UZUKI OUTBOARD MOTOR

DF9.9

DF15

FOUR STROKE

SERVICE MANUAL

For 2005 model～

99500-94J01-01E

FOREWORD

This manual contains an introductory description of the SUZUKI DF9.9/15 Outboard motors and procedures for inspection, service and overhaul of their main components.
General knowledge information is not included.

Please read the GENERAL INFORMATION section to familiarize yourself with basic information concerning this motor. Read and refer to the other sections in this manual for information regarding proper inspection and service procedures.

This manual will help you better understand these outboard motors, assisting you in providing your customers with optimum and quick service.

- *This manual has been prepared using the latest information available at the time of publication.*
  Differences may exist between the content of this manual and the actual outboard motor.
- *Illustrations in this manual are used to show the basic principles of operation and work procedures and may not represent the actual outboard motor in exact detail.*
- *This manual is intended for use by technicians who already possess the basic knowledge and skills to service SUZUKI outboard motors.*
  Persons without such knowledge and skills should not attempt to service SUZUKI outboard engines by relying on this manual only and should contact an authorized SUZUKI outboard motor dealer.

⚠ WARNING

Apprentice mechanics or do-it-yourself mechanics that don't have the proper tools and equipment may not be able to properly perform the services described in this manual.
Improper repair may result in injury to the mechanic and may render the engine unsafe for the boat operator and passengers.

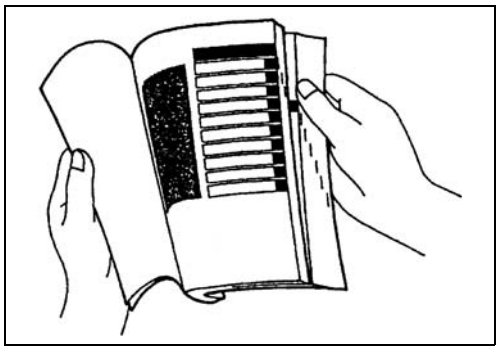
NOTE:
This manual is compiled based on 2005 (K5) model.

GROUP INDEX

HOW TO USE THIS MANUAL

TO LOCATE WHAT YOU ARE LOOKING FOR:

1. The text of this manual is divided into sections.
2. The section titles are listed on the previous page in a GROUP INDEX. Select the section needed for reference.
3. Holding the manual as shown at the right will allow you to find the first page of the section easily.
4. The first page of each section contains a table of contents to easily locate the item and page you need.

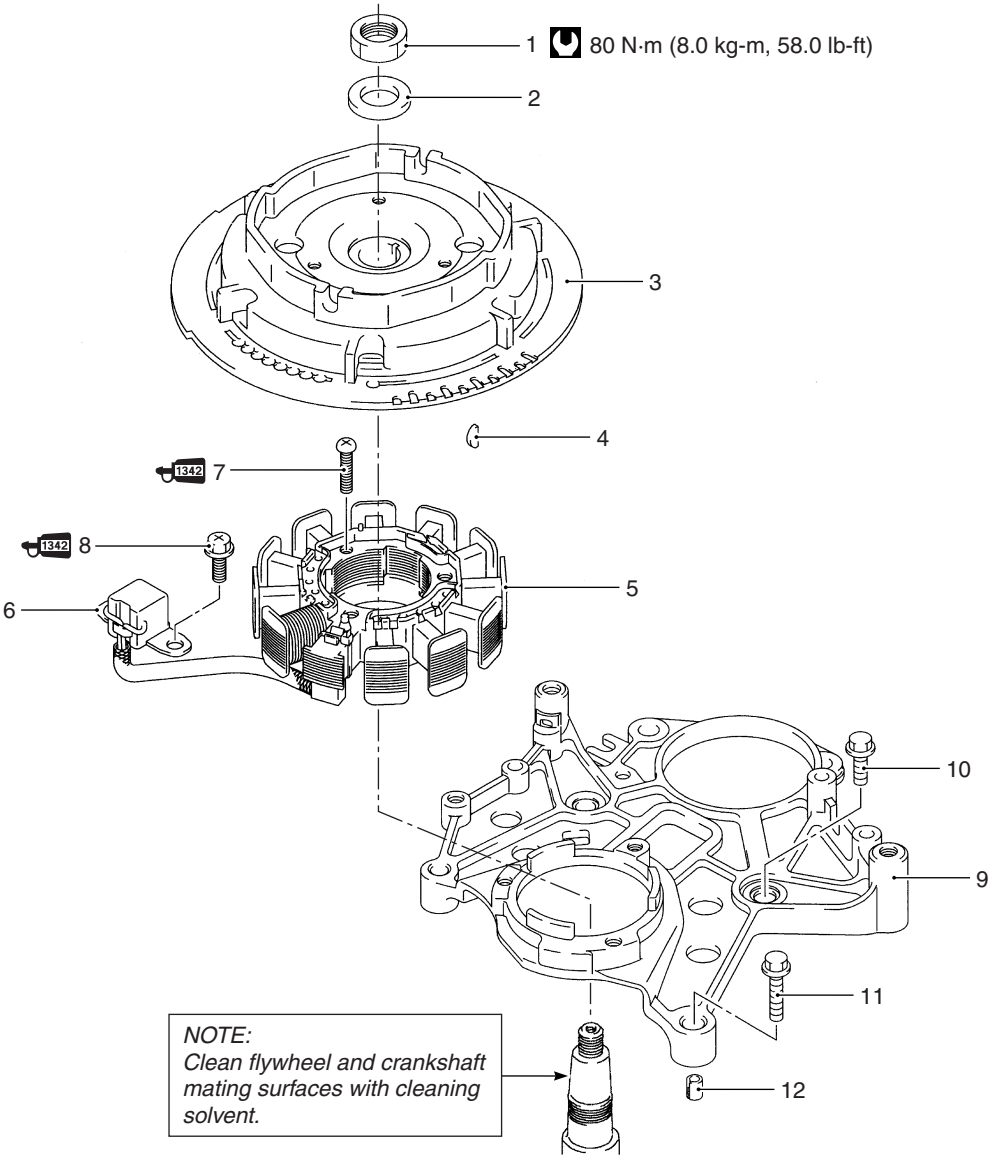


COMPONENT PARTS AND IMPORTANT ITEM ILLUSTRATIONS

Under the name of each system or unit, an exploded view is provided with work instructions and other service information such as the tightening torque, lubrication and locking agent points.

Example:

1. Nut
2. Washer
3. Flywheel
4. Key
5. Battery & condenser charge coil
6. Pulser coil
7. Screw
8. Screw
9. Stator base
10. Bolt
11. Bolt
12. Dowel pin



SYMBOL

Listed in the table below are the symbols indicating instructions and other important information necessary for proper servicing. Please note the definition for each symbol. You will find these symbols used throughout this manual. Refer back to this table if you are not sure of any symbol(s) meanings.

SYMBOL	DEFINITION	SYMBOL	DEFINITION
	Torque control required. Data beside it indicates specified torque.	1342	Apply the THREAD LOCK “1342”.
OIL	Apply the oil. Use the engine oil unless otherwise specified.	1333	Apply the THREAD LOCK SUPER “1333B”.
Gear OIL	Apply the SUZUKI OUTBOARD MOTOR GEAR OIL.	DC V	Measure in DC voltage range.
A	Apply the SUZUKI SUPER GREASE “A”.	Ω	Measure in resistance range.
W/R G's	Apply the SUZUKI WATER RESISTANT GREASE.	CONT	Measure in continuity test range.
1207B	Apply the SUZUKI BOND “1207B”.	CD77	Use peak voltmeter “Stevens CD-77”.
Si SEAL	Apply the SUZUKI SILICONE SEAL.	TOOL	Use special tool.

GENERAL INFORMATION

1

CONTENTS

WARNING/CAUTION/NOTE

Please read this manual and follow its instructions carefully. To emphasize special information, the symbol and the words WARNING, CAUTION and NOTE have special meanings. Pay special attention to the messages highlighted by these signal words.

⚠ WARNING

Indicates a potential hazard that could result in death or injury.

CAUTION

Indicates a potential hazard that could result in motor damage.

NOTE:
Indicates special information to make maintenance easier or instructions clearer.

Please note, however, that the warnings and cautions contained in this manual cannot possibly cover all potential hazards relating to the servicing, or lack of servicing, of the outboard motor. In addition to the WARNING and CAUTION stated, you must also use good judgement and observe basic mechanical safety principles.

GENERAL PRECAUTIONS

⚠ WARNING

- **Proper service and repair procedures are important for the safety of the service mechanic and the safety and reliability of the outboard motor.**
- **To avoid eye injury, always wear protective goggles when filing metals, working on a grinder, or doing other work, which could cause flying material particles.**
- **When two or more persons work together, pay attention to the safety of each other.**
- **When it is necessary to run the outboard motor indoors, make sure that exhaust gas is vented outdoors.**
- **When testing an outboard motor in the water and on a boat, ensure that the necessary safety equipment is on board. Such equipment includes: flotation aids for each person, fire extinguisher, distress signals, anchor, paddles, bilge pump, first-aid kit, emergency starter rope, etc.**
- **When working with toxic or flammable materials, make sure that the area you work in is well-ventilated and that you follow all of the material manufacturer's instructions.**
- **Never use gasoline as a cleaning solvent.**
- **To avoid getting burned, do not touch the engine, engine oil or exhaust system during or shortly after engine operation.**
- **Oil can be hazardous. Children and pets may be harmed from contact with oil. Keep new and used oil away from children and pets. To minimize your exposure to oil, wear a long sleeve shirt and moisture-proof gloves (such as dishwashing gloves) when changing oil. If oil contacts your skin, wash thoroughly with soap and water. Launder any clothing or rags if wet with oil. Recycle or properly dispose of used oil.**
- **After servicing fuel, oil/engine cooling system and exhaust system, check all lines and fittings related to the system for leaks.**
- **Carefully adhere to the battery handling instructions laid out by the battery supplier.**

CAUTION

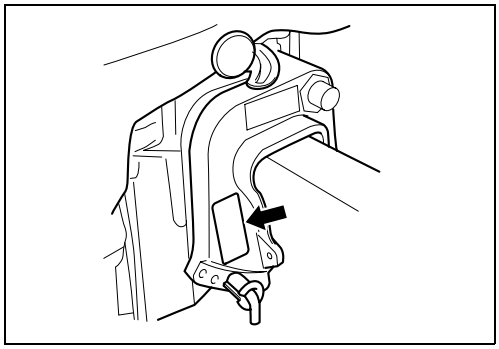
- **If parts replacement is necessary, replace the parts with Suzuki Genuine Parts or their equivalent.**
- **When removing parts that are to be reused, keep them arranged in an orderly manner so that they may be reinstalled in the proper order and orientation.**
- **Be sure to use special tools when instructed.**
- **Make sure that all parts used in assembly are clean and also lubricated when specified.**
- **When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.**
- **When removing the battery, disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable.**
- **When performing service to electrical parts, if the service procedures do not require using battery power, disconnect the negative cable at the battery.**
- **Tighten cylinder head and case bolts and nuts, beginning with larger diameter and ending with smaller diameter. Always tighten from inside to outside diagonally to the specified tightening torque.**
- **Whenever you remove oil seals, gaskets, packing, O-rings, locking washers, locking nuts, cotter pins, circlips and certain other parts as specified, always replace them with new. Also, before installing these new parts, be sure to remove any left over material from the mating surfaces.**
- **Never reuse a circlip. When installing a new circlip, take care not to expand the end gap larger than required to slip the circlip over the shaft. After installing a circlip, always ensure that it is completely seated in its groove and securely fitted.**
- **Use a torque wrench to tighten fasteners to the torque values when specified.**
  Remove grease or oil from screw/bolt threads unless a lubricant is specified.
- **After assembly, check parts for tightness and operation.**

- **To protect the environment, do not unlawfully dispose of used motor oil, other fluids and batteries.**
- **To protect the Earth's natural resources, properly dispose of used motor parts.**

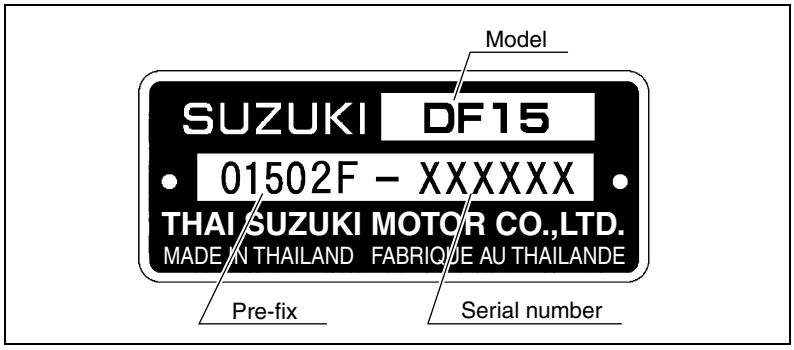
IDENTIFICATION NUMBER LOCATION

MODEL, PRE-FIX, SERIAL NUMBER

The MODEL, PRE-FIX and SERIAL NUMBER of motor are stamped on a plate attached to the clamp bracket.

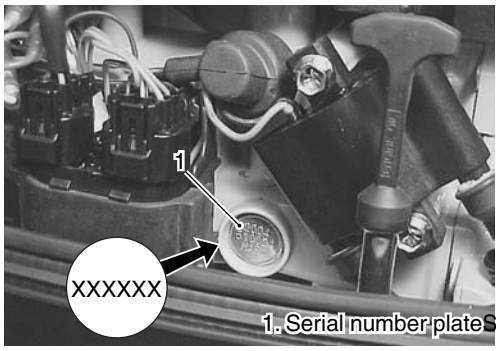


Example



ENGINE SERIAL NUMBER

A second engine serial number plate is pressed into a boss on the cylinder block.



FUEL AND OIL

GASOLINE RECOMMENDATION

Suzuki highly recommends that you use alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2+M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.

Allowable maximum blend of a single additive (not combination):

5% Methanol, 10% Ethanol, 15% MTBE

CAUTION

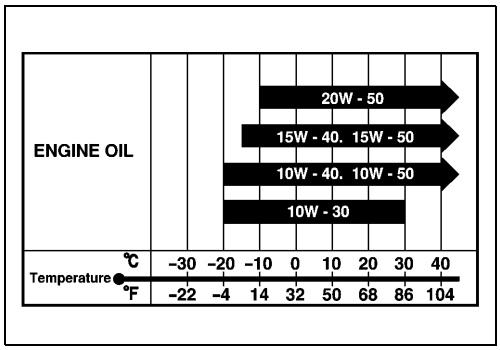
If leaded gasoline is used, engine damage may result. Use only unleaded gasoline.

ENGINE OIL

Use only oils that are rated SE, SF, SG, SH or SJ under the API (American Petroleum Institute) classification system.

The viscosity rating should be SAE 10W-40.

If SAE 10W-40 motor oil is not available, select an alternative according to the chart at right.



ENGINE BREAK-IN

The first 10 hours are critically important to ensure correct running of either a brand new motor or a motor that has been reconditioned or rebuilt. How the motor is operated during this time will have direct bearing on its life span and long-term durability.

Break-in period: 10 hours

WARM-UP RECOMMENDATION

Allow sufficient idling time (more than 5 minutes) for the engine to warm up after cold engine starting.

THROTTLE RECOMMENDATION

NOTE:
Avoid maintaining a constant engine speed for an extended period at any time during the engine break-in by varying the throttle position occasionally.

1. FIRST 2 HOURS
   For first 15 minutes, operate the engine in-gear at idling speed.
   During the remaining 1 hour and 45 minutes, operate the engine in-gear at less than 1/2 (half) throttle (3 000 r/min).

NOTE:
The throttle may be briefly opened beyond the recommended setting to plane the boat, but must be reduced to the recommended setting immediately after planing.

2. NEXT 1 HOUR
   Operate the engine in-gear at less than 3/4 (three-quarter) throttle (4 000 r/min).

3. LAST 7 HOURS
   Operate the engine in-gear at desired engine speed.
   However, do not operate continuously at full throttle for more than 5 minutes.

PROPELLERS

An outboard motor is designed to develop its rated power within a specified engine speed range. The maximum rated power delivered by the DF9.9/15 models are shown below.

Recommended full throttle speed range	**DF9.9**	**4 900 – 5 500 r/min**
	DF15	**5 400 – 6 000 r/min**

If the standard propeller fails to meet the above requirement, use another pitch propeller to hold the engine speed within the range specified above.

Propeller selection chart

Blade × Diam. (in) × Pitch (in)					
3	×	9-1/4	×	7	(M701)
3	×	9-1/4	×	8	(M821)
3	×	9-1/4	×	9	(M901, M911)
3	×	9-1/4	×	10	(M1001, M1011)
3	×	9-1/4	×	11	(M1101)

CAUTION

Installing a propeller with pitch either too high or too low will cause incorrect maximum engine speed, which may result in severe damage to the motor.

*SPECIFICATIONS

*: These specifications are subject to change without notice.

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R
PRE-FIX		00992F			01502F		

DIMENSIONS & WEIGHT

Overall length (front to back)		mm (in)	668 (26.3)					
Overall width (side to side)		mm (in)	323 (12.7)					
Overall height	S	mm (in)	1 093 (43.0)					
	L	mm (in)	1 220 (48.0)					
Weight	S	kg (lbs)	44.0 (97.0)	48.0 (105.6)	47.0 (103.4)	44.0 (97.0)	48.0 (105.6)	47.0 (103.4)
	L	kg (lbs)	45.0 (99.2)	49.0 (107.8)	48.0 (105.6)	45.0 (99.2)	49.0 (107.8)	48.0 (105.6)
Transom height [Trim position: 3]	S	mm (in. type)	422 (15)					
	L	mm (in. type)	549 (20)					

PERFORMANCE

Maximum output	kW (PS)	7.3 (9.9)	11.0 (15)
Recommended operating range	r/min	4 900 – 5 500	5 400 – 6 000
Idle speed	r/min	900 ± 50	
In-gear idle speed	r/min	Approx. 820 – 920	

POWER HEAD

Engine type		4-stroke SOHC				
Number of cylinders		2				
Bore	mm (in)	58.0 (2.28)				
Stroke	mm (in)	57.0 (2.24)				
Total displacement	cm^3 (cu. in)	302 (18.4)				
Compression ratio	:1	9.0				
Spark plug	NGK	BKR6E				
Ignition system		SUZUKI PEI (Digital CDI)				
Fuel supply system		Carburetor (Number of carb.: 1)				
Exhaust system		Through prop exhaust				
Cooling system		Water cooled				
Lubrication system		Wet sump by trochoid pump				
Starting system		Manual	Electric		Manual	Electric
Choke system (Enrichener system)		Manual		Automatic	Manual	Automatic
Throttle control		Twist grip		Remote control	Twist grip	Remote control

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

FUEL & OIL

Fuel		Suzuki highly recommends that you use alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2+M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.
Engine oil		API classification SE, SF, SG, SH, SJ Viscosity rating SAE 10W-40
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Gear oil		SUZUKI Outboard Motor Gear Oil (SAE #90 hypoid gear oil)
Gearcase oil amounts	ml (US/Imp. oz)	170 (5.7/6.0)

BRACKET

Trim angle	Degrees	4 – 20
Number of tilt pin position		5
Maximum tilt angle	Degrees	67

LOWER UNIT

Reversing system	Gear
Transmission	Forward-Neutral-Reverse
Reduction system	Bevel gear
Gear ratio	12 : 25 (2.083)
Drive line impact protection	Spline drive rubber hub
Propeller	Blade × Diam. (in) × Pitch (in)
	3 × 9-1/4 × 7 3 × 9-1/4 × 8 3 × 9-1/4 × 9 3 × 9-1/4 × 10 3 × 9-1/4 × 11

*SERVICE DATA

*: These service data are subject to change without notice.

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

POWERHEAD

Recommended operation range	r/min	4 900 – 5 500	5 400 – 6 000
Idle speed	r/min	900 ± 50 (in-gear: approx. 820 – 920)	
**Cylinder compression	kPa (kg/cm², psi)	550 – 850 (5.5 – 8.5, 78 – 120): With decompression system: DF9.9/15 820 – 1230 (8.2 – 12.3, 116 – 175): Without decompression system: DF9.9E/R, DF15E/R {Crank with recoil starter}	
**Oil pressure [Oil temp. at 60 °C (140 °F)]	kPa (kg/cm², psi)	Min. 200 (2.0, 28) Max. 500 (5.0, 71) at 3 000 r/min	
Engine oil		API classification SE, SF, SG, SH, SJ Viscosity rating SAE 10W-40	
Engine oil amount	L (US/lpm. qt))	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change	
Thermostat operating temperature	°C (°F)	58 – 62 (136 – 144)	

** Figures shown are guidelines only, not absolute service limit.

CYLINDER HEAD/CAMSHAFT

Cylinder head distortion		Limit	mm (in)	0.05 (0.002)
Cam height	IN	STD	mm (in)	23.394 – 23.454 (0.9210 – 0.9234)
		Limit	mm (in)	23.294 (0.9171)
	EX	STD	mm (in)	23.397 – 23.457 (0.9211 – 0.9235)
		Limit	mm (in)	23.297 (0.9172)
Camshaft journal oil clearance		STD	mm (in)	0.020 – 0.062 (0.0008 – 0.0024)
		Limit	mm (in)	0.100 (0.0039)
Camshaft holder inside diameter	Upper	STD	mm (in)	25.000 – 25.021 (0.9843 – 0.9851)
	Lower	STD	mm (in)	23.000 – 23.021 (0.9055 – 0.9063)
Camshaft journal outside diameter	Upper	STD	mm (in)	24.959 – 24.980 (0.9826 – 0.9835)
	Lower	STD	mm (in)	22.959 – 22.980 (0.9039 – 0.9047)
Rocker arm shaft to rocker arm clearance		STD	mm (in)	0.016 – 0.045 (0.0006 – 0.0018)
		Limit	mm (in)	0.060 (0.0024)
Rocker arm inside diameter		STD	mm (in)	13.000 – 13.018 (0.5118 – 0.5125)
Rocker arm shaft outside diameter		STD	mm (in)	12.973 – 12.984 (0.5107 – 0.5112)

Item			Unit	Data					
				DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

VALVE/VALVE GUIDE

Valve diameter	IN	STD	mm (in)	26 (1.0)
	EX	STD	mm (in)	22 (0.9)
Valve clearance (cold engine condition)	IN	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
	EX	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
Valve guide to valve stem clearance	IN	STD	mm (in)	0.010 – 0.037 (0.0004 – 0.0015)
		Limit	mm (in)	0.070 (0.0028)
	EX	STD	mm (in)	0.035 – 0.062 (0.0014 – 0.0024)
		Limit	mm (in)	0.090 (0.0035)
Valve guide inside diameter	IN	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
	EX	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
Valve stem outside diameter	IN	STD	mm (in)	5.475 – 5.490 (0.2156 – 0.2161)
	EX	STD	mm (in)	5.450 – 5.465 (0.2146 – 0.2152)
Valve guide protrusion	IN	STD	mm (in)	10.0 (0.39)
	EX	STD	mm (in)	10.0 (0.39)
Valve stem deflection	IN	Limit	mm (in)	0.16 (0.006)
	EX	Limit	mm (in)	0.16 (0.006)
Valve stem runout	IN	Limit	mm (in)	0.05 (0.002)
	EX	Limit	mm (in)	0.05 (0.002)
Valve head radial runout	IN	Limit	mm (in)	0.03 (0.001)
	EX	Limit	mm (in)	0.03 (0.001)
Valve head thickness	IN	Limit	mm (in)	0.5 (0.02)
	EX	Limit	mm (in)	0.5 (0.02)
Valve seat contact width	IN	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
	EX	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
Valve spring free length		STD	mm (in)	32.52 (1.280)
		Limit	mm (in)	32.40 (1.276)
Valve spring tension		STD	N (kg, lbs)	90 (9.0, 19.8) for 28.5 mm (1.12 in)
		Limit	N (kg, lbs)	76 (7.6, 16.8) for 28.5 mm (1.12 in)

Item			Unit	Data					
				DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

CYLINDER/PISTON/PISTON RING

Cylinder distortion		Limit	mm (in)	0.05 (0.002)
Piston to cylinder clearance		STD	mm (in)	0.0276 – 0.0425 (0.0011 – 0.0017)
		Limit	mm (in)	0.100 (0.0039)
Cylinder bore		STD	mm (in)	58.000 – 58.015 (2.2835 – 2.2841)
Cylinder measuring position			mm (in)	50 (2.0) from cylinder top surface
Piston skirt diameter		STD	mm (in)	57.965 – 57.980 (2.2821 – 2.2827)
Piston measuring position			mm (in)	15 (0.6) from piston skirt end
Wear on cylinder bore		Limit	mm (in)	0.055 (0.0022)
Piston ring end gap	1st	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
	2nd	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
Piston ring free end gap	1st	STD	mm (in)	Approx. 5.8 (0.23)
		Limit	mm (in)	4.6 (0.18)
	2nd	STD	mm (in)	Approx. 7.4 (0.29)
		Limit	mm (in)	5.9 (0.23)
Piston ring to groove clearance	1st	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
	2nd	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
Piston ring groove width	1st	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	2nd	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	Oil	STD	mm (in)	2.51 – 2.53 (0.099 – 0.100)
Piston ring thickness	1st	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
	2nd	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
Pin clearance in piston pin hole		STD	mm (in)	0.002 – 0.013 (0.0001 – 0.0005)
		Limit	mm (in)	0.040 (0.0016)
Piston pin outside diameter		STD	mm (in)	13.995 – 14.000 (0.5510 – 0.5512)
		Limit	mm (in)	13.980 (0.5504)
Piston pin hole diameter		STD	mm (in)	14.002 – 14.008 (0.5513 – 0.5515)
		Limit	mm (in)	14.030 (0.5524)

Item		Unit	Data					
			DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R
CRANKSHAFT/CONROD								
Conrod small end inside diameter	STD	mm (in)	14.006 – 14.014 (0.5514 – 0.5517)					
	Limit	mm (in)	14.040 (0.5528)					
Conrod big end oil clearance	STD	mm (in)	0.025 – 0.045 (0.0010 – 0.0018)					
	Limit	mm (in)	0.063 (0.0025)					
Conrod big end inside diameter	STD	mm (in)	29.025 – 29.034 (1.1427 – 1.1431)					
Crank pin outside diameter	STD	mm (in)	28.989 – 29.000 (1.1413 – 1.1417)					
Crank pin outside diameter difference	Limit	mm (in)	0.010 (0.0004)					
Conrod big end side clearance	STD	mm (in)	0.10 – 0.20 (0.004 – 0.008)					
	Limit	mm (in)	0.60 (0.024)					
Conrod big end width	STD	mm (in)	19.95 – 20.00 (0.785 – 0.787)					
Crank pin width	STD	mm (in)	20.10 – 20.15 (0.791 – 0.793)					
Crankshaft thrust clearance	Limit	mm (in)	0.60 (0.024)					
Crankshaft length	STD	mm (in)	126.8 – 126.9 (4.992 – 4.996)					
Crankcase length	STD	mm (in)	127.0 – 127.1 (5.000 – 5.004)					
Crankshaft journal oil clearance	STD	mm (in)	0.020 – 0.047 (0.0008 – 0.0019)					
	Limit	mm (in)	0.060 (0.0024)					
Crankshaft bearing holder inside diameter	STD	mm (in)	35.000 – 35.016 (1.3780 – 1.3786)					
Crankshaft journal outside diameter	STD	mm (in)	31.989 – 32.000 (1.2594 – 1.2598)					
Crankshaft journal outside diameter difference	Limit	mm (in)	0.010 (0.0004)					
Crankshaft bearing thickness	STD	mm (in)	1.486 – 1.494 (0.0585 – 0.0588)					

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

LOWER UNIT

Gearcase oil amounts	ml (US/Imp.oz)	170 (5.7/6.0)
Gear ratio		2.08 (12 : 25)

Preliminary gear shim & thrust washer

Pinion back up shim	mm (in)	1.0 (0.04)
Forward back up shim	mm (in)	1.0 (0.04)
Reverse back up shim	mm (in)	1.0 (0.04)
Forward thrust washer	mm (in)	1.5 (0.06)
Reverse thrust washer	mm (in)	1.5 (0.06)

Initial selection-shim adjustment may be required.

CARBURETOR

Type	KEIHIN	BCMII 23-11.5		BCMII 25-21	
I.D. mark		94J2	94J3	94J6	94J7
Main jet	#	70		115	
Pilot jet	#	38		40	
Pilot screw	Turns open	PRE-SET (1-7/8 ± 1/2)		PRE-SET (2-7/8 ± 1/2)	
Float height	mm	13.5 ± 2		13.5 ± 2	

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

ELECTRICAL

Ignition timing		Degrees	ATDC 5 – BTDC 30
Over revolution limiter		r/min	Approx. 6 500
Condenser charge coil resistance		Ω at 20 °C	12.5 – 18.8 [G – B/R]
Pulser coil resistance		Ω at 20 °C	148 – 222 [R/B – B]
Ignition coil resistance (without spark plug cap)	Primary	Ω at 20 °C	0.2 – 0.4 [O – B]
	Secondary	kΩ at 20 °C	6.8 – 10.2 [H.T. cord – H.T. cord]
Spark plug cap resistance		kΩ at 20 °C	8 – 12
Battery charge coil resistance		Ω at 20 °C	0.9 – 1.3 (DF9.9E/15E, DF9.9/15) [R – Y] 0.3 – 0.4 (DF9.9R/15R)
Battery charge coil output (12V)		Watt	80: Tiller handle model 120: Remote control model
Standard spark plug	Type	NGK	BKR6E
	Gap	mm (in)	0.7 – 0.8 (0.028 – 0.031)
Fuse amp rating		A	20: Electric start model
Recommended battery capacity (12V)		Ah (kC)	35 (126) or over: Electric start model
Starter motor relay coil resistance		Ω at 20 °C	145 – 190: Electric start model

STARTER MOTOR (only for Electric start model)

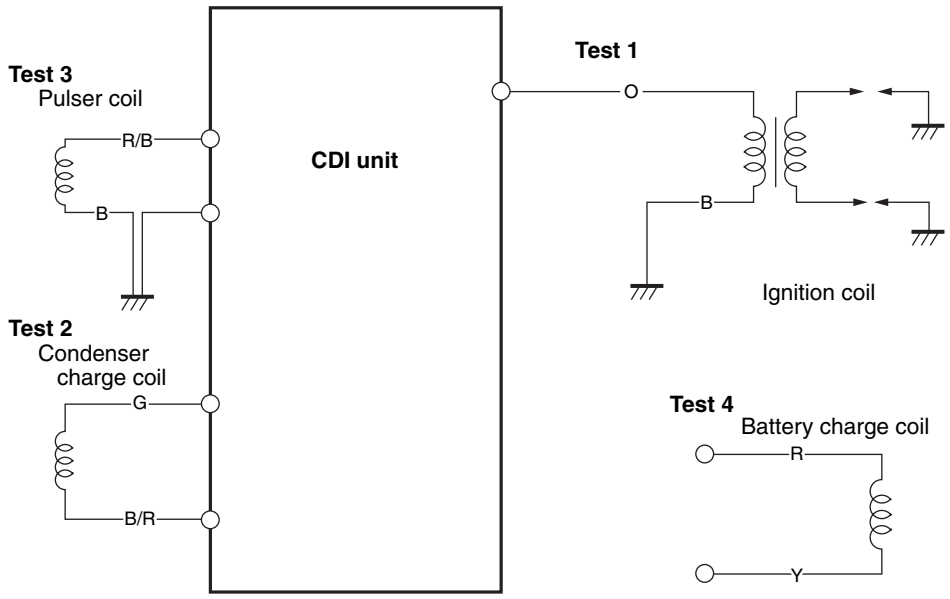
Max. continuous time of use		Sec.	30
Motor output		kW	1.4
Brush length	STD	mm (in)	15.5 (0.61)
	Limit	mm (in)	9.5 (0.37)
Commutator undercut	STD	mm (in)	0.5 – 0.8 (0.02 – 0.03)
	Limit	mm (in)	0.2 (0.01)
Commutator outside diameter	STD	mm (in)	29.0 (1.14)
	Limit	mm (in)	28.0 (1.10)
Commutator outside diameter difference	STD	mm (in)	0.05 (0.002)
	Limit	mm (in)	0.40 (0.016)

PEAK VOLTAGE

Requirements for peak voltage measurement

- Remove all spark plugs to eliminate the variables at cranking speed.
- Crank with recoil starter.
- Use a STEVENS peak voltage tester, Model CD-77.
- Use the 6-pin connector test cord (Part No. 09930-89920).

Testing sequence		Tester probe connection		Peak voltage	Tester range	Remarks
		⊕ (Red)	⊖ (Black)			
1	CDI output	Orange	Black	128 V or over	NEG 500	• With ignition coil connected • Use the 6-pin connector test cord.
2	Condenser charge coil output	Green	Black/Red	15 V or over	POS 50	With CDI unit disconnected
3	Pulser coil output	Red/Black	Black (Ground)	0.8 V or over	SEN 5	
4	Battery charge coil output	Red	Yellow	5.6 V or over	POS 50	With rectifier disconnected



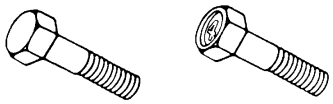
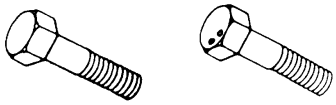
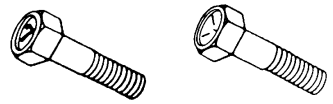
TIGHTENING TORQUE

Tightening torque – Important fasteners

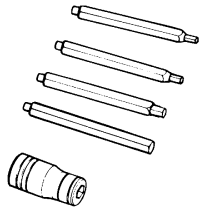
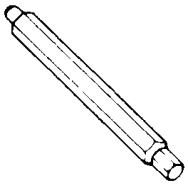
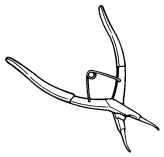
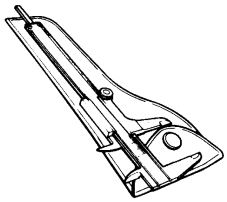
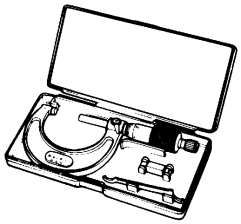
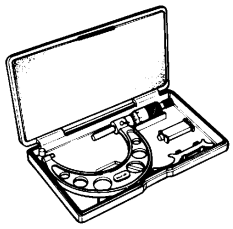
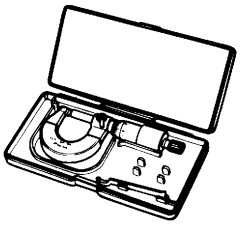
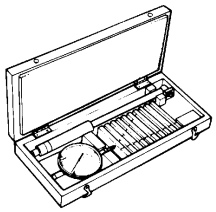
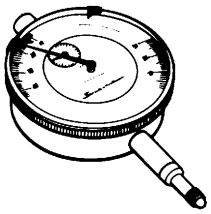
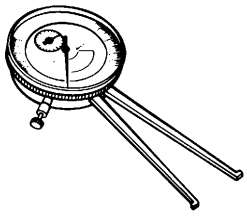
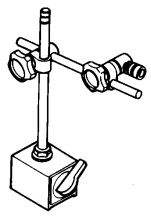
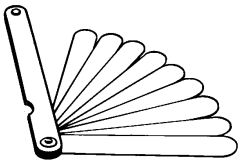
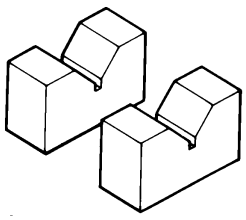
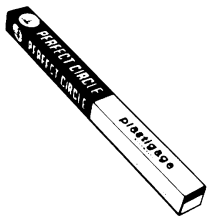
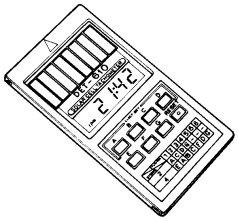
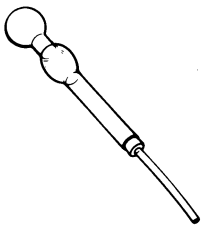
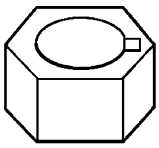
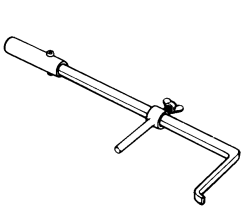
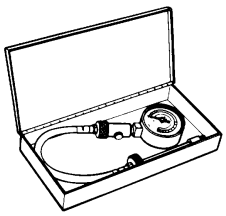
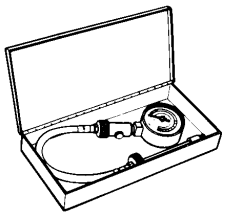
ITEM	THREAD DIAM.	TIGHTENING TORQUE		
		N·m	kg-m	lb-ft
Cylinder head cover bolt	6 mm	10	1.0	7.0
Cylinder head bolt	8 mm	27	2.7	20.0
Crankcase bolt	6 mm	14	1.4	10.0
	8 mm	25	2.5	18.0
Conrod cap bolt	7 mm	12	1.2	8.5
Oil pump bolt	6 mm	14	1.4	10.0
Oil pump gallery bolt	6 mm	14	1.4	10.0
Intake manifold bolt	8 mm	23	2.3	16.5
Carburetor mounting bolt	6 mm	10	1.0	7.0
Fuel pump bolt	6 mm	10	1.0	7.0
Thermostat cover bolt	6 mm	10	1.0	7.0
Valve adjusting lock nut	5 mm	11	1.1	8.0
Timing pulley nut	26 mm	50	5.0	36.0
Flywheel nut	14 mm	80	8.0	58.0
Spark plug	—	27	2.7	19.5
Power unit mounting bolt and nut	8 mm	23	2.3	16.5
Driveshaft housing bolt	8 mm	23	2.3	16.5
Oil pressure switch	—	13	1.3	9.5
Oil regulator	14 mm	27	2.7	19.5
Camshaft pulley bolt	6 mm	10	1.0	7.0
Engine oil drain plug	12 mm	13	1.3	9.5
Upper mount bolt	8 mm	23	2.3	16.5
Upper mount bracket bolt	8 mm	23	2.3	16.5
Lower mount cover bolt	8 mm	23	2.3	16.5
Lower mount bolt	8 mm	23	2.3	16.5
Clamp bracket shaft nut	7/8-14 UNF	43	4.3	31.0
Shallow drive arm bolt	10 mm	25	2.5	18.0
Tiller handle cover bolt	8 mm	17	1.7	12.5
Water pump case bolt	8 mm	18	1.8	13.0
Gearcase bolt	8 mm	23	2.3	16.5
Propeller nut	12 mm	18	1.8	13.0
Propeller shaft bearing housing bolt	6 mm	8	0.8	6.0

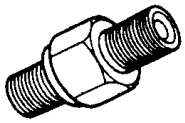
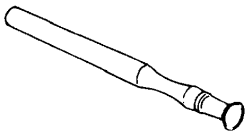
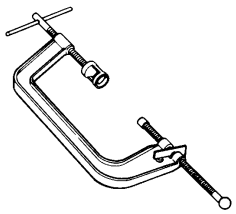
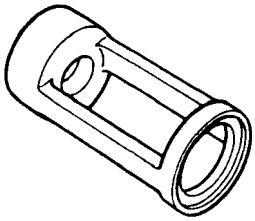
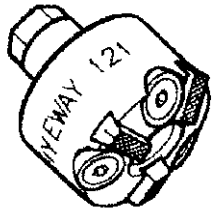
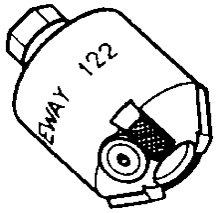
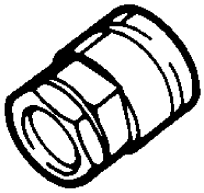
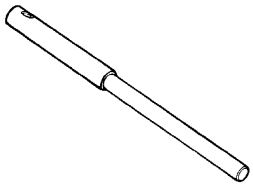
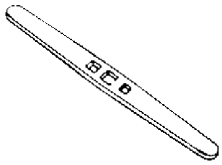
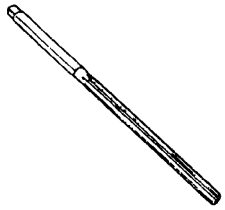
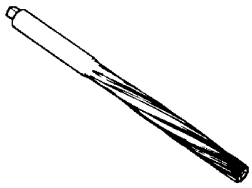
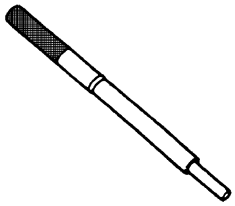
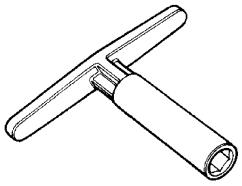
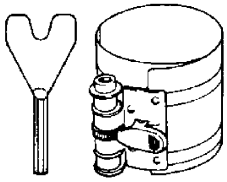
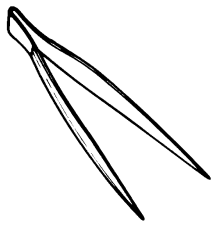
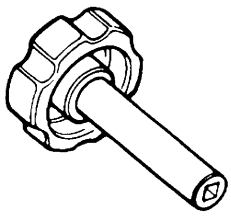
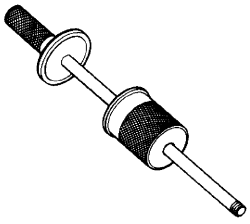
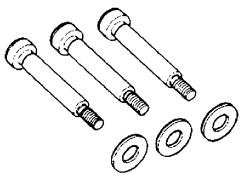
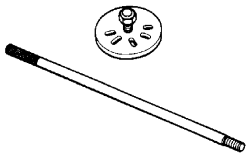
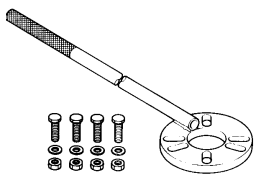
Tightening torque – General bolt

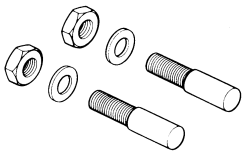
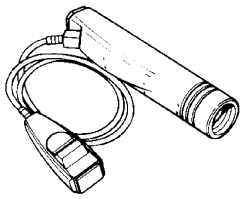
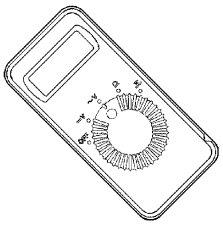
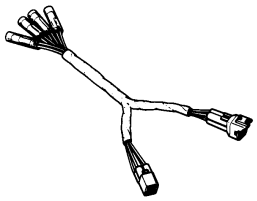
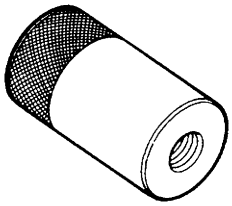
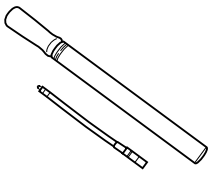
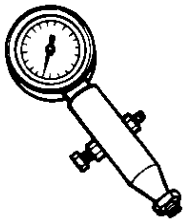
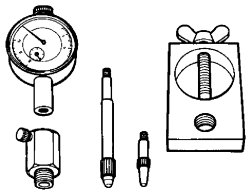
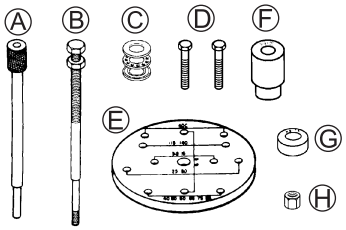
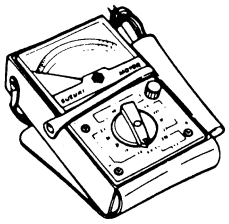
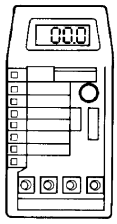
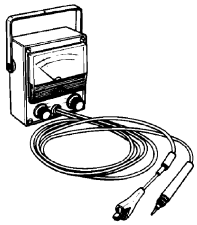
NOTE:
These value are only applicable when torque for a general bolt is not listed in the "Important Fasteners" table.

TYPE OF BOLT	THREAD DIAMETER	TIGHTENING TORQUE		
		N·m	kg-m	lb-ft
 (Conventional or "4" marked bolt)	5 mm	2 – 4	0.2 – 0.4	1.5 – 3.0
	6 mm	4 – 7	0.4 – 0.7	3.0 – 5.0
	8 mm	10 – 16	1.0 – 1.6	7.0 – 11.5
	10 mm	22 – 35	2.2 – 3.5	16.0 – 25.5
 (Stainless steel bolt)	5 mm	2 – 4	0.2 – 0.4	1.5 – 3.0
	6 mm	6 – 10	0.6 – 1.0	4.5 – 7.0
	8 mm	15 – 20	1.5 – 2.0	11.0 – 14.5
	10 mm	34 – 41	3.4 – 4.1	24.5 – 29.5
 (7 marked or  marked bolt)	5 mm	3 – 6	0.3 – 0.6	2.0 – 4.5
	6 mm	8 – 12	0.8 – 1.2	6.0 – 8.5
	8 mm	18 – 28	1.8 – 2.8	13.0 – 20.0
	10 mm	40 – 60	4.0 – 6.0	29.0 – 43.5

SPECIAL TOOLS

1.  09900-00410 Hexagon wrench set	2.  09900-00413 (5 mm) 09900-00414 (6 mm) 09900-00415 (8 mm) Hexagon bit (included in 09900-00410)	3.  09900-06108 Snap ring pliers	4.  09900-20101 (150 mm) 09900-20102 (200 mm) Vernier calipers	5.  09900-20202 Micrometer (25 – 50 mm)
6.  09900-20203 Micrometer (50 – 75 mm)	7.  09900-20205 Micrometer (0 – 25 mm)	8.  09900-20530 Cylinder gauge set (40 – 100 mm)	9.  09900-20602 Dial gauge	10.  09900-20605 Dial calipers (10 – 34 mm)
11.  09900-20701 Magnetic stand	12.  09900-20803 Thickness gauge	13.  09900-21304 Steel “V” block set	14.  09900-22301 Plastigage (0.025 – 0.076 mm)	15.  09900-26006 Engine tachometer
16.  09900-28403 Hydrometer	17.  09911-49310 Crankshaft holder	18.  09913-50121 Oil seal remover	19.  09915-64512 Compression gauge	20.  09915-77311 Oil pressure gauge

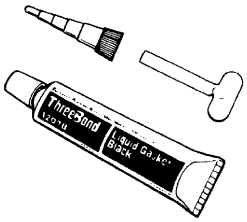
21.  **09915-78211** **Oil pressure gauge adapter**	**22.**  **09916-10911** **Valve lapper**	**23.**  **09916-14510** **Valve lifter**	**24.**  **09916-14521** **Valve lifter attachment**	**25.**  **09916-20610** **Valve seat cutter (15°) (N-121)**
26.  **09916-20620** **Valve seat cutter (45°) (N-122)**	**27.**  **09916-24440** **Handle adapter (N-503-1)**	**28.**  **09916-24450** **Solid pilot (N-100-5.52)**	**29.**  **09916-34542** **Valve guide reamer handle**	**30.**  **09916-34550** **Valve guide reamer (ϕ 5.5 mm)**
31.  **09916-38210** **Valve guide reamer (ϕ 11 mm)**	**32.**  **09916-44910** **Valve guide remover/installer**	**33.**  **09916-54910** **Handle (N-505)**	**34.**  **09916-77310** **Piston ring compressor**	**35.**  **09916-84511** **Tweezers**
36.  **09917-14910** **Valve adjuster driver**	**37.**  **09930-30104** **Sliding hammer**	**38.**  **09930-39210** **Flywheel remover attachment bolt**	**39.**  **09930-39411** **Flywheel remover**	**40.**  **09930-48720** **Flywheel holder**

41.  **09930-49210** **Flywheel holder attachment**	**42.**  **09930-76420** **Timing light**	**43.**  **09930-99320** **Digital tester**	**44.**  **09930-89920** **6-pin connector test cord**	**45.**  **09950-59320** **Propeller shaft remover**
46.  **09952-99310** **hand air pump**	**47.**  **09950-69512** **Gearcase oil leakage tester**	**48.**  **09951-09530** **Gear adjusting gauge**	**49.**  **Pinion bearing installer and remover** **09951-59910 Pinion bearing installer shaft Ⓐ** **09951-49910 Pinion bearing remover shaft Ⓑ** **09951-69910 Bearing Ⓒ** **01500-08403 Bolt Ⓓ** **09951-39914 Pinion bearing plate Ⓔ** **09951-19311 Attachment Ⓕ** **09951-79311 Spacer Ⓖ** **09951-29910 Nut Ⓗ**	
50.  **09900-25010** **Pocket tester**	**51.**  **99954-53008-820*** **Digital voltmeter**	**52.**  **99954-53873*** **Stevens CD-77** **Peak reading voltmeter**	**53.**  **99954-53883*** **Gear oil filler**	

NOTE:

** Marked part No. is in U.S. market only.*

MATERIALS REQUIRED

SUZUKI OUTBOARD MOTOR GEAR OIL  **99000-22540** **(400 ml × 24 pcs.)**	**SUZUKI SUPER GREASE "A"**  **99000-25030*** **99000-25011** **(500 g)**	**WATER RESISTANT GREASE**  **99000-25161** **(250 g)**	**SUZUKI SILICONE SEAL**  **99000-31120** **(50 g)**	**SUZUKI BOND "1207B"**  **99104-33140*** **99000-31140** **(100 g)**
THREAD LOCK "1342"  **99000-32050** **(50 g)**	**THREAD LOCK SUPER "1333B"**  **99000-32020** **(50 g)**	**4-Stroke Motor Oil** **API: SE, SF, SG, SH, SJ** **SAE: 10W-40**		

NOTE:
** Marked part No. is in U.S. market only.*

PERIODIC MAINTENANCE

2

CONTENTS

PERIODIC MAINTENANCE SCHEDULE

The chart below lists the recommended intervals for all the required periodic service work necessary to keep the motor operating at peak performance and economy.
Maintenance intervals should be judged by number of hours or months, whichever comes first.

NOTE:
More frequent servicing should be performed on outboard motors that are used under severe conditions.

PERIODIC MAINTENANCE CHART

Interval / Item to be serviced	Initial 20 hrs. or 1 month	Every 50 hrs. or 3 months	Every 100 hrs. or 6 months	Every 200 hrs. or 12 months
Spark plug	—	—	I	R
Breather Hose and Fuel line	I	I	I	I
	Replace every 2 years.			
Engine oil	R	—	R	R
Gear oil	R	—	R	R
Lubrication	—	I	I	I
Anodes and bonding wire	—	I	I	I
Battery	—	I	I	I
Bolts and nuts	T	—	T	T
Engine oil filter	R	—	—	R
Fuel filter	—	I	I	I
	Replace every 400 hours or 2 years.			
Valve clearance	I	—	—	I
Timing belt	—	—	—	I
	Replace every 4 years.			
Carburetor	I	—	I	I
Propeller nut and pin	I	—	I	I
Water pump	—	—	—	I
Water pump impeller	—	—	—	R
Idle speed	I	—	—	I
Ignition timing	—	—	—	I

I: Inspect and clean, adjust, lubricate or replace, if necessary **T:** Tighten **R:** Replace

MAINTENANCE AND TUNE-UP PROCEDURES

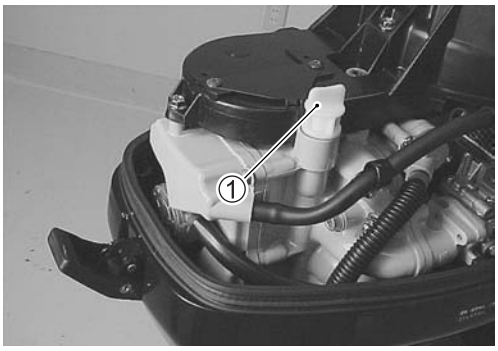
This section describes servicing procedures for each periodic maintenance requirement.

ENGINE OIL

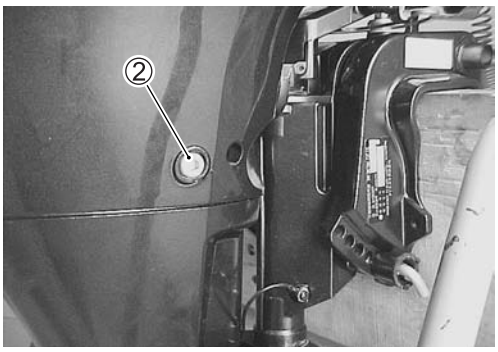
Change initially after 20 hours (1 month) and every 100 hours (6 months).

NOTE:
Engine oil should be changed while engine is warm.

1. Place outboard motor upright on a level surface.
2. Remove the motor cover.
3. Remove the oil filler cap ①.



4. Place a container under engine oil drain plug ②, then remove engine oil drain plug and gasket to drain engine oil.

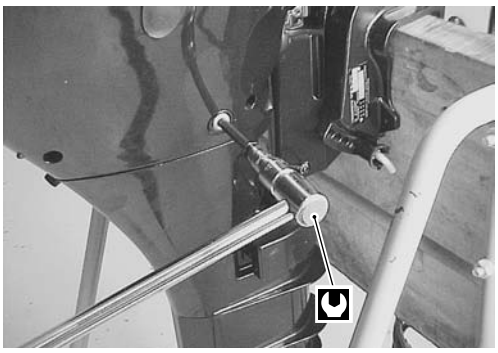


5. Install new gasket and oil drain plug.
   Tighten engine oil drain plug to specified torque.

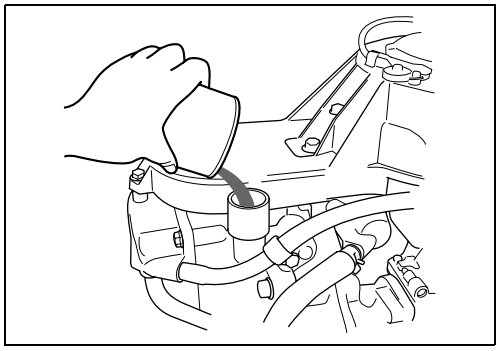
Engine oil drain plug: 13 N·m (1.3 kg-m, 9.5 lb-ft)

CAUTION

Do not re-use gasket once removed. Always use a new gasket.



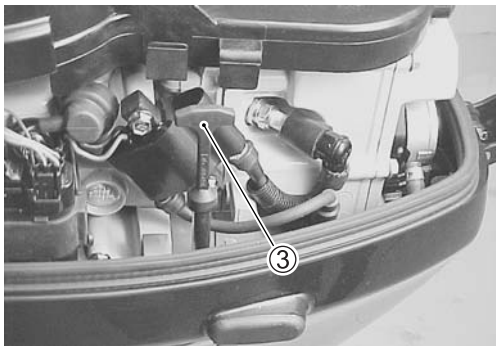
6. Pour recommended engine oil into oil filler opening, then install the oil filler cap.



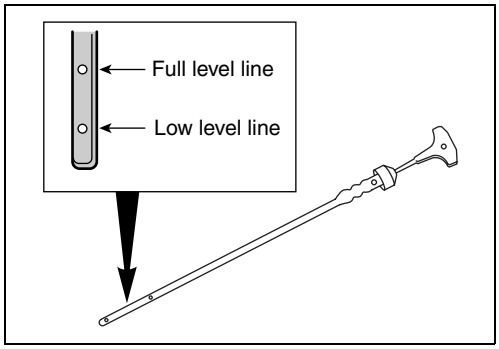
Necessary engine oil amount:
Oil change only: 1.0 L (1.1/0.9 US/Imp. qt)
Oil filter change: 1.1 L (1.2/1.0 US/Imp. qt)

Recommended oil:
- **4 stroke motor oil**
- **API classification SE, SF, SG, SH, SJ**
- **Viscosity rating SAE 10W-40**

7. Start the engine and allow it to run for several minutes at idle speed.
   Turn off engine and wait for approx. two minutes.
8. Remove the oil level dipstick ③ and wipe it clean.
9. Reinsert the dipstick fully into the dipstick tube, then remove to check oil level.



10. Oil level should be between full level Max. mark (hole) and low level Min. mark (hole).
    If level is low, add recommended oil to full level hole (Max).



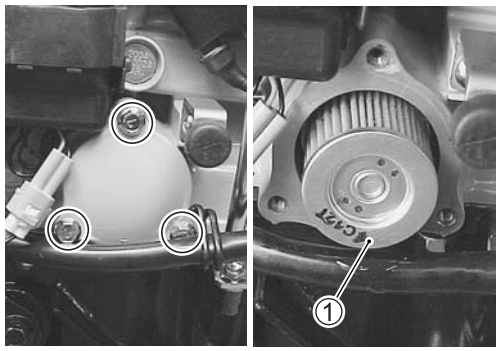
ENGINE OIL FILTER

Replace initially after 20 hours (1 month) and every 200 hours (12 months).

NOTE:
When replacing engine oil filter, change engine oil at the same time. (For oil change, see pages 2-3 and 2-4.)

Necessary engine oil amounts:
Oil filter change: 1.1 L (1.2/1.0 US/Imp. qt)

1. Remove the motor cover.
2. Remove the side covers.
3. Remove the three (3) bolts securing the oil filter cap.
4. Remove the oil filter ①.

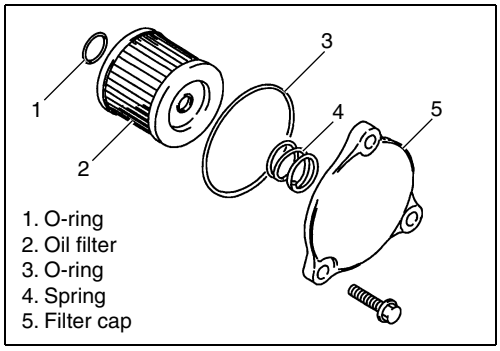


5. Assembly is reverse order of disassembly.

CAUTION

Do not re-use the O-rings once removed. Always use a new O-ring.

6. Start engine and allow it to run for several minutes at idle speed. Check that there are no leaks around filter cap.
7. Turn off engine, then recheck engine oil level.

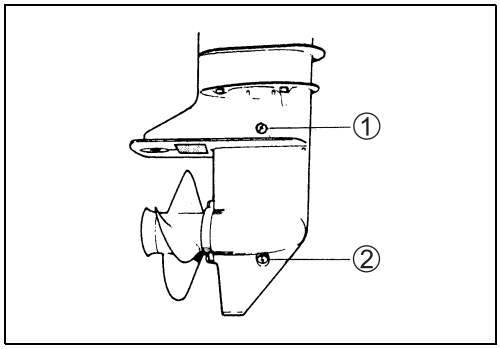


1. O-ring
2. Oil filter
3. O-ring
4. Spring
5. Filter cap

GEAR OIL

Change initially after 20 hours (1 month) and every 100 hours (6 months).

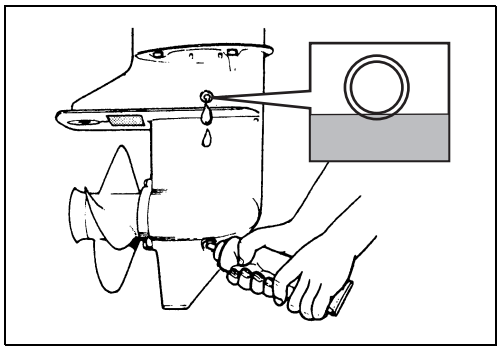
1. Place the outboard motor upright on a level surface.
2. Place a container under the lower unit.
3. Remove lower gear oil drain plug ② first, then remove gear oil level plug ① and drain gear oil.



4. Fill with recommended gear oil through oil drain hole until oil just starts to flow out from oil level hole.

   Gear oil amounts: 170 ml (5.7/6.0 US/Imp. oz)

   Recommended oil:
   SUZUKI OUTBOARD MOTOR GEAR OIL or
   SAE #90 HYPOID GEAR OIL



5. Install oil level plug before removing oil filler tube from drain hole.
6. Install oil drain plug.

CAUTION

Do not re-use gasket once removed. Always use a new gasket.

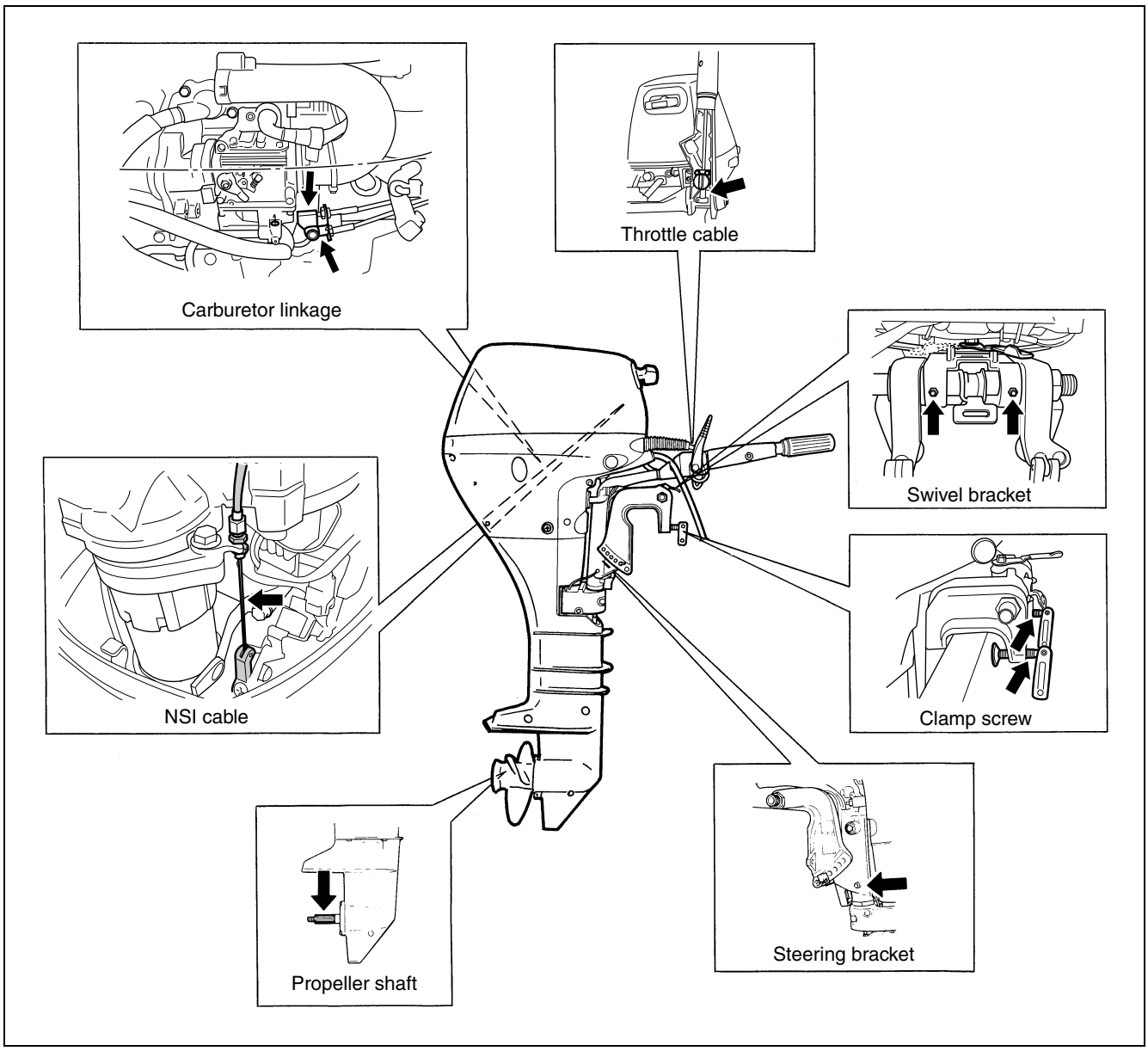
NOTE:
To avoid a possible low gear oil level, recheck gear oil level 10 minutes after doing procedure in step 6. If oil level is low, add additional gear oil until level is correct.

LUBRICATION

Inspect every 50 hours (3 months).

Apply SUZUKI Water Resistant Grease to the following points.

W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE



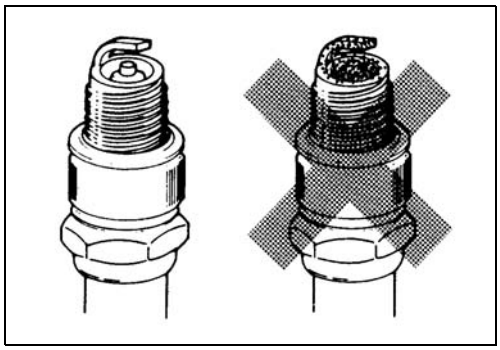
SPARK PLUG

- **Inspect every 100 hours (6 months).**
- **Replace every 200 hours (12 months).**

Standard spark plug: NGK BKR6E

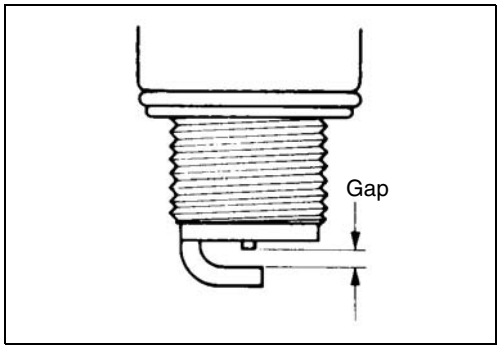
CAUTION

Only resistor (R) type spark plugs must be used with this engine. Using a non-resistor spark plug will cause ignition system malfunctions.



CARBON DEPOSIT

Inspect for a carbon deposit on spark plug base.
If carbon is present, remove it with a spark plug cleaning machine or by carefully using a pointed tool.

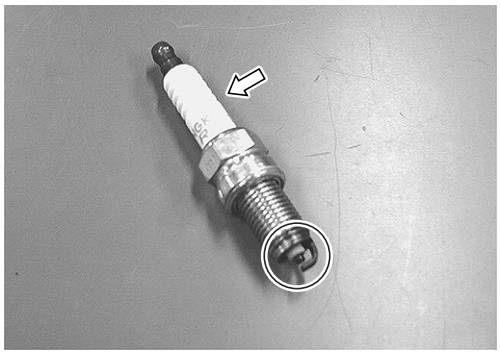


SPARK PLUG GAP

Measure spark plug gap with a thickness gauge.
Adjust to within specified range if gap is out of specification.

Spark plug gap: 0.7 – 0.8 mm (0.028 – 0.031 in)

TOOL 09900-20803: Thickness gauge

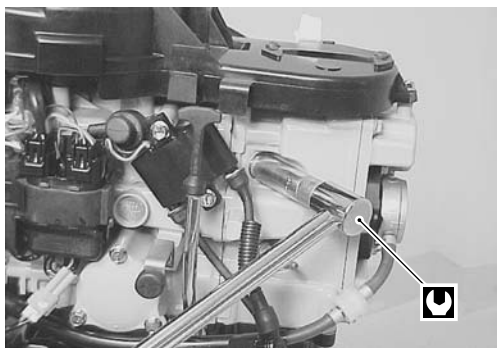


CONDITION OF ELECTRODE/INSULATOR

Check the electrode and insulator condition.
If the electrode is extremely worn or burnt, replace the spark plug.
If the spark plug has a broken insulator, damaged threads, etc., replace the spark plug.

CAUTION

Confirm the thread size and reach when replacing the plug. If the reach is too short, carbon will be deposited on the threaded portion of the plug hole resulting in possible engine damage.

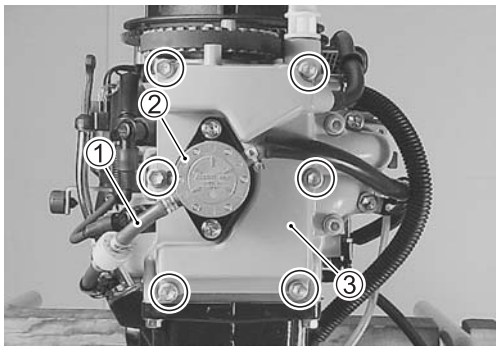


Spark plug: 27 N·m (2.7 kg-m, 20.0 lb-ft)

VALVE CLEARANCE

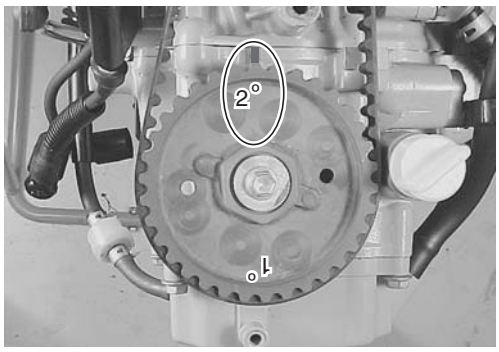
Inspect initially after 20 hours (1 month) and every 200 hours (12 months).

1. Remove following parts:
   - Motor cover
   - Side covers
   - Recoil starter
   - Spark plugs
2. Disconnect the fuel hose ① from fuel pump ②.
3. Remove the six bolts and cylinder head cover ③.



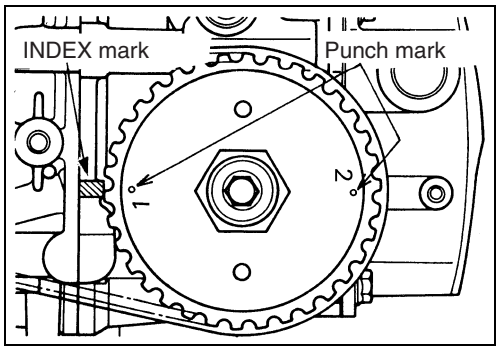
4. Rotate the flywheel clockwise to bring each piston to Top Dead Center (TDC) on compression stroke. Align each PUNCH mark on cam pulley with INDEX mark on cylinder head block.

PUNCH mark	TDC cylinder number
1	No. 1 cylinder
2	No. 2 cylinder



CAUTION

Rotate the crankshaft in the normal running direction only (clockwise) to prevent water pump impeller damage.



NOTE:

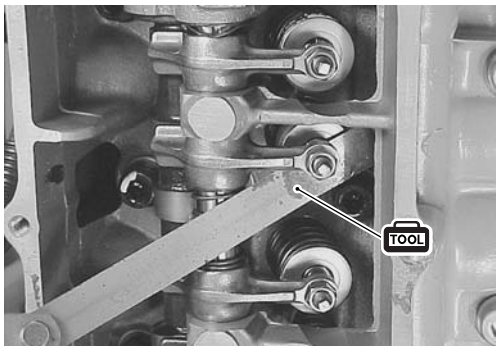
- *The piston must be at its TDC position on a compression stroke to check or adjust valve clearance.*
- *The valve clearance specification is for COLD engine condition.*

5. Insert the thickness gauge between valve stem end and valve adjusting screw on rocker arm.

TOOL 09900-20803: Thickness gauge

Valve clearance (cold engine condition):
IN. 0.18 – 0.22 mm (0.007 – 0.009 in)
EX. 0.18 – 0.22 mm (0.007 – 0.009 in)

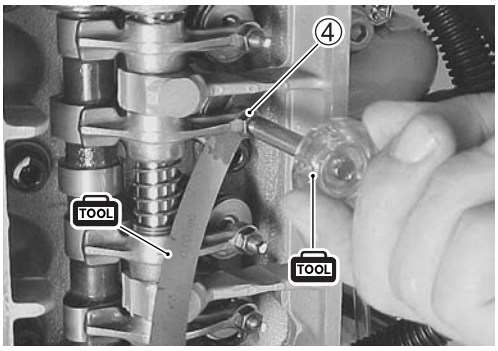
If measurement is out of specification, adjust valve clearance.



ADJUSTMENT

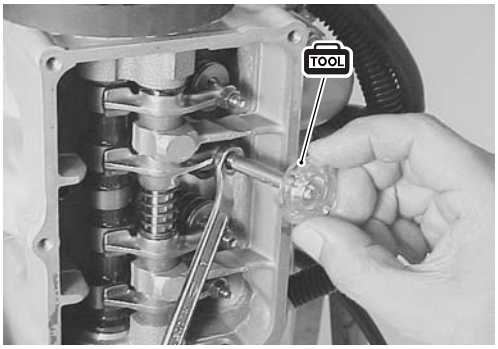
6. Loosen valve adjusting lock nut ④.
7. Turn valve adjusting screw using the valve adjustment driver to bring valve clearance to within specification.

TOOL 09900-20803: Thickness gauge
09917-14910: Valve adjustment driver



8. Tighten valve adjusting lock nut while holding valve adjusting screw.

Valve adjusting lock nut: 11 N·m (1.1 kg-m, 8.0 lb-ft)

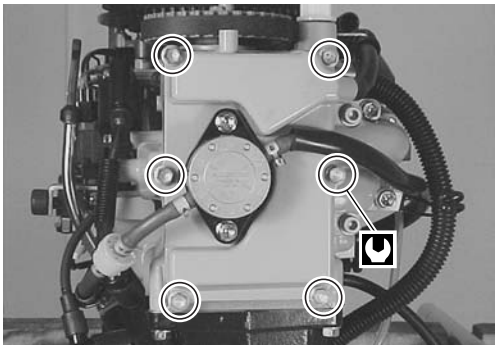


9. Recheck valve clearance.
10. Tighten the cylinder head cover bolts to specified torque.

Cylinder head cover bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)

CAUTION

Do not re-use gasket once removed. Always use a new gasket.



Checking

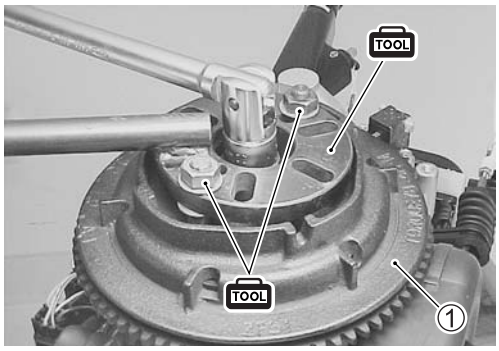
- All parts removed have been returned to their original positions.
- Check hose routing.

TIMING BELT

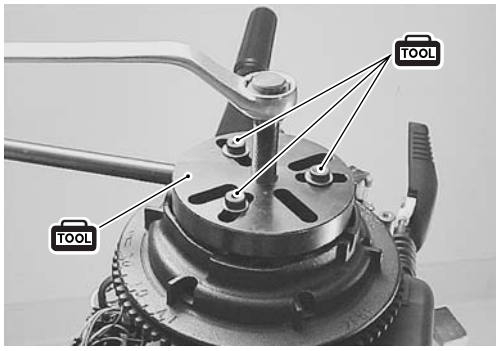
- **Inspect every 200 hours (12 months).**
- **Replace every 4 years.**

If wear, crack or other damage is found, replace the timing belt.

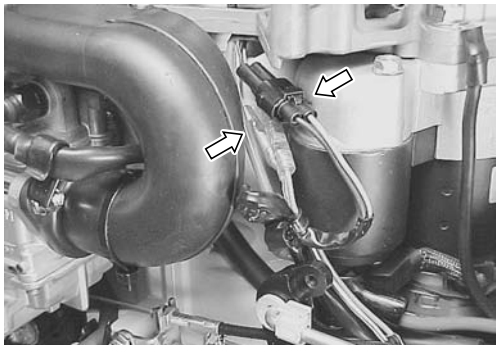
1. Remove the motor cover.
2. Remove the recoil starter.
3. Remove the side covers.
4. Remove the spark plugs.
5. Remove the flywheel ①. (See page 3-9.)



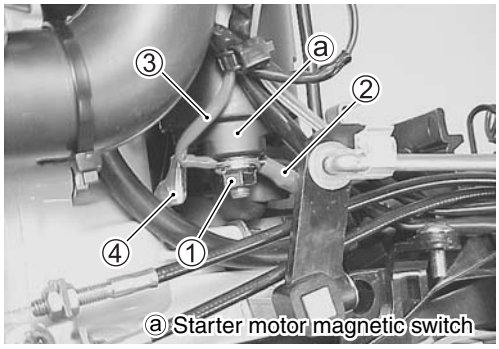
TOOL **09930-48720: Flywheel holder**
09930-49210: Flywheel holder attachment
09930-39411: Flywheel remover
09930-39210: Flywheel remover attachment bolt



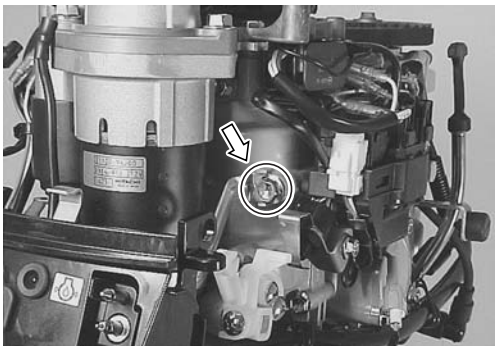
6. Disconnect stop switch lead wire connector.
   Disconnect starter button lead wire connector.



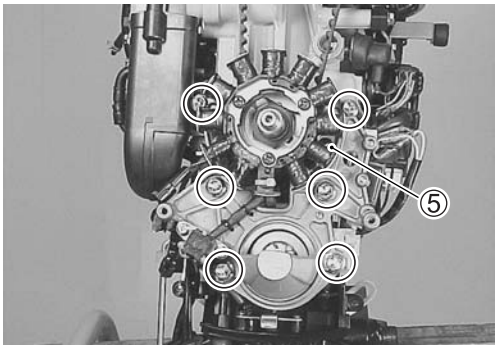
7. Remove nut ① and positive ⊕ battery cable ②, positive ⊕ battery charge cable ③ from the magnetic switch “B” terminal of starter motor.
   Disconnect the red lead wire ④ from starter motor magnetic switch “S” terminal.



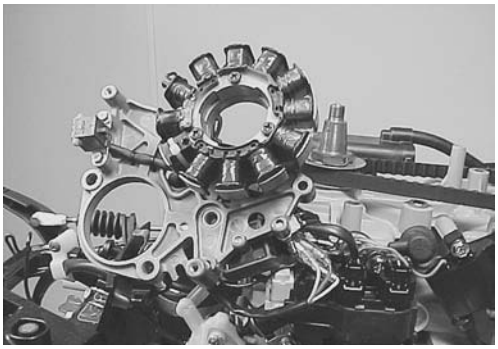
8. Loosen the port side bolt securing starter motor band.



9. Remove the four (4) bolts securing stator base ⑤.
   Remove the two (2) bolts securing starter motor.



10. Lift stator base from cylinder block and lay it on port side as shown figure.



11. Rotate the crankshaft to align the PUNCH mark on the timing pulley with the INDEX mark on the cylinder block.

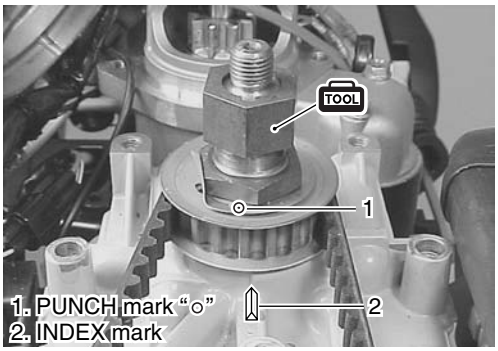
TOOL 09911-49310: Crankshaft holder

CAUTION

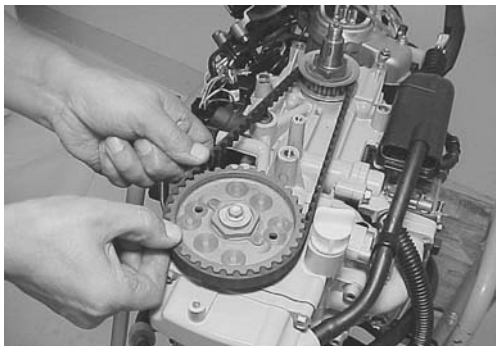
Rotate the crankshaft in the normal running direction (clockwise) to prevent water pump impeller damage.

CAUTION

Do not rotate the cam pulley with timing belt removed.



12. Remove the timing belt from the cam pulley first, then from the timing pulley.

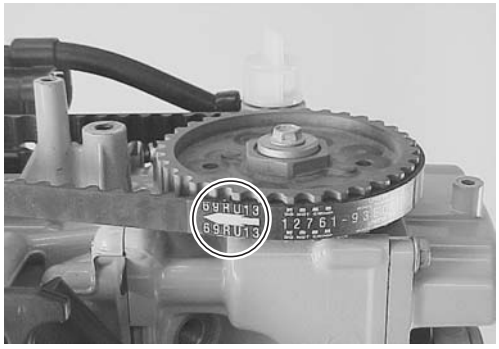


CAUTION

Do not rotate the crankshaft or the cam pulley before installing the belt; the following must be checked:
- **The PUNCH mark on the timing pulley aligns with the INDEX mark on the cylinder block.**
- **Either of the PUNCH marks on the cam pulley aligns with the INDEX mark on the cylinder head block.**

If the timing pulley or the cam pulley is rotated with the timing belt removed or installed but misaligned, this may cause the valves to become bent.
If the alignment marks are not correctly matched, loosen the valve adjusting lock nuts and the valve adjusting screws fully to prevent valve damage.
Then align the marks correctly by rotating the cam pulley clockwise.

13. Install the timing belt on the timing pulley first, then the cam pulley.



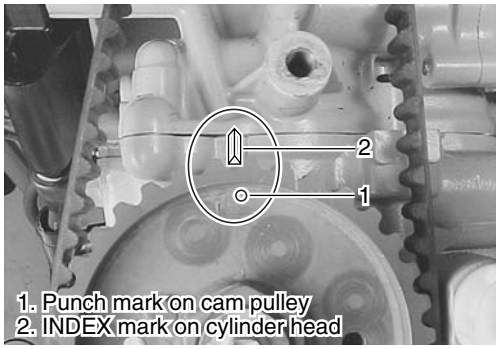
CAUTION

Always keep the timing belt away from any grease and oil.

CAUTION

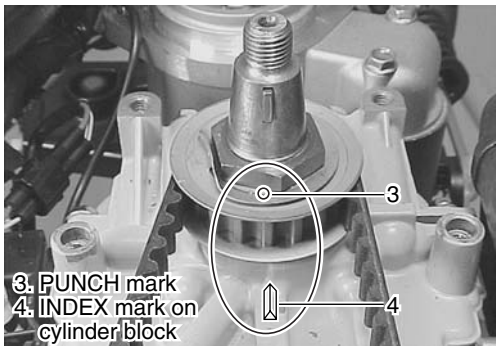
The timing belt must be installed with the arrow mark on the timing belt toward the direction of rotation.

14. Make sure that either of the PUNCH marks on the cam pulley aligns with the INDEX mark on the cylinder head block when the PUNCH mark on the timing pulley aligns with the INDEX mark on the cylinder block.



1. Punch mark on cam pulley
2. INDEX mark on cylinder head

15. Install following parts.
    - Stator base (See page 3-13.)
    - Flywheel (See page 3-13.)
    - Recoil starter (See page 5-8.)
    - Side covers
    - Spark plugs
16. Check wire routing. (See page 9-5 to 9-7.)



3. PUNCH mark
4. INDEX mark on cylinder block

IDLE SPEED

Inspect initially after 20 hours (1 month) and every 200 hours (12 months).

Checking

1. Check throttle link mechanism and carburetor throttle valve for smooth operation.
2. Attach engine tachometer cord to the ignition coil high-tension cord.

09900-26006: Engine tachometer

3. Start engine and allow to warm up.

NOTE:
Check and/or adjust the idle speed after the engine speed has stabilized.

4. Check engine idle speed.

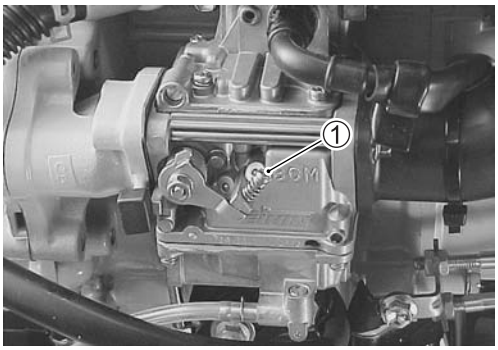
Idle speed (in neutral gear): 850 – 950 r/min

Adjustment

If engine idle speed is out of specification, adjust engine speed as follows:

Turn the throttle stop screw ①.

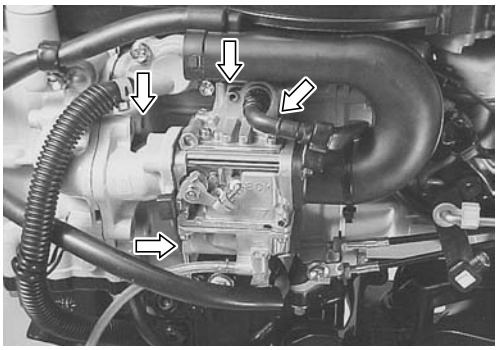
- Turning clockwise: The engine speed becomes higher.
- Turning counterclockwise: The engine speed becomes lower.



CARBURETOR

Inspect initially after 20 hours (1 month) and every 100 hours (6 months).

If crack or other damage is found on carburetor body, lever, rod, connector, inlet manifold or silencer, replace.



IGNITION TIMING

Inspect every 200 hours (12 months).

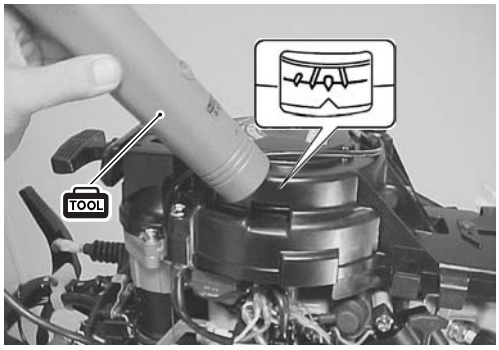
NOTE:
Before checking the ignition timing, make sure that the idle speed is adjusted within the specification.

1. Start and warm up the engine.
2. Attach the timing light to the No. 1 ignition coil high-tension cord.

09930-76420: Timing light
09900-26006: Engine tachometer

3. Check the ignition timing while operating the engine at 1 000 r/min.

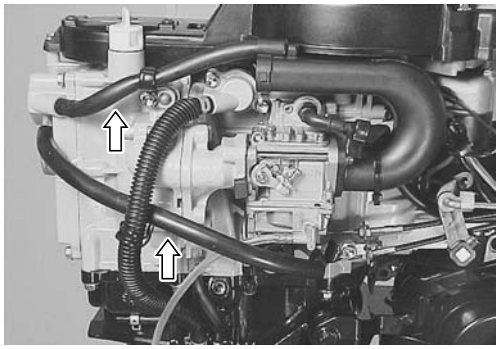
Ignition timing: Approx. ATDC 5° at 1 000 r/min

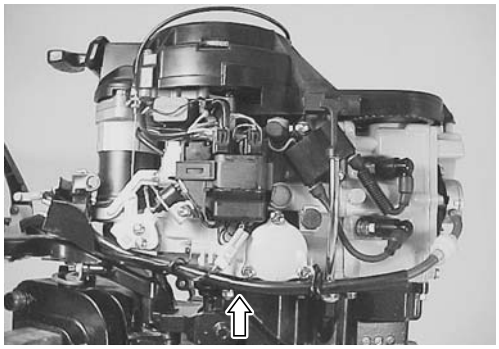


BREATHER AND FUEL LINE

- **Inspect initially after 20 hours (1 month) and every 50 hours (3 months).**
- **Replace every 2 years.**

If leakage, cracks, swelling or other damage is found, replace the breather line and/or the fuel line.

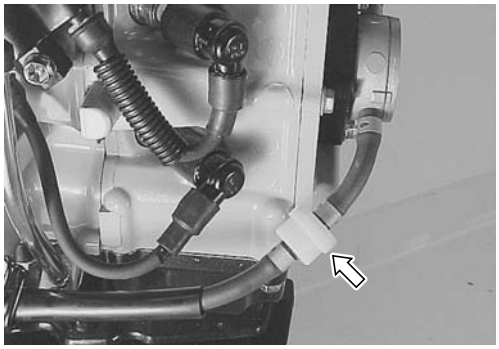




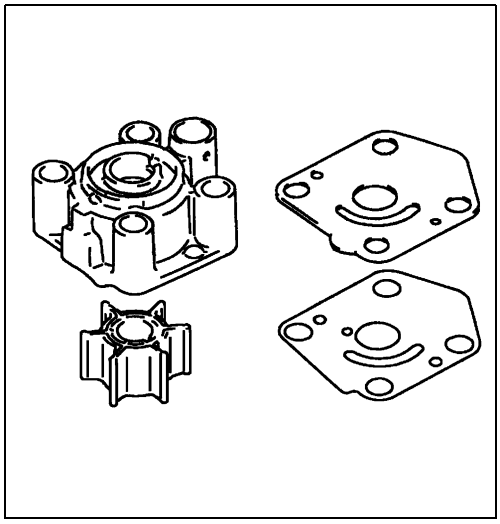
FUEL FILTER

- **Inspect every 50 hours (3 months).**
- **Replace every 400 hours or 2 years.**

If water accumulation, sediment, leakage, cracks or other damage is found, replace the fuel filter.



WATER PUMP/WATER PUMP IMPELLER



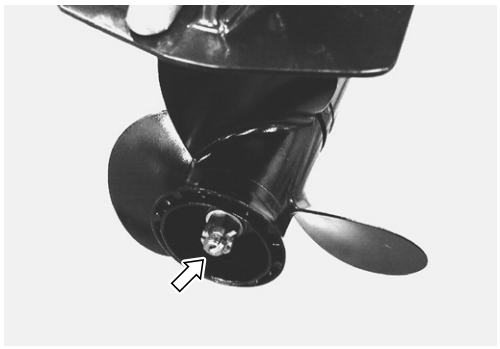
WATER PUMP
Inspect every 200 hours (12 months).

Inspect water pump case and under panel.
Replace if wear, cracks, distortion or corrosion is found.

WATER PUMP IMPELLER
Replace every 200 hours (12 months).

Inspect water pump impeller.
Replace if vanes are cut, torn or worn.

PROPELLER/NUT/PIN

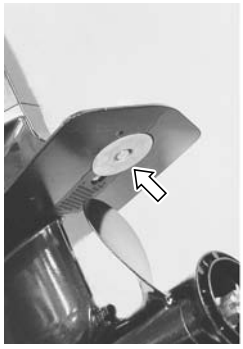


Inspect initially after 20 hours (1 month) and every 100 hours (6 months).

- Inspect propeller for bent, chipped or broken blades. Replace propeller if damage noticeably affects operation.
- Inspect propeller splines. Replace propeller if splines are worn, damaged or twisted.
- Inspect propeller bush for slippage. Replace if necessary.
- Make sure that propeller nut is torqued to specification and cotter pin is installed securely.

ANODES AND BONDING WIRES

Inspect every 50 hours (3 months).

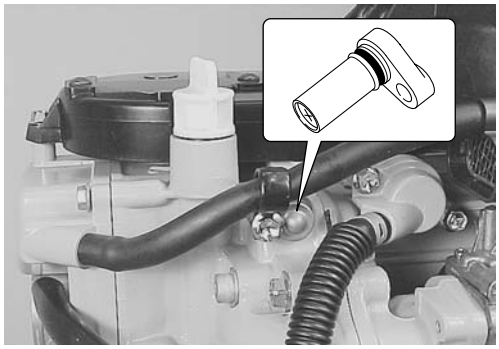


ANODES

If 2/3 of the anode has corroded away, replace the anode.
The anode should be periodically cleaned with a wire brush to ensure maximum effectiveness.

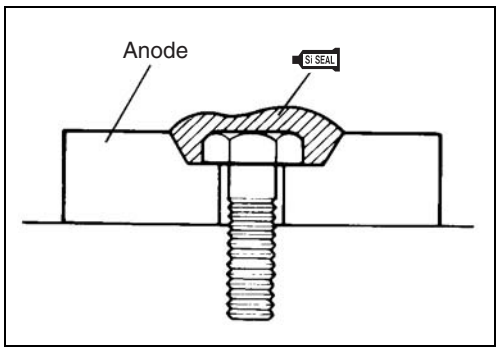
CAUTION

Never paint the anode.



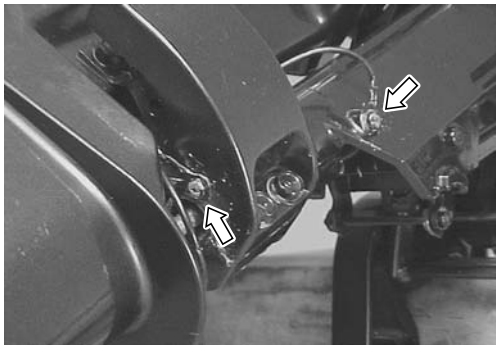
NOTE:
The anode securing bolt should be covered with SUZUKI SILICONE SEAL.

Si SEAL 99000-31120: SUZUKI SILICONE SEAL



BONDING WIRES

If breakage or other damage is found on the wire, replace the wire.
If rust, corrosion, or other damage is found on terminal, clean with cleaning solvent or replace the wire.



BATTERY

Inspect every 50 hours (3 months).

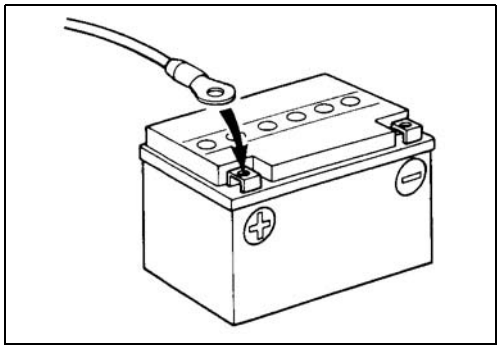
⚠ WARNING

- **Never expose battery to open flame or electric spark as batteries generate gas which is flammable and explosive.**
- **Battery acid is poisonous and corrosive. Avoid contact with eyes, skin, clothing and painted surfaces. If battery acid comes in contact with any of these, flush immediately with large amounts of water. If acid contacts the eyes or skin, get immediate medical attention.**
- **Batteries should always be kept out of reach of children.**
- **When checking or servicing battery, disconnect the negative (black) cable. Be careful not to cause a short circuit by allowing metal objects to contact battery posts and motor at the same time.**
- **Wear approved eye protection.**

Recommended battery:
12 V 35 AH (126 kC) or larger battery

CONNECTING BATTERY

Upon completion of the connection, lightly apply grease to the battery terminals.

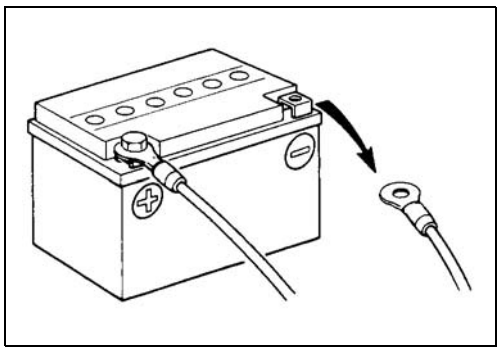


How to connect:
1. Connect the positive (+) terminal first.
2. Connect the negative (–) terminal second.

How to disconnect:
1. Disconnect the negative (–) terminal first.
2. Disconnect the positive (+) terminal second.

CAUTION

If the battery leads are loose, incorrectly connected or reversed, the electrical system could be damaged.



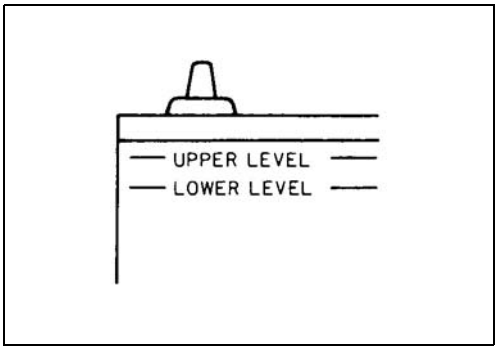
BATTERY SOLUTION LEVEL CHECK

Battery solution level should be between UPPER level and LOWER level.

If level is low, add distilled water only.

CAUTION

Once the battery has been initially serviced, NEVER add diluted sulfuric acid or battery damage will occur. Follow the battery manufacture's instructions for specific maintenance procedures.

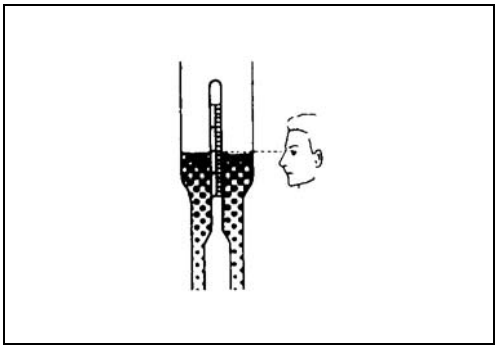


BATTERY SOLUTION GRAVITY CHECK

Measure the gravity of battery solution using a hydrometer.

09900-28403: Hydrometer

Battery solution gravity: 1.28 at 20 °C



BOLTS AND NUTS

Inspect initially after 20 hours (1 month) and every 100 hours (6 months).

Check that all bolts and nuts listed below are tightened to their specified torque.

ITEM	THREAD DIAMETER	TIGHTENING TORQUE		
		N·m	kg-m	lb-ft
Cylinder head cover bolt	6 mm	10	1.0	7.0
Cylinder head bolt	8 mm	27	2.7	20.0
Intake manifold bolt	8 mm	23	2.3	16.5
Carburetor mounting bolt	6 mm	10	1.0	7.0
Flywheel nut	14 mm	80	8.0	58.0
Power unit mounting bolt/nut	8 mm	23	2.3	16.5
Clamp bracket shaft nut	7/8-14 UNF	43	4.3	31.0
Tiller handle cover bolt	8 mm	17	1.7	12.5
Gearcase bolt	8 mm	23	2.3	16.5
Propeller nut	12 mm	18	1.8	13.0

OIL PRESSURE

Oil pressure (at normal operating temp.):
200 – 500 kPa (2.0 – 5.0 kg/cm², 28 – 71 psi)
at 3000 r/min.

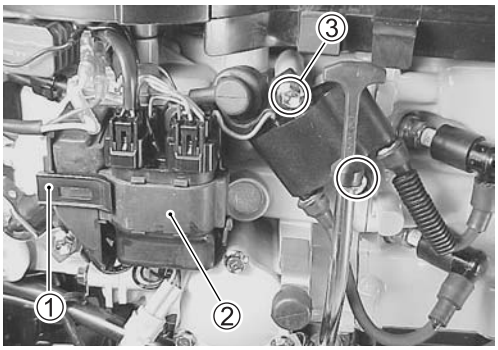
NOTE:
The figure shown above is a guideline only, not an absolute service limit.

If oil pressure is lower or higher than specification, the following causes may be considered.
(See page 6-45 for oil passage locations.)

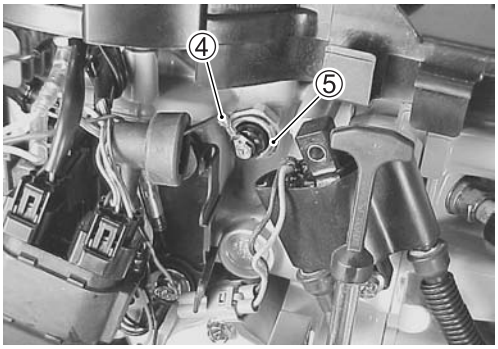
Low oil pressure
- Clogged oil filter
- Leakage from oil passages
- Defective oil pump
- Defective oil pressure regulator
- Damage O-ring
- Combination of above items

High oil pressure
- Using an engine oil of too high viscosity
- Clogged oil passage
- Clogged oil pressure regulator
- Combination of above items

TEST PROCEDURE
1. Check the engine oil level.
2. Remove the plate ① by sliding it upward.
3. Remove CDI unit ② from electric parts holder.
4. Remove the two (2) bolts ③ securing ignition coil.

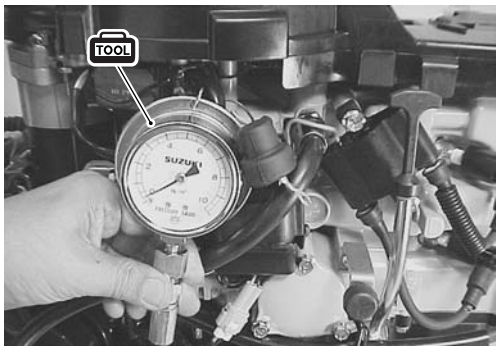


5. Loosen screw and disconnect blue lead wire ④ from oil pressure switch ⑤.
   Remove the oil pressure switch.



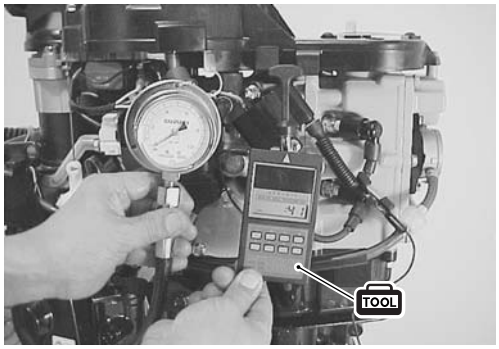
6. Install oil pressure gauge adaptor into oil pressure switch hole in place of oil pressure switch.

TOOL 09915-77311: Oil pressure gauge
09915-78211: Oil pressure gauge adapter



7. Place CDI unit in position.
   Install ignition coil, then secure with bolts.
8. Attach the engine tachometer to ignition coil high-tension cord.

TOOL 09900-26006: Engine tachometer



9. Start engine and allow to warm up as follows:

   Summer : 5 min. at 2 000 r/min
   Winter : 10 min. at 2 000 r/min

10. After warming up, shift into forward gear and increase engine speed to 3 000 r/min, then compare pressure indicated on gauge to specifications.
11. After testing, reinstall oil pressure switch.
    (See page 3-17.)

CYLINDER COMPRESSION

Cylinder compression:
Standard:
550 – 850 kPa (5.5 – 8.5 kg/cm², 78 – 120 psi.): With decompression system (DF9.9/15)
820 – 1 230 kPa (8.2 – 12.3 kg/cm², 116 – 175 psi.):
Without decompression system (DF9.9E/R, DF15E/R)
Max. difference between any other cylinders:
100 kPa (1.0 kg/cm², 14 psi.)

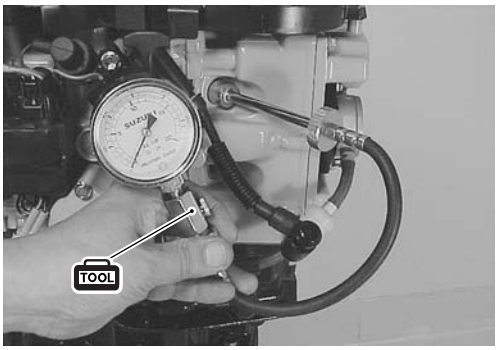
NOTE:
Figures shown are guidelines only, not absolute service limits.

Low compression pressure can indicate one or more of the following:
- Excessively worn cylinder wall
- Worn piston or piston rings
- Stuck piston rings
- Poor seating of valves
- Ruptured or otherwise damaged cylinder head gasket

TEST PROCEDURE

1. Start engine and allow to warm up, then shut engine off.
2. Remove the STBD / PORT engine side lower cover.
3. Remove all spark plugs.
4. Install the compression gauge into the plug hole.

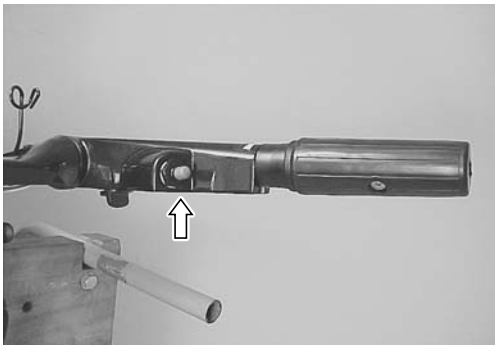
TOOL 09915-64512: Compression gauge



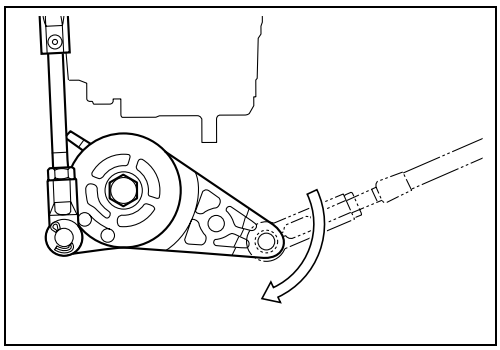
5. Disconnect the safety lanyard from the emergency stop switch.

⚠ WARNING

Disconnect the safety lanyard from the emergency stop switch prior to cranking the engine.
This will prevent any residual fuel discharged from the cylinders from being ignited by a spark discharged from the spark plug cap.



6. Disconnect the remote control throttle cable from the throttle lever. (R model)
7. • Move and hold the throttle lever in the full-open position. (R model)
   • Move and hold the throttle control grip in the full-open position. (Tiller handle model.)
8. While cranking the engine with the starter motor or recoil starter, note the maximum compression pressure reading on the gauge for each cylinder.
9. Reinstall parts removed earlier. (spark plug, side lower cover, etc.)



IGNITION AND ELECTRICAL

CONTENTS

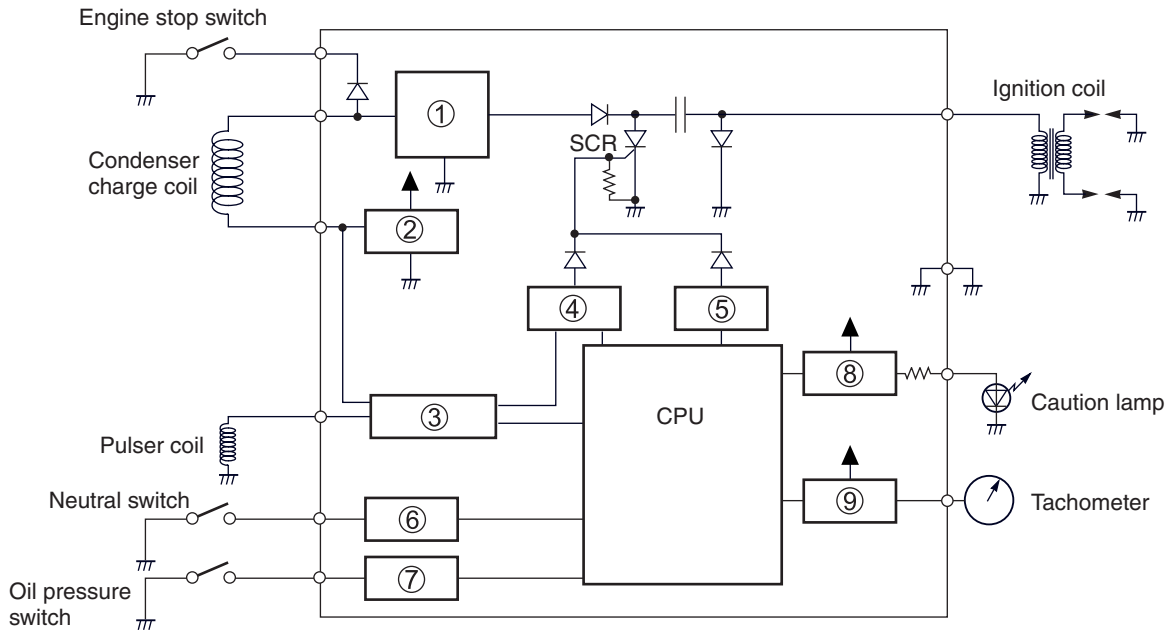
IGNITION SYSTEM

PRINCIPLES OF OPERATION

A digital CDI (condenser discharge ignition) system is employed on the DF9.9/DF15.
The condenser built in the CDI unit stores the electrical energy generated by the condenser charge coil.
The electrical energy stored in the condenser is released to the ignition coil primary windings by the ignition timing signal calculated by the CDI microcomputer from the pulser coil signals.

