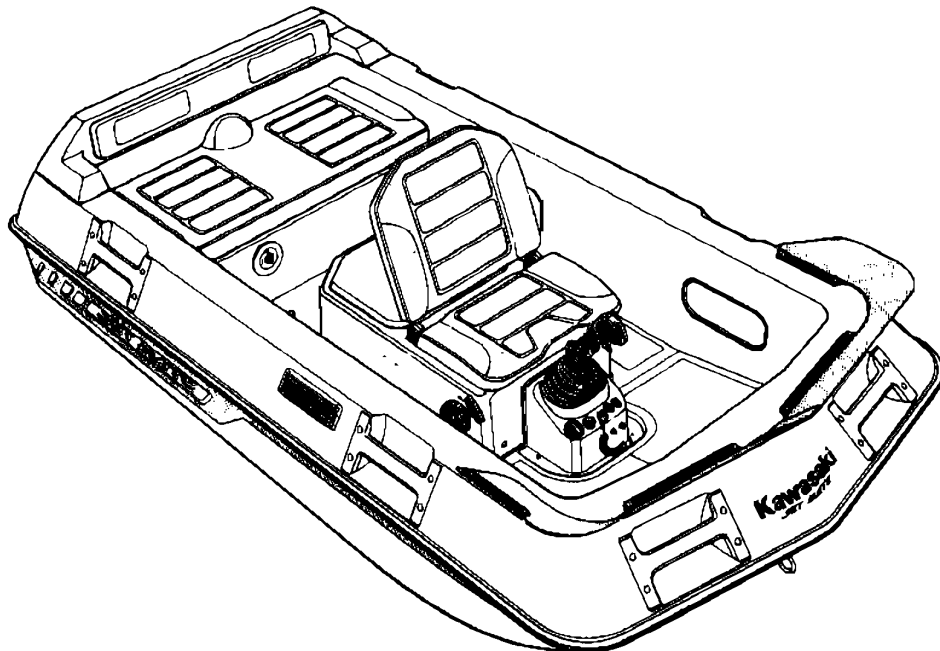


Kawasaki ***JET MATE***



Watercraft Service Manual

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QUICK REFERENCE GUIDE

GENERAL INFORMATION

1

FUEL SYSTEM

2

ENGINE LUBRICATION SYSTEM

3

EXHAUST SYSTEM

4

ENGINE TOP END

5

ENGINE REMOVAL AND INSTALLATION

6

ENGINE BOTTOM END

7

COOLING AND BILGE SYSTEMS

8

DRIVE SHAFT

9

PUMP AND IMPELLER

10

STEERING

11

HULL

12

ELECTRICAL SYSTEM

13

STORAGE

14

APPENDIX

15

This quick reference guide will assist you in locating a desired topic or procedure.

- Bend the pages back to match the black tab of the desired chapter number with the black tab on the edge at each table of contents page.

- Refer to the sectional table of contents for the exact pages to locate the specific topic required.

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Kawasaki

JET MATE

Watercraft Service Manual

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The right is reserved to make changes at any time without prior notice and without incurring an obligation to make such changes to products manufactured previously. See your watercraft dealer for the latest information on product improvements incorporated after this publication.

All information contained in this publication is based on the latest product information available at the time of publication. Illustrations and photographs in this publication are intended for reference use only and may not depict actual model component parts.

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Third edition (3) : Sep. 10, 1997 (K)

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LIST OF ABBREVIATIONS

A	ampere(s)	lb	pound(s)
ABDC	after bottom dead center	m	meter(s)
AC	alternating current	N	newton(s)
ATDC	after top dead center	Pa	pascal(s)
BBDC	before bottom dead center	Pa	Pascal(s)
BDC	bottom dead center	PS	horsepower
BTDC	before top dead center	psi	pound(s) per square inch
°C	degree(s) Celsius	r	revolution
DC	direct current	rpm	revolution(s) per minute
F	farad(s)	TDC	top dead center
°F	degree(s) Fahrenheit	TIR	total indicator reading
ft	foot, feet	V	volt(s)
g	gram(s)	W	watt(s)
h	hour(s)	Ω	ohm(s)
L	Liter(s)		



**WARNING
CONTAINS
ASBESTOS**

Breathing asbestos
dust is dangerous
to health

Follow safety
instructions

This warning may apply to any of the following components or any assembly containing one or more of these components:—

- Brake Shoes or Pads
- Clutch Friction Material
- Gaskets
- Insulators

SAFETY INSTRUCTIONS

- Operate if possible out of doors or in a well ventilated place.
- Preferably use hand tools or low speed tools equipped, if necessary, with an appropriate dust extraction facility. If high speed tools are used, they should always be so equipped.
- If possible, dampen before cutting or drilling.
- Dampen dust and place it in properly closed receptacle and dispose of it safely.

Read OWNER'S MANUAL before operating

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Foreword

This manual is designed primarily for use by trained mechanics in a properly equipped shop. However, it contains enough detail and basic information to make it useful to the owner who desires to perform his own basic maintenance and repair work. A basic knowledge of mechanics, the proper use of tools, and workshop procedures must be understood in order to carry out maintenance and repair satisfactorily. Whenever the owner has insufficient experience or doubts his ability to do the work, all adjustments, maintenance, and repair should be carried out only by qualified mechanics.

In order to perform the work efficiently and to avoid costly mistakes, read the text, thoroughly familiarize yourself with the procedures before starting work, and then do the work carefully in a clean area. Whenever special tools or equipment are specified, do not use makeshift tools or equipment. Precision measurements can only be made if the proper instruments are used, and the use of substitute tools may adversely affect safe operation.

For the duration of your warranty period, especially, we recommend that all repairs and scheduled maintenance be performed in accordance with this service manual. Any owner maintenance or repair procedure not performed in accordance with this manual may void the warranty.

To get the longest life out of your watercraft:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki watercraft parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki watercrafts are introduced by the Special Tool Manual. Genuine parts provided as spare parts are listed in the Parts Catalog.
- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

How to Use this Manual

In preparing this manual, we divided the product into its major systems. These systems became the manual's chapters. All information for a particular system from adjustment through disassembly and inspection is located in a single chapter.

The Quick Reference Guide shows you all of the product's systems and assists in locating their chapters. Each chapter in turn has its own comprehensive Table of Contents.

The Periodic Maintenance Chart is located in the General Information chapter. The chart gives a time schedule for required maintenance operations.

If you want spark plug information, for example, go to the Periodic Maintenance Chart first. The chart tells you how frequently to clean and gap the plug. Next, use the Quick Reference Guide to locate the Electrical System chapter. Then, use the Table of Contents on the first page of the chapter to find the Spark Plug section.

Whenever you see these WARNING and CAUTION symbols, heed their instructions! Always follow safe operating and maintenance practices.

WARNING

- This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.

CAUTION

- This caution symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of equipment.

This manual contains five more symbols (in addition to WARNING and CAUTION) which will help you distinguish different types of information.

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NOTE

○ *This note symbol indicates points of particular interest for more efficient and convenient operation.*

- Indicates a procedural step or work to be done.
- Indicates a procedural sub-step or how to do the work of the procedural step it follows. It also precedes the text of a WARNING, CAUTION, or NOTE.
- ★ Indicates a conditional step or what action to take based on the results of the test or inspection in the procedural step or sub-step it follows.
- ☆ Indicates a conditional sub-step or what action to take based upon the results of the conditional step it follows.

In most chapters an exploded view illustration of the system components follows the Table of Contents. In these illustrations you will find the instructions indicating which parts require specified tightening torque, oil, grease or a locking agent during assembly.

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GENERAL INFORMATION

Table of Contents

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General Specification	1-6
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Torque and Locking Agent	1-8
Cable Routing	1-10

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1-2 GENERAL INFORMATION

Before Servicing

Before starting to service a motorcycle, careful reading of the applicable section is recommended to eliminate unnecessary work. Photographs, diagrams, notes, cautions, warnings, and detailed descriptions have been included wherever necessary. Nevertheless, even a detailed account has limitations, a certain amount of basic knowledge is also required for successful work.

Especially note the following:

(1) Adjustments

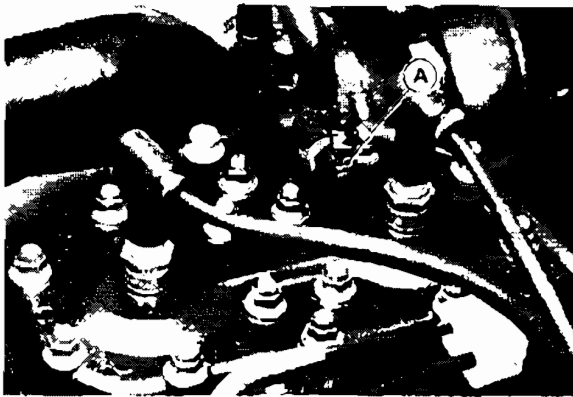
Adjustments shall be made in accordance with the Periodic Maintenance Chart or whenever troubleshooting or presence of symptoms indicate that adjustments may be required. Whenever running of the engine is required during maintenance it is best to have the watercraft in water.

CAUTION

- Do not run the engine without cooling water supply for more than 15 seconds or severe engine and exhaust system damage will occur.

(2) Auxiliary Cooling

An auxiliary cooling supply may be used if the watercraft cannot be operated in water during adjustments. If possible, always operate the watercraft in water rather than use an auxiliary cooling supply.



A. Fitting Cap



A. Garden Hose

- Remove the fitting cap at the cooling hose fitting.
- Attach to the garden hose fitting and clamp the garden hose securely (see above).
- Attach the garden hose to a faucet. Do not turn on the water until the engine is running and turn it off immediately when the engine stops. The engine requires 2.4 L/min (2.5 qts/min) at 1 800 rpm (idle) and 7.0 L/min (7.4 qts/min) at 6 000 rpm.

CAUTION

- Insufficient cooling supply will cause the engine and/or exhaust system to overheat and severe damage will occur. Excessive cooling supply may kill the engine and flood the cylinder, causing hydraulic lock. Hydraulic lock will cause severe damage to the engine. If the engine dies while using an auxiliary cooling supply, the water must be shut off immediately.

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(3) Dirt

Before removal and disassembly, clean the watercraft. Any sand entering the engine carburetor, or other parts will work as an abrasive and shorten the life of the watercraft. For the same reason, before installing a new part, clean off any dust or metal filings.

(4) Battery Ground

Remove the ground (—) lead from the battery before performing any disassembly operations on the watercraft. This prevents:

- (a) the possibility of accidentally turning the engine over while partially disassembled.
- (b) sparks at electrical connections which will occur when they are disconnected.
- (c) damage to electrical parts.

(5) Tightening Sequence

Generally, when installing a part with several bolts, nuts, or screws, they should all be started in their holes and tightened to a snug fit. Then tighten them evenly in a cross pattern. This is to avoid distortion of the part and/or causing gas or oil leakage. Conversely when loosening the bolts, nuts, or screws, first loosen all of them by about a quarter of turn and then remove them.

Where there is a tightening sequence indication in this Service Manual, the bolts, nuts, or screws must be tightened in the order and method indicated.

(6) Torque

The torque values given in this Service Manual should always be adhered to. Either too little or too much torque may lead to serious damage. Use a good quality, reliable torque wrench.

(7) Force

Common sense should dictate how much force is necessary in assembly and disassembly. If a part seems especially difficult to remove or install, stop and examine what may be causing the problem. Whenever tapping is necessary, tap lightly using a wooden or plastic faced mallet. Use an impact driver for screws (particularly for the removal of screws held by a locking agent) in order to avoid damaging the screw heads.

(8) Edges

Watch for sharp edges, especially during major engine disassembly and assembly. Protect your hands with gloves or a piece of thick cloth when lifting the engine or turning it over.

(9) High Flash-point Solvent

A high flash-point solvent is recommended to reduce fire danger. A commercial solvent commonly available in North America is Stoddard solvent (generic name). Always follow manufacturer and container directions regarding the use of any solvent.

(10) Gasket, O-ring

Do not reuse a gasket or O-ring once it has been in service. The mating surfaces around the gasket should be free of foreign matter and perfectly smooth to avoid oil or compression leaks.

(11) Liquid Gasket, Non-permanent Locking Agent

Follow manufacturer's directions for cleaning and preparing surfaces where these compounds will be used. Apply sparingly. Excessive amounts may block engine oil passages and cause serious damage. An example of a non-permanent locking agent commonly available in North America is Loctite Lock'n Seal (Blue).

(12) Press

A part installed using a press or driver, such as a seal, should first be coated with oil on its outer or inner circumference so that it will go into place smoothly.

(13) Ball Bearing

When installing a ball bearing, the bearing race which is affected by friction should be pushed by a suitable driver. This prevents severe stress on the balls and races, and prevents races and balls from being dented. Press a ball bearing until it stops at the stop in the hole or on the shaft.

(14) Oil Seal and Grease Seal

Replace any oil or grease seals that were removed with new ones, as removal generally damages seals.

When pressing in a seal which has manufacturer's marks, press it in with the marks facing out. Seals should be pressed into place using a suitable driver, which contacts evenly with the side of seal, until the face of the seal is even with the end of the hole.

(15) Seal Guide

A seal guide is required for certain oil or grease seals during installation to avoid damage to the seal lips. Before a shaft passes through a seal, apply a little oil, preferably high temperature grease on the lips to reduce rubber to metal friction.

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1-4 GENERAL INFORMATION

(16) Circlip, Retaining Ring, Cotter Pin

Replace any circlips, cotter pins and retaining rings that were removed with new ones, as removal weakens and deforms them. When installing circlips and retaining rings, take care to compress or expand them only enough to install them and no more.

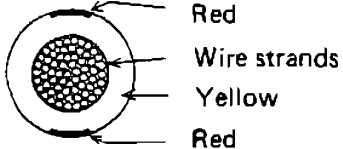
(17) Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the rubbing surfaces have an adequate lubricative film. During assembly, oil or grease (whichever is more suitable) should be applied to any rubbing surface which has lost its lubricative film. Old grease and dirty oil should be cleaned off. Deteriorated grease has lost its lubricative quality and may contain abrasive foreign particles.

Don't use just any oil or grease. Some oils and greases in particular should be used only in certain applications and may be harmful if used in an application for which they are not intended.

(18) Electrical Wires

All the electrical wires are either single-color or two-color and, with only a few exceptions, must be connected to wires of the same color. On any of the two-color wires there is a greater amount of one color and a lesser amount of a second color, so a two-color wire is identified by first the primary color and then the secondary color. For example, a yellow wire with thin red stripes is referred to as a "yellow/red" wire; it would be a "red/yellow" wire if the colors were reversed to make red the main color.

Wire (cross-section)	Name of Wire Color
	Yellow/red

(19) Replacement Parts

When there is a replacement instruction, replace these parts with new ones every time they are removed. These replacement parts will be damaged or lose their original function once removed.

(20) Inspection

When parts have been disassembled, visually inspect these parts for the following conditions or other damage. If there is any doubt as to the condition of them, replace them with new ones.

Abrasion	Crack	Hardening	Warp
Bent	Dent	Scratch	Wear
Color change	Deterioration	Seizure	

(21) Service Data

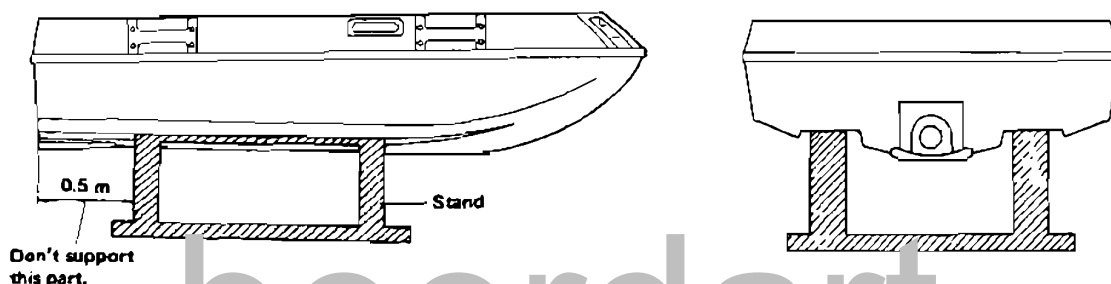
Numbers of service data in this text have following meanings:

"Standards": Show dimensions or performances which brand-new parts or systems have.

"Service limits": Indicate the usable limits. If the measurement shows excessive wear or deteriorated performance, replace the damaged parts.

(22) Hull Supporting

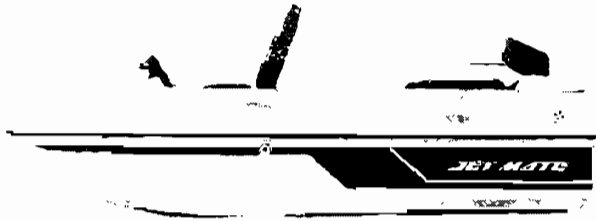
In order to work safely on the Jet Mate without damaging the hull, prepare the suitable stand, so that the supports fit into the tunnels in the hull. Be sure the stand does not touch the stern.



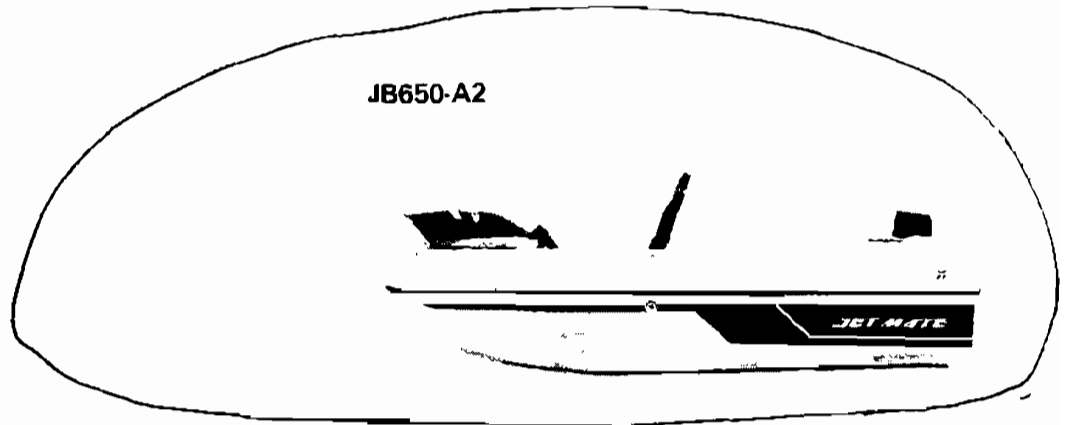
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Model Identification

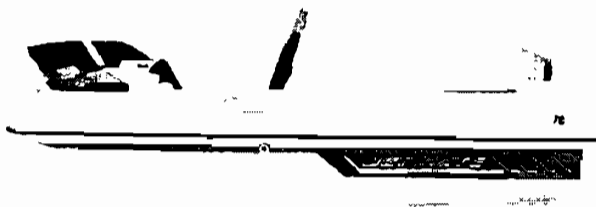
JB650-A1



JB650-A2



JB650-A3



JB650-A4



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1-6 GENERAL INFORMATION

General Specifications

Engine:		
Type	2-stroke, vertical twin, crankcase reed valve, water cooled	
Displacement	635 mL	
Bore and Stroke	76.0 x 70.0 mm	
Compression Ratio	7.2 : 1	
Maximum Horsepower	38.2 kW (52 PS) @6 000 r/min (rpm)	
Maximum Torque	64.7 N-m (6.6 kg-m, 47.7 ft-lb) @5 500 r/min (rpm)	
Ignition	Magneto CDI	
Lubrication System	Oil injection (break-in period: Oil injection and fuel mixture 50 : 1)	
Carburetor	Keihin CDK34 diaphragm type (28 mm venturi)	
Starting System	Electric Starter	
Turning Specifications:		
Spark Plug	NGK BR7ES	
Gap	0.7 – 0.8 mm	
Ignition Timing	17° BTDC @6 000 r/min (rpm), 2.0 mm @6 000 r/min (rpm)	
Carburetor		
Idle Speed	1 250 ± 100 r/min (rpm) : In water 1 800 ± 100 r/min (rpm) : Out of water	
Compression Pressure	865 – 1 325 kPa (8.8 – 13.5 kg/cm ² , 125 – 192 psi)	
Drive Shaft:		
Coupling	Direct drive from engine	
Jet Pump: Type	Axial flow, single stage	
Thrust	2 260 N (230 kg, 507 lb)	
Steering	Steerable nozzle	
Braking	Water drag	
Performance:		
†Draft (Stationary)	310 mm	
†Fuel Consumption	19 L/h @full throttle	
Maximum Capacity	3 persons, (US) 3 persons or 218 kg (480 lb)	
†Minimum Turning Radius	2.1 m	
Dimensions:		
Length	2 710 mm	
Width	1 525 mm	
Height	770 mm	
Dry Weight	239 kg	
Fuel Tank Capacity	30 L including 4 L reserve	
Engine Oil:		
Type	2-stroke, N.M.M.A. Certified for Service TC-W	
Oil Tank Capacity	5.5 L	
Electrical Equipment:		
Battery	12 V 50 Ah (20-hour rate)/40 Ah (5-hour rate)	
Maximum Generator Output	8 A/14 V @5 000 r/min (rpm)	

(US) = US model

† = This information shown here represents results under controlled conditions, and the information may not be correct under other conditions.

Specification subject to change without notice, and may not apply to every country.

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Periodic Maintenance Chart

NOTE

○ *Complete the Pre-Ride Checklist before each outing.*

Frequency Description	Initial 10 Hours	Every 25 Hours	Every 100 Hours
Check all hose clamps, nuts, bolts, and fasteners	•	•	
Torque cylinder head nuts	•	•	
Grease both ends of throttle and choke cables		•	
Clean and gap spark plug (replace if necessary)		•	
Check battery level, and terminal		•	
Lubricate steering nozzle and reverse bucket pivots		•	
Lubricate steering and shift cable ball joints		•	
Lubricate choke cable and throttle cable		•	
Inspect steering pivot (disassemble)		•	
Inspect/clean fuel filter screen		•	
Inspect engine oil vent check valve		•	
Adjust carburetor		•	
Flush cooling system (after each use in salt water)		•	
Inspect/clean flame arrestor		•	
Clean drive shaft			•
Inspect impeller blade for damage (remove)			•
Inspect/replace coupling damper			•
Inspect carburetor throttle shaft spring (replace carburetor if necessary)			•
Inspect steering and shift cables			•
Inspect/clean fuel vent screen			•
Inspect/clean anti-siphon valve			•

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1-8 GENERAL INFORMATION

Torque and Locking Agent

The following tables list the tightening torque for the major fasteners requiring use of a non-permanent locking agent or silicone sealant.

Letters used in the "Remarks" column mean:

L : Apply a non-permanent locking agent to the threads.

SS : Apply silicone sealant to the threads.

S : Tighten the fasteners following the specified sequence.

Fastener	Torque			Remarks
	N-m	kg-m	ft-lb	
Fuel System:				
Fuel Tap Knob Set Screw	—	—	—	L
Carburetor Mounting Bolts	—	—	—	L
Intake Manifold Mounting Nuts	7.8	0.80	69 in-lb	
Air Intake Cover Bolts	—	—	—	L
Throttle and Choke Cable Clamp Bolts	—	—	—	L
Fuel Pump Mounting Bolts	—	—	—	L
Exhaust System:				
Exhaust Pipe Bolts (8 mm Dia.)	25	2.5	18.0	
Exhaust Pipe Bolts (10 mm Dia.)	49	5.0	36	
Water Pipe Joints	9.8	1.0	87 in-lb	SS
Exhaust Manifold Mounting Nuts	20	2.0	14.5	S
Engine Top End:				
Cylinder Head Nuts	29	3.0	22	S
Water Pipe Joint	9.8	1.0	87 in-lb	SS
Cylinder Base Nuts	34	3.5	25	
Engine Removal/Installation:				
Engine Mounting Bolts	36	3.7	27	L
Engine Mount Bolts	16	1.6	11.6	
Engine Bed Mounting Bolts	22	2.2	16.0	L
Engine Bottom End:				
Flywheel Bolt	98	10.0	72	
Coupling	98	10.0	72	
Magneto Cover Mounting Bolts	—	—	—	L
Crankcase Bolts (6 mm Dia.)	7.8	0.80	69 in-lb	L, S
Crankcase Bolts (8 mm Dia.)	25	2.5	18.0	L, S
Water Drain Valve Mounting Bolts	—	—	—	L
Water Drain Valve Cover Bolts	—	—	—	L
Magneto Cover Stud	—	—	—	L
Cooling and Bilge System:				
Water Pipe Joint	9.8	1.0	87 in-lb	SS

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Fastener	Torque			Remarks
	N-m	kg-m	ft-lb	
Drive Shaft:				
Coupling Cover Nuts	—	—	—	L
Coupling	39	4.0	29	
Drive Shaft Holder Mounting Bolts	22	2.2	16.0	L
Pump and Impeller:				
Water Pipe Joints	9.8	1.0	87 in-lb	SS
Steering Nozzle Pivot Bolts	9.8	1.0	87 in-lb	L
Pump Outlet Mounting Bolts	—	—	—	L
Pump Cap Bolts	—	—	—	L
Impeller	98	10.0	72	
Pump Mounting Bolts	22	2.2	16.0	L
Pump Cover Mounting Bolts	9.8	1.0	87 in-lb	L
Grate Mounting Bolts	9.8	1.0	87 in-lb	L
Steering:				
Reverse Bucket Pivot Bolts	9.8	1.0	87 in-lb	L
Control Stick Mounting Bolt	22	2.2	16	
Steering Shaft Clamp Bolt	22	2.2	16	
Main Bracket Mounting Bolt	22	2.2	16	
Cable Joint Arm Pivot Bolt	22	2.2	16	
Electrical System:				
Flywheel Bolt	98	10.0	72	L
Regulator/Rectifier Mounting Bolts	7.8	0.80	69 in-lb	L
CDI Igniter Mounting Bolts	7.8	0.80	69 in-lb	L
Spark Plugs	27	2.8	20	
Grommet Cap Bolts	7.8	0.80	69 in-lb	L
Starter Motor Mounting Bolts	—	—	—	L
Electric Case Bolts	7.8	0.80	69 in-lb	L
Electric Case Mounting Bolts	7.8	0.80	69 in-lb	L

This table relating tightening torque of the stainless bolt and the nut to thread diameter, lists the basic torque for the bolts and nuts. Use this table for only the bolts and nuts which do not require a specific torque value.

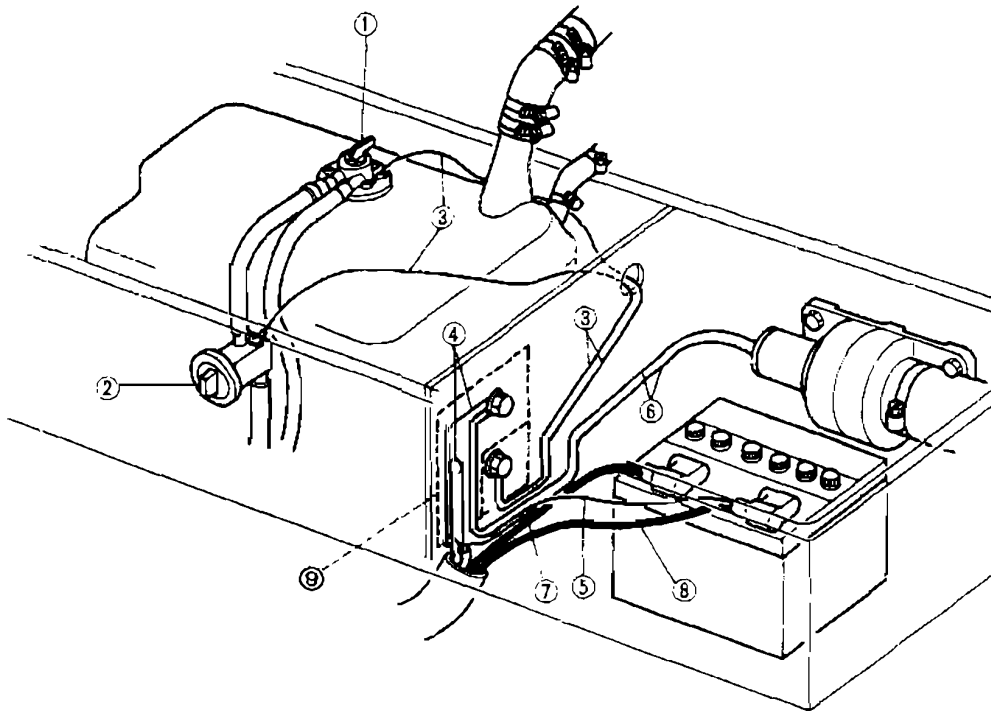
General Fasteners (stainless bolt and nut)

Threads dia.(mm)	Torque		
	N-m	kg-m	ft-lb
6	5.9 – 8.8	0.60 – 0.90	52 – 78 in-lb
8	16 – 22	1.6 – 2.2	11.6 – 15.9
10	30 – 41	3.1 – 4.2	22 – 30

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1-10 GENERAL INFORMATION

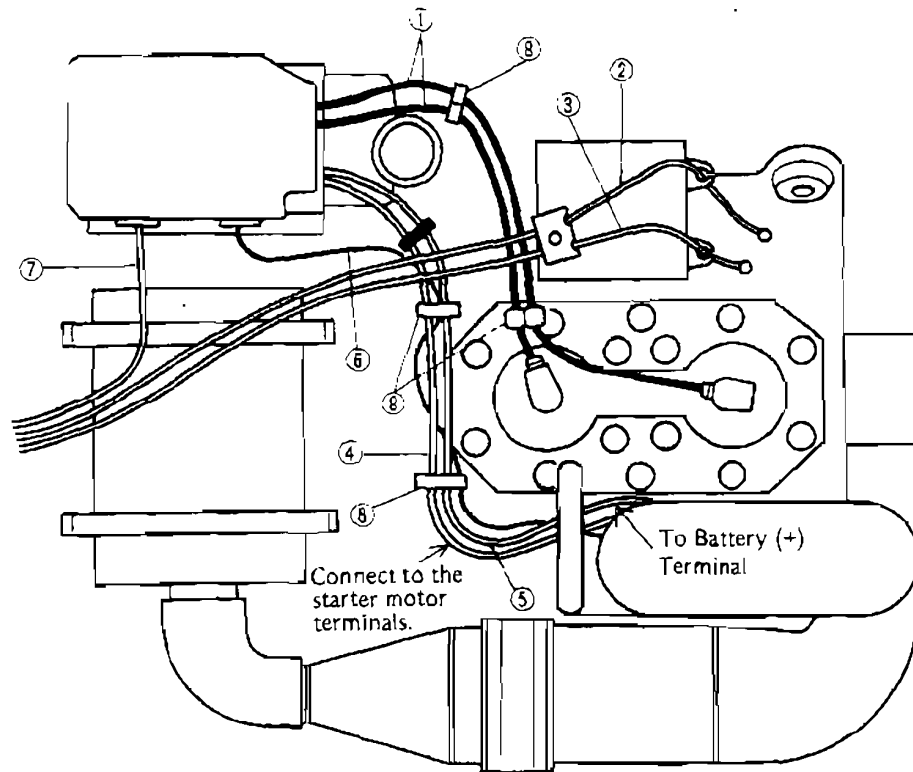
Cable Routing



1. Main Fuel Tap
2. Outside Fuel Tap
3. Ground Leads (Green)
4. Bilge Pump Leads

5. Battery Ground Lead
6. Blower Fan Leads
7. Battery (+) Cable
8. Battery (-) Cable
9. Cable Box

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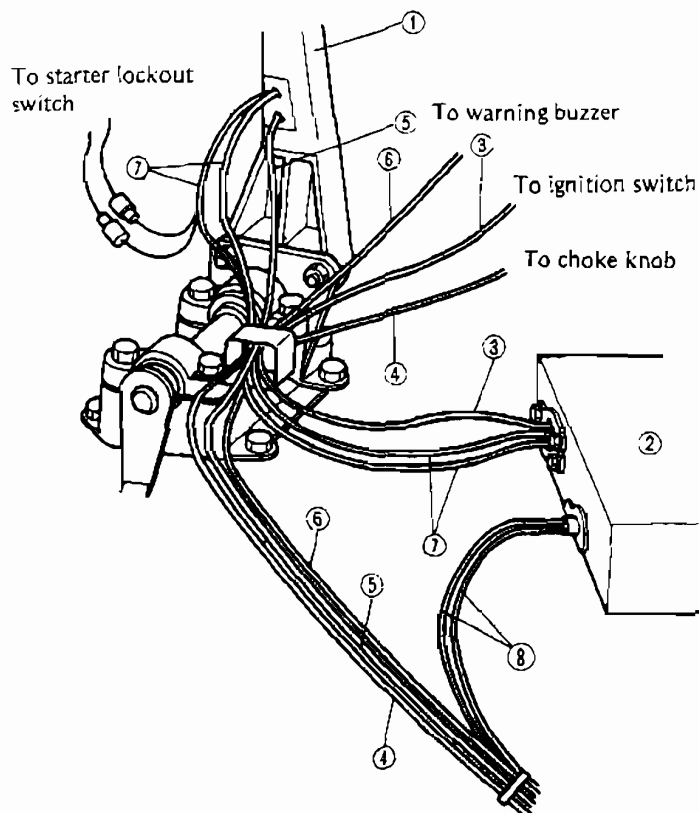


- 1. Spark Plug Leads
- 2. Throttle Cable
- 3. Choke Cable
- 4. Starter Motor Cable

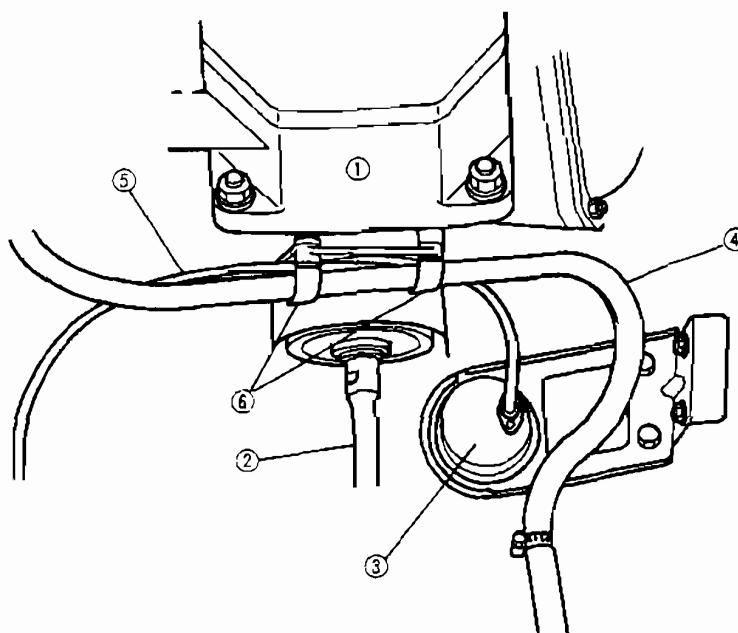
- 5. Battery (+) Cable
- 6. Stator Leads
- 7. Start/Stop and Ignition Switch Leads
- 8. Clamps

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1-12 GENERAL INFORMATION



1. Control Stick
2. Electric Case
3. Ignition Switch Leads
4. Choke Cable
5. Throttle Cable
6. Temperature Sensor Leads
7. Start/Stop Switch Leads
8. Magneto Leads



1. Cylinder
2. Drive Shaft
3. Bilge Pump
4. Inlet Cooling Hose
5. Bilge Pump Leads
6. Clamps

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FUEL SYSTEM

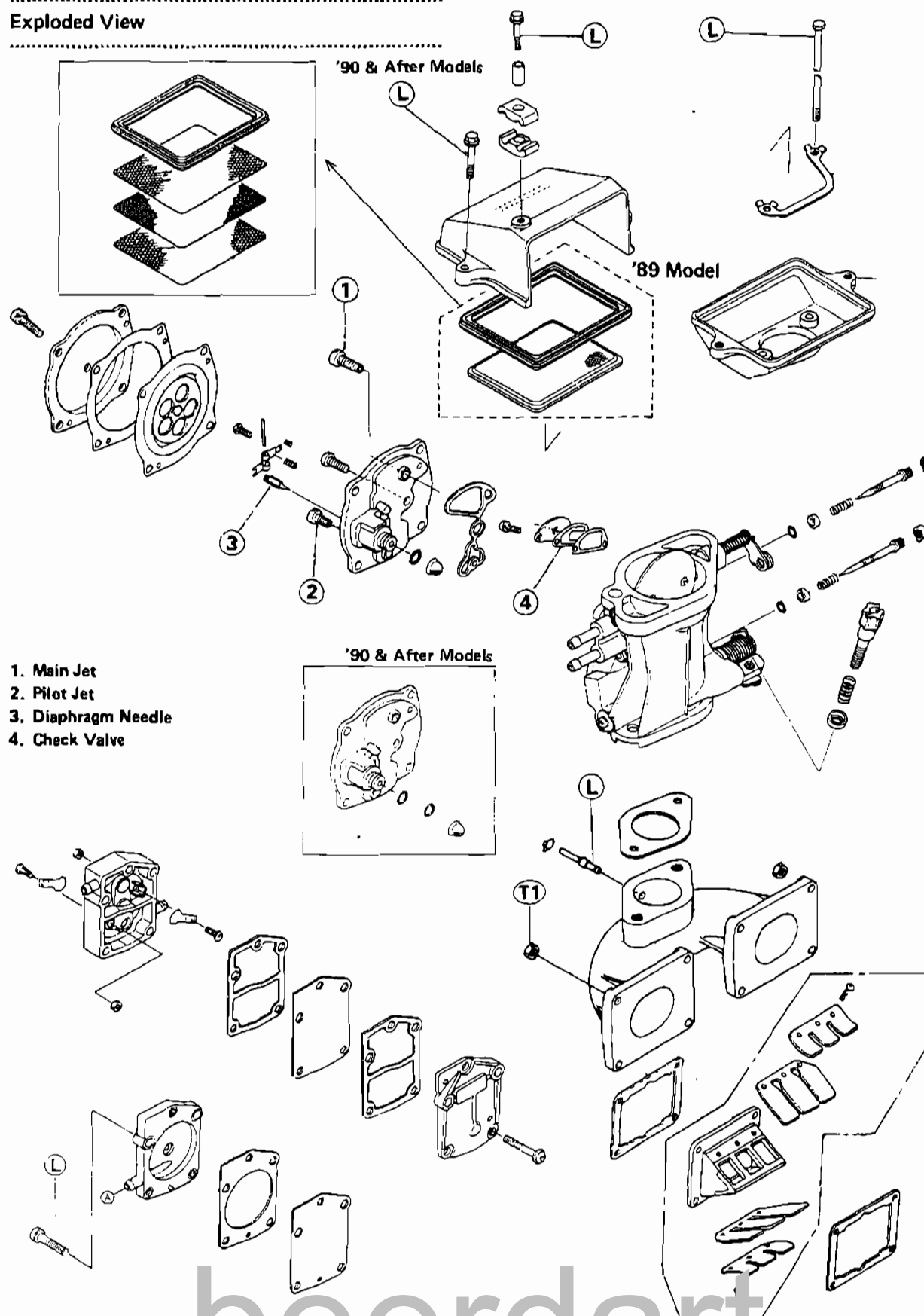
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Float Arm Level Inspection			
and Adjustment	2-14		
Flame Arrester	2-14		
Removal	2-14		
Installation	2-14		
Cleaning	2-15		

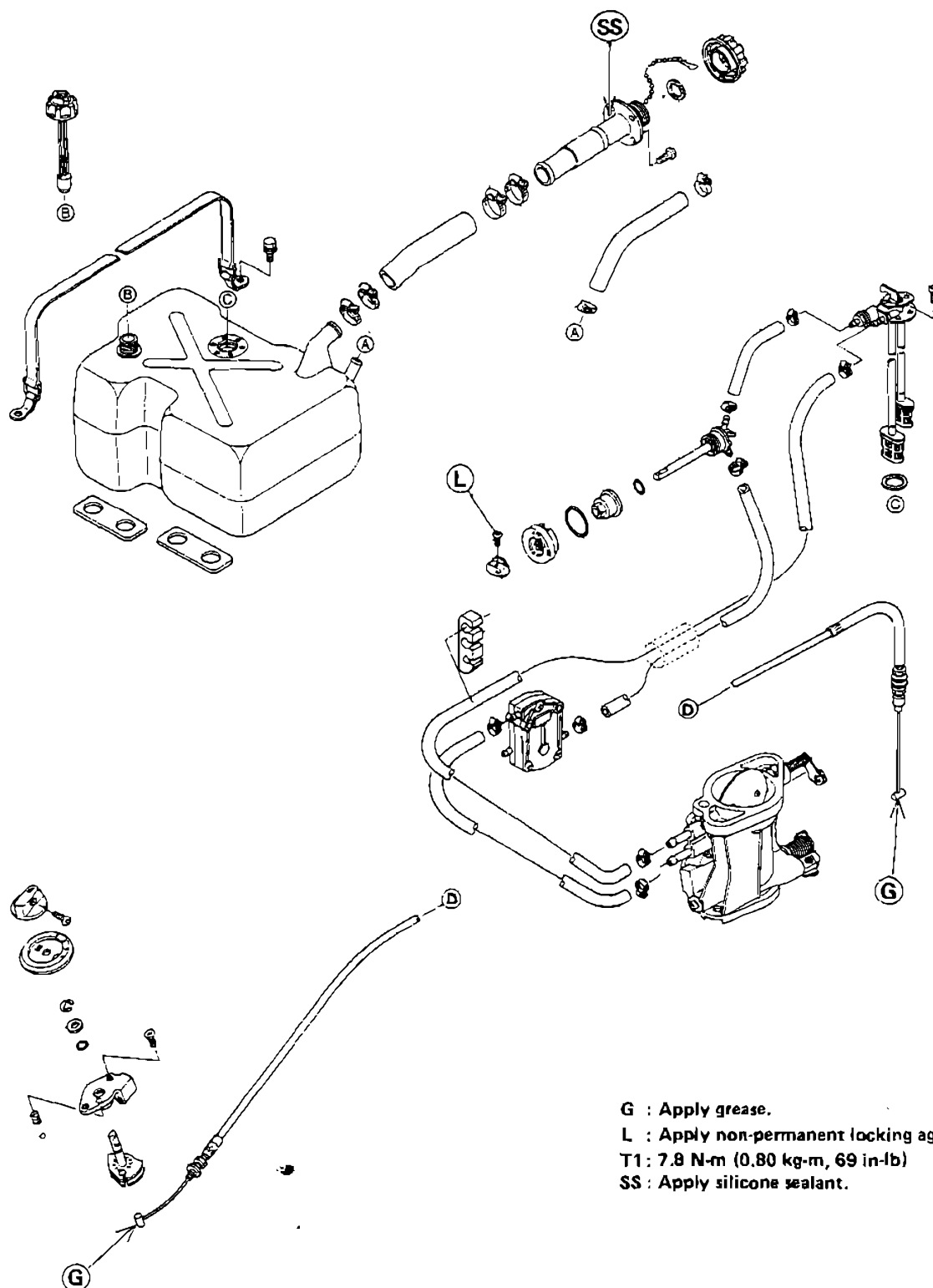
— beerdart —

2-2 FUEL SYSTEM

Exploded View



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G : Apply grease.
 L : Apply non-permanent locking agent.
 T1 : 7.8 N-m (0.80 kg-m, 69 in-lb)
 SS : Apply silicone sealant.

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2-4 FUEL SYSTEM

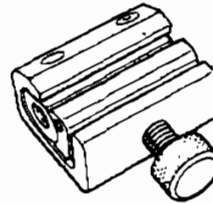
Specifications

Carburetor

Type	Keihin CDK34 Diaphragm
Size	28 mm Venturi
Mixture Screws	See Page 2-10
Main Jet	125
Pilot Jet	48
Slow Jet	58 ('89 model : 55)
Float Arm Level	1.5 ±0.5 mm

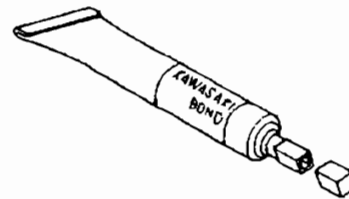
Special Tool

Pressure Cable Luber: K56019-021

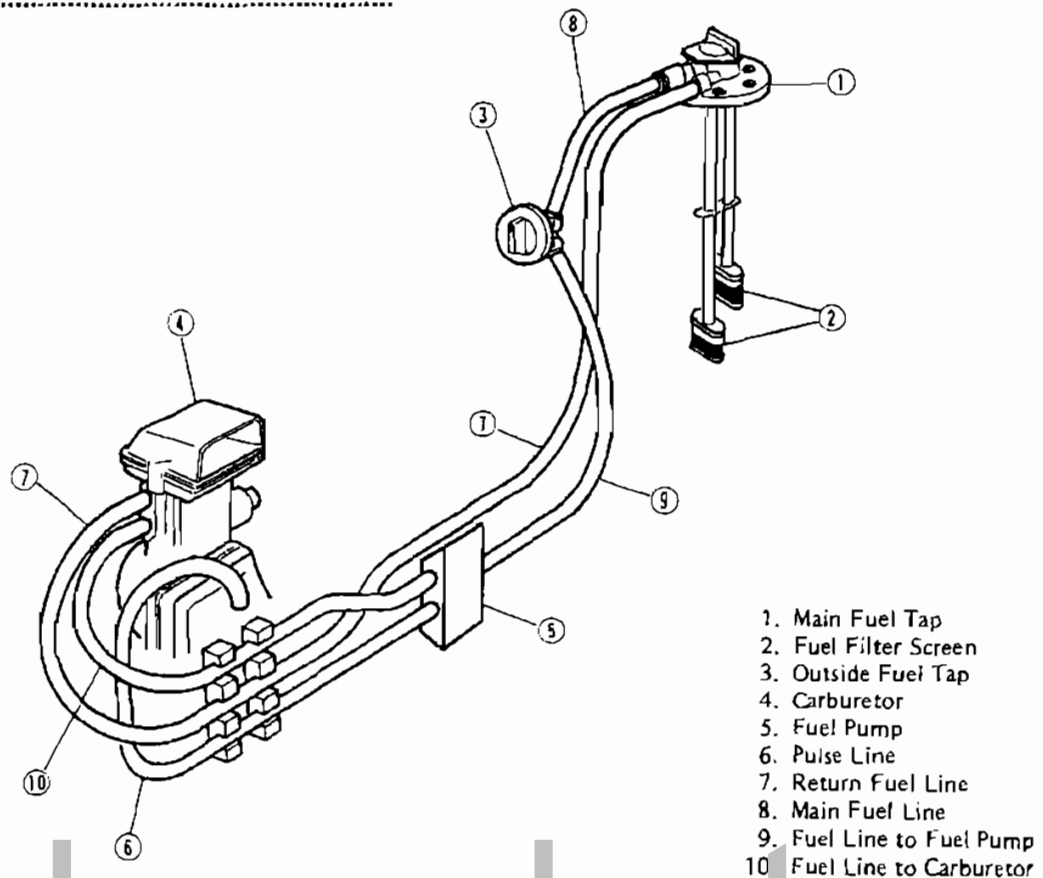


Sealant

Kawasaki Bond (Silicone Sealant): 56019-120



Fuel System Diagram



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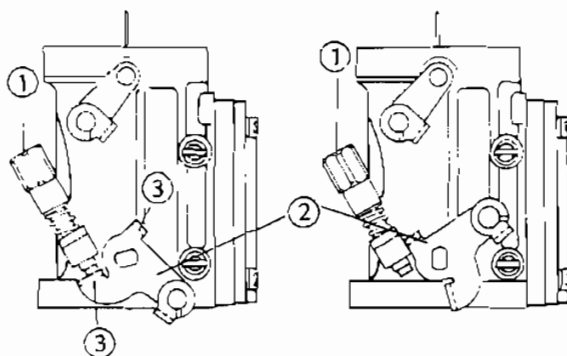
Throttle Cable

Adjustment

- Check throttle cable adjustment.
- With the throttle lever released, the stop on the throttle shaft lever should rest against the idle adjust screw, and there should be slight slack in the throttle cable.
- When the throttle lever is fully applied (Squeezed), the stop on the throttle shaft lever should be all the way up against the stop on the carburetor.

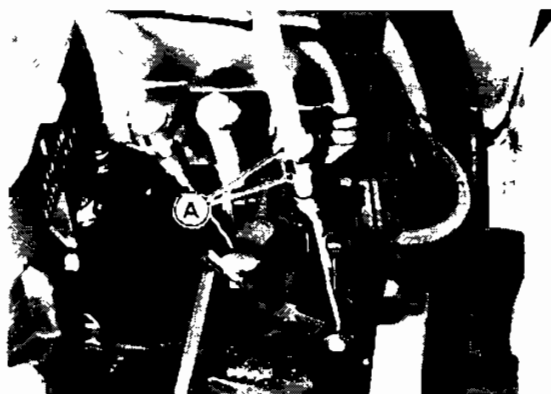
THROTTLE CLOSED
(RELEASED)

THROTTLE OPEN
(APPLIED)



1. Idle Adjust Screw
2. Throttle Shaft Lever
3. Stopper

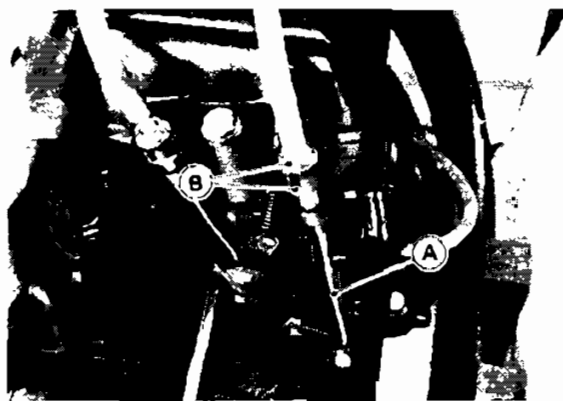
- If necessary, adjust the throttle cable.
- Loosen and turn the locknuts at the bracket until the stop on the throttle pivot arm hits against the idle adjust screw with slight cable slack.
- Tighten the locknuts securely.



A. Locknuts

Removal

- Disconnect the throttle cable from the carburetor.



