YAMAHA

Marine

# Outboards

# F4X

# SERVICE MANUAL

LIT-18616-01-79

67D-28197-Z8-11

# NOTICE

This manual has been prepared by the Yamaha Motor Company, Ltd. primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because the Yamaha Motor Company, Ltd. has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

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**F4X**
**SERVICE MANUAL**

**1st Edition, December 1998**

**Printed in USA**
**P/N 67D-28197-Z8-11**

# HOW TO USE THIS MANUAL

## 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/scratches → Replace.

To assist you to find your way through this manual, the section title and major heading is given at the top of every page.

## ILLUSTRATIONS

The illustrations within this service manual represent all of the designated models.

## CROSS REFERENCES

The cross references have been kept to a minimum. Cross references will direct you to the appropriate section or chapter.

## IMPORTANT INFORMATION

In this Service Manual particularly important information is distinguished in the following ways.

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

**⚠ WARNING**

**Failure to follow WARNING instructions could result in severe injury or death to the machine operator, a bystander, or a person inspecting or repairing the outboard motor.**

**CAUTION:**

**A CAUTION indicates special precautions that must be taken to avoid damage to the outboard motor.**

**NOTE:**

A NOTE provides key information to make procedures easier or clearer.

## HOW TO USE THIS MANUAL

① To help identify parts and clarify procedure steps, there are exploded diagrams at the start of each removal and disassembly section.

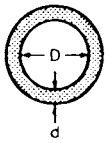
② Numbers are given in the order of the jobs in the exploded diagram. A circles number indicates a disassembly step.

③ Symbols indicate parts to be lubricated or replaced (see "SYMBOLS").

④ A job instruction chart accompanies the exploded diagram, providing the order of jobs, names of parts, notes in jobs, etc.

Example:

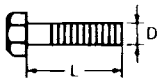
O-ring size 39.5 × 2.5 mm: Inside diameter (D) × ring diameter (d)



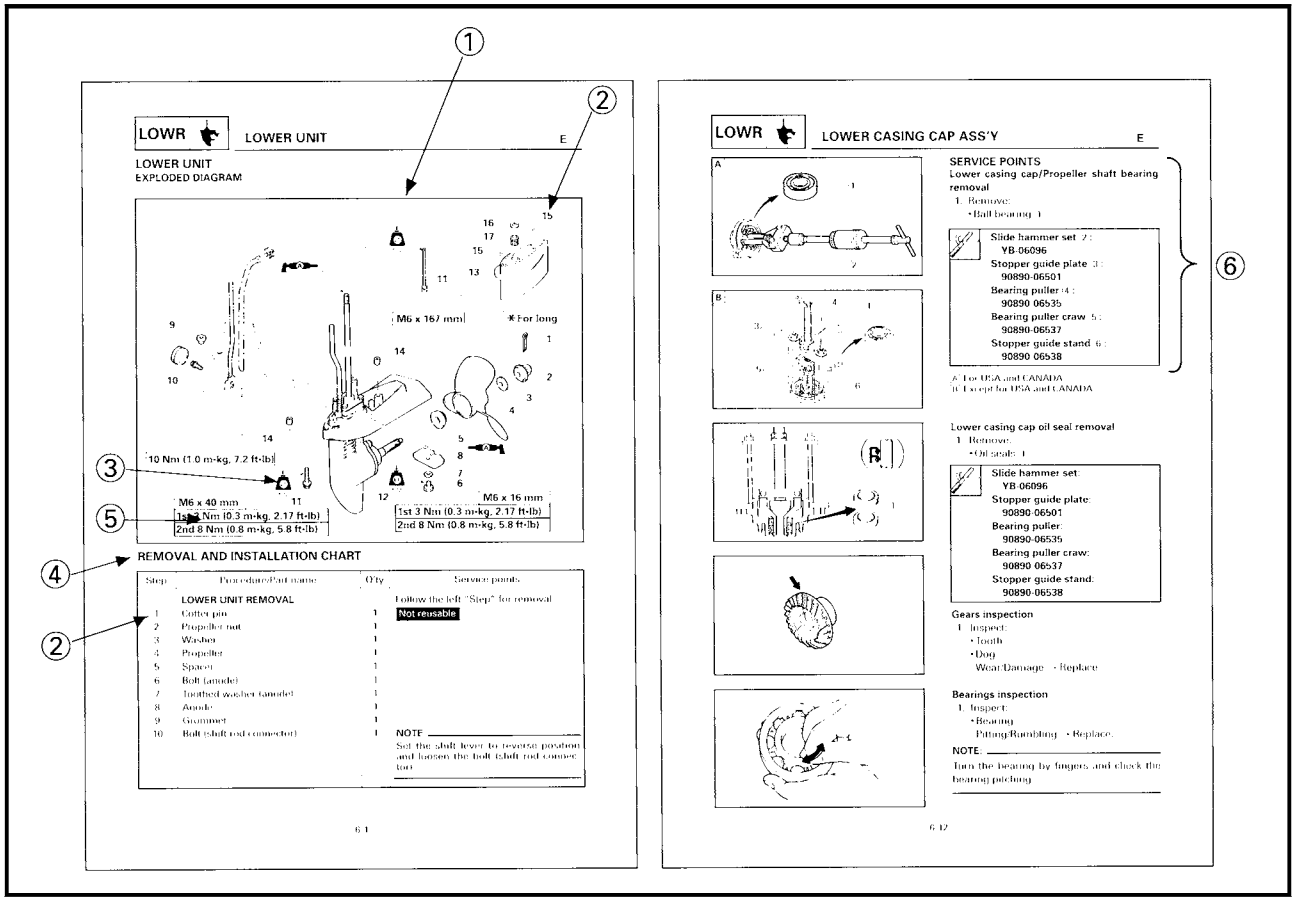

⑤ Dimension figures and the number of parts, are provided for fasteners that require a tightening torque.

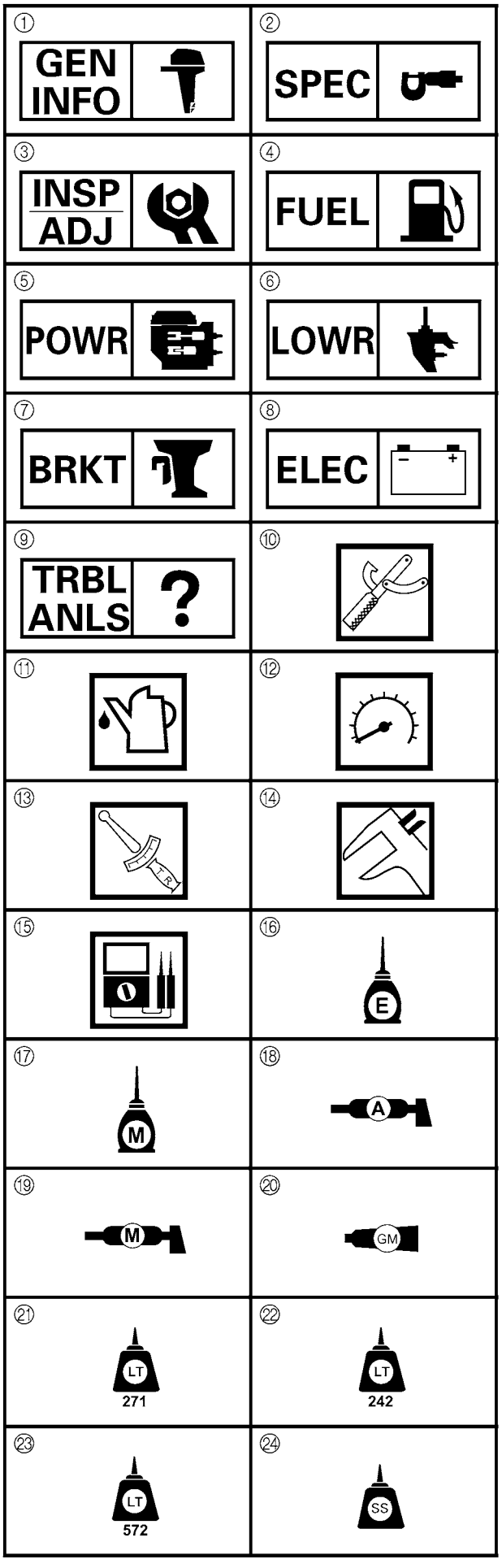
Example:

Bolt or screw size 10 × 25 mm (2) : M10 (D) × 25 mm (L) (2 pieces)




⑥ Jobs requiring more information (such as special tools and technical data) are described sequentially.



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## SYMBOLS

Symbols ① to ⑨ are designed as thumb-tabs to indicate the content of a chapter.

① General information
② Specifications
③ Periodic inspection and adjustment
④ Fuel system
⑤ Power unit
⑥ Lower unit
⑦ Bracket unit
⑧ Electrical systems
⑨ Trouble-analysis

Symbols ⑩ to ⑮ indicate specific data:

⑩ Special tool
⑪ Specified liquid
⑫ Specified engine speed
⑬ Specified torque
⑭ Specified measurement
⑮ Specified electrical value
[Resistance (Ω), Voltage (V), Electric current (A)]

Symbol ⑯ to ⑲ in an exploded diagram indicate the grade of lubricant and location of the lubrication point:

⑯ Apply Yamaha 4-stroke outboard motor oil
⑰ Apply molybdenum disulfide oil
⑱ Apply water resistant grease
(Yamaha grease A, Yamaha marine grease)
⑲ Apply molybdenum disulfide grease

Symbols ⑳ to ㉔ in an exploded diagram indicate grade of sealing or locking agent, and location of application point:

⑳ Apply Gasket Maker®
㉑ Apply LOCTITE® No. 271 (Red LOCTITE)
㉒ Apply LOCTITE® No. 242 (Blue LOCTITE)
㉓ Apply LOCTITE® No. 572
㉔ Apply silicon sealant

**NOTE:**

In this manual, the above symbols may not be used in every case.

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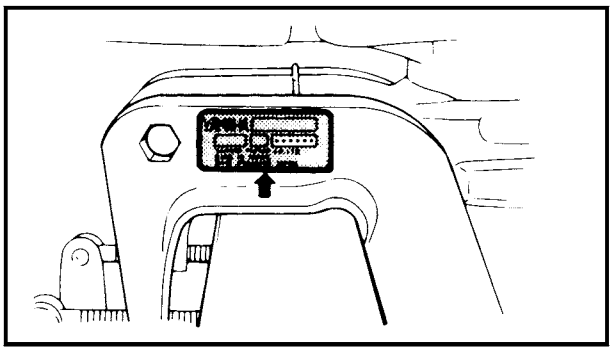
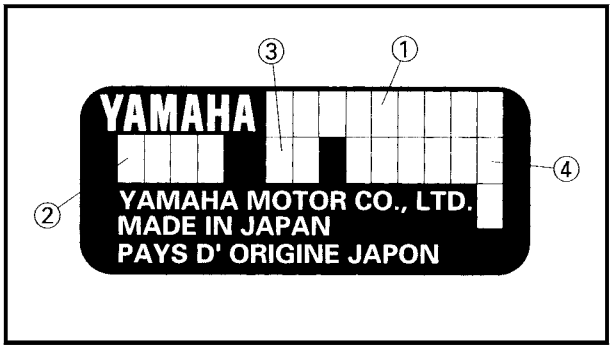
# INDEX



# CHAPTER 1
# GENERAL INFORMATION



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# IDENTIFICATION

## SERIAL NUMBER

The outboard motor's serial number is stamped on a label which is attached to the port side of the clamp bracket.

**NOTE:**

For USA model:
As an anti-theft measure, a special label on which the outboard motor's serial number is stamped is bonded to the port side of the clamp bracket. The label is specially treated so that peeling it off causes cranks across the serial number.

① Model name
② Approved model code
③ Transom height
④ Serial number

## STARTING SERIAL NUMBERS

The starting serial number blocks are as follows:

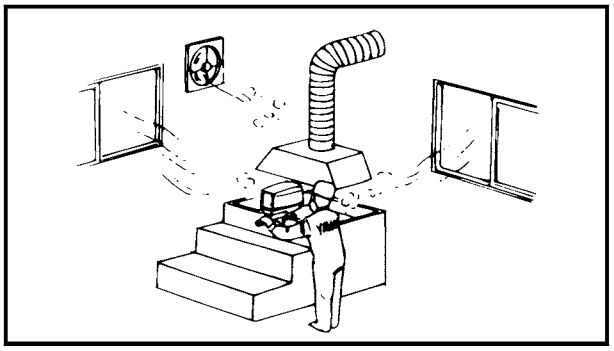
| Model name | | Approved model code | Starting serial number |
|---|---|---|---|
| Worldwide | USA/ CANADA | | |
| F4AMH | F4MSHX | 67D | S: 002408 ~ |
| | F4MLHX | | L: 300739 ~ |

## SAFETY WHILE WORKING

The procedures given in this manual are those recommended by Yamaha to be followed by Yamaha dealers and their mechanics.

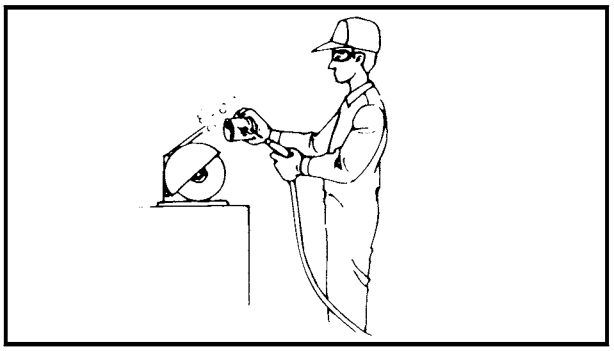
### FIRE PREVENTION

Gasoline (petrol) is highly flammable. Petroleum vapor is explosive if ignited. Do not smoke while handling gasoline and keep it away from heat, sparks and open flames.



### VENTILATION

Petroleum vapor is heavier than air and is deadly if inhaled in large quantities. Engine exhaust gases are harmful to breathe. When test-running an engine indoors, maintain good ventilation.



### SELF-PROTECTION

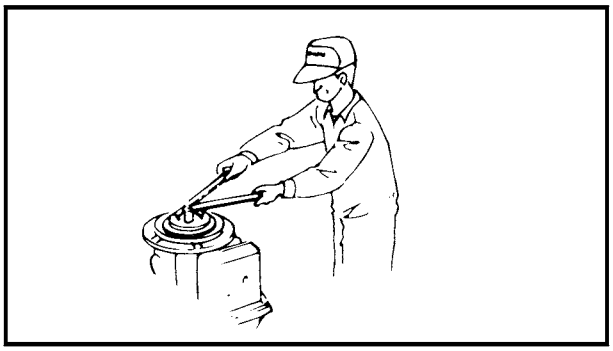
Protect your eyes with suitable safety glasses or safety goggles, when grinding or when doing any operation which may cause particles to fly off. Protect hands and feet by warning safety gloves or protective shoes if appropriate to the work you are doing.


### OILS, GREASES AND SEALING FLUIDS

Use only genuine Yamaha oils, greases and sealing fluids or those recommended by Yamaha.

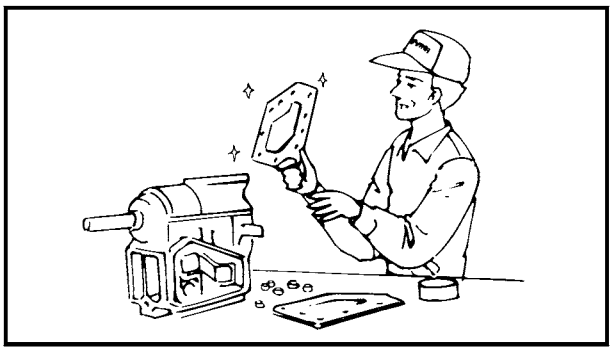
Under normal conditions of use, there should be no hazards from the use of the lubricants mentioned in this manual, but safety is all-important, and by adopting good safety practices, any risk is minimized. A summary of the most important precautions is as follows:

1. While working, maintain good standards of personal and industrial hygiene.
2. Clothing which has become contaminated with lubricants should be changed as soon as practicable, and laundered before further use.
3. Avoid skin contact with lubricants; do not, for example, place a soiled wiping-rag in your pocket.
4. Hands and any other part of the body which have been in contact with lubricants or lubricant-contaminated clothing, should be thoroughly washed with hot water and soap as soon as practicable.
5. To protect the skin, the application of a suitable barrier cream to the hands before working is recommended.
6. A supply of clean lint-free cloths should be available for wiping purposes.

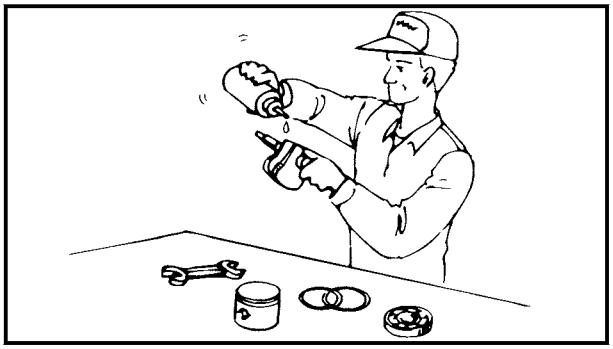


## GOOD WORKING PRACTICES

1. **The right tools**
   Use the recommended special tools to protect parts from damage. Use the right tool in the right manner — do not improvise.
2. **Tightening torque**
   Follow the tightening torque instructions. When tightening bolts, nuts and screws, tighten the large sizes first, and tighten inner-positioned fixings before outer-positioned ones.

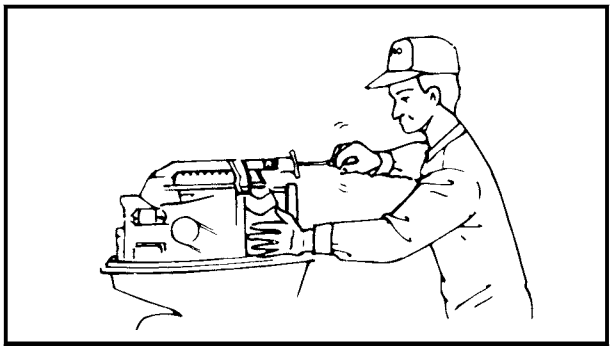


3. **Non-reusable items**
   Always use new gaskets, packings, O-rings, split-pins and circlips etc. on reassembly.

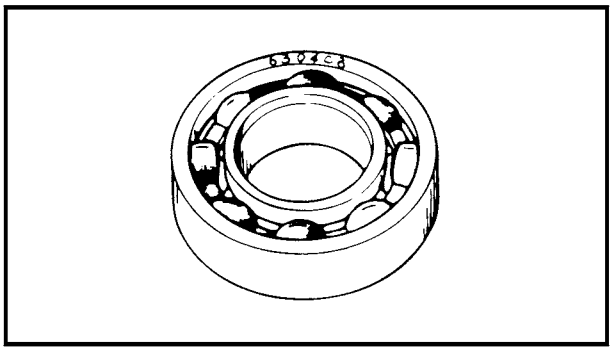


## DISASSEMBLY AND ASSEMBLY

1. Clean parts with compressed air when disassembling.
2. Oil the contact surfaces of moving parts before assembly.



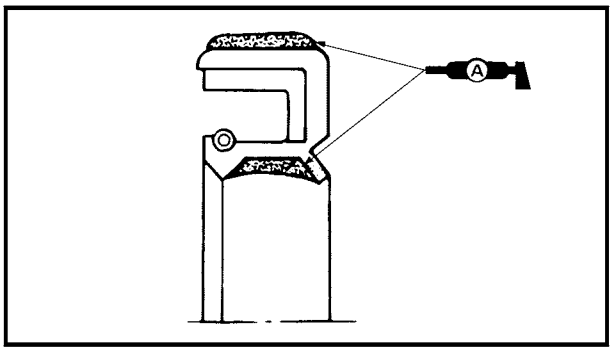
3. After assembly, check that moving parts operate normally.



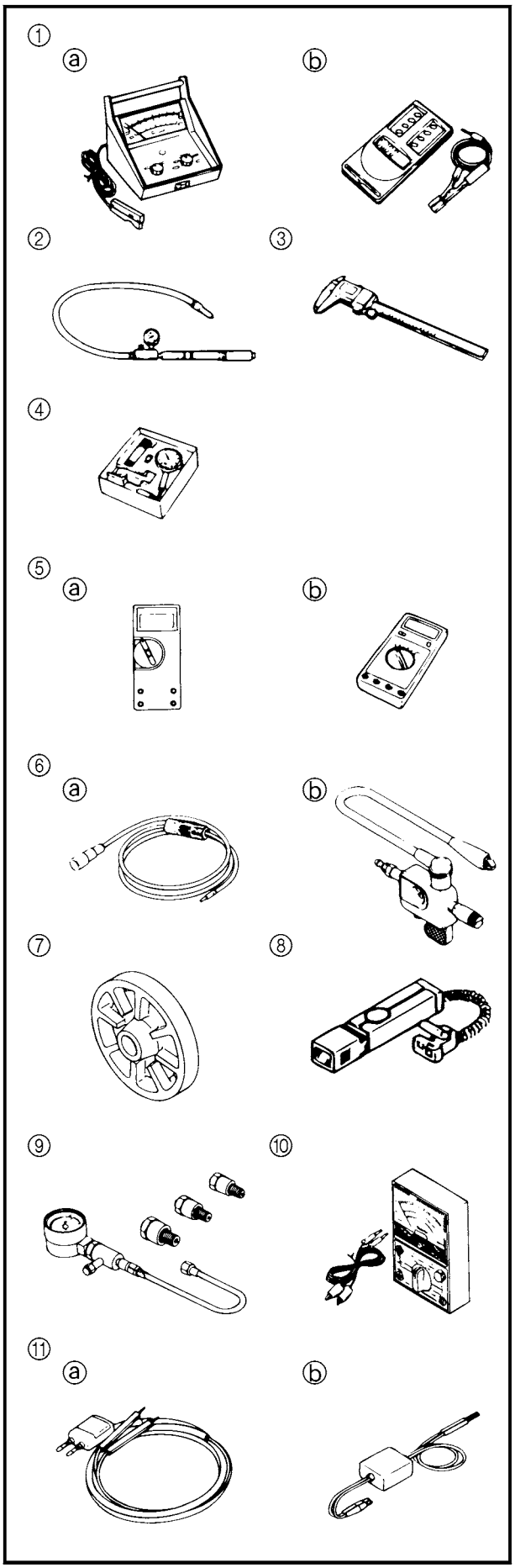
4. Install bearings with the manufacturer's markings on the side exposed to view, and liberally oil the bearings.

**CAUTION:**

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




5. When installing oil seals, apply a light coating of water-resistant grease to the outside diameter.




## SPECIAL TOOLS

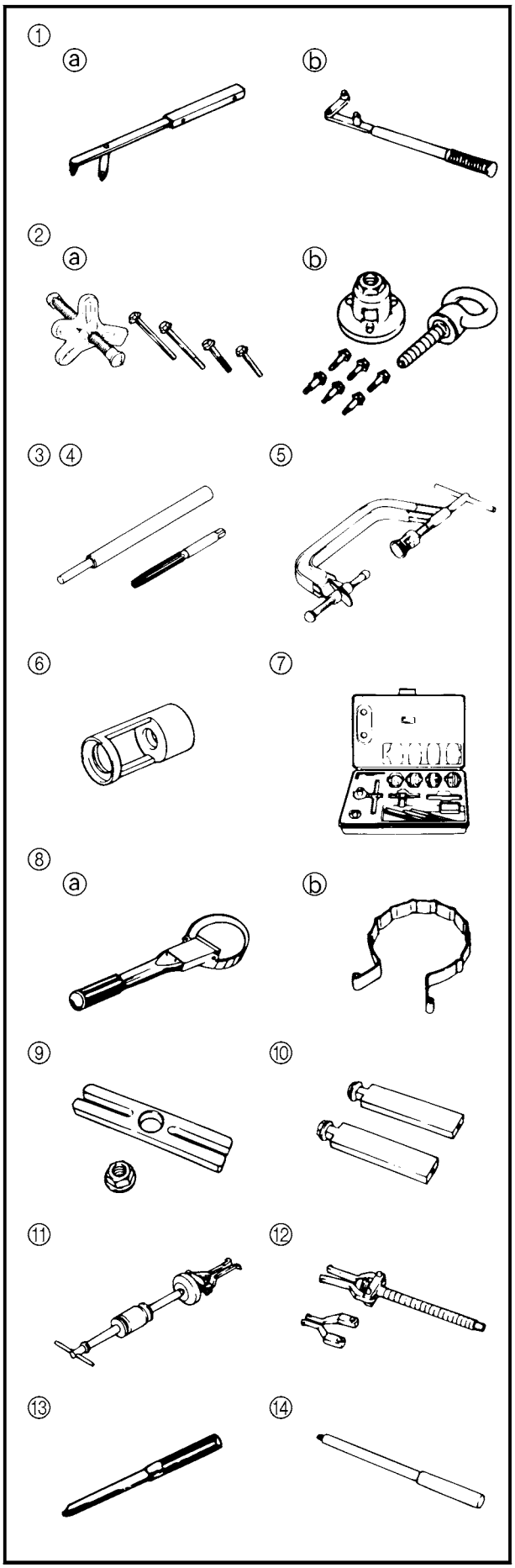
The use of correct special tools recommended by Yamaha will aid the work and enable accurate assembly and tune-up. Improvisations and use of improper tools can cause damage to the equipment.

**NOTE:**

- For U.S.A. and Canada, use part number starting with "J-", "YB-", "YM-" "YU-" or "YW-".
- For others, use part number starting with "90890-".

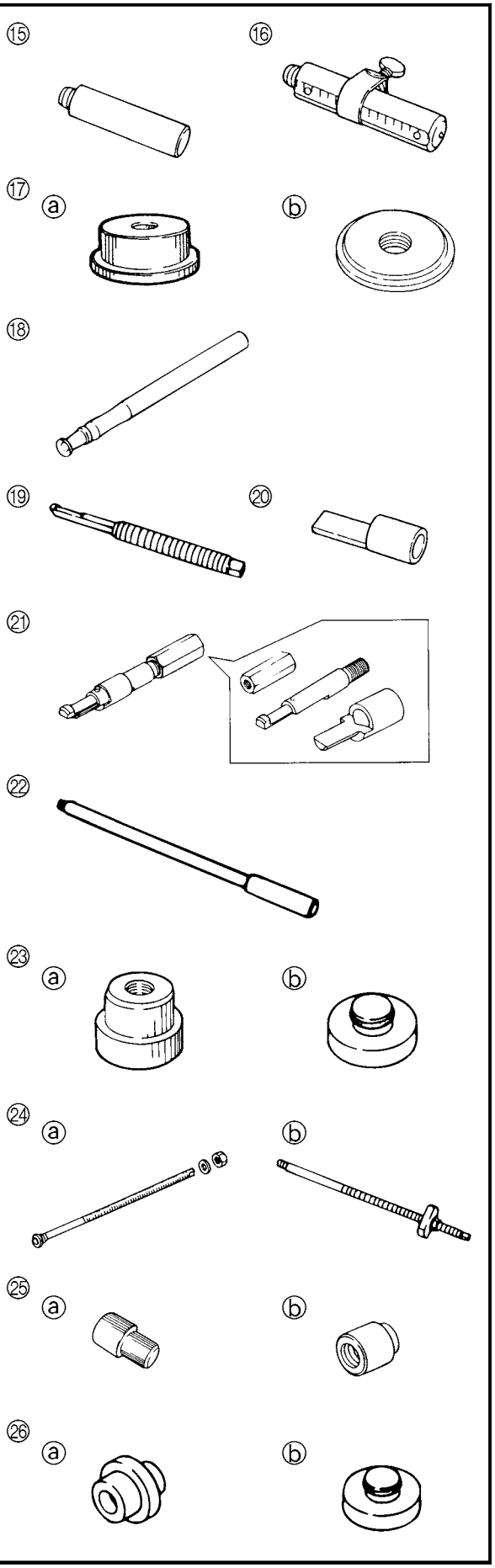
## MEASURING

1. Tachometer
   P/N. YU-08036-A ..... ⓐ
   90890-06760 ..... ⓑ
2. Leakage tester
   P/N. YB-03595
   90890-06762
3. Digital caliper
   P/N. N.A.
   90890-06704
4. Dial gauge set
   P/N. YU-03097
   90890-01252
5. Digital circuit tester
   P/N. J-39299 ..... ⓐ
   90890-06752 ..... ⓑ
6. Spark gap tester
   P/N. YM-34487 ..... ⓐ
   90890-06754 ..... ⓑ
7. Test propeller
   P/N. YB-01630
   90890-01630
8. Timing light
   P/N. YU-33277-A
   90890-03141
9. Compression gauge
   P/N. YU-33223
   90890-03160
10. Yamaha pocket tester
    P/N. YU-03112
    90890-03112
11. Peak voltage adaptor
    P/N. YU-39991 ..... ⓐ
    90890-03169 ..... ⓑ

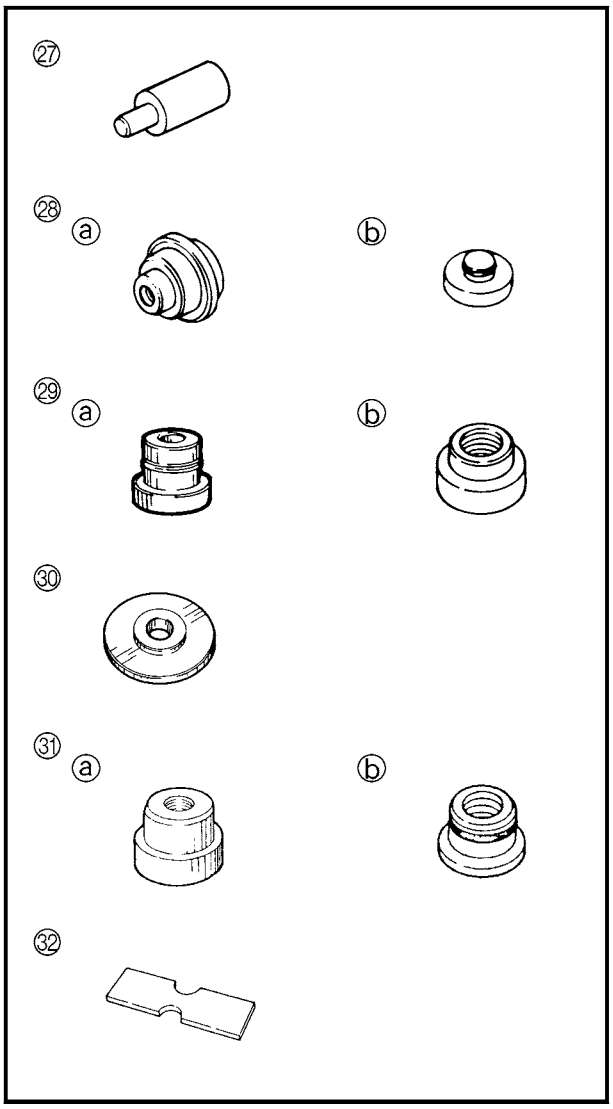



## REMOVAL AND INSTALLATION

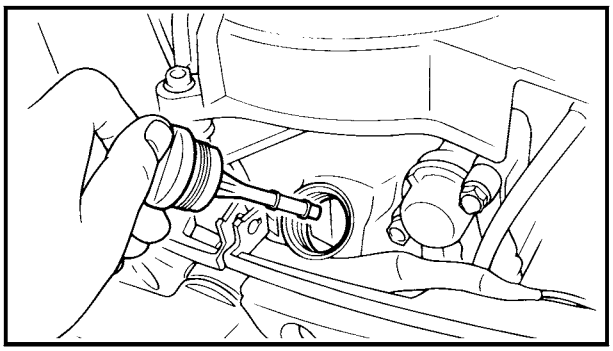
1. Flywheel holder
   P/N. YB-06139 ..... ⓐ
   90890-06522 ..... ⓑ
2. Universal puller
   P/N. YB-06117 ..... ⓐ
   90890-06521 ..... ⓑ
3. Valve guide remover and installer
   P/N. YM-01122
   90890-06801
4. Valve guide reamer
   P/N. YM-01196
   90890-06804
5. Valve spring compressor
   P/N. YM-01253
   90890-04019
6. Attachment
   P/N. YB-06554
   90890-06554
7. Valve seat cutter set
   P/N. YM-91043-C
   90890-06803
8. Piston slider
   P/N. YB-34454 ..... ⓐ
   90890-06529 ..... ⓑ
9. Stopper guide plate
   P/N. N.A.
   90890-06501
10. Stopper guide stand
    P/N. N.A.
    90890-06538
11. Slide hammer set
    P/N. YB-06096
    N.A.
12. Bearing puller
    P/N. N.A.
    90890-06535, 90890-06536,
    90890-06537
13. Driver rod
    P/N. YB-06229
14. Driver rod
    P/N. YB-06071



15. Driver rod
    P/N. N.A.
    90890-06606
16. Driver rod
    P/N. N.A.
    90890-06604
17. Ball bearing attachment
    P/N. YB-06085 ..... ⓐ
    90890-06624 ..... ⓑ
18. Valve lapper
    P/N. N.A.
    90890-06805
19. Bushing puller center bolt
    P/N. N.A.
    90890-06646
20. Bushing puller spacer
    P/N. N.A.
    90890-06648
21. Bushing puller set
    P/N. YB-06178
    N.A.
22. Driver rod
    P/N. 90890-06652
23. Bearing installer
    (Bearing inner race attachment)
    P/N. YB-06153 ..... ⓐ
    90890-06612 ..... ⓑ
24. Bushing installer center bolt
    P/N. YB-06029 ..... ⓐ
    90890-06601 ..... ⓑ
25. Bushing attachment
    P/N. YB-06027 ..... ⓐ
    90890-06651 ..... ⓑ
26. Bearing installer
    (Ball bearing attachment)
    P/N. YB-06016 ..... ⓐ
    90890-06634 ..... ⓑ

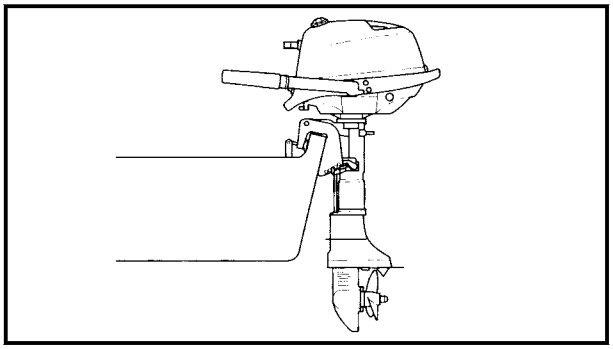



27. Bushing remover attachment
    P/N. YB-06027
    N.A.
28. Needle bearing attachment
    (Oil seal installer)
    P/N. YB-06168 ..... ⓐ
    90890-06613 ..... ⓑ
29. Bush attachment (Oil seal installer)
    P/N. YB-06230 ..... ⓐ
    90890-06649 ..... ⓑ
30. Needle bearing installer
    P/N. YB-06169
    N.A.
31. Needle bearing attachment
    P/N. YB-06082 ..... ⓐ
    90890-06615 ..... ⓑ
32. Bearing depth plate
    P/N. N.A.
    90890-06603

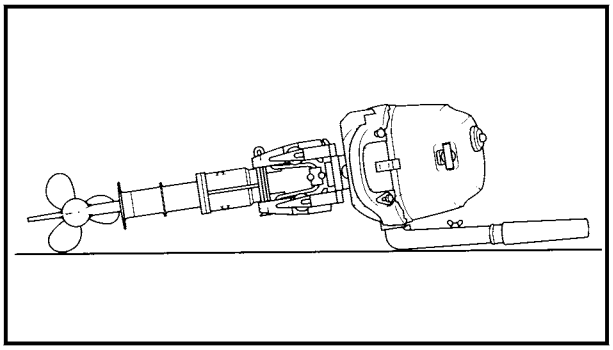


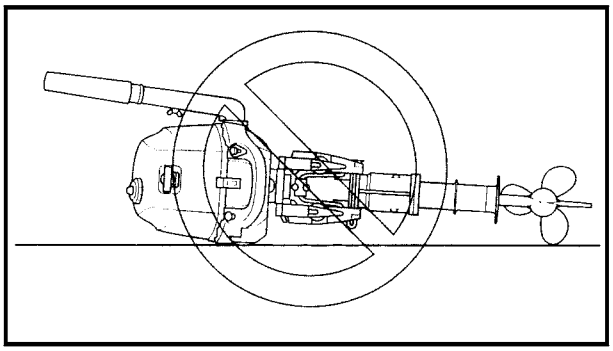
## HANDLING PRECAUTIONS

1. Pre-Operation
   This outboard is not equipped with an oil warning system. Therefore always check the engine oil level before starting the engine.



2. Storage
   To prevent oil from flowing into the cylinder from the oil pan and to also prevent oil leakage, store the outboard as shown. Do not store the outboard in any other position than that shown.





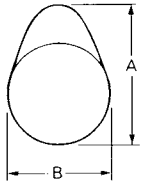
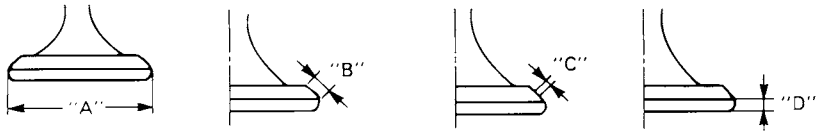
# CHAPTER 2
# SPECIFICATIONS

# GENERAL SPECIFICATIONS

| Item | Worldwide / USA/CANADA | Unit | Model<br>F4A / F4 |
|---|---|---|---|
| **DIMENSION** | | | |
| Overall length (with tiller handle) | | mm (in) | 717 (28.2) |
| Overall width | | mm (in) | 361 (14.2) |
| Overall height | | | |
| (S) | | mm (in) | 1,029 (40.5) |
| (L) | | mm (in) | 1,156 (45.5) |
| **WEIGHT** | | | |
| (With aluminum propeller) | | | |
| (S) | | kg (lb) | 22 (48.5) |
| (L) | | kg (lb) | 23 (50.7) |
| **PERFORMANCE** | | | |
| Maximum output (ISO) | | kW (hp) @r/min | 2.9 (4)/@4,500 |
| Full throttle operation | | r/min | 4,000 ~ 5,000 |
| Maximum fuel consumption | | L (US gal, Imp gal)/h @r/min | 1.6 (0.42, 0.35)/@5,000 |
| **POWER UNIT** | | | |
| Type | | | 4 stroke, OHV |
| Number of cylinders | | | 1 |
| Displacement | | $cm^3$ (cu. in) | 112 (6.8) |
| Bore × stroke | | mm (in) | 59.0 × 41.0 (2.32 × 1.61) |
| Compression ratio | | | 8.4 |
| Compression pressure | | kPa ($kg/cm^2$, psi) | 660 (6.6, 93.87) |
| Number of carburetors | | | 1 |
| Control system | | | Tiller control |
| Starting system | | | Recoil starter |
| Ignition control system | | | T.C.I. (Transistor-Controlled Ignition) |
| Starting enrichment | | | Choke valve |
| Spark plug | | | B6HS/BR6HS |
| Exhaust system | | | Under water |
| Lubrication system | | | Wet sump |
| Ignition timing | | Degree | BTDC 28 ~ 32 (Fixed) |
| **FUEL AND OIL** | | | |
| Fuel type | | | Unleaded regular gasoline |
| Fuel rating | | PON (Pump Octane Number) | 86 |
| | | RON (Research Octane Number) | 91 |
| Fuel tank capacity (Built-in) | | L (US, gal, Imp gal) | 1.1 (0.29, 0.24) |
| Engine oil | | | 4-stroke engine oil |
| Engine oil grade | | | API SE, SF, SE-SF, SE-SF-CC or SG-CD<br>SAE 10W-30, 10W40 |
| Total quantity | | $cm^3$ (US oz, imp oz) | 500 (16.9, 17.6) |

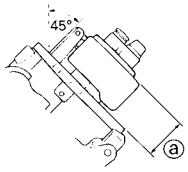
| Item | | Unit | Model |
|---|---|---|---|
| | Worldwide | | F4A |
| | USA/CANADA | | F4 |
| Gear oil | | | Hypoid gear oil |
| Gear oil grade | | | SAE# 90 |
| Total quantity | | $cm^3$ (US oz, imp oz) | 100 (3.4, 3.5) |
| **BRACKET** | | | |
| Tilt angle | | Degree | 4, 8, 12, 16, 20 |
| Tilt-up angle | | Degree | 76 |
| Steering angle | | Degree | 360 |
| Sallow water cruising angle | | Degree | 30, 42, 54 |
| **DRIVE UNIT** | | | |
| Gear positions | | | F-N-R (Forward-Neutral-Reverse) |
| Gear ratio | | | 2.08 (27:13) |
| Gear type | | | Straight bevel gear |
| Propeller direction | | | Clockwise |
| Propeller drive system | | | Spline |
| Propeller series mark | | | BA |

# MAINTENANCE SPECIFICATIONS
## POWER UNIT

| Item | Unit | Model |
|---|---|---|
| | | F4A/F4 |
| **CYLINDER HEAD** | | |
| Warpage limit | mm (in) | 0.1 (0.004) |
| **CYLINDER** | | |
| Bore | mm (in) | 59.00 ~ 59.02 (2.323 ~ 2.324) |
| Wear limit | mm (in) | 59.1 (2.33) |
| Taper limit | mm (in) | 0.08 (0.003) |
| Out of round limit | mm (in) | 0.05 (0.002) |
| **CAMSHAFT**   | | |
| Intake (A) | mm (in) | 26.736 ~ 26.836 (1.0526 ~ 1.0565) |
| Exhaust (A) | mm (in) | 26.532 ~ 26.623 (1.0442 ~ 1.0481) |
| Intake (B) | mm (in) | 21.950 ~ 22.050 (0.8642 ~ 0.8681) |
| Exhaust (B) | mm (in) | 21.950 ~ 22.050 (0.8642 ~ 0.8681) |
| Camshaft diameter (journal) | mm (in) | 14.934 ~ 14.984 (0.5880 ~ 0.5899) |
| Camshaft round limit | mm (in) | 0.03 (0.001) |
| **VALVE LIFTER** | | |
| Outside diameter | mm (in) | 7.965 ~ 7.980 (0.3136 ~ 0.3142) |
| **PUSH ROD** | | |
| Runout limit | mm (in) | 0.5 (0.02) |
| **VALVES** | | |
| Valve clearance (cold) | | |
| Intake | mm (in) | 0.10 ± 0.02 (0.004 ± 0.0008) |
| Exhaust | mm (in) | 0.10 ± 0.02 (0.004 ± 0.0008) |
|   | | |
| Head diameter (A) | | |
| Intake | mm (in) | 23.9 ~ 24.1 (0.94 ~0.95) |
| Exhaust | mm (in) | 21.9 ~ 22.1 (0.86 ~0.87) |
| Face width (B) | | |
| Intake | mm (in) | 1.84 ~ 2.26 (0.072 ~ 0.089) |
| Exhaust | mm (in) | 1.84 ~ 2.26 (0.072 ~ 0.089) |
| Seat width (C) | | |
| Intake | mm (in) | 0.6 ~ 0.8 (0.02 ~ 0.03) |
| Exhaust | mm (in) | 0.6 ~ 0.8 (0.02 ~ 0.03) |
| Margin thickness (D) | | |
| Intake | mm (in) | 0.70 (0.028) |
| Exhaust | mm (in) | 1.00 (0.039) |
| Stem outside diameter | | |
| Intake | mm (in) | 5.475 ~ 5.490 (0.2156 ~ 0.2161) |
| Exhaust | mm (in) | 5.460 ~ 5.475 (0.2150 ~ 0.2156) |
| Guide inside diameter | mm (in) | 5.500 ~ 5.512 (0.2165 ~ 0.2170) |

| Item | Unit | Model |
|---|---|---|
| | | F4A/F4 |
| Stem to guide clearance | | |
| Intake | mm (in) | 0.010 ~ 0.037 (0.0004 ~ 0.0015) |
| Exhaust | mm (in) | 0.025 ~ 0.052 (0.0010 ~ 0.0020) |
| Stem runout limit | mm (in) | 0.03 (0.0012) |
| **VALVE SPRING** | | |
| Free length | mm (in) | 35.0 (1.38) |
| Free length limit | mm (in) | 34.0 (1.34) |
| Set length | mm/kg (in/lb) | 21.6/7.2 (0.85/15.87) |
| Tilt limit | mm (in) | 1.2 (0.05) |
| **PISTON** | | |
| Piston-to-cylinder clearance | mm (in) | 0.035 ~ 0.065 (0.0014 ~ 0.0026) |
| Piston diameter (D) | | |
| Standard | mm (in) | 58.950 ~ 58.965 (2.3209 ~ 2.3215) |
| Measuring point (H) | mm (in) | 10 (0.39) |
| Pin boss inside diameter | mm (in) | 13.009 ~ 13.017 (0.5122 ~ 0.5125) |
| Oversize piston diameter | | |
| 1st* | mm (in) | 59.25 (2.333)*1 Except for USA |
| 2nd | mm (in) | 59.50 (2.343) |
| **PISTON PIN** | | |
| Outside diameter | mm (in) | 12.995 ~ 13.000 (0.5116 ~ 0.5118) |
| **PISTON RINGS** | | |
| Top ring | | |
| Type | | Plain |
| Dimensions (B × T) | mm (in) | 1.5 × 2.6 (0.06 × 0.10) |
| End gap (installed) | mm (in) | 0.10 ~ 0.20 (0.004 ~ 0.008) |
| Wear limit | mm (in) | 0.40 (0.016) |
| Side clearance (installed) | mm (in) | 0.04 ~ 0.08 (0.002 ~ 0.003) |
| 2nd ring | | |
| Type | | Plain |
| Dimensions (B × T) | mm (in) | 1.5 × 2.6 (0.06 × 0.10) |
| End gap (installed) | mm (in) | 0.25 ~ 0.40 (0.010 ~ 0.016) |
| Wear limit | mm (in) | 0.60 (0.024) |
| Side clearance (installed) | mm (in) | 0.02 ~ 0.06 (0.001 ~ 0.002) |
| Oil ring | | |
| Dimensions (B × T) | mm (in) | 2.4 × 2.5 (0.09 × 0.10) |
| End gap (installed) | mm (in) | 0.2 ~ 0.7 (0.008 ~ 0.028) |
| Wear limit | mm (in) | 0.9 (0.04) |
| **CONNECTING ROD** | | |
| Small end inside diameter | mm (in) | 13.006 ~ 13.020 (0.5120 ~ 0.5126) |
| Big end oil clearance | mm (in) | 0.016 ~ 0.046 (0.0006 ~ 0.0018) |

| Item | Unit | Model | |
|---|---|---|---|
| | | F4A/F4 | |
| **CRANKSHAFT** | | | |
| Crankshaft width | mm (in) | 64.40 ~ 64.50 (2.535 ~ 2.539) | |
| Crankshaft big end side clearance | mm (in) | 0.20 ~ 0.60 (0.008 ~ 0.024) | |
| Crank pin diameter limit | mm (in) | 25.95 (1.022) | |
| Runout limit | mm (in) | 0.03 (0.0012) | |
| **THERMOSTAT** | | | |
| ID mark | | S60°C | |
| Valve opening temperature | °C (°F) | 58 ~ 62 (136.4 ~ 143.6) | |
| Full-open temperature | °C (°F) | 70 (158) | |
| Valve lift | mm (in) | 3 (0.12) | |
| **FUEL PUMP** | | | |
| Discharge | L (US gal, Imp gal)/ h Engine @5,000 r/min | 8 (2.11, 1.76) | |
| Pressure | kPa (kgf/cm$^2$, psi) | 50 (0.5, 7.1) | |
| Plunger stroke | mm (in) | 1.8 ~ 2.2 (0.07 ~ 0.09) | |
| **CARBURETOR** | | Except for USA | For USA |
| ID mark | | 67D00 | 67D10 |
| Main jet | # | 68 | |
| Pilot jet | # | 36 | |
| Pilot screw | turns out | 1-5/8 ± 1/4 | — |
| Float height ⓐ | mm (in) | 18.0 ~ 19.0 (0.71 ~ 0.75) | |
| Idle speed | r/min | 1,500 ± 50 | |
| Trolling speed | r/min | 1,350 ± 50 | |



## LOWER

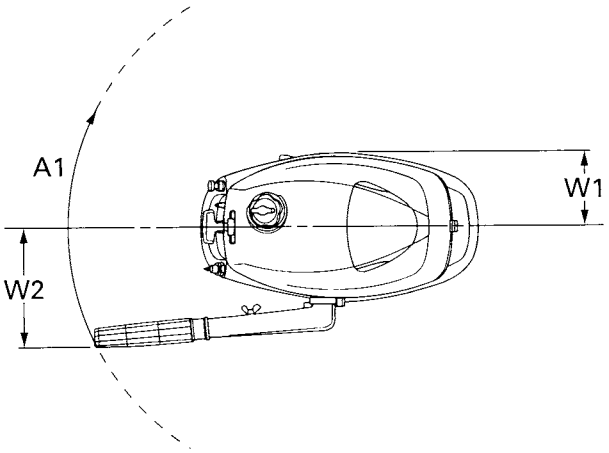
| Item | Unit | Model |
|---|---|---|
| | | F4A/F4 |
| **TEST PROPELLER** | | |
| Test propeller | Parts No. | YB-1630/90890-01630 |
| Specific revolution | r/mm | 5,250 ~ 5,450 |

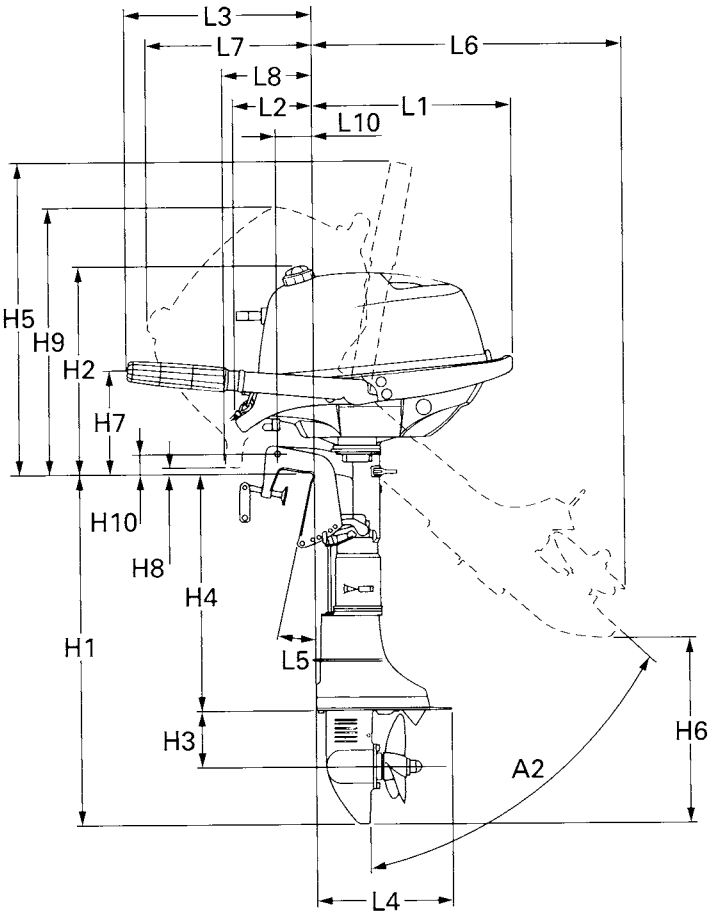
## ELECTRICAL

| Item | Unit | Model |
|---|---|---|
| | | F4A/F4 |
| **IGNITION SYSTEM** | | |
| Ignition timing | Degree | BTDC 28 ~ 32 |
| T.C.I. system output peak voltage (W – B) | | |
| @ cranking (300 r/min) open | V | 126 |
| T.C.I. air gap | mm (in) | 0.3 ~ 0.6 (0.012 ~ 0.024) |
| Spark plug gap | mm (in) | 0.6 ~ 0.7 (0.024 ~ 0.028) |
| Spark plug cap resistance (with resister type) | kΩ | 4.0 ~ 6.0 |
| Ignitor ass'y resistance | | |
| Primary coil (W-B) | Ω | 0.56 ~ 0.84 |
| Secondary coil (W-Hi-tension cord) | kΩ | 11.6 ~ 17.4 |

# DIMENSIONS

## Outboard dimension



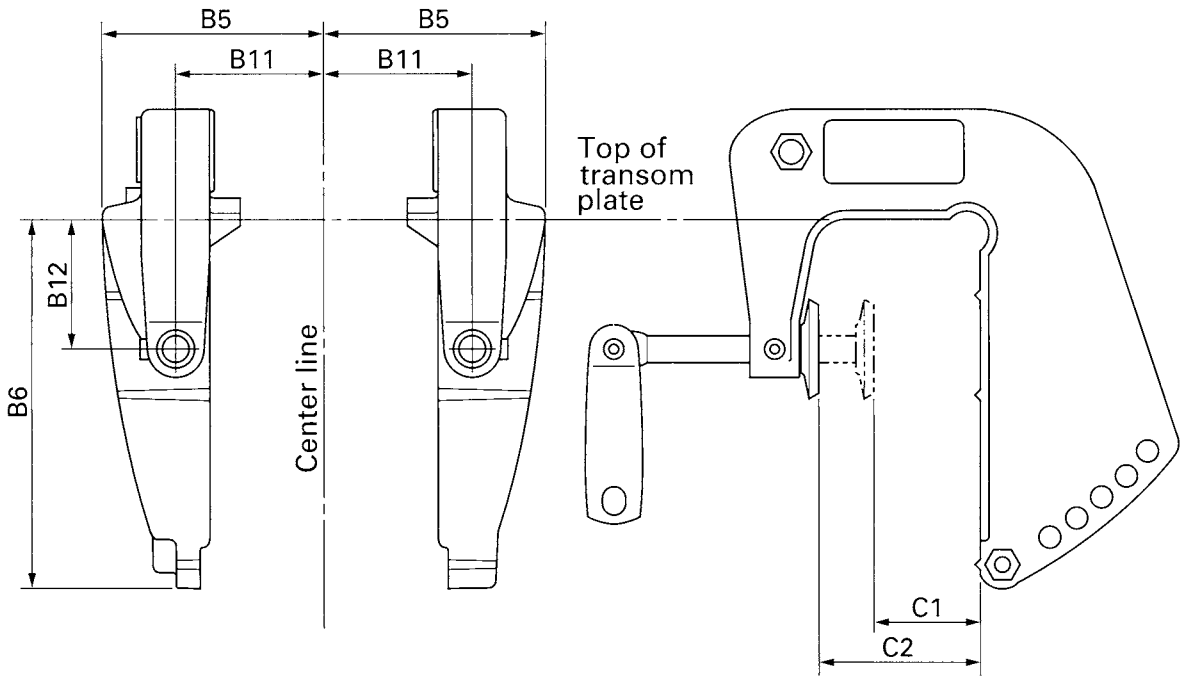




| Symbol | | Unit | Model(s) |
|---|---|---|---|
| Worldwide | | | F4A |
| USA/CANADA | | | F4 |
| L1 | | mm (in) | 375 (14.7) |
| L2 | | mm (in) | 141 (5.6) |
| L3 | | mm (in) | 342 (13.5) |
| L4 | | mm (in) | 259 (10.2) |
| L5 | (S) | mm (in) | 71 (2.8) |
| | (L) | mm (in) | 93 (3.7) |
| L6 | (S) | mm (in) | 635 (25.0) |
| | (L) | mm (in) | 753 (29.6) |
| L7 | | mm (in) | 373 (14.7) |
| L8 | | mm (in) | 149 (5.9) |
| L10 | | mm (in) | 63 (2.5) |
| H1 | (S) | mm (in) | 644 (25.4) |
| | (L) | mm (in) | 771 (30.4) |
| H2 | | mm (in) | 385 (15.2) |
| H3 | | mm (in) | 104 (4.1) |
| H4 | (S) | mm (in) | 435 (17.1) |
| | (L) | mm (in) | 562 (22.1) |
| H5 | | mm (in) | 583 (23.0) |
| H6 | (S) | mm (in) | 555 (21.9) |
| | (L) | mm (in) | 637 (25.1) |
| H7 | | mm (in) | 198 (7.8) |
| H8 | | mm (in) | 11.7 (0.46) |
| H9 | | mm (in) | 513 (20.2) |
| H10 | | mm (in) | 39 (1.5) |
| W1 | | mm (in) | 137 (5.4) |
| W2 | | mm (in) | 225 (8.9) |
| A1 | | degree | 360 |
| A2* | | degree | 69 |

*Tilt lock

## Bracket dimension

| Symbol<br>Worldwide<br>USA/CANADA | Unit | Model(s)<br>F4A<br>F4 |
|---|---|---|
| B5 | mm (in) | 82.5 (3.25) |
| B6 | mm (in) | 136 (5.35) |
| B11 | mm (in) | 55 (2.17) |
| B12 | mm (in) | 48 (1.9) |
| C1 | mm (in) | 22 (0.87) |
| C2 | mm (in) | 60 (2.36) |

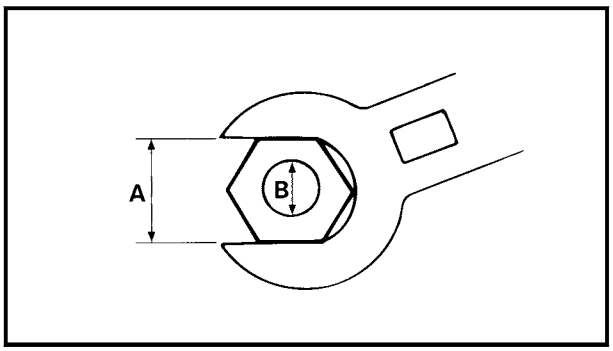


# TIGHTENING TORQUES

## SPECIFIED TORQUE

| Part to be tightened | | Part name | Thread size | Q'ty | Tightening torques | | |
|---|---|---|---|---|---|---|---|
| | | | | | Nm | m • kgf | ft • lb |
| **POWER UNIT** | | | | | | | |
| Oil drain | | Bolt | M8 | 1 | 18 | 1.8 | 13 |
| Spark plug | | — | M14 | 1 | 25 | 2.5 | 18 |
| Recoil starter | | Bolt | M6 | 3 | 8 | 0.8 | 5.8 |
| Flywheel rotor ass'y | | Nut | M10 | 1 | 44 | 4.4 | 32 |
| Carburetor | | Bolt | M6 | 2 | 8 | 0.8 | 5.8 |
| Intake manifold | | Bolt | M6 | 2 | 8 | 0.8 | 5.8 |
| Cylinder head cover | | Bolt | M6 | 4 | 11 | 1.1 | 8.0 |
| Cylinder head | 1st | Bolt | M8 | 4 | 15 | 1.5 | 10.8 |
| | 2nd | | | | 30 | 3.0 | 22 |
| | 1st | Bolt | M6 | 1 | 6 | 0.6 | 4.3 |
| | 2nd | | | | 11 | 1.1 | 8.0 |
| Locknut (rocker arm) | | Nut | M6 | 2 | 10 | 1.0 | 7.2 |
| Power unit mounting | | Bolt | M6 | 7 | 8 | 0.8 | 5.8 |
| Thermostat cover | | Bolt | M6 | 3 | 8 | 0.8 | 5.8 |
| Breather cover | | Bolt | M6 | 3 | 8 | 0.8 | 5.8 |
| Crankcase | 1st | Bolt | M8 | 7 | 10 | 1.0 | 7.2 |
| | 2nd | | | | 22 | 2.2 | 16 |
| Connecting rod | | Bolt | M7 | 2 | 12 | 1.2 | 8.7 |
| Oil splash gear unit | | Bolt | M6 | 1 | 8 | 0.8 | 5.8 |
| **LOWER UNIT** | | | | | | | |
| Lower unit mounting | 1st | Bolt | M6 | 2 | 3 | 0.3 | 2.17 |
| | 2nd | | | | 8 | 0.8 | 5.8 |
| Propeller shaft housing | | Bolt | M6 | 2 | 8 | 0.8 | 5.8 |
| Anode | 1st | Bolt | M6 | 1 | 3 | 0.3 | 2.17 |
| | 2nd | | | | 8 | 0.8 | 5.8 |
| **BRACKET** | | | | | | | |
| Steering handle mounting (pivot) | | Bolt | M8 | 1 | 18 | 1.8 | 13 |
| Shift lever | | Bolt | M6 | 1 | 4 | 0.4 | 2.9 |
| Swivel bracket 3 | | Bolt | M6 | 2 | 8 | 0.8 | 5.8 |
| Tilt lock plate | 1st | Bolt | M6 | 2 | 3 | 0.3 | 2.17 |
| | 2nd | | | | 8 | 0.8 | 5.8 |
| Clamp bracket | | Nut | M8 | 1 | 13 | 1.3 | 9.4 |
| Swivel bracket 2 (upper casing) | 1st | Bolt | M6 | 6 | 3 | 0.3 | 2.17 |
| | 2nd | | | | 8 | 0.8 | 5.8 |
| Water pump housing | 1st | Bolt | M6 | 4 | 3 | 0.3 | 2.17 |
| | 2nd | | | | 8 | 0.8 | 5.8 |
| **ELECTRICAL** | | | | | | | |
| Ignitor ass'y | | Bolt | M6 | 2 | 8 | 0.8 | 5.8 |

| Nut Ⓐ | Bolt Ⓑ | General torque specifications | | |
|---|---|---|---|---|
| | | Nm | m • kgf | ft • lb |
| 8 mm | M5 | 5.0 | 0.5 | 3.6 |
| 10 mm | M6 | 8.0 | 0.8 | 5.8 |
| 12 mm | M8 | 18 | 1.8 | 13 |
| 14 mm | M10 | 36 | 3.6 | 25 |
| 17 mm | M12 | 43 | 4.3 | 31 |




## GENERAL TIGHTENING TORQUES

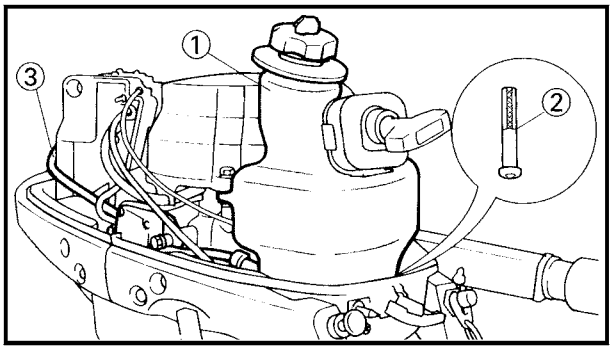
This chart specifies tightening torques for standard fasteners with standard ISO threads pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified tightening torque is reached. Unless otherwise specified, tightening torque specifications require clean, dry threads. Components should be at room temperature.