SPECIFICATION

Ignition type	CDI
Advance	Electronic microcomputer control
Ignition timing	ATDC 5° – BTDC 30°

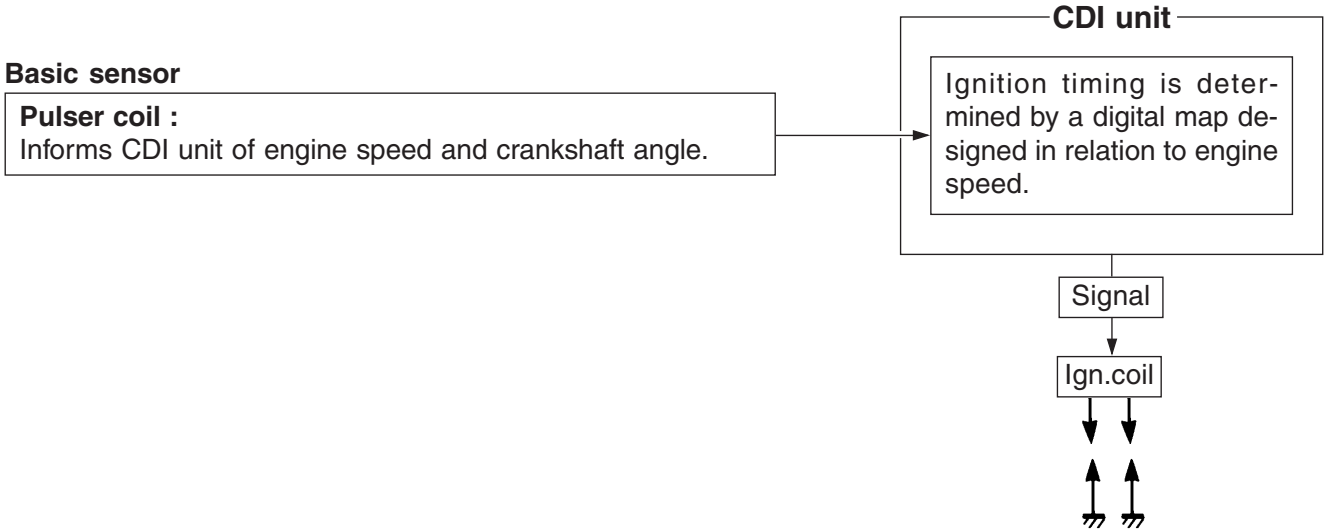


① Power source circuit (Charging circuit)
② Power source circuit
③ Base signal circuit
④ Hardware ignition signal circuit
⑤ Software ignition signal control circuit
⑥ Input circuit
⑦ Input circuit
⑧ Output circuit
⑨ Output circuit

IGNITION TIMING CONTROL

Outline

The ignition timing varies based upon engine speed.
The pulser coil monitor current engine speed and send signals to the CDI unit.
Based on this signal, the CDI unit determines the optimum ignition timing and supplies voltage to the primary winding of the ignition coil.



Control mode

When starting (at the time of cranking):

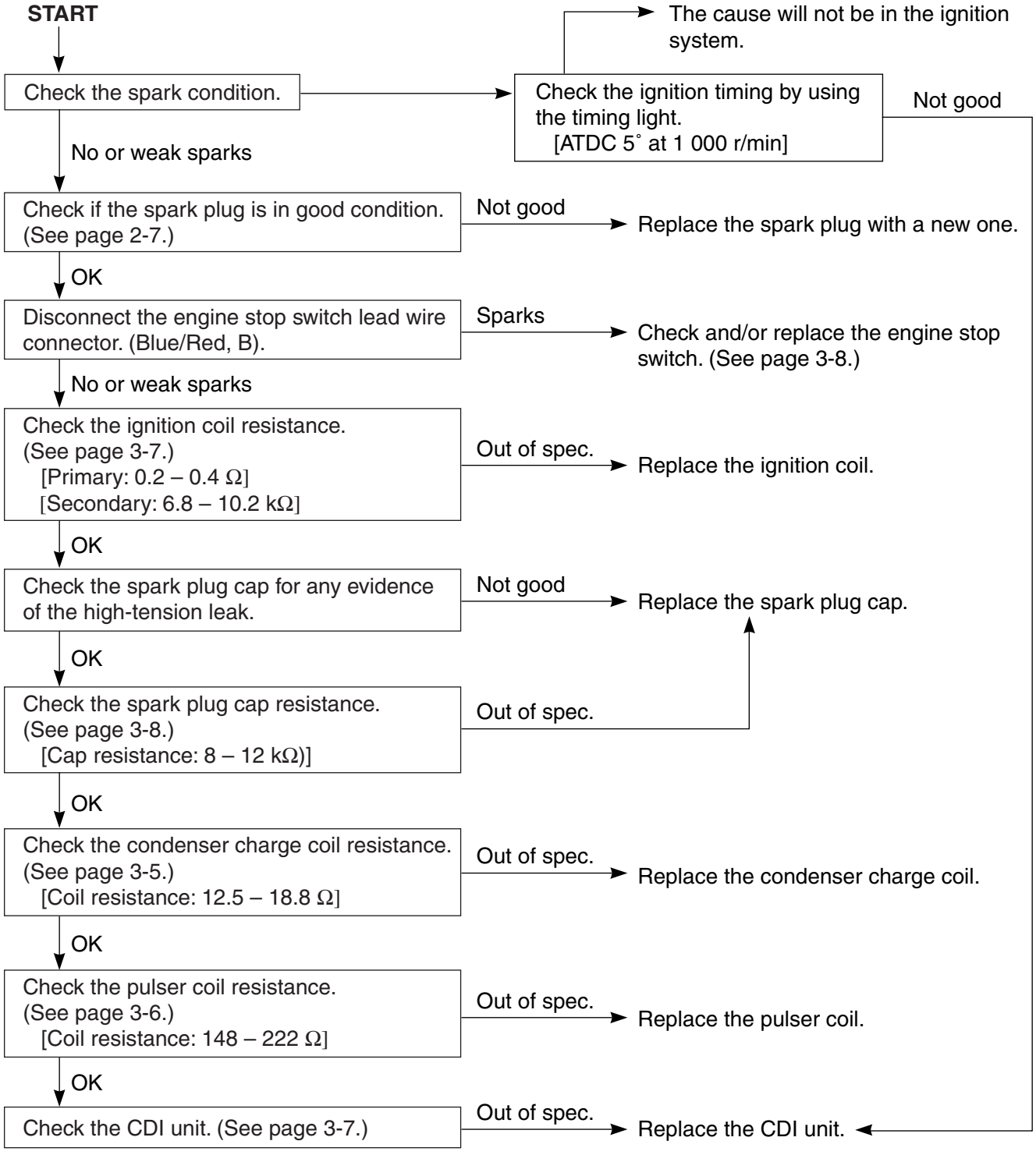
The ignition timing is fixed at ATDC 10° until the engine starts.

When operating (normal operation):

The ignition timing varies in the range of ATDC 5° – BTDC 30° according to the engine operating condition.

TROUBLESHOOTING

Perform the following ignition system tests when the engine is hard to start in order to determine if the cause is in the ignition or another system.



INSPECTION

⚠ WARNING

Always disconnect the battery cables from battery before commencing electrical resistance test.

CONDENSER CHARGE COIL OUTPUT

Peak Voltmeter Stevens CD-77
Tester range: POS 50

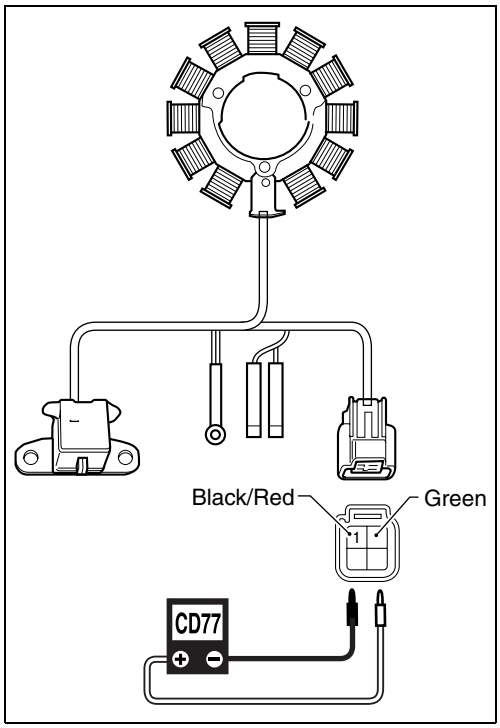
1. Disconnect the condenser charge coil lead wire connector.
2. Connect the tester probe to the coil lead wires as shown.

Tester probe connection	
⊕ (Red)	⊖ (Black)
Green	Black/Red

3. Remove the all spark plugs.
4. Crank with the recoil starter, then measure voltage.

Condenser charge coil output: 15 V or over

If measurement is out of specification, replace the condenser charge coil.



CONDENSER CHARGE COIL RESISTANCE

09930-99320: Digital tester

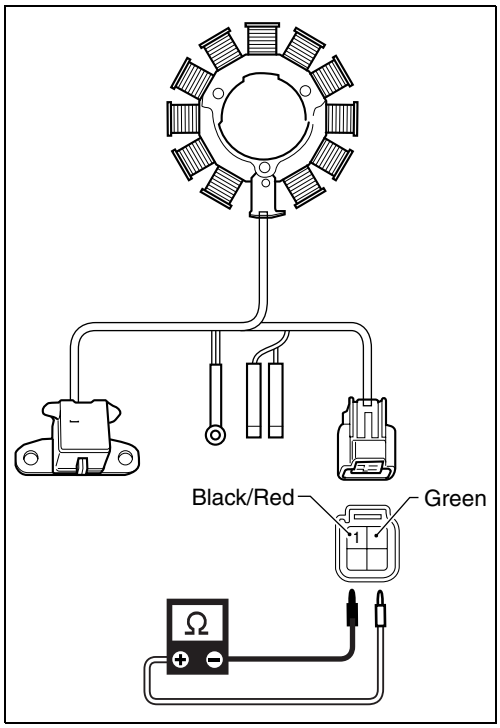
Tester range: Ω (Resistance)

1. Disconnect the condenser charge coil lead wire connector.
2. Connect the tester probe to the coil lead wires as shown.

Tester probe connection	
Probe	Other probe
Green	Black/Red

Condenser charge coil resistance: 12.5 – 18.8 Ω

If measurement is out of specification, replace the condenser charge coil.



PULSER COIL OUTPUT

Peak Voltmeter Stevens CD-77
Tester range: SEN 5

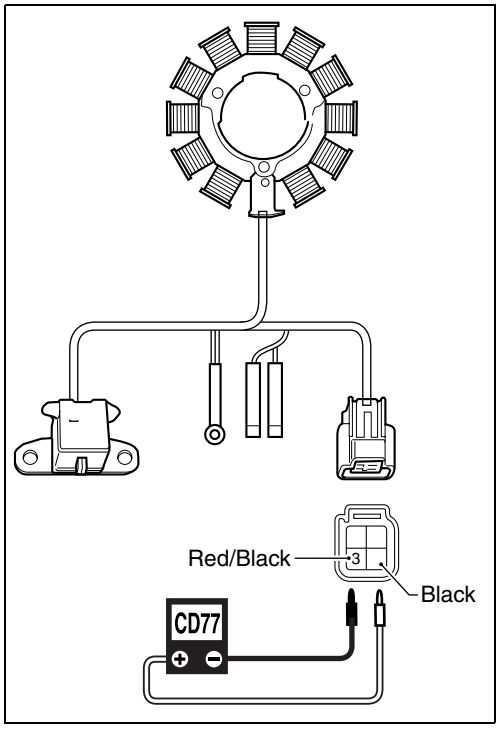
1. Disconnect the pulser coil lead wire connector.
2. Connect the tester probe to the coil lead wires as shown.

Tester probe connection	
⊕ (Red)	⊖ (Black)
Red/Black	Black (Ground)

3. Remove all spark plugs.
4. Crank with the recoil starter, then measure voltage.

Pulser coil output: 0.8 V or over

If measurement is out of specification, replace the pulser coil.



PULSER COIL RESISTANCE

09930-99320: Digital tester

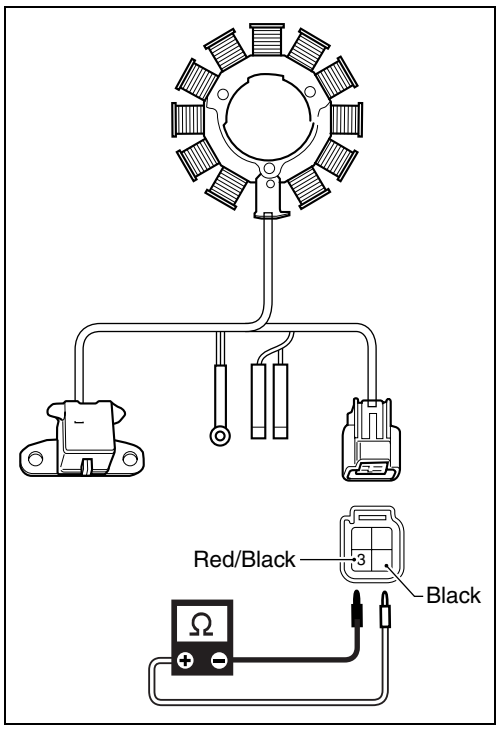
Tester range: Ω (Resistance)

1. Disconnect the pulser coil lead wire connector.
2. Connect the tester probe to the coil lead wires as shown.

Tester probe connection	
Probe	Other probe
Red/Black	Black (Ground)

Pulser coil resistance: 148 – 222 Ω

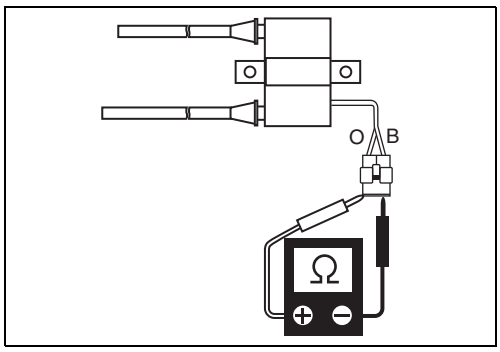
If measurement is out of specification, replace the pulser coil.



IGNITION COIL RESISTANCE

09930-99320: Digital tester

Tester range: Ω (Resistance)



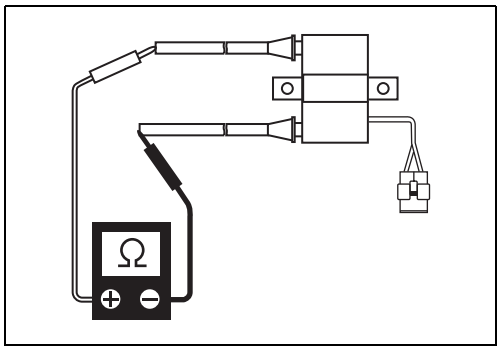
Primary side

1. Disconnect the ignition coil lead wire connector.
2. Connect the tester probe to the coil lead wires as shown.

Tester probe connection	
Probe	**Other probe**
Orange	Black

Primary coil resistance: 0.2 – 0.4 Ω

If measurement is out of specification, replace the ignition coil.



Secondary side

1. Remove the spark plug caps from the high-tension cord.
2. Connect the tester probe to the high-tension cords as shown.

Tester probe connection	
Probe	**Other probe**
High-tension cord	Other High-tension cord

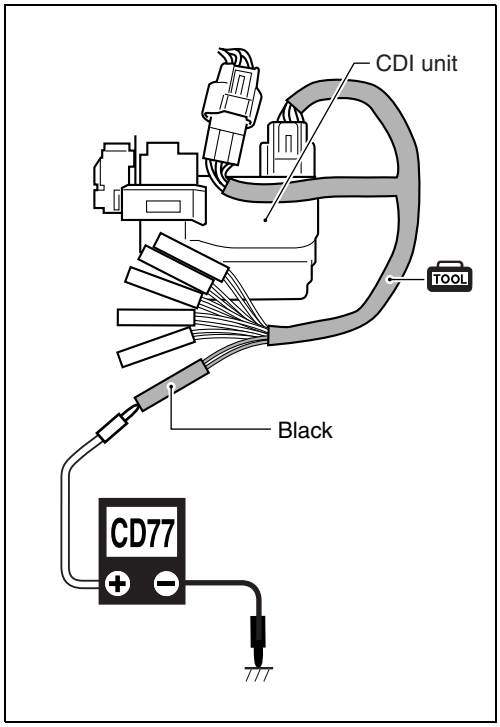
Secondary coil resistance: 6.8 – 10.2 kΩ

If measurement is out of specification, replace the ignition coil.

CDI UNIT OUTPUT

09930-89920: 6 pin connector test cord

Peak Voltmeter Stevens CD-77
Tester range: NEG 500



1. Disconnect 6 pin wire harness connector from CDI unit
2. Connect the 6 pin test cord between CDI unit and wire harness as shown in figure.
3. Connect the tester probe to the test cord lead wires as shown.

Tester probe connection	
⊕ (Red)	**⊖ (Black)**
Orange {Test cord wire color: Black}	Engine body ground

4. Remove all spark plugs.
5. Crank with the recoil starter, then measure voltage.

CDI unit output: 128 V or over

If measurement is out of specification, replace the CDI unit.

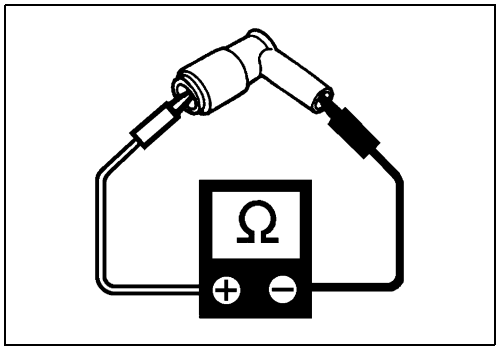
SPARK PLUG CAP

09930-99320: Digital tester

Tester range: Ω (Resistance)

Measure the spark plug cap resistance.

Tester probe connection	
Probe	**Other probe**
Cap end	Other cap end



Spark plug cap resistance: 8 – 12 kΩ

If measurement is out of specification, replace the spark plug cap.

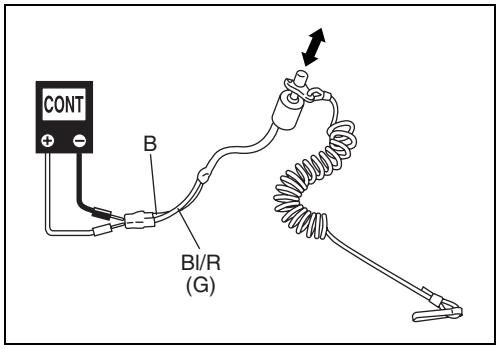
EMERGENCY & ENGINE STOP SWITCH

09930-99320: Digital tester

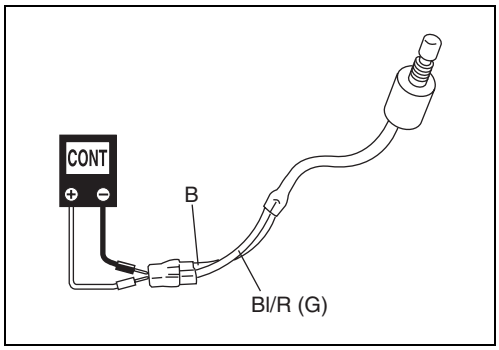
Tester range: (Continuity)

Check continuity/infinity between the wiring leads under the condition shown below.

Tester probe connection	
Probe	**Other probe**
Blue/Red Green (Note: 1)	Black



Switch condition	Continuity
Lock plate IN	No
Lock plate OUT	Yes
Lock plate IN & button depressed (Note: 2)	Yes

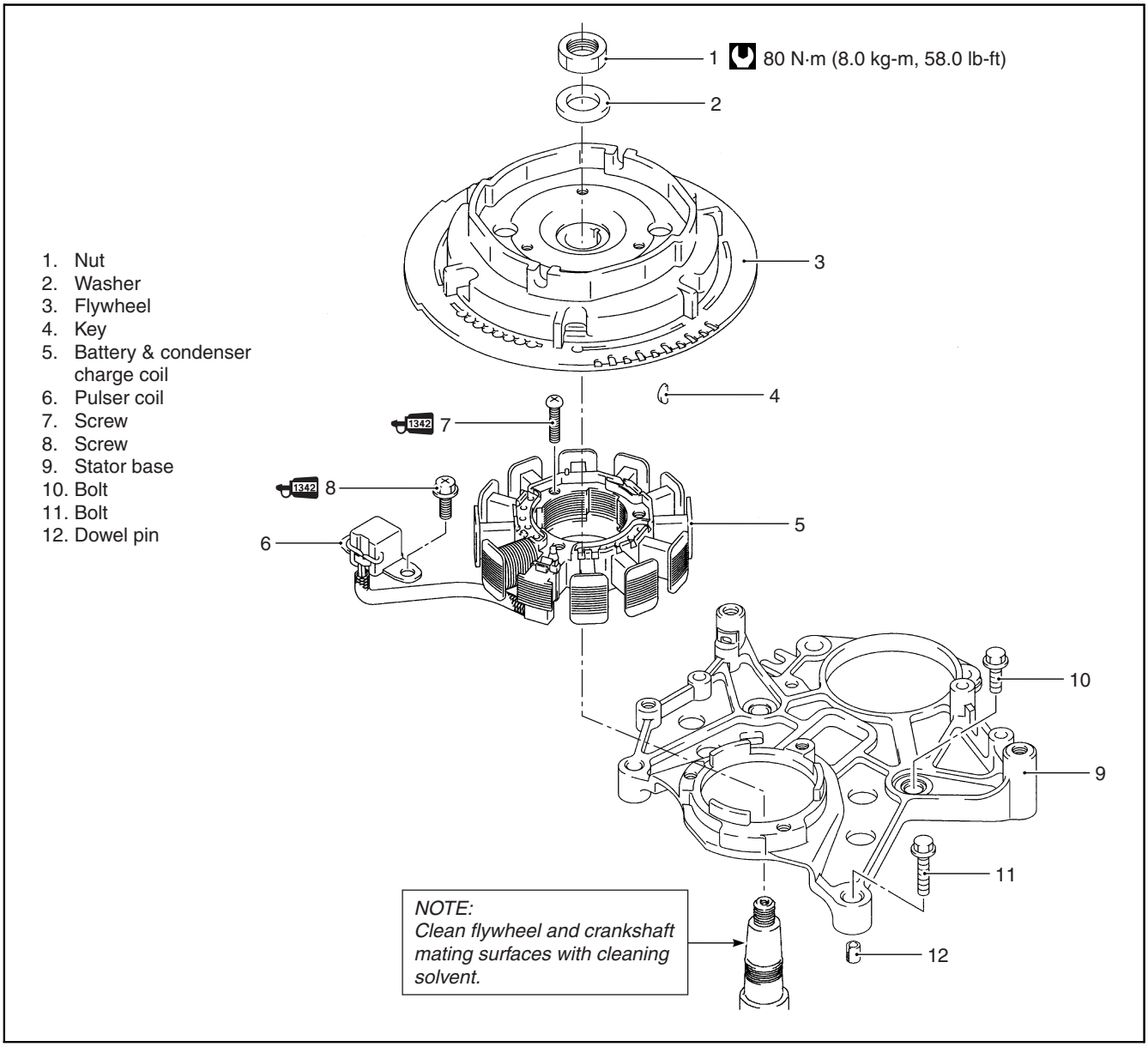


Note 1: Remote control model
Note 2: Tiller handle model

If out of specification, replace the engine stop switch.

REMOVAL/INSTALLATION

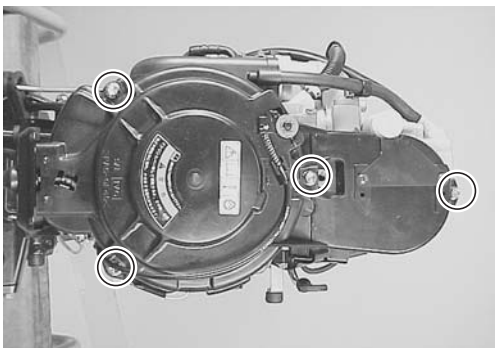
FLYWHEEL/BATTERY & CONDENSER CHARGE COIL/PULSER COIL



REMOVAL

Before removing electrical parts:
- **Disconnect battery cables from battery.**
- **Remove all spark plug caps from the spark plug.**

NOTE:
Motor depicted is electric start model.



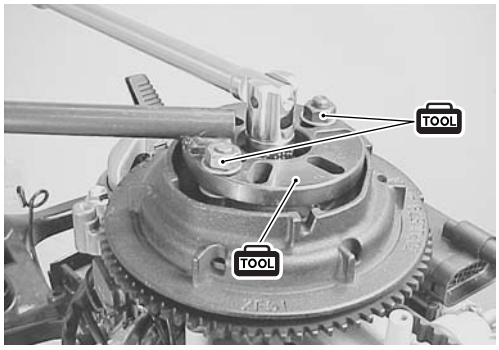
[Flywheel]

1. Remove recoil starter. (See page 5-2.)

2. Using special tools, loosen flywheel nut 2–3 turns.

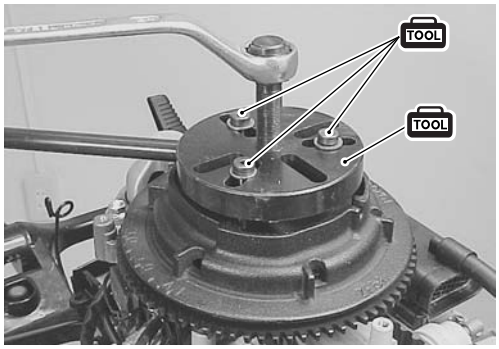
TOOL 09930-48720: Flywheel holder
09930-49210: Flywheel holder attachment

NOTE:
Do not remove flywheel nut at this time.
This nut prevents damage to the crankshaft when using flywheel remover tools.

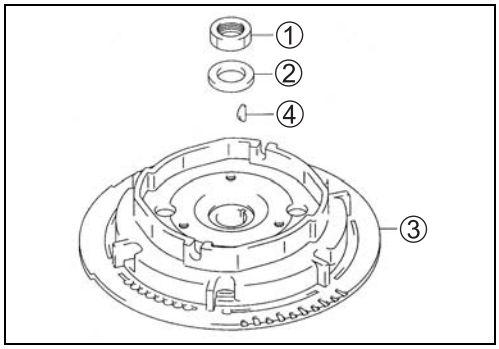


3. Using special tools, loosen flywheel from crankshaft.

TOOL 09930-39411: Flywheel remover
09930-39210: Flywheel remover bolt

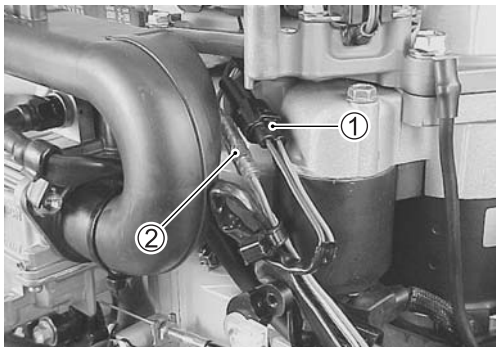


4. Remove flywheel nut ①, washer ②, flywheel ③ and key ④.

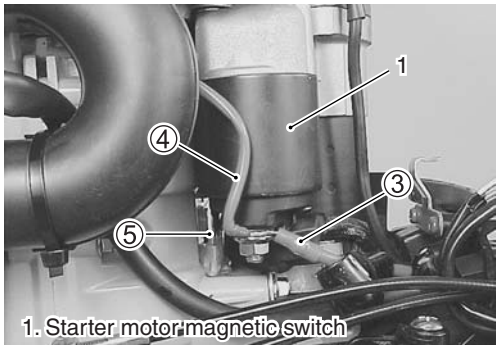


[Battery & Condenser charge coil/Pulser coil]

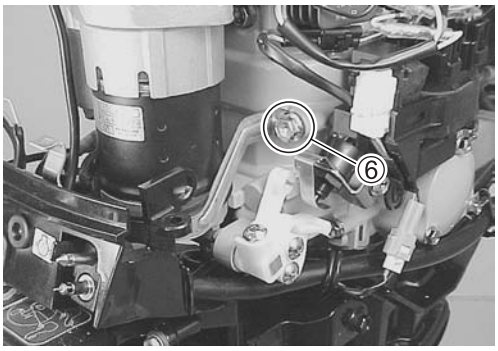
5. Remove side covers. (See page 7-2.)
6. Disconnect stop switch lead wire connector ①.
   Disconnect starter button lead wire connector ②.
   (Tiller handle model)



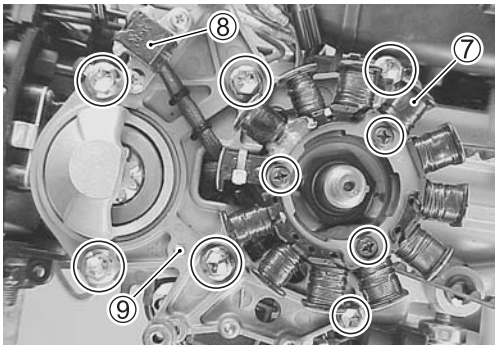
7. Remove nut and positive ⊕ battery cable ③, positive ⊕ battery charge cable ④ from the magnetic switch "B" terminal of starter motor.
   Disconnect the red lead wire ⑤ from starter motor magnetic switch "S" terminal.



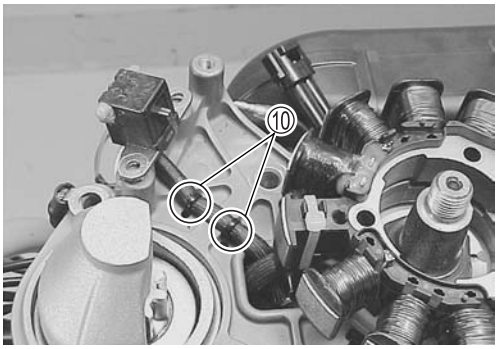
8. Loosen the PORT side bolt ⑥ securing starter motor band.



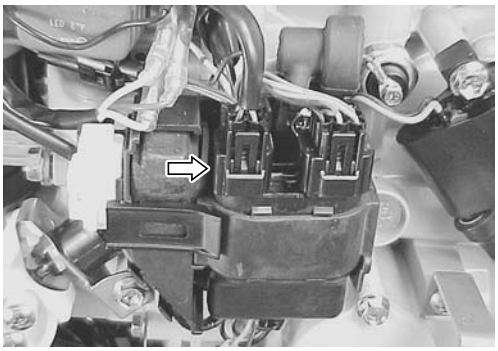
9. Remove the three (3) screws securing battery charge & condenser charge coil ⑦.
   Remove the two (2) screws securing pulser coil ⑧.
   Remove the six (6) bolts securing stator base ⑨.



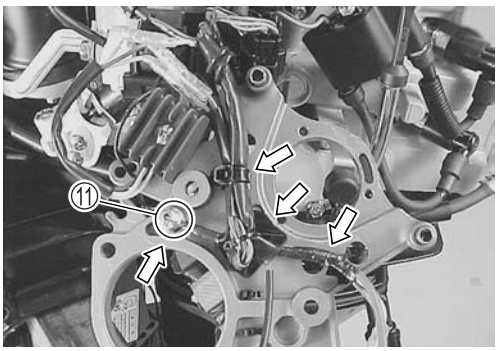
10. Cut the cable ties ⑩ securing pulser coil wiring harness to stator base.



11. Disconnect the 4-pin wiring harness connector from CDI unit.



12. Lift up and remove stator base from cylinder block.
13. Cut the cable ties securing coil wiring harness to stator base.
14. Disconnect battery charge coil lead wire connector from rectifier.
15. Remove the bolt ⑪ securing pulser coil GND lead wire.
16. Remove the battery & condenser charge coil.



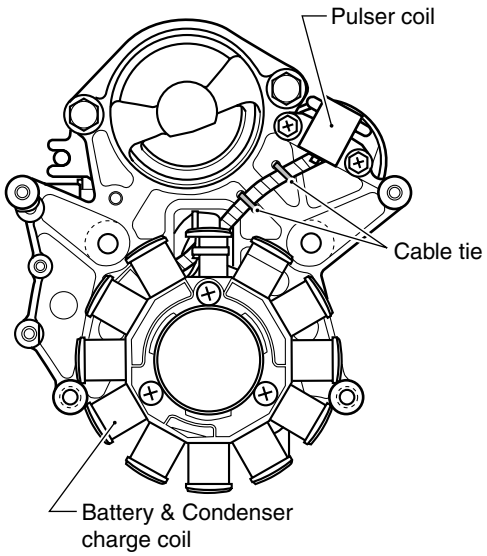
INSTALLATION

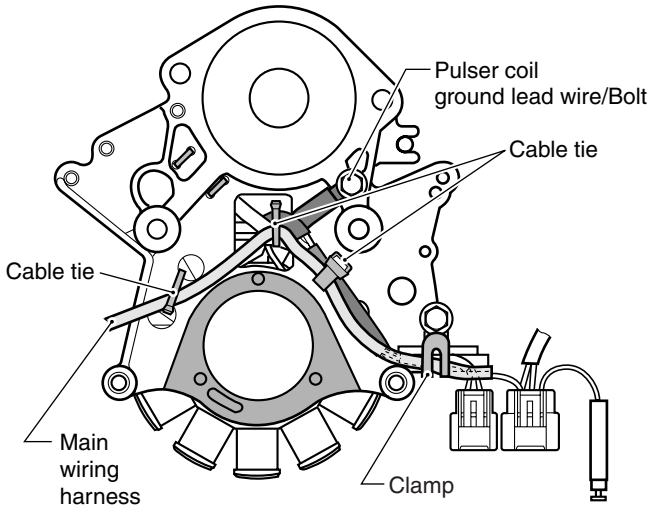
Installation is reverse order of removal with the special attention to the following steps.

Battery & Condenser charge coil/Pulser coil

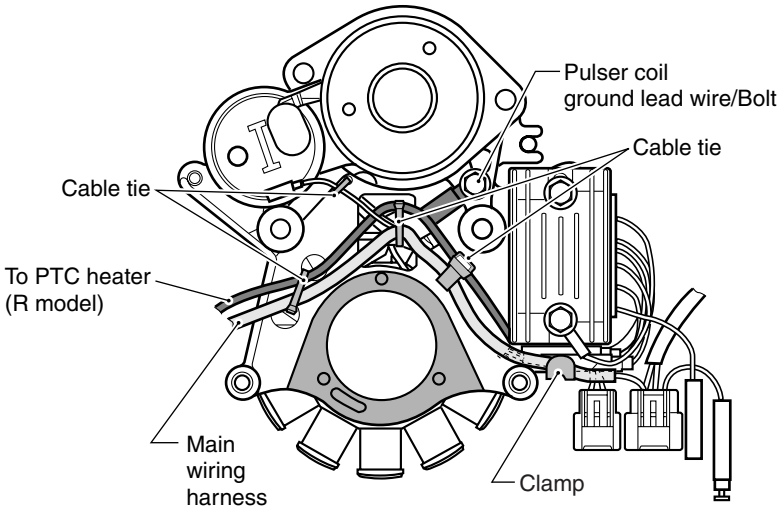
- Secure coil lead wire with cable ties, then check that coil lead wire is routed properly and away from hot or rotating parts.

Wire routing





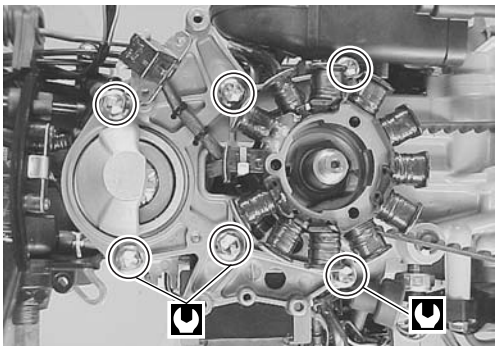
Manual starter model



Electric starter model

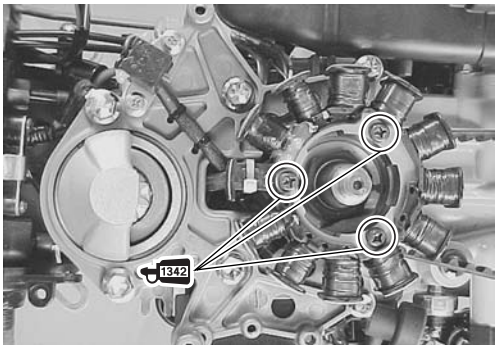
- Install stator base, then tighten stator base mounting bolts securely.

Stator base mounting bolt:
8 mm 23 N·m (2.3 kg-m, 16.5 lb-ft)
6 mm 10 N·m (1.0 kg-m, 7.0 lb-ft)



- Apply Thread Lock 1342 to the coil mounting screws.

99000-32050: THREAD LOCK 1342

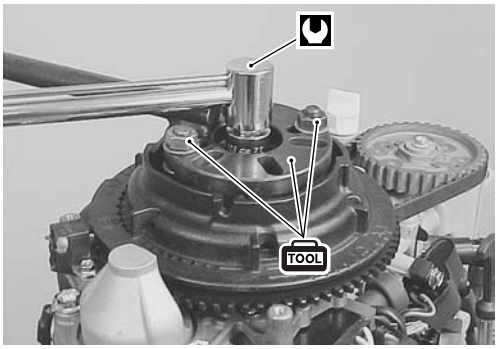


Flywheel

- Clean flywheel and crankshaft mating surfaces with cleaning solvent.
- Tighten flywheel nut to specified torque.

09930-48720: Flywheel holder
09930-49210: Flywheel holder attachment

Flywheel nut: 80 N·m (8.0 kg-m, 58.0 lb-ft)



Final assembly check

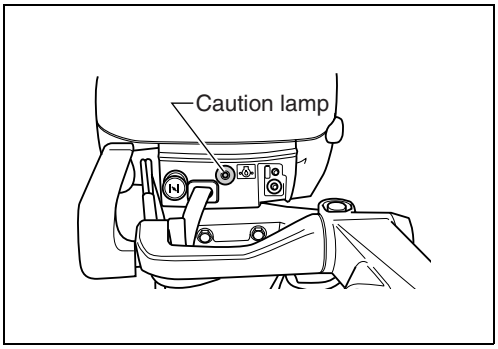
Perform the following checks to ensure proper and safe operation.

- All parts removed have been returned to their original positions.
- Wire routing match's service manual illustration. (See page 9-2 to 9-9.)

CAUTION SYSTEM

The following two caution systems alert the operator when an abnormality occurs on the engine.

- **OVER-REVOLUTION CAUTION**
- **LOW OIL PRESSURE CAUTION**



CAUTION TYPE	CAUTION LAMP	CAUTION BUZZER (*)	OVER-REV LIMITER
Over-revolution	Yes	No	Yes
Low oil pressure	Yes	Yes	Yes

*: Remote control model only

■ **LAMP CHECK**

Two (2) seconds after starting engine:

- The caution lamp turns ON.

■ **CAUTION BUZZER**

On remote control model:

The caution buzzer sounds when ignition switch is turned ON. Then it stops sounding when engine starts and the oil pressure switch turns OFF by reaching engine oil pressure at 15 kPa (0.15 kg/cm^2, 2 psi).

OVER-REVOLUTION CAUTION SYSTEM

CONDITION:

The CDI unit controlled over revolution limiter will engage at the engine speeds shown below.
Once engaged it will initiate an intermittent ignition signal to reduce engine speed.

Over revolution limiter: 6 500 r/min

ACTION:

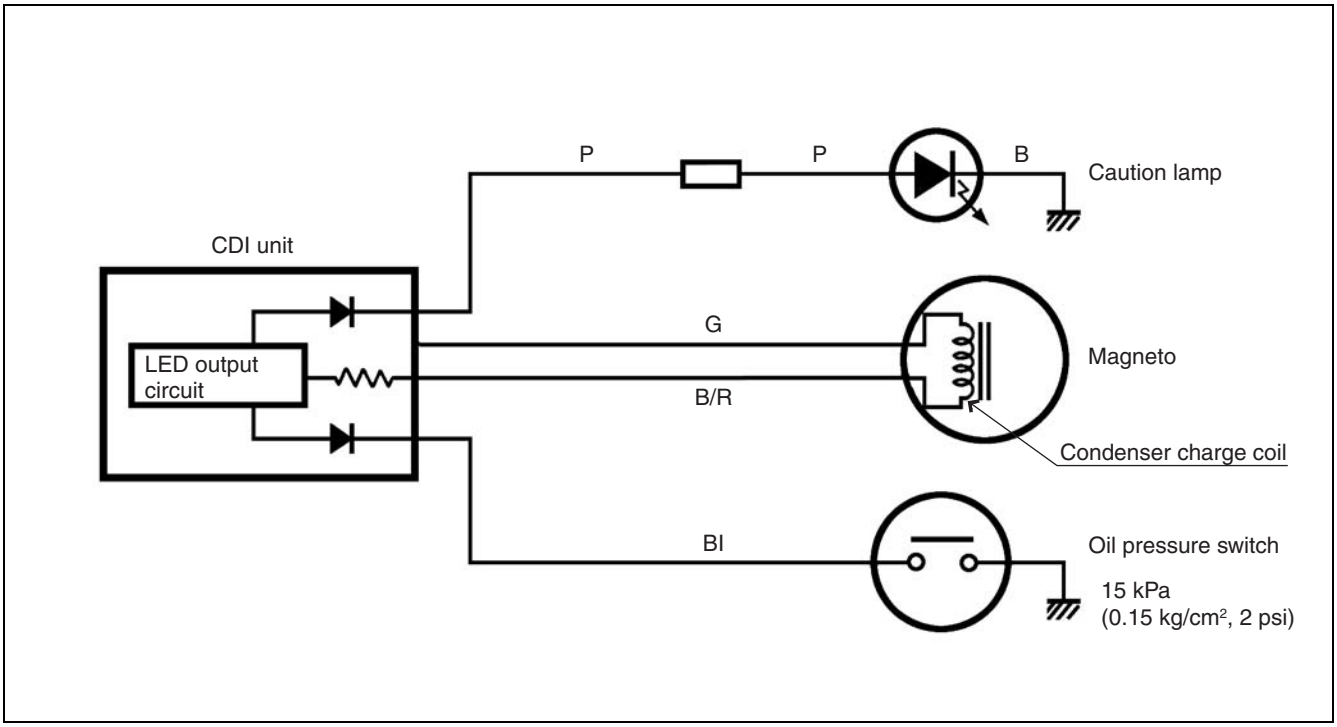
- If the operator decreases engine speed to less than approximately 6 200 r/min within 10 seconds, the over-revolution caution control will be cancelled.
- If the engine is operated at a speed above 6 500 r/min for more than 10 seconds, the engine speed will be automatically lowered to approximately 3 000 r/min by intermittent ignition.
- During operation of the over-revolution caution control, the caution lamp is ON.

RESET:

To cancel the over-revolution caution control, close the throttle to reduce the engine speed below approximately 2 500 r/min for more than one second.

NOTE:
In neutral gear, the preset maximum engine speed value before the over-revolution caution system activates is 4 000 r/min.
In the operation of Neutral gear over-revolution caution system, the lamp does not light.
To cancel the Neutral gear over-revolution caution control, close throttle completely for more than one second.

LOW OIL PRESSURE CAUTION SYSTEM



CONDITION:
Immediate activation of the system when the oil pressure switch turns “ON” due to an engine oil pressure drop below 15 kPa (0.15 kg/cm², 2 psi).

ACTION:
- The caution lamp is on.
- The caution buzzer sounds. (For remote control model only.)
- The engine speed will be automatically reduced to approx. 2 000 r/min by intermittent ignition signals if the system is activated at 2 000 r/min or higher.

RESET:
- Stop the engine and check the engine oil level. Refill the engine oil to the correct level.
- The low oil pressure caution system is reset when the oil pressure is restored to over 15 kPa (0.15 kg/cm², 2 psi) with approx. 1 500 r/min for 1.5 seconds.

If the engine oil level is correct, the following causes may be considered:
- Improper oil viscosity
- Malfunctioning oil pressure switch
- Clogged oil filter
- Worn oil pump relief valve
- Oil leakage from oil passage
- Excessive wear/damage of oil pump

TESTING OIL PRESSURE CAUTION SYSTEM

To check the oil pressure caution circuit, follow the procedure below.

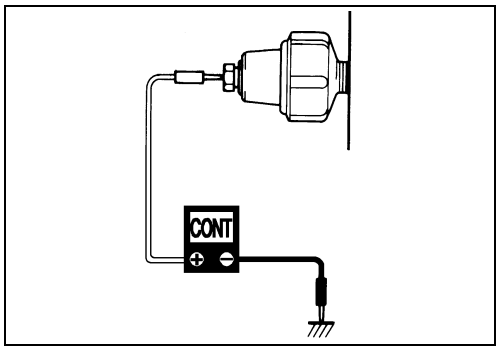
NOTE:
Before checking the oil pressure caution circuit, make sure the engine oil pressure is within specification.

OIL PRESSURE SWITCH

a. Remove the blue lead wire from the oil pressure switch.
b. Check the continuity between the switch terminal and the engine body ground.

09930-99320 : Digital circuit tester

Tester range: (Continuity)



During engine running	Infinity
At engine stop	Continuity

If measurement exceeds specification, replace oil pressure switch.

OIL PRESSURE CAUTION LAMP CIRCUIT

a. Remove the blue lead wire from the oil pressure switch.
b. Start the engine.
c. Touch the blue lead wire to the engine body ground. If the caution lamp comes on, the oil pressure switch circuit and the oil pressure caution lamp are normal.

CAUTION LAMP

Check for illumination of the caution lamp.

1. Disconnect lamp lead wires from engine harness.
2. For tests using 1.5V power source (or battery), connect the lamp lead wire to the 1.5V power source (or battery) as shown below.

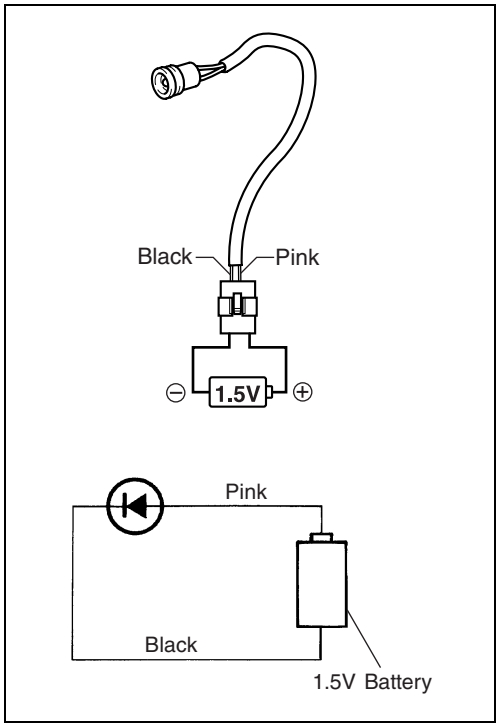
CAUTION

Do not use Battery larger than 2V.

Pink lead wire → Battery (+)
Black lead wire → Battery (–)

When 1.5 V applied → Lamp ON

If out of specification, replace the caution lamp.

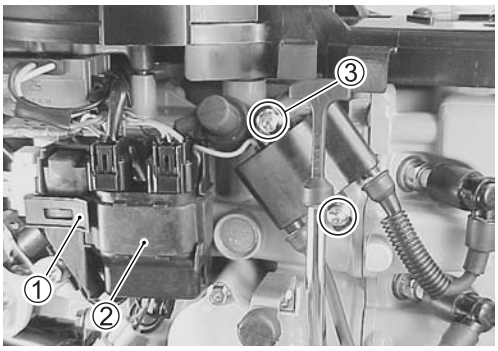


REMOVAL AND INSTALLATION

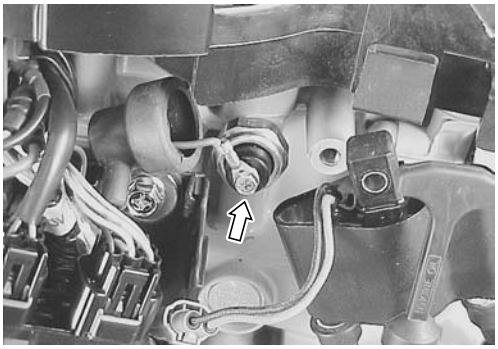
OIL PRESSURE SWITCH

Removal

1. Remove the plate ① by sliding it upward.
2. Remove CDI unit ② from electric parts holder.
3. Remove the two (2) bolts ③ securing ignition coil.



4. Loosen screw and disconnect blue lead wire from oil pressure switch.
5. Remove oil pressure switch from cylinder block.



INSTALLATION

Installation is reverse order of removal with special attention to the following steps.

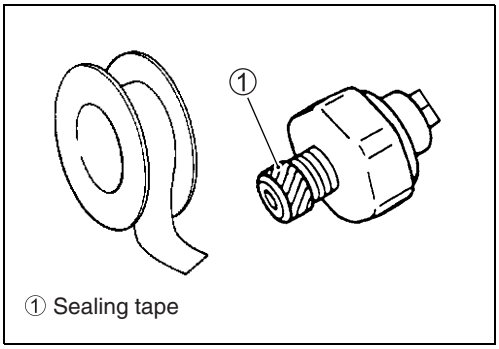
- Before installing oil pressure switch, wrap screw threads with sealing tape then tighten switch to specified torque.

NOTE:

Cut off any excess sealing tape from switch threads before installation.

Oil pressure switch: 13 N·m (1.3 kg-m, 9.5 lb-ft)

- Start engine and check oil pressure switch for oil leakage.
- Reseal switch if oil leakage is found.



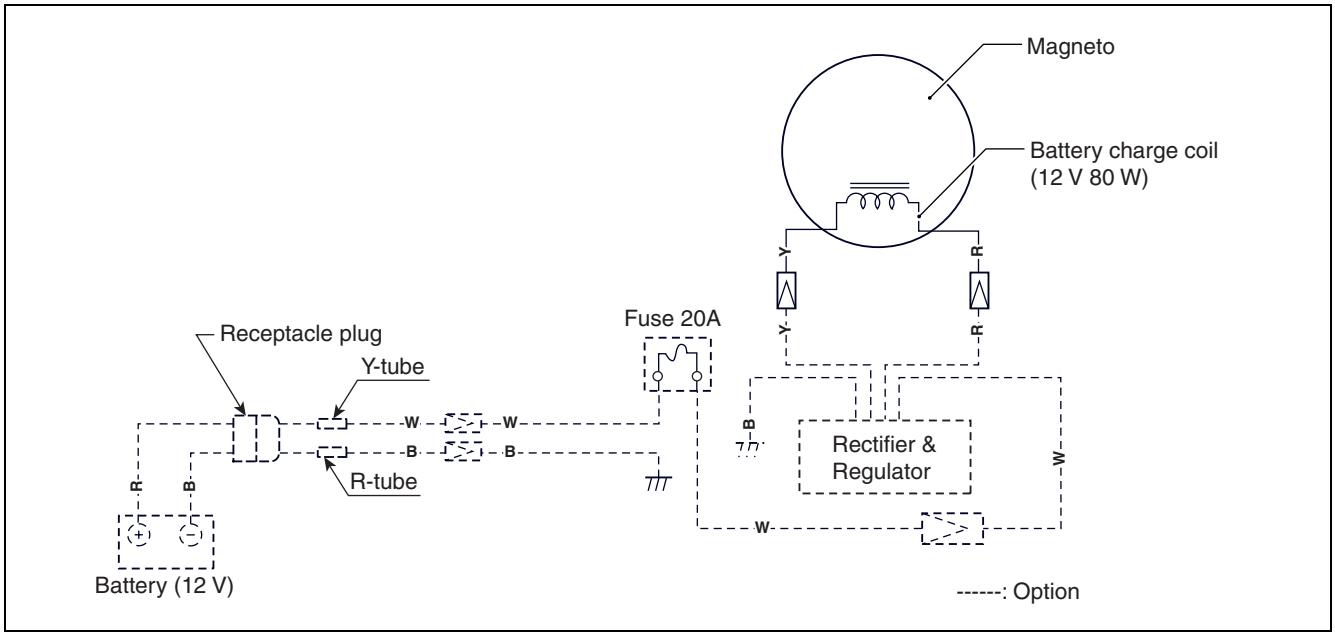
① Sealing tape

BATTERY CHARGING SYSTEM

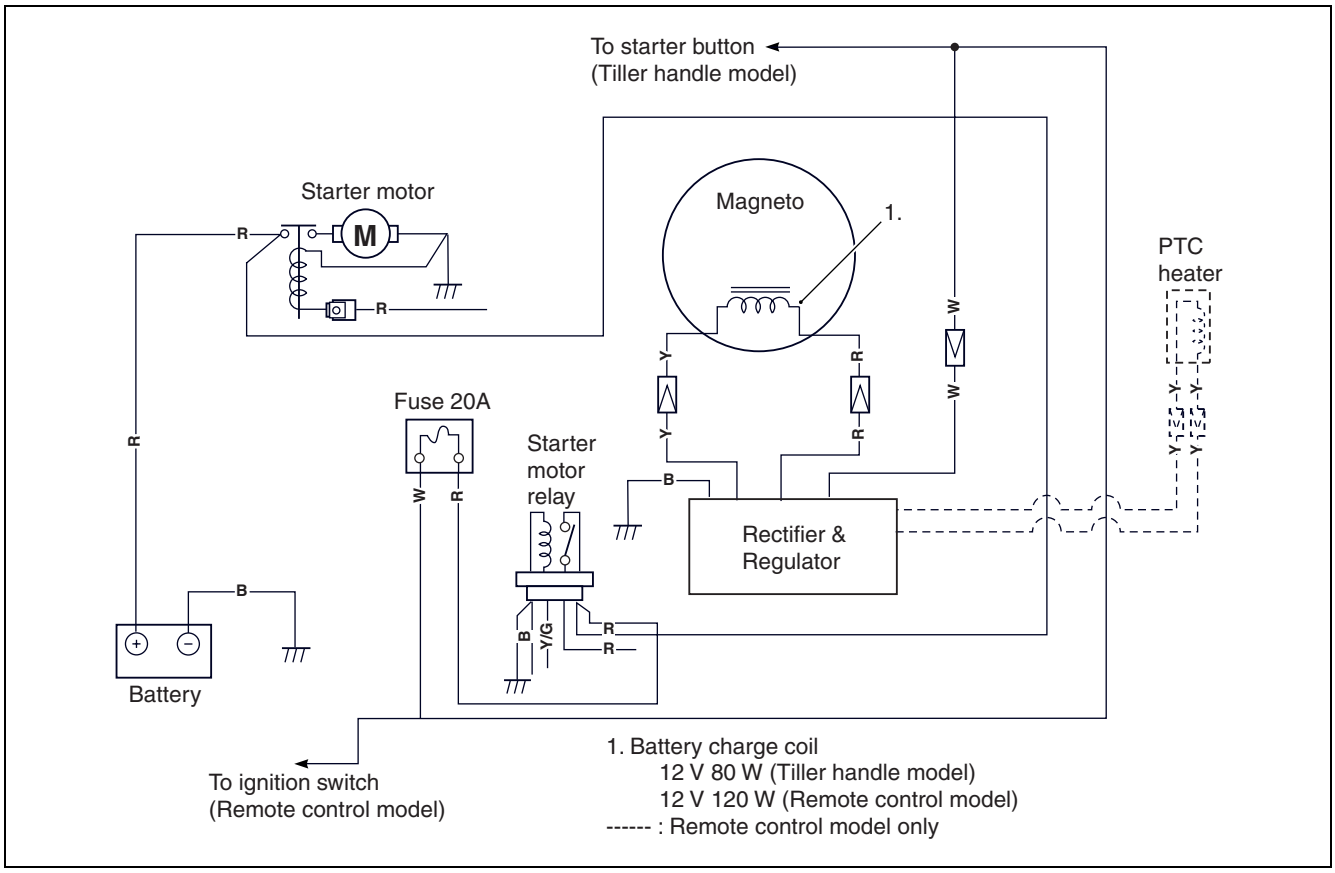
OUTLINE

The battery charging system circuit is illustrated below.
It is composed of the battery charge coil, the rectifier & regulator and the battery.
The AC current generated from the battery charge coil is converted by the rectifier into regulated DC current which is used to charge the battery.

Manual start model



Electric start model



INSPECTION

BATTERY CHARGE COIL OUTPUT

Peak Voltmeter Stevens CD-77
Tester range: POS 50

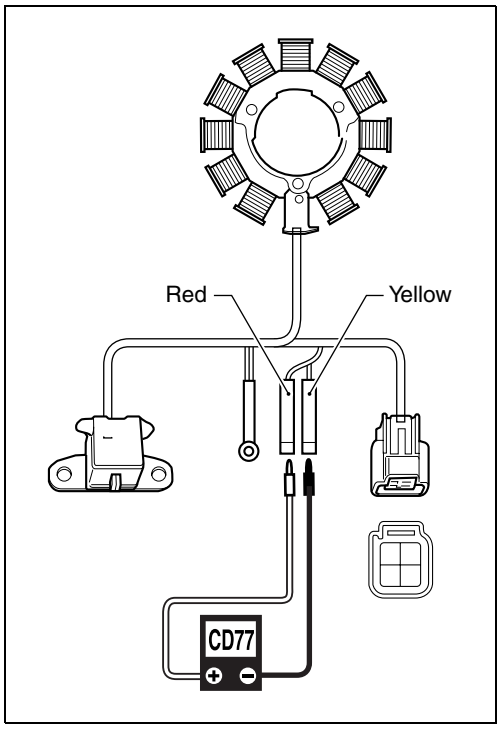
1. Disconnect battery charge coil wires from rectifier.
2. Remove all spark plugs.
3. Connect tester probe to battery charge coil lead wires as shown.

Tester probe connection	
⊕ (Red)	⊖ (Black)
Red	Yellow

4. Crank with the recoil starter.

Coil output: 5.6 V or over

If measurement is out of specification, replace the battery charge coil.



BATTERY CHARGE COIL RESISTANCE

09930-99320: Digital tester

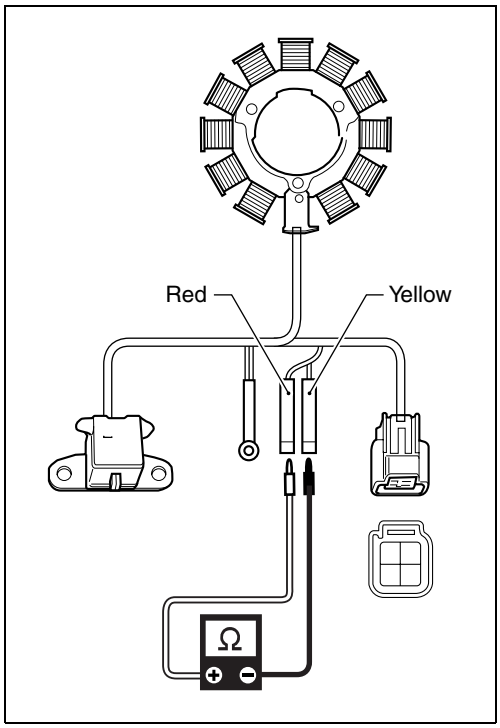
Tester range: Ω (Resistance)

1. Disconnect the battery charge coil wires from the rectifier.
2. Connect tester probe to battery charge coil lead wires as shown.

Tester probe connection	
Probe	Other probe
Red	Yellow

Coil resistance:
0.9 – 1.3 Ω {80 W coil: DF9.9E/15E, DF9.9/15}
0.3 – 0.4 Ω {120 W coil: DF9.9R/15R}

If measurement is out of specification, replace the battery charge coil.



RECTIFIER & REGULATOR

09900-25010: Pocket tester

Tester range: ×1 kΩ (Resistance)

1. Disconnect all lead wires of rectifier & regulator.
2. Measure resistance between leads in the combinations shown.

NOTE:
The values given below are for a SUZUKI pocket tester.
As thyristors, diodes, etc. are used inside this rectifier & regulator, the resistance values will differ when an ohmmeter other than SUZUKI pocket tester is used.

Rectifier & regulator resistance:

Remote control model **Unit: Approx. kΩ**

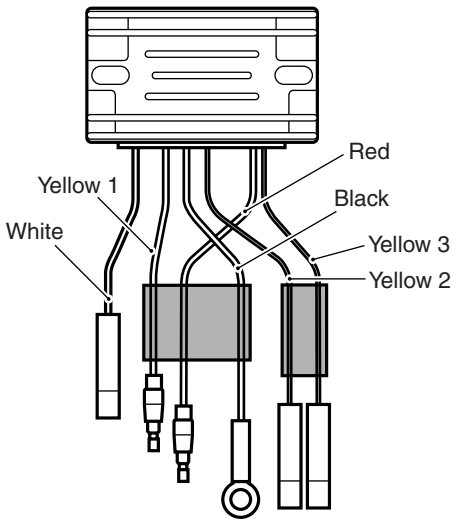
		Tester probe ⊕ (Red)					
		Black	White	Yellow 1	Red	Yellow 2	Yellow 3
Tester probe ⊖ (Black)	Black		7 – 11	2 – 4	2 – 4	2 – 3	7 – 11
	White	∞		∞	∞	∞	0
	Yellow 1	160 – 240	2 – 4		400 – 600	400 – 600	2 – 4
	Red	160 – 240	2 – 4	400 – 600		400 – 600	2 – 4
	Yellow 2	∞	∞	∞	∞		∞
	Yellow 3	∞	0	∞	∞	∞	

Tiller handle model **Unit: Approx. kΩ**

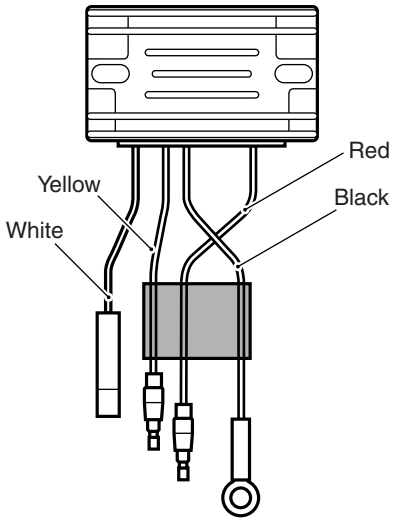
		Tester probe ⊕ (Red)			
		Black	White	Yellow	Red
Tester probe ⊖ (Black)	Black		7 – 11	2 – 4	2 – 4
	White	∞		∞	∞
	Yellow	∞	2 – 4		∞
	Red	∞	2 – 4	∞	

If measurement exceeds specification, replace rectifier & regulator.

Remote control model



Tiller handle model



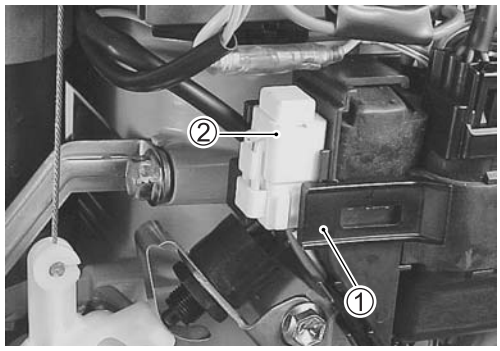
FUSE CASE/FUSE

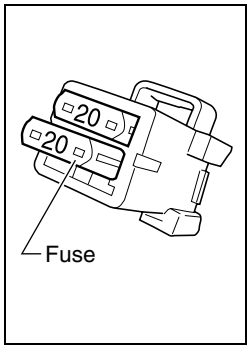
09930-99320: Digital tester

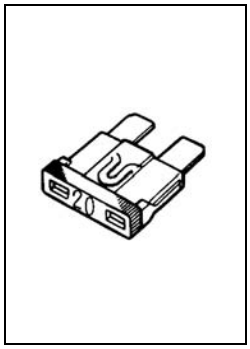
Tester range: (Continuity)

Fuse

1. Remove the plate ① by sliding it upward.
2. Remove the fuse from fuse case ②.
3. Inspect the fuse and replace with a new 20-amp fuse if needed.

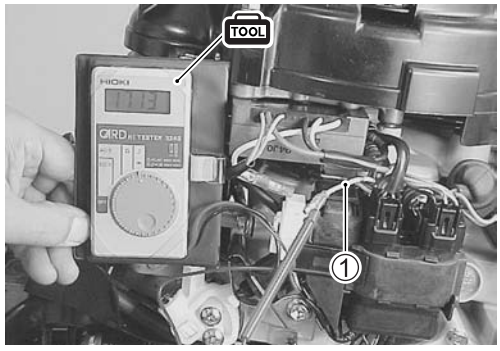




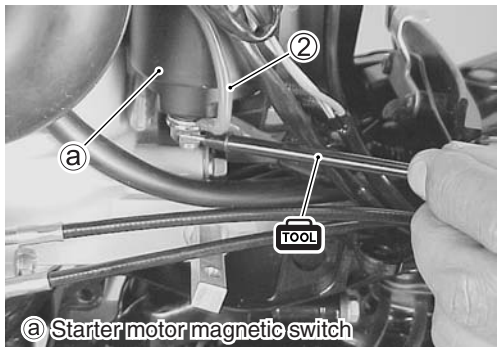


Fuse case

1. Disconnect battery cables from battery.
2. Disconnect white lead wire of rectifier from engine wire harness.
3. Check continuity between White lead wire ① of engine wire harness and Red lead wire ② of starter motor magnetic switch “B” terminal.



If no continuity is indicated, replace engine wire harness and/or fuse.



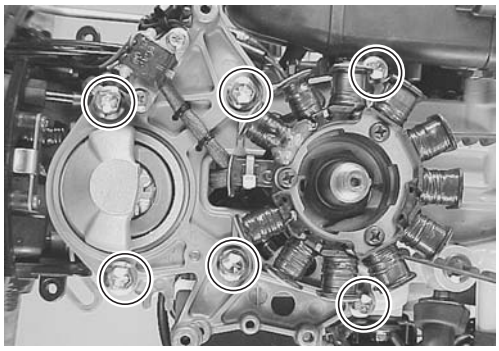
REMOVAL/INSTALLATION

REMOVAL

Before removing electrical parts:
- **Disconnect battery cables from battery.**
- **Disconnect spark plug cap from all spark plugs.**

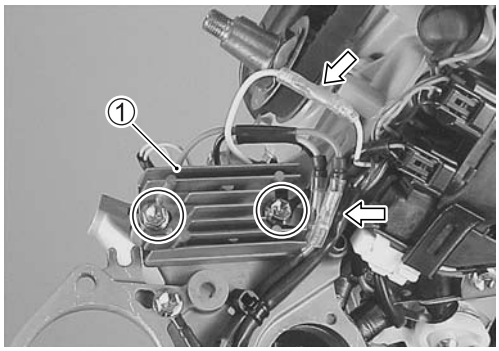
Battery & Condenser charge coil

- Remove flywheel (See page 3-9.)
- Remove the stator base and battery charge coil (See page 3-10.)



Rectifier & Regulator

- Remove the bolts securing stator base. (See page 3-10.)
- Lift stator base from cylinder block and lay it on port side as shown figure.
- Remove the screws securing the rectifier & regulator ①.
- Disconnect lead wire connectors.



INSTALLATION

Installation is reverse order of removal with special attention to the following steps.

- **Battery & Condenser charge coil**
  - Install stator base and charge coil. (See page 3-12.)
- **Wire routing**
  - Check wire routing. (See page 9-3 to 9-9.)

ELECTRIC STARTER SYSTEM

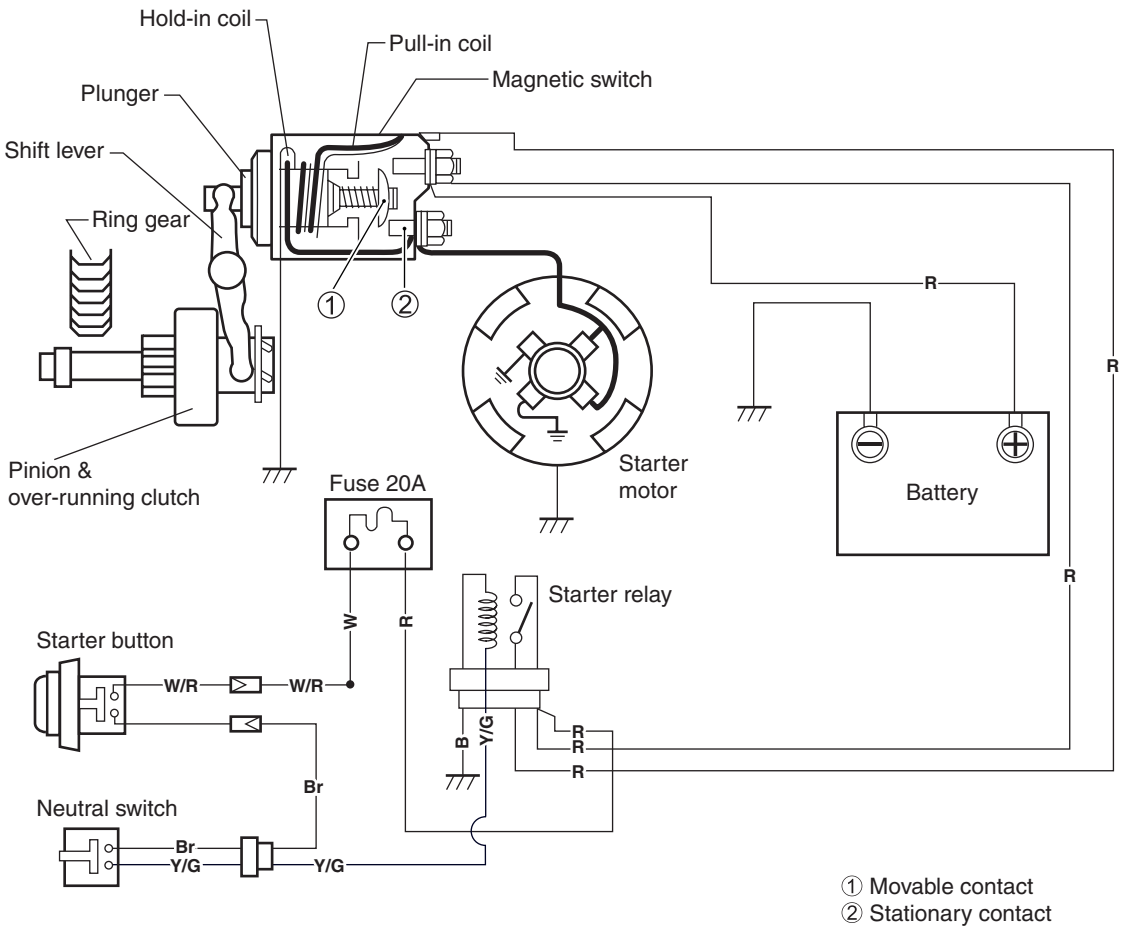
OUTLINE

The starting circuit consists of the battery, starting motor, ignition switch (or starter button), neutral switch and related electrical wiring.
These components are connected electrically as shown in figure below.

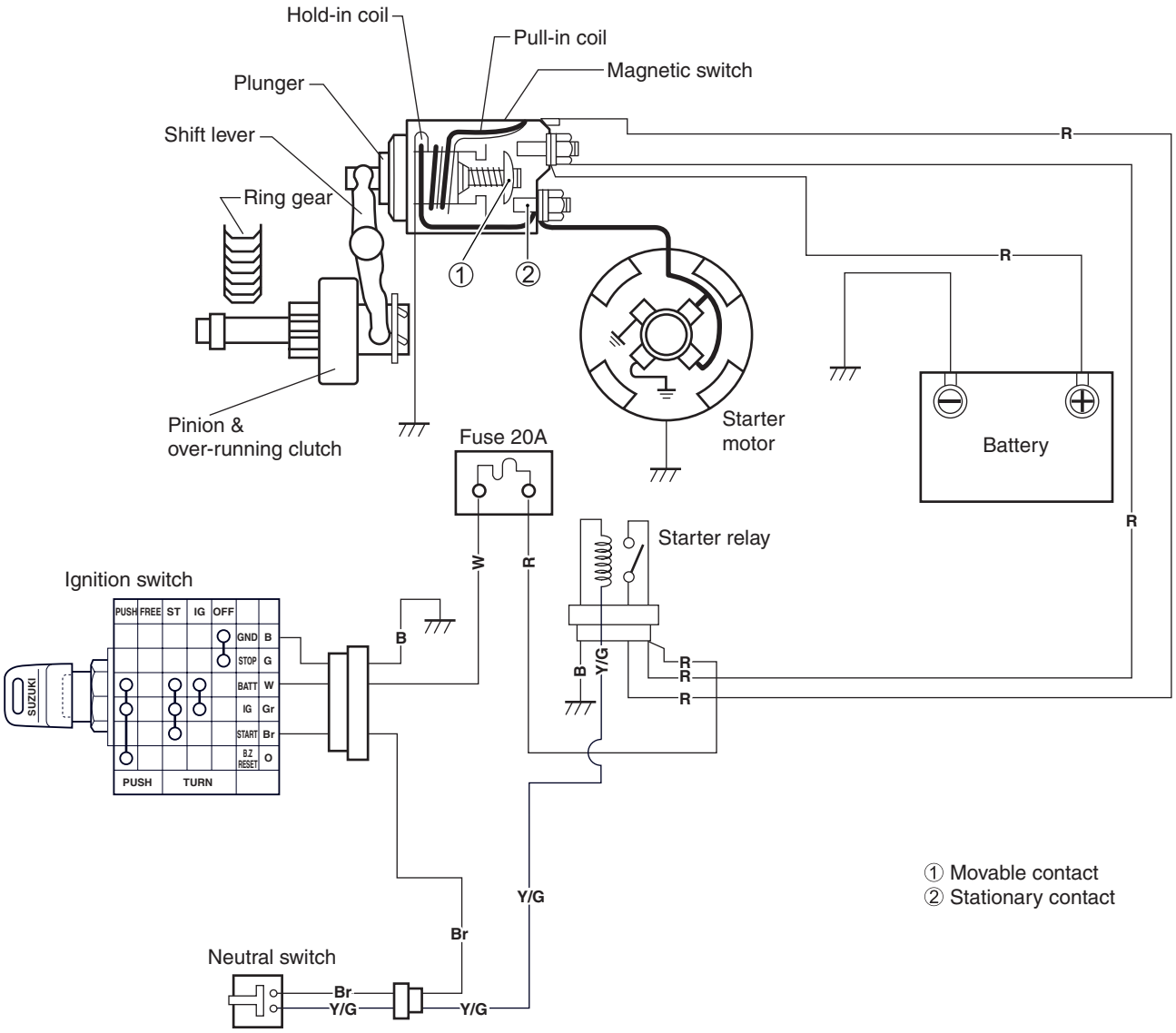
STARTING SYSTEM CIRCUIT

In the circuit shown in figure below, the magnetic switch coils are magnetized when the starter button is closed (Starter button depressed).
The resulting plunger and pinion shift lever movement causes the pinion to engage the engine flywheel gear, the magnetic switch main contacts to close, and engine cranking to take place.
When the engine starts, the pinion over-running clutch protects the armature from excessive speed until the starter button is opened, at which time the torsion spring causes the pinion to disengage.

For Tiller handle model



For Remote control model



TROUBLESHOOTING

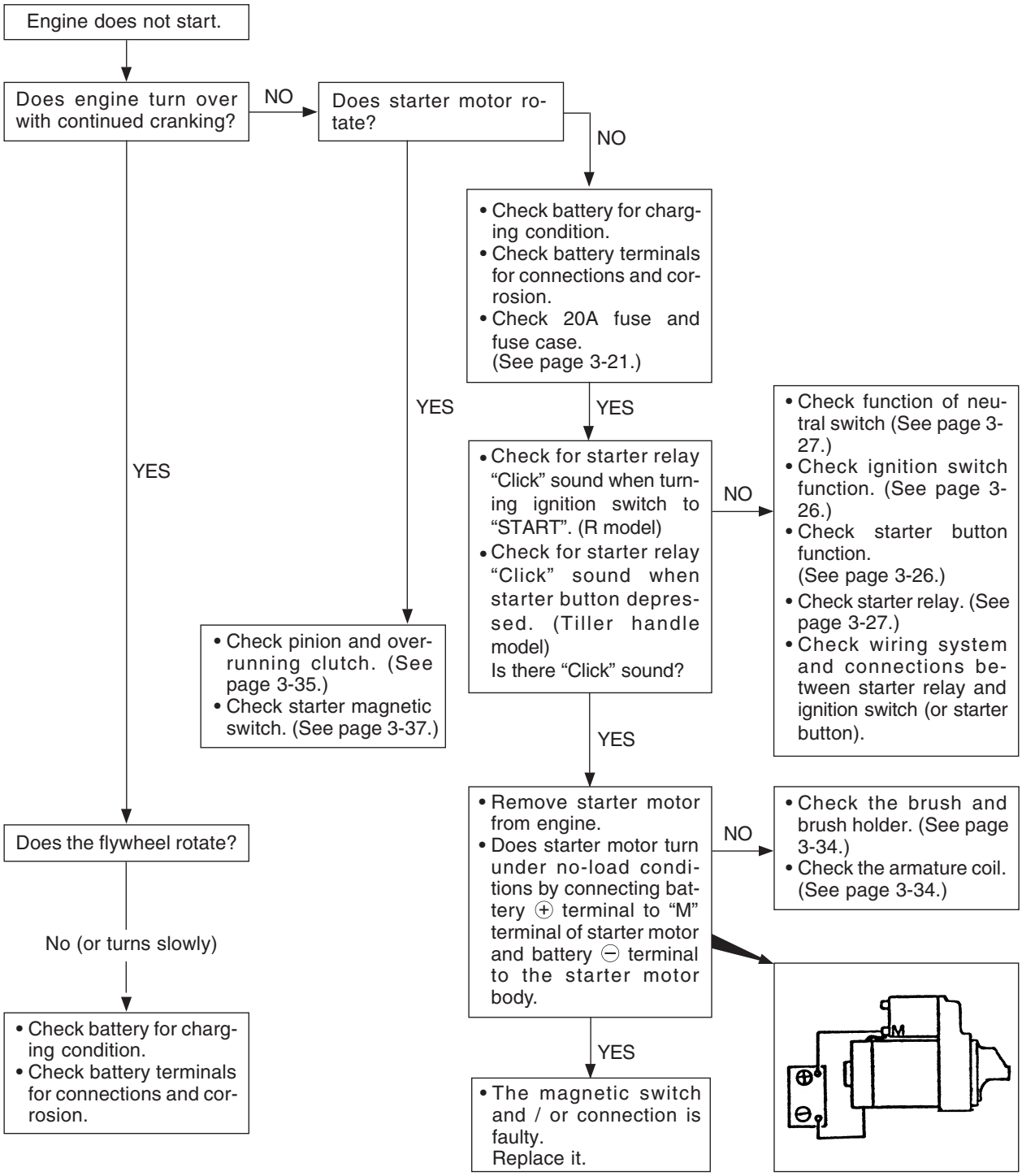
NOTE:

Before troubleshooting the electric starter system, make sure of the following :

- *Battery is fully charged.*
- *All cables / wires are securely connected.*
- *Shift is in "NEUTRAL" position.*

CAUTION

If any abnormality is found, immediately disconnect battery cables from battery.



INSPECTION

IGNITION SWITCH (Remote control model)

09930-99320: Digital tester

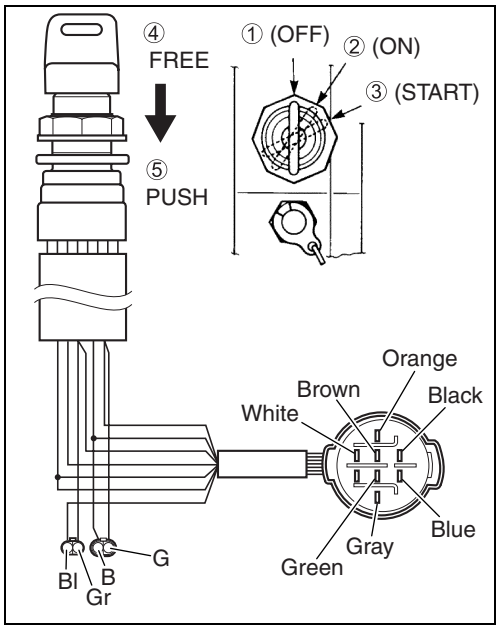
Tester range: (Continuity)

1. Disconnect the ignition switch from remote control wiring harness.
2. Check continuity between wiring leads at the key positions shown in the chart.

Key Position	Switch Lead Wires					
	Black	Green	White	Gray	Brown	Orange
① OFF	○	○				
② ON			○	○		
③ START			○	○	○	
④ FREE						
⑤ PUSH			○	○		○

○——○: Continuity

If out of specification, replace ignition switch.



STARTER BUTTON (Tiller handle model)

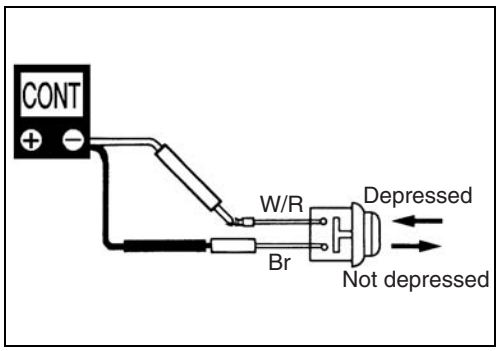
09930-99320: Digital tester

Tester range: (Continuity)

1. Disconnect the starter button lead wire.
2. Check continuity between the wiring leads under the condition shown below.

	Tester probe connection		Continuity
	Probe	Other probe	
Starter button not depressed	White/Red	Brown	No
Starter button depressed			Yes

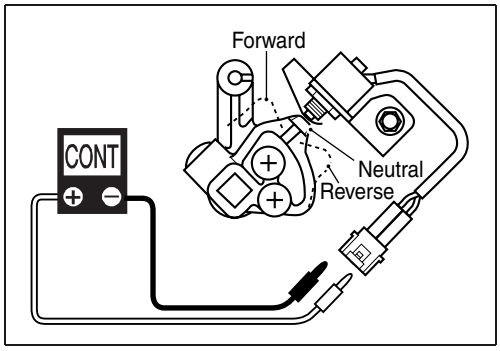
If out of specification, replace the starter button.



NEUTRAL SWITCH

09930-99320: Digital tester

Tester range: (Continuity)



1. Disconnect neutral switch lead wire.
2. Check continuity/infinity between Yellow/Green and Brown lead wire while operating the shift lever or remo-con handle.

Neutral switch function:

Shift position	Tester indicates
Neutral	Continuity
Forward	Infinity
Reverse	Infinity

If out of specification:

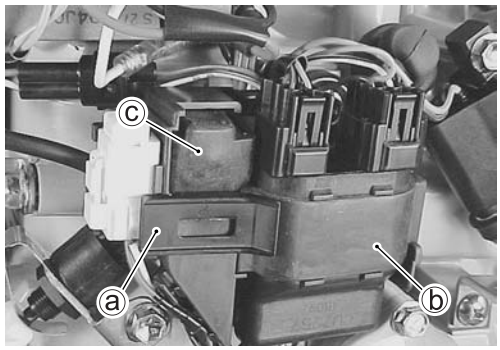
- 1st Check switch position adjustment, readjust if necessary.
- 2nd Replace neutral switch.

NOTE:
After installing neutral switch, check for proper correct function by operating remo-con handle or shift lever.

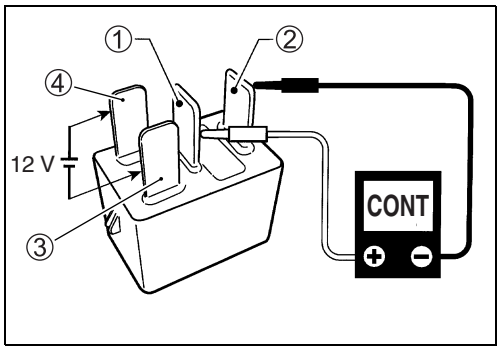
STARTER MOTOR RELAY

09930-99320: Digital tester

Tester range: (Continuity)



1. Remove the plate ⓐ by sliding it upward.
2. Remove CDI unit ⓑ.
3. Pull out relay ⓒ from electric parts holder, then disconnect starter motor relay from wire.



4. Check continuity between terminal ① and ② each time 12 V is applied. Connect positive ⊕ side to terminal ④, and negative ⊖ side to terminal ③.

Starter motor relay function:

12 V power	Continuity
Applied	Yes
Not applied	No

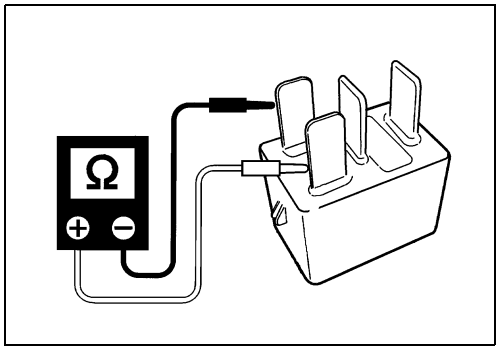
CAUTION

Be careful not to touch 12 V power supply wires to each other or with other terminals.

5. Measure resistance between relay terminals ③ and ④.

Tester range: Ω (Resistance)
Starter motor relay solenoid coil resistance:
145 – 190 Ω

If out of specification, replace starter motor relay.

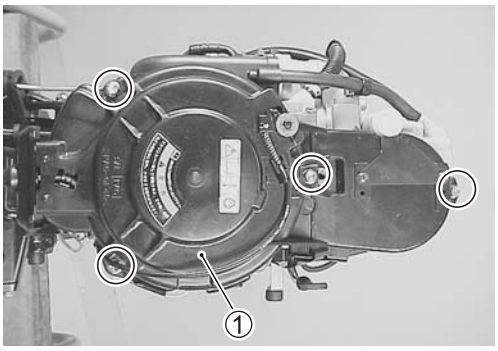


STARTER MOTOR

REMOVAL

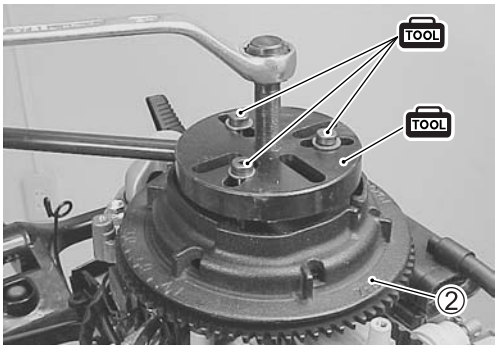
Prior to removing starter motor:
- **Disconnect battery cables from battery.**

1. Remove the side covers. (See page 7-2.)
   Remove bolts and recoil starter ①. (See page 5-2.)

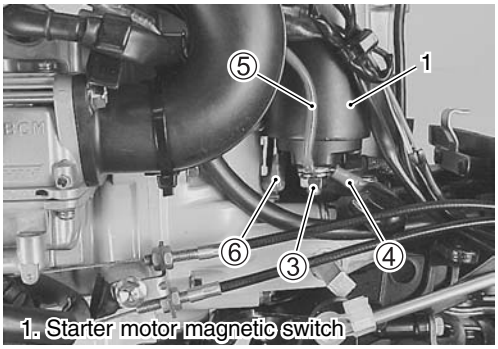


2. Remove the flywheel ②. (See page 3-9.)

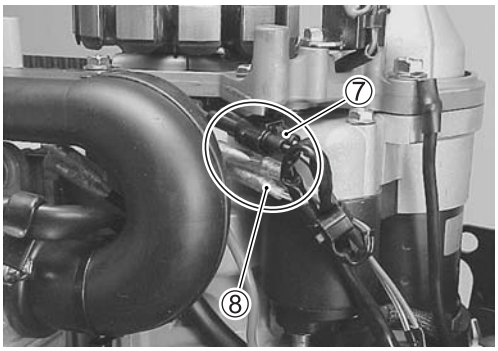
TOOL **09930-48720: Flywheel holder**
09930-49210: Flywheel holder attachment
09930-39411: Flywheel remover
09930-39210: Flywheel remover attachment bolt



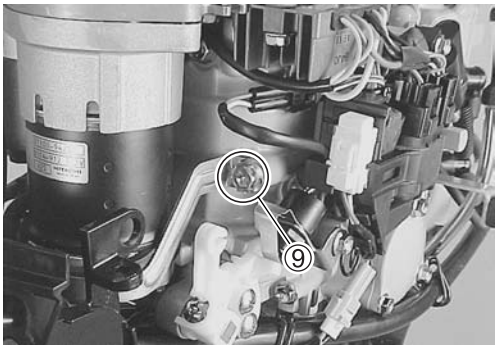
3. Remove nut ③ and positive ⊕ battery cable ④, positive ⊕ battery charge cable ⑤ from the magnetic switch "B" terminal of starter motor.
   Disconnect the red lead wire ⑥ from starter motor magnetic switch "S" terminal.



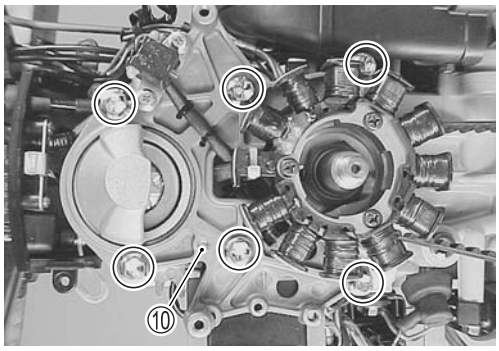
4. Disconnect engine stop switch lead wire connector ⑦.
   Disconnect starter switch lead wire connector ⑧.
   (Tiller handle model)



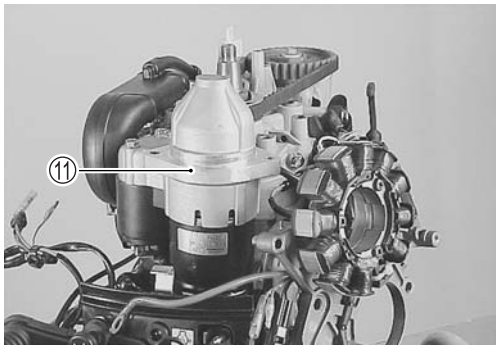
5. Remove the PORT side bolt ⑨ securing starter motor band.



6. Remove the six (6) bolts securing stator base ⑩.



7. Lift up stator base, then remove starter motor ⑪.

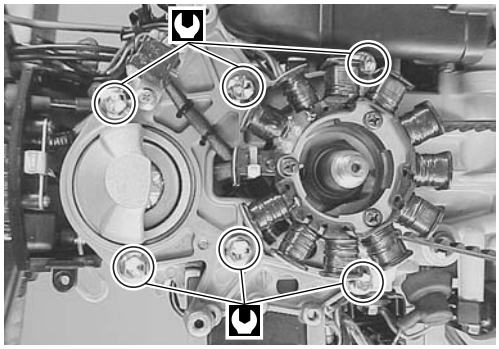


INSTALLATION

Installation is reverse order of removal with special attention to the following steps.

- Install starter motor and stator base, then tighten stator base mounting bolts securely.

Stator base mounting bolt:
8 mm 23 N·m (2.3 kg-m, 16.5 lb-ft)
6 mm 10 N·m (1.0 kg-m, 7.0 lb-ft)



- Check wire routing. (See page 9-2 to 9-9.)

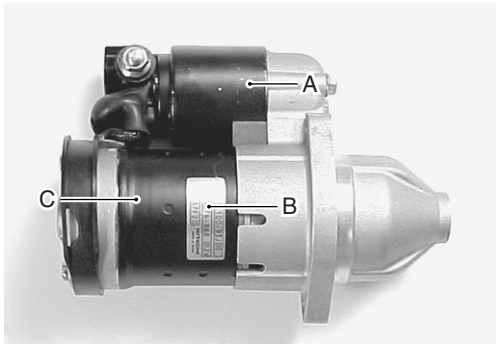
DISASSEMBLY

When overhauling starting motor, it is recommended that component parts be cleaned thoroughly.

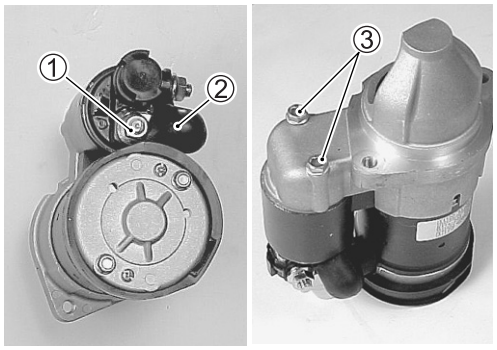
However, the yoke assembly, armature coil, over-running clutch assembly, magnetic switch assembly, and rubber or plastic parts should not be washed in a degreasing tank or with a grease dissolving solvent. These parts should be cleaned with compressed air or wiped with clean cloth.

NOTE:

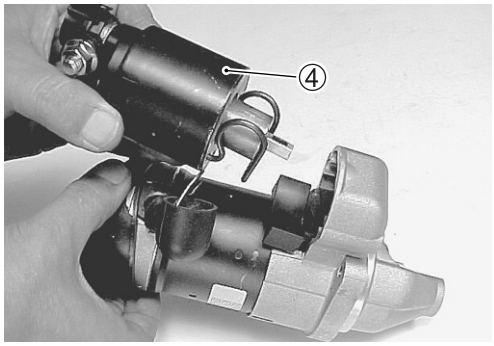
Before disassembling starting motor, be sure to put match marks at three locations (A, B and C) as shown in figure at right to avoid any possible component alignment mistakes.



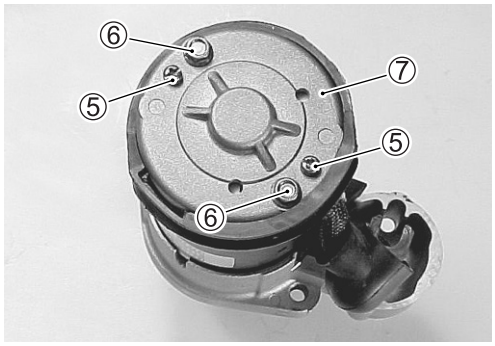
1. Remove nut ① from magnetic switch, then disconnect the connecting wire ②.
2. Remove two bolts ③ securing magnetic switch.



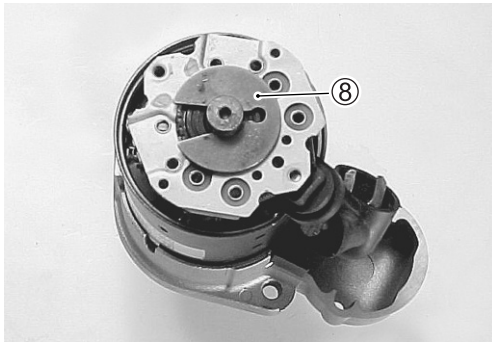
3. Remove the magnetic switch ④.



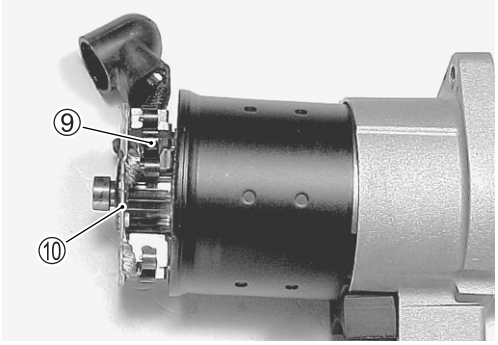
4. Remove screws ⑤, long through bolts ⑥ and rear cover ⑦.



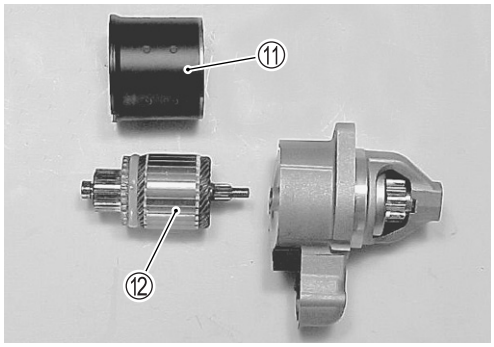
5. Remove thrust washer ⑧ with screwdriver.



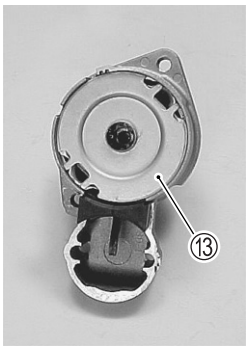
6. Pull the brush spring ⑨ up to separate the brush from the surface of the commutator, then remove the brush holder ⑩.

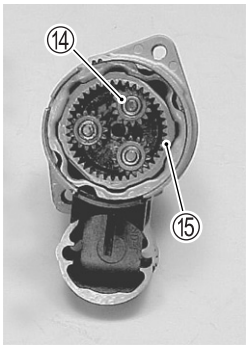


7. Remove the yoke ⑪ and armature ⑫.

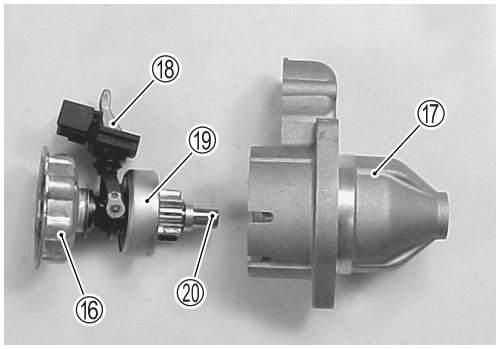


8. Remove the center cover plate ⑬.
9. Remove the planetary gears ⑭ and internal gear ⑮.

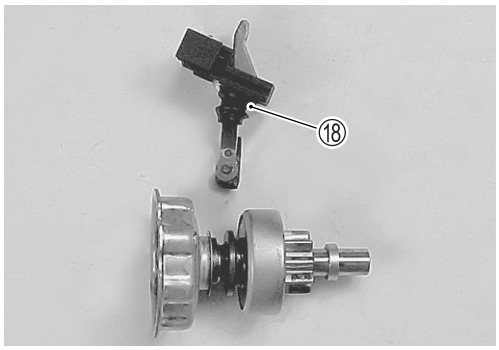




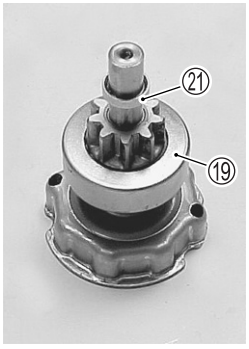
10. Remove the center bracket ⑯ (with shift lever ⑱, pinion ⑲ and pinion shaft ⑳) from front housing ⑰.

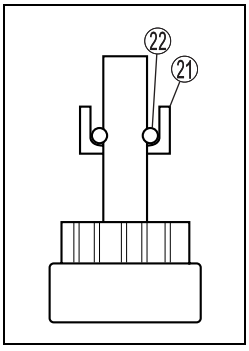


11. Remove the shift lever ⑱.



12. Push the pinion stopper ㉑ down, then remove stopper ring ㉒.
    Remove the pinion stopper and pinion ⑲.



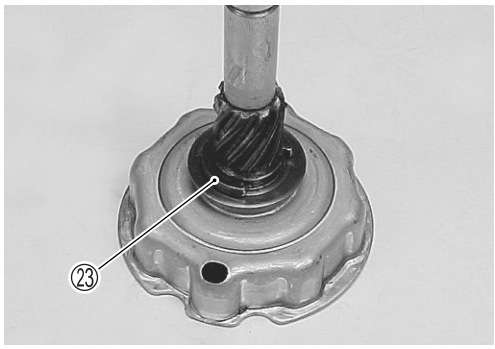


⚠ WARNING

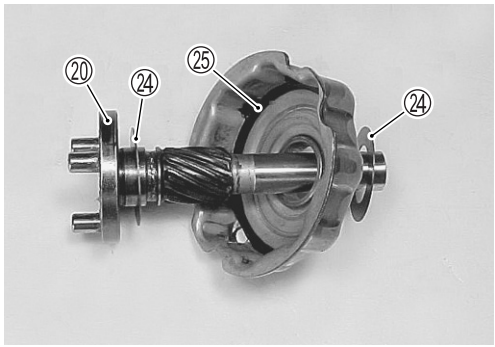
Wear safety glasses when disassembling and assembling stopper ring.

NOTE:
Using a screw-driver, pry off the stopper ring.

13. Remove the E-ring ㉓.



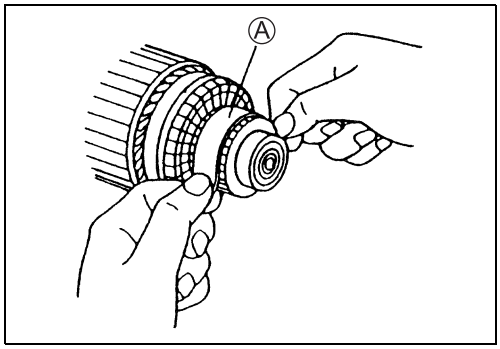
14. Remove the pinion shaft ⑳, washers ㉔ and rubber ring ㉕ from center bracket.



INSPECTION AND SERVICING

Armature and Commutator

- Inspect the commutator surface.
  If surface is gummy or dirty, clean with #500 grit emery paper Ⓐ.

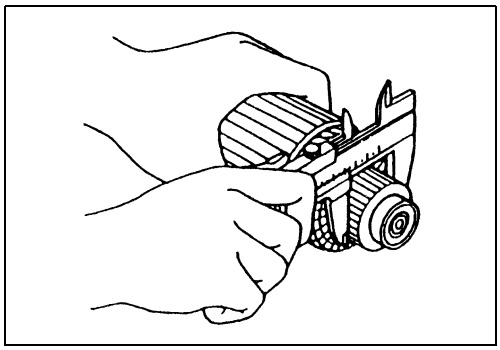


- Measure commutator outside diameter.

TOOL 09900-20101: Vernier calipers

Commutator outside diameter:
Standard: 29.0 mm (1.14 in)
Service limit: 28.0 mm (1.10 in)

If measurement exceeds service limit, replace armature.

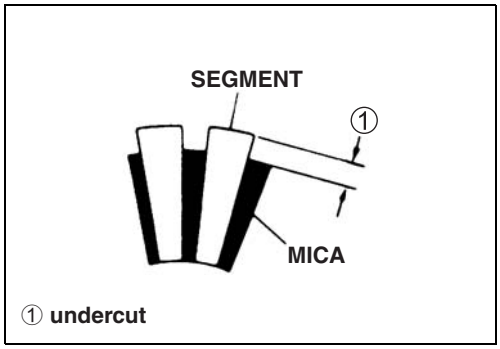


- Check that mica (insulator) between the segments is undercut to specified depth.

Commutator undercut ①:
Standard: 0.5 – 0.8 mm (0.02 – 0.03 in)
Service limit: 0.2 mm (0.01 in)

If measurement exceeds service limit, cut to specified depth.

NOTE:
Remove all particles of mica and metal using compressed air.



① **undercut**

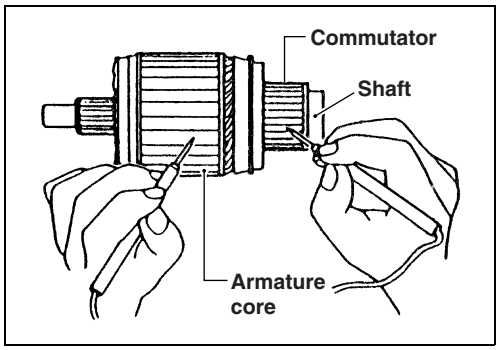
⚠ WARNING

Wear safety glasses when using compressed air.

- Check for continuity between the commutator and the armature core/shaft.
  Replace armature if continuity is indicated.

09930-99320: Digital tester

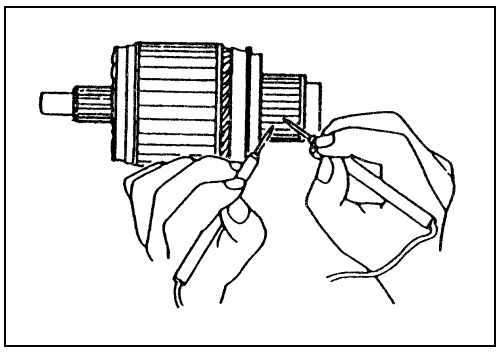
Tester range: (Continuity)



- Check for continuity between adjacent commutator segments.
  Replace armature if no continuity is indicated.

09930-99320: Digital tester

Tester range: (Continuity)



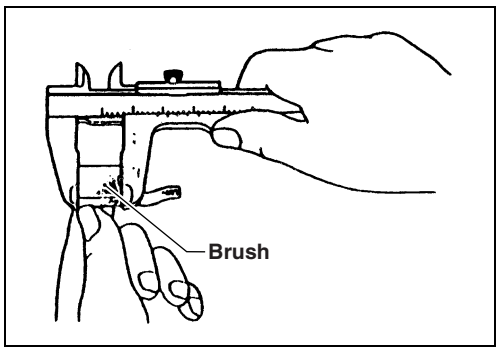
BRUSHES

Check the length of each brush.

09900-20101: Vernier calipers

Brush length:
Standard: 15.5 mm (0.61 in)
Service limit: 9.5 mm (0.37 in)

If brushes are worn down to the service limit, they must be replaced.



BRUSH HOLDER

- Check brush holder continuity.

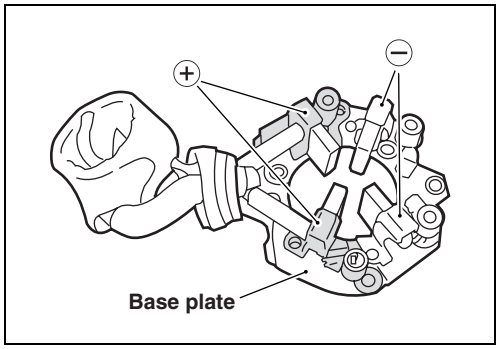
09930-99320: Digital tester

Tester range: (Continuity)

Brush holder continuity:

Tester probe connection	Continuity
Brush holder positive ⊕ to Brush holder negative ⊖	No
Brush holder positive ⊕ to Base plate (ground)	No

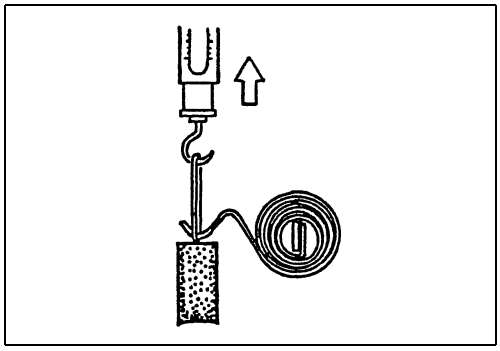
Replace brush holder if the tester doesn't show the above.



BRUSH SPRING

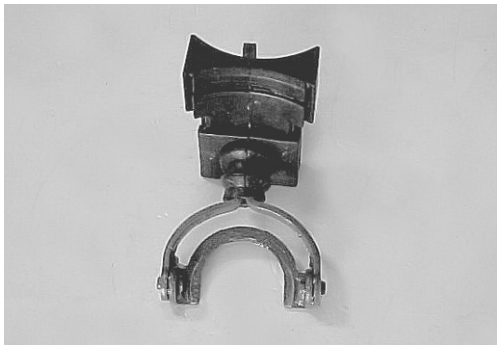
Inspect brush spring for wear, damage or other abnormal conditions.
Check the brush spring tension.
Replace if necessary.

Brush spring tension
Standard: 15 – 18 N (1.5 – 1.8 kg, 3.3 – 4.0 lb)



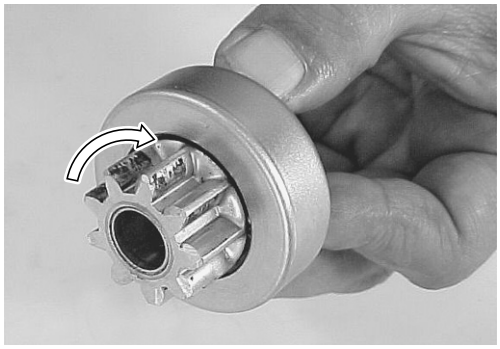
SHIFT LEVER

Inspect shift lever for wear.
Replace if necessary.

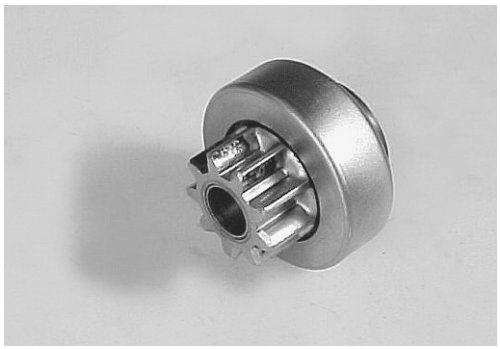


PINION AND OVER-RUNNING CLUTCH

- Inspect pinion for wear, damage or other abnormal conditions.
  Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction.
  Replace if necessary.

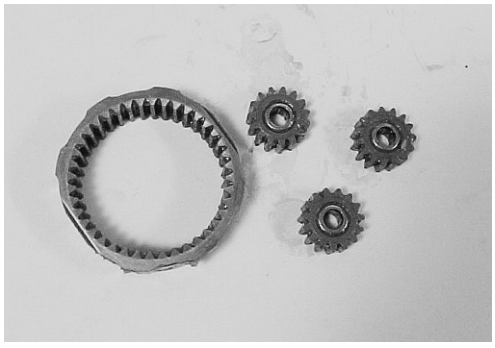


- Inspect spline teeth for wear or other damage.
  Inspect pinion for smooth movement.
  Replace if necessary.



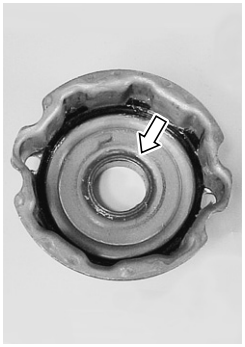
GEAR

- Inspect planetary gears and internal gear for wear, damage or other abnormal conditions.
  Replace if necessary.