A. Throttle Cable
B. Locknuts

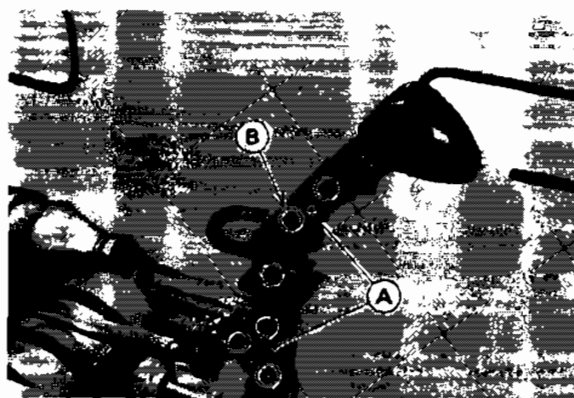
- Disassemble the control stick.
Pivot Bolt
Steering Case



A. Pivot Bolt

B. Steering Case

Covers



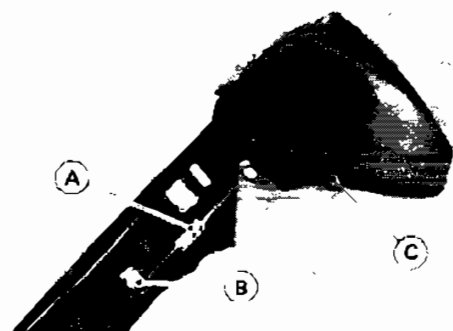
Covers

B. Screws

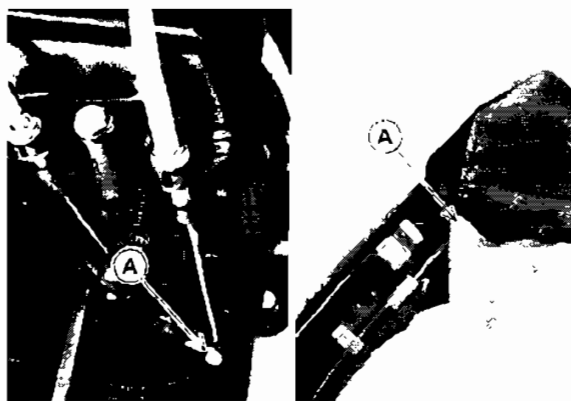
beerdart

2-6 FUEL SYSTEM

- Remove the cable clamp.
- Unscrew the throttle lever pivot screw.
- Disconnect the throttle cable from the throttle lever.



A. Throttle Cable
B. Cable Clamp
C. Pivot Screw



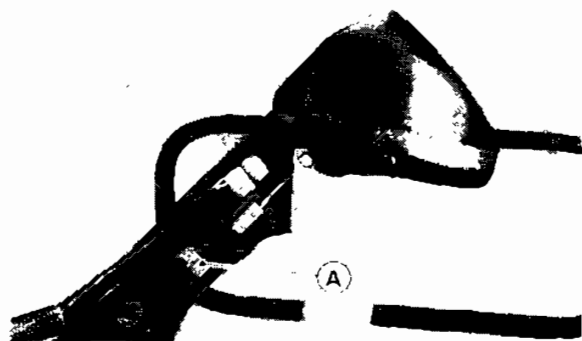
A. Apply Grease.

- Lubricate the cable by seeping oil between the cable and cable housing.

Cable Lubrication

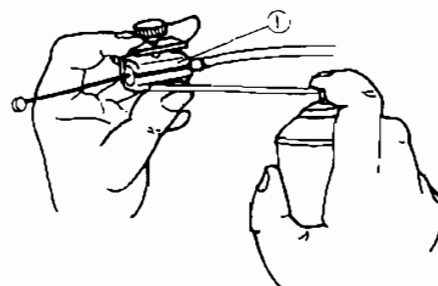
Installation

- Installation is the reverse of removal. Note the following.
- Install the throttle cable clamp as shown.



A. Clamp

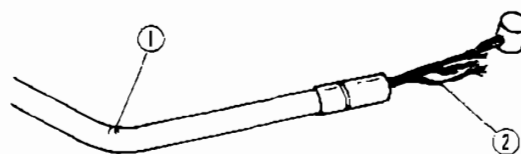
- Adjust the throttle cable.



1. Pressure Cable Luber: K56019-021

Inspection

- Examine the cable.
- ★ If the cable or cable housing is kinked or frayed, replace the cable.



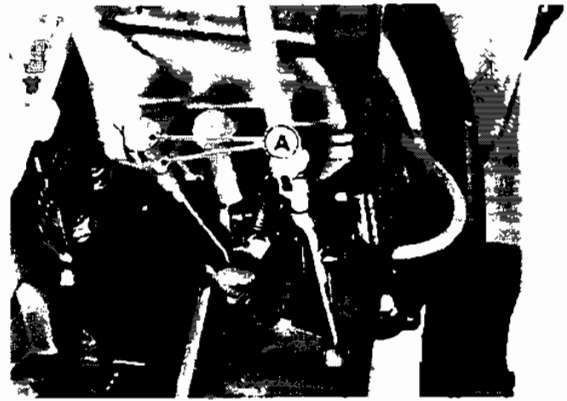
1. Kinked housing 2. Frayed Cable

Lubrication

- Apply water resistant grease to the tips of the throttle cable ends.

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- Be certain that the throttle cable moves freely in both directions.
- Loosen the adjuster locknuts, and slide the cable from the throttle shaft lever.
- Slide the inner cable back and forth in the cable housing.
- ★ If the cable does not move freely, replace it.



A. Locknuts

- Tighten the locknuts.

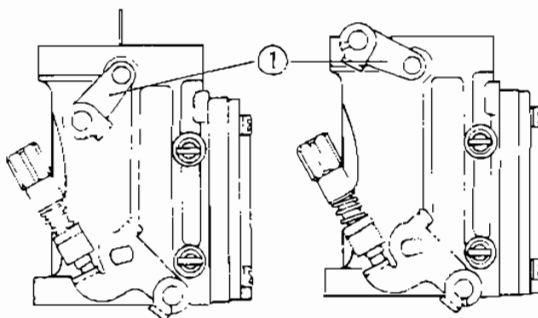
Choke Cable

Adjustment

- When the choke knob is turned counterclockwise, the choke butterfly valve in the carburetor should be completely open. Check that the choke pivot arm is down all the way with minimal cable slack. This will fully open the choke butterfly valve in the carburetor.

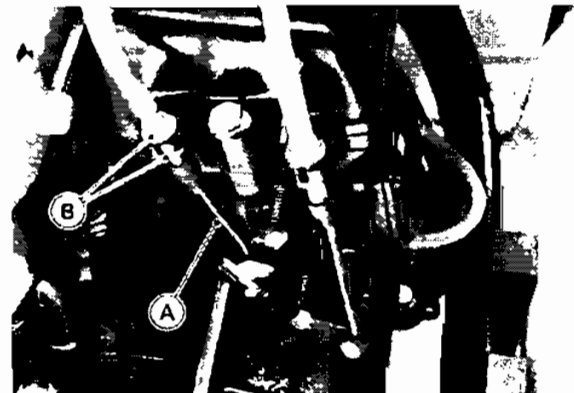
CHOKE OPEN

CHOKE CLOSED



1. Choke Pivot Arm

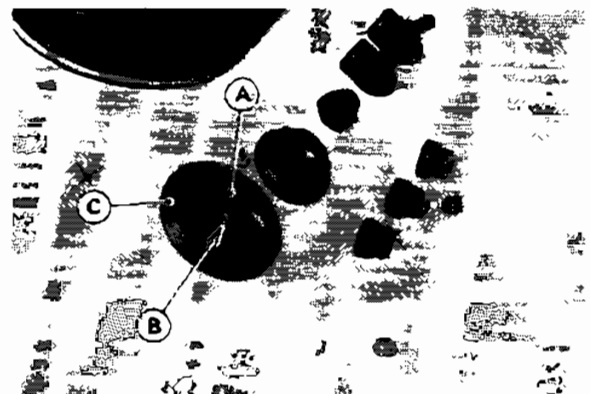
- If necessary, adjust the choke cable.
- Turn the choke knob counter clockwise completely.
- Loosen the locknuts and turn the nuts to allow a little cable slack.



A. Choke Cable

B. Locknuts

- Remove the choke knob and cap.



A. Choke Knob

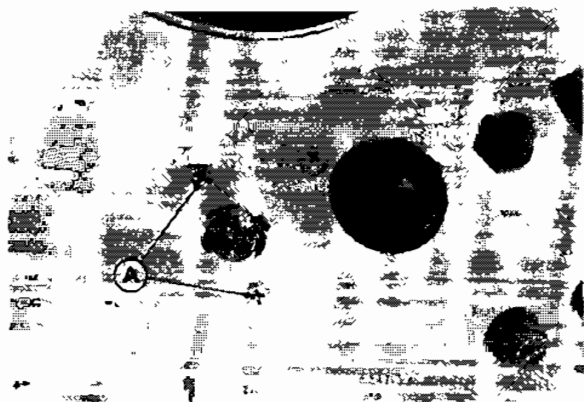
B. Screw

C. Cap

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2-8 FUEL SYSTEM

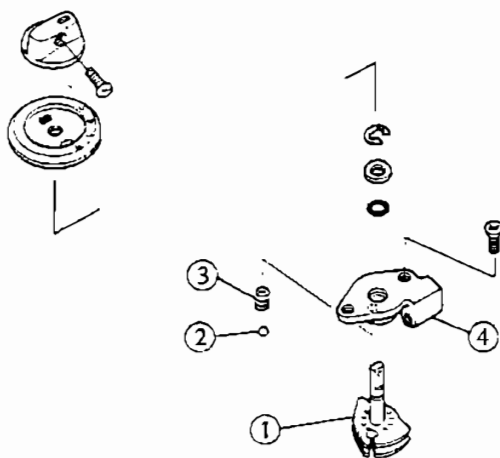
- Remove the choke knob shaft assembly.



A. Screws

NOTE

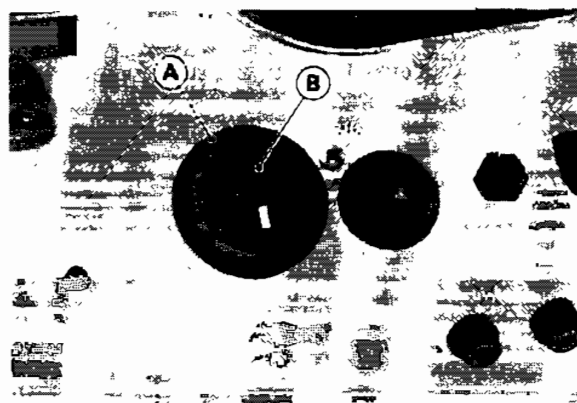
○ When pulling the choke knob shaft, two detent balls and two springs will fall out of the cable holder. Do not lose them.



1. Choke Knob Shaft
2. Detent Ball
3. Spring
4. Cable Holder

Installation

- Installation is the reverse of removal. Note the following.
- Install the choke knob and cap as shown.



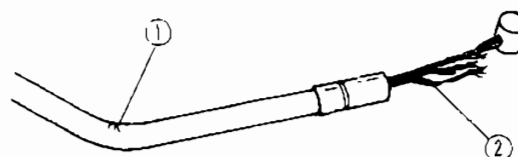
A. Cap

B. Knob

- Adjust the choke cable.

Inspection

- Examine the cable.
- ★ If the cable or cable housing is kinked or frayed, replace the cable.



1. Kinked Housing
2. Frayed Cable

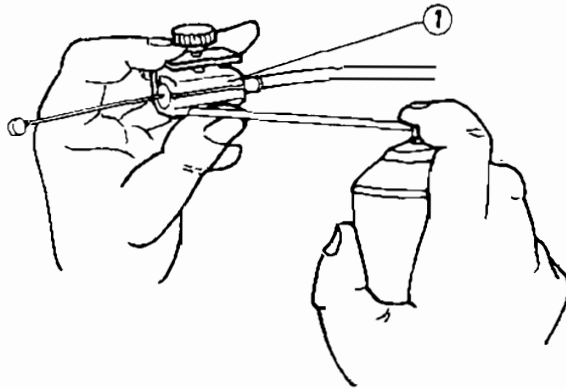
- With the choke cable disconnected at the both ends, the cable should move freely within the cable housing.
- ★ If the cable does not move freely, replace it.

Lubrication

Whenever the choke cable removed, Lubricate the choke cable as follows.

- Apply water resistant grease to the tips of the choke cable ends.
- Lubricate the choke cable by seeping oil between the cable and cable housing.

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1. Pressure Cable Luer: K56019-021

- Attached the choke cable to the carburetor and adjust the choke cable (see Choke Cable Adjustment).

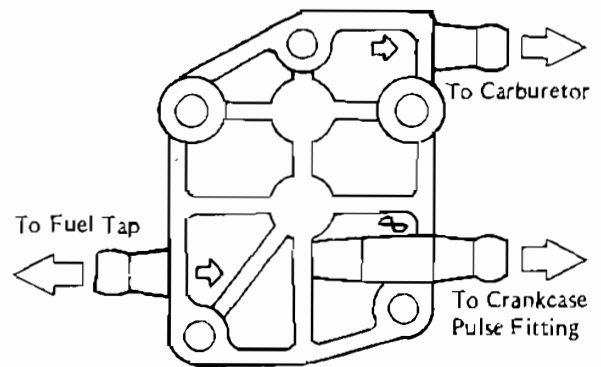


A. Fuel Pump

B. Mounting Screws

Installation Note

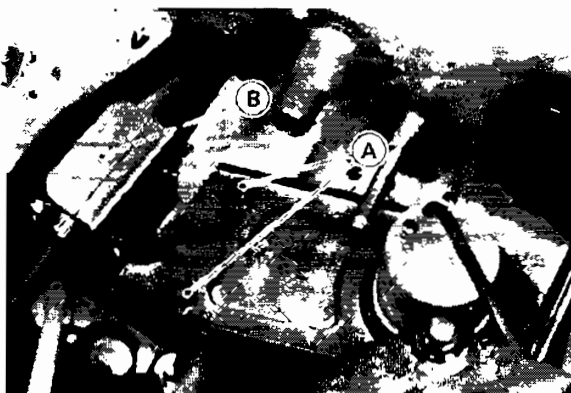
- Connect the fuel hoses as shown.



Fuel Pump

Removal

- Disconnect the cooling and bilge hoses off the bulkhead.
- Remove the bracket bolts.
- Disconnect the fuel hoses.



A. Bracket Bolts

B. Fuel Pump

- Remove the fuel pump from the bracket.

Disassembly

- Remove the fuel pump.

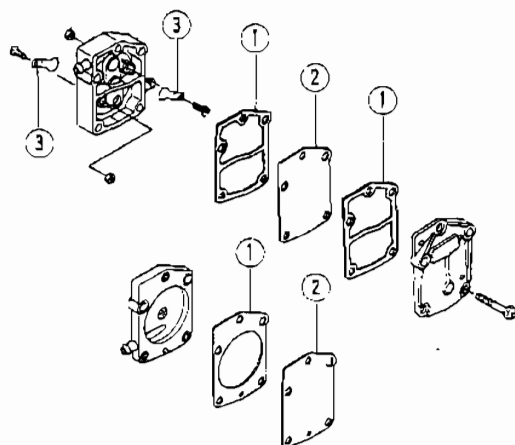
CAUTION

○The fuel pump contains delicate diaphragm that are easily damaged, and gaskets that must be replaced if the unit is disassembled. Therefore, the pump should not be disassembled unless leakage is evident or internal damage is suspected. Have spare parts available beforehand.

- Remove the fuel pump body screws.
- Carefully separate the pump assembly into its individual components. There are three body castings, three gaskets, and two diaphragms. The assembly may be stuck together, and care must be taken to avoid damaging the diaphragms and castings.

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2-10 FUEL SYSTEM



1. Gasket
2. Diaphragm
3. Check Valve

Assembly Notes

- Visually inspect the check valves, and replace them if necessary.
- Use all new gaskets and replace other parts as required.

Carburetor

Idle Speed Adjustment

- Turn the idle adjust screw as required to reach this setting.



A. Idle Adjust Screw

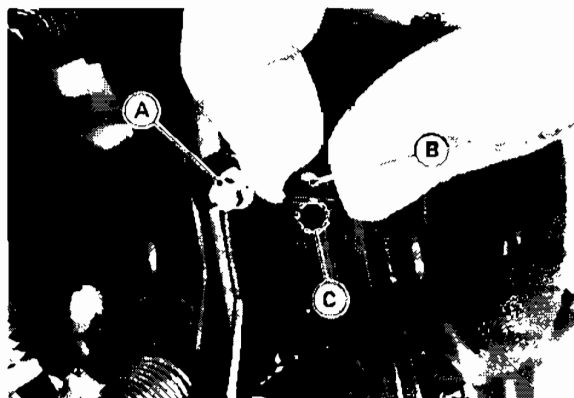
Idle Speed

- 1,250 $\pm$ 100 rpm (in water)
1,800 $\pm$ 100 rpm (out of water)

Mixture Screw Adjustment

Since every carburetor is adjusted individually at the factory using a flow meter, specific mixture screw settings cannot be given. After adjustment, a cap is installed over each mixture screw head with the point straight down to identify proper mixture screw settings for each unit. **DO NOT CHANGE THESE SETTINGS.** If the carburetor is tampered with and these settings cannot be relocated, set the mixture screws to the following guide line.

- Pull out the mixture screw caps.
- To set each screw, turn it in until it seats lightly, and then back it out the specified number of turns.



A. Mixture Screw
B. Cap

C. Downward

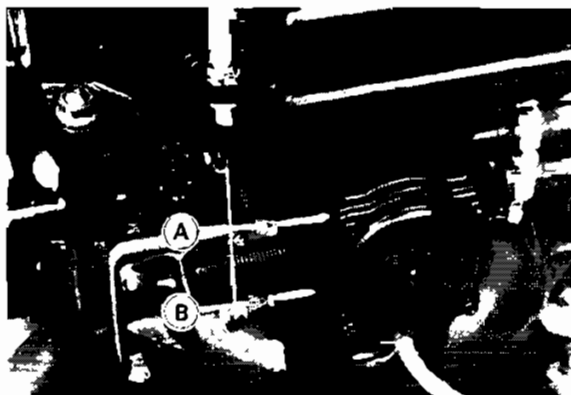
Mixture Screw	Turns Out	
	'89	'90 & Later Model
Low Speed Screw	1 1/2	1 1/8
High Speed Screw	1 1/2	3/8

These guideline represent a "starting point" from which additional fine tuning of the carburetor may be necessary.

CAUTION

- Do not force the mixture screws into their seats. You could damage the screws or the carburetor.
- Operating the watercraft with the high speed screw at too lean a setting (screwed in clockwise too far) could cause serious engine damage.

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A. High Speed Screw B. Low Speed Screw

High Altitude Performance Adjustment

The normal carburetor settings are best for sea level. If the watercraft is used at the higher elevations, the lower atmospheric pressure makes the carburetion richer. To obtain the proper carburetor setting at higher elevations, turn in the high speed screw according to the following table.

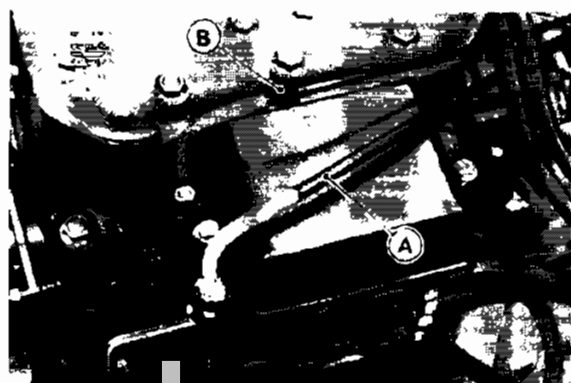
Altitude m (ft)	Turn the high speed screw in the normal position
1 000 (3 300)	1/8 turn
2 000 (6 600)	1/4 turn
3 000 (10 000)	3/8 turn

NOTE

○The adjustment of the low speed screw is not required on the actual usage.

Carburetor Removal

- Remove the following.
Throttle Cable
Choke Cable



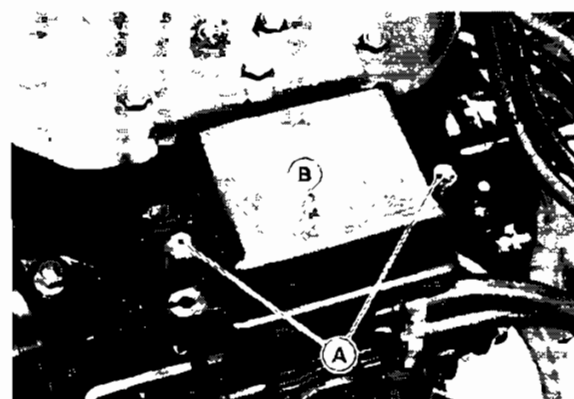
A. Throttle Cable B. Choke Cable

Fuel Hoses



A. Hoses

Air Intake Cover Flame Arrester



A. Bolts

B. Air Intake Cover

- Remove the carburetor mounting bolts and remove the carburetor.



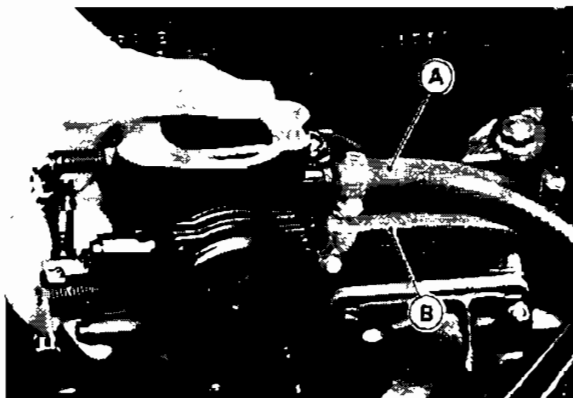
A. Mounting Bolts

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2-12 FUEL SYSTEM

Carburetor Installation

- Installation is the reverse of removal. Note the following.
- Apply a non-permanent locking agent to the carburetor mounting bolts, and tighten them securely.
- Bend the tab portions of the double washer over the bolt heads.
- Connect the fuel hoses, as shown.

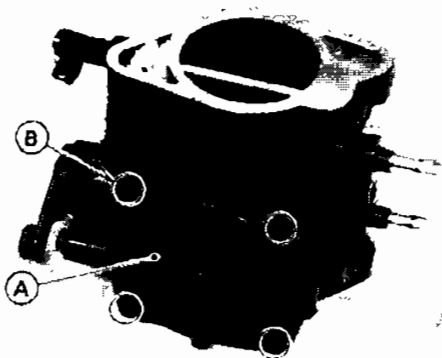


A. Return Line (To Fuel Tank)
B. Main Line (From Fuel Pump)

- Adjust the throttle and choke cables (see Throttle Cable Adjustment, Choke Cable Adjustment).

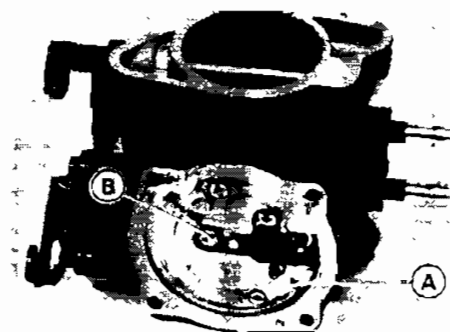
Carburetor Disassembly

- Remove the following.
Carburetor Cover



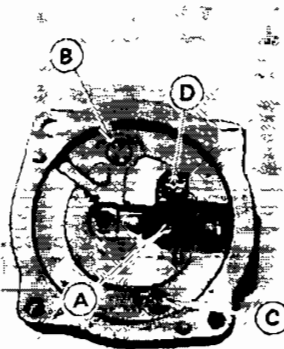
A. Carburetor Cover B. Screws

Carburetor Case



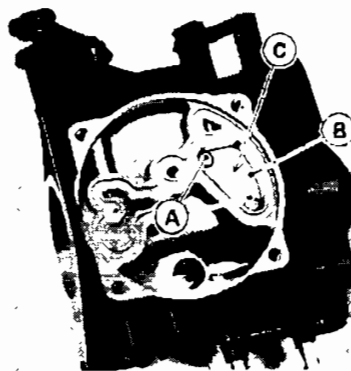
A. Carburetor Case B. Screw

Float Arm
Main Jet
Pilot Jet



A. Float Arm C. Pilot Jet
B. Main Jet D. Set Screw

Check Valve



A. Screws C. Check Valve
B. Plate

NOTE

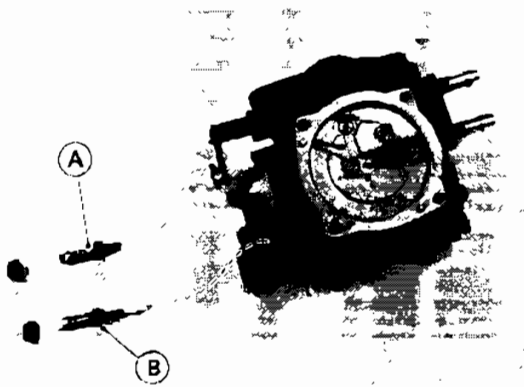
If the mixture screws need to be removed, check number of return rotations of mixture screws beforehand.

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- To remove the mixture screws, turn them counter-clockwise until they come out. Do not lose the spring, washer, and O-ring on each screw.

Carburetor Assembly

- Assembly is the reverse of disassembly. Note the following.
- If the mixture screws were removed, install them as shown.

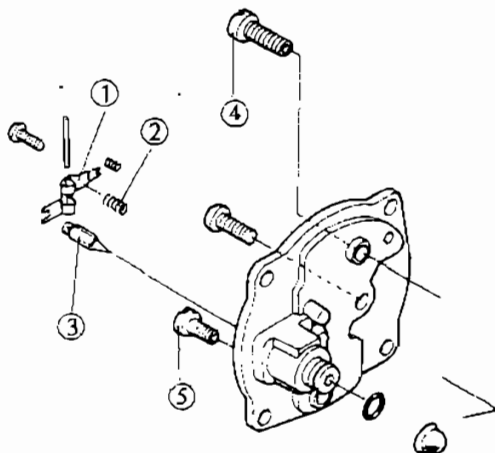


A. High

B. Low

- Place the float arm spring in its hole and install the control arm with the rounded projection seating against the top of the spring.

Carburetor Cover Assembly



1. Float Arm

2. Spring

3. Diaphragm Needle

4. Main Jet

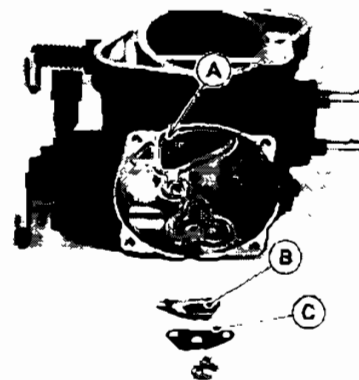
5. Pilot Jet

Carburetor Cleaning and Inspection

- Disassemble the carburetor (see Carburetor Disassembly).

WARNING

- Solvent is toxic and flammable. Avoid prolonged contact with skin and keep away from open flame. Use only in a well-ventilated area. Eye protection should be worn when compressed air is used to dry parts. Do not direct air towards anyone. Use 172 kPa (1.75 kg/cm², 25 psi) maximum nozzle pressure.
- Immerse all the metal parts in a carburetor cleaning solution.
- Rinse the parts in water.
- When the parts are clean, dry them with compressed air.
- Blow out the air and fuel passages with compressed air.
- Inspect the check valve for damage or deterioration, and replace it if necessary.
- ★ If the gasket under the check valve appears damaged, it may leak and must be replaced.

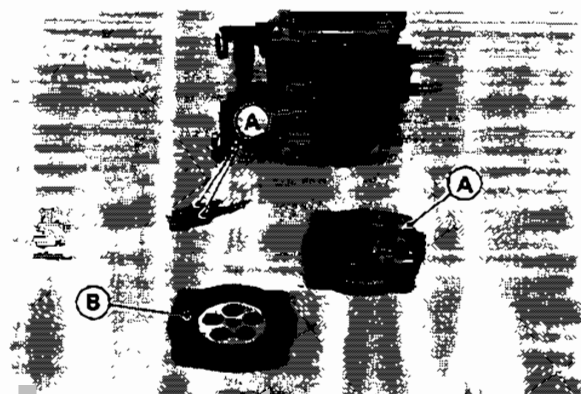


A. Gasket

B. Check Valve

C. Plate

- Check these rubber parts for damage.
O-rings
Diaphragm



O-rings

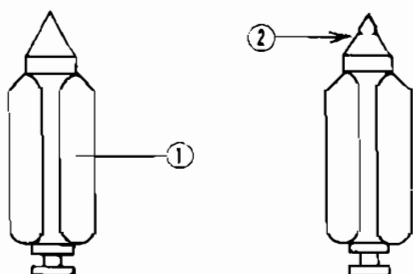
Diaphragm

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2-14 FUEL SYSTEM

- ★If any of these parts are not in good condition, replace them.
- Check the plastic tip on the diaphragm valve needle. It should be smooth, without any grooves, scratches, or tears.

Diaphragm Needle Wear



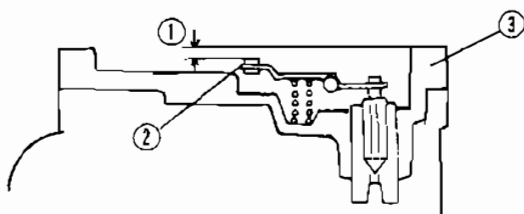
1. Diaphragm Needle 2. Diaphragm Needle 'Wear

- ★If the plastic tip is damaged, replace the needle.

Float Arm Level Inspection and Adjustment

- Check the float arm level.
- Measure from the plastic tip on the float arm to the case, as shown.

Float Arm Level Measurement



1. Float Arm Level
2. Plastic Tip
3. Carburetor Case

Float Arm Level

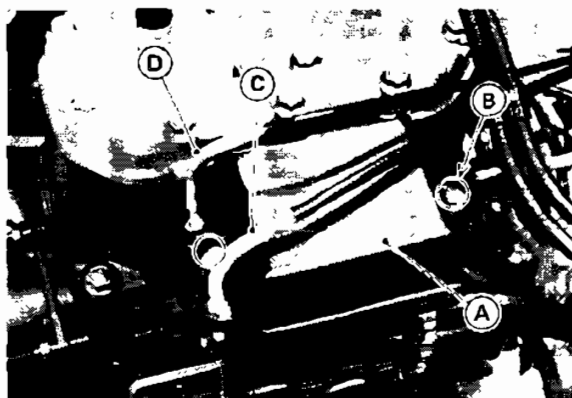
1.0 – 2.0 mm

- ★If the float arm level is incorrect, bend the float arm very slightly to change the float arm level.

Flame Arrester

Removal

- Remove the following.
 - Throttle Cable
 - Choke Cable
 - Air Intake Cover



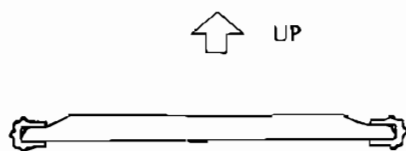
A. Air Intake Cover C. Throttle Cable
B. Bolts D. Choke Cable

- Lift out the flame arrester.

Installation

- Flame arrester installation is the reverse of removal. Note the following.
- Install the flame arrester with the flat face downward ('89 model only).
- Apply non-permanent locking agent to the air intake cover bolts.

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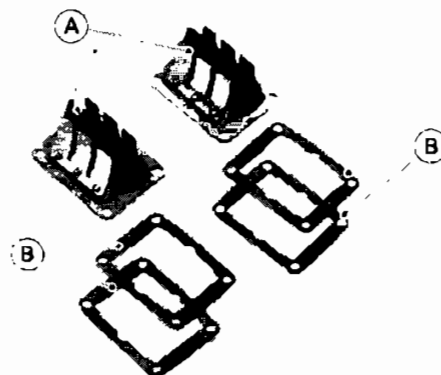
Flame Arrester Installation**Cleaning**

- Remove the flame arrester.
- Blow the flame arrester clean with compressed air.

WARNING

- Eye protection should be worn when compressed air is used to dry parts. Do not direct air toward anyone. Use 172 kPa (1.75 kg/cm², 25 psi) maximum nozzle pressure.

- Pull out the reed valves and gaskets.

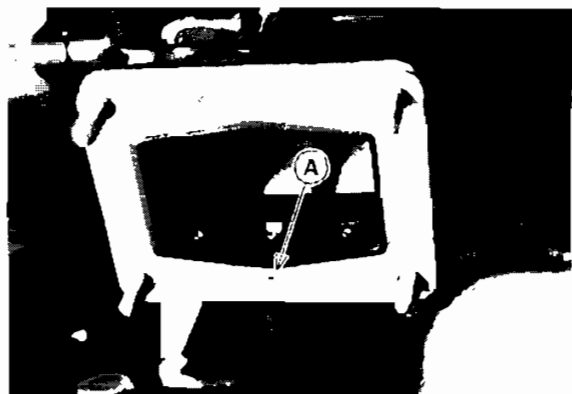


A. Reed Valves

B. Gaskets

Installation

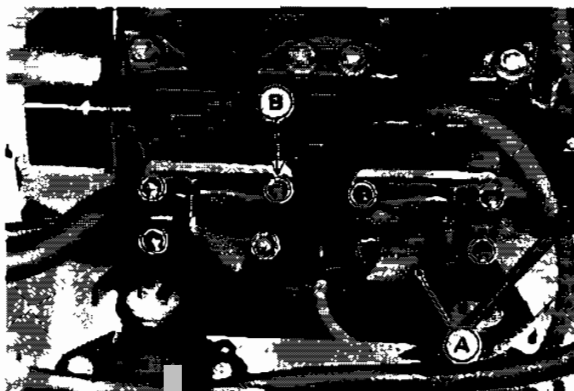
- Replace the gaskets with new ones.
- Install the reed valves so that the small hole is at the bottom.



A. Small Hole

Intake Manifold, Reed Valves**Removal**

- Remove the carburetor.
- Disconnect the oil pump outlet hose at the oil injection nozzle.
- Remove the intake manifold.



A. Intake Manifold B. Mounting Nuts

- Tighten the intake manifold mounting nuts to the specified torque.
- After installing the parts removed, bleed the oil pump if there are air bubbles in the outlet hose (see Engine Lubrication System chapter).

Reed Valve Inspection

- Check reed warp by measuring the clearance between each reed and the valve holder.
- If any one of the clearance measurements exceeds the service limit, replace the reed valve assembly with a new one.

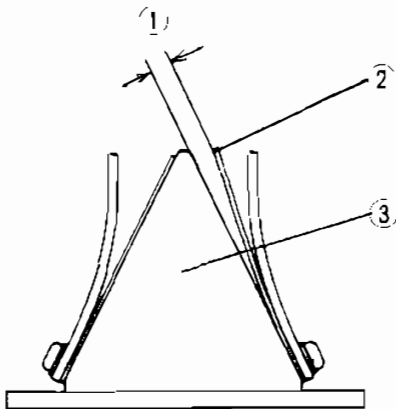
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2-16 FUEL SYSTEM

Reed Warp

Service Limit 0.2 mm

Reed Warp (exaggerated for illustration)

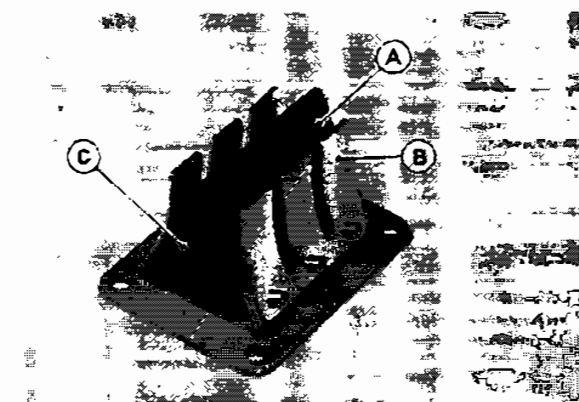


1. Clearance
2. Reed
3. Reed Valve Holder

- Check the mounting screw tightness.
- Visually inspect the reeds for cracks, folds, or other damage.
- ★ If there is any doubt as to the condition of a reed, replace the reed valve assembly.
- ★ If a reed becomes wavy, replace the reed valve assembly with a new one even if reed warp is less than their service limit.

Valve Holder Inspection

- Check the reed contact areas of the valve holder for grooves, scratches, or other damage.
- Check that the rubber coating on the valve holder does not show any signs of separation from the holder.
- ★ If there is any doubt as to the condition of the rubber coating, replace the reed valve assembly with a new one.



- A. Reed
B. Valve Stop
C. Rubber Coating

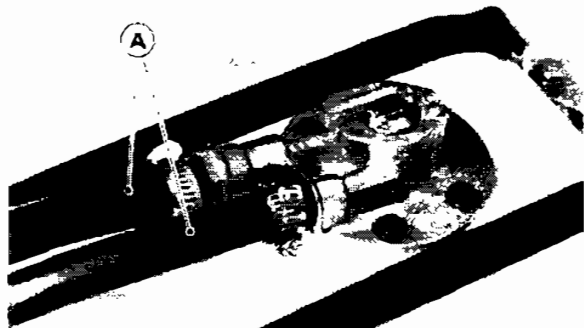
Valve Stop Inspection

- Check the valve stops for deformation, cracks, or other damage.
- ★ If there is any doubt as to the condition of a stop, replace the reed valve assembly with a new one.

Fuel Tank

Fuel Tank Removal

- Disconnect the fuel hoses.



A. Fuel Hoses

- If the level of the fuel is above the inlet neck, siphon some fuel out to prevent spilling it.

WARNING

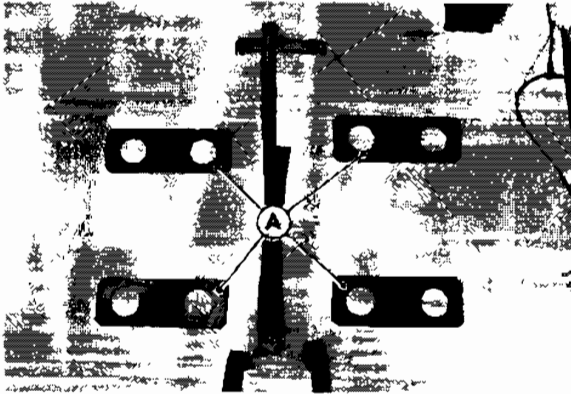
- Gasoline is extremely flammable and can be explosive under certain conditions. Push the STOP button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

- Unhook the rubber strap.
- Loosen the clamp on the fuel inlet hose and vent hose and remove the fuel tank from the hull.

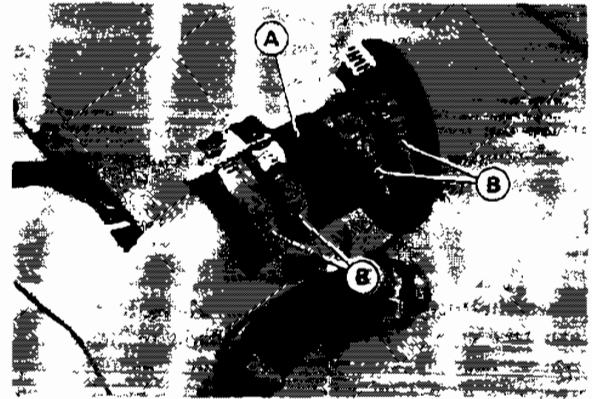
Fuel Tank Installation

- Fuel tank installation is the reverse of removal. Note the following.
- Be sure the rubber dampers are in place before putting the tank into the hull.

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A. Rubber Dampers



A. Filler Tube

B. Clamp

Fuel Tank Cleaning

- Remove the fuel tank.
- Drain the tank into a suitable container.

WARNING

○ Gasoline is extremely flammable and can be explosive under certain conditions. Push the STOP button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

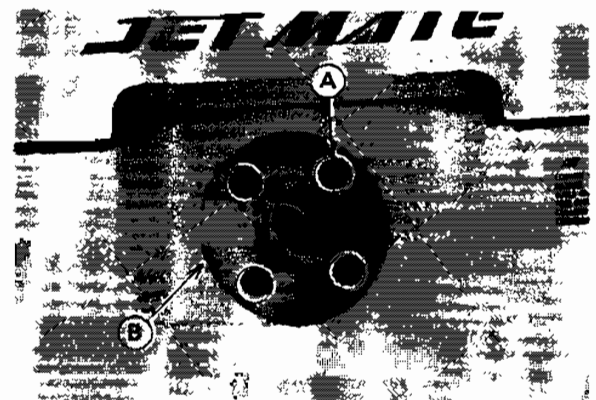
- Flush the tank repeatedly with high flash-point solvent until it is clean. It may be necessary to put a few marbles or pieces of clean gravel into the tank and shake it, to knock loose any foreign matter in the bottom.

WARNING

○ Clean the tank in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent to clean the tank. A fire or explosion could result.

Fuel Filler and Tube Removal

- Remove the fuel tank.
- Remove the fuel filler tube.



A. Screws

B. Sealant

- Take out the screws in the filler flange, cut the sealant, and pull the filler away from the hull.

Fuel Filler and Tube Installation

- Clean the hull and the filler on their mating surfaces with a greaseless, high flash-point solvent.

WARNING

○ Clean the parts in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent. A fire or explosion could result.

- Apply an even layer of silicone sealant to the mating surfaces of the filler and hull.
- Push the filler tube onto the bottom of the filler. Slide the clamp into position, and tighten it securely.

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2-18 FUEL SYSTEM

Fuel Filter Screen Cleaning

- Clean the fuel filter screens in accordance with the Periodic Maintenance Chart.
- Remove the main fuel tap.
- Wash the fuel filter screens in non-flammable or high flash-point solvent. Use a brush to remove any contaminants trapped in the screens.

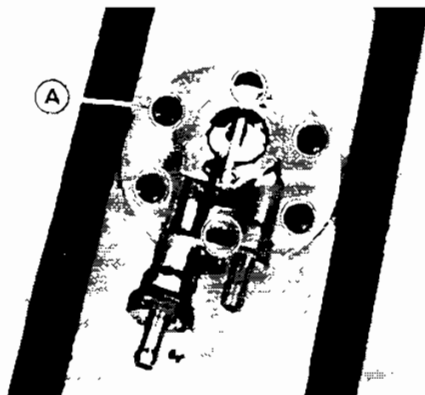
WARNING

- Clean the fuel filter screens in a well ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent. A fire or explosion could result.

Fuel Tap

Main Fuel Tap Removal/Installation

- Disconnect the fuel hoses.
- Unscrew the mounting screws.



A. Mounting Screws

- When installing the fuel tap, be careful not to over-tighten the mounting screws.
- Connect the fuel hoses (see Fuel System Diagram).

Anti-Siphon Valve Inspection

The anti-siphon valve is built into the main fuel tap. If the fuel hose were to break between the valve and the carburetor, the anti-siphon valve would prevent fuel flow from the fuel tank.

- To check anti-siphon valve operation fill the fuel tank with fuel
- Run the engine a few seconds.
- Hold a suitable container under the end of the fuel hose and then disconnect the fuel hose from the fuel pump inlet.

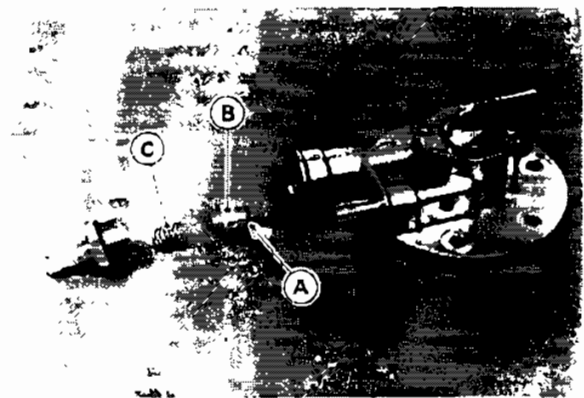
WARNING

- Gasoline is extremely flammable and can be explosive under certain conditions. Push the STOP button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.



A. Disconnect this hose.

- ☆ If the fuel flow stops, the anti-siphon valve is OK.
- ☆ If there is a constant flow of fuel from the removed hose, inspect the internal parts of the anti-siphon valve.
- Inspect the anti-siphon valve.
- Unscrew the fitting nut, and remove the spring and plunger.



A. O-Ring
Plunger

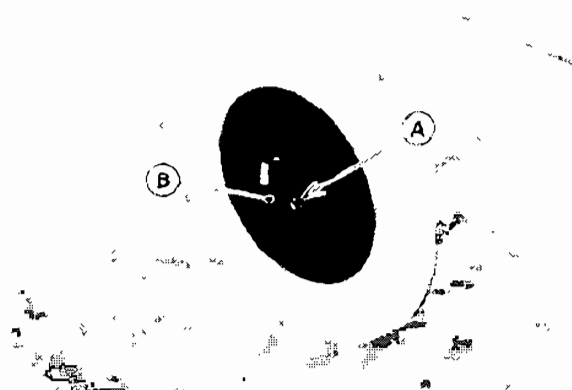
C. Spring

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- ★If there is any dirt or foreign matter in the anti-siphon valve, clean the valve parts in a high flash-point solvent.
- ★If any of these parts are damaged, replace the main fuel tap assembly.

Outside Fuel Tap Removal/Installation

- Disconnect the fuel hoses.
- Remove the fuel tap knob.



A. Set Screw

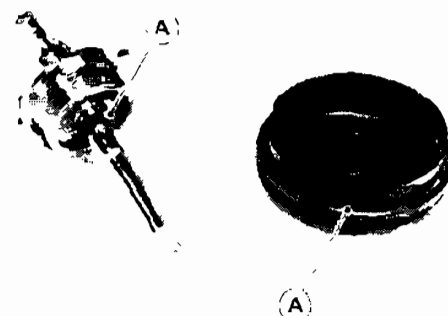
B. Knob

- Pull out the cap, and unscrew the fuel tap nut.
- Remove the outside fuel tap.



A. Fuel Tap Nut

- Installation is the reverse of removal. Note the following.
- Check the O-rings for damage.



A. O-Ring

- Install the fuel tap with the inlet hose fitting upward.

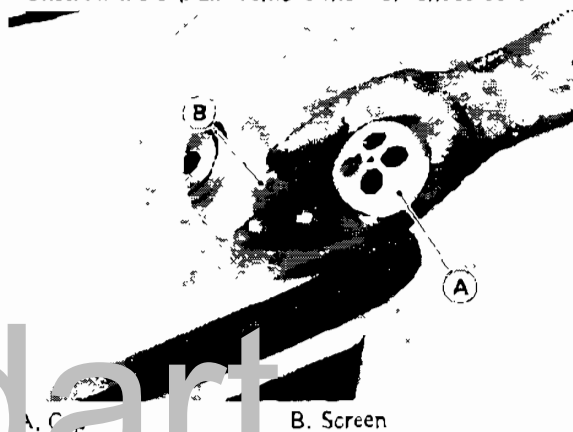


A. Inlet Hose Fitting

Fuel Vent Screen

Cleaning

- Clean the fuel vent screen in accordance with the Periodic Maintenance Chart.
- Unscrew the cap and remove the fuel vent screen.



A. Cap

B. Screen

2-20 FUEL SYSTEM

- Blow the fuel vent screen clean with compressed air.

WARNING

- Eye protection should be worn when compressed air is used to dry parts. Do not direct air toward anyone. Use 172 kPa (1.75 kg/cm², 25 psi) maximum nozzle pressure.

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ENGINE LUBRICATION SYSTEM

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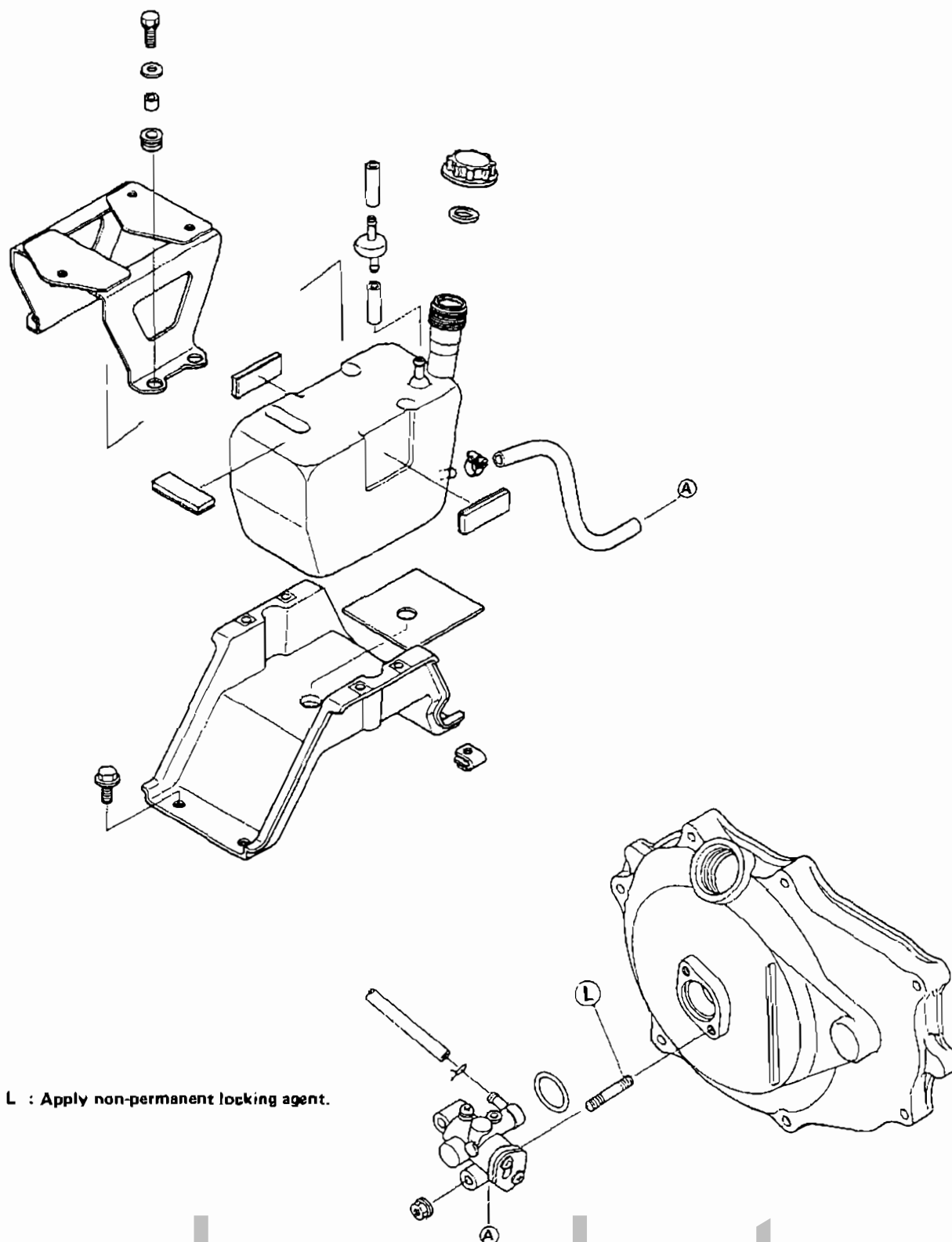
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3-2 ENGINE LUBRICATION SYSTEM

Exploded View



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Specifications

Item	Standard	Service Limit
Engine Lubrication System:		
Engine oil:	2-stroke, N.M.M.A. Certified for Service TC-W	---
Capacity	5.5 L	---
Engine oil pump:		
Oil pump output @3 000 r/min (rpm), 2 min.	5.9 – 7.2 mL	---

Oil Pump

Oil Pump Bleeding

- Make sure that there is plenty of engine oil in the oil tank and that oil flow is not restricted.
- Loosen the air bleeder screw on the oil pump a couple of turns wait until oil flows out, and then tighten the bleeder screw securely.