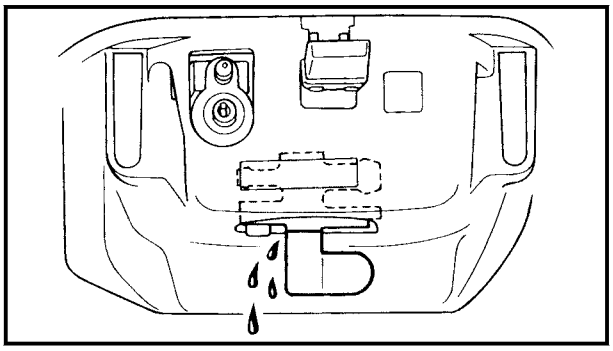
# CHAPTER 3
# PERIODIC INSPECTIONS AND ADJUSTMENTS

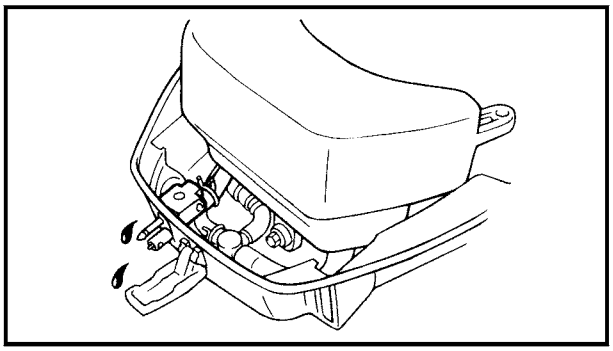
# MAINTENANCE INTERVAL CHART

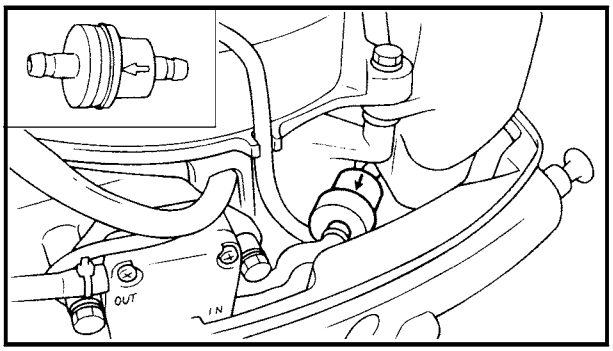
The following chart should be considered strictly as a guide to general maintenance intervals. Depending on operating conditions, the intervals of maintenance should be changed.

| Item | Remarks | Initial | | Every | | Refer page |
|---|---|---|---|---|---|---|
| | | 10 hours (Break-in) | 50 hours (3 months) | 100 hours (6 months) | 200 hours (1 year) | |
| FUEL SYSTEM: | | | | | | |
| Fuel tank and fuel line | Inspection | | | ○ | | 3-2 |
| Fuel filter | Inspection/Replacement | ○ | ○ | ○ | | 4-5 |
| Fuel cock | Inspection/Replacement | ○ | | ○ | | 4-3 |
| Carburetor | Inspection/Replacement | ○ | | ○ | | 4-12 |
| CONTROL SYSTEM: | | | | | | |
| Throttle cable | Inspection/Adjustment | ○ | | ○ | | 3-3 |
| Idling speed | Inspection/Adjustment | ○ | | ○ | | 3-3 |
| Start-in-gear projection | Inspection/Adjustment | ○ | | ○ | | 3-5 |
| POWER UNIT: | | | | | | |
| Engine oil | Inspection/Change | ○ | | ○ | | 3-5 |
| Valve clearance | Inspection/Adjustment | ○ | | ○ | | 3-7 |
| Spark timing | Inspection | ○ | | ○ | | 3-9 |
| T.C.I air gap | Inspection/Adjustment | ○ | | ○ | | 3-10 |
| Thermostat | Inspection/Replacement | | | | ○ | 5-23 |
| Water leakage | Inspection | ○ | | ○ | | — |
| Motor exterior | Inspection | | ○ | ○ | | — |
| Exhaust leakage | Inspection | ○ | ○ | ○ | | — |
| Cooling water passage | Inspection/Cleaning | | ○ | ○ | | — |
| LOWER UNIT: | | | | | | |
| Gear oil | Change | ○ | | ○ | | 3-10 |
| Impeller | Inspection | | | ○ | | 6-6 |
| Lower unit leakage | Inspection | | ○ | | ○ | 3-11 |
| Propeller | Inspection | | ○ | ○ | | — |
| GENERAL: | | | | | | |
| Anode | Inspection/Replacement | | ○ | ○ | | 3-12 |
| Spark plug | Cleaning/Adjustment/ Replacement | ○ | ○ | ○ | | 3-12 — |
| Bolts and nuts | Retightening | ○ | | ○ | | — |
| Grease points | Greasing | | | ○ | | 3-15 |








# PERIODIC SERVICE

## FUEL SYSTEM

### Fuel tank and Fuel line

1. Inspect:
   - Fuel Tank ① and fuel strainer ②
     Crack/damage/leak → Replace the damaged part(s).
     Dirt → Clean.
   - Fuel line ③
     Crack/damage/leak → Replace the defective part(s).
     Refer to "FUEL TANK, FUEL COCK AND FUEL JOINT" in chapter 4.

### Fuel cock

1. Inspect:
   - Fuel cock
     Crack/leak/clog/damage → Replace.
     Refer to "FUEL TANK, FUEL COCK AND FUEL JOINT" in chapter 4.

### Fuel joint

1. Inspect:
   - Fuel joint
     Crack/leak/clog/damage → Replace.
     Refer to "FUEL TANK, FUEL COCK AND FUEL JOINT" in chapter 4.

### Fuel filter replacement

1. Remove:
   - Fuel filter
2. Install:
   - Fuel filter

**CAUTION:**

**The arrow mark of the fuel filter must face towards the fuel pump.**

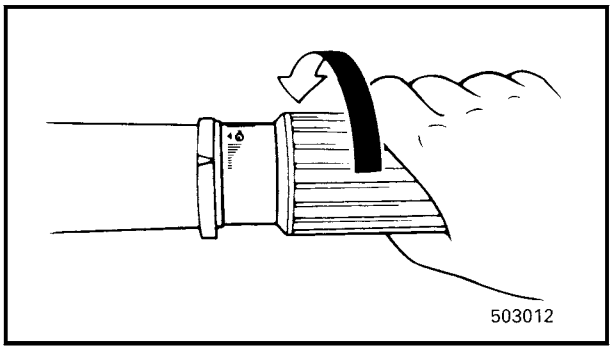
Refer to "FUEL TANK, FUEL COCK AND FUEL JOINT" in chapter 4.

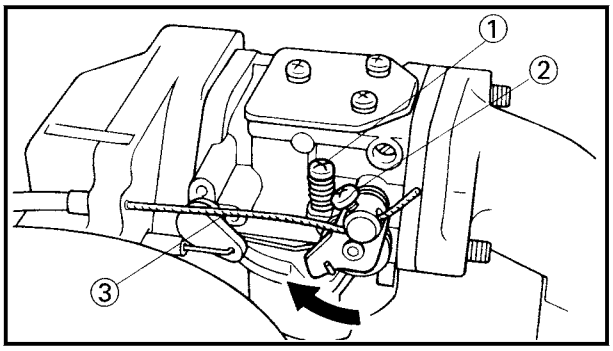
## CONTROL SYSTEM

### Throttle cable

**NOTE:**

Make sure to check the idling speed, after adjusting the throttle cable.




1. Inspect:
   - Throttle cable
     Slack → Adjust.
     Damage → Replace.
2. Adjust:
   - Throttle cable set condition

**Adjustment steps:**

- Turn the throttle grip in arrow direction and hole to fully closed position.
- Enough to loosen the throttle stop screw ①.
- Loosen the throttle cable locking screw ② and keeping the throttle lever on the carburetor fully in the closed position by turning in arrow direction.
- Check the throttle cable ③ with no (noticeable) slack, then tighten the throttle cable locking screw ②.
- Make sure the throttle lever on the carburetor fully open and fully closed in operation by turning the throttle grip.
- If the throttle lever does not operate in the fully opened position, re-adjust the throttle cable.

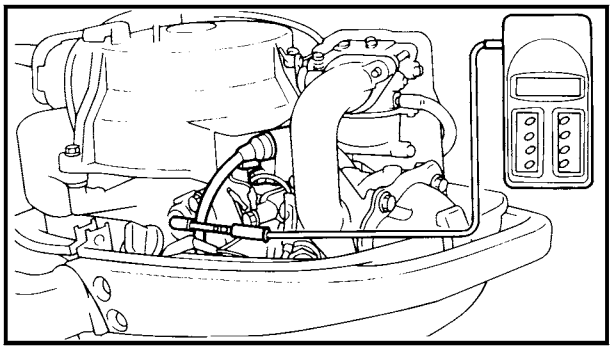
### Idling speed (for USA)

**NOTE:**

Before adjusting the idling speed, the throttle cable slack should be properly adjusted.

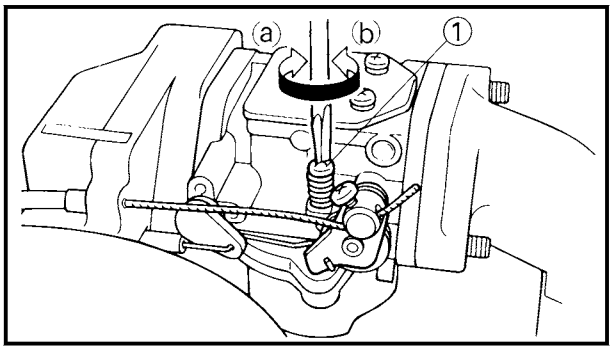
1. Measure:
   - Idling speed
     Out of specification → Adjust.

**Idling speed:**
**1,500 ± 50 r/min**



**Measurement steps:**
- Start the engine and allow it to warm up for a few minutes.
- Attach the tachometer to the spark plug lead of cylinder.

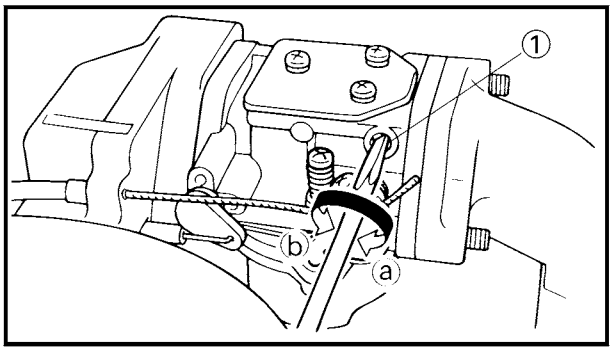
**Tachometer:**
**YU-08036-A**




2. Adjust:
   - Idling speed

**Adjustment steps:**
- Turn the throttle stop screw ① in direction ⓐ or ⓑ until the specified idling speed is obtained.

**Turning in ⓐ → Idling speed increases.**
**Turning out ⓑ → Idling speed decreases.**



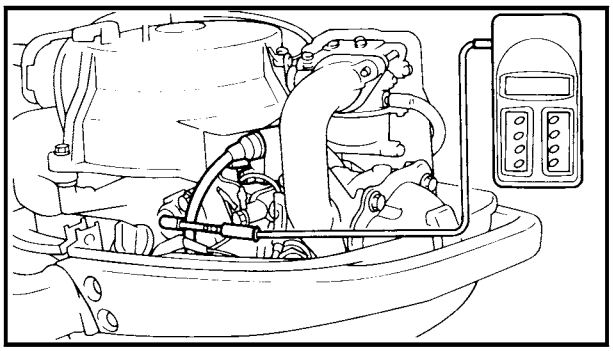

**Idling speed (Except for USA)**

**NOTE:**
Before adjusting the idling speed, the throttle cable slack should be properly adjusted.

1. Turn the pilot screw ① until it is lightly seated.
2. Turn the pilot screw ① in direction ⓐ or ⓑ until the idling speed is at highest position by the specified number of turns.

**Pilot screw:**
**1-5/8 ± 1/4 turns out**

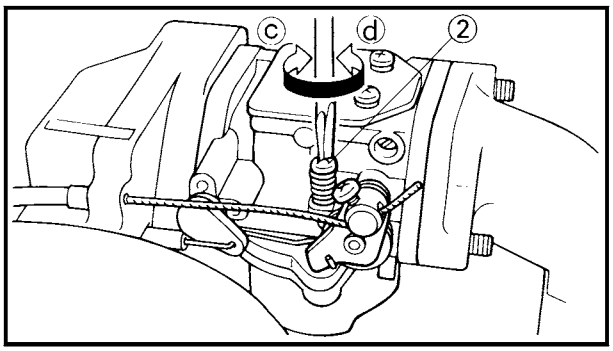
3. Measure:
   - Idling speed
     Out of specification → Adjust.



**Idling speed:**
**1,500 ± 50 r/min**

**Measurement steps:**
- Start the engine and allow it to warm up for a few minutes.
- Attach the tachometer to the spark plug lead of cylinder.

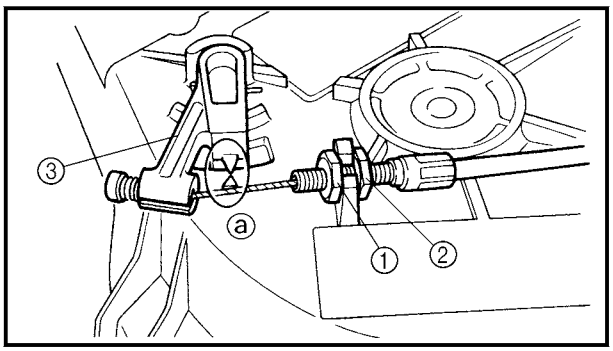
**Tachometer:**
**YU-08036-A/90890-06760**




4. Adjust:
   - Idling speed

**Adjustment steps:**
- Turn the throttle stop screw ② in direction ⓒ or ⓓ until the specified idling speed is attained.

**Turning in ⓒ → Idling speed increases.**
**Turning out ⓓ → Idling speed decreases.**




**Start-in-gear protection cable**

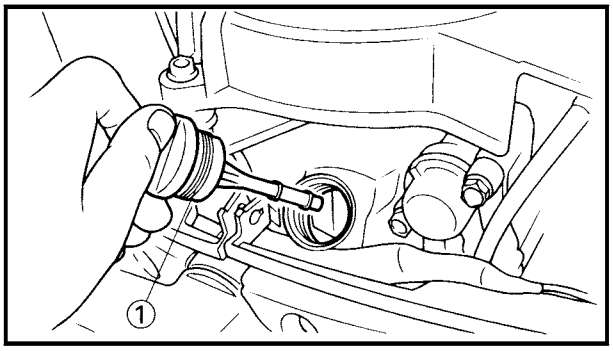
1. Check:
   - Start-in-gear protection operation
     Incorrect → Adjust.
2. Adjust:
   - Start-in-gear protection cable

**Adjustment steps:**
- Set the shift lever in neutral.
- Loosen the locknut ① or ②.
- Adjust the start-in-gear protection cable so that the marking of lever ③ can align with the marking ⓐ of the starter case.
- Tighten the locknut ② or ①.

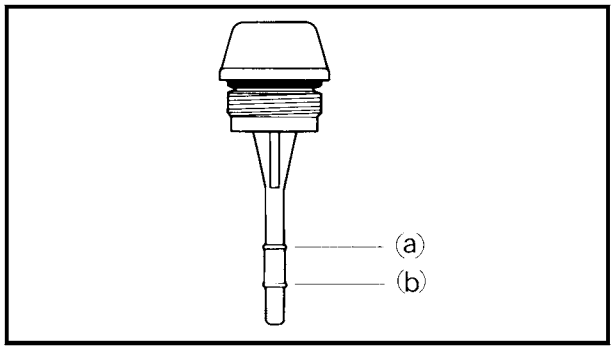
## POWER UNIT

### Engine oil level

**NOTE:**
- Run the engine for several minutes, turn it off, and check the engine oil level.
- When checking, hold the outboard motor in the upright position and screw in the oil level plug.

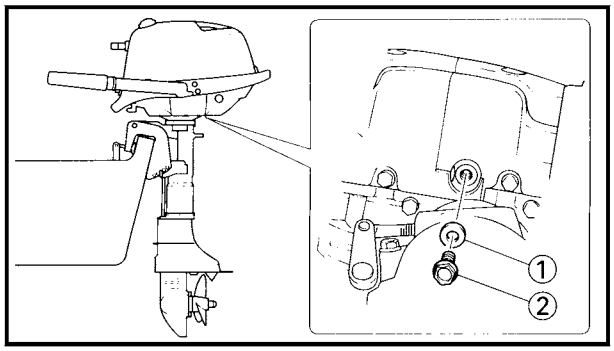


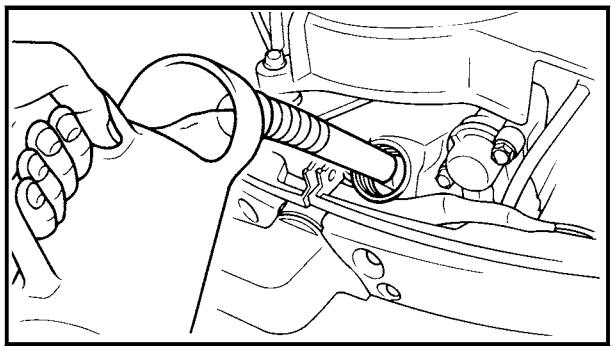

1. Remove:
   - Oil level plug ①




2. Check:
   - Engine oil level
     Between ⓐ and ⓑ → Proper quantity.
     Above ⓐ → Check for over filling or for water in the engine oil.
     Below ⓑ → Add engine oil up to level ⓐ and check for oil leakage.

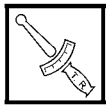
**NOTE:**
- Run the engine for several minutes, turn it off, and check the engine oil level again.
- If the engine oils still not with in the proper level, add/drain as needed.
- When installing the engine oil level plug, apply the engine oil to the O-ring.



**Engine oil replacement**

1. Remove:
   - Oil level plug
   - Drain plug with washer ②
   - Gasket ①
2. Install:
   - Gasket ①
   - Drain plug with washer ②

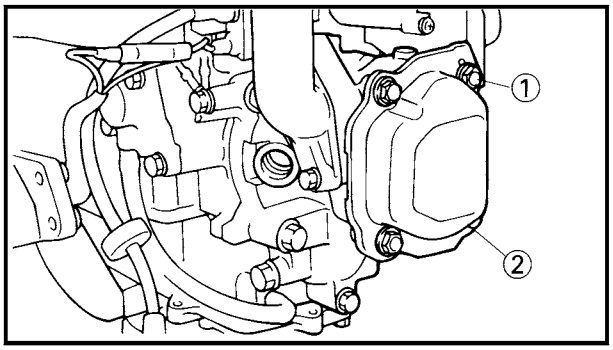


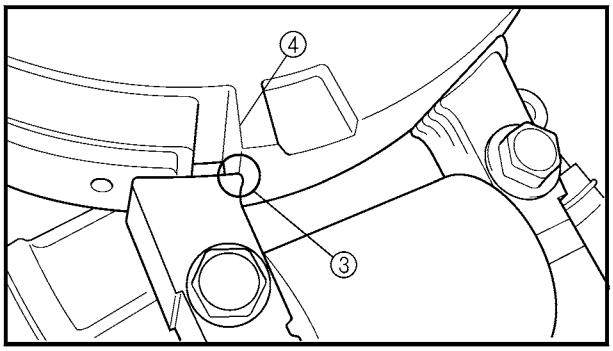
**Drain plug:**
**18 Nm (1.8 m • kg, 13 ft • lb)**

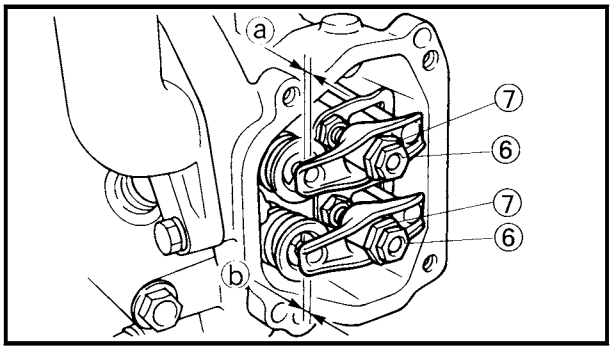
3. Fill:
   - Engine oil
     (into the crankcase)

**Recommended engine oil:**
**API: SE, SF, SE-SF, SE-SF-CC or SG-CD**
**SAE: 10W-30 or 10W-40**
**Total quantity:**
**500 $cm^3$**
**(16.9 US oz, 17.6 Imp oz)**

4. Install:
   - Oil level plug
5. Check:
   - Engine oil level
     Refer to “Engine oil level”.




**Valve clearance adjustment**

**NOTE:**

Adjust valve clearance, at room temperature, when piston is T.D.C. in compression process.

1. Remove:
   - Top cowling
   - Bolt (carrying handle)
   - Carrying handle 2 (protector)
   - Bottom cowling 2
   - Bolt (recoil starter)
   - Recoil starter ass'y
   - Spark plug
2. Remove:
   - Bolt (cylinder head cover) ①
   - Cylinder head cover ②
   - Gasket (cylinder head cover)
3. Position:
   - Flywheel rotor

**NOTE:**

- Align the projection ③ of the ignitor ass'y core with the flywheel rotor edge ④.
- Turn the flywheel rotor ass'y clockwise and check that the valves are fully closed with there rocker arm in free position.

4. Inspect:
   - Valve clearance
     Use feeler gauge.

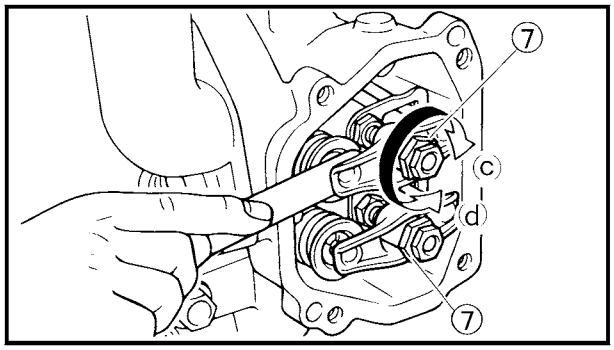
**Valve clearance**
**Intake ⓐ: 0.10 ± 0.02 mm (0.004 ± 0.0008 in)**
**Exhaust ⓑ: 0.10 ± 0.02 mm (0.004 ± 0.0008 in)**

Out of specification → Adjust.

5. Loosen:
   - lock nut (rocker arm)

**CAUTION:**

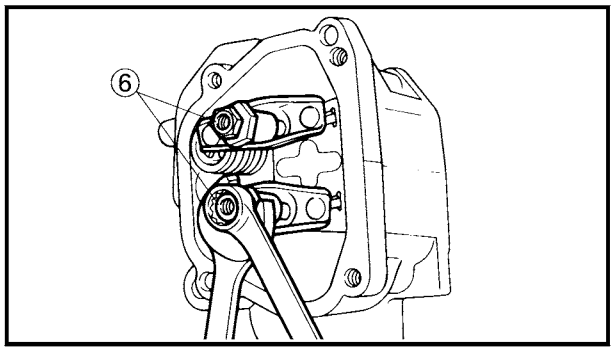
**When loosening the locknut ⑥, lock the adjuster ⑦, otherwise the locknut ⑥ will not loose.**




6. Adjust:
   - Intake valve clearance
   - Exhaust valve clearance

**Adjustment steps:**
- Loosen the lock nut and insert the 0.10 mm (0.004 in) feeler gauge between rocker arm and valve stem.
- Turn the adjuster ⑦ to obtain the proper clearance.

**Turning in ⓒ →**
**Valve clearance decreases.**
**Turning out ⓓ →**
**Valve clearance increases.**




7. Tighten:
   - locknut ⑥

**Locknut (rocker arm):**
**10 Nm (1.0 m • kg, 7.2 ft • lb)**

**CAUTION:**

**After tightening the locknut, do not loosen the adjuster or the locknut individually. Otherwise, the pivot bolt will come loose with the resultant possible damage to the outboard motor.**

**NOTE:**

Tighten the locknut, keeping the adjuster fixed.

8. Install:
   - Gasket (cylinder head cover)
   - Cylinder head cover

**Cylinder head cover:**
**11 Nm (1.1 m • kg, 8.0 ft • lb)**

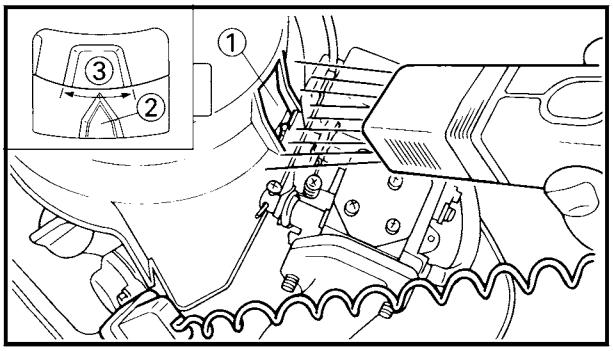
9. Install:
   - Spark plug

**Ignition timing**

**NOTE:**
Spark timing is controlled automatically by the ignitor ass'y. For this reason only the checking procedure is shown in this section.

1. Set:
   - Tachometer
   - Timing light
     To spark plug lead for cylinder.

**Tachometer:**
**YU-08036-A/90890-06760**
**Timing light:**
**YU-33277-A/90890-03141**




2. Check:
   - Ignition timing
     Beyond the firing range (dent on rotor) → Check the ignition system or replace ignitor ass'y.

**Checking steps:**
- Warm up the engine and set it at the specified speed.

**Engine idling speed:**
**1,500 ± 50 r/min**

- Direct the timing light toward the flywheel rotor ass'y ①.
- Visually check the stationary pointer ② to verify it is within the required firing range ③ indicated on the flywheel rotor ass'y.

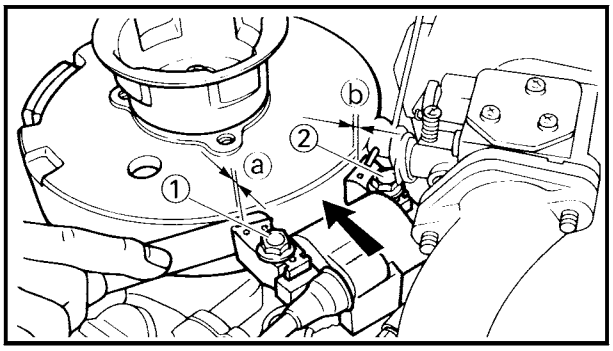
**T.C.I. air gap adjustment**

1. Remove:
   - Recoil starter ass'y
2. Measure:
   - T.C.I. air gap

   Use feeler gauge as shown (away from the magnet).

   Out of specification → Adjust.

**T.C.I. air gap:**
**0.3 ~ 0.6 mm (0.012 ~ 0.024 in)**




3. Adjust:
   - T.C.I. air gap

   Use feeler gauge to set as shown.

**Adjustment steps:**
- Loosen bolt ① and ②, insert the feeler gauge 0.3 mm (0.024 in).
- Adjust the T.C.I. air gap ⓐ and ⓑ between core of ignitor ass'y and flywheel rotor ass'y by moving the ignitor ass'y push. (gap ⓐ = gap ⓑ)
- Keep the specified air gap by the feeler gauge and tighten both bolts.

**Bolt:**
**8 Nm (0.8 m • kg, 5.8 ft • lb)**

## LOWER UNIT

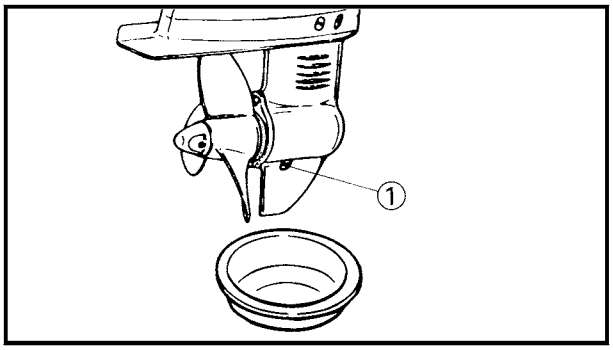
**Gear oil**

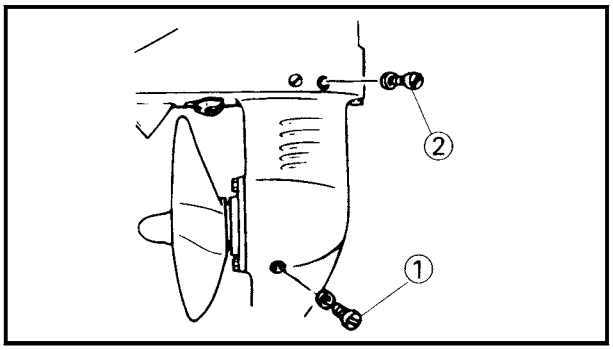
1. Check:
   - Gear oil

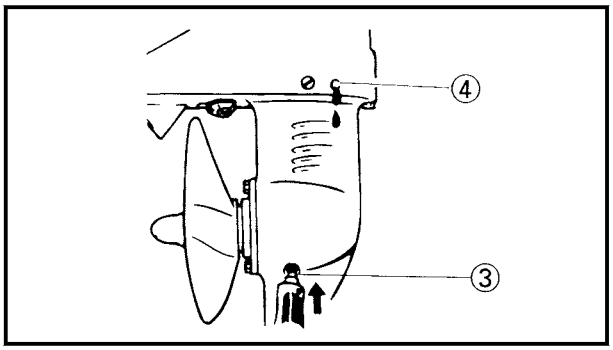
   Milky oil → Replace the oil seal.

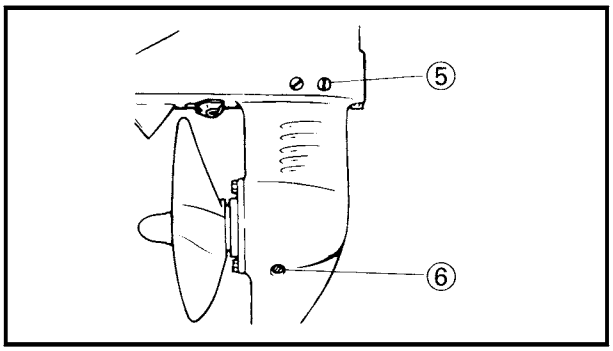
   Slag oil → Check the gear, bearing and dog.
2. Check:
   - Gear oil level

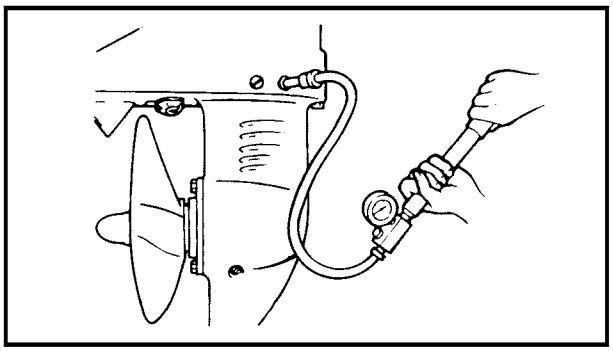
   Level is low → Add oil to the proper level.



3. Replace:
   - Gear oil

**Replacement steps:**
- Hold the outboard motor in an upright position.
- Place a container under the drain plug ①.
- Remove the drain plug, the oil level plug ②, and then drain the gear oil.
- Place the outboard in an upright position.
- Add gear oil through the drain hole ③ until it overflows at the oil level checking hole ④.

**Recommended gear oil:**
**GEAR CASE LUB (USA) or Hypoid gear oil, SAE #90**
**Total quantity:**
**100 cm³ (3.4 US oz, 3.5 Imp oz)**

- Install the oil level plug ⑤ first and then the drain plug ⑥.

**Lower unit leakage**

1. Check:
   - Pressure

   Pressure drops → Inspect the oil seals and components.

**Checking steps:**
- Connect the leakage tester to the oil level checking hole.

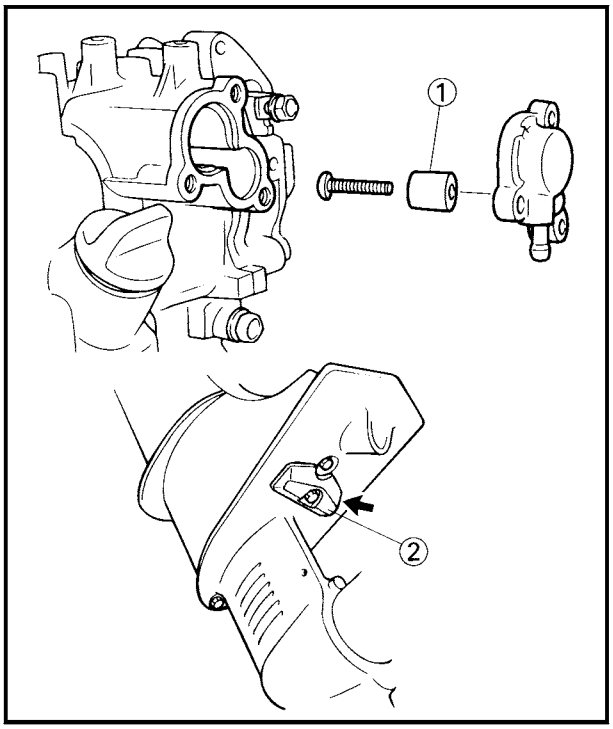
**Leakage tester:**
**YB-03595/90890-06762**

- Apply the specified pressure.

**Pressure:**
**100 kPa (1.0 kg/cm², 14.2 psi)**

- Check that the lower unit holes the specified pressure for ten seconds.

**NOTE:**
Do not over-pressurize the lower unit. Excessive pressure may cause the air to leak out.

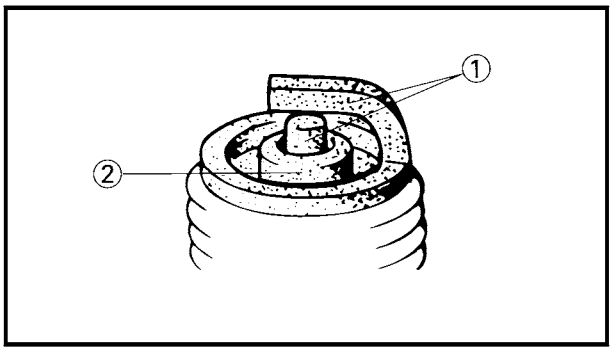



## GENERAL

### Anode

1. Inspect:
   - Anode ① (engine)
   - Anode ② (lower unit)
     Scales → Clean.
     Oil/grease → Clean.
     Wear (1/2)/damage → Replace.

**CAUTION:**
**Can not oil, grease or paint the anode, or it will not operate properly.**




### Spark plug

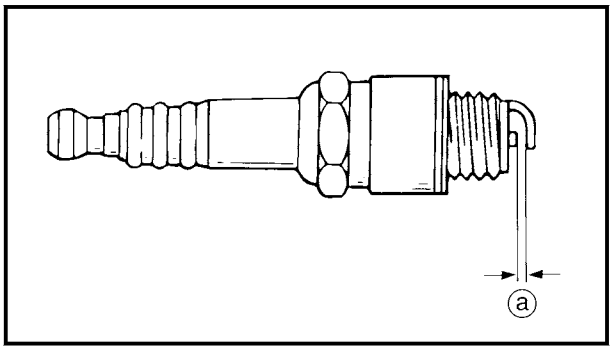
1. Remove:
   - Spark plug
2. Inspect:
   - Electrodes ①
     Cracks/excessive wear → Replace.
   - Insulator color ②
     Distinctly different color → Check the engine condition.

**Color guide:**
**Medium to light tan color:**
**Normal**
**Whitish color:**
- **Lean fuel mixture**
- **Clogged jet(s)**
- **Wrong setting**

**Blackish color:**
- **Rich mixture**
- **Defective ignition system**
- **Excessive idling**
- **Wrong spark plug**

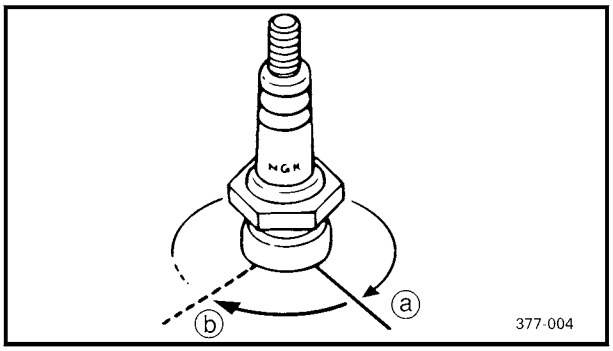
3. Clean:
   - Spark plug
     (with a spark plug cleaner or wire brush)

| | |
|---|---|
| | **Spark plug type (NGK):**<br>**B6HS/BR6HS** |




4. Measure:
   - Spark plug gap ⓐ
     Out of specification → Regap.
     Use a wire gauge.

| | |
|---|---|
| | **Spark plug gap:**<br>**0.6 ~ 0.7 mm (0.024 ~ 0.028 in)** |




5. Tighten:
   - Spark plug

| | |
|---|---|
| | **Spark plug:**<br>**25 Nm (2.5 m • kg, 18 ft • lb)** |

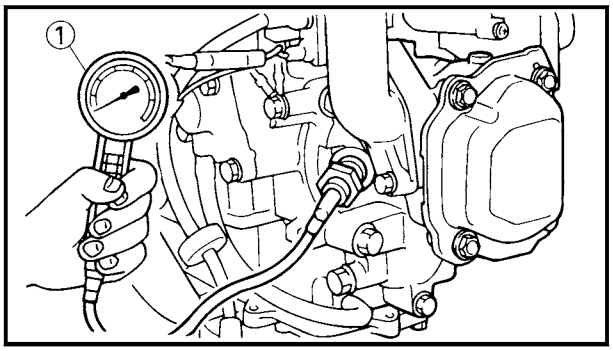
**NOTE:**
- Before installing the spark plug, clean the gasket surface and spark plug surface. Also, it is suggested to apply a thin film of anti-seize compound to the spark plug thread to prevent thread seizure.
- If a torque wrench is not available, a good estimate of the correct tightening torque is to finger tighten ⓐ the spark plug and then tighten it another 1/4 to 1/2 of ⓐ turn ⓑ.
- Always use a new spark plug gasket.

**Compression pressure**

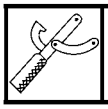
**NOTE:**
Insufficient compression pressure will result in performance loss.

1. Check:
   - Valve clearance
     Out of specification → Adjust.
     Refer to "Valve clearance adjustment".
2. Start the engine and let it warm up for several minutes.
3. Turn off the engine.
4. Remove:
   - Spark plug

**CAUTION:**
**Before removing the spark plug, use compressed air to blow away any dirt accumulated in the spark plug well to prevent it from falling into the cylinder.**




5. Set:
   - Compression gauge ①

| | |
|---|---|
|  | **Compression gauge: YU-33223/90890-03160** |

6. Measure:
   - Compression pressure

**Measurement steps:**
- Fully open the throttle grip and choke.
- Rotate the crankshaft by pulling recoil starter quickly several times and check reading on the compression gauge.

**NOTE:**
Pull the recoil starter fast and firmly with the decompressor not in operation at above 600 r/min.

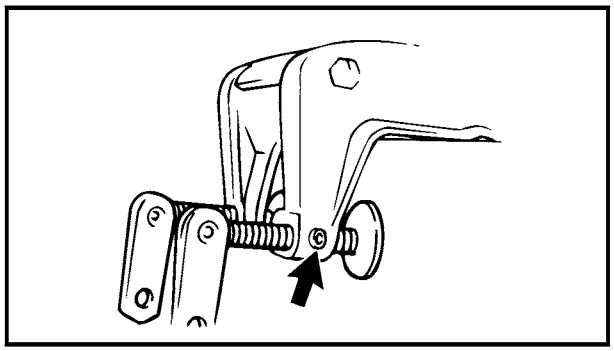
**⚠ WARNING**
**Before cranking the engine, remove the spark plug from the plug cap, and ground the spark plug lead to prevent sparking.**

**Compression pressure:**
**Standard: (without decompressor operation)**
**660 kPa (6.6 kg/cm$^2$, 93.87 psi)**

If it is below the specified pressure → Squirt a few drops of oil into the affected cylinder and measure again. Follow the table below.

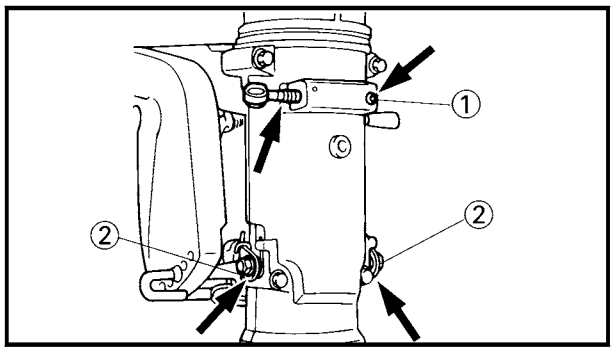
| Compression pressure (With oil applied into cylinder) | |
|---|---|
| **Reading** | **Diagnosis** |
| **Higher than without oil** | **Worn or damaged pistons** |
| **Same as without oil** | **Possible defective ring(s), valves, cylinder head gasket or piston → Repair.** |

7. Install:
   - Spark plug

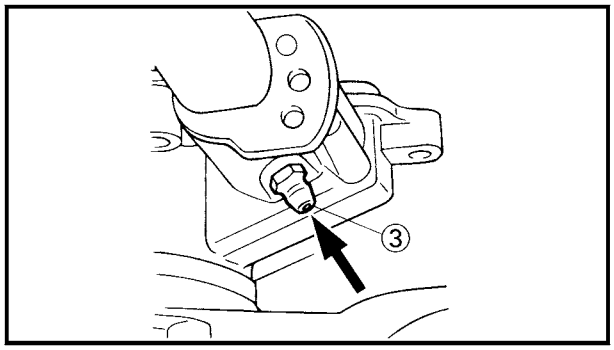


**Grease points**

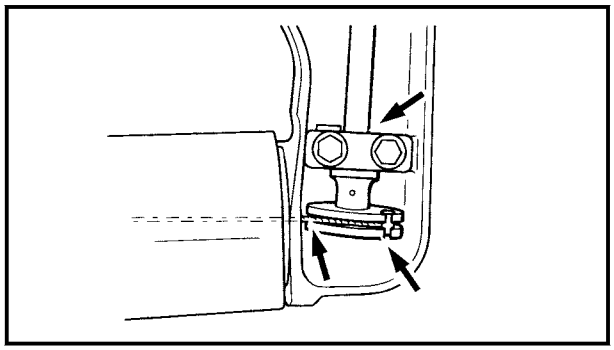
1. Apply:
   - Water resistant grease
     Refer the illustration for greasing points.
   - Grease nipple
     (clamp handle screw)



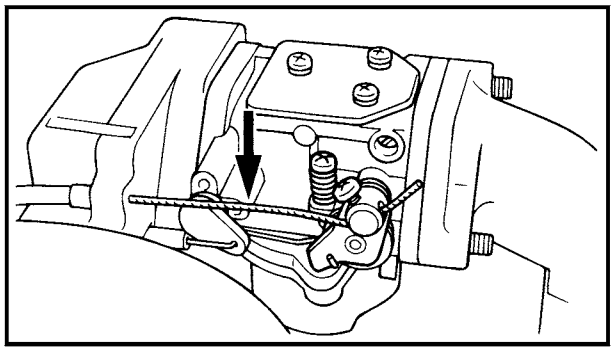

   - Grease nipple ①
     (steering friction piece screw)
   - Grease nipple (swivel bracket) ②



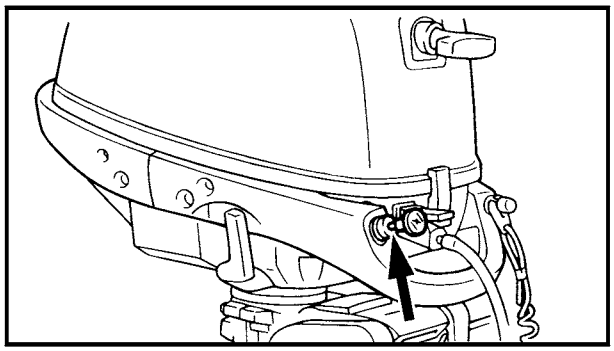

- Grease nipple (shift shaft) ③



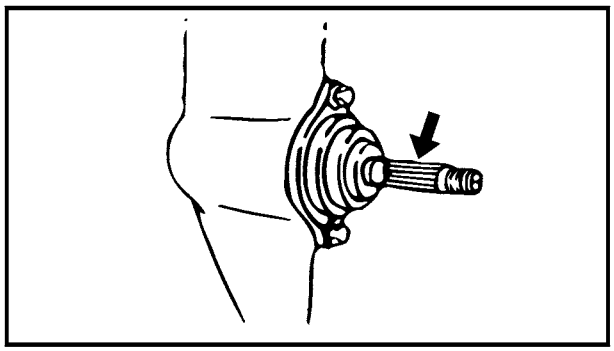
- Throttle shaft inner surface
- Throttle wire groove
- Throttle cable inner wire (handle side)



- Throttle cable inner wire (carburetor side)



- Choke knob sliding surface

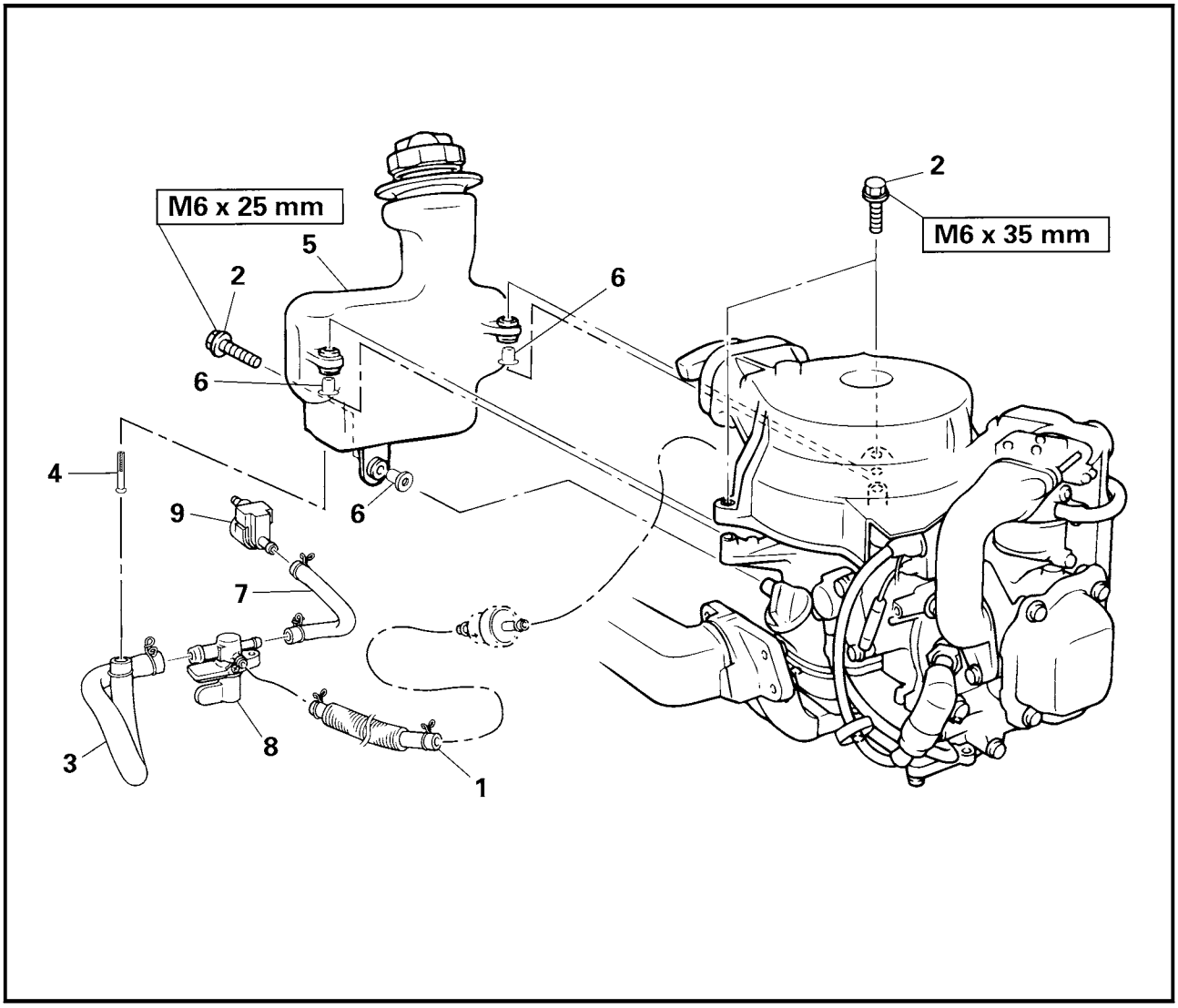


- Propeller shaft splines

# CHAPTER 4
# FUEL SYSTEM

# FUEL TANK, FUEL COCK AND FUEL JOINT

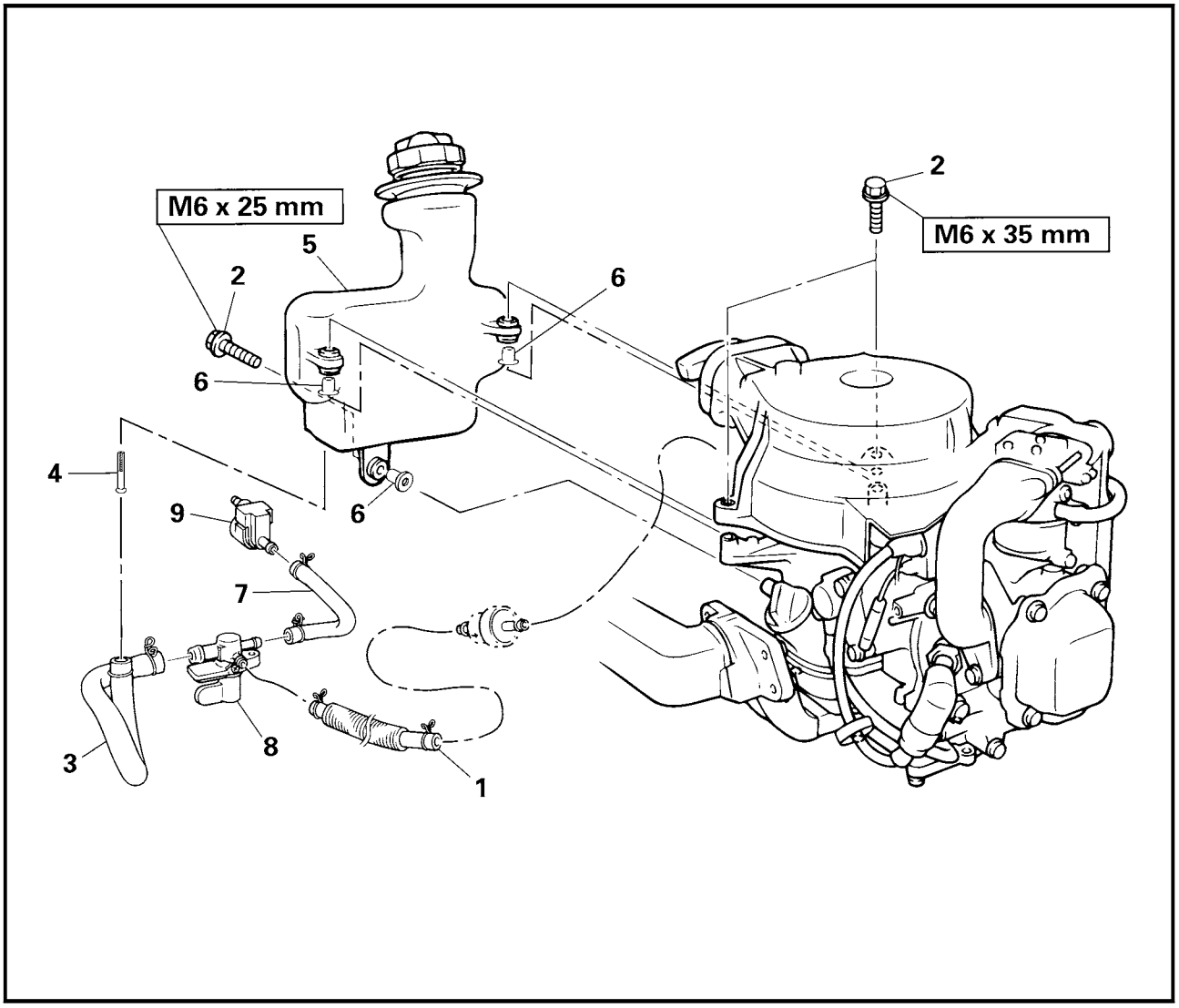
## EXPLODED DIAGRAM



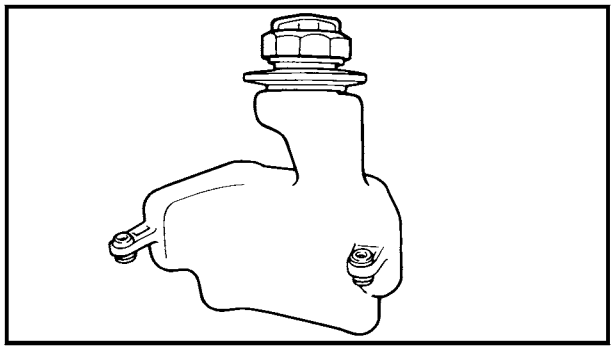

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FUEL TANK, FUEL COCK AND FUEL JOINT REMOVAL** | | Follow the left "Step" for removal.<br>**⚠ WARNING**<br>**Before removing the fuel tank, ensure empty.** |
| | Top cowling | | |
| | Choke wire | | Refer to "INTAKE SYSTEM". |
| | Engine stop switch lead | | |
| | Carrying handle 1 and 2 (protector) | | Refer to "BRACKET UNIT" in chapter 7. |
| | Bottom cowling 1 and 2 | | |
| 1 | Fuel hose (fuel cock-to-fuel filter) | 1 | **NOTE:**<br>Disconnect the fuel hose from fuel filter. |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 2 | Bolt with washer (starter case and fuel tank) | 3 | |
| 3 | Fuel hose (fuel tank-to-fuel cock) | 1 | |
| 4 | Fuel strainer | 1 | |
| 5 | Fuel tank ass'y | 1 | **NOTE:** When removing the fuel tank ass'y, lift the starter case then remove from the power unit. |
| 6 | Collar | 3 | |
| 7 | Fuel hose (fuel joint-to-fuel cock) | 1 | |
| 8 | Fuel cock ass'y | 1 | |
| 9 | Fuel joint ass'y | 1 | Reverse the removal steps for installation. |

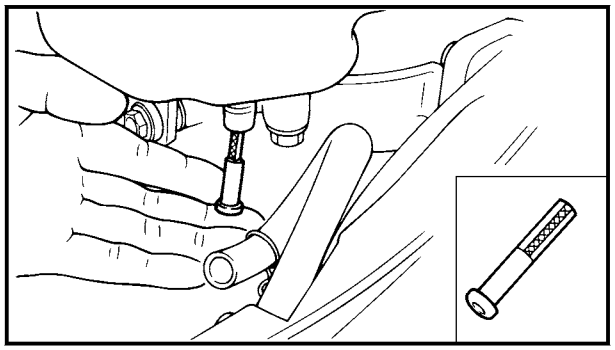


## SERVICE POINTS

### Fuel tank inspection

1. Inspect:
   - Fuel tank
   - Fuel cap

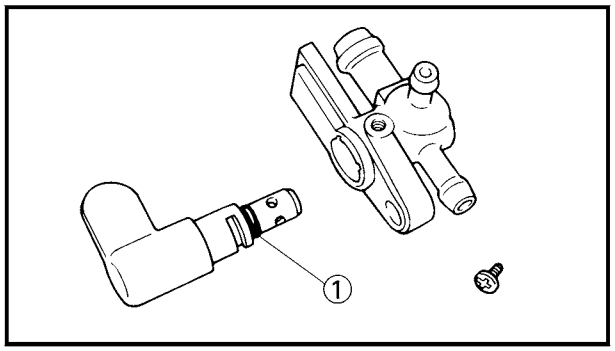
   Crack/leak/damage → Replace.
   Dart → Clean.