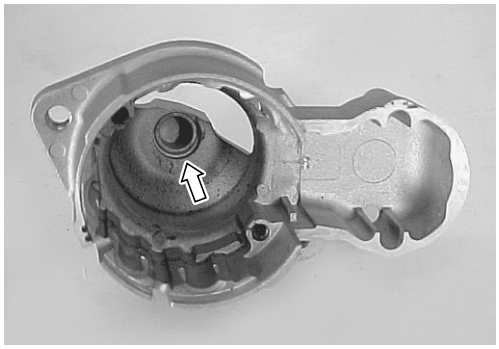
PINION SHAFT/PINION SHAFT BUSH

- Inspect pinion shaft for wear, damage or other abnormal conditions. Replace if necessary.
- Inspect pinion shaft bush for wear or other damage. Replace if necessary.



FRONT HOUSING

- Inspect front housing for wear, damage or other abnormal conditions. Replace if necessary.
- Inspect bush for wear or other damage. Replace if necessary.

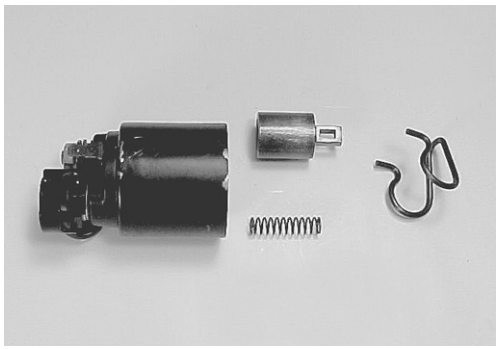


ARMATURE SHAFT BUSH

Inspect bush for wear or other damage.
Replace if necessary.

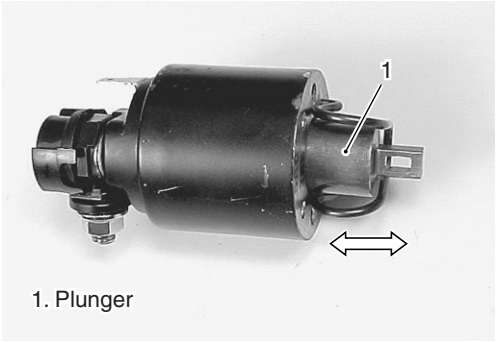
PLUNGER

Inspect plunger for wear or other damage.
Replace if necessary.



MAGNETIC SWITCH

Push in plunger and release. The plunger should return quickly to its original position.
Replace if necessary.



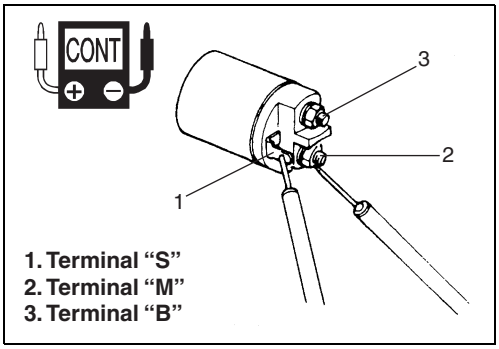
1. Plunger

Pull-in coil Open circuit Test

09930-99320: Digital tester

Tester range: (Continuity)

Check for continuity across magnetic switch “S” terminal and “M” terminal.
If no continuity exists, the coil is open and should be replaced.



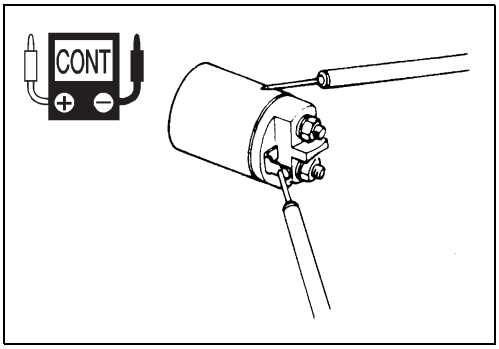
1. Terminal “S”
2. Terminal “M”
3. Terminal “B”

Hold-in coil Open circuit Test

09930-99320: Digital tester

Tester range: (Continuity)

Check for continuity across magnetic switch “S” terminal and coil case.
If no continuity exists, the coil is open and should be replaced.

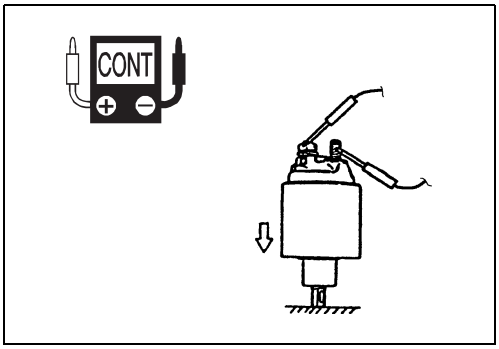


Contact points Test

09930-99320: Digital tester

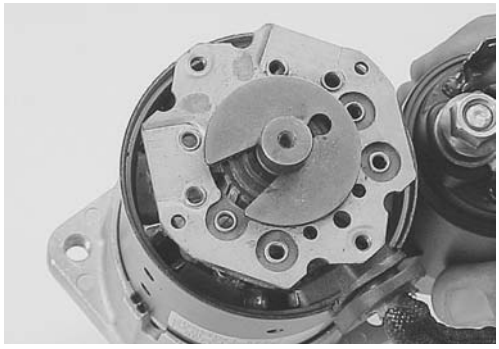
Tester range: (Continuity)

Put the plunger on the under side and then push the magnetic switch down. At this time, check for continuity between terminal “B” and terminal “M”.
Continuity indicates proper condition. If no continuity exists, replace the magnetic switch and/or plunger.



ASSEMBLY

Assembly is reverse order of disassembly with special attention to the following steps.

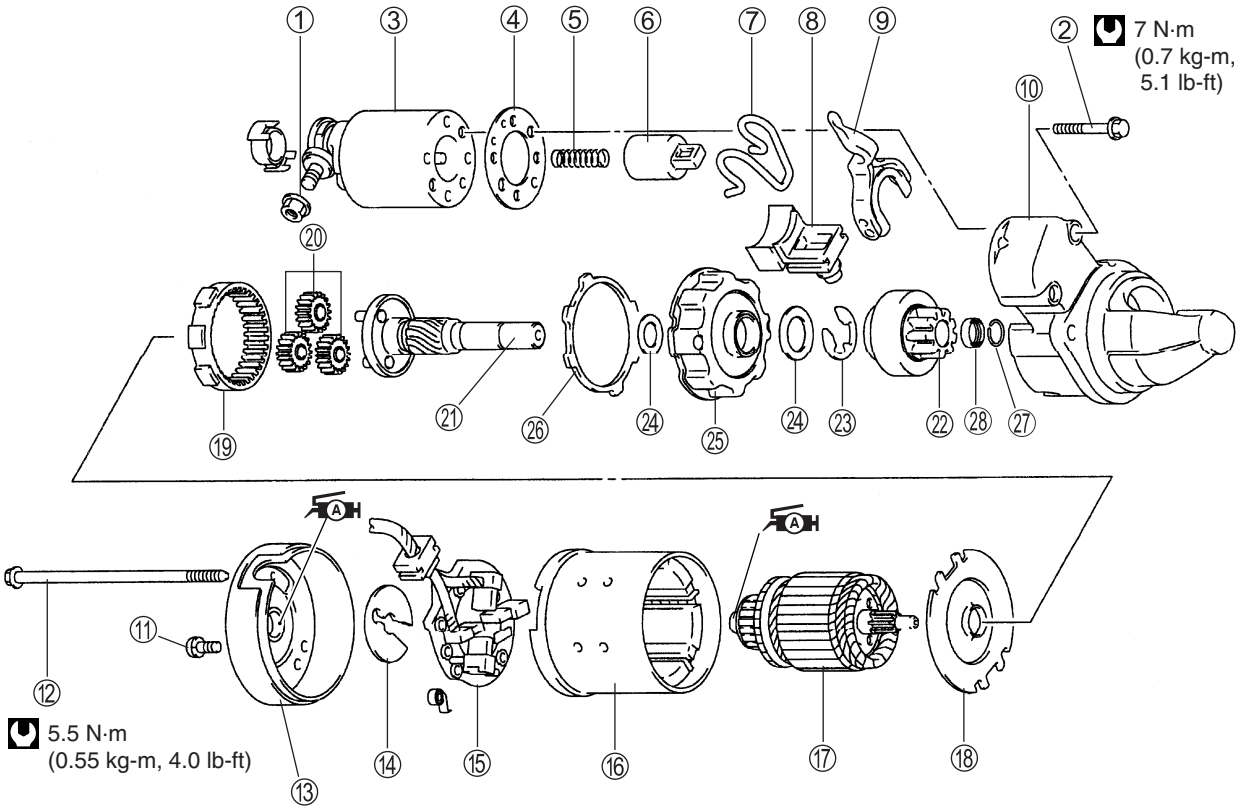


CAUTION

When installing armature, use care to avoid breaking brushes.

When installing pinion shift lever, refer to figure in construction diagram for installation direction.

Construction diagram



① Nut
② Bolt
③ Magnetic switch
④ Gasket
⑤ Spring
⑥ Plunger
⑦ Torsion spring
⑧ Rubber packing
⑨ Shift lever
⑩ Front housing
⑪ Screw
⑫ Through bolt
⑬ Rear cover
⑭ Thrust washer
⑮ Brush holder
⑯ Yoke
⑰ Armature
⑱ Center cover plate
⑲ Internal gear
⑳ Planetary gear
㉑ Pinion shaft
㉒ Pinion
㉓ E-ring
㉔ Washer
㉕ Center bracket
㉖ Rubber ring
㉗ Stopper ring
㉘ Pinion stopper

PERFORMANCE TEST

CAUTION

Each test must be performed within 3 – 5 seconds to avoid coil damage from overheating.

⚠ WARNING

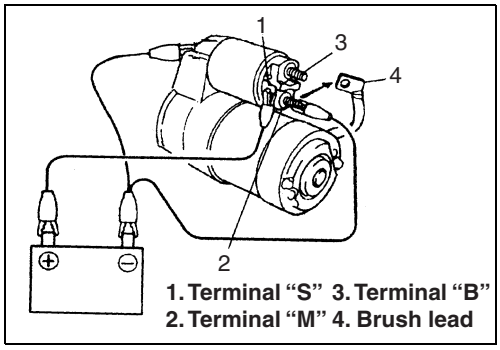
When performing the following test, be sure to connect the battery and the starting motor with a lead wire of the same size as original equipment used there.

PULL-IN/HOLD-IN TEST

Connect battery to magnetic switch as shown in figure.

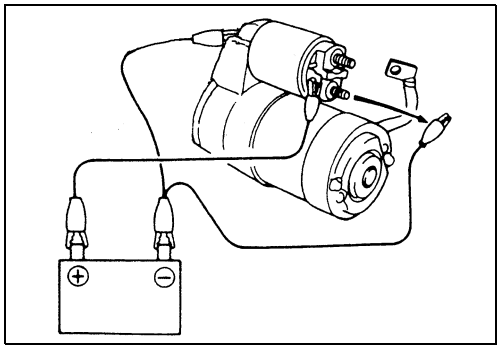
- Check that plunger and pinion (over-running clutch) move outward.
  If plunger and pinion don't move, replace magnetic switch.

NOTE:
Before testing, disconnect brush lead from terminal "M".



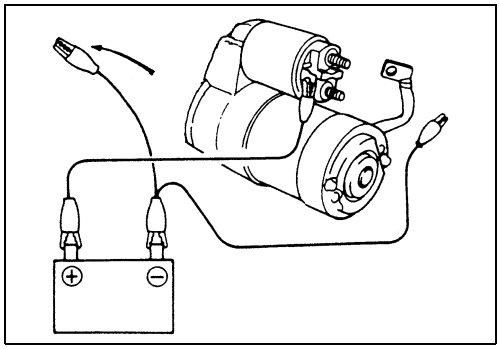
1. Terminal "S" 3. Terminal "B"
2. Terminal "M" 4. Brush lead

- While connected as above with plunger out, disconnect negative lead from terminal "M".
  Check that plunger and pinion remain out.
  If plunger and pinion return inward, replace magnetic switch.



PLUNGER AND PINION RETURN TEST

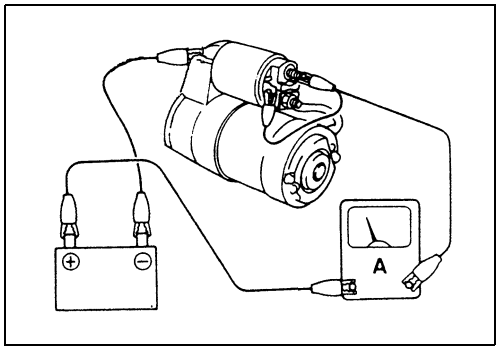
Disconnect negative lead from switch/motor body.
Check that plunger and pinion return inward.
If plunger and pinion don't return inward, replace magnetic switch.



NO-LOAD PERFORMANCE TEST

CAUTION

Before performing following test, secure the starter motor to the test bench.



1. Connect battery and ammeter to starter motor as shown.
2. Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

   No load current: Within 90 A at 11 V

FUEL SYSTEM

CONTENTS

PRECAUTION ON FUEL SYSTEM SERVICE

GENERAL PRECAUTION

⚠ WARNING

Gasoline is extremely flammable and toxic. Always observe the following precautions when working around gasoline or servicing the fuel system.

- **Disconnect battery cables except when battery power is required for servicing / inspection.**
- **Keep the working area well ventilated and away from open flame (such as gas heater) or sparks.**
- **Do not smoke or allow anyone else to smoke near the working areas.**
  Post a "NO SMOKING" sign.
- **Keep a fully charged CO_2 fire extinguisher and readily available for use.**
- **Always use appropriate safety equipment and wear safety glasses when working around pressurized fuel system.**
- **To avoid potential fire hazards, do not allow fuel to spill on hot engine parts or on operating electrical components.**
- **Wipe up fuel spills immediately.**

FUEL LINE

REMOVAL/INSTALLATION

Pay special attention to the following steps when removing or installing fuel hoses.

CAUTION

- **Do not over bend (kink) or twist hoses when installing.**
- **When installing hose clamps (clips), position tabs to avoid contact with other parts.**
- **Be sure hoses do not contact rods, levers or other components with engine either operating or at rest.**
- **Extreme care should be taken not to cut, abrade or cause any other damage to hoses.**
- **Use care not to excessively compress hoses when tightening clamps.**

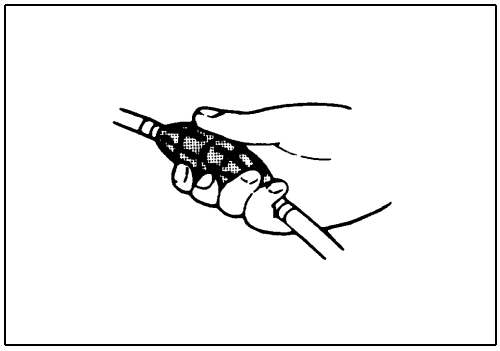
NOTE:

- *Check fuel hose routing. (See page 9-11 and 9-12.)*
- *Check for fuel leakage.*

FUEL LEAKAGE CHECK PROCEDURE

After performing any fuel system service, always be sure there is not fuel leakage by checking as follows.

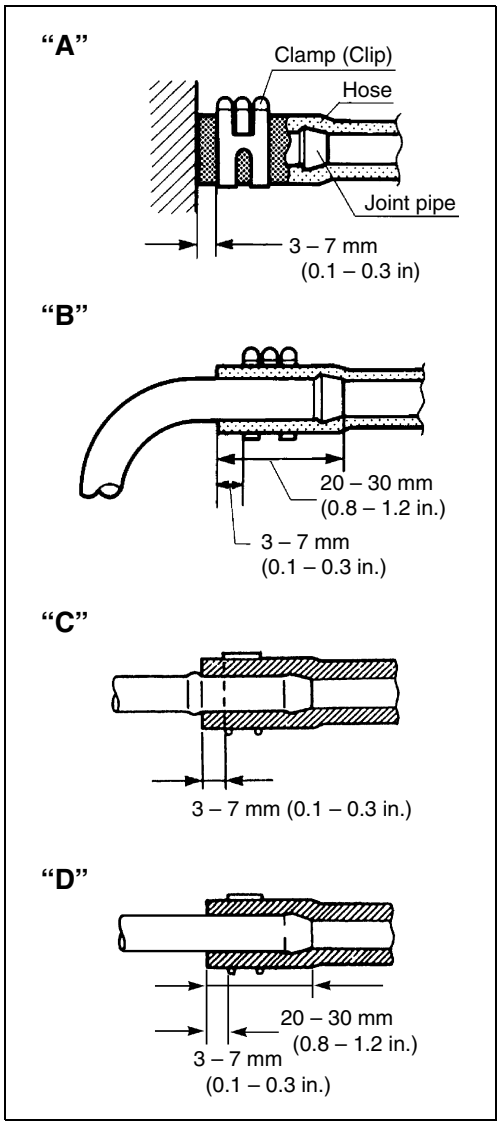
1. Squeeze fuel primer bulb until you feel resistance.
2. Once pressurized, check all connections and components for any signs of leakage.



FUEL HOSE CONNECTION

Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly by referring to the figure.

- For type “A” (short barbed end) pipe, hose must completely cover pipe.
- For type “B” (bent end) pipe, hose must cover straight part of pipe by 20 – 30mm (0.8 – 1.2 in.).
- For type “C” pipe, hose must fit up against flanged part of pipe.
- For type “D” pipe, hose must cover pipe by 20 – 30 mm (0.8 – 1.2 in.).



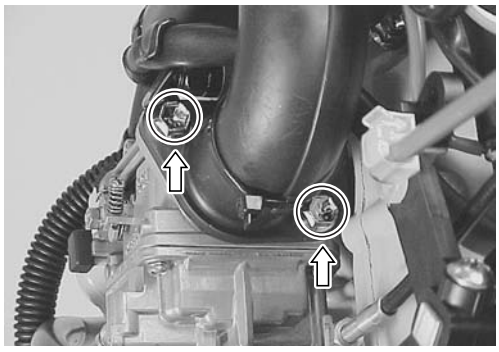
CARBURETOR

⚠ WARNING

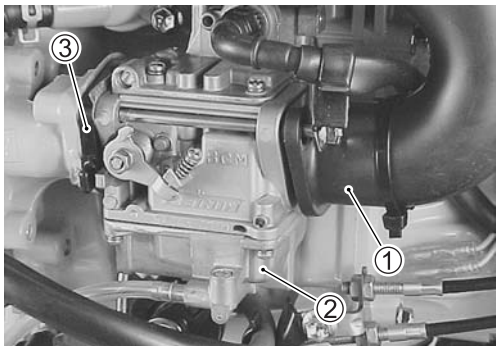
Before servicing the fuel system, read and understand "PRECAUTION ON FUEL SYSTEM SERVICE" in the previous section.

REMOVAL

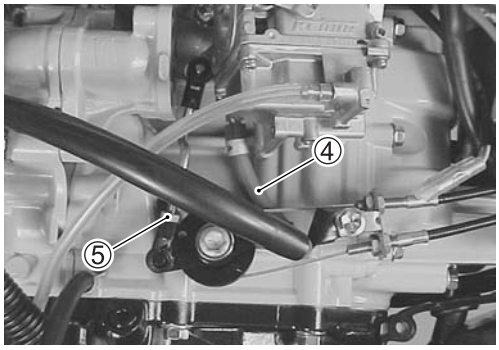
1. Remove the STBD side cover. (See page 7-2.)
2. Remove the two (2) bolts securing carburetor.



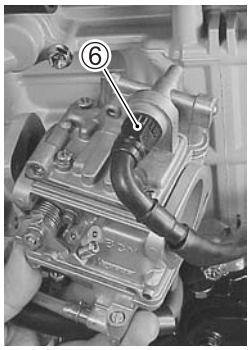
3. Remove the silencer case ①, carburetor ② and insulator ③.

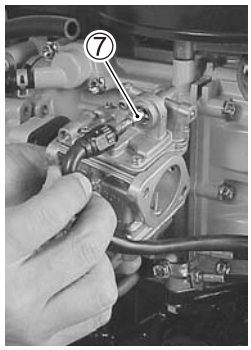


4. Detach the fuel hose ④ from carburetor inlet.
   Remove the throttle rod ⑤ from carburetor.

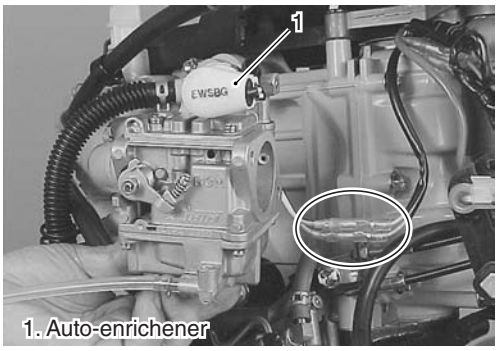


5. On tiller handle model:
   Unscrew the starter cable lock nut ⑥, then remove starter cable with starter plunger ⑦.





6. On remote control model:
   Disconnect the auto-enrichener lead wire connector.



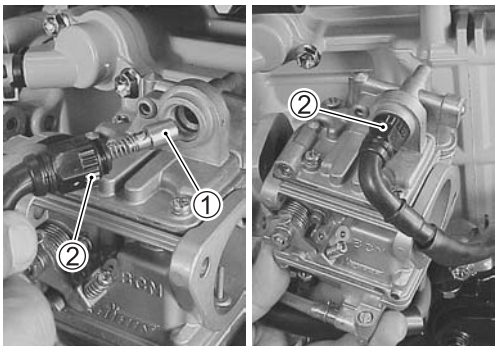
INSTALLATION

Installation is the reverse order of removal with special attention to the following steps.

CAUTION

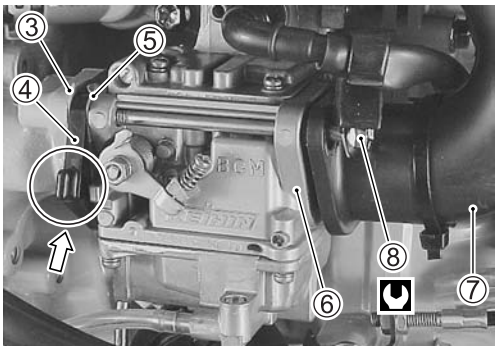
Do not re-use gasket, as sealing abilities will be insufficient. Air leakage will induce a lean air/fuel mix which will result in severe engine damage.

- On tiller handle model:
  Install starter cable with starter plunger ①, then tighten the starter cable lock nut ② securely.



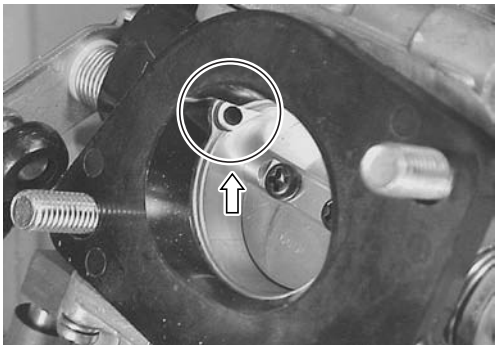
- Install insulator gasket ③, insulator ④, carburetor gasket ⑤, carburetor ⑥ and silencer case ⑦, then tighten carburetor mounting bolts ⑧ to specified torque.

Carburetor mounting bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)



NOTE:

- *When installing carburetor gasket, be sure that starter fuel passage is not obstructed.*
- *The projection of insulator must be faced to STBD and intake manifold sides.*



Final assembly check

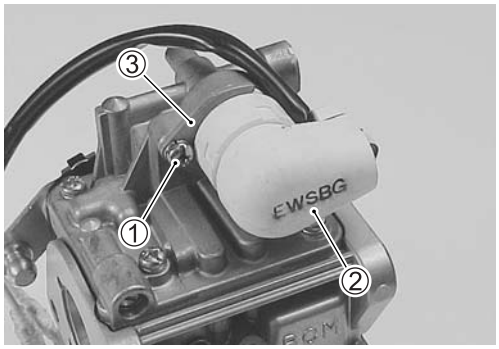
Perform the following checks to ensure proper and safe operation.

- All parts removed have been returned to their original positions.
- No fuel leakage is evident when fuel system is pressurized. (See page 4-3.)

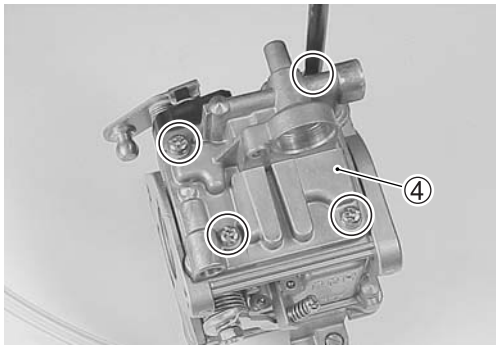
DISASSEMBLY

NOTE:
Carburetor depicted is carburetor with acceleration pump.

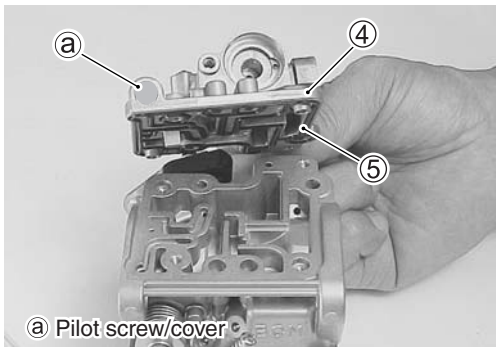
1. On remote control model:
   Remove the screw ① and the auto-enrichener ② with plate ③.



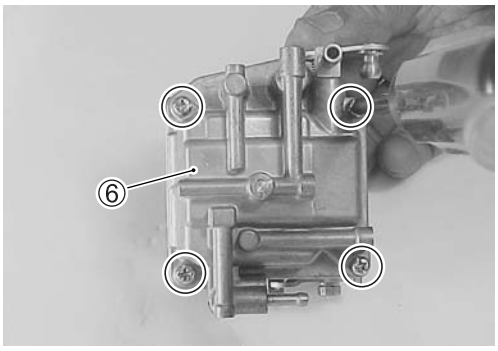
2. Remove the four (4) screws securing the top cover ④, then remove the cover and rubber gasket ⑤.

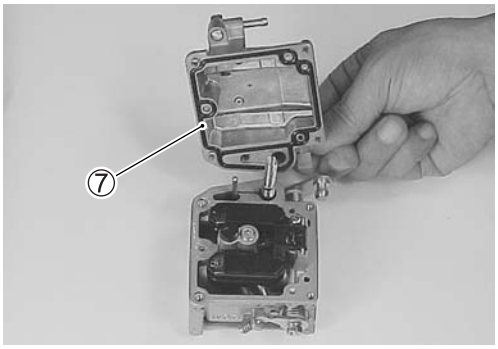


NOTE:
On the carburetor with covered pilot screw:
Do not remove the cover and adjust pilot screw.

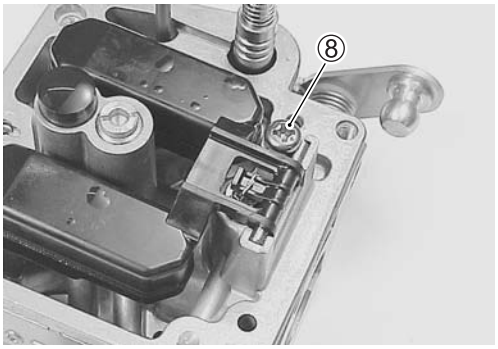


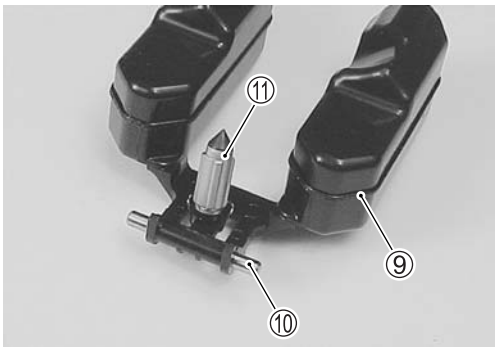
3. Remove the four (4) screws securing the float chamber ⑥, then remove the chamber and rubber gasket ⑦.



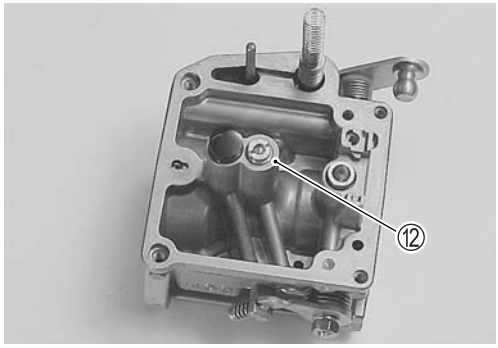


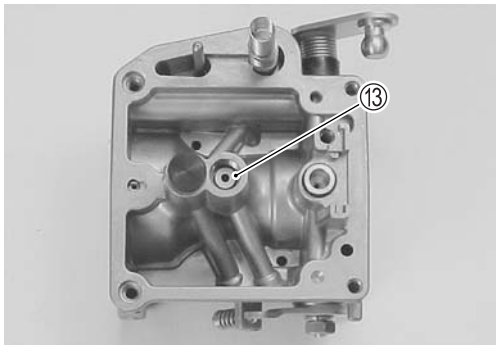
4. Remove the screw ⑧ securing float pin. Account for float ⑨, float pin ⑩ and needle valve ⑪.



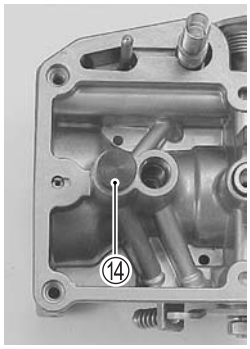


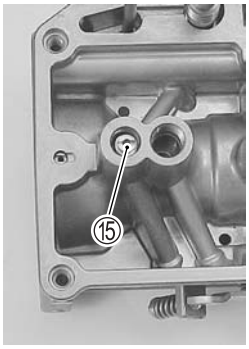
5. Remove the main jet ⑫ and main nozzle ⑬.



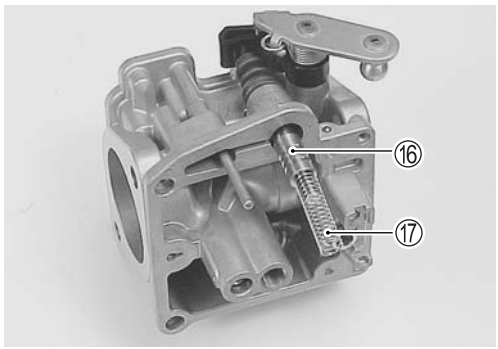


6. Remove the cap ⑭ and pilot jet ⑮.





7. Remove the acceleration pump plunger ⑯ and spring ⑰.



CLEANING & INSPECTION

Clean thoroughly with cleaning solvent and compressed air before inspection.

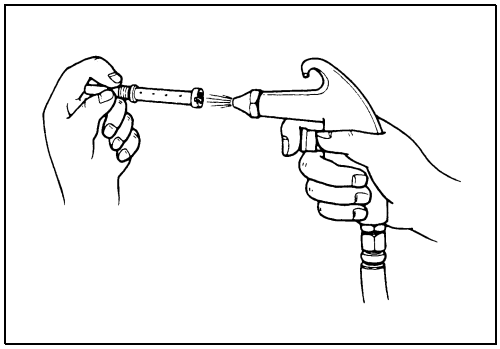
⚠ WARNING

Wear safety glasses when using compressed air to expel solvent, carburetor cleaner, etc.

CAUTION

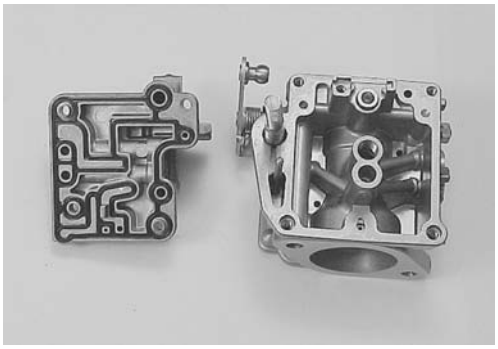
Do not place any rubber, plastic and non-metallic parts in cleaning solvent, as severe damage or deterioration will result.

NOTE:
Wire or small drill bits must not be used to clean carburetor orifices and jet.



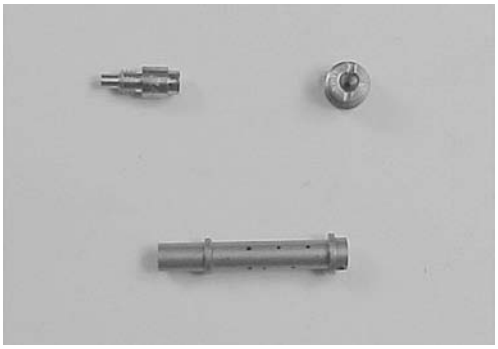
CARBURETOR BODY/TOP COVER

- Inspect the carburetor body and top cover. If cracks or other damage are found on any component, replace it.
- Clean the carburetor body and top cover so that there is no obstruction.
- Inspect the needle valve seat. Replace carburetor body if wear, damage, or other abnormal condition.



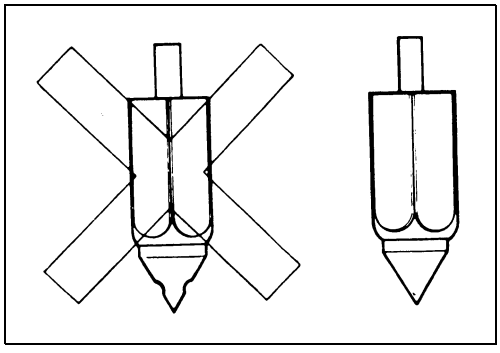
JET, NOZZLE

- Inspect the jet and nozzle. If cracks or other damage are found on the jet and nozzle, replace them.
- Clean the jet and nozzle thoroughly so that there is no obstruction.



NEEDLE VALVE ASSEMBLY

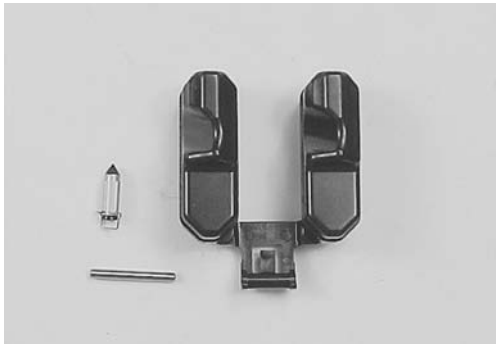
Inspect the needle valve assembly.
If broken tips or wear are found on the needle valve assembly, replace it.



FLOAT

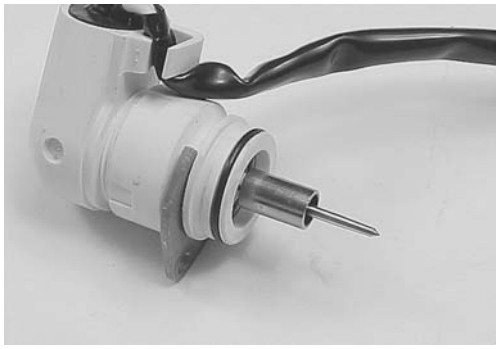
Inspect the float.

If cracks or other damage are found on the float, replace it.

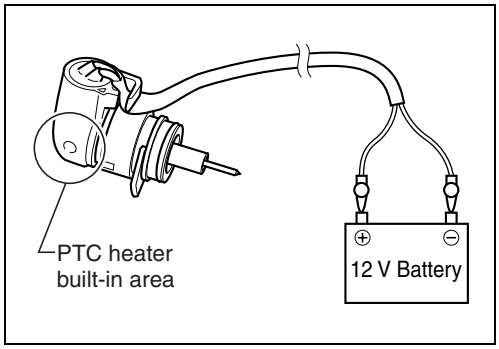


AUTO-ENRICHENER

Inspect the needle valve. If broken tips or wear are found on the needle valve, replace the auto-enrichener.



- Connect the positive ⊕ terminal of 12 V battery to Yellow lead and the negative ⊖ terminal to other yellow lead.
- Check that the auto-enrichener section (PTC heater built-in area) is heated in 5 minutes after the battery has been connected.



NOTE:

To inspect the function, check for change of temperature from the cold condition.

CAUTION

Do not attempt to disassemble the auto-enrichener for the purpose of checking temperature.

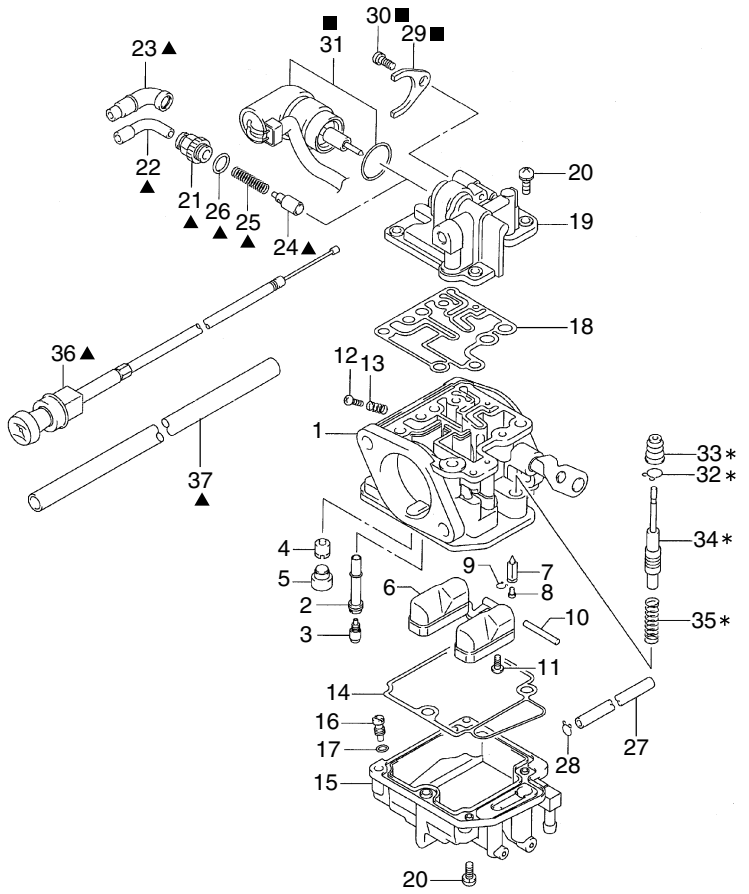
REASSEMBLY

Reassembly is reverse order of disassembly with special attention to the following steps.

CONSTRUCTION DIAGRAM

1. Carburetor body
2. Main nozzle
3. Main jet
4. Pilot jet
5. Cap
6. Float
7. Needle valve
8. Needle valve pin
9. Clip
10. Pin
11. Screw
12. Stop screw
13. Spring
14. Gasket
15. Float chamber
16. Drain screw
17. O-ring
18. U-ring
19. Top cover
20. Screw
21. Cable holder
22. Cable guide
23. Cable sealing cap
24. Starter valve
25. Spring
26. O-ring
27. Drain hose
28. Clip
29. Plate
30. Screw
31. Starter assy
32. Clip
33. Cap
34. Plunger
35. Spring
36. Starter knob assy
37. Cable protector

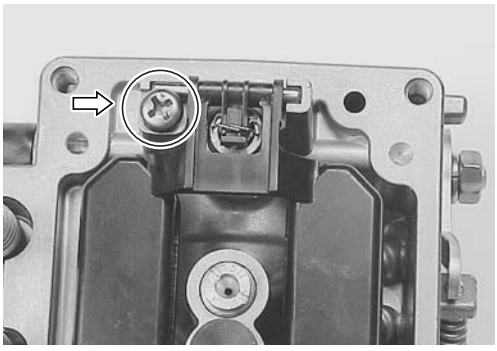
■ marked item: For DF9.9R/15R only.
∗ marked item: For DF15/E/R only.
▲ marked item: For Tiller handle model only.

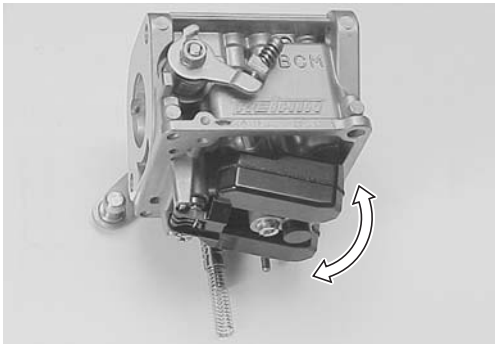


FLOAT

Install the float (with float pin and needle valve), then secure float pin with the screw.

NOTE:
After installing float, inspect for smooth movement of float.





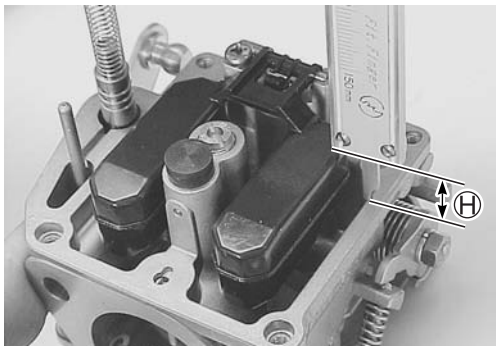
CHECKING FLOAT HEIGHT

Measure the float height.

NOTE:
Make sure that float weight is not applied to needle valve.

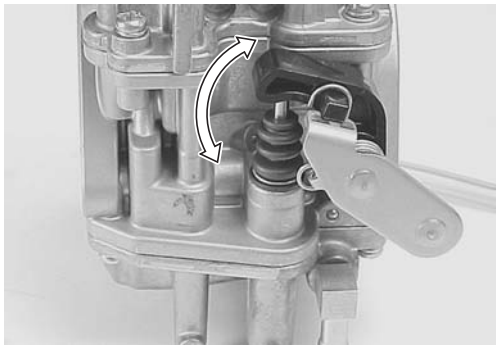
09900-20101: Vernier calipers

Float height Ⓗ: 13.5 ± 2 mm

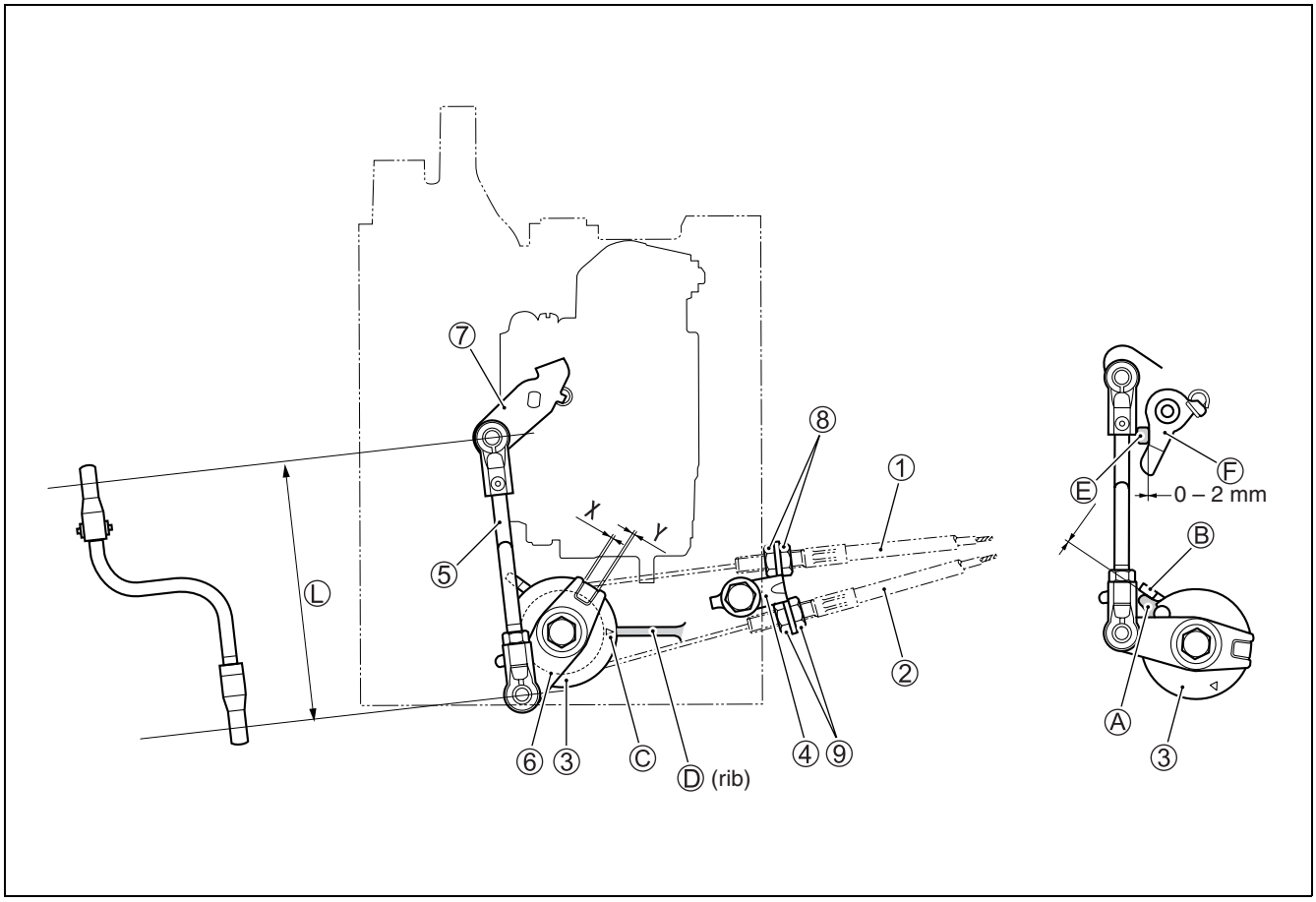


ACCELERATION PUMP

Check that the acceleration pump plunger operates smoothly and together with the throttle lever when turned.



THROTTLE CONTROL
INSTALLATION/ADJUSTMENT
TILLER HANDLE MODEL

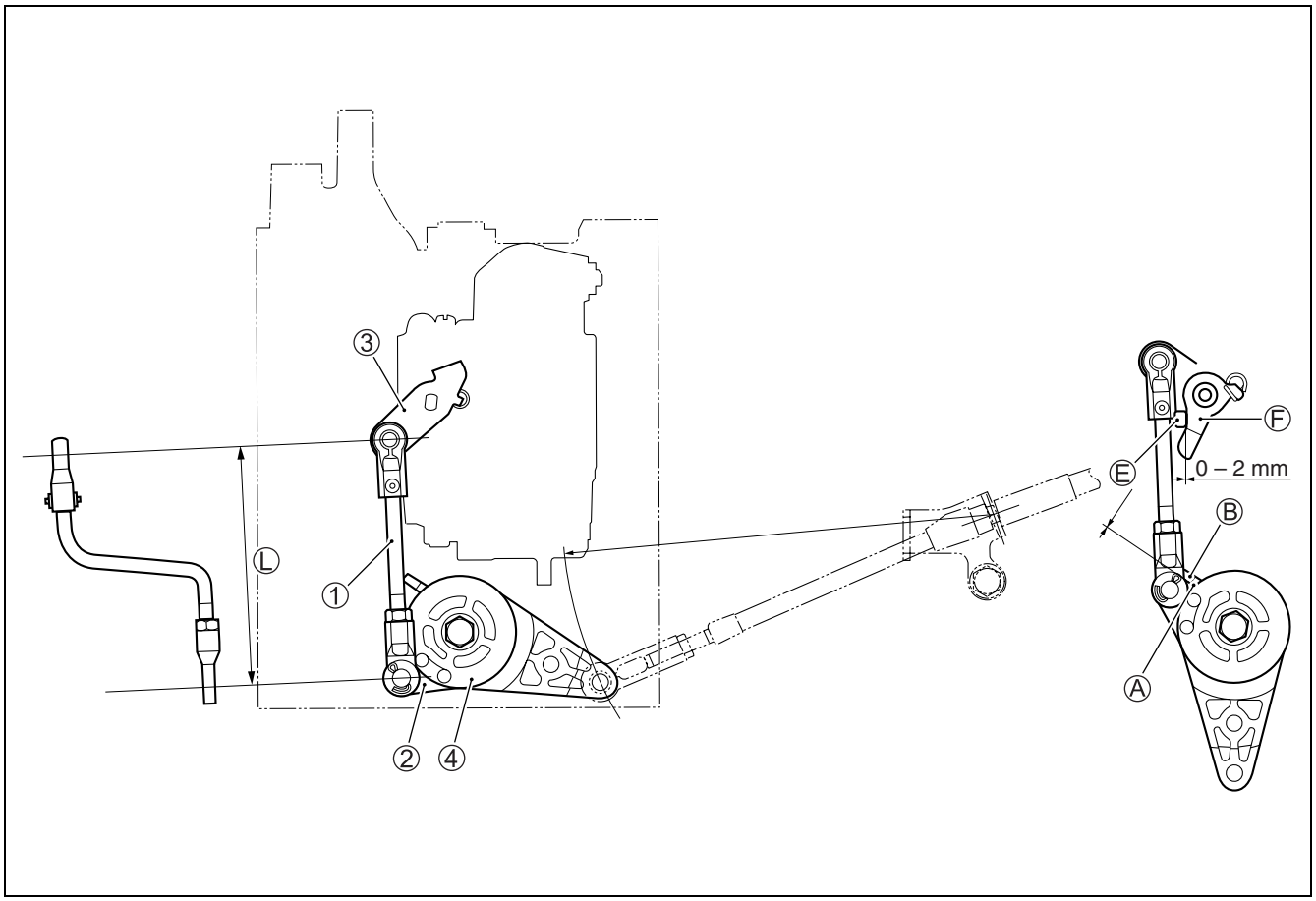


1. Fit two throttle cables, ① and ②, both to the throttle drum ③ and the cable holder ④.
2. Adjust the length of throttle rod ⑤ to the specification below:

   Throttle rod length Ⓛ : 96 mm (3.78 in.)
3. Fit one end of the throttle rod ⑤ to the throttle lever ⑥ and other end to the carburetor throttle arm ⑦.
4. Turn the throttle control grip to its full open position.
   Adjust the throttle cable ① by turning the lock nuts ⑧ to the appropriate direction so that the stopper Ⓐ on the throttle drum ③ can contact the stopper Ⓑ on the cylinder block.
5. Return the throttle control grip to its completely closed position.
   Adjust the throttle cable ② by turning the lock nuts ⑨ to the appropriate direction so that the matching mark Ⓒ can align with the rib Ⓓ on the cylinder block.
6. With the throttle control grip in completely closed position, check that there are clearances, X and Y, between the throttle drum and throttle control lever. Secure the throttle cables, ① and ②, on the cable holder by tightening the lock nut.
7. Position the throttle control grip in full open position.
   Check that there is 0 — 2 mm of clearance between the carburetor full open stopper Ⓔ and the lever Ⓕ when the throttle drum stopper Ⓐ and cylinder block stopper Ⓑ are in contact.

8. Loosen the throttle tension adjuster fully.
   Open the throttle control grip fully and then release your hold. The throttle control grip should return to the closed direction by the return spring force on the carburetor. If the grip does not return, readjustment is necessary because the throttle cable tension is considered excessive.

REMOTE CONTROL MODEL



1. Adjust the length of throttle rod ① to the specification below:

   Throttle rod length Ⓛ: 88.5 mm (3.48 in.)

2. Fit one end of the throttle rod ① to the throttle lever ② and other end to the carburetor throttle arm ③.
3. Turn the throttle drum ④ clockwise to allow the throttle drum stopper Ⓐ to contact the cylinder block stopper Ⓑ. At this time, check that there is 0 – 2 mm of clearance between the carburetor full open stopper Ⓔ and the lever Ⓕ.
   If no clearance is found, fine tune the length of throttle rod properly.

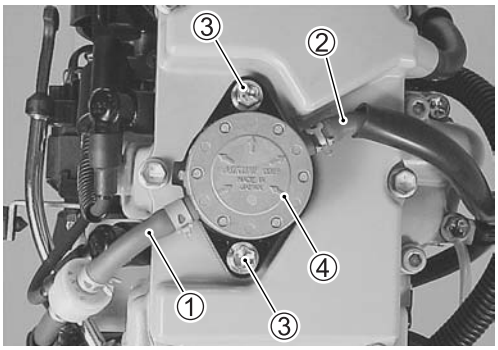
FUEL PUMP
REMOVAL/INSTALLATION

⚠ WARNING

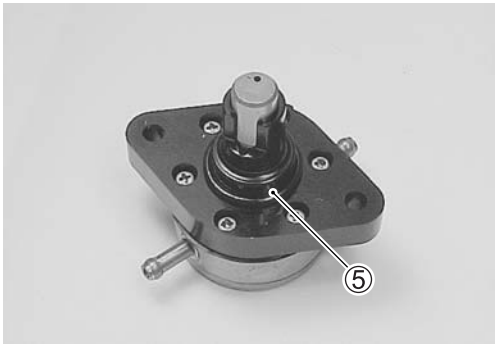
Before servicing for the fuel system, read and understand "PRECAUTION ON FUEL SYSTEM SERVICE" in the previous section.

REMOVAL

1. Disconnect the inlet hose ① and outlet hose ② from fuel pump.
2. Remove two bolts ③.



3. Remove the fuel pump ④ and O-ring ⑤.

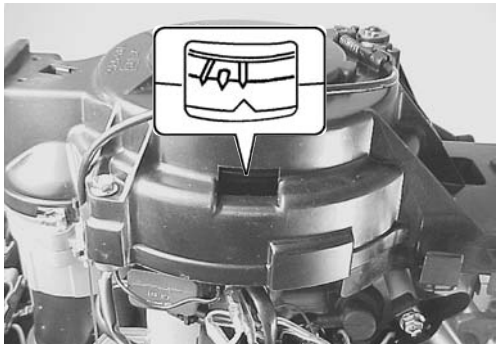


INSTALLATION

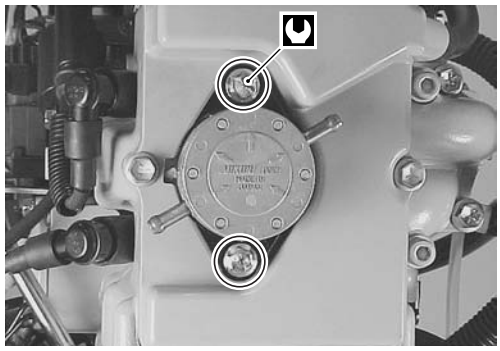
Installation is reverse order of removal with special attention to the following steps.

CAUTION

- **Before installing the fuel pump, rotate the crankshaft to bring the No. 1 (top cylinder) piston to Top Dead Center on a compression stroke.**
- **Do not re-use the O-ring once removed. Always use a new O-ring.**



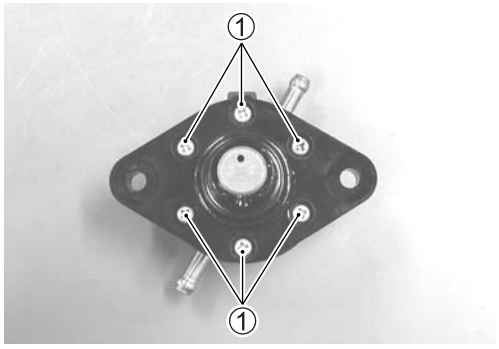
Fuel pump bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)

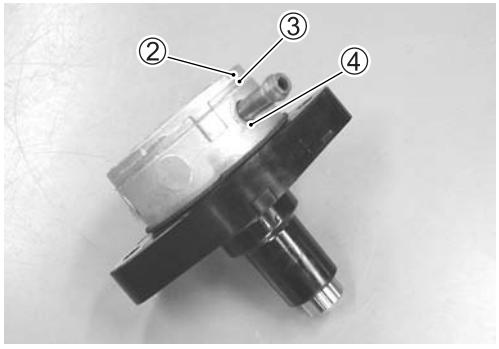


DISASSEMBLY/REASSEMBLY

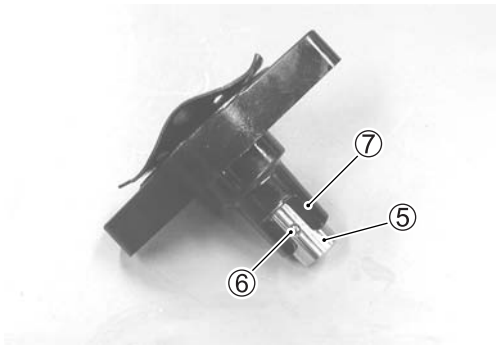
DISASSEMBLY

Remove the six screws ① and remove in sequence the outer plate ②, gasket ③ and valve body ④.



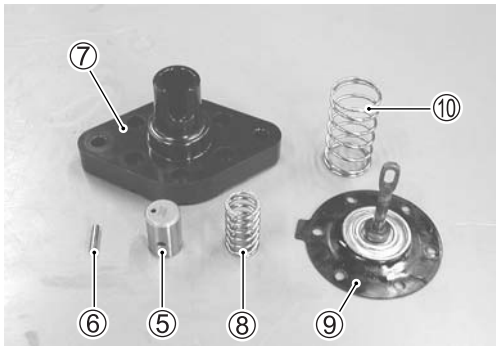


Turn the piston ⑤ until the pin ⑥ comes out through cutaway of pump body ⑦.



Remove the following parts:

- Piston ⑤
- Pin ⑥
- Pump body ⑦
- Spring ⑧
- Diaphragm ⑨
- Spring ⑩



CAUTION

Do not re-use the diaphragm set once removed. Always use a new diaphragm set.

ASSEMBLY

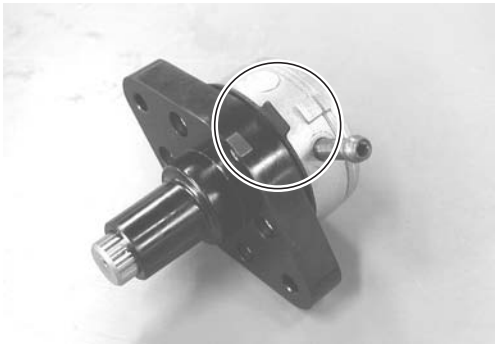
Assembly is reverse order of disassembly with special attention to the following steps.

CAUTION

Do not re-use the diaphragm set once removed. Always use a new diaphragm set.

When connecting the diaphragm set to piston with pin, align punch mark on the piston and the projection of diaphragm.

Align the projections on the pump body, the diaphragm, valve body, gasket and outer plate when assembling.



INSPECTION

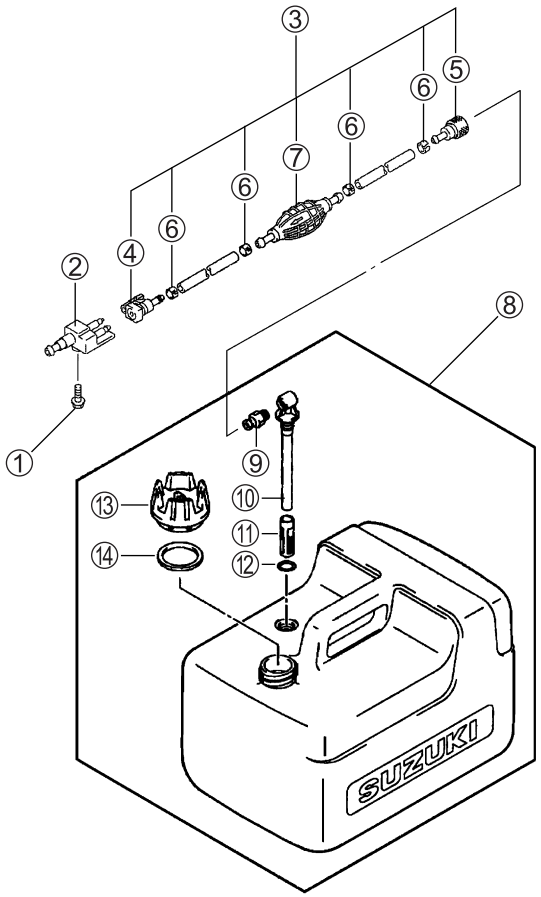
Check-valves

Inspect the fuel pump check valves. If tears, distortion or damage is found, replace the fuel pump.

Pump body

Inspect the fuel pump body and outer plate.
If cracks, nicks, distortion or damage is found, replace the fuel pump.

FUEL TANK
DISASSEMBLY/REASSEMBLY
When disassembling or reassembling the fuel tank, refer to the construction diagram below.

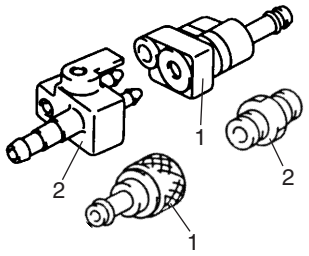


① Bolt (1)
② Fuel plug (1)
③ Fuel hose assembly (1)
④ Socket (1)
⑤ Socket (1)
⑥ Clip (4)
⑦ Primer bulb
⑧ Fuel tank assembly (1)
⑨ Fuel connector plug (1)
⑩ Outlet (1)
⑪ Outlet filter (1)
⑫ O-ring (1)
⑬ Fuel tank cap
⑭ Fuel tank cap gasket

INSPECTION

Fuel connector

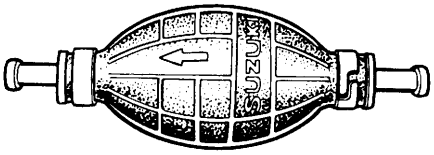
Inspect the fuel connector and connector plug. If leakage, deterioration or other damage is found, replace the connector and/or plug.



1. Connector 2. Connector plug

Fuel primer bulb

Inspect the fuel primer bulb. If crack, leakage or deterioration is found, replace the bulb.
If the check valve function is defective, replace the bulb.

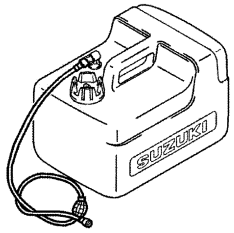


Fuel hose

Inspect the fuel hoses. If cut, crack, leakage, abrasion, tear or deterioration is found, replace the hoses.

Fuel tank

Inspect the fuel tank. If crack, leakage or deterioration is found, replace the tank.
If water or other contamination is found, drain and clean the tank.



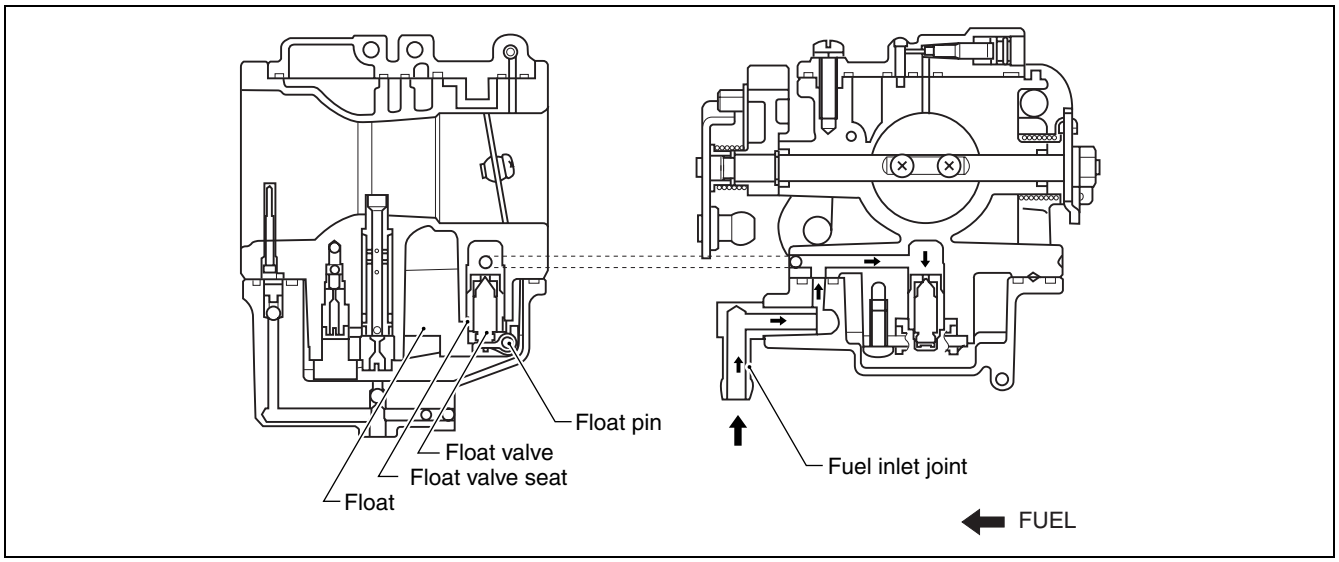
Tank cap

Check that the fuel tank vent opens and relieves internal tank pressure properly.
If vent is suspect, replace the tank cap.

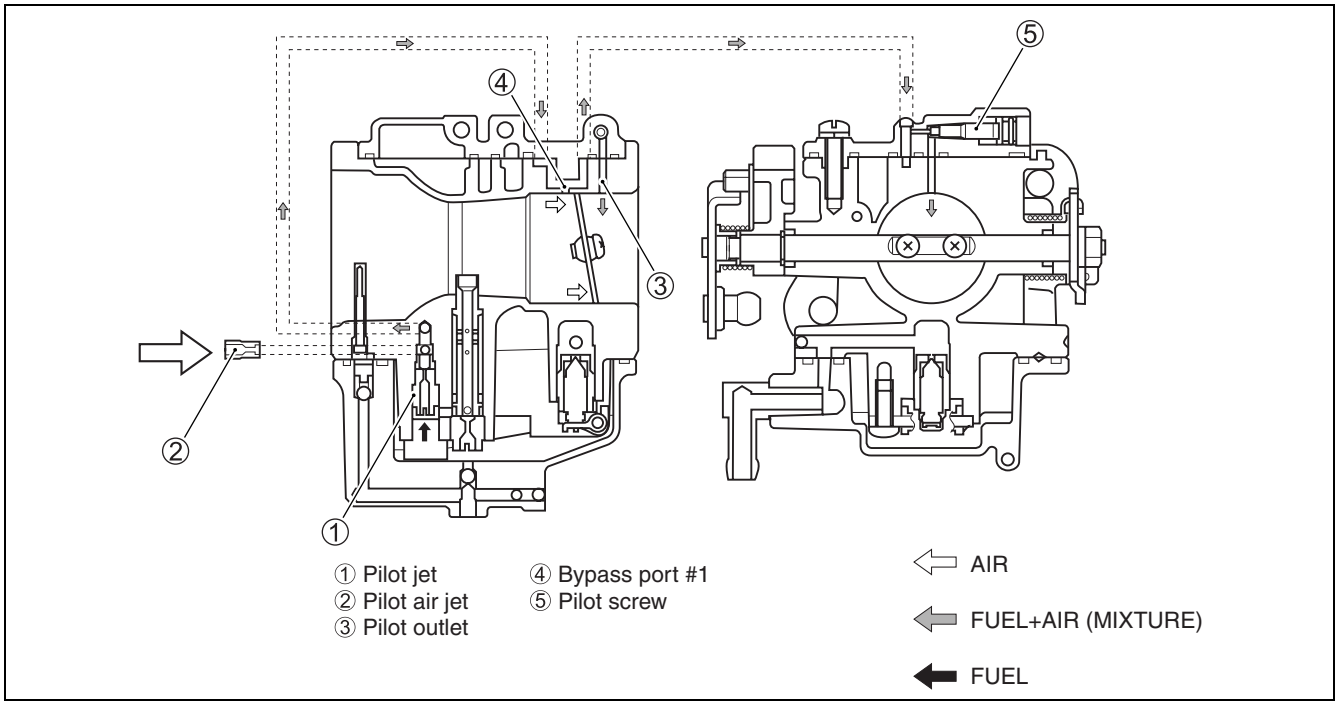
OPERATION

CARBURETOR

Float system

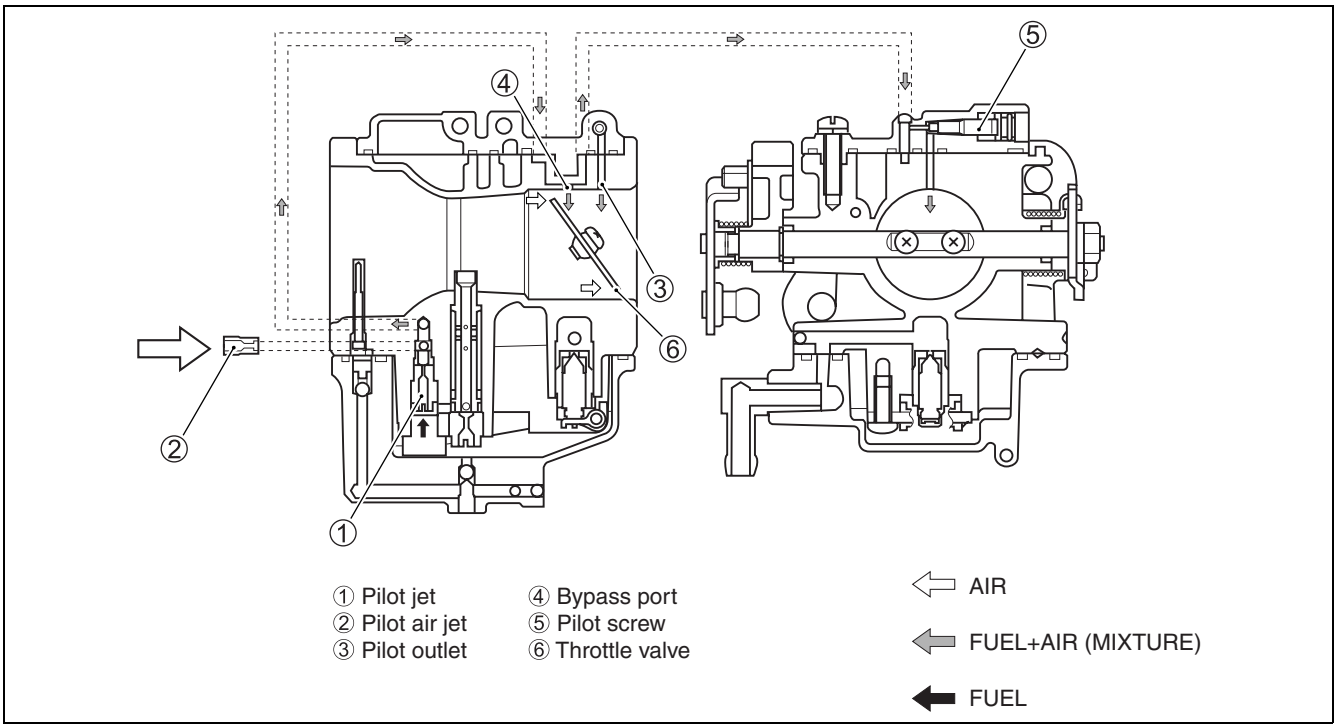


Idling/Trolling



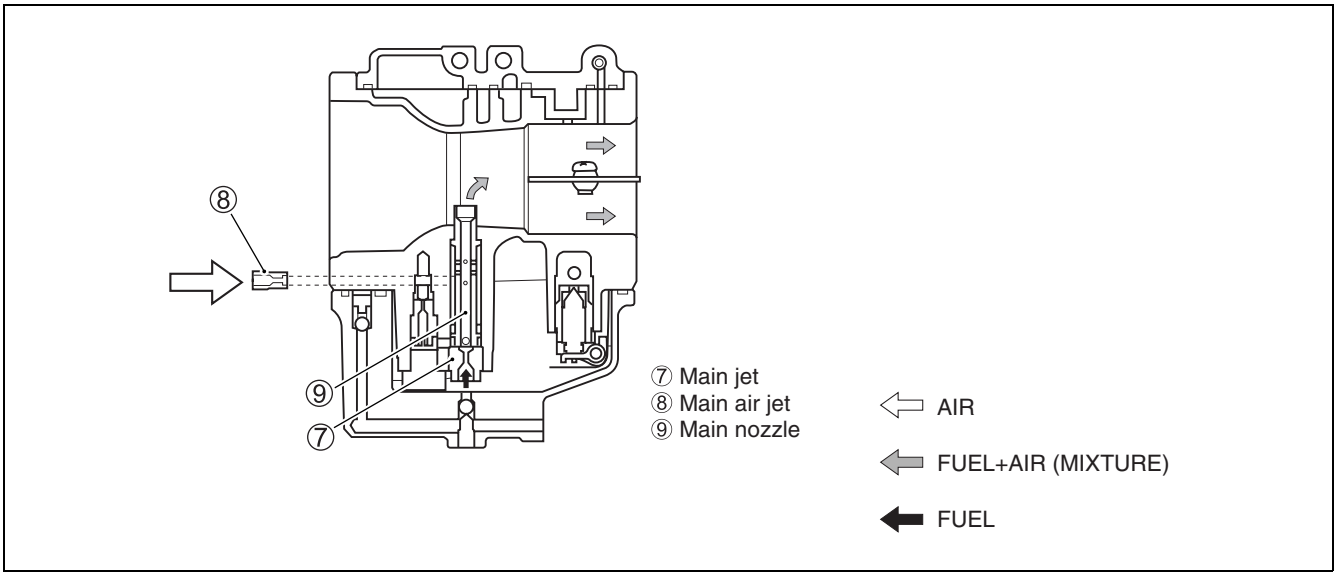
After passing through the pilot jet ①, fuel mixes with air that is supplied from the pilot air jet ②.
This mixture then passes through the pilot screw ⑤ seating area and is jetted both from the pilot outlet ③ and bypass port #1 ④.
No mixture will be jetted either from the bypass port #2 or from those located upstream but these ports serve as air passage.
As the pilot screw ⑤ is turned clockwise (screwed in), the mixture (A/F) will become leaner. As the screw is turned counterclockwise (screwed out), the mixture will become richer.
The throttle stop screw is designed to adjust the idling/trolling speed. When the stop screw is turned clockwise (screwed in), the speed raises and when turned counterclockwise (screwed out), the speed lowers.

Low-Mid speed



As the throttle valve is opened gradually, air flowing through the throttle bore increases in proportion to the valve opening angle. At this time, because fuel mixture jets from the bypass port #2 and those upstream successively, the mixture ratio (A/F) is maintained to be optimum, thereby the engine speed being raised smoothly.

Mid-High speed



When the throttle valve opens further and engine speed rises, fuel passes through the main jet ⑦ and enters the main nozzle ⑨, in which it is mixed with air supplied from the main air jet ⑧ before sprayed into the main bore.

ACCELERATION SYSTEM

Acceleration pump

Only DF15 model is equipped with an accelerator pump system.

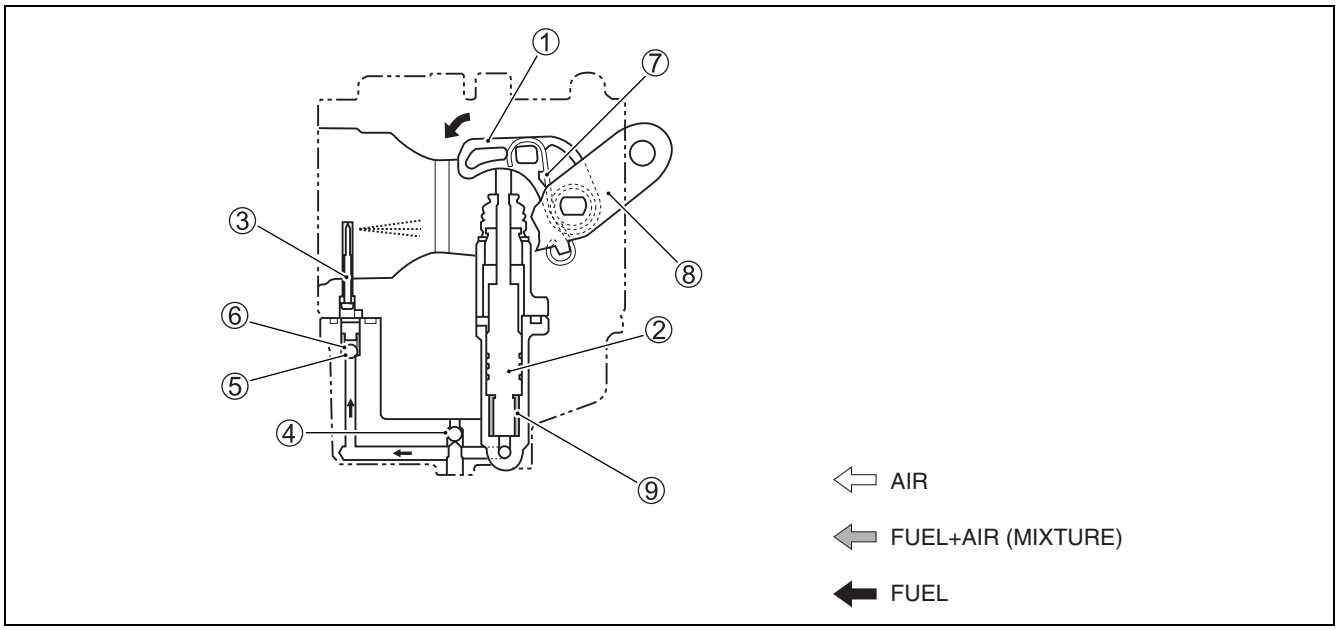
When quickly accelerated (opening the throttle valve quickly), the engine suctions a large volume of air with fuel lagging behind causing the mixture to be transitionally lean.

To compensate for such a fuel deficiency, an acceleration pump device is provided. This is a plunger type pump that pressure feeds fuel, at the time of quick acceleration, to the acceleration pump nozzle from which fuel is sprayed into the main bore preventing the mixture from becoming lean. With this provision, the engine can be accelerated smoothly.

Operation of acceleration pump

When the throttle lever ⑧ is opened quickly, the acceleration pump lever ① moves to the direction indicated by the arrow with the spring ⑦ force causing the plunger ② to be depressed. Because the check valve ④ closes due to pressure, fuel inside the acceleration pump chamber forces the check valve ⑤ open causing fuel to be sprayed to the main bore through the acceleration nozzle ③.

When the throttle lever ⑧ returns, the acceleration pump lever ① moves to the direction opposite to the arrow, which in turn causes the plunger ② to be returned by the force of spring ⑨. At this time, the check valve ⑤ is pulled back to close by the force of spring ⑥ and the check valve ④ to open allowing fuel to enter the acceleration pump chamber.



AUTO-ENRICHENER SYSTEM

Only the remote control model is equipped with an auto-enrichener system.

The automatic enrichener device consists of the PTC heater Ⓐ, the thermo-wax Ⓑ and the plunger/needle ①. When the thermo-wax Ⓑ is cold, the plunger/needle ① moves upward, fuel is drawn into the enrichener circuit from the float chamber ②.

Enrichener jet ③ meters this fuel, which then flows into fuel pipe ④ and mixes with the air coming from the upper part of the float chamber ⑤. The mixture, rich in fuel content, reaches upper part of the fuel pipe and mixes again with the air coming through a passage extending from main bore ⑥.

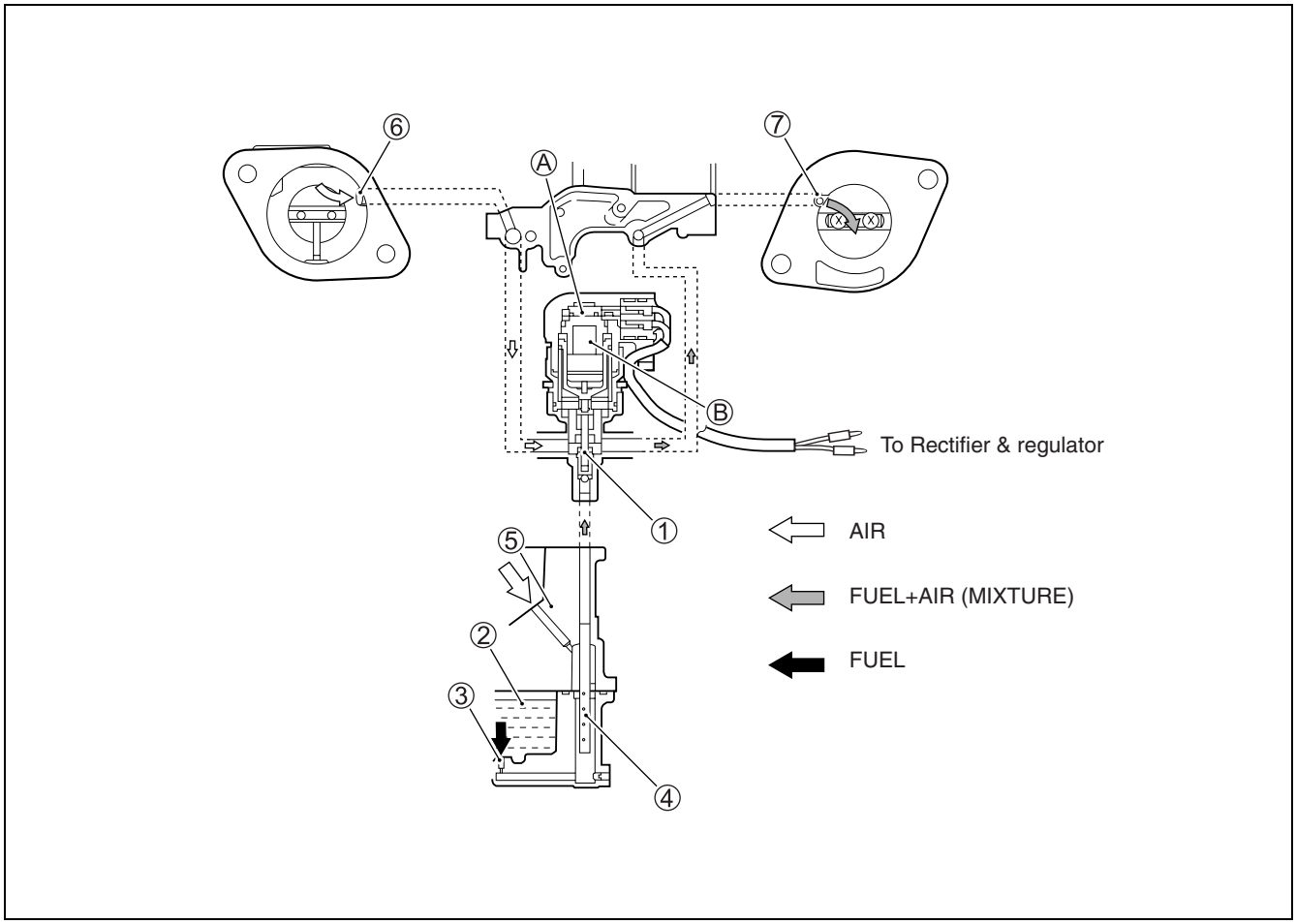
The two successive mixings of fuel with air are such that proper fuel/air mixture for starting is produced when the mixture is sprayed out through outlet port ⑦ into the main bore.

When the engine is cold:

The automatic enrichener passage is always open as the thermo-wax remains atmospheric temperature.

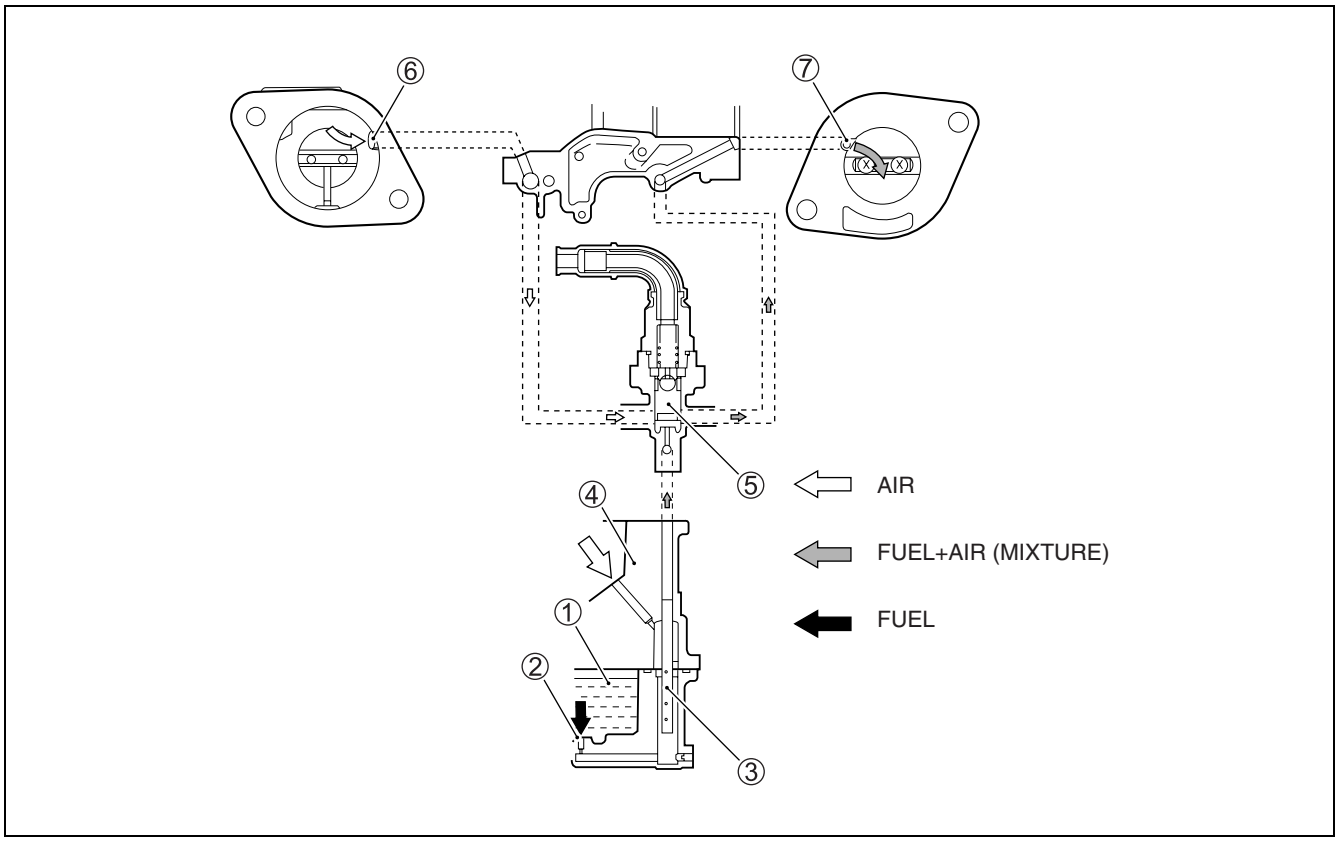
When the engine is started:

According to the PTC heater temperature, the thermo-wax gradually expands and closes enrichener passage by the needle of the plunger.



MANUAL STARTER SYSTEM

Pulling the starter knob, fuel is drawn into the starter circuit from the float chamber ①.
Starter jet ② meters this fuel, which then flows into fuel pipe ③ and mixes with the air coming from the upper part of float chamber ④. The mixture, rich in fuel content, reaches starter plunger ⑤ and mixes again with the air coming through a passage extending from main bore ⑥.
The two successive mixings of fuel with air are such that proper fuel/air mixture for starting is produced when the mixture is sprayed out through starter outlet port ⑦ into the main bore.



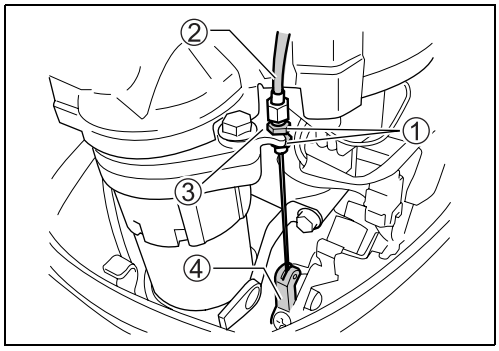
RECOIL STARTER

CONTENTS

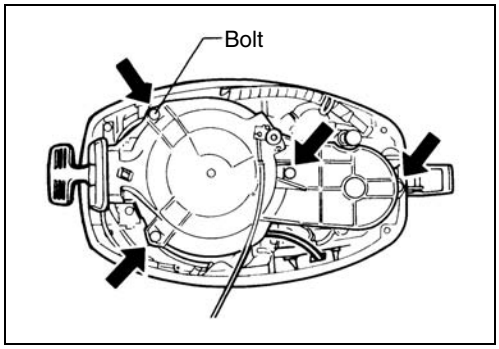
5

REMOVAL

1. Loosen the lock nuts ① and remove NSI cable ② from cable bracket (stator base) ③.
2. Remove the NSI cable from clutch notch lever ④.



3. Remove the four (4) bolts securing recoil starter.
4. Remove the recoil starter assembly.

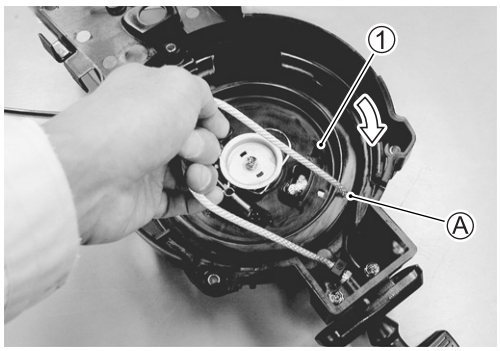


DISASSEMBLY

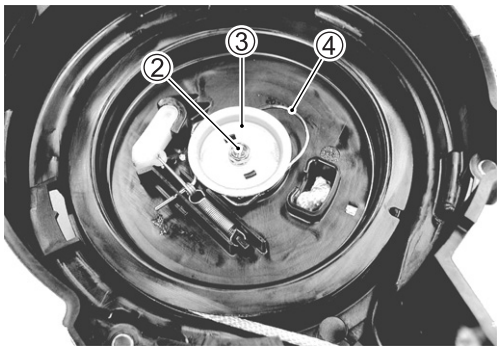
CAUTION

Because of the coiled tension in the recoil spring, wear safety glasses and hand protection when winding or unwinding this component.

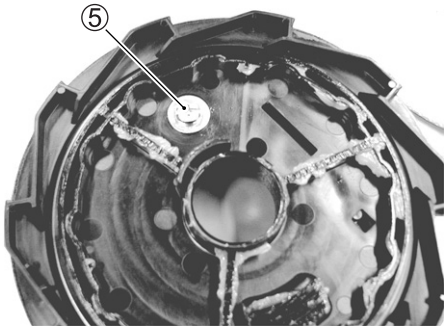
1. Pull the rope out of recoil case and guide the rope into notch Ⓐ in the reel, then turn the reel ① clockwise to release the coiled tension in the recoil spring.

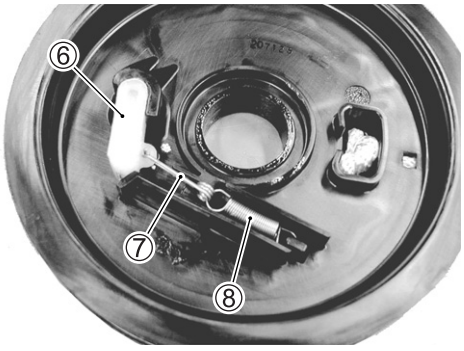


2. Remove the bolt ②, then remove the friction plate ③ with the friction spring ④.
3. Remove the reel ①.



4. Remove the screw ⑤ first, and then take off the ratchet (pawl) ⑥, ratchet guide ⑦ and return spring ⑧.



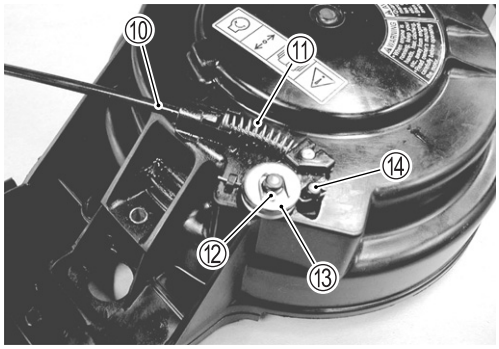


5. Remove the rope.

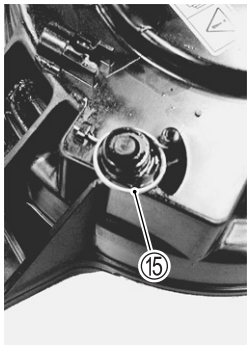
6. Remove the recoil spring ⑨.

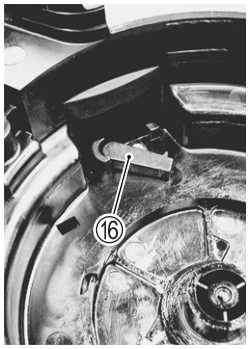
NOTE:
Do not remove the recoil spring unless replacement is necessary. It should be visually inspected in its assembled position.

7. Remove the NSI cable ⑩ with spring ⑪.
   Remove the cotter pin ⑫, washer ⑬ and stopper arm ⑭.



8. Remove the reel stopper spring ⑮ and reel stopper ⑯.

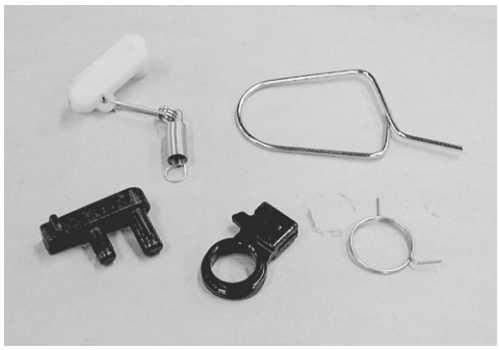




INSPECTION

NOTE:
If any parts is worn excessively, cracked, defective or damaged in any way, it must be replaced.

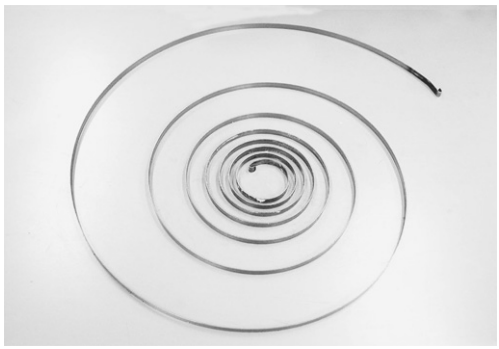
- Inspect the ratchet (pawl), stopper arm and all springs.
  If there is any defect such as excessive wear or damage, replace it.



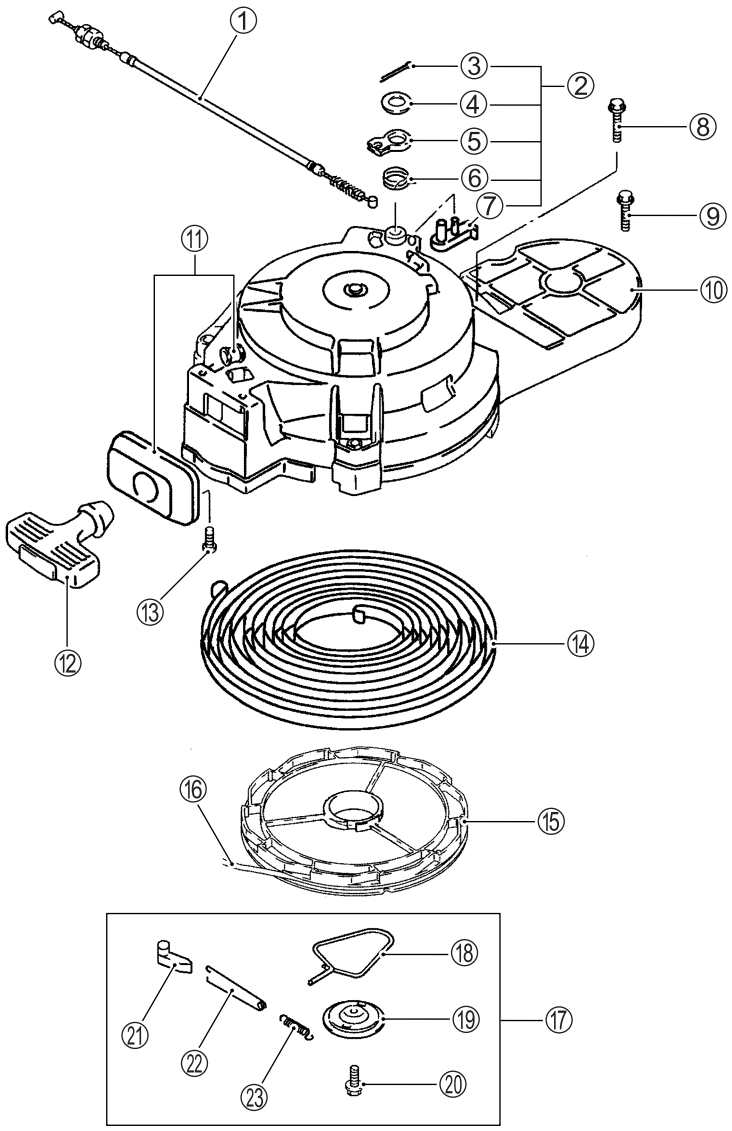
- Inspect the reel and recoil case.
  If any cracks or damage is found on them, replace it.

- Inspect the recoil rope.
  If the recoil rope is worn or damaged, replace it.

- Inspect the recoil spring.
  If there is any cracks, deformation or excessive curve on the recoil spring, replace it.



REASSEMBLY



① NSI cable (1)
② NSI set
③ Cotter pin (1)
④ Washer (1)
⑤ Stopper arm (1)
⑥ Spring (1)
⑦ Reel stopper (1)
⑧ Bolt (1)
⑨ Bolt (3)
⑩ Recoil case (1)
⑪ Rope guide (1)
⑫ Grip (1)
⑬ Screw (1)
⑭ Recoil spring (1)
⑮ Reel (1)
⑯ Rope (1)
⑰ Ratchet set
⑱ Friction spring (1)
⑲ Friction plate (1)
⑳ Bolt (1)
㉑ Ratchet (1)
㉒ Ratchet guide (1)
㉓ Return spring (1)

Reassembly is in the reverse order of disassembly with special attention to the following reassembling steps.

- Install the stopper spring as shown figure.

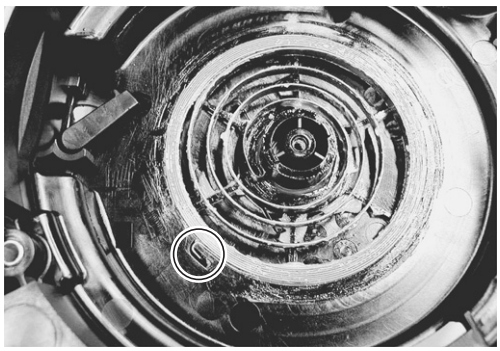
- Install NSI set and NSI cable.
  Apply grease to NSI cable.

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

- Secure the outer end of recoil spring on groove in recoil case and wind spring inward towards center of the case in a counterclockwise direction.

CAUTION

Because of the coiled tension in the recoil spring, wear the safety glasses and hand protection when winding or unwinding this components.



- Install the ratchet set.

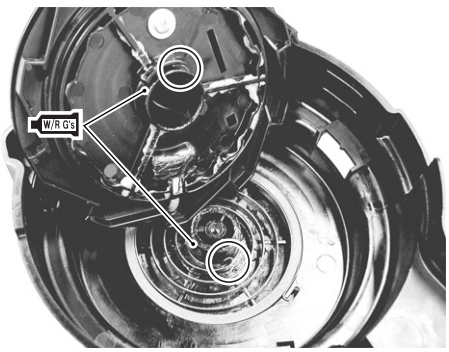
- Install the reel on the recoil case.

NOTE:

- *Apply grease to reel as shown figure.*

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

- *Align groove in the reel with bent end of spring.*

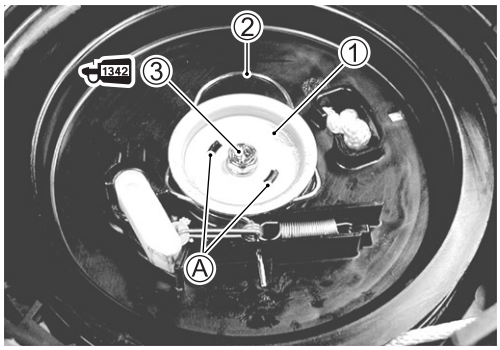


- Install the friction plate ① (with friction spring ②) and secure it with bolt ③.
  Apply THREAD LOCK to thread of bolt.

1342 **99000-32050: THREAD LOCK "1342"**

NOTE:

Twist friction plate slightly to align holes in plate with square lugs Ⓐ on center boss.



- After assembling, guide the rope into notch in the reel and rotate the reel approximately 5 turns counterclockwise until the spring is tensioned.

INSTALLATION

Installation is in the reverse order of removal with special attention to the following.

- Check to ensure that all removed parts are back in place.
- Check the neutral start interlock function.

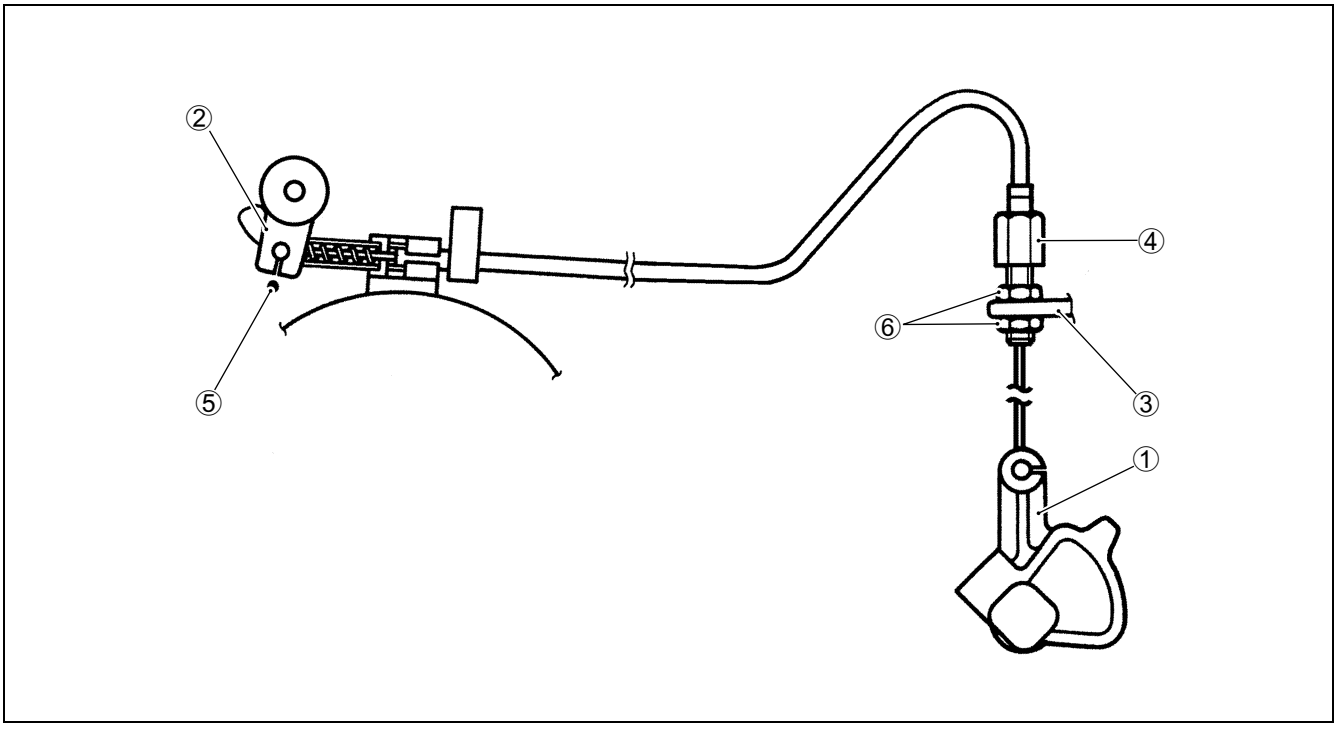
NEUTRAL START INTERLOCK (NSI)
INSTALLATION/ADJUSTMENT

1. Shift into “NEUTRAL” position.
2. Install the NSI cable in the recoil starter, the clutch notch lever ①, the stopper arm ② and the cable bracket (stator base) ③.
3. Turn the adjustment nut ④ to align the slot on the stopper arm ② with the punch mark ⑤ on the recoil starter case.
4. Pull the recoil starter and make sure that the starter does not work when the shift lever is in “FORWARD” and “REVERSE” position.
5. Tighten the lock nuts ⑥.
6. Apply SUZUKI WATER RESISTANT GREASE to the inner cable, the cable end and cable holding area.

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

CAUTION

If the NSI cable is removed or left without correct adjustment, there is a high risk of losing one’s balance and/or being thrown overboard if the motor starts in gear.



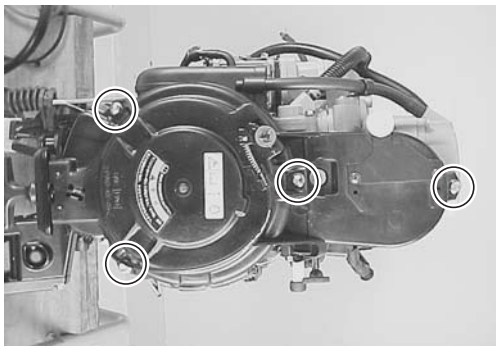
POWER UNIT

CONTENTS

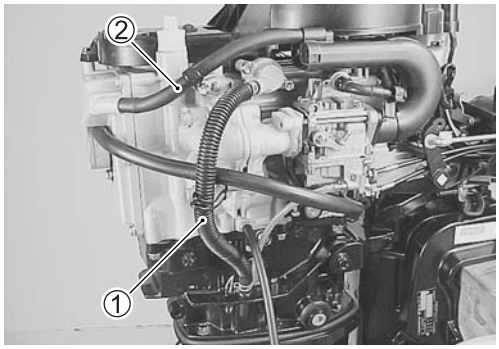
POWER UNIT
REMOVAL

Before removing power unit:
- **Disconnect battery cable from battery.**
- **Drain engine oil.**

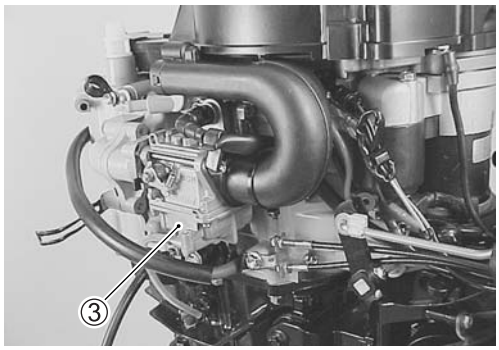
1. Remove both side covers. (See page 7-2.)
2. Remove recoil starter. (See page 5-2.)



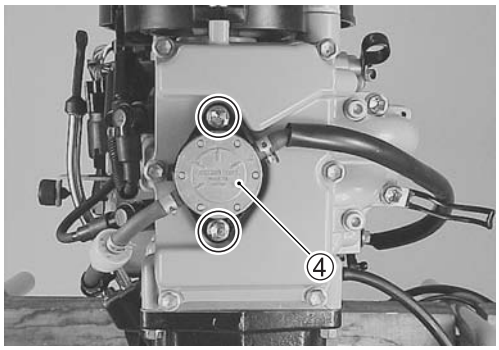
3. Disconnect water hose ① from thermostat cover and oil pan. Disconnect breather hose ② from cylinder head cover and silencer.



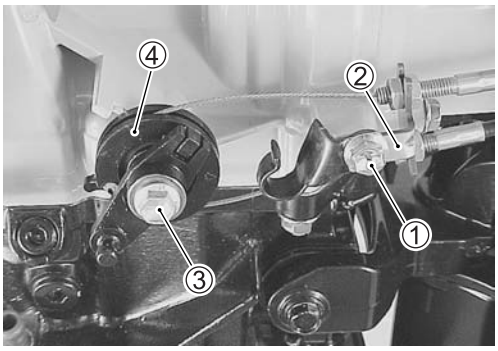
4. Remove silencer and carburetor assembly ③. (See page 4-4.)