A. Bleeder Screw

CAUTION

- Use a 50 : 1 mixture of gasoline to oil in the fuel tank in place of the gasoline normally used.
- Do not turn on the water until the engine is running and turn it off immediately when the engine stops.
- Supply the cooling system with water (see Auxiliary Cooling in the General Information chapter).
- Start the engine, keep it at idling speed and check the oil flow through the transparent outlet hose.
- Keep the engine running until the air bubble in the outlet hose disappears.

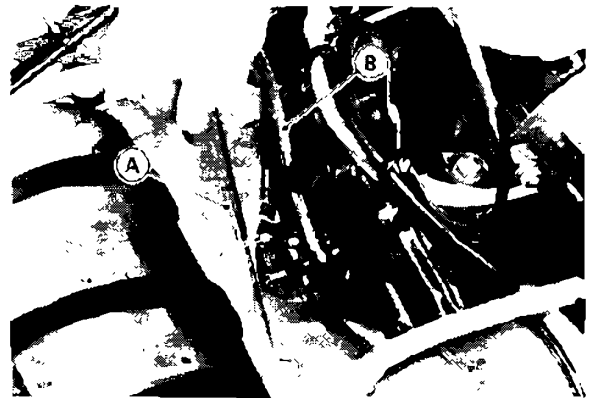
Oil Pump Performance Test

If a drop in oil Pump Performance is suspected, check the rate at which the oil is being pumped.

- Disconnect the oil pump outlet hose at the oil injection nozzle and run the hose into a measuring glass.

CAUTION

- For this test use a 50 : 1 mixture of gasoline to oil instead the gasoline normally used.



A. Measuring Glass B. Outlet Hose

- Supply the cooling system with water (see Auxiliary Cooling in the General Information chapter).
- Start the engine, and run it at a steady 3,000 rpm (use a tachometer).
- Collect the oil that is being pumped for 2 minutes. If the quantity of oil collected is within the specification, the oil pump is operating properly.

Oil Pump Output (3,000 rpm for 2 minutes)

Standard: 5.9 – 7.2 mL

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3-4 ENGINE LUBRICATION SYSTEM

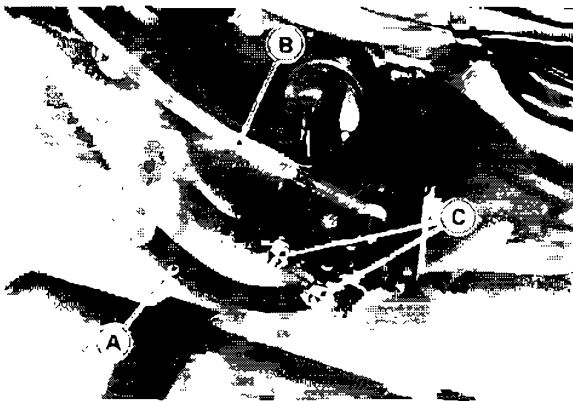
- ★If the oil pump output is subnormal, inspect the oil pump, and the inlet and outlet hoses for oil leaks.
- ★If oil leaks are not found, replace the oil pump.

NOTE

- A check valve is built into the oil pump and can not be removed.

Oil Pump Removal

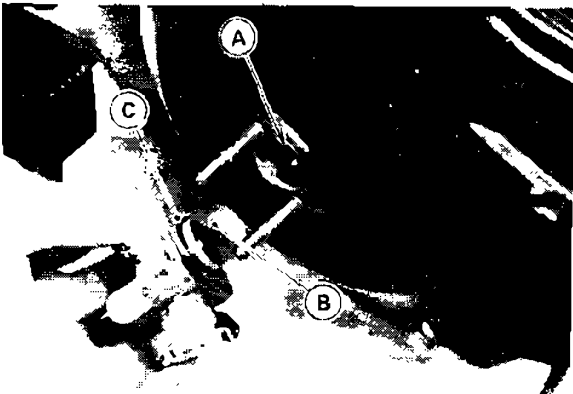
- Squeeze the inlet hose to restrict oil flow and disconnect it from the oil pump.
- Pull off the outlet hose, remove both mounting nuts and take off the oil pump and the O-ring.



A. Inlet Hose
B. Outlet Hose
C. Mounting Nuts

Oil Pump Installation

- Be sure the O-ring is in place and install the oil pump on the magneto cover.
- When mounting the oil pump, note the position of the slot in the flywheel bolt, and then turn the oil pump shaft so that it will fit into the slot.



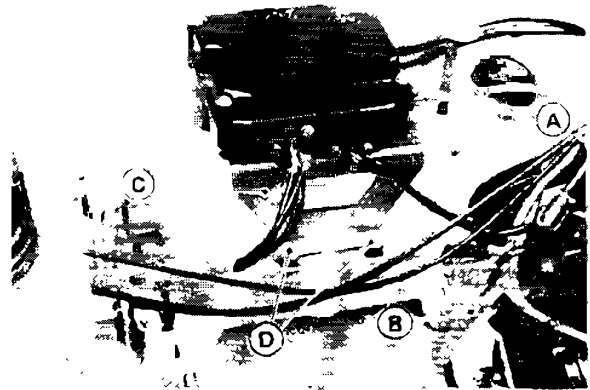
A. Slot
B. Pump Shaft
C. O-Ring

- Connect both oil Hoses and bleed the air from the system (see Oil Pump Bleeding).

Oil Tank

Oil Tank Removal

- Remove the following.
 - Engine Hood
 - Engine Oil (Drain)
 - Oil Inlet Hose
 - Oil Tank Bracket



A. Oil Tank
B. Oil Inlet Hose
C. Oil Tank Bracket
D. Mounting Bolts

Oil Tank Cleaning

- Flush the tank repeatedly with high flash-point solvent until it is clean.

WARNING

- Clean the tank in a well-ventilated area, and take ample care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low flash-point solvent to clean the tank. A fire or explosion could result.

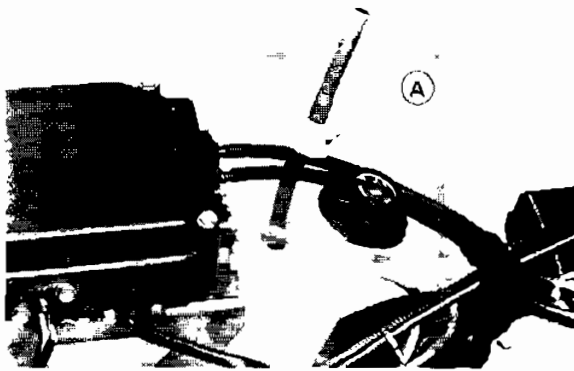
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Oil Tank Vent Check Valve

Oil Tank Vent Check Valve Mounting

The oil tank vent check valve is mounted in the oil tank vent hose to prevent oil from spilling during riding. Air can flow into the tank to allow oil to be drawn out by the oil pump, but oil can not flow out the check valve.

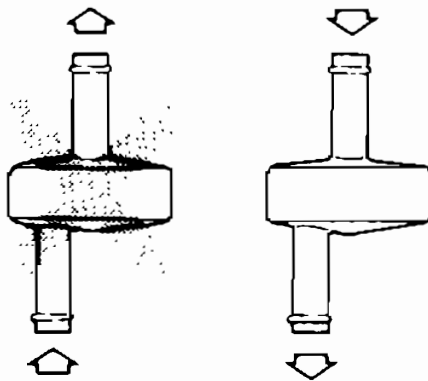
- The oil tank vent check valve must be mounted so that the arrows on its case are pointing toward the oil tank.



A. Check Valve

Oil Tank Vent Check Valve Inspection

- Remove the check valve and blow through it from each end.
- ★ If the check valve will allow air to flow as shown, it is OK.
- ★ If air will flow through the check valve in both directions or in neither direction, the check valve must be replaced.



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EXHAUST SYSTEM

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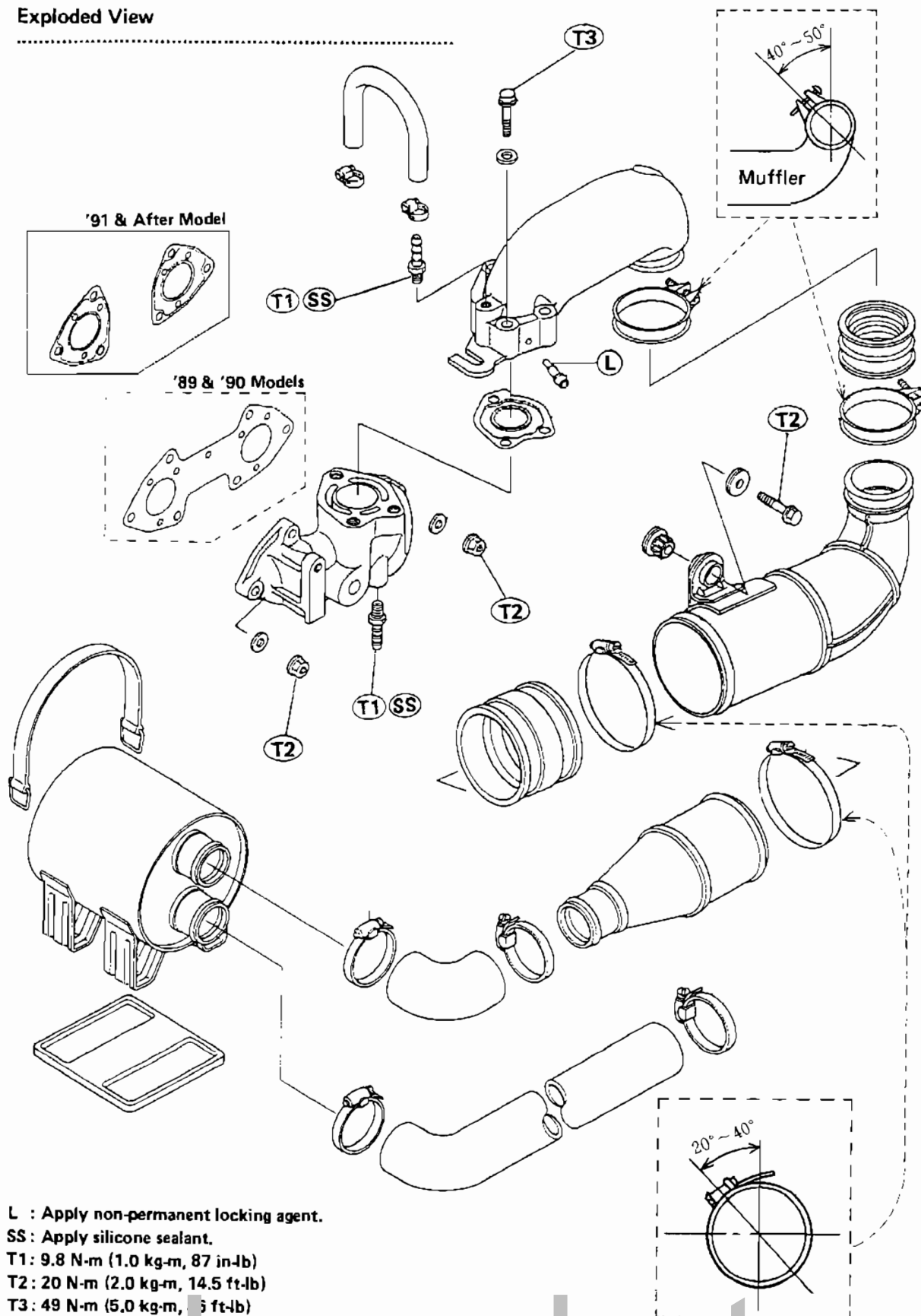
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4-2 EXHAUST SYSTEM

Exploded View

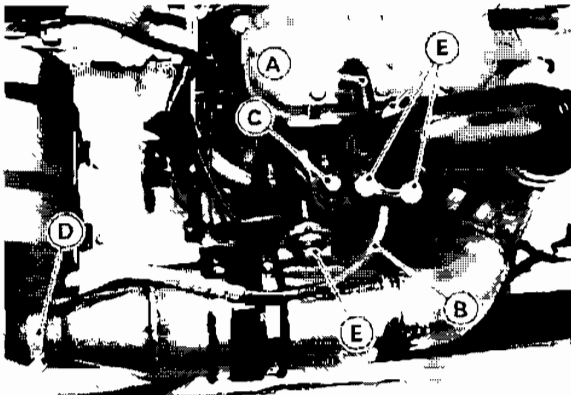


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Exhaust Pipe and Manifold

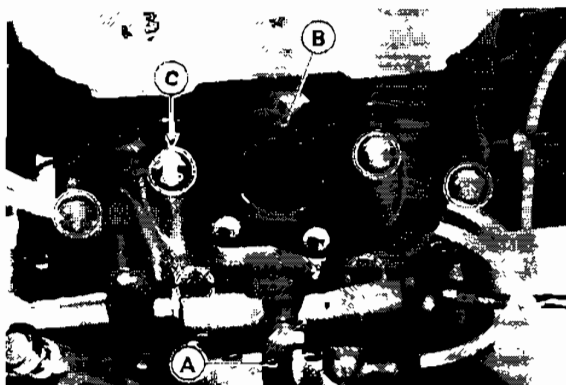
Exhaust Pipe and Manifold Removal

- Remove the following.
 - Engine Hood (see Frame chapter)
 - Cooling Hose
 - Bypass Hose
 - Water Drain Knob



- A. Cooling Hose
- B. Bypass Hose
- C. Water Drain Knob
- D. Clamp
- E. Bolts

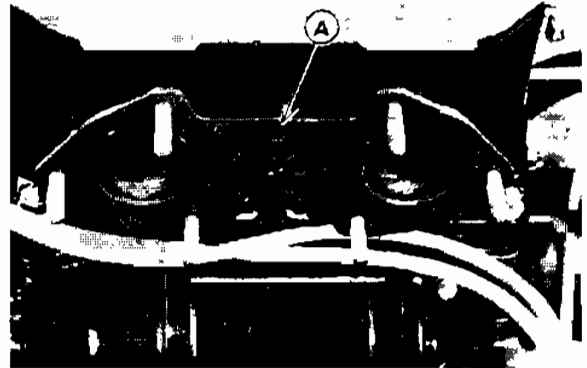
- Loosen the clamp and remove the exhaust pipe bolts.
- Remove the exhaust pipe.
- Disconnect the inlet cooling hose.
- Remove the exhaust manifold.



- A. Inlet Cooling Hose
- B. Exhaust Manifold
- C. Mounting Nuts

Exhaust Pipe and Manifold Installation

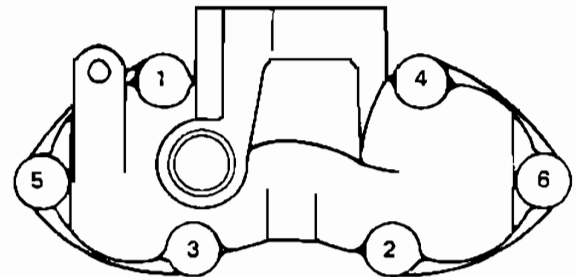
- Installation is the reverse of removal. Note the following.
- Install the exhaust manifold gasket so that the hole in the center of the gasket is up.



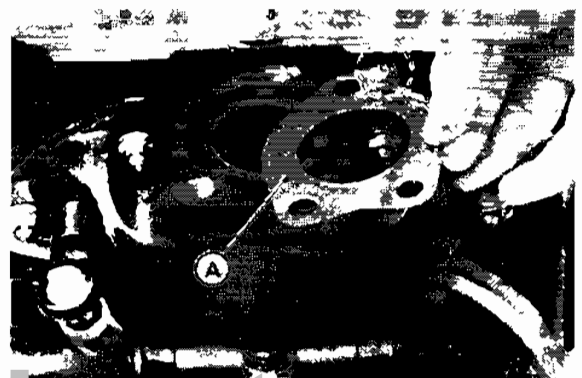
- A. Hole

- Tighten the exhaust manifold mounting nuts to the specified torque (see Exploded View), following the specified tightening sequence.

Exhaust Manifold Mounting Nuts Tightening Order



- Install the exhaust pipe gasket as shown.

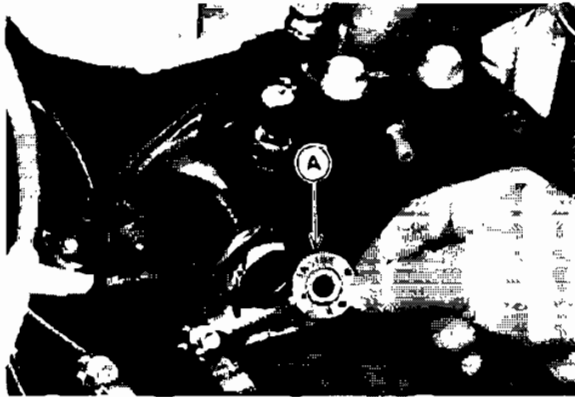


- A. Gasket

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4-4 EXHAUST SYSTEM

- Install the damper with the "INSIDE" mark facing in.



A. "INSIDE" mark

- Tighten the exhaust pipe bolts to the specified torque (see Exploded View).

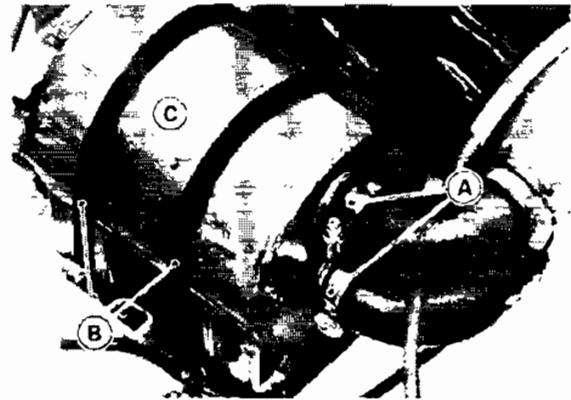
Exhaust Pipe and Manifold Cleaning and Inspection

- Clean the carbon deposits out of the exhaust passages with a blunt, rounded tool.
- Flush foreign matter out of the water passages with fresh water.
- Check the insides of the water passages for corrosion. Check the gasket surfaces for nicks or other damage.
- ★ If there is excessive corrosion or if the gasket surfaces are so badly damaged that they will not seal properly, replace the part.
- Check the stainless pipe carefully for cracks, especially in the welds. Also look for corrosion both inside and out.
- ★ If there are large cracks in the stainless pipe walls or welds, or if it is very corroded, replace the stainless pipe.
- Check the rubber parts for cracks, tears, hardening, or general deterioration.
- ★ If the rubber parts show damage or if they leak, replace them.

Water Box Muffler

Water Box Muffler Removal

- Remove the engine hood.
- Loosen the clamps.
- Unhook the rubber straps.

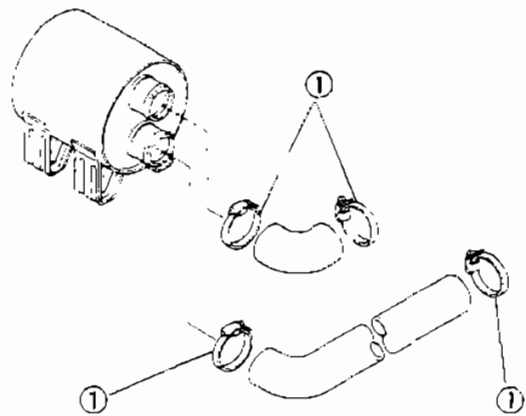


A. Clamps
B. Rubber Straps
C. Water Box Muffler

- Remove the water box muffler.

Water Box Muffler Installation Note

- Install the tube clamps as shown being careful of the screw position and the screw head direction.



1. Clamps

Water Box Muffler Inspection

- Remove the water box muffler.
- Empty any water out of the water box.
- Check the water box carefully for cracks, especially in the welds. Also look for corrosion.
- ★ If there are cracks in the water box walls or welds, or if it is very corroded, replace the water box.

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ENGINE TOP END

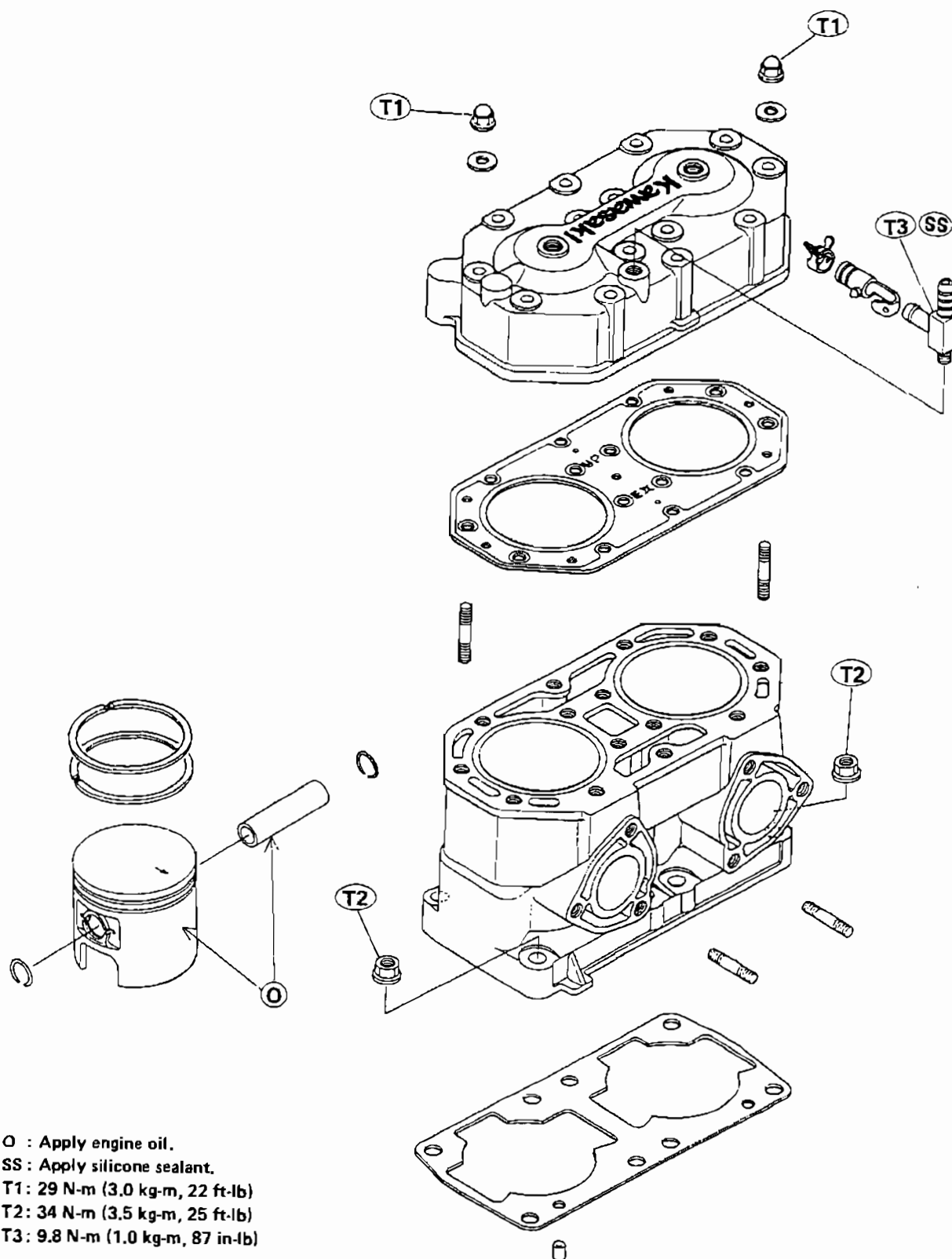
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5-2 ENGINE TOP END

Exploded View



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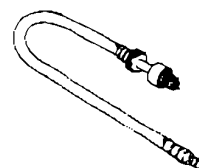
Specifications

Item	Standard	Service Limit
Cylinder Compression:	(usable range) 865 – 1,325 kPa (8.8 – 13.5 kg/cm ² , 125 – 192 psi) (open throttle)	---
Cylinder head warp	---	0.05 mm
Cylinder Block, Piston:		
Cylinder inside diameter	76.050 – 76.065 mm	76.10 mm
Piston diameter (18 mm up from bottom of skirt)	75.961 – 75.976 mm	75.81 mm
Piston/cylinder clearance	0.084 – 0.094 mm	---
Oversize piston and rings	+0.5 mm and +1.0 mm	---
Piston ring/groove clearance		
Top (keystone)	---	---
Second (keystone)	---	---
Piston ring groove width		
Top (keystone)	---	---
Second (keystone)	---	---
Piston ring thickness		
Top (keystone)	---	---
Second (keystone)	---	---
Piston ring end gap		
Top	0.2 – 0.4 mm	0.7 mm
Second	0.2 – 0.4 mm	0.7 mm

Special Tools

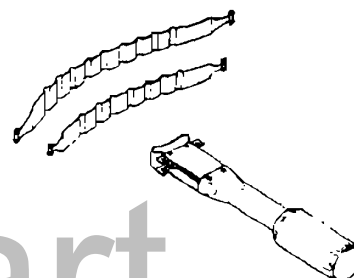
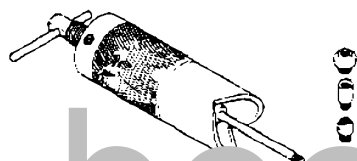
Adapter: 57001-1159

Compression Gauge: 57001-221



Piston Ring Compressor Assembly: 57001-1094

Piston Pin Puller Assembly: 57001-910



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5-4 ENGINE TOP END

Engine Top End

Disassembly and Assembly:

Engine Top End Disassembly

- Remove the following.
 - Engine Hood
 - Exhaust Pipe
 - Exhaust Manifold
 - Carburetor
- Remove the cylinder head.



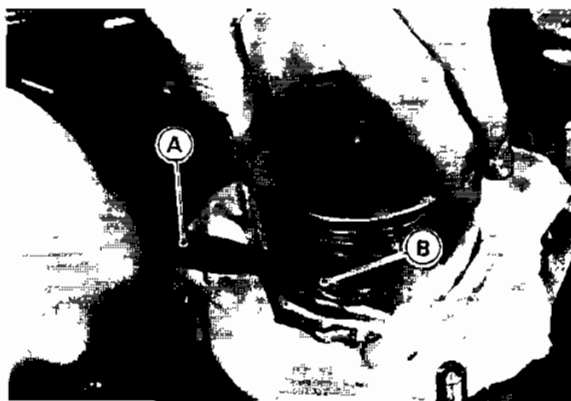
A. Cylinder Head B. Head Nuts

- Remove the cylinder.



A. Cylinder B. Base Nuts

- Stuff clean rags into the crankcase opening to prevent dirt or foreign objects from falling into the crankcase.
- Remove the piston pin snap ring.



A. Pliers

B. Snap Ring

- Remove the piston by pushing its pin out the side that the circlip was removed. Use a piston pin puller assembly (special tool), if the pin is tight.



A. Piston Pin Puller Assembly: 57001-910

- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring to remove it.

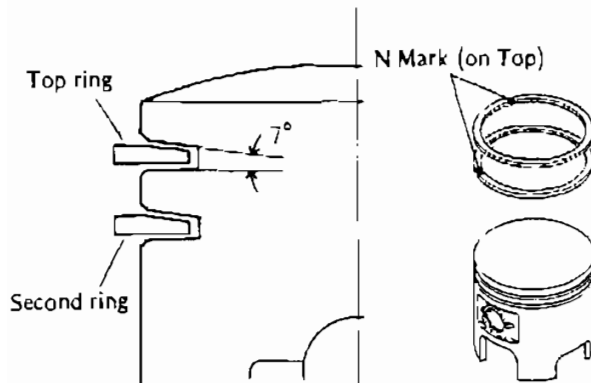


A. Piston Ring

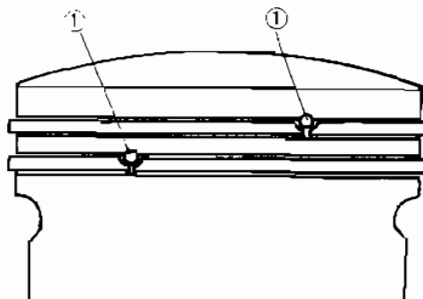
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Engine Top End Assembly

- Assembly is the reverse of disassembly. Note the following.
- If any parts in the piston assemblies require replacement, or if the cylinder is honed or replaced, be sure to check the critical clearances of the new parts against the values given in Specifications.
- Install the piston rings so that the correct side faces upwards as shown.

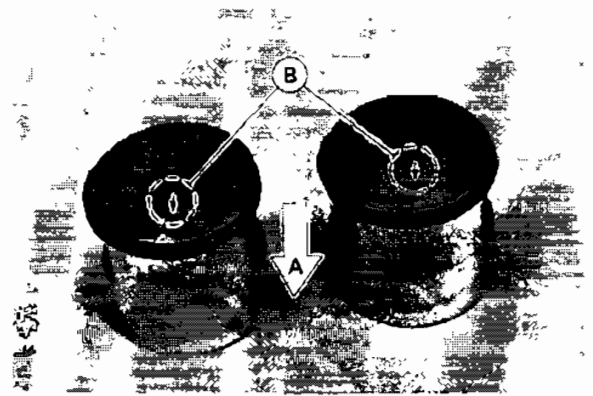
Piston Rings

- When installing the piston rings by hand, first fit one end of the piston ring against the pin in the ring groove, spread the ring opening with the other hand and then slip the ring into the groove.
- Check to see that the pin in each piston ring groove is between the ends of the piston ring.

Piston Ring Position

1. Pin

- Apply engine oil to the surface of each piston pin.
- Mount the piston on the connecting rod with the arrow on its crown pointing to the left (exhaust) side of the engine.



A. Left Side

B. Arrows

- When installing a piston pin snap ring, compress it only enough to install it and no more.

CAUTION

- Do not reuse rings, as removal weakens and deforms them. They could fall out and score the cylinder wall.

- Fit a new piston pin snap ring into the side of each piston so that the snap ring opening does not coincide with the slits of the piston pin hole.



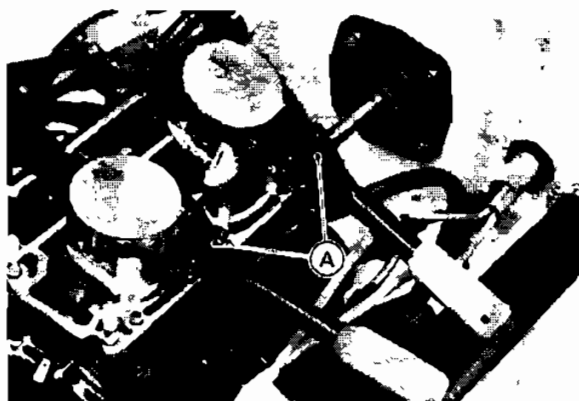
A. Slits

B. Ring Opening

- Set the new cylinder base gasket in place on the crankcase.
- Apply engine oil to the surface of the pistons.
- Compress the piston rings using the piston ring compressor assemblies (special tool).

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5-6 ENGINE TOP END



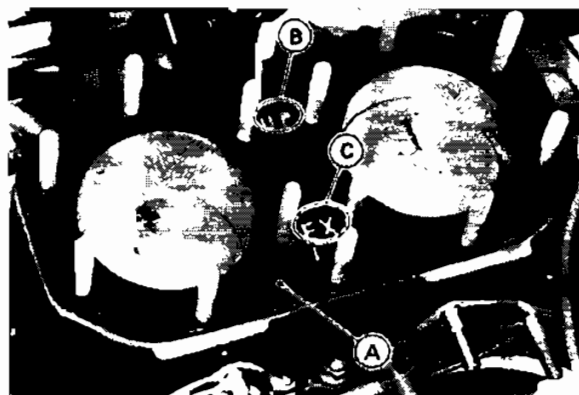
A. Piston Ring Compressor Assembly: 57001-1094

- Thoroughly oil the cylinder bores.
- Slide the cylinder block down over the crankcase studs onto the crankcase.

CAUTION

- Do not force the cylinder block. Make sure the rings are in position.

- Install the cylinder base nuts, and cross-tighten them to the specified torque (see Exploded View).
- Place a new cylinder head gasket on the cylinder head.
- The "UP" mark of the gasket must face upward and "EX" mark must face toward the exhaust side of the engine.

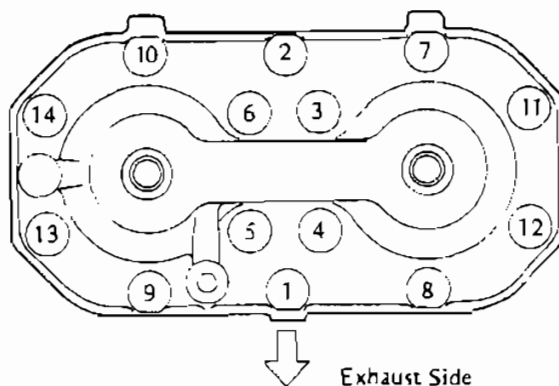


A. Head Gasket
B. "UP" Mark

C. "EX" Mark

- Install the cylinder head and tighten the cylinder head nuts to the specified torque (see Exploded View).
- The tightening sequence numbers are marked on the cylinder head.

Cylinder Head Nuts Tightening Order



- Start the engine to check for fuel and oil leaks, exhaust leaks, and excessive vibration.

WARNING

- Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas which can be lethal.

CAUTION

- Operate the engine only for short periods without cooling water. Stop the engine immediately if the temperature warning buzzer goes on. Overheating will cause severe engine and exhaust system damage.

Maintenance and Inspection:

Compression Measurement

- Thoroughly warm up the engine, while checking that there is no compression leakage from around the spark plugs or the cylinder head gasket.

CAUTION

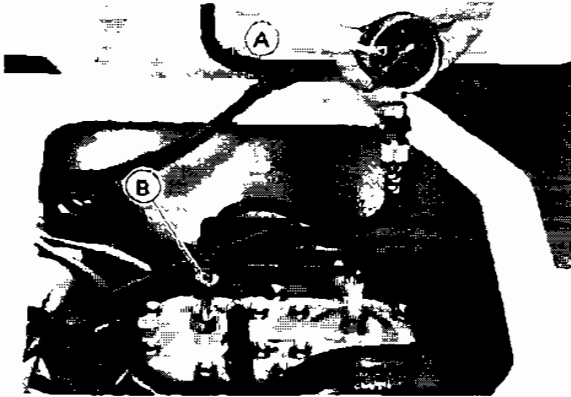
- Operate the engine only for short periods without cooling water. Stop the engine immediately if the temperature warning buzzer goes on. Overheating will cause severe engine and exhaust system damage.

- Stop the engine.
- Remove the spark plugs and screw a compression gauge (special tool) firmly into the spark plug hole.
- Using the starter motor, turn the engine over with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.
- Repeat the measurement for the other cylinder.

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Cylinder Compression (Usable Range)

865 – 1,325 kPa
 (8.8 – 13.5 kg/cm², 125 – 192 psi)
 (open throttle)



A. Compression Gauge: 57001-221
 B. Adapter: 57001-1159

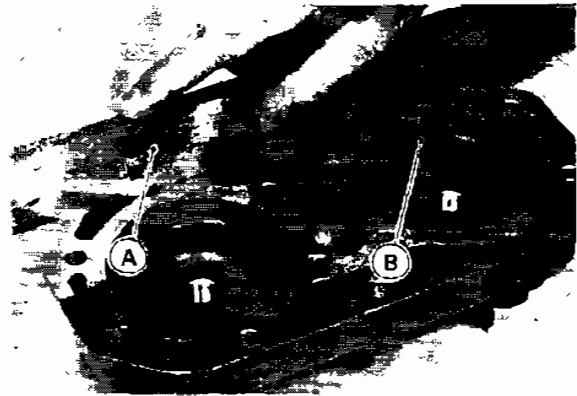
- ★ If the cylinder compression is higher than the usable range, check the following.
 - Carbon buildup on the piston head and cylinder head – clean off any carbon on the piston head and cylinder head.
 - Cylinder head gasket, cylinder base gaskets – use only the proper gaskets. The use of a gasket of incorrect thickness will change the compression.
- ★ If cylinder compression is lower than the usable range, check the following:
 - Gas leakage around the cylinder head – replace the damaged gasket and check the cylinder head for warp.
 - Piston/cylinder clearance, piston seizure.
 - Piston rings, piston ring grooves wear.

Cylinder Head Warp Inspection

- Lay a straightedge across the lower surface of the head at several different points, and measure warp by inserting a thickness gauge between the straightedge and the head.
- ★ If warp exceeds the service limit, repair the mating surface. Replace the cylinder head if the mating surface is badly damaged.

Cylinder Head War

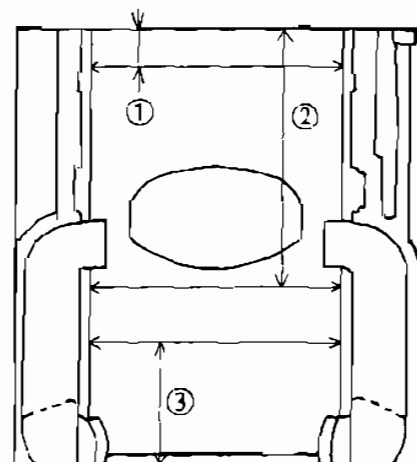
Service Limit: 0.05 mm



A. Straightedge B. Thickness Gauge

Cylinder Wear Inspection

- Inspect the inside of the cylinder for scratches and abnormal wear.
- ★ If the cylinder is damaged or badly worn, replace it with a new one.
- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the 3 locations (total of 6 measurements) shown in the figure.
- ★ If any of the cylinder inside diameter measurements exceeds the service limit, the cylinder will have to be bored oversize and then honed.

Cylinder Inside Diameter Measurement

1. 0 mm
 2. 75 mm
 3. 25 mm

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5-8 ENGINE TOP END

Cylinder Inside Diameter

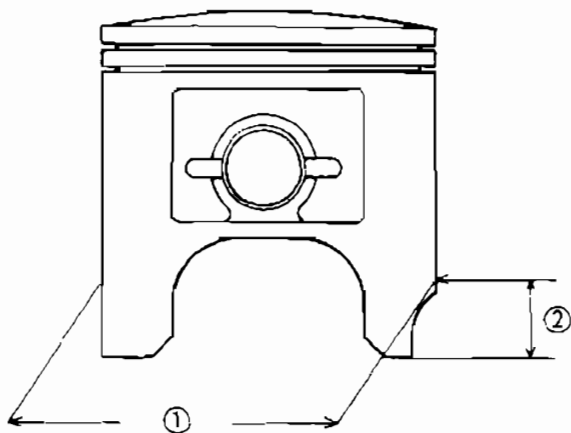
Standard: 76.050 – 76.065 mm and less than 0.01 mm difference between any two measurements

Service Limit: 76.10 mm, or more than 0.05 mm difference between any two measurements

Piston Diameter Measurement

- Measure the outside diameter of the piston 18 mm up from the bottom of the piston at a ring angle to the direction of the piston pin.

Piston Diameter Measurement



1, Piston Diameter 2, 18 mm

Piston Diameter

Standard: 75.961 – 75.976 mm

Service Limit: 75.81 mm

- If the measurement is less than the service limit, replace the piston.

NOTE

- Abnormal wear such as a marked diagonal pattern across the piston skirt may mean a bent connecting rod or a misaligned crankshaft.

Piston/Cylinder Clearance

The piston-to-cylinder clearance must be checked, and the standard value maintained anytime a piston or the cylinder block are replaced with new parts, or whenever the cylinder is rebored and oversize pistons installed.

- The most accurate way to find the piston clearance is by making separate piston and cylinder diameter measurements and then computing the difference between the two values.
- Measure the piston diameter as just described, and subtract this value from the measurement. The difference is the piston clearance.

Piston/Cylinder Clearance

0.084 – 0.094 mm

Boring and Honing

When boring and honing a cylinder, note the following:

- There are two sizes of oversize pistons available. Oversize pistons require oversize rings.

Oversize Pistons and Rings

0.5 mm Oversize

1.0 mm Oversize

- Before boring a cylinder, first measure the exact diameter of the oversize piston, and then, according to the standard clearance in the Service Data Section, determine the rebores diameter. However, if the amount of boring necessary would make the inside diameter greater than 1.0 mm oversize, the cylinder block must be replaced.
- Cylinder inside diameter must not vary more than 0.01 mm at any point.
- Be wary of measurements taken immediately after boring since the heat affects cylinder diameter.
- In the case of a rebored cylinder and oversize piston, the service limit for the cylinder is the diameter that the cylinder was bored to plus 0.1 mm and the service limit for the piston is the oversize piston original diameter minus 0.15 mm. If the exact figure for the rebored diameter is unknown, it can be roughly determined by measuring the diameter at the base of the cylinder.

Piston Ring, Piston Ring Groove Inspection

- Visually inspect the piston rings and the piston ring grooves.
- ★ If the rings are worn unevenly or damaged, they must be replaced.
- ★ If the piston ring groove are worn unevenly or damaged, the piston must be replaced and fitted with new rings.

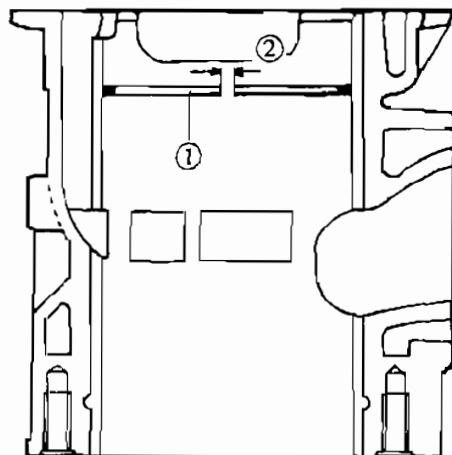
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Piston Ring End Gap

- Place the piston ring inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low.
- Measure the gap between the ends of the ring with a thickness gauge.
- ★ If the gap is wider than the service limit, the ring is worn excessively and must be replaced.

Piston Ring End Gap

	Standard	Service Limit
Top	0.20 – 0.40 mm	0.70 mm
Second	0.20 – 0.40 mm	0.70 mm

End Gap Measurement

1. Piston Ring
2. Gap

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ENGINE REMOVAL AND INSTALLATION

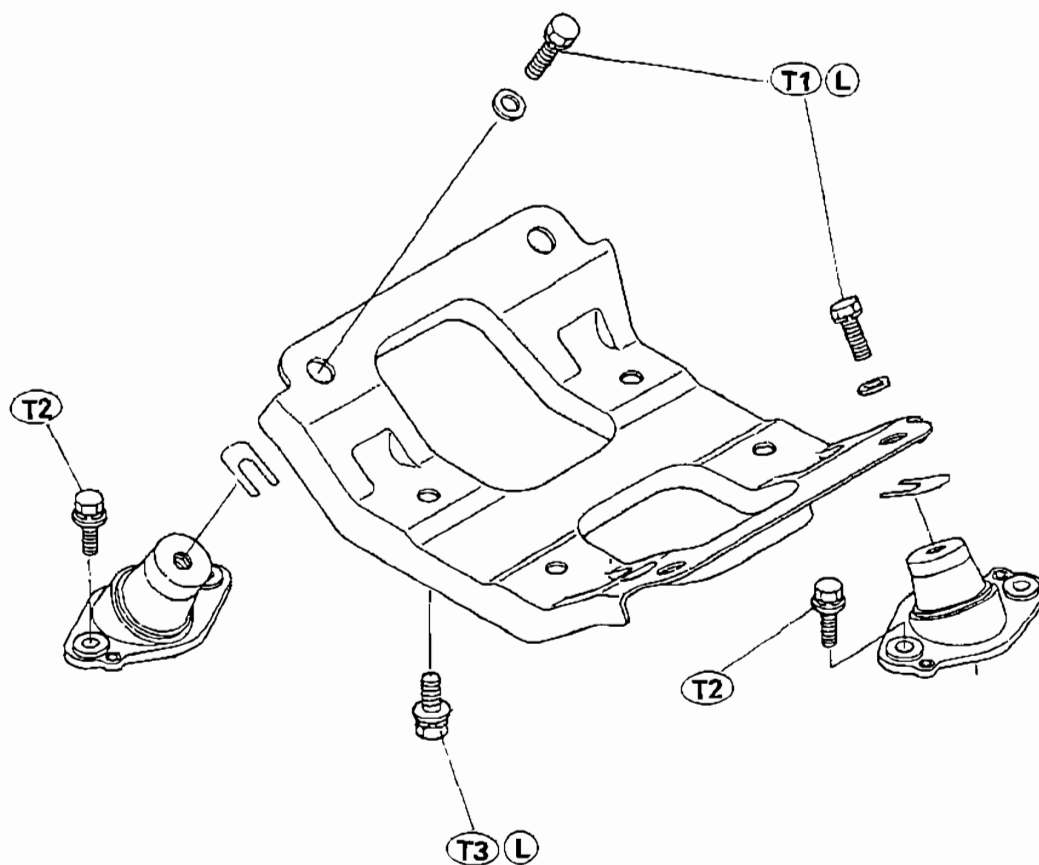
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Engine Installation	6-4

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6-2 ENGINE REMOVAL AND INSTALLATION

Exploded View



L : Apply non-permanent locking agent.

T1: 22 N·m (2.2 kg·m, 16.0 ft·lb)

T2: 16 N·m (1.6 kg·m, 11.5 ft·lb)

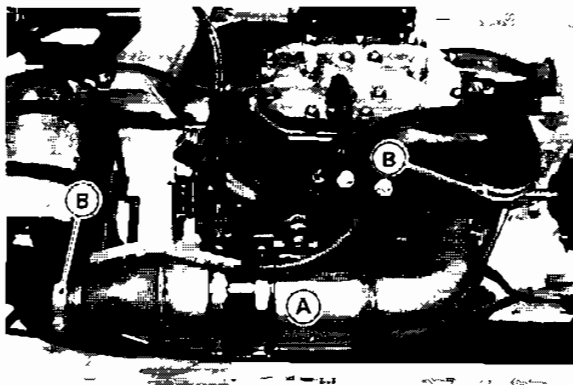
T3: 36 N·m (3.7 kg·m, 27 ft·lb)

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Engine Removal/Installation

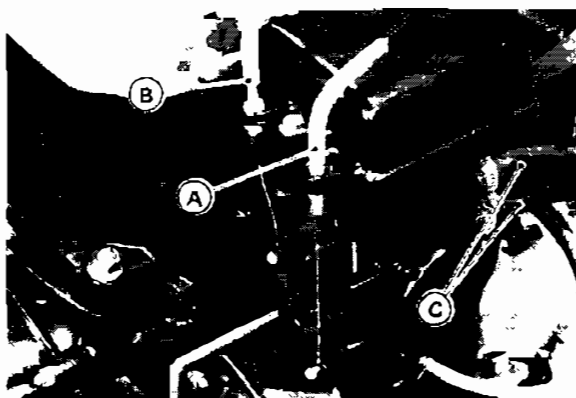
Engine Removal

- Remove the following.
Engine Hood
Expansion Chamber



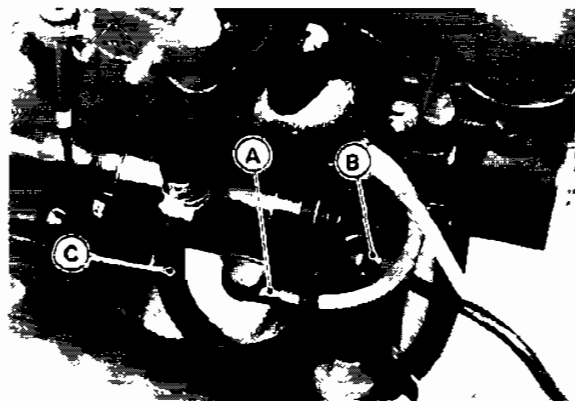
A. Expansion Chamber B. Clamp

- Disconnect the following.
Throttle Cable
Choke Cable
Fuel Hoses
Spark Plug Leads



A. Throttle Cable B. Choke Cable C. Fuel Hoses

Starter Motor Cable
Battery Ground Cable
Inlet Cooling Hose



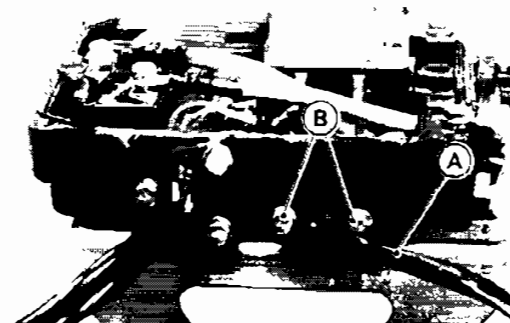
A. Starter Motor Cable
B. Battery Ground Cable
C. Inlet Cooling Hose

Oil Pump Hose (Inlet)
Pulse Hose



A. Oil Pump Hose (Inlet) B. Pulse Hose

- Open the electric case and disconnect the stator leads.

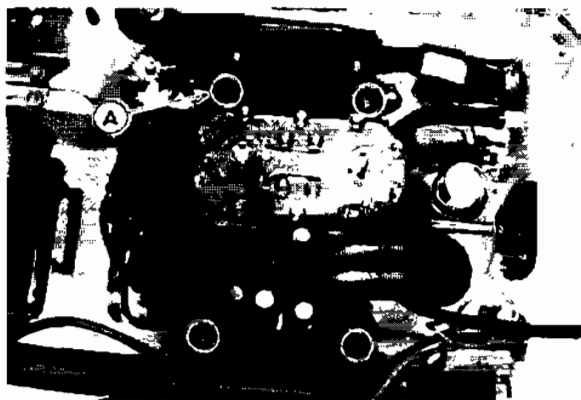


A. Stator Leads B. Bolts

- Remove the engine bed mounting bolts.
Take out any shims under the engine bed, and mark them so they may be put back in the same place.