### Fuel strainer inspection

1. Inspect:
   - Fuel strainer

   Crack/clog/damage → Replace.
   Dart → Clean.

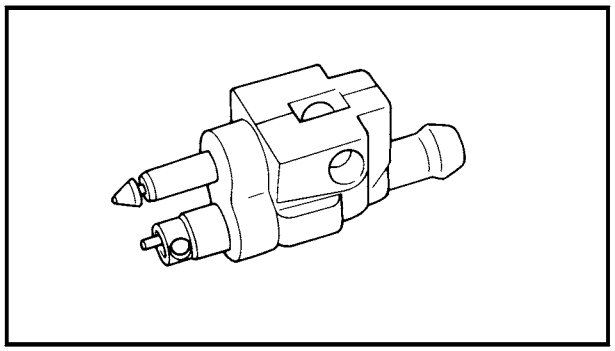



### Fuel cock inspection

1. Inspect:
   - Fuel cock ass'y

     Crack/leak/clog/damage → Replace.
   - O-ring ①

     Wear/damage → Replace.



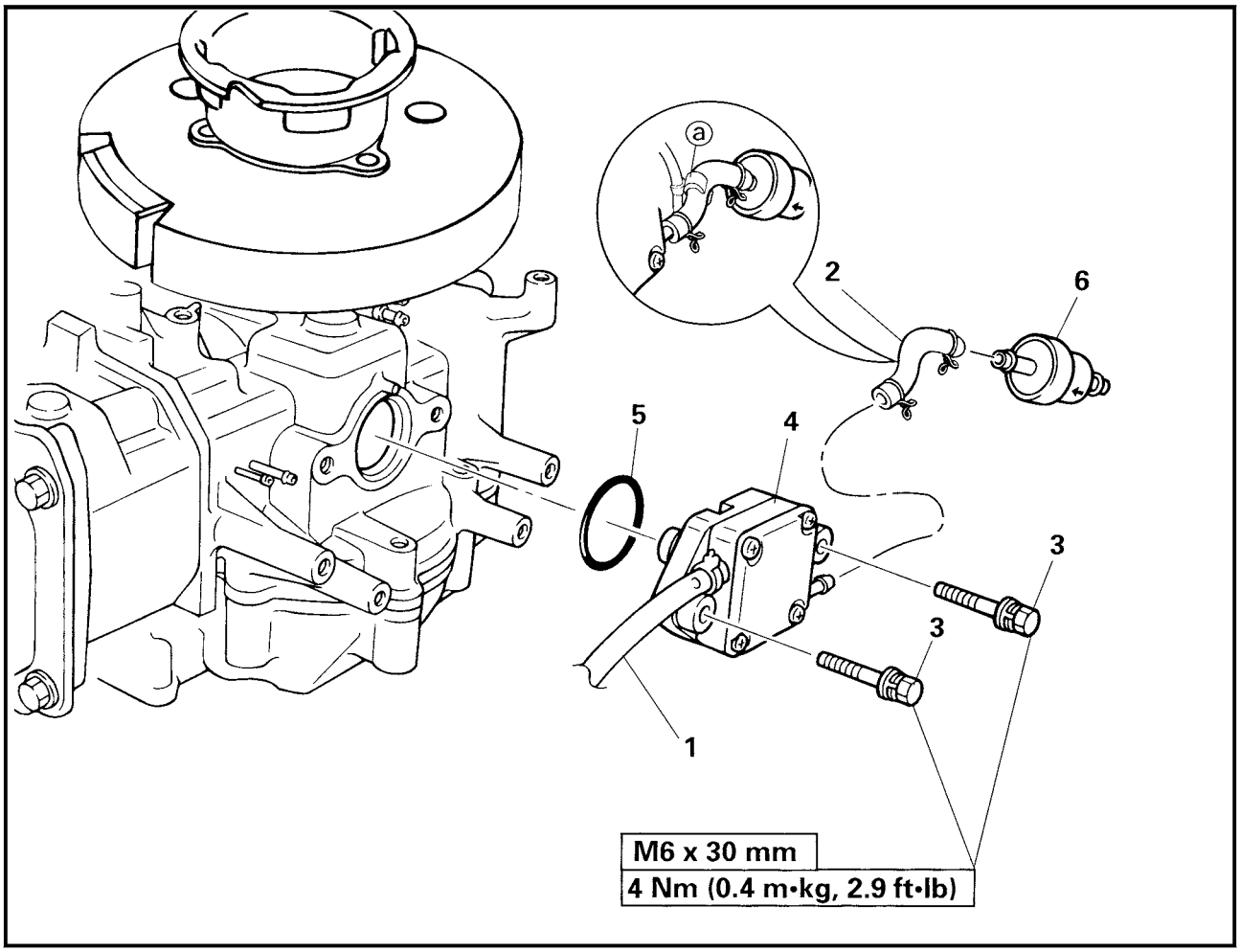
### Fuel joint inspection

1. Inspect:
   - Fuel joint

     Crack/leak/clog/damage → Replace.

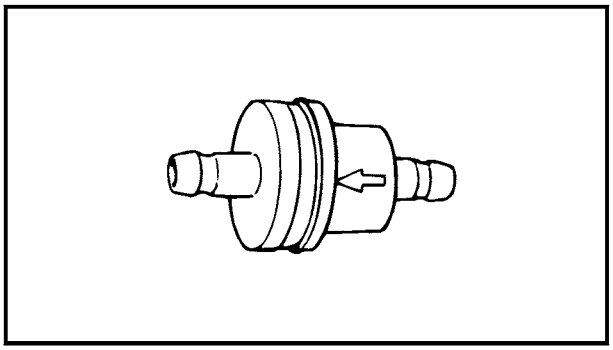
# FUEL PUMP AND FUEL FILTER

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

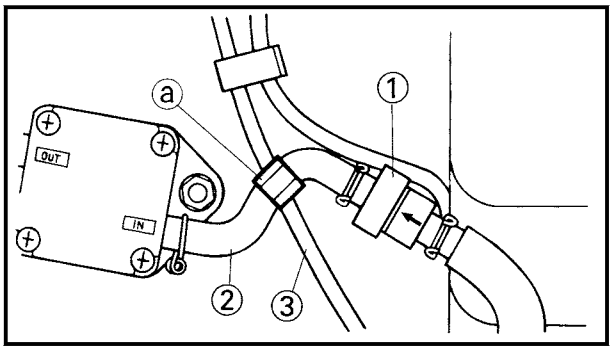
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FUEL PUMP AND FUEL FILTER REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Fuel hose (fuel pump-to-carburetor) | 1 | |
| 2 | Fuel hose (fuel filter-to-fuel pump) | 1 | **NOTE:** After connecting the fuel filter, clamp the choke wire to fuel hose using the hose clamp(s) ⓐ. |
| 3 | Bolt with washer | 2 | |
| 4 | Fuel pump ass'y | 1 | |
| 5 | O-ring | 1 | **Not reusable** |
| 6 | Fuel filter | 1 | **NOTE:** In this installation, make sure the arrow mark face the fuel pump side. |
| | | | Reverse the removal steps for installation. |



## SERVICE POINTS

### Fuel filter inspection

1. Inspect:
   - Fuel filter
     Crack/leak/clog → Replace.




### Fuel filter installation

1. Install:
   - Fuel filter ①

**CAUTION:**

**The arrow mark of the fuel filter must face towards the fuel pump.**

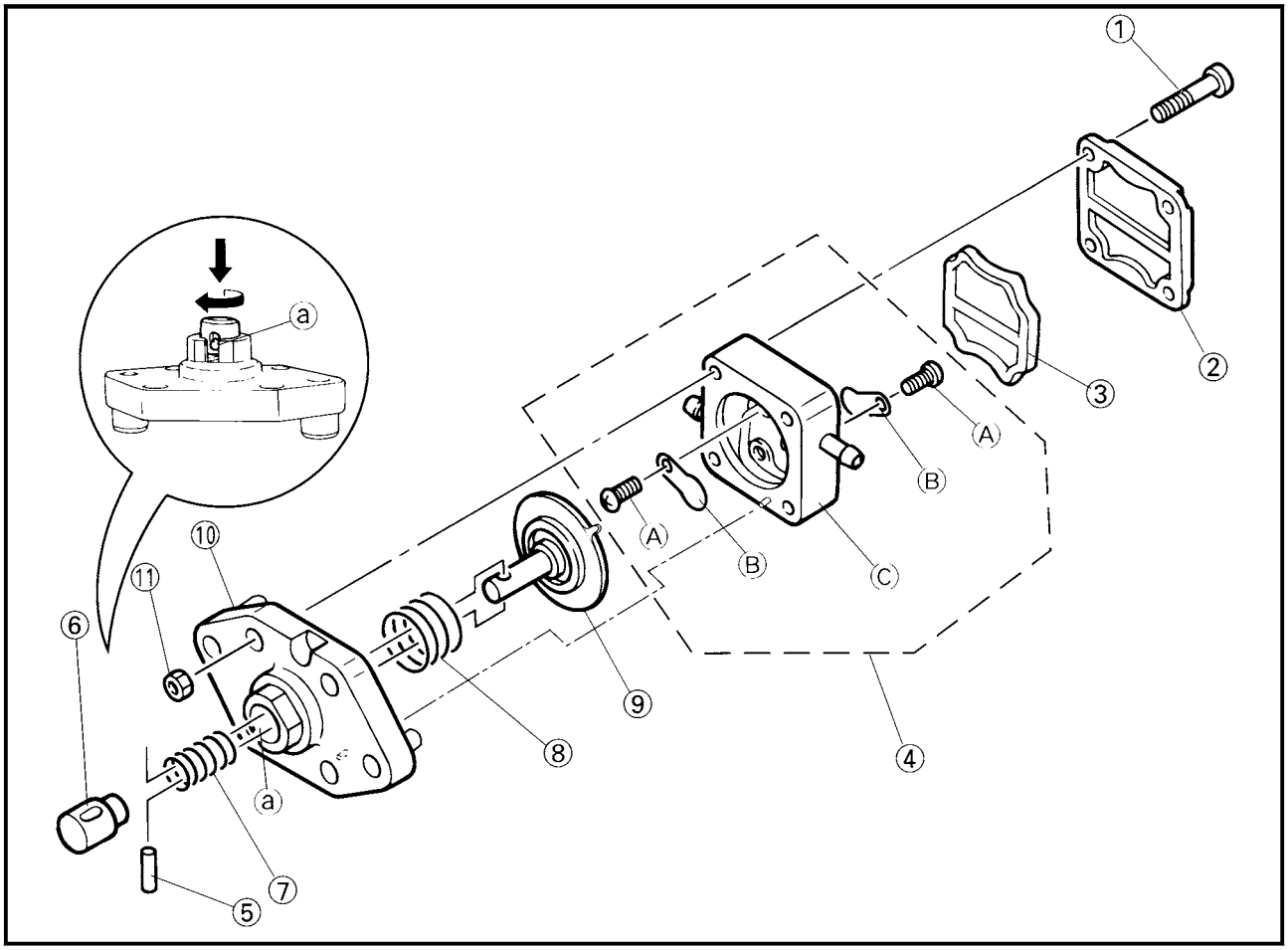
2. Install:
   - Clamp ⓐ

**NOTE:**

After connecting the fuel filter ①, clamp the choke wire ③ to fuel hose ② using the hose clamp ⓐ.

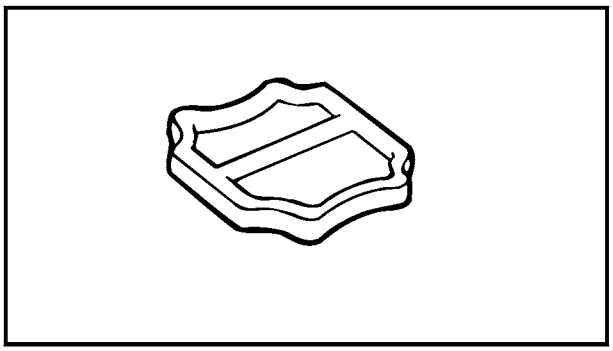
# FUEL PUMP

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FUEL PUMP DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| ① | Screw | 4 | |
| ② | Fuel pump cover | 1 | |
| ③ | Diaphragm | 1 | |
| ④ | Fuel pump body ass'y | 1 | |
| ⑤ | Pin | 1 | **NOTE:** |
| ⑥ | Plunger | 1 | When removing the pin, push turn and |
| ⑦ | Plunger spring | 1 | align the slot on the plunger with slit ⓐ |
| ⑧ | Diaphragm spring | 1 | on the pump body. |
| ⑨ | Diaphragm | 1 | |
| ⑩ | Fuel pump body 2 | 1 | |
| ⑪ | Nut | 4 | |
| | | | Reverse the disassembly steps for installation. |
| | **FUEL PUMP BODY DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| Ⓐ | Screw | 2 | |
| Ⓑ | Seat valve | 2 | |
| Ⓒ | Fuel pump body 1 | 1 | |
| | | | Reverse the disassembly steps for installation. |

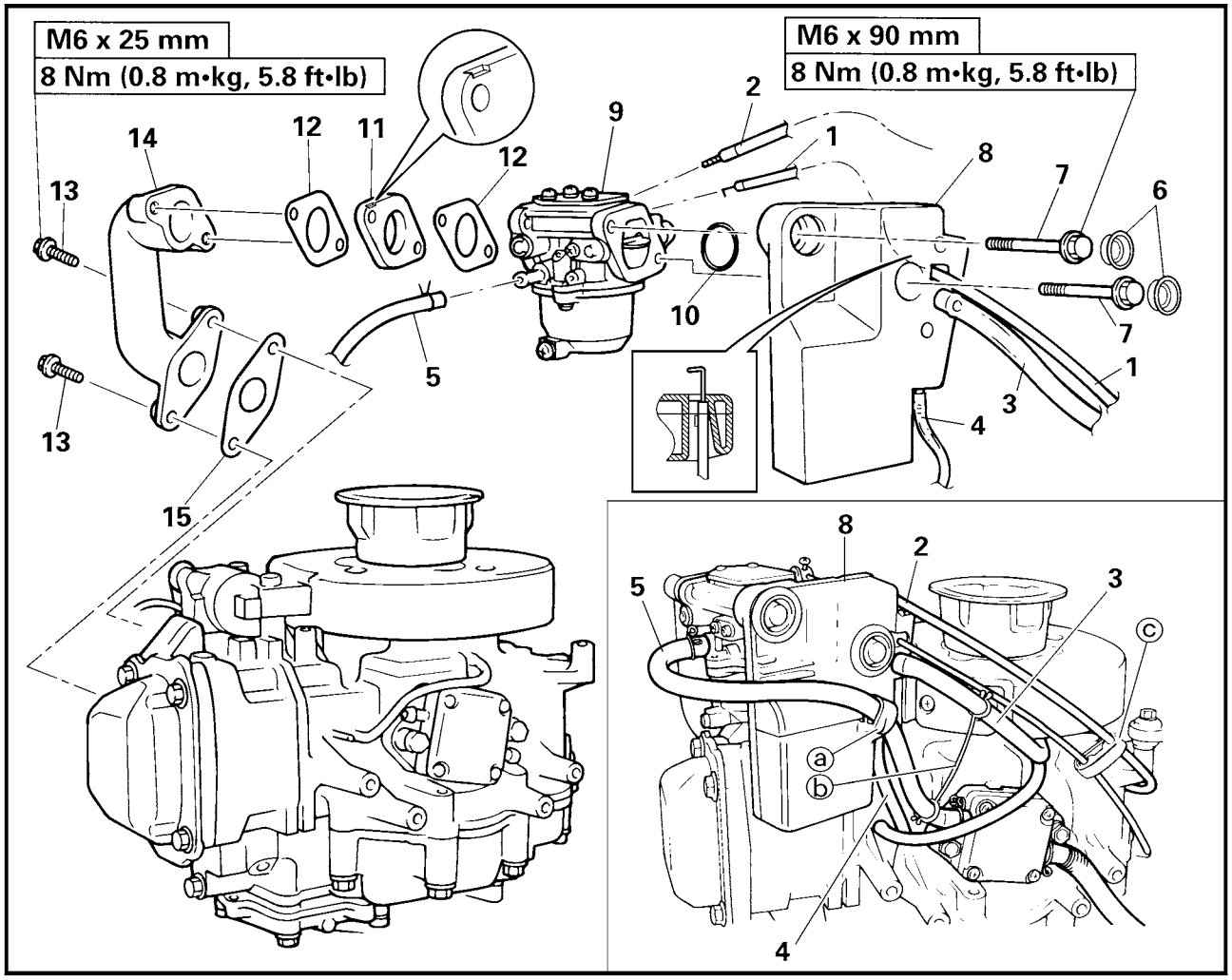


## SERVICE POINTS

### Fuel pump inspection

1. Inspect:
   - Diaphragm
     Damage → Replace.

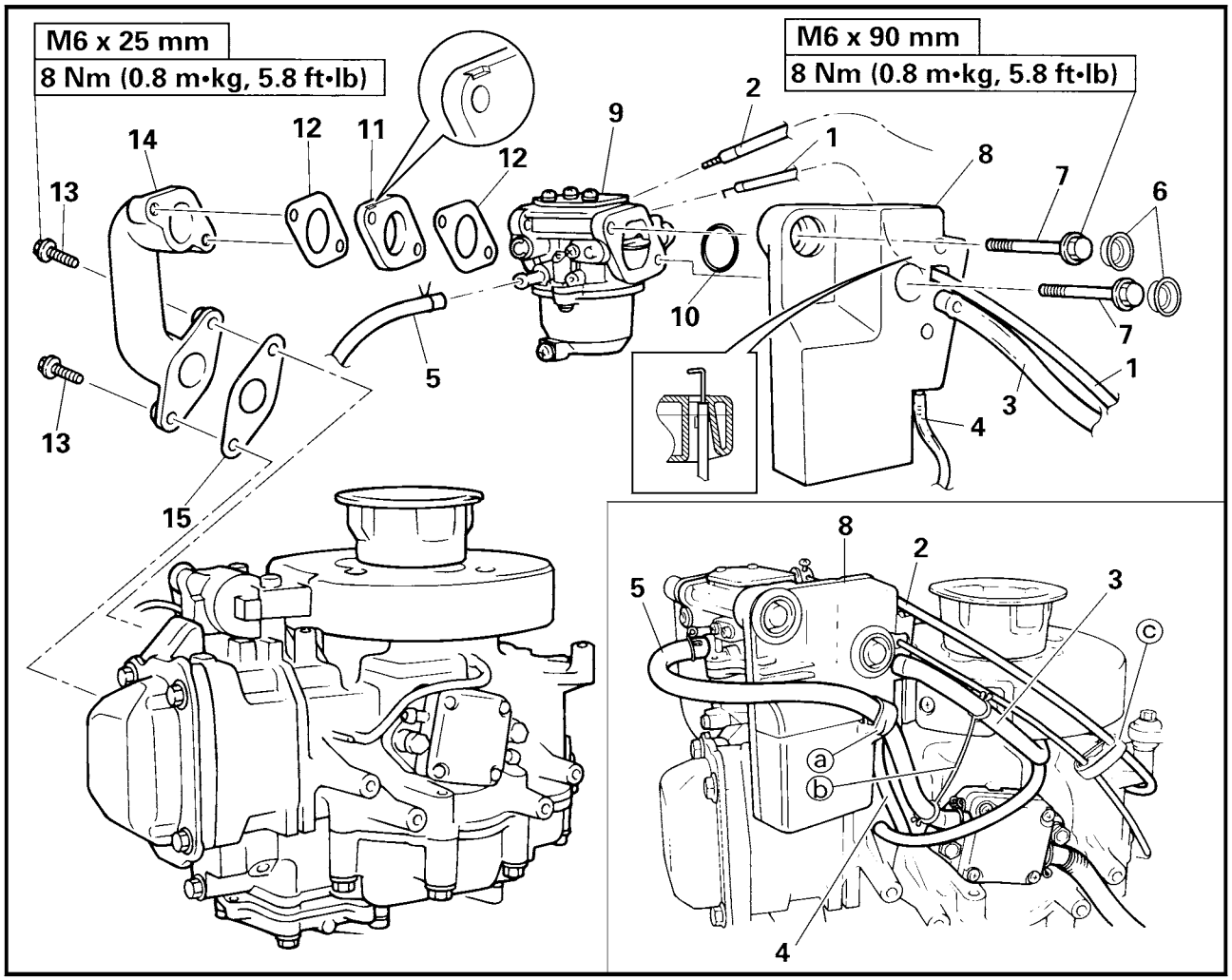
# INTAKE SYSTEM
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

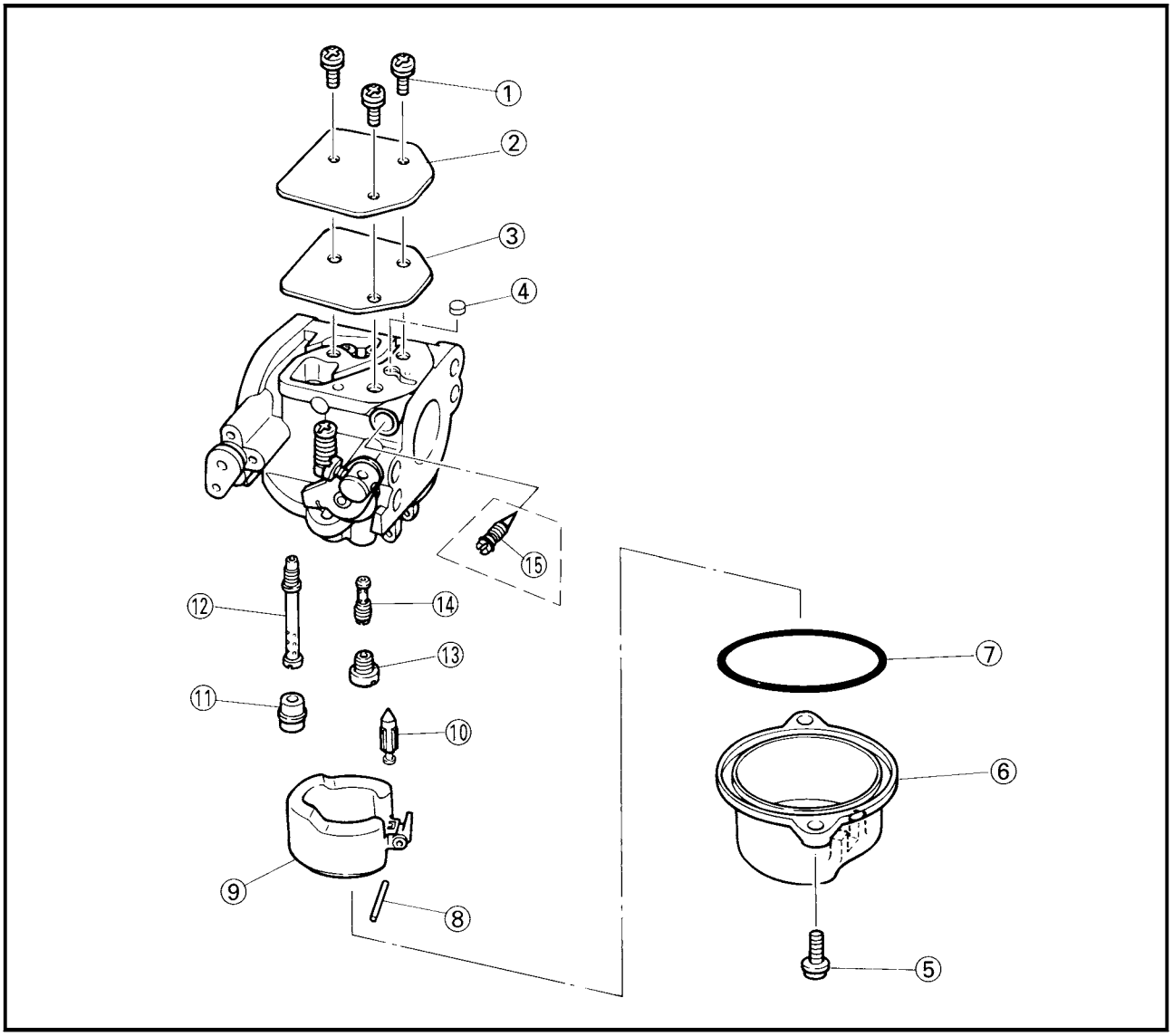
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **INTAKE SYSTEM REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Choke wire | 1 | **NOTE:** |
| 2 | Throttle cable | 1 | ● Disconnect the wire and cable from carburetor side.<br>● Clamp the wire and cable with the cable clamp ⓒ, after connected. |
| 3 | Breather hose 1 | 1 | ø9 mm<br>**NOTE:**<br>Clamp the fuel hose and breather hose with the hose clamp ⓑ, after connected. |
| 4 | Breather hose 2 | 1 | ø7 mm |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 5 | Fuel hose | 1 | **NOTE:** When connecting the fuel hose, pass the fuel hose through the clamp ⓐ on the intake silencer. |
| 6 | Grommet | 2 | |
| 7 | Bolt with washer | 2 | |
| 8 | Intake silencer ass'y | 1 | |
| 9 | Carburetor ass'y | 1 | |
| 10 | O-ring | 1 | |
| 11 | Spacer | 1 | |
| 12 | Gasket | 2 | |
| 13 | Bolt with washer | 2 | |
| 14 | Intake manifold | 1 | |
| 15 | Gasket | 1 | |
| | | | Reverse the removal steps for installation. |

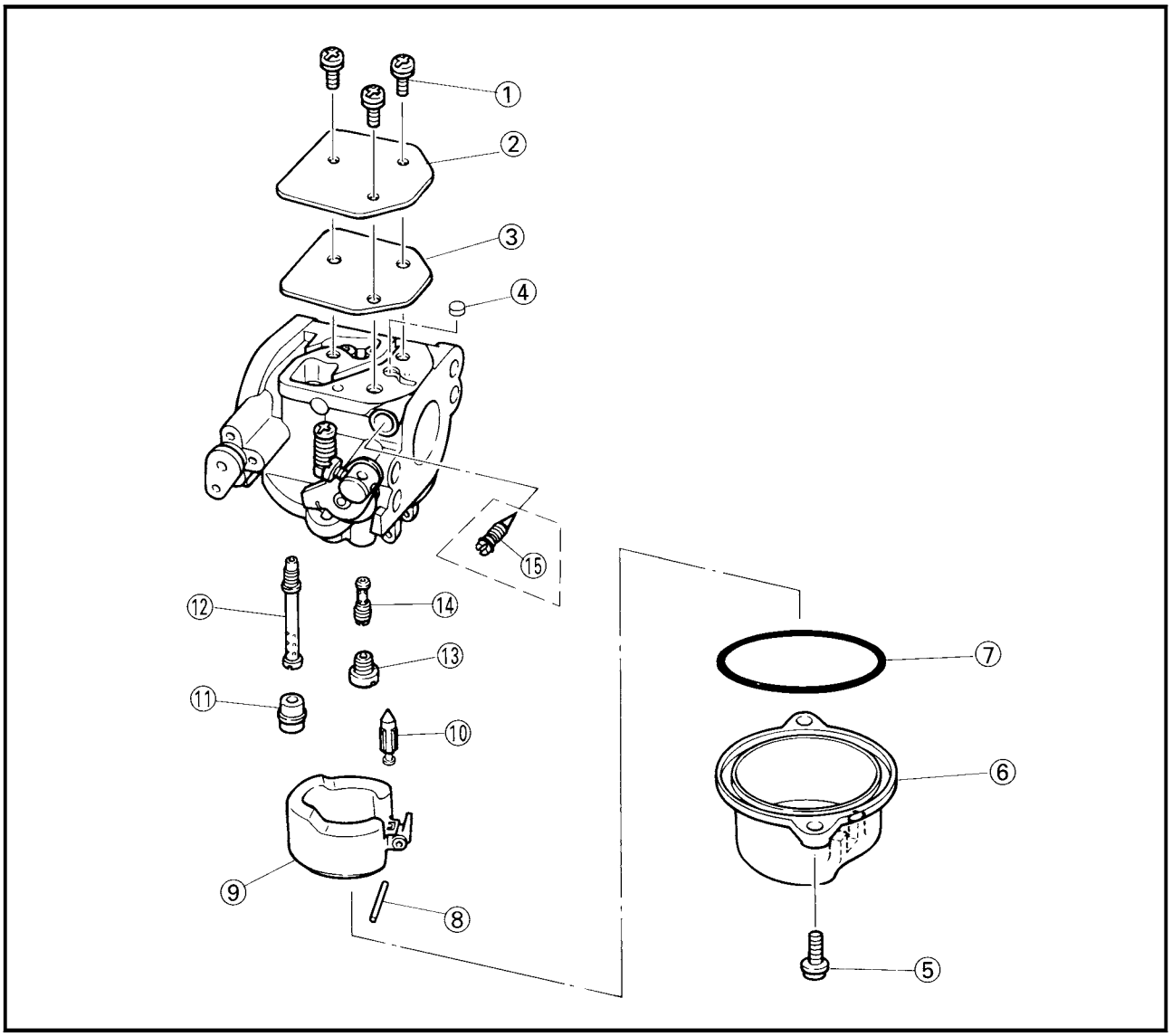
# CARBURETOR
## EXPLODED DIAGRAM



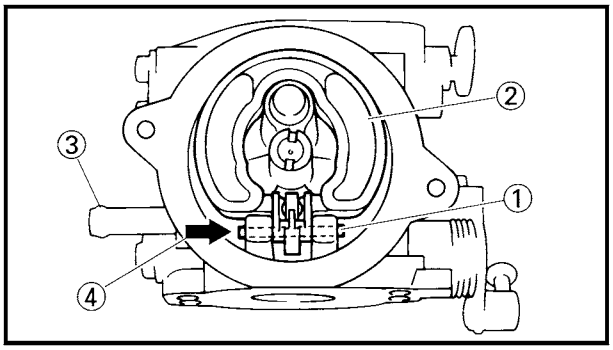

## REMOVAL AND INSTALLATION CHART

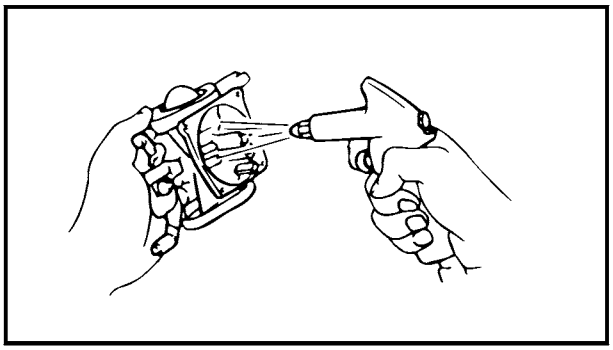
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CARBURETOR DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| | Carburetor assembly | | |
| ① | Screw with washer | 3 | |
| ② | Carburetor top cover | 1 | |
| ③ | Gasket (carburetor top cover) | 1 | |
| ④ | Plug | 1 | |
| ⑤ | Screw with washer (float chamber) | 2 | |
| ⑥ | Float chamber | 1 | |
| ⑦ | O-ring | 1 | |
| ⑧ | Float pin | 1 | |

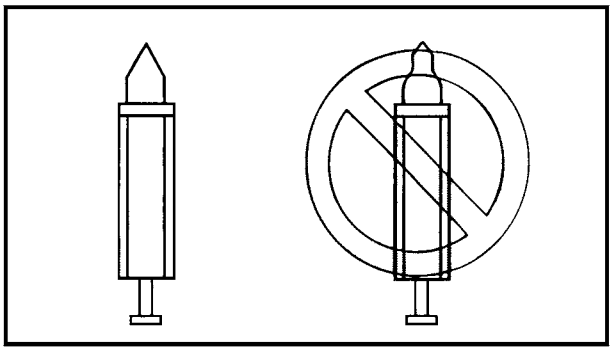
## EXPLODED DIAGRAM

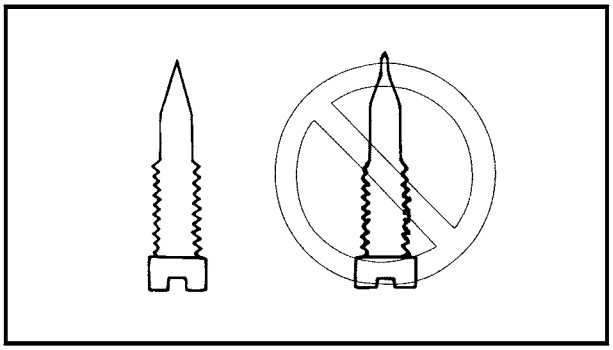


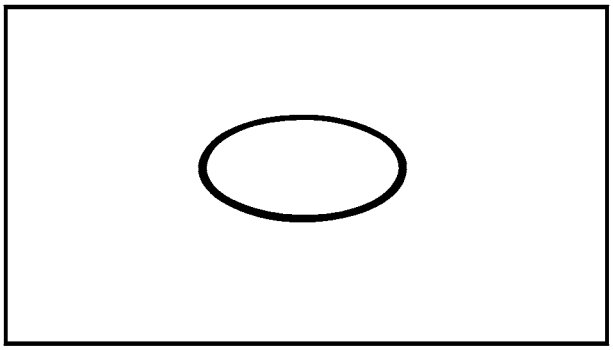

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| ⑨ | Float | 1 | |
| ⑩ | Needle valve | 1 | |
| ⑪ | Plug | 1 | |
| ⑫ | Main nozzle | 1 | |
| ⑬ | Main jet | 1 | |
| ⑭ | Pilot jet | 1 | |
| ⑮ | Pilot screw | 1 | Except for USA<br>Reverse the disassembly steps for assembly. |









## SERVICE POINTS

### Carburetor removal

1. Remove:
   - Float pin ①
   - Float ②
   - Needle valve

**NOTE:**

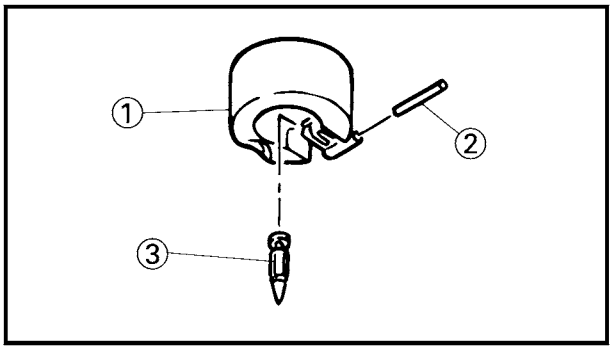
When removing the float pin ①, tap it in arrow direction ④ from pivot of the pipe joint side ③ as shown.

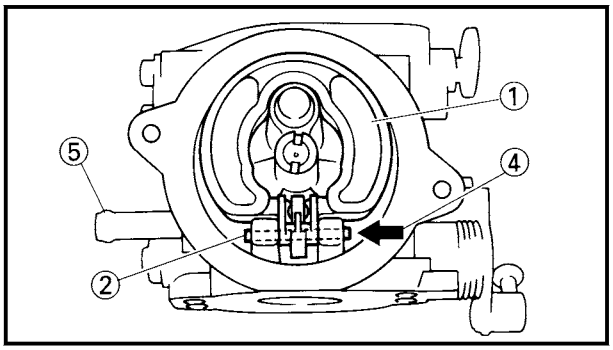
### Carburetor inspection

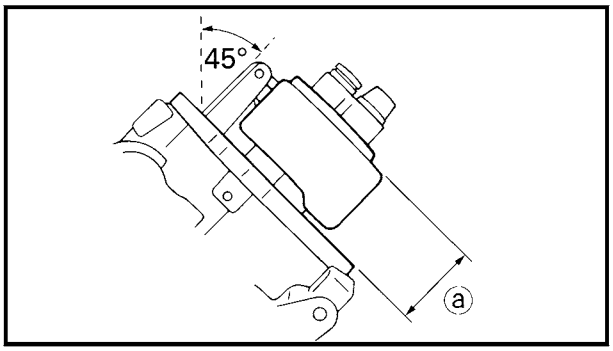
**CAUTION:**

**Do not use a steel wire to clean the jets. This may enlarge the jet diameters and seriously affect performance.**

1. Inspect:
   - Carburetor body
     Cracks/damage → Replace.
     Contamination → Clean.
2. Inspect:
   - Main jet
   - Pilot jet
   - Main nozzle
     Contamination → Clean.
3. Inspect:
   - Needle valve
   - Pilot screw (Except for USA)
     Grooved wear → Replace.
4. Inspect:
   - Float
     Cracks/damage → Replace.
5. Inspect:
   - O-ring
     Wear/cracks/damage → Replace.




**Carburetor installation**

1. Install:
   - Needle valve ③
   - Float ①
   - Float pin ②

**NOTE:**

- When setting the float ① into the carburetor, hock the needle valve ③ into the float and insert the needle valve seat.
- When installing the float pin ②, tap the float pin in arrow direction ④ to the pivot of the pipe joint side ⑤ as shown.
- After installation, make sure that the float operates smoothly.

2. Measure:
   - Float height ⓐ

   Out of specification → Replace.

**Float height:**
**18.0 ~ 19.0 mm (0.71 ~ 0.75 in)**

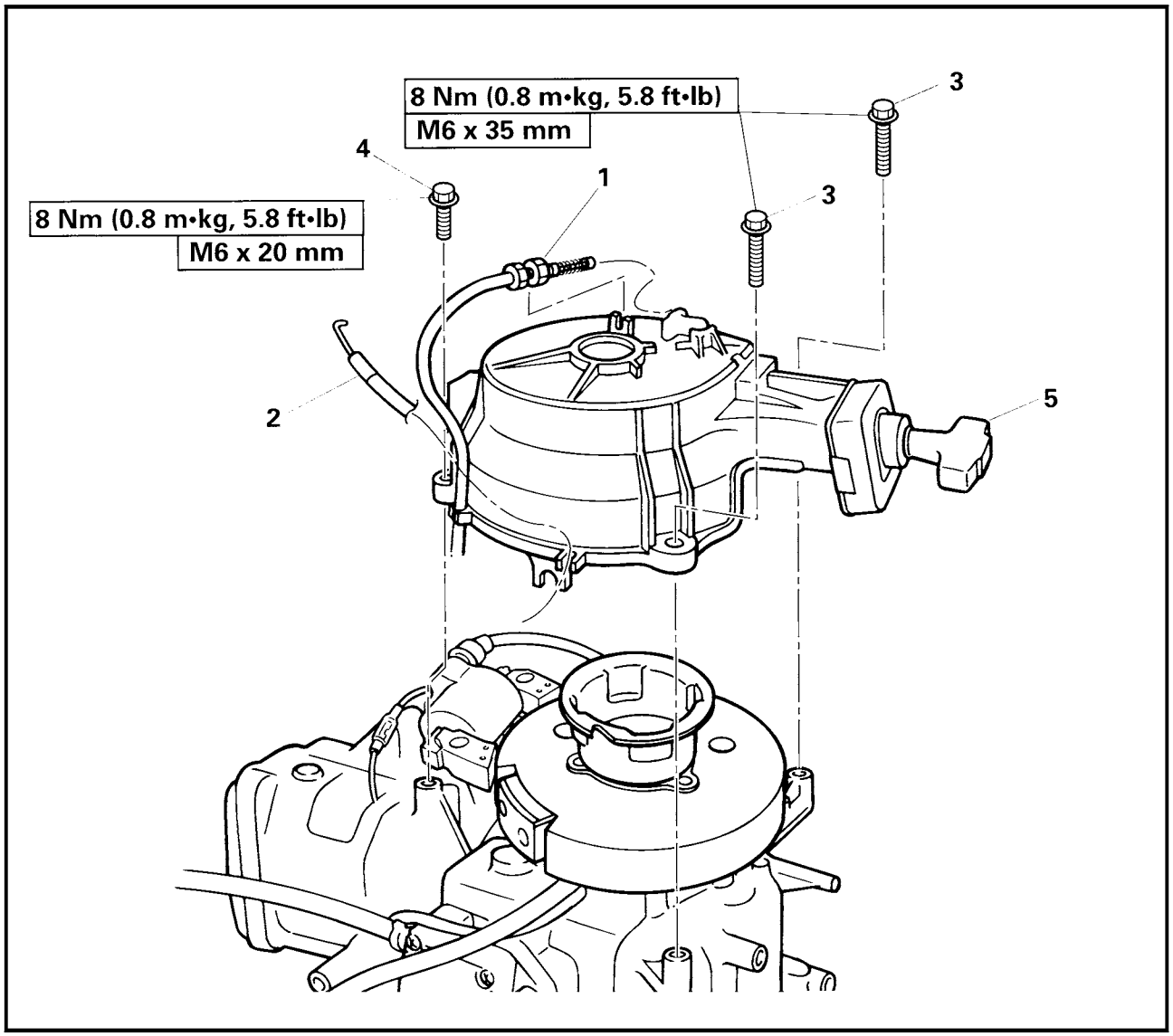
**NOTE:**

- Make sure to tilt the carburetor ass'y clockwise 45° for needle valve with spring no load, when measuring the float height.
- Take measurement at the side end of the float, as shown.

# CHAPTER 5
# POWER UNIT

# RECOIL STARTER

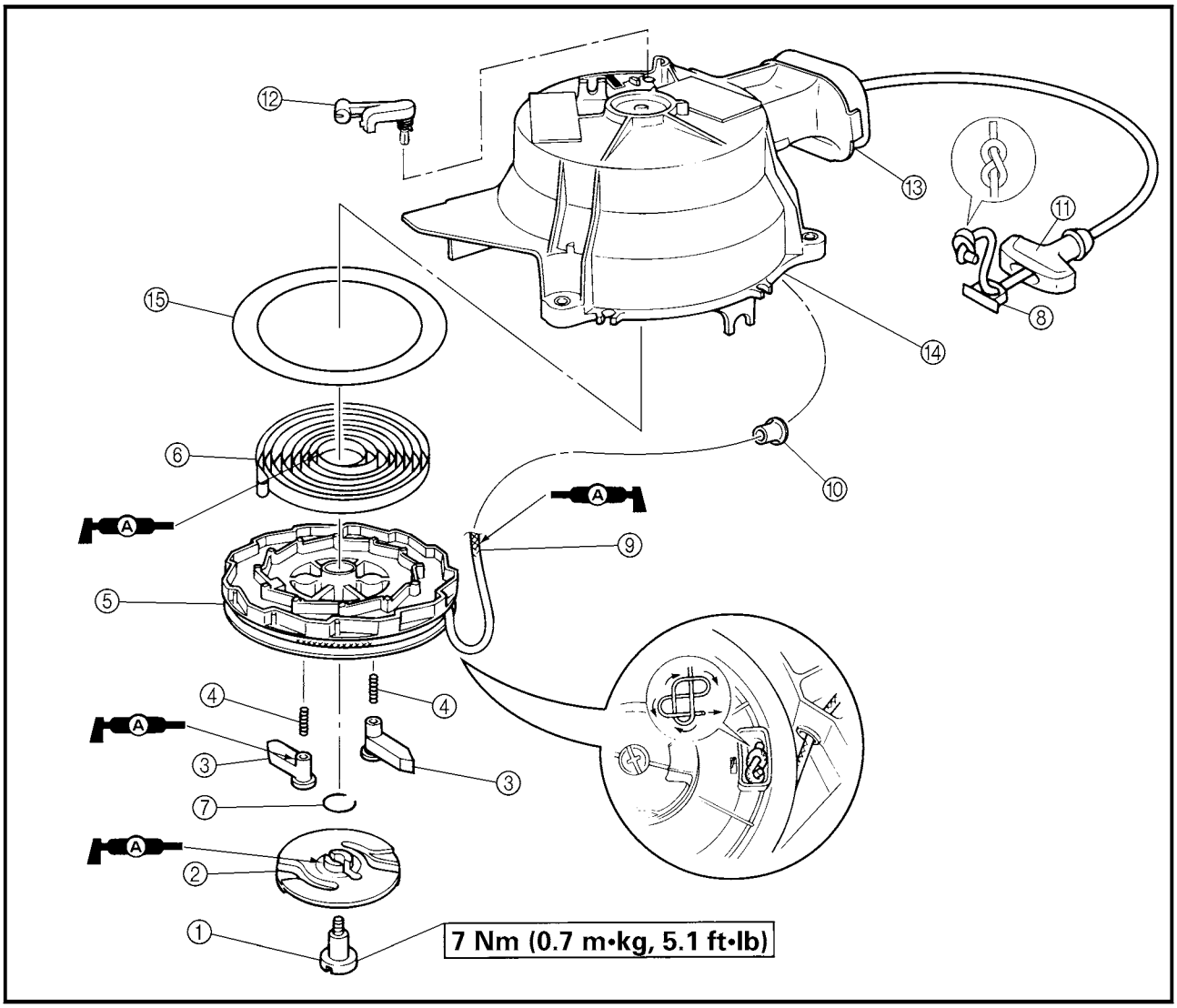
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **RECOIL STARTER REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Start-in-gear protection cable | 1 | |
| 2 | Choke wire | 1 | |
| 3 | Bolt with washer (recoil starter) | 2 | |
| 4 | Bolt with washer (recoil starter) | 1 | |
| 5 | Recoil starter ass'y | 1 | |
| | | | Reverse the removal steps for installation. |

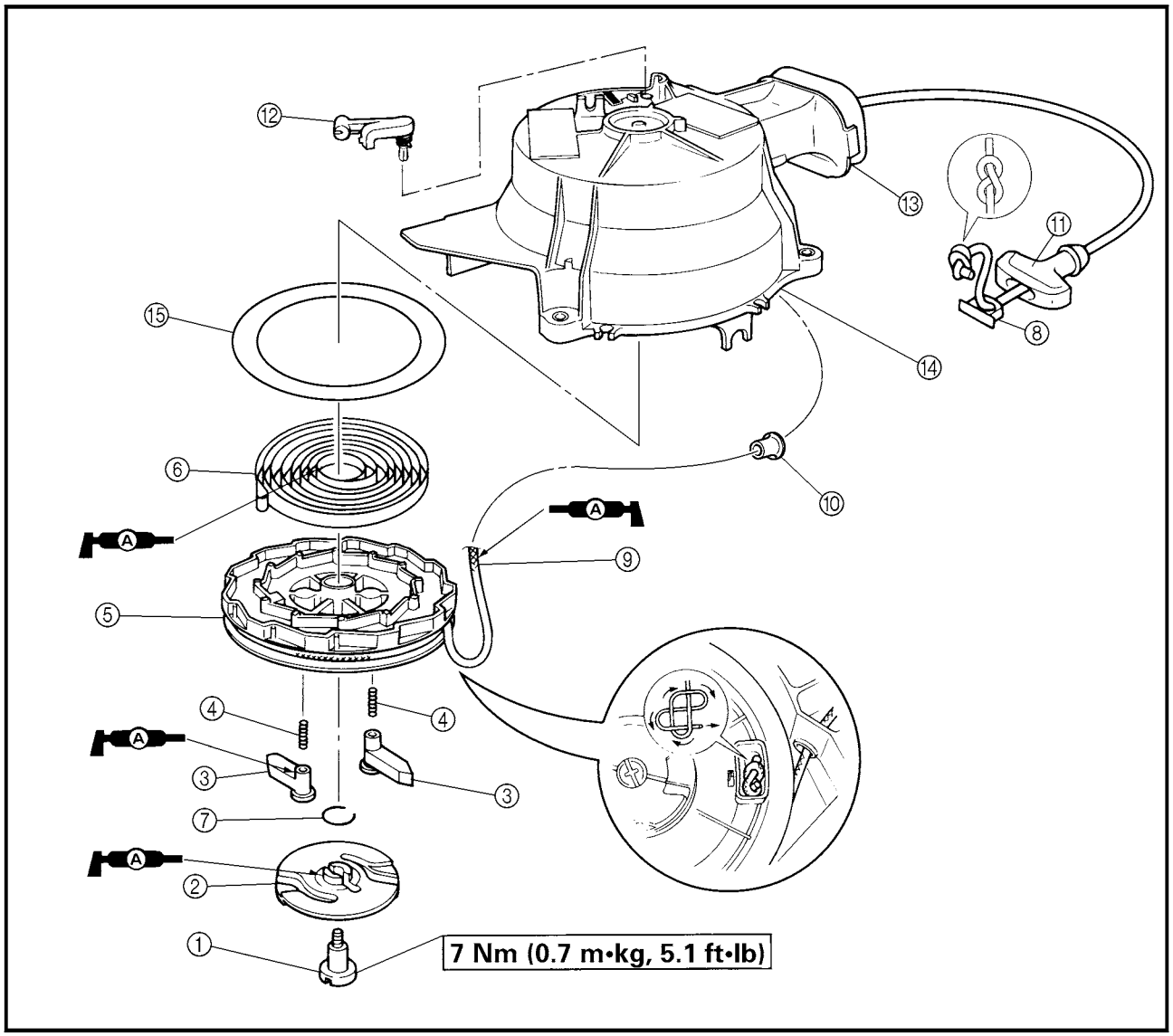
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **RECOIL STARTER DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| ① | Screw (drive plate) | 1 | |
| ② | Drive plate | 1 | |
| ③ | Drive pawl | 2 | |
| ④ | Pawl springs | 2 | |
| ⑤ | Sheave drum | 1 | |
| ⑥ | Spiral spring | 1 | |
| ⑦ | Clip (drive plate) | 1 | |
| ⑧ | Plate (starter handle) | 1 | |
| ⑨ | Starter rope | 1 | **NOTE:** Apply grease and make sure to reef knot both ends, after installation. |

## EXPLODED DIAGRAM



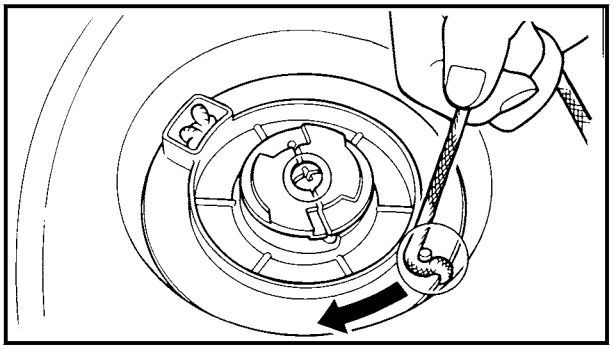

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| ⑩ | Collar | 1 | |
| ⑪ | Starter handle | 1 | |
| ⑫ | Start-in-protection lever | 1 | |
| ⑬ | Rubber seal | 1 | |
| ⑭ | Starter case | 1 | |
| ⑮ | Plate | 1 | |
| | | | Reverse the disassembly steps for assembly. |

## SERVICE POINTS

**Sheave drum removal**

**⚠ WARNING**

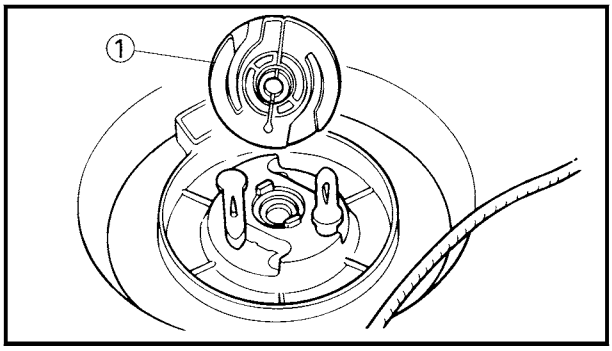
**Wear proper safety goggle and gloves to protect your eyes and hands Because: the spiral springs may jump out causing injury.**



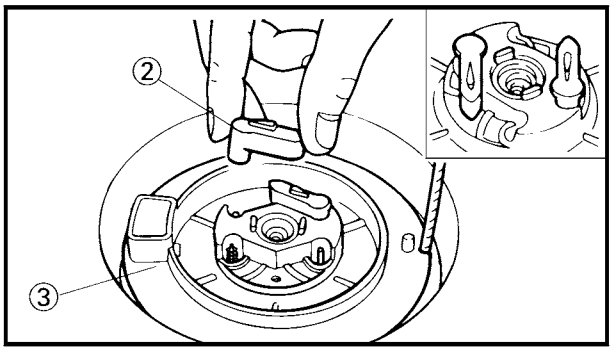
1. Rotate:
   - Sheave drum
     Turn the sheave drum clockwise until the spring is free.

**NOTE:**

- Turn the sheave drum so that the cutaway on the outer surface of the sheave drum faces toward the starter handle.
- Pass the starter rope through the cut.



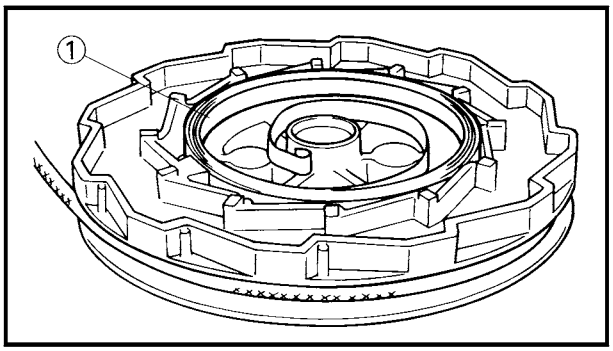

2. Remove:
   - Bolt
   - Drive plate ①
   - Drive pawl ②
   - Sheave drum ③




**⚠ WARNING**

**Be sure to check that the spiral spring is completely free to prevent it shooting out at you. Then pull the sheave drum carefully upward.**

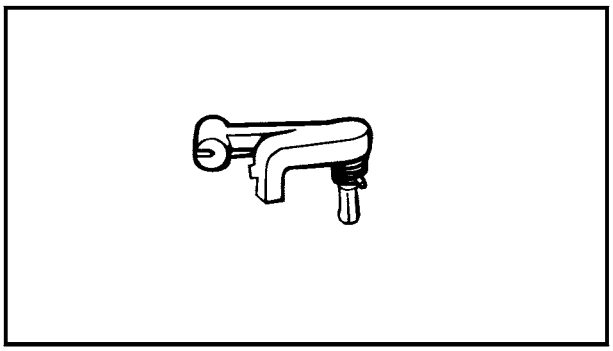
**Spiral spring removal**




1. Remove:
   - Spiral spring ①

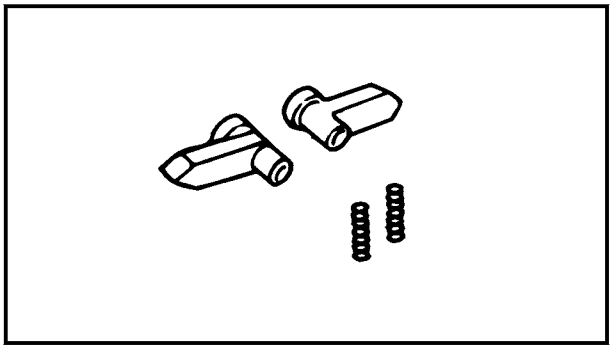
**⚠ WARNING**

**Be careful so that the spiral spring does not pop-out when removing it. Remove it by allowing it out one turn of the winding each time.**



**Start-in-gear protection lever inspection**

1. Inspect:
   - Start-in-gear protection lever
     Crack/wear/damage → Replace.



**Drive pawl and spring inspection**

1. Inspect:
   - Drive pawl
     Crack/wear/damage → Replace.
   - Drive pawl springs
     Broken/bent/damage → Replace.

**Sheave drum inspection**

1. Inspect:
   - Sheave drum
     Crack/wear/damage → Replace.

**Spiral spring inspection**

1. Inspect:
   - Spiral spring
     Broken/bent/damage → Replace.

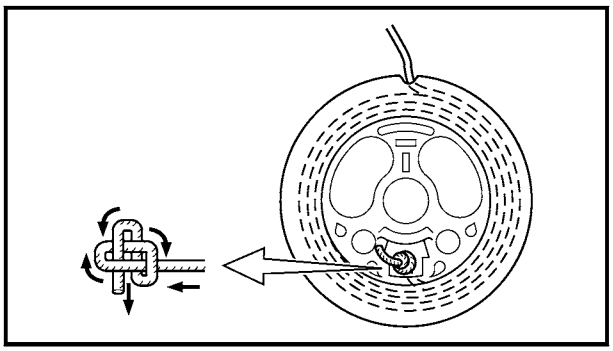
**Starter rope inspection**

1. Inspect:
   - Starter rope
     Fray/wear/damage → Replace.

**NOTE:**

- When replacing the rope, cut it the specified length and burn the rope end so that it will not trouble.
- Apply water resistant grease sufficiently on the new starter rope.

