



JETSKI®
watercraft
STX-15F



JET SKI® Watercraft Service Manual



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

- Bend the pages back to match the black tab of the desired chapter number with the black tab on the edge at each table of contents page.
- Refer to the sectional table of contents for the exact pages to locate the specific topic required.



JET SKi® Watercraft Service Manual

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No liability can be accepted for any inaccuracies or omissions in this publication, although every possible care has been taken to make it as complete and accurate as possible.

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

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

LIST OF ABBREVIATIONS

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

COUNTRY AND AREA CODES

AU	Australia	FR	France
CA	Canada	US	United States
EUR	Europe		

MAINTENANCE AND ADJUSTMENTS

Maintenance, replacement, or repair of the emission control devices and systems may be performed by any marine SI engine repair establishment or individual.

EMISSION CONTROL INFORMATION

Fuel Information

THIS ENGINE IS CERTIFIED TO OPERATE ON UNLEADED GRADE GASOLINE ONLY with an octane rating equal to or higher than that shown below.

Minimum Octane Rating: Antiknock Index* 87

Research Octane Number (RON) 91

*: The Antiknock Index is an average of the Research Octane Number (RON) and the Motor Octane Number (MON).

Emission Control Information

To protect the environment in which we all live, Kawasaki has incorporated an exhaust emission control system in compliance with applicable regulations of the United States Environmental Protection Agency.

Exhaust Emission Control System

This system reduces the amount of pollutants discharged into the atmosphere by the exhaust of this engine. The fuel, ignition and exhaust systems of this engine have been carefully designed and constructed to ensure an efficient engine with low exhaust pollutant levels.

Maintenance

Proper maintenance and repair are necessary to ensure that watercraft will continue to have low emission levels. This Service Manual contains those maintenance and repair recommendations for this engine. Those items identified by the Periodic Maintenance Chart are necessary to ensure compliance with the applicable standards.

Tampering with Emission Control System Prohibited

Federal law prohibits the following acts or the causing thereof: (1) the removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new engine for the purposes of emission control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) the use of the engine after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the acts listed below:

Do not tamper with the original emission related parts.

- * Digital Transistor Ignition System
- * Fuel Pump
- * Spark Plugs
- * Throttle Body and Internal Parts
- * Fuel Injectors
- * ECU

Foreword

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

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

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

To get the longest life out of your JET SKI® watercraft:

- Follow the Periodic Maintenance Chart in the Service Manual.
- Be alert for problems and non-scheduled maintenance.
- Use proper tools and genuine Kawasaki JET SKI® watercraft parts. Special tools, gauges, and testers that are necessary when servicing Kawasaki JET SKI® watercraft are introduced by the Service Manual. Genuine parts provided as spare parts are listed in the Parts Catalog.

- Follow the procedures in this manual carefully. Don't take shortcuts.
- Remember to keep complete records of maintenance and repair with dates and any new parts installed.

How to Use This Manual

In this manual, the product is divided into its major systems and these systems make up the manual's chapters. The Quick Reference Guide shows you all of the product's system and assists in locating their chapters. Each chapter in turn has its own comprehensive Table of Contents.

For example, if you want ignition coil information, use the Quick Reference Guide to locate the Electrical System chapter. Then, use the Table of Contents on the first page of the chapter to find the Ignition Coil section.

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

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

NOTICE is used to address practices not related to personal injury.

This manual contains four more symbols which will help you distinguish different types of information.

NOTE

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

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

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

This model, JT1500A, is mounted with a four-stroke engine.

When the JET SKI® watercraft is submerged and swamped, the four-stroke engine needs special care and systematic procedure for recovery compared with the two-stroke engine. Therefore in this manual, such procedures, which are not shown in SMs for two-stroke engines, are explained thoroughly to cope with the cases.

Refer to the section, After submerging in Chapter 9, Cooling and Bilge Systems for the summary and detailed procedures.

General Information

Table of Contents

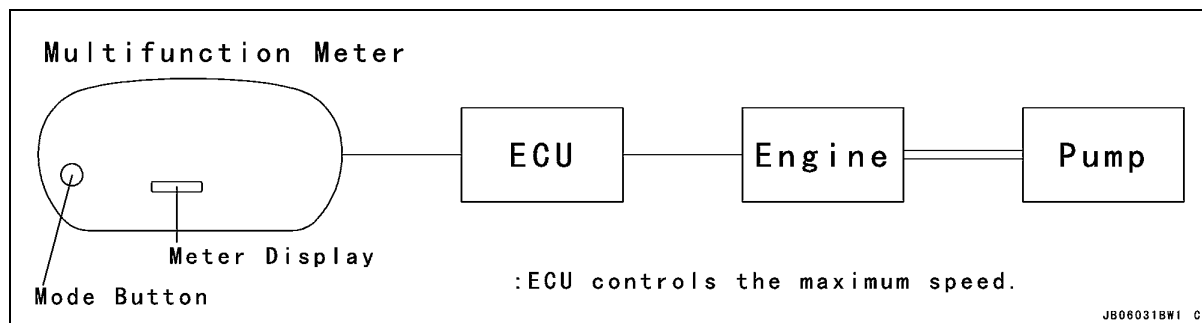
Smart Learning Operation mode (SLO) (JT1500-A2 Model ~).....	1-2
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1-2 GENERAL INFORMATION

Smart Learning Operation mode (SLO) (JT1500-A2 Model ~)

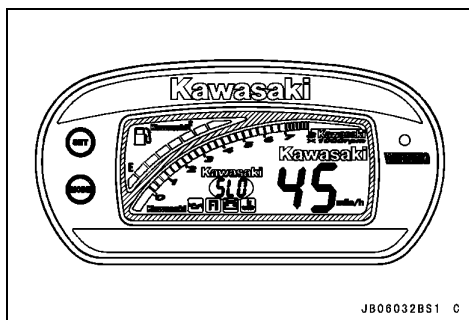
This watercraft is equipped with the Smart Learning Operation mode (SLO) and normal operation mode (Full Power Operation, FPO). The SLO mode reduces the maximum watercraft speed by approximately 30 percent for a use by unskilled operators. To change the SLO mode to FPO mode, and back again, push the "MODE" button for 7 seconds or more.



SLO mode is displayed on the meter as SLO.

NOTE

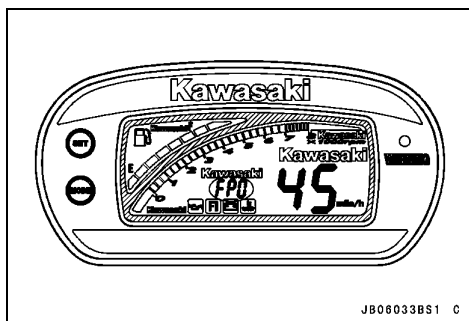
- When shifted to the SLO mode, the initial display, as shown when the ignition switch is turned on, is shown together with a buzzer sound.
- Then, "SLO" is shown blinking at every three seconds.
- Under the SLO mode, all the meter displays and other functions work in the same manner as the normal operation (Full Power Operation, FPO) mode.



Normal operation mode (Full Power Operation mode, FPO) is shown by FPO display.

NOTE

- When shifted to the normal operation mode (Full Power Operation mode, FPO), the same initial display is first shown and followed by "FPO" for two seconds. However, "FPO" is shown only once when shifted and is not displayed thereafter.
- When the ignition switch is turned off and on again, the same mode when turned off is displayed again.



Before Servicing

Before starting to perform an inspection service or carry out a disassembly and reassembly operation on watercraft, read the precautions given below. To facilitate actual operations, notes, illustrations, photographs, cautions, and detailed descriptions have been included in each chapter wherever necessary. This section explains the items that require particular attention during the removal and reinstallation or disassembly and reassembly of general parts.

Especially note the following:

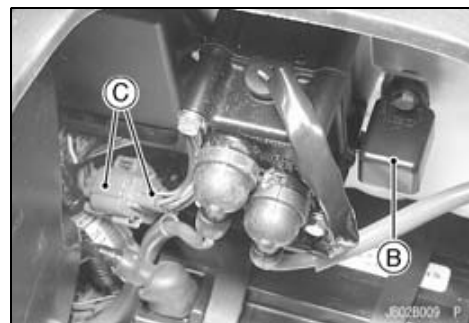
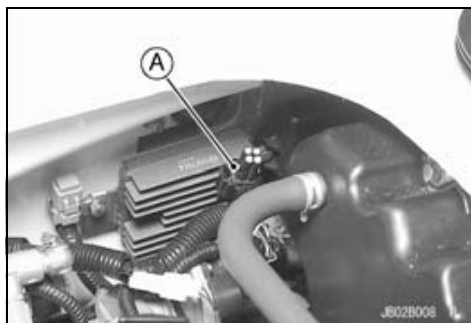
Kawasaki Diagnostic System (KDS) Software

KDS software that runs on Windows personal computer (PC) will be available as a diagnostic tool for watercraft with Kawasaki DFI system.

You need the following items to use the KDS.

Item	P/No.
KDS Software Version 3.□ (CD-ROM, Updated Version)	57001-1650
KDS3 Adapter	57001-1648 and 57001-1724 or 57001-1725
Communication Cables	57001-1649 and 57001-1688
Relay Cable	57001-1535

The connectors for the communication cable and relay cable are located in the front of the battery. Connect the communication cable to the KDS connector (4-pin) [A] and the relay cable between the relay assembly [B] connectors (8-pin) [C].



Adjustments

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

NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

Auxiliary Cooling

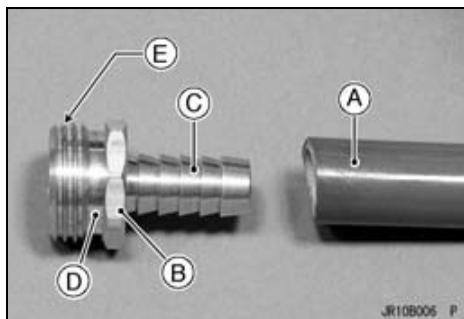
An auxiliary cooling supply may be used if the watercraft cannot be operated in water during adjustments. If possible, always operate the watercraft in water rather than use an auxiliary cooling supply.

1-4 GENERAL INFORMATION

Before Servicing

- Obtain a standard garden hose [A] and a garden hose adapter [B] as shown.
 - C: Garden Hose Fitting of Adapter
 - D: Flushing Fitting of Adapter
 - E: Thread: Rp 3/4

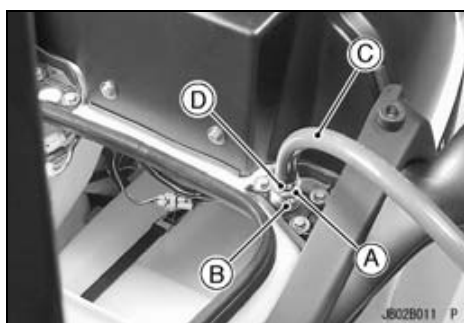
○ Optional part (P/No. 92005-3746) is available as a garden hose adapter.



- Open the front storage compartment cover.
- Remove the flushing cap [A] on the brim of the storage compartment.



- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].



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

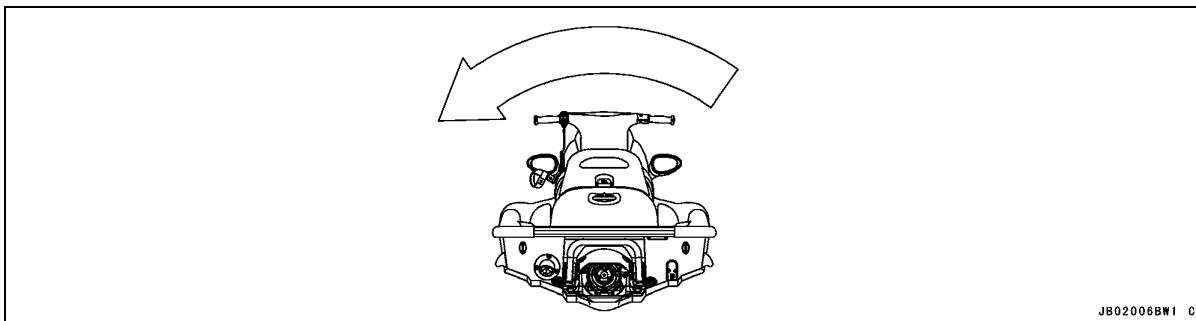
NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

An excessive supply of cooling water may cause the engine to stop and flood the cylinders, creating the potential for hydraulic lock which causes severe engine damage. To prevent engine damage when using an auxiliary cooling supply, shut the water off immediately if the engine stops running.

NOTICE

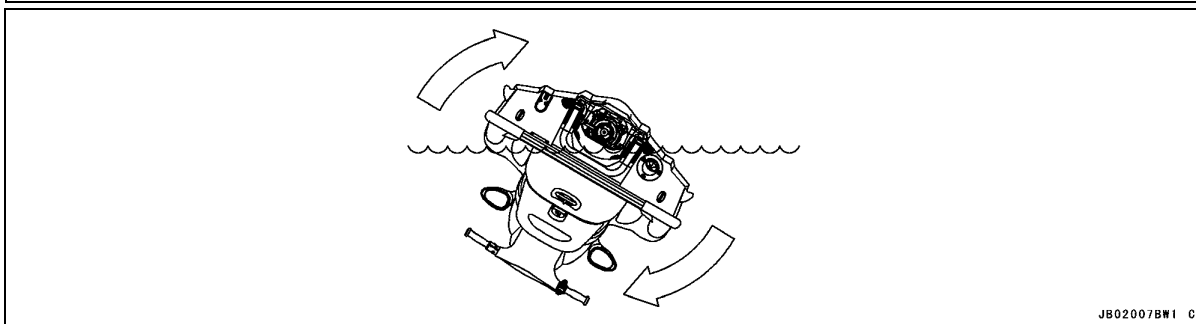
Rolling to the right side can cause water in the exhaust system to run into the engine, with possible engine damage. To prevent engine damage, always turn the boat on its left side.

Before Servicing

JB02006BW1 C

NOTICE

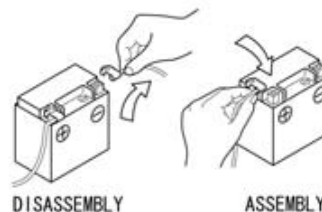
Rolling the capsized watercraft counterclockwise (to its STARBOARD side) can cause water in the exhaust system to run into the engine, with possible engine damage. Always turn the capsized boat clockwise so that the PORT side always faces downward.



JB02007BW1 C

Battery Ground

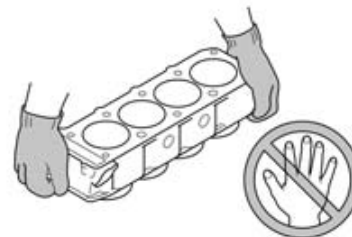
Before completing any service on the watercraft, disconnect the battery cables from the battery to prevent the engine from accidentally turning over. Disconnect the ground cable (–) first and then the positive (+). When completed with the service, first connect the positive (+) cable to the positive (+) terminal of the battery then the negative (–) cable to the negative terminal.



GB02024B S

Edges of Parts

Lift large or heavy parts wearing gloves to prevent injury from possible sharp edges on the parts.



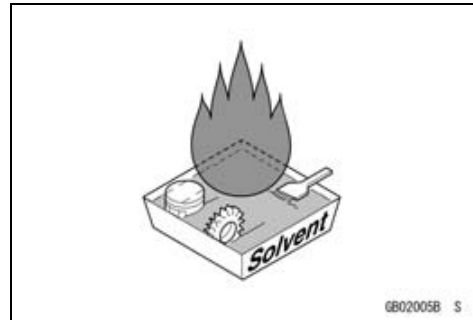
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1-6 GENERAL INFORMATION

Before Servicing

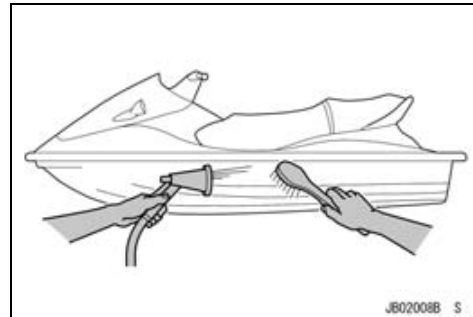
Solvent

Use a high-flush point solvent when cleaning parts. High-flush point solvent should be used according to directions of the solvent manufacturer.



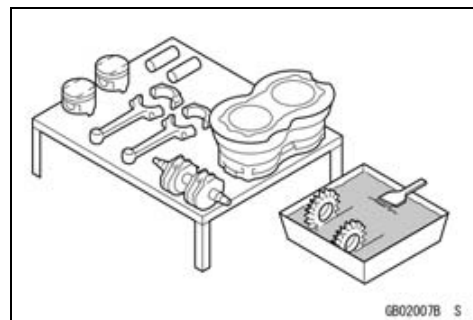
Cleaning Watercraft before Disassembly

Clean the watercraft thoroughly before disassembly. Dirt or other foreign materials entering into sealed areas during watercraft disassembly can cause excessive wear and decrease performance of the watercraft.



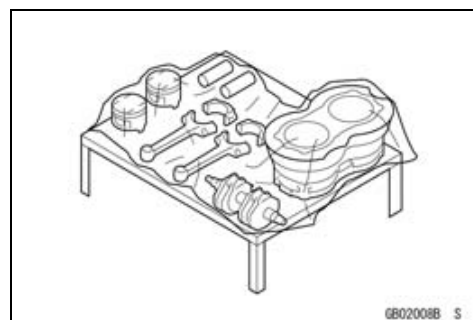
Arrangement and Cleaning of Removed Parts

Disassembled parts are easy to confuse. Arrange the parts according to the order the parts were disassembled and clean the parts in order prior to assembly.



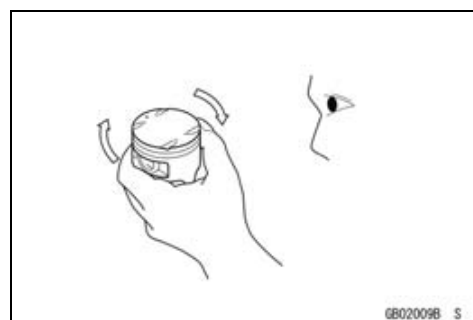
Storage of Removed Parts

After all the parts including subassembly parts have been cleaned, store the parts in a clean area. Put a clean cloth or plastic sheet over the parts to protect from any foreign materials that may collect before re-assembly.



Inspection

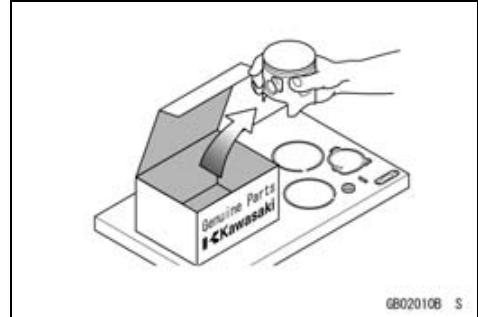
Reuse of worn or damaged parts may lead to serious accident. Visually inspect removed parts for corrosion, discoloration, or other damage. Refer to the appropriate sections of this manual for service limits on individual parts. Replace the parts if any damage has been found or if the part is beyond its service limit.



Before Servicing

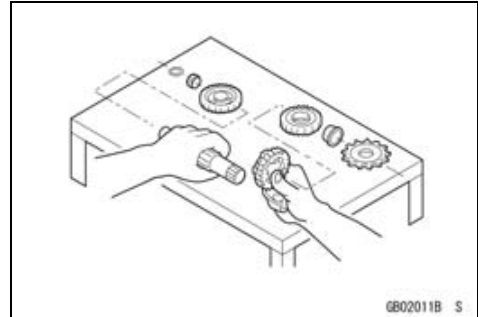
Replacement Parts

Replacement Parts must be KAWASAKI genuine or recommended by KAWASAKI. Gaskets, O-rings, oil seals, grease seals, circlips, cotter pins or self-locking nuts must be replaced with new ones whenever disassembled.



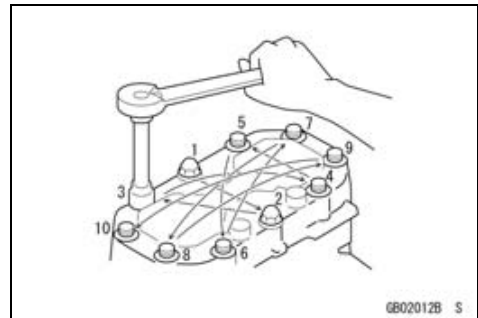
Assembly Order

In most cases assembly order is the reverse of disassembly, however, if assembly order is provided in this Service Manual, follow the procedures given.



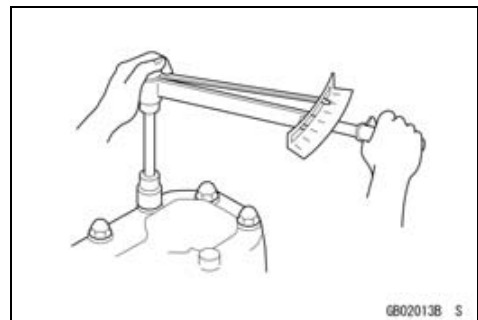
Tightening Sequence

Generally, when installing a part with several bolts, nuts, or screws, start them all in their holes and tighten them to a snug fit. Then tighten them according to the specified sequence to prevent case warpage or deformation which can lead to malfunction. Conversely when loosening the bolts, nuts, or screws, first loosen all of them by about a quarter turn and then remove them. If the specified tightening sequence is not indicated, tighten the fasteners alternating diagonally.



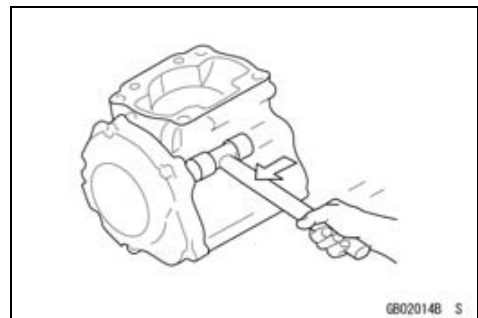
Tightening Torque

Incorrect torque applied to a bolt, nut, or screw may lead to serious damage. Tighten fasteners to the specified torque using a good quality torque wrench.



Force

Use common sense during disassembly and assembly, excessive force can cause expensive or hard to repair damage. When necessary, remove screws that have a non-permanent locking agent applied using an impact driver. Use a plastic-faced mallet whenever tapping is necessary.

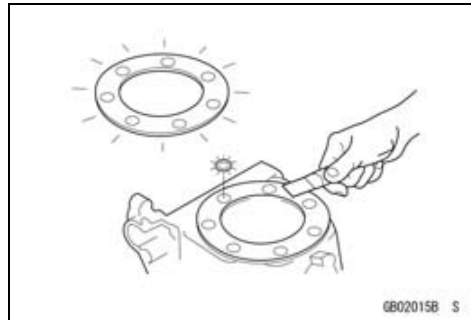


1-8 GENERAL INFORMATION

Before Servicing

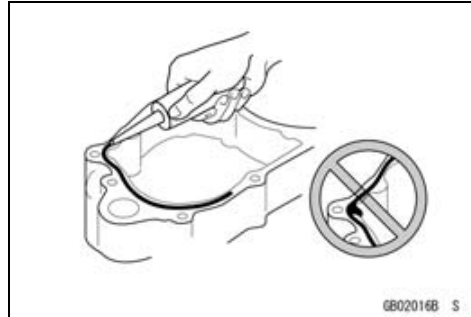
Gasket, O-ring

Hardening, shrinkage, or damage of both gaskets and O-rings after disassembly can reduce sealing performance. Remove old gaskets and clean the sealing surfaces thoroughly so that no gasket material or other material remains. Install new gaskets and replace used O-rings when re-assembling.



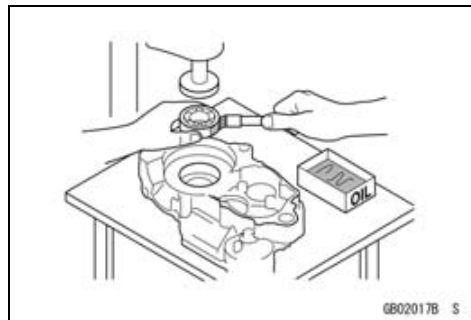
Liquid Gasket, Locking Agent

For applications that require Liquid Gasket or a Non-permanent Locking Agent, clean the surfaces so that no oil residue remains before applying liquid gasket or non-permanent locking agent. Do not apply them excessively. Excessive application can clog oil passages and cause serious damage.



Press

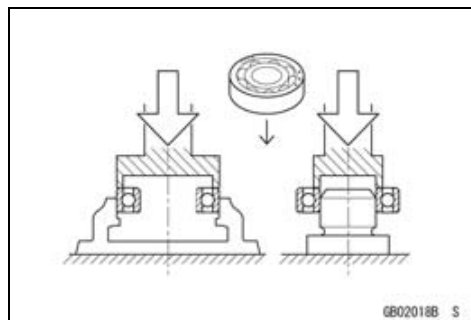
For items such as bearings or oil seals that must be pressed into place, apply small amount of oil to the contact area. Be sure to maintain proper alignment and use smooth movements when installing.



Ball Bearing

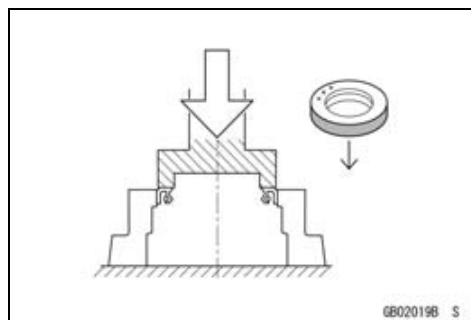
Do not remove pressed ball or needle unless removal is absolutely necessary. Replace with new ones whenever removed. Press bearings with the manufacturer and size marks facing out. Press the bearing into place by putting pressure on the correct bearing race as shown.

Pressing the incorrect race can cause pressure between the inner and outer race and result in bearing damage.



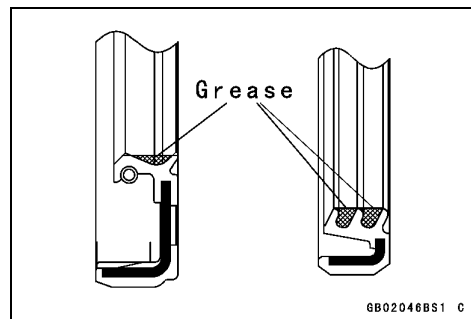
Oil Seal, Grease Seal

Do not remove pressed oil or grease seals unless removal is necessary. Replace with new ones whenever removed. Press new oil seals with manufacture and size marks facing out. Make sure the seal is aligned properly when installing.



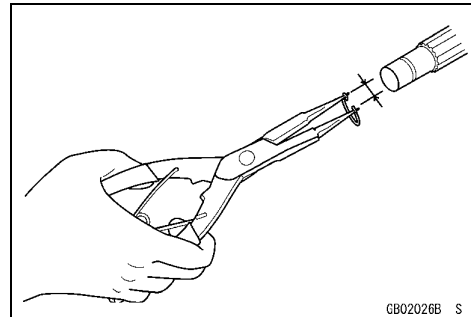
Before Servicing

Apply specified grease to the lip of seal before installing the seal.



Circlips, Cotter Pins

Replace circlips or cotter pins that were removed with new ones. Take care not to open the clip excessively when installing to prevent deformation.



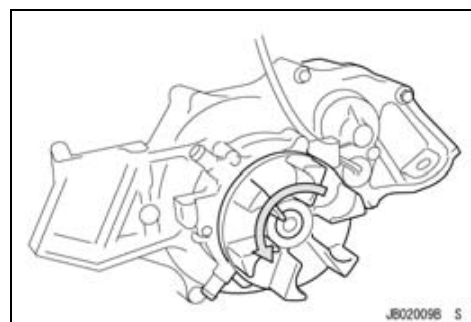
Lubrication

It is important to lubricate rotating or sliding parts during assembly to minimize wear during initial operation. Lubrication points are called out throughout this manual, apply the specific oil or grease as specified.



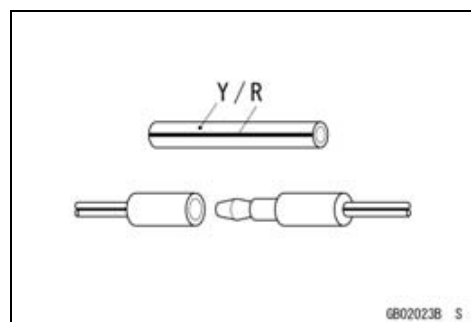
Direction of Engine Rotation

When rotating the crankshaft, by hand, the free play amount of rotating direction will affect the adjustment. Rotate the crankshaft to positive direction (counter-clockwise viewed from stern side).



Electrical Leads

A two-color lead is identified first by the primary color and then the stripe color. Unless instructed otherwise, electrical leads must be connected to those of the same color.

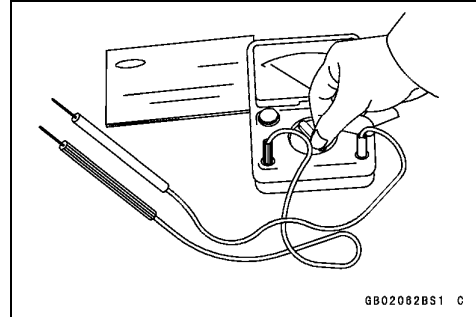


1-10 GENERAL INFORMATION

Before Servicing

Instrument

Use a meter that has enough accuracy for an accurate measurement. Read the manufacture's instructions thoroughly before using the meter. Incorrect values may lead to improper adjustments.



Model Identification

JT1500-A1 Left Side View



JT1500-A1 Right Side View



1-12 GENERAL INFORMATION

General Specifications

Items	JT1500-A1 ~ A2, A6 ~ AC
Engine	
Type	4-stroke, DOHC, 4-cylinder, water cooled
Displacement	1 498 cm ³ (91.4 cu in.)
Bore and Stroke	83 × 69.2 mm (3.27 × 2.72 in.)
Compression Ratio	10.6 : 1
Maximum Horsepower	118 kW (160 PS) @7 500 r/min (rpm) (JT1500AC) (EU) 112 kW (152 PS) @7 500 r/min (rpm) (CA, US) — — —
Maximum Torque	152 N·m (15.5 kgf·m, 112.1 ft·lb) @7 250 r/min (rpm) (JT1500AC) (EU) 144 N·m (14.7 kgf·m, 106.2 ft·lb) @7 250 r/min (rpm) (CA, US) — — —
Ignition System	Digital transistor
Lubrication System	Forced lubrication (semi-dry sump)
Carburetion System	FI (fuel injection) MIKUNI AC 60 × 1
Starting System	Electric starter
Cylinder Numbering Method	Front (bow) to rear (stern), 1-2-3-4
Firing Order	1-2-4-3
Valve Timing:	
Inlet:	
Open	22.5° BTDC
Close	67.5° ABDC
Duration	270°
Exhaust:	
Open	74.5° BBDC
Close	9.5° ATDC
Duration	264°
Tuning Specifications	
Spark plug:	
Type	NGK CR9EK
Gap	0.7 ~ 0.8 mm (0.028 ~ 0.031 in.)
Ignition Timing	3° ATDC @1 300 r/min ~ 32° BTDC @3 000 r/min (rpm)
Idle Speed	1 300 ±100 r/min (rpm) -in water 1 300 ±100 r/min (rpm) -out of water
Compression Pressure	1 190 ~ 1 799 kPa (12.1 ~ 18.3 kgf/cm ² , 173 ~ 261 psi) @430 r/min (rpm)
Drive System	
Coupling	Direct drive from engine
Jet Pump:	
Type	Axial flow single stage
Thrust	4 250 N (434 kgf, 955 lb) (JT1500AC) (EU) 4 130 N (421 kgf, 928 lb)
Steering	Steerable nozzle
Braking	Water drag
Performance	
†Minimum Turning Radius	4.0 m (13.1 ft)

General Specifications

Items	JT1500-A1 ~ A2, A6 ~ AC
†Fuel Consumption	43 L/h (11.4 US gal/h) @full throttle
†Cruising Range	134 km (87 mile) @full throttle 1 hour and 26 minutes (3 person)
Dimensions	
Overall Length	3 120 mm (122.8 in.)
Overall Width	1 180 mm (46.5 in.)
Overall Height	1 050 mm (41.3 in.)
Dry Mass	(JT1500-A1 ~ A8) 338 kg (745 lb)
Curb Mass	(JT1500A9 ~) 383 kg (845 lb)
Fuel Tank Capacity	62 L (16.4 US gal)
Engine Oil	
Grade	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2
Viscosity	SAE 10W-40
Capacity	5.0 L (5.3 US qt)
Electrical Equipment	
Battery	12 V 18 Ah
Maximum Generator Output	16 A @14 V

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

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

1-14 GENERAL INFORMATION

Unit Conversion Table

Prefixes for Units

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

Units of Mass

kg	×	2.205	=	lb
g	×	0.03527	=	oz

Units of Volume

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

Units of Force

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

Units of Length

km	×	0.6214	=	mile
m	×	3.281	=	ft
mm	×	0.03937	=	in.

Units of Torque

N·m	×	0.1020	=	kgf·m
N·m	×	0.7376	=	ft·lb
N·m	×	8.851	=	in·lb
kgf·m	×	9.807	=	N·m
kgf·m	×	7.233	=	ft·lb
kgf·m	×	86.80	=	in·lb

Units of Pressure

kPa	×	0.01020	=	kgf/cm ²
kPa	×	0.1450	=	psi
kPa	×	0.7501	=	cmHg
kgf/cm ²	×	98.07	=	kPa
kgf/cm ²	×	14.22	=	psi
cmHg	×	1.333	=	kPa

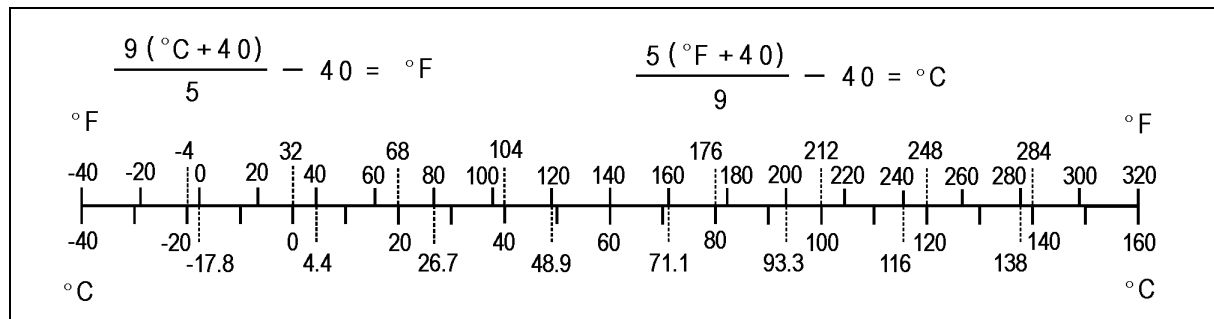
Units of Speed

km/h	×	0.6214	=	mph
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Units of Power

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

Units of Temperature



Periodic Maintenance

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2-2 PERIODIC MAINTENANCE

Periodic Maintenance Chart

The scheduled maintenance must be done in accordance with this chart to keep the watercraft in good running condition. **The initial maintenance is vitally important and must not be neglected.**

Description	Frequency	Initial 10 Hours	Every 25 Hours	Every 50 Hours	Every 100 Hours	Reference
Inspect throttle control system (e)			•			2-11
Inspect/clean air filter drain caps			•			2-11
Inspect/clean air filter				• (or every year)		2-12
Inspect fuel vent check valve			•			2-12
Clean fuel pump screen (e)			•			2-13
Inspect throttle shaft spring (replace throttle body if necessary) (e)					•	2-13
Replace engine oil				• (or every year)		2-13
Replace engine oil filter					•	2-15
Inspect air suction valve (JT1500-A1 ~ A8 Models)					•	2-16
Inspect/adjust valve clearance (e)					•	2-16
Inspect/tighten engine mounting bolts				• (or every year)		2-21
Inspect/replace coupling damper					•	2-21
Flush cooling system (after each use in salt water)			•			2-21
Flush bilge line and filter			•			2-23
Inspect impeller blades for damage (remove)					•	2-24
Lubricate jet pump bearings and seals; inspect and replace bearings/seals if necessary	Initial 25 hours or one year whichever comes first, then every 50 hours or every year whichever comes first					2-24
Inspect steering cable/shift cable					•	2-24
Lubricate handlebar pivot (disassemble)			•			2-24
Inspect hull drain screws (replace if necessary)				•		2-25
Inspect battery charging condition			•			2-25
Inspect battery terminals			•			2-25
Clean and gap spark plugs (replace if necessary) (e)			•			2-26
Lubricate throttle cable fitting at throttle body			•			2-26
Lubricate throttle cable and throttle fitting at throttle case			•			2-26
Lubricate steering cable/shift cable ball joints and steering nozzle/reverse bucket pivots			•			2-26
Check all hoses, hose clamps, nuts, bolts, and fasteners		•	•			2-29
Replace fuel hoses	Every 5 years					2-31

Periodic Maintenance Chart

(e): Emission Related Items

2-4 PERIODIC MAINTENANCE

Torque and Locking Agent

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

Letters used in the "Remarks" column mean:

EO: Apply oil to the threads and seating surface.

L: Apply a non-permanent locking agent to the threads. (Medium Strength: Loctite 242 equivalent)

LN: Apply a non-permanent locking agent to the threads. (High Strength: Loctite 271 equivalent)

MO: Apply molybdenum disulfide grease oil solution. (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1)

R: Replacement Part

S: Tighten the fasteners following the specified sequence.

SS: Apply silicone sealant to the threads.

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Fuel System				
Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
Bracket Mounting Bolts	8.8	0.90	78 in·lb	L
Inlet Manifold Mounting Bolts	25	2.5	18	L
Inlet Manifold Mounting Nuts	20	2.0	14	
Delivery Pipe Mounting Bolts	7.8	0.80	69 in·lb	
Inlet Air Pressure Sensor Bolts	7.8	0.80	69 in·lb	
Throttle Cable Holder Bolts	8.8	0.90	78 in·lb	L
Inlet Air Temperature Sensor	20	2.0	14	
Throttle Body Assy Mounting Bolts	20	2.0	14	
Inlet Manifold Drain Plug	20	2.0	14	
Inlet Manifold Plate Bolts	7.8	0.80	69 in·lb	
Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Oil Temperature Sensor	15	1.5	11	see text
Water Temperature Sensor	15	1.5	11	see text
Regulator/Rectifier Bolts	7.8	0.80	69 in·lb	
ECU Mounting Bolts	8.8	0.90	78 in·lb	L
Electrical Parts Bracket Screws	4.9	0.50	43 in·lb	L
Throttle Sensor Mounting Screws	2.0	0.20	18 in·lb	
ISC Actuator Mounting Bolts	4.9	0.50	43 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Fuel Filler Tube Clamp Screws	2.9	0.30	26 in·lb	
Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
Fuel Filter Mounting Bolts	8.8	0.90	78 in·lb	L
Fuel Pump Holder Clamp Screws	2.9	0.30	26 in·lb	
Air Filter Mounting Bolts	9.8	1.0	87 in·lb	L
Air Filter Bracket Mounting Bolts	7.8	0.80	69 in·lb	L
Throttle Cable Locknut	7.8	0.80	69 in·lb	
Throttle Case Mounting Screws	3.9	0.40	35 in·lb	
Engine Lubrication System				
Breather Plate Bolts	7.8	0.80	69 in·lb	
Oil Filler Cap	1.0	0.10	8.7 in·lb	
Oil Passage Plugs	20	2.0	14	L

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Oil Separator Tank Mounting Screws	4.9	0.50	43 in·lb	L
Breather Case Mounting Bolts	7.8	0.80	69 in·lb	
Breather Pipe Bolts	8.8	0.90	78 in·lb	L
Oil Passage Joints	11	1.1	95 in·lb	L
Oil Cooler Assembly Bolts	7.8	0.80	69 in·lb	
Oil Pressure Switch	15	1.5	11	SS
Oil Passage Bolt	78	8.0	58	S
Oil Filter	18	1.8	13	EO
Oil Cooler Positioning Bolt	20	2.0	14	S
Oil Pan Bolts	7.8	0.80	69 in·lb	S
Dipstick Tube Bolts	8.8	0.90	78 in·lb	L, S
Oil Pump Sprocket Bolt (JT1500-A1 ~ A2)	15	1.5	11	LN
Oil Pump Sprocket Bolt (JT1500A6)	16	1.6	12	LN
Oil Pump Cover Bolts	7.8	0.80	69 in·lb	
Oil Pressure Relief Valve	15	1.5	11	LN
Oil Pipe Bolts	7.8	0.80	69 in·lb	
Oil Pump Chain Guide Bolt	7.8	0.80	69 in·lb	
Chain Guide Spring Plate Bolt	7.8	0.80	69 in·lb	
Oil Pump Body Plug	20	2.0	14	L
Oil Pump Body Bolts	7.8	0.80	69 in·lb	
Oil Screen Bolts	7.8	0.80	69 in·lb	
Water Hose Joints (JT1500-A1 ~ AA Early Models)	20	2.0	14	L
Exhaust System				
Exhaust Manifold Mounting Nuts	25	2.5	18	S
Exhaust Manifold Mounting Bolts	25	2.5	18	L, S
Bypass Nozzle	—	—	—	L
Flushing Hose Joint	11	1.1	95 in·lb	L
Water Hose Joint	11	1.1	95 in·lb	L
Water Temperature Sensor	15	1.5	11	see chapter 3
Exhaust Pipe Mounting Plate Bolts	29	3.0	22	L
Exhaust Pipe Mounting Bolts	29	3.0	22	
Exhaust Tube Clamp Screws (JT1500A8 ~)	5.0	0.51	44 in·lb	
Exhaust Tube Clamp Screws (JT1500A8)	5.0	0.51	44 in·lb	
Engine Top End				
Air Suction Valve Cover Bolts	9.8	1.0	87 in·lb	
Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
Camshaft Cap Bolts	12	1.2	104 in·lb	S
Cylinder Head Bolts (M7)	20	2.0	14	S
Cylinder Head Bolts (M11)	23	2.3	17	First, MO, S
Cylinder Head Bolts (M11)	59	6.0	43	Final, MO, S
Water Jacket Plugs	20	2.0	14	L

2-6 PERIODIC MAINTENANCE

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Cylinder Head Bolts (M6)	12	1.2	104 in·lb	S
Engine Hook Bolts	20	2.0	14	
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Exhaust Side Camshaft Chain Guide Bolts (Upper)	25	2.5	18	
Exhaust Side Camshaft Chain Guide Bolts (Lower)	12	1.2	104 in·lb	
Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
Inlet Side Camshaft Chain Guide Bolts	12	1.2	104 in·lb	L
Camshaft Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	L
Camshaft Chain Tensioner Cap Bolt	20	2.0	14	
Camshaft Position Sensor Rotor Bolt	12	1.2	104 in·lb	L
Water Hose Joint	11	1.1	95 in·lb	L
Oil Passage Joint	11	1.1	95 in·lb	L
Engine Removal/Installation				
Engine Mounting Bolts	36	3.7	27	L
Engine Damper Mounting Bolts	16	1.6	12	L
Engine Bottom End				
Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
Engine Bracket Mounting Bolts	32	3.3	24	L
Timing Rotor Bolt	29	3.0	22	L
Connecting Rod Nuts	—	—	—	MO, see text
Oil Passage Plugs	20	2.0	14	L
Stator Mounting Bolts	12	1.2	104 in·lb	L
Grommet Cover Bolts	9.8	1.0	87 in·lb	L
Magneto Cover Bolts	20	2.0	14	
Output Cover Bolts	7.8	0.80	69 in·lb	
Output Shaft (JT1500-A1 ~ A9 Early Models)	245	25.0	180	MO
Output Shaft (JT1500A9 Late Model ~)	265	27.0	195	MO
Coupling	98	10	72	
Crankcase Bolts (M10)	50	5.0	36	MO, S
Crankcase Bolts (M8)	29	3.0	22	MO, S
Crankcase Bolts (M8)	29	3.0	22	S
Crankcase Bolts (M6)	12	1.2	104 in·lb	S
Cooling and Bilge Systems				
Bilge Breather Mounting Bolts	—	—	—	L
Water Hose Joint (L Shape Type)	11	1.1	95 in·lb	L
Water Hose Joint (Straight Shape Type)	20	2.0	14	L
Water Hose Joint (Straight Shape Type)	11	1.1	95 in·lb	L, see text
Cooling Hose Clamp Screws	2.5	0.25	22 in·lb	
Flushing Cap (JT1500A8 ~)	0.90	0.092	8.0 in·lb	
Drive System				
Coupling	265	27.0	195	

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Drive Shaft Holder Mounting Bolts	22	2.2	16	L
Coupling Cover Bolts	8.8	0.90	78 in·lb	L
Pump and Impeller				
Steering Nozzle Pivot Bolts	19	1.9	14	L
Pump Mounting Bolts	36	3.7	27	L
Pump Outlet Mounting Bolts	19	1.9	14	L
Pump Cap Bolts	9.8	1.0	87 in·lb	L
Pump Cap Bolts (JT1500A7 ~)	3.9	0.40	35 in·lb	L
Pump Cap Plug	3.9	0.40	35 in·lb	
Impeller	98	10	72	
Pump Bracket Mounting Bolts (2)	19	1.9	14	LN, SS
Pump Bracket Mounting Bolts (4)	9.8	1.0	87 in·lb	L
Pump Cover Mounting Bolts	7.8	0.80	69 in·lb	L
Grate Mounting Bolts	9.8	1.0	87 in·lb	L
Filter Cover Mounting Bolts	9.8	1.0	87 in·lb	L
Steering				
Handlebar Clamp Bolts	16	1.6	12	L
Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
Throttle Case Mounting Screws	3.9	0.40	35 in·lb	
Steering Shaft Locknut	49 ~ 59	5.0 ~ 6.0	36 ~ 43	
Steering Shaft Nut	2.9	0.30	26 in·lb	
Steering Holder Mounting Bolts	20	2.0	14.5	LN
Steering Neck Mounting Bolts	16	1.6	12	L
Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
Ball Joint	9.8	1.0	87 in·lb	LN
Shift Cable End Nut	9.8	1.0	87 in·lb	
Reverse Bucket Pivot Bolts	19	1.9	14	LN
Shift Cable Nut	39	4.0	29	
Steering Cable Nut	39	4.0	29	
Shift Lever Locknut	20	2.0	14.5	
Hull/Engine Hood				
Crossmember Bolts	7.8	0.80	69 in·lb	L
Handrail Bolts	9.8	1.0	87 in·lb	L
Lock Assembly Nut	4.9	0.50	43 in·lb	
Front Duct Bolts	—	—	—	L
Damper Bolts	—	—	—	L
Damper Bracket Bolts	—	—	—	L
Front Storage Compartment Cover Bolts	—	—	—	L
Hinge Bolts	—	—	—	L
Front Storage Compartment Hook Bolts	—	—	—	L
Steering Cover Bolts	—	—	—	L
Meter Screen Bolts	—	—	—	L
Seat Hook Bolts	—	—	—	L

2-8 PERIODIC MAINTENANCE

Torque and Locking Agent

Fastener	Torque			Remarks
	N·m	kgf·m	ft·lb	
Seat Locknut	—	—	—	L
Reboarding Step Bolts	—	—	—	L
Mirror Stay Bolts	—	—	—	L
Stabilizer Bolts	9.8	1.0	87 in·lb	L
Air inlet Duct Bolts	—	—	—	L
Exhaust Outlet Bolts	—	—	—	L
Electrical System				
Vehicle-Down Sensor Mounting Screws	1.5	0.15	13 in·lb	L
Electrical Parts Bracket Screws	4.9	0.50	43 in·lb	
Starter Relay Case Bolts	7.8	0.80	69 in·lb	
Ignition Coil Mounting Bolts	8.8	0.90	78 in·lb	L
Water Temperature Sensor	15	1.5	11	see text
Starter Relay Mounting Nut	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
Starter Cable Mounting Nut	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
Timing Rotor Bolt	20	2.0	14	L
Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
Rubber Grommet Holder Screws	4.4	0.45	39 in·lb	L
Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
Oil Temperature Sensor	15	1.5	11	see text
Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
Spark Plugs	13	1.3	113 in·lb	
Regulator/rectifier Bolts	7.8	0.80	69 in·lb	
Replay Assembly Bolt	2.5	0.25	22 in·lb	L
ECU Mounting Bolts	8.8	0.90	78 in·lb	L
Main Fuse Mounting Bracket Bolt	7.8	0.80	69 in·lb	
Bracket Mounting Bolts	8.8	0.90	78 in·lb	L
Multifunction Meter Mounting Bolts	3.9	0.40	35 in·lb	L
Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
Speed Sensor Mounting Bolts	3.9	0.40	35 in·lb	L
Starter Motor Through Bolts	6.4	0.65	56 in·lb	L, R
Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	L
Starter Motor Ground Bolt	7.8	0.80	69 in·lb	
Starter Motor Terminal Nut	7.8	0.80	69 in·lb	
Stator Coil Bolts	12	1.2	104 in·lb	L
Grommet Holder Bolts	8.8	0.90	78 in·lb	L

Torque and Locking Agent

The next table, relating tightening torque to thread diameter, lists the basic torque for the bolts and nuts. Use this table for only the bolts and nuts which do not require a specific torque value. All of the values are for use with dry solvent-cleaned threads.

General Fasteners (stainless bolt and nut)

Threads dia. (mm)	Torque		
	N·m	kgf·m	ft·lb
6	5.9 ~ 8.8	0.60 ~ 0.90	52 ~ 78 in·lb
8	16 ~ 22	1.6 ~ 2.2	12 ~ 16
10	30 ~ 41	3.1 ~ 4.2	22 ~ 30

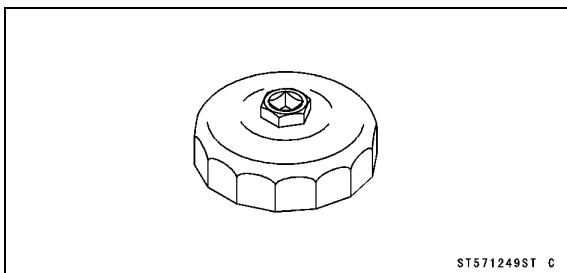
2-10 PERIODIC MAINTENANCE

Specifications

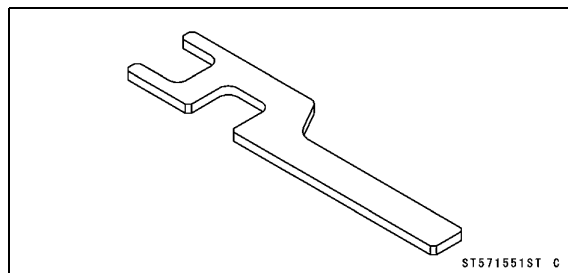
Item	Standard	Service Limit
Fuel System Throttle Lever Free Play	about 2 mm (0.08 in.)	— — —
Engine Lubrication System Engine Oil: Type Viscosity Capacity	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2 SAE 10W-40 4.0 L (4.2 US qt, when filter is not removed) 5.0 L (5.3 US qt, when engine is completely dry)	— — — — — — — — —
Engine Top End Valve Clearance: IN EX	0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.) 0.22 ~ 0.31 mm (0.0087 ~ 0.0122 in.)	— — — — — —
Electrical System Spark Plug Gap	0.7 ~ 0.8 mm (0.028 ~ 0.031 in.)	— — —

Special Tools

Oil Filter Wrench:
57001-1249



Shaft Wrench:
57001-1551



2-12 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Fuel System

Throttle Control System Inspection

- Inspect the throttle lever free play [A].
- ★ If the free play is incorrect, adjust the throttle cable.

Throttle Lever Free Play

Standard: about 2 mm (0.08 in.)

- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by the return spring.
- ★ If the throttle lever does not return properly, check the throttle cable routing, cable adjustments, and cable damage. Then lubricate the throttle cable.
- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.
- ★ If the idle speed increase, check the throttle cable adjustment and the cable routing.
- Remove the seat (see Hull/Engine Hood chapter).
- Check throttle cable adjustment.
- With the throttle lever released, the upper stop [A] on the throttle pivot arm [B] should rest against the stopper [C] on the throttle body, and there should be slight slack in the throttle cable.
- When the throttle lever is fully applied (pulled), the lower stop [D] on the pivot arm should be all the way up against the stopper on the throttle body.

- ★ If necessary, adjust the throttle cable.
- Loosen and turn the locknuts [A] at the bracket until the upper stop on the pivot arm hits against the stopper on the throttle body with slight cable slack.
- Tighten the locknuts securely.

Torque - Throttle Cable Locknuts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

NOTE

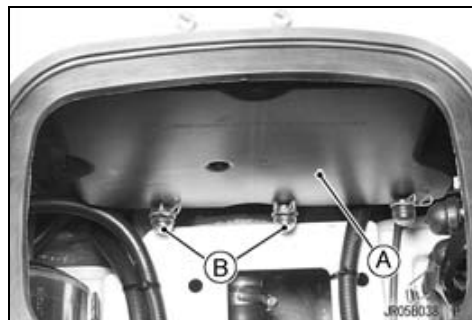
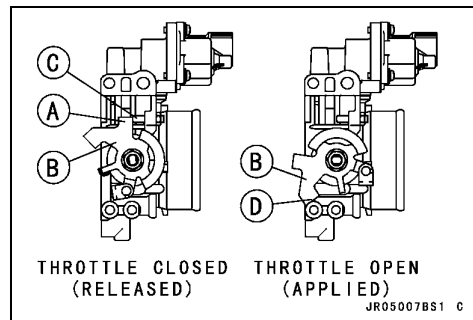
- Make sure that the throttle pivot arm stops against the stopper on the throttle body with the throttle lever released.

Air Filter Drain Caps Inspection and Cleaning

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the rear storage pocket.
- Inspect the air filter [A] for water inside with its drain caps [B].
- ★ If there is water in the caps, remove both caps and discharge the water.

NOTE

- Be sure to have a rag or cloth underneath for possible oily water.



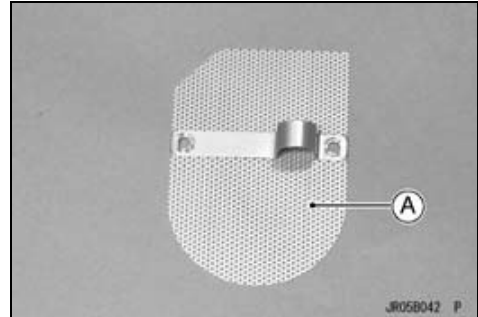
Periodic Maintenance Procedures

Air Filter Inspection and Cleaning

- Remove:
 - Air Filter (see Fuel System (DFI) chapter)
 - Flame Arrester [A] (see Air Filter Disassembly in Fuel System (DFI) chapter)



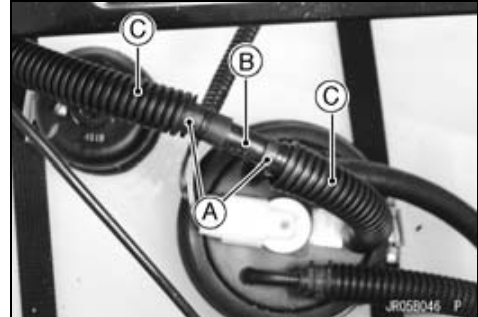
- Clean the flame arrester [A].
- Visually inspect the flame arrester for damage.
- ★ If necessary, replace it with a new one.



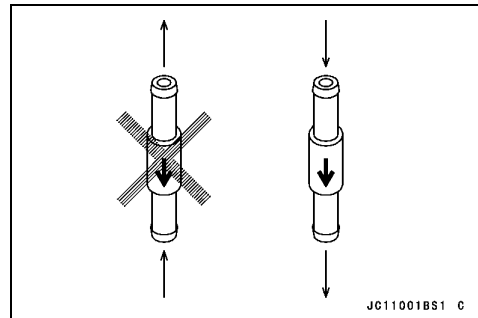
Fuel Vent Check Valve Inspection

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

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Cut off the bands [A].
- Pull out each end of the fuel vent check valve [B] from the vent hoses [C].



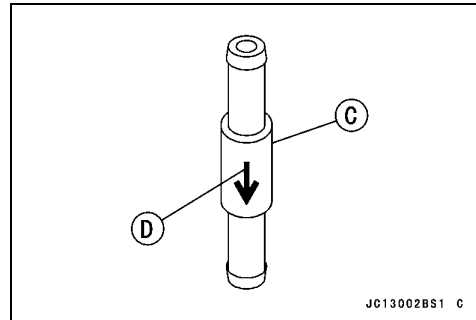
- Blow through the fuel vent check valve from each end.
- ★ If the check valve will allow air to flow as shown, it is OK.
- ★ If air will flow through the check valve in both direction or in neither direction, the check valve must be replaced.



2-14 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- The fuel vent check valve [C] must be mounted so that the arrow [D] on its case is pointing toward the fuel tank.

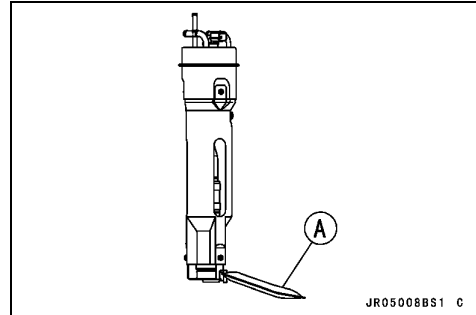


Fuel Pump Screen Cleaning

- Remove the fuel pump (see Fuel System chapter).
- Wash the fuel pump screen [A] in non-flammable or high flash-point solvent. Use a brush to remove any contaminants trapped in the screens.

⚠ WARNING

Gasoline and low flash-point solvents are extremely flammable and can be explosive under certain conditions. To prevent a fire or explosion, clean the fuel pump screen in a well-ventilated area with a high flash-point solvent away from any ignition sources, including any appliance with a pilot light.



Throttle Shaft Spring Inspection

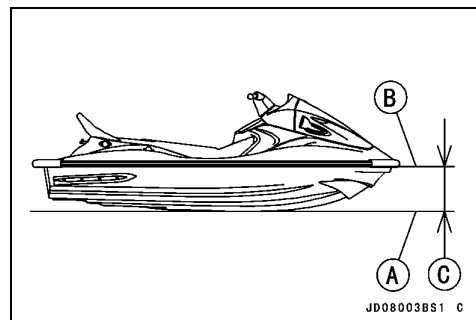
- Remove the seat (see Hull/Engine Hood chapter).
 - Check the throttle shaft spring [A] by pulling the throttle lever.
- ★ If the springs are damaged or weak, replace the throttle body.



Engine Lubrication System

Engine Oil Change

- Level the watercraft port to starboard as well as fore to aft.
 - Level Ground [A]
 - Side Bumper [B]
 - Parallel [C]



Periodic Maintenance Procedures

- In a well-ventilated area, start the engine while cooling the cooling system.
- Open the front storage compartment cover.
- Remove the flushing cap (see Cooling System Flushing).
- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].
- Warm up the engine and stop it.

NOTICE

The engine must be running before the water is turned on and the water must be turned off before the engine is stopped.
Do not run the engine without cooling water flow for more than 15 seconds.

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the oil filler cap [A] and the dipstick [B].

NOTICE

Dirt and other foreign materials can cause serious engine damage. To prevent engine damage, do not allow dirt or foreign materials to enter the engine.

- Drain the oil thorough from the dipstick tube [A] using a commercially-available vacuum pump [B].

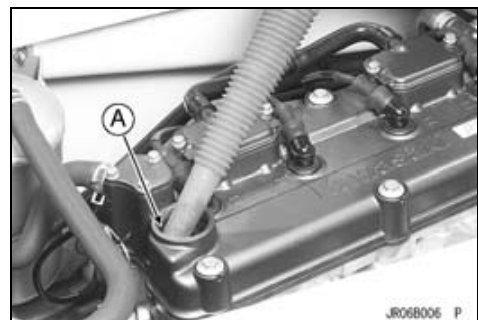
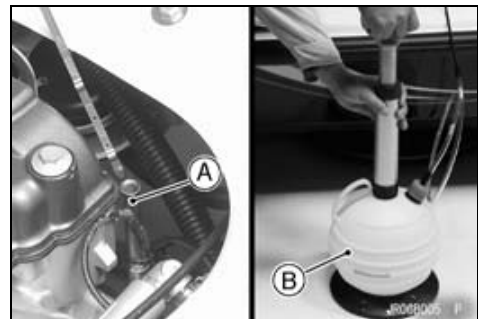
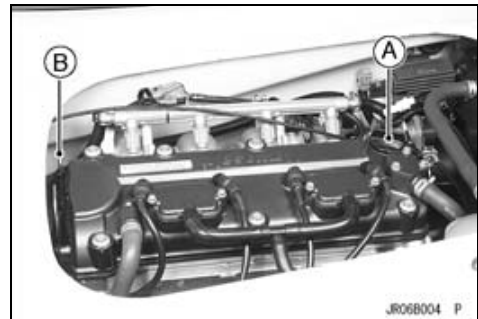
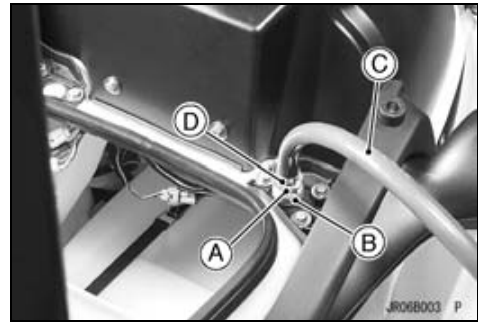
⚠ WARNING

Used engine oil is toxic and pollutes the environment. To protect the environment, do not discard used engine oil; always return it to an authorized recycling center.

- Pour in the specified type and amount of oil through the oil filler opening [A].

Engine Oil

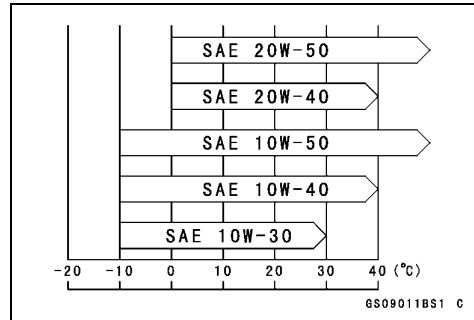
- Grade:** API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2
- Viscosity:** SAE 10W-40
- Amount:** 4.0 L (4.2 US qt, with or without the filter)
 5.0 L (5.3 US qt, when engine is completely dry)



2-16 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- Depending on the atmospheric temperature of your riding area, the engine oil viscosity should be changed according to the chart shown.
- Do not add any chemical additive to the oil. Oils fulfilling the above requirements are fully formulated and provide adequate lubrication for both the engine and clutch.

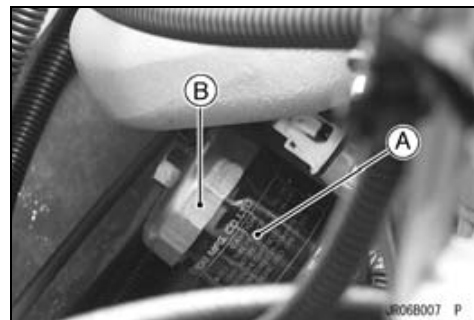


- Install the filler cap.
Torque - Oil Filler Cap: 1.0 N·m (0.10 kgf·m, 8.7 in·lb)
- Check the oil level (see Engine Lubrication System chapter).

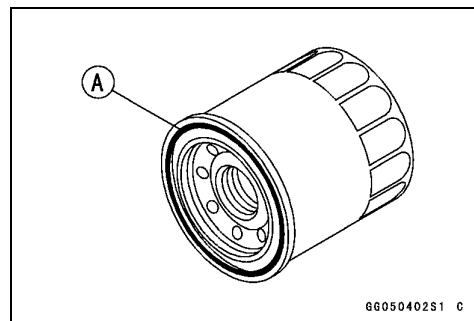
Oil Filter Replace

- Remove:
Seat (see Hull/Engine Hood chapter)
- Drain the engine oil (see Engine Oil Change).
- Place a rag or cloth under the oil filter to receive the remaining oil.
- Remove the oil filter [A] with the oil filter wrench [B].

Special Tool - Oil Filter Wrench: 57001-1249



- Replace the filter with a new one.
 - Apply engine oil to the gasket [A] before installation.
 - Tighten the filter with the oil filter wrench.
- Torque - Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)**
- Pour in the specified type and amount of oil (see Engine Oil Change).

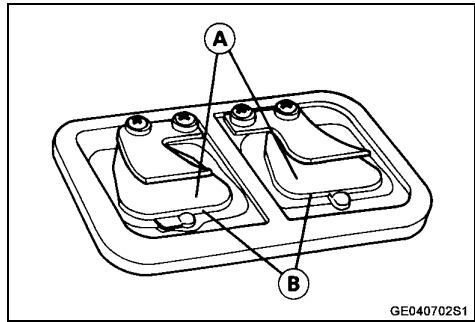


Periodic Maintenance Procedures

Engine Top End

Air Suction Valve Inspection (JT1500-A1 ~ A8 Models)

- Remove the air suction valve (see Engine Top End chapter).
- Visually inspect the reeds [A] for cracks, folds, warps, heat damage, or other damage.
- ★ If there is any doubt as to the condition of the reed, replace the air suction valve as an assembly.
- Check the reed contact areas [B] of the valve holder for grooves, scratches, any signs of separation from the holder, or heat damage.
- ★ If there is any doubt as to the condition of the reed contact areas, replace the air suction valve as an assembly.
- ★ If any carbon or other foreign particles have accumulated between the reed and the reed contact area, wash the valve assembly with a high-flash point solvent.



NOTICE

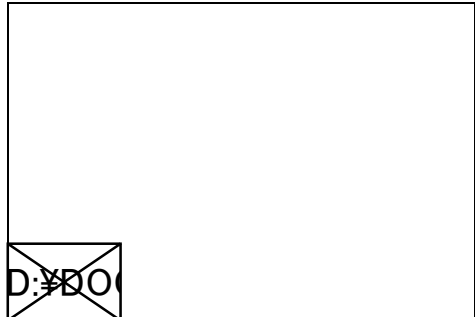
Do not scrape off the deposits with a scraper as this could damage the rubber, requiring replacement of the suction valve assembly.

Valve Clearance Inspection

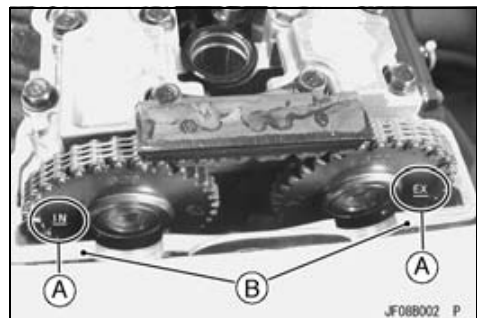
NOTE

○ Valve clearance must be checked and adjusted when the engine is cold (at room temperature).

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Cylinder Head Cover (see Engine Top End chapter)
 - Position the crankshaft at #1, #4 piston TDC as follows.
- Using the shaft wrench [A], turn the crankshaft counter-clockwise [B] and set the crankshaft at #1, 4 piston TDC.
- Special Tool - Shaft Wrench: 57001-1551**



- The timing marks [A] must be aligned with the cylinder head upper surface [B] as shown.



2-18 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

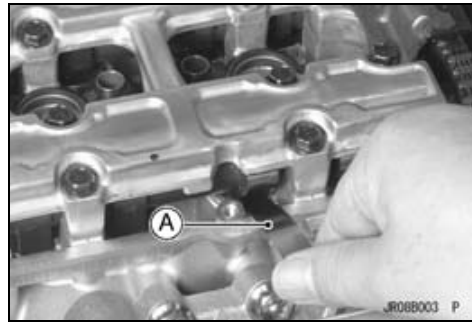
- Measure the valve clearance between the cam and the valve lifter with a thickness gauge [A].

Valve Clearance

Standard:

IN 0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)

EX 0.22 ~ 0.31 mm (0.0087 ~ 0.0122 in.)



- When positioning #1 piston TDC at the end of the compression stroke:

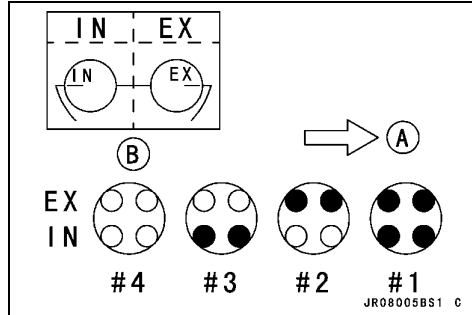
Inlet Valve Clearance of #1 and #3 Cylinders

Exhaust Valve Clearance of #1 and #2 Cylinders

Measuring Valve [●]

Bow [A]

Camshaft Sprocket Position [B]



- When positioning #4 piston TDC at the end of the compression stroke:

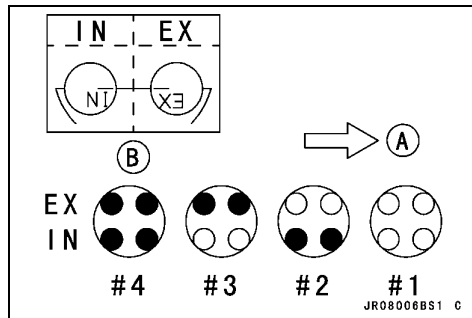
Inlet Valve Clearance of #2 and #4 Cylinders

Exhaust Valve Clearance of #3 and #4 Cylinders

Measuring Valve [●]

Bow [A]

Camshaft Sprocket Position [B]

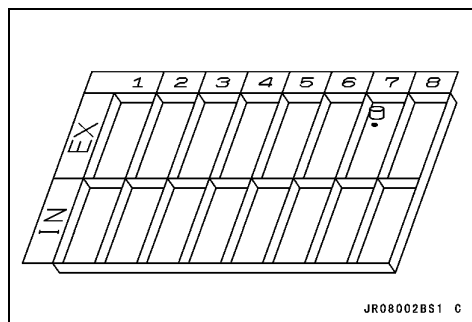


- ★ If the valve clearance is not within the specified range, first record the clearance, and then adjust it.

- To change the valve clearance, remove the camshaft chain tensioner, camshafts and valve lifters. Replace the shim with one of a different thickness.

NOTE

- Mark and record the valve lifter and shim locations so they can be reinstalled in their original positions.
- If there is no clearance, select a shim which is several sizes smaller and then measure the clearance.
- To select a new shim which brings the valve clearance within the specified range, refer to the Valve Clearance Adjustment Charts.



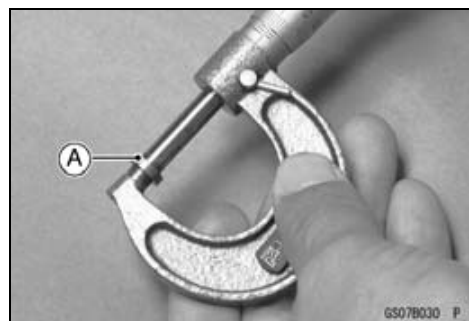
Periodic Maintenance Procedures

○ Besides the standard shims in the valve clearance adjustment charts, the following additional shims maybe used.

Adjustment Shims

Part Number	Thickness
92025-1982	2.425 mm
92025-1983	2.475 mm
92025-1984	2.525 mm
92025-1985	2.575 mm
92180-1058	2.375 mm
92180-1059	2.625 mm
92180-1194	2.675 mm
92180-1195	2.725 mm
92180-1196	2.775 mm

- Clean the shim to remove any dust or oil.
- Measure the thickness of the removed shim [A].



2-20 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

INLET VALVE CLEARANCE ADJUSTMENT CHART

		Present Shim																		Example		
Part No. (92025)		1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890
Mark		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	00
Thickness (mm)		2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00

Valve Clearance Measurement (mm)	0.00 ~ 0.02	—	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80
	0.03 ~ 0.06	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85
	0.07 ~ 0.11	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90
	0.12 ~ 0.14	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95
	0.15 ~ 0.24	Specified Clearance / No Change Required																				
	0.25 ~ 0.27	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
	0.28 ~ 0.32	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00		
	0.33 ~ 0.37	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00			
	0.38 ~ 0.42	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00				
	0.43 ~ 0.47	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00					
	0.48 ~ 0.52	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00						
	0.53 ~ 0.57	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00							
	0.58 ~ 0.62	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00								
	0.63 ~ 0.67	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00									
	0.68 ~ 0.72	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00										
	0.73 ~ 0.77	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00											
	0.78 ~ 0.82	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00												
	0.83 ~ 0.87	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00													
	0.88 ~ 0.92	2.70	2.75	2.80	2.85	2.90	2.95	3.00														
	0.93 ~ 0.97	2.75	2.80	2.85	2.90	2.95	3.00															
	0.98 ~ 1.02	2.80	2.85	2.90	2.95	3.00																
	1.03 ~ 1.07	2.85	2.90	2.95	3.00																	
	1.08 ~ 1.12	2.90	2.95	3.00																		
	1.13 ~ 1.17	2.95	3.00																			
	1.18 ~ 1.22	3.00																				

Install the shim of this thickness (mm).

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect.
This shim will give the proper clearance.

Example

Present shim is **2.60 mm**.

Measured clearance is **0.35 mm**.

Replace **2.60 mm** shim with **2.75 mm** shim.

5. Remeasure the valve clearance and readjust if necessary.

Periodic Maintenance Procedures

EXHAUST VALVE CLEARANCE ADJUSTMENT CHART

	Present Shim																				Example	
Part No. (92025)	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	
Mark	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	00	
Thickness (mm)	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	

Valve Clearance Measurement (mm)	0.00 ~ 0.04	—	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75
	0.05 ~ 0.09	—	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80
	0.10 ~ 0.14	—	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85
	0.15 ~ 0.19	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90
	0.20 ~ 0.21	—	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.70	2.75	2.80	2.85	2.90	2.95
	0.22 ~ 0.31	Specified Clearance / No Change Required																			
	0.32 ~ 0.34	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00
	0.35 ~ 0.39	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	
	0.40 ~ 0.44	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00		
	0.45 ~ 0.49	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00			
	0.50 ~ 0.54	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00				
	0.55 ~ 0.59	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00					
	0.60 ~ 0.64	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00						
	0.65 ~ 0.69	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00							
	0.70 ~ 0.74	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00								
	0.75 ~ 0.79	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00									
	0.80 ~ 0.84	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00										
	0.85 ~ 0.89	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00											
	0.90 ~ 0.94	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00												
	0.95 ~ 0.99	2.70	2.75	2.80	2.85	2.90	2.95	3.00													
	1.00 ~ 1.04	2.75	2.80	2.85	2.90	2.95	3.00														
	1.05 ~ 1.09	2.80	2.85	2.90	2.95	3.00															
	1.10 ~ 1.14	2.85	2.90	2.95	3.00																
	1.15 ~ 1.19	2.90	2.95	3.00																	
	1.20 ~ 1.24	2.95	3.00																		
	1.25 ~ 1.29	3.00																			

Install the shim of this thickness (mm).

1. Measure the clearance (when engine is cold).
2. Check present shim size.
3. Match clearance in vertical column with present shim size in horizontal column.
4. Install the shim specified where the lines intersect.
This shim will give the proper clearance.

Example

Present shim is **2.65 mm**.

Measured clearance is **0.42 mm**.

Replace **2.65 mm** shim with **2.80 mm** shim.

5. Remeasure the valve clearance and readjust if necessary.

2-22 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- Apply molybdenum disulfide oil to the valve lifters and apply engine oil to the shims, and install them.
- Install the camshafts. Be sure to install the camshafts properly (see Engine Top End chapter).
- Remeasure any valve clearance that was adjusted.
- Readjust if necessary.

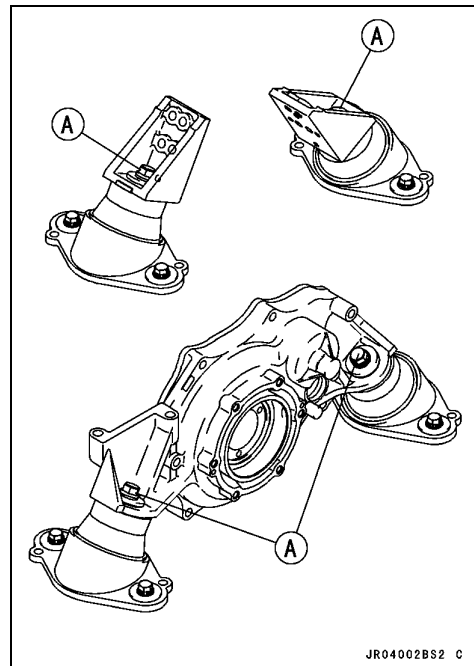
NOTICE

Using shim stock under the shim may cause it to pop out at high rpm and cause severe engine damage. Do not put shim stock under the shim. Grinding the shim may cause it to fracture, causing severe engine damage. Do not grind the shim.

Engine Mounting Bolts Inspection and Tightness

- Check the tightness of the engine mounting bolts [A].
- ★ If there are loose bolts, remove the bolts.
- Apply a non-permanent locking agent to the engine mounting bolts and tighten them.

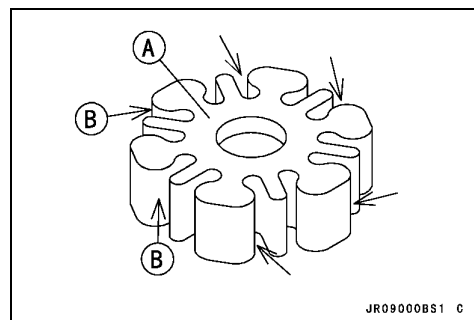
Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)



Engine Bottom End

Coupling Damper Inspection

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Engine (see Engine Removal/Installation chapter)
- Remove the coupling damper [A] and inspect it for wear [B] and deterioration.
- ★ If it is grooved or misshapen, replace it with a new damper.
- ★ If there is any doubt as to coupler condition, replace it.



Cooling and Bilge Systems

Cooling System Flushing

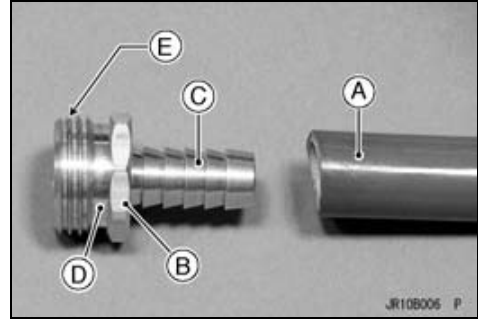
To prevent sand or salt deposits from accumulating in the cooling system, it must be flushed occasionally. Flush the system according to the Periodic Maintenance Chart, after each use in salt water, or whenever there is reduced water flow from the bypass outlet on the right side of the hull.

Periodic Maintenance Procedures

- Obtain a standard garden hose [A] and a garden hose adapter [B] as shown.
Garden Hose Fitting of Adapter [C]
Flushing Fitting of Adapter [D]
Thread: Rp 3/4 [E]

NOTE

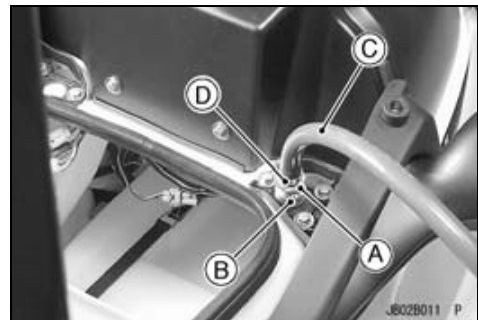
○ Optional part (P/No. 92005-3746) is available as a garden hose adapter.



- Open the front storage compartment cover.
- Remove the flushing cap [A] on the brim of the storage compartment.



- Screw a garden hose adapter [A] onto the flushing fitting [B].
- Attach a garden hose [C] to a garden hose adapter and secure the hose clamp [D].

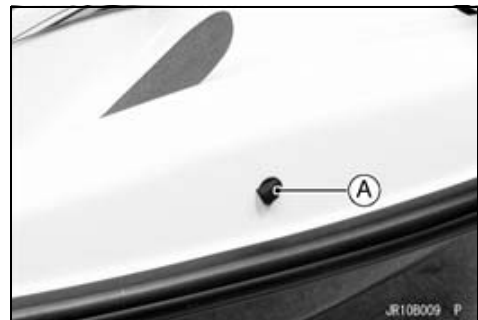


- Start the engine and allow it to idle before turning on the water.

NOTICE

If the water is turned on before the engine is running, water may flow back through the exhaust pipe and into the engine, causing severe engine damage. To prevent engine damage, be sure the engine is running before turning the water on.

- Immediately turn on the water and adjust the flow so that a little trickle of water comes out of the bypass outlet [A] on the right side of the hull.



2-24 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

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

NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

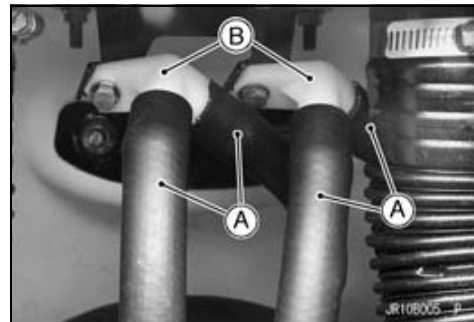
- Switch off the engine, remove the garden hose and the adapter.
- Install the flushing cap securely.

**Torque - Flushing Cap: 0.90 N·m (0.092 kgf·m, 8.0 in·lb)
(JT1500A8 Model ~)**

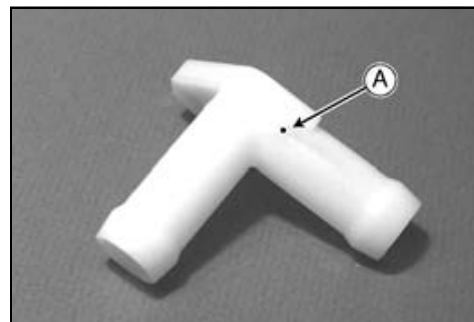
Bilge System Flushing

To prevent clogging, the bilge system should be flushed out according to the Periodic Maintenance Chart, or whenever you suspect it is blocked.

- Disconnect both bilge hoses [A] at the plastic breather fitting [B].



- Connect the bilge filter hoses (from the hull bottom) to the garden hoses, turn the water on, and flush it out for about a minute. During this procedure, water will flow into the engine compartment. Do not allow a large amount of water to accumulate in the engine compartment. Remove the drain screws in the stern to drain the engine compartment.
- Connect the other hoses (from the hull bulkhead) to the garden hose, turn the water on, and flush it out for several minutes.
- Before reconnecting the hoses to the plastic breather fitting make sure the small hole [A], on top of the breather fitting is clear.
- Reconnect the bilge hoses.



Periodic Maintenance Procedures

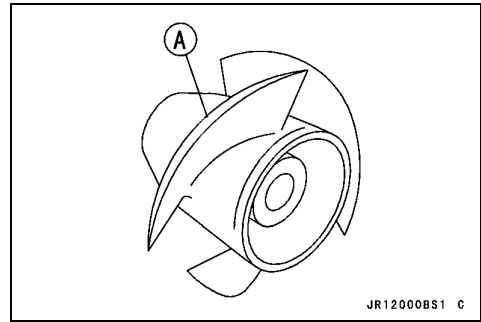
Pump and Impeller

Impeller Inspection

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

NOTE

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



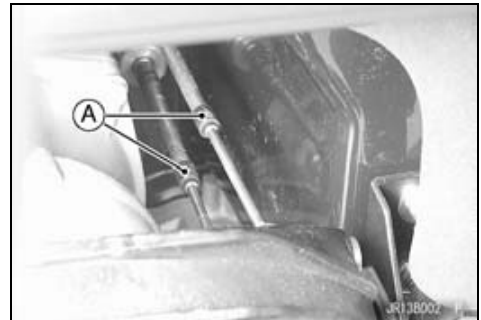
Jet Pump Bearings/seals Lubrication, Inspection and Replacement

- See Pump Disassembly in the Pump and Impeller chapter.

Steering

Steering Cable/Shift Cable Inspection

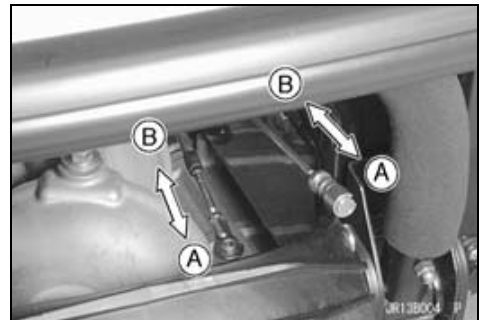
- Examine the steering cable or shift cable.
- ★ If each cables or cable housings are kinked or frayed, replace the cables.
- ★ If the each seal [A] at either end of each cable is damaged in any way, replace the cables.



- Be certain that each cable moves freely in both directions.
- Disconnect the cable joints at each end of each cable.
- Take out the cable joint bolt or ball joint and disconnect the cable joint.

NOTICE

If the watercraft is laid on its right side, water in the exhaust system may drain back into the engine a cause serious damage. Never lay the watercraft on the right side.



- Slide the inner cable back [A] and forth [B] in each cable housings.
- ★ If each cable does not move freely, replace it.

Handlebar Pivot Lubrication

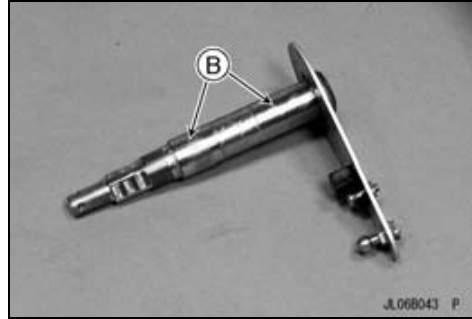
- Check the bushings for damage and wear.
- ★ If the bushings are damaged or worn, replace them.
- Grease:
Bushings [A]



2-26 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

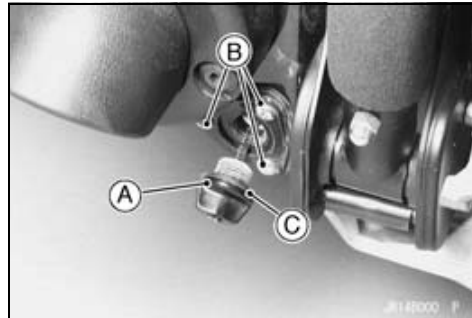
Steering Shaft [B]



Hull/Engine Hood

Drain Plug Inspection

- Check the drain plugs [A] for cracks or damage and the drain plug mounting screws [B] are tightened securely.
- Check the seals [C] for damage.
- ★ If necessary, replace the drain plugs or seals.



Electrical System

Battery Charging Condition Inspection

Battery charging condition can be checked by measuring battery terminal voltage.

- Disconnect the battery terminal leads (see Battery Removal in Electrical System chapter).
- Be sure to disconnect the negative terminal lead first.
- Measure the battery terminal voltage.

NOTE

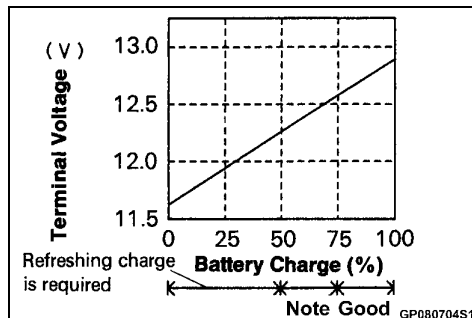
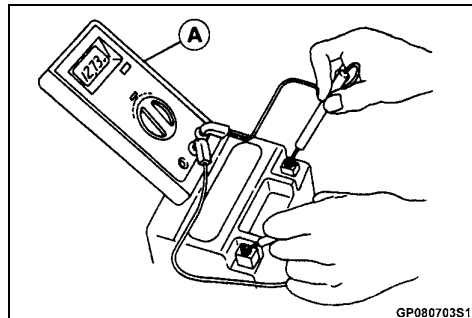
○ Measure with a digital voltmeter [A] which can be read one decimal place voltage.

- ★ If the reading is below the specified, refreshing charge is required (see Refreshing Charge in Electrical System chapter).

Battery Terminal Voltage

Standard: 12.6 V or more

- Connect the battery leads, positive first.

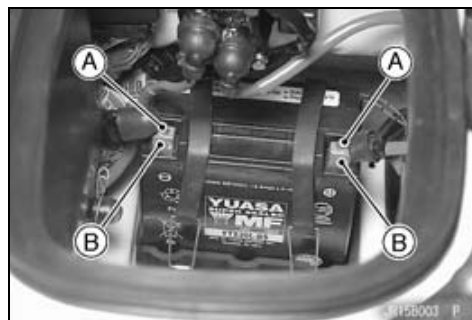


Battery Terminals Inspection

- Check the battery terminal screws [A] for tightness and make sure terminal covers are in place.

⚠ WARNING

Loose battery leads can create sparks which can cause a fire or explosion resulting in injury or death. Make sure the battery terminal screws are tightened securely and the covers are installed over the terminals.



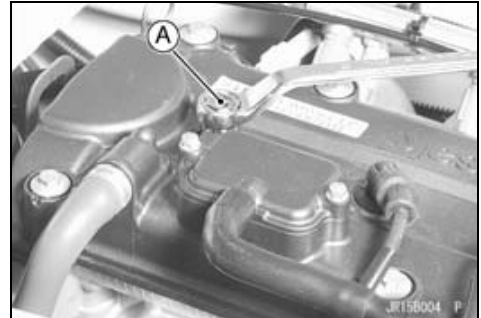
Periodic Maintenance Procedures

- Check that the battery terminals [B] are not corroded.
- ★ If necessary, remove the battery (see Electrical System chapter) and clean the terminals and cable ends using a solution of baking soda and water.
- After attaching both cables, coat the terminals and cable ends with grease to prevent corrosion.
- Install the battery (see Electrical System chapter).

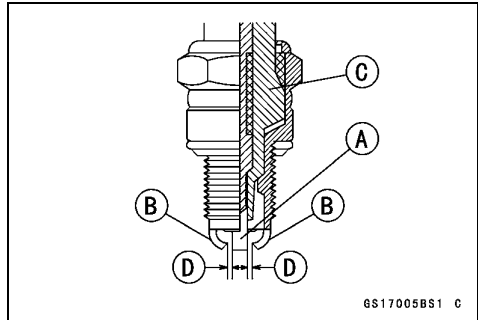
Spark Plug Cleaning and Inspection

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Spark Plug Caps
- Remove the spark plugs using the 16 mm plug wrench [A].

Owner's Tool - Spark Plug Wrench, 16 mm: 92110-1145



- Clean the spark plug, preferably in a sandblasting device, and then clean off any abrasive particles. The plug may also be cleaned using a high-flash point solvent and a wire brush or other tool.
- ★ If the spark plug center electrode [A] and/or side electrode [B] are corroded or damaged, or if the insulator [C] is cracked, replace the plug. Use the standard spark plug or its equivalent.
- Measure the gaps [D] with a wire-type thickness gauge.
- ★ If the gap is incorrect, carefully bend the side electrode with a tool to obtain the correct gap.



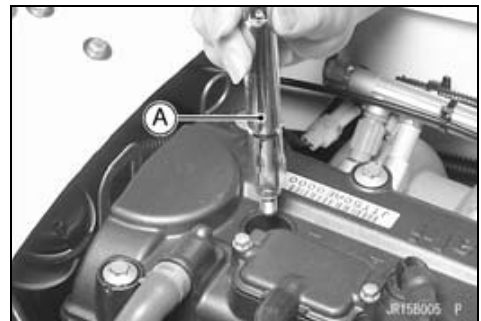
Spark Plug Gap: 0.7 ~ 0.8 mm (0.028 ~ 0.031 in.)

- Insert the spark plug vertically into the plug hole with the spark plug installed in the plug wrench [A].

Owner's Tool - Spark Plug Wrench, 16 mm: 92110-1145

- Tighten:

Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 113 in·lb)



Lubrication

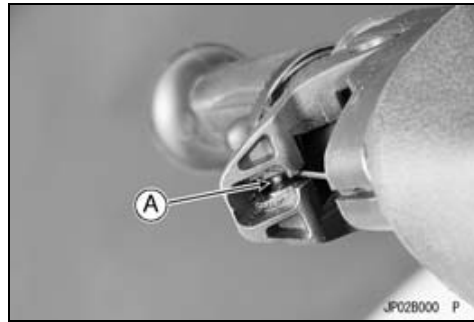
As in all marine craft, adequate lubrication and corrosion protection is an absolute necessity to provide long, reliable service. Refer to the Periodic Maintenance Chart for the frequency of the following items:

2-28 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

- Lubricate the following with grease.
- Pull the throttle lever and hold it.

Throttle Cable End at Throttle Lever [A]

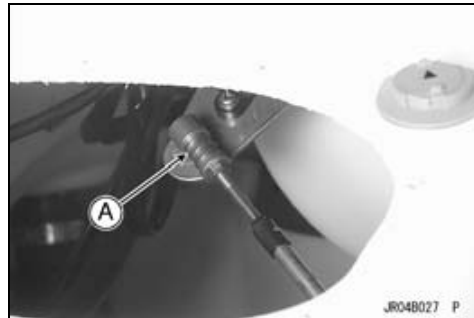


Throttle Cable End [A] at Throttle Body



- Remove the storage pocket (see Hull/Engine Hood chapter).

Steering Cable Ball Joint [A] at Steering Shaft

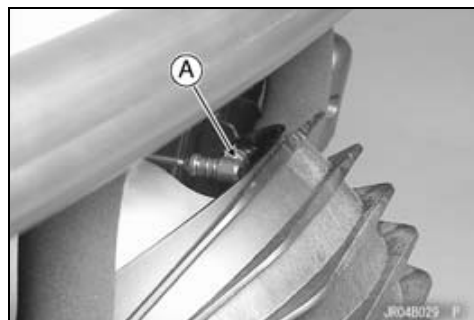


- Remove the storage pocket (see Hull/Engine Hood chapter).

Shift Cable Ball Joint [A] at Reverse Lever

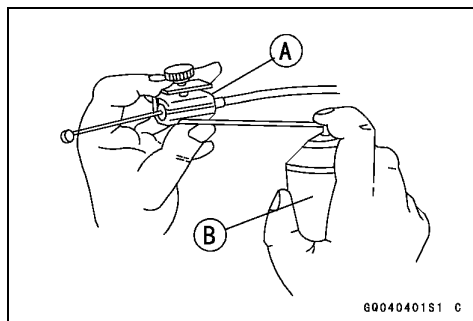


Shift Cable Ball Joint [A] at Reverse Bucket

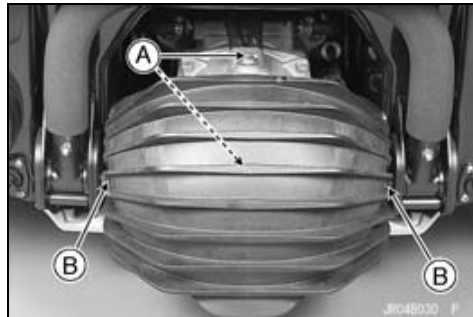


Periodic Maintenance Procedures

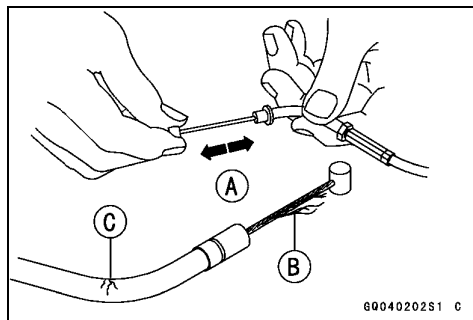
- Lubricate the following with a penetrating rust inhibitor [B].
Throttle Cable [A]



- Steering Nozzle Pivots [A]**
- Reverse Bucket Pivots [B]**



- With the cable disconnected at both ends, the cable should move freely [A] within the cable housing.
- ★ If cable movement is not free after lubricating, if the cable is frayed [B], or if the cable housing is kinked [C], replace the cable.



2-30 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

All Hoses, Hose Clamps, Nuts, Bolts and Fasteners Check

Nuts, Bolts, and Fasteners Tightness Inspection

- Check the tightness of the bolts and nuts listed here. Also, check to see that each cotter pin is in place and in good condition.

NOTE

○For the engine fasteners, check the tightness of them when the engine is cold (at room temperature).

- ★If there are loose fasteners, retighten them to the specified torque following the specified tightening sequence. Refer to the appropriate chapter for torque specifications. If torque specifications are not in the appropriate chapter, see the Standard Torque Table. For each fastener, first loosen it by 1/2 turn, then tighten it.
- ★If cotter pins are damaged, replace them with new ones.

Nut, Bolt and Fastener to be checked

Engine:

Oil Filter Cartridge
Engine Mounting Bolts (and bracket bolts)
Engine Damper Mounting Bolts
Cylinder Head Cover Bolts
Cylinder Head Bolts

Drive Shaft, Pump, and Impeller:

Drive Shaft Holder Mounting Bolts
Pump Mounting Bolts
Pump Cover Mounting Bolts
Pump Grate Mounting Bolts
Steering Nozzle Pivot Bolts
Reverse Bucket Pivot Bolts

Steering:

Handlebar Clamp Bolts
Steering Neck Mounting Bolts
Steering Holder Mounting Bolts
Steering Shaft Locknut
Steering Cable Nut
Steering Cable Joint Bolt
Shift (reverse) Cable Nut

Hull and Engine Hood:

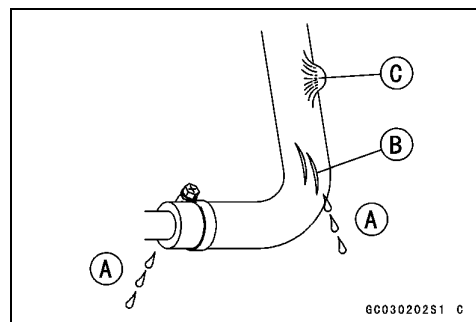
Stabilizer Bolts
Handrail Bolts

Electrical System:

Spark Plugs
Battery Terminal

Hose and Hose Connect Inspection

- Check the following hoses for leakage [A], hardening, cracking [B], checking, cuts, abrasions, breaks and bulges [C]. And make sure the hoses are not kinked or pinched.
- Fuel Hoses
Fuel Vent Hose
Oil Hoses
Cooling Hoses
Bilge Hoses
- ★If a hose is damaged in any way, replace it immediately and check all the others for damage.



Periodic Maintenance Procedures

- Make sure the above hoses are routed properly and secured with the clamps away from any moving parts and sharp edged portions.

Plastic Clamp [A]

Hose [B]

Hose Fitting [C]

NOTE

- The majority of bilge hoses have no clamps at the hose ends.

Metal Clamp [A]

Hose [B]

Hose Fitting [C]

NOTE

- Check the fuel and exhaust tubes for signs of wear, deterioration, damage or leakage. Replace if necessary.
- Make sure the above tubes are secured with the metal gear clamps away from any parts.

JT1500-A2 Model ~;

Double Spring Clamp [A]

Hose [B]

Hose Fitting [C]

NOTE

- Check the fuel hoses for signs of wear, deterioration, damage or leakage. Replace if necessary.
- Make sure the above hoses are secured with the double spring clamps away from any parts.

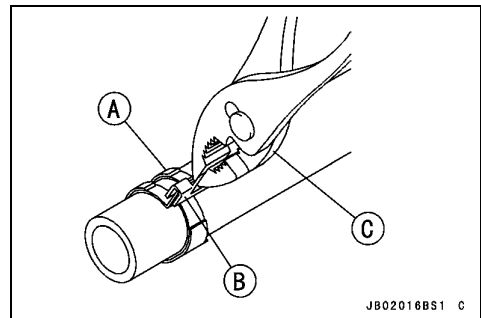
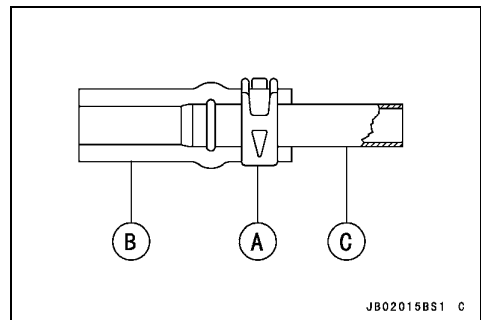
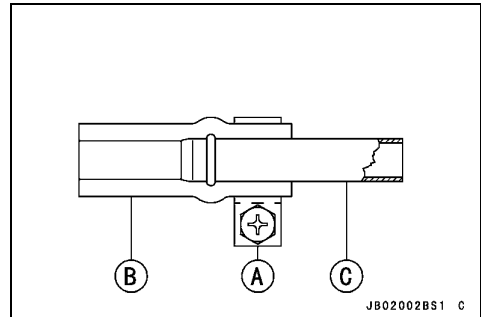
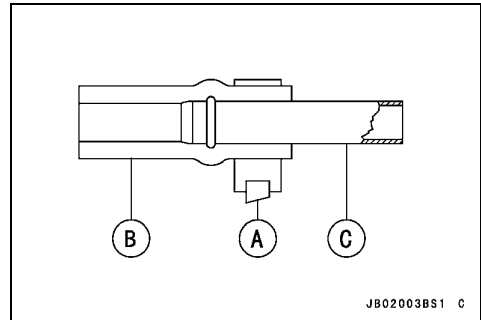
NOTICE

Reusing the double spring clamps will cause fuel leakage, creating the potential for a fire or explosion. Do not reuse the double spring clamps on the fuel line. Replace the double spring clamps with new ones.

- Replacement procedure for the double spring clamp is as follows.
- Remove the double spring clamp with pliers and disconnect the fuel hose.
- Install the fuel hose and insert the new double spring clamp [A] with the clamp stopper [B].
- Pull up the clamp stopper with pliers [C].

NOTE

- Position the double spring clamp on the fuel hose correctly.

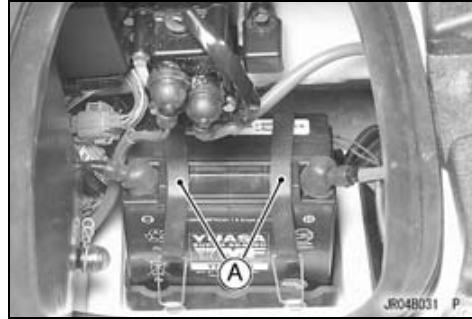


2-32 PERIODIC MAINTENANCE

Periodic Maintenance Procedures

Rubber Strap Inspection

- Check the following rubber straps for any deterioration or damage. Pull on squeeze the straps and look for cracks.
 - Battery Straps [A]
 - Fuel Tank Straps
 - Water Box Muffler Straps
- ★ If a strap is damaged in any way, replace it.



Fuel Hose Replacement

⚠ WARNING

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

- Remove the double spring clamps and fuel hoses.
- Replace the fuel hoses with new ones.
- When installing the fuel hose, route the hose according to Cable, Wire, and Hose Routing section in Appendix chapter.
- When installing the fuel hose, avoid sharp bending, kinking, flattening or twisting, and route the fuel hose with a minimum of bending so that the fuel flow will not be obstructed.
- Make sure the fuel hoses are routed properly and secured with the double spring clamps away from any moving parts and sharp edged portions (see Hose and Hose Connect Inspection).
- Start the engine and check the fuel hose for leaks.

Fuel System (DFI)

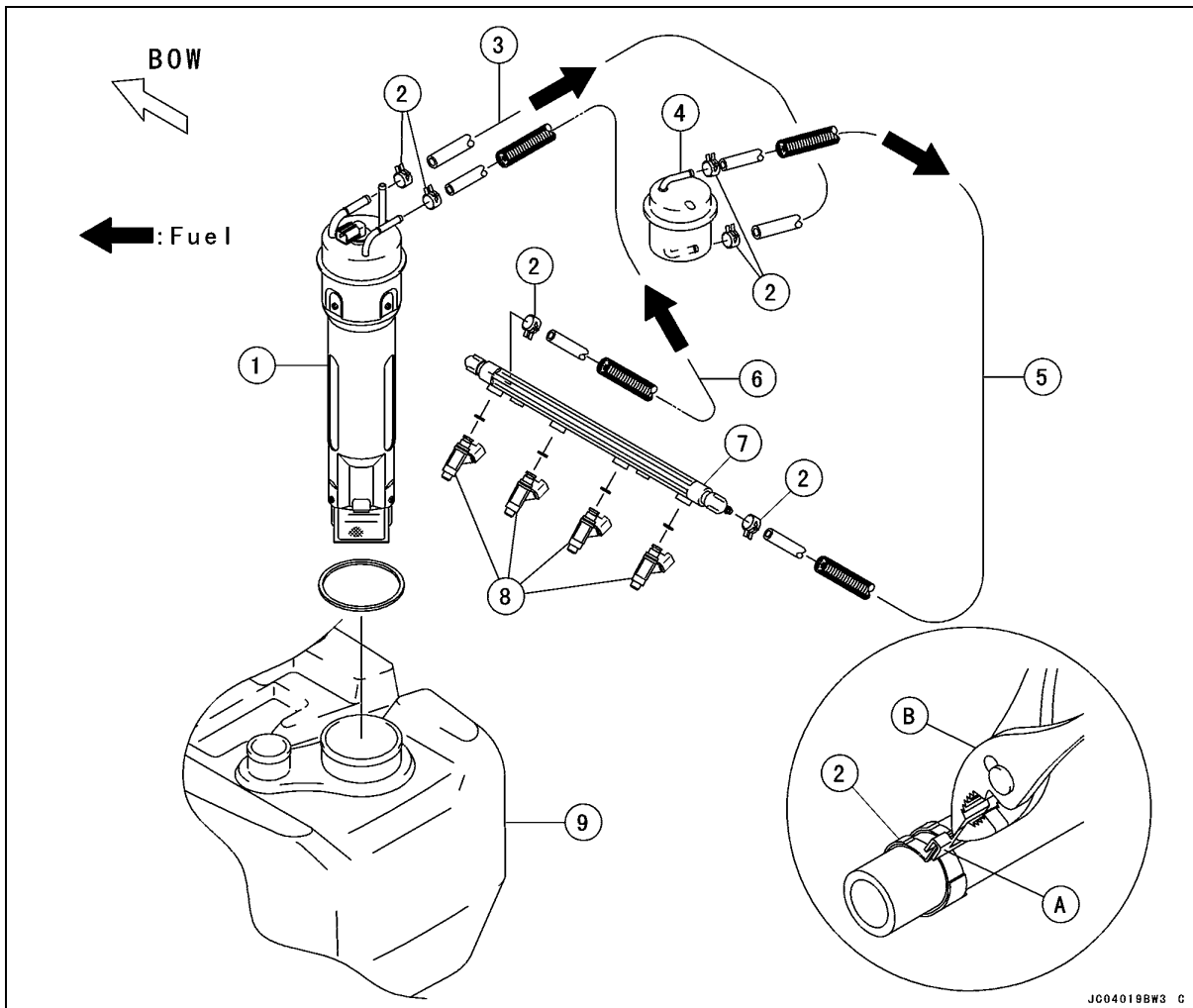
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		Fuel Filler and Tube Removal.....	3-100
		Fuel Filler and Tube Installation...	3-100
		Fuel Tank Vent Hose Installation..	3-101

Fuel System Diagram

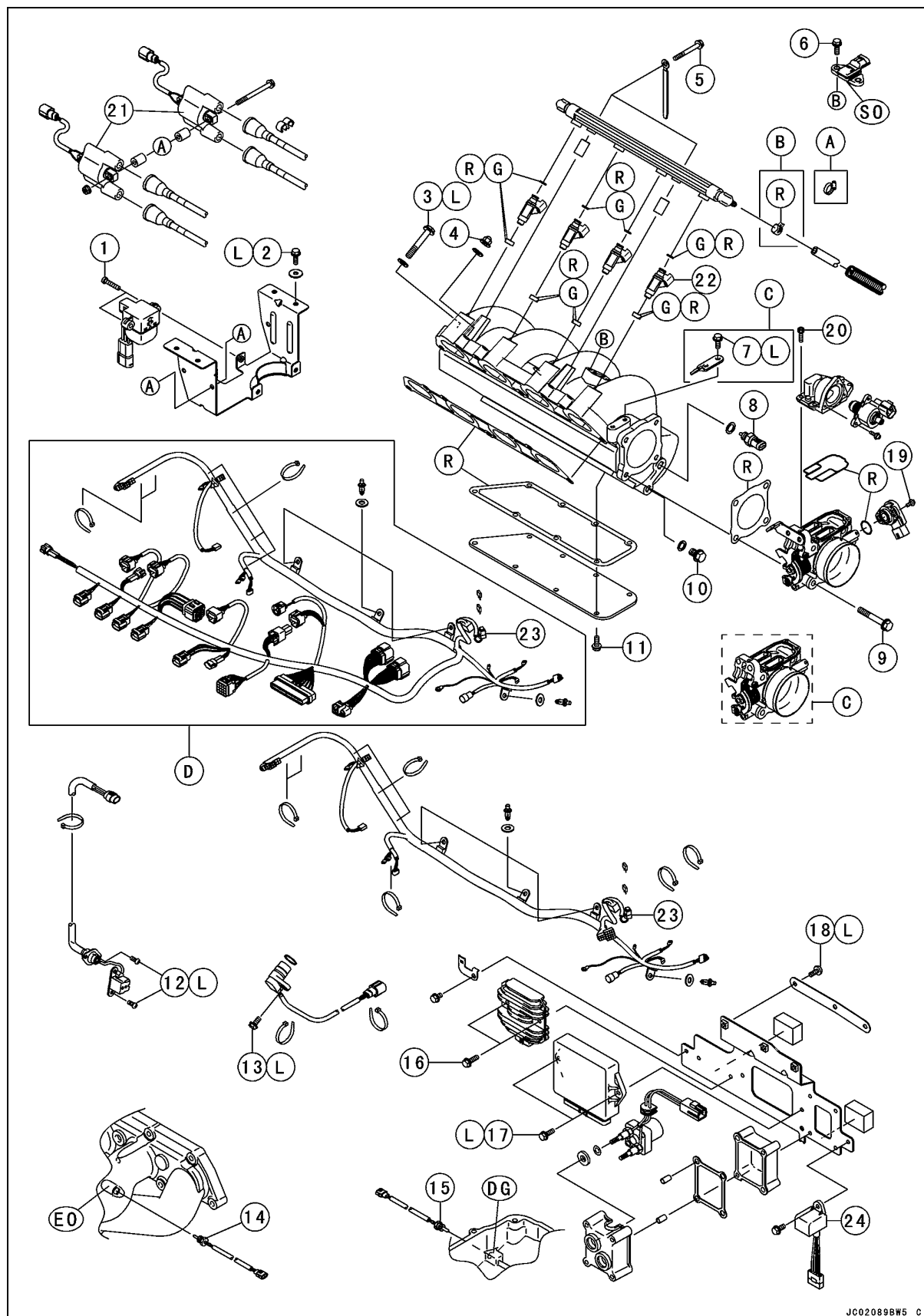


1. Fuel Pump
2. Clamps (JT1500-A1 Model)
Double Spring Clamps (JT1500-A2 Model ~)
(Installation Procedure: Pull up the clamp stopper [A] with pliers [B].)
3. Main Line
4. Fuel Filter
5. Supply Line
6. Return Line
7. Delivery Pipe
8. Fuel Injectors
9. Fuel Tank

JG04019BW3 C

3-4 FUEL SYSTEM (DFI)

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
2	Bracket Mounting Bolts	8.8	0.90	78 in·lb	L
3	Inlet Manifold Mounting Bolts	25	2.5	18	L
4	Inlet Manifold Mounting Nuts	20	2.0	14	
5	Delivery Pipe Mounting Bolts	7.8	0.80	69 in·lb	
6	Inlet Air Pressure Sensor Bolts	7.8	0.80	69 in·lb	
7	Throttle Cable Holder Bolts	8.8	0.90	78 in·lb	L
8	Inlet Air Temperature Sensor	20	2.0	14	
9	Throttle Body Assy Mounting Bolts	20	2.0	14	
10	Inlet Manifold Drain Plug	20	2.0	14	
11	Inlet Manifold Plate Bolts	7.8	0.80	69 in·lb	
12	Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
13	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
14	Water Temperature Sensor	15	1.5	11	see text
15	Oil Temperature Sensor	15	1.5	11	see text
16	Regulator/rectifier Bolts	7.8	0.80	69 in·lb	
17	ECU Mounting Bolts	8.8	0.90	78 in·lb	L
18	Electrical Parts Bracket Screws	4.9	0.50	43 in·lb	L
19	Throttle Sensor Mounting Screws	2.0	0.20	18 in·lb	
20	ISC Actuator Mounting Bolts	4.9	0.50	43 in·lb	

21. Ignition Coils

22. Fuel Injectors

23. Main Fuse 20 A

24. Relay Assembly (Main Relay/Fuel Pump Relay)

A: JT1500-A1 Model (Clamps)

B: JT1500-A2 Model ~ (Double Spring Clamps)

C: JT1500-A1 ~ A6 Model

D: JT1500A8 Model ~

DG Fill the hollow with the heat transfer grease (Heat Transfer Grease, SCH-20: 92137-1002 or equivalent).

EO: Fill the hollow with the engine oil (10W-30).

G: Apply grease.

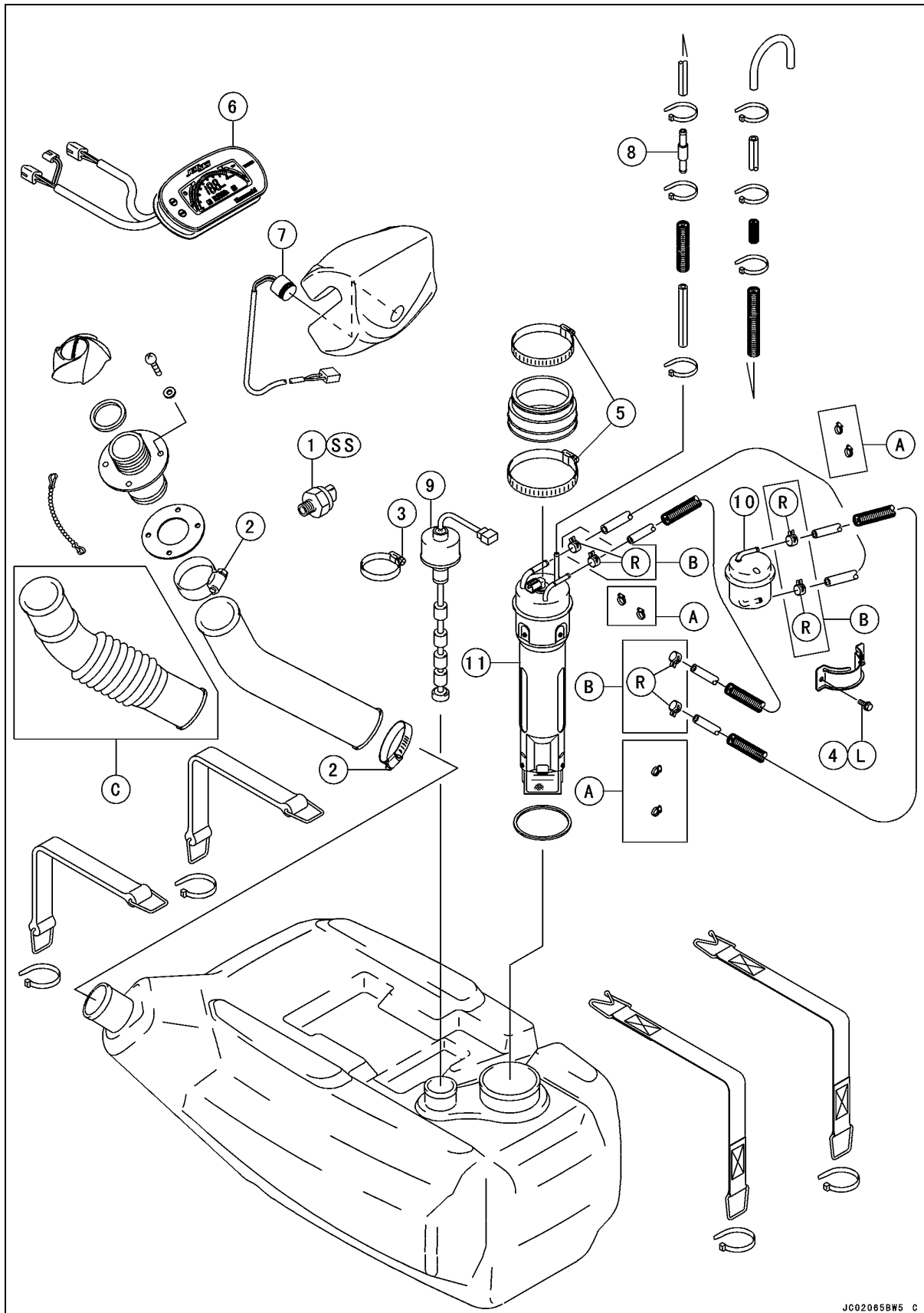
L: Apply a non-permanent locking agent.

R: Replacement Parts

SO: Apply silicone oil to the O-ring.

3-6 FUEL SYSTEM (DFI)

Exploded View



JC02065BWS C

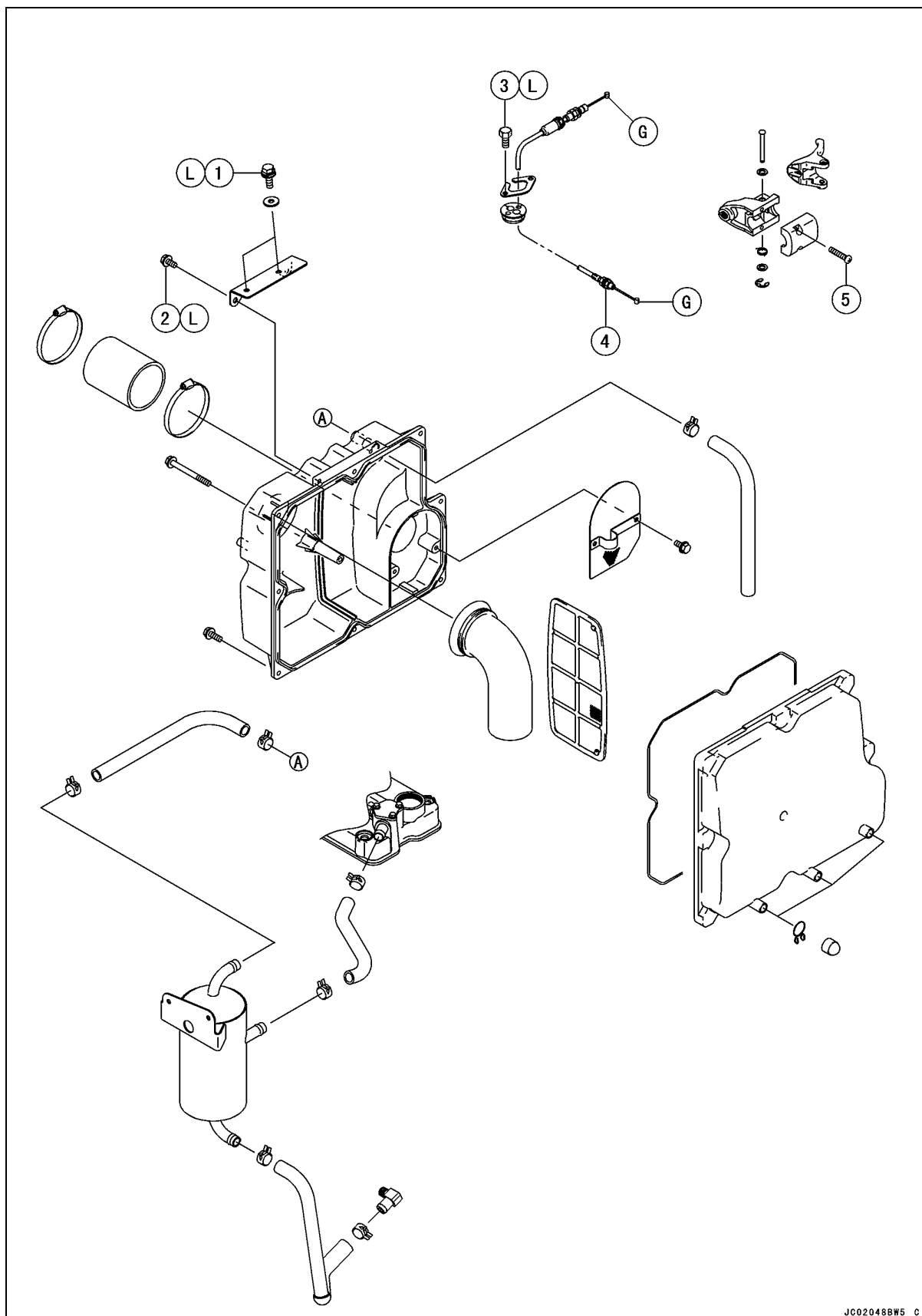
Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Oil Pressure Switch	15	1.5	11	SS
2	Fuel Filler Tube Clamp Screws	2.9	0.30	26 in·lb	
3	Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
4	Fuel Filter Mounting Bolts	8.8	0.90	78 in·lb	L
5	Fuel Pump Holder Clamp Screws	2.9	0.30	26 in·lb	

- 6. Meter Unit
- 7. Buzzer
- 8. Fuel Vent Check Valve
- 9. Fuel Level Sensor
- 10. Fuel Filter
- 11. Fuel Pump
- A: JT1500-A1 Model
- B: JT1500-A2 Model ~
- C: JT1500-A1 ~ A8, AB Late Model (AU and EUR Models) ~
- L: Apply a non-permanent locking agent.
- R: Replacement Parts
- SS: Apply silicone sealant (Liquid Gasket, TB1211: 56019-120).

3-8 FUEL SYSTEM (DFI)

Exploded View



JC02048BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air Filter Mounting Bolts	9.8	1.0	87 in·lb	L
2	Air Filter Bracket Mounting Bolts	7.8	0.80	69 in·lb	L
3	Gromet Plate Bolts	—	—	—	L
4	Throttle Cable Locknut	7.8	0.80	69 in·lb	
5	Throttle Case Mounting Screws	3.9	0.40	35 in·lb	

G: Apply grease.

L: Apply a non-permanent locking agent.

3-10 FUEL SYSTEM (DFI)

Specifications

Item	Standard
Digital Fuel Injection System	
Idle Speed	1 300 ±100 r/min (rpm) -both in and out of water
Throttle Body Assy:	
Throttle Valve	Single throttle valve
Bore	φ60 mm (2.36 in.)
ECU (Electronic Control Unit):	
Make	Mitsubishi Electric
Type	Digital memory type, with built in IC igniter, sealed with resin
Operating range	Engine speed range 100 ~ 8 100 r/min (rpm)
Fuel Pressure (High Pressure Line):	
Engine Idling	approx. 294 kPa (3.0 kgf/cm ² , 43 psi)
Fuel Pump:	
Type	Impeller type
Discharge	67 mL or more for 3 seconds
Throttle Sensor:	
Input Voltage	4.75 ~ 5.25 V DC between R and BK/W leads
Output Voltage	1.08 ~ 1.18 V DC between G/W and BK/W leads (at idle throttle opening)
Resistance	4 ~ 6 kΩ
Inlet Air Pressure Sensor:	
Input Voltage	4.75 ~ 5.25 V DC between R and BK/W leads
Output Voltage	3.75 ~ 4.25 V DC between G/R and BK/W leads at standard atmospheric pressure
Inlet Air Temperature Sensor:	
Output Voltage at ECU	about 2.3 ~ 2.6 V @20°C (68°F)
Resistance	5.4 ~ 6.6 kΩ at 0°C (32°F) 2.26 ~ 2.86 kΩ at 20°C (68°F) 0.29 ~ 0.39 kΩ at 80°C (176°F)
Water Temperature Sensor:	
Resistance	see Electrical System chapter
Output Voltage at ECU	about 3 ~ 4 V @20°C (68°F)
Vehicle-down Sensor:	
Detection Method	Magnetic flux detection method
Detection Angle	more than 110 ~ 130° for each bank
Output Voltage	with sensor tilted 110 ~ 130° or more: 0.65~ 1.35 V with sensor arrow mark pointed up: 3.55 ~ 4.45 V
Fuel Injectors:	
Type	INP-281
Nozzle Type	One spray type with 4 holes
Resistance	about 11.7 ~ 12.3 Ω at 20°C (68°F)
Oil Temperature Sensor:	
Resistance	same to water temperature sensor
Output Voltage at ECU	about 3 ~ 4 V @20°C (68°F)

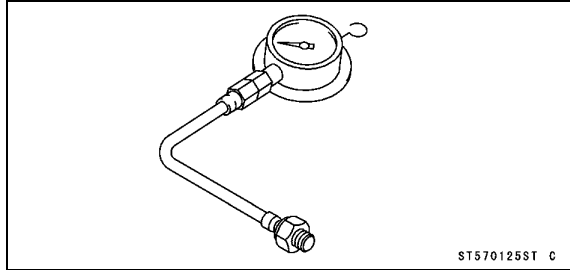
Specifications

Item	Standard
Throttle Lever and Cables Throttle Lever Free Play	about 2 mm (0.08 in.)

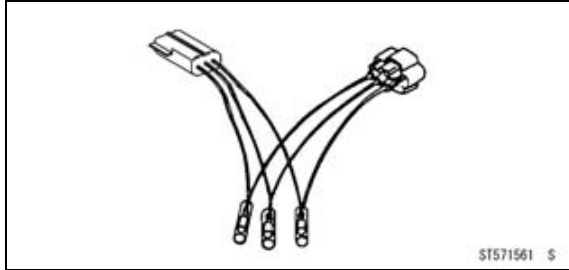
3-12 FUEL SYSTEM (DFI)

Special Tools and Sealants

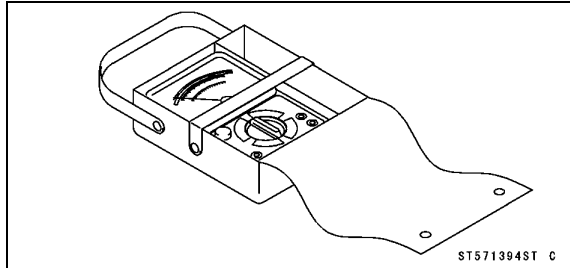
Oil Pressure Gauge, 5 kgf/cm²:
57001-125



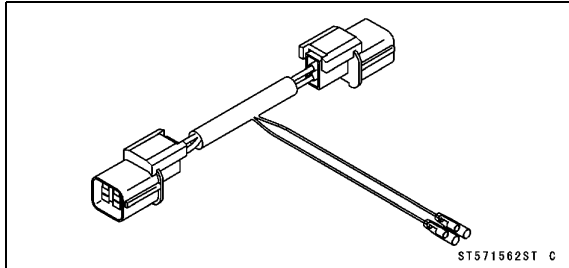
Sensor Harness Adapter:
57001-1561



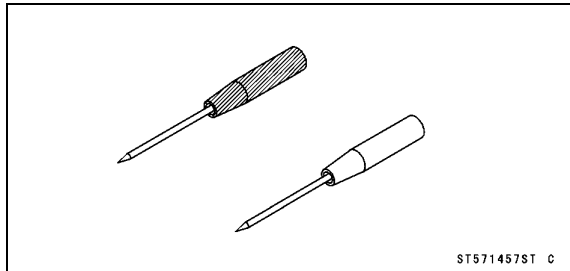
Hand Tester:
57001-1394



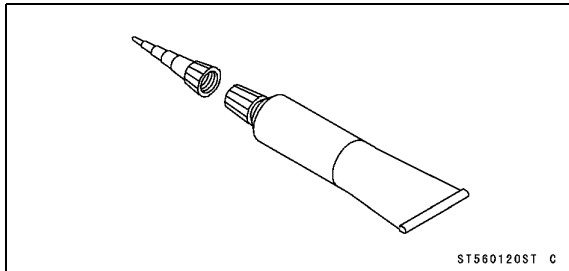
Harness Adapter:
57001-1562



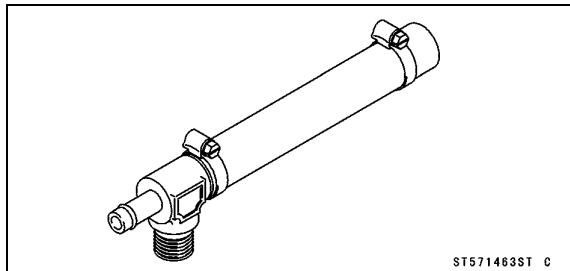
Needle Adapter Set:
57001-1457



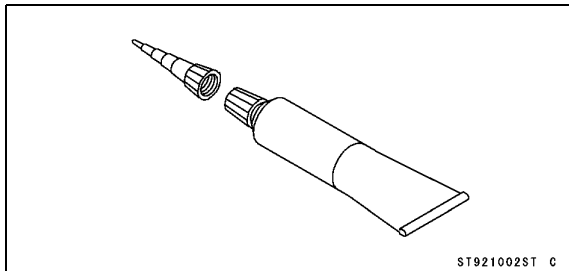
Liquid Gasket, TB1211:
56019-120



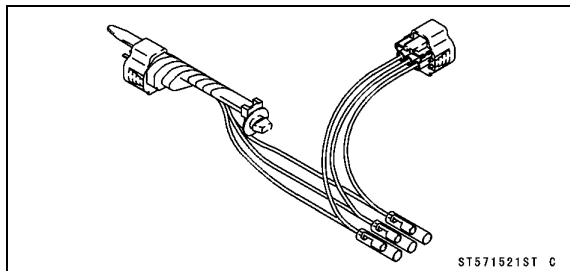
Fuel Pressure Gauge Adapter:
57001-1463



Heat Transfer Grease, SCH-20:
92137-1002

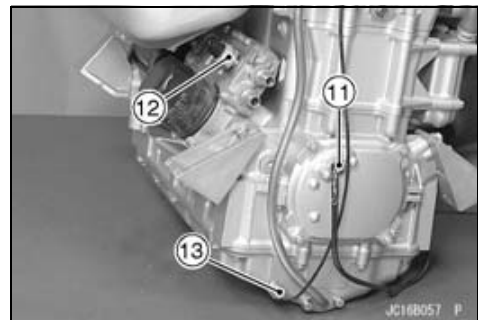
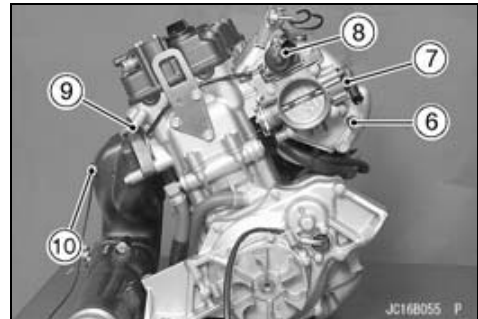
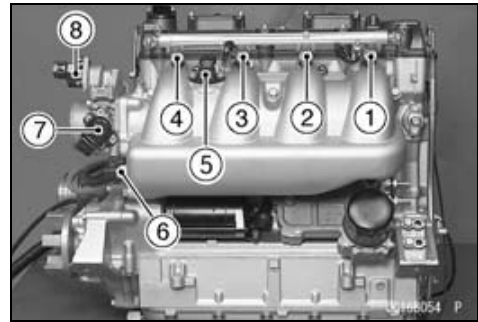


Throttle Sensor Setting Adapter:
57001-1521



DFI Parts Location

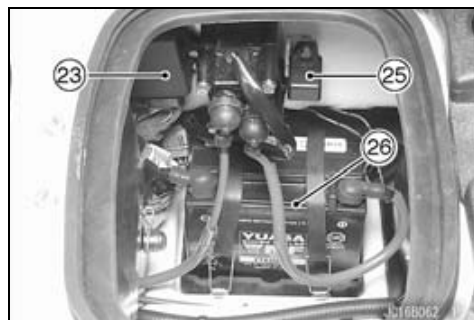
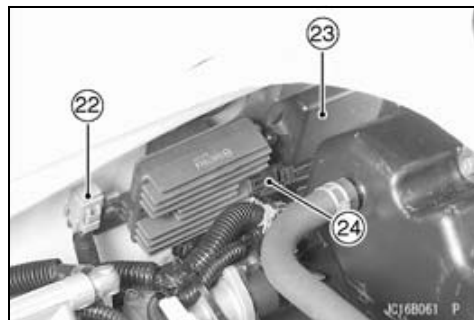
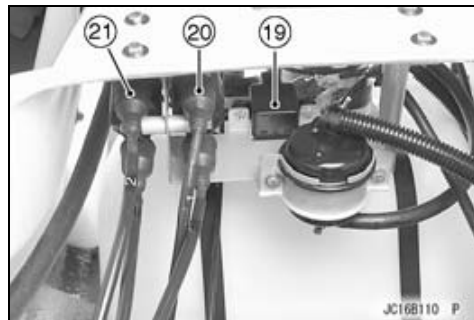
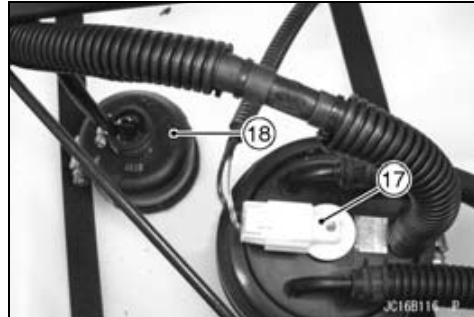
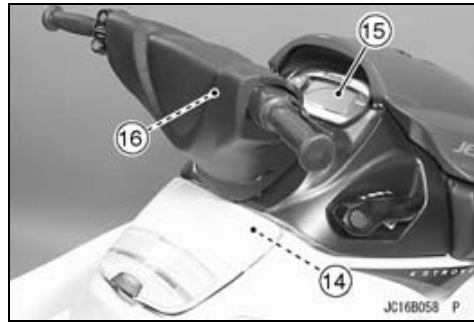
1. Fuel Injector #1
2. Fuel Injector #2
3. Fuel Injector #3
4. Fuel Injector #4
5. Inlet Air Pressure Sensor
6. Inlet Air Temperature Sensor
7. Throttle Sensor
8. ISC (Idle Speed Controller)
9. Camshaft Position Sensor
10. Water Temperature Sensor
11. Crankshaft Sensor
12. Oil Pressure Switch
13. Oil Temperature Sensor



3-14 FUEL SYSTEM (DFI)

DFI Parts Location

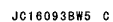
- 14. Ignition Switch
- 15. Meter Unit
- 16. Buzzer
- 17. Fuel Pump
- 18. Fuel Level Sensor
- 19. Vehicle-down Sensor
- 20. Ignition Coil #1, #4
- 21. Ignition Coil #2, #3
- 22. Main Fuse 20 A
- 23. ECU (Electronic Control Unit)
- 24. Diagnosis Connector
- 25. Relay Assembly (Main Relay/Fuel Pump Relay)
- 26. Battery



DFI Parts Location

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DFI System Wiring Diagram (JT1500-A1 ~ A7 Models)



DFI System

Part Name

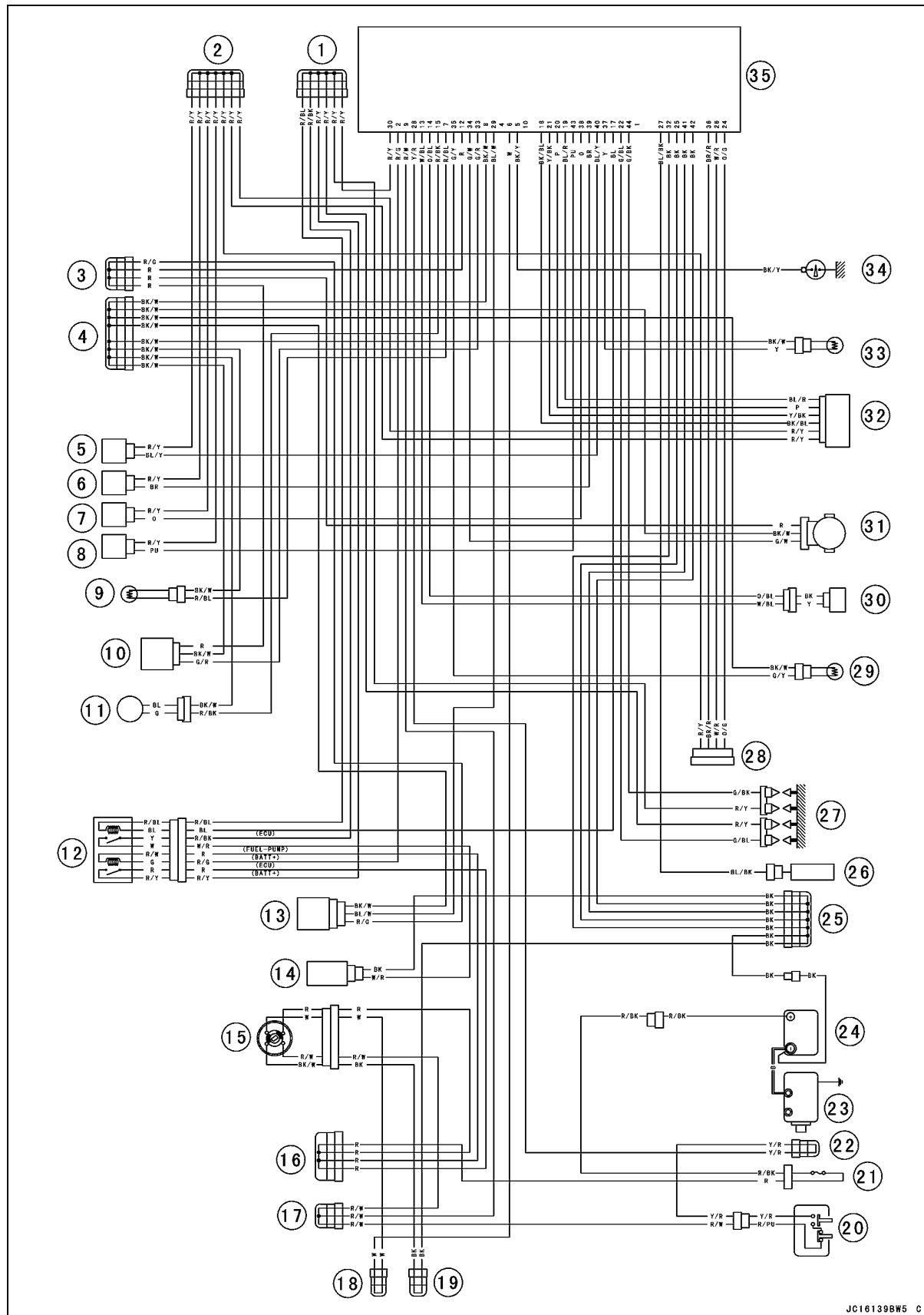
1. Fuel Injector #1
2. Fuel Injector #2
3. Fuel Injector #3
4. Fuel Injector #4
5. Joint Connector H
6. Inlet Air Temperature Sensor
7. Inlet Air Pressure Sensor
8. Joint Connector E
9. Joint Connector J
10. Crankshaft Sensor
11. Relay Assembly (Main Relay/Fuel Pump Relay)
12. Joint Connector F
13. Connector C
14. Vehicle-down Sensor
15. Meter Unit (Diagnosis Signal)
16. Ignition Switch
17. Joint Connector Q
18. Start Switch
19. Joint Connector R
20. Main Fuse 20 A
21. Starter Motor
22. Battery 12 V 18 Ah
23. ECU (Electronic Control Unit)
24. Oil Pressure Switch
25. Camshaft Position Sensor
26. ISC (Idle Speed Controller)
27. Diagnosis Connector
28. Throttle Sensor
29. Water Temperature Sensor
30. Oil Temperature Sensor
31. Connector D
32. Ignition Coils
33. Joint Connector P
34. Fuel Pump
35. Joint Connector S

A: JT1500-A2 ~ A7 Models

3-18 FUEL SYSTEM (DFI)

DFI System

DFI System Wiring Diagram (JT1500A8 Model ~)



DFI System

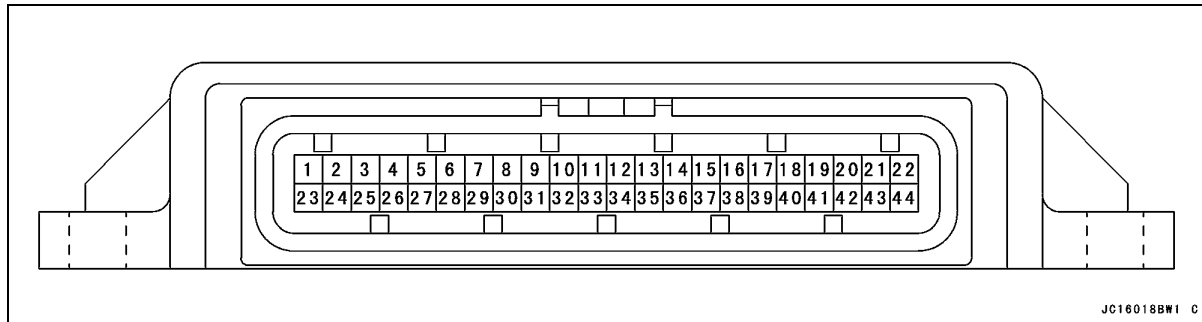
Part Name

1. Joint Connector Y
2. Joint Connector Z
3. Joint Connector X
4. Joint Connector W
5. Fuel Injector #4
6. Fuel Injector #3
7. Fuel Injector #2
8. Fuel Injector #1
9. Inlet Air Temperature Sensor
10. Inlet Air Pressure Sensor
11. Crankshaft Sensor
12. Relay Assembly (Main Relay/Fuel Pump Relay)
13. Vehicle-down Sensor
14. Fuel Pump
15. Ignition Switch
16. Joint Connector P
17. Joint Connector Q
18. Joint Connector S
19. Joint Connector R
20. Start Switch
21. Main Fuse 20A
22. Joint Connector T
23. Starter Motor
24. Battery 12 V 18 Ah
25. Joint Connector U
26. Meter Unit (Diagnosis Signal)
27. Ignition Coils
28. Diagnosis Connector
29. Water Temperature Sensor
30. Camshaft Position Sensor
31. Throttle Sensor
32. ISC (Idle Speed Controller)
33. Oil Temperature Sensor
34. Oil Pressure Switch
35. ECU (Electronic Control Unit)

3-20 FUEL SYSTEM (DFI)

DFI System

Terminal Numbers of ECU Connectors



Terminal Names

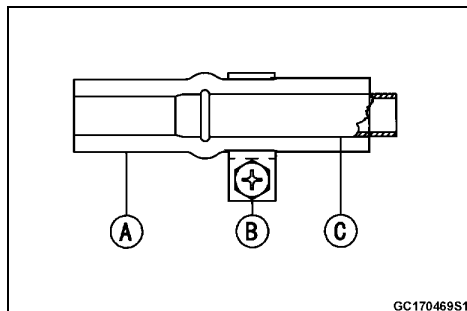
- | | |
|--|--|
| 1. Tachometer Signal | 24. Ground for External Diagnosis System |
| 2. ECU Main Relay | 25. Ground for Control System |
| 3. Unused | 26. External Diagnosis System Signal |
| 4. SLO (Smart Learning Operation) Mode (JT1500-A2 Model ~) | 27. Diagnosis Signal |
| 5. Oil Pressure Switch | 28. Start Button |
| 6. Engine Stop Switch | 29. Vehicle-down Sensor |
| 7. Inlet Air Temperature Sensor | 30. Power Supply to ECU (from Battery) |
| 8. Ground for Sensors | 31. Unused |
| 9. Ignition Switch | 32. Ground for Control System |
| 10. Steering Position Sensor | 33. Inlet Air Pressure Sensor |
| 11. Unused | 34. Throttle Sensor |
| 12. Power Supply to Sensors | 35. Water Temperature Sensor |
| 13. Cam Sensor (+) Signal | 36. External Diagnosis System Signal |
| 14. Cam Sensor (-) Signal | 37. Oil Temperature Sensor |
| 15. Crankshaft Sensor | 38. Injector #2 |
| 16. Unused | 39. Injector #3 |
| 17. Fuel Pump Relay | 40. Injector #4 |
| 18. ISC (Idle Speed Controller) | 41. Ground for Power System |
| 19. ISC (Idle Speed Controller) | 42. Ground for Power System |
| 20. ISC (Idle Speed Controller) | 43. Injector #1 |
| 21. ISC (Idle Speed Controller) | 44. Ignition Coil #2,#3 |
| 22. Ignition Coil #1,#4 | |
| 23. Unused | |

DFI Servicing Precautions

There are a number of important precautions that should be followed servicing the DFI system.