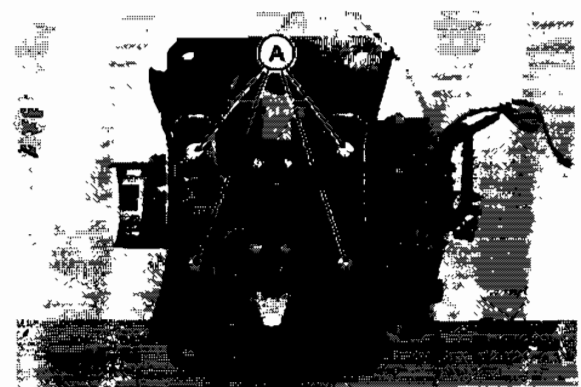
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6-4 ENGINE REMOVAL AND INSTALLATION



A. Mounting Bolts

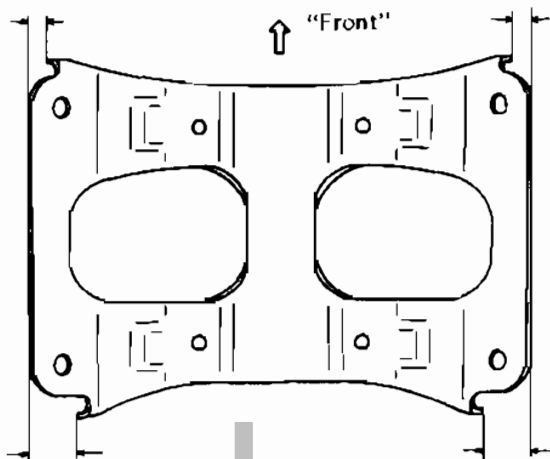
- Remove the engine.
- Remove the engine bed.



A. Mounting Bolts

Engine Installation

- Engine installation is the reverse of removal. Note the following.
- Be sure there are no foreign objects and parts inside of the hull.
- Check the coupling damper for wear and damage.
- Install the engine bed so that the small notches are on the magneto end of the engine as shown.



- Apply a non-permanent locking agent to the following mounting bolts, and tighten them to the specified torque (see Exploded View).

Engine Mounting Bolts
Engine Bed Mounting Bolts

- Check the gap between the engine bed and the dampers by rocking the engine.
- If there is a gap, insert a suitable shim between the engine bed and the damper to achieve a good fit.

Shim Selection

Shim No.	Thickness
92025-3705	±0.3 mm
92025-3706	±0.5 mm
92025-3707	±1.0 mm
92025-3708	±1.5 mm

- After installing the engine in the hull, check the following.

Throttle Cable
Choke Cable
Oil Pump Bleeding
Fuel and Exhaust Leaks

WARNING

- Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas which can be lethal.

CAUTION

- Operate the engine only for short periods without cooling water. Stop the engine immediately if the temperature warning buzzer goes on. Overheating will cause severe engine and exhaust system damage.

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ENGINE BOTTOM END

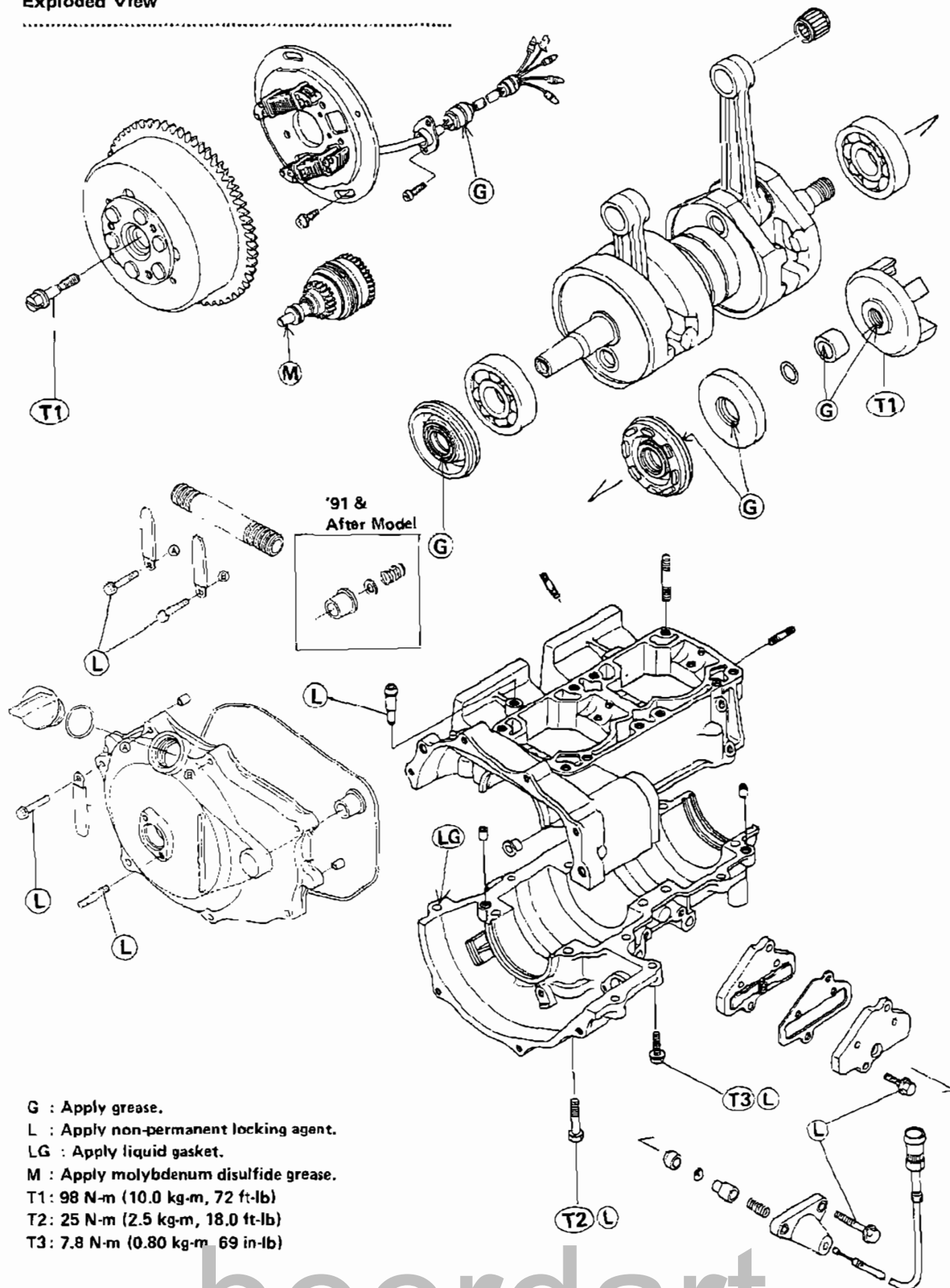
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7-2 ENGINE BOTTOM END

Exploded View



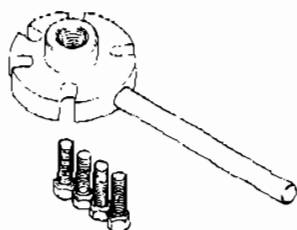
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Specifications

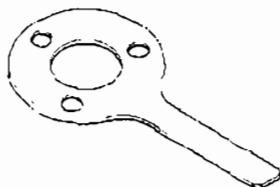
Item	Standard	Service Limit
Crankshaft:		
Runout	0.04 mm	0.10 mm TIR
Connecting Rod Side Clearance	0.45 – 0.55 mm	0.8 mm
Connecting Rod Radial Clearance	0.045 – 0.055 mm	0.11 mm
Connecting Rod Bend	0.05 mm/100 mm	0.2 mm/100 mm
Connecting Rod Twist	0.15 mm/100 mm	0.2 mm/100 mm

Special Tools

Magneto Puller: 57001-259



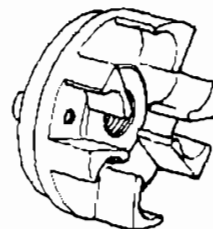
Flywheel Holder: 57001-1156



Rotor Puller: 57001-1099



Coupling Holder: 57001-1230



Sealant

Kawasaki Bond (liquid gasket): 92104-1003



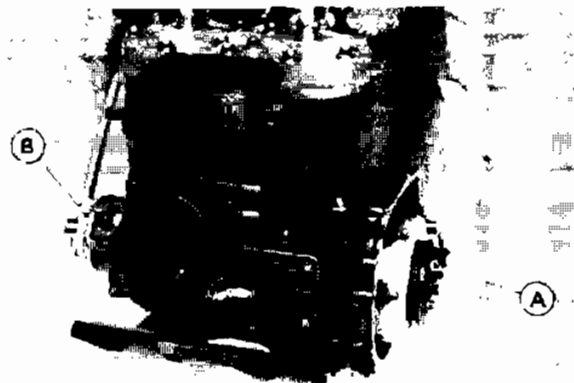
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7-4 ENGINE BOTTOM END

Coupling

Coupling Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Remove the coupling damper and cover.
- Remove the magneto cover.
- Holding the flywheel with the holder (see Magneto Flywheel Removal), unscrew the coupling with the coupling holder (special tool).



A. Holder: 57001-1156
B. Coupling Holder: 57001-1230

Coupling Installation Note

- Grease to the coupling threads.
- Screw the coupling onto the crankshaft and tighten it to the specified torque (see Exploded View).

Coupling Damper Inspection

- With the engine removed, remove the coupling damper and inspect it for wear and deterioration.
- ★ If it is grooved or misshapen, replace it with a new damper.
- ★ If there is any doubt as to coupler condition, replace it.

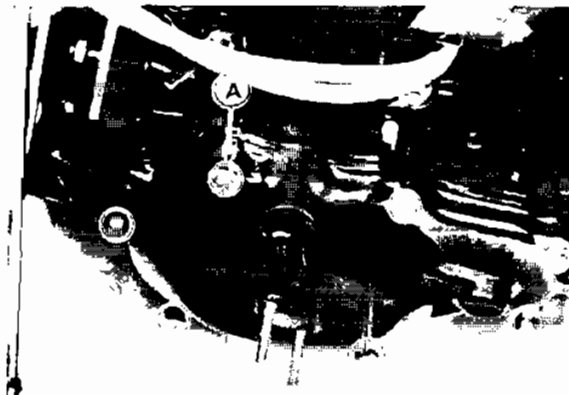


A. Wear Points

Magneto Flywheel

Magneto Flywheel Removal

- Remove the following.
 - Engine Hood
 - Oil Tank and Bracket
 - Water Box Muffler
 - Oil Pump
- Remove the magneto cover.

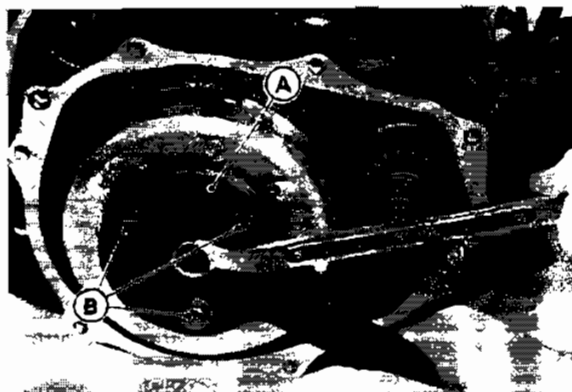


A. Magneto Cover

- Install the holder (special tool) on the flywheel with three bolts (D: 8 mm x L: 10 mm).

CAUTION

- Do not use the longer bolts. Longer bolts might hit the charging coil and damage it.



A. Holder: 57001-1156
B. Bolts (D: 8 mm x L: 10 mm)

- Pull the flywheel off the crankshaft, using the magneto puller and the rotor puller (special tools) and adapter bolt (D: 10 mm x L: 20 mm, ex. 14 mm).

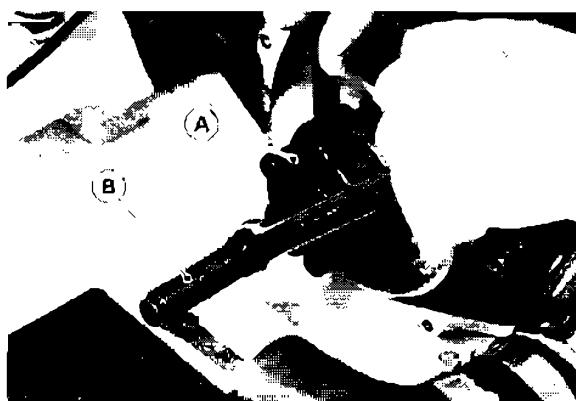
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A. Adapter Bolt(D: 10 mm x L: 20 mm, Hex. 14 mm)



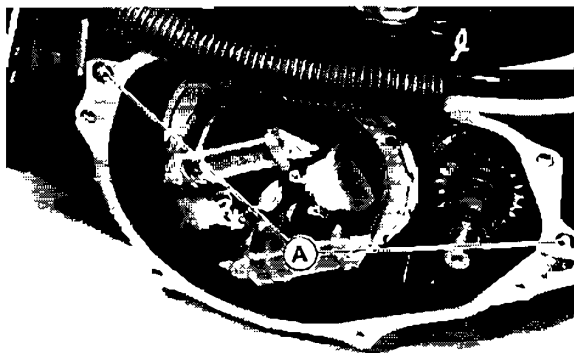
A. Woodruff Key



A. Magneto Puller: 57001-259
B. Rotor Puller: 57001-1099

CAUTION

- If the flywheel is difficult to remove, turn the puller shaft while tapping the head of the puller shaft with a hammer. Do not attempt to strike the grab bar or the flywheel itself. Striking the bar or the flywheel can cause the bar to bend or the magnets to lose their magnetism.



A. Knock Pins

- Apply a non-permanent locking agent to the threads of the magneto cover mounting bolts, and tighten them securely.

Magneto Flywheel Installation

- Installation is the reverse of removal. Note the following.
- Using a high flash-points solvents, clean off any oil or dirt that may be on the flywheel bolt, the crankshaft taper, or in the tapered hole in the flywheel.
- Fit the woodruff key securely in the crankshaft, before installing the magneto flywheel.

Stator

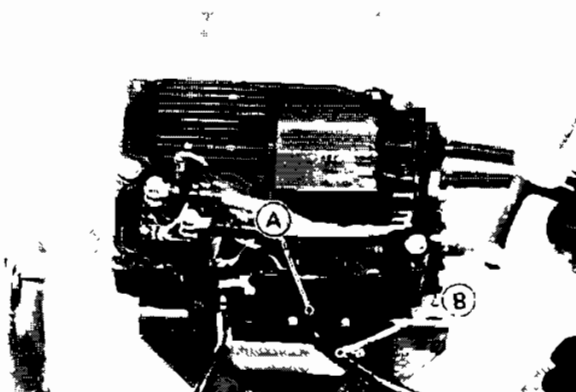
Stator Removal

- Remove the magneto flywheel.
- Open the electric case

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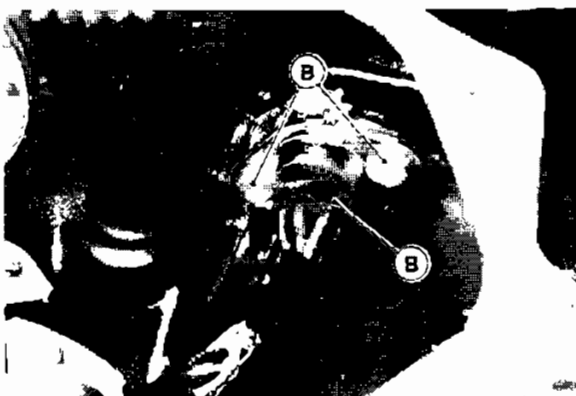
7-6 ENGINE BOTTOM END

- Remove the grommet cap and disconnect the stator leads.



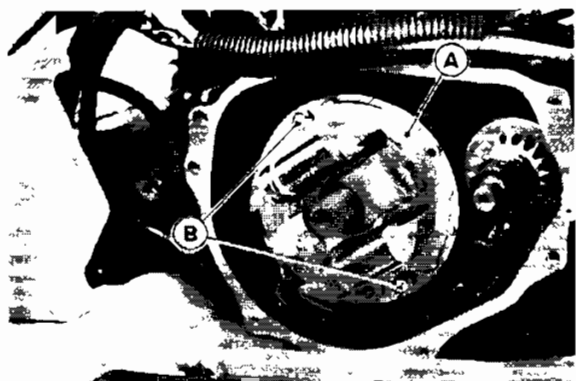
A. Grommet Cap B. Stator Leads

- Remove the grommet with the stator leads.



A. Grommet B. Screws

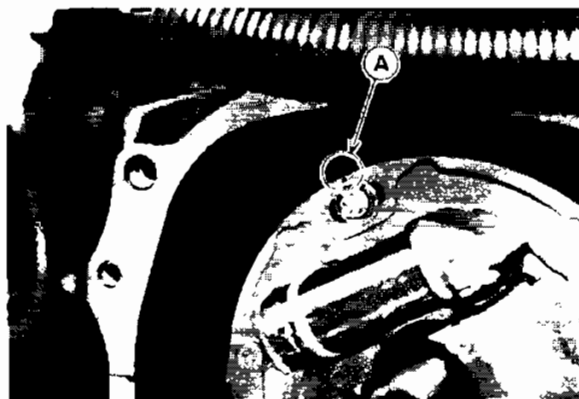
- Remove the stator.



A. Stator B. screws

Stator Installation Notes

- Grease the outer surface of the grommet.
- Align the mark on the stator plate with the timing mark on the crankcase.

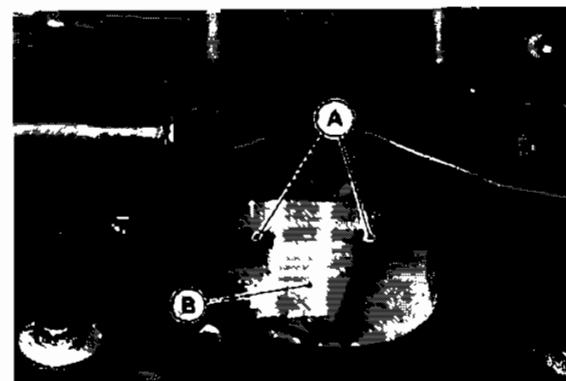


A. Align the marks.

Water Drain Valve

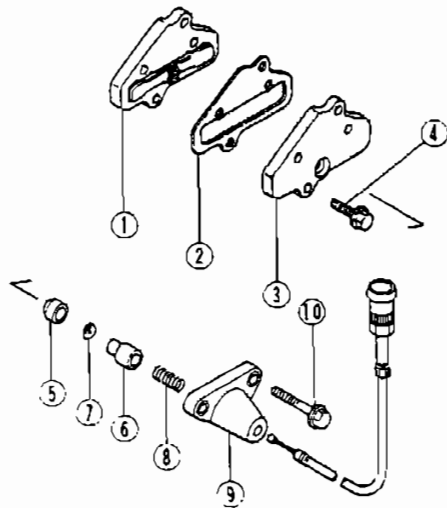
Water Drain Valve Removal

- Remove the following.
 - Engine Hood
 - Exhaust Pipe and Manifold (see Exhaust System chapter)
 - Starter Motor (see Electrical system chapter)
- Remove the water drain valve.



A. Mounting Bolts B. Water Drain Valve

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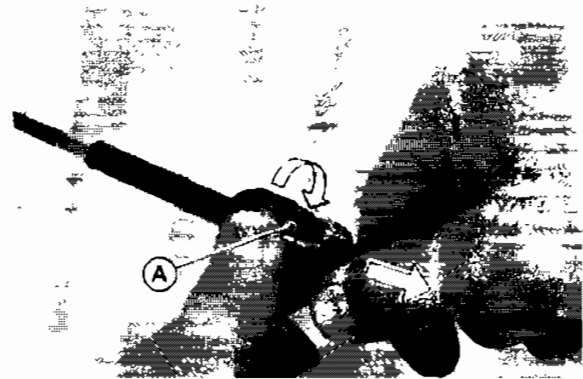
- | | |
|------------------------|--------------------------|
| 1. Reed Valve Assembly | 6. Control Valve |
| 2. Gasket | 7. E-Ring |
| 3. Reed Valve Cover | 8. Spring |
| 4. Cover Bolt | 9. Control Valve Housing |
| 5. Valve Cap | 10. Mounting Bolt |

- Remove the valve cap and then remove the E-ring to disassemble the control valve.



A. Drain Hole

- Lock the water drain valve.
- With the water drain valve knob pulled, tighten the locknut.

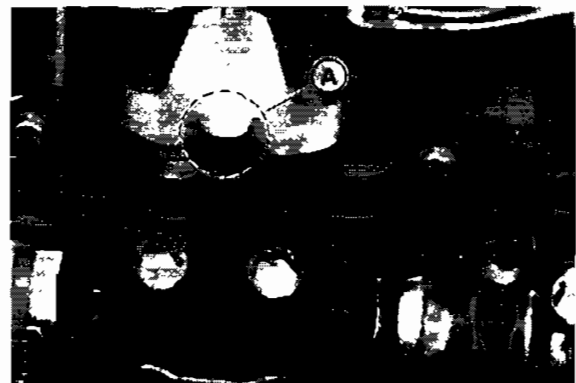


A. Locknut

- Install the assembly on the lower crankcase half.
- Apply a non-permanent locking agent to the threads of the water drain valve mounting bolts.
- Loosen the locknut just until the water drain valve knob returns by spring tension.
- After installing the water drain valve, check that the control valve fits tightly in the drain hole.

Water Drain Valve Installation

- Installation is the reverse of removal. Note the following.
- Visually inspect the reed valves for cracks, folds, or other damage.
- ★ If there is any doubt as to the condition of a reed, replace the reed valve assembly.
- Apply a non-permanent locking agent to the cover bolt threads.
- Clean the drain hole and the valve cap.
- Visually inspect the valve cap, and replace it if necessary.



Control valve fits tightly.

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7-8 ENGINE BOTTOM END

Crankcase Splitting

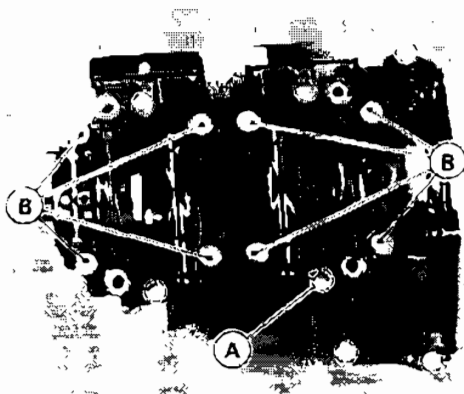
Crankcase Splitting

- Remove the engine (see Engine Removal/Installation chapter).
- Remove the following parts from the engine.
 - Exhaust Manifold
 - Carburetor
 - Intake Manifold
 - Starter Motor
 - Cylinder Head
 - Cylinder Block
 - Pistons
 - Water Drain Valve
 - Oil Pump
 - Coupling
 - Magneto Flywheel
 - Reduction Gear
 - Stator

NOTE

- Always remove the coupling before removing the magneto flywheel, or there won't be any way to hold the crankshaft while unscrewing the coupling.

- Remove the 6 mm crankcase bolts first and then the 8 mm bolts.



A. 6 mm Bolts

B. 8 mm Bolts

- Pry the points indicated in the figure to split the crankcase halves apart, and then remove the lower crankcase half.

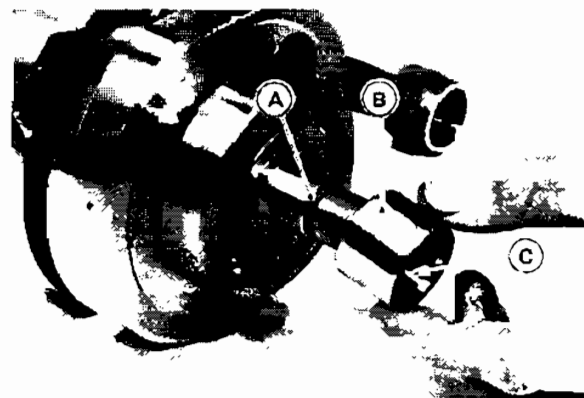


A. Pry Points

- Lift the crankshaft assembly out of the upper crankcase half.

Crankcase Assembly

- Assembly is the reverse of splitting. Note the following.
- Visually inspect the crankshaft O-ring, and replace it if necessary.
- Grease the inner surface of the collar.



A. O-Ring

B. Collar

C. Apply grease.

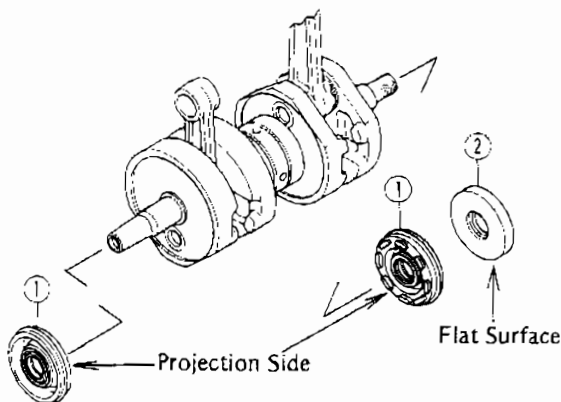
- Grease the lips of the oil seals.
- Pack grease between the rear oil seals (coupling side).

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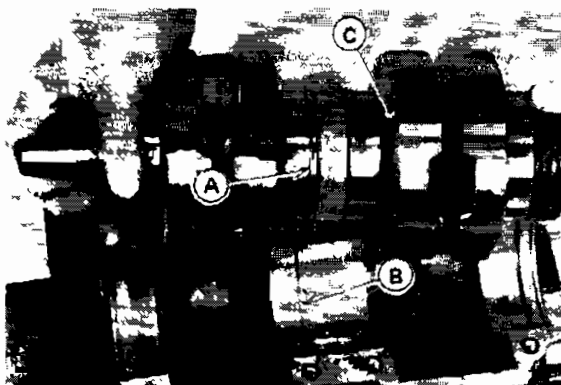
A. Pack grease.

- Install the oil seals as shown.



1. Double Lips Seals
2. Single Lip Seal

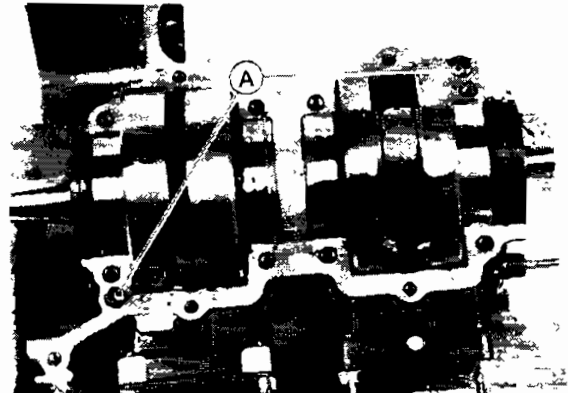
- Place the crankshaft assembly in the upper crankcase half so that the position ring on the crankshaft assembly fits into the groove in the crankcase.



A. Position Ring
B. Groove

C. Crankshaft Assembly

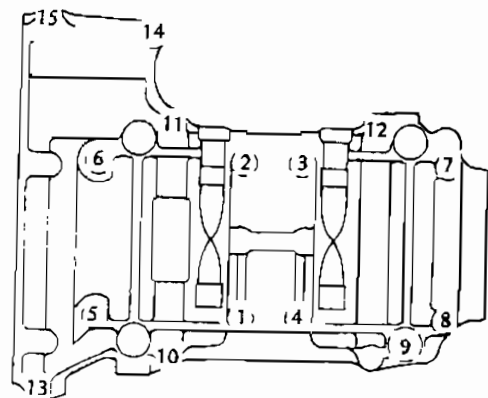
- Check that the knock pins are in place.



A. Knock Pins

- With a high flash-point solvent, clean off the mating surfaces of the crankcases halves and wipe dry.
- Apply liquid gasket to the mating surface of the lower crankcase half.
- Install the lower crankcase half onto the upper half.
- Apply a non-permanent locking agent to the crankcase bolts, and tighten them to the specified torque (see Exploded View).
- The tightening sequence numbers are marked on the lower crankcase half.

Crankcase Bolts Tightening Order



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7-10 ENGINE BOTTOM END

Crankshaft Maintenance

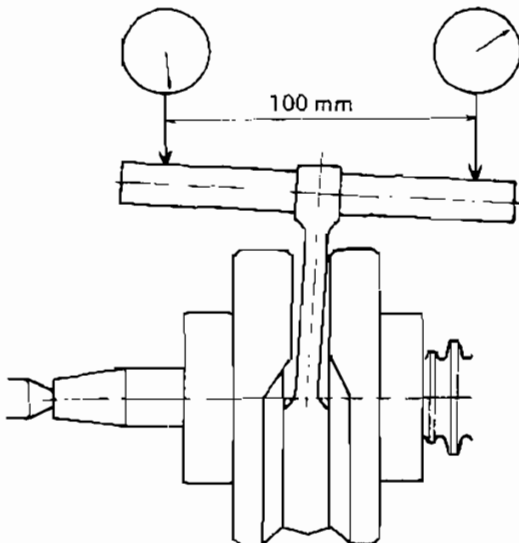
The crankshaft changes the reciprocating motion of the piston into rotating motion to drive the jet pump. Crankshaft trouble, such as excessive play or runout, will multiply the stress caused by the intermittent force on the piston and will result in not only rapid crankshaft bearing wear, but also noise, power loss, vibration, and shortened engine life. A defective crankshaft should always be detected at an early stage and repaired immediately.

The following explanation concerns the most common crankshaft problems and the method for measuring play, runout, and con-rod alignment. It does not cover crankshaft disassembly because of the highly specialized equipment that is required. If crankshaft components become damaged or worn, the entire shaft should be replaced as an assembly, or rebuilt by a properly equipped shop.

Connecting Rod Bend/Twist

- Measure connecting rod bend.
- Set the crankshaft in an alignment jig or in V blocks on a surface plate.

Connecting Rod Bend



- Select an arbor of the same diameter as the connecting rod small end and at least 100 mm long, and insert the arbor through the connecting rod small end.

- With the connecting rod held vertically, use a height gauge to measure the difference in the height of the arbor above the surface plate over a 100 mm length to determine the amount of connecting rod bend.

★ If connecting rod bend exceeds the service limit, the connecting rod or crankshaft must be replaced.

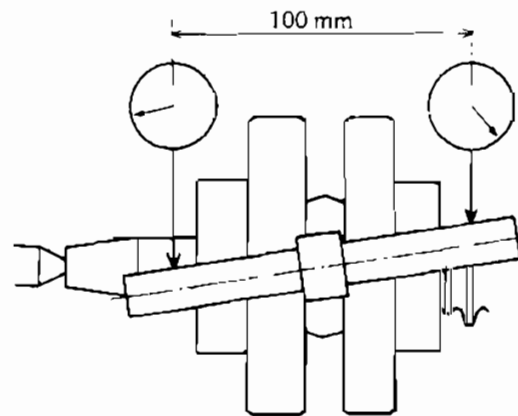
Connecting Rod Bend

Standard:	Under 0.05/100 mm
Service Limit:	0.2/100 mm

- Measure connecting rod twist.

- With the crankshaft still in the alignment jig, hold the connecting rod horizontally and measure the amount that the arbor varies from being parallel with the crankshaft over a 100 mm length of the arbor to determine the amount of connecting rod twist.

Connecting Rod Twist



- ★ If connecting rod twist exceeds the service limit, the connecting rod or crankshaft must be replaced.

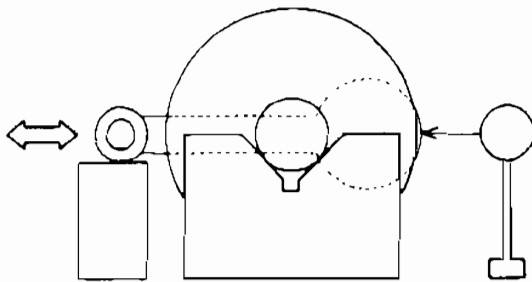
Connecting Rod Twist

Standard:	Under 0.15/100 mm
Service limit:	0.2/100 mm

Connecting Rod Big End Radial Clearance

- Check big end radial clearance.
- Set the crankshaft in an alignment jig or on V blocks, and place a dial gauge against the connecting rod big end.

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Connecting Rod Big End Radial Clearance

○ Push the connecting rod first towards the gauge and then in the opposite direction. The difference between the two gauge readings is the radial clearance.

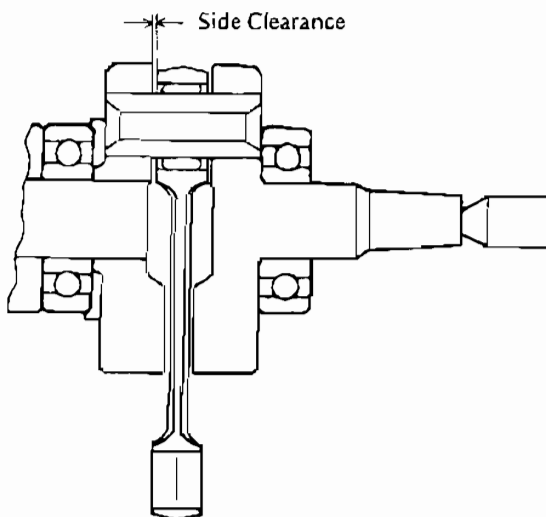
★ If the radial clearance exceeds the service limit, the crankshaft assembly must be replaced or disassembled and the crankpin, needle bearing, and connecting rod big end examined for wear.

Connecting Rod Big End Radial Clearance

Standard: 0.45 – 0.55 mm
Service Limit: 0.11 mm

Connecting Rod Big End Side Clearance

- Measure big end side clearance.
- Insert feeler gauges between the big end and either crank half to determine clearance.

Connecting Rod Big End Side Clearance

★ If the measured value exceeds the service limit, the crankshaft should be either replaced or rebuilt.

Connecting Rod Big End Side Clearance

Standard: 0.45 – 0.55 mm
Service Limit: 0.8 mm

Crankshaft Main Bearing Wear

- Wash the bearings in high flash-point solvent, blow them dry (DO NOT SPIN THEM), and lubricate them with engine oil.

WARNING

○ Solvent is toxic and flammable. Avoid prolonged contact with skin and keep away from open flame. Use only in a well-ventilated area. Eye protection should be worn when compressed air is used to dry parts. Do not direct air towards anyone. Use 172 kPa (1.75 kg/cm², 25 psi) maximum nozzle pressure.

- Turn each bearing over by hand and see that it makes no noise, turns smoothly, and has no rough spots.
- ★ If any of the bearings are defective, replace them.

Crankshaft Runout

- Check crankshaft alignment by measuring runout.
- With the crankshaft on V blocks, rotate the crankshaft slowly and measure runout at each of the locations shown.
- ★ If the runout at any point exceeds the service limit, the crankshaft must be either replaced or rebuilt.

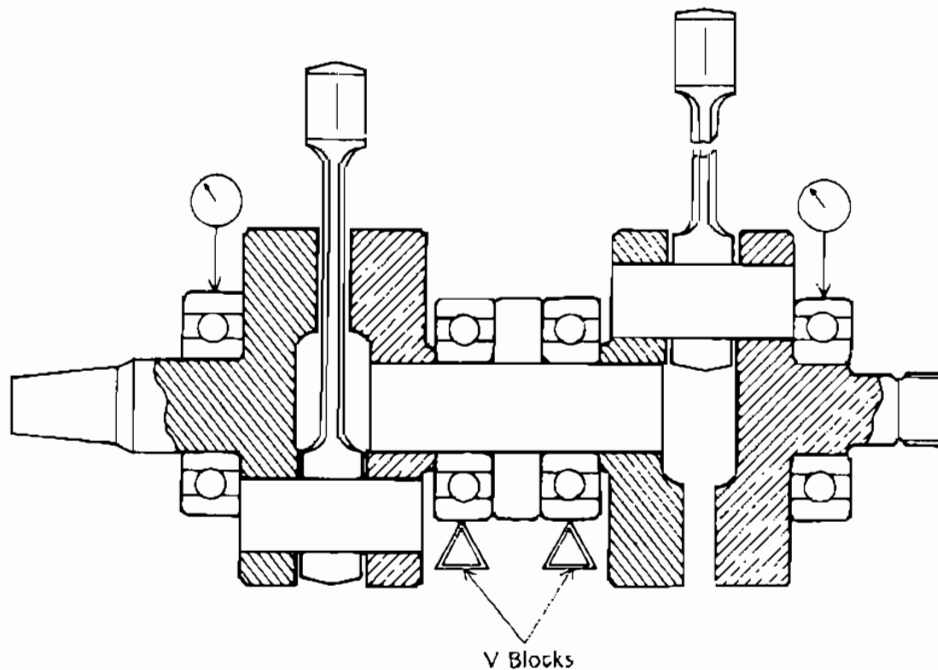
Crankshaft Runout (Either Location)

Standard: Under 0.04 mm TIR
Service: 0.10 mm TIR

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7-12 ENGINE BOTTOM END

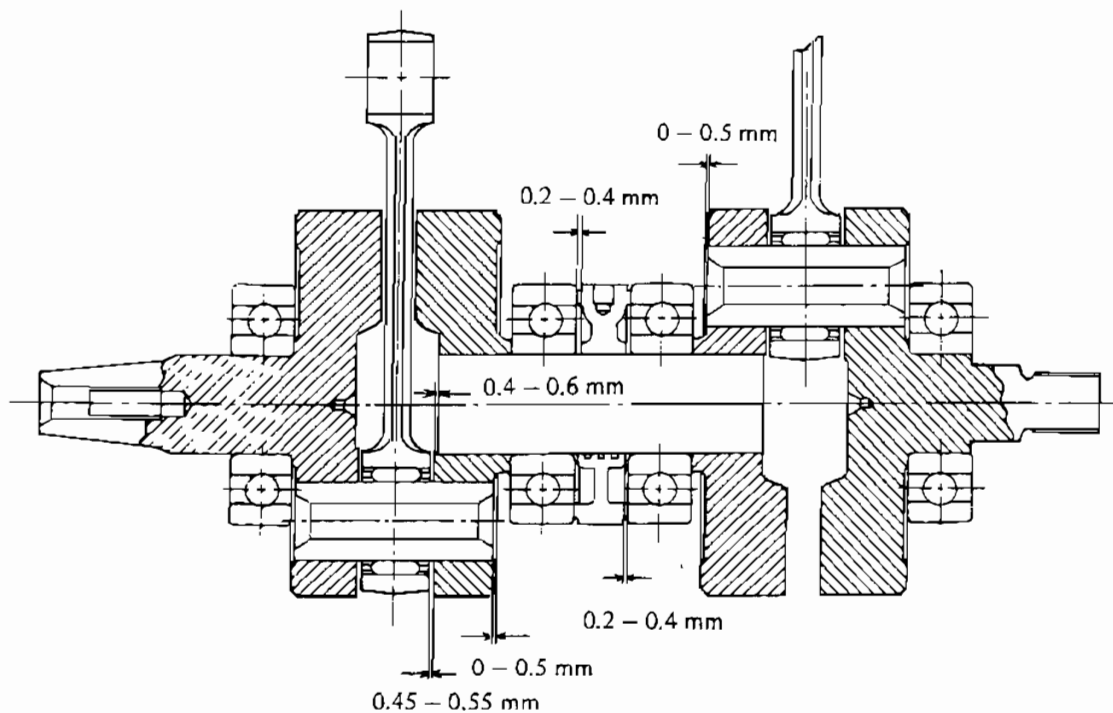
Crankshaft Runout



Crankshaft Assembly Specifications

If the crankshaft is disassembled, use these specifications during rebuilding.

Crankshaft Assembly Specifications



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COOLING AND BILGE SYSTEMS

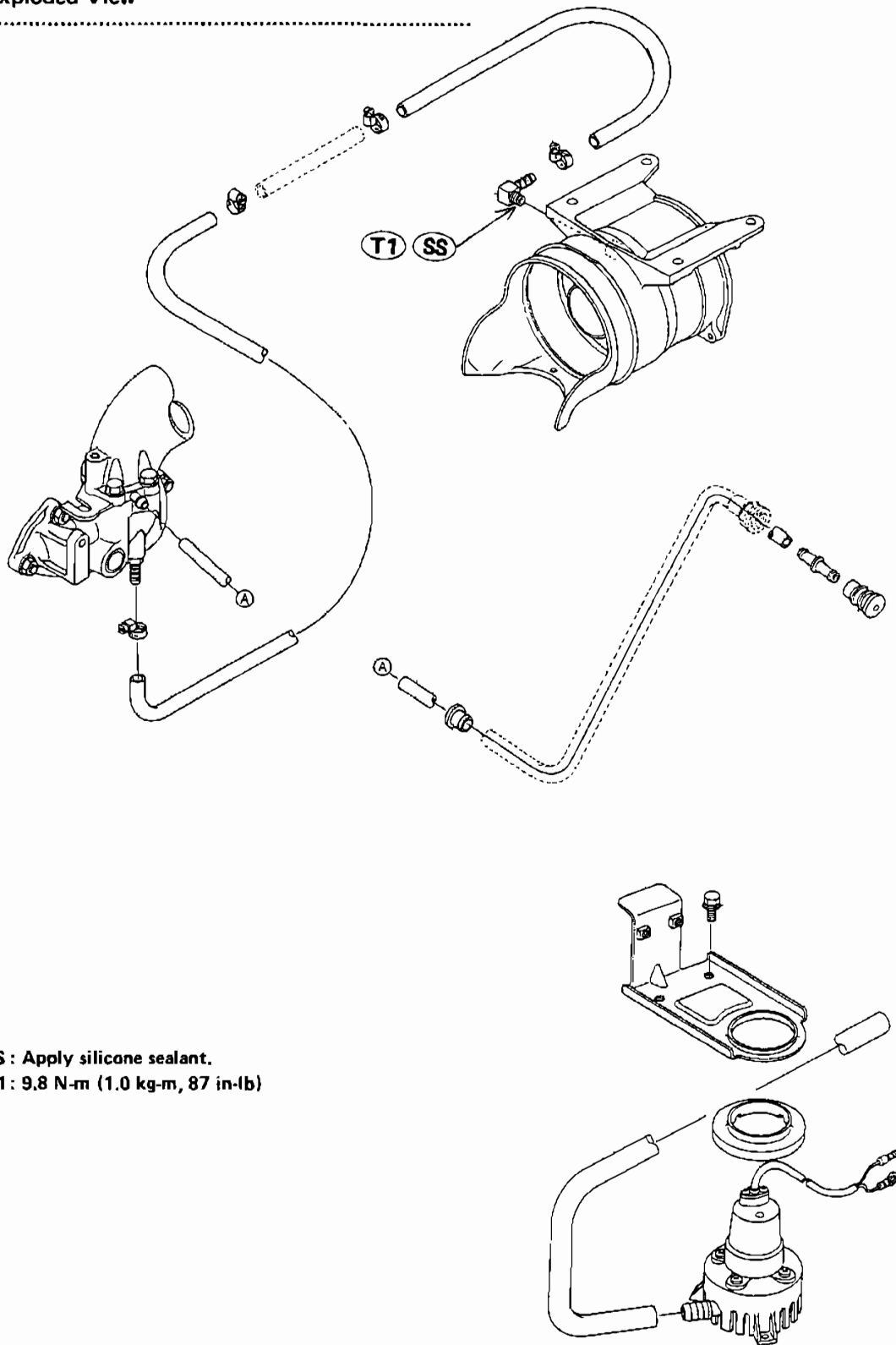
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8-2 COOLING AND BILGE SYSTEMS

Exploded View



SS : Apply silicone sealant.

T1: 9.8 N-m (1.0 kg-m, 87 in-lb)

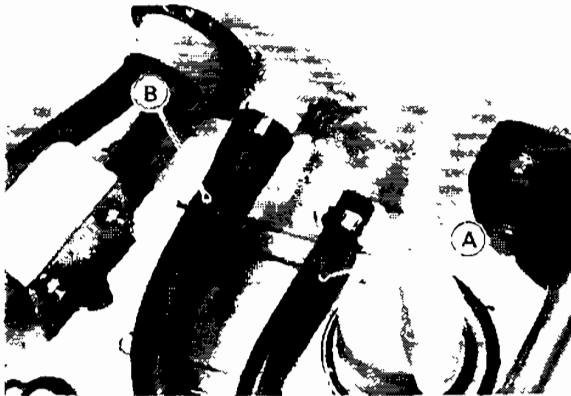
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Bilge System

Bilge Pump:

Removal

- Remove the engine hood.
- Disconnect the following.
 - Inlet Cooling Hose
 - Bilge Hose
 - Bilge Pump Leads

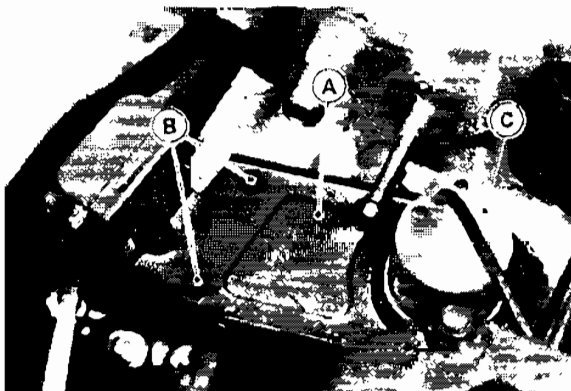


A. Inlet Cooling Hose
B. Bilge Hose



A. Bilge Pump Leads

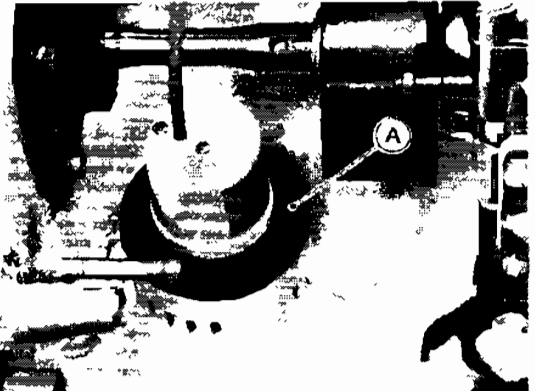
- Pull out the bilge pump leads from the pipe.
- Remove the bracket with the fuel pump.



A. Bracket
B. Bolts
C. Bilge Pump

Installation

- Put the damper between the bilge pump and bracket.



A. Damper

- Install the bilge hose with the paint marks upward.

Inspection

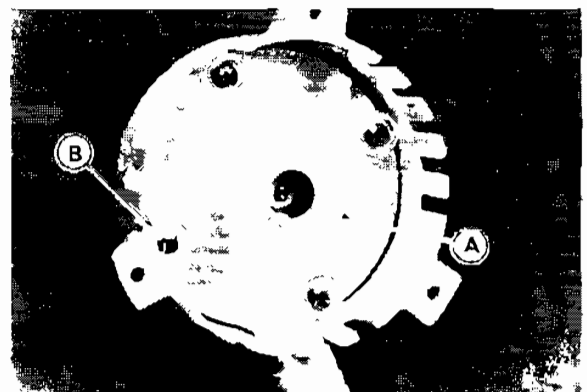
- Using two auxiliary wires, supply battery power to the bilge pump.

Wire Connections

Brown	↔	Battery (+)
Black	↔	Battery (-)

- ★ If the bilge pump does not turn at this time, the bilge pump must be replaced.

- Visually check the bilge pump impeller.
- Remove the bottom cover.

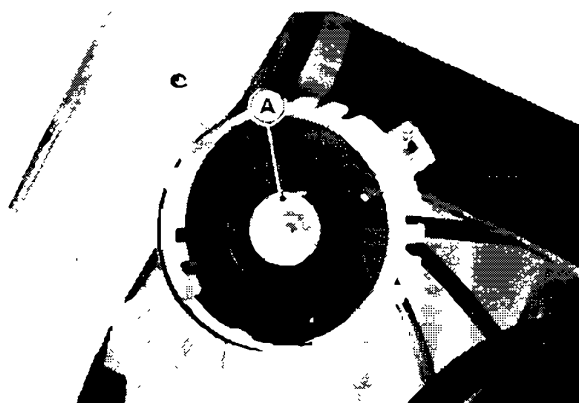


A. Bottom Cover
B. Screws

- If the blades are damaged, replace the bilge pump assembly.

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8.4 COOLING AND BILGE SYSTEMS



A. Impeller

- When installing the cooling system hoses, be sure to use the same kind of clamp as the original.

Hose Inspection

- Check the hoses for hardening, cracking, checking, cuts, abrasions, and breaks.
- ★ If a hose is damaged in any way, replace it immediately and check all the other hoses for damage.

Bilge Switch:

- Refer to the Electrical System chapter.

Cooling and Bilge System Hoses

Hose Removal/Installation

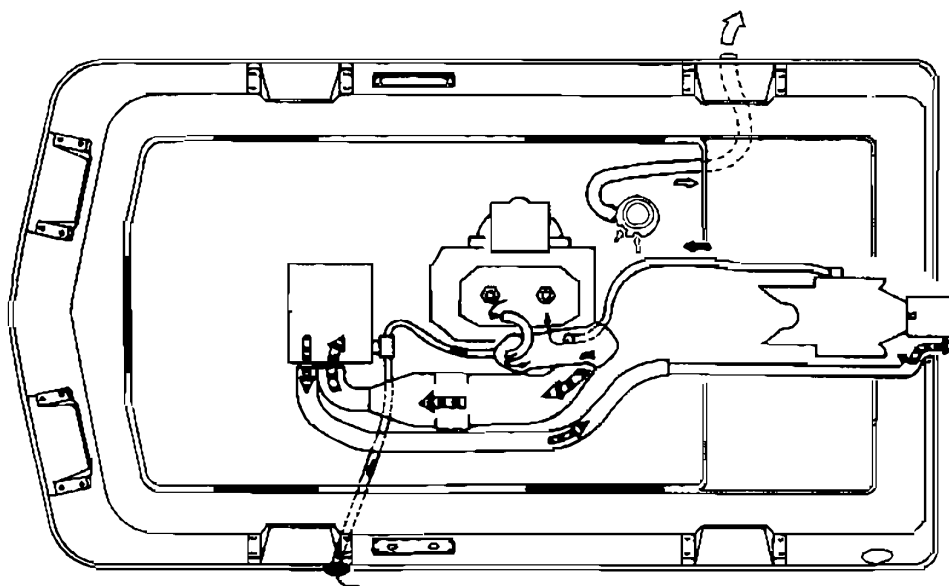
- The bilge system hose without clamps may be simply pulled off their fittings.
- All the cooling system hoses are clamped at both ends. Loosen the clamps and pull the hoses off.

Cooling and Bilge System Flushing

Cooling System Flushing

To prevent sand and salt deposits from accumulating in the cooling system, it must be flushed occasionally. Flush the system according to the Periodic Maintenance Chart or whenever there is little water flow from the bypass outlet on the left side of the hull.

- Remove the fitting cap from cooling hose fitting on the cylinder head.