5. Remove fuel pump ④. (See page 4-15.)

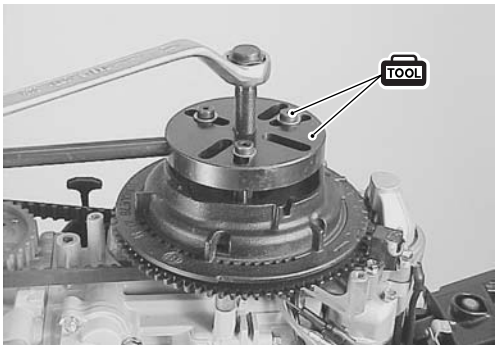


6. On tiller handle model:
   Remove bolt ① and throttle cable holder ②.
7. Remove bolt ③ and throttle drum ④.

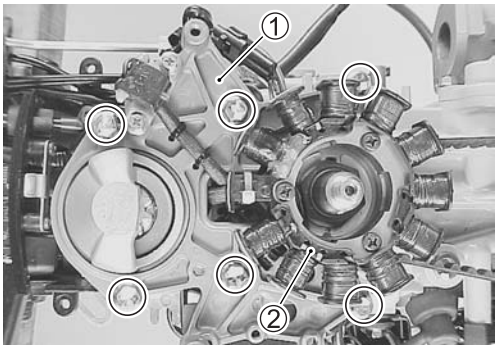


8. Remove flywheel. (See page 3-9.)

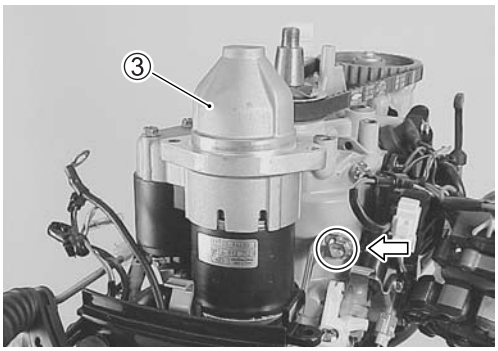
TOOL **09930-48720: Flywheel holder**
09930-49210: Flywheel holder attachment
09930-39411: Flywheel remover
09930-39210: Remover bolt



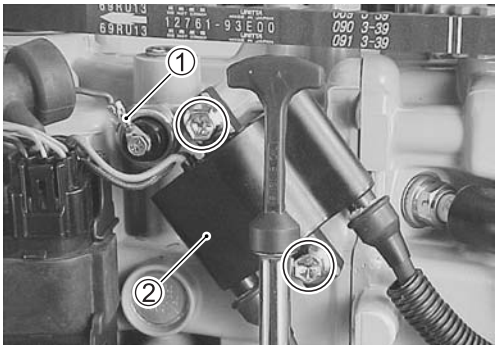
9. Unscrew the bolts securing stator base ①, then remove the stator base and the battery and condenser charge coil ②.
   Disconnect the engine stop switch lead wire connector.



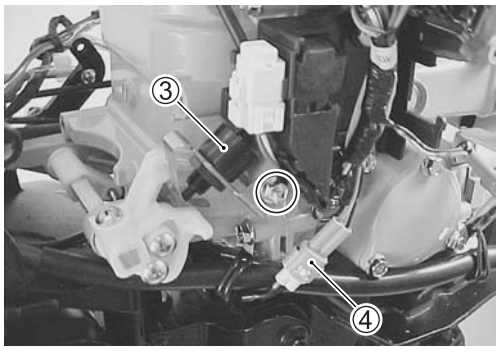
10. Remove starter motor ③. (See page 3-29.)



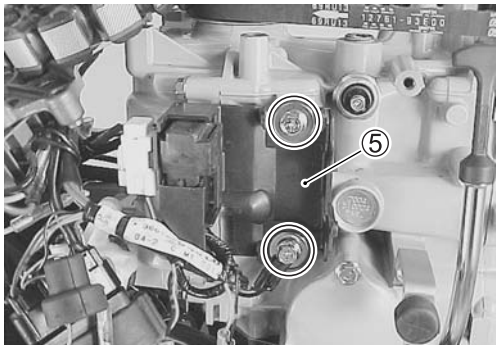
11. Loosen screw and disconnect oil pressure switch lead wire ①.
    Remove two (2) bolts and ignition coil ②, then disconnect ignition coil primary lead wire.
12. Remove all spark plugs.



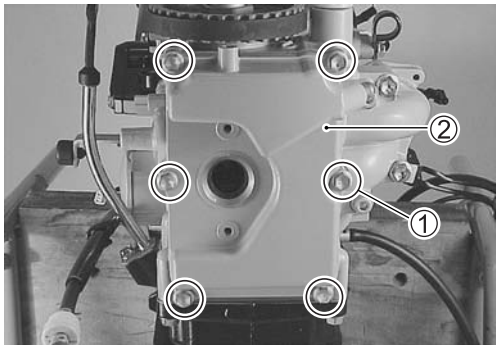
13. Remove bolt, neutral switch/switch bracket ③, then disconnect the switch lead wire connector.
    Disconnect the caution lamp lead wire connector ④.



14. Remove the two (2) bolts securing electric parts holder ⑤, then remove stator base and engine main harness assembly.



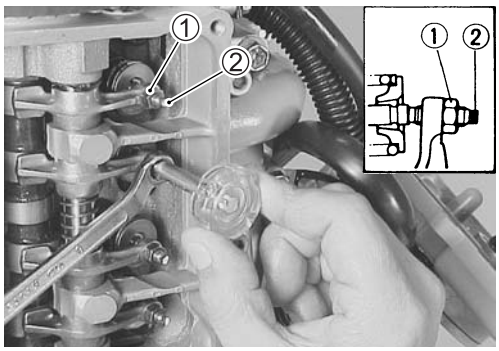
15. Remove six (6) cylinder head cover bolts ①, and then cylinder head cover ② and gasket.



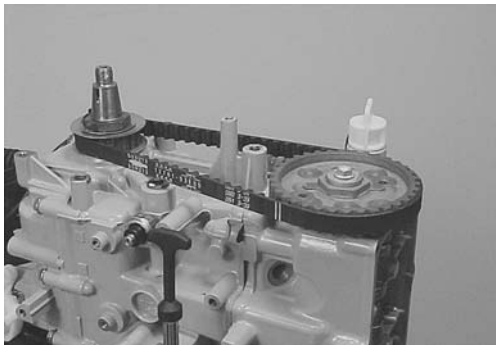
16. Loosen all valve adjusting lock nuts ①.
    Loosen the four (4) valve adjusting screws ② fully.
    Leave the screws in place.

CAUTION

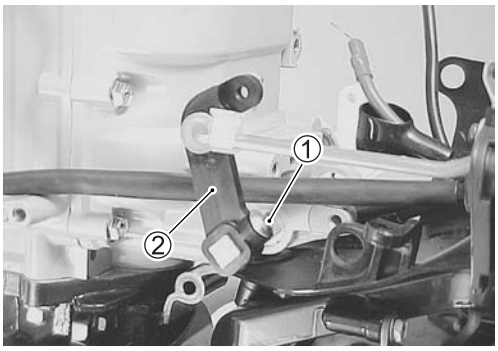
To prevent valve damage, loosen valve adjusting screws fully before removing timing belt.



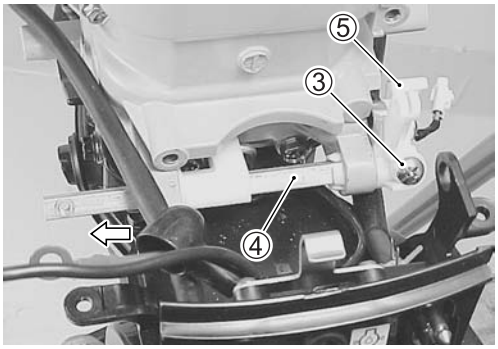
17. Remove the timing belt. (See page 2-12.)



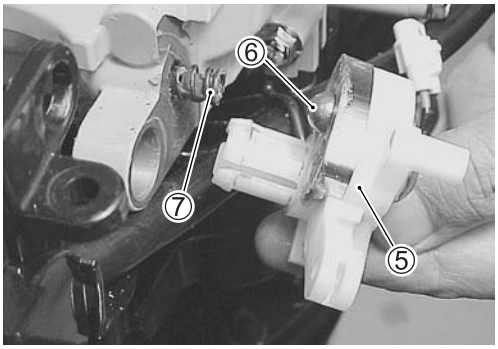
18. Unscrew the screw ①, then remove the clutch control lever ② from the clutch lever shaft.



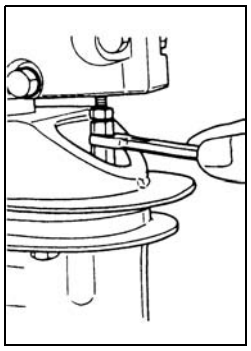
19. Remove the screw ③ securing clutch notch lever ⑤. Remove clutch lever shaft ④.



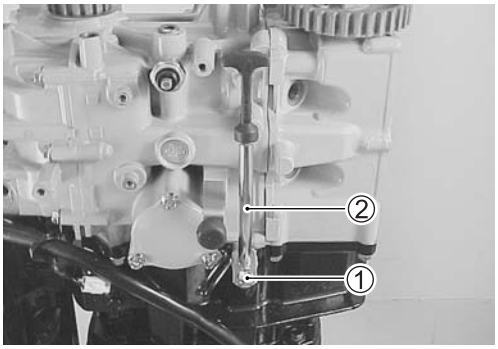
20. Remove clutch notch lever ⑤, then account for clutch notch ball ⑥ and spring ⑦.



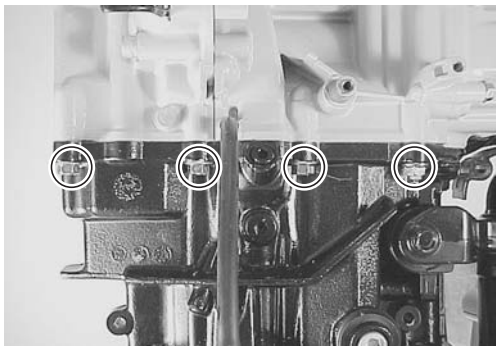
21. Separate the clutch rod from the shift rod. (See page 8-2.) Push the clutch rod arm ⑧ out from pivot eyelet on crank case.



22. Remove bolt ① and oil dipstick tube ②.



23. Remove six (6) bolts and two (2) nuts.
    Lift up and remove power unit from oil pan.



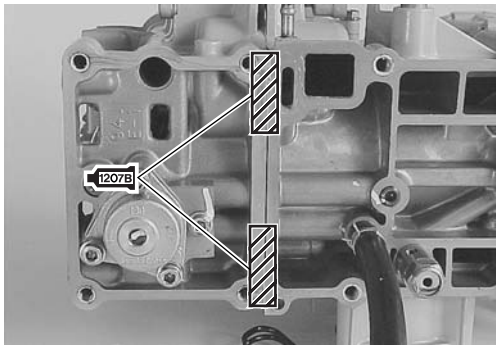
INSTALLATION

Installation is reverse order of removal with special attention to the following steps.

NOTE:
Do not re-use gasket. Always replace with new part.

POWER UNIT

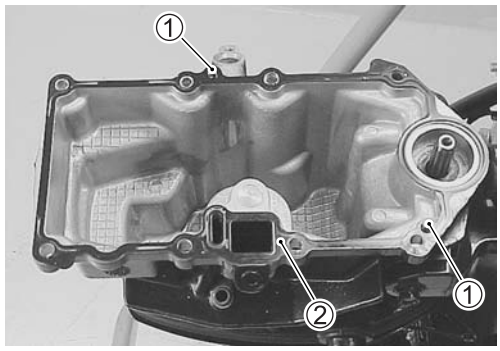
NOTE:
Before installing power unit, apply sealant to the two hatched areas shown in the illustration right.



1207B **99000-31140: SUZUKI BOND "1207B"**

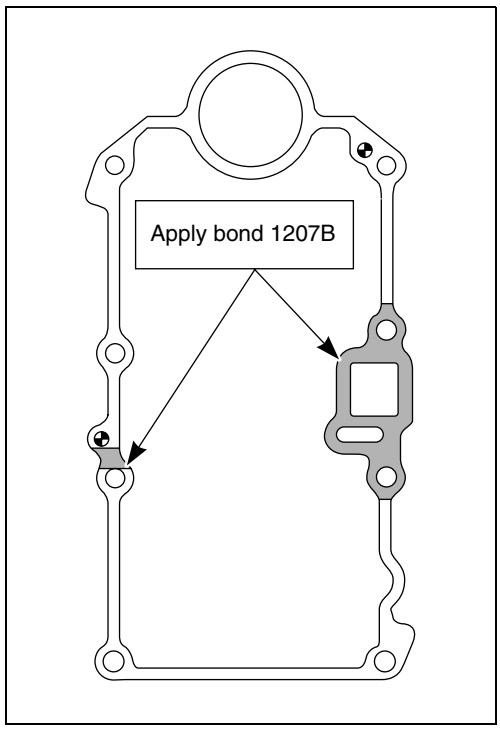
- Install dowel pins ①, gasket ②.
- Apply Suzuki Water Resistant Grease to driveshaft splines.

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**
1207B **99000-31140: SUZUKI BOND "1207B"**



NOTE:

- *Apply sealant to both surfaces of oil pan gasket at the indicated positions (as shown with hatched lines).*
- Lower the power unit onto oil pan.

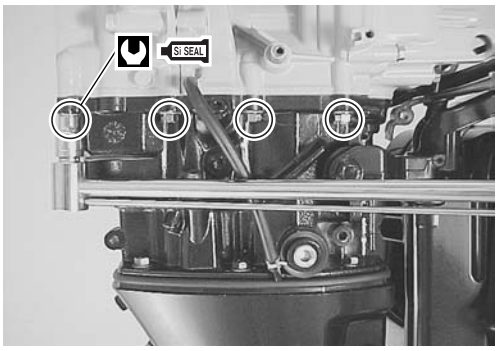


NOTE:
Rotate crankshaft to aid alignment of driveshaft and crankshaft splines.

- Apply Suzuki silicone seal to power unit mounting bolts and tighten bolts and nuts to specified torque.

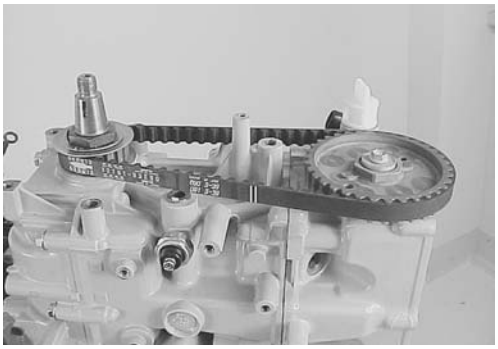
99000-31120: SUZUKI SILICONE SEAL

Power unit mounting bolt/nut:
23 N·m (2.3 kg-m, 16.5 lb-ft)



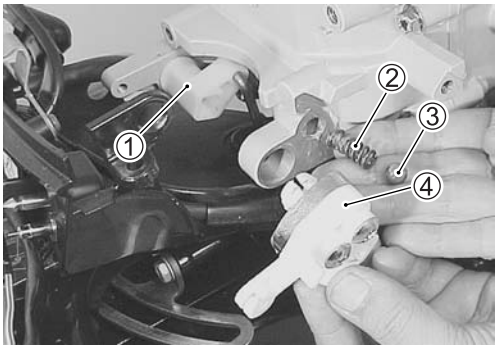
TIMING BELT

- Install timing belt. (See page 2-11 to 2-12.)

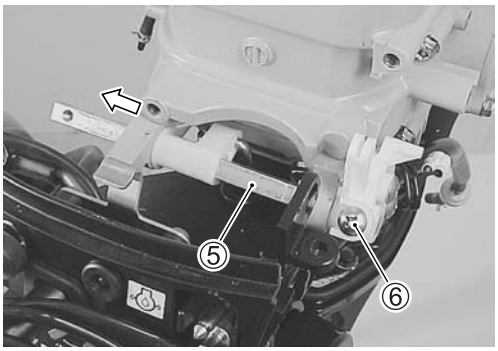


CLUTCH LEVER SHAFT

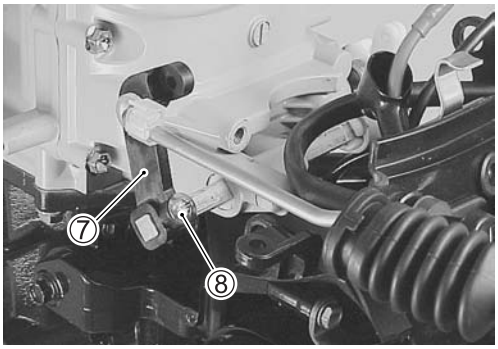
- Install clutch rod arm ①.
- Install clutch notch spring ②, ball ③ and clutch notch lever ④.



- Install clutch lever shaft ⑤ by passing it from PORT side through the clutch notch lever and then the clutch rod arm.
- Tighten the clutch notch lever with screw ⑥.

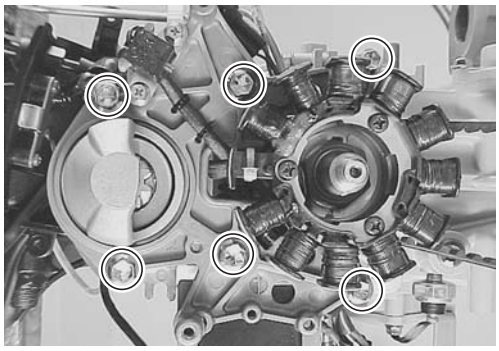


- Install clutch control lever ⑦, then tighten screw ⑧ securely.



FLYWHEEL

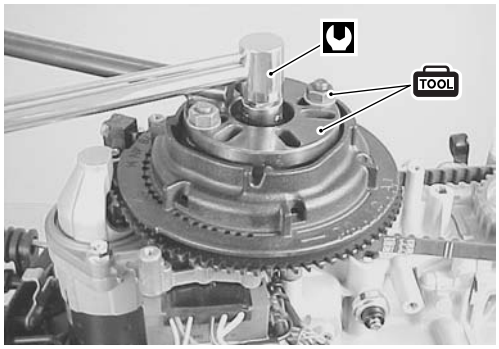
- Install stator base and the battery and condenser charge coil. (See page 3-12.)



- Install flywheel and tighten flywheel nut to specified torque. (See page 3-13.)

Flywheel nut: 80 N·m (8.0 kg-m, 58.0 lb-ft)

09930-48720: Flywheel holder
09930-49210: Flywheel holder attachment

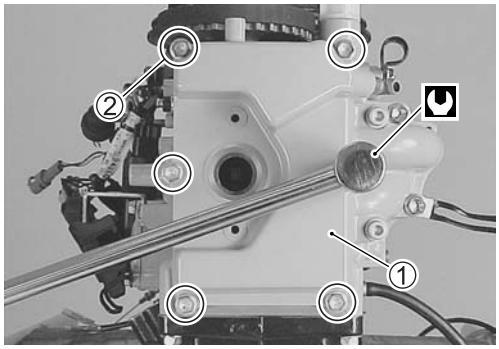


CYLINDER HEAD COVER

NOTE:
Before installing cylinder head cover, check valve clearance. (See page 2-8.)

- Install cylinder head cover gasket and cylinder head cover ①, then tighten cover bolts ② to specified torque.

Cylinder head cover bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)



FINAL ASSEMBLY CHECK

Perform the following checks to ensure proper and safe operation of the repaired unit.

- All parts removed have been returned to their original positions.
- Lower unit gear engagement is properly adjusted. (See page 8-19.)
- Fuel and water hose routing match's service manual illustration. (See page 9-11 to 9-12.)
- Wire routing match's service manual illustration. (See page 9-2 to 9-9.)
- No fuel leakage is evident when fuel system is pressurized. (See page 4-3.)
- No water leakage is evident during final test running.

CYLINDER HEAD ASSEMBLY

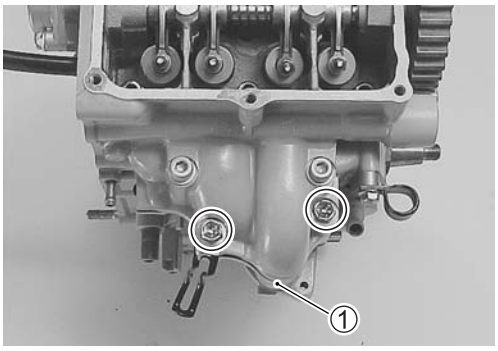
(Cylinder head/Valve/Camshaft)

REMOVAL

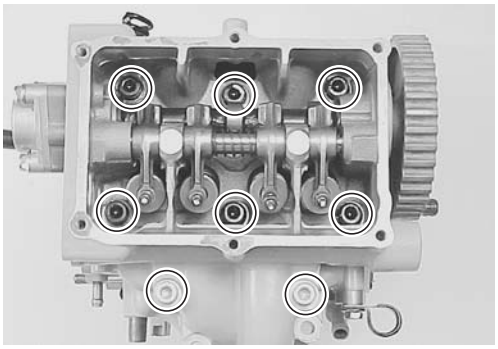
Prior to removing cylinder head:

- **Remove the power unit. (See page 6-2 to 6-6.)**

1. Remove the two (2) bolts and intake manifold ①.



2. Loosen and remove eight (8) bolts.
   Remove the cylinder head assembly and head gasket.



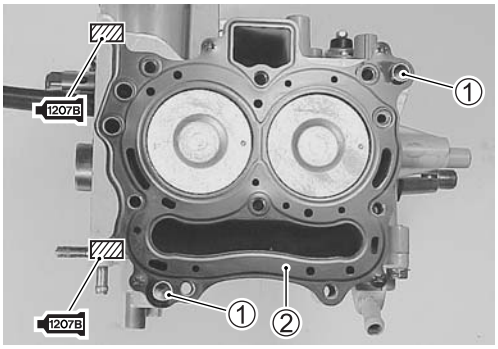
ASSEMBLY

Assemble in reverse order of removal paying special attention to the following steps.

CAUTION

Do not re-use gasket. Always use a new gasket.

1. Insert the dowel pins ① and place a new cylinder head gasket ② into position on cylinder.

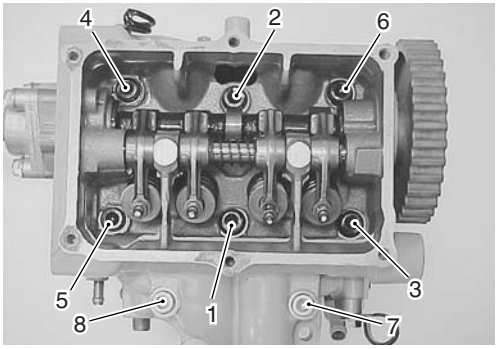


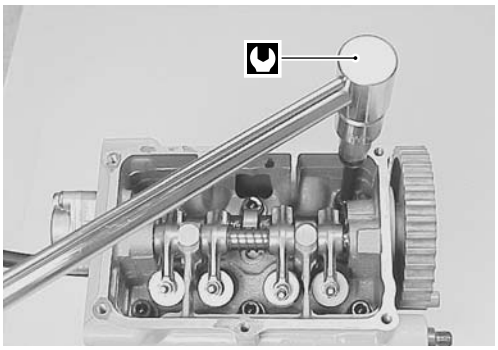
NOTE:
Before installing cylinder head gasket, apply sealant to both surfaces of the hatched areas shown in illustration.

1207B **99000-31140 : SUZUKI BOND "1207B"**

2. Position cylinder head assembly on cylinder.
3. Apply engine oil to cylinder head bolts.
4. Lightly seat all cylinder head bolts at first.
   According to tightening order in figure, tighten bolts to 1/3 of specified torque, then 2/3 of specified torque and finally to full specified torque.

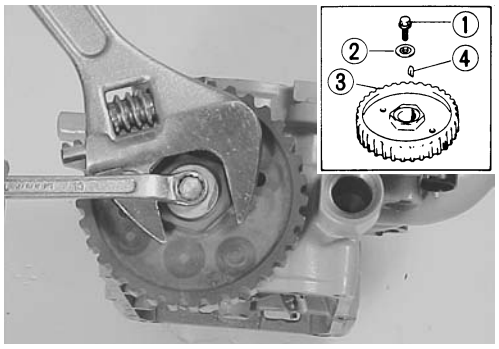
Cylinder head bolt : 27 N·m (2.7 kg-m, 20.0 lb-ft)



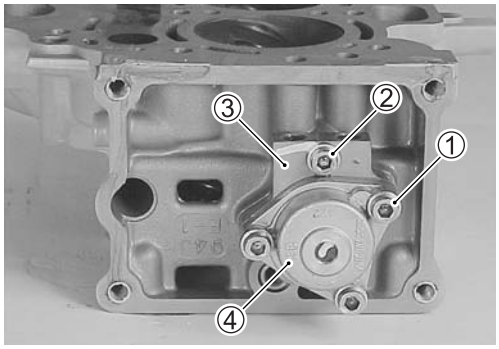


DISASSEMBLY

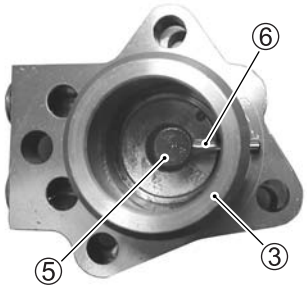
1. Remove the bolt ①, washer ② and cam pulley ③.
   Remove the key ④ from camshaft.



2. Remove the four (4) bolts ① · ②.
   Remove the oil pump assembly ④ and oil gallery block ③.

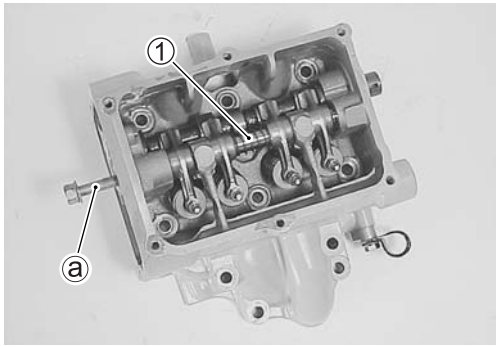


   Turn the oil pump shaft ⑤ until the pin ⑥ comes out through hole of oil gallery block ③.



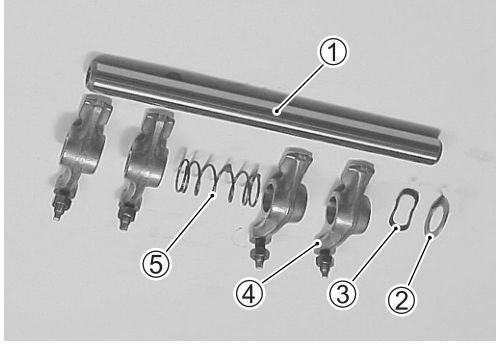
3. Remove the rocker arm shaft ①.

NOTE:
Install the 8 mm bolt ⓐ into the lower end of rocker arm shaft and pull the rocker arm shaft out.



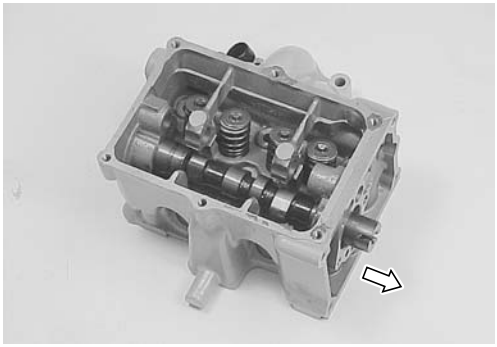
4. Remove the washer ②, wave washer ③, rocker arms ④, and spring ⑤.

NOTE:
Reassemble each rocker arm to original position.



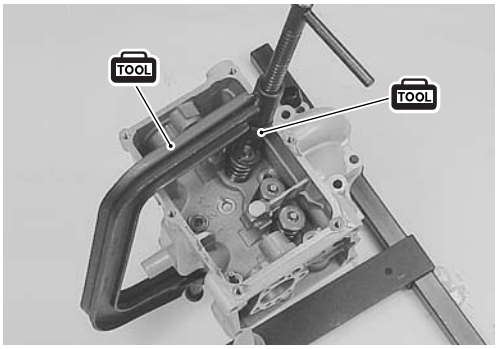
5. Remove the camshaft.

NOTE:
Pull out camshaft toward oil pan side.

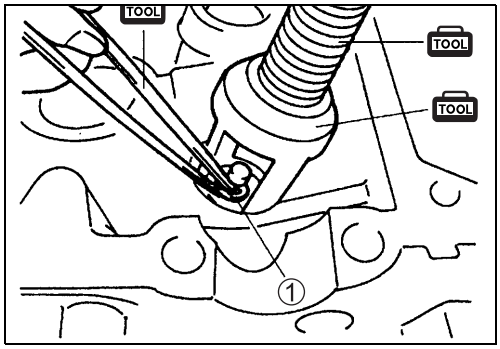


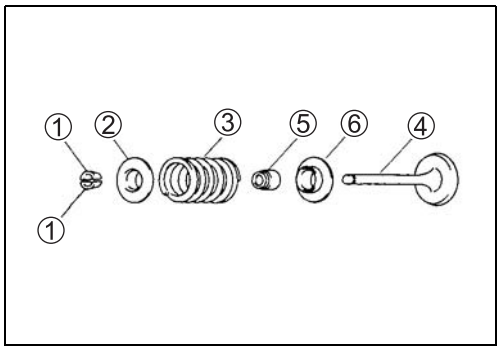
6. Using valve lifter and attachment, remove valve cotters ① while compressing valve spring.

TOOL **09916-14510 : Valve lifter**
09916-14521 : Attachment
09916-84511 : Tweezers

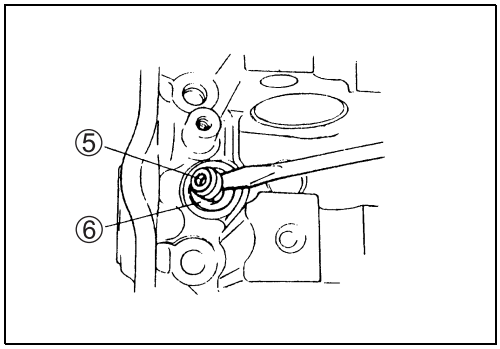


7. Remove valve spring retainer ②, valve spring ③ and valve ④.





8. Remove valve stem seal ⑤ and valve spring seat ⑥.



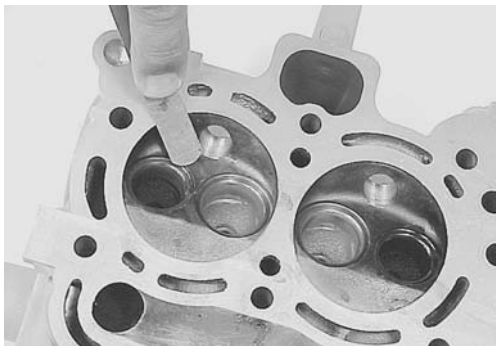
INSPECTION/SERVICING

NOTE:
If cracks, excessive wear or other damage is found on any component, replace component.

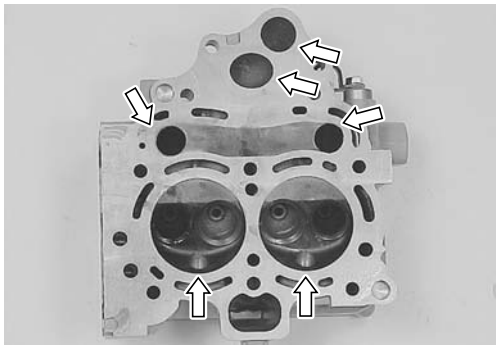
CYLINDER HEAD

Remove all carbon from combustion chambers.

NOTE:
- *Do not use any sharp edged tool to scrape carbon off cylinder head or its components.*
- *Be careful not to scuff or nick metal surfaces when decarboning.*



Inspect the intake and exhaust ports, combustion chambers and head surface.
If cracks or other damage is found, replace cylinder head.



Valve seat

Check the valve seat.
If cracks or other damage is found, replace cylinder head.

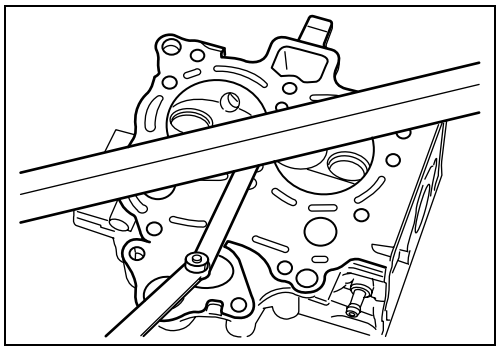
Cylinder head distortion

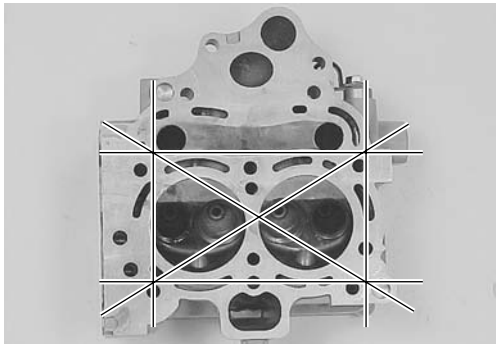
Using a straightedge and thickness gauge, measure the cylinder head distortion (gasket surface) at a total of six (6) locations as shown.

TOOL 09900-20803: Thickness gauge

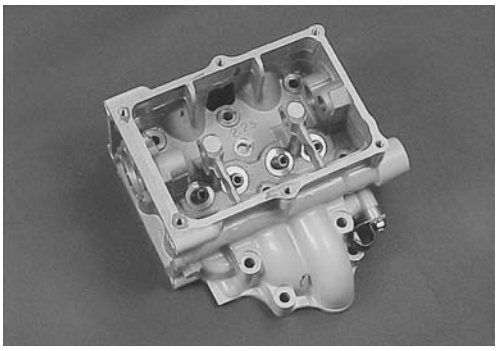
Service limit: 0.05 mm (0.002 in)

If measurement exceeds service limit, resurface or replace cylinder head.

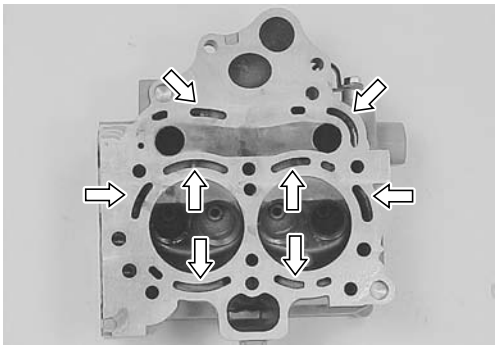




NOTE:
Cylinder head can be resurfaced, using a surface plate and #400 grit wet sandpaper. Move the cylinder head in a figure eight pattern when sanding.



Water jackets
Inspect water jackets.
If clogged or obstructed, clean water jackets.



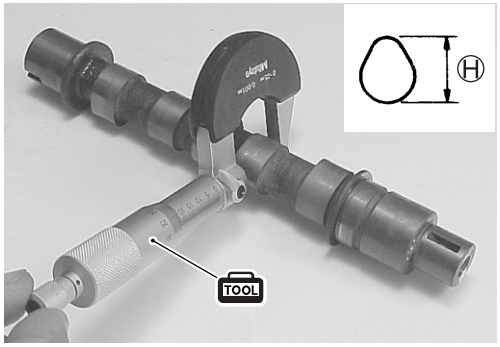
CAMSHAFT
Cam face
Inspect cam face for scratches and wear.

Cam wear
Measure cam height Ⓗ.

TOOL 09900-20205: Micrometer

Cam height
Standard:
DF9.9/15, DF9.9E/R, DF15E/R
IN 23.394 – 23.454 mm (0.9210 – 0.9234 in)
EX 23.397 – 23.457 mm (0.9211 – 0.9235 in)

Service limit:
IN 23.294 mm (0.9171 in)
EX 23.297 mm (0.9172 in)



If measurement exceeds service limit, replace camshaft.

NOTE:
DF9.9 and DF15 use the same camshaft on 2005 model. Camshaft identification on 2005 model is as follows.

Model	Identification mark
DF9.9/15	94J0
DF9.9E/R, DF15E/R	94J1

Camshaft journal oil clearance

Standard: 0.020 – 0.062 mm (0.0008 – 0.0024 in)
Service limit: 0.100 mm (0.0039 in)

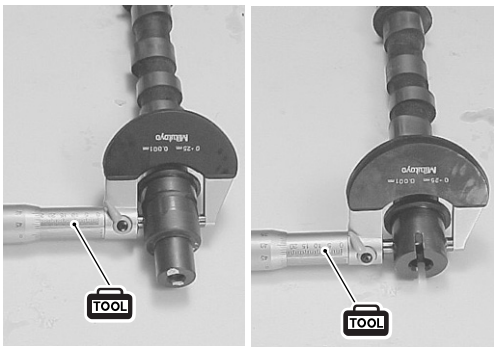
If the journal oil clearance exceeds the service limit, replace camshaft and if necessary, cylinder head and/or oil gallery block.

To check the clearance, measure the following items:
- Camshaft journal outside diameter (2 locations)
- Camshaft holder inside diameter (2 locations)

TOOL 09900-20205: Micrometer
09900-20605: Dial calipers

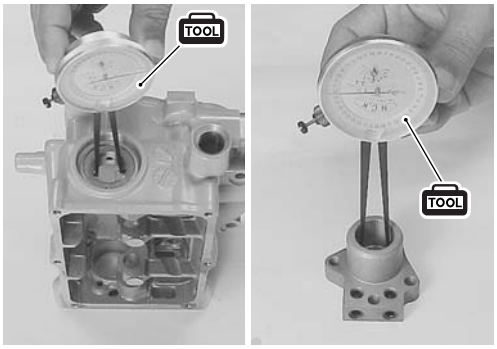
Camshaft journal outside diameter

Standard:
Upper side 24.959 – 24.980 mm (0.9826 – 0.9835 in)
Lower side 22.959 – 22.980 mm (0.9039 – 0.9047 in)



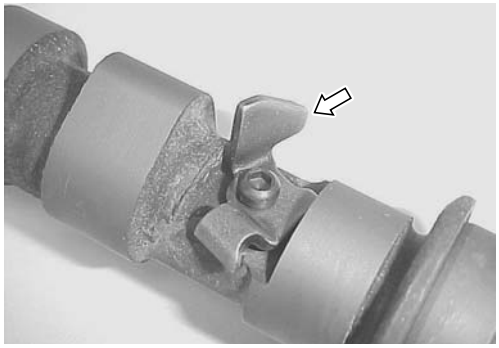
Camshaft holder inside diameter

Standard:
Upper side 25.000 – 25.021 mm (0.9843 – 0.9851 in)
Lower side 23.000 – 23.021 mm (0.9055 – 0.9063 in)



Decompression parts (For manual starter model)

Inspect the decompression parts on the camshaft.
If abnormal movement is found, replace the camshaft.



ROCKER ARM/SHAFT

Rocker arm

Inspect the cam-riding face and tip of the adjusting screw.
If excessive wear is found, replace the rocker arm and/or adjusting screw.

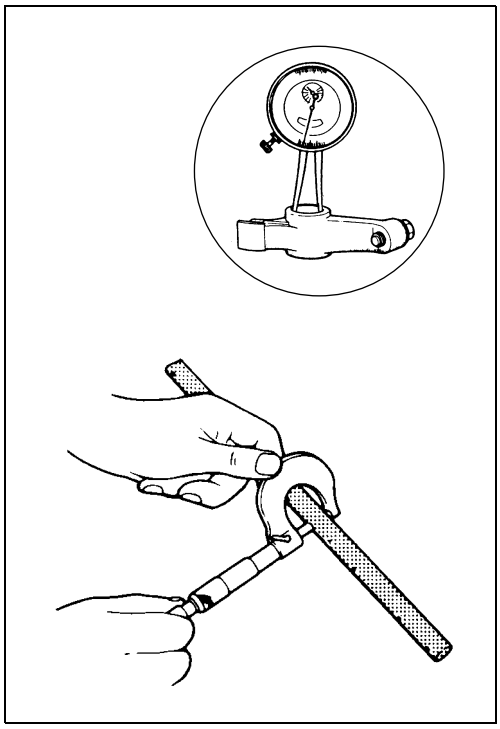
Rocker arm shaft to rocker arm clearance

Standard: 0.016 – 0.045 mm (0.0006 – 0.0018 in)
Service limit: 0.060 mm (0.0024 in)

If measurement exceeds service limit, replace rocker arm and/or rocker arm shaft.

To check the clearance, measure the following items:
- Rocker arm shaft outside diameter
- Rocker arm inside diameter

TOOL 09900-20205: Micrometer
09900-20605: Dial calipers



Rocker arm shaft outside diameter

Standard: 12.973 – 12.984 mm (0.5107 – 0.5112 in)

Rocker arm inside diameter

Standard: 13.000 – 13.018 mm (0.5118 – 0.5125 in)

VALVE/VALVE GUIDE

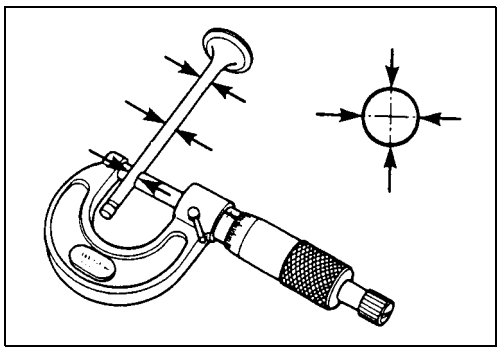
Valve guide to valve stem clearance

Standard: IN 0.010 – 0.037 mm (0.0004 – 0.0015 in)
EX 0.035 – 0.062 mm (0.0014 – 0.0024 in)
Service limit: IN 0.070 mm (0.0028 in)
EX 0.090 mm (0.0035 in)

If measurement exceeds service limit, replace valve and/or valve guide.

To check the clearance, measure the following items:
- Valve stem outside diameter
- Valve guide inside diameter

TOOL 09900-20205: Micrometer
Small bore gauge or dial calipers

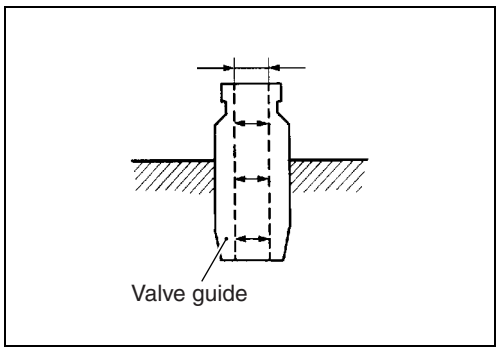


Valve stem outside diameter

Standard: IN 5.475 – 5.490 mm (0.2156 – 0.2161 in)
EX 5.450 – 5.465 mm (0.2146 – 0.2152 in)

Valve guide inside diameter

Standard: IN & EX 5.500 – 5.512 mm (0.2165 – 0.2170 in)

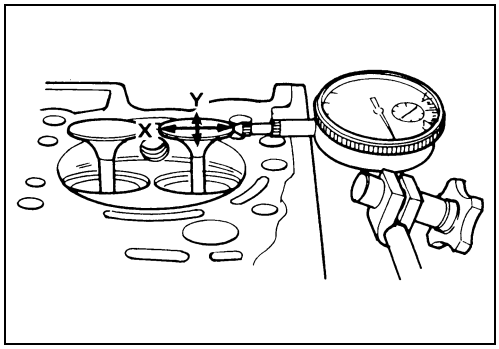


If unable to measure valve guide inside diameter, measure the "Valve stem deflection".

Valve stem deflection

Measure valve stem deflection as follows:

1. Install the valve into valve guide.
2. Position the valve head at approx. 10 mm away from valve seat.
3. Move valve head in the direction "X – Y", and measure deflection.



TOOL **09900-20602: Dial gauge**
09900-20701: Magnetic stand

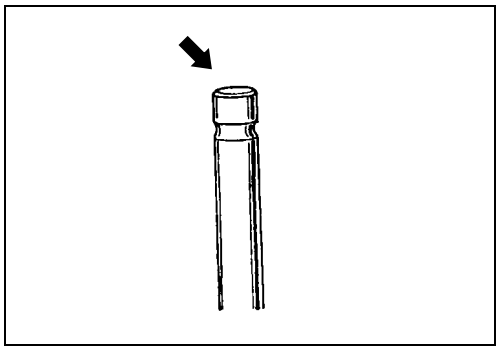
Service limit: IN & EX 0.16 mm (0.006 in)

If measurement exceeds service limit, replace valve.
If measurement still exceeds service limit with new valve, replace valve guide.

NOTE:
For valve guide replacement, see "VALVE GUIDE REPLACEMENT" section on page 6-18.

Valve stem end

Inspect valve stem end face for pitting and wear.
If pitting or wear is found, valve stem end may be resurfaced.
Use caution when resurfacing, do not grind away stem end chamfer.
When chamfer has been worn away, replace valve.



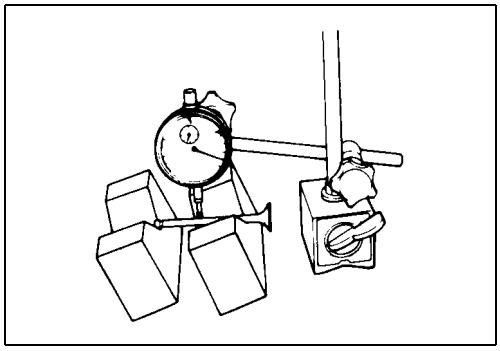
Valve stem runout

Measure valve stem runout.

09900-20602: Dial gauge
09900-20701: Magnetic stand
09900-21304: Steel "V" block set

Service limit: IN & EX 0.05 mm (0.002 in)

If measurement exceeds service limit, replace valve.



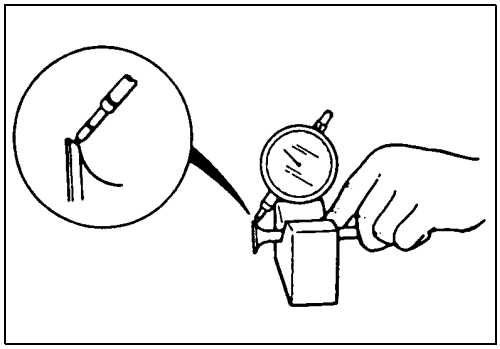
Valve head radial runout

Measure valve head radial runout.

09900-20602: Dial gauge
09900-20701: Magnetic stand
09900-21304: Steel "V" block set

Service limit: IN & EX 0.03 mm (0.001 in)

If measurement exceeds service limit, replace valve.



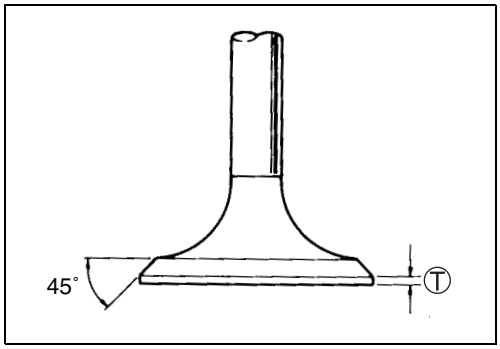
Valve head thickness

Measure valve head thickness Ⓣ.

09900-20102: Vernier Calipers

Service limit: IN & EX 0.5 mm (0.02 in)

If measurement exceeds service limit, replace valve.



Valve seat contact width

Measure valve seat contact width Ⓐ as follows:

1. Coat valve seat evenly with Prussian blue (or equivalent).
2. Install valve into valve guide.
3. Put valve lapper on valve.

09916-10911: Valve lapper

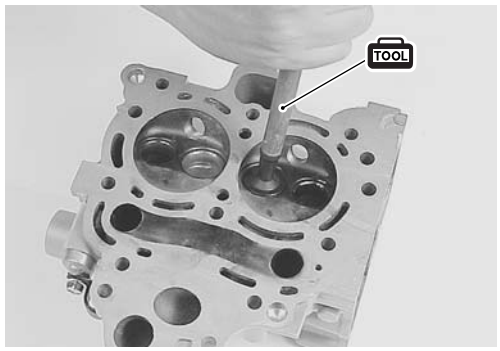
4. Rotate valve while gently tapping valve contact area against seat.
5. Repeat until a continuous pattern in the Prussian blue is seen.
6. Measure valve seat contact width Ⓐ.

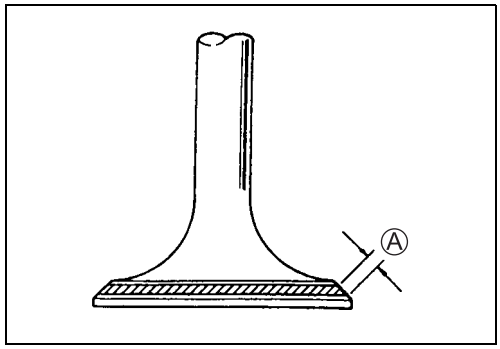
09900-20102: Vernier calipers

Standard: IN & EX 0.9 – 1.1 mm (0.035 – 0.043 in)

If measurement is out of the specification, repair valve seat.

NOTE:
For valve seat repair, see "VALVE SEAT SERVICING" section on page 6-19.

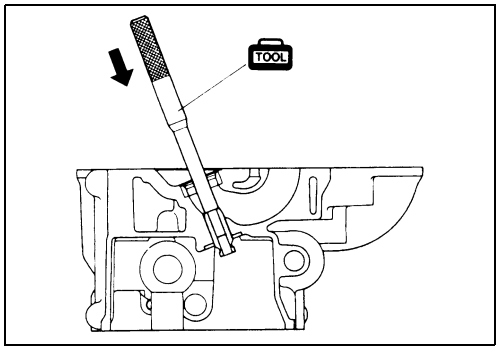




VALVE GUIDE REPLACEMENT

CAUTION

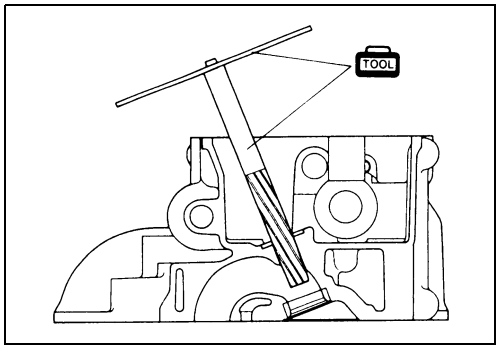
Be careful not to damage cylinder head when replacing valve guide.



1. Drive valve guide out toward valve spring side.

TOOL 09916-44910: Valve guide remover/installer

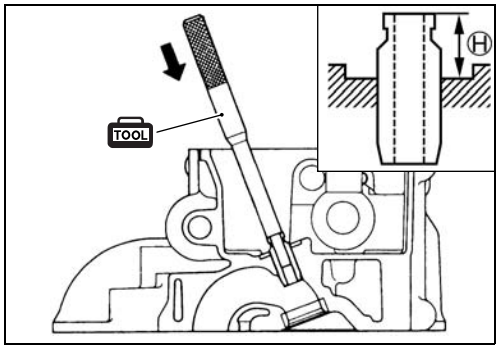
NOTE:
Do not reuse valve guide once it has been removed.
Always use a new valve guide (oversize) when assembling.



2. Ream valve guide hole with ϕ 11 mm reamer to true hole and remove burrs.

TOOL 09916-38210: Valve guide reamer (ϕ 11 mm)
09916-34542: Valve guide reamer handle

NOTE:
Turn reamer clockwise, never counterclockwise.



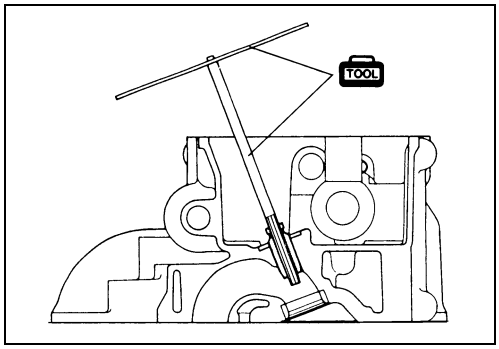
3. Drive valve guide in from valve spring side to the specified height.

TOOL 09916-44910: Valve guide Remover/installer

4. Measure valve guide protrusion Ⓗ.

TOOL 09900-20102: Vernier calipers

Valve guide protrusion:
Standard: IN & EX 10.0 ± 0.5 mm (0.39 ± 0.02 in)



5. Ream valve guide bore with ϕ 5.5 mm reamer.

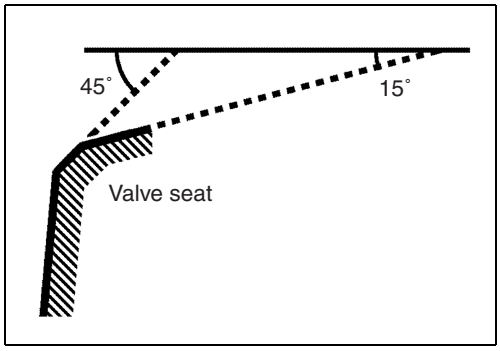
TOOL 09916-34550: Valve guide reamer (ϕ 5.5 mm)
09916-34542: Valve guide reamer handle

NOTE:
Clean and oil the valve guide bore after reaming.

VALVE SEAT SERVICING

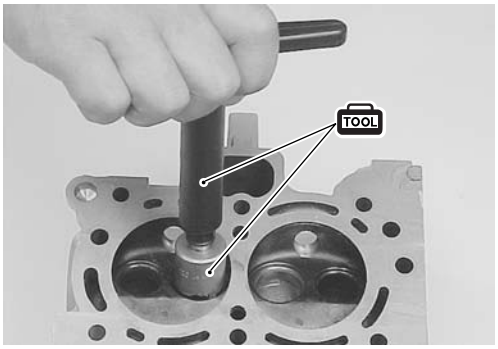
If valve seat contact width is out of specification, reface valve seat as follows:

TOOL **09916-20610: Valve seat cutter 15° (N-121)**
09916-20620: Valve seat cutter 45° (N-122)
09916-24440: Handle adapter (N-503-1)
09916-24450: Solid pilot (N-100-5.52)
09916-54910: Handle (N-505)

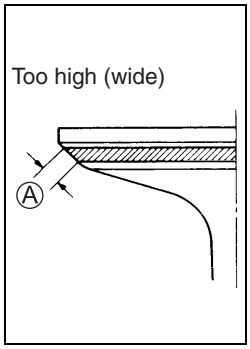


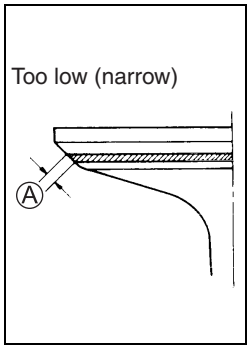
NOTE:
Turn cutter clockwise, never counterclockwise.

1. Using 45° angle cutter and reface valve seat.



2. Measure valve seat contact width Ⓐ. See the "Valve seat contact width" section on page 6-17.
3. If width Ⓐ is too high (or wide), reface valve seat using the 15° cutter.
   If width Ⓐ is too low (or narrow), reface valve seat using the 45° cutter.
4. Clean up any burrs using the 45° cutter very lightly.



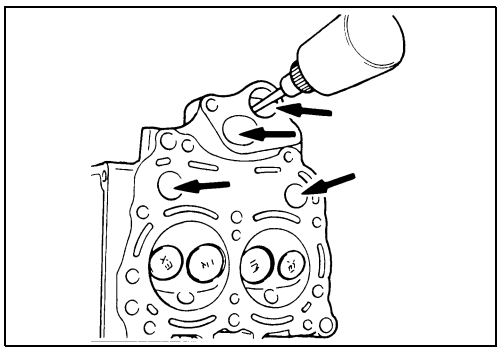


CAUTION

Grind seat areas minimally only.
Do not grind more than necessary.

5. Lap valve on seat in two steps, first with coarse grit lapping compound applied to face and the second with fine grit compound.
6. Recheck valve seat contact width Ⓐ.

NOTE:
Clean and assemble cylinder head and valve components. Fill intake and exhaust ports with solvent to check for leaks between valve seat and valve. If any leaks occur, inspect valve seat and face for burrs or other things that could prevent valve from sealing.



VALVE SPRING

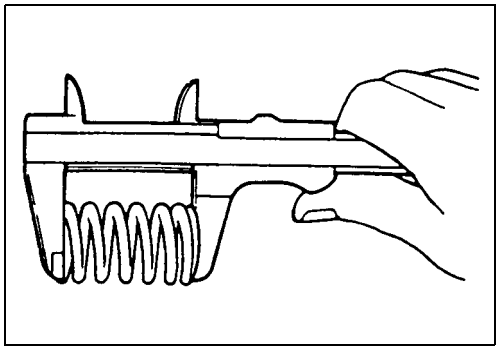
Valve spring free length

Measure the spring free length.

TOOL 09900-20102: Vernier calipers

Standard: 32.52 mm (1.280 in)
Service limit: 32.40 mm (1.276 in)

If measurement is lower than service limit, replace valve spring.



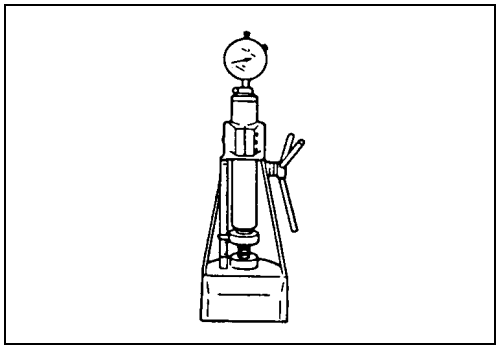
Valve spring tension

Measure the valve spring tension.

TOOL 09900-20102: Vernier caliper

Standard: 90 N (9.0 kg, 19.8 lbs) for 28.5 mm (1.12 in)
Service limit: 76 N (7.6 kg, 16.8 lbs) for 28.5 mm (1.12 in)

If measurement is lower than service limit, replace valve spring.



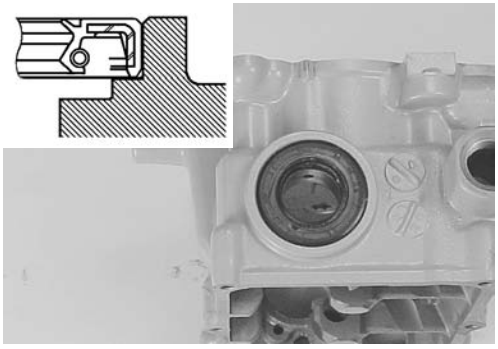
OIL SEAL

Inspect condition.

If cracked, cut or damaged, replace oil seal.

REASSEMBLY

Reassembly is reverse order of disassembly with the special attention to the following steps:



OIL SEAL

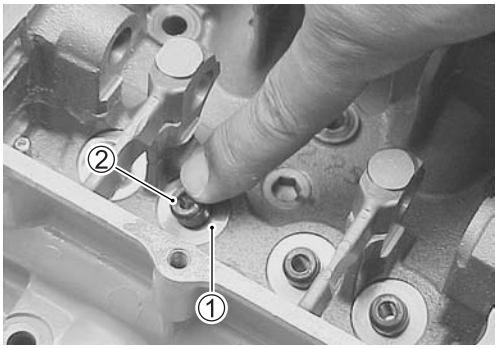
Install the oil seal with the spring/lipped side facing inward.

CAUTION

Do not re-use the seal once removed. Always install a new oil seal.

VALVE

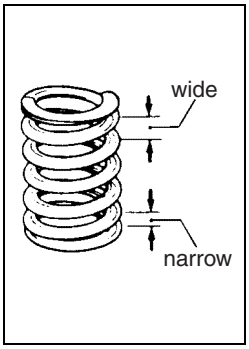
1. Install valve spring seat ①.
2. Apply engine oil to valve stem seal ②.
3. Install valve stem seal onto valve guide by pushing with finger tip.

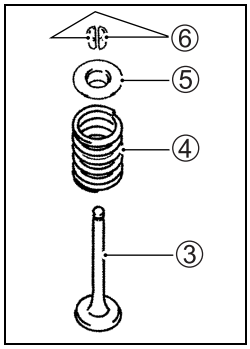


CAUTION

Do not re-use valve stem seal once removed. Always use a new valve stem seal.

4. Apply engine oil to stem seal, valve guide bore and valve stem.
5. Install valve ③, valve spring ④ and valve retainer ⑤.



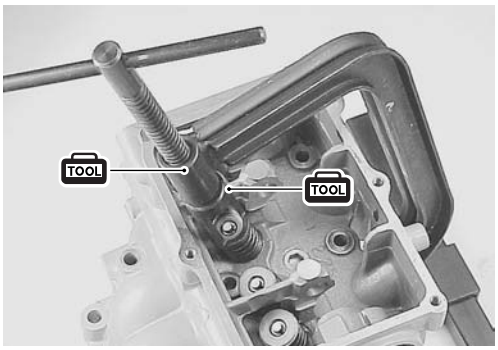


NOTE:

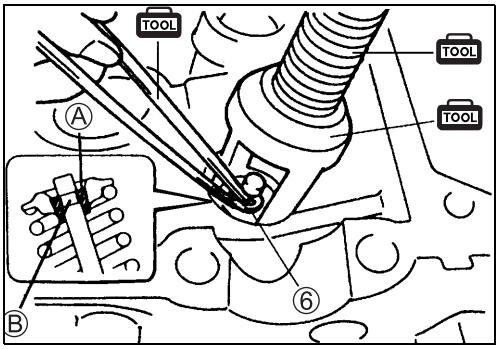
- *Reassemble each valve and valve spring to their original position.*
- *Set valve spring in place with narrow spiral area facing valve spring seat.*

6. Install valve cotters ⑥ while compressing valve spring by tool.

TOOL 09916-14510: Valve lifter
09916-14521: Attachment
09916-84511: Tweezers

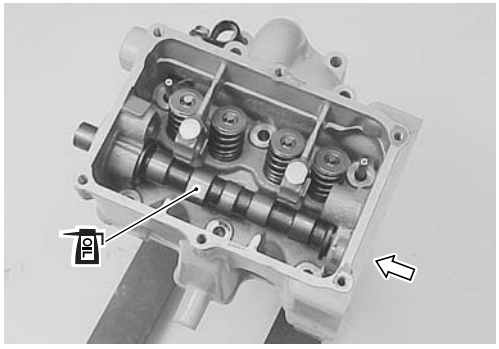


7. Make sure valve cotters Ⓐ are properly seated in groove Ⓑ.



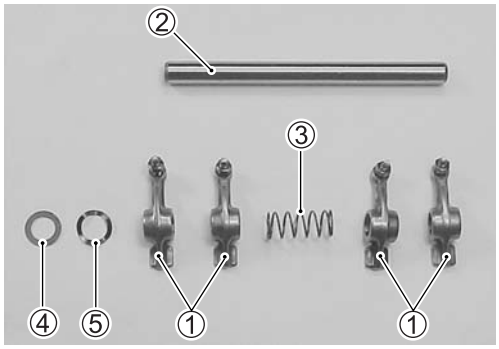
CAMSHAFT

1. Apply engine oil to the surface of each camshaft lobe and journals.
2. Install the camshaft from oil pan side.



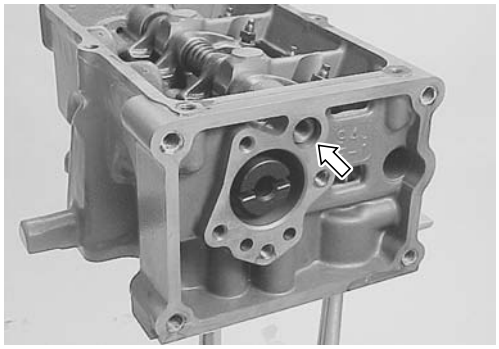
ROCKER ARM/SHAFT

1. Apply engine oil to the rocker arms ① and the rocker arm shaft ②.
2. Install the rocker arms, rocker arm spring ③, washer ④, wave washer ⑤ and rocker arm shaft ②.



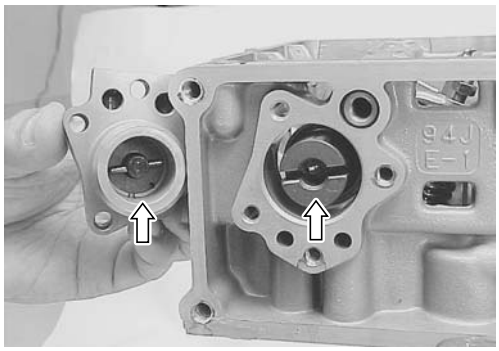
NOTE:

- *Reassemble each rocker arm to its original position.*
- *Install the rocker arm shaft with its threaded end down.*



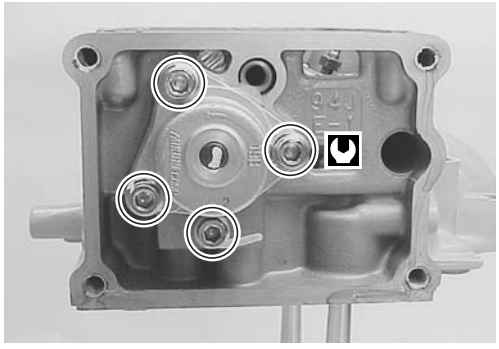
OIL PUMP

1. Install oil gallery block and oil pump assembly by aligning the pin on the oil pump shaft with the recess on the camshaft.



2. Tighten four (4) oil pump bolts securely.

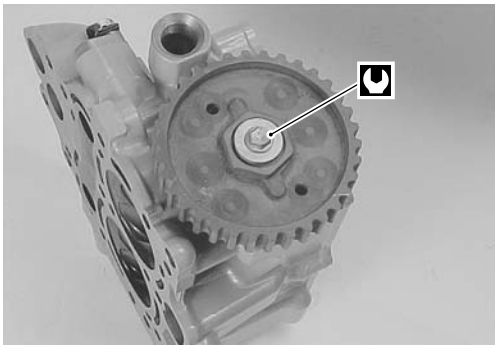
Oil pump bolt: 14 N·m (1.4 kg-m, 10.0 lb-ft)



CAMSHAFT PULLEY

1. Install the key and camshaft pulley and secure with bolt.

Camshaft pulley bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)



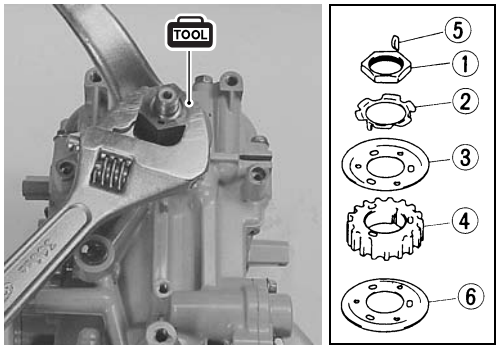
CYLINDER/CRANKSHAFT/PISTON
DISASSEMBLY

Before disassembly
- **Remove power unit. (See page 6-2 to 6-6.)**
- **Remove cylinder head assembly. (See page 6-9.)**

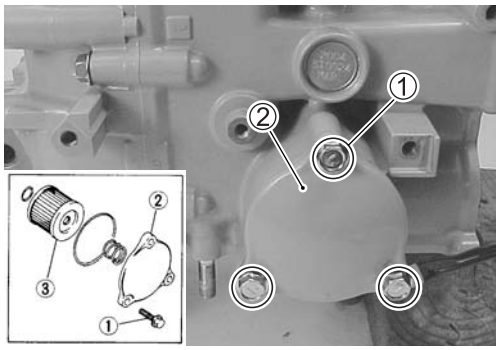
1. Using screw driver, drive locking edges of lock washer ② downward, and then remove timing pulley nut ①.

TOOL 09911-49310 : Crankshaft holder

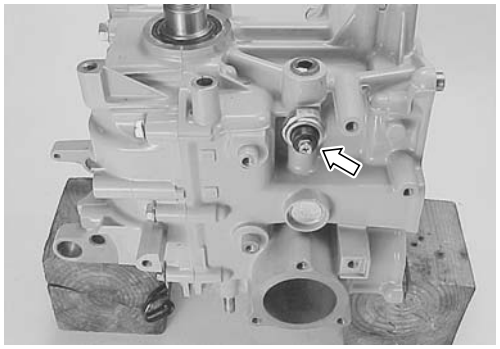
Remove the lock washer ②, upper guide ③, timing pulley ④, key ⑤ and lower guide ⑥.



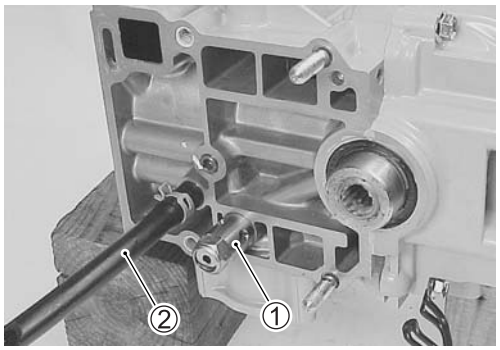
2. Remove screws ①, oil filter cap ② and oil filter ③.



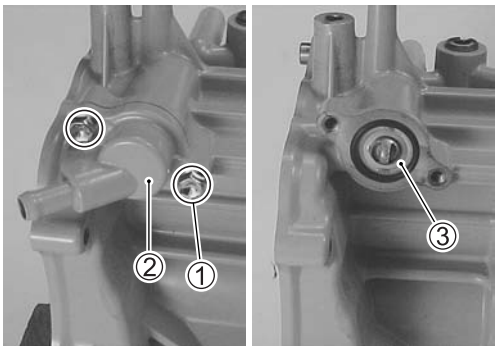
3. Remove oil pressure switch.



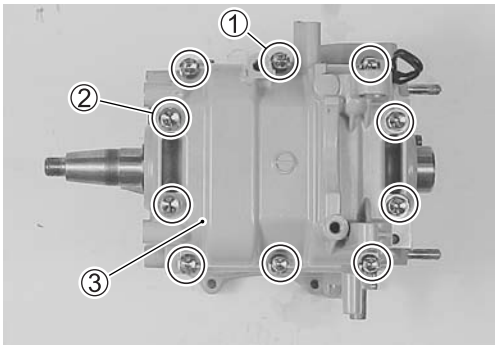
4. Remove oil pressure regulator ①.
Remove oil hose ②.



5. Remove bolts ①, thermostat cover ② and thermostat ③.

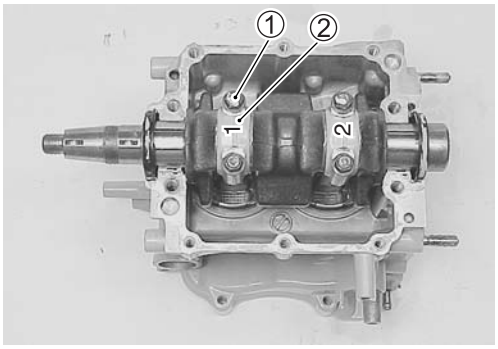


6. Remove six (6) bolts ①.
   Remove four (4) bolts ②.
   Remove crankcase ③ from cylinder block.

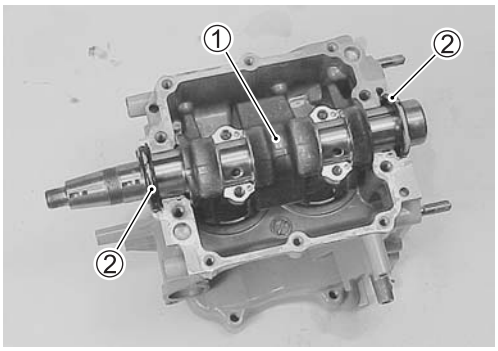


7. Remove all conrod cap bolts ① and conrod caps ②.

NOTE:
For proper assembly, mark cylinder number on all conrod caps, using quick dry paint.

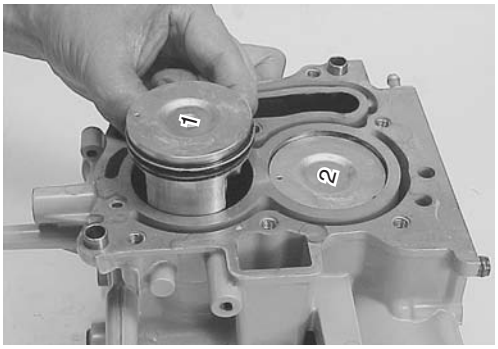


8. Remove crankshaft ①.
9. Remove oil seals ② from crankshaft.



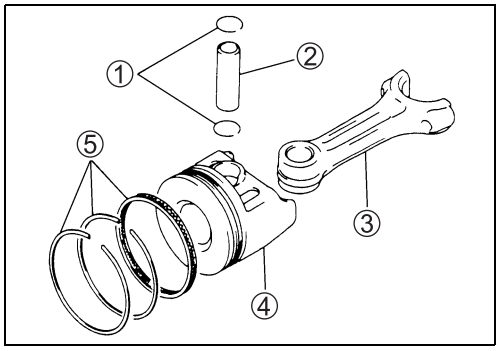
10. Push piston (with conrod) out through the top of cylinder bore.

NOTE:
- *For proper assembly, mark cylinder number on all conrods and pistons, using quick dry paint.*
- *To prevent damage to piston rings, decarbon top of cylinder bore wall before removing piston.*



11. Remove piston pin circlips ①.
12. Remove piston pin ② from conrod ③.
13. Remove two compression rings (top and 2 nd) and oil ring ⑤ from piston ④.

NOTE:
Install the 1 st ring to piston with its original direction.
There is no I.D. mark on standard size 1 st ring.



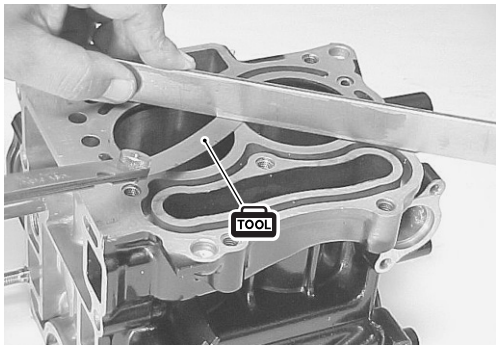
INSPECTION/SERVICING

NOTE:
If excessive wear, cracks, defective or other damage is found on any component, replace component.

CYLINDER/PISTON

Cylinder distortion

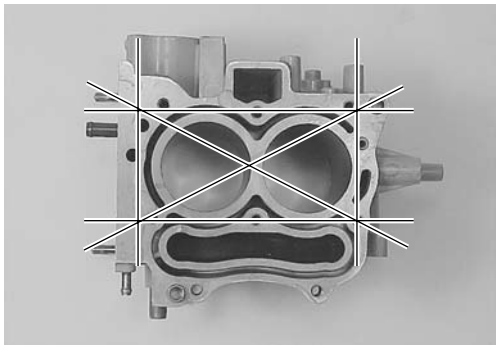
Using a straightedge and thickness gauge, measure cylinder distortion (gasketed surface) at a total of six (6) locations as shown.



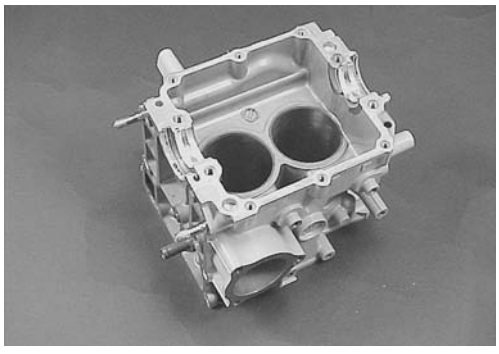
09900-20803: Thickness gauge

Service limit: 0.05 mm (0.002 in)

If measurement exceeds service limit, resurface or replace cylinder.

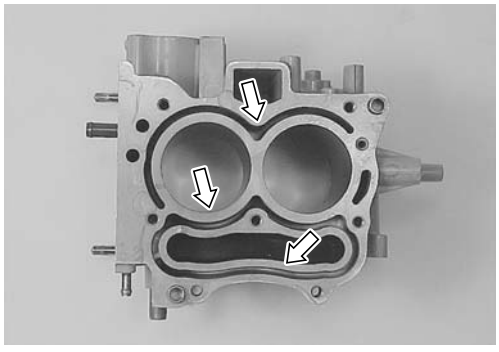


NOTE:
The cylinder can be resurfaced, using a surface plate and #400 grit wet sandpaper. Move the cylinder in a figure eight pattern when sanding.



Water jacket

Check water jackets.
If clog or obstruction is found, clean the water jacket.

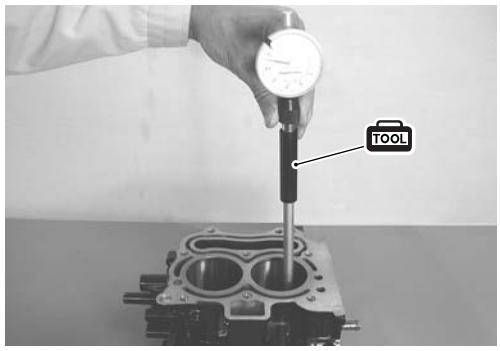


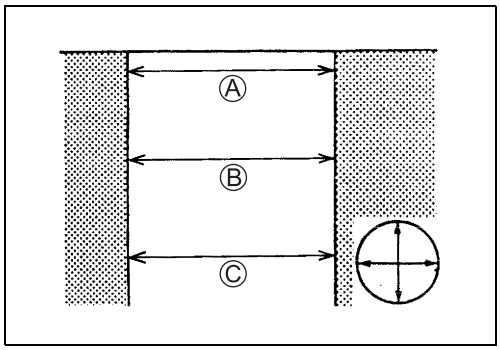
Cylinder bore wear (difference)
Measure the cylinder bore in the thrust and axial directions at the three positions Ⓐ, Ⓑ and Ⓒ as shown.
Check for the followings:
- Difference of the measurements at three positions (Taper)
- Difference between the thrust and axial measurement. (Out-of-round)

09900-20530: Cylinder gauge set

Service limit: 0.055 mm (0.0022 in)

If measurement exceeds service limit, rebore or replace cylinder.



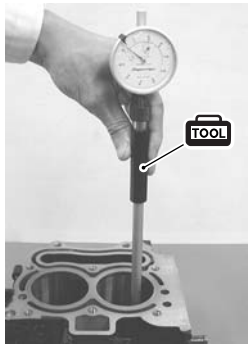


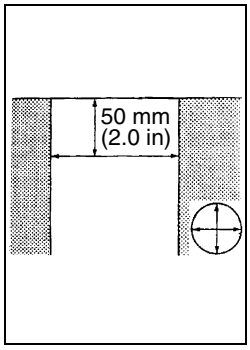
Piston to cylinder clearance
Standard: 0.0276 – 0.0425 mm (0.0011 – 0.0017 in)
Service limit: 0.100 mm (0.0039 in)

If measurement exceeds service limit, replace the piston and/or the cylinder or rebore the cylinder.

To check the clearance, measure the following items:
- Cylinder bore at 50 mm below the cylinder head gasket surface
- Piston skirt diameter at a point 15 mm above the skirt end

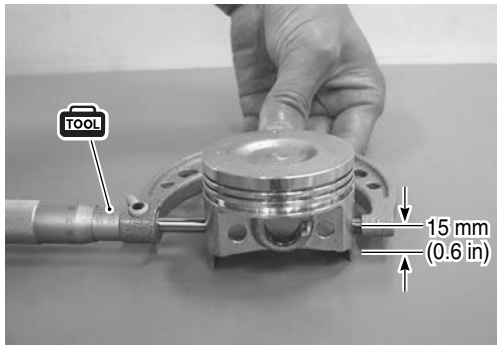
09900-20530: Cylinder gauge set
09900-20203: Micrometer





Cylinder bore
Standard: 58.000 – 58.015 mm (2.2835 – 2.2841 in)
Piston skirt diameter
Standard: 57.965 – 57.980 mm (2.2821 – 2.2827 in)

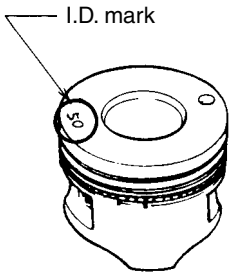
NOTE:
For this check, measure the cylinder bore and the piston skirt diameter in the direction that makes a right angle with the crankshaft (piston pin).



Identification of oversize piston/piston ring

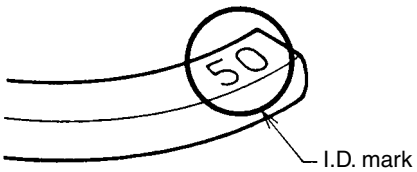
Piston

Oversize	I.D. mark
0.50 mm (0.020 in)	50



1st & 2nd ring

Oversize	I.D. mark
0.50 mm (0.020 in)	50

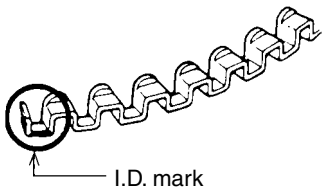


1st, 2nd ring

Oil ring

Oversize	I.D. mark
0.50 mm (0.020 in)	Red paint

NOTE:
For the oil ring side rail, measure the outer diameter of the rail to distinguish because there is no I.D. mark.



Oil ring spacer

Piston ring to groove clearance

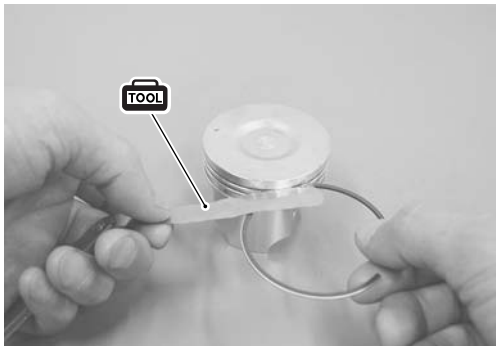
Measure the clearance after decarboning.

TOOL 09900-20803: Thickness gauge

Standard: 1st & 2nd 0.02 – 0.06 mm (0.001 – 0.002 in)
Service limit: 1st & 2nd 0.10 mm (0.004 in)

If measurement exceeds service limit, replace the piston and/or piston ring.

TOOL 09900-20102: Vernier calipers
09900-20205: Micrometer



Piston ring groove width

Standard:
1st & 2nd 1.21 – 1.23 mm (0.0476 – 0.0484 in)
Oil 2.51 – 2.53 mm (0.099 – 0.100 in)

Piston ring thickness

Standard: 1st & 2nd 1.17 – 1.19 mm (0.046 – 0.047 in)

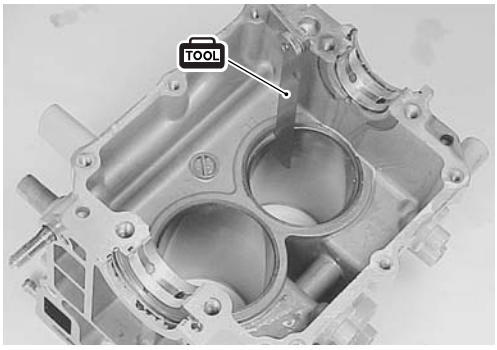
Piston ring end gap

Measure piston ring end gap with piston ring in the lowest position of cylinder bore.

TOOL 09900-20803: Thickness gauge

Standard: 1st & 2nd 0.10 – 0.25 mm (0.004 – 0.010 in)
Service limit: 1st & 2nd 0.50 mm (0.020 in)

If measurement exceeds service limit, replace piston ring.



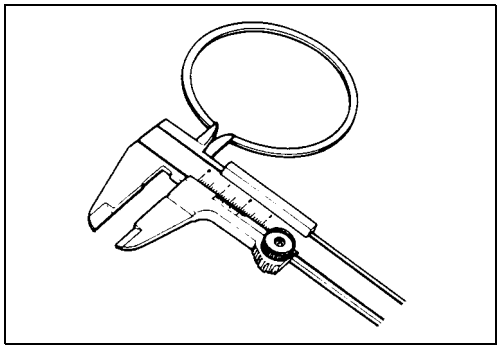
Piston ring free end gap

Measure piston ring free end gap.

TOOL 09900-20102: Vernier calipers

Standard: 1st Approx. 5.8 mm (0.23 in)
2nd Approx. 7.4 mm (0.29 in)
Service limit: 1st 4.6 mm (0.18 in)
2nd 5.9 mm (0.23 in)

If measurement exceeds service limit, replace piston ring.



Piston pin/Piston pin hole

Check for the followings:

- The piston pin and the piston pin hole are free from excessive wear and damage.
- Apply engine oil on piston pin so that the piston pin can move smoothly in the piston pin hole.

If improper condition is found, replace the piston pin and/or piston.

Pin clearance in piston pin hole

Standard: 0.002 – 0.013 mm (0.0001 – 0.0005 in)
Service limit: 0.040 mm (0.0016 in)

If measurement exceeds service limit, replace the piston pin and/or piston.

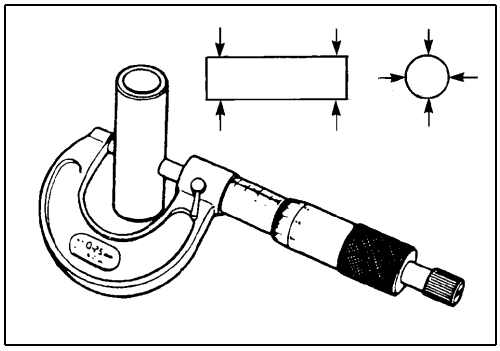
To check the clearance, measure the following items:

- Piston pin outside diameter in the thrust and axial directions
- Piston pin hole diameter in the thrust and axial directions

TOOL 09900-20205: Micrometer
09900-20605: Dial calipers

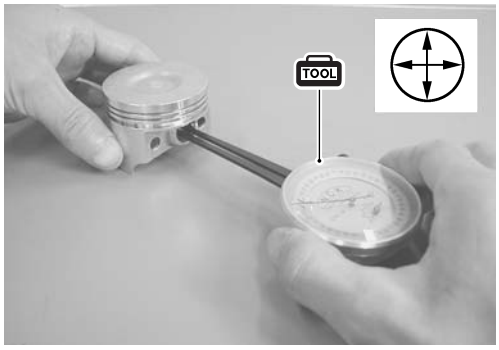
Piston pin outside diameter

Standard: 13.995 – 14.000 mm (0.5510 – 0.5512 in)
Service limit: 13.980 mm (0.5504 in)



Piston pin hole diameter

Standard: 14.002 – 14.008 mm (0.5513 – 0.5515 in)
Service limit: 14.030 mm (0.5524 in)



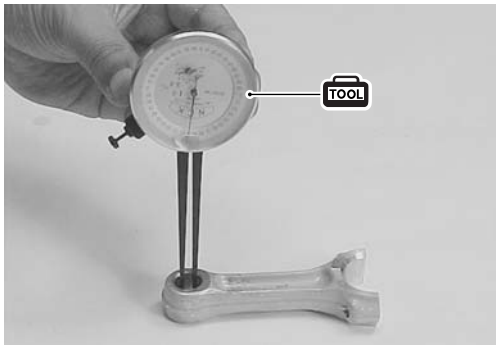
Conrod small end inside diameter

Measure the conrod small end inside diameter.

09900-20605: Dial calipers

Standard: 14.006 – 14.014 mm (0.5514 – 0.5517 in)
Service limit: 14.040 mm (0.5528 in)

If measurement is out of specification, replace the conrod.



CONROD/CRANKSHAFT/CRANKCASE

Conrod big end side clearance

Measure conrod big end side clearance with conrod installed on crank pin as shown.

09900-20803: Thickness gauge

Standard: 0.10 – 0.20 mm (0.004 – 0.008 in)
Service limit: 0.60 mm (0.024 in)

If measurement exceeds service limit, replace the conrod and/or crankshaft.

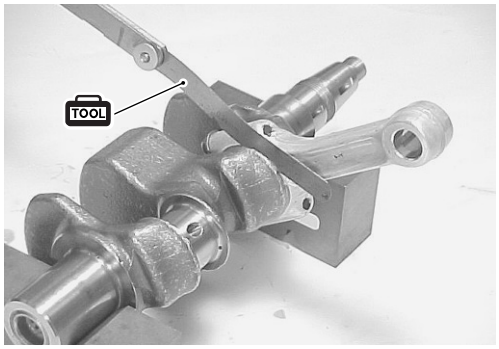
09900-20205: Micrometer
09900-20605: Dial calipers

Conrod big end width

Standard: 19.95 – 20.00 mm (0.785 – 0.787 in)

Crank pin width

Standard: 20.10 – 20.15 mm (0.791 – 0.793 in)

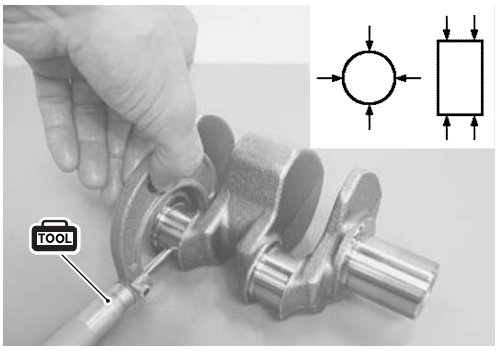


Crank pin outside diameter/difference

Measure the crank pin outside diameter in the thrust and axial directions at two positions as shown.

Check for the followings:

- Difference of the measurements at two positions (Taper)
- Difference between the thrust and axial measurement (Out-of-round)



TOOL 09900-20202: Micrometer

Out-of-round and taper

Service limit: 0.010 mm (0.0004 in)

If measurement exceeds service limit, replace the crankshaft.

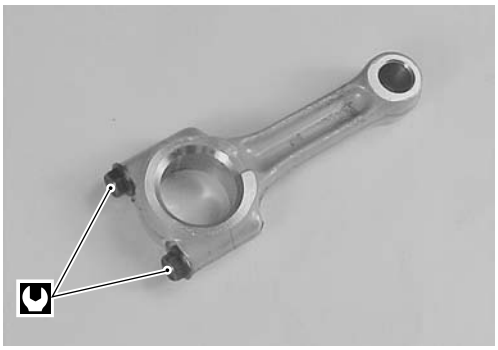
Crank pin outside diameter:

Standard: 28.989 – 29.000 mm (1.1413 – 1.1417 in)

Conrod big end inside diameter

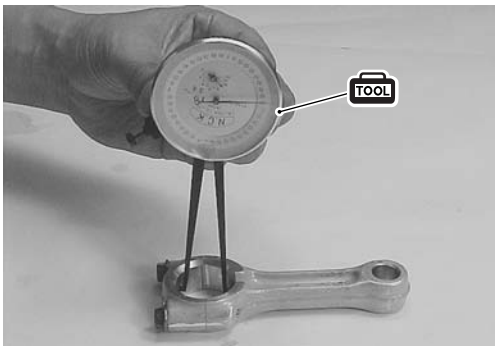
Measure the conrod big end inside diameter as follows.

1. Clean the surface of the conrod and the conrod cap.
2. Install the conrod cap to the conrod.
3. Apply the engine oil to the conrod bolts and tighten the bolts to the specified torque.



Conrod cap bolt: 12 N·m (1.2 kg-m, 8.5 lb-ft)

4. Measure the conrod big end inside diameter.



TOOL 09900-20605: Dial calipers

Conrod big end inside diameter

Standard: 29.025 – 29.034 mm (1.1427 – 1.1431 in)

Conrod big end oil clearance

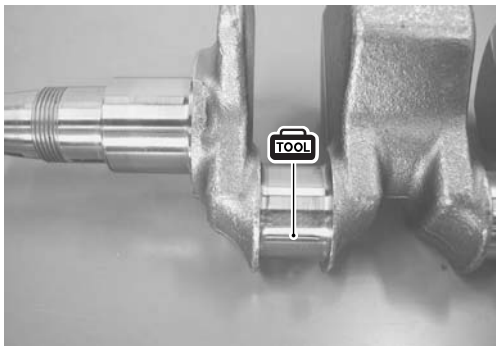
Standard: 0.025 – 0.045 mm (0.0010 – 0.0018 in)
Service limit: 0.063 mm (0.0025 in)

If measurement exceeds service limit, replace the conrod assembly and/or crankshaft.

Measure conrod big end oil clearance as follows:

1. Clean the surface of conrod, conrod cap and crank pin.
2. Place a piece of Plastigauge on crank pin parallel to the crankshaft. Avoid placing Plastigauge over the oil hole.

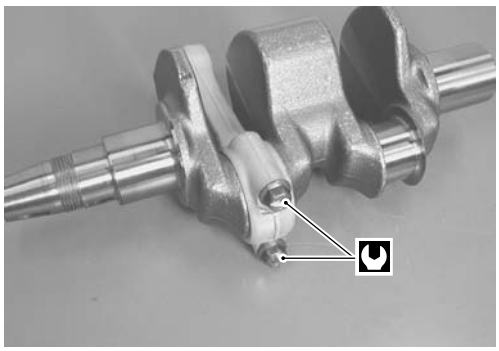
TOOL 09900-22301: Plastigauge



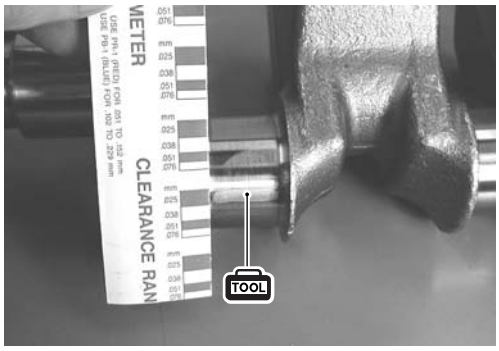
3. Install conrod and conrod cap to crank pin.
4. Apply engine oil to conrod bolts and tighten the bolts to the specified torque.

Conrod cap bolt: 12 N·m (1.2 kg-m, 8.5 lb-ft)

NOTE:
Do not rotate conrod with Plastigauge in place.



5. Remove conrod and conrod cap from crank pin.
6. Measure the compressed plastigauge width at its widest point.



CRANKSHAFT THRUST CLEARANCE

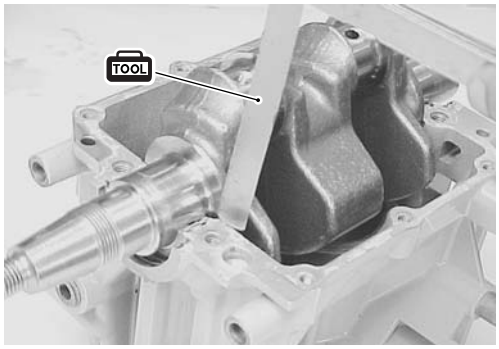
Measure the crankshaft thrust clearance.

TOOL 09900-20803: Thickness gauge

Crankshaft thrust clearance

Service limit: 0.6 mm (0.024 in)

If measurement exceeds service limit, replace crankshaft and/or crankcase.

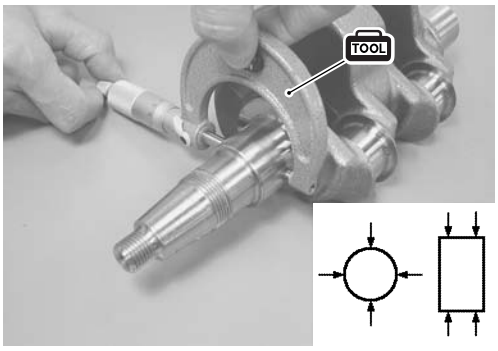


Crankshaft journal outside diameter/difference

Measure the crankshaft journal outside diameter in the thrust and axial directions at two positions as shown.

Check for the followings:

- Difference of the measurements at two positions (Taper)
- Difference between the thrust and axial measurement (Out-of-round)



TOOL 09900-20202: Micrometer

Out-of-round and taper

Service limit: 0.010 mm (0.0004 in)

If measurement exceeds service limit, replace crankshaft.

Crankshaft journal outside diameter:

Standard: 31.989 – 32.000 mm (1.2594 – 1.2598 in)

Crankshaft main bearing condition

If pitting, flaking, burn or excessive wear is found, replace both upper and lower halves.

Always replace both bearing halves, never replace only one half of a bearing set.

Crankshaft journal oil clearance

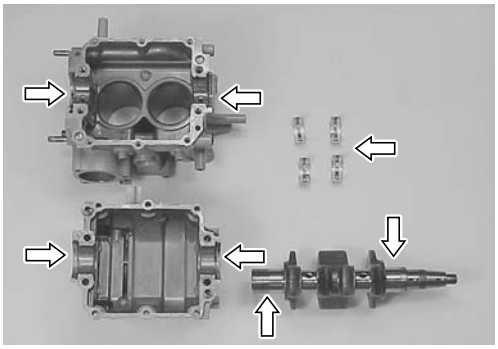
Standard: 0.020 – 0.047 mm (0.0008 – 0.0019 in)

Service limit: 0.060 mm (0.0024 in)

If measurement exceeds service limit, replace crankshaft bearing.

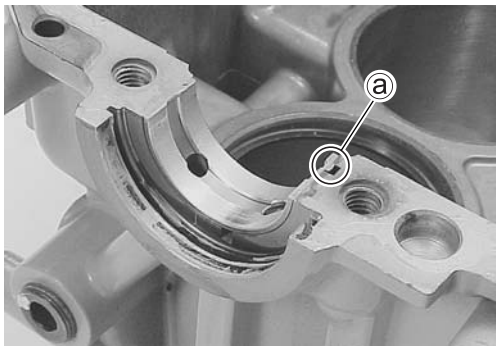
Measure the crankshaft journal oil clearance as follows:

1. Clean surface of the bearing holder (crankcase and cylinder), bearing and crankshaft bearing journal.



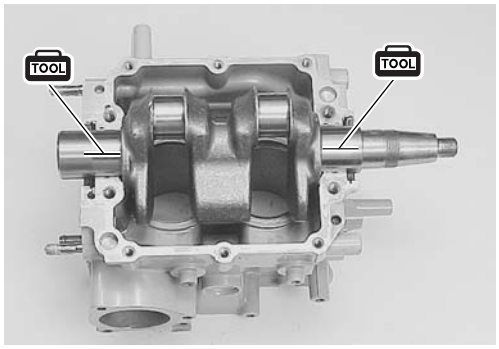
2. Install crankshaft main bearing to cylinder and crankcase.

NOTE:
- *Reassemble each bearing to its original position.*
- *Align the tab ⓐ of bearing with notch in cylinder and crankcase.*
- *Do not apply oil to bearing.*



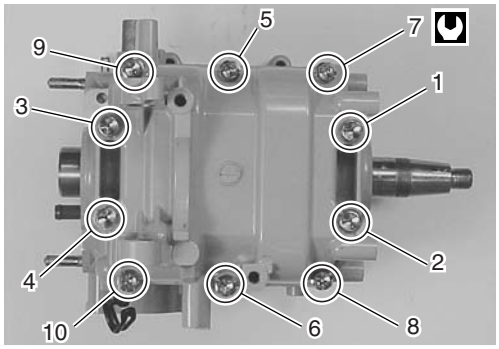
3. Install crankshaft to cylinder.
4. Place a piece of Plastigauge across full width of bearing (parallel to crankshaft) on journal.
   Do not place Plastigauge over oil hole.

TOOL 09900-22301: Plastigauge



5. Install crankcase (with the bearing) to cylinder.
6. Apply engine oil to crankcase bolts and tighten bolts to the specified torque following the order indicated.

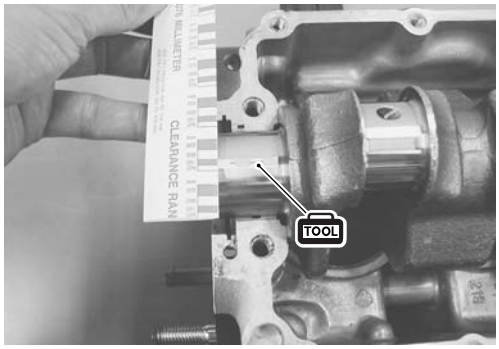
Crankcase bolt:
6 mm 14 N·m (1.4 kg-m, 10.0 lb-ft)
8 mm 25 N·m (2.5 kg-m, 18.0 lb-ft)



NOTE:
- *The crankcase must be torqued to specification in order to assure proper compression of Plastigauge and accurate reading of clearance.*
- *Do not rotate crankshaft while Plastigauge is installed.*

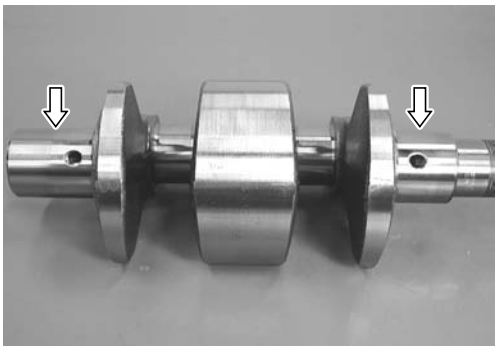
7. Remove crankcase from the cylinder.
8. Measure the compressed plastigauge width at its widest point.

NOTE:
For bearing replacement, see the "SELECTION OF MAIN BEARING" section on page 6-35.



SELECTION OF MAIN BEARING

Whenever a bearing requires replacement, select a new bearing according to following procedure.

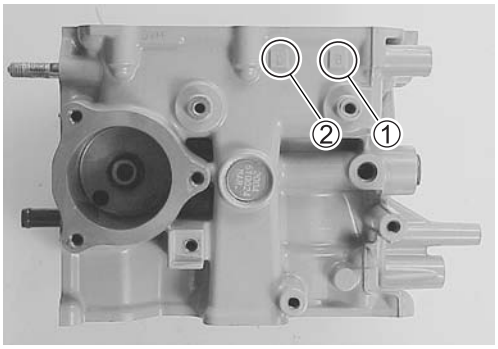


(1) Crankshaft journal outside diameter

Only one kind of crankshaft journal outside diameter is available as follow.

Standard:

Code	Crankshaft journal outside diameter
–	31.989 – 32.000 mm (1.2594 – 1.2598 in)



(2) Next, check bearing holder inside diameter without bearing.

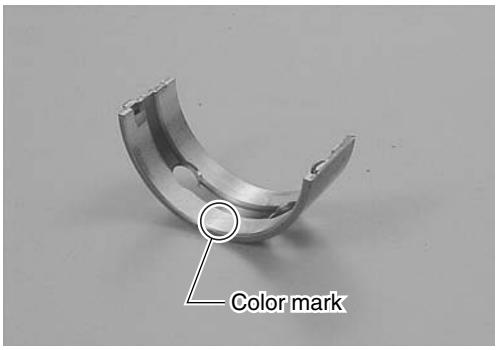
As shown in figure, the PORT side of cylinder block has two (2) stamped codes letters.

The letters (A & B) represent the bearing holder inside diameters shown below.

Standard:

Code	Crankcase bearing holder inside diameter
A	35.008 – 35.016 mm (1.3783 – 1.3786 in)
B	35.000 – 35.008 mm (1.3780 – 1.3783 in)

① Top side I.D. code ② Lower side I.D. code



(3) There are two (2) main bearings available, each of differing thickness.

To distinguish them, a color mark is painted at the position indicated in figure.

Each color represents the following thickness measured at the center of the bearing.

Standard:

Code	Crankshaft bearing thickness
Green	1.486 – 1.490 mm (0.0585 – 0.0587 in)
Black	1.490 – 1.494 mm (0.0587 – 0.0588 in)

(4) Select crankshaft main bearing referring the below table.

Bearing selection table

Item		Crankshaft journal outside diameter
Crankcase bearing holder inside diameter	Code	————
	A	Black
	B	Green

NOTE:
Measure the crankshaft journal oil clearance again after installing the new bearings selected. (See page 6-33.)

OIL SEAL
Inspect condition. If cracked, cut or damaged, replace.

REASSEMBLY

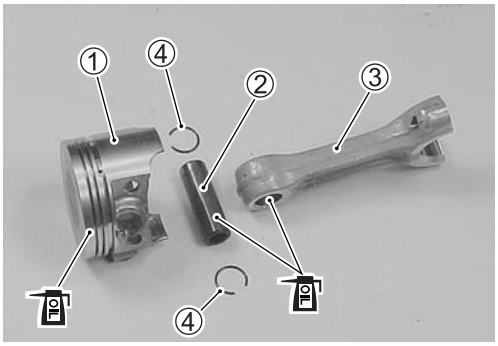
Reassembly is reverse order of disassembly with the special attention to the following steps:

CAUTION

- **If original components are not replaced, each piston, piston pin and conrod is to be assembled and installed in its original order and position.**
- **Do not re-use the gasket, oil seal, O-ring and circlip once removed. Always use new parts.**

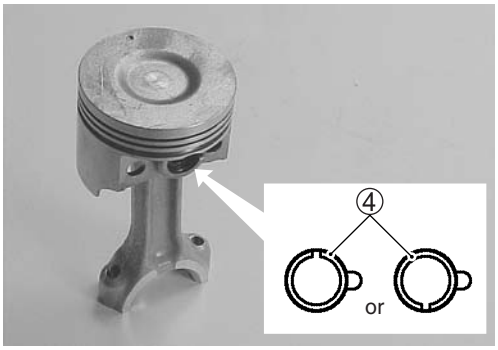
PISTON TO CONROD

1. Apply engine oil to piston pin ②, piston pin bore and conrod ③.
2. Fit conrod to piston ① as shown in figure and insert piston pin through piston and conrod.
3. Install piston pin circlips ④.



NOTE:

- *Reinstall the conrod to the original direction.*
- *Install the circlips with a gap facing either up or down as shown in the figure.*



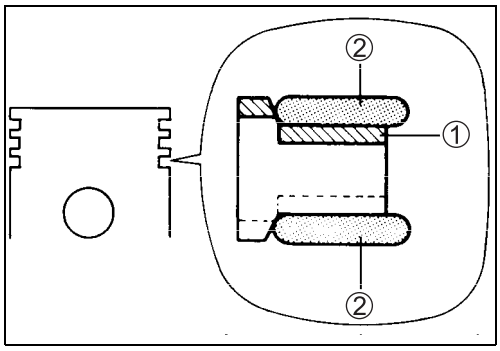
PISTON RING TO PISTON

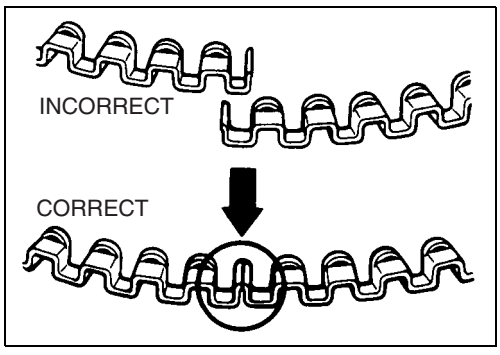
Oil ring

1. Apply engine oil to piston rings.
2. Install spacer ① first, then side rails ② to piston.

CAUTION

When installing spacer, do not allow ends to overlap in the groove.



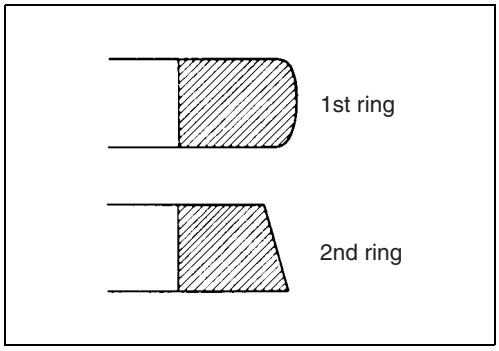


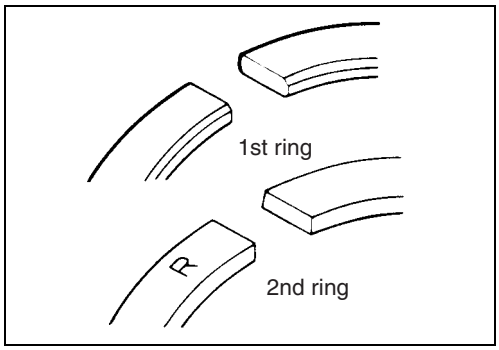
1st ring and 2nd ring

1. Apply engine oil to piston rings.
2. Install 2nd ring and 1st ring to piston.

CAUTION

- **Install 2nd ring to piston with the "R" mark toward the piston head side.**
- **Install 1st ring to piston with its original direction. There is no I.D. mark on the standard size 1st ring.**

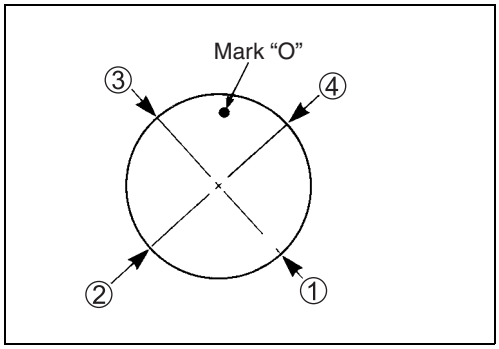




Ring gap direction

Position rings so that their gaps are staggered at approximately 90 degree angles as shown.

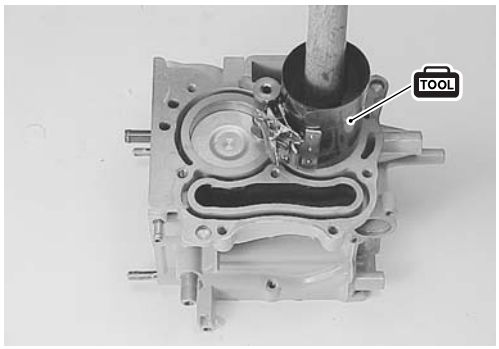
① 1st ring
② Oil ring lower side rail
③ 2nd ring
④ Oil ring upper side rail



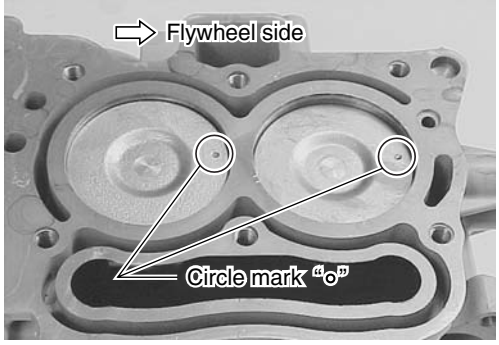
PISTON TO CYLINDER

1. Apply engine oil to piston and cylinder walls.
2. Insert piston and conrod assembly into cylinder bore from cylinder head side using the special tool.