- This DFI system is designed to be used with a 12 V sealed battery as its power source. Do not use any other battery except for a 12 V sealed battery as a power source.
- Do not reverse the battery cable connections. This will damage the ECU.
- To prevent damage to the DFI parts, do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running.
- Take care not to short the cables that are directly connected to the battery positive (+) terminal to the engine ground.
- When charging, remove the battery from the vehicle. This is to prevent ECU damage by excessive voltage.
- Whenever the DFI electrical connections are to be disconnected, first turn off the ignition switch. Conversely, make sure that all the DFI electrical connections are firmly re-connected before starting the engine.
- Do not turn the ignition switch ON while any of the DFI electrical connectors are disconnected. The ECU memorizes service codes.
- If a transceiver is installed on the vehicle, make sure that the operation of the DFI system is not influenced by electric wave radiated from the antenna. Check operation of the system with the engine at idle. Locate the antenna as far as possible away from the ECU.
- When any fuel hose is disconnected, do not turn on the ignition switch. Otherwise, the fuel pump will operate and fuel will spout from the fuel hose.
- Do not operate the fuel pump if the pump is completely dry. This is to prevent pump seizure.
- Before removing the fuel system parts, blow the outer surfaces of these parts clean with compressed air.
- When any fuel hose is disconnected, fuel may spout out by residual pressure in the fuel line. Cover the hose joint with a piece of clean cloth to prevent fuel spillage.
- When installing the fuel hoses, avoid sharp bending, kinking, flattening or twisting, and route the fuel hoses with a minimum of bending so that the fuel flow will not be obstructed.
- Route the hoses according to Cable, Wire, and Hose Routing section in the Appendix chapter.
- Install the hose clamps in the position shown, and securely tighten the clamp bolts. Check the fuel system for leaks after hose installation.

Fuel Hose [A]
Clamp [B]
Fuel Pipe [C]



GC170469S1

3-22 FUEL SYSTEM (DFI)

DFI Servicing Precautions

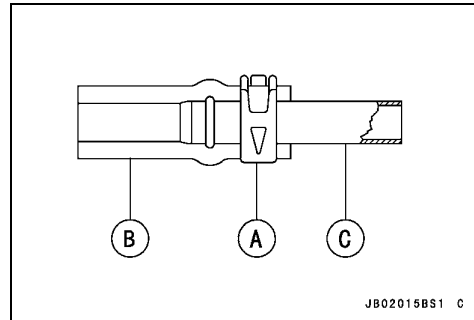
For JT1500-A2 Model ~;

- Install the double spring clamp in the position as shown, and securely pull up the clamp stopper with pliers. Check the fuel system for leaks after hose installation.

Fuel Hose [B]

Double Spring Clamp [A]

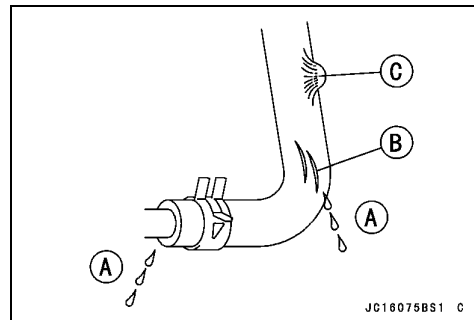
Fuel Pipe [C]



NOTICE

Reusing the double spring clamps will cause fuel leakage, creating the potential for a fire or explosion. Do not reuse the double spring clamps on the fuel line. Replace the double spring clamps with new ones.

- Replace the fuel hose if it has been sharply bent or kinked.
- The high pressure inside the fuel line can cause fuel to leak [A] or the hose to burst. Bend and twist the fuel hose while examining it.
- Replace the hose if any cracks [B] or bulges [C] are noticed.



- When checking the DFI parts, do not run the engine for 15 seconds or more without auxiliary cooling (see General Information chapter).

NOTICE

Running the engine without auxiliary cooling for 15 seconds or more, even at idle speed, may damage the rubber components in the Exhaust System. Do not run the engine for more than 15 seconds without auxiliary cooling water.

- Execute the auxiliary cooling securely in case that frequent engine running is required.
- When checking the DFI parts, use a digital meter which can be read two decimal place voltage or resistance.
- The DFI part connectors have seals, including the ECU. When measuring the input or output voltage with the connector joined, use the needle adapter set. Insert the needle adapter inside the seal until the needle adapter reaches the terminal.

Digital Meter [A]

Special Tool - Needle Adapter Set: 57001-1457



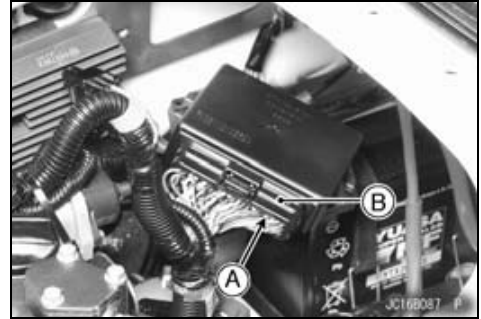
NOTICE

If the needle adapter is inserted at an angle it may create a short-circuit between the terminals and damage the electrical system. To avoid a short circuit, insert the needle adapter straight along the terminal in the connector.

DFI Servicing Precautions

○ After measurement, remove the needle adapters and apply silicone sealant to the seals [A] of the connector [B] for waterproofing.

Sealant - Liquid Gasket, TB1211: 56019-120



- Always check battery condition before replacing the DFI parts. A fully charged battery is a must for conducting accurate tests of the DFI system.
- Do not directly connect a 12 V battery to a fuel injector. Insert a resistor (5 ~ 7 Ω) or a bulb (12 V, 3 ~ 3.4 W) in series between the battery and the injector.

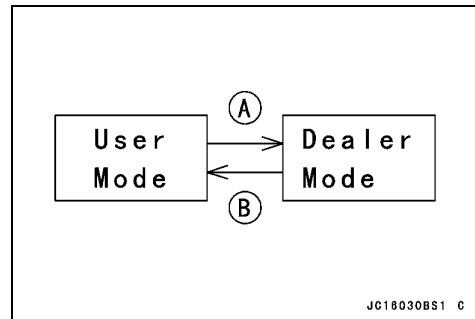
3-24 FUEL SYSTEM (DFI)

Self-Diagnosis

Self-diagnosis Outline

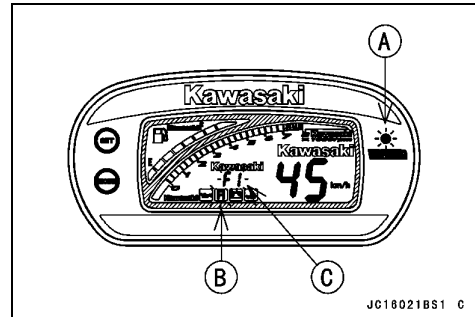
The self-diagnosis system has two modes and can be switched to another mode.

- [A] Push the “SET” button with “MODE” button at the same time for 3 seconds or more.
- [B] Push either “SET” or “MODE” button for more than one second or more.



User Mode

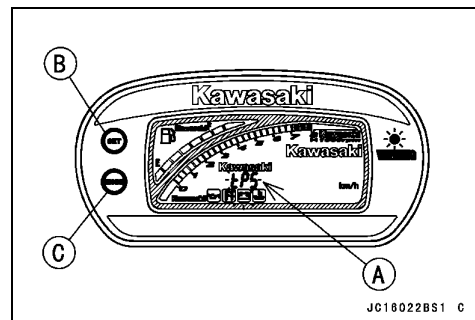
This is a standard mode and enters automatically after ignition switch ON. The ECU notifies the rider of troubles in DFI system and ignition system by flashing LED warning light [A], the FI indicator [B] and “FI” character [C] when DFI system and ignition system parts are faulty, and initiates fail-safe function. The buzzer sound goes on. In case of serious troubles ECU stops the injection/ignition/starter motor operation. The buzzer sound can be stopped by pushing either “SET” or “MODE” button.



Dealer Mode

The LCD in the meter unit displays service code character [A] to show the problem(s) which the DFI system and ignition system has at the moment of diagnosis.

- To enter the dealer mode push the “SET” button [B] with “MODE” button [C] for 3 seconds or more.
- Read the service code character in the LCD display. Refer to the “Service Code (Character) Table” in the following section.
- To return the user mode push either “SET” or “MODE” button for one second or more.
- The service code character(s) will not be shown on the LCD in the meter unit after the problems are solved.



Self-Diagnosis

Service Code (Character) Table

Service Code (used in ECU)	Service Code Character (displayed on Meter Unit)	Possible Problems	Fail-Safe Function
11		Throttle sensor malfunction, wiring open or short	The ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the D-J method (see Note 1).
12		Inlet air pressure sensor malfunction, wiring open or short	The ECU sets the DFI in the α-N method (see Note 2).
13		Inlet air temperature sensor malfunction, wiring open or short	The ECU sets the inlet air temperature at 40°C.
14		Water temperature sensor malfunction, wiring open or short	The ECU sets the water temperature at 70°C.
21		Crankshaft sensor malfunction, wiring open or short	—
23		Camshaft position sensor malfunction, wiring open or short	The ECU continues to ignite cylinders in the same sequence following the last good signal.
31		Vehicle-down sensor malfunction, wiring open or short	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
41		Injector #1 malfunction, wiring open or short	—
42		Injector #2 malfunction, wiring open or short	—
43		Injector #3 malfunction, wiring open or short	—
44		Injector #4 malfunction, wiring open or short	—
51		Ignition coil #1, #4 malfunction, wiring open or short	The ECU shuts off the injectors #1/#4 to stop fuel to the cylinders #1/#4.
52		Ignition coil #2, #3 malfunction, wiring open or short	The ECU shuts off the injectors #2/#3 to stop fuel to the cylinders #2/#3.
71		Engine overheat	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
72		Engine oil pressure too low	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
73	(JT1500-A1) 	Oil temperature sensor malfunction, wiring open or short	The ECU sets the oil temperature at 60°C. The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.
	(JT1500-A2 ~) 		
76	(JT1500-A2 ~) 	Engine oil overheat	The ECU slows down the engine speed less than 3 000 r/min (rpm) by stopping the ignition.

3-26 FUEL SYSTEM (DFI)

Self-Diagnosis

Note:

- (1) D-J Method: the DFI control method from medium to heavy engine load. When the engine load is light like at idling or low speed, the ECU determines the injection quantity by calculating from the throttle vacuum (vacuum sensor output voltage) and engine speed (crankshaft sensor output voltage).
- (2) α -N Method: As the engine speed increases, and the engine load turns middle to heavy, the ECU determines the injection quantity by calculating from the throttle opening (throttle sensor output voltage) and the engine speed.
- (3) If both throttle sensor system and inlet air pressure fails, the ECU locks ignition timing into the ignition timing at closed throttle position and sets the DFI in the α -N method.
- (4) The ECU may be involved in these problems. If all the parts and circuits checked out good, be sure to check the ECU for ground and power supply. If the ground and power supply are checked good, replace the ECU.

Memory of Service Code (Character)

The service codes (characters) in the past are stored in the ECU. However, the characters cannot be displayed in the meter. The past service codes can be confirmed by using the Kawasaki Diagnostic System and they can be erased.

Troubleshooting the DFI System
Sample Diagnosis Sheet

Rider name:	Registration No. (license plate No.):	Year of initial registration:
Model:	Engine No.:	Hull No.:
Date problem occurred:		Mileage:
Environment when problem occurred.		
Weather	☐ fine, ☐ cloudy, ☐ rain, ☐ snow, ☐ always, ☐ other:	
Temperature	☐ hot, ☐ warm, ☐ cold, ☐ very cold, ☐ always	
Problem frequency	☐ chronic, ☐ often, ☐ once	
Altitude	☐ normal, ☐ high (about 1 000 m or more)	
Watercraft conditions when problem occurred.		
Warning LED light, FI character, FI mark	☐ turn on immediately after ignition switch ON, and turn off after 1 ~ 2 seconds (normal).	
	☐ lights blink after ignition switch ON, and stay on (DFI problem)	
	☐ unlights (LED light, meter unit, ECU or its wiring fault).	
	☐ sometimes lights up (probably wiring fault).	
Starting difficulty	☐ starter motor not rotating.	
	☐ starter motor rotating but engine doesn't turn over.	
	☐ starter motor and engine don't turn over.	
	☐ no fuel flow (☐ no fuel in tank, ☐ no fuel pump sound).	
	☐ engine flooded (do not crank engine with throttle opened, which promotes engine flooding).	
	☐ no spark.	
	☐ other:	
Engine stalls	☐ right after starting.	
	☐ when opening throttle lever.	
	☐ when closing throttle lever.	
	☐ when moving off.	
	☐ when stopping the watercraft.	
	☐ when cruising.	
	☐ other:	
Poor running at low speed	☐ very low idle speed, ☐ very high idle speed, ☐ rough idle speed.	
	☐ battery voltage is low (charge the battery).	
	☐ spark plug loose (tighten it).	
	☐ spark plug dirty, broken, or gap maladjusted (remedy it).	
	☐ backfiring.	
	☐ afterfiring.	
	☐ hesitation when acceleration.	
	☐ engine oil viscosity too high.	
	☐ engine overheating.	
☐ other:		

3-28 FUEL SYSTEM (DFI)

Troubleshooting the DFI System

Poor running or no power at high speed	☐ spark plug loose (tighten it).
	☐ spark plug dirty, broken, or gap maladjusted (remedy it).
	☐ spark plug incorrect (replace it).
	☐ knocking (fuel poor quality or incorrect).
	☐ engine overheating.
	☐ engine oil level too high.
	☐ engine oil viscosity too high.
	☐ other:

Throttle Sensor (Service Code/Character-11/tPS)

Throttle Sensor Removal/Adjustment

NOTICE

A shock to the throttle sensor can damage it. Do not drop the throttle sensor.

- Remove:
Seat (see Hull/Engine Hood chapter)
Air filter (see Air Filter Removal)
- Use a Torx wrench [A] (T20, B = 3.86 mm (0.152 in.)) to remove the throttle sensor mounting screws [C].

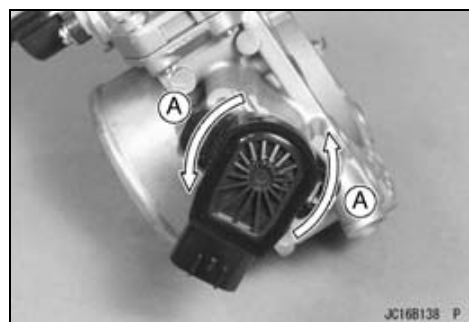
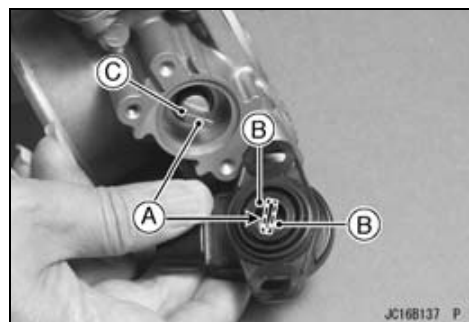
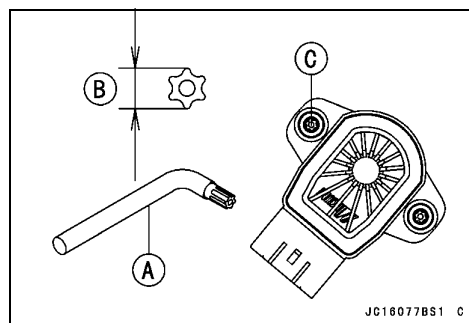
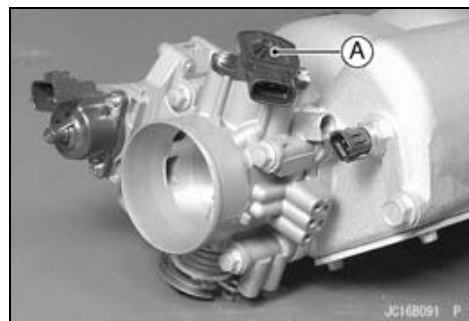
NOTE

○ In the engine compartment, there is not enough space between the throttle sensor and hull to remove the Torx screws. So use an L shape Torx wrench.

- When installing the throttle sensor, note the following (In the photo, the throttle sensor has been removed from the throttle body for clarity).

○ Align [A] the projections [B] on the throttle sensor with the throttle shaft [C] as shown when putting the throttle sensor to the throttle body.

○ Turn the throttle sensor counterclockwise [A] a little and temporarily tighten the throttle sensor mounting screws.



3-30 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code/Character-11/tPS)

- Adjust the throttle sensor positioning as follows.
- Install the air filter temporarily.
- After warming up the engine, check the idling speed.

Idle Speed

Standard: 1 300 $\pm$ 100 r/min (rpm)

- Stop the engine and turn the ignition switch OFF.
- Disconnect the throttle sensor connector and connect the throttle sensor setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the sensor setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001-1521

Throttle Sensor Output Voltage

Connections to Sensor

Meter (+) → G/W lead

Meter (-) → BK/W lead

- Start the engine with idle speed.
- Turn [A] the throttle sensor and bring the sensor output voltage within the standard range.

Output Voltage at Sensor

Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)

- Tighten the throttle sensor mounting screws.

Torque - Throttle Sensor Mounting Screws: 2.0 N·m (0.20 kgm·f, 18 in·lb)

- Recheck the sensor output voltage is within the standard range.
- Stop the engine and turn the ignition switch OFF.
- Remove the setting adapter and reconnect the throttle sensor connector.



Input Voltage Inspection

NOTE

○ Be sure the battery is fully charged.

- Turn the ignition switch OFF.
- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.
- Connect a digital voltmeter [A] to the connector [B], using the needle adapter set.

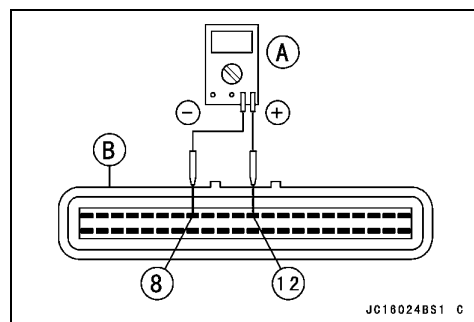
Special Tool - Needle Adapter Set: 57001-1457

Throttle Sensor Input Voltage

Connections to ECU

Meter (+) → R lead (terminal 12)

Meter (-) → BK/W lead (terminal 8)



Throttle Sensor (Service Code/Character-11/tPS)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at ECU

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★ If the reading of input voltage is less than the standard, check the ECU for its ground, power supply and wiring shorted. If the ground, power supply and wiring are good, replace the ECU.
- ★ If the input voltage is within the standard range, check the input voltage at the throttle sensor connector.
- Remove the air filter temporarily (see Air Filter Removal).
- Disconnect the throttle sensor connector and connect the setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001-1521

Throttle Sensor Input Voltage

Connections to Sensor

Meter (+) → R lead

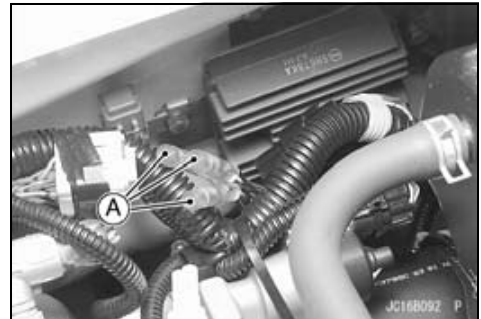
Meter (–) → BK/W lead

- Install the air filter.
- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at Sensor

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★ If the reading is out of the range, check the wiring (see wiring diagram in this section).
- ★ If the reading is good, check the output voltage of the sensor.



3-32 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code/Character-11/tPS)

Output Voltage Inspection

- Measure the output voltage at the ECU in the same way as input voltage inspection. Note the following.
Digital Voltmeter [A]
Connector [B]

Special Tool - Needle Adapter Set: 57001-1457

Throttle Sensor Output Voltage Connections to ECU

Meter (+) → G/W lead (terminal 34)

Meter (-) → BK/W lead (terminal 8)

- Start the engine.
- Check idle speed to ensure throttle opening is correct.

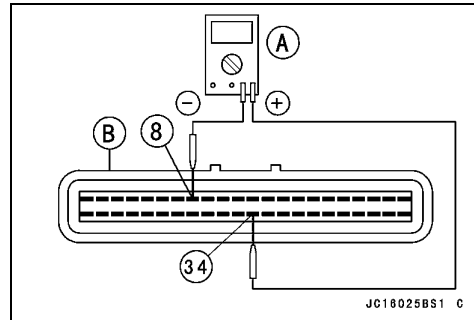
Idle Speed

Standard: 1 300 ±100 r/min (rpm)

- Measure the sensor output voltage with the idle speed.

Output Voltage at ECU

Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)



NOTICE

A shock to the throttle sensor can damage it. Do not drop the throttle sensor.

- ★ If the output voltage is within the standard range, check the ECU for a good ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the standard range (e.g. when the wiring is open, the reading is 0 V), check the output voltage at the sensor connector.

Throttle Sensor (Service Code/Character-11/tPS)

- Disconnect the throttle sensor connector and connect the setting adapter [A] between the harness connector and throttle sensor connector.
- Connect a digital meter to the setting adapter leads.

Special Tool - Throttle Sensor Setting Adapter: 57001-1521

Throttle Sensor Output Voltage Connections to Sensor

Meter (+) → G/W lead

Meter (–) → BK/W lead

- Measure the sensor output voltage with the idle speed.

Output Voltage at Sensor

Standard: 1.08 ~ 1.18 V DC (at idle throttle opening)



NOTICE

A shock to the throttle sensor can damage it. Do not drop the throttle sensor.

- After throttle sensor voltage inspection, remove the setting adapter.
- ★ If the reading is out of the standard range, inspect the throttle sensor resistance.
- ★ If the output voltage is normal, check the wiring for continuity (see next diagram).

Resistance Inspection

- Turn the ignition switch OFF.
- Remove:
Air Filter (see Air Filter Removal)
- Disconnect the throttle sensor connector and connect the setting adapter [A] to the throttle sensor [B].

Special Tool - Throttle Sensor Setting Adapter: 57001-1521

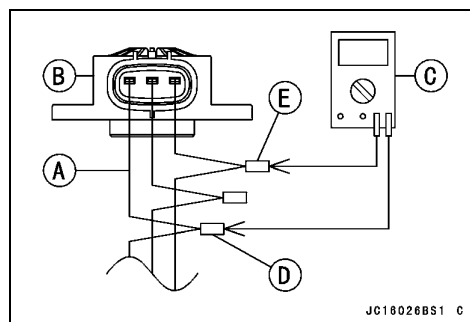
- Do not connect the harness connector.
- Connect a digital meter [C] to the harness adapter leads.
- Measure the throttle sensor resistance.

Throttle Sensor Resistance Connections to

Harness Adapter: R lead [D] ↔ BK/BL lead [E]

Standard: 4 ~ 6 kΩ

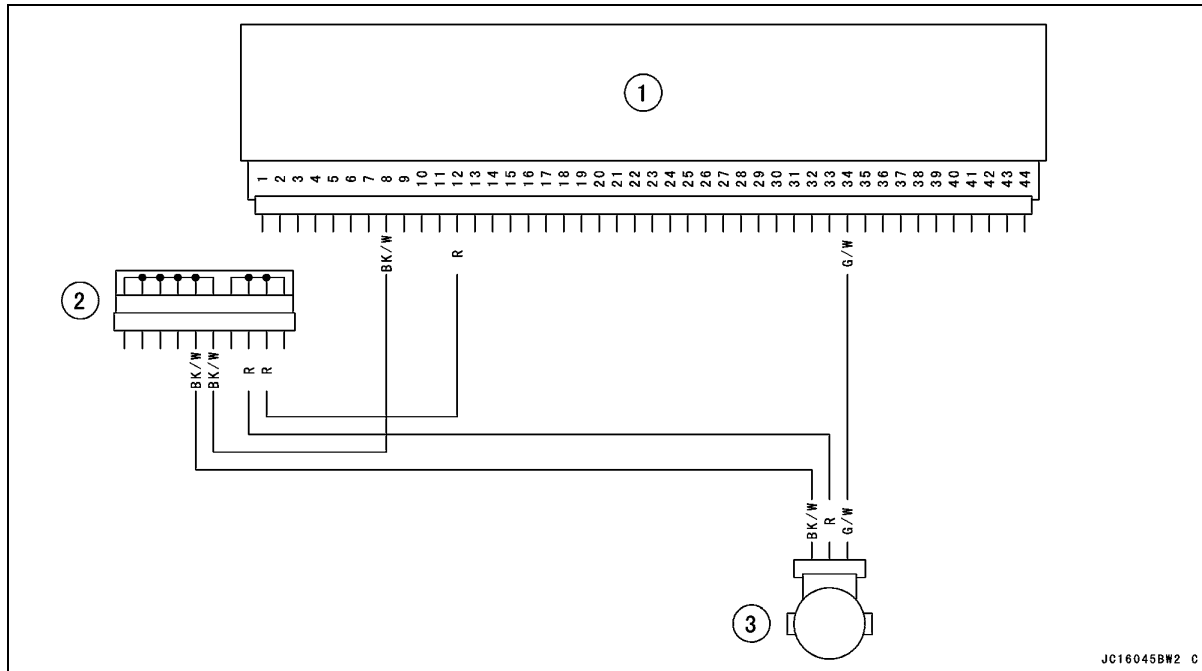
- ★ If the reading is out of the range, replace the throttle body assy.
- ★ If the reading is within the range, but the problem still exists, replace the ECU.



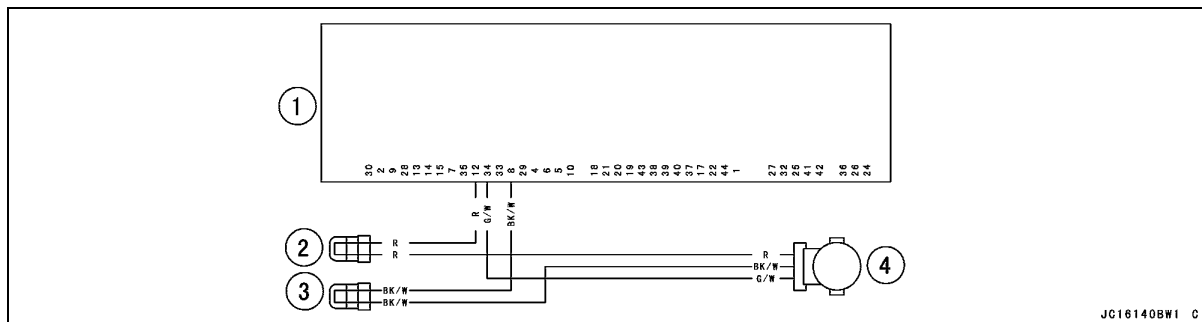
3-34 FUEL SYSTEM (DFI)

Throttle Sensor (Service Code/Character-11/tPS)

JT1500-A1 ~A7 Models



JT1500A8 Model ~



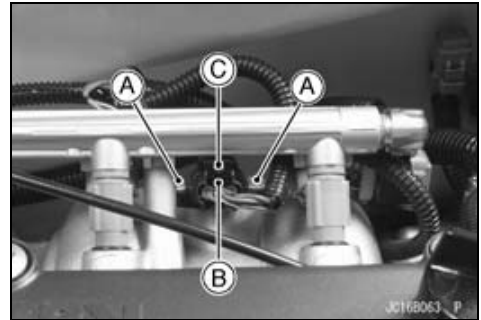
Inlet Air Pressure Sensor (Service Code/Character-12/bOSt)

NOTICE

A shock to the throttle sensor can damage it. Do not drop the throttle sensor.

Inlet Air Pressure Sensor Removal

- Turn the ignition switch off.
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Air Pressure Sensor Bolts [A]
 - Inlet Air Pressure Sensor Connector [B]
 - Inlet Air Pressure Sensor [C]



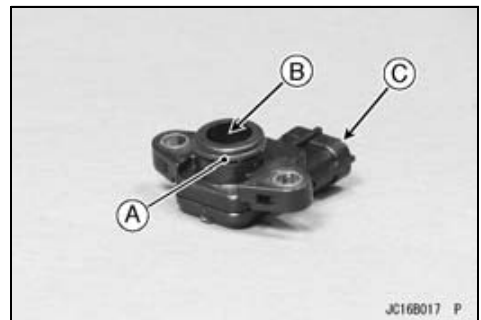
Inlet Air Pressure Sensor Installation

- Apply silicone oil to the O-ring [A].

NOTICE

Do not apply silicone oil to the sensor end (sensing part) [B] and the inside [C] of the sensor connector.

- Tighten:
 - Torque - Inlet Air Pressure Sensor Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



Input Voltage Inspection

NOTE

- Be sure the battery is fully charged.
- The inspection is the same as "Input Voltage Inspection" of the throttle sensor.

- Turn the ignition switch OFF.
- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.

- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Pressure Sensor Input Voltage Connections to ECU

Meter (+) → R lead (terminal 12)

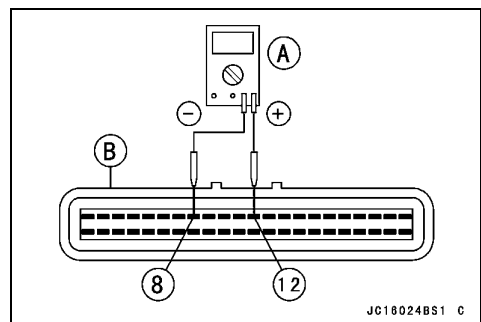
Meter (–) → BK/W lead (terminal 8)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at ECU

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★If the reading is less than the standard, check the ECU for its ground, power supply and wiring. If the ground, power supply and wiring are good, replace the ECU.



3-36 FUEL SYSTEM (DFI)

Inlet Air Pressure Sensor (Service Code/Character-12/bOSt)

- ★ If the reading is within the standard range, and check the input voltage at the sensor connector.
- Disconnect the inlet air pressure sensor connector and connect the harness adapter [A] between the harness connector and inlet air pressure sensor connector.
- Connect a digital meter to the harness adapter leads.
[B] Inlet Air Pressure Sensor

Special Tool - Sensor Harness Adapter: 57001-1561

Inlet Air Pressure Sensor Input Voltage Connections to Sensor

Meter (+) → R lead [C]

Meter (–) → BK/W lead [D]

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor input voltage.
- Wait 15 seconds before using the starter again.

Input Voltage at Sensor Connector

Standard: 4.75 ~ 5.25 V DC

- Turn the ignition switch OFF.
- ★ If the reading is out of the standard range, check the wiring (see Wiring Diagram in this section).
- ★ If the reading is good, the input voltage is normal. Check the output voltage.

Output Voltage Inspection

- Measure the output voltage at the ECU in the same way as input voltage inspection. Note the following.

Inlet Air Pressure Sensor Output Voltage

Connections to ECU

Meter (+) → G/R lead (terminal 33)

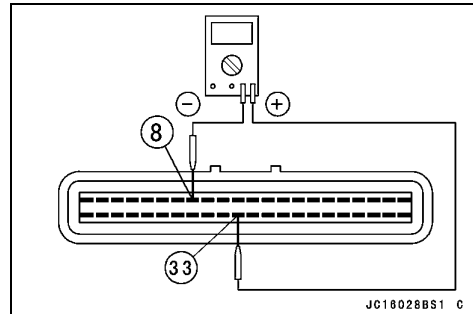
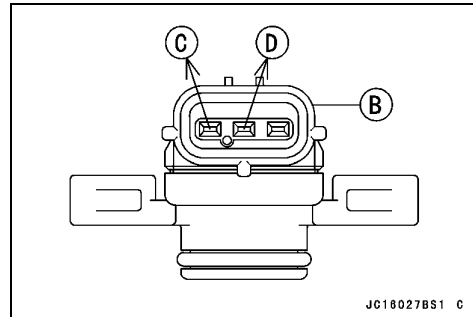
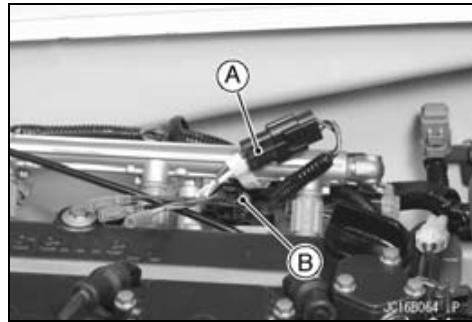
Meter (–) → BK/W lead (terminal 8)

Output Voltage at ECU

Usable Range: 3.75 ~ 4.25 V DC at the standard atmospheric pressure (101.32 kPa, 76 cmHg absolute)

NOTE

- The output voltage changes according to the local atmospheric pressure.
- The vacuum sensor output voltage is based on a nearly perfect vacuum in the small chamber of the sensor. So, the sensor indicates absolute vacuum pressure.
- ★ If the output voltage is within the usable range, check the ECU for its ground, power supply and wiring. If the ground, power supply and wiring are good, replace the ECU.



Inlet Air Pressure Sensor (Service Code/Character-12/bOSt)

- ★ If the output voltage is far out of the usable range, check the output voltage at the sensor connector [A].
- Measure the output voltage at the sensor in the same way as input voltage inspection. Note the following.

[B] Inlet Air Pressure Sensor

Special Tool - Sensor Harness Adapter: 57001-1561

**Inlet Air Pressure Sensor Output Voltage
Connections to Sensor**

Meter (+) → G/R lead [C]

Meter (–) → BK/W lead [D]

Output Voltage at Sensor Connector

**Usable Range: 3.75 ~ 4.25 V DC at the standard
atmospheric pressure (101.32 kPa or
76 cmHg absolute)**

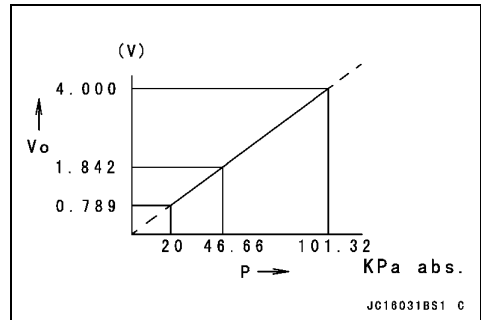
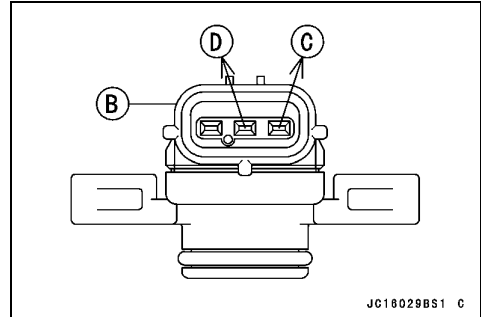
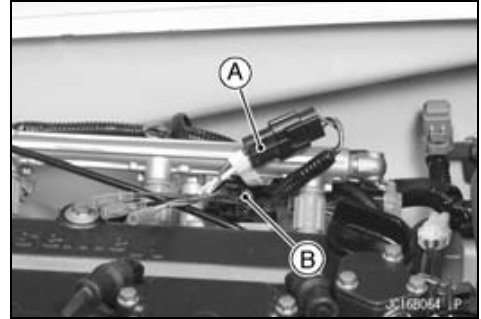
- ★ If the output voltage is normal, check the wiring for continuity (see next diagram).
- ★ If the output voltage is out of the usable range, replace the sensor.
- Turn the ignition switch OFF.
- Remove the sensor harness adapter.

Output Voltage Performance

(at Input Voltage: 4.75 ~ 5.25 V)

P: Vacuum Pressure

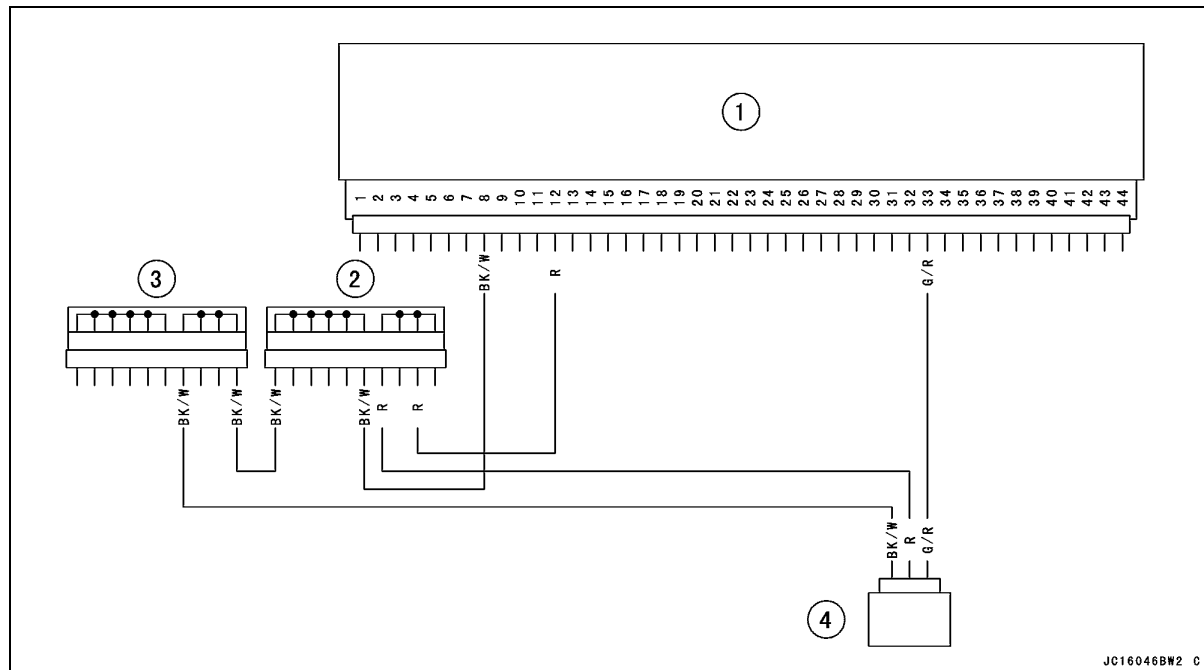
Vo: Output Voltage



3-38 FUEL SYSTEM (DFI)

Inlet Air Pressure Sensor (Service Code/Character-12/bOST)

JT1500-A1 ~ A7 Models



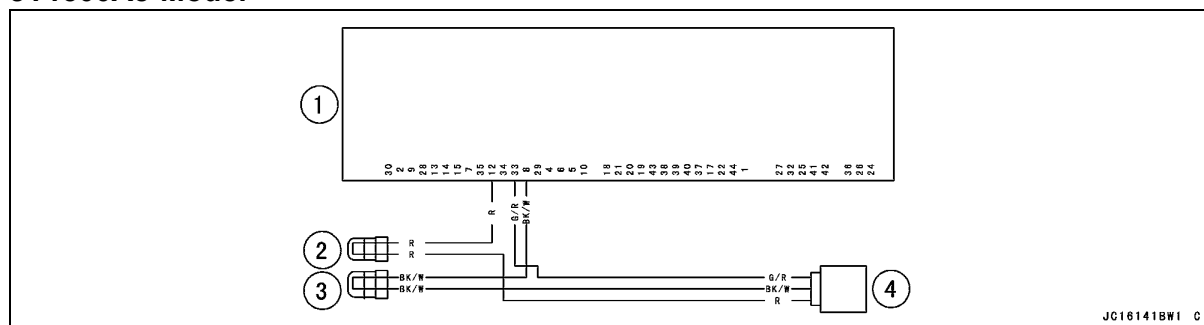
1. ECU (Electronic Control Unit)

2. Joint Connector E

3. Joint Connector H

4. Inlet Air Pressure Sensor

JT1500A8 Model ~



1. ECU (Electronic Control Unit)

2. Joint Connector X

3. Joint Connector W

4. Inlet Air Pressure Sensor

Inlet Air Temperature Sensor (Service Code/Character-13/Airt)

Inlet Air Temperature Sensor Removal/Installation

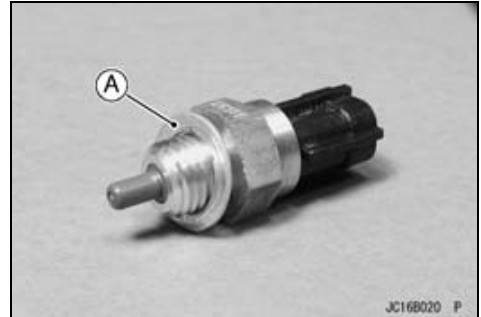
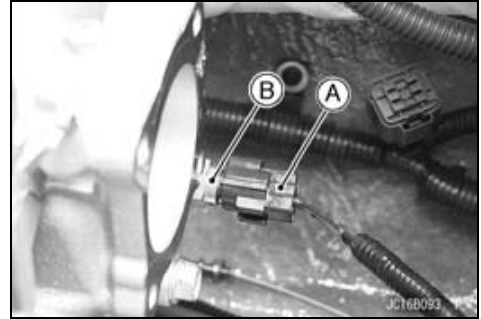
NOTICE

A shock to the throttle sensor can damage it. Do not drop the throttle sensor.

- Remove the air filter (see Air Filter Removal).
- Disconnect the connector [A] from the inlet air temperature sensor.
- Remove the inlet air temperature sensor [B] and washer.

- Install the inlet air temperature sensor and washer [A].
- Tighten:

Torque - Inlet Air Temperature Sensor: 20 N·m (2.0 kgf·m, 14 ft·lb)



Output Voltage Inspection

NOTE

○Be sure the battery is fully charged.

- Remove the ECU (see ECU Removal). Do not disconnect the ECU connector.
- Connect a digital voltmeter to the ECU connector, using needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Inlet Air Temperature Sensor Output Voltage Connections to ECU Connector

Meter (+) → R/BL lead (terminal 7)

Meter (–) → BK/W lead (terminal 8)

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Wait 15 seconds before using the starter again.

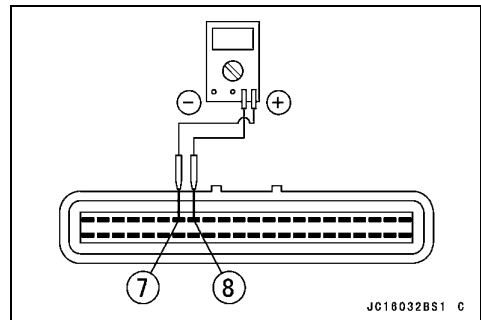
Output Voltage at ECU

Standard: about 2.3 ~ 2.6 V at inlet air temperature 20°C (68°F)

NOTE

○The output voltage changes according to the inlet air temperature.

- Turn the ignition switch OFF.



JC18032BS1 C

3-40 FUEL SYSTEM (DFI)

Inlet Air Temperature Sensor (Service Code/Character-13/Airt)

- ★ If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the specified, check the wiring (see next diagram).
- Remove the needle adapter set, and apply silicone sealant to the seals of the ECU connector for waterproofing.

Sealant - Liquid Gasket, TB1211: 56019-120

- ★ If the wiring is good, check the sensor resistance.

Sensor Resistance Inspection

- Remove the inlet air temperature sensor (see Inlet Air Temperature Sensor Removal/Installation).
- Suspend the sensor [A] in a container of machine oil so that the heat-sensitive portion and threaded portion are submerged.
- Suspend a thermometer [B] with the heat-sensitive portion [C] located in almost the same depth with the sensor.

NOTE

○ The sensor and thermometer must not touch the container side or bottom.

- Place the container over a source of heat and gradually raise the temperature of the oil while stirring the oil gently for even temperature.
- Using a digital meter, measure the internal resistance of the sensor across the terminals at the temperatures shown in the table.

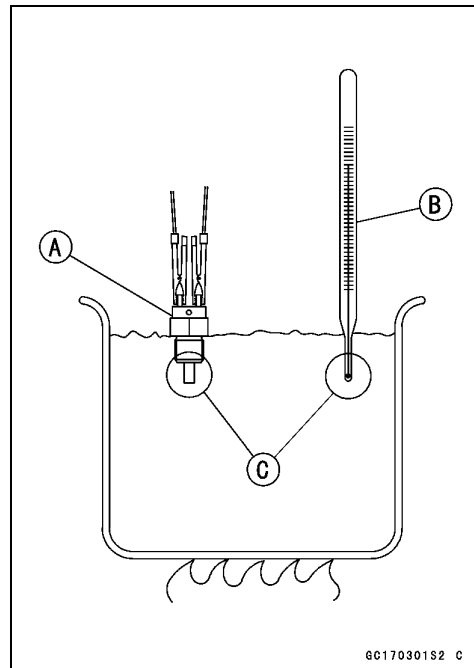
Inlet Air Temperature Sensor Resistance

Standard: 5.4 ~ 6.6 k Ω at 0°C (32°F)

2.26 ~ 2.86 k Ω at 20°C (68°F)

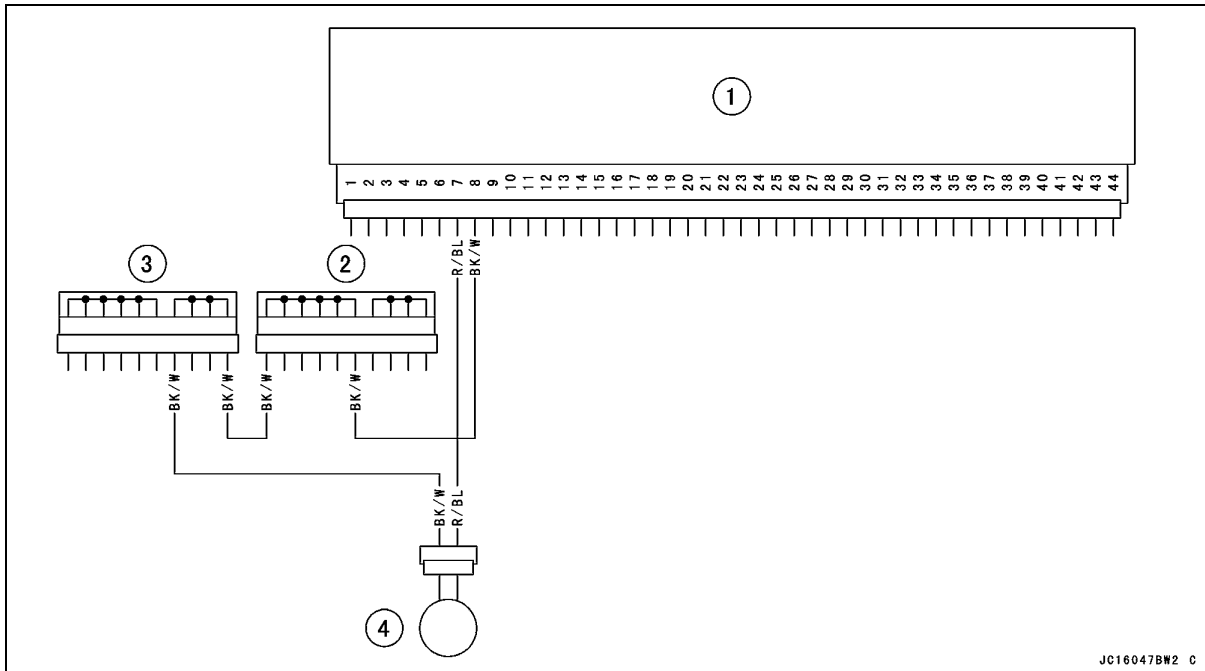
0.29 ~ 0.39 k Ω at 80°C (176°F)

- ★ If the measurement is out of the range, replace the sensor.
- ★ If the measurement is within the specified, replace the ECU.



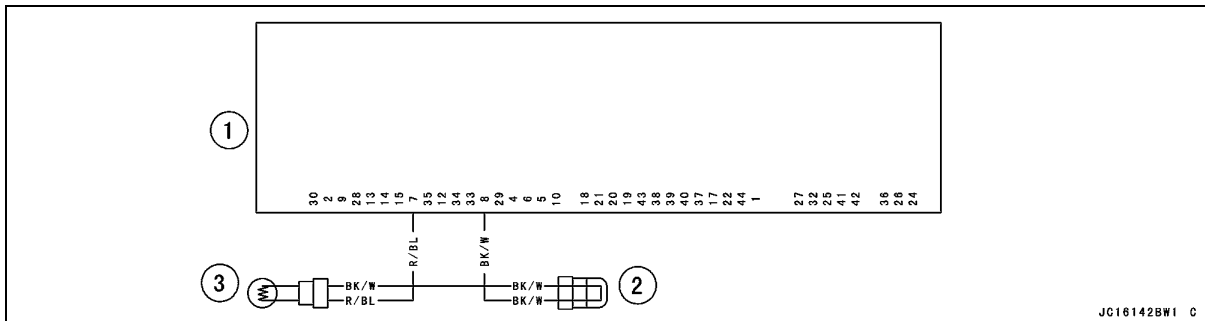
Inlet Air Temperature Sensor (Service Code/Character-13/Airt)

JT1500-A1 ~ A7 Models



1. ECU (Electronic Control Unit)
2. Joint Connector E
3. Joint Connector H
4. Inlet Air Temperature Sensor

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector
3. Inlet Air Temperature Sensor

3-42 FUEL SYSTEM (DFI)

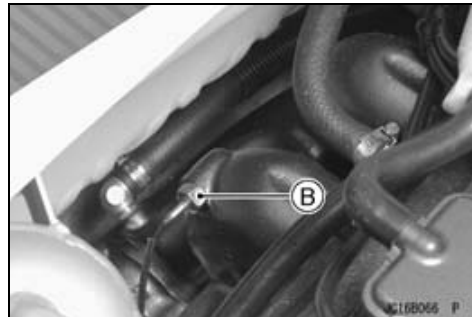
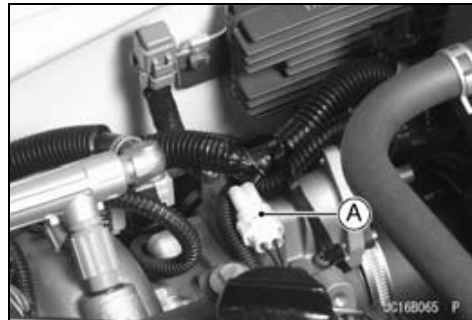
Water Temperature Sensor (Service Code/Character-14/AqUt)

Water Temperature Sensor Removal/Installation

NOTICE

A shock to the throttle sensor can damage it. Do not drop the throttle sensor.

- Disconnect the sensor connector [A], and unscrew the water temperature sensor [B].



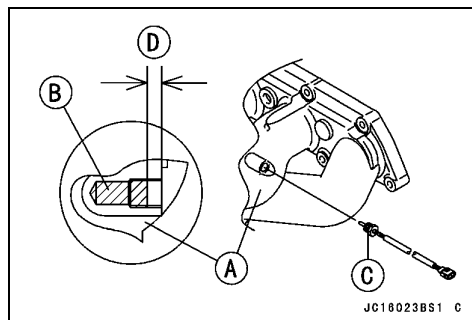
- Fill the hollow of the exhaust manifold [A] with the engine oil (10W-30) [B] as shown, before installing the water temperature sensor [C].
[D] 5 ~ 10 mm (0.2 ~ 0.4 in.)

- Tighten:

Torque - Water Temperature Sensor: 15 N·m (1.5 kgf·m, 11 ft·lb)

NOTE

- When filling the engine oil in the hollow of the exhaust pipe, remove the exhaust pipe. Fill the engine oil and install the water temperature sensor.
- Do not overfill the engine oil or silicone grease, or fitting boss could be damaged.



Output Voltage Inspection

NOTE

- Be sure the battery is fully charged.
- Remove the ECU (see ECU Removal). Do not disconnect the connector.

Water Temperature Sensor (Service Code/Character-14/AqUt)

- Connect a digital voltmeter [A] to the ECU connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Water Temperature Sensor Output Voltage

Connections to ECU

Meter (+) → G/Y lead (terminal 35)

Meter (–) → BK/W lead (terminal 8)

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Wait 15 seconds before using the starter again.

Output Voltage at ECU

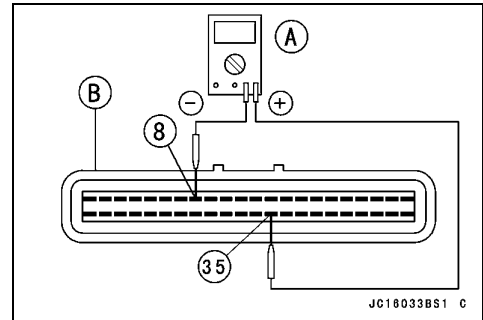
Standard: about 3 ~ 4 V at 20°C (68°F)

NOTE

- *The output voltage changes according to the coolant temperature in the engine.*

- Turn the ignition switch OFF.
- ★ If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the specified (e.g. when the wiring is open, the voltage is about 5 V), check the wiring (see next diagram).
- ★ If the wiring is good, check the water temperature sensor resistance.
- Remove the needle adapter set, and apply silicone sealant to the seals of the ECU connector for waterproofing.

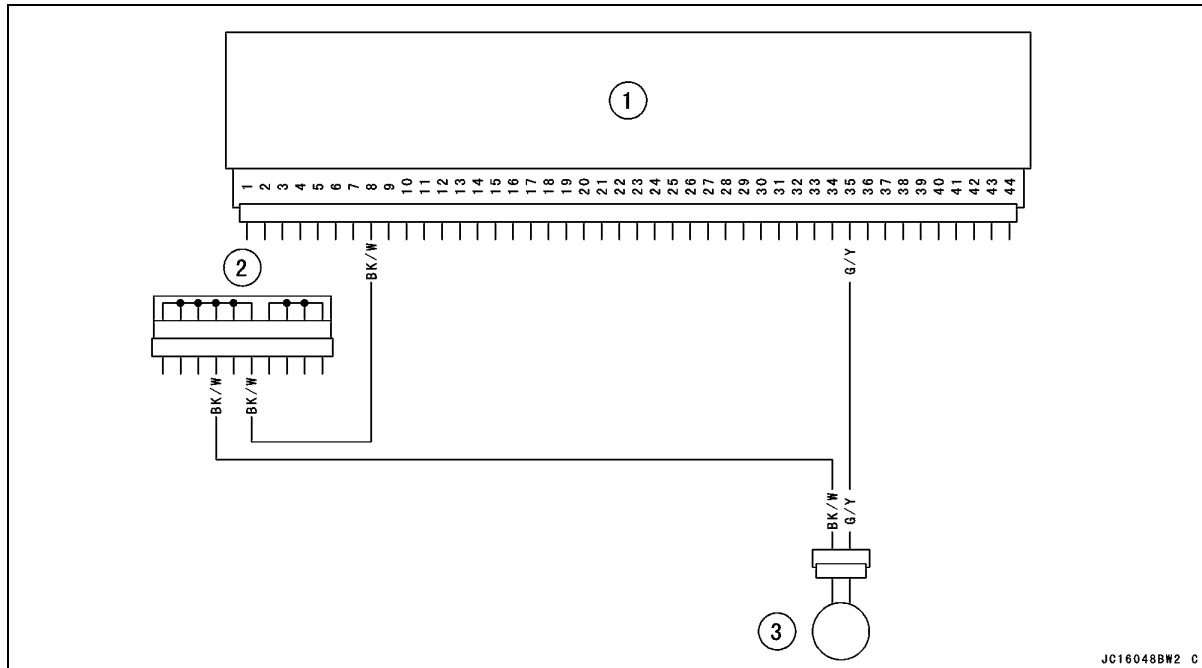
Sealant - Liquid Gasket, TB1211: 56019-120



3-44 FUEL SYSTEM (DFI)

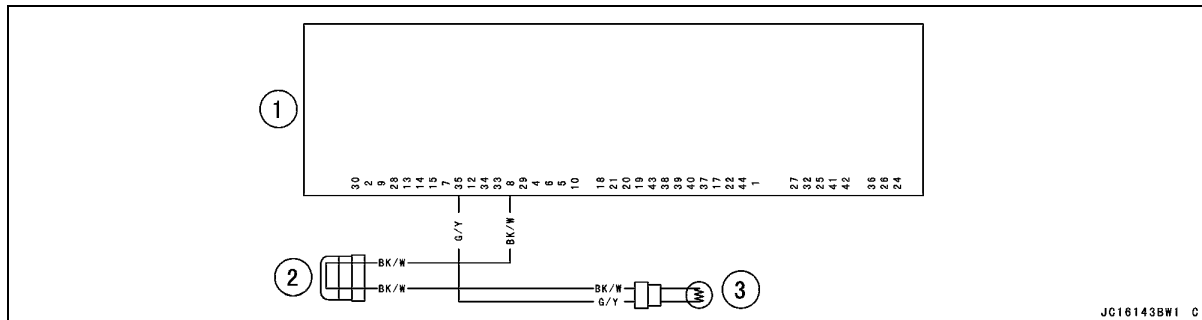
Water Temperature Sensor (Service Code/Character-14/AqUt)

JT1500-A1 ~ A7 Models



1. ECU (Electronic Control Unit)
2. Joint Connector E
3. Water Temperature Sensor

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector W
3. Water Temperature Sensor

Sensor Resistance Inspection

- Remove the water temperature sensor (see Water Temperature Sensor Removal/Installation).
- Refer to the water temperature sensor inspection in the Electrical System chapter.

Crankshaft Sensor (Service Code/Character-21/CrAg)

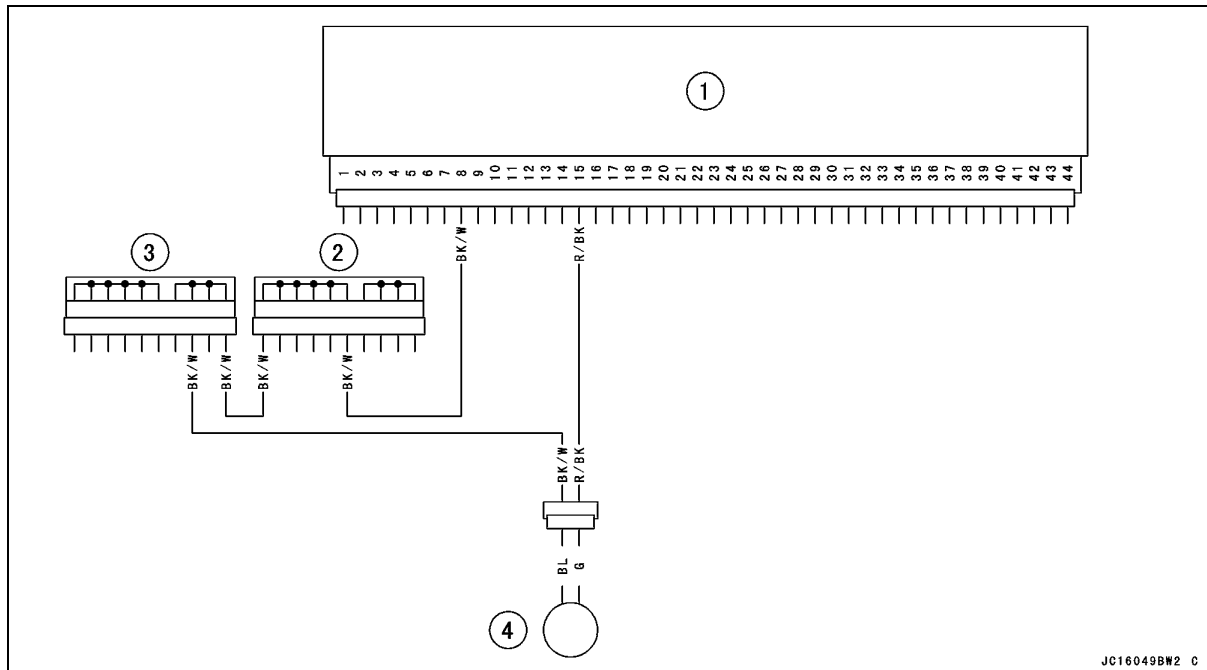
Crankshaft Sensor Removal/Installation

- Refer to the Ignition System section in Electrical System chapter.

Crankshaft Sensor Inspection

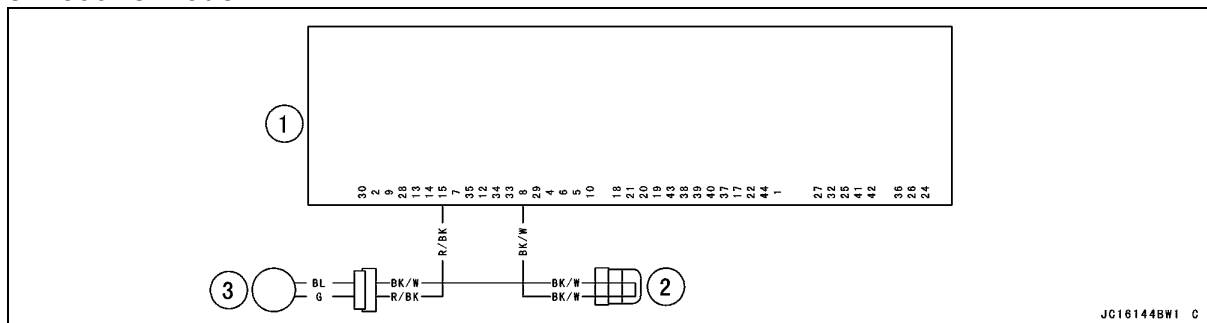
- The crankshaft sensor has no power source, and when the engine stops, the sensor generates no signals.
- Crank the engine and measure the peak voltage of the crankshaft sensor (see Electrical System chapter) in order to check the sensor.
- Check the wiring for continuity, using the following diagram.

JT1500-A1 ~ A7 Models



1. ECU (Electronic Control Unit)
2. Joint Connector E
3. Joint Connector H
4. Crankshaft Sensor

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector W
3. Crankshaft Sensor

3-46 FUEL SYSTEM (DFI)

Camshaft Position Sensor (Service Code/Character-23/CAA1)

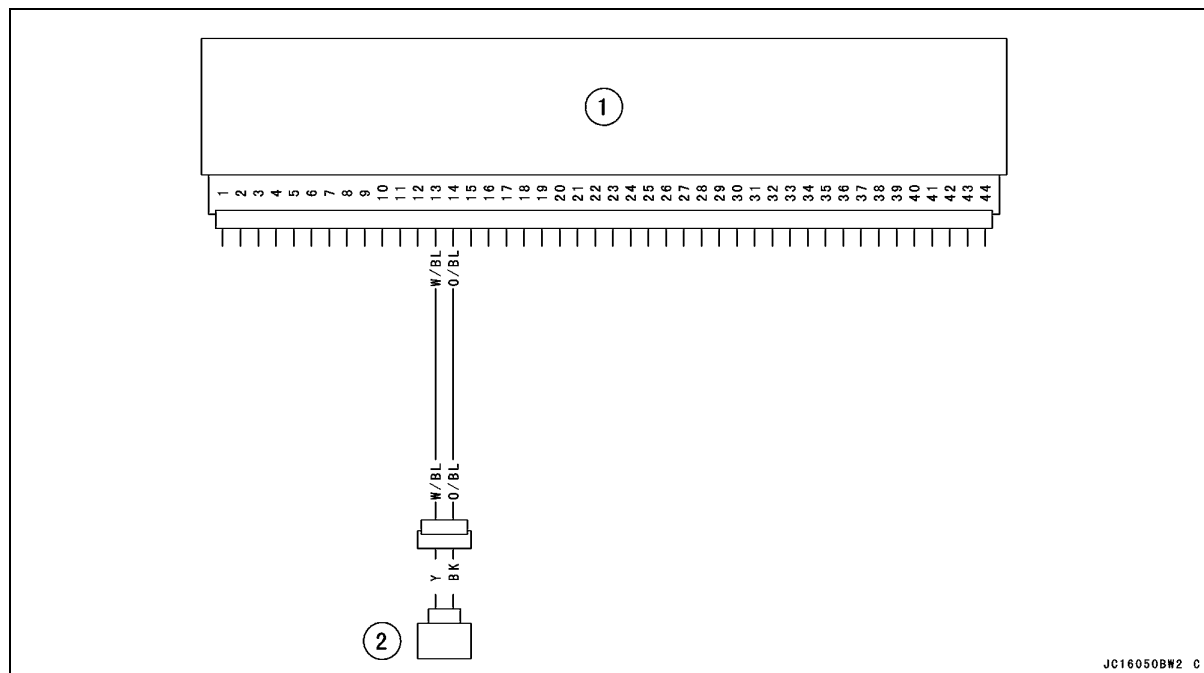
Camshaft Position Sensor Removal/Installation

The camshaft position sensor detects the position of the camshaft, and distinguishes the cylinder.

- Refer to the Ignition System section in Electric System chapter.

Camshaft Position Sensor Inspection

- The camshaft position sensor has no power source, and when the engine stops, the camshaft position sensor generates no signal.
- Crank the engine and measure the peak voltage of the camshaft position sensor (see Electrical System chapter) in order to check the sensor.
- Check the wiring for continuity, using the following diagram.



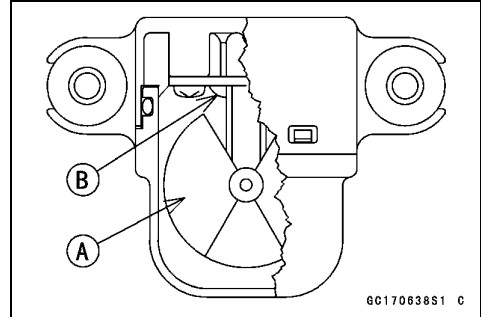
1. ECU

2. Camshaft Position Sensor

Vehicle-down Sensor (Service Code/Character-31/dOS)

This sensor has a weight [A] with two magnets inside, and sends a signal to the ECU. But when the watercraft banks 110 ~ 130° or more to either side (in fact falls down), the weight turns and shuts off the signal. The ECU senses this change, and stops the fuel pump, the fuel injectors, and the ignition system.

Hall IC [B]

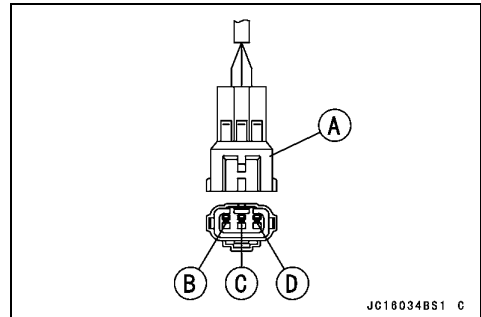


Vehicle-down Sensor Connector [A]

Ground Terminal BK/W [B]

Output Terminal BL/W [C]

Power Source Terminal R/G [D]

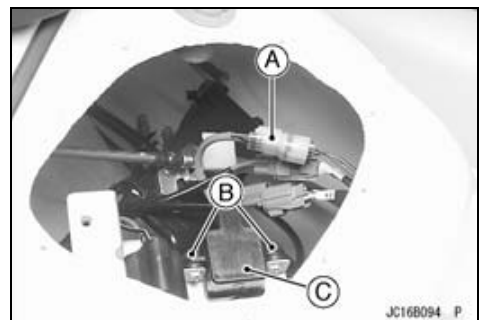
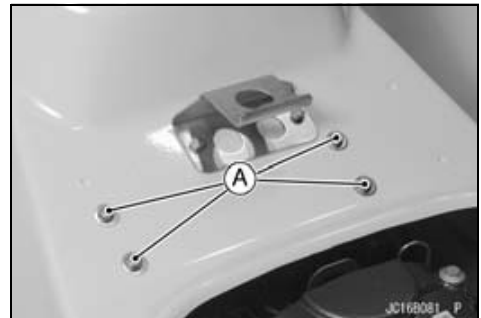


Vehicle-down Sensor Removal

NOTICE

A shock to the down sensor can damage it. Do not drop the down sensor.

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Front Storage Pocket (see Hull/Engine Hood chapter)
 - Bracket Mounting Bolts [A] and Washers
- Remove:
 - Vehicle-down Sensor Connector [A]
 - Screws [B]
 - Vehicle-down Sensor [C]

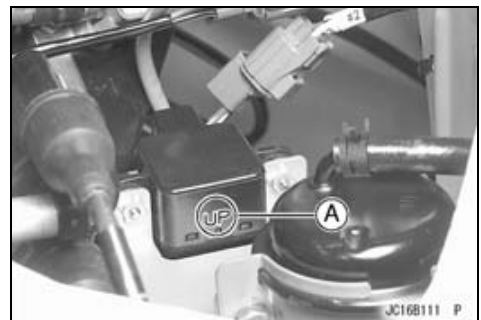


Vehicle-down Sensor Installation

- The UP mark [A] of the sensor should face upward.

⚠ WARNING

Incorrect installation of the vehicle-down sensor could cause sudden loss of engine power. The rider could lose balance during certain riding situations for an accident resulting in injury or death. Ensure that the vehicle-down sensor is held in place by the sensor brackets.



- Tighten:
 - Torque - Vehicle-down Sensor Mounting Screws: 1.5 N·m (0.15 kgf·m, 13 in·lb)

3-48 FUEL SYSTEM (DFI)

Vehicle-down Sensor (Service Code/Character-31/dOS)

Vehicle-down Sensor Inspection

NOTE

○Be sure the battery is fully charged.

- Remove:
Fuel Tank (see Fuel Tank Removal)
- Connect a digital volt meter [A] to the connector [B] of the vehicle-down sensor lead with the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Vehicle-down Sensor Power Source Voltage Connections to Sensor

Meter (+) → R/G lead [D]

Meter (–) → BK/W lead [E]

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor power source voltage.
- Wait 15 seconds before using the starter again.

Power Source Voltage at Sensor

Standard: 4.75 ~ 5.25 V

- Turn the ignition switch OFF.
- ★If there is no standard voltage, check the following:
Battery (see Electrical System chapter)
Main Fuse 20 A
Wiring for Vehicle-down Sensor Power Source (see next diagram)
- ★If the power source is normal, check the output voltage.

- Turn the ignition switch OFF.
- Remove the vehicle-down sensor. Do not disconnect the connector.
- Connect a digital volt meter [A] to the connector, with needle adapter set [B].

Special Tool - Needle Adapter Set: 57001-1457

Vehicle-down Sensor Output Voltage Connections to Sensor

Meter (+) → BL/W lead [D]

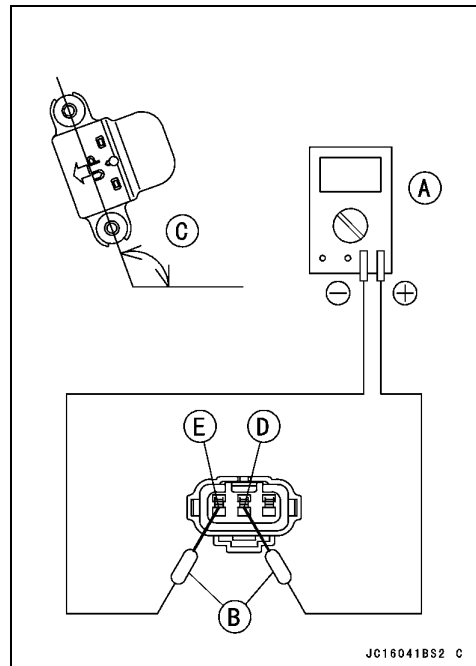
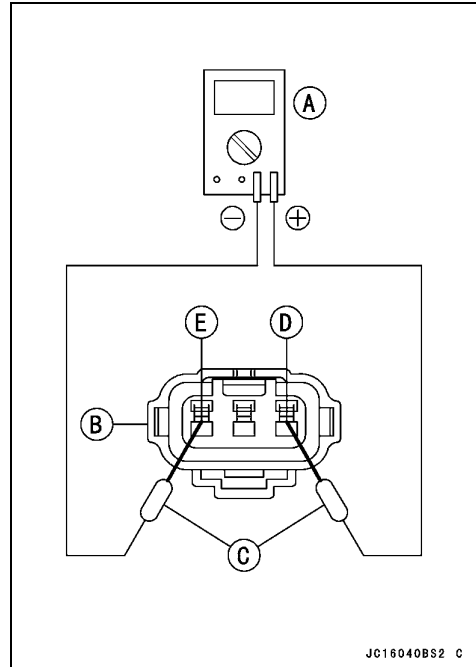
Meter (–) → BK/W lead [E]

- Hold the sensor vertically.
- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Tilt the sensor 110 ~ 130° or more [C] right or left, then hold the sensor and measure the output voltage.
- Wait 15 seconds before using the starter again.

Output Voltage at Sensor

**Standard: with sensor tilted 110 ~ 130° or more right
or left: 0.65 ~ 1.35 V**

**with sensor arrow mark pointed up: 3.55
~ 4.45 V**



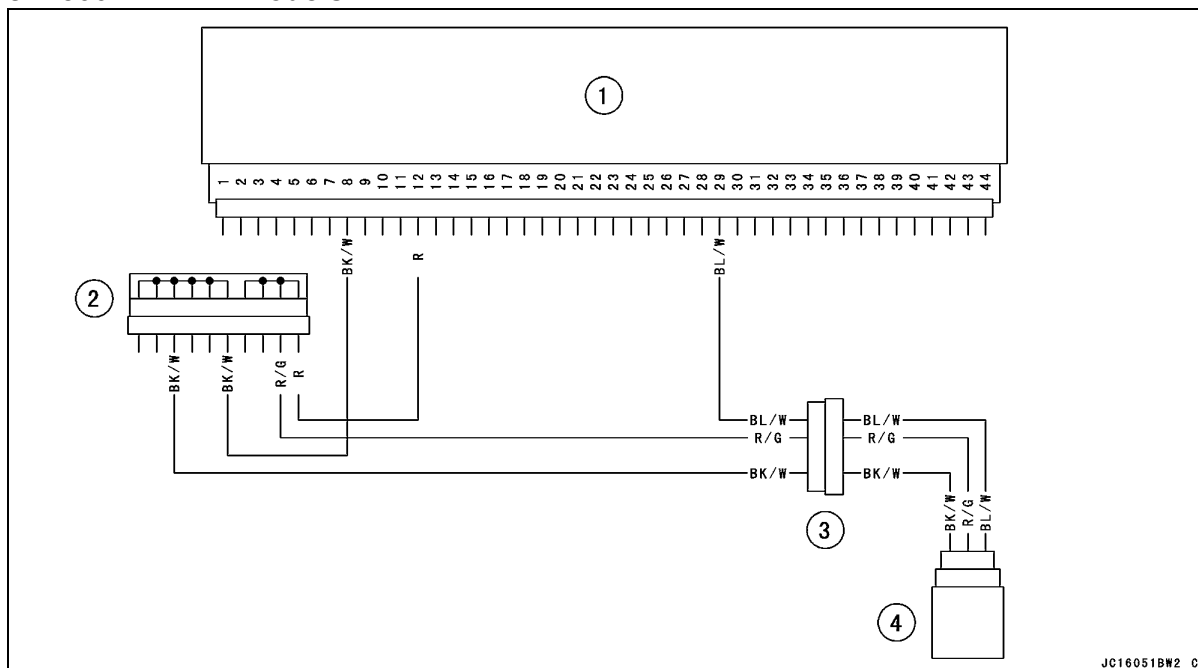
Vehicle-down Sensor (Service Code/Character-31/dOS)

- Turn the ignition switch OFF.
- Remove the needle adapter set, and apply silicone sealant to the seals of the vehicle-down sensor connector for waterproofing.

Sealant - Liquid Gasket, TB1211: 56019-120

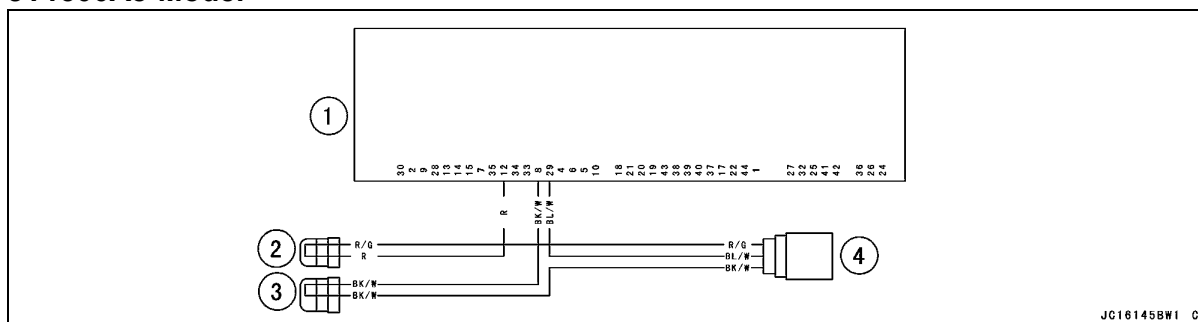
- ★ If the output voltage is normal, the wiring is suspect. Check the wiring.
- ★ If the wiring is good, check the ECU for its ground and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is out of the specified, replace the vehicle-down sensor.

JT1500-A1 ~ A7 Models



1. ECU (Electronic Control Unit)
2. Joint Connector E
3. Connector C
4. Vehicle-down Sensor

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector X
3. Joint Connector W
4. Vehicle-down Sensor

3-50 FUEL SYSTEM (DFI)

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

Fuel Injector Removal

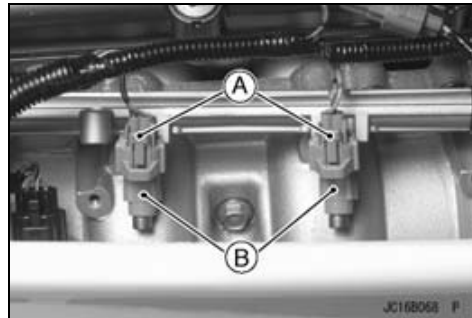
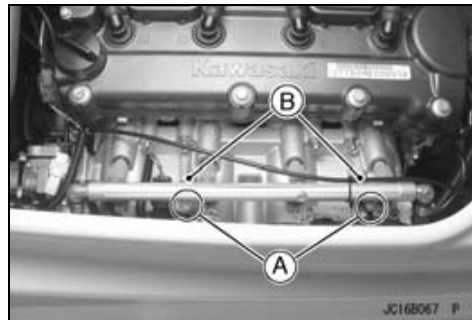
WARNING

Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Disconnect the battery (–) terminal. To avoid fuel spills, draw it from the tank when the engine is cold. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Fuel Hoses
 - Delivery Pipe Mounting Bolts [A], Collars [B] and Clamps
- Remove the delivery pipe assembly from the cylinder head.
- Push the lock [A] and disconnect the injector connectors.
- Remove the fuel injectors [B].

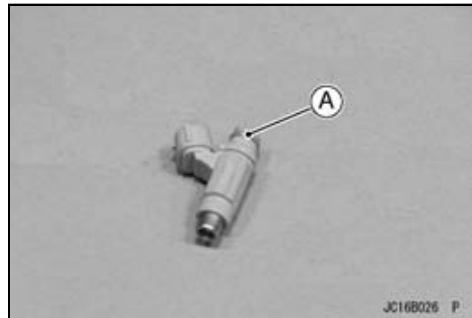
NOTICE

A shock to the fuel injector can damage it. Do not drop the fuel injector.



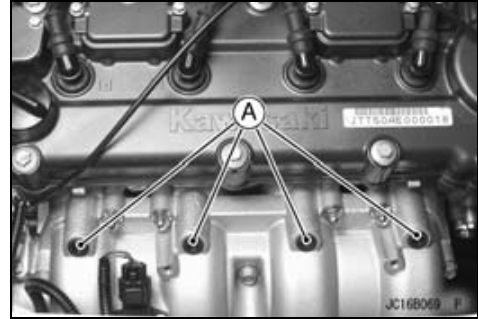
Fuel Injector Installation

- Replace the O-rings [A] of the injectors with new ones.
- Apply grease to the O-rings.
- Insert the injectors into the delivery pipe and confirm whether they turn smoothly or not.

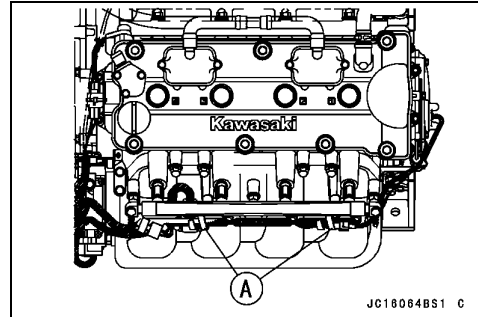


Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

- Replace the seals [A] with new ones.
- Apply grease to the inside and outside of seals.

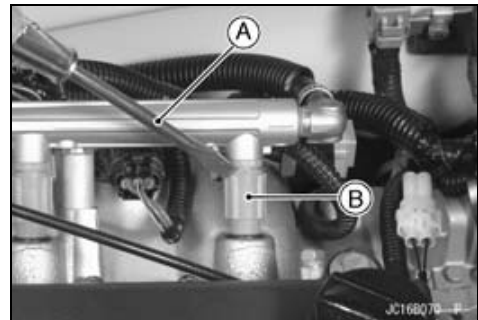


- Install:
Delivery Pipe Assembly
Collars
- Install the clamps [A] as shown.
- Tighten:
Torque - Delivery Pipe Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)
- Install the fuel hoses (see Cable, Wire, and Hose Routing section in Appendix chapter).
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)



Audible Inspection

- Start the engine.
- Apply the tip of a screwdriver [A] to the injector [B]. Put the grip end onto your ear, and listen whether the injector is clicking or not.
- A sound scope can also be used.
- Do the same for the other injector.
- ★ If all the injectors click at a regular intervals, the injectors are good.
- The click interval becomes shorter as the engine speed rises.
- ★ If either injector doesn't click, perform the "Injector Signal Test" for injector operation.

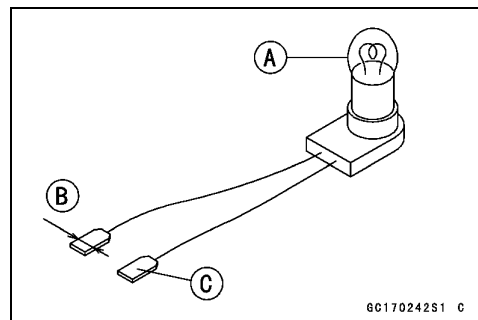


Injector Signal Test

- Prepare four test lights set with male terminals as shown.
Rating of Bulb [A]: 12 V, 3 ~ 3.4 W
Terminal Width [B]: 1.8 mm (0.07 in.)
Terminal Thickness [C]: 0.8 mm (0.03 in.)

NOTICE

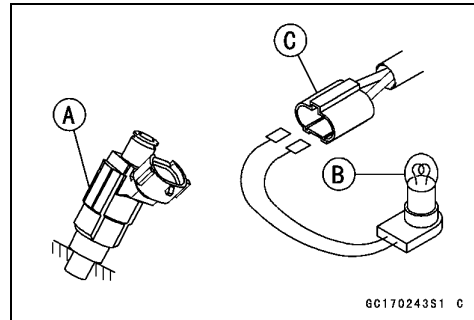
A larger terminal could damage the injector main harness connector (female), leading to harness repair or replacement. Do not use larger terminals than specified above.



3-52 FUEL SYSTEM (DFI)

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

- Remove connectors for injector [A].
- Connect each test light set [B] to the injector harness connector [C].
- Turn the ignition switch ON.
- While cranking the engine with the starter motor, watch the test lights.
- ★ If the test lights flicker at regular intervals, the injector circuit in the ECU, and the wiring are good. Perform the "Injector Resistance Inspection".



○ Injector signals can be also confirmed by connecting the hand tester ($\times 10$ V AC) instead of the test light set to the injector harness (female) connector. Crank the engine with the starter motor, and check to see if the hand oscillates at regular intervals.

Special Tool - Hand Tester: 57001-1394

- ★ If the test light doesn't flicker (or the test hand doesn't oscillates), check the wiring and connectors again. If the wiring is good, check the injector voltage.

Injector Resistance Inspection

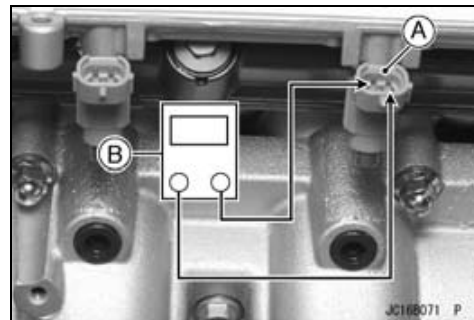
- Remove the delivery pipe assembly.
- Disconnect the connector from the injector [A].
- Measure the injector resistance with the hand tester [B].

Special Tool - Hand Tester: 57001-1394

Injector Resistance

Standard: about $11.7 \sim 12.3 \Omega$ @20°C (68°F)

- ★ If the reading is out of the range, perform the "Injector Unit Test".
- ★ If the reading is normal, perform the "Injector Unit Test" for confirmation.

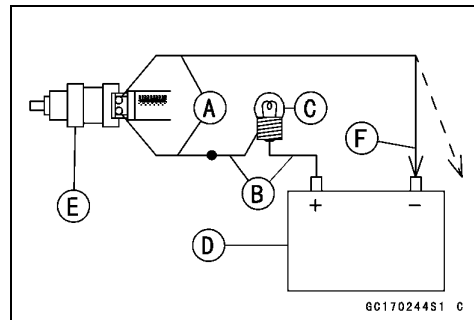


Injector Unit Test

- Use two leads [A] and the same test light set [B] as in "Injector Signal Test".
Rating of Bulb [C]: 12 V, 3 ~ 3.4 W
12 V Battery [D]

NOTICE

**The bulb works as a current limiter to protect the solenoid in the injector from excessive current. Be sure to connect the bulb in series.
(could use more info on this to make it better)**



- Connect the test light set to the injector [E] as shown.
- Open and connect [F] the end of the lead to the battery (−) terminal repeatedly. The injector should click.
- ★ If the injector does not click, replace the injector.

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

Injector Voltage Inspection

- Turn the ignition switch OFF.
- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Injector Power Source Voltage

Connector to Injector #1, #2, #3, #4

Meter (+) → R/Y lead

Meter (–) → Battery (–) Terminal

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the injector power source voltage.
- Wait 15 seconds before using the starter again.

Power Source Voltage at Injector Connector

Standard: Battery Voltage

- ★ If the power source voltage is less than standard, check the wiring (see Wiring Diagram in this section), relay (Main Relay Inspection) and ECU power source (see ECU Power Supply Inspection).

- Remove the ECU. Do not disconnect the connector.
- Connect a digital voltmeter [A] to the connector [B], with the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Injector Output Voltage

Connections to Injector #1

Meter (+) → PU lead (terminal 43)

Meter (–) → Battery (–) Terminal

Connections to Injector #2

Meter (+) → O lead (terminal 38)

Meter (–) → Battery (–) Terminal

Connections to Injector #3

Meter (+) → BR lead (terminal 39)

Meter (–) → Battery (–) Terminal

Connections to Injector #4

Meter (+) → BL/Y lead (terminal 40)

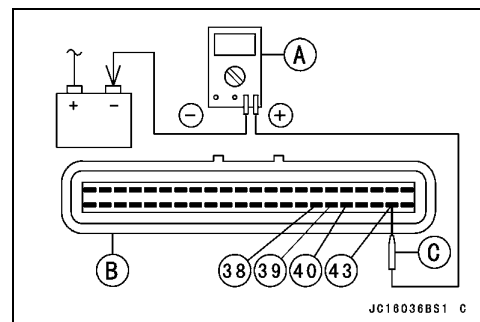
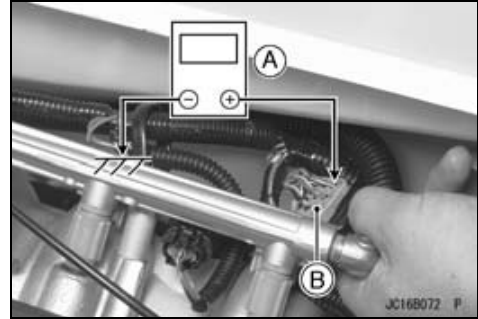
Meter (–) → Battery (–) Terminal

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the output voltage.
- Wait 15 seconds before using the starter again.

Output Voltage at Injector Connector

Standard: about 9 V or more

- ★ If the output voltage is out of the standard, replace the ECU.



3-54 FUEL SYSTEM (DFI)

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

Injector Fuel Line Inspection

- Check the injector fuel line for leakage as follows:
 - Connect a commercially available vacuum/pressure pump [A] to the supply joint of the delivery pipe [B] with the fuel hose [C] (both ends connected with the clamps [D]) as shown.
 - Plug the return joint of the delivery pipe with a rubber plug [E].
 - Tighten the clamp [F].
 - Apply soap and water solution to the areas [G] as shown.
 - Watching the pressure gauge, squeeze the pump lever [H], and build up the pressure until the pressure reaches the maximum pressure.

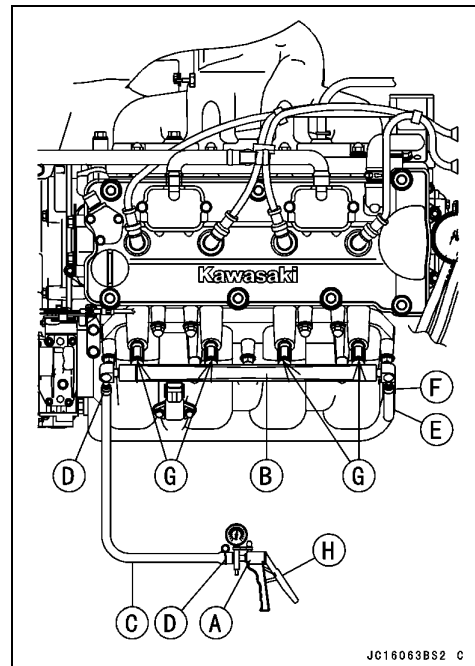
Fuel Line Maximum Pressure

Standard: 300 kPa (3.06 kgf/cm², 44 psi)

NOTICE

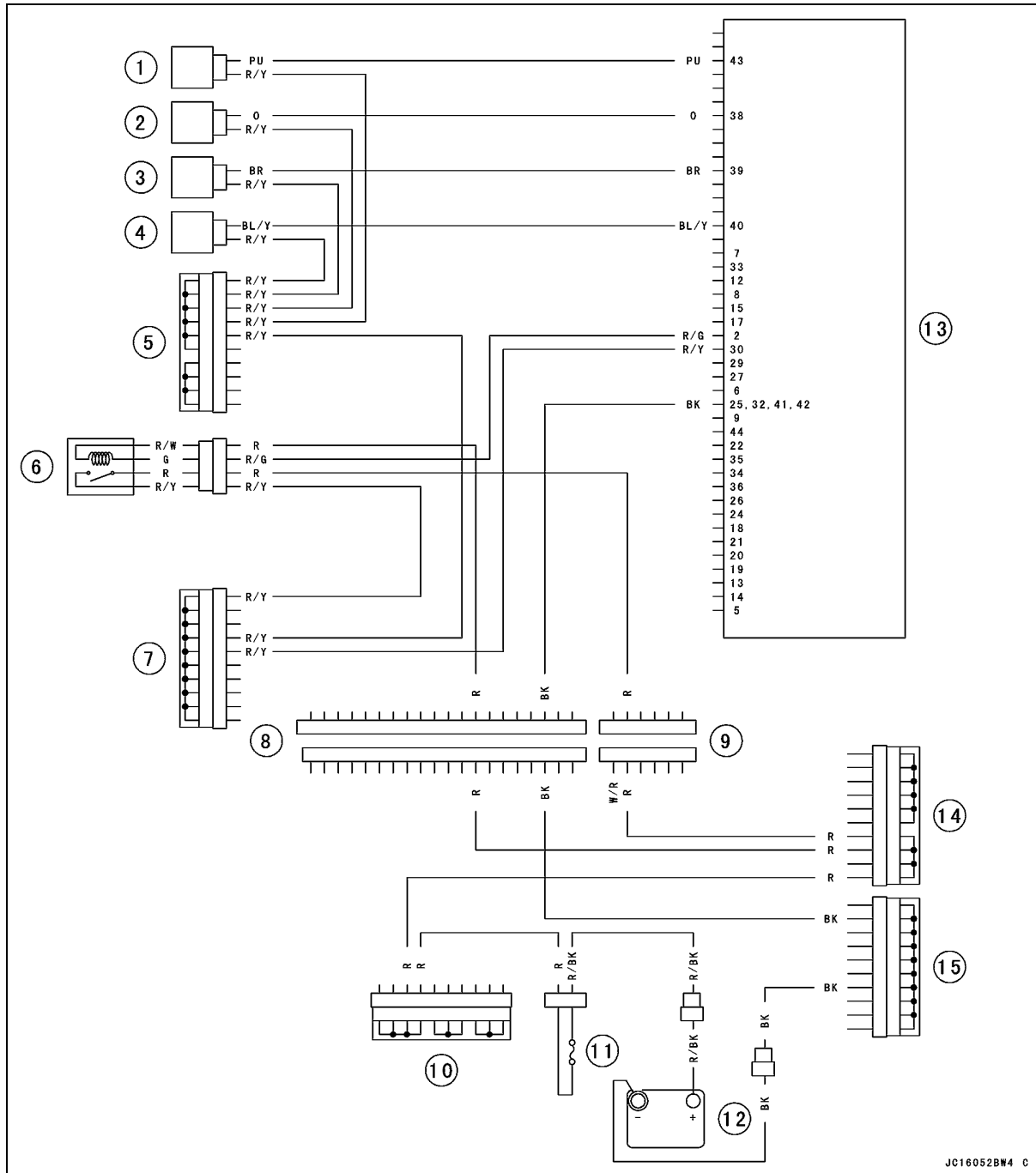
During pressure testing, do not exceed the maximum pressure for which the system is designed.

- Watch the gauge for at least 6 seconds.
- ★ If the pressure holds steady, the system is good.
- ★ If the pressure drops at once, or if bubbles are found in the area, the line is leaking. Replace the delivery pipe, injectors and related parts.
- Repeat the leak test, and check the fuel line for no leakage.
- Run the hoses correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones. (see Fuel System Diagram)



Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

JT1500-A1 ~ A7 Models

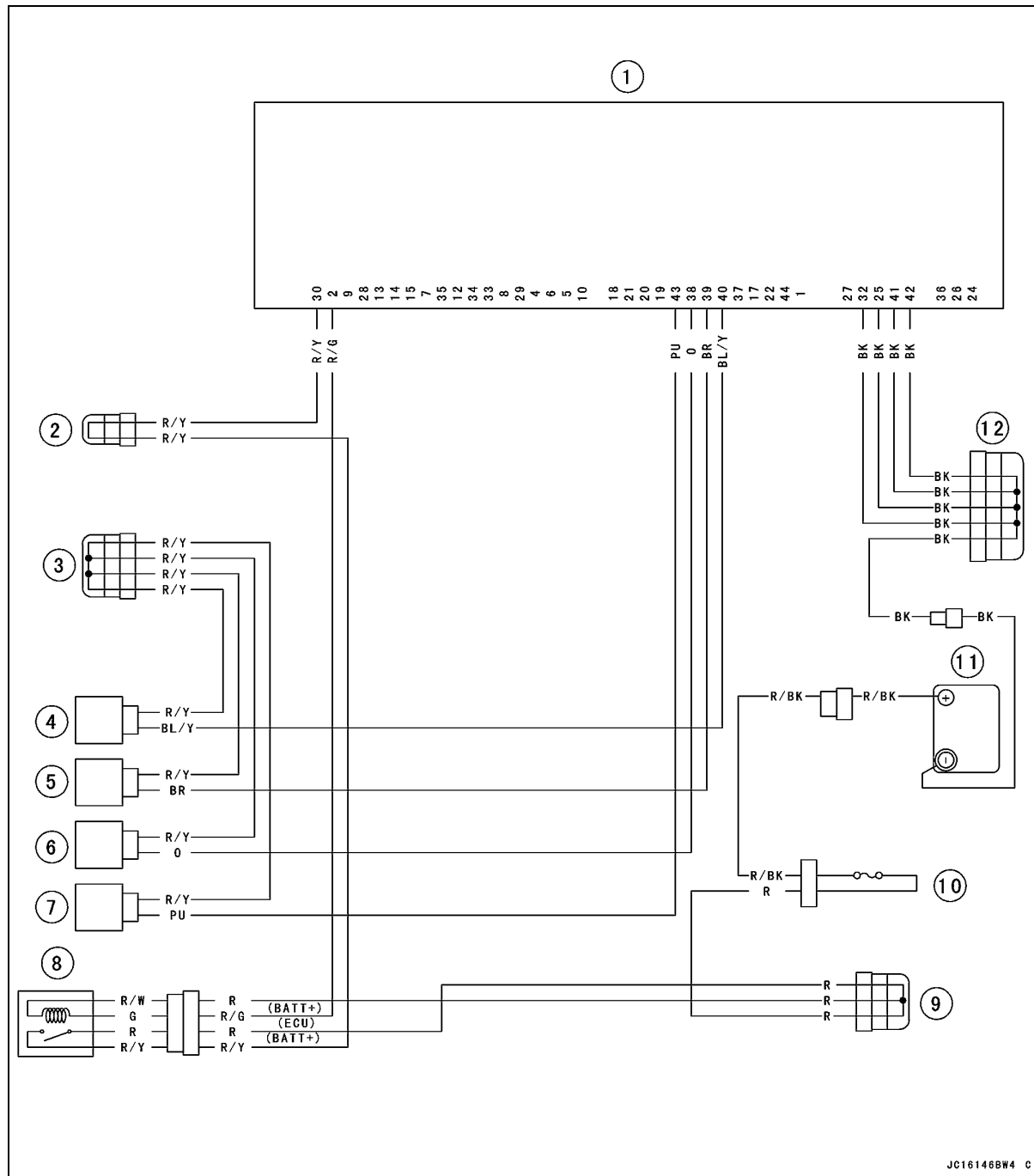


JC16052BW4 C

1. Fuel Injector #1
2. Fuel Injector #2
3. Fuel Injector #3
4. Fuel Injector #4
5. Joint Connector H
6. Main Relay in Relay Assembly
7. Joint Connector F
8. Connector C
9. Connector D
10. Joint Connector R
11. Main Fuse 20 A
12. Battery 12 V 18 Ah
13. ECU (Electronic Control Unit)
14. Joint Connector P
15. Joint Connector S

Fuel Injectors (Service Code/Character-41, 42, 43, 44/InJ1, InJ2, InJ3, InJ4)

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector Y
3. Joint Connector Z
4. Fuel Injector #4
5. Fuel Injector #3
6. Fuel Injector #2
7. Fuel Injector #1
8. Main Relay in Relay Assembly
9. Joint Connector P
10. Main Fuse 20 A
11. Battery 12 V 18 Ah
12. Joint Connector U

Ignition Coils (Service Code/Character-51, 52/COL1, COL2)

Ignition Coil #1, #4: Service Code 51-COL1

Ignition Coil #2, #3: Service Code 52-COL2

Ignition Coil Removal/Installation

NOTICE

A shock to the ignition coil can damage it. Do not drop the ignition coil.

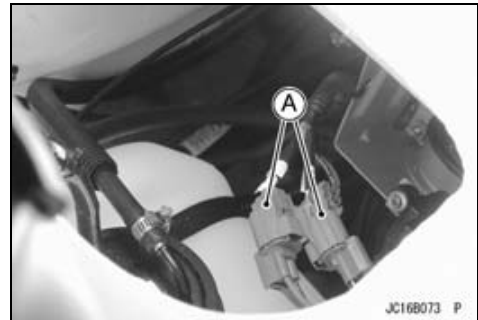
- Refer to the Ignition System section in Electrical System chapter.

Input Voltage Inspection

NOTE

○Be sure the battery is fully charged.

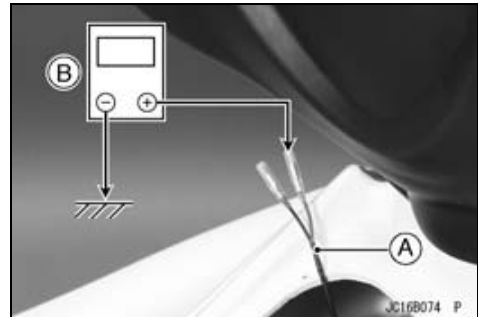
- Turn the ignition switch OFF.
- Remove:
 - Front Storage Pocket (see Hull/Engine Hood chapter)
- Disconnect the ignition coil primary lead connector(s) [A].



- Connect the harness adapter [A] and a digital voltmeter [B].

Special Tool - Harness Adapter: 57001-1562

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the input voltage.
- Wait 15 seconds before using the starter again.



Ignition Coil Input Voltage at Ignition Coil

Connections for Ignition Coil #1, #4

Meter (+) → R/Y lead

Meter (–) → Battery (–) terminal

Connections for Ignition Coil #2, #3

Meter (+) → R/Y lead

Meter (–) → Battery (–) terminal

Input Voltage at ECU

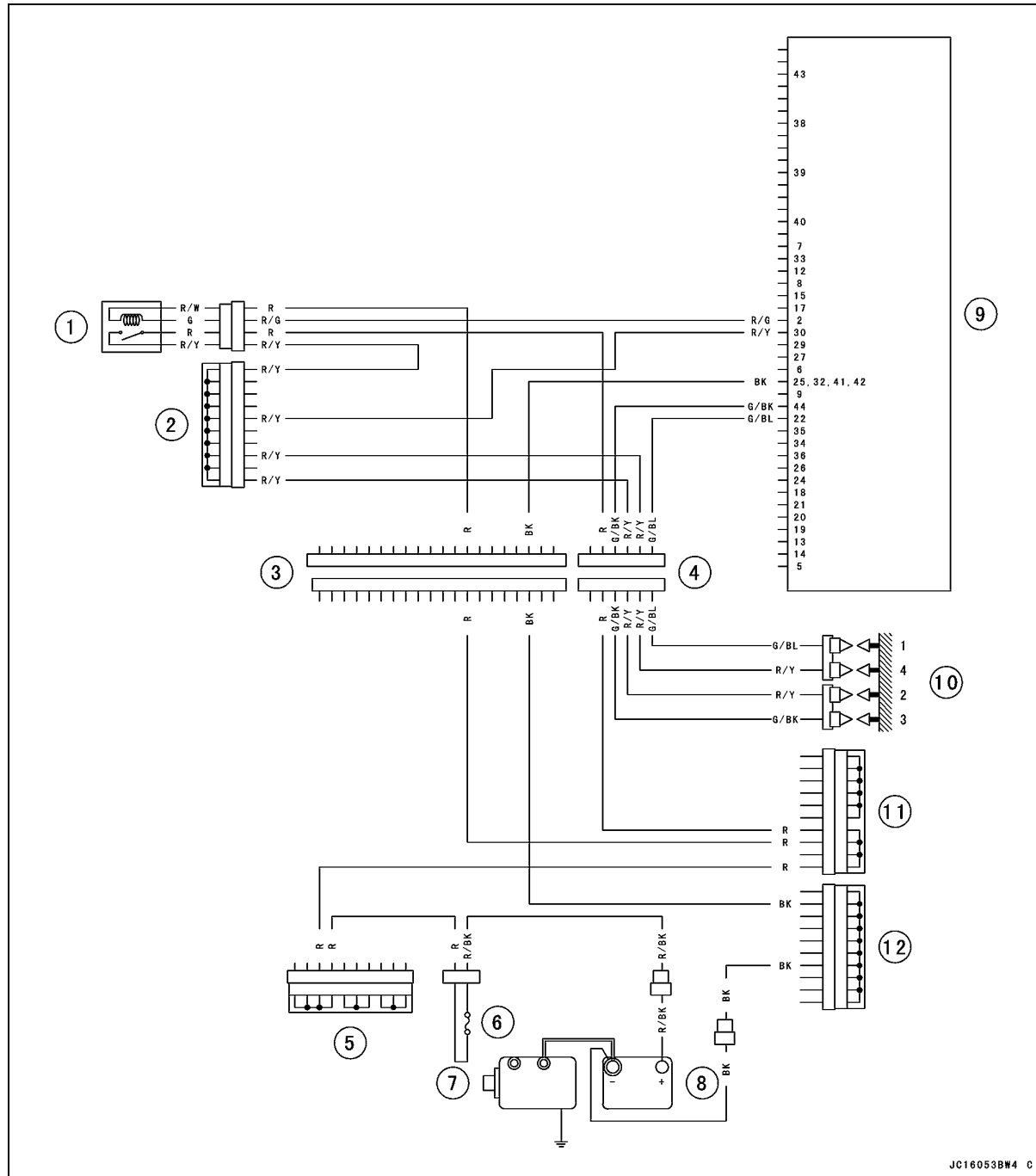
Standard: Battery Voltage

- ★If the reading is out of the standard, check the wiring (see next wiring diagram).
- ★If the reading is good, the input voltage is normal. Crank the engine, and check the peak voltage of the ignition coils (see Electrical System chapter) in order to check the primary coils.

3-58 FUEL SYSTEM (DFI)

Ignition Coils (Service Code/Character-51, 52/COL1, COL2)

JT1500-A1 ~ A7 Models

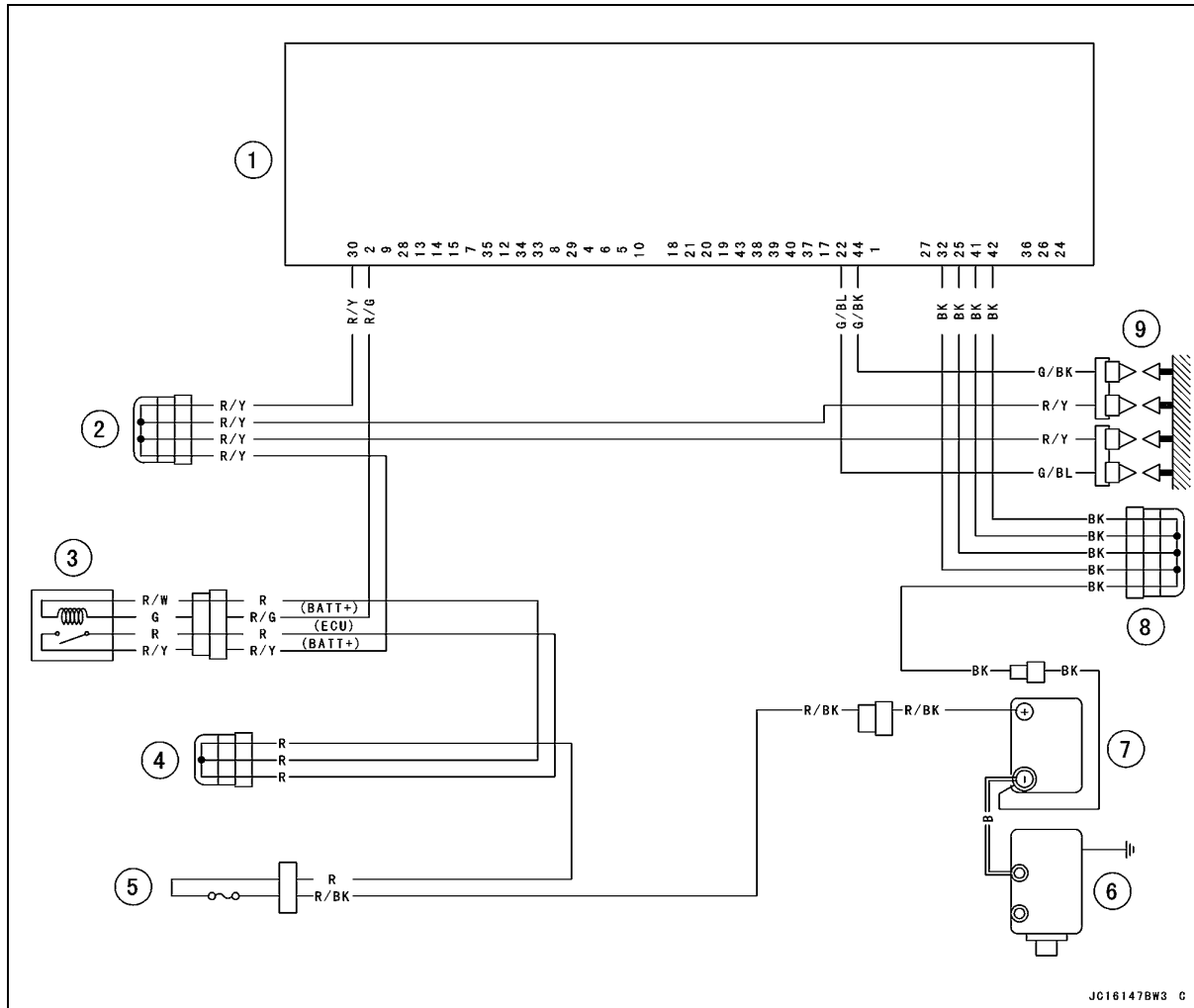


1. Main Relay in Relay Assembly
2. Joint Connector F
3. Connector C
4. Connector D
5. Joint Connector R
6. Main Fuse 20 A
7. Starter Motor
8. Battery 12 V 18 Ah
9. ECU (Electronic Control Unit)
10. Ignition Coils
11. Joint Connector P
12. Joint Connector S

JC16053B#4 C

Ignition Coils (Service Code/Character-51, 52/COL1, COL2)

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector Y
3. Main Relay in Relay Assembly
4. Joint Connector P
5. Main Fuse 20 A
6. Starter Motor
7. Battery 12 V 18 Ah
8. Joint Connector U
9. Ignition Coils

JG16147BW3 C

3-60 FUEL SYSTEM (DFI)

Engine Overheating (Service Code/Character-71/HEAt)

- If the service code is displayed, check the doubtful parts referring to the following table.

Possible Causes	Action (Chapter)
Water passage clogged, loosened or damaged	Inspect (see 9 chapter)
Incorrect engine oil level	Inspect (see 4 chapter)
Engine oil poor quality or incorrect	Change (see 4 chapter)
Water temperature sensor broken	Inspect (see 3 and 14 chapters)
Jet pump or impeller damaged	Inspect (see 11 chapter)
Oil cooler clogged	Clean (see 4 chapter)
Carbon build-up on combustion chamber	Clean (see 6 chapter)

Low Engine Oil Pressure (Service Code/Character-72/OILP)

- If the service code is displayed, check the doubtful parts referring to the following table.

Possible Causes	Action (Chapter)
Oil leak	Inspect (see 4 chapter)
Engine oil level too low	Inspect (see 4 chapter)
Engine oil viscosity too low	Inspect (see 4 chapter)
Oil filter clogged	Clean (see 4 chapter)
Oil pressure switch damaged	Inspect (see 3 and 14 chapters)
Oil cooler clogged	Inspect (see 4 chapter)
Camshaft bearing worn	Inspect (see 6 chapter)
Crankshaft bearing worn	Inspect (see 8 chapter)
Oil pressure relief valve stuck open	Change (see 4 chapter)
Oil pump damaged	Change (see 4 chapter)
Oil screen clogged	Clean (see 4 chapter)
O-ring at the oil passage in the crankcase damaged	Change (see 4 chapter)

3-62 FUEL SYSTEM (DFI)

Oil Temperature Sensor (Service Code/Character-73/OILC or 73/OILt)

Service Code/Character

JT1500-A1: 73/OILC

JT1500-A2 ~: 73/OILt

Oil Temperature Sensor Removal/Installation

NOTICE

A shock to the throttle sensor can damage it. Do not drop the throttle sensor.

- Remove:
Engine (see Engine Removal/Installation chapter)
Oil Temperature Sensor [A]
- Fill the hollow of the oil pan [A] with heat transfer grease [B] to 80% volume as shown in the figure, before installing the oil temperature sensor [C].

Heat Transfer Grease -

Heat Transfer Grease, SCH-20: 92137-1002 or equivalent

NOTICE

Overfilling the grease may damage the fitting boss. Do not overfill with grease.

- Tighten:
Torque - Oil Temperature Sensor: 15 N·m (1.5 kgf·m, 11 ft·lb)

Output Voltage Inspection

NOTE

○Be sure the battery is fully charged.

- Remove the ECU (see this chapter). Do not disconnect the connector.
- Connect a digital voltmeter [A] to the ECU connector [B], with the needle adapter set.

Special Tool - Needle Adapter Set: 57001-1457

Water Temperature Sensor Output Voltage Connections to ECU

Meter (+) → Y lead (terminal 37)

Meter (-) → BK/W lead (terminal 8)

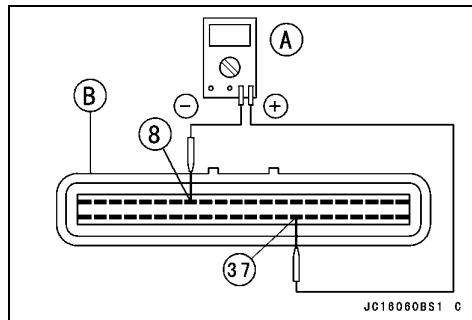
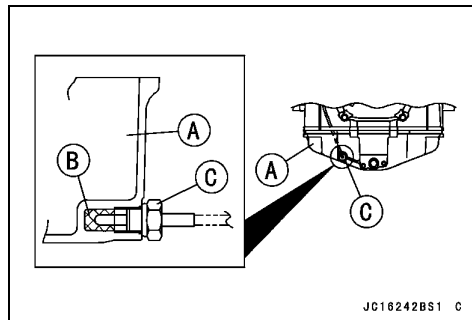
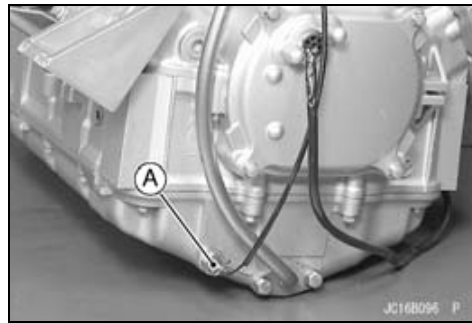
- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the sensor output voltage.
- Wait 15 seconds before using the starter again.

Output Voltage at ECU

Standard: about 3 ~ 4 V at 20°C (68°F)

NOTE

○The output voltage changes according to the oil temperature in the engine.

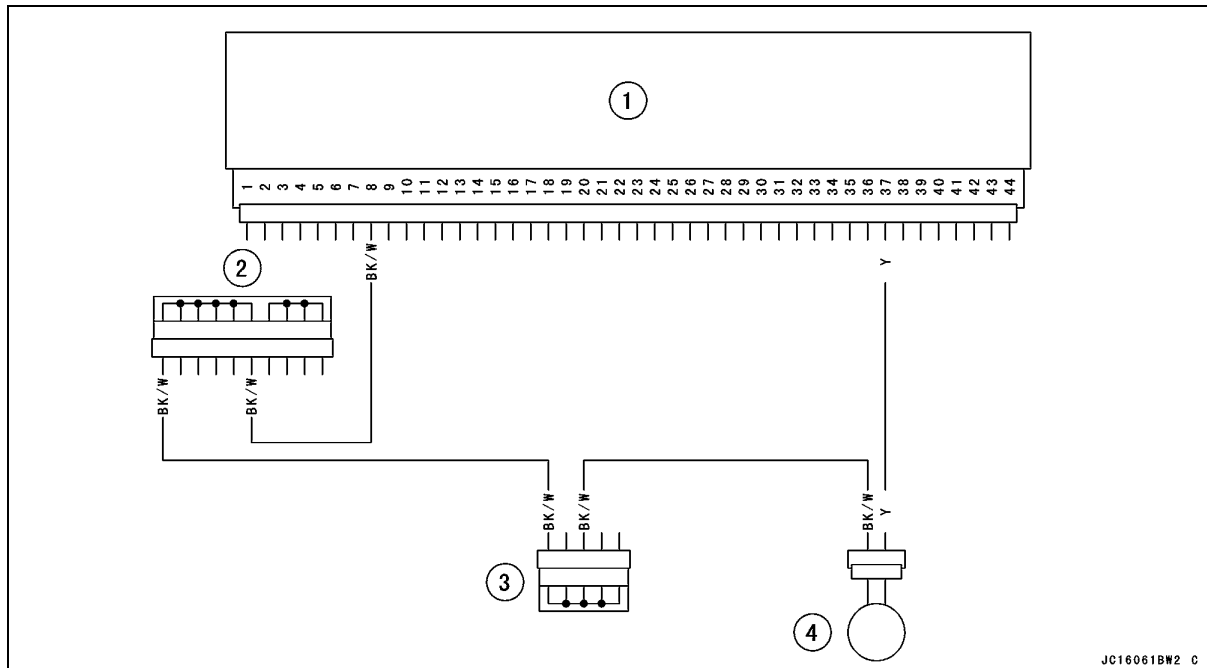


Oil Temperature Sensor (Service Code/Character-73/OILC or 73/OILt)

- Turn the ignition switch OFF.
- ★ If the output voltage is out of the specified, check the ECU for its ground, and power supply (see ECU Power Supply Inspection). If the ground and power supply are good, replace the ECU.
- ★ If the output voltage is far out of the specified (e.g. when the wiring is open, the voltage is about 5 V), check the wiring (see next diagram).
- ★ If the wiring is good, check the oil temperature sensor resistance.
- Remove the needle adapter set, and apply silicone sealant to the seals of the ECU connector for waterproofing.

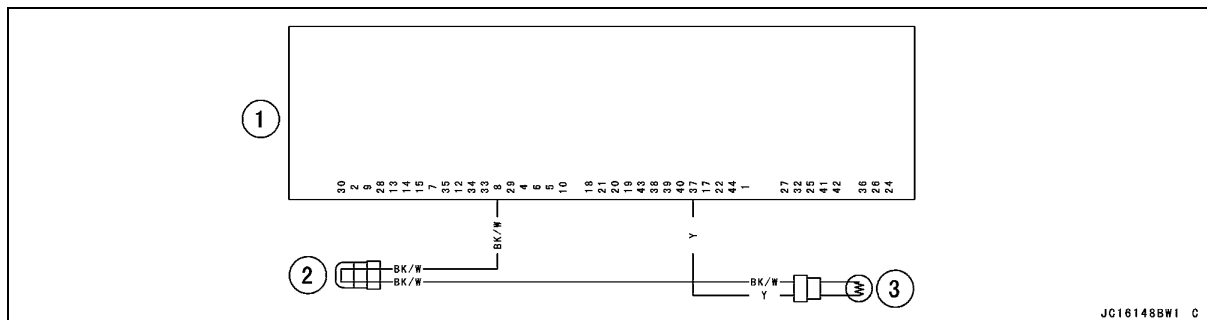
Sealant - Liquid Gasket, TB1211: 56019-120

JT1500-A1 ~ A7 Models



1. ECU (Electronic Control Unit)
2. Joint Connector E
3. Joint Connector J
4. Oil Temperature Sensor

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector W
3. Oil Temperature Sensor

3-64 FUEL SYSTEM (DFI)

Oil Temperature Sensor (Service Code/Character-73/OILC or 73/OILt)

Sensor Resistance Inspection

- Remove the oil temperature sensor (see Oil Temperature Sensor Removal/Installation).
- Refer to the Oil Temperature Sensor Inspection in the Electrical System chapter.

Engine Oil Overheating (Service Code/Character-76/OILH)**JT1500-A2 Model ~;**

- If the service code is displayed, check the doubtful parts referring to the following table.

Possible causes	Action (Chapter)
Incorrect engine oil level	Inspect (see 4 chapter)
Engine oil poor quality or incorrect	Change (see 4 chapter)
Oil temperature sensor broken	Inspect (see 3 and 14 chapters)
Oil cooler clogged	Clean (see 4 chapter)
Oil pump malfunction	Inspect (see 4 chapter)
Relief valve malfunction	Inspect (see 4 chapter)
Water passage clogged, loosened or damaged	Inspect (see 9 chapter)
Weeds or debris in jet pump	Inspect (see 11 chapter)

3-66 FUEL SYSTEM (DFI)

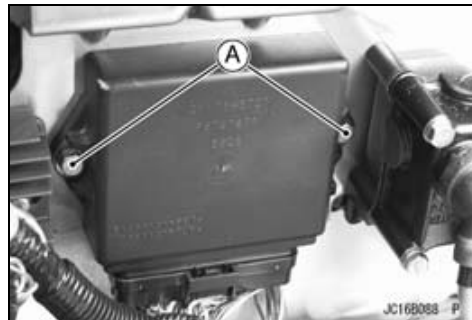
ECU

NOTICE

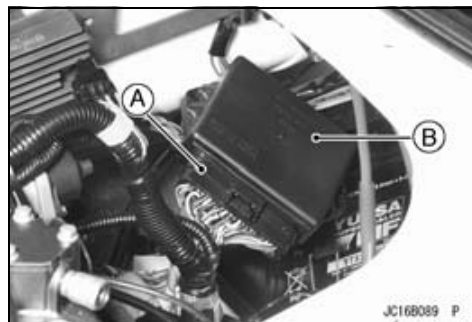
A shock to the ECU can damage it. Do not drop the ECU.

ECU Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Bolts [A]



- Disconnect the ECU lead connector [A].
- Remove:
 - ECU [B]



ECU Installation

- Connect the ECU connector and install it.
- Apply a non-permanent locking agent to the bolts and tighten them.

Torque - ECU Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78in·lb)

ECU Power Supply Inspection

- Visually inspect the terminals [A] of the ECU connectors.
- ★ If the connector is clogged with mud or dust, blow it off with compressed air.
- ★ Replace the main harness if the terminals of the main harness connector is cracked, bent, or otherwise damaged.
- ★ Replace the ECU if the terminals of the ECU connector is cracked, bent, or otherwise damaged.



- With the ECU connector [A] connected, check the following ground lead for continuity with the ignition switch OFF, using a tester and needle adapter set.

[B] Battery

[C] Tester

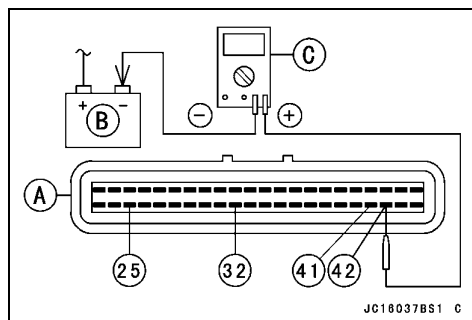
Special Tool - Needle Adapter Set: 57001-1457

ECU Grounding Inspection

25, 32, 41, or 42 (BK) Terminal ↔ **Battery (-) Terminal: 0 Ω**

Engine Ground ↔ **Battery (-) Terminal: 0 Ω**

- ★ If no continuity, check the connector, the engine ground lead, or main harness, and repair or replace them if necessary.



ECU

- Check the ECU power source voltage with a tester [A].
- Position the terminal in accordance with terminal numbers of ECU connector [B] in this chapter figure.

ECU Power Source Inspection

Tester Connections:

- 2 (R/G) Terminal – Battery (–) Terminal
- 9 (R/W) Terminal – Battery (–) Terminal
- 28 (Y/R) Terminal – Battery (–) Terminal
- 30 (R/Y) Terminal – Battery (–) Terminal

Terminal Voltage:

Ignition Switch OFF:

- 2 (R/G) Terminal → Battery Voltage
- 9 (R/W) Terminal → 0 V
- 28 (Y/R) Terminal → 0 V
- 30 (R/Y) Terminal → 0 V

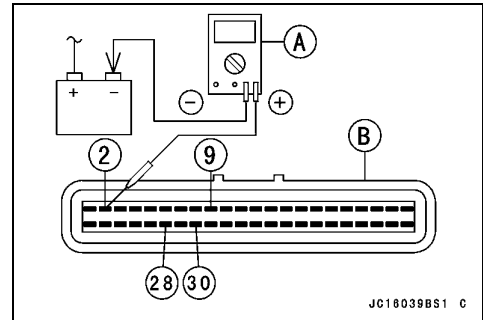
Ignition Switch ON:

- 2 (R/G) Terminal → Battery Voltage
- 9 (R/W) Terminal → Battery Voltage
- 28 (Y/R) Terminal → 0 V
- 30 (R/Y) Terminal → 0 V

Ignition Switch ON and Start Button ON:

- All Terminals → Battery Voltage

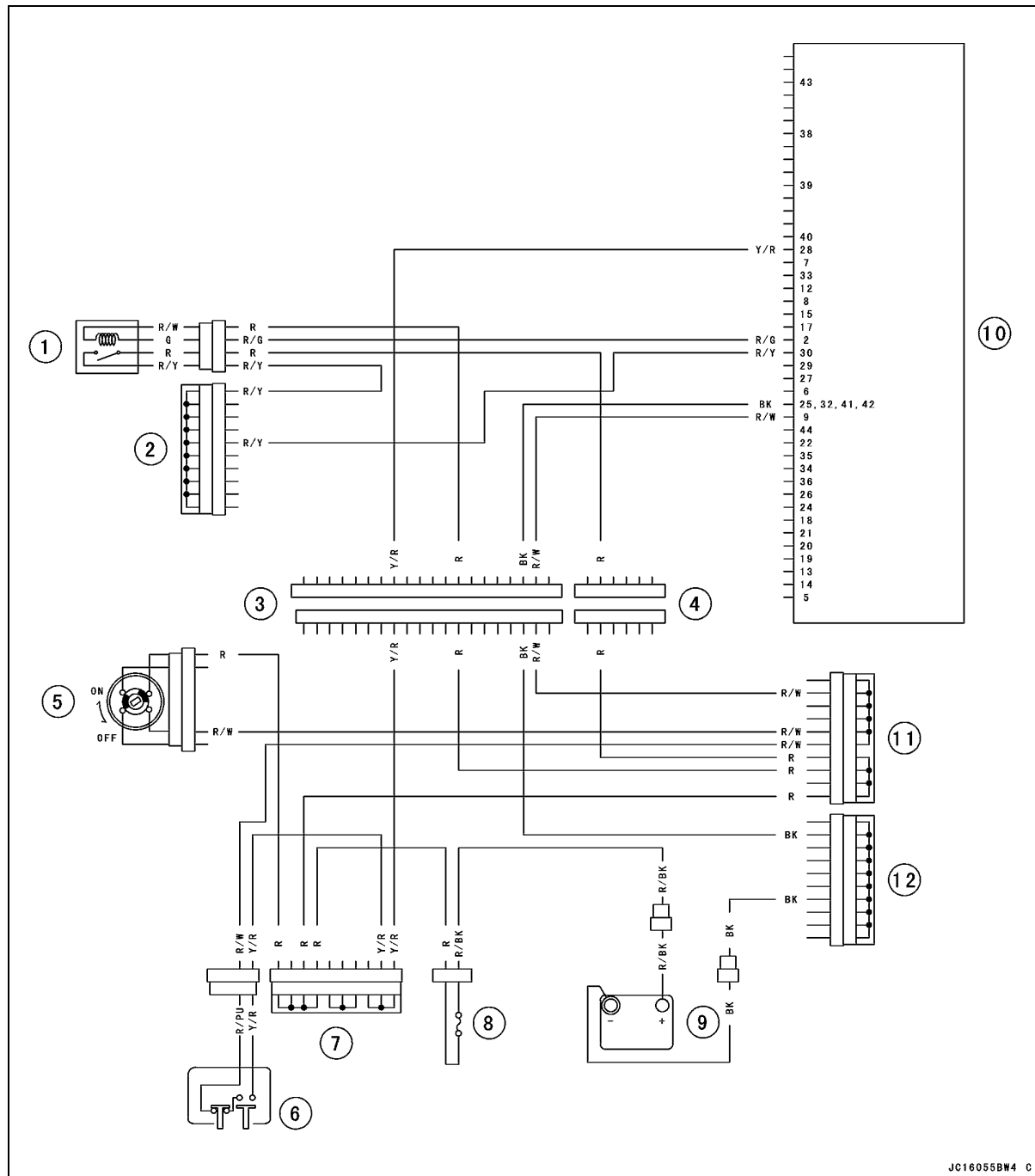
- Pushing the start button, run the engine 3 ~ 4 seconds.
- Wait 15 seconds before using the starter again.
- ★ If the tester does not read as specified, check the following:
 - Power Source Wiring (see wiring diagram below)
 - Main Fuse 20 A (see Electrical System chapter)
 - ECU Main Relay (see DFI Power Source section)
 - Ignition Switch (see Electrical System chapter)
 - Start Switch (see Electrical System chapter)



3-68 FUEL SYSTEM (DFI)

ECU

ECU Power Source Circuit (JT1500-A1 ~ A7 Models)

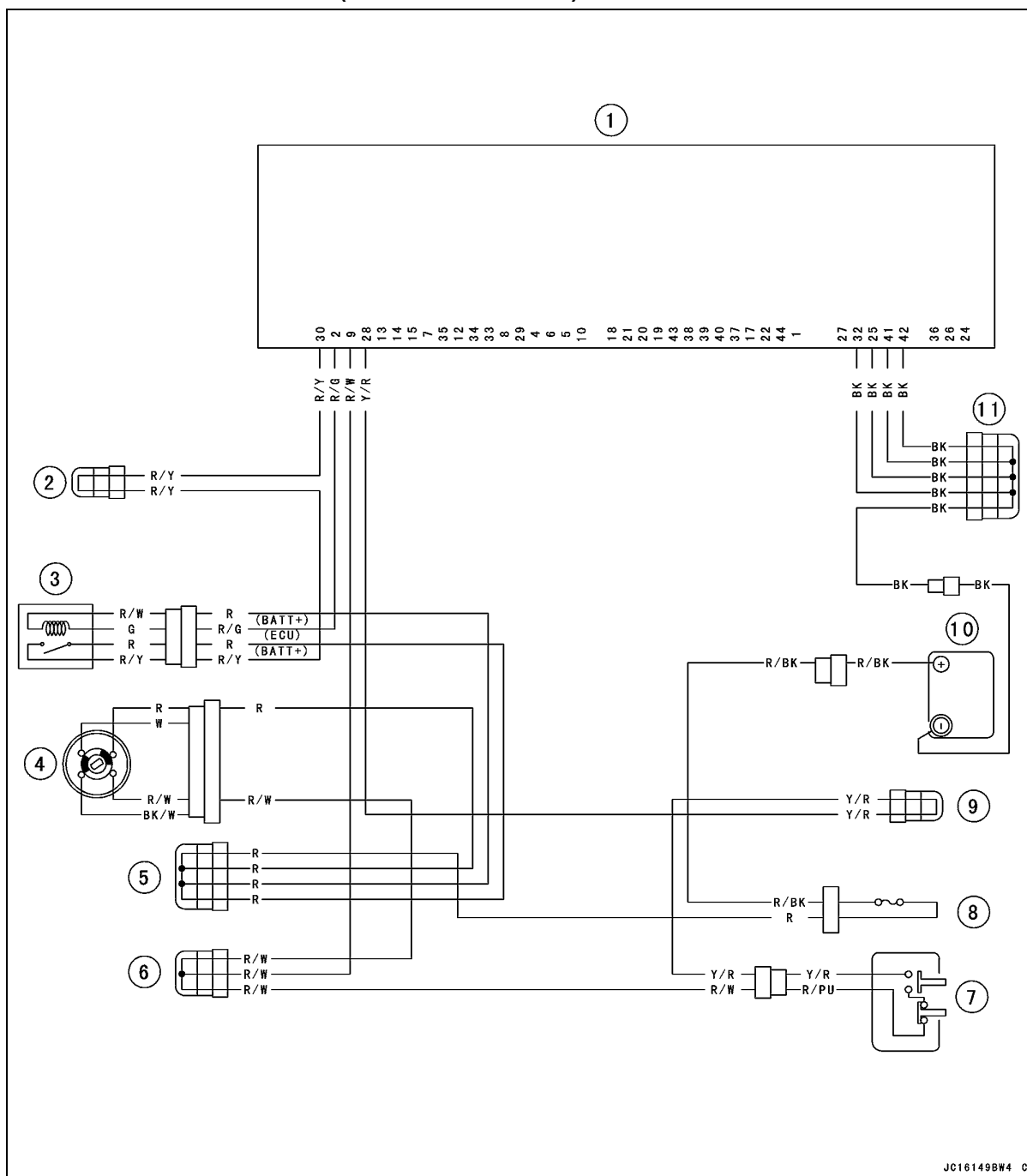


1. Main Relay in Relay assembly
2. Joint Connector F
3. Connector C
4. Connector D
5. Ignition Switch
6. Start Switch
7. Joint Connector R
8. Main Fuse 20 A
9. Battery 12 V 18 Ah
10. ECU (Electronic Control Unit)
11. Joint Connector P
12. Joint Connector S

JC16055BW4 C

ECU

ECU Power Source Circuit (JT1500A8 Model ~)



1. ECU (Electronic Control Unit)
2. Joint Connector Y
3. Main Relay in Relay Assembly
4. Ignition Switch
5. Joint Connector P
6. Joint Connector Q
7. Start Switch
8. Main Fuse 20 A
9. Joint Connector T
10. Battery 12 V 18 Ah
11. Joint Connector U

3-70 FUEL SYSTEM (DFI)

DFI Power Source

Main Fuse Inspection

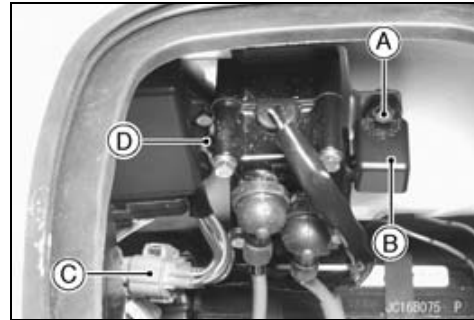
- Refer to the Fuse Inspection in the Electrical System chapter.

Relay Assembly Removal

NOTICE

A shock to the relay can damage it. Do not drop the relay.

- Remove:
 - Seats (see Hull/Engine Hood chapter)
 - Bolt [A]
 - Relay Assembly [B]
 - Connector [C] (disconnect)
 - Band [D] (Cut)



Relay Assembly Inspection

- Remove the relay assembly.
- Connect the hand tester [A] and one 12 V battery [B] to the relay connector [C] as shown.

Special Tool - Hand Tester: 57001-1394

Main Relay

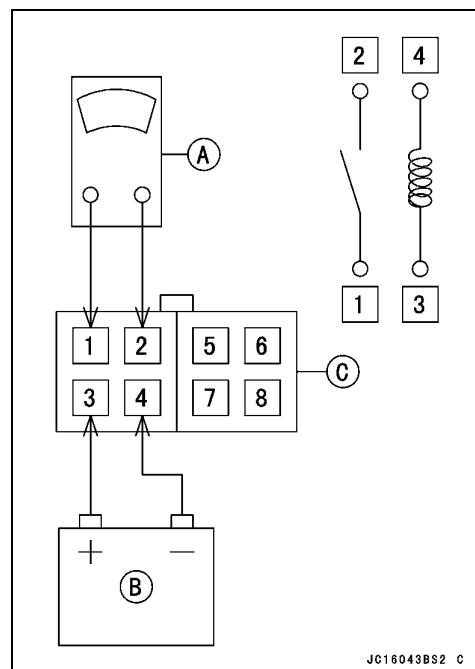
Relay Coil Terminals [3] and [4]
Relay Switch Terminals [1] and [2]

Testing Relay

Tester range: 1 Ω range

Criteria: When battery is connected $\rightarrow 0 \Omega$
When battery is disconnected $\rightarrow \infty \Omega$

- ★ If the relay does not work as specified, replace the relay assembly.



