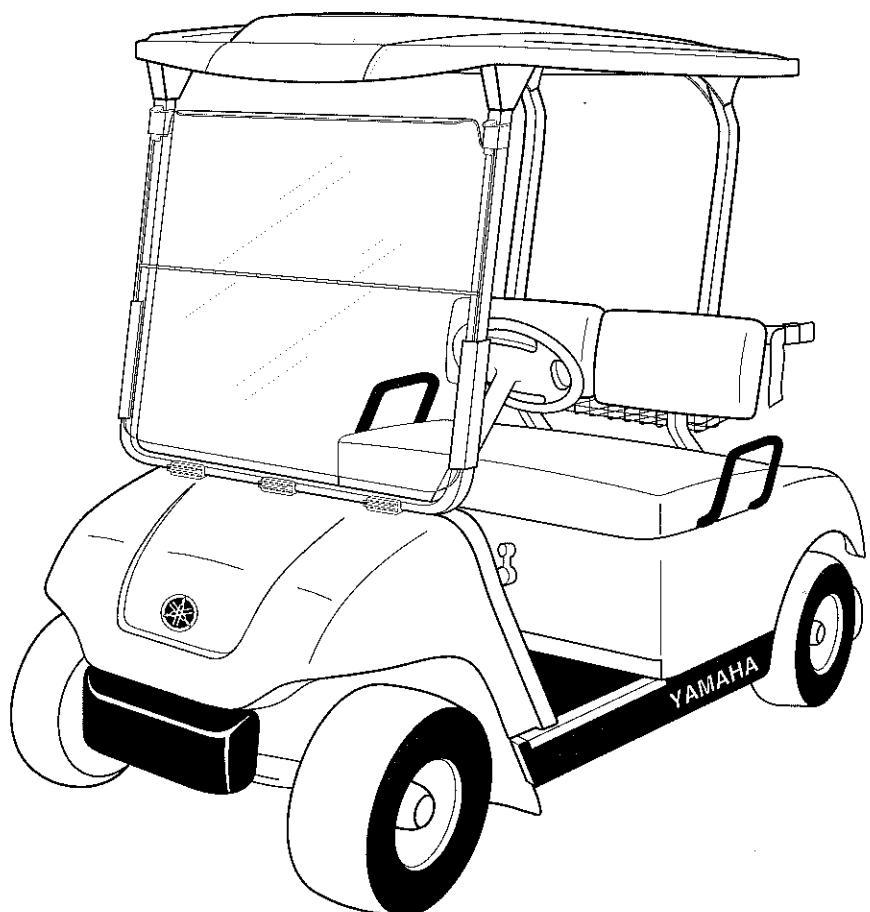




YAMAHA

YAMAHA GOLF-CAR COMPANY

2003 G22 A/E



SERVICE MANUAL

LIT-19616-22-03

G22A, G22E

GOLF CAR SERVICE MANUAL

**G22A, G22E
SERVICE MANUAL**
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P/N LIT-19616-22-03

INTRODUCTION

This manual has been written by Yamaha Golf-Car Company for use by Authorized Yamaha dealers and their qualified mechanics. It is not possible to put an entire mechanic's education into a manual, so it is assumed that persons using this book to perform maintenance and repairs on Yamaha golf cars have a basic understanding of the mechanical concepts and procedures inherent to these products. Without such knowledge, attempted repairs or service to this golf car may render it unfit to use and/or unsafe.

Yamaha Golf-Car Company is continually striving to further improve all models manufactured by the company. Modifications are therefore inevitable and will, where applicable, appear in future editions of this manual.

TECHNICAL SERVICE DEPT
YAMAHA GOLF-CAR COMPANY

HOW TO USE THIS MANUAL

Read This Important Information!

Particularly important information in this manual is distinguished by the following notations:



The Safety Alert Symbol means ATTENTION! BE ALERT! YOUR SAFETY IS INVOLVED!



WARNING Failure to follow WARNING instructions could result in severe injury or death to golf car occupants, a bystander, or a person inspecting or repairing the golf car.



CAUTION This message describes special precautions that must be taken to avoid damage to the golf car.

NOTE:

This message provides additional key information.

MANUAL FORMAT

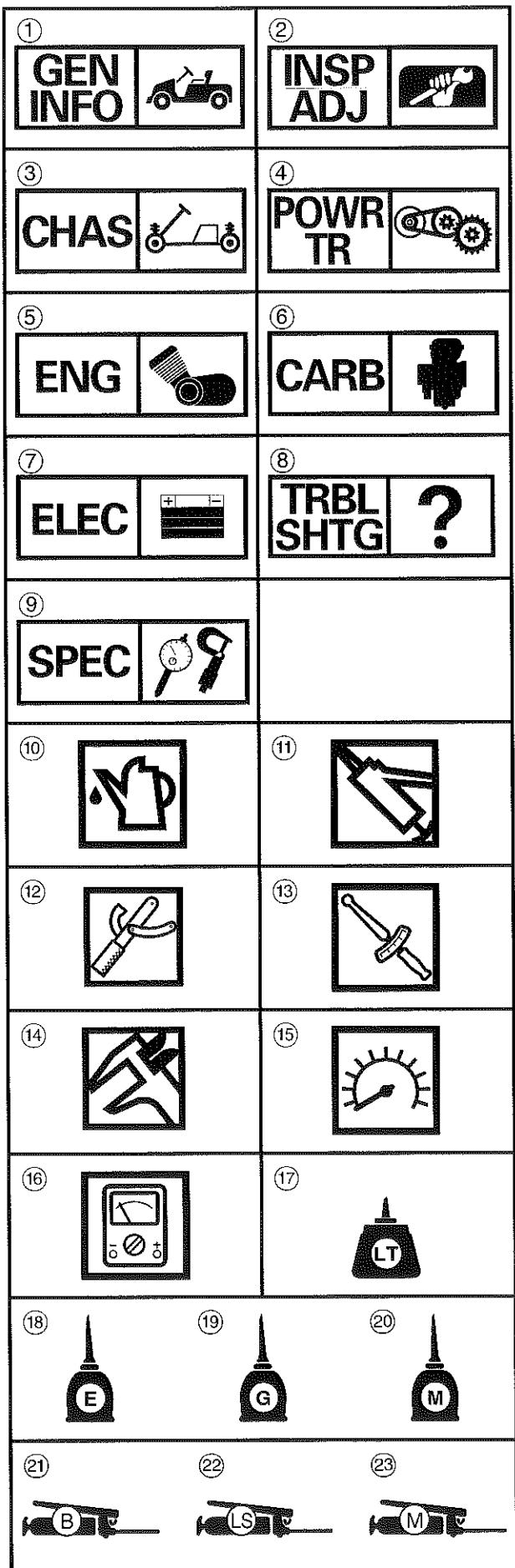
All of the procedures in this manual are organized in a sequential, step-by-step format. The information has been compiled to provide the mechanic with an easy to read, handy reference that contains comprehensive explanations of all disassembly, repair, assembly, and inspection operations.

In this revised format, the condition of a faulty component will precede an arrow symbol and the course of action required will follow the symbol, e.g.,

- Bearings
- Pitting/Damage → Replace.

EXPLODED DIAGRAM

Each chapter provides exploded diagrams before each disassembly section for ease of identifying correct disassembly and assembly procedures.



Symbol Identification

Symbols ① to ⑨ are designed as thumb tabs to indicate the contents within a chapter.

- ① General information
- ② Periodic inspection and adjustment
- ③ Chassis
- ④ Power train
- ⑤ Engine overhaul
- ⑥ Carburetion
- ⑦ Electrical
- ⑧ Troubleshooting
- ⑨ Specifications

Symbols ⑩ to ⑯ are used to identify specifications within the text.

- ⑩ Filling fluid
- ⑪ Lubricant
- ⑫ Special tool
- ⑬ Tightening torque
- ⑭ Wear limit, clearance
- ⑮ Engine speed
- ⑯ Ω, V, A

Symbols ⑰ to ㉓ are used in the exploded diagrams to indicate the grade and location of lubricant.

- ⑰ Apply locking agent
- ⑱ Apply engine oil
- ⑲ Apply gear oil
- ⑳ Apply molybdenum disulfide oil
- ㉑ Apply wheel bearing grease
- ㉒ Apply lightweight lithium soap base grease
- ㉓ Apply molybdenum disulfide grease

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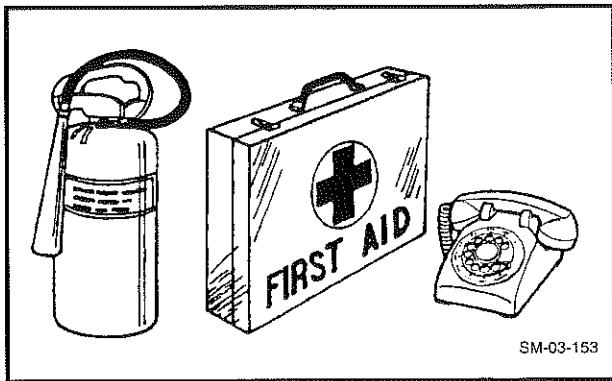
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SAFETY PRECAUTIONS

WARNING

Follow these safety precautions and exercise caution when performing service work to prevent serious accidents.

1



PREPARE FOR EMERGENCIES

Be prepared for possible injury or fire. Keep the following items handy:

- First aid kit
- Fire extinguisher
- Emergency phone numbers



HANDLE FUEL SAFELY

Use care when handling fuel – it is highly flammable. Do not smoke or have open flames or sparks nearby when handling fuel.

Always clean up spilled fuel and dispose of cleaning materials properly.

HANDLE BATTERIES SAFELY

Neutralize battery acid before performing service work. Use a baking soda and water solution to prevent unnecessary exposure to electrolyte and battery acid.

Batteries produce explosive gases. Keep sparks and flames away from batteries. Check battery electrolyte level using a flashlight.

Never check battery state of charge by connecting the battery posts with a conductor. Use a voltmeter or hydrometer. Always disconnect the negative (-) cable first and connect it last.

Do not charge battery if the battery is frozen. Allow the battery to warm first.

Always charge batteries in a well ventilated area to prevent the buildup of explosive hydrogen gas which is created when batteries are being charged.

Battery electrolyte contains sulfuric acid and is poisonous and highly caustic. Avoid contact with skin, eyes, or clothing. If electrolyte contacts the eyes, flush with water for 15 minutes and get prompt medical attention.



SAFETY PRECAUTIONS

WARNING

Follow these safety precautions. Exercise caution when performing service work to prevent serious accidents.

Before performing any service related to the speed controller, or any action requiring or allowing physical contact with electrical power components:

SECURE THE VEHICLE

- Block the front wheels.
- Raise both rear wheels off the ground to a free wheeling position.
- Do not allow anyone to stand in front of or behind the vehicle during service.

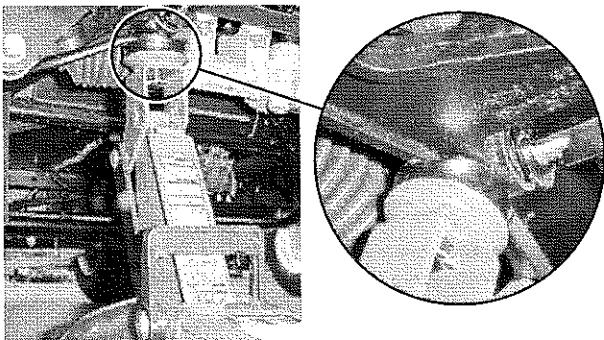
RECOMMENDED JACK POINTS

Front: Under the lower arm to frame pivot.

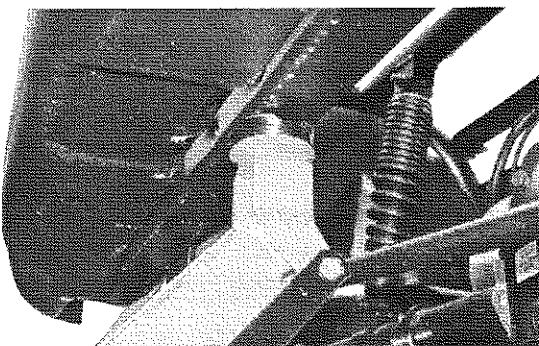
Rear: Frame cross member.

CAUTION

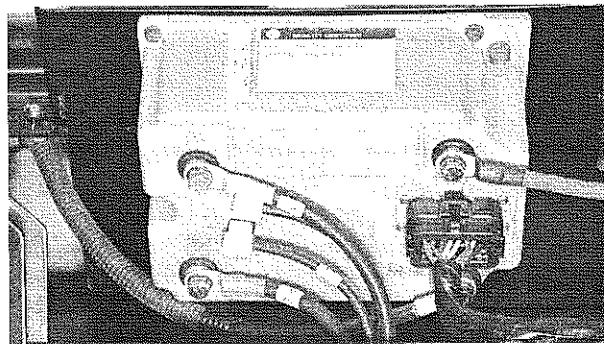
When jacking the rear of car, do not let the jack contact the rear connecting rod.



SM-03-346



SM-03-363



SM-03-347

DISCHARGE THE SPEED CONTROLLER CAPACITOR

- Turn the main switch to the "OFF" position.
- Turn the tow switch to the "TOW" position. When turned to "TOW," the controller capacitor should discharge within five seconds.
- Disconnect the black wire leads at the negative battery terminal.
- Wait 30 seconds, then attach a 48 volt test light between the positive and negative controller terminals to confirm that the capacitor is discharged (test light will not illuminate).
- If required for component testing, reconnect the battery and turn on main and tow switch for specific measurements after required meters are in place.



SAFETY PRECAUTIONS

1

WEAR PROTECTIVE CLOTHING

Many permanent injuries could be prevented by wearing appropriate safety equipment during work. Whenever applicable, put on the following:

- **Safety glasses with side shields or goggles** when performing work like grinding, chiseling, spraying or any other activity that could result in an object or chemical striking the eye.
- **Earmuffs or earplugs** when performing loud work that could harm hearing.
- **Safety shoes** when working with heavy objects that could be dropped.
- **Respiratory protection** when performing work involving dust, vapors, or gases that can cause respiratory problems.

Avoid wearing loose clothing and jewelry which could become caught in moving parts causing injury.

KEEP WORK AREA CLEAN

Properly ventilate work area to prevent buildup of dangerous gases and keep the oxygen level above OSHA's 19.5 percent minimum level.

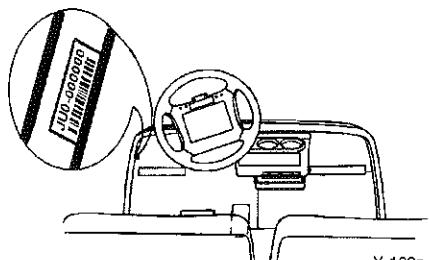
Keep shop floor clean and dry to prevent accidents due to slips.



GENERAL SERVICE INFORMATION

SERIAL NUMBERS

1

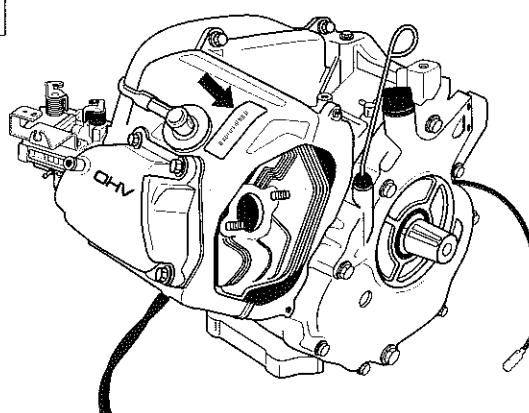


Y-102a

① G22A/G22E

The frame serial number is affixed in the location shown.

2



SM-03-399

② G22A

The engine serial number is affixed in the location shown.

IMPORTANT INFORMATION

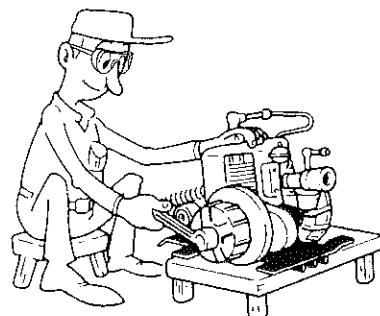


1



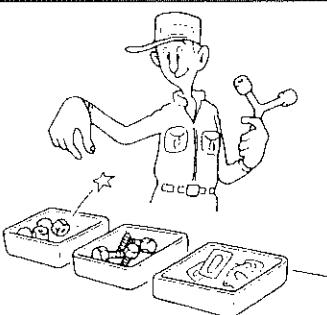
WASHING AND CLEANING

Before servicing, thoroughly clean the exterior of the car body and engine. While cleaning, take care to protect the electrical parts, such as relay switches, motor resistors, controllers, etc., from high pressure water splashes.



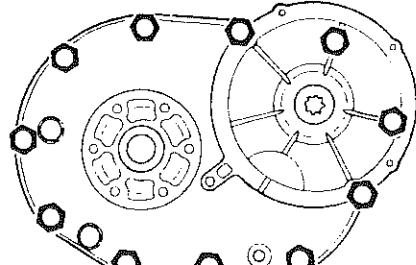
CORRECT TOOLS

Be sure to use the appropriate tool for the intended part in order to protect the part and vehicle from damage.



KEEP IT NEAT

Keep the removed parts organized in separate groups so that they will not be misplaced.



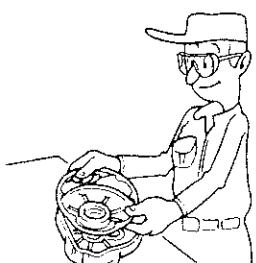
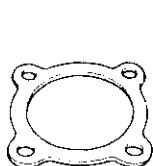
SM-03-159

TIGHTENING TORQUE

Be sure to follow tightening torque specifications. When tightening bolts, nuts, and screws, start with larger-diameter ones and work from inner-positioned ones to outer-positioned ones in a criss-cross pattern. Refer to "Tightening Torque" section of CHAPTER 9.



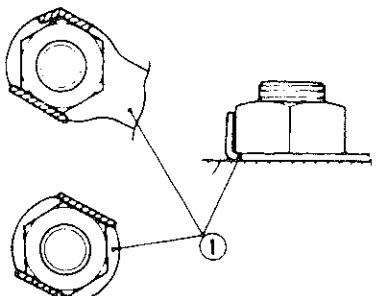
SM-03-160



SM-03-161

ALL REPLACEMENT PARTS

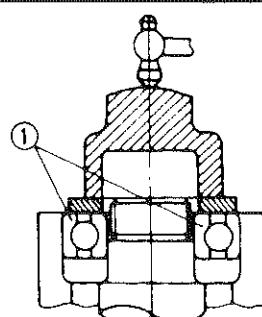
We recommend you use Yamaha genuine parts for all replacements. Use oil and/or grease recommended by Yamaha for assembly and adjustment.



SM-03-162

GASKETS, OIL SEALS AND O-RINGS

All gaskets, seals and O-rings should be replaced when an engine is overhauled. All gasket surfaces, oil seal lips, and O-rings must be cleaned prior to installation.



SM-03-164

LOCK WASHERS/PLATES AND COTTER PINS

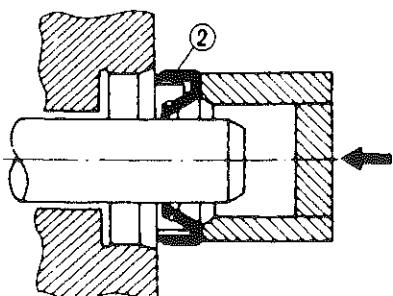
All lock washers/plates ① and cotter pins must be replaced when they are removed. Lock tabs should be bent along the bolt or nut flats after the bolt or nut has been properly tightened.

BEARINGS AND OIL SEALS

Install bearings ① and oil seals ② with their manufacturer's marks or numbers facing outward. (In other words, the stamped letters must be on the side exposed to view.) When installing oil seals, apply a light coating of light-weight lithium base grease to the seal lip(s). Oil the bearings liberally when installing.

CAUTION

Do not use compressed air to spin the bearings dry. This causes damage to the bearing surfaces.

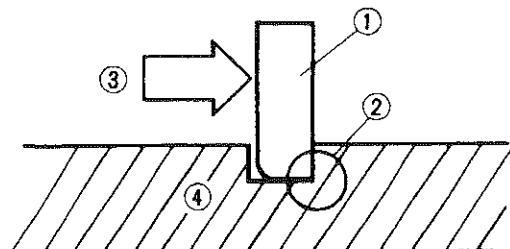


SM-03-165

IMPORTANT INFORMATION



1



SM-03-166

CIRCLIPS

All circlips should be inspected carefully before reassembly. Always replace piston pin clips after one use. Replace distorted circlips. When installing a circlip (1), make sure that the sharp-edged corner (2), is positioned opposite to the thrust (3) it receives.

(4) shaft



SM-03-167

DISASSEMBLY AND ASSEMBLY SUGGESTIONS

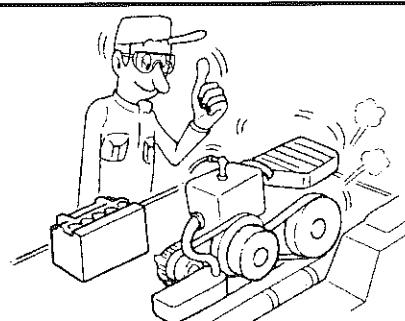
Follow these guidelines when disassembling and assembling parts:

- Clean and dry parts whenever they are disassembled.
- Oil contact surfaces of moving parts prior to assembly.



SM-03-168

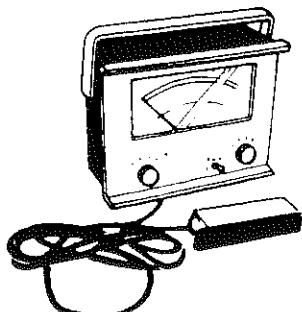
- After parts are assembled, make sure each moving part operates normally.



SM-03-169

**SPECIAL TOOLS**

The proper special tools are necessary for complete and accurate tune-up and assembly. Using the correct special tool will help prevent damage caused by the use of improper tools or improvised techniques. To order the tools specified on the following pages, please contact K&L Tool for pricing and availability at: 800-708-3184, FAX 408-727-4305.

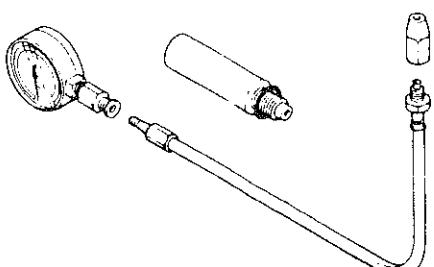


SM-03-170

FOR TUNE UP

1. Inductive Tachometer
P/N YU-8036-A

This tool is for measuring engine rpm.

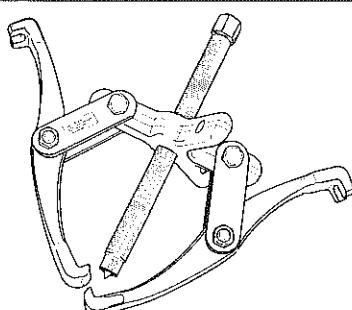


SM-03-171

2. Compression Gauge

P/N YU-33223

This gauge is used to measure the engine compression.

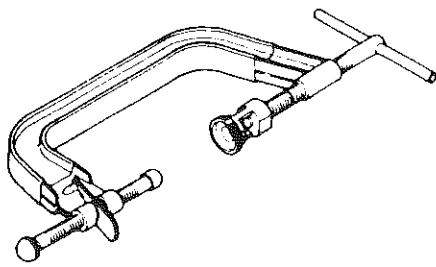


SM-03-400

FOR ENGINE SERVICE

1. Heavy-Duty Universal Puller
P/N YU-33270-B

This tool is used to remove the flywheel.



SM-03-173

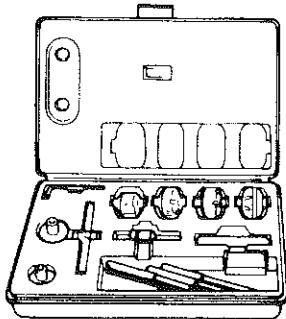
2. Valve Spring Compressor
P/N YM-1253

This tool is needed to remove and install the valve assemblies.

SPECIAL TOOLS



1

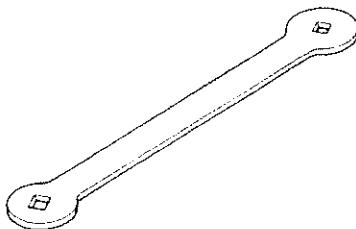


SM-03-174

3. Valve Seat Cutter Set

P/N YM-91043-C

This tool is used to resurface the valve seat.

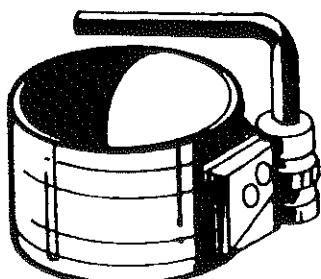


SM-03-175

4. Valve Adjuster

P/N YM-08035

This tool is used to adjust the valve clearance.

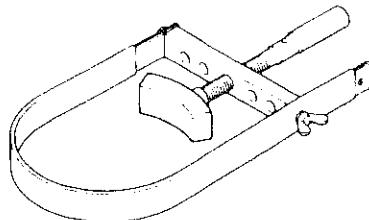


SM-03-176

5. Piston Ring Compressor

P/N YU-33294

This tool is used to squeeze ring ends together while piston is pushed into cylinder.



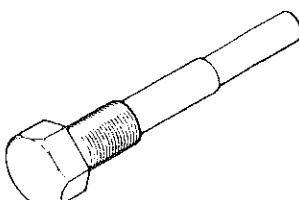
SM-03-177

FOR POWER TRAIN

1. Primary Sheave Holder

P/N YS-1880-A

This tool is used to hold the primary sheave when removing or installing the primary sheave securing bolt.



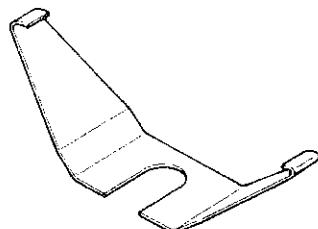
SM-03-178

2. Primary Sheave Puller

P/N YG-1876

This tool is used for removing the primary sheave.

SPECIAL TOOLS

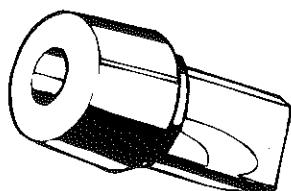


SM-03-179

3. Secondary Sheave Holder

P/N YG-40103-A

This tool is used to compress the sheave spring when removing or installing the secondary sheave securing nut.

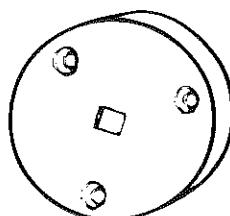


Y-840

4. Tapered clutch holder

P/N YS-38518

This tool holds fixed sheave when removing sliding sheave/slider.

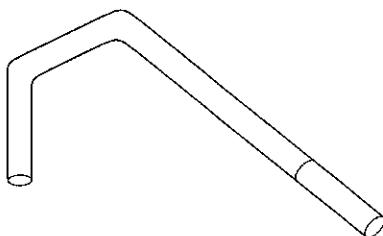


Y-841

5. Clutch spider separator

P/N YG 42131

This tool is used to remove sliding sheave/spider assembly from fixed sheave.



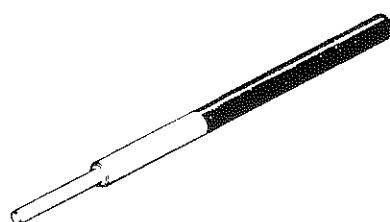
SM-03-401

6. Transaxle fluid check gauge

P/N TF-00001

Available from YGC Service at: 877-811-8250

This tool is used to measure the transaxle fluid level of G22E model golf cars that have the check/fill hole located in the upper right hand corner of the transaxle cover.



SM-03-180

FOR CHASSIS SERVICE

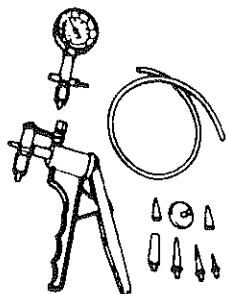
1. Drift Punch (6 mm) or Valve Guide Remover
P/N YM-4064-A

This tool is used to remove the spring pins for steering knuckle.

SPECIAL TOOLS



1

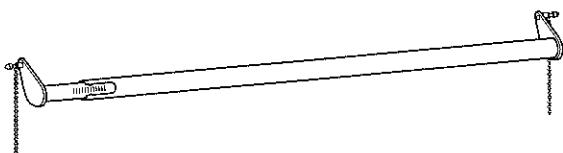


SM-03-181

2. Mityvac® Pressure Tester

P/N YB-35956-A

This tool is used for vacuum pressure testing.

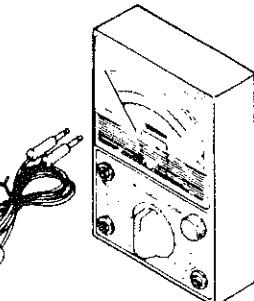


SM-03-402

3. Alignment gauge

P/N YC-39526

This tool is used to check toe-in alignment of the front tires.



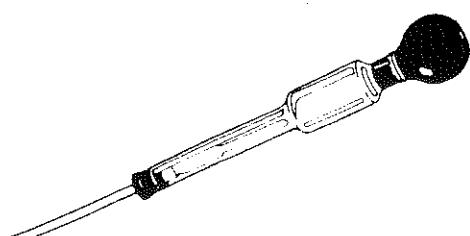
SM-03-182

FOR ELECTRICAL COMPONENTS

1. Pocket Tester

P/N YU-3112-C

This instrument is invaluable for checking the electrical system.

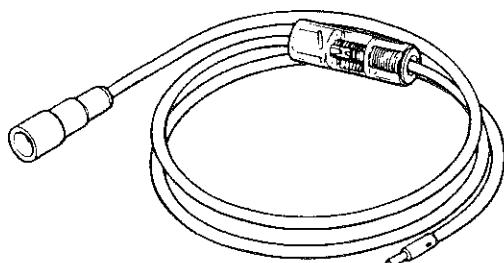


SM-03-183

2. Hydrometer

P/N YU-03036

This gauge is used to measure the specific gravity of battery electrolyte.

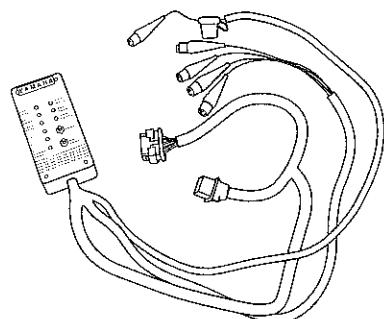


SM-03-184

3. Dynamic Spark Tester

P/N YM-34487

This tester is necessary for checking the ignition system components.



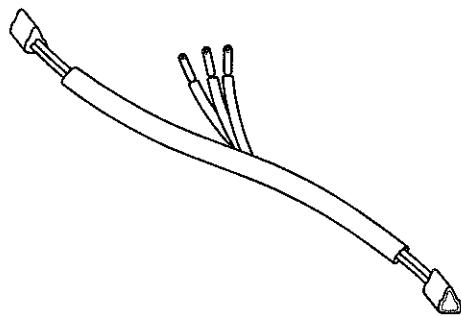
SM-03-001

4. Z-1 Tester

P/N JR1-HZ1TE-ST-ER

Available from Yamaha Parts & Accessories at:
800-688-6078.

This instrument allows you to quickly check the electrical functions of the MCU and electrical system.



SM-03-434

5. Speed sensor test cord

P/N YG-4221-A

This tool is needed to test the traction motor speed sensor voltage output.



CHAPTER 2 PERIODIC INSPECTION AND ADJUSTMENT

2

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PERIODIC INSPECTION AND ADJUSTMENT

PERIODIC MAINTENANCE

Regular maintenance is most important for best performance and safe operation.

WARNING

Be sure to turn off the main switch and apply the parking brake when you perform maintenance unless otherwise specified.

FOR G22A

C - CHECK CA - CHECK AND ADJUST R - REPLACE S - SERVICE CL - CLEAN AND LUBRICATE L - LUBRICATE

2

	Remarks	Pre-Operation	20 Rounds 20 hours 100 miles 160 kms (Every month)	125 rds 125 hrs 600 mls 1000 kms (Every 6 months)	250 rds 250 hrs 1200 mls 2000 kms (Every year)	500 rds 500 hrs 2500 mls 4000 kms (Every 2 years)	1000 rds 1000 hrs 5000 mls 8000 kms (Every 4 years)
PRE-OPERATION CHECKS	Check engine oil	C	C	C			
	Check air cooling duct	C	C	C	C	C	C
	Check fuel lines for leakage	C	C	C	C	C	C
	Check fuel level	C	C	C	C	C	C
	Check for looseness and corrosion of battery terminals and hold downs	C	C	C	C	C	C
	Check brake pedal free play and adjust if necessary	C	CA	CA	CA	CA	CA
	Check steering operation	C	C	C	C	C	
	Check tire pressure, tread depth, tire surface for damage	C	CA	CA	CA	CA	CA
	Check body and chassis for damage	C	C	C	C	C	C
	Check tightness of all bolts, nuts, and screws	C	C	C	C	C	C
EVERY MONTH	Check reverse buzzer operation	C	C	C	C	C	C
	Check fuel filter for clogging		C	C	C	C	C
	Check wear of drive belt		C	C	C	C	C
	Check operation of Forward / Reverse shifting		C	C	C	C	C
EVERY 6 MONTHS	Clean / Lube pedal control area		CL				
	Wash pre-filter, check air cleaner element			S	S	S	S
	Check spark plug and plug cap condition* / Check compression			C	C	C	C
	Check shock absorbers for oil leaks and damaged springs			C	C	C	

* Related to emission control system


FOR G22A

C - CHECK CA - CHECK AND ADJUST R - REPLACE S - SERVICE CL - CLEAN AND LUBRICATE L - LUBRICATE

	Remarks	Pre-Operation	20 Rounds 20 hours 100 miles 160 kms (Every month)	125 rds 125 hrs 600 mls 1000 kms (Every 6 months)	250 rds 250 hrs 1200 mls 2000 kms (Every year)	500 rds 500 hrs 2500 mls 4000 kms (Every 2 years)	1000 rds 1000 hrs 5000 mls 8000 kms (Every 4 years)
EVERY YEAR	Replace engine oil				R	R	R
	Adjust throttle cables,* choke cable, check carburetor throttle shaft for wear*				CA	CA	CA
	Check starter V-belt for damage and tension				C	C	C
	Check drive belt for slippage, wear or scratches				C	C	C
	Check sliding sheave and ramp shoes; Grease secondary sheave bearing				CL	CL	CL
	Grease primary sheave				L	L	L
	Check operation of speed limiter				C	C	C
	Apply battery terminal protectant				S	S	S
	Check wiring connections and insulation				C	C	C
	Check shoe lining thickness and rear axle bearing play				C	C	C
	Check steering knuckle bushing free play / Adjust wheel alignment				CA	CA	CA
	Check wheel nut tightness, front wheel bearing play				C	C	C
	Check gear box oil level and leakage				C	C	C
	Check operation and adjust pedal stop if necessary				CA	CA	CA
EVERY 2 YEARS	Check brushes for wear and commutator for dirt					C	S
EVERY 4 YEARS	Replace fuel filter and fuel hoses						R
	Check tightness of cylinder head / Adjust valves						CA
	Replace gear box oil						R
	Check for grease leakage; adjust gear box if necessary						CA

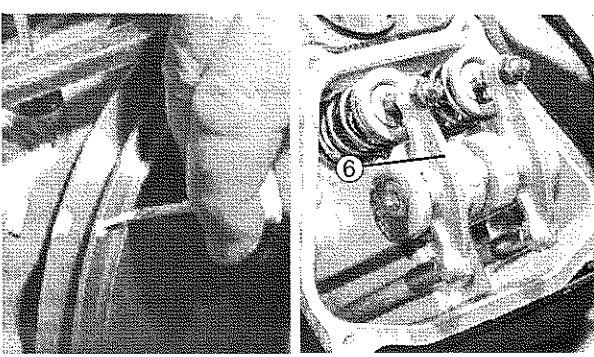
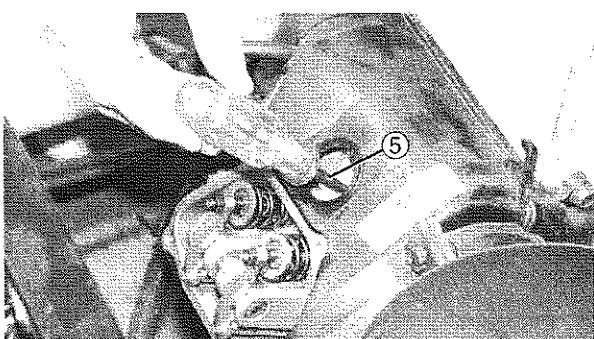
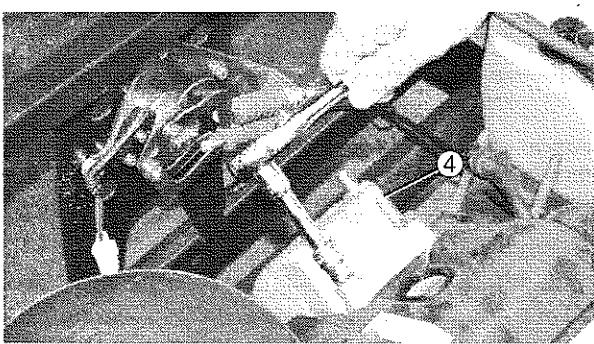
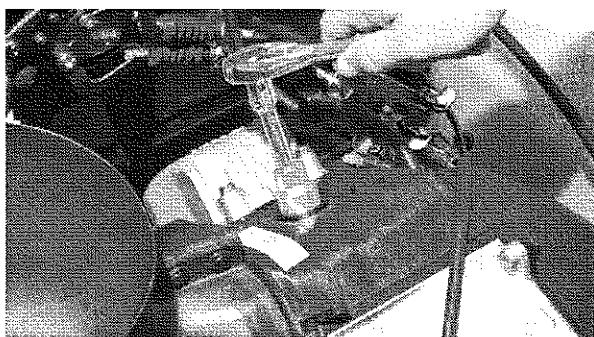
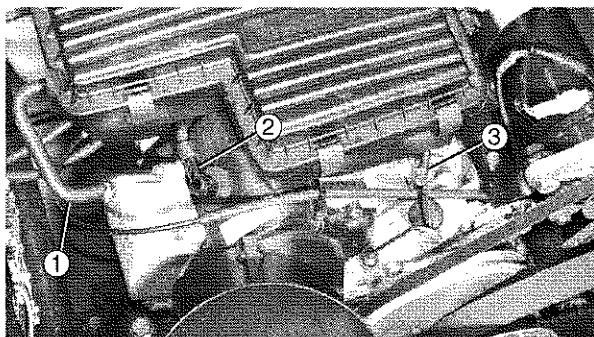
* Related to emission control system


FOR G22E

C - CHECK CA - CHECK AND ADJUST R - REPLACE S - SERVICE CL - CLEAN AND LUBRICATE L - LUBRICATE

	Remarks	Pre-Operation	20 Rounds 20 hours 100 miles 160 kms (Every month)	125 rds 125 hrs 600 mls 1000 kms (Every 6 months)	250 rds 250 hrs 1200 mls 2000 kms (Every year)	500 rds 500 hrs 2500 mls 4000 kms (Every 2 years)	1000 rds 1000 hrs 5000 mls 8000 kms (Every 4 years)
PRE-OPERATION CHECKS	Charge	S	S	S	S	S	S
	Clean battery tops, check for tightness of hold-down screws and terminals	S	S	S	S	S	S
	Check brake pedal free play and adjust if necessary	C	CA	CA	CA	CA	CA
	Check steering operation	C	C	C	C	C	C
	Check tire pressure, tread depth, tire surface for damage	C	CA	CA	CA	CA	CA
	Check body and chassis for damage	C	C	C	C	C	C
	Check tightness of all bolts, nuts, and screws	C	C	C	C	C	C
	Check reverse buzzer operation	C	C	C	C	C	C
EVERY MONTH	Check electrolyte level		C	C	C	C	C
	Check for loose or broken connections		C	C	C	C	C
	Clean / Lube pedal control area		CL				
EVERY 6 MONTHS	Check all wire insulation for cracks and/or worn spots			C	C	C	C
	Check shock absorbers for oil leaks and damaged springs			C	C	C	C
EVERY YEAR	Perform a discharge test				S	S	S
	Apply Terminal protectant				S	S	S
	Check shoe lining thickness and rear axle bearing play				C	C	C
	Check steering knuckle bushing free play / Adjust wheel alignment				CA	CA	CA
	Check wheel nut tightness, front wheel bearing play				C	C	C
	Check gear box oil level and leakage				C	C	C
	Check operation and adjust pedal stop if necessary				CA	CA	CA
EVERY 4 YEARS	Replace gear box oil						R
	Check for grease leakage; adjust gear box if necessary						CA

2



INSPECTION AND ADJUSTMENT ENGINE FOR G22A

VALVE CLEARANCE ADJUSTMENT

NOTE:

Valve clearance must be measured when the engine is cool to the touch.

1. Remove the seat.

2. Position:

- Shift lever between forward and reverse (neutral position).

3. Disconnect:

- Crankcase breather hose ①
- Oil delivery hose ③
- Spark plug lead ②

4. Remove:

- Spark plug
- Cylinder head cover ④

5. Set the piston at top dead center (TDC) on compression stroke ⑤.

NOTE:

Measure and adjust valve clearance when piston is at TDC on compression stroke only.

How to set TDC on compression stroke:

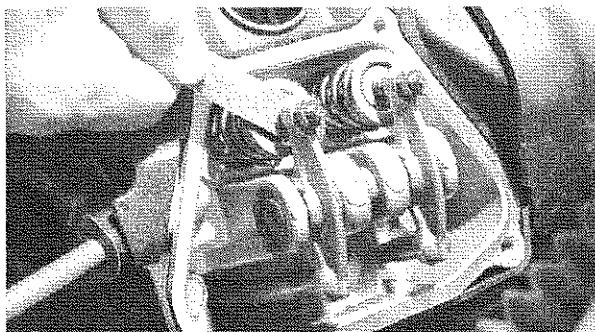
- Set the piston at TDC.

NOTE:

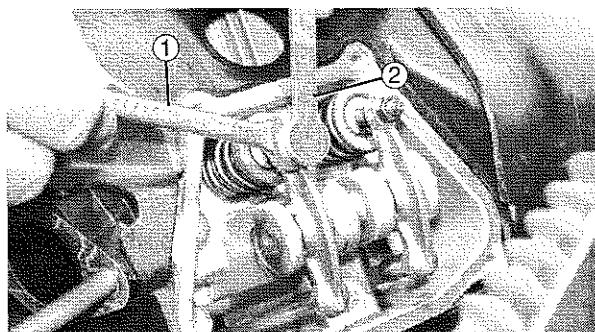
You can find TDC by inserting screwdriver into the spark plug hole and rotating the primary sheave until the screwdriver reaches its highest position ⑤.

- Paint matching marks onto the sheave and crankcase.
- Rotate the sheave counterclockwise half a turn from the TDC position.

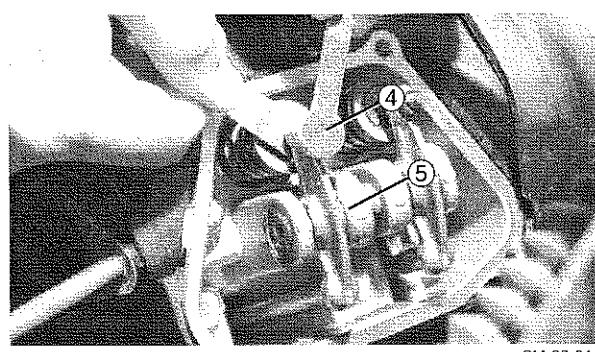
If intake rocker arm ⑥ moved → rotate sheave another 1/2 turn and you will be at TDC on compression stroke. If both rocker arms did not move → return sheave to its initial position (this is TDC, compression stroke).



SM-03-039



SM-03-040



SM-03-041

6. Measure:

- Valve clearance
Use feeler gauge
out of specification → adjust

**Intake Valve (Cold):**

0.08~0.12 mm (0.00315~0.00472 in.)

Exhaust Valve (Cold):

0.08~0.12 mm (0.00315~0.00472 in.)

2

Valve clearance adjustment steps:

- Loosen the locknut ① while holding the adjusting screw with Valve Adjuster ②.

**Valve Adjuster:**

YM-08035

- Insert the feeler gauge (specified thickness).
- Screw in the adjusting screw ④ until the rocker arm ⑤ contacts feeler gauge lightly.
- Tighten the locknut ① while holding the adjusting screw with Valve Adjuster ②.

NOTE:

Check feeler gauge fit. It should have a noticeable drag but not require excessive force.

- Rotate primary sheave two complete revolutions and recheck valve clearance specification. Perform adjustment steps over if necessary.

**Locknut:**

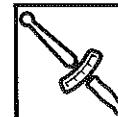
7 N·m (0.7 m·kg, 5.2 ft·lb)

NOTE:

Before replacing the cylinder head cover, thoroughly clean all gasket material from sealing surfaces.

7. Install:

- Cylinder head cover with new gasket
- Spark plug
- Oil delivery hose
- Crankcase breather hose
- Spark plug lead

**Bolts (Cylinder Head Cover):**

11 N·m (1.1 m·kg, 8.1 ft·lb)

Spark Plug:

20 N·m (2.0 m·kg, 14.8 ft·lb)

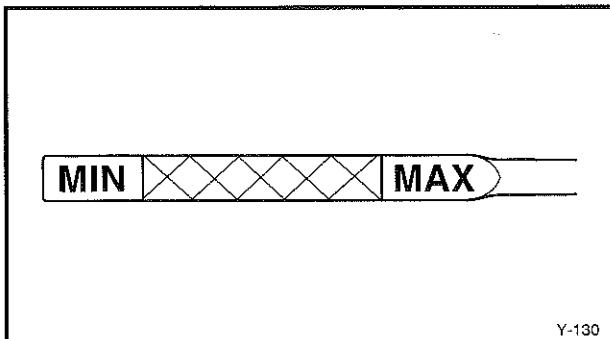
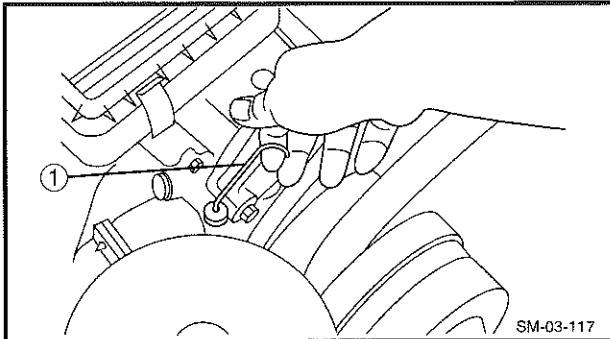
**ENGINE OIL LEVEL MEASUREMENT**

1. Place the vehicle on a level surface.

2. Inspect:

- Engine oil level

Below MIN mark → add sufficient oil

**Engine oil level measurement step:**

- Place vehicle on level surface.
- Remove the seat.
- Remove the dipstick ①, and wipe it with a clean rag.
- Insert the dipstick into the crankcase until it firmly seats in place.
- Pull up the dipstick and make sure the oil level is between the MAX and MIN level.

NOTE:

The distance between the dipstick marks represents approximately 1/2 US quart (1/2 L) of oil.

**Recommended Oil:**

**YAMALUBE 4-cycle oil or
SAE 10W30 [If temperature does not
go below 2°C (35°F): SAE 20W40]**

Oil Change Quantity:

0.9L (1.0 US quart, 900 cc)

Oil Capacity:

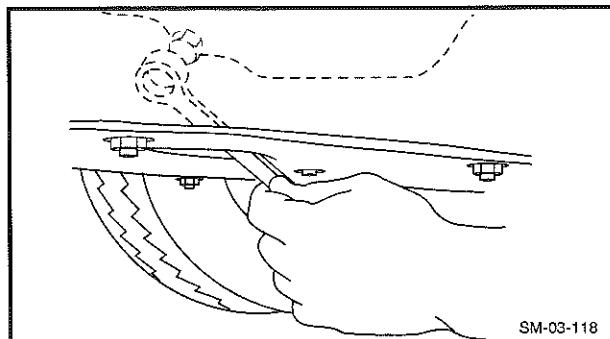
1.1 L (1.16 US quart, 1100 cc)

NOTE:

Recommended engine oil classification: API Service "SE," "SF," or "SG" type or equivalent.

CAUTION

Do not allow foreign material to enter the engine and use care not to fill past the MAX dipstick mark.

**ENGINE OIL REPLACEMENT**

1. Place the vehicle on a level surface.
2. Warm up the engine for several minutes, then place an oil pan under the engine.

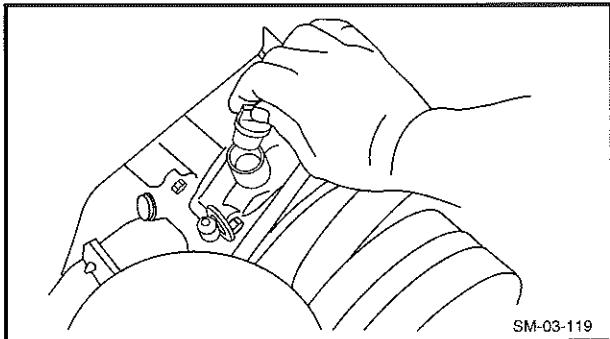
⚠ WARNING

Use caution not to touch hot engine oil, or hot engine parts, during the following procedure.

3. Remove:

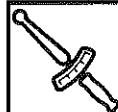
- Drain plug

Drain the engine oil



4. Install:

- Drain plug
- New drain plug gasket

**Drain Plug:**

31 N·m (3.2 m·kg, 23.9 ft·lb)

5. Remove:

- Filler cap

6. Fill

- Crankcase

**Recommended Oil:**

**YAMALUBE 4-cycle oil or
SAE 10W30 [If temperature does not
go below 2°C (35°F): SAE 20W40]**

Oil Change Quantity:

0.9L (1.0 US quart, 900 cc)

Oil Capacity:

1.1 L (1.16 US quart, 1100 cc)

2**NOTE:**

Recommended engine oil classification: API Service "SE," "SF," or "SG" type or equivalent.

CAUTION

**Do not allow foreign material to enter the engine
and use care not to fill past the MAX dipstick
mark.**

7. Install:

- Filler cap

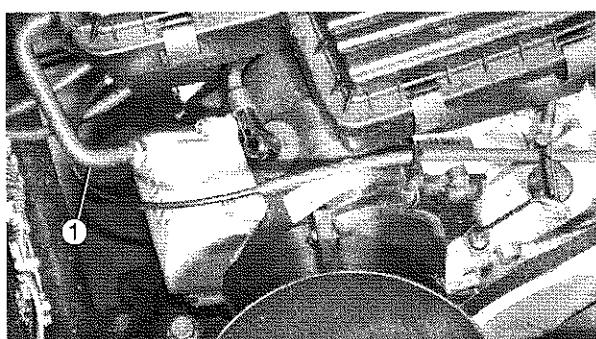
NOTE:

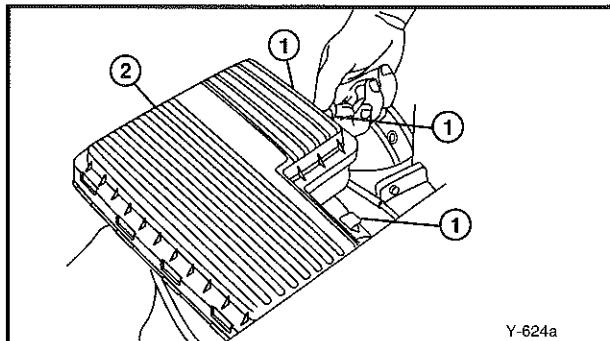
It is acceptable to change the oil more frequently if desired.

CRANKCASE BREather HOSE INSPECTION

1. Inspect:

- Crankcase breather hose ①
- Poor connection → reconnect
- Cracks/damage → replace

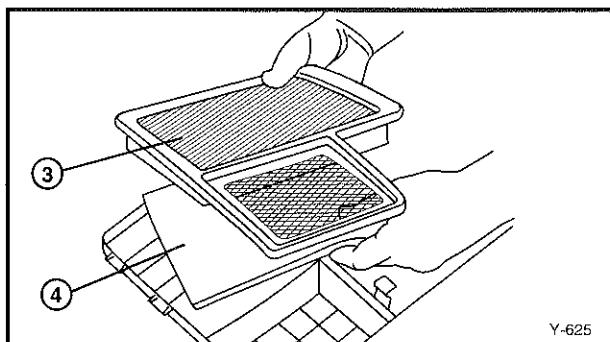




AIR FILTER CLEANING

1. Unlatch:
 - Air filter cover clips (1)
2. Remove:
 - Case cap (2)
 - Air filter (3)
 - Pre-filter (4)
3. Clean:
 - Pre-filter (4)

Wash it with soap and water (5) and allow it to dry.



CAUTION

- Do not apply oil to the element pre-filter; resistance to air flow will be increased and adversely affect the performance.
- Do not wash the air filter or use pressurized air which may damage the element.
- Do not use filters made from any other material. Engine life will be reduced.
- Be careful not to drop anything into the air inlet.

4. Install:

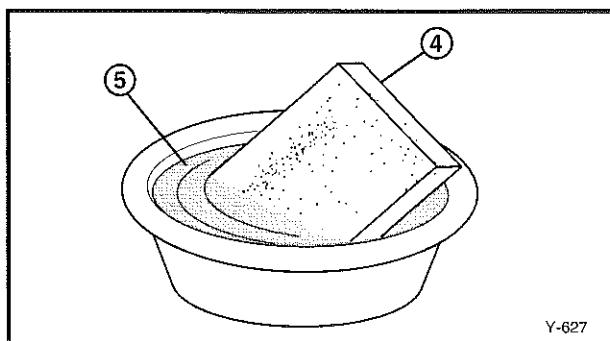
- All components

NOTE:

When assembling the air filter, reverse the removal procedure.

CAUTION

- The pre-filter has a notch on one side. It will only fit in the case one way.



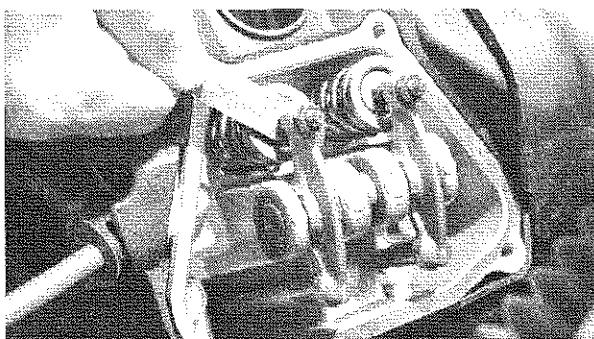


COMPRESSION PRESSURE MEASUREMENT

NOTE:

Insufficient compression pressure will result in performance loss.

2



SM-03-039

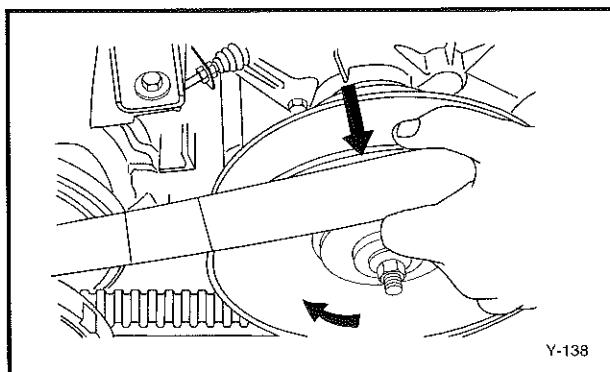
1. Measure:

- Valve clearance
Out of specification → adjust
Refer to "VALVE CLEARANCE ADJUSTMENT" section.

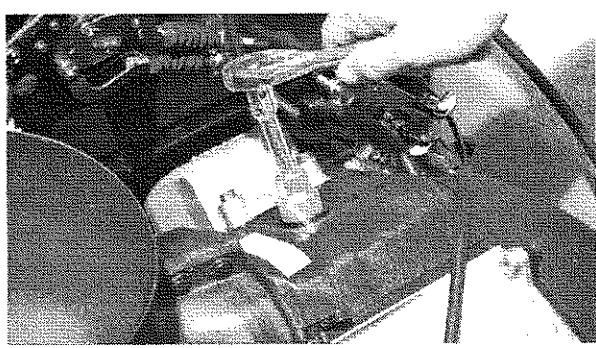
2. Warm up the engine.

3. Remove:

- Drive belt
- Spark plug



Y-138

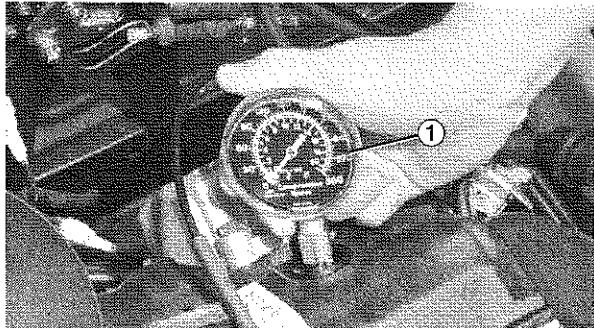


SM-03-035



4. Measure:

- Compression pressure



SM-03-259

Compression pressure measurement steps:

- Install the Compression Gauge ① using an adapter if necessary.



Compression Gauge:
YU-33223

WARNING

Before cranking the engine, disconnect ignition coil lead (Red/White, Orange).

- Crank over the engine with the electric starter (be sure the battery is fully charged) with the throttle wide-open and choke "OFF" until the compression reading on the gauge stabilizes.
- Check readings against specified levels (see chart).

Compression Pressure (at sea level):

Standard: 785 kPa (8.0 kg/cm², 114 psi)

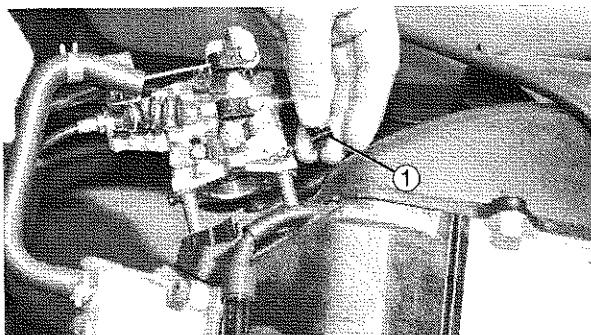
Minimum: 687 kPa (7.0 kg/cm², 100 psi)

Maximum: 883 kPa (9.0 kg/cm², 128 psi)

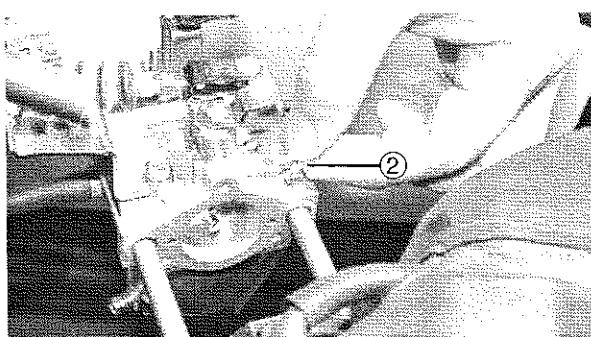
- If pressure falls below the minimum level:
 1. Apply a few drops of motor oil into the cylinder.
 2. Measure the compression again.

**Compression pressure
(with oil introduced into cylinder)**

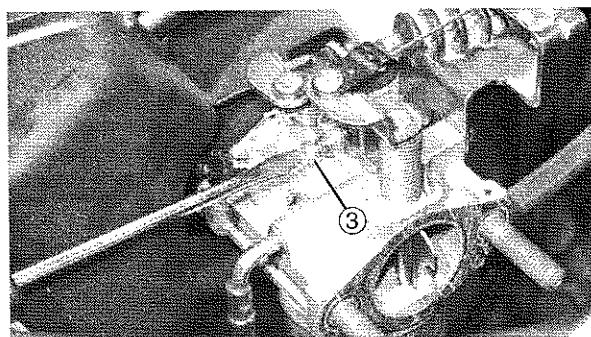
Reading	Diagnosis
Higher than without oil	Worn or damaged piston or ring.
Same as without oil	Bad valves, cylinder head gasket or worn guide.
Above maximum level	Inspect cylinder head, valve surfaces or piston crown for carbon deposits. Check decompressor.



SM-03-068



SM-03-067



SM-03-042

CARBURETOR ADJUSTMENT

NOTE:

Remove air cleaner assembly by removing two bolts at the rear of the air cleaner, the two nuts at the intake manifold and the breather hose. Remove the anti-tamper cap (1). If the cap is damaged, replace it.

1. Adjust:

- Pilot screw (2)

Pilot screw adjustment steps:

- Gently screw in the pilot screw (2).
- Back it out from its seated position.

Standard Turned out: 1 and 3/8 turns

- Adjust mixture by turning the pilot screw 1/8 ~ 1/4 turn each time.

Too Lean → turn pilot screw counterclockwise

Too Rich → turn pilot screw clockwise

2. Adjust:

- Throttle stop screw (3)

Throttle stop screw adjustment steps:

- Screw out the throttle stop screw (3) to clear the throttle arm.
- Slowly screw in the throttle stop screw (3) until it is lightly touching the throttle arm, then turn it another 1/4 turn.

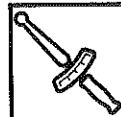
Standard Turned In: 1/4 turn

CAUTION

Do not use any other setting or adverse performance will result.

3. Make sure gaskets are clean and not damaged. Replace if necessary.

4. Install air cleaner case.



Air Cleaner Intake Manifold Nuts
and Air Cleaner Case Bolts:
7 N·m (0.7m·kg, 5.2 ft·lb)

CAUTION

Attach the breather hose firmly to the air cleaner case or engine damage may result.



ACCELERATOR STOP SWITCH

INSPECTION/ACCELERATOR PEDAL POSITION ADJUSTING BOLT HEIGHT ADJUSTMENT

1. Remove:

- Service lid

2. Inspect:

- Stop switch

Dirt deposits → clean

Irregular movement → replace switch

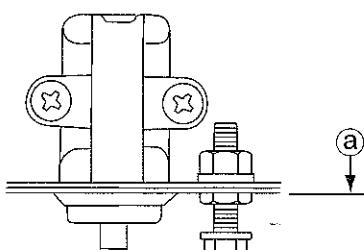
3. Measure:

- Adjusting bolt height ②.

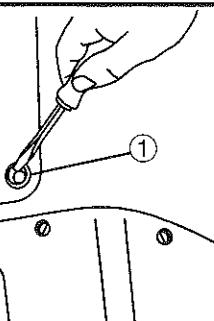
Out of specification → adjust



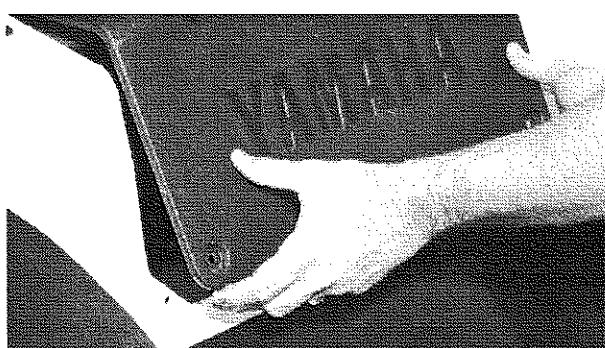
**Accelerator Pedal Position
Adjusting Bolt Height ②:**
18.00 ~ 18.40 mm (0.708 ~ 0.720 in)



Y-127

AHA

SM-03-030



SM-03-024

THROTTLE CABLE ADJUSTMENT

NOTE: _____

Before performing throttle cable adjustment, perform above switch inspection and bolt adjustment.

Full Throttle Adjustment

1. Turn the main switch to "OFF."

2. Block the wheels.

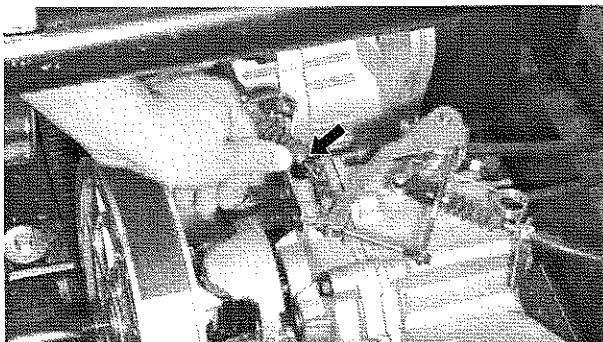
3. Remove:

- Rear access panel rivets ①

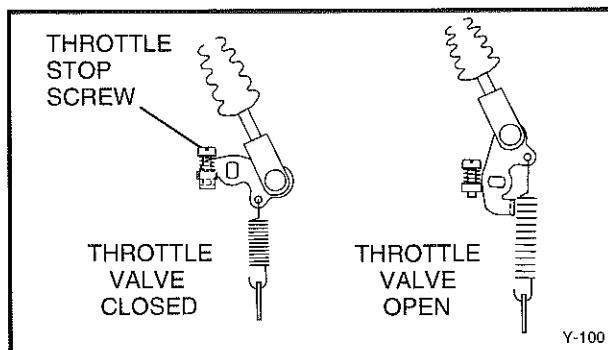
- Rear access panel

NOTE: _____

There are two separate throttle cables: 1) from accelerator pedal to speed limiter, and 2) from speed limiter to carburetor. Each cable requires adjustment for free play and full throttle operation.



SM-03-003



Y-100

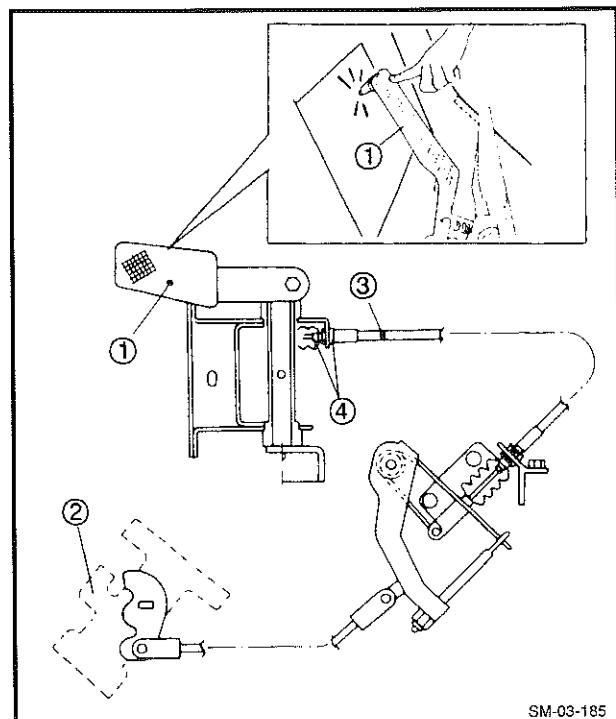
4. Adjust:

- Throttle cable 2 (Governor-Carburetor)

Throttle cable 2 adjustment steps:

- Swing the governor lever counterclockwise until it stops completely.
- While keeping the lever at this position, make sure the throttle valve in the carburetor is fully open.
- If not, adjust the throttle cable 2 by turning the adjusting nuts in or out.

2



SM-03-185

5. Adjust:

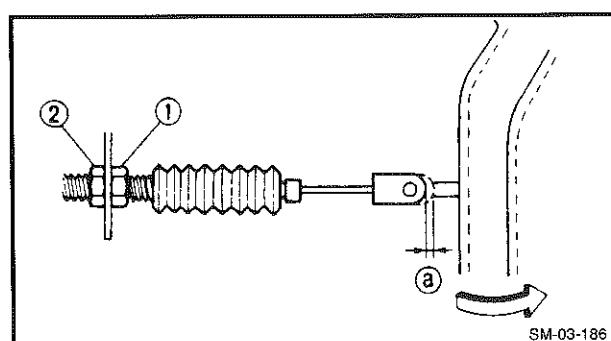
- Throttle cable 1
(Accelerator pedal-Governor) ①

Throttle cable 1 adjustment steps:

- Depress the accelerator pedal ① to limit.
- While keeping the pedal at this position, make sure the throttle valve in the carburetor ② is fully open.
- If not, adjust the throttle cable 1 ③ by turning the adjusting nuts ④ in or out.

NOTE:

Throttle valve should reach fully open at the same time the accelerator pedal reaches its limit. If the throttle valve is fully open before the accelerator pedal reaches its limit, cable 1 is too tight.



SM-03-186

Free play adjustment**1. Measure:**

- Free play (Throttle cable 2) ②
Out of specification → adjust



Free Play (Throttle Cable 2):
0.0 ~ 1.0 mm (0.0 ~ 0.04 in)



2. Adjust:

- Free play (Throttle cable 2)

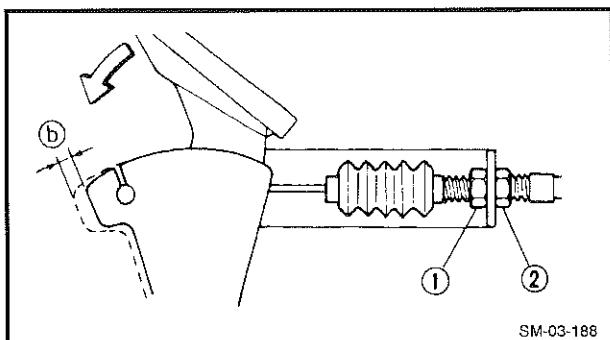
Throttle cable 2 free play adjustment steps:

- Loosen the locknut ①.
- Turn the adjuster ② in or out until the correct free play is obtained.

Turn in	Free play is decreased.
---------	-------------------------

Turn out	Free play is increased.
----------	-------------------------

- Tighten the locknut.



3. Measure:

- Free play (Throttle cable 1) ③
- Out of specification → adjust



Free Play (Throttle Cable 1):
0.0 ~ 1.0 mm (0.0 ~ 0.04 in)

4. Adjust:

- Free play (Throttle cable 1) ③

Throttle cable 1 free play adjustment steps:

- Loosen the locknut ①.
- Turn the adjuster ② in or out until the correct free play is obtained.

Turn in	Free play is decreased.
---------	-------------------------

Turn out	Free play is increased.
----------	-------------------------

- Tighten the locknut.

SPEED LIMITER ADJUSTMENT**Adjustment**

The speed limiter is properly adjusted at the factory. No adjustment is normally required.

Standard Limiter Setting:

Approximately 3,050 rpm at
19 km/h (12 mph)

**NOTE:**

- When service is performed on the throttle cables or governor parts, the golf car maximum speed should be checked and the speed limiter setting adjusted as necessary.
- Before performing repairs, mark the present limiter setting with a paint mark for future reference. Return the adjustment to the original setting after repairs are complete, then test vehicle speed.
- The speed limiter can be adjusted so the maximum speed is 10 mph ~ 14 mph (16 ~ 22 km/h).

! WARNING

Do not exceed the maximum speed setting of 14 mph (22 km/h) under any circumstances.

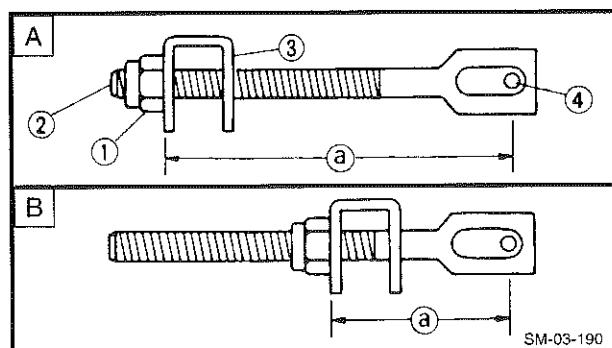
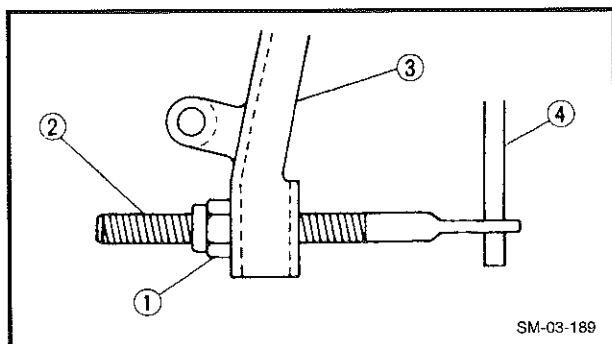
1. Check:

- Setting speed

Compare the maximum speed with another golf car driving parallel. (The golf car used for comparison should be representative of other cars in the same fleet.)

Improper setting → readjust

- ① Locknut
 ② Adjusting rod
 ③ Limiter Lever
 ④ Torsion spring

**Limiter setting adjustment steps:**

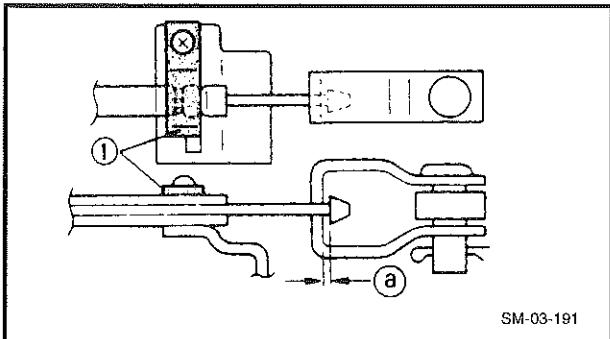
- Before getting started, mark the present setting position with a paint mark.
- Adjust the distance ④ by turning locknut ①.

To Reduce Maximum Speed →

turn locknut ① counterclockwise □

To Increase Maximum Speed →

turn locknut ① clockwise □



CHOKE CABLE ADJUSTMENT

1. Measure:

- Free play (Choke cable) ②
- Out of specification → adjust



Free Play (Choke Cable) ②
1.0 mm (0.04 in)

① Cable clamp

2. Adjust:

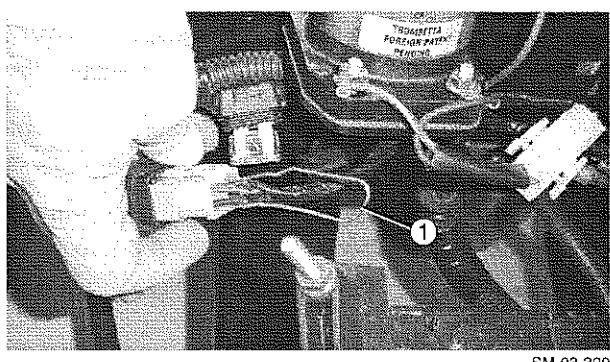
- Free play (Choke cable)

Choke cable free play adjustment steps:

- Make sure the choke knob and carburetor choke lever are in the "at rest" or "OFF" position.
- Loosen the cable clamp ①.
- Slide cable forward or backward in cable clamp until free play specification is met.
- Tighten the cable clamp screw.

NOTE:

After adjusting the choke cable, make sure the choke moves smoothly, and the choke opens fully when the choke knob is pulled all the way out.



FUEL PUMP INSPECTION

Fuel Supply to Pump

1. Remove:

- Drive belt

2. Ground engine stop relay (black to blue) using a paperclip or short length of wire ①.

3. Disconnect:

- Fuel feed hose ② from carburetor.

⚠ WARNING

Gasoline is highly flammable. Aim the fuel hose into a container. Keep away from any spark, flame or other source of ignition. Wipe up any spilled fuel immediately.

4. Place a pan or other container under the hose end.

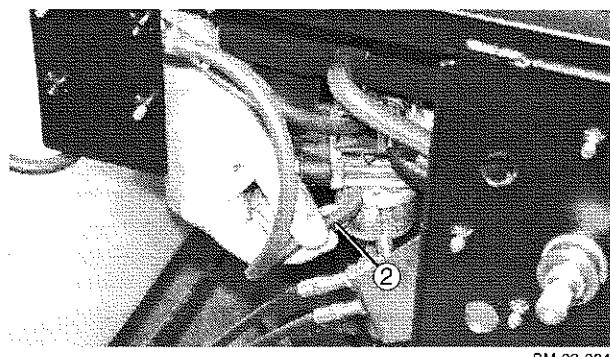
5. Crank over the engine with starter motor.

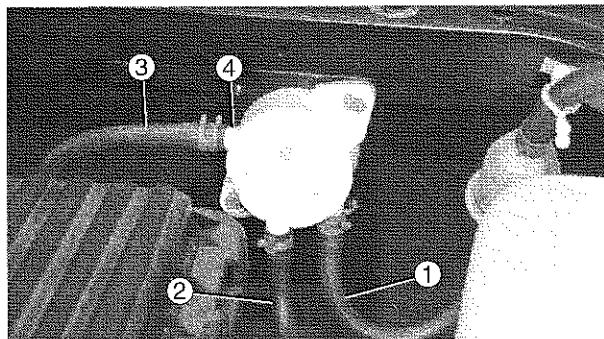
6. Check to see if fuel flows out from the feed hose end.

If fuel does not flow out, check pulse hose, fuel filter and hose from tank to pump.

Cracked/plugged → replace

Replace the pump if it leaks.





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2

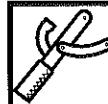
Fuel Pump Test**NOTE:**

The inspection requires "wet condition," or the presence of some fuel in the pump. A totally dry pump will not function due to air leaks through valve gaps in the pump.

1. Mark fuel pump hoses to allow for reconnection in their proper location after test.
 - ① From fuel tank
 - ② To crankcase
 - ③ To carburetor
2. Disconnect:
 - Hoses from fuel pump.

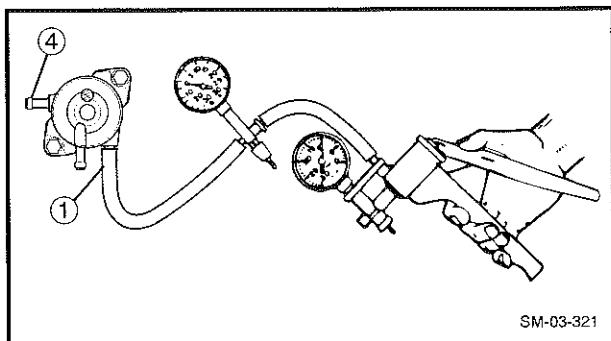
CAUTION

During the following steps, do not apply more pressure than the specification indicated.

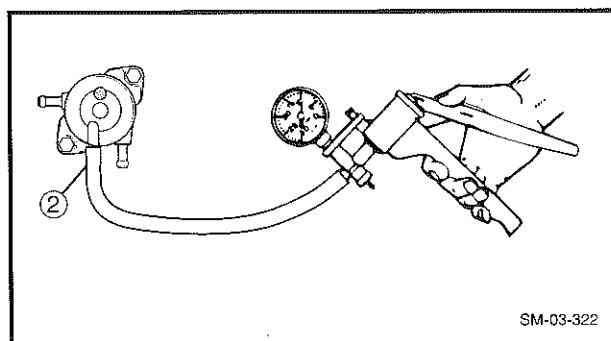


Mityvac® Pressure Tester:
YB-35956-A

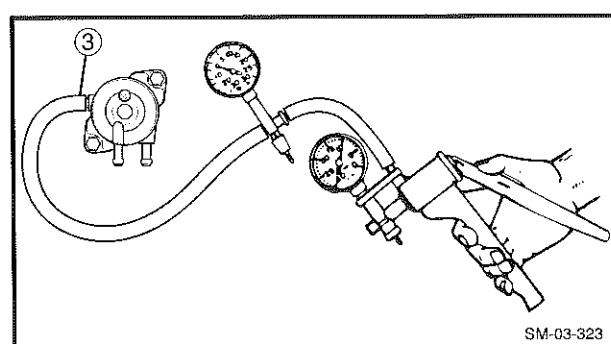
3. Connect pressure hose from Mityvac® to pump inlet spigot from fuel tank delivery hose ① (Diaphragm Test).
4. Block fuel outlet spigot ④ and pressurize to 7.0 ± 1.0 psi (48.2 ± 6.9 kPa).
5. Check:
 - Pressure being maintained
 - Pressure loss → replace pump
6. Connect pressure hose from Mityvac® to vacuum side of pump ② (Inlet Valve Test).
7. Apply negative pressure to 300 mb $\pm 10\%$.
8. Check:
 - Pressure is not released all at once.
 - Sudden pressure release → replace pump
9. Connect pressure hose from Mityvac® to pump outlet spigot ③ from fuel pump to carburetor (Outlet Valve Test).
10. Pressurize to 7.0 ± 1.0 psi (48.2 ± 6.9 kPa).
11. Check:
 - Pressure being maintained.
 - Pressure loss → replace pump



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**CAUTION**

Never attempt to disassemble the fuel pump.

12. Connect:

- Hoses to fuel pump.

FUEL FILTER INSPECTION

1. Disconnect:

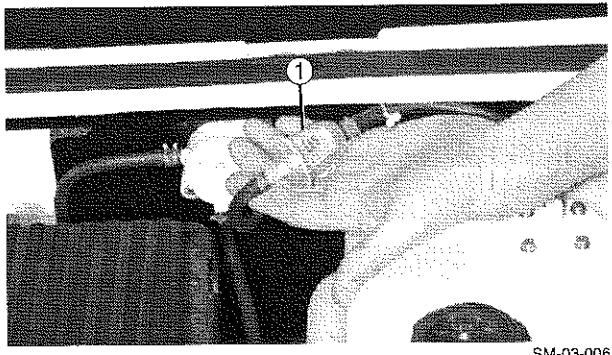
- Fuel hose from fuel pump.
- Fuel hose from gas tank.

2. Remove:

- Fuel filter ①

3. Inspect:

- Fuel filter
Contamination → replace

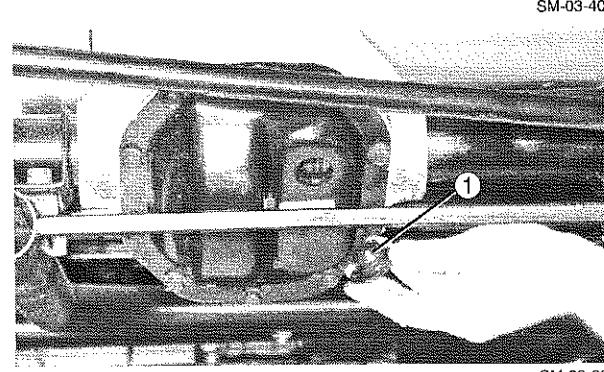
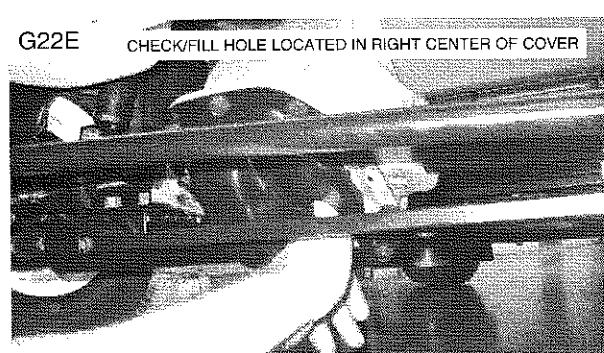
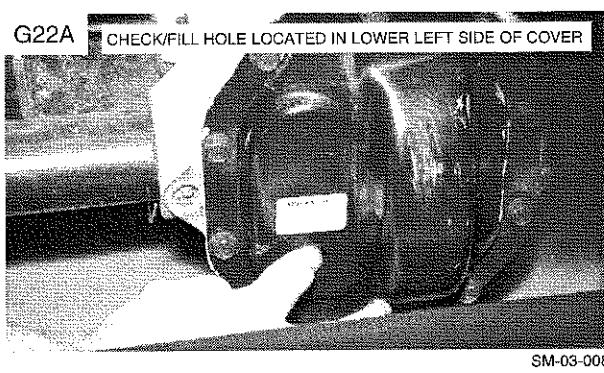
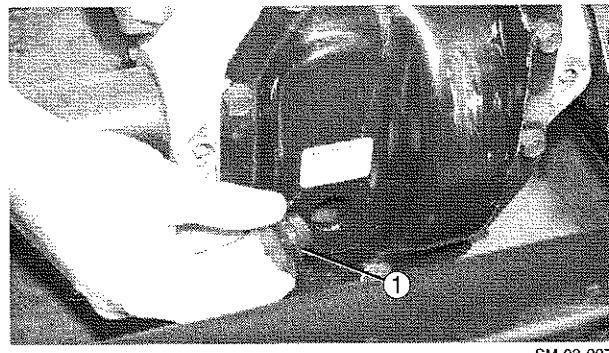


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FUEL HOSE INSPECTION

1. Inspect:

- Fuel hoses
Damage/cracks → replace
Poor connection → reconnect



POWER TRAIN

TRANSMISSION OIL LEVEL MEASUREMENT

1. Place golf car on a level surface.
2. Remove oil level plug ①.
3. Check:
 - Oil level
 - Oil level low → add sufficient oil

Transmission oil level inspection steps:

- Remove the oil level plug.
- Use finger to verify oil level.

NOTE:

Place an oil pan under the transmission case.

- If needed, add sufficient oil little by little into the oil level plug hole until oil flows out from the level plug hole.



Recommended Oil:

SAE 90 gear oil

Oil Capacity:

G22A: 415 cc (415 mL,

0.44 U.S. quart)

G22E: 300 cc (300 mL,

0.32 U.S. quart)

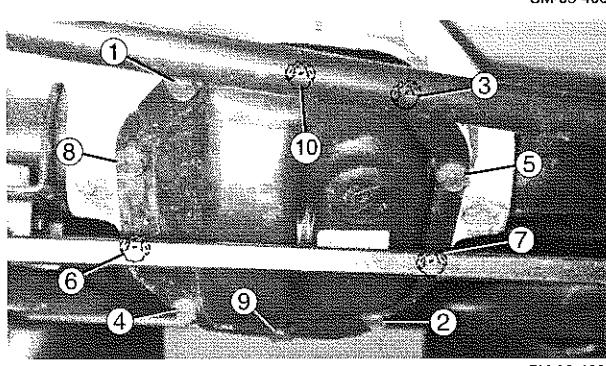
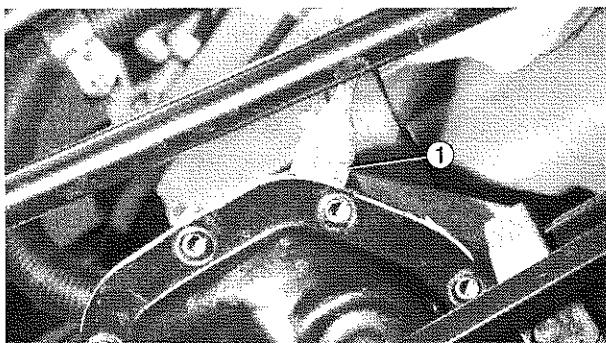
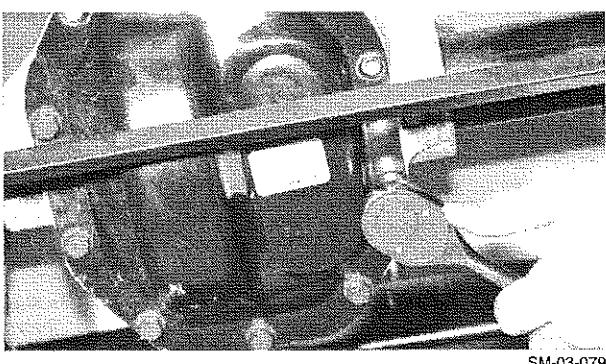
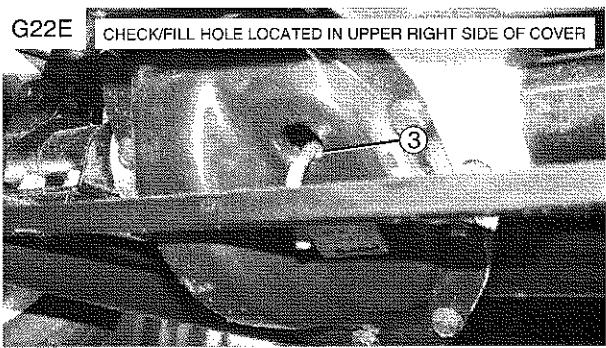
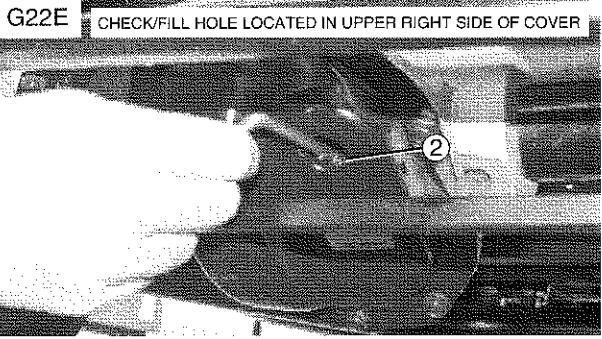
CAUTION

Do not allow foreign material to enter the transmission case.

- Allow excess oil to flow out until it stops.
- Install the oil level plug.

NOTE:

If G22E oil level check/fill hole is located in the upper right side of cover you must use the recommended special tool (G22E transaxle fluid check gauge P/N TF-00001) and follow the steps on page 2-22 to check the transmission oil.



TRANSMISSION OIL LEVEL MEASUREMENT

(G22E transaxle with check/fill hole located in upper right side of cover)

1. Remove oil level plug ① (refer to photo on page 2-21)
2. Insert transaxle oil level check gauge P/N TF-00001 into check/fill hole ②.
3. Confirm that the check gauge is fully rested on the bottom edge of the hole ③.
4. Remove the gauge from the transaxle and check the fluid level. The mark on the gauge represents the 300cc fluid level inside the transaxle.
5. Install the oil level plug.

TRANSMISSION OIL REPLACEMENT

1. Place golf car on a level surface.
2. Place an oil pan under the transmission case.
3. Remove:
 - Transmission case bolts
 - Transmission case cover
 Drain the transmission oil

NOTE:

Separate the transmission case cover from the case assembly using a gasket scraper ①.

CAUTION

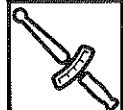
Use care not to damage the case sealing surface or deform the transmission case cover.

4. Install:

- Transmission case cover

NOTE:

Tighten the bolt in order starting with the smallest number and torque the bolts in two stages.



Transmission Case Bolts
28 N·m (2.9 m·kg, 20.7 ft·lb)

5. Fill:

- Transmission case

Refer to "TRANSMISSION OIL LEVEL MEASUREMENT" section, page 2-21.

**Recommended Oil:**

SAE 90 gear oil

Oil Capacity:

G22A: 415 cc (0.42 L,

0.44 U.S. quart)

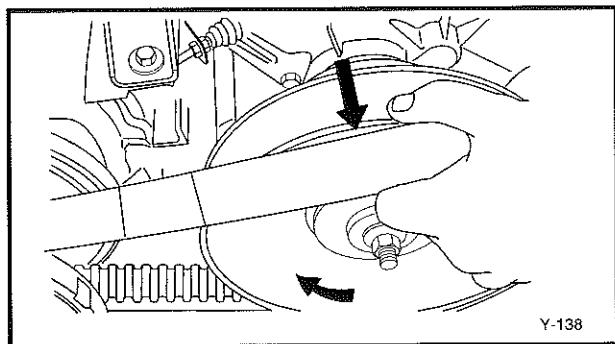
G22E: 300 cc (0.3 L,

0.32 U.S. quart)

CAUTION

Do not allow foreign material to enter the transmission case.

2

**DRIVE BELT INSPECTION FOR G22A**

1. Remove the seat.
2. Remove the drive belt.

Drive belt removal steps:

- Set the shift lever halfway between "F" and "R."
- Pull out the primary sliding sheave.
- Pull the belt outward over the edge of the secondary fixed sheave.
- Rotate the secondary sheave clockwise and the belt will roll off the secondary sheave.
- Slip the belt over the primary sheave to completely remove.

3. Inspect:

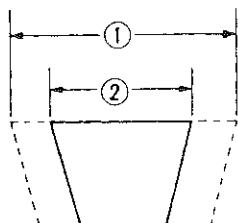
- Drive belt
Scratches/Slippage/Damage → replace

4. Measure:

- Belt width
Out of specification → replace

**Wear Limit ②:**

27.0 mm (1.06 in)

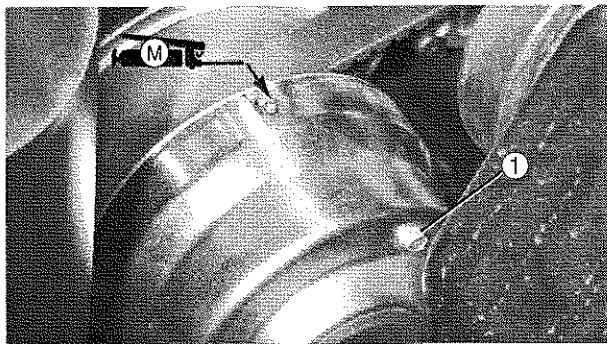


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(① New belt width: 31.0 mm (1.22 in))

5. Install the drive belt.**Drive belt installation steps:**

- Set the shift lever halfway between "F" and "R."
- Slip the belt over the primary sheave.
- Push the belt firmly into the secondary sheave at about the 10:00 o'clock position.
- Rotate the secondary sheave clockwise until the belt has rolled into position on the secondary sheave.



PRIMARY SHEAVE LUBRICATION FOR G22A

1. Lubricate:

- Primary sheave bushings



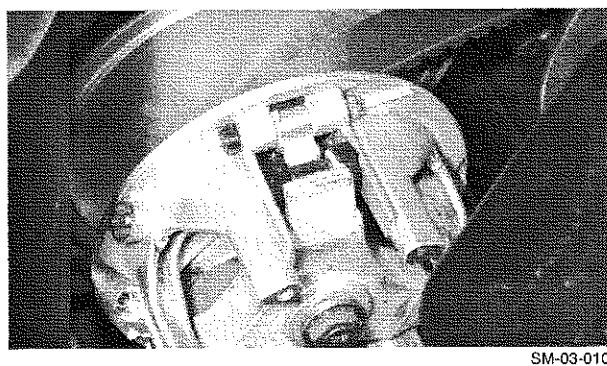
Recommended Grease:

Molybdenum disulfide grease

Grease Amount:

Three shots (Manual grease gun)

Three seconds (Automatic grease gun)

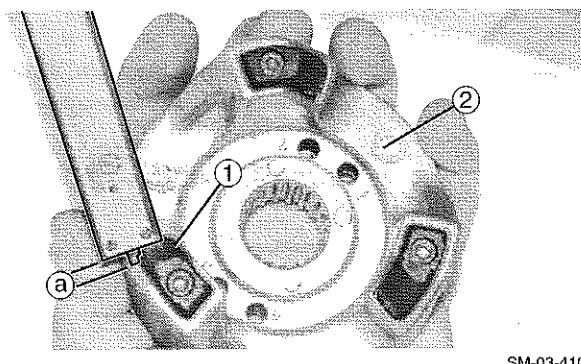


2. Inspect:

- Remove sheave cap bolts ① and inspect weights and rollers.
Worn → replace
- Lubricate rollers with Teflon® spray

CAUTION

Clean any excess grease from weights before reinstalling sheave cap. Weight pivots must be clean and dry. Oil or grease will attract dirt and cause premature wear. Be sure that no grease gets on drive belt.



SHEAVE INSPECTION

1. Inspect:

- Primary Sliding sheave movement (primary and secondary)
Check for condition by moving with hand.
Obstruction → disassemble sheave and inspect component parts
Refer to CHAPTER 4 "PRIMARY SHEAVE" and "SECONDARY SHEAVE" sections.

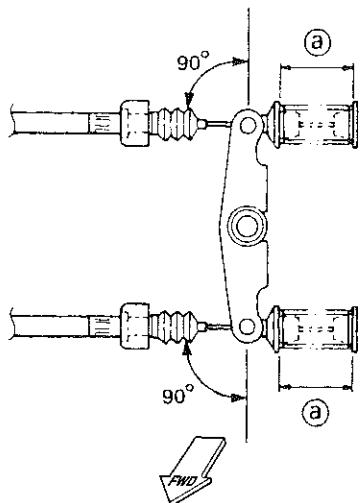
2. Measure:

- Ramp shoe thickness ① on spring seat cam ②.
Out of specification → replace

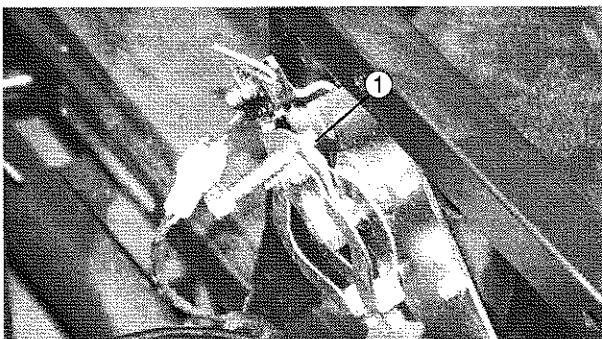


Wear Limit ④:

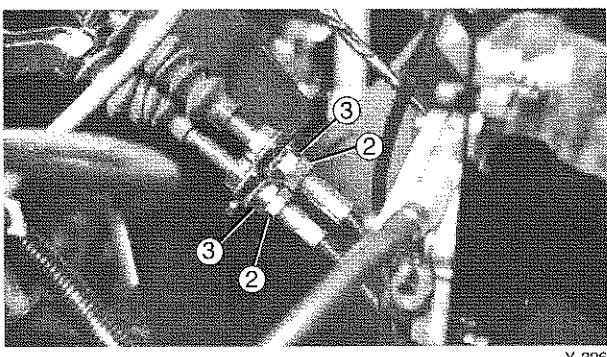
1.0 mm (0.04 in)



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LUBRICATION SECONDARY SHEAVE

Refer to CHAPTER 4 "PRIMARY SHEAVE" and "SECONDARY SHEAVE" sections.

SHIFTING CABLE ADJUSTMENT

1. Measure:

- Shift stroke
Out of specification → adjust



Shift Stroke ①:
15 ~ 17 mm (0.59 ~ 0.67 in)

Shift stroke adjustment:

- Set the shift lever halfway between "F" and "R" and pin lever in place with a bolt or pin with 8 mm diameter ①.
- Loosen the locknuts ②.
- Adjust the shift stroke by turning the adjusting nuts ③.

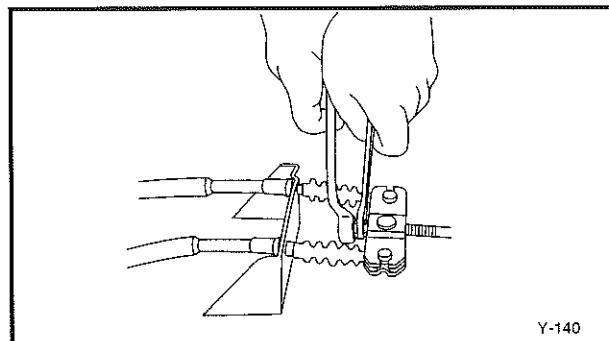
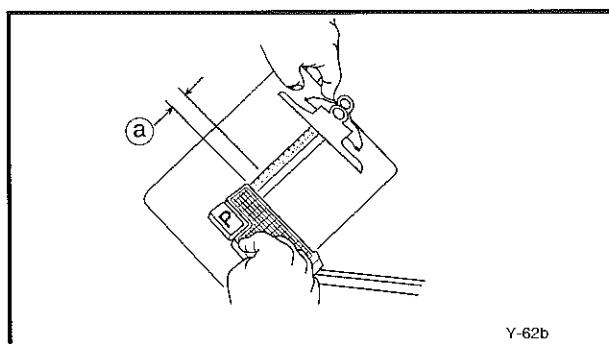
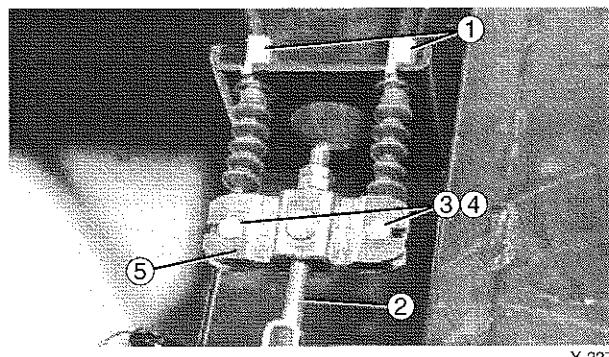
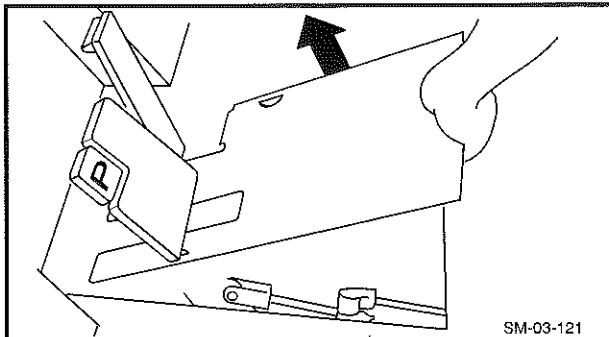
To Reduce → turn adjusting nut ③
clockwise

To Increase → turn adjusting nut ③
counterclockwise

- Tighten the locknuts ②.
- Unpin the shift lever.