**Starter rope length:**
**1,800 mm (70.9 in)**

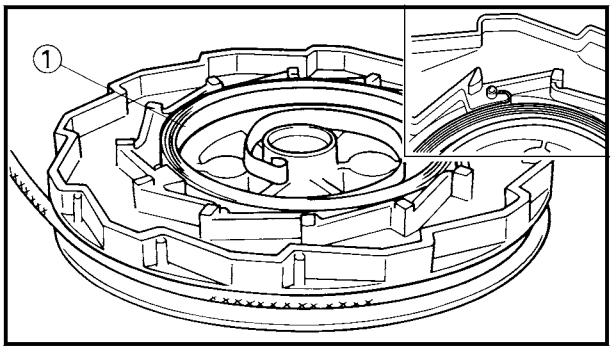


**Starter rope installation**

1. Install:
   - Starter rope

**NOTE:**

- Insert the rope through the rope holes and knot the end.
- Wind the rope 2-1/2 turns around the sheave drum.
- Place the rope at the cutaway.




**Sheave drum installation**

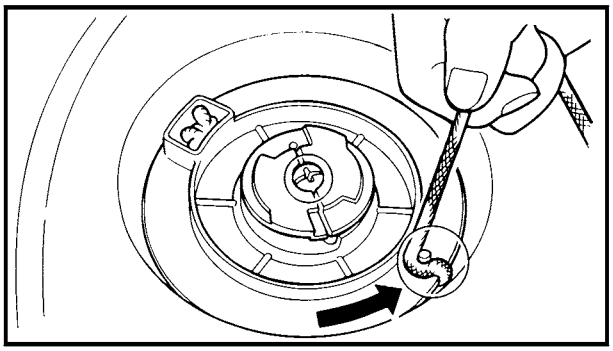
1. Install:
   - Sheave drum
   - Spiral spring

**⚠ WARNING**

**When installing the spiral spring in the sheave drum, take care to ensure that the spiral spring does not pop out and compress it by winding one turn from outside.**

**NOTE:**

Position the outer end of the spiral spring on the retainer post of the sheave drum.



**Spiral spring setting**

1. Set:
   - Spiral spring

**NOTE:**

Wind up the spring 2-1/2 turns counterclockwise with the starter rope.

**Recoil starter checking**

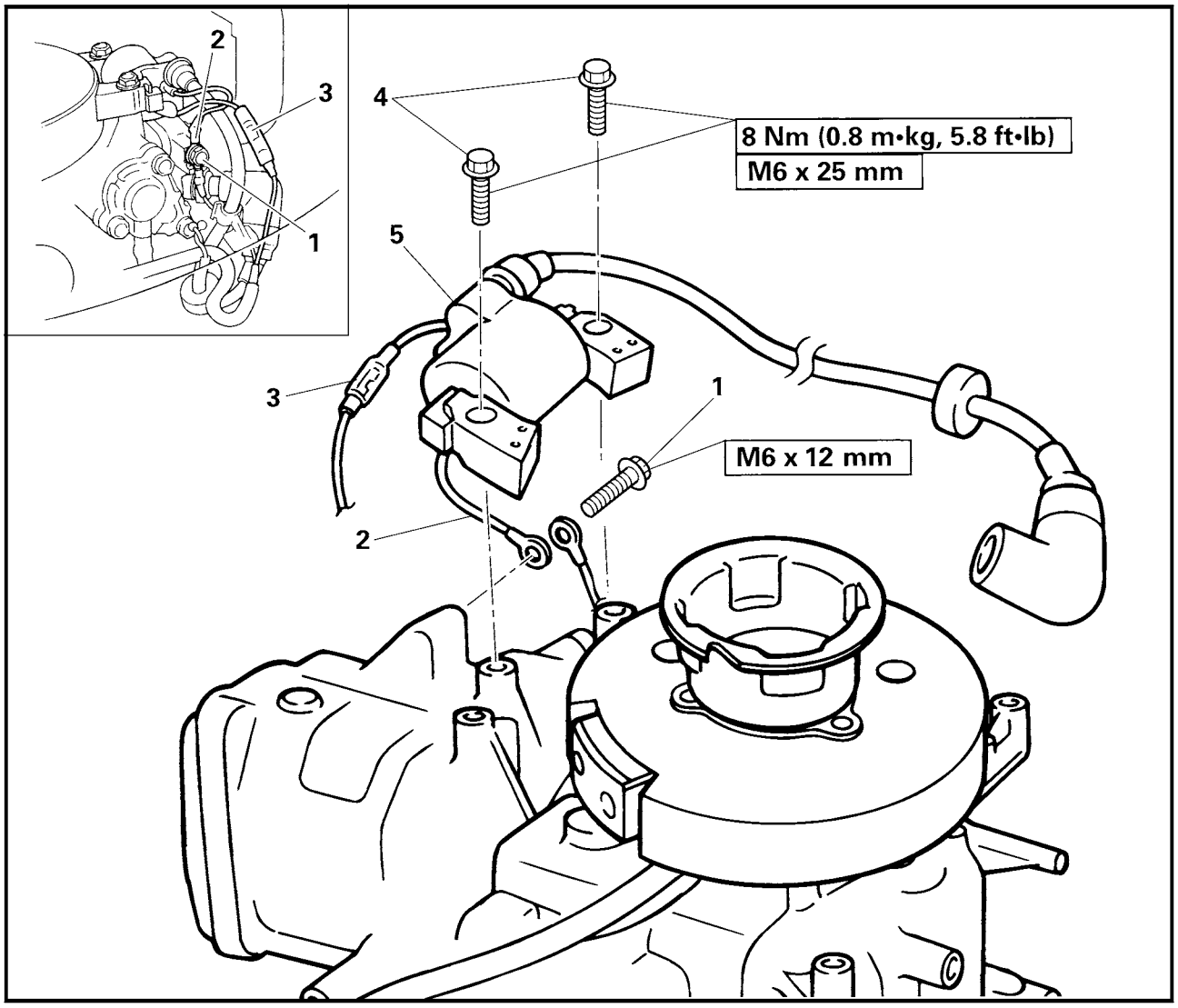
1. Check:
   - Starter operation
     Rough operation → Repair.

**NOTE:**

- When checking the recoil starter only, move out the start-in-gear protection lock.
- Adjust the start-in-gear protection wire, after install the recoil starter ass'y to the power unit. Refer to page 3-5.

# IGNITOR ASS'Y

## EXPLODED DIAGRAM

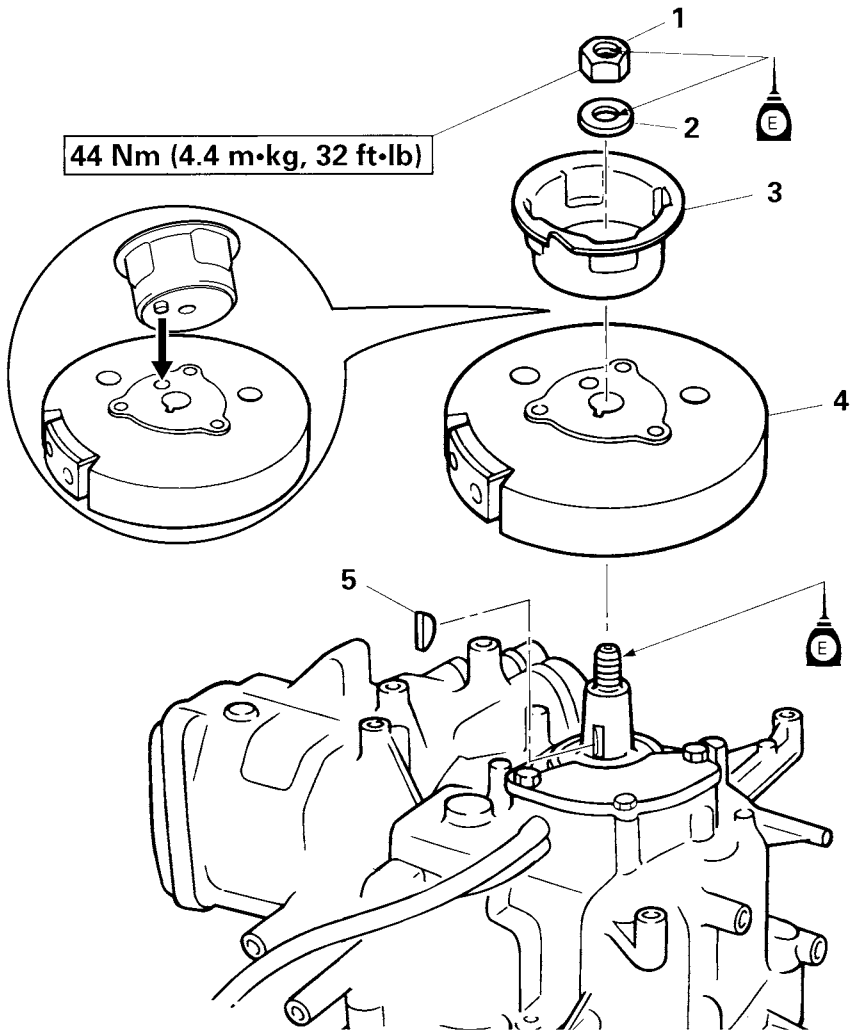



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **IGNITOR ASS'Y REMOVAL** | | Follow the left "Step" for removal.<br>**NOTE:**<br>After installing the ignitor ass'y, check the T.C.I. air gap. Refer to "T.C.I. air gap adjustment" in chapter 3. |
| | Recoil starter ass'y | | |
| 1 | Bolt with washer (ground lead) | 1 | |
| 2 | Ignitor ass'y ground lead | 1 | |
| 3 | Connector | 1 | Disconnect |
| 4 | Bolt (ignitor ass'y) | 2 | |
| 5 | Ignitor ass'y | 1 | |
| | | | Reverse the removal steps for installation. |

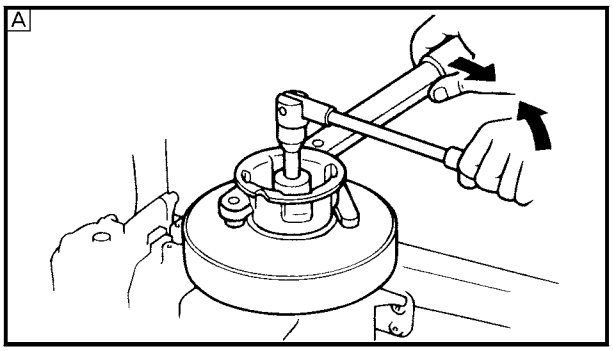
# FLYWHEEL ROTOR ASS'Y

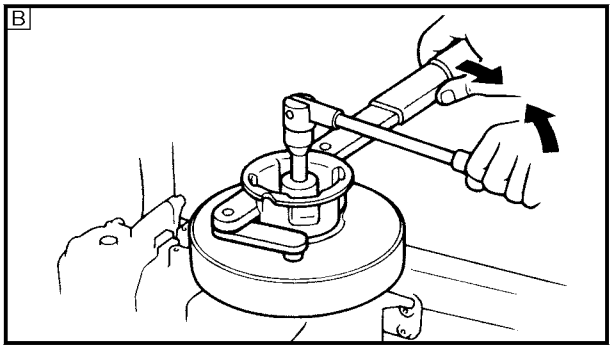
## EXPLODED DIAGRAM

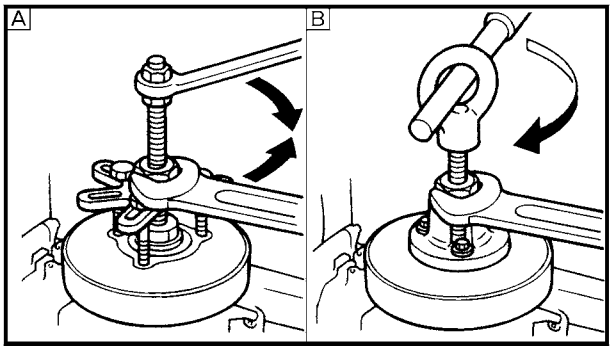


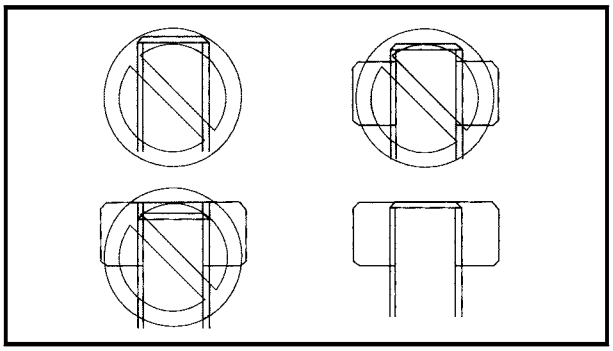

## REMOVAL AND INSTALLATION CHART

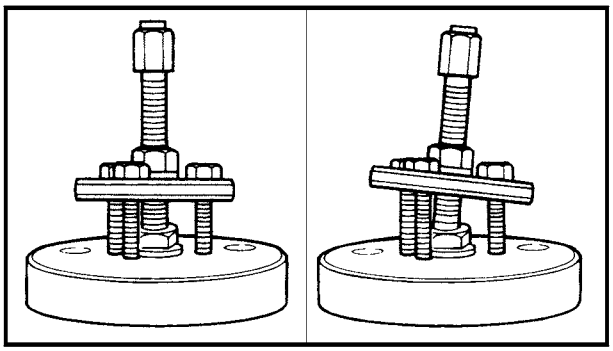
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **FLYWHEEL ROTOR ASS'Y REMOVAL** | | Follow the left "Step" for removal. |
| | Recoil starter ass'y | | |
| | Ignitor ass'y | | |
| 1 | Nut | 1 | |
| 2 | Washer | 1 | |
| 3 | Starter pulley | 1 | |
| 4 | Flywheel rotor ass'y | 1 | |
| 5 | Woodruff key | 1 | |
| | | | Reverse the removal steps for installation. |



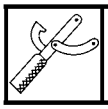





## SERVICE POINTS

**Flywheel rotor ass'y removal**

1. Remove:
   - Rotor nut
   - Washer
   - Starter pulley



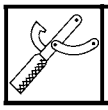
**Flywheel holder:**
**YB-06139/90890-06522**

A For USA and CANADA
B Except for USA and CANADA

**CAUTION:**

**The major load should be applied in the direction of the arrows. If the loads not applied as shown, the flywheel holder may easily slip off.**

2. Remove:
   - Flywheel rotor ass'y
   - Woodruff key



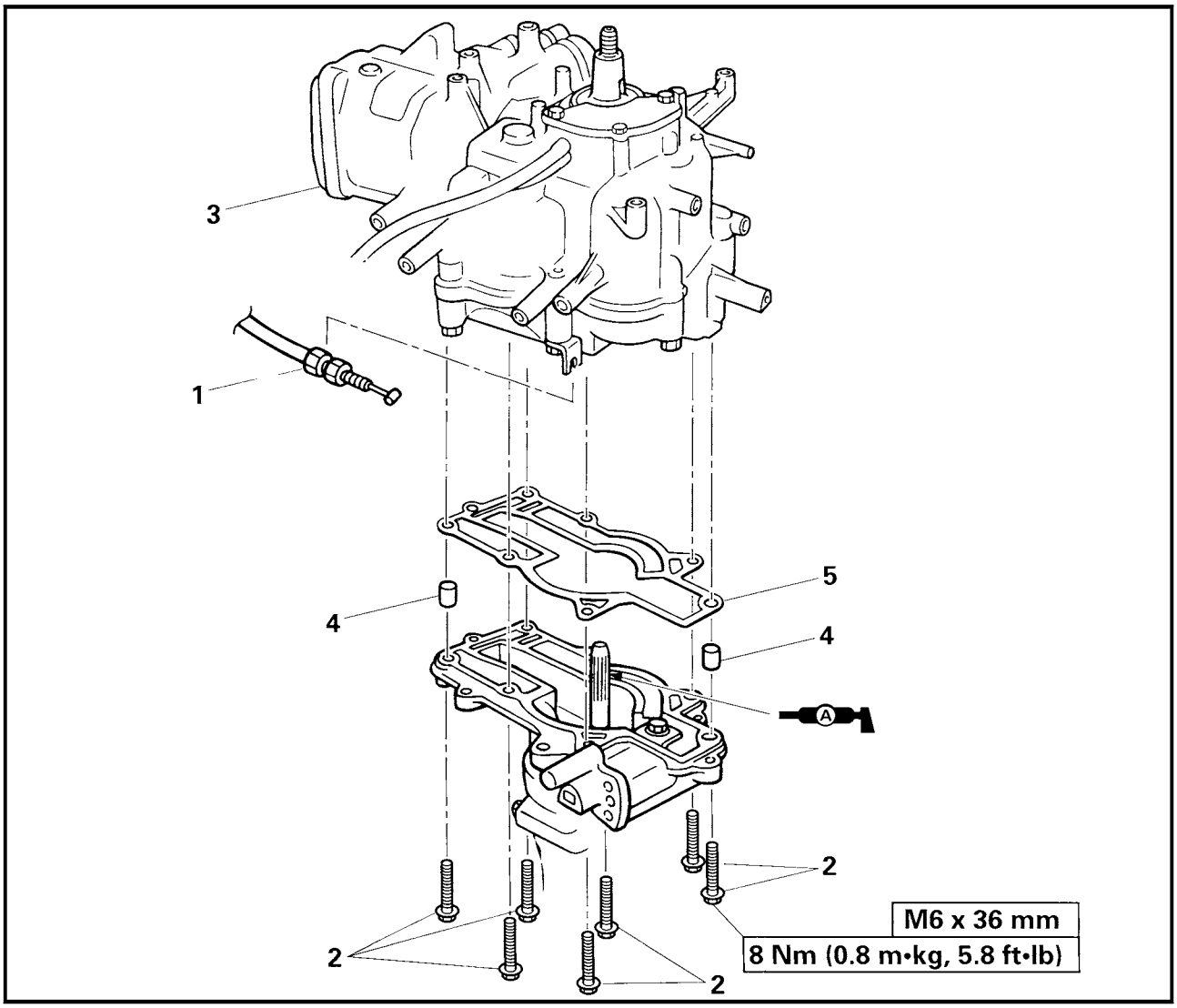
**Flywheel puller:**
**YB-06117/90890-06521**

A For USA and CANADA
B Except for USA and CANADA

**CAUTION:**

- **Keep the nut side flush with the crankshaft end until the flywheel rotor ass'y comes off the tapered portion of the crankcase.**
- **To prevent damage to the engine or tools, screw in the universal-puller set bolts evenly and completely so that the universal puller plate is parallel to the flywheel rotor ass'y.**

# POWER UNIT
## EXPLODED DIAGRAM

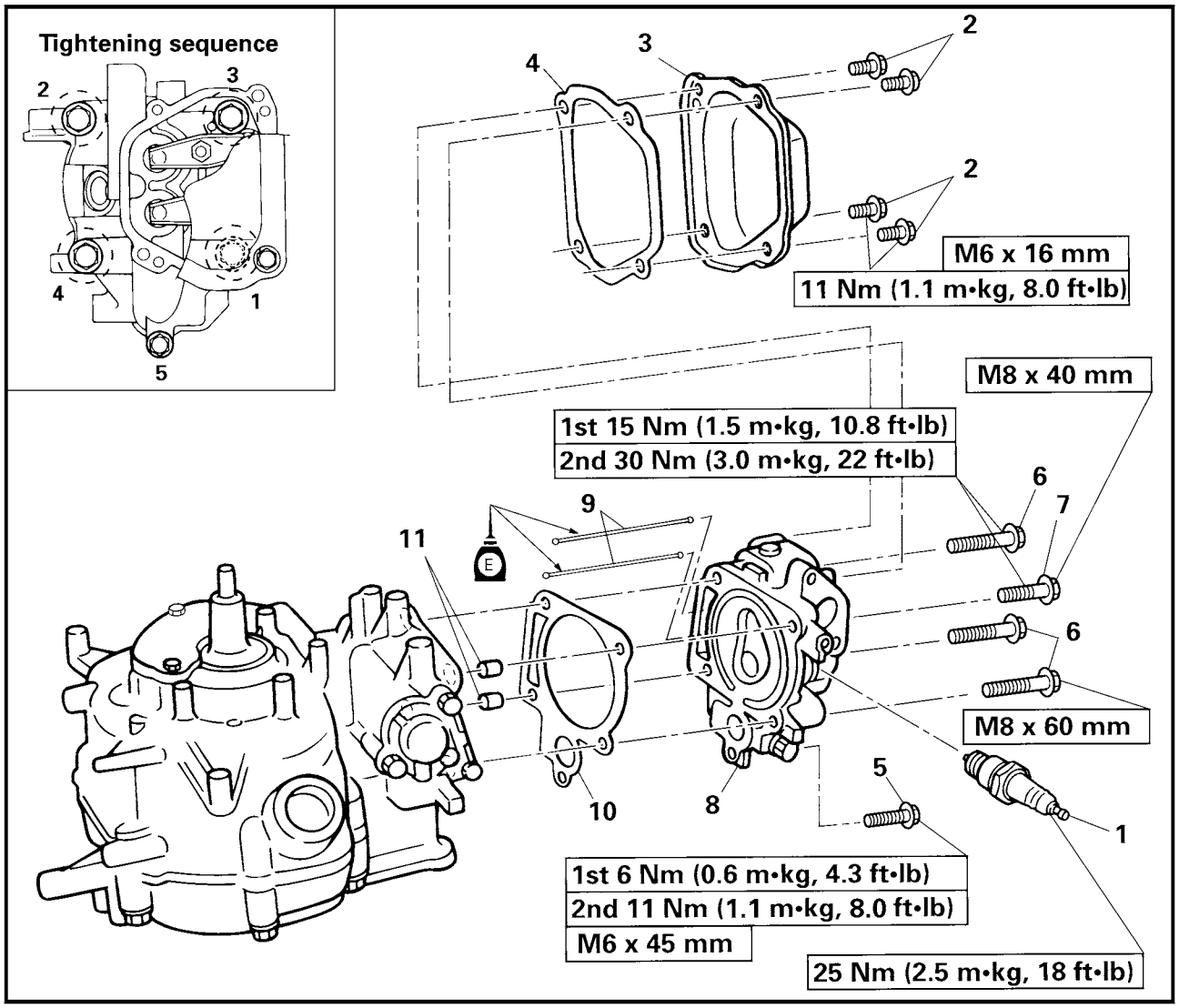



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **POWER UNIT REMOVAL** | | Follow the left "Step" for removal. |
| | Carrying handle and bottom cowling | | Refer to "CARRYING HANDLE AND BOTTOM COWLING" in chapter 7. |
| | Fuel tank and fuel cock ass'y | | Refer to "FUEL TANK, FUEL COCK AND FUEL JOINT" in chapter 4. |
| | Throttle cable | | |
| | Recoil starter ass'y | | Refer to "RECOIL STARTER". |
| 1 | Start-in-gear protection cable | 1 | Loosen the adjuster for the crankcase side. |
| 2 | Bolt (power unit) | 7 | |
| 3 | Power unit | 1 | |
| 4 | Dowel pin (upper casing) | 2 | |
| 5 | Gasket (upper casing) | 1 | **Not reusable** |
| | | | Reverse the removal steps for installation. |

# CYLINDER HEAD AND PUSH ROD

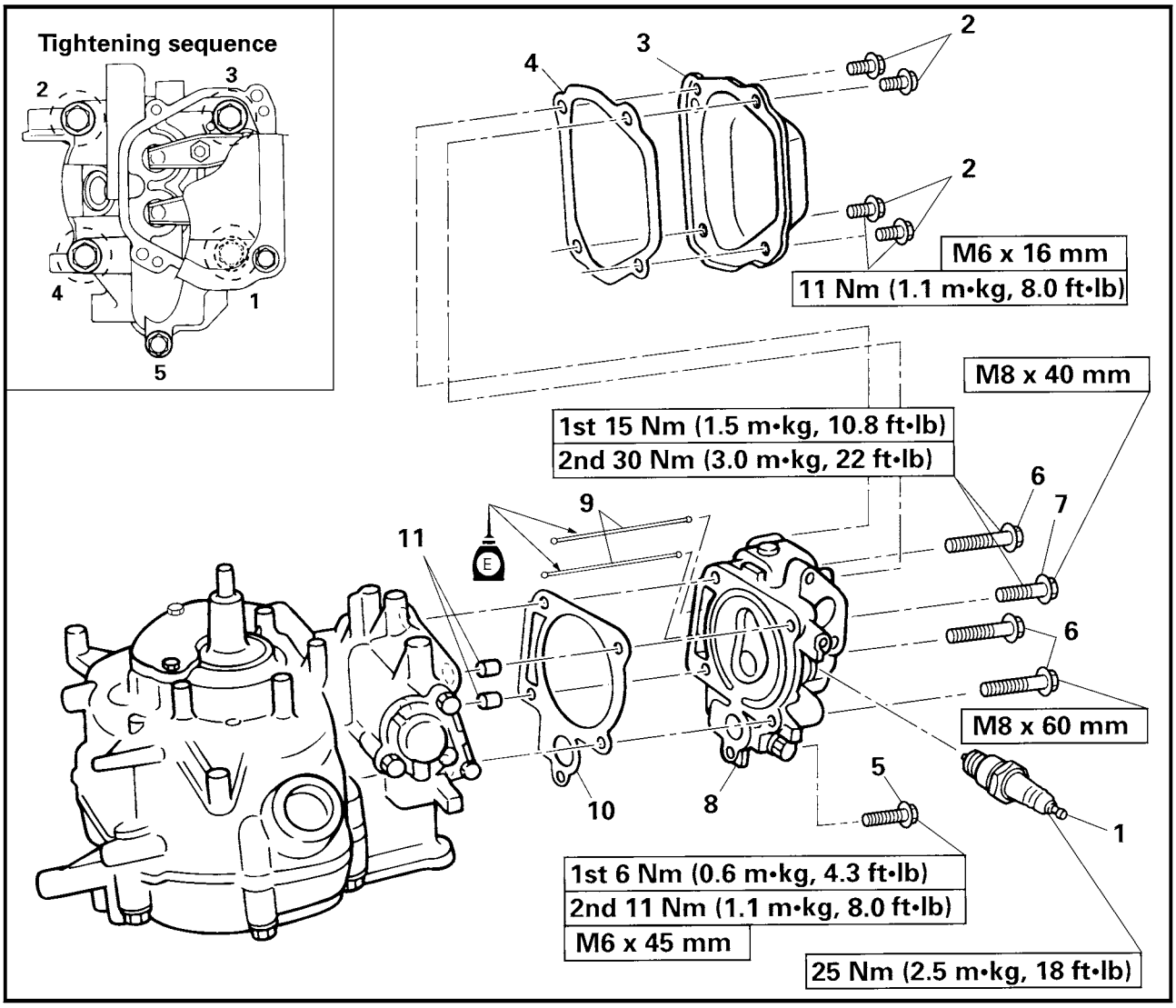
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CYLINDER HEAD AND PUSH ROD REMOVAL** | | Follow the left "Step" for removal.<br>**NOTE:**<br>● Cylinder head maintenance is possible with the power unit mounted.<br>● Loosen the locknut (rocker arm), to install the cylinder head and push rod. |
| 1 | Spark plug | 1 | |
| 2 | Bolt (cylinder head cover) | 4 | |
| 3 | Cylinder head cover | 1 | |
| 4 | Gasket (cylinder head cover) | 1 | **Not reusable** |
| 5 | Bolt (cylinder head) | 1 | |
| 6 | Bolt (cylinder head) | 3 | |
| 7 | Bolt (cylinder head) | 1 | |

## EXPLODED DIAGRAM



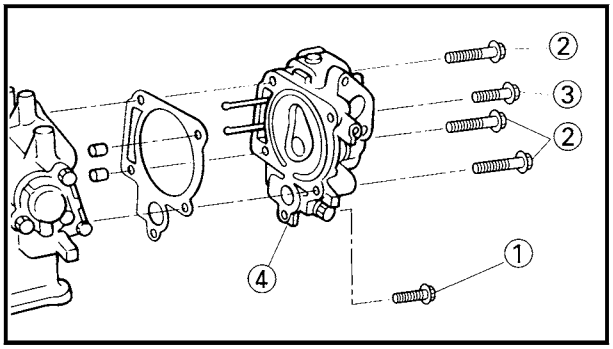

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Cylinder head ass'y | 1 | |
| 9 | Push rod | 2 | Refer to "SERVICE POINTS". |
| 10 | Gasket (cylinder head) | 1 | **Not reusable**<br>**NOTE:**<br>● Clean the cylinder head and cylinder body mating surface thoroughly.<br>● When installing the gasket, do not touch it with oily or greasy hands and do not apply any sealant. |
| 11 | Dowel pins | 2 | |
| | | | Reverse the removal steps for installation. |

## SERVICE POINTS

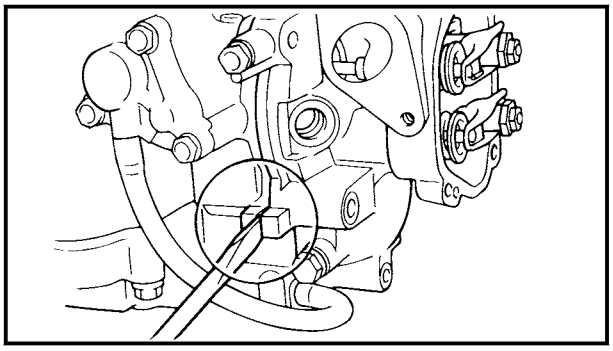
**NOTE:**
Cylinder head maintenance is possible with the power unit mounted.

### Cylinder head removal

1. Remove:
   - Bolt ① (M6 × 45 mm)
   - Bolt ② (M8 × 60 mm × 3)
   - Bolt ③ (M8 × 40 mm × 1)
   - Cylinder head ④



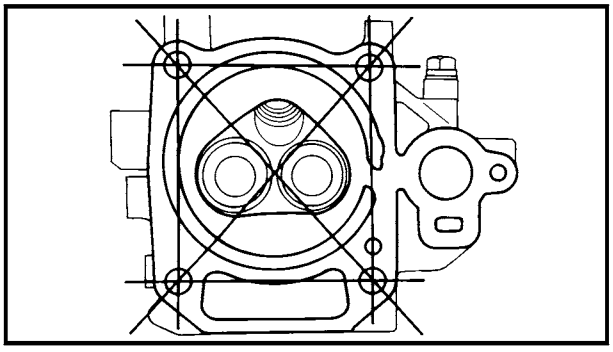

**NOTE:**
Insert a flat-head screwdriver between the tabs on both side of the cylinder and cylinder head and pry open the two parts.



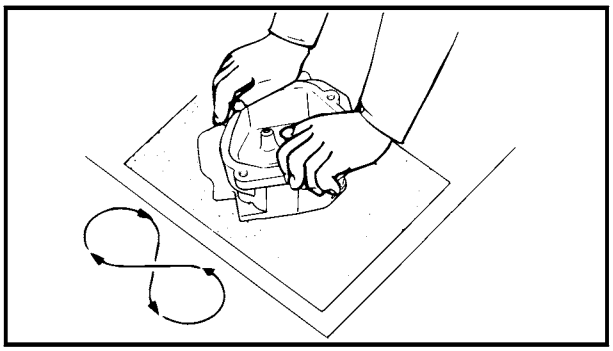
**CAUTION:**
**Do not scratch the interface of cylinder and cylinder head.**

### Cylinder head inspection

1. Measure:
   - Cylinder head warpage
     Out of specification → Resurface or replace the cylinder head.

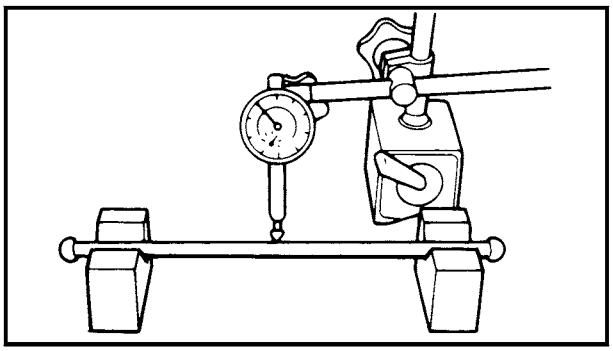


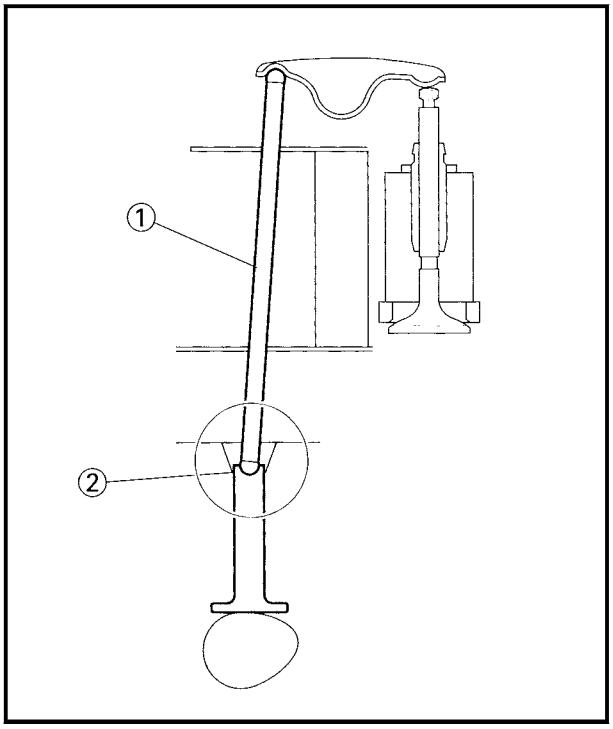
**Warpage limit:**
**0.1 mm (0.004 in)**



**Resurfacing steps:**
- Place a 400 ~ 600 grit wet sandpaper on the surface plate.
- Resurface the cylinder head using a figure-eight sanding pattern.
  To ensure an even surface, rotate the cylinder head several times.

**NOTE:**
To ensure an even surface, rotate the cylinder head several times.






**Push rod inspection**

1. Measure:
   - Push rod runout
     Out of specification → Replace the defective part.

| | |
|---|---|
| | **Push rod runout:**<br>**0.5 mm (0.02 in)** |

**Push rod installation**

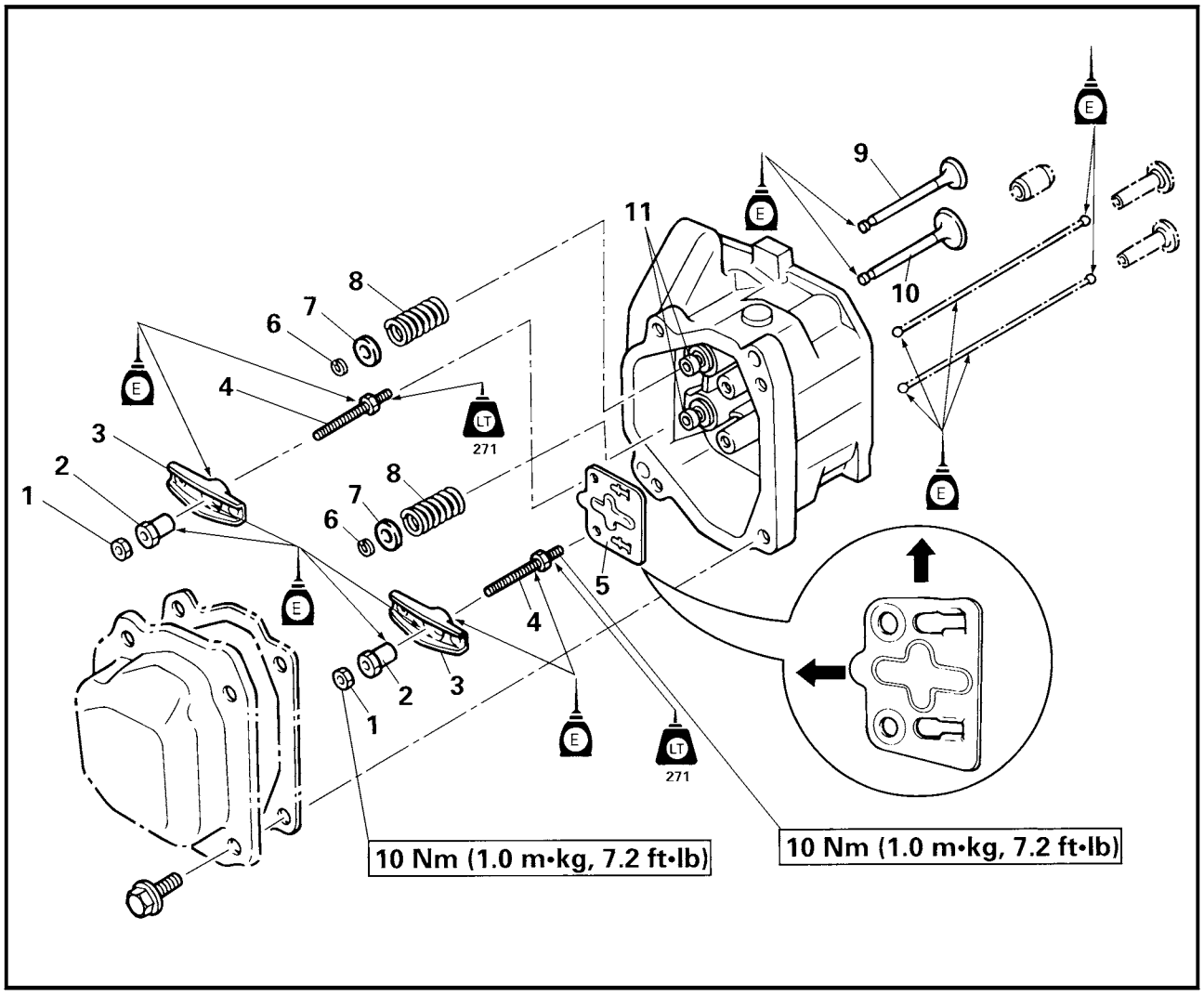
1. Loosen:
   - Locknut (rocker arm)
   - Valve adjuster
2. Install:
   - Cylinder head gasket (to cylinder body)
   - Cylinder head ass'y
   - Push rod ①

**NOTE:**

- When installing the push rod ①, check its connect position on the holder ② of valve lifter.
- After installing the push rods, crank the shaft 2 or 3 times to adjust the valve clearance.

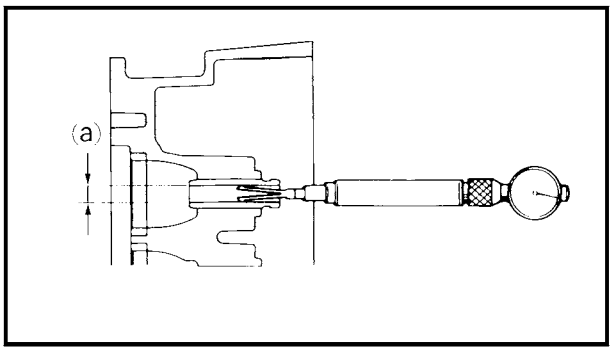
# ROCKER ARM AND VALVES

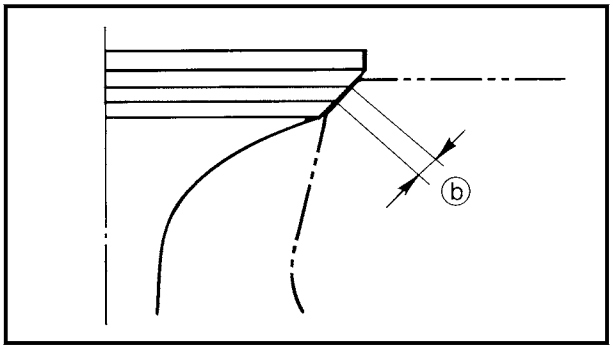
## EXPLODED DIAGRAM

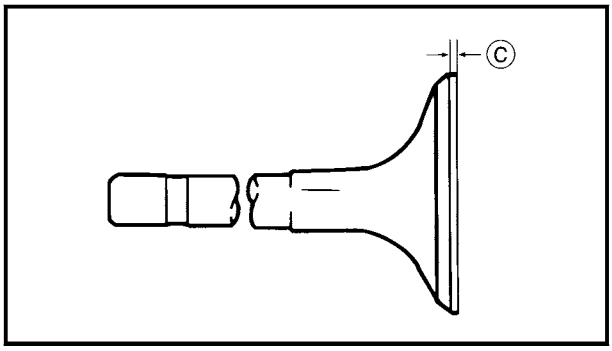


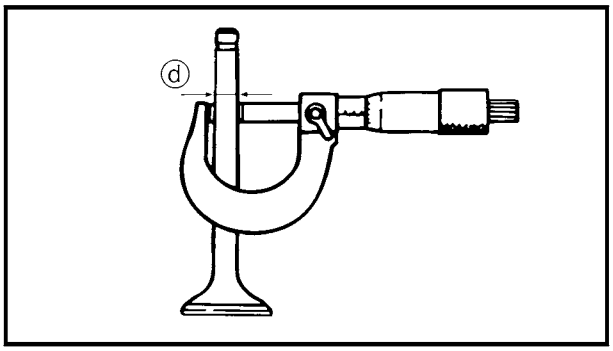

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **ROCKER ARM AND VALVE REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Locknuts | 2 | |
| 2 | Valve adjuster | 2 | |
| 3 | Rocker arms | 2 | |
| 4 | Rocker arm pivot | 2 | Apply LOCTITE® No.271 |
| 5 | Push rod guide | 1 | |
| 6 | Valve cotters | 2 | |
| 7 | Valve spring seats | 2 | |
| 8 | Valve springs | 2 | |
| 9 | Intake valve | 1 | |
| 10 | Exhaust valve | 1 | |
| 11 | Valve seals | 1 | **Not reusable** |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

### Valve inspection

1. Measure:
   - Valve guide inside diameter ⓐ
     Out of specification → Replace the valve guide.

**Valve guide inside diameter:**
**5.500 ~ 5.512 mm**
**(0.216 ~ 0.217 in)**

2. Measure:
   - Valve seat width ⓑ
     Out of specification → Reface the valve seat.

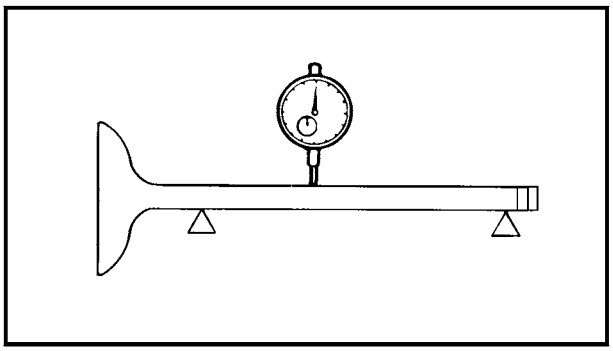
**Valve seat width:**
**Intake:**
**0.6 ~ 0.8 mm (0.02 ~ 0.03 in)**
**Exhaust:**
**0.6 ~ 0.8 mm (0.02 ~ 0.03 in)**

3. Measure:
   - Margin thickness ⓒ
     Out of specification → Replace the valve.

**Margin thickness:**
**Intake: 0.70 mm (0.028 in)**
**Exhaust: 1.00 mm (0.039 in)**

4. Measure:
   - Valve stem diameter ⓓ
     Out of specification → Replace the valve.

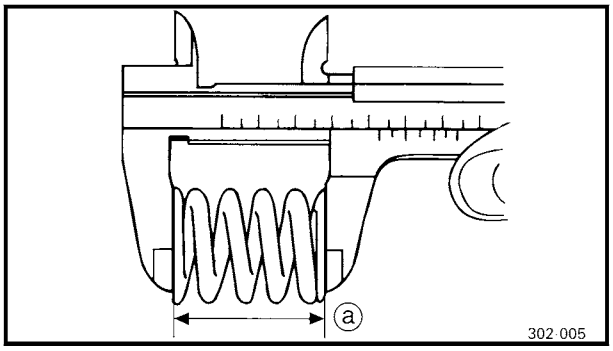
**Diameter:**
**Intake:**
**5.475 ~ 5.490 mm**
**(0.2156 ~ 0.2161 in)**
**Exhaust:**
**5.460 ~ 5.475 mm**
**(0.2150 ~ 0.2156 in)**



5. Measure:
   - Valve stem runout
     Out of specification → Replace the valve.

| | |
|---|---|
| | **Valve stem runout limit: 0.03 mm (0.0012 in)** |

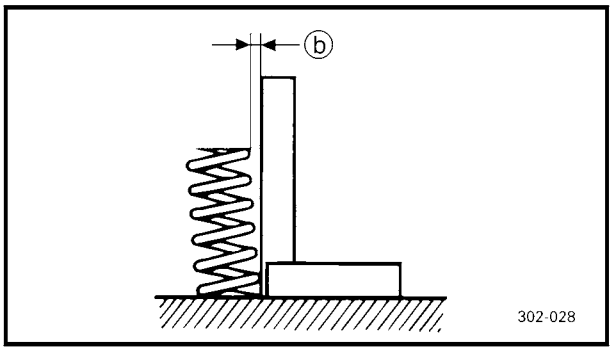
**NOTE:**
When replacing the valve, always use a new valve guide and valve seal.




**Valve spring inspection**

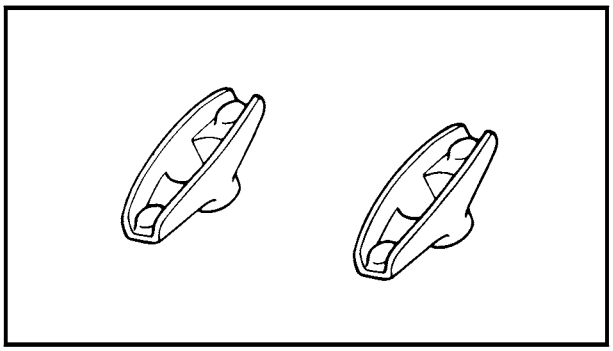
1. Measure:
   - Valve spring free length ⓐ
     Out of specification → Replace the valve spring.

| | |
|---|---|
| | **Valve spring free length limit: 34.0 mm (1.34 in)** |



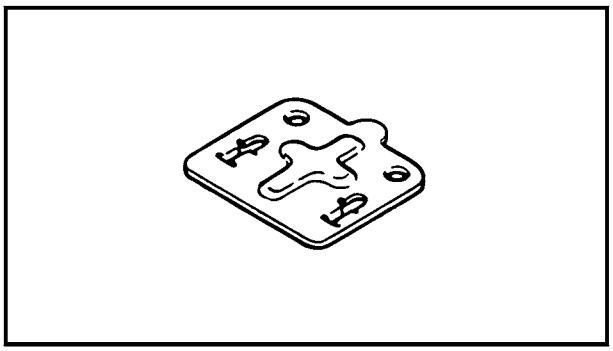

2. Measure:
   - Valve spring tilt ⓑ
     Out of specification → Replace the valve spring.

| | |
|---|---|
| | **Valve spring tilt limit: 1.2 mm (0.05 in)** |



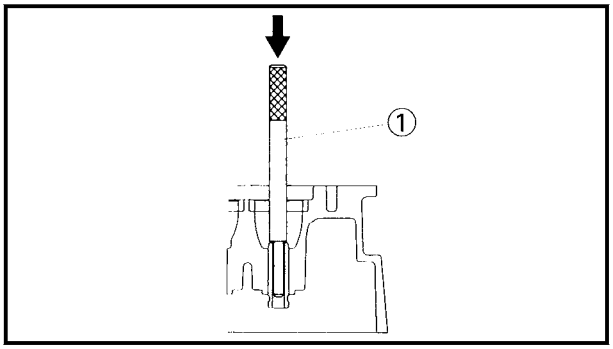
**Rocker arm inspection**

1. Inspect:
   - Rocker arm
     Cracks/wear/damage → Replace.



**Push rod guide inspection**

1. Inspect:
   - Push rod guide
     Cracks/wear/damage → Replace.




**Valve guide replacement**

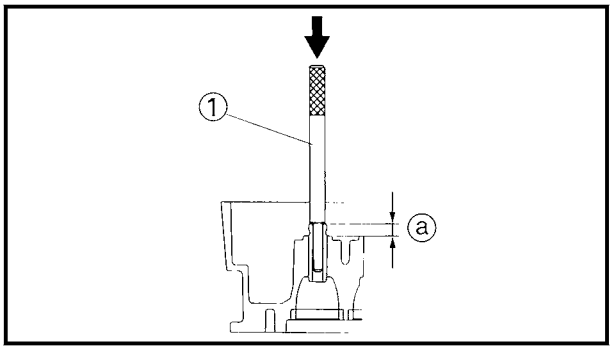
**Replacement steps:**

**NOTE:**

Heat the cylinder head to 200°C (392°F) in an oven to ease valve guide removal and installation and also to maintain correct interference fit.

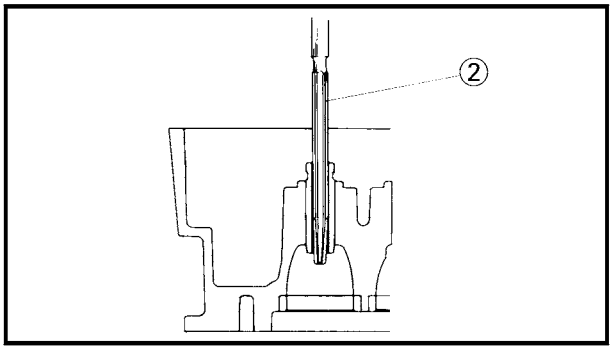
- Remove the valve guide with the valve guide remover and installer.

**Valve guide remover and installer ①:**
**YM-01122/90890-06801**




- Install the new valve guide specified position (height) with the valve guide remover and installer.

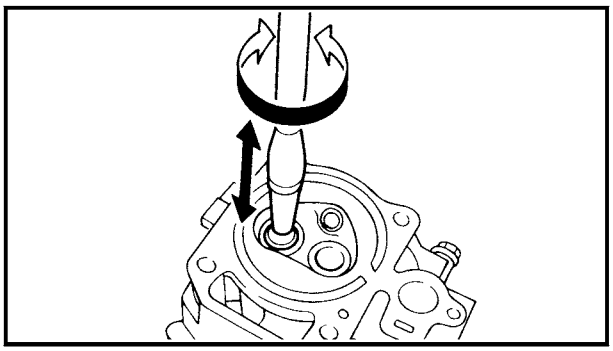
**Valve guide height ⓐ:**
**5.9 mm (0.23 in)**




- After installing the valve guide, bore the valve guide with the valve guide reamer to obtain the proper valve stem-to-valve guide clearance.

**Valve guide reamer ②:**
**YM-01196/90890-06804**

**Valve stem to valve guide clearance:**
**Intake:**
**0.010 ~ 0.037 mm**
**(0.0004 ~ 0.0015 in)**
**Exhaust:**
**0.025 ~ 0.052 mm**
**(0.0010 ~ 0.0020 in)**



### Valve seat refacing

**NOTE:**

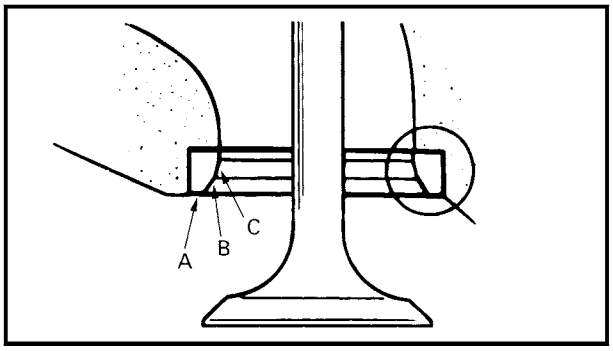
After refacing the valve seat or replacing the valve and valve guide, lap the valve seat and valve face.

**CAUTION:**

**To prevent chatter marks, turn the valve seat cutter with an even, downward pressure (4 ~ 5 kg).**

**Valve seat cutter set:**
**YM-91043-C/90890-06803**
**Valve seat lapper:**
**N.A./90890-06805**

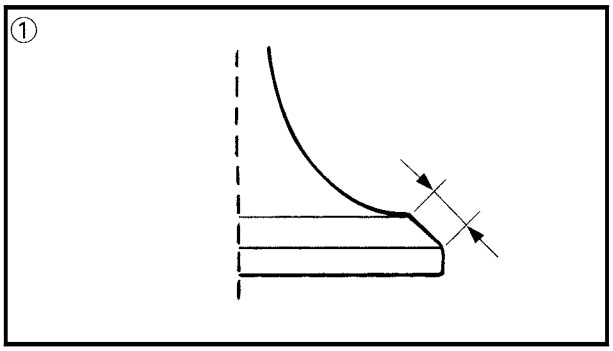
- Refer to the following chart to determine the appropriate valve seat cutter.




| Valve seat area | Valve cutter |
|---|---|
| A | 0° |
| B | 45° |
| C | 60° |

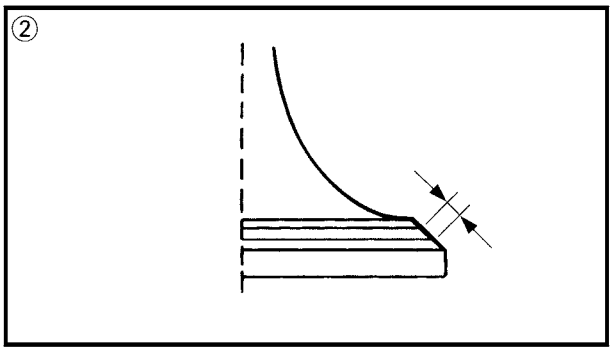
### Valve seat cutting guidelines

① The valve seat is centered on the valve face, but is too wide.

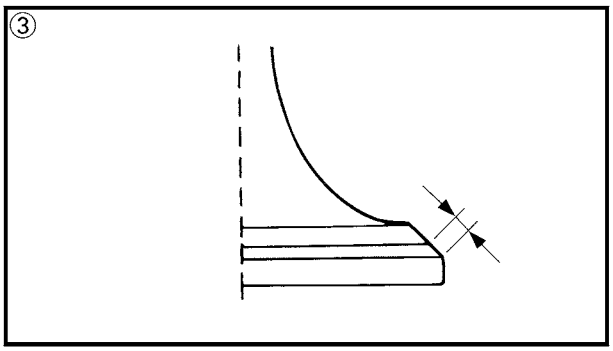



| Valve seat cutter set | | Desired result |
|---|---|---|
| Use lightly | First: 0° cutter Second: 60° cutter | To reduce the valve seat width. |

② The valve seat is in the middle of the valve face, but is too narrow.

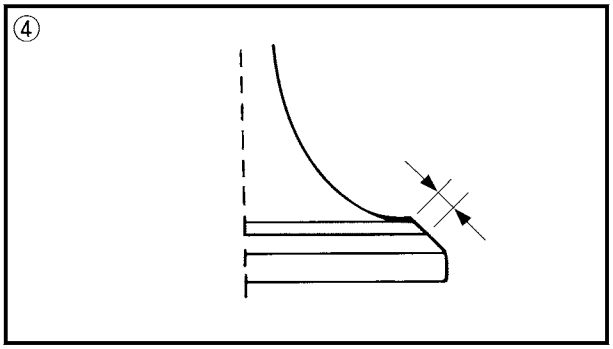



| Valve seat cutter set | | Desired result |
|---|---|---|
| Use | 45° cutter | To achieve a uniform valve seat width. |



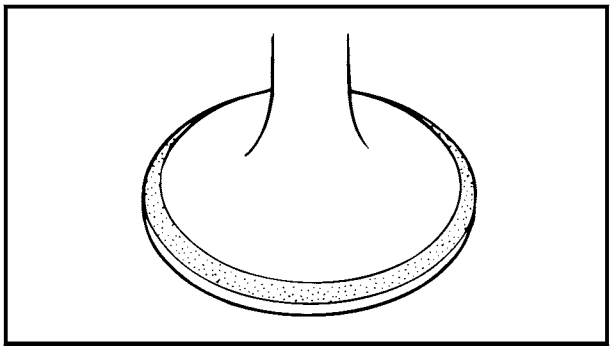

③ The valve seat is too narrow and is near the valve margin.

| Valve seat cutter set | | Desired result |
|---|---|---|
| Use | First: 0° cutter Second: 45° cutter | To achieve a centered valve seat with the proper with. |




④ The valve seat is too narrow and is near the bottom edge of the valve face.

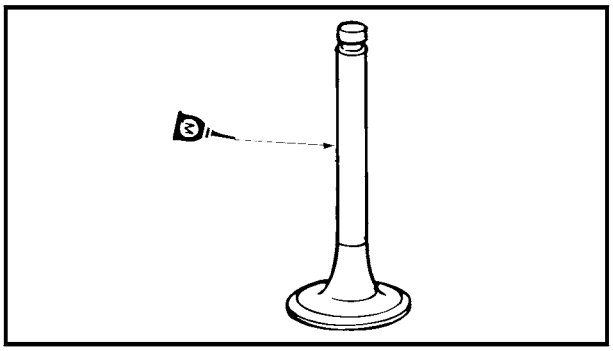
| Valve seat cutter set | | Desired result |
|---|---|---|
| Use | First: 60° cutter Second: 45° cutter | To centered the valve seat and increase its width. |



**Valve lapping**

**NOTE:**

After refacing the valve seat of replacing the valve and valve guide, the valve seat and valve face should be lapped.

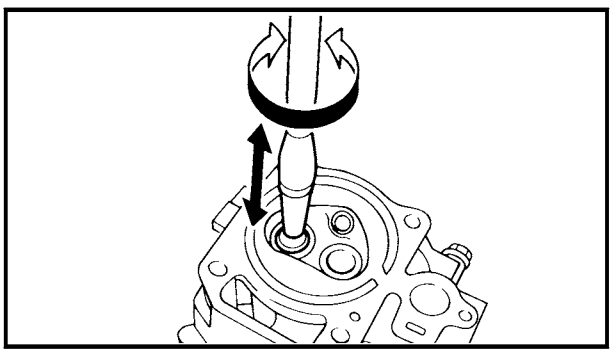


**Lapping steps:**

- Apply a coarse lapping compound to the valve face.