DFI Power Source

Fuel Pump Relay

Relay Coil Terminals [6] and [8]

Relay Switch Terminals [5] and [7]

Testing Relay

Tester range: **1 Ω range**

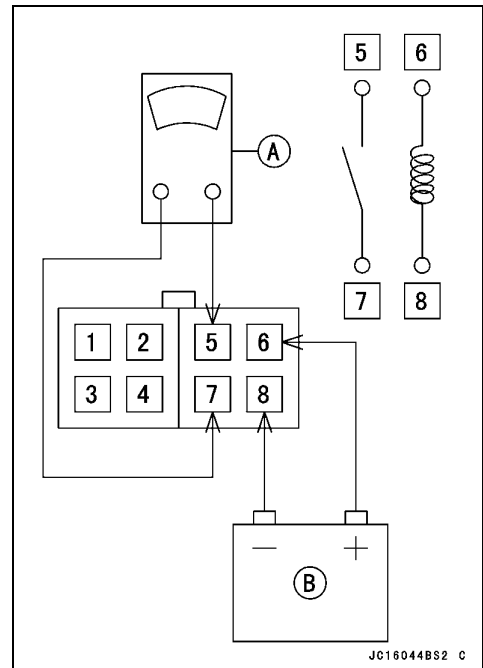
Criteria: **When battery is connected $\rightarrow 0 \Omega$**

When battery is disconnected $\rightarrow \infty \Omega$

★ If the relay does not work as specified, replace the relay assembly.

Hand Tester [A]

Battery [B]



3-72 FUEL SYSTEM (DFI)

Throttle Lever, Cable and Case

Free Play Inspection

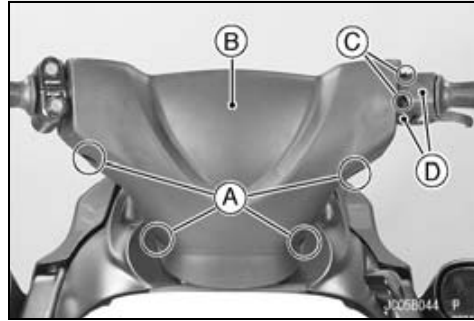
- Refer to the Throttle Control System Inspection in the Periodic Maintenance chapter.

Throttle Cable Adjustment

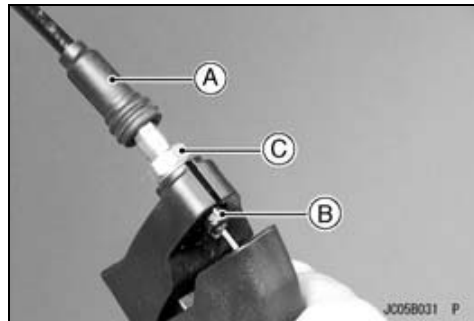
- Refer to the Throttle Control System in the Periodic Maintenance chapter.

Throttle Case Removal/Disassembly

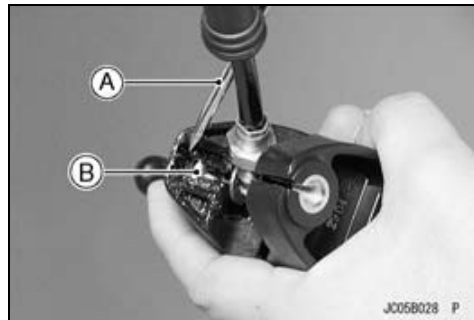
- Unscrew the mounting screws [A] and remove the handlebar pad [B].
- Remove the throttle case.
- Unscrew the throttle case mounting screws [C] separate the case halves [D].



- Disconnect the throttle cable from the case.
- Slide the rubber boots [A] and rubber cap [B] out of the place.
- Unscrew the throttle cable fitting nut [C].

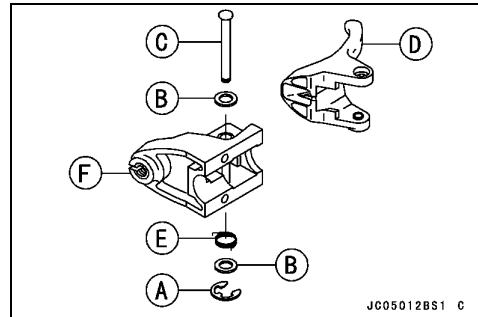
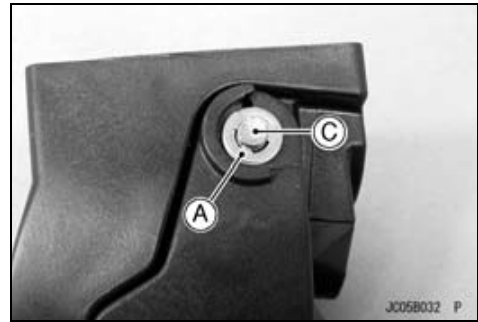


- Use a screw driver [A] to separate the tip [B] of the cable end from the case body.



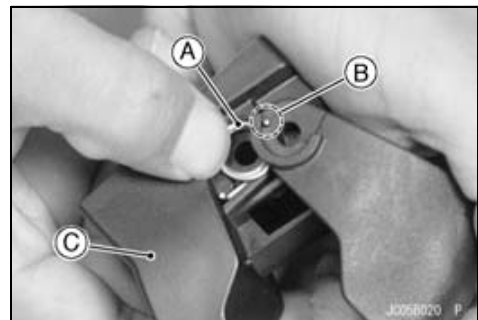
Throttle Lever, Cable and Case

- Disassemble the throttle case.
- Remove the circlip [A], flat washers [B], pin [C], throttle lever [D] and return spring [E] from the case [F].

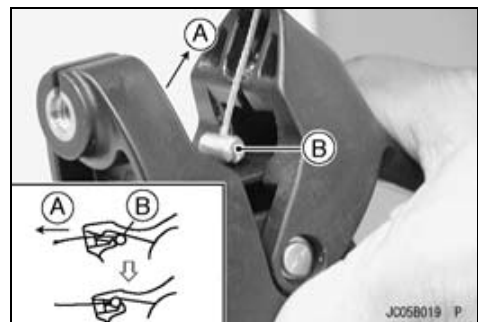


Throttle Case Assembly/Installation

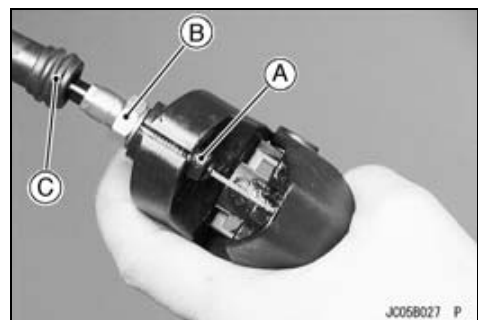
- Insert the end of the return spring [A] in the throttle lever hole [B] and set the spring in the throttle case [C] as shown.
- Install the control lever to the case.



- Lubricate the throttle cable before assembly/installation.
- Apply water resistant grease to the tips of the throttle cable end.
- Pulling the throttle cable [A], position the tips [B] of the cable end as shown.
- Tighten the cable fitting nut.



- Be sure the rubber cap [A] is in place on the throttle cable fitting nut end.
- Cover the cable fitting nut [B] with the rubber boot [C].



3-74 FUEL SYSTEM (DFI)

Throttle Lever, Cable and Case

- Tighten:
Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 35 in·lb)
- Swing the throttle lever so that the throttle valve is fully open.

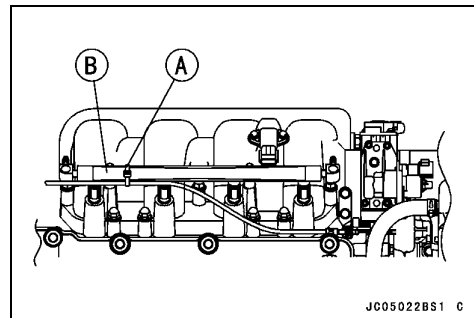
⚠ WARNING

Operation with an improperly assembled throttle case could result in an unsafe riding condition. Be sure the throttle case is assembled correctly.

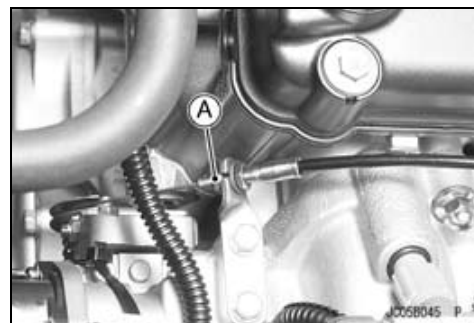
- Adjust the throttle cable (see Throttle Cable Adjustment).

Throttle Cable Removal

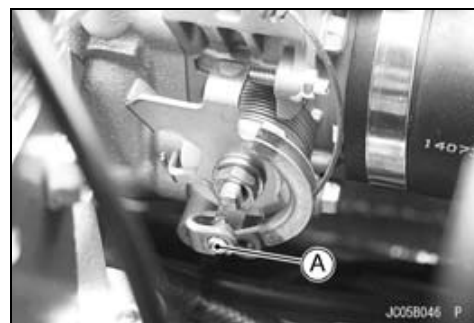
- Remove the engine hood (see Hull/Engine Hood chapter).
- Remove the band [A] on the delivery pipe [B].



- Disconnect the throttle cable from the body assy.
 - Slide out the rubber cap.
 - Unscrew the adjuster locknut [A] and slide the cable from the bracket.

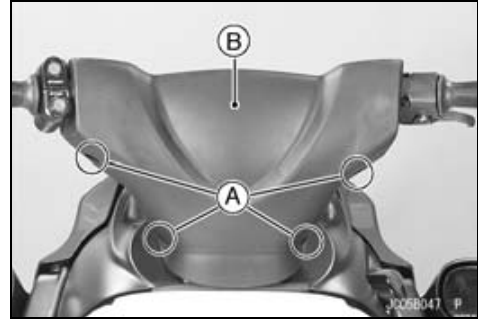


- Slide the tip [A] of the cable lower end from the throttle pivot arm.

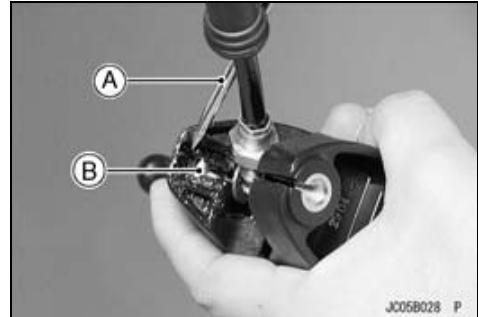


Throttle Lever, Cable and Case

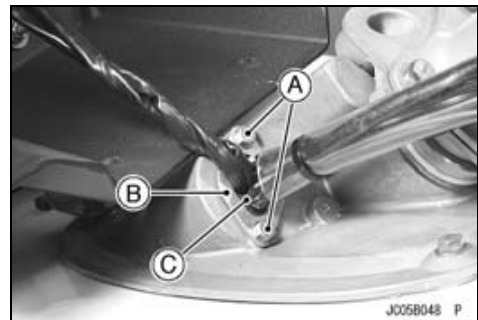
- Unscrew the mounting screws [A] and remove the handlebar pad [B].
- Take out the inner pad.



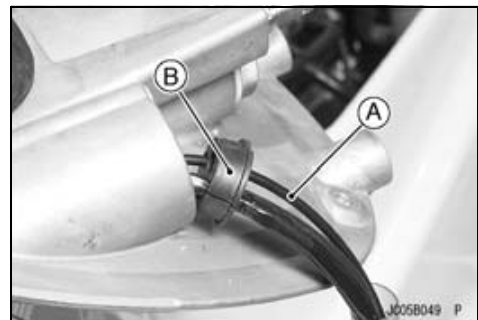
- Remove the throttle case (see Throttle Case Removal/Disassembly).
- Slide the rubber boot out of the place.
- Unscrew the throttle cable fitting nut.
- Remove the upper end of the cable from the case.
- Use a screw driver [A] to separate the cable tip [B] from the throttle lever catch.



- Remove the steering cover (see Steering Removal in Steering chapter).
- Unscrew the grommet mounting bolts [A] and pull out the plate [B] and grommet [C].

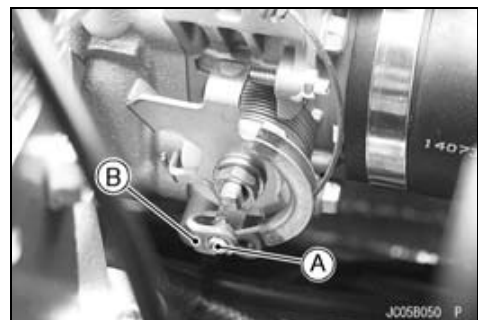


- Take the throttle cable [A] off the grommet [B].
- Pull down the throttle cable.



Throttle Cable Installation

- Lubricate the outside of the new cable with a penetrating rust inhibitor to ease cable installation.
- Slide the tip [A] of the cable lower end on the throttle pivot arm [B].



3-76 FUEL SYSTEM (DFI)

Throttle Lever, Cable and Case

- Tighten:
Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 35 in·lb)
- Route the following correctly (see Cable, Wire, and Hose Routing in Appendix chapter).
 - Throttle Cable
 - Steering Cable
 - Fuel Tank Vent Hose
 - Start/Stop Switch Leads
 - Buzzer Leads
 - Multifunction Meter Leads
- Adjust the following.
 - Throttle Cable
- Check that the throttle lever moves smoothly from full open to close, and the throttle closes quickly and completely in all steering positions by return spring.
- ★ If the throttle lever does not return properly, check the throttle routing, cable adjustments, and cable damage. Then lubricate the throttle cable.
- Run the engine at the idle speed, and turn the handlebar all the way to the right and left to ensure that the idle speed does not change.
- ★ If the idle speed increases, check the throttle cable adjustment and the cable routing.

Throttle Case and Cable Lubrication

- Refer to the Lubrication in the Periodic Maintenance chapter.

Throttle Cable Inspection

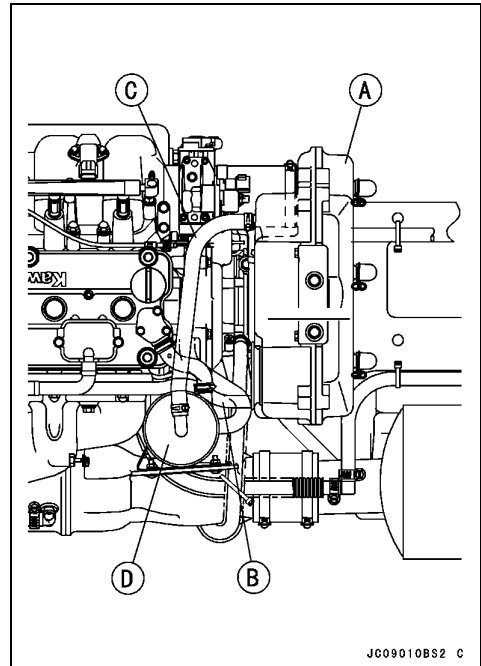
- Refer to the Lubrication in the Periodic Maintenance chapter.

Air Filter

Air Filter Removal

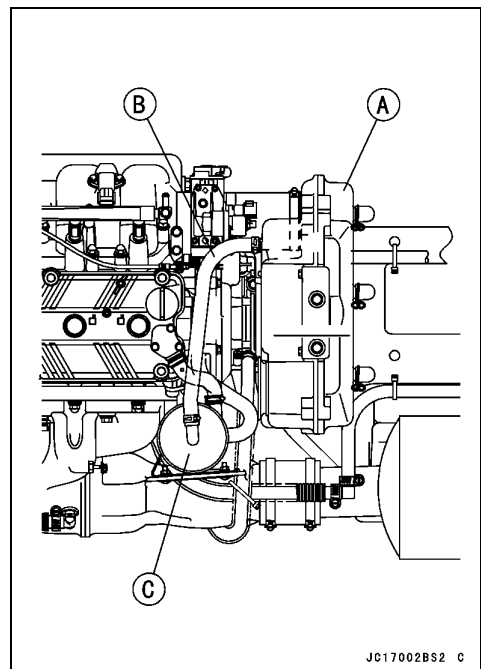
JT1500-A1 ~ A8 Models

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the rear storage pocket.
- Disconnect the following from the air filter [A].
 - Air Suction Valve Hose [B]
 - Oil Separator Tank Hose [C]
- Remove the oil separator tank [D] (see Engine Lubrication System chapter).

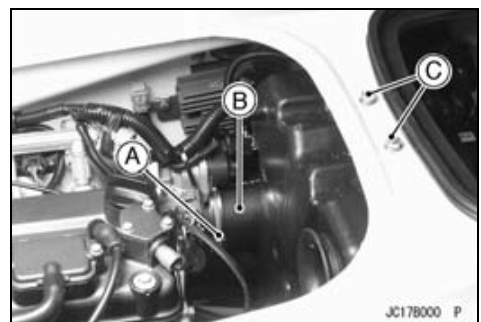


JT1500A9 Model ~

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the rear storage pocket.
- Disconnect the following from the air filter [A].
 - Oil Separator Tank Hose [B]
- Remove the oil separator tank [C] (see Engine Lubrication System chapter).



- Loosen the clamp [A] on the inlet air duct [B].
- Remove the air filter mounting bolts [C].



3-78 FUEL SYSTEM (DFI)

Air Filter

- Remove the air filter [A] out of the engine compartment.



Air Filter Installation

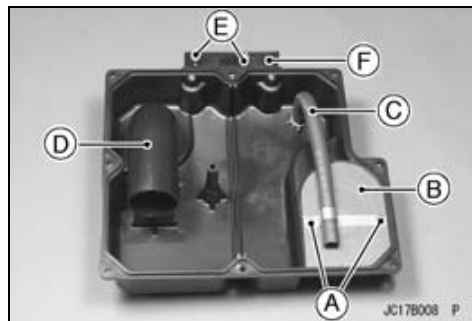
- Tighten:
Torque - Air Filter Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)

Air Filter Disassembly

- Remove:
Air Filter (see Air Filter Removal)
Air Filter Bolts [A]



- Remove:
Bolts [A]
Flame Arrester [B]
Hose [C]
Duct [D]
Air Filter Bracket Mounting Bolts [E]
Air Filter Bracket [F]



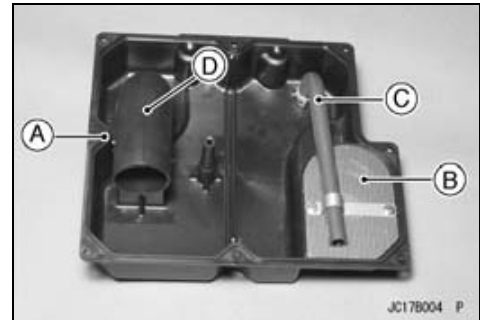
- Remove the air screen [A].



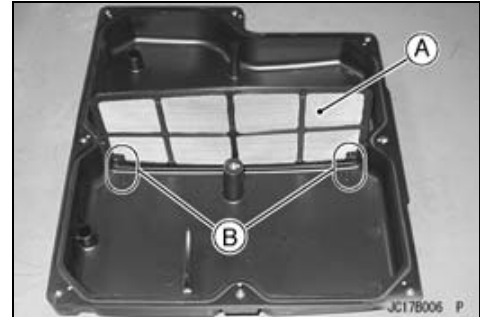
Air Filter

Air Filter Assembly

- Visually inspect the seal [A] for damage.
- ★ If necessary, replace it with a new one.
- Install the flame arrester [B], hose [C] and duct [D] as shown.



- Install the air screen [A] aligning the marks [B].



- Apply a non-permanent locking agent to the air filter bracket mounting bolts and tighten them.

Torque - Air Filter Bracket Mounting Bolts: 7.8 N m (0.80 kgf·m, 69 in·lb)

3-80 FUEL SYSTEM (DFI)

Throttle Body Assy

Idle Speed Inspection

The normal idle speed is controlled by the ECU (Electronic Control Unit).

Idle Speed

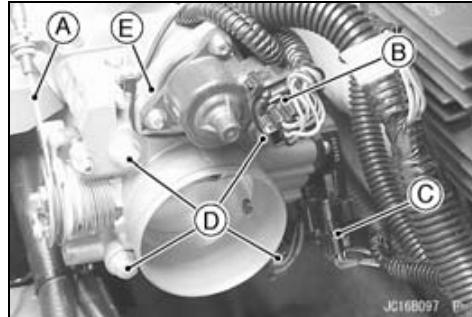
Standard: 1 300 $\pm$ 100 r/min (rpm) -both in and out of water

High Altitude Performance Adjustment

High altitude adjustment is not required as the ECU controls the air/fuel mixture automatically.

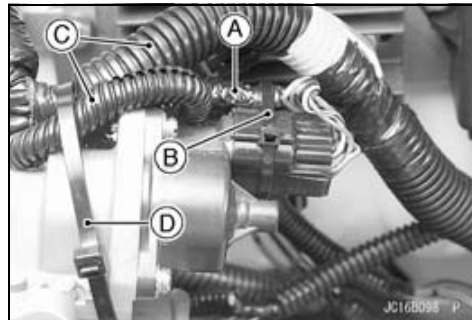
Throttle Body Assy Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter (from Throttle Body Assy)
 - Throttle Cable [A] (see Throttle Cable Removal)
 - Air Inlet Duct
 - ISC (Idle Speed Controller) Connector [B]
 - Throttle Sensor Connector [C]
 - Throttle Body Assy Mounting Bolts [D]
 - Throttle Body Assy [E]
 - Gasket



Throttle Body Assy Installation

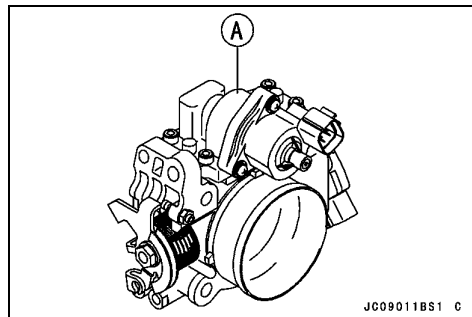
- Install a new gasket.
- Tighten:
 - Torque - Throttle Body Assy Mounting Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)**
- Install the throttle cable and adjust the free play.
- Bind the harness [A] and connector in the band [B].
- Route the harness [C] and tighten the band [D] correctly (see Appendix chapter).



Throttle Body Assy Disassembly

NOTICE

Adjustment of the air screw, throttle link mechanism and throttle body assy [A] could result in poor performance, requiring replacement of the throttle body assy. Do not remove, disassemble or adjust the air screw, throttle link mechanism and throttle body assy, they are precisely set at the manufacturer.



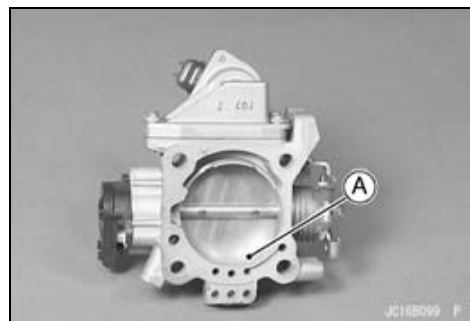
Throttle Body Assy

Throttle Bore Cleaning

- Remove the throttle body assy (see Throttle Body Assy Removal).
- Check the throttle bore [A] for carbon deposits by opening the valve.
- ★ If any carbon accumulates, wipe the carbon off the throttle bore and throttle valve, using a cotton pad.

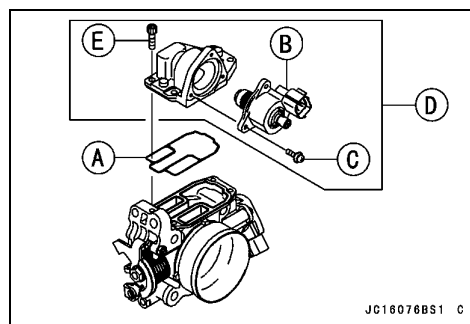
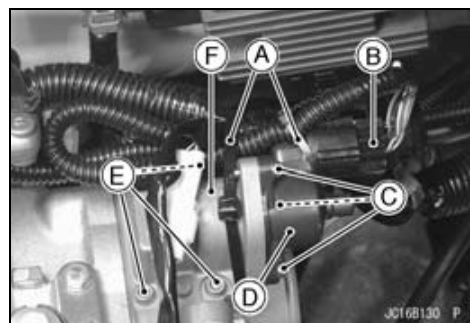
NOTICE

Pressure and/or carburetor cleaner may damage these surfaces. Do not apply pressure or use carburetor cleaner to clean these surfaces.



ISC (Idle Speed Controller) Removal/Installation

- Remove
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter (see Air Filter Removal)
 - Bands [A]
 - ISC connector [B]
 - Stepping Motor Mounting Screws [C]
 - Stepping Motor [D]
 - ISC Actuator Mounting Bolts [E]
 - ISC Actuator [F]
 - Clean the mating surface of throttle body and ISC actuator (stepping motor).
 - Replace the O-ring [A] with a new one.
 - Install the stepping motor [B] and tighten the screws [C].
 - Install the ISC actuator [D] and tighten the bolts [E].
- Torque - ISC Actuator Mounting Bolts: 4.9 N·m (0.50 kgf-m, 43 in-lb)**
- Route the harness and tighten the bands correctly (see Appendix chapter).
 - After installing the ISC actuator, check the Smart Steering System Operation in the water.



ISC (Idle Speed Controller) Inspection

- Check idle speed with a tachometer in the multifunction meter.
- With the engine idling, open and close the throttle lever.

Idle Speed

Standard: 1 300 ±100 r/min (rpm) -both in and out of water

- ★ If the idle speed is within the standard, the ISC operates properly.
- ★ If the idle speed is out of the specified range, inspect the audible operation.

3-82 FUEL SYSTEM (DFI)

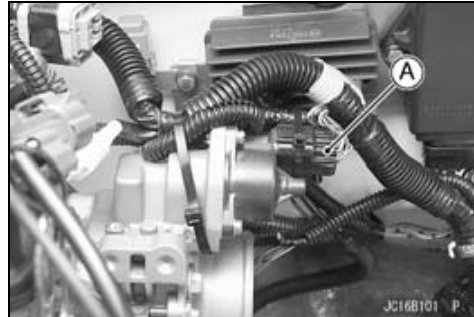
Throttle Body Assy

- Run the engine and then stop the engine.
- Certain buzzing and humming sounds will be emitted from the ISC [A] after the engine stop.
- ★ If the ISC sounds, inspect the ISC resistance.
- ★ If the ISC does not sound, replace the stepping motor.



ISC Resistance Inspection

- Remove:
 - Air Filter (from the throttle body assy)
 - ISC Connector [A] (disconnect)



- Measure the ISC resistance with the hand tester.

Special Tool - Kawasaki Hand Tester: 57001-1394

ISC [A]

Rotor [B]

ISC Resistance

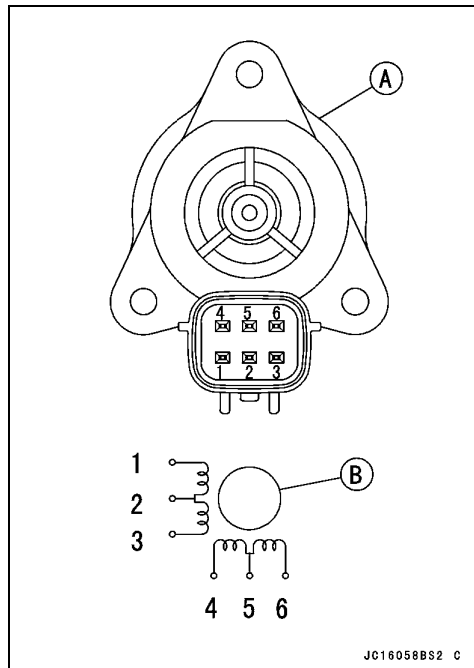
Connection: 1-2, 2-3, 4-5, 5-6 terminals

Standard: about 30 Ω (at 20°C)

Connection: 1-3, 4-6 terminals

Standard: about 60 Ω (at 20°C)

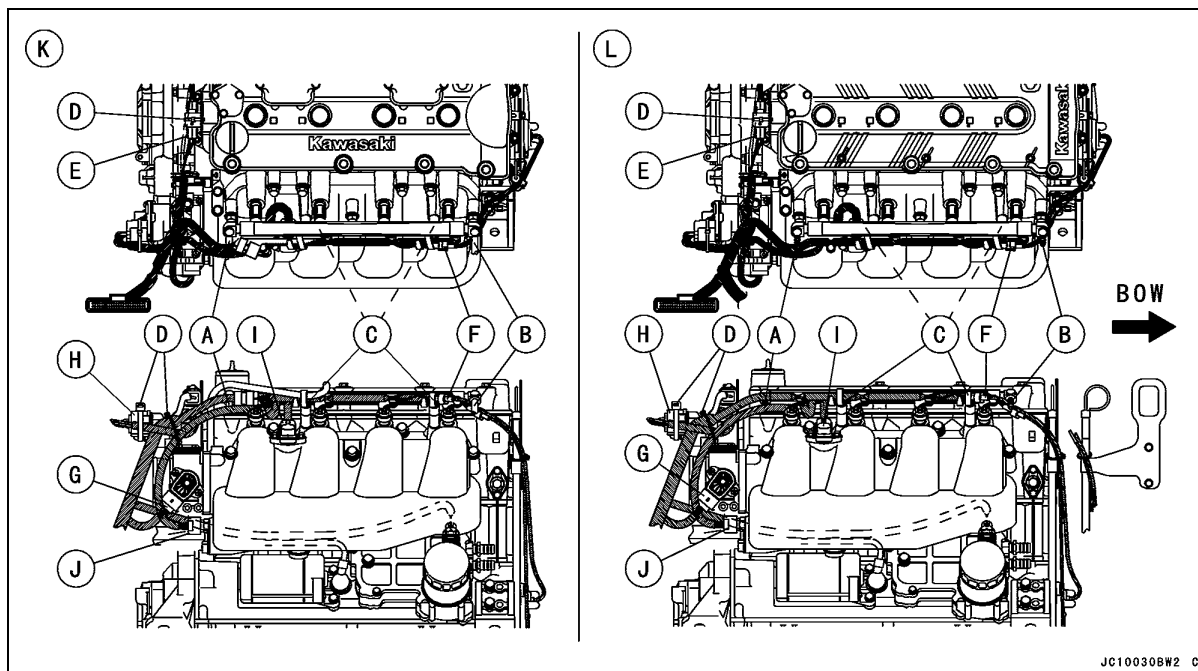
- ★ If the reading is out of the specified value, replace the stepping motor.



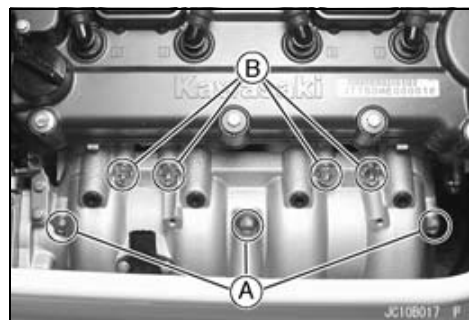
Inlet Manifold

Inlet Manifold Removal

- Remove:
 - Supply Fuel Hose [A] at Delivery Pipe
 - Return Fuel Hose [B] at Delivery Pipe
 - Delivery Pipe Mounting Bolts [C], Collars and Clamps
 - Remove the bands [D] and disconnect the following connectors.
 - Camshaft Position Sensor Connector [E]
 - Crankshaft Sensor Connector [F]
 - Disconnect:
 - Throttle Cable Lower End (see Throttle Cable Removal)
 - Throttle Sensor Connector [G] on Throttle Body Assy
 - ISC (Idle Speed Controller) Connector [H] on Throttle Body Assy
 - Inlet Air Pressure Sensor Connector [I] on Inlet Manifold
 - Inlet Air Temperature Sensor Connector [J] on Inlet Manifold
- JT1500-A1 ~ A8 Models [K]
JT1500A9 Model ~ [L]



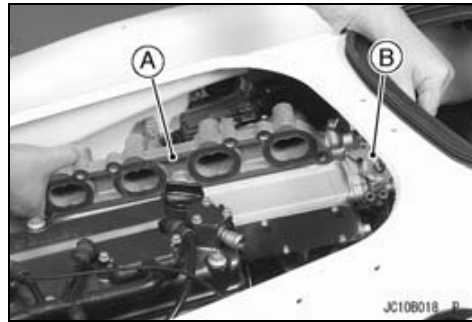
- Unscrew the inlet manifold mounting bolts [A] and nuts [B].



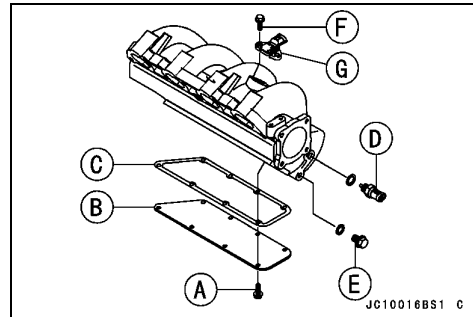
3-84 FUEL SYSTEM (DFI)

Inlet Manifold

- Remove the inlet manifold [A] with the throttle body assy [B].
- Remove the throttle body assy from the inlet manifold (see Throttle Body Assy Removal).



- Unscrew the inlet manifold plate bolts [A] and remove the plate [B] and gasket [C].
- Remove:
 - Inlet Air Temperature Sensor [D]
 - Inlet Manifold Drain Plug [E]
 - Inlet Air Pressure Sensor Bolts [F]
 - Inlet Air Pressure Sensor [G]



Inlet Manifold Installation

- Replace the inlet manifold plate gasket with a new one.
- Tighten:

Torque - Inlet Manifold Plate Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

Inlet Manifold Drain Plug: 20 N·m (2.0 kgf·m, 14 ft·lb)

Inlet Air Temperature Sensor: 20 N·m (2.0 kgf·m, 14 ft·lb)

- Apply silicone oil to the O-ring [A] on the inlet air pressure sensor [B].

NOTE

○Do not apply silicone oil to the inside of inlet air pressure sensor connector.

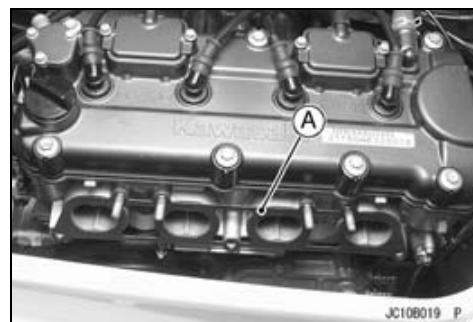
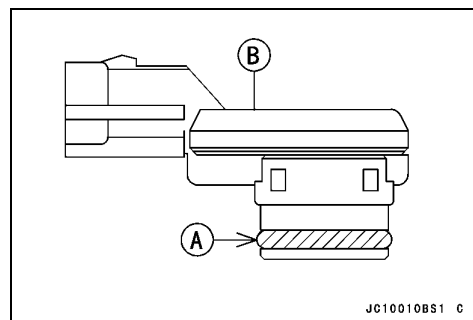
- Install the inlet air pressure sensor on the inlet manifold.
- Tighten:

Torque - Inlet Air Pressure Sensor Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Replace the inlet manifold gasket [A] with a new one and install it as shown.
- Apply a non-permanent locking agent to the inlet manifold mounting bolts and tighten them.

Torque - Inlet Manifold Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)

Inlet Manifold Mounting Nuts: 20 N·m (2.0 kgf·m, 14 ft·lb)

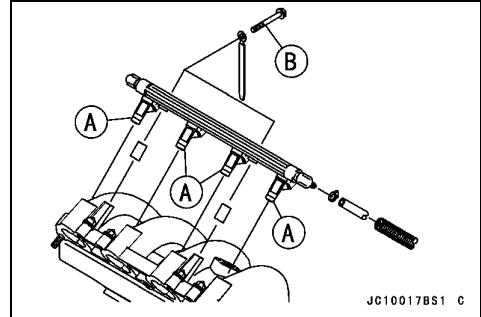


Inlet Manifold

- Replace the injector seals [A] with new ones.
- Apply grease to the inside and outside of seals.
- Tighten the delivery pipe mounting bolts [B].

Torque - Delivery Pipe Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Route the cable, wire and hose correctly (see Cable, Wire and Hose Routing in Appendix chapter).
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones (see Fuel System Diagram).



3-86 FUEL SYSTEM (DFI)

Fuel Line

Fuel Pressure Inspection

NOTE

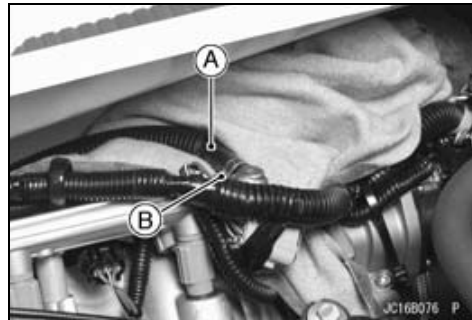
○Be sure the battery is fully charged.

- Be sure to place a piece of cloth under the fuel supply hose [A] of the fuel delivery pipe.

WARNING

Fuel is flammable and explosive under certain conditions and can cause severe burns. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately. When the fuel hose is disconnected, fuel spills out from the hose and the pipe because of residual pressure. Cover the hose connection with a piece of clean cloth to prevent fuel spillage.

- Loosen the clamp bolt [B] and pull out the fuel supply hose.
- For JT1500-A2 Model ~; Loosen the double spring clamp [B] with pliers and pull out the fuel supply hose.



Fuel Line

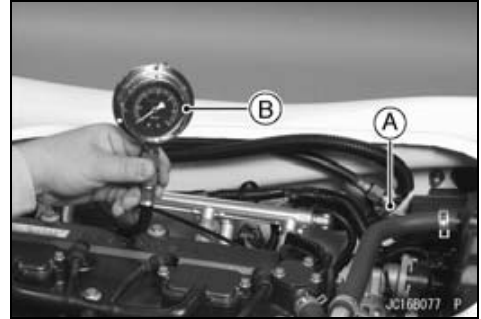
- Quickly install the fuel pressure gauge adapter [A] between the fuel supply pipe and the fuel supply hose.
- Connect the pressure gauge [B] to the fuel pressure gauge adapter.

Special Tools - Fuel Pressure Gauge Adapter: 57001-1463
Oil Pressure Gauge, 5 kgf/cm²: 57001-125

WARNING

Fuel is extremely flammable and can be explosive under certain conditions resulting in serious injury or death.

Do not try to start the engine with the fuel hoses disconnected.



- Start the engine, and let it idle.

NOTE

○ *Start the engine and inspect the fuel line leakage after installing the special tools.*

- Measure the fuel pressure with the engine idling.

Fuel Pressure (idling)

Standard: approx. 294 kPa (3.0 kgf/cm², 43 psi)

NOTE

○ *The gauge needle will fluctuate. Read the pressure at the average of the maximum and minimum indications.*

- ★ If the fuel pressure is much higher than the specified, check the following:
 Fuel Hose from Gauge Adapter to Fuel Pump Return Pipe for Sharp Bend, Kinking, or Clogging
 Fuel Pump
- ★ If the fuel pressure is much lower than specified, check the following:
 Fuel Line Leakage
 Fuel Injectors
 Fuel Pump
 Amount of Fuel Flow (see Fuel Flow Rate Inspection)
- ★ If the fuel pressure is much lower than specified, and if inspection above checks out good, replace the fuel filter and measure the fuel pressure again.
- Remove the fuel pressure gauge and adapter.
- Run the fuel hoses in accordance with the Cable, Wire, and Hose Routing section in the Appendix chapter.
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones (see Fuel System Diagram).

3-88 FUEL SYSTEM (DFI)

Fuel Line

Fuel Flow Rate Inspection

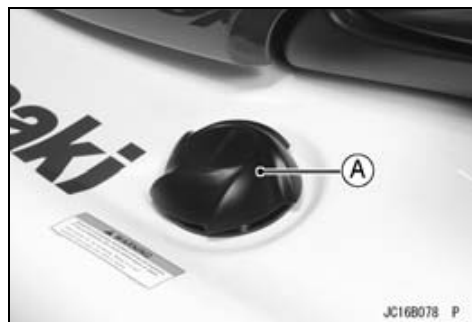
NOTE

○Be sure the battery is fully charged.

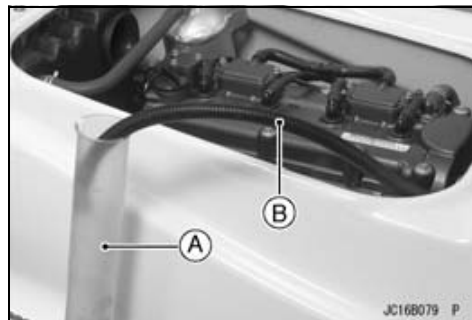
WARNING

Gasoline is extremely flammable and can be explosive under certain conditions, creating the potential for serious burns. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light. Do not smoke. Turn the ignition switch OFF. Be prepared for fuel spillage; any spilled fuel must be completely wiped up immediately.

- Turn the ignition switch OFF.
- Wait until the engine cools down.
- Open the fuel tank cap [A] to lower the pressure in the tank.



- Prepare a measuring cylinder [A].
- Disconnect the fuel supply hose from the fuel delivery pipe, and set the measuring cylinder and fuel supply hose [B] as shown.
- Close the fuel tank cap.



WARNING

Wipe off spilled out fuel immediately.
Be sure to hold the measuring cylinder vertical.

- Turn the ignition switch ON.
- Push the start button for 3 seconds.
- Measure the discharge for 3 seconds.

Amount of Fuel Flow

Standard: 67 mL or more for 3 seconds

- ★ If the fuel flow is much less than the specified, check the following:

Fuel Hose from Fuel Pump Supply Pipe to Fuel Filter for Sharp Bend, Kinking, or Clogging

Fuel Pump Operation

Fuel Pump Screen (see Fuel Pump Screen Cleaning in the Periodic Maintenance chapter)

- ★ If above inspection checks out good, replace the fuel pump, and measure the amount of fuel flow again.

- After inspection, connect the fuel hose.
- Start the engine and check for fuel leakage.
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones (see Fuel System Diagram).

Fuel Vent Check Valve

Fuel Vent Check Valve Mounting

- Refer to the Fuel Vent Check Valve Inspection in the Periodic Maintenance chapter.

Fuel Vent Check Valve Inspection

- Refer to the Fuel Vent Check Valve Inspection in the Periodic Maintenance chapter.

3-90 FUEL SYSTEM (DFI)

Fuel Filter

Fuel Filter Removal

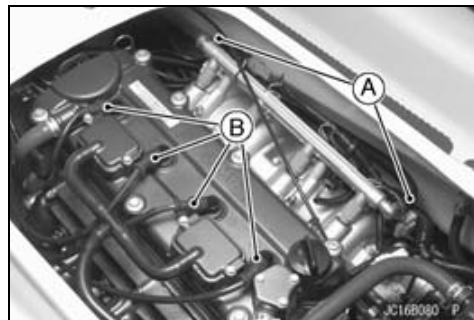
NOTE

○The fuel filter is designed to be used throughout the watercraft's life without any maintenance if it is used under normal conditions.

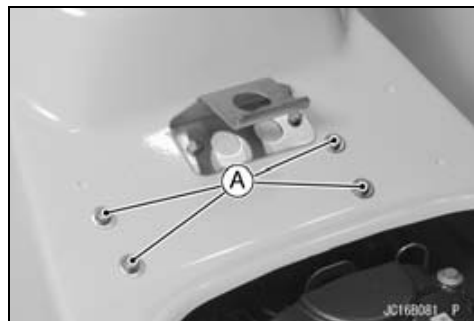
⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. To avoid a possible fire or explosion, pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

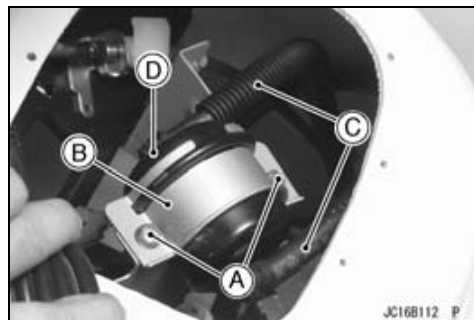
- Remove:
 - Front Storage Pocket (see Hull/Engine Hood chapter)
 - Fuel Hoses [A]
- Disconnect:
 - Spark Plug Caps [B]
 - Vehicle-down Sensor Lead Connector
 - Ignition Coil Primary Lead Connectors



- Remove:
 - Bracket Mounting Bolts [A]



- Remove:
 - Fuel Filter Mounting Bolts [A]
 - Holder [B]
 - Fuel Hoses [C]
 - Fuel Filter [D]

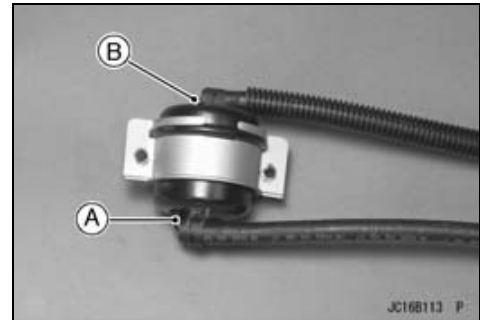


Fuel Filter

Fuel Filter Installation

- Route the hose correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones (see Fuel System Diagram).
- Install the fuel hoses to the fuel filter, noting its “IN” fitting [A] and “OUT” fitting [B].
- Install the holder and apply a non-permanent locking agent to the mounting bolts and tighten them.

Torque - Fuel Filter Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)



3-92 FUEL SYSTEM (DFI)

Fuel Pump

Fuel Pump Removal

NOTICE

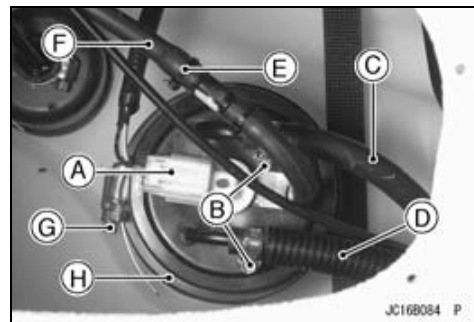
A shock to the fuel pump can damage it. Do not drop the fuel pump.

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. To avoid a possible fire or explosion, pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

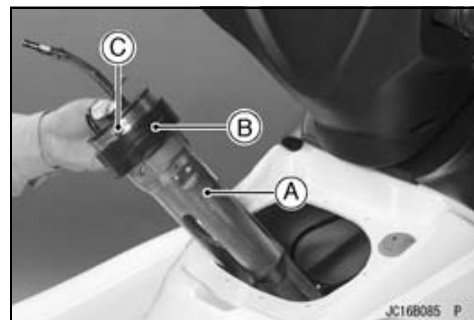
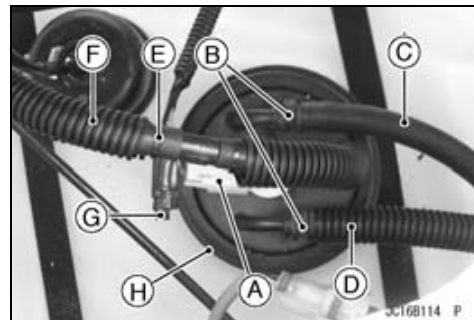
JT1500-A1 Model

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect the fuel pump lead connector [A].
- Loosen the clamp screws [B] and pull out the main [C] and return [D] fuel hoses.
- Cut off the clamp [E] and pull out the fuel vent hose [F].
- Loosen the lower side clamp screw [G] on the rubber fuel pump holder [H].



JT1500-A2 Model ~

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect the fuel pump lead connector [A].
- Loosen the double spring clamps [B] with pliers and pull out the main [C] and return [D] fuel hoses.
- Cut off the clamp [E] and pull out the fuel vent hose [F].
- Loosen the lower side clamp screw [G] on the rubber fuel pump holder [H].
- Pull the fuel pump [A] and rubber holder [B] through the opening gained after removal of the front storage pocket.
- Loosen the upper side clamp screw [C] and remove the rubber holder from the fuel pump.



Fuel Pump

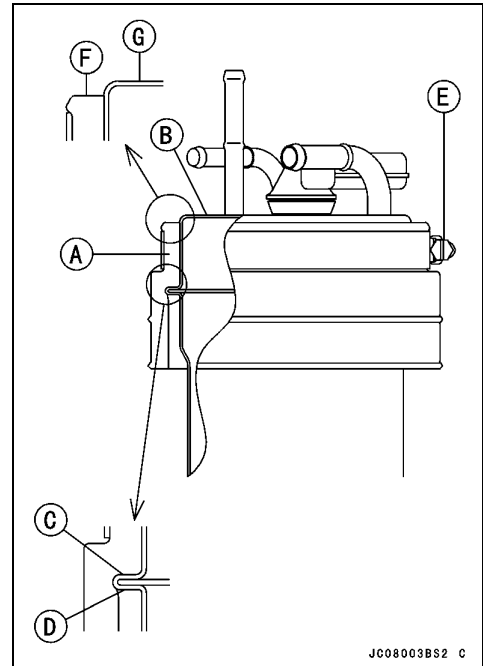
Fuel Pump Installation

- Press down the rubber holder [A] onto the fuel pump [B] so the stepped part [C] of the holder completely contacts the flanged part [D] of the pump.
- Pressing down the rubber holder onto the fuel pump.
- Set the upper side clamp (small diameter) onto the groove (for clamp installation) of the rubber holder securely, tighten the upper side clamp screw [E].

Torque - Fuel Pump Holder Clamp Screw: 2.9 N·m (0.30 kgf·m, 26 in·lb)

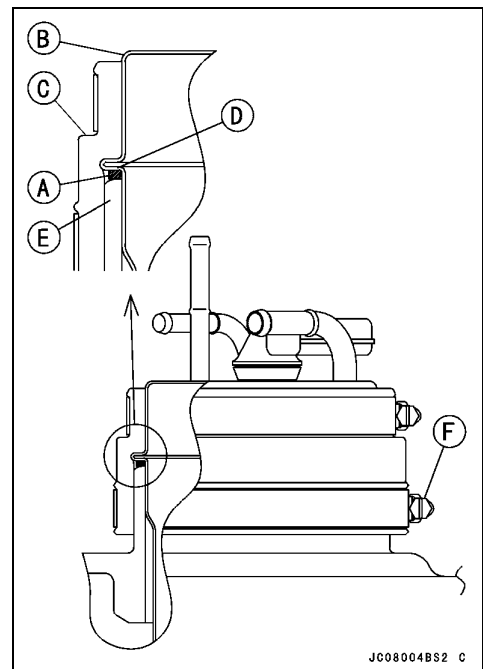
NOTE

- Install the rubber holder onto the fuel pump so the rubber holder top surface [F] must be below the top surface [G] of the fuel pump to prevent any water from collecting on top of the pump.

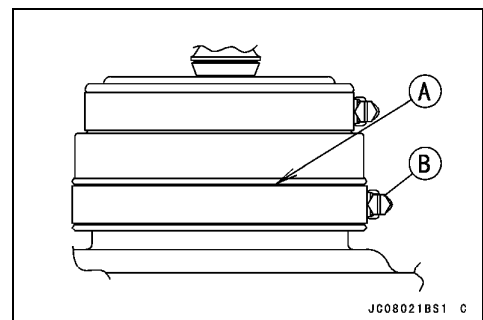


- Install the O-ring [A] to the space between fuel pump [B] and rubber holder [C] so it completely contacts the flanged part [D] of the pump.
- Insert the fuel pump with rubber holder and O-ring into the tank so its fuel hose fittings face starboard side (see Cable, Wire, and Hose Routing in Appendix chapter). And press down the pump so the O-ring [A] completely contacts the top surface of the tank [E].
- Set the lower side clamp (large diameter) onto the groove (for clamp installation) of the rubber holder securely, tighten the lower side clamp screw [F].

Torque - Fuel Pump Holder Clamp Screw: 2.9 N·m (0.30 kgf·m, 26 in·lb)



- Check the position [A] of the lower side clamp [B] around the entire circumference.



3-94 FUEL SYSTEM (DFI)

Fuel Pump

- Install the following to the fuel pump.
 - Fuel Hoses
 - Fuel Tank Vent Hose
 - Fuel Pump Lead Connector
- For JT1500-A2 Model; Replace the double spring clamps with new ones (see Fuel System Diagram).

NOTE

○ The main fuel hose is larger than the return fuel hose.

Power Source Voltage Inspection

NOTE

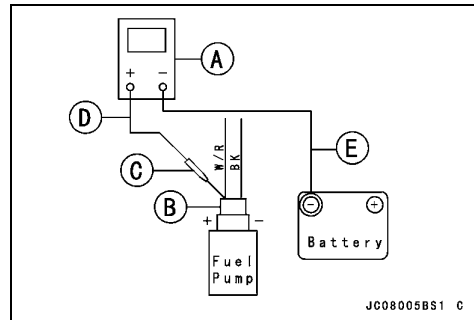
○ Be sure the battery is fully charged.

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Connect the hand tester (25 V DC) [A] to the fuel pump lead connector [B], using the needle adapter set [C].

Special Tools - Hand Tester: 57001-1394

Needle Adapter Set: 57001-1457

- Turn the ignition switch ON and push the lanyard key under the stop button.
- Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the power source voltage.
- Wait 15 seconds before using the starter again.



Pump Power Source Voltage

Connections

Tester (+) → W/R lead [D]

Tester (–) → Battery (–) Terminal [E]

Power Source Voltage at Pump Lead Connector

Standard: Battery Voltage

- ★ If the reading is good, the power source voltage is normal. Inspect the operating voltage.
- ★ If there is no battery voltage, check the following:
 - Main Fuse 20 A
 - Wiring for Fuel Pump Power Source (see Fuel Pump Circuit in this chapter)

Operating Voltage Inspection

NOTE

○ Be sure the battery is fully charged.

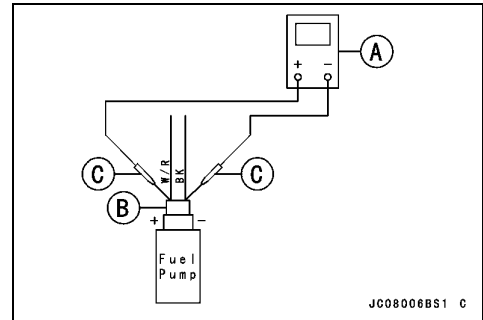
Fuel Pump

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Connect the hand tester [A] to the connector [B], using the needle adapter set [C].

Special Tools - Hand Tester: 57001-1394

Needle Adapter Set: 57001-1457

- Turn the ignition switch ON and push the lanyard key under the stop button.
 - Pushing the start button, run the engine 5 ~ 6 seconds at idling to measure the operating voltage.
- Wait 15 seconds before using the starter again.



Pump Operating Voltage

Connections

Tester (+) → W/R lead

Tester (-) → BK lead

Operating Voltage

Standard: Battery Voltage

- ★ If the reading stays on battery voltage but the pump doesn't work, replace the pump.
- ★ If there is no battery voltage at all, check the ECU for its ground and power supply (see ECU Power Supply Inspection).
- ★ If the ground and power supply are good, check the fuel pump wiring.

Fuel Pump Relay Removal

- Refer to the Relay Assembly Removal in the DFI Power Source section.

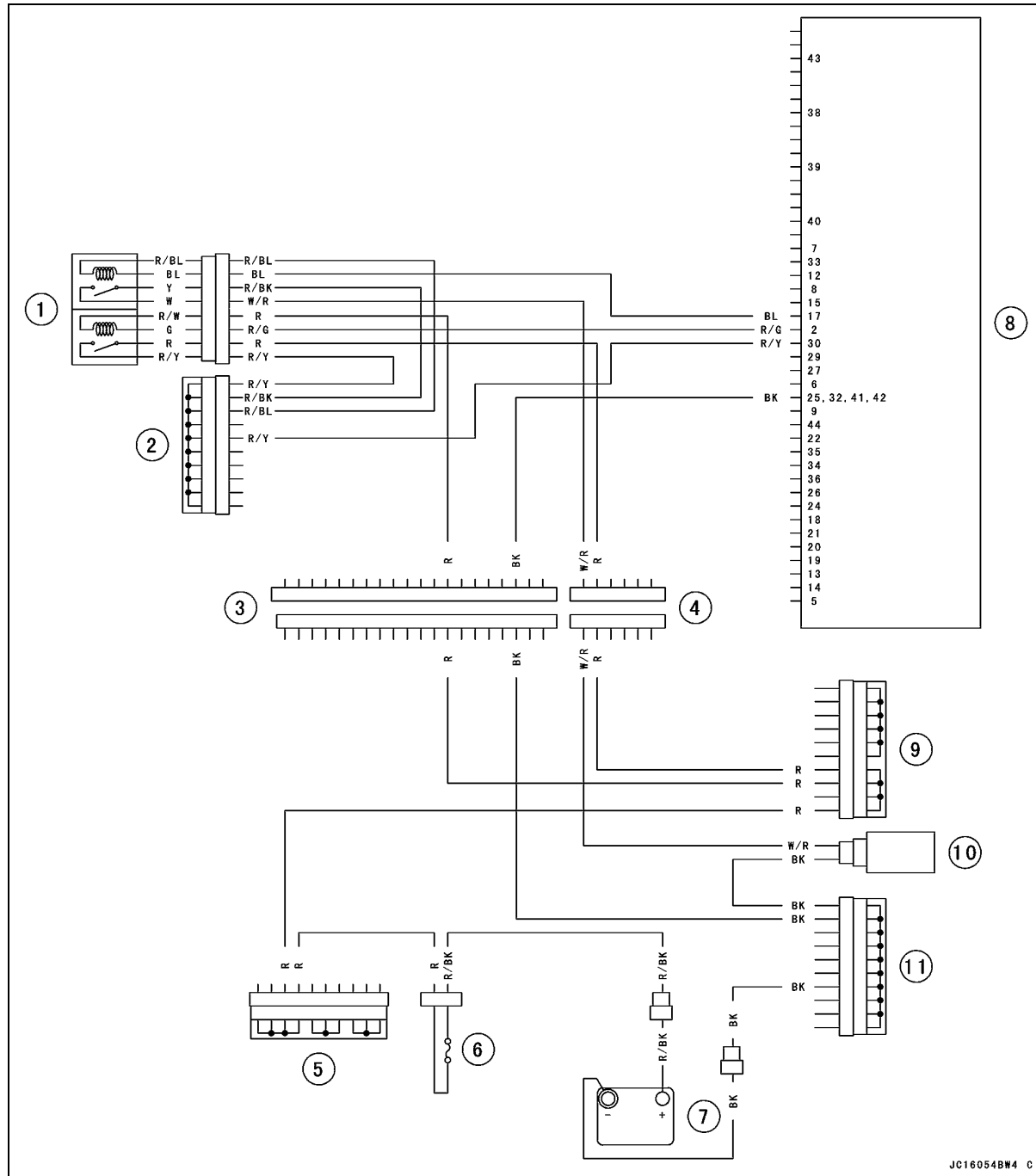
Fuel Pump Relay Inspection

- Refer to the Relay Assembly Inspection in the DFI Power Source section.

3-96 FUEL SYSTEM (DFI)

Fuel Pump

JT1500-A1 ~ A7 Models



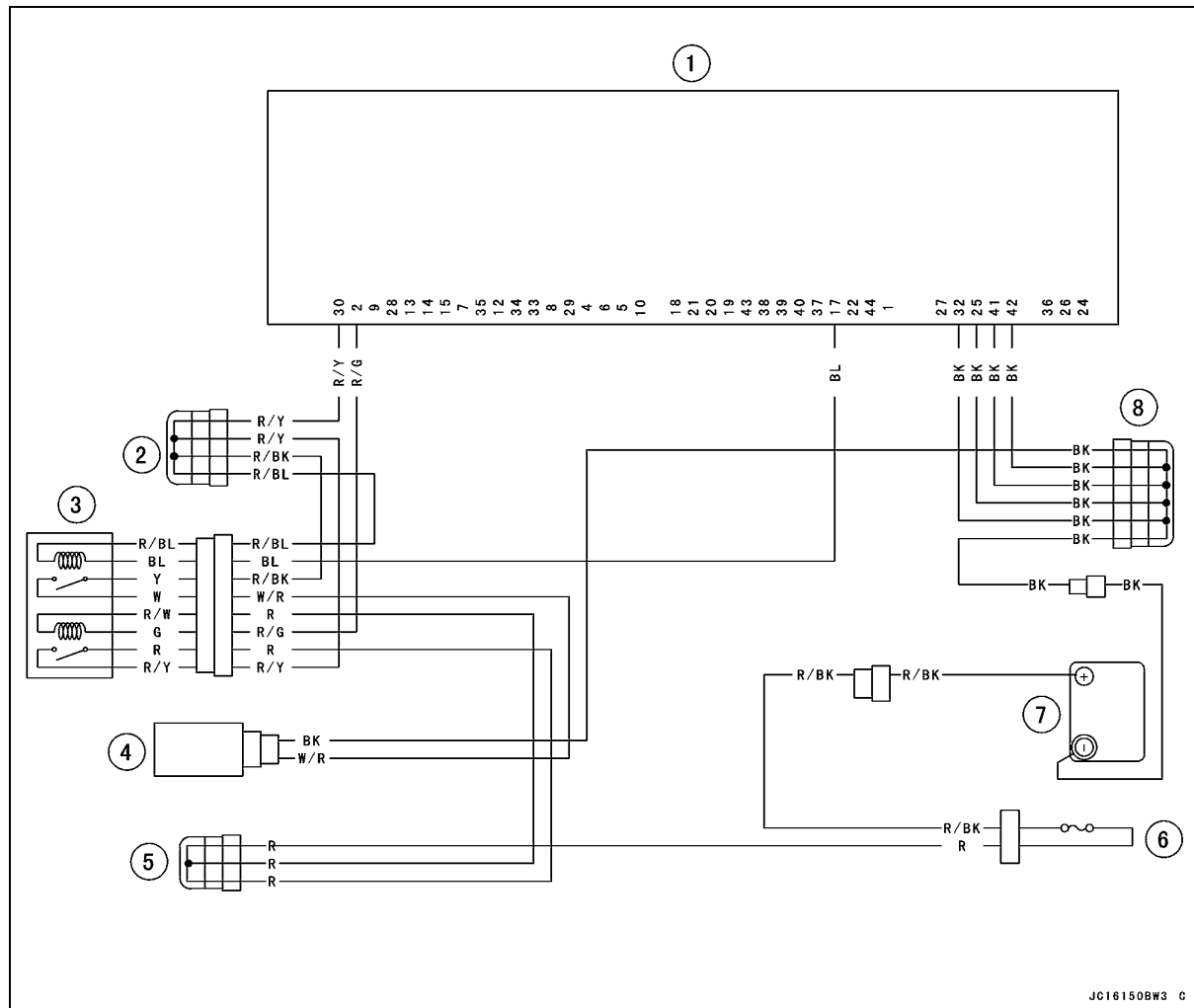
1. Relay Assembly (Main Relay/Fuel Pump Relay)
2. Joint Connector F
3. Connector C
4. Connector D
5. Joint Connector R
6. Main Fuse 20 A

7. Battery 12 V 18 Ah
8. ECU (Electronic Control Unit)
9. Joint Connector P
10. Fuel Pump
11. Joint Connector S

JC16054B#4 C

Fuel Pump

JT1500A8 Model ~



1. ECU (Electronic Control Unit)
2. Joint Connector Y
3. Relay Assembly (Main Relay/Fuel Pump Relay)
4. Fuel Pump

5. Joint Connector P
6. Main Fuse 20 A
7. Battery 12 V 18 Ah
8. Joint Connector U

JC16150BW3 C

3-98 FUEL SYSTEM (DFI)

Fuel Tank

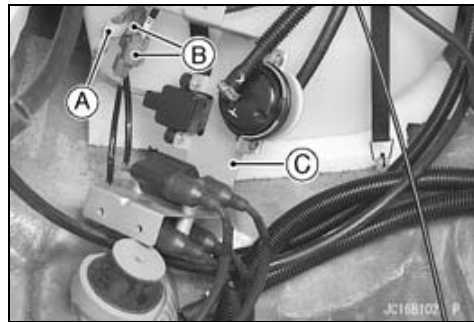
Fuel Tank Removal

- Drain the fuel tank into a suitable container.

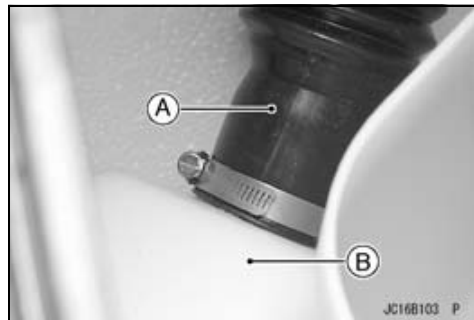
⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. To avoid a possible fire or explosion, pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

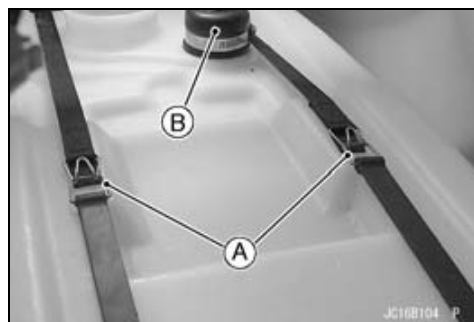
- Remove the engine (see Engine Removal/Installation chapter).
- Remove the fuel pump (see Fuel Pump Removal).
- Disconnect the following from the main harness.
 - Vehicle-down Sensor Lead Connector [A]
 - Ignition Coil Lead Connectors [B]
- Remove the bracket [C] out of the engine compartment.



- Remove the fuel filler tube [A] from the fuel tank [B].

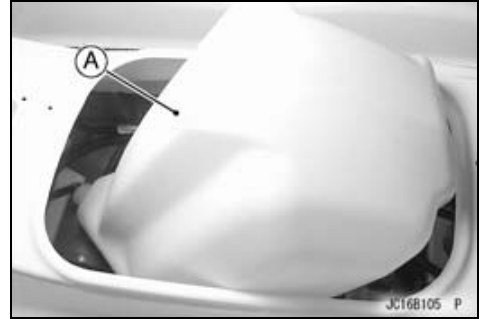


- Unhook the fuel tank straps [A].
- Remove the fuel level sensor [B].



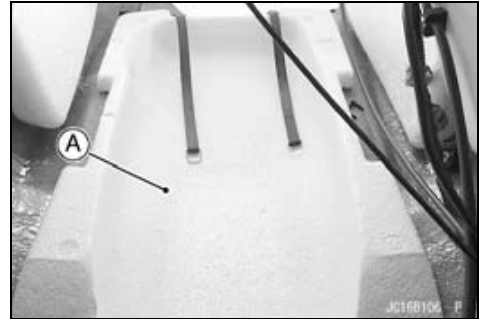
Fuel Tank

- Remove the fuel tank [A] out of the hull as shown.



Fuel Tank Installation

- Be sure the float [A] in place before putting the fuel tank into the hull.
- Route the following correctly (see Cable, Wire, and Hose Routing section in Appendix chapter).
 - Fuel Hoses
 - Fuel Tank Vent Hose
 - Fuel Level Sensor Leads
 - Other Wire and Harness
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones (see Fuel System Diagram).



Fuel Tank Cleaning

- Remove the fuel tank (see Fuel Tank Removal).
- Drain the tank into a suitable container.

WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. To avoid a possible fire or explosion, pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

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

WARNING

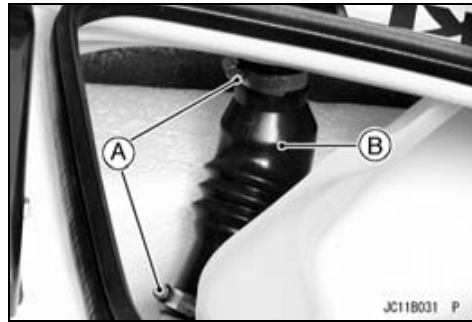
Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the tank in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the tank.

3-100 FUEL SYSTEM (DFI)

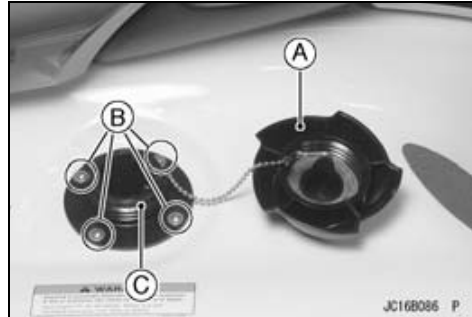
Fuel Tank

Fuel Filler and Tube Removal

- Open the front storage compartment cover.
- Loosen the fuel filler tube clamp screws [A] and remove the fuel filler tube [B].



- Remove the fuel filler cap [A].
- Take out the screws [B] in the filler flange and remove the fuel filler [C].



Fuel Filler and Tube Installation

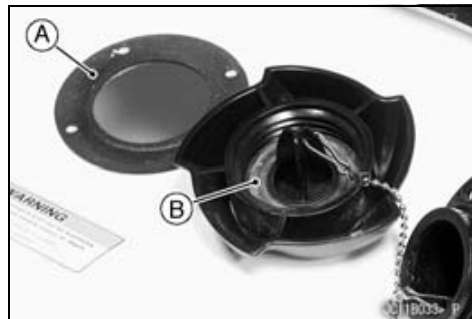
- Clean the deck and filler on their mating surfaces with greaseless, high-flash point solvent.

⚠ WARNING

Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the parts in a well-ventilated area, and take care that there is no spark or flame anywhere near the working areas. Do not use gasoline or low-flash point solvents to clean parts.

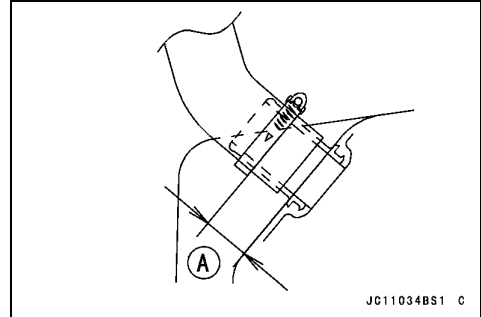
- Replace the fuel filler gasket [A] with a new one.
- Visually inspect the fuel filler cap gasket [B] for damage.
- ★ If there is any doubt as to the condition of the fuel filler gasket, replace the gasket with a new one.
- Tighten the fuel filler tube clamp screws.

Torque - Fuel Filler Tube Clamp Screws: 2.9 N·m (0.30 kgf·m, 26 in·lb)



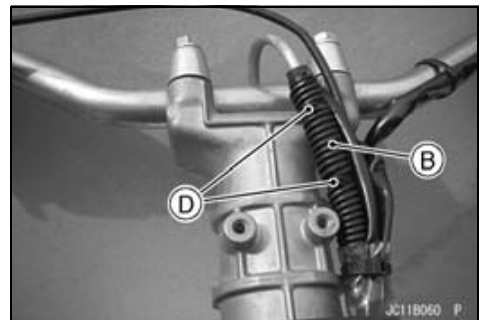
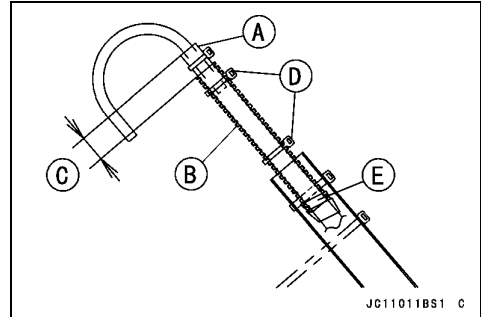
Fuel Tank

- Put the clamp onto the tank as shown.
35 mm (1.38 in.) [A]

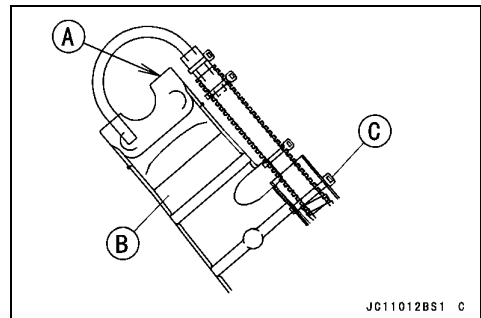


Fuel Tank Vent Hose Installation

- Remove handlebar cover and pad and cut the tie-band holding the leads and hoses over the clear tube.
- Pull out the fuel tank vent hose [A] more than 150 mm (6 inches) off the clear tube upper end for corrugated tube install [B].
- Install the corrugated tube over the vent hose so the top end of the vent hose protrudes 15 mm (0.6 inches) [C] from the end of the corrugated tube.
- Apply the new tie bands [D] at top and middle section and wrap the lower and end of the corrugated tube with a vinyl tape [E] together with the vent hose as shown.



- Pull the vent hose down into the engine compartment so that the vent hose is aligned straight with the steering shaft without any loop or looseness.
- Align the top end of the vent hose equal to or lower than the height [A] of the steering neck [B].
- Apply the large tie band [C] firmly over the clear and the corrugated tubes to hold them in place.
- Install handlebar cover and pad removed.



NOTICE

The engine will malfunction if the fuel tank air vent pipe end is obstructed by the handlebar pad and/or; if the air vent hose is folded; and/or riding the watercraft with the air vent hose remaining clogged. Be sure the fuel tank air vent pipe is installed correctly and securely.

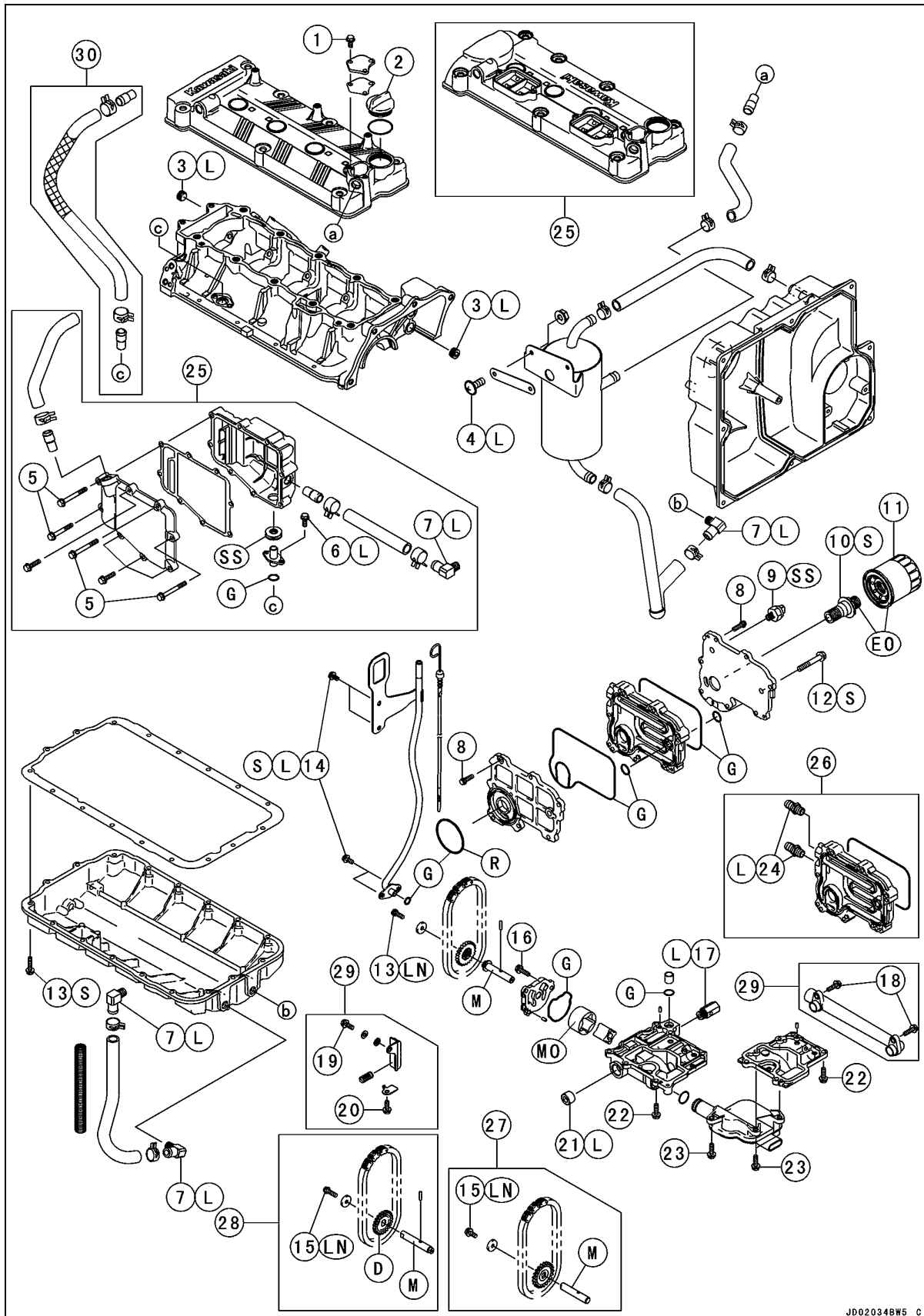
Engine Lubrication System

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4-2 ENGINE LUBRICATION SYSTEM

Exploded View



JD02034BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Breather Plate Bolts	7.8	0.80	69 in·lb	
2	Oil Filler Cap	1.0	0.10	8.7 in·lb	
3	Oil Passage Plugs	20	2.0	14	L
4	Oil Separator Tank Mounting Screws	4.9	0.50	43 in·lb	L
5	Breather Case Mounting Bolts	7.8	0.80	69 in·lb	
6	Breather Pipe Bolts	8.8	0.90	78 in·lb	L
7	Oil Passage Joints	11	1.1	95 in·lb	L
8	Oil Cooler Assembly Bolts	7.8	0.80	69 in·lb	
9	Oil Pressure Switch	15	1.5	11	SS
10	Oil Passage Bolt	78	8.0	58	S
11	Oil Filter	18	1.8	13	EO
12	Oil Cooler Positioning Bolt	20	2.0	14	S
13	Oil Pan Bolts	7.8	0.80	69 in·lb	S
14	Dipstick Tube Bolts	8.8	0.90	78 in·lb	L, S
15	Oil Pump Sprocket Bolt (JT1500-A1 ~A2)	15	1.5	11	LN
	Oil Pump Sprocket Bolt (JT1500A6 ~)	16	1.6	12	LN
16	Oil Pump Cover Bolts	7.8	0.80	69 in·lb	
17	Oil Pressure Relief Valve	15	1.5	11	LN
18	Oil Pipe Bolts	7.8	0.80	69 in·lb	
19	Oil Pump Chain Guide Bolt	7.8	0.80	69 in·lb	
20	Chain Guide Spring Plate Bolt	7.8	0.80	69 in·lb	
21	Oil Pump Body Plug	20	2.0	14	L
22	Oil Pump Body Bolts	7.8	0.80	69 in·lb	
23	Oil Screen Bolts	7.8	0.80	69 in·lb	
24	Water Hose Joints (JT1500-A1 ~ AA)	20	2.0	14	L

25: JT1500-A1 ~ A8 Models

26: JT1500-A1 ~ AA Models

27: JT1500-A1 ~ A6 Models

28: JT1500-A7 ~ AB Models

29: JT1500-A1 ~ AB Models

30: JT1500-A9 ~ AB Models

D: Stepped side faces outward.

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

R: Replacement

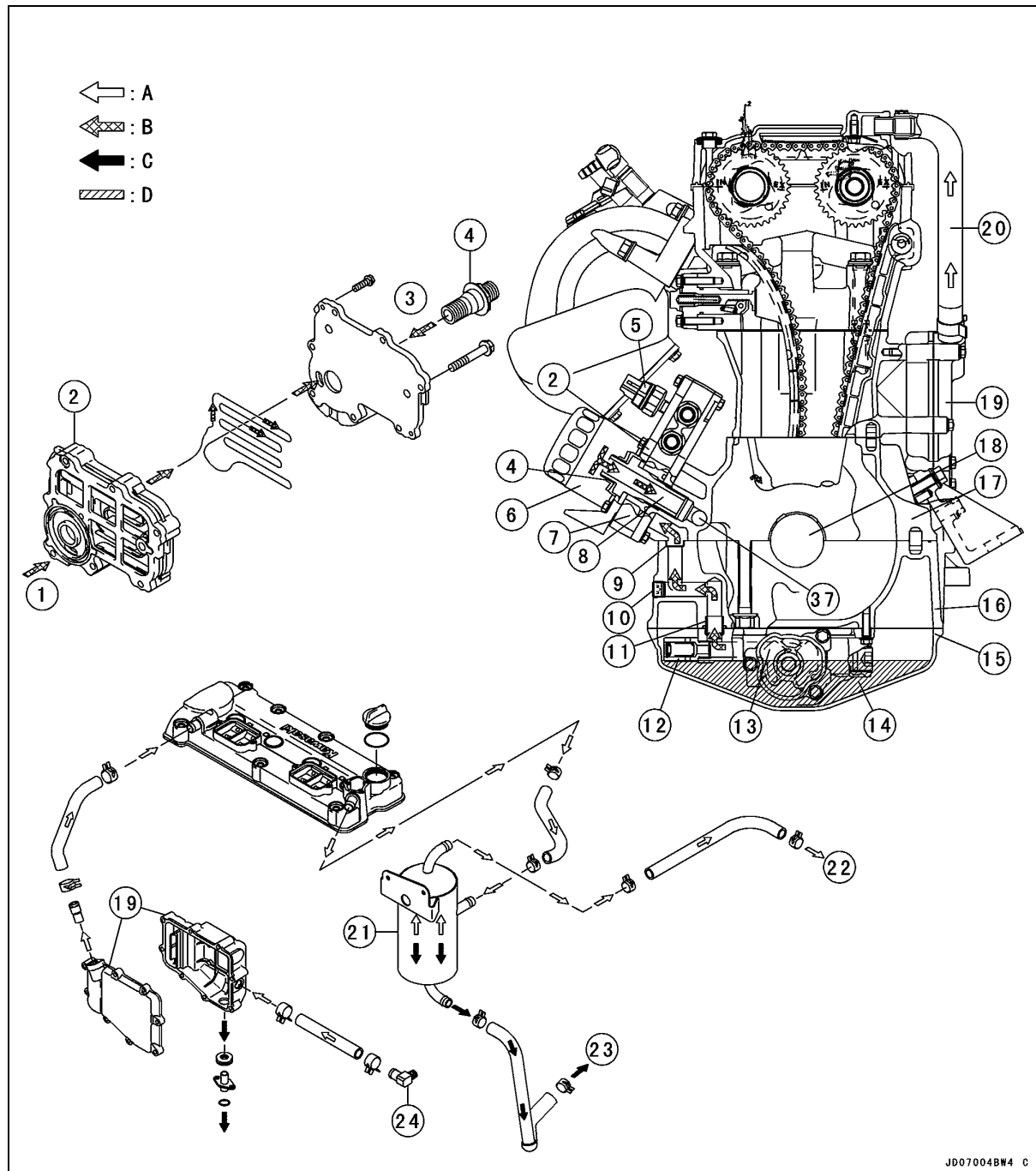
S: Follow the specific tightening sequence.

SS: Apply silicone sealant (see text).

4-4 ENGINE LUBRICATION SYSTEM

Engine Oil Flow Chart

JT1500-A1 ~ A8 Models

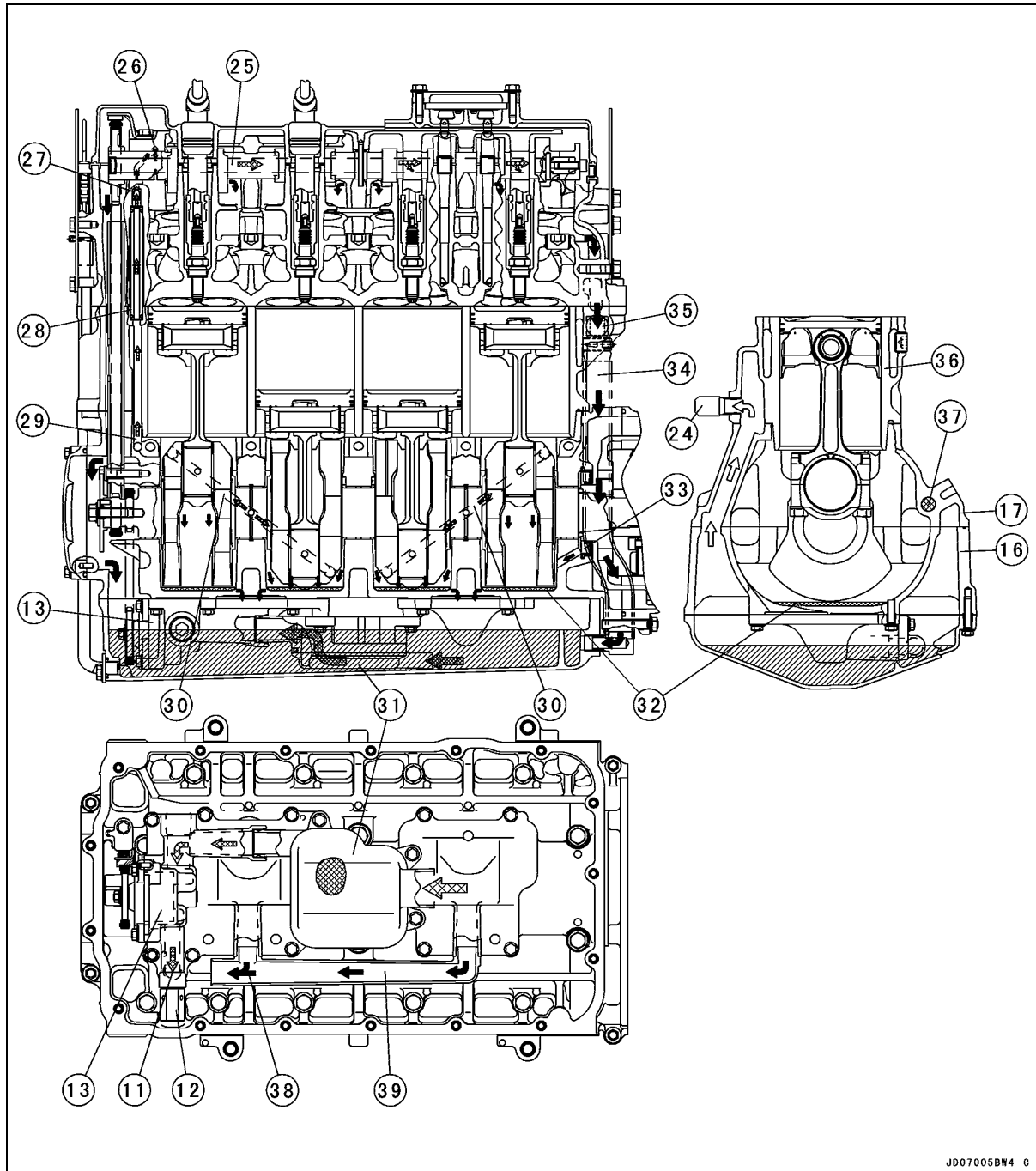


JD07004B#4 C

- | | | |
|-------------------------------|---|-------------------------------|
| A: Blowby Gas | 6. Oil Filter | 12. Oil Pressure Relief Valve |
| B: Supply Engine Oil Flow | 7. Oil Passage (to Oil Filter) | 13. Oil Pump |
| C: Return Engine Oil Flow | 8. Oil Passage (to Main Oil Passage) | 14. Oil Sump (in Oil Pan) |
| D: Oil Sump | 9. Oil Pipe (from Lower Crankcase to Upper Crankcase) | 15. Oil Pan |
| 1. from Oil Pump Side Passage | 10. Oil Passage Plug | 16. Lower Crankcase |
| 2. Oil Cooler | 11. Oil Pipe (from Oil pump to Lower Crankcase) | 17. Upper Crankcase |
| 3. to Main Oil Passage | | 18. Crankshaft |
| 4. Oil Passage Bolt | | 19. Breather Case |
| 5. Oil Pressure Switch | | 20. Breather Hose |

Engine Oil Flow Chart

JT1500-A1 ~ A8 Models



JD07005BW4 C

21. Oil Separator Tank
 22. to Air Filter
 23. to Oil Pan
 24. Joint
 25. Camshaft Oil Passage
 26. Camshaft Cap Oil Passage
 27. Oil Passage (from Oil Pipe to Camshaft Cap)

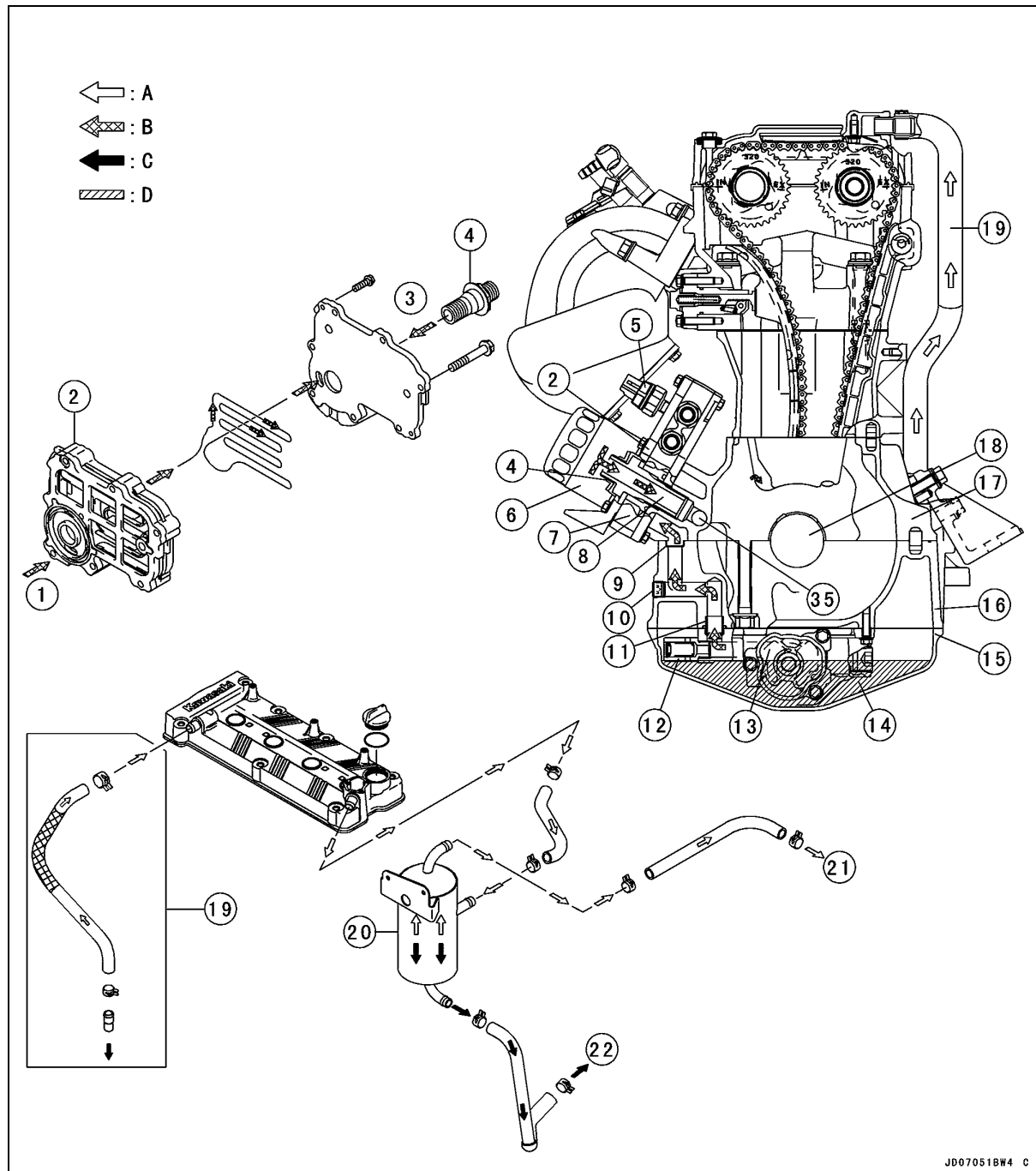
28. Oil Pipe (from Cylinder to Cylinder Head)
 29. Oil Passage (from Main Oil Passage to Oil Pipe)
 30. Crankshaft Oil Passage
 31. Oil Screen
 32. Oil Sump (in Crank Room)
 33. Oil Seal

34. Oil Hose (from Cylinder to Oil Pan)
 35. Cylinder Oil Passage Joint
 36. Cylinder
 37. Main Oil Passage
 38. to Oil Pan Sump
 39. Oil Pipe

4-6 ENGINE LUBRICATION SYSTEM

Engine Oil Flow Chart

JT1500A9 Model ~

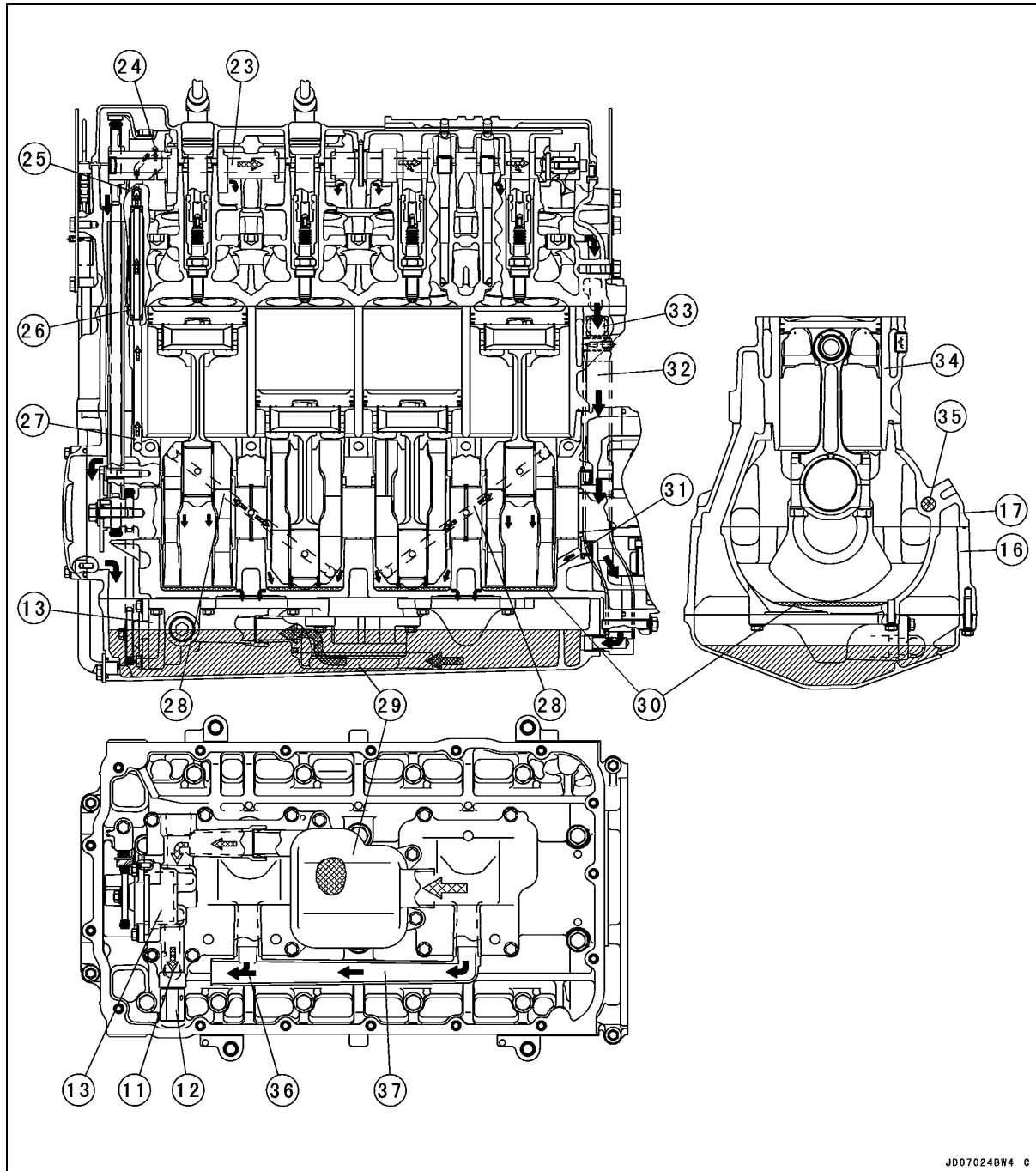


JD070518W4 C

- | | | |
|-------------------------------|---|---|
| A: Blowby Gas | 6. Oil Filter | 12. Oil Pressure Relief Valve |
| B: Supply Engine Oil Flow | 7. Oil Passage (to Oil Filter) | 13. Oil Pump |
| C: Return Engine Oil Flow | 8. Oil Passage (to Main Oil Passage) | 14. Oil Sump (in Oil Pan) |
| D: Oil Sump | 9. Oil Pipe (from Lower Crankcase to Upper Crankcase) | 15. Oil Pan |
| 1. from Oil Pump Side Passage | 10. Oil Passage Plug | 16. Lower Crankcase |
| 2. Oil Cooler | 11. Oil Pipe (from Oil pump to Lower Crankcase) | 17. Upper Crankcase |
| 3. to Main Oil Passage | | 18. Crankshaft |
| 4. Oil Passage Bolt | | 19. Breather Hose Assy (JT1500A9 ~ AB Models) |
| 5. Oil Pressure Switch | | |

Engine Oil Flow Chart

JT1500A9 Model ~



JD070248W4 C

20. Oil Separator Tank
 21. to Air Filter
 22. to Oil Pan
 23. Camshaft Oil Passage
 24. Camshaft Cap Oil Passage
 25. Oil Passage (from Oil Pipe to Camshaft Cap)
 26. Oil Pipe (from Cylinder to Cylinder Head)

27. Oil Passage (from Main Oil Passage to Oil Pipe)
 28. Crankshaft Oil Passage
 29. Oil Screen
 30. Oil Sump (in Crank Room)
 31. Oil Seal
 32. Oil Hose (from Cylinder to Oil Pan)

33. Cylinder Oil Passage Joint
 34. Cylinder
 35. Main Oil Passage
 36. to Oil Pan Sump
 37. Oil Pipe

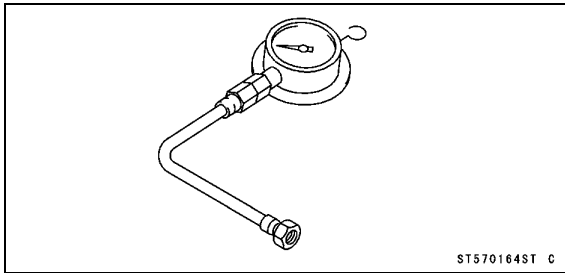
4-8 ENGINE LUBRICATION SYSTEM

Specifications

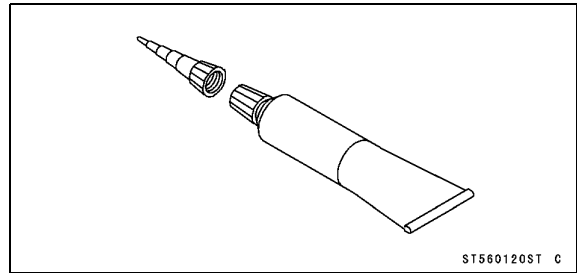
Item	Standard
Engine Oil	
Grade	API SG, SH, SJ, SL or SM with JASO MA, MA1 or MA2
Viscosity	SAE 10W-40
Capacity	4.0 L (4.2 US qt, when filter is not removed) 5.0 L (5.3 US qt, when engine is completely dry)
Level	Between upper and lower level lines (see text)
Oil Pressure Measurement	
Oil pressure @3 000 r/min (rpm), oil temperature 74°C (165°F)	461 kPa (4.7 kgf/cm ² , 67 psi)

Special Tools and Sealants

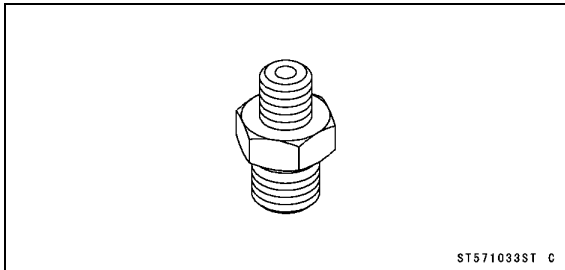
Oil Pressure Gauge, 10 kgf/cm²:
57001-164



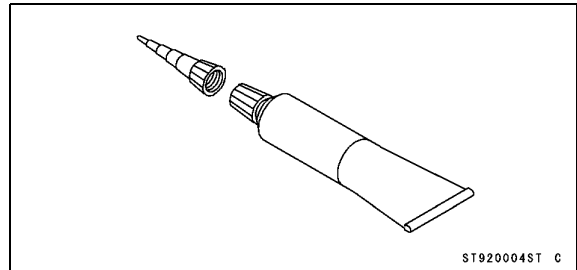
Liquid Gasket, TB1211:
56019-120



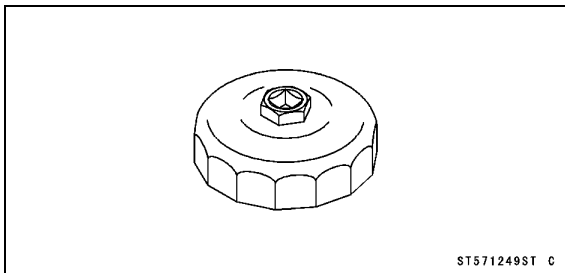
Oil Pressure Gauge Adapter, PT 1/8:
57001-1033



Liquid Gasket, TB1211F:
92104-0004



Oil Filter Wrench:
57001-1249



4-10 ENGINE LUBRICATION SYSTEM

Engine Oil and Oil Filter

WARNING

Insufficient, deteriorated or contaminated engine oil causes accelerated engine wear and may result in sudden catastrophic engine failure that can lead to an accident resulting in serious injury or death. Change the engine oil according to the periodic maintenance chart and check the oil level regularly between oil changes

Oil Level Inspection

This watercraft engine is equipped with a semi-dry sump. In the semi-dry sump engine, the oil level difference is very large between the level measured after just stopping and that after leaving for a long time.

It is necessary to check the specified amount of oil is in the engine before starting the engine every day. At this time use the cold mark of the level gauge. Then run the engine to lubricate the engine parts sufficiently. After that it is necessary to check the level by using hot mark of the level gauge.

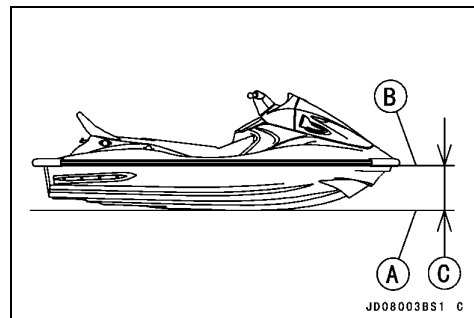
Preliminary Check

- Remove the seat (see Hull/Engine Hood chapter).
- Whenever checking the engine oil level, keep the watercraft level side to side and fore to aft as much as possible.

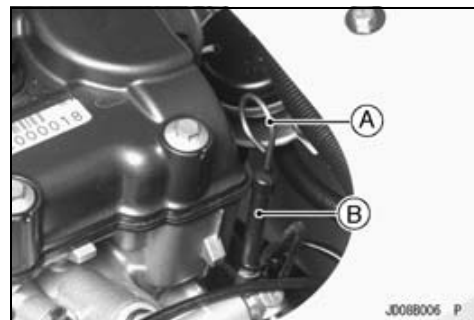
Level Ground [A]

Side Bumper [B]

Parallel [C]



- Remove the dipstick [A], wipe it dry and insert it back to the dipstick tube [B], and then remove it again to check the oil level.



- The oil level must be between the High [A] and Low [B] level lines on the dipstick [C] (Use level lines when engine is cold).

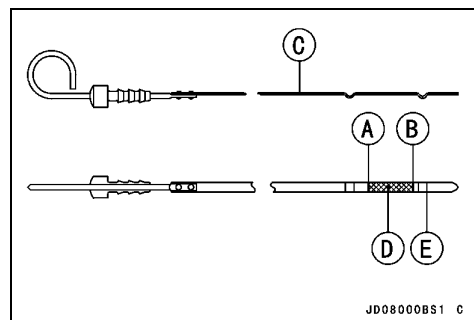
High Level Line when Cold [A]

Low Level Line when Cold [B]

Dipstick [C]

High Level Line when Hot [D]

Low Level Line when Hot [E]



Engine Oil and Oil Filter

NOTICE

Racing the engine before the oil reaches every part can cause engine seizure.

If the engine oil gets extremely low or if the oil pump or oil passages clog up or otherwise do not function properly, the oil pressure warning light will light. If this light stays on when the engine is running above idle speed, stop the engine immediately and find the cause.

- ★ If the oil level is too high, remove the excess oil using a syring or some other suitable device.
- ★ If the oil level is too low, add the oil to the low level line through the oil filter opening (see Periodic Maintenance chapter). Use the same type and make of oil that is already in the engine.

NOTE

○ If the engine oil type and make are unknown, use any brand of the specified oil to top off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.

Ordinary (standard) Check

- The preliminary is checked before the ordinary check.
- Install the removed parts.
- Launch the watercraft.
- Start the engine for several minutes.
- Ride the watercraft and run the engine at about 5 000 rpm for 5 minutes.
- Stop the engine and let it cool down for 10 minutes.
- Steady the watercraft in calm water to prevent movement, or on the ground, keep the watercraft level side to side and fore to aft as much as possible.

NOTE

○ Since the trim and list of the watercraft will significantly affect the oil level, be sure that the operator and/or cargo are not aboard the watercraft when measuring the oil level.

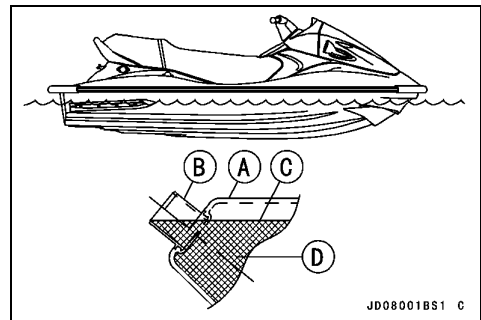
○ Also make the fuel tank [A] full if it is not full as shown to keep the watercraft level.

Fuel Tank Filler Neck [B]

Fuel Full Level [C]

Fuel [D]

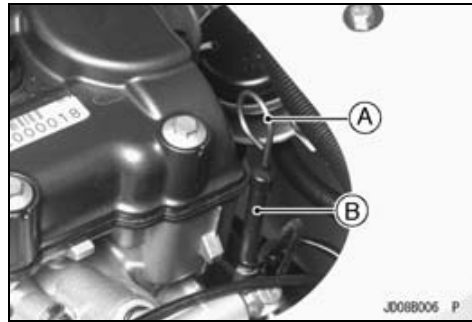
○ This measuring procedure with the watercraft afloat should be followed when the oil level is found low and to be added.



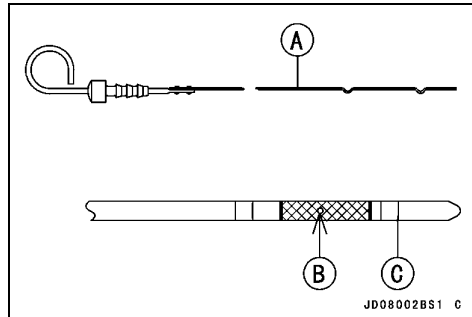
4-12 ENGINE LUBRICATION SYSTEM

Engine Oil and Oil Filter

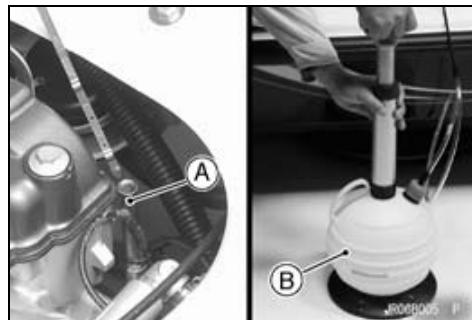
- Remove the seat (see Hull/Engine Hood chapter)
- Remove the dipstick [A], wipe it dry and insert it back to the dipstick tube [B], and then remove it again to check the oil level.



- Check the oil level using the hot level mark on the dipstick [A].
High Level Line when Hot [B]
Low Level Line when Hot [C]



- ★ If the oil level is too high, drain the excess oil thoroughly from the dipstick tube [A] using a commercially-available vacuum pump [B].



- ★ If the oil level is too low, add the oil to the high level line through the oil filler opening (see Periodic Maintenance chapter). Use the same type and make of oil that is already in the engine.

NOTE

○ If the engine oil type and make are unknown, use any brand of the specified oil to top off the level in preference to running the engine with the oil level low. Then at your earliest convenience, change the oil completely.

Engine Oil Change

- Refer to the Engine Oil Change in the Periodic Maintenance chapter.

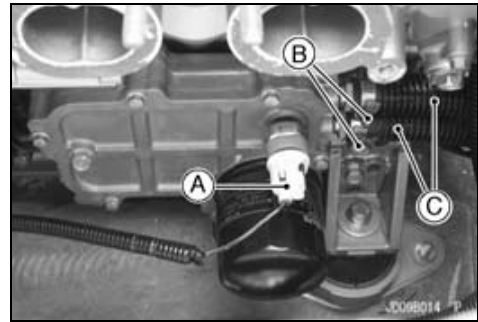
Oil Filter Replacement

- Refer to the Oil Filter Replace in the Periodic Maintenance chapter.

Oil Cooler

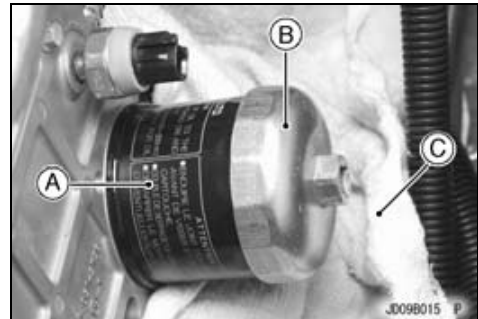
Oil Cooler Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter with Inlet Duct (see Fuel System (DFI) chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
- Disconnect the oil pressure switch connector [A].
- Loosen the clamp screws [B] and remove the oil cooler cooling hoses [C] from the oil cooler.

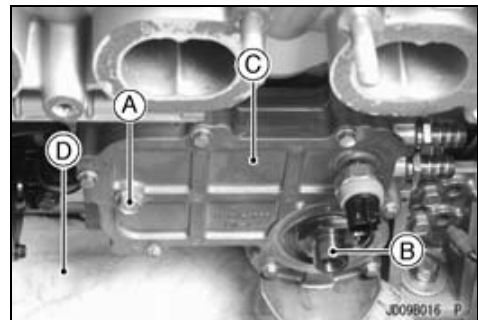


- Remove the oil filter [A] with the oil filter wrench [B].
- Place a rag or cloth [C] under the oil filter to receive the remaining oil.

Special Tool - Oil Filter Wrench: 57001-1249

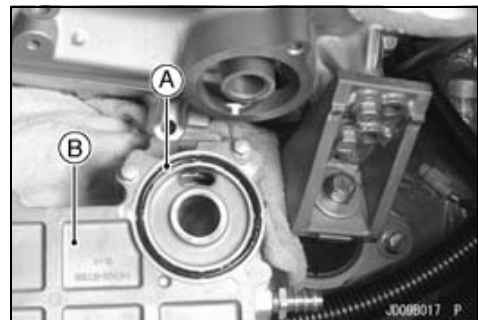


- Unscrew the oil cooler positioning bolt [A].
- Unscrew the oil passage bolt [B] and remove the oil cooler [C].
- Place a rag or cloth [D] under the oil cooler to receive the remaining oil.



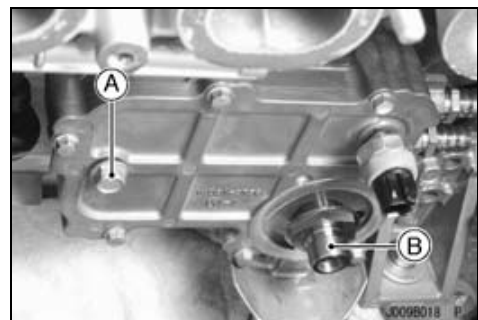
Oil Cooler Installation

- Replace the O-ring [A] with new one and apply grease to new O-ring.
- Fit the O-ring on the oil cooler [B] securely.



- Install the oil cooler positioning bolt [A] and the oil passage bolt [B] temporarily.
- Tighten the passage bolt first.
- Next, tighten the positioning bolt.

Torque - Oil Passage Bolt: 78 N·m (8.0 kgf·m, 58 ft·lb)
Oil Cooler Positioning Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)

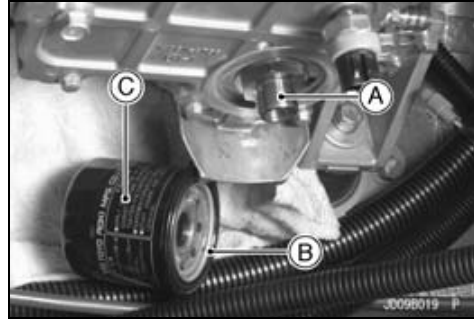


4-14 ENGINE LUBRICATION SYSTEM

Oil Cooler

- Apply engine oil to the thread [A] of the passage bolt and O-ring [B] of the oil filter [C].
- Tighten the oil filter (P/No. 16097-1072).

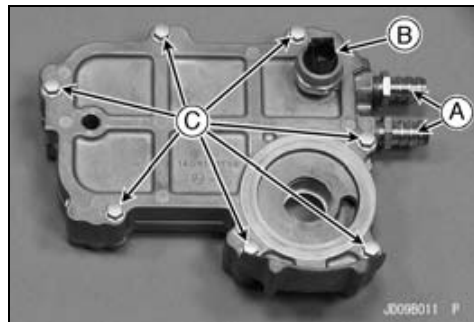
Torque - Oil Filter: 18 N·m (1.8 kgf·m, 13 ft·lb)



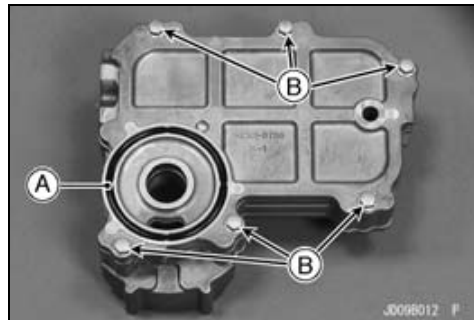
- Connect the oil pressure switch connector securely.
- Install the cooling hoses (see Cable, Wire and Hose Routing in Appendix chapter).
- Install the inlet manifold (see Fuel System (DFI) chapter).

Oil Cooler Disassembly

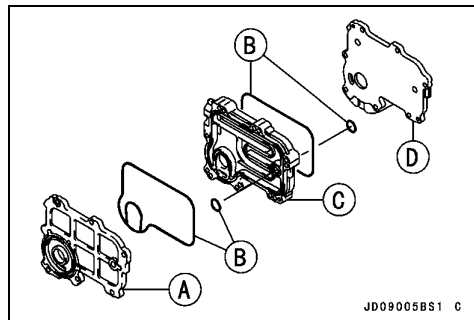
- Remove:
 - Oil Cooler (see Oil Cooler Removal)
 - Water Hose Joints [A] (JT1500-A1 ~ AA Models)
 - Oil Pressure Switch [B]
 - Oil Cooler Assembly Bolts [C]



- Remove the O-ring [A].
- Turn the oil cooler up side down, and remove the assembly bolts [B].



- Separate the oil cooler.
 - Inside Oil Cooler Cover [A]
 - O-rings [B]
 - Oil Cooler [C]
 - Outside Oil Cooler Cover [D]



Oil Cooler

Oil Cooler Assembly

- Apply grease to new O-rings, and fit them on to each groove of the coolers securely.
- Apply a non-permanent locking agent to the joints and tighten them.

Torque - Oil Cooler Assembly Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

Water Hose Joints: 20 N·m (2.0 kgf·m, 14 ft·lb)

JT1500-A1 ~ AA Models

- Install the oil cooler (see Oil Cooler Installation).

Oil Cooler Inspection

- Start the engine to check for water and oil leaks.
- ★ If the water and oil leak, replace the O-rings.

DANGER

Exhaust gas contains carbon monoxide, a colorless, odorless poisonous gas. Inhaling carbon monoxide can cause serious brain injury or death. **DO NOT** run the engine in enclosed areas. Operate only in a well-ventilated area.

NOTICE

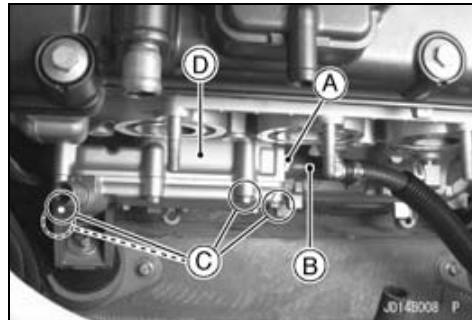
Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

4-16 ENGINE LUBRICATION SYSTEM

Breather Case and Oil Separator Tank

Breather Case Removal (JT1500-A1 ~ A8 Models)

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Exhaust Manifold (see Exhaust System chapter)
 - Clamp [A]
 - Breather Hose [B]
 - Breather Case Mounting Bolts [C]
- Pull the breather case [D] upward.



Breather Case Installation (JT1500-A1 ~ A8 Models)

- ★ If the breather pipe [A] removed, install the pipe as follow.
- Apply grease to the O-ring [B].
- Install the O-ring to the short length pipe side [C] of the breather pipe.
- Install the breather pipe so that the short length pipe side faces downward.
- Apply a non-permanent locking agent to the threads of breather pipe bolts and tighten them.

Torque - Breather Pipe Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

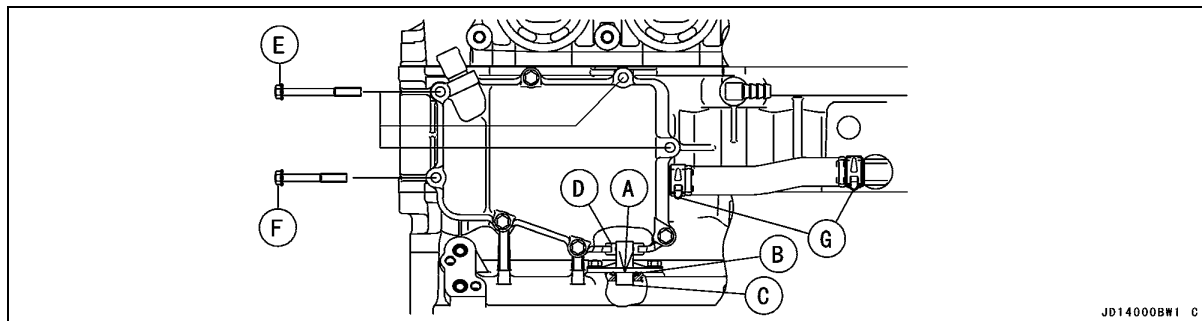
- Apply silicone sealant to the inside of the rubber grommet [D].

Sealant - Liquid Gasket, TB1211F: 92104-0004

- Tighten the breather case mounting bolts.
 - M6 × 55 Bolts [E]
 - M6 × 45 Bolt [F]

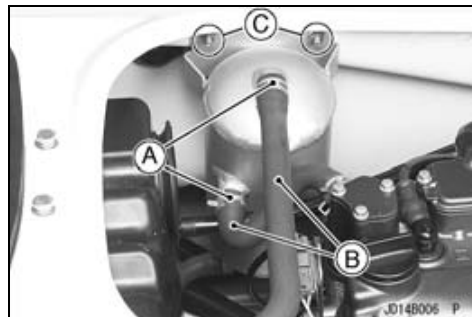
Torque - Breather Case Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install the breather hose clamp pinch head [G] as shown.



Oil Separator Tank Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Breather Hose Clamps [A] (slide out)
 - Breather Hoses [B]
 - Mounting Screws
 - Bracket
- Be careful not to drop the nuts [C].

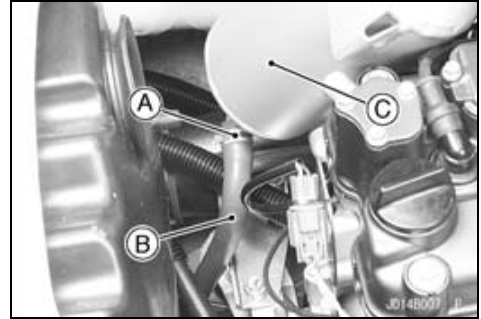


Breather Case and Oil Separator Tank

- Remove:
 - Breather Hose Clamp [A]
 - Breather Hose [B]
 - Oil Separator Tank [C]

NOTE

○ Hold the hose end to the upward. The oil will flow out if the hose lies at the bottom.



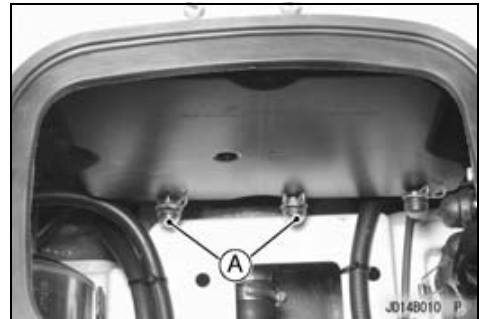
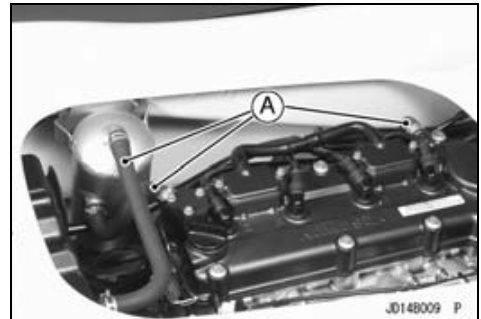
Oil Separator Tank Installation

- When installing the breather hoses, avoid sharp bending, kicking, flattening or twisting, and route the hoses according to Hose Routing section in Appendix chapter.
- Apply a non-permanent locking agent to the oil separator tank mounting screws.
- Be careful not to drop the nuts.
- Tighten:

**Torque - Oil Separator Tank Mounting Screws: 4.9 N·m
(0.50 kgf·m, 43 in·lb)**

Blowby Gas System Inspection

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly.
- ★ If they are not, correct them.
- Inspect the breather hoses [A], breather pipes and the air filter drain caps for damage or signs of deterioration. Squeeze the hoses. These hoses should not be hard and brittle, nor should be soft or swollen.
- ★ Replace any damaged hoses.
- Check that the hoses and caps are securely connected.
- The air filter drain caps [A] is provided beneath the air filter are housing catches the water or oil from the bottom of the air filter housing. Usually water or oil does not collect at the bottom of the housing. In the event that water is drawn in through the duct, or if engine oil is blown back, drain the housing.
- Pull the air filter drain plugs to drain the water or breather oil when changing engine oil.

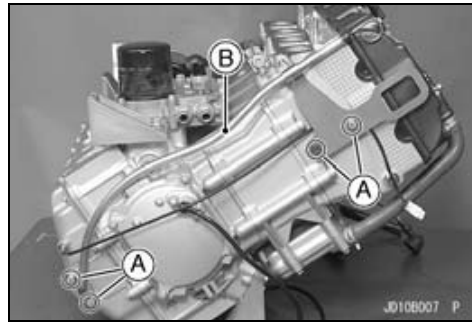


4-18 ENGINE LUBRICATION SYSTEM

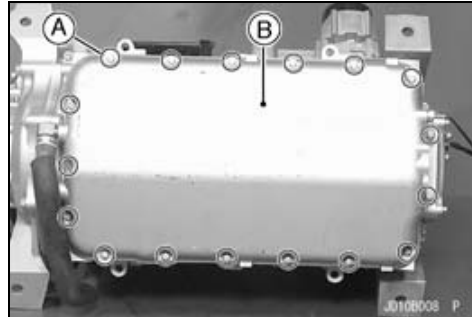
Oil Pan

Oil Pan Removal

- Drain:
Engine Oil (see Periodic Maintenance chapter)
- Remove:
Engine (see Engine Removal/Installation chapter)
- Turn the engine to the side.
- Unscrew the dipstick tube bolts [A] and pull out the dipstick tube [B].



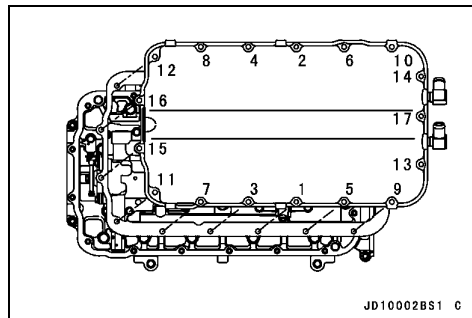
- Unscrew the oil pan bolts [A] and remove the oil pan [B].



Oil Pan Installation

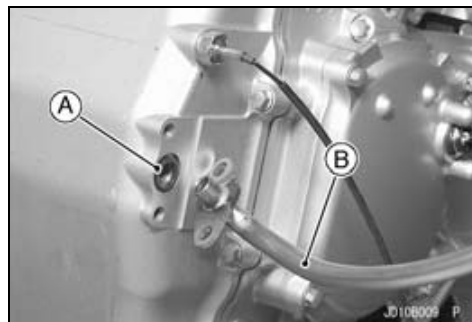
- Tighten the oil pan bolts following the tightening sequence [1 ~ 17].

Torque - Oil Pan Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



- Apply grease to the O-ring [A] on the dipstick tube [B].
- Apply a non-permanent locking agent to the dipstick tube bolts.
- Tighten all the dipstick tube bolts temporary.
- First, tighten the oil pan side bolt. Next, tighten the cylinder head side bolts.

Torque - Dipstick Tube Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

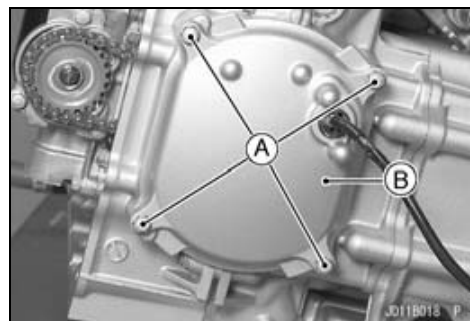


Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

Oil Pump Sprocket Removal

JT1500-A1 ~ AB Models

- Drain:
 - Engine Oil (see Periodic Maintenance chapter)
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Oil Pan (see Oil Pan Removal)
 - Crankshaft Sensor Cover Bolts [A]
 - Crankshaft Sensor Cover [B]

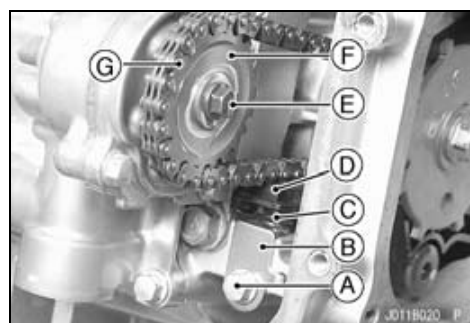


- Unscrew the oil pump chain guide bolt [A].



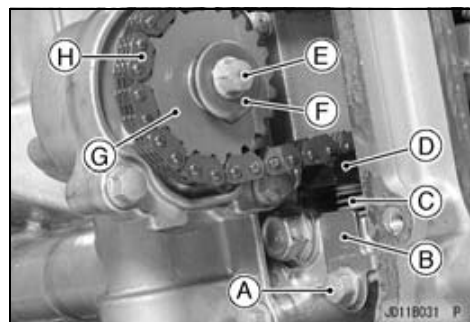
JT1500-A1 ~ A6 Models

- Unscrew the spring plate bolt [A] and remove the spring plate [B], spring [C] and the oil pump chain guide [D].
- Remove:
 - Oil Pump Sprocket Bolt [E]
 - Washer
- Pull out the oil pump sprocket [F] together with the oil pump sprocket chain [G].



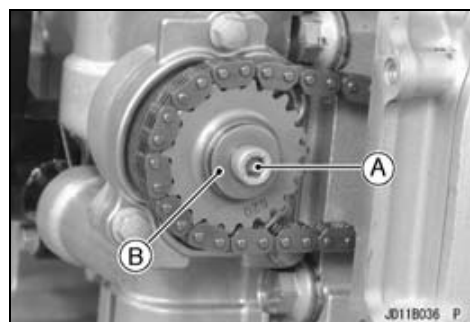
JT1500-A7 ~ AB Models

- Unscrew the spring plate bolt [A] and remove the spring plate [B], spring [C] and the oil pump chain guide [D].
- Remove:
 - Oil Pump Sprocket Bolt [E]
 - Washer [F]
- Pull out the oil pump sprocket [G] together with the oil pump sprocket chain [H].



JT1500AC Model

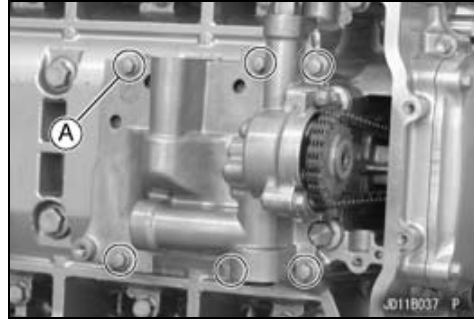
- Drain:
 - Engine Oil (see Periodic Maintenance chapter)
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Oil Pan (see Oil Pan Removal)
 - Oil Pump Sprocket Bolt [A]
 - Washer [B]



4-20 ENGINE LUBRICATION SYSTEM

Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

- Remove the oil pump body bolts [A].



- Pull out the oil pump body [A] and remove the oil pump sprocket [B].



Oil Pump Sprocket Installation

JT1500-A1 ~ A6 Models

- Engage the oil pump chain [A] to the oil pump sprocket [B].
- Install the sprocket with the chain to the oil pump shaft [C].
- Apply a non-permanent locking agent (High Strength: 271 equivalent) to the sprocket bolt.
- Tighten:

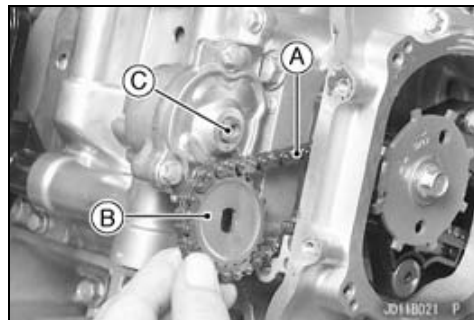
Torque - Oil Pump Sprocket Bolt: 15 N·m (1.5 kgf·m, 11 ft·lb)

(JT1500-A1~A2 Models)

Oil Pump Sprocket Bolt: 16 N·m (1.6 kgf·m, 12 ft·lb)

(JT1500A6 Model)

- Pull out the oil pump body [A] and remove the oil pump sprocket [B].

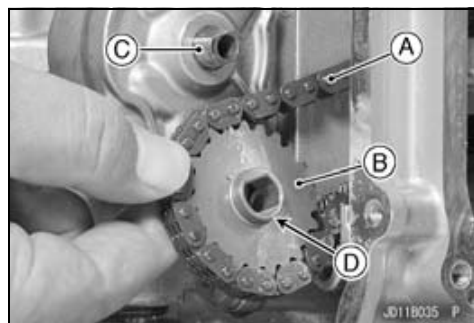


JT1500-A7 ~ AB Models

- Engage the oil pump chain [A] to the oil pump sprocket [B].
- Install the sprocket with the chain to the oil pump shaft [C] so that the stepped side [D] faces outward.
- Apply a non-permanent locking agent (High Strength: 271 equivalent) to the sprocket bolt.
- Tighten:

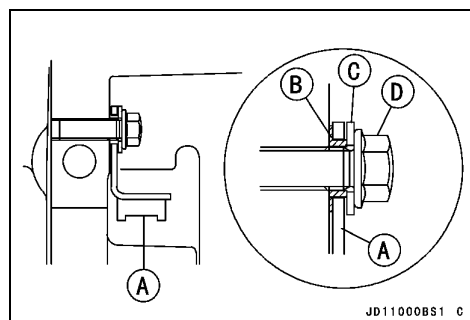
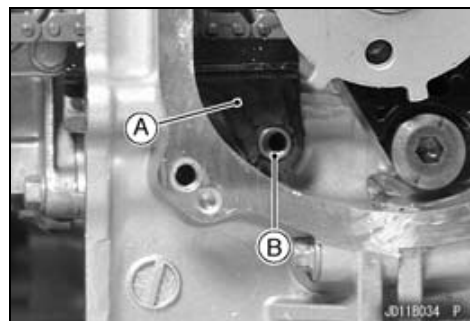
Torque - Oil Pump Sprocket Bolt: 16 N·m (1.6 kgf·m, 12 ft·lb)

- Pull out the oil pump body [A] and remove the oil pump sprocket [B].



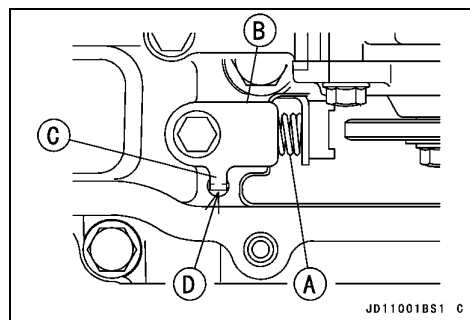
Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

- Install the oil pump chain guide [A], collar [B], washer [C], and bolt [D] as shown.
- Install the collar so that the flat surface of the collar faces to crankcase.
- Tighten:
Torque - Oil Pump Chain Guide Bolt: 7.8 N·m (0.80 kgf·m, 69 in·lb)



JT1500-A1 ~ AB Models

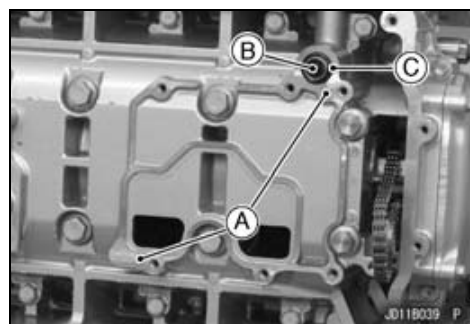
- Install the chain guide spring [A] and the spring plate [B].
- Insert the tab [C] of the spring plate in the hole [D] of the crankcase.
- Tighten:
Torque - Chain Guide Spring Plate: 7.8 N·m (0.80 kgf·m, 69 in·lb)



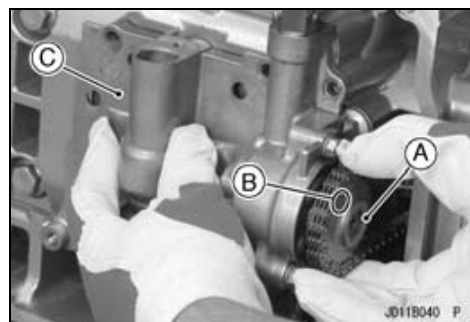
- Install:
 Oil Pan (see Oil Pan Installation)

JT1500AC Model

- Check that dowel pins [A] and oil pipe [B] are in place on the crankcase.
- Replace the O-ring [C] with a new one.



- Engage the oil pump chain with the oil pump sprocket [A].
- Install the oil pump sprocket so that the "620" Mark [B] faces outward on the oil pump body [C].
- Install the oil pump body.
- Tighten:
Torque - Oil Pump Body Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

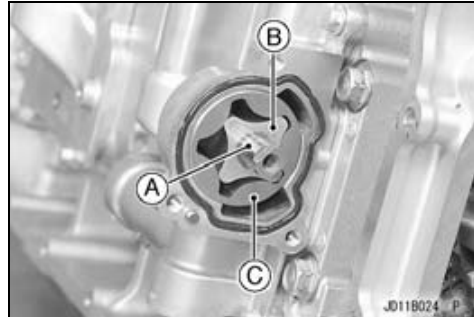
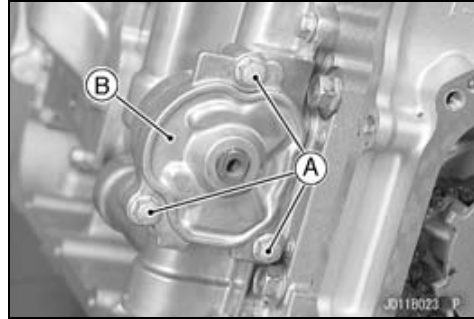


4-22 ENGINE LUBRICATION SYSTEM

Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

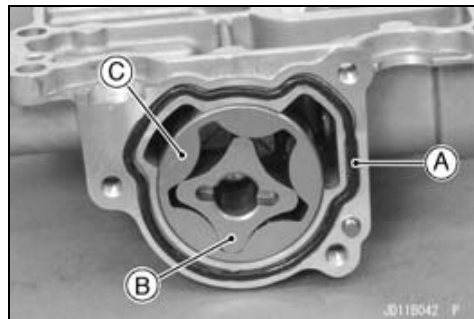
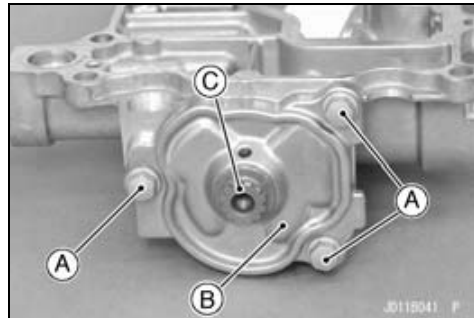
Oil Pump Removal (JT1500-A1 ~ AB Models)

- Drain:
Engine Oil (see Periodic Maintenance chapter)
- Remove:
Engine (see Engine Removal/Installation chapter)
Oil Pan (see Oil Pan Removal)
Oil Pump Sprocket (see Oil Pump Sprocket Removal)
Oil Pump Cover Bolts [A]
- Pull out the oil pump cover [B].
- Pull out the oil pump shaft [A] with inner rotor [B].
- Remove the outer rotor [C].



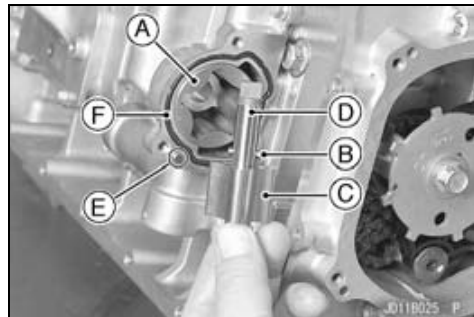
Oil Pump Removal (JT1500AC Model)

- Drain:
Engine Oil (see Engine Oil Change in the Periodic Maintenance chapter)
- Remove:
Engine (see Engine Removal in the Engine Removal/Installation chapter)
Oil Pan (see Oil Pan Removal)
Oil Pump Body (see Oil Pump Sprocket Removal)
Oil Pump Cover Bolts [A]
- Pull out the oil pump cover [B] and oil pump shaft [C].
- Remove:
O-ring [A]
Inner Rotor [B]
Outer Rotor [C]



Oil Pump Installation (JT1500-A1 ~ AB Models)

- Apply molybdenum disulfide oil solution to the outer and the inner rotors out side.
- Install the outer rotor [A] into the oil pump body.
- Apply molybdenum disulfide oil solution to the shaft.
- Assemble the pin [B], inner rotor [C] onto the oil pump shaft [D].
- Fit the pin into the slot of the inner rotor.
- Insert the shaft assembly.
- Be sure the dowel pin [E] is in place in the pump body.
- Fit the new O-ring [F] to the groove of the pump body.
- Fit the oil pump cover and tighten the cover bolts.



Torque - Oil Pump Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

- Install:
 - Oil Pump Sprocket (see Oil Pump Sprocket Installation)
 - Oil Pan (see Oil Pan Installation)

Oil Pump Installation (JT1500AC Model)

- Replace the O-ring with a new one.
- Apply molybdenum disulfide oil solution to the outer and the inner rotors out side.
- Install the outer rotor [A] and inner rotor [B] into the oil pump body.
- Apply molybdenum disulfide oil solution to the shaft.
- Assemble the oil pump cover [C], pin [D] onto the oil pump shaft [E].
- Fit the pin into the slot of the inner rotor.
- Insert the shaft assembly.
- Be sure the dowel pin [F] is in place in the oil pump body.
- Apply grease to the new O-ring [G] and fit the O-ring to the groove of the oil pump body.
- Fit the oil pump cover and tighten the oil pump cover bolts.