TOOL 09916-77310: Piston ring compressor

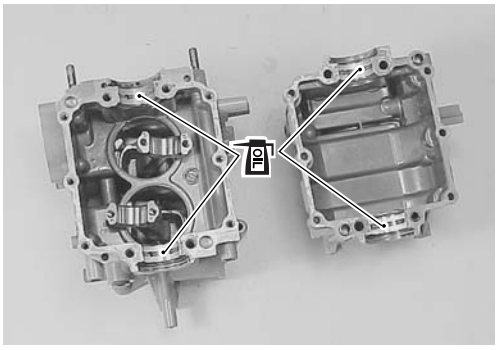


NOTE:
Position the CIRCLE mark on piston head to flywheel side.



CRANKSHAFT TO CYLINDER

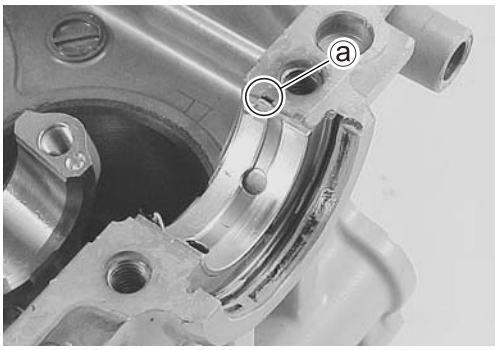
1. Install crankshaft main bearings in cylinder and crankcase.
2. Apply engine oil to bearings.



CAUTION

- **Reassemble each bearing to its original position.**
- **Do not apply oil between crank bearing holder and crankshaft bearing.**

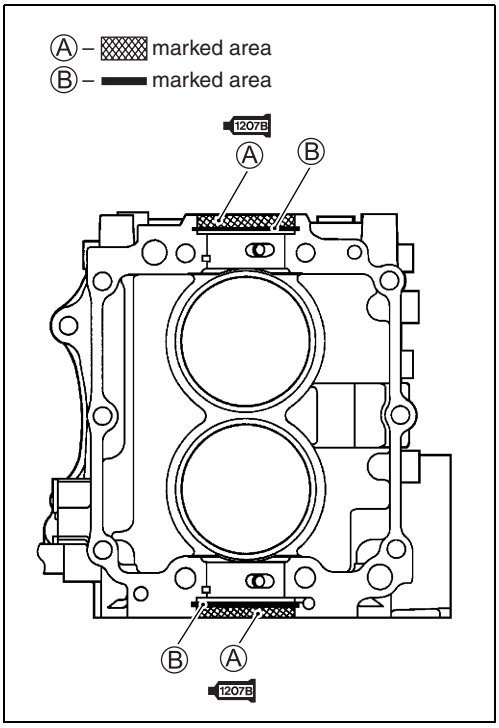
NOTE:
Align the tab ⓐ of bearing with notch in cylinder and crankcase.



3. Clean the oil seal fitting surface of cylinder.
   Apply the bond to the oil seal fitting surface of the cylinder as shown.

1207B 99000-31140: SUZUKI BOND "1207B"

Ⓐ – Oil seal fitting surface (Apply the bond.)
Ⓑ – Groove for the oil seal tab (Do not apply the bond.)

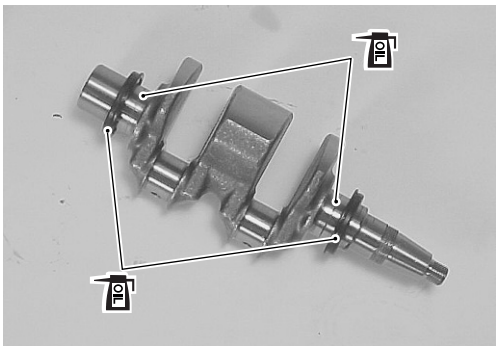


4. Apply engine oil to the lip area of the oil seals.
5. Install oil seals to crankshaft.

CAUTION

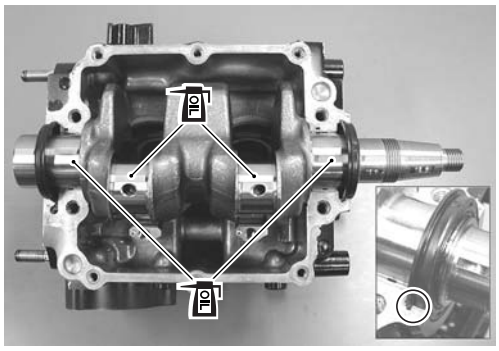
Do not re-use seal once removed. Always use a new seal.

NOTE:
Install oil seals with its spring/lipped side facing inward.



6. Apply engine oil to crank journal, crank pin and conrod.
7. Install crankshaft in cylinder.

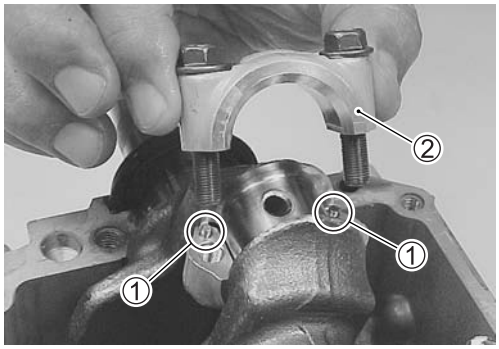
NOTE:
When installing crankshaft to cylinder, be sure to fit oil seal tabs in grooves of cylinder.



8. Apply engine oil to conrod cap.
9. Install dowel pins ① and conrod cap ② to conrod.

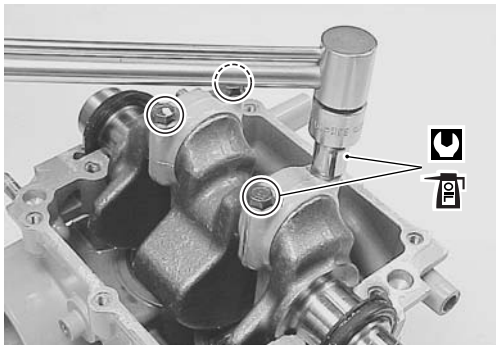
CAUTION

Reassemble each conrod cap to its original position.



10. Apply engine oil to conrod cap bolts.
11. Tighten bolts to specified torque.

Conrod cap bolt: 12 N·m (1.2 kg-m, 8.5 lb-ft)



CRANKCASE TO CYLINDER

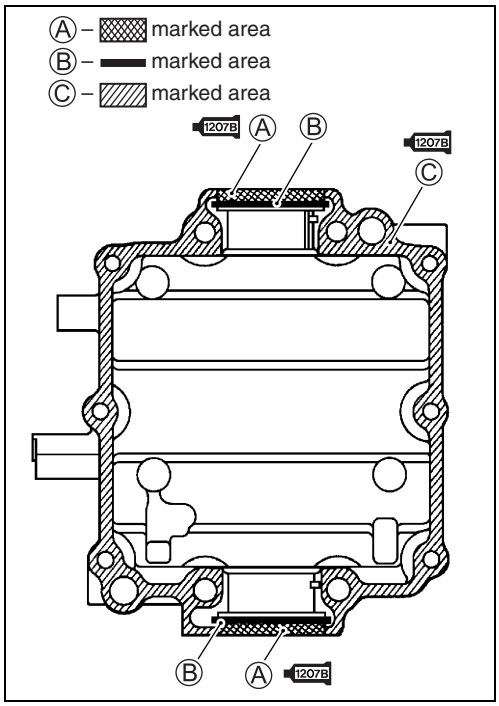
1. Clean mating surface of cylinder and crankcase.
2. Apply the bond to mating surface of crankcase as shown.

1207B 99000-31140: SUZUKI BOND "1207B"

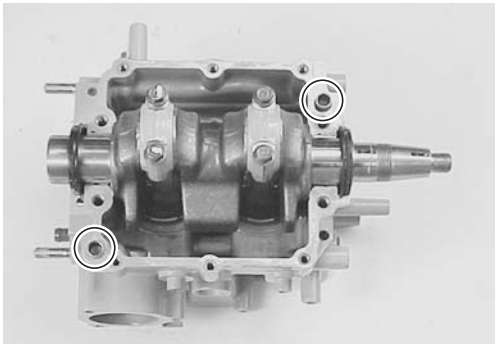
CAUTION

Apply bond to mating surface only. Do not allow bond to contact surface of bearing.

Ⓐ – Fitting surface of the oil seal (Apply the bond.)
Ⓑ – Groove for the oil seal tab (Do not apply the bond.)
Ⓒ – Mating surface of the crankcase (Apply the bond.)

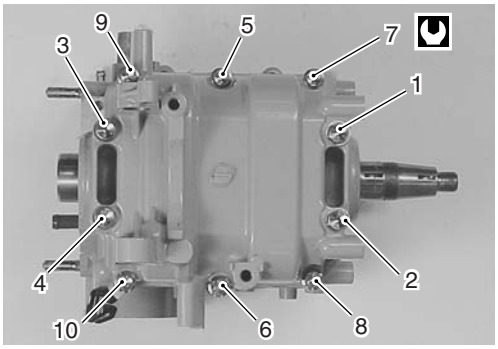


3. Install two dowel pins.



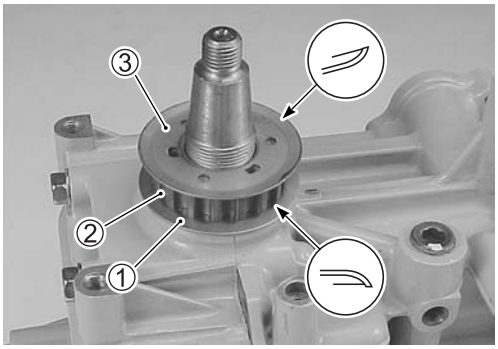
4. Install crankcase (with the bearing) to cylinder.
5. Apply engine oil lightly to crankcase bolts.
6. Tighten ten bolts to specified torque according to sequence in figure.

Crankcase bolt:
6 mm 14 N·m (1.4 kg-m, 10.0 lb-ft)
8 mm 25 N·m (2.5 kg-m, 18.0 lb-ft)



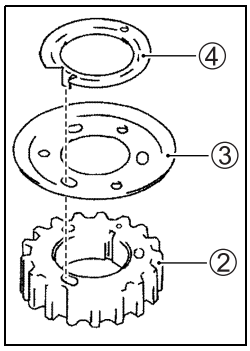
TIMING PULLEY

1. Install lower guide ①.
2. Install key.
3. Install timing pulley ② and upper guide ③ with direction as shown.
4. Install lock washer ④ with direction as shown.



NOTE:

- *Timing pulley direction:*
  Position the PUNCH mark to the upper side.
- *Belt guide direction:*
  Install the belt guides with flanges towards outside.



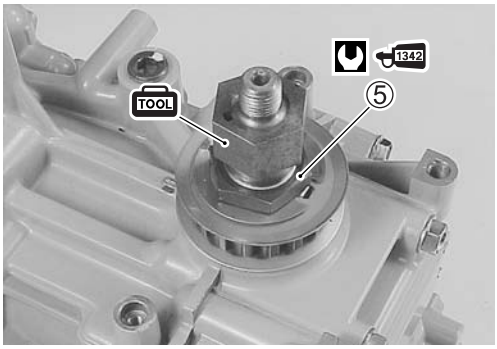
5. Apply THREAD LOCK to timing pulley nut ⑤.

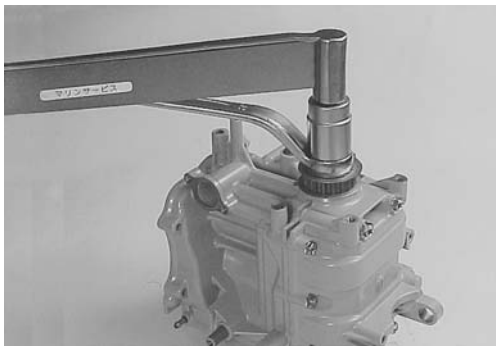
1342 99000-32050: THREAD LOCK "1342"

6. Install timing pulley nut ⑤.
   Tighten timing pulley nut ⑤ to specified torque using special tool.

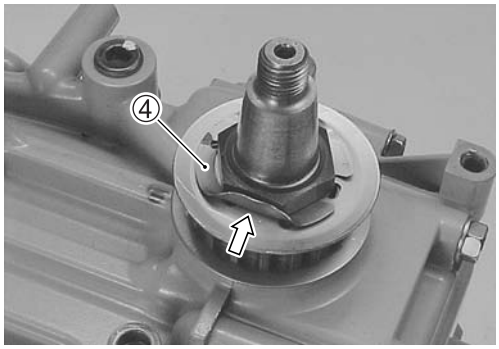
TOOL 09911-49310: Crankshaft holder

Timing pulley nut: 50 N·m (5.0 kg-m, 36.0 lb-ft)





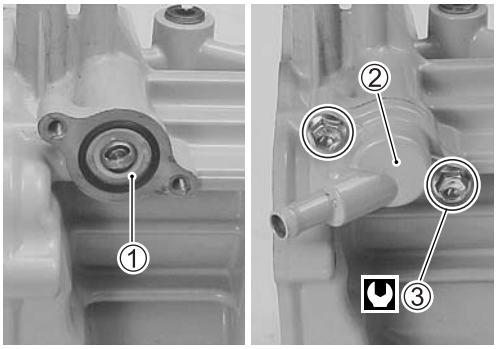
7. Bend the lock washer edge ④ toward nut for locking.



THERMOSTAT

Install thermostat ① and cover ② to cylinder and secure with bolts ③.

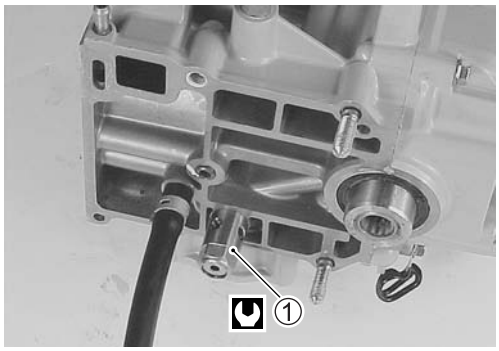
Thermostat cover bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)



OIL PRESSURE REGULATOR

Install oil pressure regulator ① to cylinder, then tighten regulator securely.

Oil pressure regulator: 27 N·m (2.7 kg-m, 19.5 lb-ft)

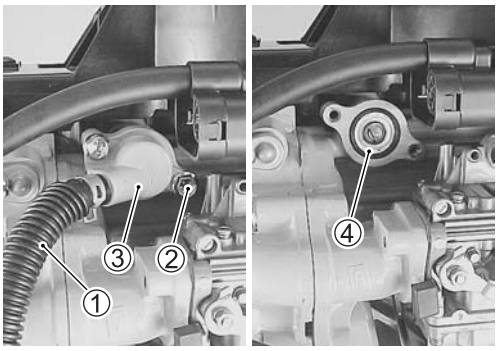


ENGINE OIL FILTER

Install the engine oil filter. (Refer to page 2-4.)

THERMOSTAT

REMOVAL



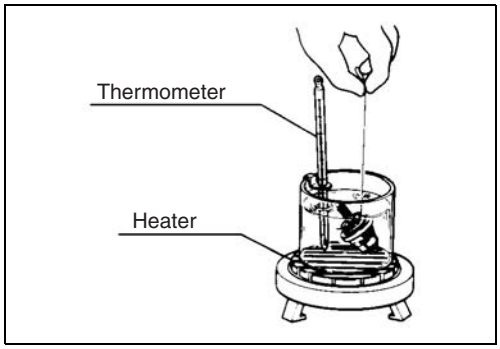
- Disconnect water hose ① from thermostat cover.
- Remove the two (2) bolts ② securing the thermostat cover, then remove the cover ③ and thermostat ④.

INSPECTION

- If salt deposits, corrosion, wear or other damage is found, clean or replace.

- **Thermostat operation**
  Check thermostat opening temperature as follows:
  - Insert a length of thread between thermostat valve / body and suspend thermostat in a container filled with water.
  - Place thermometer in container and heat water.
    Observe water temperature when thermostat valve opens and releases thread.

  Thermostat operating temperature
  Standard : 58 – 62 °C (136 – 144 °F)

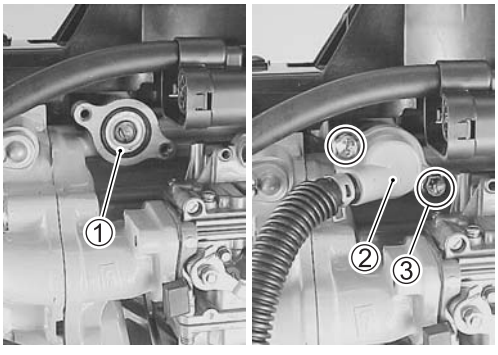


INSTALLATION

Installation is reverse order of removal with special attention to the following steps.

- Assemble thermostat ①, and thermostat cover ② to cylinder block and secure with bolts ③.

Thermostat cover bolt : 10 N·m (1.0 kg-m, 7.0 lb-ft)



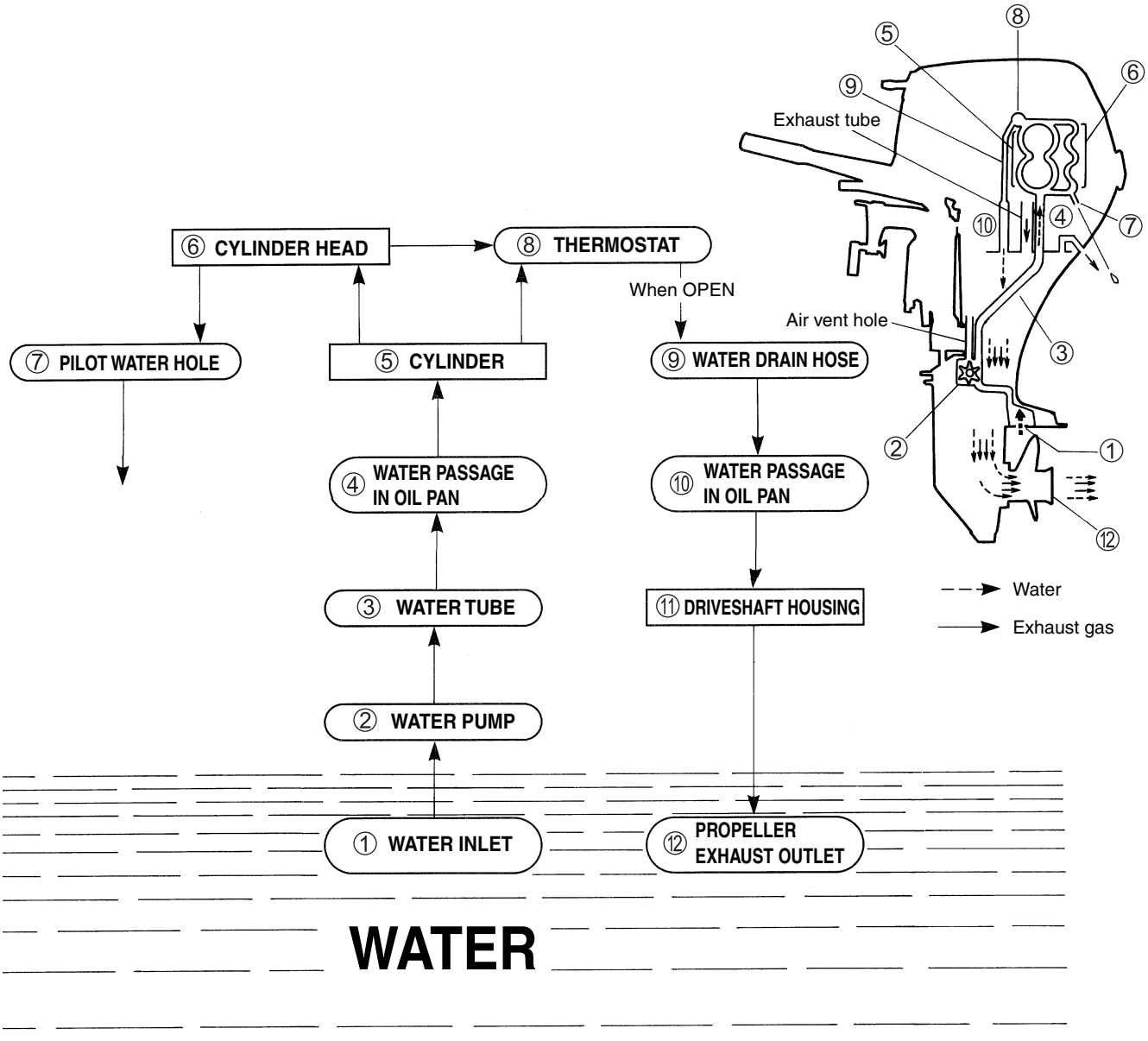
OPERATION

WATER COOLING SYSTEM

The water cooling system consists of the water pump (in the lower unit), the water tube (between the lower unit and the power unit) and the thermostat (in the cylinder). This system cools both the power unit and the exhaust and is shown in schematic form below.

If overheating occurs, the components of the cooling system must be inspected for blockage, corrosion build-up or damage.

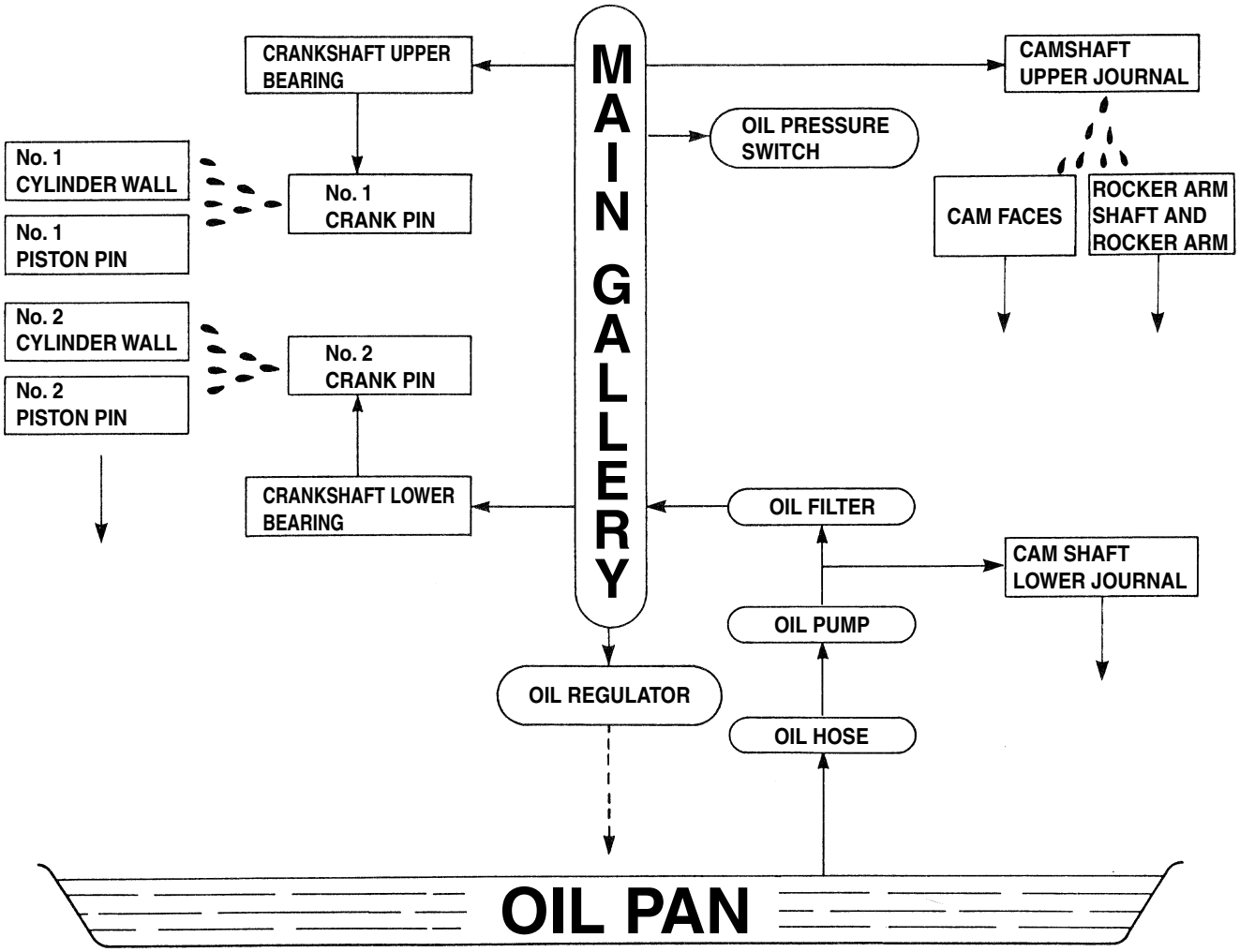
COOLING SYSTEM SCHEMATIC



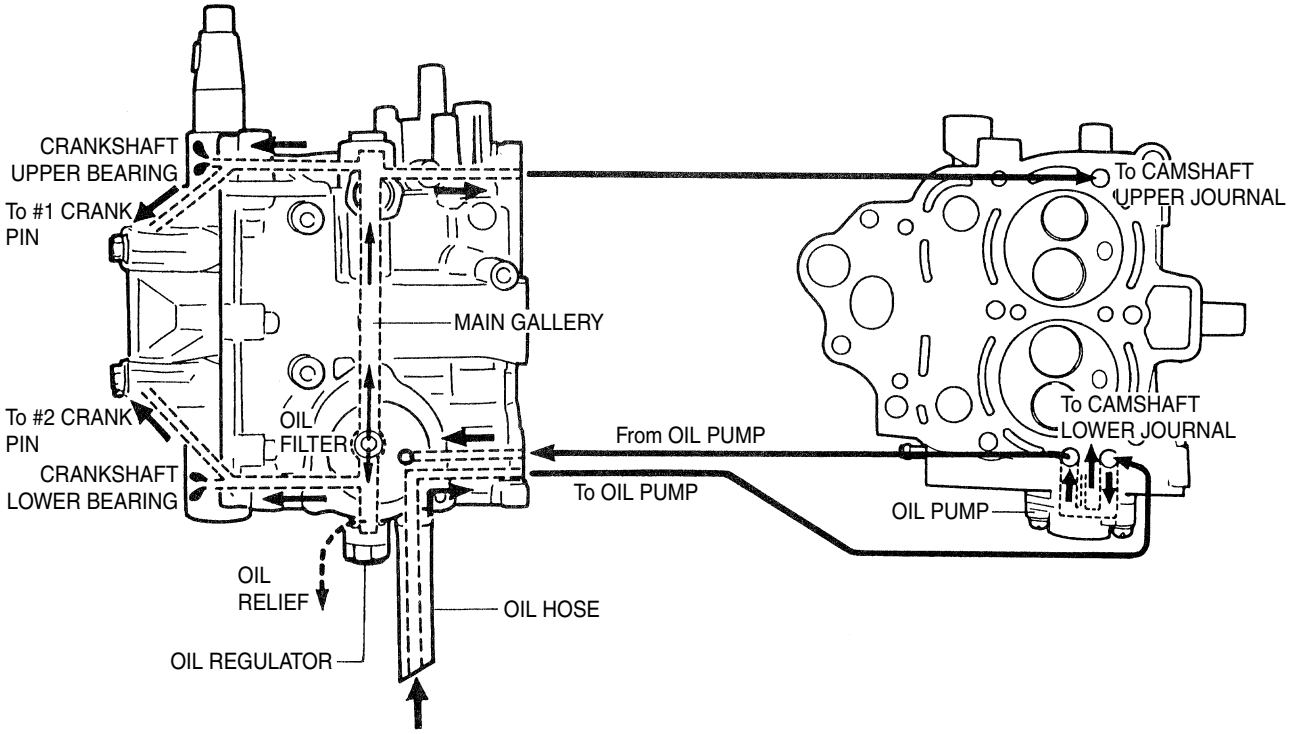
ENGINE LUBRICATION SYSTEM

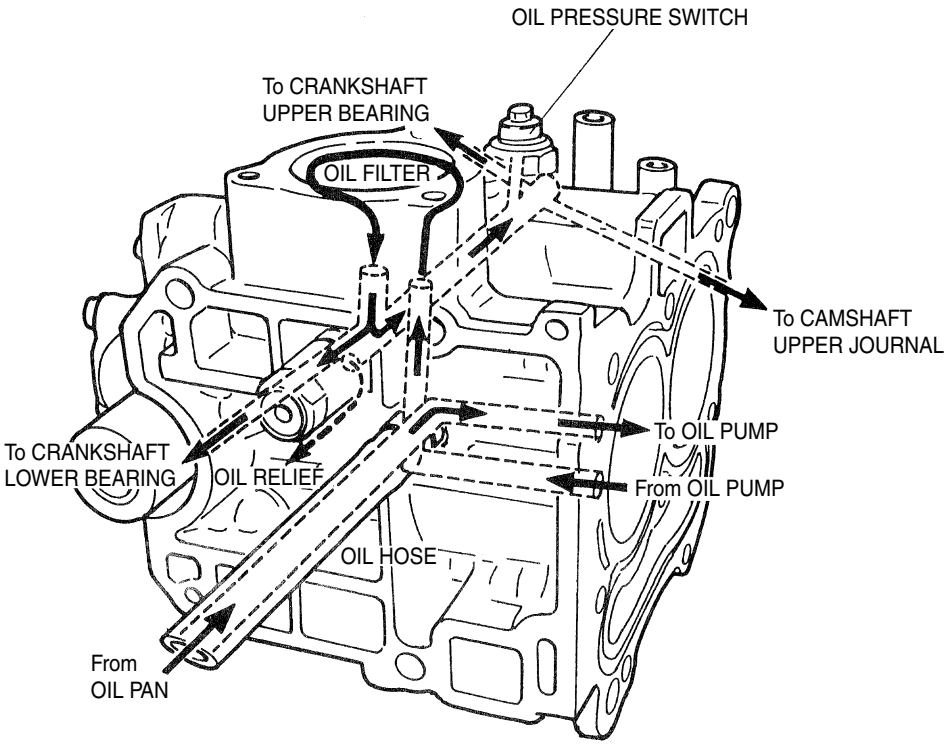
Engine oil stored in the oil pan is pumped up by the trochoid type pump.

ENGINE OIL LUBRICATION CHART



OIL PASSAGE LOCATION





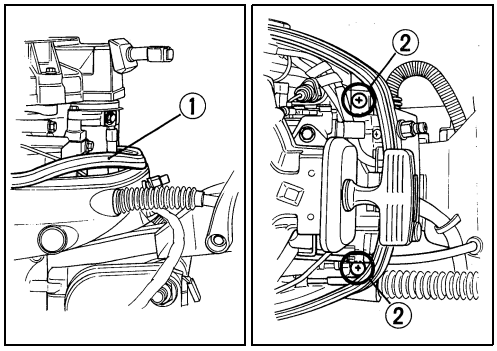
MID UNIT

CONTENTS

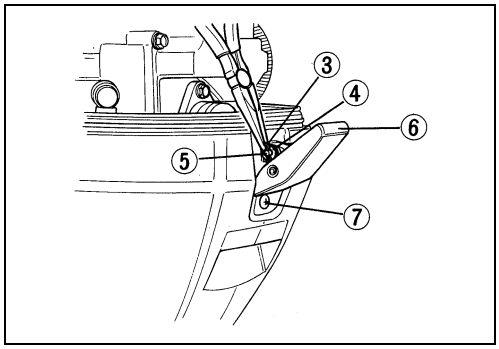
ENGINE SIDE COVER

REMOVAL

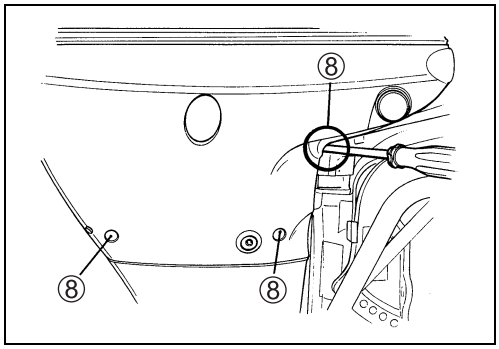
1. Remove the side cover rubber ①.
2. Remove the two screws ②.

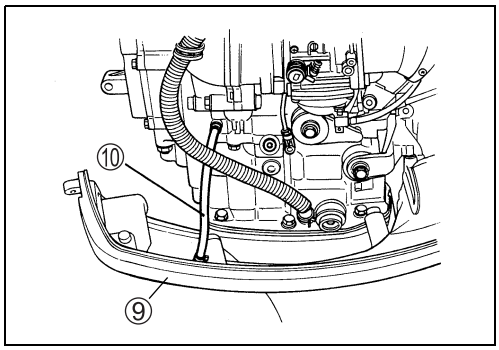


3. Remove the snap pin ③, washer ④, pin ⑤ and fastener ⑥.
4. Remove the screw ⑦.

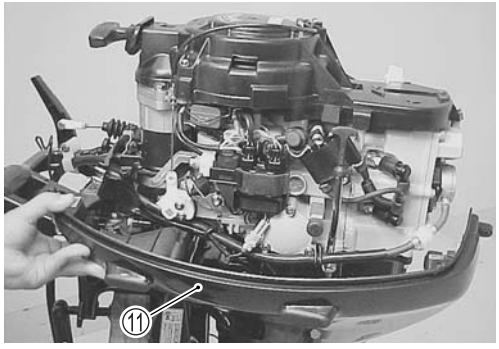


5. Remove three screws ⑧ and STBD side cover ⑨.
   Disconnect water hose ⑩.



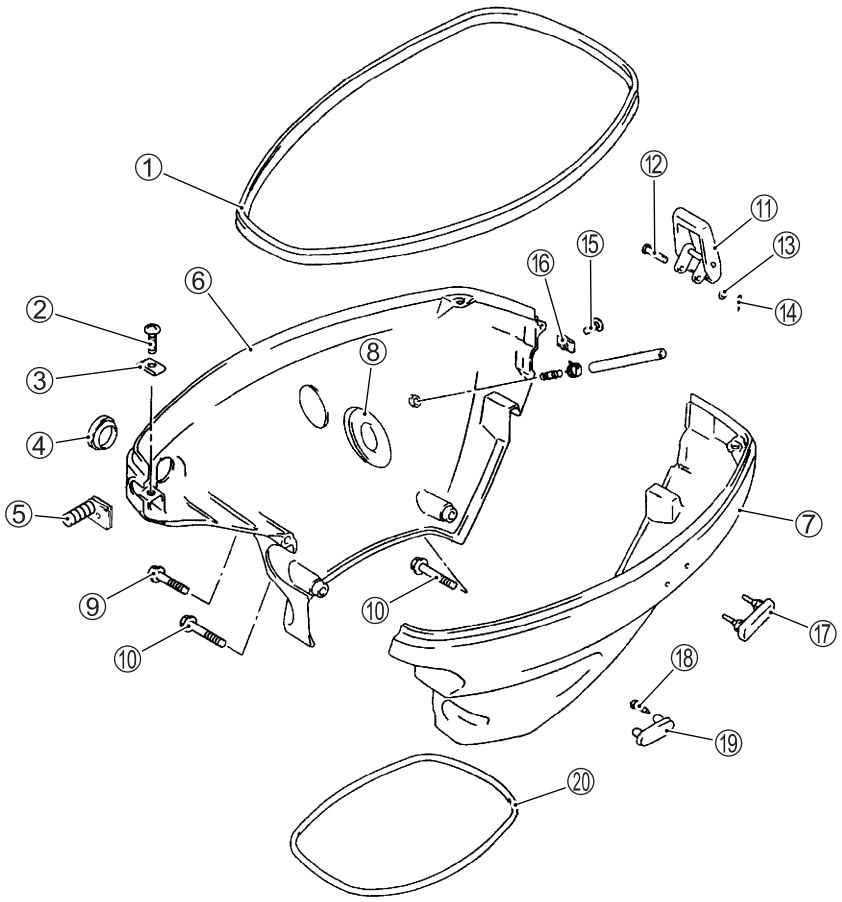


6. Remove PORT side cover ⑪.



INSTALLATION

Installation is reverse order of removal.

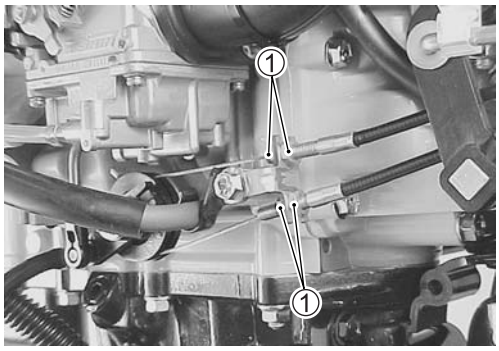


① Side cover rubber (1)
② Screw (2)
③ Nut (2)
④ Plug (1)
⑤ Cable grommet (1)
⑥ Side cover (Starboard) (1)
⑦ Side cover (Port) (1)
⑧ Side cover plug (1)
⑨ Bolt (1)
⑩ Bolt (2)
⑪ Fastener (1)
⑫ Pin (1)
⑬ Washer (1)
⑭ Snap pin (1)
⑮ Screw (1)
⑯ Nut (1)
⑰ Protector (2)
⑱ Screw (4)
⑲ Protector (2)
⑳ Side cover seal (1)

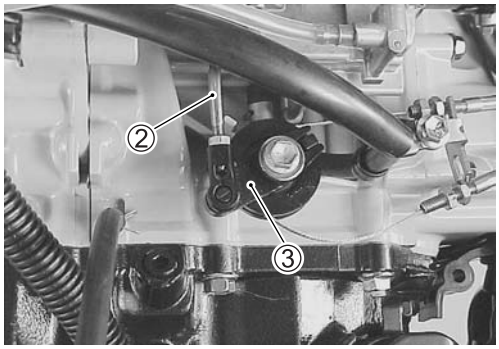
TILLER HANDLE

REMOVAL

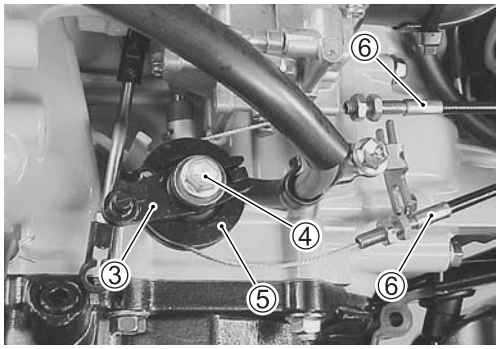
1. Remove the STBD side cover.
2. Loosen lock nuts ①.



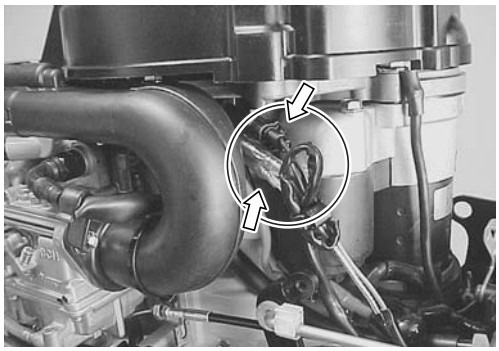
3. Remove the throttle rod ② from throttle lever ③.



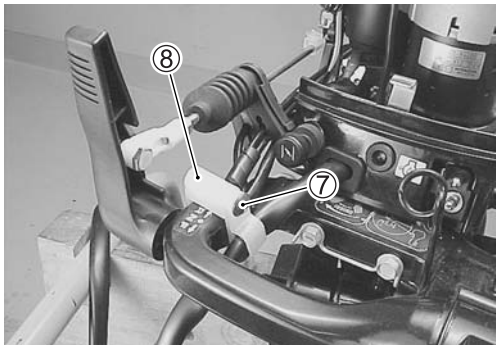
4. Remove the bolt ④, throttle lever ③ and throttle drum ⑤.
5. Remove the throttle cables ⑥ from throttle drum.



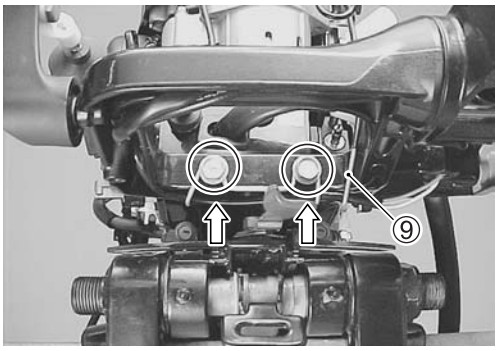
6. Disconnect emergency stop switch lead wire.
   Disconnect starter switch lead wire.



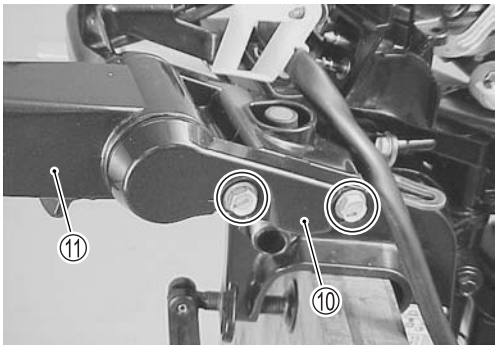
7. Remove screw ⑦ and cable clamp ⑧.



8. Remove the two (2) bolts securing fuel hose clamp ⑨.



9. Remove two (2) bolts and handle cover ⑩.
   Remove tiller handle and throttle cable assembly ⑪.



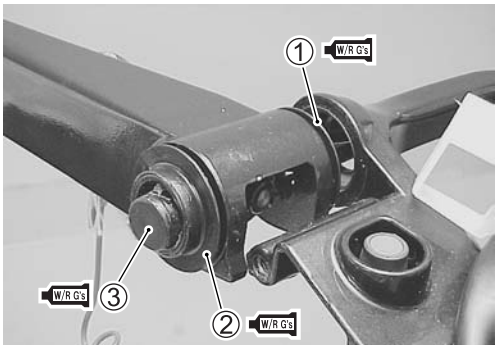
INSTALLATION

Installation is reverse order of removal with special attention to the following.

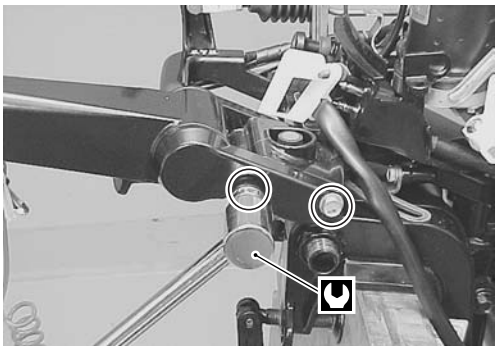
- **Tiller handle**
  - Place bush ①, bush ② and friction rubber ③ on tiller handle.
  - Install tiller handle and handle cover.
  - Tighten handle cover bolts to the specified torque.

W/R G's 99000-25161: WATER RESISTANT GREASE

Tiller handle cover bolt: 17 N·m (1.7 kg-m, 12.5 lb-ft)

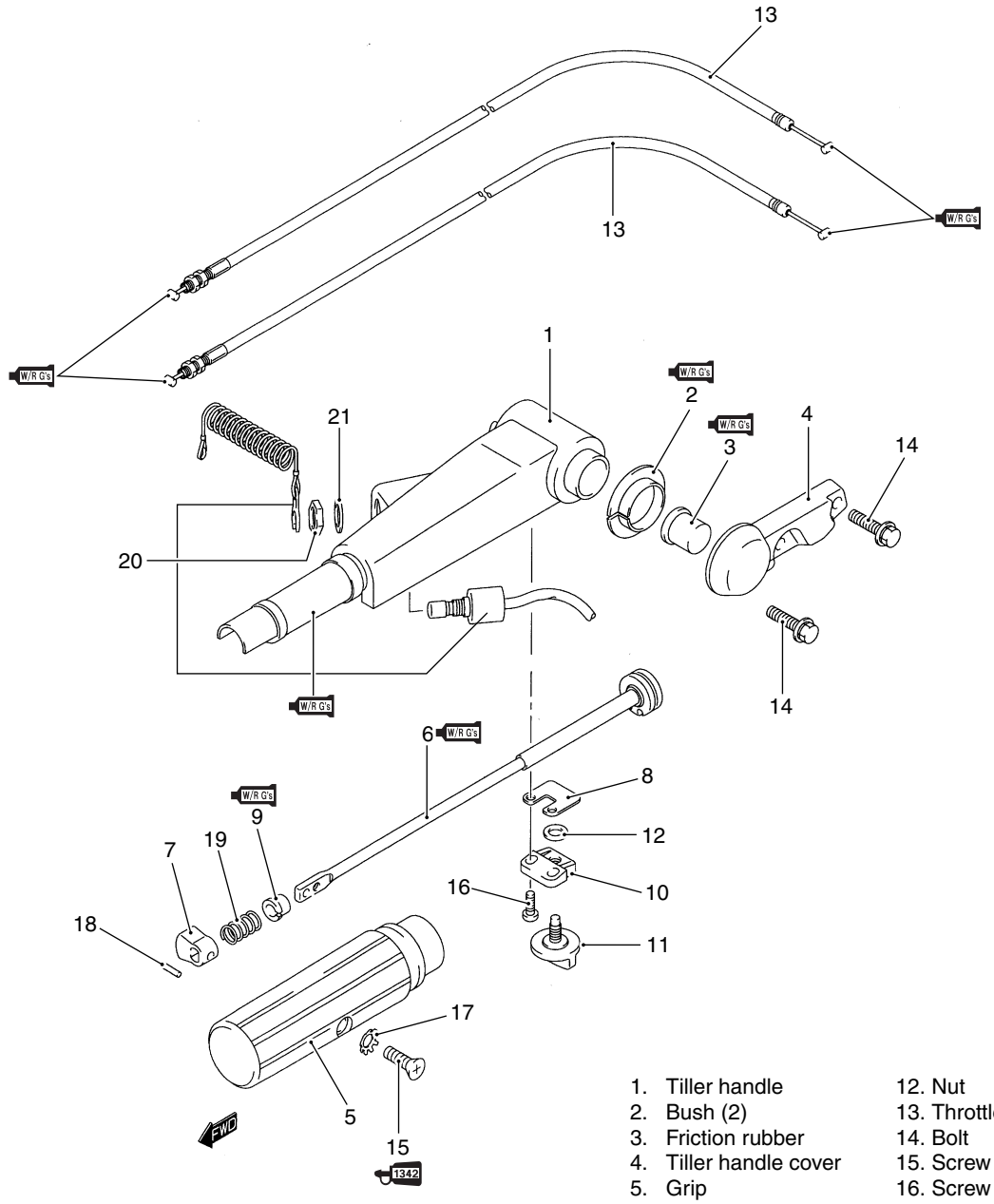


- Installation of throttle cables. (See page 4-13.)
- Check wire and cable routing. (See page 9-8 to 9-10.)



DISASSEMBLY/ASSEMBLY

When disassembling or reassembling tiller handle, refer to the construction diagram below.

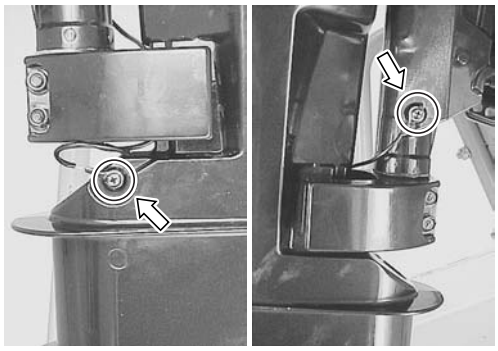


1. Tiller handle
2. Bush (2)
3. Friction rubber
4. Tiller handle cover
5. Grip
6. Handle rod
7. Stopper
8. Plate
9. Bush
10. Support
11. Knob
12. Nut
13. Throttle cable
14. Bolt
15. Screw
16. Screw
17. Washer
18. Pin
19. Spring
20. Emergency stop switch
21. Washer

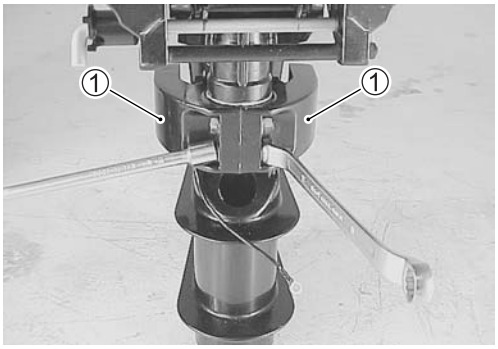
DRIVESHAFT HOUSING AND OIL PAN

REMOVAL

1. Remove power unit. (See page 6-2 to 6-6.)
2. Remove lower unit. (See page 8-2.)
3. Remove screw and bonding wire from driveshaft housing.
4. Remove screw and bonding wire from swivel bracket.



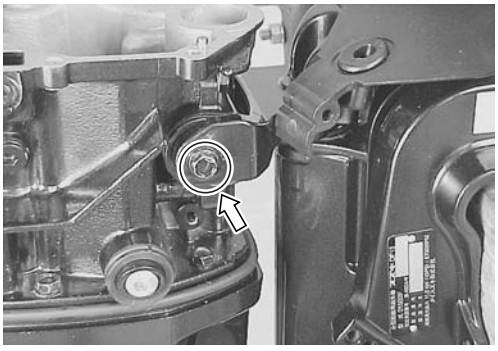
5. Remove the two lower mount cover bolts and remove STBD/PORT lower mount cover ①.

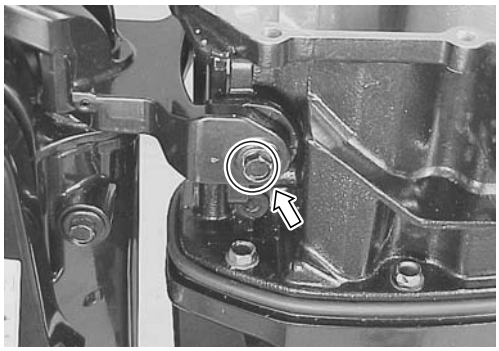


6. Remove two bolts and driveshaft housing (with oil pan).

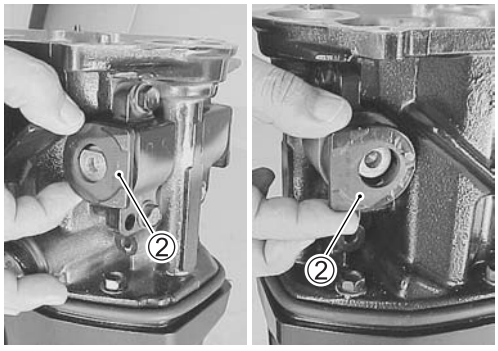
⚠ WARNING

During the removing the upper mount bolts, the driveshaft housing must be firmly secured.

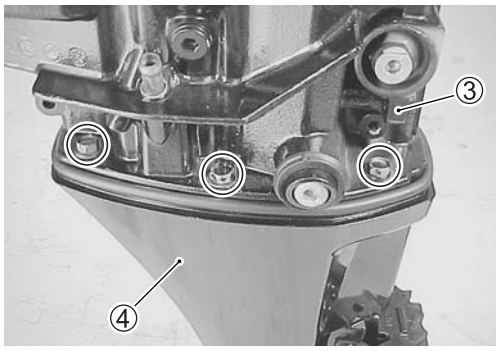




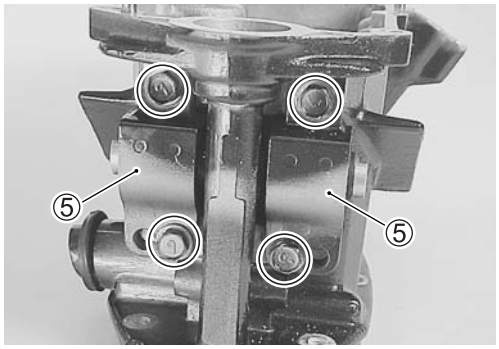
7. Remove the upper mount stoppers ②.



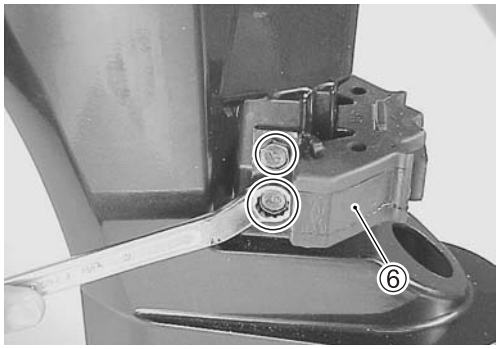
8. Remove six bolts and oil pan ③ from the driveshaft housing ④.



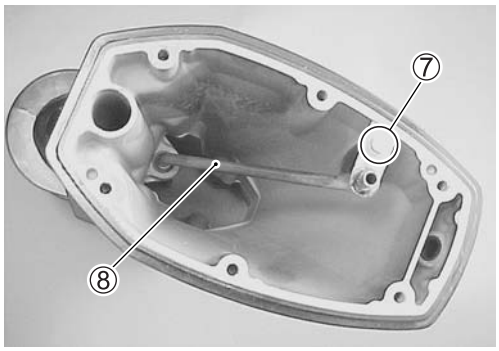
9. Remove four bolts and upper mounts ⑤.



10. Remove four bolts and lower mount ⑥.



11. Remove bolt ⑦ and water tube ⑧.

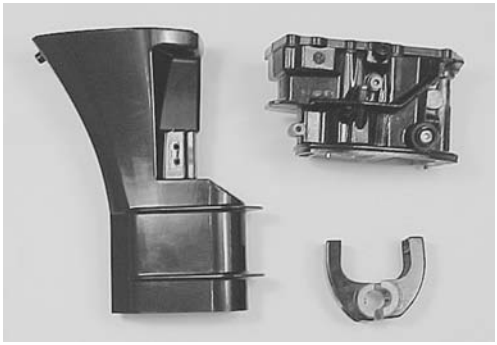


INSPECTION

NOTE:
If excessive wear, cracks, defective or other damage is found on any component, replace component.

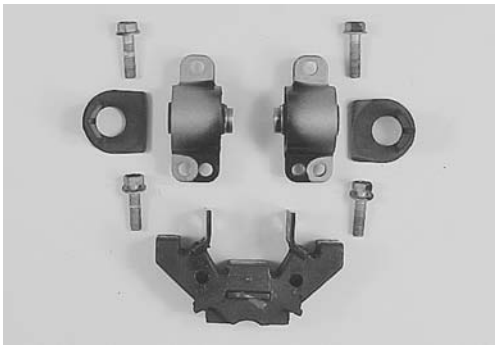
OIL PAN AND DRIVESHAFT HOUSING

Inspect the oil pan and driveshaft housing.
If crack, defective or other damage is found, replace.



MOUNT

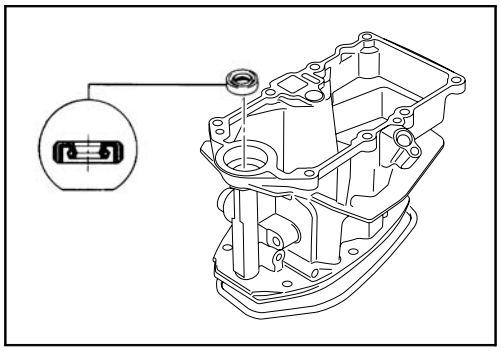
Inspect the upper mount and lower mount.
If excessively wear, corrosion or other damage is found, replace.



OIL SEAL

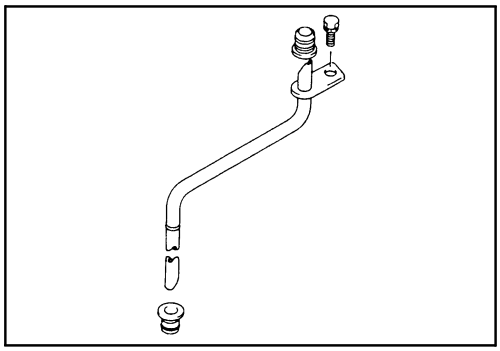
Inspect the oil seal.
If crack, cut or other damage is found, replace.

NOTE:
Install oil seal with lip (spring side) facing downward (driveshaft housing side).



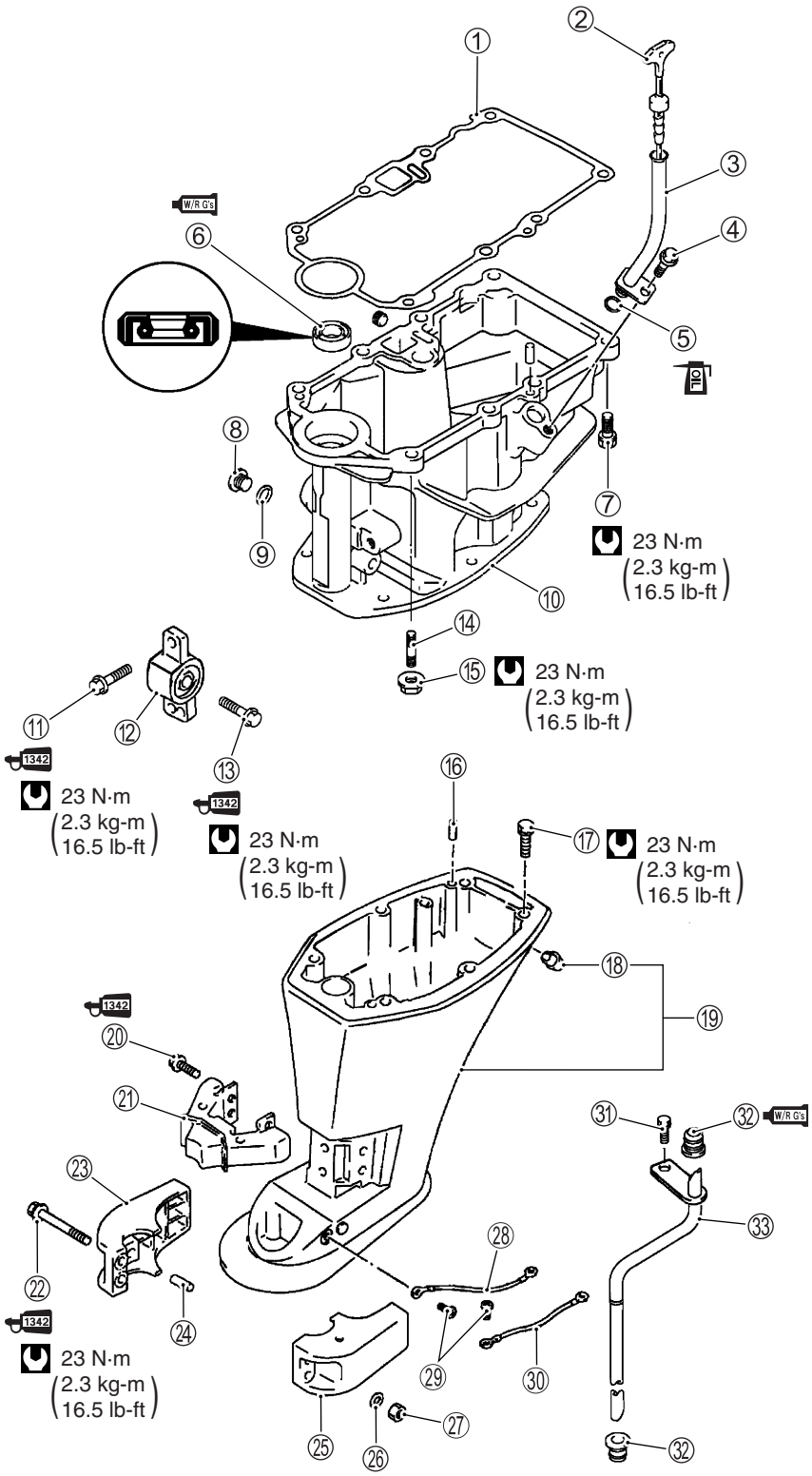
WATER TUBE

Inspect the water tube.
If clog is found, clean.
If crack, corrosion or other damage is found, replace.



REASSEMBLY

Reassembly is reverse order of removal with the special attention to the following steps.



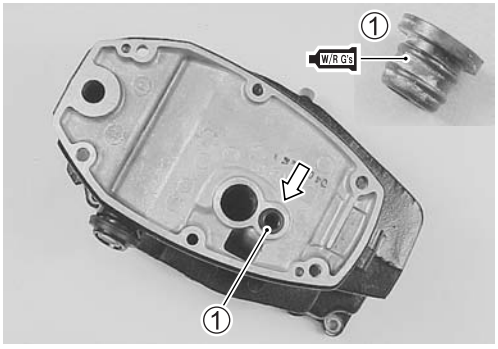
① Gasket (1)
② Oil level gauge (1)
③ Oil level gauge guide (1)
④ Bolt (1)
⑤ O-ring (1)
⑥ Oil seal (1)
⑦ Bolt (6)
⑧ Plug (2)
⑨ Gasket (2)
⑩ Oil pan assembly (1)
⑪ Bolt (4)
⑫ Upper mount (2)
⑬ Bolt (2)
⑭ Stud bolt (2)
⑮ Nut (2)
⑯ Dowel pin (2)
⑰ Bolt (6)
⑱ Pipe (1)
⑲ Driveshaft housing (1)
⑳ Bolt (4)
㉑ Lower mount (1)
㉒ Bolt (2)
㉓ Lower mount cover (STBD) (1)
㉔ Pin (2)
㉕ Lower mount cover (Port) (1)
㉖ Washer (2)
㉗ Nut (2)
㉘ Bonding wire (1)
㉙ Screw (2)
㉚ Bonding wire (1)
㉛ Bolt (1)
㉜ Grommet (2)
㉝ Water tube (1)

WATER TUBE UPPER GROMMET

- Apply grease to outer surface of the water tube upper grommet ①.

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

- Install water tube grommet ① to oil pan.



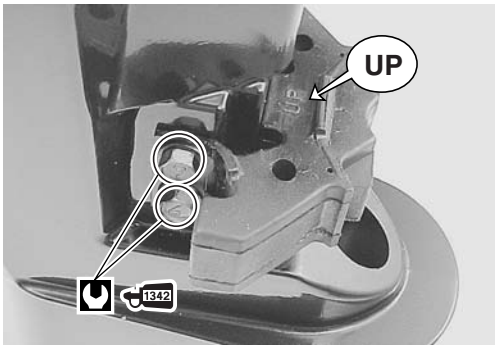
LOWER MOUNT

1. Install the lower mount with the lettered mark “UP” facing upward.
2. Apply THREAD LOCK to the lower mount bolts.

1342 **99000-32050: THREAD LOCK “1342”**

3. Tighten the lower mount bolts to the specified torque.

Lower mount bolt: 23 N·m (2.3 kg-m, 16.5 lb-ft)



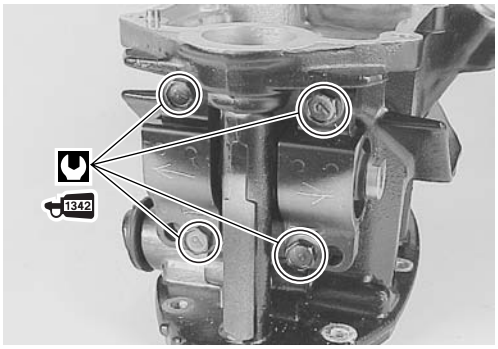
UPPER MOUNT

1. Apply THREAD LOCK to the upper mount bracket bolts.

1342 **99000-32050: THREAD LOCK “1342”**

2. Tighten the upper mount bracket bolts to the specified torque.

Upper mount bracket bolt: 23 N·m (2.3 kg-m, 16.5 lb-ft)

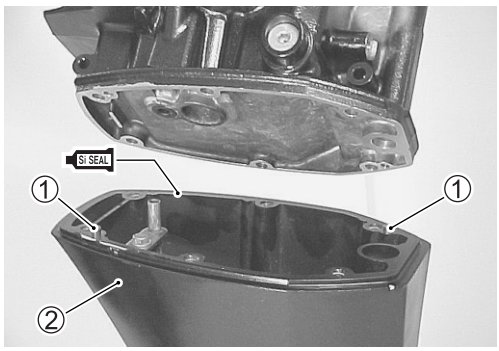


OIL PAN TO DRIVESHAFT HOUSING

1. Install two dowel pins ① to the driveshaft housing ②.
2. Apply sealant to mating surfaces of driveshaft housing and oil pan.

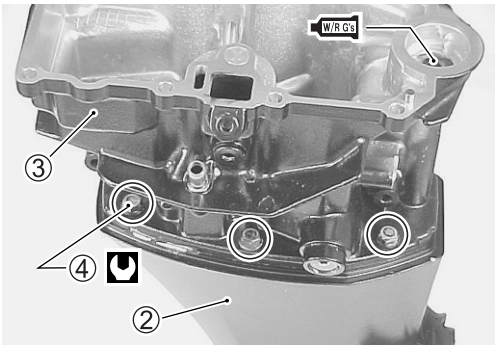
Si SEAL **99000-31120: SUZUKI SILICONE SEAL**

3. Install the oil pan ③ to driveshaft housing ②.



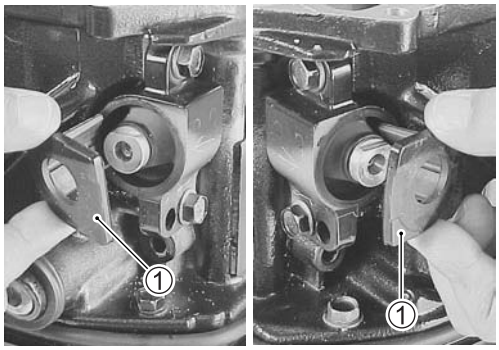
4. Tighten the driveshaft housing bolts ④ to the specified torque.

Driveshaft housing bolt: 23 N·m (2.3 kg-m, 16.5 lb-ft)



DRIVESHAFT HOUSING/OIL PAN

1. Install the upper mount stoppers ① to each upper mounts.

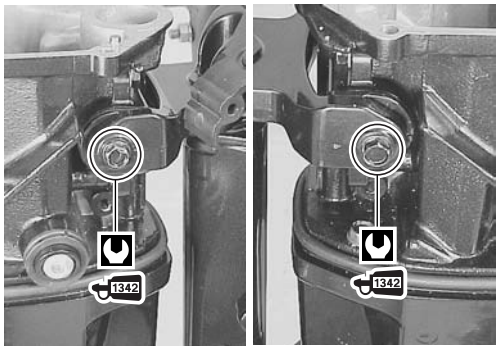


2. Install driveshaft housing/oil pan to steering bracket.
3. Apply THREAD LOCK to upper mount bolts.

1342 99000-32050: THREAD LOCK "1342"

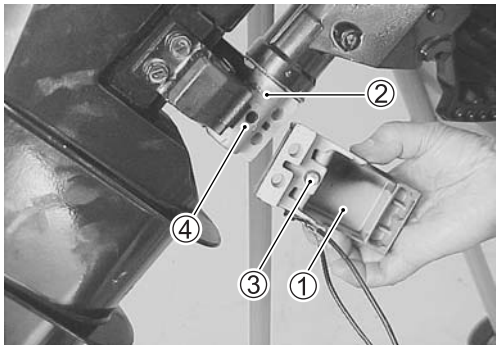
4. Tighten upper mount bolts to the specified torque.

Upper mount bolt: 23 N·m (2.3 kg-m, 16.5 lb-ft)



LOWER MOUNT COVER

1. When attaching the lower mount cover ① to steering shaft ②, ensure that the pin ③ properly fits into the hole ④ of steering shaft.

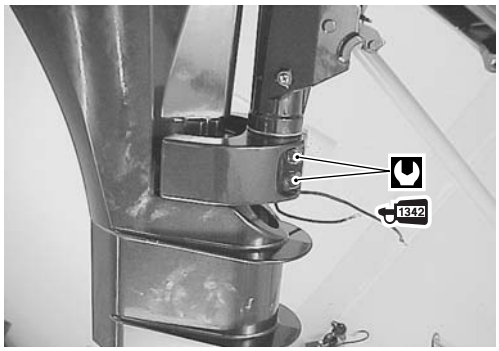


2. Apply THREAD LOCK to lower mount cover bolts.

1342 99000-32050: THREAD LOCK "1342"

3. Tighten lower mount cover bolts to the specified torque.

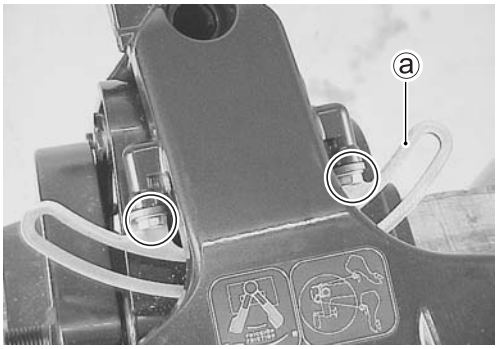
Lower mount cover bolt: 23 N·m (2.3 kg-m, 16.5 lb-ft)



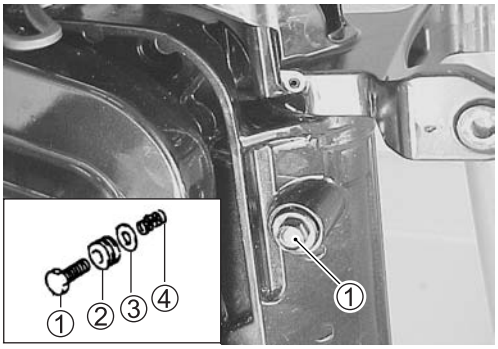
SWIVEL BRACKET, STEERING BRACKET, CLAMP BRACKET
REMOVAL/DISASSEMBLY

1. Remove driveshaft housing/oil pan. (See page 7-7.)

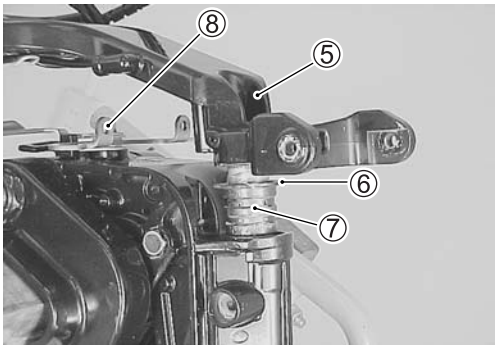
2. Remove the two (2) bolts securing steering friction adjuster plate ⓐ to the steering bracket. (Tiller handle model)



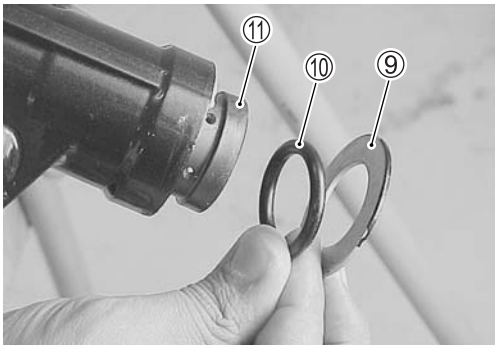
3. Remove steering adjuster bolt ①, cover ②, washer ③ and spring ④.



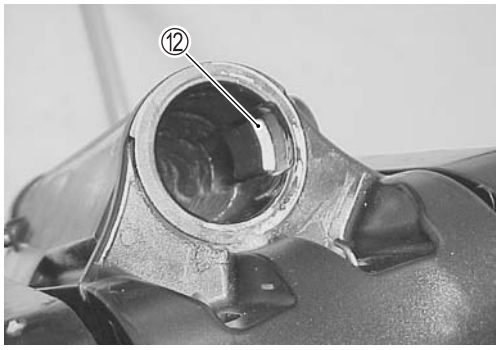
4. Lift steering bracket ⑤ upward to remove from swivel bracket.
   Remove washer ⑥, upper bush ⑦ from swivel bracket.
5. Remove steering friction adjuster set ⑧. (Tiller handle model)



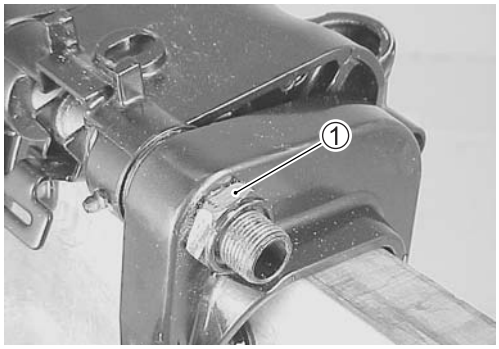
6. Remove the washer ⑨, O-ring ⑩ and lower bush ⑪.



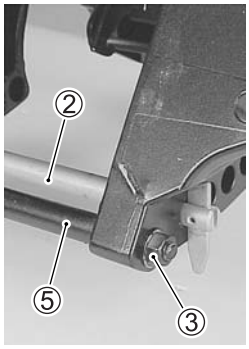
7. Remove steering adjuster plate ⑫.

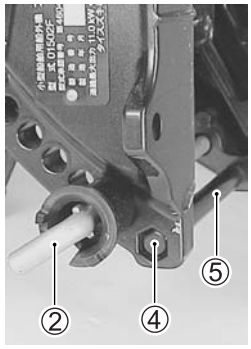


8. Remove nut ① from clamp bracket shaft.

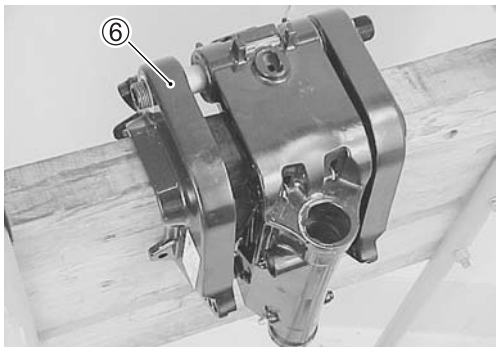


9. Remove tilt lock pin ②.
   Remove the nut ③, bolt ④ and spacer ⑤.

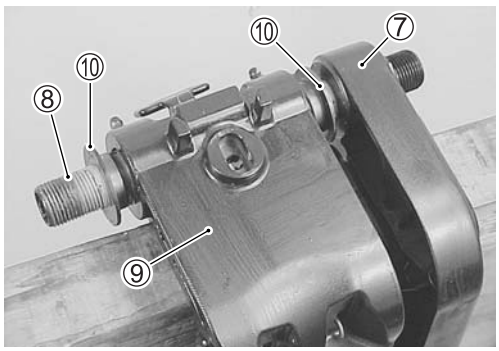




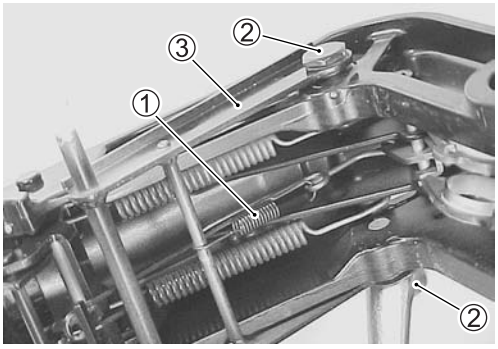
10. Slide PORT clamp bracket ⑥ off clamp bracket shaft.



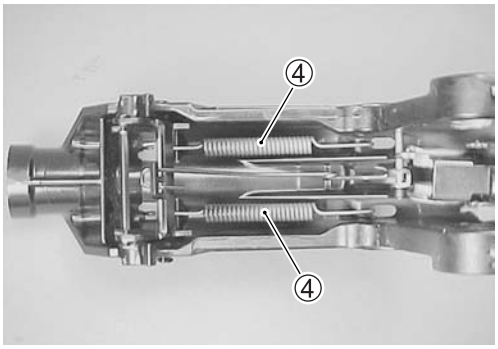
11. Pull STBD clamp bracket ⑦ outward to remove clamp bracket and bracket shaft ⑧ from swivel bracket ⑨.
    Remove bushings ⑩ from each side of swivel bracket.



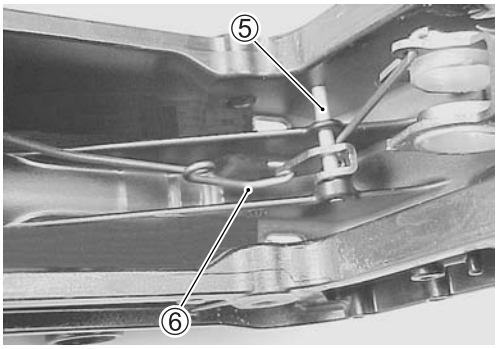
12. Remove the spring ①.
    Remove two (2) bolts ② and shallow drive arm ③.



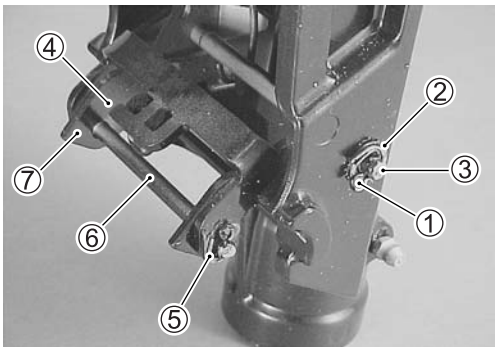
13. Remove two springs ④ from reverse lock arm and swivel bracket.



14. Remove the release arm pin ⑤ and release link ⑥.



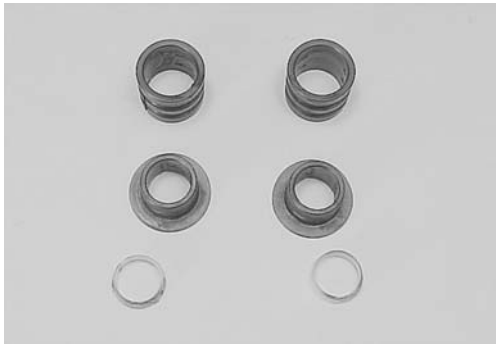
15. Remove the cotter pin ①, washer ②, pin ③ and reverse lock arm link ④.
    Remove the cotter pin ⑤, pin ⑥ and reverse lock arm ⑦.



INSPECTION

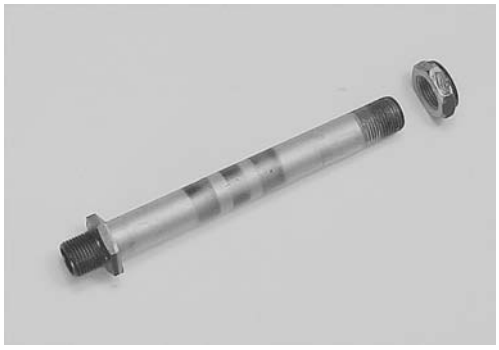
NOTE:
If excessive wear, cracks, defective or damage is found on any component, replace component.

BUSHINGS
Inspect all bushings for excessive wear or other damage.
Replace if necessary.
If bushing fit is loose when installing, replace the bushing.

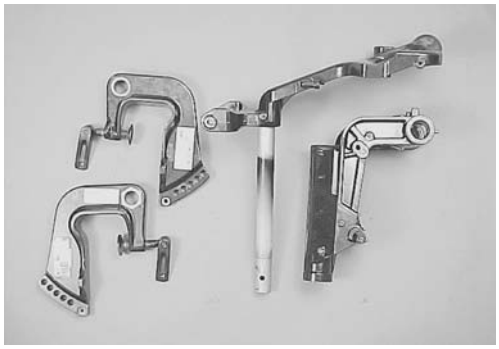


O-RING
Inspect swivel bracket O-ring for cuts, nicks, excessive wear or other damage.

CLAMP BRACKET SHAFT
Inspect the clamp bracket shaft for bend, twist or other damage.
Replace if necessary.

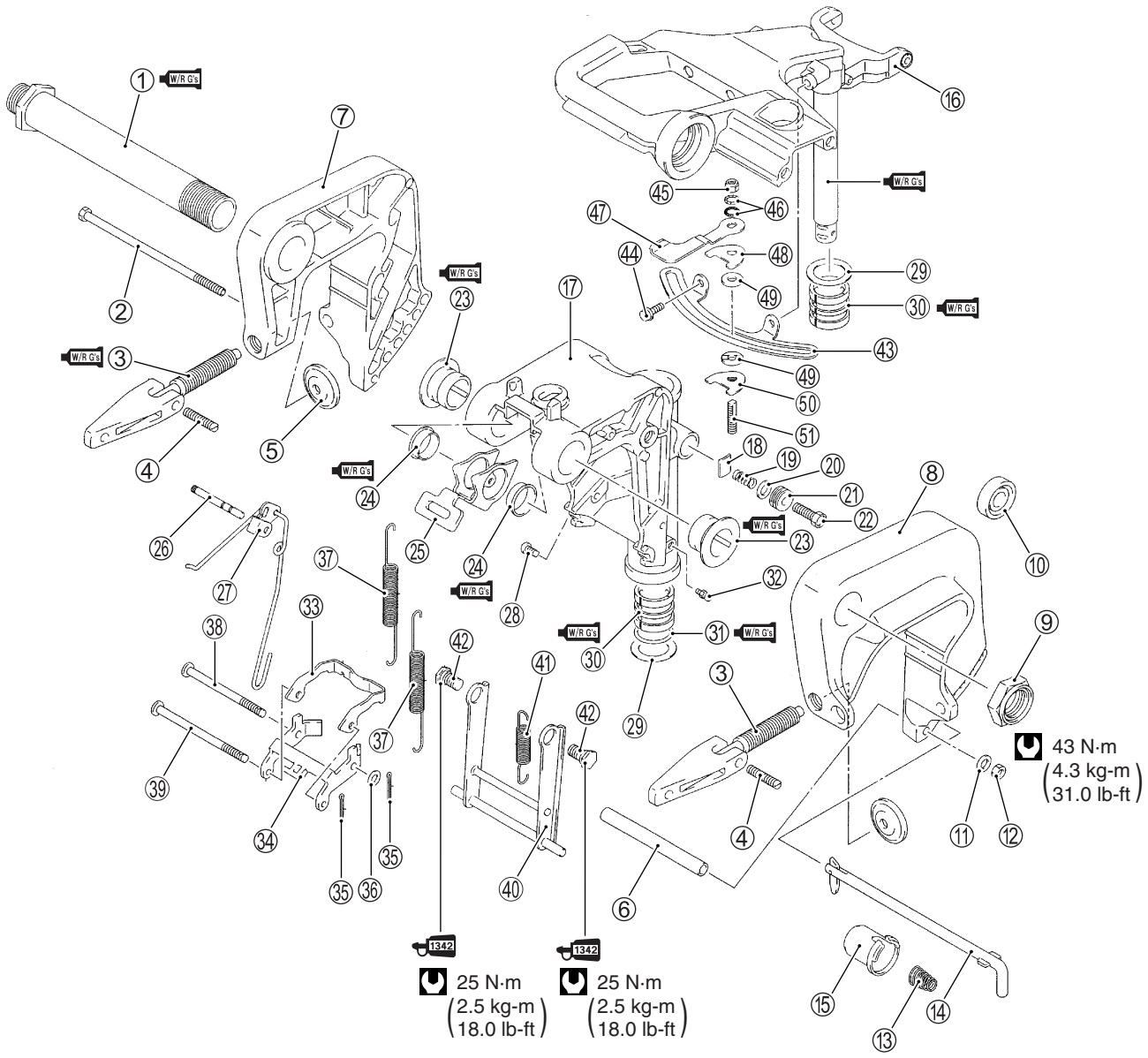


BRACKET
Inspect the clamp brackets, steering bracket and swivel bracket for excessive wear, cracks or other damage.
Replace if necessary.



REASSEMBLY

Reassembly is reverse order of removal with the special attention to the following steps.



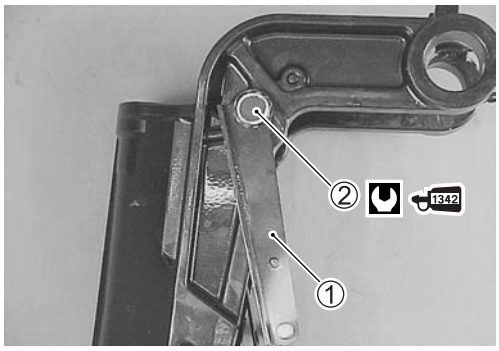
① Clamp bracket shaft (1)
② Bolt (1)
③ Clamp screw (2)
④ Pin (2)
⑤ Clamp plate (2)
⑥ Spacer (1)
⑦ Clamp bracket (STBD) (1)
⑧ Clamp bracket (Port) (1)
⑨ Nut (1)
⑩ Seal (1)
⑪ Washer (1)
⑫ Nut (1)
⑬ Spring (1)
⑭ Tilt lock pin (1)
⑮ Stopper
⑯ Steering bracket (1)
⑰ Swivel bracket (1)
⑱ Steering adjuster (1)
⑲ Spring (1)
⑳ Washer
㉑ Cover (1)
㉒ Bolt (1)
㉓ Bushing
㉔ Bushing
㉕ Release lever (1)
㉖ Release arm pin (1)
㉗ Release link (1)
㉘ Screw (1)
㉙ Washer (2)
㉚ Bushing (2)
㉛ O-ring (1)
㉜ Nipple (3)
㉝ Reverse lock arm (1)
㉞ Reverse lock arm link (1)
㉟ Cotter pin (2)
㊱ Washer (1)
㊲ Spring (2)
㊳ Pin (1)
㊴ Pin (1)
㊵ Shallow drive (1)
㊶ Spring (1)
㊷ Bolt (2)
㊸ Steering adjuster plate (1)
㊹ Bolt (2)
㊺ Nut (1)
㊻ Washer (2)
㊼ Steering adjuster (1)
㊽ Friction plate (1)
㊾ Washer (1)
㊿ Nut (1)
(51) Steering adjuster shaft (1)

SHALLOW DRIVE ARM

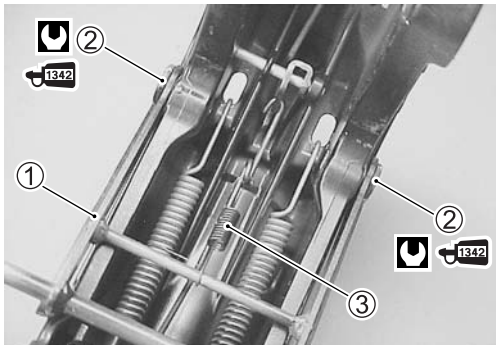
- Install shallow drive arm ①.
- Tighten shallow drive arm bolts ②, pre-coated with thread lock, to specified torque.

1342 99000-32050 : THREAD LOCK "1342"

Shallow drive arm bolt : 25 N·m (2.5 kg-m, 18.0 lb-ft)



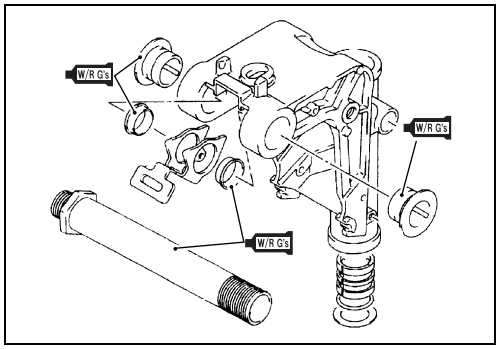
- Install arm spring ③ as shown.



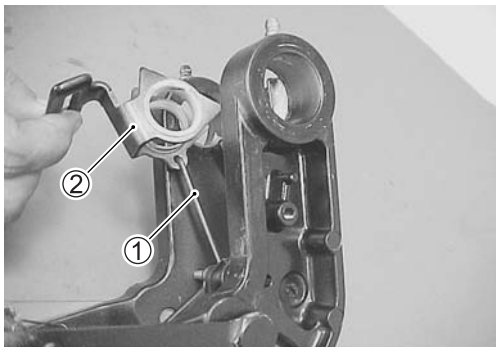
CLAMP BRACKET AND SWIVEL BRACKET

NOTE:
Before installing clamp bracket to swivel bracket, apply grease to clamp bracket shaft and bushings.

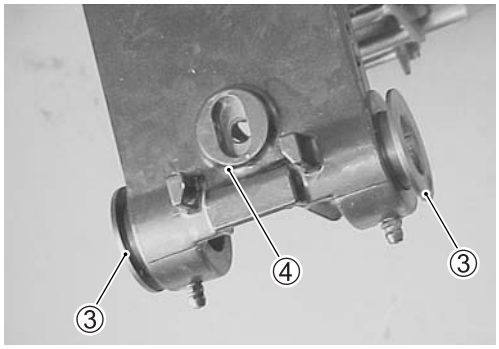
W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE



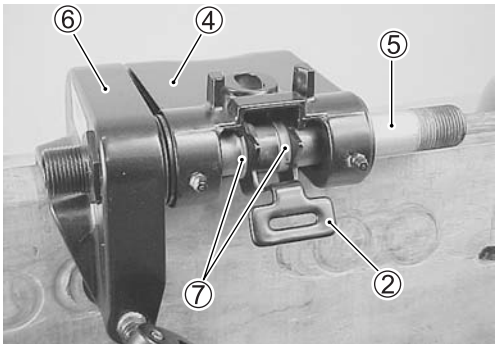
1. Connect the release link ① to release lever ②.



2. Insert PORT and STBD bushings ③ into the swivel bracket ④.

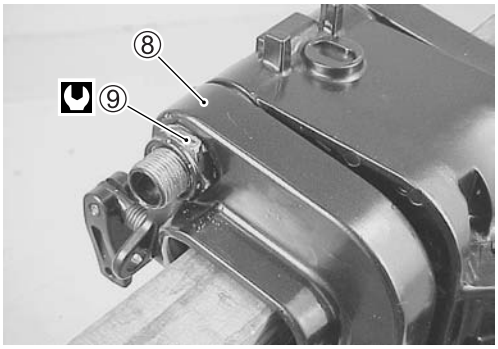


3. Assemble the clamp bracket shaft ⑤, STBD clamp bracket ⑥, release lever ②, bushings ⑦ and swivel bracket ④.



4. Install PORT clamp bracket ⑧ and clamp bracket shaft nut ⑨.
   Tighten clamp bracket shaft nut ⑨ to specified torque.

Clamp bracket shaft nut : 43 N·m (4.3 kg-m, 31.0 lb-ft)

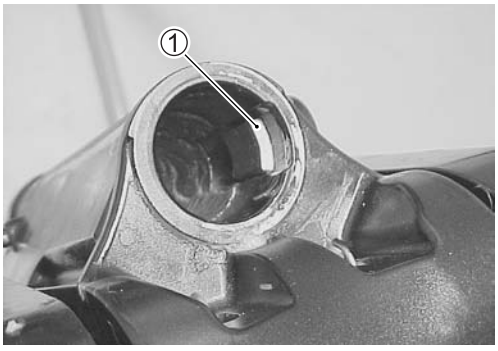


STEERING BRACKET

1. Install the steering adjuster plate ① to swivel bracket.

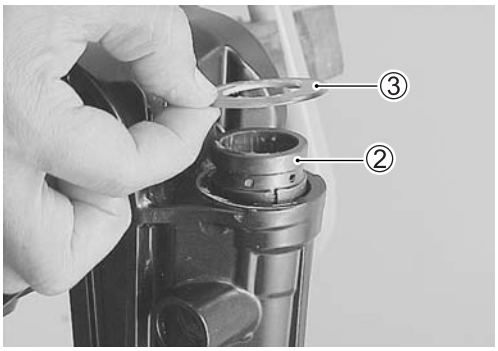
W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE

NOTE:
Apply grease to bushings, O-ring and pilot shaft portion of steering bracket.

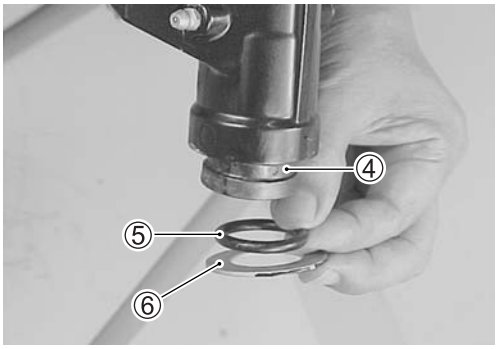


2. Install upper bushing ②, washer ③ to swivel bracket.

NOTE:
- *The bushing ② · ④ outside face is tapered.*
  Install the bushing into the swivel bracket with the smaller diameter side being inserted first.
- *Be certain that steering adjuster ① is placed between upper bushing ② and swivel bracket casing.*



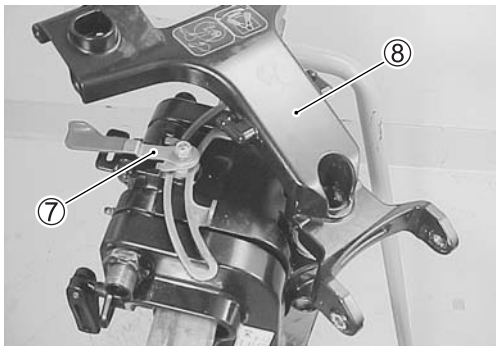
3. Install lower bushing ④, O-ring ⑤ and washer ⑥ to swivel bracket.



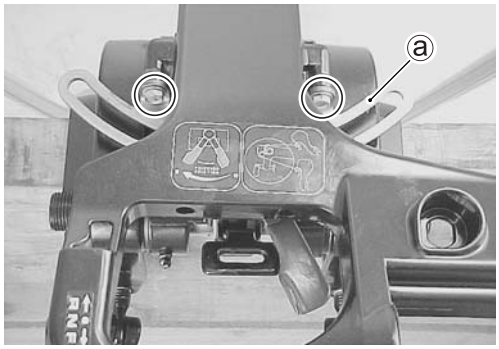
4. Install steering friction adjuster set ⑦. (Tiller handle model)
5. Apply Water Resistant Grease to steering bracket shaft.

W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE

6. Install steering bracket ⑧ to swivel bracket.

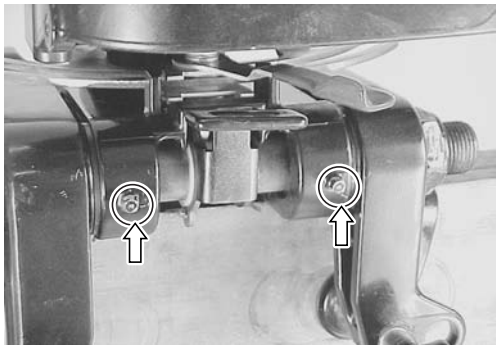


7. Install steering friction adjuster plate ⓐ to steering bracket, then securely tighten it with bolts.
   (Tiller handle model)



LUBRICATION

After completing reassembly of the mid unit, apply grease through each grease nipple.



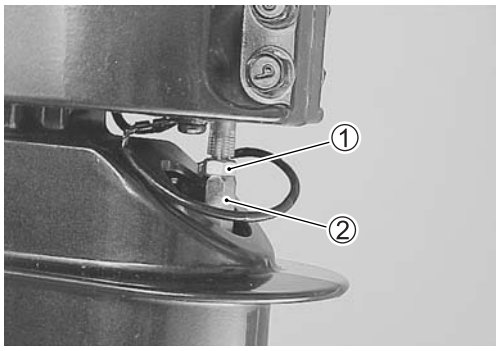
LOWER UNIT

CONTENTS

REMOVAL & DISASSEMBLY

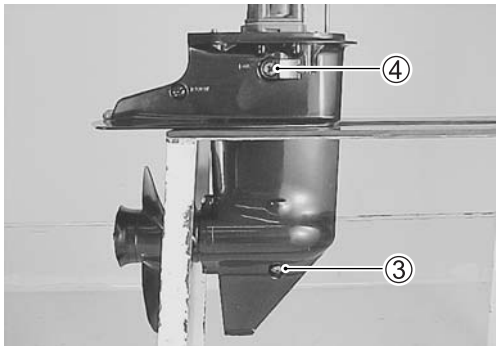
⚠ WARNING

Before removing lower unit:
- **Disconnect spark plug caps from all spark plugs.**
- **Disconnect the battery cable.**

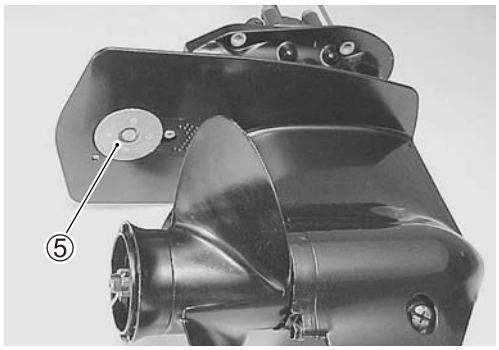


1. Loosen the clutch rod lock nut ①.
   To separate the clutch rod from the shift rod, unscrew the turnbuckle ②.
2. Remove four bolts and separate gearcase from driveshaft housing.

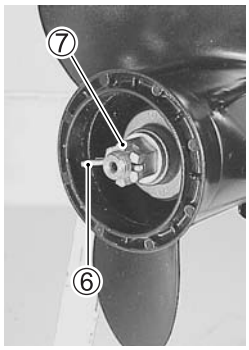
3. Place a drain pan under oil drain plug.
   Remove oil drain plug ③ first then oil level plug ④ and allow gear oil to drain.

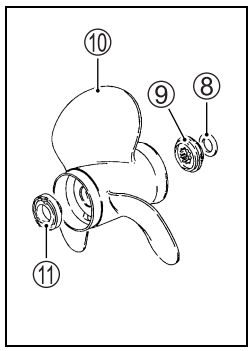


4. Remove bolt and zinc ⑤ (if necessary).



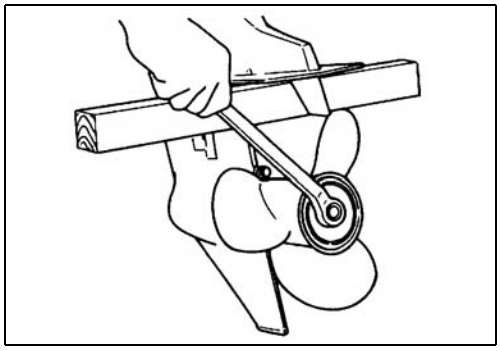
5. Remove cotter pin ⑥ from the propeller shaft and remove propeller nut ⑦.
6. Remove washer ⑧, spacer ⑨, propeller ⑩ and stopper ⑪ from propeller shaft.



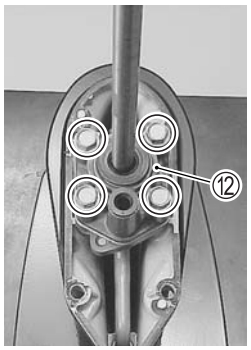


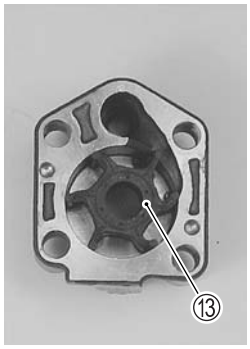
⚠ WARNING

To prevent injury from propeller blades, wear gloves and place a block of wood between the anti-cavitation plate and the propeller blade tips to lock the propeller in place.

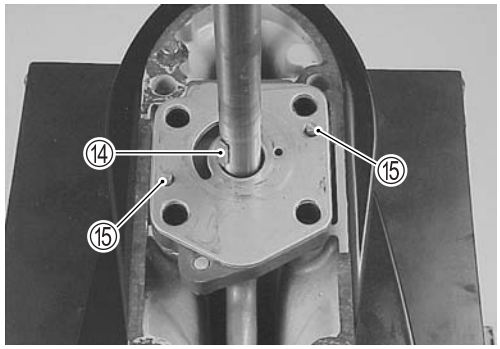


7. Remove the four bolts, then remove the water pump case ⑫ and impeller ⑬.

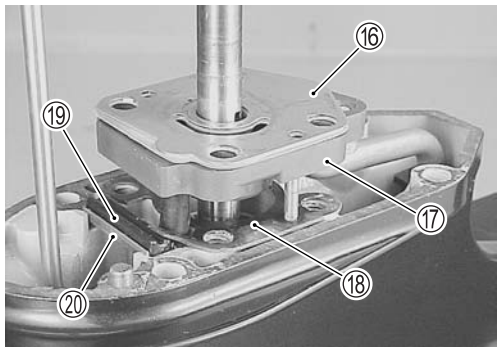




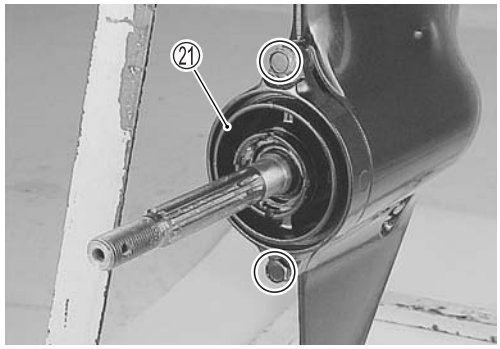
8. Remove the impeller key ⑭ and dowel pins ⑮.



9. Remove the under panel ⑯, under panel gasket, water inlet housing ⑰, gasket ⑱, exhaust seal rubber ⑲ and exhaust seal core ⑳.

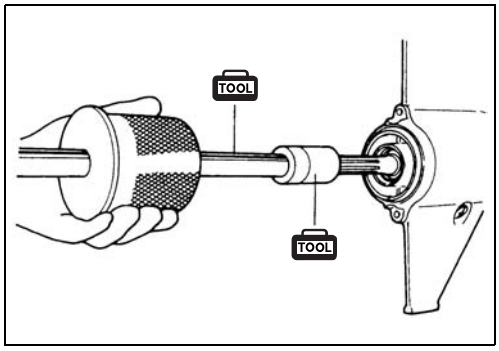


10. Remove the two bolts securing the propeller shaft bearing housing ㉑ to the gearcase.

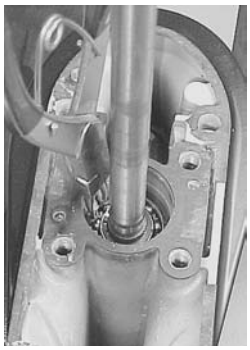


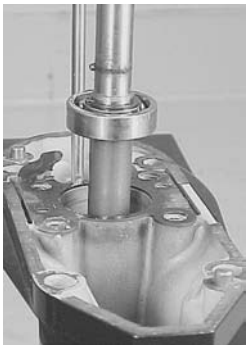
11. Using special tools, pull out the propeller shaft bearing housing.
    Remove the propeller shaft and bearing housing assembly.

TOOL **09930-30104: Sliding hammer**
09950-59320: Propeller shaft remover

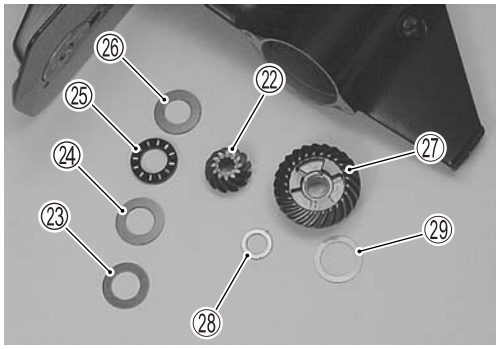


12. Remove the circlip from gearcase.
    Lift out the driveshaft assembly.

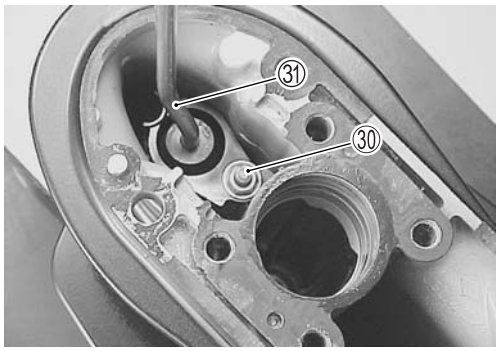




13. Remove the pinion gear ㉒, pinion gear back up shim ㉓, thrust washer ㉔, thrust bearing ㉕ and thrust washer ㉖.
14. Remove the forward gear ㉗, thrust washer ㉘ and forward gear back-up shim ㉙.

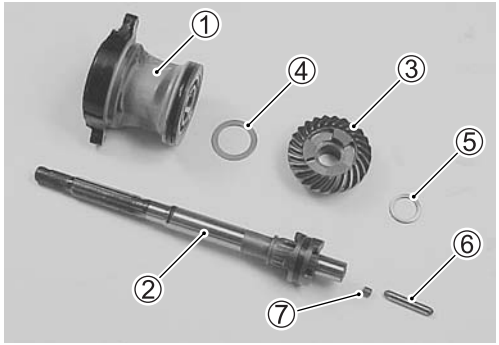


15. Remove the nut ㉚ and shift rod assembly ㉛.

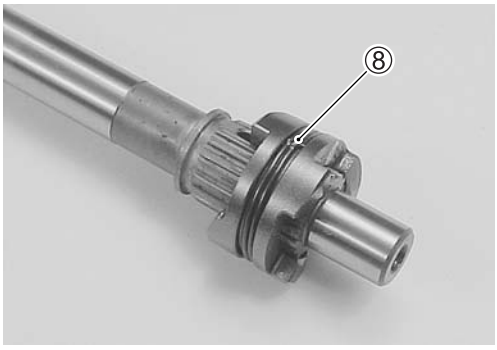


Disassembly of propeller shaft component

1. Slide propeller shaft ② away from reverse gear ③ and bearing housing assembly ①.
   Account for the reverse gear back-up shim ④ and reverse gear thrust washer ⑤.
   Pull the push rod ⑥ and push pin ⑦ out of the propeller shaft.

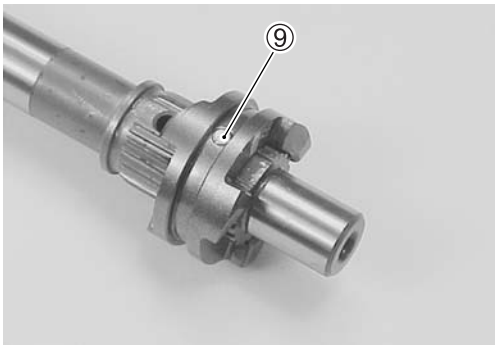


2. Remove the spring ⑧ from clutch dog shifter.

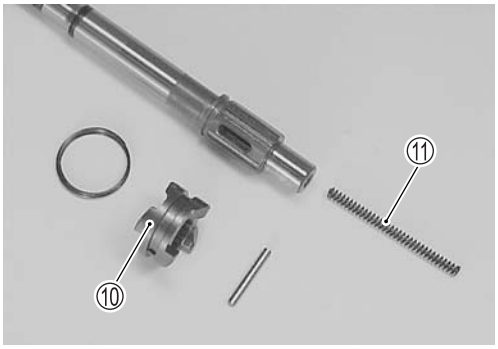


3. Use special tool to push the dog pin ⑨ out of clutch dog shifter.

TOOL 09922-89810: Shift pin remover

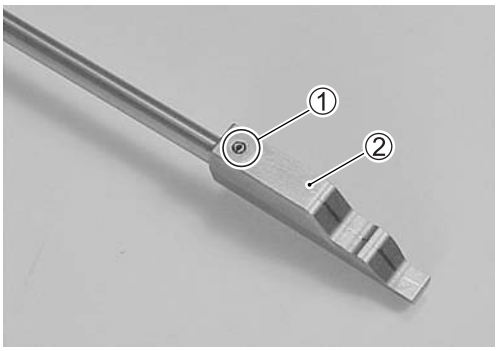


4. Remove the clutch dog shifter ⑩ and spring ⑪.

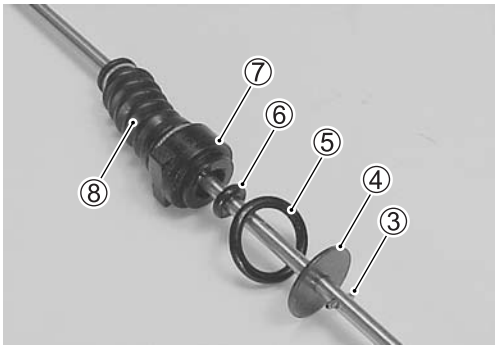


Disassembly of shift rod components

1. Push the pin ① out and remove the clutch cam ②.

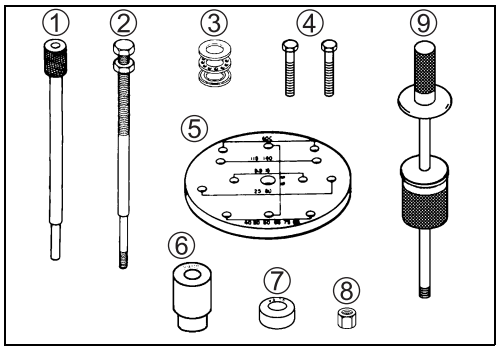


2. Remove the pin ③, washer ④, O-ring ⑤, O-ring ⑥, shift rod guide ⑦ and boot ⑧.



PINION BEARING

Removal/installation is in following procedure.