DIRECTION OF COOLING SYSTEM FLOW



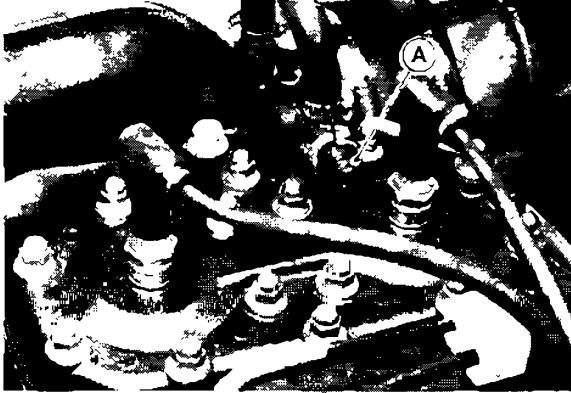
DIRECTION OF BILGE SYSTEM FLOW



DIRECTION OF COMBINED EXHAUST AND COOLING WATER FLOW

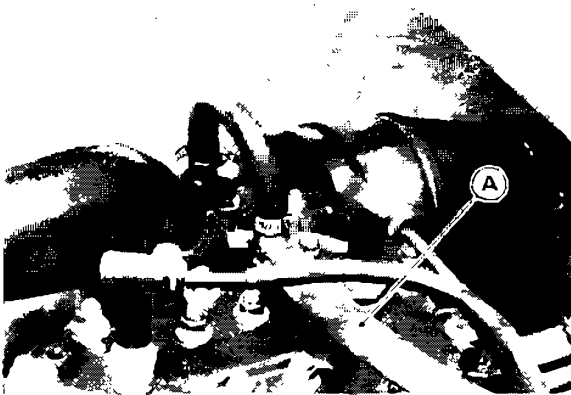
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COOLING AND BILGE SYSTEMS 8-5



A. Cap

- Attach the garden hose to the fitting.

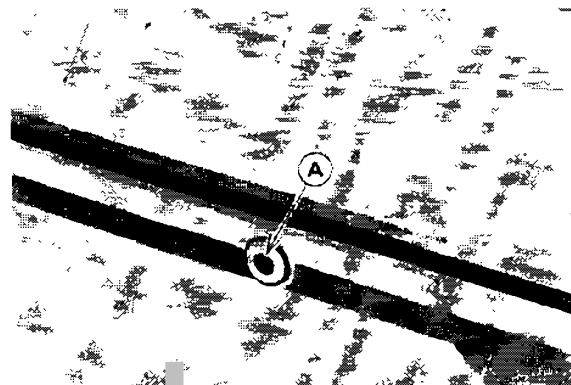


A. Garden Hose

- Start the engine and allow it to idle before turning on the water.

CAUTION

- The engine must be running before the water is turned on or water may flow back through the exhaust pipe into the engine, resulting in the possibility of severe internal damage.
- Immediately turn on the water and adjust the flow so that a little trickle comes out of the bypass outlet on the left side of the hull.



A. Bypass Outlet

- Let the engine idle for several minutes with the water running.
- Turn off the water. **Leave the engine idling.**
- Rev the engine a few times to clear the water out of the exhaust system.

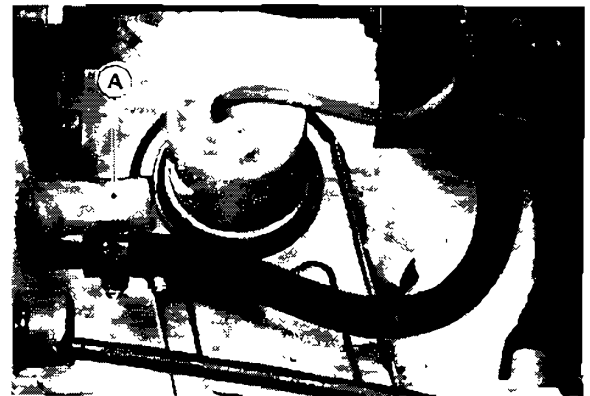
CAUTION

- Operate the engine only for short periods without cooling water. Stop the engine immediately if the temperature warning buzzer goes on. Overheating will cause severe engine and exhaust system damage.
- Switch off the engine, remove the garden hose, and reinstall the fitting.

Bilge System Flushing

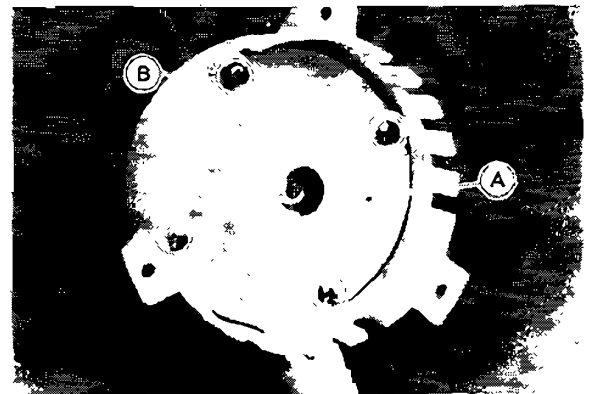
To prevent clogging, the bilge system should be flushed out whenever you suspect it is blocked.

- Remove the bilge hose.
- Flush the bilge hose thoroughly with fresh water.
- Connect a 19 mm ($\frac{3}{4}$ in.) inside diameter auxiliary hose to the bilge hose fitting on the bulkhead, turn the water on, and flush the bilge line out for several minutes.



A. Bilge Hose Fitting

- Remove the bilge pump, from the engine compartment.
- Remove the bottom cover of the bilge pump.



A. Bottom Cover

B. Screws

Clear the impeller and bottom cover of any dirt.

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DRIVE SHAFT

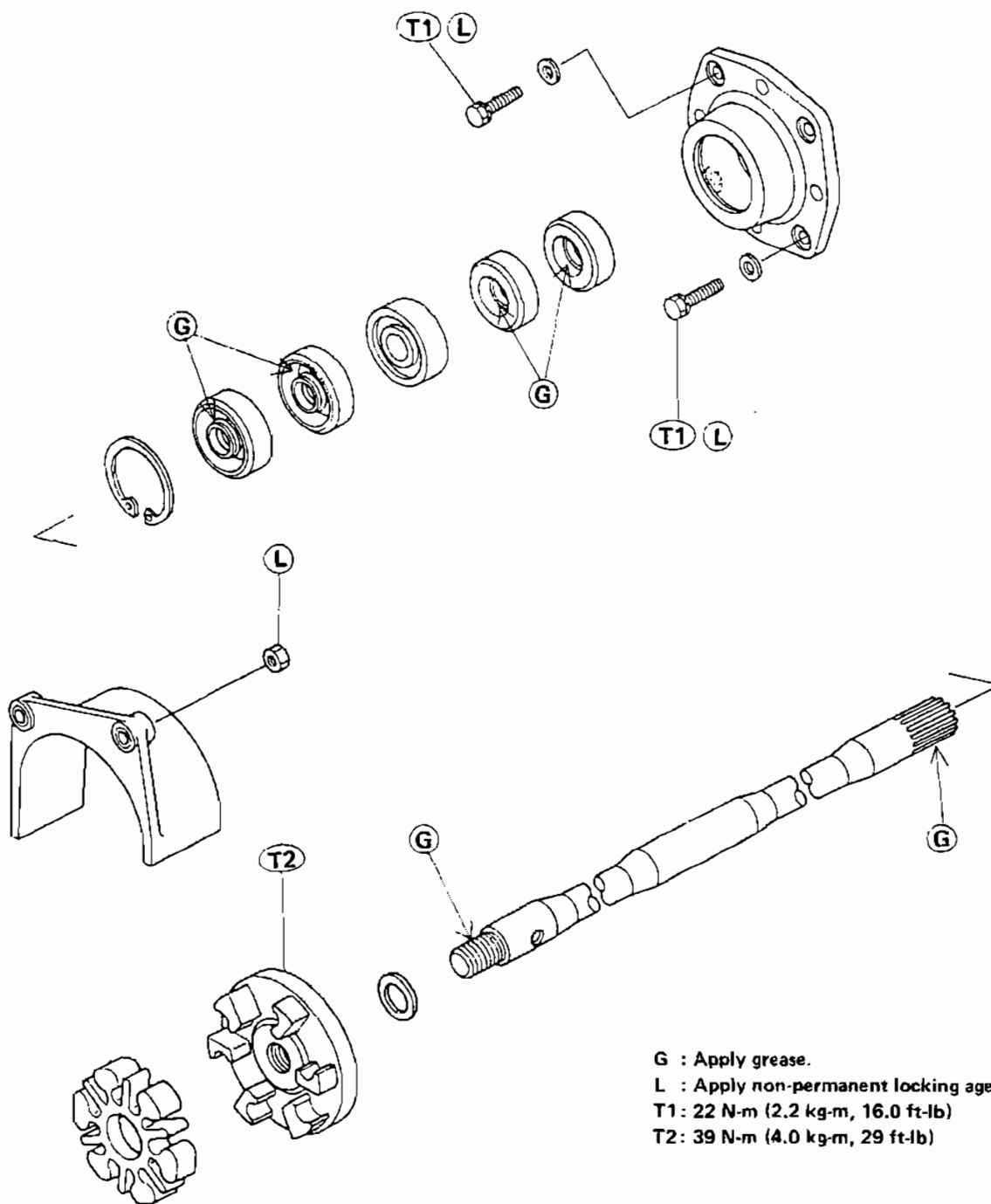
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9-2 DRIVE SHAFT

Exploded View



G : Apply grease.
L : Apply non-permanent locking agent.
T1: 22 N-m (2.2 kg-m, 16.0 ft-lb)
T2: 39 N-m (4.0 kg-m, 29 ft-lb)

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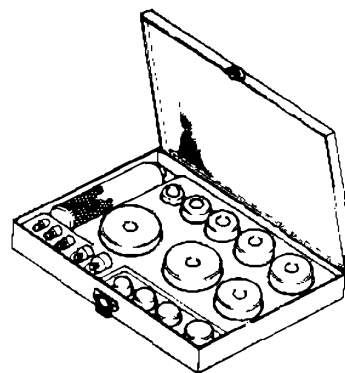
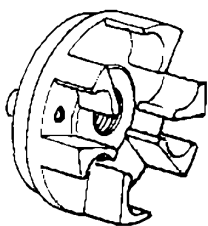
Specifications

Item	Standard	Service Limit
Drive Shaft: Drive Shaft Runout	less than 0.2 mm	0.6 mm

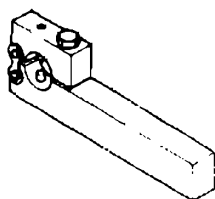
Special Tools

Bearing Driver Set: 57001-1129

Coupling Holder: 57001-1230



Drive Shaft Holder: W56019-003



Adapter: 57001-1231



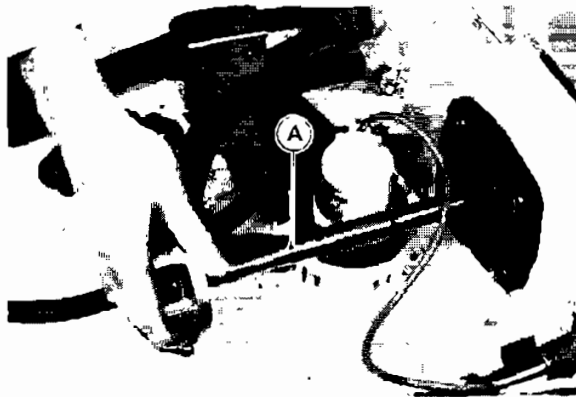
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9-4 DRIVE SHAFT

Drive Shaft/Drive Shaft Holder

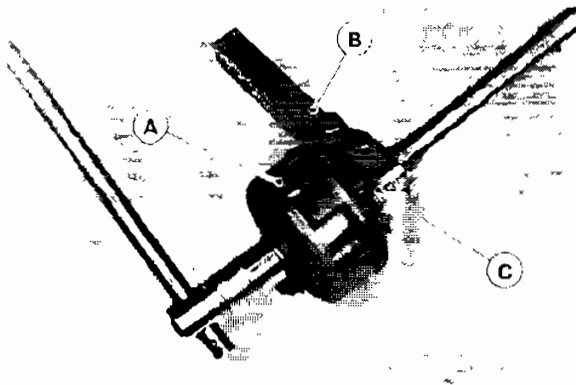
Drive Shaft Removal/Installation

- Remove the engine (see Engine Removal/Installation chapter).
- Pull the drive shaft out of the hull.



A. Drive Shaft

- Clamp the drive shaft holder and adapter (special tools) onto the drive shaft, and unscrew the coupling with the coupling holder (special tool).

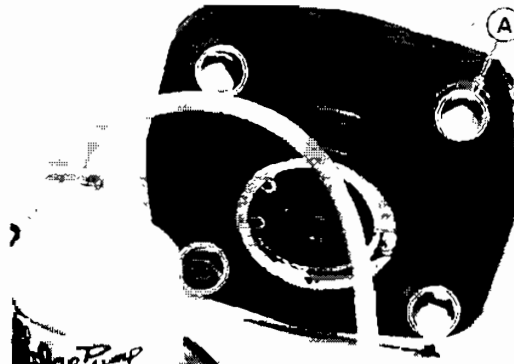


- A. Coupling Holder: 57001-1230
- B. Drive Shaft Holder: W56019-003
- C. Adapter: 57001-1231

- When installing the drive shaft, be careful of the following items.
- Apply grease to the coupling threads and tighten the coupling to the specified torque (see Exploded View).
- Apply grease to the grease seal lips and the drive shaft spline.

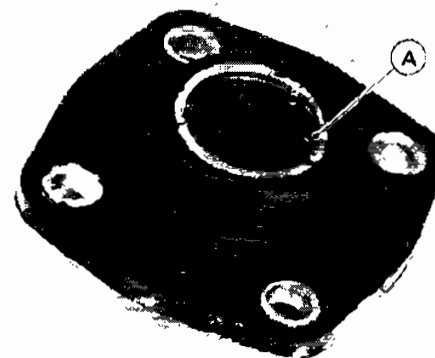
Drive Shaft Holder Removal/Disassembly

- Remove the drive shaft.
- Unscrew the mounting bolts and remove the drive shaft holder from the bulkhead.



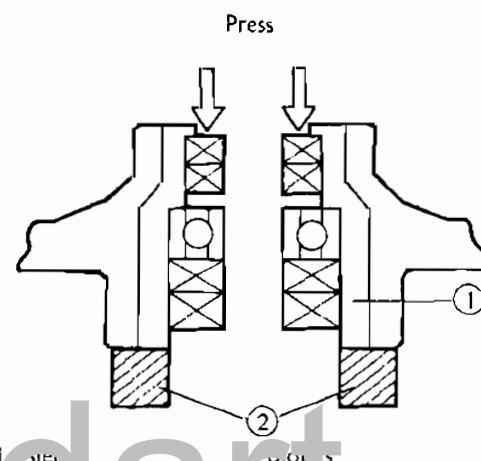
A. Mounting Bolts

- Disassemble the drive shaft holder.
- Remove the circlip.



A. Circlip

- Press the small grease seal, and the large grease seals, bearing, and small grease seals come out of the holder.

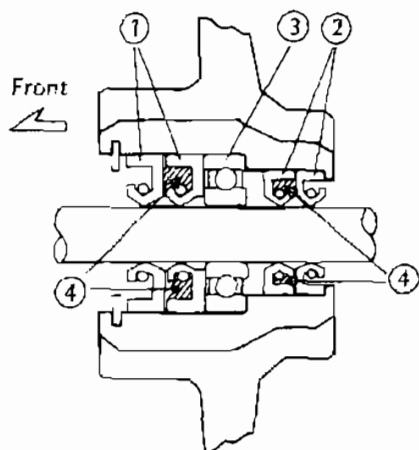


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Drive Shaft Holder Assembly/Installation

- Replace the grease seals with new ones.
- Press the bearing and grease seals into the drive shaft holder, noting the following.
 - Use a bearing driver set (special tools: 57001-1129).
 - Two Small Grease Seals
 - One Bearing
 - Two Large Grease Seals
 - Install the seals so that the sides with the spring face outward.
 - Fill the gaps between the seals with grease.

- Install the circlip
- Grease to the bearing inner surface and grease seal lips.
- Install the drive shaft holder on the bulkhead so that the circlip side face toward the front.
- Apply a non-permanent locking agent to the drive shaft holder mounting bolts, **tighten them loosely**.
- Install the drive shaft.
- After installing the engine, tighten the drive shaft holder mounting bolts to the specified torque (see Exploded View) to give proper coupling alignment.



1. Large Grease Seals
2. Small Grease Seals
3. Bearing
4. Fill with grease.

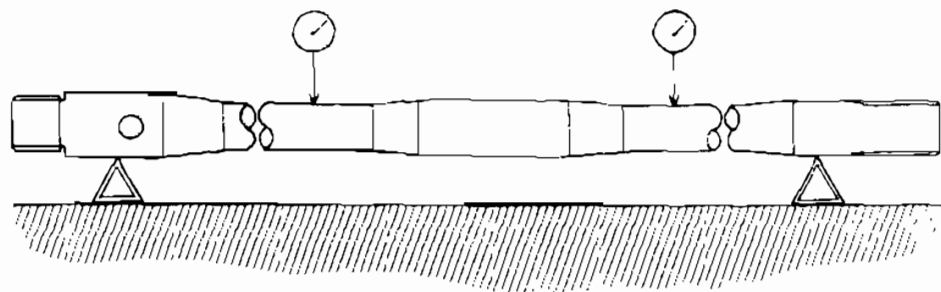
Drive Shaft Runout

- Measure drive shaft runout by supporting the shaft on V blocks and setting a dial gauge against the shaft at each point shown.
- Turn the drive shaft slowly. The difference between the highest and lowest dial gauge reading is the runout.
- ★ If any measurement exceeds the service limit, replace the shaft.

Drive Shaft Runout

Standard:	Less than 0.2 mm
Service Limit:	0.6 mm

Drive Shaft Runout



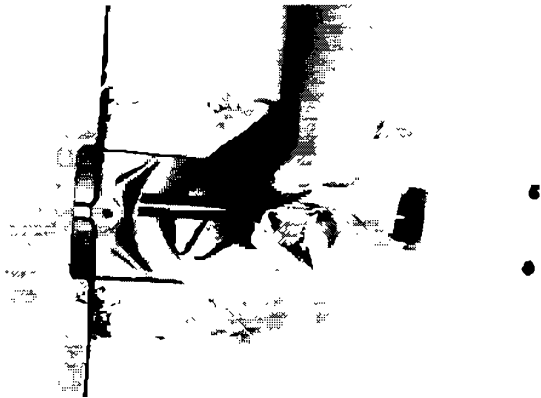
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9-6 DRIVE SHAFT

Drive Shaft Cleaning

Clean the drive shaft to prevent corrosion in accordance with the Periodic Maintenance Chart.

- Remove the grate.
- Flush the drive shaft with fresh water, and wipe the shaft.



- Replace the grate.
- Apply a non-permanent locking agent to the grate mounting bolts, and tighten them to the specified torque (see Exploded View in the Pump and Impeller chapter).

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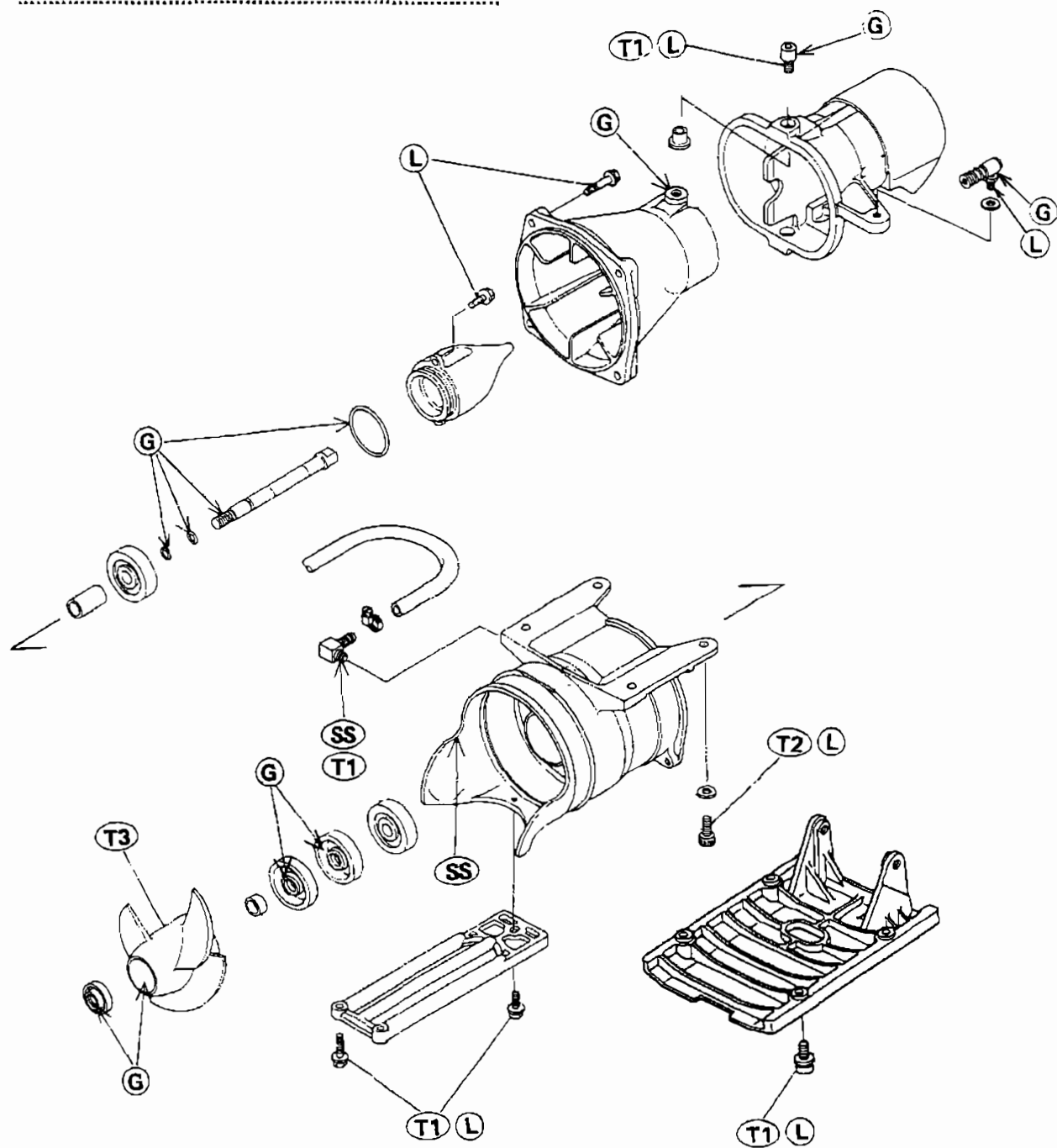
PUMP AND IMPELLER

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10-2 PUMP AND IMPELLER

Exploded View



G : Apply grease.

L : Apply non-permanent locking agent.

SS : Apply silicone sealant.

T1 : 9.8 N-m (1.0 kg-m, 87 in-lb)

T2 : 22 N-m (2.2 kg-m, 16.0 ft-lb)

T3 : 98 N-m (10.0 kg-m, 72 ft-lb)

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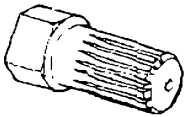
Specifications

Item	Standard	Service Limit
Jet Pump:		
Impeller Outside Diameter	139.5 – 139.6 mm	138.5 mm
Pump Case Inside Diameter	140.0 – 140.1 mm	141.1 mm
Impeller Clearance	0.2 – 0.3 mm	0.6 mm

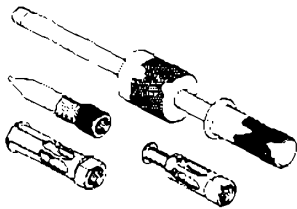
Special Tools

Bearing Driver Set: 57001-1129

Impeller Wrench: 57001-1228



Oil Seal and Bearing Remover: 57001-1058



10-4 PUMP AND IMPELLER

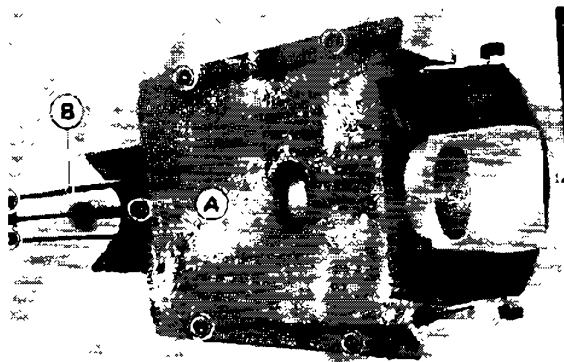
Pump and Impeller

Pump Removal

- Lift up the watercraft.
- Remove the following.
 - Reverse Cable Connector
 - Grate
 - Pump Cover



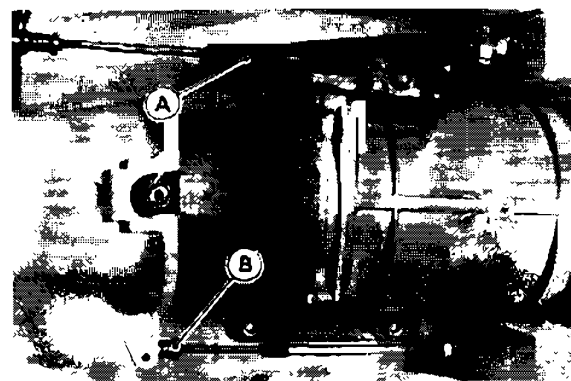
A. Connector



A. Pump Cover

B. Grate

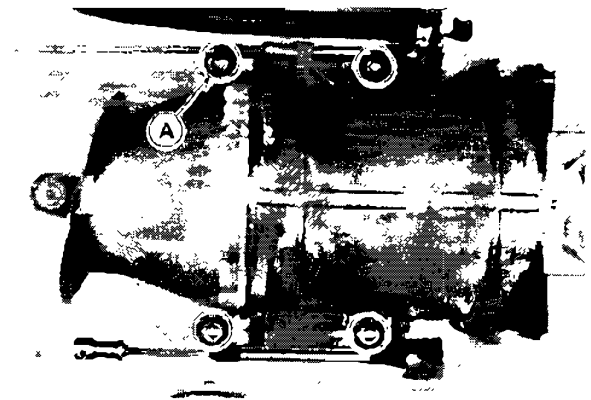
Steering Cable Connector
Cooling Hose



A. Hose

B. Cable Connector

- Unscrew the pump mounting bolts.

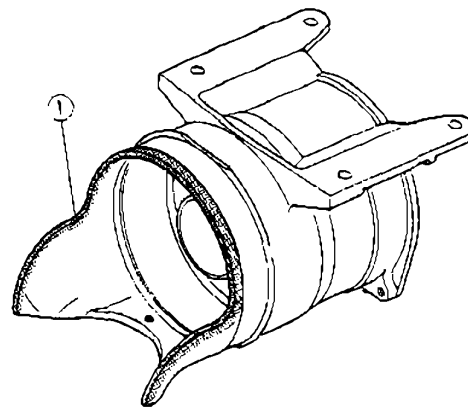


A. Mounting Bolts

- Cut the sealant at the pump intake area.
- Slide the pump to the rear.

Pump Installation

- Strip off all the old sealant around the pump intake.
- Grease the splines on the drive shaft with water resistant grease.
- Liberally coat the outside edge of the pump intake area with silicone sealant to form a seal between the pump and the hull.



1. Sealant

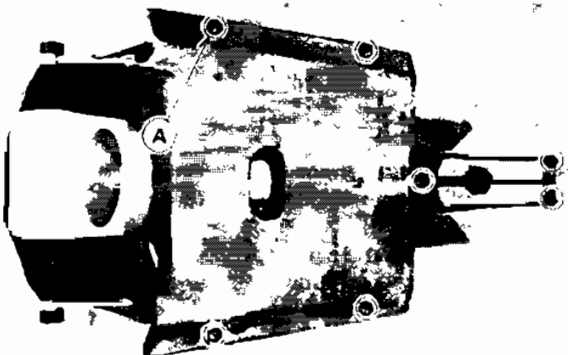
- Slip the pump into place.
- Apply a non-permanent locking agent to the pump mounting bolt threads and tighten the bolts to the specified torque (see Exploded View).
- Fill all gaps at the intake area of the pump with silicone sealant.

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A. Sealant

- Connect the hose and the steering cable.
- Install the pump cover and grate.
- Apply a non-permanent locking agent to the mounting bolts and tighten them to the specified torque (see Exploded View).



A. Mounting Bolts

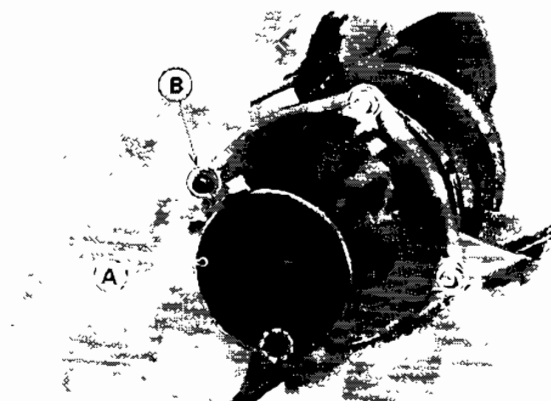
Pump Disassembly

- Remove the following.
 - Steering Nozzle
 - Pump Outlet
 - Pump Cap



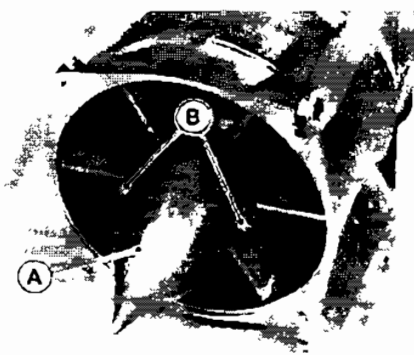
A. Steering Nozzle

B. Mounting Bolts



A. Pump Outlet

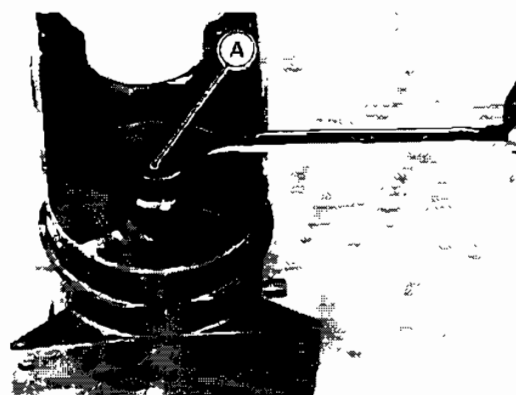
B. Mounting Bolts



A. Pump Cap

B. Bolts

- Hold the shaft in a vise, taking care not to damage it. Remove the impeller from the pump shaft with the impeller wrench (special tool) and then pull out the pump shaft.

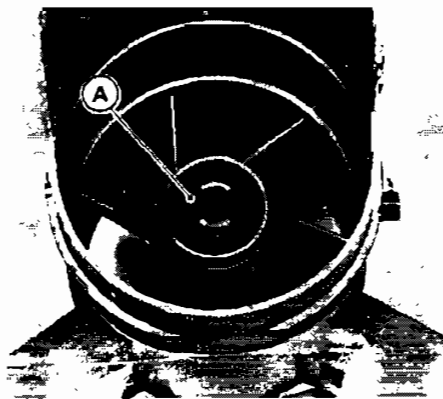


A. Impeller Wrench: 57001-1228

Pull out the bushing.

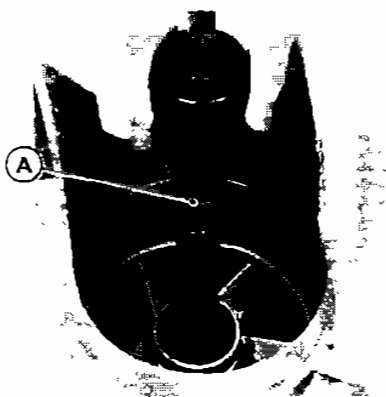
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10-6 PUMP AND IMPELLER



A. Bushing

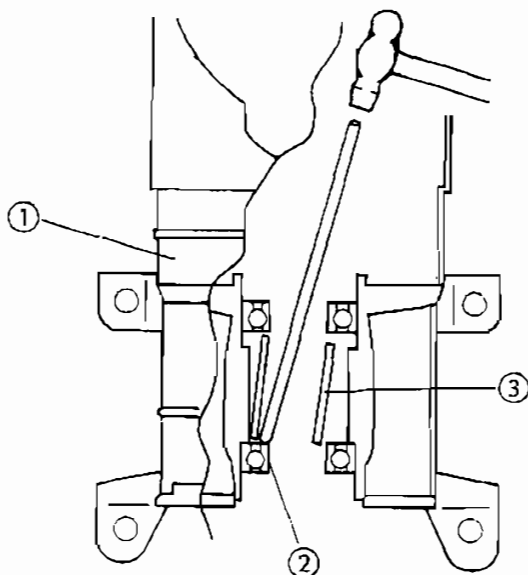
- Remove the grease seals using the oil seal and bearing remover (special tool).



A. Oil Seal and Bearing Remover: 57001-1058

- Remove the pump bearings.

Pump Bearing Removal

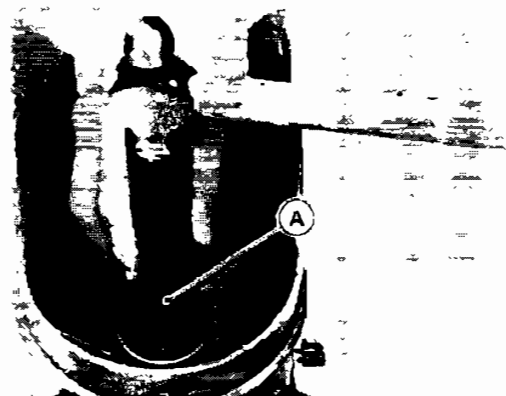


1. Pump Case
2. Bearing

3. Collar

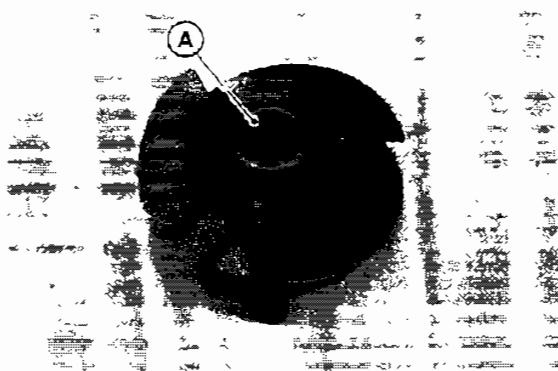
Pump Assembly

- Before installing the pump bearings, blow any dirt or foreign particles out of the pump case with compressed air.
- Install new bearings using the bearing driver set (special tool).
- Press the rear pump bearing into the pump case as far as it will go.
- Insert the collar and install the front pump bearing.



A. Bearing Driver Set: 57001-1129

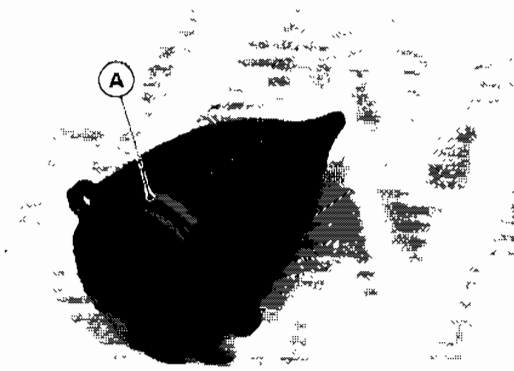
- Replace the grease seals with new ones, if necessary, and install them using the same special tool used for bearing installation.
- Press each seal into the pump case so that the side with the spring faces outward. Fill the gap between the seals with grease.
- Push the bushing into the pump case.
- Visually inspect the pump shaft O-rings, and replace them if necessary.
- Grease the pump shaft and insert it from rear of the pump case.
- Screw on the impeller and tighten it to the specified torque (see Exploded View).
- Visually inspect impeller grease seal, and replace it if necessary.



A. Grease Seal

- When installing the grease seal, pack grease inside it.
- Be sure the O-ring is in place on the pump cap.

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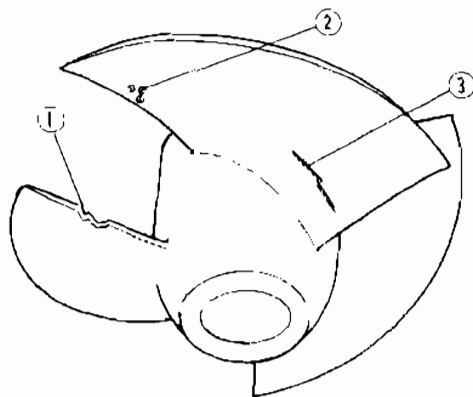


A. O-ring

- Install the pump cap, the pump outlet, and the steering nozzle.
- Apply a non-permanent locking agent to the threads of the following bolts.
 - Pump Cap Bolts
 - Pump Outlet Mounting Bolts
 - Steering Nozzle Mounting Bolts

Pump and Impeller Inspection

- Examine the impeller.
- ★ If there is pitting, deep scratches, or other damage, replace the impeller.



- 1. Nicks
- 2. Pitting
- 3. Scratches

NOTE

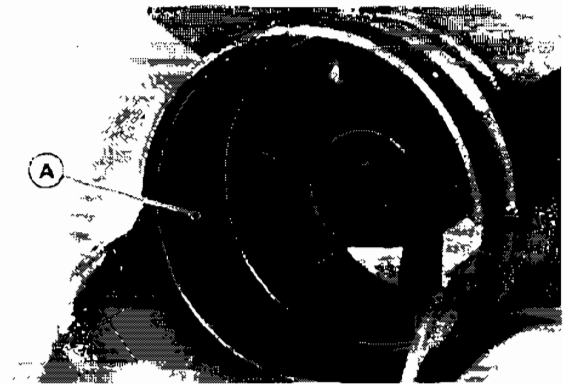
- Minor nicks and gouges in the impeller blades can be removed with abrasive paper or careful filing. Smooth leading edges are especially important to avoid cavitation.

- Measure the impeller outside diameter.
- ★ If the impeller is worn smaller than the service limit, replace it.

Impeller Outside Diameter

Standard:	139.5 – 139.6 mm
Service Limit:	138.5 mm

- Examine the pump case.
- ★ If there are deep scratches inside the pump case, replace it.



A. Check for scratches.

- Measure the inside diameter of the pump case.
- ★ If the pump case is worn beyond the service limit, replace it.

Pump Case Inside Diameter

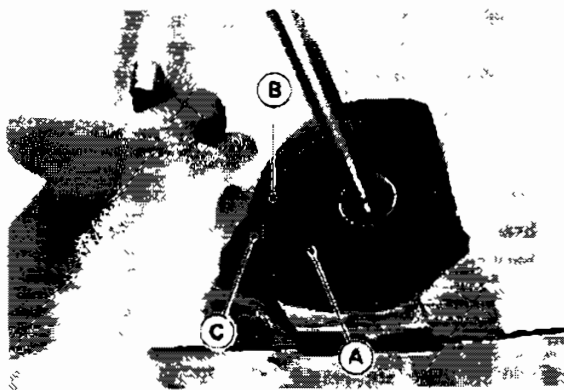
Standard:	140.0 – 140.1 mm
Service Limit:	141.1 mm

Impeller Clearance

- Impeller clearance is critical to proper performance. If the pump case and impeller are not visibly damaged, poor performance may be caused by too much impeller clearance.
- To check impeller clearance, remove the grate and insert a feeler gauge between the tip of the impeller blade and the pump case.

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10-8 PUMP AND IMPELLER



A. Blade

C. Feeler Gauge

B. Case

Impeller Clearance

Standard:	0.2 — 0.3 mm
Service Limit:	0.6 mm

★If impeller clearance is incorrect, determine if it is due to wear or damage (see Pump and Impeller Inspection).

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STEERING

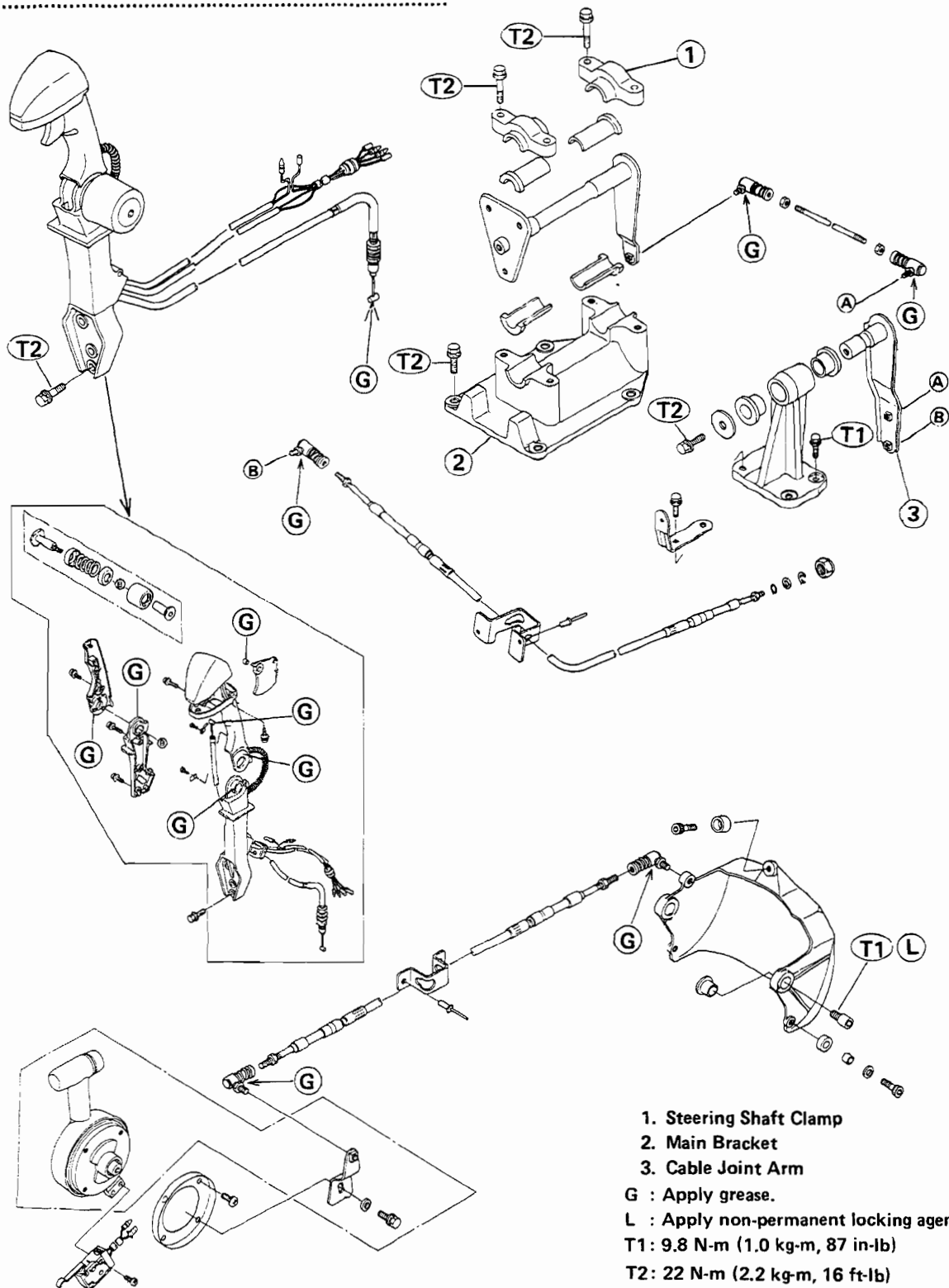
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11-2 STEERING

Exploded View

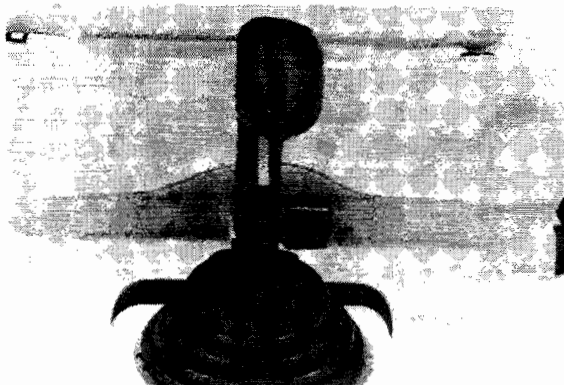


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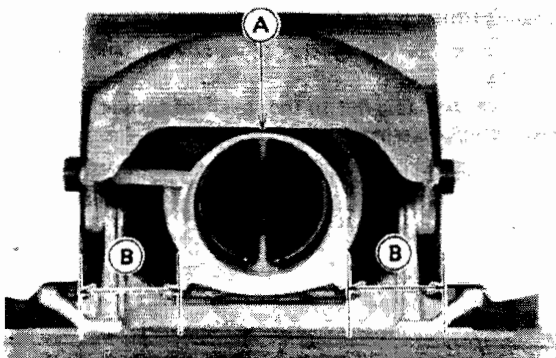
Steering Cable

Adjustment

- Position the control stick in the upright position.

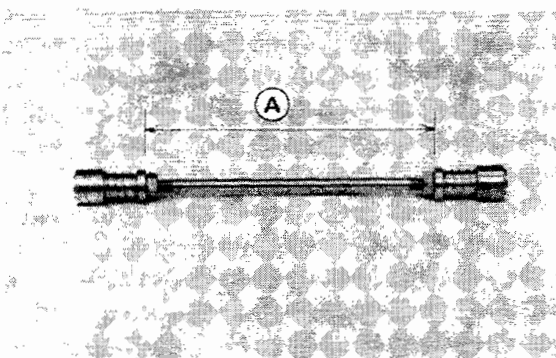


- Check that the steering nozzle is centered in the pump cavity.



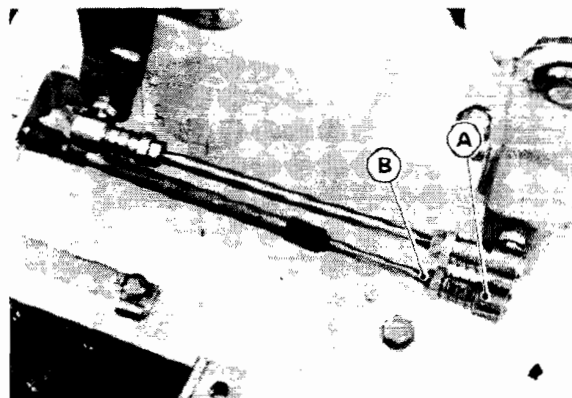
A. Nozzle Centered B. Equal

- If necessary adjust the steering cable.
- Remove the engine hood.
- The steering rod should have a length of 118 – 120 mm.



A. 118 – 120 mm

- Loosen the locknut and take the ball joint off the ball.

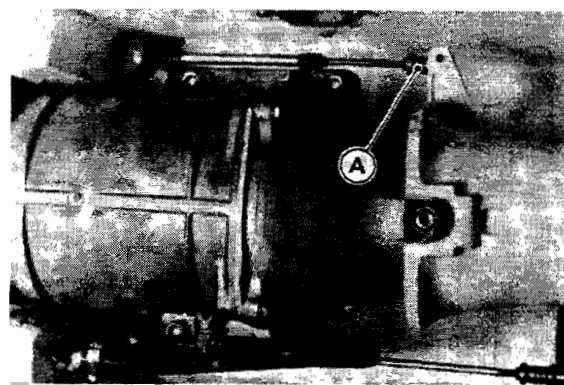
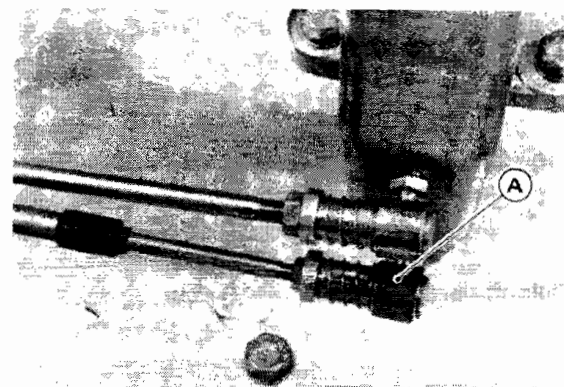


A. Ball Joint B. Locknut

- Hold the steering nozzle in the center of the pump cavity.
- Center the control stick and then turn the ball joint until the hole aligns with the ball.
- Connect the ball joint and tighten the locknut.

Removal

- Remove the following.
 - Pump Cover
 - Jet Pump
 - Engine Hood
- Disconnect the ball joint at each end of the steering cable.

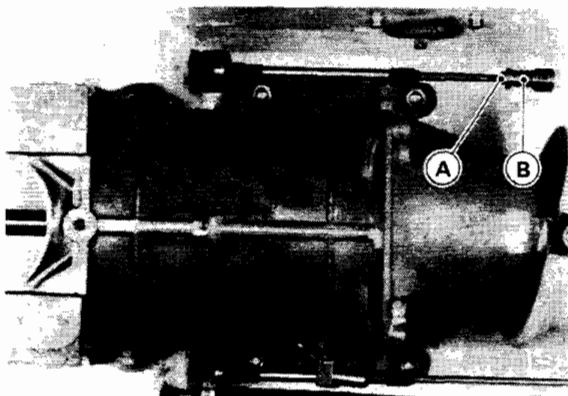


A. Ball Joint

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11-4 STEERING

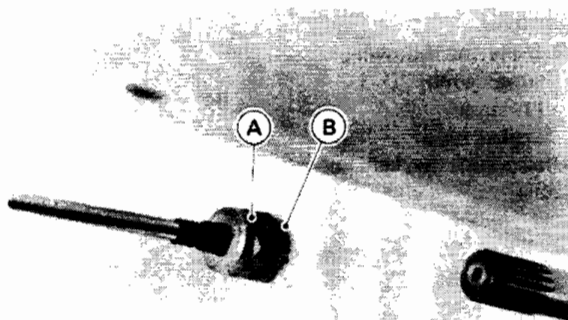
- Loosen the locknut and then remove the ball joint and locknut from the cable rear end.



A. Locknut

B. Ball Joint

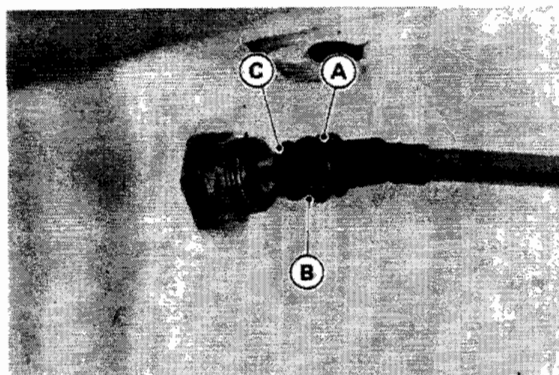
- Unscrew the cable nut while holding the fitting with a wrench.



A. Nut

B. Fitting

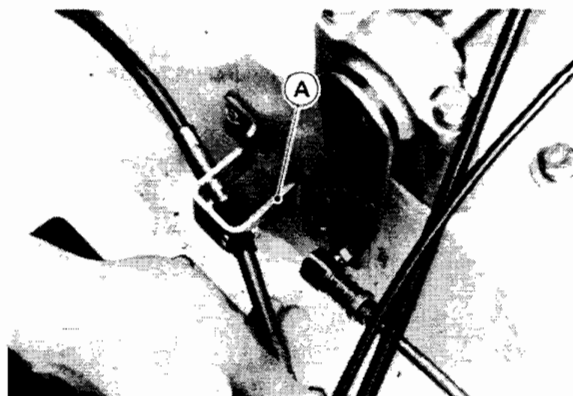
- Slide off the E-ring, washer, and O-ring.