NOTE: _____

Check shifting operation after adjusting shift stroke.



CHASSIS

BRAKE CABLE INSPECTION

1. Remove:

- Service lid

Be careful not to scratch body.

2. Inspect:

- Brake cables ①
- Brake rod ②
- Clevis pins ③
- Cotter pins ④
- Brake equalizer ⑤

Wear/damage → replace

3. Measure:

- Brake pedal free play ⑥

Press against the pedal with hand (using light force) and measure the distance the pedal travels before resistance is felt.

Out of specification → adjust



Brake Pedal Free Play ⑥

20 ~ 25 mm (0.79 ~ 0.98 in)

Free play adjustment steps:

- Loosen the locknut.
- Adjust the free play by turning the adjusting nut in or out until specification is achieved.

NOTE: The adjusting nut has a cam shape, allowing the nut to be turned only in increments of 180°.

To Reduce Free Play → turn adjusting nut clockwise

To Increase Free Play → turn adjusting nut counterclockwise

- Tighten the locknut.

WARNING

Overly tight cables will prevent proper brake self-adjuster action, reducing braking performance.



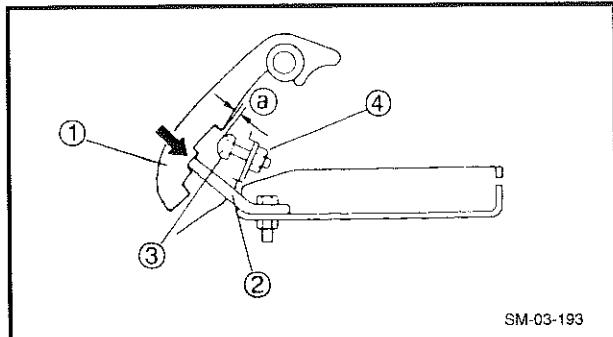
PARKING BRAKE ADJUSTMENT

NOTE:

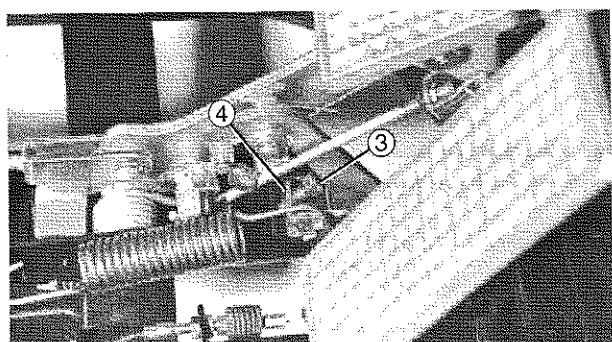
Before performing parking brake adjustment, adjust brake pedal free play.

2

1. Turn the main switch to "OFF," and remove the key.
2. Remove the service lid.
3. Inspect:
 - Parking brake ratchet ①
 - Ratchet stopper ②
 - Wear/damage → replace
4. Apply the brake. Hook the stopper ② at the second notch on the ratchet ①.
5. Measure:
 - Free play (Release timing) ④
 - Out of specification → adjust



Free Play (Release Timing):
0 - 0.3 mm (0-0.011 in)



Release timing adjustment steps:

- Loosen the locknut ④.
- Adjust the release timing by turning the adjusting bolt ③.

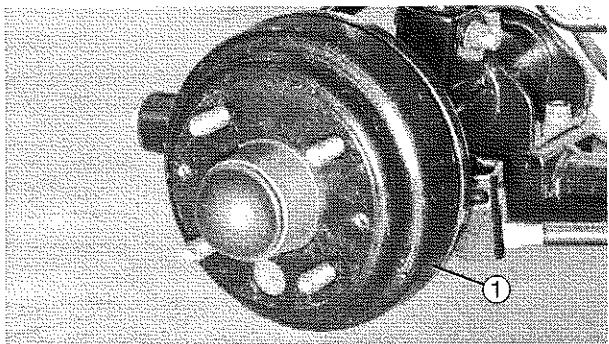
To Advance → turn adjusting bolt ③ counterclockwise

To Retard → turn adjusting bolt ③ clockwise

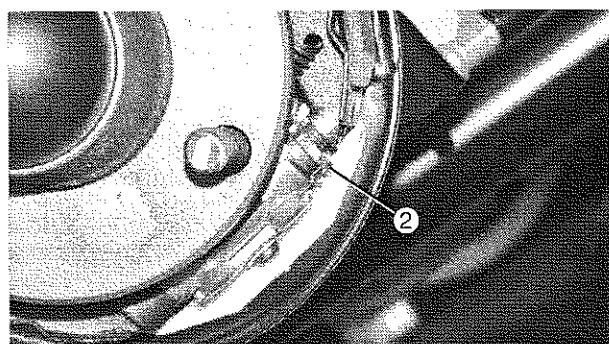
- Tighten the locknut.
- Recheck the release timing.

BRAKE SHOE LINING INSPECTION

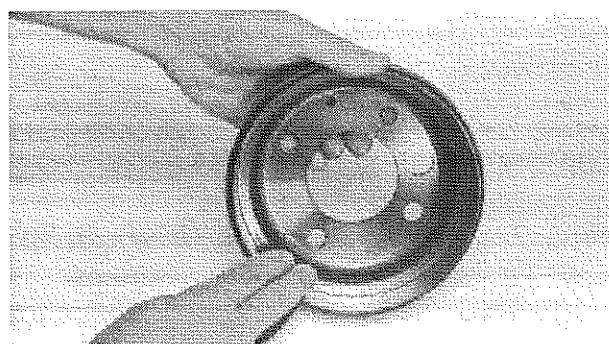
1. Turn the main switch to "OFF," and remove the key.
2. Apply parking brake, loosen the wheel nuts.
3. Block the front wheels. Jack up the rear of the car. Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.
4. Release parking brake by depressing the accelerator pedal.
5. Remove the wheel nuts and rear wheel.



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6. Remove:

- Brake drum ①

To loosen the drum, lightly tap with mallet.

NOTE: _____

If it is very hard to remove the drum, screw in the adjusting nut ② in the shoe plate. (Brake drum shown removed for clarity.)

7. Inspect:

- Drum inner surface
 - Oil → clean completely with non-oily solvent
 - Scratches → lightly polish evenly with emery cloth

8. Measure:

- Drum inside diameter
 - Out of specification → replace drum



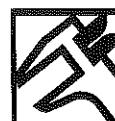
Maximum Inside Diameter:
161 mm (6.34 in)

9. Inspect:

- Shoe lining surface
 - Oil → replace/clean completely with non-oily solvent and emery cloth
 - Scratches → lightly polish evenly with emery cloth

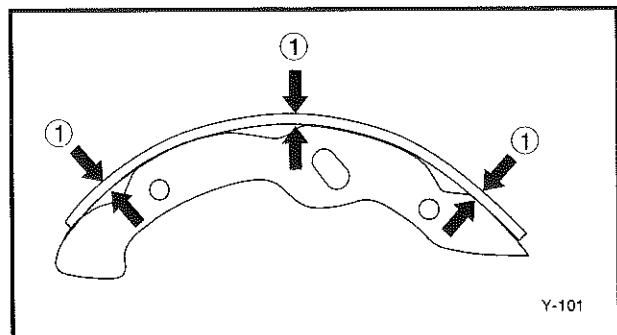
10. Measure:

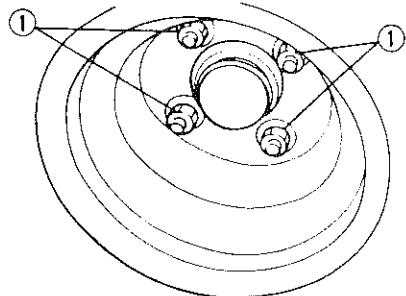
- Shoe lining thickness
 - Out of specification → replace
 - Refer to CHAPTER 3 "BRAKE" section.



Minimum Lining Thickness:
0.75 mm (0.029 in)

① Measuring points





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CAUTION

Replace the brake shoes as a set if either is found to be worn to the limit.

11. Install:

- Brake drum
- Rear wheel

WARNING

Make sure that no grease or water comes in contact with the brake drum and/or shoe surfaces.

2

12. Install:

- Wheel nuts ①

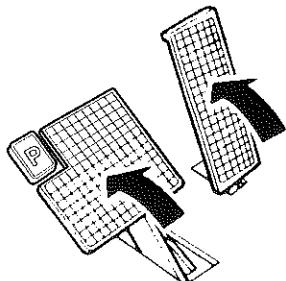
NOTE:

First, finger-tighten a top nut, then the rest diagonally. Make sure all nuts are seated before lowering the vehicle. Let the vehicle down until the weight is on the wheels. Finish tightening the nuts.



Wheel Nut ①:
90 N·m (9.2 m·kg, 66.4 ft·lb)

13. After assembling, depress the brake pedal about 10 times to adjust the shoe-drum clearance.



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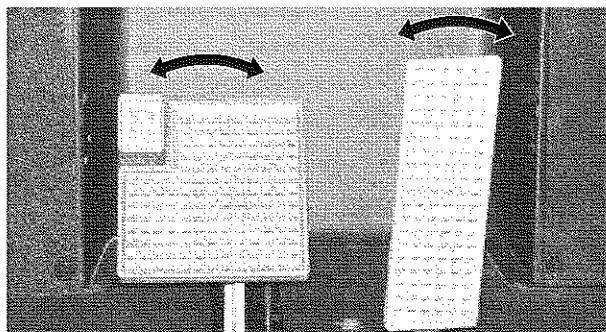
BRAKE AND ACCELERATOR PEDALS

1. Check:

- Pedal movement
Disconnect the brake rod and throttle cable.
Roughness → lubricate pivoting parts



Recommended Lubricant:
SAE 10W30 Motor Oil



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2. Check:

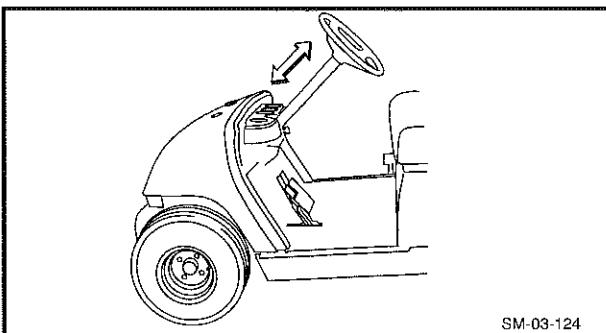
- Pedal side free play

Try to move the pedals from side to side.

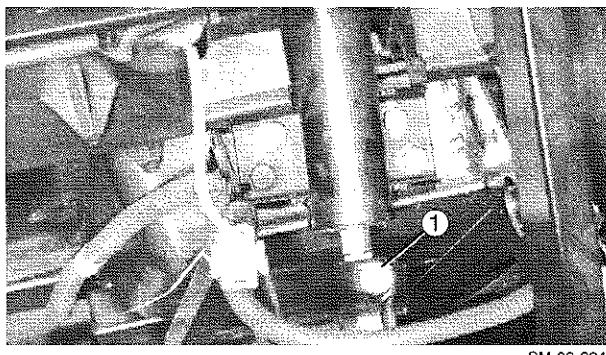
Noticeable free play → replace pivoting parts



Pedal Side Play Limit:
5 mm (0.20 in) measured at top of
pedal



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STEERING INSPECTION**Steering State Axial Play**

1. Check:

- Axial play

Pull and push the steering wheel.

Looseness → retighten steering wheel
and/or steering universal joint bolt

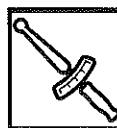
2. Tighten:

- Nut (steering wheel)

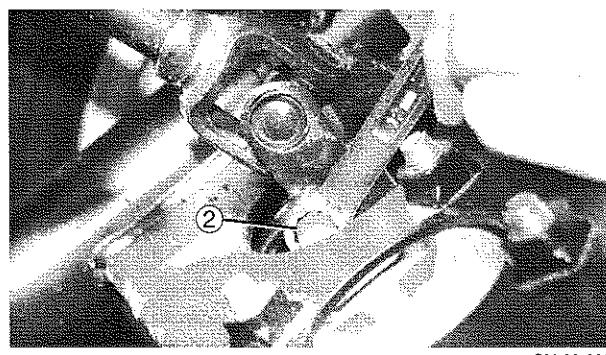
- Bolts (universal joints)

① Upper pinch bolt

② Lower pinch bolt



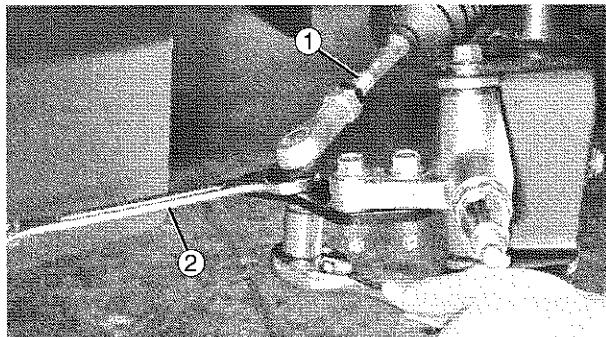
Nut (steering wheel):
35 N·m (3.6 m·kg, 25.8 ft·lb)
Bolts (universal joints) ②
22 N·m (2.2 m·kg, 16.2 ft·lb)



SM-03-325

3. Recheck:

- Axial play



SM-03-044

STEERING LINKAGE INSPECTION

Tie Rod End (Universal Joint)

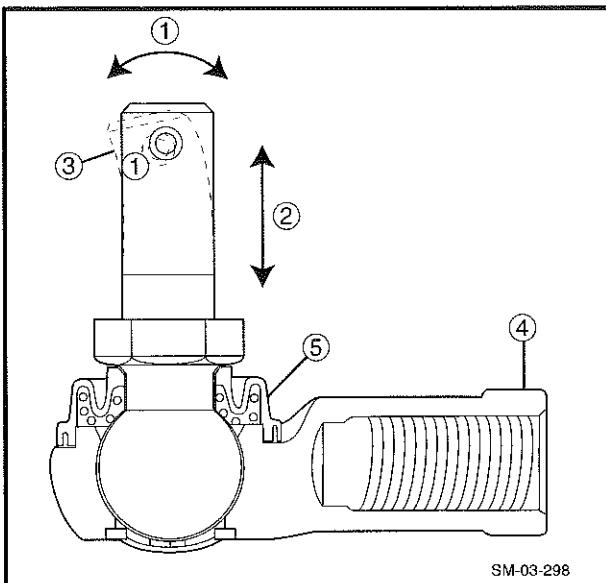
1. Remove:

- Cotter pin
- Locknut
- Tie rod (1)

NOTE: _____

When removing the locknut, hold the rod end using a 17 mm wrench (2).

2



SM-03-298

2. Check:

Tie rod ends for the following conditions:

- Un-smooth movement (1)
- Noticeable free play (2)
- Bent stud (3)
- Warped or cracked housing (4).
- Torn or cracked boot (5).

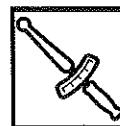
Refer to CHAPTER 3 "STEERING SYSTEM" section.

NOTE: _____

If any of the above conditions are observed, replace the tie rod ends with new ones.

3. Install:

- Tie rod (1)



**Tie Rod Idler Arm,
Knuckle Arm-Tie Rod:**
39 N·m (4.0 m·kg, 28.8 ft·lb)

Knuckle

1. Check:

- Kingpin bolt, spacer and bushing free play
 - a. Park the vehicle on a level surface and apply parking brake.
 - b. Raise the front wheels with a suitable lift.
 - c. Gently rock the front wheel side to side.
- Noticeable free play → replace bushings



**Free Play Limit 1:
5 mm (0.20 in)**

Refer to CHAPTER 3 "FRONT SUSPENSION" section.

WHEEL ALIGNMENT

Toe-In

1. Place the vehicle on a level surface.
2. Push the empty car forward 20 feet to stabilize suspension. Coast to a stop with front wheels pointed straight ahead.

NOTE: _____

Do not push the car backward or apply the brake to stop. Doing either will result in a change in toe-in.

3. Measure:

- Toe-in

Out of specification → adjust

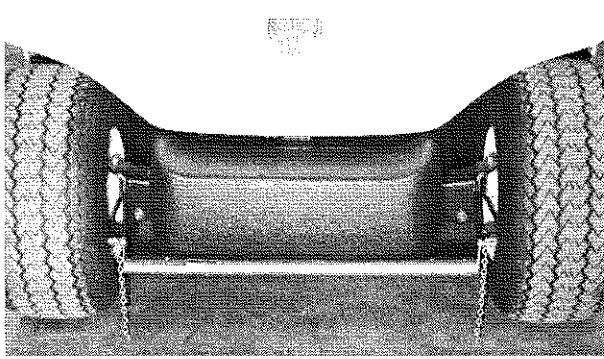


Toe-In:

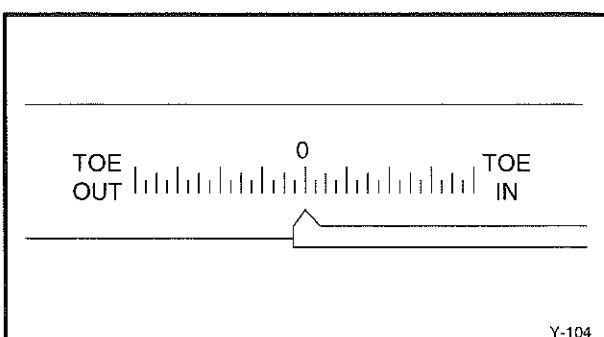
Unloaded:

0~11 mm (0.00 ~ 0.43 in)

Fully loaded: Zero mm (Zero in)



SM-03-013



Y-104

Toe-in measurement steps:

- Place the Toe Measuring Gauge between the inner sidewalls of the front tires approximately 2-1/4 in (60 mm) behind the face of the front tire. The height indicator chains should just touch the floor evenly on each side.



Toe Measuring Gauge:

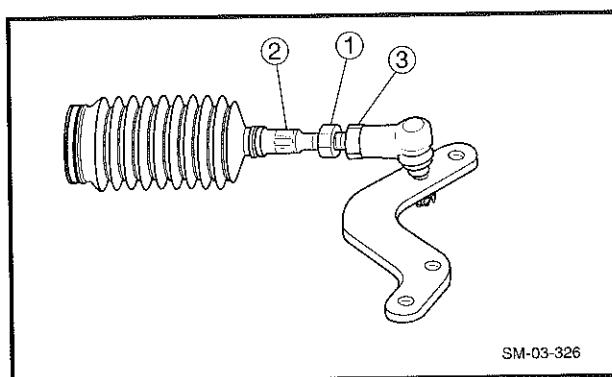
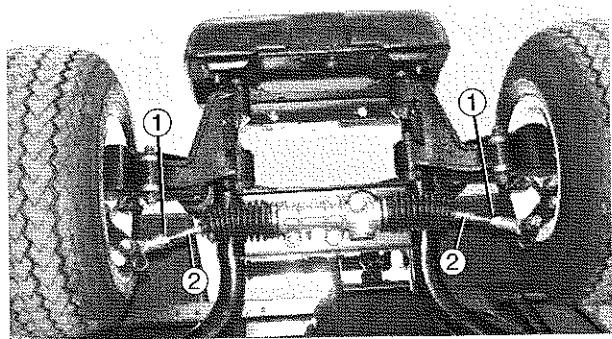
YC-39526

- Zero the scale on the gauge by sliding the moveable scale so the pointer is at 0.
- With gauge in place, roll the car forward 1/2 turn of the wheels. The height indicator chains should just touch the floor.

NOTE: _____

Move the car by pushing from the rear, or pulling directly on the front bumper. Make sure the front of the car is not lifted or pushed down, which would cause an inaccurate measurement.

- Read the toe-in measurement on the gauge scale.

**Toe-in adjustment steps:**

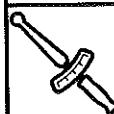
- Jack up the front of the vehicle. Apply parking brake.
- Loosen the locknuts (1).
- Adjust the toe-in by turning the tie rods (2).

To Reduce → turn the tie rods (2) to make their lengths longer (more toe-in)

To Increase → turn the tie rods (2) to make their lengths shorter (less toe-in)

NOTE:

- When loosening or tightening the locknuts (1), hold the tie-rod at a flat section (3) with a wrench.
- The length of the threads (2) of both rod ends must be the same.
- Tighten the locknuts.



Rod End Locknut:
40 N·m (4.1m·kg, 29.5 ft·lb)

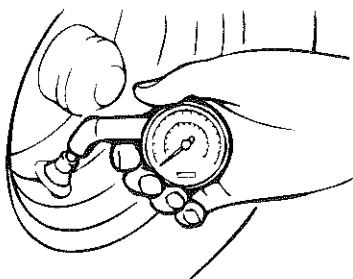
- Place the vehicle back on the ground.
- Compress the suspension by pushing down on the front bumper.

4. Recheck:

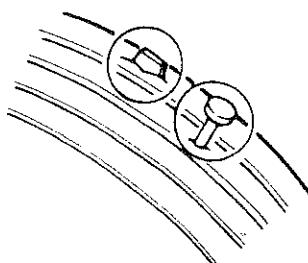
- Toe-in

Out of specification → repeat adjustment steps

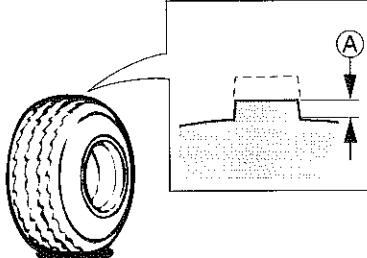
2



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SM-03-196



Y-143

TIRE AND WHEEL INSPECTION

1. Measure:

- Air pressure
Out of specification → adjust

Tire Pressure: (Front and Rear)

For G22A:

110 kPa (1.1 kg/cm², 16 psi)

For G22E:

137 kPa (1.4 kg/cm², 20 psi)

2. Inspect:

- Tire surfaces
Wear/damage/cracks/imbedded objects → replace
- Wheels
Damage/bends → replace
Never attempt even small repairs to the wheel.

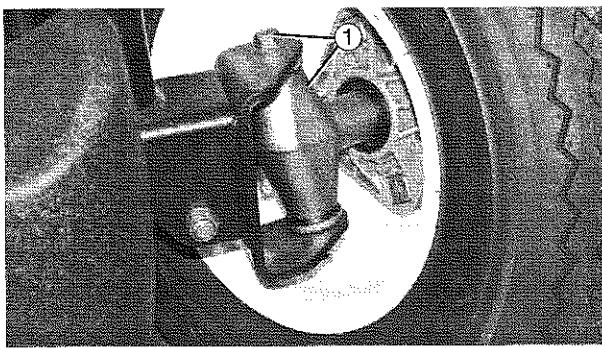
3. Measure:

- Tire tread depth **A**
Out of specification → replace



Minimum Tire Tread Depth **A:**
(Front and Rear)

1.0 mm (0.04 in)



SM-03-014

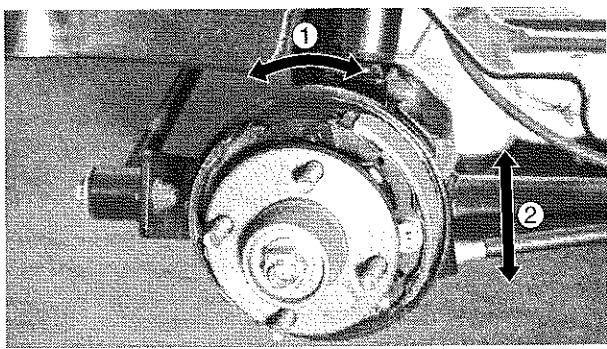
FRONT WHEEL BEARING INSPECTION

1. Apply parking brake. Jack up the front of the car.
2. Spin the wheel by hand. Touch the knuckle or kingpin ① while spinning the wheel.
Excessive vibration → replace bearings
Refer to CHAPTER 3 "FRONT WHEEL" section.

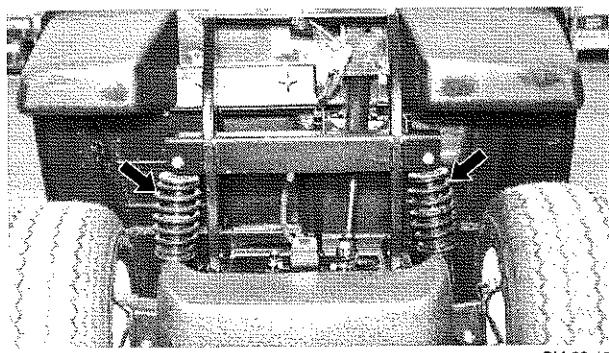
REAR AXLE BEARING INSPECTION

1. Apply the parking brake, loosen the rear wheel nuts.
2. Block the front wheels. Jack up the rear of the car.
3. Remove:
 - Rear wheels
 - Brake drums
4. Turn ① the rear axle slowly by hand.
Roughness → replace bearing
5. Gently rock ② the rear axle up and down.
Noticeable free play → replace bearing/replace axle
Refer to CHAPTER 3 "REAR AXLE WHEEL" section.

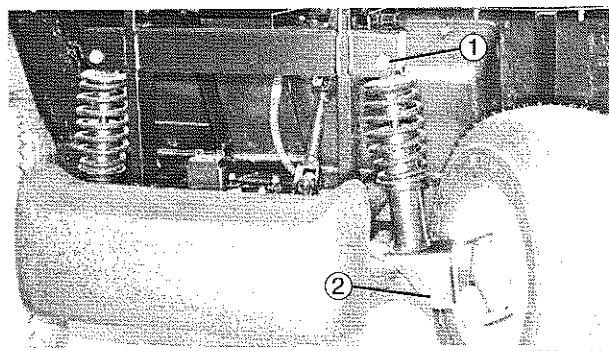
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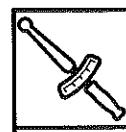
SM-03-15



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SHOCK ABSORBER INSPECTION

1. Inspect:
 - Oil leakage
Oil leaks → replace shock absorber
 - Coil spring
Fatigue/cracks/damage → replace shock absorber
- Refer to CHAPTER 3 "FRONT SUSPENSION" and "REAR SUSPENSION" sections.



Pivot Bolt-Nut:

Upper Bolt-Nut ①:

45 N·m (4.6 m·kg, 33.2 ft·lb)

Lower Bolt-Nut ②:

80 N·m (8.2 m·kg, 59.0 ft·lb)

ELECTRICAL FOR G22A**SPARK PLUG INSPECTION**

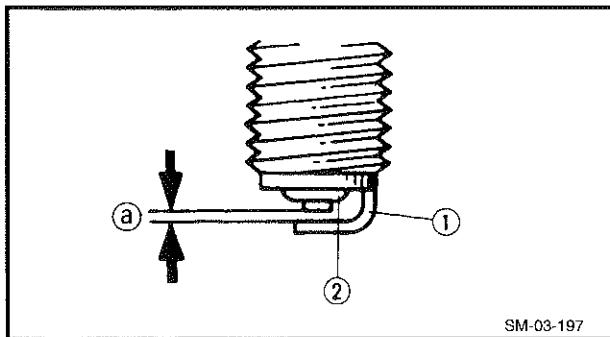
1. Remove:

- Spark plug

2. Inspect:

- Spark plug type

Incorrect → replace

**Standard Spark Plug:
BPR2ES OR BPR4ES**


3. Inspect:

- Electrode (1)

Wear/damage → replace

- Insulator (2)

Abnormal color → replace

Normal color is a medium-to-light tan color.

4. Replace spark plug if cleaning appears necessary.

5. Measure:

- Plug gap (a)

Use a wire gauge or feeler gauge.

Out of specification → re-gap


**Spark Plug Gap:
0.7 ~ 0.8 mm (0.028 ~ 0.031 in)**

6. Tighten:

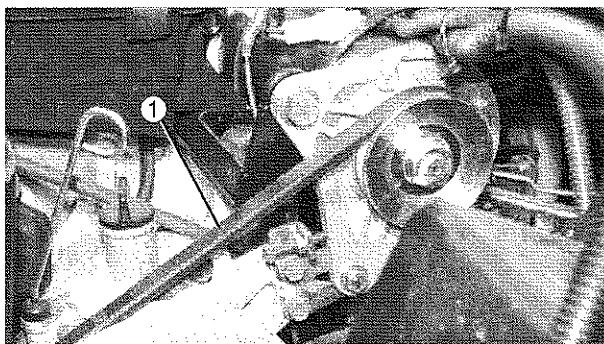
- Spark plug


**Spark Plug:
20 N·m (2.0 m·kg, 14.7 ft·lb)**
 WARNING

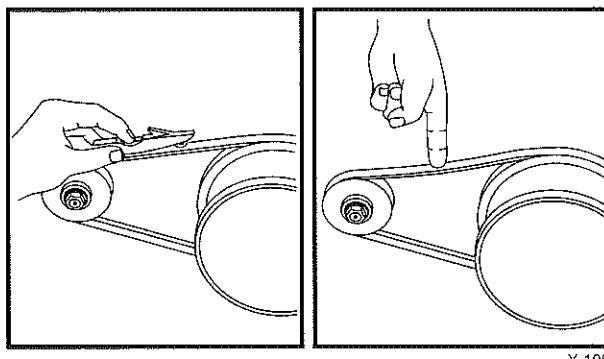
When removing or installing the spark plug, be careful not to damage the insulator. A damaged insulator could allow external sparks, which could lead to explosion or fire.

NOTE:

- Before installing a spark plug, clean the gasket and mating plug surface.
- Finger-tighten the spark plug before tightening at the specified torque.



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2**STARTER BELT INSPECTION**

1. Inspect:

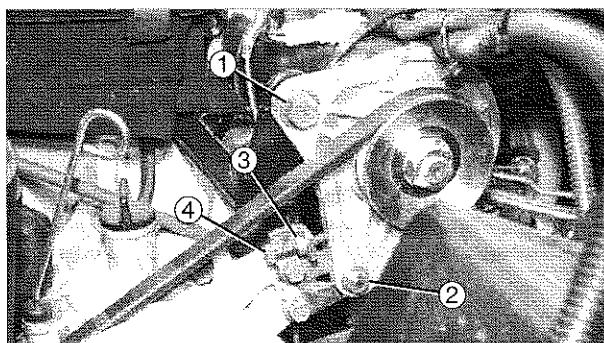
- Starter belt ①
- Wear/cracks/damage → replace

2. Check:

- Belt tension
- Out of specification → adjust
Use a belt tension indicator (e.g., Gates "Krikit" or equivalent) or depress the center of the belt with a finger.

**Starter Belt Tension ②:**

**8 ~ 12 mm/10 kg
(0.31 ~ 0.47 in/22lb)**

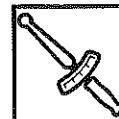


SM-03-016

STARTER BELT ADJUSTMENT

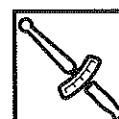
Belt tension adjustment steps:

- Loosen the **two** large 12 mm flange bolts ① that secure the starter generator to its mounting bracket.
- Loosen the lower tensioner locknut ②.
- Loosen adjuster bolt locknut ③.
- Turn adjuster bolt ④ in to increase belt tension. Turn adjuster bolt out to decrease tension.
- Tighten the **two** 12 mm flange bolts ①.

**Starter Generator Bracket Bolt:**

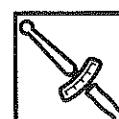
59 N·m (6.0 m·kg, 43.5 ft·lb)

- Tighten lower tensioner locknut ②.

**Lower Tensioner Locknut**

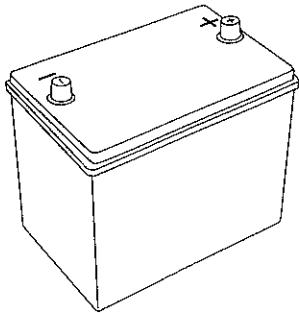
21 N·m (2.1 m·kg, 15.5 ft·lb)

- Tighten adjuster locknut ③.

**Adjuster Locknut:**

7 N·m (0.7 m·kg, 5.2 ft·lb)

- Recheck belt tension. Readjust if necessary.



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BATTERY INSPECTION** WARNING**

Battery electrolyte is dangerous; it contains sulfuric acid and is therefore poisonous and highly caustic.

Always follow these precautionary measures:

- Avoid bodily contact with electrolyte as it can cause severe burns or permanent eye injury.
- Wear protective eye gear when handling or working near batteries.

Antidote (EXTERNAL):

- SKIN – flush with water.
- EYES – flush with water for 15 minutes and get immediate medical attention.

Antidote (INTERNAL)

- Drink large quantities of water or milk, follow with milk of magnesia, beaten egg or vegetable oil. Get immediate medical attention.

Batteries also generate explosive hydrogen gas. Therefore, you should always follow these precautionary measures:

- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks or open flames (e.g., welding equipment, lighted cigarettes, etc.).
- **DO NOT SMOKE** when charging or handling batteries.

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

1. Inspect:

- Battery case
Cracks/damage → replace
- Battery hold-down bracket
Loose → tighten
- Dirty → clean with wire brush or solution of baking soda and water
Poor connection → correct

NOTE:

After cleaning the terminals, lightly apply grease to the terminal posts.

Replace the battery if:

- Battery voltage will not rise to manufacturer's specified value (usually a stabilized open circuit voltage of 12.4 volts).
- Battery case or terminals are damaged.

**BATTERY CHARGING****! WARNING**

Follow charger manufacturer's instructions when charging batteries. Never use a charger without these instructions.

CAUTION

If maintenance-free batteries are charged at ampere rates or periods of time greater than those specified by the manufacturer, the life of the battery may be shortened.

- Charge battery following manufacturer's instructions on the charger.

! WARNING

Always turn the charger to the "OFF" position before connecting the leads to the battery.

NOTE:

Periodic charging is necessary during extended storage.

2



ELECTRICAL FOR G22E

BATTERY CHARGING

The batteries must be charged properly before using for the first time. This initial charge will prolong the life of the batteries.

CAUTION

To ensure maximum battery performance:

- Charge a new battery before use.
- Maintain proper electrolyte level.
Be especially careful not to overfill the batteries or allow the electrolyte level to drop below the top of the plates.
- Do not overcharge the batteries.

Failure to observe these points will result in a shortened battery life.

NOTE:

Periodic charging is necessary during extended storage.

Battery charging steps:

- **Before charging:** only add distilled water if fluid is below the top of the plates, and then add just enough to cover plates.
- **After charging:** check that the fluid level is approximately 1/4 to 1/2 inch (6.4 ~ 12.7 mm) above the plates and 1/4 to 3/8 inch (6.4 ~ 9.5 mm) below the level indicator. If the fluid level is low, carefully add distilled water. Adding distilled water after charging prevents boil over.
- Add only distilled water after a battery has been placed in service. **Never add more acid to battery.**

WARNING

Battery electrolyte is dangerous; it contains sulfuric acid and is therefore poisonous and highly caustic.

Always follow these precautionary measures:

- Avoid bodily contact with electrolyte as it can cause severe burns or permanent eye injury.
- Wear protective eye gear when handling or working near batteries.

Antidote (EXTERNAL):

- SKIN – flush with water.
- EYES – flush with water for 15 minutes and get immediate medical attention.

Antidote (INTERNAL)

- Drink large quantities of water or milk, follow with milk of magnesia, beaten egg or vegetable oil. Get immediate medical attention.

Batteries also generate explosive hydrogen gas. Therefore, you should always follow these precautionary measures:

- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks or open flames (e.g., welding equipment, lighted cigarettes, etc.).
- DO NOT SMOKE when charging or handling batteries.

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

48V BATTERY CHARGER

The following is a summary of the 48V charger features, operating instructions, LED light monitoring system and preferable charging recommendations. Do not attempt to recharge the golf car's batteries without thoroughly reading and understanding this section and the owner's manual provided with the 48V charger.

Preferable charging:

- Connect car to same charger every night.
- Recharge batteries as soon after usage as possible.
- For the first ten rounds, new batteries should go only 18 holes between charges.
- A 20 minute charge between rounds helps extend battery life.
- Organize and store the cars so they can be used equally.
- The batteries should be charged every day if used.

48V CHARGER FEATURES

1. When the charger completes a charging cycle, an internal relay turns the charger off automatically, preventing any additional power consumption.
2. If AC power is lost during charging and the DC charging cord stays plugged into car, the charge cycle will resume from the same point in the cycle when AC power is restored.
3. If AC power is lost after a complete charge cycle, the charger will remain off when AC power is restored.
4. For winter or extended storage, place the tow/run switch on the golf car in the tow position and leave the charger connected. After two weeks and when battery voltage drops to 2.05 volts per cell (48 Volts), a refresh charge cycle will occur automatically.
5. The charger has reverse polarity protection.
6. If the charge cycle does not complete within 16 hours, the charger will turn off and the LED will signal an abnormal charge cycle.

2

48V CHARGER OPERATING INSTRUCTIONS

1. Turn golf car main switch to "OFF" position.
2. Plug AC cord into grounded receptacle.
3. Plug DC cord into car's charge receptacle.
4. The charger will go through a self diagnostic test (each of the five LED lights will flash).
5. When the car is ready for service, disconnect the DC outlet plug from the golf car receptacle by grasping the plug body and pulling the plug straight out of the receptacle.

LED READINGS – NORMAL CHARGE CYCLE

INITIAL / READY / FINAL STAGE		
LED COLOR	SYMBOL	CHARGE STATUS
GREEN	 100%	100% charged
GREEN		Charging in progress
GREEN	 80%	80% charged (above 2.38 V per cell)
GREEN	 25%	Below 80% (less than 2.38V per cell)

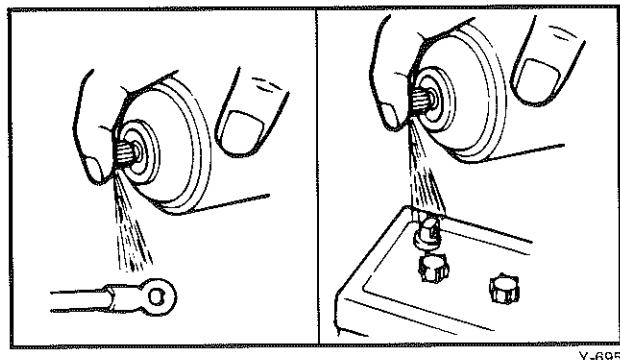
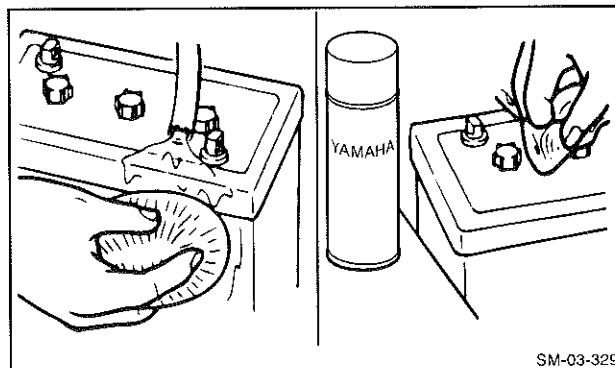
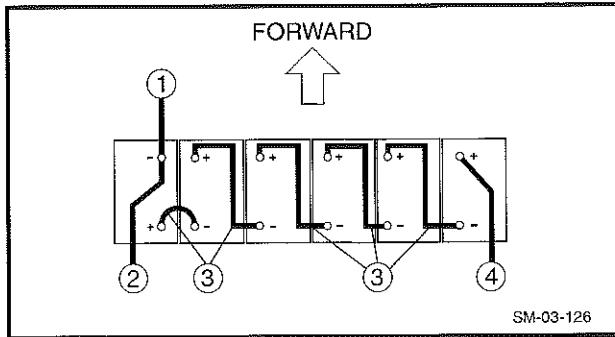


LED READING - ABNORMAL CHARGE CYCLE

ABNORMAL CYCLE / FAULT CODES			
LED COLOR	SYMBOL	PROBLEM	REMEDY
★ YELLOW		Charge cycle did not complete in 16 hours.	Check batteries. Refer to CHAPTER 2, "BATTERY INSPECTION" section in the Service Manual.
★ - ★ YELLOW		Open battery cells detected.	Check open circuit voltage on each battery. Low reading indicates open cell. Replace battery(s) as required.
NONE all LED's off	N/A	Batteries were disconnected from the charger during the charging cycle.	Re-connect and charge again.
★ YELLOW ★ GREEN		AC power to charger is off.	<ol style="list-style-type: none"> 1. Check AC power cord. If it is unplugged, plug it back in. If it is already plugged in, unplug it. Restore power to AC receptacle. 2. Plug the charger back into the grounded receptacle. <p>NOTE: _____ If DC cord was left plugged in during an AC power outage, the previous charge cycle will continue when power is restored. Otherwise the charge cycle will restart from "INITIAL STAGE".</p>
★ ★ YELLOW Flashes ★ GREEN -OR- ★ ★ YELLOW Flashes ★ GREEN	 	Output overcurrent condition. Short circuit in charger DC cord, car's receptacle, or battery wiring.	Unplug AC charger cord from receptacle. Repair short circuit as necessary.

BATTERY INSPECTION**! WARNING**

Secure vehicle and discharge the controller capacitor. Refer to CHAPTER 1 "SAFETY PRECAUTIONS" section.

2

1. The wire leads are as shown:

- ① To receptacle
- ② To motor control unit
- ③ Between batteries
- ④ To relay

! WARNING

- Always disconnect the negative lead to the motor control unit first, and install it last.
- Insulate wrenches with tape to avoid short circuiting of the batteries.

2. Wash the battery tops, sides and surrounding area. Use a 100/1 mixture of water and baking soda. Be careful not to get this solution into the batteries. After drying, coat the battery tops with a battery cleaner protectant, such as ACC-BATCC-LN-PR battery cleaner and protector.

3. Inspect:

- Lead terminals
 - Battery terminals
- Corrosion → clean

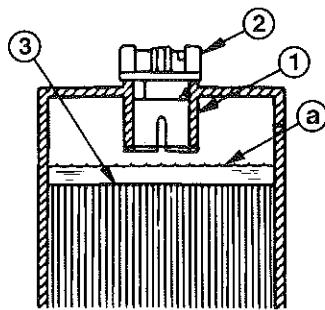
Terminal cleaning steps:

- Spray the terminals with a mixture of baking soda and water. Allow a few minutes for the solution to work.
- Rinse with low pressure water.
- Allow terminals to dry and coat with anti-corrosion spray, such as ACC-BATTP-RO-TE battery terminal protector.

4. Inspect:

- Hold-downs
- Use a wire brush.
- Corrosion → clean with baking soda and water/replace

After cleaning, rinse with water. Repaint with a corrosion resistant spray protectant, such as ACC-BATTP-RO-TE battery terminal protector.



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5. Check:

- Electrolyte level ①

Below level → add distilled water

② Proper fill level – DO NOT OVERFILL!

- **Before charging:** only add distilled water if fluid is below the top of the plates. Add just enough to cover plates.

- **After charging:** check that the fluid level is approximately 1/4 to 1/2 inch (6.4 ~ 12.7 mm) above the plates and 1/4 to 3/8 inch (6.4 ~ 9.5 mm) below the level indicator. If the fluid is low, carefully add distilled water. Adding distilled water **after** charging prevents boil over.

① Level indicator

② Cap

③ Plate

6. Inspect:

- Cap vent

Contamination → clean

7. Measure:

- Specific gravity

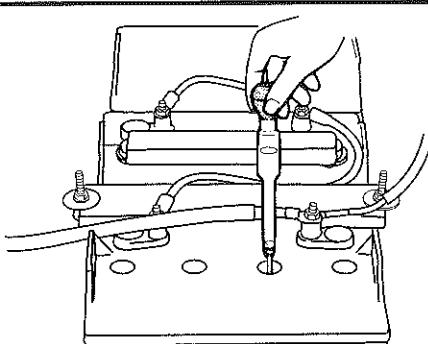
Use a hydrometer

Less than 1.260 → charge battery



Hydrometer:

YU-03036, 90890-03036

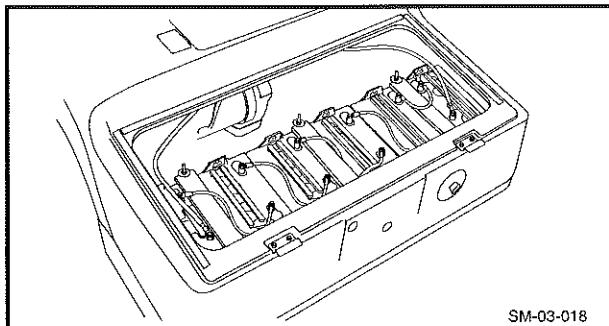


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- Check the specific gravity of each cell with a hydrometer. If the hydrometer reading is below the specification, additional charging is necessary.

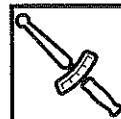
Temperature		Satisfactory Uncorrected Hydrometer reading
°F	°C	
120	48.9	1.244
110	43.3	1.248
100	37.8	1.252
90	32.2	1.256
80	26.7	1.260
70	21.1	1.264
60	15.6	1.268
50	10.0	1.272
40	4.4	1.276
30	-1.1	1.280

- Install the filler caps and thoroughly wipe off the fluid around the filler caps.

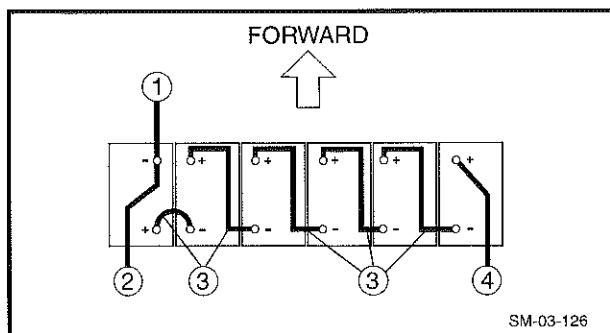


8. Install:

- Batteries

**Battery Holder:**

2 N·m (0.2 m·kg, 1.4 ft·lb)

2

9. Connect the wire leads as shown.

- ① To receptacle
- ② To motor control unit
- ③ Between batteries
- ④ To relay

⚠ WARNING
When installing batteries:

- Carefully place battery cables and holdowns making sure that cables do not lay across vent caps.
- Always remove the negative (-) cable ② to the motor control first, and install it last.

CAUTION

Do not overtighten the battery holdown nuts.
Excessive force will damage the battery casing.

**CHARGE RECEPTACLE INSPECTION****! WARNING**

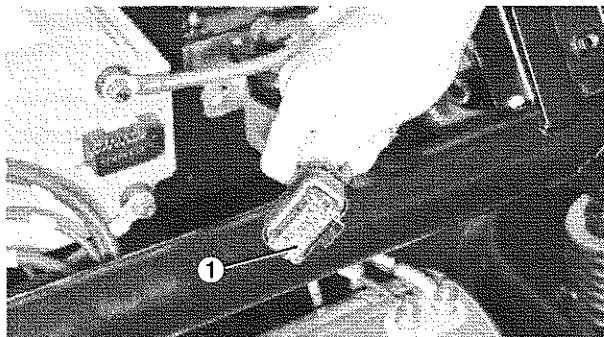
Secure vehicle and discharge the controller capacitor. Refer to CHAPTER 1 "SAFETY PRECAUTIONS" section.

1. Inspect

- Receptacle contacts
- Damaged/loose/burned → replace receptacle

! WARNING

Damaged receptacle contacts can cause excessive resistance (heat) and lead to fire.



SM-03-127

CONTROLLER CONNECTOR INSPECTION**! WARNING**

Secure vehicle and discharge the controller capacitor. Refer to CHAPTER 1 "SAFETY PRECAUTIONS" section.

1. Inspect:

- Controller pins
- Female connector terminals ①. Lubricate with light mechanical lube if necessary.

CAUTION

Use care when connecting the wire harness controller plug. The terminals inside are easily damaged which can cause failure symptoms.

! WARNING

Batteries generate explosive hydrogen gas. Therefore you should always follow these precautionary measures:

- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks, or open flames (e.g., welding equipment, lighted cigarettes, etc.)
- DO NOT SMOKE when charging or handling batteries.

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

1. Battery Discharge Testing - Why

The purpose of the discharge load test is to determine how many minutes it will take to bring the total voltage of a freshly charged 48 volt battery pack to 42 volts respectively. This test represents the maximum work or run time capability of a 48-volt battery pack at 80°F to fall to 42 volts. Seventy minutes should deliver 36 holes of golf for most courses. A shorter time period will indicate that one or more batteries need service or replacement.

When you are load testing, you will need a load tester and a high quality digital voltmeter capable of reading at least 55 volts DC. Use the voltmeter to monitor the overall voltage decrease of the pack and the decreasing voltage of each individual battery during testing. Individual batteries that decrease at a faster rate are the weaker ones. Note the weak batteries. The weaker batteries will require careful measurement after the discharge tester shuts off. Once the weaker batteries are identified they need to be replaced with ones of comparable age and strength of the remaining pack.

2. Battery Discharge Testing - Things to Be Aware Of

Non-functioning chargers (or just unplugged chargers) can create frustrating problems, especially if cars are not returned to the same charger every night. Look for tripped circuit breakers, damaged cords and plugs. Battery problems may be charger induced. Design a schedule that allows discharge testing on one car per day or at least every other day. Follow your plan faithfully.

Test each car once the first year and twice each succeeding year. If your course exceeds the national average of 250 rounds each year then your discharge testing schedule must be increased accordingly. Consult your Yamaha service representative for help with schedule adjustments. If you start out discharge testing an older fleet with questionable batteries then at least 10% (i.e. 10 cars out of 100) should be tested. These results will give you a feel for your replacement battery needs.

Obtain a good quality discharge tester such as the Lester 17770. Carefully follow the procedure found in the Section 3 "Step by Step" Testing.

Remember that 70 minutes is the industry standard considered adequate for 36 holes of play but as cars enter their third and fourth years of service, it is normal for a few batteries to fail. Widespread failures or lack of 36-hole performance in the second year is not normal.

Ambient temperature has an effect on discharge times. When temperatures are low, discharge times decrease. The chart on page 2-49 is helpful for predicting the effects of temperature on discharge testing.

Be sure that you do the **loaded individual battery measurements** with the battery pack fully charged to 42 (48-volt). If you **do not** do this part of the test immediately after the tester shuts off, the batteries will "recover" as they sit. Recovered batteries will give false readings. If more than a few minutes elapse before you do individual battery measurements, turn the discharge tester back on. Allow the tester to run until the total battery pack voltage is again approaching the shut off point (**42 volts** for 48-volt cars). This will prevent a false "good" voltage measurement from a recovered battery.

NOTE:

Be certain you understand this paragraph before you turn your discharge tester on for the first time. You cannot achieve accurate results without a complete understanding of the testing process.

3. Battery Discharge Testing "Step by Step"

Before you start testing do the following preliminary checks.

- a. Fully charge the batteries (a full charger cycle).
- b. Inspect all cables and connections.
- c. Check the water level in each cell and add water as necessary.



- d. Start the charger and let it finish charging again.
- e. Let the batteries cool for 5 minutes.

⚠ WARNING

Batteries generate explosive hydrogen gas. Therefore you should always follow these precautionary measures:

- Charge batteries in a well-ventilated area.
- Keep batteries away from fire, sparks, or open flames (e.g., welding equipment, lighted cigarettes, etc.)
- DO NOT SMOKE when charging or handling batteries.

KEEP BATTERIES AND ELECTROLYTE OUT OF REACH OF CHILDREN.

The following instructions are specifically for the Lester 17770 Discharge Tester. You will need a thermometer, discharge tester and a digital voltmeter for the following tests. Attach the discharge tester, be sure to observe polarity. Heavily coated battery terminals may not provide good electrical connections. Clean if necessary.

1. Record surface voltage from the discharge tester readout panel. Record the ambient temperature.
2. Turn on the discharge tester. Wait at least 3 minutes. If you have a bad connection (or reverse polarity) the tester will shut off in 3 minutes. Correct any problems.
3. Let the tester run until it shuts off and **immediately** record the surface voltage from the discharge tester readout. Restart the discharge tester and let it run until the voltage reaches 42 volts (48-volt car).
4. While the discharge tester is still connected measure and record each individual battery voltage. Look over the voltage measurements you just recorded. A difference of 0.5 volts from the highest to lowest measurement indicates a weak battery.
5. Turn off the discharge tester. Wait until the fan stops and then disconnect the battery leads.

⚠ WARNING

If the fan is running and you disconnect the unit a spark will be produced.

NOTE:

The chart on page 2-50 is a handy place to record your measurements.

DISCHARGE MINUTES ADJUSTED FOR TEMPERATURE

2

Discharge Minutes	Temperature											
	F°	80	75	70	65	60	55	50	45	40	35	30
	C°	27	24	21	18	15.5	13	10	7	4.5	2	-1
105	105											
100	100	103	107									
95	95	98	101	105								
90	90	93	96	100	103	107						
85	85	88	91	94	97	101	105					
80	80	83	85	88	92	95	99	103				
75	75	77	80	83	86	89	93	97	101	105		
70	70	72	75	77	80	83	87	90	94	98	103	
65	65	67	69	72	75	77	80	84	87	91	96	
60	60	62	64	66	69	71	74	77	81	84	88	
55	55	57	59	61	63	65	68	71	74	77	81	
50	50	52	53	55	57	60	62	64	67	70	74	
45	45	46	48	50	52	54	56	58	60	63	66	
40	40	41	43	44	46	48	50	52	54	56	59	
35	35	36	37	39	40	42	43	45	47	49	51	
30	30	31	32	33	34	36	37	39	40	42	44	
25	25	26	27	28	29	30	31	32	34	35	37	
20	20	21	21	22	23	24	25	26	27	28	29	
15	15	15	16	17	17	18	19	19	20	21	22	
10	10	10	11	11	11	12	12	13	13	14	15	

$$\text{ADJUSTED DISCHARGE} \quad = \quad \frac{\text{DISCHARGE MINUTES}}{1 - ((80 - \text{TEMP}) / 100) * .64}$$

BATTERY DISCHARGE CHART**BATTERY DISCHARGE TESTING**

CAR #	FORWARD						DATE ___/___/___
							
- O	O +	O +	O +	O +	O +	O +	
+ O	O -	O -	O -	O -	O -	O -	

Date Code	Discharge Time	Manufacturer's Code					
							DATE ___/___/___
CAR #	FORWARD						DATE ___/___/___
- O	O +	O +	O +	O +	O +	O +	
+ O	O -	O -	O -	O -	O -	O -	

Date Code	Discharge Time	Manufacturer's Code					
							DATE ___/___/___
CAR #	FORWARD						DATE ___/___/___
- O	O +	O +	O +	O +	O +	O +	
+ O	O -	O -	O -	O -	O -	O -	

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Record test results including individual battery voltages immediately after discharge test.

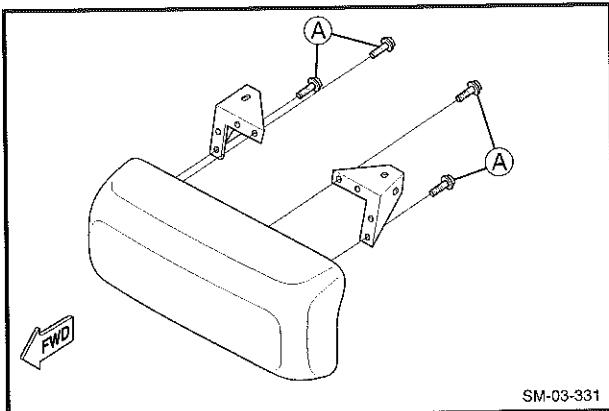
Restart the Discharge Tester after it reaches 42 volts. Immediately measure and record each battery's voltage in the boxes provided above.



CHAPTER 3 CHASSIS

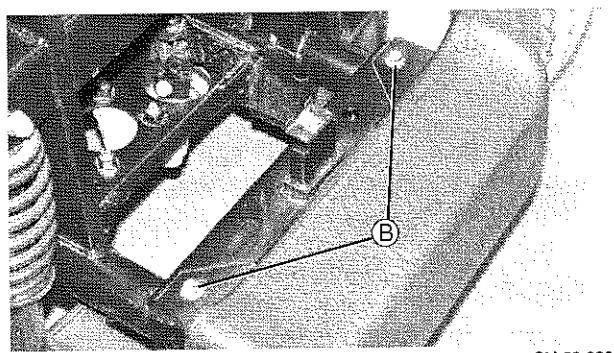
3

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**CHASSIS****FRONT AND REAR BUMPER
REMOVAL**

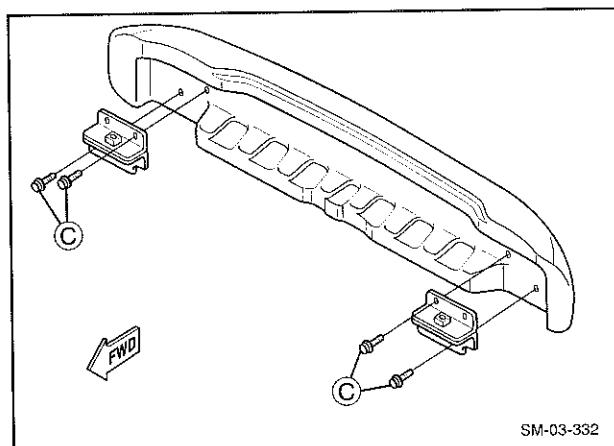
1. Remove:

- Bolts
- Front bumper



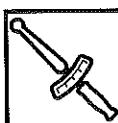
2. Remove:

- Bolts
- Rear bumper

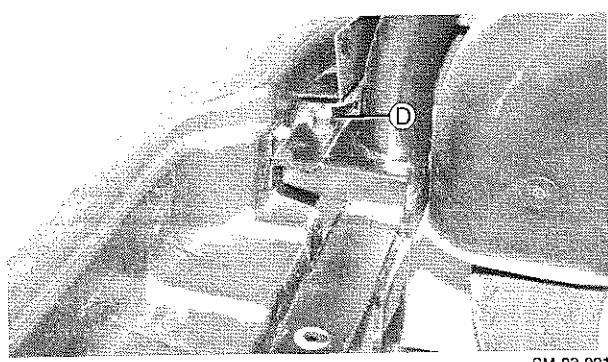
3**INSTALLATION**

1. Install:

- Front bumper
- Reverse the "REMOVAL" procedures.

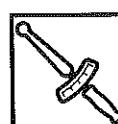
**Tightening torque:**

- Ⓐ = 7 N·m (0.7 m·kg, 5.2 ft·lb)
Ⓑ = 22 N·m (2.2 m·kg, 16.2 ft·lb)



2. Install:

- Rear bumper

**Tightening torque:**

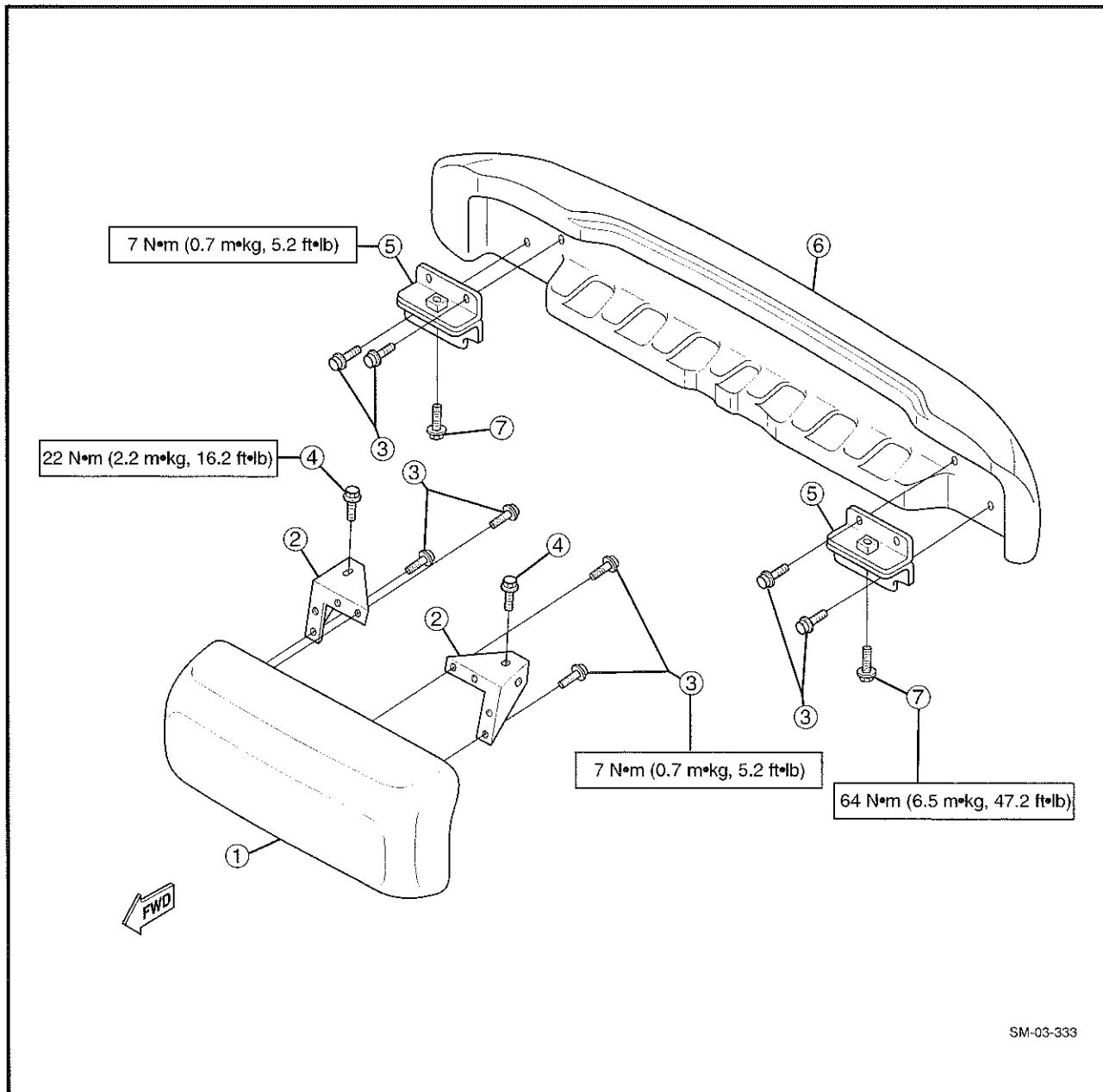
- Ⓒ = 7 N·m (0.7 m·kg, 5.2 ft·lb)
Ⓓ = 64 N·m (6.5 m·kg, 47.2 ft·lb)

FRONT AND REAR BUMPER

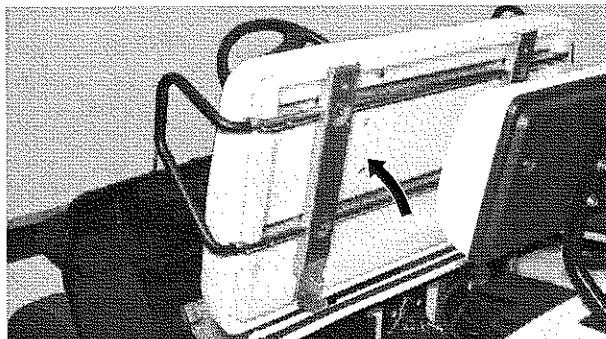


BUMPERS

- | | |
|---------------------|--------------------|
| ① Front bumper | ⑤ Rear bumper stay |
| ② Front bumper stay | ⑥ Rear bumper |
| ③ Flange bolt | ⑦ Flange bolt |
| ④ Flange bolt | |



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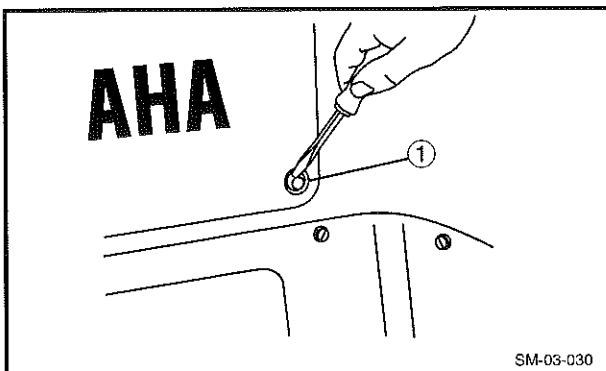


SM-03-022

SEAT REMOVAL

1. Remove:

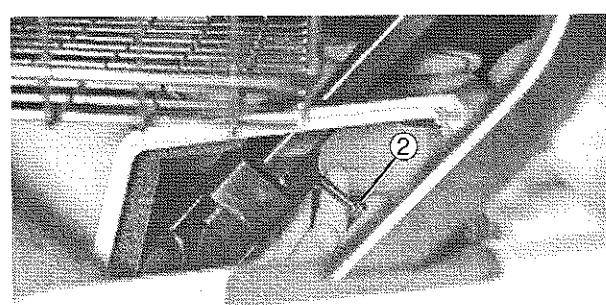
- Seat
- Rear access panel rivets ①
- Rear access panel



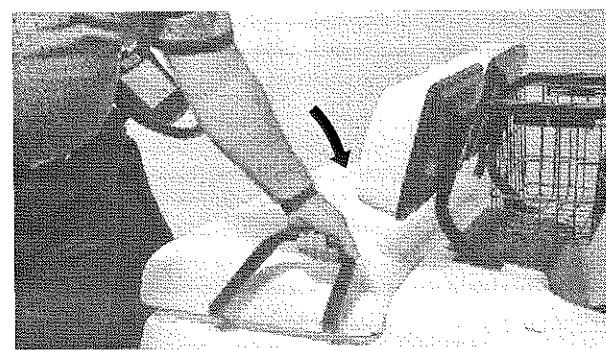
SM-03-030



SM-03-024



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3

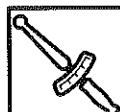
2. Remove:

- Bolts ②
- Seat back support

INSTALLATION

1. Install:

- Seat back support
- Bolts ②



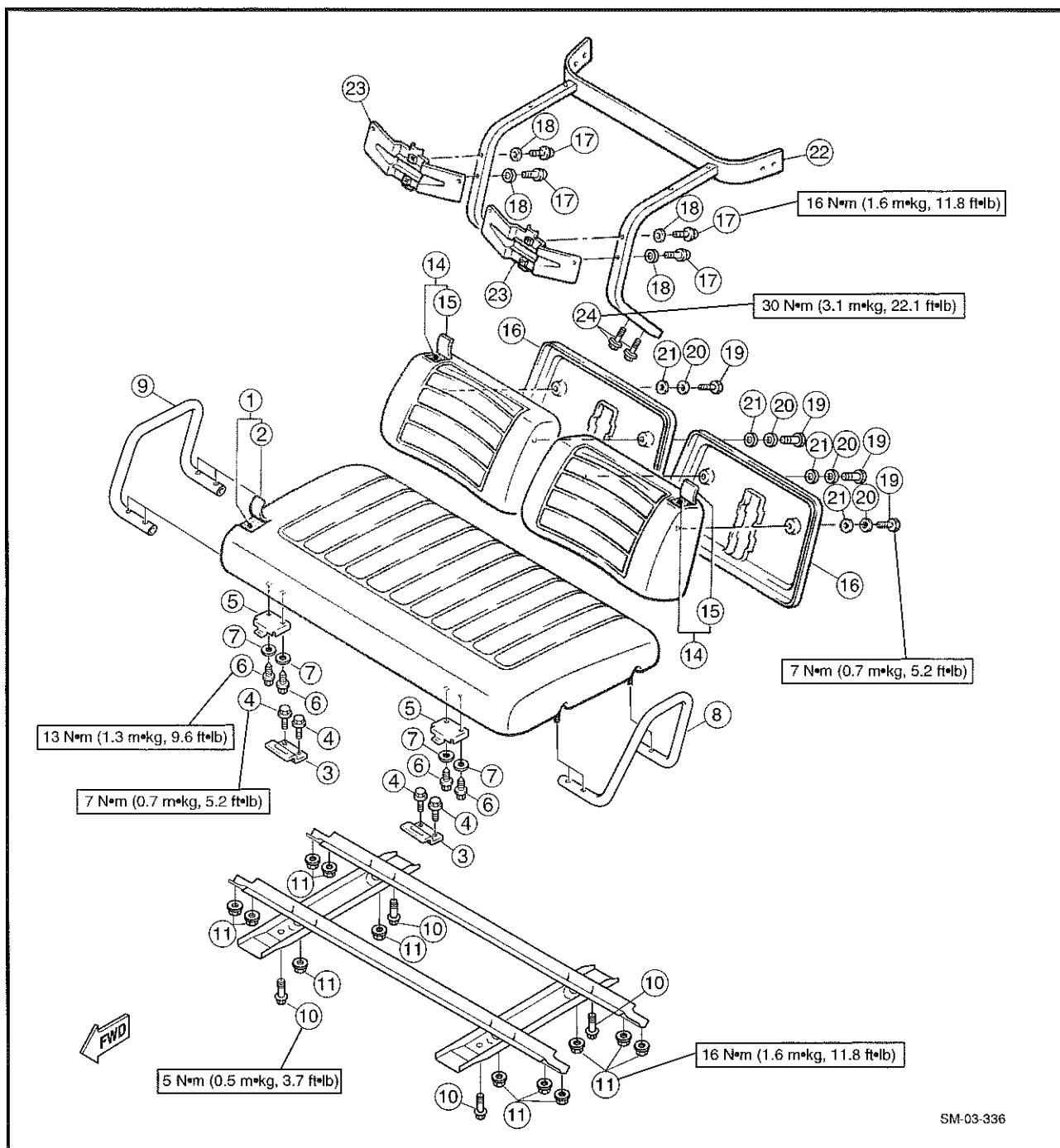
Tightening torque:
30 N·m (3.1 m·kg, 22.1 ft·lb)

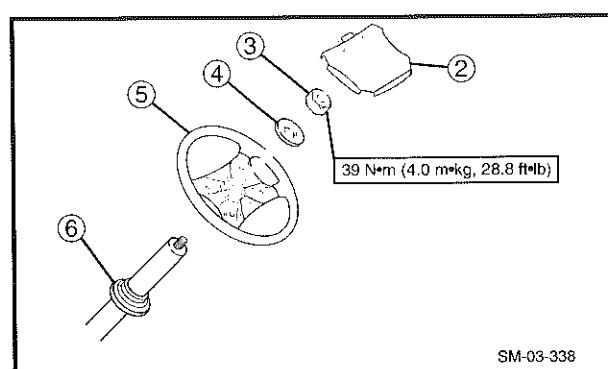
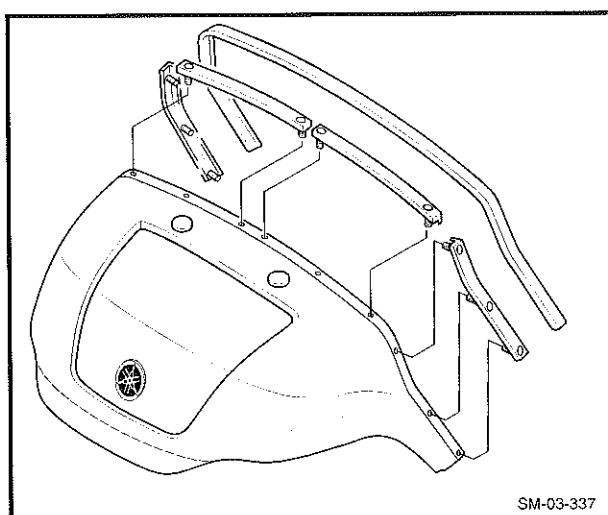
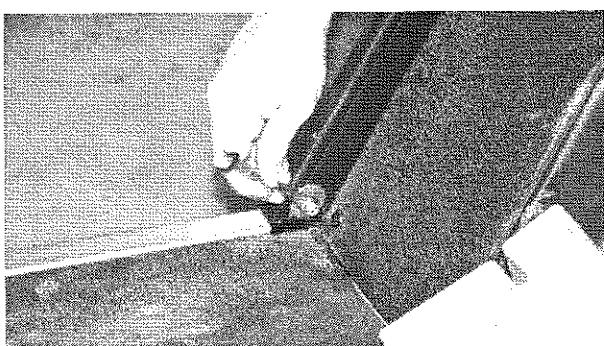
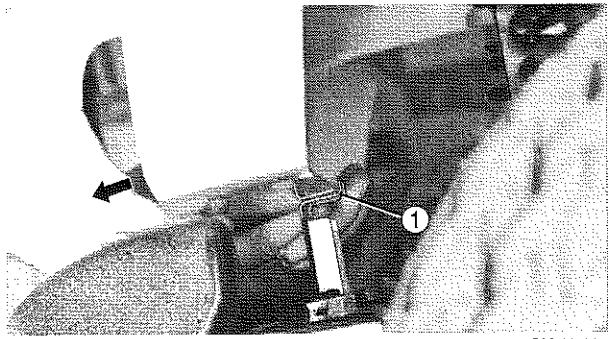
2. Install:

- Seat
- Rear access panel

SEAT

- | | | |
|----------------------|----------------------|---------------------|
| ① Seat cushion | ⑨ Armrest 2 | ⑯ Bolt w/ washer |
| ② Cover, seat 2 | ⑩ Tapping screw | ⑰ Washer |
| ③ Hinge, seat female | ⑪ Nut, U-flange | ⑲ Flange bolt |
| ④ Flange bolt | ⑫ Reinforcement 1 | ⑳ Washer |
| ⑤ Hinge, seat male | ⑬ Reinforcement 2 | ㉑ Washer |
| ⑥ Bolt | ⑭ Seat back | ㉒ Seat back support |
| ⑦ Washer | ⑮ Cover, seat back 2 | ㉓ Seat retainer |
| ⑧ Armrest 1 | ⑯ Cover, seat back | ㉔ Flange bolt |





FRONT COWLING

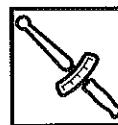
REMOVAL

1. Remove:

- Front cowl from clip ①

2. Remove:

- Nuts
- Washers



Tightening torque:

4 N·m (0.4 m·kg, 3.0 ft·lb)

3

3. Remove:

- Front cowling with trim

NOTE: _____

Use care not to pull rubber trim off the plates it is mounted on.

Front Storage Panel Removal

1. Remove:

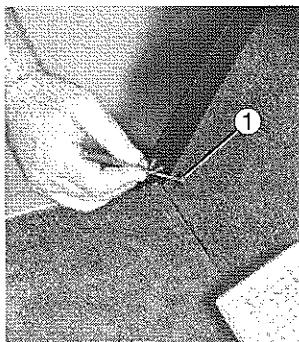
- Scorecard holder ②
- Steering wheel nut ③
- Washer ④
- Steering wheel ⑤
- Cover hole ⑥

NOTE: _____

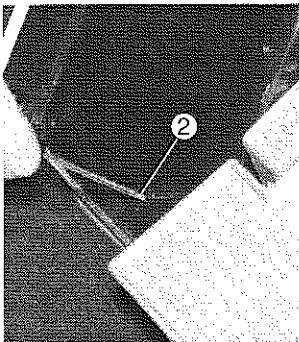
The scorecard holder is removed by pressing its mounting pins from the back of the steering wheel.

FRONT COWLING

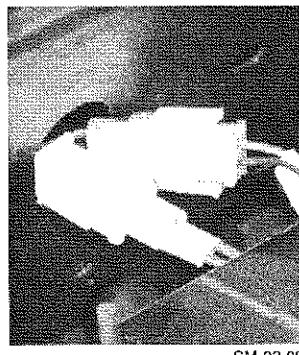
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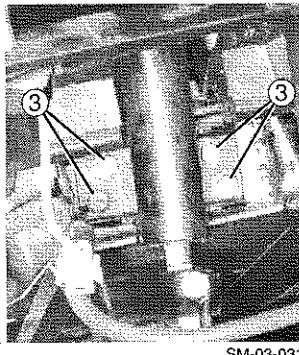
SM-03-339



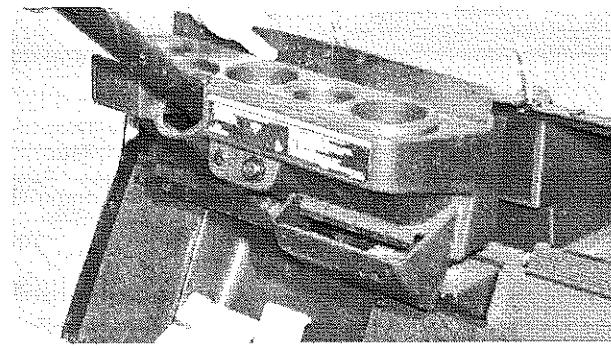
SM-03-027



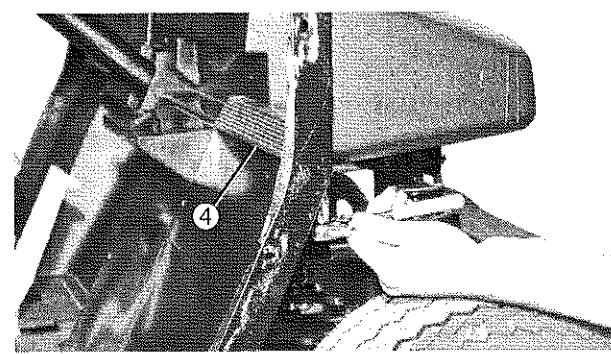
SM-03-028



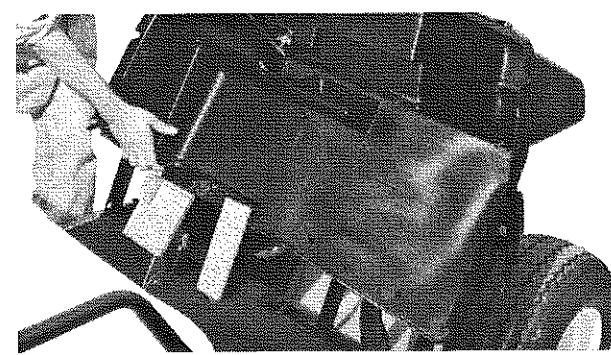
SM-03-031



SM-03-029



SM-03-340



SM-03-341

2. Remove:

- Rivets in floor mat ①
- Floor mat
- Rivets in dash panel ②

NOTE: _____

Remove plastic rivets by depressing the pin in the center of the rivet with a punch or small screwdriver.

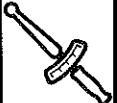
3. Disconnect:

- Main switch lead
- Oil warning lamp lead

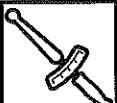
4. Loosen and remove the four steering column to frame bolts ③ to aid in front storage removal.

5. Remove:

- Screws in housing holder
- Housing holder

	Tightening torque: 7 N·m (0.7 m·kg, 5.2 ft·lb)
---	--

6. Remove cap nuts from rubber protectors ④ from RS/LS dash panel.

	Tightening torque: 7 N·m (0.7 m·kg, 5.2 ft·lb)
---	--

7. Remove dash panel.

INSTALLATION

Reverse the "REMOVAL" procedure.

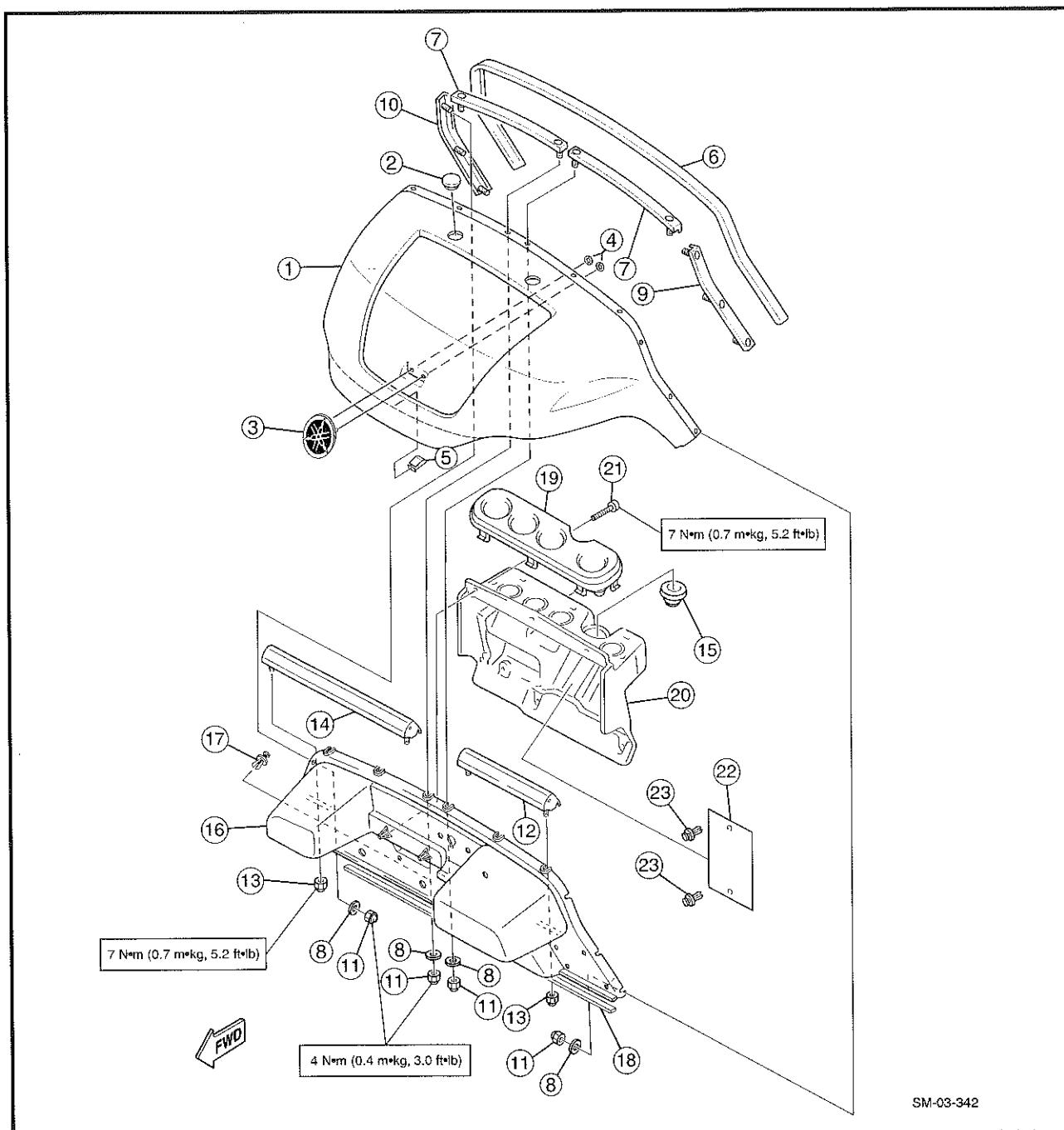
	Steering Wheel Tightening torque: 39 N·m (4.0 m·kg, 28.8 ft·lb)
---	---

	Steering Column to Frame Bolt torque: 21 N·m (2.1 m·kg, 15.5 ft·lb)
---	---

FRONT COWLING

- | | | |
|------------------------|-------------------------|-------------------|
| ① Front cowl | ⑨ Body protect plate 2 | ⑯ Rivet |
| ② Protector cap | ⑩ Body protect plate 3 | ⑰ Seal |
| ③ Emblem | ⑪ Nut | ⑲ Beverage holder |
| ④ Nut special | ⑫ Rubber body protect 4 | ⑳ Holder housing |
| ⑤ Clip | ⑬ Nut | ㉑ Screw |
| ⑥ Protector 1 | ⑭ Rubber body protect 5 | ㉒ Plate 2 |
| ⑦ Body protect plate 1 | ⑮ Hole cover | ㉓ Rivet |
| ⑧ Washer | ⑯ Front storage panel | |

3





REAR BODY

REMOVAL

1. Remove:

- Seat
- Seat back support

NOTE:

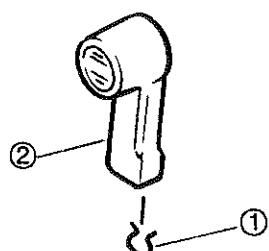
Refer to page 3-5.

2. Disconnect:

- Choke cable for G22A

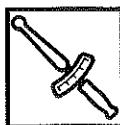
3. Remove:

- Hairpin clip ① from handle shaft behind handle for G22A
- Shift handle ② for G22A



SM-03-202

- Bolts ③
- Hinges ④
- Screws ⑤

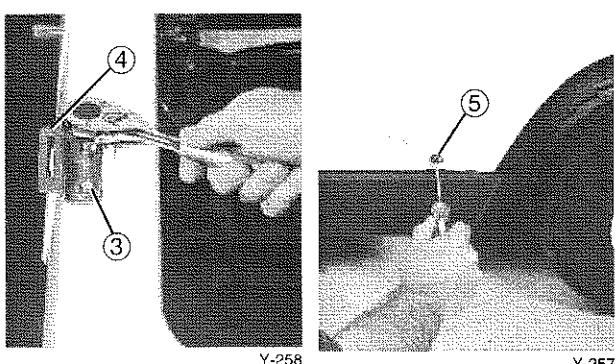


Hinge Bolt torque:

7 N·m (0.7 m·kg, 5.2 ft·lb)

Body screws:

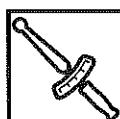
7 N·m (0.7 m·kg, 5.2 ft·lb)



Rear Floor Cover Removal

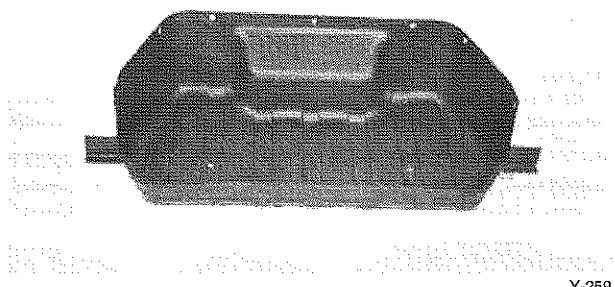
1. Remove:

- Rivets
- Screws
- Rear floor cover

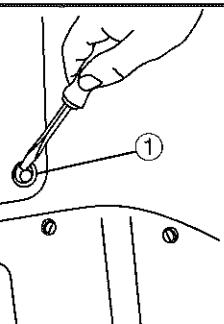


Rear Floor Cover Screw torque:

7 N·m (0.7 m·kg, 5.2 ft·lb)



Y-259

**AHA**

SM-03-030

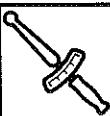
2. Remove

- Rear access panel rivets ①
- Rear access panel
- Bolts ②
- Seat back support

INSTALLATION

Reverse the "REMOVAL" procedure.

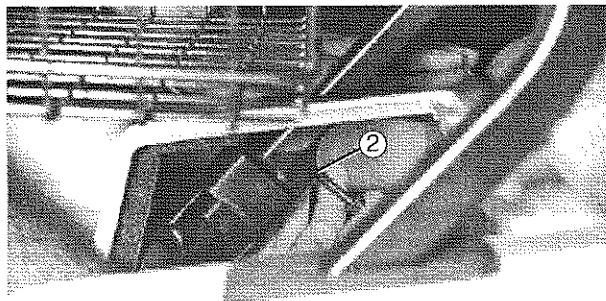
Note the following points:

**Seat Back Support Bolt torque:**

30 N·m (3.1 m·kg, 22.1 ft·lb)

3

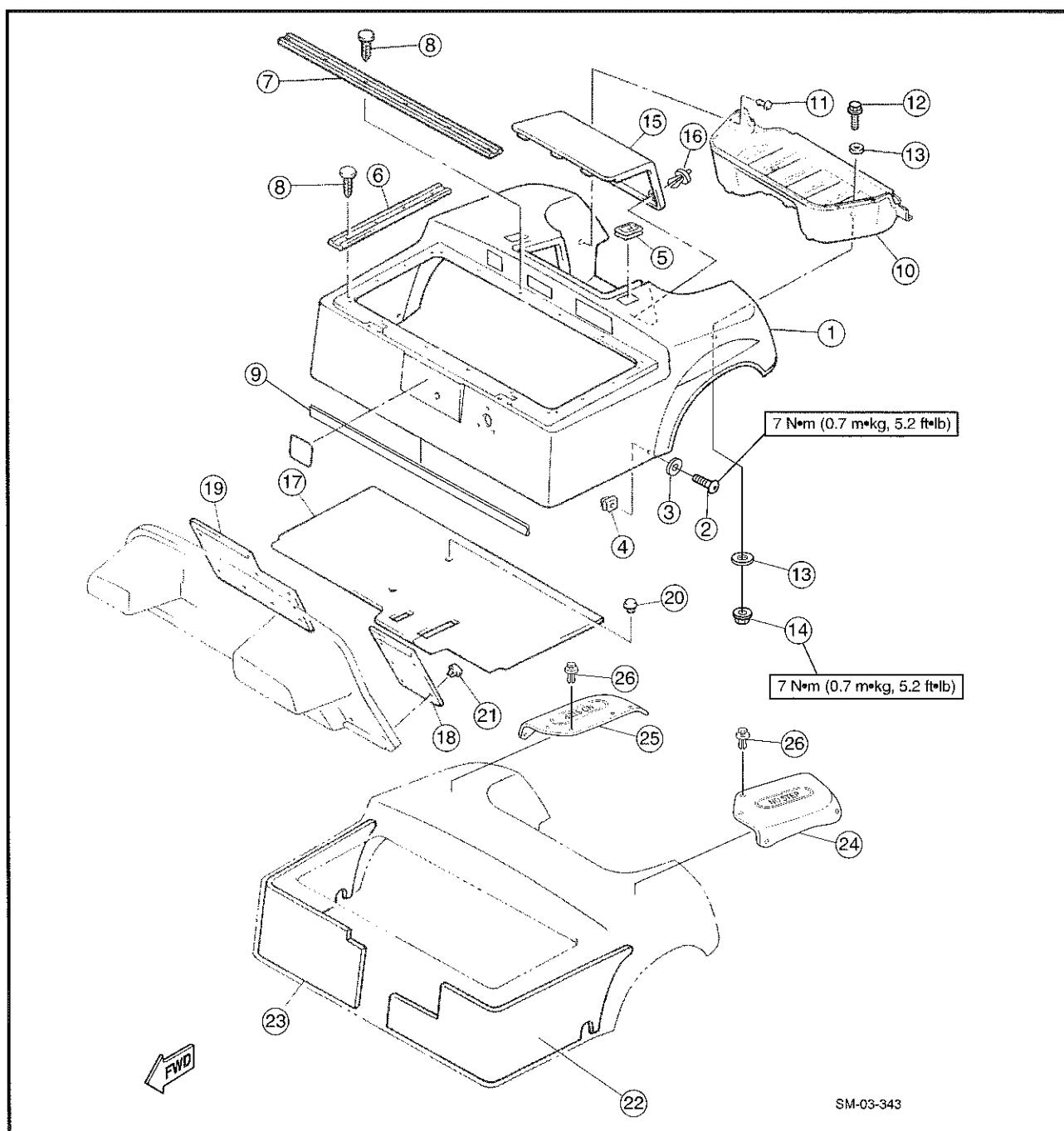
SM-03-024



Y-247

REAR COWLING FOR G22A

- | | | |
|------------------|--------------------|------------------|
| ① Rear body | ⑩ Rear floor cover | ⑯ Floor mat 3 |
| ② Screw | ⑪ Rivet | ⑰ Rivet |
| ③ Washer | ⑫ Bolt | ㉑ Blind rivet |
| ④ Spring nut | ⑬ Washer | ㉒ Silencer pad 1 |
| ⑤ Protector | ⑭ Nut | ㉓ Silencer pad 2 |
| ⑥ Seat seal | ⑮ Inspection cover | ㉔ Body mat LS |
| ⑦ Seat seal 2 | ⑯ Blind rivet | ㉕ Body mat RS |
| ⑧ Plug | ⑰ Floor mat 1 | ㉖ Rivet |
| ⑨ Rear body trim | ⑱ Floor mat 2 | |



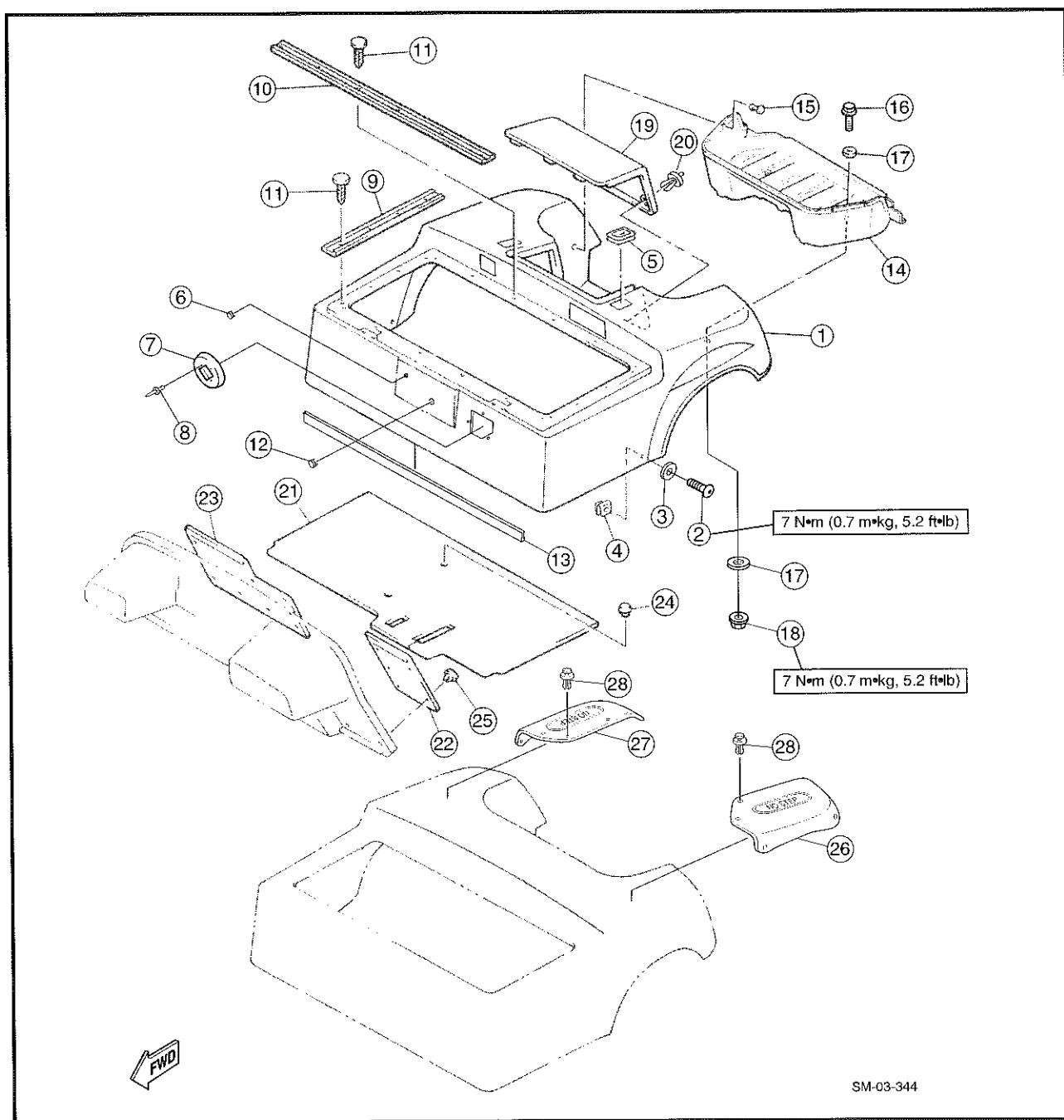
SM-03-343



REAR COWLING FOR G22E

- | | | |
|---------------|--------------------|---------------|
| ① Rear body | ⑪ Plug | ㉑ Floor mat 1 |
| ② Screw | ⑫ Plug | ㉒ Floor mat 2 |
| ③ Washer | ⑬ Rear body trim | ㉓ Floor mat 3 |
| ④ Spring nut | ⑭ Rear floor cover | ㉔ Rivet |
| ⑤ Protector | ⑮ Rivet | ㉕ Blind rivet |
| ⑥ Cap end | ⑯ Bolt | ㉖ Body mat LS |
| ⑦ Guide | ⑰ Washer | ㉗ Body mat RS |
| ⑧ Rivet | ⑱ Nut | ㉘ Rivet |
| ⑨ Seat seal | ⑲ Inspection cover | |
| ⑩ Seat seal 2 | ㉐ Blind rivet | |

3



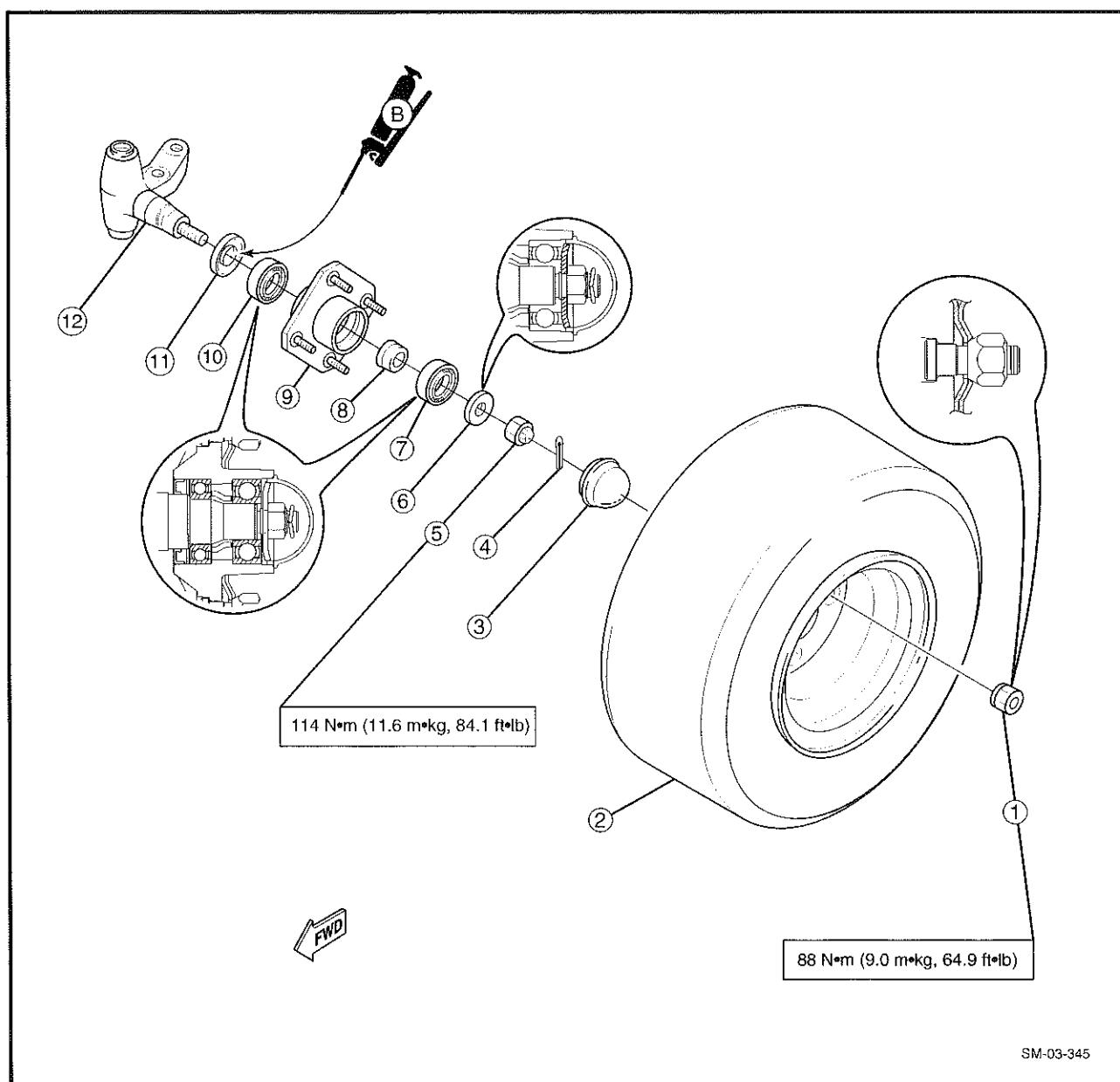
FRONT WHEEL

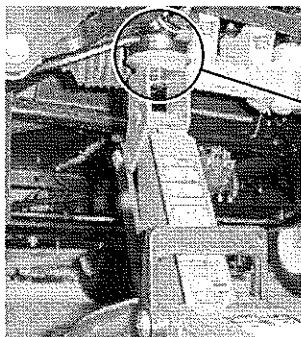


FRONT WHEEL

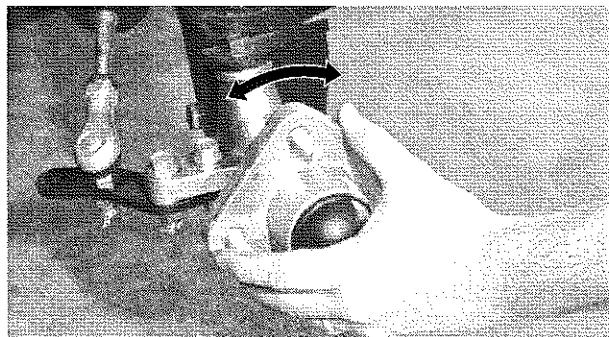
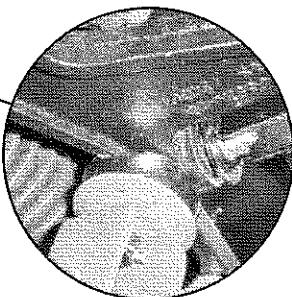
- ① Lug nut
- ② Tire/wheel assembly
- ③ Dust cover
- ④ Cotter pin
- ⑤ Axle nut
- ⑥ Conical washer
- ⑦ Hub bearing
- ⑧ Spacer
- ⑨ Front hub
- ⑩ Hub bearing
- ⑪ Oil seal
- ⑫ Knuckle

A	TIRE SIZE: 18 x 8.50-8.00/4PR
B	TIRE TYPE: TUBELESS (Sawtooth tread pattern)
C	TIRE PRESSURE: For G22A 110 kPa (1.1 kg/cm ² , 16 psi) For G22E 137 kPa (1.4 kg/cm ² , 20 psi)
D	WEAR LIMIT: 1.0 mm (0.04 in)
E	RIM SIZE: 7.00-I-8.00
F	WHEEL ALIGNMENT:
G	Toe-in Unloaded/Fully loaded: 1 ~ 11 mm (0.04 ~ 0.43 in)/Zero mm (Zero in)
H	Camber: Unloaded/Fully loaded: Zero deg (non-adjustable)

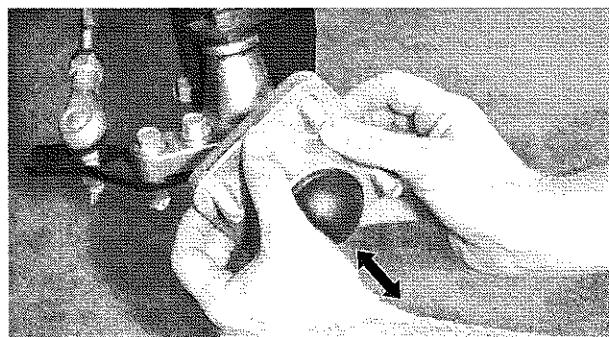




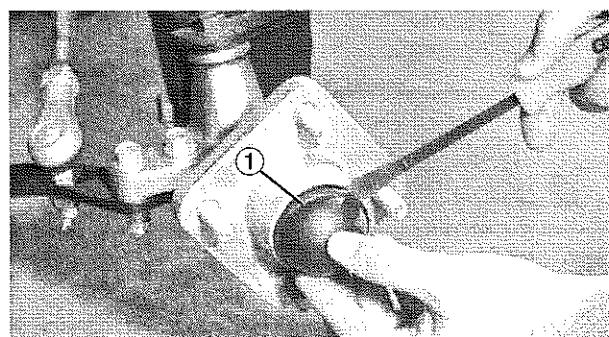
SM-03-346



SM-03-045



SM-03-046



SM-03-047

REMOVAL

1. Place the vehicle on a level surface.
2. Apply parking brake.
3. Loosen:
 - Nuts (Front wheel)
4. Jack up the front wheels by placing a suitable stand under the frame.
Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.
5. Remove:
 - Nuts (Front wheel)
 - Front wheel

3**6. Check:**

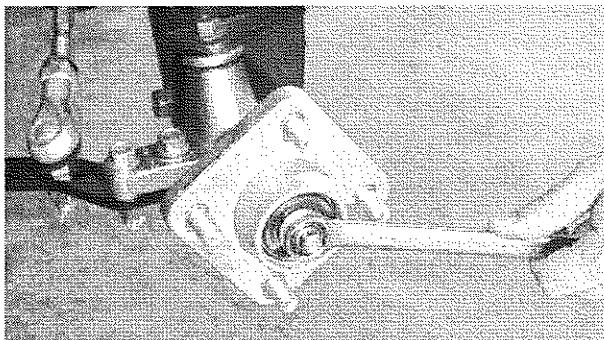
- Movement (Wheel bearing)
Rotate the hub by hand.
Roughness → replace bearing

7. Check:

- Freeplay (Wheel bearing)
Gently rock the hub back and forth.
Looseness/noticeable freeplay → retighten the hub nut.
Still play → replace bearing

8. Remove:

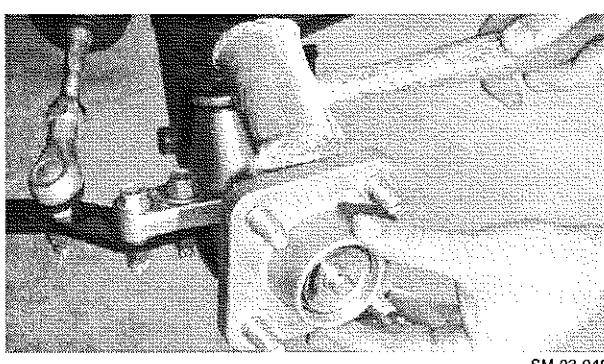
- Dust cover ①



SM-03-048

9. Remove:

- Cotter pin
- Hub nut
- Conical washer



SM-03-049

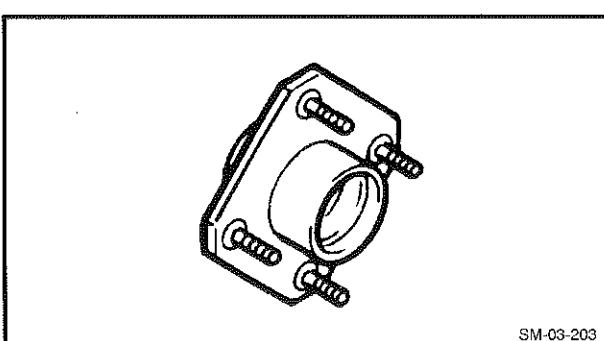
10. Remove:

- Hub (Front wheel)
- Tap the hub out using a soft hammer.