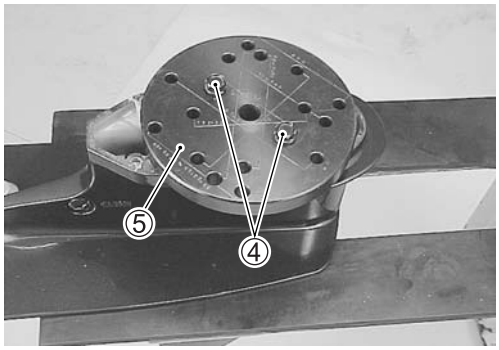
Removal & Installation tools

09951-59910: Shaft (Installation) ①
09951-49910: Shaft (Removal) ②
09951-69910: Bearing ③
01500-08403: Bolt ④
09951-39914: Plate ⑤
09951-19311: Attachment ⑥
09951-79311: Spacer (Attachment) ⑦
09951-29910: Nut ⑧
09930-30104: Sliding hammer ⑨

REMOVAL

1. Set the plate ⑤ on the gearcase with two bolts ④.

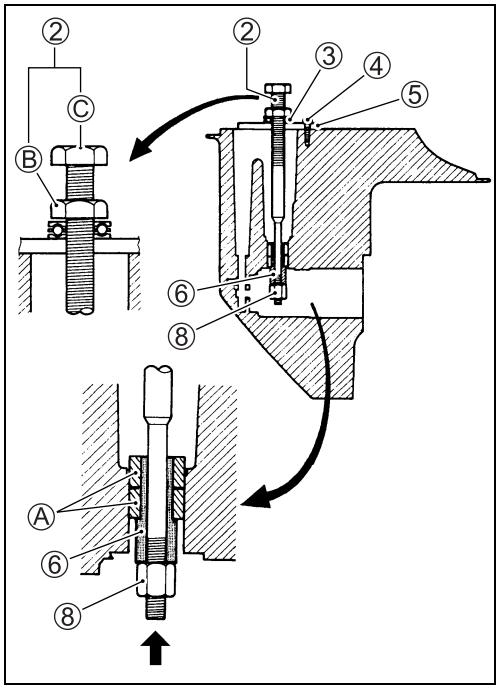
NOTE:
Using the two water pump bolt holes.



2. Set the shaft (removal) ②, bearing ③, attachment ⑥ and nut ⑧ as shown.
3. To push the pinion bearings Ⓐ out of gearcase, turn the lower nut Ⓑ clockwise while holding bolt Ⓒ tightly.

CAUTION

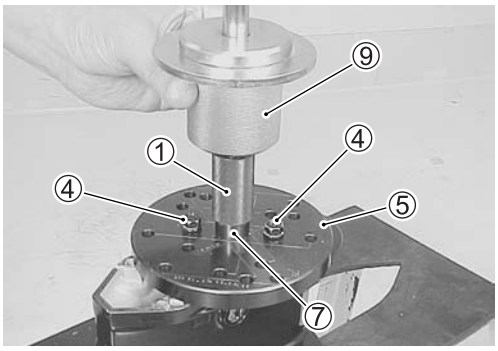
Do not re-use the pinion bearing once removed.
Always use a new pinion bearing.



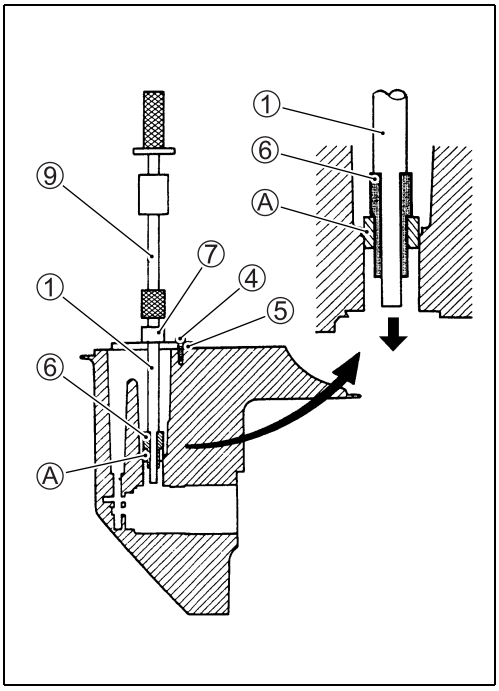
INSTALLATION

CAUTION

- **Before installing the bearing, ensure that the inside of the gearcase is clean and free of debris.**
- **Ensure that the bearing stamped mark faces upward.**



1. Set the installation shaft ①, plate ⑤, spacer ⑦, attachment ⑥ and pinion bearing Ⓐ as shown in the figure.
2. Place the shaft ① (with the pinion bearing Ⓐ on the end of shaft) into the gearcase.
3. Secure the plate ⑤ by tightening bolts ④.
4. Thread the sliding hammer ⑨ into the top of the shaft ①.
5. Drive the pinion bearing Ⓐ down into position by gently striking the shaft ① until the coupler touches the spacer ⑦.
6. Repeat Nos. 1 – 5 to install the second bearing.



INSPECTION

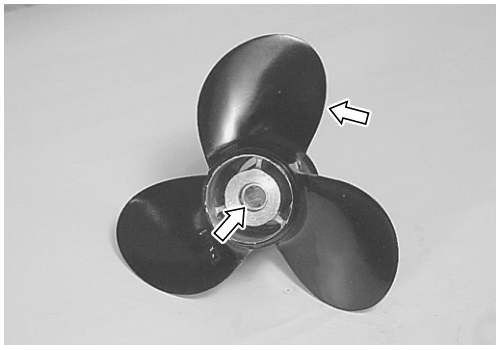
NOTE:
Thoroughly wash all metal components with cleaning solvent and dry with compressed air.

⚠ WARNING

Wear the safety glasses when using compressed air.

PROPELLER

- Inspect the propeller for bent, chipped or broken blades. Replace or repair if necessary.
- Inspect the propeller bushing splines for wear or other damage. Replace if necessary.
- Inspect the propeller bushing for deterioration or slipping. Replace if necessary.



GEARCASE

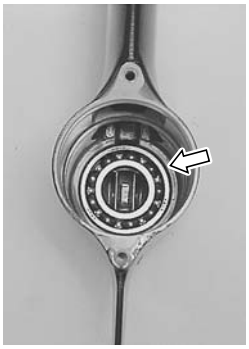
- Inspect the gearcase for cracks or other damage. Replace if necessary.
- Inspect the pinion bearing for pitting, rough or other damage. Replace if necessary.

NOTE:
If removal and replacement are required, see the "PINION BEARING" section on page 8-6.

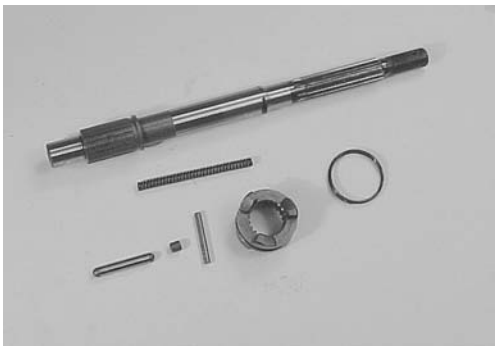
GEARS

- Inspect the forward gear, reverse gear and pinion gear teeth and engaging dogs for excessive wear or other damage. Replace if necessary.

- Inspect the thrust bearing and forward gear bearing for pitting, rough or other damage. Replace if necessary.



PROPELLER SHAFT COMPONENTS

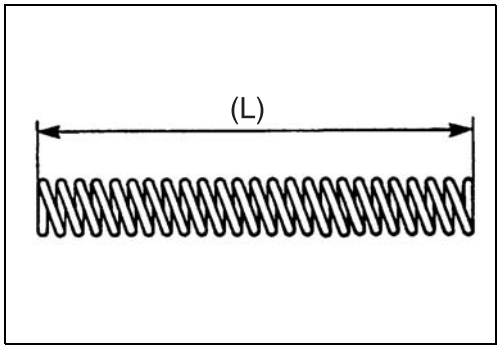


- Inspect the push rod and push rod pin for excessive wear or other damage. Replace if necessary.
- Inspect the clutch dog shifter for excessive wear, chip or other damage. Replace if necessary.
- Inspect the dog pin for bent or other damage. Replace if necessary.
- Inspect the propeller shaft/splines for wear, twist or other damage. Replace if necessary.

- Measure the clutch return spring free length.

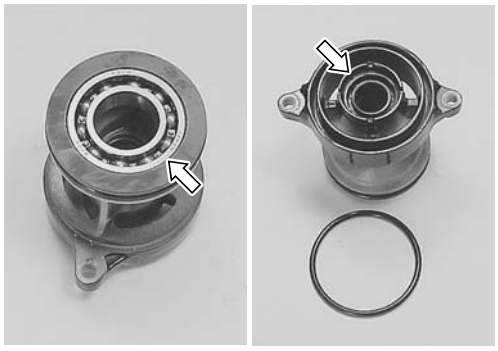
TOOL **09900-20101: Vernier calipers**

Clutch return spring free length (L)
Standard: 70 mm (2.8 in)
Service limit: 67 mm (2.6 in)



If measurement exceeds service limit, replace the clutch return spring.

PROPELLER SHAFT BEARING HOUSING



- Inspect the housing for cracks or other damage. Replace if necessary.
- Inspect the propeller shaft bush and the reverse gear bearing for pitting, rough or other damage. Replace if necessary.
- Inspect the oil seals and the O-ring for cuts, nicks or tears. Replace if necessary.

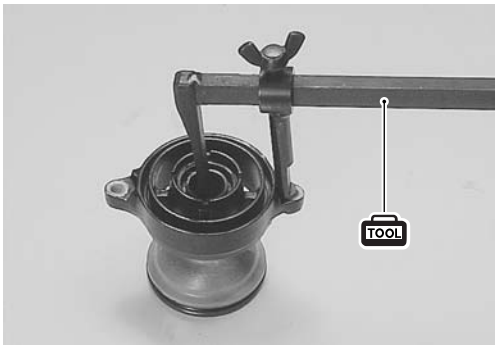
Replacing propeller shaft oil seal

1. Extract the oil seals using the oil seal remover.

TOOL **09913-50121: Oil seal remover**

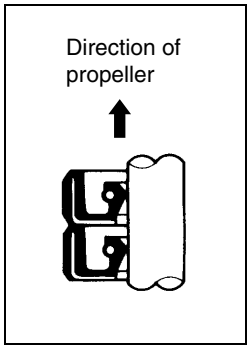
CAUTION

Do not re-use oil seal once removed.
Always use new oil seal.



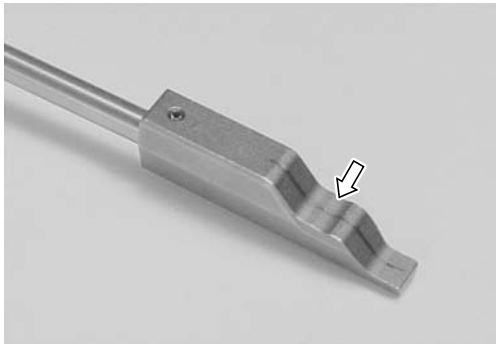
2. Apply the grease to the inner circumference of the housing.
3. Using an oil seal installer, drive two oil seals (one at a time) into the housing.
   The lipped portion of the seal should face toward the propeller.
   Apply the grease to the seal lips.

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**



SHIFT CAM AND RELATED ITEMS

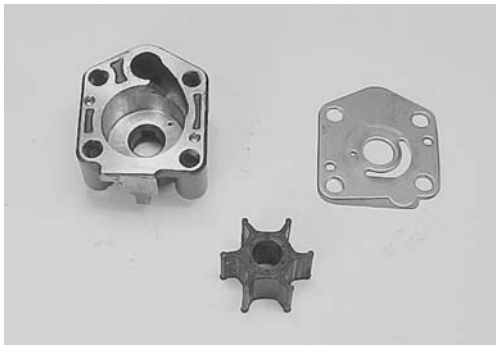
- Inspect the “stepped” surfaces of the shift cam for excessive wear, chip or other damage. Replace if necessary.



- Inspect the shift rod guide for excessive wear, pit, corrosion or stiff. Replace if necessary.
- Inspect the O-ring for wear, cuts, nicks or tears. Replace if necessary.
- Inspect the boot for cracked or other damage. Replace if necessary.

WATER PUMP AND RELATED ITEMS

- Inspect the impeller vanes for cuts, cracks, tears or excessive wear. Replace if necessary.
- Inspect the pump case and the under panel for cracks, distortion or corrosion. Replace if necessary.



WATER INLET HOUSING

- Inspect the housing for cracks or other damage. Replace if necessary.
- Inspect the oil seal for wear, cuts, nicks or tears. Replace if necessary.

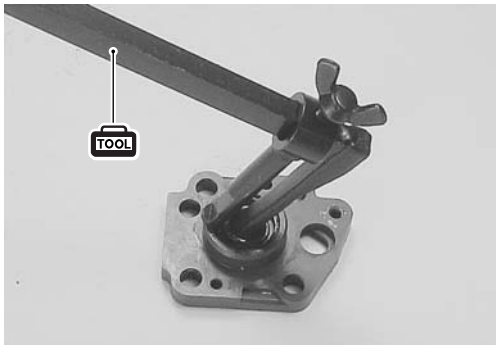
Replacing oil seal

1. Extract the oil seal using the oil seal remover.

TOOL 09913-50121: Oil seal remover

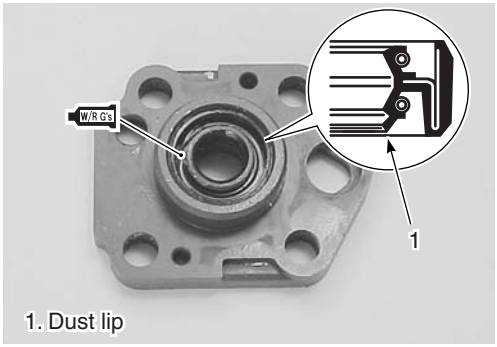
2. Apply the water resistant grease to the inner circumference of the housing.

W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE



3. Using an oil seal installer, drive the oil seal into the housing.
   The dust lipped portion of the seal should face toward the water pump case.
   Apply the grease to the seal lips.

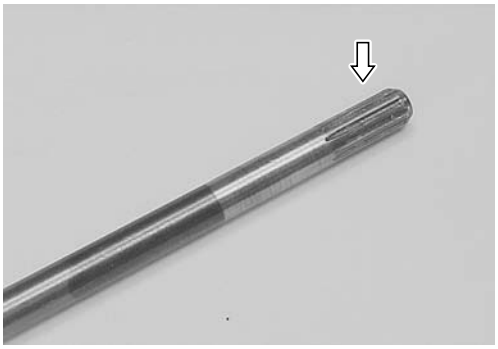
W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

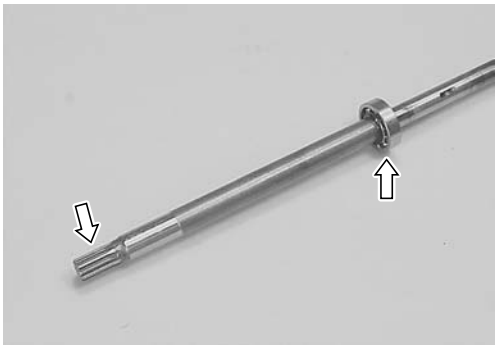


1. Dust lip

DRIVESHAFT

- Inspect the driveshaft/splines for wear, twist or other damage. Replace if necessary.
- Inspect the driveshaft bearing for pitting, rough or other damage. Replace if necessary.

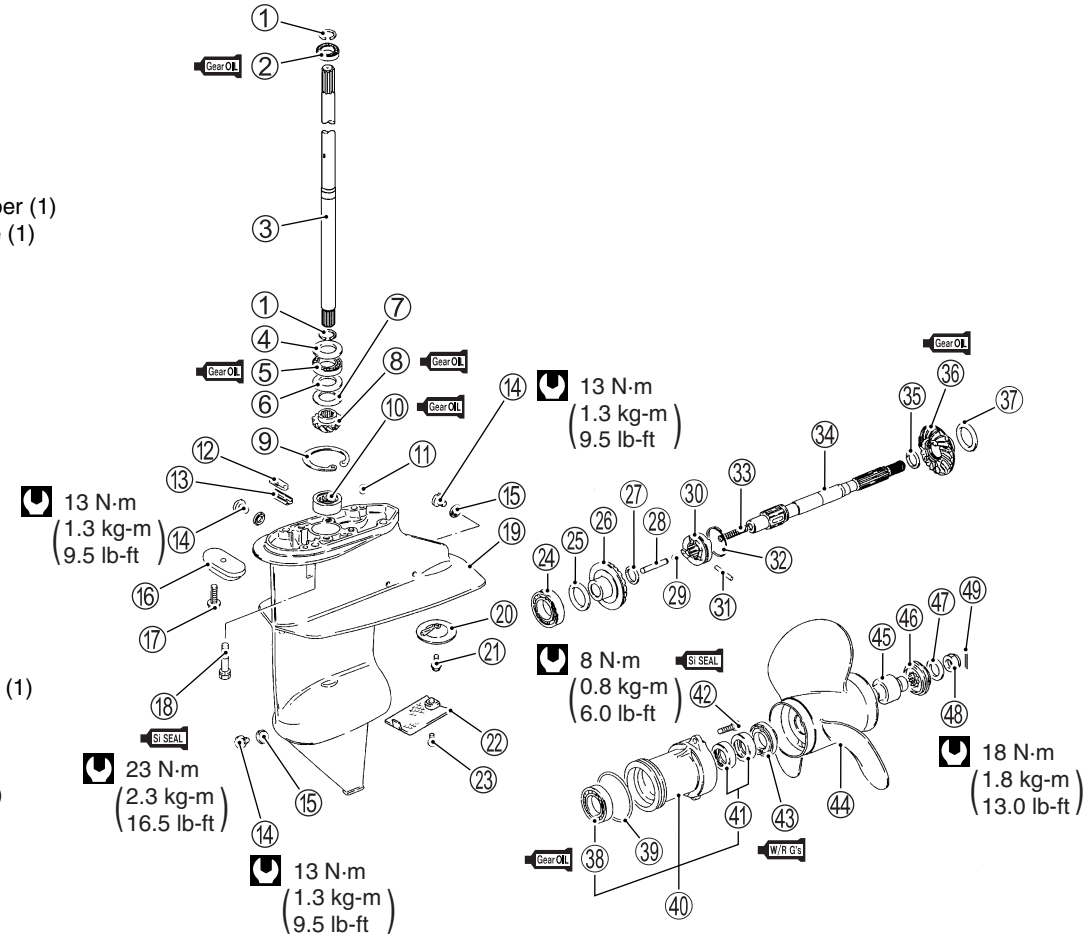




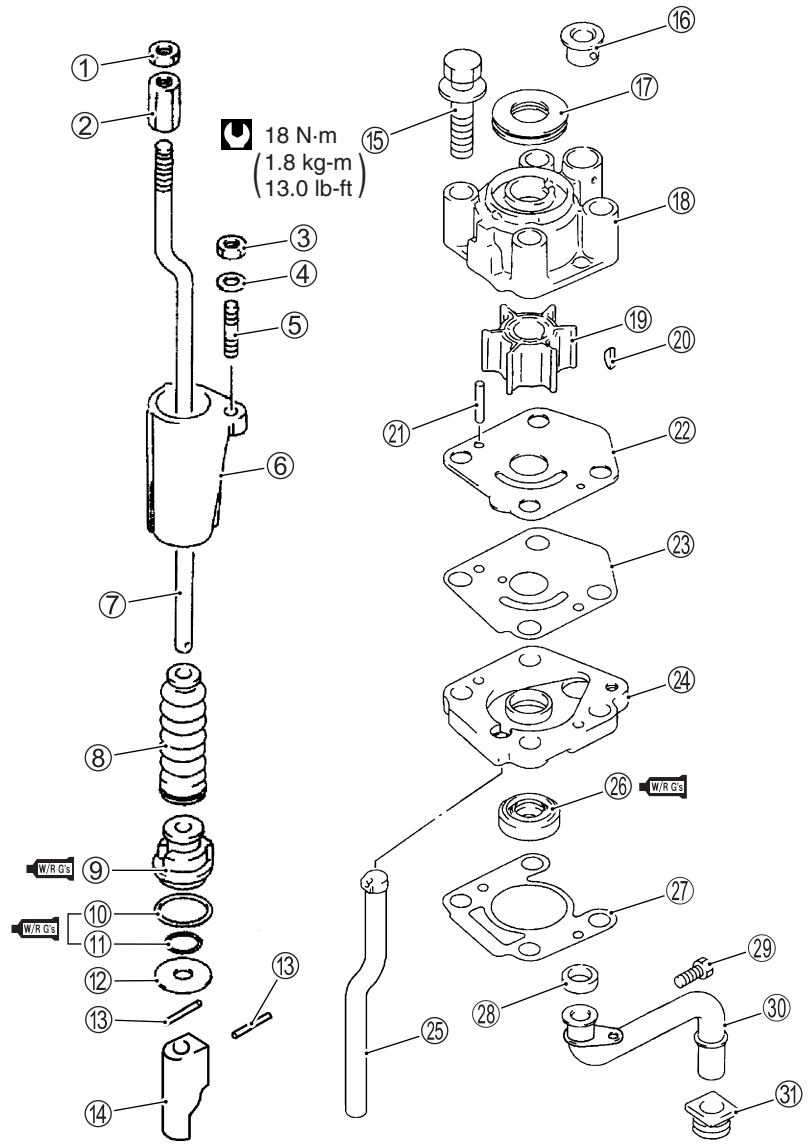
ASSEMBLY & INSTALLATION

Assembly & installation are reverse order of removal & disassembly with the special attention to the following steps.

① Circlip (2)
② Bearing (1)
③ Driveshaft (1)
④ Washer (1)
⑤ Bearing (1)
⑥ Washer (1)
⑦ Shim (1)
⑧ Pinion gear (1)
⑨ Circlip (1)
⑩ Pinion bearing (2)
⑪ Dowel pin (2)
⑫ Exhaust seal rubber (1)
⑬ Exhaust seal core (1)
⑭ Plug (3)
⑮ Gasket (3)
⑯ Zinc (1)
⑰ Bolt (1)
⑱ Bolt (4)
⑲ Gearcase (1)
⑳ Zinc (1)
㉑ Bolt (1)
㉒ Water filter (1)
㉓ Screw (1)
㉔ Bearing (1)
㉕ Shim (1)
㉖ Forward gear (1)
㉗ Thrust washer (1)
㉘ Push rod (1)
㉙ Push pin (1)
㉚ Clutch dog shifter (1)
㉛ Dog pin (1)
㉜ Dog spring (1)
㉝ Return spring (1)
㉞ Propeller shaft (1)
㉟ Washer (1)
㊱ Reverse gear (1)
㊲ Shim (1)
㊳ Bearing (1)
㊴ O-ring (1)
㊵ Propeller shaft bearing housing (1)
㊶ Oil seal (2)
㊷ Bolt (2)
㊸ Propeller bush stopper (1)
㊹ Propeller (1)
㊺ Propeller bush (1)
㊻ Spacer (1)
㊼ Washer (1)
㊽ Nut (1)
㊾ Cotter pin (1)



① Nut (1)
② Turnbuckle (1)
③ Nut (1)
④ Washer (1)
⑤ Stud bolt (1)
⑥ Collar (1)
⑦ Shift rod (1)
⑧ Boot (1)
⑨ Shift rod guide (1)
⑩ O-ring (1)
⑪ O-ring (1)
⑫ Washer (1)
⑬ Spring pin (2)
⑭ Shift cam (1)
⑮ Bolt (4)
⑯ Bush (1)
⑰ Grommet (1)
⑱ Water pump case (1)
⑲ Impeller (1)
⑳ Key (1)
㉑ Dowel pin (2)
㉒ Under panel (1)
㉓ Gasket (1)
㉔ Water inlet housing (1)
㉕ Water drain tube (1)
㉖ Oil seal (1)
㉗ Gasket (1)
㉘ Grommet
㉙ Bolt (1)
㉚ Water inlet tube (1)
㉛ Grommet (1)



CAUTION

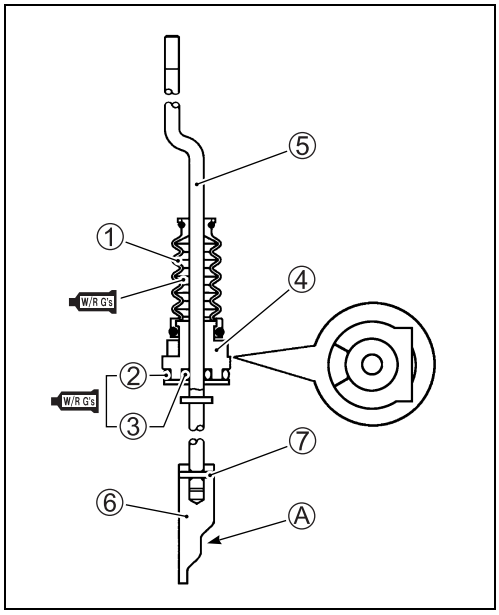
- **Make sure that all parts used in assembly are clean and lubricated.**
- **After assembly, check parts for tightness and smoothness of operation.**
- **Before final assembly, be absolutely certain that all gear contact, shim adjustments and tolerances are correct.**
  Failure to correctly adjust these areas will result in lower unit damage. (See the "GEARS SHIMMING AND ADJUSTMENT" section on page 8-21.)

SHIFT ROD/SHIFT CAM ASSEMBLY

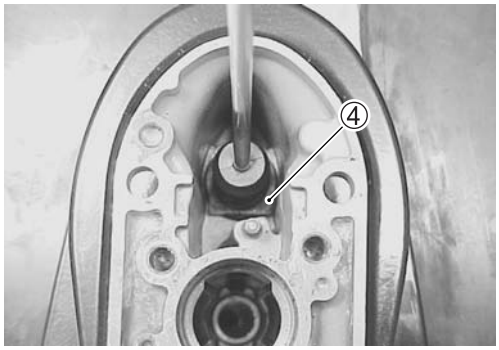
- Apply the grease to the inside of the boot ①, O-ring ② and O-ring ③.

W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE

- Install the shift rod guide ④ to shift rod ⑤ as shown in the figure.
- Attach the shift cam ⑥ to shift rod as shown in the figure and insert the spring pin ⑦.
- Install the shift rod/shift cam assembly to gearcase with the face Ⓐ of cam facing toward propeller side.

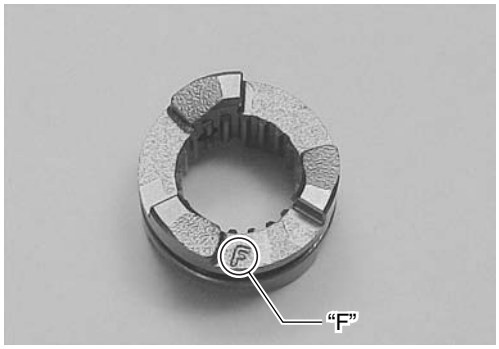


- Install the shift rod guide ④ to gearcase as shown in the figure.

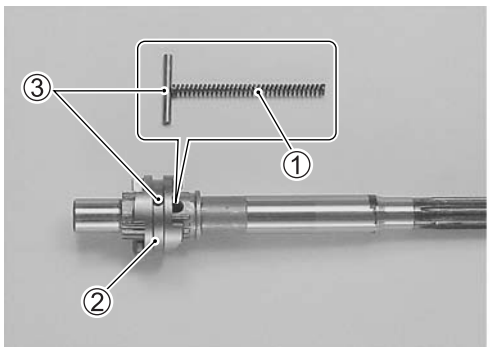


PROPELLER SHAFT/CLUTCH DOG ASSEMBLY

- Install the clutch dog shifter with “F” mark toward forward gear side.



- Insert the return spring ① into propeller shaft. Depress the return spring and slide the dog pin ③ into both dog ② and propeller shaft as shown in right figure.

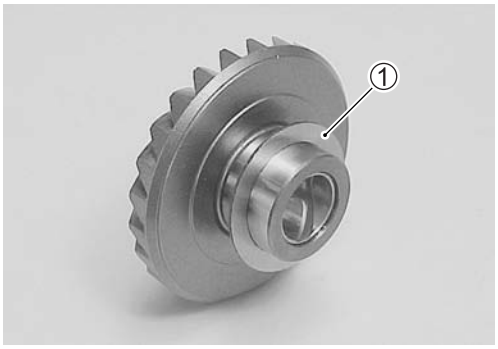


- Install the dog spring ④, ensuring that it fits snugly into groove on clutch dog shifter.

FORWARD GEAR

Apply gear oil to the forward gear and place the back-up shim ① in position, then install forward gear.

Gear OIL **99000-22540: SUZUKI OUTBOARD MOTOR GEAR OIL**

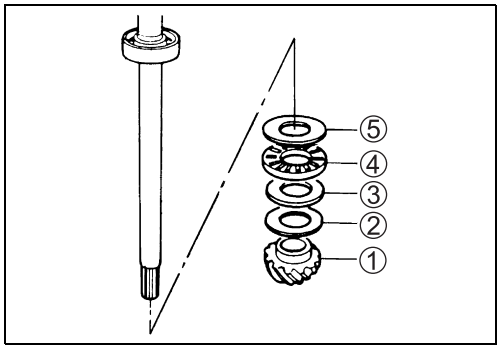


PINION GEAR AND DRIVE SHAFT

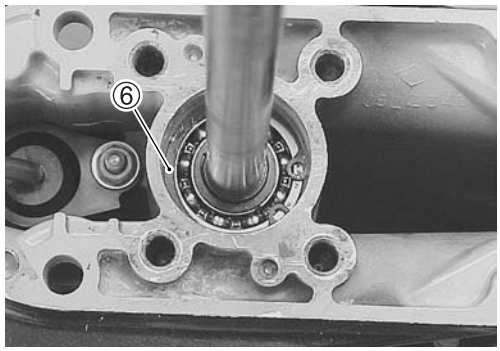
1. Apply gear oil to the thrust bearing ④ and pinion gear ①.

Gear OIL **99000-22540: SUZUKI OUTBOARD MOTOR GEAR OIL**

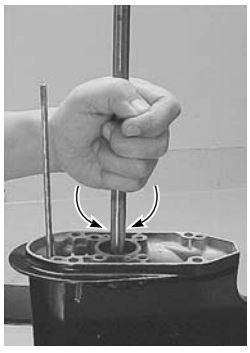
2. Place the pinion gear ①, back-up shim ②, thrust washer (I.D. 20 mm) ③, thrust bearing ④ and thrust washer (I.D. 21 mm) ⑤ in gearcase.
3. Lower the driveshaft assembly down into the gearcase until the bottom of shaft passes to center of pinion gear.

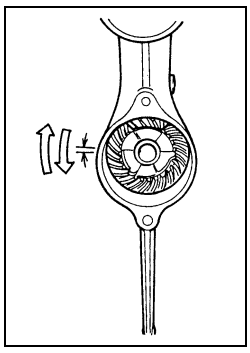


4. Install the circlip ⑥.



5. Check the backlash exists between the pinion gear and forward gear. (See “FORWARD GEAR/PINION GEAR” section on page 8-21 to 8-23.)





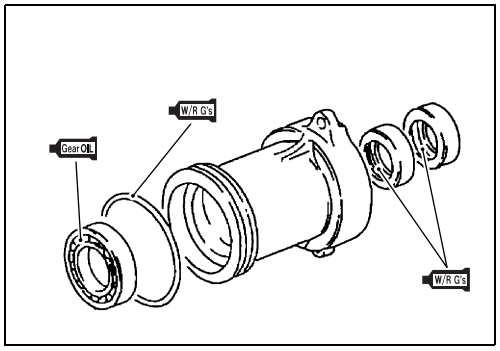
PROPELLER SHAFT/BEARING HOUSING

- Apply grease to the oil seals and O-ring.

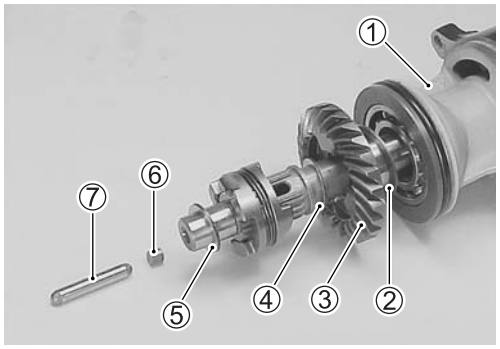
W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

- Apply gear oil to the bearing and bush.

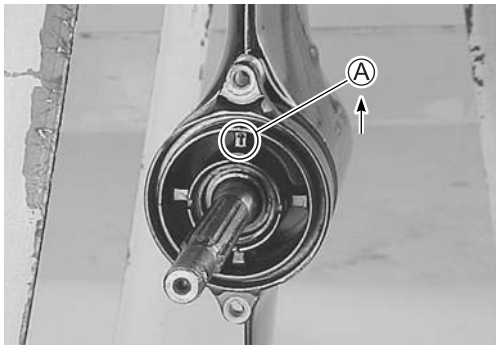
Gear OIL **99000-22540: SUZUKI OUTBOARD MOTOR GEAR OIL**



- Assemble the propeller shaft in the following sequence: forward thrust washer ⑤, reverse thrust washer ④, reverse gear ③, reverse gear back-up shim ② and propeller shaft housing ①.
- Insert the push pin ⑥ and push rod ⑦ into propeller shaft.

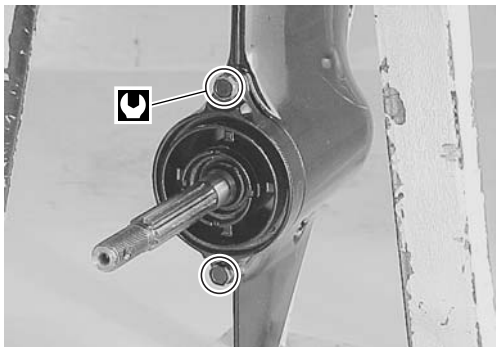


- Install the propeller shaft and bearing housing assembly to gearcase with the arrow mark Ⓐ of housing toward upside.

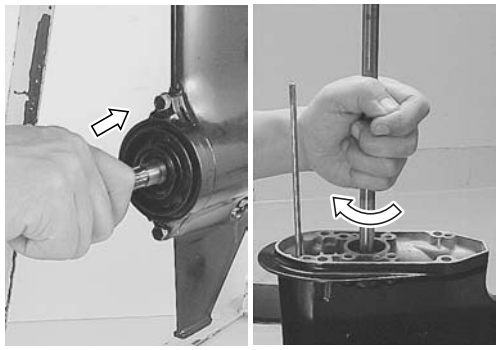


- When the housing is fully seated, tighten both retaining bolts to the specified torque.

Bearing housing bolt: 8 N·m (0.8 kg-m, 6.0 lb-ft)



- Check and adjust the shimming of the gears. (See page 8-23.)

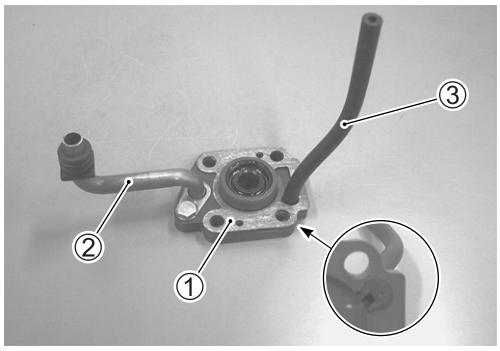


WATER INLET HOUSING

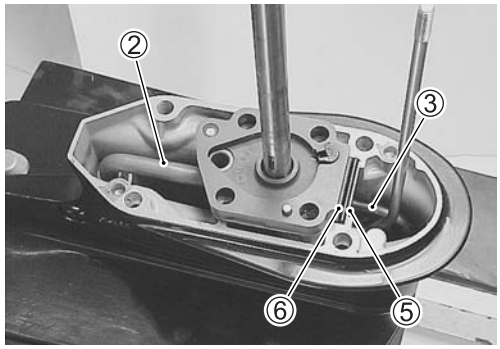
1. Apply grease to the oil seal.

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

2. Install the gasket ①, water inlet tube ② and water drain tube ③ to the water inlet housing.

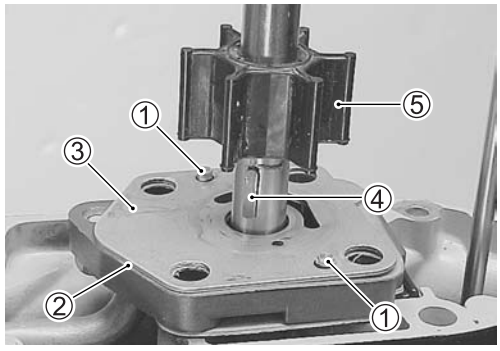


3. Install the exhaust seal core ⑤ and seal rubber ⑥.
4. Install the water inlet housing assembly to the gearcase. Place the water inlet tube ② and drain tube ③ into position.



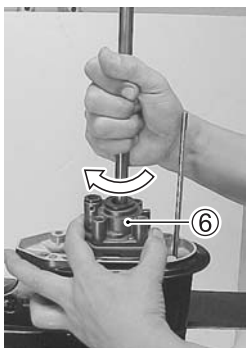
WATER PUMP

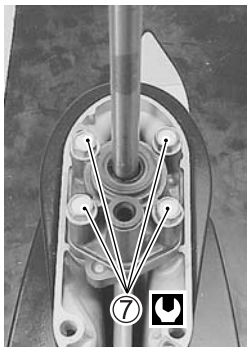
1. Place the dowel pins ①, under panel gasket ② and under panel ③ into position.
2. Insert the key ④ in the driveshaft and slide the impeller ⑤ onto driveshaft, ensuring that key and keyway are aligned.



3. Install the pump case ⑥ while rotating driveshaft clockwise to flex the impeller vanes in correct direction.
4. Tighten the four pump case bolts ⑦ to the specified torque.

Pump case bolt: 18 N·m (1.8 kg-m, 13.0 lb-ft)





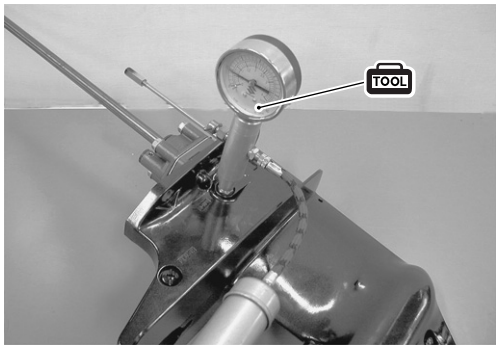
LEAKAGE CHECK

Check for leakage of oil seal and O-ring when applying specified pressure inside of the gearcase.

09950-69512 : Oil leakage tester
09952-99310 : Hand air pump

Procedure

1. Install the oil leakage tester into oil level hole.
2. Connect a hand air pump to the oil leakage tester.
3. While rotate the driveshaft and propeller shaft clockwise several times, apply specified pressure for leakage test.



NOTE:
Apply low initial pressure of 20 – 40 kPa, (0.2 – 0.4 kg/cm², 2.8 – 5.7 psi) first, then apply specified pressure.

Leakage test pressure: 100 kPa (1.0 kg/cm², 14.2 psi)

CAUTION

Do not exceed pressure of 110 kPa (1.1kg/cm², 15.6 psi) or damage to oil seals will result.

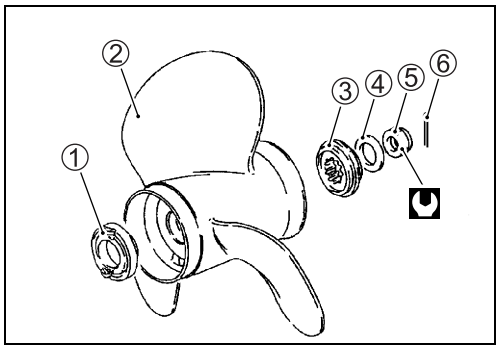
4. Once stabilized, pressure should remain steady for at least 5 min.
   If pressure does not fall, sealing performance is correct.

PROPELLER INSTALLATION

1. Install the propeller stopper ① onto the propeller shaft, then slide on the propeller ②.
2. Install the spacer ③, washer ④ and nut ⑤, then tighten nut to specified torque.

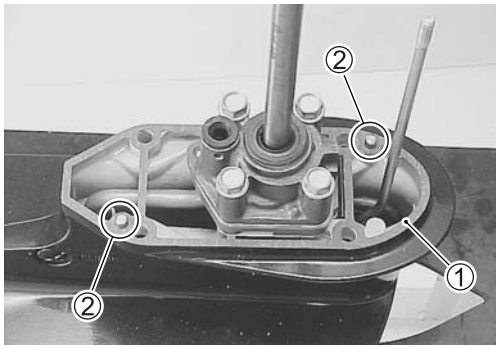
Propeller nut: 18 N·m (1.8 kg-m, 13.0 lb-ft)

3. Push cotter pin ⑥ through nut and shaft, then bend to secure.



LOWER UNIT INSTALLATION

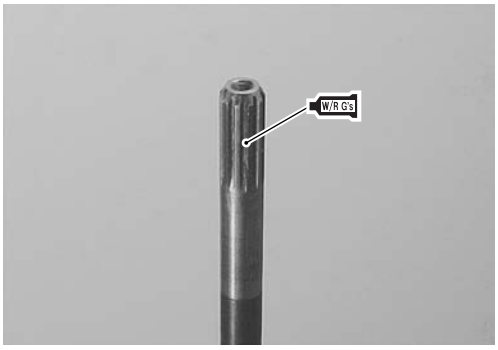
1. Install the gasket ① and two dowel pins ②.



2. Apply grease to the driveshaft splines.

W/R G's **99000-25161: SUZUKI WATER RESISTANT GREASE**

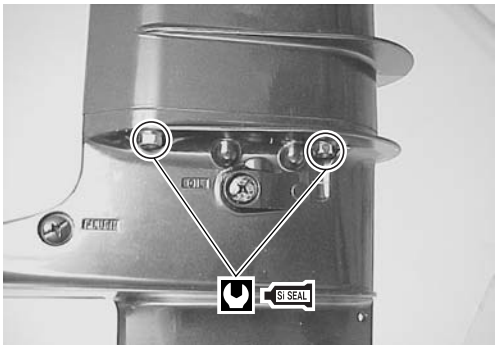
3. Slide the gearcase into place, making sure that the top of driveshaft engages properly with crankshaft and water tube locates in water pump case outlet.



4. Apply seal to the four gearcase bolts and tighten them to the specified torque.

Si SEAL **99000-31120: SUZUKI SILICONE SEAL**

Gearcase bolt: 23 N·m (2.3 kg-m, 16.5 lb-ft)

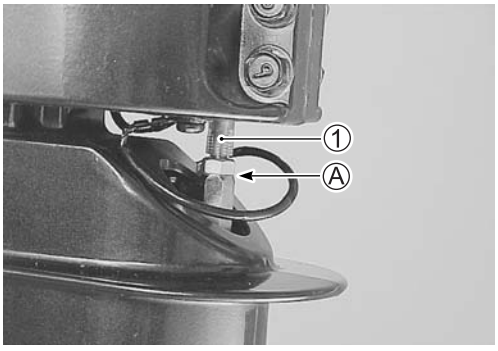


CLUTCH ADJUSTMENT

1. Install the hose ① on the clutch rod.
2. Connect the clutch rod to shift rod as shown.

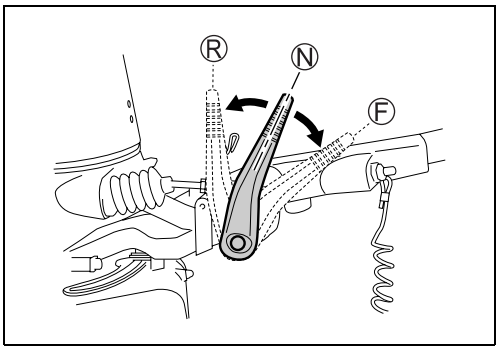
CAUTION

Make sure that chamfered edge Ⓐ of the turnbuckle faces upward to seat against the upper nut when tightened.

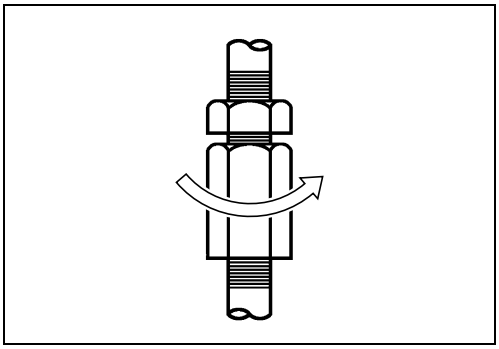


Adjustment step:

1. Shift the clutch lever from Neutral Ⓝ through Forward Ⓕ and Reverse Ⓡ to check that proper engagement of both gears is at an equal angle from Neutral.

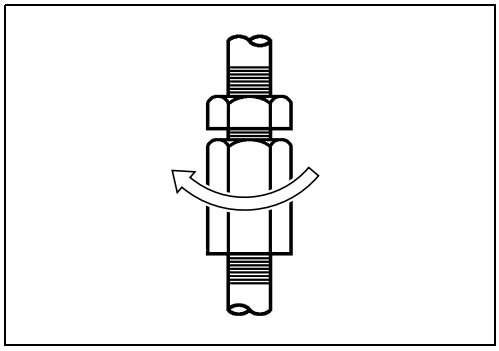


- If Forward gear engages earlier (at a smaller angle) than Reverse, the turnbuckle should be rotated counterclockwise until both gears engage with the same amount of clutch lever travel.



- If Reverse gear engages earlier than Forward, the turnbuckle should be rotated clockwise.

2. Lock the upper nut securely against the turnbuckle when clutch lever adjustment is correct.



GEAR OIL

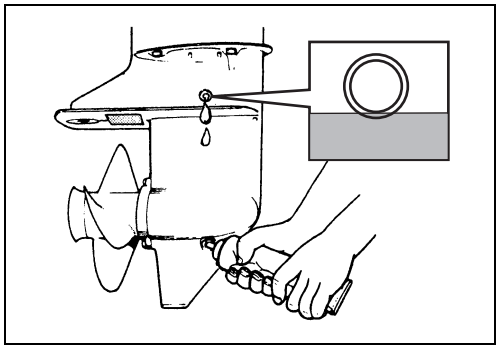
Fill the gearcase with specified gear oil.

See the "PERIODIC MAINTENANCE/GEAR OIL" section on page 2-5.

Necessary amount of gear oil:

170 ml (5.7/6.0 US/Imp.oz)

99000-22540: SUZUKI OUTBOARD MOTOR GEAR OIL

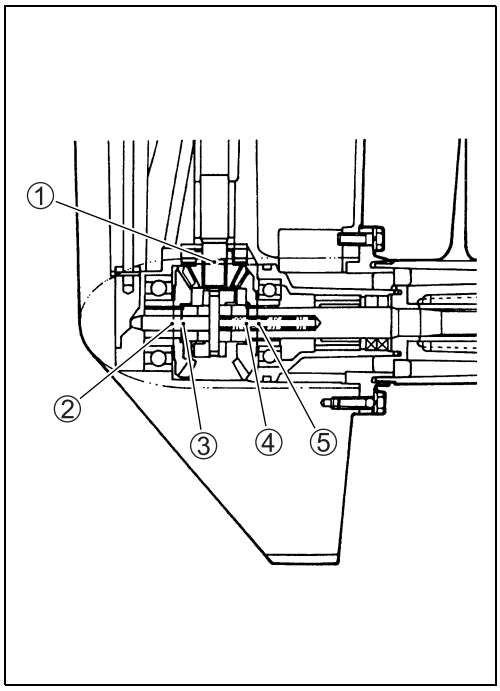


LOWER UNIT GEARS- SHIMMING AND ADJUSTMENT

If lower unit has been rebuilt or has had components replaced, shimming for correct gear contact and backlash will have to be adjusted to ensure smooth, reliable operation of gears.

Shim/Washer & Mounting position

	Numerical index/item	Available thickness (mm)	Design specification thickness (mm)
①	Pinion gear back up shim	0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3	1.0
②	Forward gear back up shim	0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3	1.0
③	Forward gear thrust washer	1.5	1.5
④	Reverse gear thrust washer	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9	1.5
⑤	Reverse gear back up shim	0.7, 0.8, 0.9, 1.0, 1.1, 1.2, 1.3	1.0



FORWARD GEAR/PINION GEAR

Step to prior to adjustment

Correctly assemble forward gear, pinion gear, driveshaft and related components. (See page 8-15.)

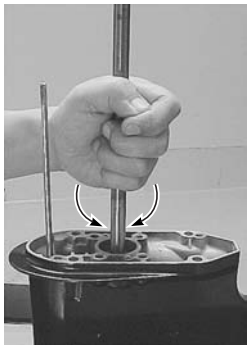
NOTE:

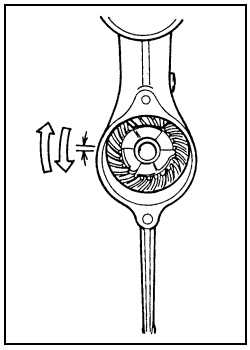
When installing the forward gear back-up shim, choose shim thinner than design specification for calculating adjustment.

Adjusting gear backlash

Check a slight amount of backlash exists between the pinion gear and forward gear by slightly rotating driveshaft or forward gear by hand.

- If backlash is larger than the specified, thickness of the forward gear back-up shim must be increased.
- If backlash is smaller, the forward gear back-up shim thickness must be decreased.



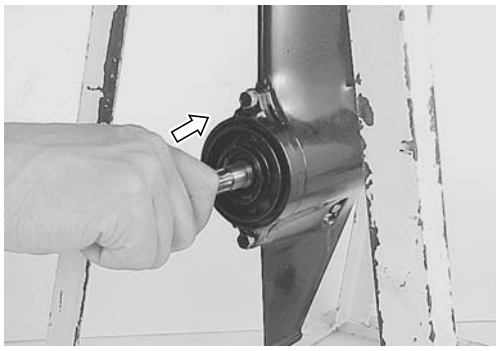


Checking and adjusting tooth contact pattern (Pinion and forward gear)

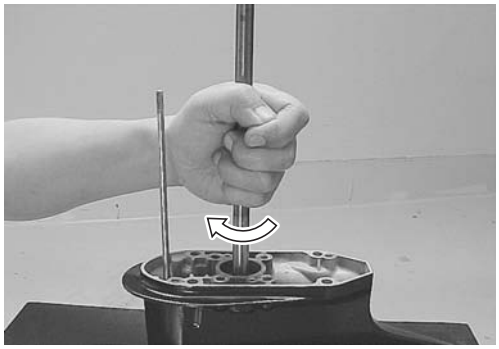
1. To assess tooth contact, apply a light coat of Prussian Blue on the convex surface of forward gear.
2. Install propeller shaft and housing assembly (minus reverse gear and internal components).

Propeller shaft bearing housing bolt:
8 N·m (0.8 kg-m, 6.0 lb-ft)

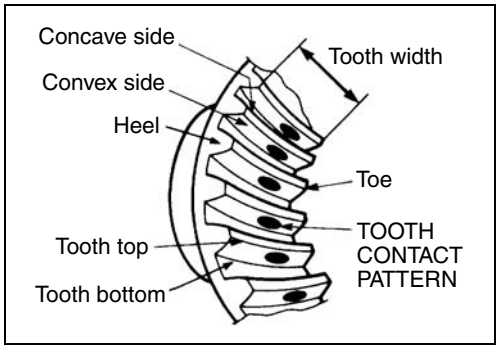
3. Push propeller shaft inward and hold in position.



4. Rotate the driveshaft clockwise 5 – 6 times by hand.



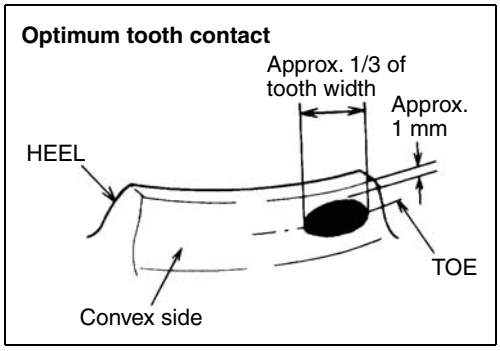
5. Carefully pull out propeller shaft and housing to check tooth contact pattern.



Optimum tooth contact
The optimum tooth contact is shown at right.
A shim adjustment may be necessary to obtain this contact pattern.

CAUTION

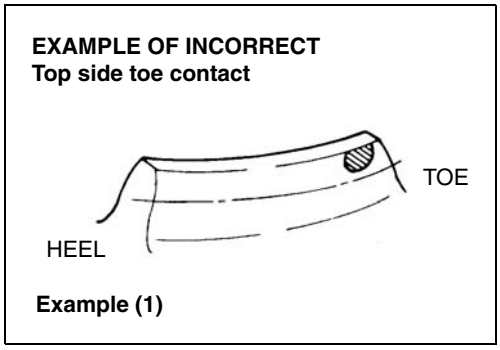
Gear backlash should be checked when increasing or decreasing shim thickness to adjust tooth contact.



Example (1)
Incorrect topside toe contact:
Correction measures:
- Decrease thickness of forward gear back-up shim.
- Slightly increase pinion gear back-up shim thickness.

CAUTION

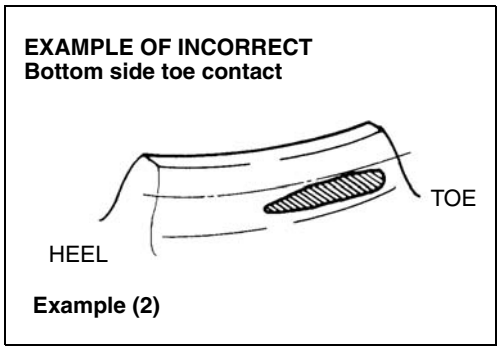
Do not set tooth contact in this position (top side toe contact). Damage and chipping of forward and pinion gear may result.



Example (2)
Incorrect bottom side toe contact:
Correction measures:
- Increase thickness of forward gear back-up shim.
- Slightly decrease pinion gear back-up shim thickness.

CAUTION

Do not set tooth contact in this position (bottom side toe contact). Chipping of pinion gear may result.

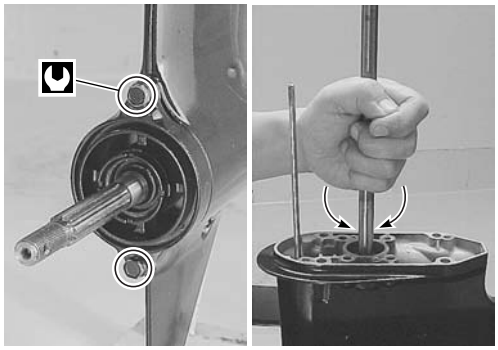


PINION GEAR/REVERSE GEAR

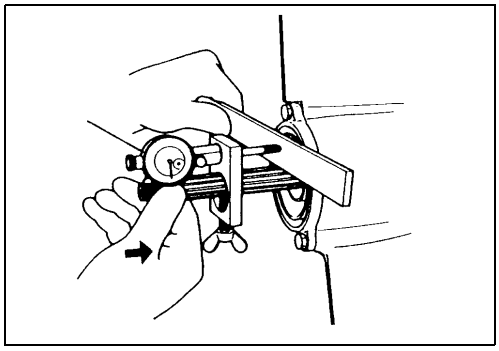
1. Check the amount of backlash between the pinion gear and forward gear. (See page 8-21.)
2. Install the propeller shaft/bearing housing assembly to the gearcase.

Propeller shaft bearing housing bolt:
8 N·m (0.8 kg-m, 6.0 lb-ft)

3. Check the amount of backlash by slightly rotating the drive-shaft by hand.
4. Backlash should not be less than when checked step (1).
   If backlash is less, reduce the reverse gear back-up shim thickness.



CHECKING PROPELLER SHAFT THRUST PLAY



After adjusting all gear positions, measure the propeller shaft thrust play. If not within the following specification, a shim adjustment is required.

Propeller shaft thrust play: 0.2 – 0.4 mm (0.01 – 0.02 in)

NOTE:
Maintain the forward gear thrust washer at the standard thickness (1.5 mm) and adjust only the reverse gear thrust washer with shim.

1. Assemble gear adjusting gauge to the propeller shaft.

TOOL 09951-09530: Gear adjusting gauge

2. Slowly push the propeller shaft inward.
3. Hold shaft in and set dial gauge pointer to zero.
4. Slowly pull shaft outward and read the maximum thrust play on the dial gauge.

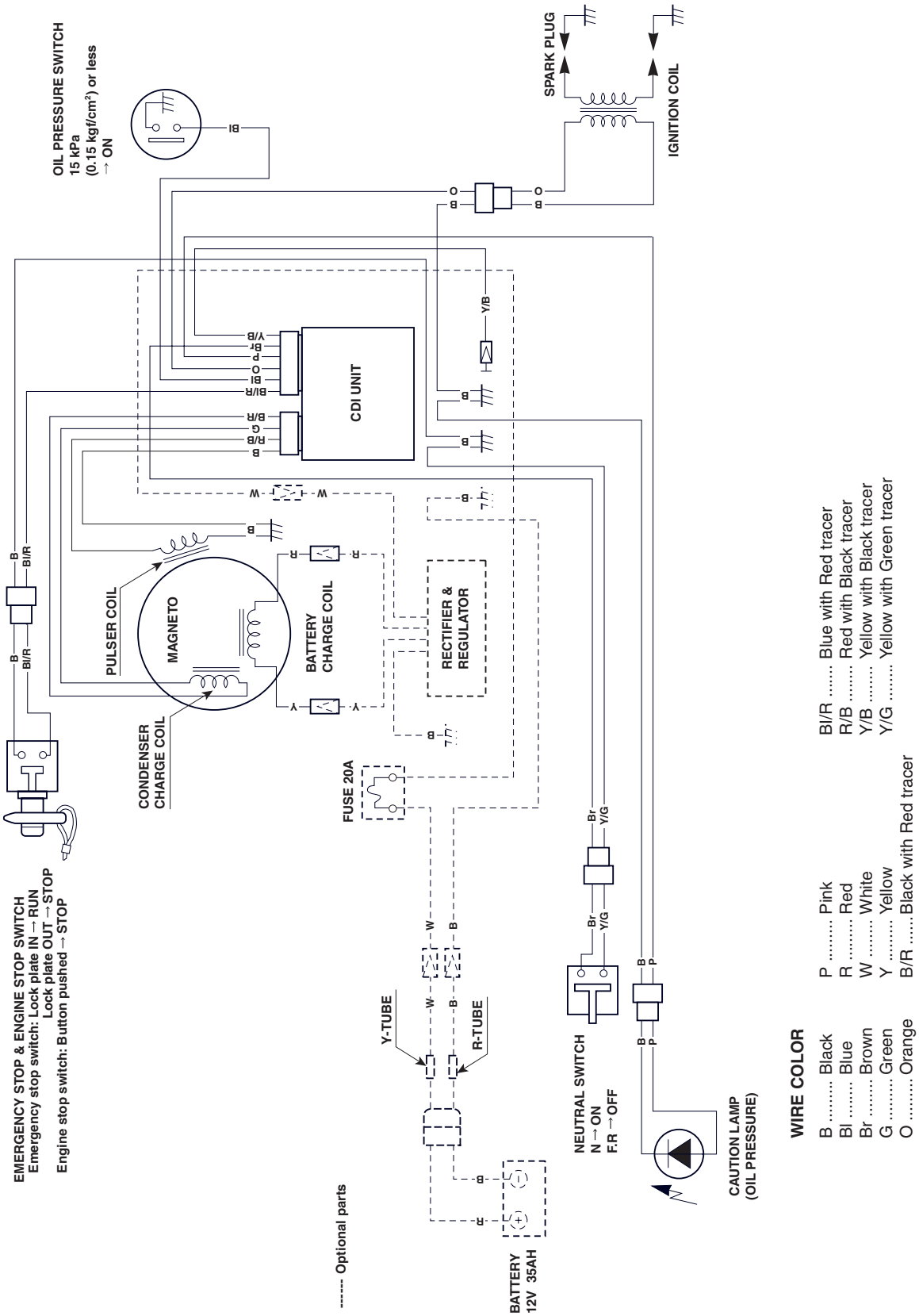
If measurement is more than specification, increase reverse gear thrust washer thickness.
If measurement is less than specification, reduce reverse gear thrust washer thickness.

WIRE/HOSE ROUTING

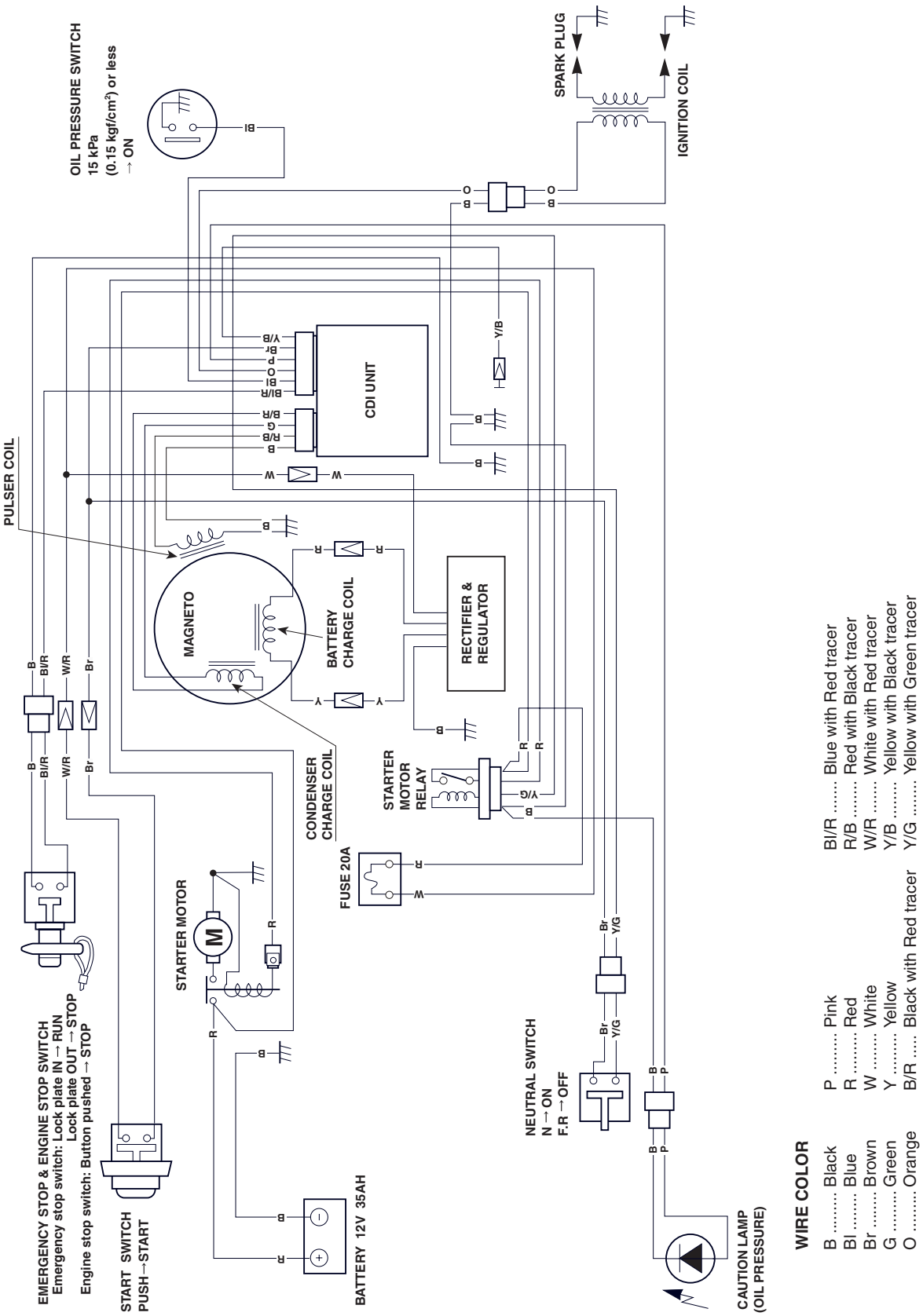
CONTENTS

9

WIRING DIAGRAM
DF9.9/DF15



DF9.9E/DF15E



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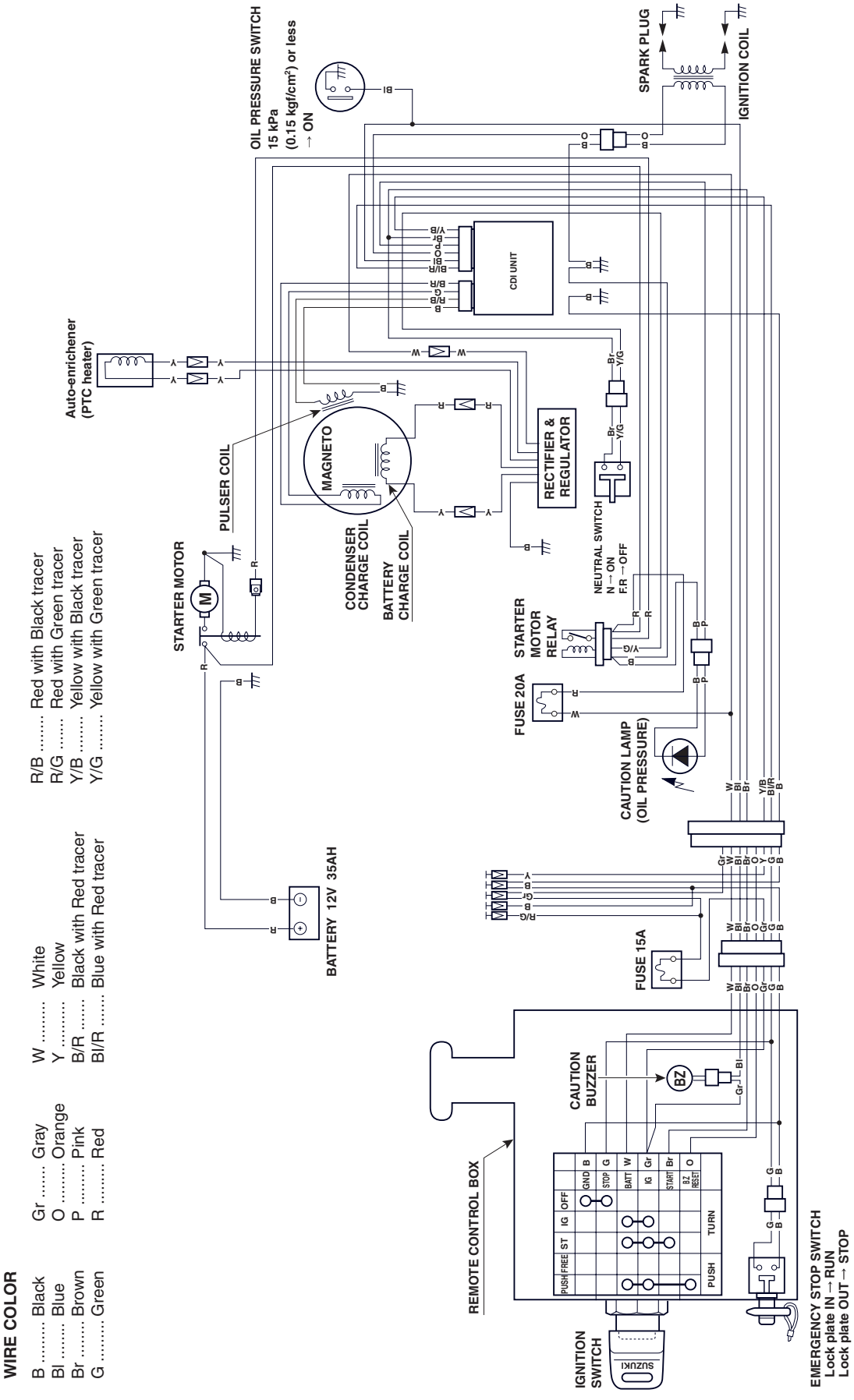
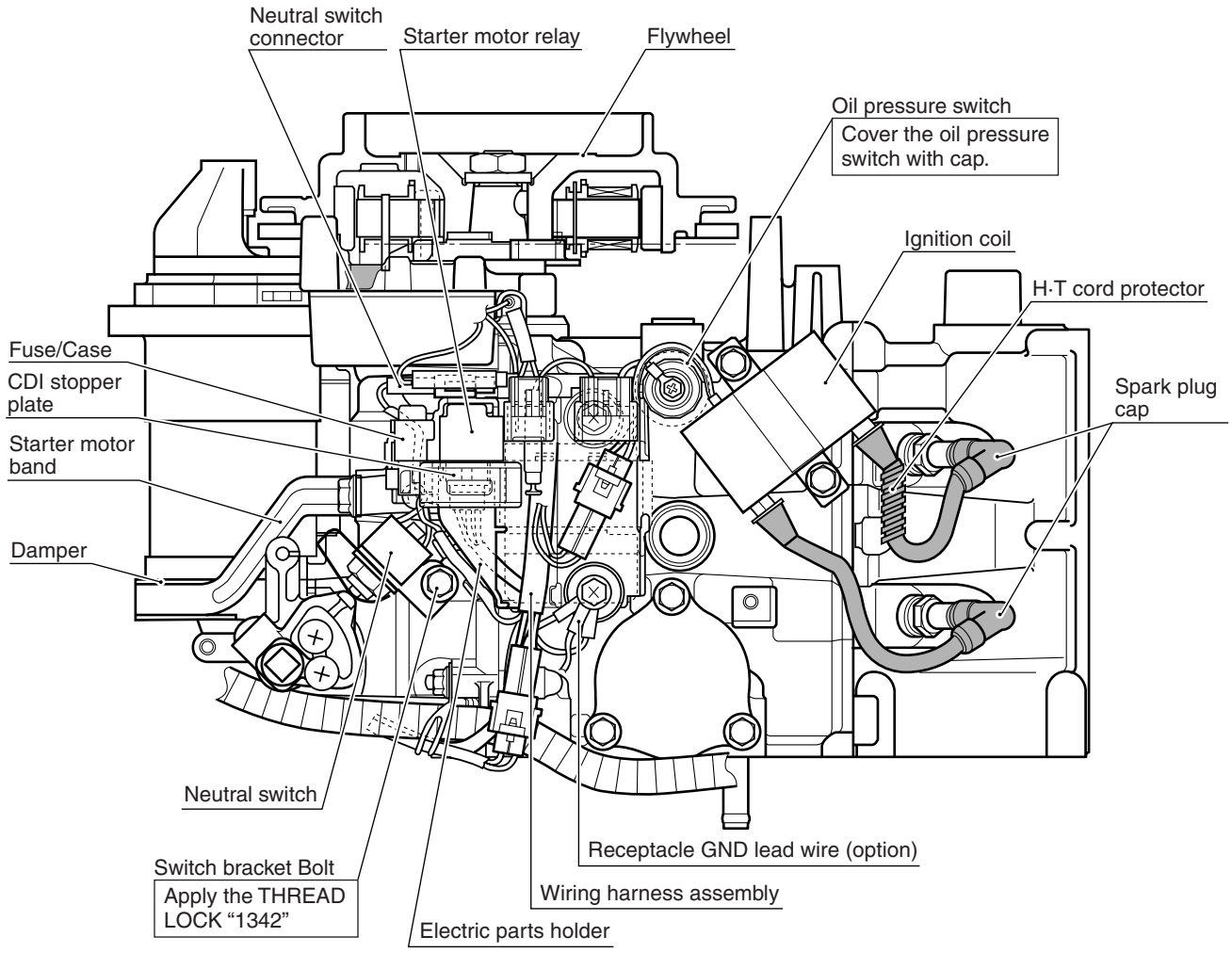
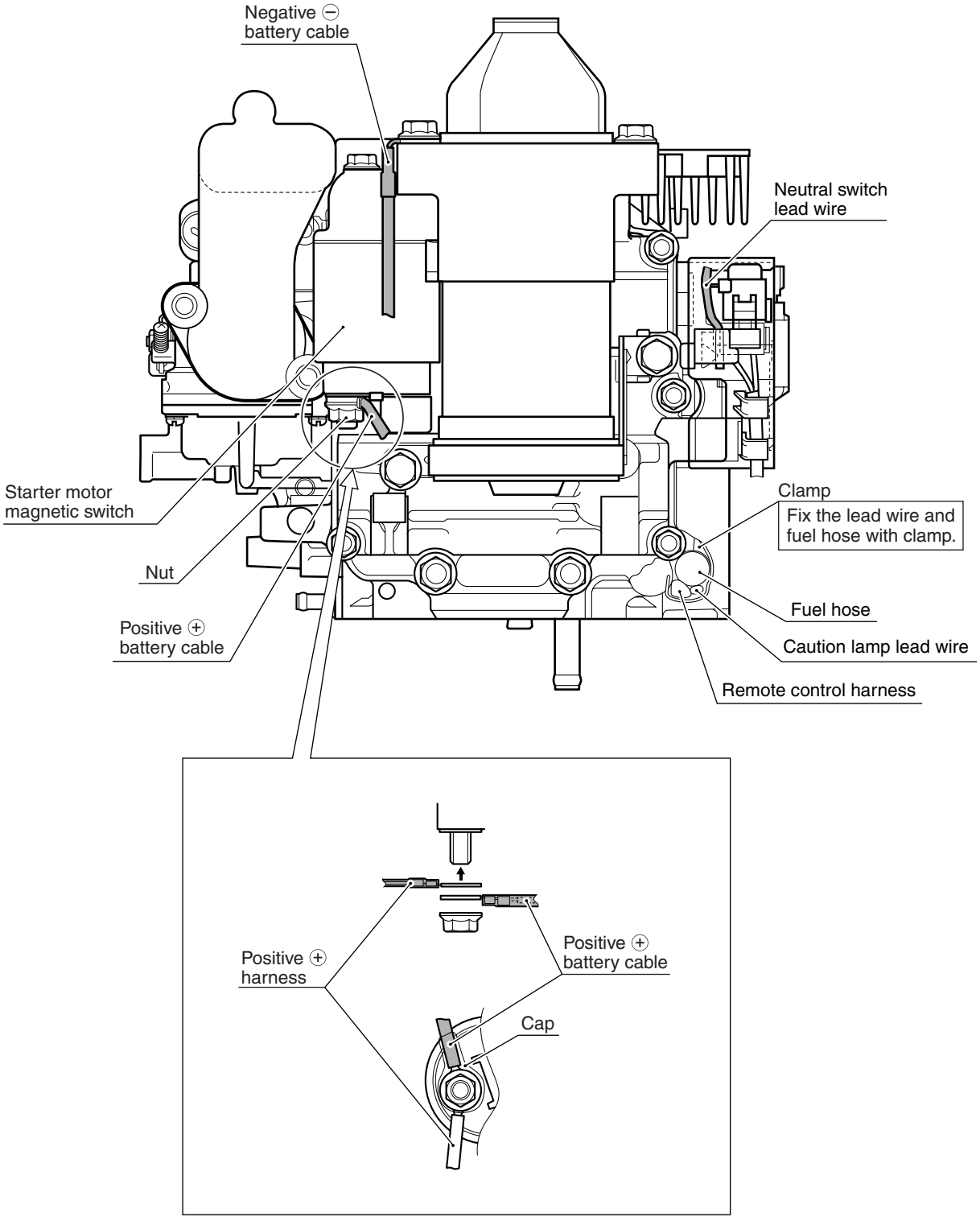
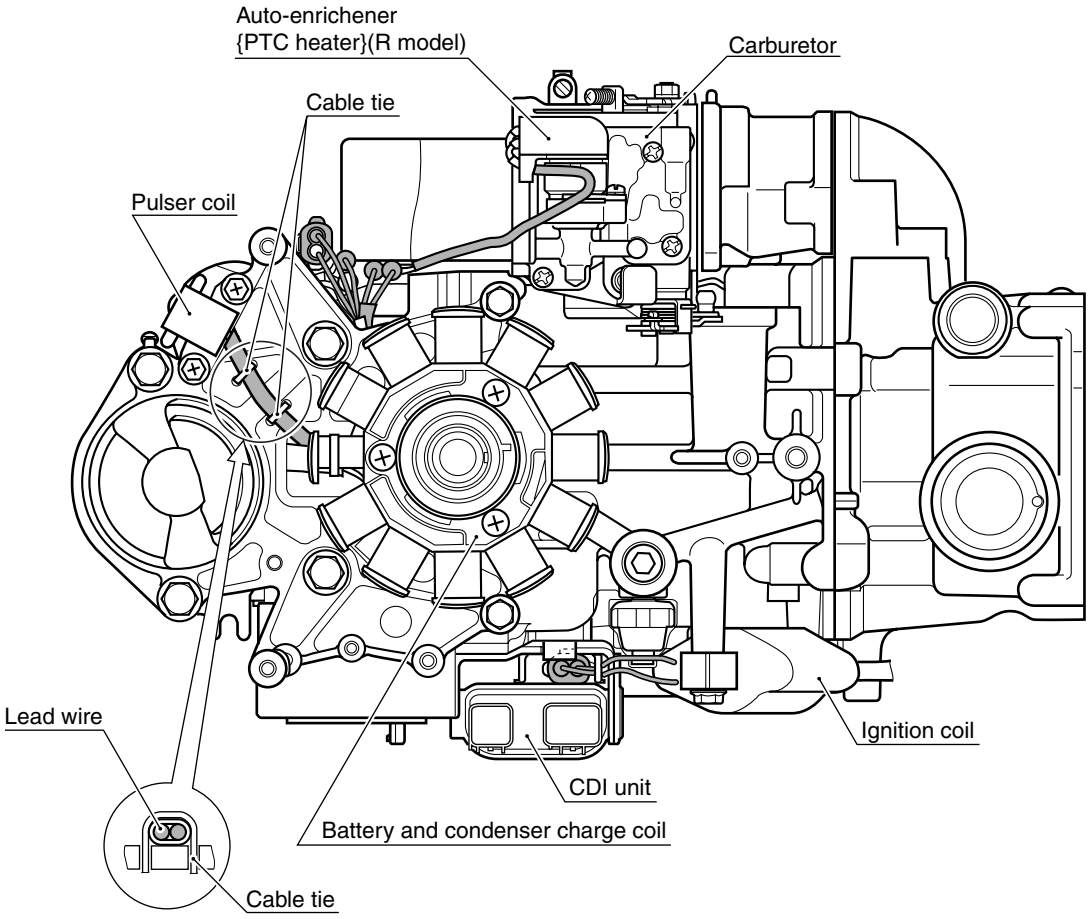
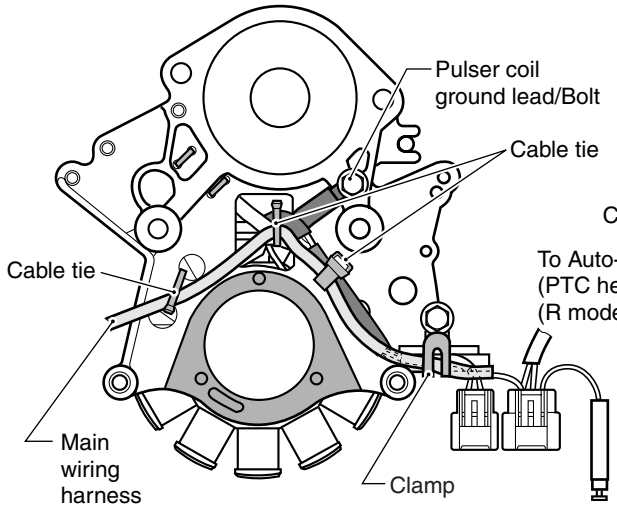


WIRE ROUTING

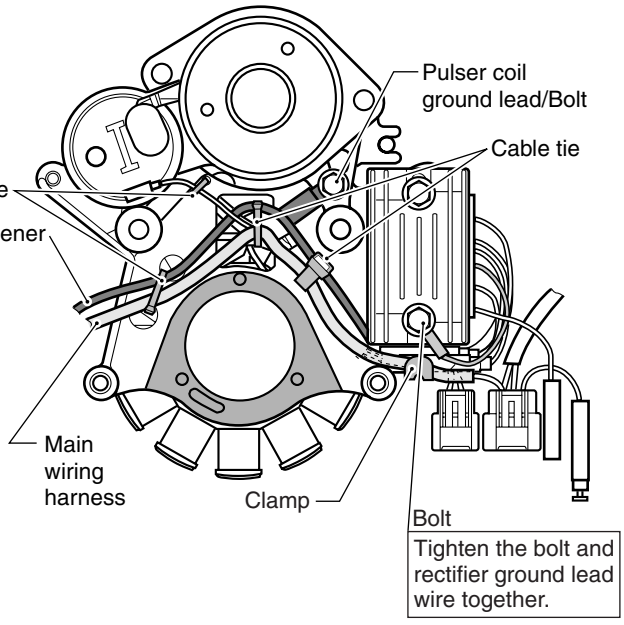






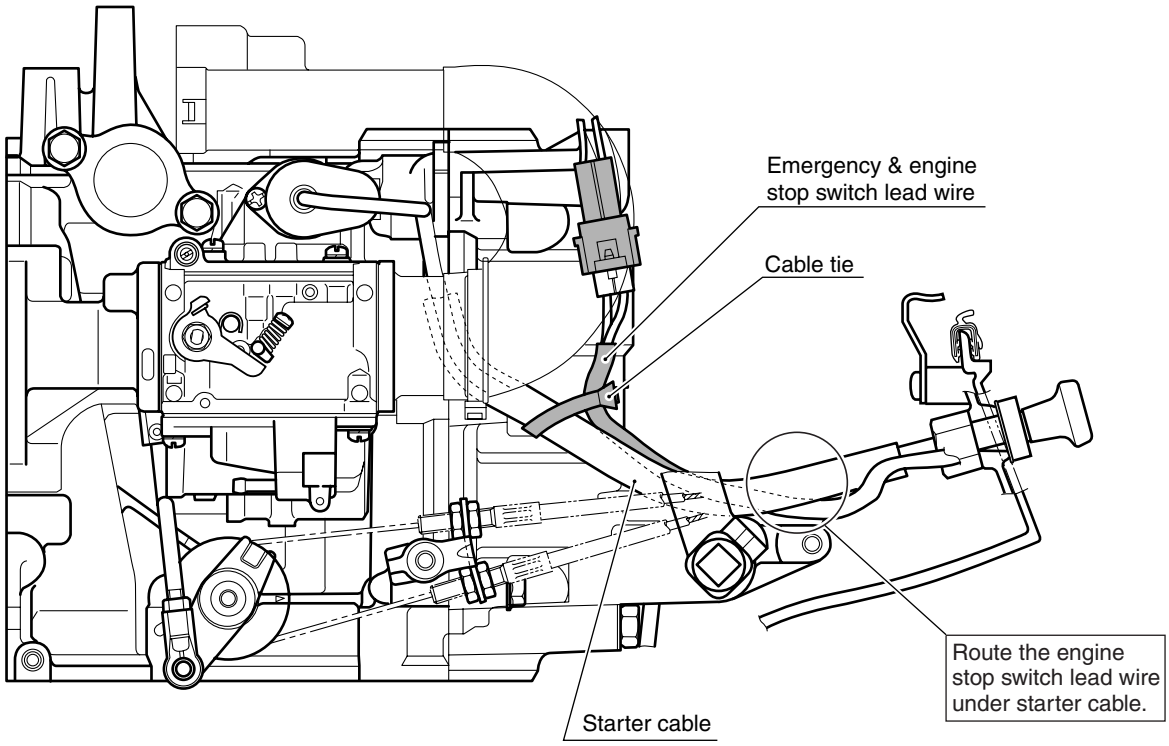


Manual starter model

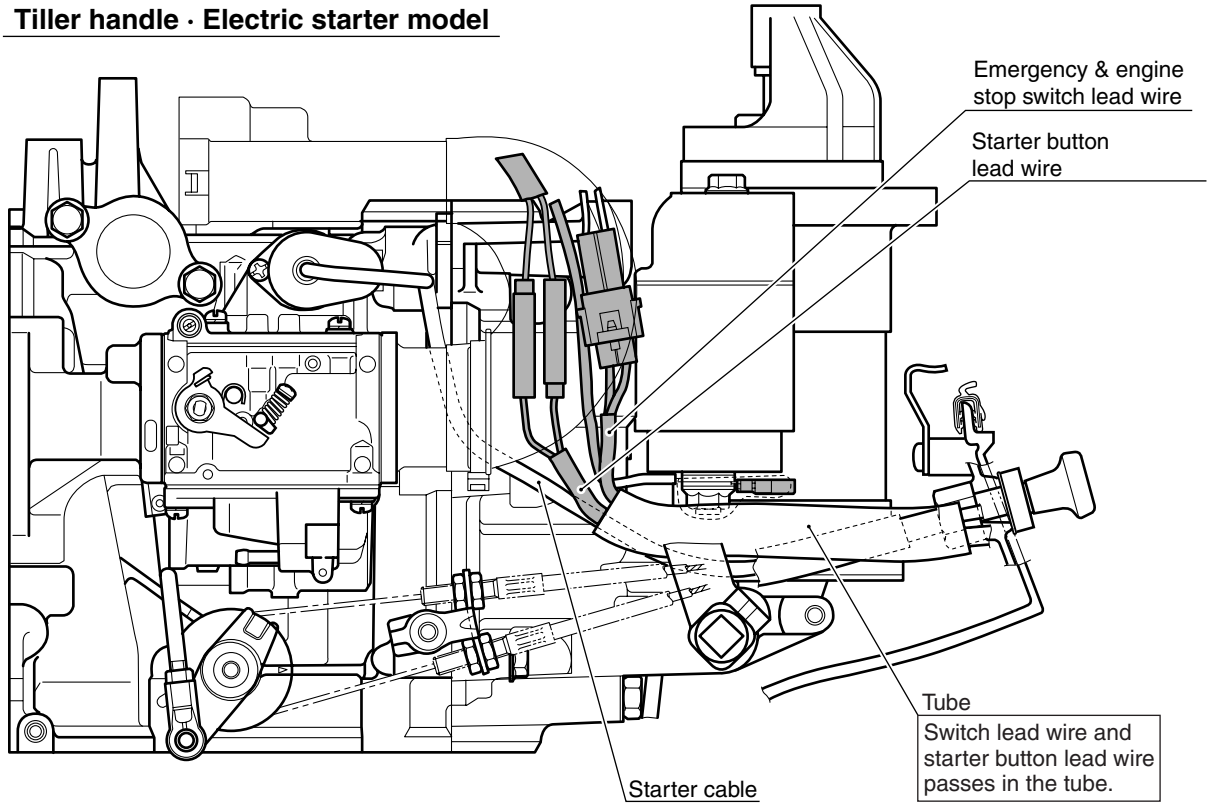


Electric starter model

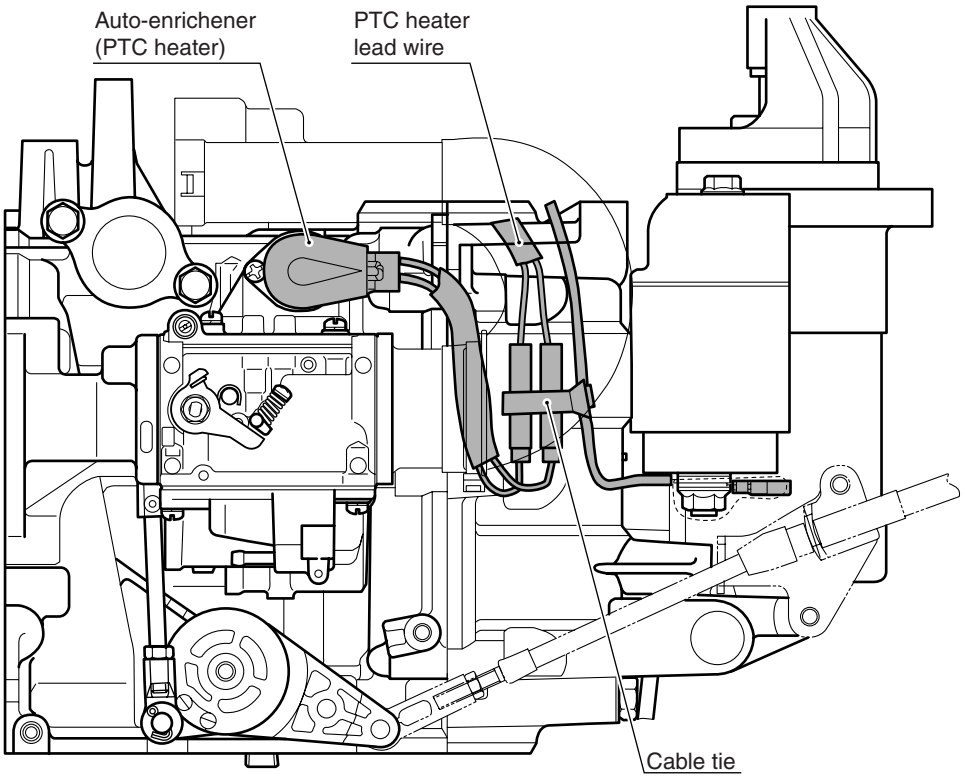
Tiller handle · Manual starter model



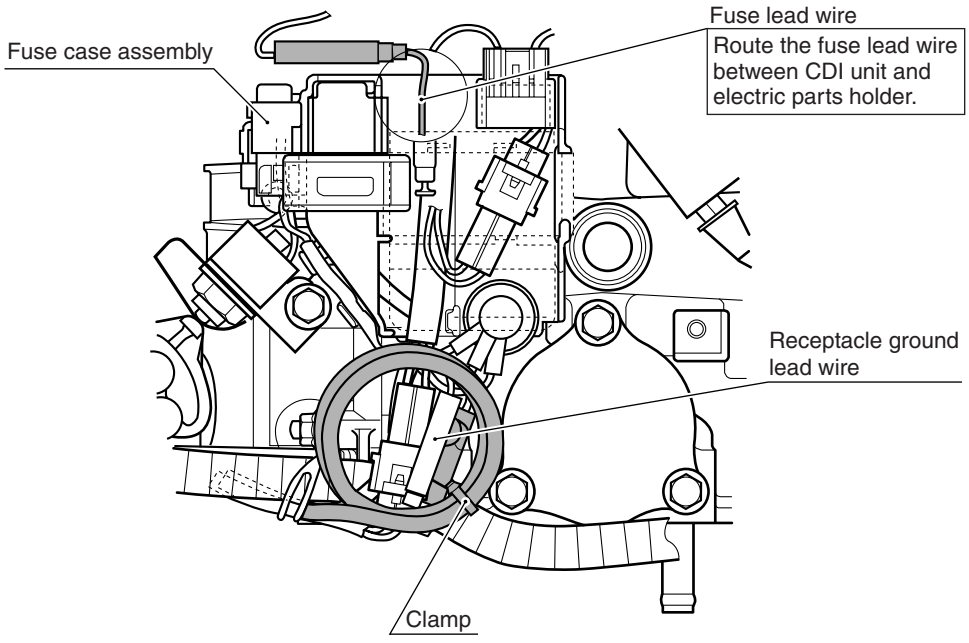
Tiller handle · Electric starter model



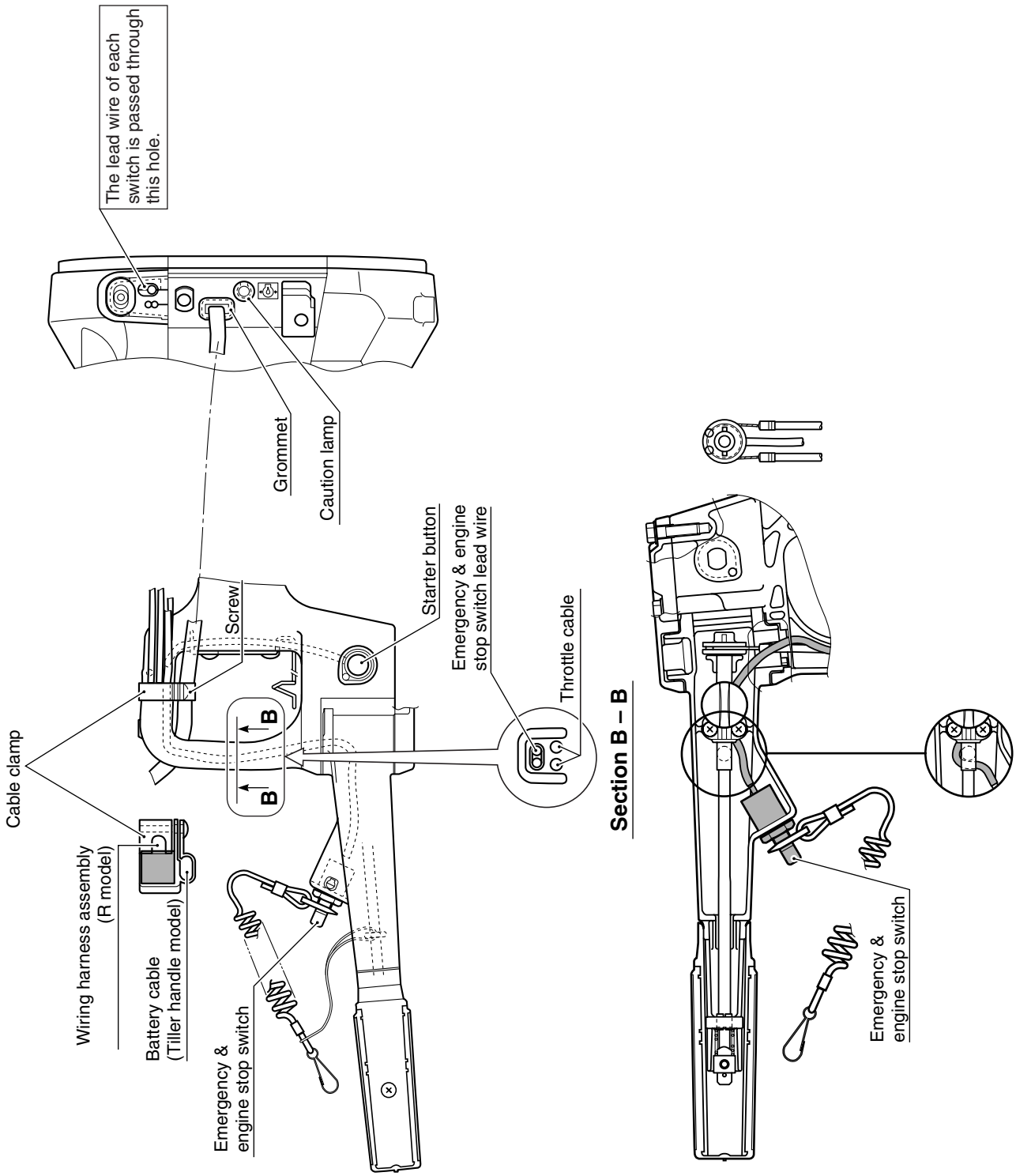
Remote control model



Routing of Receptacle lead wire (Optional part)



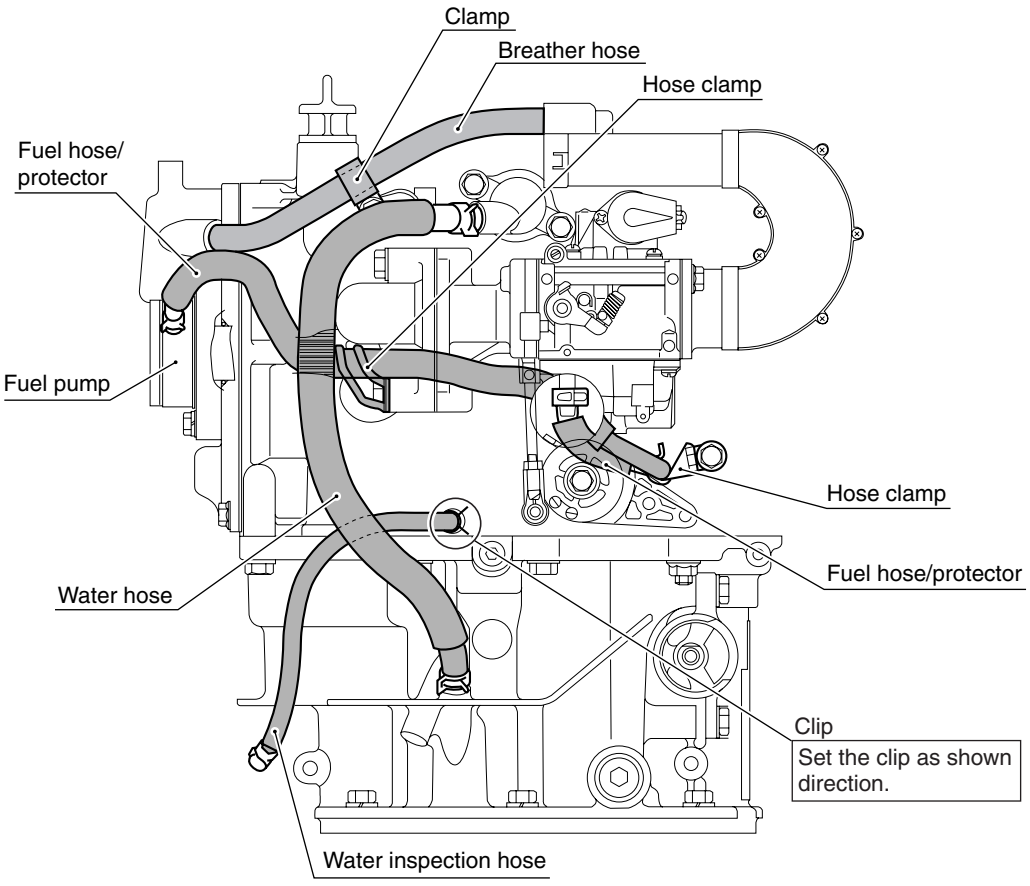
Tiller handle

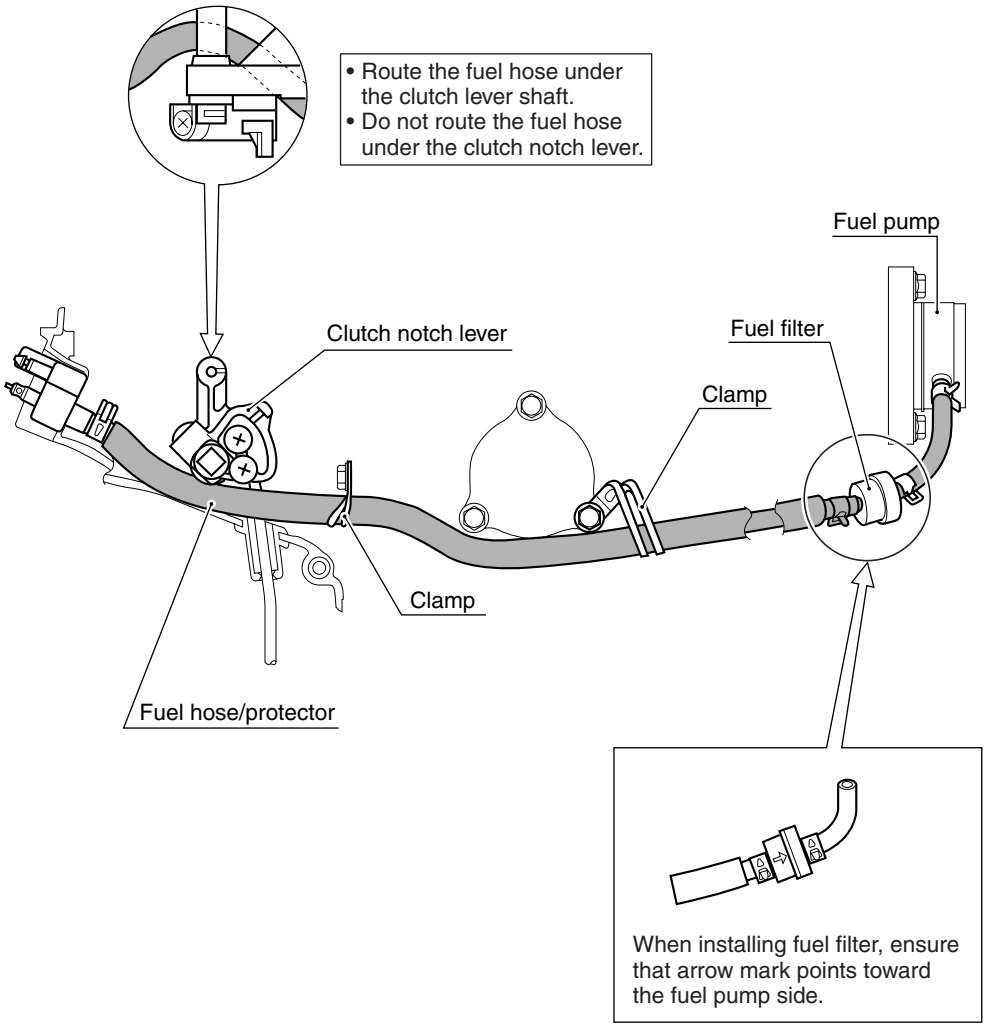


FUEL/WATER HOSE ROUTING

CAUTION

- **Do not over-bend (kink) or twist hoses when installing.**
- **When installing hose clips, position tabs to avoid contact with other parts.**
- **Check that hoses do not contact rods and levers during either engine operation or standstill.**
- **Extreme care should be taken not to cut, abrade or cause any other damage on hoses.**
- **Care should be taken not to cause hoses to be compressed excessively by any clamp when fitted.**





DF9.9/15 "K6" (2006) MODEL

CONTENTS

*SPECIFICATIONS

*: These specifications are subject to change without notice.

Item		Unit	Data					
			DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R
PRE-FIX			00992F			01502F		

DIMENSIONS & WEIGHT

Overall length (front to back)		mm (in)	668 (26.3)					
Overall width (side to side)		mm (in)	323 (12.7)					
Overall height	S	mm (in)	1 093 (43.0)					
	L	mm (in)	1 220 (48.0)					
Weight	S	kg (lbs)	44.0 (97.0)	48.0 (105.6)	47.0 (103.4)	44.0 (97.0)	48.0 (105.6)	47.0 (103.4)
	L	kg (lbs)	45.0 (99.2)	49.0 (107.8)	48.0 (105.6)	45.0 (99.2)	49.0 (107.8)	48.0 (105.6)
Transom height [Trim position: 3]	S	mm (in. type)	422 (15)					
	L	mm (in. type)	549 (20)					

PERFORMANCE

Maximum output	kW (PS)	7.3 (9.9)	11.0 (15)
Recommended operating range	r/min	4 900 – 5 500	5 400 – 6 000
Idle speed	r/min	900 ± 50	
In-gear idle speed	r/min	Approx. 820 – 920	

POWER HEAD

Engine type		4-stroke SOHC				
Number of cylinders		2				
Bore	mm (in)	58.0 (2.28)				
Stroke	mm (in)	57.0 (2.24)				
Total displacement	cm^3 (cu. in)	302 (18.4)				
Compression ratio	:1	9.0				
Spark plug	NGK	BKR6E				
Ignition system		SUZUKI PEI (Digital CDI)				
Fuel supply system		Carburetor (Number of carb.: 1)				
Exhaust system		Through prop exhaust				
Cooling system		Water cooled				
Lubrication system		Wet sump by trochoid pump				
Starting system		Manual	Electric		Manual	Electric
Choke system (Enrichener system)		Manual		Automatic	Manual	Automatic
Throttle control		Twist grip		Remote control	Twist grip	Remote control

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

FUEL & OIL

Fuel		Suzuki highly recommends that you use alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2+M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.
Engine oil		API classification SE, SF, SG, SH, SJ Viscosity rating SAE 10W-40
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Gear oil		SUZUKI Outboard Motor Gear Oil (SAE #90 hypoid gear oil)
Gearcase oil amounts	ml (US/Imp. oz)	170 (5.7/6.0)

BRACKET

Trim angle	Degrees	4 – 20
Number of tilt pin position		5
Maximum tilt angle	Degrees	67

LOWER UNIT

Reversing system	Gear
Transmission	Forward-Neutral-Reverse
Reduction system	Bevel gear
Gear ratio	12 : 25 (2.083)
Drive line impact protection	Spline drive rubber hub
Propeller	Blade × Diam. (in) × Pitch (in) (I.D. No.)
	3 × 9-1/4 × 7 (M701) 3 × 9-1/4 × 9 (M901) 3 × 9-1/4 × 10 (M1001) 3 × 9-1/4 × 11 (M1101) • 3 × 9-1/4 × 8 (M821) • 3 × 9-1/4 × 9 (M911) • 3 × 9-1/4 × 10 (M1011)
• Thick-blade type	

*SERVICE DATA

*: These service data are subject to change without notice.

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

POWERHEAD

Recommended operation range	r/min	4 900 – 5 500	5 400 – 6 000
Idle speed	r/min	900 ± 50 (in-gear: approx. 820 – 920)	
**Cylinder compression	kPa (kg/cm², psi)	550 – 850 (5.5 – 8.5, 78 – 120): With decompression system: DF9.9/15 820 – 1230 (8.2 – 12.3, 116 – 175): Without decompression system: DF9.9E/R, DF15E/R {Crank with recoil starter}	
**Oil pressure [Oil temp. at 60 °C (140 °F)]	kPa (kg/cm², psi)	Min. 200 (2.0, 28) Max. 500 (5.0, 71) at 3 000 r/min	
Engine oil		API classification SE, SF, SG, SH, SJ Viscosity rating SAE 10W-40	
Engine oil amount	L (US/lpm. qt))	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change	
Thermostat operating temperature	°C (°F)	58 – 62 (136 – 144)	

** Figures shown are guidelines only, not absolute service limit.

CYLINDER HEAD/CAMSHAFT

Cylinder head distortion		Limit	mm (in)	0.05 (0.002)
Cam height	IN	STD	mm (in)	23.394 – 23.454 (0.9210 – 0.9234)
		Limit	mm (in)	23.294 (0.9171)
	EX	STD	mm (in)	23.397 – 23.457 (0.9211 – 0.9235)
		Limit	mm (in)	23.297 (0.9172)
Camshaft journal oil clearance		STD	mm (in)	0.020 – 0.062 (0.0008 – 0.0024)
		Limit	mm (in)	0.100 (0.0039)
Camshaft holder inside diameter	Upper	STD	mm (in)	25.000 – 25.021 (0.9843 – 0.9851)
	Lower	STD	mm (in)	23.000 – 23.021 (0.9055 – 0.9063)
Camshaft journal outside diameter	Upper	STD	mm (in)	24.959 – 24.980 (0.9826 – 0.9835)
	Lower	STD	mm (in)	22.959 – 22.980 (0.9039 – 0.9047)
Rocker arm shaft to rocker arm clearance		STD	mm (in)	0.016 – 0.045 (0.0006 – 0.0018)
		Limit	mm (in)	0.060 (0.0024)
Rocker arm inside diameter		STD	mm (in)	13.000 – 13.018 (0.5118 – 0.5125)
Rocker arm shaft outside diameter		STD	mm (in)	12.973 – 12.984 (0.5107 – 0.5112)

Item			Unit	Data					
				DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

VALVE/VALVE GUIDE

Valve diameter	IN	STD	mm (in)	26 (1.0)
	EX	STD	mm (in)	22 (0.9)
Valve clearance (cold engine condition)	IN	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
	EX	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
Valve guide to valve stem clearance	IN	STD	mm (in)	0.010 – 0.037 (0.0004 – 0.0015)
		Limit	mm (in)	0.070 (0.0028)
	EX	STD	mm (in)	0.035 – 0.062 (0.0014 – 0.0024)
		Limit	mm (in)	0.090 (0.0035)
Valve guide inside diameter	IN	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
	EX	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
Valve stem outside diameter	IN	STD	mm (in)	5.475 – 5.490 (0.2156 – 0.2161)
	EX	STD	mm (in)	5.450 – 5.465 (0.2146 – 0.2152)
Valve guide protrusion	IN	STD	mm (in)	10.0 (0.39)
	EX	STD	mm (in)	10.0 (0.39)
Valve stem deflection	IN	Limit	mm (in)	0.16 (0.006)
	EX	Limit	mm (in)	0.16 (0.006)
Valve stem runout	IN	Limit	mm (in)	0.05 (0.002)
	EX	Limit	mm (in)	0.05 (0.002)
Valve head radial runout	IN	Limit	mm (in)	0.03 (0.001)
	EX	Limit	mm (in)	0.03 (0.001)
Valve head thickness	IN	Limit	mm (in)	0.5 (0.02)
	EX	Limit	mm (in)	0.5 (0.02)
Valve seat contact width	IN	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
	EX	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
Valve spring free length		STD	mm (in)	32.52 (1.280)
		Limit	mm (in)	32.40 (1.276)
Valve spring tension		STD	N (kg, lbs)	90 (9.0, 19.8) for 28.5 mm (1.12 in)
		Limit	N (kg, lbs)	76 (7.6, 16.8) for 28.5 mm (1.12 in)

Item			Unit	Data					
				DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

CYLINDER/PISTON/PISTON RING

Cylinder distortion		Limit	mm (in)	0.05 (0.002)
Piston to cylinder clearance		STD	mm (in)	0.0276 – 0.0425 (0.0011 – 0.0017)
		Limit	mm (in)	0.100 (0.0039)
Cylinder bore		STD	mm (in)	58.000 – 58.015 (2.2835 – 2.2841)
Cylinder measuring position			mm (in)	50 (2.0) from cylinder top surface
Piston skirt diameter		STD	mm (in)	57.965 – 57.980 (2.2821 – 2.2827)
Piston measuring position			mm (in)	15 (0.6) from piston skirt end
Wear on cylinder bore		Limit	mm (in)	0.055 (0.0022)
Piston ring end gap	1st	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
	2nd	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
Piston ring free end gap	1st	STD	mm (in)	Approx. 5.8 (0.23)
		Limit	mm (in)	4.6 (0.18)
	2nd	STD	mm (in)	Approx. 7.4 (0.29)
		Limit	mm (in)	5.9 (0.23)
Piston ring to groove clearance	1st	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
	2nd	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
Piston ring groove width	1st	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	2nd	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	Oil	STD	mm (in)	2.51 – 2.53 (0.099 – 0.100)
Piston ring thickness	1st	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
	2nd	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
Pin clearance in piston pin hole		STD	mm (in)	0.002 – 0.013 (0.0001 – 0.0005)
		Limit	mm (in)	0.040 (0.0016)
Piston pin outside diameter		STD	mm (in)	13.995 – 14.000 (0.5510 – 0.5512)
		Limit	mm (in)	13.980 (0.5504)
Piston pin hole diameter		STD	mm (in)	14.002 – 14.008 (0.5513 – 0.5515)
		Limit	mm (in)	14.030 (0.5524)

Item		Unit	Data					
			DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

CRANKSHAFT/CONROD

Conrod small end inside diameter	STD	mm (in)	14.006 – 14.014 (0.5514 – 0.5517)
	Limit	mm (in)	14.040 (0.5528)
Conrod big end oil clearance	STD	mm (in)	0.025 – 0.045 (0.0010 – 0.0018)
	Limit	mm (in)	0.063 (0.0025)
Conrod big end inside diameter	STD	mm (in)	29.025 – 29.034 (1.1427 – 1.1431)
Crank pin outside diameter	STD	mm (in)	28.989 – 29.000 (1.1413 – 1.1417)
Crank pin outside diameter difference	Limit	mm (in)	0.010 (0.0004)
Conrod big end side clearance	STD	mm (in)	0.10 – 0.20 (0.004 – 0.008)
	Limit	mm (in)	0.60 (0.024)
Conrod big end width	STD	mm (in)	19.95 – 20.00 (0.785 – 0.787)
Crank pin width	STD	mm (in)	20.10 – 20.15 (0.791 – 0.793)
Crankshaft thrust clearance	Limit	mm (in)	0.60 (0.024)
Crankshaft length	STD	mm (in)	126.8 – 126.9 (4.992 – 4.996)
Crankcase length	STD	mm (in)	127.0 – 127.1 (5.000 – 5.004)
Crankshaft journal oil clearance	STD	mm (in)	0.020 – 0.047 (0.0008 – 0.0019)
	Limit	mm (in)	0.060 (0.0024)
Crankshaft bearing holder inside diameter	STD	mm (in)	35.000 – 35.016 (1.3780 – 1.3786)
Crankshaft journal outside diameter	STD	mm (in)	31.989 – 32.000 (1.2594 – 1.2598)
Crankshaft journal outside diameter difference	Limit	mm (in)	0.010 (0.0004)
Crankshaft bearing thickness	STD	mm (in)	1.486 – 1.494 (0.0585 – 0.0588)

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

LOWER UNIT

Gearcase oil amounts	ml (US/Imp.oz)	170 (5.7/6.0)
Gear ratio		2.08 (12 : 25)

Preliminary gear shim & thrust washer

Pinion back up shim	mm (in)	1.0 (0.04)
Forward back up shim	mm (in)	1.0 (0.04)
Reverse back up shim	mm (in)	1.0 (0.04)
Forward thrust washer	mm (in)	1.5 (0.06)
Reverse thrust washer	mm (in)	1.5 (0.06)

Initial selection-shim adjustment may be required.