A. E-Ring
B. Washer

C. O-Ring

- Pull out the steering cable toward the front.
- Unhook the cable from the cable holder.



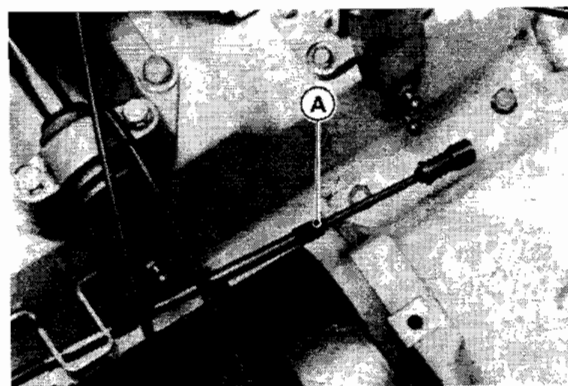
A. Cable Holder

Installation

- Installation is the reverse of removal. Note the following.
- Tighten the cable nut to the specified torque.
- Adjust the steering cable.

Inspection

- Examine the steering cable.
- ★ If the cable or cable housing is kinked or frayed, replace the cable.
- ★ If the seal at either end of the cable is damaged in any way, replace the cable.



A. Seal

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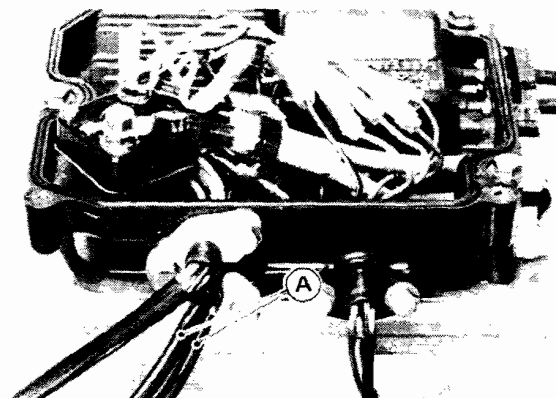
- Be certain that the cable moves freely in both directions.
- Disconnect the ball joint at each end of the cable.
- Slide the outer sleeve away from the ball slightly, and lift the cable from the ball.
- Slide the inner cable back and forth in the cable housing.
- ★ If the cable does not move freely, replace it.

Lubrication

NOTE

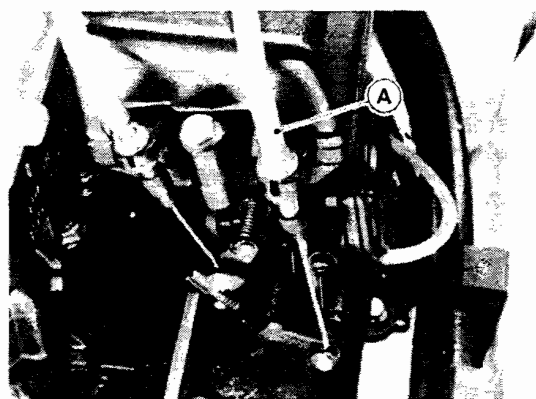
- *The steering cable is sealed at each end and does not require lubrication. If the seals are damaged, the cable must be replaced.*

- Open the electric case.
- Remove the start/stop switch leads from the electric case.



A. Start/Stop Switch Leads

- Disconnect the throttle cable from the carburetor.



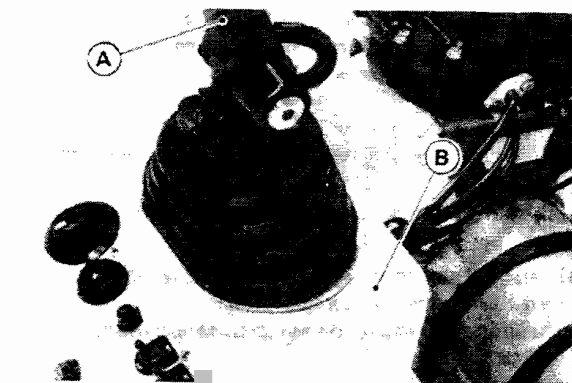
A. Throttle Cable

Control Stick

Removal

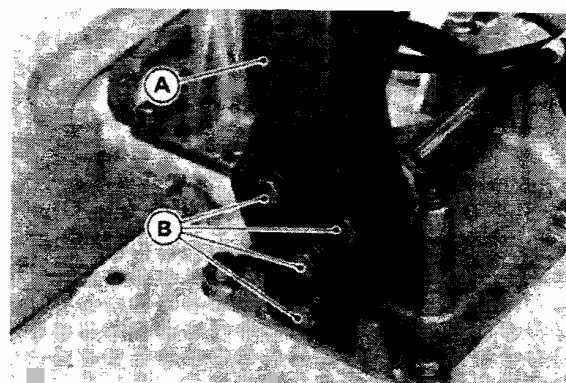
- Remove the following.
 - Engine Hood
 - Steering Case

- Remove the control stick.



A. Control Stick

B. Steering Case



A. Control Stick

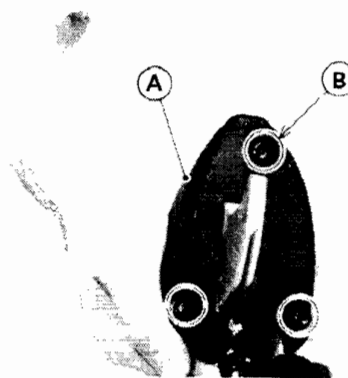
B. Mounting Bolts

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11-6 STEERING

Installation

- Installation is the reverse of removal. Note the following.
- Connect the start/stop switch leads. Refer to the wiring diagram.
- Check and adjust the following, after control stick installation.
 - Steering Cable
 - Throttle Cable
 - Choke Cable



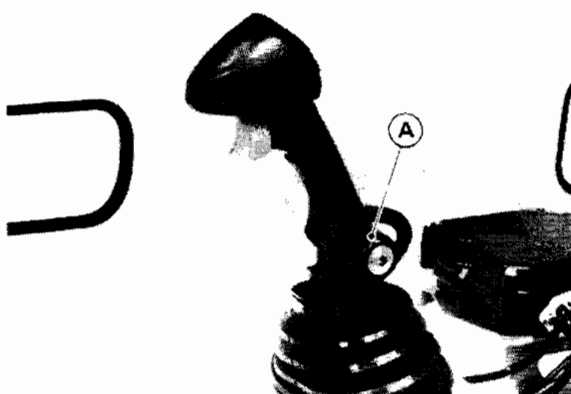
A. Cap

B. Screws

- Remove the start stop switch
- Remove the throttle lever.

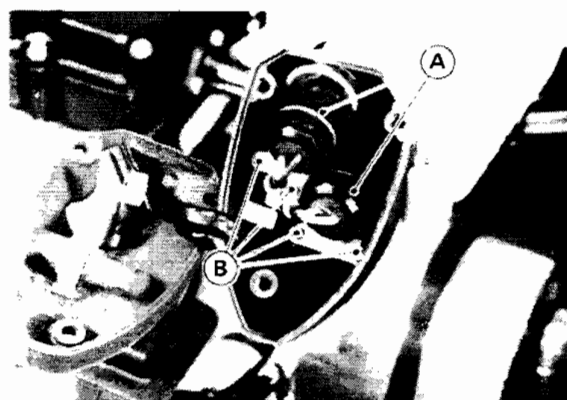
Disassembly

- Remove the following.

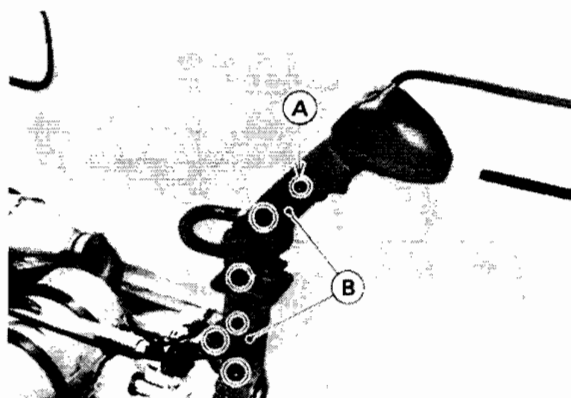


A. Control Stick Pivot
B. Boot

C. Steering Case



A. Start/Stop Switch
B. Screws



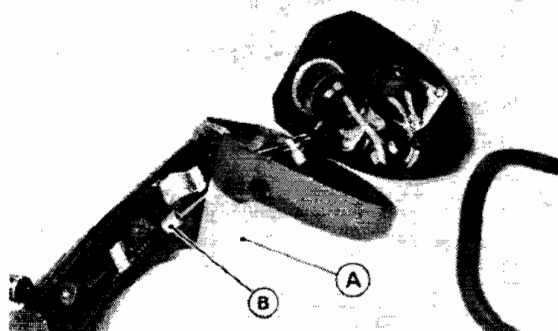
A. Screws

B. Covers

Assembly

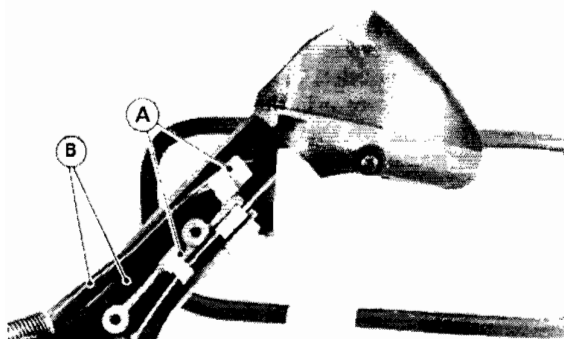
- Assembly is the reverse of disassembly. Note the following.
- The start switch has white and black leads.
- The start switch has red/white and green/white leads.
- Install the throttle lever in position.
- Apply grease to the upper and lower control stick joints (see Exploded View).
- Apply grease to the throttle lever collar (see Exploded View).
- Check that the throttle outer cable end is in the groove of the upper stick.
- Tighten the control stick mounting bolt to the specified torque (see Exploded View).
- Check and adjust the following, after installation.
 - Throttle Cable
 - Choke Cable
 - Steering Cable

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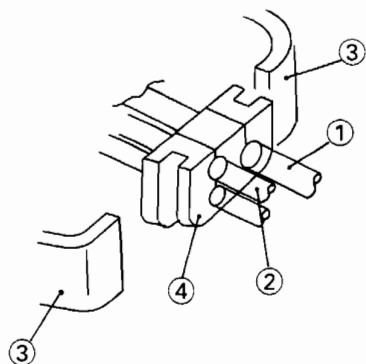
A. Throttle Lever B. Throttle Outer Cable End

- Install the clamps.



A. Clamps B. Leads

- Check that the grommet for the throttle cable, start and stop leads is in place.

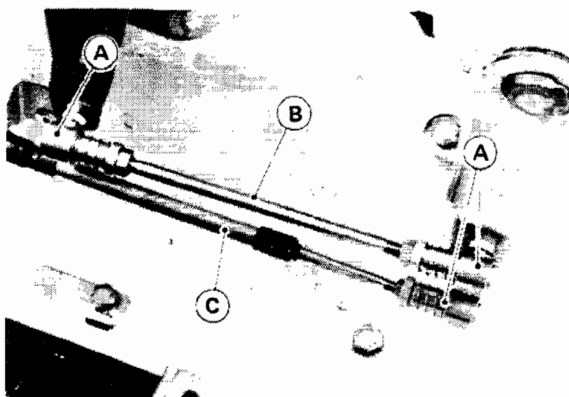


1. Throttle Cable
2. Leads
3. Lower Left Control Stick
4. Grommet

Steering Bracket

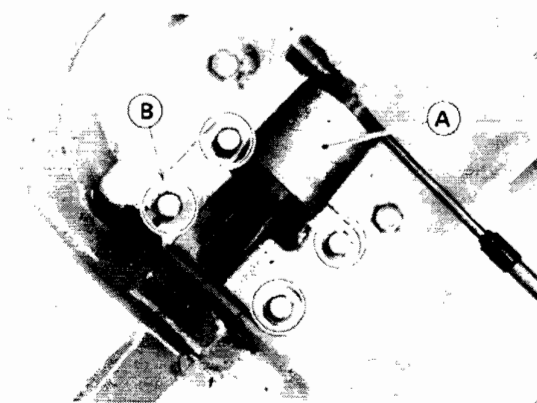
Removal

- Disconnect the ball joints of the steering cable and rod.



A. Ball Joints B. Steering Rod C. Steering Cable

- Remove the right side bracket.

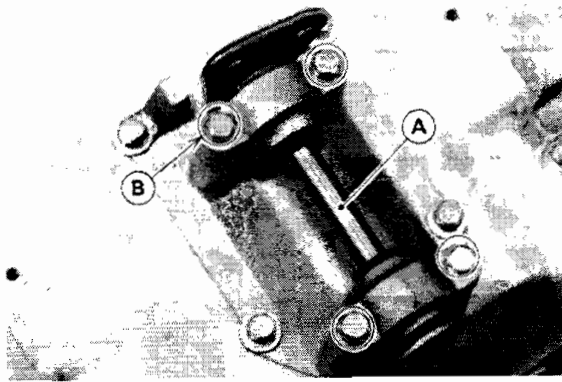


A. Right Side Bracket B. Bolts

- Remove the following for main bracket removal.
Steering Case (see Hull chapter)
Control Stick
Steering Shaft

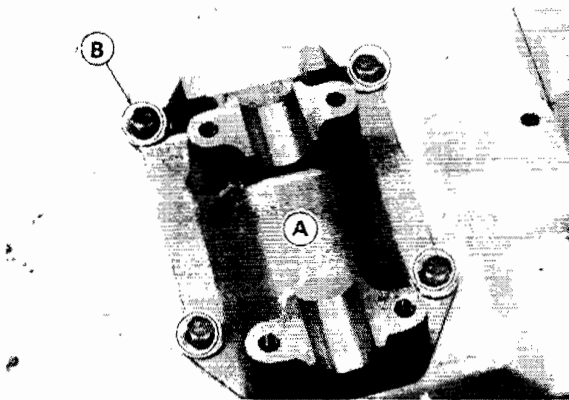
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11-8 STEERING



A. Steering Shaft B. Clamp Bolts

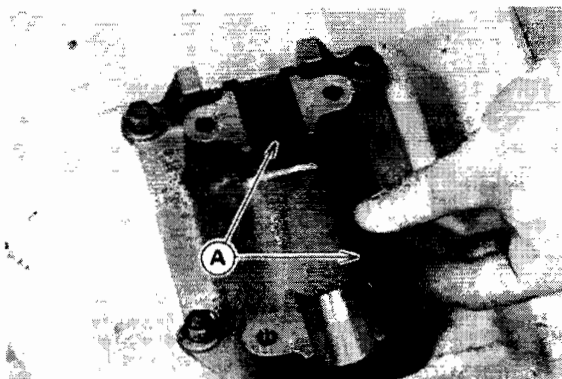
- Remove the main bracket.



A. Bracket B. Bolts

Installation

- Installation is the reverse of removal. Note the following.
- Tighten the following bolts to the specified torque (see Exploded View).
 - Steering Shaft Clamp Bolts
 - Main Bracket Mounting Bolts
 - Cable Joint Arm Pivot Bolt
- Check the bushings for damage and wear.



A. Check Surfaces for wear

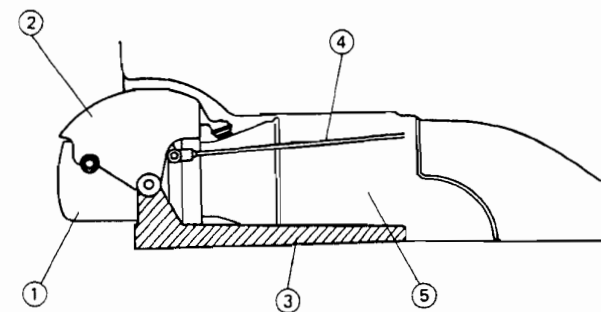
- ★ If the bushings are damaged or worn, replace them.
- Clean the steering shaft, and check the surface for corrosion and wear.
- Check and adjust the following, after installation.
 - Throttle Cable
 - Choke Cable
 - Steering Cable

Reverse System

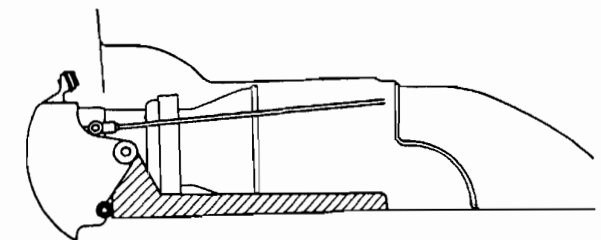
Shift Cable Adjustment

- Check the shift cable adjustment.
- When the shift lever is in the F position, the damper on the top of the reverse bucket should stop against the top of the pump outlet.
- When the shift lever is in the R position, the dampers on the bottom of the reverse bucket should stop against the end of the pump cover.

Forward Position



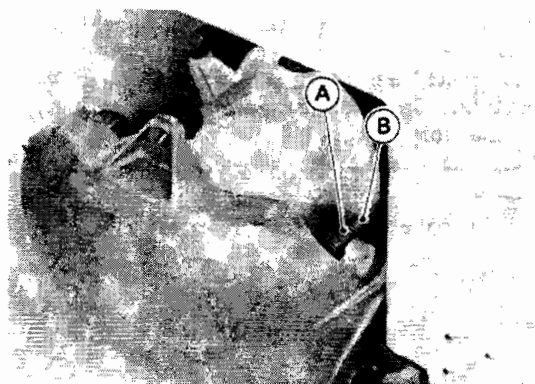
Reverse Position



- | | |
|--------------------|----------------|
| 1. Steering Nozzle | 4. Shift Cable |
| 2. Bucket | 5. Jet Pump |
| 3. Jet Pump Cover | |

- ★ If the dampers do not stop where they should the shift cable must be adjusted.
- Disconnect the shift cable ball joint and loosen the lock nut.

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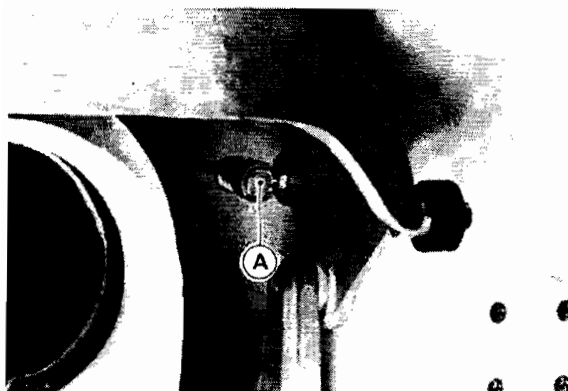
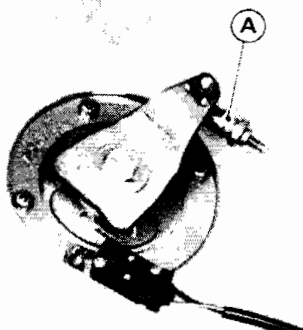


A. Ball Joint B. Locknut

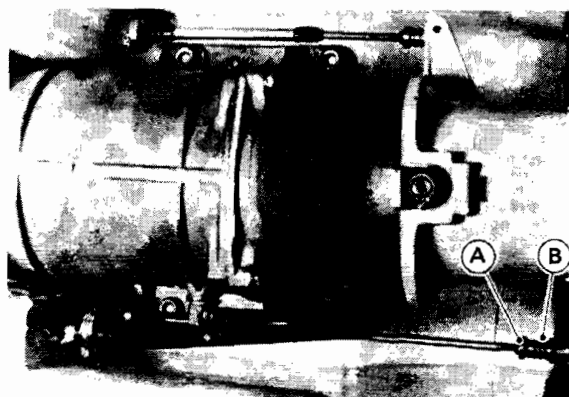
- Turn the ball joint on the cable to adjust the shift cable.
- Connect the ball joint and check cable adjustment again.
- When adjustment is correct, tighten the shift cable locknut.

Shift Cable Removal

- Remove the following.
Pump Cover
Jet Pump
Engine Hood
- Disconnect the ball joint at each end of the shift cable.

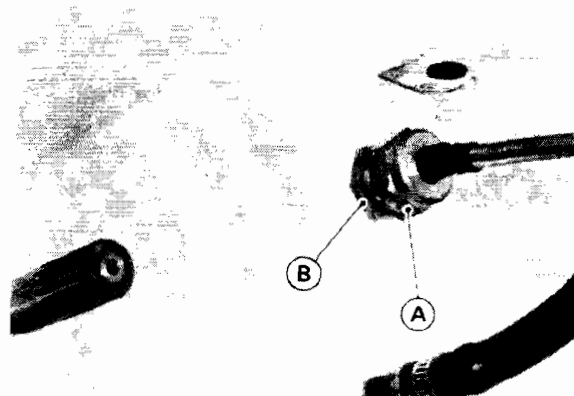


A. Ball Joint



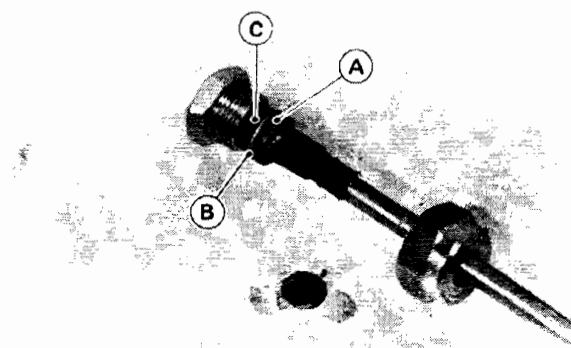
A. Locknut B. Ball Joint

- Unscrew the cable nut while holding the fitting with a wrench.



A. Nut B. Fitting

- Slide off the E-ring, washer, and O-ring.

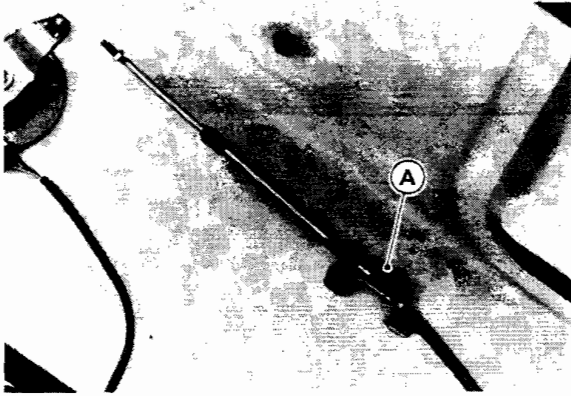


A. E-Ring B. Washer C. O-Ring

- Pull out the cable toward the front.
- Unhook the cable from the cable holder.

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11-10 STEERING



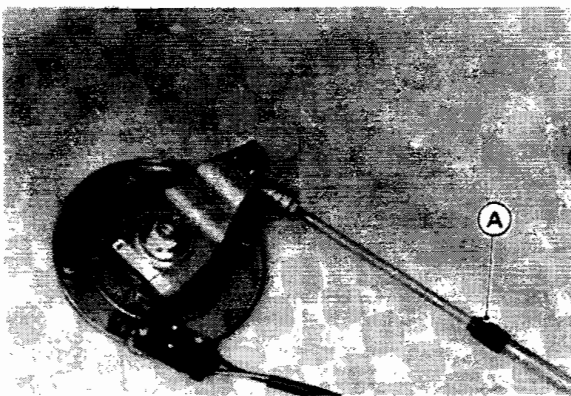
A. Cable Holder

Shift Cable Installation

- Installation is the reverse of removal. Note the following.
- Tighten the cable nut to the specified torque (see Exploded View).
- Adjust the shift cable.

Shift Cable Inspection

- Examine the shift cable.
- ★ If the cable or cable housing is kinked or frayed, replace the cable.
- ★ If the seal at either end of the cable is damaged in any way, replace the cable.



A. Seal

- Be certain that the cable moves freely in both directions.
- Disconnect the ball joint at each end of the cable.
- Slide the outer sleeve away from the ball slightly, and lift the cable from the ball.
- Slide the inner cable back and forth in the cable housing.
- ★ If the cable does not move freely, replace it.

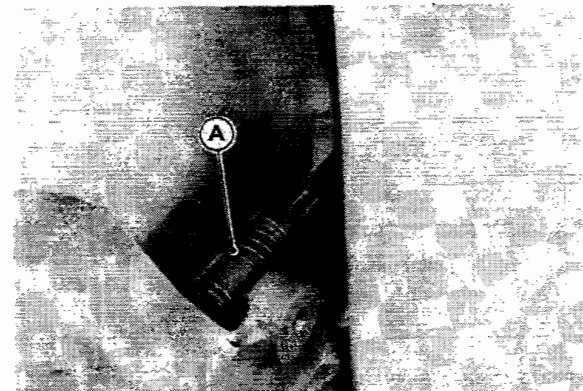
Shift Cable Lubrication

NOTE

- The shift cables are sealed at each end and does not require lubrication. If the seals are damaged, the cable must be replaced.

Reverse Bucket Removal/Installation

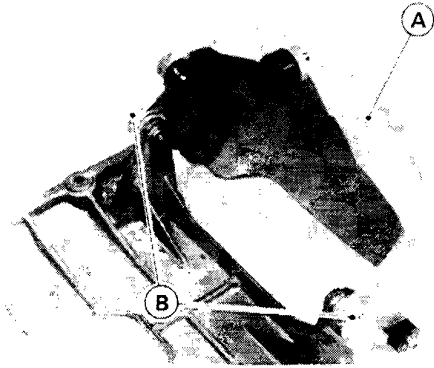
- Disconnect the ball joint at rear end of the shift cable.



A. Ball Joint

- Remove the pump cover.
- Remove the reverse bucket.

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A. Reverse Bucket B. Pivot Bolts

- Installation is the reverse of removal. Note the following.
 - Apply a non-permanent locking agent to the reverse bucket pivot bolts, and tighten them to the specified torque (see Exploded View).
 - After installation, check the shift cable adjustment.

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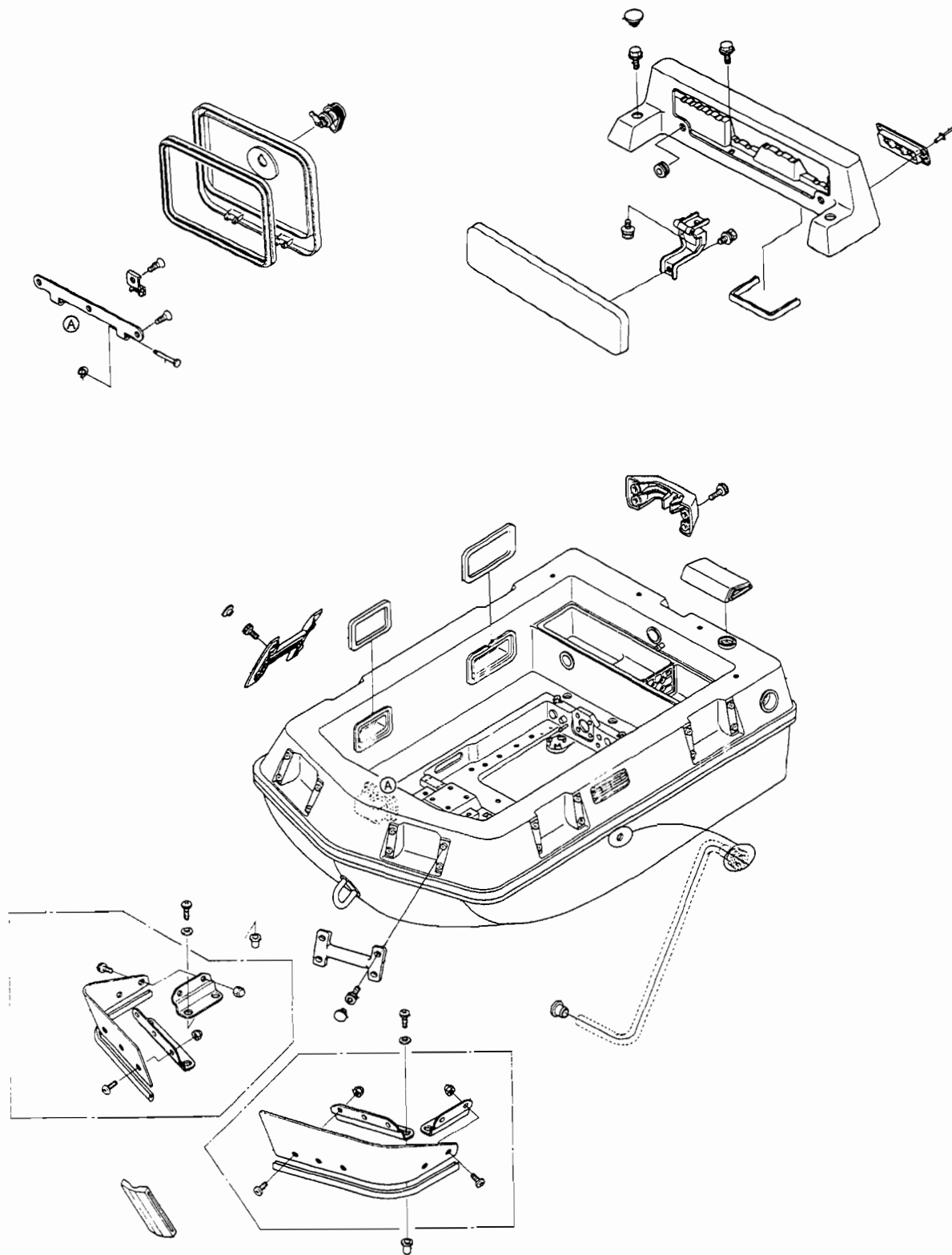
HULL

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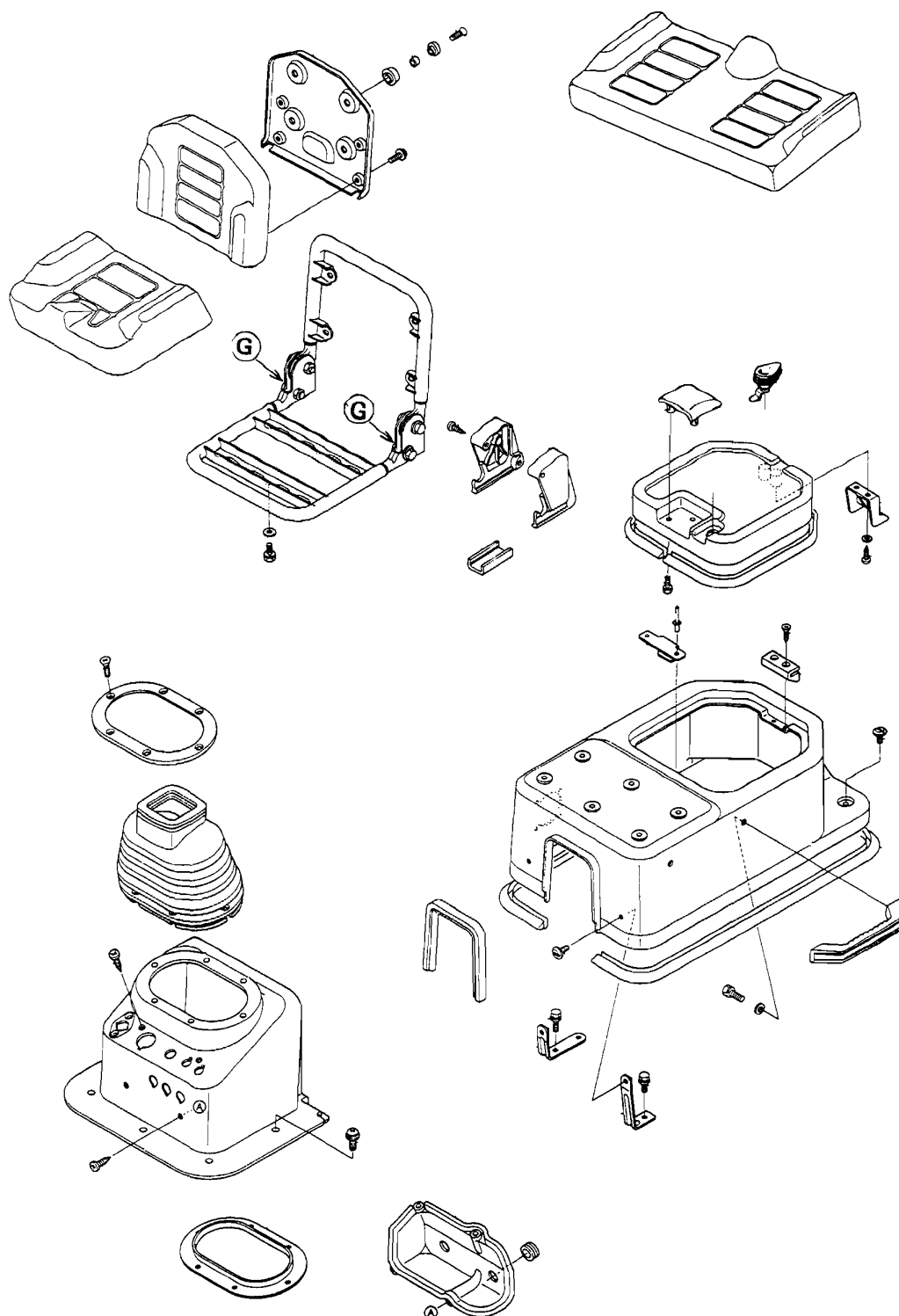
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12-2 HULL

Exploded View



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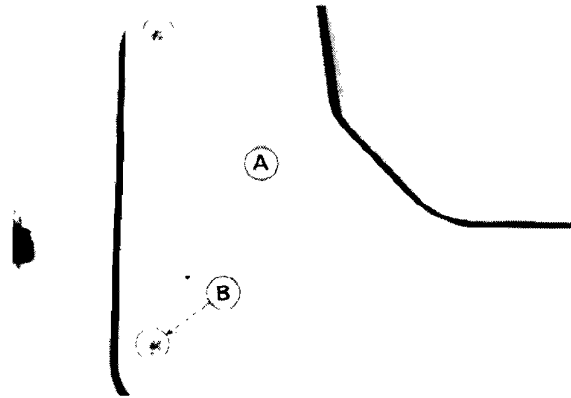
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12-4 HULL

Engine Hood/Steering Case

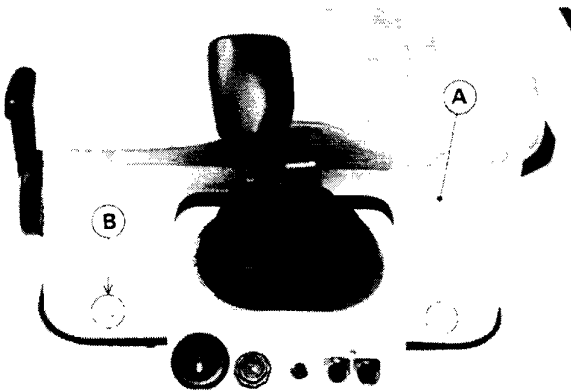
Engine Hood Removal/Installation

- Unscrew the engine hood mounting screws.



A. Engine Hood

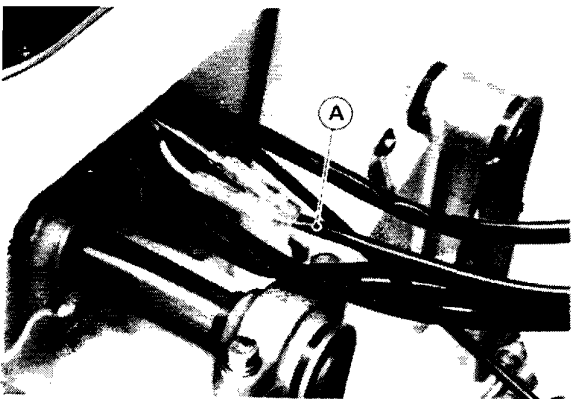
B. Screws



A. Engine Hood

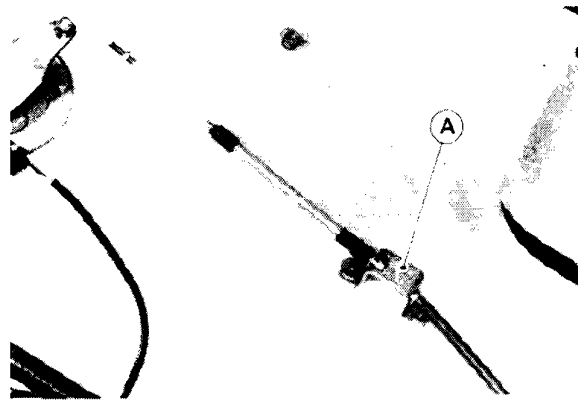
B. Screws

- Disconnect the starter lockout switch lead.



A. Starter Lockout Switch Lead

- Remove the ball joint at the shift cable.
- Disconnect the shift cable from the cable holder.

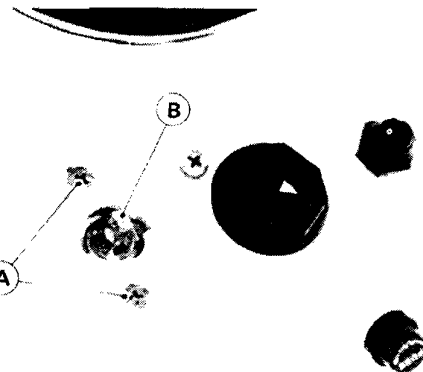


A. Cable Holder

- Remove the engine hood.
- Installation is the reverse of removal. Note the following.
- Check the reverse system function, after installation.

Steering Case Removal

- Remove the engine hood.
- Unscrew the steering case screws.
- Remove the choke knob shaft.

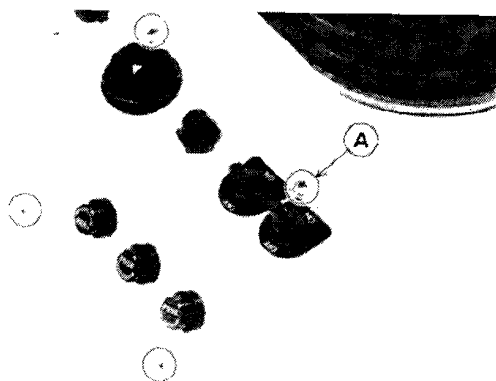


A. Screws

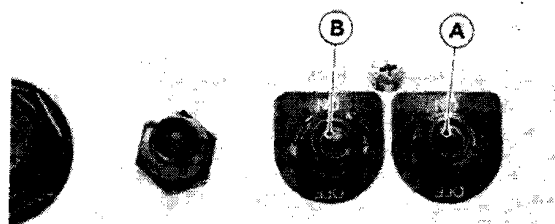
B. Choke Knob Shaft

- Remove the steering case.
- Remove the switch cover screws and disconnect the lead connectors.

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A. Screws



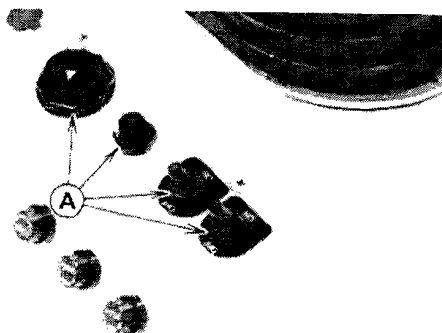
A. Blower Fan Switch B. Bilge Pump Switch

Back Rest

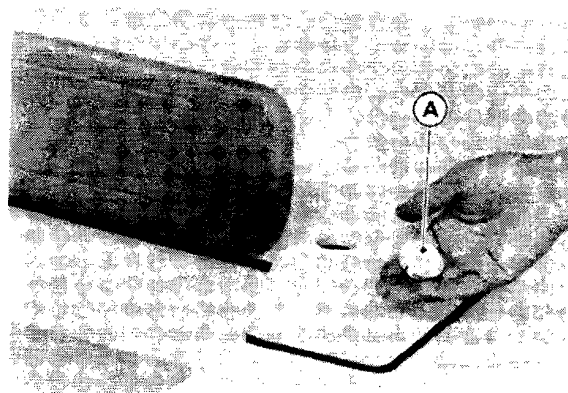
Removal/Installation

- Unscrew the mounting bolts.

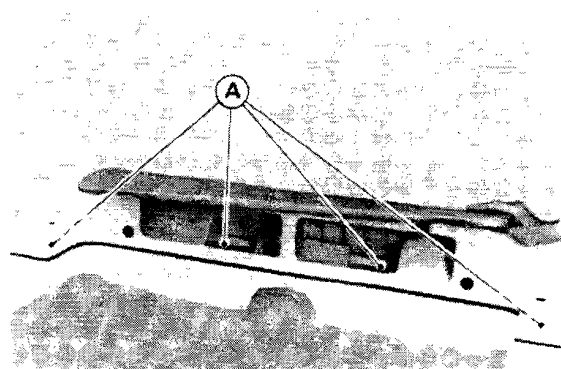
- Remove the following.
Blower Fan Switch
Bilge Pump Switch
Engine Shut-Off Switch
Ignition Switch



A. Mounting Nuts



A. Cap



A. Mounting Bolts

Steering Case Installation

- Installation is the reverse of removal. Note the following.
- Install the bilge pump and blower fan switch as shown.
- The blower fan switch has yellow and red leads.

- Remove the back rest.
- Installation is the reverse of removal.

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12-6 HULL

Hull Replacement

To replace the hull, remove the following parts.

- Engine Hood
- Back Rest
- Steering Case
- Battery
- Blower Fan
- Fuel Tank
- Electric Case
- Oil Tank and Tank Rest
- Control Stick and Brackets
- Exhaust Pipe and Tube
- Water Box Muffler
- Engine and Mounts
- Fuel Pump
- Bilge Pump
- Drive Shaft and Shaft Holder
- Fuel Tap
- Jet Pump
- Steering and Shift Cables
- Hull Grips
- Rubber Strap Hooks
- Dampers

The following parts cannot be removed from the hull and must be replaced.

- Decals
- Labels
- Registration Number (if any)

If the new hull is to be painted, do that first. Then install the parts removed in the reverse order of their removal. Finally, install the labels, decals, mats and the registration numbers.

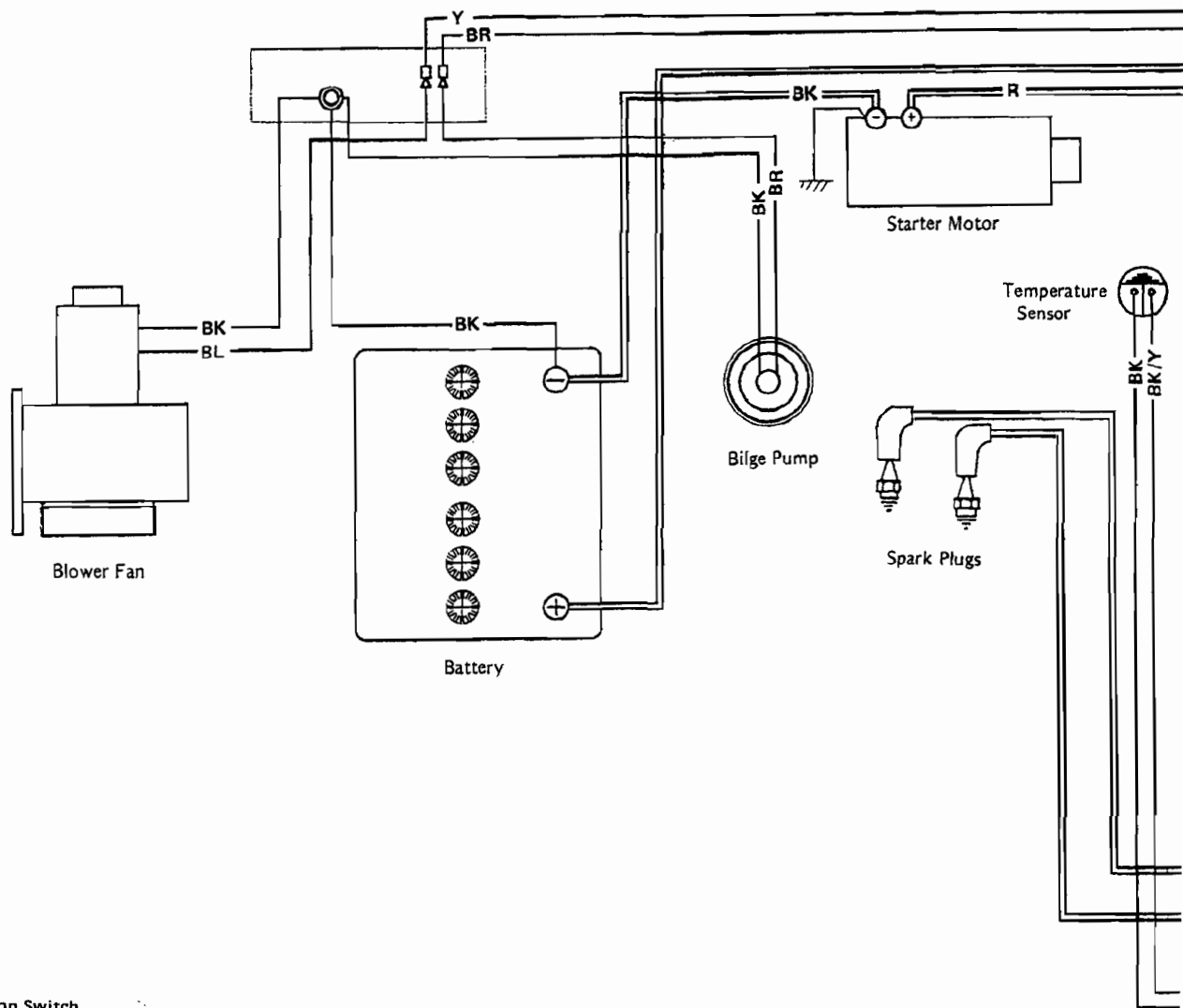
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ELECTRICAL SYSTEM

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Wiring Diagram



Ignition Switch

	BK	W	R/PU	R
OFF				
ON				

Start/Stop Switch

	Start Switch		Stop Switch	
	R/PU	G/W	W	BK
Free				
Push on				

Engine Shut-off Switch

	W	BK
When lanyard is installed		
When lanyard is removed		

Starter Lockout Switch

	G/W	BK/Y
Shift lever Position		
F or R position		
Engine starting position		

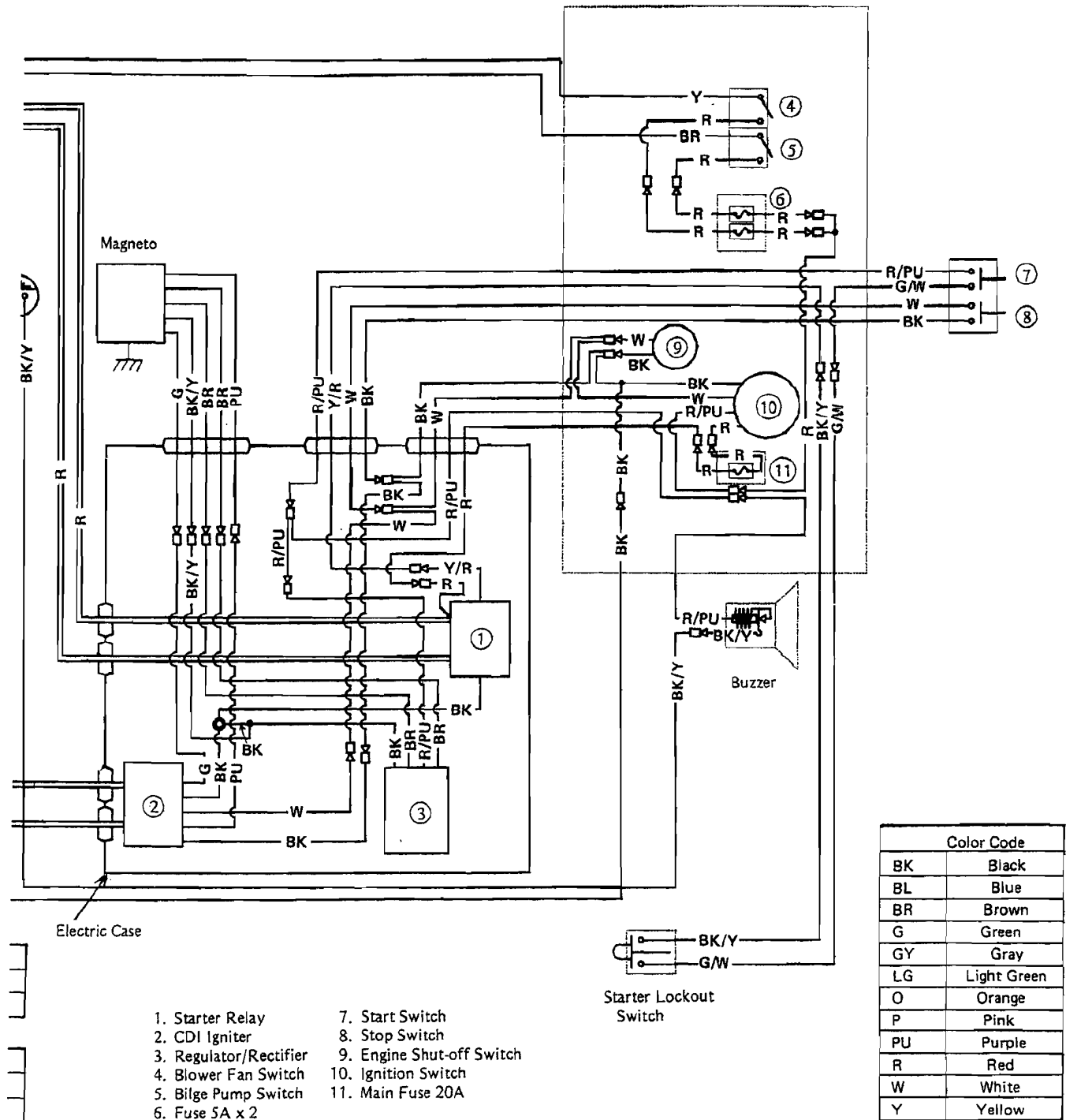
Bilge Pump Switch

	R	BR
OFF		
ON		

Blower Fan Switch

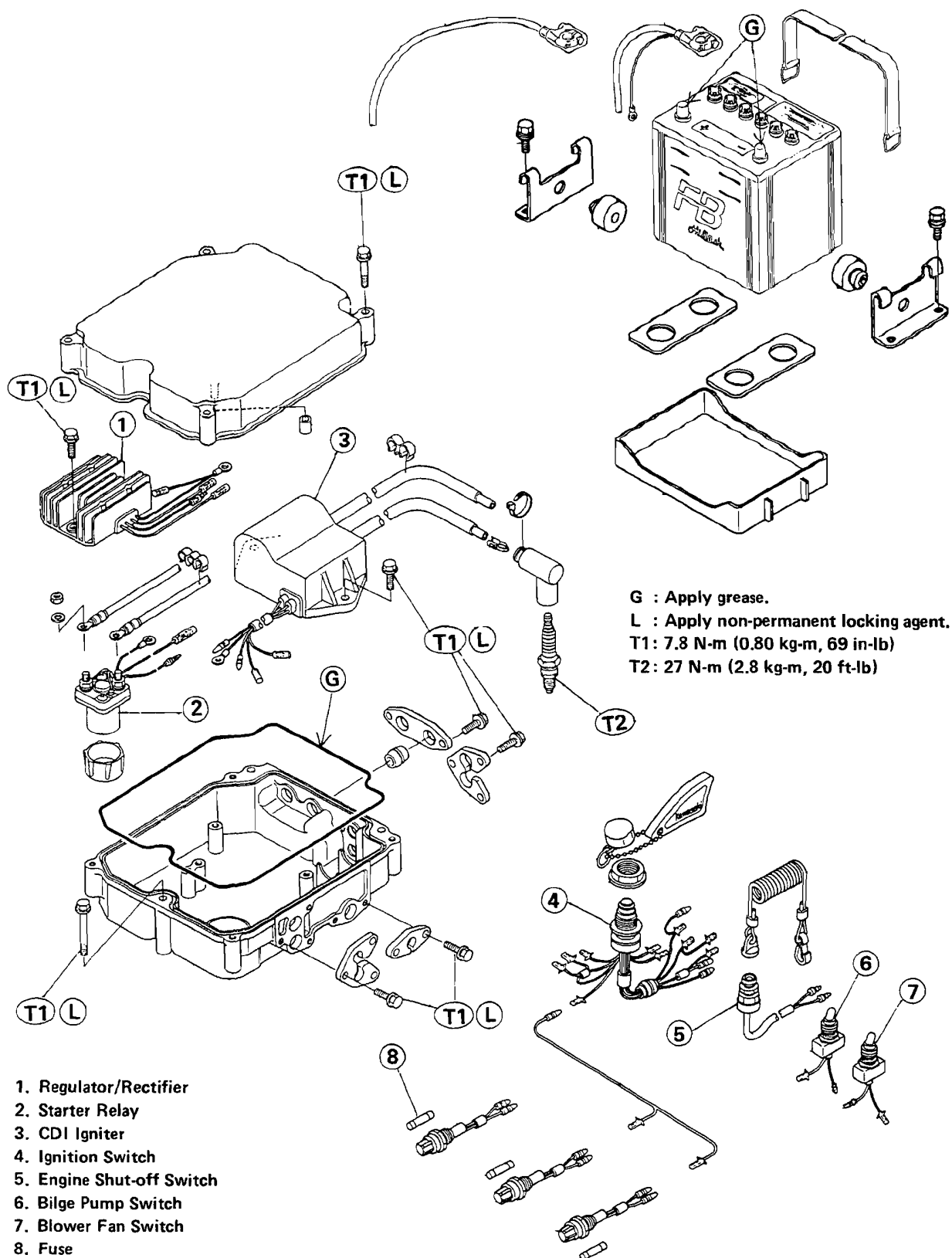
	R	Y
OFF		
ON		

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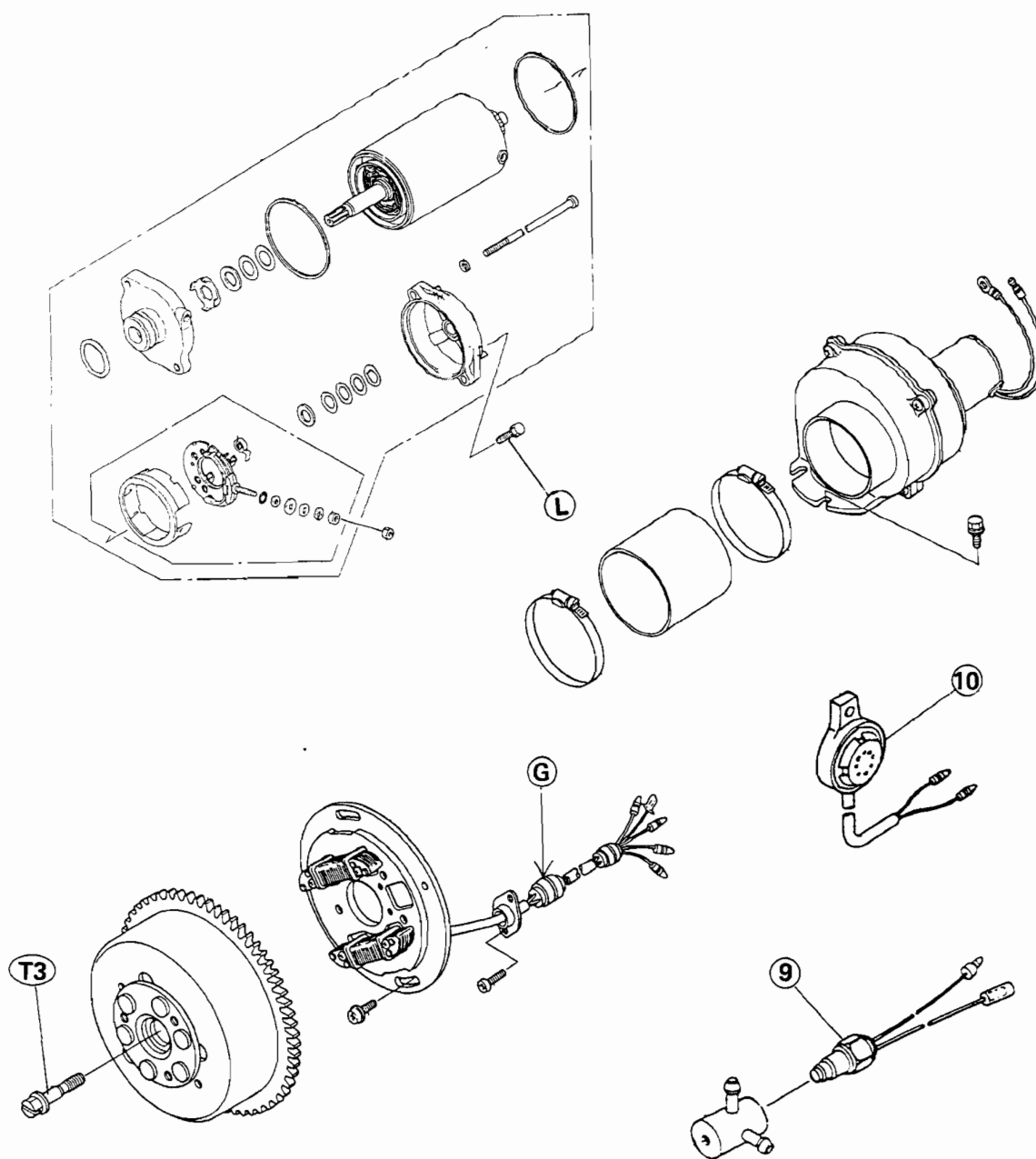
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Exploded View



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13-4 ELECTRICAL SYSTEM



G : Apply grease.