INSPECTION

1. Inspect:

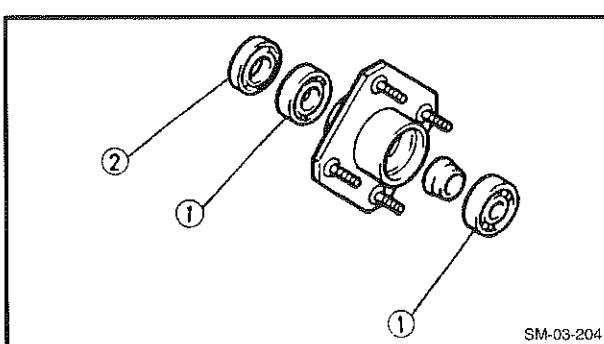
- Wheel
Cracks/bends/warping → replace



SM-03-203

2. Inspect:

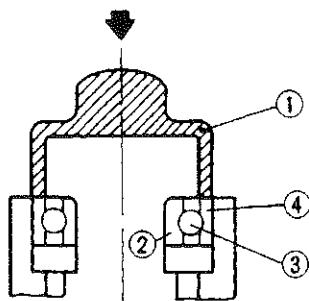
- Wheel hub
Cracks/damage → replace



SM-03-204

3. Inspect:

- Bearings (Wheel hub) ①
Bearings allow play in the wheel hub or the wheel turns roughly → replace
- Oil seal ②
Wear/Damage → replace



SM-03-205

Wheel bearing and oil seal replacement steps:

- Clean the inside of the wheel hub.
- Remove the oil seal and the bearing using a general bearing puller.
- Install the new bearing and oil seal by reversing the previous steps.

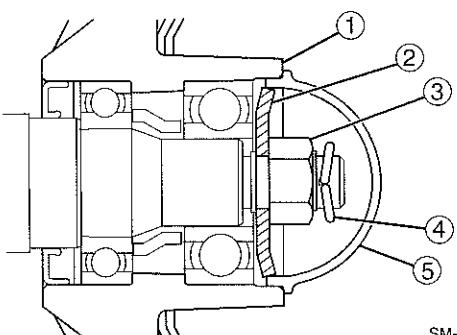
NOTE:

Use a socket ① that matches the outside diameter of the race of the bearing and oil seal.

CAUTION

Do not strike the center race ② or balls ③ of the bearing. Contact should be made only with the outer race ④.

3



SM-03-348

INSTALLATION

Reverse the "REMOVAL" procedure.

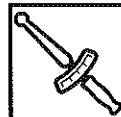
Note the following points.

1. Install:

- Hub ①
- Conical washer ②
- Hub nut ③

NOTE:

Install the conical washer ② with the tapered side facing inward.

**Hub Nut ③:**

114 N·m (11.6 m·kg, 84.1 ft·lb)

2. Install:

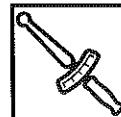
- Cotter pin ④ (New)
- Dust cover ⑤

WARNING

Always use a new cotter pin.

3. Install:

- Front wheel

**Nut (Front Wheel):**

88 N·m (9.0 m·kg, 64.9 ft·lb)

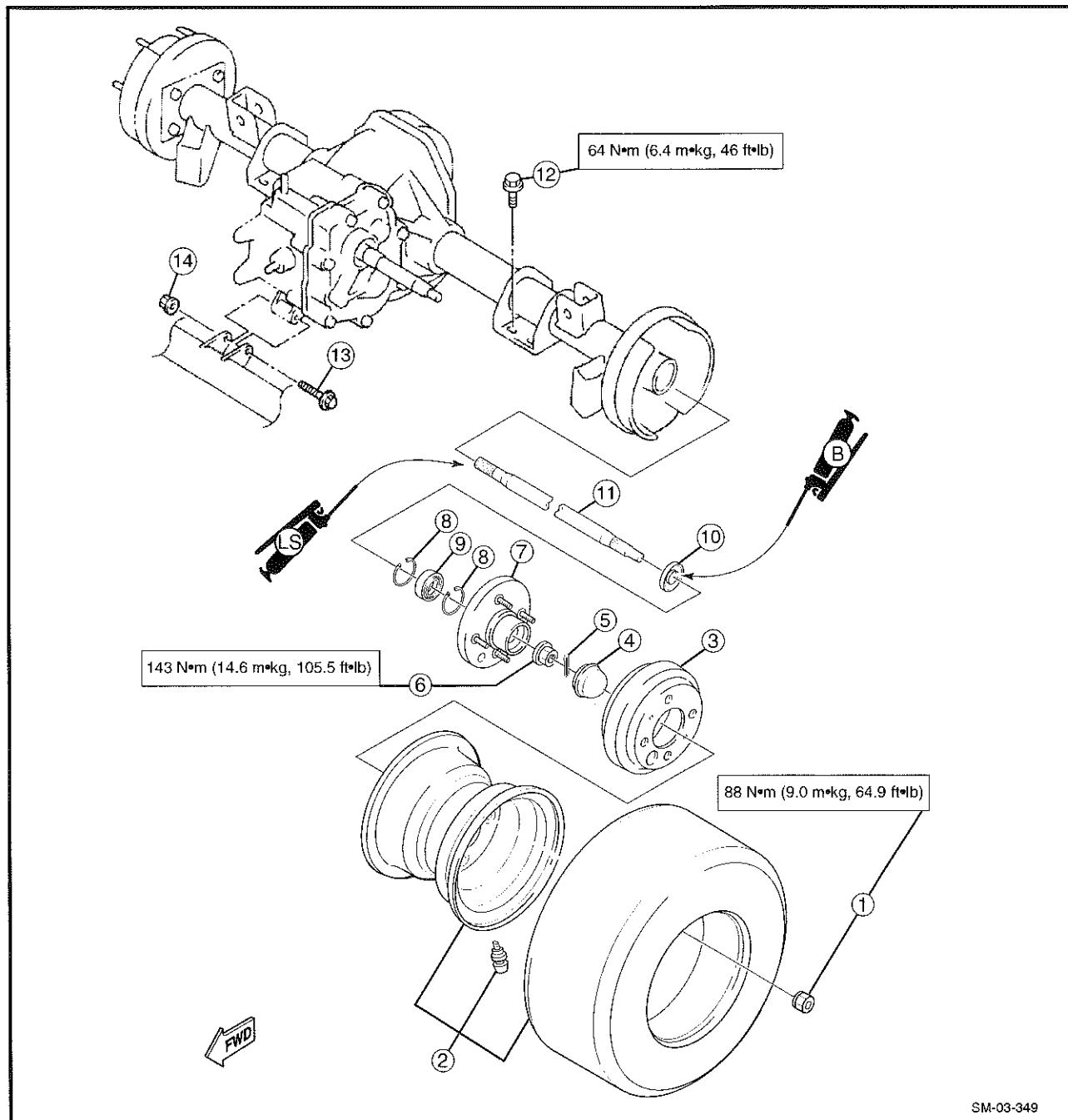
REAR AXLE WHEEL FOR G22A

CHAS 

REAR AXLE WHEEL FOR G22A

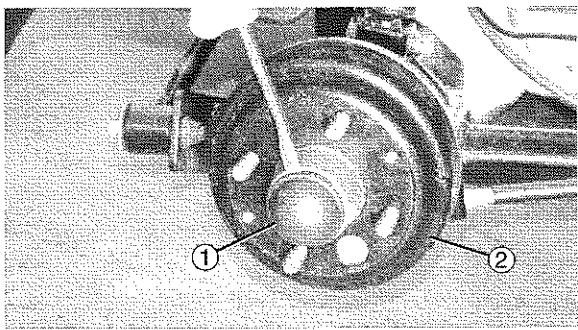
- ① Lug nut
- ② Tire/wheel assembly
- ③ Brake drum
- ④ Dust cover
- ⑤ Cotter pin
- ⑥ Axle nut
- ⑦ Rear axle hub
- ⑧ Circlip
- ⑨ Axle bearing
- ⑩ Axle seal
- ⑪ Rear axle shafts
- ⑫ Bolt
- ⑬ Bolt
- ⑭ Nut

A	TIRE SIZE: 18 x 8.50-8.00/4PR	E	RIM SIZE: 7.00-L-8.00
B	TIRE TYPE: TUBELESS (Sawtooth tread pattern)	F	WHEEL ALIGNMENT:
C	TIRE PRESSURE: For G22A 108 kPa (1.1 kg/cm ² , 16 psi) For G22E 137 kPa (1.4 kg/cm ² , 20 psi)	G	Toe-in: Zero mm (Zero in)
D	WEAR LIMIT: 1.0 mm (0.04 in)	H	Camber: Zero deg (non-adjustable)
I	REAR AXLE RUNOUT: Limit: 0.30 mm (0.012 in)		

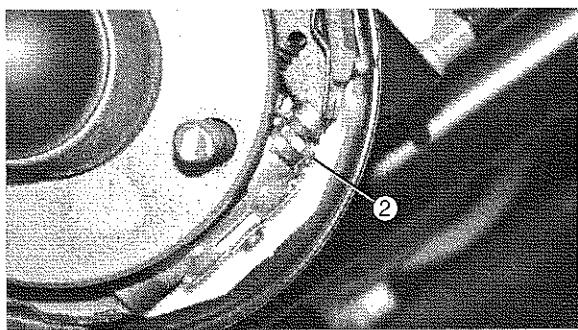


SM-03-349

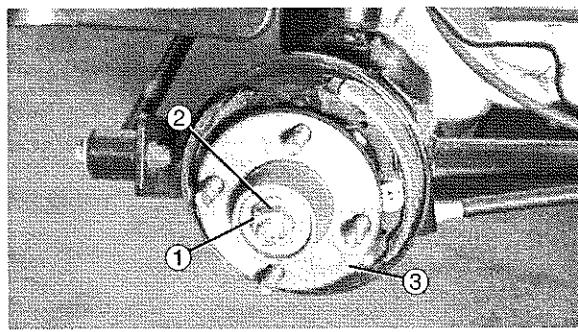
REAR AXLE WHEEL FOR G22A



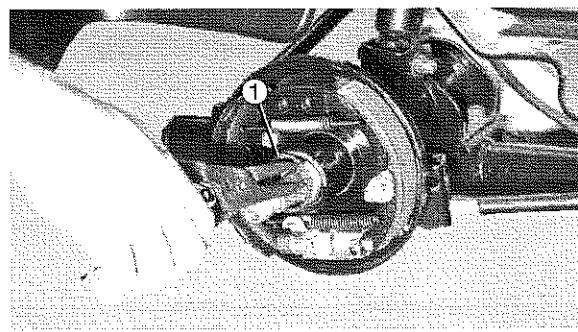
SM-03-054



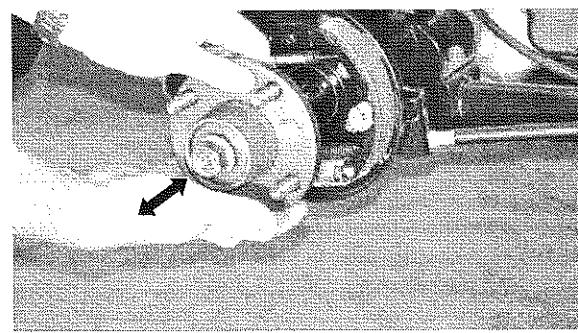
SM-03-043



SM-03-055



SM-03-056



SM-03-057

REMOVAL

1. Place the vehicle on a level surface.
2. Apply parking brake and block the front wheels.
3. Loosen:
 - Lug nuts (Rear wheel)
4. Jack up the rear wheels by placing a suitable stand under the frame.
Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.
5. Remove:
 - Lug nuts (Rear wheel)
 - Rear wheel
6. Release parking brake by depressing the accelerator pedal.
7. Remove:
 - Dust cover ①
 - Brake drum ②

3

NOTE:

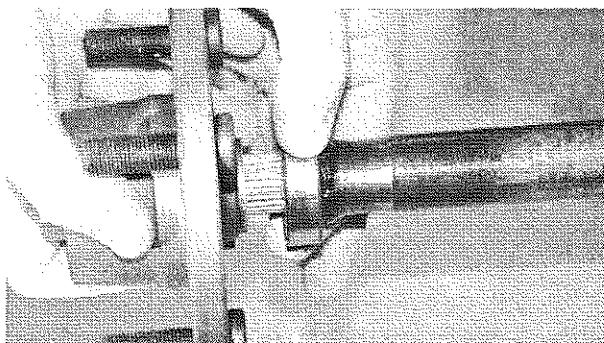
If it is very difficult to remove the drum, screw in the adjusting nut ③ in the shoe plate.

8. Remove:
 - Cotter pin ①
 - Nut from axle shaft ②
 - Washer
 - Rear hub
9. Remove:
 - Circlip ①
10. Remove:
 - Rear axle shaft
Tip: Replace hub and nut onto axle shaft.
Use a "push-pull" motion to tap the axle shaft out.

INSPECTION

1. Inspect:
 - Wheel
 - Cracks/bends/warping → replace

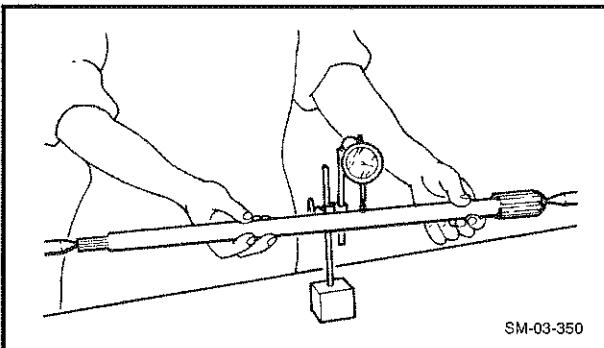
REAR AXLE WHEEL FOR G22A



SM-03-058

2. Inspect:

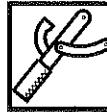
- Axle bearing movement
Rotate bearing by finger.
Roughness/wear → replace bearing
- Oil seal damage/wear → replace



SM-03-350

3. Measure:

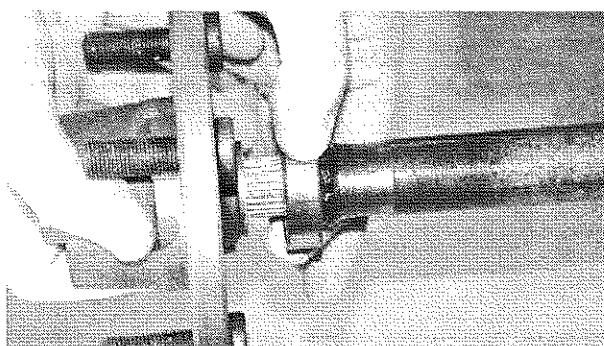
- Axle shaft runout
Use a centering device and the dial gauge.
Out of specification → replace



Dial Gauge:
YU-03097



Runout Limit:
0.30 mm (0.012 in.)



SM-03-058

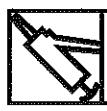
INSTALLATION

Reverse the "REMOVAL" procedure.

Note the following points.

1. Lubricate:

- Bearing outer surface



**Lightweight Lithium Soap
Base Grease**

- Axle shaft spline



Anti Seize Lubricant

REAR AXLE WHEEL FOR G22A

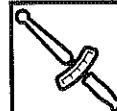


2. Install:

- Circlip

3. Install:

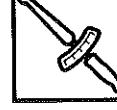
- Hub, washer, nut, cotter pin



Nut on Axle Shaft:

143 N·m (14.6 m·kg, 105.5 ft·lb)

- Rear wheel



Lug nut (Rear Wheel):

88 N·m (9.0 m·kg, 64.9 ft·lb)

3

REAR AXLE WHEEL FOR G22E

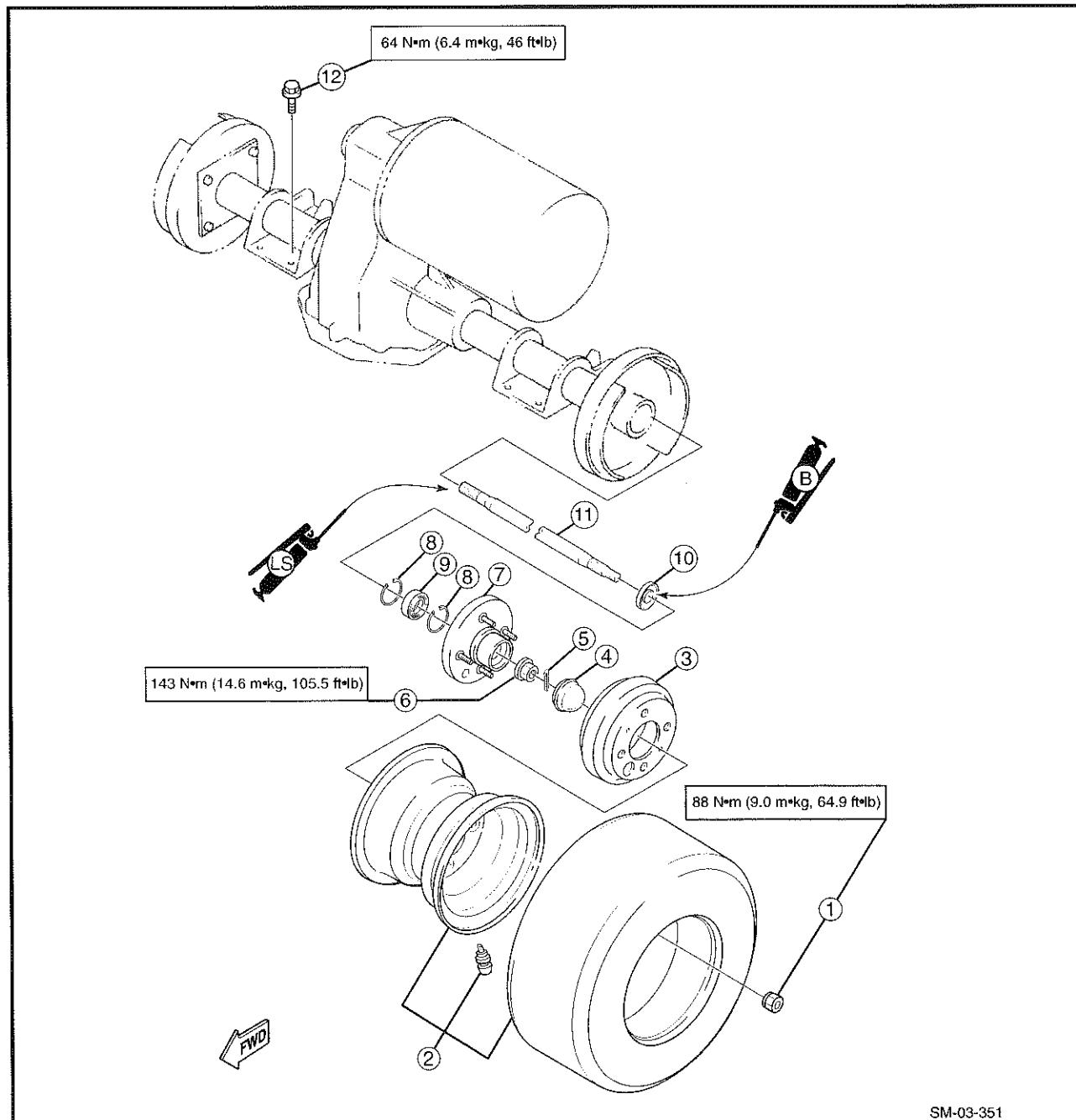
CHAS 

REAR AXLE WHEEL FOR G22E

- ① Lug nut
- ② Tire/wheel assembly
- ③ Brake drum
- ④ Dust cover
- ⑤ Cotter pin
- ⑥ Axle nut
- ⑦ Rear axle hub
- ⑧ Circlip
- ⑨ Axle bearing
- ⑩ Axle seal
- ⑪ Rear axle shafts
- ⑫ Bolt

A	TIRE SIZE: 18 x 8.50-8.00/4PR
B	TIRE TYPE: TUBELESS (Sawtooth)
C	TIRE PRESSURE: 137 kPa (1.4 kg/cm ² , 20 psi)
D	WEAR LIMIT: 1.0 mm (0.04 in)
E	RIM SIZE: 7.00-L-8.00

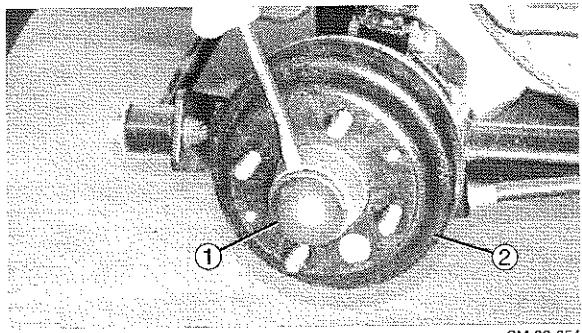
F	WHEEL ALIGNMENT:
G	Toe-in: Zero mm (Zero in)
H	Camber: Zero deg (non-adjustable)
I	REAR AXLE RUNOUT: Limit: 0.30 mm (0.012 in)



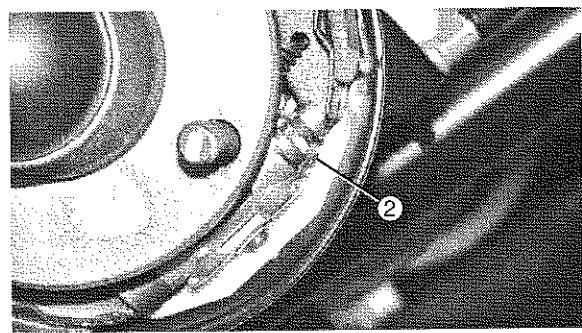
SM-03-351

REAR AXLE WHEEL FOR G22E

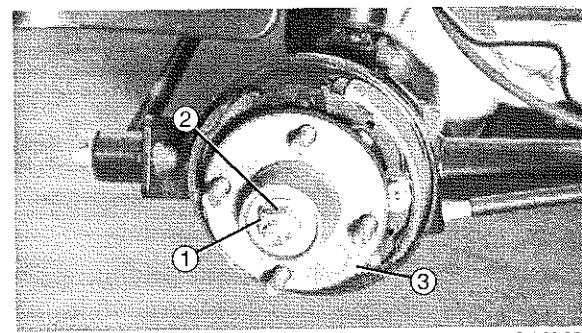
CHAS 



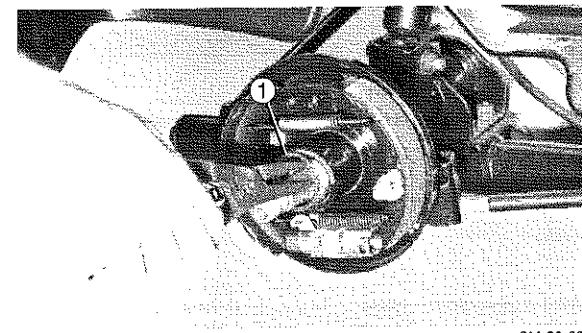
SM-03-054



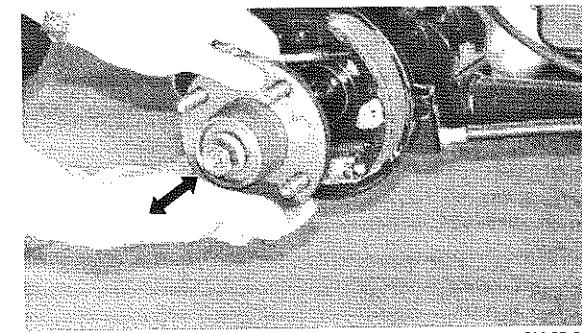
SM-03-043



SM-03-055



SM-03-056



SM-03-057

REMOVAL

1. Place the vehicle on a level surface.
2. Apply parking brake and block the front wheels.
3. Loosen:
 - Lug nuts (Rear wheel)
4. Jack up the rear wheels by placing a suitable stand under the frame.
Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.
5. Remove:
 - Lug nuts (Rear wheel)
 - Rear wheel
6. Release parking brake by depressing the accelerator pedal.
7. Remove:
 - Dust cover ①
 - Brake drum ②

3

NOTE:

If it is very difficult to remove the drum, screw in the adjusting nut ③ in the shoe plate.

8. Remove:
 - Cotter pin ①
 - Flange nut from axle shaft ②
 - Rear hub ③
9. Remove:
 - Circlip 1
10. Remove:
 - Rear axle shaft

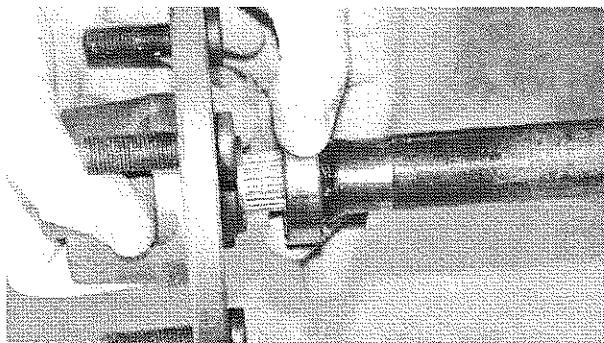
Tip: Replace hub and nut onto axle shaft.
Use a "push-pull" motion to tap the axle shaft out.

INSPECTION

1. Inspect:
 - Wheel
 - Cracks/bends/warping → replace

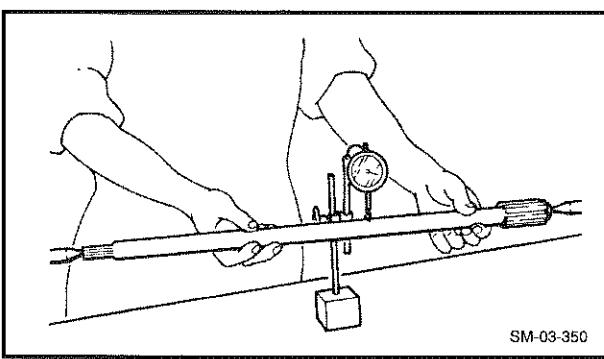
REAR AXLE WHEEL FOR G22E

CHAS 



2. Inspect:

- Axle bearing movement
Rotate bearing by finger.
Roughness/wear → replace bearing
- Oil seal damage/wear → replace



3. Measure:

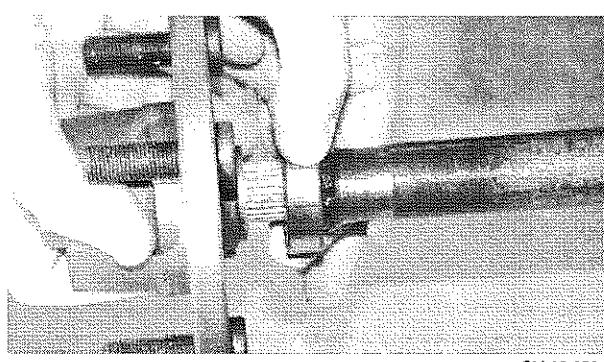
- Axle shaft runout
Use a centering device and the dial gauge.
Out of specification → replace



Dial Gauge:
YU-03097



Runout Limit:
0.30 mm (0.012 in.)



INSTALLATION

Reverse the "REMOVAL" procedure.

Note the following points.

1. Lubricate:

- Bearing outer surface



**Lightweight Lithium Soap
Base Grease**

- Axle shaft spline



Anti Seize Lubricant

REAR AXLE WHEEL FOR G22E

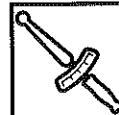


2. Install:

- Circlip

3. Install:

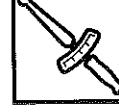
- Hub, washer, nut, cotter pin



Nut on Axle Shaft:

143 N·m (14.6 m·kg, 105.5 ft·lb)

- Rear wheel



Lug nut (Rear Wheel):

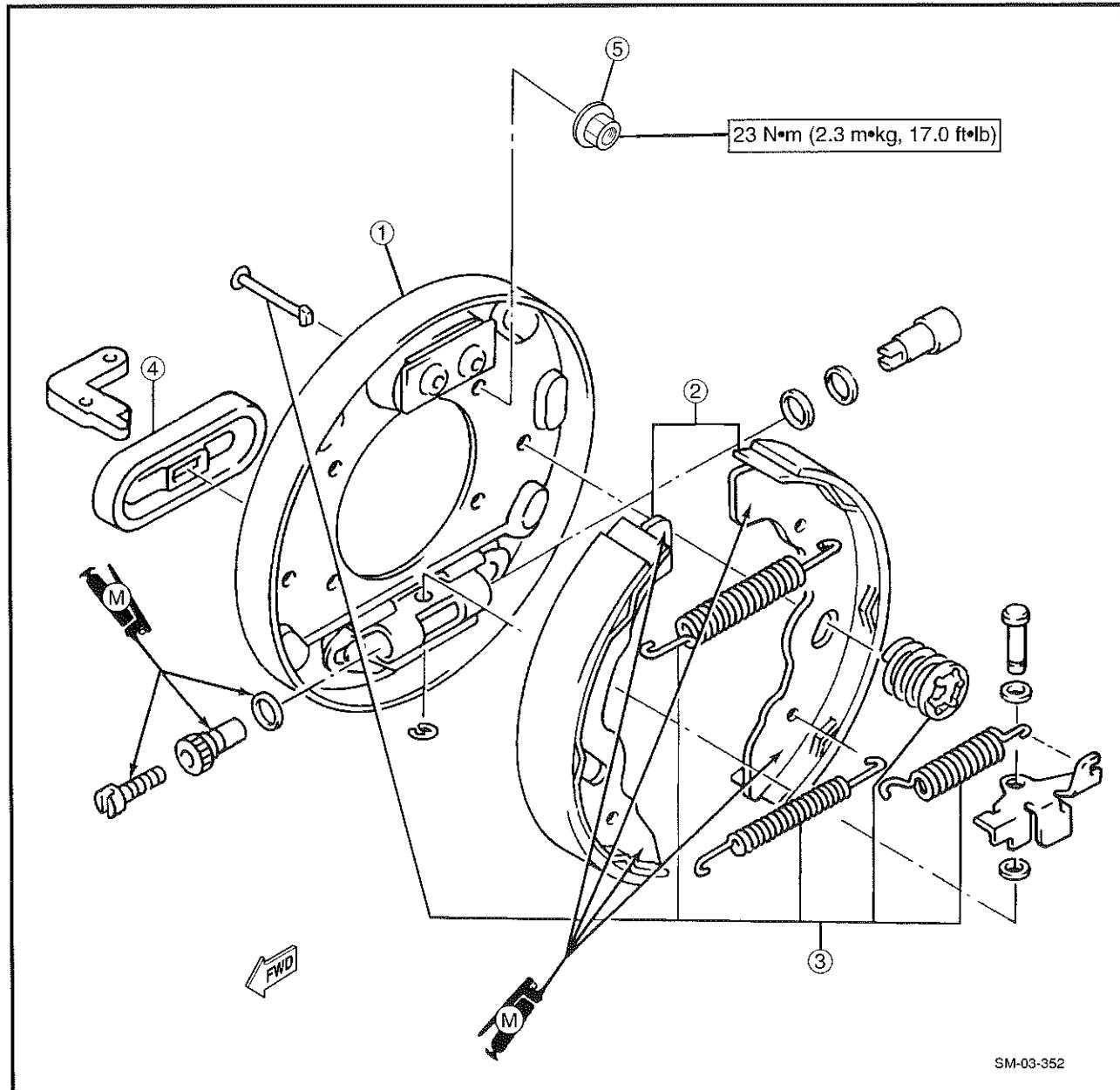
88 N·m (9.0 m·kg, 64.9 ft·lb)



BRAKE

- ① Brake shoe plate
- ② Brake shoes
- ③ Repair parts kit
- ④ Dust cover
- ⑤ Nut

A	BRAKE SHOE LINING THICKNESS: Standard: 4.0 mm (0.16 in) Limit: 0.75 mm (0.029 in)
B	BRAKE DRUM INSIDE DIAMETER: Standard: 160 mm (6.30 in) Limit: 161 mm (6.34 in)

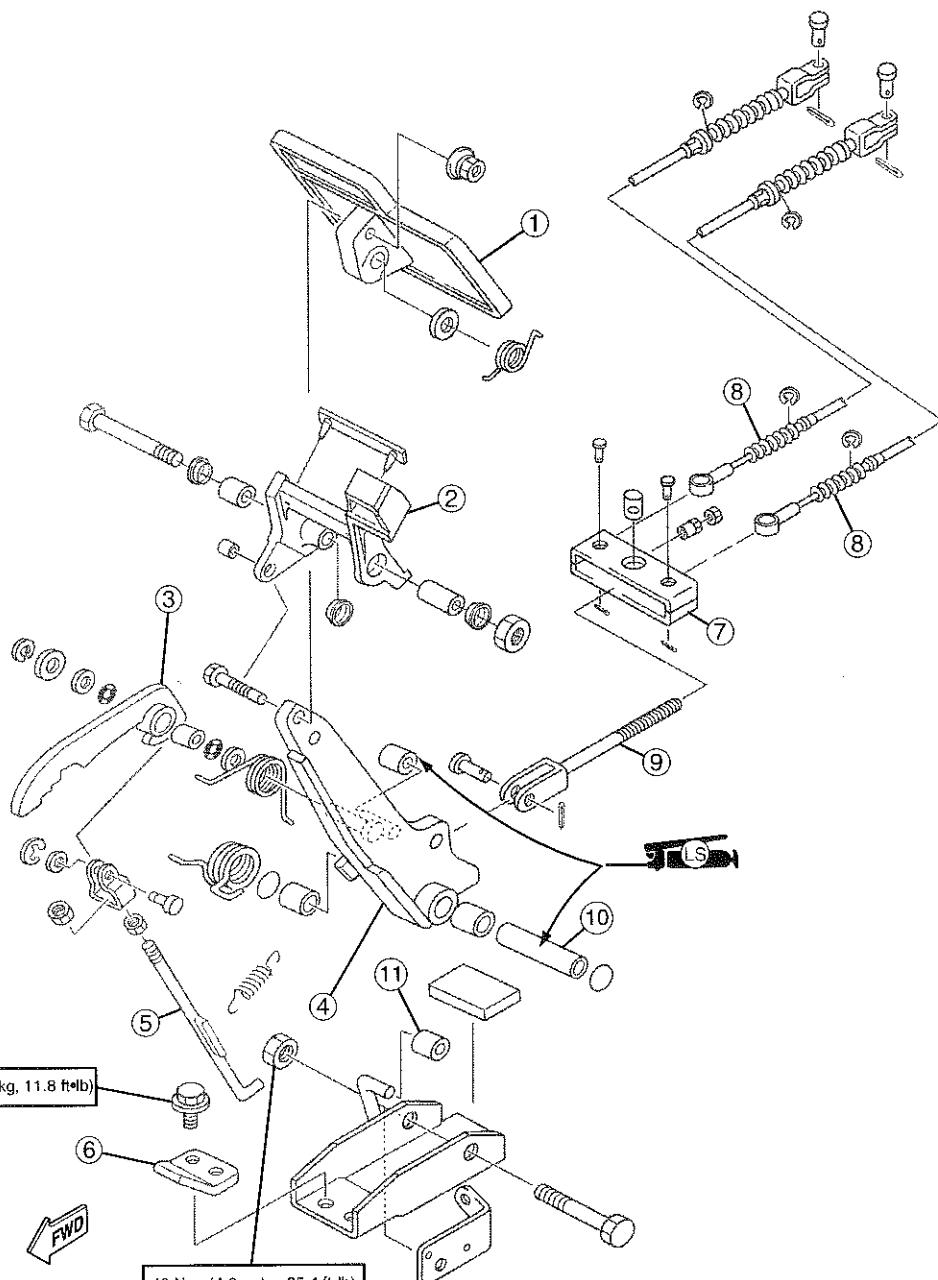


BRAKE PEDAL

- | | |
|-------------------------|-------------------|
| ① Brake pedal | ⑦ Brake equalizer |
| ② Parking brake pedal | ⑧ Brake cable |
| ③ Parking brake ratchet | ⑨ Brake arm |
| ④ Brake arm | ⑩ Collar |
| ⑤ Parking brake rod | ⑪ Bushing |
| ⑥ Ratchet stopper | |

A BRAKE PEDAL FREEPLAY:
25 ~ 30 mm (0.98 ~ 1.18 in)

3



SM-03-353

DISASSEMBLY

1. Remove:

- Rear wheel
- Brake drum

For G22A:

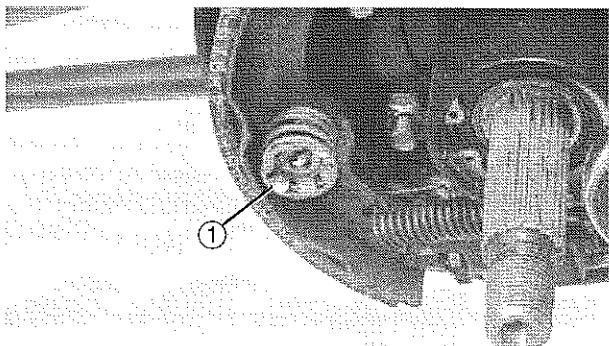
- Refer to steps 1 through 10 "REAR AXLE WHEEL REMOVAL" section on page 3-19.
- Refer to steps 1 through 10 "REAR AXLE WHEEL REMOVAL" section on page 3-23.

2. Remove:

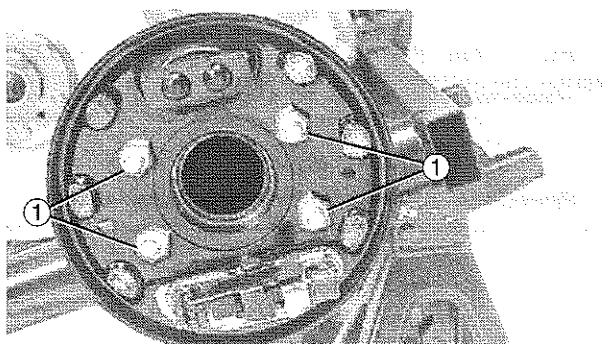
- Shoe clamp springs ① While depressing the spring ① with a spring removal tool or pliers, turn it to align the spring slot with the pin head.

3. Remove:

- Brake shoes (with tension springs)



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SM-03-059

4. Remove:

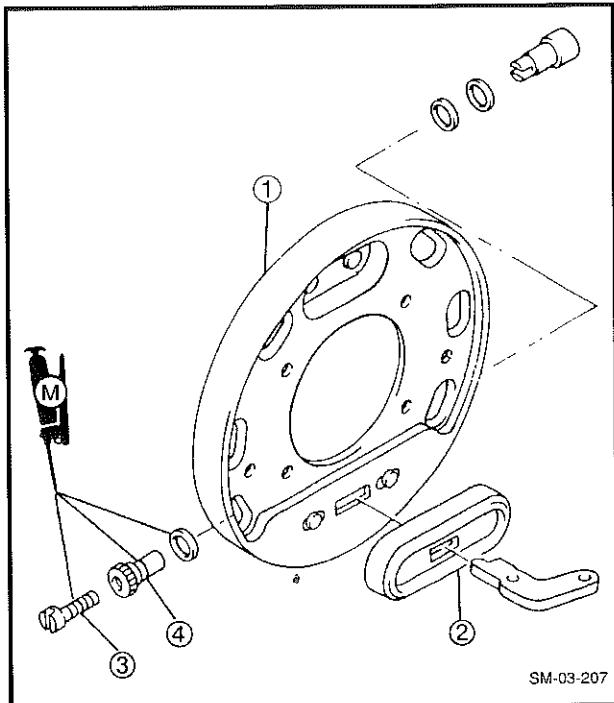
- Nuts ①



INSPECTION

Brake Shoe and Brake Drum

Refer to CHAPTER 2, "BRAKE" and "ACCELERATOR PEDAL INSPECTION" sections.



Brake Shoe Plate

1. Inspect:

- Brake shoe plate (1)
Bends/cracks/damage → replace

2. Inspect:

- Dust cover (2)
Cracks/wear → replace

3. Check:

- Lever holder
Irregular movement → lubricate with high temperature grease

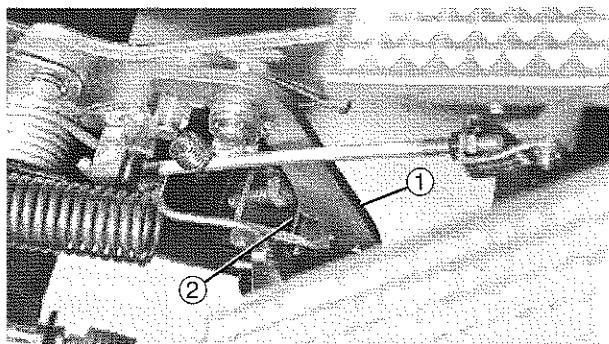
4. Turn the adjusting bolt (3) in completely by hand. Do not tighten it so that movement is not free. This bolt must rotate freely.

3

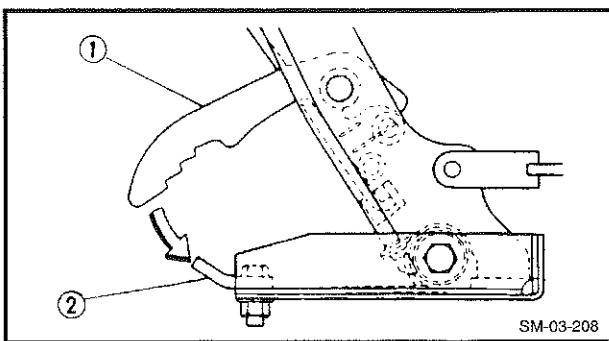
NOTE: _____

Lubricate the adjusting bolt with high temperature grease.

(4) Adjusting nut



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SM-03-208

Brake Pedal**1. Check:**

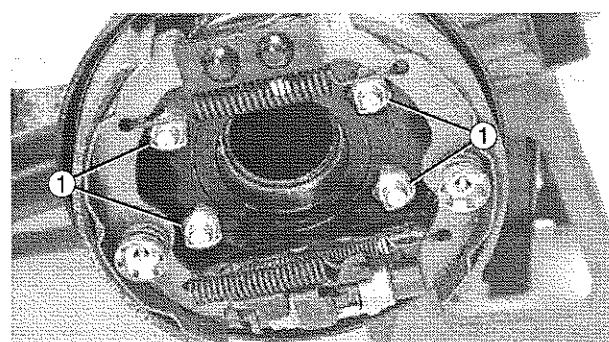
- Pedal movement
- Side freeplay

Refer to Chapter 2, "BRAKE" and "ACCELERATOR PEDAL INSPECTION" sections.

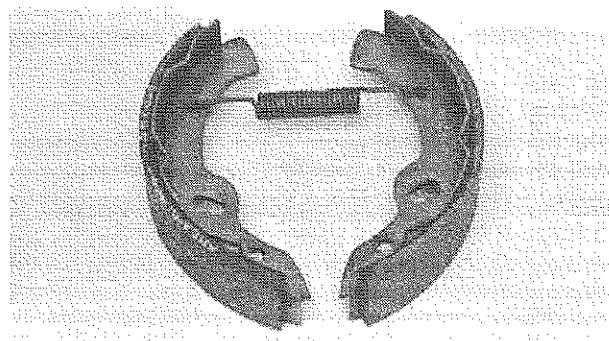
2. Inspect:

- Parking brake ratchet ①
- Ratchet stopper ②

Wear/damage → replace



SM-03-113



Y-279

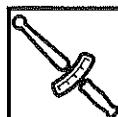
ASSEMBLY

Reverse the "DISASSEMBLY" procedure.

Note the following points.

Brake Shoe**1. Install:**

- Shoe plate
- Nuts ①
- Brake shoes

**Nut (Shoe Plate):**

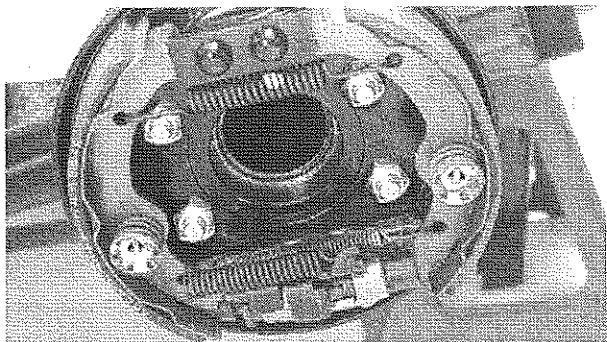
23 N·m (2.3 m·kg, 17.0 ft·lb)

Brake shoe assembly steps:

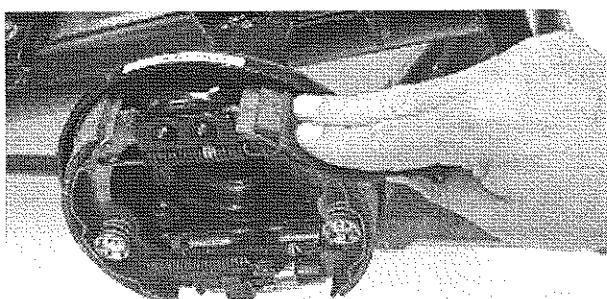
- Apply a light coat of high temperature grease to each end of both brake shoes.

 WARNING

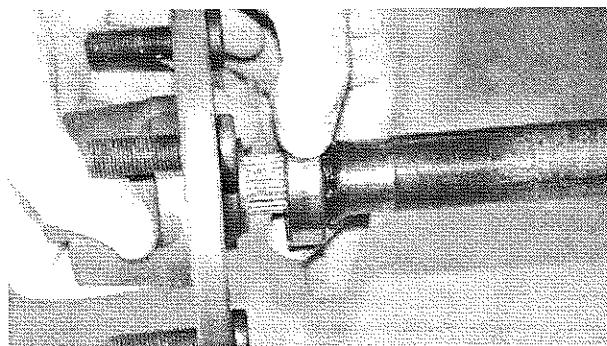
Keep hands clean while handling brake shoes.
Be sure that no grease gets on the lining surface.



SM-03-111



SM-03-112



SM-03-058

- Hook the upper spring (larger) onto the shoes.
- Install the shoes onto the shoe plate.

CAUTION

Align the shoe end with slot of the adjusting bolt head.

- Install the clamp springs
- Install the lower springs (smaller) onto the shoes.
- Lightly polish the new lining surfaces with emery cloth.

3

2. Lubricate:

- Bearing outer surface



**Lightweight Lithium Soap
Base Grease**

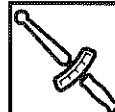
3. Install:

- | | |
|-------------------|--------------|
| • Rear axle shaft | • Cotter pin |
| • Circlip | • Brake drum |
| • Hub | • Rear wheel |
| • Washer | • Dust Cover |
| • Nut | |

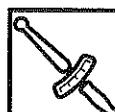
Refer to "REAR AXLE WHEEL -
INSTALLATION" section.



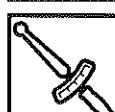
Note the following points:



Nut (Shoe Plate) G22A:
23 N·m (2.3 m·kg, 17.0 ft·lb)



Nut Rear Axle Shaft:
143 N·m (14.6 m·kg, 105.5 ft·lb)



Wheel Nut:
88 N·m (9.0 m·kg, 64.9 ft·lb)

4. Adjust:

- Free play (Brake cable)

Refer to CHAPTER 2 "BRAKE CABLE INSPECTION" section.



Free Play (Brake Cable):
20 ~ 25 mm (0.79 ~ 0.98 in.)

5. Adjust:

- Free play (release timing)

Refer to CHAPTER 2 "PARKING BRAKE ADJUSTMENT" section.



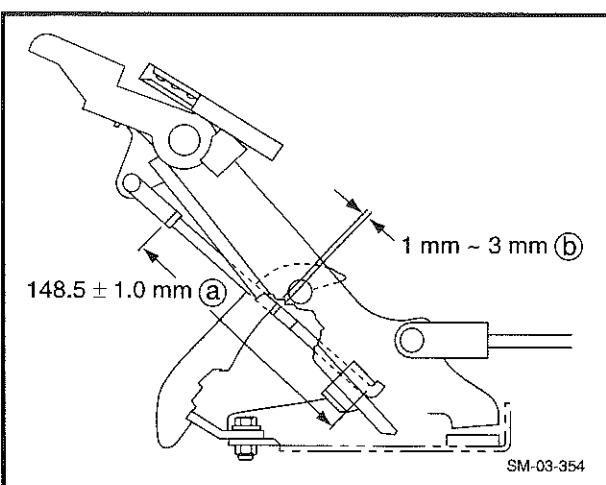
Free Play (Release Timing):
0 ~ 0.3 mm (0 ~ 0.01 in.)

6. Adjust:

- Parking rod length (Parking brake pedal) ②



Parking Rod Length:
 $148.5 \pm 1 \text{ mm}$ (5.85 ± 0.04 in.)



Rod length adjustment step:

- Engage first notch of parking brake.
- Check clearance ③.

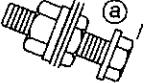


③: 1 mm ~ 3 mm

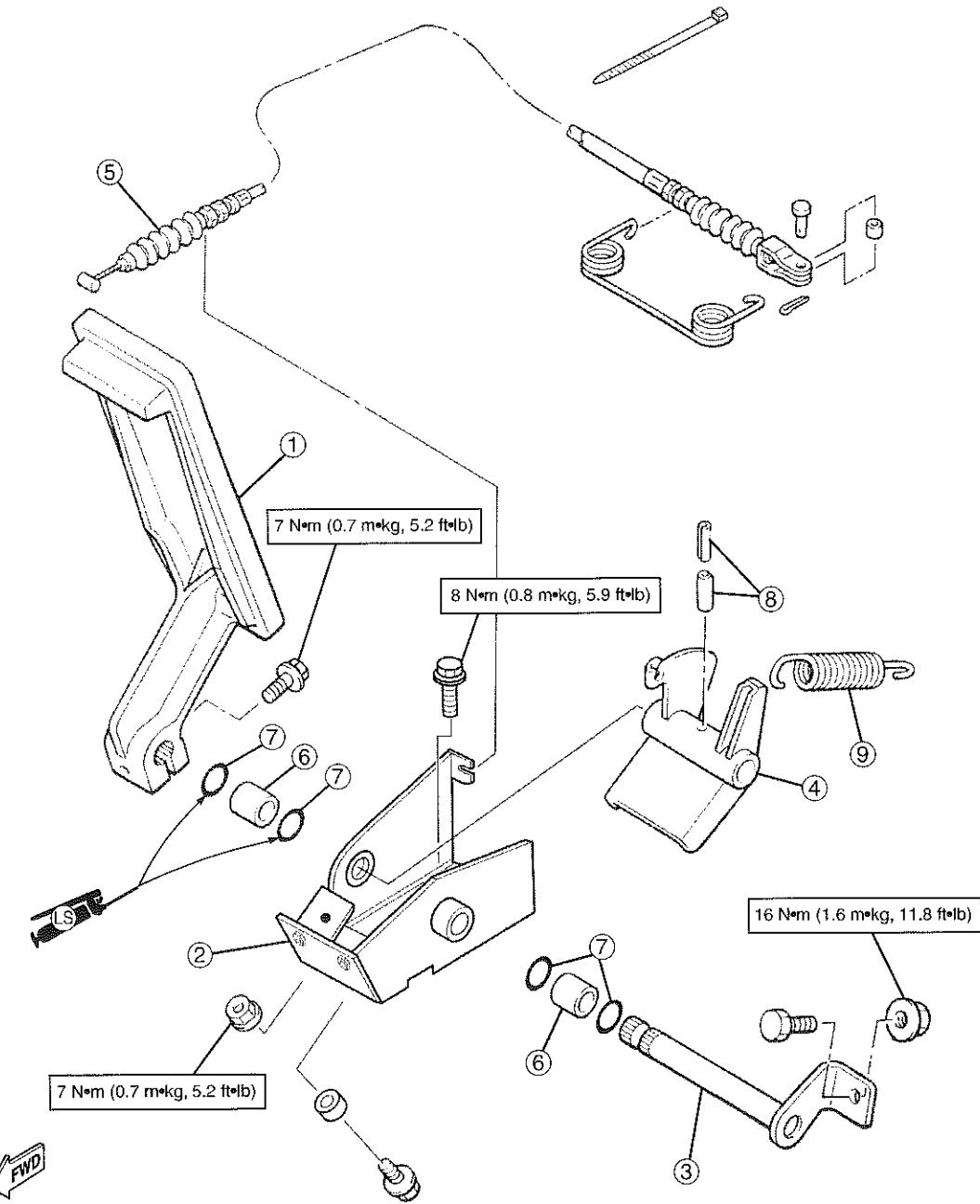
- Adjust length of parking rod by loosening the locknut and turning the adjuster nut as required.

ACCELERATOR PEDAL**FOR G22A**

- | | |
|---------------------|------------------|
| ① Accelerator pedal | ⑥ Bushing |
| ② Pedal bracket | ⑦ O-ring |
| ③ Pedal shaft | ⑧ Spring pin |
| ④ Accelerator arm | ⑨ Tension spring |
| ⑤ Throttle cable | |

A	* ACCELERATOR PEDAL POSITION ADJUSTING BOLT HEIGHT ⑩:
	 18.00 ~ 18.40 mm (0.708 ~ 0.720 in)

3



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ACCELERATOR PEDAL

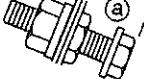
CHAS

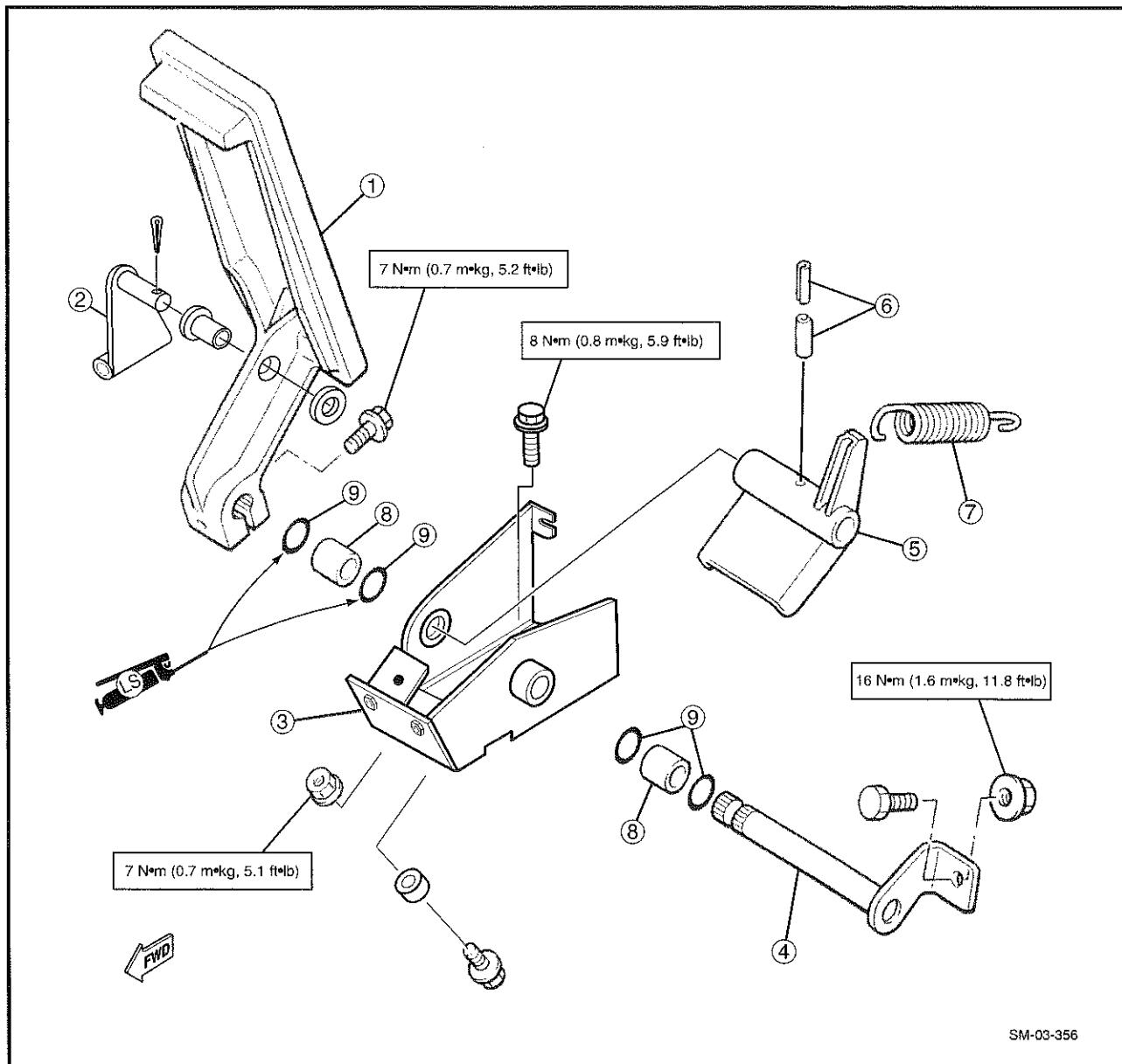


FOR G22E

- ① Accelerator pedal
- ② Crank pedal lever
- ③ Pedal bracket
- ④ Accelerator shaft
- ⑤ Accelerator arm

- ⑥ Spring pin
- ⑦ Tension spring
- ⑧ Bushing
- ⑨ O-ring

A	* ACCELERATOR PEDAL POSITION ADJUSTING BOLT HEIGHT ⑩:	
	 ⑩	18.00 ~ 18.40 mm (0.708 ~ 0.720 in)

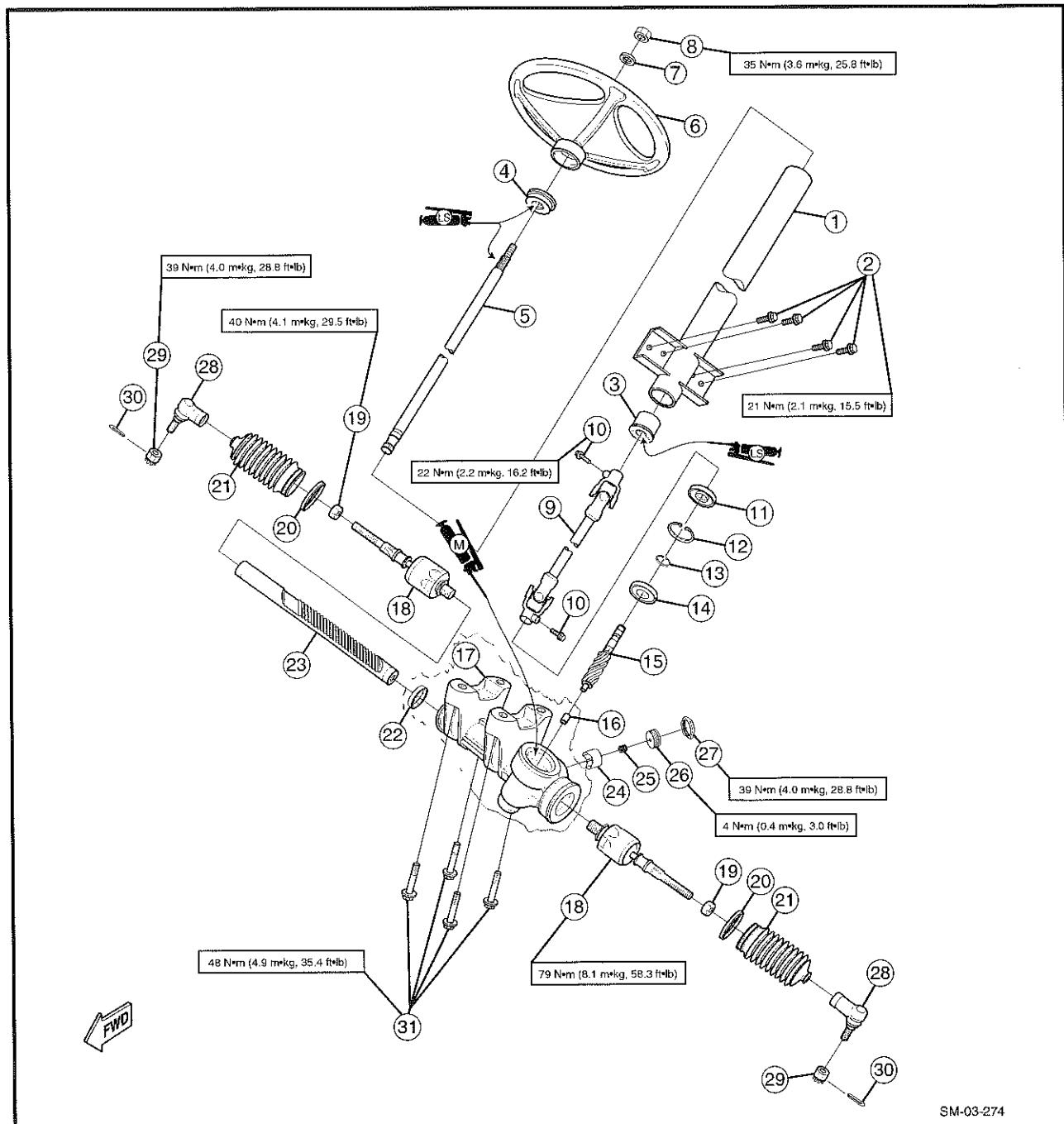


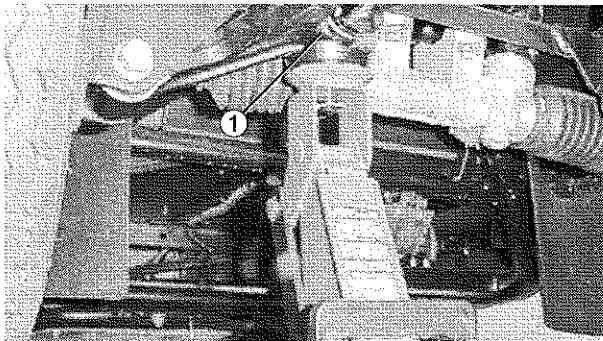
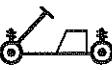
SM-03-356

STEERING SYSTEM

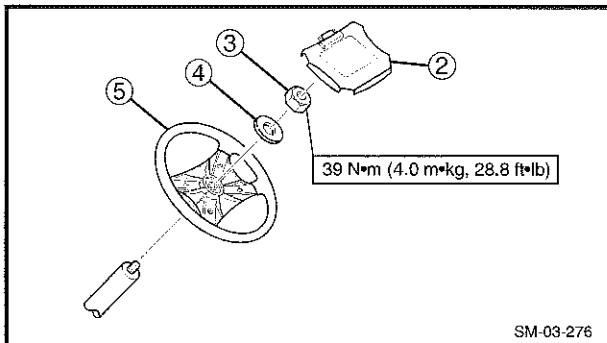
- | | | |
|-------------------|--------------------|--------------------|
| ① Steering column | ⑫ Circlip | ㉓ Rack gear |
| ② Bolts | ⑬ Circlip | ㉔ Pressure pad |
| ③ Lower holder | ⑭ Bearing | ㉕ Spring |
| ④ Upper holder | ⑮ Pinion gear | ㉖ Adjustment cover |
| ⑤ Steering rod | ⑯ Needle bearing | ㉗ Adjustment lock |
| ⑥ Steering wheel | ⑰ Steering housing | ㉘ Tie rod-end |
| ⑦ Washer | ⑱ Tie rod | ㉙ Nut |
| ⑧ Nut | ⑲ Nut | ㉚ Cotter pin |
| ⑨ Steering joint | ㉑ Clamp | ㉛ Flange bolt |
| ⑩ Pinch bolt | ㉒ Boot | |
| ⑪ Oil seal | ㉓ Bearing | |

3





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REMOVAL

1. Place the vehicle on a level surface.
 2. Apply parking brake.
 3. Jack up the front wheels by placing a suitable stand under the frame (1).
- Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.

4. Remove:

- Scorecard holder (2)
- Steering wheel nut (3)
- Washer (4)
- Steering wheel (5)

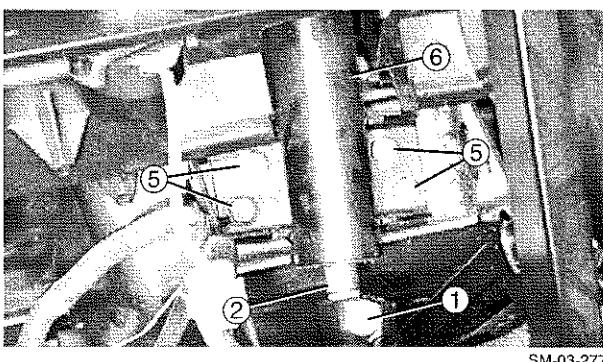
NOTE:

The scorecard holder is removed by pressing the mounting pins from the back of the steering wheel.

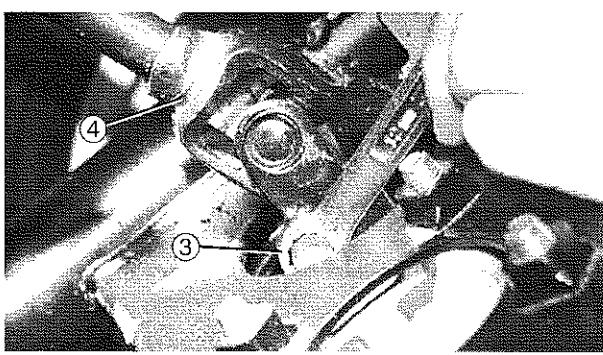
5. Remove:

See item description on page 3-35.

- Upper pinch bolt (1)
- Steering shaft (2) (Removal optional)
- Lower pinch bolt (3)
- Steering u-joint assembly (4)
- Steering column bolts (5)
- Steering column from frame (6)



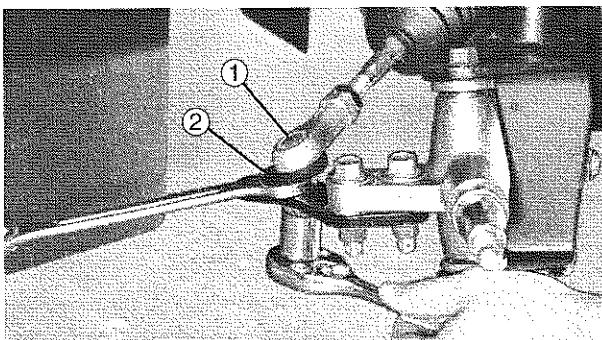
SM-03-277



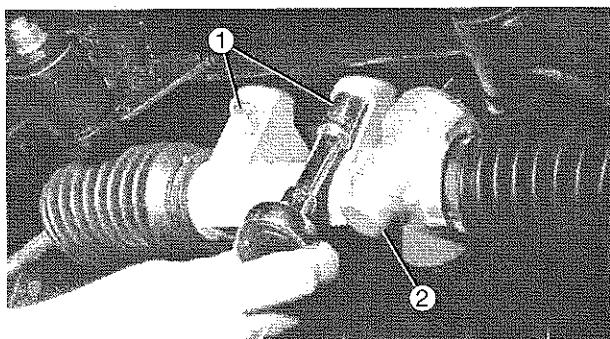
SM-03-278

NOTE:

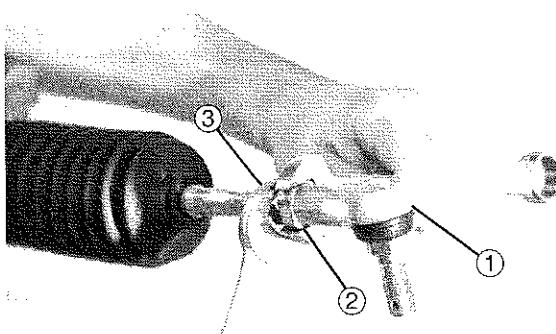
To help in removal of the upper pinch bolt from steering shaft, reinstall the steering wheel nut on the shaft to keep it from slipping through the column. Afterwards, if necessary, remove shaft from top of column.



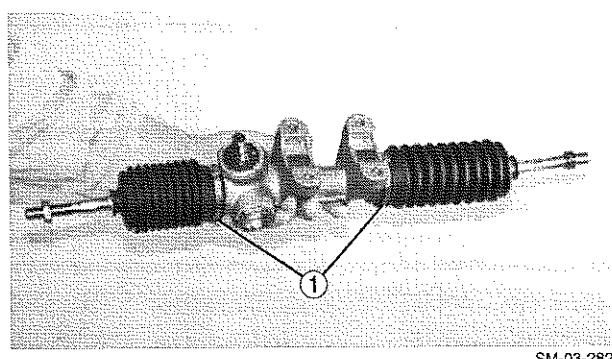
SM-03-279



SM-03-280



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REMOVAL

6. Remove:

- Cotter pins LS and RS
- Tie rod end from knuckle arm ①
- When removing the locknut, hold the rod end using a 17 mm wrench ②.

3

7. Remove:

- Steering assembly bolts ①
- Steering assembly from frame ②

8. Remove:

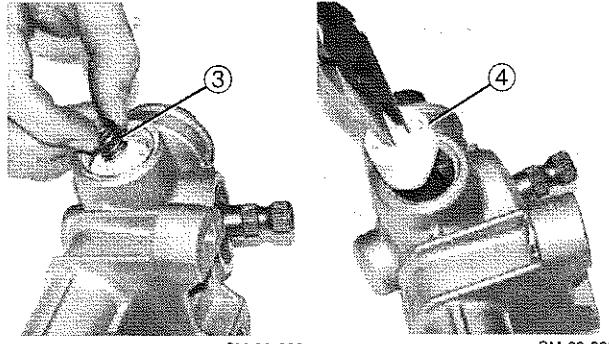
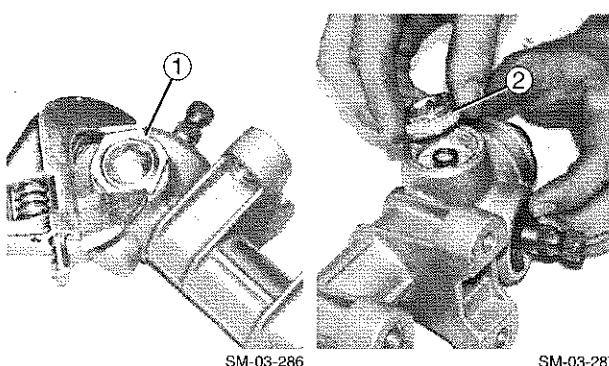
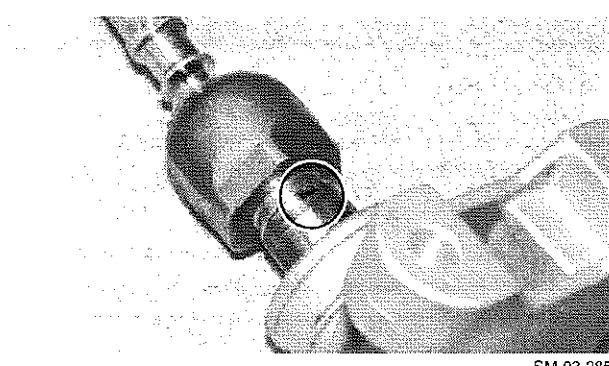
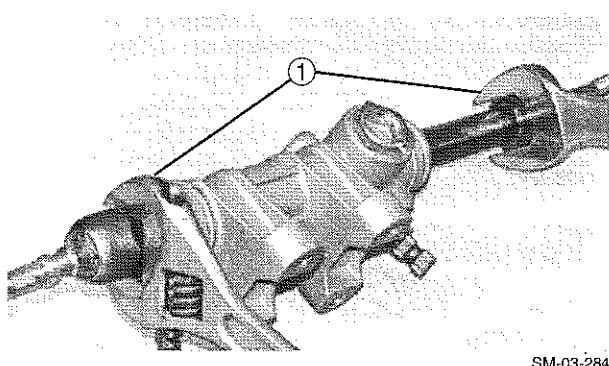
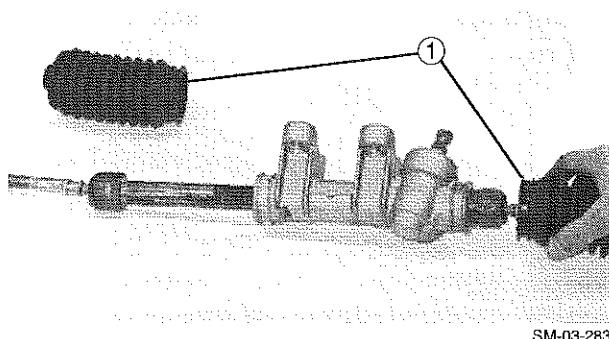
- Tie rod end ①
- While holding squared end of tie rod end with wrench ②, loosen lock nut ③ with wrench.

9. Remove:

- Boot clamps ①

NOTE: _____

The clamps will be permanently damaged after removal and must be replaced with new ones.



DISASSEMBLY

1. Remove:

- Boots (1)

2. Remove:

- Tie rods (1)

IMPORTANT:

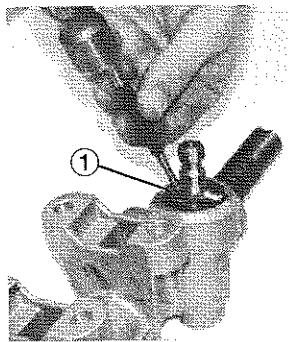
Notice that the tie rod surface that meets flush against the gear rack has a punch mark. This punch mark is needed to prevent loosening of the tie rods. During reassembling, the tie rods must be punched again on opposite side of original punch.

3. Remove:

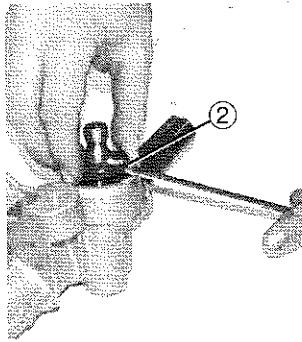
- Adjustment lock nut (1)
- Adjustment cover (2)
- Spring (3)
- Pressure pad (4)

NOTE:

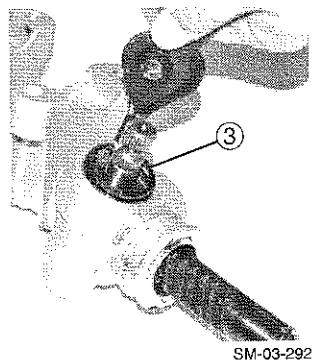
Slightly grip the pressure pad with needle nose pliers to make removal easier.



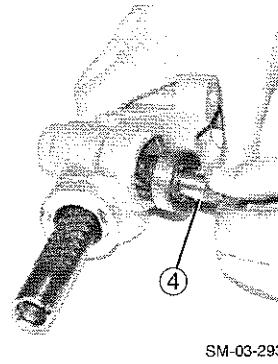
SM-03-290



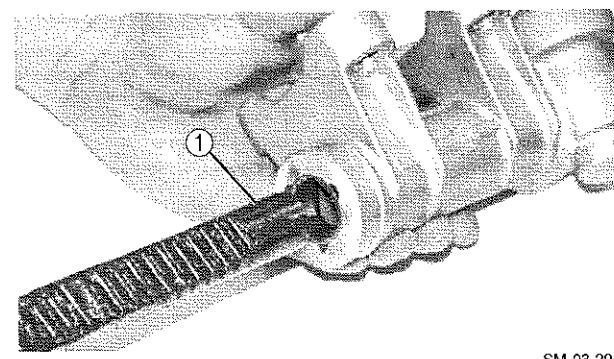
SM-03-291



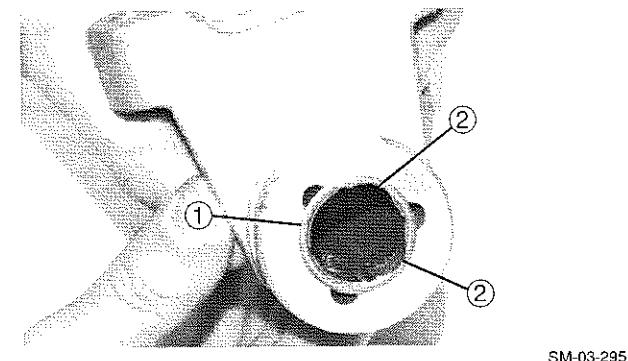
SM-03-292



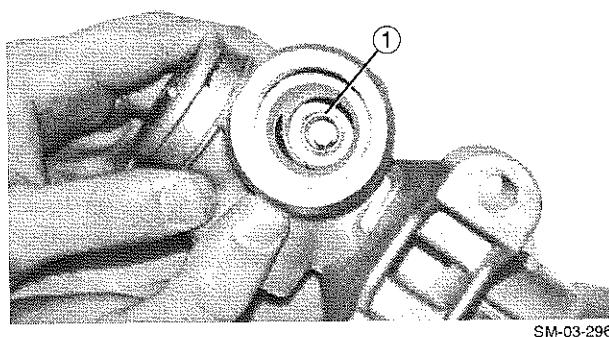
SM-03-293



SM-03-294



SM-03-295



SM-03-296

DISASSEMBLY

4. Remove:

- Use punch to break oil seal ①
- Oil seal ②
- Circlip ③
- Pinion shaft with bearing ④

NOTE:

Check bearing movement on pinion shaft by rotating with fingers. If rotation is rough, replace bearing.

3

5. Remove:

- Rack gear from housing ①

IMPORTANT:

Be careful to note the orientation of the rack gear. It will have to be reinstalled in the same orientation or the steering stroke will be off.

INSPECTION

1. Inspect:

- Pinion shaft bearing ④
- Insert bearing ①
- ~~Notches and orientation of notches to housing end ②~~

NOTE:

~~Mark housing end to orientate bearing into the housing for alignment to rack gear.~~

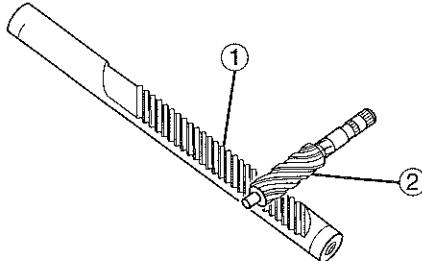
and insert bearing

2. Inspect:

- Pinion needle bearing ①

NOTE:

It is not recommended that the needle bearing be replaced as a single item. The housing may be subject to damage during the removal. A new steering assembly is recommended in this situation.



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INSPECTION

3. Inspect:

- Rack gear teeth ①
- Pinion gear teeth ②

NOTE:

Wear pattern on gear teeth should be in the center area of rack and pinion gear teeth. An uneven wear pattern may indicate improper adjustment or lack of lubricant.

4. Inspect:

- Tie rods for free movement. Grinding may indicate contamination of grit into the ball joint.
- Tie rods for straightness

5. Inspect:

- Pressure pad for excessive wear

6. Inspect:

- Boots for tears or cracks

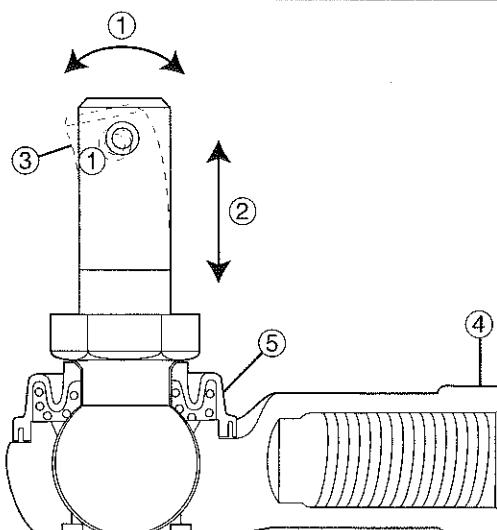
7. Inspect:

Tie rod ends for the following conditions:

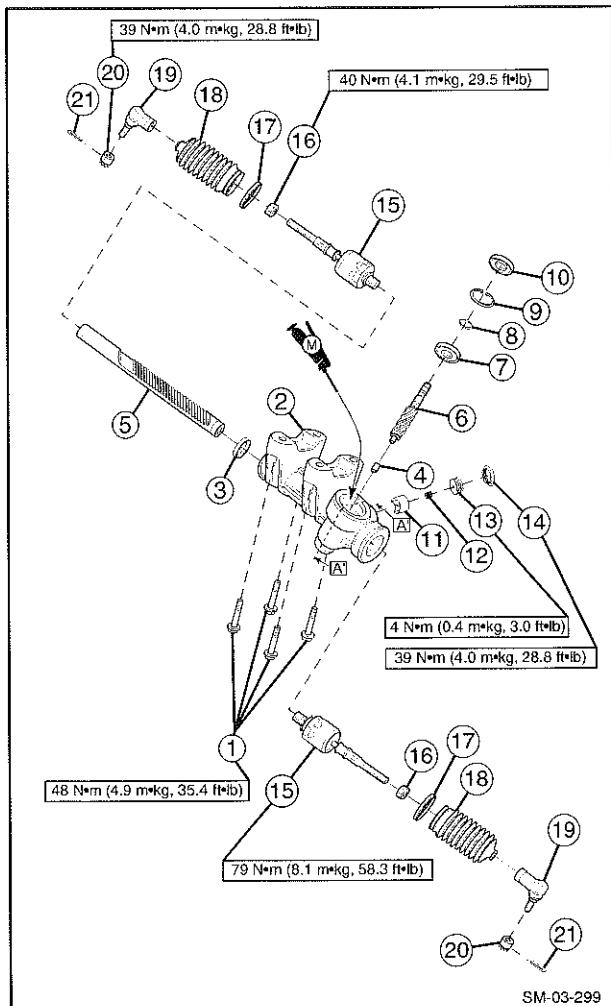
- Unsmooth movement ①
- Noticeable free play ②
- Bent stud ③
- Warped or cracked housing ④
- Torn or cracked boot ⑤

NOTE:

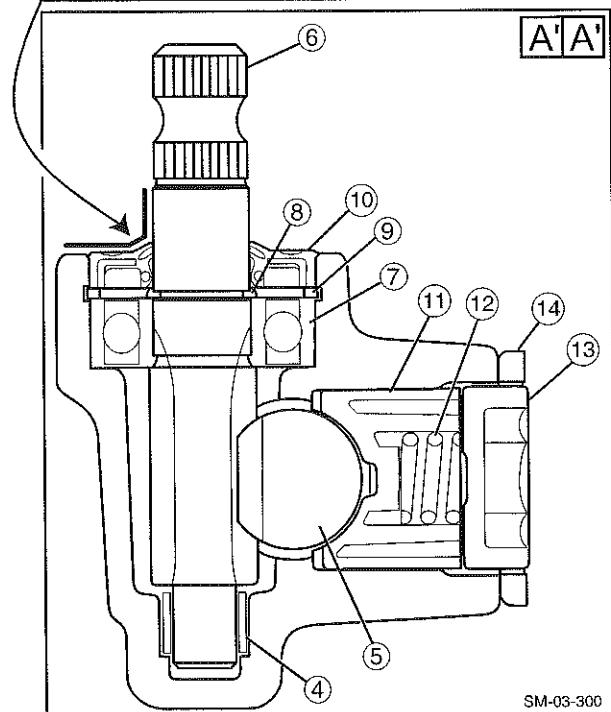
If any of the above conditions are observed, replace the tie rod ends with new ones.



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Rack center mark shall be painted yellow to slash part in the position of rack center.
(width about 2mm) Marking position shall be opposite to yoke side.



ASSEMBLY

Note the following points:

1. Lubricate:

- Bearings
- Rack gear
- Pinion gear
- Oil seal lip

Lithium Soap Base Grease:
Lightly Coat

2. Install:

Reverse the "DISASSEMBLY" procedure. See item description on page 3-35.

3

NOTE:

Be sure the rack gear is orientated correctly before installing.

3. Adjust:

Refer to "ADJUST" procedure (page 3-42).

4. Add grease to the steering gearbox.

NOTE:

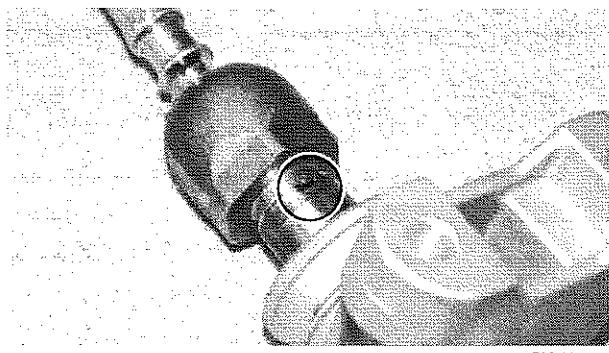
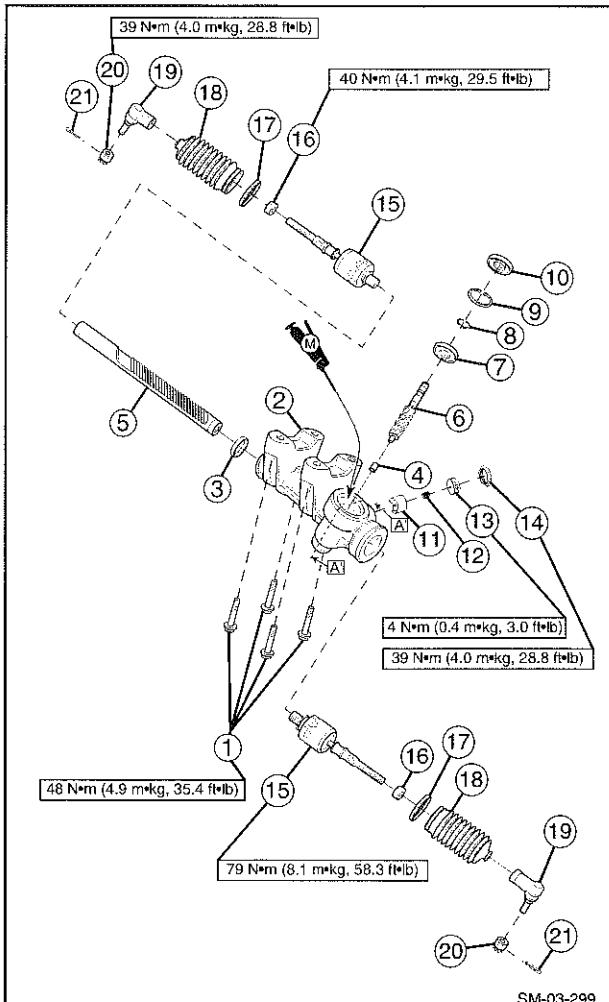
Be sure to correctly align paint marks during the installation of rack and pinion gears. This will be needed for attaching the steering u-joint to pinion properly.

Adjustment Cover Torque:
4 N·m (0.4 m·kg, 3.0 ft·lb)

Adjustment Lock Nut Torque:
39 N·m (4.0 m·kg, 28.8 ft·lb)

Tie Rod to Rack Gear Torque:
79 N·m (8.1 m·kg, 58.3 ft·lb)

Steering Assembly to Frame Torque:
48 N·m (4.9 m·kg, 35.4 ft·lb)

**ADJUST**

1. Adjust:

Backlash (Rack gear-pinion gear)

- With rack gear (5) at center stroke, bring adjust cover (13) to force pressure pad (11) to make contact with rack gear (5), back off and then tighten to 4 N·m (0.4 m·kg, 3.0 ft·lb)
- Tighten adjustment lock nut (14) to 39 N·m (4.0 m·kg, 28.8 ft·lb)
- Tighten tie rods (15) to 79 N·m (8.1 m·kg, 58.3 ft·lb)

IMPORTANT:

Notice that the tie rod surface that meets flush against the gear rack has a punch mark. This punch mark is needed to prevent loosening of the tie rods. During reassembling, the tie rods must be punched again on opposite side of original punch. (See photo below left.)

- Install boots (18), new clamps (17) with both ends in same direction

IMPORTANT:

Verify that all lubrication points and torque settings have been achieved.

**Steering Gearbox Grease:****Multi-type grease****12.5 cc (12 g, 0.423 US oz)**

INSTALLATION

Reverse the "DISASSEMBLY" procedure. See item description on page 3-35.

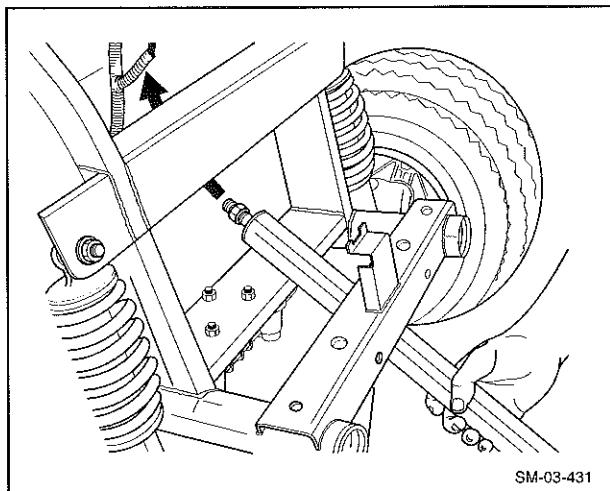
Note the following points:

1. Lubricate:

- Holder upper and lower, where steering shaft will make contact

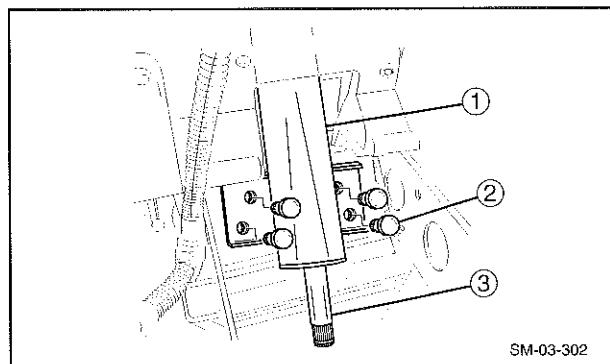
NOTE: _____

If holder upper and lower were removed during the disassembly, do not use grease to help ease the assembly of the holders into the steering column.

3

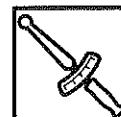
2. Install:

- Steering column under the front frame as shown in illustration

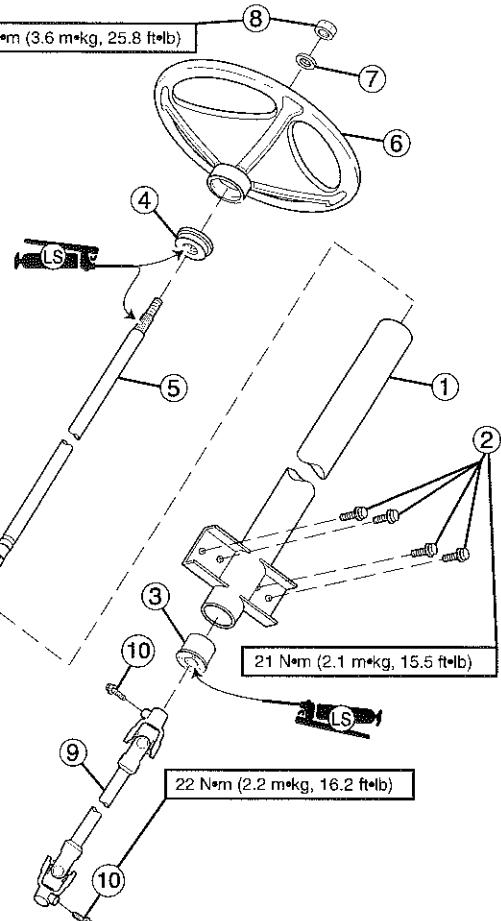


3. Install:

- Steering column to frame ①
- Bolts ②
- Steering shaft ③



**Steering Column to Frame Torque:
21 N·m (2.1 m·kg, 15.5 ft·lb)**



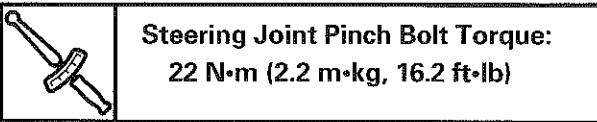
SM-03-303

INSTALLATION

Reverse the "DISASSEMBLY" procedure. See item description on page 3-35.

4. Install:

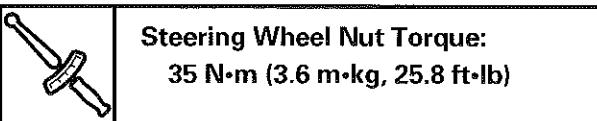
- Steering joint ⑨ upper and lower pinch bolts ⑩

**NOTE:**

Installing the nut on the steering rod to keep the rod from slipping through the column will help in this procedure.

5. Install:

- Steering wheel ⑥



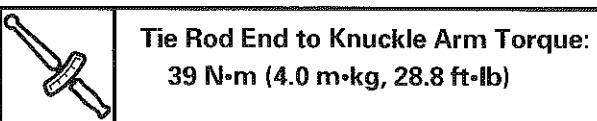
6. Install:

- Tie rod ends ① to knuckle arms ②
- Use new cotter pins

7. Install:

- Front wheel/tire assembly

Refer to "FRONT WHEEL - REMOVAL" section, page 3-15.