Torque - Oil Pump Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install:
 - Oil Pump Sprocket (see Oil Pump Sprocket Installation)
 - Oil Pan (see Oil Pan Installation)

Oil Pump Inspection

- Remove the oil pump parts.
- Visually inspect the oil pump outer, inner rotors and cover.
- ★ If there is any damage or uneven wear, replace the rotors and cover.

Oil Screen Removal

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Oil Pan (see Oil Pan Removal)
 - Oil Screen Bolts [A]
- Pull out the oil screen [B] to the coupling side.

Oil Screen Installation

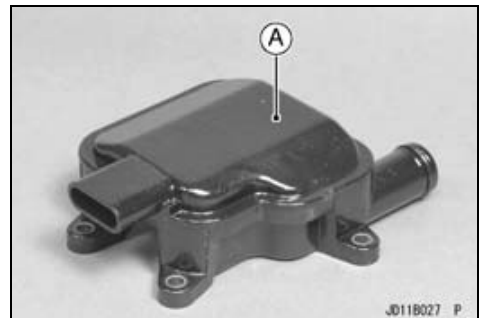
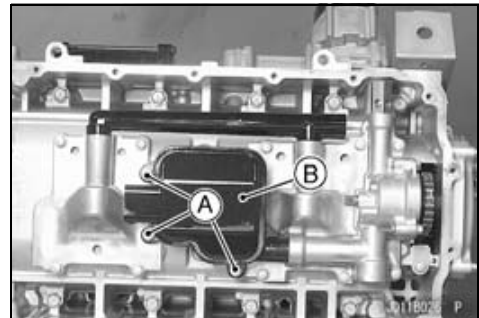
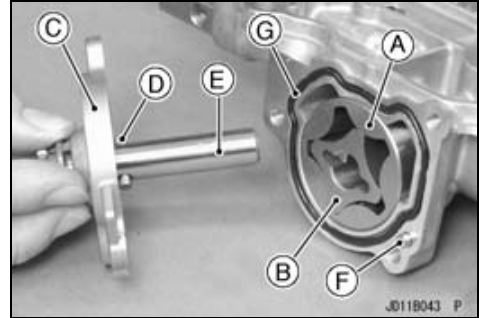
- Clean the oil screen [A] with high-flash point solvent and remove any particles stuck to it.

⚠ WARNING

Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the screen in a well-ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or a low-flash point solvent to clean the screen.

NOTE

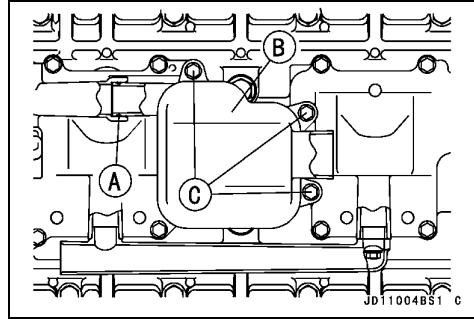
- While cleaning the screen, check for any metal particles that might indicate internal engine damage.



4-24 ENGINE LUBRICATION SYSTEM

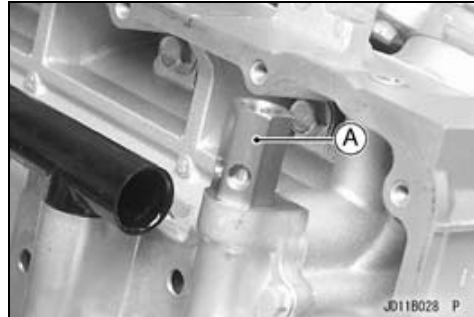
Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

- Apply grease to the O-ring [A].
- Install the oil screen [B].
- Tighten:
Torque - Oil Screen Bolts [C]: 7.8 N·m (0.80 kgf·m, 69 in·lb)
- Install:
Oil Pan (see Oil Pan Installation)



Oil Pressure Relief Valve Inspection

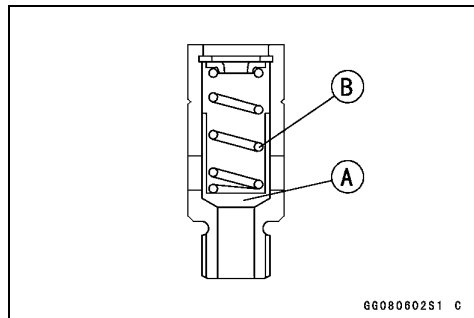
- Remove:
Oil Pan (see Oil Pan Removal)
Relief Valve [A]
- Check to see if the valve [A] slides smoothly when pushing it in with a wooden or other soft rod, and see if it comes back to its seat by spring [B] force.



NOTE

○Inspect the valve in its assembled state. Disassembly and assembly may change the valve performance.

- ★If any rough spots are found during above inspection, wash the valve clean with a high-flash point solvent and blow out any foreign particles that may be in the valve with compressed air.



⚠ WARNING

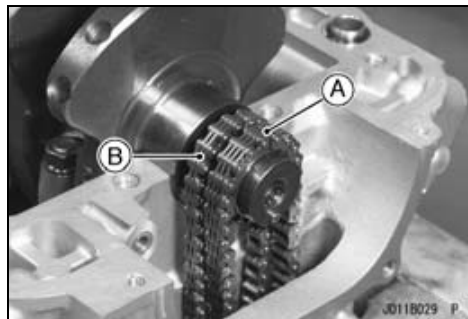
Gasoline and low-flash point solvents can be flammable and/or explosive and cause severe burns. Clean the relief valve in a well-ventilated area, and take care that there is no spark or flame anywhere near the working areas. Do not use gasoline or low-flash point solvents to clean the relief valve.

- ★If cleaning does not solve the problem, replace the relief valve as an assembly. The relief valve is precisely made with no allowance for replacement of individual parts.
 - Apply a non-permanent locking agent to the relief valve.
 - Install the relief valve and tighten it.
- Torque - Oil Pressure Relief Valve: 15 N·m (1.5 kgf·m, 11 ft·lb)

Oil Pump Sprocket, Oil Pump and Oil Pressure Relief Valve

Oil Pump Sprocket Chain Removal

- Split the crankcase (see Engine Bottom End chapter).
- Remove the camshaft chain [A] and the oil pump sprocket chain [B].

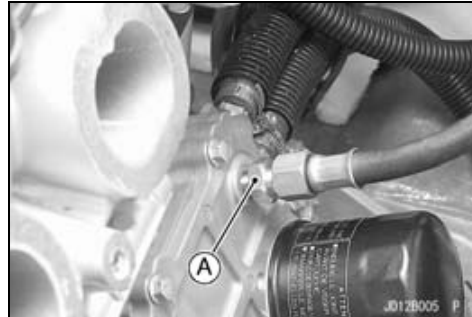
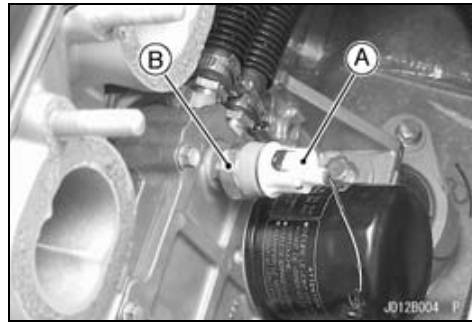


4-26 ENGINE LUBRICATION SYSTEM

Oil Pressure Measurement

Oil Pressure Measurement

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
 - Oil Pressure Switch Connector [A] (disconnect)
 - Oil Pressure Switch [B]
 - Install the oil pressure gauge adapter [A] to the switch hole.
Special Tool - Oil Pressure Gauge Adapter, PT 1/8: 57001-1033
 - Install the oil pressure gauge [A] to the adapter.
Special Tool - Oil Pressure Gauge, 10 kgf/cm²: 57001-164
 - Out off a rag or cloth.
 - Install:
 - Inlet Manifold (see Fuel System (DFI) chapter)
 - Launch the watercraft.
 - Start the engine for several minutes.
 - Run the engine at the specified speed, and read the oil pressure gauge.
 - ★ If the oil pressure is significantly below the specification, inspect the oil pump and relief valve.
 - ★ If the oil pump and relief valve are not at fault, inspect the rest of the lubrication system.
- Oil Pressure**
Standard: 461 kPa (4.7 kgf/cm², 67 psi) @3 000 r/min (rpm), oil temperature 74°C (165°F)
- Stop the engine.
 - Raise the watercraft to the land.
 - Remove:
 - Inlet Manifold
 - Oil Pressure Gauge and Adapter



Oil Pressure Measurement

WARNING

Hot oil can cause severe burns. Beware of hot engine oil that will drain through the oil passage when the gauge adapter is removed.

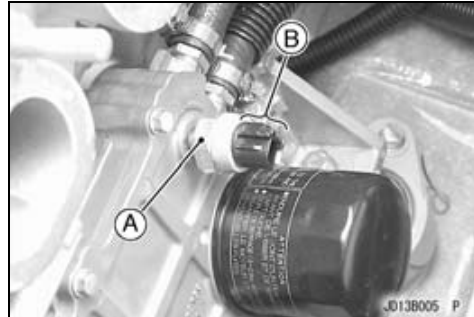
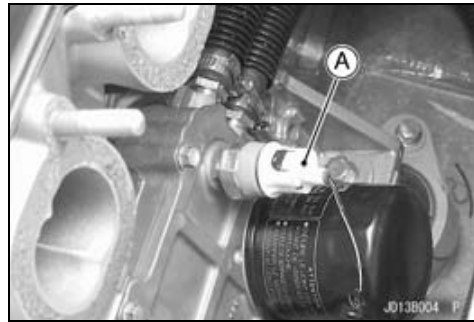
- Install:
 - Oil Pressure Switch (see Oil Pressure Switch Installation)
 - Inlet Manifold

4-28 ENGINE LUBRICATION SYSTEM

Oil Pressure Switch

Oil Pressure Switch Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
 - Disconnect:
 - Switch Connector [A]
-
- Place a rag or cloth under the oil pressure switch [A] and remove the oil pressure switch.
 - Do not damage the connect part [B] of the switch.



Oil Pressure Switch Installation

- Apply silicone sealant to the threads of the oil pressure switch and tighten it.
- Sealant - Liquid Gasket, TB1211: 56019-120**
- Torque - Oil Pressure Switch: 15 N·m (1.5 kgf·m, 11 ft·lb)**
- Connect the switch connector.
 - Install the removed parts.

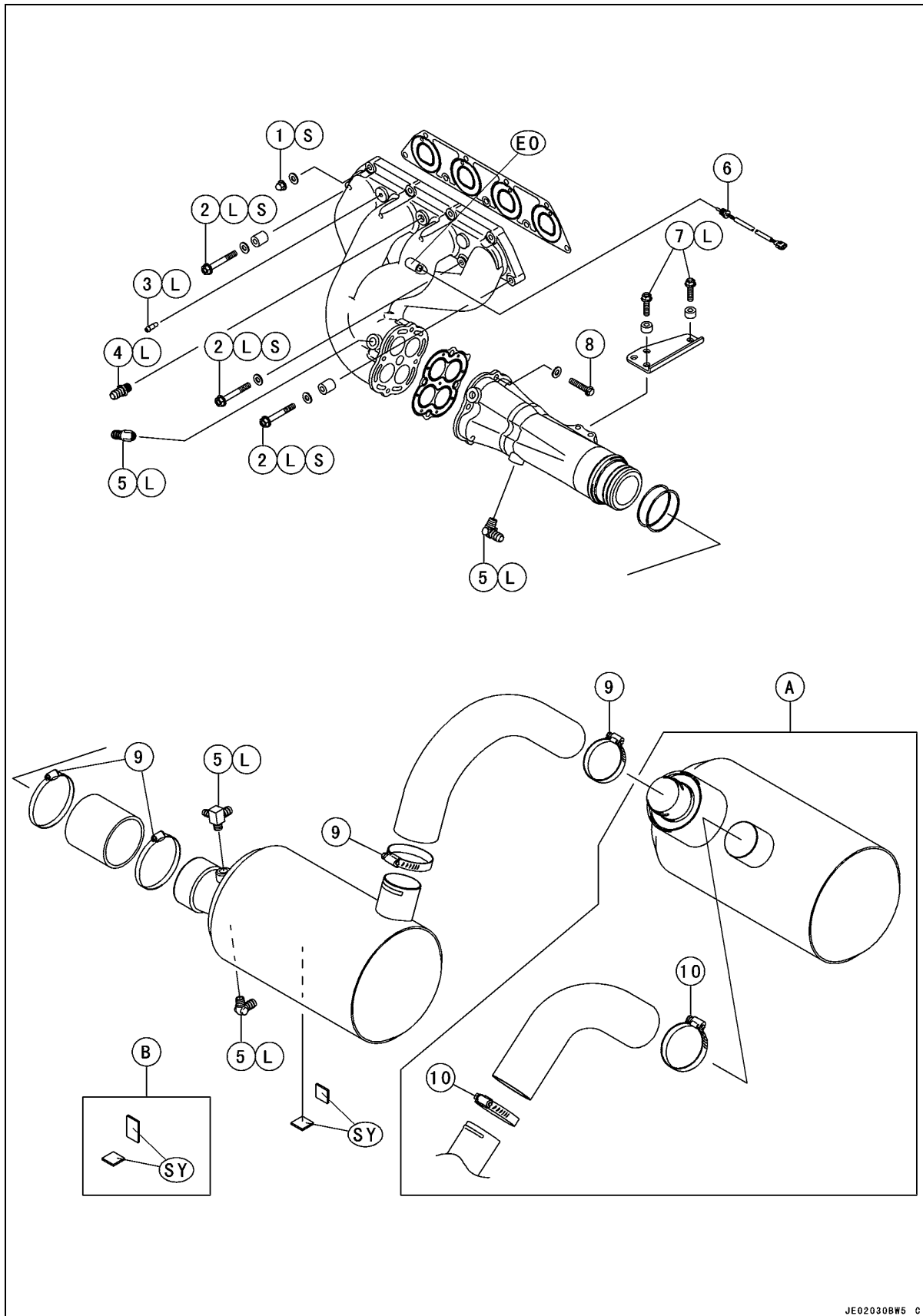
Exhaust System

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5-2 EXHAUST SYSTEM

Exploded View



JE02030BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Manifold Mounting Nuts	25	2.5	18	S
2	Exhaust Manifold Mounting Bolts	25	2.5	18	L, S
3	Bypass Nozzle	—	—	—	L
4	Flushing Hose Joint	11	1.1	95 in·lb	L
5	Water Hose Joint	11	1.1	95 in·lb	L
6	Water Temperature Sensor	15	1.5	11	see chapter 3
7	Exhaust Pipe Mounting Plate Bolts	29	3.0	22	L
8	Exhaust Pipe Mounting Bolts	29	3.0	22	
9	Exhaust Tube Clamp Screws (JT1500A8 ~)	5.0	0.51	44 in·lb	
10	Exhaust Tube Clamp Screws (JT1500A8)	5.0	0.51	44 in·lb	

A: JT1500-A1 ~ A8 Models

B: JT1500-A1 ~ AA Models

EO: Fill the hollow with the engine oil (10W-30).

L: Apply a non-permanent locking agent.

S: Follow the specific tightening sequence.

SY: Apply synthetic rubber adhesive.

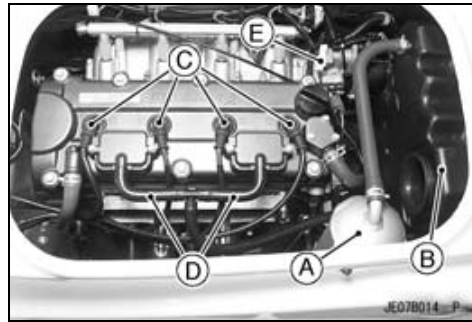
5-4 EXHAUST SYSTEM

Exhaust Manifold

Exhaust Manifold Removal

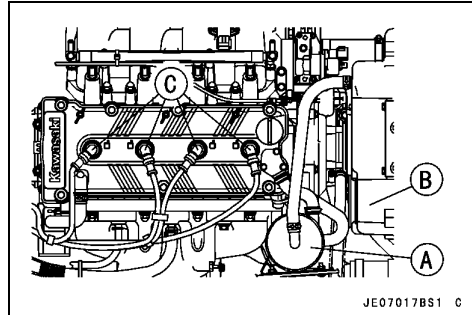
JT1500-A1 ~ A8 Models

- Remove:
 - Oil Separator Tank [A] with the Oil Separator Hoses (see Engine Lubrication System chapter)
 - Air Filter [B] (see Fuel System chapter)
- Disconnect:
 - Spark Plug Caps [C] (see Periodic Maintenance chapter)
 - Hoses [D]
 - Water Temperature Sensor Connector [E]

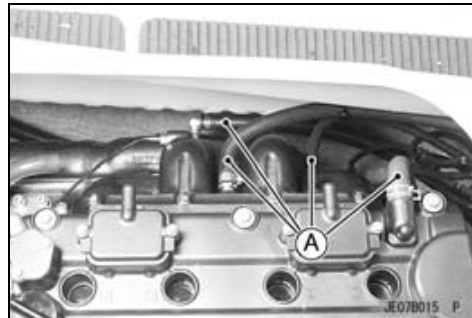


JT1500A9 Model ~

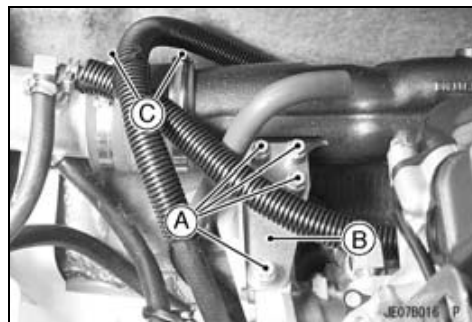
- Remove:
 - Oil Separator Tank [A] with the Oil Separator Hoses (see Engine Lubrication System chapter)
 - Air Filter [B] (see Fuel System chapter)
- Disconnect:
 - Spark Plug Caps [C] (see Periodic Maintenance chapter)
 - Water Temperature Sensor Connector



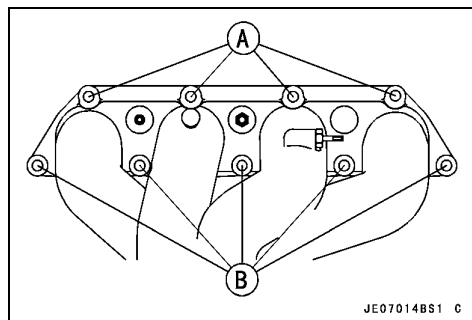
- Disconnect:
 - Hoses [A]



- Remove:
 - Bolts [A] and Collars
 - Exhaust Pipe Mounting Plate [B]
- Loosen:
 - Joint Tube Clamp Screws [C]

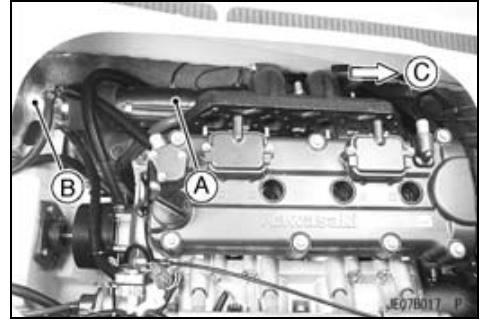


- Remove the exhaust manifold mounting nuts [A] and bolts [B].
- Remove the exhaust manifold from the engine.

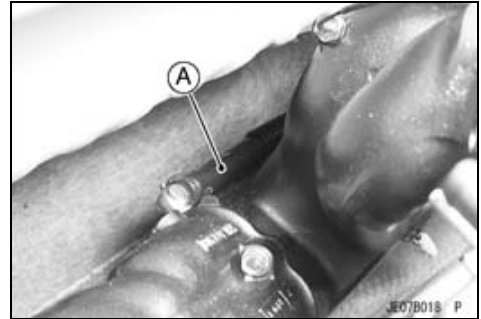


Exhaust Manifold

- Disconnect the exhaust pipe [A] from the left water box muffler [B] by pulling the exhaust manifold with the exhaust pipe toward the front [C].



- Take out the exhaust manifold with the exhaust pipe from the hull.
- Disconnect the hose [A] from the exhaust pipe.

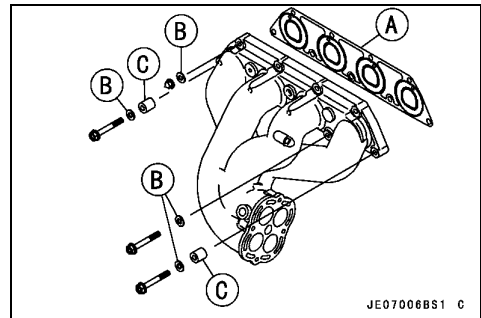


Exhaust Manifold Installation

NOTE

○ Unhook the rubber strap and remove the front exhaust tube from the water box muffler for easier installation of the exhaust manifold, and after connecting the water box muffler to the exhaust pipe, hook the rubber strap and install the tube.

- Replace the exhaust manifold gasket [A] with a new one.
- Install the exhaust manifold and the washers [B] and collars [C] as shown.
- Apply a non-permanent locking agent to the exhaust manifold mounting bolts.



- Tighten the exhaust manifold mounting nuts and bolts following the specified tightening sequence.

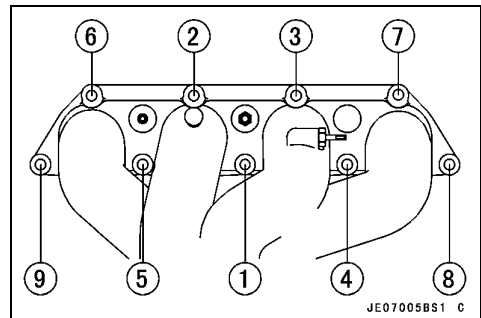
Torque - Exhaust Manifold Mounting Nuts: 25 N·m (2.5 kgf·m, 18 ft·lb)

Exhaust Manifold Mounting Bolts: 25 N·m (2.5 kgf·m, 18 ft·lb)

- Apply a non-permanent locking agent to the exhaust pipe mounting plate bolts and install the collars.
- Tighten:

Torque - Exhaust Pipe Mounting Plate Bolts: 29 N·m (3.0 kgf·m, 22 ft·lb)

- Connect the water box muffler to the exhaust pipe after binding the two rings with the paper tape (see Exhaust Pipe Installation).



5-6 EXHAUST SYSTEM

Exhaust Manifold

- ★ If the water temperature sensor is removed, see water temperature sensor removal/installation in Fuel System chapter.
- Check the hose routing and clamp screw position (see Cable, Wire and Hose Routing in Appendix chapter).

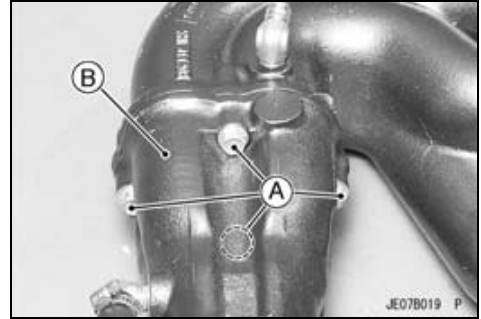
Exhaust Manifold Cleaning and Inspection

- Remove the exhaust manifold parts.
- Clean the carbon deposits out of the exhaust passages with a blunt, rounded tool.
- Flush foreign matter out of the water passages with fresh water.
- Check the insides of the water passages for corrosion. Check the gasket surfaces for nicks or other damage.
- ★ If there is excessive corrosion or if the gasket surfaces are so badly damaged that they will not seal properly, replace the part.

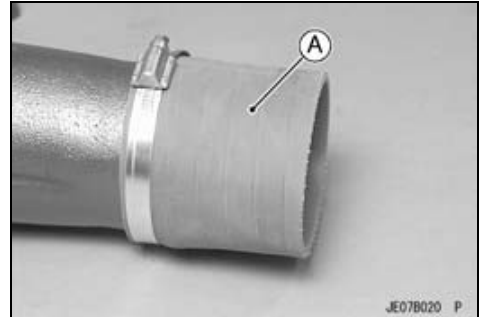
Exhaust Pipe

Exhaust Pipe Removal

- Remove:
 - Exhaust Manifold with Exhaust Pipe (see Exhaust Manifold Removal)
 - Exhaust Pipe Mounting Bolts [A]
 - Exhaust Pipe [B]

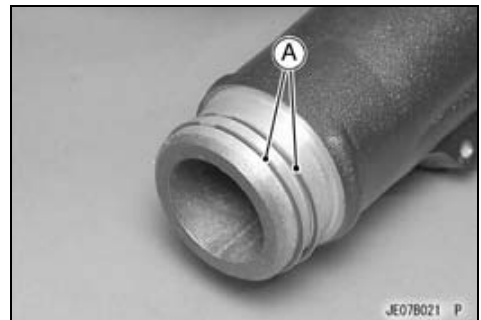


- Remove the joint tube [A] and the two rings.

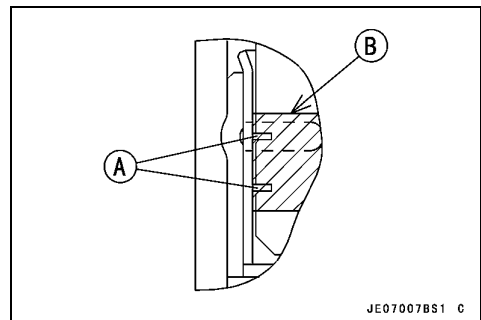


Exhaust Pipe Installation

- Install the two rings [A] in the ring grooves of the exhaust pipe.
- ★ If the two rings are damaged or warped, replace the rings.



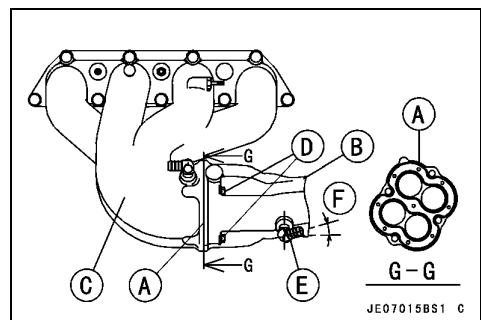
- Bind the two rings [A] securely by putting the paper tape [B] around the rings so that it is easy to insert the water box muffler into the exhaust pipe. The paper tape can be burned out soon after firing.
- Install the joint tube to the exhaust pipe.



- Replace the exhaust pipe gasket [A] with a new one as shown.
- Install the exhaust pipe [B] to the exhaust manifold [C] and tighten the bolts [D].

Torque - Exhaust Pipe Mounting Bolts: 30 N·m (3.0 kgf·m, 22 ft·lb)

[E] Water Hose Joint
[F] 30°



5-8 EXHAUST SYSTEM

Exhaust Pipe

Exhaust Pipe Cleaning and Inspection

- Remove the exhaust pipe parts.
- Clean the carbon deposits out of the exhaust passages with a blunt, rounded tool.
- Flush foreign matter out of the water passages with fresh water.
- Check the insides of the water passage for corrosion.
- Check the gasket surface for nicks or other damage.
- ★ If there is excessive corrosion or if the gasket surfaces are so badly damaged that they will not seal properly, replace the part.

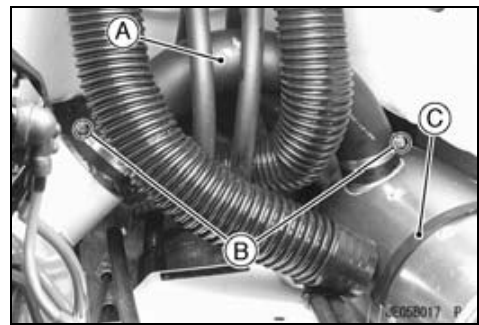
Water Box Muffler

Water Box Muffler Removal

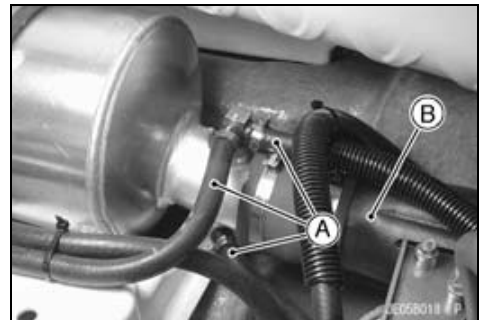
NOTE

○ JT1500-A1 ~ A8 Models have the water box mufflers located at left and right, however JT1500A9 Model ~ has it only left side.

- Remove:
 - Rear Storage Pocket
 - Oil Separator Tank with Oil Separator Hoses (see the Lubrication System chapter)
 - Air Filter (see the Fuel System chapter)
- Loosen:
 - Joint Tube Clamp Screw (see Exhaust Manifold Removal)
- Remove the front exhaust tube [A] by loosening the clamp screws [B].
- Unhook the rubber strap [C] from the left water box muffler.



- Remove:
 - Hoses [A]
 - Exhaust Manifold [B] (see Exhaust Manifold Removal)



- Remove the left water box muffler by pulling it to the rear.

NOTE

○ When removing the left water box muffler, remove the water box muffler [A] from the deck with turning it with the welding spot [B] and rivets [C].

○ Only left side water box muffler should be removed or inspected.

- Remove the joint tube from the exhaust pipe.

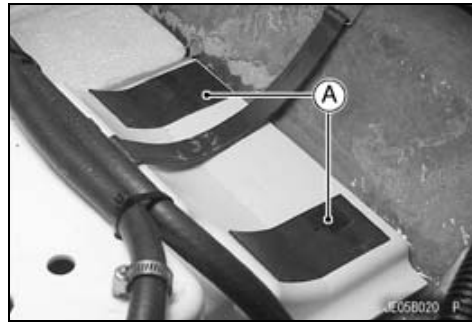


5-10 EXHAUST SYSTEM

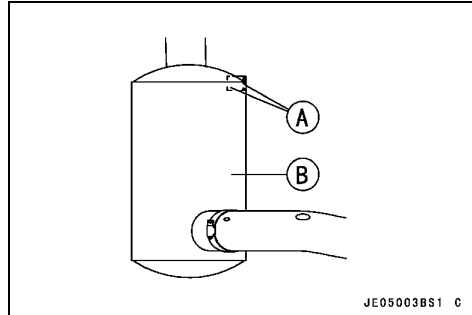
Water Box Muffler

Water Box Muffler Installation

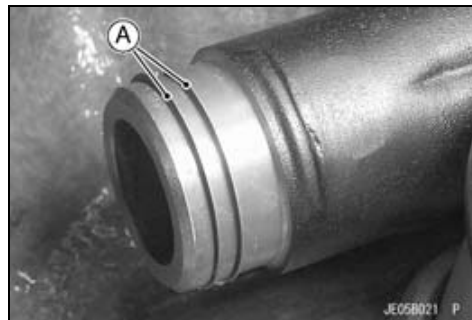
- Be sure the dampers [A] on the hull bottom and muffler body are in place.



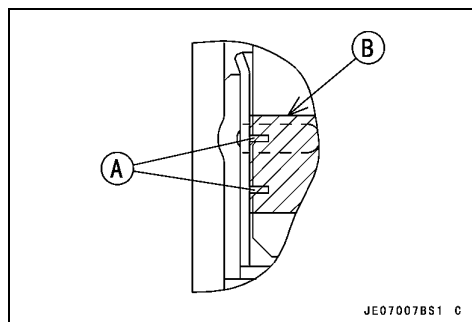
- Be sure the dampers [A] on the left side water box muffler [B] are in place.



- Make sure the two rings [A] are installed to the correct position.
- ★ If the rings are damaged or warped, replace the rings with new ones.



- Bind the two rings [A] by putting the paper tape [B] around the rings. The paper tape can be burned out soon after firing.



- Install the joint tube to the exhaust pipe.
- Install the left water box muffler to the exhaust pipe.
- Tighten the clamp securing the front exhaust tube, noting its screw position, and check the hose routing and clamp screw position (see Cable, Wire and Hose Routing in Appendix chapter).

Torque - Exhaust Tube Clamp Screws: 5.0 N·m (0.51 kgf·m, 44 in·lb)

Water Box Muffler

Water Box Muffler Inspection

- Remove the left water box muffler.
- Empty water out of the water box.
- Check the inlet spigot for damage caused by excessive heat.
- ★ If there is heat damage to the inlet spigot, check the cooling system for blockage (see Cooling System Flushing in the Periodic Maintenance chapter) and the fuel system for proper adjustment (see Fuel System chapter).

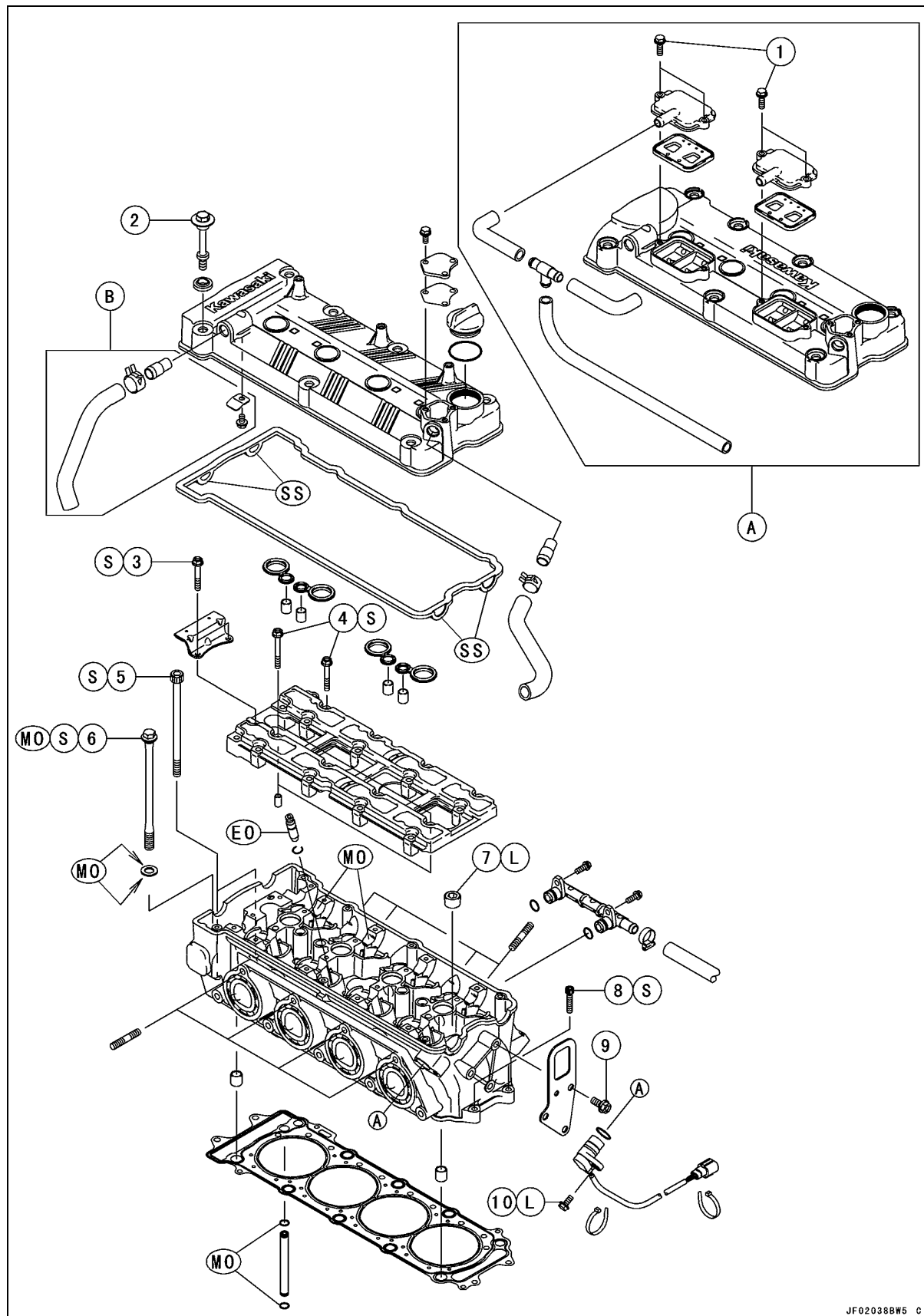
Engine Top End

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6-2 ENGINE TOP END

Exploded View



JF02038BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Air Suction Valve Cover Bolts	9.8	1.0	87 in·lb	
2	Cylinder Head Cover Bolts	9.8	1.0	87 in·lb	
3	Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
4	Camshaft Cap Bolts	12	1.2	104 in·lb	S
5	Cylinder Head Bolts ($\phi 7$)	20	2.0	14	S
6	Cylinder Head Bolts ($\phi 11$)	23	2.3	17	First, MO, S
	Cylinder Head Bolts ($\phi 11$)	59	6.0	43	Final, MO, S
7	Water Jacket Plugs	20	2.0	14	L
8	Cylinder Head Bolts ($\phi 6$)	12	1.2	104 in·lb	S
9	Engine Hook Bolts	20	2.0	14	
10	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L

A: JT1500-A1 ~ A8 Models

B: JT1500-A1 ~ AB Models

EO: Apply engine oil.

L: Apply a non-permanent locking agent.

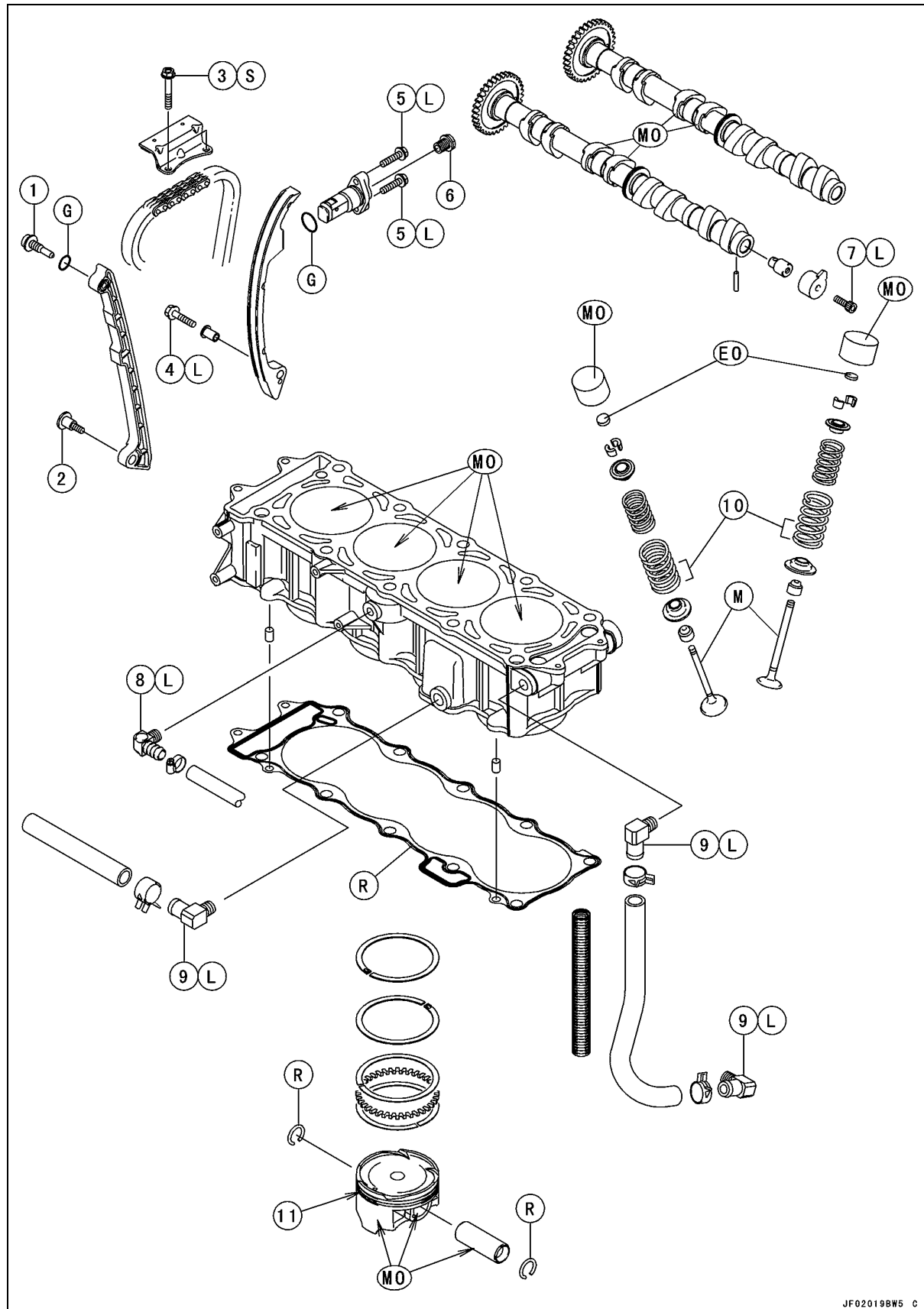
MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

S: Follow the specific tightening sequence.

SS: Apply silicone sealant.

6-4 ENGINE TOP END

Exploded View



JF02019BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Exhaust Side Camshaft Chain Guide Bolts (Upper)	25	2.5	18	
2	Exhaust Side Camshaft Chain Guide Bolts (Lower)	12	1.2	104 in·lb	
3	Upper Camshaft Chain Guide Bolts	12	1.2	104 in·lb	S
4	Inlet Side Camshaft Chain Guide Bolt	12	1.2	104 in·lb	L
5	Camshaft Chain Tensioner Mounting Bolts	9.8	1.0	87 in·lb	L
6	Camshaft Chain Tensioner Cap Bolt	20	2.0	14	
7	Camshaft Position Sensor Rotor Bolt	12	1.2	104 in·lb	L
8	Water Hose Joint	11	1.1	95 in·lb	L
9	Oil Passage Joint	11	1.1	95 in·lb	L

10. Closed coil end faces downward.

11. A marking hollow faces exhaust side.

EO: Apply engine oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

R: Replacement Parts

S: Follow the specific tightening sequence.

6-6 ENGINE TOP END

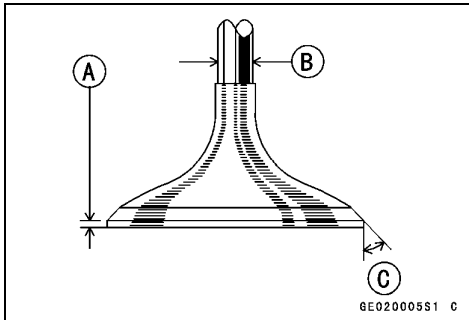
Specifications

Item	Standard	Service Limit
Camshafts		
Cam Height:		
Exhaust	36.143 ~ 36.257 mm (1.4229 ~ 1.4274 in.)	36.04 mm (1.4189 in.)
Inlet	36.440 ~ 36.554 mm (1.4346 ~ 1.4391 in.)	36.34 mm (1.431 in.)
Camshaft Journal, Camshaft Cap Clearance	0.028 ~ 0.071 mm (0.0011 ~ 0.0028 in.)	0.16 mm (0.006 in.)
Camshaft Journal Diameter	23.950 ~ 23.972 mm (0.9429 ~ 0.9438 in.)	23.92 mm (0.942 in.)
Camshaft Bearing Inside Diameter	24.000 ~ 24.021 mm (0.9449 ~ 0.9457 in.)	24.08 mm (0.948 in.)
Camshaft Runout	TIR 0.02 mm (0.0008 in.) or less	TIR 0.1 mm (0.004 in.)
Cylinder Head		
Cylinder Compression	(usable range) 1 185~ 1 795 kPa (12.1 ~ 18.3 kgf/cm ² , 172 ~ 260 psi) @430 r/min. (rpm)	— — —
Cylinder Head Warp	— — —	0.05 mm (0.002 in.)
Valves		
Valve Clearance:		
Exhaust	0.22 ~ 0.31 mm (0.0087 ~ 0.0122 in.)	— — —
Inlet	0.15 ~ 0.24 mm (0.0059 ~ 0.0094 in.)	— — —
Valve Head Thickness:		
Exhaust	0.8 mm (0.03 in.)	0.5 mm (0.02 in.)
Inlet	0.5 mm (0.02 in.)	0.25 mm (0.0098 in.)
Valve Stem Bend	TIR 0.01 mm (0.0004 in.) or less	TIR 0.05 mm (0.002 in.)
Valve Stem Diameter:		
Exhaust	4.955 ~ 4.970 mm (0.1951 ~ 0.1957 in.)	4.94 mm (0.194 in.)
Inlet	4.975 ~ 4.990 mm (0.1959 ~ 0.1965 in.)	4.96 mm (0.195 in.)
Valve Guide Inside Diameter:		
Exhaust	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.07 mm (0.200 in.)
Inlet	5.000 ~ 5.012 mm (0.1969 ~ 0.1973 in.)	5.07 mm (0.200 in.)
Valve/valve Guide Clearance (Wobble Method):		
Exhaust	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)	0.35 mm (0.014 in.)
Inlet	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)	0.29 mm (0.011 in.)
Valve Seat Cutting Angle	45°, 32°, 60°, 55°	— — —
Valve Seating Surface:		
Outside Diameter:		
Exhaust	27.6 ~ 27.8 mm (1.087 ~ 1.094 in.)	— — —
Inlet	32.6 ~ 32.8 mm (1.283 ~ 1.291 in.)	— — —
Width:		
Exhaust	0.8 ~ 1.2 mm (0.03 ~ 0.047 in.)	— — —
Inlet	0.5 ~ 1.0 mm (0.02 ~ 0.039 in.)	— — —
Valve Spring Free Length:		
Exhaust (Inner)	38.08 mm (1.499 in.)	36.7 mm (1.445 in.)
Exhaust (Outer)	45.97 mm (1.810 in.)	44.3 mm (1.744 in.)
Inlet (Inner)	37.97 mm (1.495 in.)	36.5 mm (1.437 in.)

Specifications

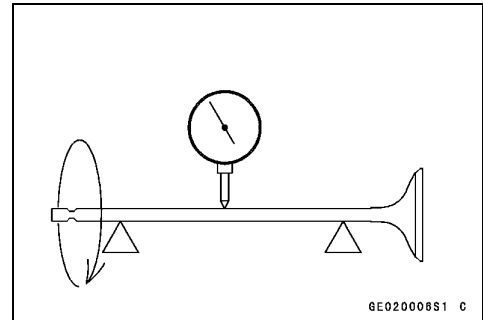
Item	Standard	Service Limit
Inlet (Outer)	45.78 mm (1.802 in.)	44.2 mm (1.740 in.)
Cylinder, Piston		
Cylinder Inside Diameter	82.994 ~ 83.006 mm (3.2675 ~ 3.2679 in.)	83.10 mm (3.272 in.)
Piston Diameter	82.919 ~ 82.934 mm (3.2645 ~ 3.2651 in.)	82.77 mm (3.259 in.)
Piston/cylinder Clearance	0.060 ~ 0.087 mm (0.0024 ~ 0.0034 in.)	— — —
Piston Ring/groove Clearance:		
Top	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)	0.17 mm (0.0067 in.)
Second	0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)	0.16 mm (0.0063 in.)
Piston Ring Groove Width:		
Top	0.92 ~ 0.94 mm (0.0362 ~ 0.0370 in.)	1.02 mm (0.0402 in.)
Second	1.01 ~ 1.03 mm (0.0398 ~ 0.0406 in.)	1.11 mm (0.0437 in.)
Piston Ring Thickness:		
Top	0.87 ~ 0.89 mm (0.0343 ~ 0.0350 in.)	0.80 mm (0.0315 in.)
Second	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)	0.90 mm (0.0354 in.)
Piston Ring End Gap:		
Top	0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in.)	0.7 mm (0.0276 in.)
Second	0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)	0.8 mm (0.0315 in.)

Valve Head Thickness



Valve Head Thickness [A]
Valve Stem Diameter [B]
45° [C]

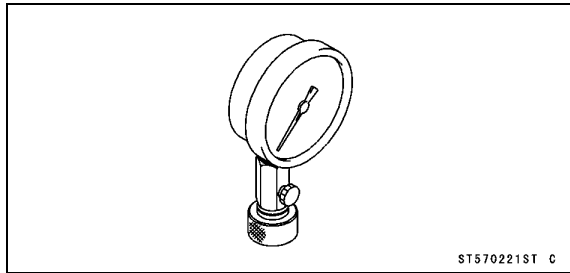
Valve Stem Bend



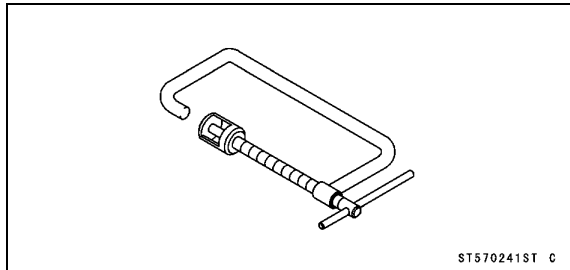
6-8 ENGINE TOP END

Special Tools and Sealant

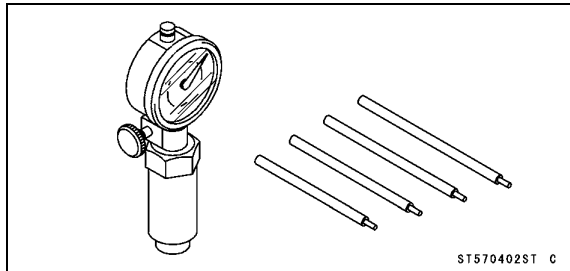
Compression Gauge, 20 kgf/cm²:
57001-221



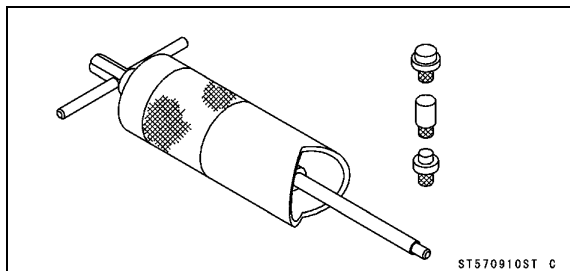
Valve Spring Compressor Assembly:
57001-241



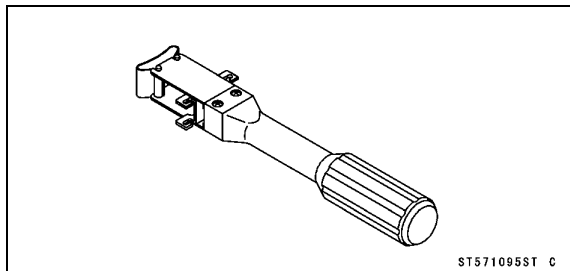
Top Dead Center Finder:
57001-402



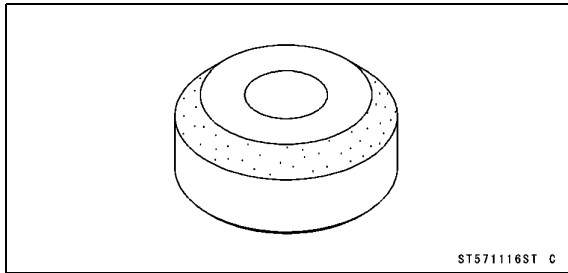
Piston Pin Puller Assembly:
57001-910



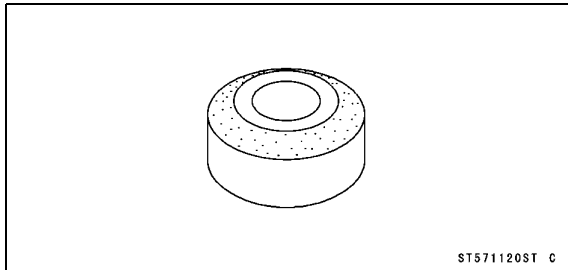
Piston Ring Compressor Grip:
57001-1095



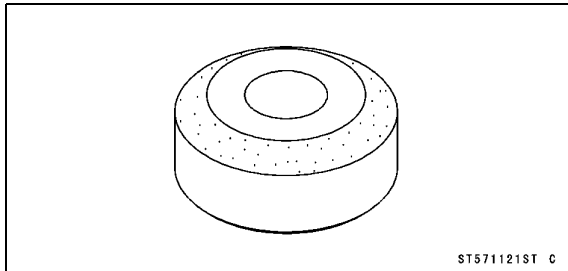
Valve Seat Cutter, 45° - ϕ 35:
57001-1116



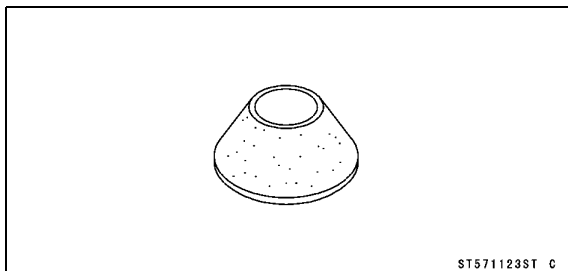
Valve Seat Cutter, 32° - ϕ 30:
57001-1120



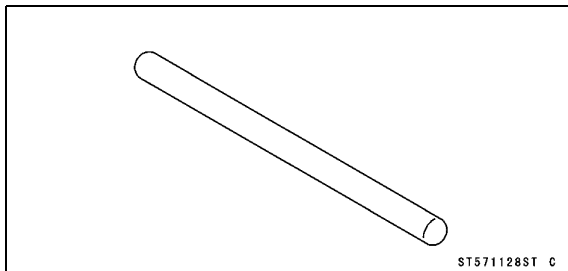
Valve Seat Cutter, 32° - ϕ 35:
57001-1121



Valve Seat Cutter, 60° - ϕ 30:
57001-1123

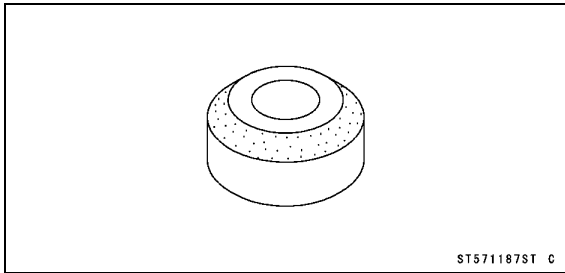


Valve Seat Cutter Holder Bar:
57001-1128

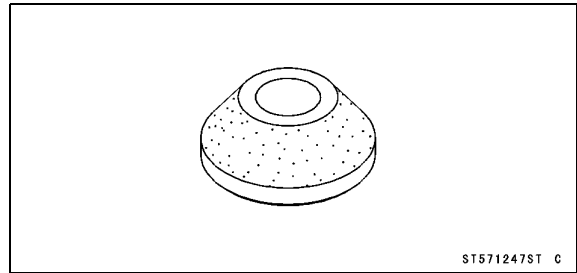


Special Tools and Sealant

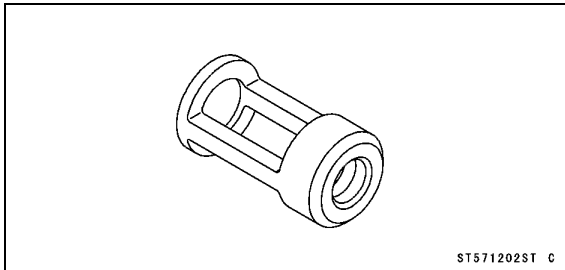
Valve Seat Cutter, 45° - $\phi 30$:
57001-1187



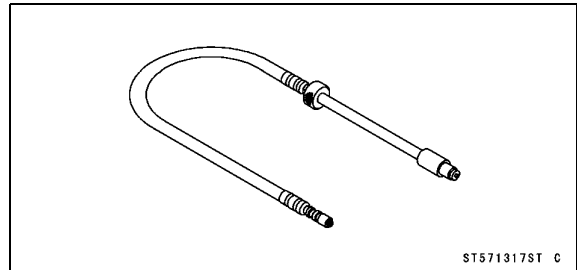
Valve Seat Cutter, 55° - $\phi 35$:
57001-1247



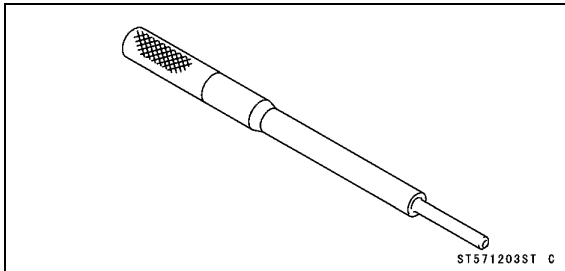
Valve Spring Compressor Adapter, $\phi 22$:
57001-1202



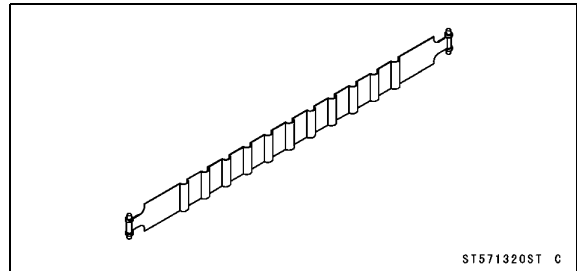
Compression Gauge Adapter, M10 × 1.0:
57001-1317



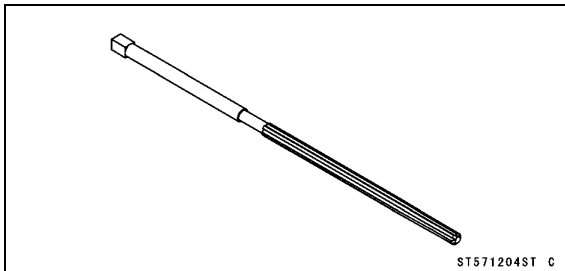
Valve Guide Arbor, $\phi 5$:
57001-1203



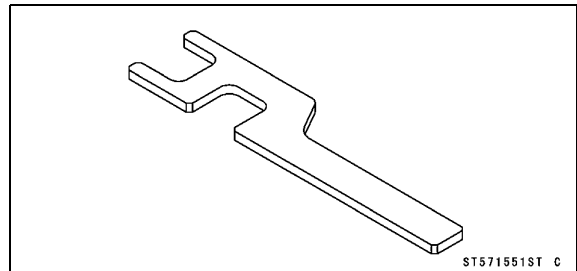
Piston Ring Compressor Belt, $\phi 80 \sim \phi 91$:
57001-1320



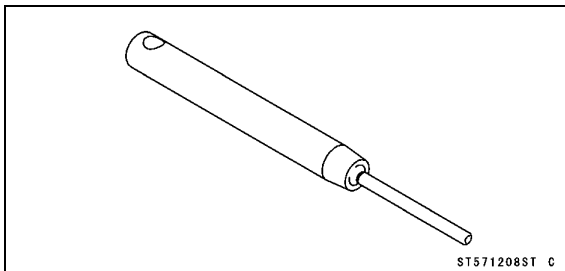
Valve Guide Reamer, $\phi 5$:
57001-1204



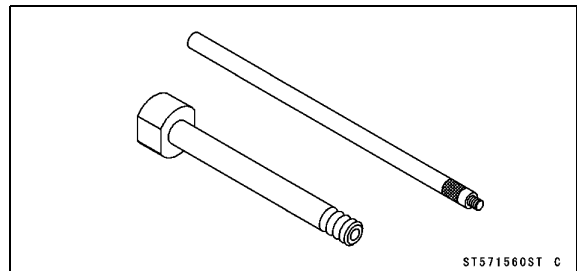
Shaft Wrench:
57001-1551



Valve Seat Cutter Holder, $\phi 5$:
57001-1208



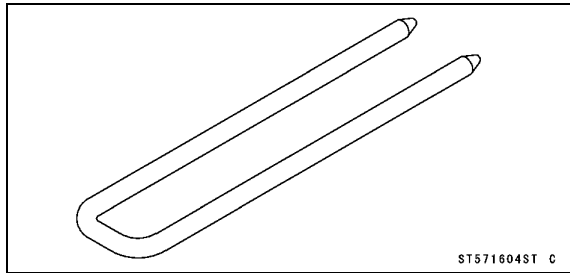
TDC Measurement Tool:
57001-1560



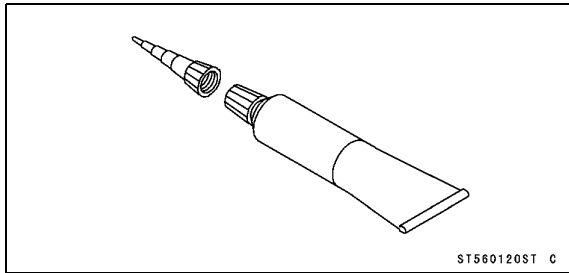
6-10 ENGINE TOP END

Special Tools and Sealant

Piston Base, $\phi 8$:
57001-1604



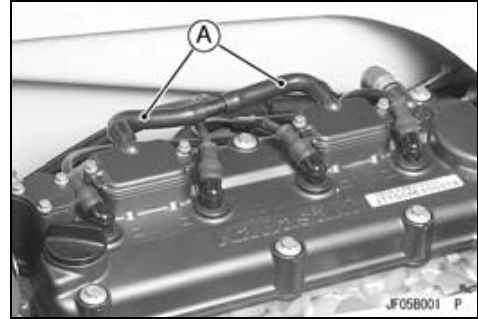
Liquid Gasket, TB1211:
56019-120



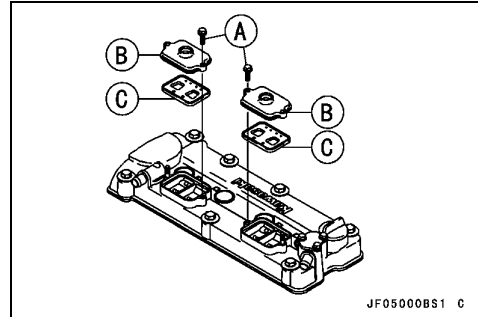
Clean Air System

Air Suction Valve Removal (JT1500-A1 ~ A8 Models)

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Hoses [A]



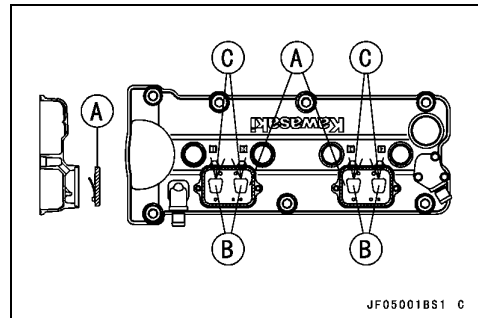
- Remove:
 - Air Suction Valve Cover Bolts [A]
 - Air Suction Valve Covers [B]
 - Air Suction Valve Assembly [C]



Air Suction Valve Installation (JT1500-A1 ~ A8 Models)

- Install the valve assembly [A] so that its reeds [B] side faces inside and its opening [C] side faces inlet side.
- Install the air suction valve covers.

Torque - Air Suction Valve Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



Air Suction Valve Check (JT1500-A1 ~ A8 Models)

- Refer to Air Suction Valve Inspection in the Periodic Maintenance chapter.

Clean Air System Hose Inspection (JT1500-A1 ~ A8 Models)

- Be certain that all the hoses are routed without being flattened or kinked, and are connected correctly to the air filter housing, throttle body and air suction valve covers.
- ★ If they are not, correct them. Replace them if they are damaged.

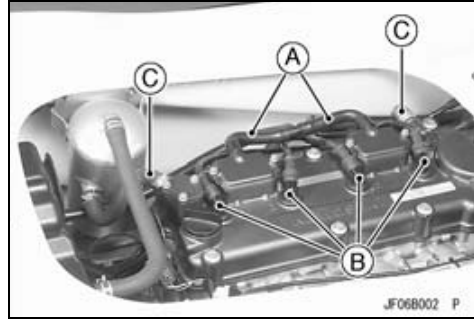
6-12 ENGINE TOP END

Cylinder Head Cover

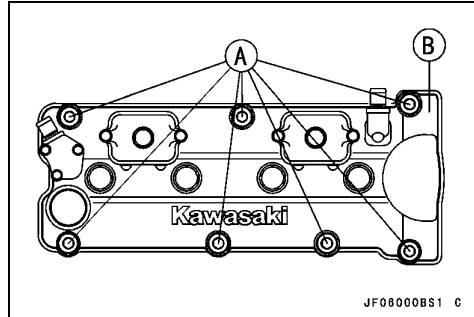
Cylinder Head Cover Removal

JT1500-A1 ~ A8 Models

- Remove:
 - Air Suction Valve Hoses [A]
 - Spark Plug Caps [B]
 - Breather Hoses [C]

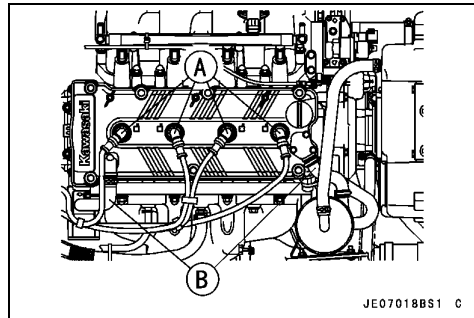


- Remove the cylinder head cover bolts [A] and take off the cover [B].

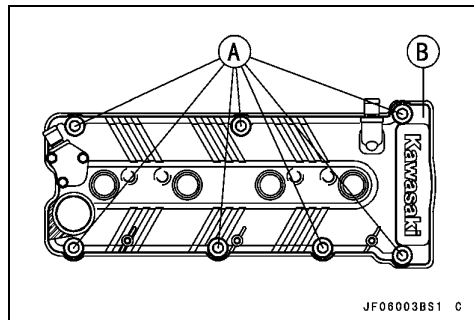


JT1500A9 Model ~

- Remove:
 - Spark Plug Caps [A]
 - Breather Hoses [B]

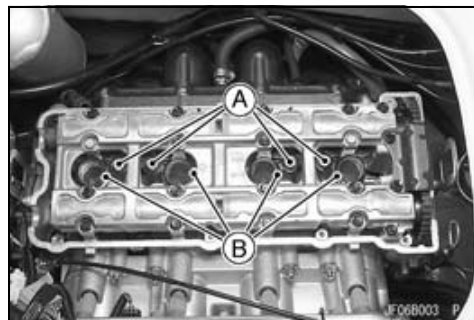


- Remove the cylinder head cover bolts [A] and take off the cover [B].



Cylinder Head Cover Installation

- Be sure to install the pins [A] and rubber gaskets [B].

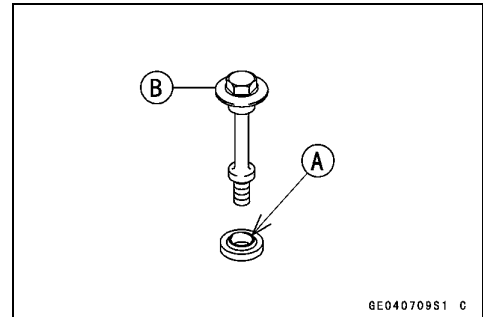
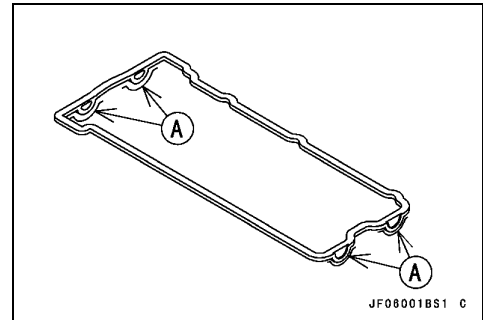


Cylinder Head Cover

- Replace the head cover gasket with a new one if damaged.
- Apply silicone sealant [A] to the cylinder head cover gasket as shown.

Sealant - Liquid Gasket, TB1211: 56019-120

- Install the washer with the metal side [A] faces upward.
- Tighten:
Torque - Cylinder Head Cover Bolts [B]: 9.8 N·m (1.0 kgf·m, 87 in·lb)
- Route the hoses correctly (see Appendix chapter).



6-14 ENGINE TOP END

Camshaft Chain Tensioner

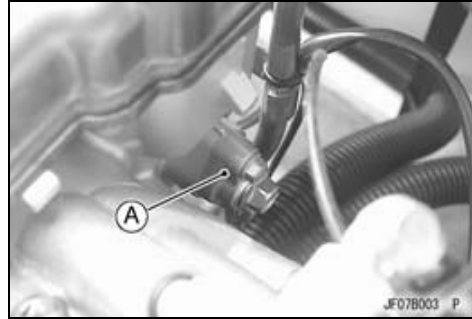
Camshaft Chain Tensioner Removal

NOTICE

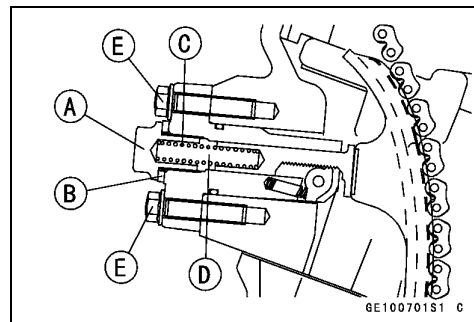
This is a non-return type camshaft chain tensioner. The push rod does not return to its original position once it moves out to take up camshaft chain slack. Observe all the rules listed below.

The camshaft chain tensioner can be damaged if not removed and reset, causing severe engine damage. To prevent damaging the cam chain tensioner, do not loosen the mounting bolts only halfway. Retightening the mounting bolts from this position could damage the tensioner and the camshaft chain. Once the bolts are loosened, the tensioner must be removed and reset as described in "Camshaft Chain Tensioner installation".

Turning the crankshaft while the cam chain tensioner is removed can upset the timing and damage the valves. Do not turn the crankshaft when the tensioner is removed.

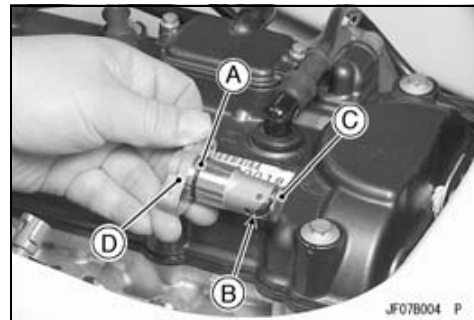


- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Cap Bolt [A]
 - Washer [B]
 - Spring [C]
 - Rod [D]
- Remove the mounting bolts [E] and take off the camshaft chain tensioner.



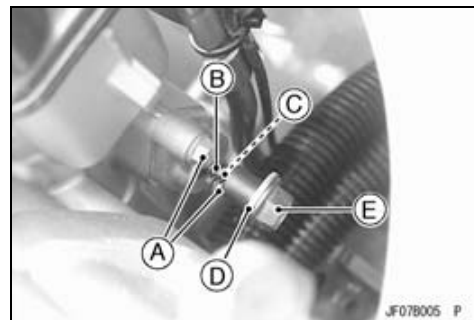
Camshaft Chain Tensioner Installation

- Apply grease to the O-ring [A].
- Release the stopper [B] and push the push rod [C] into the tensioner body [D] fully.
- Install the tensioner body so that the stopper faces downward.



- Apply a non-permanent locking agent to the tensioner mounting bolts [A].
- Tighten the tensioner mounting bolts.
 - Torque - Camshaft Chain Tensioner Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- Install the spring [B], rod [C] and washer [D].
- Tighten the cap bolt [E].

Torque - Camshaft Chain Tensioner Cap Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)



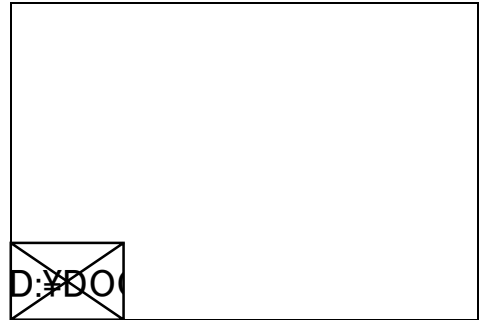
Camshaft, Camshaft Chain

Camshaft Removal

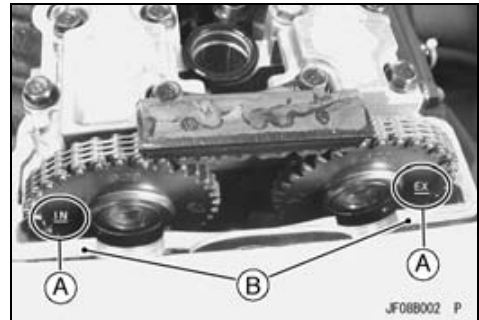
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Spark Plugs (see Electrical System in the Periodic Maintenance chapter)
 - Cylinder Head Cover (see Cylinder Head Cover Removal)
 - Air Filter (see Fuel System (DFI) chapter)
- Position the crankshaft at #1, #4 piston TDC as follows.

- Using the shaft wrench [A], turn the crankshaft counter-clockwise [B] and set the crankshaft at #1, 4 piston TDC.

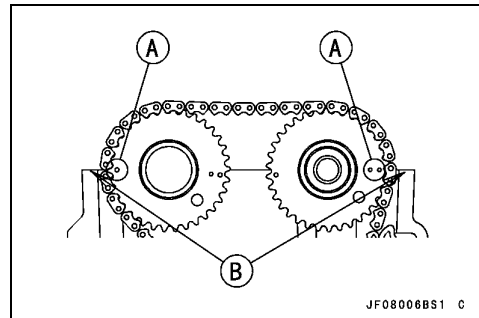
Special Tool - Shaft Wrench: 57001-1551



- The timing marks [A] must be aligned with the cylinder head upper surface [B] as shown (JT1500-A1 ~ A9 Early Models).



- The timing marks [A] must be aligned with the cylinder head upper surface [B] as shown (JT1500A9 Late Model ~).



6-16 ENGINE TOP END

Camshaft, Camshaft Chain

- Remove:
 - Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
 - Camshaft Cap Bolts [A]
 - Upper Camshaft Chain Guide [B]
 - Camshaft Cap [C]
 - Camshafts
- Stuff a clean cloth into the chain tunnel to keep any parts from dropping into the crankcase.

NOTICE

A kinked cam chain could damage both the chain and the sprocket on the crankshaft. The crankshaft can be turned while the camshafts are removed, but always pull the cam chain taut to avoid kinking the chain on the crankshaft sprocket.

Camshaft Installation

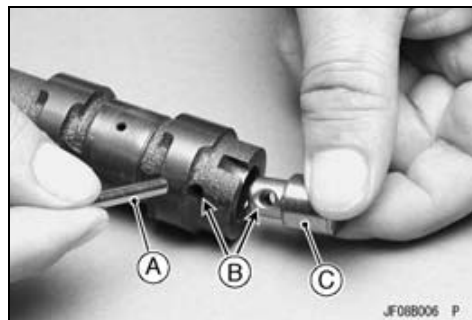
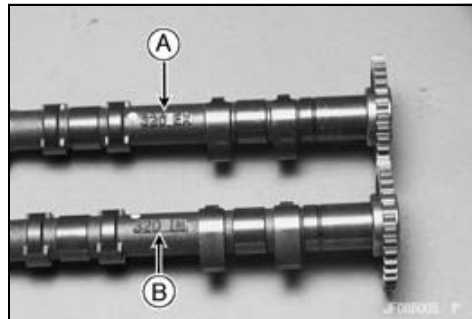
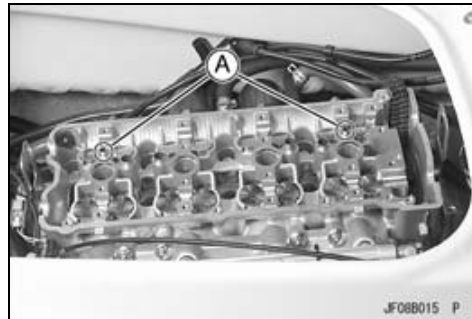
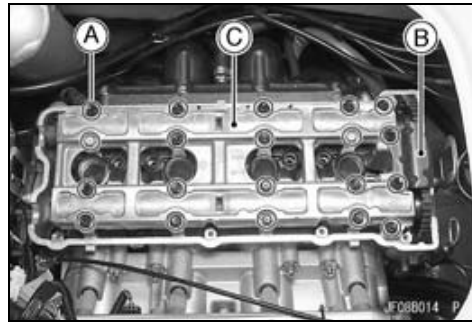
- Be sure to install the following parts.
 - Pins [A]

- Apply molybdenum disulfide oil solution to all cam parts and journals.

NOTE

○ *The exhaust camshaft has a 320 EX mark [A] and the inlet camshaft has a 320 IN mark [B]. Be careful not to mix up these shafts.*

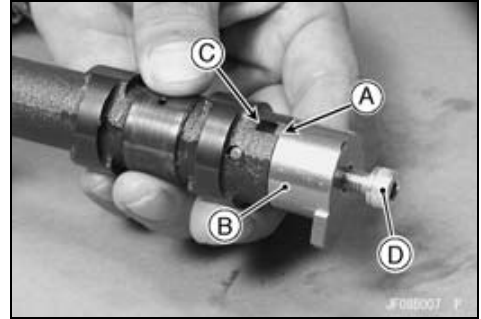
- ★ If the camshaft position sensor rotor is removed, install it as follows.
- Insert the pin [A] into the holes [B] in the camshaft and boss [C].



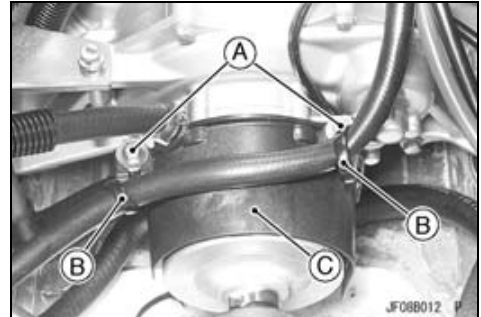
Camshaft, Camshaft Chain

- Fit the projection [A] of the rotor [B] on the camshaft recess [C].
- Apply a non-permanent locking agent to the camshaft position sensor rotor bolt [D], and tighten it.

Torque - Camshaft Position Sensor Rotor Bolt: 12 N·m (1.2 kgf·m, 104 in·lb)

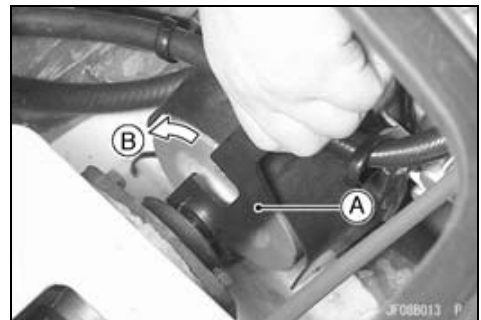


- Remove:
 - Coupling Cover Bolts [A]
 - Clamps [B]
 - Coupling Cover [C]

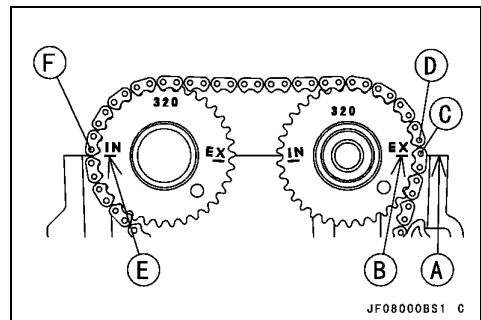


- Remove the spark plugs.
- Using the shaft wrench [A], turn the crankshaft counter-clockwise [B] and set the crankshaft at #1, 4 piston TDC (see Piston TDC Finding).

Special Tool - Shaft Wrench: 57001-1551



- Pull the tension side (exhaust side) of the chain taut to install the chain.
- Engage the camshaft chain with the camshaft sprockets so that the timing marks on the sprockets are positioned as shown.
- The timing marks must be aligned with the cylinder head upper surface [A] (JT1500-A1 ~ A9 Early Models).
 - EX mark [B]
 - #1 Pin [C]
 - #2 Pin [D]
 - IN mark [E]
 - #31 Pin [F]



6-18 ENGINE TOP END

Camshaft, Camshaft Chain

○The timing marks must be aligned with the cylinder head upper surface [A] (JT1500A9 Late Model ~).

EX mark (two punch marks) [B]

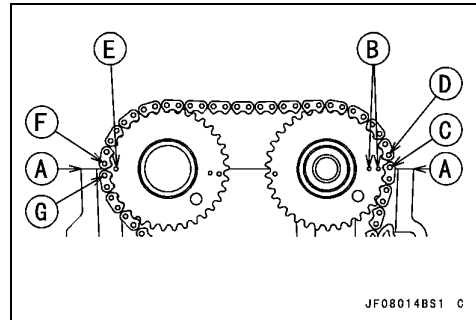
#1 Pin [C]

#2 Pin [D]

IN mark (one punch mark) [E]

#31 Pin [F]

#32 Pin [G]

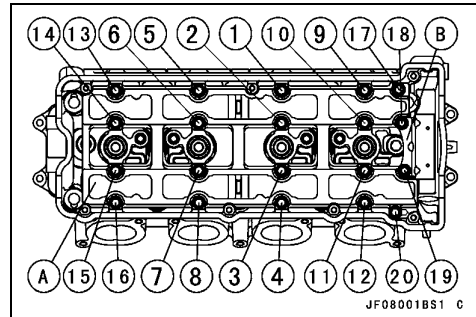


- Install the camshaft cap [A] and upper camshaft chain guide [B]. While pushing the camshaft chain, tighten all camshaft bolts and chain guide bolts.
- Install the longer (white) bolts to the #10 and #14 position shown by triangle marks.
- First tighten the all camshaft cap and chain guide bolts evenly to seat the camshaft in place, then tighten all bolts following the specified tightening sequence.

Torque - Camshaft Cap Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)

Upper Camshaft Chain Guide Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)

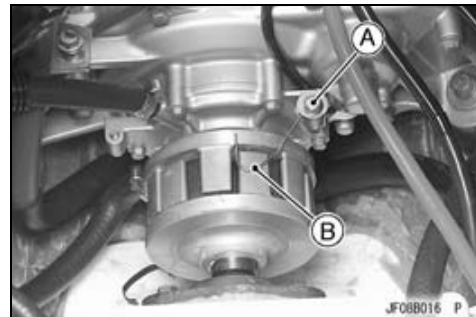
- Tighten the camshaft chain tensioner (see Camshaft Chain Tensioner installation).
- Turn the crankshaft counterclockwise two turns.
- Install the cylinder head cover (see Cylinder Head Cover installation).



Piston TDC Finding

This job can be done when the engine is on the hull and during camshaft installation.

- Prepare a suitable wire for pointer.
- Using the coupler cover bolt [A], hold the wire pointer [B].



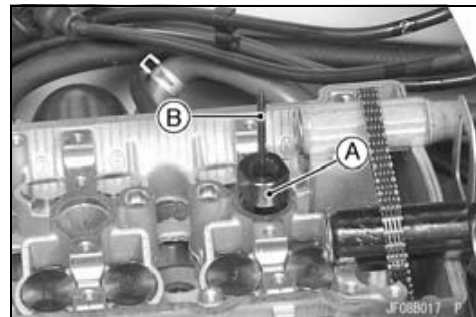
- Remove:
 - #1 Spark Plug (Front Side)
- Install the piston top detector [A] in the hole of the plug.

Special Tool - TDC Measurement Tool: 57001-1560

- Insert the gauge extender [B] into the detector.
- Using the shaft wrench, turn the crankshaft until the gauge extender reaches its highest point.

Special Tool - Shaft Wrench: 57001-1551

- Remove the extender and install it to the gauge.

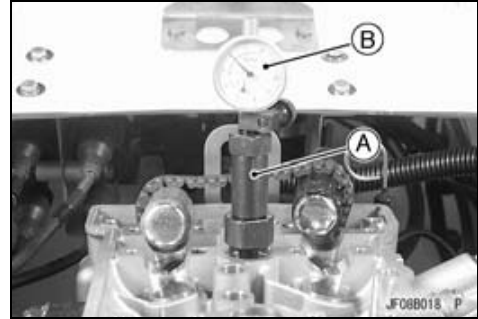


Camshaft, Camshaft Chain

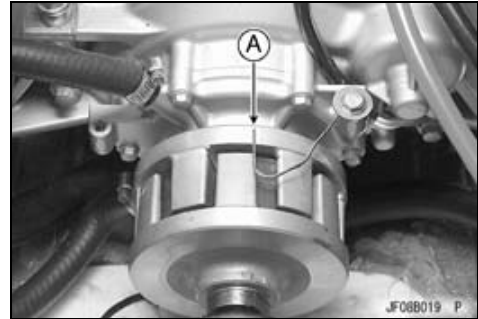
- Install the top dead center finder [A] and the gauge [B] with the extender.

Special Tool - Top Dead Center Finder: 57001-402

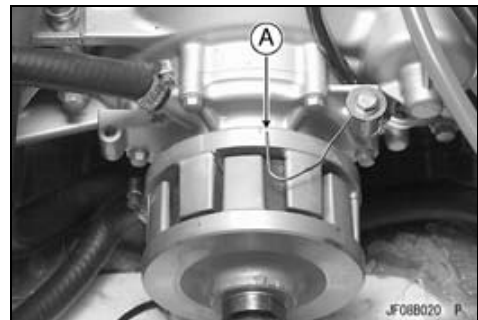
- Set the gauge at position that the needle on the gauge rotates a few turns.
- Set the gauge to read "0".



- Turn the crankshaft counterclockwise until the needle will stop fluctuating, then scribe a mark [A] on the coupling at the tip of the wire pointer.



- Turn the crankshaft clockwise until the needle will stop fluctuating, then describe a mark [A] on the coupling at the tip of the wire pointer.



- Turn the crankshaft so that the wire pointer is halfway [A] between the two described marks.
- The crankshaft is now at TDC for #1 and #4 Cylinders.



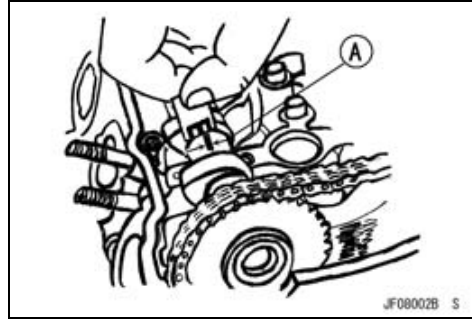
6-20 ENGINE TOP END

Camshaft, Camshaft Chain

Camshaft, Camshaft Cap Wear

- Cut strips of plastigage (press gauge) to journal width. Place a strip on each journal parallel to the camshaft installed in the correct position.
- Measure each clearance between the camshaft journal and the camshaft cap using plastigage [A].
- Tighten:

Torque - Camshaft Cap Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)
Upper Camshaft Chain Guide Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)



NOTE

○ Do not turn the camshaft when the plastigage is between the journal and camshaft cap.

Camshaft Journal, Camshaft Cap Clearance

Standard: 0.028 ~ 0.071 mm (0.0011 ~ 0.0028 in.)
Service Limit: 0.16 mm (0.006 in.)

- ★ If any clearance exceeds the service limit, measure the diameter of each camshaft journal with a micrometer.

Camshaft Journal Diameter

Standard: 23.950 ~ 23.972 mm (0.9429 ~ 0.9438 in.)
Service Limit: 23.92 mm (0.942 in.)

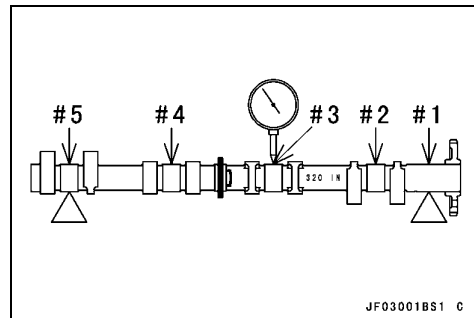
- ★ If the camshaft journal diameter is less than the service limit, replace the camshaft with a new one and measure the clearance again
- ★ If the clearance still remains out of the limit, replace the cylinder head with camshaft cap.

Camshaft Runout

- Remove the camshaft (see Camshaft Removal).
- Set the camshaft on V blocks.
- Measure runout with a dial gauge at the specified place as shown.
- ★ If the runout exceeds the service limit, replace the camshaft.

Camshaft Runout

Standard: TIR 0.02 mm (0.0008 in.) or less
Service Limit: TIR 0.1 mm (0.004 in.)

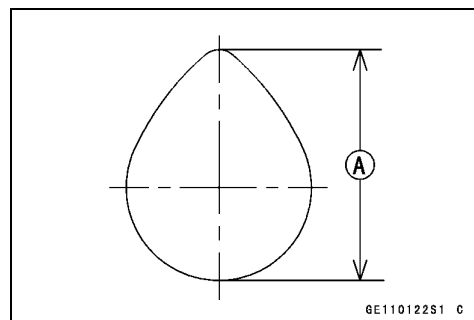


Cam Wear

- Remove the camshaft (see Camshaft Removal).
- Measure the height [A] of each cam with a micrometer.
- ★ If the cams are worn down past the service limit, replace the camshaft.

Cam Height

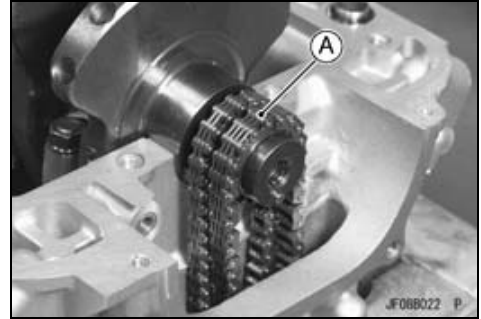
Standard:
Exhaust 36.143 ~ 36.257 mm (1.4229 ~ 1.4274 in.)
Inlet 36.440 ~ 36.554 mm (1.4346 ~ 1.4391 in.)
Service Limit:
Exhaust 36.04 mm (1.419 in.)
Inlet 36.34 mm (1.431 in.)



Camshaft, Camshaft Chain

Camshaft Chain Removal

- Split the crankcase (see Engine Bottom End chapter).
- Remove the camshaft chain [A] from the crankshaft sprocket.



6-22 ENGINE TOP END

Cylinder Head

Cylinder Compression Measurement

NOTE

○ Use the battery which is fully charged.

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

NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

- Stop the engine.
- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect both two connection on the ignition coil primary lead connectors [A].
- Remove:
Spark Plugs (see Electrical System in Periodic Maintenance chapter)
- Attach the compression gauge [A] and adapter [B] firmly into the spark plug hole.
- Using the starter motor, turn the engine with the throttle fully open until the compression gauge stops rising; the compression is the highest reading obtainable.

Special Tools - Compression Gauge, 20 kgf/cm²: 57001-221
Compression Gauge Adapter, M10 × 1.0: 57001-1317

Cylinder Compression

Usable Range: 1 185 ~ 1 795 kPa (12.1 ~ 18.3 kgf/cm², 172 ~ 260 psi) @430 r/min (rpm)

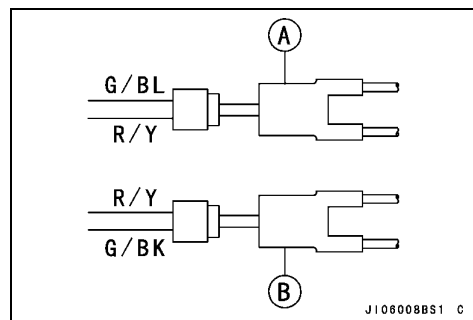
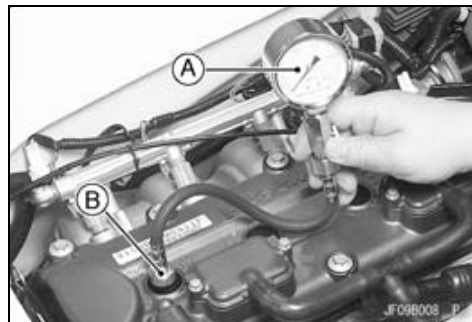
- Repeat the measurement for the other cylinders.
- Install the spark plugs (see Electrical System in Periodic Maintenance chapter).
- Tighten:

Torque - Spark Plugs: 13 N·m (1.3 kgf·m, 113 in·lb)

- Reconnect the primary ignition coil lead connectors, noting the #1, #4 [A] and the #2, #3 [B] coil connectors. the #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.

NOTE

○ The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).



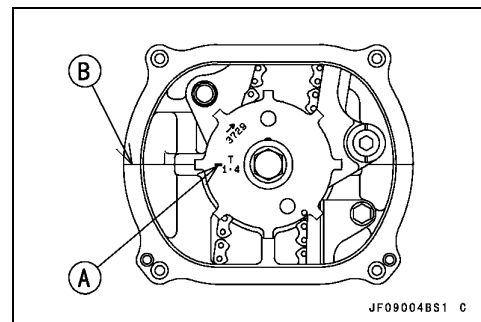
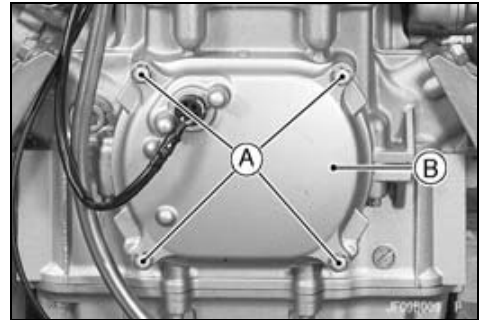
Cylinder Head

The following table should be consulted if the obtainable compression reading is not within the usable range.

Problem	Diagnosis	Remedy (Action)
Cylinder compression is higher than usable range	Carbon accumulation on piston and in combustion chamber possibly due to damaged valve stem oil seal and/or damaged piston oil rings (This may be indicated by white exhaust smoke).	Remove the carbon deposits and replace damaged parts if necessary.
	incorrect cylinder head gasket thickness.	Replace the gasket with a standard part.
Cylinder compression is lower than usable range	Gas leakage around cylinder head	Replace damaged gasket and check cylinder head warp.
	Bad condition of valve seating	Repair if necessary.
	incorrect valve clearance	Adjust the valve clearance.
	incorrect piston/cylinder clearance	Replace the piston and/or cylinder
	Piston seizure	Inspect the cylinder and replace/repair the cylinder and/or piston as necessary.
	Bad condition of piston ring and/or piston ring grooves	Replace the piston and/or the piston rings.

Cylinder Head Removal

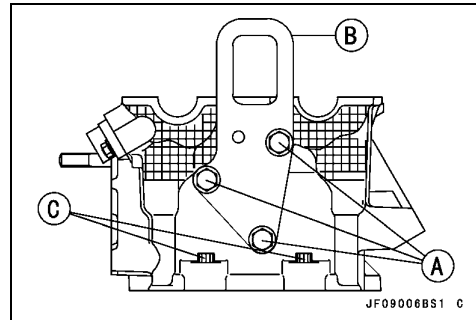
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Cylinder Head Cover (see Cylinder Head Cover Removal)
- Unscrew the crankshaft sensor cover bolts [A] and remove the crankshaft sensor cover [B].
- Drain the engine oil by one liter.
- Turn the crankshaft clockwise and set the crankshaft at #1, 4 piston TDC.
 - TDC Mark [A] for #1, 4 pistons
 - Timing Mark [B] (Crankcase halves mating surface)
- Remove:
 - Camshaft Chain Tensioner (see Camshaft Chain Tensioner Removal)
 - Camshafts (see Camshaft Removal)



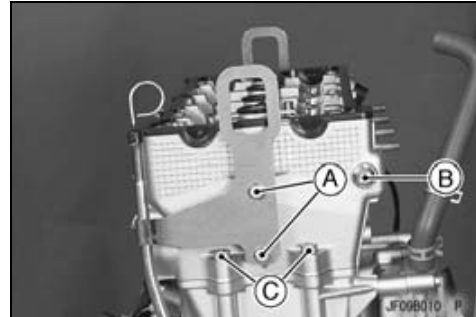
6-24 ENGINE TOP END

Cylinder Head

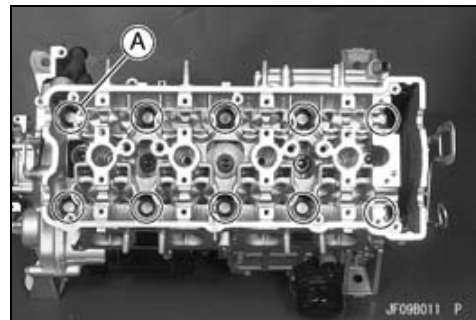
- Remove:
 - Engine Hook Bolts [A]
 - Engine Hook [B]
 - Cylinder Head Bolts [C]



- Remove:
 - Upper Dipstick Tube Bolts [A]
 - Upper Exhaust Side Camshaft Chain Guide Bolt [B]
 - M7 Cylinder Head Bolts [C]



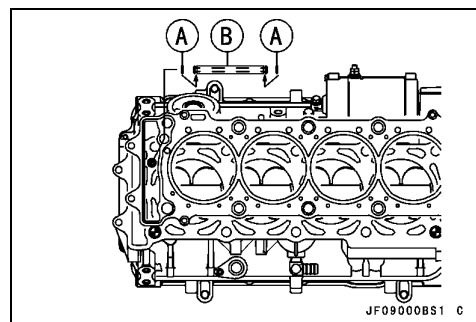
- Remove the M11 cylinder head bolts [A] and washers.
- Take off the cylinder head.



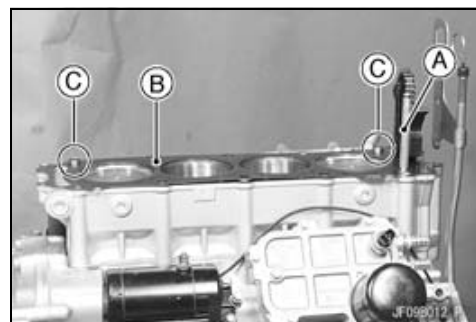
Cylinder Head Installation

NOTE

- The camshaft cap is machined with the cylinder head, so if a new cylinder head is installed, use the cap that is supplied with the new head.
- Replace that the O-rings [A] of the oil pipe [B] and apply molybdenum disulfide oil solution to them.

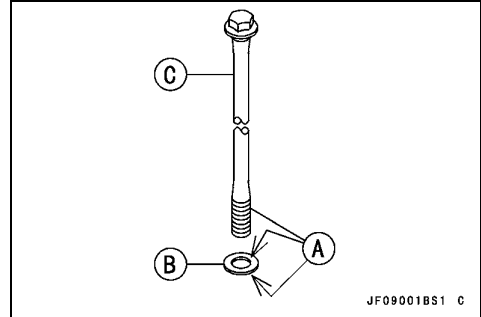


- Verify that the oil pipe [A] is installed properly.
- Install a new cylinder head gasket [B], and knock pins [C].



Cylinder Head

- Apply molybdenum disulfide oil solution [A] to both sides of the M11 cylinder head bolt washers [B] and the thread of head bolts [C].



- Install the cylinder head.
- First, tighten the M11 cylinder head bolts following the tightening sequence [1 ~ 10].

Torque - Cylinder Head Bolts (M11):

First: 23 N·m (2.3 kgf·m, 17 ft·lb)

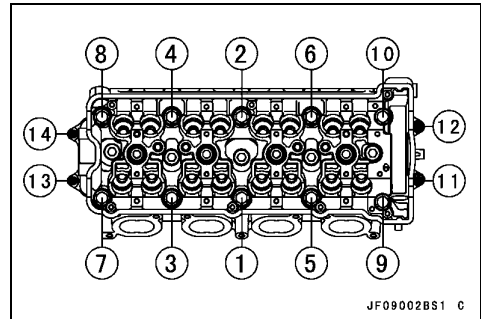
Final: 59 N·m (6.0 kgf·m, 43 ft·lb)

- Next, tighten the M7 cylinder head bolts following the tightening sequence [11 ~ 12].

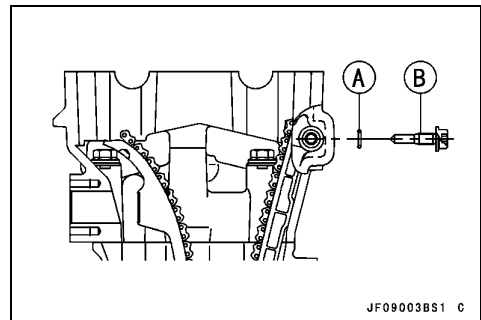
Torque - Cylinder Head Bolts (M7): 20 N·m (2.0 kgf·m, 14 ft·lb)

- Lastly, tighten the M6 cylinder head bolts following the tightening sequence [13 ~ 14].

Torque - Cylinder Head Bolts (M6): 12 N·m (1.2 kgf·m, 104 in·lb)



- Apply grease to the O-ring [A].
- Install:
 - O-ring
 - Upper Exhaust Side Camshaft Chain Guide Bolt [B]
- Tighten:
 - Torque - Exhaust Side Camshaft Chain Guide Bolt (Upper):**
25 N·m (2.5 kgf·m, 18 ft·lb)
- Install the camshafts (see Camshaft Installation).



Cylinder Head Warp

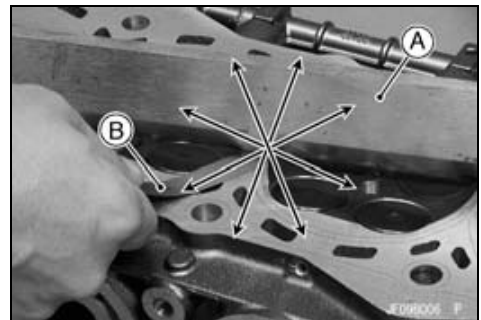
- Remove the cylinder head (see Cylinder Head Removal).
- Clean the cylinder head.
- Lay a straightedge across the lower surface of the cylinder head at several positions.
- Measure the space between the straightedge [A] and the head with a thickness gauge [B].

Cylinder Head Warp

Standard: ---

Service Limit: 0.05 mm (0.002 in.)

- ★ If the cylinder head is warped more than the service limit, replace it.
- ★ If the cylinder head is warped less than the service limit, repair the head by rubbing the lower surface on emery paper secured to a surface plate (first No. 200, then No. 400).



6-26 ENGINE TOP END

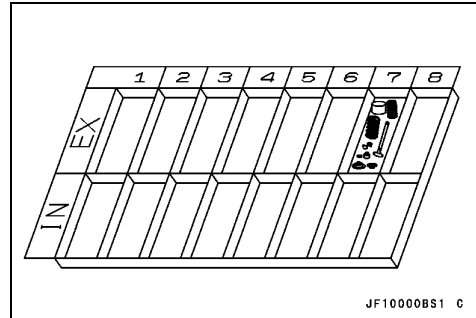
Valves

Valve Clearance Check

- Refer to the Valve Clearance Inspection in the Periodic Maintenance chapter.

Valve Removal

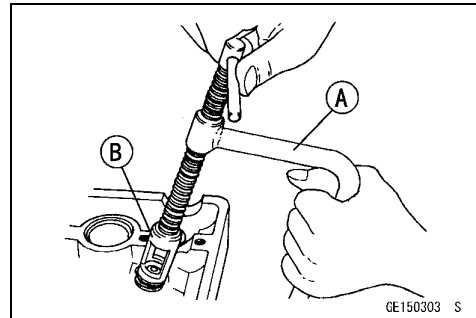
- Remove the cylinder head (see Cylinder Head Removal).
- Remove the valve lifter and shim.
- Mark and record the valve lifter and shim locations so they can be installed in their original positions.



- Using the valve spring compressor assembly, remove the valve.

Special Tools - Valve Spring Compressor Assembly: 57001-241 [A]

Valve Spring Compressor Adapter, $\phi 22$: 57001-1202 [B]

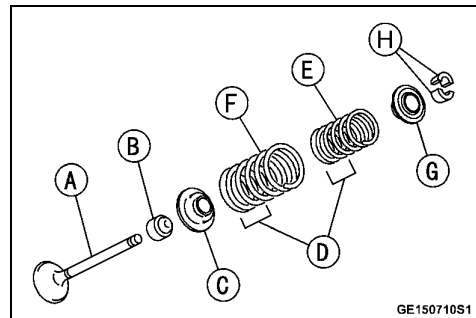


Valve Installation

- Replace the oil seal with a new one.
- Apply thin coat of molybdenum disulfide grease to the valve stem before valve installation.
- Install the springs so that the closed coil end faces downwards.

Valve Spring Paint Color: EX-Red
IN-Blue

- [A] Valve Stem
- [B] Oil Seal
- [C] Spring Seat
- [D] Closed Coil End
- [E] Valve Springs (Inner)
- [F] Valve Springs (Outer)
- [G] Retainer
- [H] Split Keepers

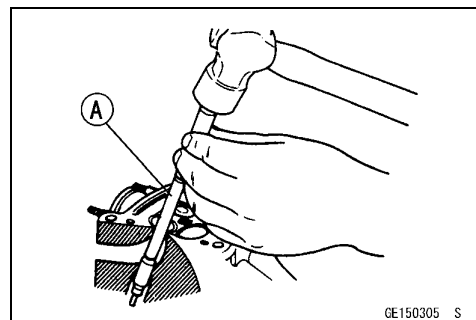


Valve Guide Removal

- Remove:
 - Valve (see Valve Removal)
 - Oil Seal
 - Spring Seat
- Heat the area around the valve guide to 120 ~ 150°C (248 ~ 302°F), and hammer lightly on the valve guide arbor [A] to remove the guide from the top of the head.

NOTICE

Heating the cylinder head with a torch will warp the head. To prevent warping the cylinder head, soak it in hot oil.



Special Tool - Valve Guide Arbor, $\phi 5$: 57001-1203

Valves

Valve Guide Installation

- Apply engine oil to the valve guide outer surface before installation.
- Heat the area around the valve guide hole to about 120 ~ 150°C (248 ~ 302°F).
- Drive the valve guide in from the top of the head using the valve guide arbor. The flange stops the guide from going in too far.

Special Tool - Valve Guide Arbor, ϕ 5: 57001-1203

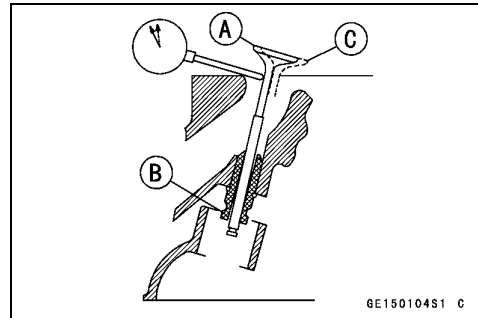
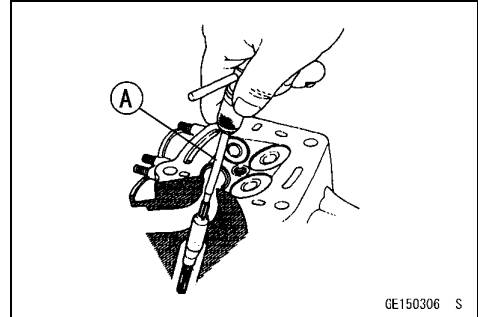
- Ream the valve guide with valve guide reamer [A] even if the old guide is reused.

Special Tool - Valve Guide Reamer, ϕ 5: 57001-1204

Valve-to-Guide Clearance Measurement (Wobble Method)

If a small bore gauge is not available, inspect the valve guide wear by measuring the valve to valve guide clearance with the wobble method as indicated below.

- Insert a new valve [A] into the guide [B] and set a dial gauge against the stem perpendicular to it as close as possible to the cylinder head mating surface.
- Move the stem back and forth [C] to measure valve/valve guide clearance.
- Repeat the measurement in a direction at a right angle to the first.
- ★ If the reading exceeds the service limit, replace the guide.



NOTE

○ The reading is not actual valve/valve guide clearance because the measuring point is above the guide.

Valve/Valve Guide Clearance (Wobble Method)

Standard:

Exhaust	0.09 ~ 0.17 mm (0.0035 ~ 0.0067 in.)
Inlet	0.03 ~ 0.11 mm (0.0012 ~ 0.0043 in.)

Service Limit:

Exhaust	0.35 mm (0.014 in.)
Inlet	0.29 mm (0.011 in.)

6-28 ENGINE TOP END

Valves

Valve Seat Inspection

- Remove the valve (see Valve Removal).
- Check the valve seating surface [A] between the valve [B] and valve seat [C].
- Measure the outside diameter [D] of the seating pattern on the valve seat.
- ★ If the outside diameter is too large or too small, repair the seat (see Valve Seat Repair).

Valve Seating Surface Outside Diameter

Standard:

Exhaust 27.6 ~ 27.8 mm (1.087 ~ 1.094 in.)

Inlet 32.6 ~ 32.8 mm (1.283 ~ 1.291 in.)

- Measure the seat width [E] of the portion where there is no build-up carbon (white portion) of the valve seat with a vernier caliper.

Good [F]

- ★ If the width is too wide [G], too narrow [H] or uneven [J], repair the seat (see Valve Seat Repair).

Valve Seating Surface Width

Standard:

Exhaust 0.8 ~ 1.2 mm (0.03 ~ 0.047 in.)

Inlet 0.5 ~ 1.0 mm (0.02 ~ 0.039 in.)

Valve Seat Repair

- Repair the valve seat with the valve seat cutters [A].

Special Tools- Valve Seat Cutter Holder, $\phi 5$:
57001-1208 [B]
Valve Seat Cutter Holder Bar:
57001-1128 [C]

[For Inlet Valve Seat]

Valve Seat Cutter, 45° - $\phi 35$:
57001-1116

Valve Seat Cutter, 32° - $\phi 35$:
57001-1121

Valve Seat Cutter, 55° - $\phi 35$:
57001-1247

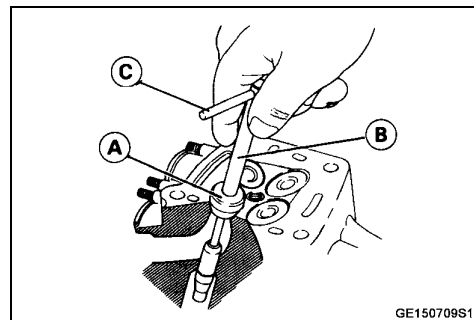
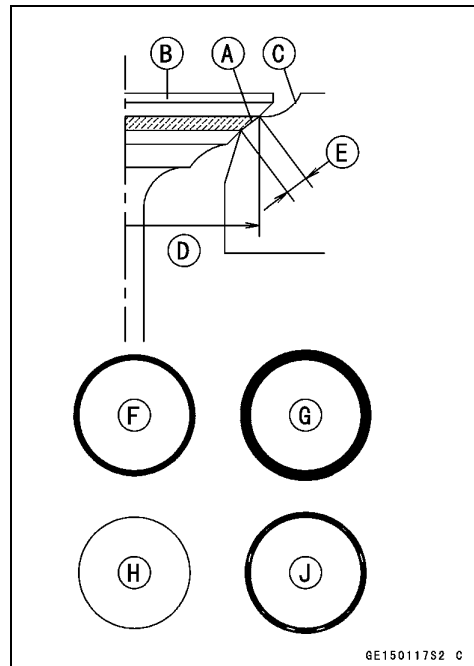
[For Exhaust Valve Seat]

Valve Seat Cutter, 45° - $\phi 30$:
57001-1187

Valve Seat Cutter, 32° - $\phi 30$:
57001-1120

Valve Seat Cutter, 60° - $\phi 30$:
57001-1123

- ★ If the manufacturer's instructions are not available, use the following procedure.



Valves

Seat Cutter Operation Care

1. This valve seat cutter is developed to grind the valve for repair. Therefore the cutter must not be used for other purposes than seat repair.
2. Do not drop or shock the valve seat cutter, or the diamond particles may fall off.
3. Do not fail to apply engine oil to the valve seat cutter before grinding the seat surface. Also wash off ground particles sticking to the cutter with washing oil.

NOTE

○Do not use a wire brush to remove the metal particles from the cutter. It will take off the diamond particles.

4. Setting the valve seat cutter holder in position, operate the cutter in one hand. Do not apply too much force to the diamond portion.

NOTE

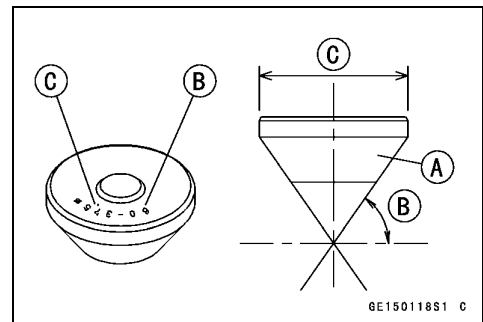
○Prior to grinding, apply engine oil to the cutter and during the operation, wash off any ground particles sticking to the cutter with washing oil.

5. After use, wash it with washing oil and apply thin layer of engine oil before storing.

Marks Stamped on the Cutter

The marks stamped on the back of the cutter [A] represent the following.

- 60° Cutter angle [B]
 37.5φ Outer diameter of cutter [C]



Operating Procedures

- Clean the seat area carefully.
- Coat the seat with machinist's dye.
- Fit a 45° cutter into the holder and slide it into the valve guide.
- Press down lightly on the handle and turn it right or left. Grind the seating surface only until it is smooth.

NOTICE

Overgrinding the seat will reduce valve clearance by sinking the valve into the head. If the valve sinks too far into the head, it will be impossible to adjust the clearance, and the cylinder head must be replaced. Do not overgrind the seat.

6-30 ENGINE TOP END

Valves

- Measure the outside diameter of the seating surface with a vernier caliper.
- ★ If the outside diameter of the seating surface is too small, repeat the 45° grind until the diameter is within the specified range.

Widened Width [A] of engagement by machining with 45° cutter

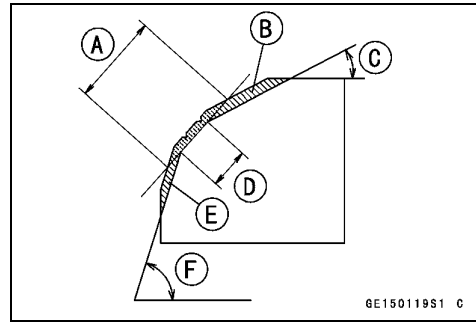
Ground Volume [B] by 32° cutter

32° [C]

Correct Width [D]

Ground Volume [E] by 60° or 55° cutter

60° or 55° [F]

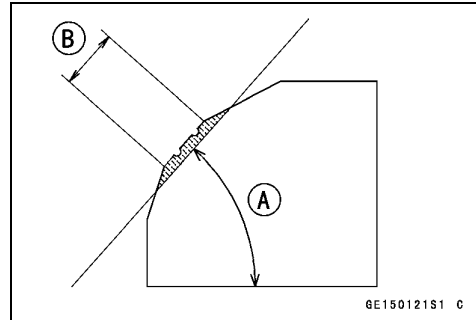


- Measure the outside diameter of the seating surface with a vernier caliper.
- ★ If the outside diameter of the seating surface is too small, repeat the 45° grind [A] until the diameter is within the specified range.

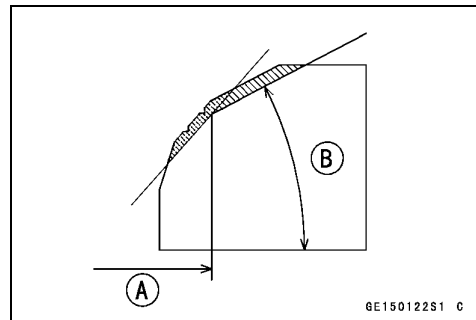
Original Seating Surface [B]

NOTE

- Remove all pittings of flaws from 45° ground surface.
- After grinding with 45° cutter, apply thin coat of machinist's dye to seating surface. This makes seating surface distinct and 32° and 60° grinding operation easier.
- When the valve guide is replaced, be sure to grind with 45° cutter for centering and good contact.



- ★ If the outside diameter [A] of the seating surface is too large, make the 32° grind described below.
- ★ If the outside diameter of the seating surface is within the specified range, measure the seat width as described below.
- Grind the seat at a 32° angle [B] until the seat outside diameter is within the specified range.
- To make the 32° grind, fit a 32° cutter into the holder, and slide it into the valve guide.
- Turn the holder one turn at a time while pressing down very lightly. Check the seat after each turn.



NOTICE

The 32° cutter removes material very quickly. Check the seat outside diameter frequently to prevent overgrinding.

- After making the 32° grind, return to the seat outside diameter measurement step above.
- To measure the seat width, use a vernier caliper to measure the width of the 45° angle portion of the seat at several places around the seat.
- ★ If the seat width is too narrow, repeat the 45° grind until the seat is slightly too wide, and then return to the seat outside diameter measurement step above.

Valves

- ★ If the seat width is too wide, make the 60° or 55° [A] grind described below.
- ★ If the seat width is within the specified range, lap the valve to the seat as described below.
- Grind the seat at a 60° or 55° angle until the seat width is within the specified range.
- To make the 60° or 55° grind, fit 60° or 55° cutter into the holder, and slide it into the valve guide.
- Turn the holder, while pressing down lightly.
- After making the 60° or 55° grind, return to the seat width measurement step above.

Correct Width [B]

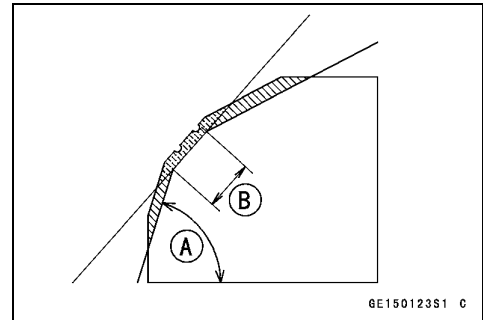
- Lap the valve to the seat, once the seat width and outside diameter are within the ranges specified above.
- Put a little coarse grinding compound on the face of the valve in a number of places around the valve head.
- Spin the valve against the seat until the grinding compound produces a smooth, matched surface on both the seat and the valve.
- Repeat the process with a fine grinding compound.

[A] Lapper

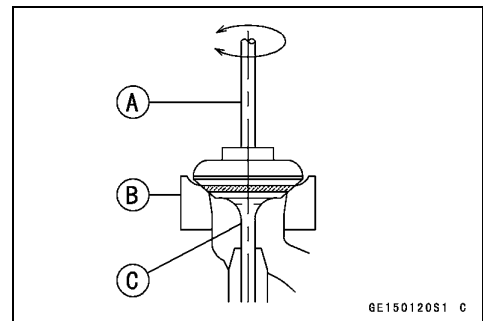
[B] Valve Seat

[C] Valve

- The seating area should be marked about in the middle of the valve face.
- ★ If the seat area is not in the right place on the valve, check to be sure the valve is the correct part. If it is, it may have been refaced too much; replace it.
- Be sure to remove all grinding compound before assembly.
- When the engine is assembled, be sure to adjust the valve clearance (see Valve Clearance Inspection in the Periodic Maintenance chapter).

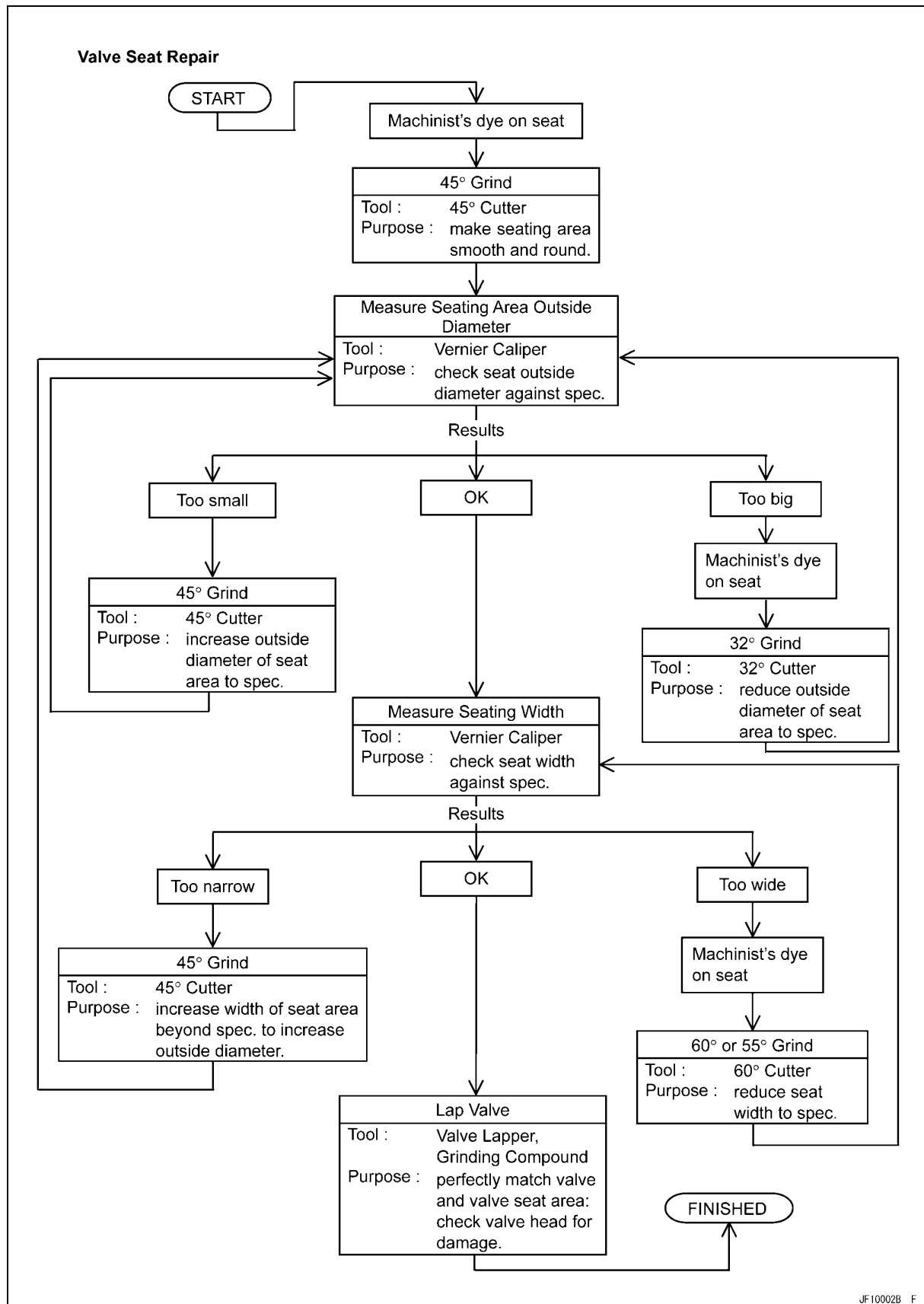


6E150123S1 C



6E150120S1 C

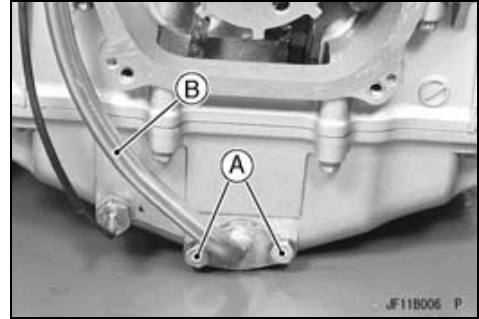
Valves



Cylinder, Pistons

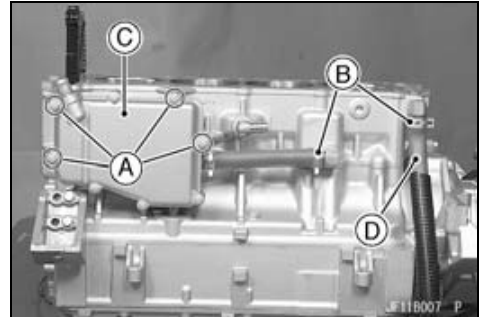
Cylinder Removal

- Drain the engine oil (see Periodic Maintenance chapter).
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Cylinder Head (see Cylinder Head Removal)
 - Dipstick Tube Bolts [A]
 - Dipstick Tube [B]



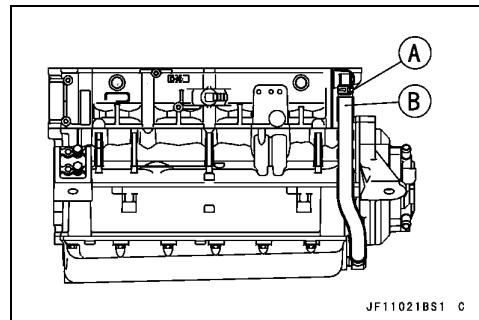
JT1500-A1 ~ A8 Models

- Remove:
 - Breather Case Mounting Bolts [A]
 - Clamp [B]
 - Breather Case (with Hose)
 - Oil Hose

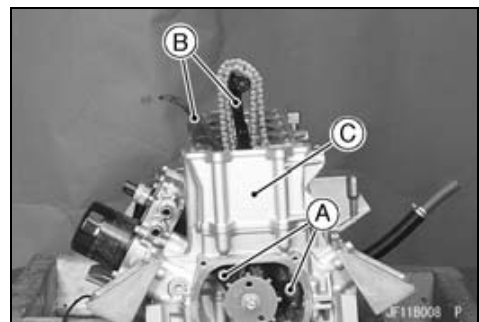


JT1500A9 Model ~

- Remove:
 - Clamp [A]
 - Oil Hose [B]



- Remove:
 - Camshaft Chain Guide Bolts [A]
 - Camshaft Chain Guide [B]
 - Cylinder [C]



Piston Removal

- Remove the cylinder (see Cylinder Removal).
- Place a clean cloth under the pistons and remove the piston pin snap ring [A] from the outside of each piston.

NOTICE

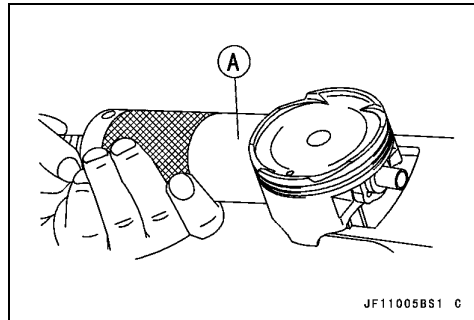
Snap rings are weakened and deform when removed and may fall out, scoring the cylinder wall and causing severe engine damage. Do not re-use snap rings, always replace them.



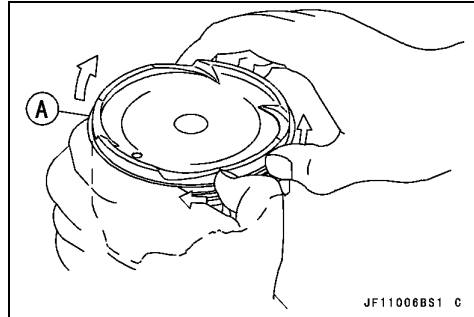
6-34 ENGINE TOP END

Cylinder, Pistons

- Remove the piston pins with a piston pin puller [A].
Special Tool - Piston Pin Puller Assembly: 57001-910
- Remove the pistons.



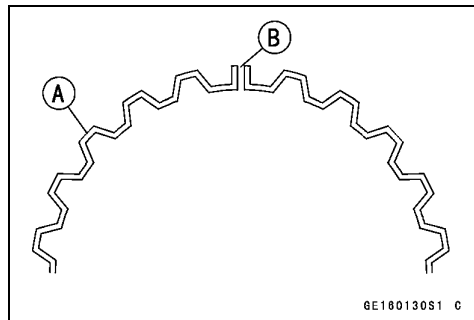
- Carefully spread the ring opening with your thumbs and then push up on the opposite side of the ring [A] to remove it.
- Remove the 3-piece oil ring with your thumbs in the same manner.



Piston/Cylinder Installation

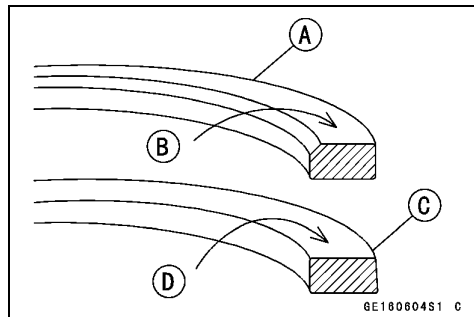
NOTE

- If a new cylinder is used, use new piston rings.
- If new pistons and/or a new cylinder are installed, apply thin coat of molybdenum disulfide oil solution to the new pistons and cylinder bores.
- Install the oil ring expander [A] in the bottom piston ring groove so the ends [B] butt together.
- Install the oil ring steel rails, one above the expander and one below it.
- Spread the rail with your thumbs, but only enough to fit the rail over the piston.
- Release the rail into the bottom piston ring groove.



NOTE

- The oil ring rails have no "top" or "bottom".
- Do not mix up the top and second ring.
- Install the top ring [A] so that the "R" mark [B] faces up.
- Install the second ring [C] so that the "RN" mark [D] faces up.
- Apply molybdenum disulfide oil solution to the piston rings.



Cylinder, Pistons

NOTE

○If a new piston is used, use new piston ring.

- Install the piston with its dent mark facing exhaust side.
- Fit a new piston pin snap ring into the side of the piston so that the ring opening [A] does not coincide with the slit [B] of the piston pin hole.
- Apply molybdenum disulfide oil solution to the piston pins and piston journals.
- When installing the piston pin snap ring, compress it only enough to install it and no more.

NOTICE

Snap rings are weakened and deform when removed and may fall out, scoring the cylinder wall and causing severe engine damage. Do not re-use snap rings, always replace them.

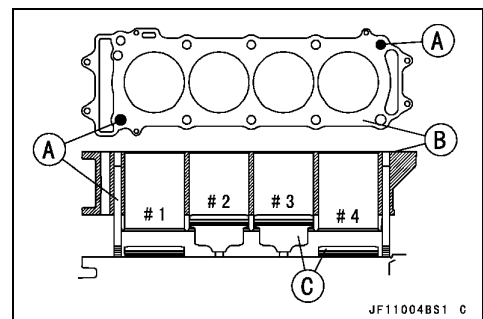
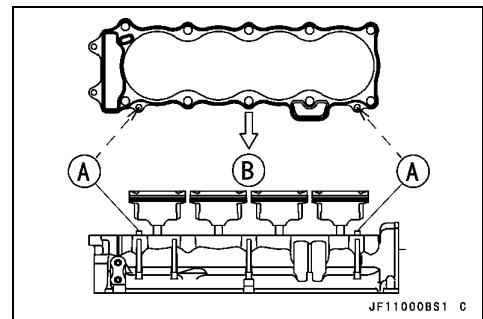
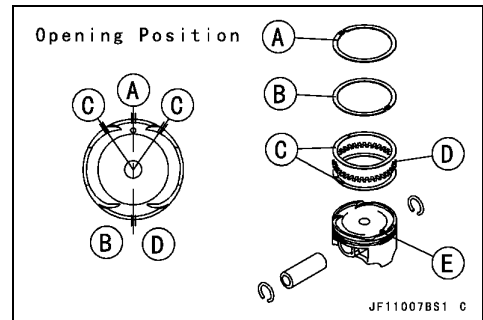
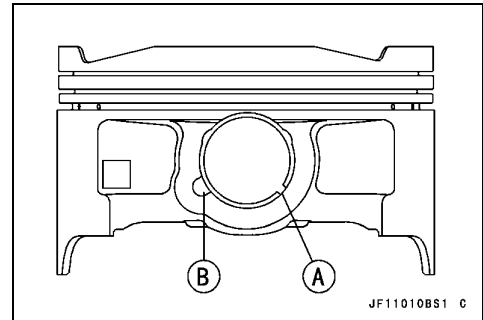
- The piston ring openings must be positioned as shown in the figure. The openings of the oil ring steel rails must be about 30 ~ 40° of angle from the opening of the top ring.
- [A] Top Ring
[B] Second Ring
[C] Oil Ring Steel Rails
[D] Oil Ring Expander
[E] Dent (Exhaust Side)

- Replace the cylinder gasket with a new one, and install the pins [A] and new cylinder gasket.
- Exhaust Side [B]
- Apply molybdenum disulfide oil solution to the cylinder bore, external of pistons and piston rings.

- Insert the piston in the cylinder by two methods.

With the Hand

- Position the crankshaft at #2, #3 piston TDC.
- Install the two cylinder head bolts [A] diagonally in the crankcase.
- Install the cylinder block [B].
- Pistons [C]
- First insert the #2, #3 pistons, and then rotate the crankshaft at 90° angle.
- Insert the piston rings with your thumbs or the thin (–) screw driver.



6-36 ENGINE TOP END

Cylinder, Pistons

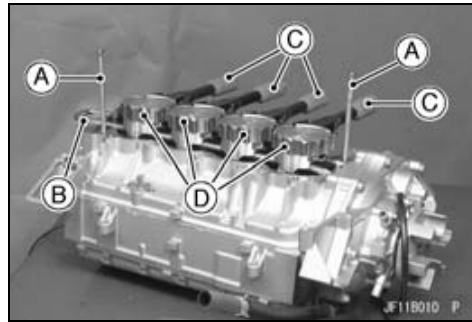
With the Special Tools

- Install the two cylinder head bolts [A] diagonally in the crankcase.
- Slip the piston bases [B] under the pistons to hold them level.
- Compress the piston rings using the piston ring compressor grips [C] and piston ring compressor belts [D] with chamfered side upward.

Special Tools - Piston Base, $\phi 8$: 57001-1604

Piston Ring Compressor Grip: 57001-1095

**Piston Ring Compressor Belt, $\phi 80 \sim \phi 91$:
57001-1320**



- Push down vigorously the cylinder aligning the cylinder bores with all the piston heads.
- Install the cylinder so that its angle aligns the piston angle after removing the piston ring compressor belts.
- Install the removed parts.

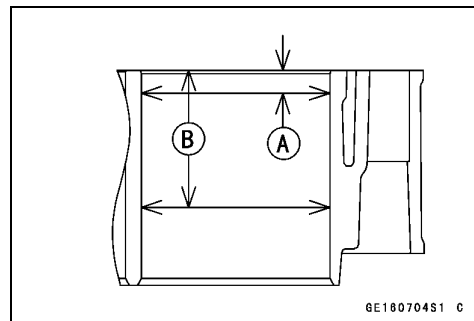
Cylinder Wear

- Since there is a difference in cylinder wear in different directions, take a side-to-side and a front-to-back measurement at each of the two locations (total of four measurements) shown in the figure.

- ★ If any of the cylinder inside diameter measurements exceeds the service limit, replace the cylinder.

[A] 10 mm (0.39 in.)

[B] 60 mm (2.36 in.)



Cylinder Inside Diameter

Standard: 82.994 ~ 83.006 mm (3.2675 ~ 3.2679 in.)

Service Limit: 83.10 mm (3.272 in.)

Piston Wear

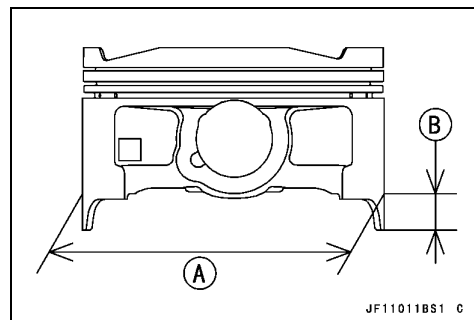
- Measure the outside diameter [A] of each piston 18 mm (0.71 in.) [B] up from the bottom of the piston at a right angle to the direction of the piston pin.

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

Piston Diameter

Standard: 82.919 ~ 82.934 mm (3.2645 ~ 3.2651 in.)

Service Limit: 82.77 mm (3.259 in.)



Cylinder, Pistons

Piston Ring, Piston Ring Groove Wear

- Check for uneven groove wear by inspecting the ring seating.
- ★ The rings should fit perfectly parallel to groove surfaces. If not, replace the piston and all the piston rings.
- With the piston rings in their grooves, make several measurements with a thickness gauge [A] to determine piston ring/groove clearance.

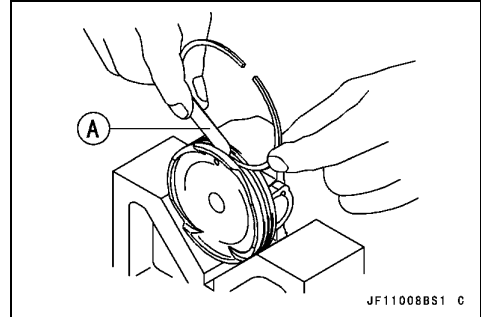
Piston Ring/Groove Clearance

Standard:

Top	0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)
Second	0.02 ~ 0.06 mm (0.0008 ~ 0.0024 in.)

Service Limit:

Top	0.17 mm (0.0067 in.)
Second	0.16 mm (0.0063 in.)



Piston Ring Groove Width

- Measure the piston ring groove width.
- Use a vernier caliper at several points around the piston.

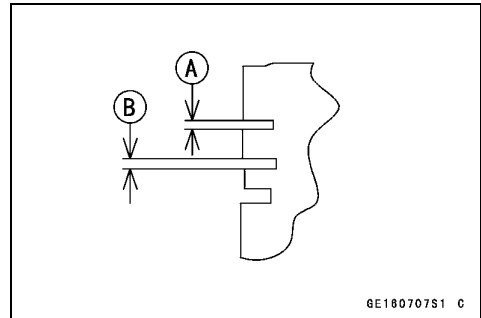
Standard:

Top [A]	0.92 ~ 0.94 mm (0.0362 ~ 0.0370 in.)
Second [B]	1.01 ~ 1.03 mm (0.0398 ~ 0.0406 in.)

Service Limit:

Top [A]	1.02 mm (0.0402 in.)
Second [B]	1.11 mm (0.0437 in.)

- ★ If the width of any of the two grooves is wider than the service limit at any point, replace the piston.



Piston Ring Thickness

- Measure the piston ring thickness.
- Use the micrometer to measure at several points around the ring.

Piston Ring Thickness

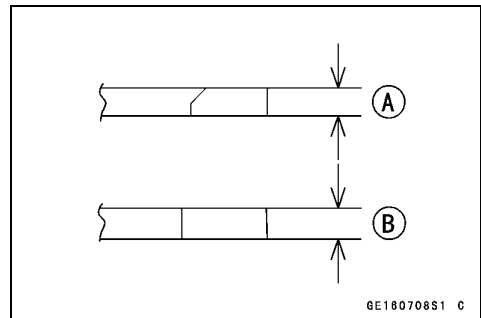
Standard:

Top [A]	0.87 ~ 0.89 mm (0.0343 ~ 0.0350 in.)
Second [B]	0.97 ~ 0.99 mm (0.0382 ~ 0.0390 in.)

Service Limit:

Top [A]	0.80 mm (0.0315 in.)
Second [B]	0.90 mm (0.0354 in.)

- ★ If any of the measurements is less than the service limit on either of the rings, replace all the rings.



NOTE

- When using new rings in a used piston, check for uneven groove wear. The rings should fit perfectly parallel to the groove sides. If not, replace the piston.

6-38 ENGINE TOP END

Cylinder, Pistons

Piston Ring End Gap

- Place the piston ring [A] inside the cylinder, using the piston to locate the ring squarely in place. Set it close to the bottom of the cylinder, where cylinder wear is low.
- Measure the gap between the ends of the ring with a thickness gauge [B].

Piston Ring End Gap

Standard:

Top **0.25 ~ 0.40 mm (0.0098 ~ 0.0157 in.)**

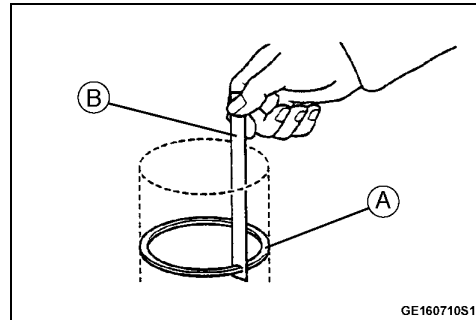
Second **0.40 ~ 0.55 mm (0.0157 ~ 0.0217 in.)**

Service Limit:

Top **0.7 mm (0.0276 in.)**

Second **0.8 mm (0.0315 in.)**

- ★ If the end gap of either ring is greater than the service limit, replace all the rings.