CARBURETOR

Type	KEIHIN	BCMII 23-11.5		BCMII 25-21	
I.D. mark		94J2	94J3	94J6	94J7
Main jet	#	70		115	
Pilot jet	#	38		40	
Pilot screw	Turns open	PRE-SET (1-7/8 ± 1/2)		PRE-SET (2-7/8 ± 1/2)	
Float height	mm	13.5 ± 2		13.5 ± 2	

Item		Unit	Data					
			DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

ELECTRICAL

Ignition timing		Degrees	ATDC 5 – BTDC 30
Over revolution limiter		r/min	Approx. 6 500
Condenser charge coil resistance		Ω at 20 °C	12.5 – 18.8 (G – B/R)
Pulser coil resistance		Ω at 20 °C	148 – 222 (R/B – B)
Ignition coil resistance (without spark plug cap)	Primary	Ω at 20 °C	0.2 – 0.4 (O – B)
	Secondary	kΩ at 20 °C	6.8 – 10.2 (H.T. cord – H.T. cord)
Spark plug cap resistance		kΩ at 20 °C	8 – 12
Battery charge coil resistance		Ω at 20 °C	0.9 – 1.3 (DF9.9/15) (R – Y) 0.3 – 0.4 (DF9.9E/15E/9.9R/15R)
Battery charge coil output (12V)		Watt	80: (DF9.9/15) 120: (DF9.9E/15E/9.9R/15R)
Standard spark plug	Type	NGK	BKR6E
	Gap	mm (in)	0.7 – 0.8 (0.028 – 0.031)
Fuse amp rating		A	20: Electric start model
Recommended battery capacity (12V)		Ah (kC)	35 (126) or over: Electric start model
Starter motor relay coil resistance		Ω at 20 °C	145 – 190: Electric start model

STARTER MOTOR (only for Electric start model)

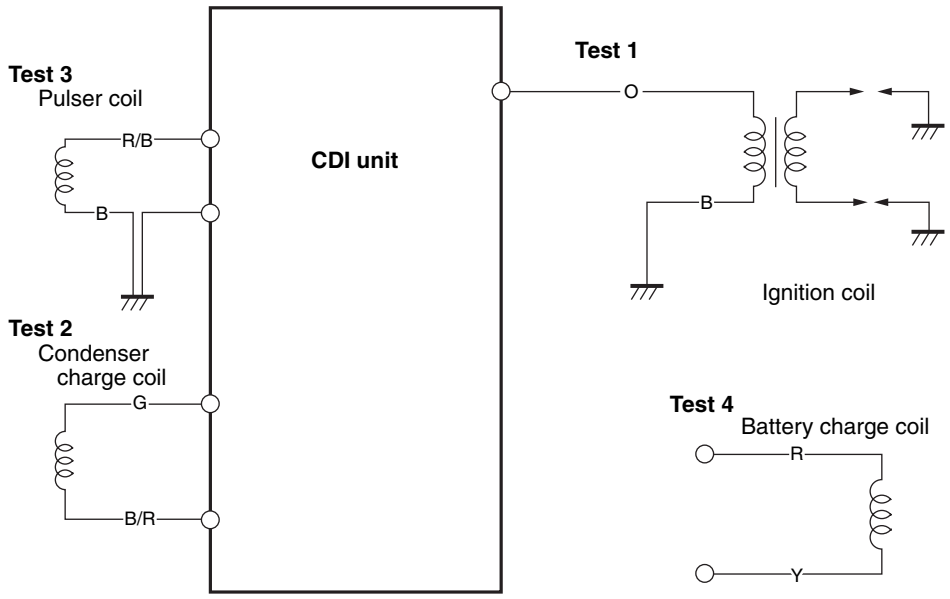
Max. continuous time of use		Sec.	30
Motor output		kW	1.4
Brush length	STD	mm (in)	15.5 (0.61)
	Limit	mm (in)	9.5 (0.37)
Commutator undercut	STD	mm (in)	0.5 – 0.8 (0.02 – 0.03)
	Limit	mm (in)	0.2 (0.01)
Commutator outside diameter	STD	mm (in)	29.0 (1.14)
	Limit	mm (in)	28.0 (1.10)
Commutator outside diameter difference	STD	mm (in)	0.05 (0.002)
	Limit	mm (in)	0.40 (0.016)

PEAK VOLTAGE

Requirements for peak voltage measurement

- Remove all spark plugs to eliminate the variables at cranking speed.
- Crank with recoil starter.
- Use a STEVENS peak voltage tester, Model CD-77.
- Use the 6-pin connector test cord (Part No. 09930-89920).

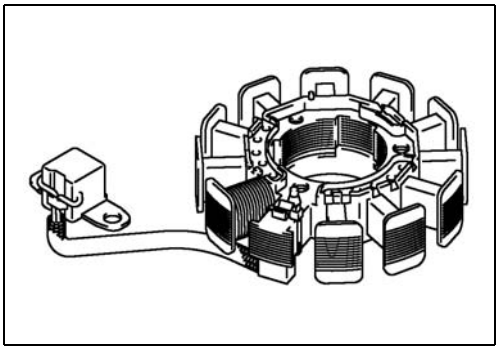
Testing sequence		Tester probe connection		Peak voltage	Tester range	Remarks
		⊕ (Red)	⊖ (Black)			
1	CDI output	Orange	Black	128 V or over	NEG 500	• With ignition coil connected • Use the 6-pin connector test cord.
2	Condenser charge coil output	Green	Black/Red	15 V or over	POS 50	With CDI unit disconnected
3	Pulser coil output	Red/Black	Black (Ground)	0.8 V or over	SEN 5	
4	Battery charge coil output	Red	Yellow	5.6 V or over	POS 50	With rectifier disconnected



BATTERY CHARGE COIL

For DF9.9E/DF15E (Electric Start Model)

The battery charge coil out put for DF9.9E and DF15E has been changed from 12 V 80 W to 12 V 120 W.



BATTERY CHARGE COIL RESISTANCE

09930-99320: Digital tester

Tester range: Ω (Resistance)

1. Disconnect the battery charge coil wires from the rectifier.
2. Connect tester probe to battery charge coil lead wires as shown.

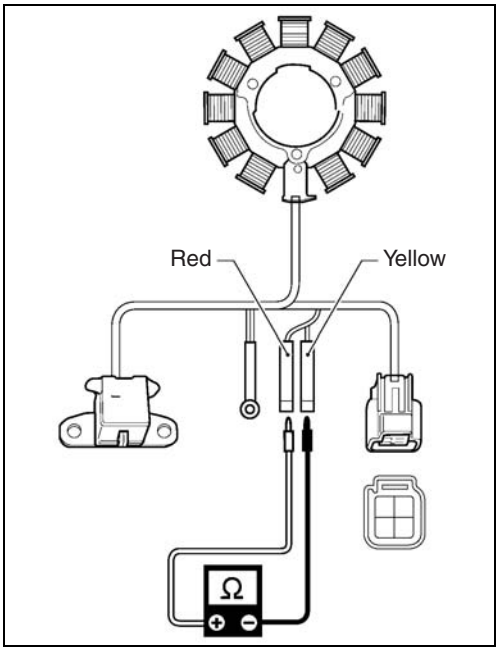
Tester probe connection	
Probe	**Other probe**
Red	Yellow

Coil resistance:

0.9 – 1.3 Ω {80 W coil: DF9.9/15}

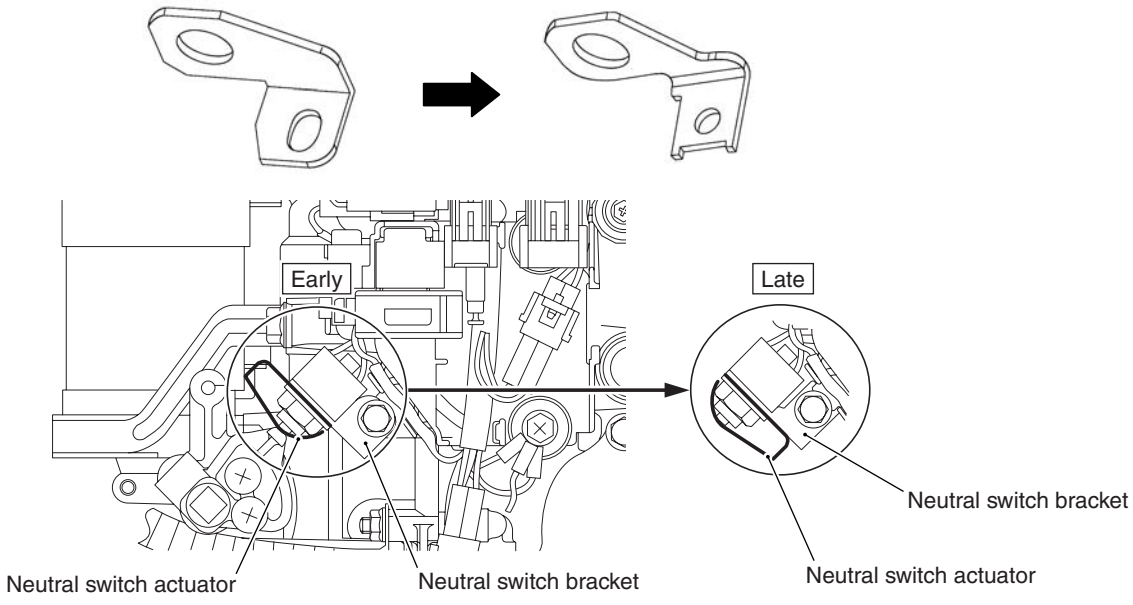
0.3 – 0.4 Ω {120 W coil: DF9.9E/15E/9.9R/15R}

If measurement is out of specification, replace the battery charge coil.



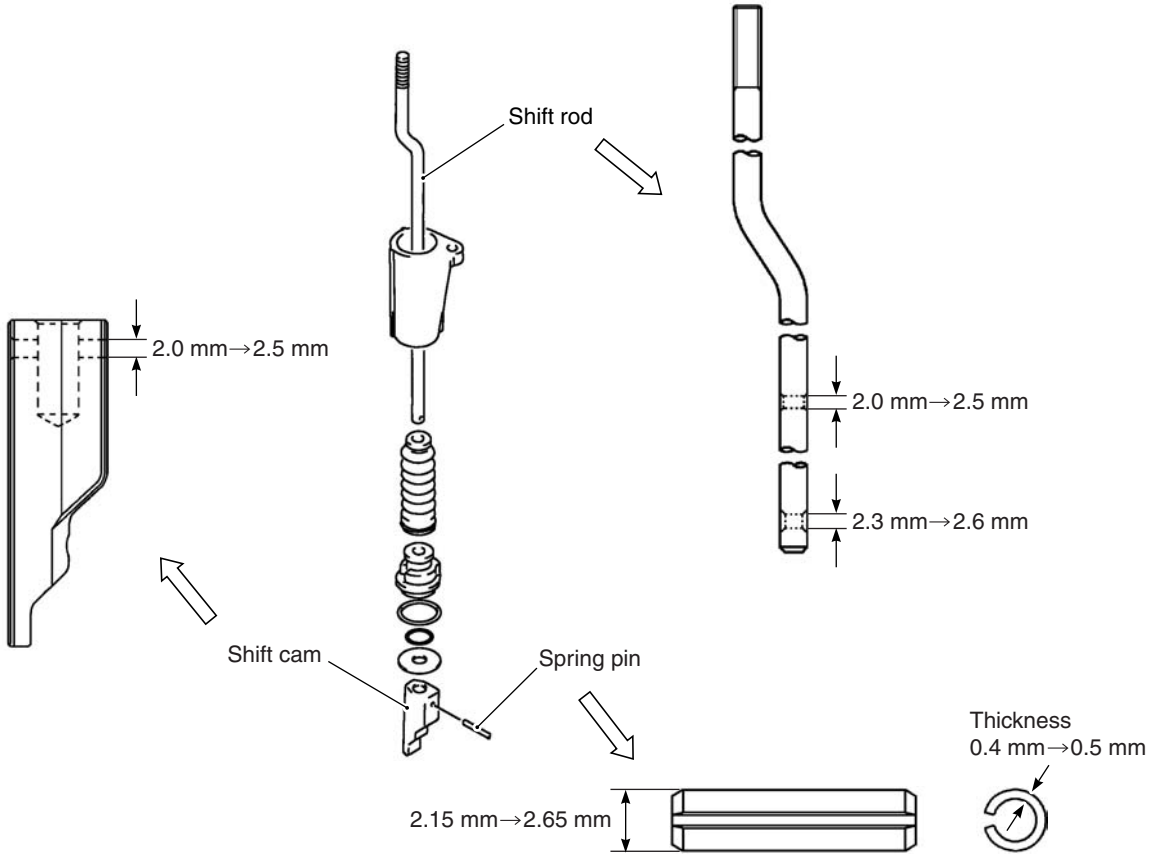
NEUTRAL SWITCH BRACKET

The neutral switch bracket has been changed in shape.
In accordance with this change, the direction of installation of neutral switch actuator has been changed.



SHIFT CAM SPRING PIN, SHIFT CAM AND SHIFT ROD

The diameter of shift cam spring pin has been changed from 2.15 mm to 2.65 mm.
The thickness of shift cam spring pin has been changed, 0.4 to 0.5.
In accordance with this change, the pin hole diameter of shift cam and shift rod has been changed.



DF9.9/15 "K7" (2007) MODEL

CONTENTS

*SPECIFICATIONS

*: These specifications are subject to change without notice.

Item		Unit	Data					
			DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R
PRE-FIX			00992F			01502F		

DIMENSIONS & WEIGHT

Overall length (front to back)		mm (in)	668 (26.3)					
Overall width (side to side)		mm (in)	323 (12.7)					
Overall height	S	mm (in)	1 093 (43.0)					
	L	mm (in)	1 220 (48.0)					
Weight	S	kg (lbs)	44.0 (97.0)	48.0 (105.6)	47.0 (103.4)	44.0 (97.0)	48.0 (105.6)	47.0 (103.4)
	L	kg (lbs)	45.0 (99.2)	49.0 (107.8)	48.0 (105.6)	45.0 (99.2)	49.0 (107.8)	48.0 (105.6)
Transom height [Trim position: 3]	S	mm (in. type)	422 (15)					
	L	mm (in. type)	549 (20)					

PERFORMANCE

Maximum output	kW (PS)	7.3 (9.9)	11.0 (15)
Recommended operating range	r/min	4 900 – 5 500	5 400 – 6 000
Idle speed	r/min	900 ± 50	
In-gear idle speed	r/min	Approx. 820 – 920	

POWER HEAD

Engine type		4-stroke SOHC				
Number of cylinders		2				
Bore	mm (in)	58.0 (2.28)				
Stroke	mm (in)	57.0 (2.24)				
Total displacement	cm^3 (cu. in)	302 (18.4)				
Compression ratio	:1	9.0				
Spark plug	NGK	BKR6E				
Ignition system		SUZUKI PEI (Digital CDI)				
Fuel supply system		Carburetor (Number of carb.: 1)				
Exhaust system		Through prop exhaust				
Cooling system		Water cooled				
Lubrication system		Wet sump by trochoid pump				
Starting system		Manual	Electric		Manual	Electric
Choke system (Enrichener system)		Manual		Automatic	Manual	Automatic
Throttle control		Twist grip		Remote control	Twist grip	Remote control

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

FUEL & OIL

Fuel		Suzuki highly recommends that you use alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2+M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.
Engine oil		API classification SE, SF, SG, SH, SJ Viscosity rating SAE 10W-40
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Gear oil		SUZUKI Outboard Motor Gear Oil (SAE #90 hypoid gear oil)
Gearcase oil amounts	ml (US/Imp. oz)	170 (5.7/6.0)

BRACKET

Trim angle	Degrees	4 – 20
Number of tilt pin position		5
Maximum tilt angle	Degrees	67

LOWER UNIT

Reversing system	Gear
Transmission	Forward-Neutral-Reverse
Reduction system	Bevel gear
Gear ratio	12 : 25 (2.083)
Drive line impact protection	Spline drive rubber hub
Propeller	Blade × Diam. (in) × Pitch (in)
	3 × 9-1/4 × 7 (M701) 3 × 9-1/4 × 9 (M901) 3 × 9-1/4 × 10 (M1001) 3 × 9-1/4 × 11 (M1101) • 3 × 9-1/4 × 8 (M821) • 3 × 9-1/4 × 9 (M911) • 3 × 9-1/4 × 10 (M1011)
• Thick-blade type	

*SERVICE DATA

*: These service data are subject to change without notice.

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

POWERHEAD

Recommended operation range	r/min	4 900 – 5 500	5 400 – 6 000
Idle speed	r/min	900 ± 50 (in-gear: approx. 820 – 920)	
**Cylinder compression	kPa (kg/cm^2, psi)	550 – 850 (5.5 – 8.5, 78 – 120): With decompression system: DF9.9/15 820 – 1230 (8.2 – 12.3, 116 – 175): Without decompression system: DF9.9E/R, DF15E/R {Crank with recoil starter}	
**Oil pressure [Oil temp. at 60 °C (140 °F)]	kPa (kg/cm^2, psi)	Min. 200 (2.0, 28) Max. 500 (5.0, 71) at 3 000 r/min	
Engine oil		API classification SE, SF, SG, SH, SJ Viscosity rating SAE 10W-40	
Engine oil amount	L (US/lpm. qt))	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change	
Thermostat operating temperature	°C (°F)	58 – 62 (136 – 144)	

** Figures shown are guidelines only, not absolute service limit.

CYLINDER HEAD/CAMSHAFT

Cylinder head distortion		Limit	mm (in)	0.05 (0.002)
Cam height	IN	STD	mm (in)	23.394 – 23.454 (0.9210 – 0.9234)
		Limit	mm (in)	23.294 (0.9171)
	EX	STD	mm (in)	23.397 – 23.457 (0.9211 – 0.9235)
		Limit	mm (in)	23.297 (0.9172)
Camshaft journal oil clearance		STD	mm (in)	0.020 – 0.062 (0.0008 – 0.0024)
		Limit	mm (in)	0.100 (0.0039)
Camshaft holder inside diameter	Upper	STD	mm (in)	25.000 – 25.021 (0.9843 – 0.9851)
	Lower	STD	mm (in)	23.000 – 23.021 (0.9055 – 0.9063)
Camshaft journal outside diameter	Upper	STD	mm (in)	24.959 – 24.980 (0.9826 – 0.9835)
	Lower	STD	mm (in)	22.959 – 22.980 (0.9039 – 0.9047)
Rocker arm shaft to rocker arm clearance		STD	mm (in)	0.016 – 0.045 (0.0006 – 0.0018)
		Limit	mm (in)	0.060 (0.0024)
Rocker arm inside diameter		STD	mm (in)	13.000 – 13.018 (0.5118 – 0.5125)
Rocker arm shaft outside diameter		STD	mm (in)	12.973 – 12.984 (0.5107 – 0.5112)

Item			Unit	Data					
				DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

VALVE/VALVE GUIDE

Valve diameter	IN	STD	mm (in)	26 (1.0)
	EX	STD	mm (in)	22 (0.9)
Valve clearance (cold engine condition)	IN	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
	EX	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
Valve guide to valve stem clearance	IN	STD	mm (in)	0.010 – 0.037 (0.0004 – 0.0015)
		Limit	mm (in)	0.070 (0.0028)
	EX	STD	mm (in)	0.035 – 0.062 (0.0014 – 0.0024)
		Limit	mm (in)	0.090 (0.0035)
Valve guide inside diameter	IN	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
	EX	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
Valve stem outside diameter	IN	STD	mm (in)	5.475 – 5.490 (0.2156 – 0.2161)
	EX	STD	mm (in)	5.450 – 5.465 (0.2146 – 0.2152)
Valve guide protrusion	IN	STD	mm (in)	10.0 (0.39)
	EX	STD	mm (in)	10.0 (0.39)
Valve stem deflection	IN	Limit	mm (in)	0.16 (0.006)
	EX	Limit	mm (in)	0.16 (0.006)
Valve stem runout	IN	Limit	mm (in)	0.05 (0.002)
	EX	Limit	mm (in)	0.05 (0.002)
Valve head radial runout	IN	Limit	mm (in)	0.03 (0.001)
	EX	Limit	mm (in)	0.03 (0.001)
Valve head thickness	IN	Limit	mm (in)	0.5 (0.02)
	EX	Limit	mm (in)	0.5 (0.02)
Valve seat contact width	IN	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
	EX	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
Valve spring free length		STD	mm (in)	32.52 (1.280)
		Limit	mm (in)	32.40 (1.276)
Valve spring tension		STD	N (kg, lbs)	90 (9.0, 19.8) for 28.5 mm (1.12 in)
		Limit	N (kg, lbs)	76 (7.6, 16.8) for 28.5 mm (1.12 in)

Item			Unit	Data					
				DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

CYLINDER/PISTON/PISTON RING

Cylinder distortion		Limit	mm (in)	0.05 (0.002)
Piston to cylinder clearance		STD	mm (in)	0.0276 – 0.0425 (0.0011 – 0.0017)
		Limit	mm (in)	0.100 (0.0039)
Cylinder bore		STD	mm (in)	58.000 – 58.015 (2.2835 – 2.2841)
Cylinder measuring position			mm (in)	50 (2.0) from cylinder top surface
Piston skirt diameter		STD	mm (in)	57.965 – 57.980 (2.2821 – 2.2827)
Piston measuring position			mm (in)	15 (0.6) from piston skirt end
Wear on cylinder bore		Limit	mm (in)	0.055 (0.0022)
Piston ring end gap	1st	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
	2nd	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
Piston ring free end gap	1st	STD	mm (in)	Approx. 5.8 (0.23)
		Limit	mm (in)	4.6 (0.18)
	2nd	STD	mm (in)	Approx. 7.4 (0.29)
		Limit	mm (in)	5.9 (0.23)
Piston ring to groove clearance	1st	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
	2nd	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
Piston ring groove width	1st	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	2nd	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	Oil	STD	mm (in)	2.51 – 2.53 (0.099 – 0.100)
Piston ring thickness	1st	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
	2nd	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
Pin clearance in piston pin hole		STD	mm (in)	0.002 – 0.013 (0.0001 – 0.0005)
		Limit	mm (in)	0.040 (0.0016)
Piston pin outside diameter		STD	mm (in)	13.995 – 14.000 (0.5510 – 0.5512)
		Limit	mm (in)	13.980 (0.5504)
Piston pin hole diameter		STD	mm (in)	14.002 – 14.008 (0.5513 – 0.5515)
		Limit	mm (in)	14.030 (0.5524)

Item		Unit	Data					
			DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

CRANKSHAFT/CONROD

Conrod small end inside diameter	STD	mm (in)	14.006 – 14.014 (0.5514 – 0.5517)
	Limit	mm (in)	14.040 (0.5528)
Conrod big end oil clearance	STD	mm (in)	0.025 – 0.045 (0.0010 – 0.0018)
	Limit	mm (in)	0.063 (0.0025)
Conrod big end inside diameter	STD	mm (in)	29.025 – 29.034 (1.1427 – 1.1431)
Crank pin outside diameter	STD	mm (in)	28.989 – 29.000 (1.1413 – 1.1417)
Crank pin outside diameter difference	Limit	mm (in)	0.010 (0.0004)
Conrod big end side clearance	STD	mm (in)	0.10 – 0.20 (0.004 – 0.008)
	Limit	mm (in)	0.60 (0.024)
Conrod big end width	STD	mm (in)	19.95 – 20.00 (0.785 – 0.787)
Crank pin width	STD	mm (in)	20.10 – 20.15 (0.791 – 0.793)
Crankshaft thrust clearance	Limit	mm (in)	0.60 (0.024)
Crankshaft length	STD	mm (in)	126.8 – 126.9 (4.992 – 4.996)
Crankcase length	STD	mm (in)	127.0 – 127.1 (5.000 – 5.004)
Crankshaft journal oil clearance	STD	mm (in)	0.020 – 0.047 (0.0008 – 0.0019)
	Limit	mm (in)	0.060 (0.0024)
Crankshaft bearing holder inside diameter	STD	mm (in)	35.000 – 35.016 (1.3780 – 1.3786)
Crankshaft journal outside diameter	STD	mm (in)	31.989 – 32.000 (1.2594 – 1.2598)
Crankshaft journal outside diameter difference	Limit	mm (in)	0.010 (0.0004)
Crankshaft bearing thickness	STD	mm (in)	1.486 – 1.494 (0.0585 – 0.0588)

Item	Unit	Data					
		DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

LOWER UNIT

Gearcase oil amounts	ml (US/Imp.oz)	170 (5.7/6.0)
Gear ratio		2.08 (12 : 25)

Preliminary gear shim & thrust washer

Pinion back up shim	mm (in)	1.0 (0.04)
Forward back up shim	mm (in)	1.0 (0.04)
Reverse back up shim	mm (in)	1.0 (0.04)
Forward thrust washer	mm (in)	1.5 (0.06)
Reverse thrust washer	mm (in)	1.5 (0.06)

Initial selection-shim adjustment may be required.

CARBURETOR

Type	KEIHIN	BCMII 23-11.5		BCMII 25-21	
I.D. mark		94J2	94J3	94J6	94J7
Main jet	#	70		115	
Pilot jet	#	38		40	
Pilot screw	Turns open	PRE-SET (1-7/8 ± 1/2)		PRE-SET (2-7/8 ± 1/2)	
Float height	mm	13.5 ± 2		13.5 ± 2	

Item		Unit	Data					
			DF9.9	DF9.9E	DF9.9R	DF15	DF15E	DF15R

ELECTRICAL

Ignition timing		Degrees	ATDC 5 – BTDC 30
Over revolution limiter		r/min	Approx. 6 500
Condenser charge coil resistance		Ω at 20 °C	12.5 – 18.8 (G – B/R)
Pulser coil resistance		Ω at 20 °C	148 – 222 (R/B – B)
Ignition coil resistance (without spark plug cap)	Primary	Ω at 20 °C	0.2 – 0.4 (O – B)
	Secondary	kΩ at 20 °C	6.8 – 10.2 (H.T. cord – H.T. cord)
Spark plug cap resistance		kΩ at 20 °C	8 – 12
Battery charge coil resistance		Ω at 20 °C	0.9 – 1.3 (DF9.9/15) (R – Y) 0.3 – 0.4 (DF9.9E/15E/9.9R/15R)
Battery charge coil output (12V)		Watt	80: (DF9.9/15) 120: (DF9.9E/15E/9.9R/15R)
Standard spark plug	Type	NGK	BKR6E
	Gap	mm (in)	0.7 – 0.8 (0.028 – 0.031)
Fuse amp rating		A	20: Electric start model
Recommended battery capacity (12V)		Ah (kC)	35 (126) or over: Electric start model
Starter motor relay coil resistance		Ω at 20 °C	145 – 190: Electric start model

STARTER MOTOR (only for Electric start model)

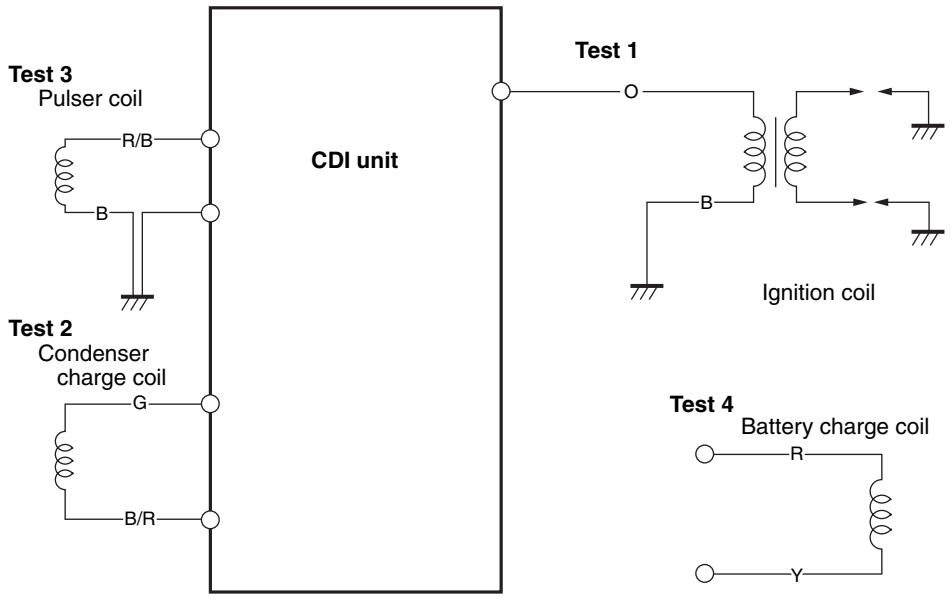
Max. continuous time of use		Sec.	30
Motor output		kW	1.4
Brush length	STD	mm (in)	15.5 (0.61)
	Limit	mm (in)	9.5 (0.37)
Commutator undercut	STD	mm (in)	0.5 – 0.8 (0.02 – 0.03)
	Limit	mm (in)	0.2 (0.01)
Commutator outside diameter	STD	mm (in)	29.0 (1.14)
	Limit	mm (in)	28.0 (1.10)
Commutator outside diameter difference	STD	mm (in)	0.05 (0.002)
	Limit	mm (in)	0.40 (0.016)

PEAK VOLTAGE

Requirements for peak voltage measurement

- Remove all spark plugs to eliminate the variables at cranking speed.
- Crank with recoil starter.
- Use a STEVENS peak voltage tester, Model CD-77.
- Use the 6-pin connector test cord (Part No. 09930-89920).

Testing sequence		Tester probe connection		Peak voltage	Tester range	Remarks
		⊕ (Red)	⊖ (Black)			
1	CDI output	Orange	Black	128 V or over	NEG 500	• With ignition coil connected • Use the 6-pin connector test cord.
2	Condenser charge coil output	Green	Black/Red	15 V or over	POS 50	With CDI unit disconnected
3	Pulser coil output	Red/Black	Black (Ground)	0.8 V or over	SEN 5	
4	Battery charge coil output	Red	Yellow	5.6 V or over	POS 50	With rectifier disconnected



TIGHTENING TORQUE

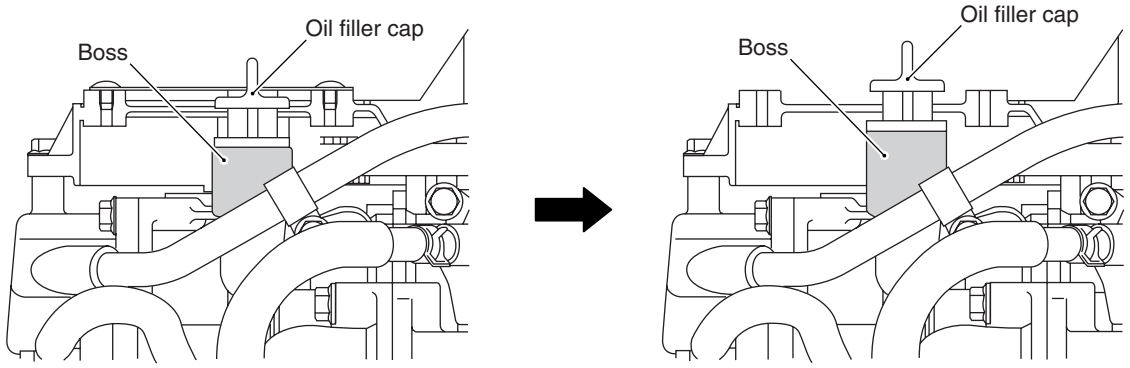
Tightening torque – Important fasteners

* Tightening torque has been changed from the 2007 year model.

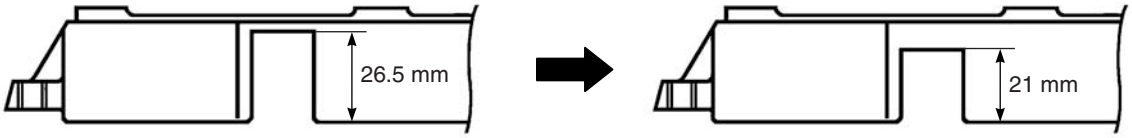
ITEM	THREAD DIAM.	TIGHTENING TORQUE		
		N·m	kg-m	lb-ft
Cylinder head cover bolt	6 mm	10	1.0	7.0
Cylinder head bolt	8 mm	27	2.7	20.0
Crankcase bolt	6 mm	14	1.4	10.0
	8 mm	25	2.5	18.0
Conrod cap bolt	7 mm	12	1.2	8.5
Oil pump bolt	6 mm	14	1.4	10.0
Oil pump gallery bolt	6 mm	14	1.4	10.0
Intake manifold bolt	8 mm	23	2.3	16.5
Carburetor mounting bolt	6 mm	10	1.0	7.0
Fuel pump bolt	6 mm	10	1.0	7.0
Thermostat cover bolt	6 mm	10	1.0	7.0
Valve adjusting lock nut	5 mm	11	1.1	8.0
Timing pulley nut	26 mm	50	5.0	36.0
Flywheel nut	14 mm	80	8.0	58.0
Spark plug	—	27	2.7	19.5
Power unit mounting bolt and nut	8 mm	23	2.3	16.5
Driveshaft housing bolt	8 mm	17	1.7	12.5
Oil pressure switch	—	13	1.3	9.5
Oil regulator	14 mm	27	2.7	19.5
Camshaft pulley bolt	6 mm	10	1.0	7.0
Engine oil drain plug	12 mm	13	1.3	9.5
Upper mount bolt	8 mm	23	2.3	16.5
Upper mount bracket bolt	8 mm	23	2.3	16.5
Lower mount cover bolt	8 mm	23	2.3	16.5
Lower mount bolt	8 mm	23	2.3	16.5
Clamp bracket shaft nut	7/8-14 UNF	43	4.3	31.0
Shallow drive arm bolt	10 mm	25	2.5	18.0
Tiller handle cover bolt	8 mm	17	1.7	12.5
Water pump case nut	*6 mm	*8	*0.8	*6.0
Gearcase bolt	8 mm	17	1.7	12.5
Propeller nut	12 mm	18	1.8	13.0
Propeller shaft bearing housing bolt	6 mm	8	0.8	6.0
Oil pan bolt and nut	8 mm	23	2.3	16.5

CYLINDER HEAD, RECOIL STARTER ASSY AND TIMING BELT COVER

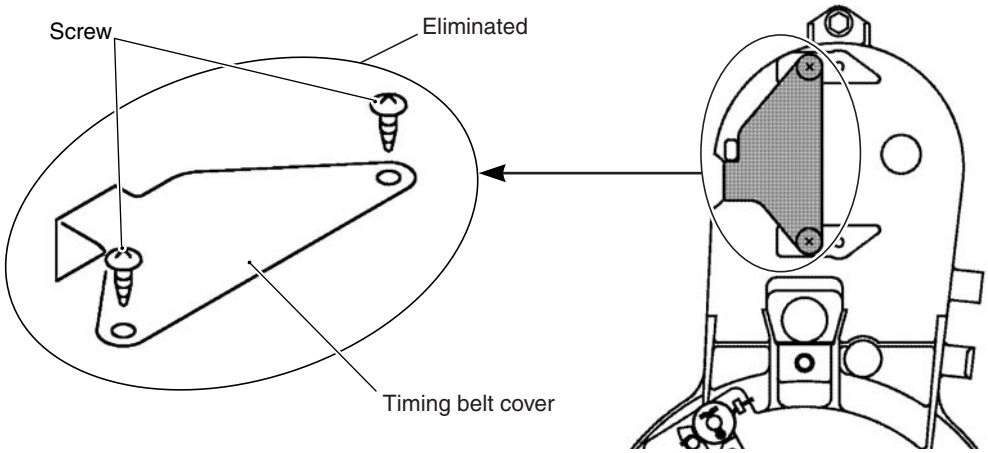
The cylinder head has been extended at the part of boss for the oil filler cap.
The recoil starter case has been changed in shape.
The timing belt cover and cover screw have been eliminated.



Recoil starter case

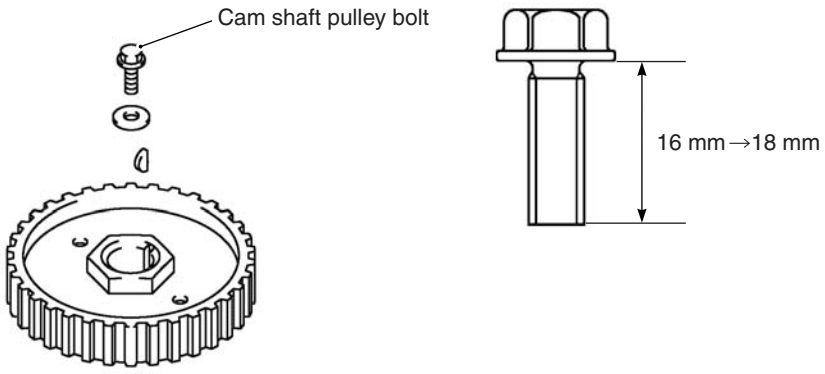


Timing belt cover



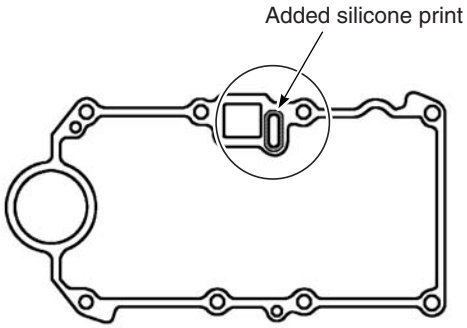
CAM SHAFT PULLEY BOLT

The length of cam shaft pulley bolt has been changed from 16 mm to 18 mm.



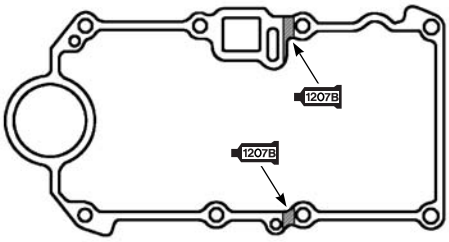
OIL PAN GASKET

The silicone print has been added to water passage of oil pan gasket.



Before installing the oil pan gasket, apply sealant to both surfaces of the hatched areas shown in illustration.

1207B 99000-31140: SUZUKI BOND "1207B"



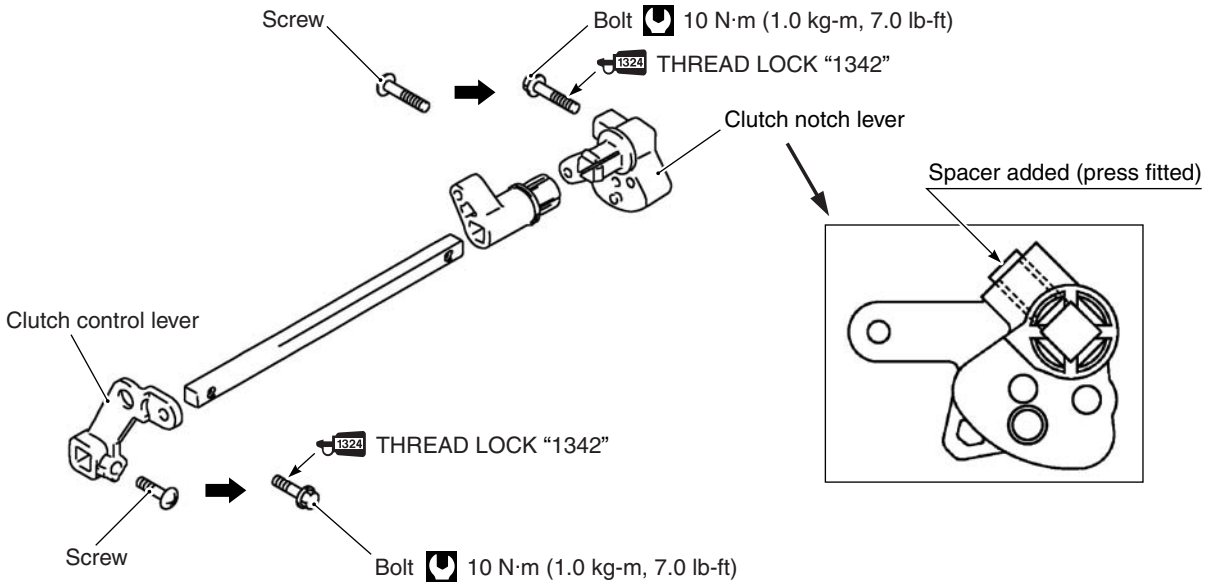
CLUTCH NOTCH LEVER

The clutch notch lever has been changed in shape and the spacer has been added.
The screw of clutch notch lever has been changed to bolt.
The screw of clutch control lever has been changed to bolt.
Apply thread lock to clutch lever notch bolt and clutch control lever bolt, and tighten bolts to specified torque.

1342 99000-32050: THREAD LOCK "1342"

Clutch notch lever bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)

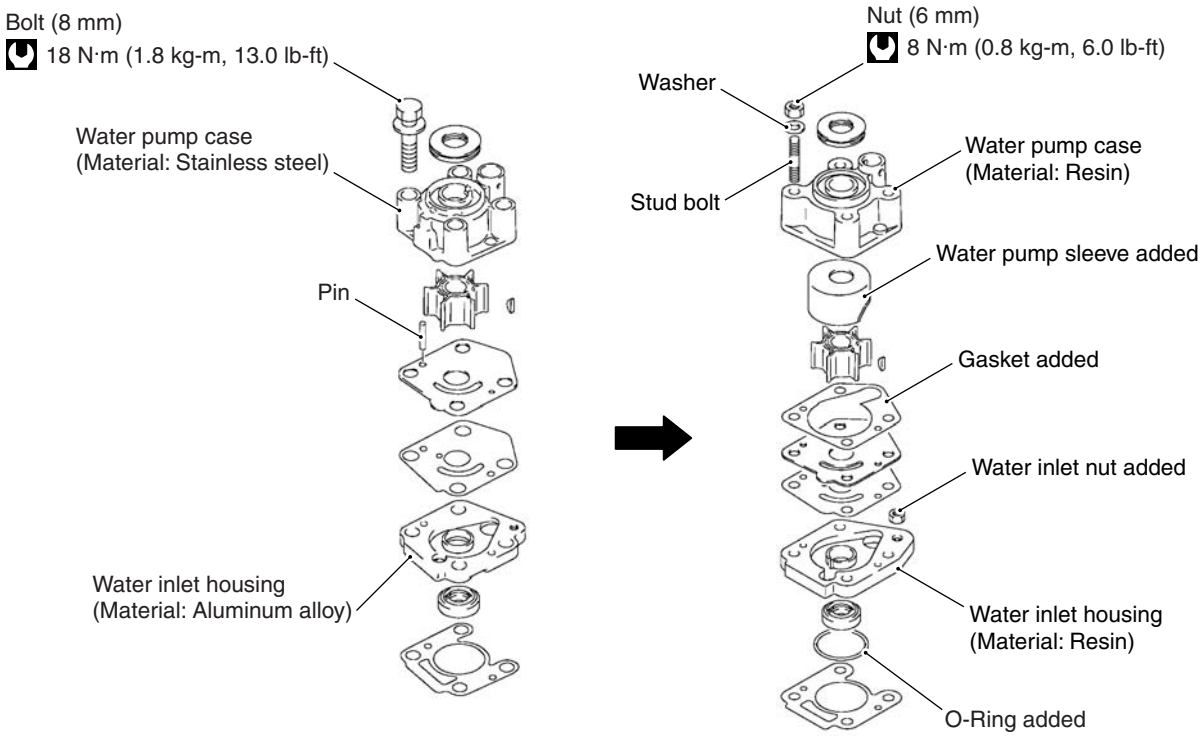
Clutch control lever bolt: 10 N·m (1.0 kg-m, 7.0 lb-ft)

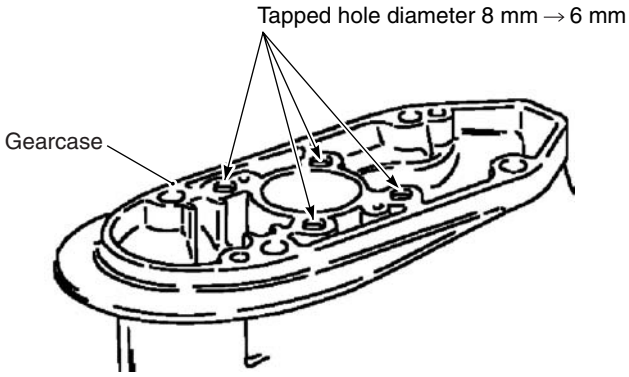


WATER PUMP AND GEARCASE

The water pump case and related parts have been changed as follows.

- The water pump case has been changed in material from stainless steel to resin.
- The water inlet housing has been changed in material from aluminum alloy to resin.
- The water pump case securing 8 mm bolts have been changed to 6 mm stud bolts with nuts and washers. In accordance with this change, diameter of tapped holes on the gearcase have been changed from 8 mm to 6 mm. Tightening torque has been changed from 18 N·m to 8 N·m.
- The water pump case sleeve has been added.
- A water pump case gasket has been added between pump case and pump case under panel.
- An O-ring has been added on the water inlet housing.
- The locating pins have been eliminated.

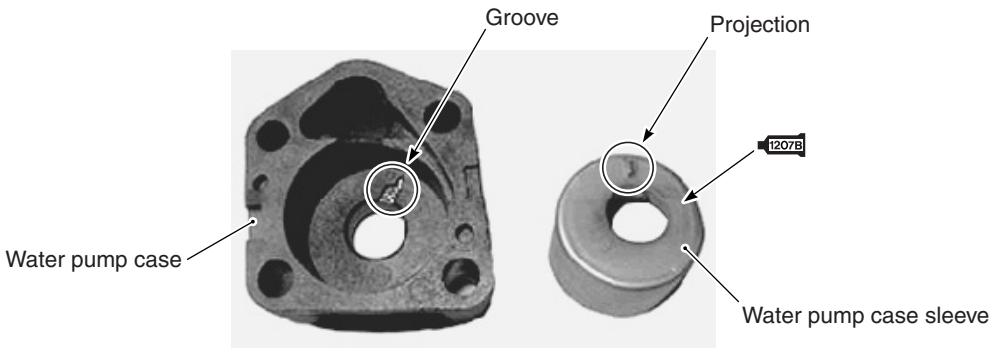




Water pump case sleeve installation

1. Apply SUZUKI BOND “1207B” onto the outer-surface of water pump case sleeve.
2. Install the water pump sleeve into the water pump case by confirming the projection on the sleeve should meet with the groove on the pump case.

1207B 99000-31140: SUZUKI BOND “1207B”



DF9.9T/TH "K8" (2008) MODEL

CONTENTS

*SPECIFICATIONS

*: These specifications are subject to change without notice.

Item		Unit	Data	
			DF9.9T	DF9.9TH
PRE-FIX			00992F	

DIMENSIONS & WEIGHT

Overall length (front to back)		mm (in)	668 (26.3)	
Overall width (side to side)		mm (in)	323 (12.7)	
Overall height	L	mm (in)	1 220 (48.0)	
	X	mm (in)	1 347 (53.0)	
Weight	L	kg (lbs)	53.5 (117.9)	54.5 (120.2)
	X	kg (lbs)	55.0 (121.3)	56.0 (123.5)
Transom height	L	mm (in. type)	545 (20)	
	X	mm (in. type)	672 (25)	

PERFORMANCE

Maximum output	kW (PS)	7.3 (9.9)
Recommended operating range	r/min	4 900 – 5 500
Idle speed	r/min	900 ± 50
In-gear idle speed	r/min	Approx. 820 – 920

POWER HEAD

Engine type		4-stroke SOHC	
Number of cylinders		2	
Bore	mm (in)	58.0 (2.28)	
Stroke	mm (in)	57.0 (2.24)	
Total displacement	cm^3 (cu. in)	302 (18.4)	
Compression ratio	:1	9.0	
Spark plug	NGK	BKR6E	
Ignition system		SUZUKI PEI (Digital CDI)	
Fuel supply system		Carburetor (Number of carb.: 1)	
Exhaust system		Through prop exhaust	
Cooling system		Water cooled	
Lubrication system		Wet sump by trochoid pump	
Starting system		Electric	
Choke system (Enrichener system)		Automatic	Manual
Throttle control		Remote control	Twist grip

Item	Unit	Data	
		DF9.9T	DF9.9TH

FUEL & OIL

Fuel		Suzuki highly recommends the use of alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2+M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.
Engine oil		• API classification: SE, SF, SG, SH, SJ or NMMA FC-W classification: SE, SF, SG, SH, SJ • Viscosity rating: SAE 10W-40 or NMMA FC-W 10W-40
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Gear oil		SUZUKI Outboard Motor Gear Oil (SAE #90 hypoid gear oil)
Gearcase oil amounts	ml (US/Imp. oz)	170 (5.7/6.0)

BRACKET

Trim angle	Degrees	0 – 12
Number of tilt pin position		4
Maximum tilt angle	Degrees	66

LOWER UNIT

Reversing system	Gear
Transmission	Forward-Neutral-Reverse
Reduction system	Bevel gear
Gear ratio	12 : 25 (2.083)
Drive line impact protection	Spline drive rubber hub
Propeller	Blade × Diam. (in) × Pitch (in)
	4 × 10 × 5

*SERVICE DATA

*: These service data are subject to change without notice.

Item	Unit	Data	
		DF9.9T	DF9.9TH

POWERHEAD

Recommended operation range	r/min	4 900 – 5 500
Idle speed	r/min	900 ± 50 (in-gear: approx. 820 – 920)
**Cylinder compression	kPa (kg/cm^2, psi)	820 – 1230 (8.2 – 12.3, 116 – 175): Without decompression system {Crank with recoil starter}
**Oil pressure [Oil temp. at 60 °C (140 °F)]	kPa (kg/cm^2, psi)	Min. 200 (2.0, 28) Max. 500 (5.0, 71) at 3 000 r/min
Engine oil		• API classification: SE, SF, SG, SH, SJ or NMMA FC-W classification: SE, SF, SG, SH, SJ • Viscosity rating: SAE 10W-40 or NMMA FC-W 10W-40
Engine oil amount	L (US/lpm. qt))	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Thermostat operating temperature	°C (°F)	58 – 62 (136 – 144)

** Figures shown are guidelines only, not absolute service limit.

CYLINDER HEAD/CAMSHAFT

Cylinder head distortion		Limit	mm (in)	0.05 (0.002)
Cam height	IN	STD	mm (in)	23.394 – 23.454 (0.9210 – 0.9234)
		Limit	mm (in)	23.294 (0.9171)
	EX	STD	mm (in)	23.397 – 23.457 (0.9211 – 0.9235)
		Limit	mm (in)	23.297 (0.9172)
Camshaft journal oil clearance		STD	mm (in)	0.020 – 0.062 (0.0008 – 0.0024)
		Limit	mm (in)	0.100 (0.0039)
Camshaft holder inside diameter	Upper	STD	mm (in)	25.000 – 25.021 (0.9843 – 0.9851)
	Lower	STD	mm (in)	23.000 – 23.021 (0.9055 – 0.9063)
Camshaft journal outside diameter	Upper	STD	mm (in)	24.959 – 24.980 (0.9826 – 0.9835)
	Lower	STD	mm (in)	22.959 – 22.980 (0.9039 – 0.9047)
Rocker arm shaft to rocker arm clearance		STD	mm (in)	0.016 – 0.045 (0.0006 – 0.0018)
		Limit	mm (in)	0.060 (0.0024)
Rocker arm inside diameter		STD	mm (in)	13.000 – 13.018 (0.5118 – 0.5125)
Rocker arm shaft outside diameter		STD	mm (in)	12.973 – 12.984 (0.5107 – 0.5112)

Item			Unit	Data	
				DF9.9T	DF9.9TH

VALVE/VALVE GUIDE

Valve diameter	IN	STD	mm (in)	26 (1.0)
	EX	STD	mm (in)	22 (0.9)
Valve clearance (cold engine condition)	IN	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
	EX	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
Valve guide to valve stem clearance	IN	STD	mm (in)	0.010 – 0.037 (0.0004 – 0.0015)
		Limit	mm (in)	0.070 (0.0028)
	EX	STD	mm (in)	0.035 – 0.062 (0.0014 – 0.0024)
		Limit	mm (in)	0.090 (0.0035)
Valve guide inside diameter	IN	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
	EX	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
Valve stem outside diameter	IN	STD	mm (in)	5.475 – 5.490 (0.2156 – 0.2161)
	EX	STD	mm (in)	5.450 – 5.465 (0.2146 – 0.2152)
Valve guide protrusion	IN	STD	mm (in)	10.0 (0.39)
	EX	STD	mm (in)	10.0 (0.39)
Valve stem deflection	IN	Limit	mm (in)	0.16 (0.006)
	EX	Limit	mm (in)	0.16 (0.006)
Valve stem runout	IN	Limit	mm (in)	0.05 (0.002)
	EX	Limit	mm (in)	0.05 (0.002)
Valve head radial runout	IN	Limit	mm (in)	0.03 (0.001)
	EX	Limit	mm (in)	0.03 (0.001)
Valve head thickness	IN	Limit	mm (in)	0.5 (0.02)
	EX	Limit	mm (in)	0.5 (0.02)
Valve seat contact width	IN	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
	EX	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
Valve spring free length		STD	mm (in)	32.52 (1.280)
		Limit	mm (in)	32.40 (1.276)
Valve spring tension		STD	N (kg, lbs)	90 (9.0, 19.8) for 28.5 mm (1.12 in)
		Limit	N (kg, lbs)	76 (7.6, 16.8) for 28.5 mm (1.12 in)

Item		Unit	Data	
			DF9.9T	DF9.9TH

CYLINDER/PISTON/PISTON RING

Cylinder distortion		Limit	mm (in)	0.05 (0.002)
Piston to cylinder clearance		STD	mm (in)	0.0276 – 0.0425 (0.0011 – 0.0017)
		Limit	mm (in)	0.100 (0.0039)
Cylinder bore		STD	mm (in)	58.000 – 58.015 (2.2835 – 2.2841)
Cylinder measuring position			mm (in)	50 (2.0) from cylinder top surface
Piston skirt diameter		STD	mm (in)	57.965 – 57.980 (2.2821 – 2.2827)
Piston measuring position			mm (in)	15 (0.6) from piston skirt end
Wear on cylinder bore		Limit	mm (in)	0.055 (0.0022)
Piston ring end gap	1st	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
	2nd	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
Piston ring free end gap	1st	STD	mm (in)	Approx. 5.8 (0.23)
		Limit	mm (in)	4.6 (0.18)
	2nd	STD	mm (in)	Approx. 7.4 (0.29)
		Limit	mm (in)	5.9 (0.23)
Piston ring to groove clearance	1st	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
	2nd	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)
		Limit	mm (in)	0.10 (0.004)
Piston ring groove width	1st	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	2nd	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	Oil	STD	mm (in)	2.51 – 2.53 (0.099 – 0.100)
Piston ring thickness	1st	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
	2nd	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)
Pin clearance in piston pin hole		STD	mm (in)	0.002 – 0.013 (0.0001 – 0.0005)
		Limit	mm (in)	0.040 (0.0016)
Piston pin outside diameter		STD	mm (in)	13.995 – 14.000 (0.5510 – 0.5512)
		Limit	mm (in)	13.980 (0.5504)
Piston pin hole diameter		STD	mm (in)	14.002 – 14.008 (0.5513 – 0.5515)
		Limit	mm (in)	14.030 (0.5524)

Item		Unit	Data	
			DF9.9T	DF9.9TH

CRANKSHAFT/CONROD

Conrod small end inside diameter	STD	mm (in)	14.006 – 14.014 (0.5514 – 0.5517)
	Limit	mm (in)	14.040 (0.5528)
Conrod big end oil clearance	STD	mm (in)	0.025 – 0.045 (0.0010 – 0.0018)
	Limit	mm (in)	0.063 (0.0025)
Conrod big end inside diameter	STD	mm (in)	29.025 – 29.034 (1.1427 – 1.1431)
Crank pin outside diameter	STD	mm (in)	28.989 – 29.000 (1.1413 – 1.1417)
Crank pin outside diameter difference	Limit	mm (in)	0.010 (0.0004)
Conrod big end side clearance	STD	mm (in)	0.10 – 0.20 (0.004 – 0.008)
	Limit	mm (in)	0.60 (0.024)
Conrod big end width	STD	mm (in)	19.95 – 20.00 (0.785 – 0.787)
Crank pin width	STD	mm (in)	20.10 – 20.15 (0.791 – 0.793)
Crankshaft thrust clearance	Limit	mm (in)	0.60 (0.024)
Crankshaft length	STD	mm (in)	126.8 – 126.9 (4.992 – 4.996)
Crankcase length	STD	mm (in)	127.0 – 127.1 (5.000 – 5.004)
Crankshaft journal oil clearance	STD	mm (in)	0.020 – 0.047 (0.0008 – 0.0019)
	Limit	mm (in)	0.060 (0.0024)
Crankshaft bearing holder inside diameter	STD	mm (in)	35.000 – 35.008 (1.3780 – 1.3783)
Crankshaft journal outside diameter	STD	mm (in)	31.989 – 32.000 (1.2594 – 1.2598)
Crankshaft journal outside diameter difference	Limit	mm (in)	0.010 (0.0004)
Crankshaft bearing thickness	STD	mm (in)	1.486 – 1.490 (0.0585 – 0.0587)

Item	Unit	Data	
		DF9.9T	DF9.9TH

LOWER UNIT

Gearcase oil amounts	ml (US/Imp.oz)	170 (5.7/6.0)
Gear ratio		2.08 (12 : 25)

Preliminary gear shim & thrust washer

Pinion back up shim	mm (in)	1.0 (0.04)
Forward back up shim	mm (in)	1.0 (0.04)
Reverse back up shim	mm (in)	1.0 (0.04)
Forward thrust washer	mm (in)	1.5 (0.06)
Reverse thrust washer	mm (in)	1.5 (0.06)

Initial selection-shim adjustment may be required.

CARBURETOR

Type	KEIHIN	BCMII 23-11.5	
I.D. mark		94J3	94J2
Main jet	#	70	
Pilot jet	#	38	
Pilot screw	Turns open	PRE-SET (1-7/8 ± 1/2)	
Float height	mm	13.5 ± 2	

Item		Unit	Data	
			DF9.9T	DF9.9TH

ELECTRICAL

Ignition timing		Degrees	ATDC 5 – BTDC 30
Over revolution limiter		r/min	Approx. 6 500
Condenser charge coil resistance		Ω at 20 °C	12.5 – 18.8 (G – B/R)
Pulser coil resistance		Ω at 20 °C	148 – 222 (R/B – B)
Ignition coil resistance (without spark plug cap)	Primary	Ω at 20 °C	0.2 – 0.4 (O – B)
	Secondary	kΩ at 20 °C	6.8 – 10.2 (H.T. cord – H.T. cord)
Spark plug cap resistance		kΩ at 20 °C	8 – 12
Battery charge coil resistance		Ω at 20 °C	0.3 – 0.4 (R – Y)
Battery charge coil output (12V)		Watt	120
Standard spark plug	Type	NGK	BKR6E
	Gap	mm (in)	0.7 – 0.8 (0.028 – 0.031)
Fuse amp rating		A	20
Recommended battery capacity (12V)		Ah (kC)	35 (126) or over
Starter motor relay coil resistance		Ω at 20 °C	145 – 190
PT motor relay coil resistance		Ω at 20 °C	25 – 37

STARTER MOTOR

Max. continuous time of use		Sec.	30
Motor output		kW	1.4
Brush length	STD	mm (in)	15.5 (0.61)
	Limit	mm (in)	9.5 (0.37)
Commutator undercut	STD	mm (in)	0.5 – 0.8 (0.02 – 0.03)
	Limit	mm (in)	0.2 (0.01)
Commutator outside diameter	STD	mm (in)	29.0 (1.14)
	Limit	mm (in)	28.0 (1.10)
Commutator outside diameter difference	STD	mm (in)	0.05 (0.002)
	Limit	mm (in)	0.40 (0.016)

PTT MOTOR

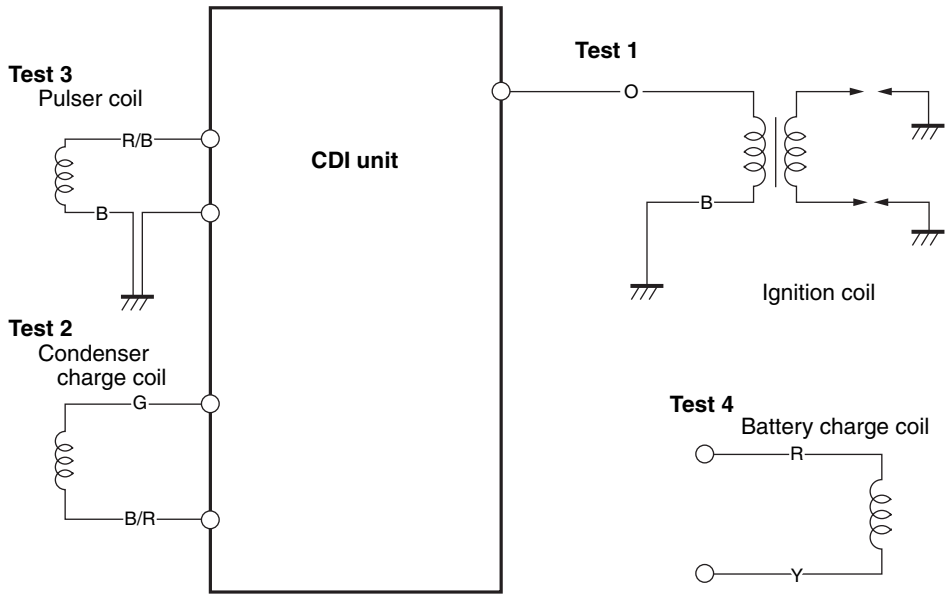
Brush length	STD	mm (in)	10.0 (0.39)
	Limit	mm (in)	5.5 (0.22)
Commutator outside diameter	STD	mm (in)	22.0 (0.87)
	Limit	mm (in)	21.0 (0.83)

PEAK VOLTAGE

Requirements for peak voltage measurement

- Remove all spark plugs to eliminate the variables at cranking speed.
- Crank with recoil starter.
- Use a STEVENS peak voltage tester, Model CD-77.
- Use the 6-pin connector test cord (Part No. 09930-89920).

Testing sequence		Tester probe connection		Peak voltage	Tester range	Remarks
		⊕ (Red)	⊖ (Black)			
1	CDI output	Orange	Black	128 V or over	NEG 500	• With ignition coil connected • Use the 6-pin connector test cord.
2	Condenser charge coil output	Green	Black/Red	15 V or over	POS 50	With CDI unit disconnected
3	Pulser coil output	Red/Black	Black (Ground)	0.8 V or over	SEN 5	
4	Battery charge coil output	Red	Yellow	5.6 V or over	POS 50	With rectifier disconnected

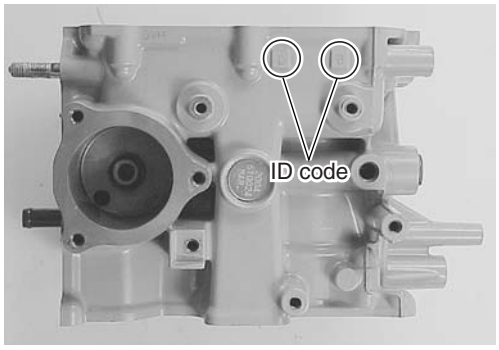


TIGHTENING TORQUE

Tightening torque – Important fasteners

ITEM	THREAD DIAM.	TIGHTENING TORQUE		
		N·m	kg-m	lb-ft
Cylinder head cover bolt	6 mm	10	1.0	7.0
Cylinder head bolt	8 mm	27	2.7	20.0
Crankcase bolt	6 mm	14	1.4	10.0
	8 mm	25	2.5	18.0
Conrod cap bolt	7 mm	12	1.2	8.5
Oil pump bolt	6 mm	14	1.4	10.0
Oil pump gallery bolt	6 mm	14	1.4	10.0
Intake manifold bolt	8 mm	23	2.3	16.5
Carburetor mounting bolt	6 mm	10	1.0	7.0
Fuel pump bolt	6 mm	10	1.0	7.0
Thermostat cover bolt	6 mm	10	1.0	7.0
Valve adjusting lock nut	5 mm	11	1.1	8.0
Timing pulley nut	26 mm	50	5.0	36.0
Flywheel nut	14 mm	80	8.0	58.0
Spark plug	—	25	2.5	18.0
Power unit mounting bolt and nut	8 mm	23	2.3	16.5
Driveshaft housing bolt	8 mm	17	1.7	12.5
Oil pan bolt and nut	8 mm	23	2.3	16.5
Oil pressure switch	—	13	1.3	9.5
Oil regulator	14 mm	27	2.7	19.5
Camshaft pulley bolt	6 mm	10	1.0	7.0
Engine oil drain plug	12 mm	13	1.3	9.5
Upper mount bolt	8 mm	23	2.3	16.5
Upper mount bracket bolt	8 mm	23	2.3	16.5
Lower mount cover bolt	8 mm	23	2.3	16.5
Lower mount bolt	8 mm	23	2.3	16.5
Clamp bracket shaft nut	7/8-14 UNF	43	4.3	31.0
Shallow drive arm bolt	10 mm	25	2.5	18.0
Tiller handle cover bolt	8 mm	17	1.7	12.5
Water pump case nut	6 mm	8	0.8	6.0
Gearcase bolt	8 mm	17	1.7	12.5
Propeller nut	12 mm	18	1.8	13.0
Propeller shaft bearing housing bolt	6 mm	8	0.8	6.0

CYLINDER/CRANKSHAFT BEARING



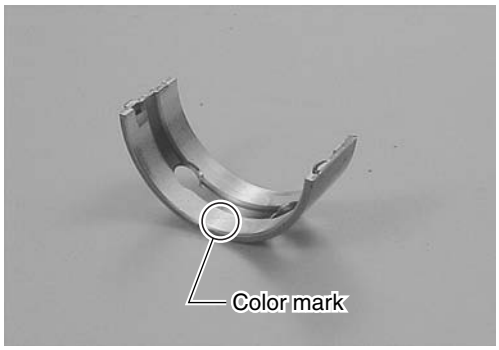
The number of types of bearing holder inside diameter for the crankcase has been reduced to one, as follows:
Because of that, engraving of the bore ID code has been abolished.

Standard:

Code	Crankcase bearing holder inside diameter
A	35.008 – 35.016 mm (1.3783 – 1.3786 in)
B	35.000 – 35.008 mm (1.3780 – 1.3783 in)

⇩

Code	Crankcase bearing holder inside diameter
	35.000 – 35.008 mm (1.3780 – 1.3783 in)



As the number of types of bearing holder inside diameter for the crankcase has been reduced to one, the number of types of crankshaft bearing has also been reduced to one as follows:

NOTE:
When the crankshaft bearing is replaced, the oil clearance should be checked in the crankshaft journal.

Standard:

Code	Crankshaft bearing thickness
Green	1.486 – 1.490 mm (0.0585 – 0.0587 in)
Black	1.490 – 1.494 mm (0.0587 – 0.0588 in)

⇩

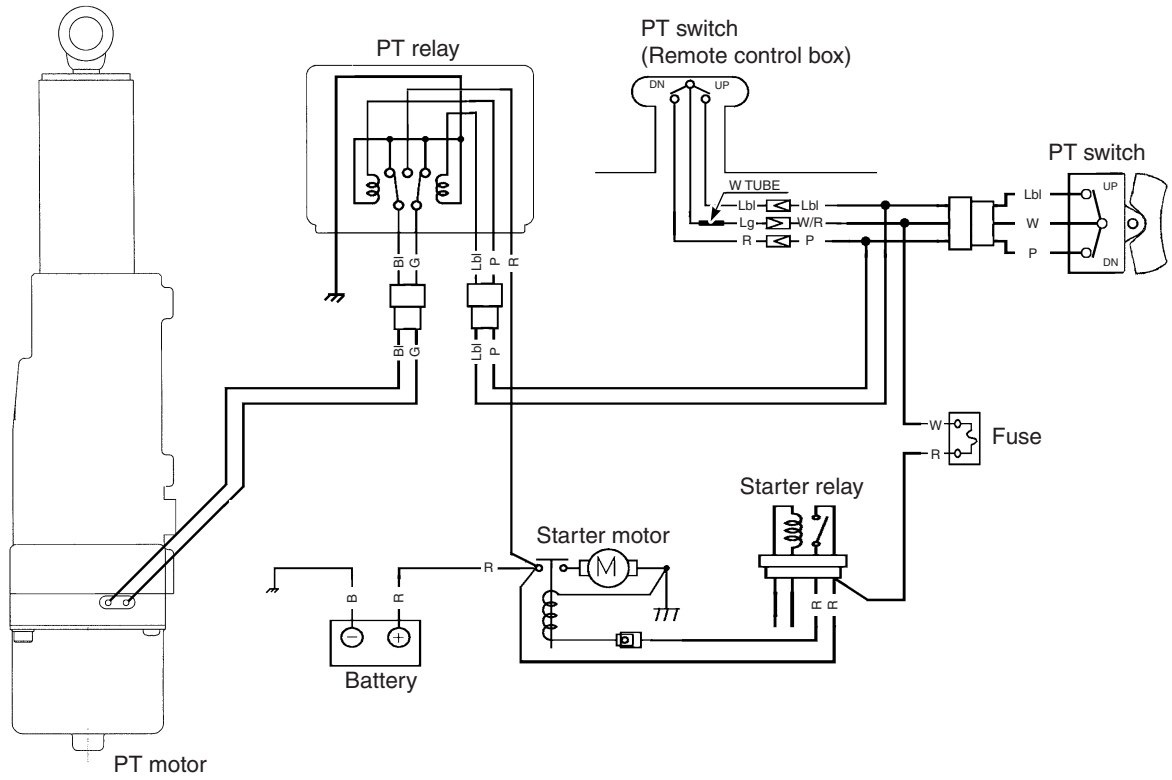
Code	Crankshaft bearing thickness
Green	1.486 – 1.490 mm (0.0585 – 0.0587 in)

NOTE:
The above change applies also to 2008 Model DF9.9/15.

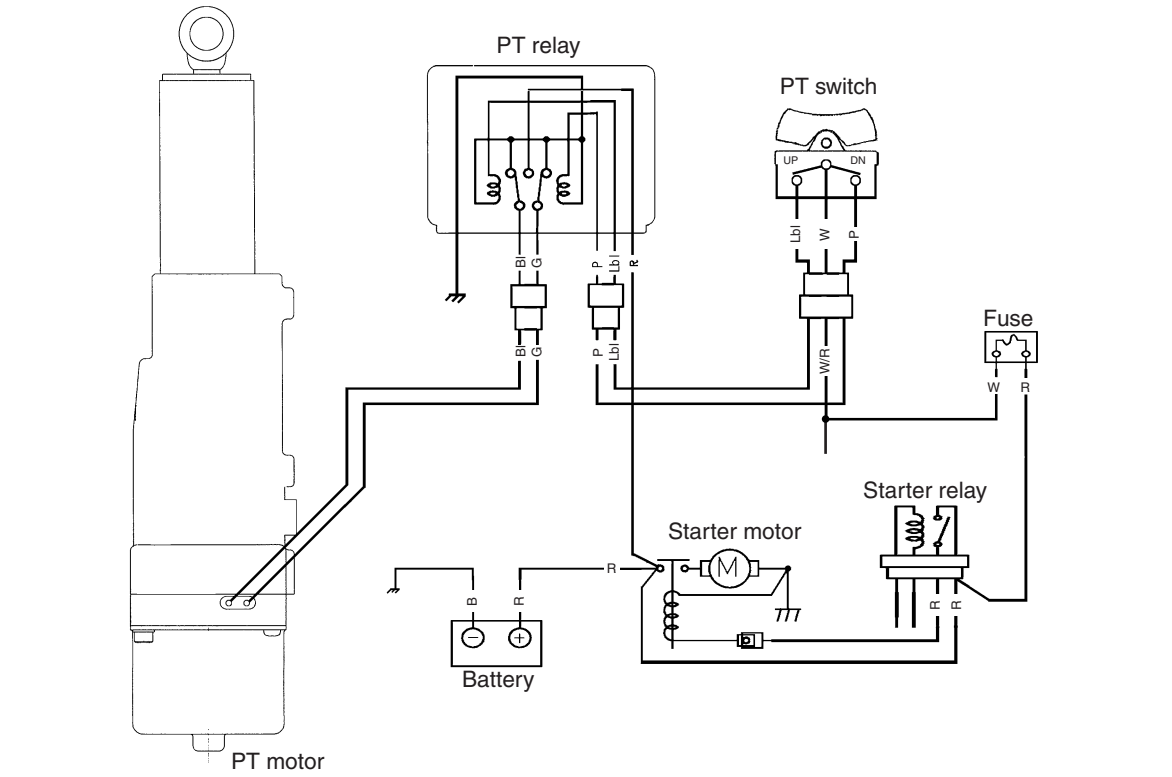
POWER TILT

SYSTEM WIRING DIAGRAM

For DF9.9T



For DF9.9TH

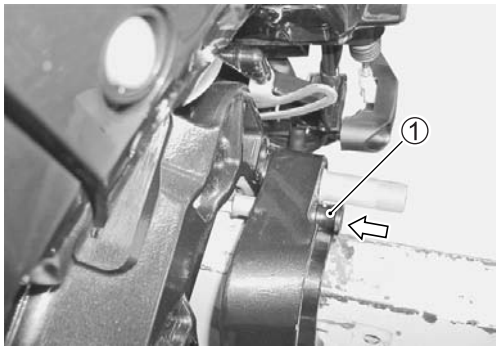


SERVICE PROCEDURE

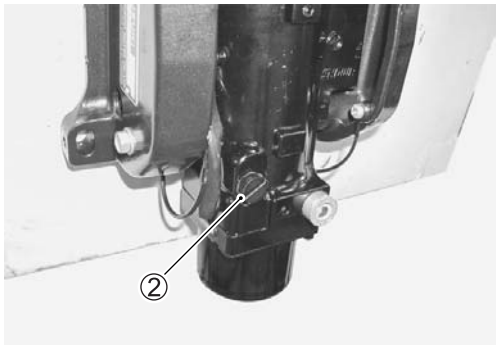
OIL LEVEL

To check the PT oil level:

1. Raised the engine to a full-tilt position.
2. Push in the tilt up lock knob ①.



3. Remove the oil filler plug ②.
4. If oil can be seen at filler plug level, the unit is full.
5. If oil level is low, refill with the recommended oil.



Recommended oil:

Dexron Ⅲ automatic transmission fluid or equivalent

CAUTION

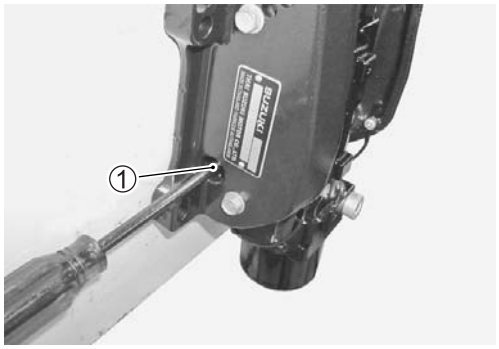
To ensure consistent pump operation, do not mix different types of oil.

6. Reinstall oil filler plug.

AIR BLEEDING

1. Check that the manual release valve ① is tightened to the specified torque.

Manual release valve: 1.8 N·m (0.18 kg-m, 1.3 lb-ft)

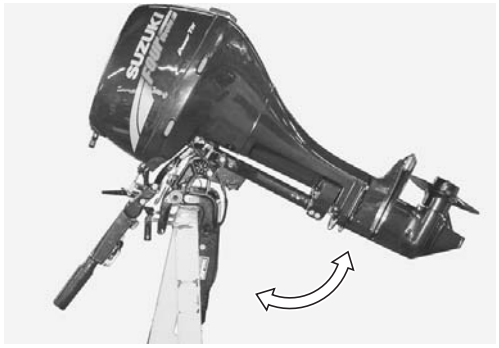


CAUTION

Do not over-tighten manual release valve.

Counterclockwise = Open
Clockwise = Close

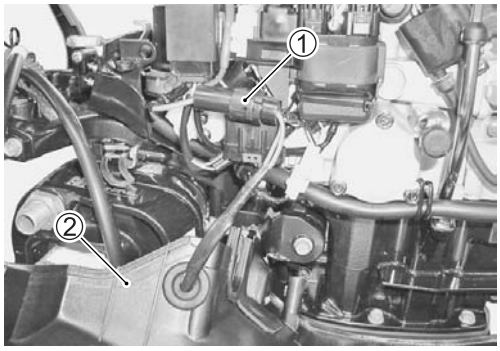
2. Operate the PT switch, raising and lowering the motor up and down (full tilt position to full tilt down position) 4 to 5 times.
3. Check oil level, topping off if necessary.
4. Reinstall oil filler plug.



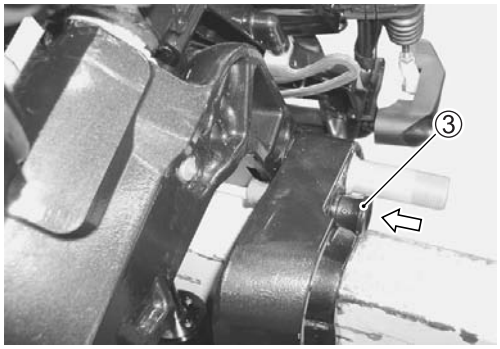
POWER TILT UNIT

REMOVAL

Disconnect battery cables from battery.
Remove the motor cover.
Remove side cover.
Disconnect the PT motor cable connector ① from the PT relay.
Remove the PT motor cable from the PORT side cover ②.

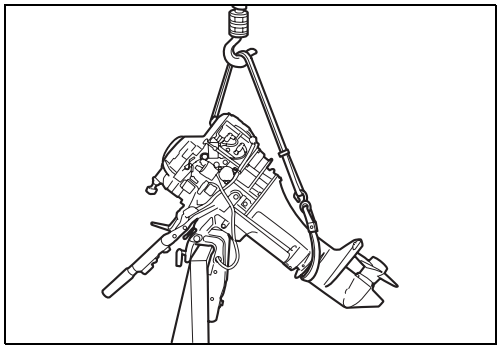


Raise the motor to the full tilt position and push in the tilt up lock knob ③.

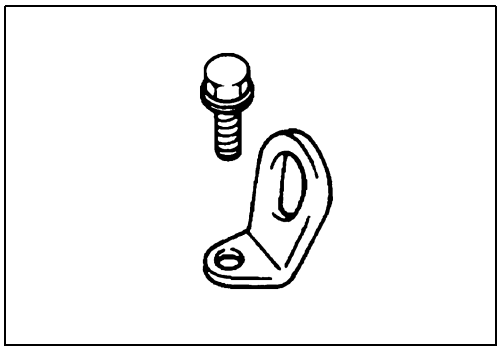


⚠ WARNING

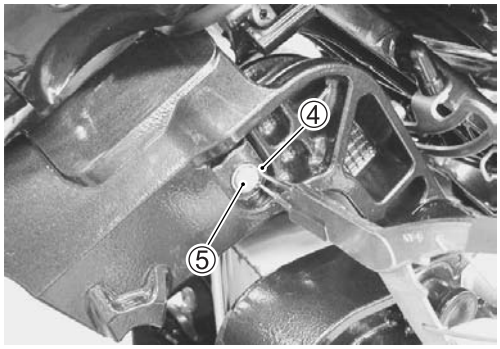
During the following procedures, the motor must be firmly secured and its weight fully supported. (See right.)



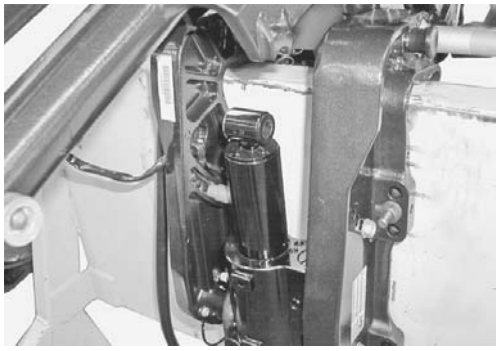
NOTE:
Since this outboard motor is not equipped with an engine hook, it is necessary to install the option parts, Engine Hook (11291-91B50) and a bolt (01550-08207).



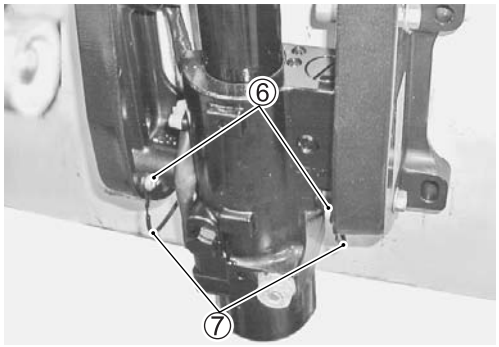
Remove the tilt rod snap ring ④ and push tilt cylinder upper shaft pin ⑤ out.



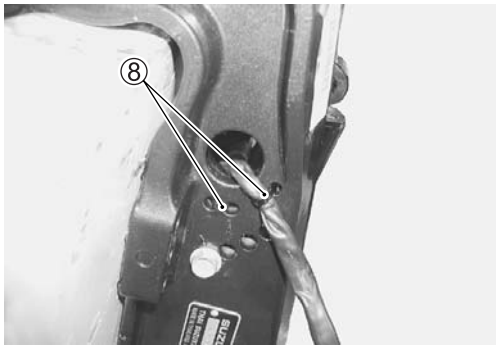
Connect the PT motor cable connector to PT relay.
Lower tilt rod to full down position and disconnect the battery cable.
Disconnect the PT motor cable connector from the PT relay.



Remove the two (2) screws ⑥ securing bonding wire ⑦.

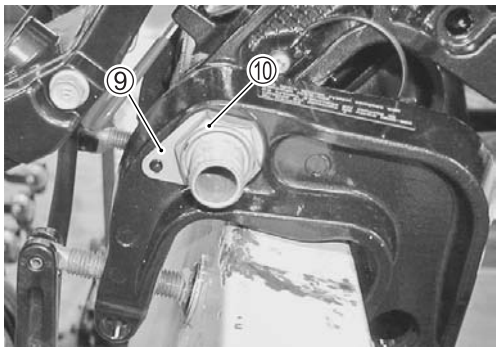


Cut the cable ties ⑧ binding PT motor cable.

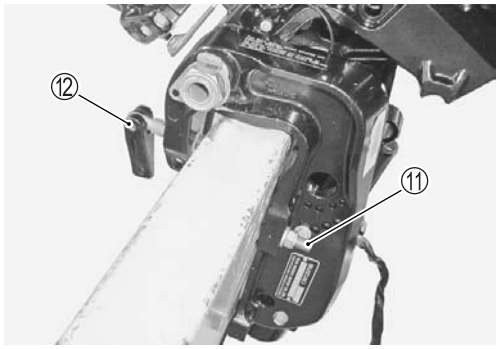


Using flat screw driver, drive locking edge of lock washer ⑨ to clamp bracket side.
Loosen the clamp bracket shaft nut ⑩.

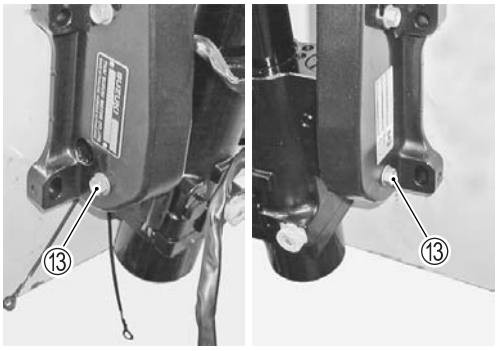
NOTE:
Complete removal of the clamp bracket shaft nut is not required. Nut should be loosened as far as the end of the shaft threads only to facilitate removal of the PT unit.



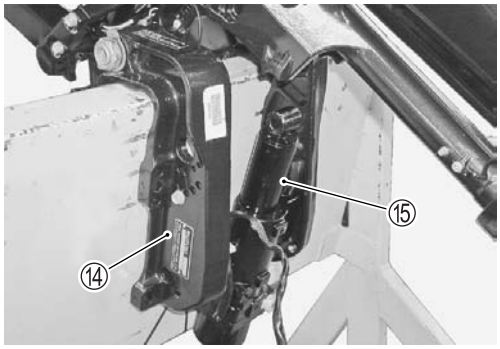
Remove a PORT engine mounting bolt ⑪.
Loosen the PORT clamp screw ⑫.



Remove the two (2) bolts ⑬ securing tilt cylinder lower shaft to STBD/PORT clamp bracket.



Slide the PORT clamp bracket ⑭ fully outward to the left hand side.
Remove the PT unit ⑮ from between the clamp brackets.

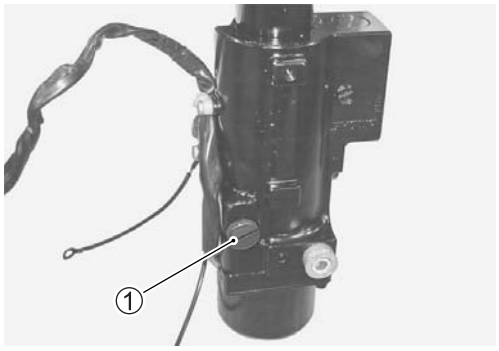


PT MOTOR

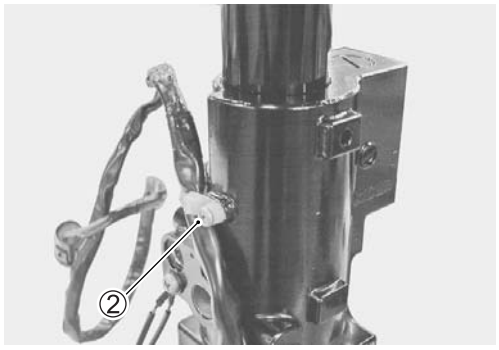
REMOVAL

NOTE:
Before removing PT motor, wash the PT body with a stiff bristle brush and hot, soapy water to remove sand or dirt and dry the PT body with compressed air.

Unscrew the oil filler plug ① and drain PT oil into suitable container.

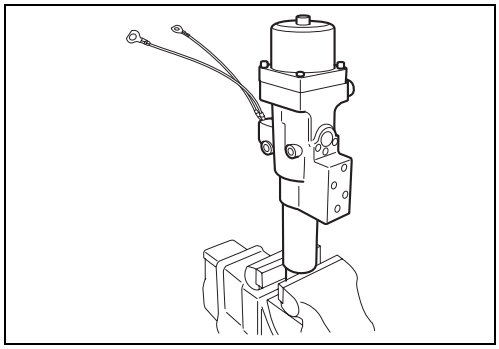


Remove the screw ② securing clamp of PT motor cable.

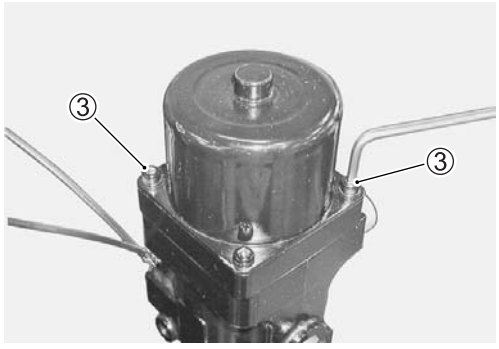


Place the upper eye of the tilt rod in a vise.
Tighten the vise only enough to secure the tilt rod, DO NOT OVER TIGHTEN.

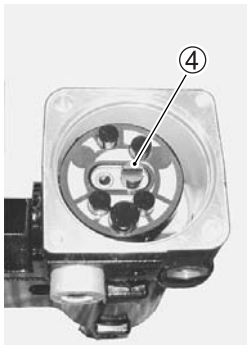
NOTE:
To prevent damage to the tilt rod use wood blocks, vise jaw protectors, etc., between the vise jaws and PT components before tightening vise.

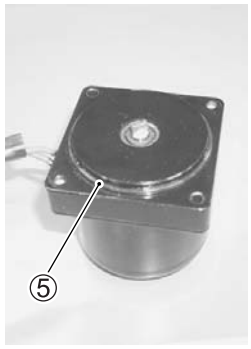


Remove the two (2) bolts ③ securing PT motor, then detach the PT motor assembly.



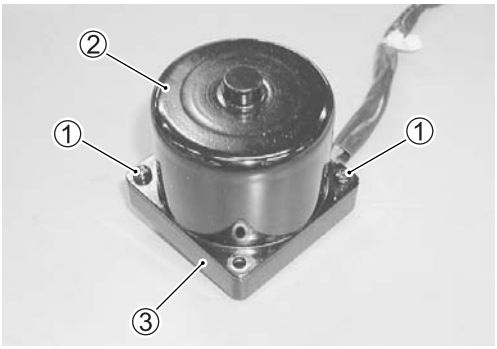
Note the position of drive joint ④ and O-ring ⑤ and remove them.



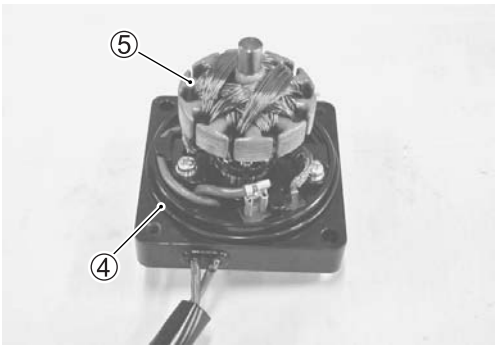


DISASSEMBLY

For correct assembly, scribe an alignment mark on the field case and brush holder.
Remove the two (2) screws ① securing the field case ② to the brush holder ③.



Slide the field case upward and away from the brush holder.
Note the position of the O-ring ④ encircling the brush holder.
Remove the armature ⑤ from the brush holder.



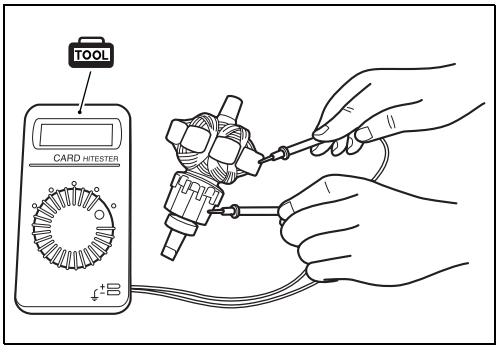
INSPECTION

Armature and commutator

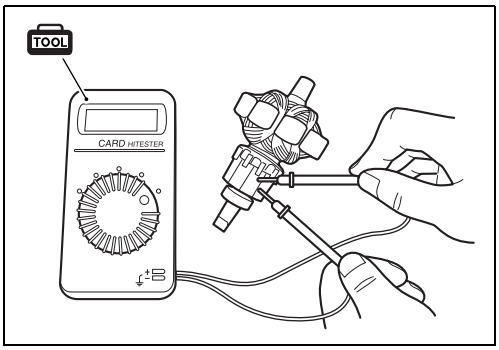
Check for continuity between the commutator and the armature core/shaft.
Replace armature if continuity is indicated.

TOOL 09930-99320: Digital tester

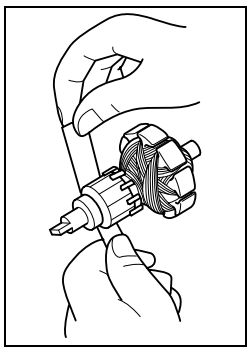
CONT Tester range: (Continuity)



Check continuity between adjacent commutator segments.
Replace armature if no continuity is indicated.



Inspect the commutator surface.
If surface is gummy or dirty, clean with 400 grit emery paper.



Measure commutator outside diameter.

TOOL 09900-20101: Vernier calipers

Commutator outside diameter:

Standard	**22.0 mm (0.87 in)**
Service limit	**21.0 mm (0.83 in)**

If measurement exceeds service limit, replace armature.

Ensure that the mica (insulator) between commutator segments is undercut to specified depth.

Commutator undercut:

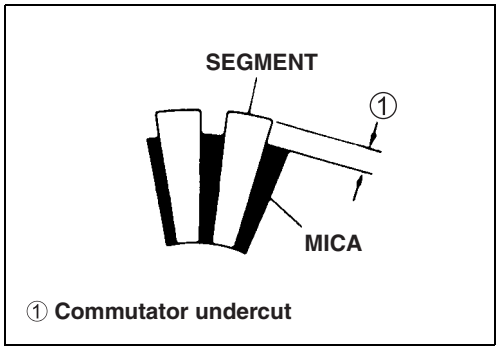
Standard	**1.6 – 1.9 mm (0.06 – 0.07 in)**
Service limit	**1.0 mm (0.04 in)**

If undercut is less than service limit, cut to specified depth.

NOTE:
Remove all particles of mica and metal using compressed air.

⚠ WARNING

Wear safety glasses when using compressed air.



① **Commutator undercut**

Brushes

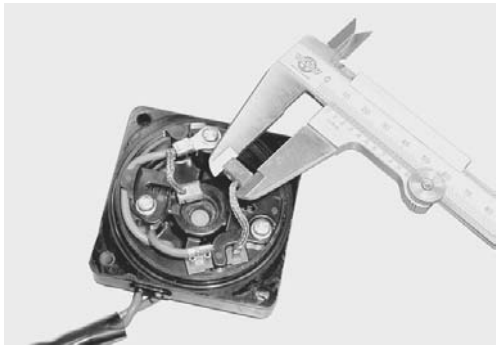
Check the length of each brush.

TOOL 09900-20101: Vernier calipers

Brush length:

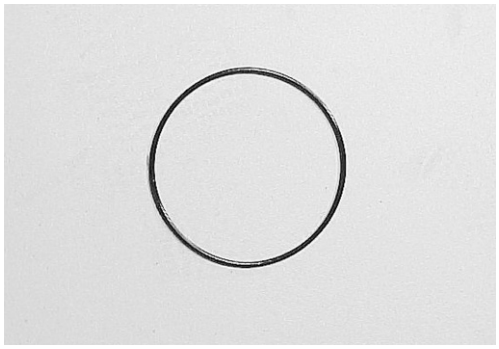
Standard	**10.0 mm (0.39 in)**
Service limit	**5.0 mm (0.20 in)**

If brushes are worn down to the service limit, they must be replaced.



O-ring

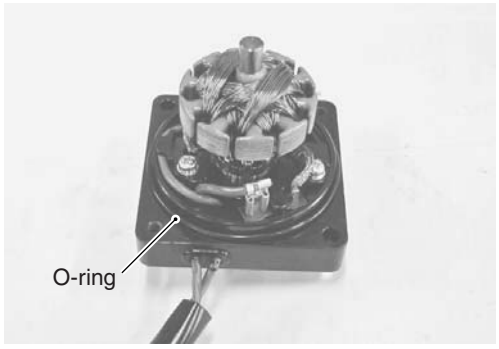
Inspect the O-ring between the PT motor and PT pump case. Replace if cuts, nicks or tears are found.



ASSEMBLY

Assembly is reverse of disassembly with special attention to following steps.

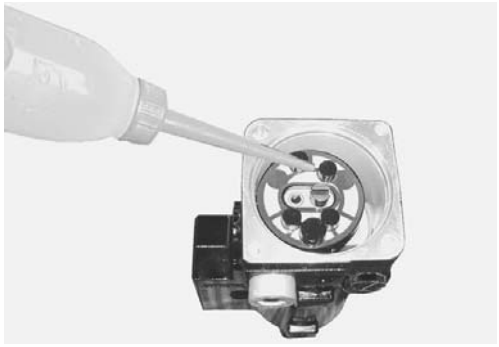
- Install armature to brush holder first.
  When installing the armature, use care to avoid breaking the brushes.
- Match up previously scribed alignment marks.
- Install the field case.



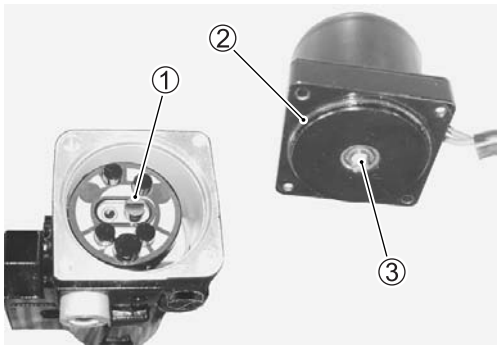
INSTALLATION

Installation is reverse of removal with special attention to following steps.

- Ensure that the drive joint ① is aligned and firmly inserted into the gear pump assembly.
- Fit O-ring ② to PT motor.
- Check the level of PT fluid contained in the PT pump case. If level is low, add recommended PT fluid until level with mating surface of PT motor.

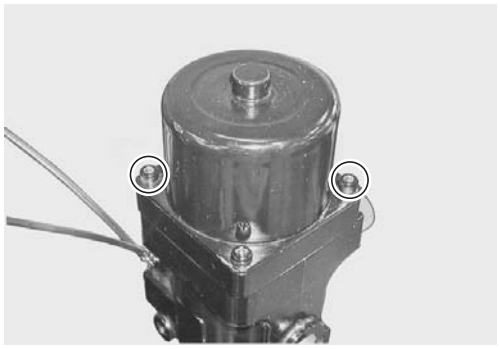


- Ensure that the faces of the PT motor and pump unit are free of dirt or debris.
  When attaching the PT motor to the PT pump case, ensure that the tip of armature shaft ③ fits firmly into the drive joint ①.

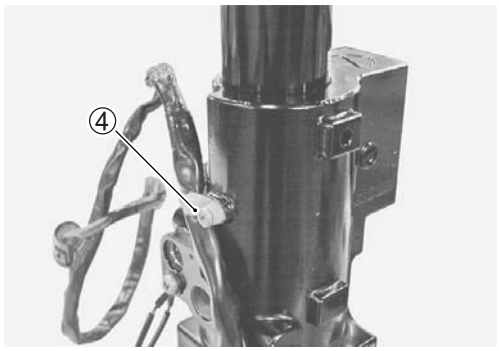


- Tighten the two (2) bolts to specified torque.

PT motor bolt: 5 N·m (0.5 kg-m, 3.6 lb-ft)



- Fix the PT motor cable with clamp ④.



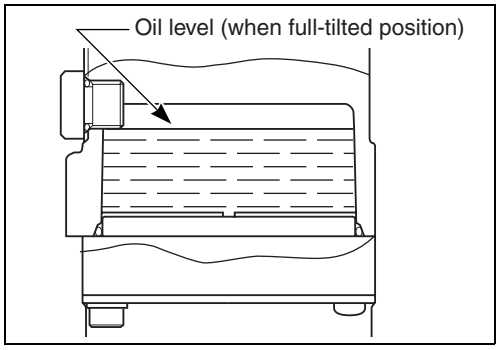
AIR BLEEDING

(Air bleeding on unit as alone)

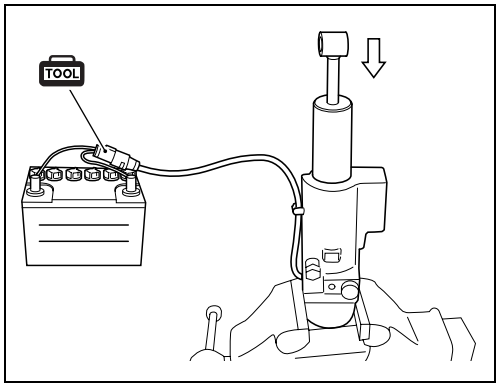
Before installing the PT unit on the outboard motor, use the following procedure to bleed air from the system.

1. Support the PT unit in an upright position in a vise.
2. Fill the reservoir with PT oil to the specified level, then install oil filler plug.
3. Tighten the manual release valve to the specified torque.
4. Connect the PT cable extension to the PT motor cable connector.

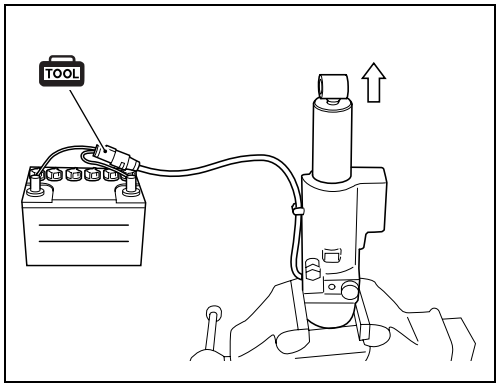
TOOL 09945-79310: PT cable extension



5. Connect the two extension cable lead wires (G to pos./Bl to neg.) to the battery as shown in the illustration. Operate the PT motor until the PT rod is in the fully trimmed down position (completely contracted).
   If the rod does not come down smoothly, push it in by hand while operating the motor.



6. Reverse the two extension cable lead wires (Bl to pos./G to neg.).
   Operate the PT motor until the PT rod is in the full tilt up position (fully extended)
   If the rod does not come up smoothly, pull it up by hand while operating the motor.
7. Remove the reservoir oil filler plug and fill with PT fluid to the specified level.
8. Repeat procedures 5 – 7 until the fluid level in the PT unit stabilizes at the specified position.



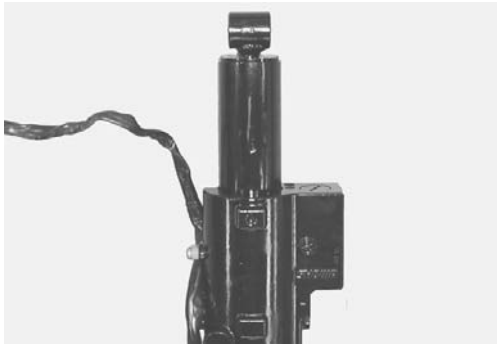
NOTE:
Repeat the air bleeding procedure after the PT unit has been installed on the outboard motor.
(For air bleeding, see page 14.)

INSTALLATION

Installation is reverse order of removal with special attention to the following steps.

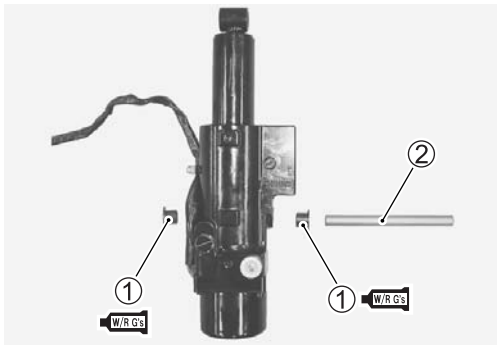
Lower tilt rod to full down position.

TOOL 09945-79310: PT cable extension

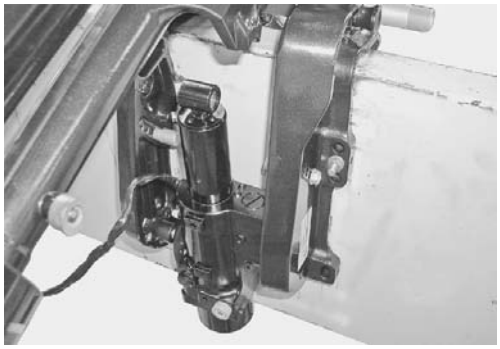


Apply Water Resistant Grease to the tilt cylinder lower shaft and lower shaft bushes.
Install bushes ① and tilt cylinder lower shaft ② to PT unit.

W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE

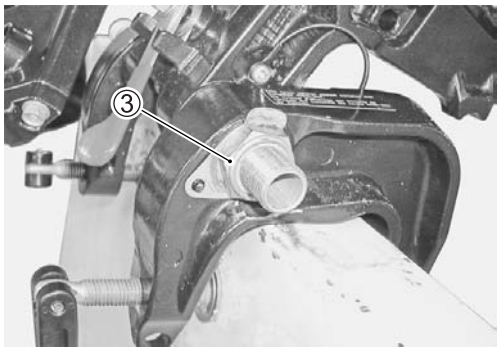


Place the PT unit in position between the clamp brackets.

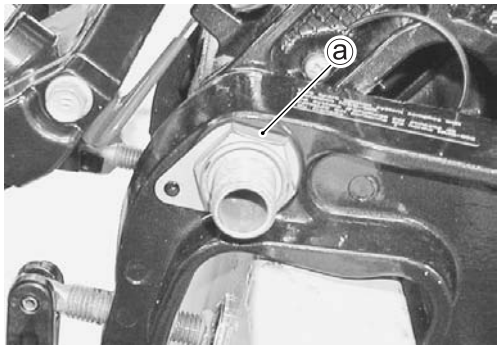


Tighten the clamp bracket shaft nut ③ to specified torque.

Clamp bracket shaft nut: 43 N·m (4.3 kg-m , 31.0 lb-ft)

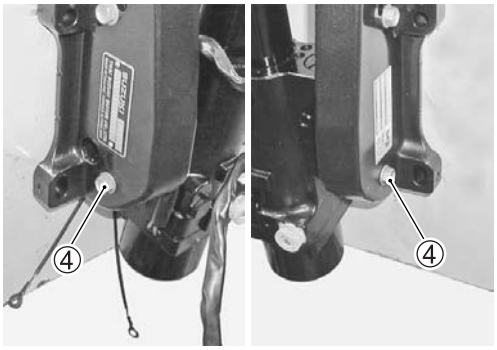


NOTE:
After tightening clamp bracket shaft nut with specific torque, bend lock washer edge ⓐ toward nut for locking.