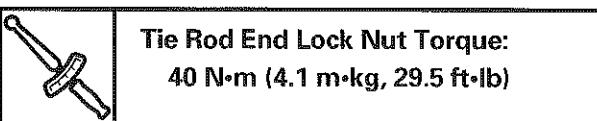


8. Position the front wheels straight ahead.

9. Adjust:

- Toe in

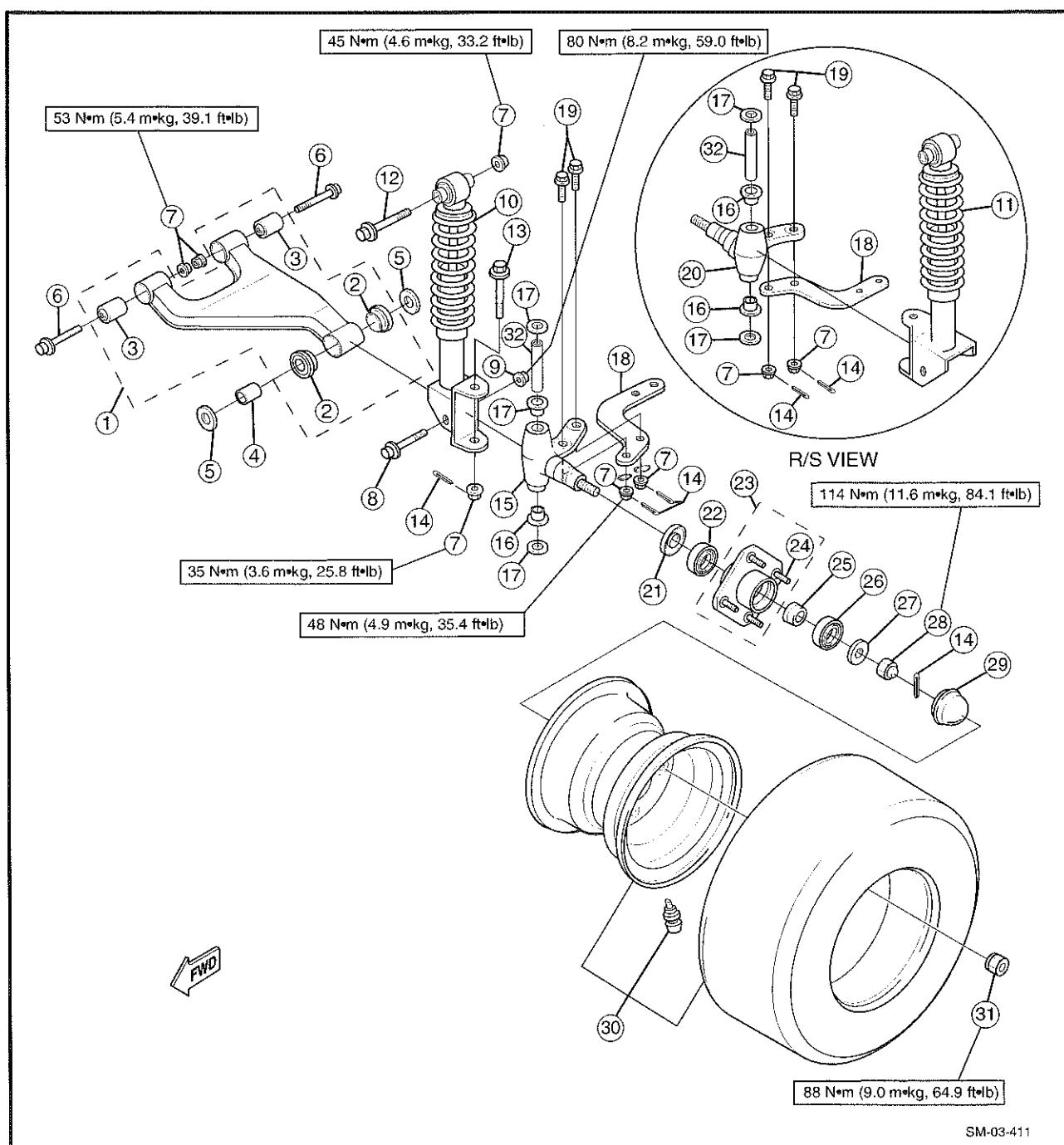
Refer to "WHEEL ALIGNMENT" section, page 2-32.

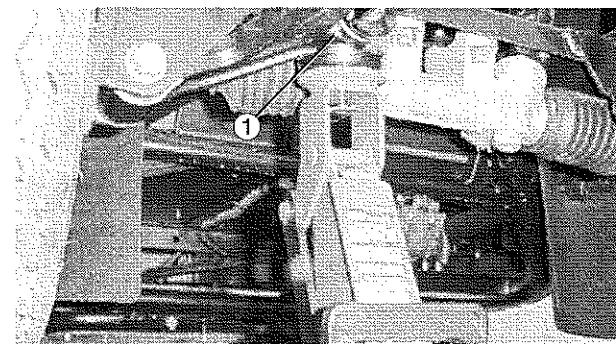


FRONT SUSPENSION

- | | | |
|-------------------------|-----------------------|------------------|
| ① Front lower arm comp. | ⑫ Flange bolt | ㉓ Hub |
| ② Bushing solid | ⑬ Flange bolt | ㉔ Knurled bolt |
| ③ Bush 1 | ⑭ Split pin | ㉕ Collar |
| ④ Collar | ⑮ LH steering knuckle | ㉖ Bearing |
| ⑤ Cover 1 | ⑯ Solid bush | ㉗ Washer |
| ⑥ Flange bolt | ⑰ Thrust cover 1 | ㉘ Nut |
| ⑦ Nut | ⑱ Knuckle arm | ㉙ Hub dust cover |
| ⑧ Flange bolt | ⑲ Flange bolt | ㉚ Wheel assembly |
| ⑨ Nut | ⑳ RH steering knuckle | ㉛ Nut |
| ⑩ Cushion assembly | ㉑ Oil seal | ㉜ Spacer |
| ⑪ Cushion assembly 2 | ㉒ Bearing | |

3

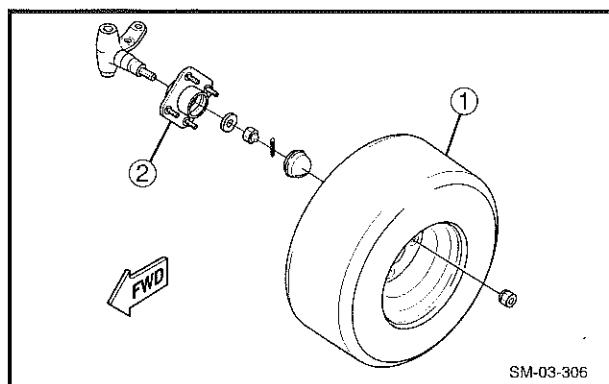




SM-03-305

REMOVAL

1. Place the vehicle on a level surface.
2. Apply parking brake.
3. Loosen nuts (front wheel).
4. Jack up the front wheels and place a suitable stand beneath the frame ①.
Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.

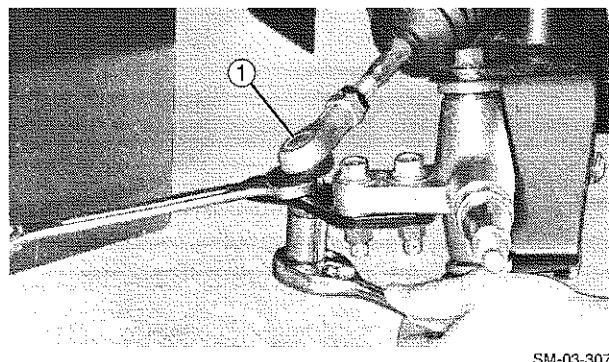


SM-03-306

5. Remove:

- Front wheel ①
- Hub front wheel ②

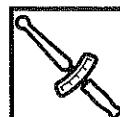
Refer to "FRONT WHEEL - REMOVAL" section.



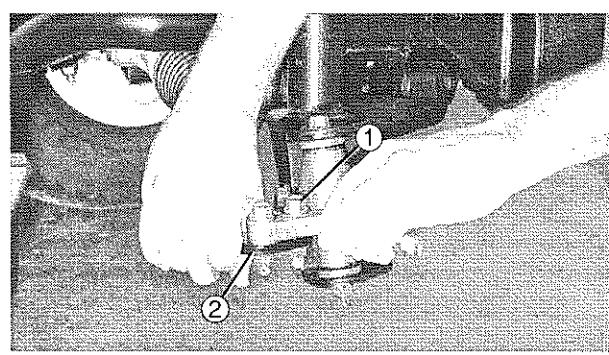
SM-03-307

6. Remove:

- Cotter pin
- Flange nut
- Tie rod ① from the knuckle arm



Tie Rod to Knuckle Arm:
39 N·m (4.0 m·kg, 28.8 ft·lb)



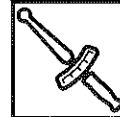
SM-03-308

NOTE:

When removing the lock nut, hold the rod end using a 17 mm wrench.

7. Check:

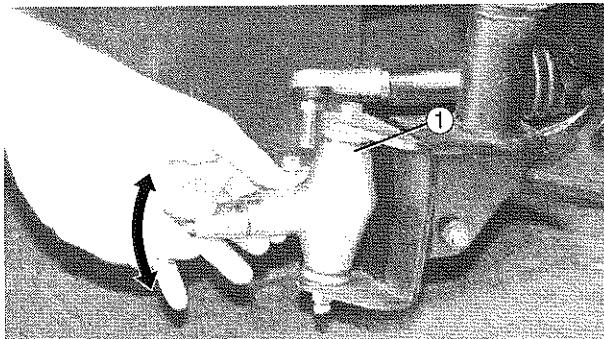
- Free play steering knuckle ① to knuckle arm ②.
- If free play, remove bolts and inspect steering knuckle and knuckle arm for wear.
If no wear present → replace and tighten bolts
If worn → replace knuckle arm and/or steering knuckle



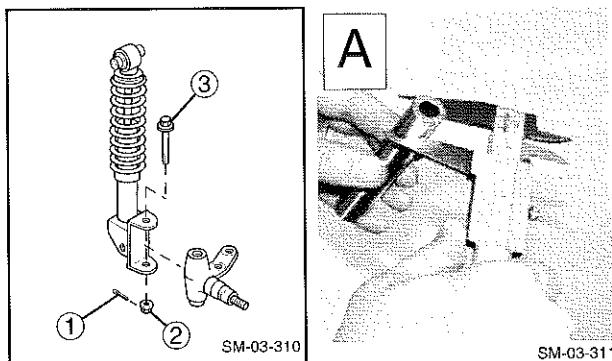
Knuckle Arm to Steering Knuckle:
48 N·m (4.9 m·kg, 35.4 ft·lb)

FRONT SUSPENSION

CHAS 



SM-03-309



SM-03-310

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3

8. Check:

- Steering knuckle bushing to sleeve free play ①.

If free play:

- Remove cotter pin ①
- Lock nut ②
- Bolt ③

9. Inspect thrust washers, spacer and bushings for wear.

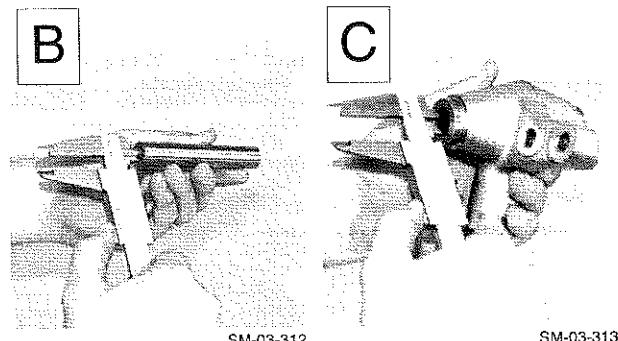
A Spacer outside min. OD: 17.025 mm
(0.6702 in.)

B Spacer inside max. ID: 10.05 mm
(0.3956 in.)

C Bushing inside max. ID: 17.041 mm
(0.6709 in.)

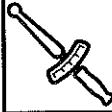
If no wear present → replace and tighten bolts

If worn → replace thrust washers and/or bushing and/or spacer and/or bolt



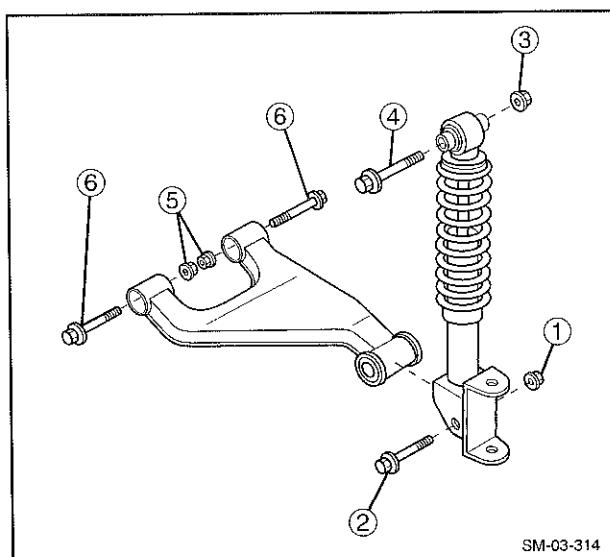
SM-03-312

SM-03-313

 **Steering Knuckle to Shock:**
35 N·m (3.6 m·kg, 25.8 ft·lb)

10. Remove:

- Lock nut ①
- Shock bolt to lower arm ②
- Lock nut ③
- Shock bolt to frame ④
- Lock nuts ⑤
- Lower arm to frame bolts ⑥



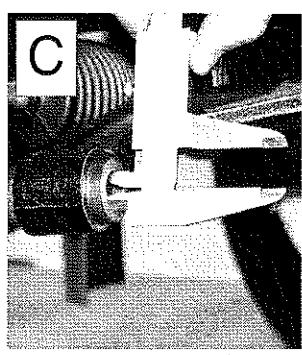
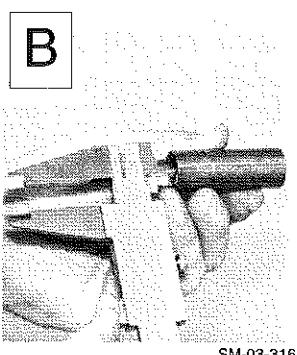
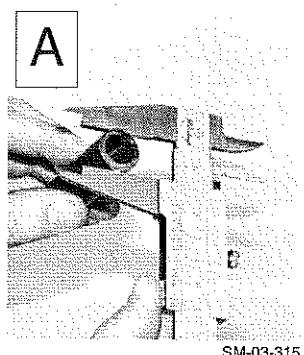
SM-03-314

INSPECTION

1. Inspect:

- Shock absorbers
Refer to CHAPTER 2 "SHOCK ABSORBER INSPECTION" section.

FRONT SUSPENSION



2. Inspect:

- Lower arm
Bends/damage → replace

3. Inspect:

- Inspect lower arm pivot thrust washers, spacer and bushings at the shock for wear

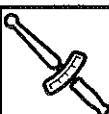
A Spacer outside min. OD: 18.016 mm
(0.7092 in.)

B Spacer inside max. ID: 12.05 mm
(0.4744 in.)

C Bushing inside max. ID: 18.0423 mm
(0.7103 in.)

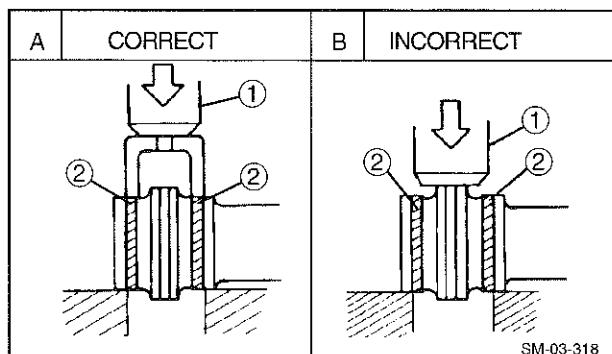
If no wear present → replace and tighten bolt

If worn → replace bushing and/or spacer and/or bolt



Lower Arm to Shock:

80 N·m (8.2 m·kg, 59.0 ft·lb)



4. Inspect:

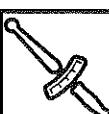
- Bushing (lower arm pivot at frame)
Wear/damage → replace

Pivot bushing (lower arm to frame) replacement steps:

- Remove the bushing using a hydraulic press (1).
- Install the new bushing.

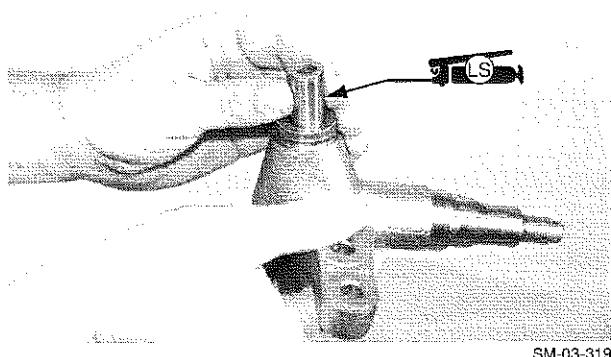
NOTE: _____

Do not press the center collar and rubber of the bushing. Contact should be made only with the outer collar (2).



Lower Arm to Frame:

53 N·m (5.4 m·kg, 39.1 ft·lb)



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INSTALLATION

Reverse the "REMOVAL" procedure. Note the following points:

1. Install:

- New cotter pins
- Knuckle arm to shock bolt
- Knuckle arm to steering knuckle bolts
- Hub flange nut

2. Lubricate:

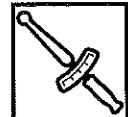
- Spacer



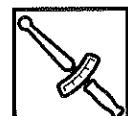
**Lightweight Lithium Soap
Base Grease**

3

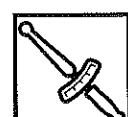
3. Torque:



**Shock to Frame (Upper Shock Bolt):
45 N·m (4.6 m·kg, 33.2 ft·lb)**



**Hub Nut:
114 N·m (11.6 m·kg, 84.1 ft·lb)**



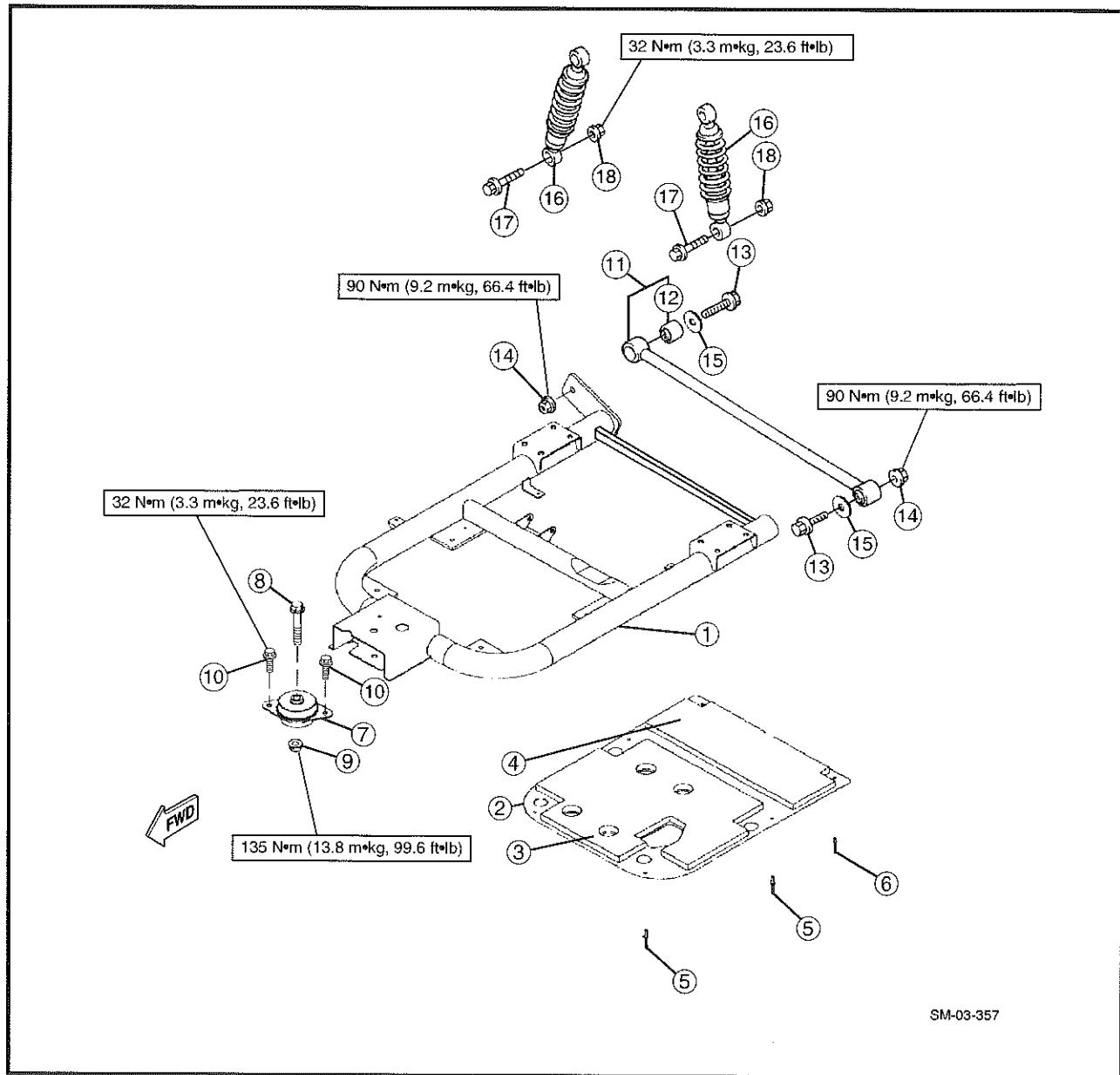
**Lug Nut (Front Wheel):
88 N·m (9.0 m·kg, 64.9 ft·lb)**

REAR ARM SUSPENSION



REAR ARM SUSPENSION FOR G22A

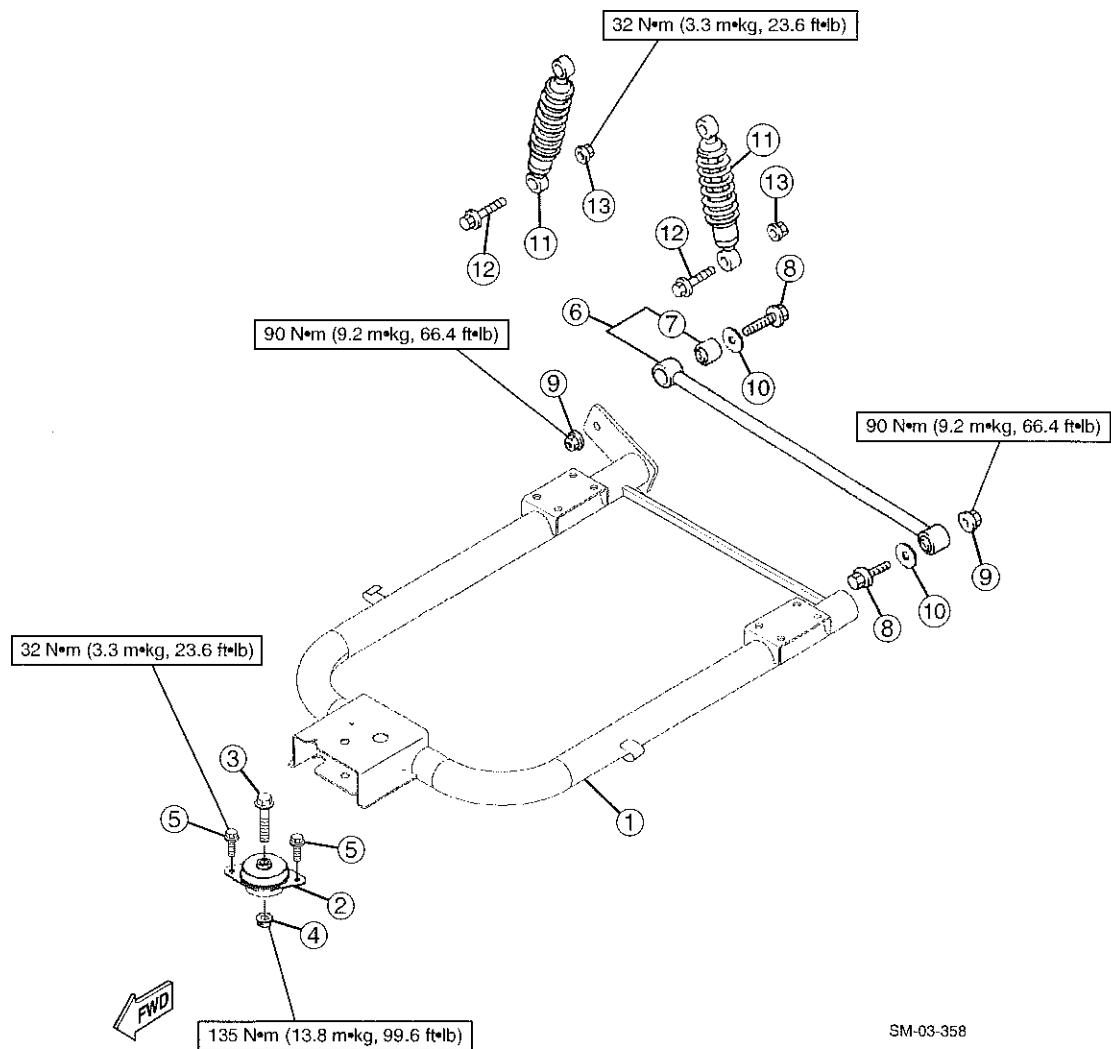
- | | |
|------------------|-------------------|
| ① Rear arm comp. | ⑩ Bolt w/ washer |
| ② Cover, 1 | ⑪ Rod, connecting |
| ③ Panel, inner 1 | ⑫ Bushing, 2 |
| ④ Panel, inner 2 | ⑬ Flange bolt |
| ⑤ Rivet | ⑭ Nut |
| ⑥ Rivet | ⑮ Washer |
| ⑦ Bushing, 1 | ⑯ Shock absorber |
| ⑧ Flange bolt | ⑰ Flange bolt |
| ⑨ Nut | ⑱ Nut |



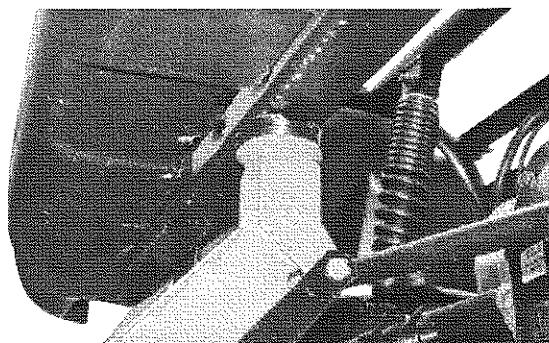
REAR ARM SUSPENSION FOR G22E

- | | |
|---------------------|------------------|
| ① Rear arm comp. | ⑧ Flange bolt |
| ② Bushing, 1 | ⑨ Nut |
| ③ Flange bolt | ⑩ Washer |
| ④ Nut | ⑪ Shock absorber |
| ⑤ Bolt w/ washer | ⑫ Flange bolt |
| ⑥ Rod, connecting 2 | ⑬ Nut |
| ⑦ Bushing, 2 | |

3



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**REMOVAL**

1. Place the vehicle on a level surface.
2. Block the front wheels. Jack up the rear wheels and place a suitable stand under the frame.
Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.

NOTE: _____

When removing the shock absorbers, support the rear arm with a jack.

3. Remove:

- Engine For G22A
- Traction motor/rear axle assembly For G22E
Refer to CHAPTER 7 "TRACTION MOTOR REMOVAL" section and CHAPTER 4 "TRANSMISSION" section.
- Transmission/rear axle assembly For G22A
Refer to CHAPTER 5 "ENGINE REMOVAL" section and CHAPTER 4 "TRANSMISSION" section.

4. Disconnect:

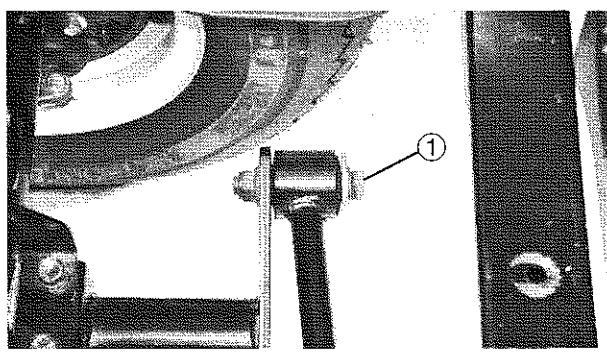
- Brake cables

5. Remove:

- Rear shock absorbers

6. Remove:

- Connecting rod bolt ①
- Rear arm pivot pin
- Rear arm



**INSPECTION**

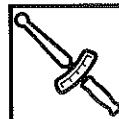
1. Inspect:
 - Shock absorbers
Refer to CHAPTER 2 "SHOCK ABSORBER INSPECTION" section.
2. Inspect:
 - Rear arm
Bends/damage → replace
3. Inspect:
 - Bushing (rear arm pivot)
Wear/damage → replace
Try to move the arm back and forth.
Noticeable freeplay → replace pivot bushing
4. Inspect
 - Torsion bar
Damage/bends → replace
 - Connecting rod bushings
Damage/wear → replace

3**INSTALLATION**

Reverse the "REMOVAL" procedure.

Note the following points.

1. Install
 - Rear arm
 - Transmission/rear axle assembly
 - Engine For G22A:
 - Traction motor/rear axle assembly For G22E:
 - Rear shock absorbers
 - Brake cables
 - Torsion bar

**Nut (Rear Arm Busing):**

135 N·m (13.8 m·kg, 99.6 ft·lb)

Bolt ~ Rear axle assembly to rear arm

64 N·m (6.5 m·kg, 46.8 ft·lb)

Bolt ~ Transmission case to rear arm**For G22A**

23 N·m (2.3 m·kg, 17.0 ft·lb)

Nut ~ Engine mount bracket to rear arm For G22A

26 N·m (2.7 m·kg, 19.2 ft·lb)

Nut ~ Shock absorber pivot

32 N·m (3.3 m·kg, 23.6 ft·lb)

Nut ~ Connecting Rod

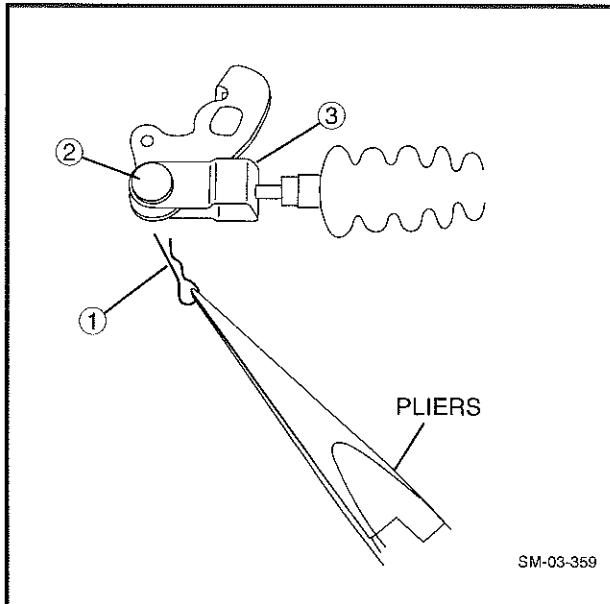
90 N·m (9.2 m·kg, 66.4 ft·lb)

CABLE MAINTENANCE**NOTE:**

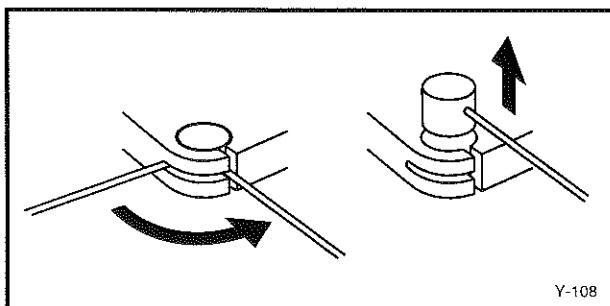
Cables must be kept properly lubricated to prevent deterioration.

⚠ WARNING

Improperly routed or adjusted cables may make the golf car unsafe. Before connecting cables, refer to CHAPTER 9 "CABLE ROUTING" for proper routing.

**1. Disconnect clevis attachments by removing:**

- Cotter pin ①
- Clevis pin ②
- Retaining clip ③

**2. Disconnect pin attachments by disconnecting:**

- Clevis end of cable
Turn cable so it aligns with slot and pull upward.

3. Remove:

- Cables
From the clamps and bands

4. Check:

- Cable free movement
Inspect for obstructions, wear or damage.
Kinking/frayed strands/damage → replace

CABLE MAINTENANCE



5. Lubricate:

- Cables
- Use the Cable Injector.



Cable Injector:

ACC-11110-43-12

**Available from Yamaha Parts &
Accessories at: 800-688-6078**

NOTE:

Choice of lubricant depends upon conditions and preferences. The use of a semi-drying chain and cable lubricant will perform adequately under most conditions.

3

6. Install:

- Cables

Reverse the removal procedure.

7. Adjust

- Free play (brake cable)
- Free play (throttle cable 1, 2) (G22A)
- Free play (choke cable) (G22A)

Refer to CHAPTER 2, "BRAKE CABLE INSPECTION," "THROTTLE CABLE ADJUSTMENT" and "CHOKE CABLE ADJUSTMENT" sections.



Free play (Brake Cable):

20 ~ 25 mm (0.79 ~ 0.98 in)

Free play (Throttle Cable 1):

0.0 ~ 1.0 mm (0.0 ~ 0.04 in)

Free play (Throttle Cable 2):

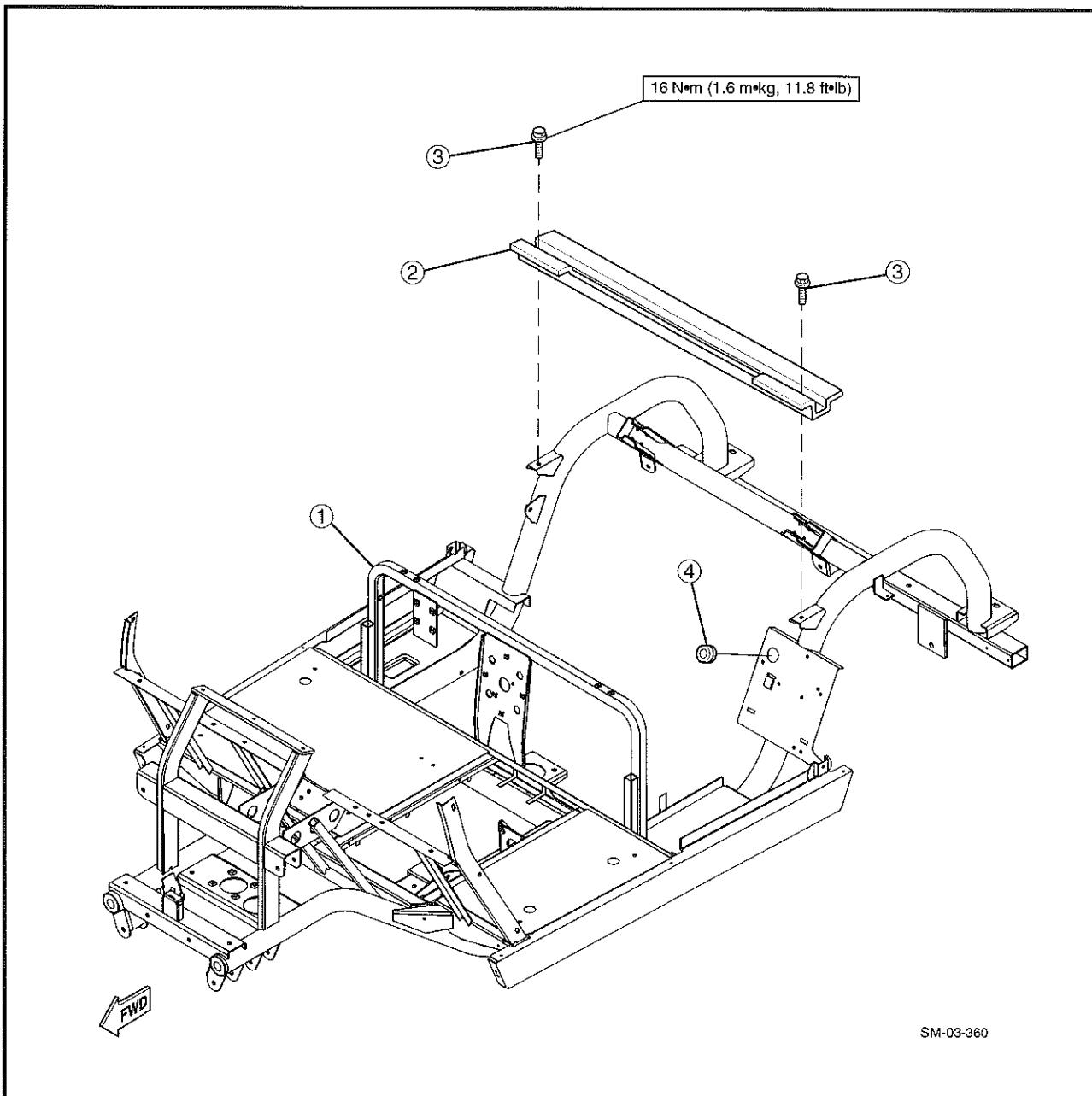
0.0 ~ 1.0 mm (0.0 ~ 0.04 in)

Free play (Choke Cable):

1.0 mm (0.04 in)

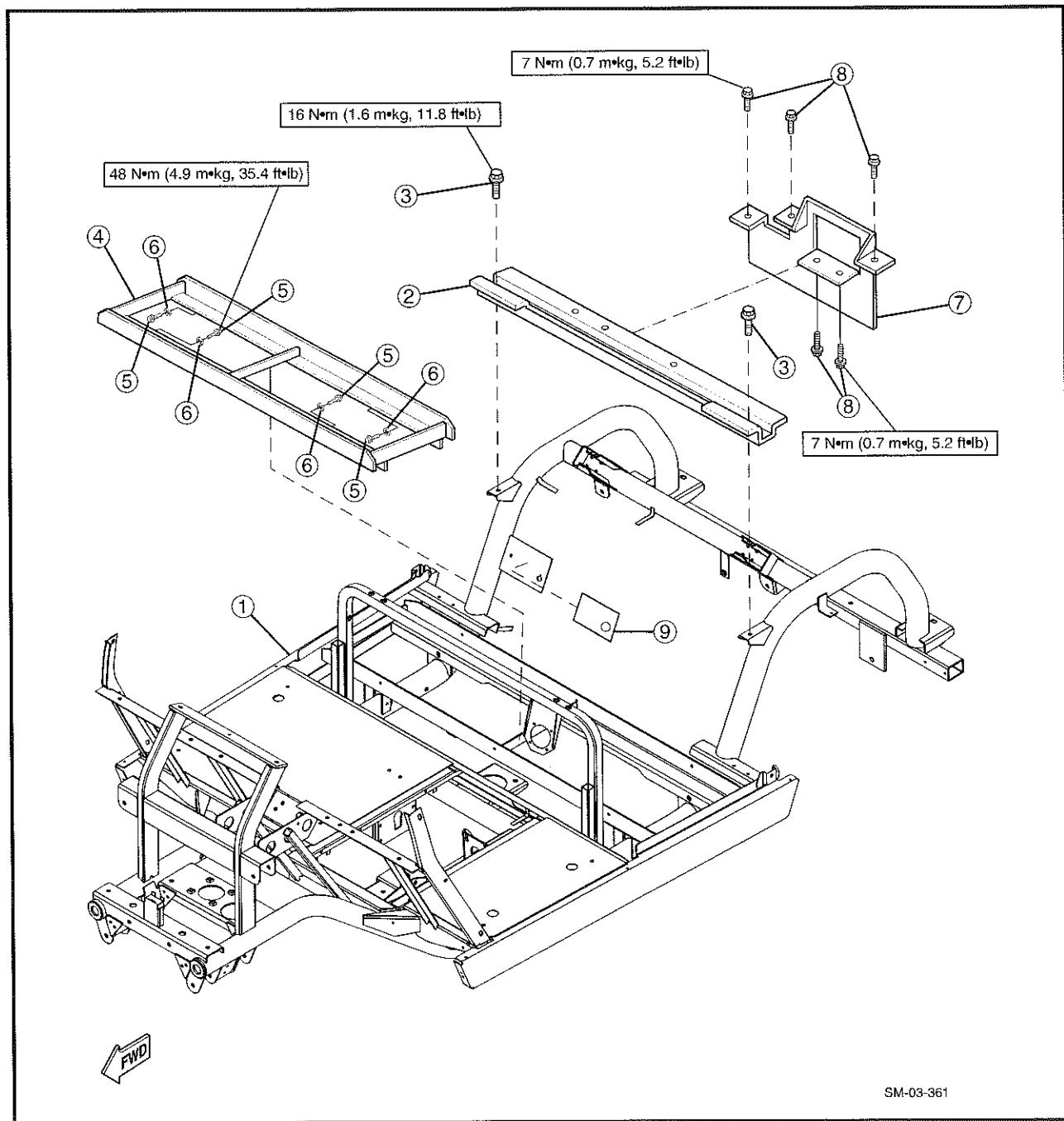
FRAME FOR G22A

- ① Frame
- ② Body mounting support
- ③ Flange bolt
- ④ Grommet



FRAME FOR G22E

- | | |
|-------------------------|-------------------------|
| ① Frame | ⑥ Washer |
| ② Body mounting support | ⑦ Bracket 3 |
| ③ Flange bolt | ⑧ Tapping screw |
| ④ Battery base | ⑨ Tow/run caution label |
| ⑤ Flange bolt | |

3

NOTES



CHAPTER 4 POWER TRAIN

POWER TRAIN FOR G22A	
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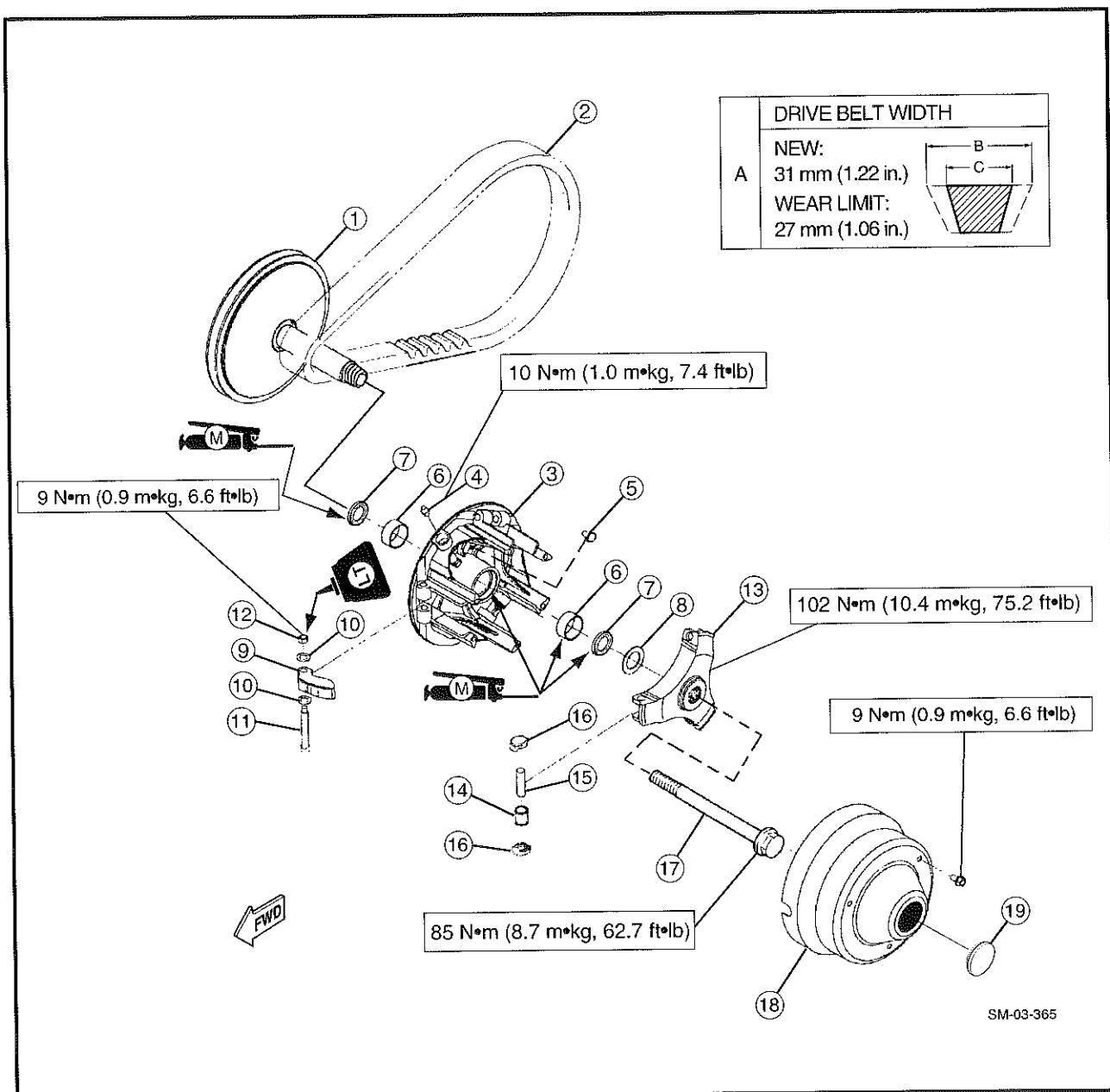
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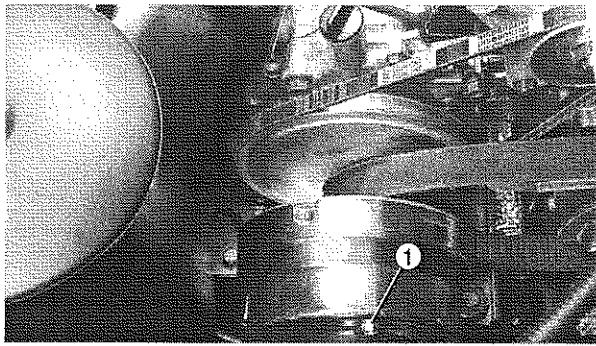
POWER TRAIN

POWER TRAIN FOR G22A

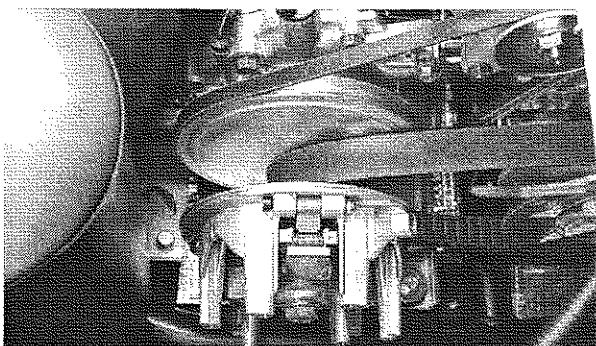
PRIMARY SHEAVE

- | | | |
|------------------|------------------|--------------|
| ① Fixed sheave | ⑧ Washer | ⑯ Pin, dowel |
| ② Drive belt | ⑨ Weight | ⑰ Slider |
| ③ Sliding sheave | ⑩ Shim | ⑱ Bolt |
| ④ Grease nipple | ⑪ Bolt | ⑲ Cap |
| ⑤ Plug | ⑫ Nut | ⑳ Cover dust |
| ⑥ Bushing | ⑬ Spider | |
| ⑦ Oil seal | ⑭ Collar, roller | |

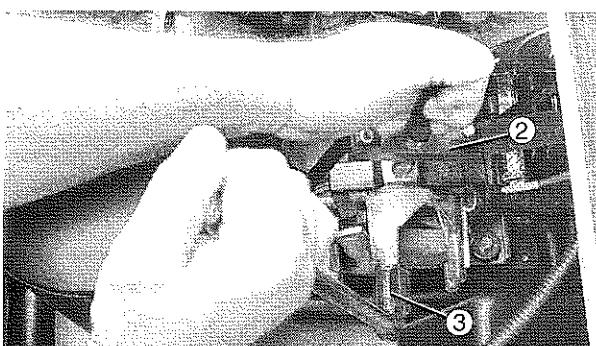




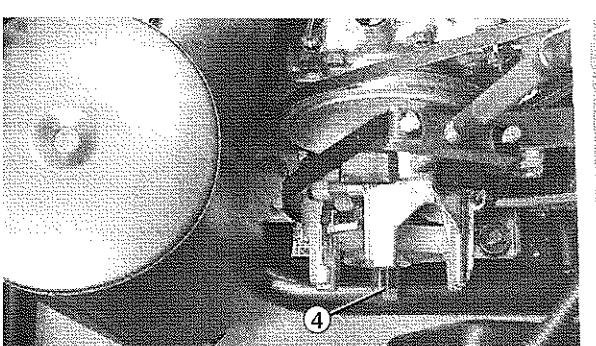
Y-783



Y-544



Y-784



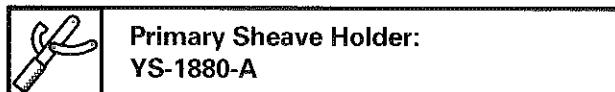
Y-785

REMOVAL

1. Remove:
 - Primary sheave cap bolts ①

2. Attach

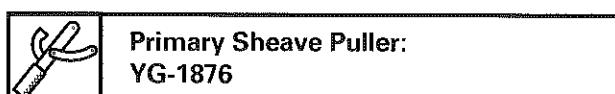
- Primary sheave holder ②

**3. Remove:**

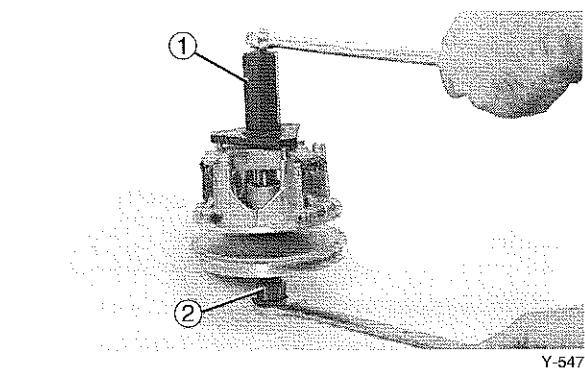
- Bolt (primary sheave) ③

4. Attach:

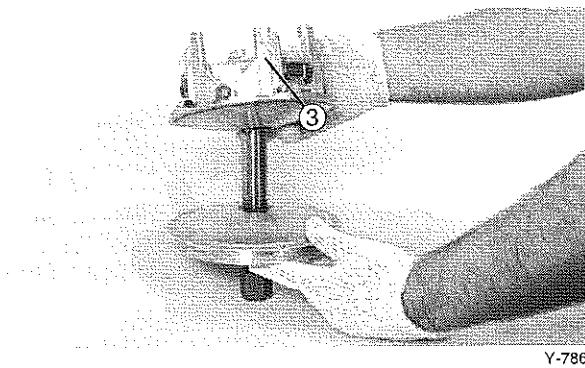
- Primary sheave puller ④

**5. Remove:**

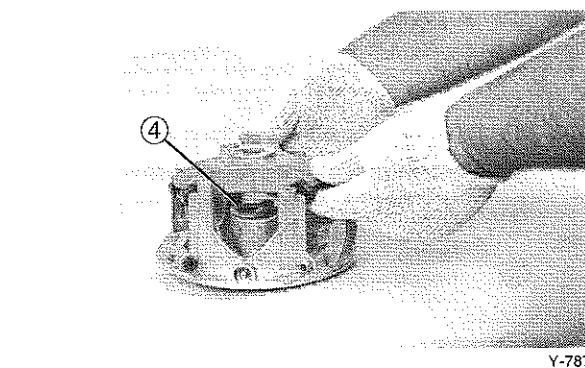
- Primary sheave assembly
When removing the sheave, tighten the sheave puller ④
- Slide drive belt off.
- Starter belt.



Y-547



Y-786



Y-787

DISASSEMBLY

1. Attach:

- Spider removal tool (1)

 **Spider Removal Tools:**
YG-42131 (1) Spider Separator
YS-38518 (2) Tapered Clutch Holder

2. Remove:

- Sliding sheave (3) from fixed sheave using the spider removal tools (spider has right hand thread).
- Lift off sliding sheave (3) with spider still attached.

NOTE:

- Use a commercial grade heat gun to lightly heat spider to free up the locking agent. Direct heat only at the top of spider threaded area.
- DO NOT overheat, damage to the slider could occur. DO NOT heat for more than ONE minute continuously. Discoloration of the slider may indicate damage from excessive heat.
- Leave tapered clutch holder tool installed in fixed sheave for assembly.

4

3. Separate spider from sliding sheave.

- Note position of plain washer (4) between slider and sheave.

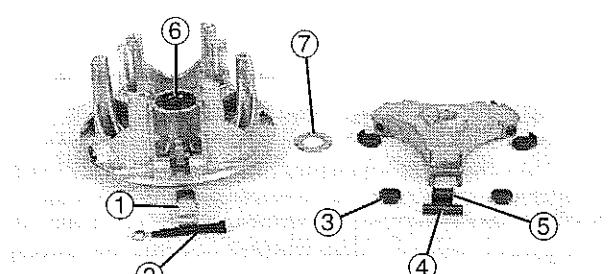
4. Remove:

- Sliders
- Plain washers
- Roller collars
- Dowel pins
- Nuts
- Bolts
- Thrust shims
- Weights

INSPECTION

1. Inspect:

- Weights (1)
Irregular operation/Damage → replace
- Bolts (2)
- Thrust shims (not shown)
- Sliders (3)
- Dowel pins (4)
- Roller collars (5)
Wear/Scratches/Damage → replace
- Oil seals (6)
Wear/Damage → replace
- Plain washer (7)



SM-03-132



ASSEMBLY

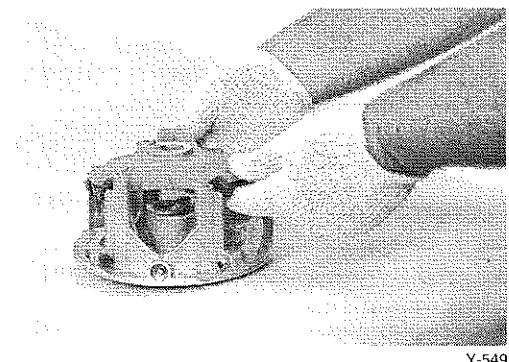
Reverse the "DISASSEMBLY" procedure.
Note the following points.

NOTE:

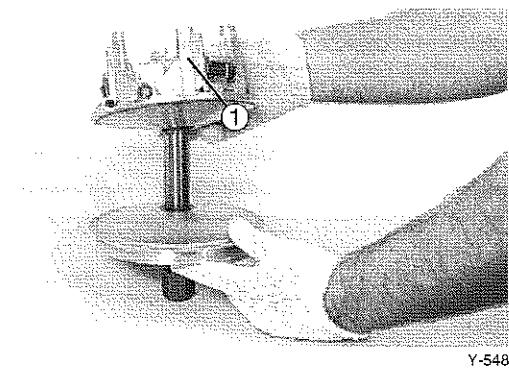
Apply LOCTITE® to the weight nuts and threads of the spider.



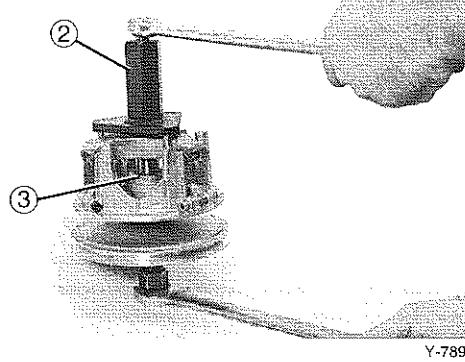
Weight Bolt Nut:
9 N·m (0.9 m·kg, 6.6 ft·lb)



Y-549



Y-548



Y-789

NOTE:

Use Teflon lubricant to install rollers and sliders.

1. Grease the bushing and oil seal lips inside of the sliding sheave.

2. Position:

- Weights toward inside of sheave.
- Spider
Into sliding sheave.
- Plain washer between slider and sheave.

3. Install:

- Sliding sheave ①
Onto fixed sheave.
- Check position of plain washer ③ between spider and sliding sheave.

CAUTION

DO NOT damage or deform the oil seal lips during installation.

4. Tighten using spider removal tools ②.



Spider/Sheave Assembly:
102 N·m (10.4 m·kg, 75.2 ft·lb)

**INSTALLATION**

Reverse the "REMOVAL" procedure.

Note the following points:

1. Remove any oil and/or grease from the tapered portion of crankshaft and primary sheave using a non-oily solvent.

2. Install:

- Primary sheave assembly
- Sheave securing bolt

Lightly tighten the bolt in this step.

3. Check:

- Sliding sheave operation

Push and pull the sliding sheave by hand.

Irregular operation → reassemble primary sheave

4. Attach:

- Primary sheave holder ①

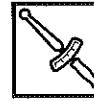


**Primary Sheave Holder:
YS-1880-A**

4

5. Tighten:

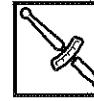
- Bolt (primary sheave) ②



**Bolt (Primary Sheave):
85 N·m (8.7 m·kg, 62.7 ft·lb)**

6. Install:

- Primary sheave cap and bolts ①



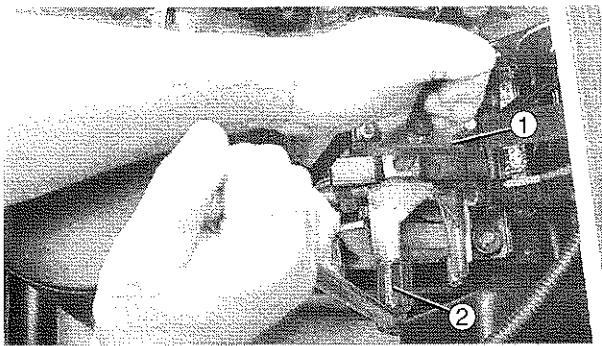
**Primary Sheave Cap Bolts:
9 N·m (0.9 m·kg, 6.6 ft·lb)**

- Drive belt ②

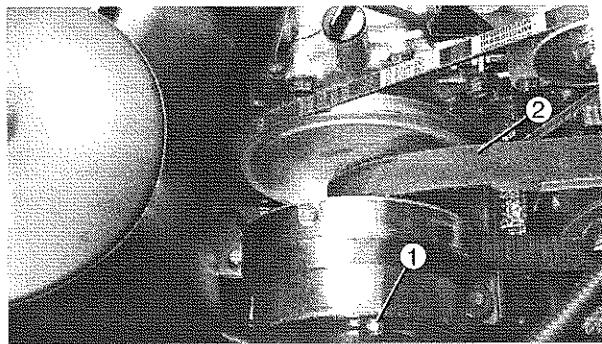
Refer to CHAPTER 2 "DRIVE BELT INSPECTION" section.

- Starter belt

Refer to CHAPTER 2 "STARTER BELT ADJUSTMENT" section.



Y-545

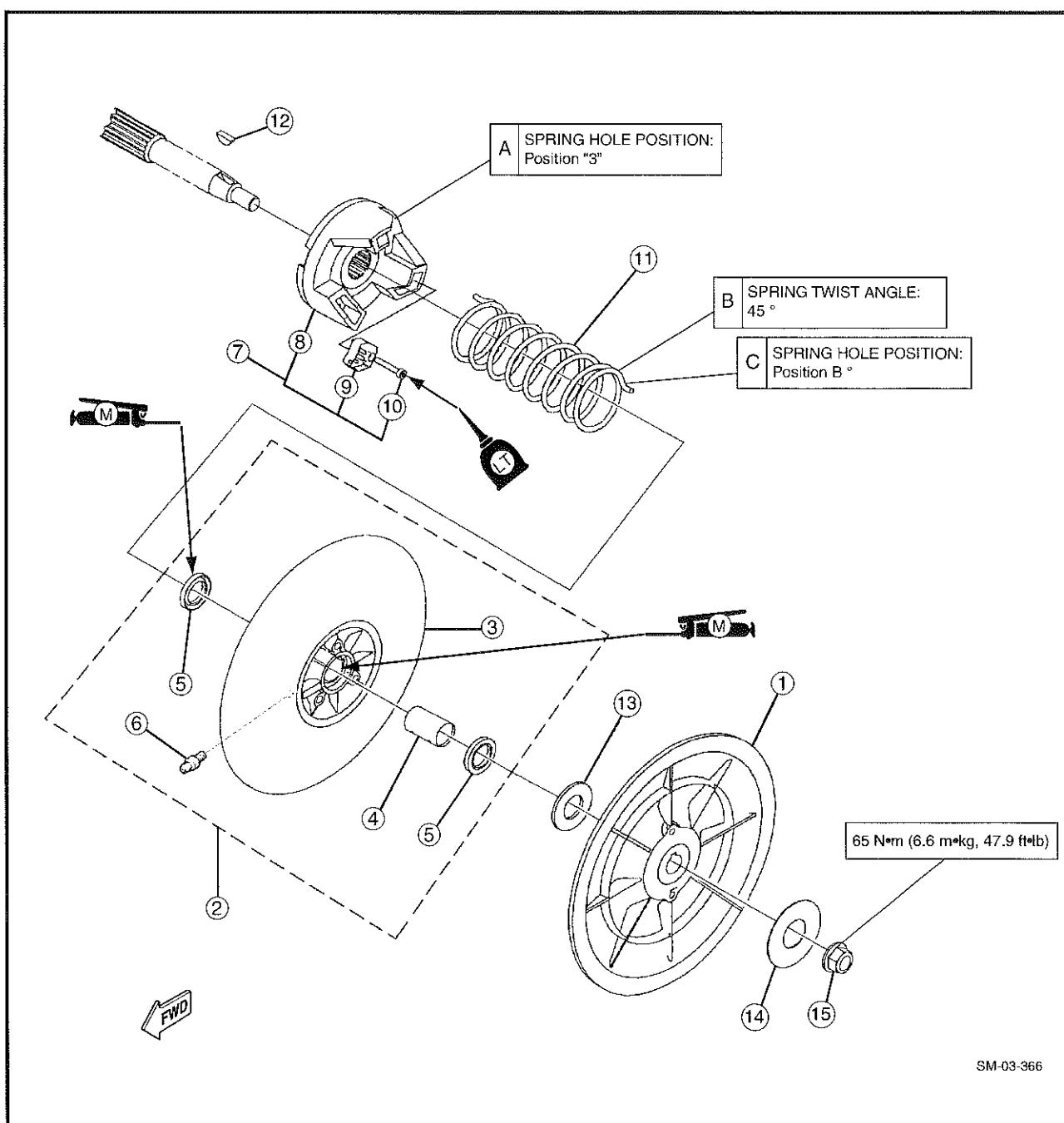


Y-543

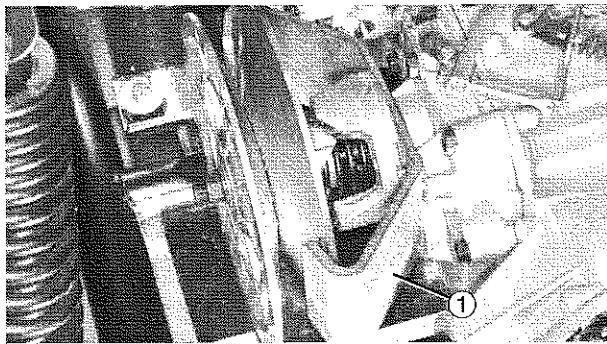


SECONDARY SHEAVE

- | | |
|--------------------------------|------------------|
| ① Secondary fixed sheave | ⑨ Ramp shoe |
| ② Secondary sliding sheave kit | ⑩ Bolt |
| ③ Secondary sliding sheave | ⑪ Torsion spring |
| ④ Bushing, bi-metal formed | ⑫ Woodruff key |
| ⑤ Oil seal | ⑬ Washer |
| ⑥ Grease nipple | ⑭ Washer |
| ⑦ Secondary spring seat comp. | ⑮ Nut |
| ⑧ Secondary spring seat | |



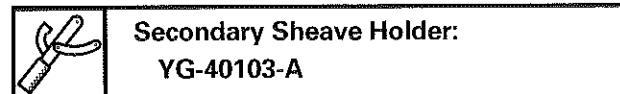
SM-03-366



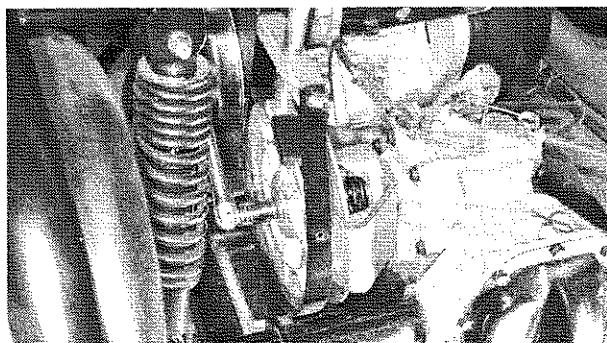
SM-03-071

DISASSEMBLY

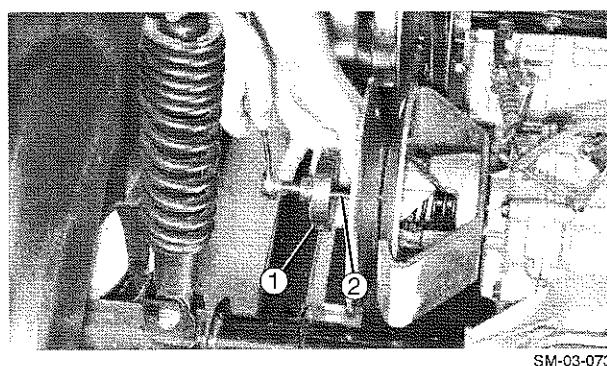
1. Remove the rear cowling.
Refer to CHAPTER 3 "REAR BODY" section.
2. Remove the drive belt.
3. Put car in gear and set parking brake.
4. Attach:
 - Secondary Sheave Holder ①



5. Remove:
 - Sheave securing nut
 - Washer



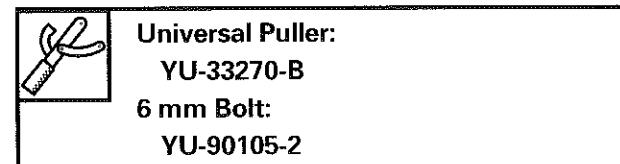
SM-03-072



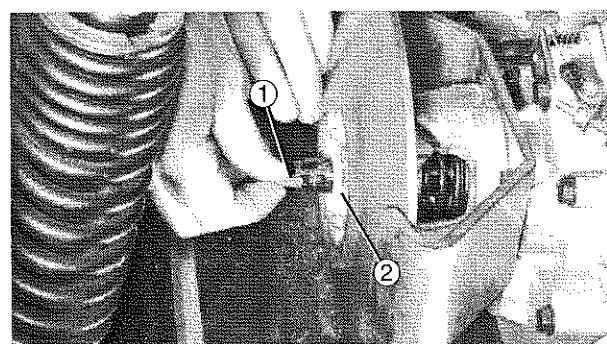
SM-03-073

4

6. Attach:
 - Universal Puller ①
 - 6 mm Bolts ②

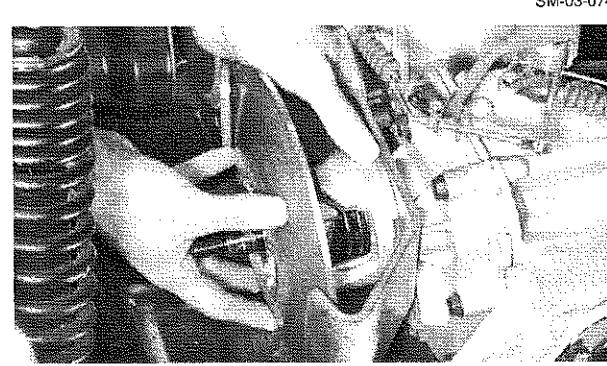


7. Remove
 - Fixed sheave
 - Woodruff key ①
 - Plastic washer ②
(from the input shaft)



SM-03-074

8. Remove:
 - Secondary Sheave Holder
When removing the sheave holder, push in the sliding sheave by hand.
9. Release spring force slowly, then remove the sliding sheave.
10. Remove:
 - Compression spring
 - Spring seat



SM-03-075

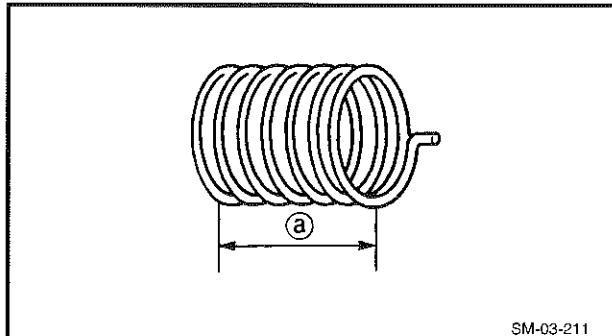
INSPECTION

1. Inspect:

- Sliding sheave

- Fixed sheave

Warping/Scratches/Damage → replace



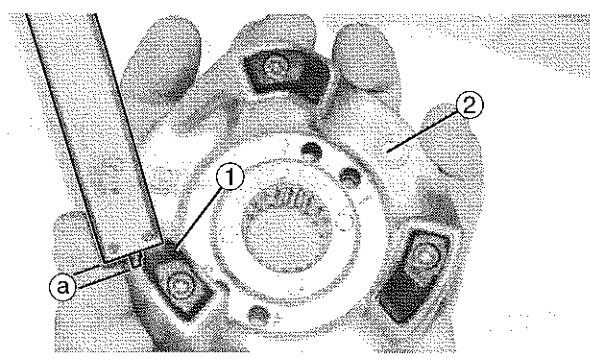
2. Measure:

- Free length (Secondary spring) @

Less than specification → replace



Free Length (Secondary spring):
Limit: 100 mm (3.94 in)

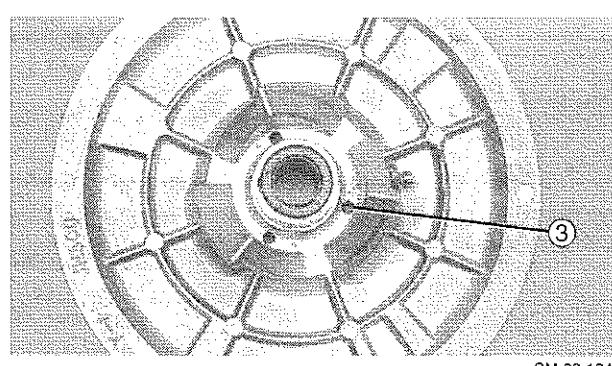


3. Measure:

- Ramp shoe thickness ① on spring seat cam ②
Out of specification → replace



Wear Limit: @:
1.0 mm (0.04 in)



4. Inspect:

- Oil seal
Wear/Damage → replace

- Bushing

Wear/Damage → replace

ASSEMBLY

Reverse the "DISASSEMBLY" procedure.

Note the following points.

1. Install:

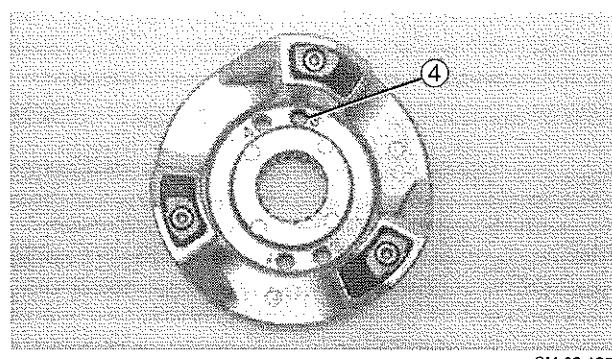
- Spring seat
Onto the input shaft.

2. Grease the bushing and oil seal lips inside of the sliding sheave.

3. Hook the spring end into the spring hole "B" ③ in the sheave.

4. Install the spring and sliding sheave onto the input shaft.

5. Hook the other end of spring into the hole "3" ④ in the spring seat.



6. Install:

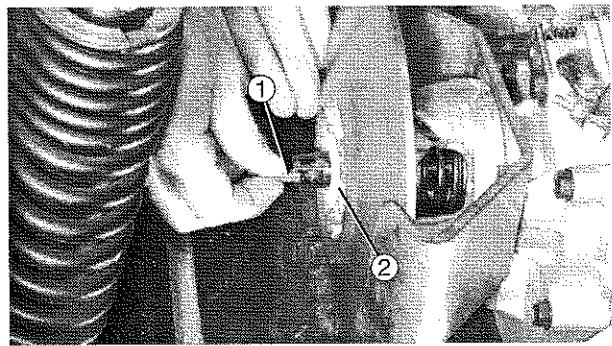
- Secondary Sheave Holder
Onto the sliding sheave.

Secondary sheave holder installation steps:

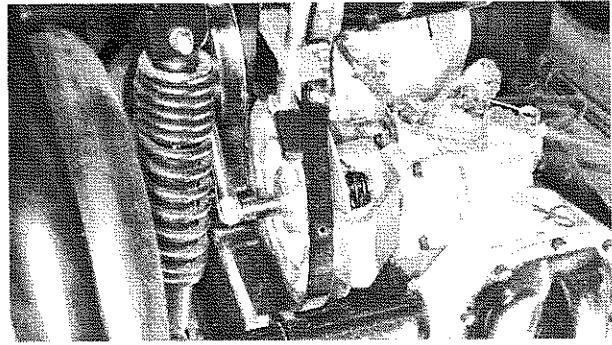
- Push the sliding sheave in while turning it approximately 45° clockwise to preload the spring.
Then hold the sheave in this position.
- Hook the Secondary Sheave Holder onto the sliding sheave.



Secondary Sheave Holder:
YG-40103-A



SM-03-074



SM-03-072

4

7. Remove any oil and/or grease from the tapered portion of input shaft and fixed sheave using a non-greasy solvent.

8. Install:

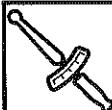
- Plastic washer (2)
- Woodruff key (1)
- Fixed sheave
- Washer
- Securing nut



Primary Sheave Holder:
YS-1880-A

9. Tighten:

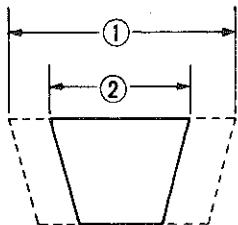
- Nut (Secondary sheave)



Nut (Secondary sheave):
65 N·m (6.6 m·kg, 47.9 ft·lb)

10. Install:

11. Remove the excess grease from the sheaves and input shaft.
12. Install the drive belt.



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DRIVE V-BELT

INSPECTION AND REPLACEMENT

Refer to CHAPTER 2 "DRIVE BELT INSPECTION" section.



Drive Belt Width:

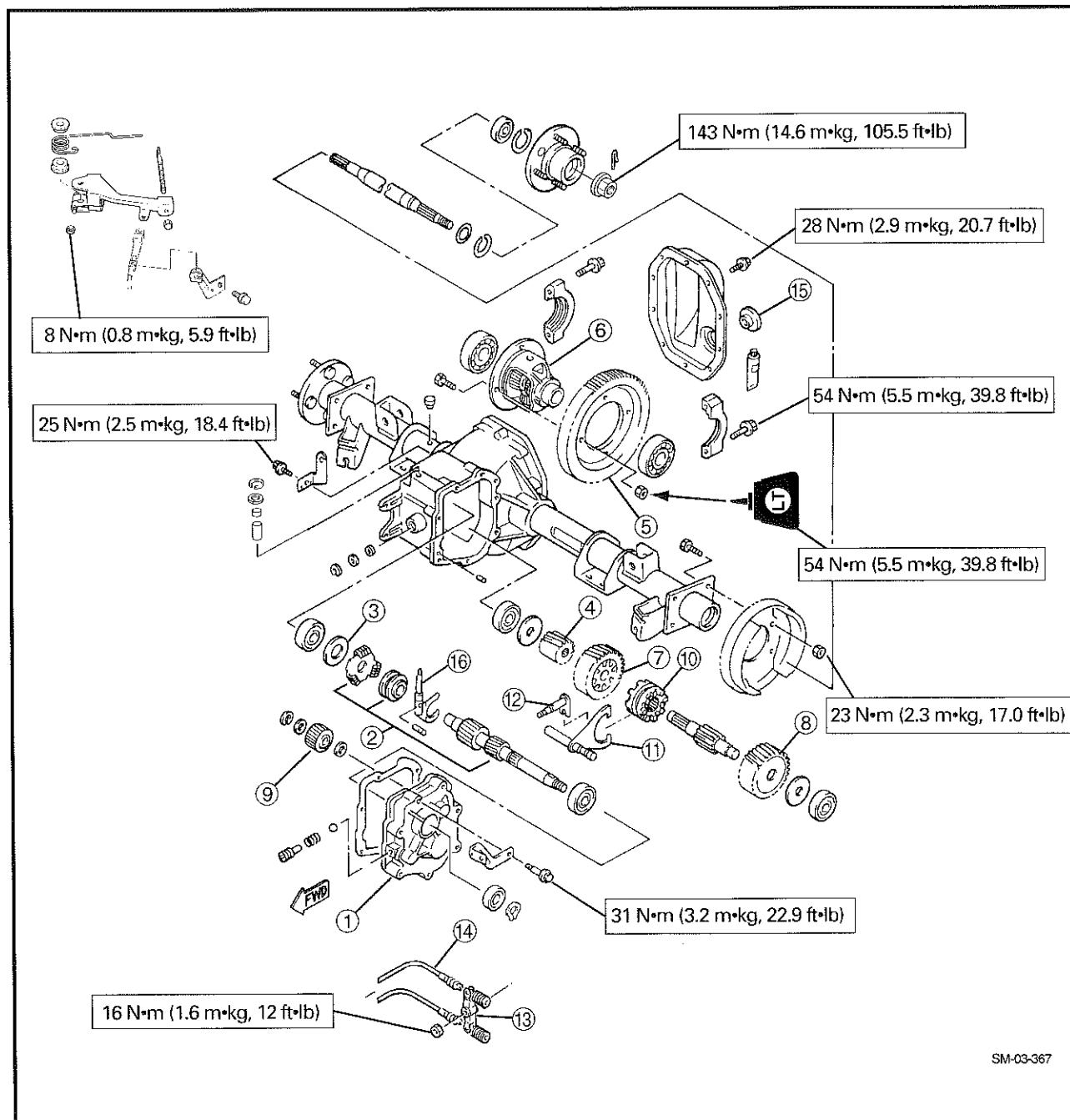
New ① : 31 mm (1.22 in)

Wear limit ② : 27 mm (1.06 in)

TRANSMISSION

- | | | |
|--------------------------|--------------------------------|--|
| (1) Transmission cover | (7) Wheel gear 1 (Forward) | (13) Shift lever 2 |
| (2) Input shaft assembly | (8) Wheel gear 2 (Reverse) | (14) Shift cable |
| (3) Shim | (9) Idler gear (Reverse) | (15) Stopper (Oil level fill/check plug) |
| (4) Pinion gear | (10) Guide collar (Dog clutch) | (16) Governor lever (bar, 1) |
| (5) Primary gear | (11) Shift bar 2 (Shift fork) | |
| (6) Differential | (12) Shift bar 1 (Shift shaft) | |

4



SM-03-367



REMOVAL

1. Remove:

- Drive belt
- Secondary sheave

Refer to CHAPTER 4 "SECONDARY SHEAVE" section.

NOTE: _____

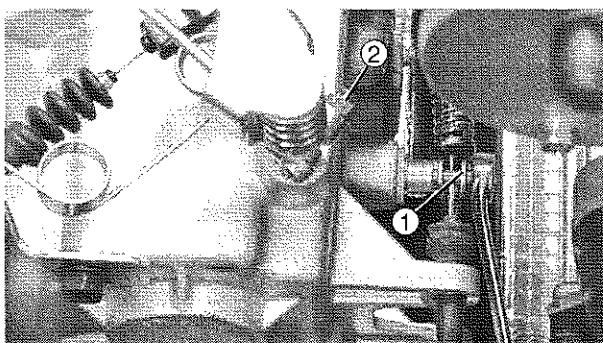
It is not necessary to remove the rear axle assembly in order to service the transmission or differential. If in-chassis service is desired, disregard steps 7-13.

2. Set the brake, block the front wheel, jack up the rear of the vehicle and place a stand under the frame. Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.

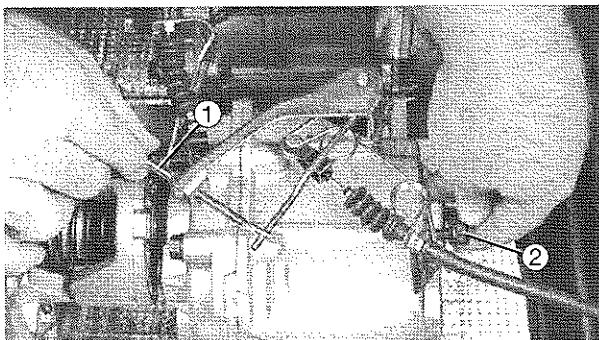
3. Remove rear axle wheel. See CHAPTER 3 "REAR AXLE WHEEL FOR G22A" section.

4. Remove:

- Shift lever nut ①
- Governor lever nut ②



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POWER TRAIN FOR G22A


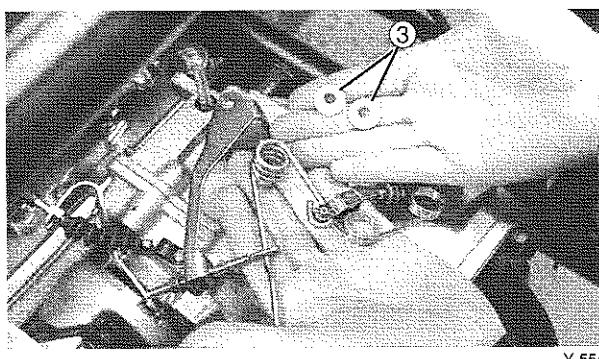
Y-553

5. Remove:

- Speed limiter lever bracket bolts (1) and (2)
- Speed limiter lever as a unit
- Spring and 2 plastic bushings (3) (keep for installation)

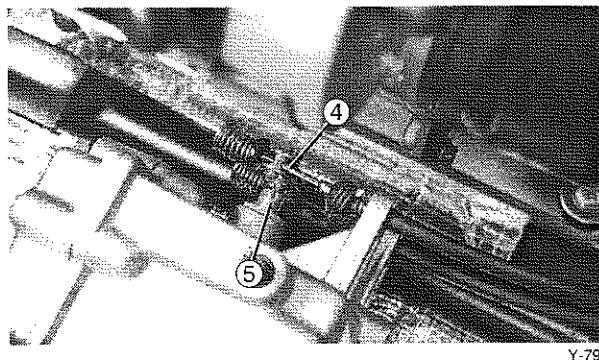
NOTE:

If removing speed limiter lever as a unit, no cable adjustment is necessary when installing.



Y-554

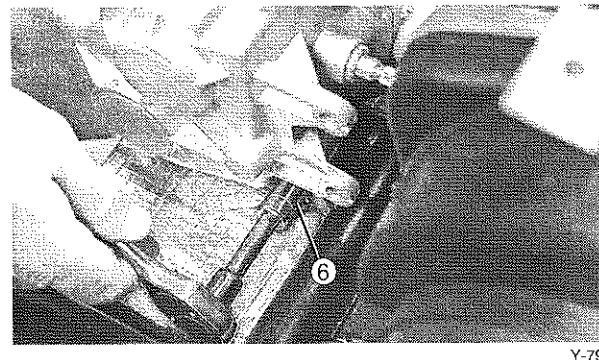
4



Y-791

6. Remove

- Shift cables (4)
- Mark shift shaft and lever for alignment during installation (5).

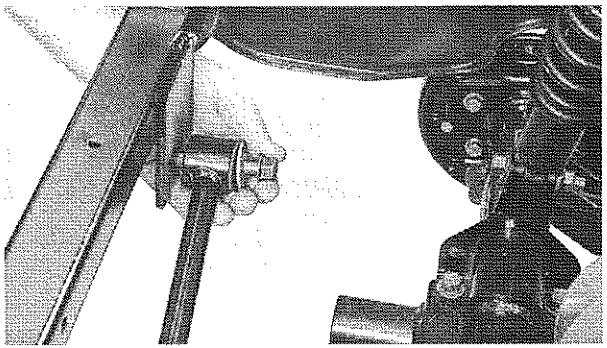


Y-792

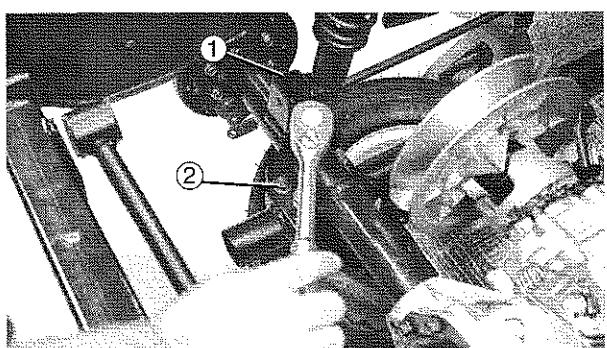
7. Remove:

- Remove transmission mounting bolt and nut (6).

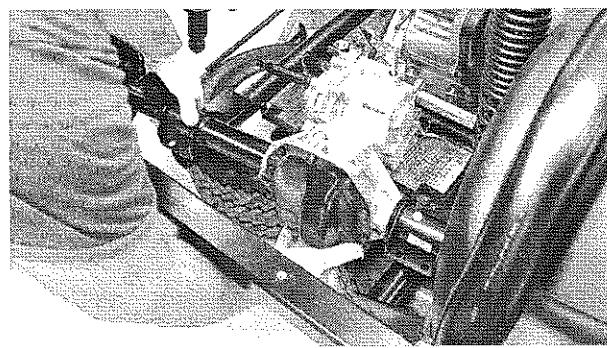
POWER TRAIN FOR G22A



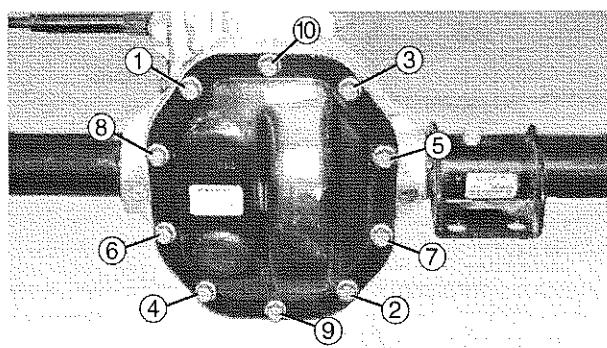
Y-556



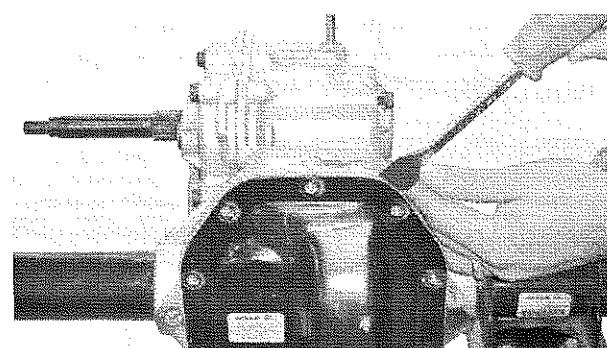
Y-828



Y-558



SM-03-078



SM-03-368

8. Remove:

- Rear arm connecting rod.

9. Support rear arm so it does not drop to the floor during rear axle removal.

10. Remove:

- Bottom shock bolts ①
- Bolts ② holding the rear axle to rear arm.

11. Lift transmission out through the rear of the car. Place on suitable work surface.

12. Place an oil pan under the transmission case.

13. Remove:

- Bolts ① ~ ⑩

NOTE:

All transmission case bolts and differential cover bolts are 1/2 inch wrench size.

- Transmission case cover using a putty knife.
- Drain transmission oil.

CAUTION

Use care not to damage the case sealing surface or deform the transmission case cover.

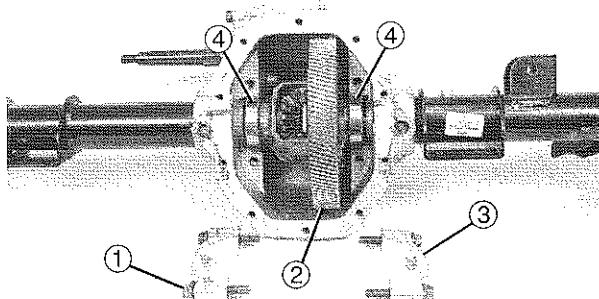
DIFFERENTIAL DISASSEMBLY

1. Remove:

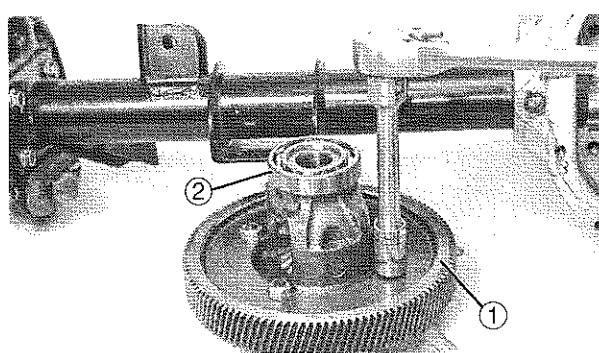
- Rear hubs
- Axles

Refer to CHAPTER 3 "REAR AXLE WHEEL FOR G22A" section.

POWER TRAIN FOR G22A



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4

2. Remove:

- Bearing holder bolts ①

CAUTION

Mark bearing holders before removal so they can be returned to their original position - bearing holders are not interchangeable.

- Bearing holders ③
- Differential assembly with ring gear ② and bearings ④

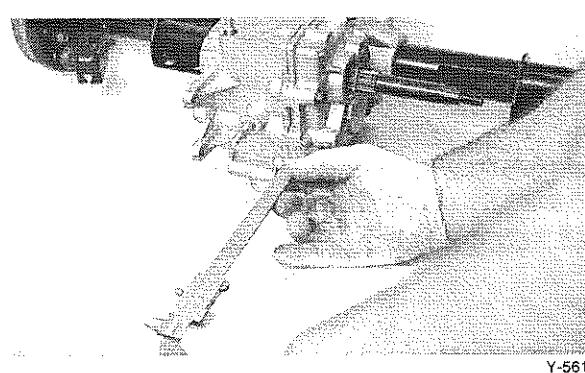
3. Separate:

- Ring gear ①
- Differential assembly ②

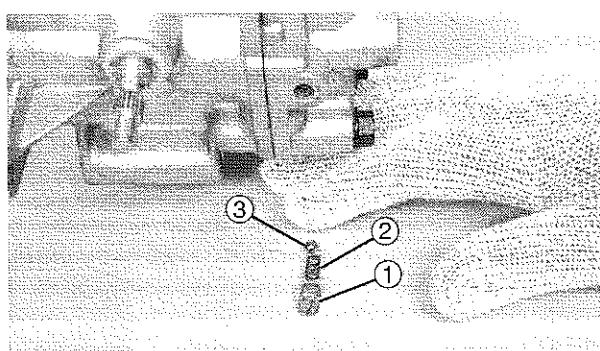
DIFFERENTIAL INSPECTION

1. Inspect:

- Ring gear
- Differential gear
Damage Wear → replace
- Bearing
Pitting/Damage → replace
- O-ring
Wear/Damage → replace



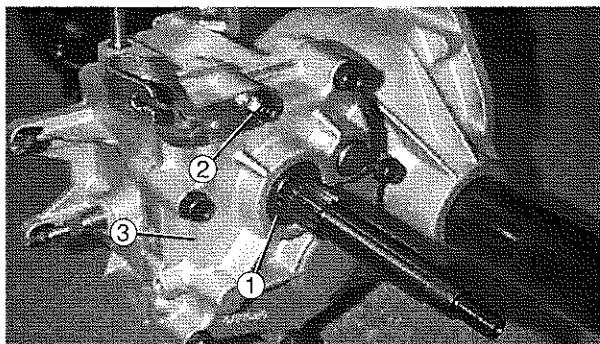
Y-561



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2. Remove:

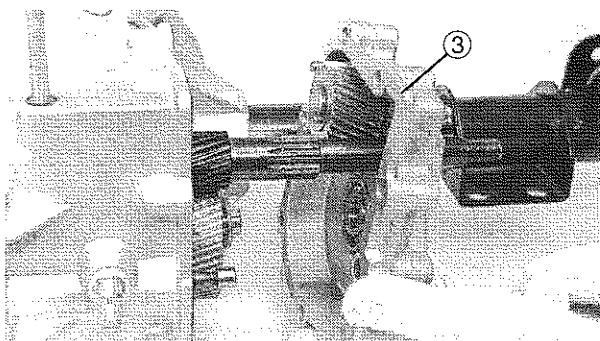
- Screw ①
- Spring ②
- Detent ball ③



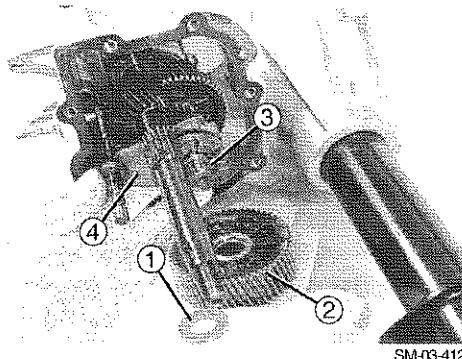
Y-563a

3. Remove:

- Input shaft circlip ①
- Transmission case bolts ②
- Remove cover ③
- Use pry points to avoid case damage



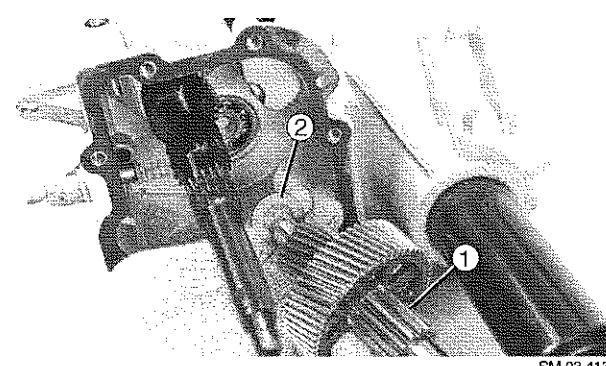
Y-564



SM-03-412

4. Remove:

- End washer ①
- Reverse wheel gear ②
- Dog clutch ③
- Shift fork ④

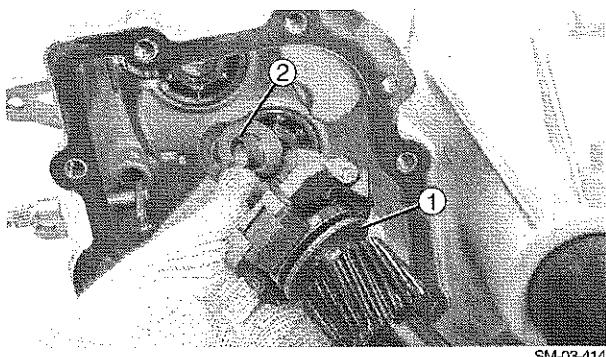


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5. Remove:

- Counter shaft with forward wheel gear ①
- End washer ②

POWER TRAIN FOR G22A



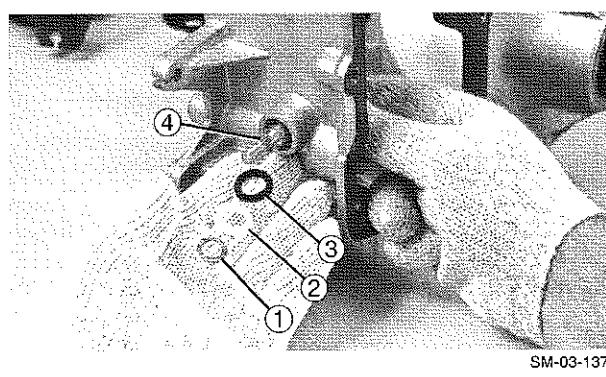
6. Remove:

- Input shaft ①
- Shim(s) ② if used.

Note thickness and diameter of shims.

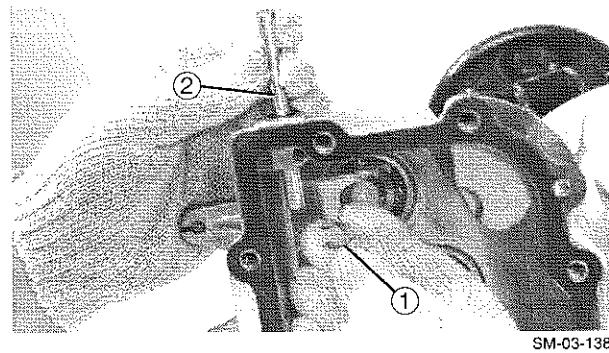
CAUTION

Shim(s) are used as needed to establish input shaft end play of 0.002-0.005". Use the same shim(s) during installation. Do not change shim(s) unless crankcase is replaced. As an added precaution, always remeasure input shaft end play prior to final assembly. Shim as needed.



7. Remove:

- Circlip ①
- Plastic collar ②
- Oil seal ③
- Shift shaft ④



8. Remove:

- Retainer ①
- Washer
- Oil seal
- Governor bushing
- Governor shaft ②

4

TRANSMISSION INSPECTION

1. Inspect:

- Bearings
- Rough movement → replace

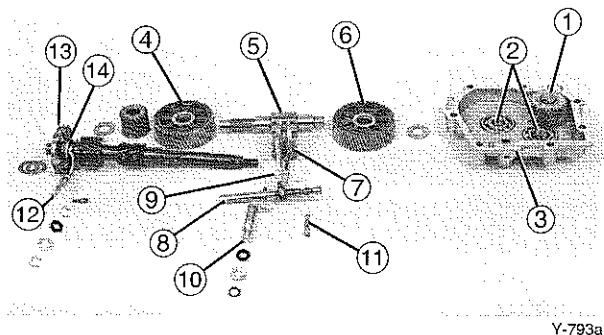
NOTE:

Use a bearing puller to remove bearings. If necessary, use a heat gun to heat the case before removing or installing bearings.

CAUTION

Do not overheat the transmission case. Damage to the case may result.

POWER TRAIN FOR G22A



2. Inspect:

- Gears ①
Damage/Wear → replace
- Bearings ②
Pitting/Damage → replace
- Oil Seals
Wear/Damage → replace
- Transmission case ③
Cracks/Damage → replace

3. Inspect:

- Wheel gear 1 (Forward) ④
Wear/Cracks/Damage → replace
- Countershaft ⑤
- Wheel gear 2 (Reverse) ⑥
Wear/Cracks/Damage → replace
- Dog clutch ⑦
Damage → replace

4. Inspect:

- Guide bar ⑧ and pin
- Shift fork ⑨
- Shift shaft and oil seal ⑩

5. Inspect:

- Detent screw, spring, ball ⑪
Wear/Damage → replace

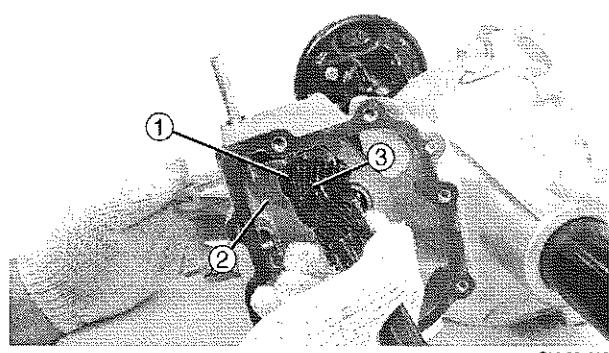
6. Inspect:

- Governor lever, bushing, oil seal, washer, and retainer ⑫
- Governor weights ⑬
- Idler collar ⑭
Wear/Damage → replace
- Input shaft gearwear.
- Backing plate secure on shaft.

TRANSMISSION ASSEMBLY

Reverse the "DISASSEMBLY" procedure.

Note the following points.



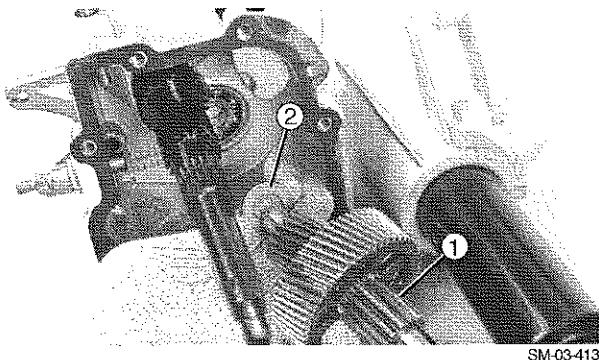
1. When installing the input shaft be sure to install the original shims (if equipped) ①.