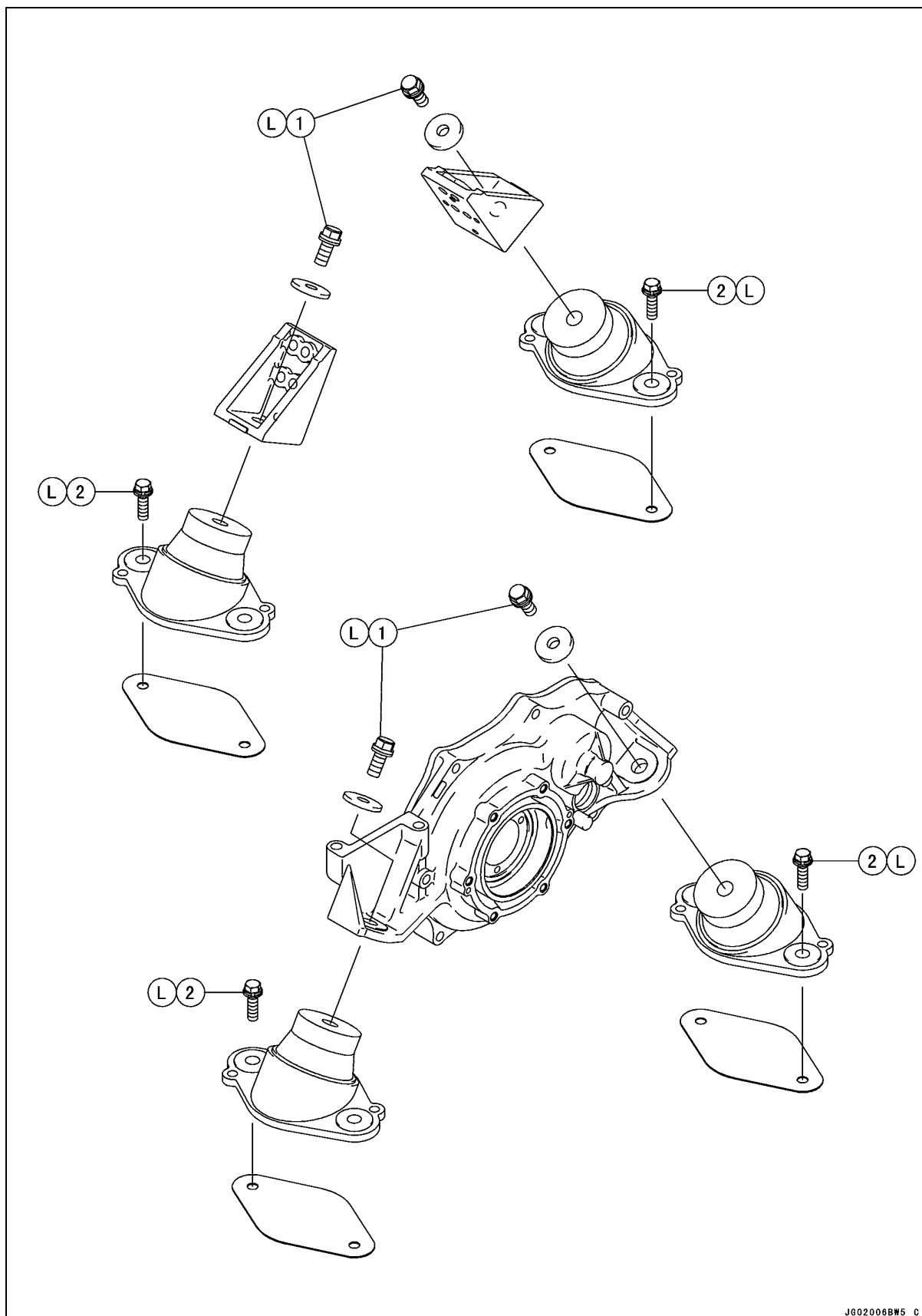
Engine Removal/Installation

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7-2 ENGINE REMOVAL/INSTALLATION

Exploded View



ENGINE REMOVAL/INSTALLATION 7-3

Exploded View

No	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Engine Mounting Bolts	36	3.7	27	L
2	Engine Damper Mounting Bolts	16	1.6	12	L

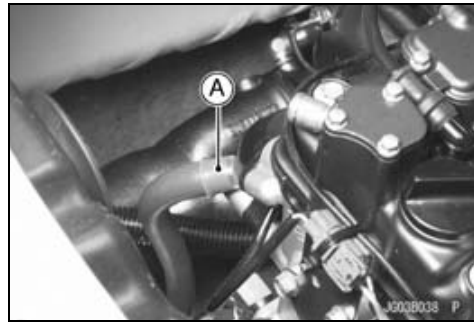
L: Apply a non-permanent locking agent.

7-4 ENGINE REMOVAL/INSTALLATION

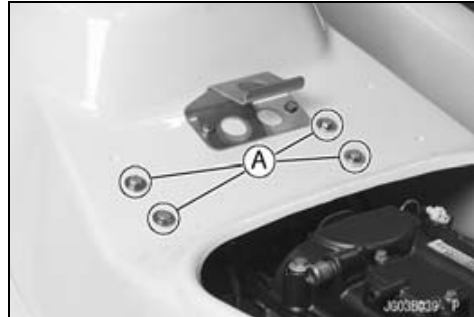
Engine Removal/Installation

Engine Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Oil Separator Tank (see Lubrication System)
- Plug the hose end [A].
- ★ If the engine disassembles, drain the oil (see Engine Oil Change in Periodic Maintenance chapter).



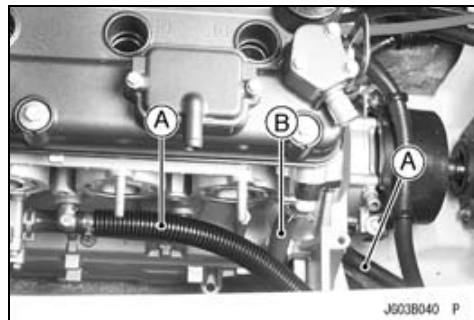
- Remove:
 - Air Filter (see Fuel System (DFI) chapter)
 - Inlet Manifold (see Fuel System (DFI) chapter)
 - Exhaust Manifold (see Exhaust System chapter)
 - Bolts [A] and Ignition Coil Bracket



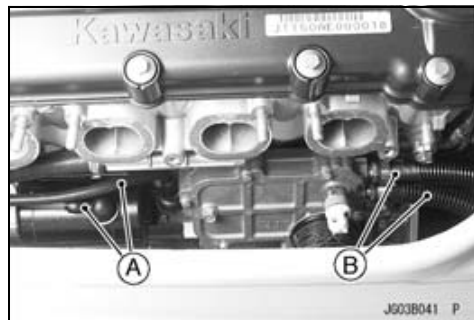
- Remove:
 - Cooling Hoses [A]
- The oil hose [B] is not necessary removal.

NOTE

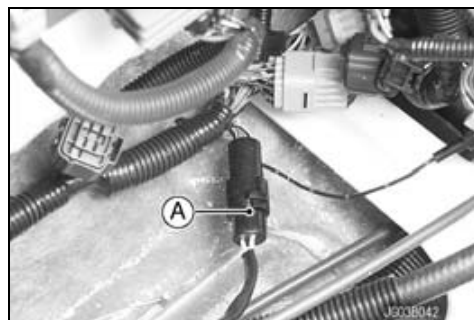
○ If the oil is in the engine and the removed hose lies down, the oil will flow out from hose end.



- Remove:
 - Starter Motor Cables [A]
 - Cooling Hoses [B]

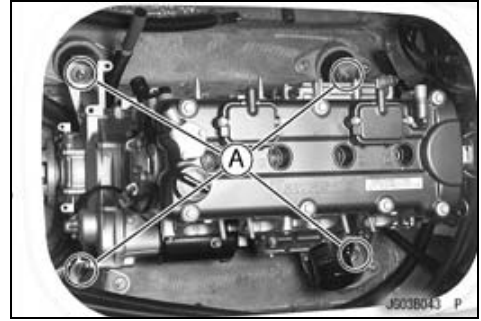


- Disconnect:
 - Alternator Lead Connector [A]

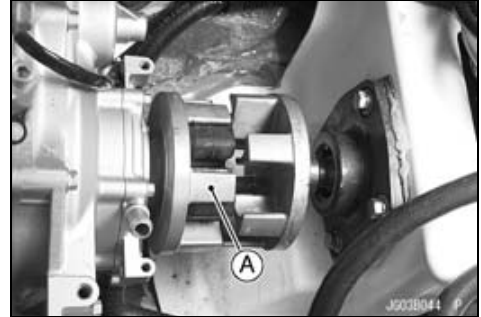


Engine Removal/Installation

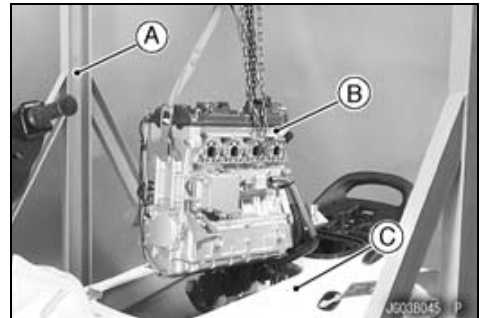
- Remove:
Engine Mounting Bolts [A]



- Slide the engine toward the front to disengage the coupling [A].



- Using the lifter [A], raise the front side of the engine a little and lift the engine [B] out off the hull [C].

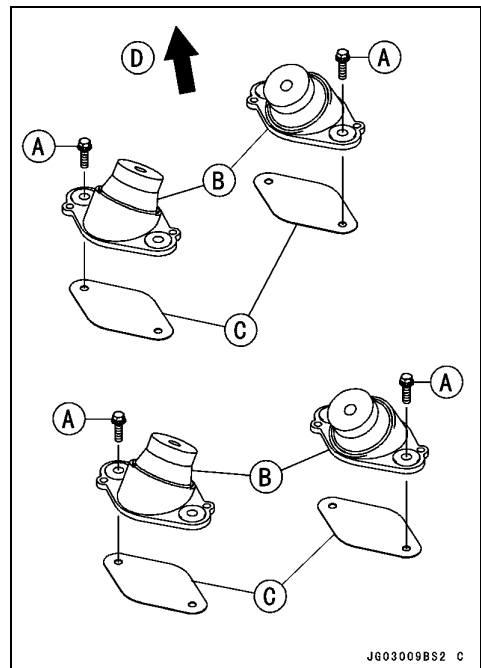


Engine Damper Removal

- Remove:
Engine Damper Mounting Bolts [A]
Engine Damper [B]
Shim [C] (0 ~ 2 pieces)
Bow [D]
- Record the number of shims of four positions so they can be put back in the same position.

NOTICE

Incorrect shims could cause drive shaft misalignment. Install the shims to the same position.



JG03009BS2 C

7-6 ENGINE REMOVAL/INSTALLATION

Engine Removal/Installation

Engine Damper Installation

- Install the shim(s) of the same number.
- Apply a non-permanent locking agent to the engine damper mount bolts, and tighten them.

Torque - Engine Damper Mounting Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)

Engine Installation

- Be sure there are no foreign objects and parts inside of the hull.
- Clean the bilge filter (see Filter Cleaning and Inspection in Cooling and Bilge Systems chapter).
- Check the coupling damper for wear damage (see Coupling Damper Inspection in Periodic Maintenance chapter).
- Install the inlet manifold (see Fuel System chapter).
- Apply a non-permanent locking agent to the engine mounting bolts, and tighten them.

Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

- After installing the engine in the hull, check the following.
 - Throttle Cable
 - Fuel and Exhaust Leaks

DANGER

Exhaust gas contains carbon monoxide, a colorless, odorless poisonous gas. Inhaling carbon monoxide can cause serious brain injury or death. DO NOT run the engine in enclosed areas. Operate only in a well-ventilated area.

NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

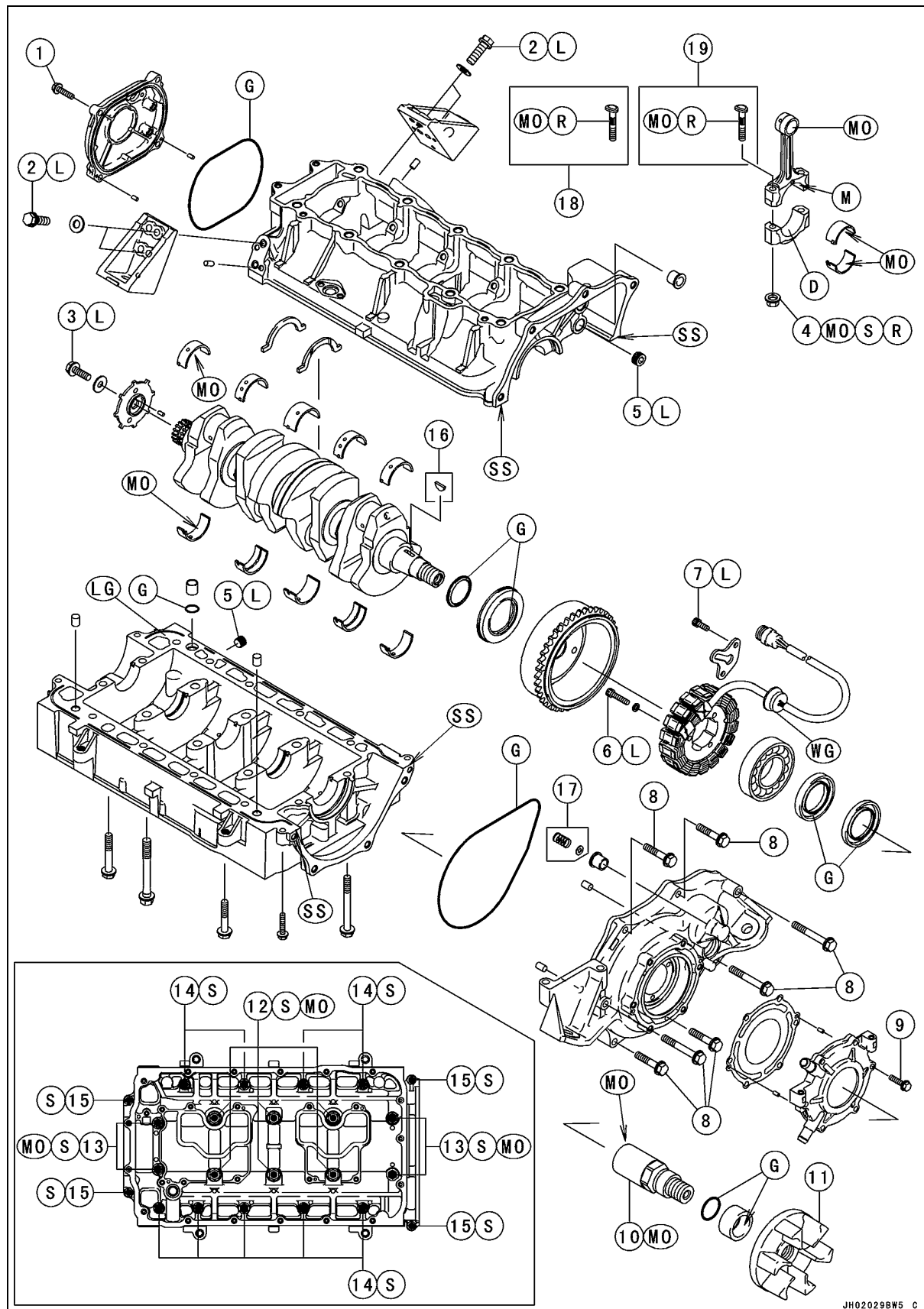
Engine Bottom End

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8-2 ENGINE BOTTOM END

Exploded View



JH02029BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
2	Engine Bracket Mounting Bolts	32	3.3	24	L
3	Timing Rotor Bolt	29	3.0	22	L
4	Connecting Rod Nuts	—	—	—	MO, see text
5	Oil Passage Plugs	20	2.0	14	L
6	Stator Mounting Bolts	12	1.2	104 in·lb	L
7	Grommet Cover Bolts	9.8	1.0	87 in·lb	L
8	Magneto Cover Bolts	20	2.0	14	
9	Output Cover Bolts	7.8	0.80	69 in·lb	
10	Output Shaft (JT1500-A1 ~ A9 Early Models)	245	25.0	180	MO
	Output Shaft (JT1500A9 Late Model ~)	265	27.0	195	MO
11	Coupling	98	10	72	
12	Crankcase Bolts (M10)	50	5.0	36	MO, S
13	Crankcase Bolts (M8)	29	3.0	22	MO, S
14	Crankcase Bolts (M8)	29	3.0	22	S
15	Crankcase Bolts (M6)	12	1.2	104 in·lb	S

16. JT1500-A1 ~ A6 Models

17. JT1500-A1 ~ AB Models

18. JT1500-A1 ~ AB Models (Engine No.; ~ JTT50AE036455)

18. JT1500-AB ~ AC Models (Engine No.; JTT50AE036456 ~)

D: Do not apply any grease or oil.

G: Apply grease.

L: Apply a non-permanent locking agent.

LG: Apply liquid gasket (Liquid Gasket, TB1215B: 92104-1062).

M: Apply molybdenum disulfide grease.

MO: Apply molybdenum disulfide oil solution (mixture of the engine oil and molybdenum disulfide grease in a weight ratio 10 : 1).

R: Replacement Parts.

S: Follow the specific tightening sequence.

SS: Apply silicone sealant.

WG: Apply water resistant grease.

8-4 ENGINE BOTTOM END

Specifications

Item	Standard	Service Limit
Crankshaft, Connecting Rods		
Connecting Rod Bend	— — —	0.2/100 mm (0.008/3.94 in.)
Connecting Rod Twist	— — —	0.2/100 mm (0.008/3.94 in.)
Connecting Rod Big End Side Clearance	0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)	0.58 mm (0.023 in.)
Connecting Rod Big end Bearing Insert/crankpin Clearance	0.041 ~ 0.071 mm (0.0016 ~ 0.0028 in.)	0.11 mm (0.0043 in.)
Crankpin Diameter:	38.984 ~ 39.000 mm (1.5348 ~ 1.5354 in.)	38.97 mm (1.534 in.)
Marking:		
None	38.984 ~ 38.992 mm (1.5348 ~ 1.5351 in.)	— — —
○	38.993 ~ 39.000 mm (1.5352 ~ 1.5354 in.)	— — —
Connecting Rod Big End Bore Diameter:	42.000 ~ 42.016 mm (1.6535 ~ 1.6542 in.)	— — —
Marking		
None	42.000 ~ 42.008 mm (1.6535 ~ 1.65386 in.)	— — —
○	42.009 ~ 42.016 mm (1.65389 ~ 1.6542 in.)	— — —
Connecting Rod Big End Bearing Insert Thickness:		
Brown	1.475 ~ 1.480 mm (0.05807 ~ 0.05827 in.)	— — —
Black	1.480 ~ 1.485 mm (0.05827 ~ 0.05846 in.)	— — —
Blue	1.485 ~ 1.490 mm (0.05846 ~ 0.05866 in.)	— — —

Connecting Rod Big End Bearing Insert Selection (TJ1500-A1 ~ AB Models)

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-3710
None	None	Black	92139-3709
○	○		
○	None	Blue	92139-3708

Specifications

Item	Standard		Service Limit	
Connecting Rod Big End Bearing Insert Selection (JT1500AC Model)				
Connecting Rod Big End Inside Diameter Marking	Crankpin Diameter Marking	Bearing Insert		
		Size Color	Part Number	
	None	○	Pink	92139-0724
	None	None	Yellow	92139-0723
	○	○		
○	None	Green	92139-0722	

Crankshaft Side Clearance	0.05 ~ 0.24 mm (0.0020 ~ 0.0094 in.)	0.44 mm (0.017 in.)
Crankshaft Runout	TIR 0.03 mm (0.0012 in.) or less	TIR 0.07 mm (0.0028 in.)
Crankshaft Main Bearing Insert/journal Clearance	0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in.)	0.08 mm (0.0032 in.)
Crankshaft Main Journal Diameter:	40.984 ~ 41.000 mm (1.6135 ~ 1.6142 in.)	40.96 mm (1.613 in.)
Marking		
None	40.984 ~ 40.992 mm (1.6135 ~1.61385 in.)	— — —
1	40.993 ~ 41.000 mm (1.61389 ~ 1.6142 in.)	— — —
Crankcase Main Bearing Bore Diameter:	44.000 ~ 44.016 mm (1.7323 ~ 1.7329 in.)	— — —
Marking		
○	44.000 ~ 44.008 mm (1.7323 ~ 1.73259 in.)	— — —
None	44.009 ~ 44.016 mm (1.73263 ~ 1.7329 in.)	— — —
Crankshaft Main Bearing Insert Thickness:		
Brown	1.490 ~ 1.494 mm (0.05866 ~ 0.05882 in.)	— — —
Black	1.494 ~ 1.498 mm (0.05882 ~ 0.05898 in.)	— — —
Blue	1.498 ~ 1.502 mm (0.05898 ~ 0.05913 in.)	— — —

8-6 ENGINE BOTTOM END

Specifications

Item	Standard	Service Limit
------	----------	---------------

Crankshaft Main Bearing Insert Selection (JT1500-A1 ~ AB Models)

Crankcase Main Bearing Bore Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal Nos.
○	1	Brown	92139-3704	1, 5
			92139-3713	3
			92139-3707	2, 4
○	None	Black	92139-3703	1, 5
None	1		92139-3712	3
			92139-3706	2, 4
None	None	Blue	92139-3702	1, 5
			92139-3711	3
			92139-3705	2, 4

*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

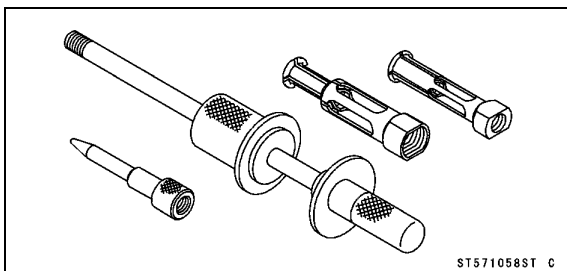
Crankshaft Main Bearing Insert Selection (JT1500AC Model)

Crankcase Main Bearing Bore Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal Nos.
○	1	Pink	92139-0727	1, 5
			92139-0730	2, 4
			92139-0733	3
○	None	Yellow	92139-0726	1, 5
None	1		92139-0729	2, 4
			92139-0732	3
None	None	Green	92139-0725	1, 5
			92139-0728	2, 4
			92139-0731	3

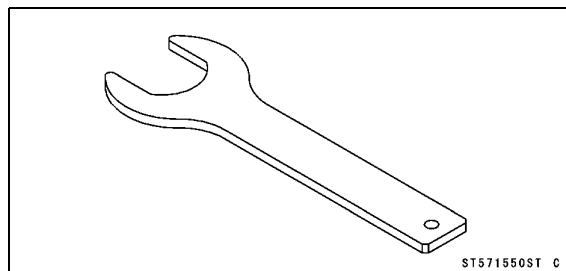
*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

Special Tools and Sealant

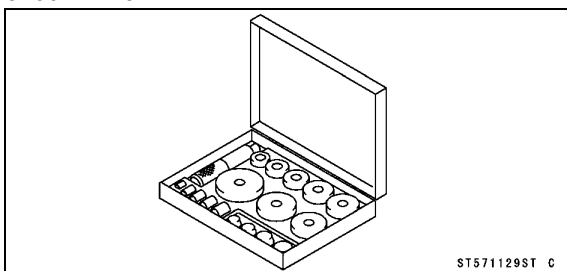
Oil Seal & Bearing Remover:
57001-1058



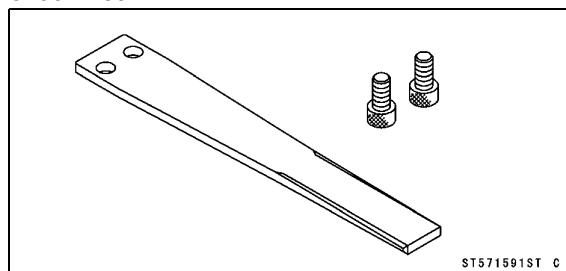
Output Shaft Wrench, Hex 36:
57001-1550



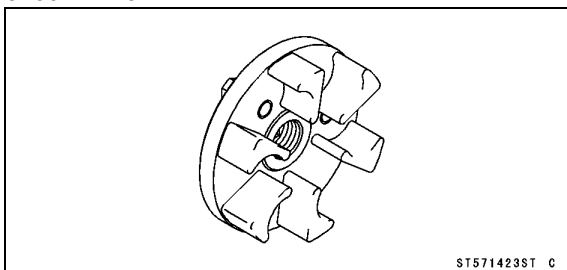
Bearing Driver Set:
57001-1129



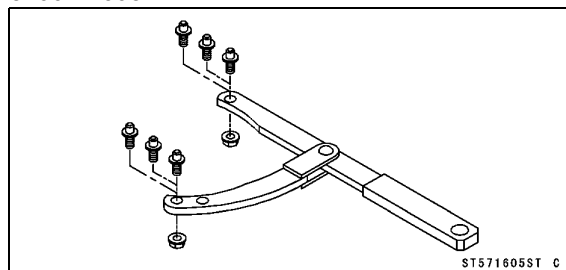
Grip:
57001-1591



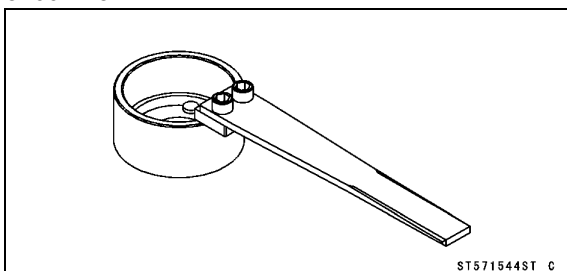
Coupling Holder #2:
57001-1423



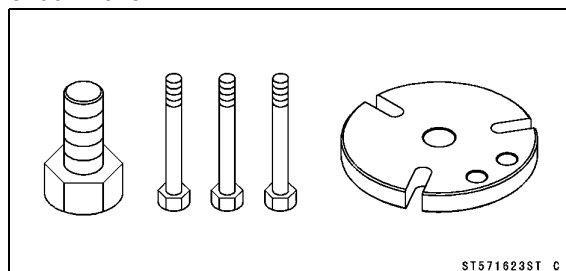
Flywheel & Pulley Holder:
57001-1605



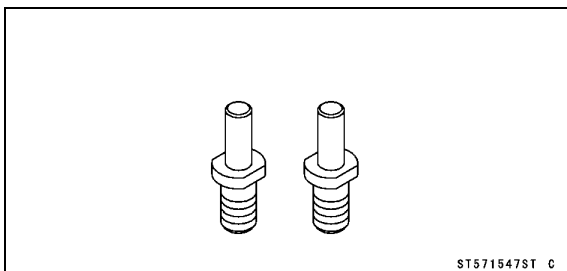
Rotor Holder:
57001-1544



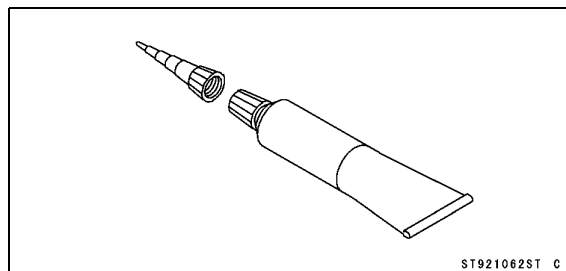
Rotor Puller:
57001-1623



Holder Attachment:
57001-1547



Liquid Gasket, TB1215B:
92104-1062



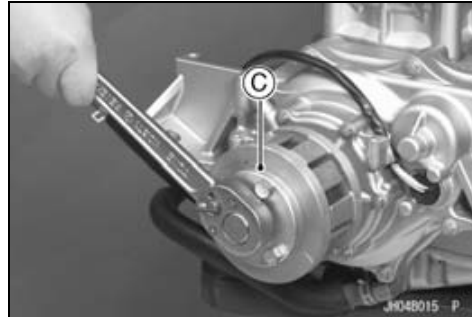
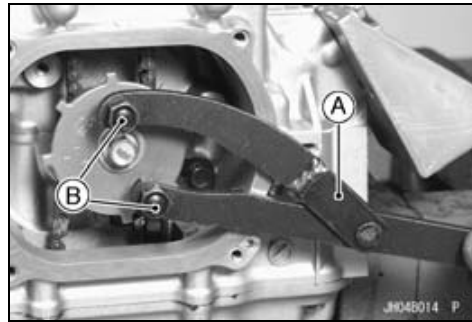
8-8 ENGINE BOTTOM END

Coupling

Coupling/Output Shaft Removal

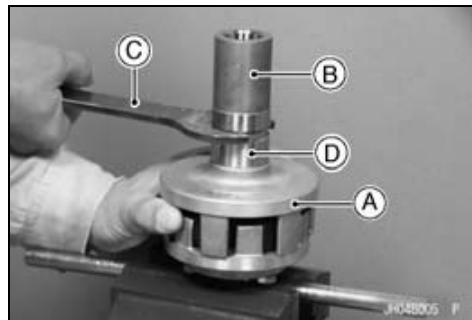
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Crankshaft Sensor Cover (see Electrical System chapter)
- Holding the timing rotor, unscrew the coupling.

**Special Tools - Flywheel & Pulley Holder: 57001-1605 [A]
Holder Attachment: 57001-1547 [B]
Coupling Holder #2: 57001-1423 [C]**

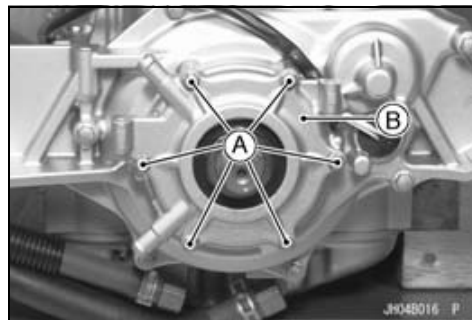


- ★ If the coupling [A] and output shaft [B] removed together, holding the coupling, unscrew the output shaft with the output shaft wrench [C].
Collar [D]

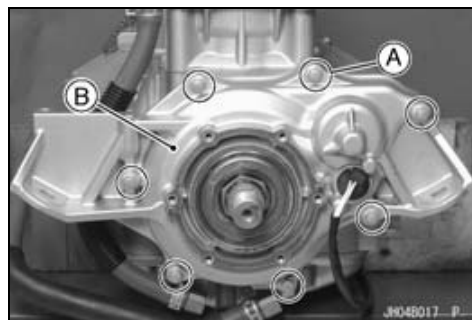
Special Tool - Output Shaft Wrench, Hex 36: 57001-1550



- Remove:
 - Output Cover Bolts [A]
 - Output Cover [B]

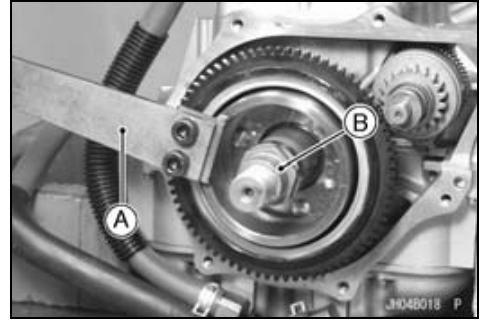


- Remove:
 - Magneto Cover Bolts [C]
 - Magneto Cover



Coupling

- Using the rotor holder [A], remove the output shaft [B].
Special Tool - Rotor Holder: 57001-1544



Coupling/Output Shaft Installation

- Apply molybdenum disulfide oil solution to the seating surface of the output shaft.
- Using the rotor holder [A], install the output shaft [B].

Special Tool - Rotor Holder: 57001-1544

- Tighten:

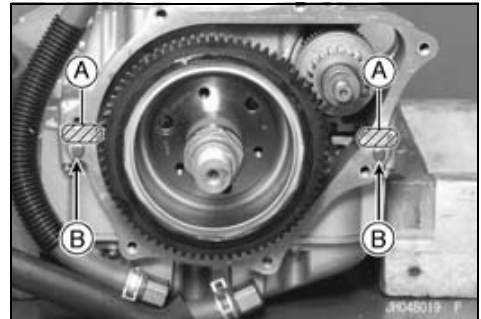
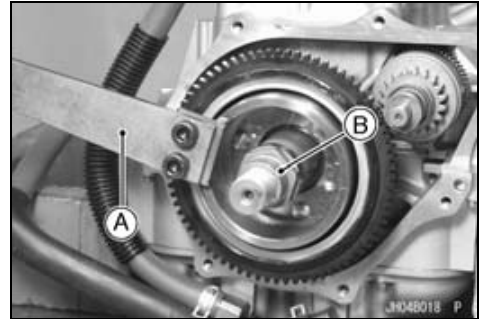
(JT1500-A1 ~ A9 Early Models)

Torque - Output Shaft: 245 N·m (25.0 kgf·m, 180 ft·lb)

(JT1500A9 Late Model ~)

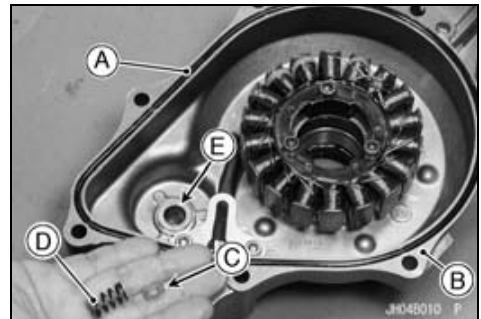
Torque - Output Shaft: 265 N·m (27.0 kgf·m, 195 ft·lb)

- Apply silicone sealant [A] to the crankcase halves mating surfaces on the magneto cover.
- Be sure to install the dowel pins [B].

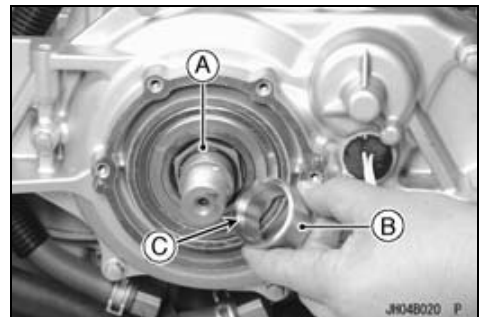


- Apply grease to the O-ring [A], and fit the O-ring onto the groove of the magneto cover [B].
- Install the magneto cover.
- Be sure to install the washer [C] and the spring [D] into the hole [E] of the bushing.
- Tighten:

Torque - Magneto Cover Bolts: 20 N·m (2.0 kgf·m, 14 ft·lb)



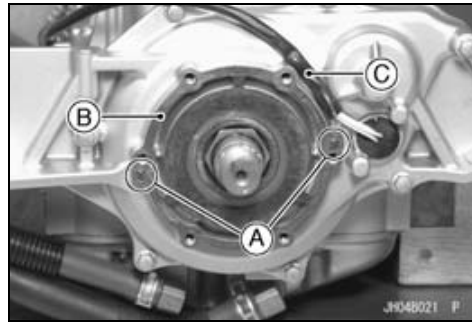
- Apply grease to the O-ring [A] and collar inside.
- Install the collar [B] so that the chamfer side [C] faces inward.



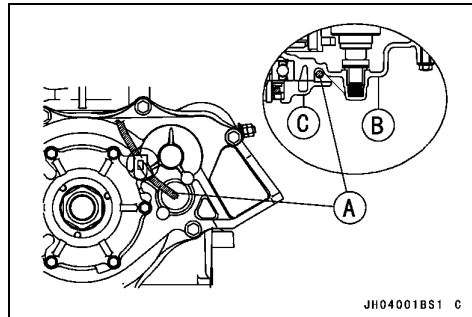
8-10 ENGINE BOTTOM END

Coupling

- Install:
 - Pins [A]
 - Gasket [B]
- Position the magnet lead [C] as shown.



- Apply grease to the oil seal lip.
- Install the output cover.
- Run the magneto lead [A] between the magneto cover [B] and the output cover [C] as shown.
- Tighten:
 - Torque - Output Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)**

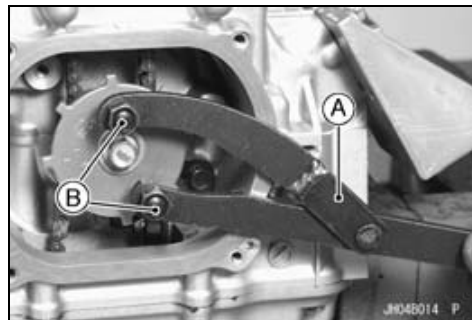


- Install the coupling by using the old timing rotor as a holding tool.

Special Tools - Flywheel & Pulley Holder: 57001-1605 [A]
Holder Attachment: 57001-1547 [B]
Coupling Holder #2: 57001-1423

Torque - Coupling: 98 N·m (10 kgf·m, 72 ft·lb)

- Then remove the timing rotor. **This removed rotor should be stored as a special tool** by grinding the letter or marking an adequate mark for verifying.
- Then install one **new** timing rotor. Use the following as a new part.



Model Name	Part No.
JT1500-A1 ~ A6	21007-3730
JT1500A7 ~	21007-3746

- Install:
 - Crankshaft Sensor Cover
 - Engine (see Engine Removal/Installation chapter)

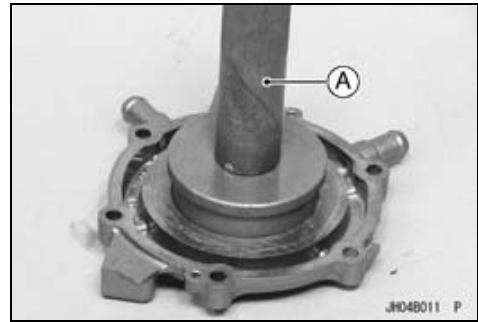
Coupling Damper Inspection

- Refer to the Coupling Damper Inspection in the Periodic Maintenance chapter.

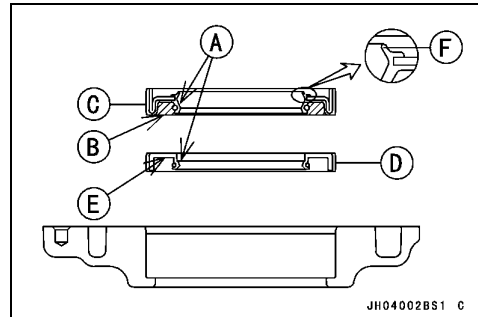
Coupling

Output Cover Oil Seal Replacement

- Remove:
Output Cover (see Coupling/Output Shaft Removal)
- Using the bearing driver [A], remove the oil seals as a set.
Special Tool - Bearing Driver Set: 57001-1129



- Replace the oil seals with new ones.
- Apply thin coat grease to the oil seal lips [A].
- Pack grease [B] between the oil seal lip and housing of the oil seal (flywheel side oil seal [C]).
- Press in the oil seals until they are bottomed.
- Install the coupling oil seal [D] so that the manufacturer's marks [E] face coupling side.
- Install the flywheel side oil seal so that the dust seal [F] side face out.



Oil Seal Inspection

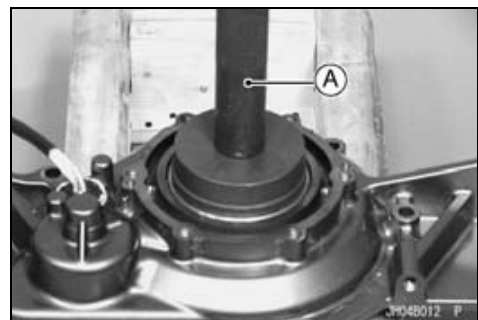
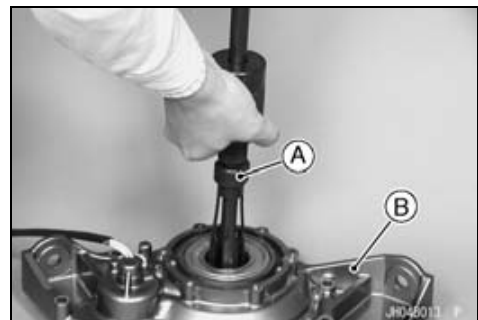
- Inspect the oil seal.
- Replace it if the lips are misshapen, discolored (indicating that the rubber has deteriorated), hardened or otherwise damaged.

Magneto Cover Bearing Replacement

NOTICE

Removing the ball bearing may damage it. Do not remove the ball bearing unless absolutely necessary.

- Remove:
Magneto Cover (see Coupling/Output Shaft Removal)
- Using the oil seal and bearing remover [A], remove the ball bearing from the magneto cover [B].
- When removing the ball bearing, hold the magneto cover.
- Special Tool - Oil Seal and Bearing Remover: 57001-1058**
- Using a press and the bearing driver set [A], install the new bearing until it stops at the bottom of its housing.
- Special Tool - Bearing Driver Set: 57001-1129**



Ball Bearing Lubrication

NOTE

- Since the bearings are packed with grease and sealed on both sides, lubrication is not required.

8-12 ENGINE BOTTOM END

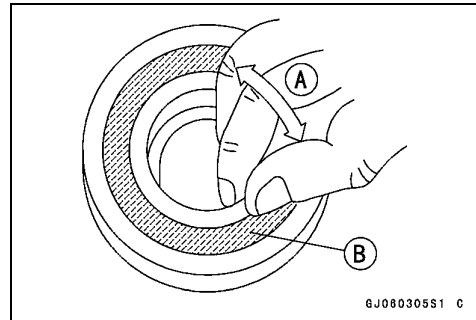
Coupling

Ball Bearing Inspection

NOTE

○ *It is not necessary to remove the bearings for inspection. If the bearing is removed, it will need to be replaced with a new one.*

- Spin [A] it by hand to check its condition.
- ★ If it is noisy, does not spin smoothly, or has any rough spots, it must be replaced.
- Examine the bearing seal [B] for tears or leakage.
- ★ If the seal is torn or is leaking, replace the bearing.



Magneto Flywheel

Magneto Flywheel Removal

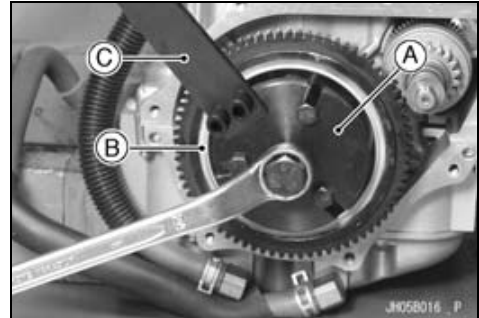
- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Crankshaft Sensor Cover (see Electrical System chapter)
 - Coupling (see Coupling/Output Shaft Removal)
 - Magneto Cover (see Coupling/Output Shaft Removal)

○ Using the rotor puller [A], pull off the flywheel [B].

Special Tool - Rotor Puller: 57001-1623
Grip: 57001-1591 [C]

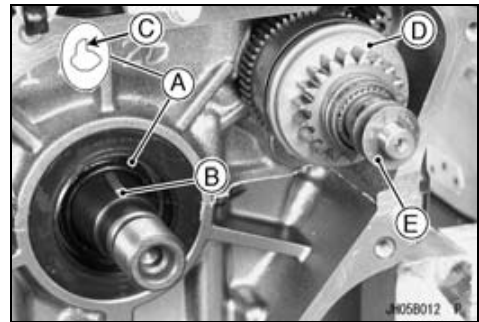
NOTICE

Hitting the head of the rotor puller may cause a loss in rotor magnetism. To prevent a loss in rotor magnetism, do not hit the head of the rotor puller.



Magneto Flywheel Installation

- Using a high-flash points solvents, clean off any oil or dirt that may be on the crankshaft taper, and in the tapered hole in the magneto flywheel.
- Install the O-ring [A] directly as shown.
- This face [C] is magneto flywheel side.
- Fit the woodruff key [B] securely in the crankshaft before installing the magneto flywheel.
- ★ If the reduction gear [D] is removed, apply a molybdenum disulfide grease to both ends of its shaft.
- Install the reduction gear and the washer [E].



8-14 ENGINE BOTTOM END

Magneto Flywheel

- Apply grease to the boss outside [A] of the magneto flywheel [B].
10 mm (0.39 in.) [C]
- Install the magneto flywheel.

NOTE

- Confirm the magneto flywheel fit or not to the crankshaft before tightening it with specified torque.
- Install the output shaft and tighten it with 70 N·m (7.0 kgf·m, 52 ft·lb) of torque.
- Remove the output shaft.
- Check the tightening torque with rotor puller.

Special Tool - Rotor Puller: 57001-1623

Grip: 57001-1591

- ★ If the magneto flywheel is not pulled out with 20 N·m (2.0 kgf·m, 52 ft·lb) of drawing torque, it is installed correctly.
- ★ If the magneto flywheel is pulled out with under 20 N·m (2.0 kgf·m, 52 ft·lb) of drawing torque, clean off any oil dirt or flaw of the crankshaft and magneto flywheel tapered portion, and dry them with a clean cloth. Then, confirm that it is not pulled out with above torque.
- Tighten the output shaft while holding the magneto flywheel steady with the rotor holder.

Special Tool - Rotor Holder: 57001-1544

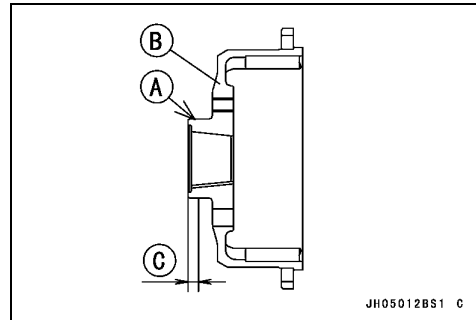
(JT1500-A1 ~ A9 Early Models)

Torque - Output Shaft: 245 N·m (25.0 kgf·m, 180 ft·lb)

(JT1500A9 Late Model ~)

Torque - Output Shaft: 265 N·m (27.0 kgf·m, 195 ft·lb)

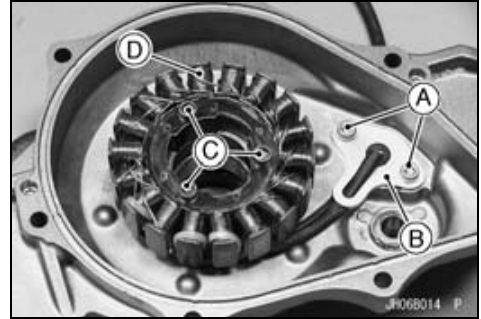
- Install:
Magneto Cover (see Coupling/Output Shaft Installation)



Stator

Stator Removal

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Magneto Cover (see Coupling/Output Shaft Removal)
 - Grommet Cover Mounting Bolts [A]
 - Grommet Cover [B]
 - Stator Mounting Bolts [C] with Washers
 - Stator Assembly [D]



Stator Installation

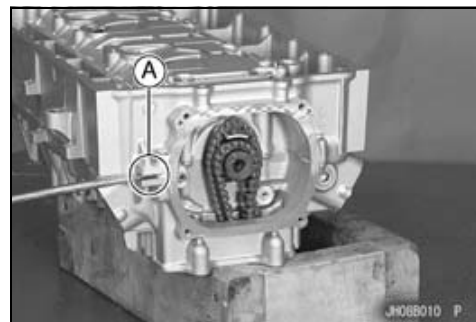
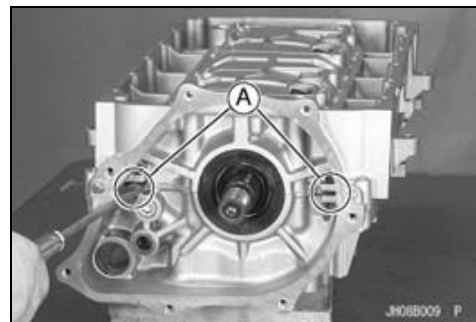
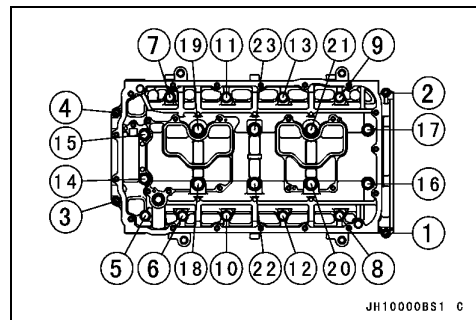
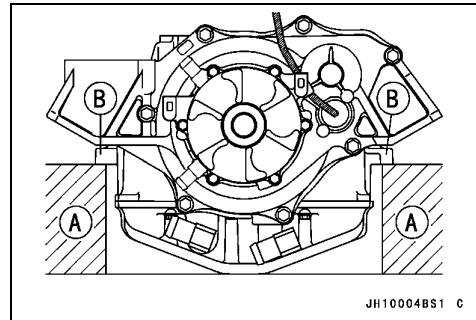
- Apply water resistant grease to the outside of the grommet.
 - Apply a non-permanent locking agent to the grommet cover bolts.
 - Tighten:
 - Torque - Grommet Cover Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
 - Apply a non-permanent locking agent to the stator mounting bolts and put the washers.
 - Tighten:
 - Torque - Stator Mounting Bolts: 12 N·m (1.2 kgf·m, 104 in·lb)**
- When installing the stator, fix the stator lead to the groove of the magneto cover.
- Be sure to the stator lead have no slack and bite.

8-16 ENGINE BOTTOM END

Crankcase Splitting

Crankcase Splitting

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Engine (see Engine Removal/Installation chapter).
 - Drain the engine oil (see Periodic Maintenance chapter).
 - Set the engine on a clean surface and hold the engine steady while parts are being removed.
 - Suitable Props [A]
 - Lower Crankcase Projections [B]
-
- Remove:
 - Crankshaft Sensor Cover (see Electrical System chapter)
 - Cylinder Head (see Engine Top End chapter)
 - Piston (see Engine Top End chapter)
 - Starter Motor (see Electrical System chapter)
 - Oil Pump Bodies (see Engine Lubrication System chapter)
 - Magneto Flywheel (see Magneto Flywheel Removal)
 - Oil Filter (see Periodic Maintenance chapter)
 - Remove the crankcase bolts.
 - First loosen the M6 bolts [1 ~ 4].
 - Next loosen the M8 bolts [5 ~ 17].
 - Last loosen the M10 bolts [18 ~ 23].
-
- Using the pry points [A], split the crankcase halves.
 - Lift off the lower crankcase half.



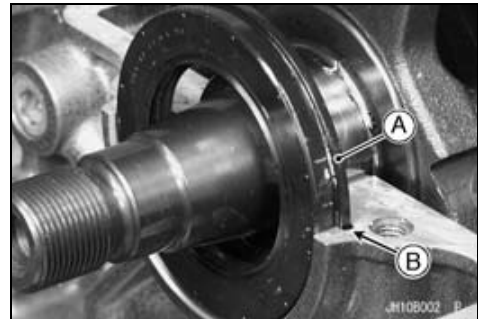
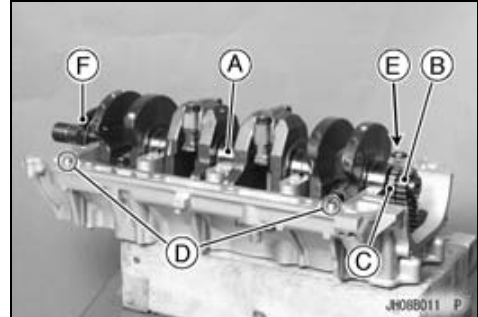
Crankcase Splitting

Crankcase Assembly

NOTICE

The upper and lower crankcase halves are machined at the factory in the assembled state, so the crankcase halves must be replaced as a set.

- With high-flash point solvent, clean off the mating surfaces of the crankcase halves and wipe dry.
- Using compressed air, blow out the oil passages in the crankcase halves.
- Install:
 - Crankshaft [A] and Connecting Rods (see Crankshaft Installation)
 - Camshaft Chain [B]
 - Oil Pump Sprocket Chain [C]
 - Dowel Pins [D]
 - Oil Passage Pipe [E] with O-ring
 - Oil Seal [F]
- Before fitting the lower case on the upper case, check the following.
 - Be sure to hang the camshaft and oil pump sprocket chain on the crankshaft.
 - Check to see that the oil seal [A] is in the groove [B] of the crankcase.

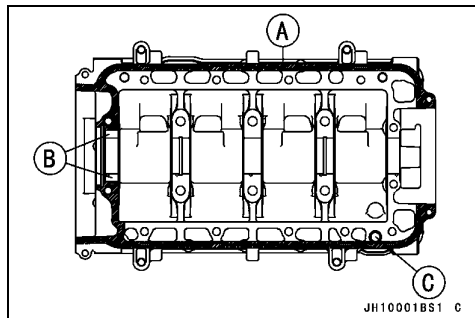


- Apply liquid gasket [A] to the mating surface of the lower crankcase half.

NOTE

- Make the application finish within 30 minutes when the liquid gasket to the mating surface of the lower crankcase half is applied.
- Moreover fit the case and tighten the case bolts just after finishing the application of the liquid gasket.

Sealant - Liquid Gasket, TB1215B: 92104-1062



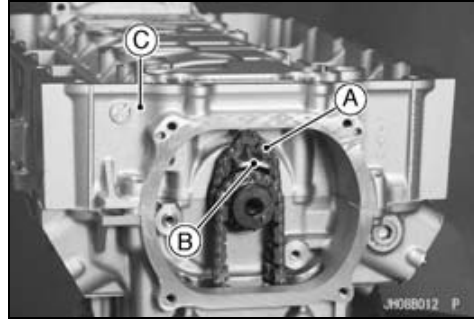
NOTICE

Do not apply liquid gasket around the crankshaft main bearing inserts [B], and oil passage hole [C].

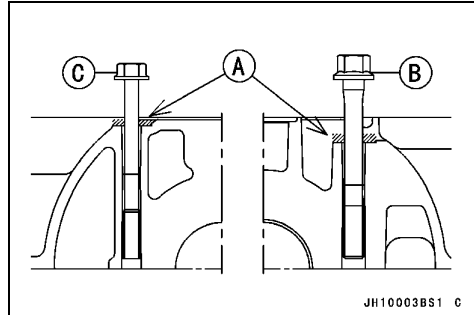
8-18 ENGINE BOTTOM END

Crankcase Splitting

- Install the oil pump sprocket chain [A] on the chain guide [B] of the lower crankcase [C].



- Apply molybdenum disulfide oil solution to the bolt seating surfaces [A] on the lower crankcase for the M10 bolts [B] and M8 [7 ~ 10] bolts [C].



- Tighten the crankcase bolts.
- Following the sequence numbers on the lower crankcase half, tighten the M10 bolts [1 ~ 6].

Torque - Crankcase Bolts (M10): 50 N·m (5.0 kgf·m, 36 ft·lb)

- Following the sequence numbers, tighten the M8 bolts [7 ~ 10].

Torque - Crankcase Bolts (M8): 29 N·m (3.0 kgf·m, 22 ft·lb)

- Following the sequence numbers, tighten the M8 bolts [11 ~ 19].

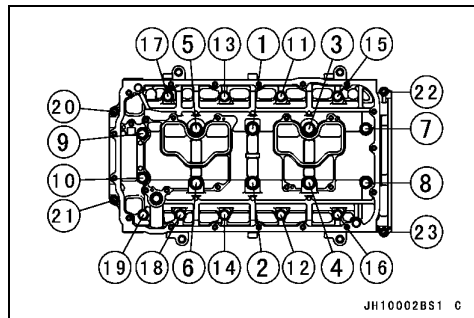
Torque - Crankcase Bolts (M8): 29 N·m (3.0 kgf·m, 22 ft·lb)

- Following the sequence numbers, tighten the M7 bolts [20 ~ 23].

Torque - Crankcase Bolts (M6): 12 N·m (1.2 kgf·m, 104 in·lb)

- After tightening all crankcase bolts, check the following item.

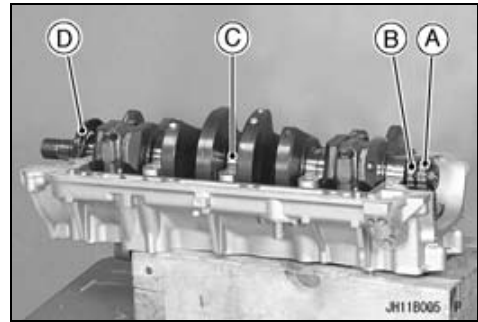
Crankshaft turn freely.



Crankshaft and Connecting Rods

Crankshaft Removal

- Split the crankcase (see Crankcase Splitting).
- Remove:
 - Camshaft Chain [A]
 - Oil Pump Sprocket Chain [B]
- Remove the crankshaft [C] with the oil seal [D].



Crankshaft Installation

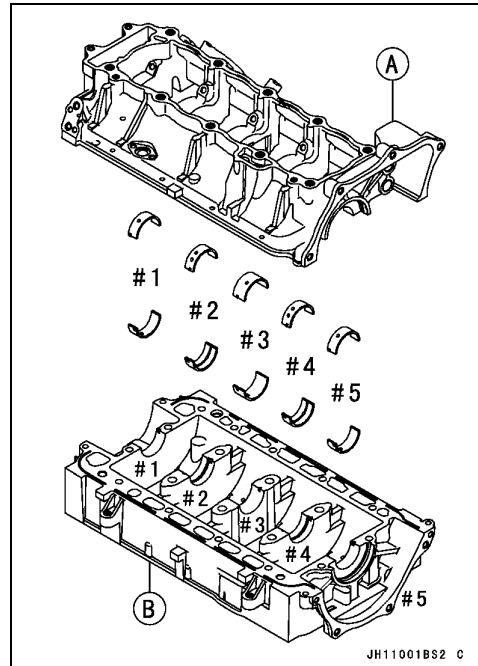
NOTICE

If the crankshaft, bearing inserts, or crankcase halves are replaced with new ones, select the bearing inserts and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

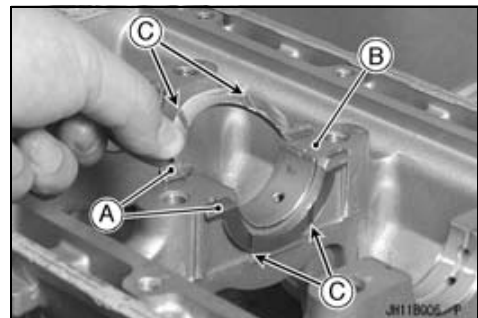
- Fit the crankshaft main bearing inserts on the upper [A] and lower [B] crankcase halves.
 - #1, 5 Bearing Inserts (no Groove, same)
 - #2, 4 Bearing Inserts (Groove, same)
 - #3 Bearing Insert (no Groove)

NOTE

- Be sure the bearing inserts are seated in the saddles, and the tangs in the bearing inserts are aligned with the notches in the saddles.
- Apply molybdenum disulfide oil solution to the crankshaft main bearing inserts.



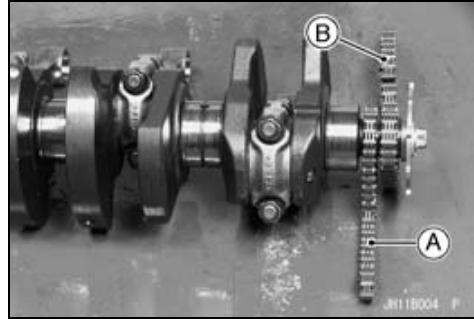
- Fit the thrust washers [A] to both sides of the upper crankcase #3 main bearing [B].
 - Install the thrust washer so that the oil grooves [C] face outward.



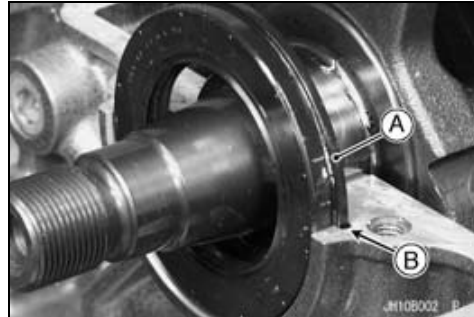
8-20 ENGINE BOTTOM END

Crankshaft and Connecting Rods

- Install the crankshaft with the oil pump sprocket chain [A] and camshaft chain [B] hanging on them.



- Fit the oil seal [A] into the groove [B] of the crankcase.
- Assemble the crankcase (see Crankcase Assembly).



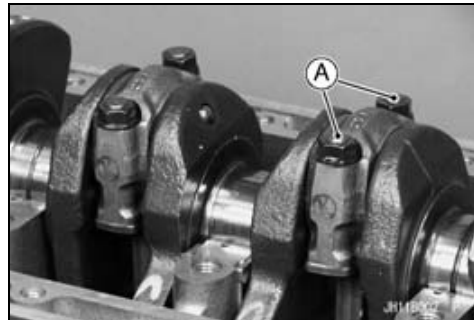
Connecting Rod Removal

- Split the crankcase (see Crankcase Splitting).
- Remove the connecting rod nuts [A].
- Remove the crankshaft.

NOTE

○ Mark and record the locations of the connecting rods and their big end caps so that they can be reassembled in their original positions.

- Remove the connecting rods from the crankshaft.



Connecting Rod Installation

WARNING

Gasoline and low flash-point solvents are extremely flammable and can be explosive under certain conditions. To prevent a fire or explosion, clean the crankshaft, bolts, nuts and connecting rods in a well-ventilated area with a high flash-point solvent away from any ignition sources, including any appliance with a pilot light.

- After removing the connecting rods from the crankshaft, clean them with high-flash point solvent.
- Blow the crankshaft oil passages with compressed air to remove any foreign particles or residue that may have accumulated in the passages.

Crankshaft and Connecting Rods

NOTICE

Using connecting rods with different weight marks increases engine vibration. To minimize vibration, the connecting rods should have the same weight mark.

Big End Cap [A]
Connecting Rod [B]
Weight Mark, Alphabet [C]
Diameter Mark [D]

- ★ If the connecting rods, big end bearing inserts, or crankshaft are replaced with new ones, select the bearing insert and check clearance with a plastigage before assembling engine to be sure the correct bearing inserts are installed.

NOTICE

Connecting rod bolts are designed to stretch when tightened; reusing them can lead to catastrophic engine failure. Never reuse connecting rod bolts. See the table below for correct bolt and nut usage.

- Apply grease and oil to the following portions.
Apply molybdenum disulfide grease [A].
Do not apply grease and oil [B].
Apply molybdenum disulfide oil solution [C].

NOTICE

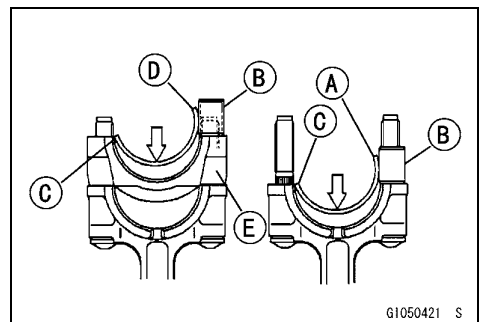
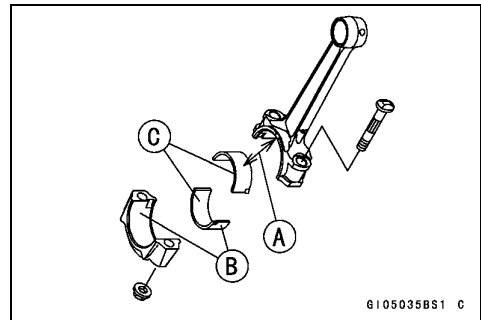
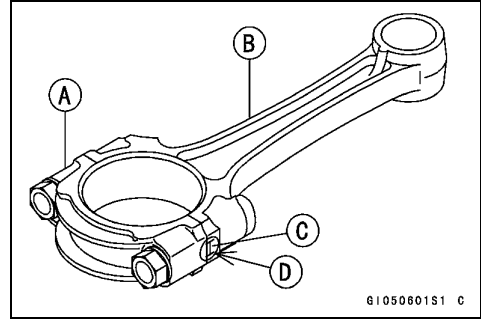
Do not apply grease to the inner surface of the lower big end cap or to the outer surface of the lower bearing insert.

- Install the bearing insert as shown to prevent its outer surface from scratch damage with connecting rod edge.
Connecting Rod Side Bearing Insert [A]
Dowel Pin [B]
Claw Side [C]
Cap Side Bearing Insert [D]
Connecting Rod Cap [E]

- Replace the connecting rod big end bolts and nuts with new ones.
- Be sure to clean the bolts, nuts, and connecting rods thoroughly with high-flash point solvent, because the new connecting rods, bolts, and nuts are treated with anti-rust solution.

NOTICE

Immediately dry the bolts and nuts with compressed air after cleaning. Clean and dry the bolts and nuts completely.

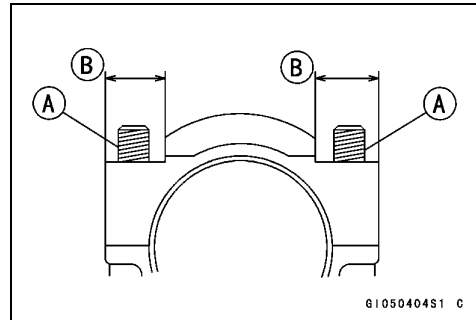


8-22 ENGINE BOTTOM END

Crankshaft and Connecting Rods

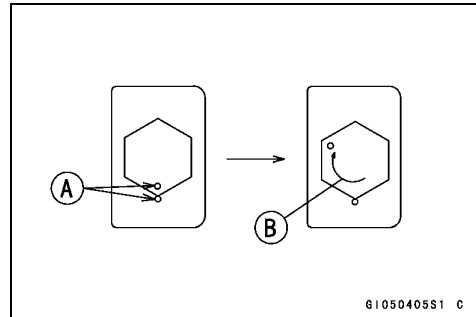
JT1500-A1 ~ AB Models (Engine No.; ~ JTT50AE036455)

- Apply small amount of molybdenum disulfide oil solution to the threads [A] and seating surfaces [B] of the connecting rod nuts.



- First, tighten the nuts to the specified torque. See the table below.
- Next, tighten the nuts by **120°** more.
- Mark [A] the connecting rod big end caps and nuts so that nuts can be turned 120° [B] properly.
- Tighten the hexagon nut by 2 corners.

Connecting Rod Assy	Bolt, Nut	Torque + Angle N·m (kgf·m, ft·lb)
New	Use the bolts and nuts attached to new con-rod. Another new bolts and nuts.	21.6 (2.2, 16) + 120°
Used	Replace the bolts and nuts with new ones	21.6 (2.2, 16) + 120°



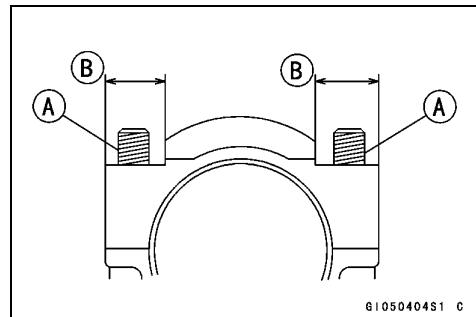
NOTICE

Since the connecting rod bolts are designed to stretch when tightened, overtightening the nuts will excessively stretch the bolts, weakening them so that they may break and cause severe engine damage. Do not overtighten the nuts.

JT1500-AB ~ AC Models (Engine No.; JTT50AE036456 ~)

(1) Bolt Length Measurement Method

- Install new bolts and nuts in reused connecting rods.
- Dent both bolt head and bolt tip with a punch.
- Apply molybdenum disulfide oil solution to the threads [A] and seating surfaces [B] of the connecting rod nuts.



Crankshaft and Connecting Rods

- Before tightening, use a point micrometer to measure the length of new connecting rod bolts and record the values to find the bolt stretch.

Connecting Rod [A]

Dent here with a punch [B].

Nuts [C]

Fit micrometer pins into dents [D].

- Apply a small amount of molybdenum disulfide oil to the following.

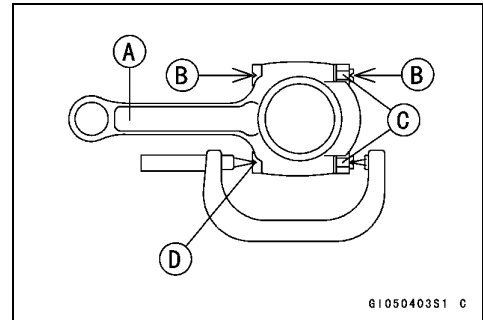
Threads of Nuts and Bolts

Seating Surfaces of Nuts and Connecting rods

- Tighten the big end nuts until the bolt elongation reaches the length specified in the table.
- Check the length of the connecting rod bolts.
- ★ If the stretch is more than the usable range, the bolt has stretched too much. An overelongated bolt may break in use.

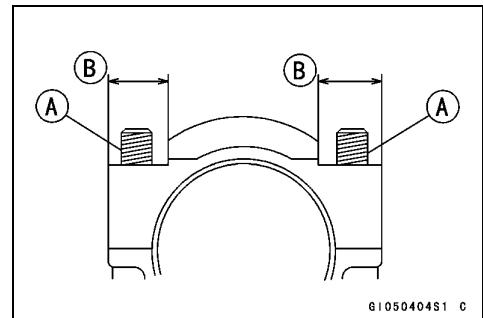
$$\text{Bolt Length after tightening} - \text{Bolt Length before tightening} = \text{Bolt Stretch}$$

Connect- ing Rod Assy	Bolt	Nut	Usable Range of Connecting Rod Bolt Stretch
New	Use the bolts attached to new con-rod.	Attached to new con-rod	0.20 ~ 0.29 mm (0.0098 ~ 0.0134 in.)
	New	New	
Used	Replace the bolts with new ones.	Replace the nuts with new ones.	0.20 ~ 0.29 mm (0.0098 ~ 0.0134 in.)



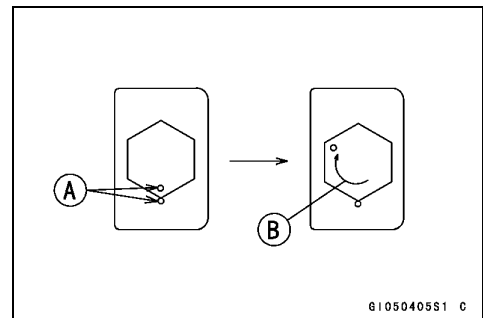
(2) Rotation Angle Method

- ★ If you don't have a point micrometer, you may tighten the nuts using the "Rotation Angle Method".
- Install new bolts and nuts in reused connecting rod.
- Apply molybdenum disulfide oil solution to the threads [A] and seating surfaces [B] of the connecting rod nuts.



- First, tighten the nuts to the specified torque. See the table below.
 - Next, tighten the nuts $120^\circ \pm 5^\circ$.
- Mark [A] the connecting rod big end caps and nuts so that nuts can be turned 120° [B] properly.

Connecting Rod Assy	Bolt	Nut	Torque + Angle N·m (kgf·m, ft·lb)
New	Use the bolts attached to new con-rod.	Attached to new con-rod	18 (1.8, 13) + 120°
	New	New	18 (1.8, 13) + 120°
Used	Replace the bolts with new ones	Replace the nuts with new ones	18 (1.8, 13) + 120°



8-24 ENGINE BOTTOM END

Crankshaft and Connecting Rods

Connecting Rod Bend

- Remove the connecting rod big end bearing inserts, and reinstall the connecting rod big end caps.
 - Select an arbor [A] of the same diameter as the connecting rod big end, and insert the arbor through the connecting rod big end.
 - Select an arbor of the same diameter as the piston pin at least 100 mm (3.94 in.) long, and insert the arbor [B] through the connecting rod small end.
 - On a surface plate, set the big-end arbor on V blocks [C].
 - Measure the difference in the heights of the arbor above the surface plate over a 100 mm (3.94 in.) distance-on the arbor to determine the amount of connecting rod bend with the connecting rod held vertically, and using a height gauge.
- ★ If connecting rod bend exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Bend

Service Limit: 0.2/100 mm (0.008/3.94 in.)

Connecting Rod Twist

- On surface plate, set the big-end arbor [A] on V block [C].
 - Measure the difference in the heights of the arbor [B] above the surface plate over a 100 mm (3.94 in.) distance-on the arbor to determine the amount of connecting rod twist with the connecting rod held horizontally, and using a height gauge.
- ★ If connecting rod twist exceeds the service limit, the connecting rod must be replaced.

Connecting Rod Twist

Service Limit: 0.2/100 mm (0.008/3.94 in.)

Connecting Rod Big End Side Clearance

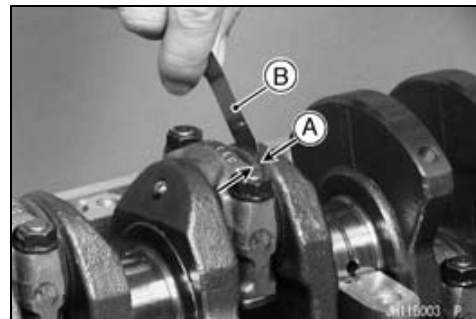
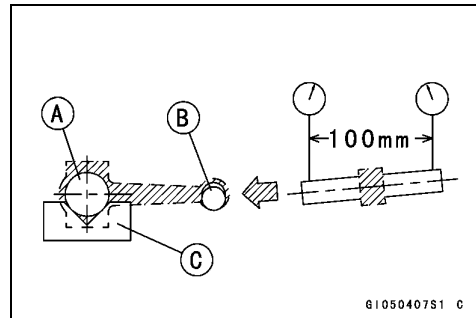
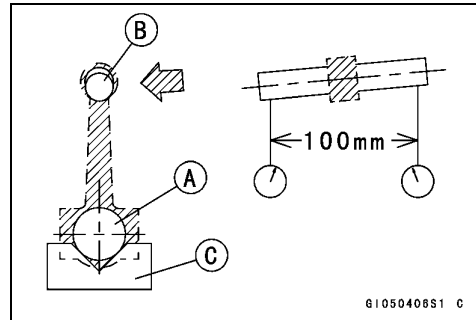
- Measure connecting rod big end side clearance [A].
- Insert a thickness gauge [B] between the big end and either crank web to determine clearance.

Connecting Rod Big End Side Clearance

Standard: 0.13 ~ 0.38 mm (0.0051 ~ 0.0150 in.)

Service Limit: 0.58 mm (0.023 in.)

- ★ If the clearance exceeds the service limit, replace the connecting rod with a new one and then check clearance again. If clearance is too large after connecting rod replacement, the crankshaft also must be replaced.



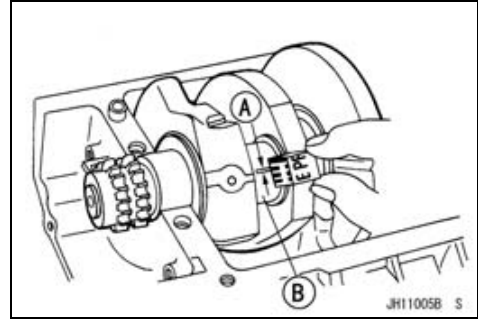
Crankshaft and Connecting Rods

Connecting Rod Big End Bearing Insert/Crankpin Wear

- Measure the bearing insert/crankpin [B] clearance with a plastigage [A].

NOTE

- Tighten the connecting rod big end nuts to the specified torque (see Connecting Rod Installation).
- Do not move the connecting rod and crankshaft during clearance measurement.

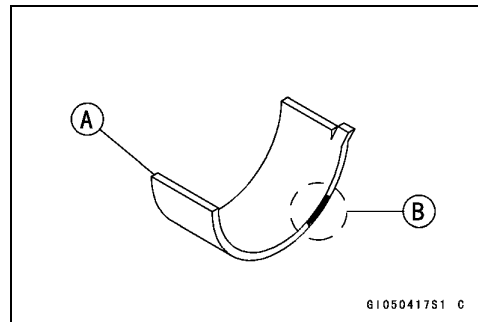


Connecting Rod Big End Bearing Insert/Crankpin Clearance

Standard: 0.041 ~ 0.071 mm (0.0016 ~ 0.00280 in.)

Service Limit: 0.11 mm (0.0043 in.)

- ★ If clearance is within the standard, no bearing replacement is required.
- ★ If clearance is between 0.072 mm (0.00284 in.) and the service limit (0.11 mm, 0.0043 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/crankpin clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If the clearance exceeds the service limit, measure the diameter of the crankpins.



Crankpin Diameter

Standard: 38.984 ~ 39.000 mm (1.5348 ~ 1.5354 in.)

Service Limit: 38.97 mm (1.534 in.)

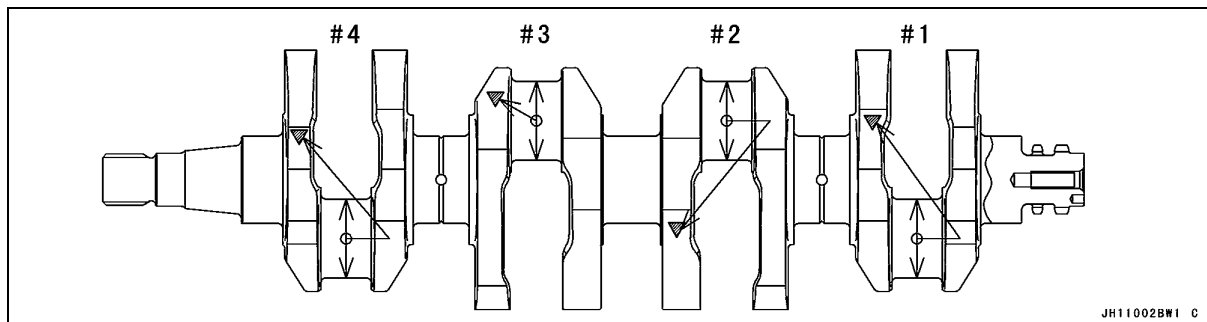
- ★ If any crankpin has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured crankpin diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.

Crankpin Diameter Marks

None 38.984 ~ 38.992 mm (1.5348 ~ 1.5351 in.)

○ 38.993 ~ 39.000 mm (1.5352 ~ 1.5354 in.)

Δ: Crankpin Diameter Marks, "○" mark or no mark.



8-26 ENGINE BOTTOM END

Crankshaft and Connecting Rods

- Measure the connecting rod big end bore diameter, and mark each connecting rod big end in accordance with the bore diameter.

Big End Cap [A]

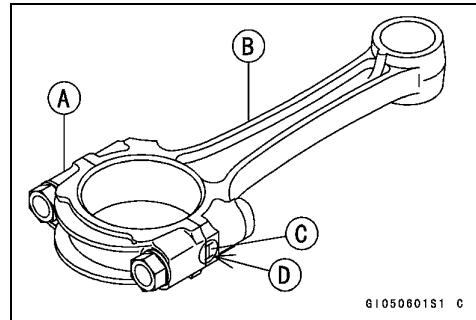
Connecting Rod [B]

Weight Mark [C]: A letter of the alphabet

Bore Diameter Mark (Around Weight Mark) [D]: "○" or no mark.

NOTE

- Tighten the connecting rod big end nuts to the specified torque (see *Connecting Rod Installation*).
- The mark already on the big end should almost coincide with the measurement.



Connecting Rod Big End Bore Diameter Marks

None 42.000 mm ~ 42.008 mm (1.6535 ~ 1.65386 in.)

○ 42.009 ~ 42.016 mm (1.65389 ~ 1.6542 in.)

- Select the proper bearing insert in accordance with the combination coding of the connecting rod and crankshaft.
- Install the new inserts in the connecting rod and check insert/crankpin clearance with the plastigage.

JT1500-A1 ~ AB Models

Con-rod Big End Bore Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Brown	92139-3710
None	None	Black	92139-3709
○	○		
○	None	Blue	92139-3708

JT1500AC Model

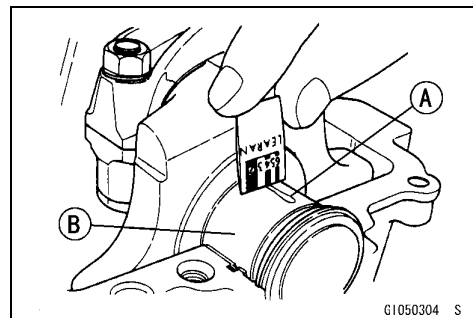
Connecting Rod Big End Inside Diameter Marking	Crankpin Diameter Marking	Bearing Insert	
		Size Color	Part Number
None	○	Pink	92139-0724
None	None	Yellow	92139-0723
○	○		
○	None	Green	92139-0722

Crankshaft Main Bearing Insert/Journal Wear

- Measure the bearing insert/journal [B] clearance with a plastigage [A].

NOTE

- Tighten the crankcase bolts to the specified torque (see *Crankcase Assembly*).
- Do not turn the crankshaft during clearance measurement.
- Journal clearance less than 0.025 mm (0.0010 in.) can not be measured by plastigage, however, using genuine parts maintains the minimum standard clearance.



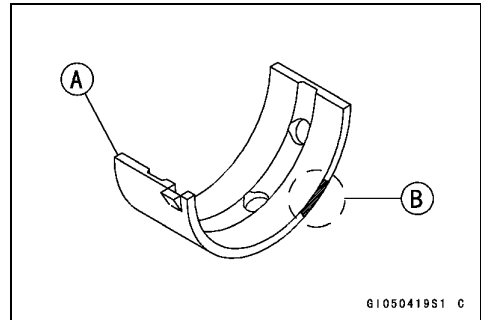
Crankshaft and Connecting Rods

Crankshaft Main Bearing Insert/Journal Clearance

Standard: 0.030 ~ 0.054 mm (0.0012 ~ 0.0021 in.)

Service Limit: 0.08 mm (0.0032 in.)

- ★ If clearance is within the standard, no bearing replacement is required.
- ★ If clearance is between 0.055 mm (0.022 in.) and the service limit (0.08 mm, 0.0032 in.), replace the bearing inserts [A] with inserts painted blue [B]. Check insert/journal clearance with the plastigage. The clearance may exceed the standard slightly, but it must not be less than the minimum in order to avoid bearing seizure.
- ★ If clearance exceeds the service limit, measure the diameter of the crankshaft main journal.



Crankshaft Main Journal Diameter

Standard: 40.984 ~ 41.000 mm (1.6135 ~ 1.6142 in.)

Service Limit: 40.96 mm (1.613 in.)

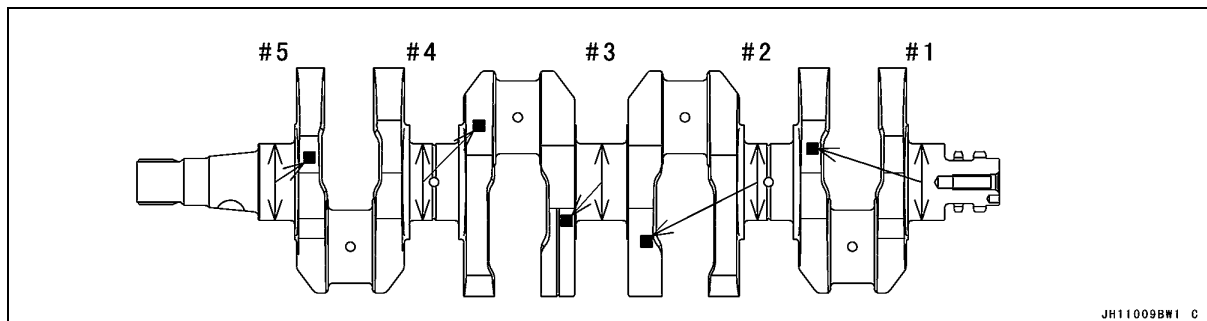
- ★ If any journal has worn past the service limit, replace the crankshaft with a new one.
- ★ If the measured journal diameters are not less than the service limit, but do not coincide with the original diameter markings on the crankshaft, make new marks on it.

Crankshaft Main Journal Diameter Marks

None 40.984 ~ 40.992 mm (1.6135 ~ 1.61385 in.)

1 40.993 ~ 41.000 mm (1.61389 ~ 1.6142 in.)

- : Crankshaft Main Journal Diameter Marks, "1" mark or no mark.



- Measure the main bearing bore diameter, and mark [B] the upper crankcase half [A] in accordance with the bore diameter.
- Crankcase main bearing bore diameter marks are "○" mark and no mark.

NOTE

- Tighten the crankcase bolts to the specified torque (see Crankcase Assembly).
- The mark already on the upper crankcase half should almost coincide with the measurement.

Crankcase Main Bearing Bore Diameter Marks

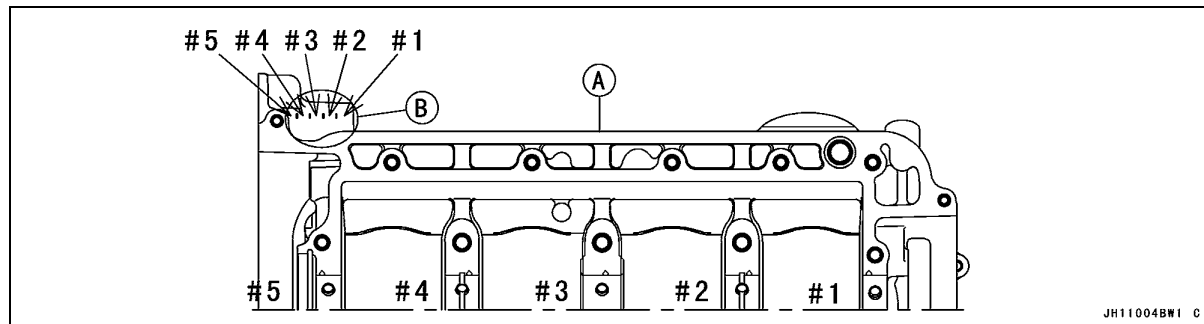
○ 44.000 ~ 44.008 mm (1.7323 ~ 1.73259 in.)

None 44.009 ~ 44.016 mm (1.73263 ~ 1.7329 in.)

8-28 ENGINE BOTTOM END

Crankshaft and Connecting Rods

Marking Position



- Select the proper bearing insert in accordance with the combination coding of the crankcase and crankshaft.
- Install the new inserts in the crankcase halves and check insert/journal clearance with the plastigage.

1500-A1 ~ AB Models

Crankcase Main Bearing Bore Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal No.
○	1	Brown	92139-3704	1, 5
			92139-3713	3
			92139-3707	2, 4
○	None	Black	92139-3703	1, 5
			92139-3712	3
None	1		92139-3706	2, 4
			None	None
92139-3711	3			
92139-3705	2, 4			

*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

1500AC Model

Crankcase Main Bearing Inside Diameter Marking	Crankshaft Main Journal Diameter Marking	Bearing Insert*		
		Size Color	Part Number	Journal No.
○	1	Pink	92139-0727	1, 5
			92139-0730	2, 4
			92139-0733	3
○	None	Yellow	92139-0726	1, 5
			92139-0729	2, 4
None	1		92139-0732	3
None	None	Green	92139-0725	1, 5
			92139-0728	2, 4
			92139-0731	3

*The bearing inserts for Nos. 2 and 4 journals have an oil groove, respectively.

Crankshaft and Connecting Rods

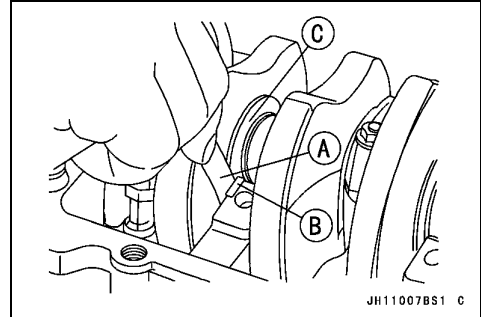
Crankshaft Side Clearance

- Insert a thickness gauge [A] between the thrust washer [B] and the crank web [C] at the No. 3 main journal to determine clearance.
- ★ If the clearance exceeds the service limit, replace the thrust washer as a set and check the width of the crankshaft #3 main journal.

Crankshaft Side Clearance

Standard: 0.05 ~ 0.24 mm (0.0020 ~ 0.0094 in.)

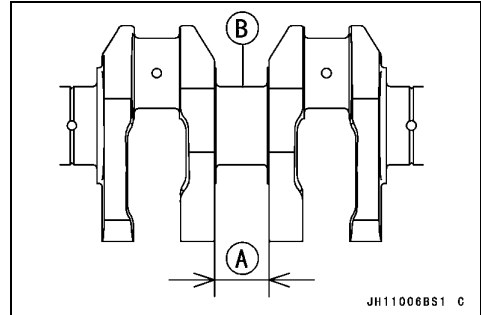
Service Limit: 0.44 mm (0.017 in.)



- Measure the crankshaft #3 main journal width [A].
- ★ If the measurement exceeds the standard, replace the crankshaft [B].

Crankshaft #3 Main Journal Width

Standard: 27.45 ~ 27.55 mm (1.0807 ~ 1.0846 in.)



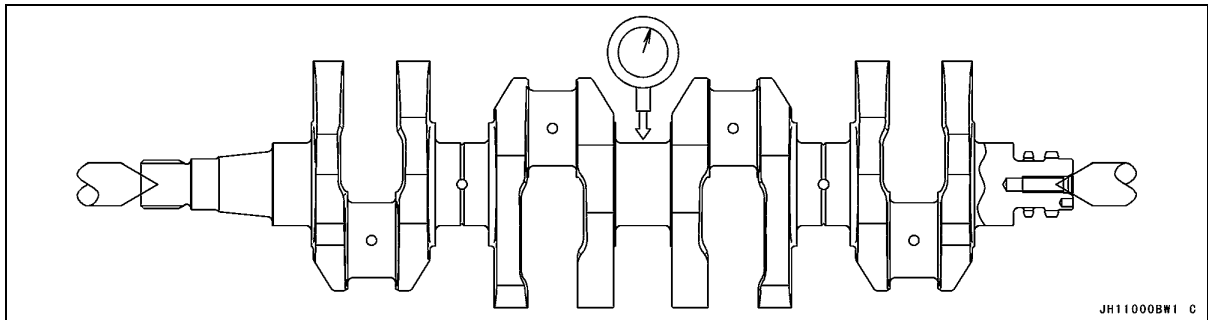
Crankshaft Runout

- Measure the crankshaft runout.
- ★ If the measurement exceeds the service limit, replace the crankshaft.

Crankshaft Runout

Standard: TIR 0.03 mm (0.0012 in.) or less

Service Limit: TIR 0.07 mm (0.0028 in.)



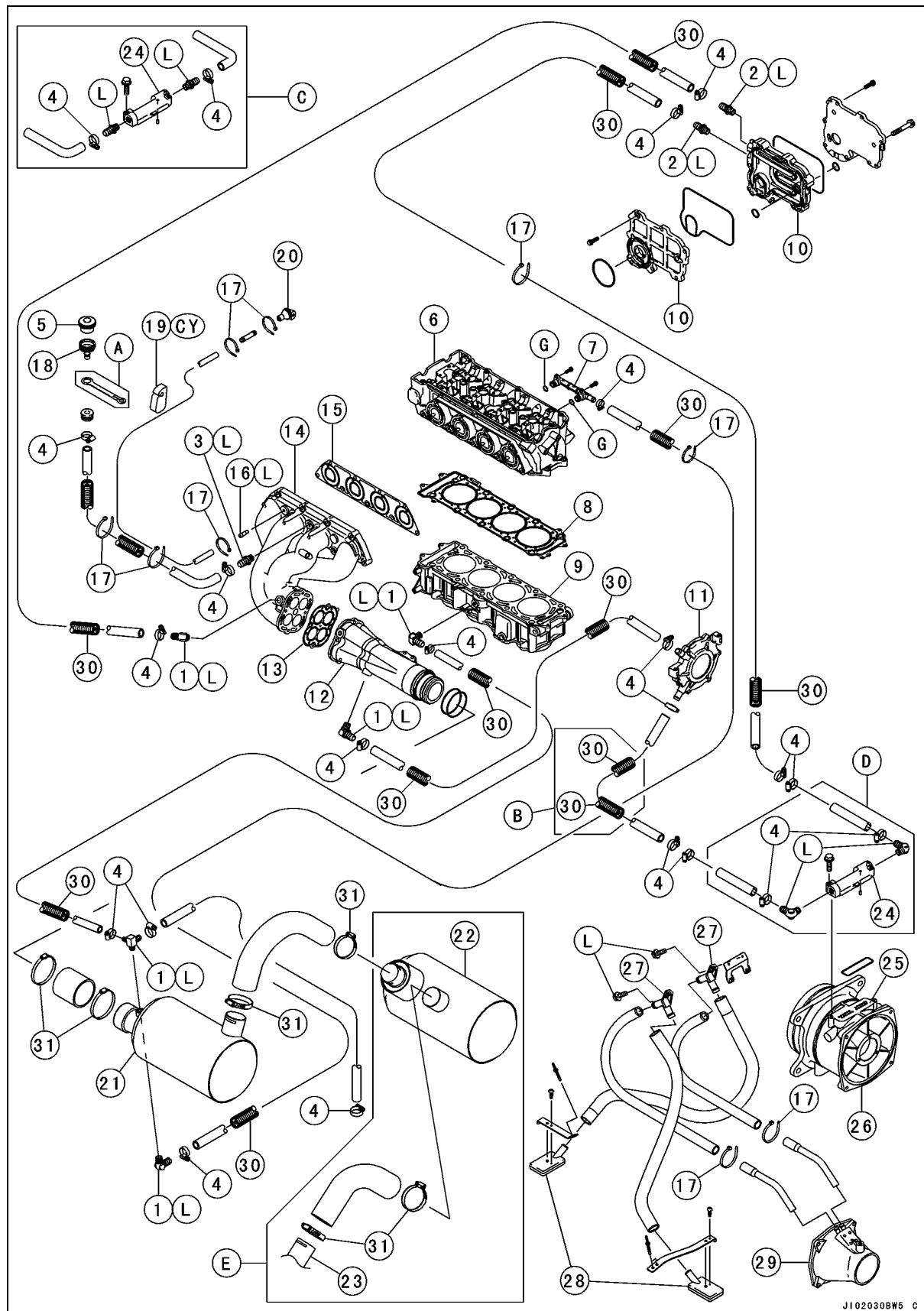
Cooling and Bilge Systems

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9-2 COOLING AND BILGE SYSTEMS

Exploded View



J102030BWS C

Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Water Hose Joint (L Shape Type)	11	1.1	95 in·lb	L
2	Water Hose Joint (Straight Shape Type)	20	2.0	14	L
3	Water Hose Joint (Straight Shape Type)	11	1.1	95 in·lb	L
4	Cooling Hose Clamp Screws	2.5	0.25	22 in·lb	
5	Flushing Cap (JT1500A8 ~)	0.90	0.092	8.0 in·lb	

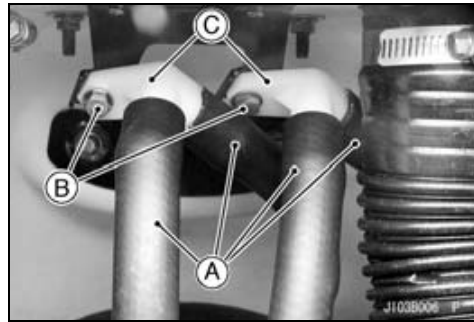
- 6. Cylinder Head
- 7. Water Pipe
- 8. Cylinder Head Gasket
- 9. Cylinder
- 10. Oil Cooler
- 11. Output Cover
- 12. Exhaust Pipe
- 13. Exhaust Pipe Gasket
- 14. Exhaust Manifold
- 15. Exhaust Manifold Gasket
- 16. Bypass Outlet Nozzle
- 17. Plastic Clamp
- 18. Flushing Fitting
- 19. Detent
- 20. Bypass Outlet
- 21. Left Water Box Muffler
- 22. Right Water Box Muffler
- 23. Tail Pipe
- 24. Cooling Water Filter Cover
- 25. Cooling Water Filter
- 26. Pump
- 27. Bilge Breather
- 28. Bilge Filter
- 29. Pump Outlet
- 30. Protective Tube
- 31. Metal Clamp
- A: JT1500-A2 Model ~
- B: JT1500A6 Model ~
- C: JT1500-A1 ~ A6 Models
- CY: Apply cyanoacrylate cement.
- D: JT1500A7 Model ~
- E: JT1500-A1 ~ A8 Models
- G: Apply grease.
- L: Apply a non-permanent locking agent.

9-4 COOLING AND BILGE SYSTEMS

Bilge System

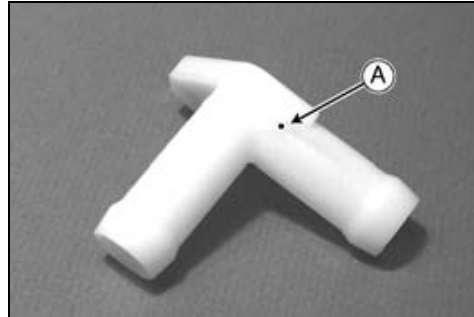
Breather Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Rear Storage Pocket
- Pull the hoses [A] off the breather.
- Unscrew the mounting bolts [B], and remove the breathers [C].



Breather Installation

- Be sure the small hole [A] in the breather is open before installing it.
- Apply a non-permanent locking agent to the breather mounting bolts and tighten them.



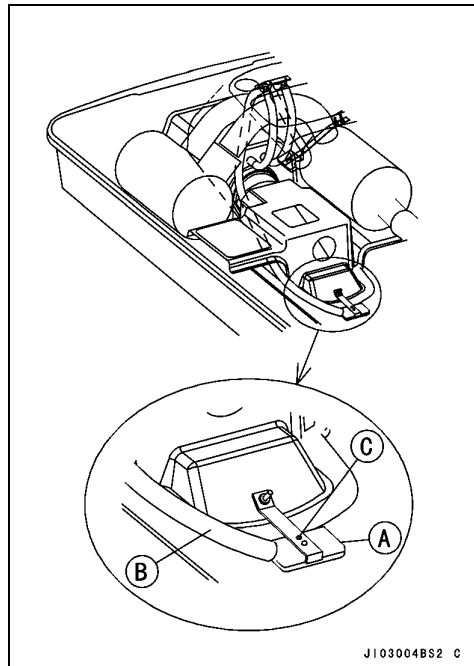
Breather Cleaning and Inspection

- Check that the small hole in the top of the breather is open by blowing in one end of the breather and plugging the other.
- ★ If the hole is plugged, clean it with compressed air. Do not open it with a pointed object (like a needle or a piece of wire), because the hole may be enlarged. If the hole is too large, the bilge system may not suck water out of the hull as it should.

Filter Removal

Follow the next procedures to remove the right side filter [A].

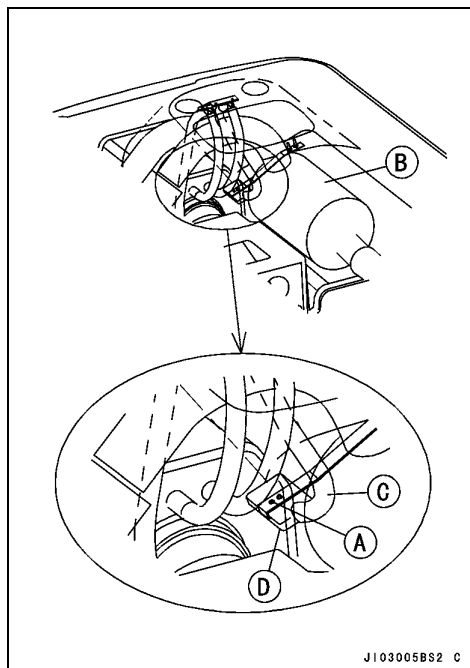
- Remove the engine (see Engine Removal/Installation chapter).
- Pull the hose [B] off the filter.
- Unscrew the mounting screw [C] and remove the filter.



Bilge System

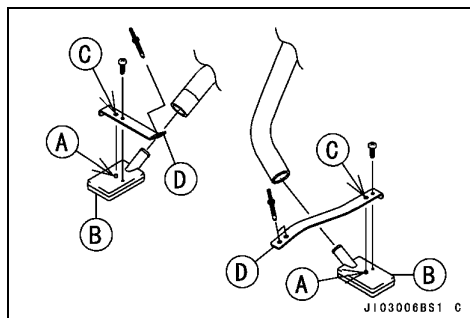
Follow the next procedures to remove the left side filter [D].

- Remove the water box muffler [B] (see Exhaust System chapter).
- Pull the hose [C] off the filter.
- Unscrew the mounting screw [A] and remove the filter.



Filter Installation

- Align the projections [A] on the filters [B] with the holes [C] on the brackets [D].



Filter Cleaning and Inspection

- Flush the filter thoroughly with fresh water and shake it dry.
- Water must flow freely through the filter, but large debris must not.
- ★ If the filter cannot be cleaned, or if it is broken and allows debris to pass through, replace it.

9-6 COOLING AND BILGE SYSTEMS

Cooling and Bilge System Hoses

Hose Removal

- The majority of bilge hoses have no clamps at the hose ends. The majority of bilge system hoses may be simply pulled off their fittings.

NOTE

○ *Some of the bilge system hoses have plastic clamps at hose ends.*

- All the cooling system hoses are clamped at both ends. Loosen the clamps and pull the hoses off.

Hose Installation

- To install the bilge filter hose, push the hose over the end of the filter.

NOTE

○ *Some of the bilge system hoses have plastic clamps at hose ends.*

- When installing the cooling system hoses, be sure to use the same kind of clamp as the original. Some of the clamps are metal for tighter clamping ability (required when smooth fittings are used). Plastic clamps are used where tight clamping is not required.

Hose Inspection

- Refer to the Hose and Hose Connect Inspection in the Periodic Maintenance chapter.

Cooling and Bilge System Flushing

Cooling System Flushing

- Refer to the Cooling System Flushing in the Periodic Maintenance chapter.

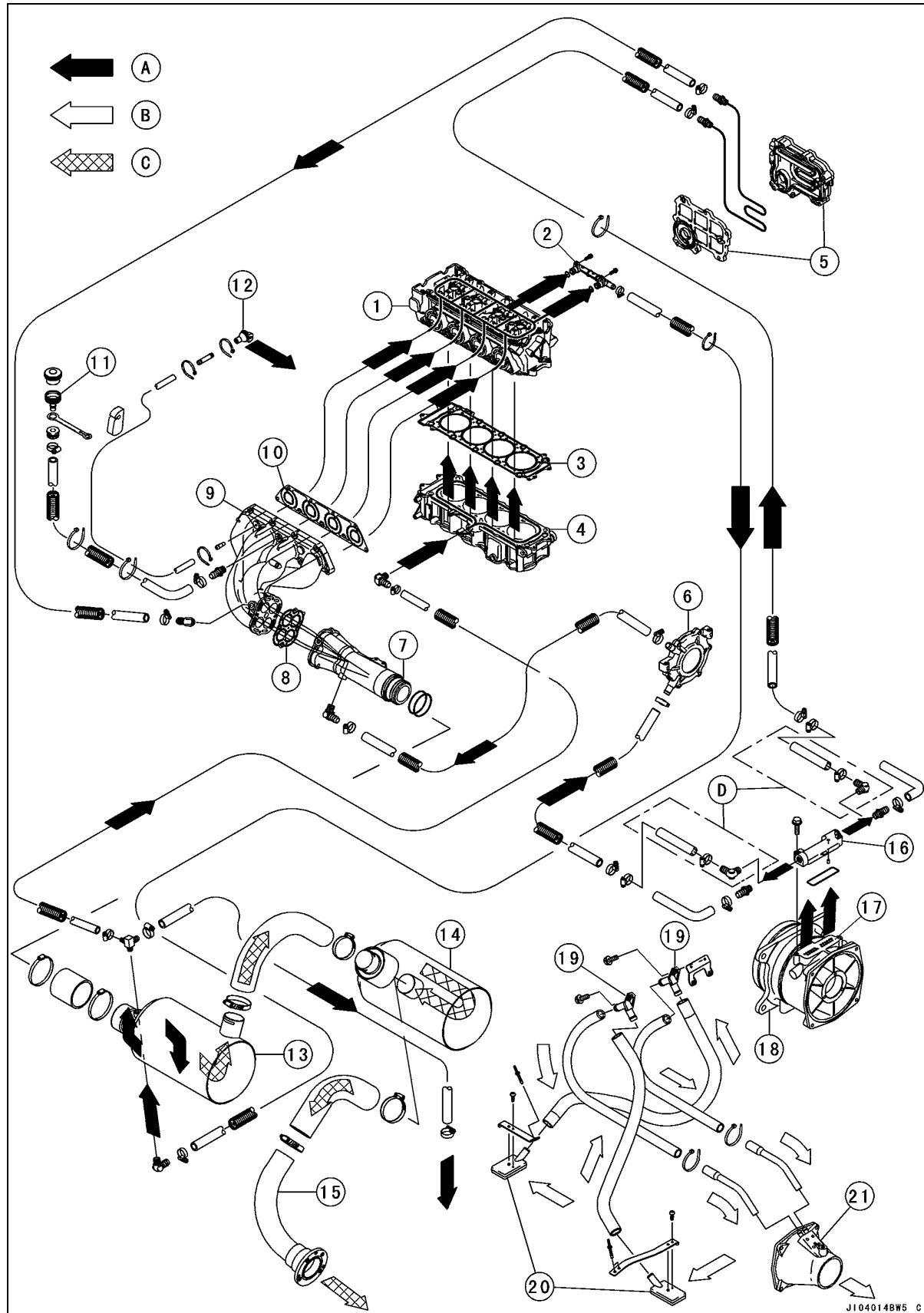
Bilge System Flushing

- Refer to the Bilge System Flushing in the Periodic Maintenance chapter.

9-8 COOLING AND BILGE SYSTEMS

Cooling and Bilge System Flow Diagram

JT1500-A1 ~ A8 Models



Cooling and Bilge System Flow Diagram

1. Cylinder Head
 2. Water Pipe
 3. Cylinder Head Gasket
 4. Cylinder
 5. Oil Cooler
 6. Output Cover
 7. Exhaust Pipe
 8. Exhaust Pipe Gasket
 9. Exhaust Manifold
 10. Exhaust Manifold Gasket
 11. Flushing Fitting
 12. Bypass Outlet
 13. Left Water Box Muffler
 14. Right Water Box Muffler
 15. Tail Pipe
 16. Cooling Water Filter Cover
 17. Cooling Water Filter
 18. Pump
 19. Bilge Breather
 20. Bilge Filter
 21. Pump Outlet
- A. Direction of Cooling System Flow
B. Direction of Bilge System Flow
C. Direction of Combined Exhaust Gas and Cooling Water Flow
D: JT1500A7 Model ~

Cooling and Bilge System Flow Diagram

This diagram illustrates the assembly of a 2000 cc engine. The components are numbered 1 through 20. The assembly sequence is indicated by arrows: A (solid black), B (white with black outline), and C (hatched). The parts include the cylinder head (1), intake manifold (2), gasket (3), crankcase (4), crankshaft (7), pistons (8), connecting rods (9), timing belt (10), timing cover (11), water pump (12), alternator (13), belt (14), fan (15), fan shroud (16), fan pulley (17), timing belt tensioner (18), timing belt guide (19), and timing belt cover (20).

Cooling and Bilge System Flow Diagram

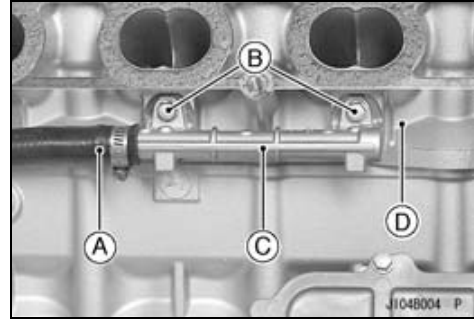
1. Cylinder Head
 2. Water Pipe
 3. Cylinder Head Gasket
 4. Cylinder
 5. Oil Cooler
 6. Output Cover
 7. Exhaust Pipe
 8. Exhaust Pipe Gasket
 9. Exhaust Manifold
 10. Exhaust Manifold Gasket
 11. Flushing Fitting
 12. Bypass Outlet
 13. Water Box Muffler
 14. Tail Pipe
 15. Cooling Water Filter Cover
 16. Cooling Water Filter
 17. Pump
 18. Bilge Breather
 19. Bilge Filter
 20. Pump Outlet
- A. Direction of Cooling System Flow
 - B. Direction of Bilge System Flow
 - C. Direction of Combined Exhaust Gas and Cooling Water Flow

9-12 COOLING AND BILGE SYSTEMS

Water Pipe

Water Pipe Removal

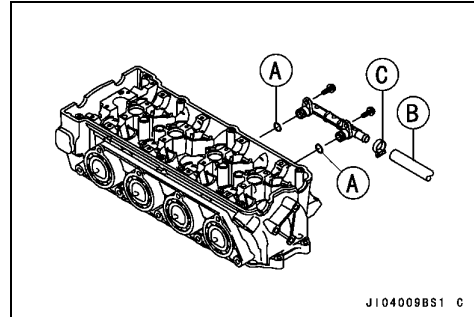
- Remove the inlet manifold (see Fuel System).
- Disconnect the cooling hose [A] onto the water hose joint.
- Unscrew the mounting bolts [B] and remove the water pipe [C] from the cylinder head [D].



Water Pipe Installation

- Apply grease to the O-rings [A] and install the water pipe with the mounting bolts.
- Install cooling hose [B] (cylinder head ~ water box muffler) to the water hose joint and secure the hose clamp [C].
- Tighten:

Torque - Cooling Hose Clamp Screws: 2.5 N·m (0.25 kgf·m, 22 in·lb)



After Submerging

NOTICE

If water enters the engine it will cause severe damage. Do not operate the watercraft with water in the engine. Do not try to start the engine until it is completely empty of water. If water gets into the engine, follow this procedure immediately! If water is left in the engine more than a few hours, it will destroy the crankshaft bearings and damage other internal engine parts.

If the watercraft becomes swamped, water may enter the engine through the throttle body. Water may also enter the fuel tank.

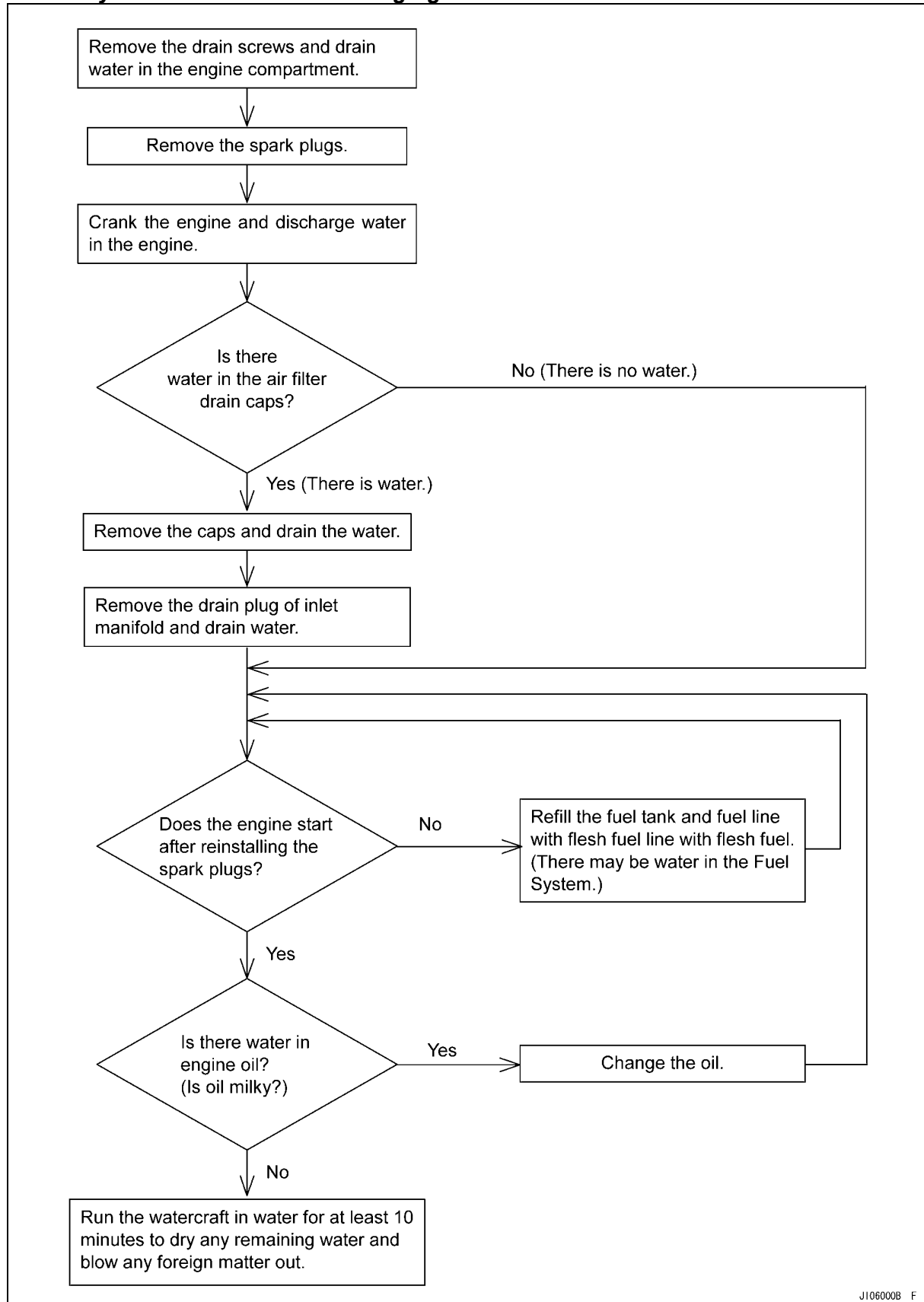
The following procedures explain the necessary steps you must provide.

Read the summary of the procedure first and then their detailed procedures carefully.

9-14 COOLING AND BILGE SYSTEMS

After Submerging

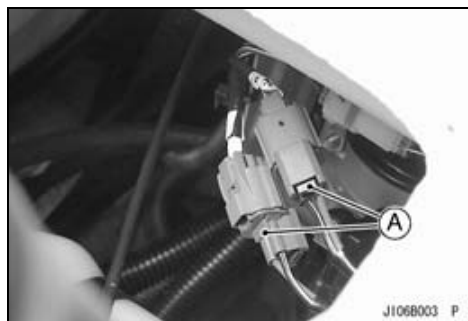
Summary Procedures after Submerging



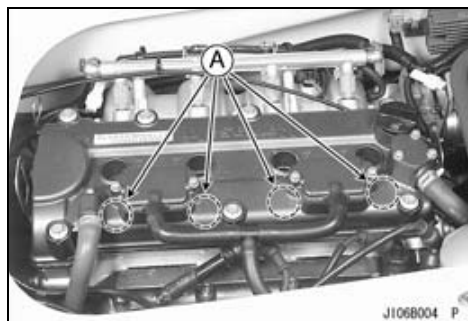
After Submerging

Detailed Procedures after Submerging

1. Remove the seat (see Hull/Engine Hood chapter).
2. Remove the drain screws in the stern to drain water out of the engine compartment.
3. Remove the front storage pocket (see Hull/Engine Hood chapter).
4. Disconnect both two connectors [A] on the primary ignition leads located near the ignition coil.



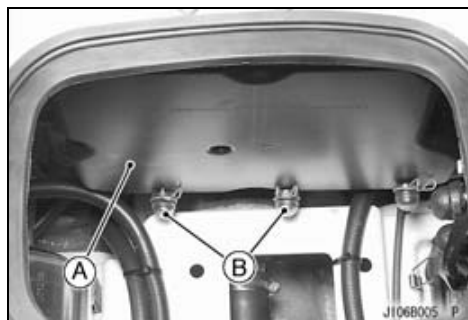
5. Pull and remove all the spark plug caps.
6. Remove all spark plugs. (see Spark Plug Cleaning and Inspection in Periodic Maintenance chapter)
7. Turn the ignition switch on, push the lanyard key under the stop button, and push the start button.
8. If there is any water in the engine, it will be pumped out of the spark plug holes [A]. Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again. Be sure that all the water is out of the engine.



WARNING

A water and gasoline mixture will be forcibly ejected from the spark plug holes and could injure your eyes. To prevent eye injury, do not lean over the engine when performing this procedure. If gas does get in your eyes, immediately wash them with plenty of clean, fresh water and consult a physician as soon as possible.

9. Remove the rear storage pocket, and check the air filter [A] for water inside with its drain caps [B].
10. If you see water in the caps, remove both caps and discharge the water. Be sure to have a rag or cloth underneath for possible oily water. And proceed to the next procedure (No.11).



NOTE

○If you see water in the caps, there is a great possibility that water has entered the inlet manifold. If there is no water in the caps, then proceed to No.12.

11. Remove the drain plug [A] of the inlet manifold [B] and discharge water, if any, into a rag or cloth. (If you do not see water in the caps for the air filter mentioned above, omit this procedure and proceed to the next procedure, No.12).



12. Spray the spark plugs clean and install them with their plug caps.

9-16 COOLING AND BILGE SYSTEMS

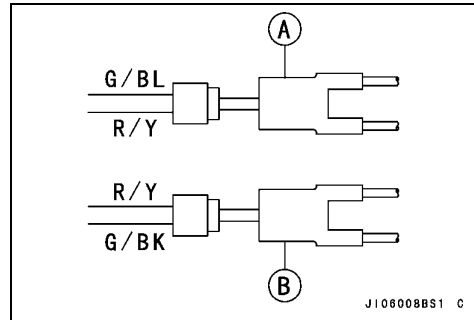
After Submerging

13. Reconnect the primary ignition coil lead connectors, noting the #1, #4 [A] and the #2, #3 [B] coil connectors. The #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.

NOTE

- The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).

14. Start the engine by pressing the start button and run less than 15 seconds.



NOTICE

Running the engine with the watercraft out of the water for more than 15 seconds at a time will cause overheating resulting in engine and exhaust system damage. To prevent engine and exhaust system damage, do not run the engine with the watercraft out of the water for more than 15 seconds at a time. Never operate the engine at maximum speed out of the water.

15. Remove the dipstick [A] and check for the water presence in the engine oil. (If there is water in it, oil looks milky.)
16. If the oil looks milky, then change the oil and repeat procedures 14 and 15 until the oil does not turn milky any more.
17. If the engine does not start, there may be water in the fuel system.



After Submerging

18. If the fuel tank has water in it, it must be emptied by pump or siphon. Refill the tank with fresh fuel. Do not dump contaminated fuel in places not designated for that purpose.

** WARNING**

Gasoline is extremely flammable and can be explosive under certain conditions. To avoid a possible fire or explosion, pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

** WARNING**

Gasoline is toxic and pollutes the environment. To protect the environment, do not discard gasoline; always return it to an authorized recycling center.

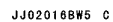
19. Continued trouble may require cleaning of the fuel line to drain water.
20. Try to start the engine (procedure No.14) and proceed to the procedures No.15 and 16.
21. Reinstall the seat and secure it.
22. Reinstall the drain screws in the stern.
23. Finally, run the watercraft IN WATER for at least 10 minutes to dry any remaining water and blow any foreign matter (like salt) out through the exhaust.

Drive System

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Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Coupling	265	27.0	195	
2	Drive Shaft Holder Mounting Bolts	22	2.2	16	L
3	Coupling Cover Bolts	8.8	0.90	78 in·lb	L

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

SS: Apply silicone sealant.

WG: Apply water resistance grease.

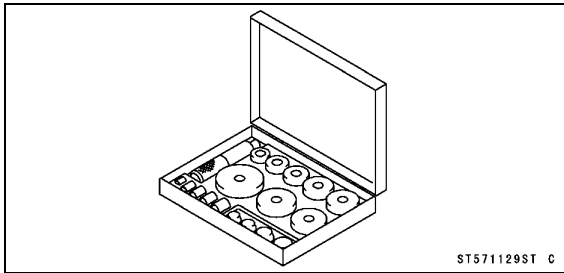
10-4 DRIVE SYSTEM

Specification

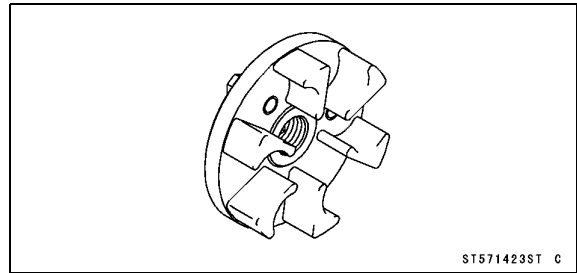
Item	Standard	Service Limit
Drive Shaft Runout (see P10-8)	[A] TIR 0.1 mm (0.0039 in.) or less [B] TIR 0.2 mm (0.0079 in.) or less	TIR 0.2 mm (0.0079 in.) TIR 0.6 mm (0.0236 in.)

Special Tools

Bearing Driver Set:
57001-1129



Coupling Holder #2:
57001-1423



10-6 DRIVE SYSTEM

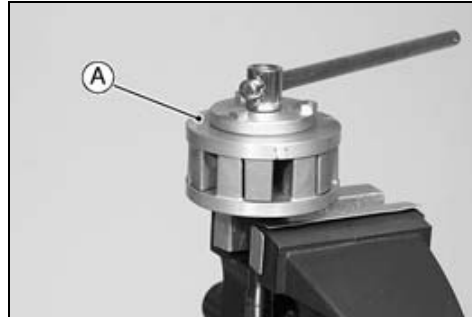
Drive Shaft/Drive Shaft Holder

Drive Shaft Removal/Installation

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



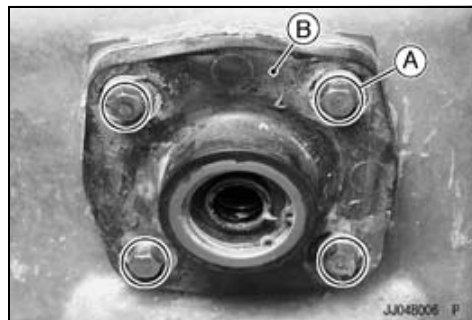
- Hold the drive shaft in a vice, and unscrew the coupling.
Special Tool - Coupling Holder: 57001-1423 [A]



- When installing the drive shaft, be careful of the following items.
- Apply a non-permanent locking agent to the threads of drive shaft and tighten the coupling.
- Torque - Coupling: 265 N·m (27.0 kgf·m, 195 ft·lb)**
- Apply grease to the grease seal lips and the drive shaft spline.

Drive Shaft Holder Removal/Disassembly

- Remove the drive shaft.
- Unscrew the mounting bolts [A] and remove the drive shaft holder [B] from the bulkhead.

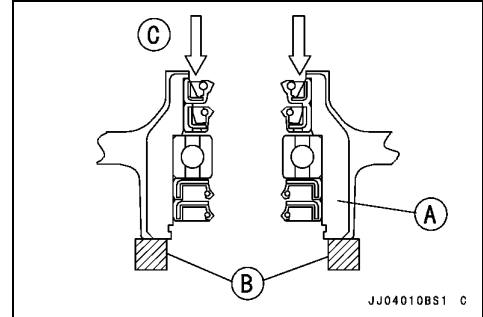


- Disassemble the drive shaft holder.
- Remove the circlip [A].



Drive Shaft/Drive Shaft Holder

- Press the small grease seal, and the large grease seals, bearing, and small grease seals come out of the holder.
- [A] Sleeve
- [B] Blocks
- [C] Press

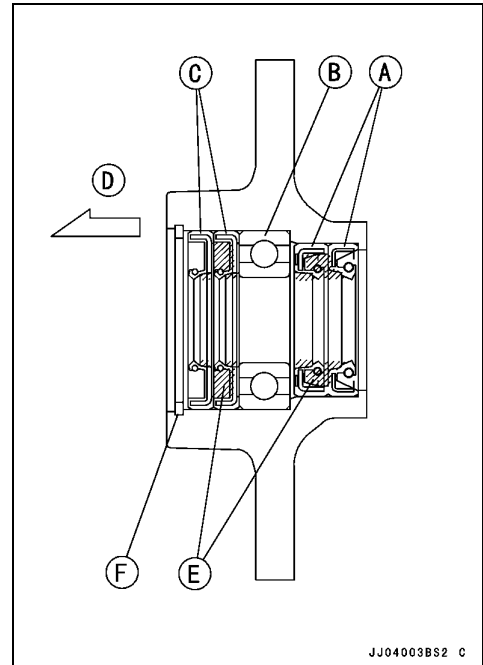


Drive Shaft Holder Assembly/Installation

- Replace the grease seals with new ones.
- Press the bearing and grease seals into the drive shaft holder, noting the following.
- Install the parts in this order.
 - Two Small Grease Seals [A]
 - One Bearing [B]
 - Two Large Grease Seals [C]
 - Front [D]

Special Tool - Bearing Driver Set: 57001-1129

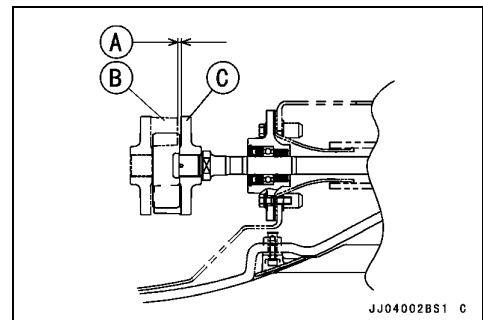
- Install the seals so that the sides with the spring face outward.
- Fill the gaps between the seals with water resistance grease [E].
- Install the circlip [F].
- Apply water resistance grease to the bearing inner surface and grease seal lips.



- Install the drive shaft holder on the bulkhead so that the circlip side face toward the front.
- Apply a non-permanent locking agent to the drive shaft holder mounting bolts, tighten them loosely.
- Install the drive shaft.
- After installing the engine, tighten the drive shaft holder mounting bolts to the specified torque to give proper coupling alignment.

Torque - Drive Shaft Holder Mounting Bolts: 22 N·m (2.2 kgf·m, 16 ft·lb)

- Make sure the clearance [A] between the engine coupling [B] and the drive shaft coupling [C] is 3 ~ 5 mm (0.12 ~ 0.20 in.).



10-8 DRIVE SYSTEM

Drive Shaft/Drive Shaft Holder

Drive Shaft Runout

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

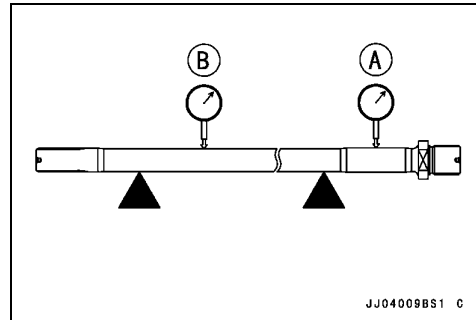
Drive Shaft Runout

Standard: TIR 0.1 mm (0.0039 in.) or less [A]

TIR 0.2 mm (0.0079 in.) or less [B]

Service Limit: TIR 0.2 mm (0.0079 in.) [A]

TIR 0.6 mm (0.0236 in.) [B]



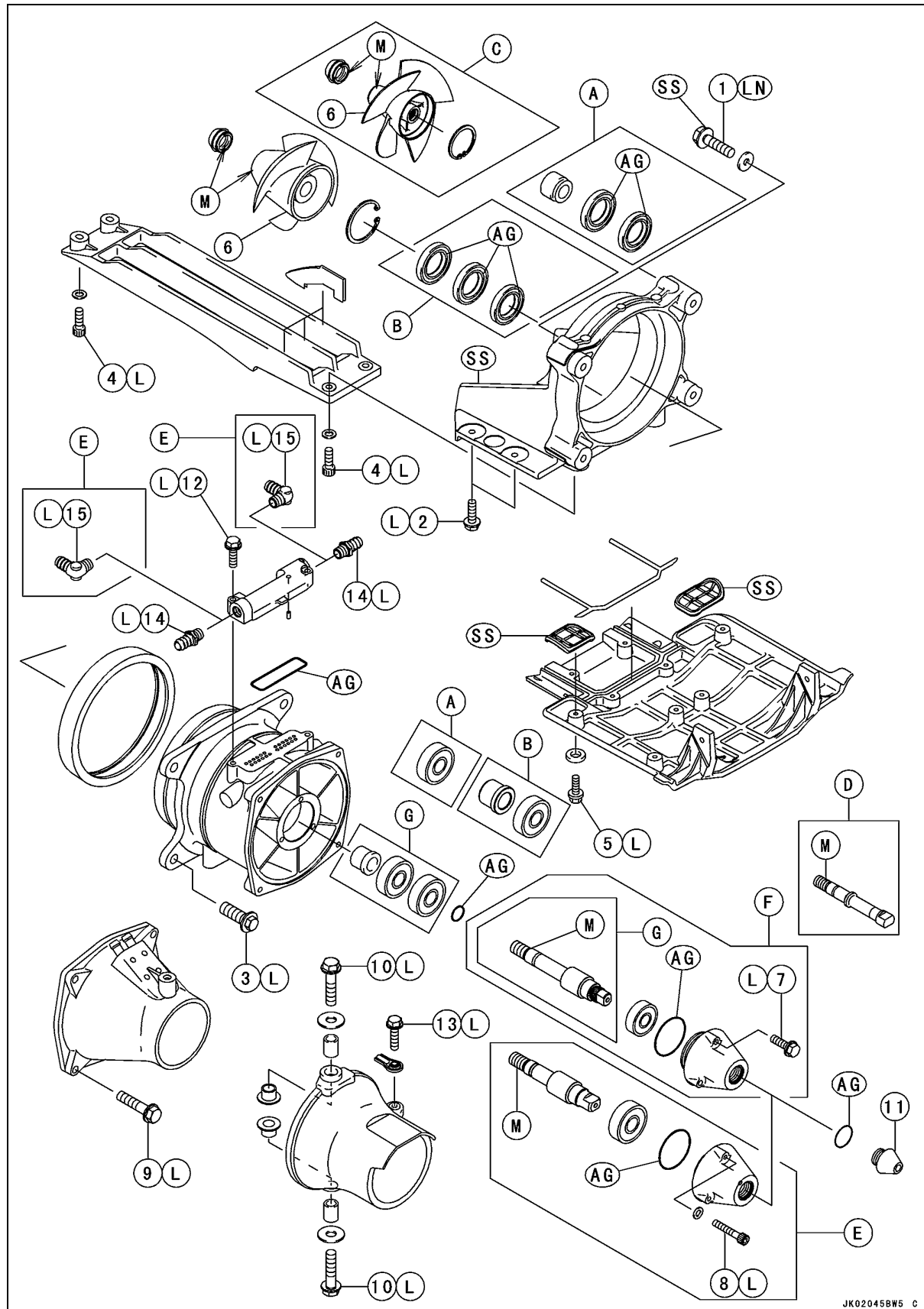
Pump and Impeller

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11-2 PUMP AND IMPELLER

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Pump Bracket Mounting Bolts (2)	19	1.9	14	LN, SS
2	Pump Bracket Mounting Bolts (4)	9.8	1.0	87 in·lb	L
3	Pump Mounting Bolts	36	3.7	27	L
4	Grate Mounting Bolts	9.8	1.0	87 in·lb	L
5	Pump Cover Mounting Bolts	7.8	0.80	69 in·lb	L
6	Impeller	98	10	72	
7	Pump Cap Bolts	9.8	1.0	87 in·lb	L
8	Pump Cap Bolts	3.9	0.40	35 in·lb	L
9	Pump Outlet Mounting Bolts	19	1.9	14	L
10	Steering Nozzle Pivot Bolts	19	1.9	14	L
11	Pump Cap Plug	3.9	0.40	35 in·lb	
12	Filter Cover Mounting Bolts	9.8	1.0	87 in·lb	L
13	Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
14	Water Hose Joint	—	—	—	L
15	Water Hose Joint	—	—	—	L

A: JT1500-A1 Model

B: JT1500-A2 ~ AB Models

C: JT1500A6 (France) ~/A9 (Europe) Model ~

D: JT1500-A1 ~ A6, AB Models

E: JT1500A7 ~ AA Models

F: JT1500-A ~ A6, AB, AC Models

G: JT1500AC Model

AG: Apply lithium grease (NLGI Grade No.2)

L: Apply a non-permanent locking agent.

LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).

M: Apply molybdenum disulfide grease.

SS: Apply silicone sealant.

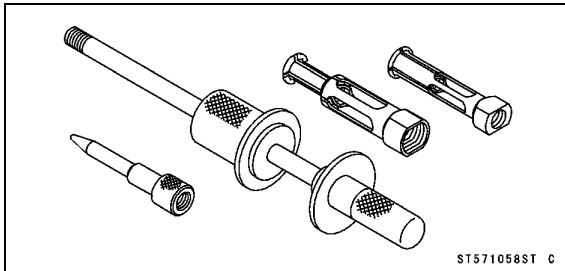
11-4 PUMP AND IMPELLER

Specifications

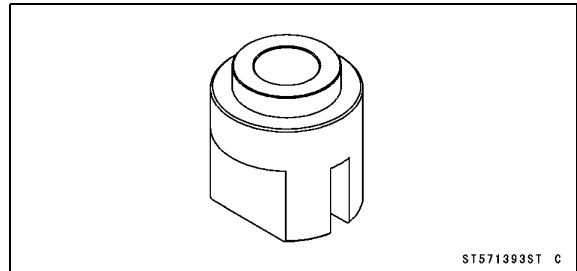
Item	Standard	Service Limit
Jet Pump		
Impeller Outside Diameter	147.5 ~ 147.7 mm (5.8071 ~ 5.8149 in.)	146.5 mm (5.7677 in.)
Pump Case Inside Diameter	148.0 ~ 148.1 mm (5.8268 ~ 5.8307 in.)	149.1 mm (5.8701 in.)
Impeller Clearance	0.15 ~ 0.3 mm (0.0059 ~ 0.0118 in.)	0.6 mm (0.0236 in.)

Special Tools and Sealant

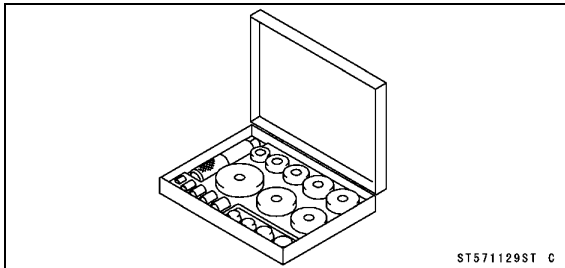
Oil Seal & Bearing Remover:
57001-1058



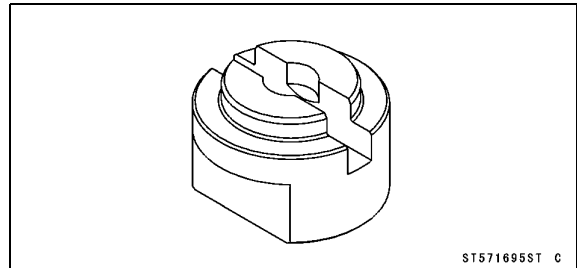
Impeller Holder:
57001-1393



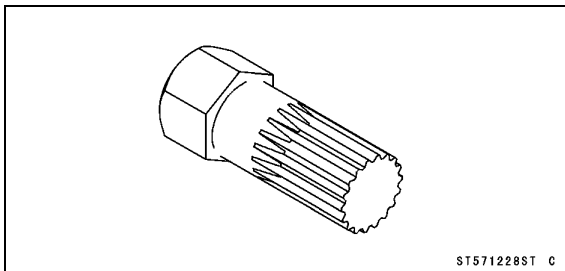
Bearing Driver Set:
57001-1129



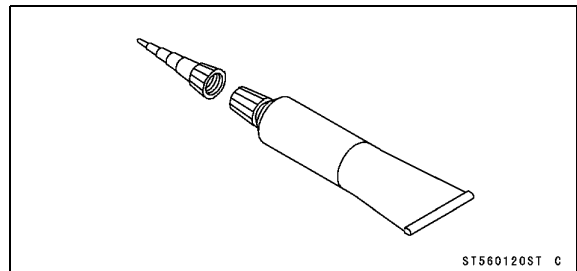
Impeller Holder :
57001-1695



Impeller Wrench:
57001-1228



Liquid Gasket, TB1211:
56019-120

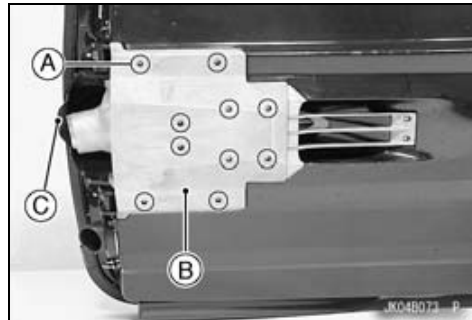


11-6 PUMP AND IMPELLER

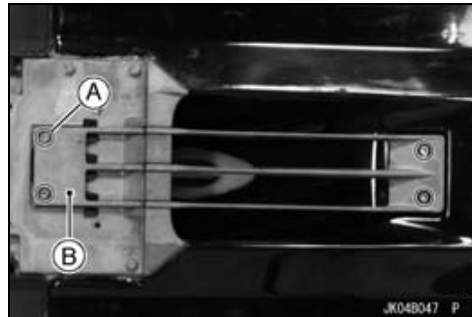
Pump and Impeller

Pump Removal

- Turn the craft on its left side.
- Disconnect the reverse cable ball joint at the rear end.
- Unscrew the pump cover mounting bolts [A], and remove the pump cover [B] with the reverse bracket [C].

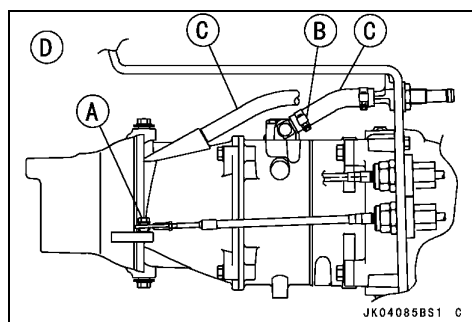
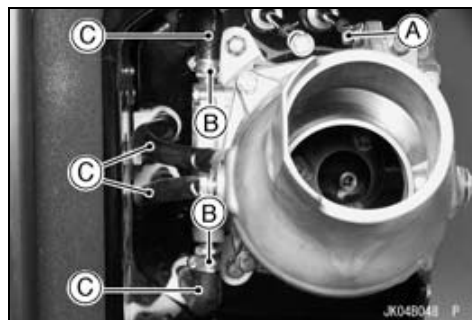


- Unscrew the grate mounting bolts [A] and remove the grate [B].

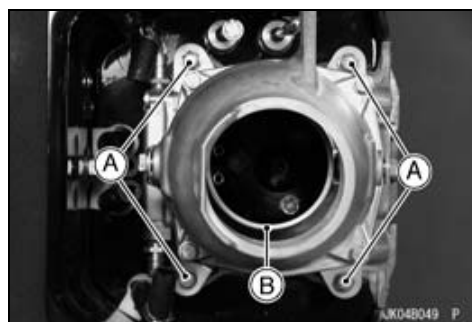


- Remove the joint bolts [A] and take off the steering cable joint.
- Loosen the clamps [B] on the inlet cooling hose, and pull off the hoses [C].

JT1500A7 Model ~ [D]

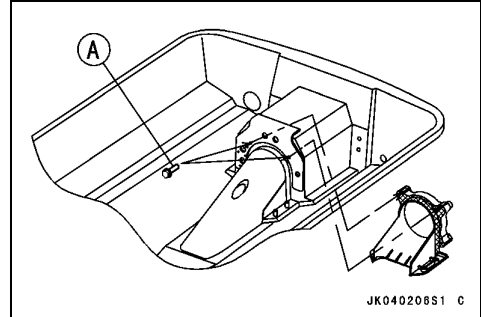


- Unscrew the pump mounting bolts [A].
- Slide the pump [B] to the rear to disengage the drive shaft, and remove it from the hull.

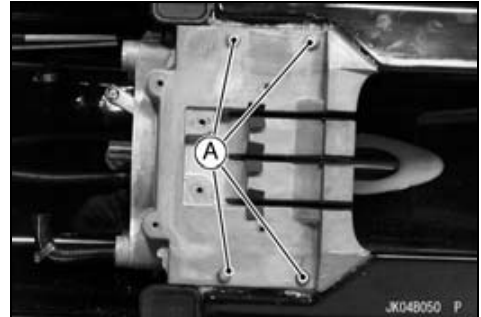


Pump and Impeller

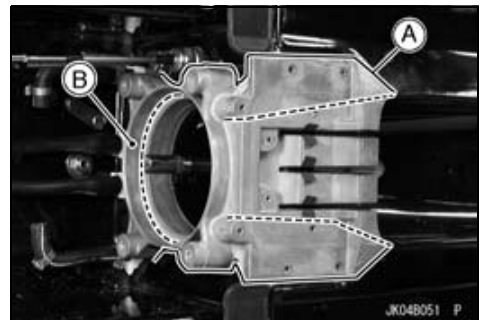
- To remove the pump bracket, perform the following procedures.
- Take out the pump bracket mounting bolts [A] and washer in the hull.