**CAUTION:**

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



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

**NOTE:**

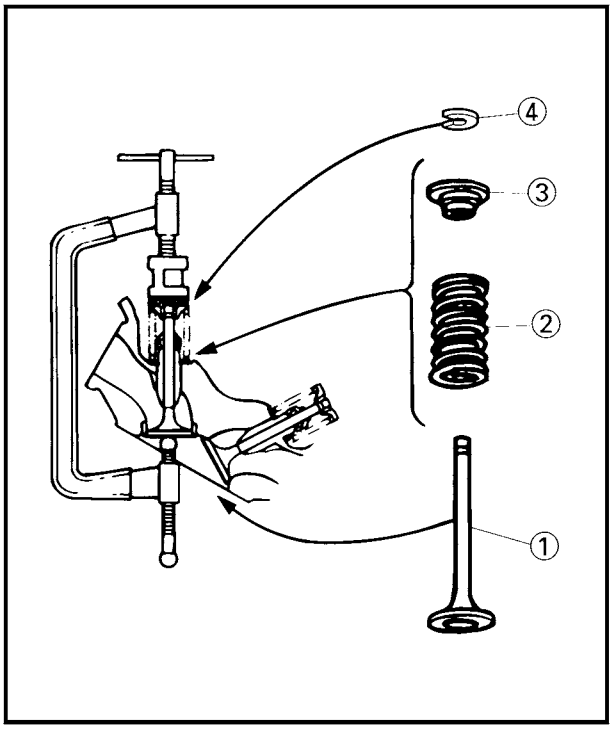
To obtain the best lapping results, lightly tap the valve seat while rotating the valve back and forth between your hands.

- Apply the fine lapping compound to the valve face and repeat the above steps.

**NOTE:**

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

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




**Valve installation**

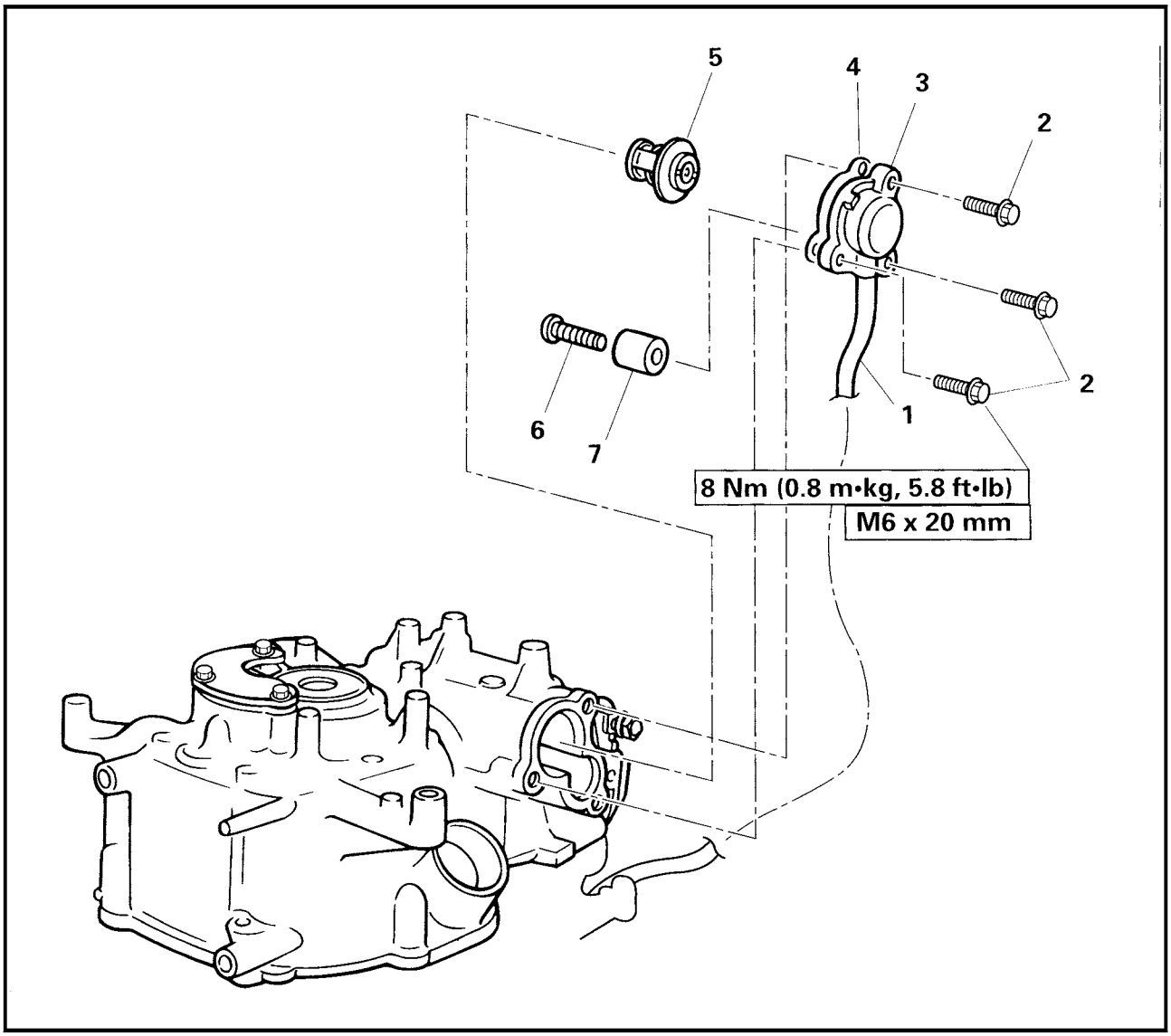
1. Install:
   - Valve ①
   - Valve spring ②
   - Spring retainer ③
   - Valve cotter ④

**Valve spring compressor:**
**YM-01253/90890-04019**
**Attachment:**
**YB-06554/90890-06554**

**NOTE:**

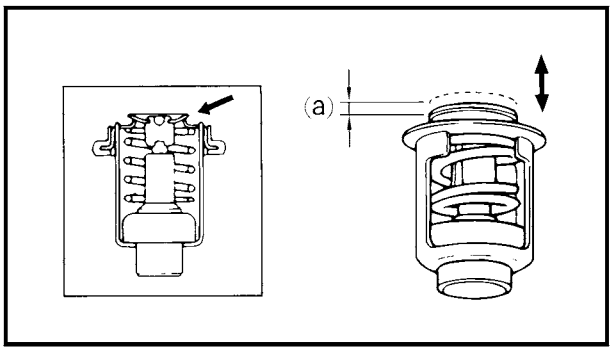
Set the attachment on the center of spring retainer.

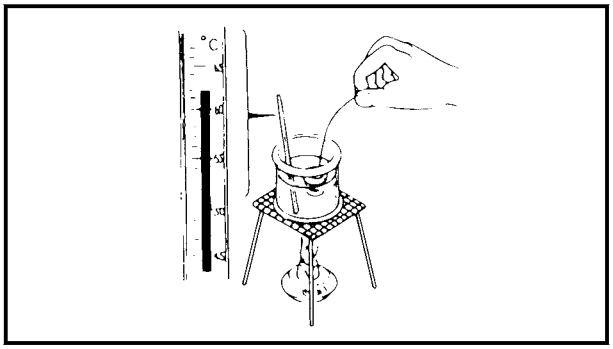
# THERMOSTAT
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **THERMOSTAT REMOVAL** | | Follow the left "Step" for removal. |
| | Oil level plug | | |
| 1 | Hose | 1 | |
| 2 | Bolt with washer (thermostat cover) | 3 | |
| 3 | Thermostat cover | 1 | |
| 4 | Gasket (thermostat) | 1 | **Not reusable** |
| 5 | Thermostat | 1 | |
| 6 | Screw (cylinder anode) | 1 | |
| 7 | Cylinder anode | 1 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

### Thermostat inspection

1. Measure:
   - Valve operating temperature
   - Valve lift ⓐ

   Out of specification → Replace the thermostat.

| | Water temperature | Valve lift |
|---|---|---|
| | Below 58 ~ 62°C (136.4 ~ 143.6°F) | 0 mm (0 in) |
| | Above 70°C (158°F) | 3 mm (0.12 in) |

**Measuring steps:**
- Suspend the thermostat in a container filled with water.
- Slowly heat the water.
- Place a thermometer in the water.
- While stirring the water, observe the thermometer's indicated temperature.

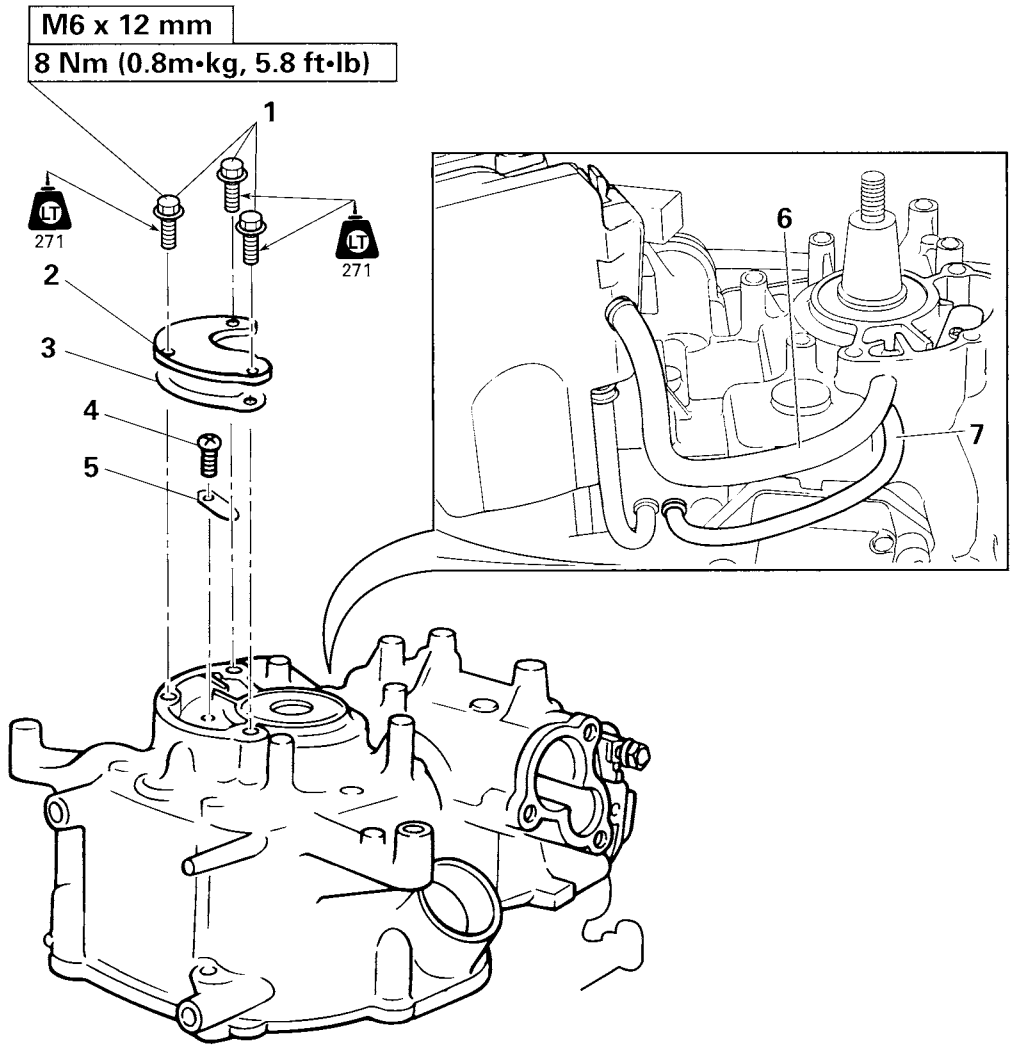
### Anode inspection

1. Inspect:
   - Anode

   Refer to "ANODE" in chapter 3.

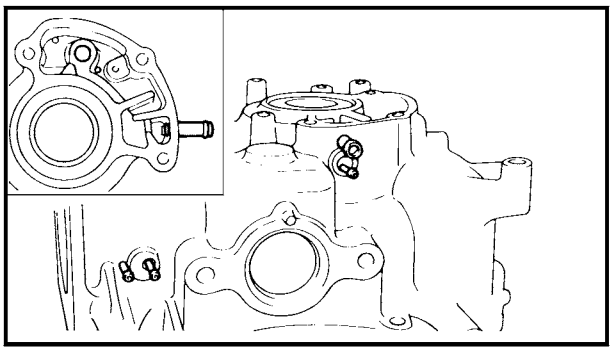
# BREATHER VALVE

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **BREATHER VALVE REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Bolt with washer (breather cover) | 3 | |
| 2 | Breather cover | 1 | **Not reusable** |
| 3 | Gasket (breather cover) | 1 | |
| 4 | Screw (breather valve) | 1 | |
| 5 | Breather valve | 1 | |
| 6 | Breather hose 1 | 1 | |
| 7 | Breather hose 2 | 1 | |
| | | | Reverse the removal steps for installation. |



## SERVICE POINTS

### Breather valve inspection

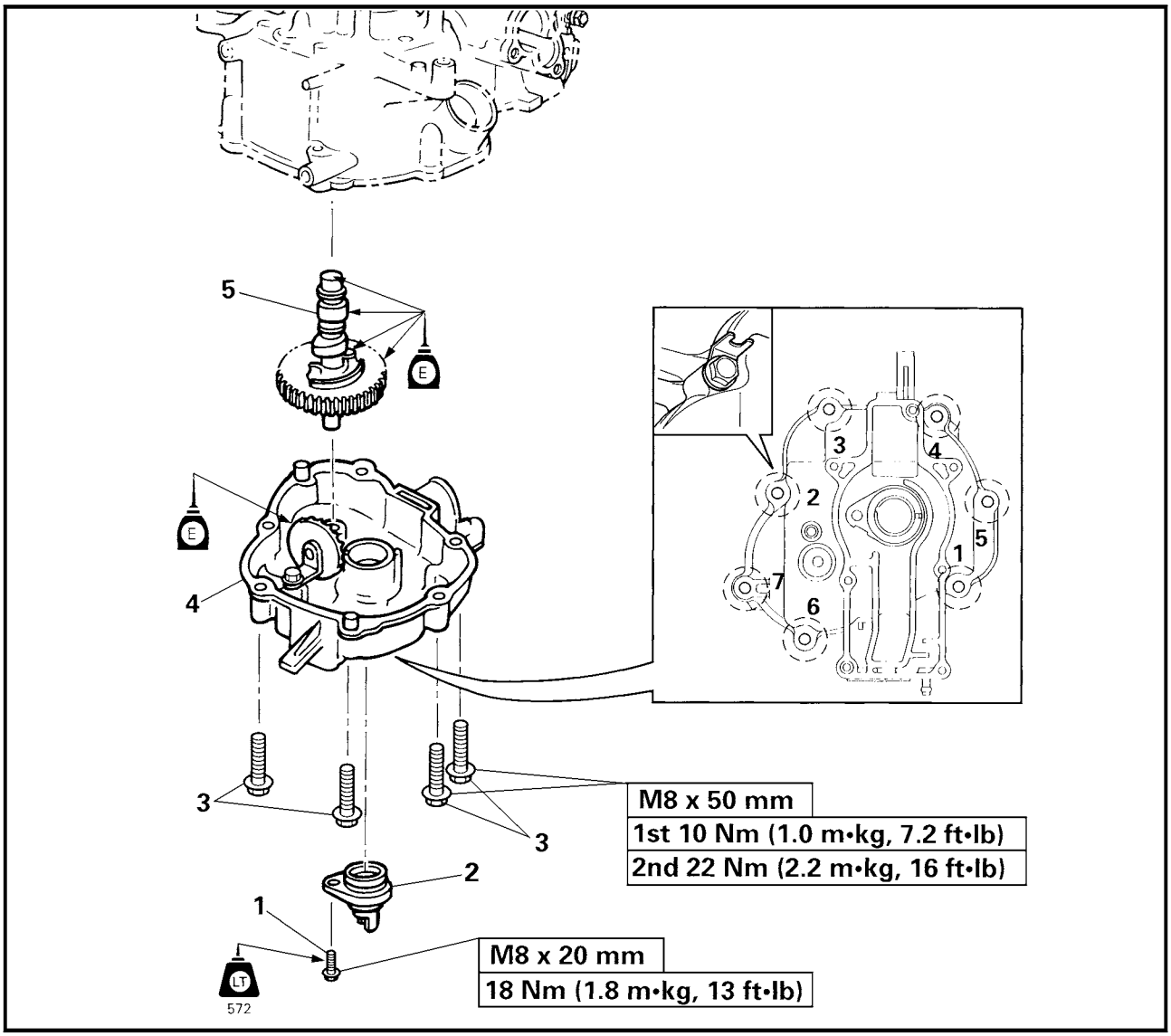
1. Inspect:
   - Breather valve
     Damage/crack/bend → Replace.

### Breather route inspection

1. Inspect:
   - Breather hose 1 (large)
     Crack/leak/damage → Replace.
   - Breather hole
     Clog → Clean.
   - Breather hose 2 (small)
     Crack/leak/damage → Replace.

# CRANKCASE AND CAMSHAFT

## EXPLODED DIAGRAM

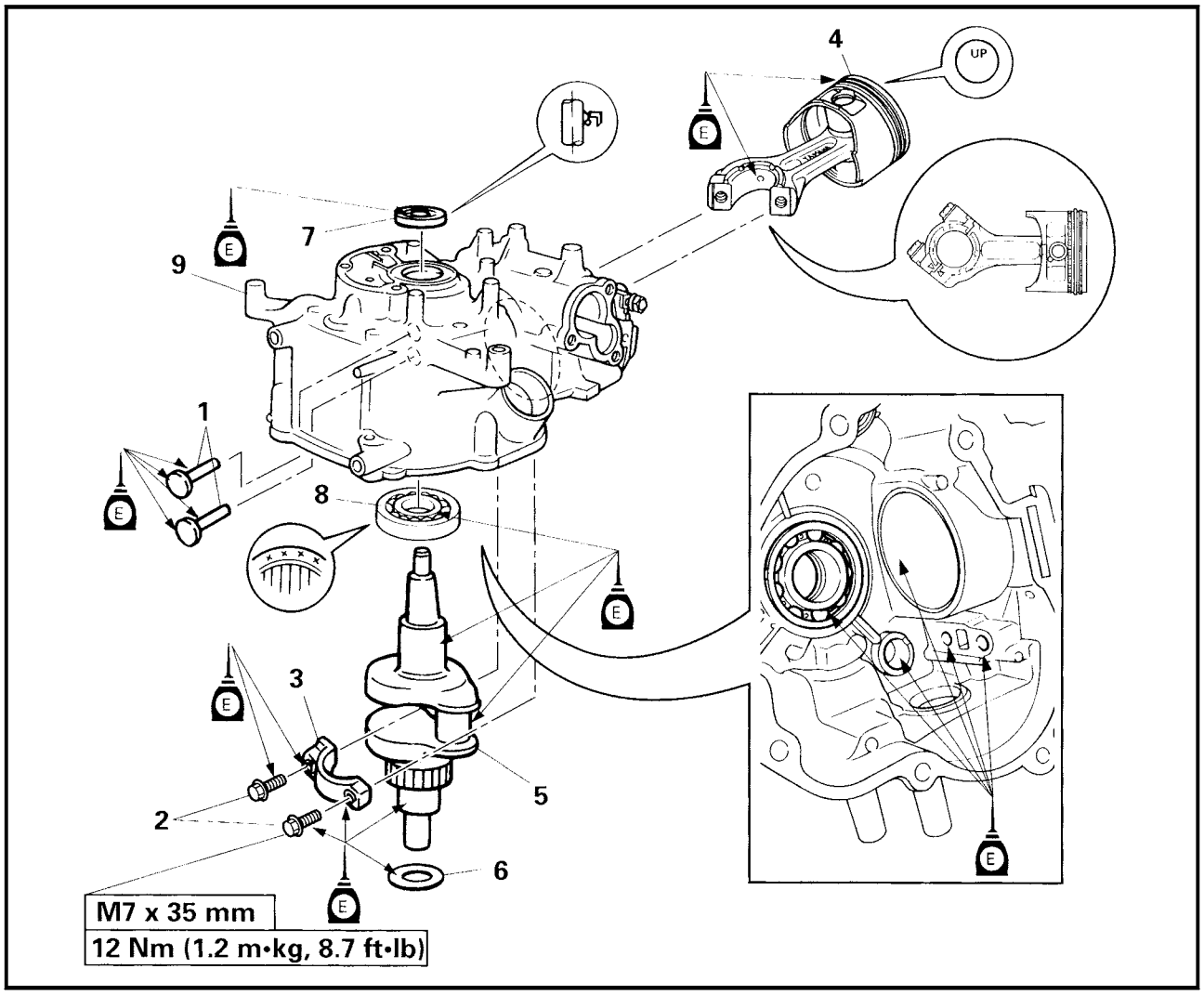



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CRANKCASE AND CAMSHAFT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Bolt (oil seal housing) | 1 | |
| 2 | Oil seal housing ass'y | 1 | |
| 3 | Bolt with washer (crankcase) | 7 | |
| 4 | Crankcase | 1 | |
| 5 | Camshaft ass'y | 1 | **NOTE:** When installing the camshaft, the crankshaft ass'y must be fitted to the cylinder body. |
| | | | Reverse the removal steps for installation. |

# CRANKSHAFT AND CYLINDER BODY

## EXPLODED DIAGRAM

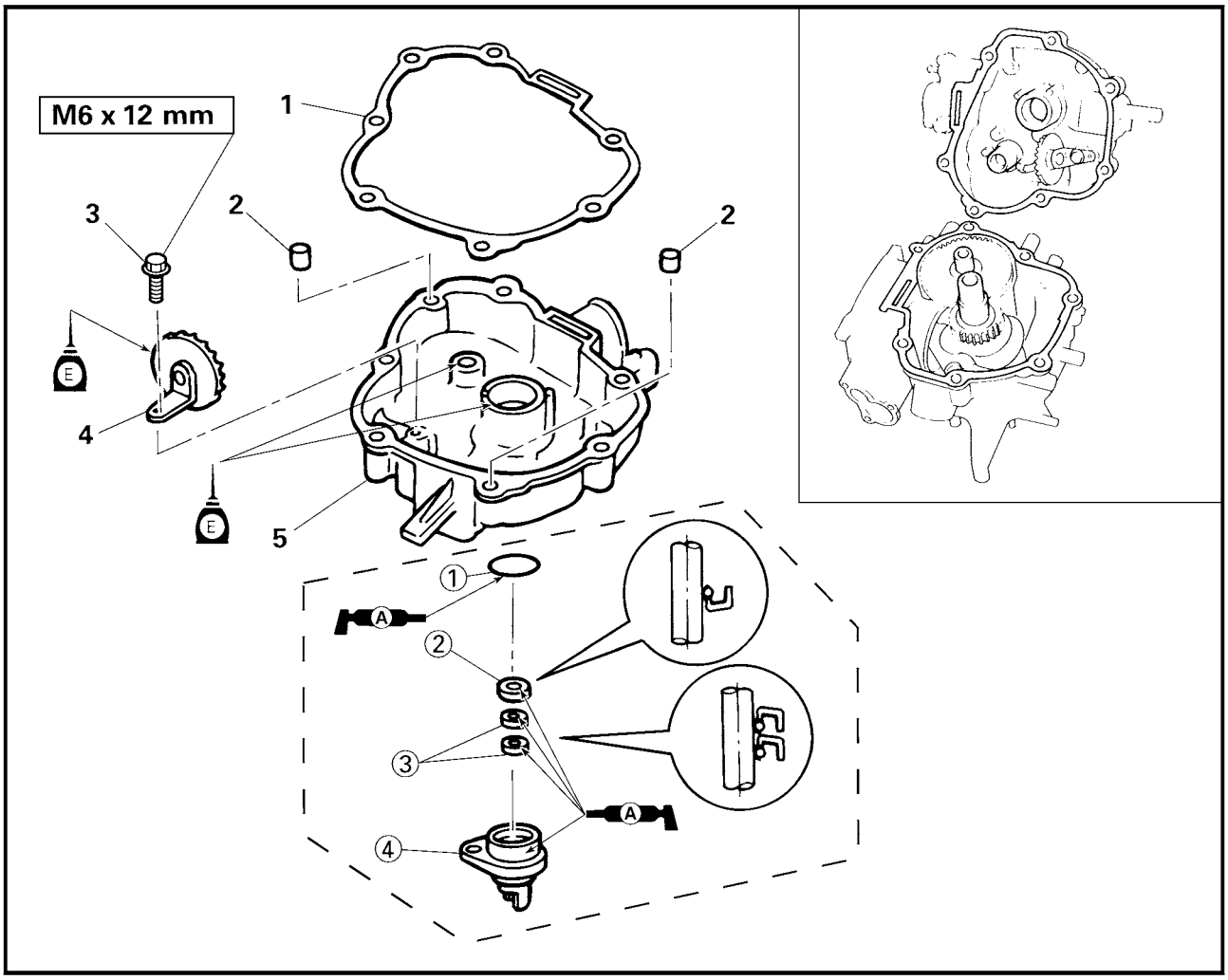



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CRANKSHAFT AND CYLINDER BODY REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Valve lifter | 2 | |
| 2 | Bolt (connecting rod cap) | 2 | |
| 3 | Connecting rod cap | 1 | |
| 4 | Connecting rod and piston ass'y | 1 | **NOTE:** Install the connecting rod and piston ass'y "YAMAHA" mark side to the rotor side. |
| 5 | Crankshaft | 1 | |
| 6 | Plate washer | 1 | |
| 7 | Oil seal (cylinder body) | 1 | **Not reusable** |
| 8 | Ball bearing | 1 | |
| 9 | Cylinder body | 1 | |
| | | | Reverse the removal steps for installation. |

# OIL SPLASHER GEAR AND OIL SEAL HOUSING

## EXPLODED DIAGRAM

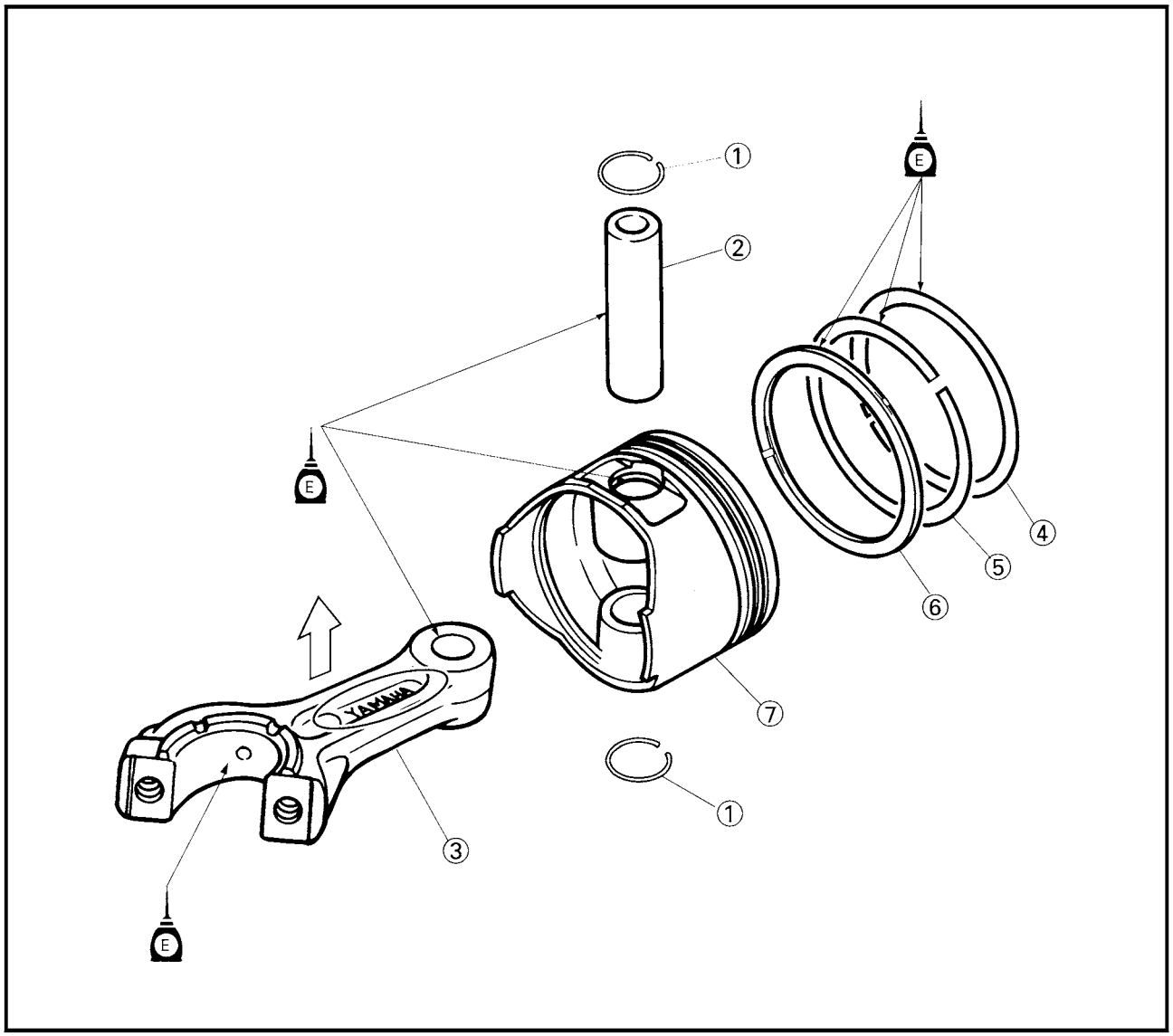



## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **OIL SPLASHER GEAR REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Gasket (crankcase) | 1 | **Not reusable** |
| 2 | Dowel pin | 2 | |
| 3 | Bolt (oil splasher gear) | 1 | |
| 4 | Oil splasher gear | 1 | |
| 5 | Crankcase | 1 | |
| | | | Reverse the removal steps for installation. |
| | **OIL SEAL HOUSING ASS'Y DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| ① | O-ring | 1 | |
| ② | Oil seal | 1 | **Not reusable** |
| ③ | Oil seal | 2 | |
| ④ | Oil seal housing | 1 | |
| | | | Reverse the disassembly steps for assembly. |

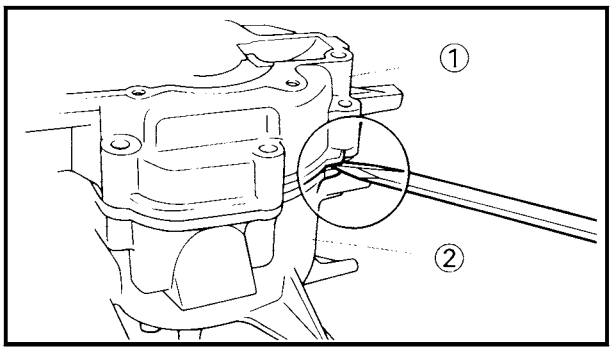
# CONNECTING ROD AND PISTON

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CONNECTING ROD AND PISTON DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| 1 | Piston pin clip | 2 | |
| 2 | Piston pin | 1 | |
| 3 | Connecting rod | 1 | |
| 4 | Top ring | 1 | **NOTE:** When reusing piston rings, mark them on the upper side for easy assemble. |
| 5 | 2nd ring | 1 | |
| 6 | Oil ring | 1 | |
| 7 | Piston | 1 | |
| | | | Reverse the disassembly steps for assembly. |




## SERVICE POINTS

### Crankcase removal

1. Remove:
   - Crankcase ①
   - Cylinder body ②

**NOTE:**

- Position the crankcase up side down.
- Insert a flat-head screwdriver between the tabs on both side of the crankcase and cylinder body and pry open the two parts.

**CAUTION:**

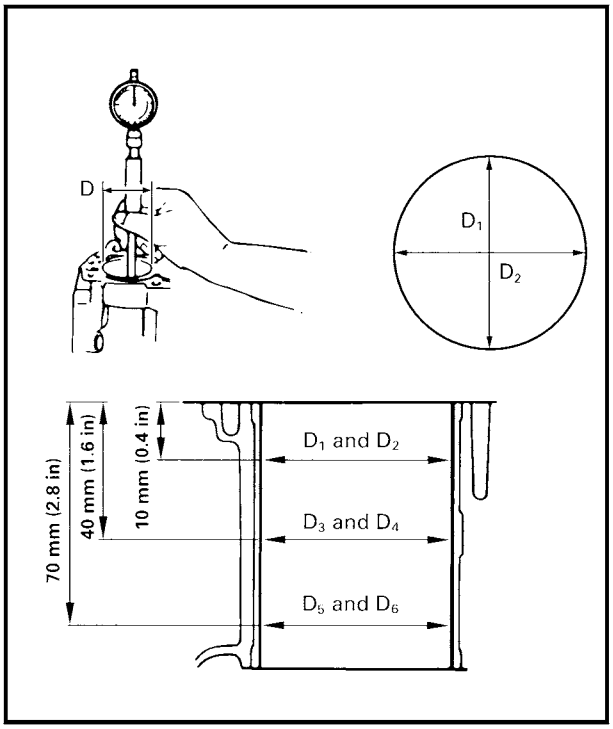
**Do not scratch the interface of the crankcase and cylinder.**

### Cylinder inspection

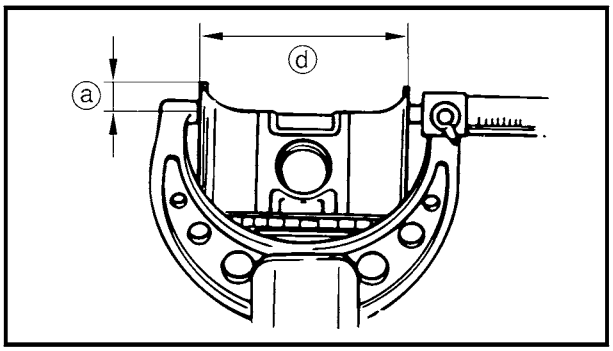
1. Measure:
   - Cylinder bore
     Out of specification → Rebore or replace the cylinder.

**NOTE:**

Measure the cylinder bore in parallel and at right angle to the crankshaft. Then, average the measurements.




| | Standard | Wear limit |
|---|---|---|
| Cylinder bore "D" | 59.00 ~ 59.02 mm (2.323 ~ 2.324 in) | — |
| Taper limit "T" | — | 0.08 mm (0.003 in) |
| Out of round limit | — | 0.05 mm (0.002 in) |
| D = Maximum Dia. ($D_1$ ~ $D_6$)<br>T = (maximum $D_1$ or $D_2$) ~ (minimum $D_5$ or $D_6$) | | |




### Piston inspection

1. Measure:
   - Piston diameter
     Out of specification → Replace the piston.

| | Distance ⓐ | Piston diameter ⓓ |
|---|---|---|
| Standard | 10 mm (0.39 in) | 58.950 ~ 58.965 mm (2.3209 ~ 2.3215 in) |

**Oversize piston diameter:**
***Over size 1: 59.25 mm (2.333 in)**
**Over size 2: 59.50 mm (2.343 in)**

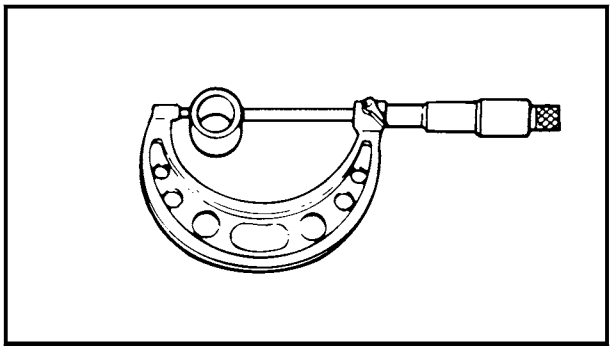
*Except for USA

**Piston-to-cylinder clearance inspection**

1. Calculate:
   - Piston-to-cylinder clearance
     Out of specification → Replace the piston and piston rings, the cylinder or both.

| Piston-to-cylinder clearance | = | Cylinder bore | – | Piston diameter |
|---|---|---|---|---|

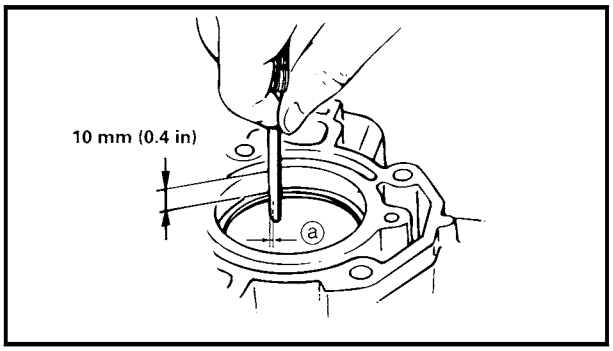
**Piston-to-cylinder clearance:**
**0.035 ~ 0.065 mm**
**(0.0014 ~ 0.0026 in)**



**Piston pin inspection**

1. Measure:
   - Piston pin outside diameter
     Out of specification → Replace the piston pin.

**Piston pin outside diameter:**
**12.995 ~ 13.000 mm**
**(0.5116 ~ 0.5118 in)**

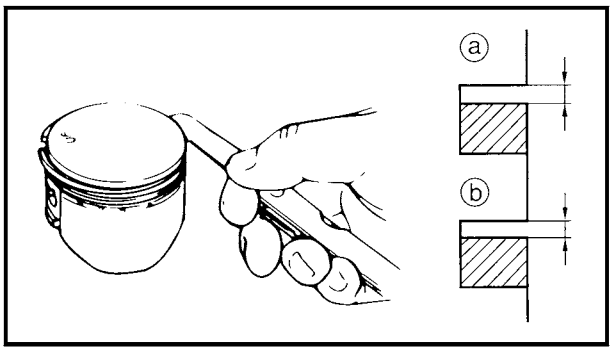



**Piston ring inspection**

1. Measure:
   - End gap ⓐ
     Out of specification → Replace the piston ring.

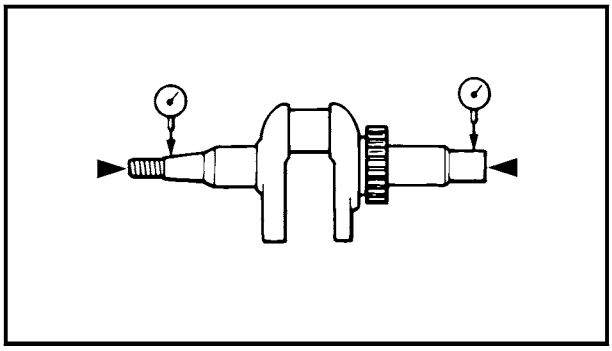
**End gap (installed)**
**Top ring:**
**0.10 ~ 0.20 mm**
**(0.004 ~ 0.008 in)**
**2nd ring:**
**0.25 ~ 0.40 mm**
**(0.010 ~ 0.016 in)**
**Oil ring:**
**0.2 ~ 0.7 mm (0.008 ~ 0.028 in)**

**NOTE:**
Push the piston ring into the cylinder with the piston crown.




2. Measure:
   - Side clearance
     Out of specification → Replace the piston and piston rings as a set.

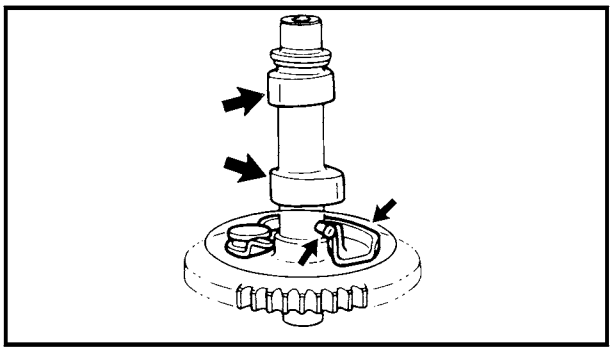
**Side clearance:**
**Top ring ⓐ:**
**0.04 ~ 0.08 mm**
**(0.002 ~ 0.003 in)**
**2nd ring ⓑ:**
**0.02 ~ 0.06 mm**
**(0.001 ~ 0.002 in)**



**Crankshaft inspection**

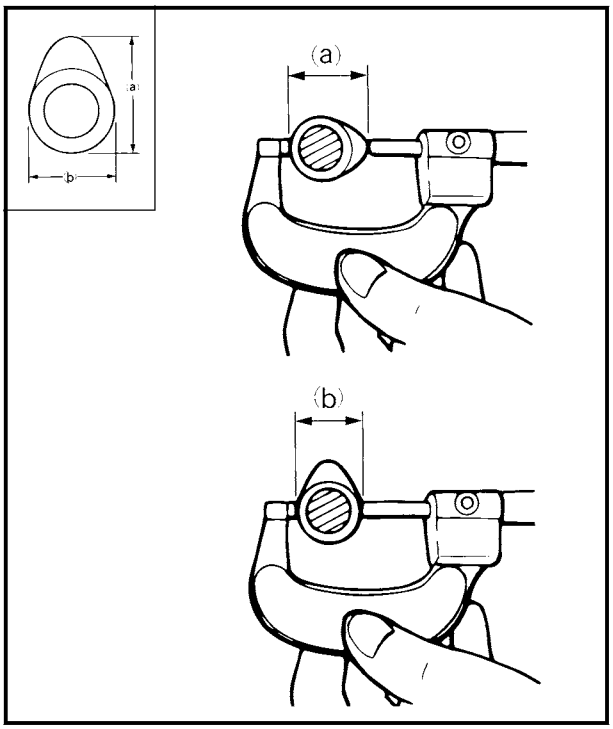
1. Measure:
   - Crankshaft runout
   - Crank pin diameter
     Out of specification → Replace the crankshaft.

**Crankshaft runout limit:**
**0.03 mm (0.0012 in)**
**Crank pin diameter limit:**
**25.95 mm (1.022 in)**



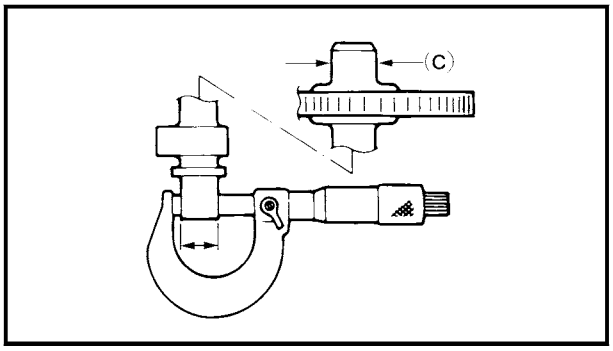
**Camshaft inspection**

1. Inspect:
   - Camshaft
   - Decompressor
   - Camshaft gear teeth
     Wear/damage/crack → Replace.
   - Weight and pin
     Unsmooth operation → Replace.



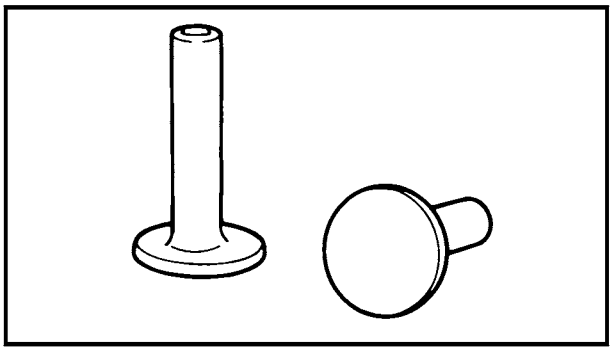

2. Measure:
   - Camshaft lobe dimensions ⓐ and ⓑ
     Out of specification → Replace the camshaft.

**Camshaft lobe dimension:**
**ⓐ Intake:**
**26.736 ~ 26.836 mm**
**(1.0526 ~ 1.0265 in)**
**ⓑ Intake:**
**21.950 ~ 22.050 mm**
**(0.8642 ~ 0.8681 in)**
**ⓐ Exhaust:**
**26.532 ~ 26.623 mm**
**(1.0442 ~ 1.0481 in)**
**ⓑ Exhaust:**
**21.950 ~ 22.050 mm**
**(0.8642 ~ 0.8681 in)**



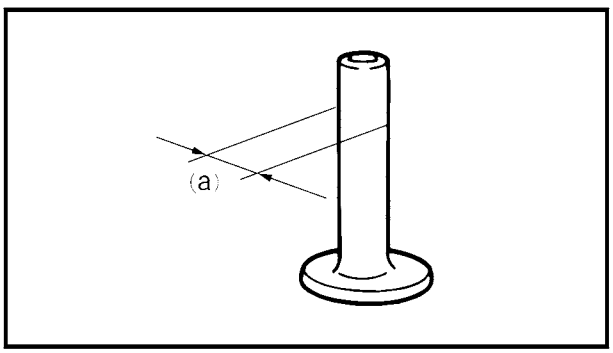

3. Measure:
   - Camshaft diameter ⓒ
     Out of specification → Replace the camshaft.

**Camshaft diameter (journal):**
**14.934 ~ 14.984 mm**
**(0.5880 ~ 0.5899 in)**



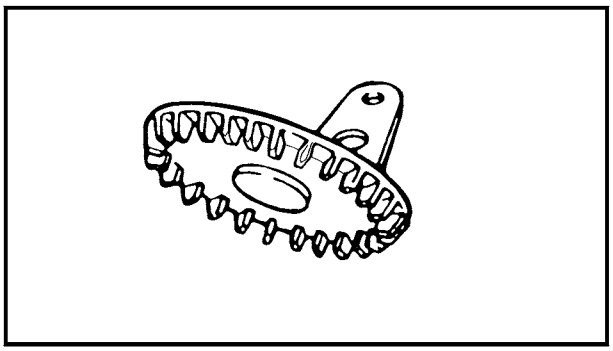
**Valve lifter inspection**

1. Inspect:
   - Valve lifter
     Wear/damage → Replace the valve lifter.



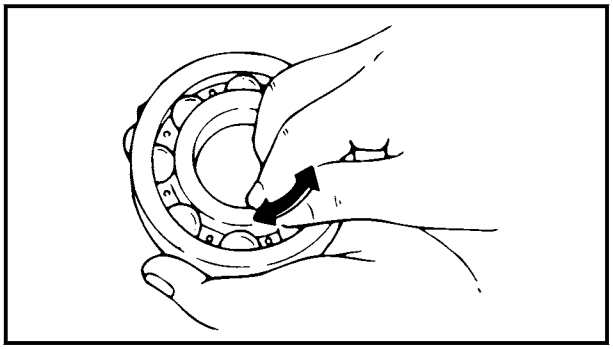

2. Measure:
   - Valve lifter outside diameter ⓐ
     Out of specification → Replace the valve lifter.

**Valve lifter outside diameter:**
**7.965 ~ 7.980 mm**
**(0.3136 ~ 0.3142 in)**



**Oil splash gear unit inspection**

1. Inspect:
   - Oil splash gear unit
   - Gear teeth
     Unsmooth operation → Replace.
     Wear/damage/crack → Replace.

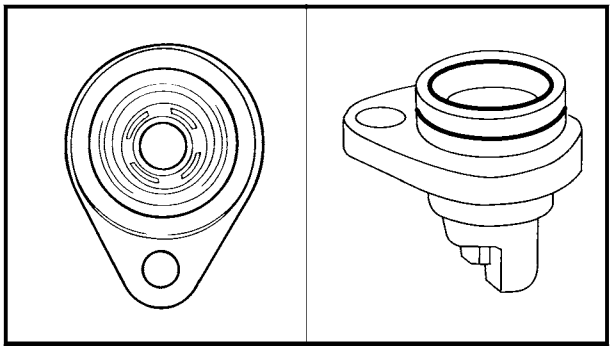


**Bearing inspection**

1. Inspect:
   - Bearing
     Pitting/rumbling → Replace.

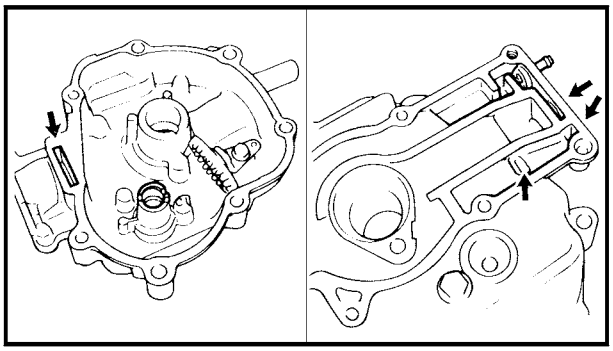
**NOTE:**

Turn the bearing by fingers and check the bearing pitching.



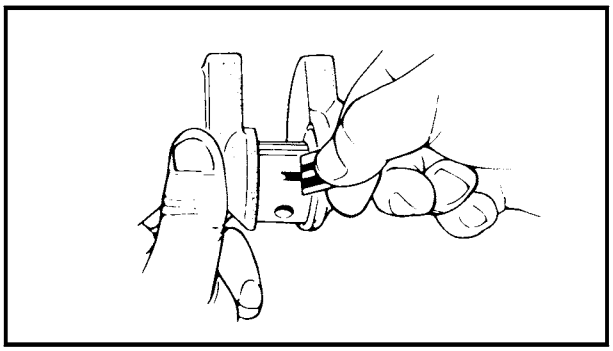
**Oil seal housing inspection**

1. Inspect:
   - Oil seal housing
     Crack/damage → Replace.



**Crankcase inspection**

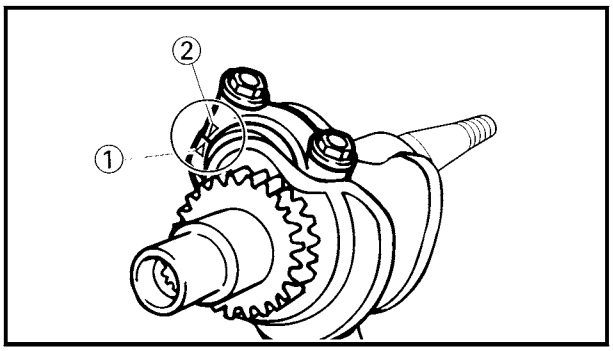
1. Inspect:
   - Crankcase
     (water passage and shaft holder)
     Crack/wear/damage → Replace.
     Clog/dusty → Clean.

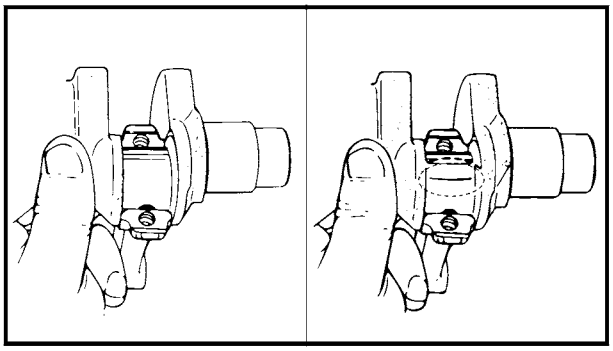


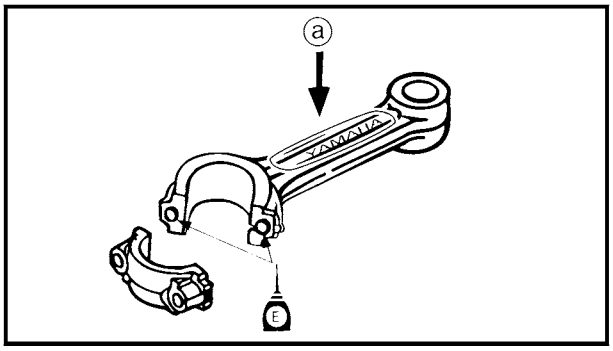
**Connecting rod oil clearance inspection**

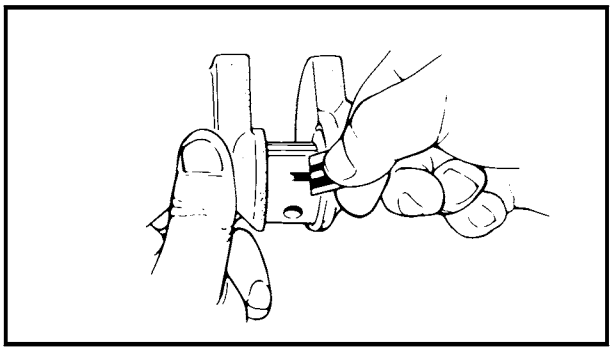
1. Measure:
   - Connecting rod big end oil clearance
     Out of specification → Replace the connecting rod as a set.

**Big end oil clearance:**
**0.016 ~ 0.046 mm**
**(0.0006 ~ 0.0018 in)**





**Measurement steps:**

**CAUTION:**

**Make sure that the "▽" connecting rod mark ① is aligned with the "△" cap mark ②.**

- Clean the cap and big end contact surface of the connecting rod.
- Fit the connecting rod to the crankshaft.
- Put a piece of Plastigauge® on to the crank pin.
- Assemble the connecting rod cap on to the crank pin.

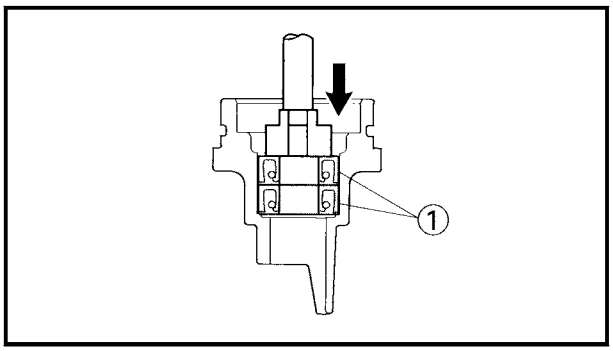
**NOTE:**

- Make sure that the "YAMAHA" mark ⓐ on the connecting rod faces upwards on the flywheel rotor ass'y.
- Do not move the crankshaft until big-end oil clearance measurement has been completed.

- Apply motor oil to the bolts and the bolt seat.
- Tighten the bolts to the specified torque.

| | |
|---|---|
|  | **Bolt: (connecting rod cap) 12 Nm (1.2 m • kg, 8.7 ft • lb)** |

- Remove the connecting rod cap.
- Measure the width of the compressed Plastigauge® on the crank pin.



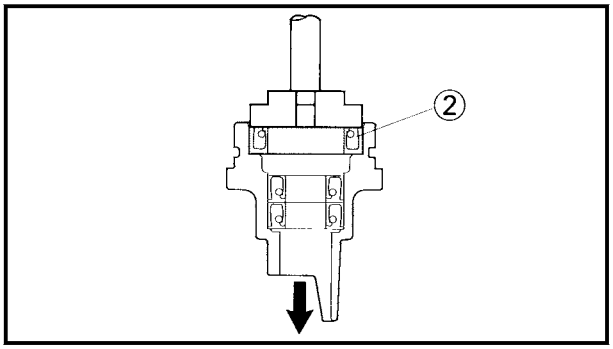

**Oil seal housing assembly**

1. Install:
   - Oil seals ①
     (housing lower and center)

**NOTE:**

Use the special tool, to install the two oil seals (one by one).

**Driver rod:**
**YB-06229/90890-06652**
**Bushing attachment:**
**YB-06230/90890-06649**

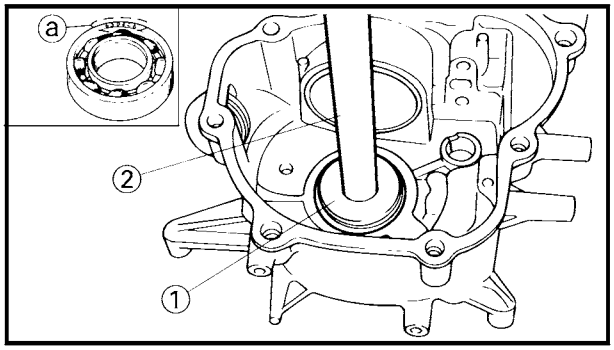



2. Install:
   - Oil seal ② (upper housing)

**NOTE:**

Install the Oil seal direction upside down as shown.

**Needle bearing attachment:**
**YB-06168/90890-06613**
**Driver rod:**
**YB-06071/90890-06652**



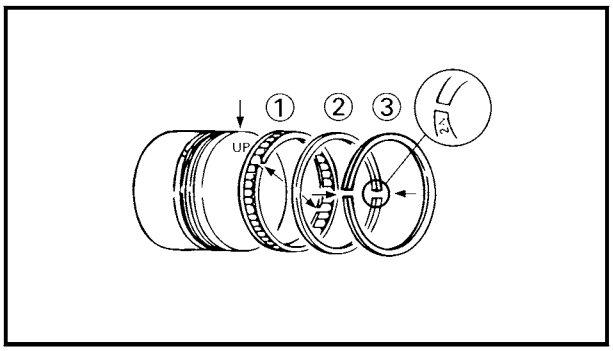

**Crankshaft bearing installation**

1. Install:
   - Crankshaft bearing

**NOTE:**

Fit the ball bearing with its manufacturer's marks ⓐ in the direction of the flywheel rotor side.

**Install:**
**Bearing attachment ①:**
**YB-06085/90890-06624**
**Driver rod ②:**
**YB-06071/90890-06605**
**Remove:**
**Bearing attachment:**
**YB-06153/90890-06612**
**Driver rod:**
**YB-06071/90890-06652**

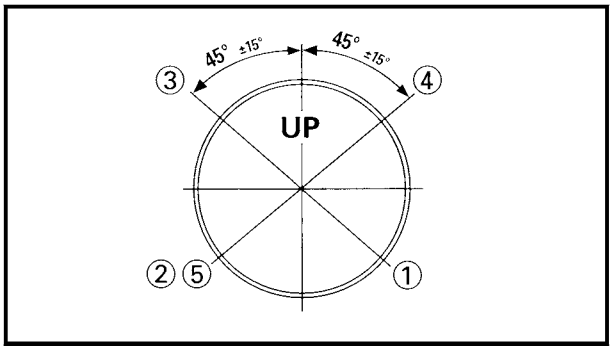



**Piston ring installation**

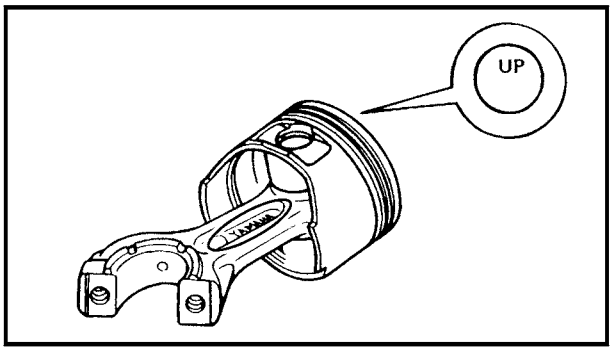
1. Install:
   - Oil ring ①
   - 2nd piston ring ②
   - Top piston ring ③

**NOTE:**

- Install the oil ring, by first fitting the expander ring and then installing the side rail ring.
- Make sure that the "2N" mark is on the 2nd upper ring to install the piston.
- When reusing the top ring, be sure to mark and install in the original upward position.
- After installing the piston rings, check that they move smoothly.