2. Install the governor fork ② onto the governor idler collar ③ between the washer and gear.

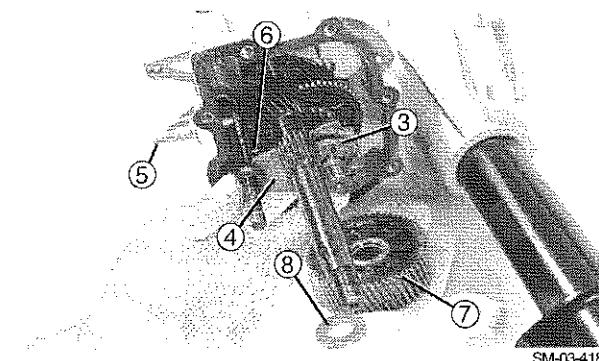
3. Apply:

- Gear oil to all oil seals and bearings.

POWER TRAIN FOR G22A



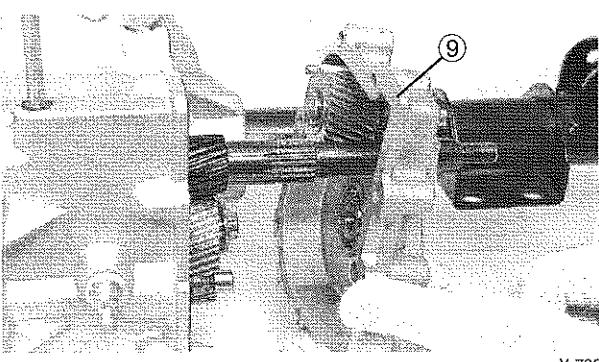
4. Install countershaft and forward wheel gear ① with thick, silver color thrust washer ②. The forward gear is smaller in diameter and has an "F" marked between two of the engagement dog slots.



5. Install:
 - Dog clutch ③

NOTE:

Before installing the clutch, engage the shift fork ④ with groove of the clutch ③. Then turn the shift shaft lever to align the slot of the shift shaft ⑤ with pin ⑥.



- Drive gear 2 ⑦ (reverse) with end washer ⑧. (The reverse drive gear is larger in diameter and has an "R" marked between two of the engagement dog slots.)

6. Install:
 - Gasket (New)
 - Transmission cover ⑨
 - Circlip on input shaft

7. Tighten:
 - Bolts (Transmission cover)

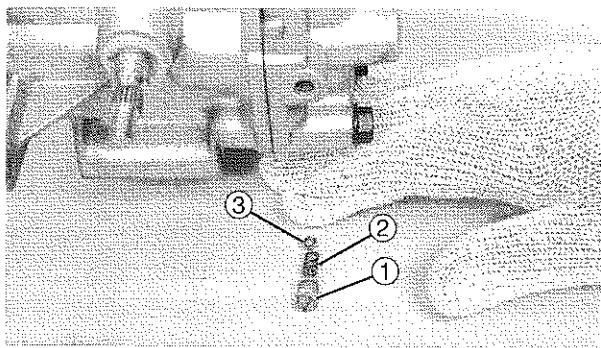
Tighten them in a crisscross pattern.



Transmission Cover:

First: 20 N·m (2.0 m·kg, 14.8 ft·lb)
Final: 31 N·m (3.2 m·kg, 22.9 ft·lb)

4

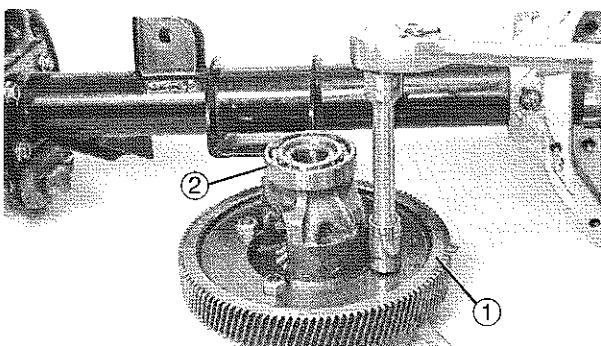


Y-562

8. Install:

- Detent ball ③
- Spring ②
- Transmission shift detent screw ①

9. Tighten transmission shift detent screw to specification measured during disassembly.



Y-560

DIFFERENTIAL ASSEMBLY

Reverse the "DISASSEMBLY" procedure.
Note the following points.

1. Tighten:

- Differential case nuts attaching ring gear ① to differential assembly ②.

 Differential Case Nuts:

54 N·m (5.5 m·kg, 39.8 ft·lb)

NOTE:

Apply LOCTITE® to the differential case nuts.

2. Tighten:

- Differential bearing holder bolts ①

CAUTION

Differential bearing holders ③ must be installed in their original locations. Holders and case are marked with locating letters.

 Differential Bearing Holder Bolts:

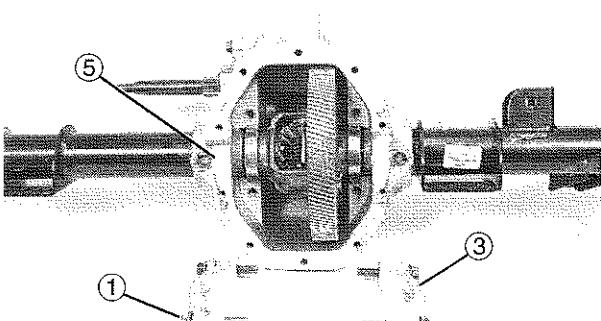
54 N·m (5.5 m·kg, 39.8 ft·lb)

NOTE:

Clean the transmission cover surface ⑤.

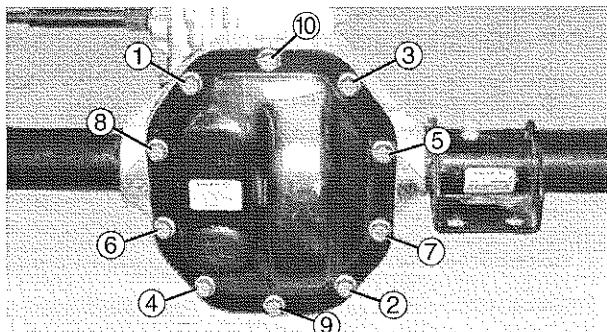
3. Apply:

- RTV Quick Gasket sealant (ACC-QUICK-GSKT) or Three Bond 1215 (to the cover surface and into the 10 bolt holes)

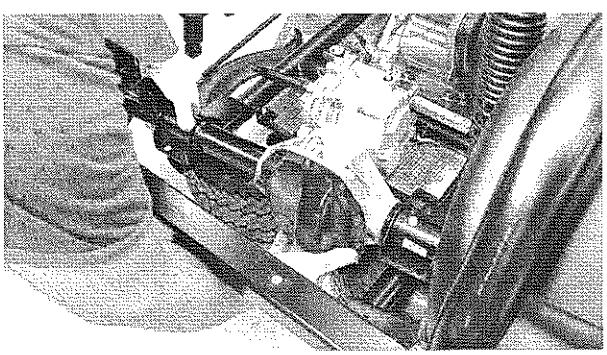


SM-03-369

POWER TRAIN FOR G22A



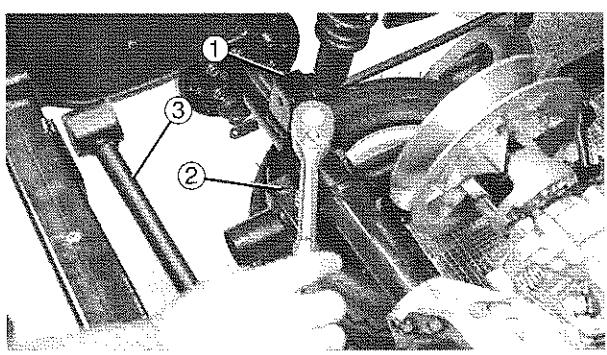
SM-03-078



Y-558



Y-799



Y-842

4. Tighten:

- Transmission cover bolts ① through ⑩
- New transmission case holes are not threaded. Bolts are self-tapping.

NOTE:

Tighten the bolts in order starting with the smallest number and torque the bolts in two stages.



Transmission Cover Bolts:

- First: 20 N·m (2.0 m·kg, 14.8 ft·lb)
Final: 28 N·m (2.9 m·kg, 20.7 ft·lb)

4

INSTALLATION

Reverse the "REMOVAL" procedure. Note the following points.

1. Install:

- Transmission case assembly
- Transmission mount bolt and nut



Transmission Mount Nut:

- 23 N·m (2.3 m·kg, 17.0 ft·lb)

- Rear arm bolts ②



Axle Housing - Rear Arm (2):

- 64 N·m (6.5 m·kg, 47.2 ft·lb)

2. Install:

- Rear shock absorber pivot bolts ①



Shock Absorber Pivot Bolt ①:

- 32 N·m (3.3 m·kg, 23.6 ft·lb)

- Rear arm connecting rod ③



Connecting Rod Nut Torque:

- 90 N·m (9.2 m·kg, 66.4 ft·lb)

- Rear axle shafts

Refer to CHAPTER 3 "REAR AXLE WHEEL FOR G22A, REMOVAL" section.

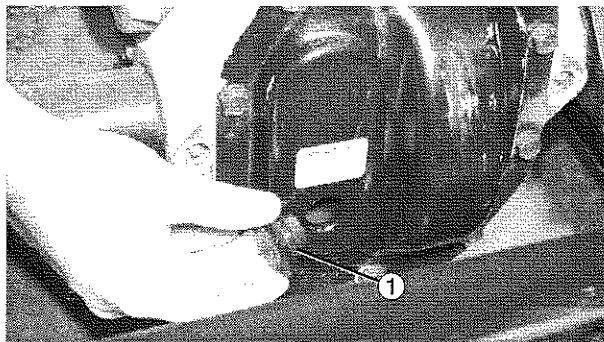
- Rear wheels



Rear Wheel:

- 88 N·m (9.0 m·kg, 64.9 ft·lb)

POWER TRAIN FOR G22A



SM-03-007

3. Fill:

- Transmission case
- Replace oil level fill/check plug ①

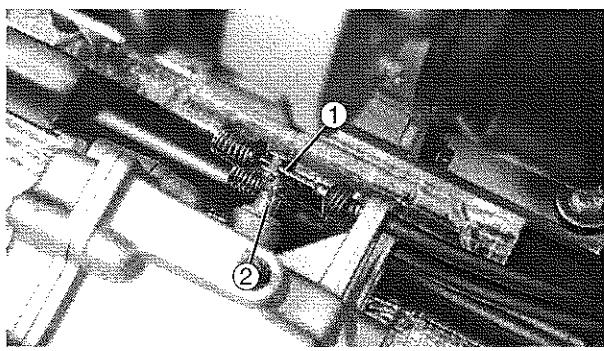


Recommended Oil:

SAE 90 gear oil

Oil Capacity:

415 cc (415 mL, 0.44 US qt)



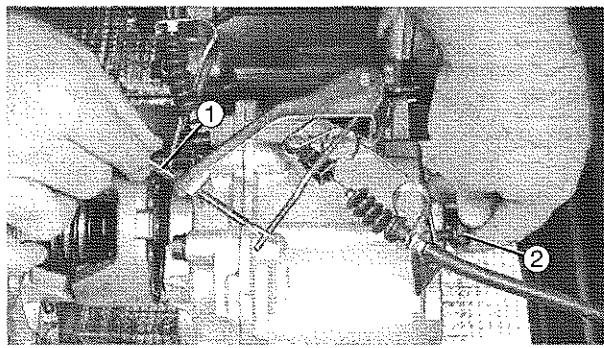
Y-573

4. Connect:

- Shifting cables ① (with lever ②) onto shaft
- Align line on shaft with dot on shift lever
- Shift lever nut

NOTE:

Align the match marks on the lever and shaft. Scribe mark on shift shaft end should be in 9 o'clock position (transmission in neutral) with lever straight up and down.



Y-553

5. Install:

- Speed limiter lever onto the governor shaft. Make sure to install the two plastic bushings ③.
- Governor lever nut



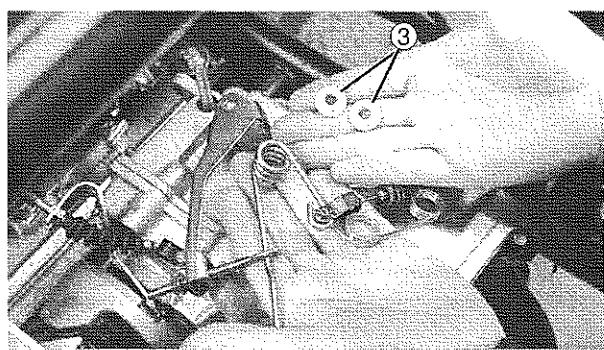
Governor Lever Nut:

8 N·m (0.8 m·kg, 5.9 ft·lb)

- Speed limiter lever bolts ① and ②

NOTE:

If speed limiter lever was removed as a unit, no throttle cable adjustment is necessary.



Y-554

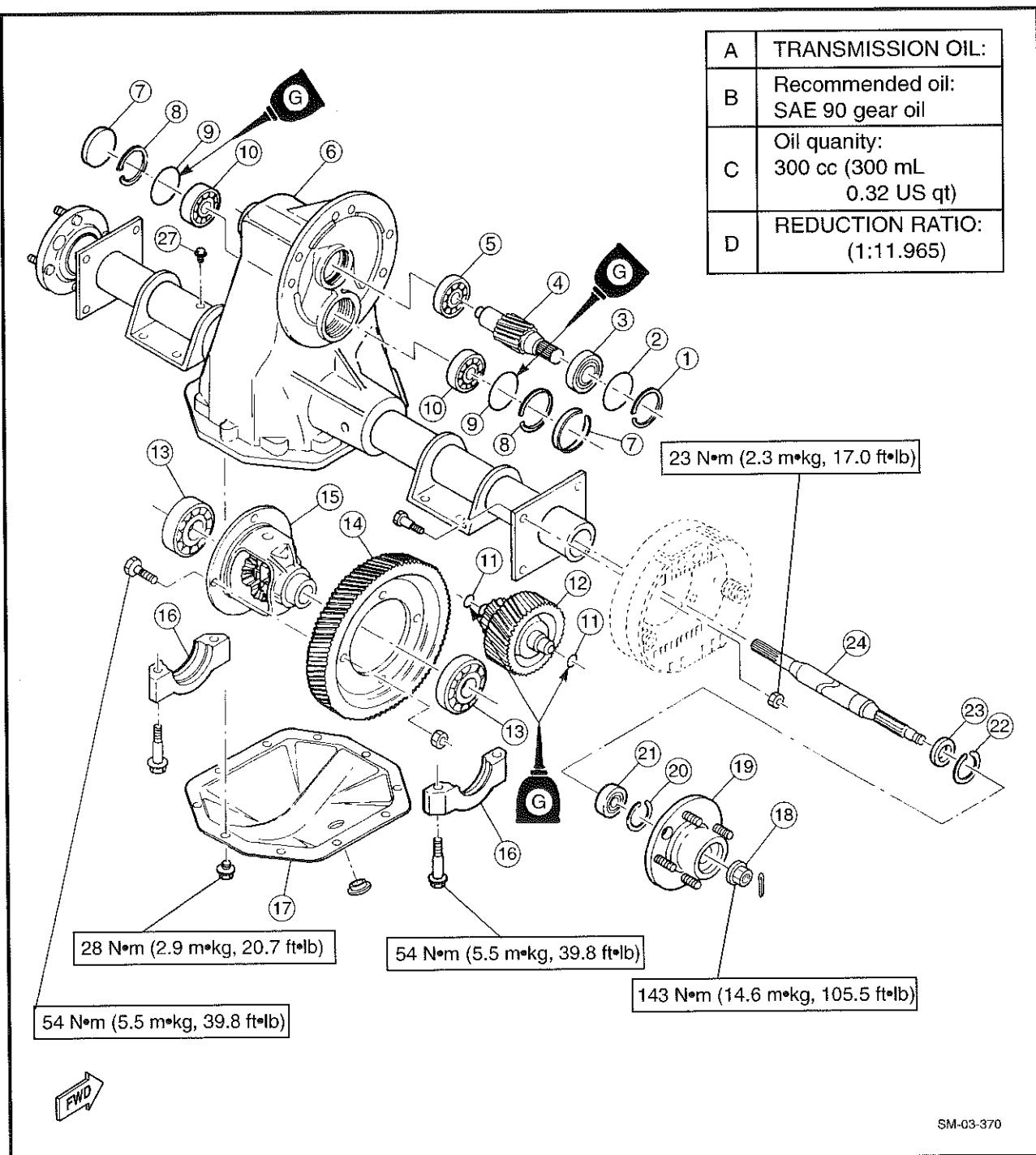
6. Adjust:

- Throttle cable free play
- Refer to CHAPTER 2 "THROTTLE CABLE ADJUSTMENT" section.

POWER TRAIN FOR G22E

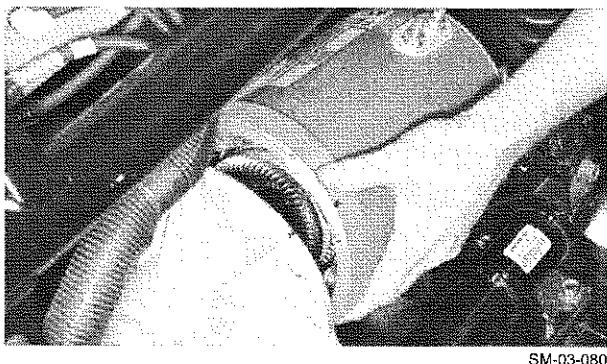
TRANSMISSION

- | | | |
|-----------------|---------------------------|-------------------|
| ① Circlip | ⑩ Bearing | ⑯ Rear axle hub |
| ② O-ring | ⑪ O-ring | ⑰ Circlip |
| ③ Bearing | ⑫ Counter gear assembly | ㉑ Bearing |
| ④ Input shaft | ⑬ Bearing | ㉒ Circlip |
| ⑤ Bearing | ⑭ Ring gear | ㉓ Oil seal |
| ⑥ Case assembly | ⑮ Differential assembly | ㉔ Rear axle shaft |
| ⑦ Blind plug | ⑯ Bearing holder | ㉕ Stopper |
| ⑧ Circlip | ⑰ Transmission case cover | ㉖ Rear axle shaft |
| ⑨ O-ring | ⑱ Flange nut | ㉗ Vent |

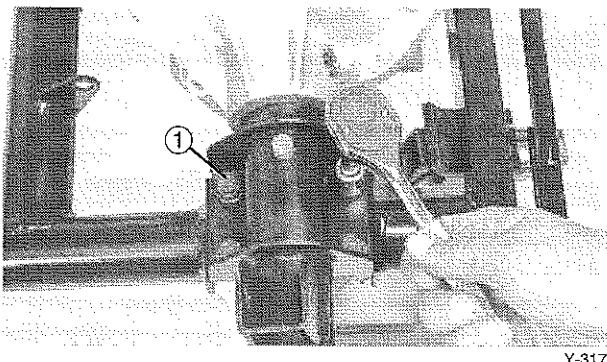


**REMOVAL**

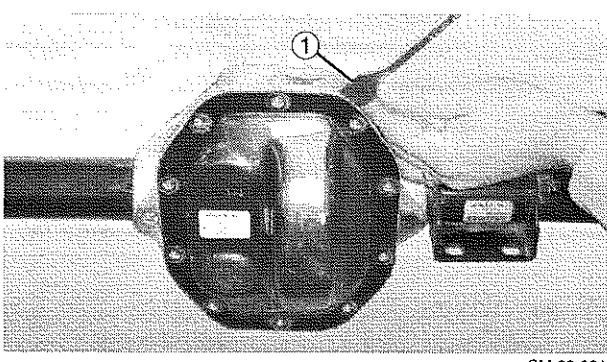
1. Block the front wheel. Jack up the rear of the vehicle, place a stand under the frame. Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.
2. Remove:
 - Rear wheels
 - Rear axle shafts
 - Refer to CHAPTER 3 "REAR AXLE WHEEL FOR G22E, REMOVAL" section.
3. Remove:
 - Rear shock absorbers
 - Disconnect negative and positive power leads from motor
 - Disconnect the speedometer wire harness from electric motor
4. Remove:
 - 4 bolts from electric motor to transmission
 - Carefully lower and set motor aside
 - Bolts ① from rear arm
 - Rear arm connecting rod
 - Support swing arm so it does not drop to the floor
 - Transmission case assembly



SM-03-080



Y-317



SM-03-081

DISASSEMBLY

1. Place an oil pan under transmission case.
2. Remove:
 - Bolts

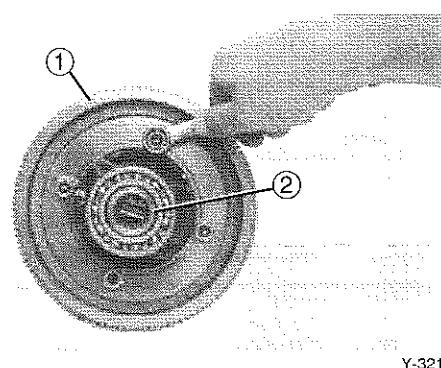
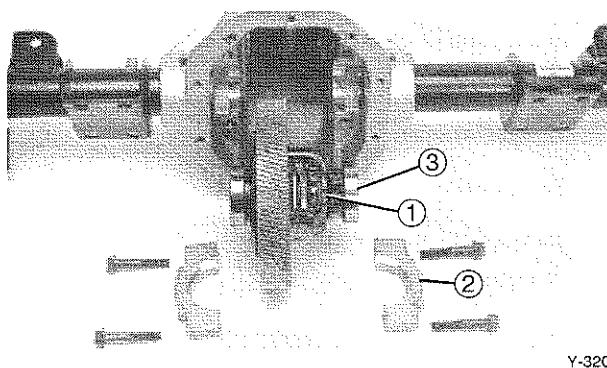
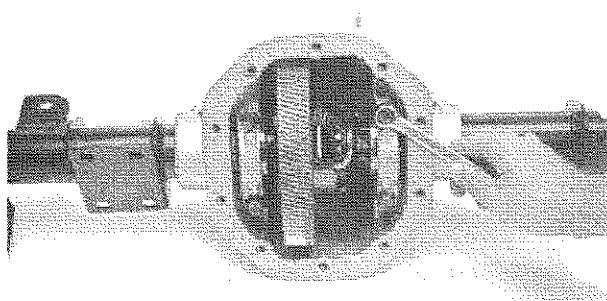
NOTE:

All transmission case bolts and differential cover bolts are 1/2 inch wrench size.

- Transmission case cover using a putty knife
- Drain transmission oil

CAUTION

Use care not to damage the case sealing surface or deform the transmission case cover.



3. Remove:

- Differential bearing holder bolts

CAUTION

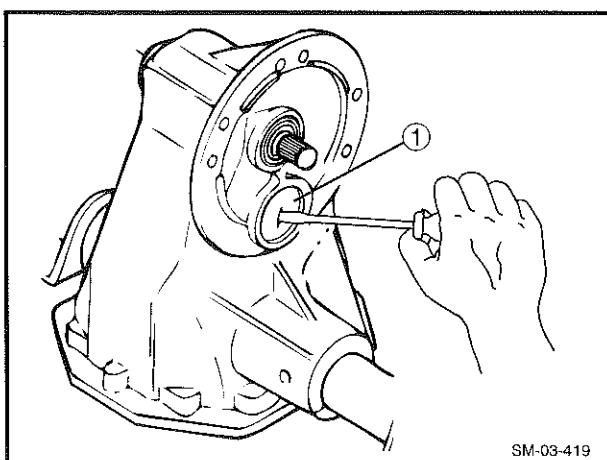
Mark bearing holders before removal so they can be returned to their original position - bearing holders are not interchangeable.

- Differential assembly with ring gear ①
- Bearing holder ②
- Bearing ③

4

4. Separate:

- Ring gear ①
- Differential assembly ②

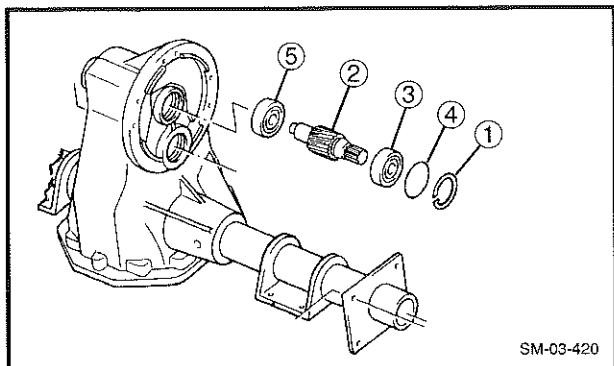


5. Remove:

- Blind plug ① (both sides)

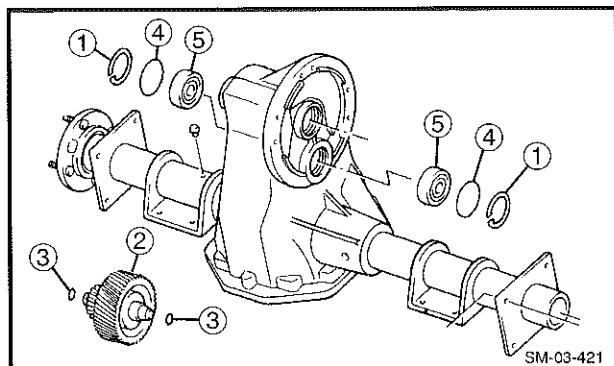
NOTE:

Punch or drill near the center of blind plug. Insert a suitable sized sheet metal screw until the plug is forced out of the bearing bore.



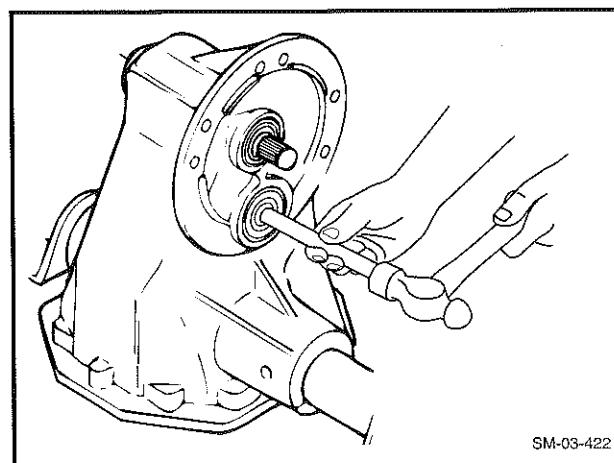
5. Remove :

- Circlip ①
- Input shaft ②
- Bearing ③
- O-ring ④
- Bearing ⑤

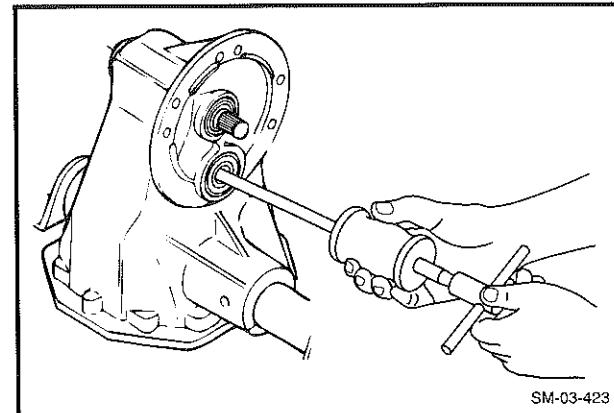


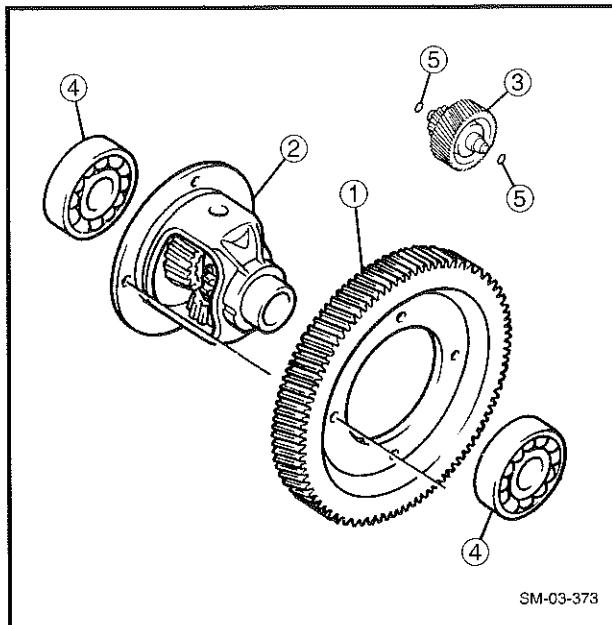
6. Remove:

- Circlip ①
(from counter gear bore)
- Counter gear ②
- O-ring of counter gear ③
- O-ring of bearing ④
- Bearing ⑤

**Counter gear removal steps:**

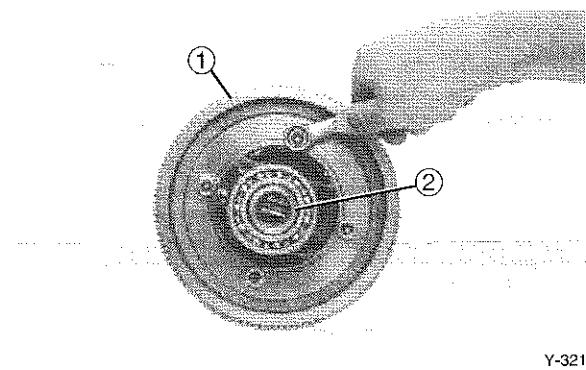
1. Push out the counter gear shaft of input side from bearing inner race.
2. Remove the bearing of input side using the bearing puller.
3. Repeat the step 1 for counter gear bearing on opposite side.



**INSPECTION**

1. Inspect:

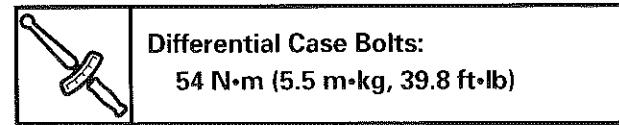
- Ring gear ①
- Differential gear ②
- Counter gear ③
- Damage Wear → replace
- Bearing ④
- Pitting/Damage → replace
- O-ring ⑤
- Wear/Damage → replace

**ASSEMBLY**

Reverse the "DISASSEMBLY" procedure. Note the following points.

1. Tighten:

- Differential case bolts attaching ring gear ① to differential assembly ②.

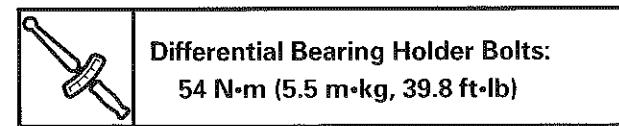


2. Tighten:

- Differential bearing holder bolts

CAUTION

Differential bearing holders must be installed in their original locations.

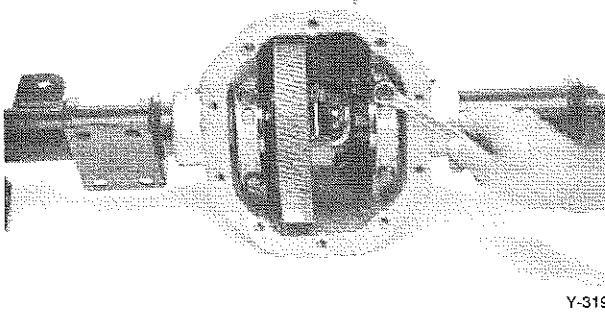


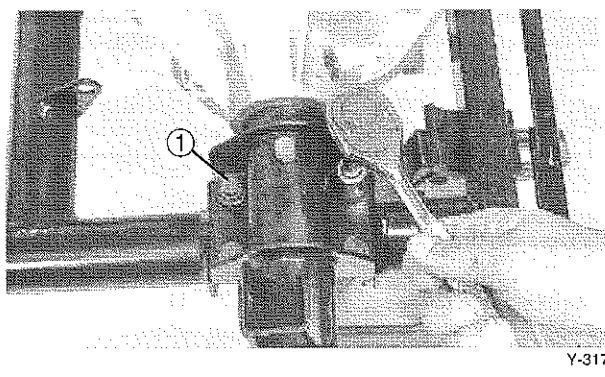
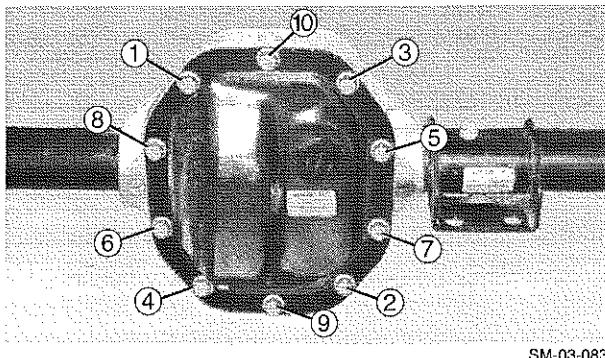
Replace the two blind plugs in the transaxle with new blind plugs.

NOTE: _____
Clean the transmission case surface.

3. Apply:

- RTV Quick Gasket sealant (ACC-QUICK-GS-KT) or Three Bond 1215 (to the case surface and into the 10 bolt holes)



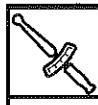


4. Tighten:

- Transmission case bolts

NOTE:

Tighten the bolt in order, starting with the smallest number and torque the bolts in two stages.

**Transmission Case Bolts:**

First: 20 N·m (2.0 m·kg, 14.8 ft·lb)

Final: 28 N·m (2.9 m·kg, 20.7 ft·lb)

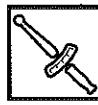
INSTALLATION

Reverse the "Removal" procedure.

Note the following points.

1. Install:

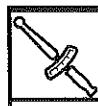
- Transmission case assembly
- Rear arm bolts ①

**Axle Housing - Rear Arm**

64 N·m (6.5 m·kg, 46.8 ft·lb)

2. Install:

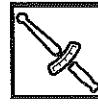
- Traction motor
Refer to CHAPTER 7 "TRACTION MOTOR" section.
- Rear shock absorbers

**Shock Absorber Pivot Bolt:
(Upper and Lower)**

32 N·m (3.3 m·kg, 23.6 ft·lb)

- Rear axle shafts
Refer to CHAPTER 3 "REAR AXLE WHEEL FOR G22E, REMOVAL" section.

- Rear wheels

**Rear Wheel:**

88 N·m (9.0 m·kg, 64.9 ft·lb)

3. Fill:

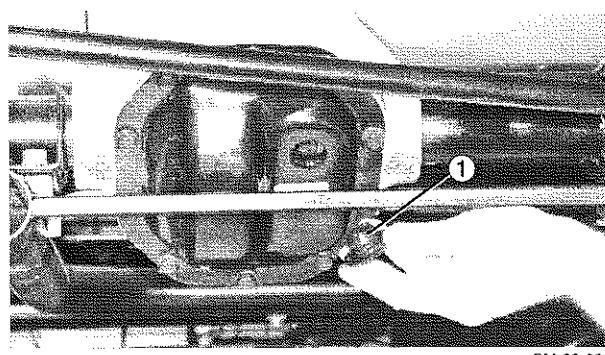
- Transmission case
- Replace oil level fill/check plug ①

**Recommended Oil:**

SAE 90 gear oil

Oil Capacity:

300 cc (300 mL, 0.32 US qt)





CHAPTER 5 ENGINE OVERHAUL

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ENGINE REMOVAL

ENG



ENGINE OVERHAUL

ENGINE REMOVAL

NOTE:

It is not necessary to remove the engine in order to remove the following components:

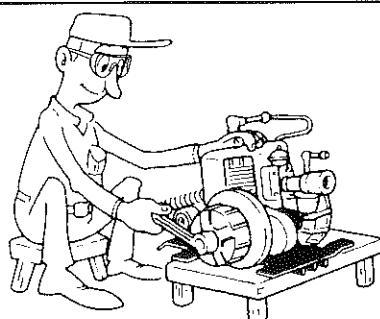
- Cylinder head assembly
- Carburetor
- Starter-generator
- Primary sheave
- Air shroud
- Ignition unit
- Flywheel



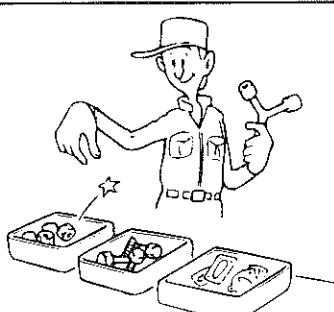
Y-528



Y-529



SM-03-157



Y-531

PREPARATION FOR REMOVAL

1. Remove all dirt, mud, dust, and foreign material before removal and disassembly.

2. Use proper tools and cleaning equipment. Refer to CHAPTER 1 "SPECIAL TOOLS".

CAUTION

Make sure all traces of cleaner are removed before engine is reassembled. Engine oil can be adversely affected by even small amounts of cleaner.

5

NOTE:

When disassembling the engine, keep mated parts together. This includes gears, cylinders, pistons, and other parts that have been "mated" through normal wear. Mated parts must be reused as an assembly or replaced.

3. During the engine disassembly, clean all parts and place them in trays in the order of disassembly. This will speed up assembly time and help assure that all parts are correctly reinstalled in the engine.

4. Disconnect the battery negative lead.

**DRIVE BELT**

1. Remove:
 - Drive belt

Refer to CHAPTER 4 "SECONDARY SHEAVE DISASSEMBLY" section.

PRIMARY CLUTCH

1. Remove:
 - Primary clutch

Refer to CHAPTER 4 "POWER TRAIN PRIMARY SHEAVE" section.

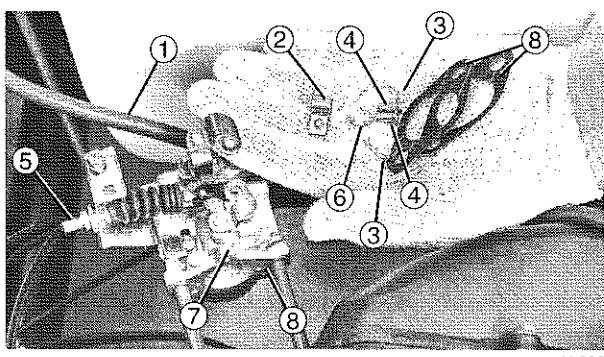
AIR CLEANER CASE

1. Remove:
 - Air cleaner

Refer to CHAPTER 2 "CARBURETOR ADJUSTMENT" section.

 WARNING

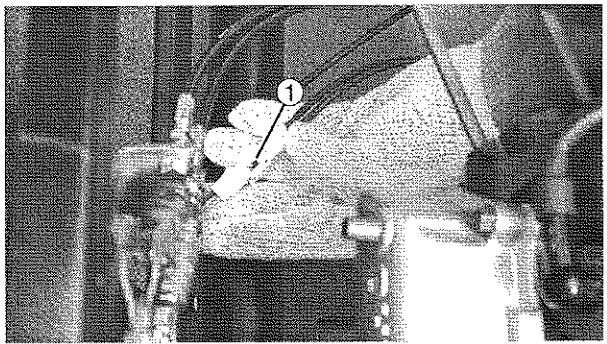
Gasoline may be present in the carburetor and fuel system. Use care during engine removal not to spill gasoline. Gasoline is extremely flammable, and its vapors can explode if ignited.

**CARBURETOR**

1. Disconnect:
 - Fuel hose ①
2. Remove:
 - Choke cable clamp ②
3. Remove:
 - Cotter pin from clevis pin ③
 - Clevis pin ④
 - Choke cable
4. Remove:
 - Circlip ⑥
 - Cotter pin from clevis pin ③
 - Clevis pin ④
 - Throttle cable ⑤
5. Remove:
 - Carburetor assembly ⑦
 - Three gaskets ⑧ (Replace if damaged.)

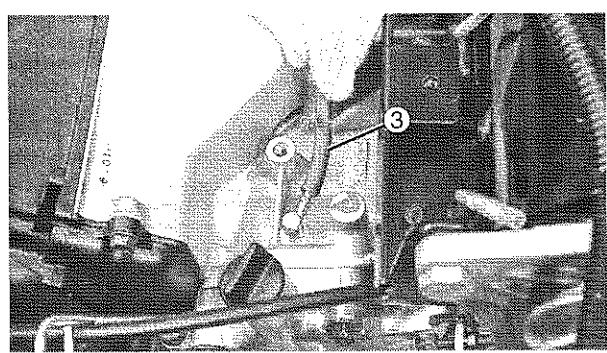
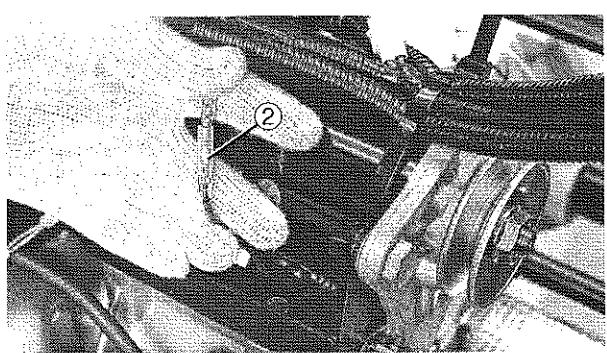
ENGINE REMOVAL

ENG

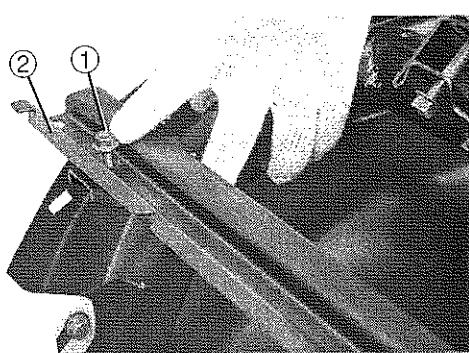


WIRING AND HOSE

1. Disconnect:
 - Ignition lead ①
 - Oil warning level switch lead (blue) ②
2. Disconnect:
 - Pulser hose ③ from crankcase

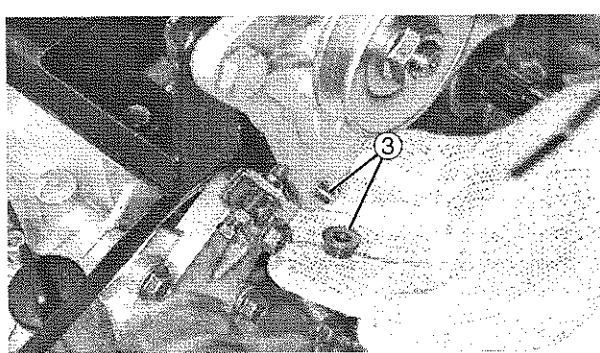


5



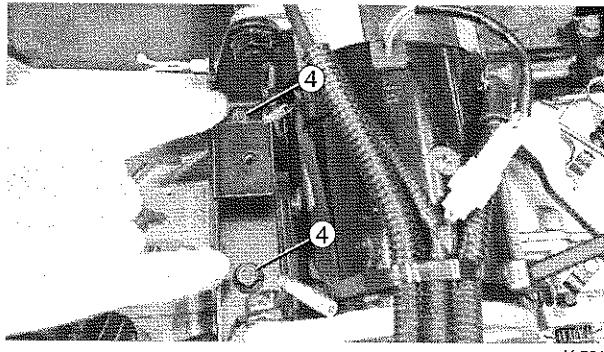
STARTER GENERATOR

1. Remove:
 - Seat support bolts ①
 - Seat support ②
 - Starter generator lead wire clamp ③
2. Remove:
 - Lower bolt from starter generator mount ③



ENGINE REMOVAL

ENG

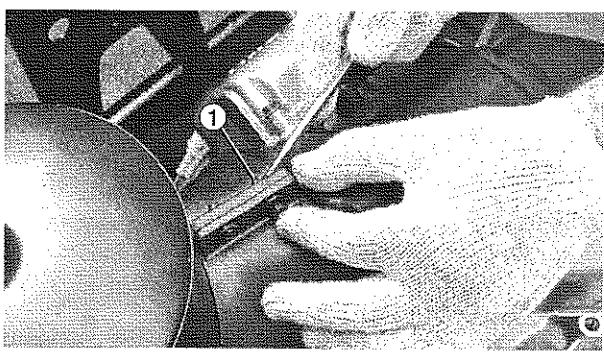


3. Remove

- Starter generator bracket mount bolts (4)
- Starter generator

NOTE:

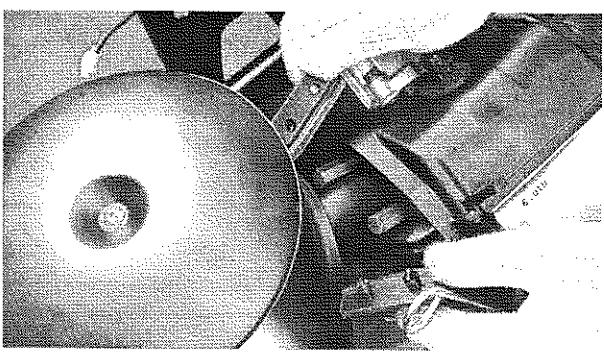
Disconnect starter generator leads if servicing is necessary.



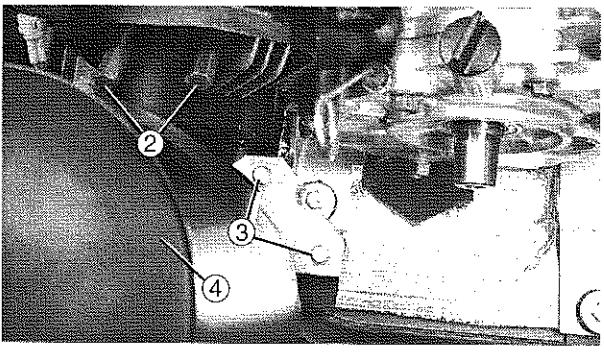
MUFFLER

1. Remove:

- Muffler joint rivets (1)



Y-583

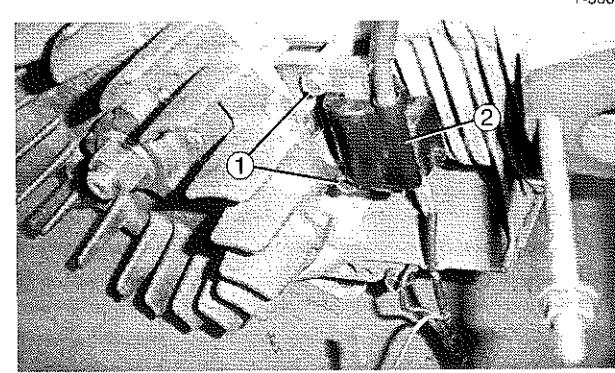
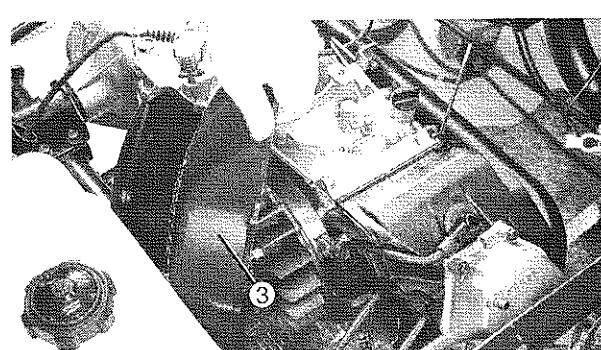
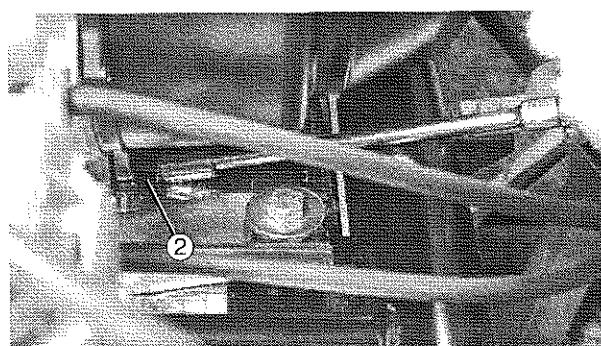
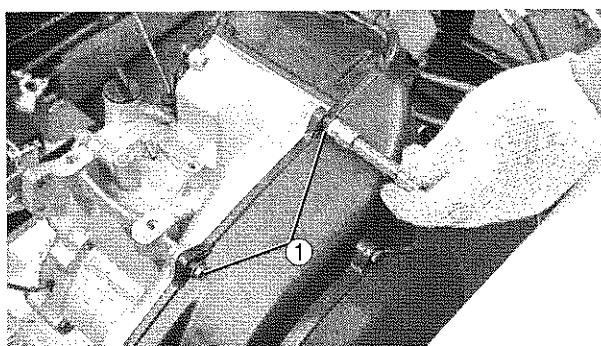
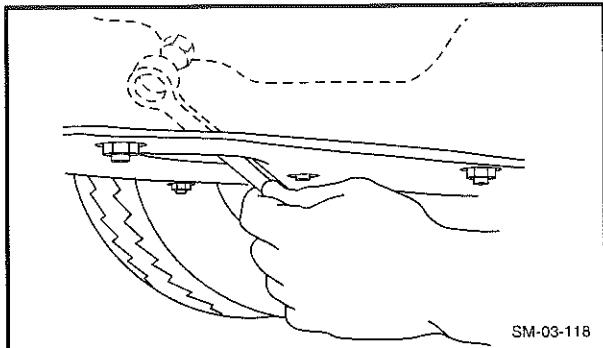


2. Remove:

- Exhaust pipe holding nuts (2)
- Muffler mount bolts (3)
- Muffler (4) and gasket

ENGINE REMOVAL

ENG



ENGINE OIL DRAIN

Refer to CHAPTER 2 "ENGINE OIL REPLACEMENT" section for complete instructions.

1. Place a proper catch container under the oil drain plug.
2. Remove drain plug.
3. Drain engine oil completely.

AIR SHROUD

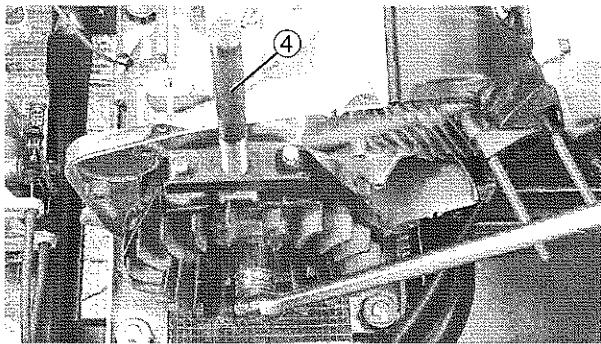
1. Remove:
 - Top bolts ①
 - Bottom bolt ②

NOTE: _____
Bottom bolt is accessed from underneath the frame.

5

2. Rotate the air shroud ③ and remove.

3. Remove TCI ignition unit.
 - TCI ignition unit bolts ①
 - TCI ignition unit ②



Y-801

FLYWHEEL**1. Remove:**

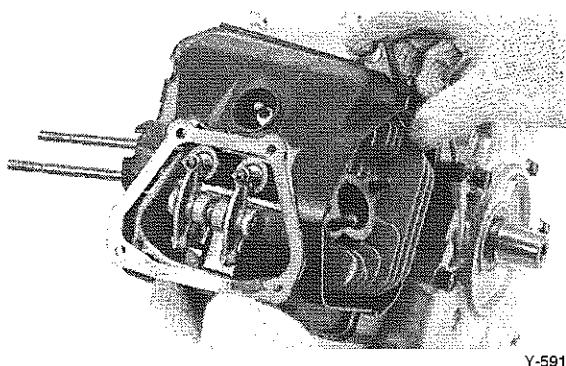
- Flywheel securing nut and washer
- Use a Sheave Holder (4)

NOTE:

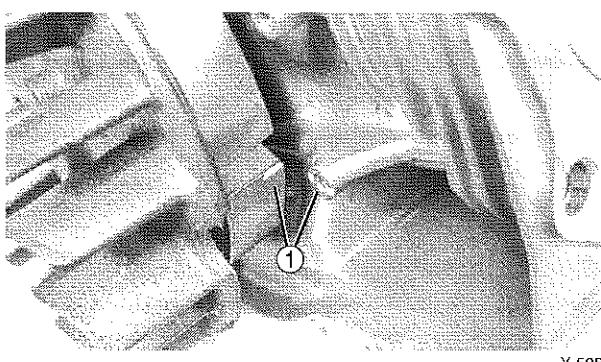
Engine shown removed for visual reference only.
It is not necessary to remove engine for flywheel
removal.



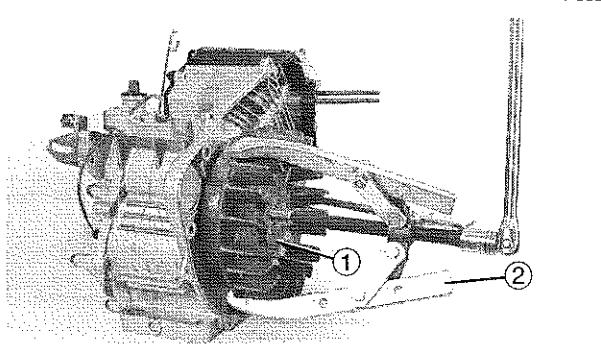
**Primary Sheave Holder:
YS-1880-A**



Y-591



Y-595



Y-590

2. Remove:

- Remove valve cover
- Air shroud
- Valve cover gasket
- Spark plug

**3. Place valve at TDC compression stroke. Refer to CHAPTER 2 "INSPECTION AND ADJUSTMENT ENGINE" section.
Mark flywheel at TDC for installation (1)****4. Remove:**

- Flywheel (1)
- Use a 2 or 3 jaw puller (2)

NOTE:

Flywheel can be removed in the frame by removing the fuel tank.

ENGINE REMOVAL**1. Remove:**

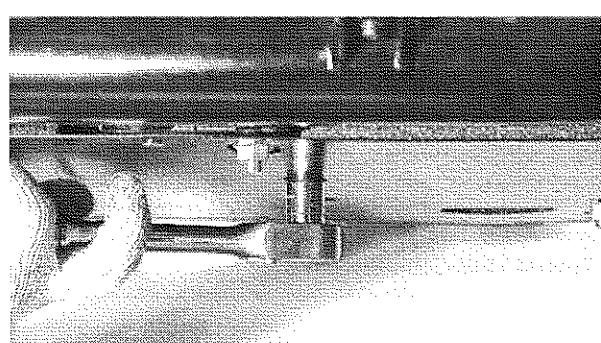
- Engine mount nuts underneath rear arm

2. Remove:

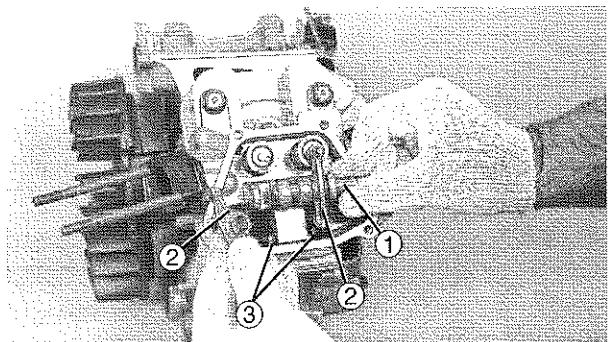
- Engine – place on a suitable work space

NOTE:

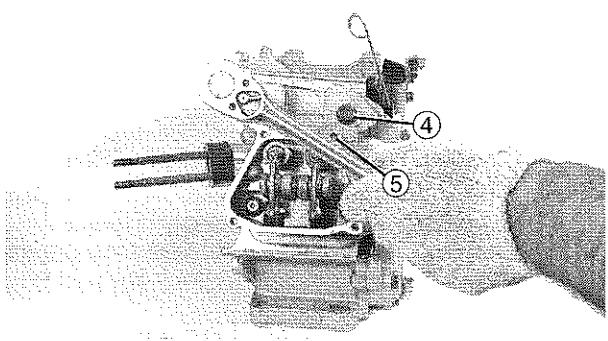
The engine weighs 21.9 kg (48.3 lbs) without the starter.



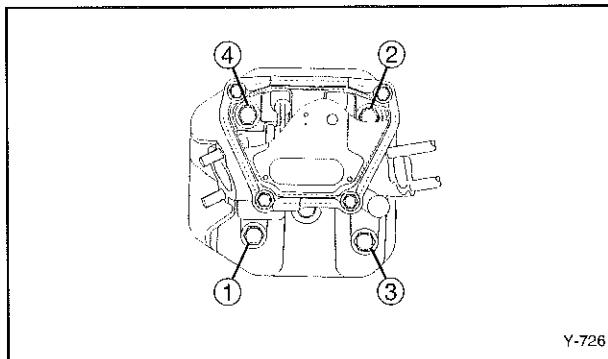
Y-594



Y-593



Y-592



Y-726

5

CYLINDER HEAD**CAUTION**

The following photos show the engine being disassembled/assembled while wearing cotton gloves. To prevent contaminating internal components of the engine do not wear cotton gloves.

1. Remove:

- Rocker shaft ① and arms ②
- Push rods (Exhaust/Intake) ③

NOTE:

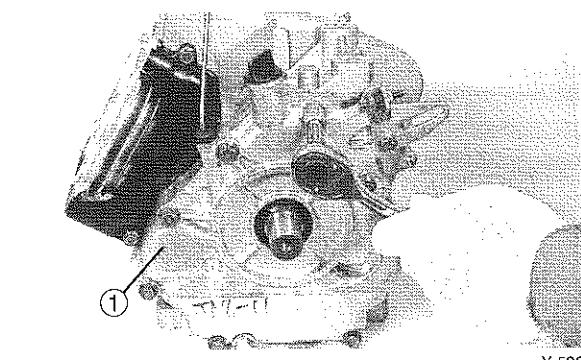
Mark both push rods so they can be installed in their original positions.

2. Remove:

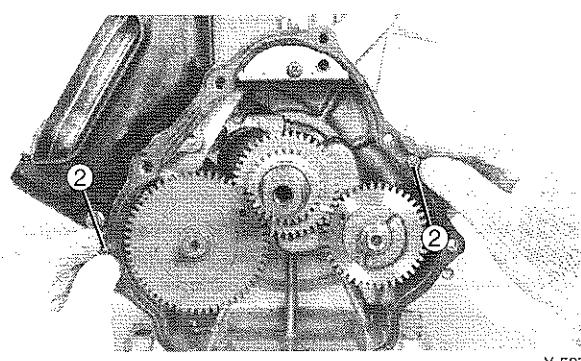
- Cylinder head bolts ④
- Head ⑤ and head gasket

NOTE:

Loosen bolts in numbered sequence as shown. Start by loosening each bolt 1/2 turn until all are loose.



Y-596



Y-597

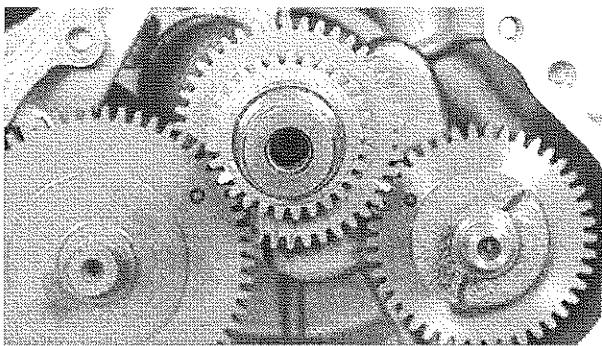
CRANKCASE COVER

1. Remove:

- Bolts
- Crankcase cover ①
- Dowel pins ②
- Gasket

ENGINE DISASSEMBLY

ENG



CAMSHAFT

NOTE:

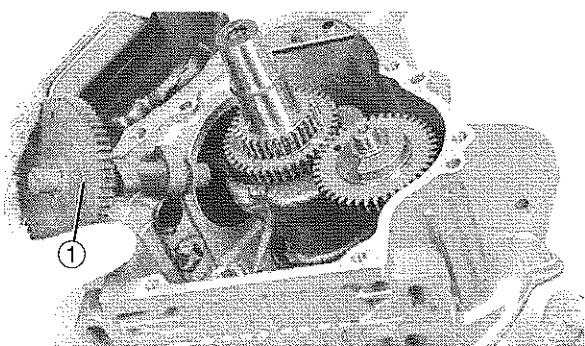
Before removal note alignment marks for assembly. The punch and paint marks on the crankshaft align with the holes on balancer and camshaft, indicating Top Dead Center (TDC) for the piston.

1. Remove:

- Cam shaft ①

NOTE:

Before removing the camshaft, place the engine with its left-side up to prevent the tappets from falling out.

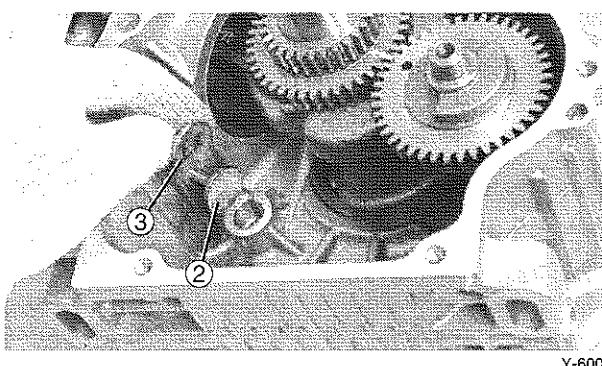


2. Remove:

- Intake ② and exhaust tappets ③

NOTE:

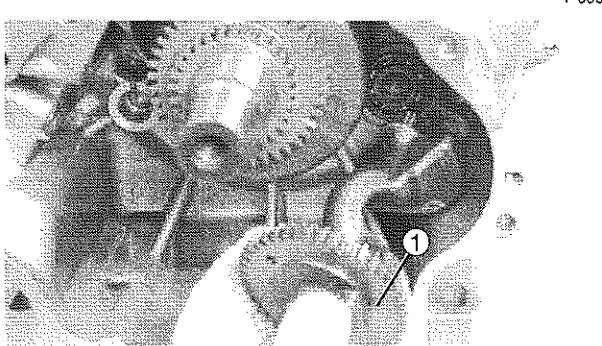
Mark both tappets so they can be installed in their original guide hole.



BALANCER SHAFT AND CRANKSHAFT

1. Remove:

- Balancer ①



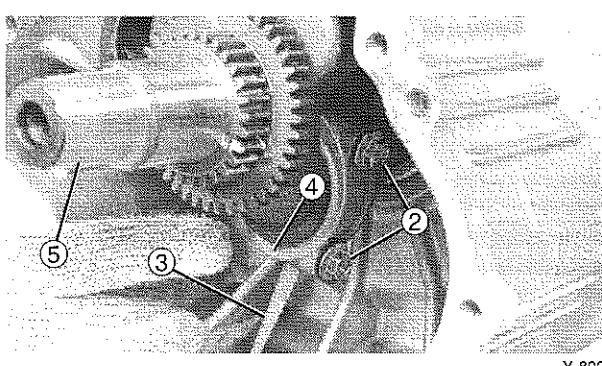
2. Remove:

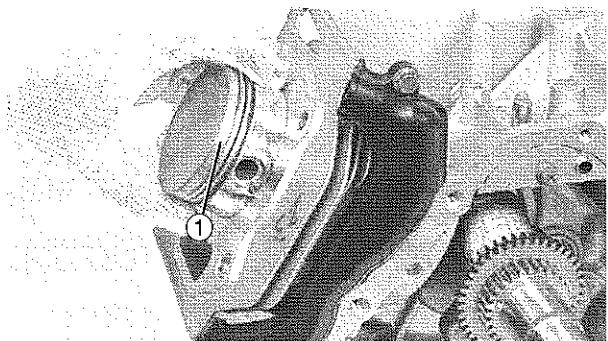
- Connecting rod bolts ②

NOTE:

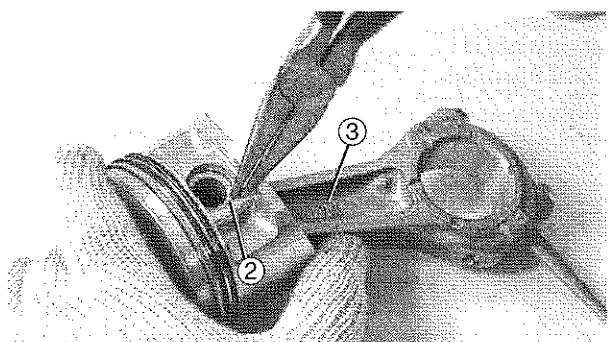
The oil splasher ③ is part of connecting rod cap. Remove cap with care; keep bolts with cap. When installing connecting rod cap make sure splasher is pointing down and arrows ④ on cap match.

- Crankshaft ⑤

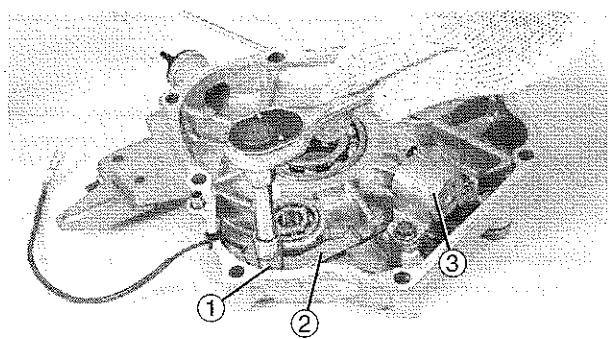




Y-603



Y-803



Y-605

5

PISTON AND CONNECTING ROD

1. Remove:

- Piston / connecting rod from crankcase ①

2. Remove

- Clip ② (if replacing rod, piston or piston pin)

NOTE:

"YAMAHA" cast on left side of connecting rod ③ always faces primary clutch side of engine.

OIL SENDER AND WIRE GUIDE PLATE

1. Remove:

- Bolts ①
- Wire guide plate ②
- Oil sender switch ③

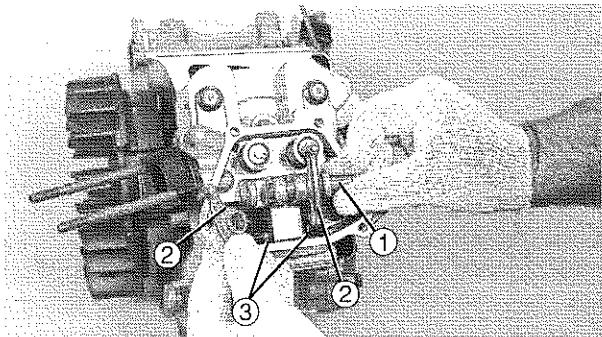
BEARINGS

1. Remove:

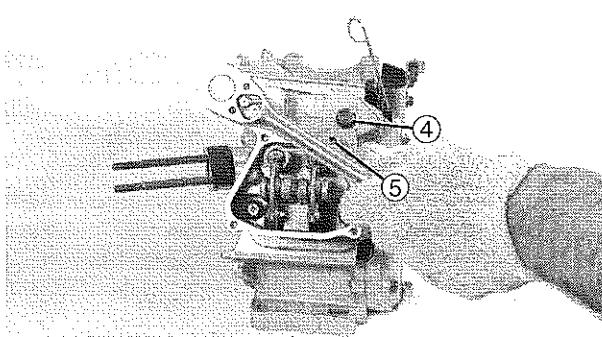
- Bearings ① - heat case evenly with heat gun. Use a bearing puller ② to remove bearings.

CAUTION

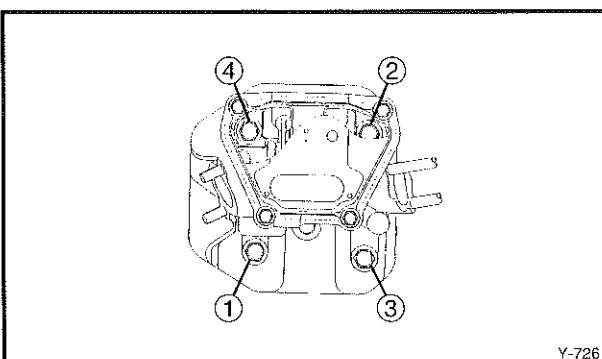
Do not overheat the engine cases. Damage to the cases may result.



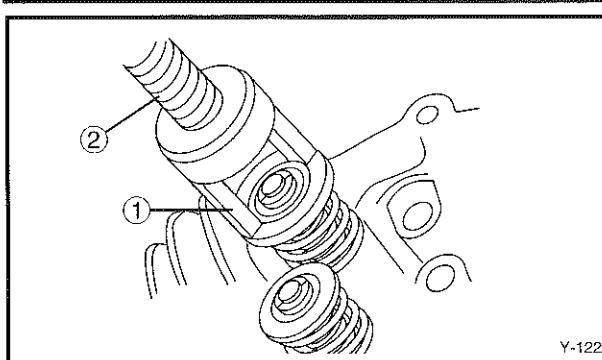
Y-593



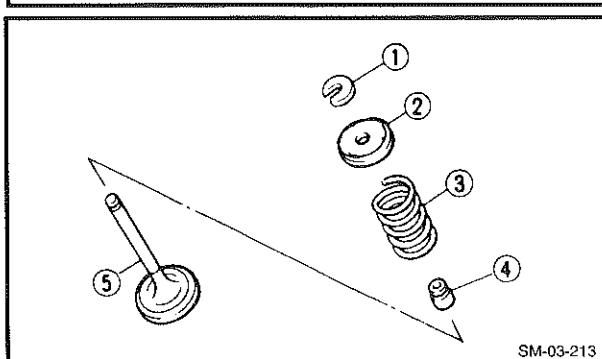
Y-592



Y-726



Y-122



SM-03-213

INSPECTION AND REPAIR

CYLINDER HEAD

1. Remove:

- Rocker shaft ① and arms ②
- Push rods (Exhaust/Intake) ③

NOTE: _____

Mark both push rods so they can be installed in their original positions.

2. Remove:

- Cylinder head bolts ④
- Head ⑤ and head gasket

NOTE: _____

Loosen bolts in numbered sequence as shown. Start by loosening each bolt 1/2 turn until all are loose.

3. Attach:

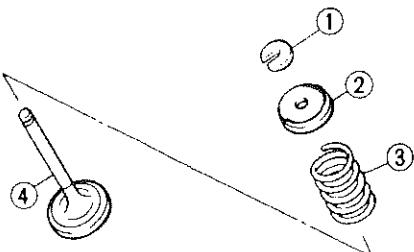
- Adapter ①
- Valve Spring Compressor ②



**Valve Spring Compressor:
YM-1253**

4. Remove:

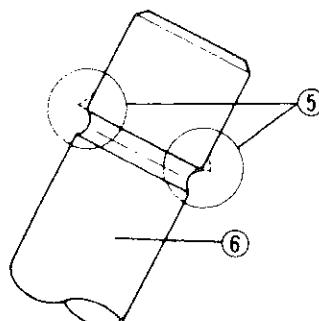
- Valve retainer ①
Use magnet or tweezers.
- Valve spring seat (Upper) ②
- Valve spring ③
- Oil seal ④
- Valve (Intake) ⑤



SM-03-214

5. Remove:

- Valve retainer ①
Use magnet or tweezers.
- Valve spring seat (Upper) ②
- Valve spring ③
- Valve (Exhaust) ④



SM-03-215

NOTE: _____

Deburr ⑤ any deformed valve stem ⑥ end. Use an oil stone to smooth the stem end.

6. Remove:

- Carbon deposit.
Use rounded scraper.

5

NOTE: _____

Do not use a sharp instrument and avoid damaging or scratching:

- Spark plug threads
- Valve seat
- Cylinder head

7. Measure:

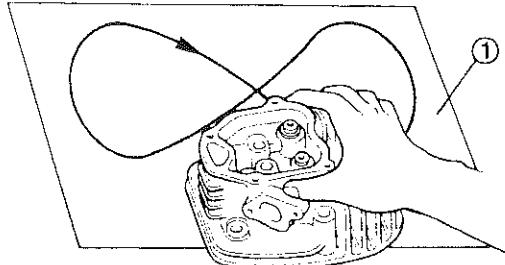
- Cylinder head warpage
Out of specification → resurface.

NOTE: _____

Check cylinder head for flatness by laying it on a surface plate and using a 0.001 in. feeler gauge between the mating surfaces to detect any warpage.

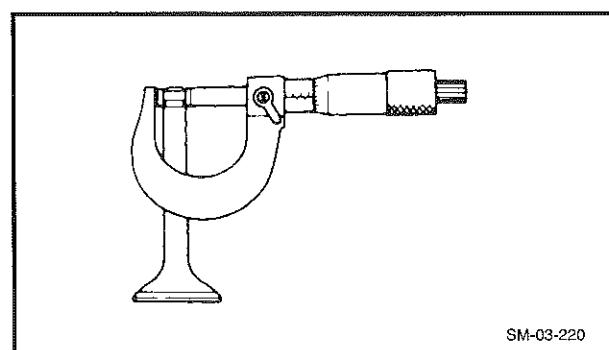
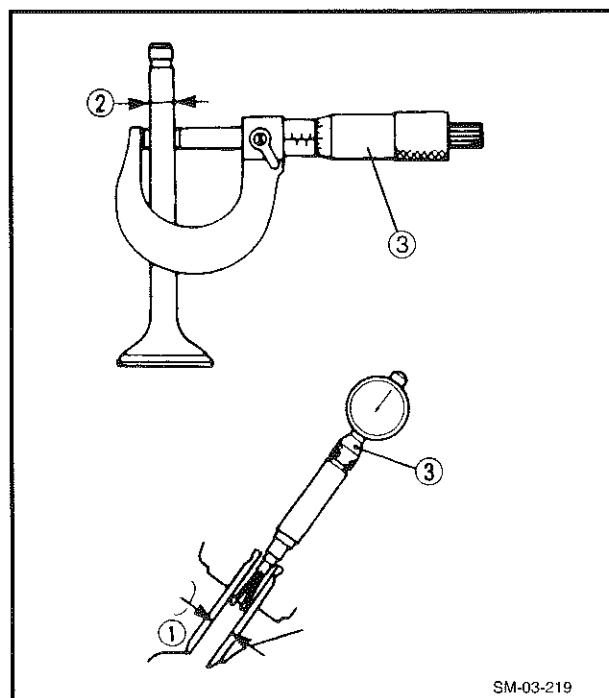
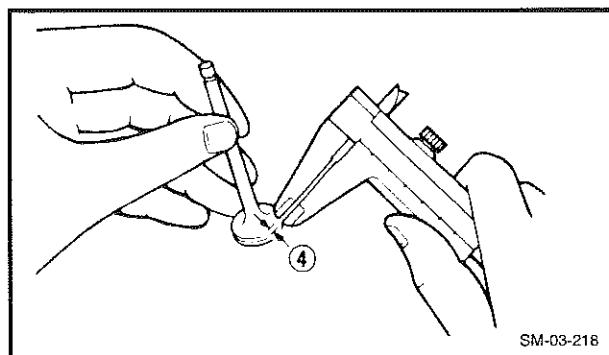
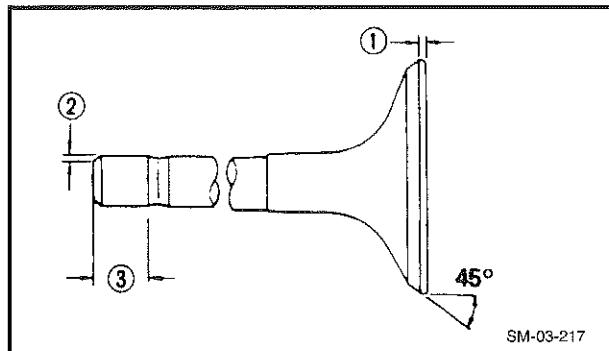


Cylinder Head Warp Limit:
Less than 0.03 mm (0.001 in)



SM-03-216

① Emery paper (400 ~ 600 grit wet)

**VALVE**

1. Inspect:

- Valve face
 - Stem end
- Wear/Pitting → reface
Out of specification → replace



① Margin Thickness (Service limit):

Intake 1.2 mm (0.047 in)

Exhaust 0.65 mm (0.025 in)

② Beveled :

No minimum*

③ Minimum Length (Service limit):
No minimum*

④ Seat Width (Valve face)

1.0 mm (0.040 in)

*If valve stem end is damaged,
replace valve.

2. Measure:

- Valve stem clearance

Valve stem clearance =

Valve guide inside diameter ① –
Valve stem diameter ②

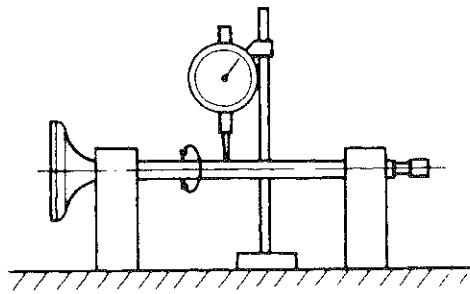
Out of specification → replace either valve and/or guide
Use a Micrometer and Bore Gauge ③.

Valve Stem/Guide Clearance		Maximum
Intake	0.037 - 0.064 mm (0.0015 ~ 0.0025 in)	0.10 mm (0.0040 in)
Exhaust	0.030 ~ 0.057 mm (0.0012 ~ 0.0022 in)	0.10 mm (0.0040 in)

3. Inspect:

- Valve stem end

Mushroom shape/Larger diameter than rest of stem → replace valve, valve guide, and oil seal



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4. Measure:

- Valve stem runout
Out of specification → replace



Maximum Runout:
0.01 mm (0.0004 in)

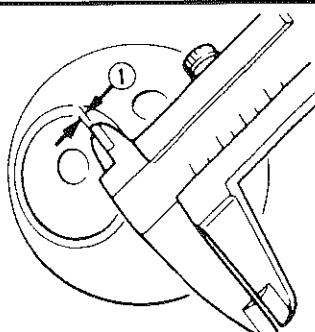
VALVE SEAT

1. Clean:

- Valve face
- Valve seat
Remove carbon deposit.

2. Inspect:

- Valve seat
Pitting/Wear → reface valve seat



SM-03-222

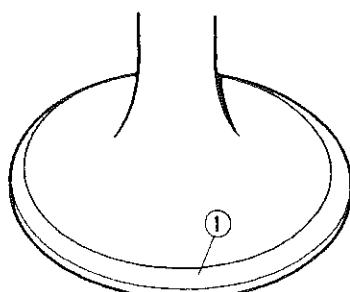
3. Measure:

- Valve seat width ①
Out of specification → reface valve seat



Valve Seat Width:
Std: 0.7~0.9 mm
(0.028~0.035 in)
Wear Limit:
1.4 mm (0.055 in)

5



SM-03-223

Valve seat width measurement steps:

- Apply Mechanic's bluing dye (Dykel) ① to the valve face.
- Install the valve into the cylinder head.
- Press the valve through the valve guide and onto the valve seat to make a clean pattern.
- Measure the valve seat width. Wherever the valve seat and valve face made contact, bluing will have been removed from valve face.
- If the valve seat width on valve face is too wide or too narrow, or seat is not centered, the valve seat must be refaced.



4. Reface:

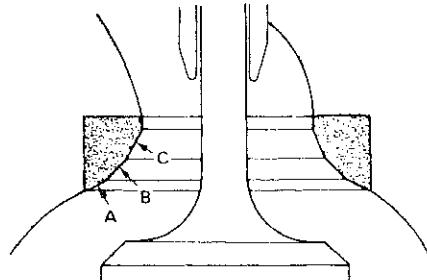
- Valve seat

Use 10°, 45° and 60° Valve Seat Cutter.

CAUTION

Remove just enough material to achieve satisfactory seat.

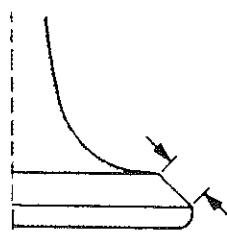
When twisting cutter, apply light downward pressure with finger tips on each end of T-bar, and twist one direction evenly to prevent chatter marks.



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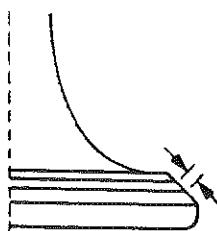
Cut sections as follows	
Section	Cutter
A	10°
B	45°
C	60°

A



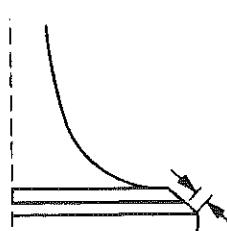
SM-03-225

B



SM-03-226

C



SM-03-227

Valve seat refacing steps:

- A** Valve face indicates that valve seat is centered on valve face but is too wide.

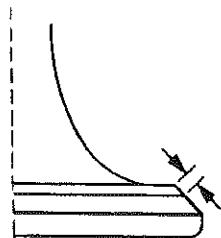
Valve Seat Cutter Set		Desired Result
Use lightly	10° cutter	To reduce valve seat width to 1.0 mm (0.04 in)
	60° cutter	

- B** Valve seat is in the middle of the valve face but too narrow.

Valve Seat Cutter Set		Desired Result
Use	45° cutter	To achieve a uniform valve seat width of 1.0 mm (0.04 in)

- C** Valve seat is too narrow and right up near valve margin.

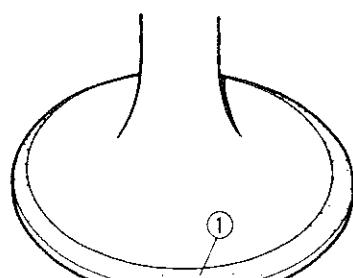
Valve Seat Cutter Set		Desired Result
Use	10° cutter	To center the seat and to achieve its width of 1.0 mm (0.04 in)
	45° cutter	



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D Valve seat is too narrow and is located down near the bottom edge of the valve face.

Valve Seat Cutter Set		Desired Result
Use	60° cutter, first	To center the seat and increase its width.
	45° cutter	



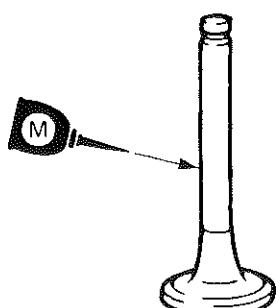
SM-03-229

Valve lapping steps:

- Apply a fine lapping compound ① to the valve face.

CAUTION

Be sure no compound enters the gap between the valve stem and guide.

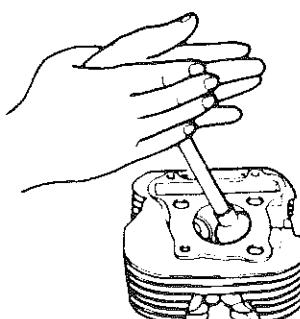


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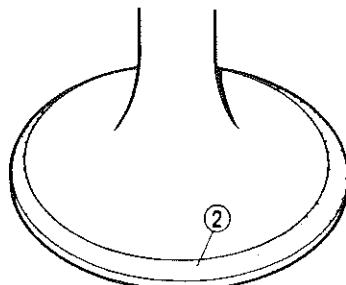
- Apply a molybdenum disulfide oil to the valve stem.
- Install the valve into the cylinder head.
- Turn the valve until the valve face and valve seat are evenly polished, then clean off all compound.

NOTE:

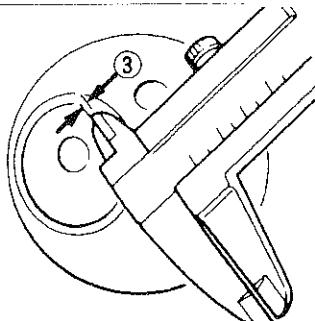
To obtain the best lapping result, lightly tap the valve seat while rotating the valve back and forth between your hand.



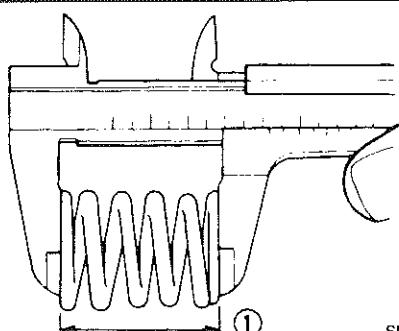
SM-03-231



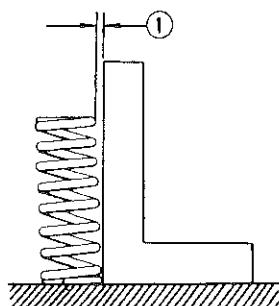
SM-03-232



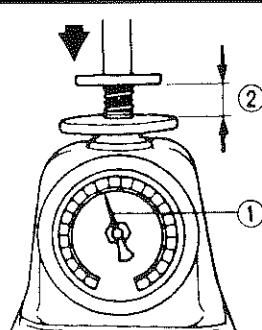
SM-03-233



SM-03-234



SM-03-235



SM-03-236

NOTE:

Be sure to clean off all compound from the valve face and valve seat after every lapping operation.

- Apply the Mechanic's bluing dye (Dykeim) ② to the valve face.
- Install the valve into the cylinder head.
- Press the valve through the valve guide and onto the valve seat to make a clear pattern.
- Measure the valve seat width ③ again. If the valve seat width is out of specification, reface and lap the valve seat.

VALVE SPRING

1. Measure:

- Spring free length ①
Out of specification → replace



**Valve Spring Free Length Limit
(IN/EX):**

36.2 mm (1.425 in)

2. Measure:

- Spring tilt ①
Out of specification → replace



Tilt Limit:

2.5° or 1.6 mm (0.063 in)

3. Measure:

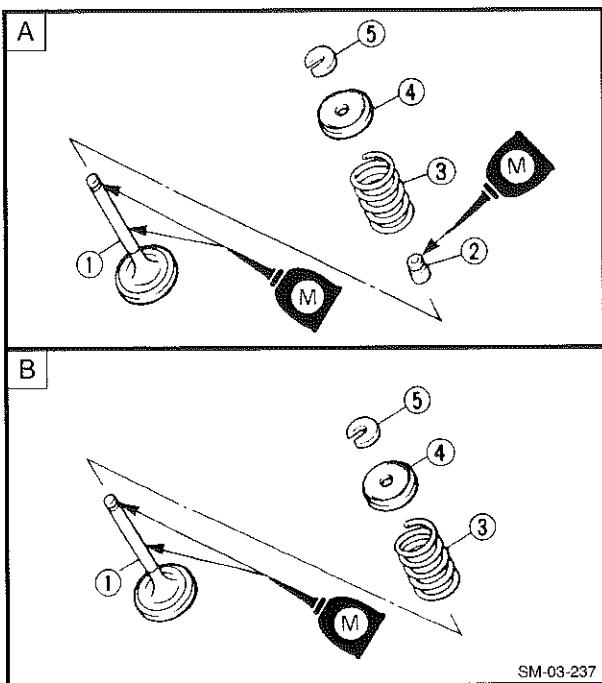
- Spring force (Installed length)
Out of specification → replace



Valve Compressed Force Limit:

Intake: 7.0 kg (15.41 lb)

Exhaust: 9.0 kg (19.81 lb)

**VALVE INSTALLATION**

1. Lubricate
 - Valve stem
 - Oil seal
 - Valve stem end

High-Quality Motor Oil or
Molybdenum Disulfide Grease

2. Install:
 - Valve (1)
 - Oil seal (2)
 - Valve spring (3)
 - Valve spring seat (4) (Upper)
 - Valve retainer (5)

Use the Valve Spring Compressor.

■ INTAKE

■ EXHAUST

Valve Spring Compressor:
YM-1253

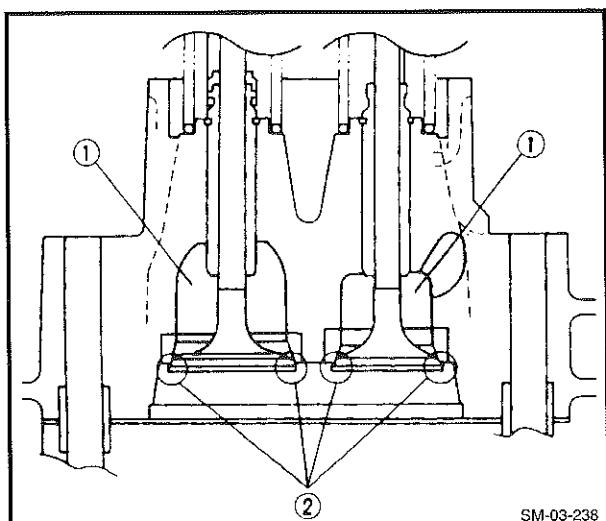
5

3. Check:

- Valve sealing

Leakage at valve seat → reface, relap or
replace valve

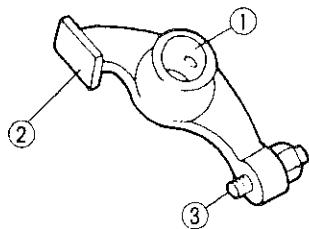
Refer to "VALVE SEAT" section.

**Valve seat checking steps:**

- Pour a clean solvent (1) into the intake and exhaust ports.
- Check the valve sealing, there should be no leakage at the valve seat (2).

Relapping steps:

- Disassemble head parts.
- Repeat lapping steps using fine lapping compound.
- Clean all parts thoroughly.
- Reassemble and check for leakage again using solvent.
- Repeat steps as often as necessary to effect a satisfactory seal.



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ROCKER ARM

1. Inspect:

- Rocker arm shaft hole ①
 - Valve contact surface ②
 - Adjuster surface ③
- Wear/Pitting/Scratches/Blue discoloration
→ replace

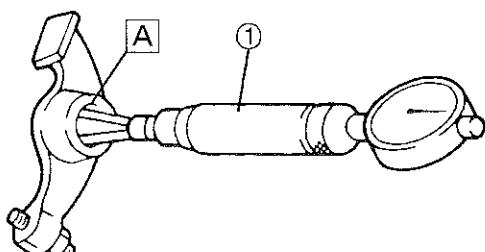


SM-03-240

2. Inspect:

• Rocker arm shaft

Groove can be felt (bearing surface), Blue discoloration (rocker arm shaft) → replace then inspect lubrication system



SM-03-241

3. Measure:

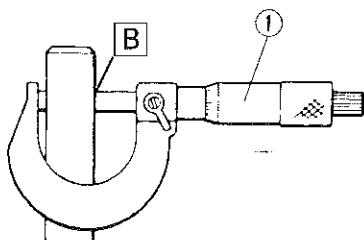
• Rocker arm inside diameter ④

Use a Bore gauge ④.

Out of specification → replace

**Rocker Arm Inside Diameter:**

A 12.00 ~ 12.02 mm
(0.472 ~ 0.473 in)



SM-03-242

4. Measure:

• Rocker arm shaft outside diameter ⑤

Use a Micrometer ⑤.

Out of specification → replace

**Rocker Arm Shaft Outside Diameter:**

B 11.90 ~ 11.99 mm
(0.469 ~ 0.472 in)

5. Measure:

• Rocker arm/Rocker arm shaft clearance

Calculate clearance by subtracting
inside diameter **A** of rocker arm from
outside diameter **B** of rocker shaft.

**Rocker Arm-Rocker Arm Shaft**

Clearance = A - B :

0.01 ~ 0.07 mm

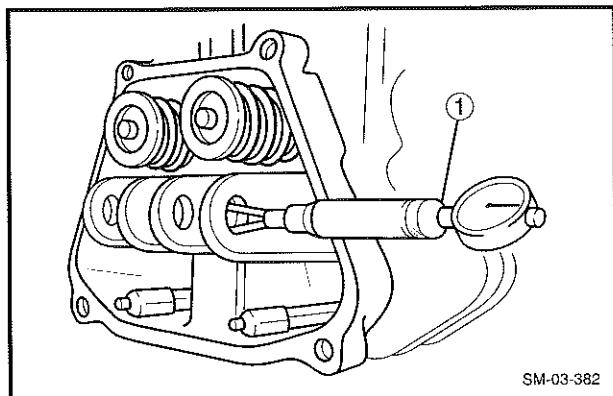
(0.0004 ~ 0.0028 in)

< Limit: 0.12 mm (0.0047 in) >



6. Inspect:

- Rocker arm shaft support hole
Wear/Pitting/Scratches/Blue discoloration
→ replace



7. Measure:

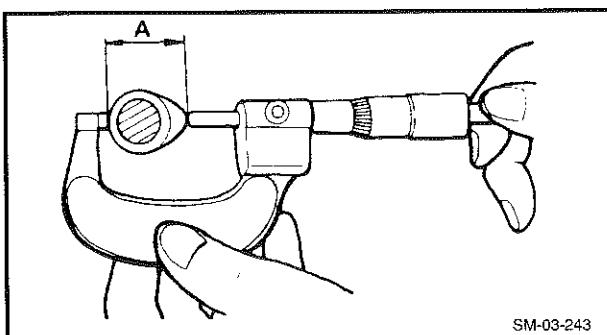
- Rocker arm shaft support inside diameter
Use a Bore Gauge ①.
Out of specification → replace

**Rocker Arm Shaft Support****Inside Diameter:**

12.00 ~ 12.14 mm
(0.472 ~ 0.478 in)

**Rocker Arm Shaft-Rocker Arm
Shaft Support Clearance:**

Limit: 0.24 mm (0.0094 in)

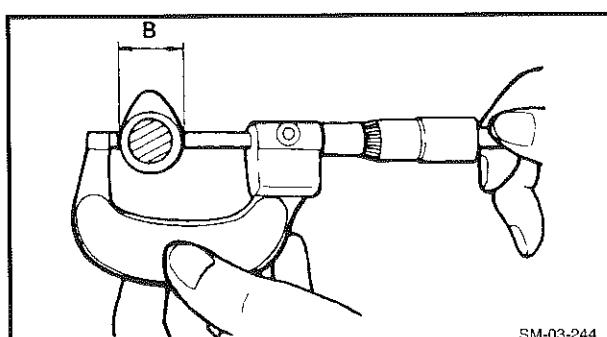
**CAMSHAFT**

1. Inspect:

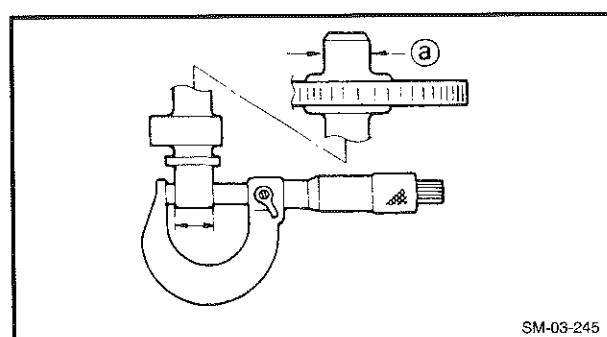
- Cam lobes
Pitting/Scratches/Blue discoloration
→ replace

2. Measure:

- Cam lobes
Use Micrometer.
Out of specification → replace



	Cam Lobe "A"	Cam Lobe "B"
In	32.495 ~ 32.595 mm (1.279 ~ 1.283 in)	26.029 ~ 26.129 mm (1.024 ~ 1.028 in)
Ex	32.495 ~ 32.595 mm (1.279 ~ 1.283 in)	26.029 ~ 26.129 mm (1.024 ~ 1.028 in)



3. Measure:

- Camshaft bearing surface diameter ④
Use a micrometer.
Out of specification → replace camshaft
- Camshaft pivot inside diameter:
Out of specification → replace crankcase cover and/or crankcase



Camshaft Bearing Surface Diameter:

15.90 ~ 15.97 mm

(0.625 ~ 0.628 in)

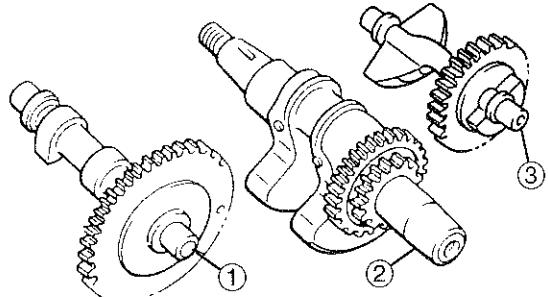
Camshaft Pivot inside Diameter:

16.00 ~ 16.05 mm

(0.630 ~ 0.632 in)

Clearance Limits:

0.03 ~ 0.15 mm (0.001 ~ 0.005 in)



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GEARS

1. Inspect:

- Gear teeth
- Blue Discoloration/Pitting /Wear
→ replace

① Camshaft

② Crankshaft

③ Balancer shaft

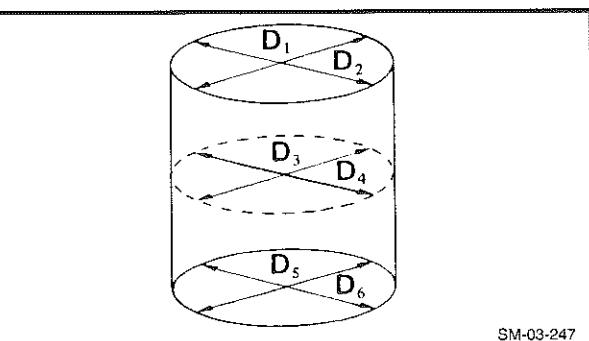
CYLINDER AND PISTON

1. Inspect:

- Cylinder and piston walls
- Vertical scratches → rebore or replace cylinder and piston

2. Measure:

- Piston-to-cylinder clearance



SM-03-247

Piston-to-cylinder clearance measurement steps:

First step:

- Measure the cylinder bore "D" with a cylinder Bore Gauge.

NOTE:

Measure the cylinder bore "D" in parallel to and at right angles to the crankshaft. Then, find the average of the measurements.



Cylinder Bore "D":

85.00 ~ 85.02 mm (3.346 ~ 3.347 in)

< Limit: 85.05 mm (3.348 in) >

Taper Limit "T":

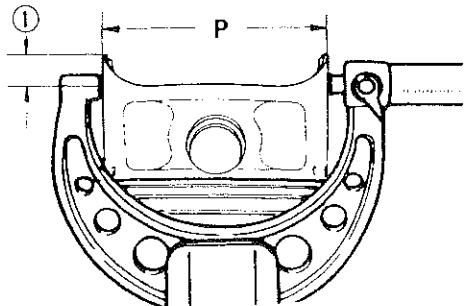
0.15 mm (0.006 in)

Out of Round Limit "R":

0.15 mm (0.006 in)

D = Maximum Diameter

T = (Maximum D₁ or D₂) – (Maximum D₅ or D₆)



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$$R = (\text{Maximum } D_1, D_3 \text{ or } D_5) - (\text{Minimum } D_2, D_4 \text{ or } D_6)$$

- If out of specification, re bore or replace the crankcase assembly and replace the piston and piston ring as a set.

Second step:

- Measure the piston skirt diameter "P" with a micrometer.

① 5 mm (0.20 in) from the piston bottom edge

**Piston Outside Diameter "P"**

Standard	84.96 ~ 84.98 mm (3.345 ~ 3.346 in)
Oversize 1	85.25 mm (3.356 in)
Oversize 2	85.50 mm (3.366 in)

- If out of specification, replace the piston and piston rings as a set.

Third step:

- Calculate the piston-to-cylinder clearance with following formula:

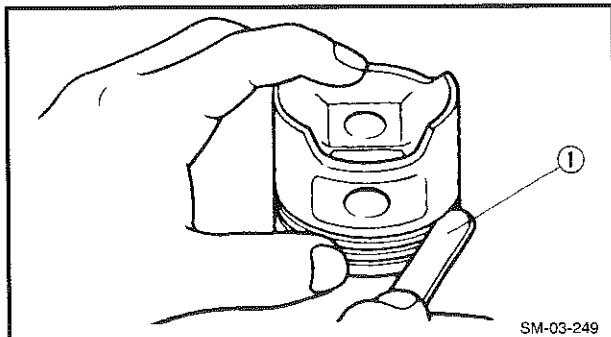
$$\text{Piston-to-cylinder Clearance} = \text{Cylinder Bore "C"} - \text{Piston Skirt Diameter "P"}$$

- If out of specification, re bore or replace the crankcase assembly and replace the piston and piston ring as a set.



Piston-to-cylinder Clearance:
0.03 ~ 0.05mm.
(0.0012 ~ 0.0020 in)
< Limit: 0.10 mm (0.0039 in) >

5



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PISTON RING AND PIN**Piston Ring**

1. Measure:

- Side clearance

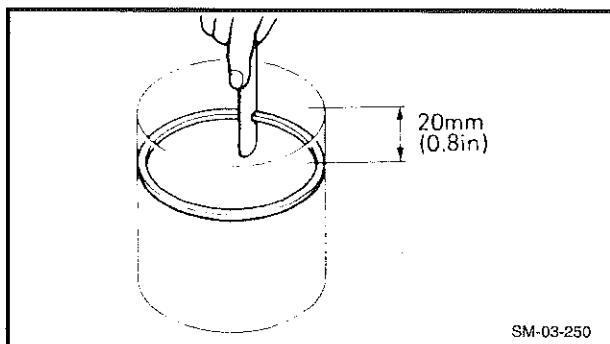
Use the Feeler Gauge ①

Out of specification → replace piston and/or rings

**NOTE:**

Decarbon the piston ring grooves and rings before measuring the side clearance.