- Take out the pump bracket mounting bolts [A].



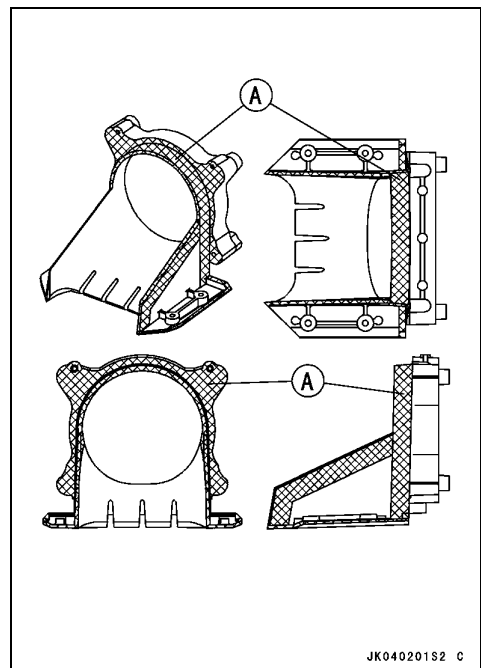
- Cut the sealant at the indicated area [A] in the figure and remove the pump bracket [B].



Pump Installation

- Strip off all the old sealant around the pump intake.
- Liberally coat the outside edge of the pump bracket with silicon sealant [A] to form a seal between the bracket and the hull.

Sealant - Liquid Gasket, TB1211: 56019-120



11-8 PUMP AND IMPELLER

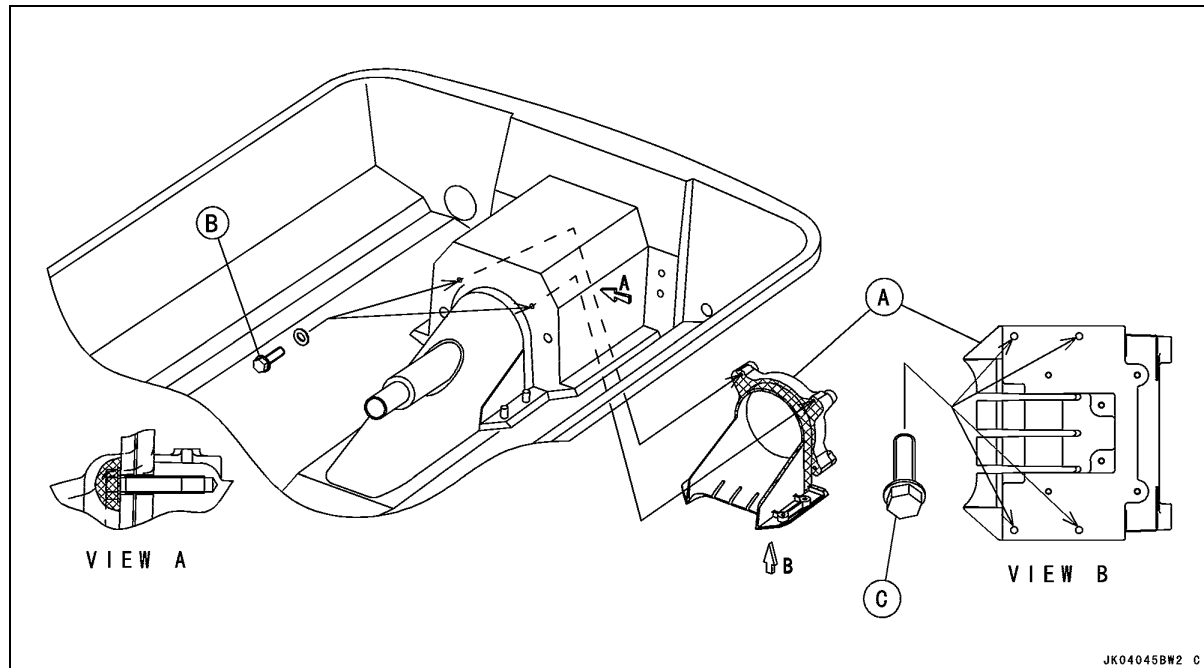
Pump and Impeller

- Install the pump bracket [A] to the hull.
- Apply a non-permanent locking agent or a non-permanent locking agent (High Strength: 271 equivalent) to the following bolts and tighten them.

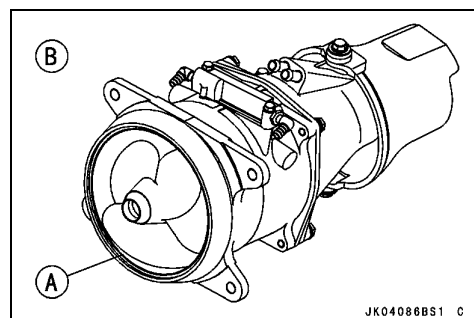
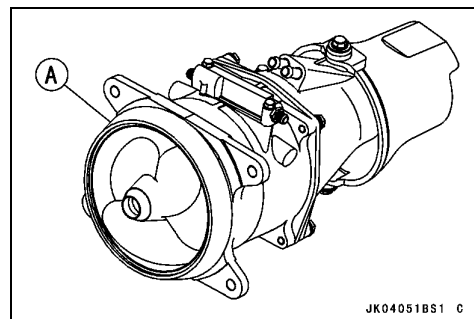
Torque - Pump Bracket Mounting Bolts (2) [B]: 19 N·m (1.9 kgf·m, 14 ft·lb) (Loctite 271 equivalent)

Pump Bracket Mounting Bolts (4) [C]: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- As for the pump bracket mounting bolts (2) in the hull, the bolt heads should be wrapped in silicone sealant.



- Be sure trim seal [A] is in place.
JT1500A7 Model ~ [B]



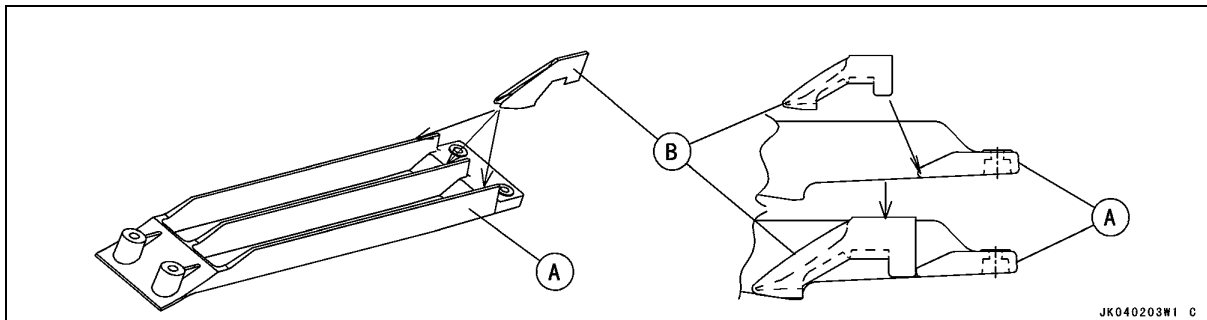
Pump and Impeller

- Grease the splines on the drive shaft with water resistant grease.
- Install the pump.
- Apply a non-permanent locking agent to the pump mounting bolts and tighten them.

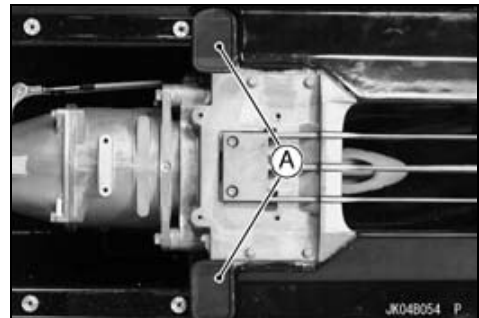
Torque - Pump Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

- Install the grate [A].
- Be sure the trim seals [B] are in the position.
- Apply a non-permanent locking agent to the grate mounting bolts and tighten them.

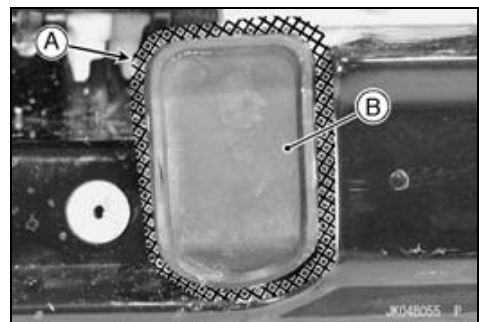
Torque - Grate Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



- Be sure the seals [A] on the hull are in the position.



- Coat the outside edge [A] of the seal [B] with silicone sealant to form a seal between the hull and seal.

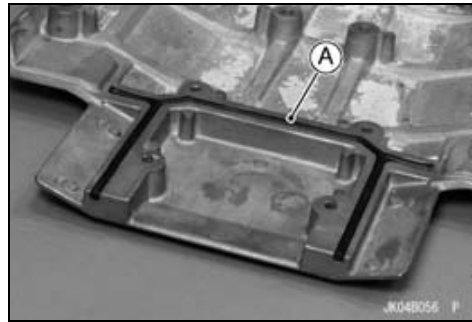


11-10 PUMP AND IMPELLER

Pump and Impeller

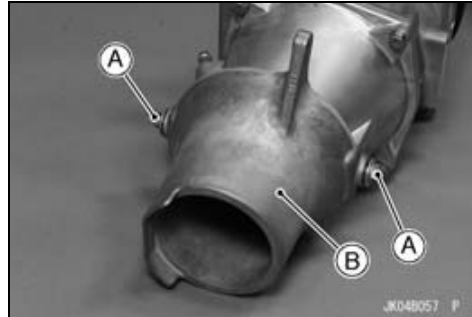
- Install the pump cover.
- Be sure the seal [A] is in the position.
- Apply a non-permanent locking agent to the pump cover mounting bolts and tighten them.

Torque - Pump Cover Mounting Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

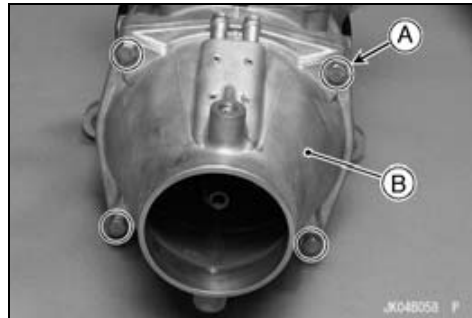


Pump Disassembly

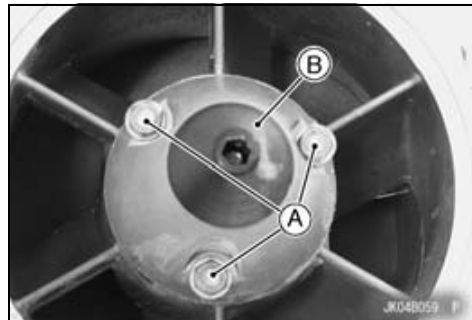
- Unscrew the steering nozzle pivot bolts [A], and remove the steering nozzle [B].



- Unscrew the pump outlet mounting bolts [A], and remove the pump outlet [B].



- Unscrew the pump cap bolts [A], and remove the pump cap [B].



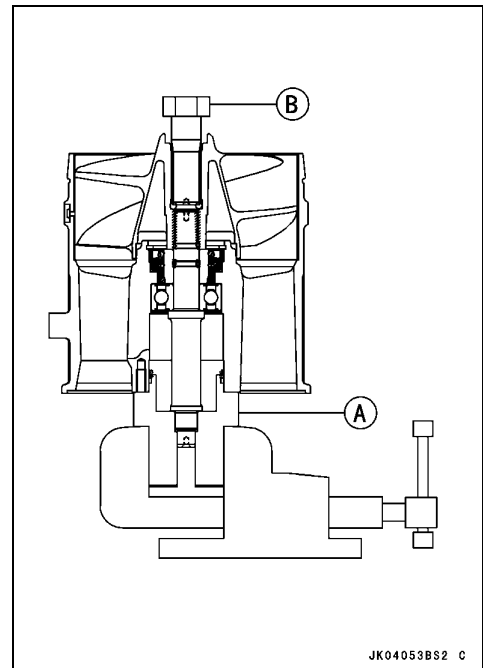
Pump and Impeller

- Pull out the impeller seal on the impeller.
- Hold the shaft in the impeller holder, taking care not to damage it.
- Remove the impeller from the pump shaft.

JT1500-A1 ~ A6, AB ~ AC Models

Special Tools - Impeller Holder: 57001-1393 [A]

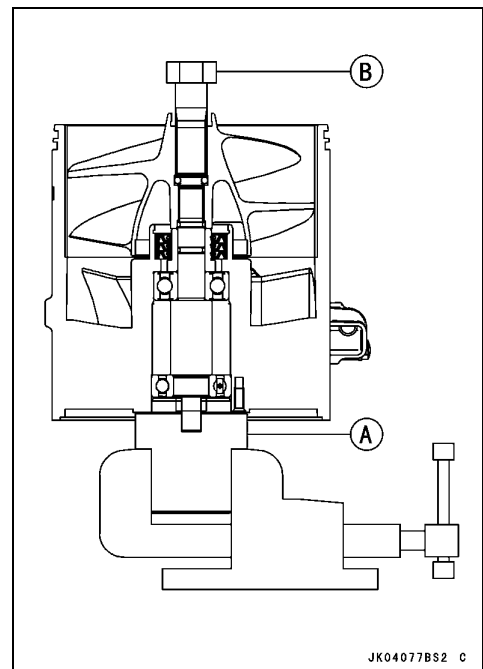
Impeller Wrench: 57001-1228 [B]



JT1500A7 ~ AA Models

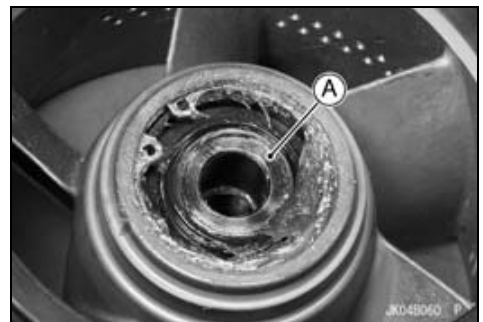
Special Tools - Impeller Holder: 57001-1695 [A]

Impeller Wrench: 57001-1228 [B]



JT1500-A1 Model

- Pull out the bushing [A].



11-12 PUMP AND IMPELLER

Pump and Impeller

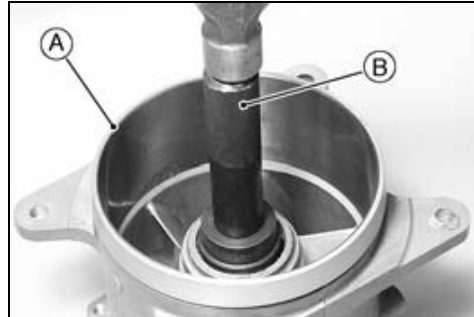
- Remove the circlip.
- Remove the grease seals.

Special Tool - Oil Seal & Bearing Remover: 57001-1058 [A]



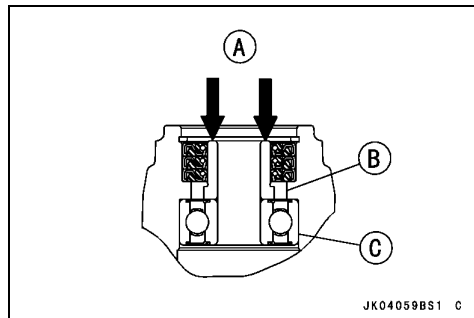
- Remove the bearing by tapping evenly around the bearing inner race from the front end of the pump case [A].

Special Tool - Bearing Driver Set: 57001-1129 [B]



JT1500-A2 Model ~

- Press [A] the bussing [B] and the ball bearing [C]. They come out of the pump case.



- Remove the circlip.
- Remove the grease seals.

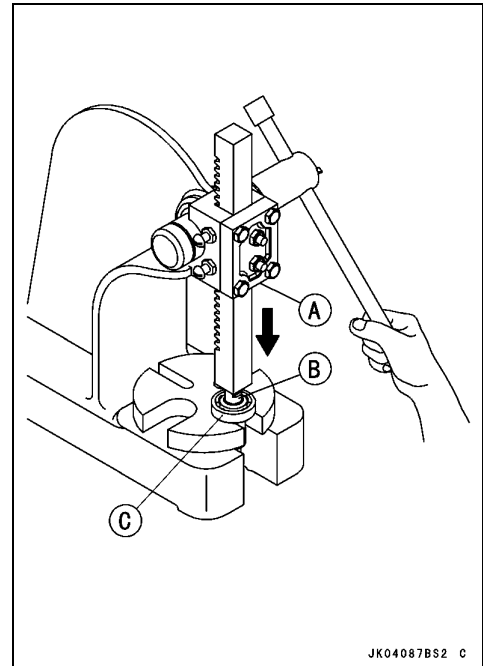
Special Tool - Oil Seal & Bearing Remover: 57001-1058 [A]



Pump and Impeller

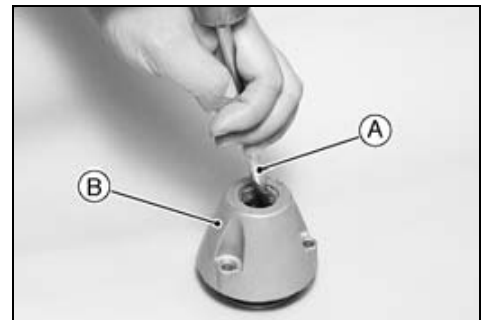
JT1500A7 Model ~

- Remove the pump shaft bearing.
- Using a hand press [A] push out the pump shaft [B] and remove the bearing [C].



JT1500-A1 ~ A6, AB ~ AC Models

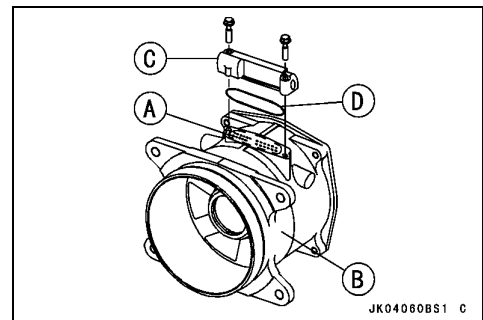
- Insert a metal rod [A] into the pump cap [B] from the rear end, remove the bearing by tapping evenly around the bearing inner race from the rear end of the pump cap.



Pump Assembly

- Before installing the pump bearing, blow any dirt or foreign particles out of the pump case with compressed air.
- Before installing the pump bearing, remove the filter cover [C], and check the filter inside or outside [A] on the pump case [B] if the foreign particles do not cling to the filter.
- Apply high grade water resistant grease to the O-ring [D].
- Apply a non-permanent locking agent to the filter cover mounting bolts and tighten them.

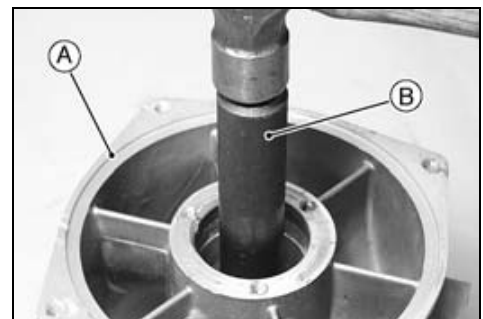
Torque - Filter Cover Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



JT1500-A1 Model

- Install a new bearing into the pump case [A] as far as it will go.

Special Tool - Bearing Driver Set: 57001-1129 [B]



11-14 PUMP AND IMPELLER

Pump and Impeller

- Replace the grease seals with new ones, if necessary, and install them.

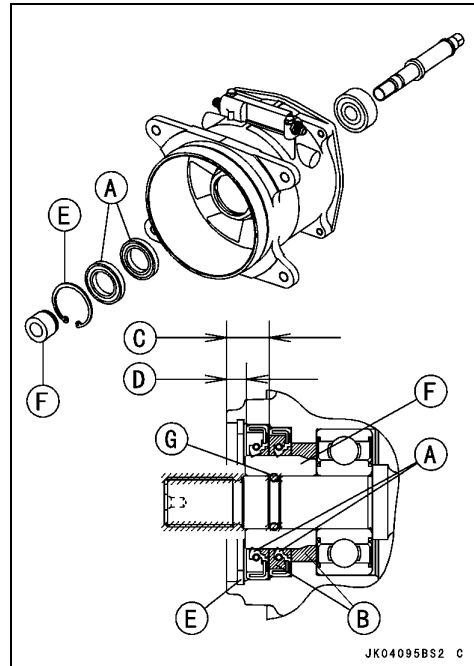
Special Tool - Bearing Driver Set: 57001-1129

- Press each seal [A] into the pump case so that the side with the spring faces outward. Fill [B] the gap between the seals, and between the seal and the bearing with high grade water resistance grease.

13.6 ~ 13.8 mm (0.535 ~ 0.543 in.) [C]

6.5 ~ 6.7 mm (0.256 ~ 0.264 in.) [D]

- Install the circlip [E].
- Push the bushing [F] into the pump case.
- Visually inspect into the pump shaft O-rings [G], and replace them if necessary.
- Apply molybdenum disulfide grease to the pump shaft and insert it from rear of the pump case.



JT1500-A2 Model ~

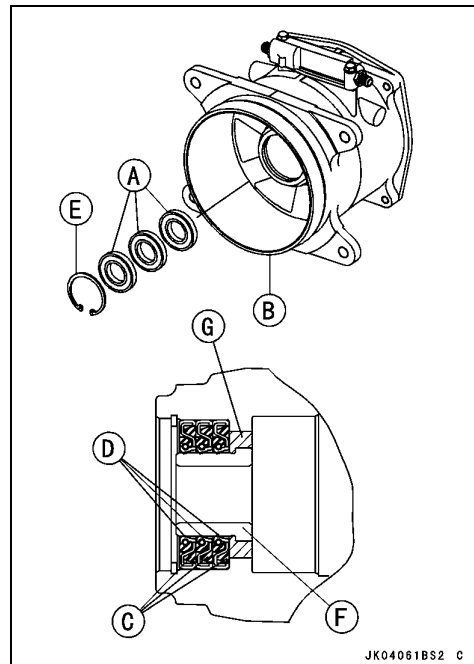
- Replace the grease seals with new ones, if necessary, and install them.

Special Tool - Bearing Driver Set: 57001-1129

- Press each seal [A] into the pump case [B] so that the side with the spring faces outward.

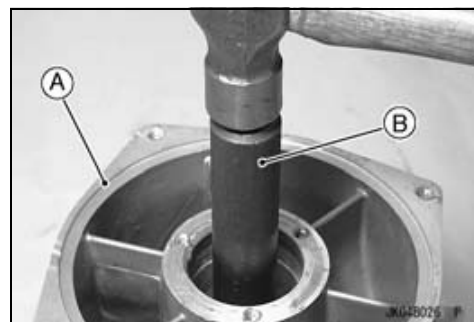
- Fill the gap between the grease seals [C] with high grade water resistance grease and apply it each grease seal lip [D].

- Install the circlip [E].
- Install the bushing [F] into the pump case.
- Fill with high grade water resistance grease [G].



- Install a new bearing into the pump case [A] as far as it will go.

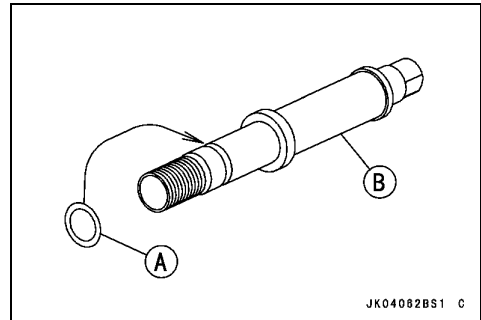
Special Tool - Bearing Driver Set: 57001-1129 [B]



Pump and Impeller

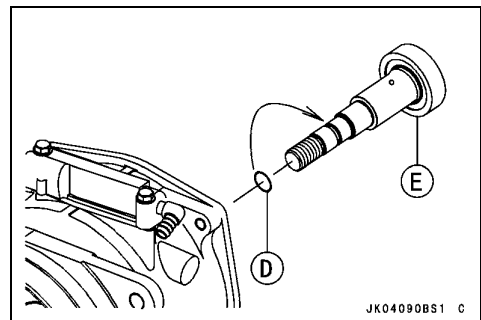
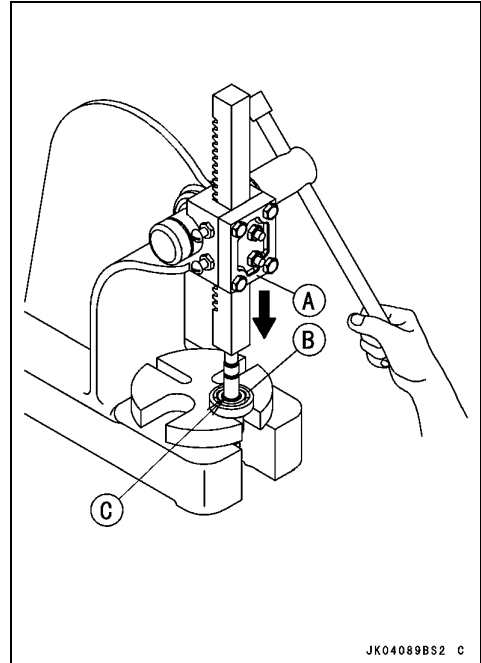
JT1500-A1 ~ A6, AB ~ AC Models

- Visually inspect the pump shaft O-rings [A], and replace if necessary.
- Install the O-ring over the pump shaft [B].
- Grease the O-ring with high grade water resistance grease.

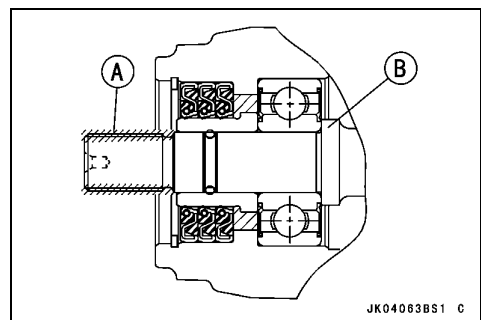


JT1500A7 ~ AA Models

- Install the pump shaft to the bearing.
- Using a hand press [A], press the shaft until its step bottoms the new ball bearing [B] inner race.
- Install the O-ring [D] over the pump shaft [E].
- Grease the O-ring with high grade water resistance grease.



- Apply molybdenum disulfide grease [A] to the thread of the pump shaft
- Push the pump shaft [B] into the pump case (JT1500-A1 ~ A6, AB ~ AC Models).
- Push the pump shaft with bearing into the pump case (JT1500A7 ~ AA Models).



11-16 PUMP AND IMPELLER

Pump and Impeller

JT1500-A1 Model ~

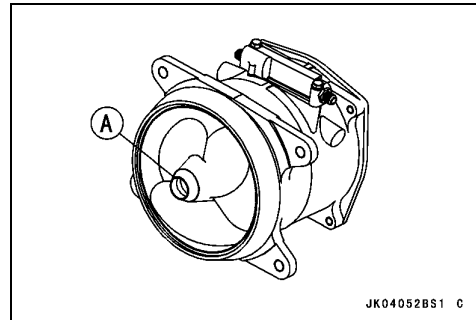
- Screw on the impeller and tighten.

Special Tools - Impeller Holder: 57001-1393

Impeller Wrench: 57001-1228

Torque - Impeller: 98 N·m (10 kgf·m, 72 ft·lb)

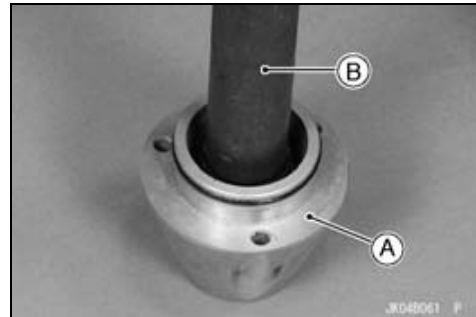
- Visually inspect impeller seal [A], and replace it if necessary.
- Install the seal on the impeller.



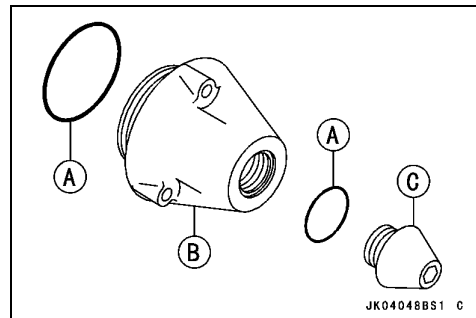
JT1500-A1 ~ A6, AB ~ AC Models

- Before installing the cap bearing, blow any dirt or foreign particles out of the pump cap [A] with compressed air.
- Install new bearing into the cap as far as it will go.

Special Tool - Bearing Driver Set: 57001-1129 [B]



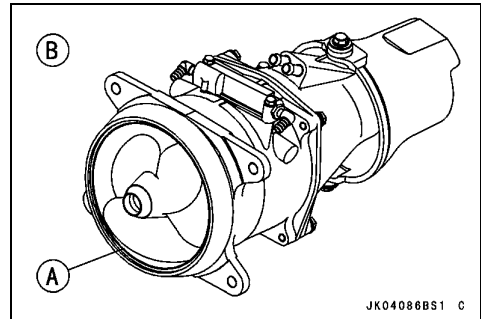
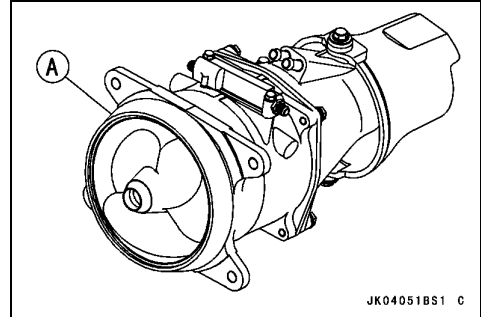
- Be sure the O-rings [A] are in place on the pump cap [B] and plug [C].
- Apply high grade water resistance grease to the O-rings.



- Install the following.
 - Pump Cap
 - Pump Cap Plug
 - Pump Outlet
 - Steering Nozzle
- Apply a non-permanent locking agent to the thread of the following.
 - Pump Cap Bolts
 - Pump Outlet Mounting Bolts
 - Steering Nozzle Pivot Bolts
- Tighten:
 - Torque - Pump Cap Plug: 3.9 N·m (0.40 kgf·m, 35 in·lb)**
 - Pump Cap Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
 - JT1500-A1 ~ A6, AB ~ AC Models**
 - Pump Cap Bolts: 3.9 N·m (0.40 kgf·m, 35 in·lb)**
 - JT1500A7 ~ AA Models**
 - Pump Outlet Mounting Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)**
 - Steering Nozzle Pivot Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)**

Pump and Impeller

- Be sure the pump seal [A] is in place on the pump case.
JT1500A7 ~ AA Models [B]



Impeller Inspection

- Refer to Impeller Inspection in the Periodic Maintenance chapter.

Impeller Outside Diameter Measurement

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

Impeller Outside Diameter

Standard: 147.5 ~ 147.7 mm (5.8071 ~ 5.8149 in.)

Service Limit: 146.5 mm (5.7677 in.)

Pump Inspection

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



○ Measure the inside diameter of the pump case.

- ★ If the pump case is worn beyond the service limit, replace it.

Pump Case Inside Diameter

Standard: 148.0 ~ 148.1 mm (5.8268 ~ 5.8307 in.)

Service Limit: 149.1 mm (5.8701 in.)

11-18 PUMP AND IMPELLER

Pump and Impeller

Impeller Clearance

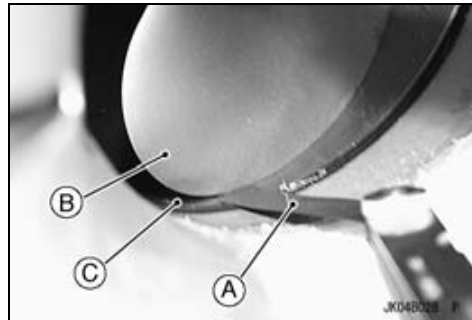
- Impeller clearance is critical to proper performance. If the pump case and impeller are not visibly damaged, poor performance may be caused by too much impeller clearance.
- To check impeller clearance, remove the grate and insert a feeler gauge [A] between the tip of the impeller blade [B] and the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

Impeller Clearance

Standard: 0.15 ~ 0.3 mm (0.0059 ~ 0.0118 in.)

Service Limit: 0.6 mm (0.0236 in.)

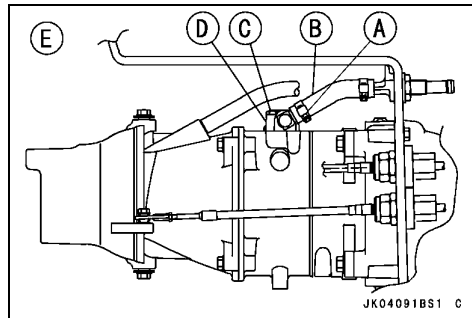
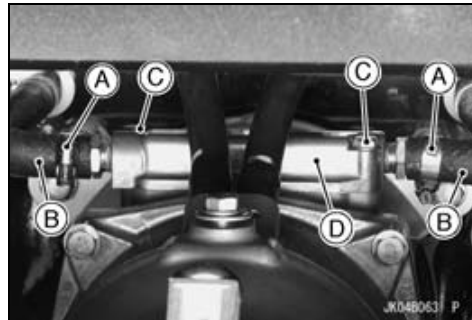
- ★ If impeller clearance is incorrect, determine if it is due to wear or damage (see Pump and Impeller Inspection).



Water Filter Cover Removal/Installation

- Loosen the clamps [A] and pull off the hoses [B].
 - Remove the filter cover mounting bolts [C].
 - Take out the filter cover [D].
 - Replace the gasket with a new one.
 - Installation is the reverse order of removal.
 - Apply a non-permanent locking agent to the filter cover mounting bolts and tighten them.
- JT1500A7 ~ AA Models [E]

Torque - Filter Cover Mounting Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)



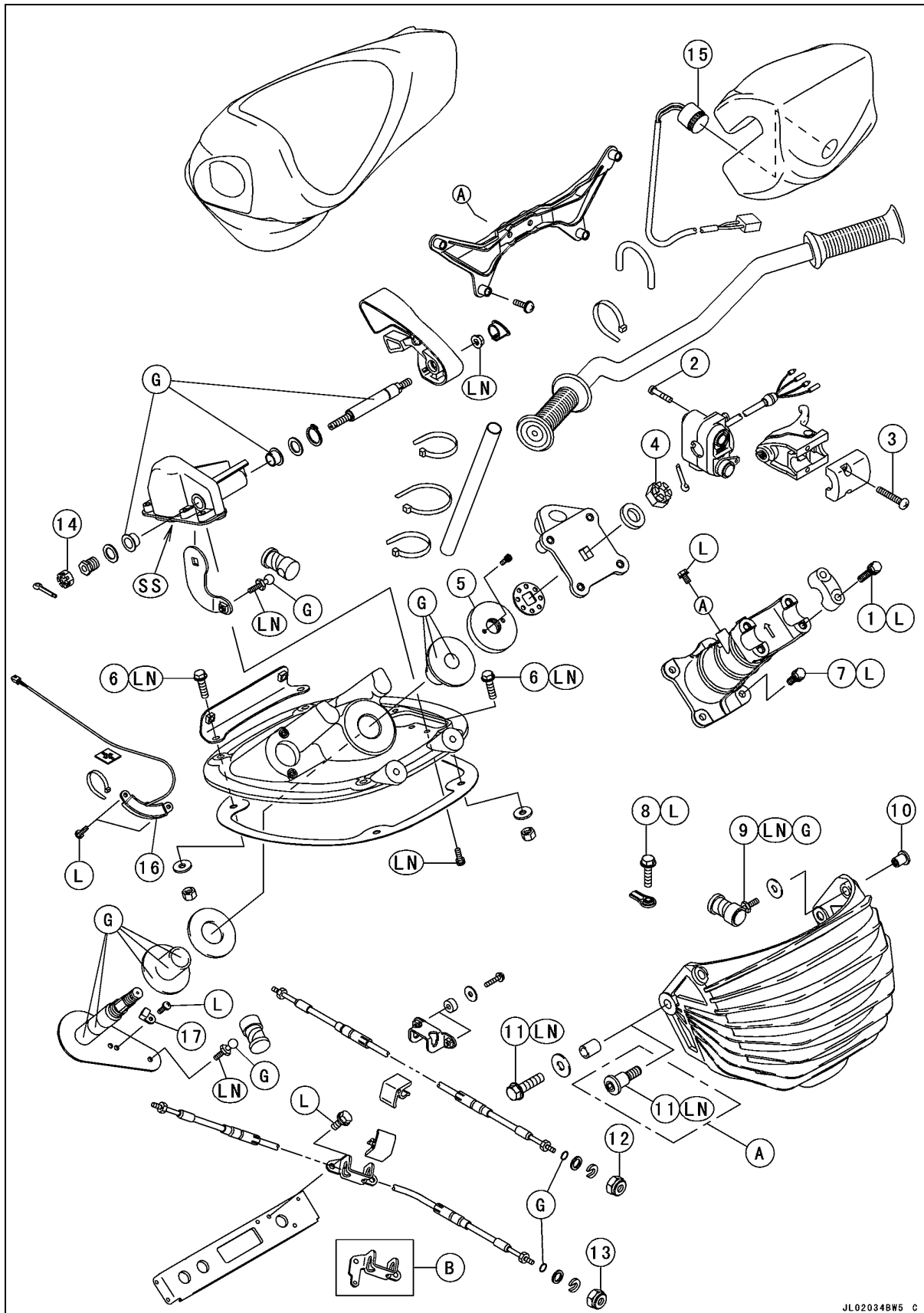
Steering

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12-2 STEERING

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Handlebar Clamp Bolts	16	1.6	12	L
2	Start/stop Switch Case Mounting Screws	3.9	0.40	35 in·lb	
3	Throttle Case Mounting Screws	3.9	0.40	35 in·lb	
4	Steering Shaft Locknut	49 ~ 59	5.0 ~ 6.0	36 ~ 43	
5	Steering Shaft Nut	2.9	0.30	26 in·lb	
6	Steering Holder Mounting Bolts	20	2.0	14.5	LN
7	Steering Neck Mounting Bolts	16	1.6	12	L
8	Steering Cable Joint Bolt	9.8	1.0	87 in·lb	L
9	Ball Joint	9.8	1.0	87 in·lb	LN
10	Shift Cable End Nut	9.8	1.0	87 in·lb	
11	Reverse Bucket Pivot Bolts	19	1.9	14	LN
12	Shift Cable Nut	39	4.0	29	
13	Steering Cable Nut	39	4.0	29	
14	Shift Lever Locknut	20	2.0	14.5	

15. Buzzer

16. Steering Position Sensor

17. Magnet

A: JT1500A7 Model ~

B: JT1500-A1 ~ AA Models

G: Apply grease.

L: Apply a non-permanent locking agent.

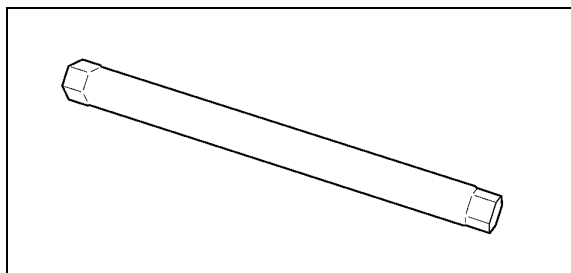
LN: Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent).

SS: Apply silicone sealant.

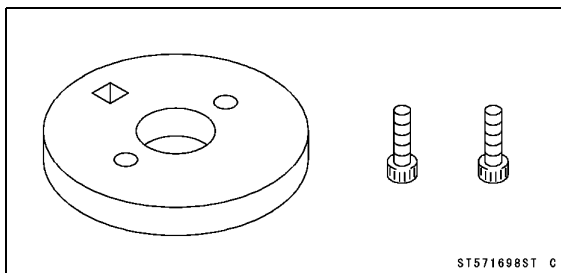
12-4 STEERING

Special Tools

Box Wrench (27 mm):
57001-1451

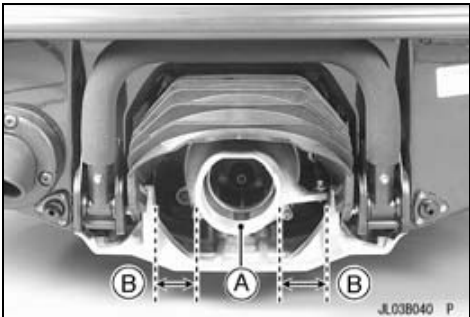
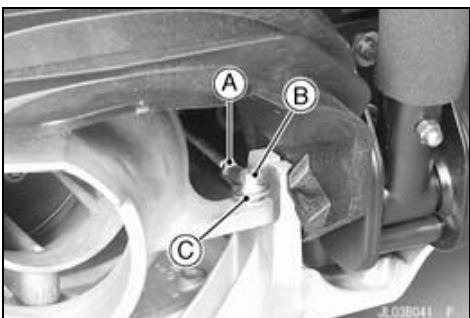


Nut Tightening Plate:
57001-1698



Steering Cable

Steering Cable Adjustment

- Check the steering cable adjustment.
 - Center the handlebar in the straight-ahead position.
- 
- Check that the steering nozzle [A] is centered in the pump cavity.
 - The same distance [B].
- 
- If necessary, adjust the steering cable.
 - Loosen the locknut [A] on the end of the steering cable located to the right of the steering nozzle.
 - Take out the cable joint bolt [B] and disconnect the cable joint [C] from the steering nozzle.
 - Center the handlebar in a straight ahead steering position.
 - Turn the joint on the cable to adjust the steering.
 - Temporarily tighten the cable joint bolt, and connect the joint with the nozzle and check cable adjustment again.
 - When adjustment is correct, unscrew the cable joint bolt and apply a non-permanent locking agent to it. And tighten the cable joint bolt and the steering cable locknut securely.
- 
- Torque - Steering Cable Joint Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)**
- As an additional check, turn the handlebar all the way to the left and right, and measure the distance between the nozzle and the edge of the pump cavity. It should be equal at both extremes.

Steering Cable Removal

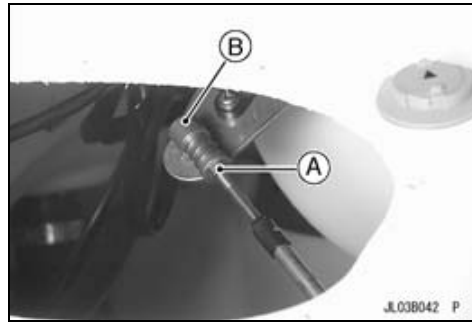
- Remove the screws [A] and remove the front storage pocket [B].



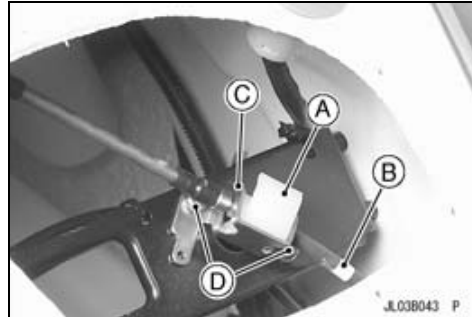
12-6 STEERING

Steering Cable

- Loosen the locknut [A] at the front end of the steering cable, and slide back the outer sleeve of the ball joint and take off the ball joint [B] and remove the locknut from the cable front end.



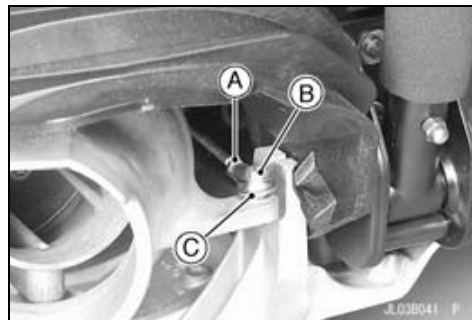
- Pull the holder [A] off the cable bracket.
- Slide the steering cable [B] off the cable bracket [C], and if the cable is hard to remove, unscrew the cable bracket mounting bolts [D], and remove the cable bracket.



- Turn the watercraft on its left side and remove the pump cover (see Pump Removal in Pump/Impeller chapter).

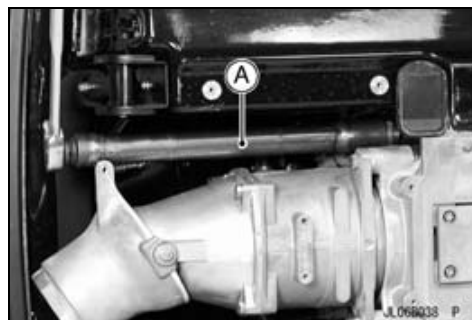
NOTICE

If the watercraft is laid on its right side, water in the exhaust system may drain back into the engine a cause serious damage. Never lay the watercraft on the right side.



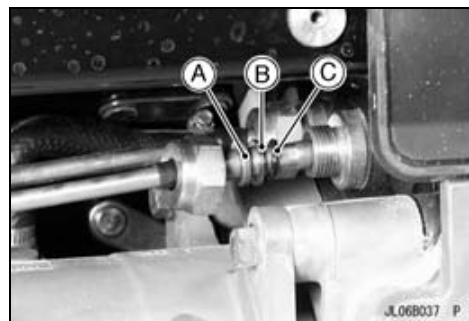
- Loosen the locknut [A] at the rear end of the steering cable, and remove the joint bolt [B].
- Remove the joint [C] and locknut from the cable end.
- Unscrew the large nut (steering cable nut) in the hull with a wrench.
- Special tool, box wrench [A] is useful to remove the large nut (steering cable nut).

Special Tool - Box Wrench: 57001-1451



Steering Cable

- Slide off the snap ring [A], washer [B] and O-ring [C].
- Pull out the steering cable toward the rear.



Steering Cable Installation

- Slide a short piece of rubber or plastic tubing over the front cable end to guide the cable through the hull.
- Lubricate the outside of the new cable to ease cable installation.
- Tighten:

Torque - Steering Cable Nut: 39 N·m (4.0 kgf·m, 29 ft·lb)

- Apply a non-permanent locking agent to the cable joint bolt and the steering cable bracket mounting bolts, if removed.
- Tighten:

Torque - Steering Cable Joint Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)

- Apply a water resistant grease to the joint ball [A].
- Adjust the steering cable (see Steering Cable Adjustment).



Steering Cable Inspection

- Refer to the Steering Cable/Shift Cable Inspection in the Periodic Maintenance chapter.

Steering Cable Lubrication

NOTE

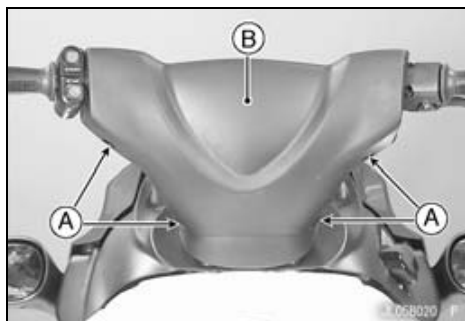
- *The steering cable is sealed at each end and do not require lubrication. If the seal is damaged, the cable must be replaced.*

12-8 STEERING

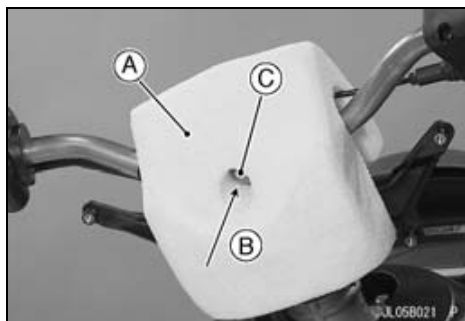
Handlebar

Handlebar Removal

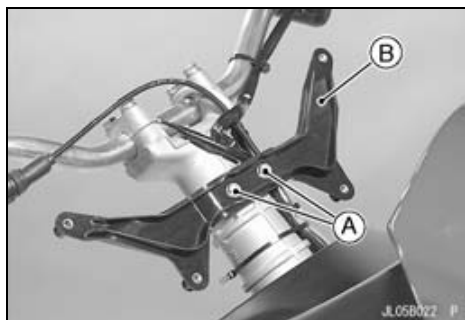
- Unscrew the mounting screws [A] and remove the handlebar pad [B].



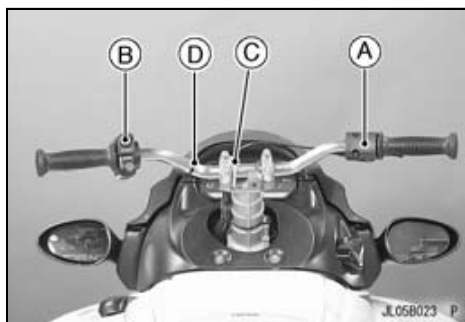
- Remove the inner pad [A], pushing [B] the buzzer [C].



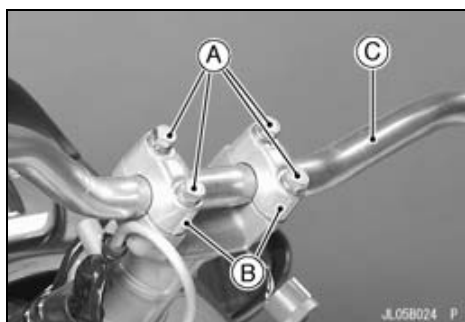
- Unscrew the bolts [A] and remove the pad holder [B].



- Take out the throttle case mounting screws and remove the throttle case [A].
- Take out the switch case mounting screws and remove the switch case [B].
- Unhook the pipe [C].
- Cut off the clamp [D].



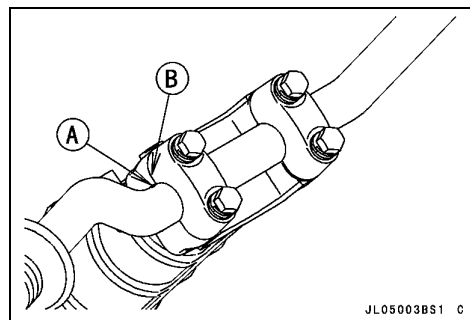
- Unscrew the handlebar clamp bolts [A] and remove the handlebar clamps [B] and handlebar [C].



Handlebar

Handlebar Installation

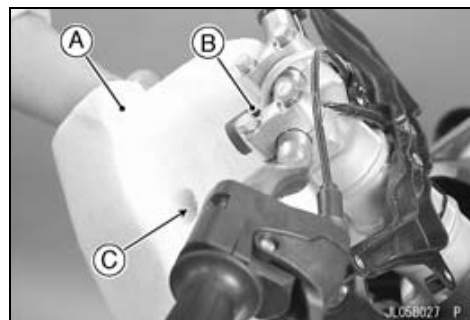
- Install the pad holder.
 - Apply a non-permanent locking agent to the pad holder bolts.
 - Install the handlebar on the holder of the steering neck.
 - Apply a non-permanent locking agent to the handlebar clamp bolts.
 - Align the punch mark [A] on the left side of the handlebar with the parting line [B].
 - Tighten the front and then rear handlebar clamp bolts to the specified torque.
- Torque - Handlebar Clamp Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)**
- Install the fuel vent hose.
 - Refer to the Fuel Tank Vent Hose Installation in the Fuel System chapter.



NOTICE

The engine will malfunction if the fuel tank air vent pipe end is obstructed by the handlebar pad and/or; if the air vent hose is folded; and/or riding the watercraft with the air vent hose remaining clogged. Be sure the fuel tank air vent pipe is installed correctly and securely.

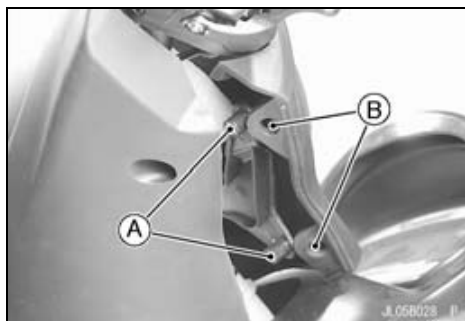
- Install the throttle case and switch case.
 - Tighten the screws.
- Torque - Throttle Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 3.5 in·lb)**
- start/stop Switch Case Mounting Screws: 3.9 N·m (0.40 kgf·m, 3.5 in·lb)**
- Route the cable, wire and hose correctly (see Appendix chapter).
 - Install the inner pad [A] on the handlebar, putting the buzzer [B] into the hollow [C] on the inner pad.



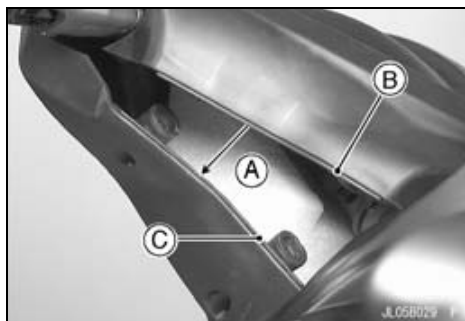
12-10 STEERING

Handlebar

- Install the bosses [A] on the pad holder to the holes [B] on the handlebar pad.



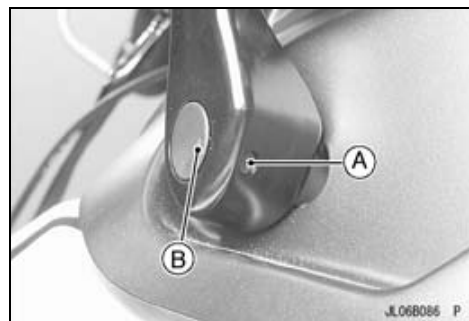
- Align [A] the projection [B] on the pad with the groove [C] on the pad.



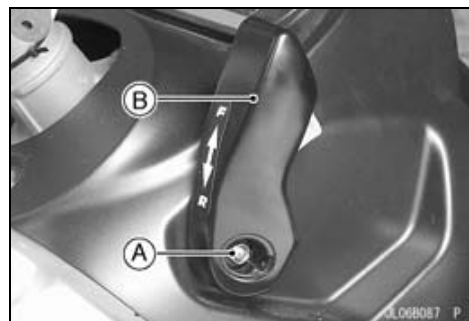
Steering

Steering Removal

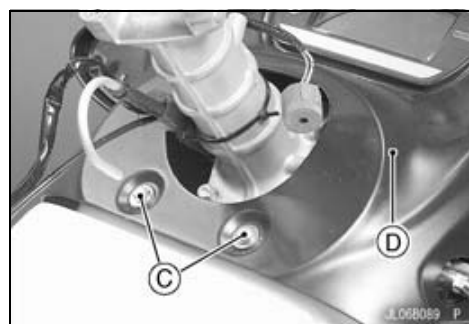
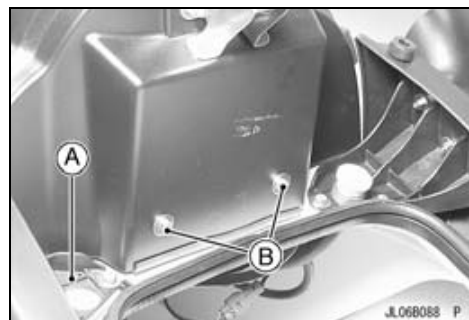
- Remove the handlebar and pad holder (see Handlebar Removal).
- Unscrew the set screw [A] and take out the cap [B].



- Unscrew the shift lever nut [A] and remove the shift lever [B].



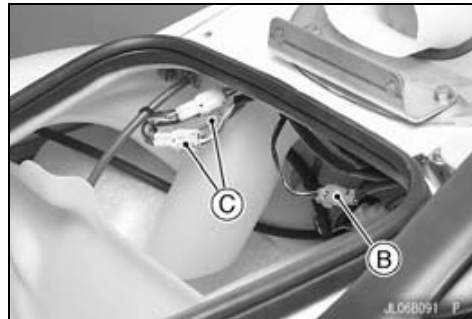
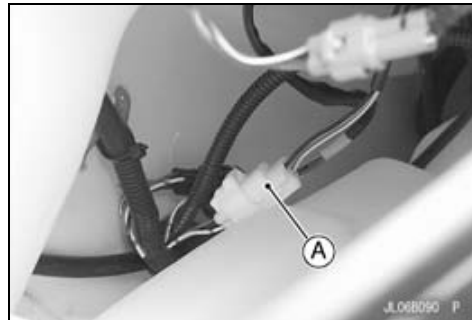
- Remove the right stay [A] with the right mirror (see Hull/Engine Hood chapter).
- Unscrew the steering cover mounting bolts [B], [C] and lift up the steering cover [D].



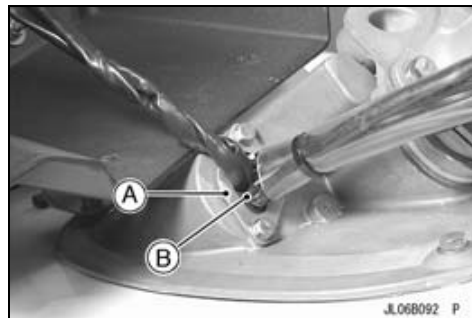
12-12 STEERING

Steering

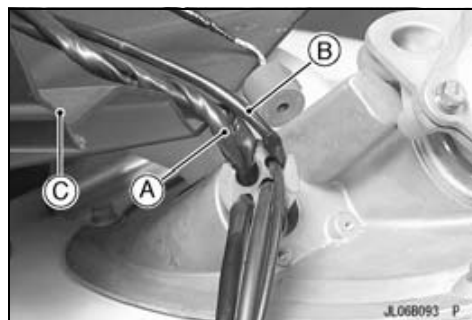
- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect:
 - Steering Position Sensor Lead Connector [A]
 - Buzzer Connector [B]
 - Multifunction Meter Lead Connectors [C]
 - Steering Cable Ball Joint at Upper End
 - Shift Cable Ball Joint at Upper End



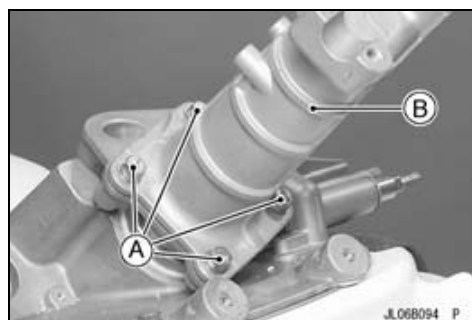
- Take out the grommet mounting plate [A] and pull the grommet [B].



- Pull out the multifunction meter leads [A] and buzzer lead [B] from the grommet.
- Remove the steering cover [C].

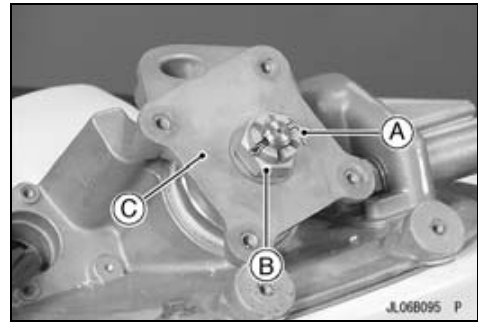


- Unscrew the steering neck mounting bolts [A] and remove the steering neck [B].

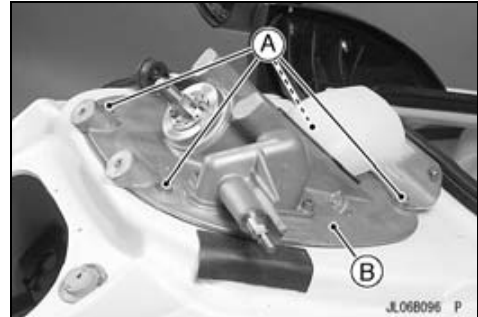


Steering

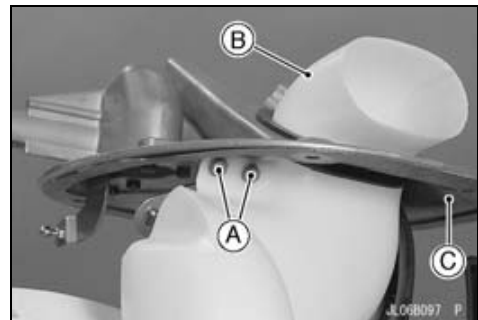
- Remove the cotter pin [A] and steering shaft locknut [B].
- Take out the holder [C].



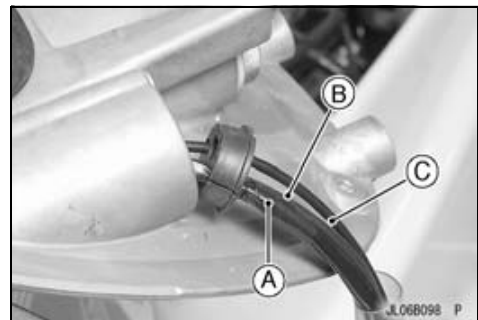
- Unscrew the steering holder mounting bolts [A], nuts, and washers, and lift up the steering holder [B].



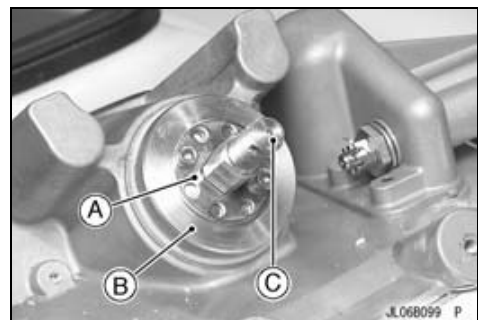
- Take out the air intake duct mounting bolts [A] and remove the air intake duct [B] from the steering holder [C].



- Disconnect the switch case lead connector and pull the leads [A] out of the hull.
- Disconnect the pipe at the fuel vent hose upper end and pull down the fuel vent hose [B].
- Disconnect the throttle cable upper end at the throttle case and pull down the throttle cable [C].



- Remove the lock plate [A].
- Take out the steering shaft nut [B] and pull down the steering shaft [C].
- Remove the steering holder.

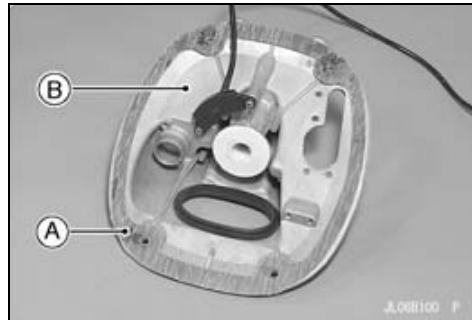


12-14 STEERING

Steering

Steering Installation

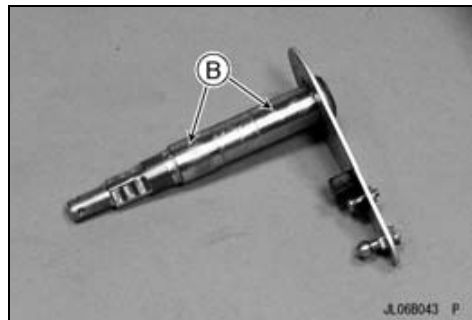
- Replace the gasket [A] on the steering holder [B] with a new one.



- Check the bushings for damage and wear before installing the steering holder.
- ★ If the bushings are damaged or worn, replace them.
- Grease:
Bushings [A]



Steering Shaft [B]



- Install the steering shaft nut [A] to the steering holder by tightening the nut with hand, and then loosen it a fraction of turn.
- Using the special tool tighten the steering shaft nut with the specified torque.

Torque - Steering Shaft Nut: 2.9 N·m (0.30 kgf·m, 26 in·lb)

Special Tool - Nut Tightening Plate: 57001-1698

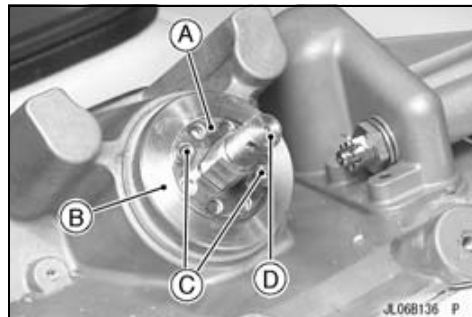
- If steering is too tight, turn the steering shaft nut counter-clockwise to loosen.
- If the steering is too loose, turn the steering shaft nut clockwise to tighten.



- Install the lock plate [A].
- Loosen the steering shaft nut [B] until the steering shaft nut hole aligns with the one of the lock plate.
- Tighten the lock plate bolts [C].
- Steering Shaft [D]
- Be sure that the steering shaft turns, freely. If not, adjust the steering shaft again.

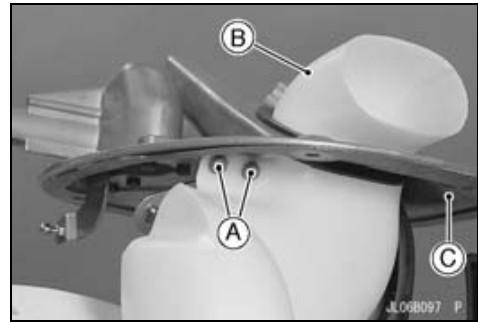
NOTE

- The steering shaft must be turned smoothly when the cable is connected.



Steering

- Install the air intake duct [B] to the steering holder [C].
- Apply a non-permanent locking agent to the air intake duct mounting bolts [A].



- Tighten the steering shaft locknut [A].
Torque - Steering Shaft Locknut: 49 ~ 59 N·m (5.0 ~ 6.0 kgf·m, 36 ~ 43 ft·lb)

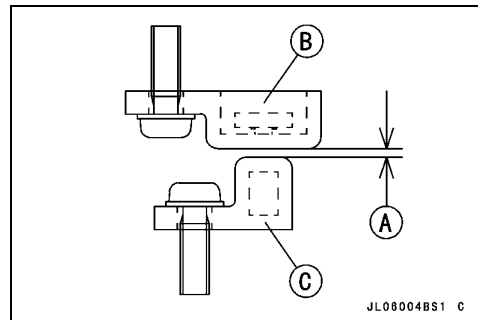


- Turning the steering shaft fully in left and right direction, check whether the steering position sensor comes in contact with the magnet.
- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance

Standard: 0.5 ~ 1.5 mm (0.02 ~ 0.06 in.)

- ★ If necessary, adjust the clearance by turning the steering shaft nut.

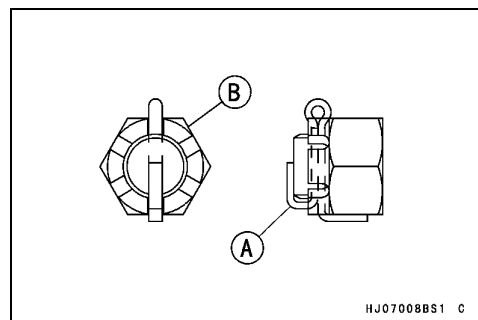
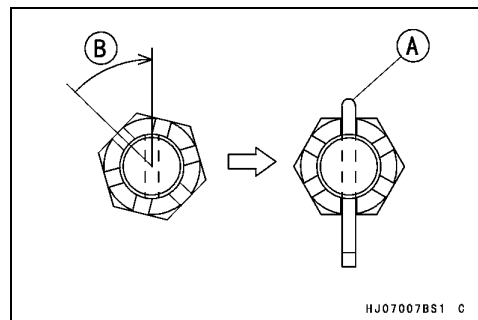


- Insert a new cotter pin [A].

NOTE

- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle, tighten the nut clockwise [B] up to next alignment.
- It should be within 30 degrees.
- Loosen once and tighten again when the slot goes past the nearest hole.

- Bend the cotter pin [A] over the nut.



12-16 STEERING

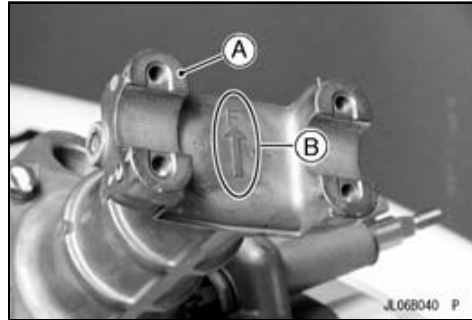
Steering

- Install the steering holder.
- Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the steering holder mounting bolts and tighten them.

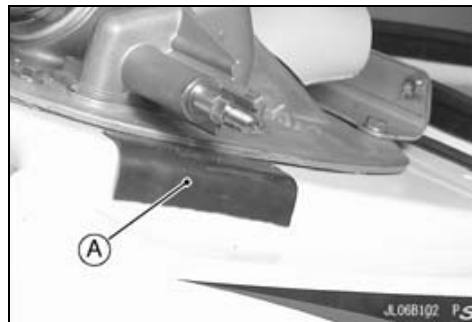
Torque - Steering Holder Mounting Bolts: 20 N·m (2.0 kgf·m, 14.5 in·lb)

- Install the steering neck [A] so that its arrow mark [B] points toward the front.
- Apply a non-permanent locking agent to the steering neck mounting bolts and tighten them.

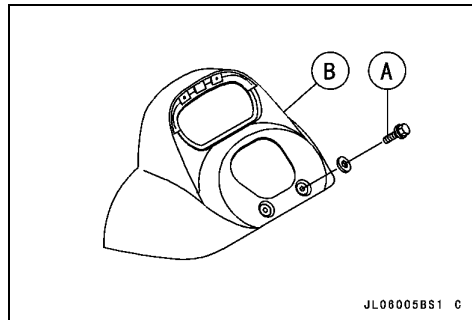
Torque - Steering Neck Mounting Bolts: 16 N·m (1.6 kgf·m, 12 ft·lb)



- Be sure that the damper [A] is in position.



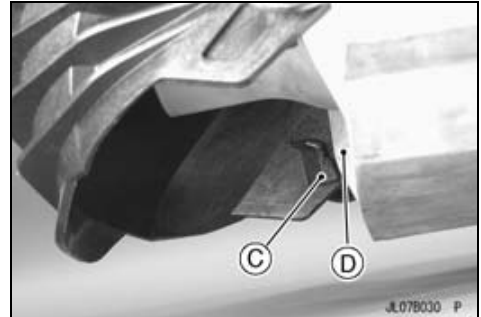
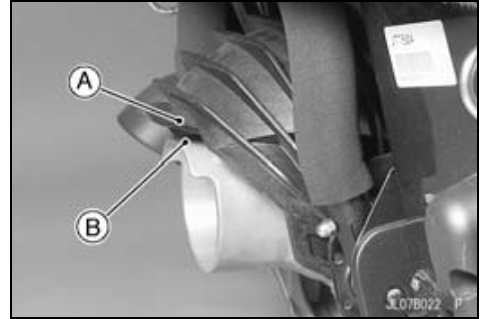
- Apply a non-permanent locking agent to the grommet mounting plate.
- Apply a non-permanent locking agent to the steering cover mounting bolts.
- Install the steering cover mounting bolts [A] to the steering cover [B].
- Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the shift lever nut.
- Apply a water resistant grease to the joint balls of the shift cable and shift link rod.
- Adjust the shift cable and steering cable.



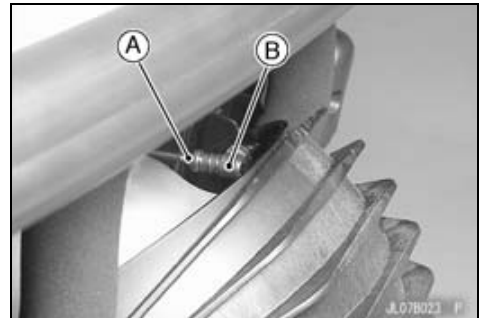
Reverse System

Shift Cable Adjustment

- Check the shift cable adjustment.
- When the shift lever is in the "F" position, the lower edge [A] of the bucket should be held above the top [B] of the steering nozzle with slight play so it doesn't interfere with the water flow from the jet pump.
- When the shift lever is in the "R" position, the lower stopper [C] on the bucket should rest against the bottom [D] of the pump cover.



- ★ If either position is incorrect, adjust the shift cable.
- Put the shift lever in the "R" position.
- Loosen the locknut [A] at the end of the shift cable.
- Slide back the outer sleeve and take the ball joint [B] off the ball.
- Turn the ball joint on the cable to adjust the shift cable.
- Connect the ball joint and check the cable adjustment again.
- When adjustment is correct, tighten the shift cable locknut.

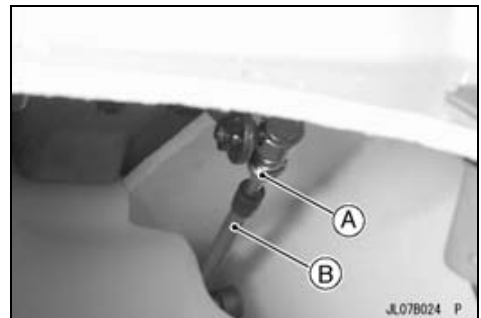


Shift Cable Removal

- Take out the storage case screws [A] and remove the storage case [B].



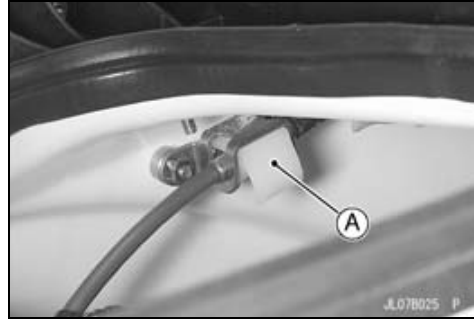
- Loosen the locknut [A] at the front end of the shift cable [B].



12-18 STEERING

Reverse System

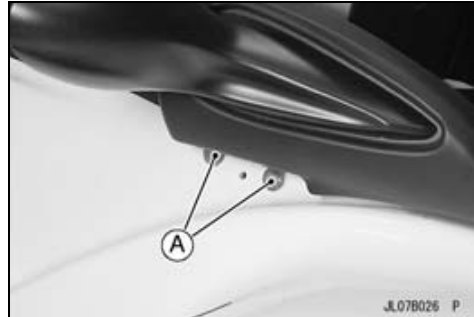
- Pull the holder [A] off the cable bracket.



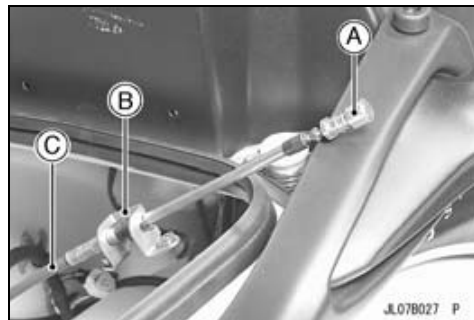
- Remove the right side cover (see Hull/Engine Hood chapter).
- Unscrew the bolts [A] and remove the cable bracket.

NOTE

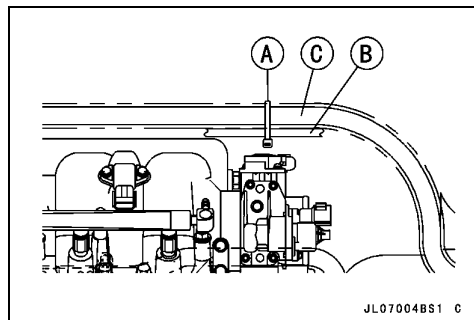
○ The collars on the inside of the hull will drip down when the bolts are removed.



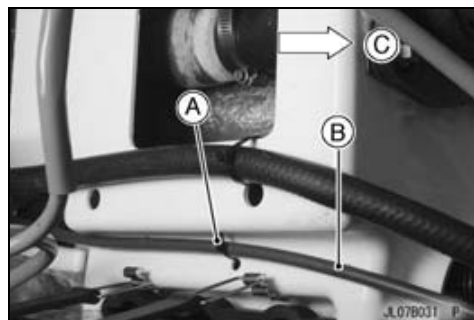
- Remove the ball joint [A] and cable bracket [B] from the shift cable [C].



- Cut off the band [A] holding the shift cable [B] and inlet cooling hose [C] for the oil cooler.



- Cut off the band [A] holding the shift cable [B].
Bow [C]



Reverse System

- Turn the watercraft on its left side and remove the pump cover (see Pump/Impeller chapter).

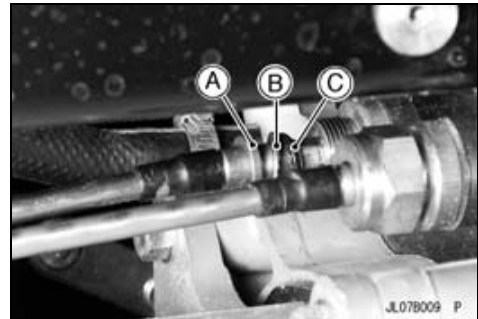
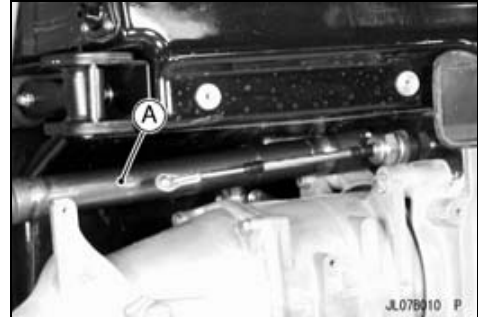
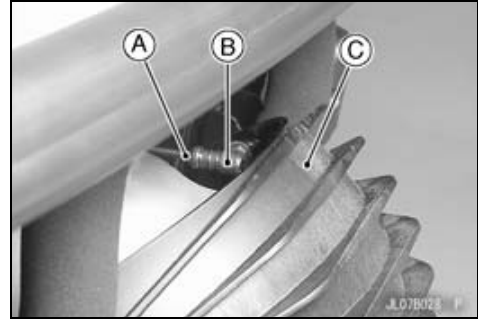
NOTICE

If the watercraft is laid on its right side, water in the exhaust system may drain back into the engine a cause serious damage. Never lay the watercraft on the right side.

- Loosen the locknut [A] at the rear end of the shift cable, and remove the ball joint [B] from the reverse bucket [C],
- Disconnect the shift cable from the fitting at the middle of the hull.
- Unscrew the large nut (shift cable nut) in the hull with a wrench.
- Special tool, box wrench [A] is useful to remove the large nut (shift cable nut).

Special Tool - Box Wrench: 57001-1451

- Pull the cable from the cable detente in the engine compartment.
- Slide off the snap ring [A], washer [B] and O-ring [C].
- Pull out the shift cable toward the rear.



Shift Cable Installation

- Slide a short piece of rubber or plastic tubing over the front cable end to guide the cable through the hull.
- Lubricate the outside of the new cable to ease cable installation.
- Tighten the shift cable nut.

Torque - Shift Cable Nut: 39 N·m (4.0 kgf·m, 29 ft·lb)

- Apply a non-permanent locking agent to the cable bracket mounting bolt.
- Apply a water resistant grease to the joint ball at each end of shift cable.
- Adjust the shift cable (see Shift Cable Adjustment).

Shift Cable Inspection

- Refer to the Steering Cable/Shift Cable Inspection in the Periodic Maintenance chapter.

Shift Cable Lubrication

NOTE

- The shift cable is sealed at each end and do not require lubrication. If the seal is damaged, the cable must be replaced.

12-20 STEERING

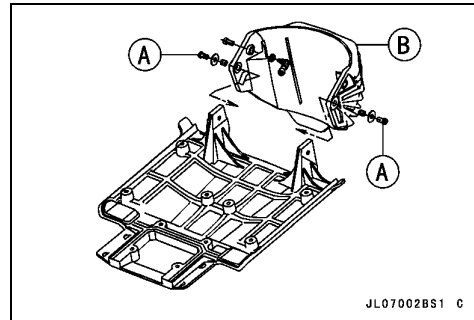
Reverse System

Reverse Bucket Removal/Installation

- Disconnect the ball joint at rear end of the shift cable.
- Remove the pump cover.
- Unscrew the pivot bolts [A] and remove the reverse bucket [B].
- Installation is the reverse of removal. Note the following.
- Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the reverse bucket pivot bolts, and tighten them.

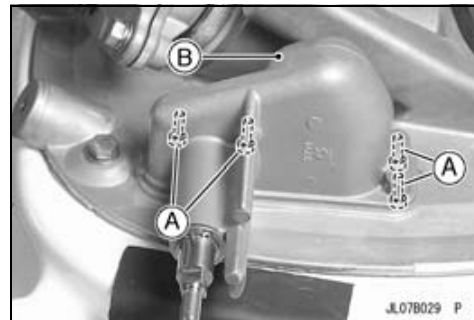
Torque - Reverse Bucket Pivot Bolts: 19 N·m (1.9 kgf·m, 14 ft·lb)

- After installation, check the shift cable adjustment.



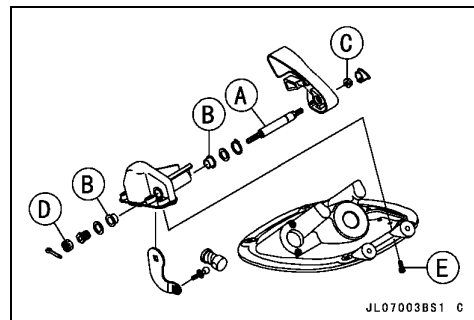
Shift Lever Shaft Removal/Installation

- Remove:
 - Steering Cover (see Steering Removal)
 - Steering Cable Ball Joint at Upper End (disconnect)
- Unscrew the mounting bolts [A] on the inside of the hull and remove the shift lever holder [B].



- Assemble the shift lever holder, noting the following.
- Grease:
 - Shift Lever Shaft [A]
 - Bushings [B]
- Apply silicone sealant to the mating surface between the shift lever holder bottom and steering holder upper surface.
- Apply a non-permanent locking agent (High Strength: Loctite 271 equivalent) to the lever nut [C] and the shift lever holder mounting bolts [E].
- Tighten the shift lever locknut [D].

Torque - Shift Lever Locknut: 20 N·m (2.0 kgf·m, 14.5 ft·lb)



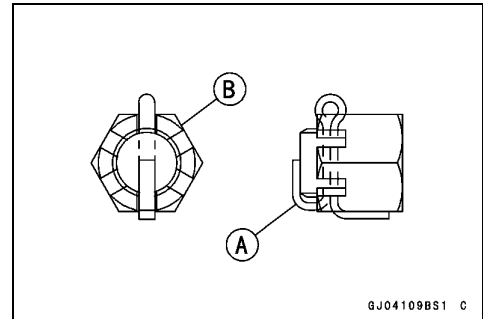
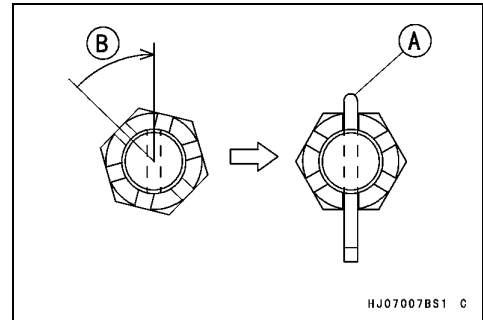
Reverse System

- Insert a new cotter pin [A].

NOTE

- When inserting the cotter pin, if the slots in the nut do not align with the cotter pin hole in the axle, tighten the nut clockwise [B] up to next alignment.
- It should be within 30 degrees.
- Loosen once and tighten again when the slot goes past the nearest hole.

- Bend the cotter pin [A] over the nut.



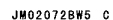
- Before connecting the shift and steering cables, apply a water resistant grease to their joint balls.

Hull/Engine Hood

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Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Crossmember Bolts	7.8	0.80	69 in·lb	L
2	Handrail Bolts	9.8	1.0	87 in·lb	L
3	Lock Assembly Nut	4.9	0.50	43 in·lb	
4	Front Duct Bolts	—	—	—	L
5	Damper Bolts	—	—	—	L
6	Damper Bracket Bolts	—	—	—	L
7	Front Storage Compartment Cover Bolts	—	—	—	L
8	Hinge Bolts	—	—	—	L
9	Front Storage Compartment Hook Bolts	—	—	—	L
10	Steering Cover Bolts	—	—	—	L
11	Meter Screen Bolts	—	—	—	L
12	Seat Hook Bolts	—	—	—	L
13	Seat Locknut	—	—	—	L
14	Reboarding Step Bolts	—	—	—	L
15	Mirror Stay Bolts	—	—	—	L

A: JT1500-A1 ~ A2 Model

B: JT1500A6 Model ~

C: JT1500A7 Model ~

D: JT1500-A1 ~ A8 Models

E: JT1500-A1 ~ AA Models

F: JT1500-A1 ~ AA, AB (other than AU) Models

CY: Apply cyanoacrylate cement.

L: Apply a non-permanent locking agent.

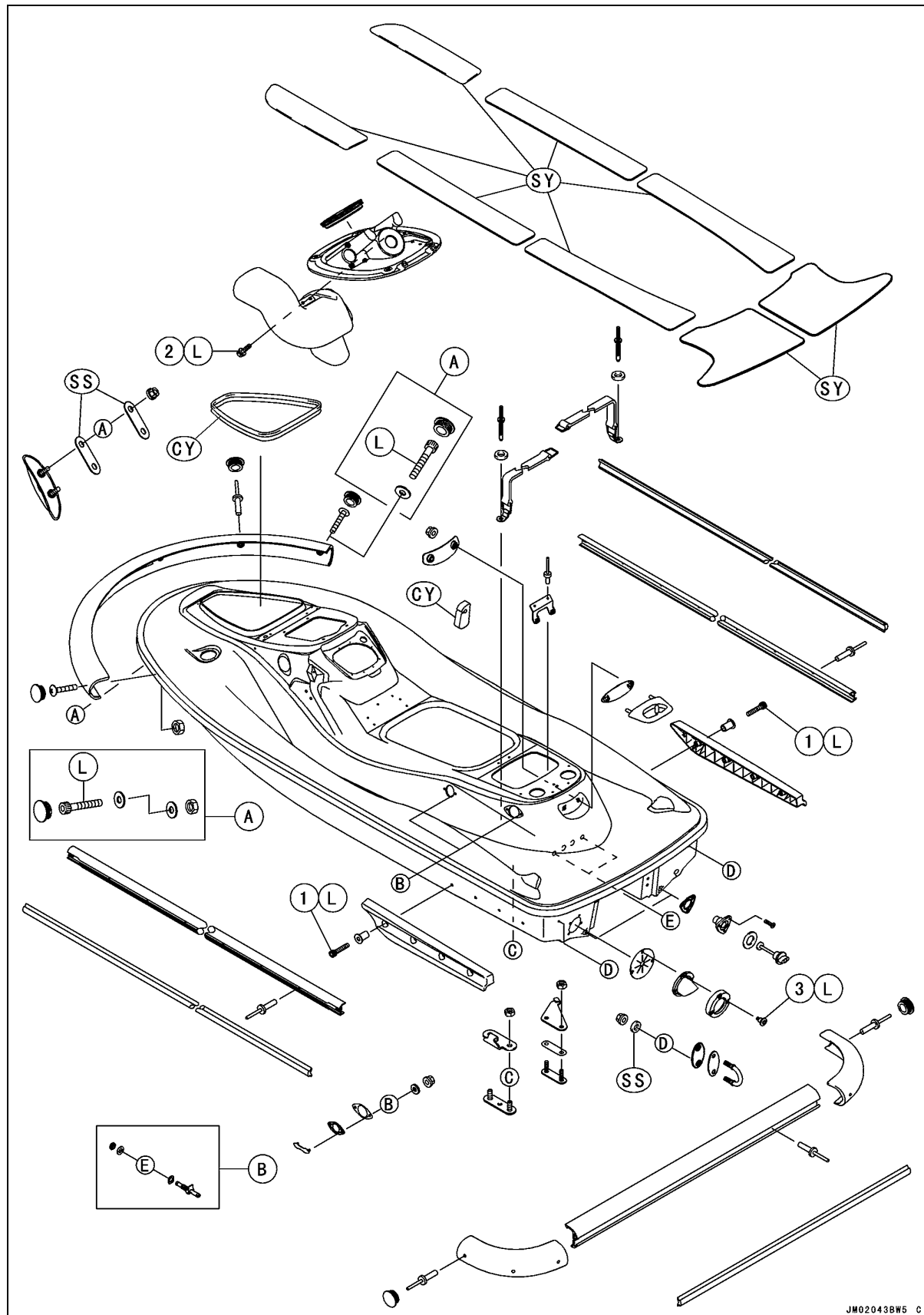
R: Replacement Parts

SY: Apply synthetic rubber adhesive.

13-4 HULL/ENGINE HOOD

Exploded View

JT1500-A1 ~ A8 Models



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Stabilizer Bolts	9.8	1.0	87 in·lb	L
2	Air Inlet Duct Bolts	—	—	—	L
3	Exhaust Outlet Bolts	—	—	—	L

A: JT1500A7 Model ~

B: JT1500A8 Model

CY: Apply cyanoacrylate cement.

L: Apply a non-permanent locking agent.

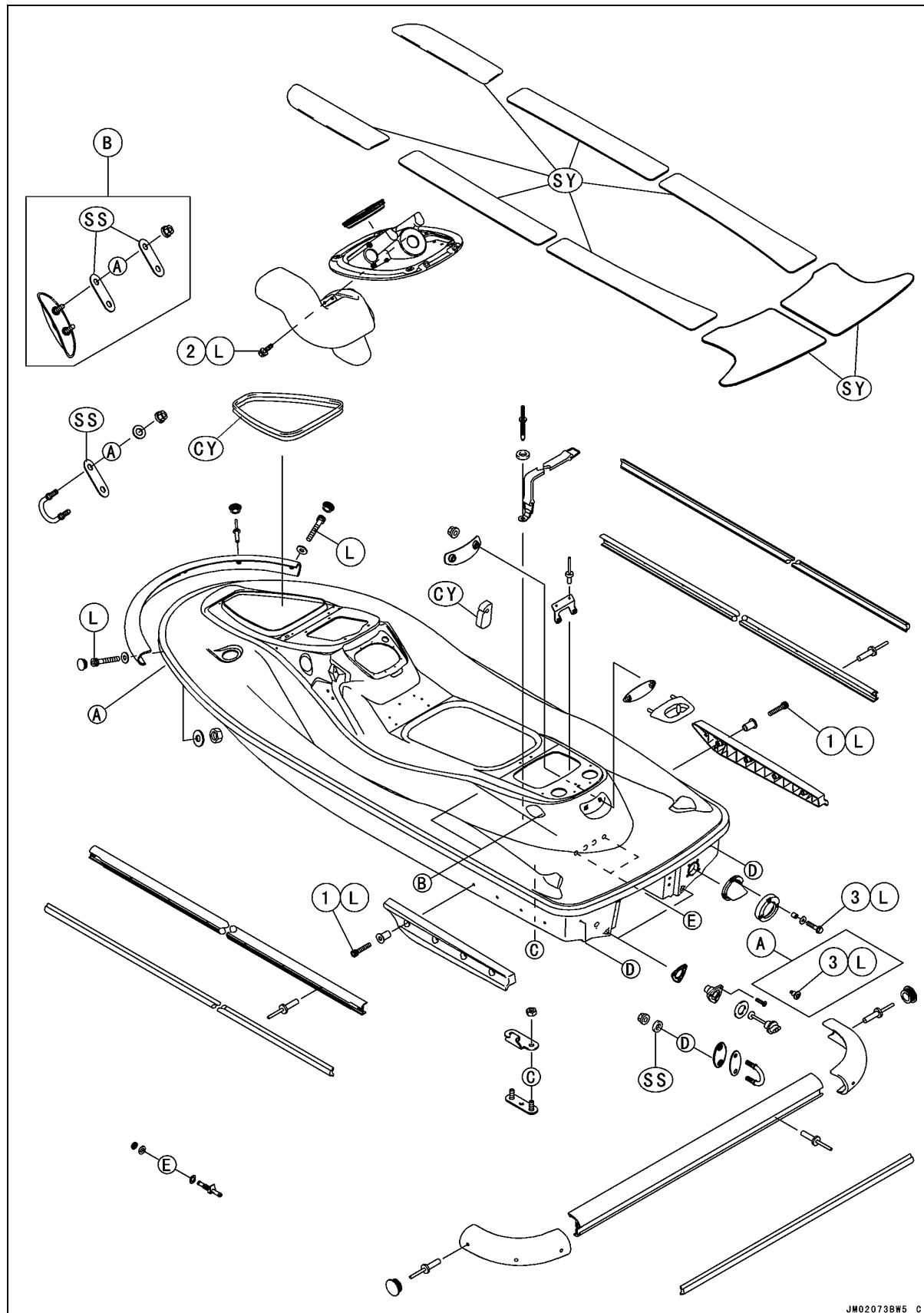
SS: Apply silicone sealant.

SY: Apply synthetic rubber adhesive.

13-6 HULL/ENGINE HOOD

Exploded View

JT1500A9 Model ~



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Stabilizer Bolts	9.8	1.0	87 in·lb	L
2	Air Inlet Duct Bolts	—	—	—	L
3	Exhaust Outlet Bolts	—	—	—	L

A: JT1500A9 ~ AA Models

B: JT1500A9 ~ AB Models

CY: Apply cyanoacrylate cement.

L: Apply a non-permanent locking agent.

SS: Apply silicone sealant.

SY: Apply synthetic rubber adhesive.

13-8 HULL/ENGINE HOOD

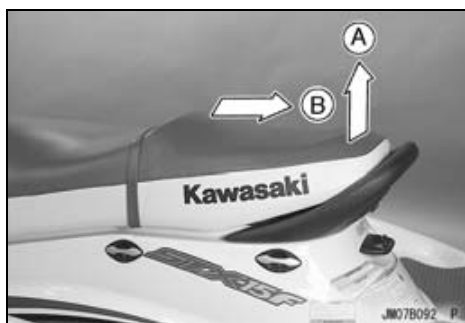
Fittings

Seat Removal (JT1500-A1 ~ A2 Models)

- Pull [A] the latch handle [B].

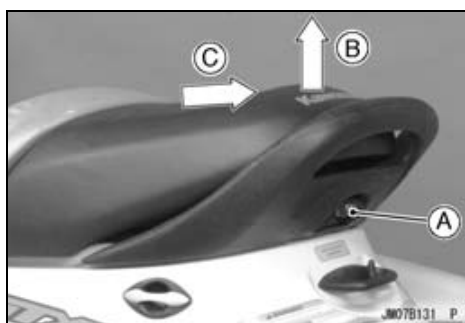


- Remove the seat up [A] and to the rear [B].

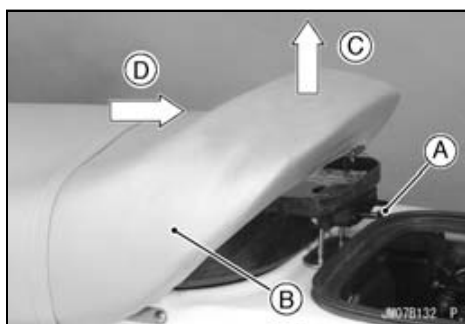


Seat Removal (JT1500A6 Model ~)

- Pull the latch handle [A].
- Remove the rear seat up [B] and to the rear [C].

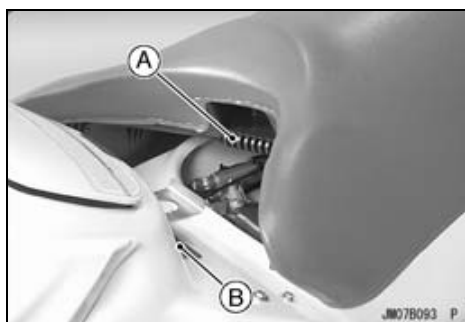


- Pull the latch handle [A] of the front seat [B].
- Remove the front seat up [C] and rear [D].



Seat Installation (JT1500-A1 ~ A2 Models)

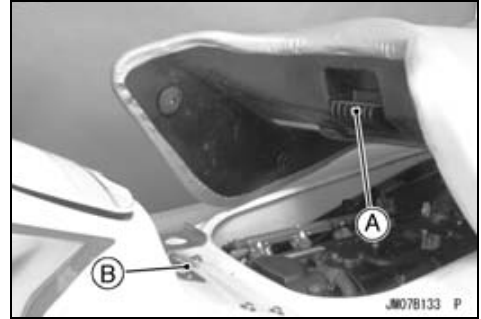
- Insert the seat hook [A] into the bracket [B] on the deck and slide it all the way forward by pushing the rear of the seat.
- Push down on the rear of the seat to lock it.



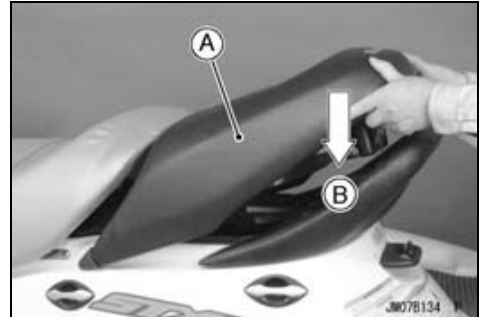
Fittings

Seat Installation (JT1500A6 Model ~)

- Insert the seat hook [A] into the bracket [B] on the deck and slide it all the way forward by pushing the rear of the front seat.
- Push down on the rear of the front seat to lock it.

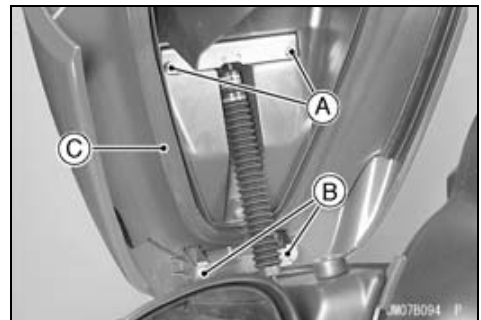


- Install the rear seat [A] and push down [B] on the rear of the rear seat to lock it.

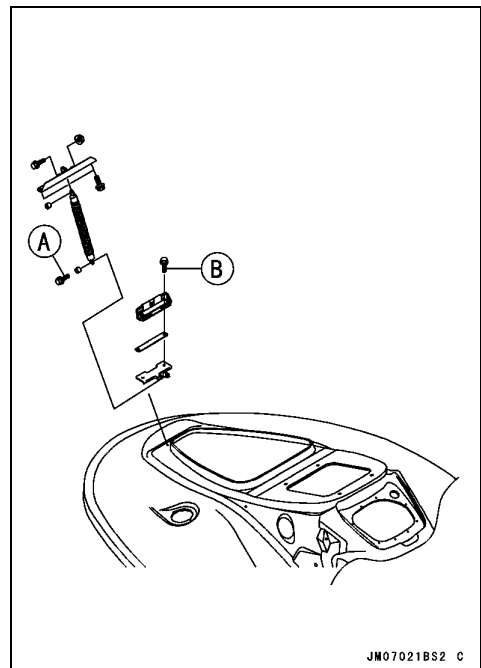


Front Storage Compartment Cover Removal

- Remove:
 - Damper Bracket Mounting Bolts [A]
 - Front Storage Compartment Cover Bracket Mounting Bolts [B]
 - Front Storage Compartment Cover Assembly [C]



- To remove the hinge assembly, remove the following.
 - Damper Bolt [A]
 - Hinge Bolts [B]

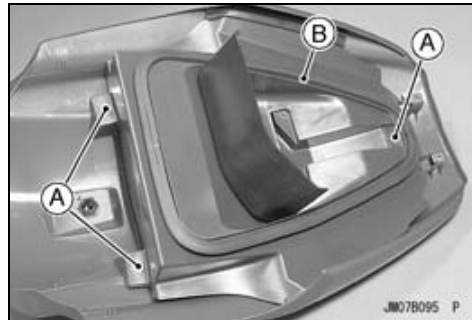


13-10 HULL/ENGINE HOOD

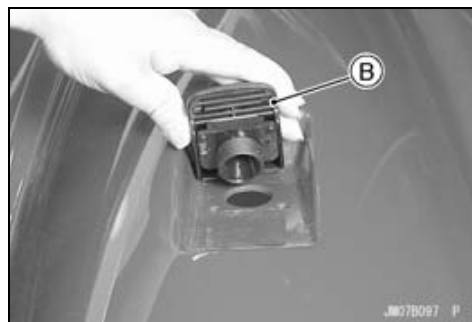
Fittings

Front Storage Compartment Cover Disassembly

- Unscrew the front duct bolts [A] and remove the front duct [B].



- Unscrew the lock assembly nut [A] and remove the lock assembly [B].

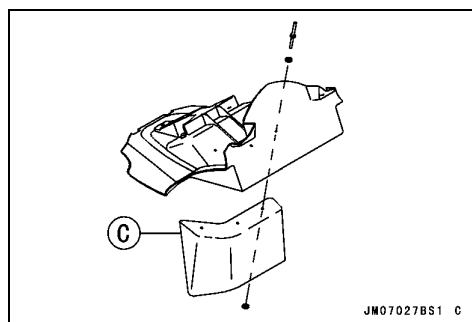
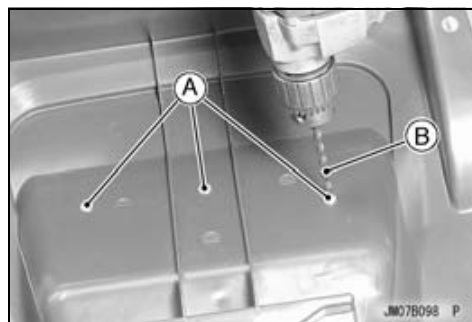


- Drill out the rivets [A] with a drill bit [B] of the correct size and remove the front duct cover [C].

Rivet Removal Drill Bit Size
5.0 mm (0.2 in.)

NOTE

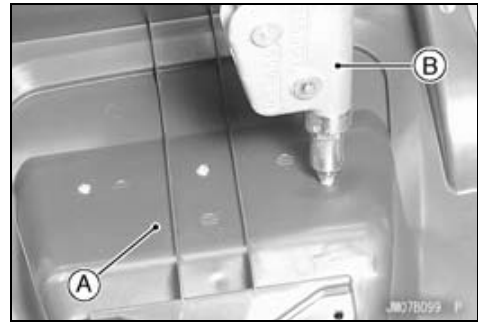
- Stop drilling when the rivet head starts to turn with drill bit.
- Tap the rivet out with a suitable punch and hammer.



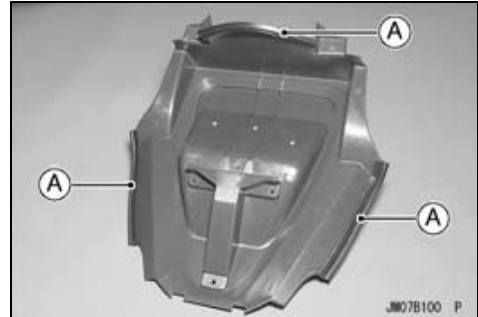
Fittings

Front Storage Compartment Cover Assembly

- Secure the front duct cover to the front duct [A] with the rivets using a riveter [B].



- Be sure that the trim seals [A] are in position.



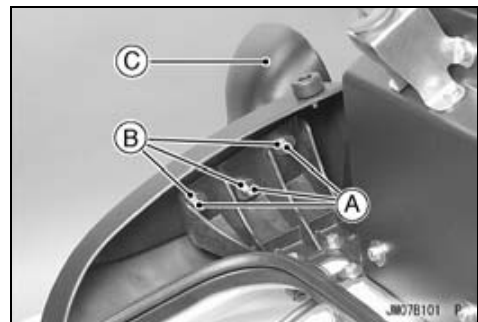
- Tighten the lock assembly nut.

Torque - Lock Assembly Nut: 4.9 N·m (0.50 kgf·m, 43 in·lb)

- Apply a non-permanent locking agent to the following bolts.
 - Air Duct Bolts
 - Hinge Bolts
 - Damper Bolts

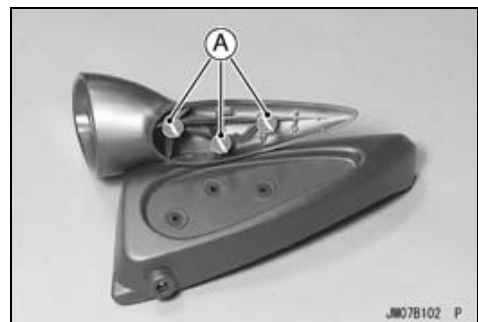
Mirror Removal

- Open the front storage compartment cover.
- Unscrew the nuts [A] and washers [B] and remove the mirrors [C] (both sides).



Mirror Installation

- Be sure that the washer [A] are in position.



13-12 HULL/ENGINE HOOD

Fittings

Mirror Stay Removal

- To remove the right mirror stay [A], remove the bolts [B].

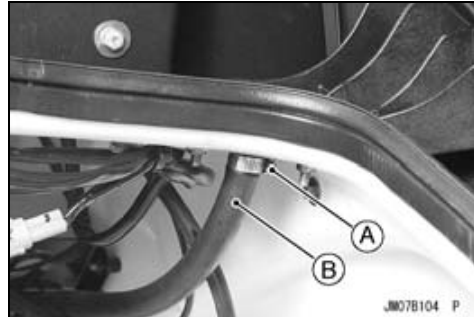
NOTE

○The plate [C] on the inside of the hull will drop down when the last bolt is removed.

- Remove the right mirror (see Mirror Removal).



- To remove the left mirror stay, perform the next procedures.
- Loosen the clamp [A] and disconnect the flushing hose [B].

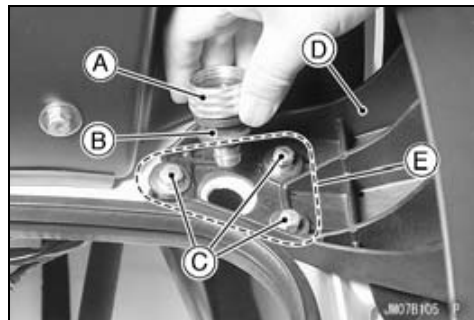


- Remove the flushing cap.
- Pull up the flushing fitting [A] with the damper [B] from the hull.
- Unscrew the bolt [C] and remove the left mirror stay [D].

NOTE

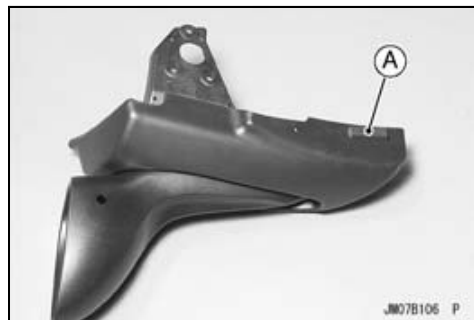
○The plate [E] on the inside of the hull will drop down when the last bolt is removed.

- Remove the left mirror (see Mirror Removal).



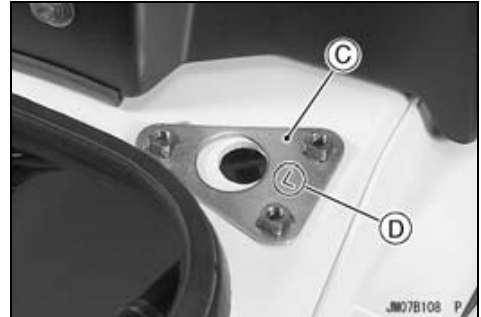
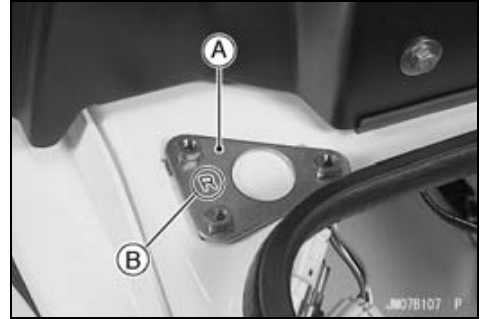
Mirror Stay Installation

- Be sure the dampers [A] are in position (both sides).



Fittings

- The right plate [A] on the inside of the hull has a R mark [B] and the left plate [C] has L mark [D].
- Apply a non-permanent locking agent to the mirror stay bolts and tighten them securely.



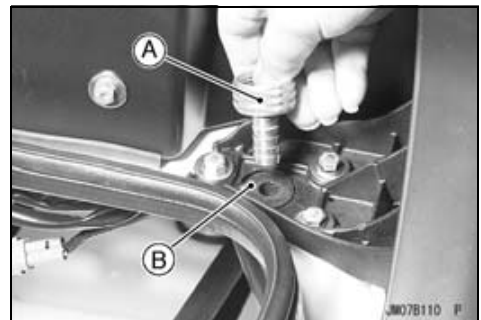
- Install the damper [A] onto the hull.

NOTE

○Apply a little oil to the damper to make installation easy.



- Install the flushing fitting [A] into the damper [B].



Front Storage Pocket Removal

- Remove the front storage pocket mounting screws [A].
- Remove the front storage pocket [B].



Front Storage Pocket Installation

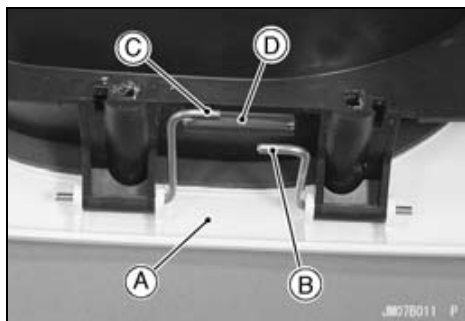
- Installation is the reverse of removal.

13-14 HULL/ENGINE HOOD

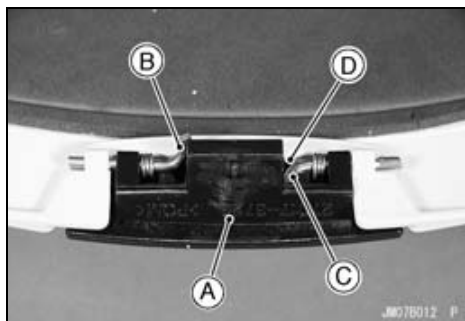
Fittings

Storage Pocket Disassembly/Assembly

- To remove the storage pocket cover [A], turn and pull out the shaft [B] (both side).
- When installing the shafts, put the shaft end [C] (both side) into the hollow [D] on the storage pocket.

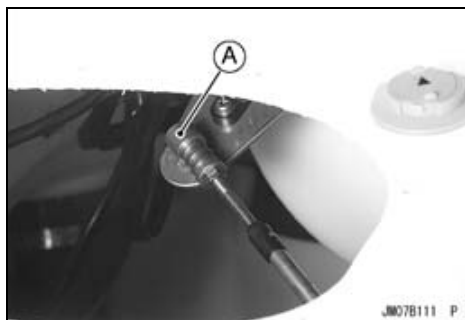


- To remove the lock [A], turn and pull out the shaft [B] (both side).
- When installing the shafts, push the shaft end [C] (both side) into the hollow [D] on the lock.

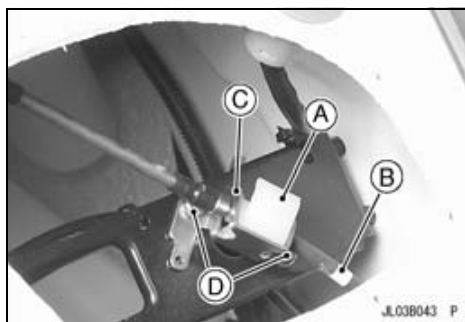


Crossmember Removal

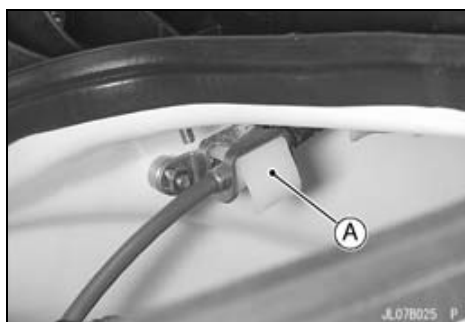
- Remove the front storage pocket (see Front Storage Pocket Removal).
- Disconnect the steering cable upper end [A].



- Pull out the holder [A].
- Unscrew the mounting bolts [D] and remove the cable bracket [C] with the cable [B].

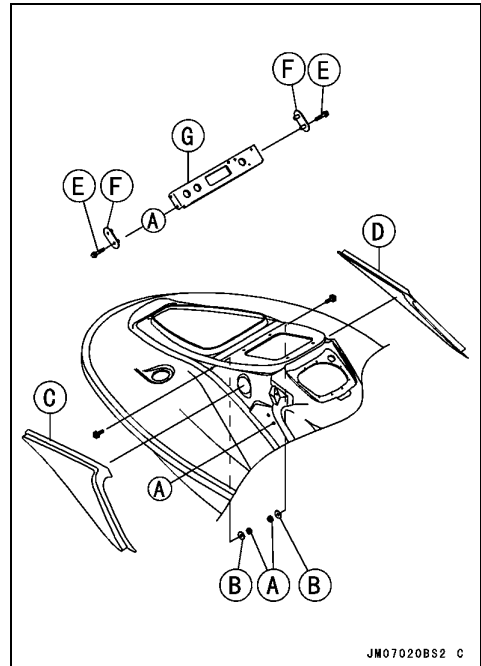


- To remove the right side cover, pull the holder [A] off the cable bracket.



Fittings

- Unscrew the mounting nuts [A] and washers [B] and the left [C] and right [D] covers.
- Unscrew the crossmember bolts [E] and bracket [F], and remove the crossmember [G].



Crossmember Installation

- Apply a non-permanent locking agent to the crossmember bolts and tighten them.

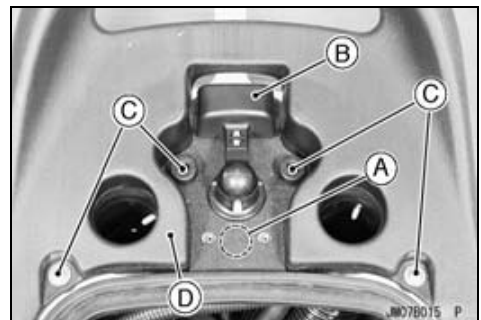
Torque - Crossmember Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Be sure that the dampers [A] are in position.
- Apply a non-permanent locking agent to the cable bracket mounting bolts and tighten them securely.



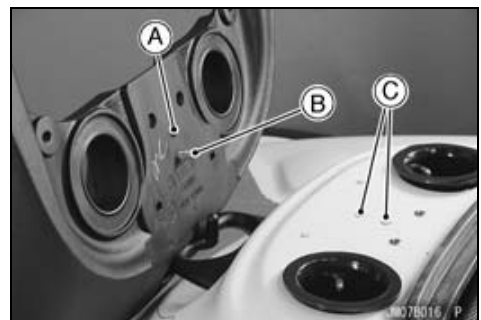
Handrail Removal

- Remove the seat (see this chapter).
- Disconnect the bilge hoses from the breather fitting.
- Unscrew the mounting nut [A] and washer inside the hull, and remove the lock assembly [B].
- Holding the nuts and washers inside hull, unscrew the mounting bolts [C], and remove the handrail [D].



Handrail Installation

- When installing the lock assembly and handrail, align the projection [A] and stud bolt [B] on the lock assembly with holes [C] on the hull.

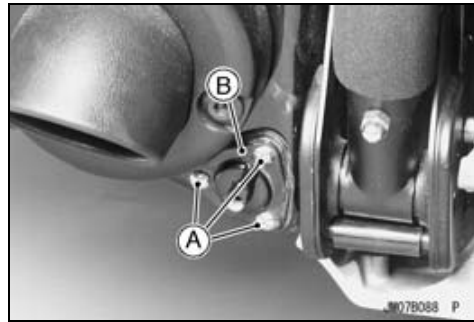


13-16 HULL/ENGINE HOOD

Fittings

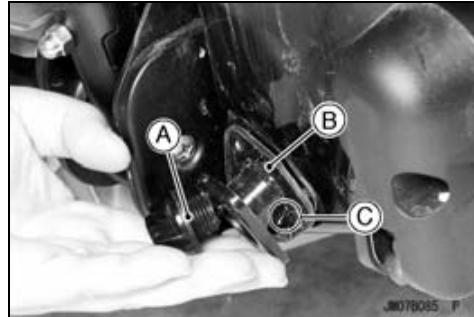
Drain Plug Housing Removal

- Unscrew the screws [A] and remove the drain plug housing [B].



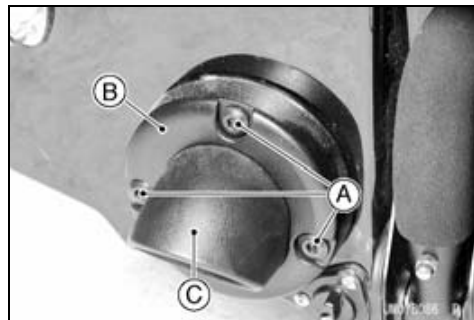
Drain Plug Housing Installation

- Check the seal [A] for damage.
- ★ If necessary, replace new ones.
- Install the new gasket [B] so that its “OUT” mark [C] faces outwards.



Exhaust Outlet Removal

- Unscrew the mounting bolts [A] and remove the holder [B] and exhaust outlet [C].
- The exhaust outlet is located at the left on the hull in JT1500-A1 ~ A8 Models, however it is located at right on the hull in JT1500A9 Model ~.

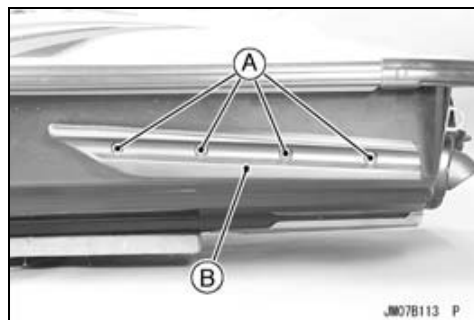


Exhaust Outlet Installation

- Apply a non-permanent locking agent to the mounting bolts and tighten them securely.

Stabilizer Removal

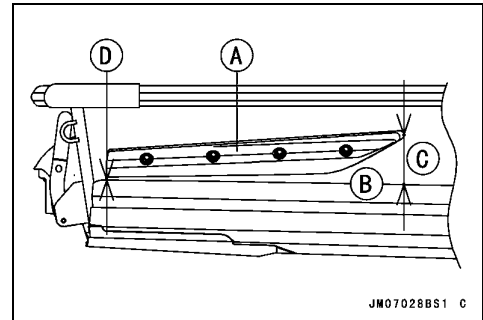
- Unscrew the stabilizer bolts [A] and remove the stabilizer [B].
- The exhaust outlet is located at the left on the hull in JT1500-A1 ~ A8 Models, however it is located at right on the hull in JT1500A9 Model ~.



Fittings

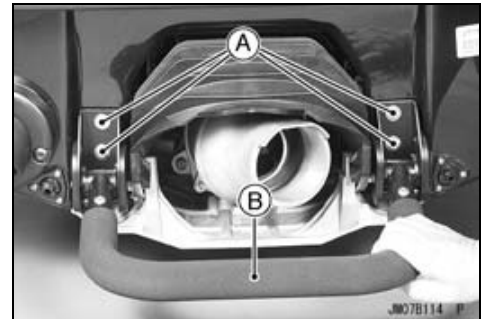
Stabilizer Installation

- Install the stabilizer as shown.
 - Stabilizer [A]
 - Chine Line [B]
 - 105 ±3 mm (4.13 ±0.12 in.) [C]
 - 20 ±2 mm (0.79 ±0.08 in.) [D]
 - Apply a non-permanent locking agent to the stabilizer bolt and tighten them.
- Torque - Stabilizer Bolts: 9.8 N·m (1.0 kgf·m, 87 in·lb)**



Reboarding Step Removal

- Unscrew the reboarding step bolts [A] and remove the reboarding step [B].



Reboarding Step Installation

- Apply a non-permanent locking agent to the reboarding step bolts and tighten them securely.

13-18 HULL/ENGINE HOOD

Hull Replacement

To replace the hull, remove the various parts in the following suggested order.

- Battery and Pad
- Exhaust Pipe and Expansion Chamber
- Inlet Manifold
- Engine and Mounts
- Air Filter
- Water Box Muffler
- Drive Shaft and Shaft Holder
- Pump and Hoses
- Steering Cover
- Handlebar and Steering
- Steering Cable
- Reverse Cable
- Crossmember
- Fuel Tank and Filler
- Bilge and Cooling System Hose
- Bypass Hose and Outlet
- Bumpers
- Engine Hood Latch
- Front Storage Compartment Cover and Brackets
- Handrail

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

- Decals
- Labels
- Mats
- Registration Number (if any)

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

Rubber Parts

NOTE

○ The rubber parts on the watercraft are fastened in place with various adhesives. To replace a rubber part, use a cement in the following table, or an equivalent.

WARNING

Many solvents and adhesives are flammable, may be harmful to the skin and eyes, and may emit harmful vapors. Read all product warnings before use. Use only in a well-ventilated area and never near an open flame.

For this Application	Type
Mats	Synthetic Rubber
Engine Hood Gasket	Adhesive
Front Storage Compartment Cover	(P/N: 92104-3701)
Trim Seal	
Detents	Cyanoacrylate Cement
Handlebar Grips	

NOTICE

When the cement cures it may be impossible to reposition the part. Be very careful that the part is positioned correctly when you apply the cement.

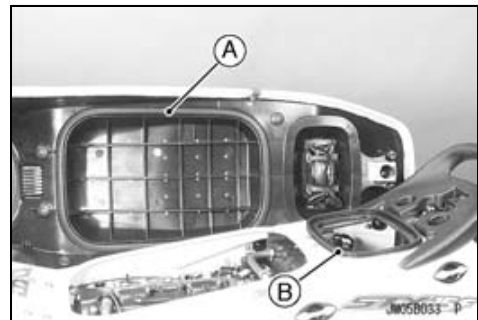
WARNING

Cyanoacrylate cement is harmful to the eyes and makes skin immediately stick to anything touched. To prevent contact with cyanoacrylate cement, always wear safety goggles and gloves. If there is eye contact, do not try to wash it out -- immediately contact a physician. In case of skin contact, do not touch any other part of your body; allow the cement to cure and it will eventually wear off.

Rubber Parts Location

Engine Hood Gasket [A]

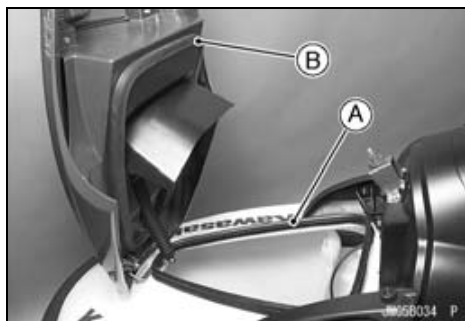
Rear Storage Trim Seal [B]



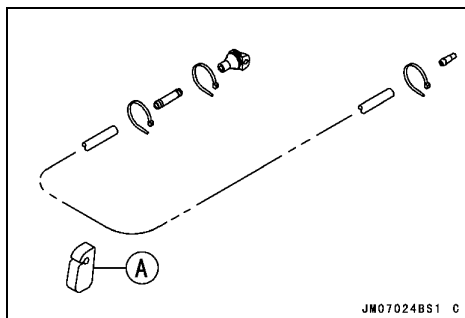
13-20 HULL/ENGINE HOOD

Rubber Parts

Front Storage Compartment Gasket [A]
Front Storage Compartment Cover Trim Seal [B]



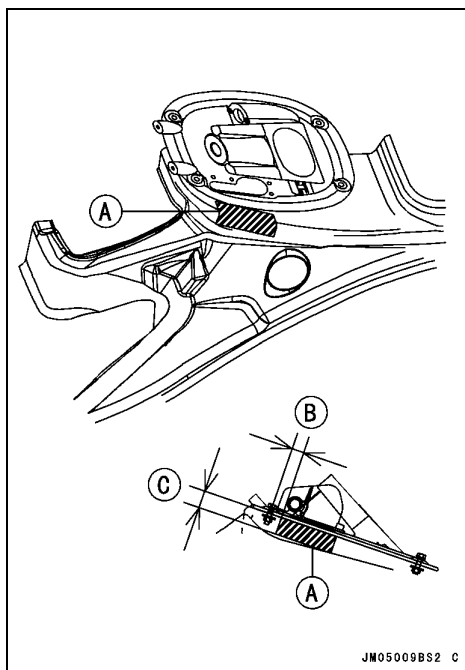
Detent [A]



Mats [A]



Damper on Deck [A] (starboard side only)
20 mm (0.79 in.) [B]
30 mm (1.18 in.) [C]



Rubber Parts

Rivet Removal

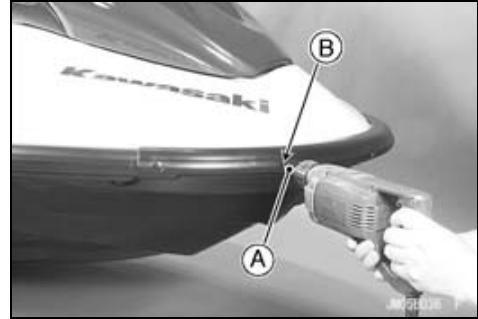
- Drill out the rivet with a drill bit [A] of the correct size.

Rivet Removal Drill Bit Size

5.0 mm (0.2 in.)

NOTE

- Stop drilling when the rivet head [B] starts to turn with drill bit.
- Tap the rivet out with a suitable punch and hammer.



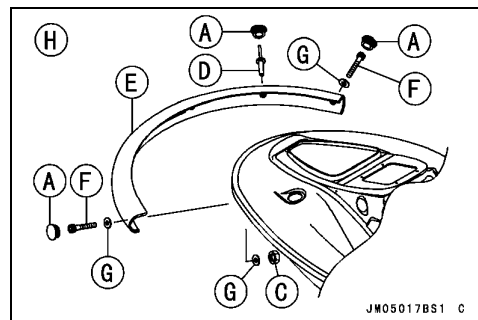
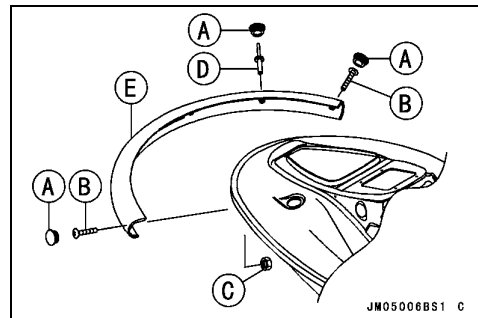
Rivet Installation

- Secure the parts to the hull with the rivets using a riveter [A].



Front Bumper Removal

- Take out the plugs [A].
- Take out the mounting screw [B] and nuts [C].
- Take out the mounting bolts [F], nuts [C] and washers [G].
- [H] JT1500A7 Model ~
- Drill out the rivets [D] (see Rivet Removal).
- Remove the front bumper [E].



Front Bumper Installation

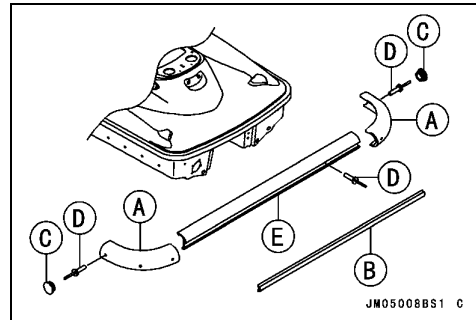
- Secure the front bumper to the hull flange with the rivets (see Rivet Installation).

13-22 HULL/ENGINE HOOD

Rubber Parts

Rear Bumper Removal

- Remove the corner bumpers [A] and trim strip [B].
- Take out the plugs [C].
- Drill out the rivets [D] (see Rivet Removal).
- Remove the rear bumper [E].

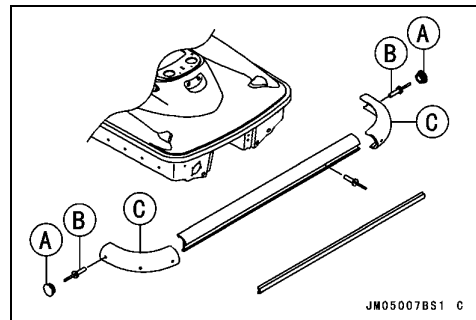


Rear Bumper Installation

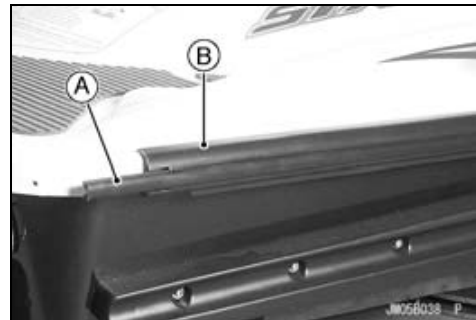
- Secure the bumpers to the hull flange with the rivets (see Rivet Installation).

Side Bumper Removal

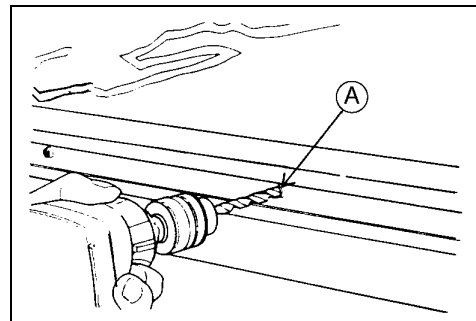
- Take out the plugs [A].
- Drill out the rivets [B] (see Rivet Removal).
- Remove the corner bumper [C].



- Remove the trim strip [A] from the side bumper [B].



- Drill out the rivets [A] (see Rivet Removal).



Side Bumper Installation

- Secure the side bumpers to the hull flange with the rivets (see Rivet Installation).
- Install the trim strip.

Electrical System

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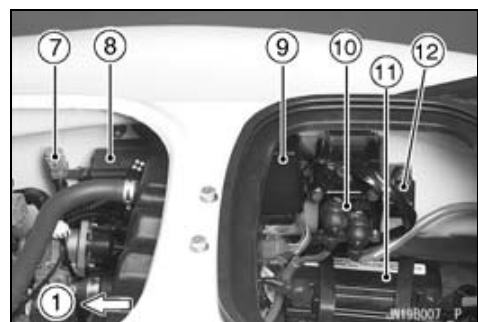
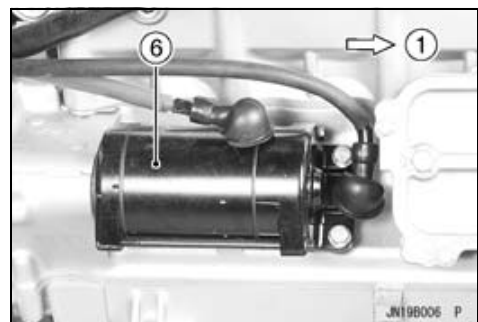
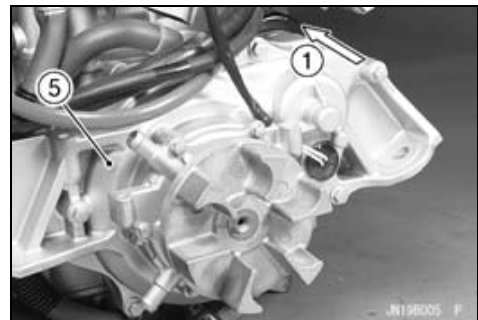
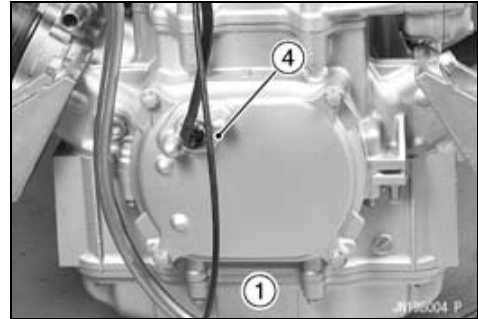
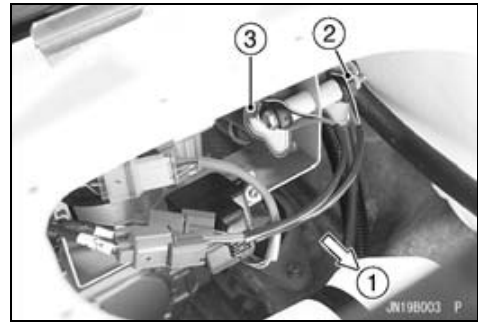
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14-2 ELECTRICAL SYSTEM

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Parts Location

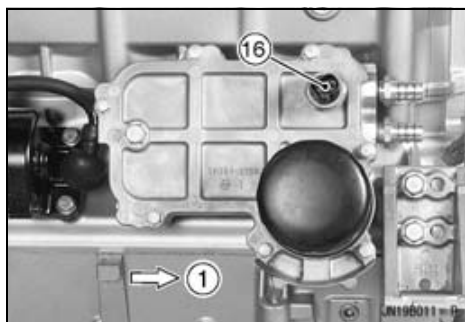
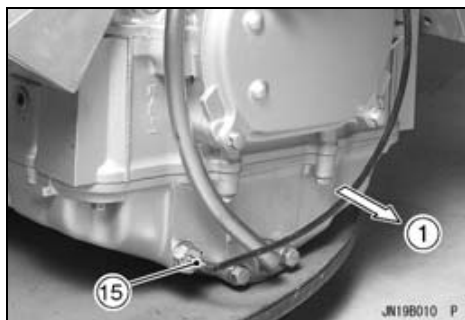
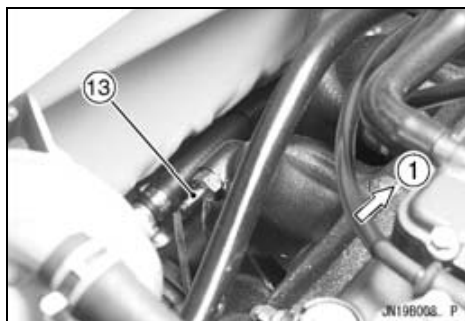
1. Bow
2. Ignition Coil #2, #3
3. Ignition Coil #1, #4
4. Crankshaft Sensor
5. Magneto
6. Starter Motor
7. Fuse Case
8. Regulator/Rectifier
9. ECU (Electronic Control Unit)
10. Starter Relay
11. Battery
12. Relay Assembly (Main Relay/Fuel Pump Relay)



14-4 ELECTRICAL SYSTEM

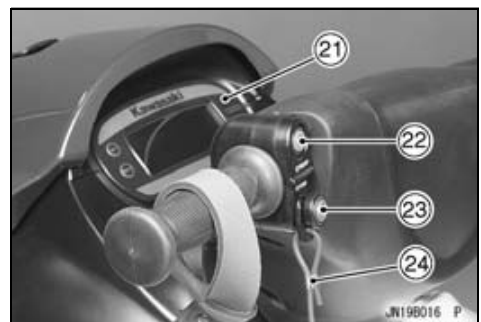
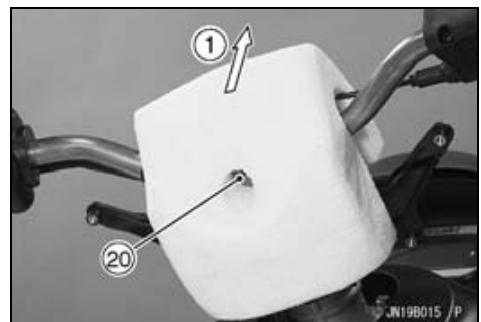
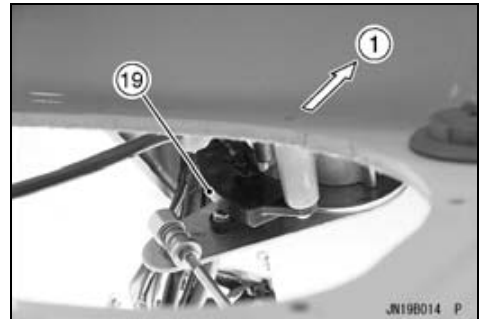
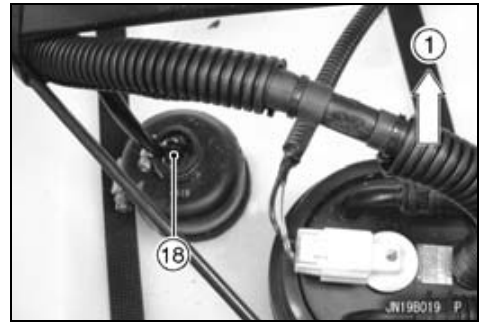
Parts Location

- 13. Water Temperature Sensor
- 14. Camshaft Position Sensor
- 15. Oil Temperature Sensor
- 16. Oil Pressure Switch
- 17. Speed Sensor



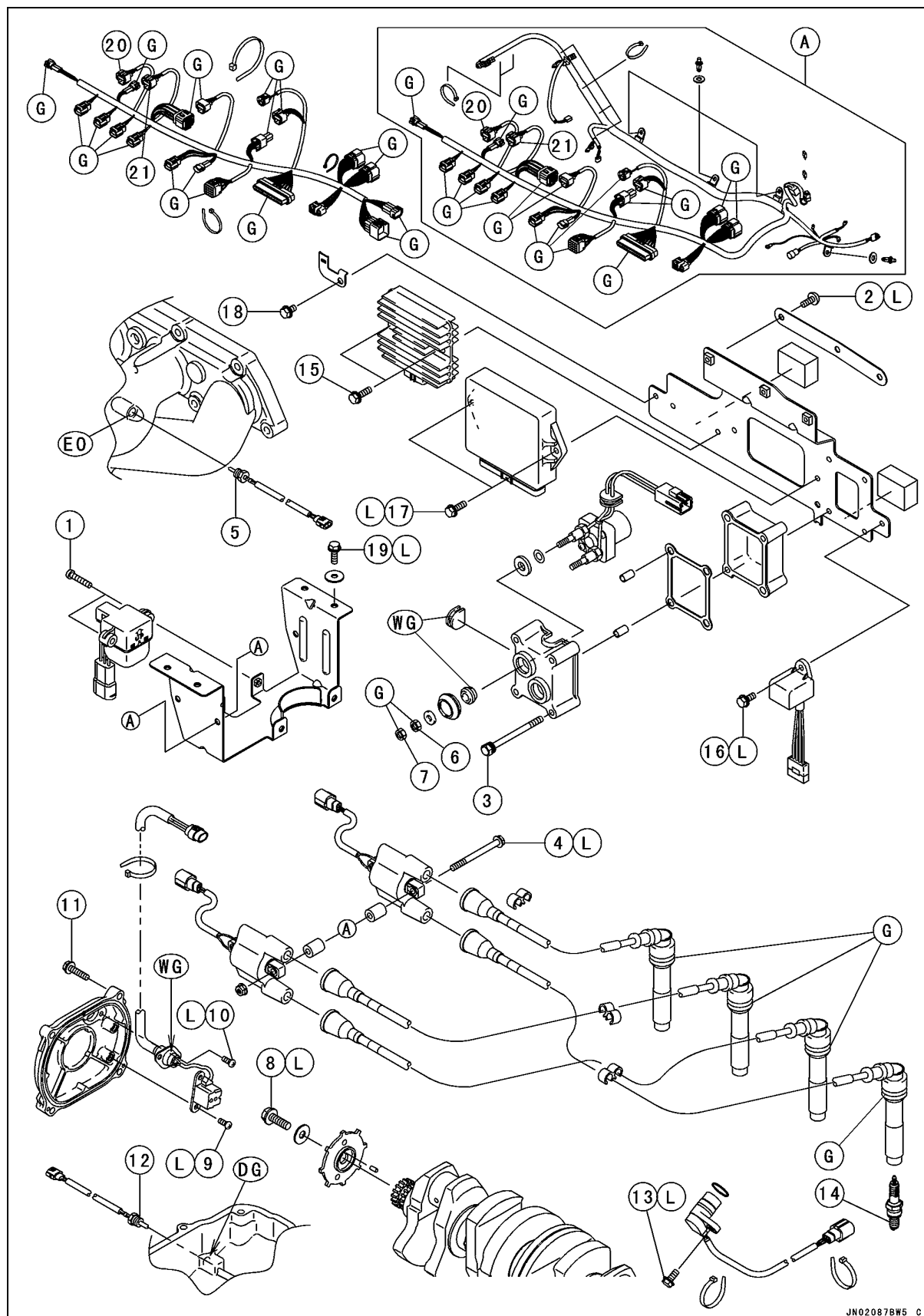
Parts Location

- 18. Fuel Level Sensor
- 19. Steering Position Sensor
- 20. Buzzer
- 21. Multifunction Meter
- 22. Starter Switch
- 23. Engine Stop Switch
- 24. Lanyard Key (Tether Code)
- 25. Ignition Switch



14-6 ELECTRICAL SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Vehicle-down Sensor Mounting Screws	1.5	0.15	13 in·lb	
2	Electrical Parts Bracket Screws	4.9	0.50	43 in·lb	L
3	Starter Relay Case Bolts	7.8	0.80	69 in·lb	
4	Ignition Coil Mounting Bolts	8.8	0.90	78 in·lb	L
5	Water Temperature Sensor	15	1.5	11	see text
6	Starter Relay Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
7	Starter Cable Mounting Nuts	3.5 ~ 4.5	0.35 ~ 0.45	30 ~ 40 in·lb	
8	Timing Rotor Bolt	20	2.0	14	L
9	Crankshaft Sensor Screws	4.4	0.45	39 in·lb	L
10	Rubber Grommet Holder Screws	4.4	0.45	39 in·lb	L
11	Crankshaft Sensor Cover Bolts	7.8	0.80	69 in·lb	
12	Oil Temperature Sensor	15	1.5	11	see text
13	Camshaft Position Sensor Bolt	9.8	1.0	87 in·lb	L
14	Spark Plugs	13	1.3	113 in·lb	
15	Regulator/Rectifier Bolts	7.8	0.80	69 in·lb	
16	Relay Assembly Bolt	2.5	0.25	22 in·lb	L
17	ECU Mounting Bolts	8.8	0.90	78 in·lb	L
18	Main Fuse Mounting Bracket Bolt	7.8	0.80	69 in·lb	
19	Bracket Mounting Bolts	8.8	0.90	78 in·lb	L

20. Do not apply grease for inlet air pressure sensor lead connector.

21. Do not apply grease for inlet air temperature sensor lead connector.

A: JT1500A8 Model ~

DG: Fill the hollow with the heat transfer grease (Heat Transfer Grease, SCH-20: 92137-1002 or equivalent).