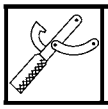



2. Offset the piston ring and oil ring end gaps as shown.
   - Oil ring end gap ① (lower rail)
   - Oil ring end gap ② (expander ring)
   - Oil ring end gap ③ (upper rail)
   - 2nd piston ring end gap ④
   - Top piston ring end gap ⑤




**Connecting rod and piston installation**

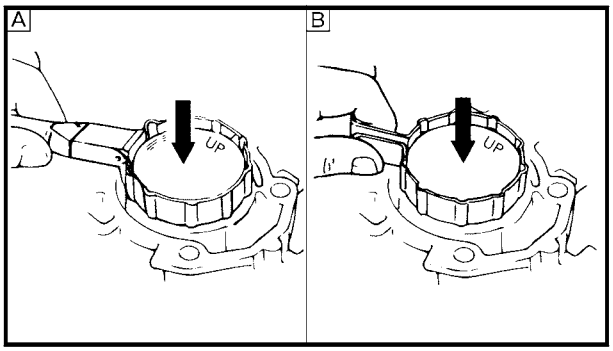
1. Install:
   - Connecting rod
   - Piston



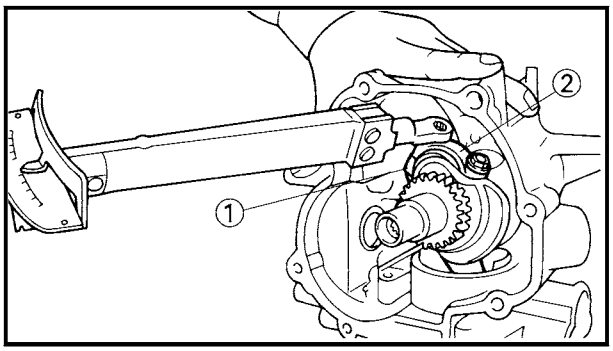
**Piston slider:**
**YB-34454/90890-06529**

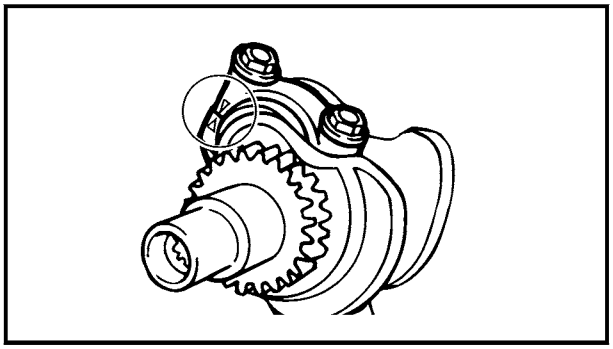
**CAUTION:**

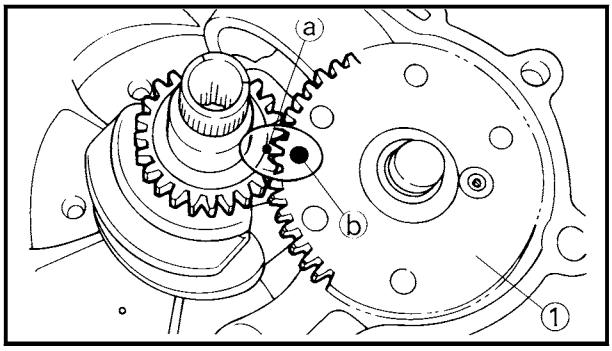
- **Make sure that the end gap of each ring is positioned correctly, then install the piston.**
- **Install the connecting rod and piston with the marks "YAMAHA" and "UP" facing the flywheel rotor.**

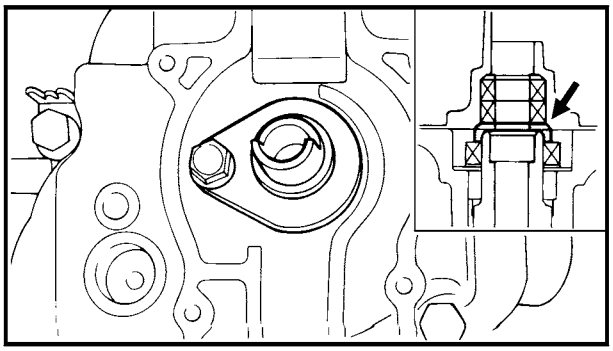


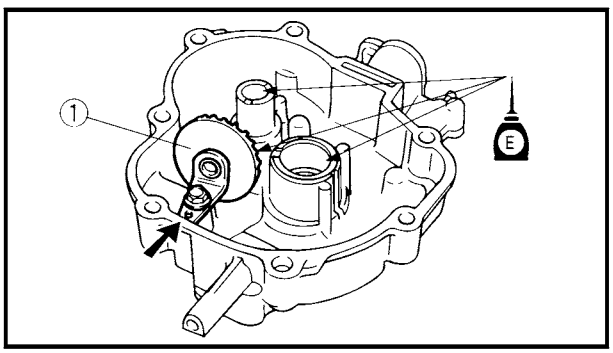

A For USA and CANADA
B Except for USA and CANADA








**Connecting rod installation**

1. Install:
   - Crankshaft
   - Connecting rod ①
   - Connecting rod cap ②

   Use the torque wrench to tighten.

| | |
|---|---|
| | **Bolt (Connecting rod cap): 12 Nm (1.2 m • kg, 8.7 ft • lb)** |

**CAUTION:**

**Make sure that the "▽" connecting rod mark is aligned with the "△" cap mark.**

**NOTE:**

- Apply motor oil to the bolts and bolt seat.
- First install the crankshaft, then install the connecting rod and tighten with torque wrench as shown.

**Camshaft installation**

1. Install:
   - Camshaft ①

**CAUTION:**

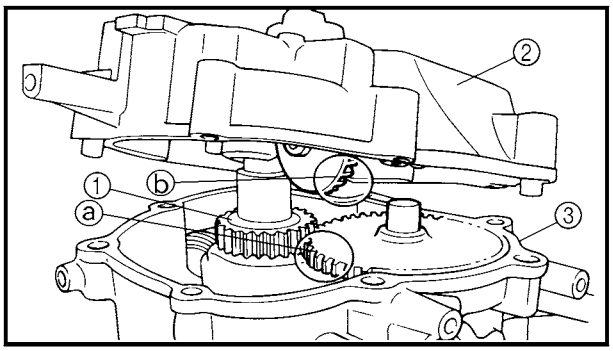
**Make sure that the "●" crankshaft gear mark ⓐ is aligned with the "●" camshaft gear mark ⓑ.**

**Crankcase assembly**

1. Install:
   - Oil seal housing ass'y
   - Oil splash gear unit ①

**NOTE:**

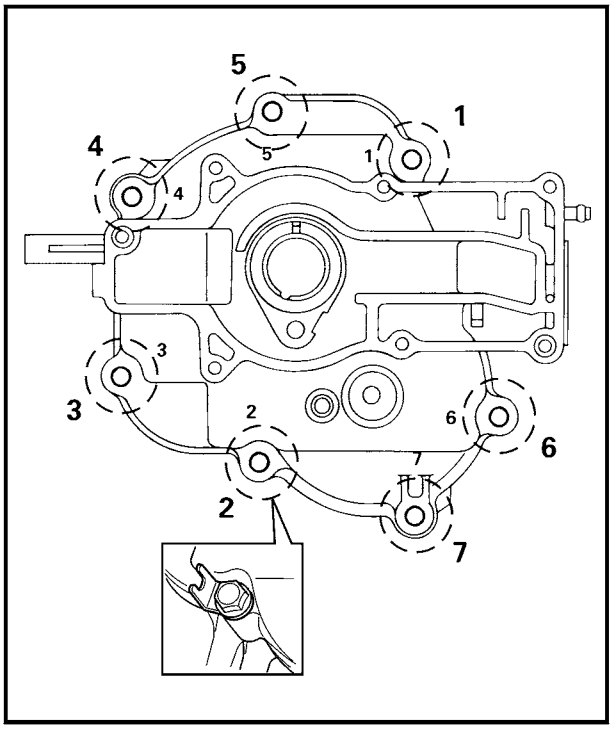
- Apply grease as shown, before installation.
- Set the hole of the gear unit holder to the notch on the crankcase.



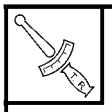

2. Install:
   - Plate washer ①
   - Dowel pin
   - Gasket (crankcase)
   - Crankcase ②
   - Cylinder body ③

**CAUTION:**

- **When assembling the crankcase and cylinder body, make sure that the camshaft gear teeth ⓐ mesh with the oil splash gear ⓑ.**
- **If the crankcase mating surfaces are not fitted properly, give a slight turn to the oil splash gear to correct it.**




3. Tighten:
   - Bolt (crankcase)



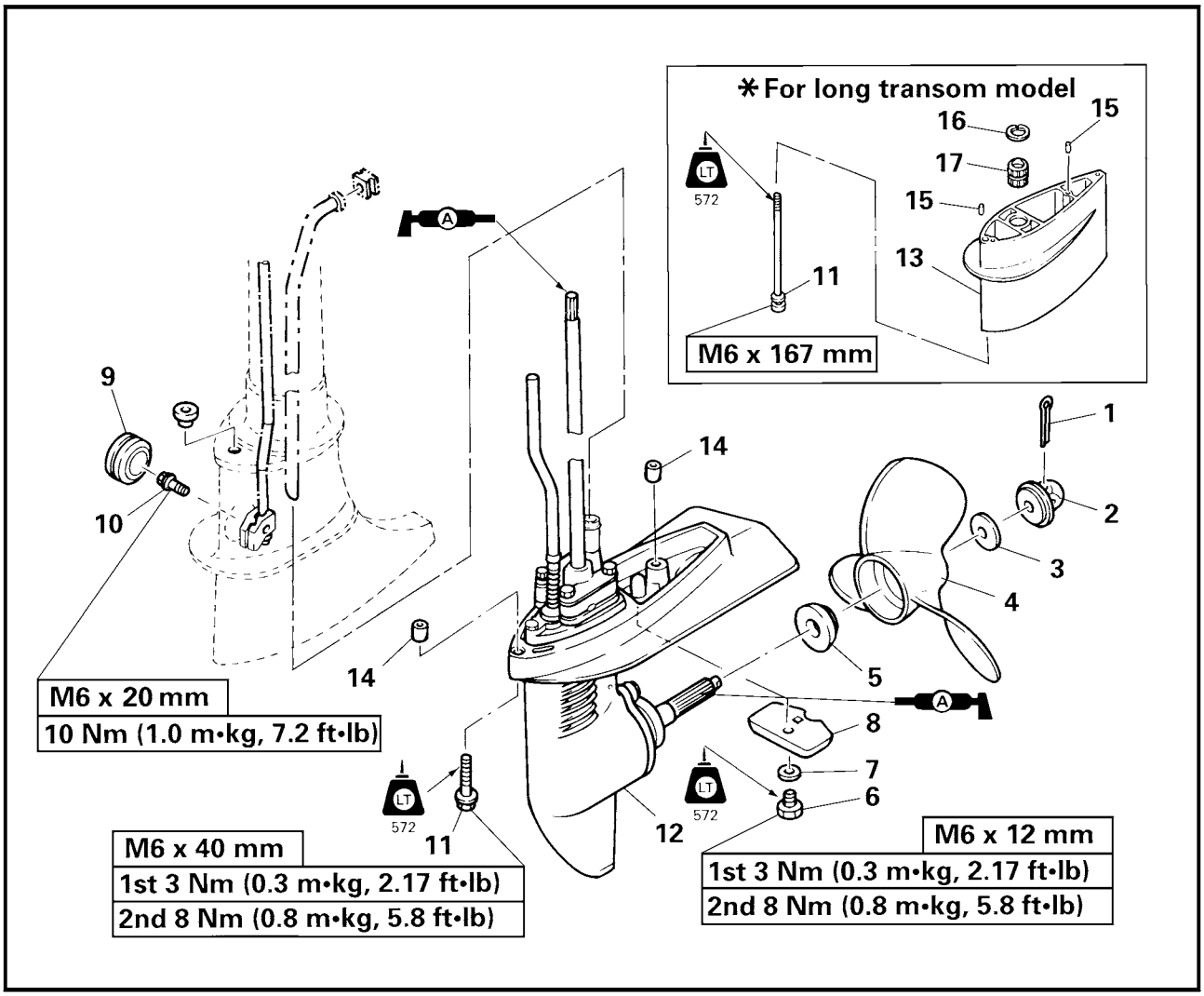
**Bolt:**
**1st: 10 Nm (1.0 m • kg, 7.2 ft • lb)**
**2nd: 22 Nm (2.2 m • kg, 16 ft • lb)**

**NOTE:**

Make sure tightening sequence is observed as shown.

# CHAPTER 6
# LOWER UNIT

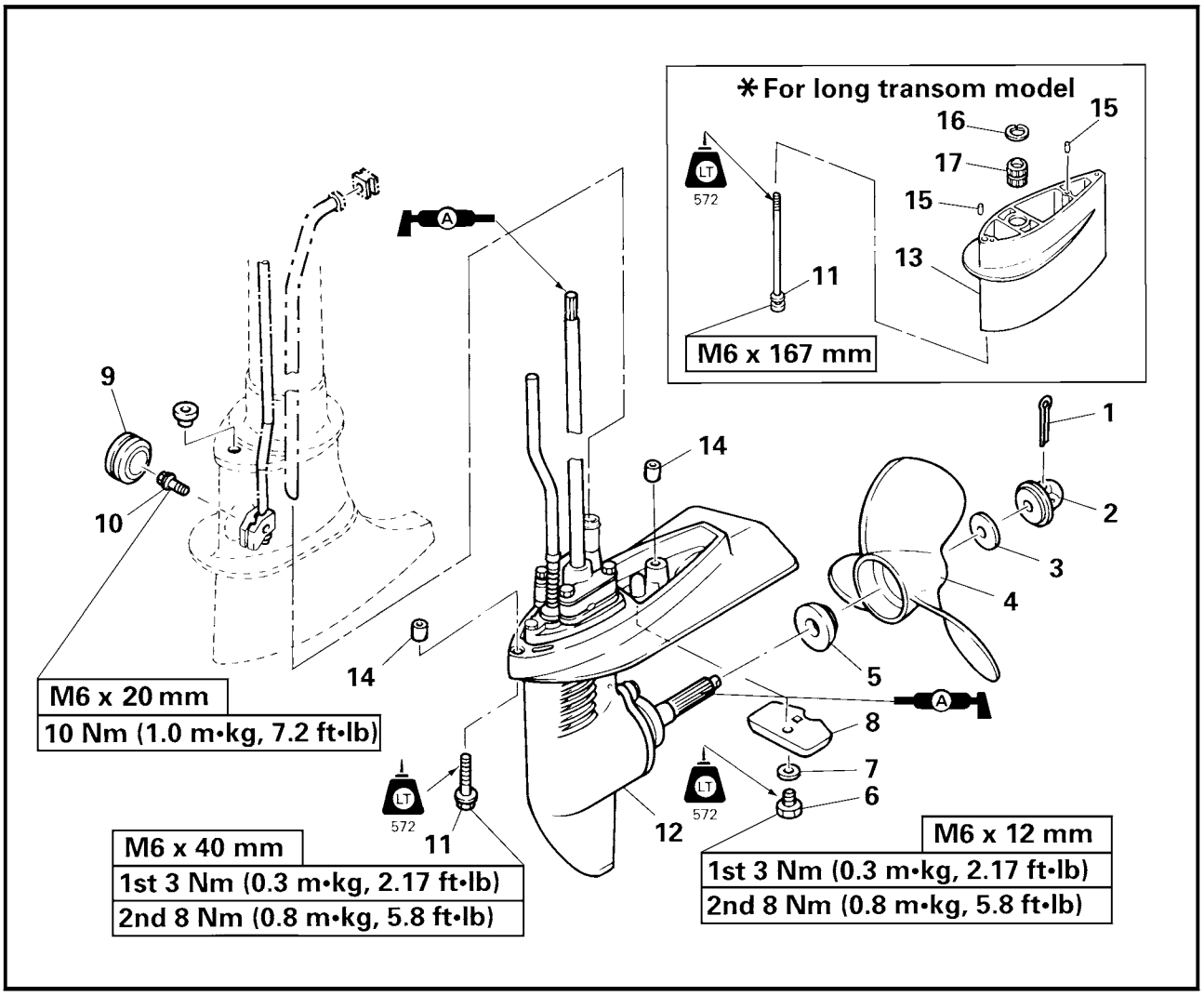
# LOWER UNIT
## EXPLODED DIAGRAM



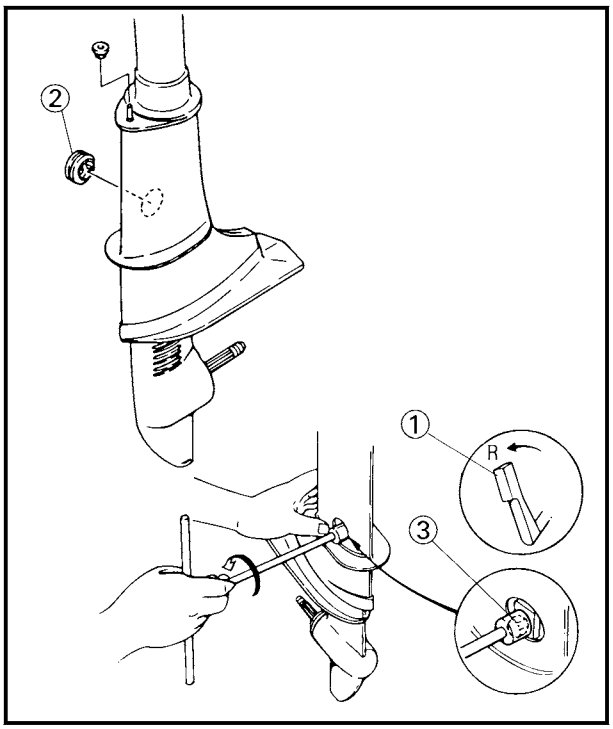

## REMOVAL AND INSTALLATION CHART

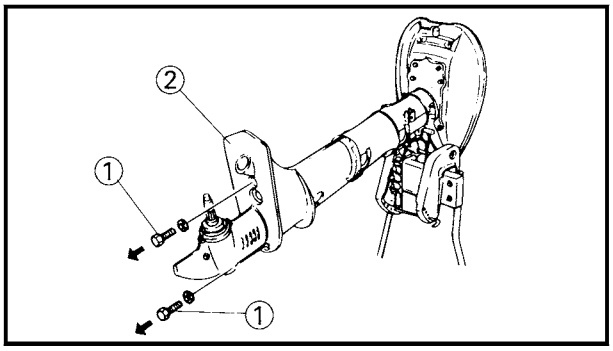
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **LOWER UNIT REMOVAL** | | Follow the left "Step" for removal. |
| 1 | Cotter pin | 1 | **Not reusable** |
| 2 | Propeller nut | 1 | |
| 3 | Washer | 1 | |
| 4 | Propeller | 1 | |
| 5 | Spacer | 1 | |
| 6 | Bolt (anode) | 1 | |
| 7 | Toothed washer (anode) | 1 | |
| 8 | Anode | 1 | |
| 9 | Grommet | 1 | |
| 10 | Bolt (shift rod connector) | 1 | **NOTE:** Set the shift lever to reverse position, and loosen the bolt (shift rod connector). |

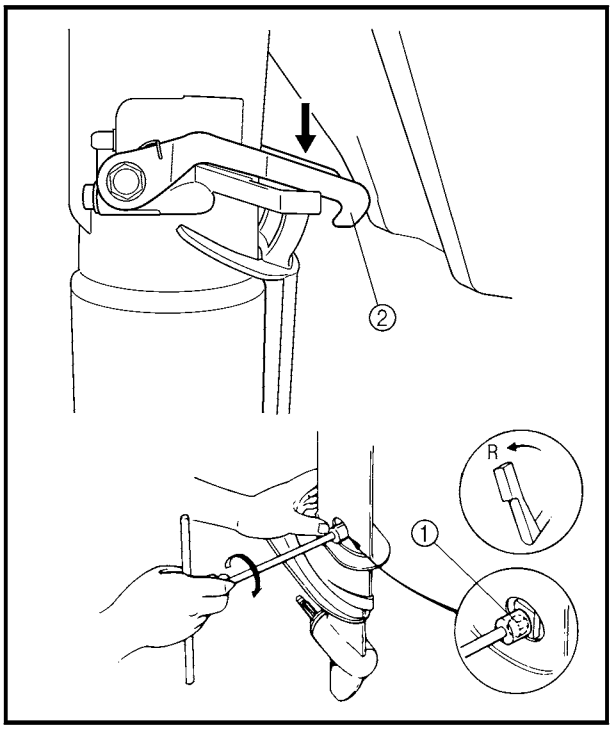
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 11 | Bolt with washer (lower unit) | 2 | For S-transom model<br>*For L-transom model<br>**NOTE:**<br>When removing, screw out the bolt (rear) from upper case and remove the lower unit with extension. |
| 12 | Lower unit ass'y | 1 | |
| 13 | Lower unit with extension | 1 | For L-transom model |
| 14 | Dowel pins | 2 | |
| 15 | Dowel pins | 2 | For L-transom model |
| 16 | Circlip | 1 | |
| 17 | Bushing | 1 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

### Lower unit removal

**NOTE:**

- It is possible to remove the Lower unit from the upper case without removing the power unit.
- Set the shift lever ① to "REVERSE" position, then remove and install the lower unit.

1. Remove:
   - Grommet ②
2. Loosen:
   - Bolt ③ (shift rod connector)

3. Remove:
   - Bolt ① (lower unit)
   - Lower unit ②

**NOTE:**

For long transom model:

- When removing, screw out the bolt (rear) from upper case and remove the lower unit with extension.
- When installing, hold the bolt (rear) in hole of the extension and install the lower unit with extension to the upper case.

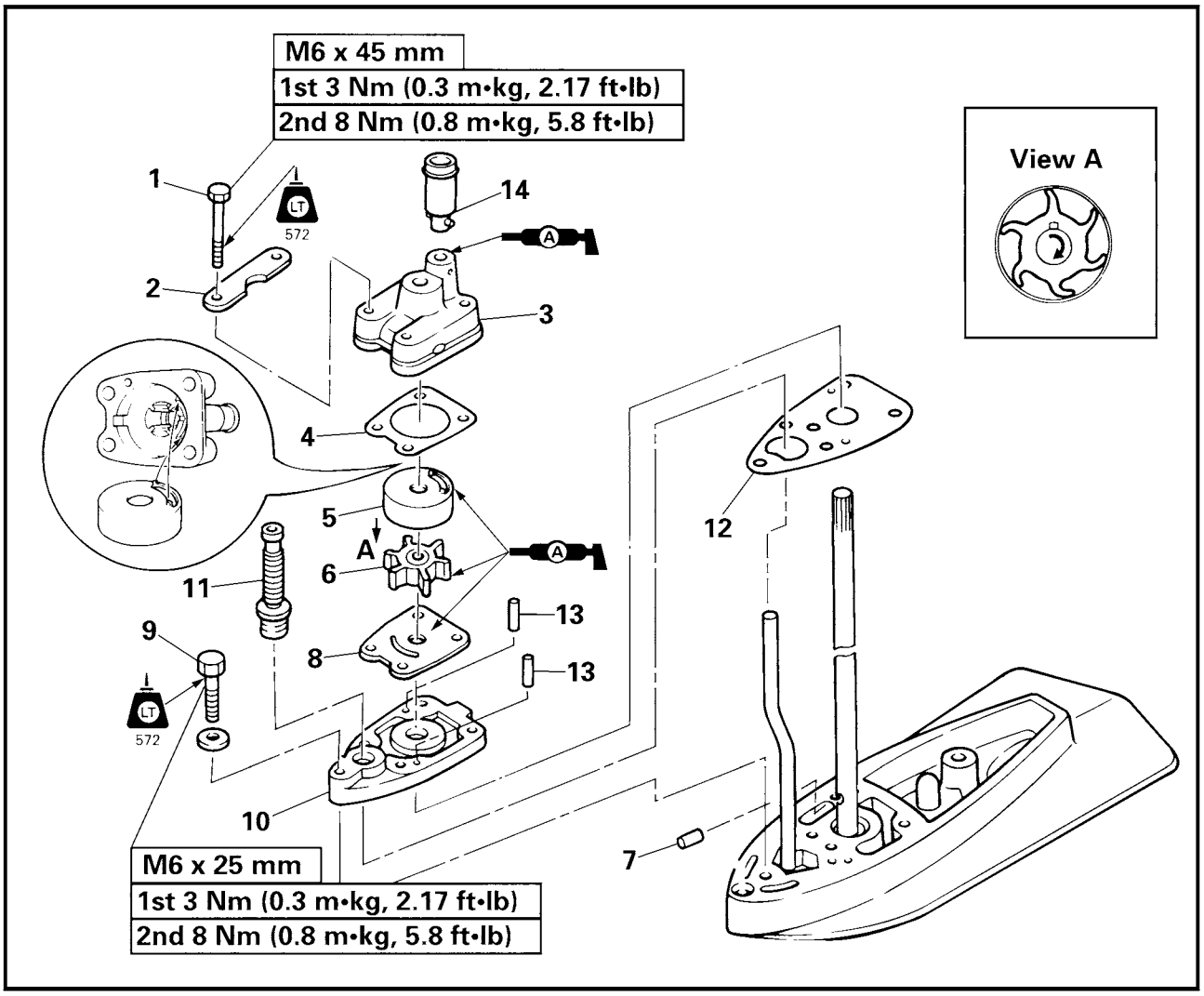
### Lower unit installation

1. Tighten:
   - Bolt ① (shift rod connector)

**NOTE:**

Push down the tilt lock plate ② until it contacts the stopper and locate the shift lever in "REVERSE" position. Then tighten the bolt ①.

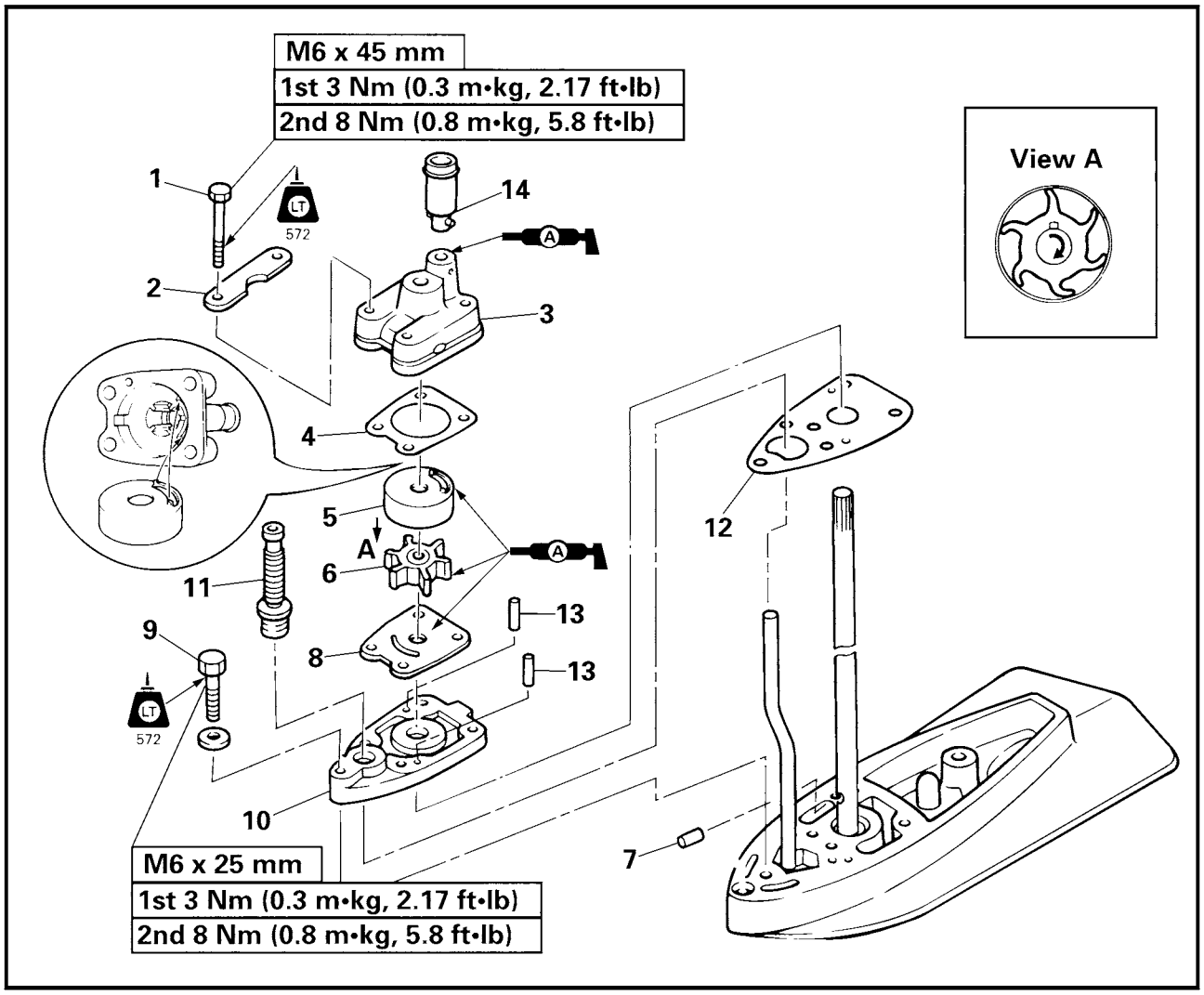
# WATER PUMP
## EXPLODED DIAGRAM



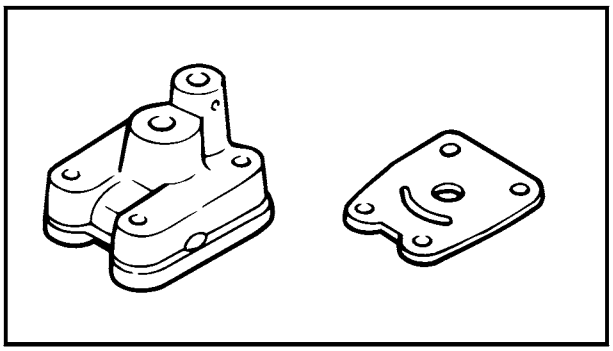

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **WATER PUMP REMOVAL** | | Follow the left "Step" for removal. |
| | Lower unit ass'y | | |
| 1 | Bolt (water pump) | 4 | |
| 2 | Plate | 2 | |
| 3 | Water pump housing | 1 | **NOTE:** To install the water pump housing with the insert cartridge, turn the drive shaft clockwise. |
| 4 | Gasket (water pump) | 1 | **Not reusable** |
| 5 | Insert cartridge | 1 | |
| 6 | Impeller | 1 | |
| 7 | Pin (impeller) | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 8 | Outer plate cartridge | 1 | |
| 9 | Bolt (plate) | 1 | |
| 10 | Plate | 1 | |
| 11 | Shift rod boots | 1 | |
| 12 | Lower casing packing | 1 | **Not reusable** |
| 13 | Dowel pin (plate) | 2 | |
| 14 | Boots | 1 | |
| | | | Reverse the removal steps for installation. |

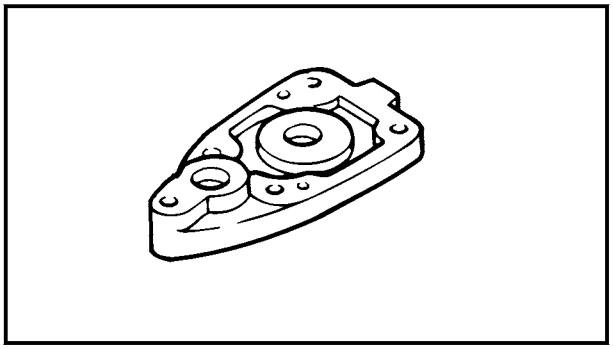


## SERVICE POINTS

### Water pump housing inspection

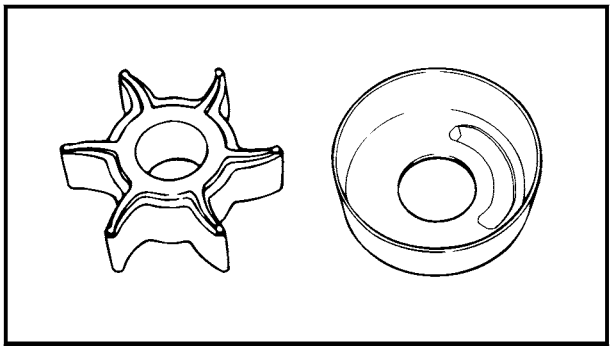
1. Inspect:
   - Water pump housing
   - Outer plate cartridge

   Crack/twist/scratch/damage → Replace.



2. Inspect:
   - Plate

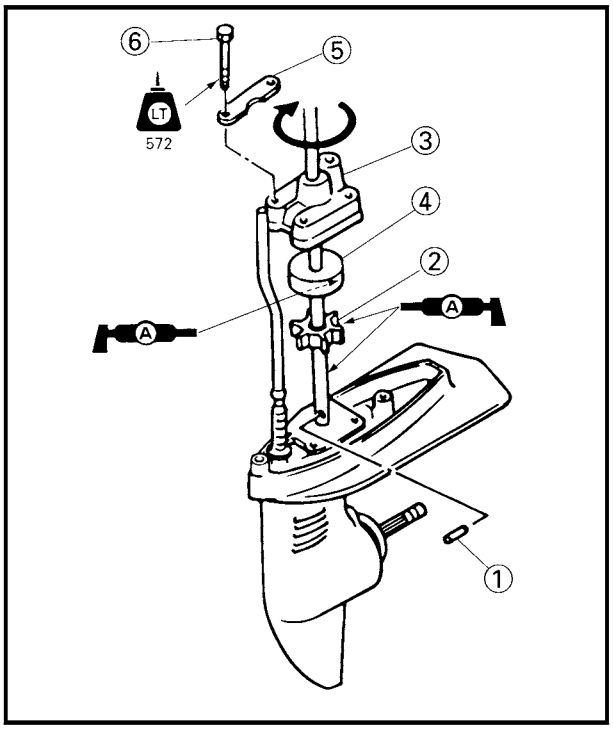
   Crack/twist/scratch/damage → Replace.



### Impeller and insert cartridge inspection

1. Inspect:
   - Impeller
   - Insert cartridge

   Crack/distortion/burning/damage → Replace.




### Water pump installation

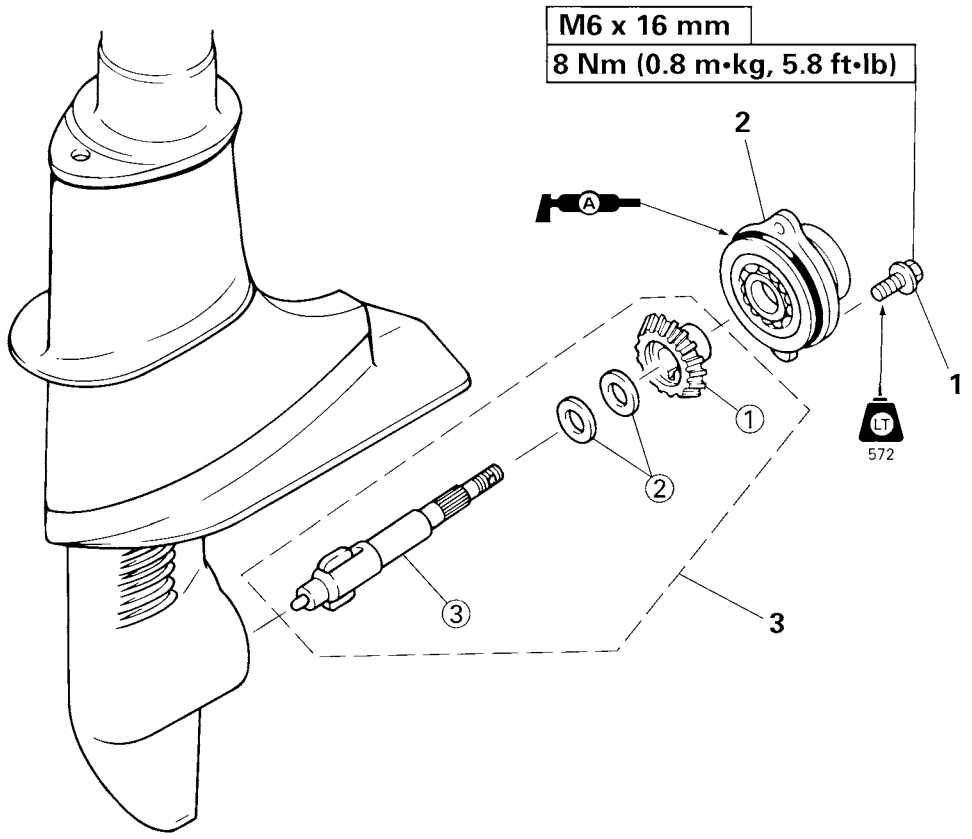
**NOTE:**

- When removing or installing the impeller, apply a thin coat of water resistant grease to the entire surface of the drive shaft.
- Apply the grease to the impeller blades, insert cartridge inner surface.
- Be sure to turn the drive shaft clockwise, otherwise the impeller blade will be twisted the other way. thus reducing pump performance.

1. Install:
   - Dowel pin ① (drive shaft)
   - Impeller ②
   - Water pump housing ③ with insert cartridge ④
   - Plate ⑤
   - Bolt ⑥

# LOWER CASING CAP ASS'Y, REVERSE GEAR AND PROPELLER SHAFT

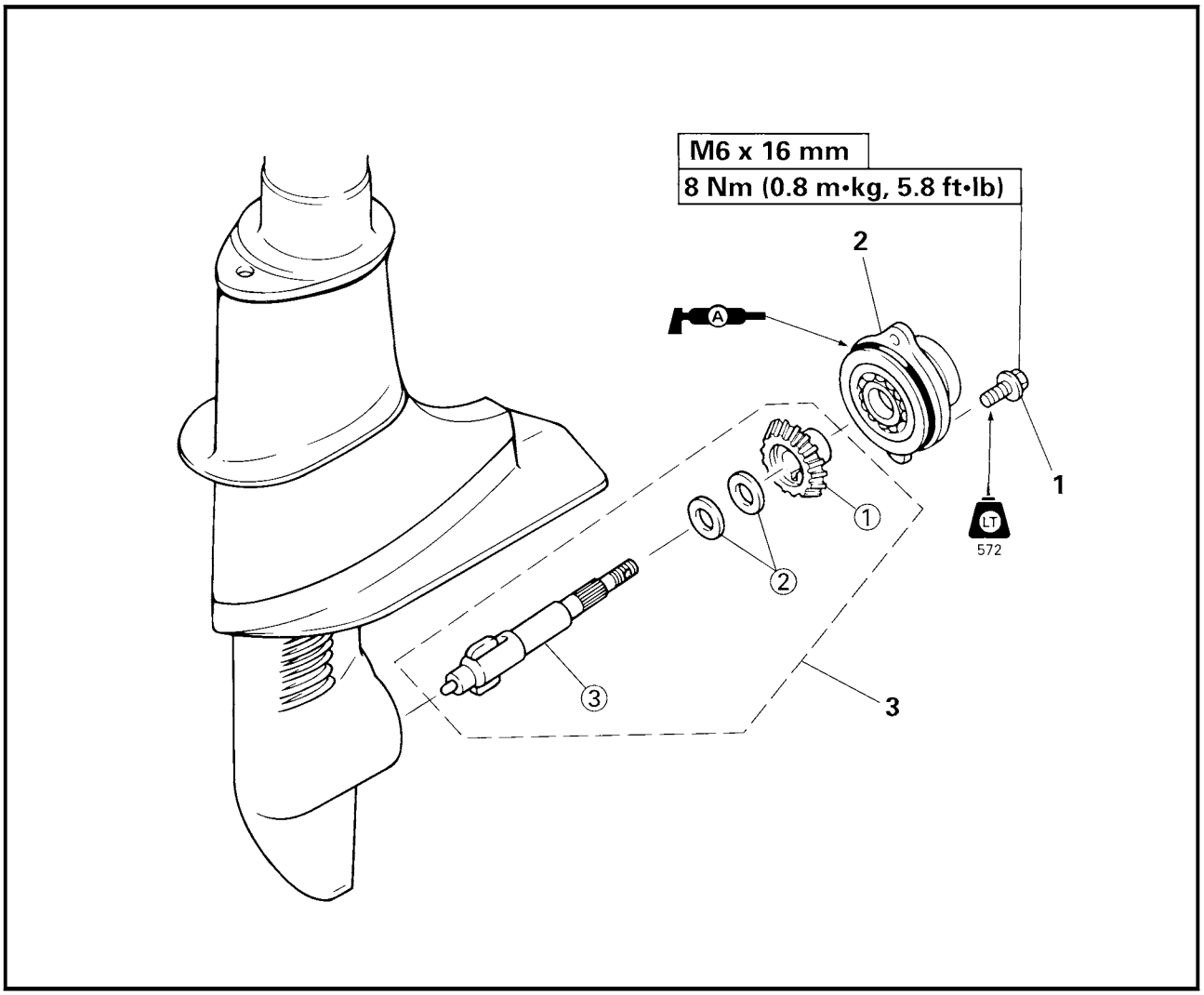
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

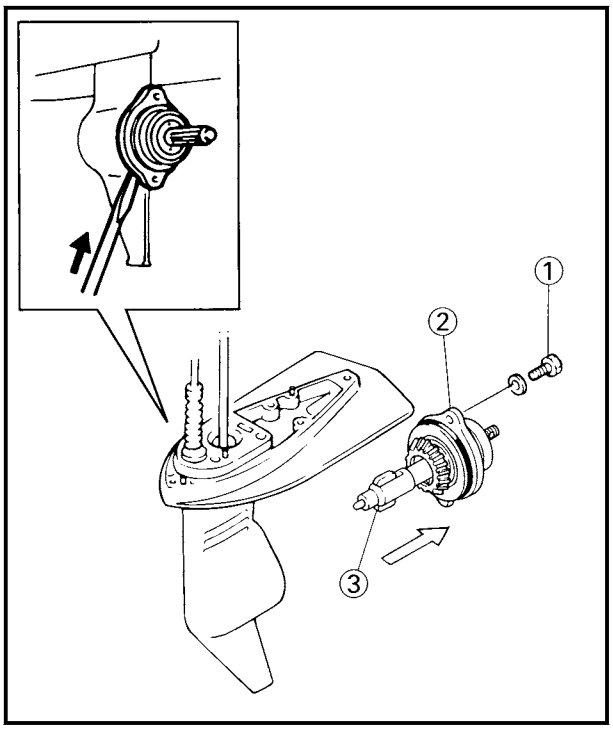
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **LOWER CASING CAP ASS'Y, REVERSE GEAR AND PROPELLER SHAFT REMOVAL** | | Follow the left "Step" for removal. |
| | Gear oil | | |
| | Propeller | | |
| 1 | Bolt (lower casing cap) | 2 | |
| 2 | Lower casing cap ass'y | 1 | **NOTE:** When installing, mesh the teeth of reverse gear with pinion gear by turning the drive shaft, then install the lower casing cap ass'y. |
| 3 | Propeller shaft | 1 | Reverse the removal steps for installation. |

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **PROPELLER SHAFT WITH REVERSE GEAR DISASSEMBLY** | | Follow the left "Step" for removal. |
| ① | Reverse gear | 1 | |
| ② | Thrust washer | 2 | |
| ③ | Propeller shaft ass'y | 1 | |
| | | | Reverse the disassembly steps for assembly. |



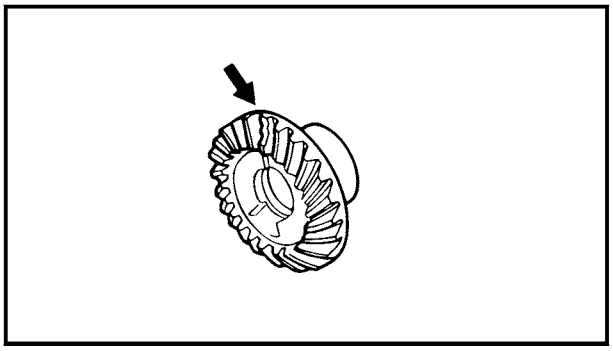

## SERVICE POINTS

**Lower casing cap ass'y, reverse gear and propeller shaft removal**

1. Remove:
   - Bolts ①
   - Lower casing cap ass'y ② with propeller shaft ③

**NOTE:**

Insert a flat head screwdriver into the slit between the sealing surfaces of the Lower case, and pry them slightly open.



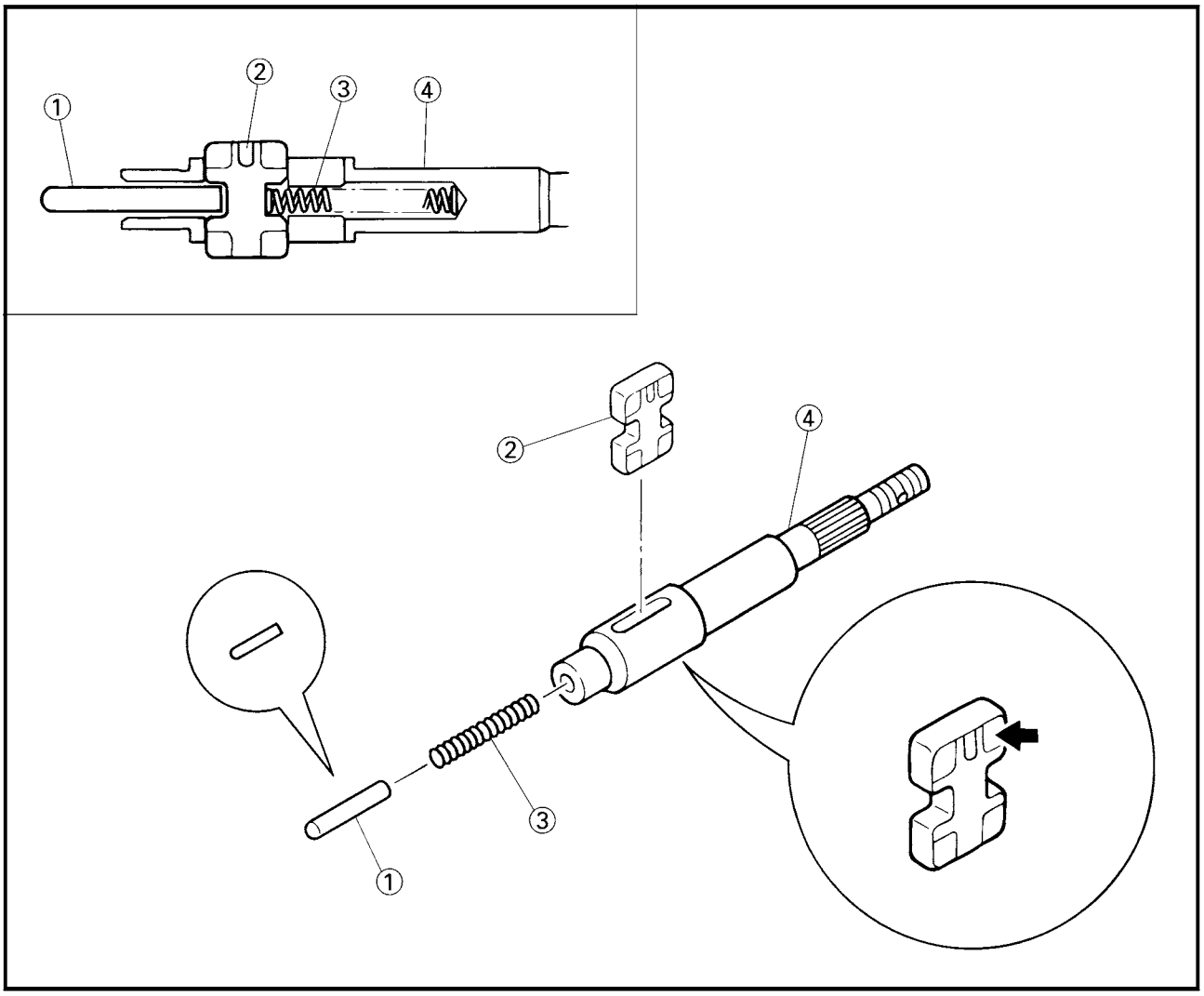
**Reverse gear inspection**

1. Inspect:
   - Tooth
   - Dog

   Wear/damage → Replace.

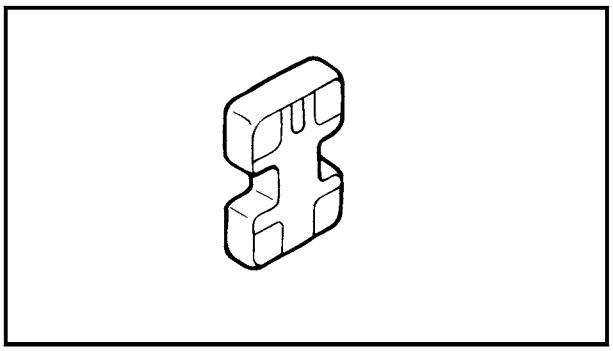
# PROPELLER SHAFT ASS'Y

## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

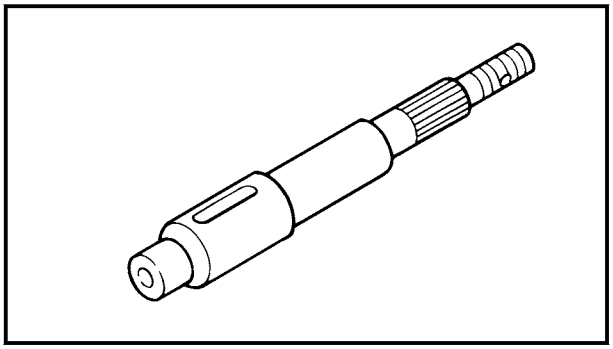
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **PROPELLER SHAFT ASS'Y DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| ① | Shift plunger | 1 | |
| ② | Dog clutch | 1 | |
| ③ | Shift spring | 1 | |
| ④ | Propeller shaft | 1 | |
| | | | Reverse the disassembly steps for assembly. |



## SERVICE POINTS

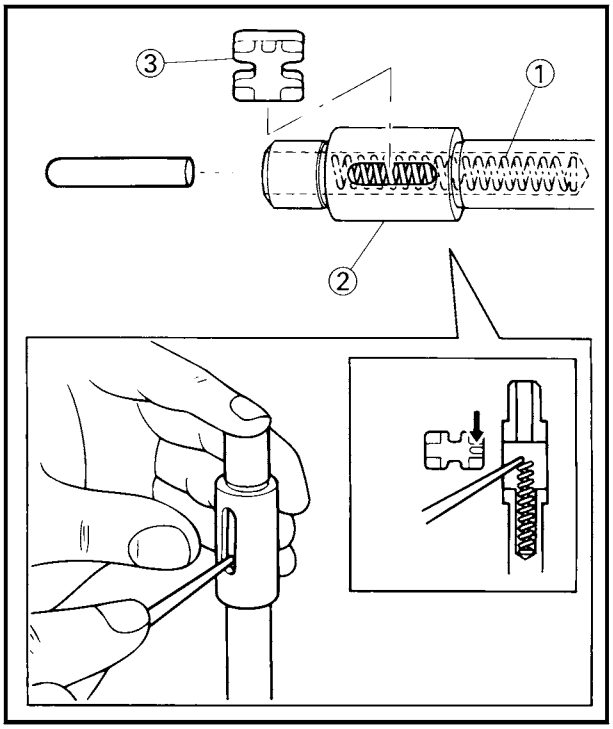
### Dog clutch inspection

1. Inspect:
   - Dog clutch
     Wear/damage → Replace.



### Propeller shaft inspection

1. Inspect:
   - Propeller shaft
     Wear/damage → Replace.



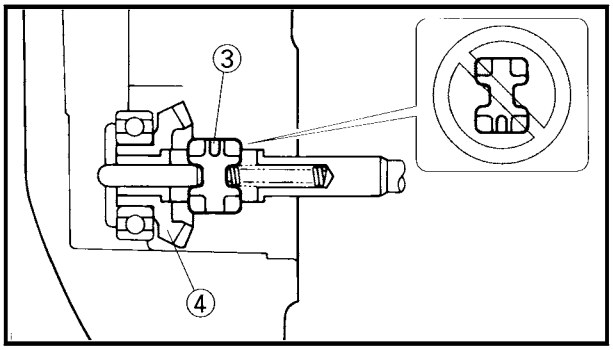

### Dog clutch and shift spring installation

1. Install:
   - Shift spring ①

**NOTE:**

- Insert the shift spring into the open end of the propeller shaft.
- Cover the hole with the finger as shown so that the shift spring pops out and the dog clutch can be inserted by pushing the spring down with a flat head screwdriver.

2. Install:
   - Propeller shaft ②
   - Dog clutch ③

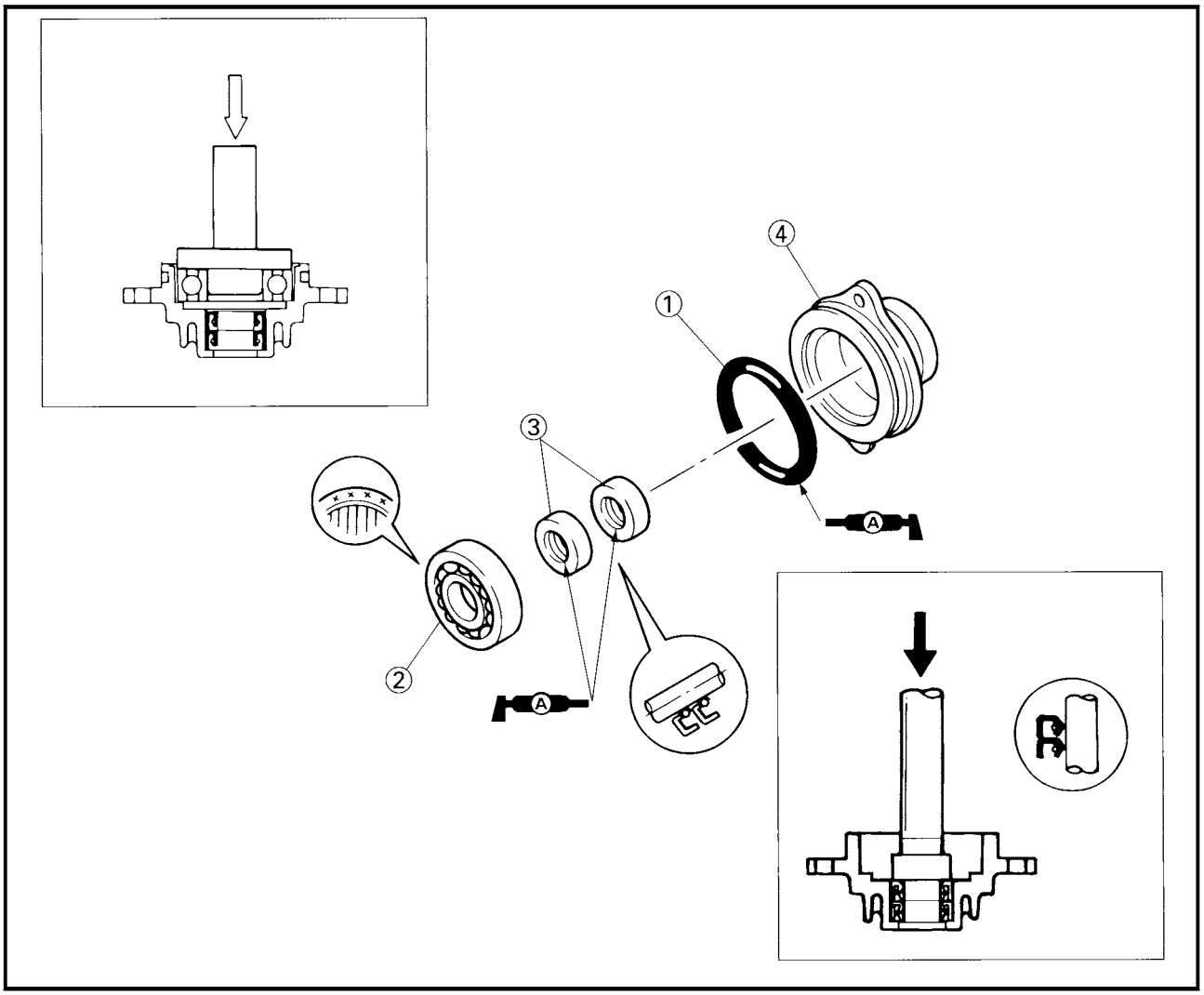



**NOTE:**

The dog clutch ③ should be fitted with the "U" mark dent upward and the forward gear ④ set on dog clutch's left side.