	Side Clearance	
	Standard	Limit
Top Ring	0.04 ~ 0.08 mm (0.0015 ~ 0.0031 in)	0.10 mm (0.0039 in)
2nd Ring	0.03 ~ 0.07 mm (0.001 ~ 0.003 in)	0.09 mm (0.004 in)

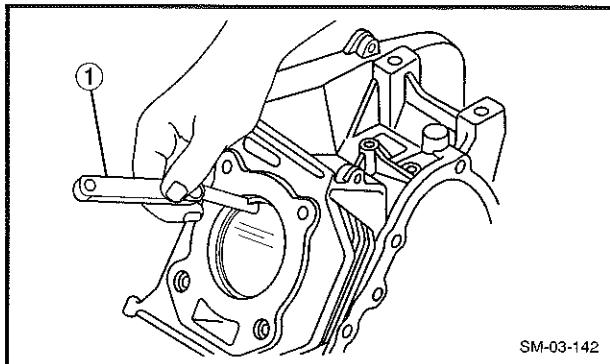


2. Position:

- Piston ring
Into cylinder

NOTE:

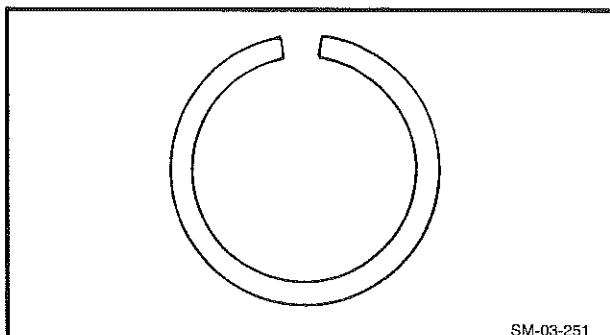
Insert each ring, one at a time, into the cylinder, and push it approximately 20 mm (0.8 in) into the cylinder. Push the ring with the piston crown so that the ring will be at a right angle to the cylinder bore.



3. Measure:

- End gap
Use a Feeler Gauge ①
Out of specification → replace rings as set

	End Gap	
	Standard	Limit
Top Ring	0.25 ~ 0.4 mm (0.010 ~ 0.016 in)	1.0 mm (0.04 in)
2nd Ring	0.25 ~ 0.4 mm (0.010 ~ 0.016 in)	1.0 mm (0.04 in)
Oil Ring	0.2 ~ 0.7 mm (0.008 ~ 0.028 in)	1.3 mm (0.05 in)

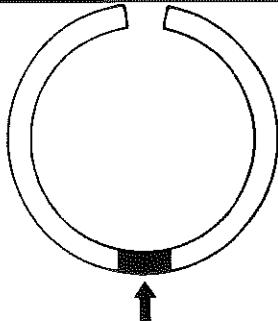
**Piston Ring Oversize**

- Top and 2nd piston ring
Oversize top and middle ring sizes are stamped on top of ring.

Oversize 1	0.25 mm (0.0098 in)
Oversize 2	0.50 mm (0.0197 in)

INSPECTION AND REPAIR

ENG



SM-03-252

- Oil control ring

Expander spacer of bottom ring (oil control ring) is color-coded to identify sizes.

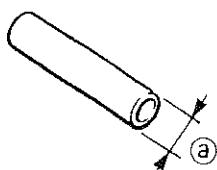
Size	Color
Oversize 1	White
Oversize 2	Blue

Piston Pin

1. Inspect:

- Piston pin

Blue discoloration/Grooves → replace
then inspect lubrication system



SM-03-253

2. Measure:

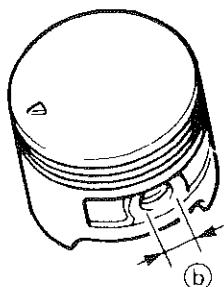
- Outside diameter ② (Piston pin)
- Out of specification → replace



Outside Diameter (Piston Pin):

19.995 ~ 20.000 mm
(0.7872 ~ 0.7874 in)

5



SM-03-254

3. Measure:

- Piston pin-to-piston clearance
- Out of specification → replace piston

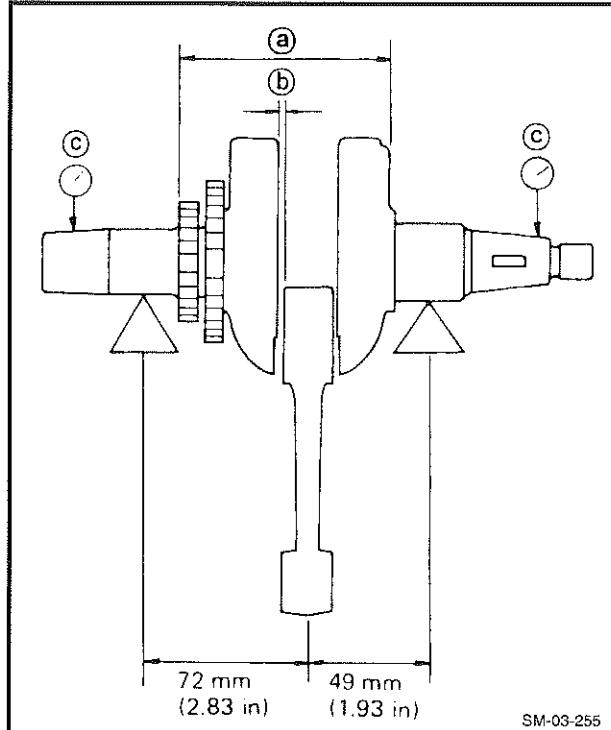
Piston Pin-to-Piston Clearance =

Bore Size (Piston Pin) ③ -
Outside Diameter (Piston Pin) ②



Piston Pin-to-Piston Clearance:

0.004 ~ 0.015 mm
(0.0002 ~ 0.0006 in)
< Limit: 0.07 mm (0.003 in) >



CRANKSHAFT AND CONNECTING ROD

Crankshaft Runout

1. Measure:

- Crankshaft assembly width (a).
- Out of specification → replace crankshaft



Crankshaft Assembly Width (a):

107.20 ~ 107.50 mm
(4.220 ~ 4.232 in)

• Crankshaft deflection (c)

- Use V-blocks and Dial Gauge.
Out of specification → replace



Crankshaft Deflection (c):

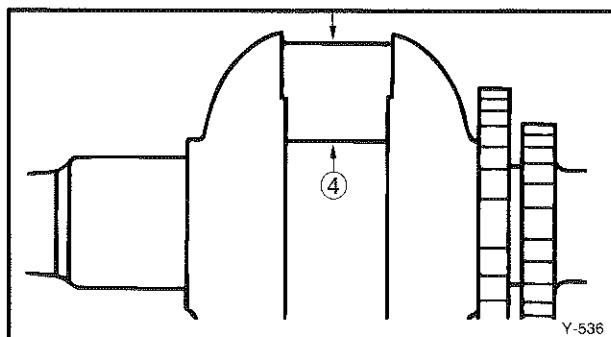
0.05 mm (0.002 in)

- Connecting rod big end side clearance (b).
- Out of specification → replace connecting rod



Big End Side Clearance (b):

0.20 ~ 0.65 mm (0.008 ~ 0.025 in)



Crank Pin Outside Diameter

1. Measure:

- Crank pin outside diameter (4)
- Use a micrometer.
- Out of specification → replace

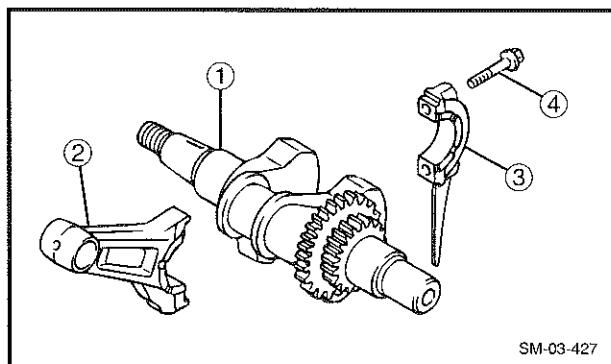


Crank Pin Outside Diameter:

35.97 ~ 35.98 mm
(1.4161 ~ 1.4165 in)

Crank Pin Round or Taper Limit:

0.03 mm (0.0012 in)



Connecting Rod Oil Clearance

1. Clean:

- Crankshaft (1)
- Connecting rod (2) and cap (3)

2. Attach:

- Plastigage®
- Onto the crank pin.



Plastigage

YU-33210

3. Install:

- Connecting rod (2)
- Connecting rod cap (3).

**NOTE:**

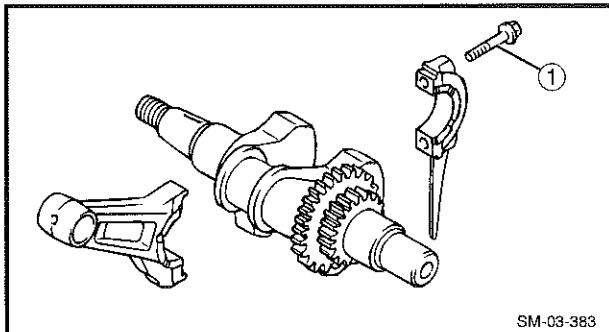
Be sure the arrows on both components align.
Plastigage should be 90° from rod cap to rod seam.

4. Lubricate:

- Connecting rod cap bolt threads



Molybdenum Disulfide Grease or Oil

**5. Tighten:**

- Connecting rod cap bolts ①

NOTE:

Do not turn connecting rod until clearance measurement has been completed.

CAUTION

Tighten to full torque specification without pausing.

5

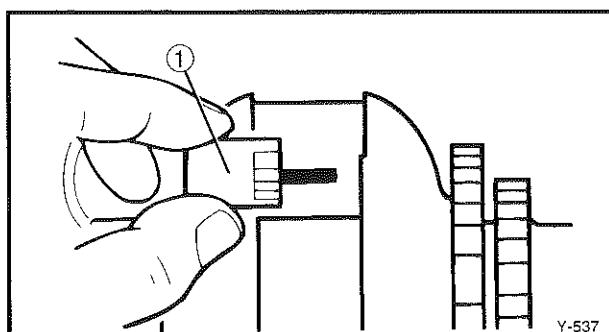
6. Remove:

- Connecting rod cap
- Use care in removing.

7. Measure:

- Width of Plastigage® ①

Out of specification → replace connecting rod and/or replace crankshaft if necessary



Connecting Rod Oil Clearance:

0.016 ~ 0.046 mm

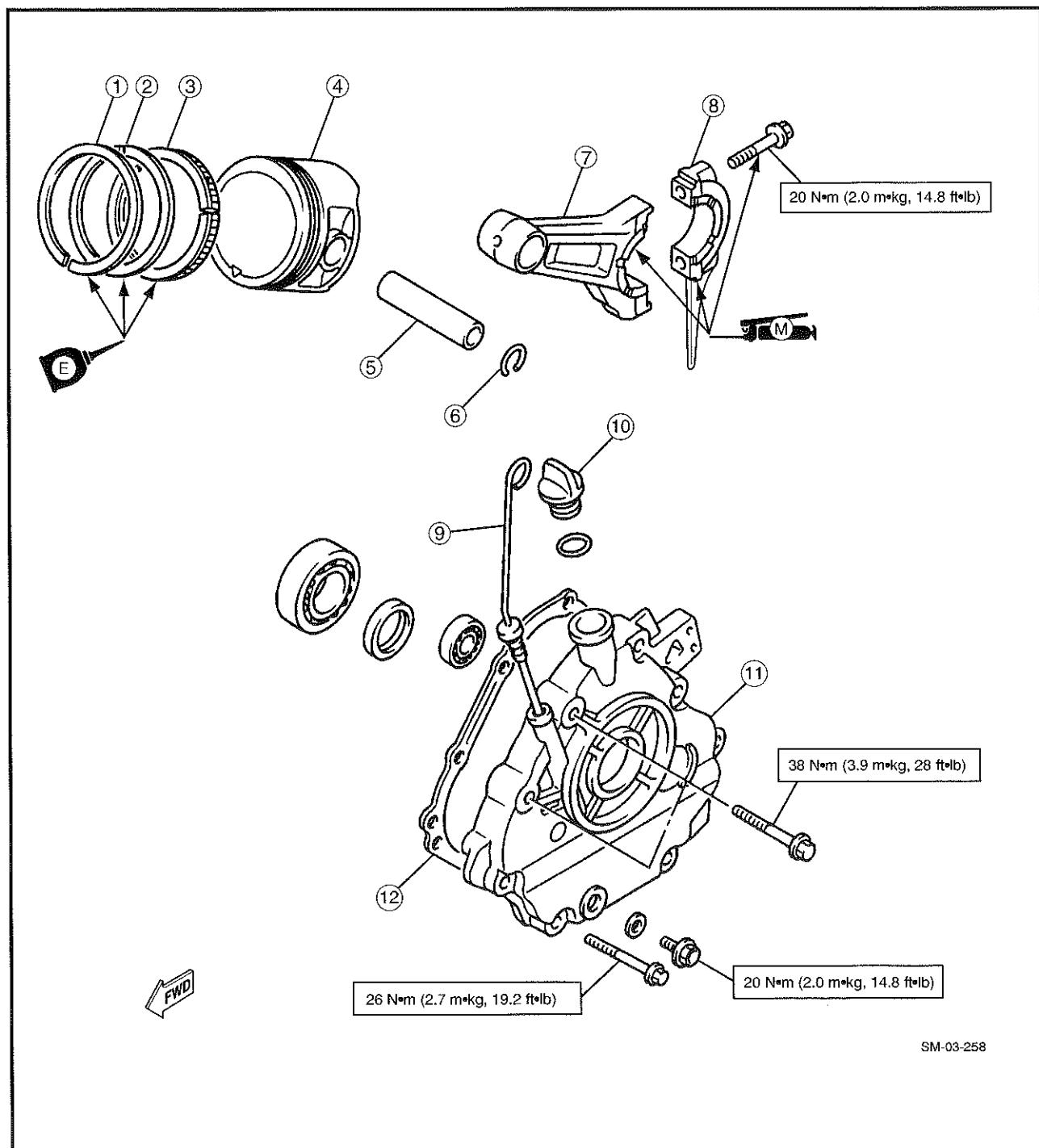
(0.0006 ~ 0.0018 in)

< Limit: 0.1 mm (0.004 in) >



PISTON, CONNECTING ROD, AND CRANKCASE COVER

- | | |
|--------------------|-------------------|
| ① Top ring | ⑦ Connecting rod |
| ② 2nd ring | ⑧ Rod cap |
| ③ Oil control ring | ⑨ Dip stick |
| ④ Piston | ⑩ Filler cap |
| ⑤ Piston pin | ⑪ Crankcase cover |
| ⑥ Piston pin clip | ⑫ Gasket |



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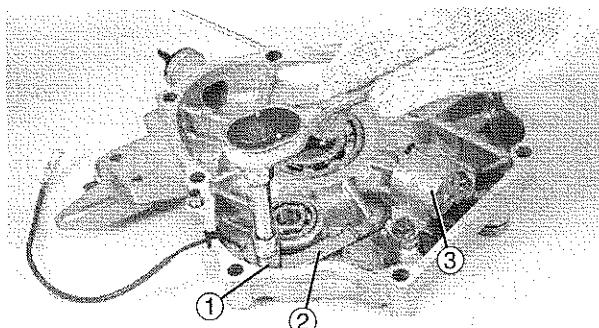


INSTALLATION

BEARINGS

1. Install:

- Bearings using a press. Lubricate races and bearings to ease assembly.

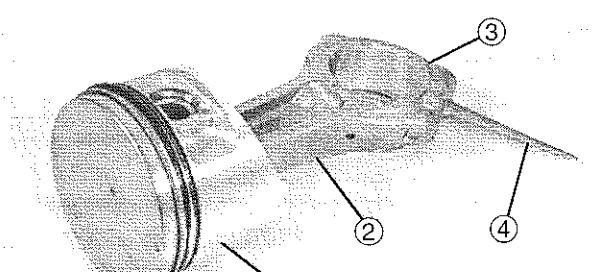
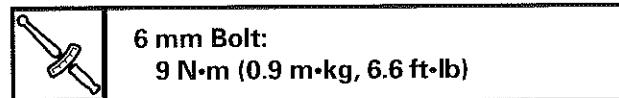


Y-605

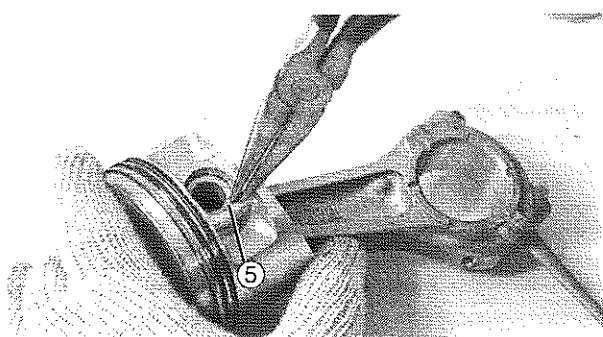
OIL SENDER AND WIRE GUIDE PLATE

1. Install:

- Oil sender ③
- Wire guide plate ②
- Bolts ①



Y-805



Y-806

PISTON AND CONNECTING ROD

1. Install:

- Piston rings onto the piston using a piston ring expander.

NOTE:

Be sure to install the rings so that manufacturer's marks or numbers are located on the top side of the rings. Oil the pistons and rings liberally.

5

NOTE:

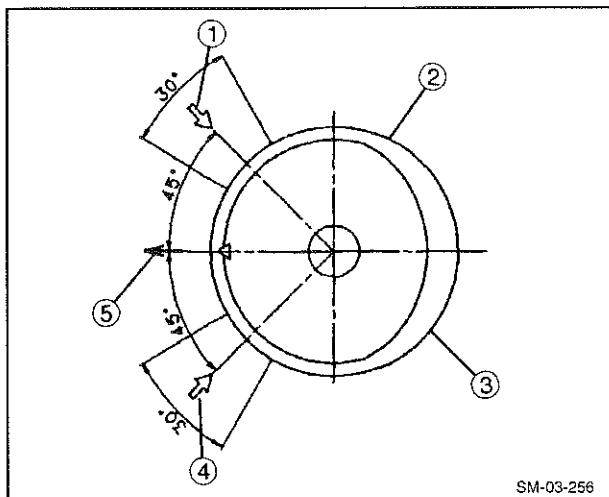
- Arrow on piston top ① faces front of engine.
- "YAMAHA" casting ② faces primary clutch side of engine.
- Match arrows on rod and rod cap ③.
- Splasher ④ points to bottom of engine.
- Always install new piston pin clips ⑤.

2. Install:

- Piston clip ⑤

3. Oil liberally:

- Piston
- Rings
- Cylinder
- Piston Pin



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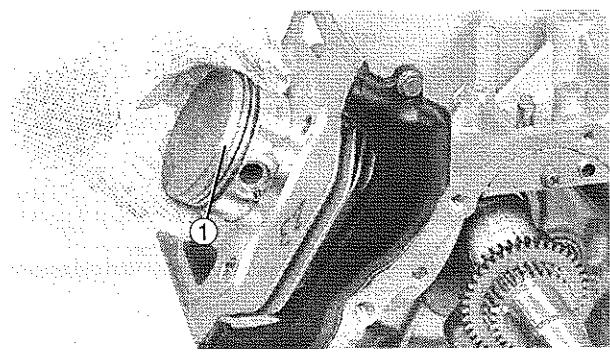
4. Set:

- Piston ring ends

NOTE: _____

Make sure the ends of the oil ring expander does not overlap.

- ① Top ring
- ② Oil ring (lower rail)
- ③ Oil ring (upper rail)
- ④ 2nd ring
- ⑤ Arrow mark



Y-603

5. Install:

- Piston/Connecting rod (1) into cylinder using a piston ring compressor.

NOTE: _____

The arrow mark on the piston should face toward the front of the engine (push rod side).



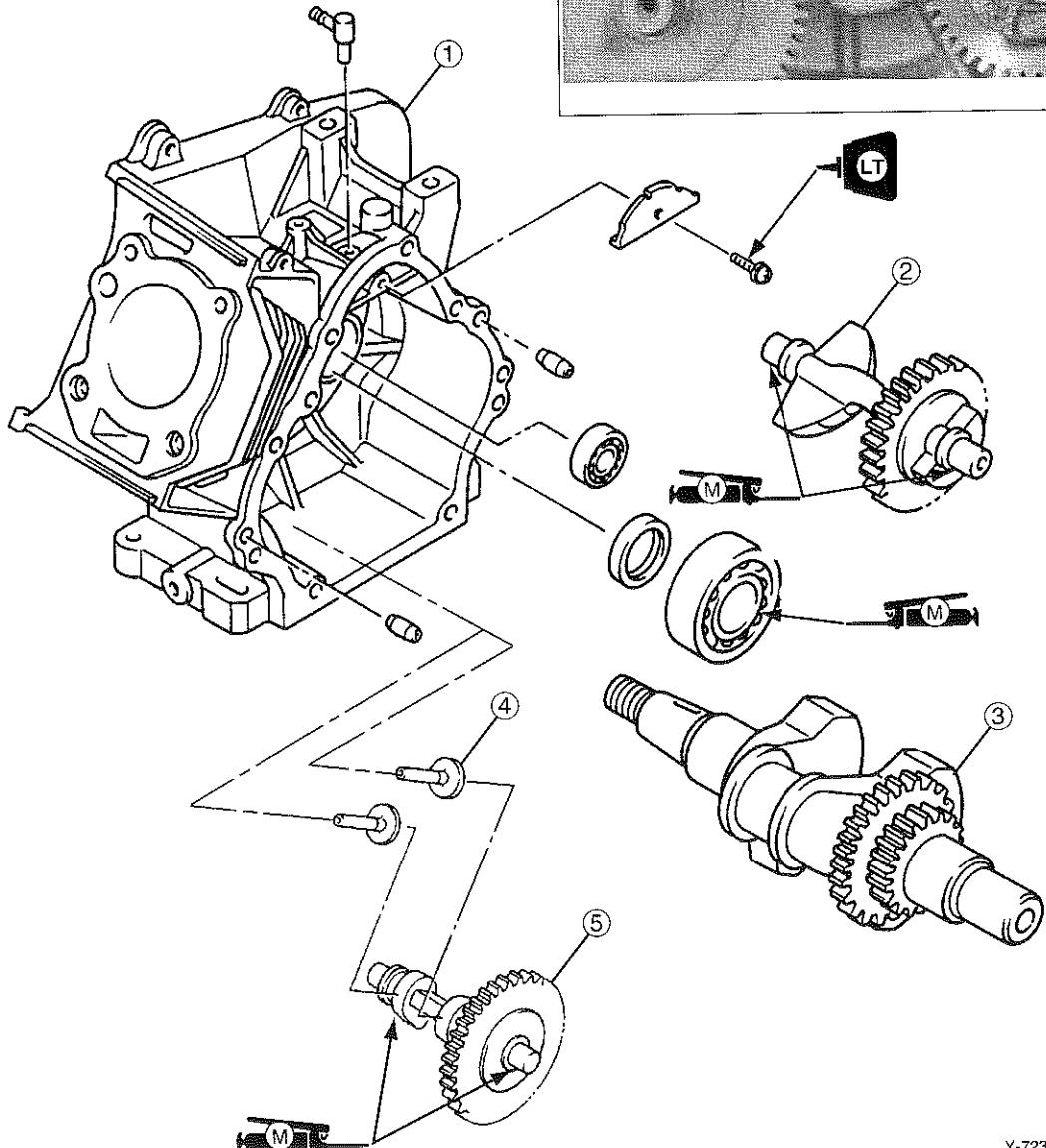
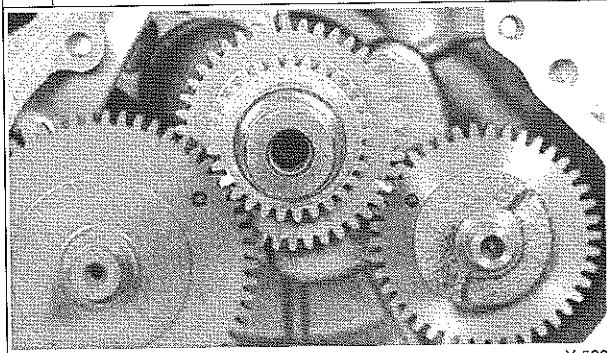
Piston Ring Compressor:
YU-33294

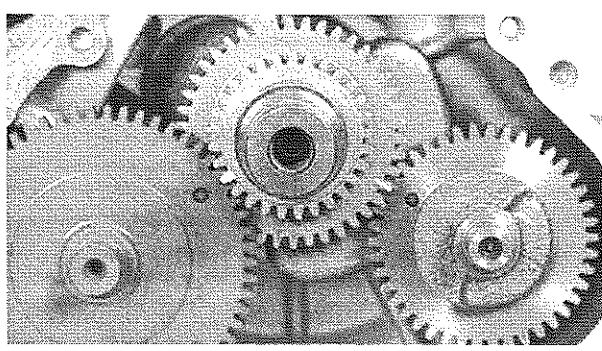
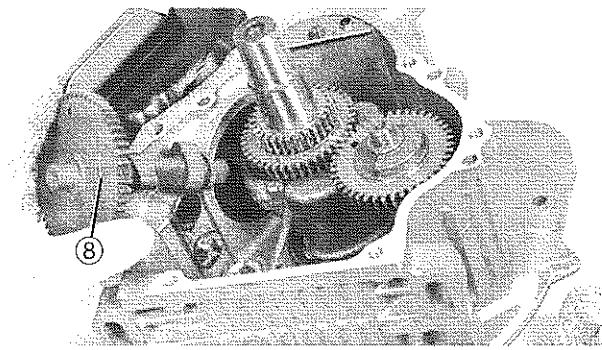
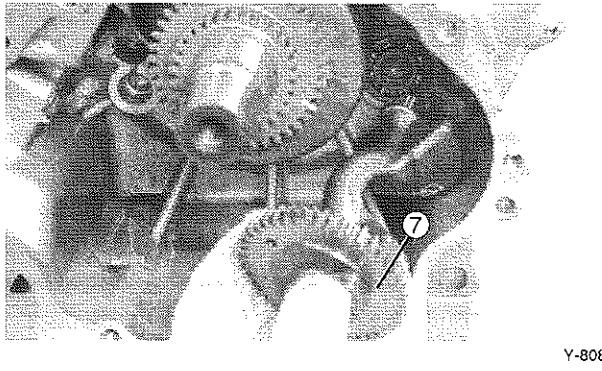
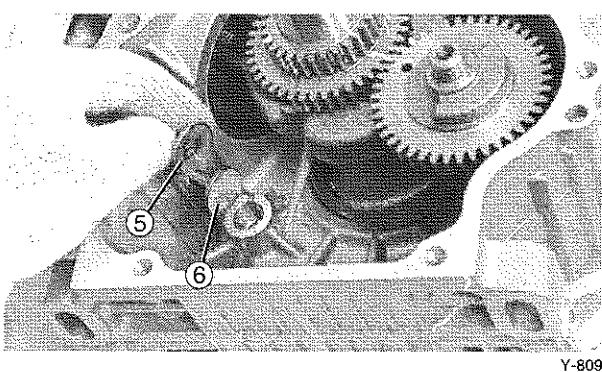
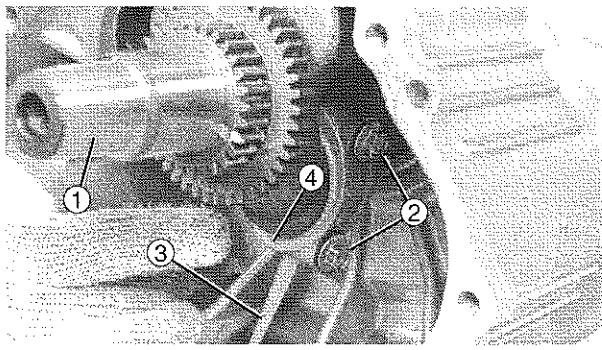


CRANKSHAFT, BALANCER SHAFT, AND CAMSHAFT

- ① Crankcase
- ② Balancer shaft
- ③ Crankshaft
- ④ Tappet
- ⑤ Camshaft

A | TIMING GEAR ALIGN MARK:





CRANKSHAFT, BALANCER SHAFT, AND CAMSHAFT

1. Install:

- Crankshaft (1)
- Connecting rod cap (3)
- Connecting rod cap bolts (2)

NOTE:

Make sure splasher (3) is pointing down and arrows (4) on cap match.

2. Lubricate:

- Connecting rod bolt threads



Molybdenum Disulfide Grease



Connecting Rod Bolts:
20 N·m (2.0 m·kg, 14.8 ft·lb)

- Tappets (Exhaust (5)/Intake (6))

NOTE:

Be sure the tappets are fully installed.

3. Install:

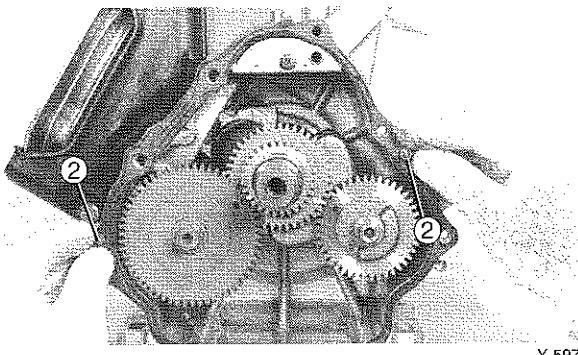
- Balancer shaft (7)
- Camshaft (8)

NOTE:

Align the hole in the camshaft gear with the punch mark on the crankshaft cam gear. Align the hole in the balancer shaft gear with the punch mark on the crankshaft balancer gear.

NOTE:

Do not turn the crankshaft in this position until the rocker arms are installed.



Y-597

CRANKCASE COVER

1. Install:

- Dowel pins ②
- Gasket (New)

2. Install:

- Crankcase cover

NOTE: _____

Follow the numbers for tightening sequence shown in photo. Bolts ③ and ⑤ are 10 mm thread size.



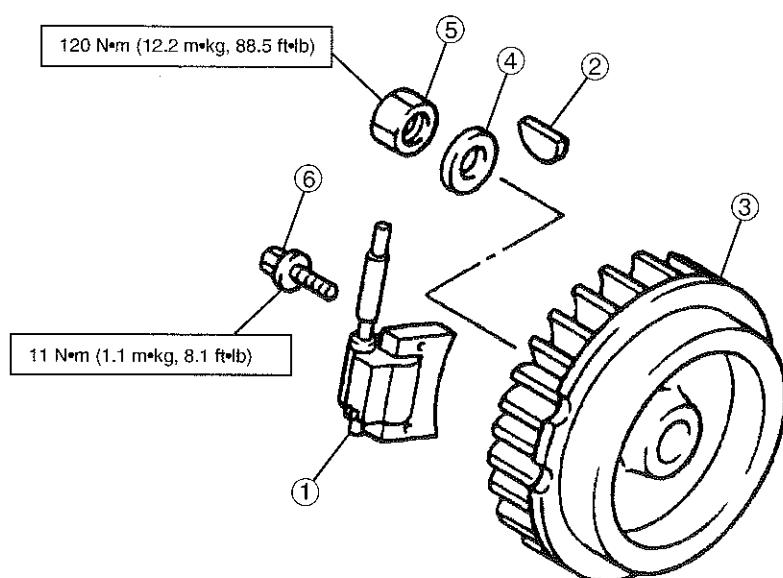
Y-730

Crankcase Cover Bolt :

8 mm: 26 N·m (2.7 m·kg, 19.2 ft·lb)
10 mm: 38 N·m (3.9 m·kg, 28 ft·lb)

**FLYWHEEL**

- ① T.C.I. unit
- ② Woodruff key
- ③ Flywheel
- ④ Spring washer
- ⑤ Nut
- ⑥ Bolt



**FLYWHEEL**

1. Remove any oil and/or grease from the tapered portion of crankshaft and flywheel with a non-oily solvent.

3. Install:

- Woodruff key
- Flywheel
- Washer
- Spring Washer
- Nut

4. Tighten:

- Flywheel securing nut

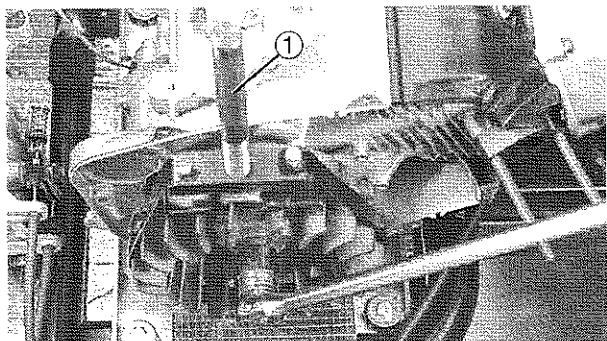
Use the Primary Sheave Holder ①.

**Flywheel Securing Nut:**

120 N·m (12.2 m·kg, 88.5 ft·lb)

**Primary Sheave Holder:**

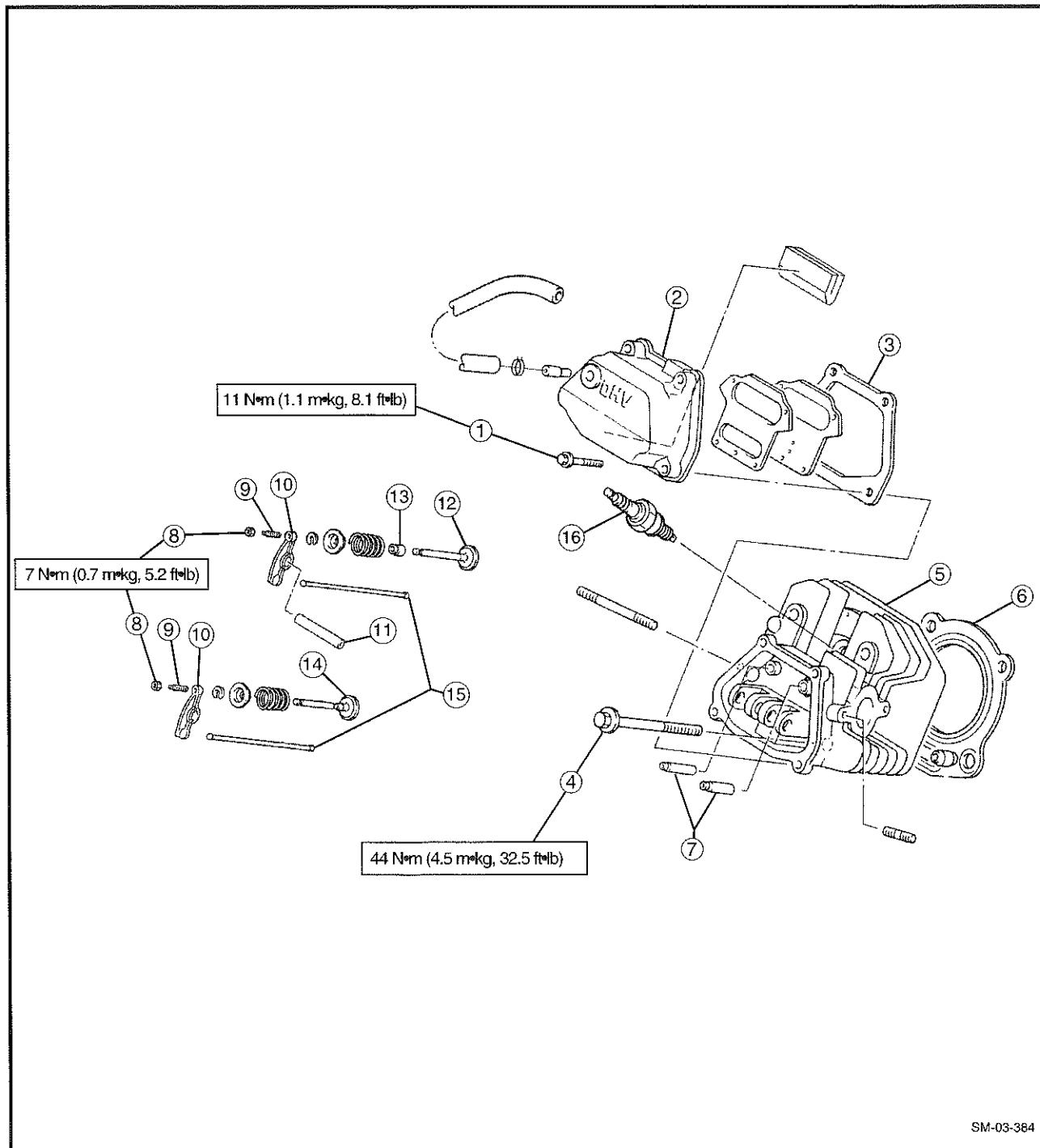
YS-1800-A



Y-589

**CYLINDER HEAD AND ROCKER ARM**

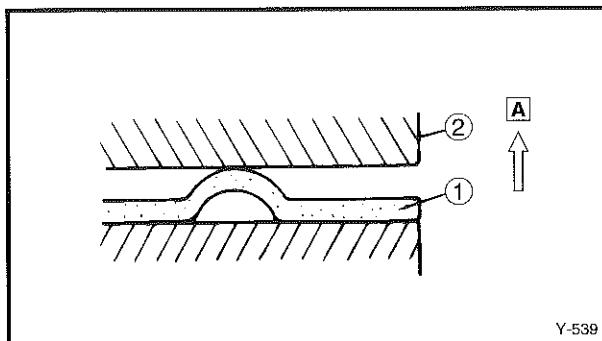
- | | |
|------------------------------|---------------------------|
| ① Cylinder head cover bolts | ⑨ Valve adjustment screws |
| ② Cylinder head cover | ⑩ Rocker arms |
| ③ Cylinder head cover gasket | ⑪ Rocker arm shaft |
| ④ Cylinder head bolts | ⑫ Intake valve |
| ⑤ Cylinder head | ⑬ Intake valve stem seal |
| ⑥ Cylinder head gasket | ⑭ Exhaust valve |
| ⑦ Valve guides | ⑮ Push rods |
| ⑧ Valve adjustment lock nuts | ⑯ Spark plug |



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ENGINE ASSEMBLY AND ADJUSTMENT

ENG



Y-539

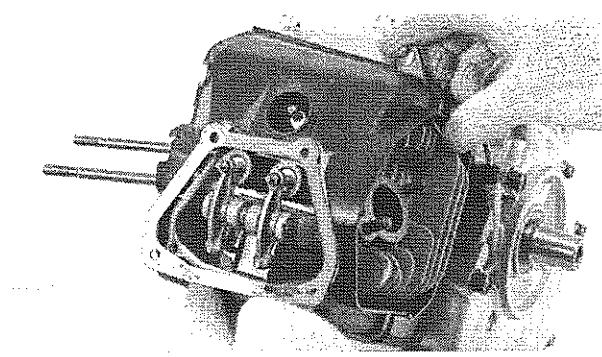
CYLINDER HEAD

1. Install:

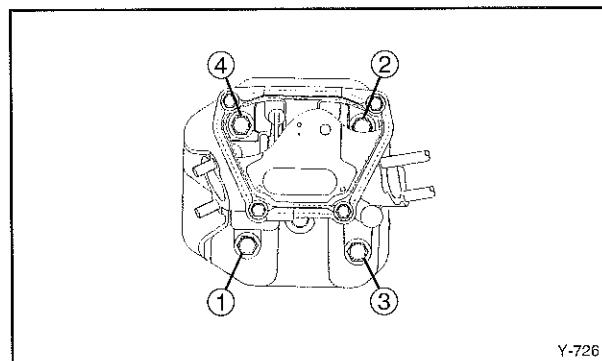
- Dowel pins
- Gasket (New) ①
- Cylinder head ②
- Bolts

NOTE:

The swelling side of the new gasket ① should face upward A.



Y-591



Y-726

NOTE:

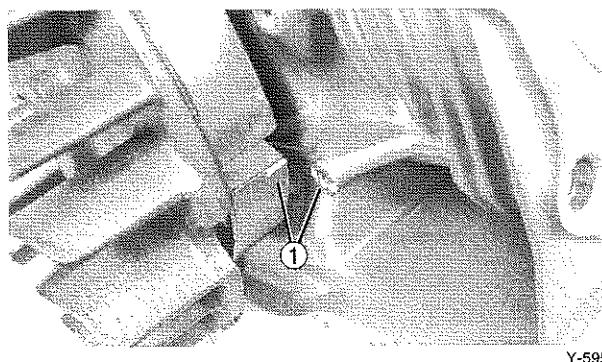
Tighten the bolts in sequence as shown and torque the bolts in two stages.



Bolt (Cylinder Head):

First: 20 N·m (2.0 m·kg, 14.8 ft·lb)
Final: 44 N·m (4.5 m·kg, 32.5 ft·lb)

5

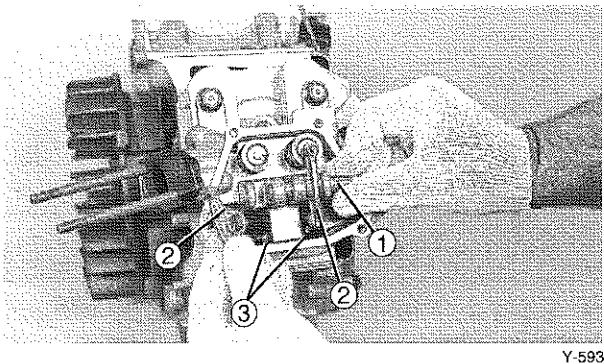


Y-595

- Make sure piston is at TDC ①.

ENGINE ASSEMBLY AND ADJUSTMENT

ENG



Y-593

2. Install:

- Pushrods (Exhaust/Intake) ③
- Rocker shaft ① and arms ②

3. Adjust:

- Valve clearance

Refer to CHAPTER 2 "VALVE CLEARANCE ADJUSTMENT" section.



Valve Clearance (Cold):

Intake and exhaust:

0.08 mm ~ 0.12 mm (0.003 ~ 0.004 in)

4. Install:

- Cylinder air shroud
- Gasket (New)
- Cylinder head cover
- Spark plug

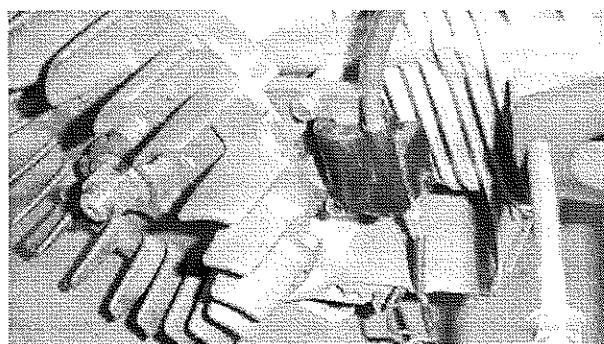


Bolt (Cylinder Head Cover):

11 N·m (1.1 m·kg, 8.1 ft·lb)

Spark Plug:

20 N·m (2.0 m·kg, 14.8 ft·lb)



SM-03-143

IGNITION UNIT

1. Install:

- Ignition unit

NOTE: _____

Rotate flywheel 180° to line up the 2 flywheel cut-aways with the ignition unit bolt holes. Install ignition unit. Pull the unit away from the flywheel while tightening the two bolts.



Ignition Unit Bolt:

11 N·m (1.1 m·kg, 8.1 ft·lb)

NOTE: _____

Rotate the flywheel magnet past the ignition unit to confirm that there is an air gap between the magnet and ignition unit. If not, loosen the bolts and repeat procedure.



T.C.I. Air Gap:

0.3 ~ 0.5 mm (0.012 ~ 0.020 in)

2. Install:

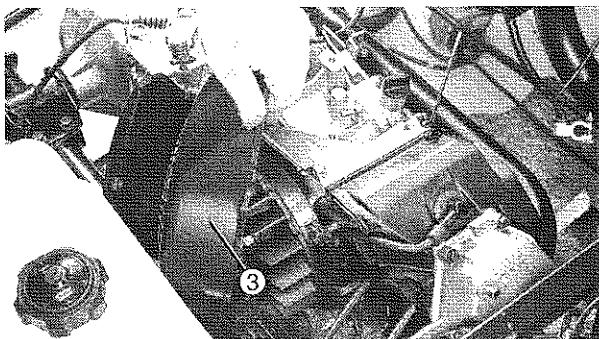
- Spark plug cap



AIR SHROUD

NOTE:

The air shroud may be installed before re-installing the engine in the car.



Y-588

1. Install:

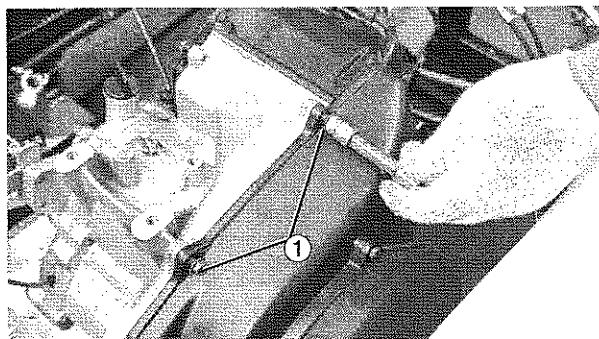
- Flywheel air shroud ③



Bolt (Air Shroud - Side):

8 N·m (0.8 m·kg, 5.9 ft·lb)

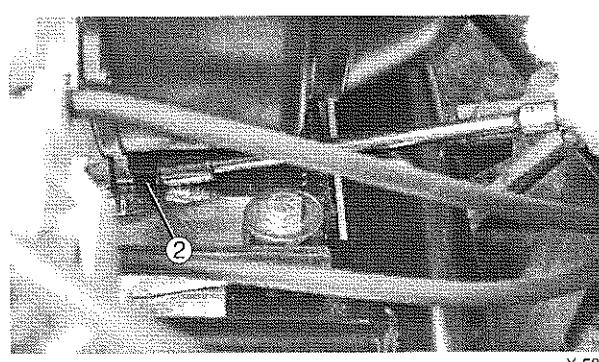
LOCTITE®



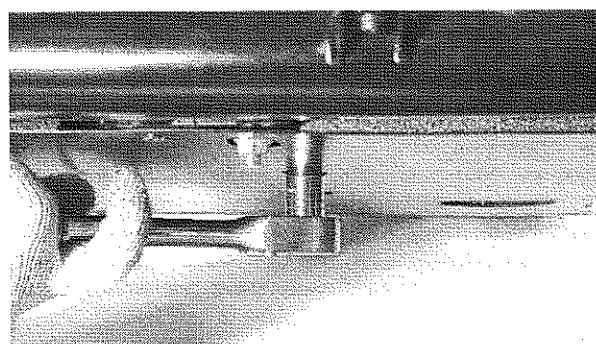
Y-586

- Mounting bolts ① and ②

5



Y-587



Y-594

REMOUNTING ENGINE

Reverse the "ENGINE REMOVAL" procedure.
Note the following points.

1. Install:

- Engine with bolts and special washers
- Mounting nuts



Engine Mounting Nut:

26 N·m (2.7 m·kg, 19.2 ft·lb)



PRIMARY SHEAVE

1. Install:

- Primary sheave assembly

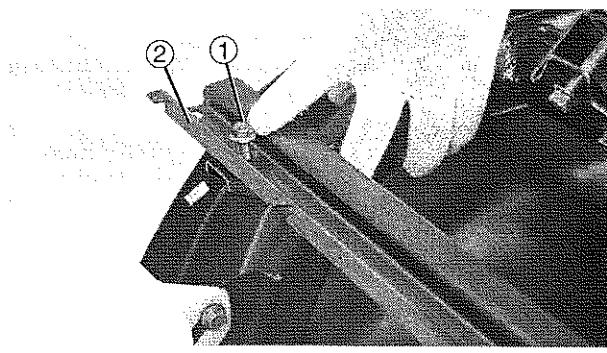
Use the Primary Sheave Holder.

Refer to CHAPTER 4 "PRIMARY SHEAVE - INSTALLATION" section.



Bolt (Primary Sheave):

85 N·m (8.7 m·kg, 62.7 ft·lb)



Y-579

STARTER-GENERATOR

1. Install:

- Seat support (2) and bolts (1)
- Starter-generator
- Bolts and nuts (4) (3)
- V-belt

2. Adjust:

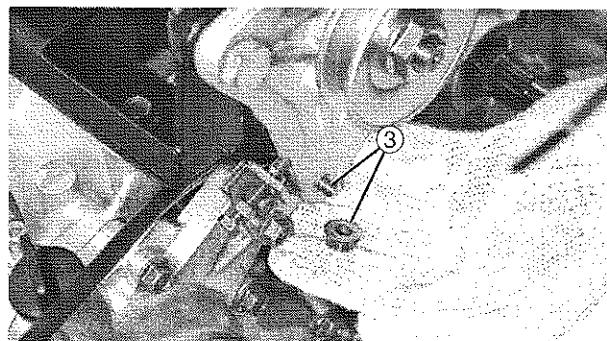
- Belt tension

Refer to CHAPTER 2 "STARTER BELT ADJUSTMENT" section.

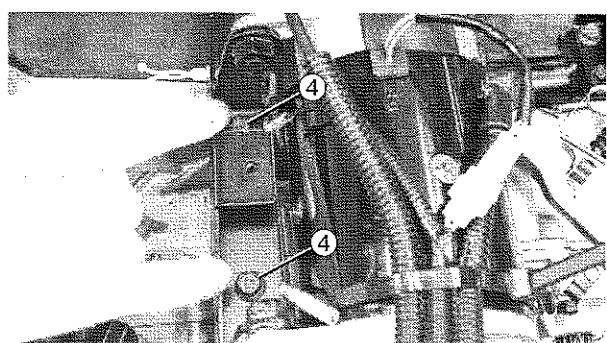


Starter Belt Tension:

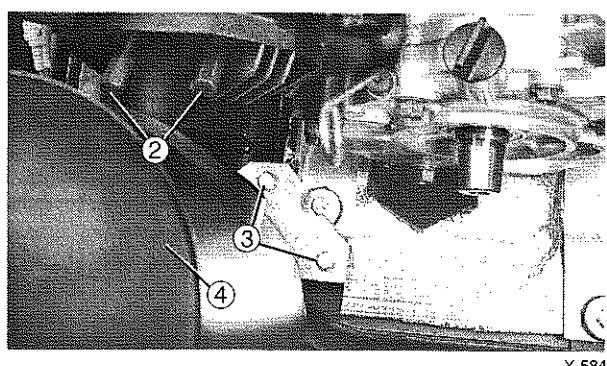
8 ~ 12 mm /10kg
(0.31 ~ 0.47 in/22 lb)



Y-578



Y-581



Y-584

3. Install:

- Muffler assembly (with new gasket (4))
- Muffler mount bolts (3)
- Exhaust pipe holding nuts (2)
- Crankcase pulse hose
- Carburetor
- Air cleaner case

4. Tighten:

- Bolts/Nuts/Screws

ENGINE ASSEMBLY AND ADJUSTMENT

ENG



Exhaust Flange Nut (2):
16 N·m (1.6 m·kg, 11.8 ft·lb)
Muffler Holding Bolts (3):
16 N·m (1.6 m·kg, 11.8 ft·lb)
Carburetor Holding Nut:
6.5 N·m (0.7 m·kg, 4.8 ft·lb)
Spark Plug:
20 N·m (2.0 m·kg, 14.8 ft·lb)

5. Connect:

- Throttle cable
- Choke cable
- Fuel hose

6. Adjust:

- Free play (Throttle cable)
- Free play (Choke cable)

Refer to "THROTTLE CABLE ADJUSTMENT" and "CHOKE CABLE ADJUSTMENT" sections.



Free Play (Throttle Cable):
0.0 ~ 1.0 mm (0.0 ~ 0.4 in)
Free Play (Choke Cable):
1.0 mm (0.04 in)

7. Fill:

- Crankcase

Refer to "ENGINE OIL REPLACEMENT" section.



Recommended Oil:
YAMALUBE 4-cycle oil or SAE 10W30
(If temperature does not go below
2°C (35°F): SAE 20W40)
Oil Change Quantity:
0.9 L (1.0 US qt, 900 cc)
Oil Capacity:
1.0 L (1.16 US qt, 1000 cc)

5

NOTE:

Recommended engine oil classification; API Service SE, SF, or SG. Engine oils labeled "Energy Conserving II" are recommended.

CAUTION

Do not allow foreign material to enter the engine.

NOTES

**CHAPTER 6
CARBURETION**

CARBURETOR	6-3
SECTION VIEW.....	6-4
REMOVAL.....	6-6
DISASSEMBLY	6-6
INSPECTION	6-8
ASSEMBLY.....	6-9
INSTALLATION	6-12

CARBURETION

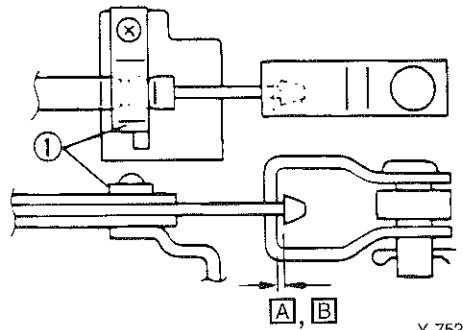
CARBURETOR

- | | |
|-----------------------|----------------------|
| ① Cable housing clamp | ⑧ Cover holding bolt |
| ② Pilot screw (P.S.) | ⑨ Float needle valve |
| ③ Throttle stop screw | ⑩ Pilot jet (P.J.) |
| ④ Main jet (M.J.) | ⑪ Pipe, main bleed |
| ⑤ Main nozzle A | ⑫ Drain screw |
| ⑥ Float | ⑬ Anti-tamper cap |
| ⑦ Float chamber cover | |

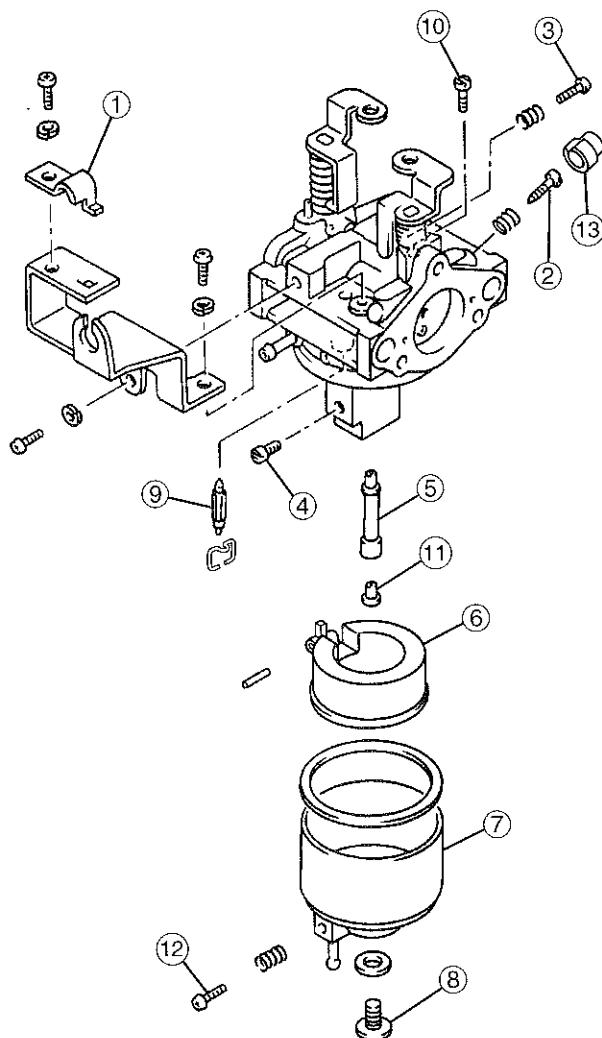
SPECIFICATIONS

Main jet	(M.J.)	#87.5
Main air jet	(M.A.J.)	Ø1.6
Pilot jet	(P.J.)	#65.0
Pilot air jet	(P.A.J.)	Ø0.9
Throttle valve	(Th.V.)	#150
Valve seat	(V.S.)	Ø1.0
By-pass (1)	(B.P.-1)	Ø0.7
By-pass (2)	(B.P.-2)	Ø0.8
By-pass (3)	(B.P.-3)	Ø0.8
Pilot outlet	(P.O.)	Ø1.0
Pilot screw	(P.S.)	1-3/8 turn out
Float height	(F.H.) FIXED	14.5 mm (0.57 in)

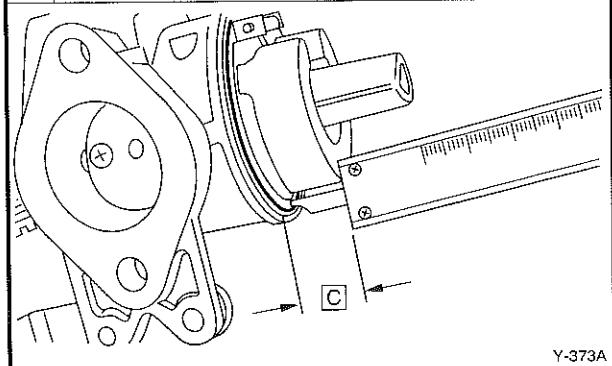
A CHOKE CABLE FREE PLAY:
1.0 mm (0.04 in)



B THROTTLE CABLE FREE PLAY:
0.0 ~ 1.0 mm (0.0 ~ 0.04 in)



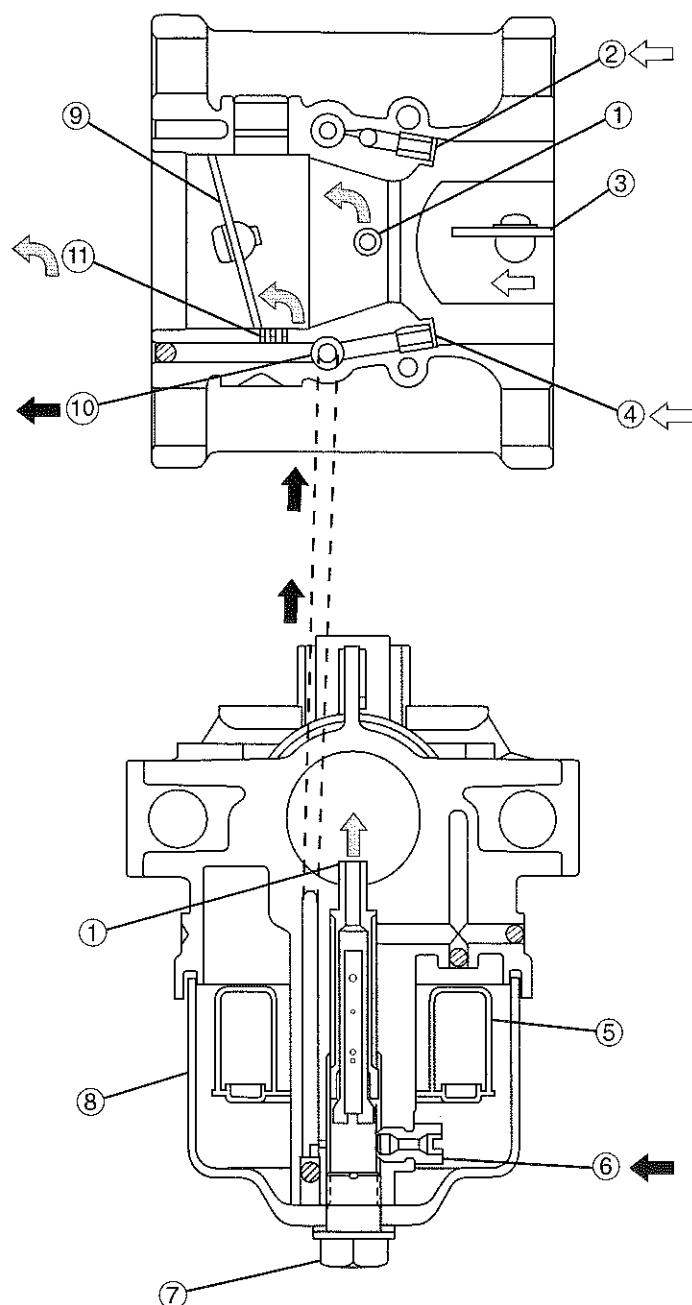
C FLOAT HEIGHT (F.H.):
14.5 mm (0.57 in)



**SECTION VIEW****Main Metering System**

- | | |
|-----------------------|------------------|
| ① Main nozzle | ⑨ Throttle valve |
| ② Main air jet | ⑩ Pilot jet |
| ③ Choke valve | ⑪ Bypass hole |
| ④ Pilot air jet | |
| ⑤ Float | |
| ⑥ Main jet | |
| ⑦ Cover holding bolt | |
| ⑧ Float chamber cover | |

A		AIR
B		MIXTURE
C		FUEL

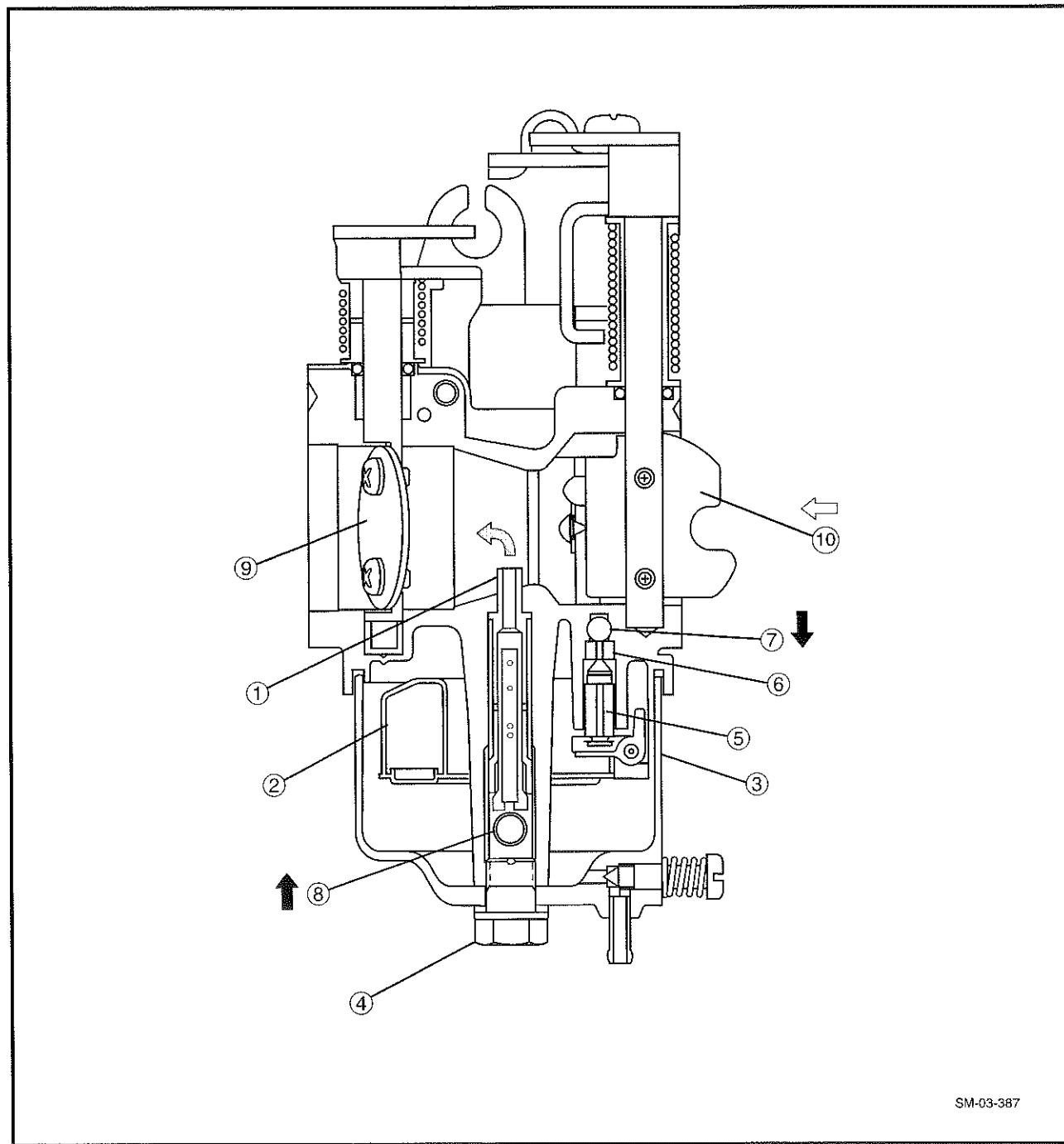


SM-03-386

**Float System**

- | | |
|-----------------------|------------------|
| ① Main nozzle | ⑥ Valve seat |
| ② Float | ⑦ Fuel inlet |
| ③ Float chamber cover | ⑧ Main jet |
| ④ Cover holding bolt | ⑨ Throttle valve |
| ⑤ Needle valve | ⑩ Choke valve |

A		AIR
B		MIXTURE
C		FUEL



6

SM-03-387

**NOTE:**

Refer to CHAPTER 6 "SECTION VIEW" for "Main Metering System" and "Float System" drawings.

CAUTION

The following photos show the carburetor being disassembled/assembled while wearing cotton gloves. To prevent contaminating internal components of the carburetor, do not wear cotton gloves.

REMOVAL

1. Remove:

- Carburetor assembly

Refer to CHAPTER 5 "ENGINE REMOVAL - CARBURETOR" section.

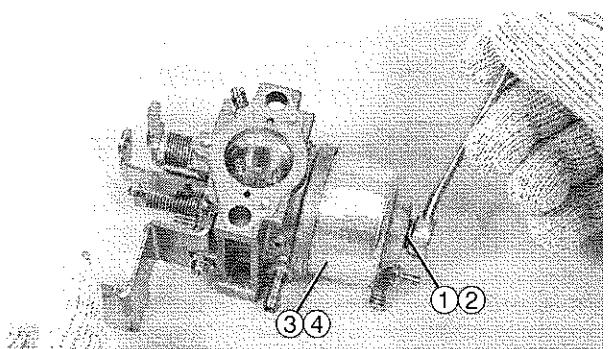
CAUTION

Do not disassemble throttle valve. If throttle valve service is required, replace the carburetor assembly.

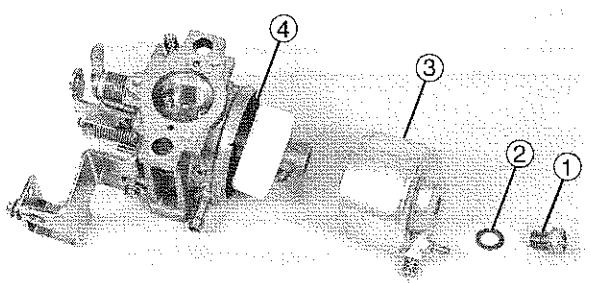
DISASSEMBLY

1. Remove:

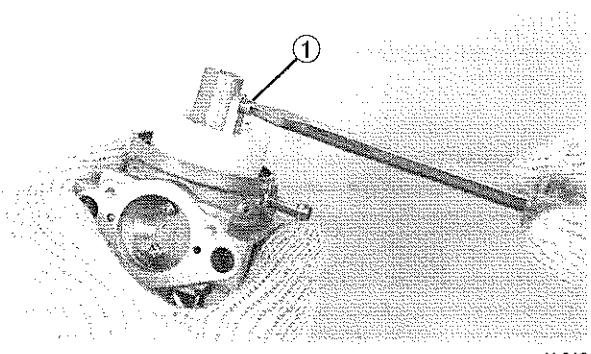
- Cover holding bolt ①
- Gasket ②
- Float chamber cover ③
- Rubber gasket ④



Y-611



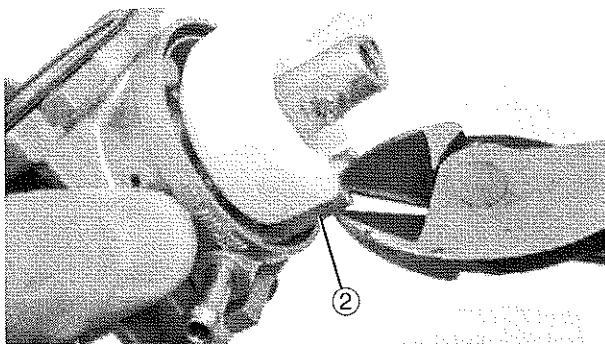
Y-612



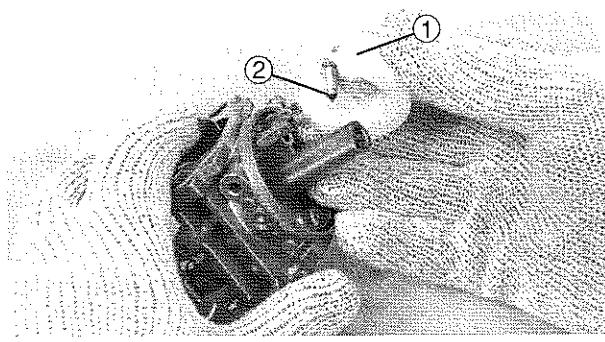
Y-613

2. Remove:

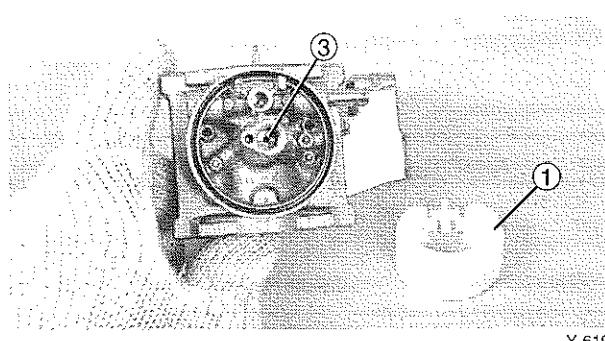
- Main jet ①



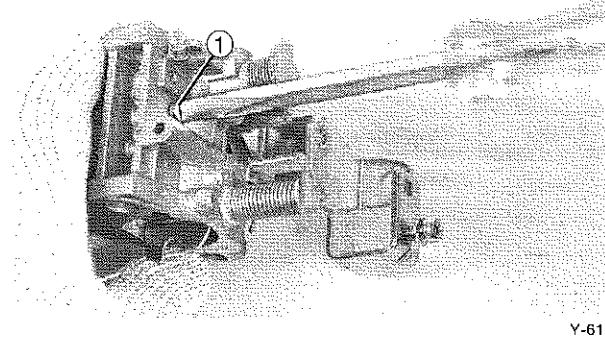
SM-03-144



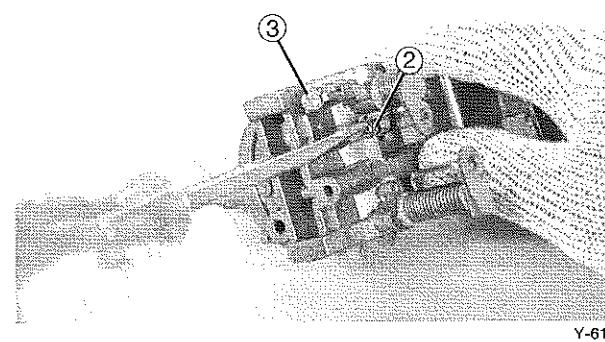
Y-615



Y-619



Y-616



Y-617

3. Remove:

- Float pin (2)

CAUTION

Float pin (2) is staked on one end. When driving out float pin, use a small punch on opposite end of staking. Use care not to break the float stanchions.

4. Remove:

- Float (1)
- Float needle valve (2)
- Main nozzle A (3)

NOTE:

Do not remove the second main nozzle (main nozzle B), which can be seen after nozzle A is removed. Nozzle B is fixed, and may be cleaned in place if required.

6

5. Remove:

- Pilot jet (1)
- Throttle stop screw (2) (with spring)
- Tamper cap and pilot screw (3) (with spring)

**INSPECTION**

1. Inspect

- Carburetor body
 - Fuel passage
- Contamination → clean

NOTE:

- Use a carburetor cleaner for cleaning.
- Blow out all passages and jets with compressed air.

WARNING

Carburetor cleaners are extremely flammable.

- Keep sparks and flames away from work area.
- Follow all cleaner manufacturer's warnings and instructions.
- NEVER use gasoline as a cleaning agent.

2. Inspect:

- Float ①
Damaged → replace
- Rubber gasket
Damaged/Torn → replace
- Needle valve ②
Wear → replace
- Valve seat
Wear/Damage → replace the carburetor body

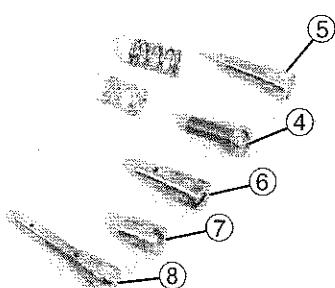
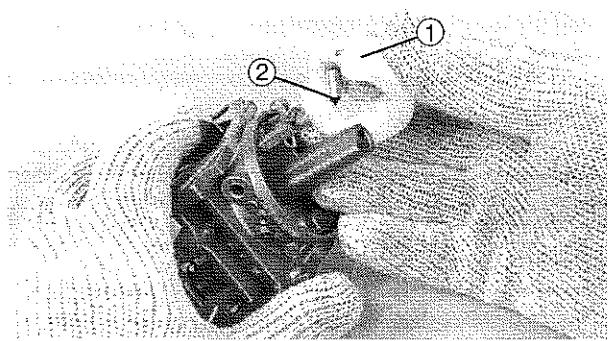
3. Inspect:

- Throttle stop screw ④
- Pilot screw ⑤
- Pilot jet ⑥
Wear/Damage/Corrosion → replace

4. Inspect:

- Main jet ⑦
- Main nozzle A ⑧
- Pilot jet ⑥
Contamination → clean/replace

Y-615

**NOTE:**

Blow out the jets with compressed air.

5. Inspect:

- Throttle valve
Wear/Damage → replace carburetor
- Choke valve
Wear/Damage → replace carburetor body



6. Check:

- Choke valve free movement Sticking → replace parts

ASSEMBLY

Reverse the "DISASSEMBLY" procedures.
Note the following points.

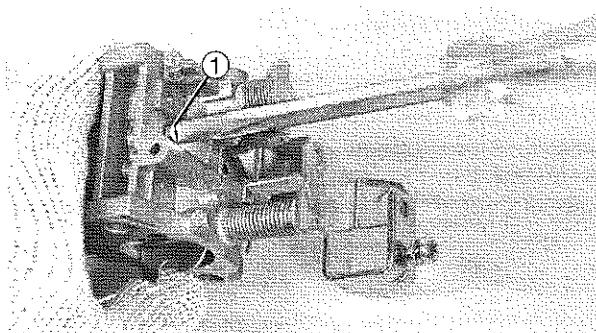
NOTE:

Before reassembling, wash all the parts with a carburetor cleaner.

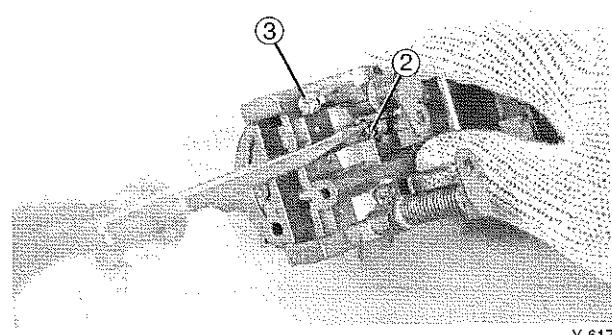
 WARNING

Carburetor cleaners are extremely flammable.

- Keep sparks and flames away from work area.
- Follow all cleaner manufacturer's warnings and instructions.
- NEVER use gasoline as a cleaning agent.



Y-616



Y-617

1. Install:

- Pilot jet ①
- Throttle stop screw ② (with spring)
- Pilot screw ③ (with spring)

NOTE:

See page 2-13 for pilot screw and throttle stop screw setting procedures.

6

2. Adjust:

- Throttle stop screw



Standard Turned In:
1/4 turn

- Pilot screw
- Replace anti-tamper cap

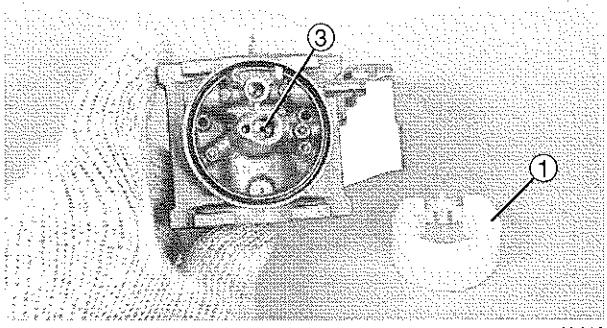


Standard Turned Out:
1-3/8 turns

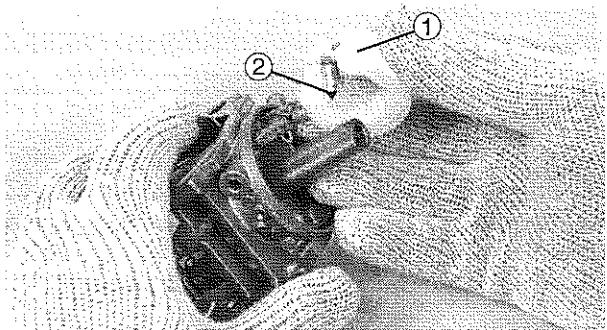


3. Install:

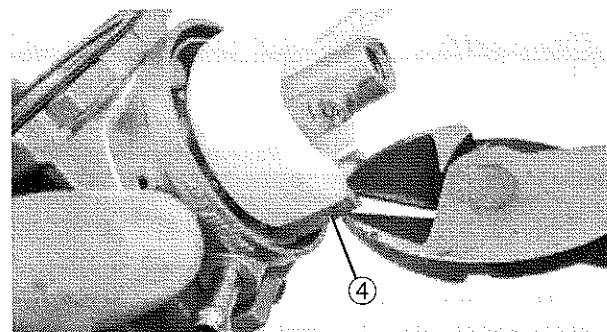
- Main nozzle A ③
- Float needle valve ②
- Float ①
- Float pin ④



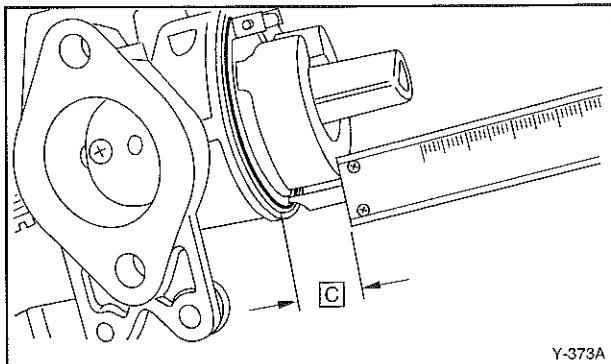
Y-619



Y-615



SM-03-145



4. Measure:

- Float height

Float height is preset at the factory. If out of specification, replace needle valve, float or carburetor assembly.



Float Height (F.H.) 14.5 mm (0.57 in)

Measurement of float height:

- Hold the carburetor in an upside down position.
- Incline the carburetor at 60 ~ 70° (so that the float valve does not compress as a result of float weight).
- Measure the distance from the inside of the gasket sealing surface of the carburetor body to the top of the float.

NOTE:

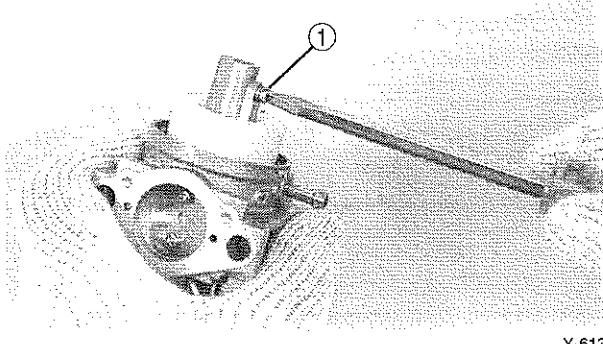
The float should be just resting on, but not depressing, the spring loaded inlet needle.

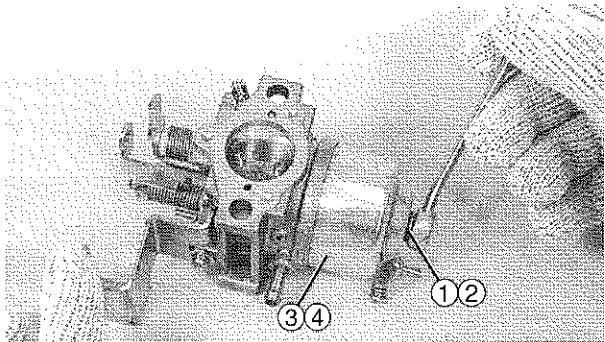
- If the float height is not within specification, inspect the valve seat and needle valve.
- If needle valve rubber seat or body is worn, or if spring is damaged or sticking, replace needle valve.
- If valve seat is worn, replace carburetor.
- If both are fine, replace the float.
- Recheck the float height.

6

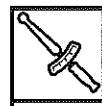
5. Install:

- Main jet ①

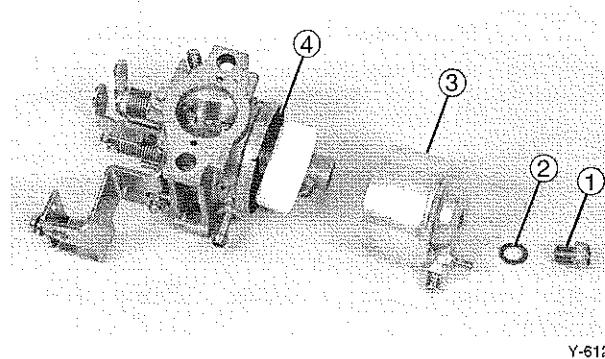


**6. Installation:**

- New rubber gasket ④
- Float chamber cover ③
- Gasket ②
- Cover holding bolt ①



Carburetor Holding Nut and Air Cleaner Case:
6.5 N·m (0.7 m·kg, 4.8 ft·lb)

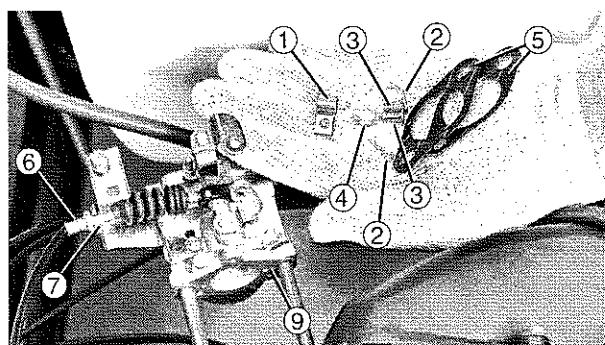
**INSTALLATION**

Reverse the "REMOVAL" procedures.
Note the following points.

1. Install:

- Carburetor
- Air cleaner case

- ① Cable housing clamp
- ② Cotter pin
- ③ Clevis pin
- ④ Circlip
- ⑤ Gasket
- ⑥ Throttle cable
- ⑦ Throttle cable locknut

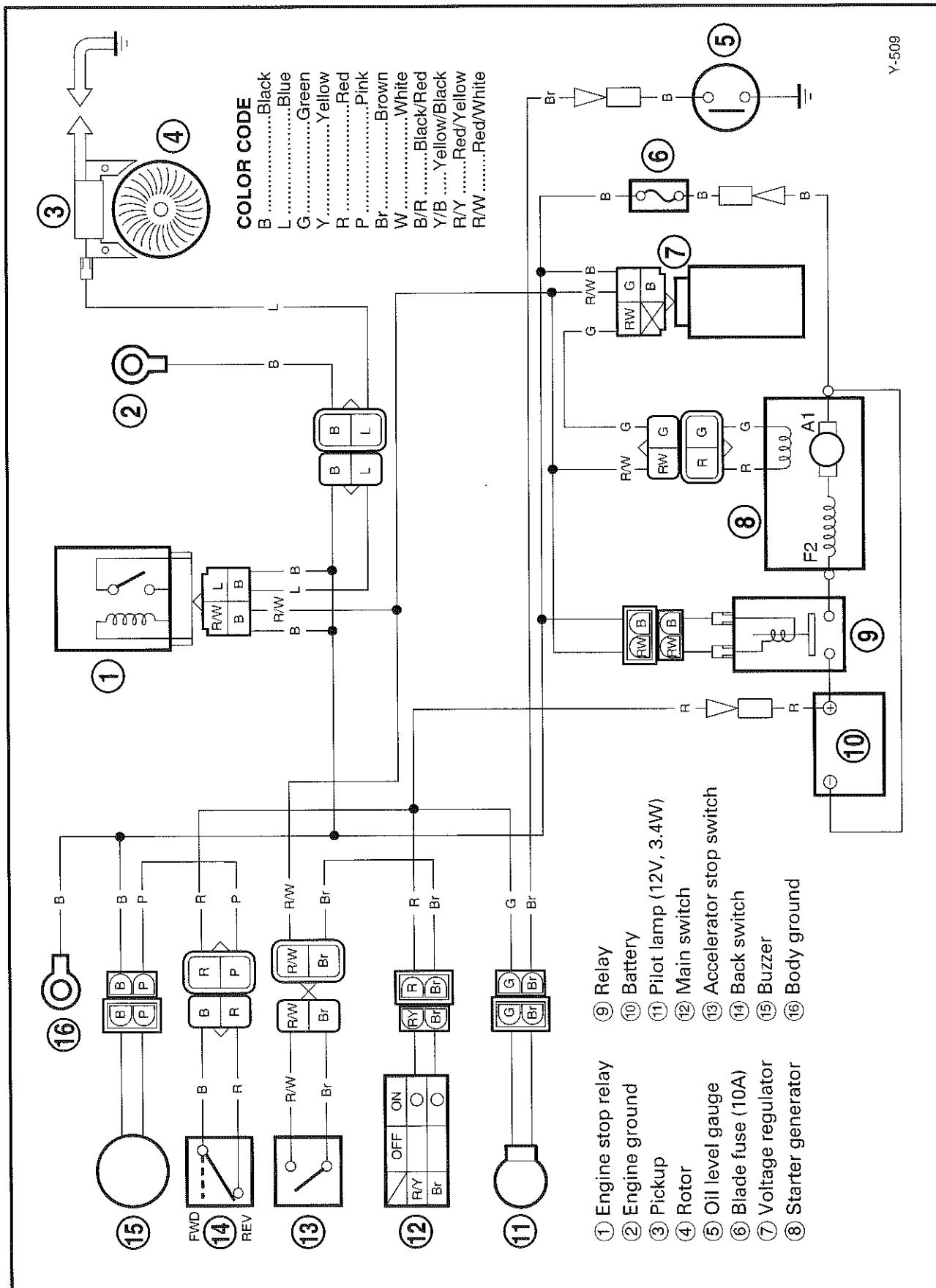




CHAPTER 7 ELECTRICAL

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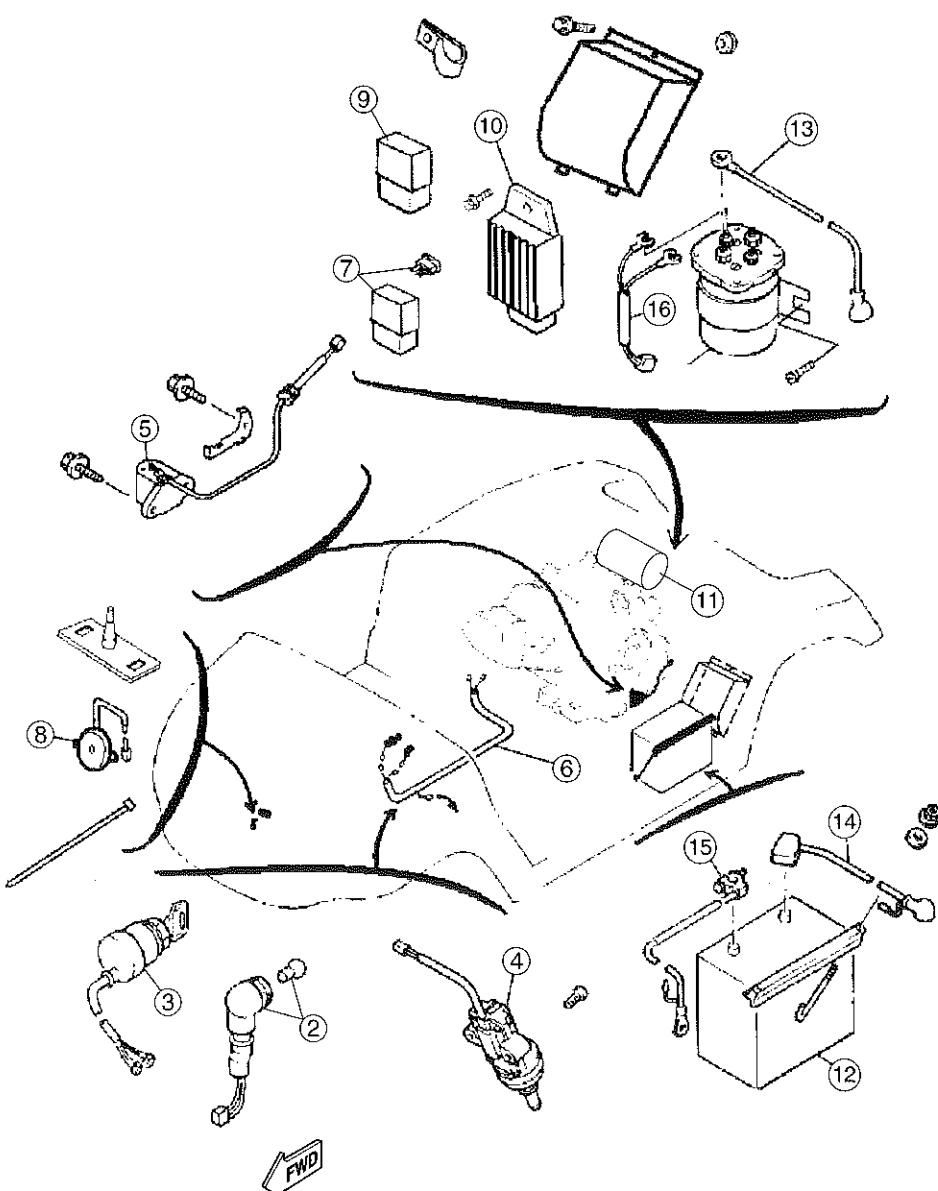
G22A WIRING DIAGRAM





ELECTRICAL COMPONENT LOCATIONS

- | | | |
|---------------------------|---------------------|-------------------------|
| ① Solenoid relay | ⑦ Fuse | ⑫ Battery |
| ② Pilot lamp | ⑧ Reverse buzzer | ⑬ Relay plus lead wire |
| ③ Main switch | ⑨ Engine stop relay | ⑭ Battery plus lead |
| ④ Accelerator stop switch | ⑩ Voltage regulator | ⑮ Battery earth lead |
| ⑤ Oil level switch | ⑪ Starter generator | ⑯ Wire harness sub lead |
| ⑥ Wire harness | | |

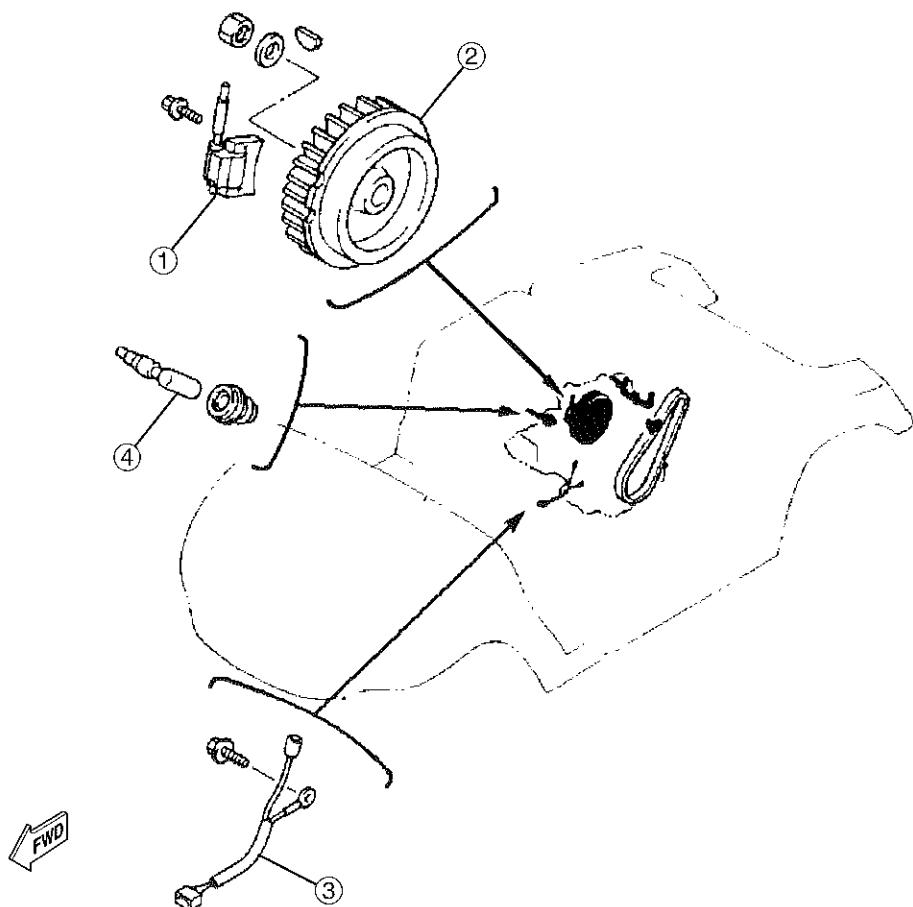


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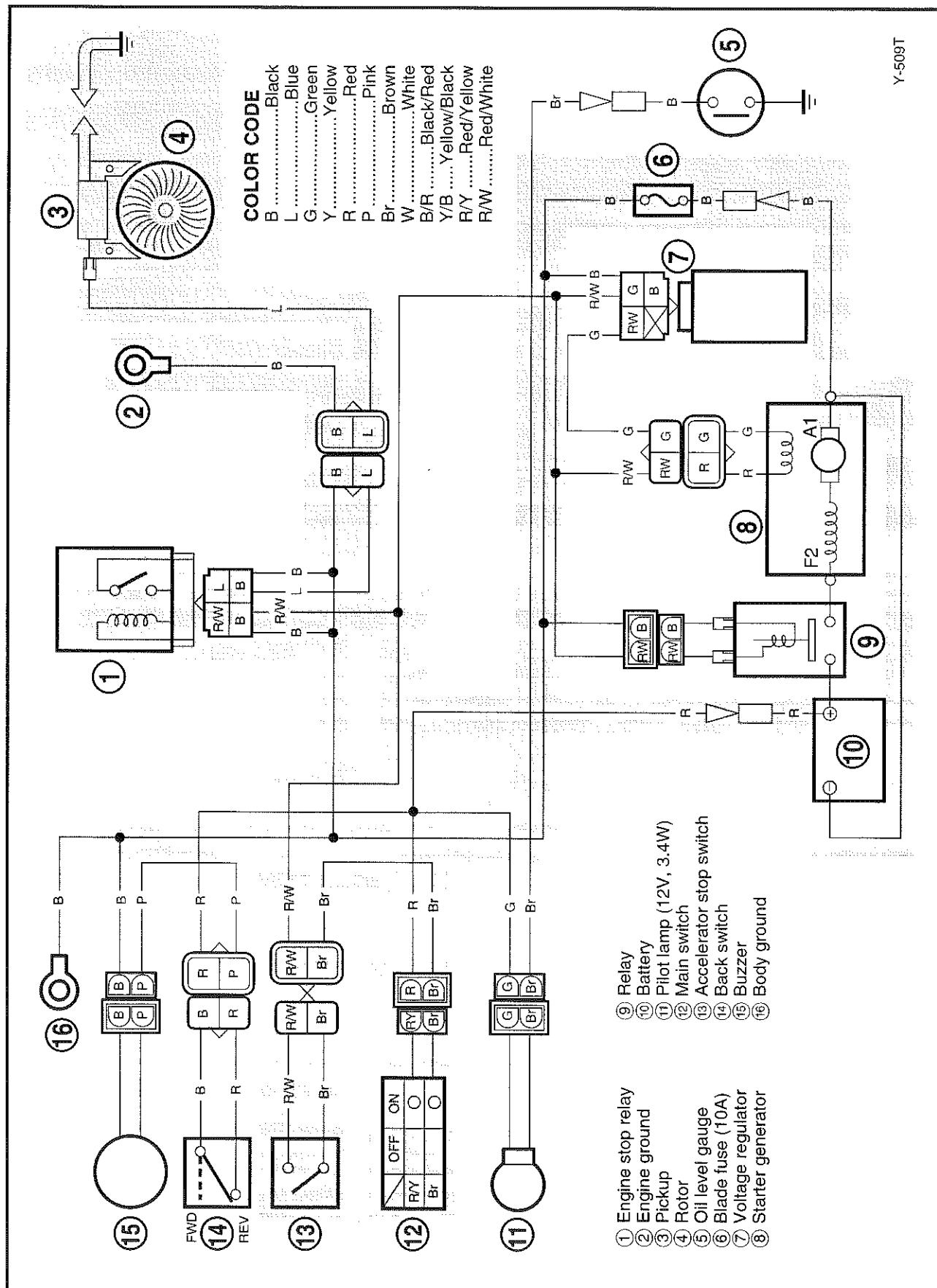
ELECTRICAL COMPONENTS (ENGINE)

- ① T.C.I. unit
- ② Flywheel
- ③ T.C.I. unit wire sub-lead
- ④ Spark plug cap





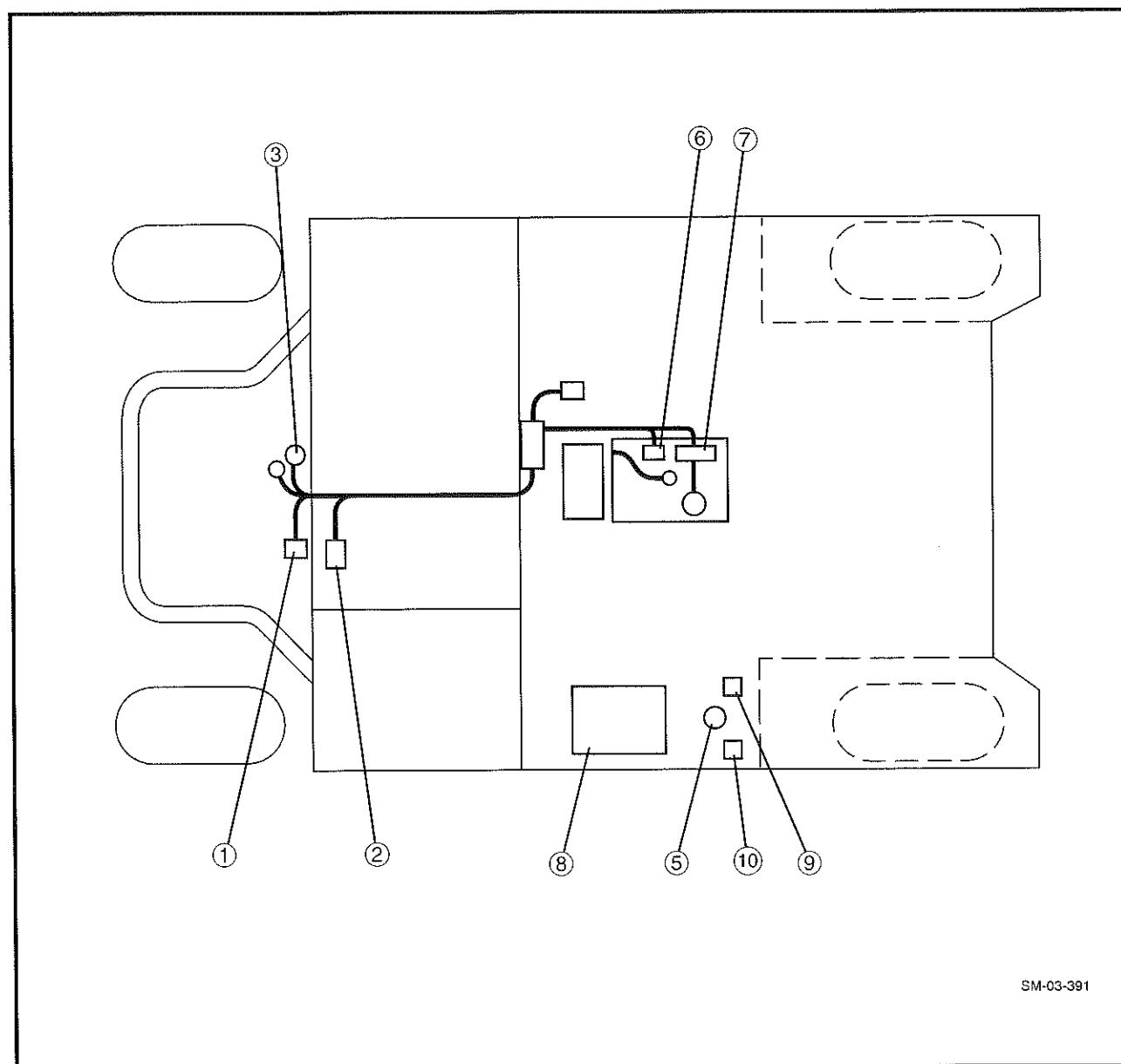
IGNITION SYSTEM





IGNITION SYSTEM COMPONENTS

- ① Main switch
- ② Accelerator stop switch
- ③ Reverse buzzer
- ④ Spark plug
- ⑤ Solenoid
- ⑥ TCI ignition
- ⑦ Flywheel
- ⑧ Battery (12V)
- ⑨ Fuse
- ⑩ Engine stop relay





TROUBLESHOOTING

THE STARTER DOES NOT TURN

Procedure

Check:

- | | |
|----------------------------|----------------------|
| 1. Battery | 6. Solenoid relay |
| 2. Fuse | 7. Wiring connection |
| 3. Main switch | |
| 4. Accelerator stop switch | |
| 5. Starter-generator | |

NOTE: _____

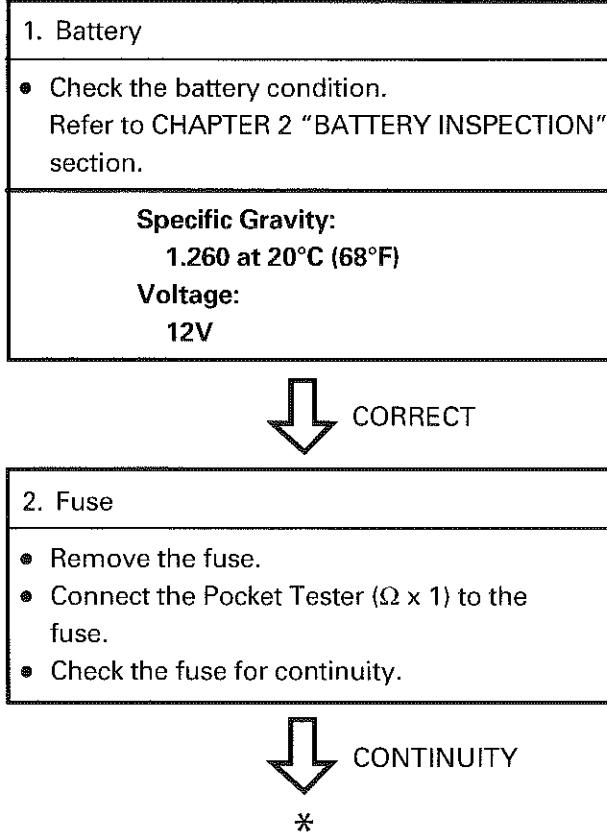
- Remove the following parts before troubleshooting.
 - 1) Seat
 - 2) Service lid
 - 3) Drink holder insert
- Use the following special tools in this troubleshooting.