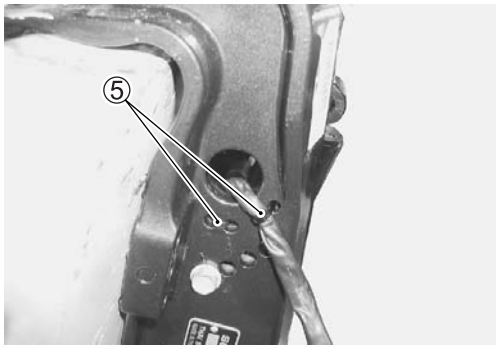


Tighten two (2) tilt cylinder lower shaft bolts ④ to specified torque.

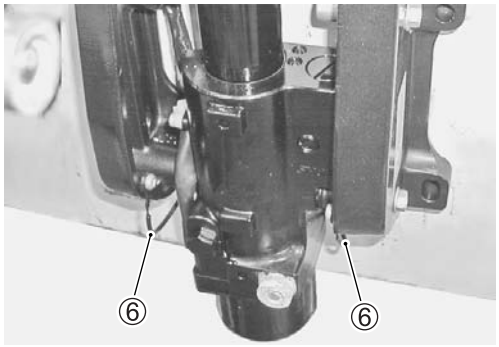
Tilt cylinder lower shaft: 17 N·m (1.7 kg-m, 12.5 lb-ft)



Route the PT motor cable in through the PORT clamp bracket and fix the PT motor cable with cable tie ⑤.

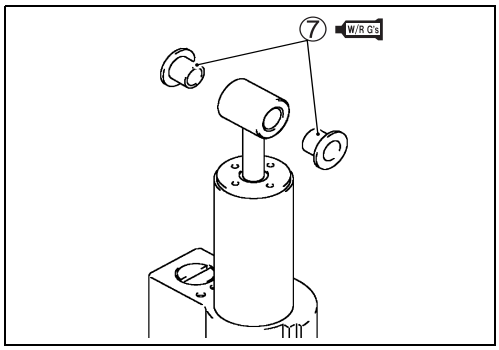


Install bonding wires ⑥, then tighten screws securely.



Apply Water Resistant Grease to tilt rod upper bushes ⑦, then install bushes in tilt rod.
Operate the PT motor to extend the tilt rod upward.
Align the tilt rod with the hole in the swivel bracket as the tilt rod extends.

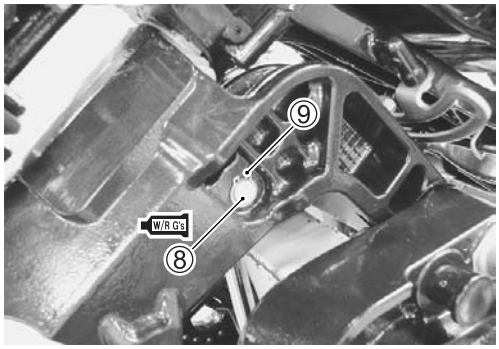
W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE



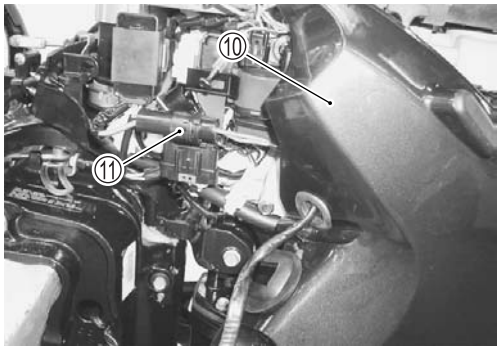
Apply Water Resistant Grease to the tilt rod upper shaft ⑧, then insert the shaft through the swivel bracket and tilt rod.

W/R G's 99000-25161: SUZUKI WATER RESISTANT GREASE

Secure the upper shaft with the snap ring ⑨.



Route the PT motor cable in through the port side cover ⑩ and connect the PT cable connector ⑪ to the PT relay.
(Cable routing – See the WIRE ROUTING section on page 41.)



PT MOTOR RELAY

INSPECTION

1. Disconnect battery cable from battery.
2. Disconnect all cables/lead wires from PT relay.
3. Check resistance between each two (2) lead wires.

09930-99320: Digital tester

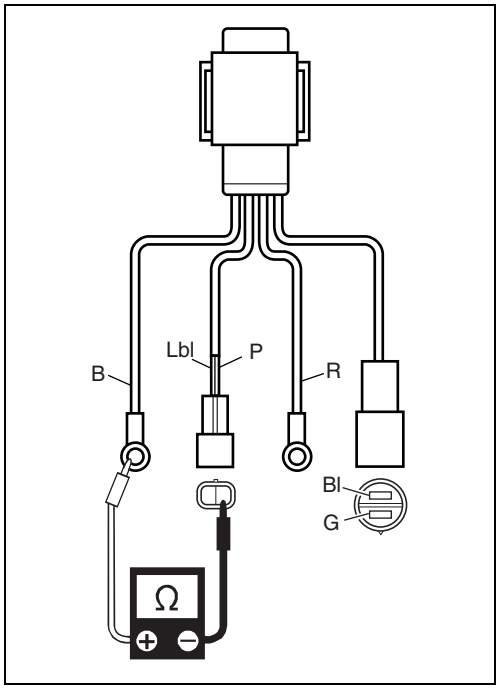
Tester range: Ω (Resistance)

Between "P" wire and "B" wire: 25 – 37 Ω
Between "Lbl" wire and "B" wire: 25 – 37 Ω

4. Connect "R" wire to positive ⊕ terminal, and black wire to negative ⊖ terminal of 12 V battery.

CAUTION

Each operation test must be performed within 3 – 5 seconds to avoid overheat damage to the relay coil.



5. Temporarily connect a jumper wire from the "P" lead wire to the battery positive ⊕ terminal, then check voltage between "G" wire and "B" wire.

09930-99320: Digital tester

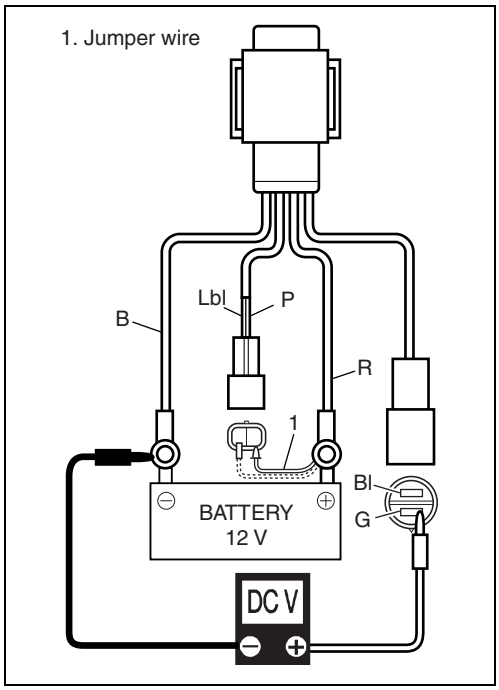
Tester range: DCV

Between "G" wire and "B" wire: 12 V (Battery voltage)

6. Temporarily connect a jumper wire from the "Lbl" lead wire to the battery positive ⊕ terminal, then check voltage between "Bl" wire and "B" wire.

Between "Bl" wire and "B" wire: 12 V (Battery voltage)

7. If inspection in step 3 and/or step 5, 6 fails, replace PT relay.

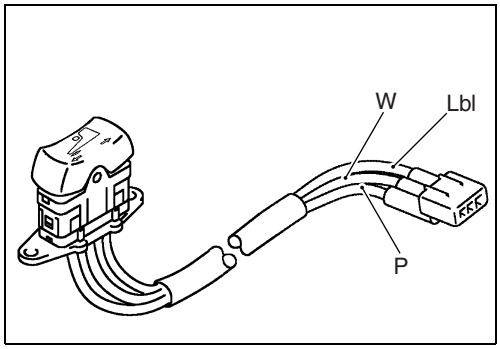


PT SWITCH

Test continuity between the switch lead wires at each of the three switch positions.

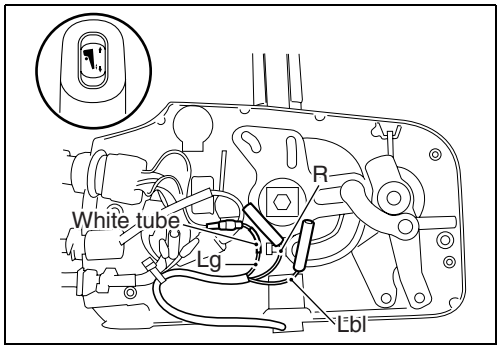
09930-99320: Digital tester

Tester range: (Continuity)



	Tester probe connection		Tester indicates
	Red ⊕	**Black ⊖**	
DN side depressed	• Red	• Lg (with white tube)	Continuity
	• Pink	• White	
UP side depressed	Light Blue	• Lg (with white tube)	Continuity
		• White	
Not depressed	• Red • Pink	• Lg (with white tube)	Infinity
	Light Blue	• White	

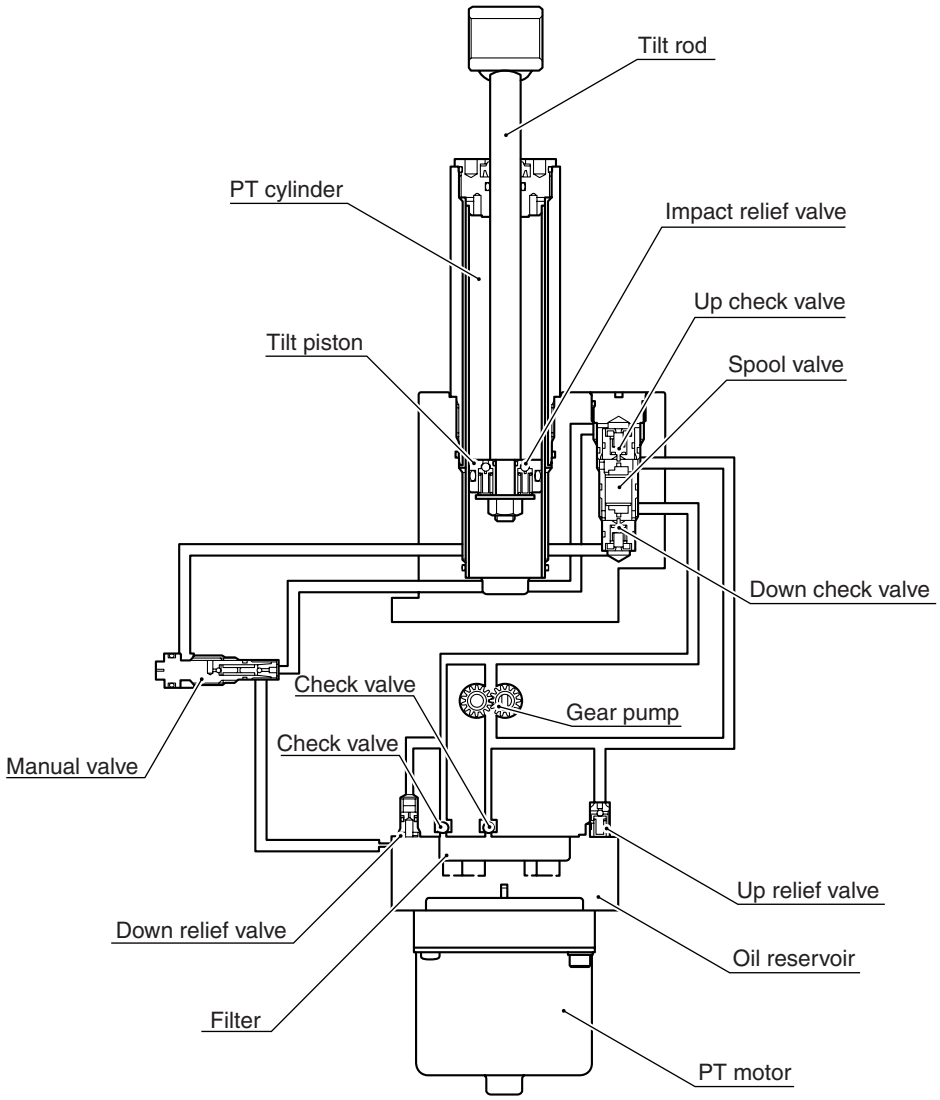
Remote control box side



	Tester probe connection		Tester indicates
	Red ⊕	**Black ⊖**	
DN side depressed	• Red	• Lg (with white tube)	Continuity
	• Pink	• White/Red	
UP side depressed	Light Blue	• Lg (with white tube)	Continuity
		• White/Red	
Not depressed	• Red • Pink	• Lg (with white tube)	Infinity
	Light Blue	• White/Red	

OPERATION

COMPONENT PARTS



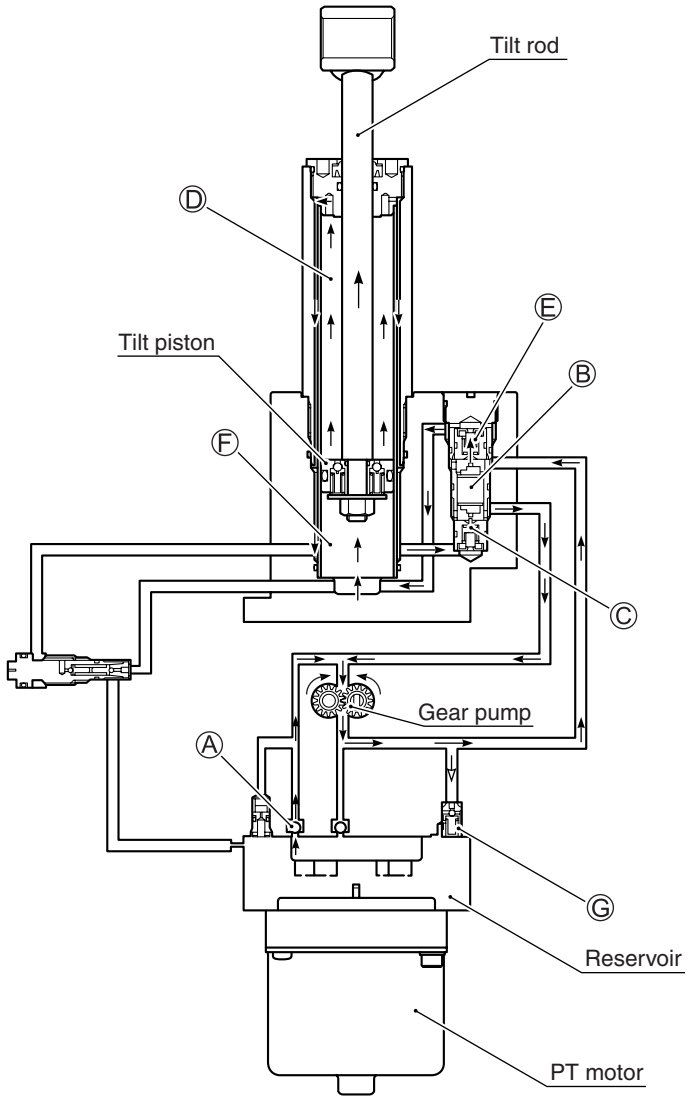
* When the manual valve is to be opened, turn the manual release valve to the left about two turns.
* When the oil level of the system should be checked, inspect by placing the motor in the maximum tilt up position.

PRINCIPLES OF OPERATION

By motor operation, the geared pump will be driven, and by turning the motor to the right or to the left, oil flow will change its direction, and this causes up and down movements of the piston rod of the tilt cylinder.

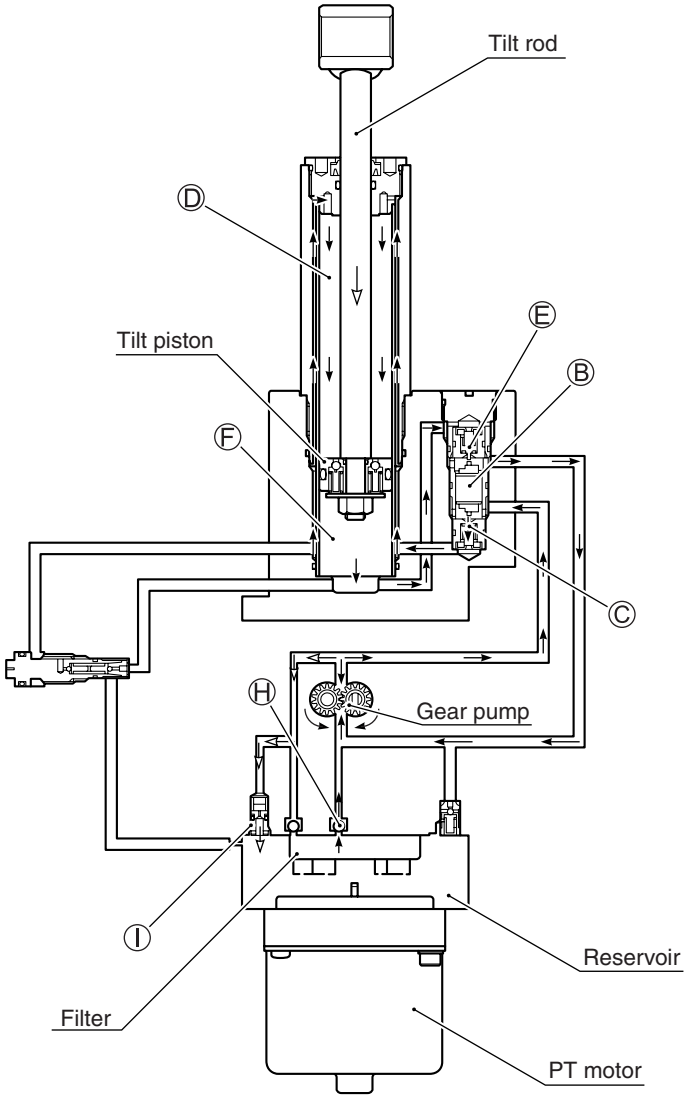
TILT UP

(1) When the PT switch is operated in the "UP" position, the motor and gear pump will rotate in a clockwise direction.
(2) Pressurized oil will open the check valve Ⓐ and oil flow from the gear pump enters the spool valve Ⓑ, moving it to the lower. Following operation of the spool valve Ⓑ, it open the down check valve Ⓒ and returns oil from the upper chamber Ⓓ of the tilt cylinder to the gear pump.
(3) Pressure built up by the gear pump will then open the up check valve Ⓔ, oil will enter the lower chamber Ⓕ of the tilt cylinder and thereby pushing the tilt piston upward.
(4) Oil in the upper chamber Ⓓ of the tilt cylinder is returned to the gear pump through the down check valve Ⓒ.
(5) Throughout the tilt-up action operation range, there is a difference in oil volume between the upper and lower chambers of the tilt cylinder, and in order to settle the oil shortage, oil is returned from the reservoir to the gear pump through the check valve Ⓐ.
(6) When the motor stops, both the down check valve Ⓒ and up check valve Ⓔ will close to retain tilt position.
(7) When the engine is fully tilted up, oil pressure will correspondingly increase in the lower chamber Ⓕ of the tilt cylinder. But, to protect the PT unit from excessively high pump pressure, the up relief valve Ⓖ begins to open.



TILT DOWN

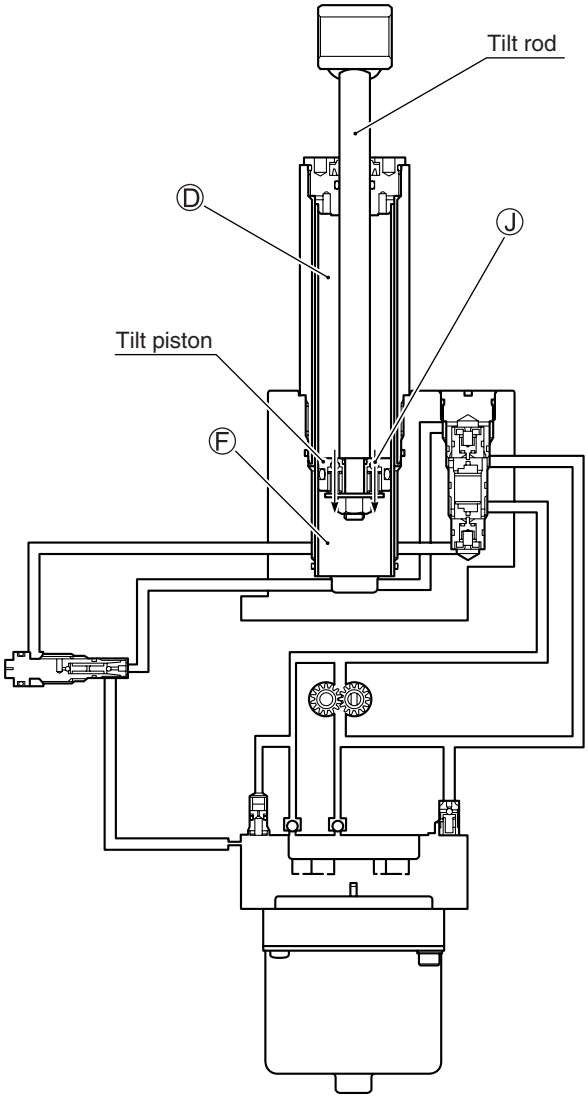
(1) When the PT switch is operated in the "DOWN" position, the motor and gear pump will rotate in a counterclockwise direction.
(2) Pressurized oil will open the check valve Ⓗ and oil flow from the gear pump enters the spool valve Ⓑ, moving it to the upper. Following operation of the spool valve Ⓑ, opening the up check valve Ⓔ and returning oil from the lower chamber Ⓕ of the tilt cylinder to the gear pump.
(3) Pressure built up by the gear pump will then open the down check valve Ⓒ, oil will enter the upper chamber Ⓓ of the tilt cylinder and thereby pushing the tilt piston downward.
(4) Oil in the lower chamber Ⓕ of the tilt cylinder is returned to the gear pump through the up check valve Ⓔ.
(5) Throughout the tilt down action operation range, there is a difference in oil volume between the upper and lower chambers of the tilt cylinder, and any surplus oil is then therefore directed to the reservoir by means of the down relief valve Ⓘ.
(6) When the engine is fully tilted down, oil from the gear pump now returns to the reservoir through the down relief valve Ⓘ.



SHOCK ABSORBER CIRCUIT

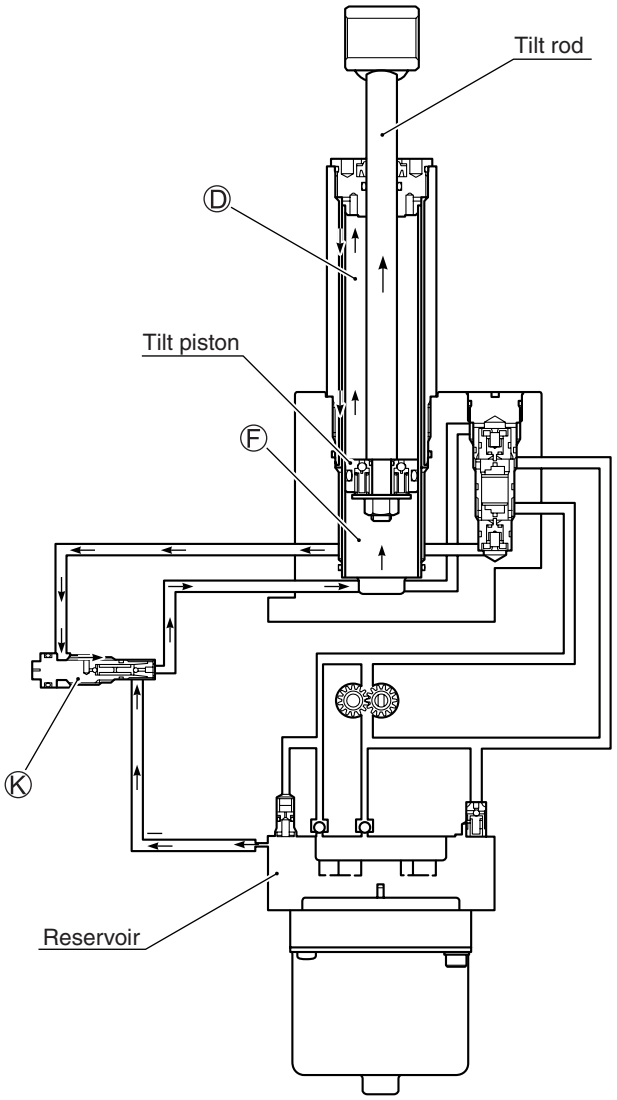
This incorporated safety feature is for protection of the gearcase and prevention of internal PT pressure build-up in the event of an impact.

(1) The pressure from a sudden impact will make impact relief valve Ⓙ open, allowing oil from the upper chamber Ⓓ of the tilt cylinder to flow into the area between the tilt piston and the lower chamber Ⓕ. The tilt rod will then extend.



MANUAL RELEASE CIRCUIT (UP MODE)

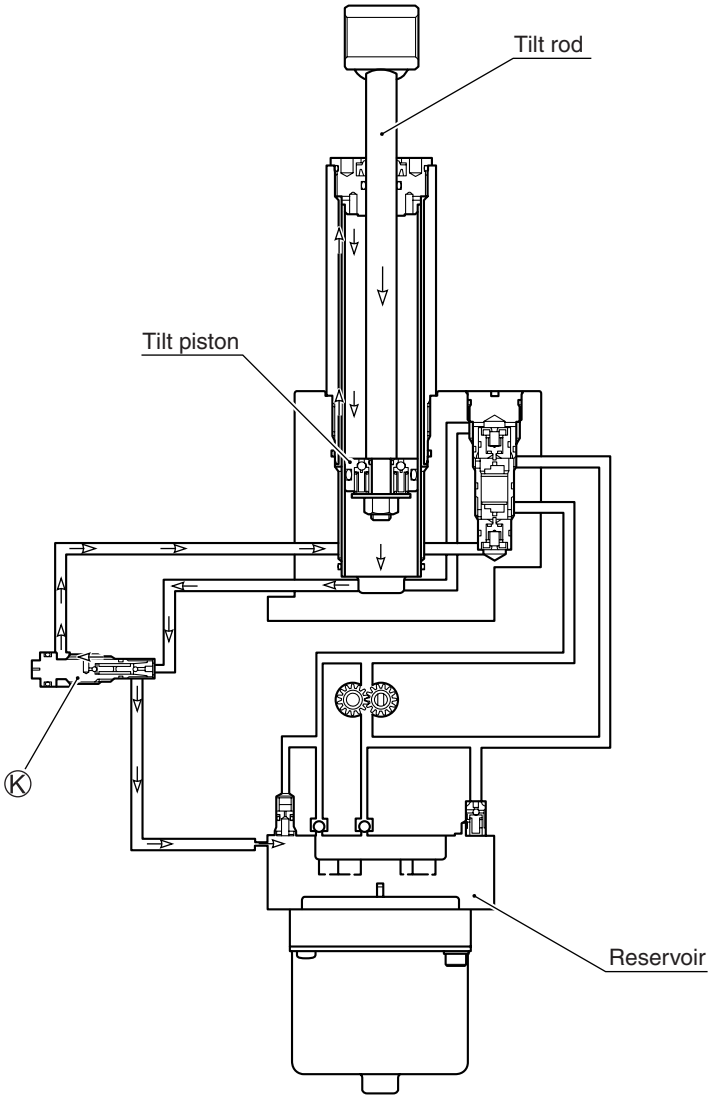
(1) With the manual release valve Ⓚ open, the engine can also be raised manually to the fully tilted position.
(2) Oil from the upper chamber Ⓓ of the tilt cylinder will flow through manual release valve Ⓚ into the lower chamber Ⓕ of the cylinder.
(3) The upward movement of the tilt rod will increase the cylinder area beneath it, thereby allowing oil from the reservoir to flow into this area.



MANUAL RELEASE CIRCUIT (DOWN MODE)

(1) By opening the manual release valve Ⓚ, the engine can be lowered manually to a running position. Oil underneath the tilt piston will be directed through this valve into the area above the tilt piston.

(2) The volume of oil flowing from under the tilt piston will be larger than the area above the tilt piston can accommodate. Excess oil therefore returns through the manual release valve Ⓚ to the reservoir.

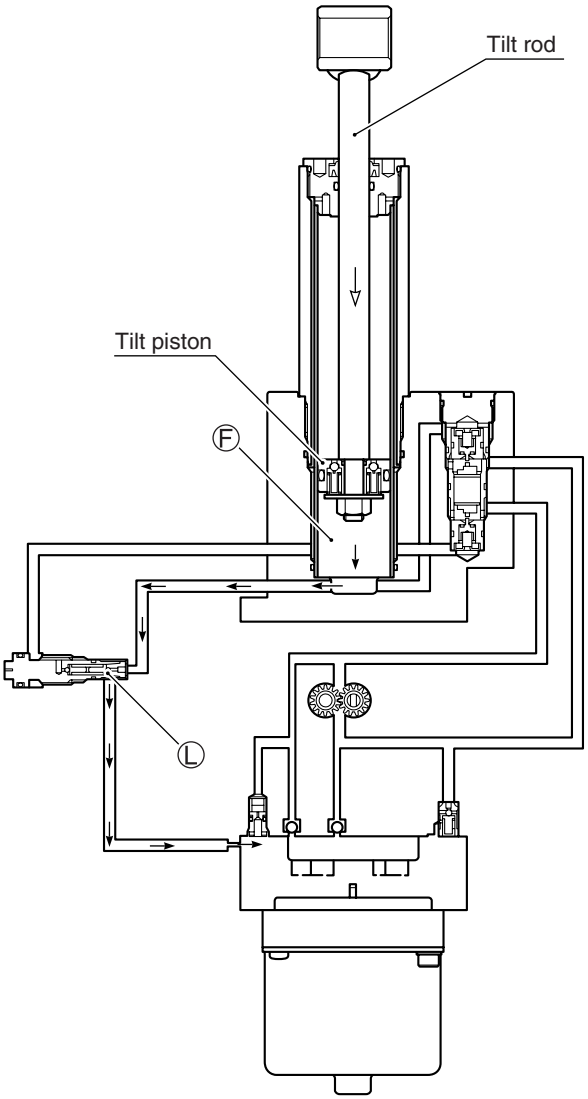


THERMAL VALVE

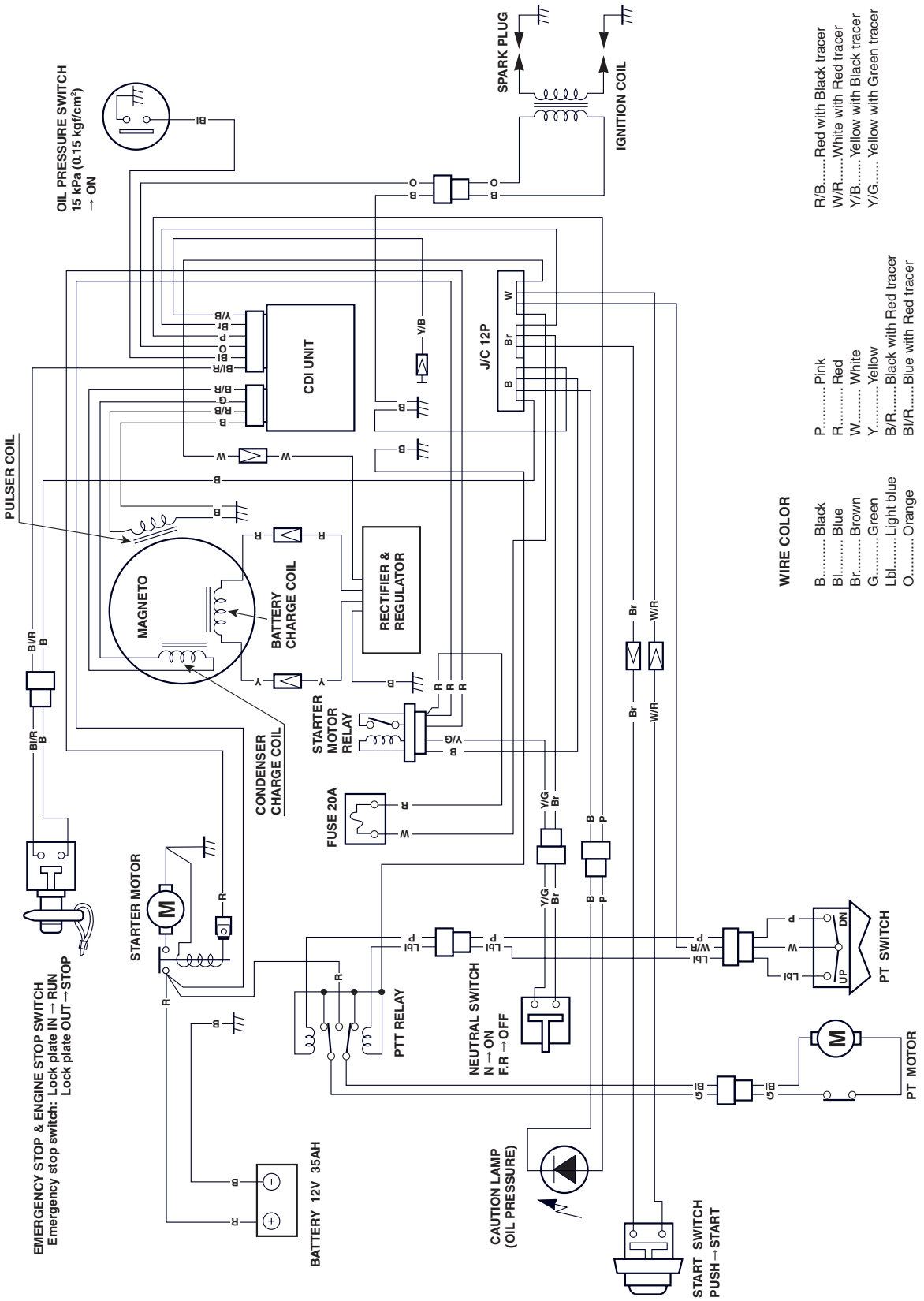
The PT system incorporates a thermal valve Ⓛ for protection of the internal components, should excessive downward force be exerted on the lower unit with the motor in a tilted position, or (in the case of an impact in reverse gear), the outboard clamp/swivel brackets and the boat transom.

Should the propeller strike an underwater object whilst in reverse gear, a build up of pressure will be induced in the lower cylinder chamber Ⓕ, whereby the outboard mounting bracket and/or the boat transom may sustain damage. To prevent this, the thermal valve Ⓛ will open to relieve the oil pressure, thereby softening the impact.

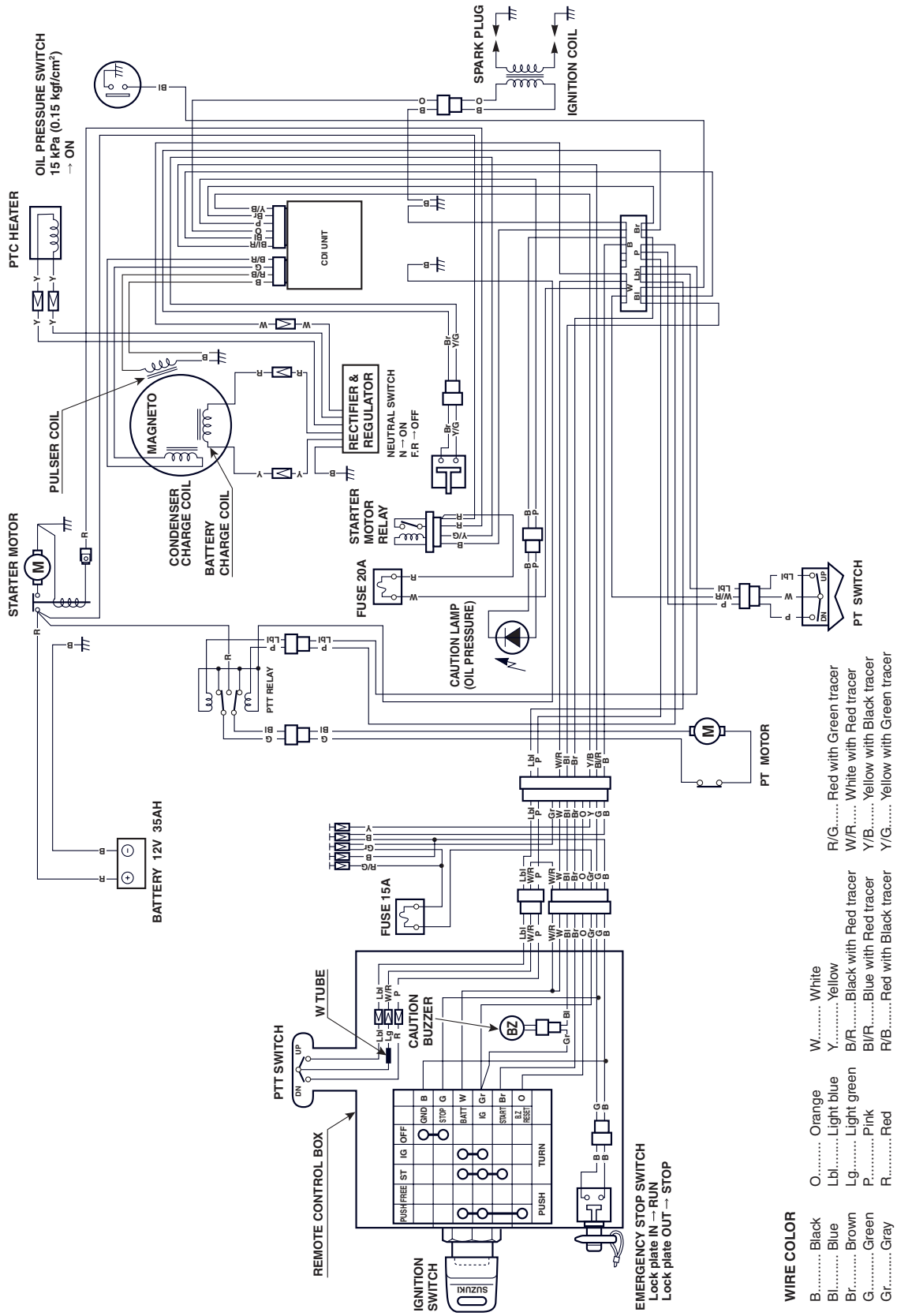
Internal PT circuits are protected, as the thermal valve Ⓛ will open to reduce oil pressure (caused by either hot climate or abnormally heavy usage).



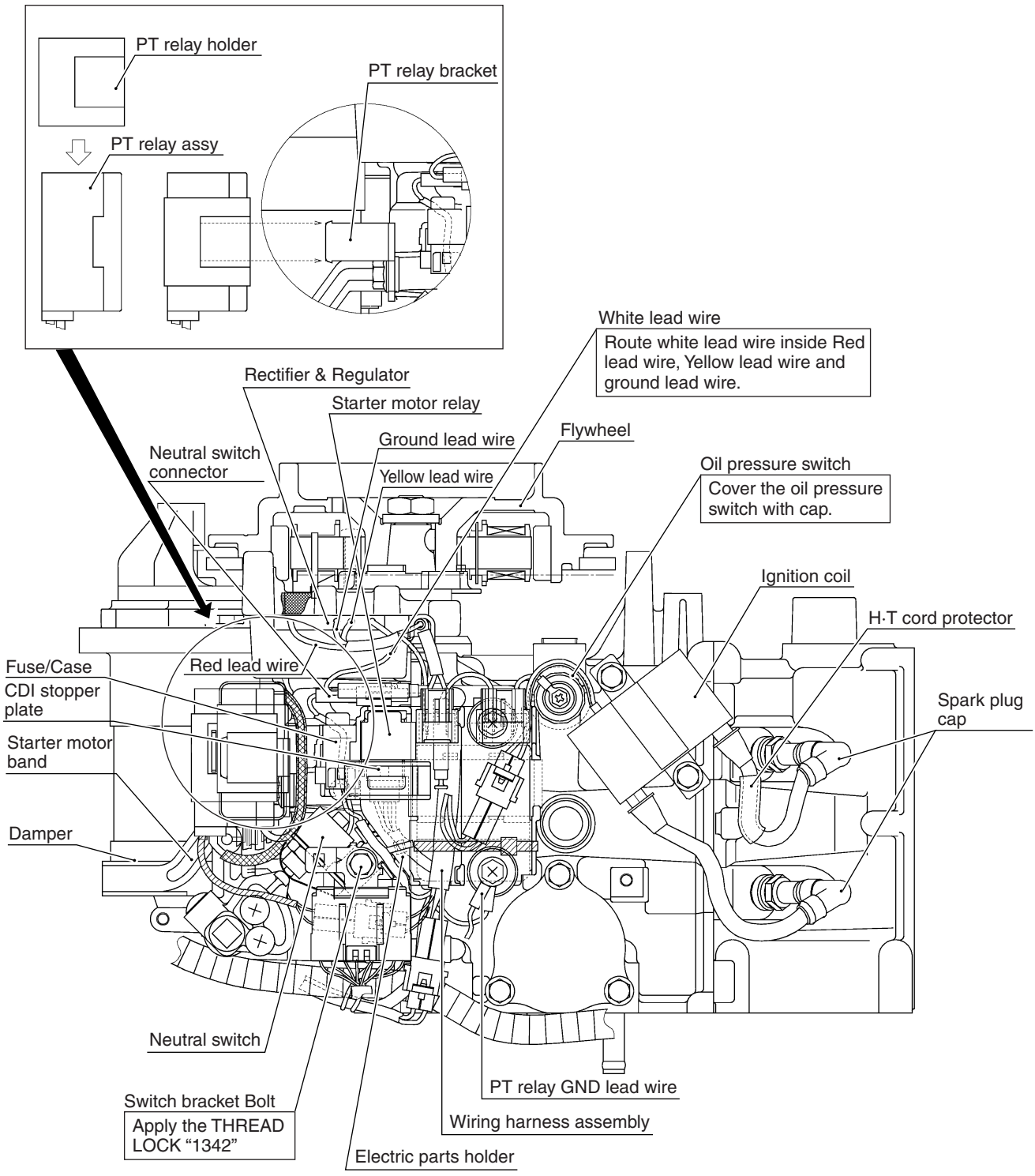
WIRING DIAGRAM
DF9.9TH (TILLER HANDLE)

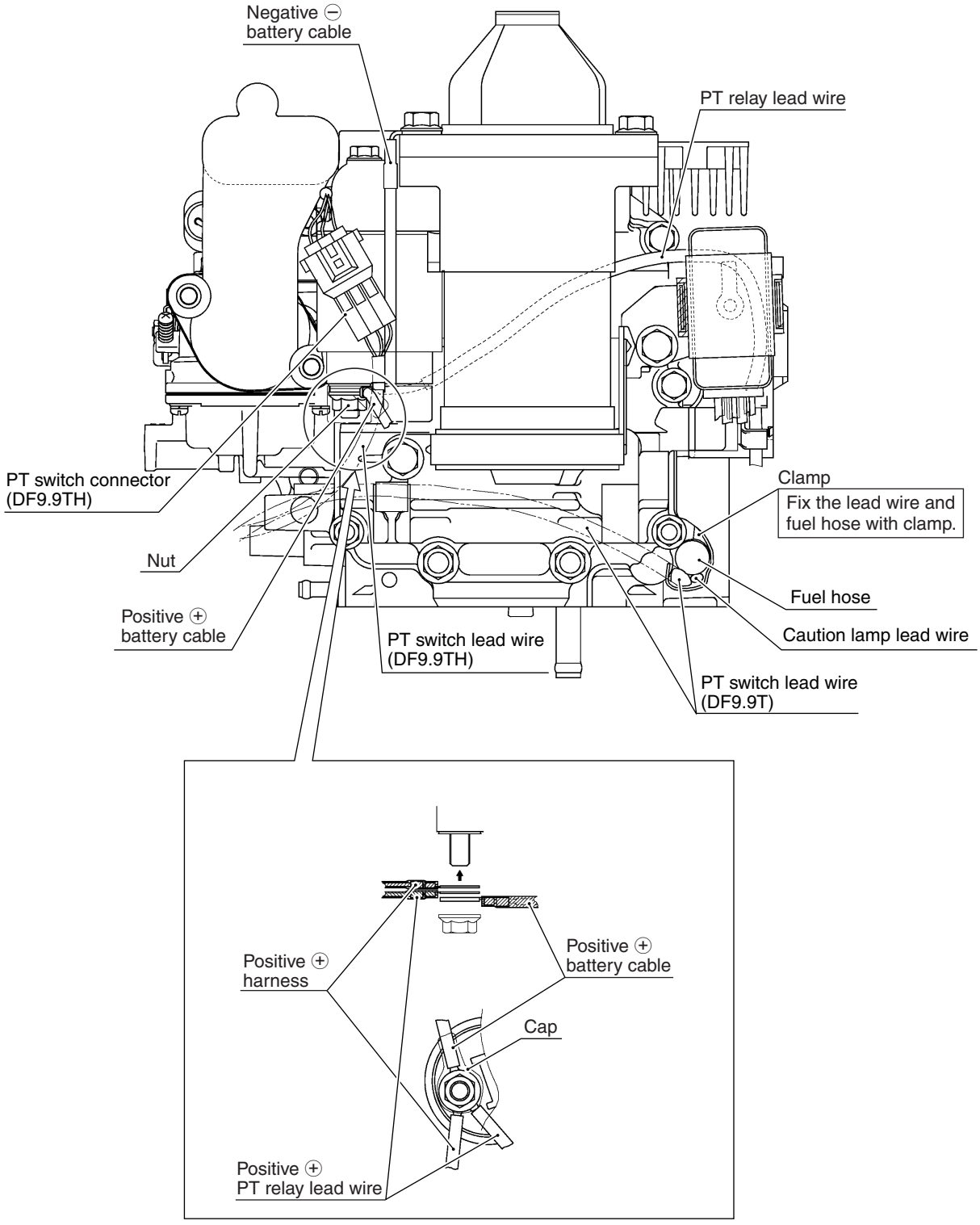


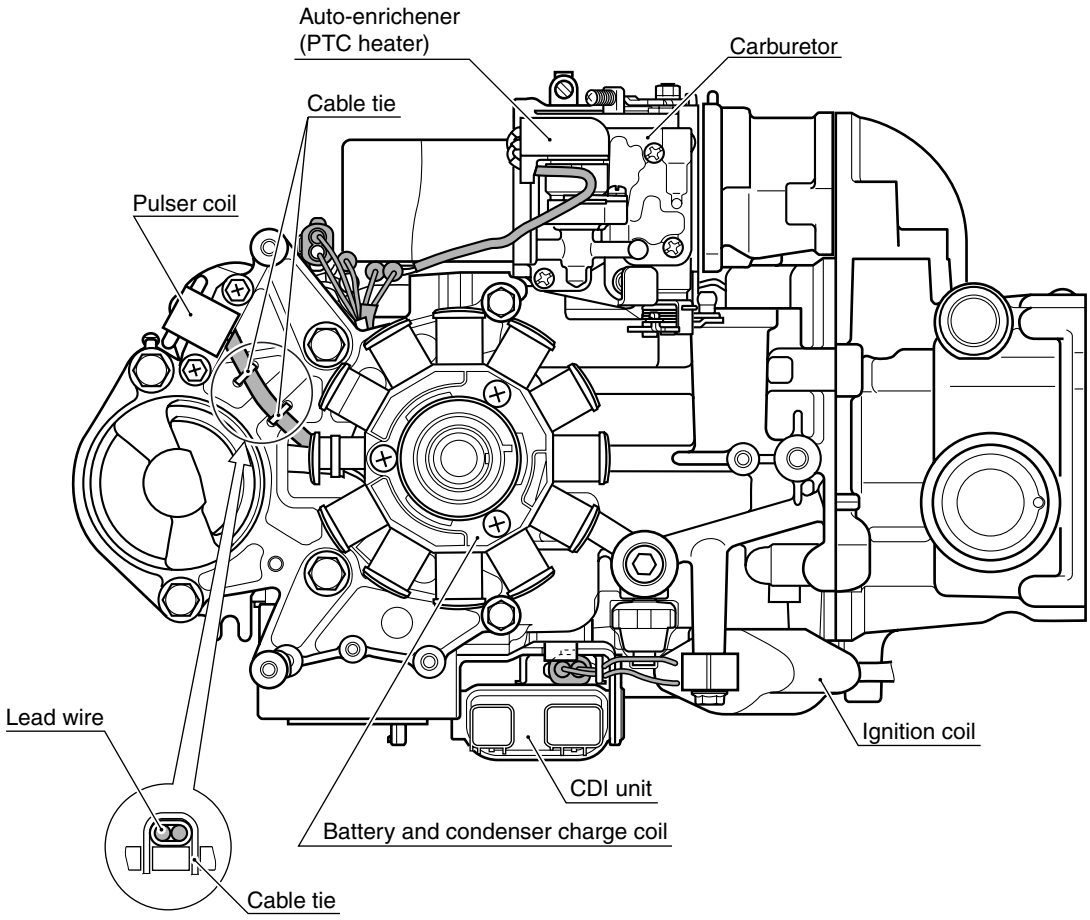
DF9.9T (REMOTE CONTROL)

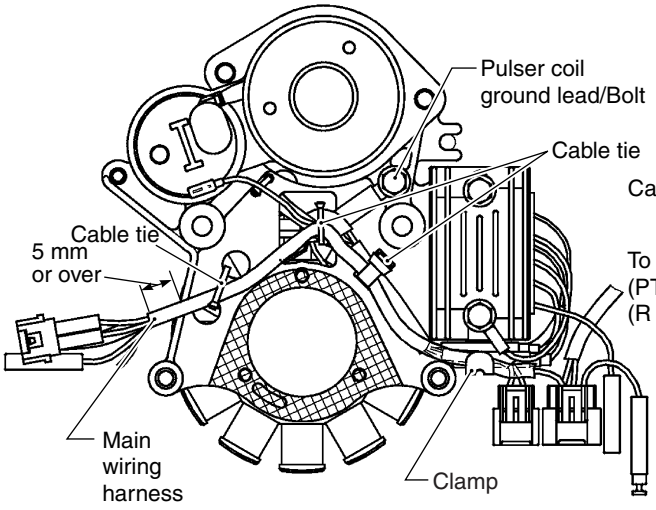


WIRE ROUTING

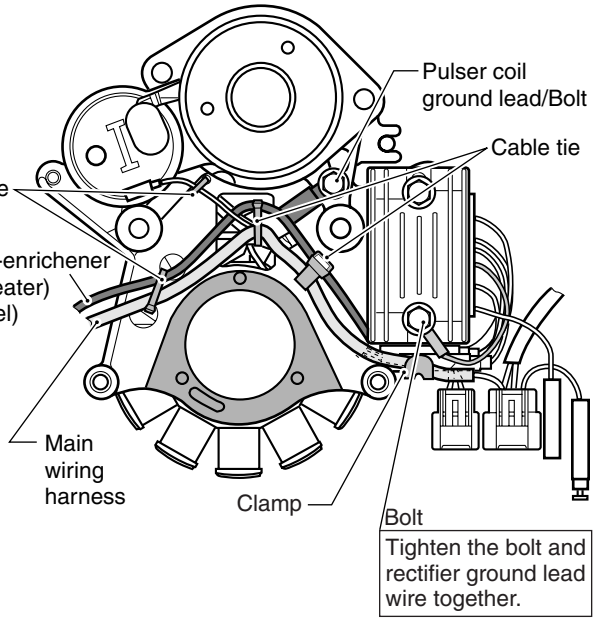






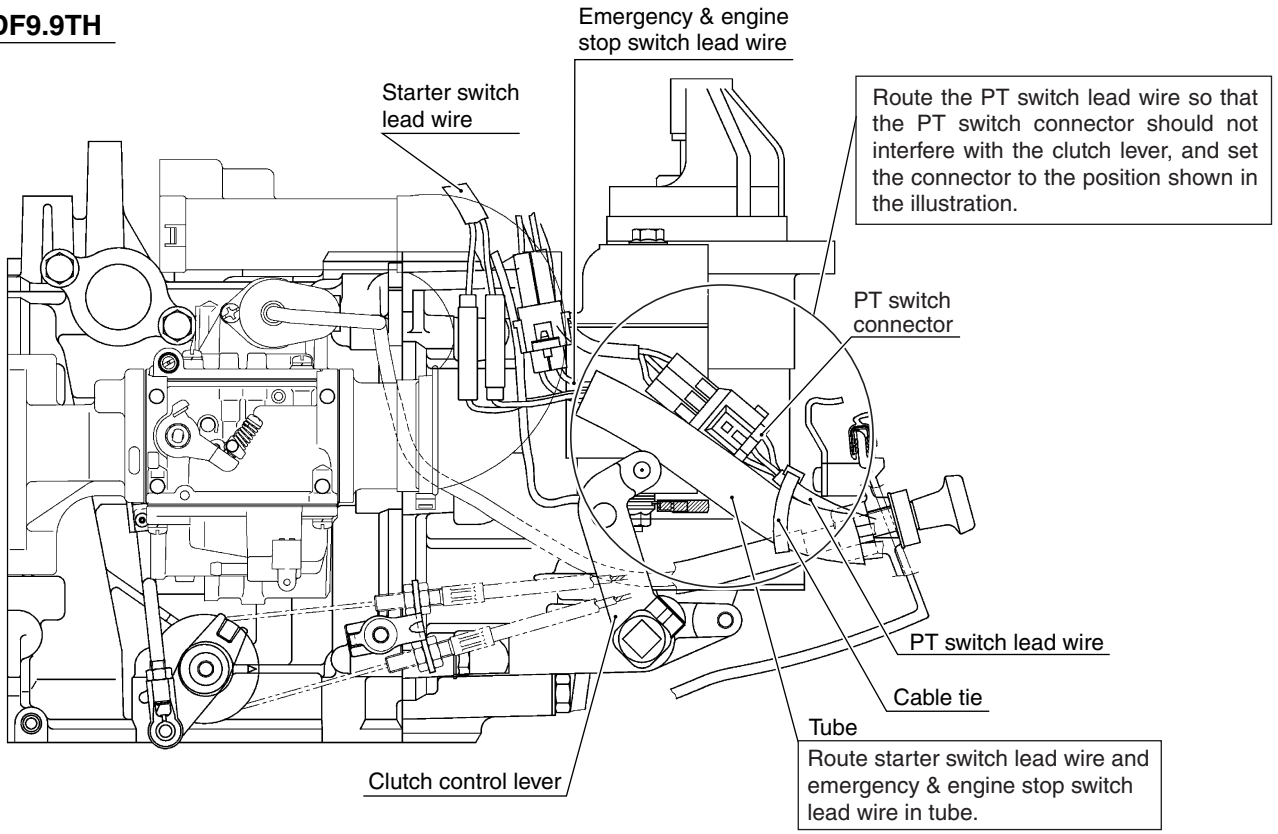


DF9.9TH

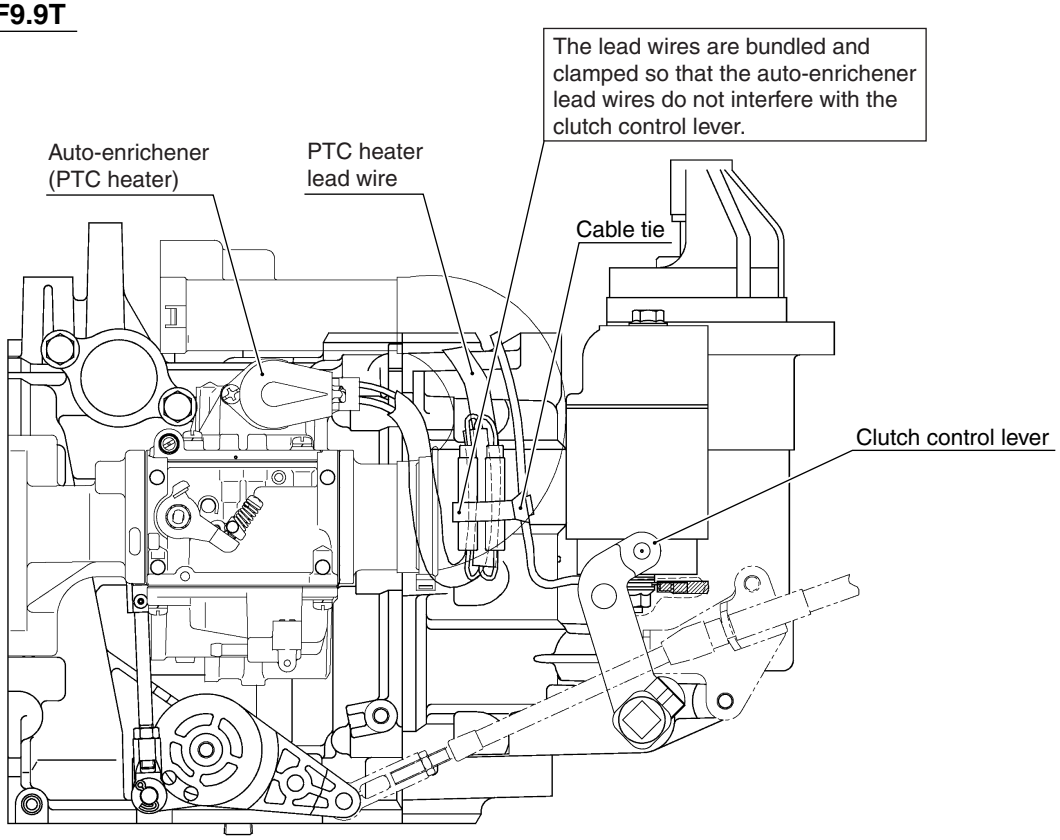


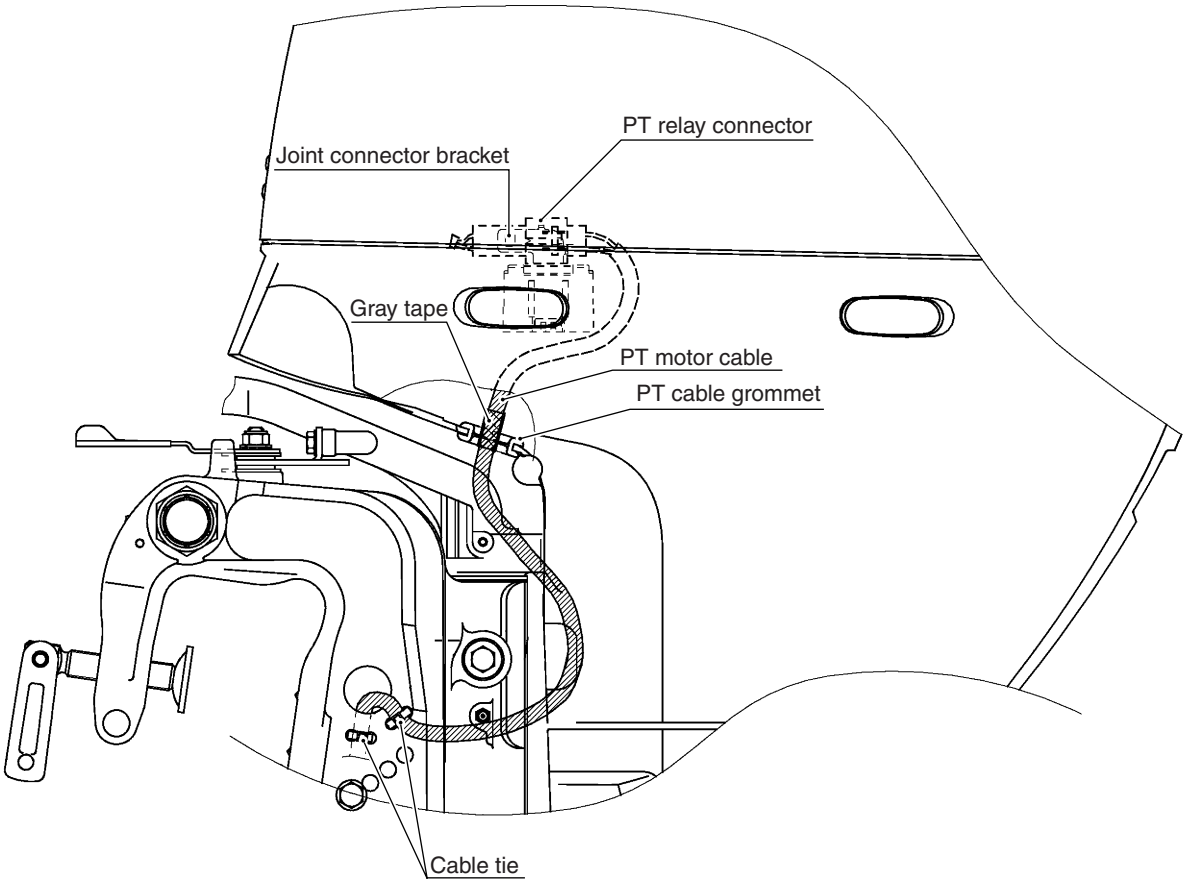
DF9.9T

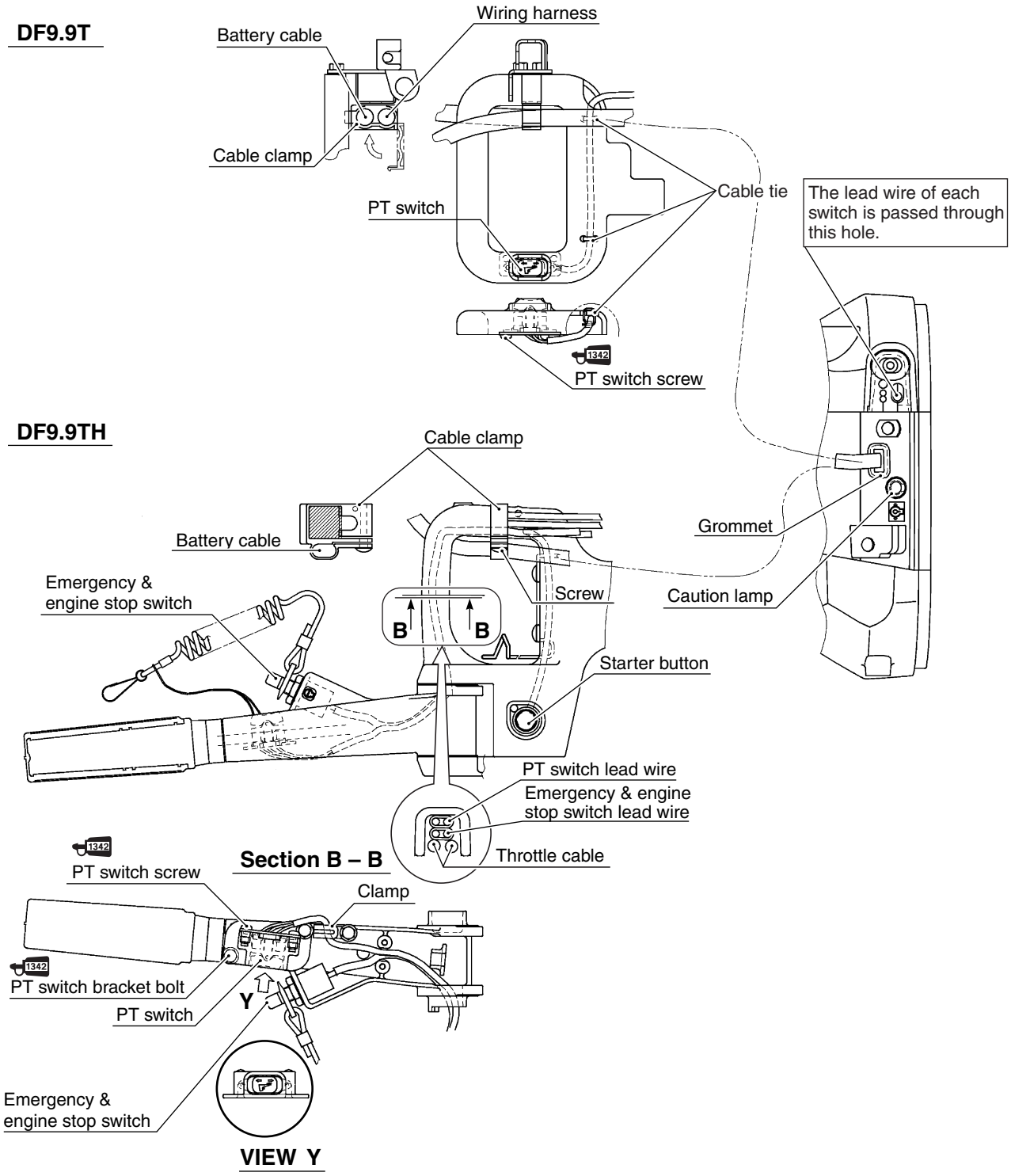
DF9.9TH



DF9.9T







Prepared by

SUZUKI MOTOR CORPORATION

Service Department

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Manual No.99500-94J01-01E
Printed in Japan

ZUKI OUTBOARD MOTOR

F9.9T/TH
F15 FOUR STROKE

PPLEMENTARY SERVICE MANUAL

Applicable model and effective serial number:

00993F-110001 and later
01503F-110001 and later

Use this supplement with the following service manual:
DF9.9/15 Service Manual (P/no., 99500-94J0•-01E)

99501-94J20-01E

DF9.9T/TH/DF15 (Serial No. 110001 and later)

FOREWORD

This supplementary service manual describes the outline, technical data and servicing procedures which differ from those of the following models.
Please read and thoroughly familiarize yourself with this information before using it for your service activities.

Applicable model and effective serial number:
00993F-110001 and later
01503F-110001 and later

NOTE:
- *Use this supplement with the following service manual:*
  DF9.9/15 Service Manual (P/no, 99500-94J0 • -01E)

CONTENTS

GENERAL INFORMATION

*SPECIFICATIONS (DF9.9T/TH)

*: These specifications are subject to change without notice.

Item		Unit	Data	
			DF9.9T	DF9.9TH
PRE-FIX			00993F	

DIMENSIONS & WEIGHT

Overall length (front to back)		mm (in)	668 (26.3)	
Overall width (side to side)		mm (in)	323 (12.7)	
Overall height	L	mm (in)	1 220 (48.0)	
	X	mm (in)	1 347 (53.0)	
Weight	L	kg (lbs)	53.5 (117.9)	54.5 (120.2)
	X	kg (lbs)	55.0 (121.3)	56.0 (123.5)
Transom height	L	mm (in. type)	545 (20)	
	X	mm (in. type)	672 (25)	

PERFORMANCE

Maximum output	kW (PS)	7.3 (9.9)
Recommended operating range	r/min	4 900 – 5 500
Idle speed	r/min	900 ± 50
In-gear idle speed	r/min	Approx. 820 – 920

POWER HEAD

Engine type		4-stroke SOHC	
Number of cylinders		2	
Bore	mm (in)	58.0 (2.28)	
Stroke	mm (in)	57.0 (2.24)	
Total displacement	cm^3 (cu. in)	302 (18.4)	
Compression ratio	:1	9.0	
Spark plug	NGK	CPR6EA-9	
Ignition system		SUZUKI PEI (Digital CDI)	
Fuel supply system		Carburetor (Number of carb.: 1)	
Exhaust system		Through prop exhaust	
Cooling system		Water cooled	
Lubrication system		Wet sump by trochoid pump	
Starting system		Electric	
Choke system (Enrichener system)		Automatic	Manual
Throttle control		Remote control	Twist grip

Item	Unit	Data	
		DF9.9T	DF9.9TH

FUEL & OIL

Fuel		Suzuki highly recommends the use of alcohol-free unleaded gasoline with a minimum pump octane rating of 87 (R/2+M/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.
Engine oil		• API classification: SG, SH, SJ, SL, SM or NMMA FC-W classification: SG, SH, SJ, SL, SM • Viscosity rating: SAE 10W-40 or NMMA FC-W 10W-40
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Gear oil		SUZUKI Outboard Motor Gear Oil or SAE 90 hypoid gear oil, API classification GL-5
Gearcase oil amounts	ml (US/Imp. qt)	170 (5.7/6.0)

BRACKET

Trim angle	Degree	0 – 12
Number of tilt pin position		4
Maximum tilt angle	Degree	66

LOWER UNIT

Reversing system	Gear
Transmission	Forward-Neutral-Reverse
Reduction system	Bevel gear
Gear ratio	12 : 25 (2.08)
Drive line impact protection	Spline drive rubber hub
Propeller	Blade × Diam. (in) × Pitch (in)
	4 × 10 × 5

*SPECIFICATIONS (DF15)

*: These specifications are subject to change without notice.

Item		Unit	Data		
			DF15	DF15E	DF15R
PRE-FIX			01503F		

DIMENSIONS & WEIGHT

Overall length (front to back)		mm (in)	668 (26.3)		
Overall width (side to side)		mm (in)	323 (12.7)		
Overall height	S	mm (in)	1095 (43.1)		
	L	mm (in)	1220 (48.0)		
Weight	S	kg (lbs)	44 (97.0)	47.5 (104.7)	46.5 (102.5)
	L	kg (lbs)	45 (99.2)	48.5 (106.9)	47.5 (104.7)
Transom height [Trim position: 3]	S	mm (inch type)	422 (15)		
	L	mm (inch type)	549 (20)		

PERFORMANCE

Maximum output	kW (PS)	11.0 (15)
Recommended operating range	r/min	5400 – 6000
Idle speed	r/min	900 ± 50 (in-gear: approx. 870)

POWERHEAD

Engine type		4-stroke SOHC		
Number of cylinders		2		
Bore	mm (in)	58.0 (2.28)		
Stroke	mm (in)	57.0 (2.24)		
Total displacement	cm^3 (cu in)	302 (18.4)		
Compression ratio	:1	9.0		
Spark plug	NGK	CPR6EA-9		
Ignition system		SUZUKI PEI (Digital CDI)		
Fuel supply system		Carburetor (Number of carb. : 1)		
Exhaust system		Through prop exhaust		
Cooling system		Water cooled		
Lubrication system		Wet sump by trochoid pump		
Starting system		Manual	Electric	
Choke system (Enrichener system)		Manual		Automatic
Throttle control		Twist grip		Remote control

Item	Unit	Data		
		DF15	DF15E	DF15R

FUEL & OIL

Fuel		Suzuki highly recommends the use of alcohol-free unleaded gasoline with a minimum pump octane rating of 87 ((R + M)/2 method) or 91 (Research method). However, blends of unleaded gasoline and alcohol with equivalent octane content may be used.
Engine oil		• API classification : SG, SH, SJ, SL, SM or NMMA FC-W classification : SG, SH, SJ, SL, SM • Viscosity rating : SAE 10W-40 or NMMA FC-W 10W-40
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Gear oil		SUZUKI Outboard Motor Gear Oil or SAE 90 hypoid gear oil, API classification GL-5
Gearcase oil amounts	ml (US/Imp. oz)	170 (5.7/6.0)

BRACKET

Trim angle	Degree	4 – 20
Number of tilt pin position		5
Maximum tilt angle	Degree	67

LOWER UNIT

Reversing system	Gear
Transmission	Forward-Neutral-Reverse
Reduction system	Bevel gear
Gear ratio	12 : 25 (2.083)
Drive line impact protection	Spline drive rubber hub
Propeller	Blade × Diam. (in) × Pitch (in) (I.D. No.)
	3 × 9-1/4 × 7 (M701) 3 × 9-1/4 × 9 (M901) 3 × 9-1/4 × 10 (M1001) 3 × 9-1/4 × 11 (M1101)
• Thick-blade type	• 3 × 9-1/4 × 8 (M821) • 3 × 9-1/4 × 9 (M911) • 3 × 9-1/4 × 10 (M1011)

*SERVICE DATA (DF9.9T/TH)

*: These service data are subject to change without notice.

Item	Unit	Data	
		DF9.9T	DF9.9TH

POWERHEAD

Recommended operation range	r/min	4 900 – 5 500
Idle speed	r/min	900 ± 50 (in-gear: approx. 820 – 920)
**Cylinder compression	kPa (kg/cm^2, psi)	820 – 1230 (8.2 – 12.3, 116 – 175): Without decompression system {Crank with recoil starter}
**Oil pressure [Oil temp. at 60 °C (140 °F)]	kPa (kg/cm^2, psi)	Min. 200 (2.0, 28) Max. 500 (5.0, 71) at 3 000 r/min
Engine oil		• API classification: SG, SH, SJ, SL, SM or NMMA FC-W classification: SG, SH, SJ, SL, SM • Viscosity rating: SAE 10W-40 or NMMA FC-W 10W-40
Engine oil amount	L (US/lpm. qt)	1.0 (1.1/0.9): Oil change only 1.1 (1.2/1.0): Oil filter change
Thermostat operating temperature	°C (°F)	58 – 62 (136 – 144)

** Figures shown are guidelines only, not absolute service limit.

CYLINDER HEAD/CAMSHAFT

Cylinder head distortion		Limit	mm (in)	0.05 (0.002)
Cam height	IN	STD	mm (in)	23.394 – 23.454 (0.9210 – 0.9234)
		Limit	mm (in)	23.294 (0.9171)
	EX	STD	mm (in)	23.397 – 23.457 (0.9211 – 0.9235)
		Limit	mm (in)	23.297 (0.9172)
Camshaft journal oil clearance		STD	mm (in)	0.020 – 0.062 (0.0008 – 0.0024)
		Limit	mm (in)	0.100 (0.0039)
Camshaft holder inside diameter	Upper	STD	mm (in)	25.000 – 25.021 (0.9843 – 0.9851)
	Lower	STD	mm (in)	23.000 – 23.021 (0.9055 – 0.9063)
Camshaft journal outside diameter	Upper	STD	mm (in)	24.959 – 24.980 (0.9826 – 0.9835)
	Lower	STD	mm (in)	22.959 – 22.980 (0.9039 – 0.9047)
Rocker arm shaft to rocker arm clearance		STD	mm (in)	0.016 – 0.045 (0.0006 – 0.0018)
		Limit	mm (in)	0.060 (0.0024)
Rocker arm inside diameter		STD	mm (in)	13.000 – 13.018 (0.5118 – 0.5125)
Rocker arm shaft outside diameter		STD	mm (in)	12.973 – 12.984 (0.5107 – 0.5112)

Item			Unit	Data	
				DF9.9T	DF9.9TH

VALVE/VALVE GUIDE

Valve diameter	IN	STD	mm (in)	26 (1.0)
	EX	STD	mm (in)	22 (0.9)
Valve clearance (cold engine condition)	IN	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
	EX	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
Valve guide to valve stem clearance	IN	STD	mm (in)	0.010 – 0.037 (0.0004 – 0.0015)
		Limit	mm (in)	0.070 (0.0028)
	EX	STD	mm (in)	0.035 – 0.062 (0.0014 – 0.0024)
		Limit	mm (in)	0.090 (0.0035)
Valve guide inside diameter	IN	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
	EX	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
Valve stem outside diameter	IN	STD	mm (in)	5.475 – 5.490 (0.2156 – 0.2161)
	EX	STD	mm (in)	5.450 – 5.465 (0.2146 – 0.2152)
Valve guide protrusion	IN	STD	mm (in)	10 (0.39)
	EX	STD	mm (in)	10 (0.39)
Valve stem deflection	IN	Limit	mm (in)	0.16 (0.006)
	EX	Limit	mm (in)	0.16 (0.006)
Valve stem runout	IN	Limit	mm (in)	0.05 (0.002)
	EX	Limit	mm (in)	0.05 (0.002)
Valve head radial runout	IN	Limit	mm (in)	0.03 (0.001)
	EX	Limit	mm (in)	0.03 (0.001)
Valve head thickness	IN	Limit	mm (in)	0.5 (0.02)
	EX	Limit	mm (in)	0.5 (0.02)
Valve seat contact width	IN	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
	EX	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
Valve spring free length		STD	mm (in)	32.52 (1.280)
		Limit	mm (in)	32.40 (1.276)
Valve spring tension		STD	N (kg, lbs)	90 (9.0, 19.8) for 28.5 mm (1.12 in)
		Limit	N (kg, lbs)	76 (7.6, 16.8) for 28.5 mm (1.12 in)

Item			Unit	Data	
				DF9.9T	DF9.9TH

CYLINDER/PISTON/PISTON RING

Cylinder distortion		Limit	mm (in)	0.05 (0.002)
Piston to cylinder clearance		STD	mm (in)	0.0276 – 0.0425 (0.0011 – 0.0017)
		Limit	mm (in)	0.100 (0.0039)
Cylinder bore		STD	mm (in)	58.000 – 58.015 (2.2835 – 2.2841)
Cylinder measuring position			mm (in)	50 (2.0) from cylinder top surface
Piston skirt diameter		STD	mm (in)	57.965 – 57.980 (2.2821 – 2.2827)
Piston measuring position			mm (in)	15 (0.6) from piston skirt end
Wear on cylinder bore		Limit	mm (in)	0.055 (0.0022)
Piston ring end gap	1st	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
	2nd	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)
		Limit	mm (in)	0.50 (0.020)
Piston ring free end gap	1st	STD	mm (in)	Approx. 5.8 (0.23)
		Limit	mm (in)	4.6 (0.18)
	2nd	STD	mm (in)	Approx. 7.4 (0.29)
		Limit	mm (in)	5.9 (0.23)
Piston ring to groove clearance	1st	STD	mm (in)	0.02 – 0.06 (0.0008 – 0.0024)
		Limit	mm (in)	0.10 (0.004)
	2nd	STD	mm (in)	0.02 – 0.06 (0.0008 – 0.0024)
		Limit	mm (in)	0.10 (0.004)
Piston ring groove width	1st	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	2nd	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)
	Oil	STD	mm (in)	2.51 – 2.53 (0.0988 – 0.0996)
Piston ring thickness	1st	STD	mm (in)	1.17 – 1.19 (0.0461 – 0.0469)
	2nd	STD	mm (in)	1.17 – 1.19 (0.0461 – 0.0469)
Pin clearance in piston pin hole		STD	mm (in)	0.002 – 0.013 (0.0001 – 0.0005)
		Limit	mm (in)	0.040 (0.0016)
Piston pin outside diameter		STD	mm (in)	13.995 – 14.000 (0.5510 – 0.5512)
		Limit	mm (in)	13.980 (0.5504)
Piston pin hole diameter		STD	mm (in)	14.002 – 14.008 (0.5513 – 0.5515)
		Limit	mm (in)	14.030 (0.5524)

Item		Unit	Data	
			DF9.9T	DF9.9TH
CRANKSHAFT/CONROD				
Conrod small end inside diameter	STD	mm (in)	14.006 – 14.014 (0.5514 – 0.5517)	
	Limit	mm (in)	14.040 (0.5528)	
Conrod big end oil clearance	STD	mm (in)	0.025 – 0.045 (0.0010 – 0.0018)	
	Limit	mm (in)	0.063 (0.0025)	
Conrod big end inside diameter	STD	mm (in)	29.025 – 29.034 (1.1427 – 1.1431)	
Crank pin outside diameter	STD	mm (in)	28.989 – 29.000 (1.1413 – 1.1417)	
Crank pin outside diameter difference	Limit	mm (in)	0.010 (0.0004)	
Conrod big end side clearance	STD	mm (in)	0.10 – 0.20 (0.004 – 0.008)	
	Limit	mm (in)	0.60 (0.024)	
Conrod big end width	STD	mm (in)	19.95 – 20.00 (0.785 – 0.787)	
Crank pin width	STD	mm (in)	20.10 – 20.15 (0.791 – 0.793)	
Crankshaft thrust clearance	Limit	mm (in)	0.60 (0.024)	
Crankshaft length	STD	mm (in)	126.8 – 126.9 (4.992 – 4.996)	
Crankcase length	STD	mm (in)	127.0 – 127.1 (5.000 – 5.004)	
Crankshaft journal oil clearance	STD	mm (in)	0.020 – 0.047 (0.0008 – 0.0019)	
	Limit	mm (in)	0.060 (0.0024)	
Crankshaft bearing holder inside diameter	STD	mm (in)	35.000 – 35.008 (1.3780 – 1.3783)	
Crankshaft journal outside diameter	STD	mm (in)	31.989 – 32.000 (1.2594 – 1.2598)	
Crankshaft journal outside diameter difference	Limit	mm (in)	0.010 (0.0004)	
Crankshaft bearing thickness	STD	mm (in)	1.486 – 1.490 (0.0585 – 0.0587)	

Item	Unit	Data	
		DF9.9T	DF9.9TH

LOWER UNIT

Gearcase oil amount	ml (US/Imp.oz)	170 (5.7/6.0)
Gear ratio		2.08 (12 : 25)

Preliminary gear shim & thrust washer

Pinion back up shim	mm (in)	1.0 (0.04)
Forward back up shim	mm (in)	1.0 (0.04)
Reverse back up shim	mm (in)	1.0 (0.04)
Forward thrust washer	mm (in)	1.5 (0.06)
Reverse thrust washer	mm (in)	1.5 (0.06)

Initial selection-shim adjustment may be required.

CARBURETOR

Type	KEIHIN	BCMII 23-11.5	
I.D. mark		94J3A	94J2A
Main jet	#	70	
Pilot jet	#	38	
Pilot screw	Turns open	PRE-SET (1-7/8 ± 1/2)	
Float height	mm	13.5 ± 2	

Item		Unit	Data	
			DF9.9T	DF9.9TH

ELECTRICAL

Ignition timing		Degree	ATDC 5 – BTDC 30
Over revolution limiter		r/min	Approx. 6 500
Condenser charge coil resistance		Ω at 20 °C	12.5 – 18.8 (G – B/R)
Pulser coil resistance		Ω at 20 °C	148 – 222 (R/B – B)
Ignition coil resistance (without spark plug cap)	Primary	Ω at 20 °C	0.2 – 0.4 (O – B)
	Secondary	kΩ at 20 °C	6.8 – 10.2 (H.T. cord – H.T. cord)
Spark plug cap resistance		kΩ at 20 °C	4 – 6
Battery charge coil resistance		Ω at 20 °C	0.3 – 0.44 (R – Y)
Battery charge coil output (12V)		Watt	120
Standard spark plug	Type	NGK	CPR6EA-9
	Gap	mm (in)	0.8 – 0.9 (0.031 – 0.035)
Fuse amp rating		A	20
Recommended battery capacity (12V)		Ah (kC)	35 (126) or over
Starter motor relay coil resistance		Ω at 20 °C	145 – 190
PT motor relay coil resistance		Ω at 20 °C	25 – 37

STARTER MOTOR

Max. continuous time of use		Sec.	30
Motor output		kW	1.4
Brush length	STD	mm (in)	15.5 (0.61)
	Limit	mm (in)	9.5 (0.37)
Commutator undercut	STD	mm (in)	0.5 – 0.8 (0.02 – 0.03)
	Limit	mm (in)	0.2 (0.01)
Commutator outside diameter	STD	mm (in)	29.0 (1.14)
	Limit	mm (in)	28.0 (1.10)
Difference between max/min diameter of commutator	STD	mm (in)	0.05 (0.002)
	Limit	mm (in)	0.40 (0.016)

PTT MOTOR

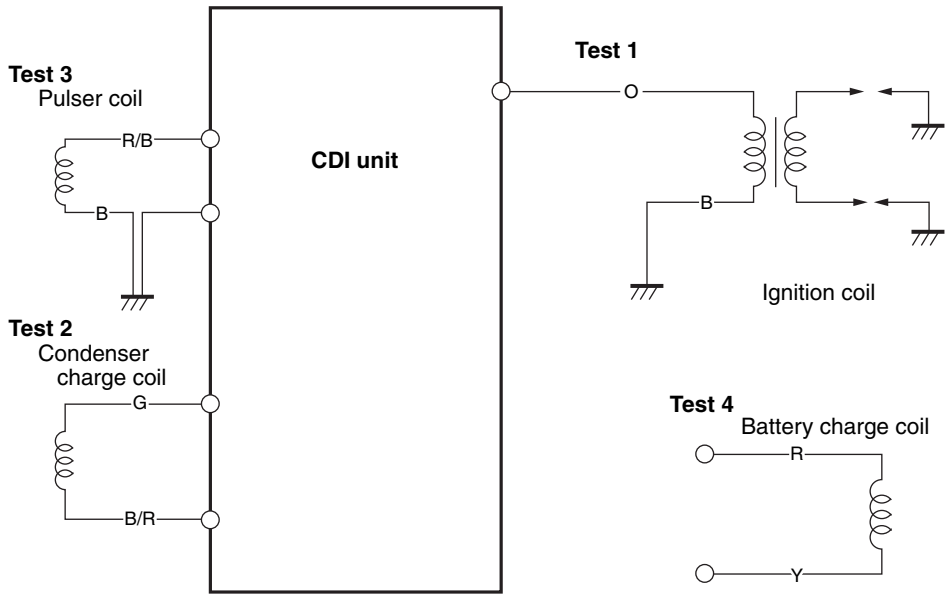
Brush length	STD	mm (in)	10.0 (0.39)
	Limit	mm (in)	5.5 (0.22)
Commutator outside diameter	STD	mm (in)	22.0 (0.87)
	Limit	mm (in)	21.0 (0.83)

PEAK VOLTAGE

Requirements for peak voltage measurement

- Remove all spark plugs to eliminate the variables at cranking speed.
- Crank with recoil starter.
- Use a STEVENS peak voltage tester, Model CD-77.
- Use the 6-pin connector test cord (Part No. 09930-89920)

Testing sequence		Tester probe connection		Peak voltage	Tester range	Remarks
		⊕ (Red)	⊖ (Black)			
1	CDI output	Orange	Black	128 V or over	NEG 500	• With ignition coil connected. • Use the 6-pin connector test cord.
2	Condenser charge coil output	Green	Black/Red	15 V or over	POS 50	With CDI unit disconnected
3	Pulser coil output	Red/Black	Black (Ground)	0.8 V or over	SEN 5	
4	Battery charge coil output	Red	Yellow	5.6 V or over	POS 50	With rectifier disconnected



*SERVICE DATA (DF15)

*: These service data are subject to change without notice.

Item	Unit	Data		
		DF15	DF15E	DF15R

POWERHEAD

Recommended operating range	r/min	5400 – 6000
Idle speed	r/min	900 ± 50 (in-gear: approx. 870)
* Cylinder compression (with decompression system)	kPa (kg/cm², psi)	550 – 850 (5.5 – 8.5, 78 – 120) With decompression system (Manual start model) 820 – 1230 (8.2 – 12.3, 116 – 175): Without decompression system (Electricl start model) (Crank with recoil starter)
* Oil pressure (Oil temp. at 60 °C (140 °F)	kPa (kg/cm², psi)	Min. 200 (2.0, 28) Max. 500 (5.0, 71) at 3000 r/min
Engine oil		• API classification : SG, SH, SJ, SL, SM or NMMA FC-W classification : SG, SH, SJ, SL, SM • Viscosity rating : SAE 10W-40 or NMMA FC-W 10W-40
Engine oil amounts	L (US/Imp. qt)	1.0 (1.1/0.9) . . . . Oil change only 1.1 (1.2/1.0) . . . . Oil filter change
Thermostat operating temperature	°C (°F)	58 – 62 (136 – 144)

* Figures shown are guidelines only, not absolute service limits.

CYLINDER HEAD/CAMSHAFT

Cylinder head distortion		Limit	mm (in)	0.05 (0.002)
Cam height	IN	STD	mm (in)	23.394 – 23.454 (0.9210 – 0.9234)
		Limit	mm (in)	23.294 (0.9171)
	EX	STD	mm (in)	23.397 – 23.457 (0.9211 – 0.9235)
		Limit	mm (in)	23.297 (0.9172)
Camshaft journal oil clearance		STD	mm (in)	0.020 – 0.062 (0.0008 – 0.0024)
		Limit	mm (in)	0.100 (0.0039)
Camshaft holder inside diameter	Upper	STD	mm (in)	25.000 – 25.021 (0.9843 – 0.9851)
	Lower	STD	mm (in)	23.000 – 23.021 (0.9055 – 0.9063)
Camshaft journal outside diameter	Upper	STD	mm (in)	24.959 – 24.980 (0.9826 – 0.9835)
	Lower	STD	mm (in)	22.959 – 22.980 (0.9039 – 0.9047)
Rocker arm shaft to rocker arm clearance		STD	mm (in)	0.016 – 0.045 (0.0006 – 0.0018)
		Limit	mm (in)	0.060 (0.0024)
Rocker arm inside diameter		STD	mm (in)	13.000 – 13.018 (0.5118 – 0.5125)
Rocker arm shaft outside diameter		STD	mm (in)	12.973 – 12.984 (0.5107 – 0.5112)

Item			Unit	Data		
				DF15	DF15E	DF15R

VALVE/VALVE GUIDE

Valve diameter	IN	STD	mm (in)	26 (1.0)
	EX	STD	mm (in)	22 (0.9)
Valve clearance (Cold engine condition)	IN	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
	EX	STD	mm (in)	0.18 – 0.22 (0.007 – 0.009)
Valve guide to valve stem clearance	IN	STD	mm (in)	0.010 – 0.037 (0.0004 – 0.0015)
		Limit	mm (in)	0.070 (0.0028)
	EX	STD	mm (in)	0.035 – 0.062 (0.0014 – 0.0024)
		Limit	mm (in)	0.090 (0.0035)
Valve guide inside diameter	IN	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
	EX	STD	mm (in)	5.500 – 5.512 (0.2165 – 0.2170)
Valve stem outside diameter	IN	STD	mm (in)	5.475 – 5.490 (0.2156 – 0.2161)
	EX	STD	mm (in)	5.450 – 5.465 (0.2146 – 0.2152)
Valve guide protrusion	IN	Limit	mm (in)	10.0 (0.39)
	EX	Limit	mm (in)	10.0 (0.39)
Valve stem deflection	IN	Limit	mm (in)	0.16 (0.006)
	EX	Limit	mm (in)	0.16 (0.006)
Valve stem runout	IN	Limit	mm (in)	0.05 (0.002)
	EX	Limit	mm (in)	0.05 (0.002)
Valve head radial runout	IN	Limit	mm (in)	0.03 (0.001)
	EX	Limit	mm (in)	0.03 (0.001)
Valve head thickness	IN	Limit	mm (in)	0.5 (0.02)
	EX	Limit	mm (in)	0.5 (0.02)
Valve seat contact width	IN	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
	EX	STD	mm (in)	0.9 – 1.1 (0.035 – 0.043)
Valve spring free length		STD	mm (in)	32.52 (1.280)
		Limit	mm (in)	32.40 (1.276)
Valve spring tension		STD	N (kg, lbs)	90 (9.0, 19.8) for 28.5 mm (1.12 in)
		Limit	N (kg, lbs)	76 (7.6, 16.8) for 28.5 mm (1.12 in)

Item			Unit	Data		
				DF15	DF15E	DF15R
CYLINDER/PISTON/PISTON RING						
Cylinder distortion		Limit	mm (in)	0.05 (0.002)		
Piston to cylinder clearance		STD	mm (in)	0.0276 – 0.0425 (0.0011 – 0.0017)		
		Limit	mm (in)	0.100 (0.0039)		
Cylinder bore		STD	mm (in)	58.000 – 58.015 (2.2835 – 2.2841)		
Cylinder measuring position			mm (in)	50 (2.0) from cylinder top surface		
Piston skirt diameter		STD	mm (in)	57.965 – 57.980 (2.2821 – 2.2827)		
Piston measuring position			mm (in)	15 (0.6) from piston skirt end		
Wear on cylinder bore		Limit	mm (in)	0.055 (0.0022)		
Piston ring end gap	1st	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)		
		Limit	mm (in)	0.50 (0.020)		
	2nd	STD	mm (in)	0.10 – 0.25 (0.004 – 0.010)		
		Limit	mm (in)	0.50 (0.020)		
Piston ring free end gap	1st	STD	mm (in)	Approx. 5.8 (0.23)		
		Limit	mm (in)	4.6 (0.18)		
	2nd	STD	mm (in)	Approx. 7.4 (0.29)		
		Limit	mm (in)	5.9 (0.23)		
Piston ring to groove clearance	1st	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)		
		Limit	mm (in)	0.10 (0.004)		
	2nd	STD	mm (in)	0.02 – 0.06 (0.001 – 0.002)		
		Limit	mm (in)	0.10 (0.004)		
Piston ring groove width	1st	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)		
	2nd	STD	mm (in)	1.21 – 1.23 (0.0476 – 0.0484)		
	Oil	STD	mm (in)	2.51 – 2.53 (0.099 – 0.100)		
Piston ring thickness	1st	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)		
	2nd	STD	mm (in)	1.17 – 1.19 (0.046 – 0.047)		
Pin clearance in piston pin hole		STD	mm (in)	0.002 – 0.013 (0.0001 – 0.0005)		
		Limit	mm (in)	0.040 (0.0016)		
Piston pin outside diameter		STD	mm (in)	13.995 – 14.000 (0.5510 – 0.5512)		
		Limit	mm (in)	13.980 (0.5504)		
Piston pin hole diameter		STD	mm (in)	14.002 – 14.008 (0.5513 – 0.5515)		
		Limit	mm (in)	14.030 (0.5524)		

Item		Unit	Data		
			DF15	DF15E	DF15R
CRANKSHAFT/CONROD					
Conrod small end inside diameter	STD	mm (in)	14.006 – 14.014 (0.5514 – 0.5517)		
	Limit	mm (in)	14.040 (0.5528)		
Conrod big end oil clearance	STD	mm (in)	0.025 – 0.045 (0.0010 – 0.0018)		
	Limit	mm (in)	0.063 (0.0025)		
Conrod big end inside diameter	STD	mm (in)	29.025 – 29.034 (1.1427 – 1.1431)		
Crank pin outside diameter	STD	mm (in)	28.989 – 29.000 (1.1413 – 1.1417)		
Crank pin outside diameter difference	Limit	mm (in)	0.010 (0.0004)		
Conrod big end side clearance	STD	mm (in)	0.10 – 0.20 (0.004 – 0.008)		
	Limit	mm (in)	0.60 (0.024)		
Conrod big end width	STD	mm (in)	19.95 – 20.00 (0.785 – 0.787)		
Crank pin width	STD	mm (in)	20.10 – 20.15 (0.791 – 0.793)		
Crankshaft thrust clearance	Limit	mm (in)	0.60 (0.024)		
Crankshaft length	STD	mm (in)	126.8 – 126.9 (4.992 – 4.996)		
Crankcase length	STD	mm (in)	127.0 – 127.1 (5.000 – 5.004)		
Crankshaft journal oil clearance	STD	mm (in)	0.020 – 0.047 (0.0008 – 0.0019)		
	Limit	mm (in)	0.060 (0.0024)		
Crankcase bearing holder inside diameter	STD	mm (in)	35.000 – 35.008 (1.3780 – 1.3783)		
Crankshaft journal outside diameter	STD	mm (in)	31.989 – 32.000 (1.2594 – 1.2598)		
Crankshaft journal outside diameter difference	Limit	mm (in)	0.010 (0.0004)		
Crankshaft bearing thickness	Limit	mm (in)	1.486 – 1.490 (0.0585 – 0.0587)		

Item	Unit	Data		
		DF15	DF15E	DF15R

LOWER UNIT

Gearcase oil amounts	ml (US/Imp. oz)	170 (5.7/6.0)
Gear ratio		2.08 (12:25)
Preliminary gear shim & thrust washer		
Pinion back up shim	mm (in)	1.0 (0.04)
Forward back up shim	mm (in)	1.0 (0.04)
Reverse back up shim	mm (in)	1.0 (0.04)
Forward thrust washer	mm (in)	1.5 (0.06)
Reverse thrust washer	mm (in)	1.5 (0.06)

Initial selection-shim adjustment may be required.

CARBURETOR

Type	KEIHIN	BCMⅡ25-21	
I.D. mark		94J6A	94J7A
Main jet	#	115	
Pilot jet	#	40	
Pilot screw	Turns open	PRE-SET(2-7/8 ± 1/2)	
Float height	mm	13.5 ± 2	

Item		Unit	Data		
			DF15	DF15E	DF15R

ELECTRICAL

Ignition timing		Degree	ATDC 5 – BTDC 30		
Over revolution limiter		r/min	6500		
Condenser charge coil resistance		Ω at 20 °C	12.5 – 18.8 (G–B/R)		
Pulser coil resistance		Ω at 20 °C	148 – 222 (R/B–B)		
Ignition coil resistance (Without spark plug cap)	Primary	Ω at 20 °C	0.2 – 0.4 (O–B)		
	Secondary	kΩ at 20 °C	6.8 – 10.2 (High-tension cord – High-tension cord)		
Spark plug cap resistance		kΩ at 20 °C	4 – 6		
Battery charge coil resistance		Ω at 20 °C	0.9 – 1.3 (R–Y)		0.3 – 0.4 (R–Y)
Battery charge coil output (12 V)		Watt	80		120
Standard spark plug	Type	NGK	CPR6EA-9		
	Gap	mm (in)	0.8 – 0.9 (0.031 – 0.035)		
Fuse amp rating		A	—	20	
Recommended battery capacity (12 V)		Ah (kC)	—	35 (126) or over	
Starter motor relay coil resistance		Ω at 20 °C	—	145 – 190	

STARTER MOTOR

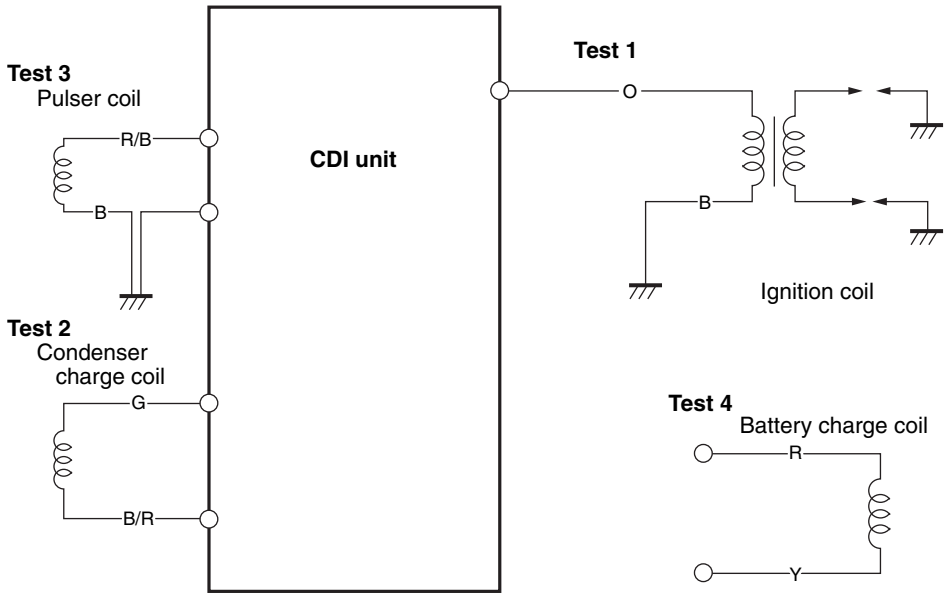
Max. continuous time of use		Sec	—	30
Motor output		kW	—	1.4
Brush length	STD	mm (in)	—	15.5 (0.61)
	Limit	mm (in)	—	9.5 (0.37)
Commutator undercut	STD	mm (in)	—	0.5 – 0.8 (0.02 – 0.03)
	Limit	mm (in)	—	0.2 (0.01)
Commutator outside diameter	STD	mm (in)	—	29.0 (1.14)
	Limit	mm (in)	—	28.0 (1.10)
Commutator outside diameter difference	STD	mm (in)	—	0.05 (0.002)
	Limit	mm (in)	—	0.40 (0.016)

PEAK VOLTAGE

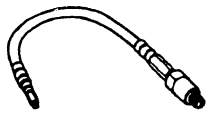
Requirements for peak voltage measurement

- Remove all spark plugs to eliminate the variables at cranking speed.
- Crank with recoil starter.
- Use a STEVENS peak voltage tester, Model CD-77.
- Use the 6-pin connector test cord (Part No. 09930-89920).

Testing sequence		Tester probe connection		Peak voltage	Tester range	Remarks
		⊕ (Red)	⊖ (Black)			
1	CDI output	Orange	Black	128 V or over	NEG 500	• With ignition coil connected • Use the 6-pin connector test cord.
2	Condenser charge coil output	Green	Black/Red	15 V or over	POS 50	With CDI unit disconnected
3	Pulser coil output	Red/Black	Black (Ground)	0.8 V or over	SEN 5	
4	Battery charge coil output	Red	Yellow	5.6 V or over	POS 50	With rectifier disconnected



SPECIAL TOOLS



09915-63311
Compression gauge adaptor

PERIODIC MAINTENANCE

MAINTENANCE AND TUNE-UP PROCEDURES

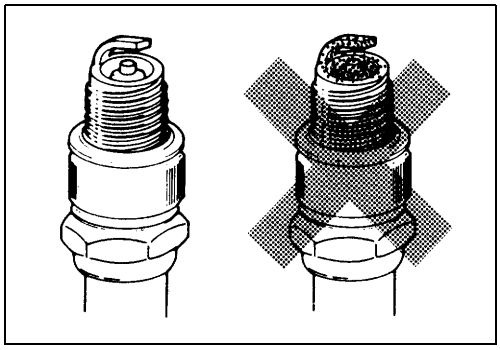
SPARK PLUG

- **Inspect every 100 hours (6 months).**
- **Replace every 200 hours (12 months).**

Standard spark plug: NGK CPR6EA-9

CAUTION

Only resistor (R) type spark plugs must be used with this engine. Using a non-resistor spark plug will cause ignition system malfunctions.



CARBON DEPOSIT

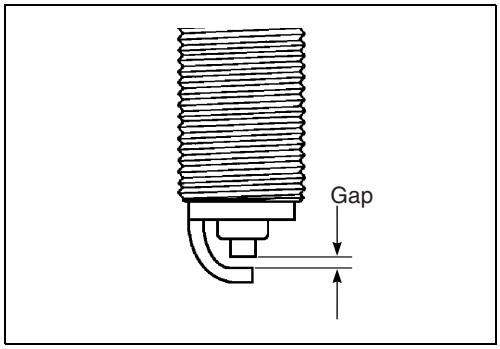
Inspect for a carbon deposit on spark plug base.
If carbon is present, remove it with a spark plug cleaning machine or by carefully using a pointed tool.

SPARK PLUG GAP

Measure spark plug gap with a thickness gauge.
Adjust to within specified range if gap is out of specification.

Spark plug gap: 0.8 – 0.9 mm (0.031 – 0.035 in)

09900-20803: Thickness gauge



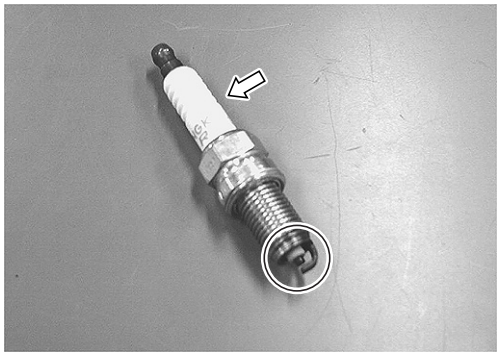
CONDITION OF ELECTRODE/INSULATOR

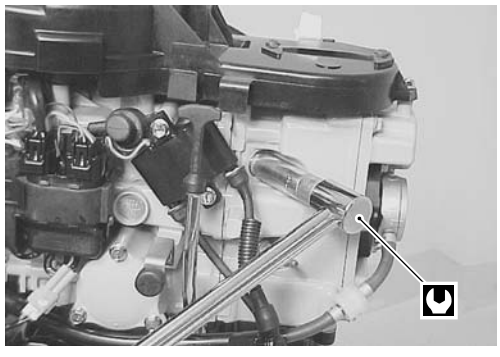
Check the electrode and insulator condition.
If the electrode is extremely worn or burnt, replace the spark plug.
If the spark plug has a broken insulator, damaged threads, etc., replace the spark plug.

CAUTION

Confirm the thread size and reach when replacing the plug. If the reach is too short, carbon will be deposited on the threaded portion of the plug hole resulting in possible engine damage.

Spark plug: 11 N·m (1.1 kg-m, 8.0 lb-ft)





CYLINDER COMPRESSION

Cylinder compression:
Standard:
550 – 850 kPa (5.5 – 8.5 kg/cm², 78 – 120 psi.): With decompression system (DF15)
820 – 1 230 kPa (8.2 – 12.3 kg/cm², 116 – 175 psi.):
Without decompression system (DF9.9T/TH, DF15E/R)
Max. difference between any other cylinders:
100 kPa (1.0 kg/cm², 14 psi.)

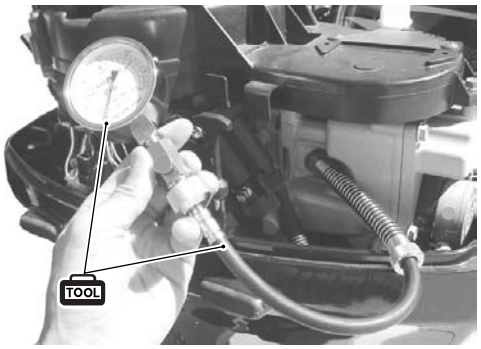
NOTE:
Figures shown are guidelines only, not absolute service limits.

Low compression pressure can indicate one or more of the following:
- Excessively worn cylinder wall
- Worn piston or piston rings
- Stuck piston rings
- Poor seating of valves
- Ruptured or otherwise damaged cylinder head gasket

TEST PROCEDURE

1. Start engine and allow to warm up, then shut engine off.
2. Remove the STBD / PORT engine side lower cover.
3. Remove all spark plugs.
4. Install the compression gauge into the plug hole.

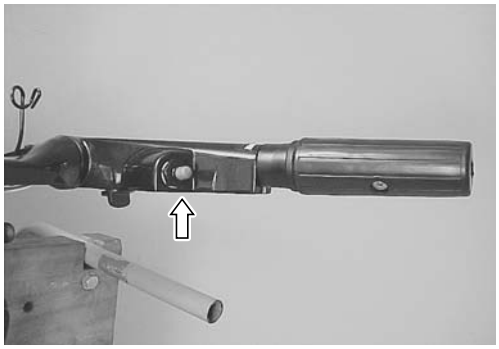
TOOL 09915-64512: Compression gauge
09915-63311: Compression gauge adapter



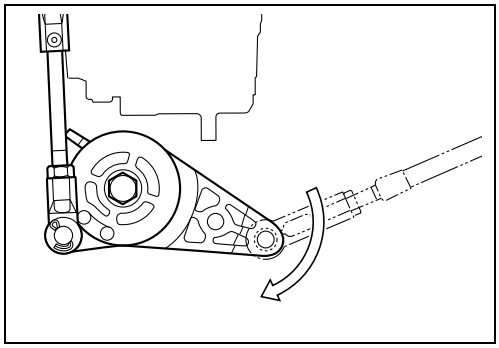
5. Disconnect the safety lanyard from the emergency stop switch.

⚠ WARNING

Disconnect the safety lanyard from the emergency stop switch prior to cranking the engine.
This will prevent any residual fuel discharged from the cylinders from being ignited by a spark discharged from the spark plug cap.



6. Disconnect the remote control throttle cable from the throttle lever. (R model)
7. • Move and hold the throttle lever in the full-open position. (R model)
   • Move and hold the throttle control grip in the full-open position. (Tiller handle model.)
8. While cranking the engine with the starter motor or recoil starter, note the maximum compression pressure reading on the gauge for each cylinder.
9. Reinstall parts removed earlier. (spark plug, side lower cover, etc.)



IGNITION AND ELECTRICAL

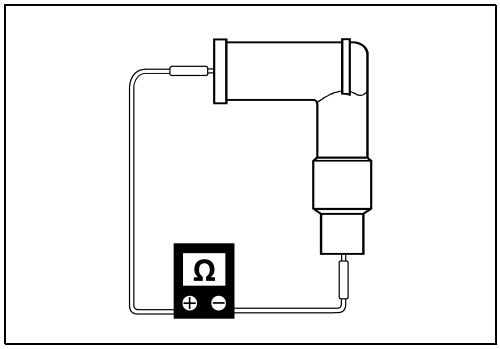
IGNITION SYSTEM

INSPECTION

SPARK PLUG CAP

09930-99320: Digital tester

Tester range: Ω (Resistance)



Measure the spark plug cap resistance.

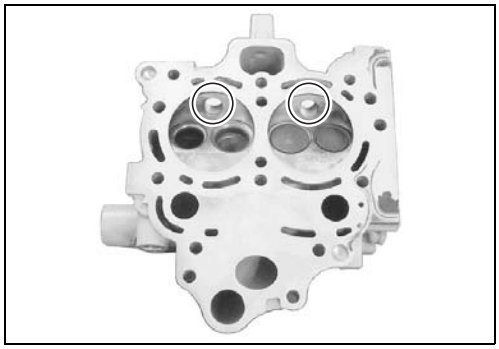
Tester probe connection	
Probe	**Other probe**
Cap end	Other cap end

Spark plug cap resistance: 4 – 6 kΩ

If measurement is out of specification, replace the spark plug cap.

POWER UNIT

CYLINDER HEAD



The thread diameter of the spark plug hole on the cylinder head has been changed from 14 mm to 10 mm.

NOTE:
Interchangeability:
The new cylinder head can be installed on the early model with the new cylinder head, spark plug and spark plug cap used together as a set.

Prepared by

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Outboard Motor Engineering Department

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