L : Apply non-permanent locking agent.

T3: 98 N-m (10.0 kg-m, 72 ft-lb)

9. Temperature Sensor

10. Warning Buzzer

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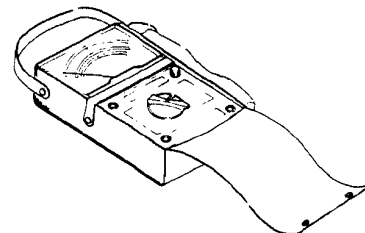
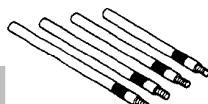
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Specifications

Item	Standard	Service Limit
Battery:		
Type	12 V 50 Ah (20-HR)/40 Ah (5-HR)	— — —
Specific gravity of electrolyte	1.280 @20°C (68°F)	— — —
Electric Starter System:		
Starter motor: Brush length	12.5 mm	6.5 mm
Commutator diameter	28 mm	27 mm
Charging System:		
Regulator/rectifier output voltage	Battery voltage — 14.5±0.5 V	— — —
Charging coil output voltage	42 V	— — —
Charging coil resistance		
Brown ↔ Brown	0.3 — 0.6 Ω	— — —
Green ↔ Black/Yellow	13.6 — 20.5 Ω	— — —
Ignition System:		
Ignition timing	17° BTDC @6,000 r/min (rpm)	— — —
Ignition coil: secondary winding resistance	2.1 — 3.1 kΩ	— — —
Spark plug: Type	NGK BR7ES	— — —
Gap	0.7 — 0.8 mm	— — —
Exciter coil resistance	1.0 — 1.6 kΩ	— — —

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Special Tools

Top Dead Center Finder: 57001-402

Hand Tester: 57001-983



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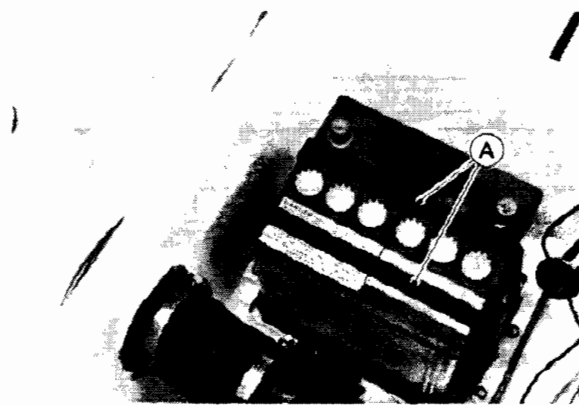
13-6 ELECTRICAL SYSTEM

Battery

Precautions

Following a few simple rules will greatly extend the life of the battery.

- When the level of the electrolyte in the battery is low, add only distilled water to each cell, until the level is at the upper level line marked on the outside of the battery. Ordinary tap water is not a substitute for distilled water and will shorten the life of the battery.
- Never add sulphuric acid solution to the battery. This will make the electrolyte solution too strong and will ruin the battery within a very short time.
- Avoid quick-charging the battery. A quick-charge will damage the battery plates.
- Never let a good battery stand for more than 30 days without giving it a supplemental charge, and never let a discharged battery stand without charging it. If a battery stands for any length of time, it slowly self-discharges. Once it is discharged, the plates sulphate (turn white), and the battery will no longer take a charge.
- Keep the battery well-charged during cold weather so that the electrolyte does not freeze and crack open the battery. The more discharged the battery becomes, the more easily it freezes.
- DON'T INSTALL THE BATTERY BACKWARDS. The negative side is grounded.



A. Battery Straps

Battery Installation

- Be sure the battery dampers are in position in the battery compartment.

Battery Removal

WARNING

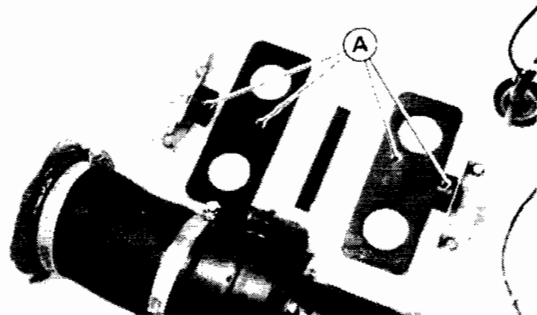
○Battery electrolyte contains sulphuric acid which is poisonous and causes severe burns. When installed in the battery, electrolyte generates hydrogen gas which under certain conditions is flammable and explosive. Keep all flames and sparks (cigarettes, etc.) away and always wear eye protection when working on or near the battery.

- Disconnect the battery cables.

WARNING

○To prevent possible personal injury and damage to electrical components, always disconnect the grounded cable first.

- Unhook the battery straps.
- Carefully lift the battery from the engine compartment.

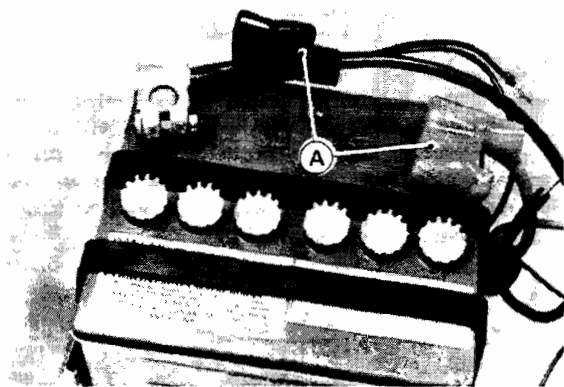


A. Dampers

- Place the battery in position.
- Install the battery with the negative (–) terminal toward the bow (forward).
- Hook the battery straps.
- Connect the battery cables, positive first.
- After attaching both cables, coat the terminals and cable ends with grease to prevent corrosion.
- Slide the protective boot over each terminal.

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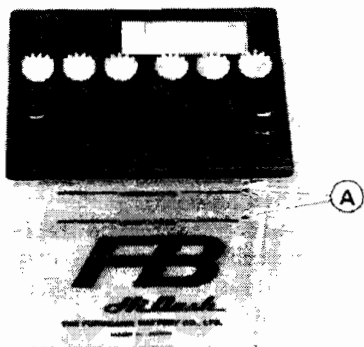
Hydrometer



A. Protective Boots

Electrolyte Level Inspection

- Remove the battery.
- Visually check the electrolyte level in the battery.

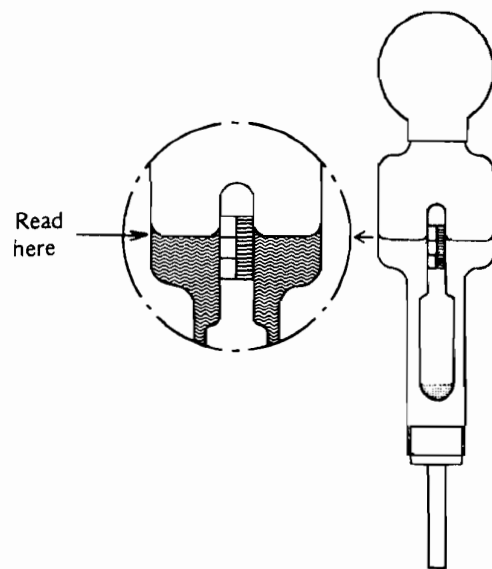


A. Level Lines

- ★ If the level of electrolyte in any cell is below the lower level line on the battery case, add distilled water only to that cell.
- Install the battery.

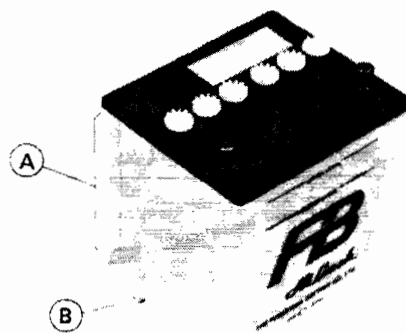
Battery Condition

- Before charging, check battery condition by testing the specific gravity of the electrolyte in each cell.
- Draw a little fluid from the cell with a hydrometer.
- Read the level of the electrolyte on the floating scale. This is the specific gravity of the electrolyte.



1. Read here.

- Look for sediment and white sulfation inside the cells.



A. Sulfation here.
B. Sediment here.

- See the Battery Troubleshooting Guide in Battery Test Charging.
- ★ If the specific gravity is below 1.280 the battery needs to be charged.

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13-8 ELECTRICAL SYSTEM

NOTE

- The specific gravity of the electrolyte varies with changes in temperature, so the specific gravity reading must be corrected for the temperature of the electrolyte.
- Celsius: Add 0.007 points to reading for each 10°C above 20°C or subtract 0.007 points for each 10°C below 20°C.
- Fahrenheit: Add 0.004 points to reading for each 10°F above 68°F or subtract 0.004 points for each 10°F below 68°F.

- ★If the specific gravity of any of the cells is more than 0.050 away from any other reading, the battery will probably not accept a charge. It is generally best to replace a battery in this condition.
- ★If the specific gravity of all the cells is 1.280 or more the battery is fully charged.

Battery Initial Charging

Before being placed in service, a new battery should be given an initial charging.

- Fill each cell to the upper level line on the battery case with fresh electrolyte at a temperature of 30°C (86°F) or less. Let the battery stand about 30 minutes before charging.

NOTE

- If the electrolyte level drops, add electrolyte to the upper level line before charging.
- Leaving the caps off the cells, connect the battery to a charger, set the charging rate at 1/10 the battery capacity, and charge it for 10 hours. For example, if the battery is rated at 50 Ah, the charging rate would be 5 A.

WARNING

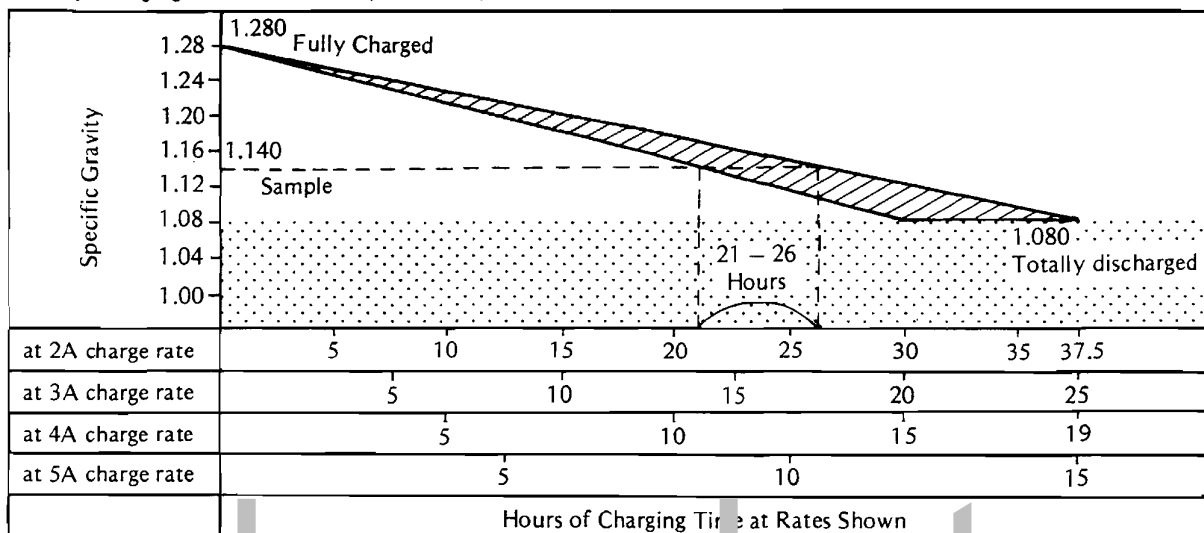
- Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger. This procedure prevents sparks at the battery terminals which could ignite any battery gases.

CAUTION

- Do not use a high rate battery charger, as it typically employed at automotive service stations, unless the charger rate can be reduced to the level required. Charging the battery at a rate higher than specified may ruin the battery. Charging at a high rate causes excess heat which can warp the plates and cause internal shorting. Higher-than-normal charging rates also cause the plates to shed active material. Deposits will accumulate, and can cause internal shorting.
- If the temperature of the electrolyte rises above 45°C (115°F) during charging, reduce the charging rate to lower the temperature, and increase charging time proportionately.

- Turn the charger off, then disconnect it from the battery.
- Check battery voltage. Battery voltage should be 12 – 13 V.
- Check the specific gravity of each cell with a hydrometer (see Battery Condition).
- ★If the voltmeter or hydrometer readings are below those specified, additional charging is necessary before the battery can be installed.

Battery Charging Rate/Time Table (12V 50Ah)



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Battery Troubleshooting Guide

	Good Battery	Suspect Battery	Action
Plates	(+) chocolate color (-) gray	white (sulphated); + plates broken or corroded	Replace
Sediment	none, or small amount	sediment up to plates, causing short	Replace
Voltage	above 12 V	below 12 V	Test charge
Electrolyte Level	above plates	below top of plates	Fill and test charge
Specific Gravity	above 1.200 in all cells; no two cells more than 0.020 different	below 1.100, or difference of more than 0.020 between two cells	Test charge

Battery Ordinary Charging

- Remove the battery from the hull (see Battery Removal).
- Clean off the battery (see Battery Cleaning).
- If any of the cells are low, fill them to the LOWER level line with distilled water only. The electrolyte will expand during charging, and the level will rise.
- Connect a charger to the battery BEFORE plugging it in or turning it on.

WARNING

○ Keep the battery away from sparks and open flames during charging, since the battery gives off an explosive gas mixture of hydrogen and oxygen. When using a battery charger, connect the battery to the charger before turning on the charger. This procedure prevents sparks at the battery terminals which could ignite any battery gases.

- Set the charge rate and time according to the battery condition previously determined (see Battery Condition), using the table.

CAUTION

- Do not use a high rate battery charger, as is typically employed at automotive service stations, unless the charger rate can be reduced to the level required. Charging the battery at a rate higher than specified may ruin the battery. Charging at a high rate causes excess heat which can warp the plates and cause internal shorting. Higher-than-normal charging rates also cause the plates to shed active material. Deposits will accumulate, and can cause internal shorting.
- If the temperature of the electrolyte rises above 45°C (115°F) during charging, reduce the charging rate to lower the temperature, and increase charging time proportionately.

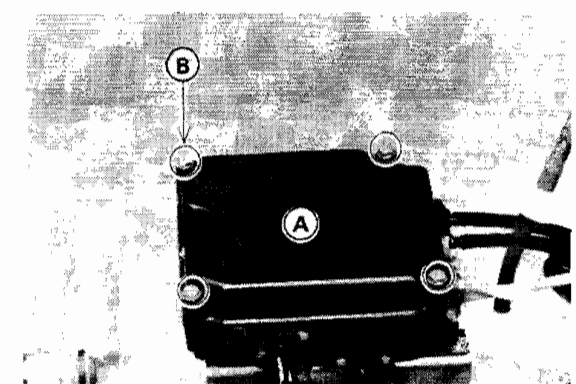
- Turn the charger off or unplug it, then disconnect it from the battery.
- Check battery condition (see Battery Condition).
- ★ If the battery condition indicates that it is not fully charged, additional charging time is necessary.

Battery Test Charging

- If the battery is suspected of being defective, sulfated, or unable to take a charge, consult the Battery Troubleshooting Guide table.
- To test charge a battery, perform the ordinary charging procedure and monitor the battery voltage and other signs as mentioned below.

Electric Starter System**Starter Relay:****Removal**

- Disconnect the battery ground cable.
- Open the electric case.



A Electric Case

B Bolts

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13-10 ELECTRICAL SYSTEM

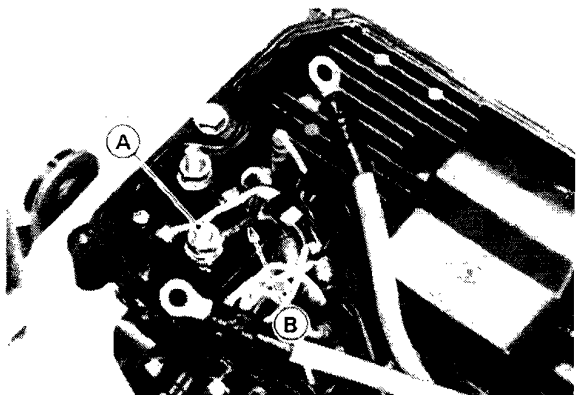
- Disconnect the following.
 - Starter Motor Cable
 - Battery Cable
 - Starter Relay Lead Connectors



A, Starter Relay

Installation

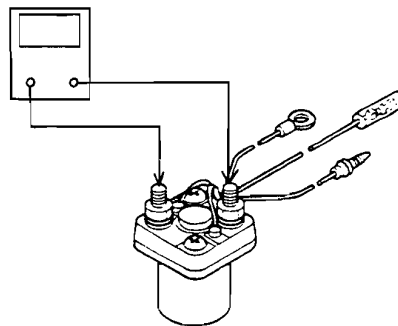
- Installation is the reverse of removal. Note the following.
- Connect the ground lead (black) to the CDI igniter mounting bolt.
- Connect the battery cable to the relay (+) terminal having red lead.



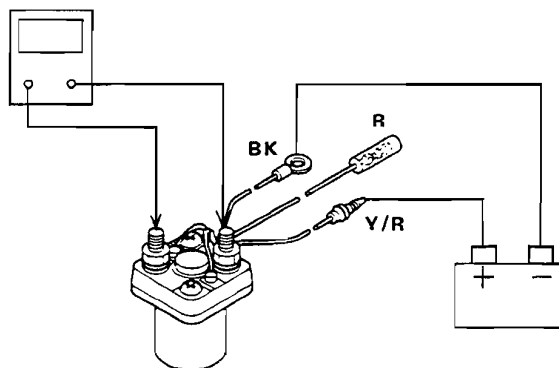
A, Relay (+) Terminal B, Red Lead

Inspection

- Set ohmmeter to $R \times 1 \Omega$ scale.
- Connect meter leads to starter relay as shown.



- ★ If resistance is less than infinite, the starter relay switch is not returning and must be replaced.
- Set ohmmeter to $R \times 1 \Omega$ scale.
- Connect meter leads to starter relay as shown.
- Activate starter relay switch by connecting a 12 V battery as shown.



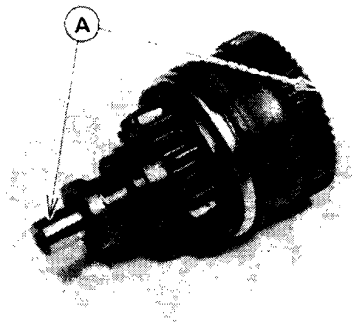
- ★ If the starter relay switch clicks and the ohmmeter indicates zero resistance, the starter relay switch is good.
- ★ If the meter indicates high or infinite (∞) resistance, the starter relay switch is defective and must be replaced.

Reduction Gear:

Removal/Installation Notes

- Before removing the reduction gear, remove the magneto flywheel (see Engine Bottom End chapter).
- When installing the reduction gear, apply a molybdenum disulfide grease to both ends of its shaft.

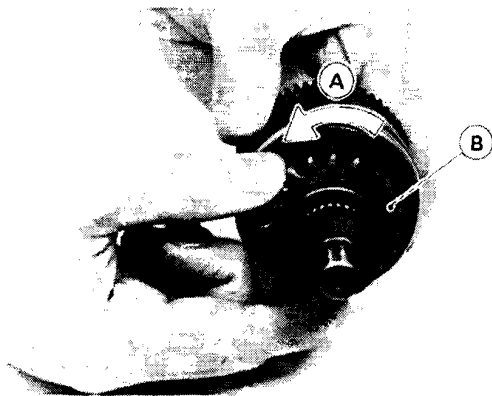
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A. Grease

Inspection

- Rotate the pinion gear counterclockwise. The gear must be rotate freely.



A. Free

B. Pinion Gear

- Rotate the pinion gear clockwise all the way. The pinion gear will be advanced along the reduction gear shaft, and stopped against the stopper.

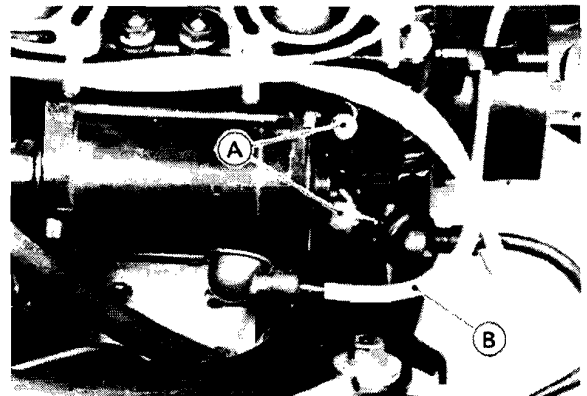


A. Stopper

- Release the pinion gear. The pinion gear must return to the initial position rapidly.
- ★ If the pinion gear does not function properly, replace it.

Starter Motor:**Removal**

- Remove the exhaust pipe and manifold (see Exhaust System chapter).
- Disconnect the battery ground cable.
- Disconnect the starter motor cable.
- Remove the starter motor.



A. Mounting Bolts

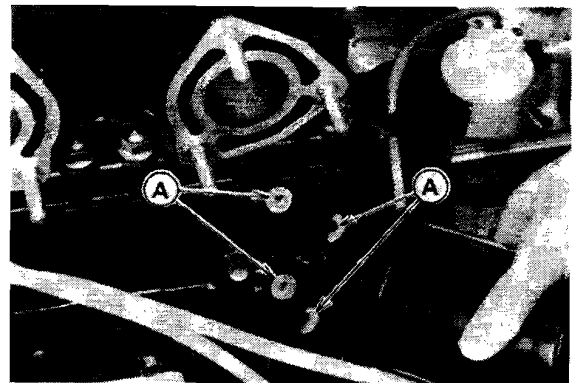
B. Starter Motor Cable

CAUTION

- Do not tap the starter motor shaft or body. Tapping on the shaft or body could damage the motor.

Installation

- Starter motor installation is the reverse of removal. Note the following.
- Clean the starter motor lugs and the crankcase where the starter motor is grounded.



A. Clean here.

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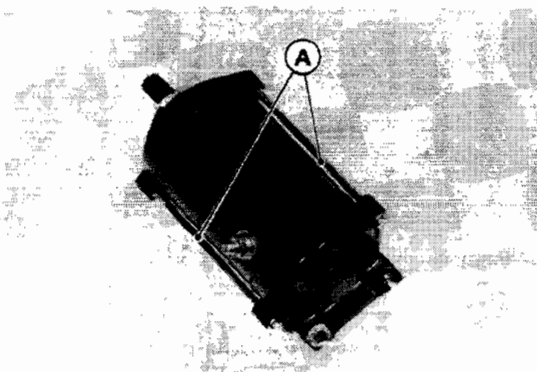
13-12 ELECTRICAL SYSTEM

- Apply a small amount of engine oil to the O-ring.
- Apply a non-permanent locking agent to the starter motor mounting bolt threads.
- Connect the battery ground cable to the bottom starter motor mounting bolt.

- Remove the nut and the terminal bolt, and then remove the brush and the plastic holder.

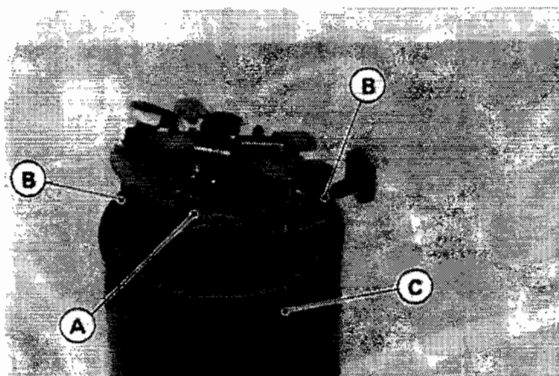
Disassembly

- Unscrew the retaining screws and remove both end covers.



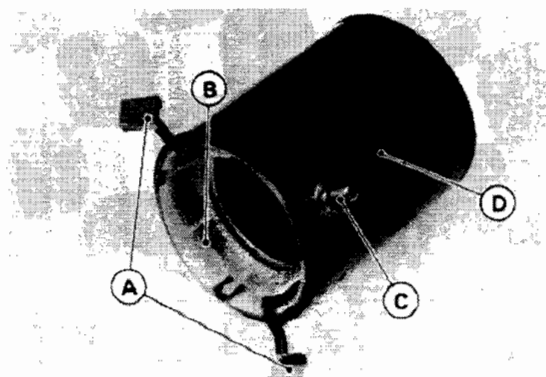
A. Screws

- Pull the armature out the pinion gear end.
- Remove the brush plate from the leads.



A. Brush Plate
B. Brush Lead

C. Yoke

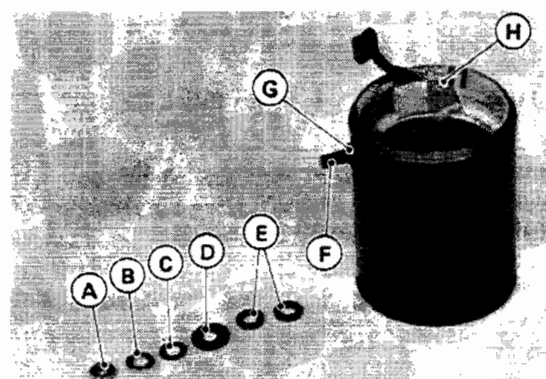


A. Brushes
B. Holder

C. Terminal Bolt
D. Yoke

Assembly

- Install the terminal bolt as shown.

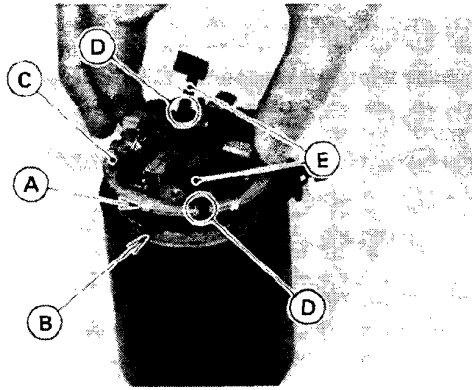


A. Nut
B. Spring Washer
C. Washer
D. Large Insulator

E. Small Insulator
F. Terminal Bolt
G. O-ring
H. Plastic Holder

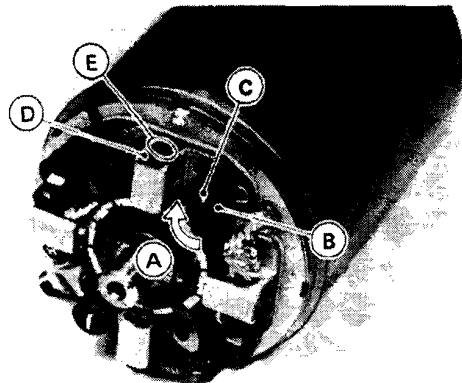
- Install the brush plate as follows.
- Install the brush plate on the yoke fitting the brush leads into the notches in the plate. Fit the brush plate tongue into the yoke notch.

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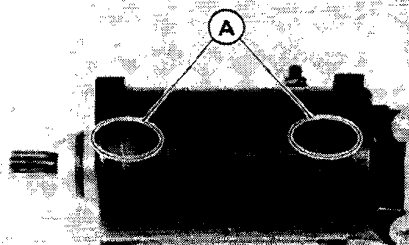
A. Tongue
B. Notch
C. Brush Plate
D. Notches
E. Brush Leads

- Insert the armature into the yoke.
- Keeping the motor upright, install the brush springs. Fit the spring on the spring post halfway; the post must be positioned in the D-shaped end of the spring. Turn the other end of the spring a half turn clockwise, and fit the end in the brush groove. Push the spring onto the post to the stepped portion.



A. Half Turn Clockwise
B. Spring
C. Spring Post
D. Brush
E. Brush Groove

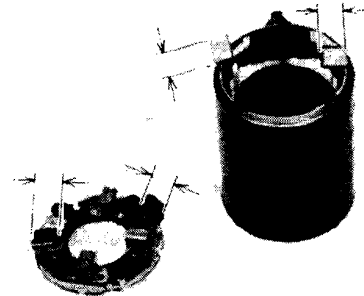
- To install the end covers on the yoke, align the mark on the each end cover with the marks on the yoke.



A. Align the mark

Brush Inspection

- Measure the length of each brush.
- ★ If any is worn down to the service limit, replace all the brushes.



Starter Motor Brush Length

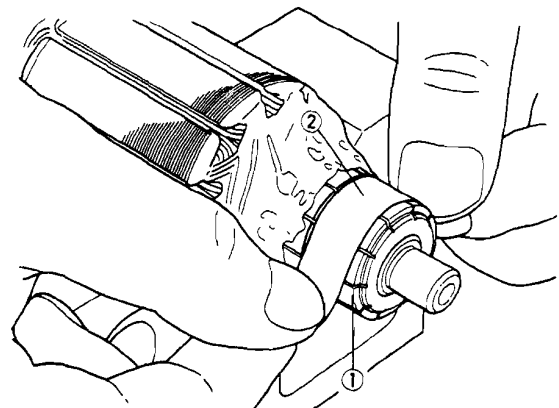
Standard:	12.5 mm
Service Limit:	6.5 mm

Brush Spring Inspection

- Check that the brush springs are in place and will snap the brushes firmly into place.
- ★ If not, reinstall or replace the spring.

Commutator Cleaning and Inspection

- Smooth the commutator surface if necessary with fine emery cloth, and clean out the grooves.



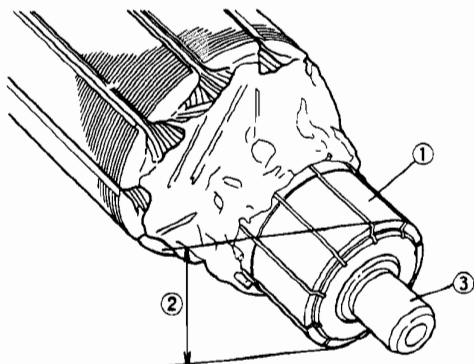
Commutator

2. Emery Cloth

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13-14 ELECTRICAL SYSTEM

- Measure the diameter of the commutator.
- ★ Replace the starter motor with a new one if the commutator diameter is less than the service limit.



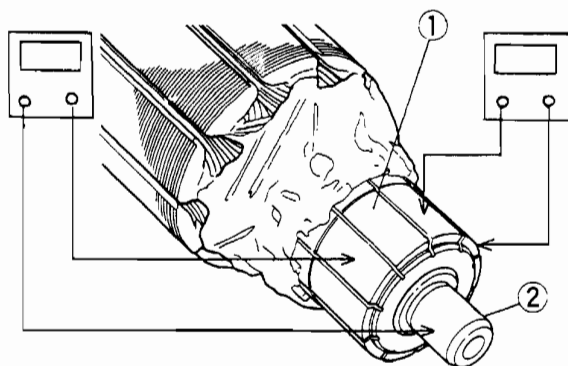
1. Commutator Segment 3. Shaft
2. Diameter

Commutator Diameter

Standard:	28 mm
Service Limit:	27 mm

Armature Inspection

- Using the $\times 1 \Omega$ ohmmeter range, measure the resistance between any two commutator segments.
- ★ If there is a high resistance or no reading (∞) between any two segments, a winding is open and the starter motor must be replaced.



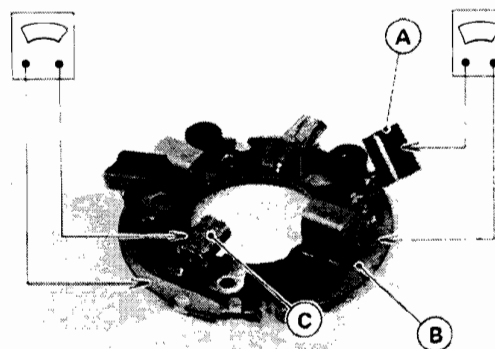
1. Segment 2. Shaft

- Using the highest ohmmeter range, measure the resistance between the commutator and the shaft.
- ★ If there is any reading at all, the armature has a short and the starter motor must be replaced.

Even if the foregoing checks show the armature to be good, it may be defective in some manner not readily detectable with an ohmmeter. If all other starter motor and starter motor circuit components check good, but the starter motor still does not turn over or only turns over weakly, replace the starter motor with a new one.

Brush Plate Inspection

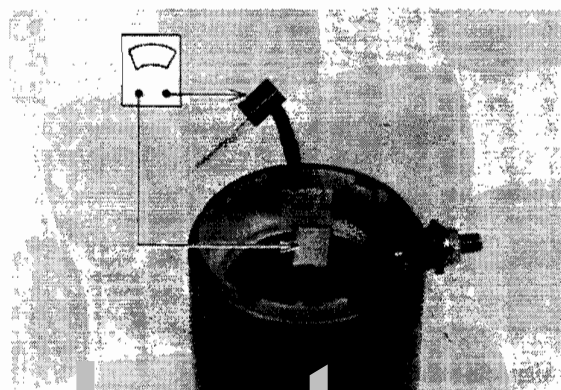
- Using the $\times 1 \Omega$ ohmmeter range, measure the resistance between the brush and the brush plate.
- ★ If there is not close to zero ohms, the brush plate has an open and the brush plate must be replaced.
- Using the highest ohmmeter range, measure the resistance between the brush plate and the brush holders.
- ★ If there is any reading at all, the brush holder has a short and the brush plate must be replaced.



- A. Brush C. Brush Holder
B. Brush Plate

Brush and Lead Assembly Inspection

- Using the $\times 1 \Omega$ ohmmeter range, measure the resistance between the brushes.
- ★ If there is a high resistance or no reading (∞), a lead is open and the brush and lead assembly must be replaced.



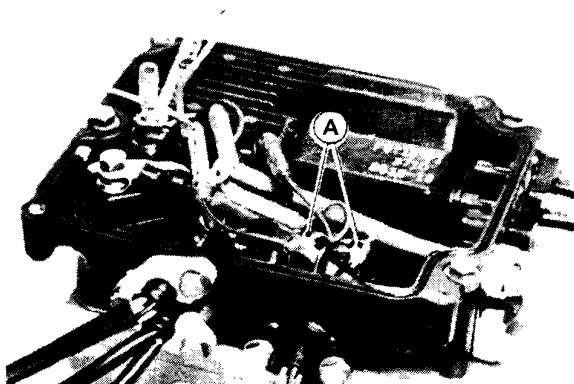
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13-16 ELECTRICAL SYSTEM

Charging System

Charging Coil Testing:

- Open the electric case.
- Remove the magneto leads off the electric case.
- Temporarily connect the magneto leads except the charging coil leads (brown).



A. Charging Coil Leads

- With a multimeter, check the charging coil output (in circuit) according to the following table with the engine running at approximately 3,000 rpm.

WARNING

- To avoid electrical shock, do not perform this test with the watercraft in the water.

CAUTION

- Operate the engine only for short periods without cooling water. Stop the engine immediately if the temperature warning buzzer goes on. Overheating will cause severe engine and exhaust system damage.

Charging Coil Output Test

Item	Meter Setting	Connection	Standard Value
Charging Coil	250 VAC	Brown ↔ Brown	42 V

- ★ If the charging coil output voltage is correct, check the regulator according to the regulator test procedure.
- ★ If the charging coil output voltage is low, check the charging coil resistance with a multimeter according to the following table.

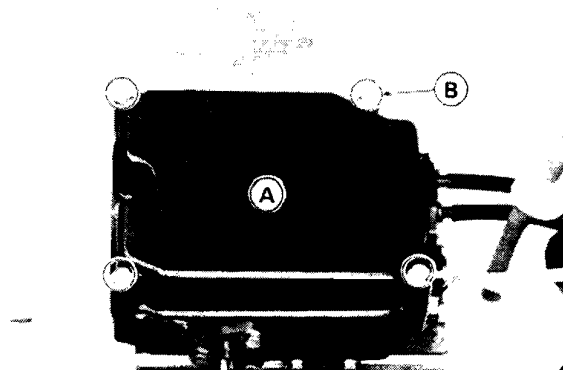
Charging Coil Resistance Test

Item	Meter Setting	Connection	Standard Value
Charging Coil	R x 1 Ω	Brown ↔ Brown	0.3 – 0.6 Ω
		Green ↔ Black/ Yellow	13.6 – 20.5 Ω

- ☆ If the coil has normal resistance, but the voltage check shows the charging system to be defective, then the permanent magnets in the flywheel have probably weakened, necessitating flywheel replacement.

Regulator/Rectifier: Removal

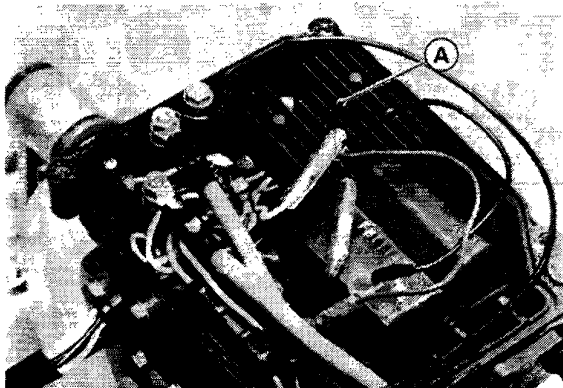
- Disconnect the battery ground cable.
- Open the electric case.



A. Electric Case

B. Bolts

- Remove the regulator/rectifier.



A. Regulator/Rectifier

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Installation

- Apply a non-permanent locking agent to the following bolts, and tighten them to the specified torque.
Regulator/Rectifier Mounting Bolts
Electric Case Bolts

Inspection

- With a multimeter set to the $R \times 1\text{ k}\Omega$ range, test the regulator/rectifier according to the following table.

Regulator/Rectifier Resistance Test(Unit: $\text{k}\Omega$)

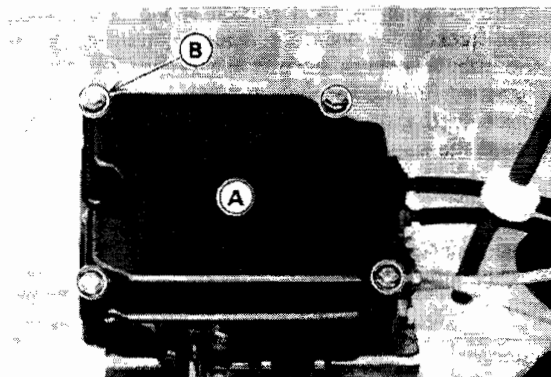
Tester Negative (-) Lead Connection	Tester Positive (+) Lead Connection			
	Lead Color	Red/Purple	Brown	Black
	Red/Purple		20 – 100	15 – 80
	Brown	1 – 5		20 – 100
	Black	2 – 10	1 – 5	

Measure with the Kawasaki Hand Tester 57001-983.
A tester other than the Kawasaki Hand Tester may show different readings.

- ★ If any of the values obtained do not agree with the above table, the regulator/rectifier must be replaced.

Ignition System**CDI Igniter Removal**

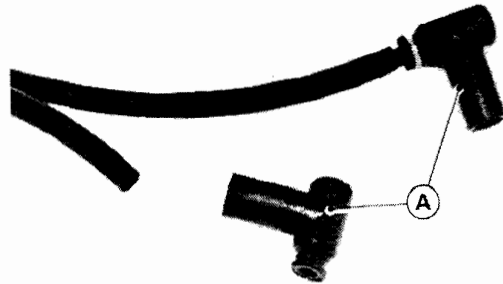
- Disconnect the battery ground cable.
- Open the electric case.



A. Electric Case

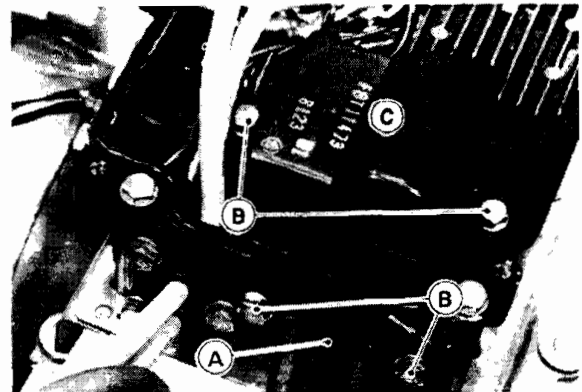
B. Bolts

- Remove the following.
Spark Plug Caps



A. Spark Plug Cap

Grommet Cap Bolts
CDI Igniter Lead Connectors
CDI Igniter Mounting Bolts

A. Grommet Cap
B. Bolts

C. CDI Igniter

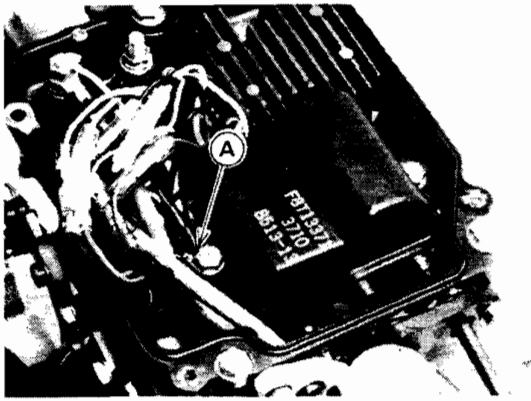
- Remove the CDI igniter.

CDI Igniter Installation

- Installation is the reverse of removal. Note the following.
- Apply a non-permanent locking agent to the removed bolts, and tighten them to the specified torque.
- Connect the ground leads to the CDI igniter mounting bolt.

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13-18 ELECTRICAL SYSTEM



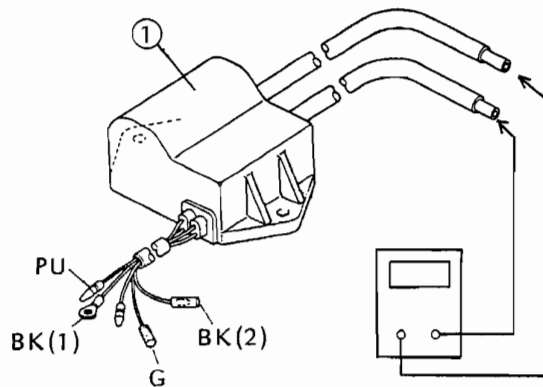
A. Ground Leads

CDI Igniter Inspection

- Measure the secondary winding resistance.
- Pull the spark plug cap off the lead.
- Connect an ohmmeter between the spark plug leads.
- Set the meter to the x 1 k Ω range, and read the meter.

Ignition Coil Winding Resistance

Secondary windings: 2.1 – 3.1 k Ω



1. CDI Igniter

- ★ If the secondary winding does not have the correct resistance, replace the CDI igniter.
- Measure the internal resistance.
- Set the ohmmeter to the x 1 k Ω range, and connect it to the leads from the CDI igniter to check the internal resistance of the CDI igniter.
- ★ If the readings do not correspond to the table, replace the CDI igniter.

(unit: k Ω)

Meter Range x 1 k Ω		Meter (+) Lead Connection				
		PU	G	BK(1)	W	BK(2)
Meter (-) Lead Connection	PU		* 500 ↓ ∞	* 500 ↓ ∞	∞	* 500 ↓ ∞
	G	* 500 ↓ ∞		* 500 ↓ ∞	∞	* 500 ↓ ∞
	BK(1)	3 – 4	20 – 30		∞	0
	W	* 40 – 150 ↓ 200 – 1000	* 14 – 22 ↓ 50 – 150	* 14 – 22 ↓ 50 – 150		* 14 – 22 ↓ 50 – 150
	BK(2)	3 – 4	20 – 30	0	∞	

*= If measuring these resistance twice, wait for 30 minutes for capacitor charging.

Measure with the Kawasaki Hand Tester 57001-983. A tester other than the Kawasaki Hand Tester may show different readings.

Exciter Coil Inspection

If the spark is weak or absent at the spark plug, and the CDI igniter is found to be functioning properly, and the wiring is all in good condition and properly connected (check for loose or corroded conditions); the cause may be a short or open in the exciter coil, or loss of magnetism in the flywheel magnets. With a multi-meter set to the proper range, measure the resistance between the leads shown in the following table.