Pocket Tester:
YU-3112-C



Hydrometer:
YU-03036



INCORRECT

- Refill battery fluid.
- Clean battery terminals.
- Recharge or replace battery.

NO CONTINUITY

Replace fuse.

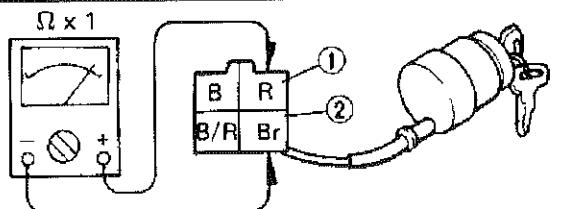


3. Main switch

- Disconnect the main switch coupler from the wire harness.
- Connect the Pocket Tester ($\Omega \times 1$) to the main switch.

Tester (+) Lead → Red Lead ①

Tester (-) Lead → Brown Lead ②



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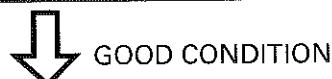
- Turn the main switch to "ON," "CHECK" and "OFF."
- Check the main switch for continuity.

Switch position	Good condition	Bad condition		
OFF	X	O	X	O
CHECK	X	O	X	O
ON	O	X	X	O

O: Continuity X: No continuity

BAD CONDITION

Replace main switch.



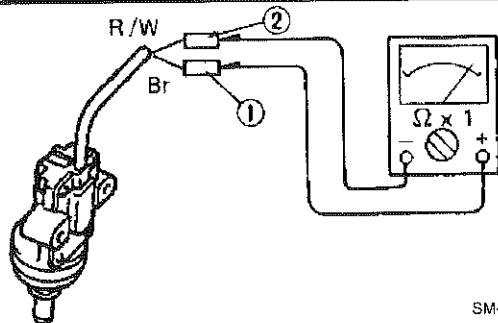
GOOD CONDITION

4. Accelerator stop switch

- Disconnect the accelerator stop switch leads from the wire harness.
- Connect the Pocket Tester ($\Omega \times 1$) to the accelerator stop switch.

Tester (+) Lead → Brown Lead ①

Tester (-) Lead → Red/White Lead ②



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- Push the accelerator pedal.
- Check the accelerator stop switch for continuity.

Accelerator Pedal position	Good condition	Bad condition		
Push	O	O	X	X
Free	X	O	O	X

O: Continuity X: No continuity

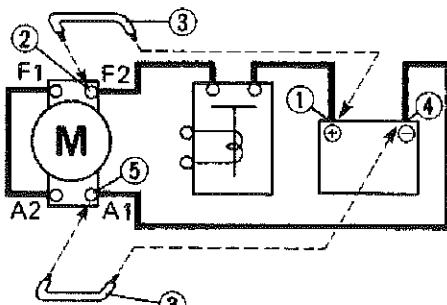
GOOD CONDITION

BAD CONDITION

Replace accelerator stop switch.

5. Starter-generator

- Connect the battery positive terminal ① and starter-generator terminal F2 ② using the jumper lead ③*.
- Connect the battery negative terminal ④ and starter-generator terminal A1 ⑤ using the jumper lead ③*.
- Check the starter-generator operation.



SM-03-264

*

WARNING

- A wire for the jumper lead must have at least the equivalent capacity of the battery lead or the jumper lead may burn.
- This check is likely to produce sparks, so be sure that no flammable gas or fluids are in the vicinity.

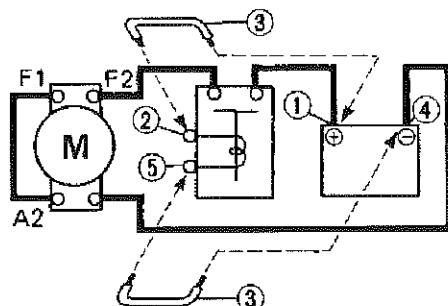
FAULTY

Repair and/or replace starter-generator.

OK

6. Solenoid relay

- Disconnect the solenoid relay leads (Red/White, Black).
- Connect the battery positive terminal ① and solenoid relay lead (Red/White) ② using the jumper lead ③.
- Connect the battery negative terminal ④ and solenoid relay lead (Black) ⑤ using the jumper lead ③.
- Check the starter-generator operation.



SM-03-265

FAULTY

Replace solenoid relay.



7. Wiring connection

- Check the entire starting system for connections.
Refer to "IGNITION SYSTEM DIAGRAM" on page 7-6.



TROUBLESHOOTING

NO SPARK OR WEAK SPARK

Procedure

Check

1. Spark plug cap resistance
2. T.C.I. air gap
3. T.C.I. unit resistance

NOTE:

- Also refer to PAGE 7-6 "IGNITION SYSTEM" section.
- Use the following special tools in this troubleshooting.



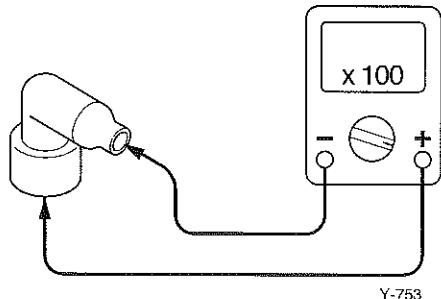
Pocket Tester:
YU-3112-C



Dynamic Spark Tester:
YM-34487

1. Spark plug cap resistance

- Remove the spark plug cap.
- Connect the Pocket Tester ($\Omega \times 1k$) to the spark plug cap.



- Check the spark plug cap for specified resistance.



Spark Plug Cap Resistance:
4 ~ 6 k Ω at 20°C (68°F)

OUT OF SPECIFICATION

Replace spark plug cap.

MEETS
SPECIFICATION



2. T.C.I. air gap

- Rotate the flywheel magnet past the ignition unit to confirm that there is an air gap between the magnet and ignition unit.

**T.C.I. Air Gap:**

0.3 ~ 0.5 mm (0.012 ~ 0.020 in)

MEETS
SPECIFICATION

OUT OF SPECIFICATION



Loosen T.C.I. mounting bolts and adjust to specification using a feeler gauge.

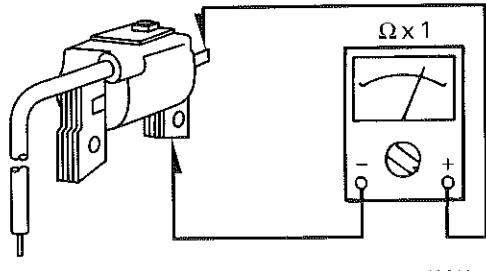
3. T.C.I. unit resistance

- Disconnect the T.C.I. unit coupler from the wire harness.
- Connect the Pocket Tester to the ignition coil.

Primary Coil A:

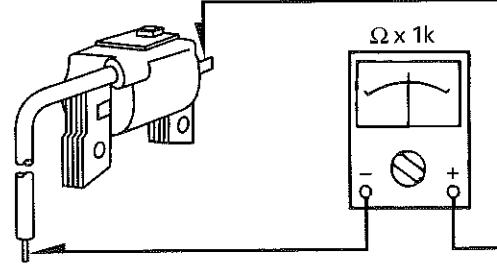
Tester (+) Lead → Terminal
Tester (-) Lead → Coil base

A

**Primary Coil B:**

Tester (+) Lead → Terminal
Tester (-) Lead → High Tension Wire

B



- Measure the primary and secondary coil resistances.

**Primary Coil Resistance:**
0.9 ~ 1.5Ω at 20°C (68°F)**Secondary Coil Resistance:**
10.5 ~ 12.9kΩ ± 20% at 20°C (68°F)

OUT OF SPECIFICATION



Replace T.C.I. Unit.



G22A IGNITION SYSTEM TROUBLESHOOTING

ENGINE WILL NOT RUN, NO SPARK

Procedure

Check:

- 1. Ignition unit
- 2. Engine stop relay

NOTE:

- Use the following special tool in this troubleshooting.



Pocket Tester:
YU-3112-C



Dynamic Spark Tester:
YM-34487

1. Ignition unit

- Disconnect multi-plug from Engine Stop Relay.
- Crank the engine.



SPARK PRESENT

NO SPARK PRESENT

Replace Ignition Unit.

2. Engine stop relay

- With accelerator pedal depressed, check for voltage at the R/W wire at engine stop relay.



VOLTAGE

NO VOLTAGE

Repair R/W wire circuit.

- With ohmmeter, confirm Black wire continuity from engine stop relay to ground and to engine crankcase.



CONTINUITY

NO CONTINUITY

Repair Black wire.



- With ohmmeter, confirm continuity of Blue wire from relay to Ignition unit.

NO CONTINUITY

CONTINUITY

Repair Blue wire.

- R/W, Black and Blue wires correct.

Replace Engine Stop Relay



THE BATTERY IS NOT CHARGED

Procedure

Check:

1. Battery
2. Charging voltage
3. Charging coil resistance
4. Wiring connection

NOTE:

- Remove the following parts before troubleshooting.
- 1) Seat

- Use the following special tools in this troubleshooting.



Pocket Tester:
YU-3112-C



Hydrometer:
YU-03036

1. Battery

- Check the battery condition.
Refer to CHAPTER 2 "BATTERY INSPECTION" section.

Specific Gravity:
1.260 at 20°C (68°F)
Voltage:
12V

INCORRECT

- Refill battery fluid.
- Clean battery terminals.
- Recharge or replace battery.

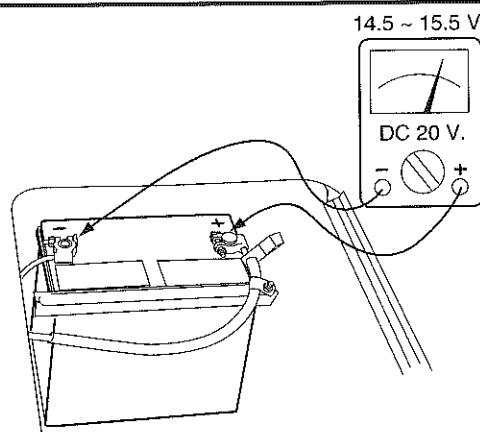


GOOD CONDITION

2. Charging Voltage

- Connect the Pocket Tester (DC20V) to the battery.

Tester (+) Lead → Battery Positive Terminal
Tester (-) Lead → Battery Negative Terminal



Y-112b

- Remove the drive belt.
- Start the engine and accelerate to about 2,500 r/min.*
- Measure the charging voltage.



Charging Voltage:
14.5 ~ 15.5V at 2,500 r/min

↓ OUT OF SPECIFICATION

*

! WARNING

Be sure the drive belt is removed when starting the engine. The speed limiter will not function, so you must regulate engine speed with the throttle.

MEETS SPECIFICATION

Replace battery.

3. Charging coil resistance

- Disconnect the starter-generator thin leads (Red, Green).
- Connect the Pocket Tester ($\Omega \times 1$) to the starter-generator thin leads.

Tester (+) Lead → Red Lead
Tester (-) Lead → Green Lead

- Measure the charging coil resistance.



Charging Coil Resistance:
4.5 ~ 5.5 Ω at 20°C (68°F)

↓ MEETS SPECIFICATION

4. Wiring connection

- Check the entire starting system for connections.
Refer to "IGNITION SYSTEM DIAGRAM" on page 7-6.

↓ CORRECT

Repair and/or replace voltage regulator.

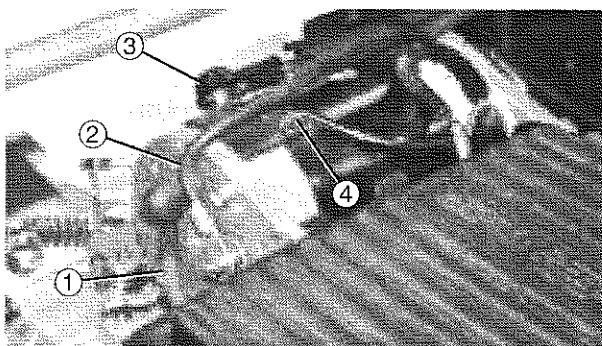
OUT OF SPECIFICATION

Repair and/or replace starter-generator.

7

POOR CONNECTION

Correct.



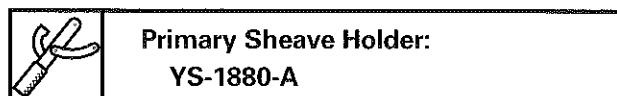
SM-03-086

Removal

1. Remove the seat.
2. Disconnect the battery negative lead.
 - Starter-generator lead to relay (Red) (1)
 - Starter-generator lead to negative battery post (Black) (2)
 - Starter-generator lead to fuse (Black) (3)
 - Starter-generator charging coil leads (Red, Green) (4)

3. Attach:

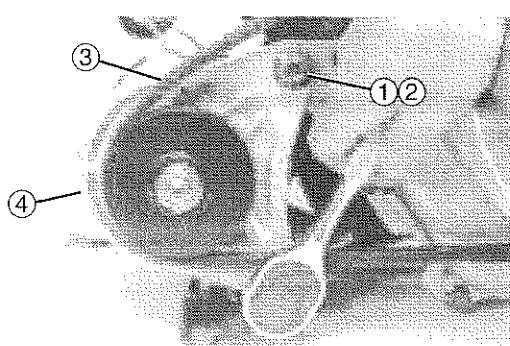
- Primary Sheave Holder to primary sheave.

**4. Loosen:**

- Pulley nut (starter-generator) while holding primary sheave in place.

5. Remove:

- Bolts and nuts (1), (2)
- V-belt (3)
- Starter-generator (4)



Y-341

Disassembly

Refer to page 7-19.

1. Remove:
 - Pulley nut
 - Belt pulley assembly

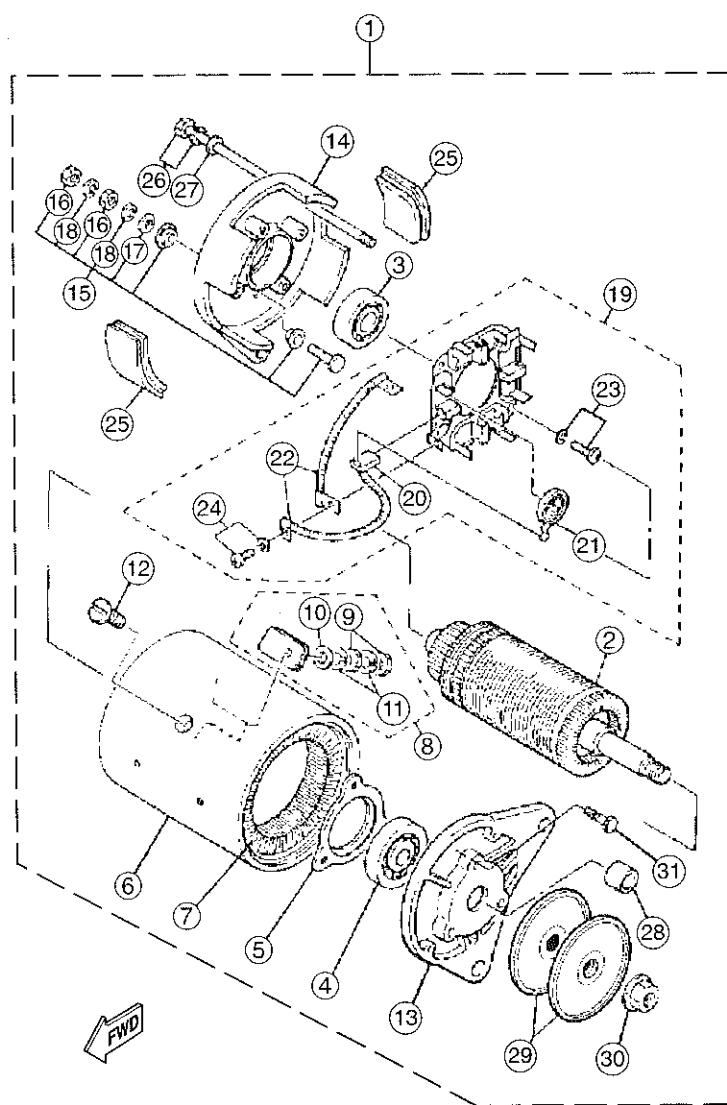
**STARTER-GENERATOR**

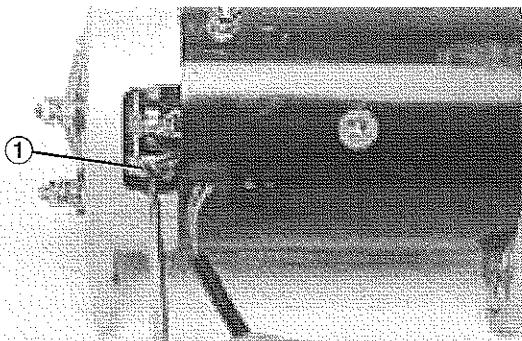
- ① Starter generator
- ② Armature assembly
- ③ Bearing 1
- ④ Bearing 2
- ⑤ Bearing holder
- ⑥ Stator assembly
- ⑦ Field coil assembly
- ⑧ Screw
- ⑨ Nut
- ⑩ Washer
- ⑪ Washer
- ⑫ Screw
- ⑬ Bracket, starter generator 1
- ⑭ Bracket, starter generator 2

- ⑯ Screw
- ⑯ Nut
- ⑯ Washer
- ⑯ Washer
- ⑯ Brush holder assembly
- ⑯ Brush
- ⑯ Brush spring
- ⑯ Wire, lead
- ⑯ Pan head screw
- ⑯ Pan head screw
- ⑯ Screw
- ⑯ Nut
- ⑯ Washer
- ⑯ Washer
- ⑯ Brush cover
- ⑯ Screw
- ⑯ Washer
- ⑯ Spacer
- ⑯ Pulley
- ⑯ Flange nut
- ⑯ Screw

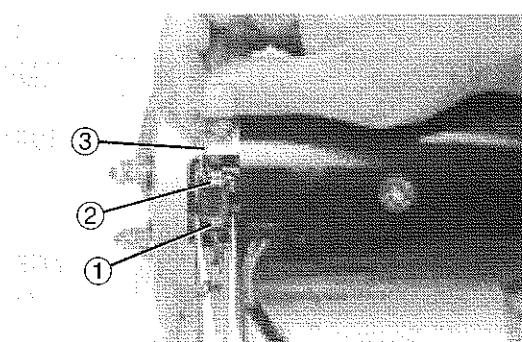
NOTE: _____

* The brush cover having a drain channel must face downward.

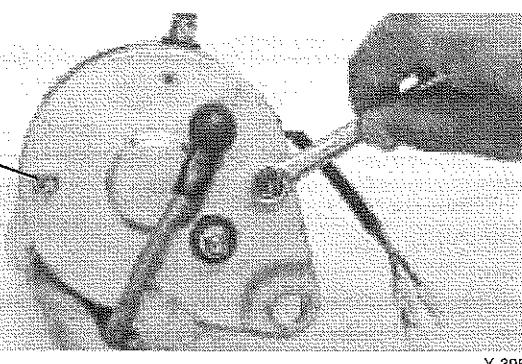




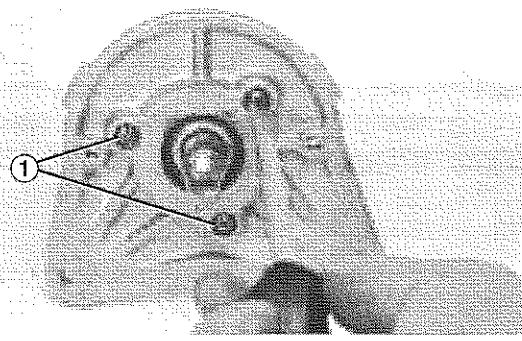
Y-393



Y-394



Y-395



Y-396



Y-397

2. Remove:

- Brush covers
- Lead connecting screws ①

CAUTION

Hold brush holder tabs in place with pliers when removing stubborn lead connecting screws to avoid twisting tabs.

3. Remove:

- Brush ①

Remove it while pulling up the brush spring ② with a spring puller (made from steel wire) ③ or a bent paper clip.

CAUTION

Do not pull wire lead of brush. Use care when removing brushes, they are easily damaged.

4. Remove:

- Bolts ①

5. Separate the yoke, armature and bracket (brush side).

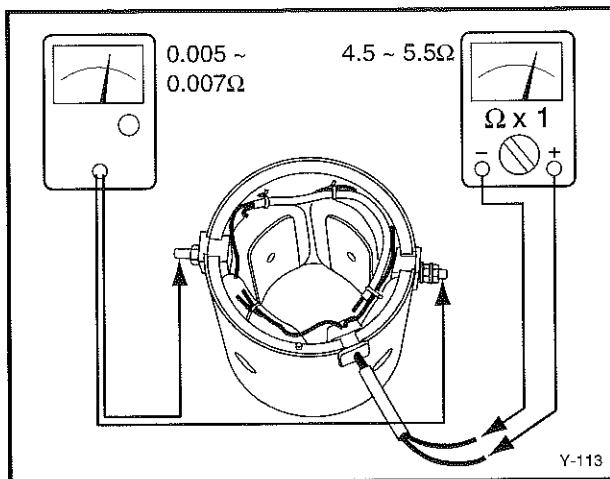
6. Remove:

- Screws ①

7. Separate the bracket (pulley side) and armature assembly.

Inspection

1. Clean the interior of the yoke and brackets with compressed air.
2. Inspect:
 - Outer surface (yoke and brackets)
Cracks/Damage → replace



3. Inspect:

- Yoke
Defects → replace

Yoke inspection steps:

- Connect the Low Reading Ohmmeter to the yoke terminal F1, F2.
- Connect the Pocket Tester to the charging coil leads (Red, Green).
- Measure the field coil resistance (Series and Shunt).

**Low Reading Ohmmeter:**

YU-91026

Pocket Tester:

YU-3112-C

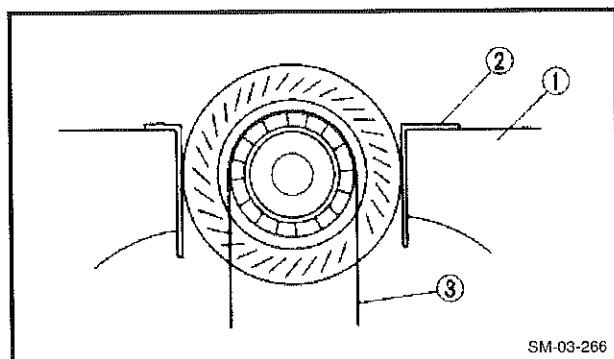
**Field Coil Resistance:****Series (F1 - F2):**

0.005 ~ 0.007Ω at 20°C (68°F)

Shunt (Red - Green):

4.5 ~ 5.5Ω at 20°C (68°F)

- If the resistance is incorrect, replace the yoke.

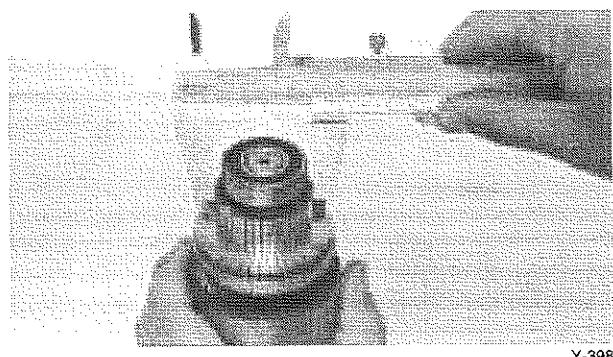


4. Inspect:

- Commutator (Outer surface)
Hold the armature in a vise (1) between copper or aluminum plates (2).
Dirty → clean with #600 grit emery cloth (3)

CAUTION

Hold armature lightly between padded vise jaws to avoid damaging armature.

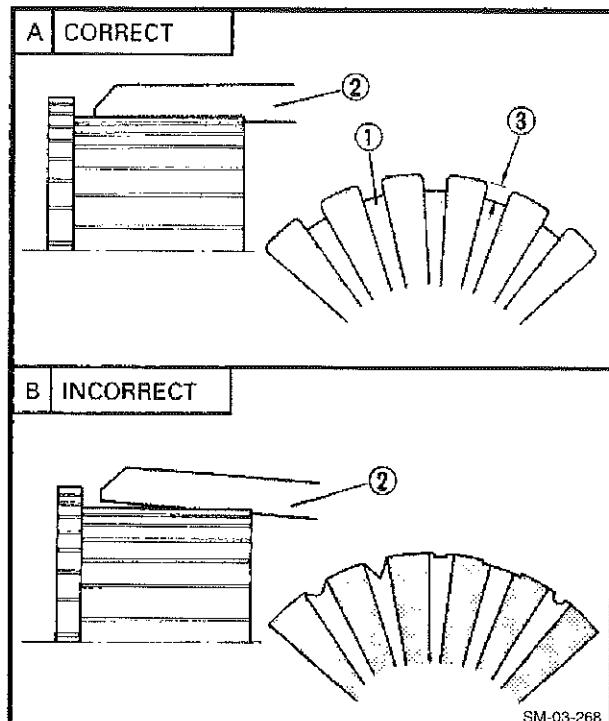


5. Measure:

- Commutator (Diameter)
Measure the diameter of the commutator as shown.
Out of specification → replace

**Wear Limit (Minimum Diameter):**

39 mm (1.54 in)



6. Measure:

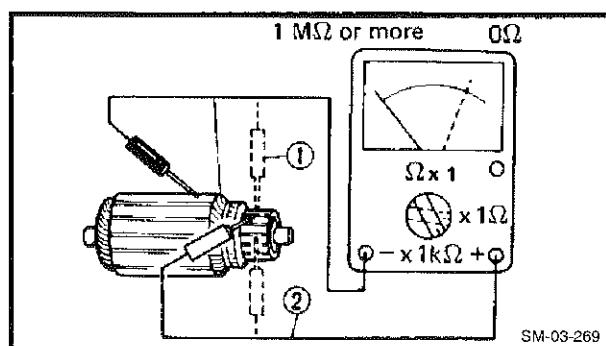
- Mica ① (Insulation depth)
(between commutator segments)
Out of specification → scrape mica to proper limits
Use a hacksaw blade ② that is ground to fit.
Re-measure Mica Undercut ③.

**Mica Undercut ③**

Limit: 0.25 mm (0.0098 in)

NOTE:

- The mica insulation of the commutator must be undercut to ensure proper operation of the commutator.
- Carefully clean between the segments after the above steps.



7. Inspect:

- Armature coil (insulation/continuity)
Defects → replace armature

Armature coil inspecting steps:

- Connect the Pocket Tester for continuity check ① and insulation check ②.
- Measure the armature coil resistances.

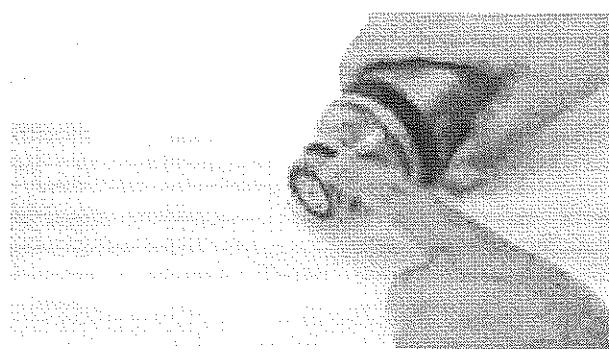
**Pocket Tester:**
YU-3112-6**Armature Coil Resistances:****Continuity Check ①**

0Ω at 20°C (68°F)

Insulation Check ②

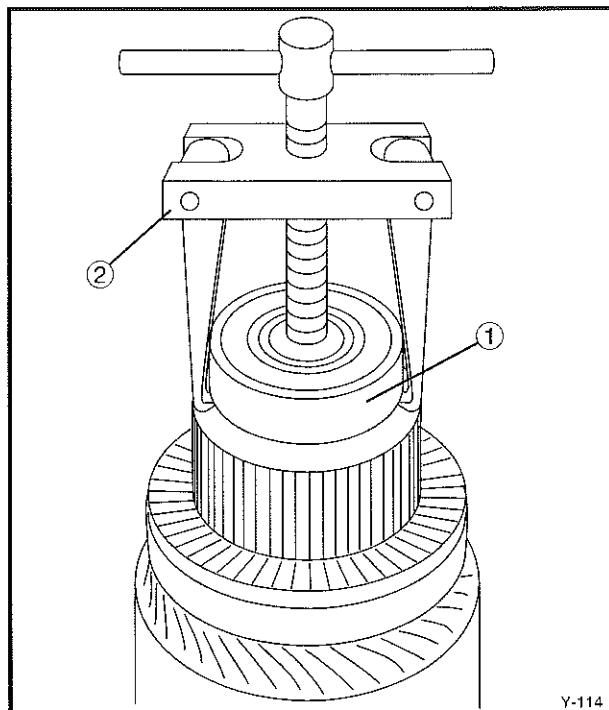
More than 1 MΩ at 20°C (68°F)

- If the resistance is incorrect, replace the armature.



8. Check:

- Bearing movement
Rotate with fingers.
Roughness/Wear → replace



Y-114

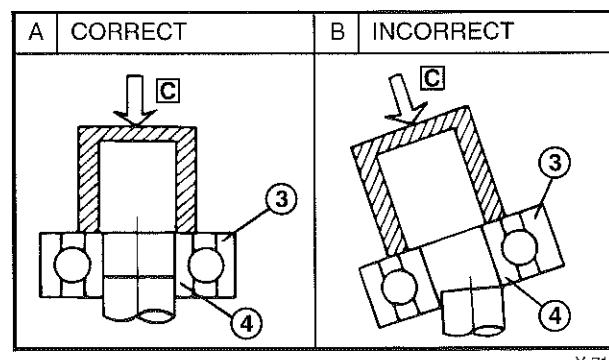
Bearing replacement steps:

- Remove the bearing ① with a bearing puller ②.
- Install the new bearing.

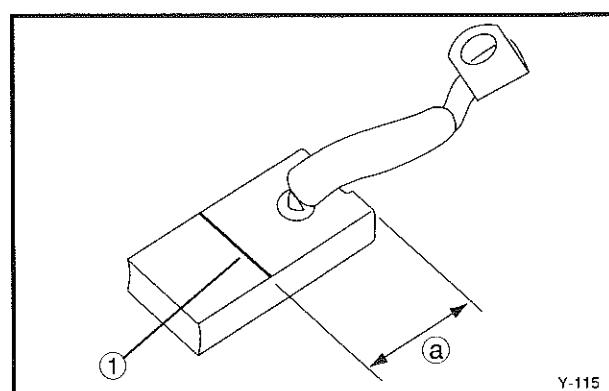
CAUTION

Do not strike the outer race ③ or balls of the bearing. Contact should be made only with the center race ④.

PRESS



Y-711



Y-115

9. Measure:

- Brush length
Out of specification → replace

**Minimum Brush Length ②:**

16 mm (0.63 in)

① Wear indicator

7

Assembly

Reverse the "Disassembly" procedure.

Note the following points:

1. Measure:

- Brush spring force
Use a spring scale ①.
Pull the scale and check reading as the brush spring just comes off the brush.
Out of specification → replace

Brush Spring Force:

340 ~ 460 g (12.0 ~ 16.2 oz)

**Installation**

Reverse the "Removal" procedure.

Note the following points:

1. Adjust:

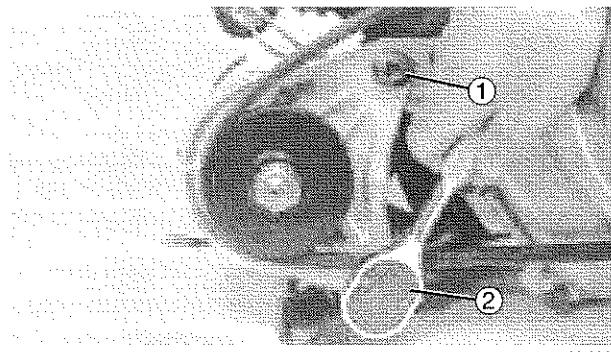
- Starter belt tension

Refer to CHAPTER 2 "STARTER BELT INSPECTION" section.

**Starter Belt Tension:**

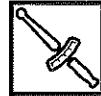
8 ~ 12 mm/10 kg

(0.31 ~ 0.47 in/22 lb)



2. Tighten:

- Bolts and nuts ①, ②

**Starter Generator Bracket Bolt ①**

59 N·m (6.0 m·kg, 43.5 ft·lb)

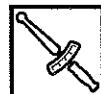
Lower Tensioner Locknut ②

14 N·m (1.4 m·kg, 10 ft·lb)

3. Tighten:

- Pulley nut

Tighten it while holding the primary sheave with Primary Sheave Holder.

**Pulley Securing Nut:**

91 N·m (9.3 m·kg, 67.1 ft·lb)

**Primary Sheave Holder:**

YS-1880-A



SOLENOID RELAY

Function

The solenoid coil, when activated by closing the engine stop switch, closes the solenoid contacts, thus providing the starter with current.

It also acts as a safety device, preventing the vehicle from abruptly starting when the main switch is operated.

Inspection

1. Remove:

- Seat
- Drive belt

2. Turn the main switch to "ON" ①.

3. Check:

- Solenoid relay (Clicking)

Press the accelerator pedal to close the engine stop switch.

If clicking → check for continuity between the two contact posts with Pocket Tester, while the solenoid is activated. If there is no continuity, replace the relay.

Not clicking → measure coil resistance in solenoid

4. Disconnect:

- Solenoid coil leads (Black, Red/White)

5. Measure:

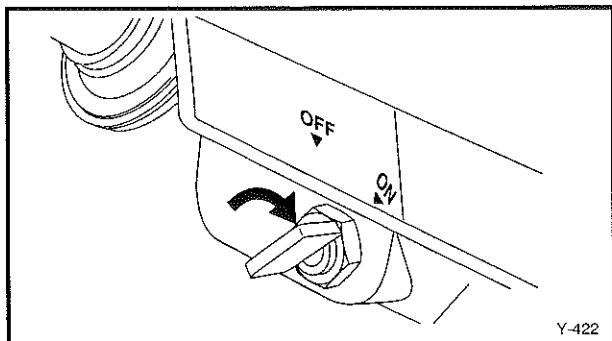
- Coil resistance

Use the Pocket Tester ②.

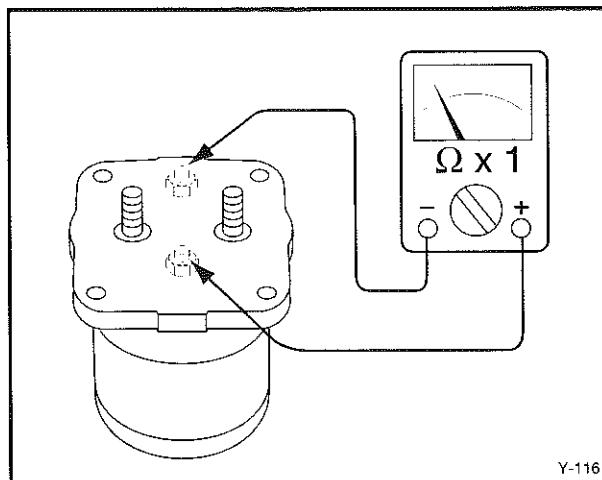
Out of specification → replace

Within specification → inspect starting circuit

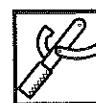
Refer to "TROUBLESHOOTING" section.



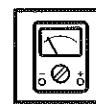
Y-422



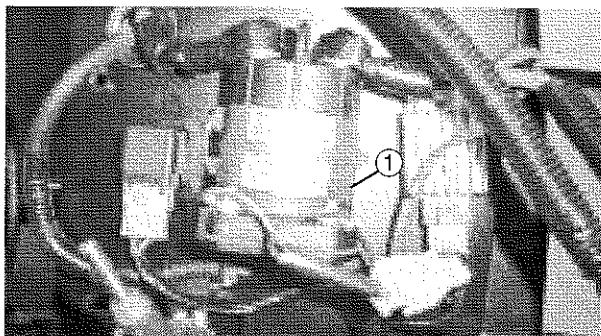
Y-116



Pocket Tester:
YU-3112-C



Solenoid Coil Resistance:
 $21\Omega \pm 10\%$ at 20°C (68°F)



SM-03-065

6. Check:

- Connection of leads to main solenoid terminals.
- Looseness → tighten

**Terminal Nut:****6 N·m (0.6 m·kg, 4.4 ft·lb)**

7. Replace:

- Drive belt

Removal

1. Disconnect:

- Battery positive lead
- Leads to solenoid terminals

2. Remove:

- Solenoid relay ①

Installation

Reverse the "Removal" procedure.

Note the following points.

1. Install:

- Solenoid relay ①

2. Connect:

- Lead from starter-generator (Red)
- Leads to solenoid coil (Black, Red/White)
- Battery negative lead (Black)

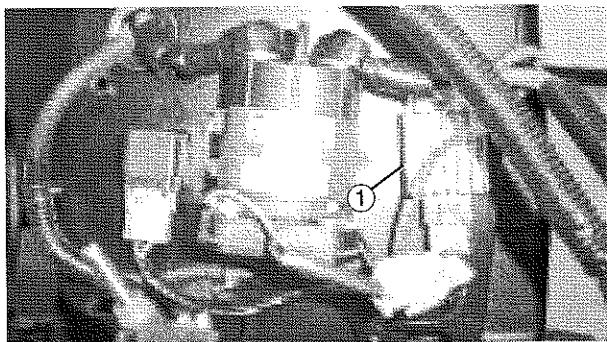
VOLTAGE REGULATOR**Generator Voltage Inspection**

1. Remove:

- Drive belt
- Refer to CHAPTER 2 "DRIVE BELT INSPECTION" section.

2. Connect the Pocket Tester (DC20V) to the battery.

**Pocket Tester:****YU-3112-C**



SM-03-146

3. Start the engine and accelerate to about 2,500 r/min.

4. Measure:

- Generator voltage

Out of specification → see page 7-12 for troubleshooting



Generator Voltage:

14 ~ 15V

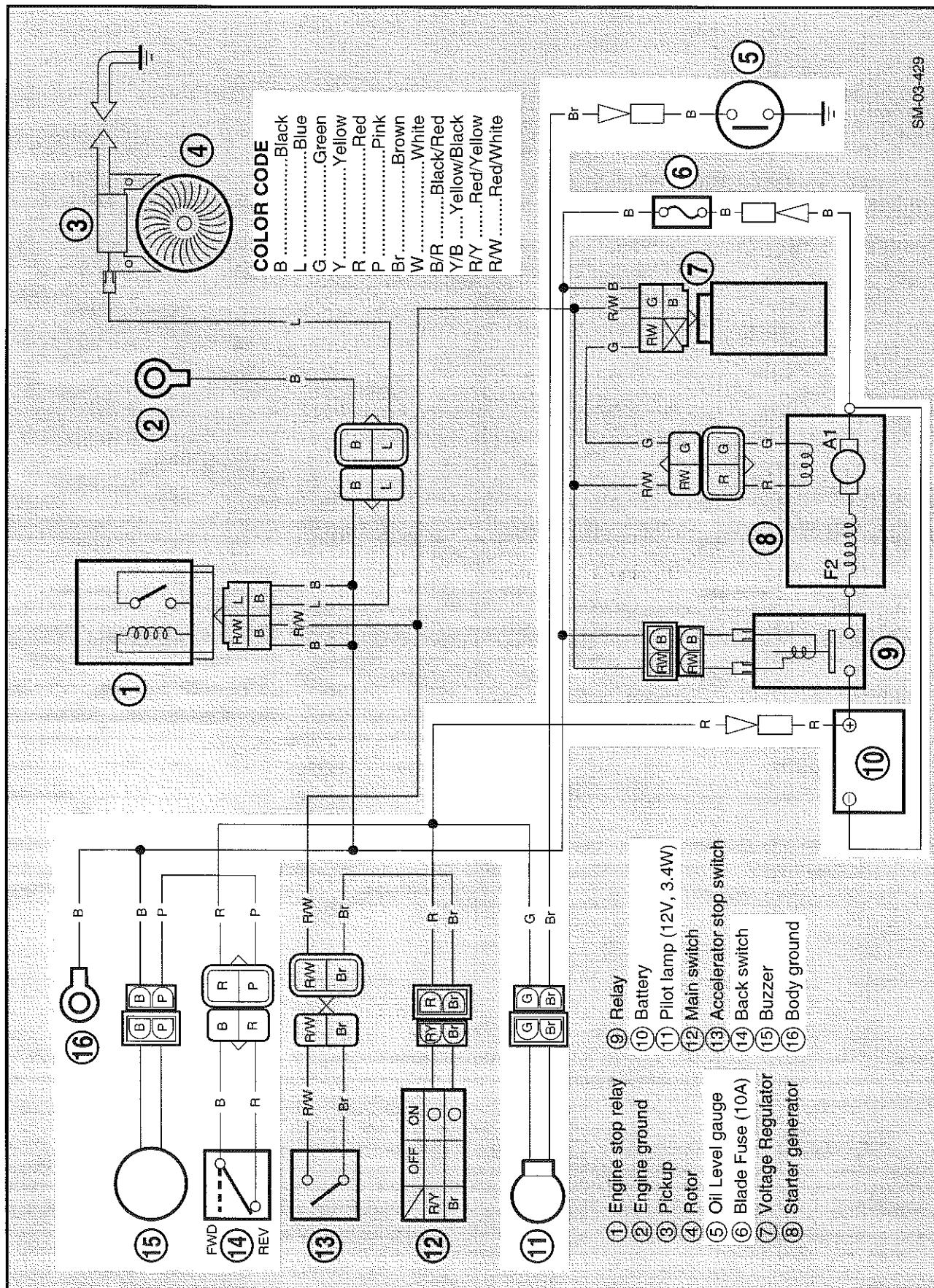
Voltage regulator ①

NOTE: _____

The voltage regulator is solid state and non-adjustable. Refer to page 7-16 "THE BATTERY IS NOT CHARGED" for troubleshooting procedures.



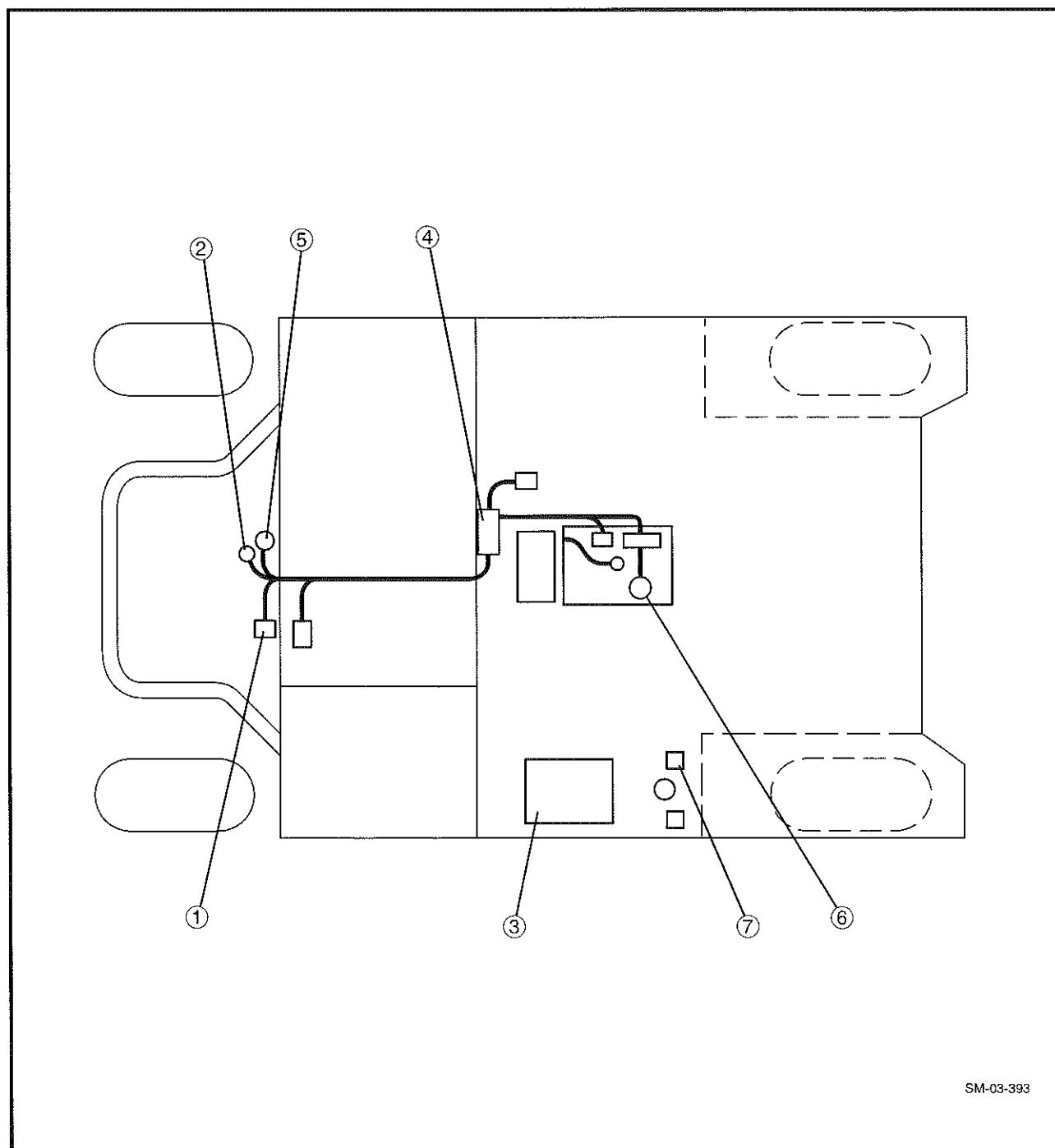
SIGNAL SYSTEM (OIL WARNING/REVERSE BUZZER)





SIGNAL SYSTEM COMPONENTS

- ① Main switch
- ② Oil level indicator light
- ③ Battery (12V)
- ④ Forward/reverse switch
- ⑤ Reverse buzzer
- ⑥ Oil level switch
- ⑦ Fuse





TROUBLESHOOTING

THE OIL LEVEL INDICATOR LIGHT DOES NOT COME ON

Procedure

Check:

- | | |
|---------------------|----------------------|
| 1. Bulb | 4. Voltage to lamp |
| 2. Bulb socket | 5. Wiring connection |
| 3. Oil level switch | 6. Lamp check |

NOTE:

- Remove the following parts before troubleshooting.
 - 1) Seat
 - 2) Drink holder insert
- Use the following special tools in this troubleshooting.



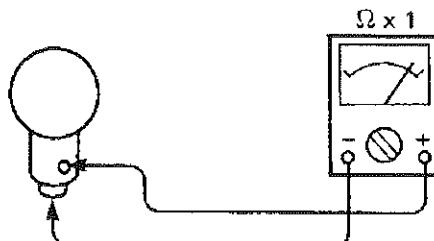
Pocket Tester:
YU-3112-C



Hydrometer:
YU-03036

1. Bulb

- Remove the bulb.
- Connect the Pocket Tester ($\Omega \times 1$) to the bulb.



SM-03-272

- Check the bulb for continuity.

NO CONTINUITY

Replace bulb.

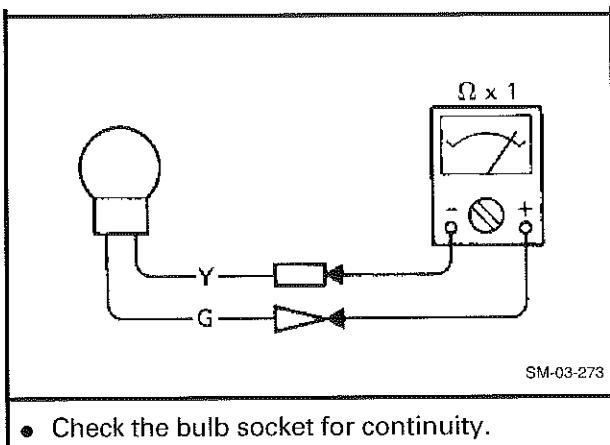


2. Bulb socket

- Disconnect the indicator light leads (Green, Yellow).
- Connect the Pocket Tester ($\Omega \times 1$) to the leads.

Tester (+) Lead → Green Lead

Tester (-) Lead → Yellow Lead



NO CONTINUITY

Replace bulb socket.

**3. Oil level switch**

- Disconnect the oil level switch lead.
- Connect the Pocket Tester ($\Omega \times 1$) to the oil level switch lead (Black).

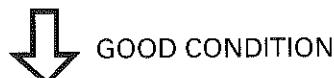
Tester (+) Lead → Black Lead**Tester (-) Lead → Ground (Engine body)**

- Turn the main switch to the "Check" position (halfway between "OFF" and "ON").
- Check the oil level switch for continuity.
- Drain the engine oil.
Refer to CHAPTER 2 "ENGINE OIL REPLACEMENT" section.
- Check the oil level switch for continuity.

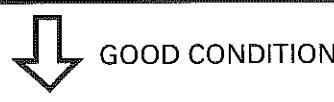
Oil level	Good condition	Bad condition		
Full	X	X	O	O
Empty	O	X	X	O
O: Continuity X: No continuity				

BAD CONDITION

Replace oil level switch.

**4. Voltage to lamp**

- Disconnect the indicator light leads (Green, Yellow).
- With main switch in "CHECK" position, check Green lead for voltage.



*

NO VOLTAGE

Replace ignitor unit.

**5. Wiring connection**

- Check the connections of the entire signal system.
Refer to "SIGNAL SYSTEM (OIL WARNING/REVERSE BUZZER" on page 7-28.

POOR CONNECTION

Correct the connection.

**6. Lamp check**

- Turn the main switch to "CHECK" to verify repairs are satisfactory.

BULB DOESN'T LIGHT

Recheck wiring connections.



THE REVERSE BUZZER DOES NOT OPERATE

Procedure

Check:

1. Battery
2. Fuse
3. Buzzer switch
4. Reverse buzzer
5. Wiring connection

NOTE:

- Remove the following parts before troubleshooting.
 - 1) Seat
- Use the following special tools in this troubleshooting.



Pocket Tester:
YU-3112-C



Hydrometer:
YU-03036

1. Battery

- Check the battery condition.
Refer to CHAPTER 2 "BATTERY INSPECTION" section.

Specific Gravity:

1.260 at 20°C (68°F)

Voltage:

12V

INCORRECT

- Refill battery fluid.
- Clean battery terminals.
- Recharge or replace battery.



CORRECT

2. Fuse

- Remove the fuse.
- Connect the Pocket Tester ($\Omega \times 1$) to the fuse.
- Check the fuse for continuity.

NO CONTINUITY

Replace fuse.



CONTINUITY

*

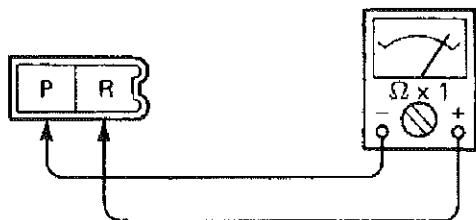


3. Buzzer switch

- Disconnect the buzzer switch coupler.
- Connect the Pocket Tester ($\Omega \times 1$) to the buzzer switch coupler.

Tester (+) Lead → Red Lead ①

Tester (-) Lead → Brown Lead ②



SM-03-271

- Turn the shift lever "FORWARD" and "REVERSE" position.
- Check the buzzer switch for continuity.

Lever position	Good condition	Bad condition		
Push	X	X	O	O
Free	O	X	X	O

O: Continuity X: No continuity

BAD CONDITION

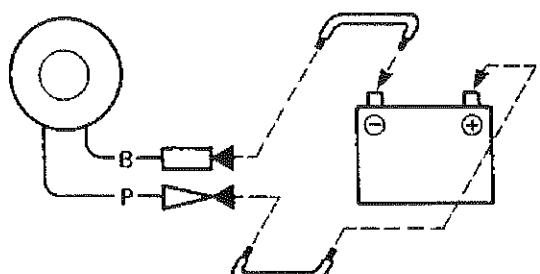
Replace buzzer switch.



GOOD CONDITION

4. Reverse buzzer

- Disconnect the reverse buzzer leads.
- Connect jumper leads to the reverse buzzer leads (Black, Pink) and battery.



SM-03-270

- Confirm the reverse buzzer sounds.

FAULTY

Replace backup buzzer.



OK

*

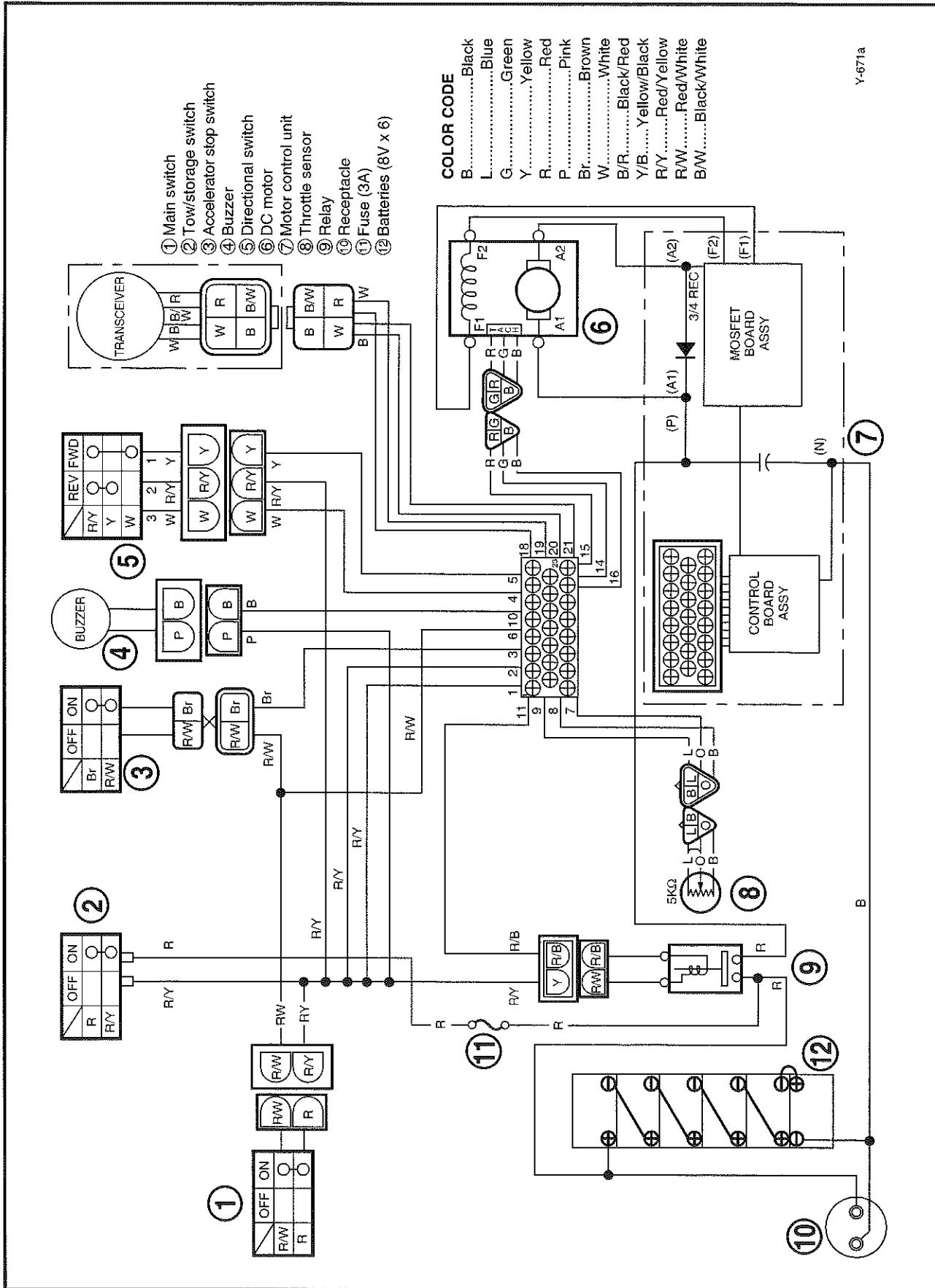


5. Wiring connection

- Check the entire signal system for connection.
Refer to "WIRING DIAGRAM" section.



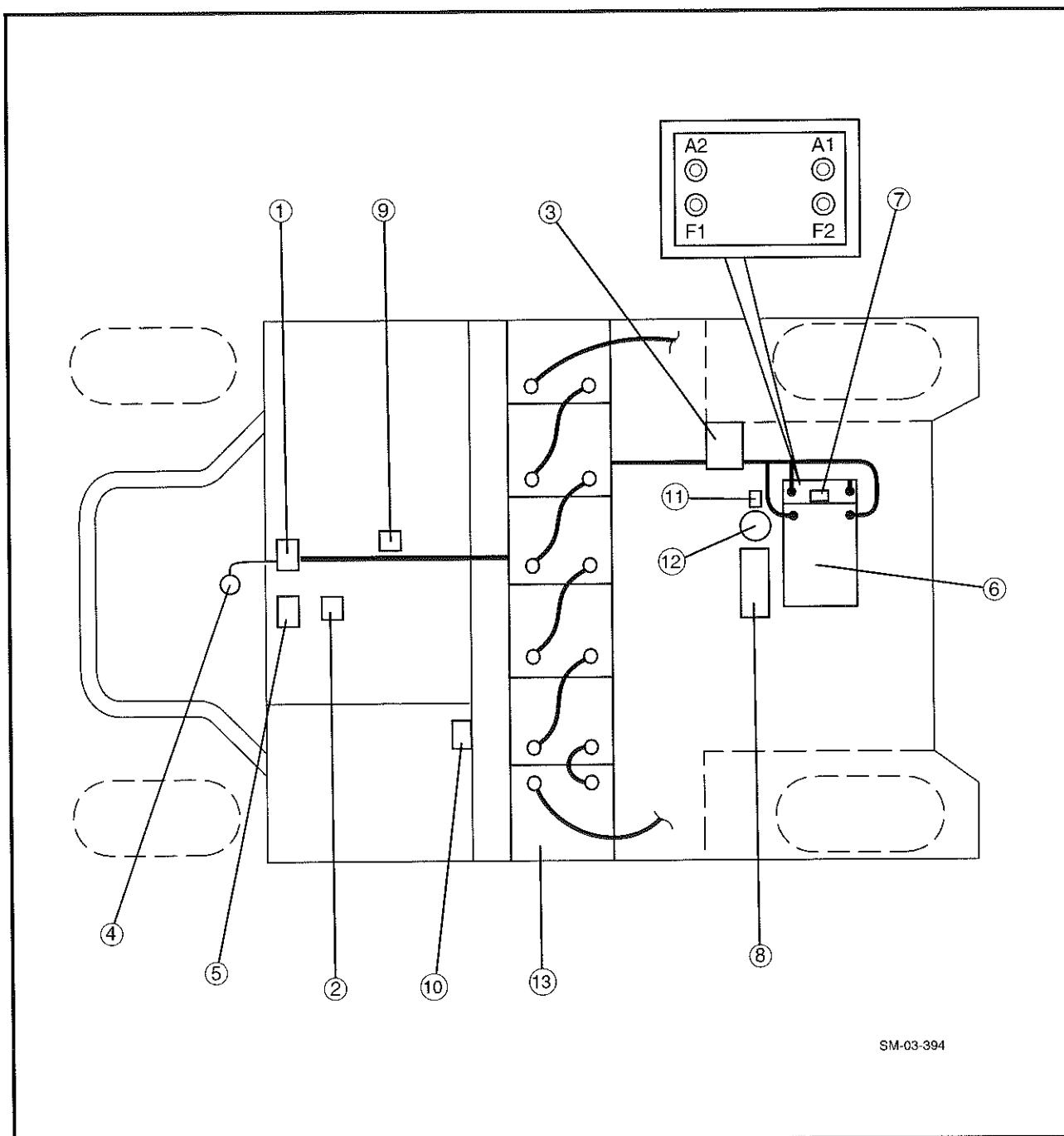
G22E WIRING DIAGRAM





ELECTRICAL COMPONENT LOCATIONS

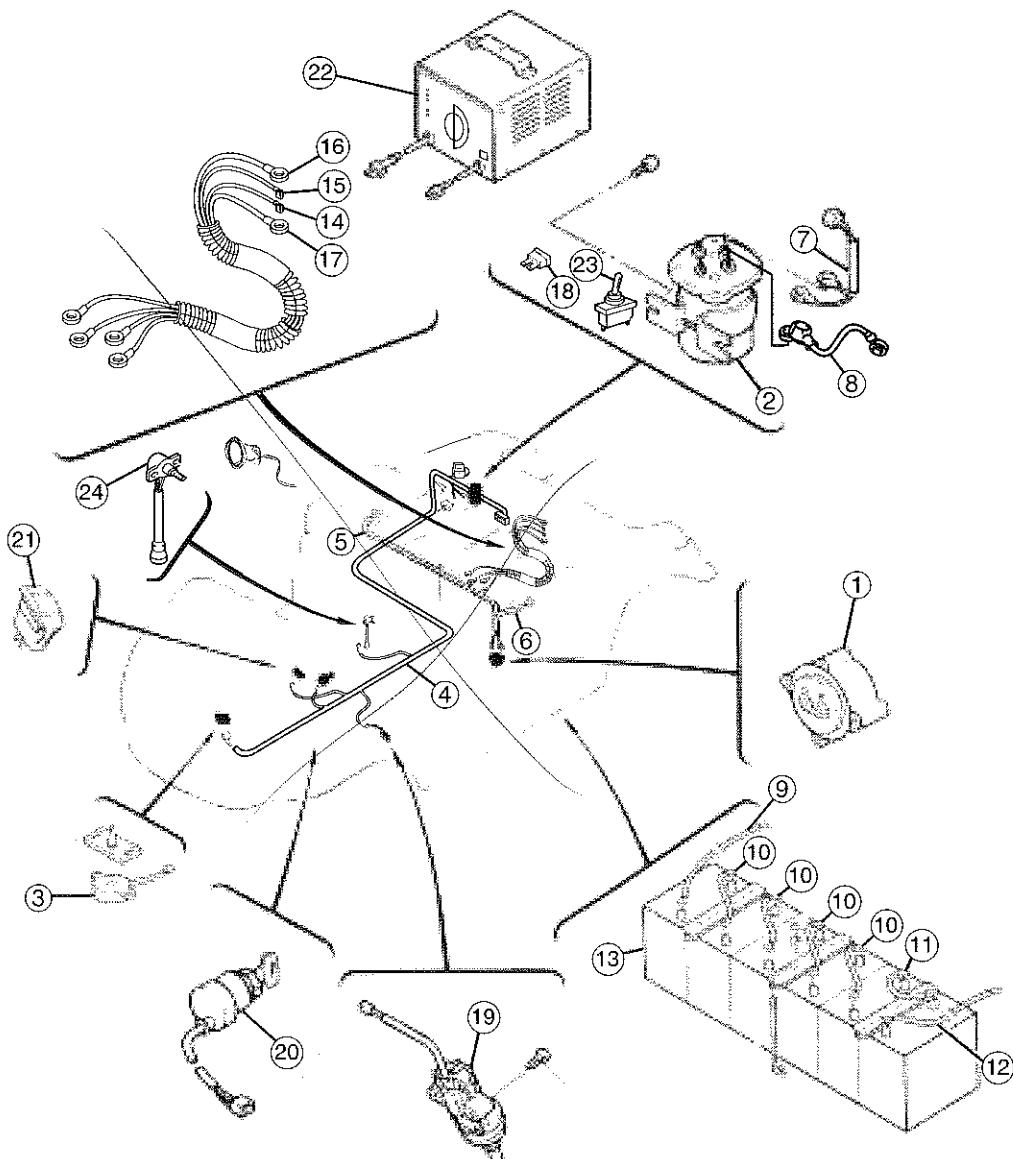
- | | |
|---------------------------|-----------------------|
| ① Main switch | ⑧ Motor control unit |
| ② Accelerator stop switch | ⑨ Throttle sensor |
| ③ Tow/storage switch | ⑩ Charging receptacle |
| ④ Reverse buzzer | ⑪ Fuse |
| ⑤ Forward-reverse switch | ⑫ Solenoid relay |
| ⑥ Traction motor | ⑬ Batteries (8V x 6) |
| ⑦ Speed sensor | |





ELECTRICAL COMPONENTS

- | | | |
|------------------|----------------------|----------------------------|
| ① Receptacle | ⑨ Wire plus lead | ⑯ Wire lead 2 (A2) |
| ② Solenoid relay | ⑩ Battery lead 2 | ⑰ Fuse (3A) |
| ③ Buzzer | ⑪ Battery lead 3 | ⑲ Accelerator stop switch |
| ④ Wire harness | ⑫ Battery lead 1 | ⑳ Main switch |
| ⑤ Wire lead 1 | ⑬ Batteries (8V x 6) | ㉑ Forward/reverse switch |
| ⑥ Wire lead 2 | ⑭ Wire lead, F1 | ㉒ Battery charger |
| ⑦ Wire harness | ⑮ Wire lead, F2 | ㉓ Tow switch |
| ⑧ Wire 7 | ⑯ Wire lead 1 (A1) | ㉔ Throttle position sensor |



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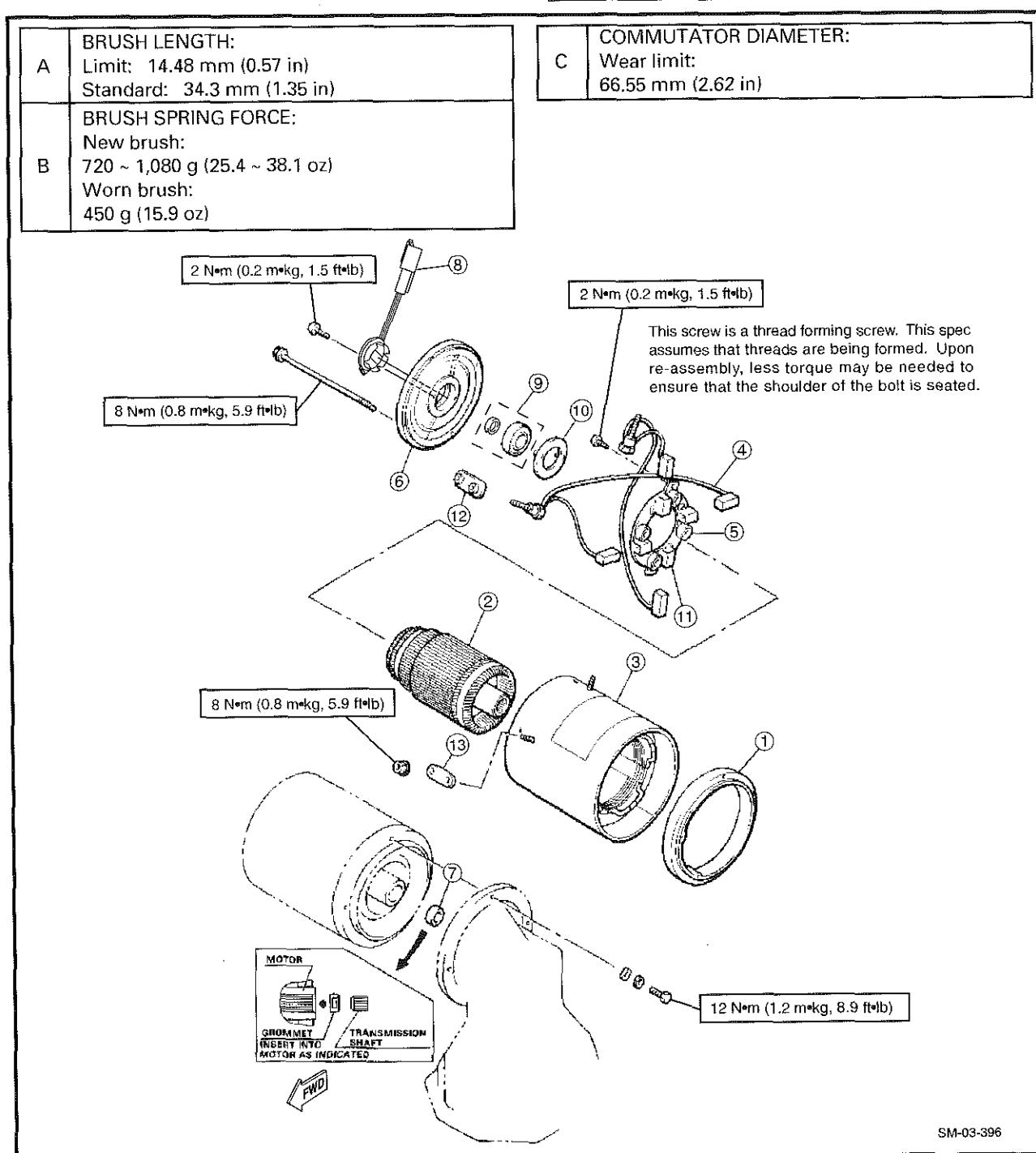


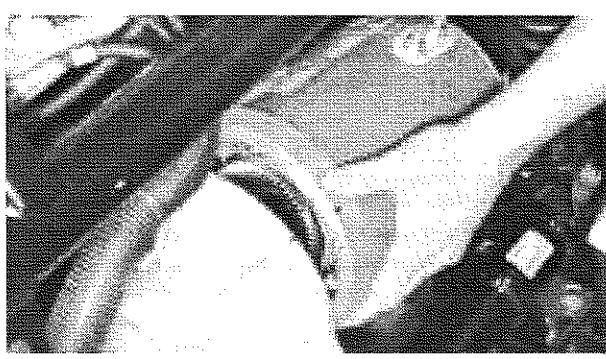
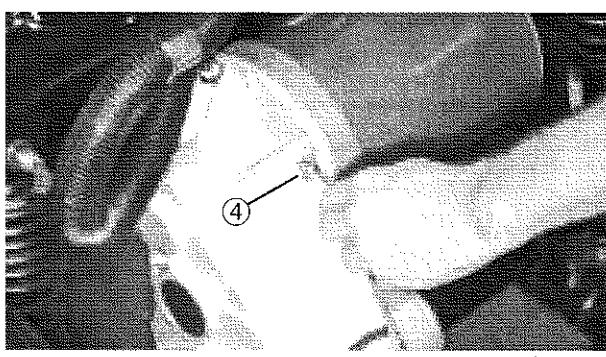
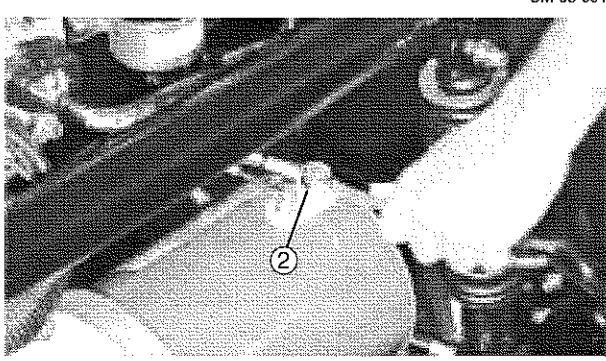
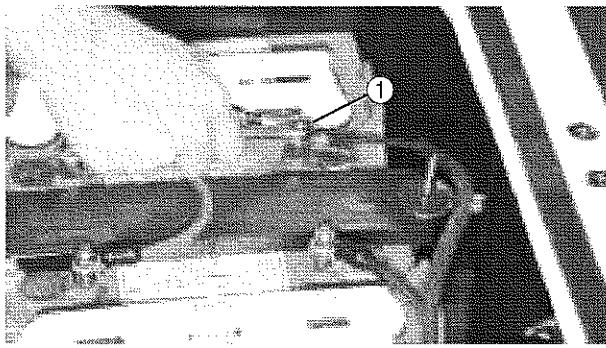
TRACTION MOTOR

- | | |
|-----------------------|-------------------------|
| ① Front bracket | ⑧ Pickup assembly |
| ② Armature assembly | ⑨ Bearing w/ magnet |
| ③ Field coil assembly | ⑩ Retainer |
| ④ Brush set | ⑪ Brush holder assembly |
| ⑤ Brush spring | ⑫ Washer 2 |
| ⑥ Bracket | ⑬ Washer 1 |
| ⑦ Grommet | |

SPECIFICATIONS	
Model	5BC59JBS6370
Voltage	48V DC
Rated output KW/HP	2.5 KW (3.4 HP) for 30 min.
Performance	
Current	44A
Voltage	48V
Set Torque	5.58 N•m (0.57 m•kg, 4.1 ft•lb)
Revolution	2,970 rpm
Weight	16.5 kg (36.4 lb)

A	BRUSH LENGTH: Limit: 14.48 mm (0.57 in) Standard: 34.3 mm (1.35 in)
B	BRUSH SPRING FORCE: New brush: 720 ~ 1,080 g (25.4 ~ 38.1 oz) Worn brush: 450 g (15.9 oz)
C	COMMUTATOR DIAMETER: Wear limit: 66.55 mm (2.62 in)





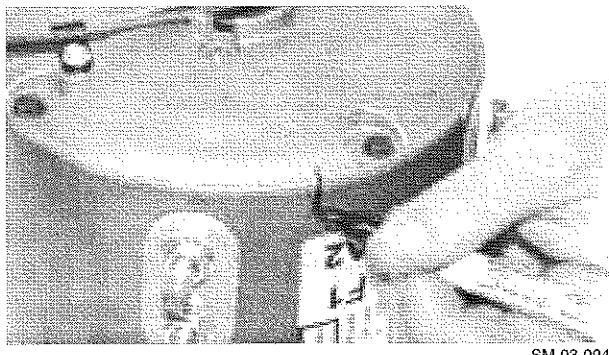
TRACTION MOTOR

! WARNING

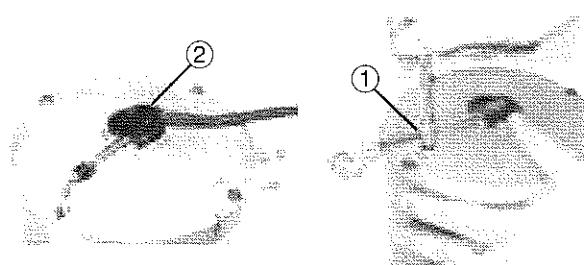
Secure vehicle and discharge the controller capacitor. Refer to CHAPTER 1 "SAFETY PRECAUTIONS" section.

REMOVAL

1. Remove:
 - Seat
 - Service access panel
2. Disconnect:
 - Negative battery lead ①
3. Disconnect:
 - All four leads ② from the motor terminals.
Mark leads for installation.
 - Speed sensor leads ③
4. Remove:
 - Motor securing bolts ④
5. Remove:
 - Traction motor

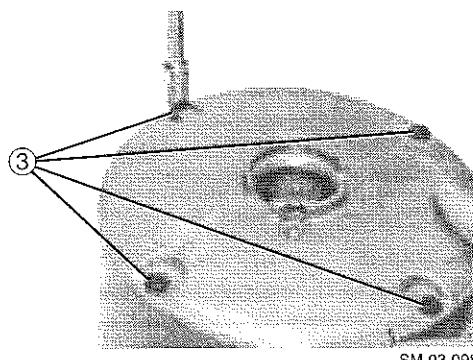


SM-03-094

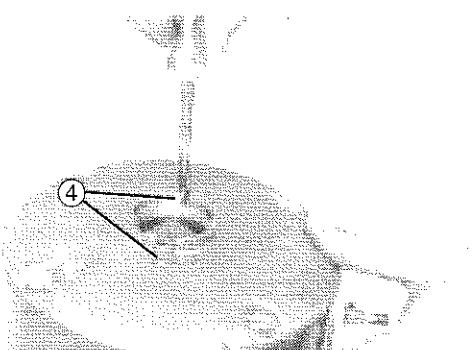


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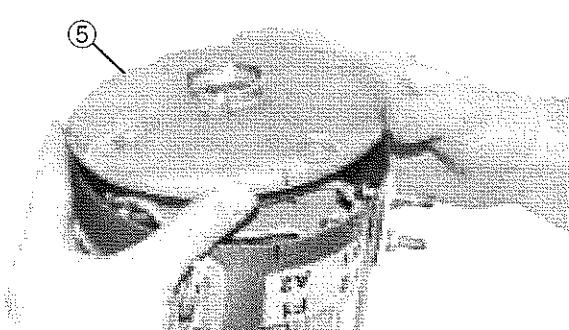
SM-03-096



SM-03-098



SM-03-097



SM-03-099

DISASSEMBLY

1. Mark cover and body of motor. This will serve as an alignment mark during assembly.

2. Remove:

- Screw wire holder ①
- Pickup assembly ②

3. Remove:

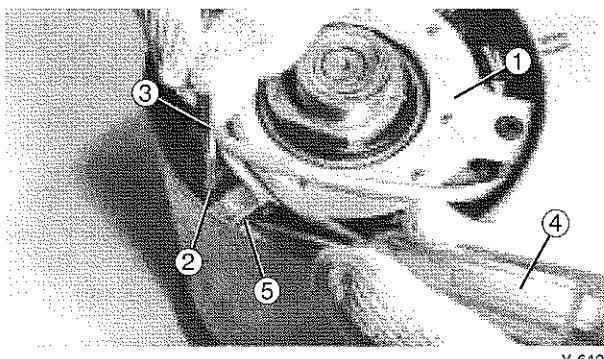
- Bolts ③

4. Remove:

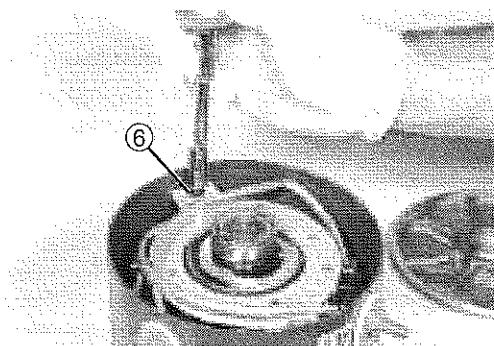
- Set screws ④ for bearing/magnet assembly

5. Remove:

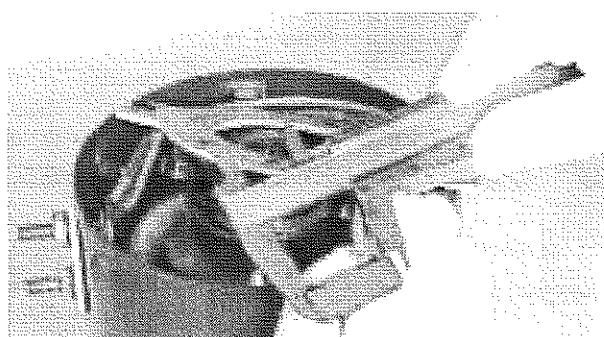
- Cover ⑤



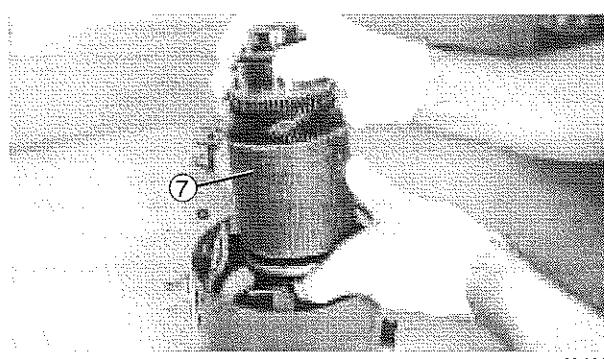
Y-642



Y-643



Y-644



Y-820

6. Remove:

- Brush holder ①.

NOTE:

Pull back on spring ② with one screw driver ③ and with other ④ get under wire and pull back on brush ⑤ to pull it away from rotor. There are four brushes.

- Remove brush holder bolts ⑥

7. Check:

- Brush length

Length of new brush is 34.3 mm.

Out of specification → replace



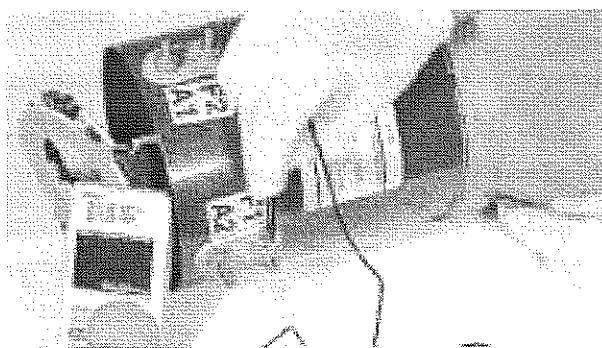
**Minimum Brush Length:
14.48 mm (0.57 in)**

NOTE:

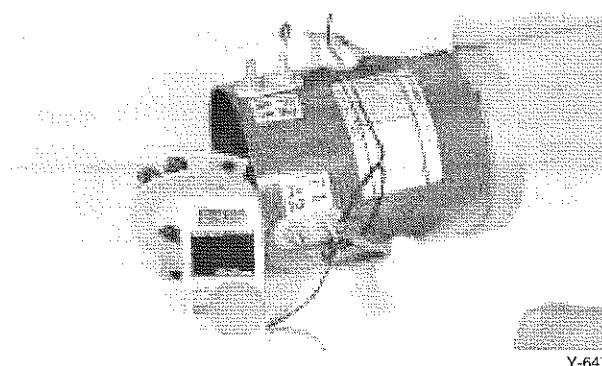
Leave brush leads attached to yoke while checking brush length.

8. Remove:

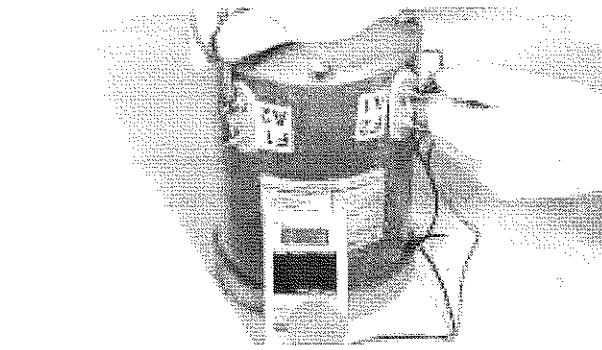
- Armature ⑦

**INSPECTION AND TESTING**

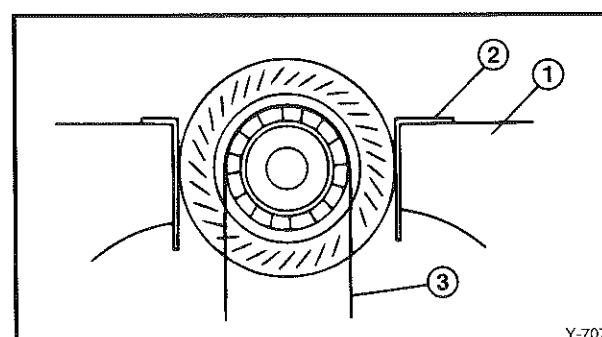
Y-646



Y-647



Y-649



Y-707

1. Clean the interior of the yoke and bracket with compressed air.

2. Inspect:

- Outer surface
Cracks/Damage → replace

3. Measure:

- Insulation resistance (F1 and ground, F2 and ground).
Defective → replace



Insulation Resistance:
More than 1 M ohms at 20°C (68°F)

4. Measure:

- Field coil resistance (F1 to F2)
Use the Low Reading Ohmmeter.
Out of specification → replace



Field Coil Resistance:
1.15 ~ 1.41 ohms at 20°C (68°F)

5. Measure:

- Armature coil resistance (Armature and brushes installed)
(A1 to A2)
Use the Low Reading Ohmmeter.
Out of specification → replace



Armature Coil Resistance:
0.0216 ~ 0.0264 ohms at 20°C (68°F)

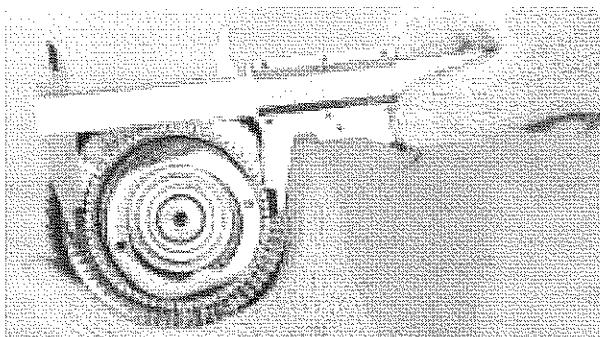
7

6. Inspect:

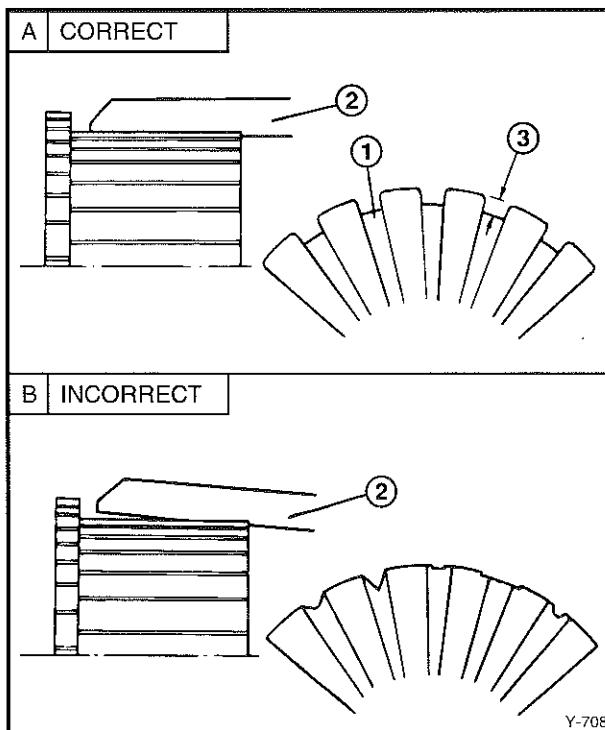
- Commutator (Outer surface)
Hold the armature in a vise (1) and copper or aluminum plate (2).
Dirty → clean with #600 grit emery cloth (3)

CAUTION

Hold armature lightly between padded vise jaws to avoid damaging armature.



Y-650



Y-708

7. Measure:

- Commutator (Diameter)

Out of specification → replace

Measure the diameter of the commutator as shown.

Out of specification → replace



Wear Limit (Minimum Diameter):
66.55 mm (2.62 in)

8. Measure:

- Mica ① (Insulation depth)

(between commutator segments)

Out of specification → scrape mica to proper limits

Use a hacksaw blade ② that is ground to fit.

Re-measure Mica Undercut ③.

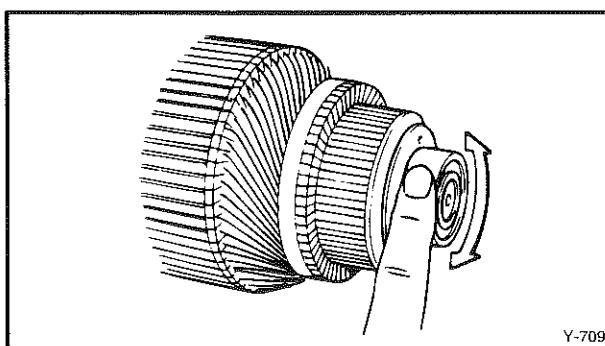


Mica Undercut ③:
Limit: 0.25 mm (0.0098 in)

NOTE:

The mica insulation of the commutator must be undercut to ensure proper operation of the commutator.

Carefully clean between the segments after the above steps.



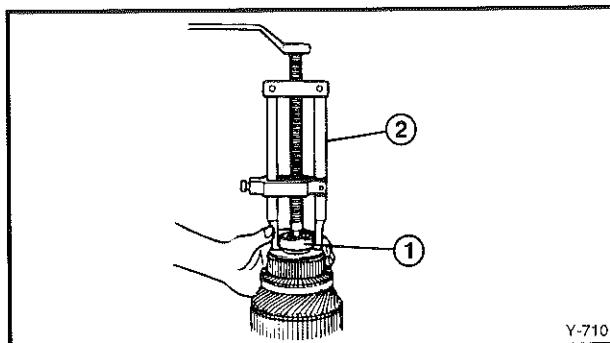
Y-709

9. Check:

- Bearing movement

Rotate with fingers.

Roughness/Wear → replace



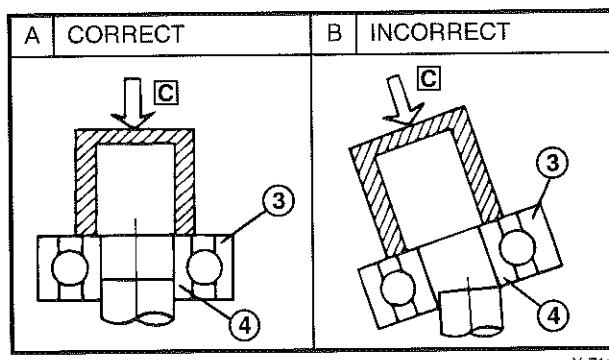
Y-710

Bearing replacement steps:

- Remove the bearing ① with a bearing puller ②.
- Install the new bearing.

CAUTION

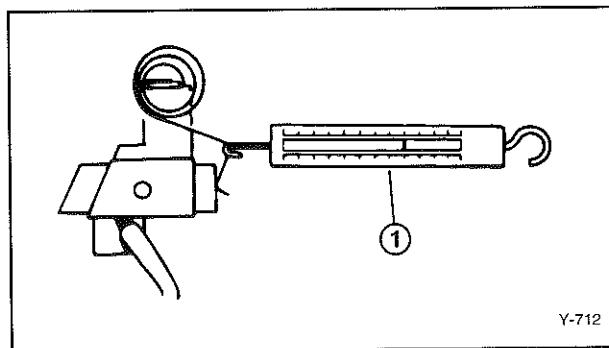
Do not strike the outer race ③ or balls of the bearing. Contact should be made only with the center race ④.



Y-711

C PRESS**10. Install:**

- Armature coil into the brush holder.



Y-712

11. Measure:

- Brush spring force

Use a spring scale ①.

Pull the scale and check reading as the brush spring just comes off the brush.

Out of specification → replace

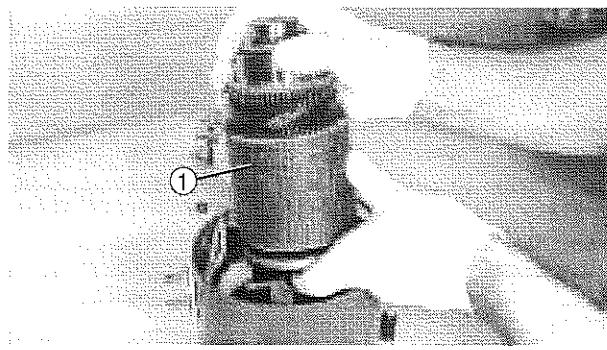
**Brush Spring Force:**

New Brush: 720 ~ 1,080 g
(25.4 ~ 38.1 oz)

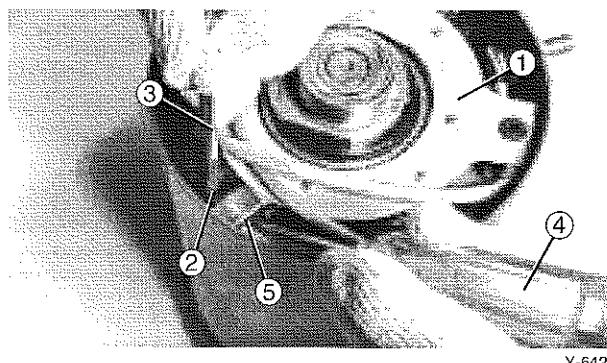
Limit: 450 g (15.9 oz)

**ASSEMBLY**

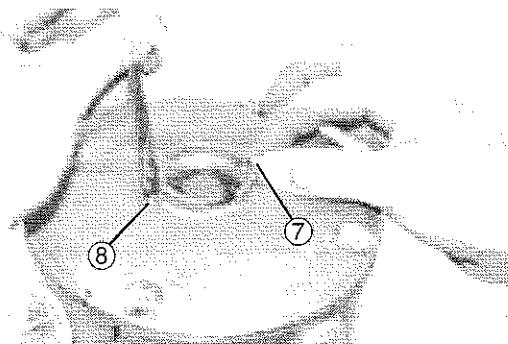
Reverse the "Disassembly" procedure.
Note the following points.



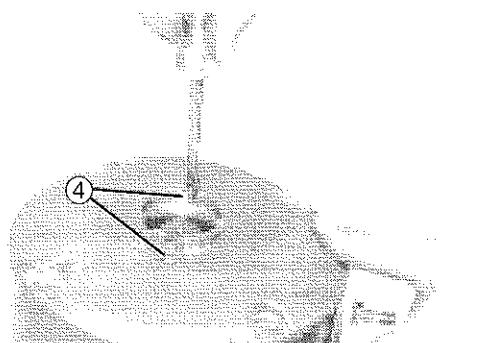
Y-645



Y-642



SM-03-100



SM-03-097

CAUTION

When installing armature into yoke, use care not to damage brushes.

1. Install:

- Armature (1)

CAUTION

When installing armature into yoke, use care not to damage brushes.

2. Install:

- Brush holder (1). Reposition brush springs (2). Use the screwdrivers (3) and (4) to position brush (5).

NOTE:

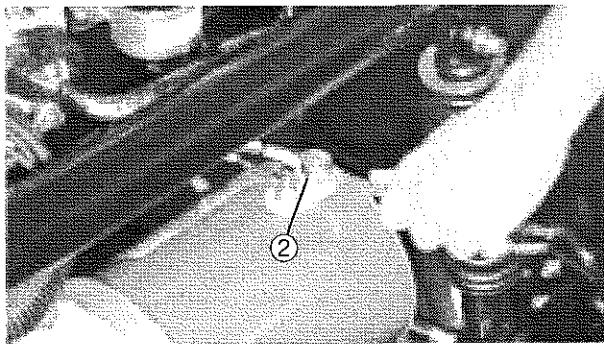
When installing cover, install a pilot screw (8-32 x 1-1/4") (7) first to hold the bearing retainer. Pull up on pilot screw (7) and install screw (8). Remove pilot screw and install second screw.



INSTALLATION

Reverse the "Removal" procedure.

Note the following points.