# LOWER CASING CAP ASS'Y

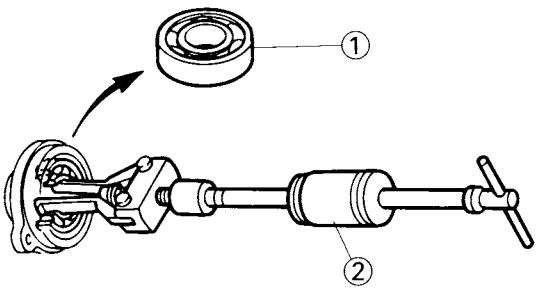
## EXPLODED DIAGRAM



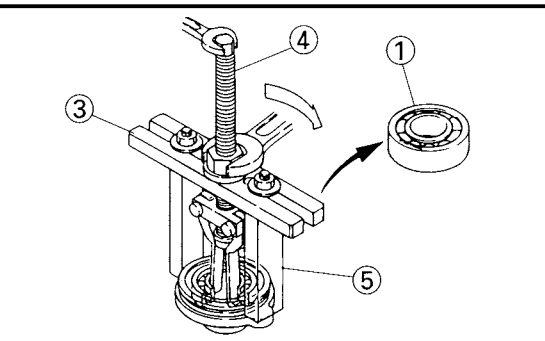

## REMOVAL AND INSTALLATION CHART

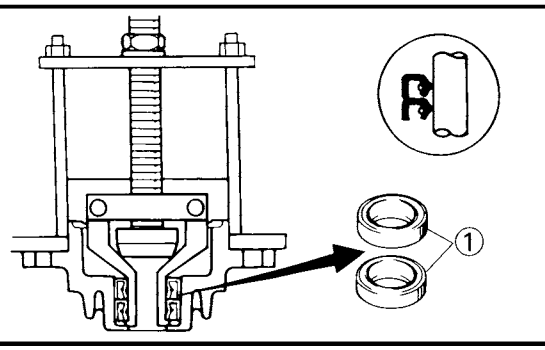
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **LOWER CASING CAP ASS'Y DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| | Lower casing cap ass'y | | |
| ① | O-ring | 1 | |
| ② | Ball bearing (reverse gear) | 1 | **Not reusable** |
| ③ | Oil seal (propeller shaft) | 2 | **Not reusable** |
| ④ | Lower casing cap | 1 | |
| | | | Reverse the disassembly steps for assembly. |

A




B




## SERVICE POINTS

**Lower casing cap/Propeller shaft bearing removal**

1. Remove:
   - Ball bearing ①

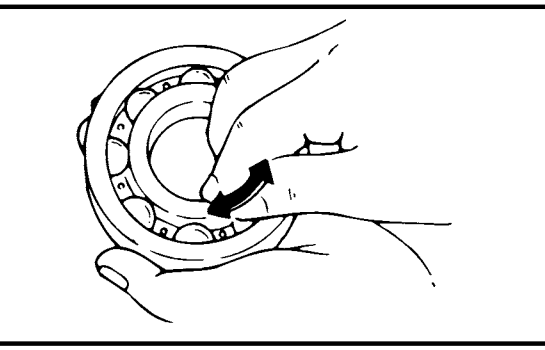
**Slide hammer set ②:**
**YB-06096**
**Stopper guide plate ③:**
**90890-06501**
**Bearing puller ④:**
**90890-06535**
**Stopper guide stand ⑤:**
**90890-06538**

A For USA and CANADA
B Except for USA and CANADA

**Lower casing cap oil seal removal**

1. Remove:
   - Oil seals ①

**Slide hammer set:**
**YB-06096**
**Stopper guide plate:**
**90890-06501**
**Bearing puller:**
**90890-06535**
**Stopper guide stand:**
**90890-06538**

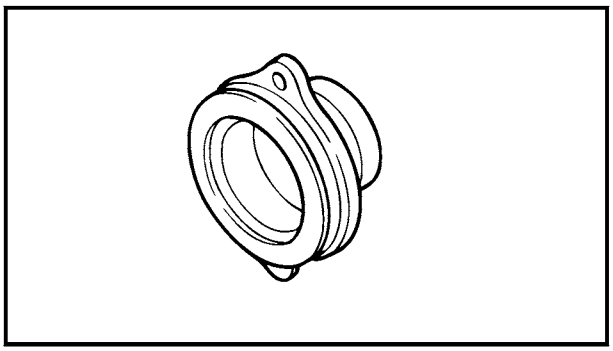


**Bearings inspection**

1. Inspect:
   - Bearing
     Pitting/rumbling → Replace.

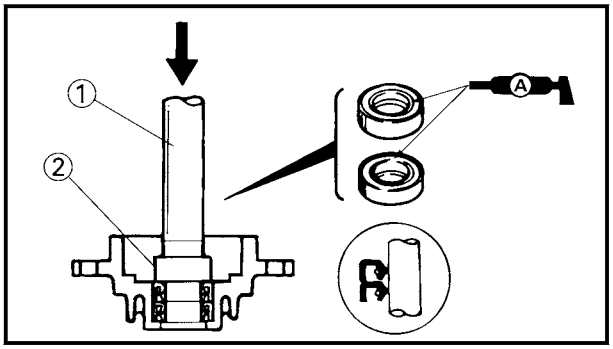
**NOTE:**

Turn the bearing by fingers, and check the bearing pitching.



**Lower casing cap inspection**

1. Clean:
   - Lower casing cap
     Use a soft brush and solvent.
2. Inspect:
   - Lower casing cap
     Crack/damage → Replace.



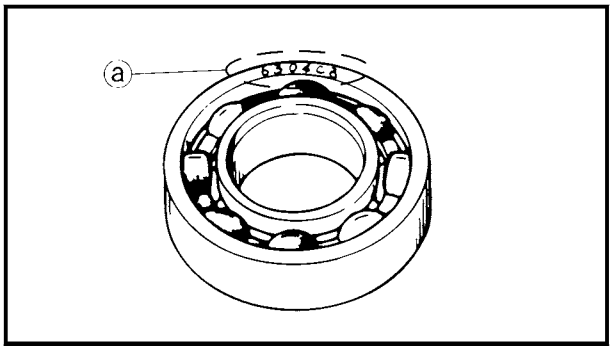

**Lower casing cap assembly**

1. Install:
   - Oil seals

**NOTE:**

Use the special tools to install the oil seals (one by one) until stopping the bottom.

**Driver rod ①:**
**YB-06229/90890-06652**
**Bushing attachment ②:**
**YB-06230/90890-06649**

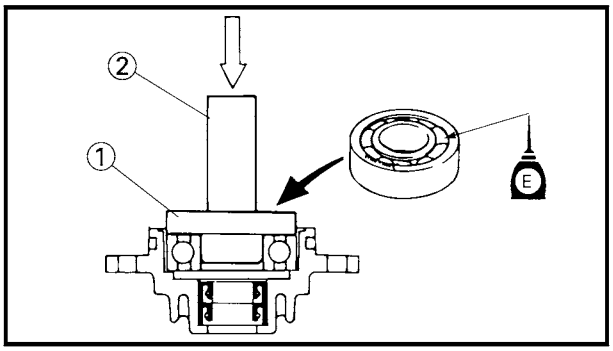


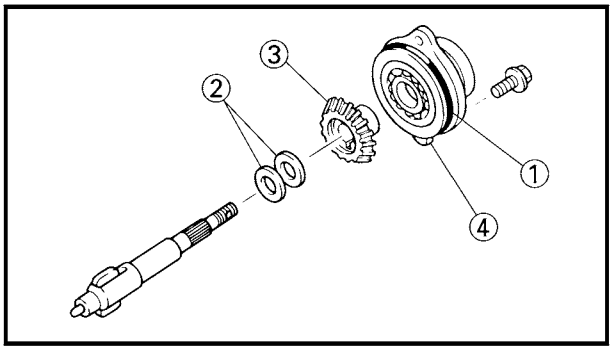

2. Install:
   - Propeller shaft bearing

**NOTE:**

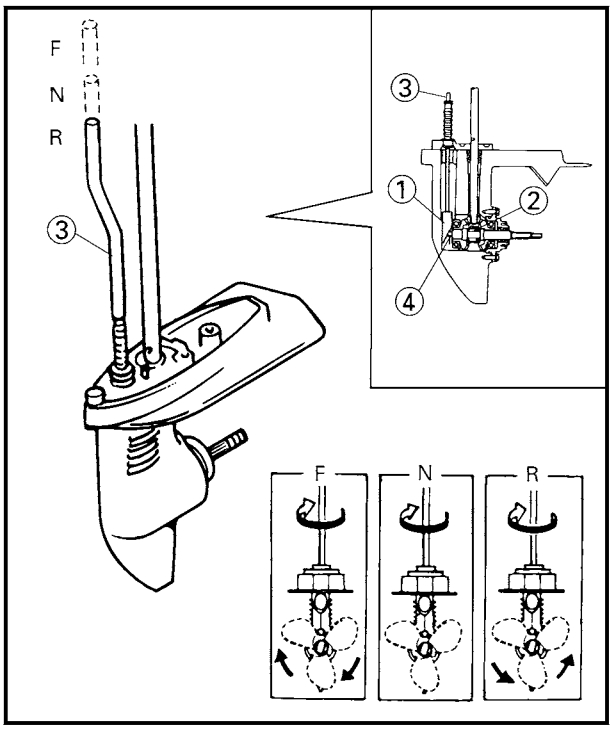
- Install the ball bearing with its manufacturer's marks a facing the reverse gear.
- Use the special tools, press the bearing into the bottom of the casing cap.

**Ball bearing attachment ①:**
**YB-06016/90890-06634**
**Driver rod ②:**
**YB-06071/90890-06606**




3. Assemble:
   - O-ring ①
   - Thrust washer ②
   - Reverse gear ③ to Propeller shaft ass'y
   - Lower case cap ④




**Gear shift inspection**

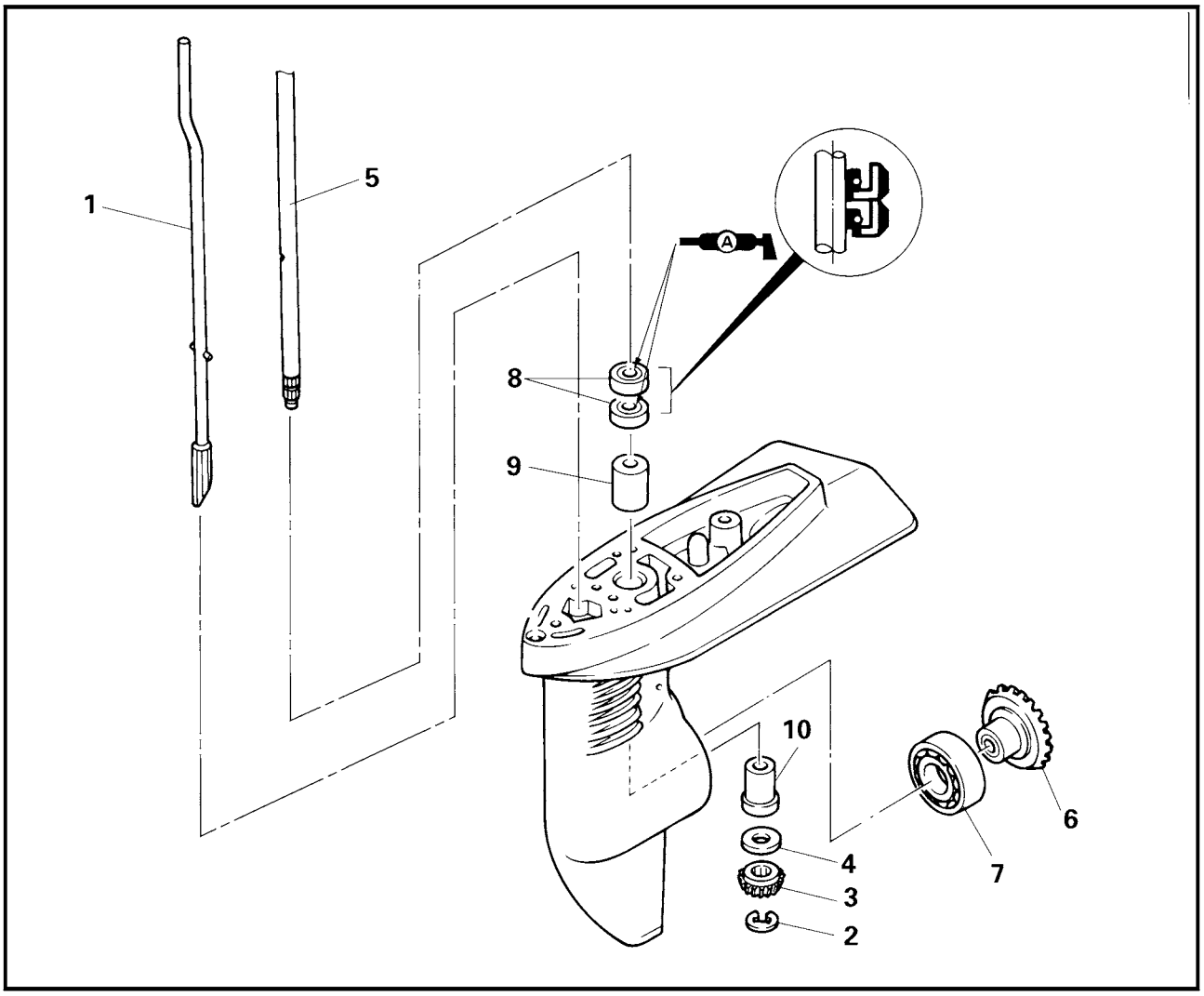
1. Inspect:
   - Shift cam ① operation
     Unsmooth operation → Repair.

**NOTE:**

- Check that the dog clutch ② shift to "Forward", "Neutral" and "Reverse" is correct by pulling or pushing the shift rod ③.
- Take care not to remove the shift cam from the shift plunger ④ by pulling up the shift rod too far.

# DRIVE SHAFT, FORWARD GEAR AND SHIFT ROD

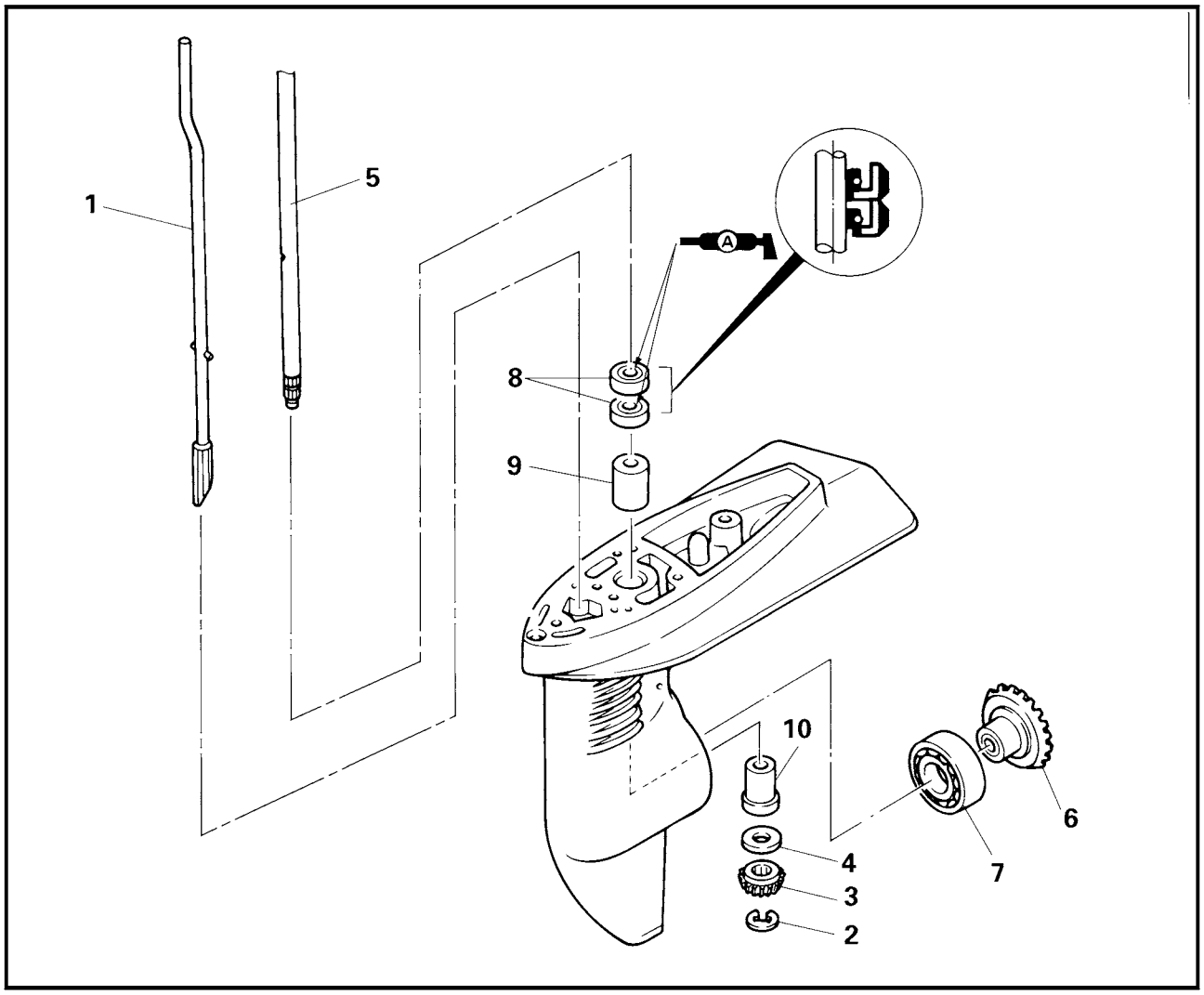
## EXPLODED DIAGRAM



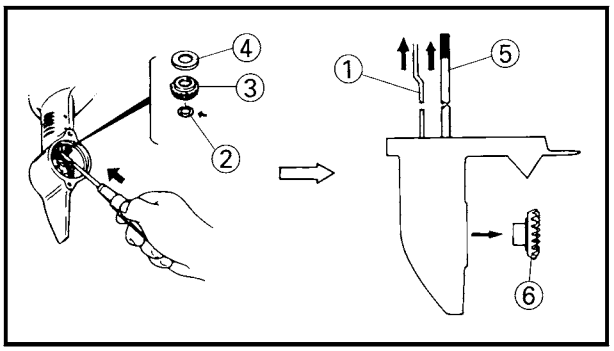

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **DRIVE SHAFT, FORWARD GEAR AND SHAFT ROD REMOVAL** | | Follow the left "Step" for removal. |
| | Propeller shaft ass'y | | |
| | Water pump ass'y | | |
| | Plate (water pump) | | |
| 1 | Shift rod | 1 | |
| 2 | Circlip (pinion gear) | 1 | |
| 3 | Pinion gear | 1 | **NOTE:** When removing the pinion gear, pull up the drive shaft slightly. |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Plate washer | 1 | |
| 5 | Drive shaft | 1 | |
| 6 | Forward gear | 1 | |
| 7 | Ball bearing (forward gear) | 1 | |
| 8 | Oil seal (drive shaft) | 2 | **Not reusable** |
| 9 | Upper bushing | 1 | |
| 10 | Lower bushing | 1 | |
| | | | Reverse the removal steps for installation. |




## SERVICE POINTS

### Pinion and forward gear removal

1. Remove:
   - Shift rod ①
   - Circlip ②
   - Pinion gear ③
   - Plate washer ④
   - Drive shaft ⑤
   - Forward gear ⑥

**NOTE:**

When removing the pinion gear, pull up the drive shaft slightly.

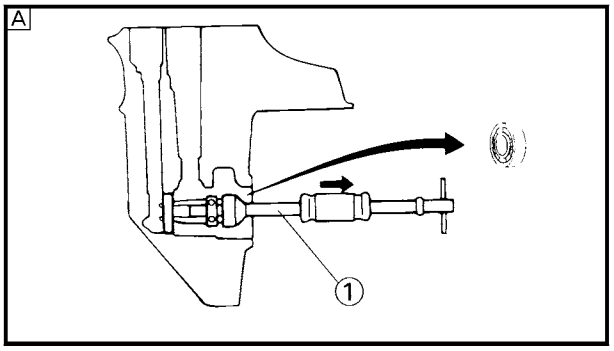
### Lower case disassembly

1. Remove:
   - Ball bearing (forward gear)

**NOTE:**

Install the bearing puller in the forward gear bearing, and tighten the puller so that claws hold the inner race of the bearing; see the illustration. Remove the bearing with the bearing puller.

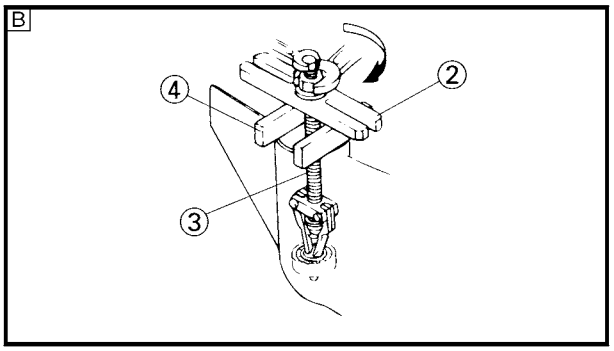
A

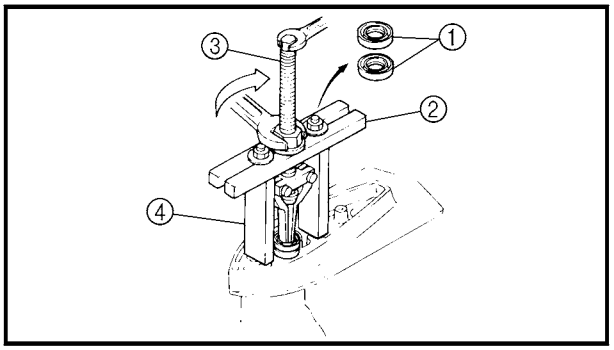



**Slide hammer set ①:**
**YB-06096**
**Stopper guide plate ②:**
**90890-06501**
**Bearing puller ③:**
**90890-06535**
**Stopper guide stand ④:**
**90890-06538**

A For USA and CANADA
B Except for USA and CANADA

B

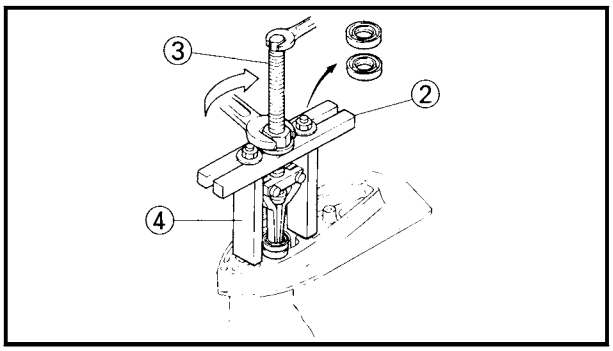



2. Remove:
   - Oil seals ①

**NOTE:**

Install the puller attachment and puller in the drive shaft oil seals, tighten the puller so that claws hold the oil seals and remove the seals with the puller.

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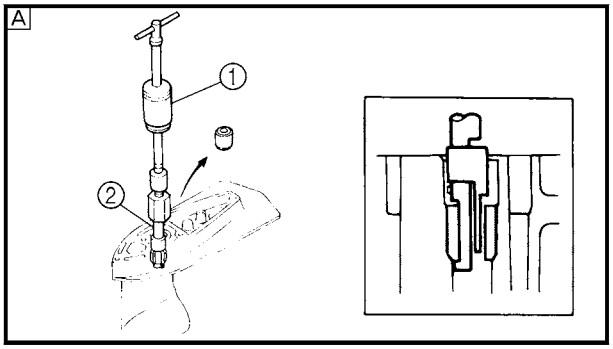


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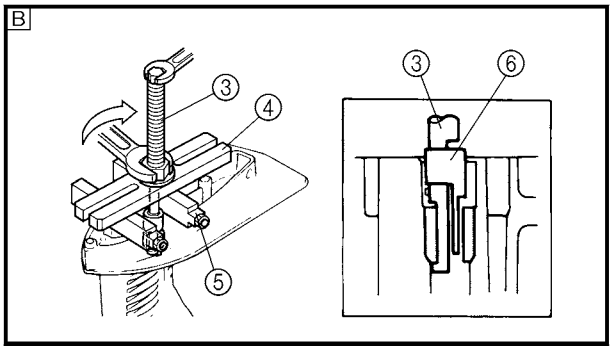
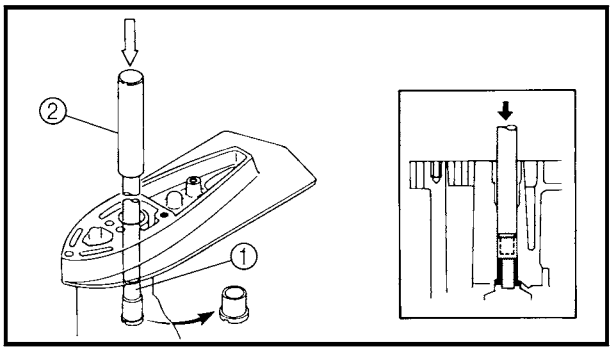
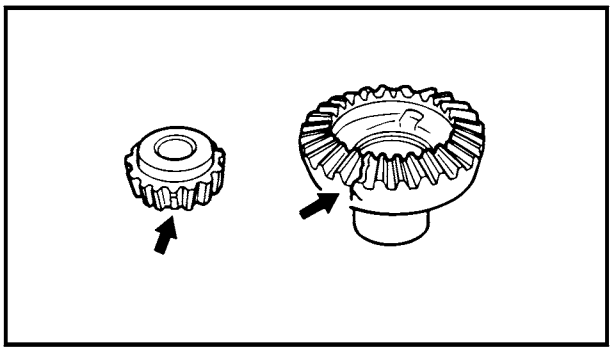


**Stopper guide plate ②:**
**90890-06501**
**Bearing puller ③:**
**90890-06535**
**Stopper guide stand ④:**
**90890-06538**

3. Remove:
   - Upper bushing

**NOTE:**

As shown, install the bushing puller in the upper bushing, and insert the puller so that claw hold the underside of the bushing. Remove the bushing with the bushing puller.

**Slide hammer set ①:**
**YB-06096**
**Bushing puller:**
**YB-06178 ②**
**90890-06646 ③**
**Stopper guide plate ④:**
**90890-06501**
**Stopper guide stand ⑤:**
**90890-06538**
**Bushing puller spacer ⑥:**
**90890-06648**

A For USA and CANADA
B Except for USA and CANADA

4. Remove:
   - Lower bushing

**NOTE:**

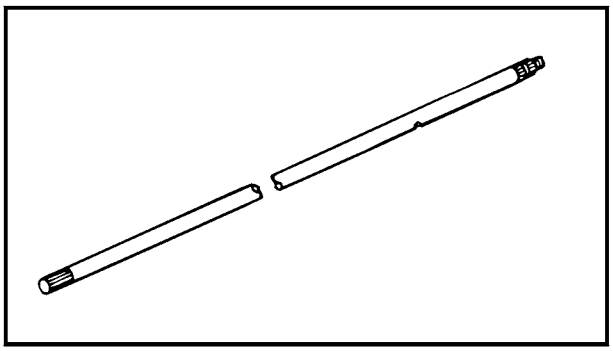
Install the bushing remover attachment and driver rod in the drive shaft lower bushing, and remove the bushing with the driver rod.

**Bushing attachment ①:**
**YB-06027/90890-06651**
**Driver rod ②:**
**YB-06229/90890-06652**

**Pinion and forward gear inspection**

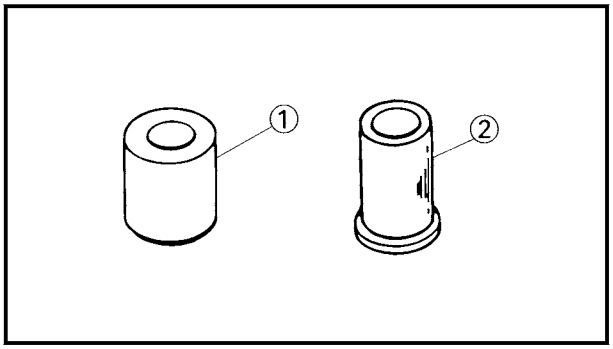
1. Inspect:
   - Tooth
   - Dog

   Wear/damage → Replace.



**Drive shaft inspection**

1. Inspect:
   - Drive shaft
     Wear/damage → Replace.




**Bushing inspection**

1. Inspect:
   - Upper bushing ①
   - Lower bushing ②
     Wear/crack/damage → Replace.

**Shift cam inspection**

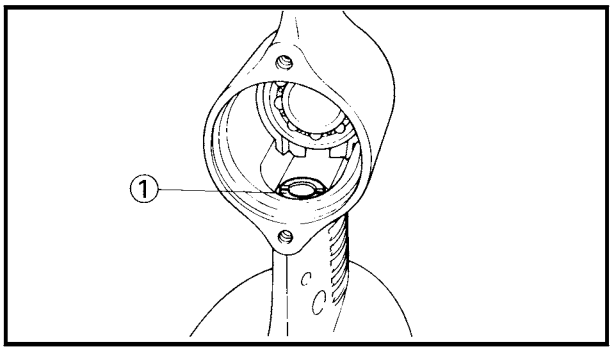
1. Inspect:
   - Shift cam
     Wear/damage → Replace.

**Bearing inspection**

1. Inspect:
   - Bearing
     Pitting/rumbling → Replace.

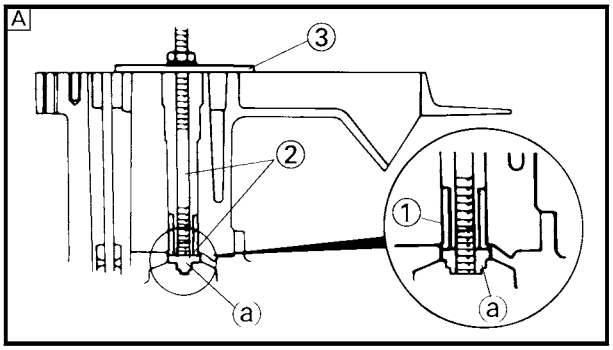
**Lower case inspection**

1. Clean:
   - Lower case
     Use a soft brush and solvent.
2. Inspect:
   - Water passage
     Mineral deposits/corrosion → Clean.
3. Inspect:
   - Lower case
     Crack/damage → Replace.




**Lower case assembly**

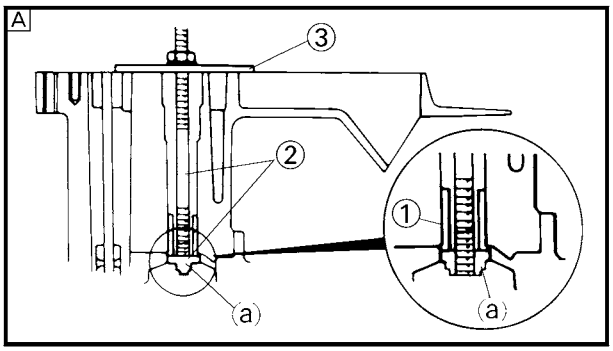
1. Install:
   - Lower bushing ①




**NOTE:**

- Using the special tools press-fit bushing until it contacts the gear case.
- (For US and CANADA) In this operation, the bushing support ⓐ of the bushing installer ass'y ② should be installed with the larger diameter end on the bushing side.

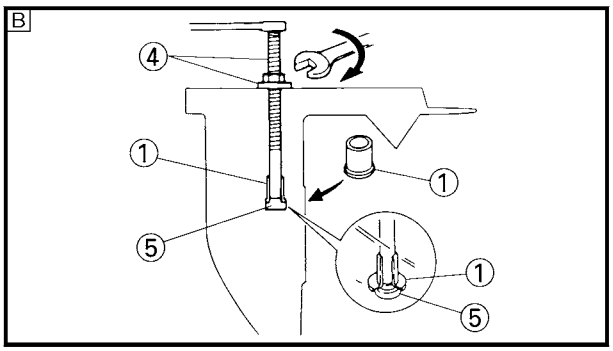
A

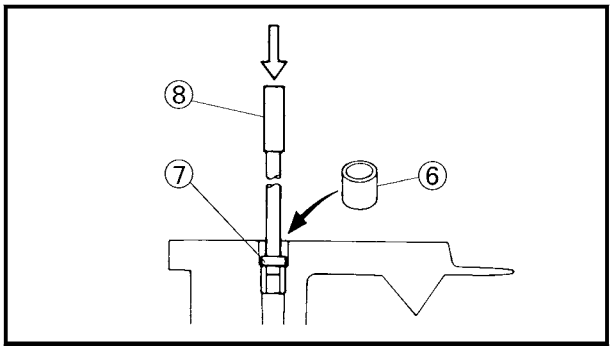



**Bushing installer ass'y ②:**
**YB-06029**
**Needle bearing installer ③:**
**YB-06169**
**Bushing installer center bolt ④:**
**90890-06601**
**Bushing attachment ⑤:**
**90890-06649**

A For USA and CANADA
B Except for USA and CANADA

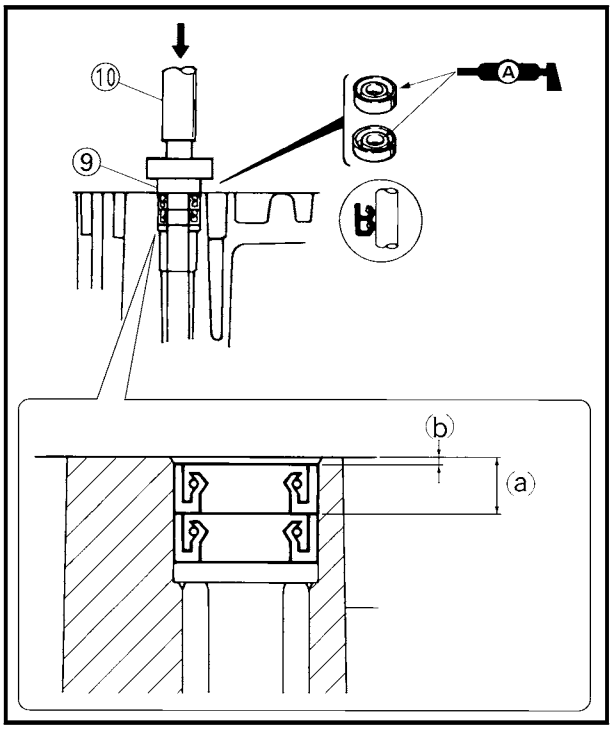
B




2. Install:
   - Upper bushing ⑥

**Bushing attachment ⑦:**
**YB-06027/90890-06651**
**Driver rod ⑧:**
**YB-06229/90890-06652**

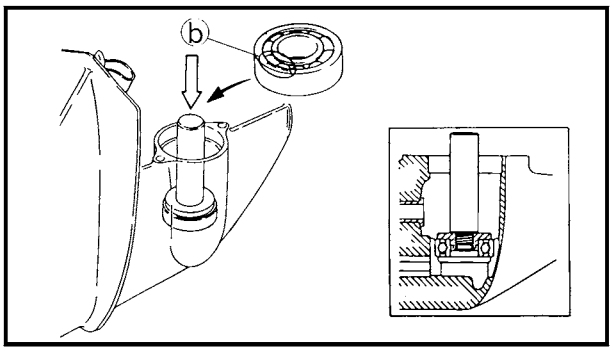



3. Install:
   - Oil seal

**Bearing attachment ⑨:**
**YB-06082/90890-06615**
**Driver rod ⑩:**
**YB-06229/90890-06604**

**NOTE:**
Use the oil seal installer (bearing attachment), install the two oil seals at the specified depth from top of the lower case mating surface (one by one).

**Oil seal set depth:**
**ⓐ: 8.0 mm (0.3 in)**
**ⓑ: 1.0 mm (0.04 in)**




4. Install:
   - Ball bearing (forward gear)

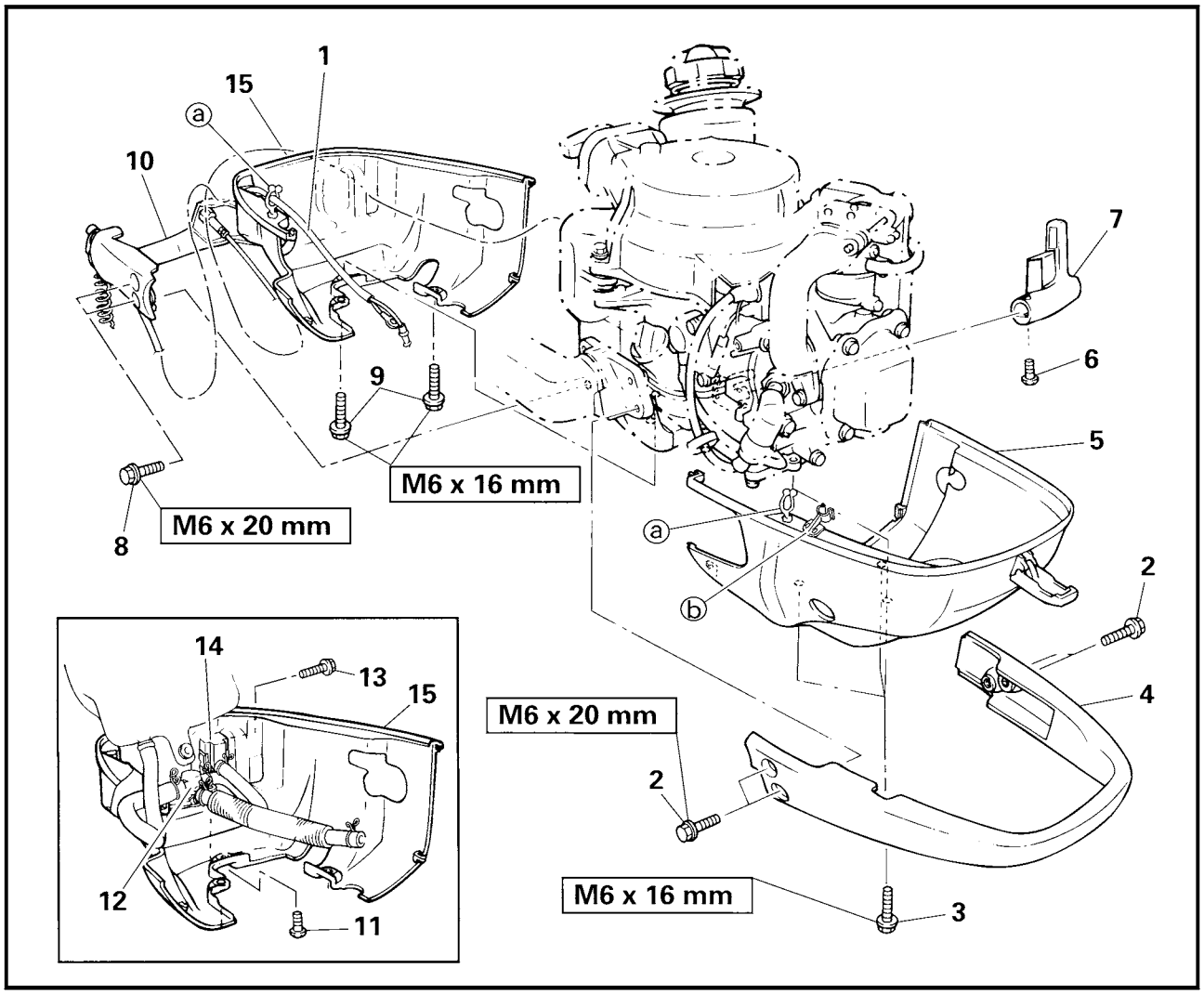
**NOTE:**
Install the ball bearing with its manufacturer's marks ⓑ facing the forward gear.

**Bearing installer:**
**(Ball bearing attachment)**
**YB-06016/90890-06634**
**Driver rod:**
**YB-06071/90890-06606**

# CHAPTER 7
# BRACKET UNIT

# CARRYING HANDLE AND BOTTOM COWLING

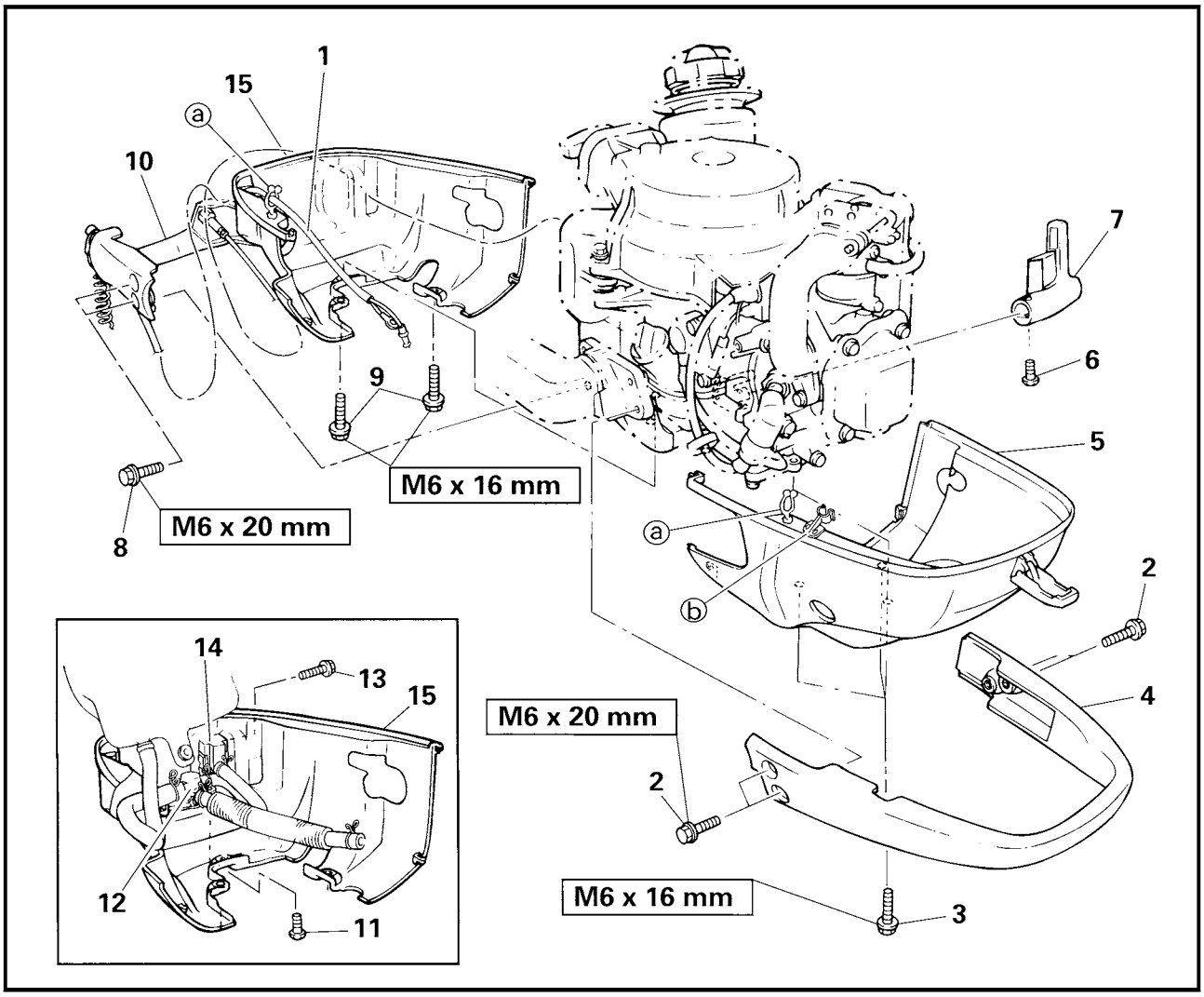
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

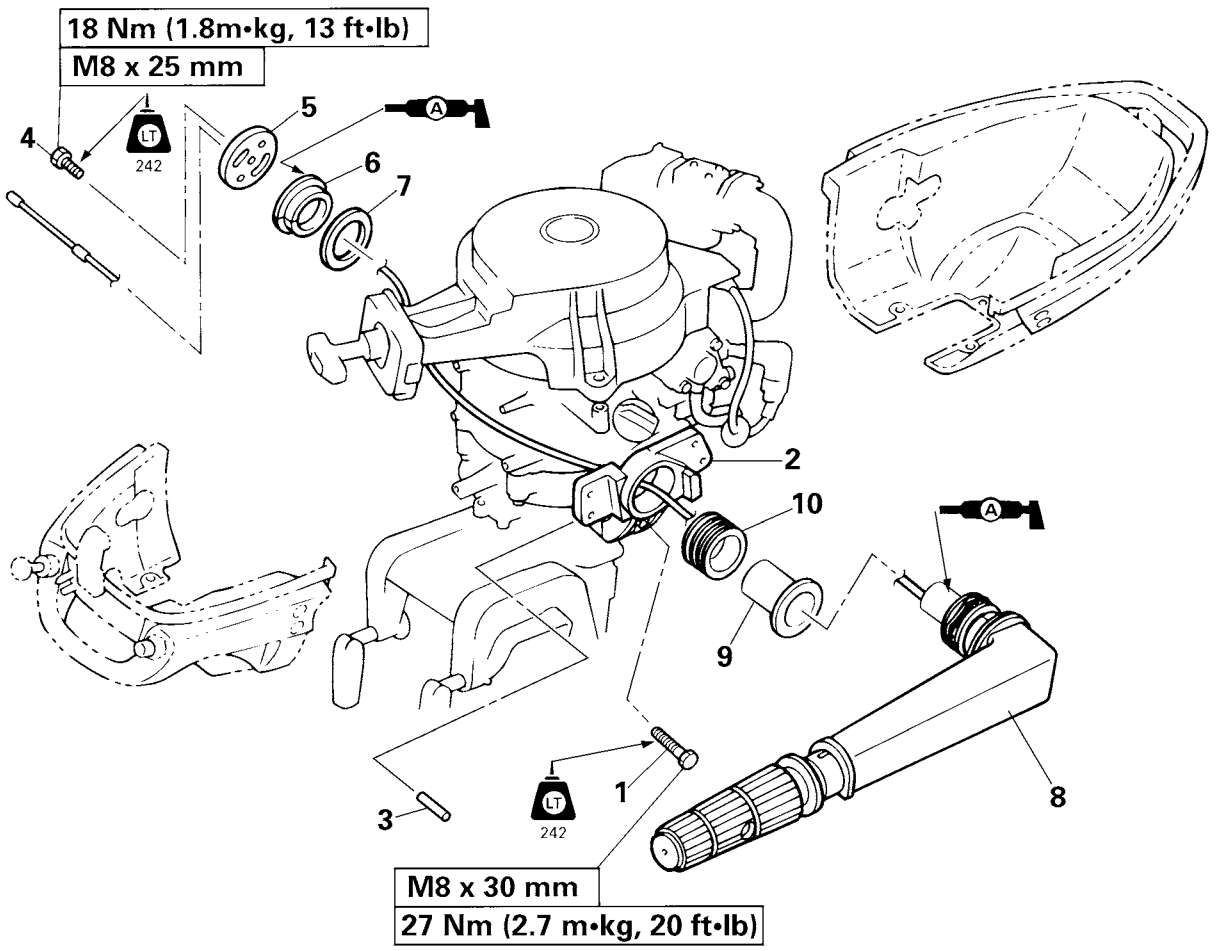
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CARRYING HANDLE AND BOTTOM COWLING REMOVAL** | | Follow the left "Step" for removal. |
| | Top cowling | | |
| | Choke wire | | Refer to "INTAKE SYSTEM" in chapter 4. |
| 1 | Engine stop switch lead | 1 | **NOTE:** After installation, clamp the engine stop switch lead to part 2 using the lead clamp ⓐ. |
| 2 | Bolt with washer (carrying handle 2) | 4 | |
| 3 | Bolt with washer (bottom cowling 2) | 3 | |
| 4 | Carrying handle 2 (protector) | 1 | |
| 5 | Bottom cowling 2 | 1 | **NOTE:** Clamp the hi-tension cord using the cord clamp ⓑ, after the bottom cowling 2 has been fitted. |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 6 | Screw (shift lever) | 1 | |
| 7 | Shift lever | 1 | |
| 8 | Bolt with washer (carrying handle 1) | 4 | |
| 9 | Bolt with washer (bottom cowling 1) | 3 | |
| 10 | Carrying handle 1 ass'y | 1 | |
| 11 | Screw | 1 | |
| 12 | Fuel cock ass'y | 1 | |
| 13 | Bolt with washer | 1 | |
| 14 | Fuel joint ass'y | 1 | |
| 15 | Bottom cowling 1 ass'y | 1 | |
| | | | Reverse the removal steps for installation. |

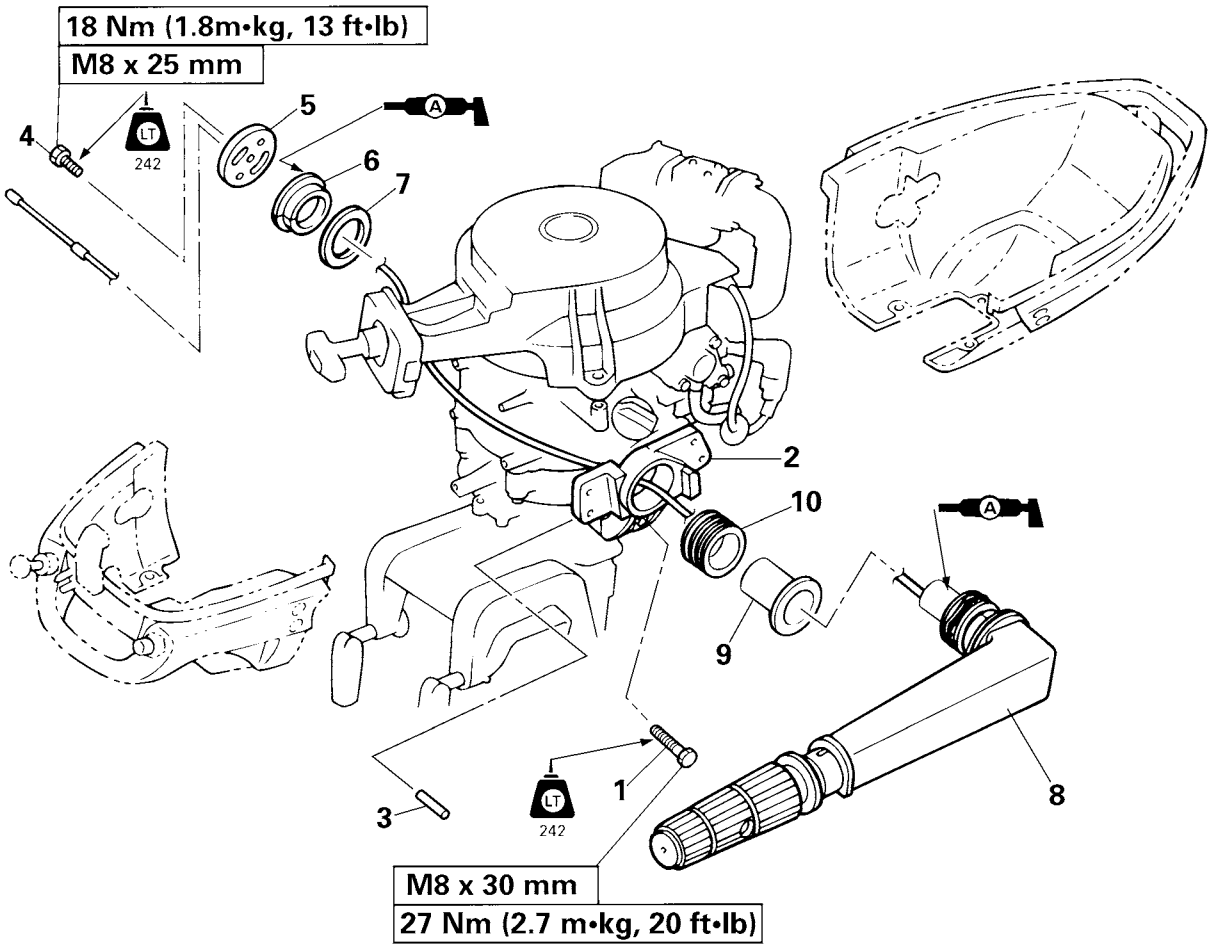
# STEERING HANDLE
## EXPLODED DIAGRAM



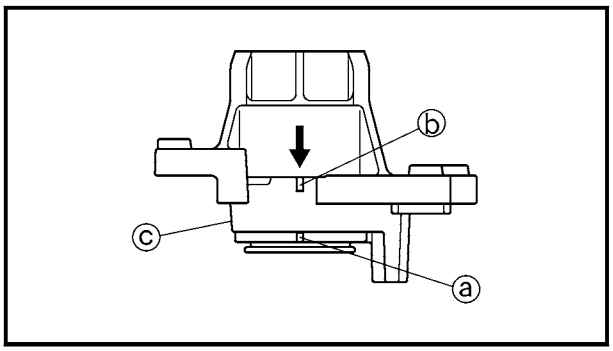

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STEERING HANDLE REMOVAL** | | Follow the left "Step" for removal. |
| | Carrying handle 2 (protector) | | |
| | Bottom cowling 2 | | |
| | Carrying handle 1 | | |
| | Engine stop switch lead | | **NOTE:** |
| | Choke wire | | Disconnect from the power unit side. |
| | Throttle cable | | |
| | Bottom cowling 1 | | |
| 1 | Bolt (steering bracket) | 2 | |
| 2 | Steering bracket | 1 | |
| 3 | Dowel pin | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 4 | Bolt (steering handle ass'y) | 1 | |
| 5 | Steering handle cover | 1 | |
| 6 | Collar | 1 | |
| 7 | Plate washer | 1 | |
| 8 | Steering handle ass'y | 1 | |
| 9 | Collar | 1 | |
| 10 | Rubber bushing | 1 | |
| | | | Reverse the removal steps for installation. |



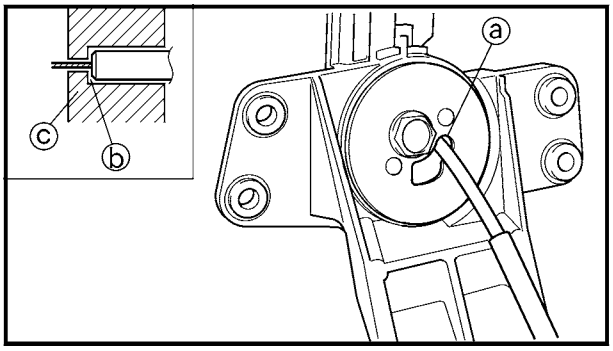

## SERVICE POINTS

### Rubber bushing installation

1. Install:
   - Rubber bushing

**NOTE:**

- Align the projection ⓐ on the pressure fit side of the rubber bushing flange with the projection ⓑ on the steering bracket.
- Push the rubber bushing on its inner cylinder in the direction of the arrow as shown and pressure fit it into the steering bracket.
- After fitting it, check that there is no clearance between the bushing flange and the steering bracket end ⓒ.



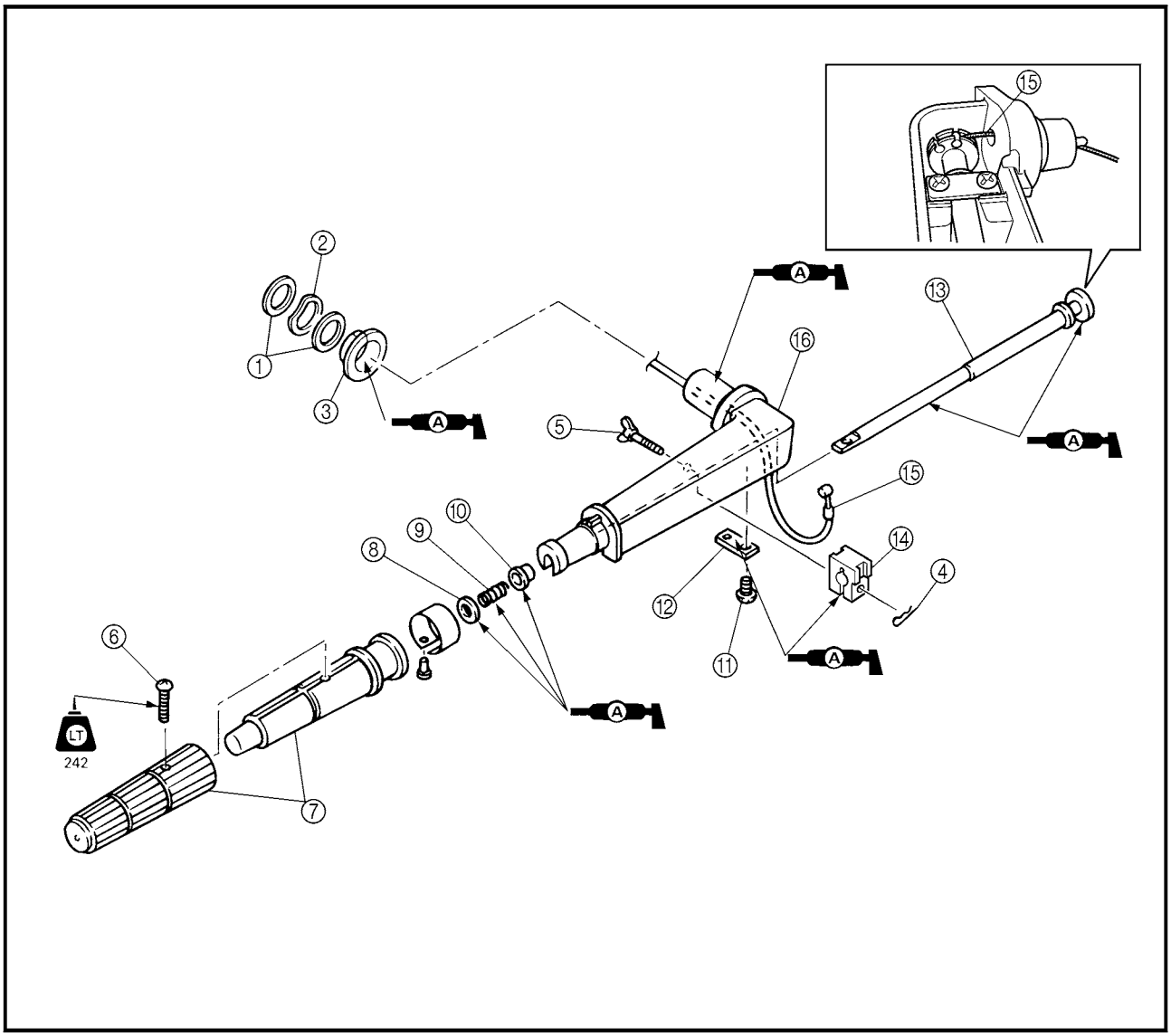

### Throttle cable installation

1. Install:
   - Throttle cable

**NOTE:**

The throttle cable should be routed through the cut ⓐ in the steering handle cover with the outer tube end ⓑ in contact with the step ⓒ in the steering handle.