EO: Fill the hollow with engine oil (10W-30).

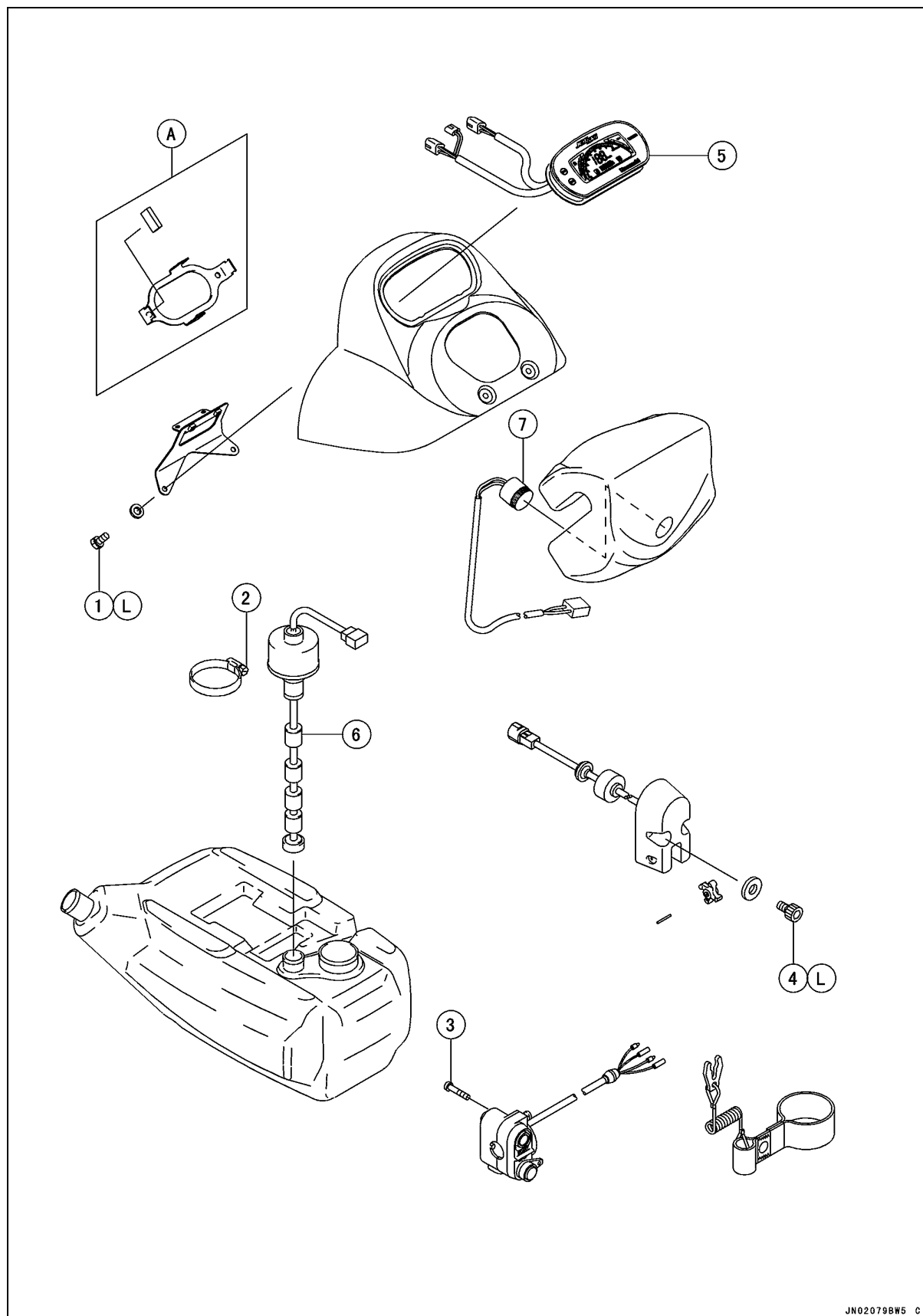
G: Apply grease.

L: Apply a non-permanent locking agent.

WG: Apply water resistant grease.

14-8 ELECTRICAL SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Multifunction Meter Mounting Bolts	3.9	0.40	35 in·lb	L
2	Fuel Level Sensor Clamp Screw	2.9	0.30	26 in·lb	
3	Start/stop Switch Case Mounting Screw	3.9	0.40	35 in·lb	
4	Speed Sensor Mounting Bolts	3.9	0.40	35 in·lb	L

5. Multifunction Meter

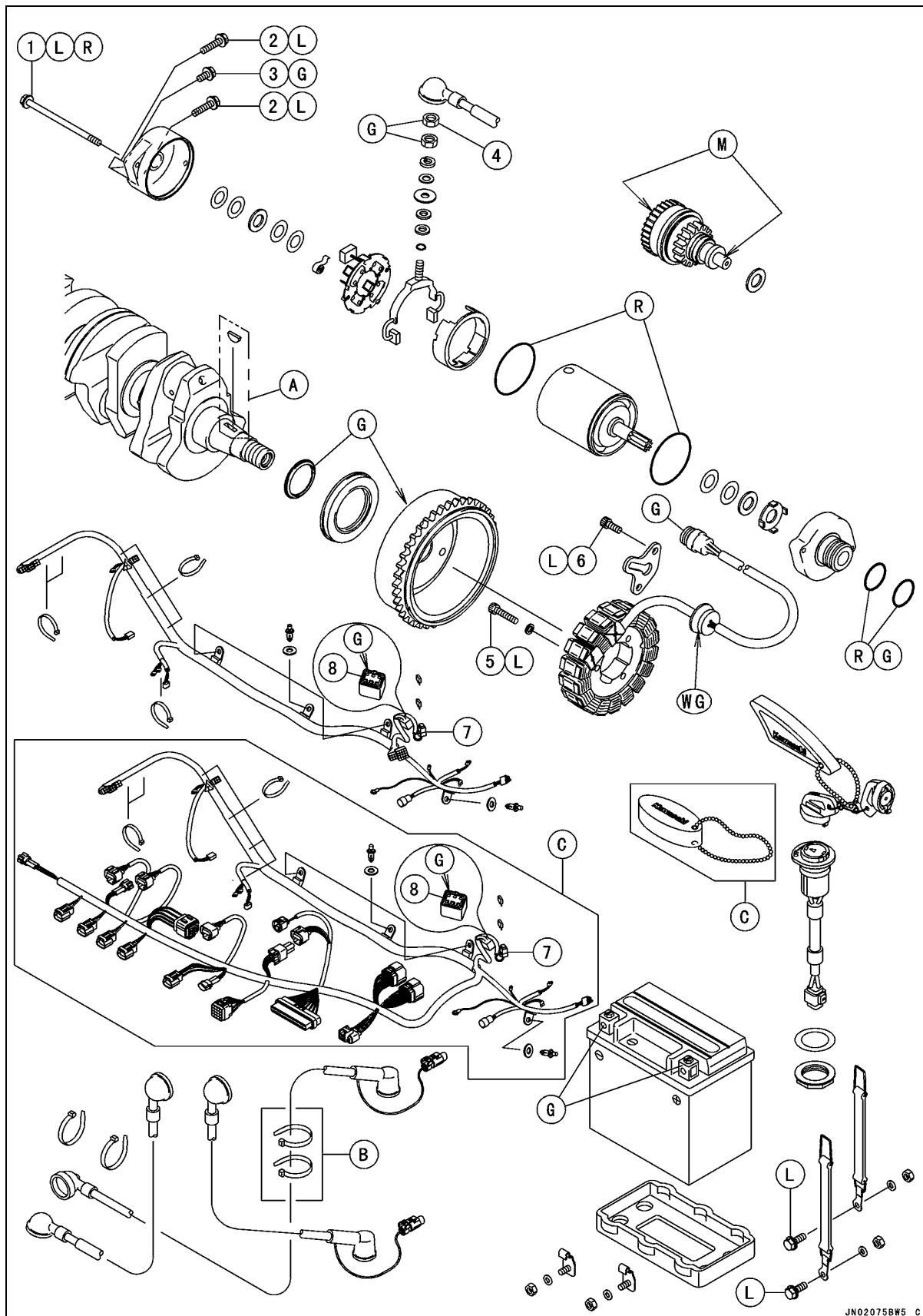
6. Fuel Level Sensor

7. Buzzer

A: JT1500-A1 ~ AA Models

14-10 ELECTRICAL SYSTEM

Exploded View



Exploded View

No.	Fastener	Torque			Remarks
		N·m	kgf·m	ft·lb	
1	Starter Motor Through Bolts	6.4	0.65	56 in·lb	L, R
2	Starter Motor Mounting Bolts	8.8	0.90	78 in·lb	L
3	Starter Motor Ground Bolt	8.8	0.90	78 in·lb	
4	Starter Motor Terminal Nut	8.8	0.90	78 in·lb	
5	Stator Coil Bolts	12	1.2	104 in·lb	L
6	Grommet Holder Bolts	8.8	0.90	78 in·lb	L

7. Main Fuse 20 A

8. Harness Connector (to Regulator/Rectifier)

A: JT1500-A1 ~ A6 Models

B: JT1500-A1 ~ A8 Models

C: JT1500A8 ~ AA Models

G: Apply grease.

L: Apply a non-permanent locking agent.

M: Apply molybdenum disulfide grease.

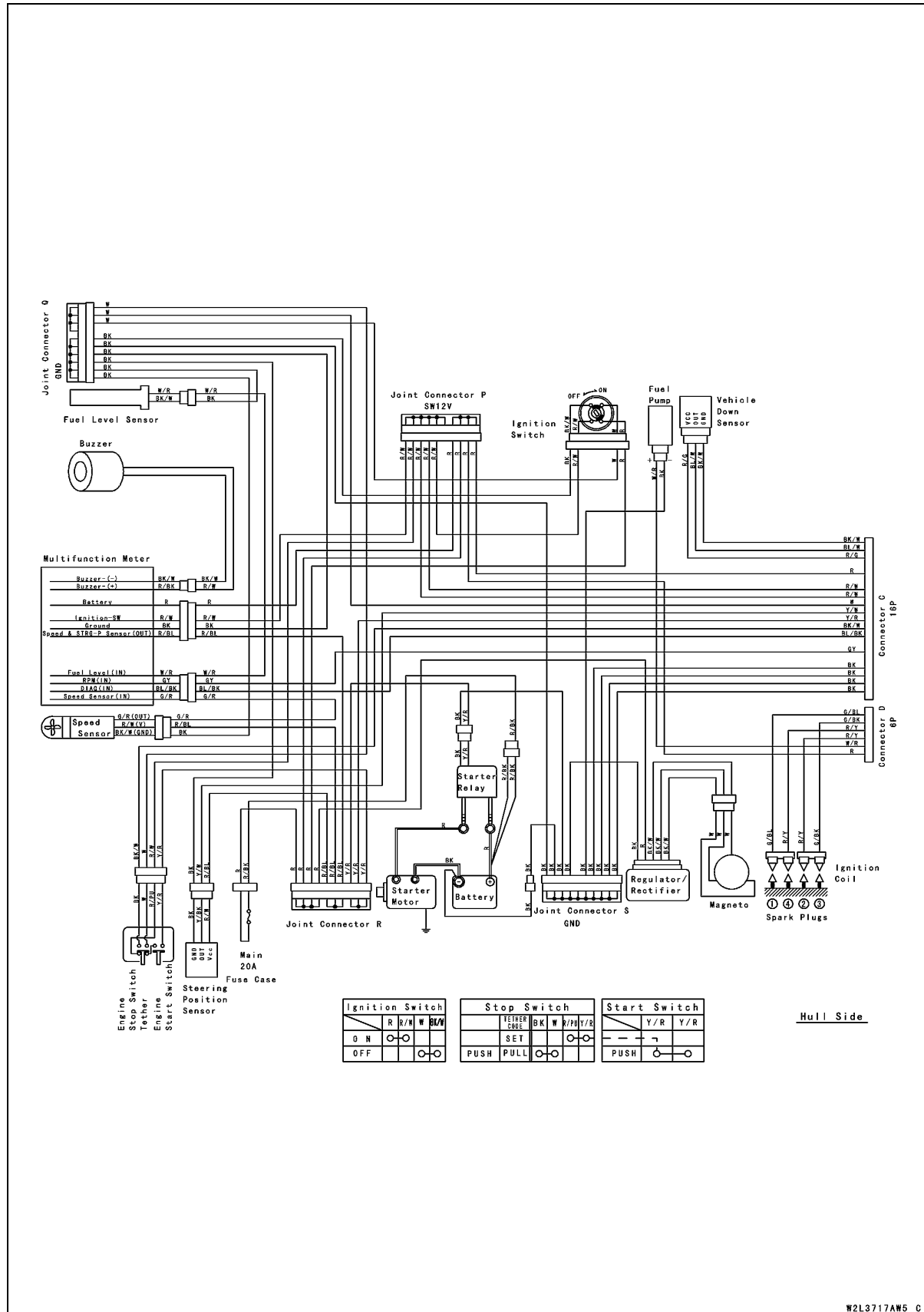
R: Replacement parts.

WG: Apply water resistant grease.

14-12 ELECTRICAL SYSTEM

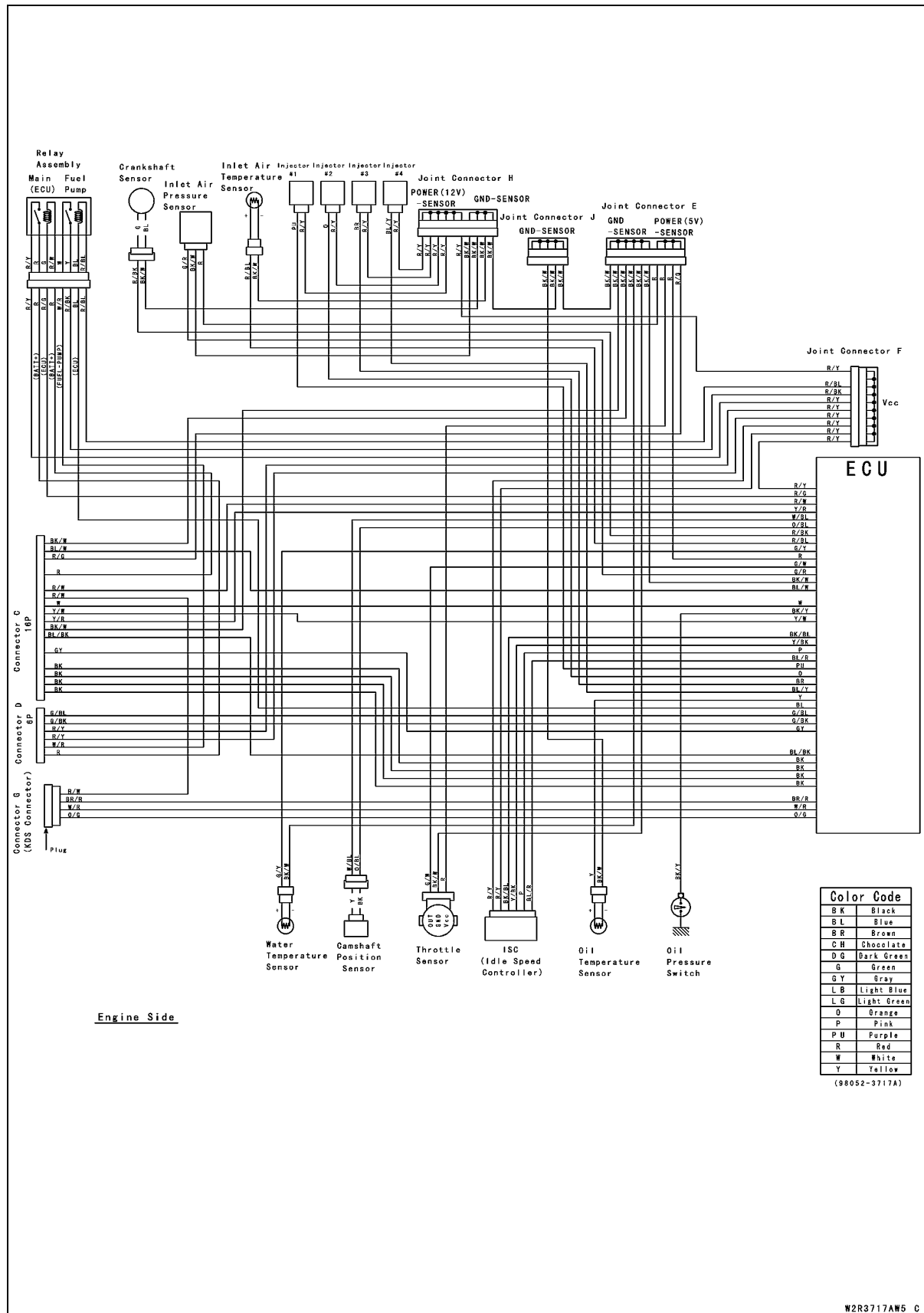
Wiring Diagram

JT1500-A1 Model



Wiring Diagram

JT1500-A1 Model

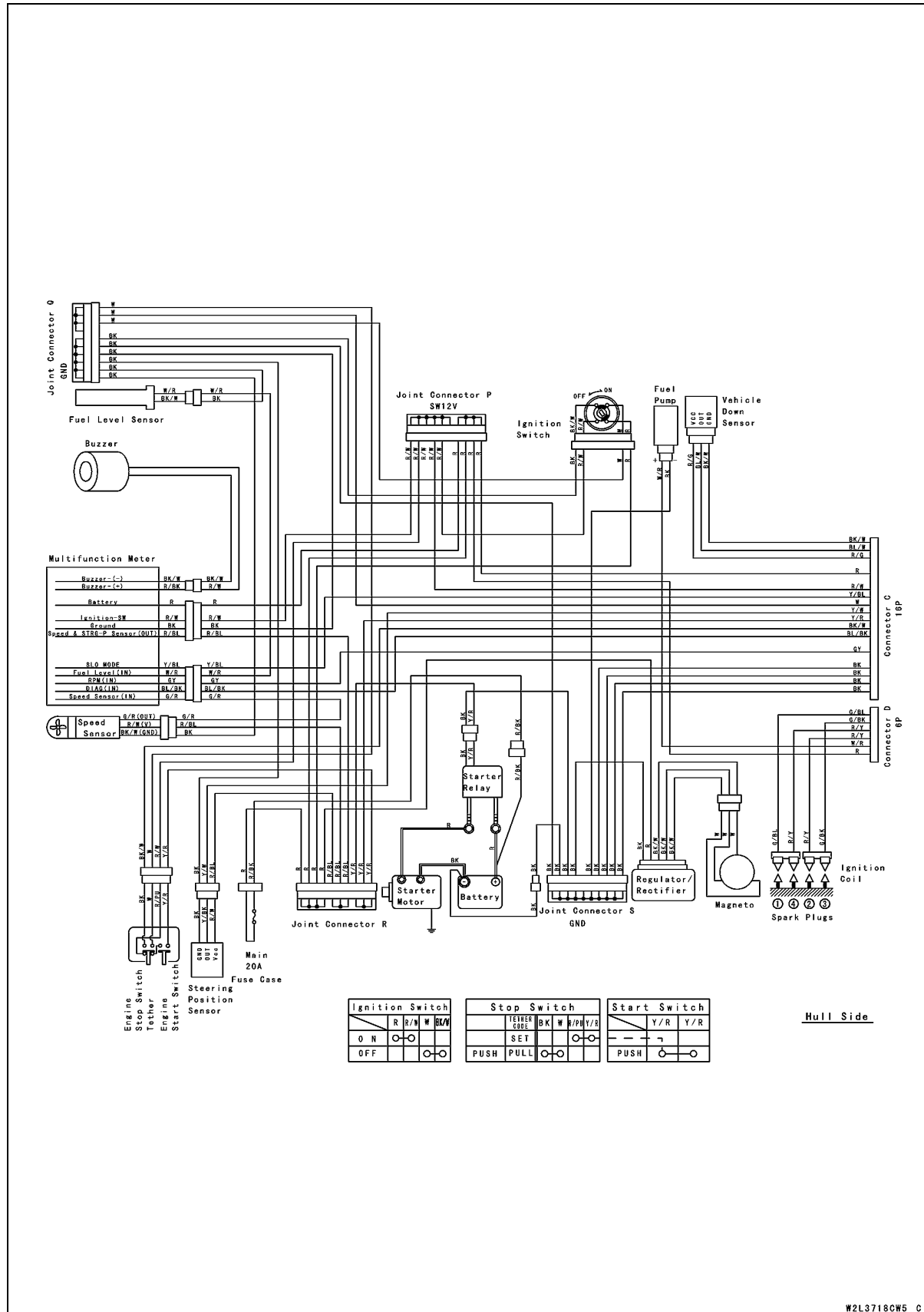


W2R3717AW5 C

14-14 ELECTRICAL SYSTEM

Wiring Diagram

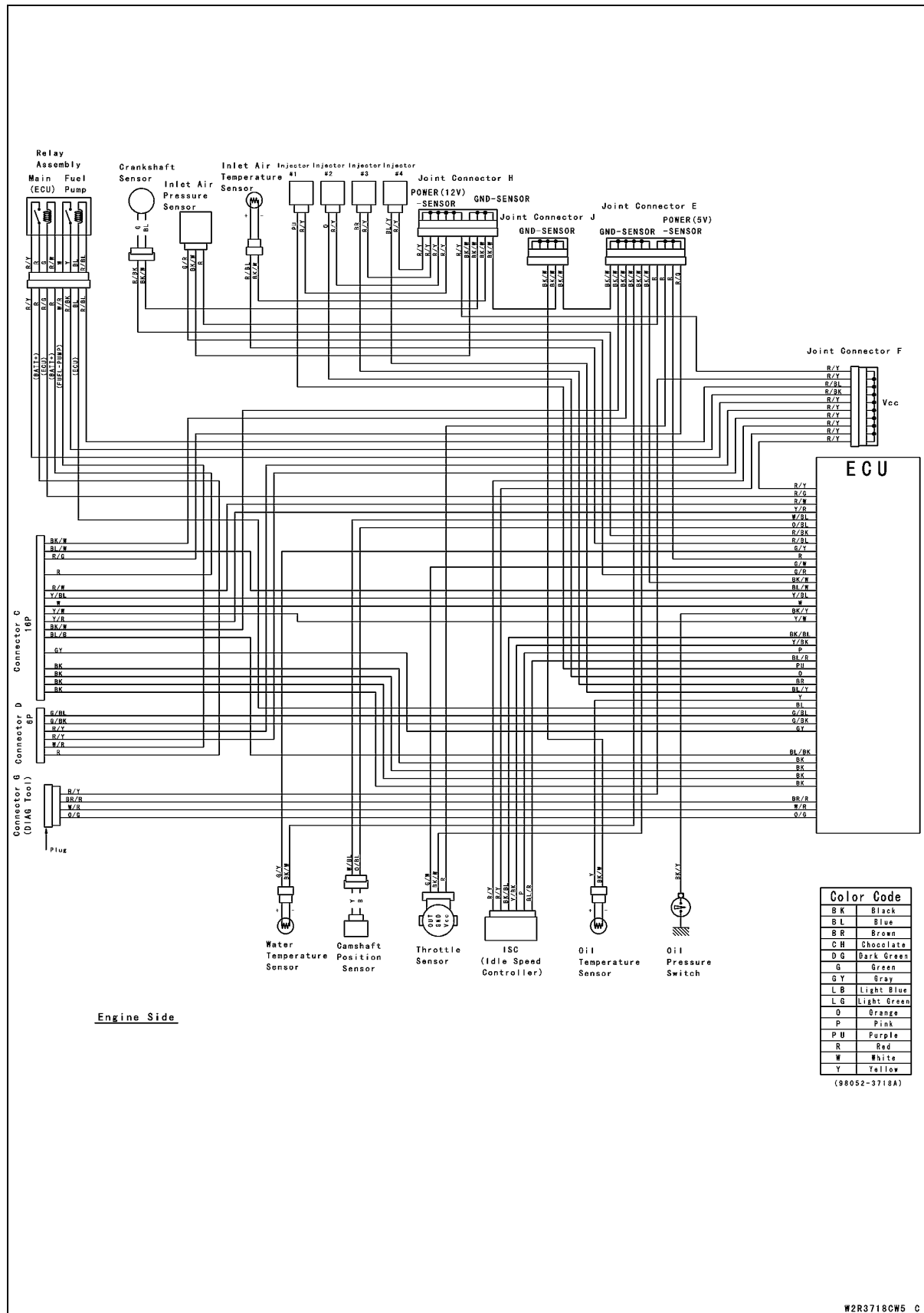
JT1500-A2 ~ A7 Models



#2L3718CWS C

Wiring Diagram

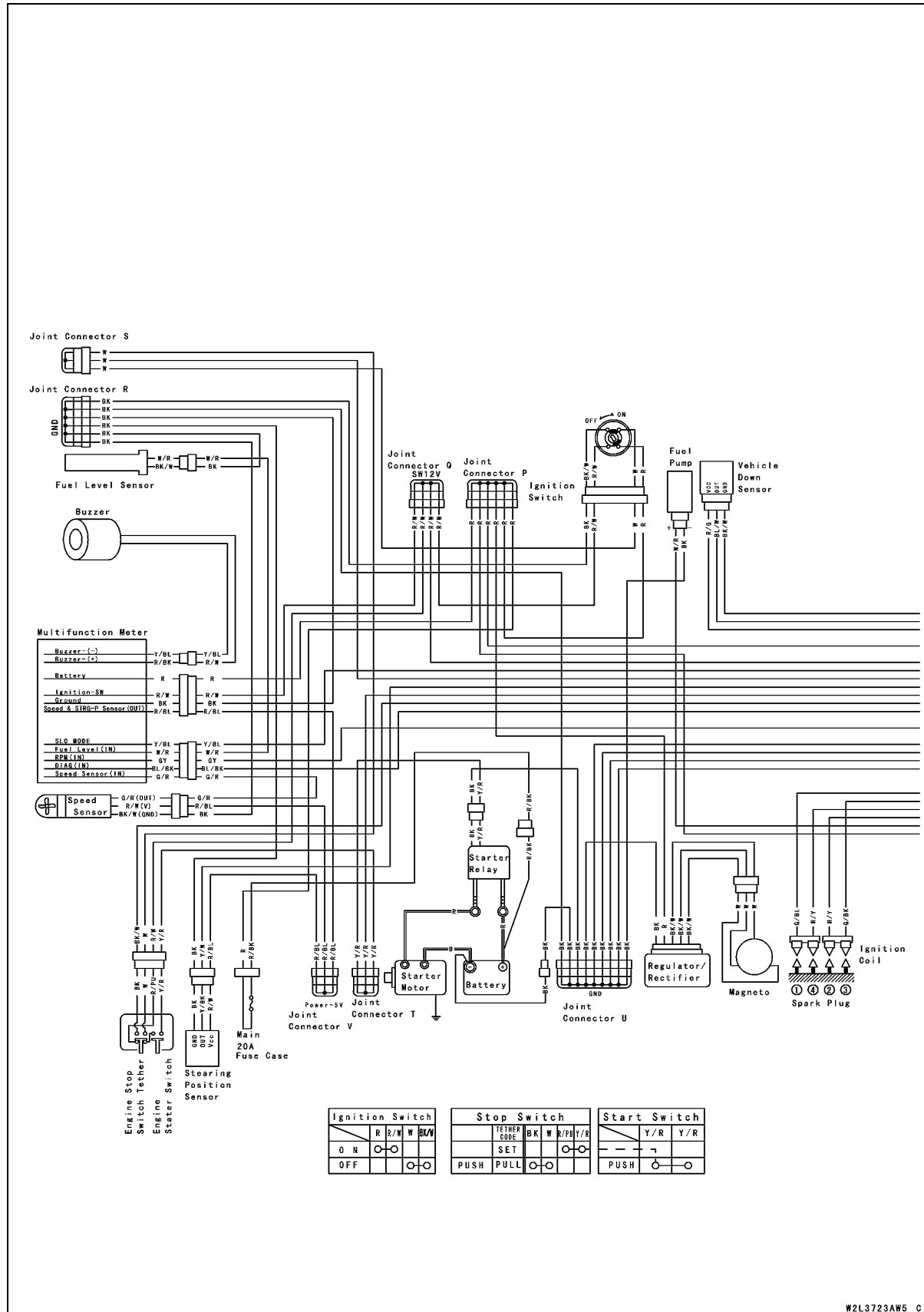
JT1500-A2 ~ A7 Models



14-16 ELECTRICAL SYSTEM

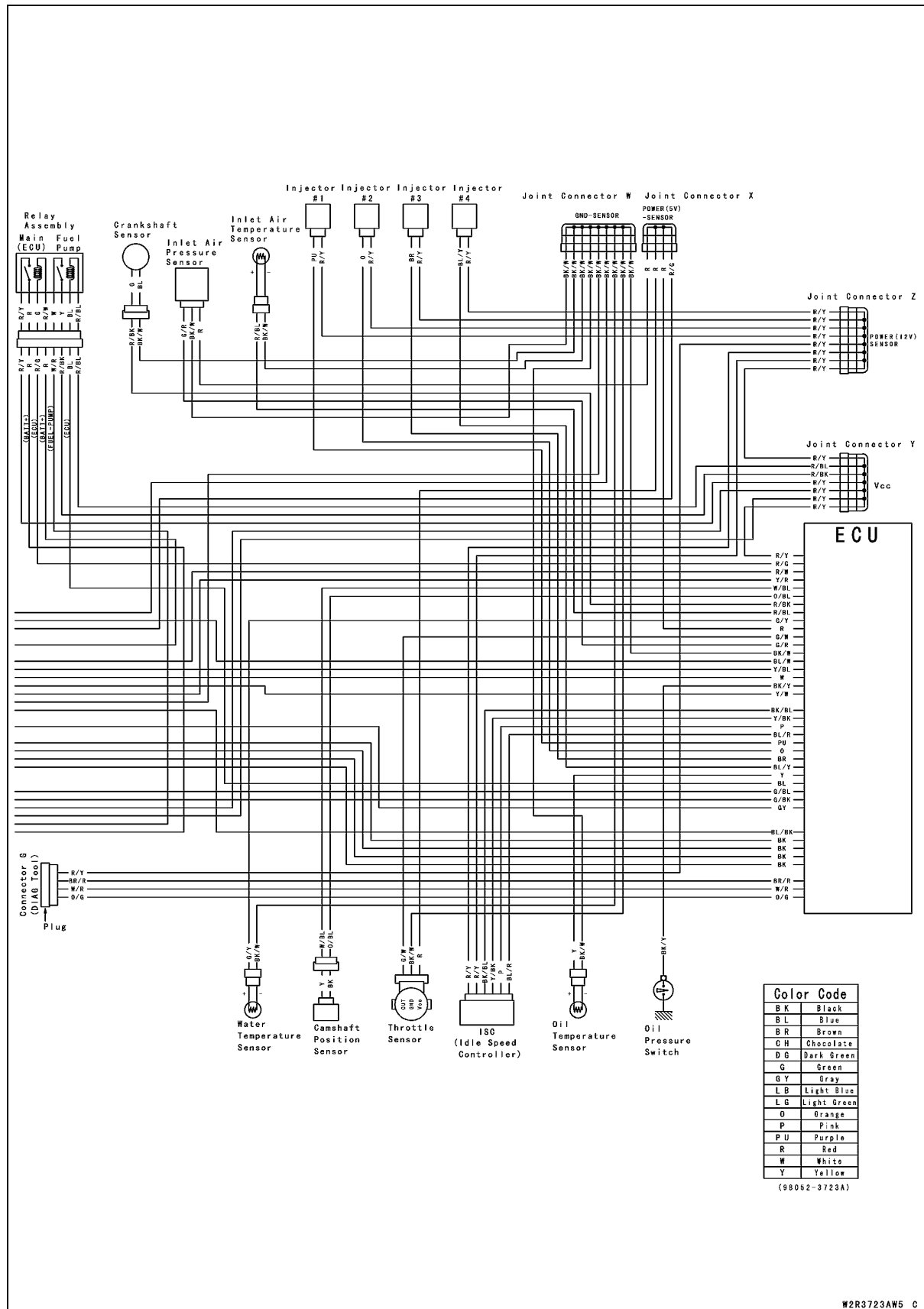
Wiring Diagram

JT1500A8 Model ~



Wiring Diagram

JT1500A8 Model ~



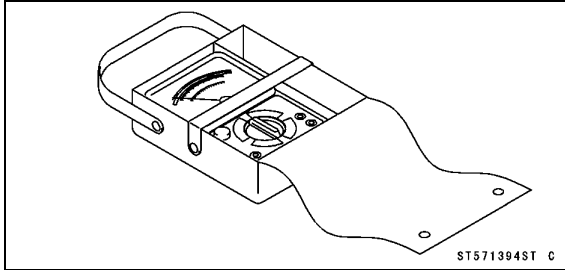
14-18 ELECTRICAL SYSTEM

Specifications

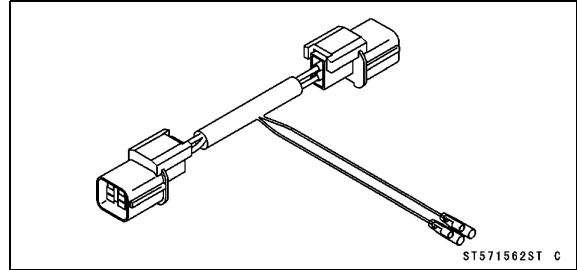
Item	Standard	Service Limit
Battery Type	12 V 18 Ah	— — —
Electric Starter System Starter Motor: Brush Length Commutator Diameter	 12 mm (0.4724 in.) 28 mm (1.1024 in.)	 6.5 mm (0.2559 in.) 27 mm (1.063 in.)
Charging System Regulator/rectifier Output Voltage Alternator Output Voltage Stator Coil Resistance	 Battery Voltage 14 ~ 15 V 48 ~ 72 V 0.432 ~ 0.648 Ω	 — — — — — — — — —
Ignition System Ignition Coil: Primary Winding Resistance Secondary Winding Resistance Spark Plug: Type Gap Crankshaft Sensor Resistance	 1.53 ~ 2.07 Ω 12.50 ~ 16.91 k Ω NGK CR9EK 0.7 ~ 0.8 mm (0.0276 ~ 0.0315 in.) 408 ~ 612 Ω	 — — — — — — — — — — — — — — —

Special Tools and Sealant

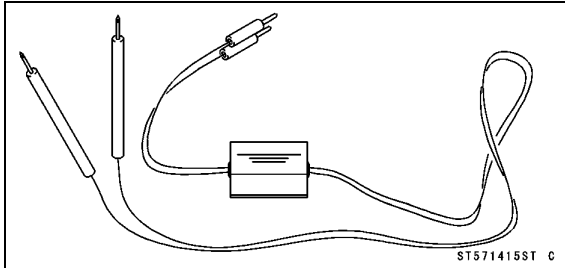
Hand Tester:
57001-1394



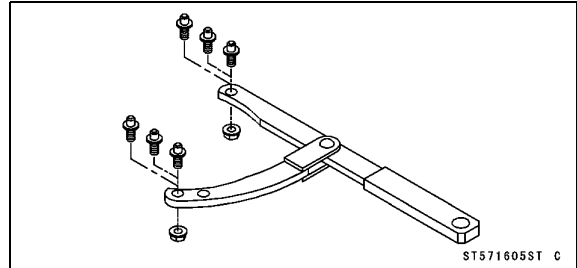
Harness Adapter:
57001-1562



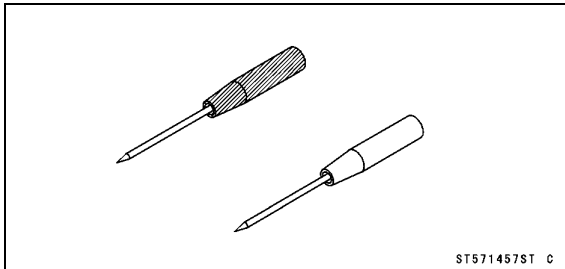
Peak Voltage Adapter:
57001-1415



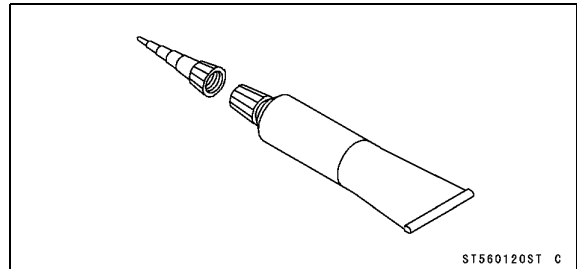
Flywheel & Pulley Holder:
57001-1605



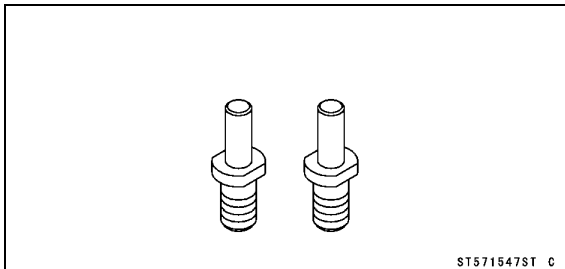
Needle Adapter Set:
57001-1457



Liquid Gasket, TB1211:
56019-120



Holder Attachment:
57001-1547



14-20 ELECTRICAL SYSTEM

Precautions

There are a number of important precautions that should be followed servicing electrical systems.

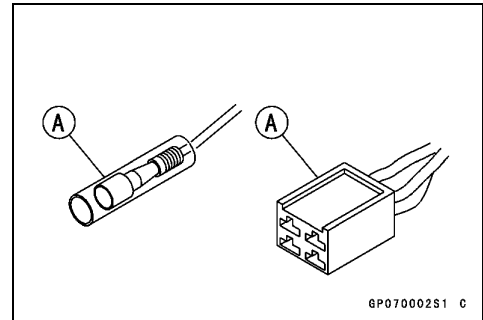
- Do not reverse the battery cable connections. This will burn out the diodes on the electrical parts.
- Always check battery condition before condemning other parts of an electrical system. A fully charged battery is a must for conducting accurate electrical system tests.
- The electrical parts should never be struck sharply, as with a hammer, or allowed to fall on a hard surface. Such a shock to the parts can damage them.
- To prevent damage to electrical parts, do not disconnect the battery leads or any other electrical connections when the ignition switch is on, or while the engine is running.
- Because of the large amount of current, never keep the starter button pushed when the starter motor will not turn over, or the current may burn out the starter motor windings.
- Do not use a meter illumination bulb rated for other than voltage or wattage specified in the wiring diagram, as the meter or gauge panel could be warped by excessive heat radiated from the bulb.
- Take care not to short the leads that are directly connected to the battery positive (+) terminal to the chassis ground.
- Troubles may involve one or in some cases all items.
Never replace a defective part without determining what CAUSED the failure. If the failure was caused by some other item or items, they must be repaired or replaced, or the new replacement will soon fail again
- Make sure all connectors in the circuit are clean and tight, and examine leads for signs of burning, fraying, etc. Poor leads and bad connections will affect electrical system operation.
- Measure coil and winding resistance when the part is cold (at room temperature).

Color Codes

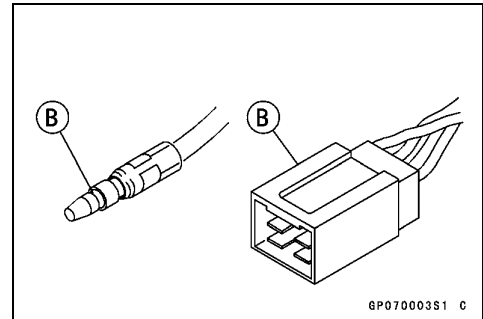
BK: Black	LG: Light Green
BL: Blue	O: Orange
BR: Brown	P: Pink
CH: Chocolate	PU: Purple
DG: Dark Green	R: Red
G: Green	W: White
GY: Gray	Y: Yellow
LB: Light Blue	

Precautions

- Electrical Connectors
Connectors [A]



- Connectors [B]



14-22 ELECTRICAL SYSTEM

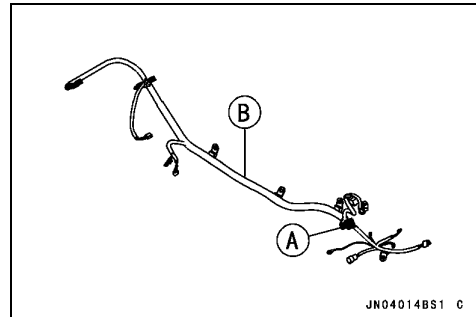
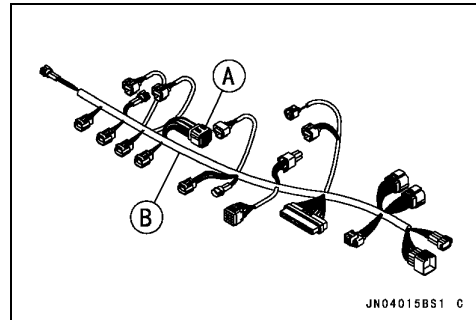
Electrical Wiring

Wiring Inspection

- Visually inspect the wiring for signs of burning, fraying, etc.
- ★ If any wiring is poor, replace the damaged wiring.
- Pull each connector [A] apart and inspect it for corrosion, dirt, and damage.
- ★ If the connector is corroded or dirty, clean it carefully. If it is damaged, replace it.
- Check the wiring for continuity.
- Use the wiring diagram to find the ends of the lead which is suspected of being a problem.
- Connect the hand tester between the ends of the leads.

Special Tool - Hand Tester: 57001-1394

- Set the tester to the $\times 1 \Omega$ range, and read the tester.
- ★ If the tester does not read 0Ω , the lead is defective. Replace the lead or the wiring harness [B] if necessary.



Battery

Battery Removal

- Disconnect the battery cables [A].

⚠ WARNING

Electrical components, including the battery, can cause shocks and burns. To prevent injury and damage to electrical components, always disconnect the grounded cable first.

- Unhook the battery straps [B].
- Carefully lift the battery from the engine compartment.

Battery Installation

- Be sure the battery damper [A] is in position in the battery compartment.
- Hook the battery straps.
- Connect the battery cable, positive first.
- After attaching both cables, coat the terminals and cable ends with grease to prevent corrosion.
- Slide the protective boot over each terminal.

⚠ WARNING

Loose battery cables can create sparks which can cause a fire or explosion resulting in injury or death. Make sure the battery terminal screws are tightened securely and the covers are installed over the terminals.

NOTICE

Reversing the battery connections may damage the electrical system. To prevent damage, be sure the battery connections are correct.

Battery Activation

Electrolyte Filling

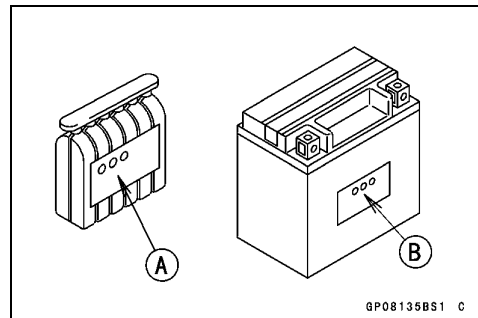
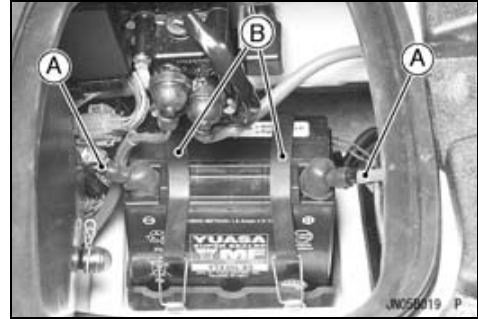
- Make sure that the model name [A] of the electrolyte container matches the model name [B] of the battery. These names must be the same.

Battery Model Name

JT1500A: YTX20L-BS

NOTICE

Each battery comes with its own specific electrolyte container; using the wrong container may overfill the battery with incorrect electrolyte, which can shorten battery life and deteriorate battery performance. Be sure to use the electrolyte container with the same model name as the battery since the electrolyte volume and specific gravity vary with the battery type.



GP08135BS1 C

14-24 ELECTRICAL SYSTEM

Battery

NOTICE

Do not remove the aluminum sealing sheet [A] from the filler ports [B] until just prior to use. Be sure to use the dedicated electrolyte container for correct electrolyte volume.

⚠ DANGER

Sulfuric acid in battery electrolyte can cause severe burns. To prevent burns, wear protective clothing and safety glasses when handling electrolyte. If the electrolyte comes in contact with your skin or eyes, wash the area with liberal amounts of water and seek medical attention for more severe burns.

- Place the battery on a level surface.
- Check to see that the sealing sheet has no peeling, tears, or holes in it.
- Remove the sealing sheet.

NOTE

○The battery is vacuum sealed. If the sealing sheet has leaked air into the battery, it may require a longer initial charge.

- Remove the electrolyte container from the vinyl bag.
- Detach the strip of caps [A] from the container and set aside, these will be used later to seal the battery.

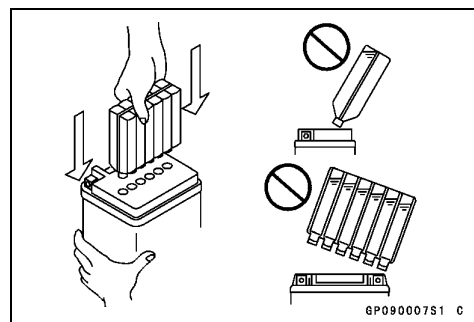
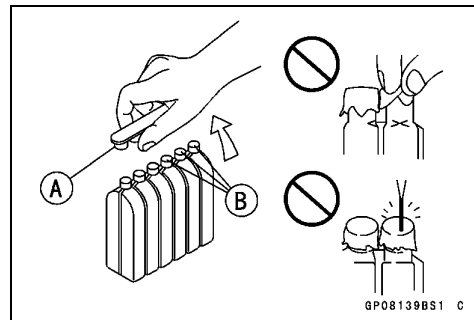
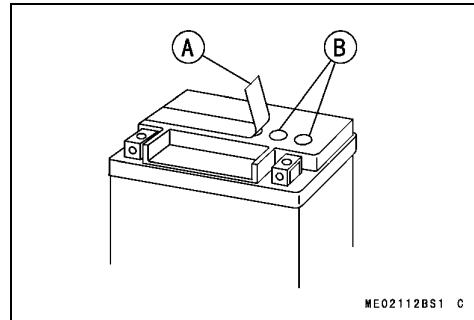
NOTE

○Do not pierce or otherwise open the sealed cells [B] of the electrolyte container. Do not attempt to separate individual cells.

- Place the electrolyte container upside down with the six sealed cells into the filler ports of the battery. Hold the container level, push down to break the seals of all six cells. You will see air bubbles rising into each cell as the ports fill.

NOTE

○Do not tilt the electrolyte container.



Battery

- Check the electrolyte flow.
- ★ If no air bubbles [A] are coming up from the filler ports, or if the container cells have not emptied completely, tap the container [B] a few times.

NOTE

○ Be careful not to have the battery fall down.

- Keep the container in place. Don't remove the container from the battery, the battery requires all the electrolyte from the container for proper operation.

NOTICE

Removal of the container before it is completely empty can shorten the service life of the battery. Do not remove the container until it is completely empty.

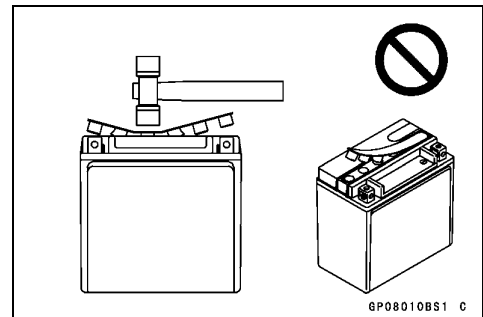
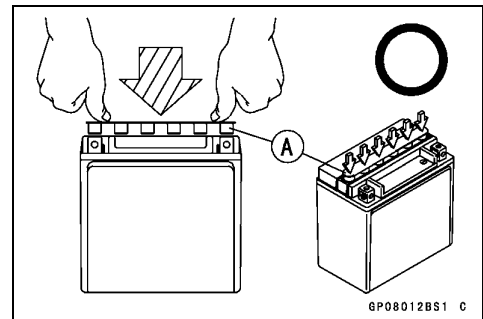
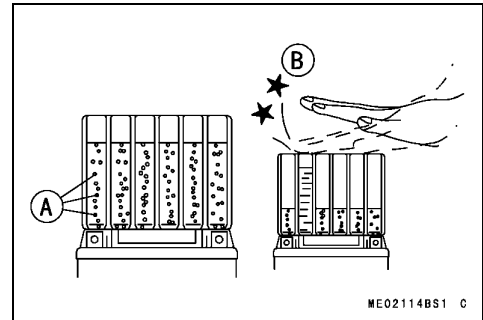
- After filling, let the battery sit for 20 ~ 60 minutes with the electrolyte container kept in place, which is required for the electrolyte to fully permeate into the plates.
- Make sure that the container cells have emptied completely, and remove the container from the battery.
- Place the strip of caps [A] loosely over the filler ports, press down firmly with both hands to seat the strip of caps into the battery (don't pound or hammer). When properly installed, the strip of caps will be level with the top of the battery.

NOTICE

Once the strip of caps is installed onto the battery, never remove the caps, nor add water or electrolyte to the battery.

NOTE

○ Charging the battery immediately after filling can shorten service life.



14-26 ELECTRICAL SYSTEM

Battery

Initial Charge

- Newly activated sealed batteries require an initial charge.

Standard Charge: 1.8 A × 5 ~ 10 hours

- ★ If using a recommended battery charger, follow the charger's instructions for newly activated sealed battery.

Kawasaki-recommended chargers:

Battery Mate 150-9

OptiMate PRO 4-S/PRO S/PRO2

Yuasa MB-2040/2060

Christie C10122S

- ★ If the above chargers are not available, use equivalent one.
- Let battery sit 30 minutes after initial charge, then check voltage using a voltmeter. (Voltage immediately after charging becomes temporarily high. For accurate measuring, let the battery sit for given time.)

NOTE

- *Charging rates will vary depending on how long the battery has been stored, temperature, and the type of charger used. If voltage is not at least 12.8 V, repeat charging cycle.*
- *To ensure maximum battery life and customer satisfaction, it is recommended the battery be load tested at three times its amp-hour rating for 15 seconds. Re-check voltage and if less than 12.8 V repeat the charging cycle and load test. If still below 12.8 V the battery is defective.*

Precautions

- 1) No need of topping-up

No topping-up is necessary in this battery until it ends its life under normal use. Forcibly prying off the seal cap to add water is very dangerous. Never do that.

- 2) Refreshing charge

If an engine will not start, it indicates the battery has been discharged. Give refresh charge for 5 to 10 hours with charge current shown in the specification (see this chapter).

When a fast charge is inevitably required, do it following precisely the maximum charge current and time conditions indicated on the battery.

NOTICE

This battery is designed to sustain no unusual deterioration if refresh-charged according to the method specified above. However, the battery's performance may be reduced noticeably if charged under conditions other than given above. Never remove the seal cap during refresh charge.

If by chance an excessive amount of gas is generated due to overcharging, the relief valve releases the gas to keep the battery normal.

- 3) When you do not use the watercraft for months:

Give a refresh charge before you store the watercraft and store it with the negative lead removed. Give a refresh charge **once a month** during storage.

- 4) Battery life:

If the battery will not start the engine even after several refresh charges, the battery has exceeded its useful life. Replace it (Provided, however, the watercraft's starting system has no problem).

Battery

⚠ DANGER

Batteries produce an explosive gas mixture of hydrogen and oxygen that can cause serious injury and burns if ignited. Keep the battery away from sparks and open flames during charging. When using a battery charger, connect the battery to the charger before turning on the charger. This procedure prevents sparks at the battery terminals which could ignite any battery gases. The electrolyte contains sulfuric acid. Be careful not to have it touch your skin or eyes. If touched, wash it off with liberal amount of water and seek medical attention for more severe burns.

Interchange

A sealed battery can fully display its performance only when combined with a proper watercraft electric system. Therefore, replace a sealed battery only on watercraft which was originally equipped with a sealed battery.

Be careful, if a sealed battery is installed on watercraft which had an ordinary battery as original equipment, the sealed battery's life will be shortened.

Charging Condition Inspection

- Refer to Battery Charging Condition Inspection in the Periodic Maintenance chapter.

Refreshing Charge

- Remove the battery [A] (see Battery Removal).
- Refresh-charge by following method according to the battery terminal voltage.

NOTICE

The battery is a sealed type and never needs to have water added. Never remove the strip cap, even during charging, or you may damage the battery. Never add water. Charge the battery with the current and time as stated below.

Terminal Voltage: 11.5 ~ less than 12.6 V

Standard Charge: 1.8 A × 5 ~ 10 h (see following chart)

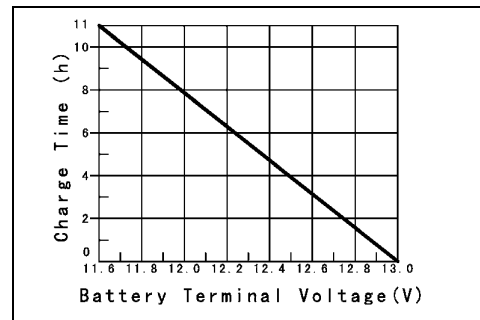
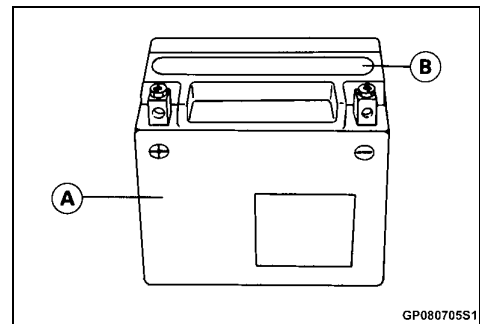
Quick Charge: 9.0 A × 1.0 h

NOTICE

If possible, do not quick charge. If the quick charge is done due to unavoidable circumstances, do standard charge later on.

Terminal Voltage: less than 11.5 V

Charging Method: 1.8 A × 20 h



14-28 ELECTRICAL SYSTEM

Battery

NOTE

- Increase the charging voltage to a maximum voltage of 25 V if the battery will not accept current initially. Charge for no more than five minutes at the increased voltage then check if the battery is drawing current.
- If the battery will accept current, decrease the voltage and charge by the standard charging method described on the battery case. If the battery will not accept current after 5 minutes, replace the battery.

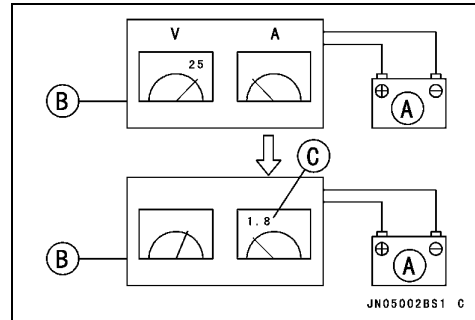
Battery [A]

Battery Charger [B]

Standard Value [C]

- Determine battery condition after refreshing charge.
- Determine the condition of the battery 30 minutes after completion of the charge by measuring the terminal voltage according to the table below.

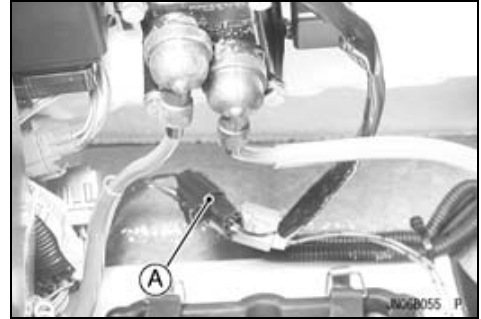
Criteria	Judgement
12.6 V or more	Good
12.0 ~ less than 12.6 V	Charge insufficient → Recharge
less than 12.0 V	Unserviceable → Replace



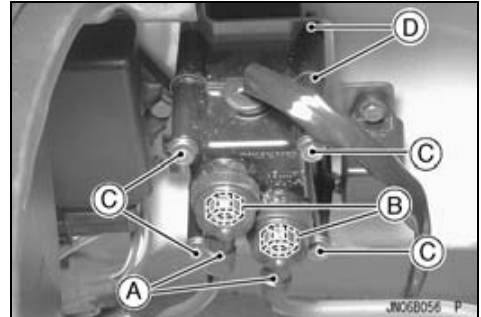
Electric Starter System

Starter Relay Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Rear Storage Pocket (see Hull/Engine Hood chapter)
 - Battery (see this chapter)
- Disconnect the negative battery cable from the battery terminal. (see Battery Removal).
- Disconnect the starter relay lead connector [A].



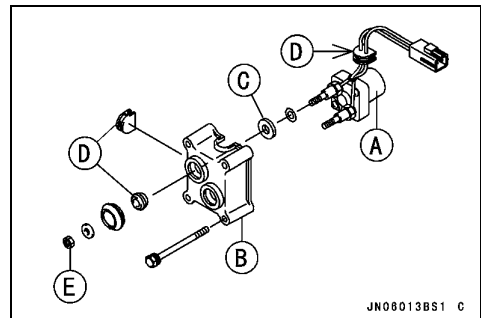
- Slide out the rubber caps [A].
- Remove the nuts [B] from the battery and starter terminals on the start relay switch.
- Remove the starter relay case bolts [C] and slide the starter relay switch from the relay case [D], being careful not to lose any of the insulating washers or grommets.



Starter Relay Installation

- Mount the starter relay switch [A] in the relay case [B].
- Coat the insulating washers [C] and grommets [D] with water resistant grease.
- Be certain all insulating washers and grommets are in position.
- Tighten the relay mounting nuts [E] securely.

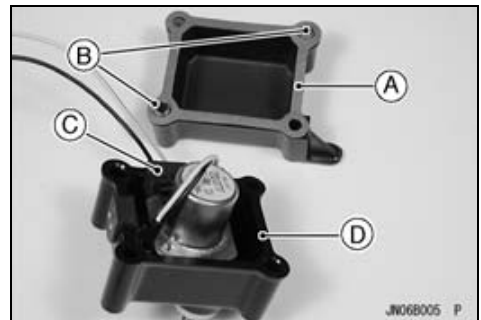
Torque - Starter Relay Mounting Nuts: 4 N·m (0.40 kgf·m, 35 in·lb)



- Replace the gasket [A] with a new one.
- Be sure the dowel pins [B] are in position.
- Be sure the grommet [C] is installed on the relay case [D].
- Be sure the battery cable is connected to the battery terminal having red mark.
- Tighten:

Torque - Starter Relay Case Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

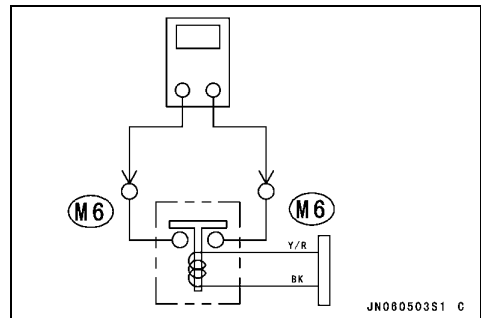
Starter Cable Mounting Nuts: 3.5 ~ 4.5 N·m (0.35 ~ 0.45 kgf·m, 30 ~40 in·lb)



Starter Relay Inspection

- Remove the starter relay (see Starter Relay Removal).
- Set hand tester to $R \times 1 \Omega$ range.
- Connect meter leads to starter relay as shown.
- ★ If resistance is less than infinite, the starter relay switch is not returning and must be replaced.

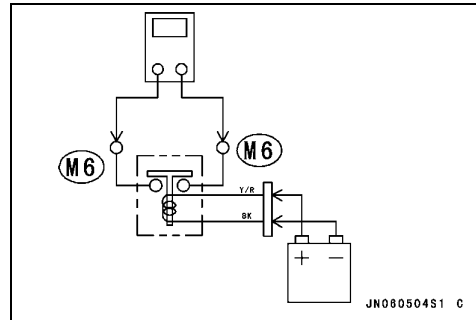
Special Tool - Hand Tester: 57001-1394



14-30 ELECTRICAL SYSTEM

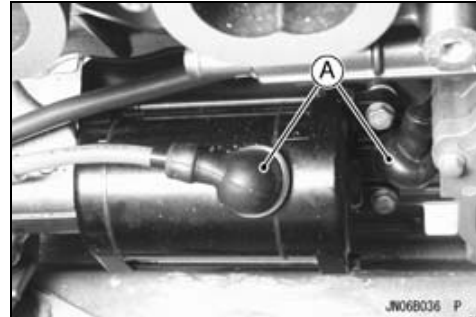
Electric Starter System

- Set ohmmeter to $R \times 1 \Omega$ range.
- Connect meter leads to starter relay as shown.
- Activate starter relay switch by connecting a 12 V battery as shown.
- ★ If the starter relay switch clicks and the ohmmeter indicates zero resistance, the starter relay switch is good.
- ★ If the meter indicates high or infinite (∞) resistance, the starter relay switch is defective and must be replaced.

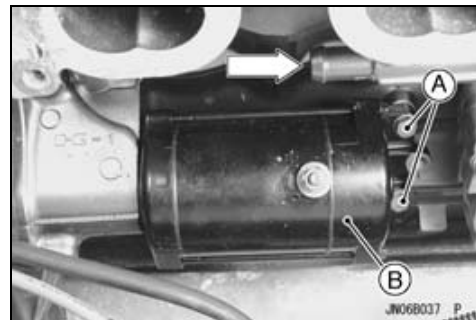


Starter Motor Removal

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Inlet Manifold (see Fuel System chapter)
- Side out the rubber caps [A] and remove the terminal nuts.



- Remove the mounting bolts [A].
- Pull out the starter motor [B].

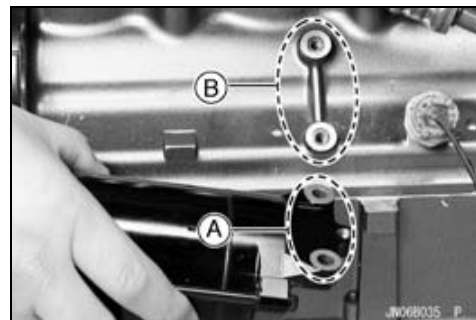


Starter Motor Installation

NOTICE

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

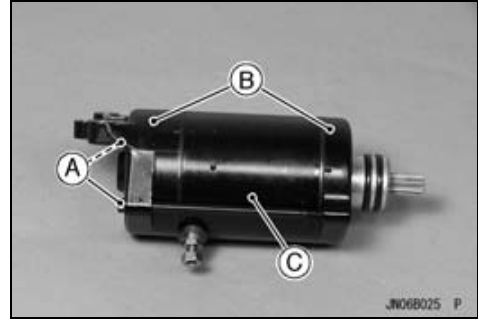
- When installing the starter motor, clean the starter motor legs [A] and crankcase [B] where the starter motor is grounded.
- Apply grease to the O-rings [A].
- Install the starter motor and tighten the mounting bolts.
 - Torque - Starter Motor Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)**



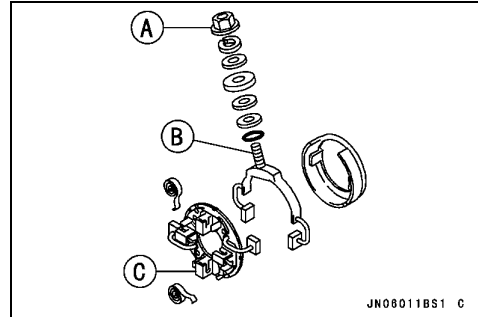
Electric Starter System

Starter Motor Disassembly

- Remove the starter motor (see Starter Relay Removal).
- Take off the starter motor through bolts [A] and remove both end covers [B] and pull the armature out of the yoke [C].

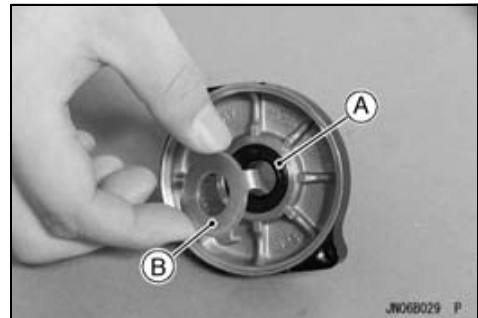


- Remove the terminal locknut [A] and terminal bolt [B], and then remove the brush with the brush plate [C] from the yoke.

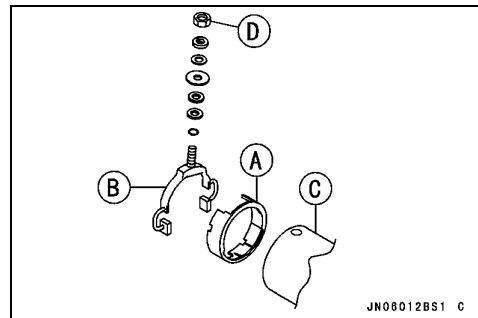


Starter Motor Assembly

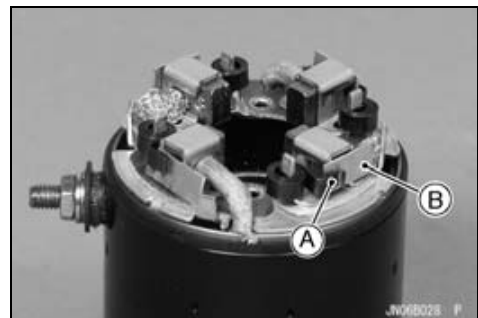
- Apply a thin coat of grease to the oil seal [A].
- Fit the toothed washer [B] into the end cover.



- Install the plate cover [A] and the positive brush assembly [B] in the yoke [C].
- Tighten the terminal nut [D] securely.



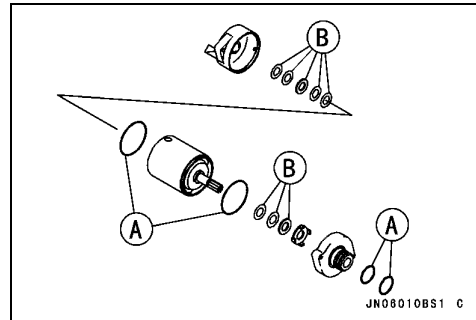
- Holding the spring ends [A] with suitable plates [B], put the armature among the brushes.



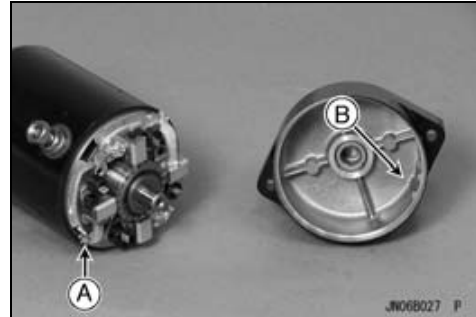
14-32 ELECTRICAL SYSTEM

Electric Starter System

- Install the O-rings [A] and the washers [B] as shown.

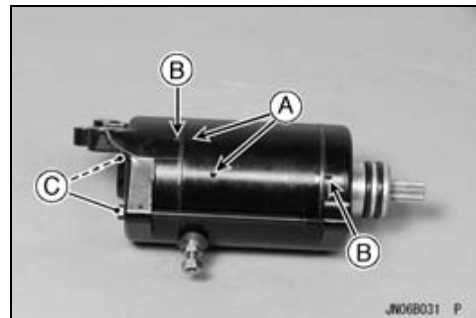


- Fit the tongue [A] on the brush plate into the end cover groove [B].



- Align the lines [A] on the yoke with the lines [B] on the both end covers.
- Replace the starter motor through bolts [C] with new ones.
- Tighten:

Torque - Starter Motor Through Bolts: 6.4 N·m (0.65 kgf·m, 56 in·lb)



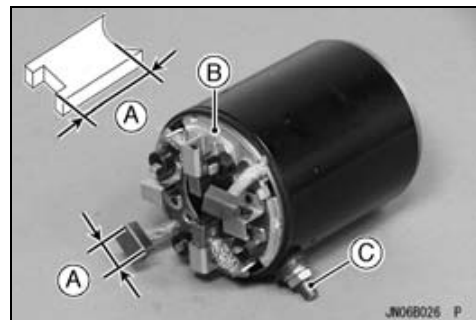
Brush Inspection

- Measure the length [A] of each brush.
- ★ If any is worn down to the service limit, replace the negative brush assembly [B] and the positive brush assembly [C].

Starter Motor Brush Length

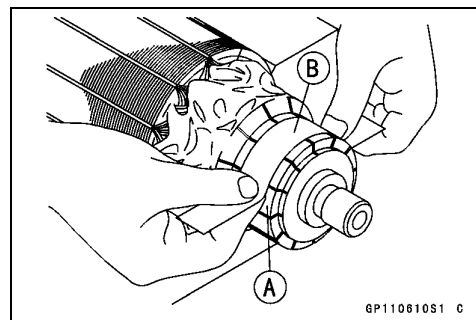
Standard: 12 mm (0.4724 in.)

Service Limit: 6.5 mm (0.2559 in.)



Commutator Cleaning and Inspection

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

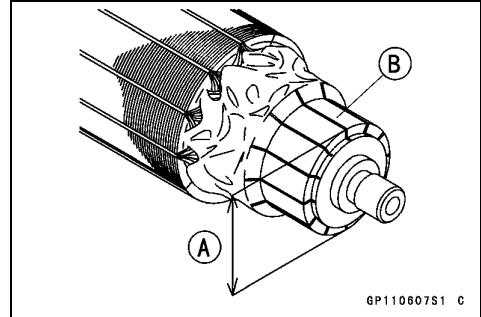


Electric Starter System

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

Commutator Diameter

Standard:	28 mm (1.1024 in.)
Service Limit:	27 mm (1.063 in.)

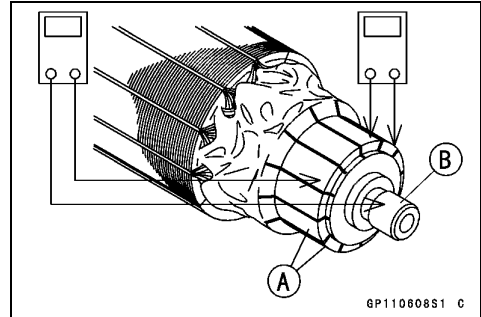


Armature Inspection

- Using the $\times 1 \Omega$ hand tester range, measure the resistance between any two commutator segments [A].

Special Tool - Hand Tester: 57001-1394

- ★ If there is a high resistance or no reading (∞) between any two segments, a winding is open and the starter motor must be replaced.
- Using the highest hand tester range, measure the resistance between the segments and the shaft [B].
- ★ If there is any reading at all, the armature has a short and the starter motor must be replaced.



NOTE

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

Brush Lead Inspection

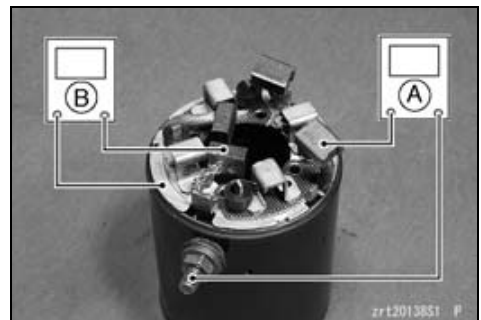
- Using the $\times 1 \Omega$ hand tester range, measure the resistance as shown.

[A] Terminal and Positive Brush

[B] Brush Plate and Negative Brush

Special Tool - Hand Tester: 57001-1394

- ★ If there is not close to zero ohms, the brush lead has an open. Replace the positive brush assembly and/or the negative brush assembly.



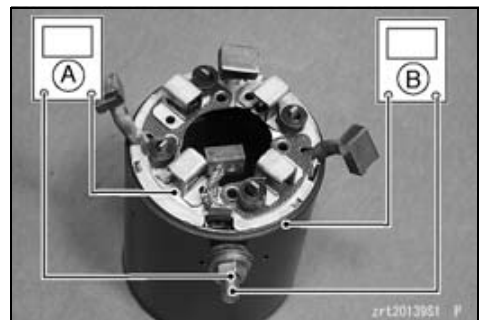
Brush Plate and Terminal Bolt Inspection

- Using the highest hand tester range, measure the resistance as shown.

[A] Terminal Bolt and Brush Plate

[B] Terminal Bolt and Yoke

- ★ If there is any reading, the negative brush assembly and/or positive brush assembly have a short. Replace the negative and positive brush assemblies.

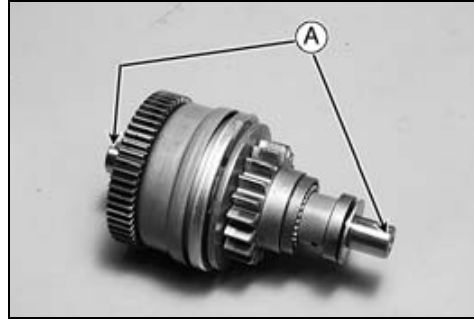


14-34 ELECTRICAL SYSTEM

Electric Starter System

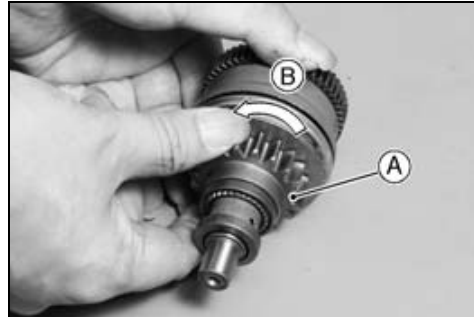
Reduction Gear Removal/Installation

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

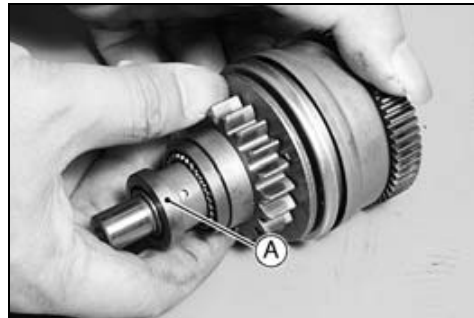


Reduction Gear Inspection

- Rotate the pinion gear [A] counterclockwise. The gear must be rotated freely [B].

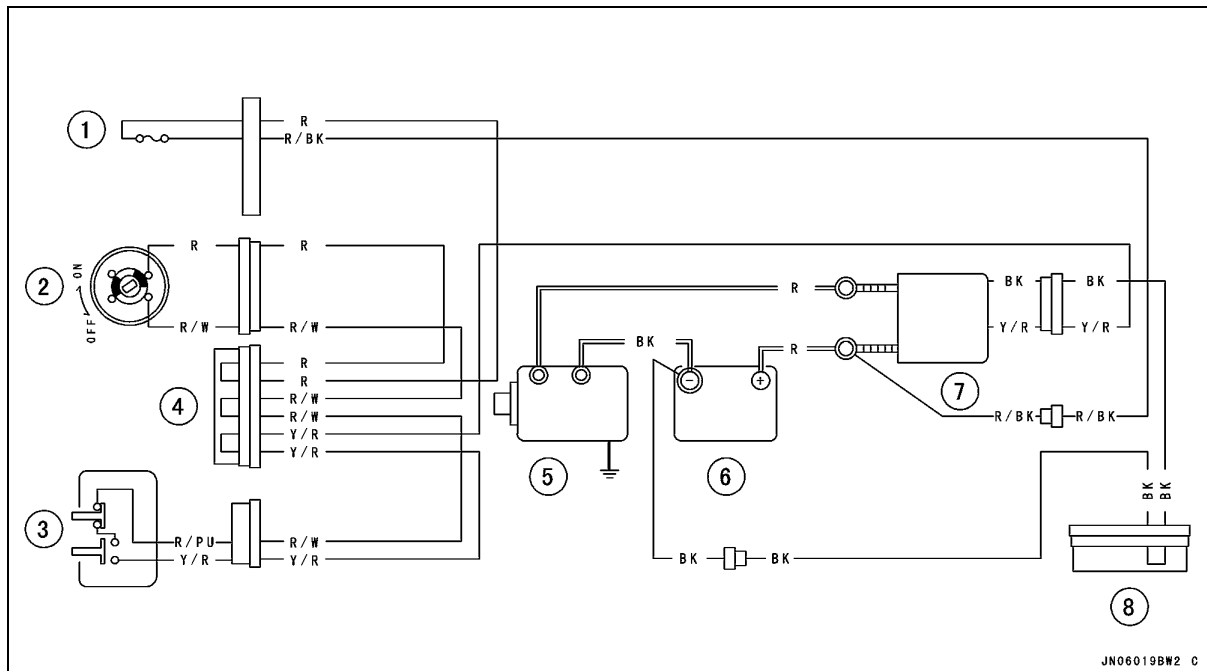


- Rotate the pinion gear clockwise all the way. The pinion gear will be advanced along the reduction gear shaft, and stopped against the stopper [A].
- Release the pinion gear. The pinion gear must return to the initial position rapidly.
- ★ If the pinion gear does not function properly, replace it.



Electric Starter System

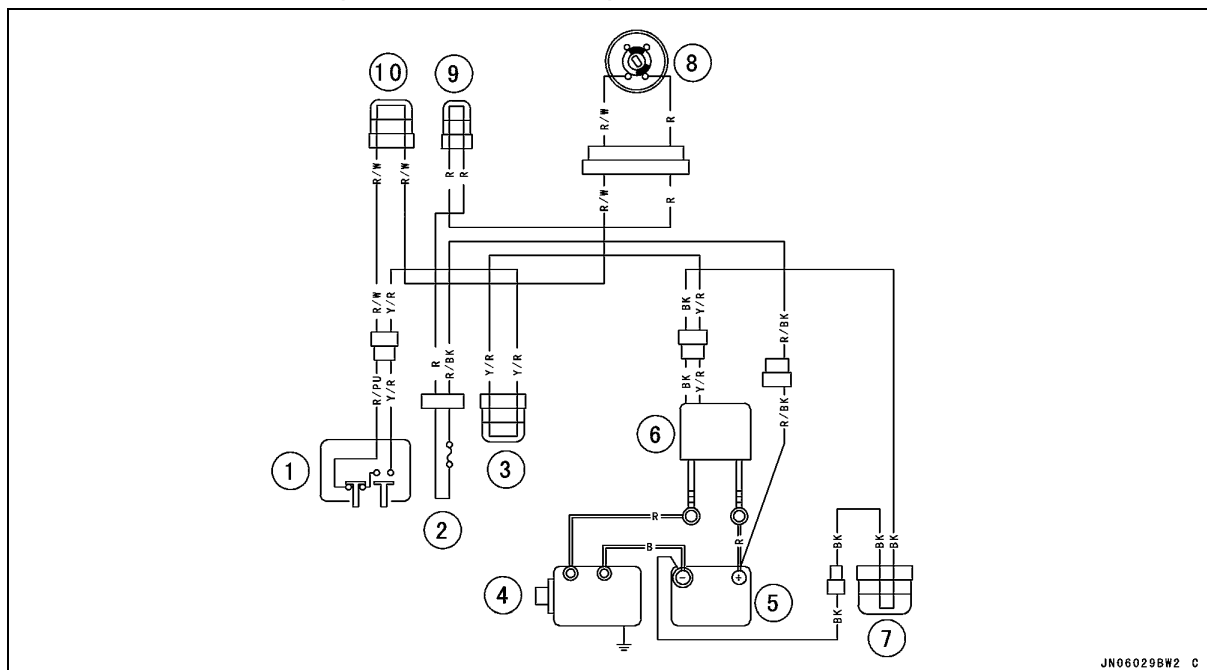
Electric Starter Circuit (JT1500-A1 ~ A7 Models)



1. Main Fuse 20 A
2. Ignition Switch
3. Engine Starter Switch
4. Joint Connector R

5. Starter Motor
6. Battery 12 V 18 Ah
7. Starter Relay
8. Joint Connector S (Ground)

Electric Starter Circuit (JT1500A8 Model ~)



1. Engine Starter Switch
2. Main Fuse 20 A
3. Joint Connector T
4. Starter Motor
5. Battery 12 V 18 Ah

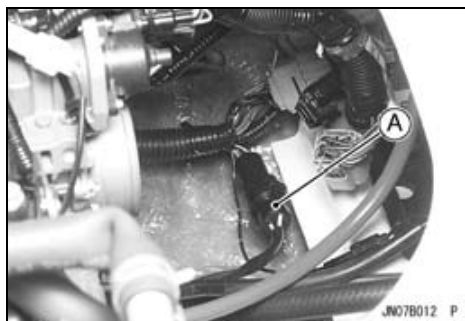
6. Starter Relay
7. Joint Connector U
8. Ignition Switch
9. Joint Connector P
10. Joint Connector G

14-36 ELECTRICAL SYSTEM

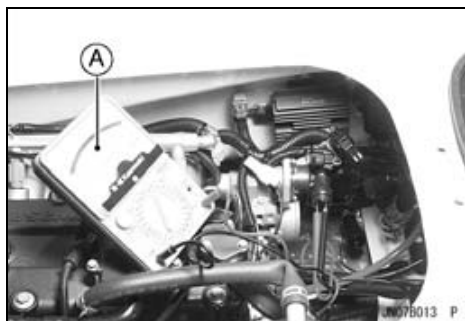
Charging System

Magneto Output Voltage

- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Air Filter with Duct (see Fuel System chapter)
- Disconnect the 3-pin stator coil leads connector [A].



- With the hand tester [A] check the magneto output (in circuit) according to the following table with the engine running at approximately 3 000 rpm.



⚠ WARNING

Water is a high conductor of electricity and performing an electrical circuit inspection on water could cause severe electrical shock to you. To prevent shocks, do not inspect the electrical system while the boat is in the water and do not touch the alternator output leads while the engine is running.

NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

Magneto Output Voltage

Meter Setting	Connections		Standard Value
	Meter (+) to	Meter (–) to	
250 V AC	White lead	White lead	48 ~ 72 V

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

Stator Coil Resistance Test

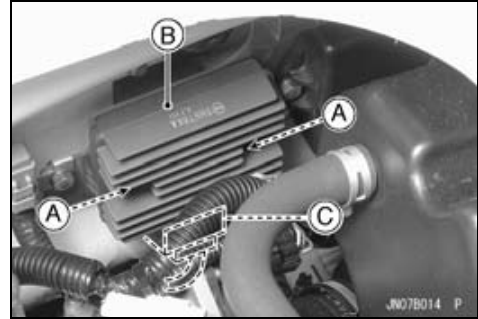
Meter Setting	Connections		Standard Value
	Meter (+) to	Meter (–) to	
$R \times 1 \Omega$	White lead	White lead	0.432 ~ 0.648 Ω

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

Charging System

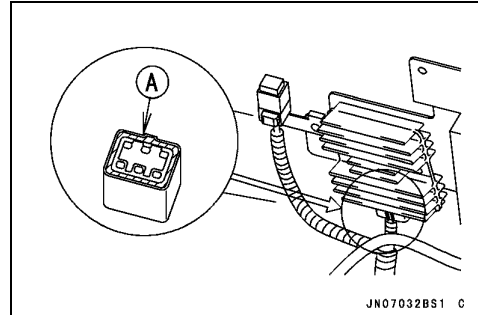
Regulator/Rectifier Removal/Installation

- Remove the seat (see Hull/Engine Hood chapter).
- Unscrew the mounting bolts [A] and remove the regulator/rectifier [B].
- Disconnect the connector [C].



- Apply grease to all around on the top surface of harness connector [A] for waterproofing.
- Tighten:

Torque - Regulator/rectifier Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)



Regulator/Rectifier Inspection

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

Special Tool - Hand Tester: 57001-1394

Regulator/Rectifier Inspection

Unit: $\text{k}\Omega$

		Tester (+) Lead Connection				
	Terminal	+	~	~	~	-
(-)*	+	-	500 ~ ∞	500 ~ ∞	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	-	500 ~ ∞	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	500 ~ ∞	-	500 ~ ∞	500 ~ ∞
	~	2 ~ 20	500 ~ ∞	500 ~ ∞	-	500 ~ ∞
	-	2 ~ 40	2 ~ 20	2 ~ 20	2 ~ 20	-

(-)*: Tester (-) lead Connection

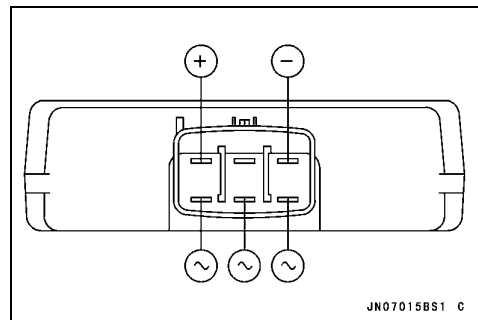
- ★ If any of the values obtained do not agree with the above table, the regulator/rectifier must be replaced.

Regulator Inspection

- To test the regulator out of circuit, use three 12 V batteries and a test light (12 V 3 ~ 6 W bulb in a socket with leads).

NOTICE

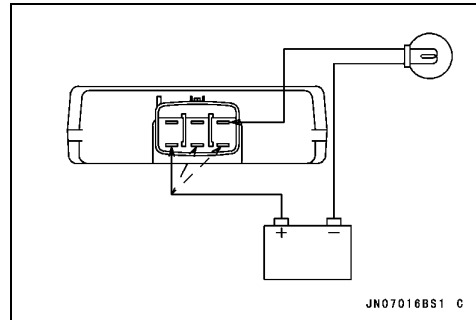
The test light works as an indicator and also as a current limiter to protect the regulator/rectifier from excessive current. Do not use an ammeter instead of a test light.



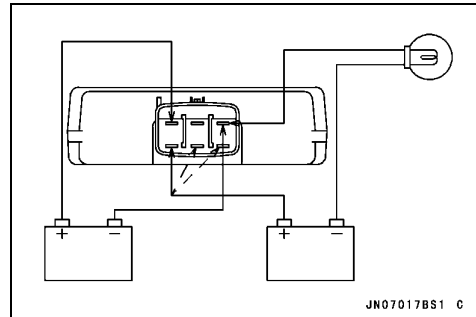
14-38 ELECTRICAL SYSTEM

Charging System

- Do the 1st step regulator circuit test.
- Connect the test light and the 12 V battery to the regulator/rectifier as shown.
- Check infinity (∞) terminals respectively.
- ★ If the test light turns on, the regulator/rectifier is defective. Replace it.
- ★ If the test light does not turn on, continue the test.



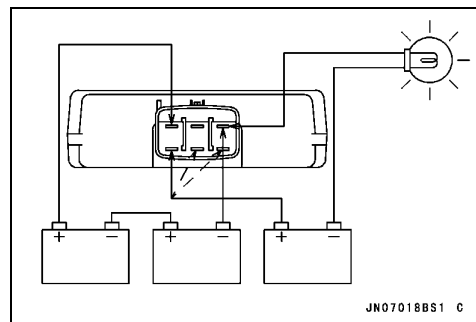
- Do the 2nd step regulator circuit test.
- Connect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- Apply 12 V to the positive (+) terminal.
- Check infinity (∞) terminals respectively.
- ★ If the test light turns on, the regulator/rectifier is defective. Replace it.
- If the test light does not turn on, continue the test.



- Do the 3rd step regulator circuit test.
- Connect the test light and the 12 V battery in the same manner as specified in the "1st step regulator circuit test".
- Momentarily apply 24 V to the positive (+) terminal by adding a 12 V battery.
- Check infinity (∞) terminals respectively.

NOTICE

If more than 24 volts is applied or 24 volts applied for more than a few seconds, the regulator/rectifier may be damaged. To prevent damage to the regulator/rectifier, do not apply more than 24 volts, and do not apply 24 volts for more than a few seconds.



- ★ If the test light does not light when 24 V is applied momentarily to the positive (+) terminal, the regulator/rectifier is defective. Replace it.
- ★ If the regulator/rectifier passes all the tests described, it may still be defective. If the charging system still does not work properly after checking all the components and the battery, test the regulator/rectifier by replacing it with a known good unit.
- Repeat the test for another regulator/rectifier.

14-40 ELECTRICAL SYSTEM

Ignition System

WARNING

The ignition system produces extremely high voltage. Do not touch the spark plugs, ignition coils, or spark plug high-tension leads while the engine is running, or you could receive a severe electrical shock.

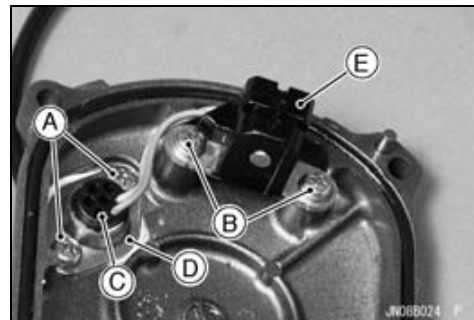
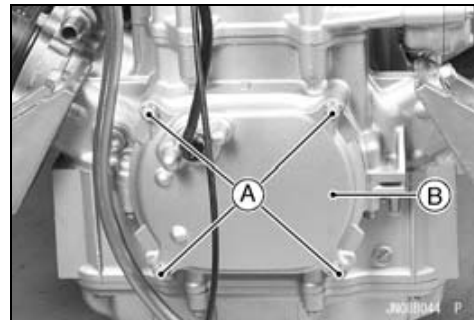
NOTICE

Disconnecting the battery cables or any other electrical connections when the ignition switch is on or while the engine is running can damage the ECU (Electronic Control Unit). Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running.

Installing the battery cables backwards can damage the diodes and ECU. Be sure to install the cables properly.

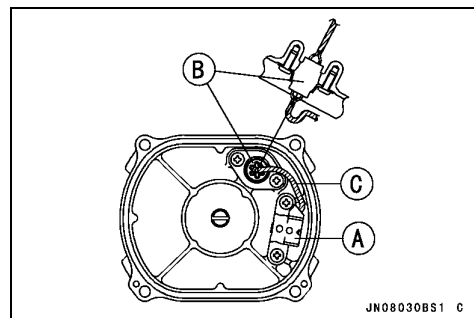
Crankshaft Sensor Removal

- Remove:
 - Engine (see Engine Removal/Installation chapter)
 - Crankshaft Sensor Cover Bolts [A]
 - Crankshaft Sensor Cover [B]
- Unscrew:
 - Rubber Grommet Holder Screws [A]
 - Crankshaft Sensor Screws [B]
- Push out the rubber grommet [C] with the holder [D].
- Remove the crankshaft sensor [E].



Crankshaft Sensor Installation

- Run the sensor lead through the cover hole.
- Install the crankshaft sensor [A].
- Apply a non-permanent locking agent to the sensor screws and tighten them.
 - Torque - Crankshaft Sensor Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)**
- Install the rubber grommet [B] in the sensor cover hole.
- Run the sensor lead [C] as shown.
- Apply water resistant grease to the grommet outside.
- Apply a non-permanent locking agent to the grommet holder screws and tighten them.
 - Torque - Rubber Grommet Holder Screws: 4.4 N·m (0.45 kgf·m, 39 in·lb)**



Ignition System

- Apply grease to the O-ring and fit it in the groove of the sensor cover.
- Apply silicone sealant [A] to the crankcase halves mating surface on the right and left sides of the crankshaft sensor mount.

Sealant - Liquid Gasket, TB1211: 56019-120

- Install the crankshaft sensor cover.
- Tighten:

Torque - Crankshaft Sensor Cover Bolts: 7.8 N·m (0.80 kgf·m, 69 in·lb)

- Install the Engine (see Engine Removal/Installation chapter).

Timing Rotor Removal

- Remove the engine (see Engine Removal/Installation chapter).
- Remove the crankshaft sensor cover (see Crankshaft Sensor Removal).
- Remove the timing rotor [A].
- Holding the timing rotor with the flywheel and pulley holder [B] and unscrew the bolt [C].

Special Tools - Flywheel & Pulley Holder: 57001-1605

Flywheel and Pulley Holder Adapter: 57001-1547 [D]

Timing Rotor Installation

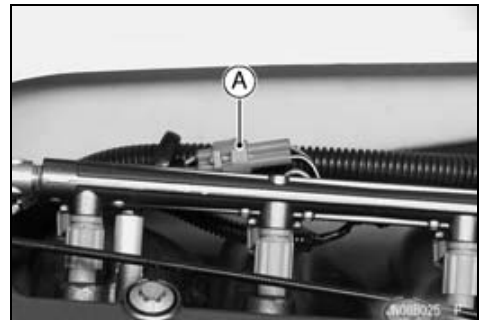
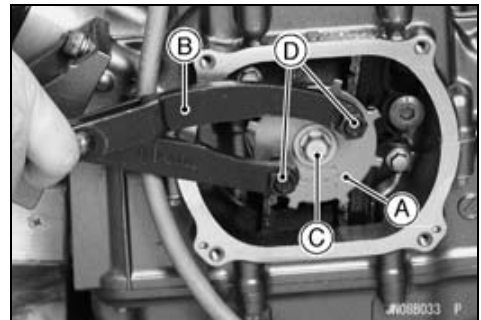
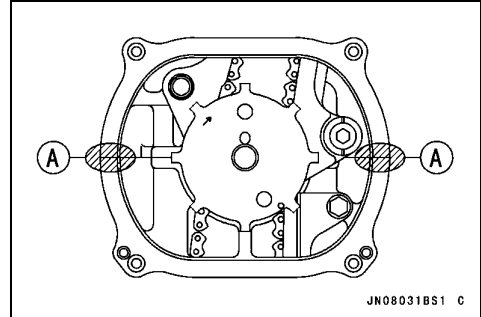
- Fit the rotor to the crankshaft.
- Apply a non-permanent locking agent to the rotor bolt.
- Tighten the rotor bolt.

Torque - Timing Rotor Bolt: 20 N·m (2.0 kgf·m, 14 ft·lb)

- Install the crankshaft sensor cover (see Crankshaft Sensor Installation).

Crankshaft Sensor Inspection

- Remove:
 - Seat (see Hull/Engine Hood chapter)
- Disconnect the 2-pin crankshaft sensor leads connector (Blue) [A].



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Ignition System

- Set the hand tester to the $\times 100 \Omega$ range, zero it, and connect it to the crankshaft sensor lead terminals (G and BL) in the connector.
- ★ If there is more resistance than the specified value, the sensor has an open lead and must be replaced. Much less than this resistance means the sensor is shorted, and must be replaced.

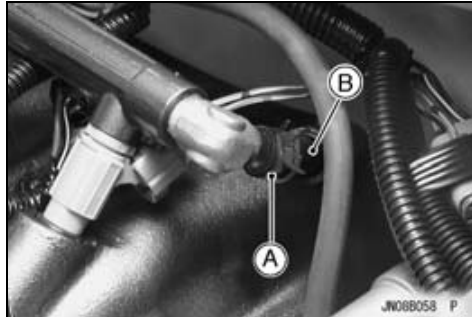
Crankshaft Sensor Resistance

Standard: 408 ~ 612 Ω

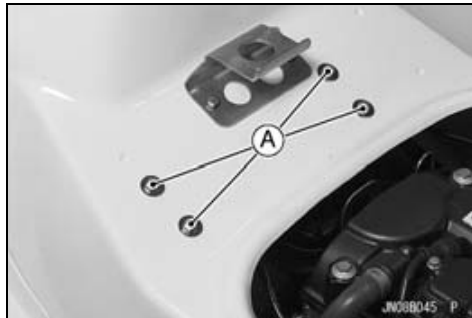


Ignition Coil Removal

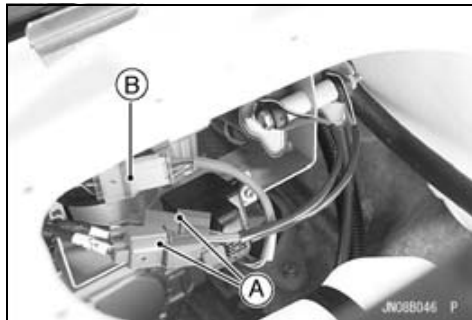
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Front Storage Pocket (see Hull/Engine Hood chapter)
 - Spark Plug Caps (see Periodic Maintenance chapter)
 - Clamp [A] (JT1500-A1 Model)
 - Double Spring Clamp [A] (JT1500-A2 Model ~)
 - Fuel Supply Hose End [B]



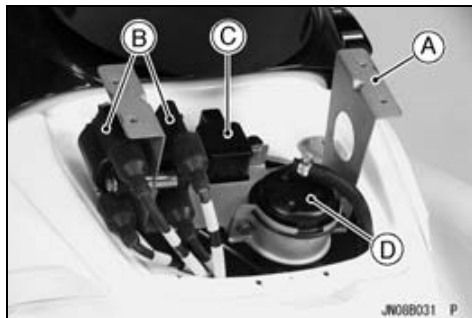
- Bracket Mounting Bolts [A].



- Disconnect the ignition coil primary lead connectors [A] and vehicle-down sensor lead connector [B].

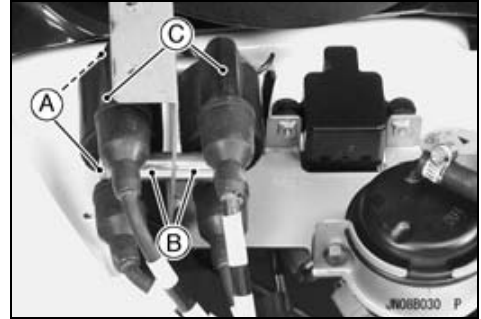


- Pull up the bracket [A] together with the ignition coils [B], vehicle-down sensor [C], and fuel filter [D] installed.

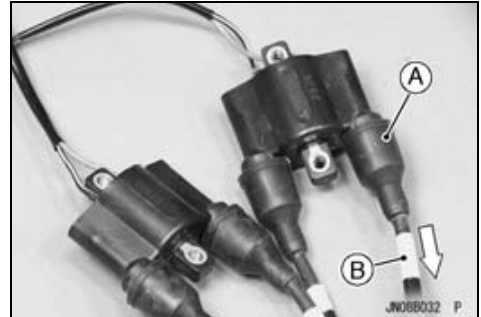


Ignition System

- Unscrew the nuts [A] and remove the bolts, collars [B] and ignition coils [C].



- Pull out the high tension lead [B] from the ignition coil [A]. Lubricate the leads with penetrating rust inhibitor.



Ignition Coil Installation

- Connect the high tension lead to each ignition coil as follows.
 - #1 High Tension Lead Length 340 mm (13.4 in.) [A]
 - #2 High Tension Lead Length 450 mm (17.7 in.) [B]
 - #3 High Tension Lead Length 540 mm (21.3 in.) [C]
 - #4 High Tension Lead Length 600 mm (23.6 in.) [D]

○ Each lead number is marked [E].

- Apply a non-permanent locking agent to the ignition coil mounting bolts.
- Install the #1, 4 ignition coil [F] and #2, 3 ignition coil [G] to the bracket [H] and tighten the bolts.

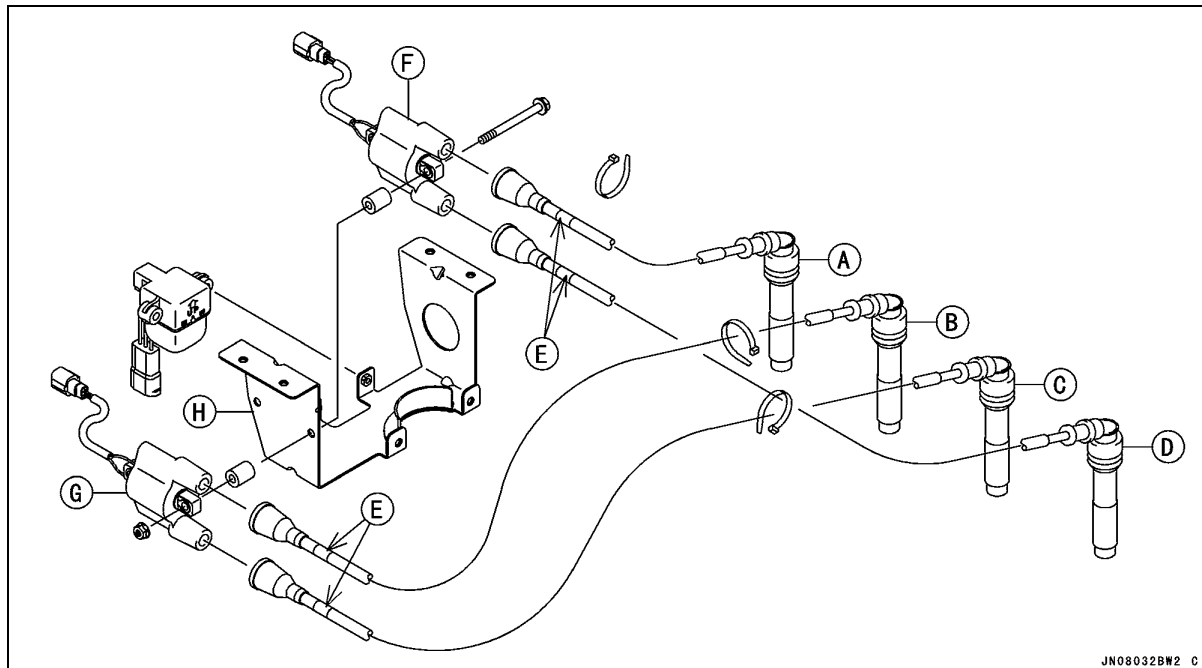
Torque - Ignition Coil Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

- Apply a non-permanent locking agent to the bracket mounting bolts and tighten them.

Torque - Bracket Mounting Bolts: 8.8 N·m (0.90 kgf·m, 78 in·lb)

14-44 ELECTRICAL SYSTEM

Ignition System



- Install the removal parts.
- For JT1500-A2 Model ~; Replace the double spring clamps with new ones (see Fuel System (DFI) chapter).

Ignition Coil Inspection

Measuring arcing distance

The most accurate test for determining the condition of the ignition coil is made by measuring arcing distance.

- Remove the ignition coil (see Ignition Coil Removal).
- Connect the ignition coil [A] (with the spark plug cap left installed on the spark plug lead) to the tester [B], and measure the arcing distance.

Auxiliary wire [C]

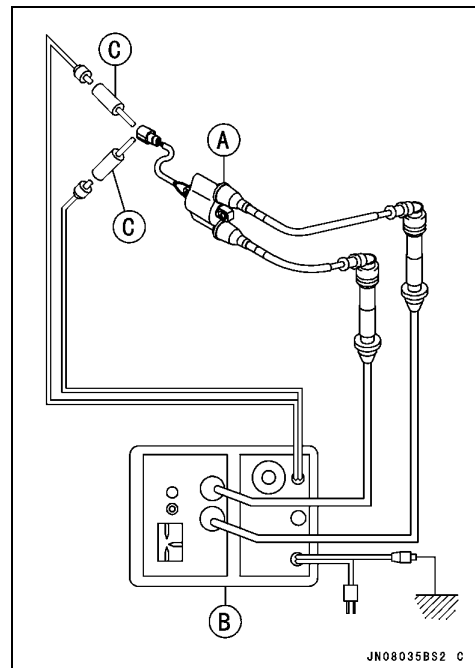
⚠ WARNING

To avoid extremely high voltage shocks, do not touch the coil body or leads.

- ★ If the distance reading is less than the specified value, the ignition coil or spark plug cap is defective.

3 Needle Arcing Distance

Standard: 7 mm (0.28 in.) or more



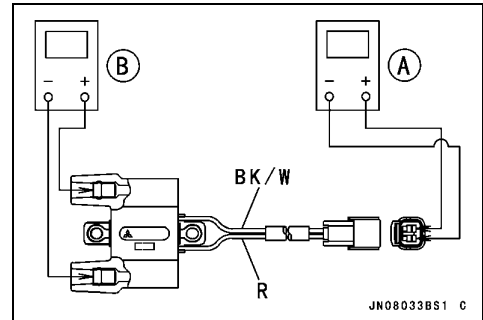
- To determine which part is defective, measure the arcing distance again with the spark plug leads removed from the ignition coil (see Ignition Coil Removal).
- ★ If the arcing distance is subnormal as before, the trouble is with the ignition coil itself. If the arcing distance is now normal, the trouble is with the spark plug lead.

Ignition System

Measuring coil resistance

If the Coil Tester is not available, the coil can be checked for a broken or badly shorted winding with a hand tester. However, a hand tester can not detect layer shorts and shorts resulting from insulation breakdown under high voltage.

- Disconnect the primary leads from the coil terminals.
- Measure the primary winding resistance as follows [A].
 - Connect the tester between the coil terminals.
 - Set the tester to the $\times 1 \Omega$ range, and read the tester.
- Measure the secondary winding resistance as follows [B].
 - Remove the high tension leads (see Ignition Coil Removal).
 - Connect the tester between the secondary lead terminals.
 - Set the tester to the $\times 1 \text{ k}\Omega$, and read the tester.
- ★ If the hand tester does not read as specified, replace the coil.



Winding Resistance

Standard: Primary windings $1.53 \sim 2.07 \Omega$

Secondary windings $12.50 \sim 16.91 \text{ k}\Omega$

- ★ If the tester reads are as specified, the ignition coil windings are probably good. However, if the ignition system still does not perform as it should after all other components have been checked, test replace the coil with one known to be good.

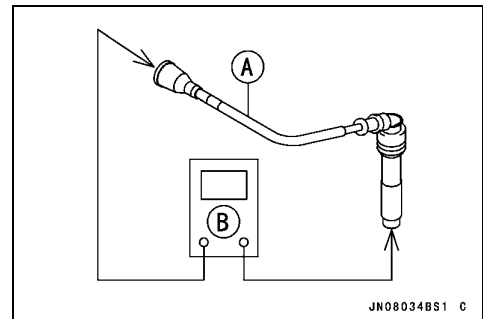
Measuring high tension lead resistance

- Check the high tension lead [A] for visible damage.
- ★ If the high tension lead is damaged, replace the high tension lead.
- Measure the lead resistance with the hand tester [B].

Spark Plug Lead Resistance

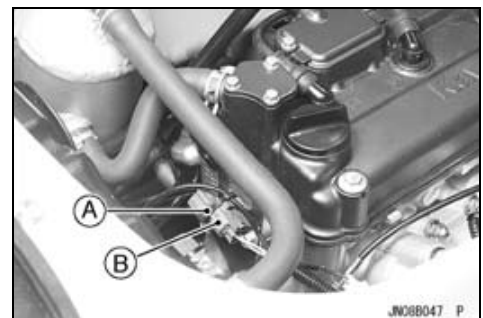
Standard: $3.75 \sim 6.25 \text{ k}\Omega$

- ★ If the hand tester does not read as specified, replace the lead



Camshaft Position Sensor Removal

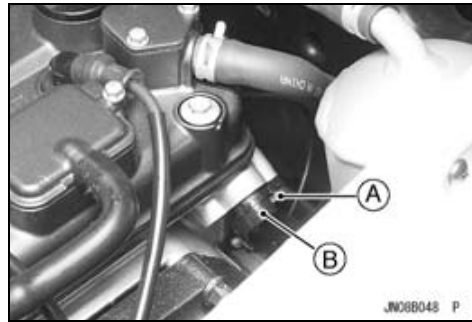
- Remove:
 - Seat (see Hull/Engine Hood chapter)
- Cut off the clamp [A].
- Disconnect the camshaft position sensor lead connector [B].



14-46 ELECTRICAL SYSTEM

Ignition System

- Remove:
 - Camshaft Position Sensor Bolt [A]
 - Camshaft Position Sensor [B]



Camshaft Position Sensor Installation

- Apply grease or engine oil to the O-ring on the camshaft position sensor.
- Tighten:
 - Torque - Camshaft Position Sensor Bolt: 9.8 N·m (1.0 kgf·m, 87 in·lb)**

Camshaft Position Sensor Inspection

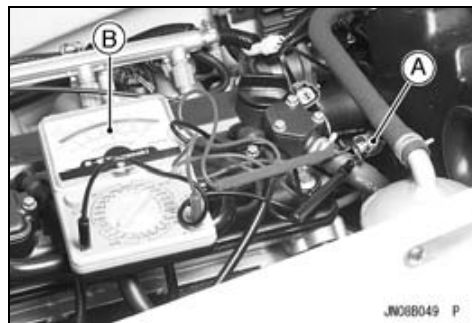
- Remove:
 - Seat (see Hull/Engine Hood chapter)
 - Camshaft Position Sensor Lead Connector [A] (disconnect)
- Set the hand tester [B] to the $\times 10 \Omega$ range and connect it to the yellow and black leads in the connector.

Special Tool - Hand Tester: 57001-1394

- ★ If there is more resistance than the specified value, the sensor coil has an open lead and must be replaced. Much less than this resistance means the sensor coil is shorted, and must be replaced.

Camshaft Position Sensor Resistance: 400 ~ 460 Ω

- Using the highest resistance range of the tester, measure the resistance between the camshaft position sensor leads and chassis ground.
- ★ Any tester reading less than infinity (∞) indicates a short, necessitating replacement of the camshaft position sensor.



Igniter Removal/Installation

- Refer to the ECU Removal in the Fuel System (DFI) chapter.

Ignition System

Igniter Inspection

○The igniter is built in the ECU (Electronic Control Unit).

NOTICE

Disconnecting the battery cables or any other electrical connections when the ignition switch is on or while the engine is running can damage the igniter in the ECU (Electronic Control Unit). Do not disconnect the battery cables or any other electrical connections when the ignition switch is on, or while the engine is running.

Ignition Coil Primary Peak Voltage Check

NOTE

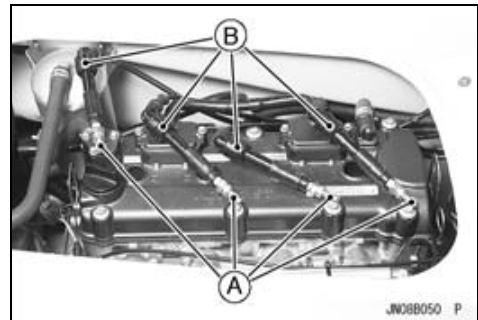
○Be sure the battery is fully charged.

- Remove:
Seat (see Hull/Engine Hood chapter)
- Pull all the spark plug caps from the spark plugs.
- Install the new spark plugs [A] into each plug caps [B], and ground them onto the engine.

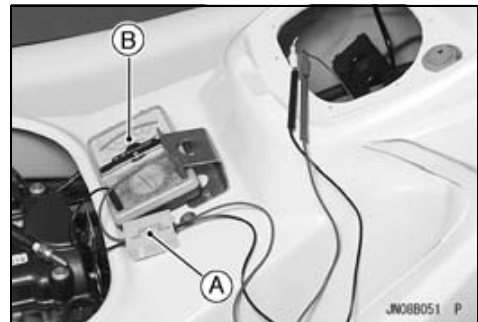
NOTE

○Maintain the correct value of compression pressure for the cylinder (Be sure to measure the voltage with the spark plug installed to the cylinder head).

- Remove:
Front Storage Pocket (see Hull/Engine Hood chapter)
- Install the peak voltage adapter [A] into the hand tester [B].



JN08B050 P



JN08B051 P

14-48 ELECTRICAL SYSTEM

Ignition System

- Connect the peak voltage adapter [A] to the ignition coil primary lead connector [D], using the harness adapter [C].
Hand Tester [B]
Ignition Coil [E]
Spark Plugs [F]

Special Tools - Hand Tester: 57001-1394

Harness Adapter: 57001-1562

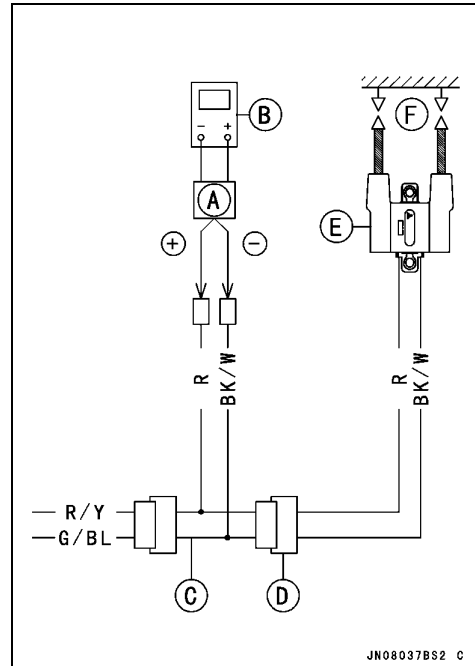
Peak Voltage Adapter: 57001-1415

Type: KEK-54-9-B

Hand Tester Range: × DC 1 000 V

Primary Lead Connections

	Adapter (R, +)		Adapter (BK, -)
#1, 4 Ignition Coil:	R	↔	BK/W (Ground)
#2, 3 Ignition Coil:	R	↔	BK/W (Ground)



WARNING

To avoid extremely high voltage shocks, do not touch the spark plugs or tester connections.

- Turn the ignition switch on and push the lanyard key under the stop button.
- Pushing the starter button, crank the engine 4 ~ 5 seconds to measure the primary peak voltage.
- Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again.
- Repeat the measurements 5 or more times for one ignition coil.

Ignition Coil Primary Peak Voltage

Standard: 250 V or more

- Repeat the test for the other ignition coil.
- ★ If the reading is less than the specified value, see "Ignition System Troubleshooting" table to determine whether igniter is good or no good.

Ignition System

Crankshaft Sensor Peak Voltage Check

NOTE

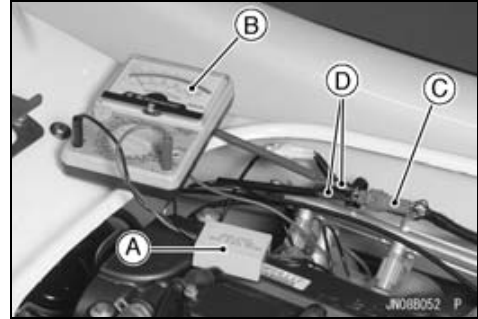
○Be sure the battery is fully charged.

- Connect the peak voltage adapter [A] to the hand tester [B].

Special Tool - Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

- Connect the adapter the crankshaft sensor lead connector [C], using the needle adapter set [D].

Special Tools - Hand Tester: 57001-1394
Needle Adapter Set: 57001-1457



Connections

	Adapter (R, +)		Adapter (BK, -)
Crankshaft Sensor:	G	↔	BL

Hand Tester Range: × DC 10 V

- Turn the ignition switch on and push the lanyard key under the stop button.
- Pushing the starter button, crank the engine 4 ~ 5 seconds to measure the crankshaft sensor peak voltage.
- Do not operate the starter for longer than 5 seconds. Wait 15 seconds before using it again.
- Repeat the measurements 5 or more times.

Crankshaft Sensor Peak Voltage
Standard: 2.5 V or more

- ★ If the reading is less than the specified value, check the crankshaft sensor (see Crankshaft Sensor Inspection).

Camshaft Position Sensor Peak Voltage Inspection

- Remove:
 Seat (see Hull/Engine Hood chapter)
- Set the digital meter [B] to the 10 V DC range.
- Connect the peak voltage adapter [C] to the digital meter.

Special Tool - Peak Voltage Adapter: 57001-1415
Type: KEK-54-9-B

- Connect the peak voltage adapter to the camshaft sensor lead connector [D], using the needle adapter set [A].

Special Tool - Needle Adapter Set: 57001-1457

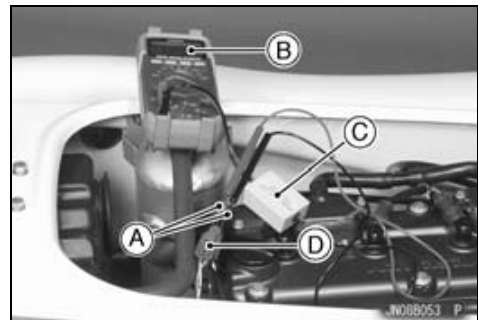
Connections

Camshaft Sensor Lead		Adapter		Hand Tester
Black	←	Red	→	(+)
Yellow	←	Black	→	(-)

- Turn the ignition switch and engine stop switch on.
- Pushing the starter button, turn the engine 4 ~ 5 seconds to measure the camshaft position sensor peak voltage.
- Repeat the measurement 5 or more times.

Camshaft Position Sensor Peak Voltage
Standard: 0.4 V or more

- ★ If the peak voltage is lower than the standard, inspect the camshaft position sensor.



14-50 ELECTRICAL SYSTEM

Ignition System

Spark Plug Removal

- Refer to the Spark Plug Cleaning and Inspection in the Periodic Maintenance chapter.

Spark Plug Installation

- Refer to the Spark Plug Cleaning and Inspection in the Periodic Maintenance chapter.

Spark Plug Inspection

- Refer to the Spark Plug Cleaning and Inspection in the Periodic Maintenance chapter.

Spark Plug Adjustment

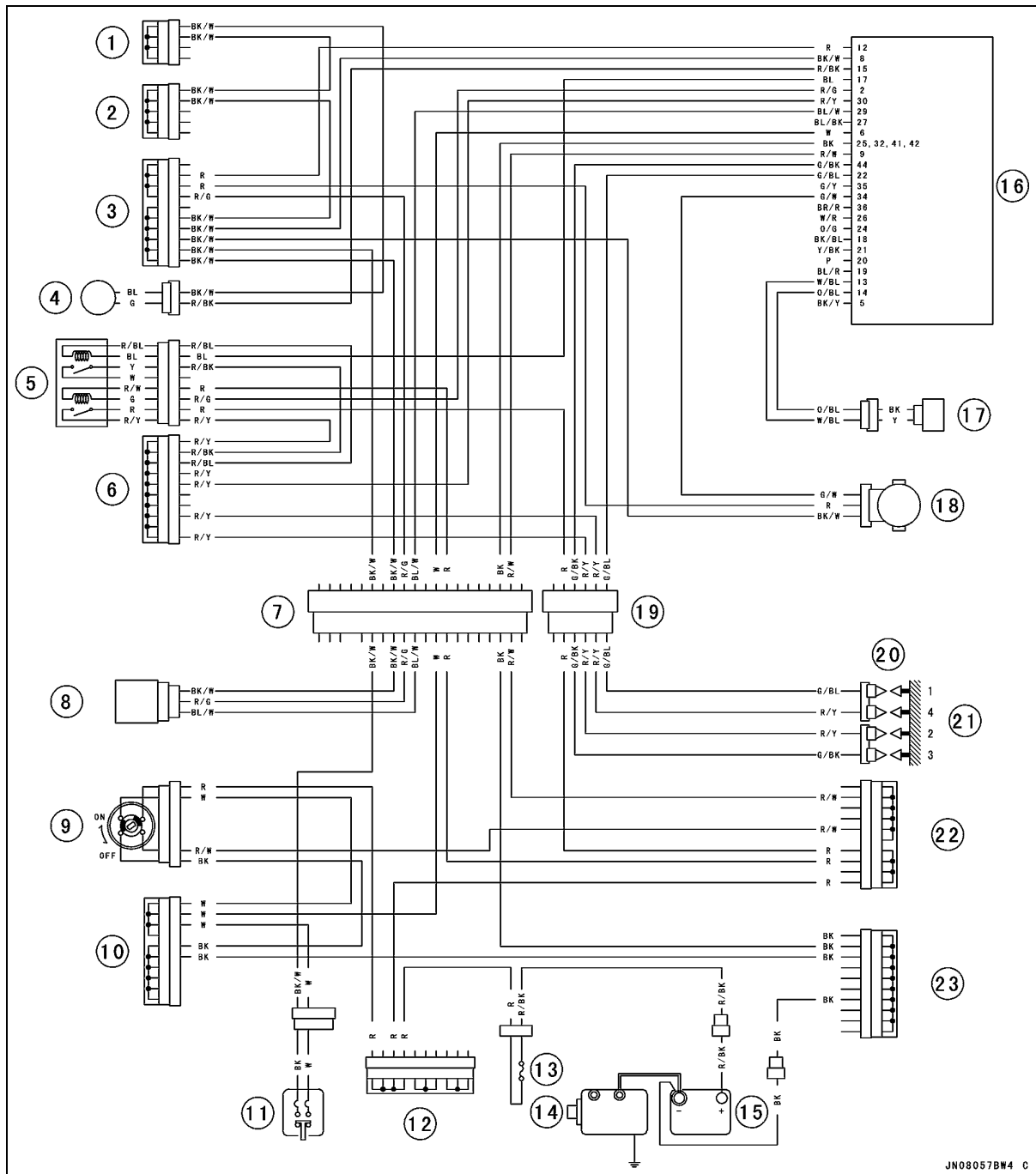
- Refer to the Spark Plug Cleaning and Inspection in the Periodic Maintenance chapter.

Spark Plug Cleaning

- Refer to the Spark Plug Cleaning and Inspection in the Periodic Maintenance chapter.

Ignition System

Ignition System Circuit (JT1500-A1 ~ A7 Models)



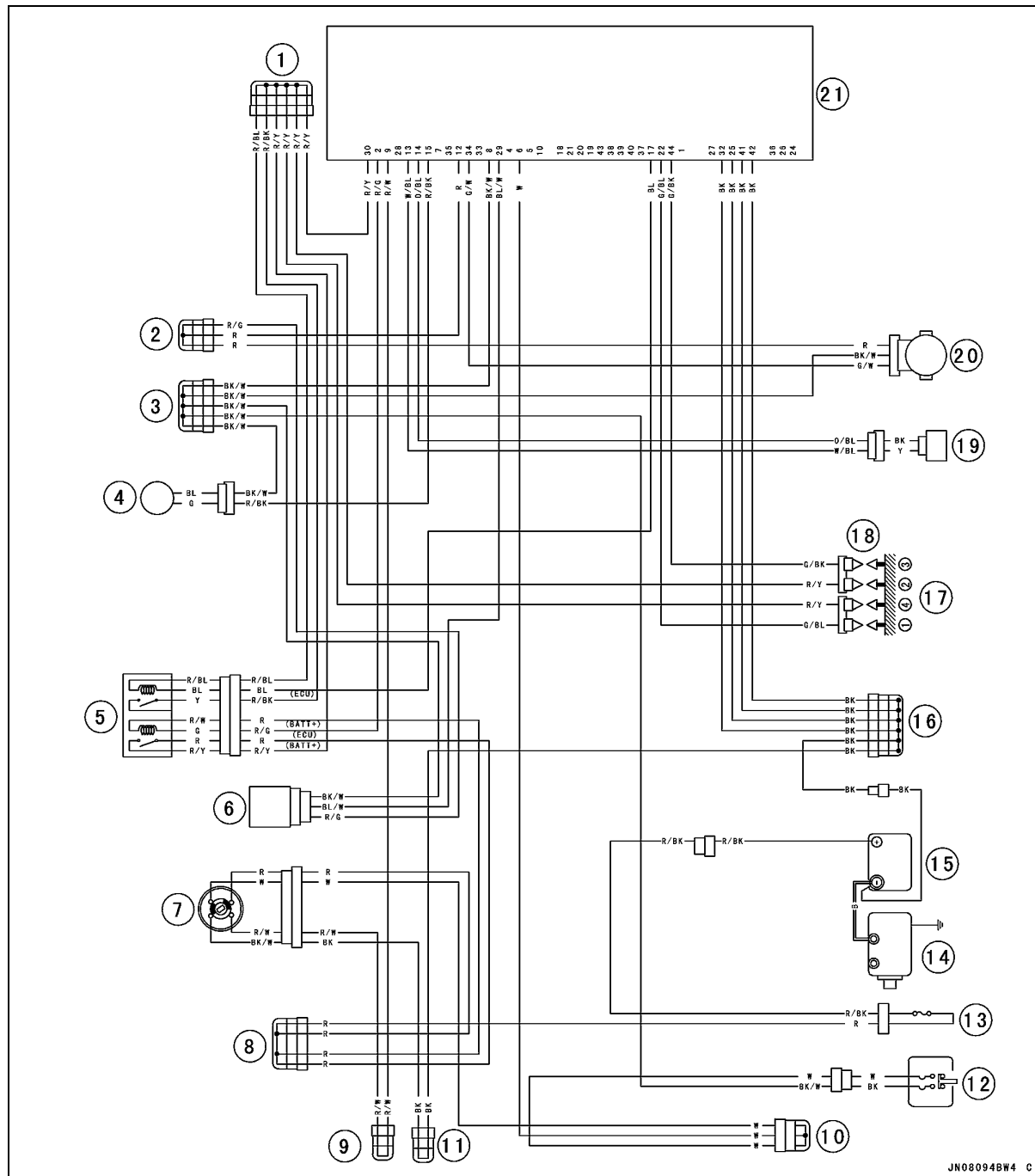
JN08057BW4 C

- | | | |
|--|-----------------------------------|------------------------------|
| 1. Joint Connector H | 9. Ignition Switch | 17. Camshaft Position Sensor |
| 2. Joint Connector J | 10. Joint Connector Q | 18. Throttle Sensor |
| 3. Joint Connector E | 11. Engine Stop Switch | 19. Connector D |
| 4. Crankshaft Sensor | 12. Joint Connector R | 20. Ignition Coils |
| 5. Relay Assembly (Main Relay/Fuel Pump Relay) | 13. Main Fuse 20 A | 21. Spark Plugs |
| 6. Joint Connector F | 14. Starter Motor | 22. Joint Connector P |
| 7. Connector C | 15. Battery 12 V 18 Ah | 23. Joint Connector S |
| 8. Vehicle-down Sensor | 16. ECU (Electronic Control Unit) | |

14-52 ELECTRICAL SYSTEM

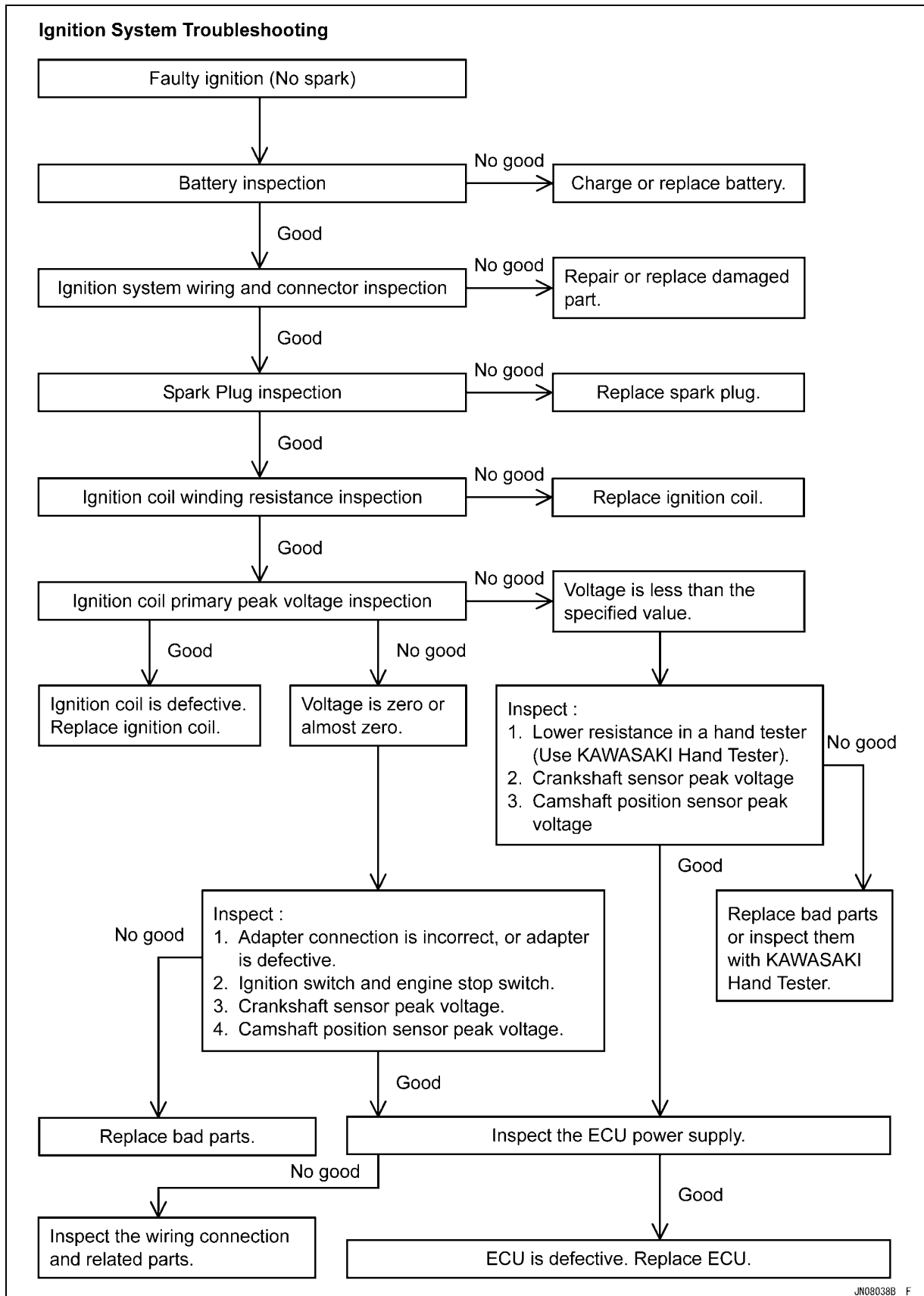
Ignition System

Ignition System Circuit (JT1500A8 Model ~)



JN080948W4 C

Ignition System

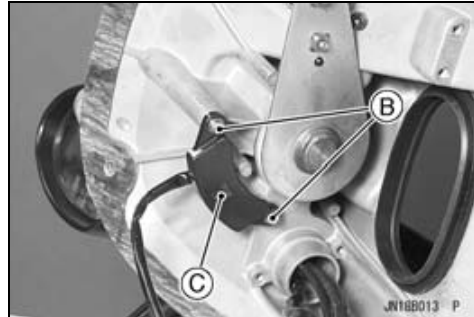
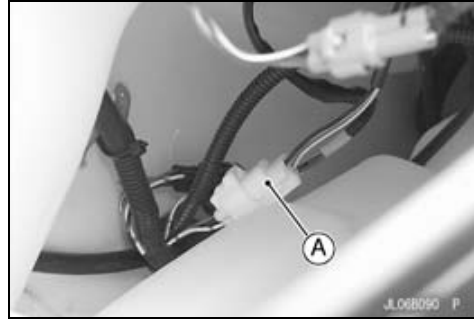


14-54 ELECTRICAL SYSTEM

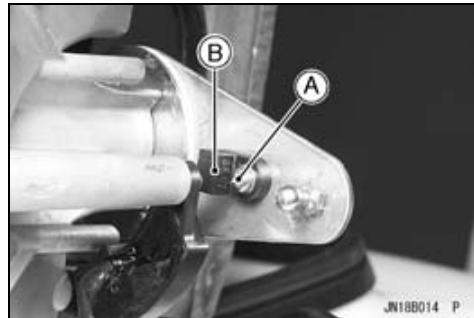
Kawasaki Smart Steering System

Steering Position Sensor and Magnet Removal

- Remove the steering holder (see Steering Removal in Steering chapter).
- Remove or disconnect:
 - Steering Position Sensor Lead Connector [A]
 - Leads Clamp on Steering Holder
 - Steering Position Sensor Mounting Screws [B]
 - Steering Position Sensor [C]

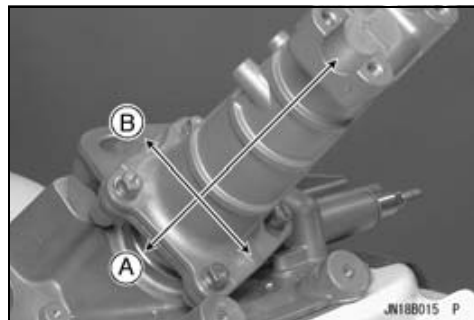


- Unscrew the mounting screw [A] and remove the magnet [B].

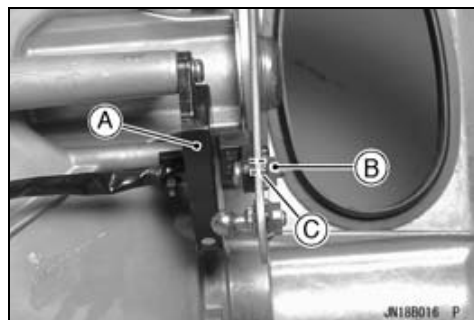


Steering Position Sensor and Magnet Installation

- Moving the steering shaft in the direction [A] and [B], check the steering shaft for excessive play.
- ★ If necessary, adjust the steering shaft nut or replace the bushings.



- Apply a non-permanent locking agent to the steering position sensor mounting screws and magnet mounting screw.
- Install the steering position sensor [A] to the steering holder and align the projection [B] on the magnet with the hole [C] on the steering shaft plate.



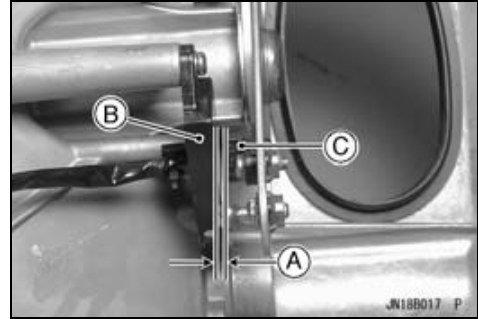
Kawasaki Smart Steering System

- Turning the steering shaft fully in left and right direction, check whether the steering position sensor comes in contact with the magnet.
- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance

Standard: 0.5 ~ 1.5 mm (0.02 ~ 0.06 in.)

- ★ If necessary, adjust the steering shaft nut.
- Check the operation of Kawasaki Smart Steering system.



Inspection of Kawasaki Smart Steering System

- Inspect the smart steering system with the watercraft in the water.
- Center the handlebar in the straight-ahead position .
- Squeeze the throttle lever and allow it to approx. 4 000 r/min (rpm) or above for 4 seconds or more.
- Release the throttle lever.
- Within 1 second, turn the handlebar all the way to the left or right and check the engine speed increases to approx. 2 800 r/min (rpm).
- Center the handlebar in the straight-ahead position, and check the engine speed decreases to an idle speed.
- ★ If the Kawasaki Smart Steering system does not operate normally, check the steering position sensor clearance.

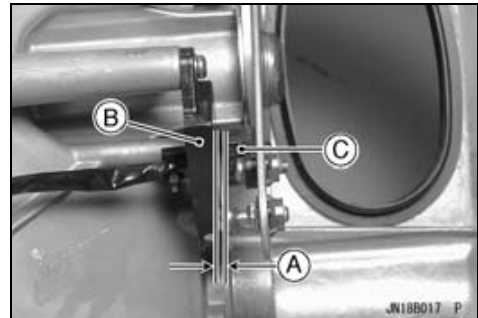
Steering Position Sensor Clearance

- Check the clearance [A] between the steering position sensor [B] and the magnet [C] with feeler gauge.

Steering Position Sensor Clearance

Standard: 0.5 ~1.5 mm (0.02 ~ 0.06 in.)

- ★ If the clearance is the specified value, inspect steering position sensor input voltage.
- ★ If necessary, adjust the steering shaft nut.



14-56 ELECTRICAL SYSTEM

Kawasaki Smart Steering System

Steering Position Sensor Input Voltage Inspection

- Measure the input voltage to the steering position sensor.

NOTE

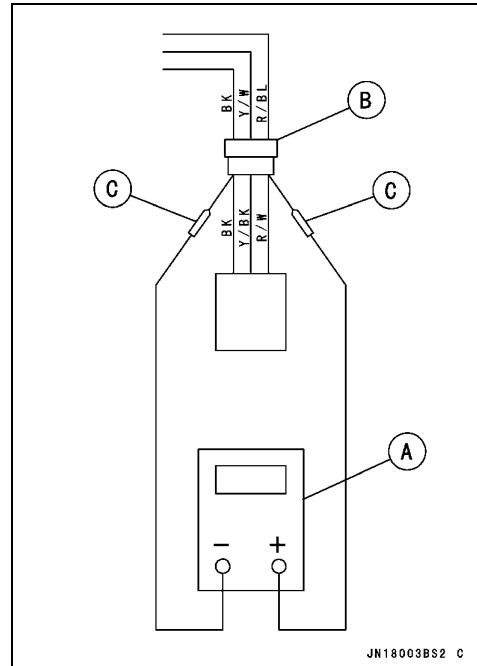
- Be sure the battery is fully charged.
- Connect a digital voltmeter [A] to the lead connector [B] of the steering position sensor using the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Connections to Steering Position Sensor Connector

Meter (+) → R/W Terminal

Meter (–) → BK Terminal



- Turn the ignition switch ON.
- Center the handlebar in the straight-ahead position.
- Measure the input voltage.

Steering Position Sensor Input Voltage

Standard: Battery Voltage

- Turn the ignition switch OFF.
- ★ If the reading is good, inspect steering position sensor output voltage.
- ★ If the reading is out of the standard, check the following.
 - Battery Voltage
 - 20 A Main Fuse
 - Power Source Wiring (see Steering Position Sensor Circuit)

Kawasaki Smart Steering System

Steering Position Sensor Output Voltage Inspection

- Measure the output voltage from the steering position sensor.

NOTE

- Be sure the battery is fully charged
- Connect a digital voltmeter [A] to the lead connector [B] of the steering position sensor using the needle adapter set [C].

Special Tool - Needle Adapter Set: 57001-1457

Connections to Steering Position Sensor Connector

Meter (+) → Y/BK Terminal

Meter (–) → BK Terminal

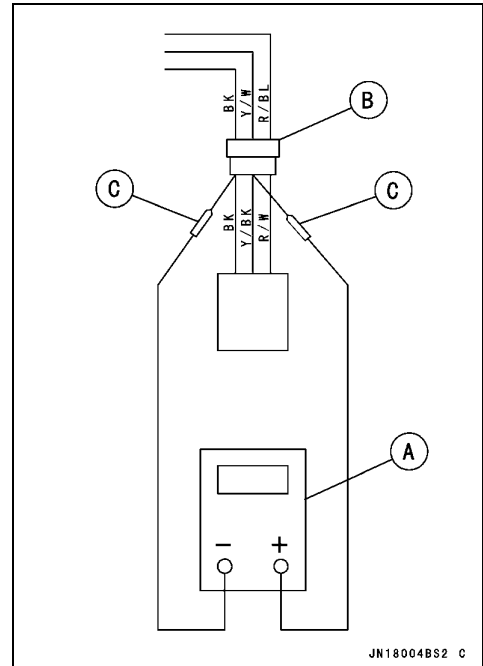
- Turn the ignition switch ON.
- Turn the handlebar fully left or right.
- Measure the output voltage.