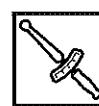
SM-03-092



Motor Securing Bolt: (Upper)
12 N·m (1.2 m·kg, 8.9 ft·lb)

1. Connect:

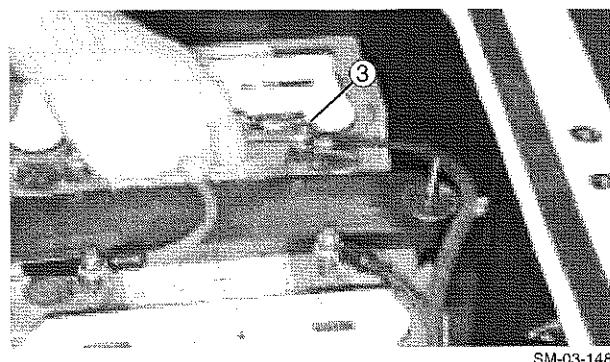
- Motor terminal leads ①
- Speed sensor leads ②



Motor Terminal Leads
8 N·m (0.8 m·kg, 5.9 ft·lb)



SM-03-147



SM-03-148

2. Connect:

- Negative battery lead ③

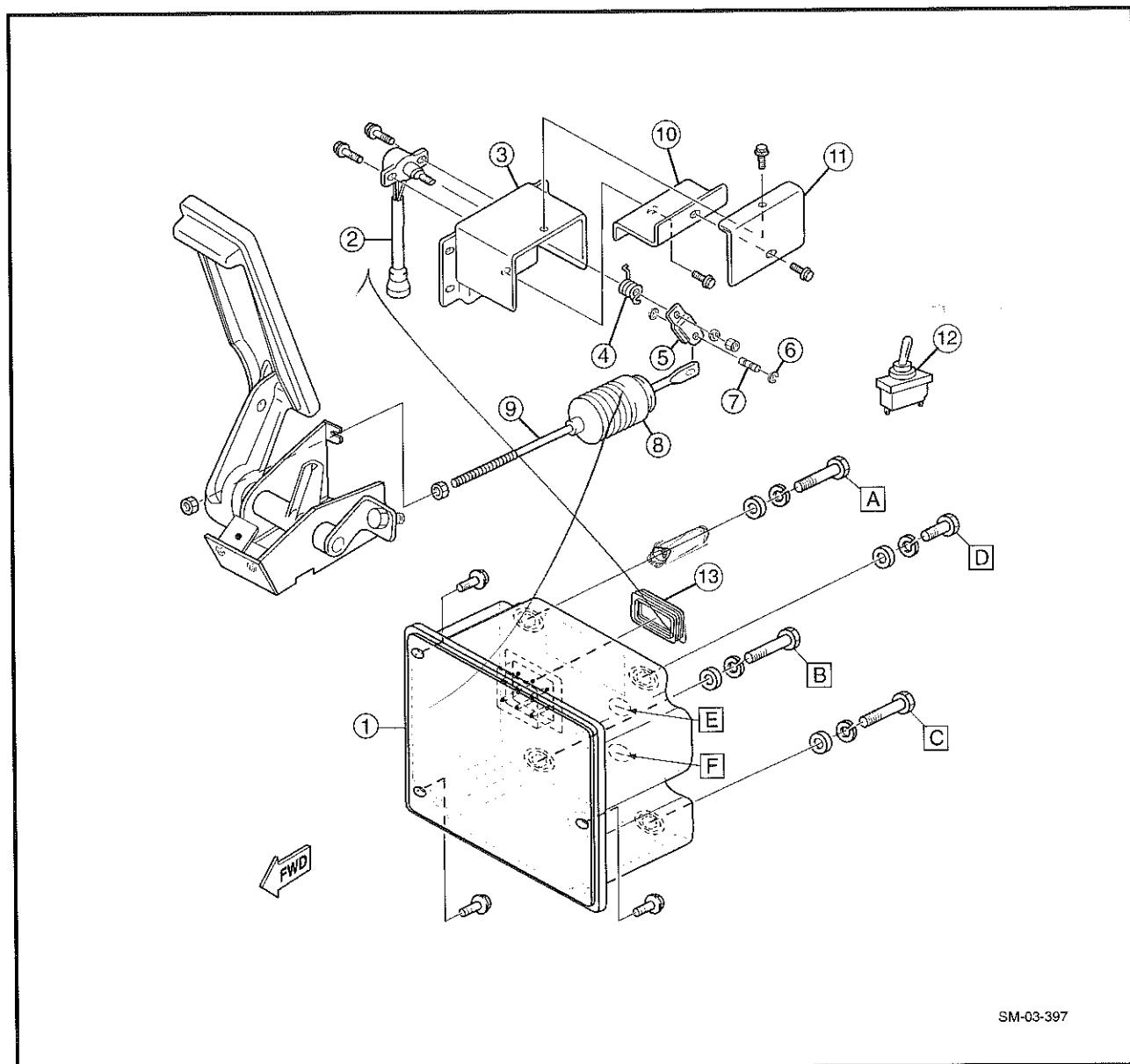
3. Install:

- Seat

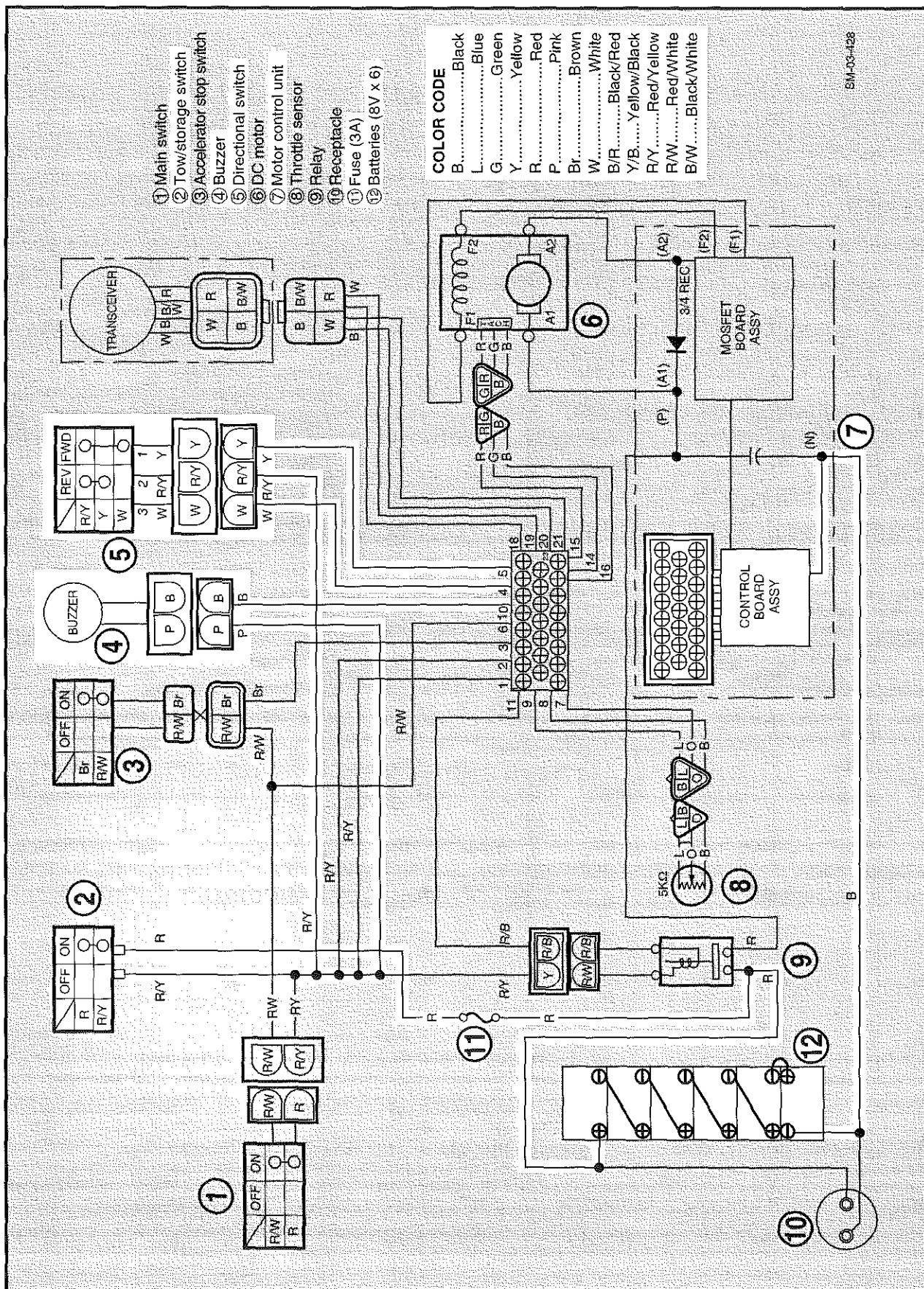


MOTOR CONTROL UNIT

- | | |
|----------------------|--------------------------------|
| ① Motor Control Unit | ⑪ Cover 2 |
| ② Throttle sensor | ⑫ Tow/run switch |
| ③ Throttle bracket | ⑬ MCU seal |
| ④ Return spring | A To Solenoid relay (Positive) |
| ⑤ Throttle arm | B To Battery (Negative) |
| ⑥ Circlip | C To Traction motor A2 |
| ⑦ Pedal crank pin | D To Traction motor A1 |
| ⑧ Cover 1 | E To Traction motor F2 |
| ⑨ Joint rod | F To Traction motor F1 |
| ⑩ Plate 1 | |



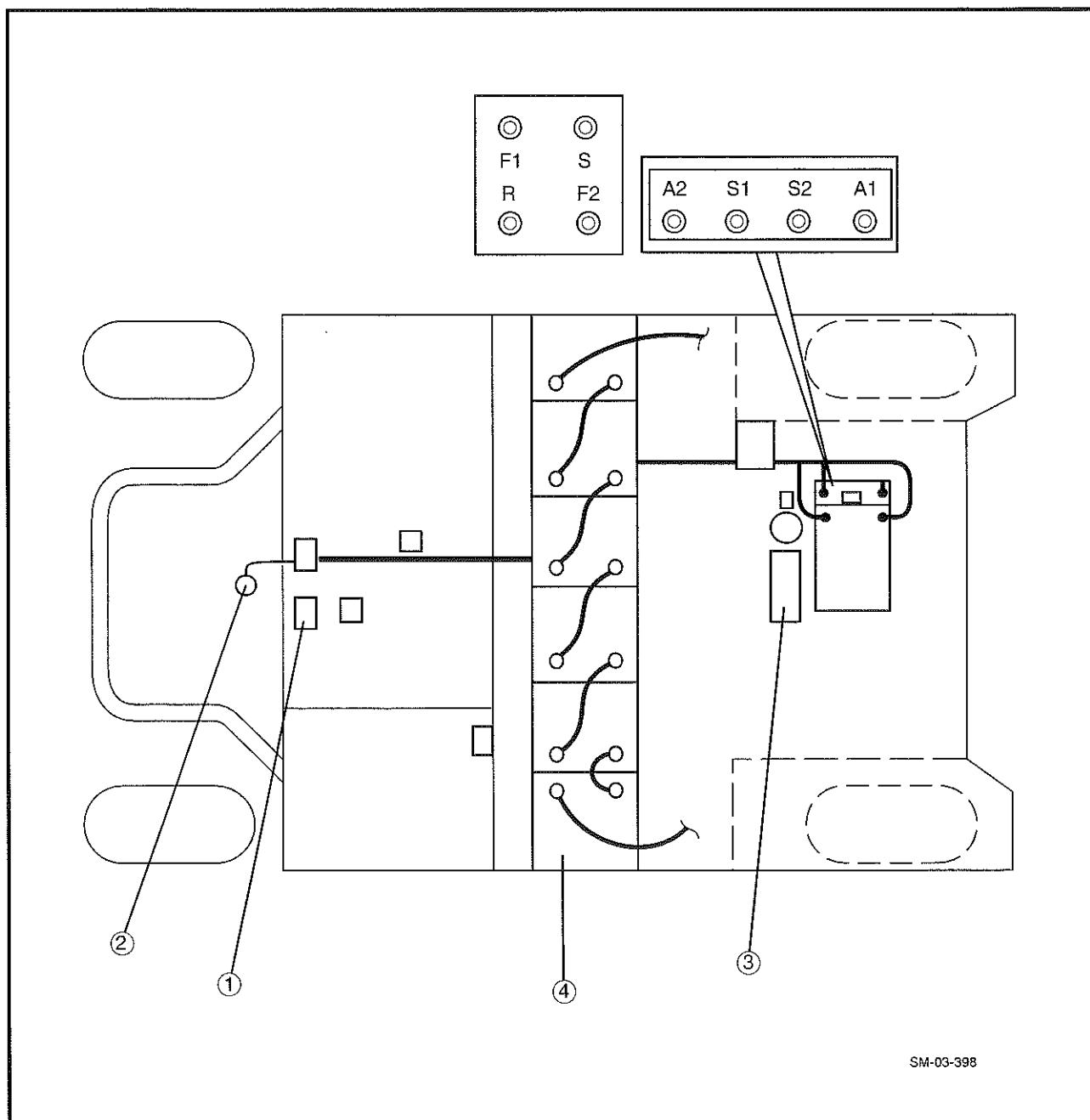
SIGNAL SYSTEM





SIGNAL SYSTEM COMPONENTS

- ① Main switch
- ② Reverse buzzer
- ③ Fuse
- ④ Batteries (8V x 6)



SM-03-398

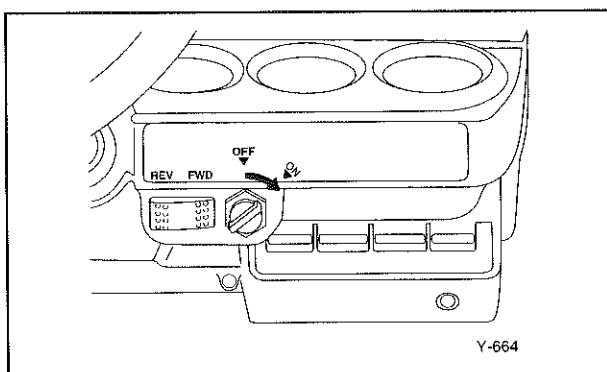
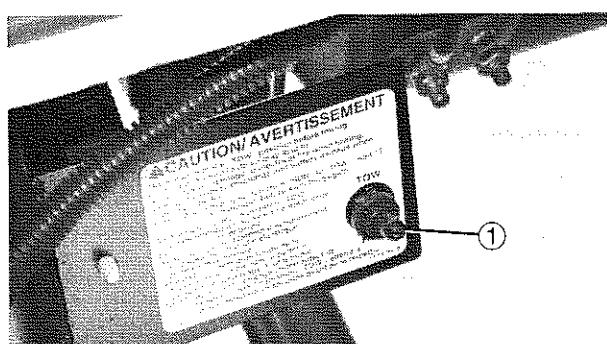
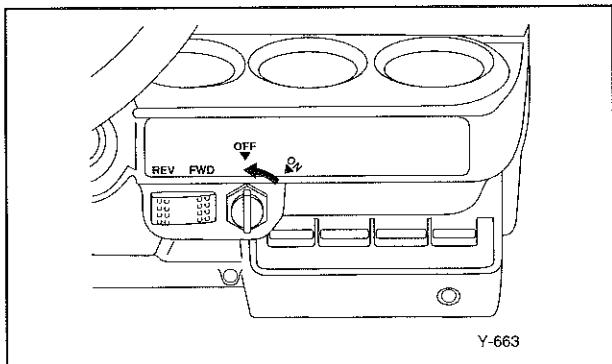
CHAPTER 8 TROUBLESHOOTING

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ELECTRICAL TROUBLESHOOTING

Should any one of the troubles below occur, it is advisable to check for the possible cause in the order specified.

Refer to page 9-21 "G22E WIRING DIAGRAM."



Before performing any tests in this chapter, reset the Controller as follows:

1. Turn main switch OFF and tow switch ① to "Tow" position. Wait 30 seconds.
2. Turn main switch ON, and tow switch to "RUN" position.

Test the reported malfunction. If the problem is now corrected, the controller needed to reset internally. There are two potential causes of this condition.

1. The user operated the tow switch without allowing the system to reset. Educate the user that the tow switch is to be used by service personnel only for vehicle towing or long term storage.
2. If this kind of malfunction occurs more frequently, there may be a fault caused by a poor or intermittent wire connection.

WARNING

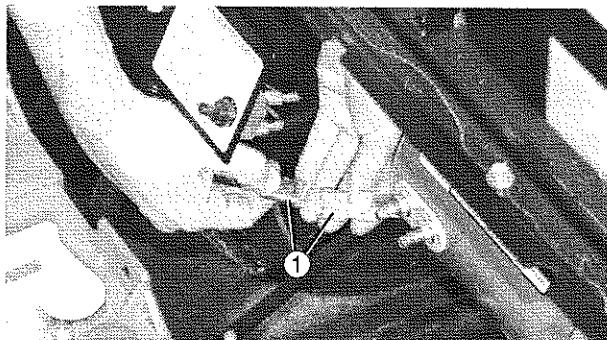
Secure vehicle and discharge the controller capacitor. Refer to CHAPTER 1 "SAFETY PRECAUTIONS" section.

ACCELERATION BECOMES ROUGH, UNEVEN OR JERKY**VISUAL INSPECTION**

1. Check for loose or separated connections between the speed controller and solenoid relay.
2. Check for loose terminals and connections.

TEST THROTTLE POSITION SENSOR

3. Test the throttle position sensor. Refer to page 8-10 "THROTTLE POSITION SENSOR CHECK" section.

CAR DOES NOT SLOW ON DOWN-HILL GRADE AND/OR CAR WILL ROLL AWAY WITHOUT SLOWING

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VISUAL INSPECTION

1. Check the speed sensor connector pins ①.
 - A. If OK, go to step 2.
 - B. If not OK, repair.

SPEED SENSOR WIRE HARNESS CHECK

2. Disconnect the speed sensor harness connector. Using a voltmeter, test the wire harness side red and black wires for voltage supply of 5 VDC \pm 10%. (Touch voltmeter red (+) probe to harness red wire, black (-) probe to harness black wire.)
 - A. If OK, go to step 5.
 - B. If no voltage, go to step 3.
3. Using an ohmmeter or self powered test light, check the continuity of the red, green and black wires from the speed sensor connector to the controller.

CAUTION

Use care when probing the female connectors inside the wire harness controller plug. The terminals are easily damaged which can cause failure symptoms.

- A. If not OK, repair wiring.
- B. If OK, reset the controller with tow switch again and perform step 3 again. If still no voltage, replace controller.
4. Using a voltmeter, test controller terminal pin numbers 15 (positive) and 16 (negative) for voltage supply of 5 VDC \pm 10%.
 - A. If OK, reconnect controller connector and go to step 5.
 - B. If no voltage, reset the controller with tow switch again and perform step 3 again. If still no voltage, replace controller.

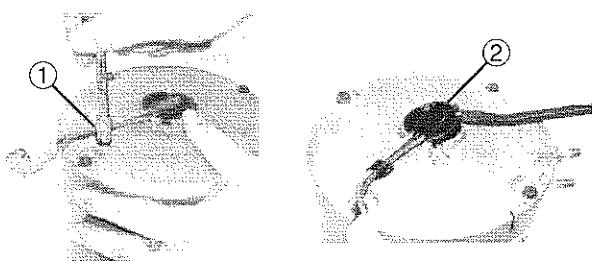
SPEED SENSOR TEST

5. Using an analog voltmeter, check the speed sensor output using the test cord (YG-42221).



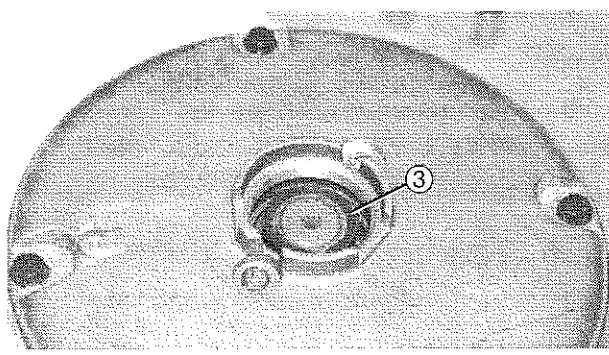
**Speed Sensor Test Cord:
YG-42221-A**

- Block the front wheels. Raise one rear wheel off the ground using a jack and stand.
 - Attach test cord between harness and sensor leads.
 - Touch voltmeter red (+) probe to test cord green wire, black (-) probe to test cord black wire.
 - Slowly rotate the rear wheel and check for a voltage reading that swings from zero VDC up to 5 VDC \pm 10%.
- A. If OK, replace controller.
 - B. If not OK, go to step 6.

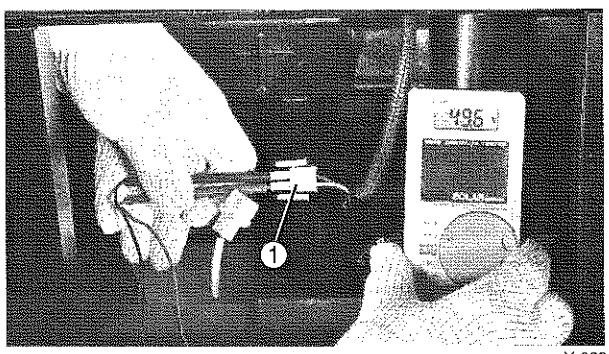


SM-03-096

SM-03-095



SM-03-089



Y-688

SPEED SENSOR MAGNET CHECK

6. Remove:

- Screw wire holder ①
- Pickup assembly ②

Check the magnet ③ on the shaft for foreign material.

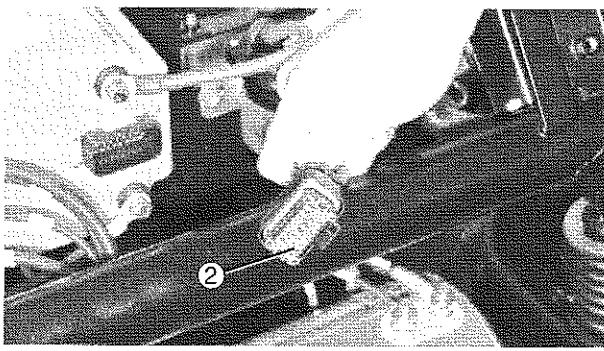
- A. If contaminated, clean, reinstall and perform step 5 again.
- B. If step 5 fails again, replace sensor, magnet or traction motor as required.

NOTE:

Be sure to verify the rollaway feature (including buzzer) is operating before releasing the car to the customer.

CAR HAS NO REVERSE WARNING BEEPER**BUZZER WIRING CHECK**

1. Check for power and ground at buzzer connector ①, with F/R switch in reverse.
 - A. If both are present, replace buzzer.
 - B. If no power is present, check the fuse, tow switch and wiring. Repair as needed.
 - C. If no ground is present, go to step 2.



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GROUND WIRE CHECK

2. Check the continuity of the black wire from controller terminal 10 ② to the reverse buzzer.

CAUTION

Use care when probing the female connectors inside the wire harness controller plug. The terminals are easily damaged which can cause failure symptoms.

- A. If OK, replace controller.
- B. If open circuit, repair and recheck operation.

THE CAR'S TOP SPEED IS SLOWER**CHECK BRAKES AND CHASSIS**

1. Confirm that brakes are not dragging, chassis toe-in is within specification, and nothing is rubbing against the wheels.

VISUAL INSPECTION

2. Check the batteries, speed controller and traction motor for loose, shorted or separated connections.

CHECK BATTERIES

3. Check the batteries for sulfation and discharge capacity.
Check the battery electrolyte level and charged condition. Refer to CHAPTER 2 "BATTERY INSPECTION" section.

TEST THROTTLE POSITION SENSOR

4. Check the throttle position sensor. Refer to page 8-10 "THROTTLE POSITION SENSOR CHECK" section.

CHECK TRACTION MOTOR

5. Check the traction motor for worn or separated brushes, or dirty commutator. Refer to CHAPTER 7 "TRACTION MOTOR" section.

CAR ONLY RUNS IN ONE DIRECTION**CHECK FORWARD/REVERSE DIRECTION SWITCH**

1. Check direction wiring and test direction switch. Refer to page 8-12 "DIRECTION SWITCH CHECK" section.

CAR WON'T RUN EITHER DIRECTION, SOLENOID DOES NOT CLICK

RESET CONTROLLER

1. Confirm that controller has been reset. Refer to page 8-3 "ELECTRICAL TROUBLESHOOTING" section.
2. Place Forward/Reverse direction switch in reverse position. If reverse warning sounds, go to step 9. If no warning sounds, go to step 3.

VISUAL INSPECTION

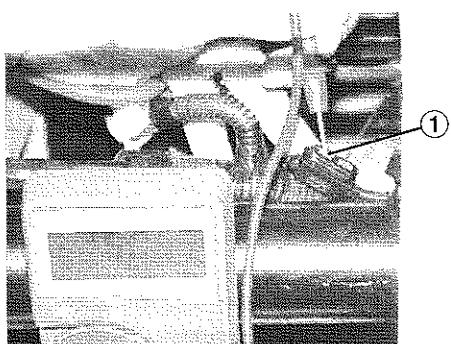
3. Visually inspect for loose connections or broken wires.
 - A. If OK go to step 4.
 - B. If not OK, repair.

CHECK BATTERIES

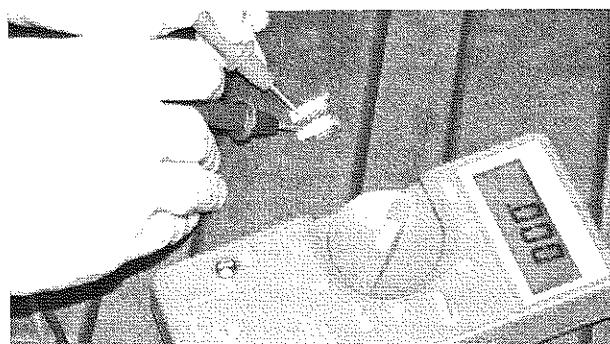
4. Check battery condition. Refer to CHAPTER 2, "BATTERY INSPECTION" section.
 - A. If OK go to step 5.
 - B. If not OK, service or replace batteries.

FUSE CHECK

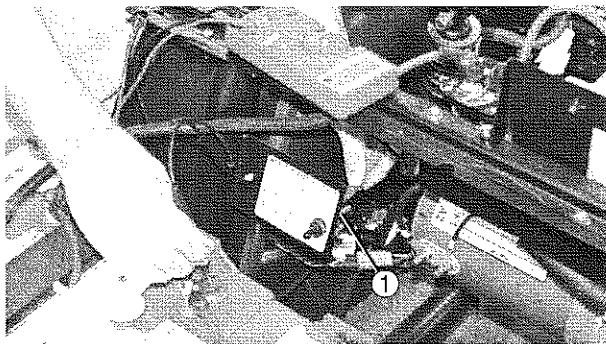
5. Check fuse. (Should have power on both red wires.)
 - A. Check for power to fuse holder ①.
 - B. If no voltage is present on either wire, repair open circuit between fuse and charge receptacle.
 - C. If voltage is present on only one side of the fuse, replace the fuse.
 - D. If voltage is present on both wires, fuse is OK; go to step 6.



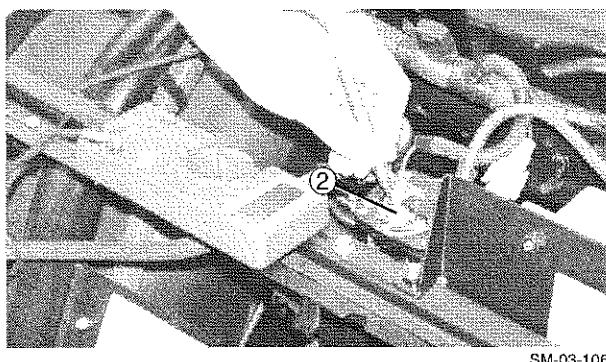
SM-03-101



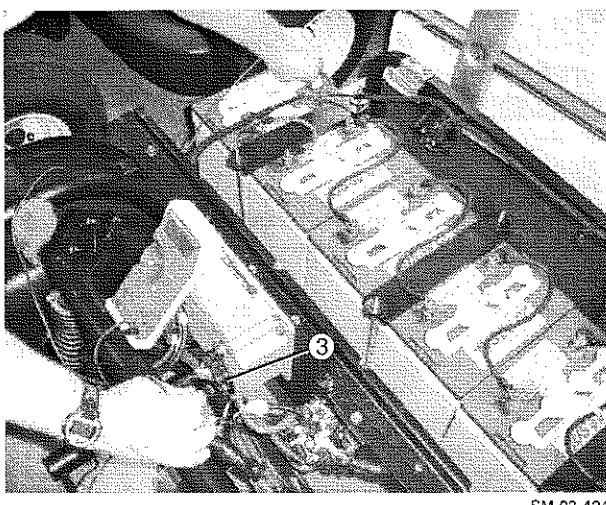
SM-03-102

**TOW SWITCH TEST**

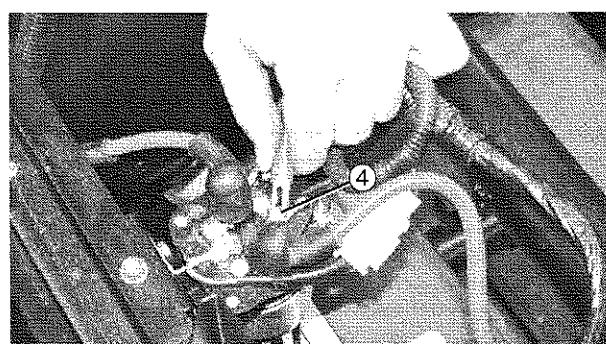
6. Test tow switch. (It should have power on both red and red/yellow wires when in "RUN" position ①.) Jump these two wires together to bypass the switch.
 - A. If car operates, replace tow switch.
 - B. If it doesn't, go to step 7.
 - C. If there is no power to the switch, repair the open circuit between the tow switch and the fuse.

**WIRE CHECK SOLENOID TO TOW SWITCH**

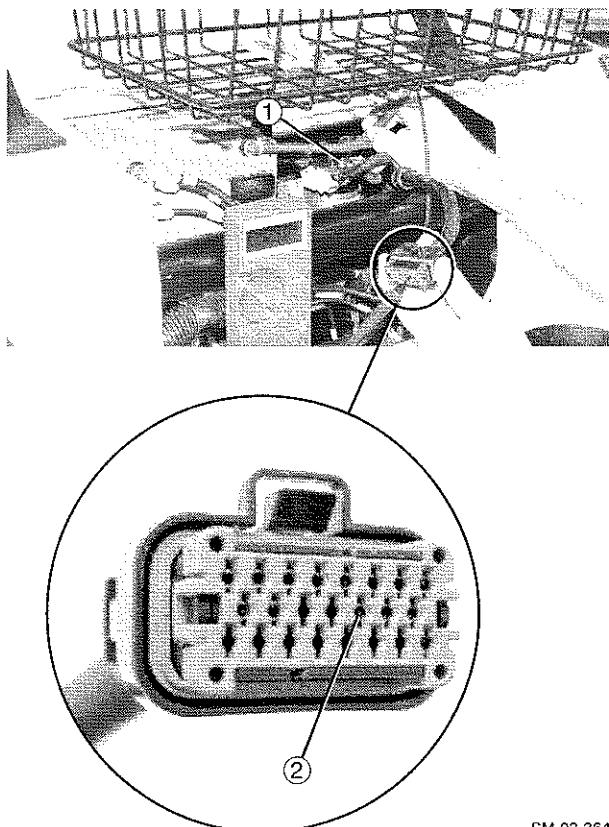
7. Check for voltage at red/yellow wire at solenoid (small wire) ②.
 - A. If no voltage is present, repair the open circuit between the tow switch and solenoid.
 - B. If voltage present, go to step 8.

**CONTROLLER GROUND WIRE CHECK**

8. Test the ground wire ③ at the controller with a voltmeter to see if it is grounded (voltmeter from positive battery terminal to negative wire terminal at controller).
 - A. If not repair the ground connection.
 - B. If OK, go to step 9.

**SOLENOID GROUND BYPASS**

9. Connect a temporary ground (jumper) from the red/black wire of the solenoid (small wire) ④ to battery pack ground side.
Note: Key doesn't need to be ON and pedal need not be depressed.
 - A. If the solenoid still doesn't click, go to step 11.
 - B. If the solenoid now clicks, go to step 10.

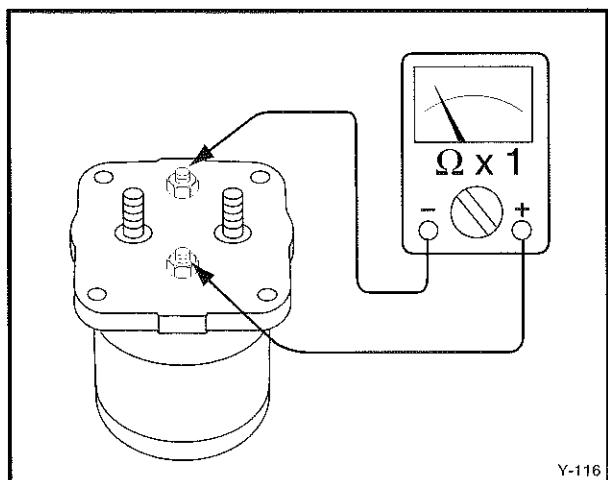
**WIRE CHECK - SOLENOID TO CONTROLLER**

10. Check continuity of red/black wire from solenoid ① to controller. (Ground it from controller terminal ② to controller main ground.) You must disconnect the controller connector for this test.

CAUTION

Use care when probing the female connectors inside the wire harness controller plug. The terminals are easily damaged which can cause failure symptoms.

- If the solenoid clicks, reconnect components and test the car. If relay does not click, replace controller.
- If the relay does not click, repair the open condition in the red/black wire between the solenoid and controller.

**SOLENOID RELAY BENCH TEST**

11. Bench test the solenoid relay.

- Remove:
 - Seat
- Turn the main switch to "ON."
- Check:
 - Solenoid relay (clicking sound)
Press accelerator pedal to close the accelerator stop switch.
If clicking → check for continuity between the two contact posts with Pocket Tester while the solenoid is activated. If there is no continuity, replace the relay.
If not clicking → measure coil resistance in solenoid
- Check:
 - Solenoid relay (no clicking sound)

CAUTION

Disconnect battery negative lead before removing solenoid leads.

Disconnect solenoid leads.
Measure coil resistance use the Pocket Tester.
Out of specification → replace



Pocket Tester:
YU-3112-C



Solenoid Coil Resistance:
336 Ω at 20° C (68° F)

Installation

- E. Install:
 - Solenoid relay
- F. Connect:
 - Leads



Nut (Terminal):
6 N·m (0.6 m·kg, 4.4 ft·lb)

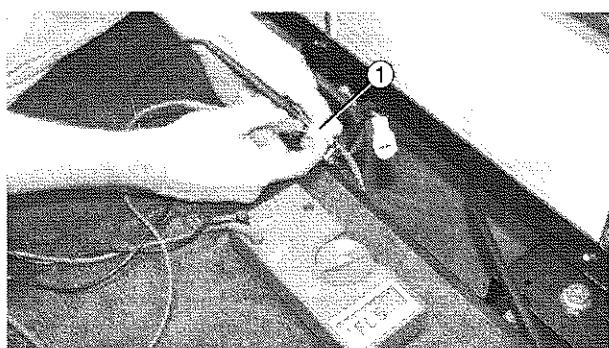
CAR WON'T RUN EITHER DIRECTION, SOLENOID DOES CLICK

VISUAL INSPECTION

1. Visually inspect for loose connections or broken wires.
 - A. If loose, repair.
 - B. If OK, go to step 2.

CHECK BATTERIES

2. Test batteries to determine if they are installed correctly and with a hydrometer and voltmeter. Refer to CHAPTER 2 "BATTERY INSPECTION" section.
 - A. If OK, go to step 3.
 - B. If not OK, correct as necessary.



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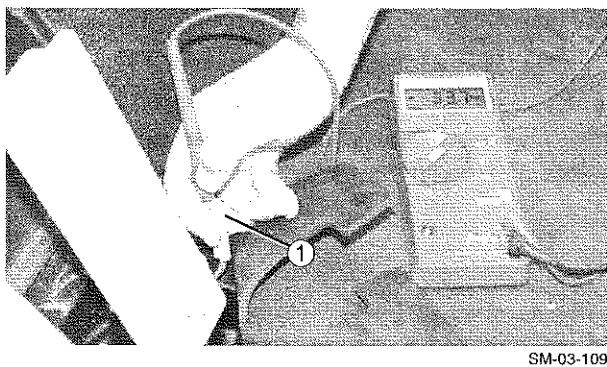
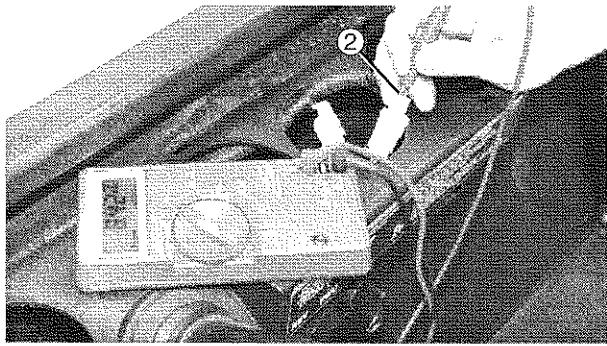
THROTTLE POSITION SENSOR CHECK

3. Disconnect the three wire connector to the throttle position sensor (blue, black and orange harness wires.) Check the resistance across the sensor side of the connector ①. A good sensor will read the following:
 - Blue to Black - 5000 ohms (5K) pedal, any position.
 - Orange to Black - Use an analog ohmmeter. The reading should vary from 0 ~ 150 ohms with accelerator pedal at rest, to up to 5000 (5K) ohms with pedal fully depressed.

NOTE:

Resistance should evenly sweep while slowly pressing the accelerator pedal. This is why an analog ohmmeter is preferable. If there is a dead spot, it could result in intermittent operation of the car.

- A. If the sensor is good, reconnect it and go to step 4.
- B. If the throttle position sensor is bad, replace it.

**MAIN SWITCH CHECK**

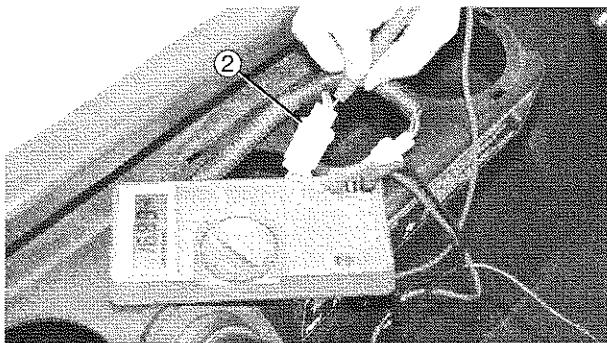
4. Check for voltage on the red/yellow and red/white wires at the main switch (2). Key must be on and tow switch on.
 - A. If voltage is present on both, go to step 5.
 - B. If there is no voltage on red/yellow wire, repair open circuit between tow and main switch.
 - C. If there is voltage on the red/yellow but not the red/white, with key on, replace the main switch.

ACCELERATOR STOP SWITCH CHECK

5. Check for voltage on the red/white at accelerator (stop) switch (1) with key on.
 - A. If no voltage is present, repair the open circuit between the main switch and the accelerator stop switch.
 - B. If voltage is present on the red/white wire with accelerator pressed and key on, but is not present on the brown wire of the accelerator switch, replace the accelerator stop switch.
 - C. If voltage is present on both wires of the switch and terminal 3 at the controller, go to step 6.

NOTE:

If there is voltage on the brown wire at the stop switch but not on terminal 3 of the controller, repair the open circuit in the brown wire between the controller and accelerator stop switch.



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DIRECTION SWITCH CHECK

6. With tow switch "ON" (run), check for voltage on the red/yellow wire at the direction switch ②.
 - A. If no voltage is present on the red/yellow wire repair open circuit between direction switch and tow switch.
 - B. If voltage is present, place direction switch in forward. Check for voltage on the white wire of the switch ② and at terminal 4, of the controller connector.
 - If voltage is present at terminal 4, replace the controller.
 - If voltage is not present on the white wire of the switch, replace the switch.
 - If voltage is present on the white wire of the switch but not terminal 4, repair the open circuit between the controller and the direction control switch.
 - If car still won't run, go to step 7.

SOLENOID RELAY BENCH TEST

7. Test solenoid. Refer to page 8-9 "SOLENOID RELAY BENCH TEST" section. If car still won't run, go to step 8.

CHECK TRACTION MOTOR

8. Test traction motor:
 - Insulation resistance
 - Field coil resistance
 - Armature resistance

Refer to CHAPTER 7 "INSPECTION AND TESTING" section.

 - If traction motor tests good replace controller.

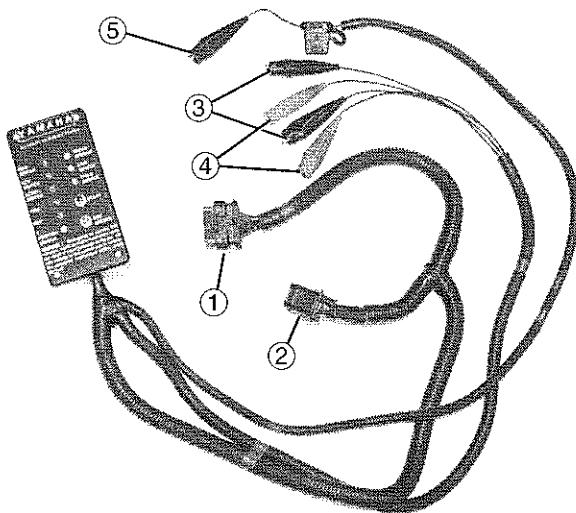
TROUBLESHOOTING FOR G22E

**TRBL
SHTG**



TRACTION MOTOR

Condition	Possible Cause	Correction
MOTOR DOES NOT TURN	1. Brushes are off commutator.	1. Adjust properly or replace.
	2. Motor terminals are loose or corroded.	2. Tighten or clean.
	3. Leads are broken.	3. Check for breaks at bend or joint. Replace or repair leads.
	4. Field coil is open.	4. Repair or replace at a service shop.
	5. Armature coil is open.	5. Repair or replace at a service shop.
MOTOR TURNS SLOWLY	1. Terminals are loose or corroded.	1. Retighten or clean.
	2. Leads are nearly broken or connections are faulty.	2. Check for any defect of leads at bend or joint. Replace leads or repair connections.
	3. Mechanical problem inside motor.	3. Check.
MOTOR IS NOISY	1. Bolts are loose.	1. Retighten.
	2. Motor has foreign matter inside.	2. Clean motor interior.
	3. Bearings are faulty.	3. Replace.
	4. Bearings contain foreign matter.	4. Replace.
	5. Bearings need grease.	5. Replace.
BEARING HEAT EXCESSIVE	1. Bearings are faulty or lack grease.	1. Replace.
	2. Improperly installed.	2. Adjust, replace if necessary.
POOR MOTOR PERFORMANCE	1. Load exceeds specification.	1. Adjust load to spec.
	2. Armature is out of round.	2. Repair or replace at service shop.
	3. Brushes are worn beyond limits.	3. Replace.
	4. Commutator is excessively rough.	4. Smooth with sandpaper (#500 ~ 600).
	5. High mica segment.	5. Recondition at service shop.
	6. Commutator is dirty with oil or dust.	6. Clean with a cleaner, and dry cloth.
	7. Armature coil is shorted or broken.	7. Repair or replace at service shop.
VIBRATION	1. Motor installed loosely.	1. Retighten.
	2. Motor turns irregularly.	2. Repair or replace at service shop.

**Z-1 DIAGNOSTIC TESTER**

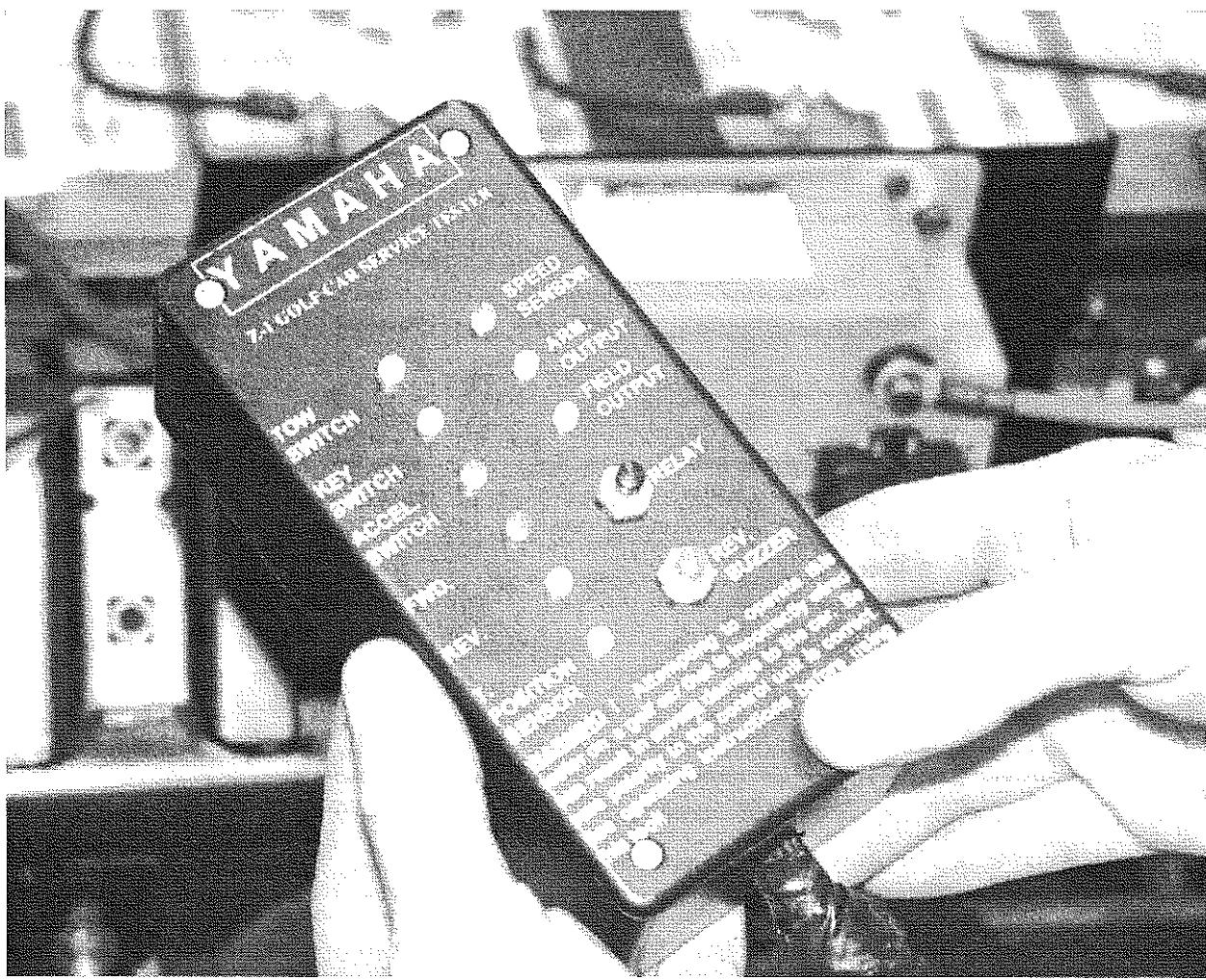
SM-03-374

Z-1 HARNESS IDENTIFICATION

- Female end to Motor Control Unit ①
- Male end to Golf Car harness female end ②
- Black alligator clips to A1 and A2 motor terminals ③
- Red alligator clips to motor field terminals ④
- Black alligator clip ground lead with fuse ⑤

NOTE:

See photo below for LED and button identification.



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**READ THESE INSTRUCTIONS BEFORE USING:****⚠ WARNING**

Do not store the Z-1 in high heat areas (like the seat of a car in hot weather). The box can melt or warp.

Before connecting the Z-1 tester to the golf car, visually inspect for:

- Loose connections
- Shorted wiring
- Corroded battery terminals
- Blown fuse
- Reversed polarity to controller (due to incorrect assembly)

⚠ WARNING

Attempting to operate the tester on a golf car with battery terminals to the controller reversed will destroy the controller, motor and solenoid. (Damage may result in the tester also.)

If the above items are OK, test the batteries per Yamaha Service Manual procedures. Refer to CHAPTER 2 "PERIODIC INSPECTION AND ADJUSTMENT" (Electrical Section).

⚠ WARNING

The rollaway and regenerative braking functions will be disabled while the tester is connected to the car.

⚠ WARNING

Raise and support a rear wheel for safety when testing an electric car. Refer to CHAPTER 1 "RECOMMENDED JACK POINTS" section.

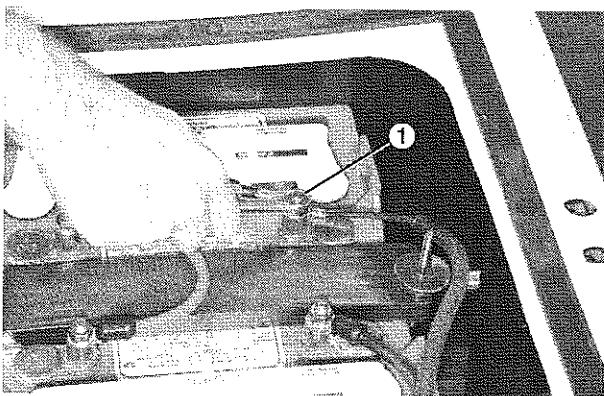
It is recommended that the first time you connect the Z-1 tester to a golf car you use a car that is functioning normally. This will allow you to see what the LED lights should be doing.

⚠ WARNING

Never short the armature or field leads together at the motor or controller. The controller will be damaged and may fail prematurely.

⚠ WARNING

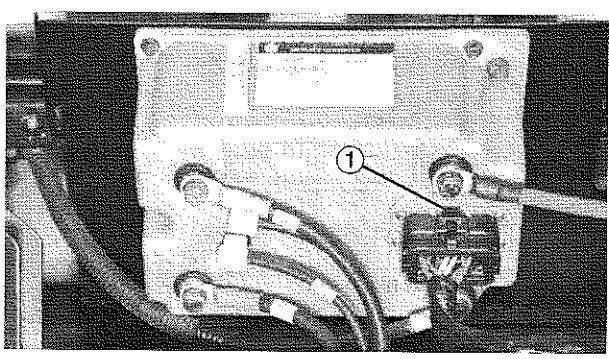
When disconnecting the Z-1 tester from a golf car, never pull the harness wires of the tester. Always grasp the connector itself, not the wires.



OPERATION INSTRUCTIONS

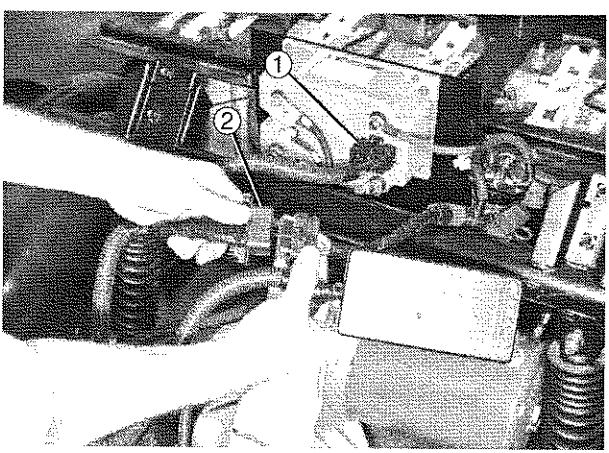
1. Remove:

- Disconnect the negative battery leads ① from the battery pack (prevents a short circuit on step 2).



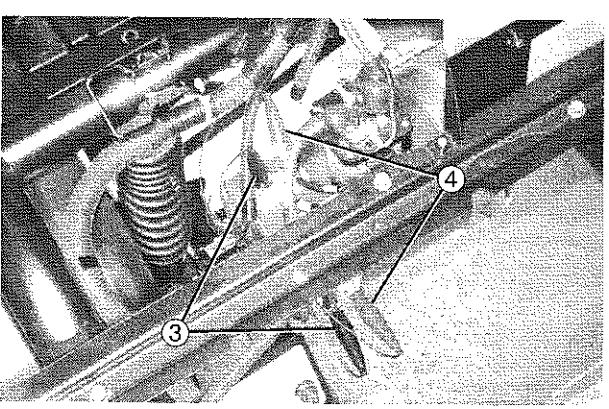
2. Remove:

- Using finger, release the multi-wire connector on the front of the controller ①.



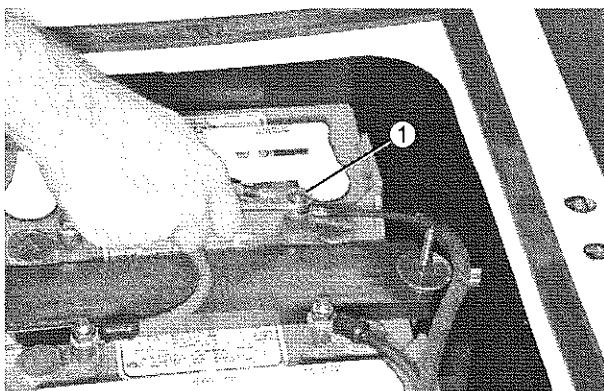
3. Connect:

- Lead ① of the Z-1 tester to the Controller and lead ② of the Z-1 tester to the Golf Car harness connector that was disconnected in step 2.



4. Connect:

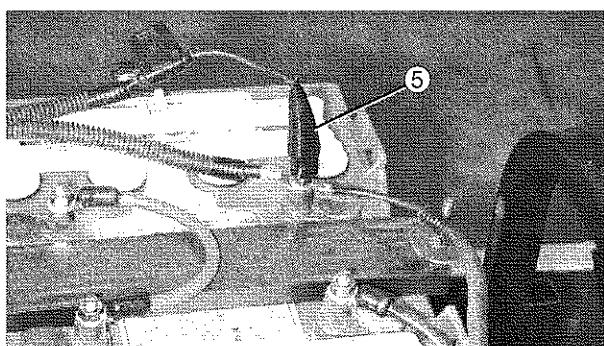
- Carefully connect the two black alligator clips ③ of the Z-1 tester to the A-1 and A-2 motor terminals.
- Carefully connect the two red alligator clips ④ of the Z-1 tester to the motor field terminals.



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5. Connect:

- Negative battery leads ① from the battery pack.



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6. Connect:

- Black ground lead with fuse alligator clip ⑤ to the negative side of the battery pack.

LED INDICATOR	NORMAL OPERATION	POSSIBLE CAUSE OF MALFUNCTION	G22 SERVICE MANUAL REFERENCE
TOW SWITCH	Lights when fuse is good and tow switch is in "run" position.	Blown fuse Loose fuse holder connection Open circuit Bad tow switch	CHAPTER 8 "TOW SWITCH TEST" section
KEY (MAIN) SWITCH	Lights when tow switch is in "run" position and key is turned on.	Bad main switch Open wire harness	CHAPTER 8 "MAIN SWITCH CHECK" section
ACCELERATOR SWITCH	With tow switch in the "run" position and the main switch on, this LED should illuminate only after the accelerator pedal is depressed. It should go out when the pedal is released.	<i>Light on before depressing the pedal check:</i> Accelerator rod linkage adjustment Pedal stopper bolt height Debris in pedal linkage Shorted switch <i>Light does not illuminate</i> Open accelerator switch Open circuit wire harness	CHAPTER 8 "ACCELERATOR STOP SWITCH CHECK" section
THROTTLE POSITION SENSOR	With tow switch on, the light should get brighter as the accelerator is pressed and dimmer as it is released.	Throttle position sensor TPS linkage loose inside Open circuit wire harness	CHAPTER 8 "THROTTLE POSITION SENSOR CHECK" section
ARMATURE OUTPUT INDICATOR	Lights when the tow switch is in the "run" position, key is on and accelerator pedal is depressed. The further the pedal is depressed, the brighter the light should get.	No light indicates no output from the controller. Check all other contacts before replacing the controller. (If the armature and field lights light but the motor won't run, check the motor.)	CHAPTER 7 "TRACTION MOTOR" section
FIELD OUTPUT INDICATOR	Lights when the tow switch is in the "run" position, key is on and accelerator pedal is depressed. It should get very bright initially, then get a little dimmer.	No light indicates no output from the controller. Check all other inputs and solenoid contacts before replacing the controller. (If the armature and field lights light but the motor won't run, check the motor.)	CHAPTER 7 "TRACTION MOTOR" section
TACH/SPEED SENSOR	Should blink off and on as the car slowly moves forward or in reverse. It may stay on solid if the car stops with the magnet lined up with the sensor.	Remove sensor and clean. Connect K & L YG-42221 and check per manual.	CHAPTER 8 "SPEED SENSOR TEST" section

LED INDICATOR	NORMAL OPERATION	POSSIBLE CAUSE OF MALFUNCTION	G22 SERVICE MANUAL REFERENCE
FORWARD AND REVERSE DIRECTION SWITCH	<p>Should light when the tow switch is in the "run" position and the direction switch is in the forward position.</p> <p>Both LEDs should never be illuminated at the same time.</p>	<p><i>If neither the forward or reverse light comes on check:</i></p> <ul style="list-style-type: none"> • Fuse • Tow switch • Open to R/Y at direction switch <p><i>If the forward and reverse light come on at the same time, check for water in the direction switch.</i></p> <p><i>If the reverse LED is inoperative (no reverse) check:</i> Open circuit yellow wire to the controller.</p> <p><i>If the forward LED is inoperative (no forward) check:</i> Check circuit white wire to the controller.</p>	CHAPTER 8 "TOW SWITCH TEST" section

OUTPUT CYCLING SWITCHES

Manually operates the reverse buzzer and solenoid

REVERSE BUZZER	<p>With tow switch in the "run" position, pressing the button on the tester grounds the buzzer allowing it to operate. (By-passes controller)</p>	<p>If the buzzer doesn't operate check:</p> <ul style="list-style-type: none"> • Power to reverse buzzer • Buzzer • Wiring 	CHAPTER 8 "CAR HAS NO REVERSE WARNING BUZZER" section
SOLENOID WARNING! DO NOT PRESS THIS BUTTON UNTIL YOU HAVE CHECKED THAT THE CONTROLLER POLARITY TO THE BATTERIES IS CORRECT (NEGATIVE LEAD ON TOP). MCU AND MOTOR WILL BE DAMAGED.	<p>With the tow switch in the "run" position:</p> <ol style="list-style-type: none"> 1. Wait 30 seconds to be sure the solenoid is disengaged. 2. Press the button on the tester and listen for a solenoid click. <p>(By-passes the controller to check the solenoid primary coil.)</p>	<p>If the solenoid doesn't click check:</p> <ul style="list-style-type: none"> • R/Y wire at solenoid for power • Continuity of R/B wire to terminal 11 of the controller 	CHAPTER 8 "SOLENOID RELAY BENCH TEST" section

NOTES



CHAPTER 9 SPECIFICATIONS

GENERAL SPECIFICATIONS

FOR G22A	9-3
FOR G22E	9-3

MAINTENANCE SPECIFICATIONS FOR G22A

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TIGHTENING TORQUE FOR G22E

POWER TRAIN	9-18
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CABLE/WIRE ROUTING FOR G22E

CABLE ROUTING FOR G22E	9-20
WIRING DIAGRAM FOR G22E.....	9-21



GENERAL SPECIFICATIONS

Item	Model	G22A	G22E
Model Code: Frame Serial Number		JU0 JU0-000101 ~	JU2 JU2-000101 ~
Dimensions:			
Overall Length		2385 mm (93.9 in)	←
Overall Width		1200 mm (47.2 in)	←
Overall Height (Steering height)		1190 mm (46.8 in)	←
Height of Floor		280 mm (11 in)	←
Wheelbase		1630 mm (64.2 in)	←
Tread:			
Front		870 mm (34.3 in)	←
Rear		980 mm (38.6 in)	←
Min. Ground Clearance		96 mm (3.77 in)	←
Weight:			
Dry Weight (without battery)		304 kg (670 lb)	249 kg (549 lb)
Performance:			
Maximum Speed		19 km/h (12 mph)	←
Minimum Turning Radius		2.8 m (113 in)	←
Seating Capacity		2 persons	←
Hill Climbing Ability		27° on pavement	20° on pavement

MAINTENANCE SPECIFICATIONS FOR G22A

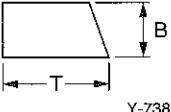
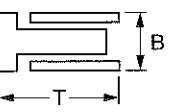
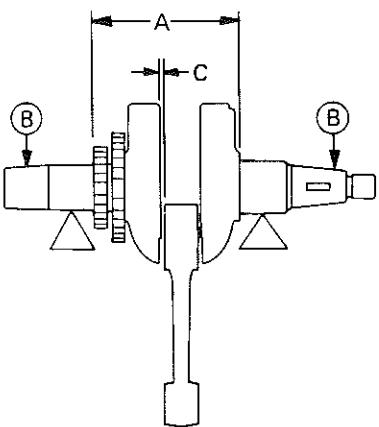


ENGINE

Item	G22A
Description Engine Type Number of Cylinder Displacement Bore x Stroke Compression Ratio Compression Pressure (at sea level)	Forced air cooled 4-stroke OHV gasoline Single 357 cm ³ 85.0 x 63.0 mm (3.34 x 2.48 in) 8.1 : 1 Standard: $785.0 \pm 98.0 \text{ kPa}$ ($7.85 \pm 0.98 \text{ kg/cm}^2$, 114 psi)
Auto Decompression Starting System Ignition System Lubrication System	Starter TCI Magneto Wet sump
Cylinder Head: Combustion Chamber Volume (With spark plug) Head Gasket Thickness	$38.1 \pm 0.4 \text{ cc}$ * $0.27 \pm 0.05 \text{ mm}$ ($0.01 \pm 0.001 \text{ in}$)
Cylinder: Material Bore Size Limit	Cast iron sleeved aluminum (crankcase) 85.00 ~ 85.02 mm (3.346 ~ 3.347 in) 85.05 mm (3.348 in)
Piston: Outside Diameter STANDARD Oversize: 1 2	84.96 ~ 84.98 mm (3.345 ~ 3.346 in) 85.25 mm (3.356 in) 85.50 mm (3.366 in)
Piston: Piston-to-Cylinder Clearance Oversize: 1 2 Piston Pin Outside Diameter Piston Pin-to-Piston Clearance	0.03 ~ 0.05 mm (0.0012 ~ 0.0020 in) 0.25 mm (0.01 in) 0.50 mm (0.02 in) 19.995 ~ 20.000 mm (0.7872 ~ 0.7874 in) 0.004 ~ 0.015 mm (0.0002 ~ 0.0005 in)
Piston Ring: Top Ring Type Dimensions (B x T) End Gap (Installed) < Limit > Side Clearance (Installed) < Limit >	Barrel 1.5 x 3.6 mm (0.059 x 0.141 in) 0.25 ~ 0.40 mm (0.001 ~ 0.016 in) < 1.0 mm (0.04 in) > 0.04 ~ 0.08 mm (0.0015 ~ 0.003 in) < 0.1 mm (0.004 in) >
Engine Oil: Recommended Oil Oil Change Quantity Oil Capacity	YAMALUBE 4 cycle oil or SAE10 W30 type SE, SF, or SG 1.0 U.S. qt (0.9 L, 900 cc) 1.16 U.S. qt (1.0 L, 1000 cc)

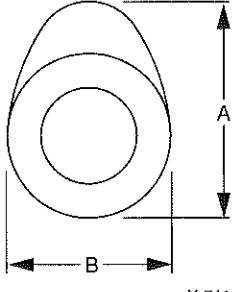
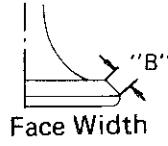
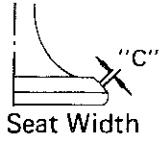
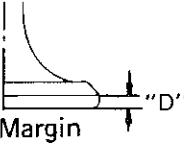
MAINTENANCE SPECIFICATIONS FOR G22A



Item	G22A
2nd Ring: Type Dimensions (B x T) End Gap (Installed) < Limit > Side Clearance < Limit > (Installed)	 Taper 1.5 x 3.6 mm (0.059 x 0.141 in) 0.25 ~ 0.40 mm (0.001 ~ 0.016 in) < 1.0 mm (0.04 in) > 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in) < 0.1 mm (0.004 in) >
Oil Ring: Dimensions (B x T) End Gap (Installed)	 3.0 x 2.8 mm (0.118 x 0.110 in) 0.2 ~ 0.7 mm (0.008 ~ 0.028 in)
Small End Bearing: Type	None
Big End Bearing: Type	None
Crankshaft: Crankshaft Assembly Width "A" Crankshaft Deflection "B" Connecting Rod Big End Side Clearance "C"	107.2 ~ 107.5 mm (4.220 ~ 4.232 in) 0.05 mm (0.0020 in) 0.2 ~ 0.65 mm (0.008 ~ 0.025 in)
	
Crank Pin Outside Diameter Crank Pin Type Crank Oil Seal Type (Both) x Q'ty	35.969 ~ 35.984 mm (1.416 ~ 1.417 in) Solid crankshaft SD 35 50 8 x 2 pc
Camshaft: Drive Method < Limit >	Gear drive 15.95 mm (0.628 in) < 0.15 mm (0.0059 in) >

MAINTENANCE SPECIFICATIONS FOR G22A



Item	G22A																
Cam Dimensions: Intake "A" "B" Exhaust "A" "B"	<p>32.495 ~ 32.595 mm (1.279 ~ 1.283 in) 26.029 ~ 26.129 mm (1.024 ~ 1.028 in)</p> <p>32.495 ~ 32.595 mm (1.279 ~ 1.283 in) 26.029 ~ 26.129 mm (1.024 ~ 1.028 in)</p>  <p style="text-align: center;">Y-741</p>																
Rocker Arm/Rocker Arm Shaft: Arm Inside Diameter Shaft Outside Diameter Arm-to-Shaft Clearance	<p>12.00 ~ 12.02 mm (0.472 ~ 0.473 in) 11.90 ~ 11.99 mm (0.469 ~ 0.472 in) 0.01 ~ 0.07 mm (0.0004 ~ 0.0028 in)</p>																
Valve, Valve Seat, Valve Guide: Valve Clearance (Cold) IN. EX. Valve Dimensions:	<p>0.08 ~ 0.12 mm (0.003 ~ 0.004 in) 0.08 ~ 0.12 mm (0.003 ~ 0.004 in)</p> <div style="display: flex; justify-content: space-around;">     </div> <p style="text-align: center;">Y-742</p>																
"A" Head Diameter "B" Face Width "C" Seat Limit Width "D" Margin Thickness Limit	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">IN.</td> <td style="width: 33%;">32 mm (1.259 in)</td> </tr> <tr> <td>EX.</td> <td>27 mm (1.062 in)</td> </tr> <tr> <td style="width: 33%;">IN.</td> <td style="width: 33%;">2.6 mm (0.102 in)</td> </tr> <tr> <td>EX.</td> <td>1.6 mm (0.063 in)</td> </tr> <tr> <td style="width: 33%;">IN.</td> <td style="width: 33%;">1.0 mm (0.0393 in)</td> </tr> <tr> <td>EX.</td> <td>1.0 mm (0.0393 in)</td> </tr> <tr> <td style="width: 33%;">IN.</td> <td style="width: 33%;">1.2 mm (0.047 in)</td> </tr> <tr> <td>EX.</td> <td>0.5 ~ 0.8 mm (0.019 ~ 0.031 in)</td> </tr> </table>	IN.	32 mm (1.259 in)	EX.	27 mm (1.062 in)	IN.	2.6 mm (0.102 in)	EX.	1.6 mm (0.063 in)	IN.	1.0 mm (0.0393 in)	EX.	1.0 mm (0.0393 in)	IN.	1.2 mm (0.047 in)	EX.	0.5 ~ 0.8 mm (0.019 ~ 0.031 in)
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EX.	0.5 ~ 0.8 mm (0.019 ~ 0.031 in)																
Valve Spring Free Length < Limit > Spring Tilt Spring Force	<p>36.2 mm (1.43 in) < 35.0 mm > (1.38 in) 2.5° or 1.6 mm (0.063 in)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">IN.</td> <td style="width: 50%;">7.0 kg</td> </tr> <tr> <td>EX.</td> <td>9.0 kg</td> </tr> </table>	IN.	7.0 kg	EX.	9.0 kg												
IN.	7.0 kg																
EX.	9.0 kg																
Throttle Cable Freeplay: Cable 1 Cable 2 Choke Cable Freeplay	<p>0.2 ~ 0.5 mm (0.008 ~ 0.020 in) 0.5 mm (0.020 in) 1.0 mm (0.040 in) ></p>																

MAINTENANCE SPECIFICATIONS FOR G22A



Item	G22A
Carburetor:	
Model/Maker	BV26-21-83/MIKUNI
I.D. Mark	JR700
Venturi Diameter	(Ven. T.)
Main Jet	ø21 mm (ø0.826 in)
Main Air Jet	(M.A.J.)
Pilot Jet	#87.5
Pilot Air Jet	(P.J.)
Throttle Valve	(P.A.J.)
Valve Seat	(Th.V.)
By-pass (1)	(V.S.)
By-pass (2)	(B.P. 1)
By-pass (3)	(B.P. 2)
Pilot Outlet	(B.P. 3)
Pilot Screw	(P.O.)
Float Height	(P.S.)
	14.5 mm (0.56 in)
Fuel Pump:	
Manufacturer/Type	MIKUNI/DF-52-205 (Diaphragm)
Fuel Tank:	
Recommended Fuel	Unleaded regular gasoline
Fuel Rating P.O.N (#1)	MIN. 87 octane
Fuel Tank Capacity	23.0 L (6.1 US gal)
Fuel Tank Material/Color	Polyethylene/Natural

TRANSMISSION

Item	G22A
Transmission:	
Type	V-belt automatic centrifugal engagement
Primary Reduction Ratio	3.1 : 1 ~ 0.8 : 1
Primary Spring:	None
Secondary Spring:	
Outside Diameter x Wire Diameter	59 x 4.5 mm (2.32 x 0.18 in)
No. of Turns/Free Length	7.25/100.5±1.5 mm (3.95±0.059 in)
Twist Angle (Preload setting)	30° (B-3)
Torque Cam Angle	37.5°
Sheave Center to Center Distance	270.5 mm (10.65 in)
Sheave Off-Set	24.3 mm (0.96 in)
V-belt Width and Outer Line Length	31 x 1,010 mm (1.22 x 39.76 in)
V-belt Wear Limit	27 mm (1.06 in)

MAINTENANCE SPECIFICATIONS FOR G22A



Item	G22A
Differential/Reduction Gear:	
Secondary Reduction System	Helical gear
Secondary Reduction Ratio:	
Forward	11.34 : 1
Reverse	15.25 : 1
Differential Type	Bevel gear
Lubricant/Capacity	SAE 90 gear oil/415 cc (415 mL, 0.44 US qt)
Governor:	
Type	Oil bath flyweight
Adjustment	Screw with lock nut
Factory Speed Setting	19 km/h (12 mph)

MAINTENANCE SPECIFICATIONS FOR G22A



ELECTRICAL

Item	G22A
Voltage:	12V Negative ground
Ignition System: Type Model/Manufacturer Dynamic Timing	T.C.I. JR7/MORIC 28° B.T.D.C. at 3,000 r/min
Ignition Advance Curve:	
<p style="text-align: right;">Y-780</p>	
Ignition: Primary Winding Resistance Secondary Winding Resistance	0.9 ~ 1.5Ω ± 20% at 20°C (68°F) (Coil base to terminal) 10.5 ~ 12.9 kΩ ± 20% at 20°C (68°F) (High tension cord to terminal)

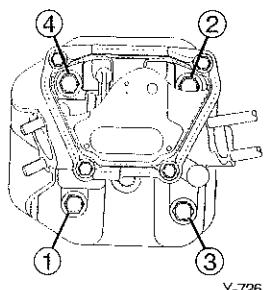
TIGHTENING TORQUE FOR G22A



ENGINE

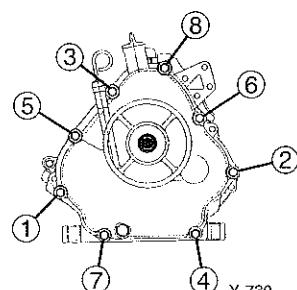
Part to be tightened	Part name	Thread size	Tightening torque			Remarks
			N·m	m·kg	ft·lb	
Spark Plug		M14 x P1.25	20	2.0	14.8	
Air Shroud	Bolt	M6 x P1.0	8	0.8	5.9	
Cylinder Head	Bolt	M10 x P1.25	44	4.5	32.5	
Cylinder Head Cover	Bolt	M6 x P1.0	11	1.1	8.1	
Valve Adjuster Locknut	Nut	M5 x P0.5	7	0.7	5.2	
Connecting Rod Cap	Nut	M8 x P1.25	20	2.0	14.8	With oil splasher
Cylinder x Exhaust Pipe	Nut	M8 x P1.25	16	1.6	11.8	
Exhaust Pipe x Bracket	Bolt	M8 x P1.25	16	1.6	11.8	
Exhaust Bracket x Rear Arm	Bolt	M8 x P1.25	16	1.6	11.8	
Carburetor x Joint	Nut	M6 x P1.0	6.5	0.7	4.8	
Flywheel	Nut	M18 x P1.5	120	12.2	88.5	
Crankcase x Engine Bracket	Bolt	M10 x P1.25	35	3.6	25.8	
Engine Bracket x Rear Arm	Nut	M8 x P1.25	26	2.7	19.2	
Crankcase Cover, 8 mm	Bolt	M8 x P1.25	26	2.7	19.2	
Crankcase Cover, 10 mm	Bolt	M10 x P1.25	38	3.9	28	
Crankcase Drain Plug	Bolt	M12 x P1.5	20	2.0	14.8	

[Cylinder Head Tightening Sequence]



Y-726

[Crankcase Cover Tightening Sequence]



Y-730

TIGHTENING TORQUE FOR G22A

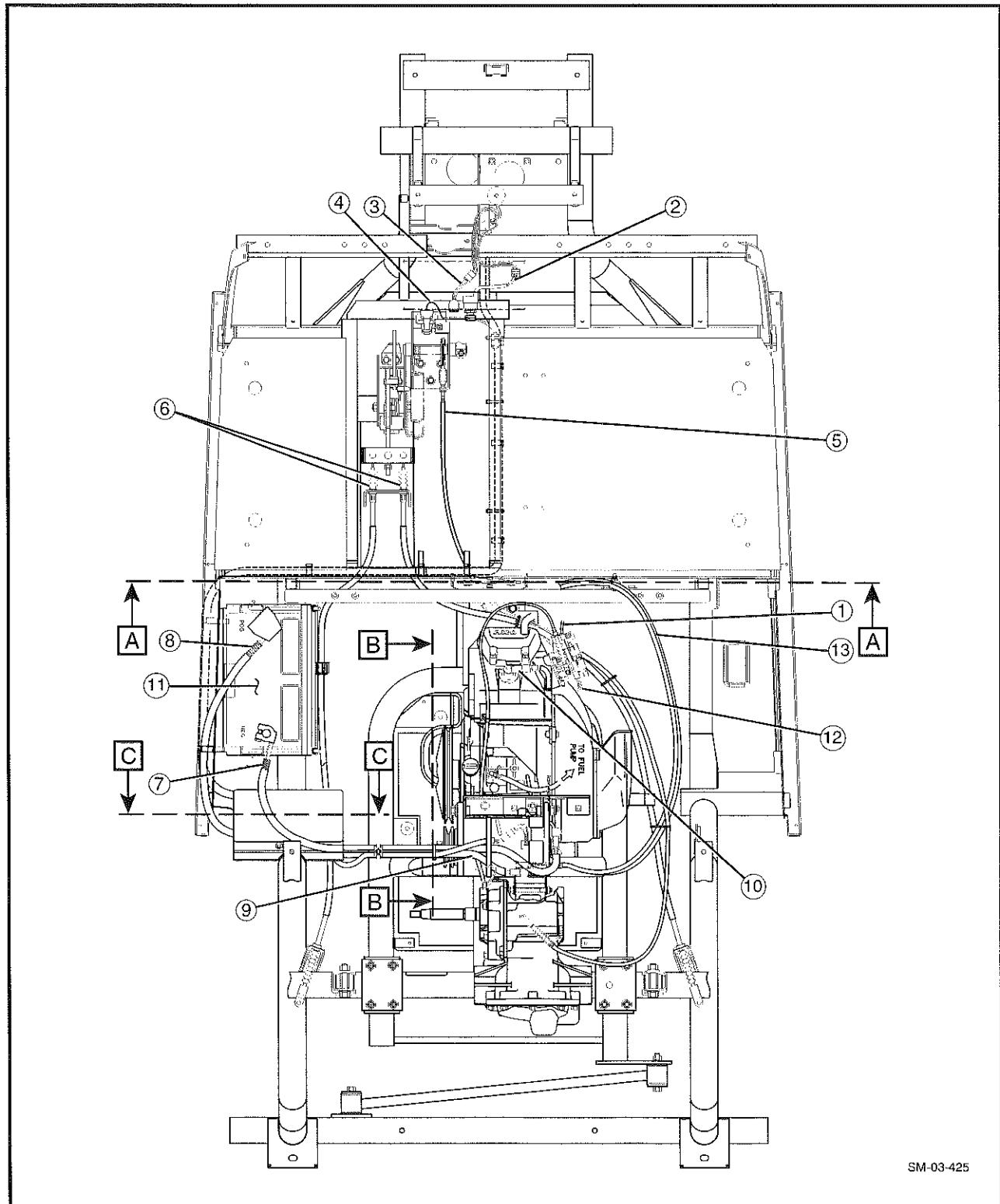
SPEC**POWER TRAIN**

Part to be tightened	Part name	Thread size	Tightening torque			Remarks
			N•m	m•kg	ft•lb	
Primary Sheave x Engine	Bolt	1/2-20UNF-2A	85	8.7	62.7	
Secondary Sheave x Input Shaft	Castle nut	M12 x P1.25	65	6.6	47.9	
Transmission Case x Rear Arm	Bolt	M8 x P1.25	23	2.3	17	
Rear Axle Housing x Rear Arm	Bolt	M10 x P1.25	64	6.5	47.2	
Rear Arm Connecting Rod	Nut	M12 x P1.50	90	9.2	66.4	
Transmission Cover 1 and Transmission Cover 2	Bolt	5/16-18UNF-2B	20	2.0	14.8	First
Differential Case x Ring Gear	Bolt	M8 x P1.25	28	2.9	20.7	Final
			54	5.5	39.8	

CABLE/WIRE ROUTING FOR G22A



- | | |
|---------------------|-----------------------------------|
| ① Choke cable | ⑧ Positive lead |
| ② Main switch wire | ⑨ Lead wires to starter generator |
| ③ Pilot lamp wire | ⑩ Spark plug lead |
| ④ Stop switch wire | ⑪ Battery |
| ⑤ Accelerator cable | ⑫ T.C.I. Unit wire lead |
| ⑥ Brake cables | ⑬ Shift cables |
| ⑦ Negative lead | |



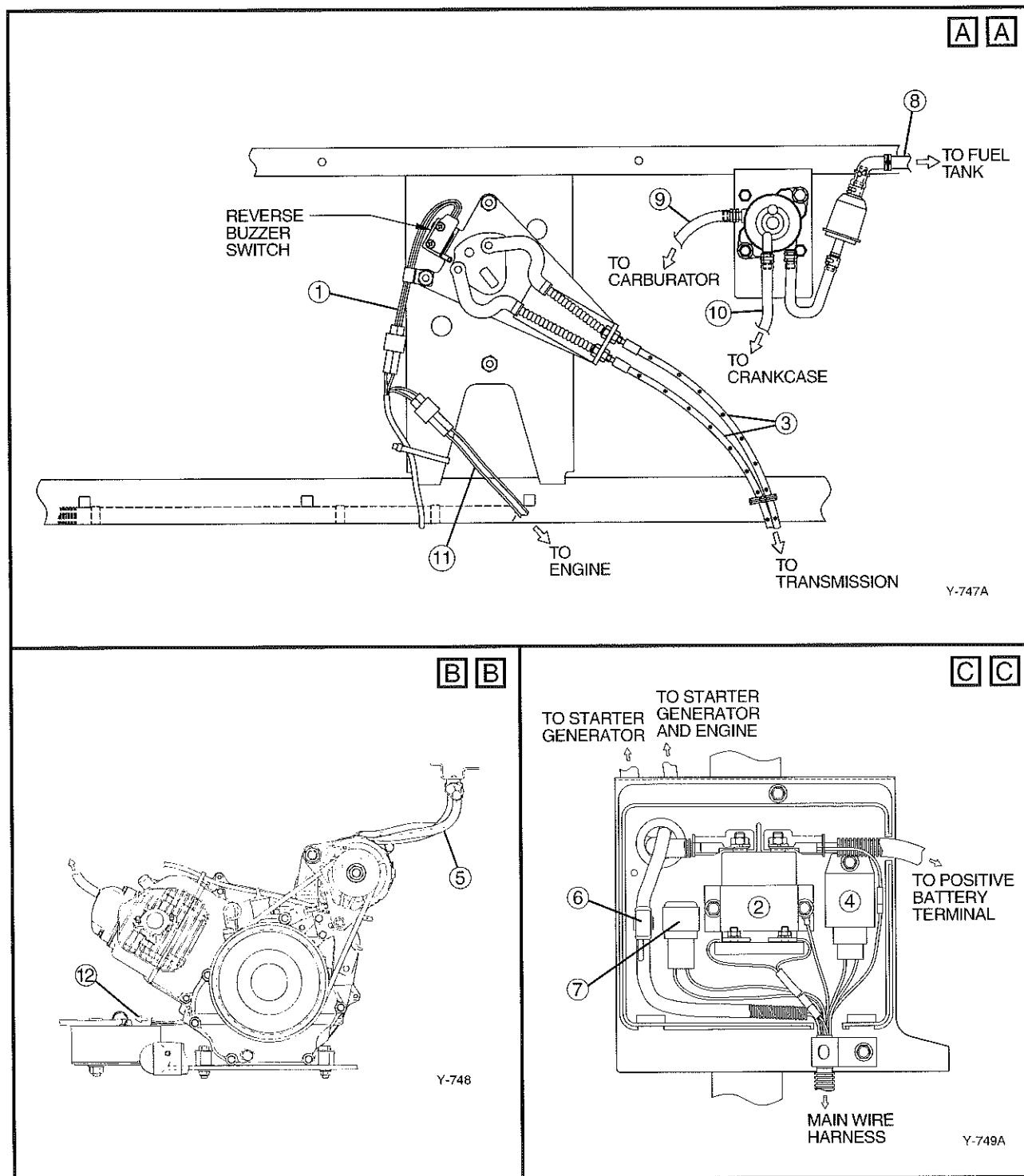
SM-03-425

CABLE ROUTING FOR G22A

SPEC

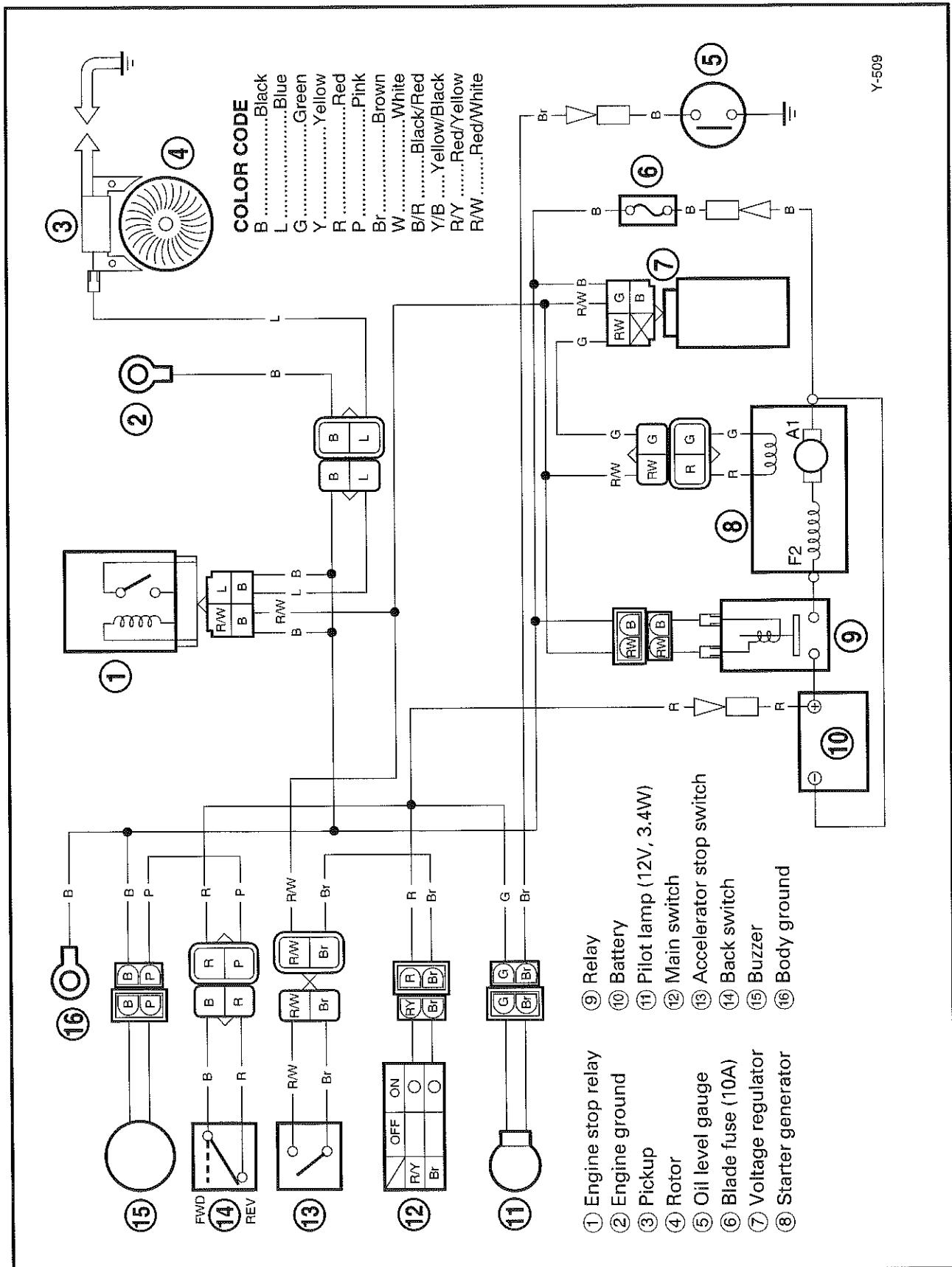


- | | |
|------------------------------|---------------------------|
| ① Reverse buzzer switch lead | ⑦ Stop relay |
| ② Solenoid relay | ⑧ Fuel hose to fuel tank |
| ③ Shift cables | ⑨ Fuel hose to carburetor |
| ④ Voltage regulator | ⑩ Pulse hose to crankcase |
| ⑤ Starter generator leads | ⑪ T.C.I. Unit wire lead |
| ⑥ Fuse | ⑫ Oil warning switch lead |



WIRING DIAGRAM FOR G22A

SPEC



MAINTENANCE SPECIFICATIONS FOR G22E



ELECTRICAL

Item	G22E
Voltage:	48V DC, 8V Battery x 6 pcs series (locally supplied)
Traction Motor:	
Model/Manufacturer	5BC59JBS6370 / GE
Rated Voltage	48V DC
Power/Horsepower	2.5 kw (3.4 hp) @ 35-40 rpm for 30 minutes
Voltage	48V
Set Torque	5.58 N·m (0.57 m·kg, 4.12 ft·lb)
Revolutions	2,970 r/min
Allowable Maximum Revolutions	5,500 r/min
Direction of Rotation	Clockwise and counter clockwise
Brush Length-Std/Min.	34.3 mm (1.35 in)/14.48 mm (0.57 in)
Brush Spring Pressure-Max./Min.	720 ~ 1,080 g (25.4 ~ 38.1 oz)/450 g (15.9 oz)
Mica Undercut-Std/Min.	0.79 mm (0.031 in)/0.25 mm (0.0098 in)
Armature Coil Resistance	0.0216 ~ 0.0264Ω at 20°C (68°F)
Field Coil Resistance	1.15 ~ 1.41Ω at 20°C (68°F)
Insulation Resistance (All measurements)	1MΩ
Motor Controller:	FET (Field Effect Transistor) chopper
Model/Manufacturer	JU2 / GE
Solenoid Relay:	
Model/Manufacturer	586-120111-3/STANCOR/WHITE RODGERS
Amperage Rating	100A, PEAK at 300A for 3 minutes
Solenoid Coil Resistance (Z)	Z: 336Ω ± 10% at 20°C (68°F)
Resistance (X)	X: OFF ∞ ON 0Ω
	<p style="text-align: center;">Y-714</p>

MAINTENANCE SPECIFICATIONS FOR G22E



Item	G22E
Shift Switch: Voltage/Maximum Current Capacity	48 VDC / 10 mA Rated Type-SPDT-2 position maintained contact
Battery: Type Quantity/Connection Minimum Recommended Output Specific Gravity Maximum difference (at 1.200 corrected min.) [Battery Arrangement and Terminal Connections]	US Battery 8V Electric vehicle deep cycle GC-2 6 pcs/Series 110 minutes at 56A at 80°F 80°F (fully charged) 1.280
 Y-672a	<p>Connect the wire leads as shown.</p> <ul style="list-style-type: none"> Ⓐ To receptacle Ⓑ To motor control unit Ⓒ Between batteries Ⓓ To relay
Tow Switch: Mfg Rated Load Volts Type	NKK 5 ADC min. 48 VDC SPST, 2 position maintained contact

MAINTENANCE SPECIFICATIONS FOR G22E



Item	G22E
Back Buzzer:	
Type	Piezo Ceramic Buzzer
Model/Manufacturer	JU2/YAMAHA
Frequency	2.4 ~ 3.6 kHz
Current	Less than 25 mA
Sound Pressure	83 dB/1 min./48V
Minimum Operating Voltage	10VDC
Plus Fuse:	
Amperage	3A

TIGHTENING TORQUE FOR G22E

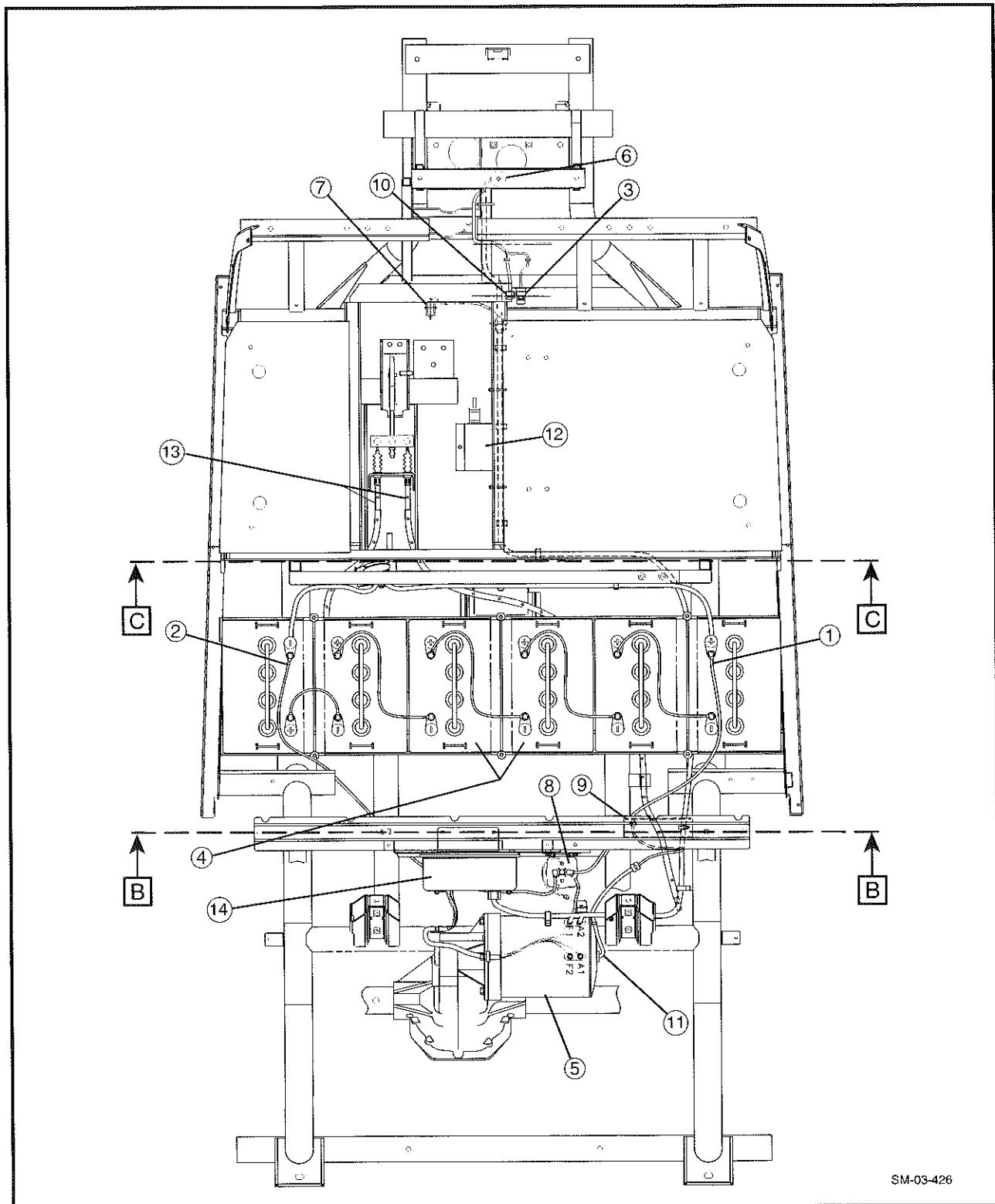


POWER TRAIN

Part to be tightened	Part name	Thread size	Tightening torque			Remarks
			Nm	m•kg	ft•lb	
For G22E						
Transmission Case x Traction Motor	Bolt	M6 x P1.0	12	1.2	8.9	
Rear Axle Housing x Rear Arm	Bolt	M10 x P1.25	64	6.5	47.2	
Transmission Cover 1 and	Bolt	5/16-18UNF-2B	20	2.0	14.8	First
Transmission Cover 2			28	2.9	20.7	Final
Differential Case x Ring Gear	Bolt	M8 x P1.25	54	5.5	39.8	

CABLE/WIRE ROUTING FOR G22E

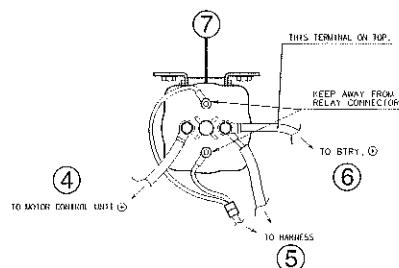
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|---------------------------|----------------------------------|
| ① Positive lead | ⑧ Solenoid relay |
| ② Negative lead | ⑨ Tow/Run switch |
| ③ Main switch | ⑩ Direction switch |
| ④ Batteries | ⑪ Speed sensor |
| ⑤ Traction motor | ⑫ Throttle position sensor (TPS) |
| ⑥ Buzzer | ⑬ Brake cables |
| ⑦ Accelerator stop switch | ⑭ Motor control unit (MCU) |



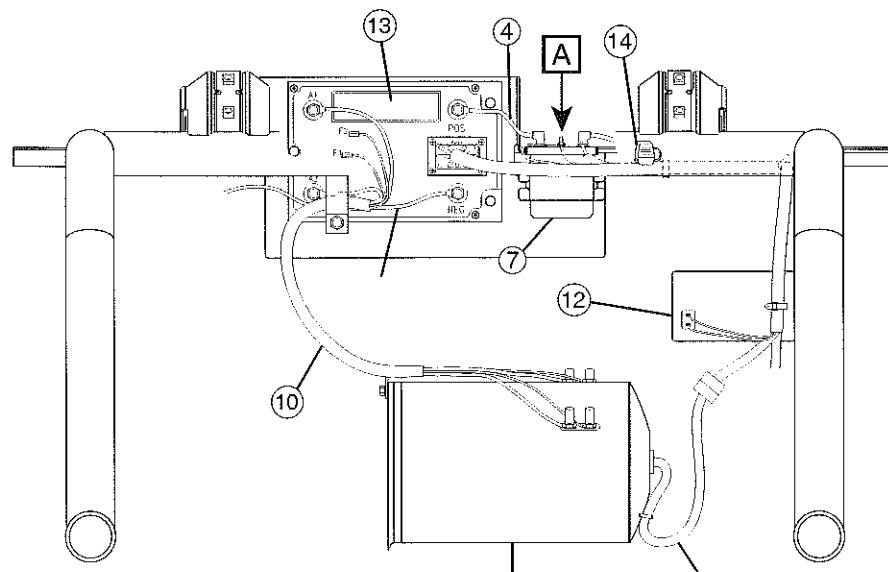
CABLE ROUTING FOR G22E



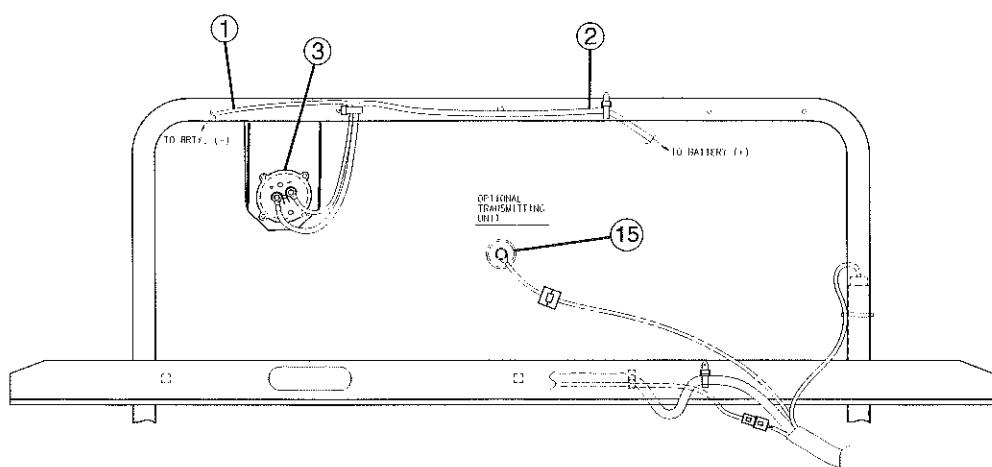
- | | |
|--|------------------------------|
| ① Receptacle to battery (negative) | ⑨ Speed sensor |
| ② Receptacle to battery (positive) | ⑩ MCU to traction motor |
| ③ Charging receptacle | ⑪ MCU to battery (negative) |
| ④ Solenoid relay to MCU | ⑫ Tow/Run switch |
| ⑤ Solenoid relay to harness | ⑬ Motor control unit (MCU) |
| ⑥ Solenoid relay to battery (positive) | ⑭ Fuse holder and 3A fuse |
| ⑦ Solenoid relay | ⑮ Optional transmitting unit |
| ⑧ Traction motor | |



A



B

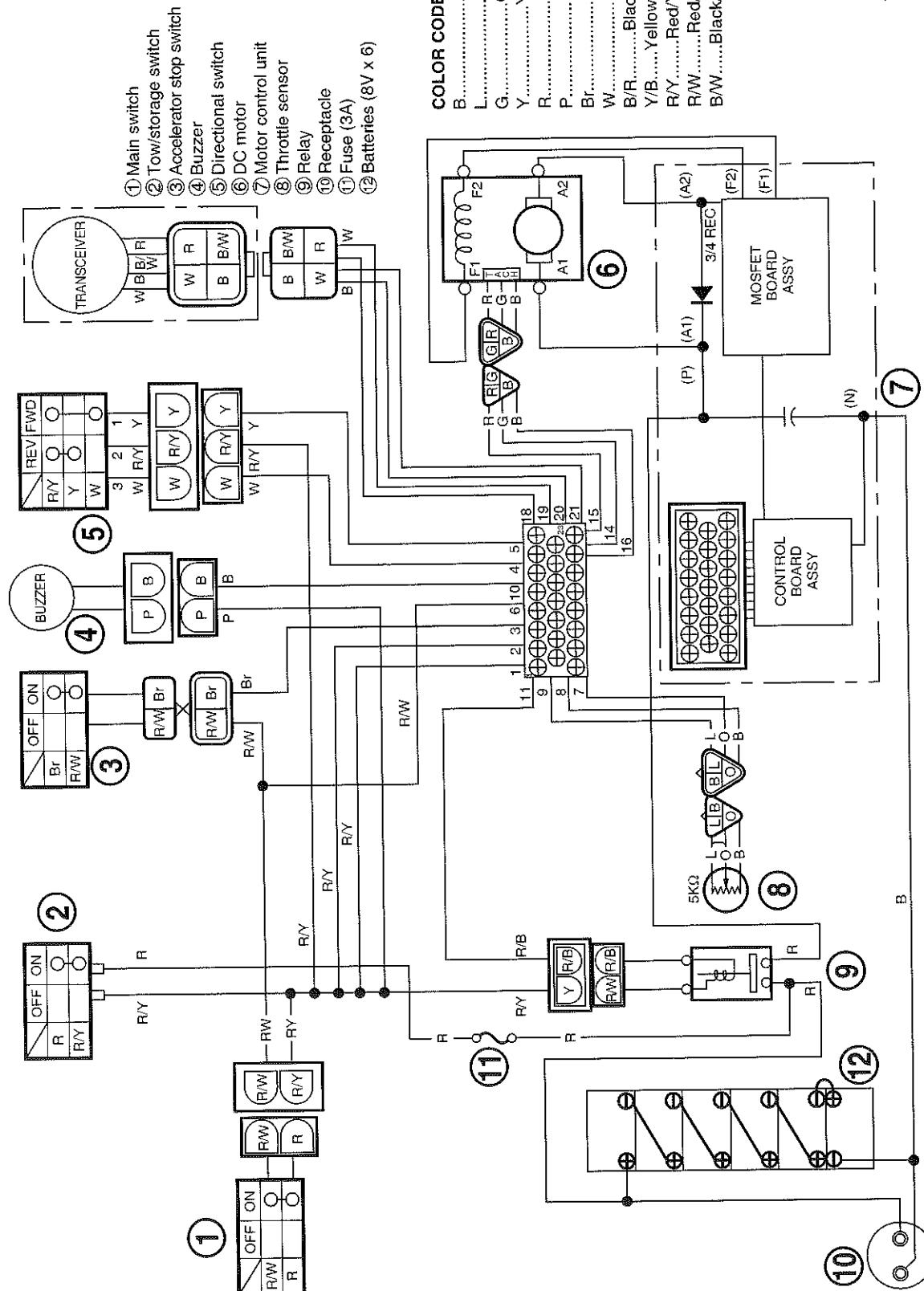


C

SM-03-430

WIRING DIAGRAM FOR G22E

SPEC



Y-671a

9

NOTES





YAMAHA

YAMAHA GOLF-CAR COMPANY

Printed in U.S.A.
.04.03-500 KCC