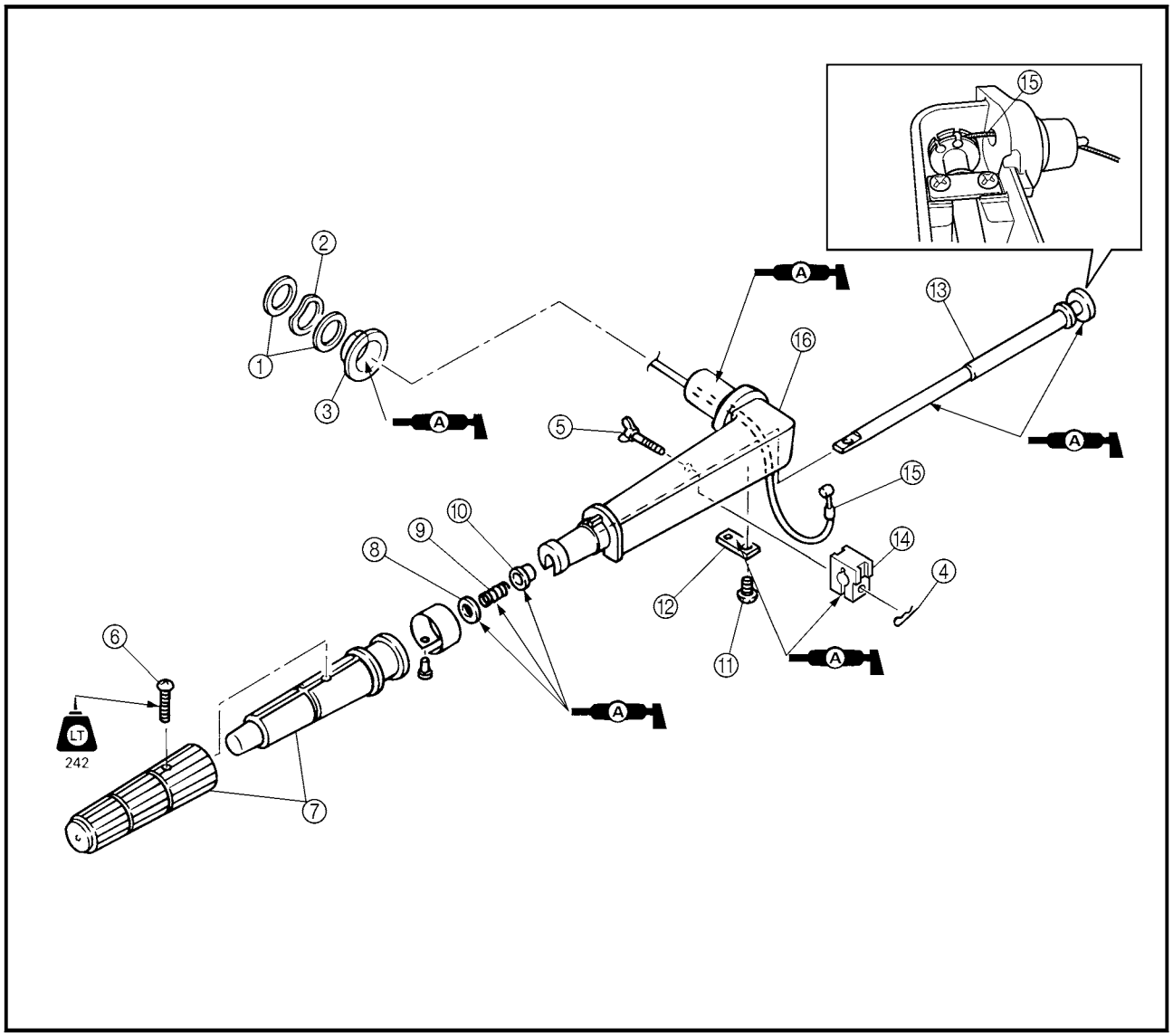
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

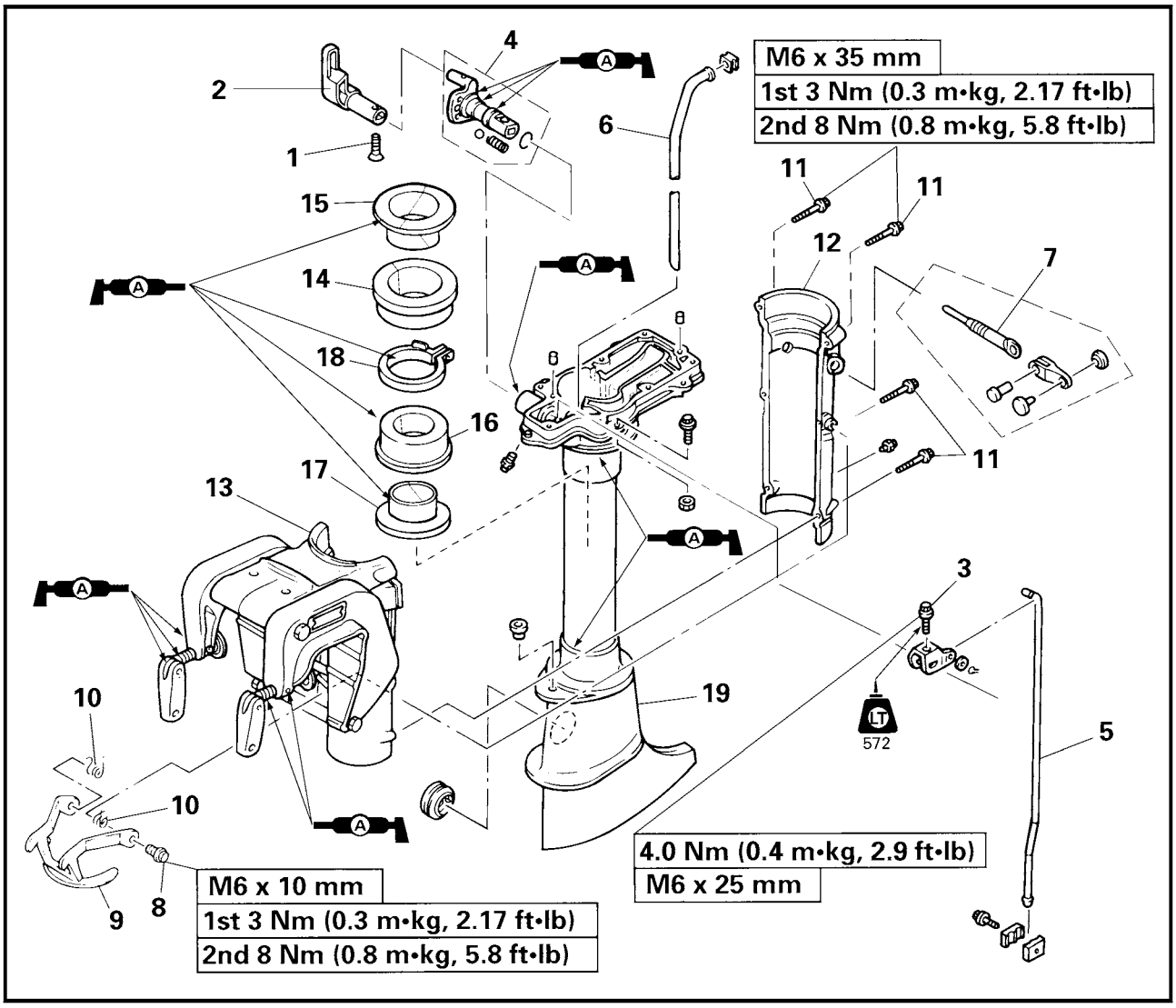
| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **STEERING HANDLE DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| | Steering handle ass'y | | |
| ① | Metal washer | 2 | |
| ② | Wave washer | 1 | |
| ③ | Collar | 1 | |
| ④ | Cotter pin | 1 | |
| ⑤ | Friction adjusting screw | 1 | |
| ⑥ | Screw | 1 | |
| ⑦ | Steering grip | 1 | |
| ⑧ | Washer | 1 | |

## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| ⑨ | Spring | 1 | |
| ⑩ | Bushing | 1 | |
| ⑪ | Bolt | 2 | |
| ⑫ | Plate | 1 | |
| ⑬ | Throttle shaft | 1 | |
| ⑭ | Friction piece | 1 | |
| ⑮ | Throttle cable | 1 | |
| ⑯ | Steering handle | 1 | |
| | | | Reverse the disassembly steps for assembly. |

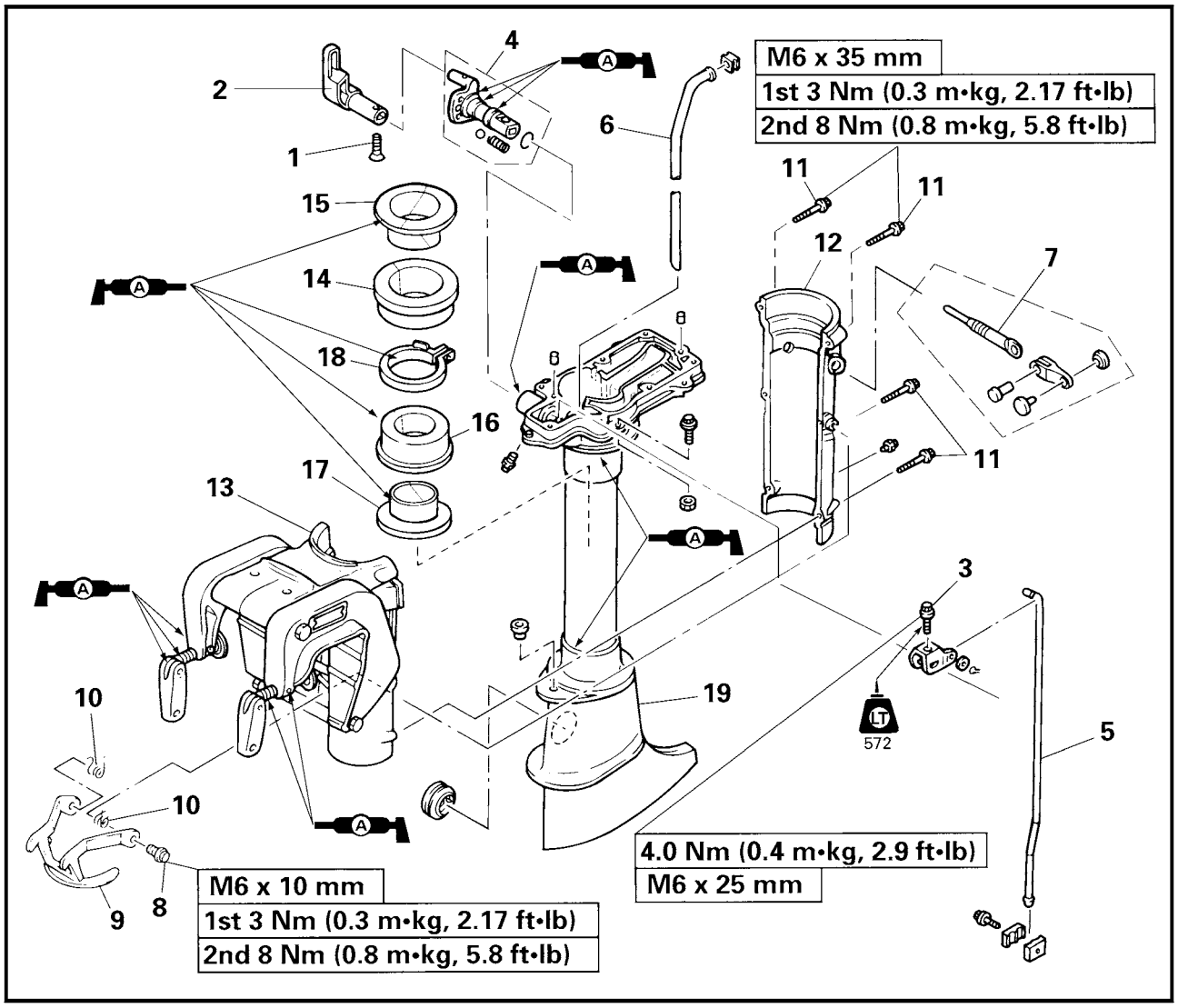
# UPPER CASE ASS'Y
## EXPLODED DIAGRAM



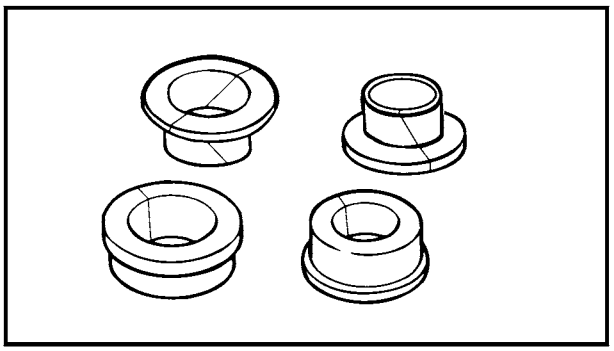

## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **UPPER CASE ASS'Y REMOVAL** | | Follow the left "Step" for removal. |
| | Power unit | | Refer to "POWER UNIT" in chapter 5. |
| | Lower unit | | Refer to "LOWER UNIT" in chapter 6. |
| | Steering handle | | Refer to "STEERING HANDLE". |
| 1 | Screw (shift lever) | 1 | |
| 2 | Shift lever | 1 | |
| 3 | Bolt (shift shaft) | 1 | |
| 4 | Shift shaft ass'y | 1 | |
| 5 | Shift rod ass'y | 1 | |
| 6 | Water tube | 1 | |
| 7 | Steering friction screw ass'y | 1 | |
| 8 | Bolt (tilt lock plate) | 2 | |

## EXPLODED DIAGRAM



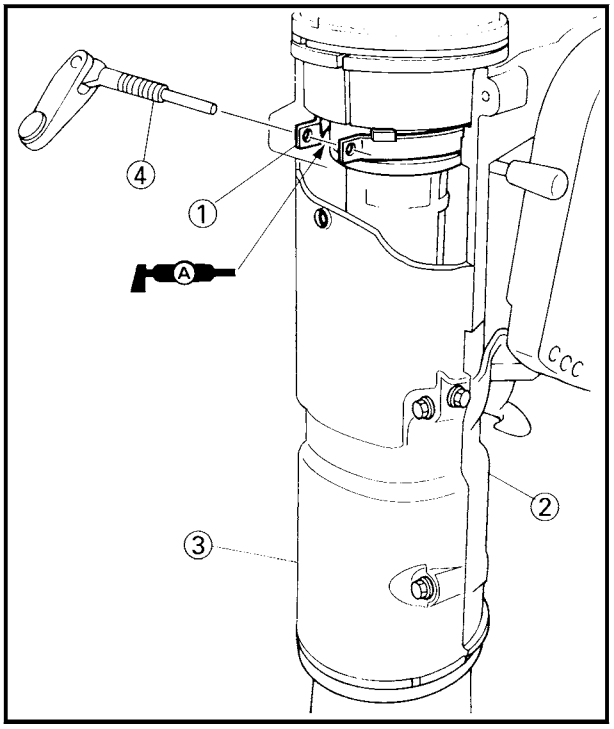

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| 9 | Tilt lock plate | 1 | |
| 10 | Spring | 2 | |
| 11 | Bolt (swivel bracket) | 6 | |
| 12 | Swivel bracket 2 | 1 | |
| 13 | Swivel bracket 1 ass'y | 1 | |
| 14 | Pivot shaft bushing 2 | 1 | |
| 15 | Pivot shaft bushing 1 | 1 | |
| 16 | Pivot shaft bushing 3 | 1 | |
| 17 | Pivot shaft bushing 4 | 1 | |
| 18 | Friction plate | 1 | |
| 19 | Upper casing | 1 | Reverse the disassembly steps for installation. |



## SERVICE POINTS

### Bushing inspection

2. Inspect:
   - Bushing
     Damage/crack → Replace.



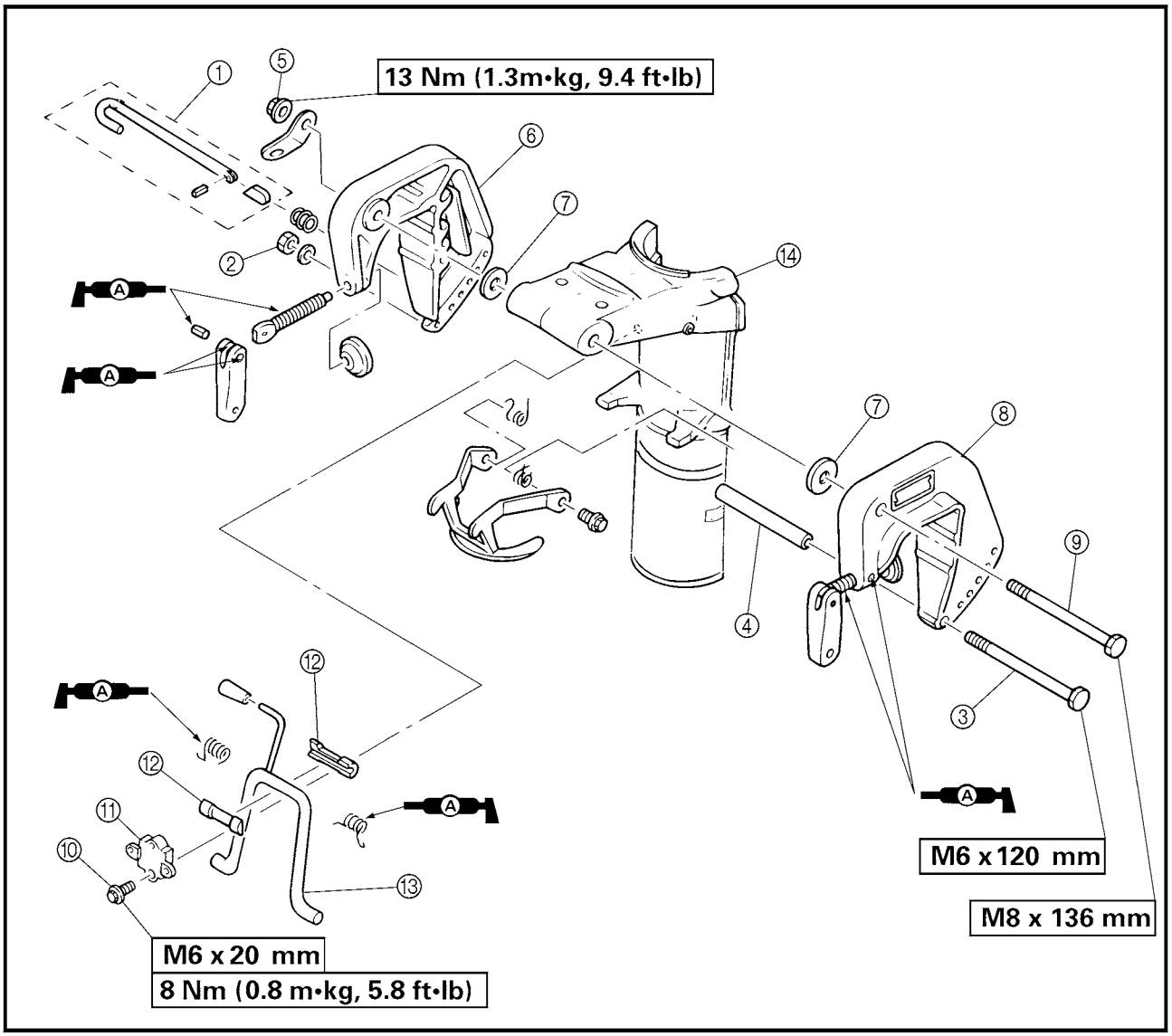

### Friction plate installation

1. Install:
   - Friction plate ①
   - Swivel bracket ass'y 1 ②
   - Swivel bracket ass'y 2 ③
   - Steering friction screw ④

**NOTE:**

Apply grease to the friction plate ① and set to the swivel bracket 1 ass'y ② as shown, then install the swivel bracket ass'y 2 ③ and tighten the friction screw ④.

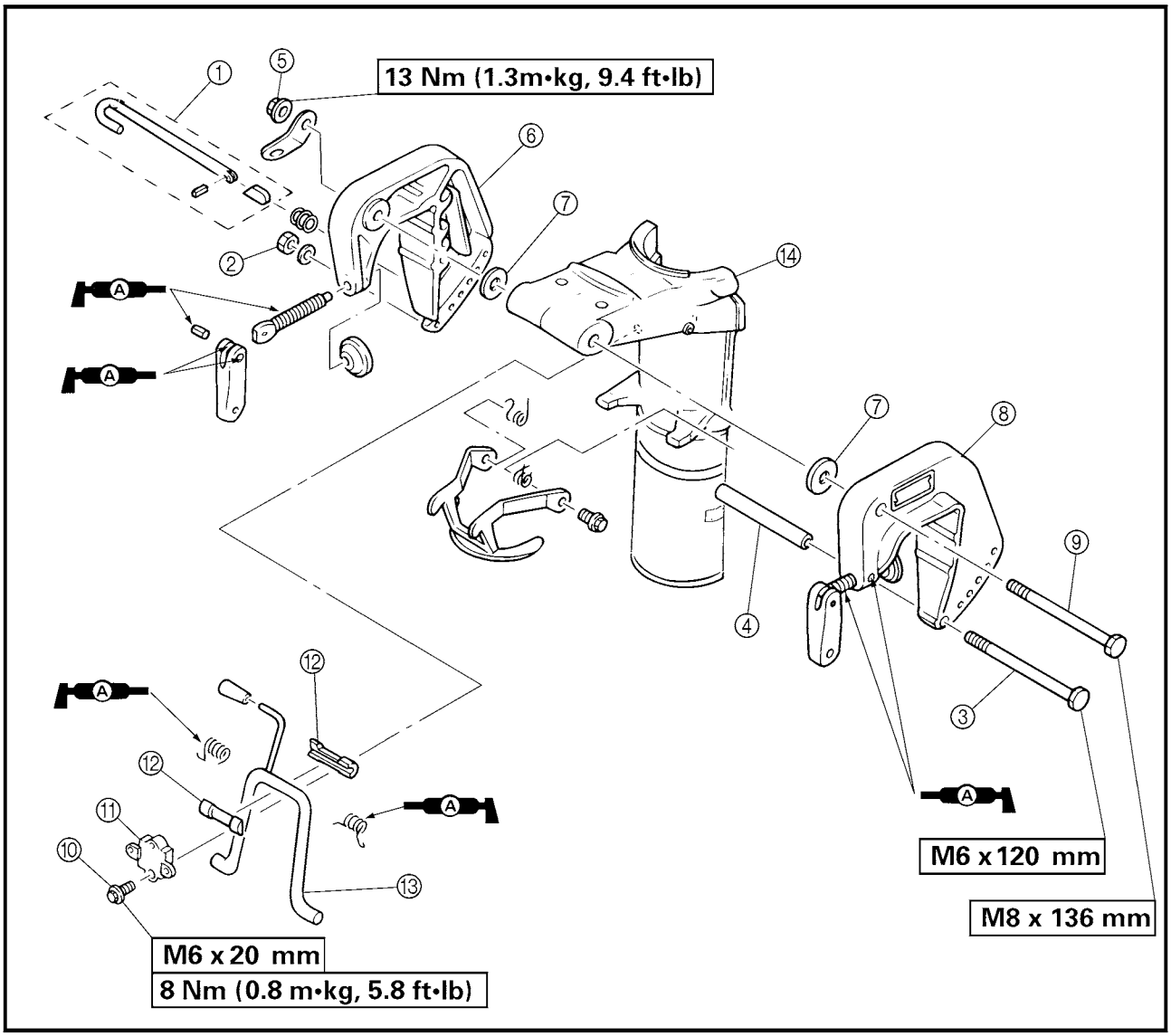
# CLAMP BRACKET
## EXPLODED DIAGRAM




## REMOVAL AND INSTALLATION CHART

| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| | **CRAMP BRACKET DISASSEMBLY** | | Follow the left "Step" for disassembly. |
| ① | Tilt rod | 1 | |
| ② | Clamp bracket nut (under) | 1 | |
| ③ | Clamp bracket bolt (under) | 1 | |
| ④ | Collar (clamp bracket under) | 1 | |
| ⑤ | Clamp bracket nut (upper) | 1 | |
| ⑥ | Clamp bracket (right) | 2 | |
| ⑦ | Washer | 2 | |
| ⑧ | Clamp bracket (left) | 1 | |
| ⑨ | Clamp bracket bolt (upper) | 1 | |
| ⑩ | Bolt (cap) | 2 | |
| ⑪ | Swivel bracket 3 | 1 | |

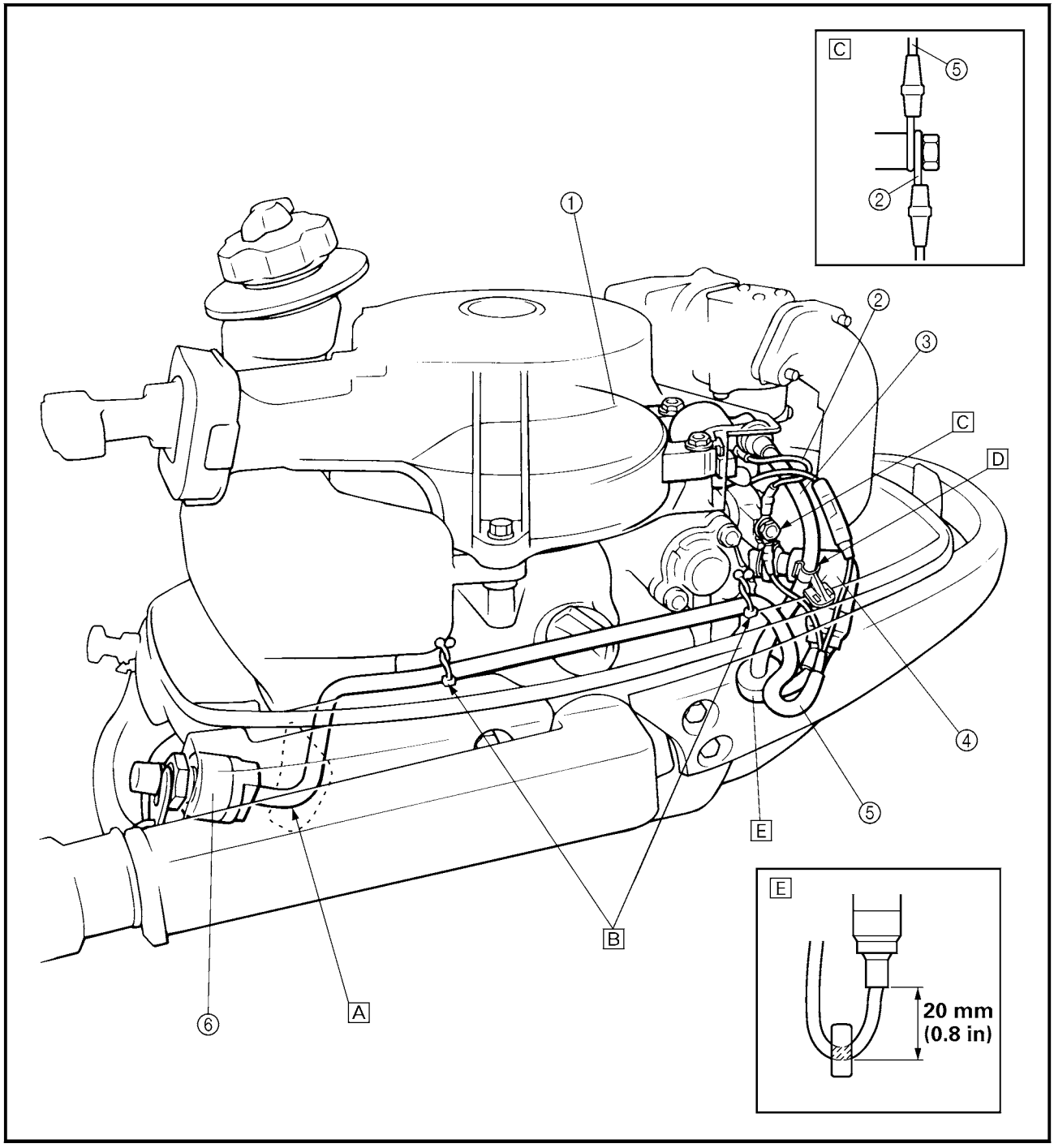
## EXPLODED DIAGRAM




| Step | Procedure/Part name | Q'ty | Service points |
|---|---|---|---|
| ⑫ | Bushing | 2 | |
| ⑬ | Tilt stopper lever | 1 | |
| ⑭ | Swivel bracket 1 | 1 | |
| | | | Reverse the disassembly steps for assembly. |

# CHAPTER 8
# ELECTRICAL SYSTEMS

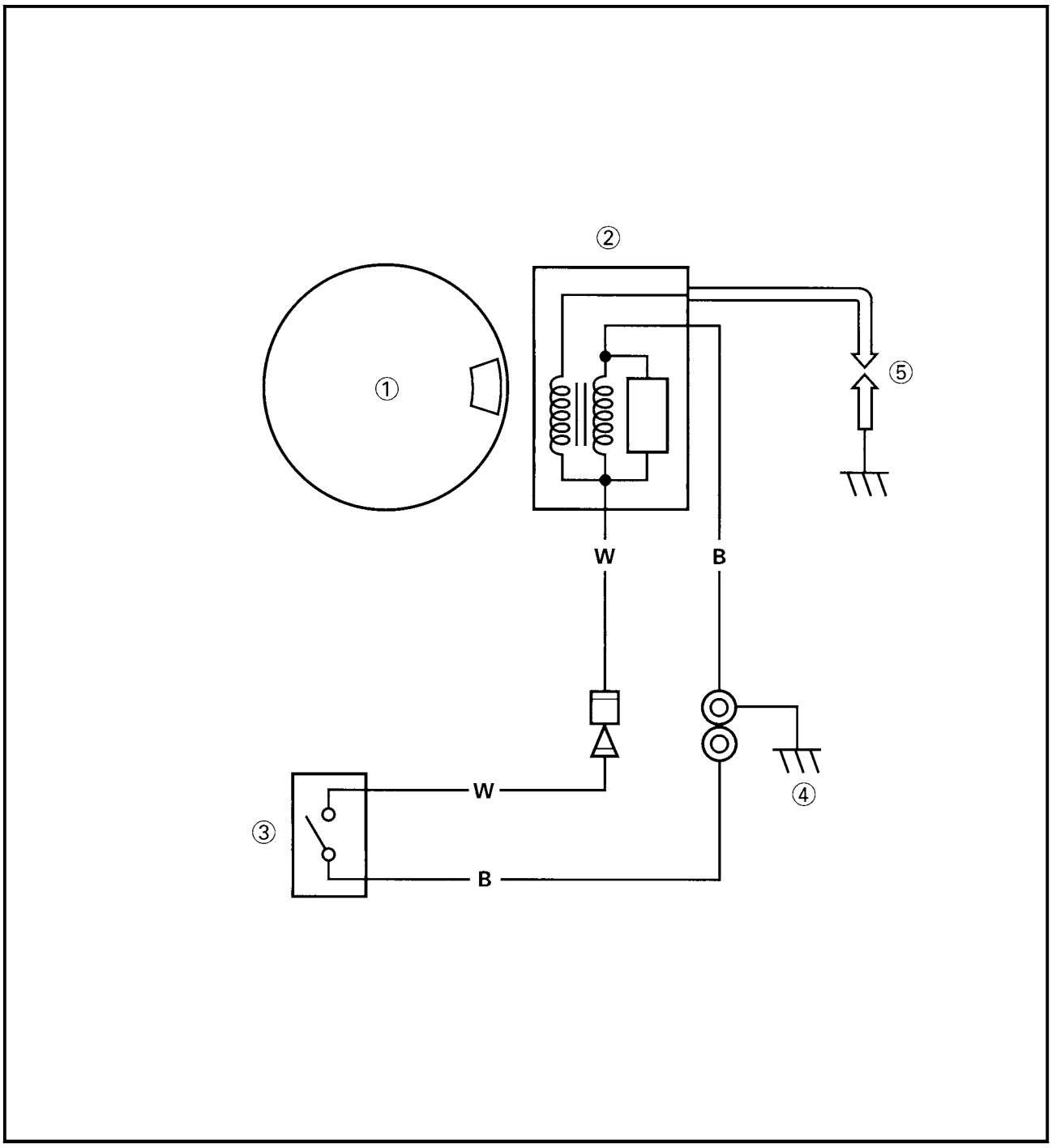
# ELECTRICAL COMPONENTS




① Flywheel rotor ass'y
② Ignitor ass'y lead
③ High tension cord
④ Spark plug cap
⑤ Engine stop switch lead
⑥ Engine stop switch

[A] Pass the engine stop switch lead into the bottom cowling port side slit.
[B] Clamp the engine stop switch lead by the clamp on the bottom cowling.
[C] Ground the cylinder body.
[D] Clamp the high-tension cord to the clamp on the bottom cowling, using the clamp provided.
[E] Fix the grommet on the high tension cord approximately 20 mm (0.8 in) from the plug cap end, using an adhesive in the shaded area.

# WIRING DIAGRAM




① Flywheel rotor ass'y
② Ignitor ass'y
③ Engine stop switch
④ Ground
⑤ Spark plug

B : Black
W : White

# ELECTRICAL ANALYSIS

## INSPECTION

### Digital circuit tester

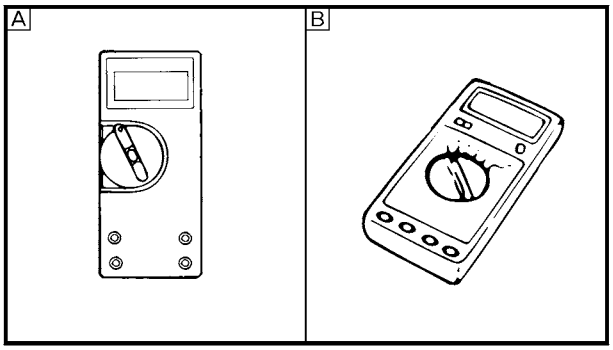
**NOTE:**

Throughout this chapter the digital circuit tester's part number has been omitted. Refer to the following part number.

| | |
|---|---|
| | **Digital circuit tester: J-39299/90890-06752** |

**NOTE:**

" ○——○ " indicates a continuity of electricity; i.e., a closed circuit at the respective switch position.



A For USA and CANADA
B Except for USA and CANADA

### Peak voltage measurement

**NOTE:**

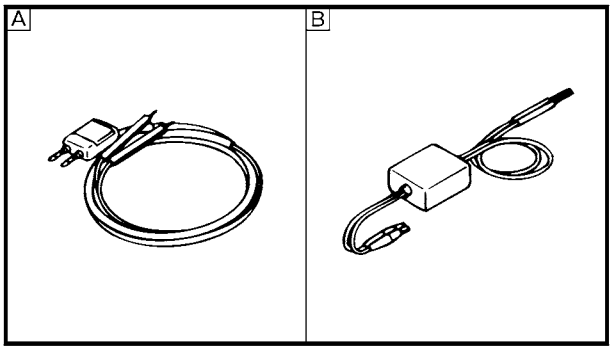
- When checking the condition of the ignition system it is vital to know the peak voltage.
- Cranking speed is dependent on many factors (e.g., fouled or weak spark plugs, a weak battery, etc.). If one of these is defected, the peak voltage will be lower than specification.
- If the peak voltage measurement is not within specification the engine will not operate properly.
- A low peak voltage will also cause components to prematurely wear.

### Peak voltage adaptor

**NOTE:**

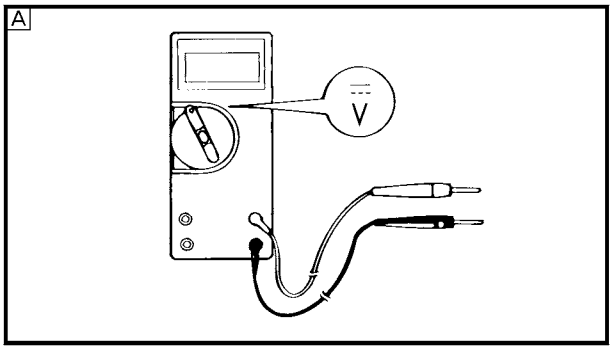
- Throughout this chapter the peak voltage adaptor's part number has been omitted. Refer to the following part number.
- The peak voltage adaptor should be used with the digital circuit tester.

| | |
|---|---|
| | **Peak voltage adaptor: YU-39991/90890-03169** |

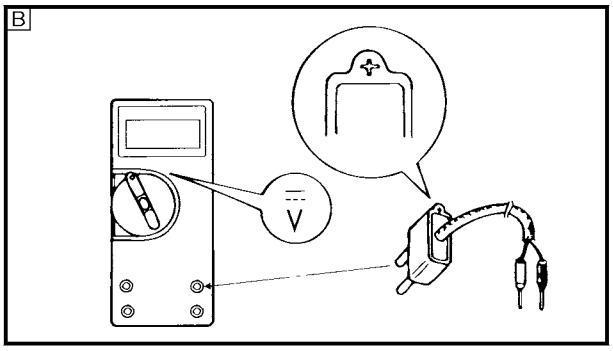


A For USA and CANADA
B Except for USA and CANADA

A



B



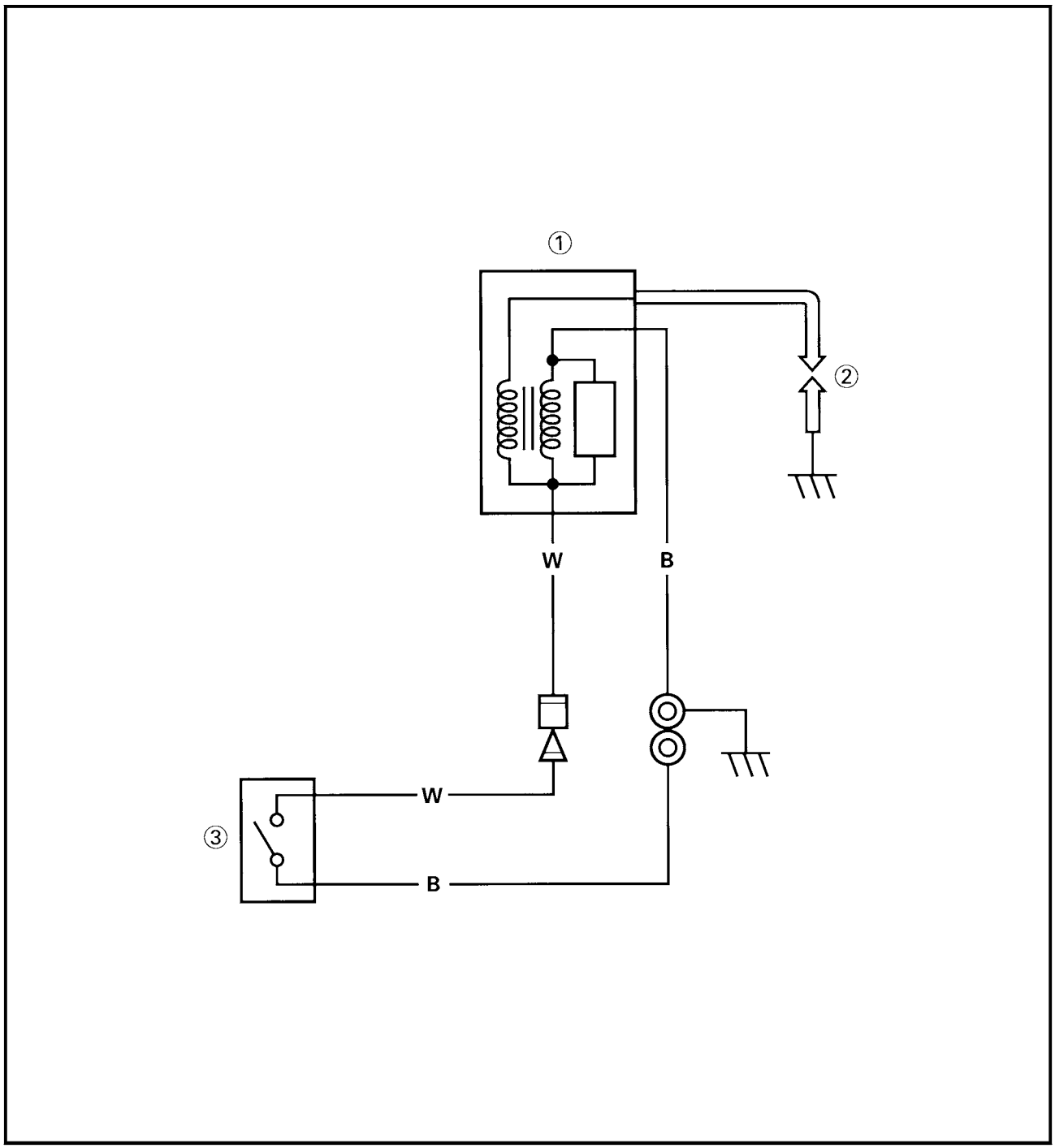
- When measuring the peak voltage, connect the peak voltage adaptor to the digital tester and switch the selector to the DC voltage mode.

**NOTE:**

- Make sure that the adaptor leads are properly installed in the digital circuit tester.
- Make sure that the positive pin (the "+" mark facing up as shown) on the adaptor is installed into the positive terminal of the tester.
- The test harness is needed for the following tests.

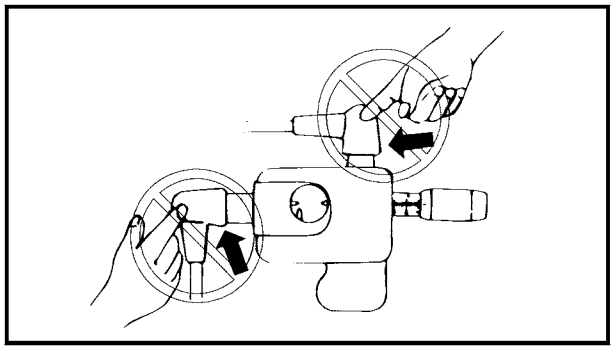
A Voltage measurement
B Peak voltage measurement

# IGNITION SYSTEM
## WIRING DIAGRAM




① Ignitor ass'y
② Spark plug
③ Engine stop switch

B : Black
W : White



## IGNITION SPARK GAP

**⚠ WARNING**

- **When checking the spark gap, do not touch any of the connections of the spark gap tester lead wires.**
- **When performing the spark gap test, take special care not to let sparks leak out of the removed spark plug cap.**
- **When performing the spark gap check, keep flammable gas or liquids away, since this test can produce sparks.**

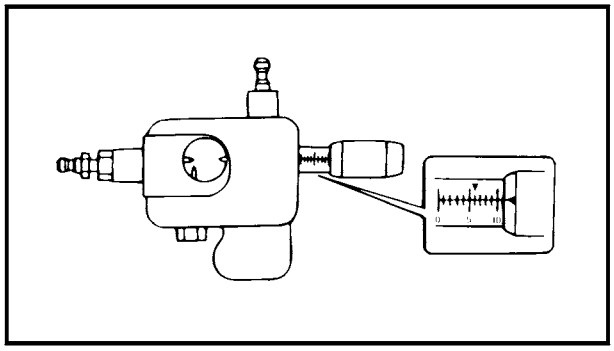
1. Check:
   - Ignition spark gap
     Less than specification → Continue to check the ignitor ass'y output.

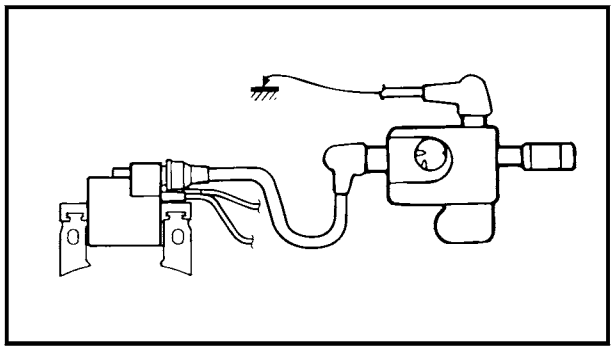
**Spark gap:**
**9 mm (0.4 in)**

**Checking steps:**
- Remove the spark plugs from the engine.
- Connect the spark plug cap to the spark gap tester.
- Set the spark gap length on the adjusting knob.

**Spark gap tester:**
**YM-34487/90890-06754**

- Crank the engine and observe the ignition system spark through the discharge window.

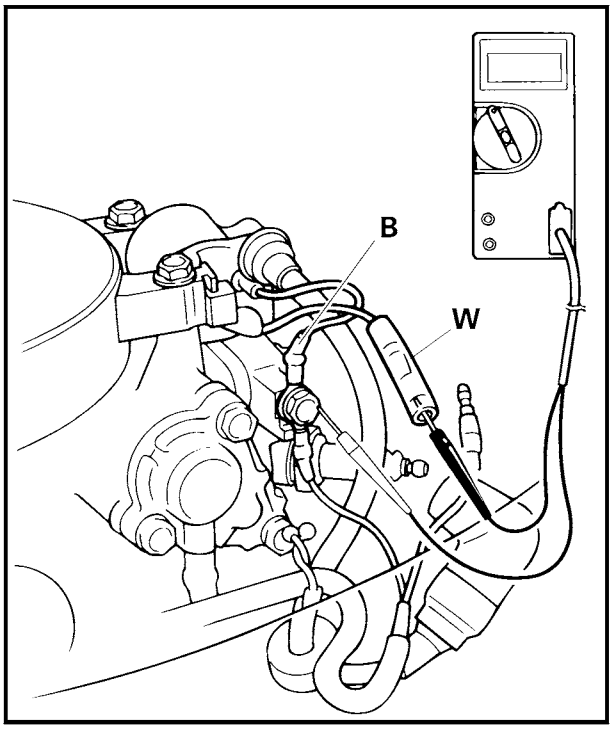




## IGNITION SYSTEM PEAK VOLTAGE

**⚠ WARNING**

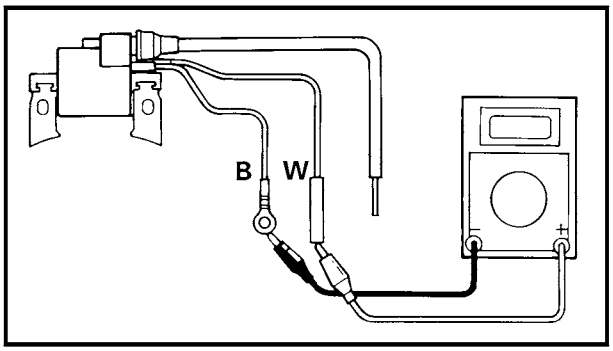
**When checking the T.C.I. system do not touch any of the connections of the digital tester lead wires and high-tension cord.**




1. Remove:
   - Spark plug cap
2. Disconnect:
   - Ignitor ass'y lead (W)
3. Measure:
   - Ignitor ass'y output peak voltage
     Below specification → Replace the or check the ignitor ass'y.

**Output peak voltage:**
**Tester (+) lead → Black lead**
**Tester (–) lead → White lead**

| | Cranking (300 r/min) |
|---|---|
| | Opened |
| V | 126 |



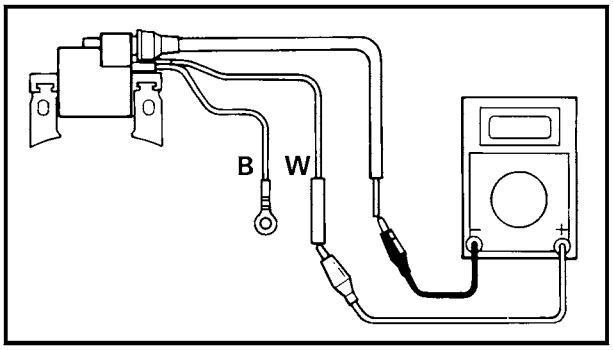

**Ignitor ass'y coil resistance**

1. Remove:
   - Ignitor ass'y
2. Measure:
   - Ignitor ass'y coil resistance
     Out of specification → Replace.

**Ignitor ass'y coil resistance:**
**Primary coil: 0.56 ~ 0.84 Ω**

**Measuring steps:**
- Connect the pocket tester (Ω × 1) to the ignitor ass'y lead.

**Primary:**
**Tester (+) lead → White lead**
**Tester (–) lead → Black lead**




**Ignitor ass'y coil resistance:**
**Secondary coil: 11.6 ~ 17.4 kΩ**

**Measuring steps:**
- Connect the pocket tester (kΩ × 1) to the ignitor ass'y lead.

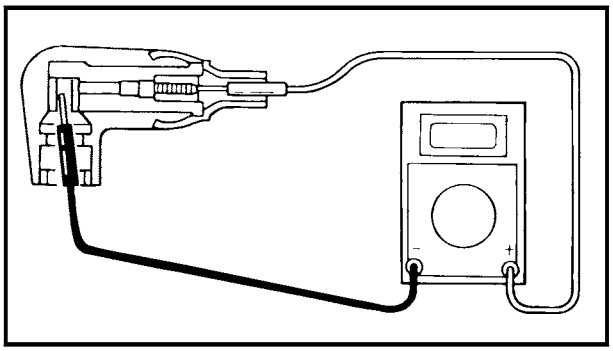
**Secondary:**
**Tester (+) lead → White lead**
**Tester (–) lead → High-tension cord**

## SPARK PLUG

Refer to "GENERAL" in chapter 3.

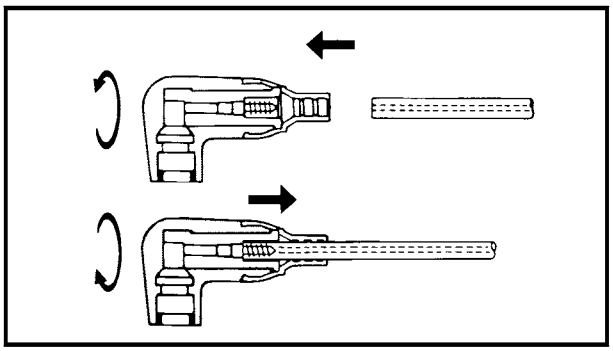
## SPARK PLUG CAP (WITH RESISTER)

1. Inspect:
   - Spark plug cap
     Loose → Tighten.
     Cracks/damage → Replace.
2. Remove:
   - Spark plug cap

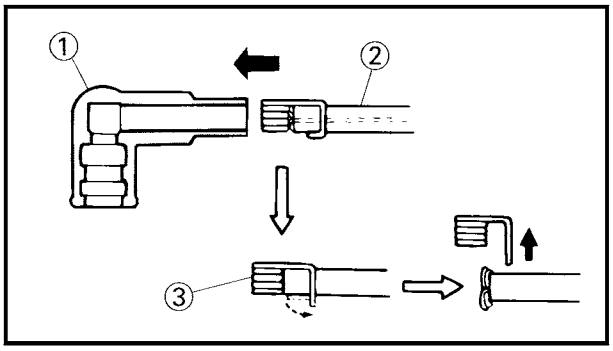


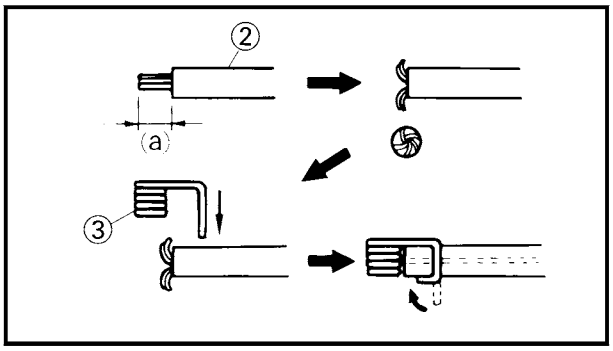
3. Measure:
   - Spark plug cap resistance
     Out of specification → Replace.

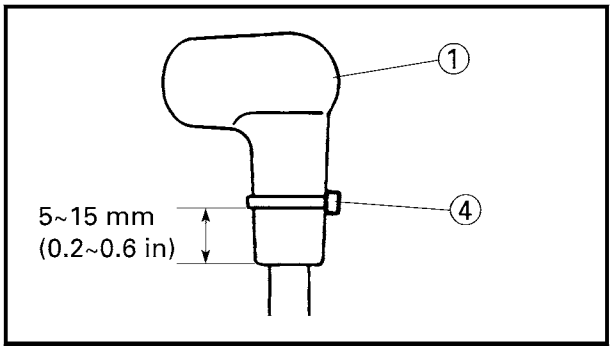
**Spark plug cap resistance:**
**With resister type**
**4.0 ~ 6.0 kΩ**

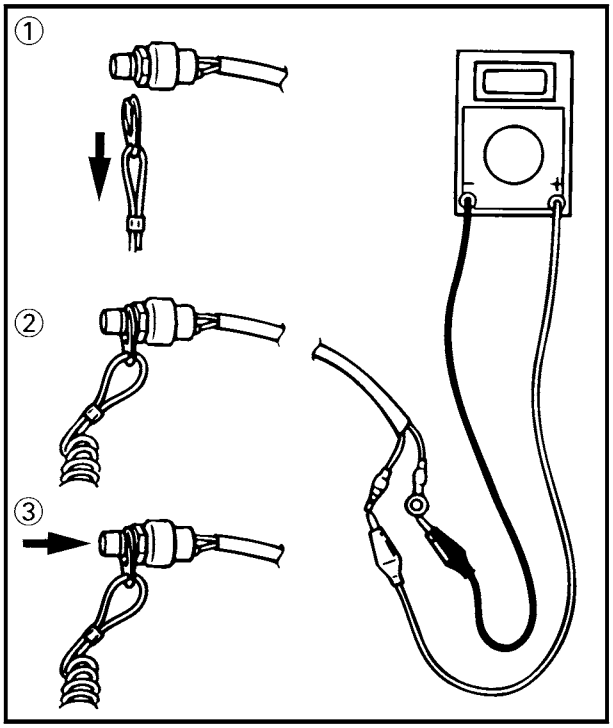


**Replacement steps:**
**(resister type)**
- To remove the spark plug cap turn it counter clockwise.
- To install the spark plug cap turn it clockwise until it is tight.




## SPARK PLUG CAP (STANDARD)

1. Inspect:
   - Spark plug cap
     Cracks/damage → Replace.
   - Plug cap spring
     Deformity/damage → Replace.

**Replacement steps:**
**(standard type)**

- Remove the high-tension cord ② from the spark plug cap ① by pulling it.
- Remove the plug cap spring ③ and lift up from the high-tension cord ②.
- Cut off the end of the high-tension cord about length ⓐ.

**Length ⓐ:**
**5 mm (0.2 in)**

- Strip off cord end about ⓐ and fit the plug cap spring ③.
- To fit the high-tension cord to the spark plug cap push into the plug cap.
- Bind the plug cap ① bottom tightly with the clamp clip ④ and fasten it.

## ENGINE STOP SWITCH

1. Check:
   - Continuity
     No continuity → Replace.

| | Lead color | |
|---|---|---|
| | White | Black |
| **Remove the lock plate ①.** | ○—— | ——○ |
| **Install the lock plate ②.** | | |
| **Push the Button ③.** | ○—— | ——○ |

# CHAPTER 9
# TROUBLE ANALYSIS

# TROUBLE ANALYSIS

**NOTE:**

The following items should be checked before the "Trouble analysis" chart is consulted.
1. There are no incorrect wiring connections.
2. Wiring connections are properly secured and are not rusty.
3. The lanyard is attached to the engine stop switch.
4. The shift position is in neutral.
5. Fuel is reaching the carburetor.
6. The rigging and engine settings are correct.
7. The engine is free from any "Hull problem".

## TROUBLE ANALYSIS CHART

| Trouble mode | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | ROUGH IDLING | ENGINE STALLS | ENGINE WILL NOT STOP | POOR PERFORMANCE | OVERHEATING | LOOSE STEERING | HARD SHIFTING | Relative part | Reference chapter |
| | | | | | | | | FUEL SYSTEM | |
| ○ | | ○ | | ○ | | | | Fuel hose | 4 |
| ○ | | | | ○ | | | | Fuel joint | 4 |
| ○ | ○ | | | ○ | | | | Fuel filter | 4 |
| ○ | | | | ○ | | | | Fuel pump | 4 |
| ○ | ○ | | | ○ | | | | Carburetor | 4 |
| | ○ | ○ | | ○ | | | | ● Idle speed | 3 |
| | ○ | ○ | | ○ | ○ | | | ● Pilot screw* | *3 |
| ○ | ○ | ○ | | ○ | ○ | | | ● Pilot jet | 3 |
| | | ○ | | ○ | | | | Throttle cable | 3 |
| | | | | | | | | POWER UNIT | |
| ○ | ○ | ○ | | | ○ | | | Spark plug | 3 |
| ○ | ○ | | | ○ | | | | Compression | 3 |
| ○ | | | | | | | | Valve clearance | 3 |
| ○ | ○ | | | ○ | | | | T.C.I. air gap | 3 |
| ○ | ○ | | | ○ | | | | Intake and exhaust valves | 5 |
| ○ | ○ | | | ○ | | | | Intake and exhaust valve seat | 5 |
| ○ | ○ | | | | | | | Cylinder head gasket | 5 |
| ○ | | | | ○ | | | | Piston rings | 5 |
| ○ | | | | ○ | | | | Piston | 5 |
| | | | | | ○ | | | Thermostat | 5 |
| | | | | | ○ | | | Water passage | 5 |

* Except for USA

# TROUBLE ANALYSIS



| Trouble mode | | | | | | | | Check elements | |
|---|---|---|---|---|---|---|---|---|---|
| ENGINE WILL NOT START | ROUGH IDLING | ENGINE STALLS | ENGINE WILL NOT STOP | POOR PERFORMANCE | OVERHEATING | LOOSE STEERING | HARD SHIFTING | Relative part | Reference chapter |
| | | | | | | | | LOWER UNIT | |
| ○ | | | | | | | ○ | Neutral position | 6 |
| ○ | | | | | | | ○ | Clutch | 6 |
| ○ | | | | | | | ○ | Gear | 6 |
| | | | | ○ | ○ | | | Water inlet | 6 |
| | | | | ○ | ○ | | | Water pump | 6 |
| | | | | ○ | | | | Propeller shaft | 6 |
| | | | | | | | ○ | Shifter/Pin | 6 |
| | | | | | | | ○ | Shift cam | 6 |
| | | | | | | | ○ | Shift rod | 6 |
| | | | | | | | ○ | Lower case | 6 |
| | | | | | | | | BRACKET UNIT | |
| | | | | | | ○ | | Bracket | 7 |
| | | | | | | ○ | | Mount rubber | 7 |
| | | | | | | ○ | | Steering friction ass'y | 7 |
| | | | | | | | | ELECTRICAL | |
| ○ | ○ | ○ | | ○ | | | | Ignitor ass'y | 8 |
| | | | ○ | | | | | Engine stop switch/Wire lead | 8 |

YAMAHA

YAMAHA MOTOR CO., LTD.

Printed in USA

Dec. 1998 – × 1 CR

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