Exciter Coil Resistance Tests

Item	Meter Setting	Connection	Standard Value
Exciter Coil	R x 100 Ω	Purple ↔ Black / Yellow	1 – 1.6 k Ω

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- ★If the resistances in this test are found to be less than the proper values, there is probably a short in the exciter coil.
- ★No reading (∞) indicates an open circuit.
- ★In either case, replace the coil.
- ★If, however, the coil checks out good, the cause is most likely a loss of magnetism in the flywheel, necessitating flywheel replacement.

Spark Plug Removal

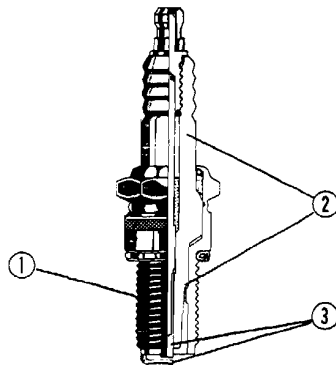
- Pull off the spark plug caps.
- Unscrew the spark plugs.
- Be careful to avoid breaking the ceramic on the spark plugs.

Spark Plug Installation

- Be sure the spark plug threads are clean and dry.
- Tighten the spark plugs to the specified torque (see Exploded View).
- Be careful to avoid breaking the ceramic on the spark plugs.
- Connect the spark plug caps.

Spark Plug Inspection

- Remove the spark plugs (see Spark Plug Removal).



1. Threads 3. Electrodes
2. Ceramic Insulator

- Examine the ceramic insulator and electrodes.
- ★If the insulator appears glazed or very white, or if there are gray metallic deposits on the electrodes, combustion chamber temperatures are too high. Refer to Troubleshooting.

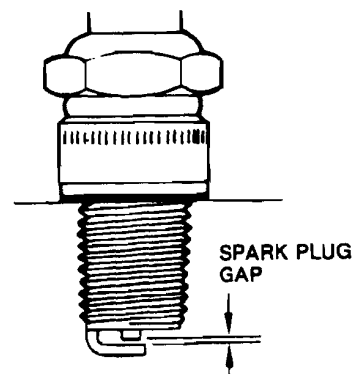
- ★If the insulator appears dry and sooty the fuel/air mixture is overly rich (see Carburetor Adjustments in the Fuel System chapter).
- If the insulator and electrodes are wet and oily, an improper oil type or an excess oil output may be the cause.
- ★If the ceramic insulator is cracked, replace the plug.
- ★If the electrodes are badly worn or burned, replace the plug.
- Examine the spark plug threads.
- ★If the threads are damaged, replace the plug.

Spark Plug Cleaning

- Clean the electrodes and the ceramic insulator around the center electrode with an abrasive blasting device.
- Be certain that all abrasive particles are removed from the plug.
- Clean the entire plug in a high flash point solvent.

Spark Plug Adjustment

- Measure the spark plug gap.
- Check the distance between the electrodes with a feeler gauge or a wire gauge.



Spark Plug Gap

0.7 – 0.8 mm (0.028 – 0.032 in)

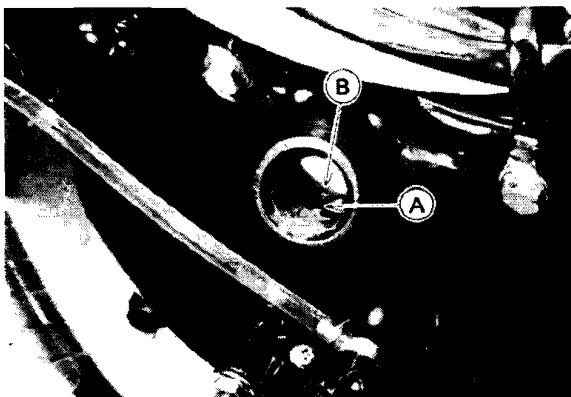
- ★If the gap is not within specifications, adjust it.
- Adjust the gap by carefully bending the side electrode with a tool designed for this purpose.

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13-20 ELECTRICAL SYSTEM

Ignition Timing Inspection (dynamic)

- Remove the magneto breather plug.
- Attach a timing light and a tachometer following the manufacturer's instructions.
- Start the engine and run it at approximately 6,000 rpm.
- Direct the timing light at the notch and timing mark on the flywheel.
- The timing is correct if the mark aligns with the projection.



A. Projection

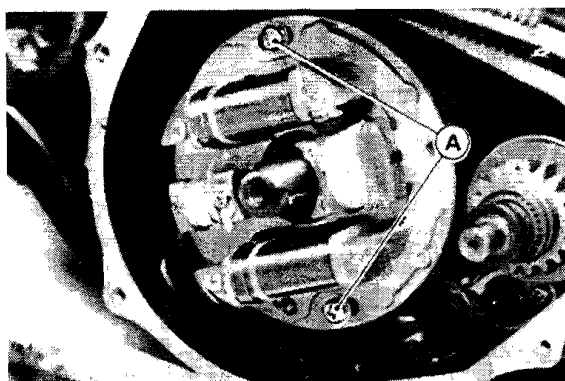
B. Timing Mark

- Shut off the engine.

CAUTION

- Do not run the engine for more than 15 seconds without cooling water.
- Take care not to over-rev the engine while running it with no load.

★ If the timing is incorrect, remove the flywheel, loosen the stator screws, and reposition the stator as necessary to correct the timing. Tighten the screws and recheck the timing.



A. Stator Set Screws

- When the ignition timing is properly adjusted, remove the timing light and the tachometer.

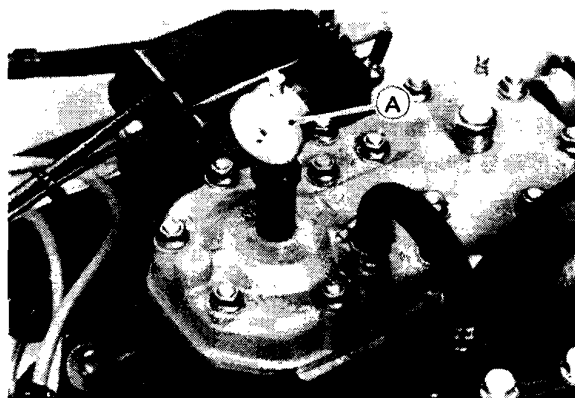
CAUTION

- When adjusting the stator, be careful not to damage the coils.

Verification of Timing Marks

The accuracy of the timing marks can be checked with the top dead center finder (special tool).

- Remove the magneto cover.
- Remove the spark plug from the front cylinder and install the top dead center finder (special tool) in the plug hole.



A. Top Dead Center Finder: 57001-402

- Position the piston at top dead center.
- Turn the flywheel clockwise until the dial gauge reads the value shown in the table.

Piston Position at Timing Mark

Distance from TDC: 2.0 mm

- Reinstall the magneto cover and remove the magneto breather plug.
- The timing mark on the flywheel should align with the projection on the magneto cover at this point.

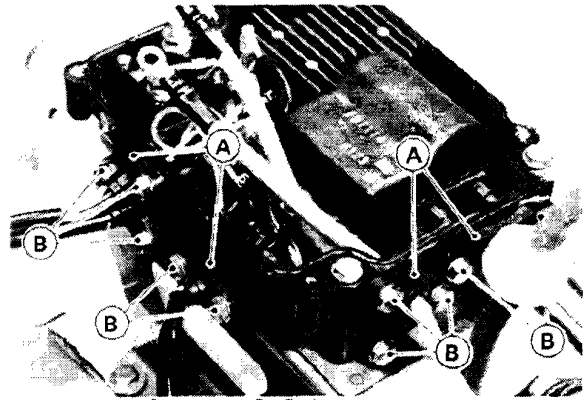
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- ★If it does not, set the piston at the specified position BTDC (before top dead center) and make a new timing mark on the flywheel just under the projection.
- Check the ignition timing.

NOTE

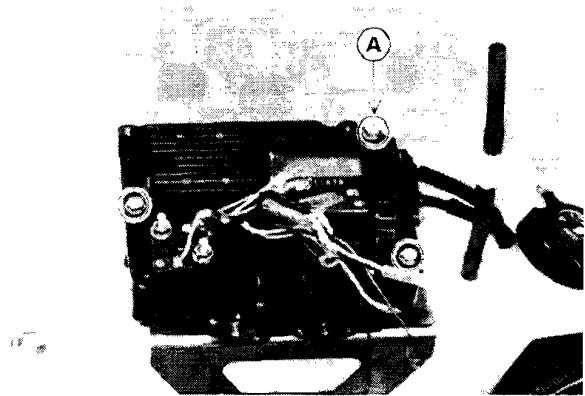
○When inspecting ignition timing after verifying the timing marks with a dial gauge, use your new timing mark.

- Remove the top dead center finder and replace the spark plug and plug lead.



A. Grommet Caps B. Bolts

- Disconnect the battery cable, starter motor cable, and wire leads.
- Remove the electric case.

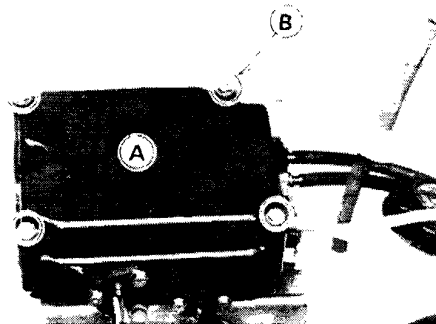


A. Electric Case Mounting Bolts

.....
Electric Case

Removal/Disassembly

- Remove the engine hood.
- Disconnect the battery ground cable.
- Open the electric case.

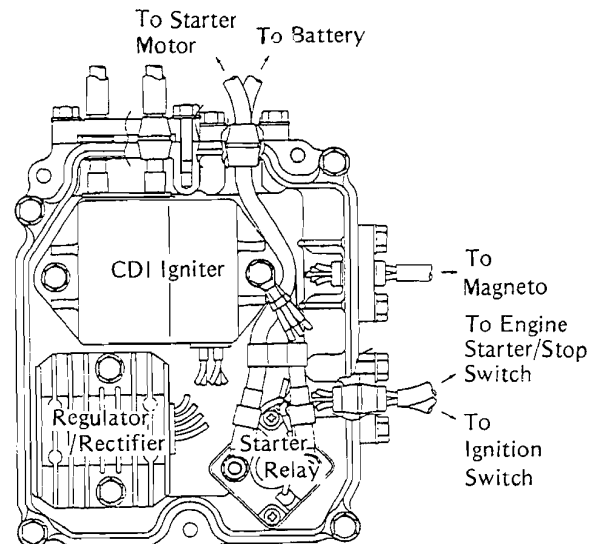


A. Electric Case B. Bolts

- Remove the grommet caps.

Assembly/Installation

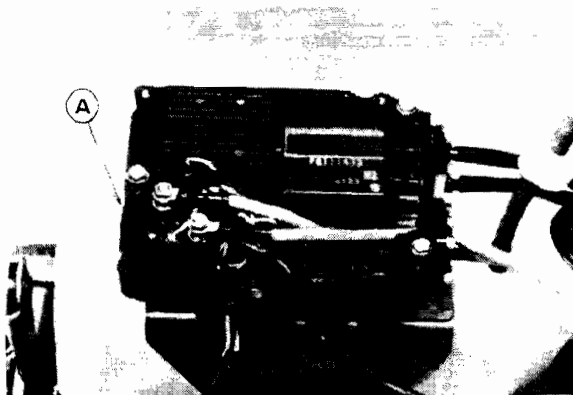
- Run the wire leads through the electric case hole.



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13-22 ELECTRICAL SYSTEM

- Connect the battery cable to the relay (+) terminal having red lead.
- Connect the wire leads. Refer to the Wiring Diagram.
- Connect the ground leads (black) to the CDI igniter mounting bolt.
- Apply a non-permanent locking agent to all the removed bolts, and tighten them to the specified torque.
- Apply water resistant grease to the O-ring of electric case.



A. Apply grease.

Blower Fan Inspection

- Using two auxiliary wires, supply battery power to the blower fan.

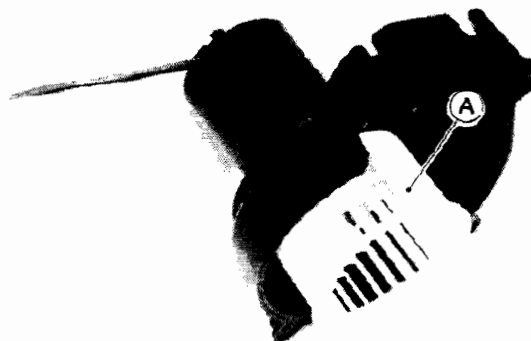
Wire Connections

Blue Lead ↔ Battery (+)

Black Lead ↔ Battery (—)

- ★ If the fan does not turn at this time, the fan is defective and must be replaced.

- Remove the blade cover, and check the fan blades.



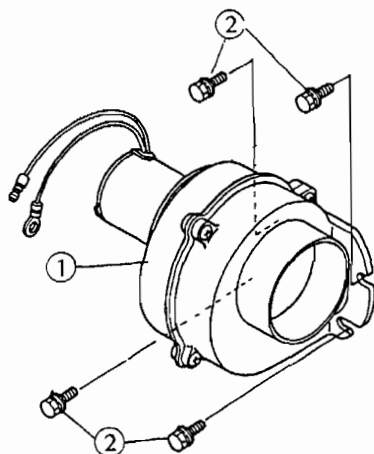
A. Fan Blades

- ★ If the fan blades are damaged, replace the blower fan assembly.

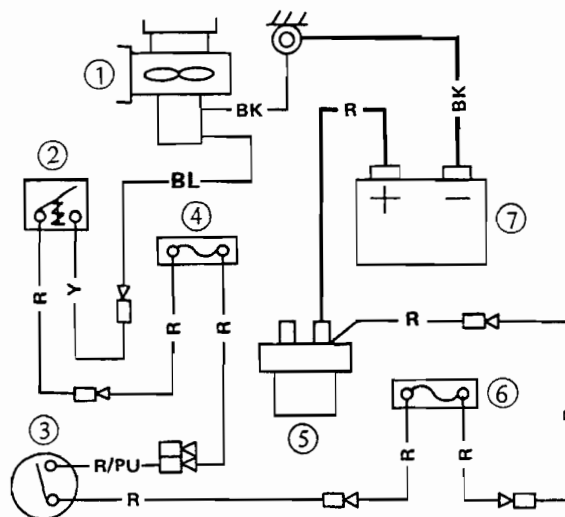
Blower Fan System

Blower Fan Removal

- Loosen the clamp.
- Disconnect the fan leads.
- Unscrew the mounting bolts.



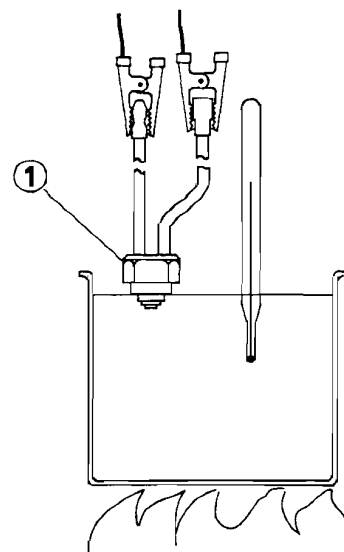
1. Blower Fan
2. Mounting Bolts



1. Blower Fan
2. Blower Fan Switch
3. Ignition Switch
4. Fan Fuse (5A)
5. Starter Relay
6. Main Fuse (20A)
7. Battery

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- Suspend the sensor in a container of water so that the temperature sensing projection is submerged.
- Suspend a thermometer in the water.



NOTE

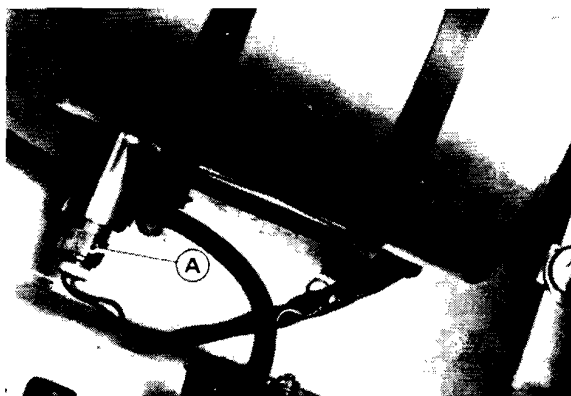
1. Warning Buzzer
2. CDI Igniter
3. Temperature Sensor
4. Ignition Switch
5. Starter Relay
6. Battery

CAUTION

- **Do not let the engine continue running when the warning buzzer goes on. Prolong engine operation will result in sever damage from overheating.**

Temperature Sensor Inspection

- Remove the temperature sensor.



A. Temperature sensor

Temperature Sensor Connections

Rising temperature: From OFF to ON
at 95°C (203°F)

Failling temperature: From ON to OFF
at 88°C (190°F)

ON: Less than 0.5Ω

OFF: More than 1 M Ω

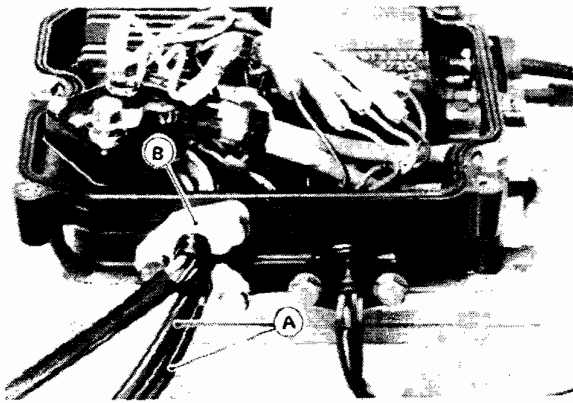
Switches

Start/Stop Switch:

Removal/Installation

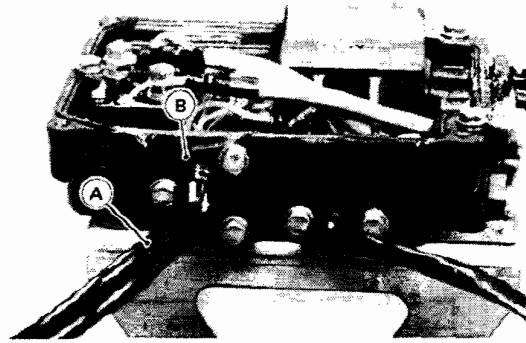
- Open the electric case.
- Remove the grommet cap.
- Disconnect the start/stop switch leads.

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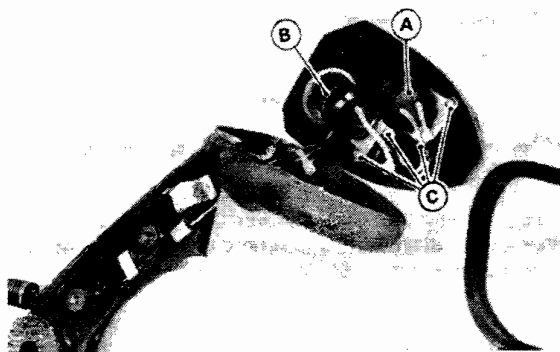
A. Start/Stop Switch Leads B. Grommet Cap

- Disassemble the control stick (see Steering chapter).
- Remove the start/stop switches.



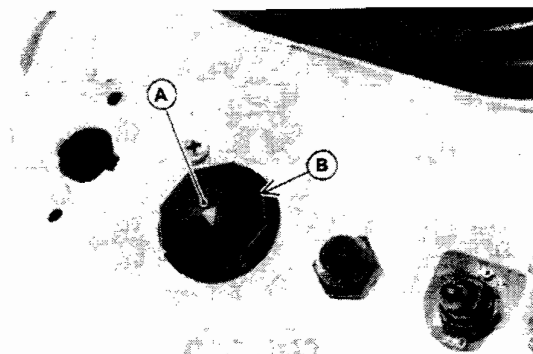
A. Ignition Switch Leads B. Grommet Cap

- Remove the steering cover (see Steering chapter).
- Remove the ignition switch.



A. Start Switch B. Stop Switch
C. Screws

- Installation is the reverse of removal.
- The stop switch has white and black leads.
- Connect the start/stop switch leads. Refer to the Wiring Diagram.
- Apply a non-permanent locking agent to the electric case bolts.



A. Ignition Switch B. Mounting Nut

- Installation is the reverse of removal.
- Apply a non-permanent locking agent to the electric case bolts.

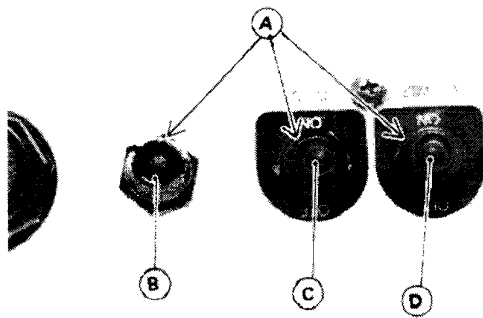
Ignition Switch: Removal/Installation

- Open the electric case.
- Remove the grommet cap.
- Disconnect the ignition switch leads.

Engine Shut-off Switch/Bilge Pump Switch/ Blower Fan Switch: Removal/Installation

- Remove the steering cover (see Steering chapter).
- Unscrew the mounting nuts, and remove the switches.

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A. Mounting Nuts
B. Engine Shut-off Switch
C. Bilge Pump Switch
D. Blower Fan Switch

- Installation is the reverse of removal. Note the following.
- The blower fan switch has yellow and red leads.

Switch Inspection:

- Using an ohmmeter, check to see that only the connections shown in the table have continuity (about zero ohms).
- ★ If the switch has an open or short, repair it or replace it with new one.

Ignition Switch

	BK	W	R/PU	R
OFF	○	—	○	
ON				○

Start/Stop Switch

	Start Switch		Stop Switch	
	R/PU	G/W	W	BK
Free				
Push on	○	—	○	—

Engine Shut-off Switch

	W	BK
When lanyard is installed		
When lanyard is removed	○	—

Starter Lockout Switch

Shift lever Position	G/W	BK/Y
F or R position		
Engine starting position	○	—

Bilge Pump Switch

	R	BR
OFF		
ON	○	—

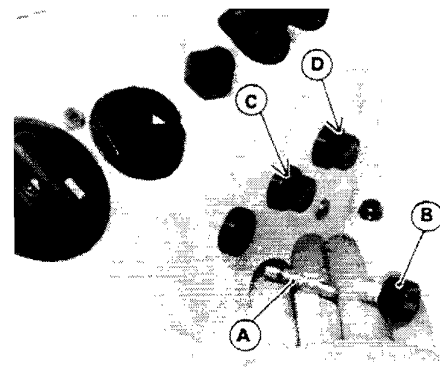
Blower Fan Switch

	R	Y
OFF		
ON	○	—

Fuse

Inspection

- While pushing the fuse cap, turn it counterclockwise, and then remove the cap with the fuse.



A. Main Fuse 20A
B. Fuse Cap
C. Bilge 5A
D. Blower 5A

- Inspect the fuse element.

- ★ If it is blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.

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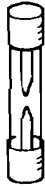
13-26 ELECTRICAL SYSTEM

CAUTION

○When replacing a fuse, be sure the new fuse matches the specified fuse rating for that circuit. Installation of a fuse with a higher rating may cause damage to wiring and components.



Normal



Failed

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STORAGE

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14-2 STORAGE AND TRANSPORTING

Preparation for Storage

During the winter, or whenever the watercraft will not be in use for a long period of time, proper storage is essential. It consists of checking and replacing missing or worn parts; lubricating parts to ensure that they do not become rusted; and, in general, preparing the watercraft so that when the time comes to use it again, it will be in top condition.

Cooling System

- Clean the cooling system (see Cooling system Flushing in the Cooling and Bilge Systems chapter).

Bilge System

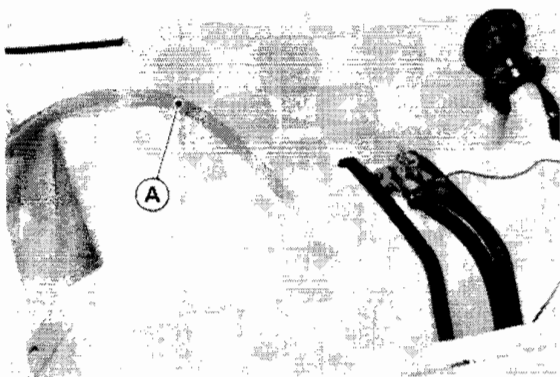
- Clean the bilge system (see Bilge System Flushing in the Cooling and Bilge System chapter).

Fuel System

WARNING

- Gasoline is extremely flammable and can be explosive under certain conditions. Push the STOP button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

- Drain the fuel tank. This should be done with a siphon or pump.
- Clean the filter screens (see Fuel Filter Screen Cleaning in the Fuel System chapter).

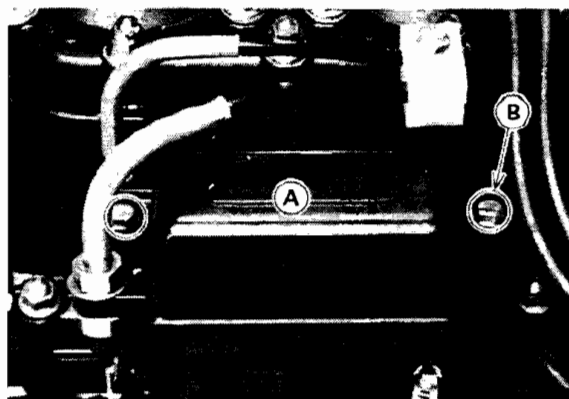


A. Siphon Hose

- Start the engine and run it only for short periods until all fuel in the carburetor is used up.

CAUTION

- Operate the engine only for short periods without cooling water. Stop the engine immediately if the temperature warning buzzer goes on. Overheating will cause severe engine and exhaust system damage.
- Remove the air intake cover from the carburetor.



A. Air Intake Cover B. Bolts

- Lift out the flame arrester and clean it, if necessary (see Flame Arrester Cleaning in the Fuel System chapter)
- Spray a penetrating rust inhibitor down the carburetor bore.
- Install the flame arrester with the flat face downward.
- Reinstall the cover, apply a non-permanent locking agent to the threads of the air intake cover bolts and tighten securely.

Engine

- Remove the spark plugs and pour one ounce of motor oil into each cylinder.

CAUTION

- Do not use too much oil, or the crank seals may be damaged when the engine is next started.

- Ground the spark plugs, turn the engine over several times with the starter motor to coat the cylinder walls with oil, then replace the spark plugs.
- Remove the exhaust tube and pour three ounces of automobile antifreeze into the water box muffler. Replace the exhaust tube.

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Battery

- Remove the battery (see Battery Removal in the Electrical System chapter).
- Clean the exterior with a solution of baking soda and water (one heaping tablespoon of baking soda in one cup of water). Rinse thoroughly with water.

CAUTION

- Do not allow any soda solution to enter the battery.
- Check the electrolyte and fill to the upper level mark with distilled water, if necessary.
- Check the specific gravity with a hydrometer and recharge if necessary.
- Cover both battery terminals with grease.
- Store the battery in a cool, dry place. Do not expose it to freezing temperatures.

NOTE

- Check the battery at least every 30 days and recharge if necessary. A neglected battery will gradually lose its charge and begin to sulfate (plates turn white). Once this reaction has begun, the battery usually cannot be salvaged.

Lubrication

- Carry out all recommended lubrication procedures (see Lubrication in the Appendix chapter).

General

- Wash the watercraft and dry it thoroughly, making sure to drain the engine compartment completely.

CAUTION

- Use only a mild detergent in water to wash the hull. Harsh solvents may attack the surface or smear the colors.
- Apply a good grade of wax to all exterior hull surfaces.
- Lightly spray all exposed metal parts with a penetrating rust inhibitor.
- Cover the watercraft and store it in a clean, dry place.

Removal from Storage

Lubrication

- Carry out all recommended lubrication procedures (see Lubrication in the Appendix chapter).

General Inspection

- Check for binding or sticking throttle, choke, or steering mechanism. The throttle lever must return fully when released.
- Clean and gap spark plugs (see Spark Plug Cleaning and Spark Plug Adjustment in the Electrical System chapter).
- Check all rubber hoses for weathering, cracking, or looseness.
- Remove the jet pump cover. Check cooling hose for weathering, cracking or looseness.
- Replace them if necessary. Replace the cover and tighten securely.
- Check the fire extinguisher for a full charge.
- Check the battery, charge if necessary, and clean the terminals. Install the battery (see Battery Installation in the Electrical System chapter).

Fuel System

- Check and clean or replace the fuel filter screens as necessary (see Fuel Filter Screen Cleaning in the Fuel System chapter).
- Inspect the engine oil tank vent check valve (see Engine Lubrication System chapter).

WARNING

- Gasoline is extremely flammable and can be explosive under certain conditions. Push the STOP button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.
- After refueling and before starting the engine, run the blower fan for 4 minutes to ventilate the engine compartment.

WARNING

- A concentration of gasoline fumes in the engine compartment can cause a fire or explosion.
- Check for fuel leaks. Repair if necessary.
- Check the engine oil level. Fill the oil tank with the specified oil up to the F (Full) mark.

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14-4 STORAGE AND TRANSPORTING

Test Run

WARNING

- Do not run the engine in a closed area. Exhaust gases contain carbon monoxide, a colorless, odorless, poisonous gas. Breathing exhaust gas leads to carbon monoxide poisoning, asphyxiation, and death.
- Start the engine and run it only for short periods. Check for fuel, oil and exhaust leaks. Any leaks must be repaired.

CAUTION

- Operate the engine only for short periods without cooling water. Stop the engine immediately if the temperature warning buzzer goes on. Overheating will cause severe engine and exhaust system damage.
- Do not run the engine at maximum speed out of the water. Severe engine damage may result.

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APPENDIX

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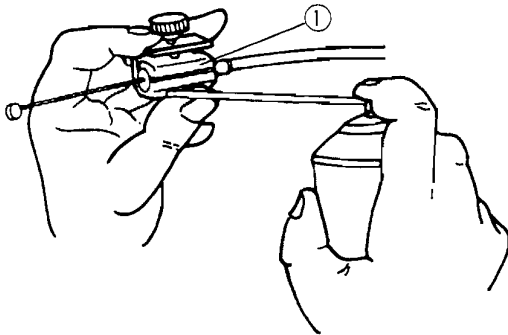
15-2 APPENDIX

Lubrication

As in all marine craft, adequate lubrication and corrosion protection is an absolute necessity to provide long, reliable service. Refer to the Periodic Maintenance Chart for the frequency of the following items:

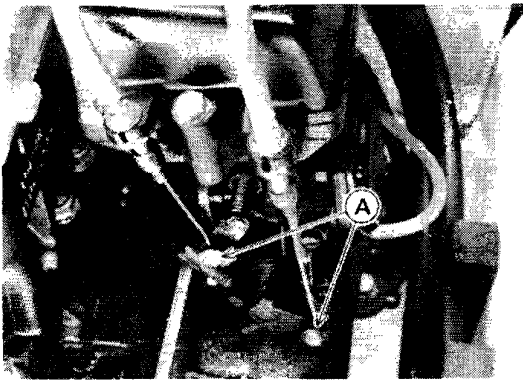
- Lubricate the following with a penetrating rust inhibitor.

Choke Cable, and Throttle Cable

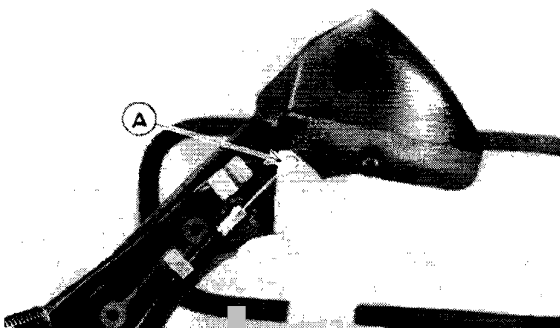


1. Pressure Cable Luber: K56019-021

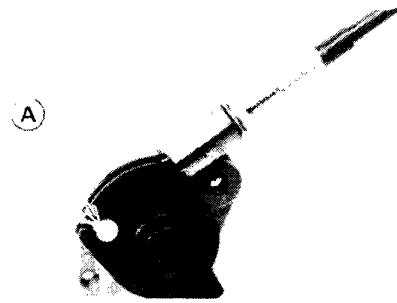
- Lubricate the throttle cable ends and choke cable ends with a high quality waterproof grease.



A. Apply grease.

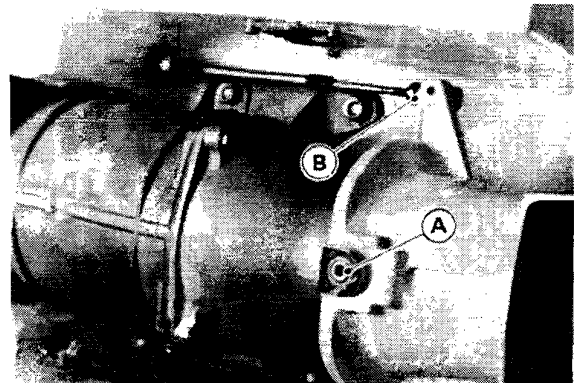


A. Apply grease.



A. Apply grease.

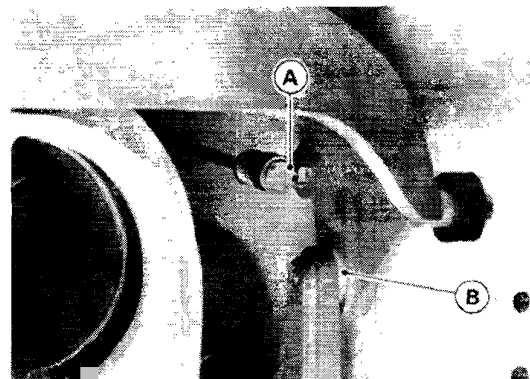
Steering Cable Ball Joints, and Nozzle Pivot



A. Nozzle Pivot

B. Ball Joint

Shift Cable Ball Joints, and Bucket Pivot

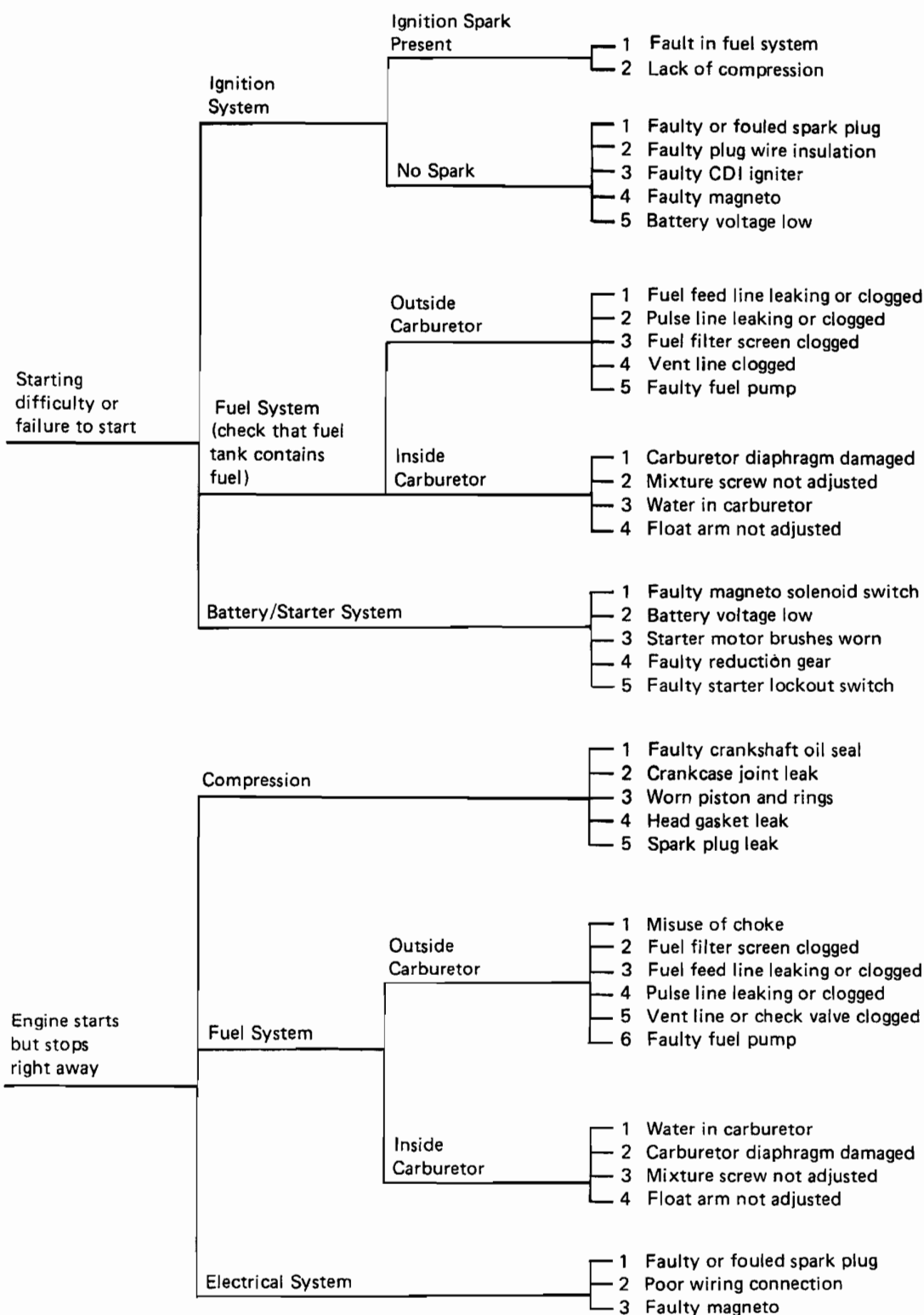


A. Ball Joint

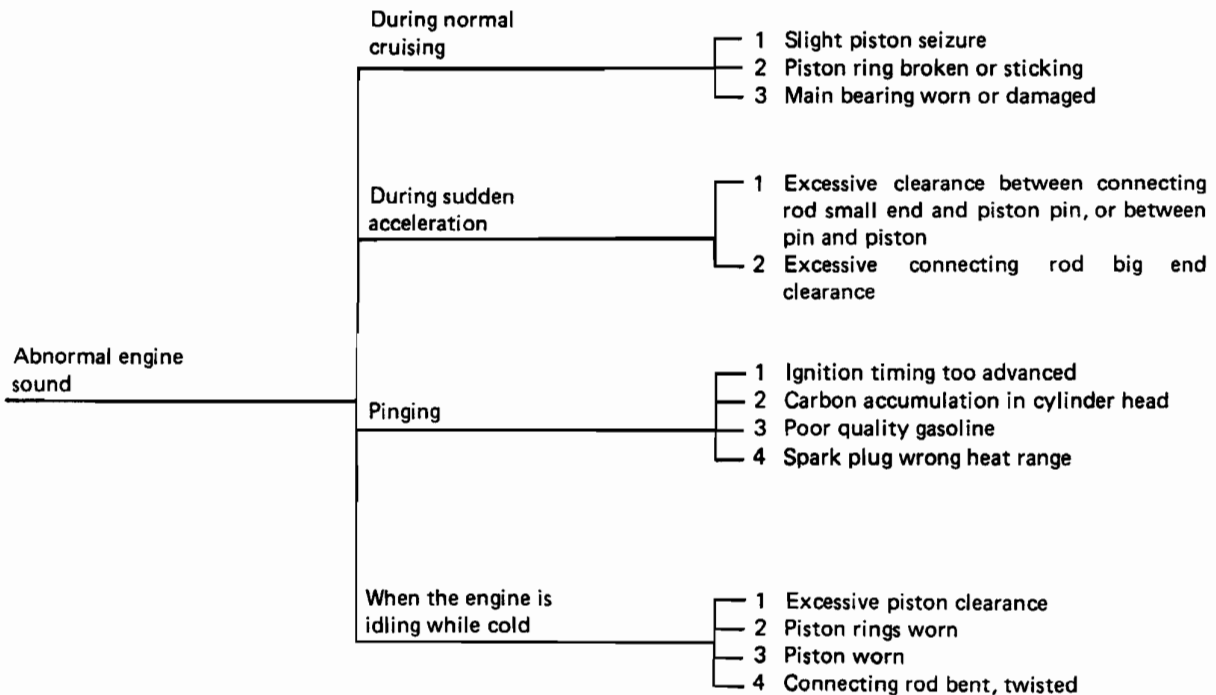
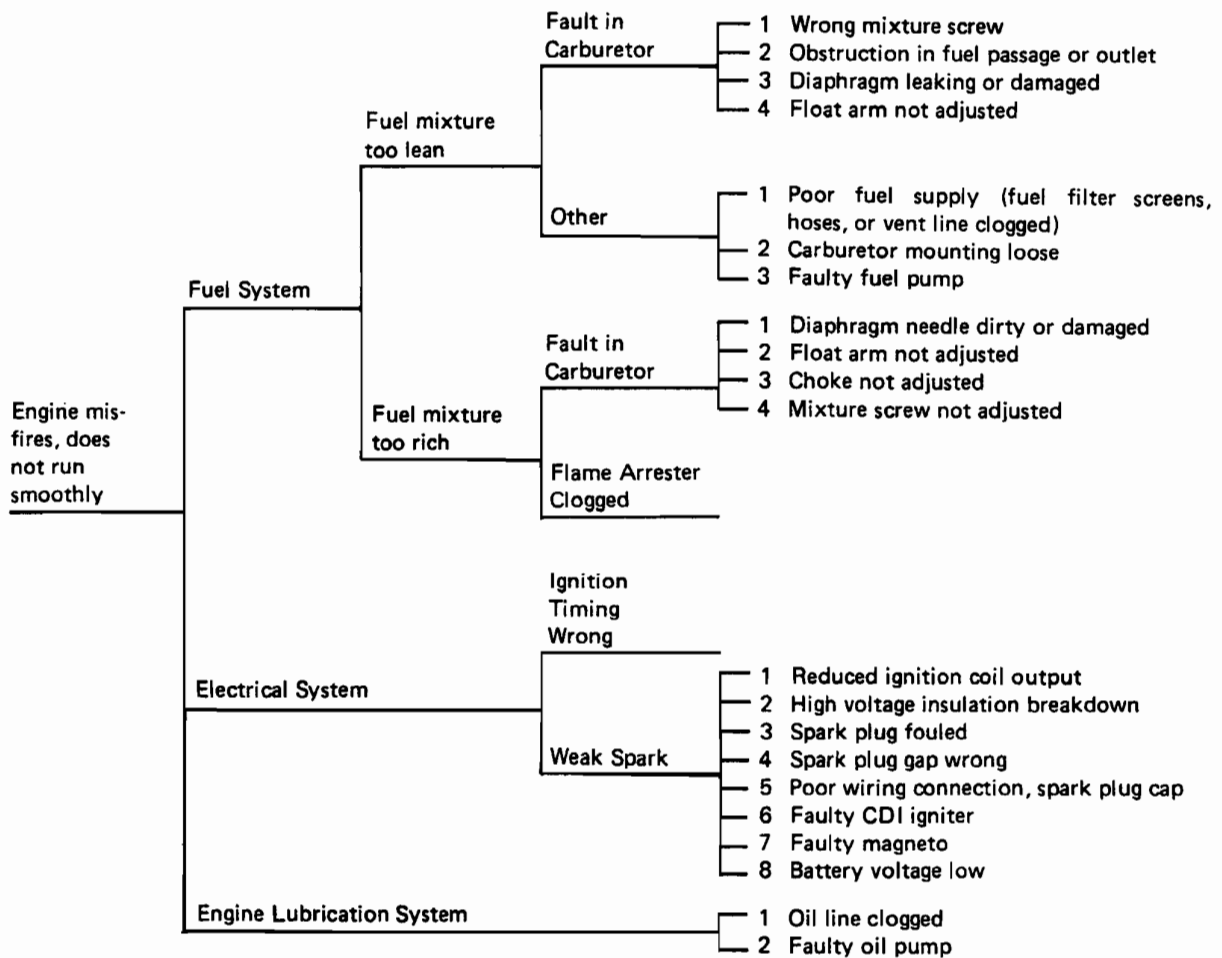
B. Bucket Pivot

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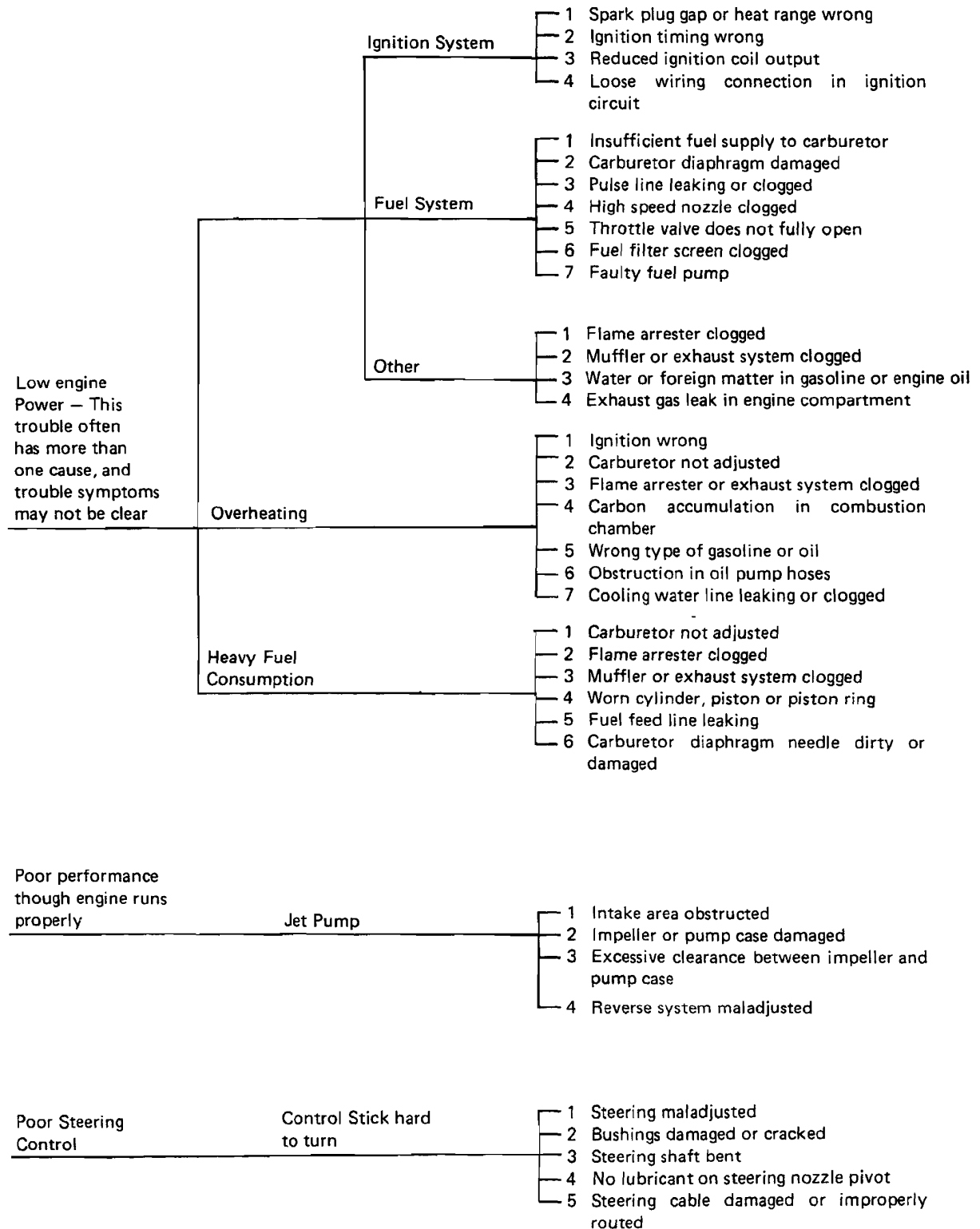
Troubleshooting



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15-6 APPENDIX

Unit Conversion Table

Prefixes for Units:

Prefix	Symbol	Power
mega	M	x 1,000,000
kilo	k	x 1,000
centi	c	x 0.01
milli	m	x 0.001
micro	μ	x 0.000001

Units of Mass:

kg	x	2.205	=	lb
g	x	0.03527	=	oz

Units of Volume:

L	x	0.2642	=	gal (US)
L	x	0.2200	=	gal (imp)
L	x	1.057	=	qt (US)
L	x	0.8799	=	qt (imp)
L	x	2.113	=	pint (US)
L	x	1.816	=	pint (imp)
mL	x	0.03381	=	oz (US)
mL	x	0.02816	=	oz (imp)
mL	x	0.06102	=	cu in

Units of Force:

N	x	0.1020	=	kg
N	x	0.2248	=	lb
kg	x	9.807	=	N
kg	x	2.205	=	lb

Units of Length:

km	x	0.6214	=	mile
m	x	3.281	=	ft
mm	x	0.03937	=	in

Units of Torque:

N-m	x	0.1020	=	kg-m
N-m	x	0.7376	=	ft-lb
N-m	x	8.851	=	in-lb
kg-m	x	9.807	=	N-m
kg-m	x	7.233	=	ft-lb
kg-m	x	86.80	=	in-lb

Units of Pressure:

kPa	x	0.01020	=	kg/cm ²
kPa	x	0.1450	=	psi
kPa	x	0.7501	=	cm Hg
kg/cm ²	x	98.07	=	kPa
kg/cm ²	x	14.22	=	psi
cm Hg	x	1.333	=	kPa

Units of Speed:

km/h	x	0.6214	=	mph
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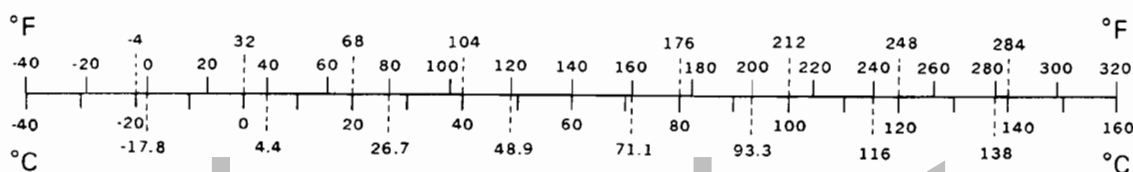
Units of Power:

kW	x	1.360	=	PS
kW	x	1.341	=	HP
PS	x	0.7355	=	kW
PS	x	0.9863	=	HP

Units of Temperature:

$$\frac{9(^{\circ}\text{C} + 40)}{5} - 40 = ^{\circ}\text{F}$$

$$\frac{5(^{\circ}\text{F} + 40)}{9} - 40 = ^{\circ}\text{C}$$



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MODEL APPLICATION

Year	Model	Beginning Hull No.
1989	JB650-A1	JKA00001 H889 or JB650A-000001
1990	JB650-A2	JKA00001 I990 or JB650A-000501
1991	JB650-A3	JKA00001 G091 or JB650A-001801
1992	JB650-A4	JKA00001 C192



Part No. 99924-1121-03

Printed in Japan

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