Steering Position Sensor Output Voltage

Standard: approx. 0 V

NOTE

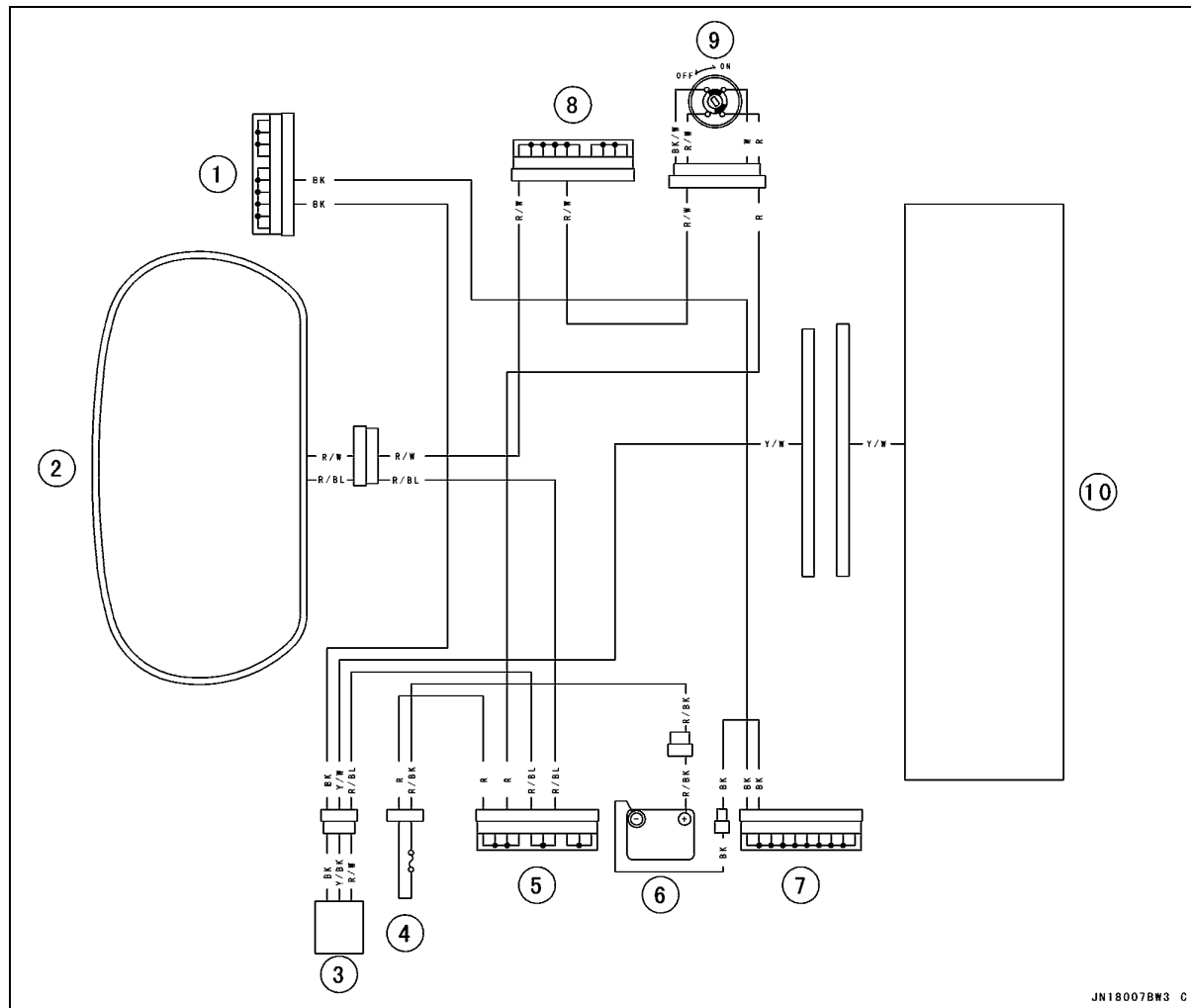
- When the handlebar is centered in straight-ahead position the output voltage standard value is battery voltage.
- Turn the ignition switch OFF.
- ★ If the reading is out of the standard, suspect the following.
 - Damaged Steering Position Sensor
 - Open Sensor Circuit
- ★ If the reading is the standard, but the Kawasaki Smart Steering system does not operate, suspect the ECU and idle speed control in the throttle body.



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Kawasaki Smart Steering System

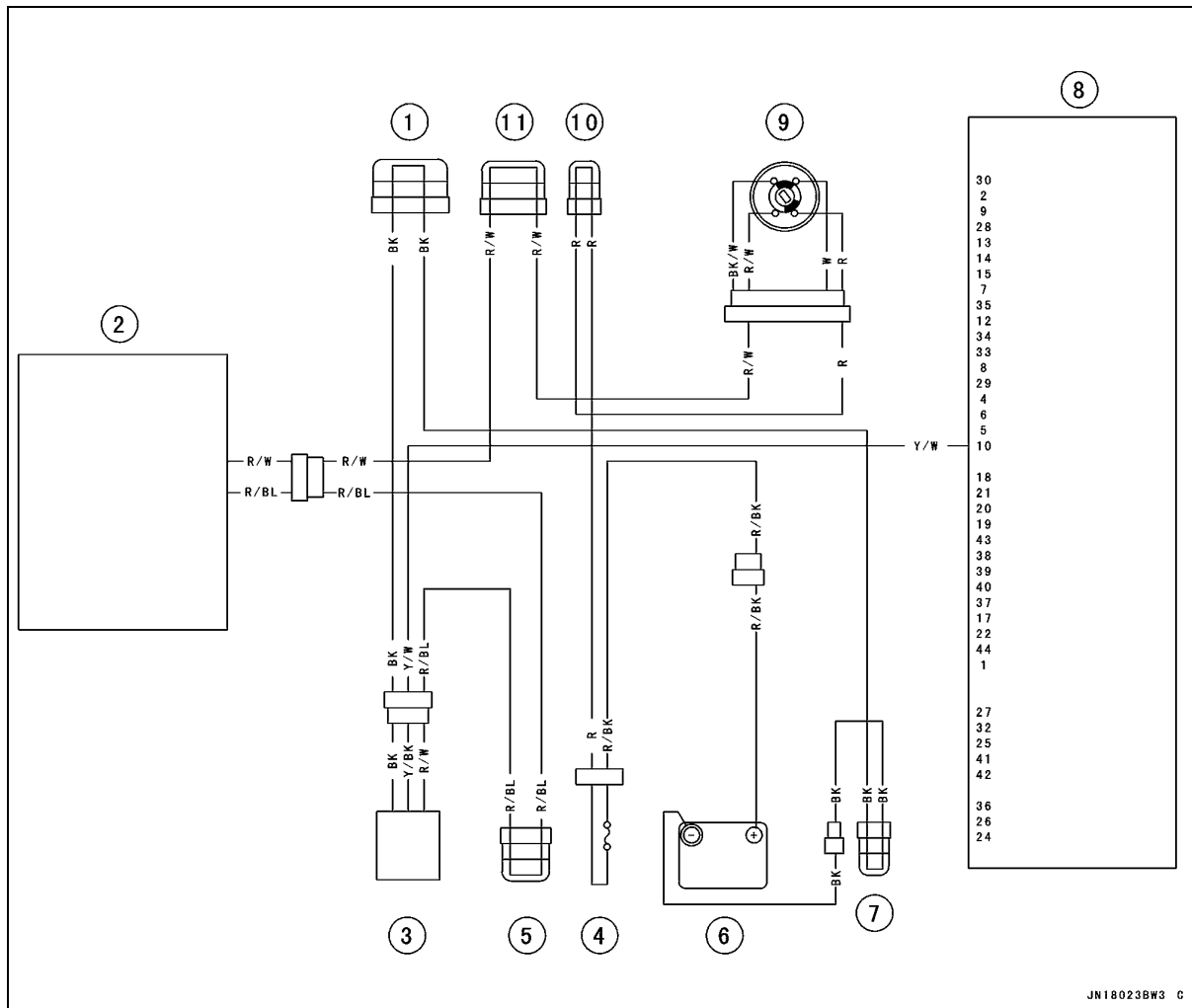
Steering Position Sensor Circuit (JT1500-A1 ~ A7 Models)



1. Joint Connector Q
2. Multifunction Meter
3. Steering Position Sensor
4. Main Fuse 20 A
5. Joint Connector R
6. Battery 12 V 18 Ah
7. Joint Connector S
8. Joint Connector P
9. Ignition Switch
10. ECU (Electronic Control Unit)

Kawasaki Smart Steering System

Steering Position Sensor Circuit (JT1500A8 Model ~)



1. Joint Connector R
2. Multifunction Meter
3. Steering Position Sensor
4. Main Fuse 20 A
5. Joint Connector V
6. Battery 12 V 18 Ah
7. Joint Connector U
8. ECU (Electronic Control Unit)
9. Ignition Switch
10. Joint Connector P
11. Joint Connector Q

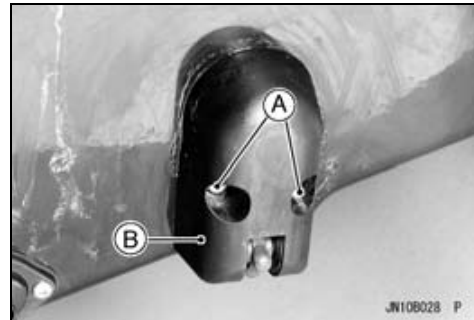
JN18023BW3 C

14-60 ELECTRICAL SYSTEM

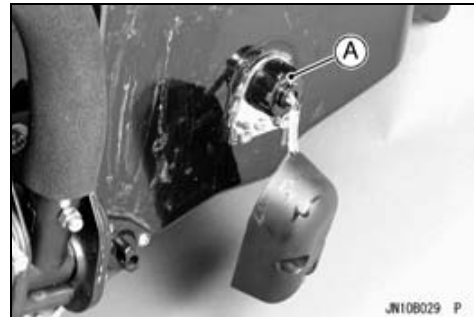
Sensors

Speed Sensor Removal/Installation

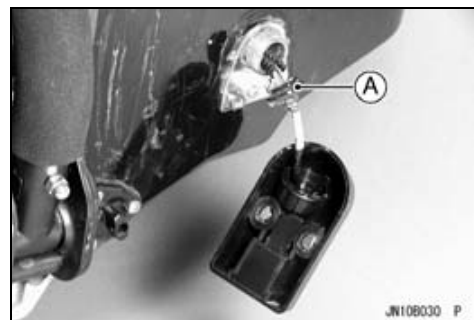
- Unscrew the mounting bolts [A] and remove the speed sensor assembly [B].
- The speed sensor is located at the right on the hull in JT1500-A1 ~ A8 Models, however it is located at left on the hull in JT1500A9 Model ~.



- Unscrew the cap [A].
- Pull out the speed sensor connector and disconnect it.

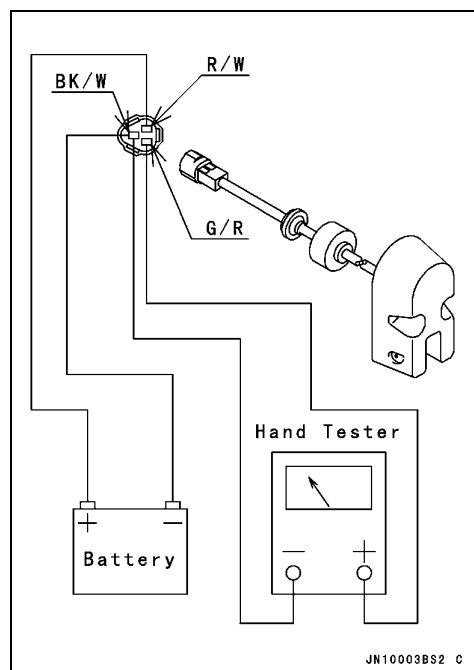


- When installing the speed sensor assembly, note the following.
- Apply silicone sealant around the grommet [A] and lead wires.



Speed Sensor Inspection

- Remove the speed sensor.
- Connect the battery and tester leads to the sensor as shown.



Sensors

- Rotate the waterwheel by hand slowly.
- Measure the output voltage of the speed sensor.

**G/R (+), BK/W (-) → 0 ~ battery voltage; twice a rotation
(Rotate it slowly.)**

- ★ If the voltage does not rise from zero to battery voltage twice a rotation, replace the sensor.



- Measure the output voltage of the sensor at higher speeds.

○ Rotate the waterwheel in a fair speed by air.

G/R (+), BK/W (-) → approx. 5 V

- ★ If the sensor voltage does not reach 5 volts when spun with compressed air, replace the sensor.

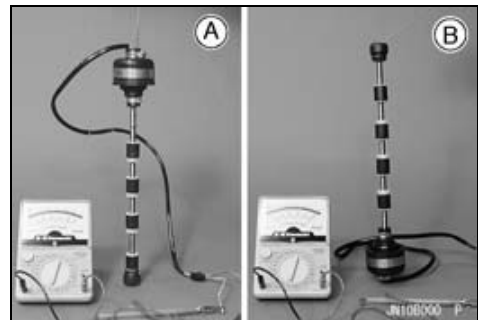


Fuel Level Sensor Inspection

- Open the front storage compartment cover.
- Disconnect the fuel level sensor 2-pin connector.
- Loosen the clamp, and remove the fuel level sensor out of the fuel tank.
- Set the hand tester (ohmmeter) to the $\times 1 \text{ k}\Omega$ range.

Special Tool - Hand Tester: 57001-1394

- Connect the tester leads the W/R and BK/W leads to check the switching operation of the float.

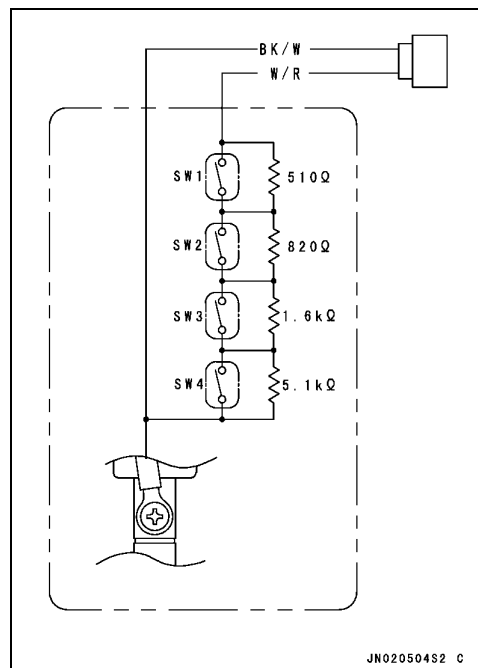


Meter Reading

When sensor is held upright [A]: approx. 8.03 k Ω

When sensor is held upside down [B]: approx. 0 Ω

- ★ The meter should read as specified. If it does not, replace the fuel level sensor.



Throttle Sensor Removal/Installation

- Refer to the Throttle Sensor Removal/Adjustment in the Fuel System chapter.

14-62 ELECTRICAL SYSTEM

Sensors

Throttle Sensor Inspection

- Refer to the Throttle Sensor Section in the Fuel System chapter.

Water Temperature Sensor Inspection

- Remove the water temperature sensor (see Feul (DFI) System chapter).
- Suspend the sensor [A] in a container of water so that the temperature-sensing projection is submerged.
- Suspend an accurate thermometer [B] in the water.

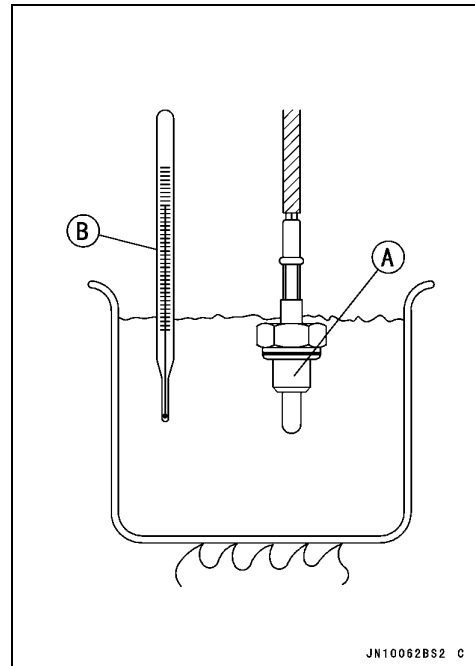
NOTE

○The sensor and thermometer must not touch the container side or bottom.

- Place the container over a source of heat and gradually raise the temperature of the water while stirring the water gently.
- Using the hand tester, measure the internal resistance of the sensor at the temperatures shown in the table.
- ★If the hand tester does not show the specified values, replace the sensor.

Water Temperature Sensor Resistance

Water Temperature	Sensor Resistance
20°C (68°F)	approx. 293 kΩ
50°C (122°F)	approx. 78.5 kΩ
90°C (194°F)	approx. 18.1 kΩ
100°C (212°F)	approx. 13.2 kΩ



Inlet Air Temperature Sensor Inspection

- Refer to the Inlet Air Temperature Sensor Section in the Fuel System chapter.

Oil Temperature Sensor Inspection

- Remove the oil temperature sensor (see Feul (DFI) System chapter).
- Suspend the sensor [A] in a container of water so that the temperature-sensing projection is submerged.
- Suspend an accurate thermometer [B] in the water.

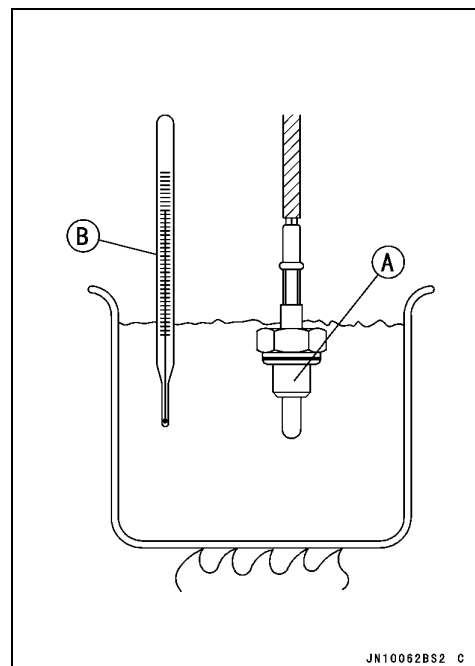
NOTE

○The sensor and thermometer must not touch the container side or bottom.

- Place the container over a source of heat and gradually raise the temperature of the water while stirring the water gently.
- Using the hand tester, measure the internal resistance of the sensor at the temperatures shown in the table.
- ★If the hand tester does not show the specified values, replace the sensor.

Oil Temperature Sensor Resistance

Oil Temperature	Sensor Resistance
20°C (68°F)	approx. 293 kΩ
50°C (122°F)	approx. 78.5 kΩ
90°C (194°F)	approx. 18.1 kΩ
100°C (212°F)	approx. 13.2 kΩ



Multifunction Meter

Display Function Inspection

- Using the auxiliary wires, connect the 12 V battery [A] to the meter unit [B] connector as follows.

JT1500-A2 Model ~ [C]

JT1500-A1 Model [D]

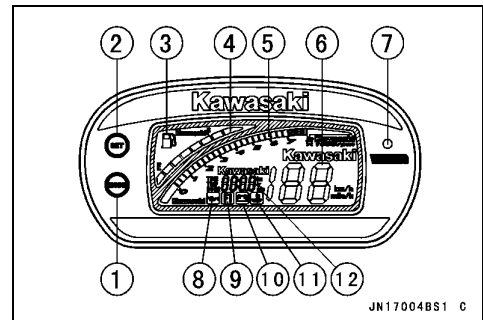
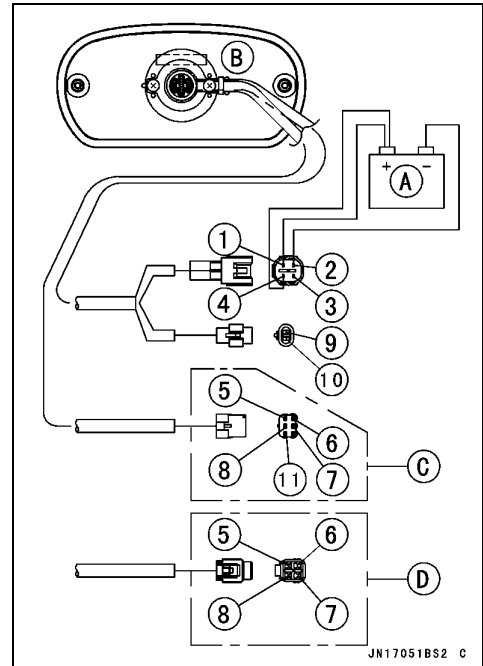
- Connect the battery positive terminal to the terminal [1].
- Connect the battery negative terminal to the terminal [2].

- [1] R Battery (+)
- [2] BK, Ground (-)
- [3] R/BL, Speed Sensor
- [4] R/W Ignition Switch (+)
- [5] W/R, Fuel Level Sensor
- [6] BL/BK, Diagnosis Signal
- [7] GY, Tachometer Pulse
- [8] G/R, Speed Sensor Pulse
- [9] BK/W, Buzzer (-)
- [10] R/BK, Buzzer (+)
- [11] Y/BL, SLO (Smart Learning Operation) Mode

Battery Voltage Range: 10 ~ 16 V

- When the positive terminal (+) of battery is connected to the terminal [4] completely, inspect that every LCD segment and LED warning light will be lit for several seconds just after disappearance of demonstrative figure-expression.
- Check that when the terminals are disconnected, all the LCD segments and LED warning light disappear.
- ★ If the LCD segments and LED warning light will not appear, replace the meter assembly.

- [1] MODE Button
- [2] SET Button
- [3] Fuel Indicator
- [4] Fuel Level Gauge
- [5] Tachometer
- [6] Speedometer
- [7] "LED" Warning Light
- [8] Engine Oil Pressure Indicator
- [9] FI Indicator
- [10] Low Battery Voltage Indicator
- [11] Engine Cooling Water Temperature Indicator
- [12] Multifunction Display



NOTICE

Do not drop the meter unit. Do not short the terminals.

If the multifunction meter displays incorrectly while the engine is running, first disconnect the (-) battery terminal lead and reconnect it again to recover the meter display.

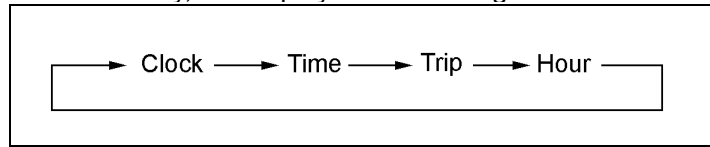
Then, check to see that the standard plugs and/or plug caps are installed. Install only the standard plugs and/or plug caps. The resistors are embedded in both parts.

14-64 ELECTRICAL SYSTEM

Multifunction Meter

MODE/SET Button Inspection

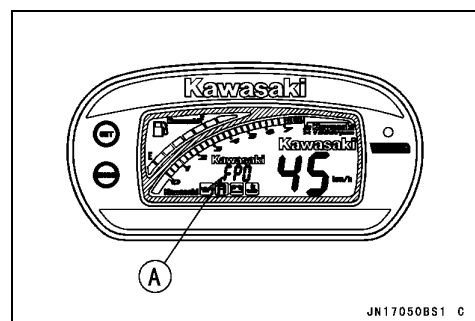
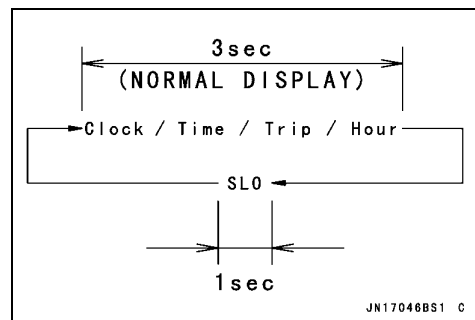
- Check that when the MODE button is pushed and held continuously, the display rotates through the four modes.



- Indicate the clock mode.
- Check that when the SET button is pushed for more than two seconds, the meter display turns to the clock set mode.
- ★ If the display function does not work, replace the meter assembly.
- Indicate the time mode.
- Check that when the SET button is pushed for more than two seconds, the meter display turns to "00:00".
- ★ If the display function does not work, replace the meter assembly.
- Indicate the trip mode.
- Check that when the SET button is pushed for more than two seconds, the meter display turns to "000.0".
- ★ If the display function does not work, replace the meter assembly.

SLO (Smart Learning Operation) Mode Inspection (JT1500-A2 Model ~)

- Confirmation of the SLO mode shift.
 - To change the normal operation mode to SLO mode, push the "MODE" button for 7 seconds or more.
 - The same initial display as shown when ignition switch turned on is shown together with two times buzzer sound.
 - Then "SLO" (1 second) and normal display (Clock/Time/Trip/Hour) (3 seconds) are shown blinking alternately.
- Confirmation of the normal operation mode shift.
 - To change the SLO mode to normal operation mode, push the "MODE" button for 7 seconds or more.
 - The same initial display is first shown and followed by "FPO" [A] for 2 seconds.
 - However "FPO" is shown only once when shifted and not displayed thereafter.
- ★ If the display function does not work, replace the meter assembly.



Multifunction Meter

Fuel Level Gauge/Symbol/FUEL Characters/Warning Light Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the "Display Function Inspection".
- Connect the variable rheostat [A] to the terminal [5] as shown.
JT1500-A2 Model ~ [B]
JT1500-A1 Model [C]
- Check that the number of segments matches the resistance value of the variable rheostat.

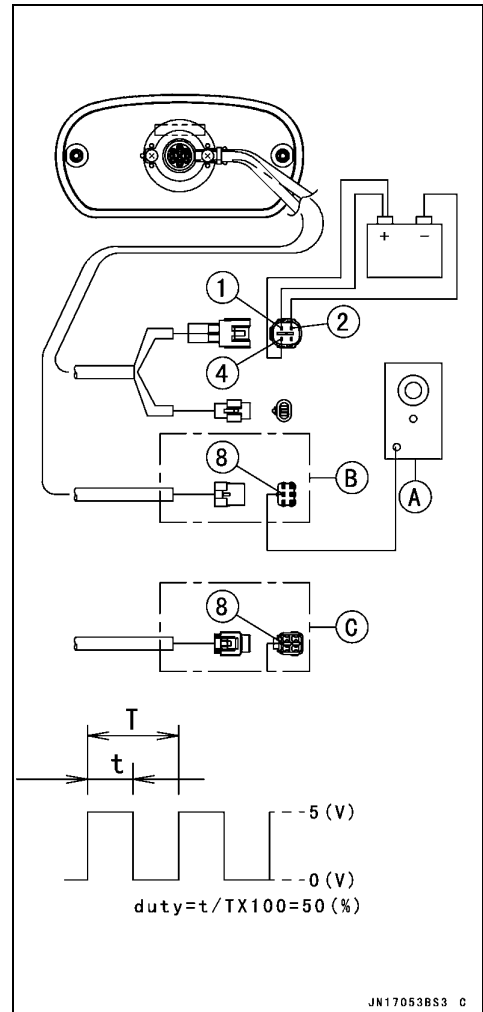
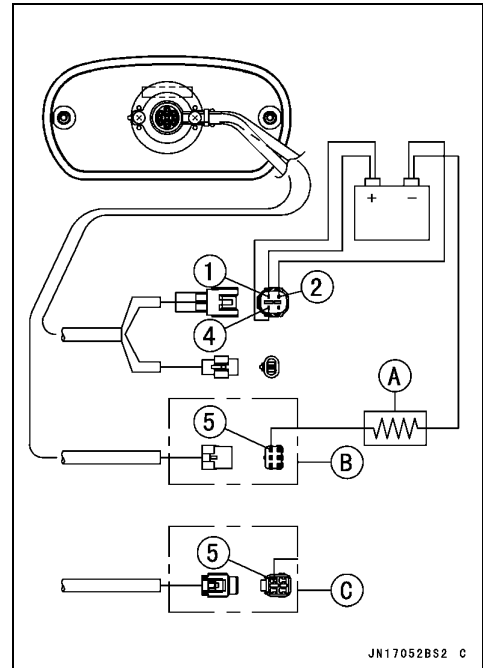
Resistance Value (Ω)	Display Segments
8030	0*
2930	1 ~ 2
1330	3 ~ 4
510	5 ~ 6
0	7 ~ 8

*: The LED warning light, fuel symbol and FUEL characters flash at the same time.

- If any display function does not work, replace the meter assembly.

Speedometer Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the "Display Function Inspection".
- The speed equivalent to the input frequency is indicated in the oscillator [A] if the square wave (illustrated as shown) would be input into the terminal [8].
JT1500-A2 Model ~ [B]
JT1500-A1 Model [C]
- Indicates approximately 60 mph in case the input frequency would be approximately 265 Hz.
- Indicates approximately 60 km/h in case the input frequency would be approximately 165 Hz.



14-66 ELECTRICAL SYSTEM

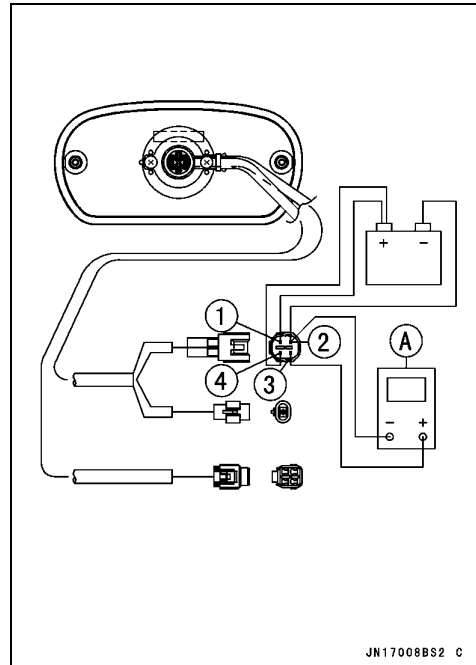
Multifunction Meter

- If the oscillator is not available, the speedometer can be checked as follows.
 - Install the meter unit.
 - Turn on the ignition switch.
 - Rotate the waterwheel by hand.
 - Check that the speedometer shows the speed.
- ★ If the speedometer does not work, check the speed sensor electric source voltage and speed sensor.



Speed Sensor Electric Source Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the "Display Function Inspection".
- Set the hand tester [A] to the DC 25 V range and connect it to the terminals [3] and [2].
- ★ If the voltage is less than 7 V, replace the meter assembly.



Multifunction Meter

Tachometer Inspection

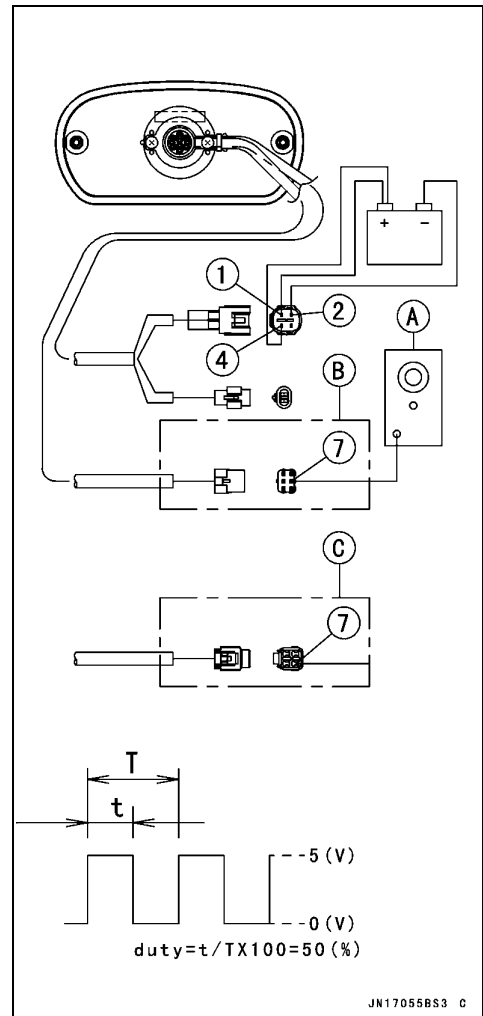
- Connect the 12 V battery and terminals in the same manner as specified in the "Display Function Inspection".
- The revolutions per minute (rpm) equivalent to the input frequency is indicated in the oscillator [A] if the square wave (illustrated as shown) would be input into the terminal [7].

JT1500-A2 Model ~ [B]

JT1500-A1 Model [C]

- The tachometer indicates approximately 3 000 r/min (rpm) in case the input frequency would be approximately 100 Hz.

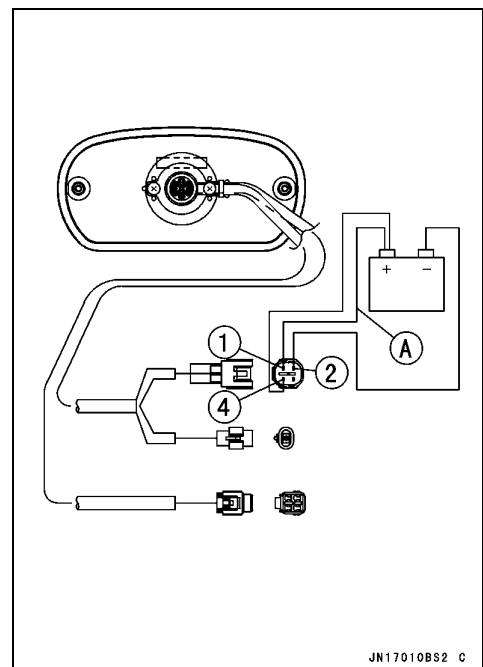
- ★ If the tachometer does not work normally, replace the meter assembly.



Battery Symbol/bAt Characters/LED Inspection

- Connect the 12 V battery and terminals in the same manner as specified in the "Display Function Inspection".
- Check that the battery symbol/bAt characters/LED flash when the input voltage to the terminal [A] is lowered to 12 volts or less. And check that the meter returns in the state of normality when the input voltage to the black lead terminal is raised to 12.5 V or more.

- ★ If any display function does not work, replace meter assembly.



14-68 ELECTRICAL SYSTEM

Multifunction Meter

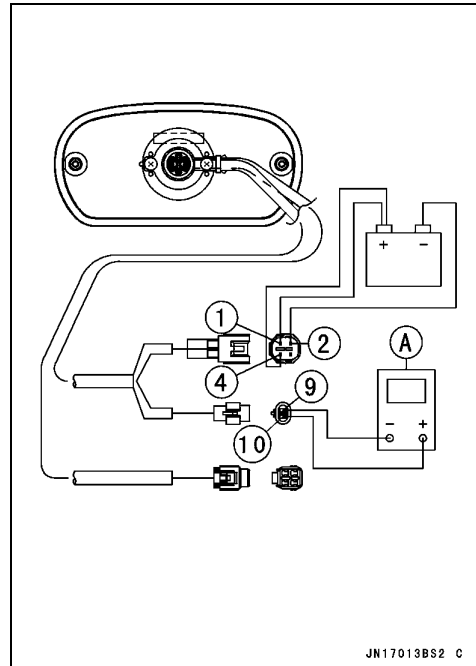
Buzzer Inspection

- Make sure that the buzzer sounds correctly when turning the ignition switch key to the "ON" position and warning the trouble after connecting the buzzer between [9] and [10].
- If the output voltage between [9] and [10] is out of the range during the buzzer sound, replace the meter assy.

Output Voltage

7 ~ 14 V for normal sound, 2 ~ 4 V for low sound.

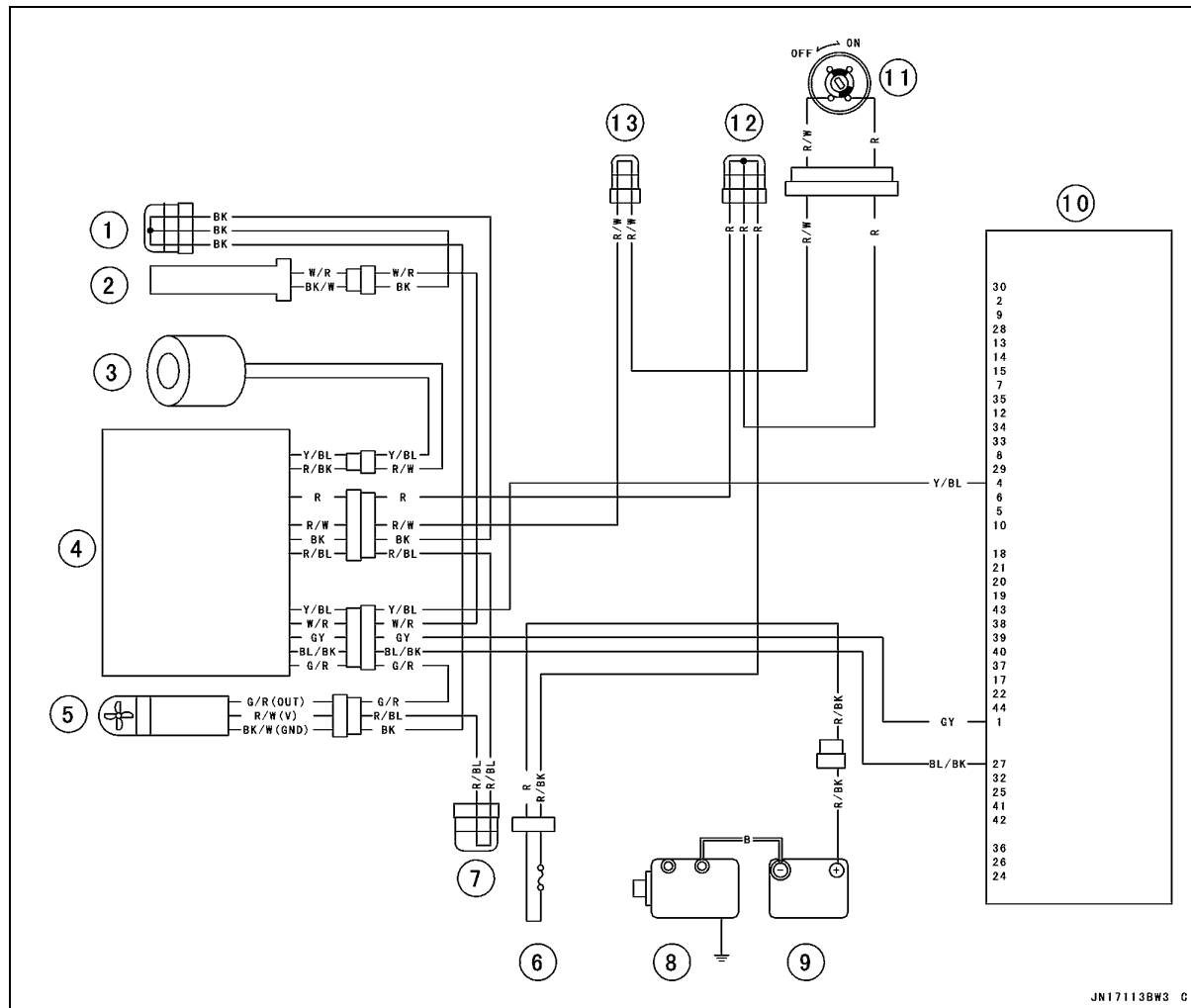
Hand tester [A]



14-70 ELECTRICAL SYSTEM

Multifunction Meter

Multifunction Meter Circuit (JT1500A8 Model ~)

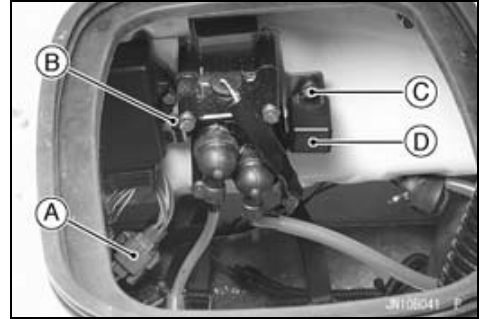


1. Joint Connector R
2. Fuel Level Sensor
3. Buzzer
4. Multifunction Meter
5. Speed Sensor
6. Main Fuse 20 A
7. Joint Connector V
8. Starter Motor
9. Battery 12 V 18 Ah
10. ECU (Electronic Control Unit)
11. Ignition Switch
12. Joint Connector P
13. Joint Connector Q

Relay Assembly

Removal

- Remove the seat (see Hull/Engine Hood chapter).
- Remove the rear storage pocket.
- Remove:
 - Relay Assembly Connector [A]
 - Clamp [B]
 - Bolt [C]
 - Relay Assembly [D]



Installation

- Apply a non-permanent locking agent to the relay assembly mounting bolt and tighten it securely.
- Route the relay assembly leads correctly (see Cable, Wire and Harness Routing in Appendix chapter).

Circuit Inspection

- Remove the relay assembly.
- Check conductivity of the following numbered terminals by connecting the hand tester and one 12 V battery to the relay assembly as shown.
- ★ If the tester does not read as specified, replace the relay assembly.

14-72 ELECTRICAL SYSTEM

Relay Assembly

Relay Assembly Circuit Inspection (with the battery disconnected)

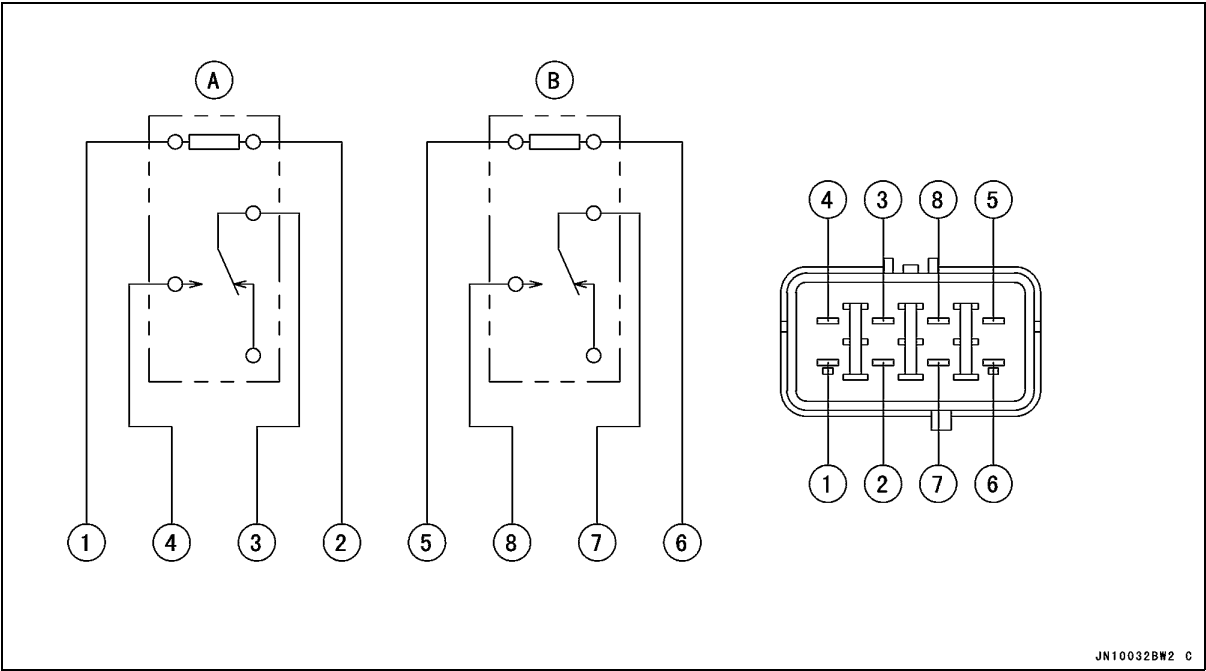
	Tester Connection	Tester Reading (Ω)
ECU Main Relay [A]	3-4	∞
	1-2	Not ∞^*
Fuel Pump Relay [B]	7-8	∞
	5-6	Not ∞^*

(*) : The actual reading varies with the hand tester used.

Relay Assembly Circuit Inspection (with the battery connected)

	Battery Connection (+) (-)	Tester Connection	Tester Reading (Ω)
ECU Main Relay [A]	1-2	3-4	0
Fuel Pump Relay [B]	5-6	7-8	0

(+) : Apply positive lead.
(-) : Apply negative lead.



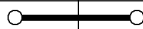
Switches

Switch Inspection

- Using a hand tester, check to see that only the connections shown in the table have continuity (about zero ohms).
- For the switch housing and the ignition switch, refer to the tables in the Wiring Diagram.
- ★ If the switch has an open or short, repair it or replace it with a new one.

Special Tool - Hand Tester: 57001-1394

Ignition Switch

	R	R/W	BK/W	W
ON				
OFF				

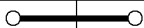
Start Switch

	Y/R	Y/R
PUSH		

Stop Switch

	BK	W
FREE		
PUSH		

Tether Switch

TETHER CORD	BK	W	R/PU	Y/R
SET				
PULL				

Engine Oil Pressure Switch Connections*

	SW. Terminal	
When engine is stopped		
When engine is running		

*: Engine lubrication system is in good condition

14-74 ELECTRICAL SYSTEM

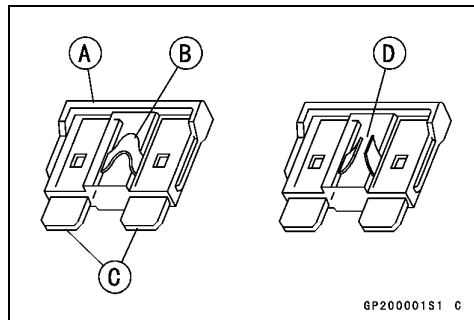
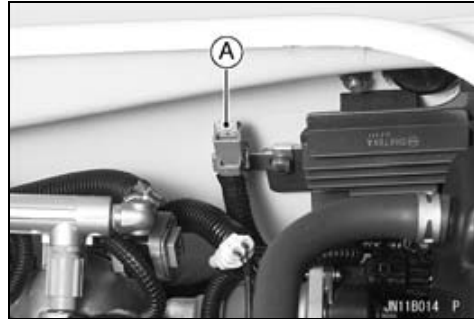
Fuse

Fuse Inspection

- Remove:
 - Seat
 - Fuse Case [A]

- Take out the fuse [A].

- Inspect the fuse element.
- ★ If it blown out, replace the fuse. Before replacing a blown fuse, always check the amperage in the affected circuit. If the amperage is equal to or greater than the fuse rating, check the wiring and related components for a short circuit.
 - Housing [A]
 - Fuse Element [B]
 - Terminals [C]
 - Blown Element [D]



NOTICE

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

Storage

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15-2 STORAGE

Preparation for Storage

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

NOTE

○ *Personal watercraft is not meant to be left in the water for extended periods. Continuous exposure to water over a long period of time will cause the hull paint to bubble and peel. It also causes electrolytic erosion of the metal parts of the pump, decreasing its service life. Larger boats which are left in the water must be hauled out periodically, so the bottom of the hull can be scraped and repainted with anti-fouling paint. They also usually have a sacrificial anode to reduce electrolytic erosion of metal parts in contact with the water.*

Cooling System

- Clean the cooling system (see Cooling System Flushing in the Periodic Maintenance chapter).
- When storing the watercraft in an area where the temperature drops below freezing, perform the following.

Discharging water in the exhaust system

NOTICE

Water in the exhaust system could freeze during cold weather and damage the exhaust pipe. Discharge water from the exhaust system after flushing the cooling system.

- After flushing, remove the cooling water hose [C] from the fitting [B] on the engine output cover [A] at the rear of the engine. Lead the hose to the lowest level in the engine room so that water remaining in the exhaust pipe [D] drains out.

Air Filter Box [E]

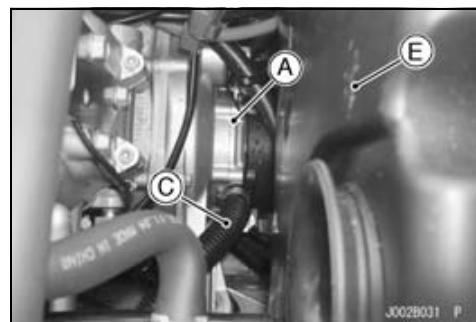
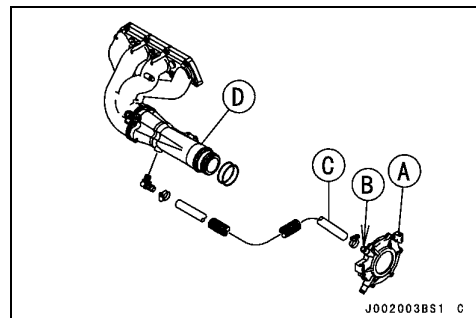
- Connect the hose to fitting on the output cover and tighten the clamp securely.

NOTICE

If the hose comes off during operation, cooling water could swamp the boat.

Connect the hose securely to the fitting.

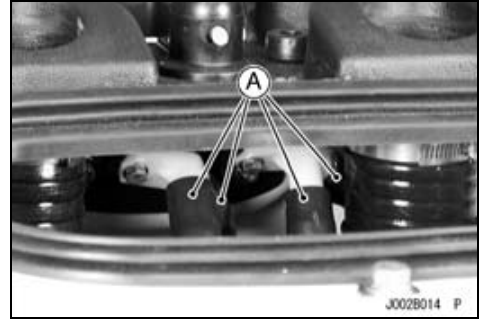
If you are not confident you can perform storage procedures, ask your Kawasaki JET SKi watercraft dealer for this service.



Preparation for Storage

Bilge System

- Clean the bilge system (see Bilge System Flushing in the Periodic Maintenance chapter). Before reconnecting the hoses to the plastic breather fitting, blow air through both hoses [A] to force all water out of the bilge system.



Engine Oil

- Change the engine oil (see Engine Lubrication System in Periodic Maintenance chapter).

Fuel System

⚠ WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. To avoid a possible fire or explosion, pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

- Drain the fuel tank. This should be done with a siphon or pump.
[A] Siphon Hose

NOTE

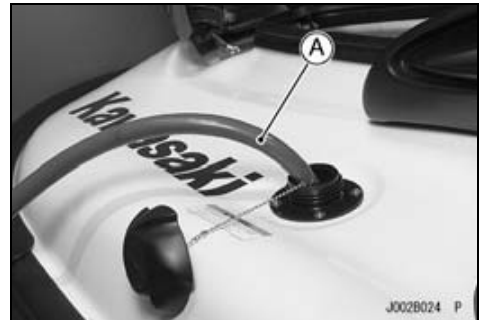
○Lift the stern upward a little so that fuel and water in the bottom of the fuel tank may flow toward the fuel filter to completely drain the fuel tank.

- Remove the fuel pump (see the Fuel System chapter).
- Clean the fuel pump screen [A] (see Fuel System in Periodic Maintenance chapter).
- Refill the fuel tank with fresh fuel approximately 10 L (2.6 gal U.S.).
- Turn the ignition switch on.
- Push the lanyard key under the stop button, and start the engine and run it in 15 second periods until all fuel in the fuel system is with fresh fuel. Wait 5 minutes between 15 seconds running periods.

NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

- Pull the lanyard key off the stop button and turn the ignition switch off.
- Drain the fuel tank.
- Leave the fuel filler cap loose to prevent condensation in the tank.

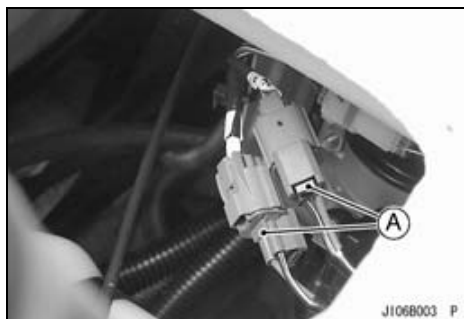


15-4 STORAGE

Preparation for Storage

Engine

- Remove the front storage pocket (see Hull/Engine Hood chapter).
- Disconnect both two connection on the ignition coil primary lead connectors [A].
- Remove the spark plugs (see Electrical System in Periodic Maintenance chapter).
- Spray fogging oil directly into each cylinder.
- Turn the ignition switch on.
- Push the lanyard key under the stop button. Turn the engine over several times with the start button to coat the cylinder walls with oil.



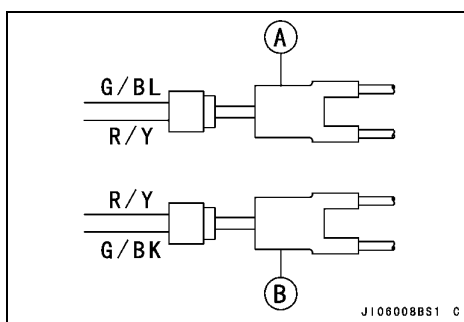
WARNING

An air/oil mist may be forcibly ejected from the spark plug holes and could get into your eyes. Do not lean over the engine when performing this procedure. If you do get oil in your eyes, wash them immediately with liberal amounts of clean, fresh water and consult a physician as soon as possible.

- Pull the lanyard key off the stop button and turn the ignition switch off.
- Spray the spark plugs with fogging oil, and reinstall the spark plugs and caps (see Electrical System in Periodic Maintenance chapter).
- Reconnect the primary ignition coil lead connectors, noting the #1, #4 [A] and the #2, #3 [B] coil connectors. The #1, #4 coil connector has a red/yellow and a green/blue leads from the main harness. The #2, #3 coil connector has a red/yellow and green/black leads from the main harness.

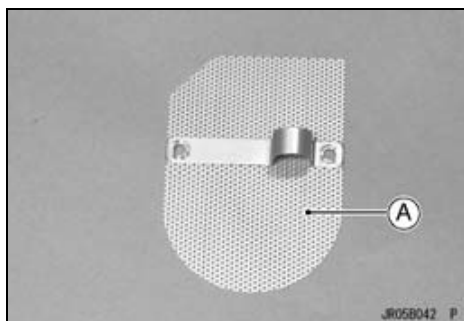
NOTE

○The service codes (COIL1 and COIL2) caused by this procedure are stored in the ECU. If necessary, these service codes can be erased by using the Kawasaki Diagnostic System (KDS).



Air Filter

- Remove the air filter (see Fuel (DFI) System chapter).
- Disassemble the air filter (see Fuel (DFI) System chapter).
- Wash and dry the flame arrester [A].
- Assemble and install the air filter (see Fuel (DFI) System chapter).



Preparation for Storage

Battery

- Give a refresh charge before you store the watercraft and store it with the negative lead removed. Give a refresh charge once a month during storage.
- Remove the battery (see Battery Removal in the Electrical System chapter).
- Clean the exterior with a solution of baking soda and water (one heaping tablespoon of baking soda in one cup of water). Rinse thoroughly with water.

NOTICE

Do not allow any soda solution to enter the battery.

- Coat both battery terminals with grease.
- Store the battery in a cool, dry place. Do not expose it to freezing temperatures.

Engine Mounting Bolts

- Tighten all engine mounting bolts (see Engine Removal/Installation chapter).

Torque - Engine Mounting Bolts: 36 N·m (3.7 kgf·m, 27 ft·lb)

Lubrication

- Carry out all recommended lubrication procedures (see Lubrication in Periodic Maintenance chapter).

General

- Wash the engine compartment with fresh water and remove the drain screw in the stern to drain the water. Wipe up any water left in the compartment.

NOTICE

Harsh solvents may attack the surface or smear the colors of the hull. Use only a mild detergent in water to wash the hull.
--

- Apply a good grade of wax to all exterior hull surfaces.
- Lightly spray all exposed metal parts with a penetrating rust inhibitor.
- Remove the seat, or block the seat up with 10 mm (0.39 in.) spacers to insure adequate ventilation, and prevent corrosion.
- Cover the watercraft and store it in a clean, dry place.

15-6 STORAGE

Removal from Storage

Lubrication

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

General Inspection

- Check for binding or sticking throttle, steering or shift mechanism. The throttle lever must return fully when released.
- Clean and gap spark plugs (see Electrical System in Periodic Maintenance chapter).
- Check all rubber hoses for weathering a cracking, or looseness.
- Check that the drain screw in the stern is securely tightened.
- Check the fire extinguisher for a full charge.
- Check the battery, charge if necessary, and clean the terminals. Install the battery (see Battery Installation in Electrical System chapter).

Fuel System

- Check and clean or replace the fuel pump screens as necessary (see Fuel System in Periodic Maintenance chapter).

WARNING

Gasoline is extremely flammable and can be explosive under certain conditions. To avoid a possible fire or explosion, pull the lanyard key off the stop button. Do not smoke. Make sure the area is well ventilated and free from any source of flame or sparks; this includes any appliance with a pilot light.

- After refueling and before starting the engine, tilt the seat to the rear for several minutes to ventilate the engine compartment.

WARNING

A concentration of gasoline fumes in the engine compartment can cause a fire or explosion. To prevent a fire or explosion, remove the seat to vent the engine compartment.

- Check for fuel leaks. Repair if necessary.
- Check the engine oil level. Fill the oil with the specified oil.

Removal from Storage

Test Run

DANGER

Exhaust gas contains carbon monoxide, a colorless, odorless poisonous gas. Inhaling carbon monoxide can cause serious brain injury or death. **DO NOT** run the engine in enclosed areas. Operate only in a well-ventilated area.

- Start the engine and run it only for 15 seconds. Check for fuel, oil and exhaust leaks. Any leaks must be repaired.

NOTICE

Operating the engine without cooling water for more than 15 seconds, especially at high rpm, will cause severe engine and exhaust system damage. To avoid engine damage, do not run the engine without providing sufficient cooling water.

- Install the seat making sure it is locked.

Appendix

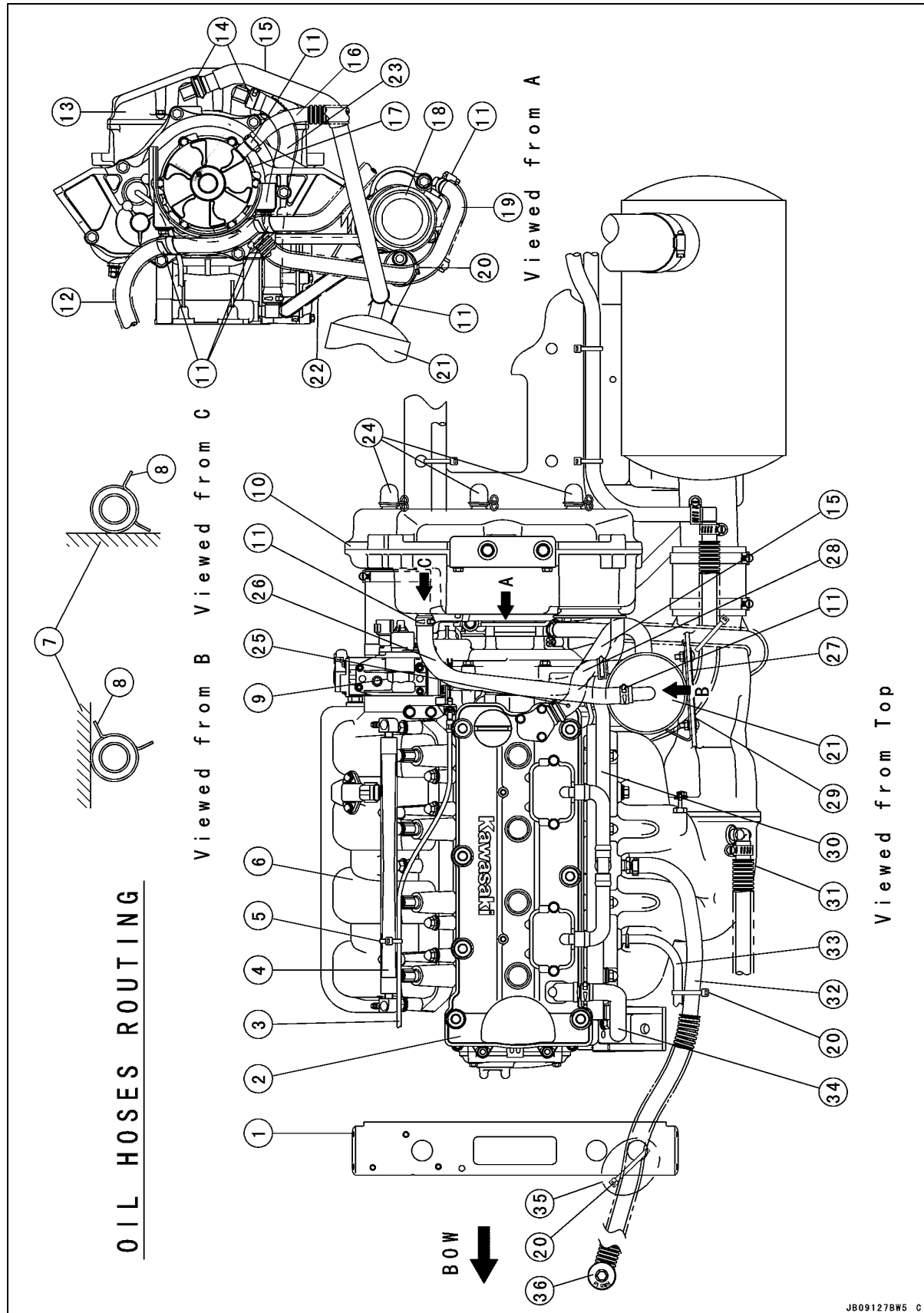
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Troubleshooting Guide	16-46

16-2 APPENDIX

Cable, Wire and Hose Routing

JT1500-A1 ~ A8 Models



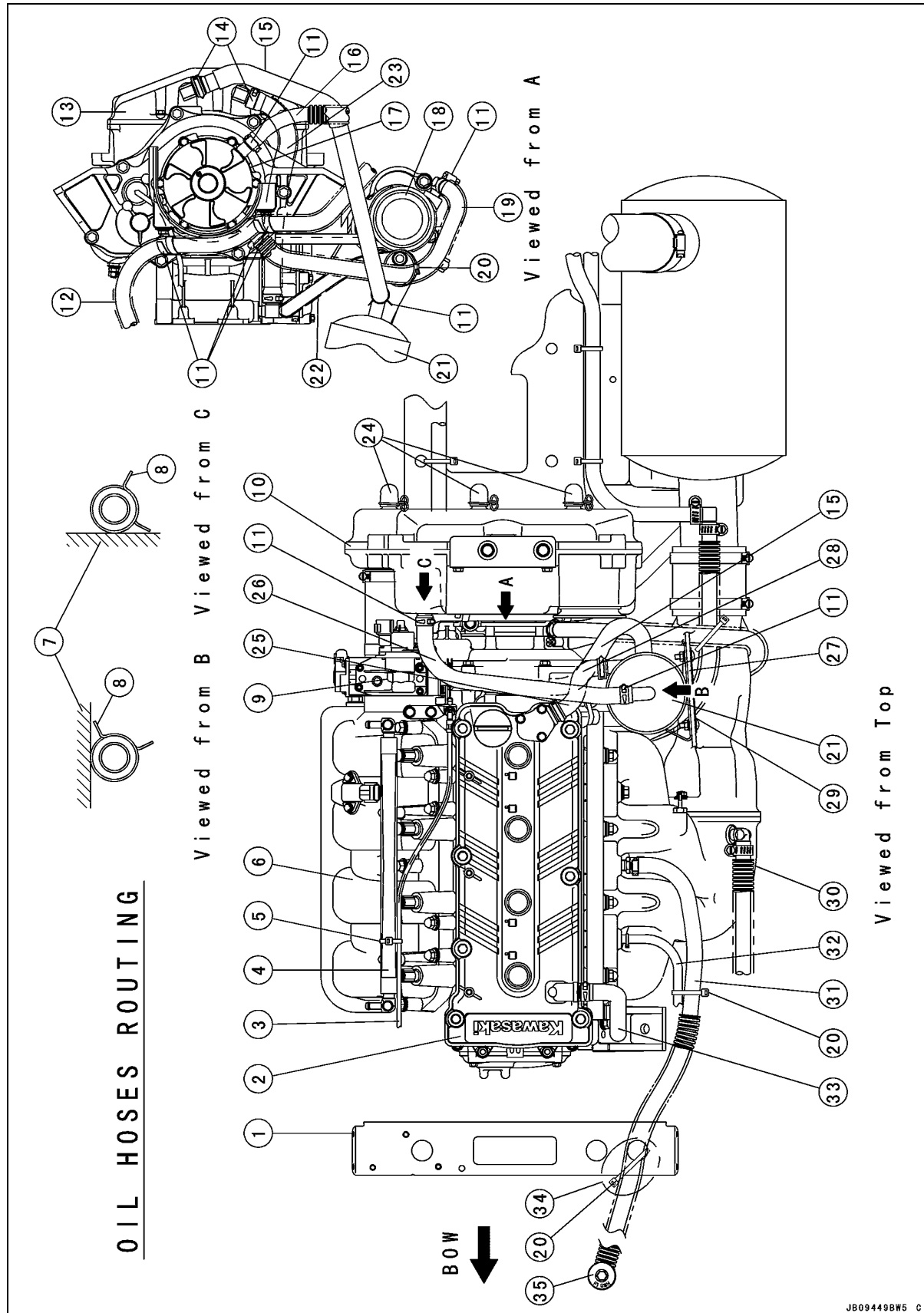
Cable, Wire and Hose Routing

1. Crossmember
2. Cylinder Head Cover
3. Throttle Cable
4. Delivery Pipe
5. Fix the throttle cable to the delivery pipe with the band.
6. Inlet Manifold
7. Horizontal Plane
8. Position the clamp pinch head below the horizontal plane.
9. Throttle Body Assy
10. Air Filter
11. Clamps
12. Cooling Hose (Cylinder ~ Left Water Box Muffler)
13. Oil Pan
14. Position the clamp pinch head as shown.
15. Oil Separator Tank Hose (Tank ~ Oil Pan)
16. Cooling Hose (Pump ~ Output Cover)
17. Output Cover
18. Exhaust Pipe
19. Cooling Hose (Output Cover ~ Exhaust Pipe)
20. Bands
21. Oil Separator Tank
22. Cooling Hose (Left Water Box Muffler ~ Cylinder)
23. Return Oil Hose (Cylinder ~ Oil Pan)
24. Air Filter Drain Caps
25. White Mark
26. Oil Separator Tank Hose (Tank ~ Air Filter)
27. Deck (Port Side)
28. Oil Separator Tank Hose (Cylinder Head Cover ~ Tank)
29. Plate
30. Air Suction Valve Hose
31. Exhaust Manifold
32. Flushing Hose
33. Bypass Outlet Hose
34. Breather Hose (Cylinder Head ~ Breather Case)
35. Run the flushing hose under the crossmember. Fix the flushing hose with the band at the left end hole so that the hose does not touch the crossmember.
36. Flushing Cap

16-4 APPENDIX

Cable, Wire and Hose Routing

JT1500A9 Model ~

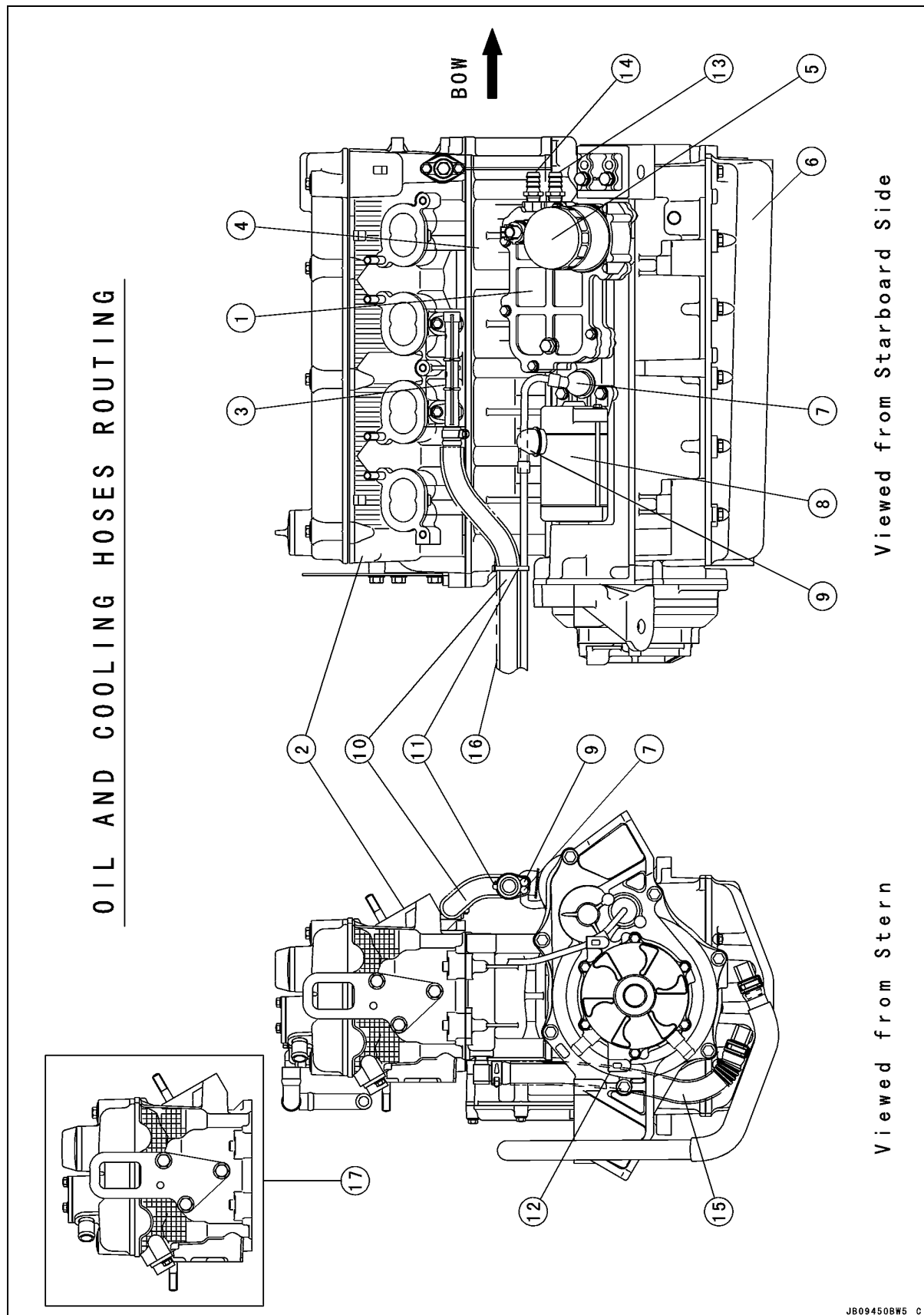


Cable, Wire and Hose Routing

1. Crossmember
2. Cylinder Head Cover
3. Throttle Cable
4. Delivery Pipe
5. Fix the throttle cable to the delivery pipe with the band.
6. Inlet Manifold
7. Horizontal Plane
8. Position the clamp pinch head below the horizontal plane.
9. Throttle Body Assy
10. Air Filter
11. Clamps
12. Cooling Hose (Cylinder ~ Left Water Box Muffler)
13. Oil Pan
14. Position the clamp pinch head as shown.
15. Oil Separator Tank Hose (Tank ~ Oil Pan)
16. Cooling Hose (Pump ~ Output Cover)
17. Output Cover
18. Exhaust Pipe
19. Cooling Hose (Output Cover ~ Exhaust Pipe)
20. Bands
21. Oil Separator Tank
22. Cooling Hose (Water Box Muffler ~ Cylinder)
23. Return Oil Hose (Cylinder ~ Oil Pan)
24. Air Filter Drain Caps
25. White Mark
26. Oil Separator Tank Hose (Tank ~ Air Filter)
27. Deck (Port Side)
28. Oil Separator Tank Hose (Cylinder Head Cover ~ Tank)
29. Plate
30. Exhaust Manifold
31. Flushing Hose
32. Bypass Outlet Hose
33. Breather Hose (Cylinder Head ~ Breather Case) (JT1500A9 ~ AB Models)
34. Run the flushing hose under the crossmember. Fix the flushing hose with the band at the left end hole so that the hose does not touch the crossmember.
35. Flushing Cap

16-6 APPENDIX

Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

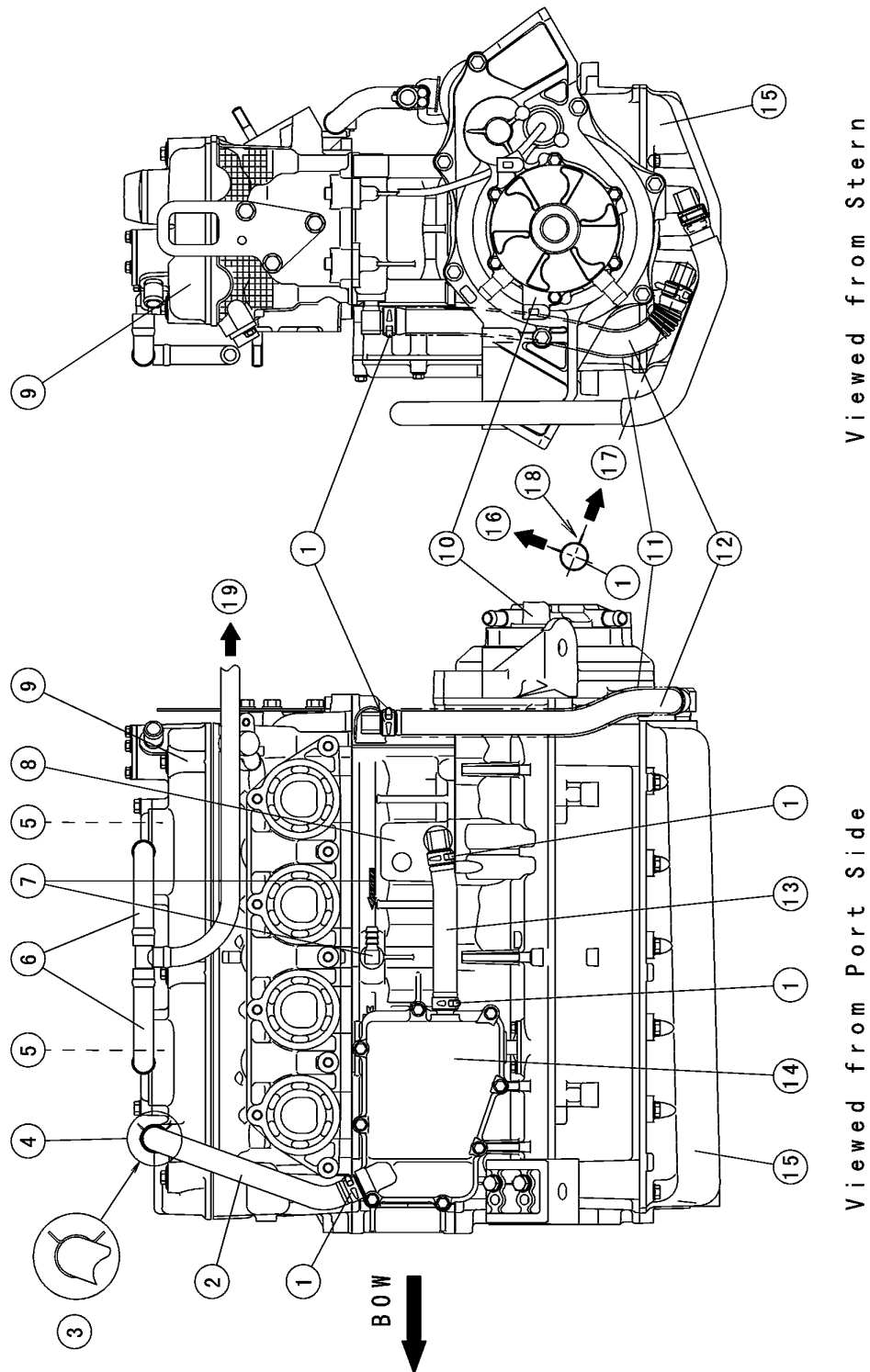
1. Oil Cooler
2. Cylinder Head
3. Water Pipe
4. Cylinder
5. Oil Filter
6. Oil Pan
7. Battery (-) Cable
8. Starter Motor
9. Starter Motor Cable
10. Cooling Hose (Cylinder Head ~ Left Water Box Muffler)
11. Fix the No.10 cooling hose, battery (-) cable and starter motor cable with the band.
12. Output Cover
13. Water Hose Joint (Inlet)
14. Water Hose joint (Outlet)
15. Return Oil Hose (Cylinder ~ Oil Pan)
16. Protective Tube
17. JT1500A9 Model ~

16-8 APPENDIX

Cable, Wire and Hose Routing

JT1500-A1 ~ A8 Models

BREATHER AND COOLING HOSES ROUTING



Cable, Wire and Hose Routing

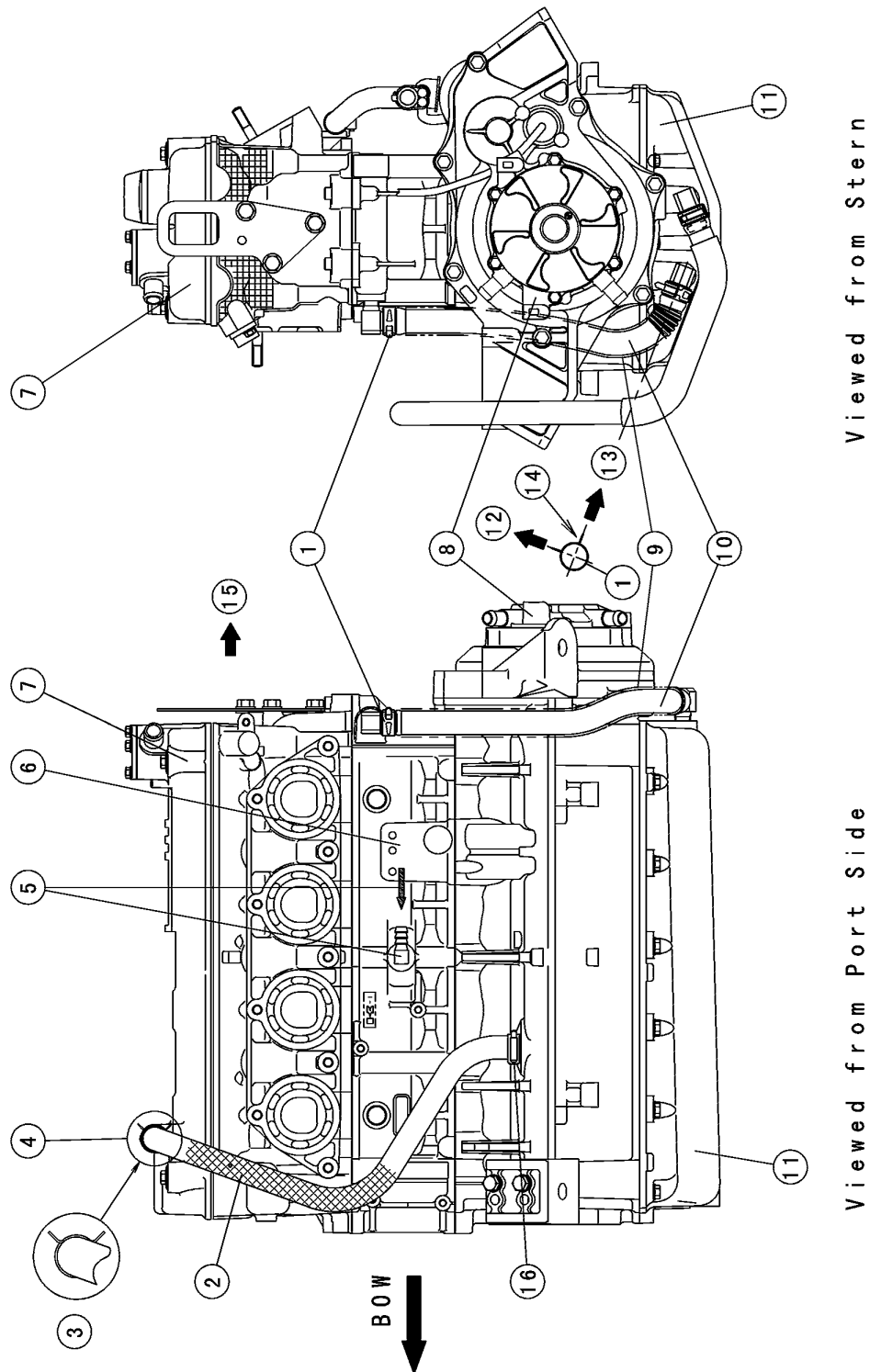
1. Clamps
2. Breather Hose (Cylinder Head ~ Breather Case)
3. Clamp Detail
4. Position the clamp pinch heads as shown.
5. Air Suction Valve
6. Air Suction Valve Hose
7. Inlet Water Pipe Joint on the Cylinder (Cooling Water from Left Water Box Muffler)
8. Cylinder
9. Cylinder Head Cover
10. Output Cover
11. Protective Tube
12. Return Oil Hose (Cylinder ~ Oil Pan)
13. Breather Hose (Cylinder ~ Breather Case)
14. Breather Case
15. Oil Pan
16. Front Pinch Head
17. Rear Pinch Head
18. Position the clamp so that its pinch heads do not touch the oil separator tank hose.
19. To Air Filter

16-10 APPENDIX

Cable, Wire and Hose Routing

JT1500A9 Model ~

BREATHER AND COOLING HOSES ROUTING



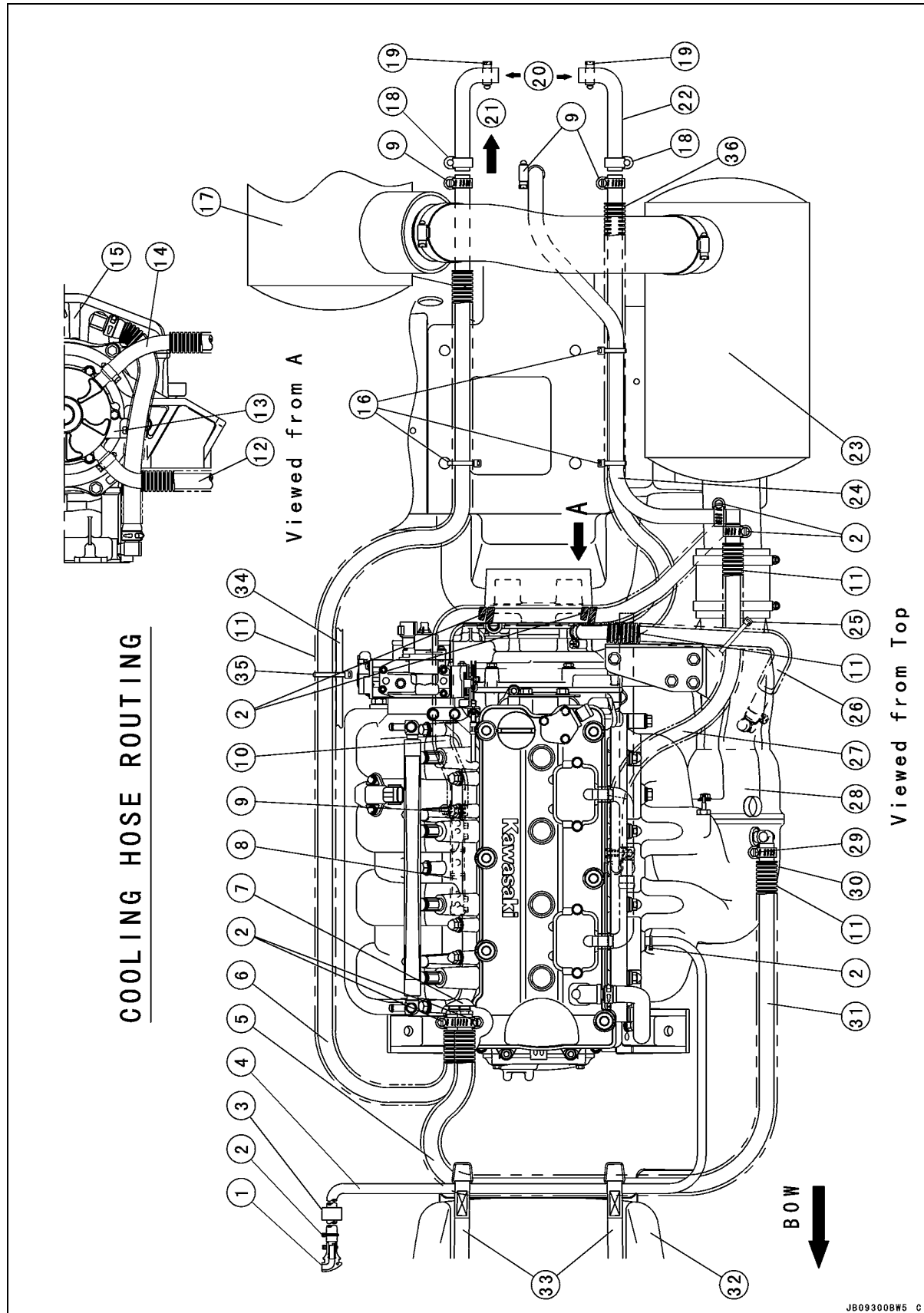
Cable, Wire and Hose Routing

1. Clamps
2. Breather Hose (Cylinder Head ~ Crankcase) (JT1500A9 ~ AB Models)
3. Clamp Detail (JT1500A9 ~ AB Models)
4. Position the clamp pinch heads as shown. (JT1500A9 ~ AB Models)
5. Inlet Water Pipe Joint on the Cylinder (Cooling Water from Water Box Muffler)
6. Cylinder
7. Cylinder Head Cover
8. Output Cover
9. Protective Tube
10. Return Oil Hose (Cylinder ~ Oil Pan)
11. Oil Pan
12. Front Pinch Head
13. Rear Pinch Head
14. Position the clamp so that its pinch heads do not touch the oil separator tank hose.
15. To Air Filter
16. Clamp (JT1500A9 ~ AB Models)

16-12 APPENDIX

Cable, Wire and Hose Routing

JT1500-A1 ~ A8 Models



Cable, Wire and Hose Routing

Refer to the Exploded View and Flow Diagram in the Cooling and Bilge Systems chapter.

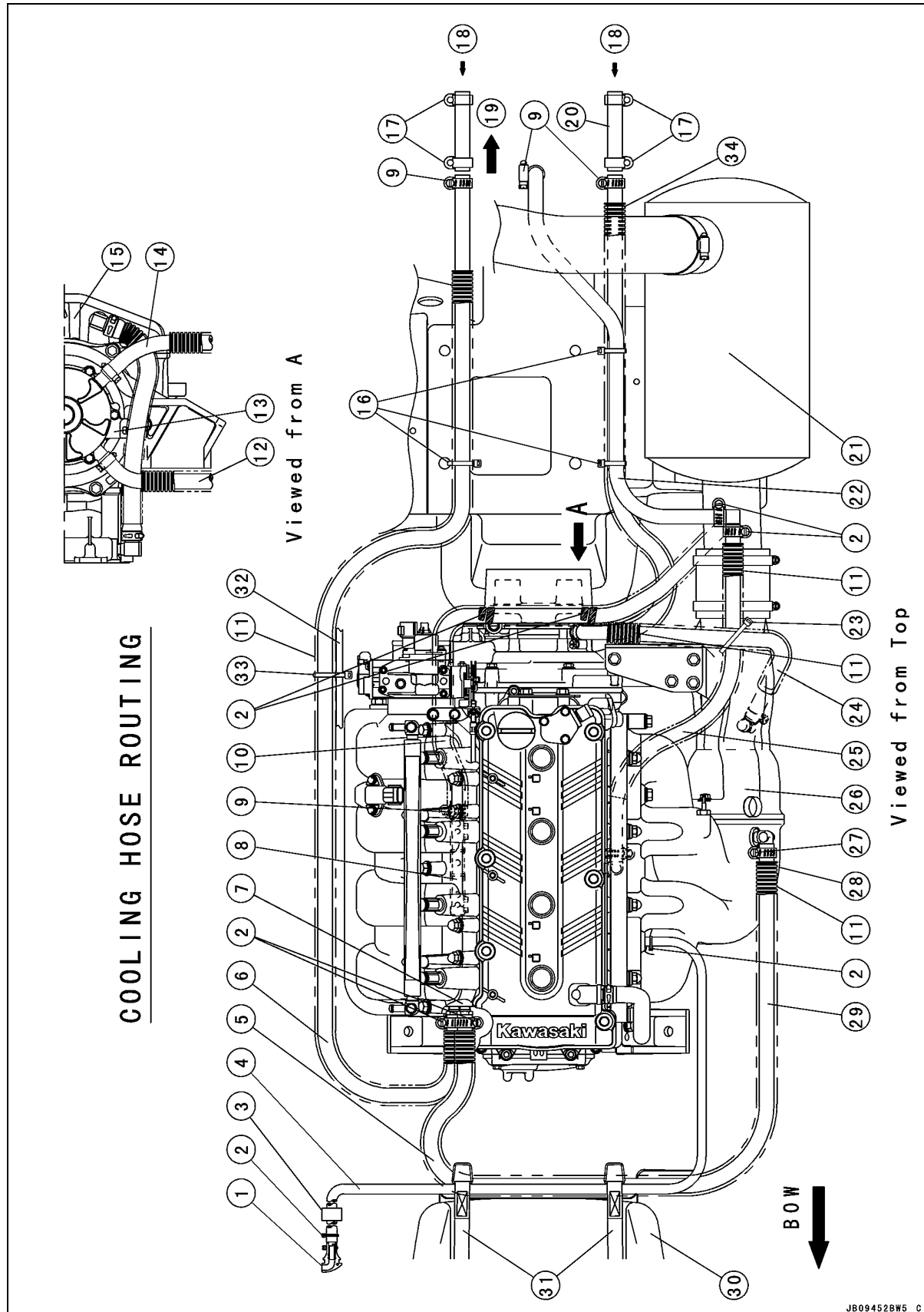
Install the clamp as shown, noting its screw head direction.

1. Bypass Outlet
2. Clamps
3. Holder
4. Bypass Outlet Hose: Run the bypass outlet hose between the fuel tank and the straps as shown.
5. Cooling Hose (Oil Cooler ~ Exhaust Manifold): Run the cooling hose between the fuel tank and the straps as shown.
6. Cooling Hose (Pump ~ Oil Cooler)
7. Oil Cooler
8. Water Pipe on the Cylinder Head
9. Position the clamp screw head as shown.
10. Cooling Hose (Cylinder Head ~ Water Pipe Joint under the Left Water Box Muffler)
11. Protective Tube
12. Cooling Hose (Output Cover ~ Exhaust Pipe)
13. Output Cover
14. Cooling Hose (Pump ~ Output Cover)
15. Oil Pan
16. Bands
17. Right Water Box Muffler
18. Position the clamp so that its screw head faces downward and outside.
19. Position the clamp so that its screw head faces backward.
20. Pump
21. Drain
22. Cooling Hose (Pump ~ Output Cover)
23. Left Water Box Muffler
24. Cooling Hose (Left Water Box Muffler ~ Hull)
25. Fix the No.26 and No.27 cooling hoses with the band.
26. Cooling Hose (Output Cover ~ Exhaust Pipe)
27. Cooling Hose (Left Water Box Muffler ~ Cylinder): Run the No.27 cooling hose under the No.26 cooling hose as shown.
28. Exhaust Pipe
29. Position the clamp so that its screw head faces inside.
30. Exhaust Manifold
31. Cooling Hose (Oil Cooler ~ Exhaust Manifold)
32. Fuel Tank
33. Fuel Tank Strap
34. Shift Cable
35. Fix the No. 6 cooling hose and the shift cable with the band.
36. Protective Tube (JT1500A6 Model ~)

16-14 APPENDIX

Cable, Wire and Hose Routing

JT1500A9 Model ~



Cable, Wire and Hose Routing

Refer to the Exploded View and Flow Diagram in the Cooling and Bilge Systems chapter.

Install the clamp as shown, noting its screw head direction.

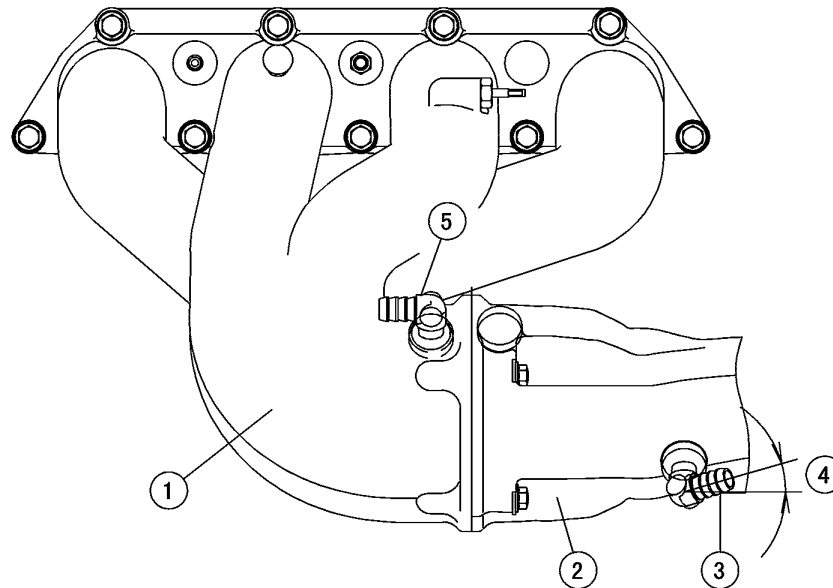
1. Bypass Outlet
2. Clamps
3. Holder
4. Bypass Outlet Hose: Run the bypass outlet hose between the fuel tank and the straps as shown.
5. Cooling Hose (Oil Cooler ~ Exhaust Manifold): Run the cooling hose between the fuel tank and the straps as shown.
6. Cooling Hose (Pump ~ Oil Cooler)
7. Oil Cooler
8. Water Pipe on the Cylinder Head
9. Position the clamp screw head as shown.
10. Cooling Hose (Cylinder Head ~ Water Pipe Joint under the Water Box Muffler)
11. Protective Tube
12. Cooling Hose (Output Cover ~ Exhaust Pipe)
13. Output Cover
14. Cooling Hose (Pump ~ Output Cover)
15. Oil Pan
16. Bands
17. Position the clamp so that its screw head faces downward and outside.
18. Pump
19. Drain
20. Cooling Hose (Pump ~ Output Cover)
21. Water Box Muffler
22. Cooling Hose (Water Box Muffler ~ Hull)
23. Fix the No.26 and No.27 cooling hoses with the band.
24. Cooling Hose (Output Cover ~ Exhaust Pipe)
25. Cooling Hose (Water Box Muffler ~ Cylinder): Run the No.27 cooling hose under the No.26 cooling hose as shown.
26. Exhaust Pipe
27. Position the clamp so that its screw head faces inside.
28. Exhaust Manifold
29. Cooling Hose (Oil Cooler ~ Exhaust Manifold)
30. Fuel Tank
31. Fuel Tank Strap
32. Shift Cable
33. Fix the No. 6 cooling hose and the shift cable with the band.
34. Protective Tube

16-16 APPENDIX

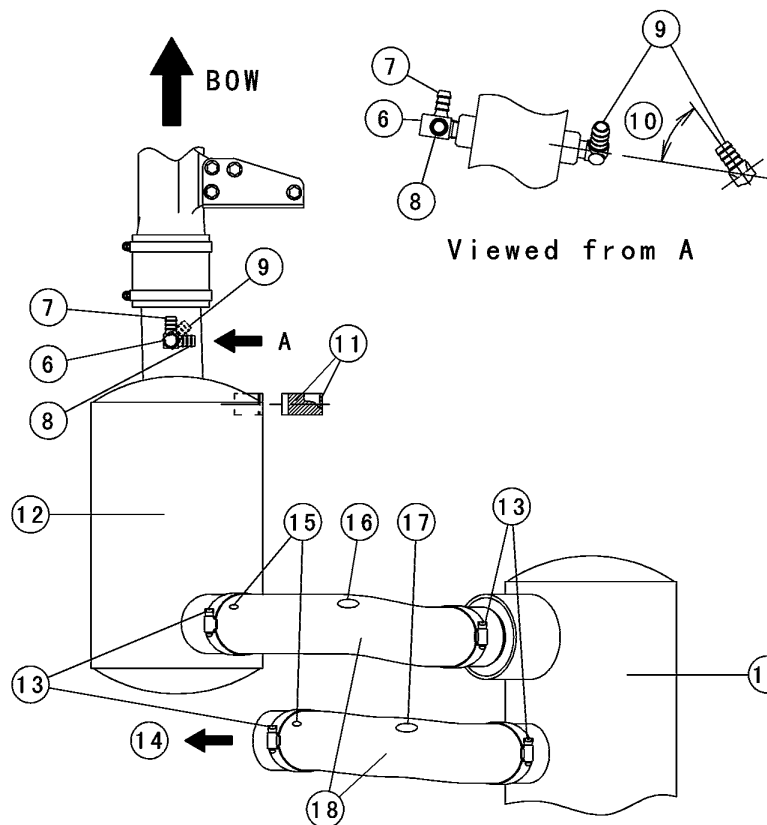
Cable, Wire and Hose Routing

JT1500-A1 ~ A8 Models

INSTALLING DIRECTION OF WATER HOSE JOINT



Viewed from Port Side



Viewed from Top

JB09131BWS C

Cable, Wire and Hose Routing

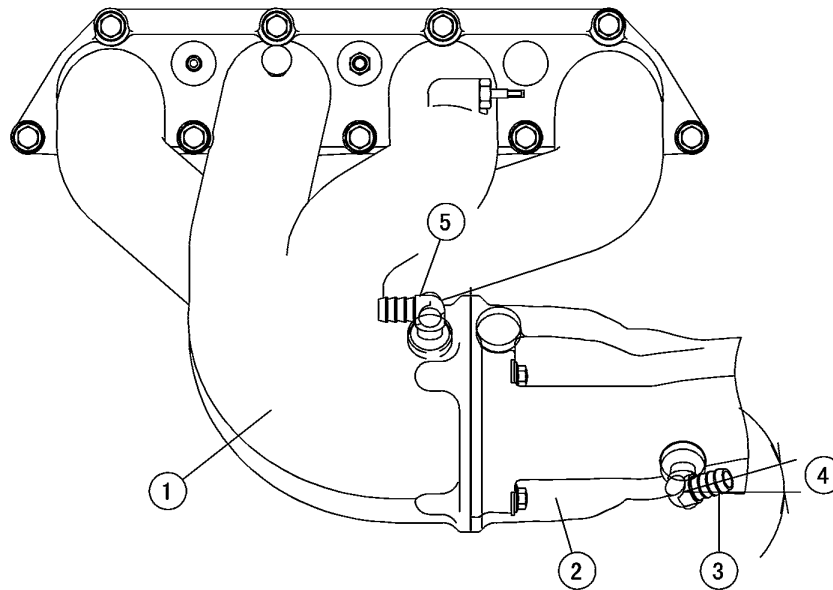
1. Exhaust Manifold
2. Exhaust Pipe
3. Water Hose Joint (Cooling Hose from the Output Cover)
4. 30°
5. Water Hose Joint (Cooling Hose from the Oil Cooler)
6. Upper Water Hose Joint
7. Water Hose Joint (Left Water Box Muffler ~ Cylinder)
8. Water Hose Joint (Left Water Box Muffler ~ Drain)
9. Lower Water Hose Joint
10. 45°
11. Dampers
12. Left Water Box Muffler
13. Position the clamp so that their screw heads face forward.
14. To Tail Pipe
15. White Marks
16. F Mark
17. R Mark
18. Exhaust Tubes
19. Right Water Box Muffler

16-18 APPENDIX

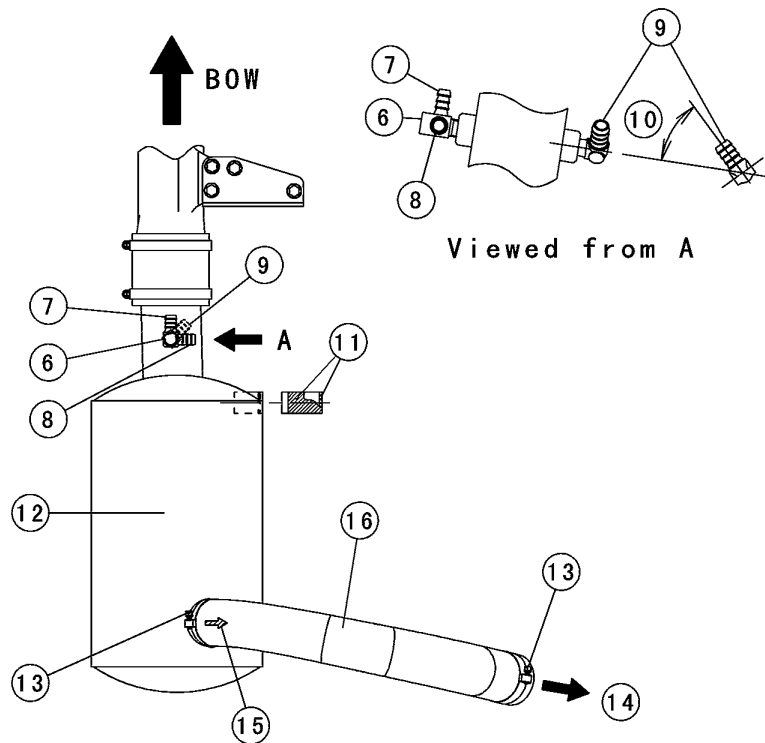
Cable, Wire and Hose Routing

JT1500A9 Model ~

INSTALLING DIRECTION OF WATER HOSE JOINT



Viewed from Port Side



Viewed from Top

JB09453BWS C

Cable, Wire and Hose Routing

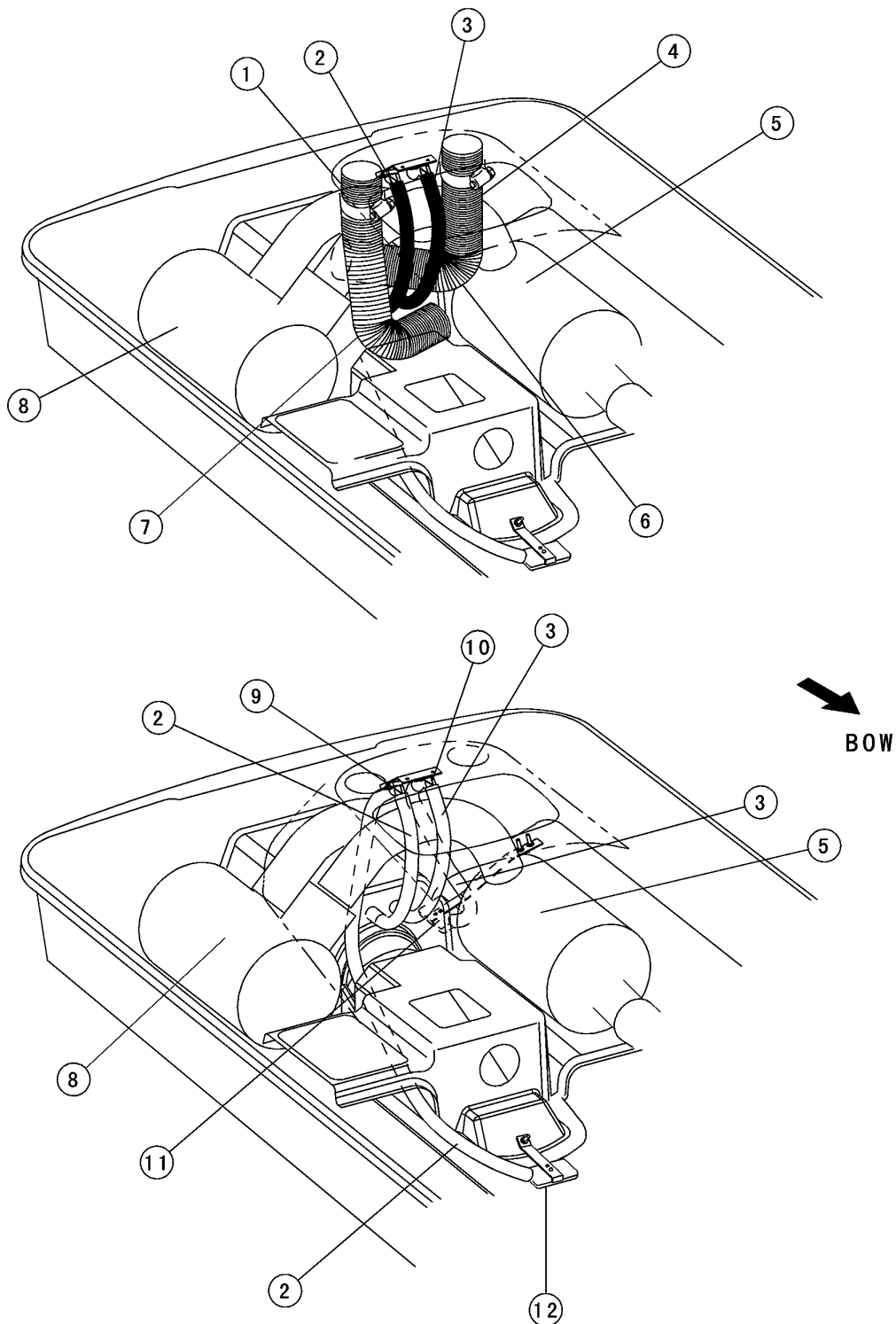
1. Exhaust Manifold
2. Exhaust Pipe
3. Water Hose Joint (Cooling Hose from the Output Cover)
4. 30°
5. Water Hose Joint (Cooling Hose from the Oil Cooler)
6. Upper Water Hose Joint
7. Water Hose Joint (Water Box Muffler ~ Cylinder)
8. Water Hose Joint (Water Box Muffler ~ Drain)
9. Lower Water Hose Joint
10. 45°
11. Dampers
12. Water Box Muffler
13. Position the clamp so that their screw heads face forward.
14. To Tail Pipe
15. Arrow Mark
16. Exhaust Tube

16-20 APPENDIX

Cable, Wire and Hose Routing

JT1500-A1 ~ A8 Models

BILGE HOSE ROUTING



JB09132BWS C

Cable, Wire and Hose Routing

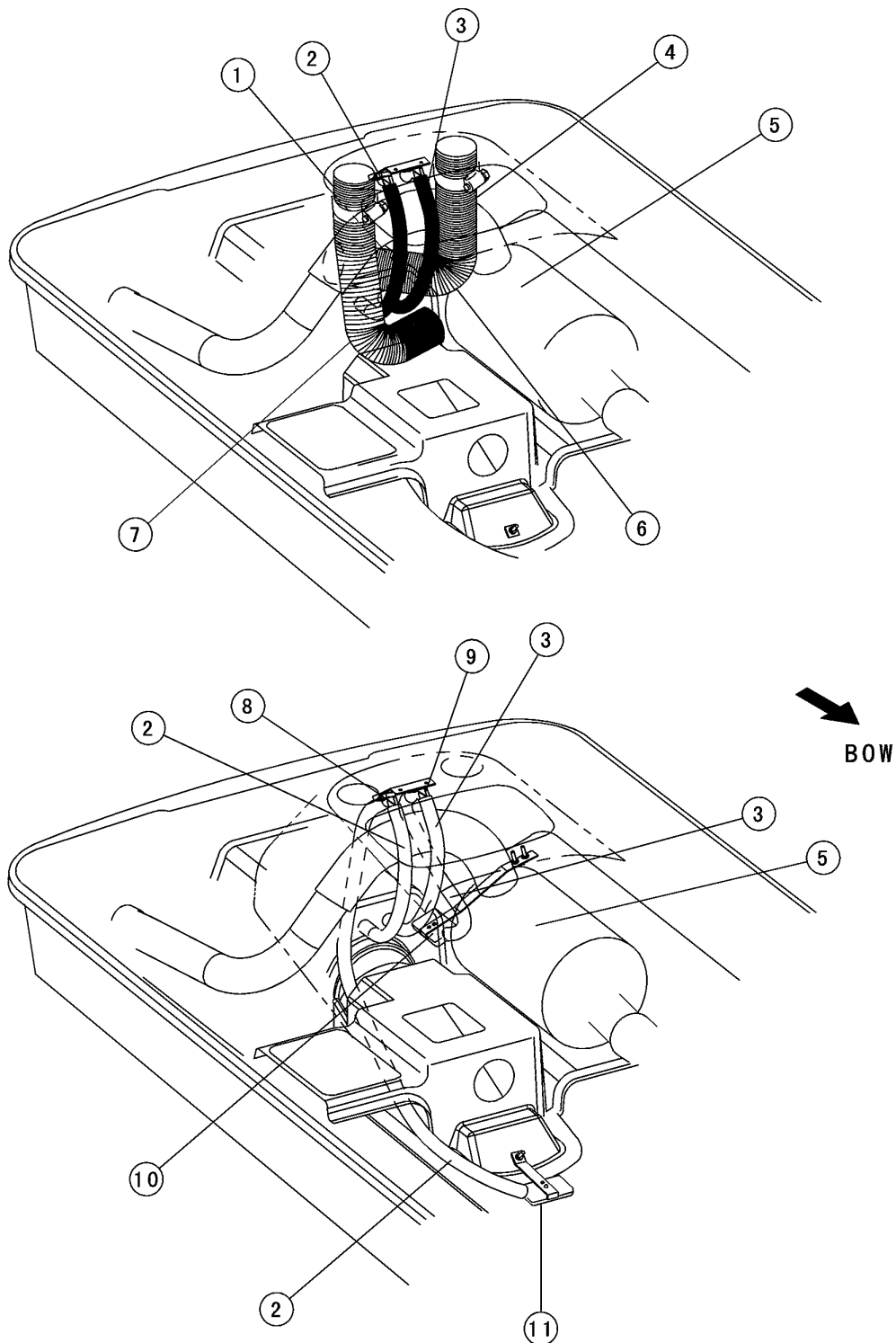
1. Right Rear Duct
2. Right Bilge Hose
3. Left Bilge Hose
4. Left Rear Duct
5. Left Water Box Muffler
6. Position the left rear duct inside the left bilge hose as shown.
7. Position the right rear duct under the right bilge hose as shown.
8. Right Water Box Muffler
9. Right Bilge Breather
10. Left Bilge Breather
11. Left Bilge Filter
12. Right Bilge Filter

16-22 APPENDIX

Cable, Wire and Hose Routing

JT1500A9 Model ~

BILGE HOSE ROUTING



JB09454BWS C

Cable, Wire and Hose Routing

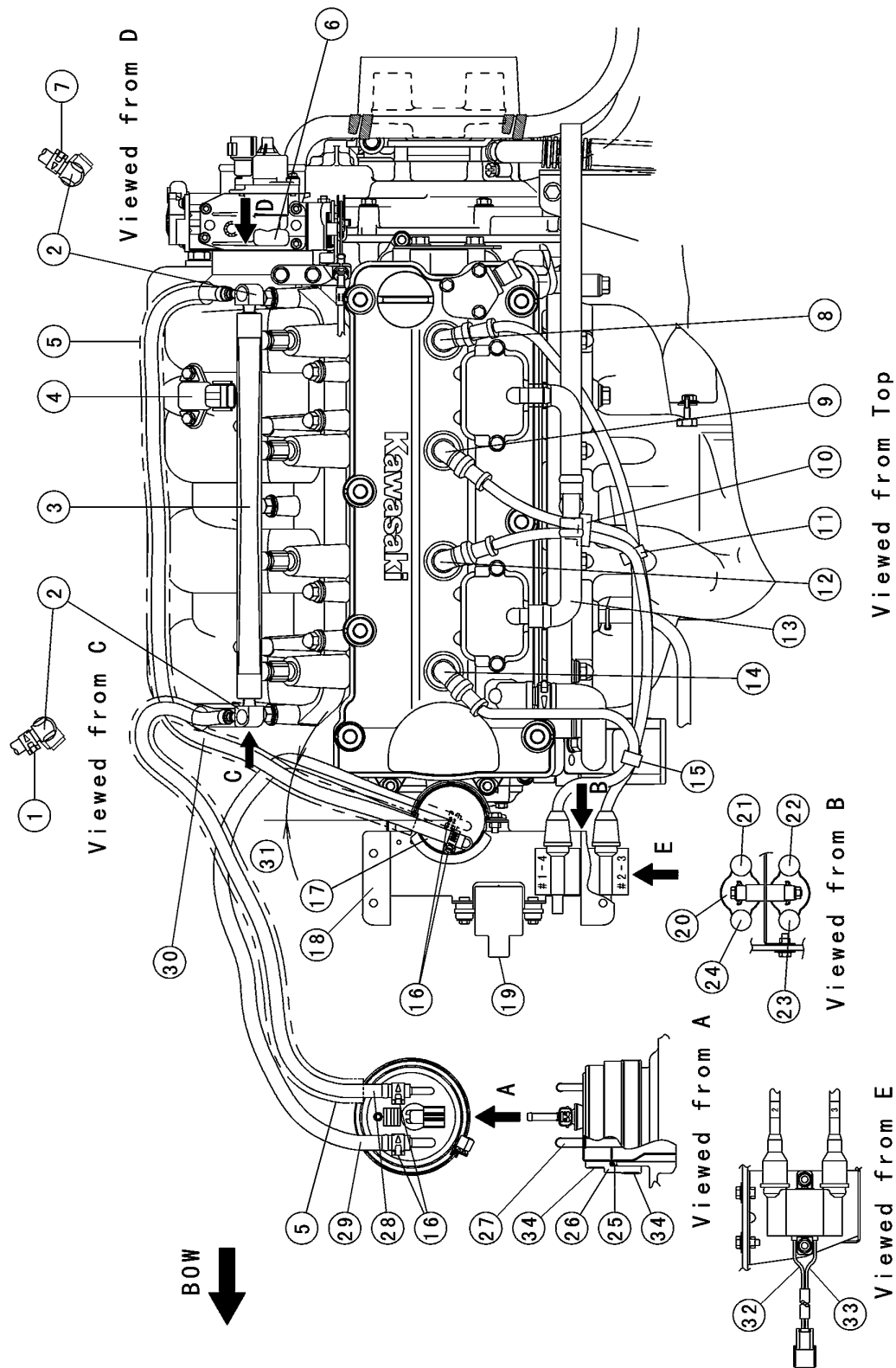
1. Right Rear Duct
2. Right Bilge Hose
3. Left Bilge Hose
4. Left Rear Duct
5. Water Box Muffler
6. Position the left rear duct inside the left bilge hose as shown.
7. Position the right rear duct under the right bilge hose as shown.
8. Right Bilge Breather
9. Left Bilge Breather
10. Left Bilge Filter
11. Right Bilge Filter

16-24 APPENDIX

Cable, Wire and Hose Routing

JT1500-A1 ~ A8 Models

FUEL AND IGNITION SYSTEM ROUTING



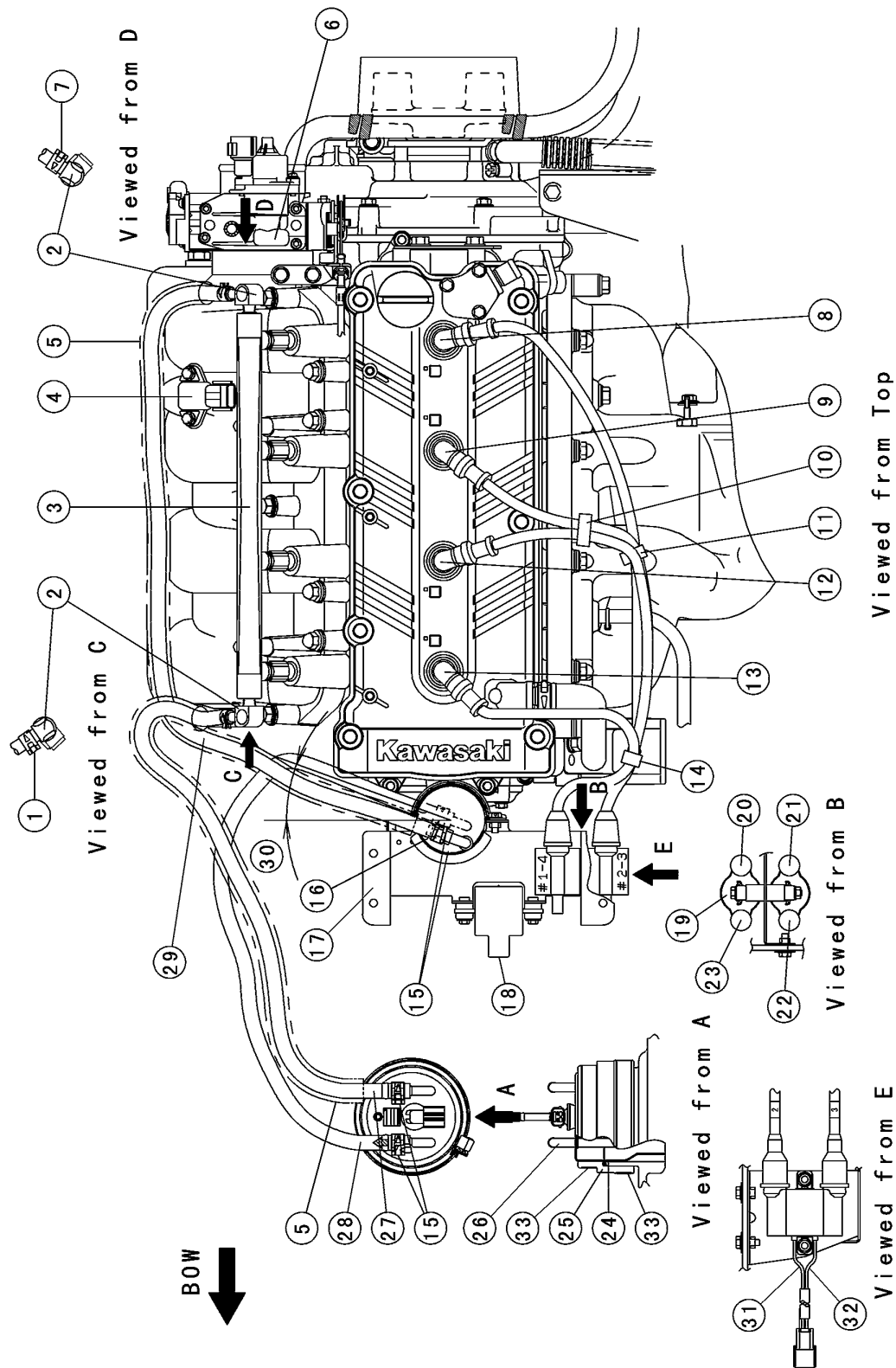
JB092368W5 C

Cable, Wire and Hose Routing

1. Position the clamp screw so that its head faces forward (JT1500-A1 Model).
Position the double spring clamp so that its pinch head faces forward (JT1500-A2 Model ~).
2. Delivery Pipe Joints
3. Delivery Pipe
4. Inlet Air Pressure Sensor
5. Protective Tube
6. Throttle Body Assy
7. Position the clamp screw so that its head faces backward (JT1500-A1 Model).
Position the double spring clamp so that its pinch head faces backward (JT1500-A2 Model ~).
8. #4 Spark Plug Cap
9. #3 Spark Plug Cap
10. Fix the #2 and #3 high tension leads with the clamp.
11. Fix the #3 and #4 high tension leads with the clamp.
12. #2 Spark Plug Cap
13. Air Suction Valve Hose
14. #1 Spark Plug Cap
15. Fix the #1 and #2 high tension leads with the clamp.
16. Clamp (JT1500-A1 Model)
Double Spring Clamp (JT1500-A2 Model ~)
17. Fuel Filter
18. Bracket
19. Vehicle-down Sensor
20. Ignition Coils
21. #4 High Tension Lead
22. #3 High Tension Lead
23. #2 High Tension Lead
24. #1 High Tension Lead
25. O-ring
26. Holder
27. Fuel Pump
28. Return Fuel Hose
29. Main Fuel Hose
30. Supply Fuel Hose
31. 20°
32. Position the black/white lead upward (both ignition coils).
33. Position the red lead downward (both ignition coils).
34. Clamp

JT1500A9 Model ~

FUEL AND IGNITION SYSTEM ROUTING



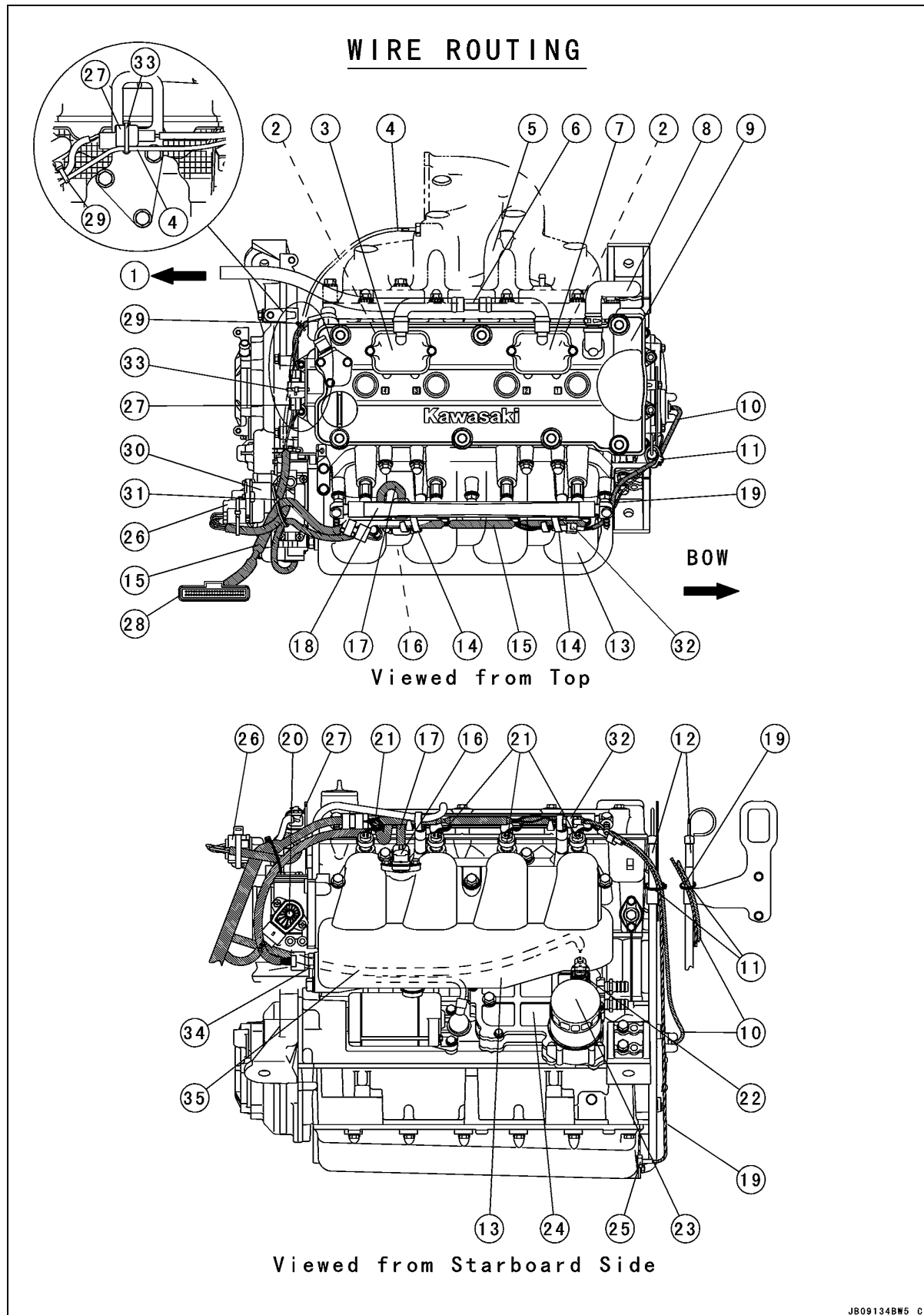
Cable, Wire and Hose Routing

1. Position the double spring clamp so that its pinch head faces forward.
2. Delivery Pipe Joints
3. Delivery Pipe
4. Inlet Air Pressure Sensor
5. Protective Tube
6. Throttle Body Assy
7. Position the double spring clamp so that its pinch head faces backward.
8. #4 Spark Plug Cap
9. #3 Spark Plug Cap
10. Fix the #2 and #3 high tension leads with the clamp.
11. Fix the #3 and #4 high tension leads with the clamp.
12. #2 Spark Plug Cap
13. #1 Spark Plug Cap
14. Fix the #1 and #2 high tension leads with the clamp.
15. Double Spring Clamp
16. Fuel Filter
17. Bracket
18. Vehicle-down Sensor
19. Ignition Coils
20. #4 High Tension Lead
21. #3 High Tension Lead
22. #2 High Tension Lead
23. #1 High Tension Lead
24. O-ring
25. Holder
26. Fuel Pump
27. Return Fuel Hose
28. Main Fuel Hose
29. Supply Fuel Hose
30. 20°
31. Position the black/white lead upward (both ignition coils).
32. Position the red lead downward (both ignition coils).
33. Clamp

16-28 APPENDIX

Cable, Wire and Hose Routing

JT1500-A1 ~ A8 Models



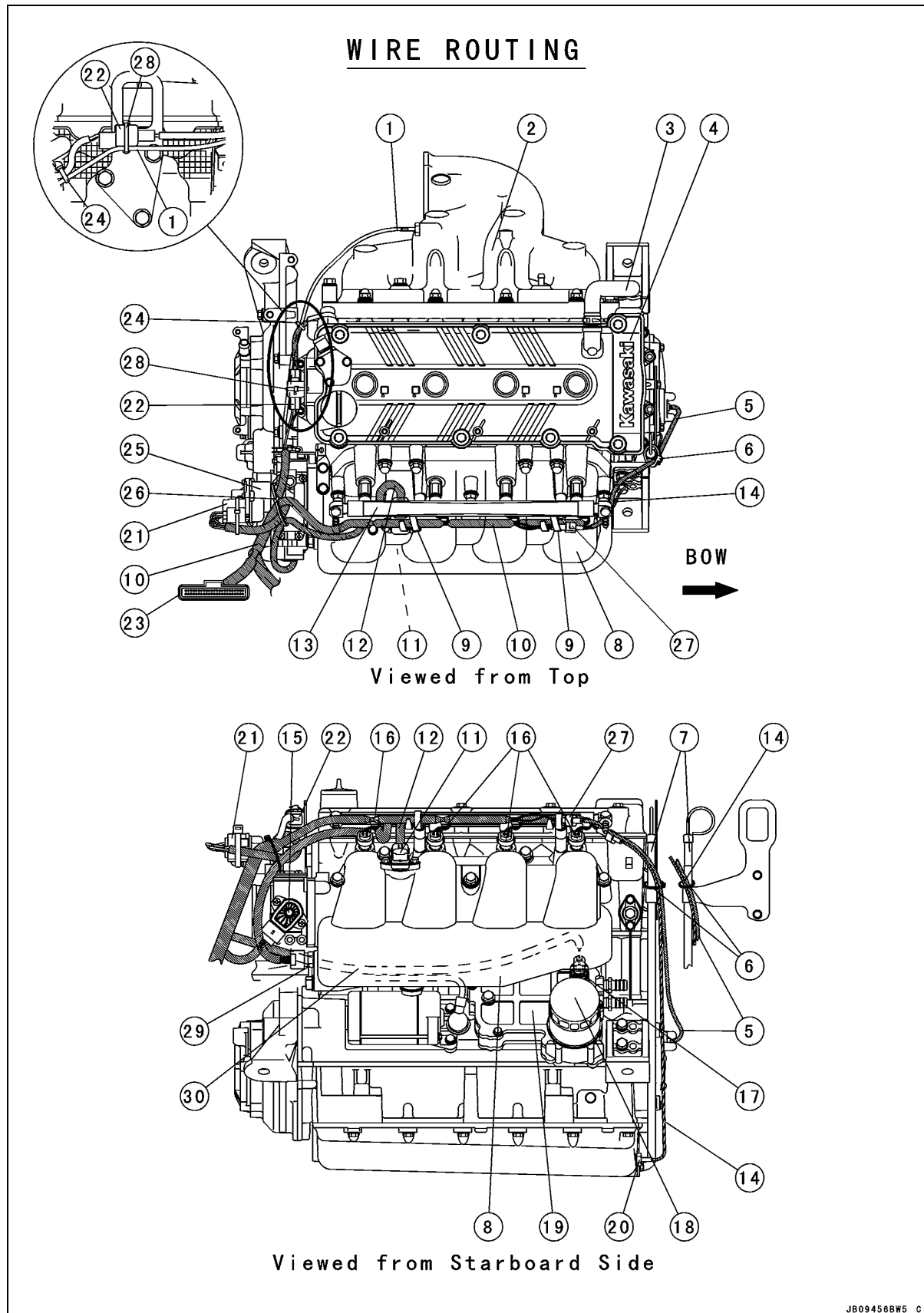
Cable, Wire and Hose Routing

1. Air Suction Valve Hose (to Air Filter)
2. Air Suction Valve
3. Air Suction Valve Cover (Rear)
4. Water Temperature Sensor Leads
5. Exhaust Manifold
6. Air Suction Valve Hose Fitting
7. Air Suction Valve Cover (Front)
8. Breather Hose
9. Cylinder Head Cover
10. Crankshaft Sensor Leads
11. Fix the crankshaft sensor lead and the oil temperature sensor lead to the dipstick pipe with the band.
12. Dipstick Pipe
13. Inlet Manifold
14. Clamp the engine harness and the crankshaft sensor lead connector.
15. Engine Harness
16. Inlet Air Pressure Sensor
17. Run the inlet air pressure sensor leads under the delivery pipe.
18. Delivery Pipe
19. Oil Temperature Sensor Leads
20. Throttle Sensor Connector
21. Injectors
22. Oil Pressure Switch
23. Oil Filter
24. Oil Cooler
25. Oil Temperature Sensor
26. ISC (Idle Speed Controller) Connector
27. Camshaft Position Sensor Connector
28. ECU (Electronic Control Unit) Connector
29. Clamp the water temperature sensor and camshaft position sensor leads.
30. ISC (Idle Speed Controller)
31. Fix the engine harness to the ISC with the band.
32. Crankshaft Sensor Lead Connector
33. Fix the camshaft position sensor connector and water temperature sensor leads with the band.
34. Inlet Air Temperature Sensor
35. Run the oil pressure switch lead between the cylinder and inlet manifold.

16-30 APPENDIX

Cable, Wire and Hose Routing

JT1500A9 Model ~



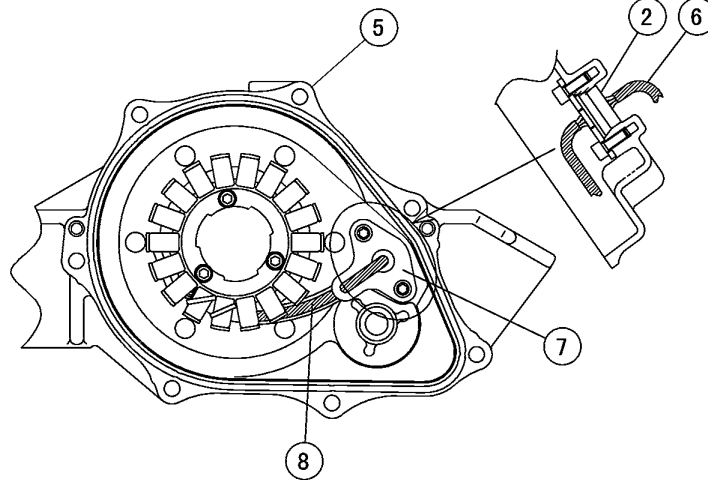
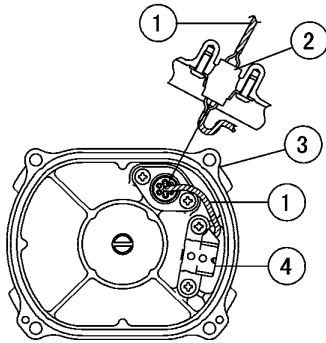
Cable, Wire and Hose Routing

1. Water Temperature Sensor Leads
2. Exhaust Manifold
3. Breather Hose (JT1500A9 ~ AB Models)
4. Cylinder Head Cover
5. Crankshaft Sensor Leads
6. Fix the crankshaft sensor lead and the oil temperature sensor lead to the dipstick pipe with the band.
7. Dipstick Pipe
8. Inlet Manifold
9. Clamp the engine harness and the crankshaft sensor lead connector.
10. Engine Harness
11. Inlet Air Pressure Sensor
12. Run the inlet air pressure sensor leads under the delivery pipe.
13. Delivery Pipe
14. Oil Temperature Sensor Leads
15. Throttle Sensor Connector
16. Injectors
17. Oil Pressure Switch
18. Oil Filter
19. Oil Cooler
20. Oil Temperature Sensor
21. ISC (Idle Speed Controller) Connector
22. Camshaft Position Sensor Connector
23. ECU (Electronic Control Unit) Connector
24. Clamp the water temperature sensor and camshaft position sensor leads.
25. ISC (Idle Speed Controller)
26. Fix the engine harness to the ISC with the band.
27. Crankshaft Sensor Lead Connector
28. Fix the camshaft position sensor connector and water temperature sensor leads with the band.
29. Inlet Air Temperature Sensor
30. Run the oil pressure switch lead between the cylinder and inlet manifold.

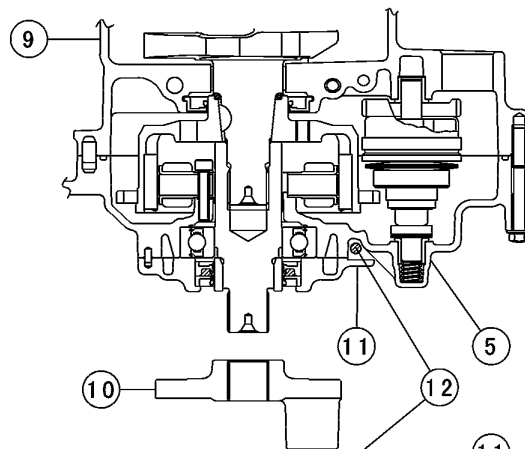
16-32 APPENDIX

Cable, Wire and Hose Routing

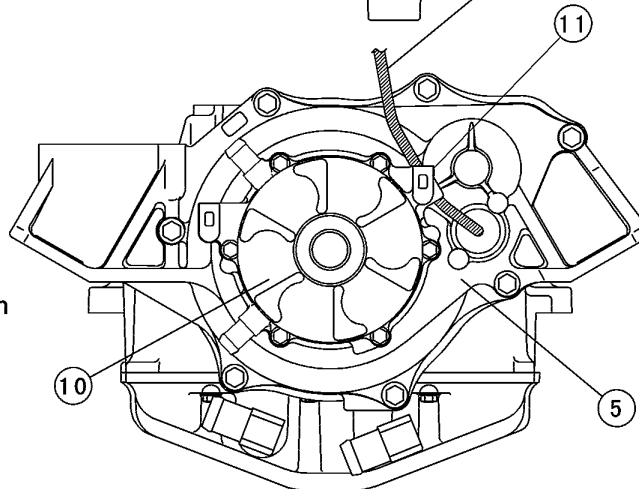
WIRE ROUTING AT CRANKSHAFT SENSOR AND MAGNETO COVER



Viewed from Top



Viewed from Stern



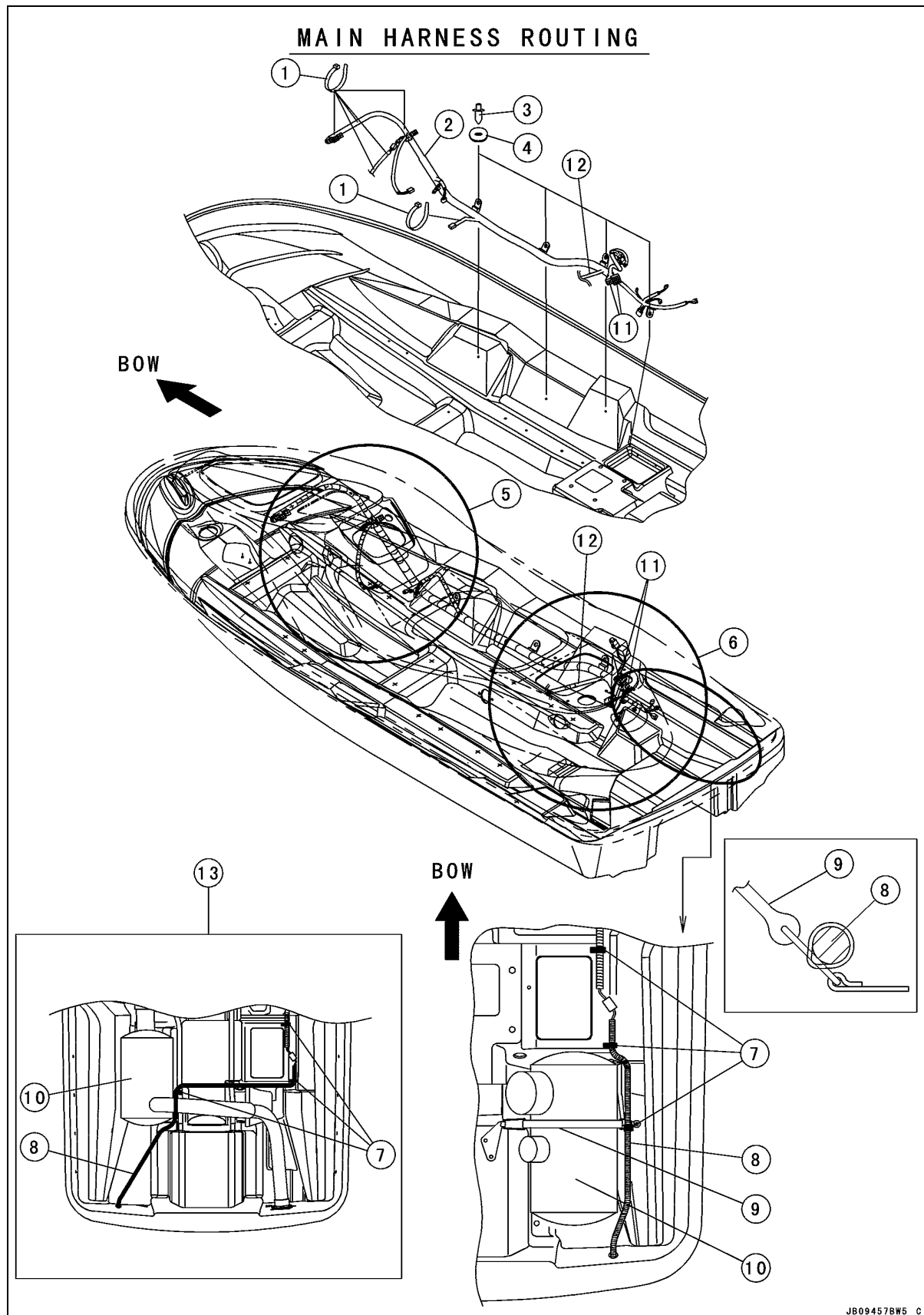
JB09135BW5 C

Cable, Wire and Hose Routing

1. Crankshaft Sensor Leads
2. Grommet
3. Crankshaft Sensor Cover (Reverse Side)
4. Crankshaft Sensor
5. Magneto Cover (Reverse Side)
6. Magneto Leads
7. Plate for fixing the magneto leads: Do not place the leads between the plate and magneto cover.
8. Run the magneto leads along the hollow of the magneto cover.
9. Crankcase
10. Coupling
11. Output Cover
12. Run the magneto leads between the magneto cover and output cover. Do not pinch the leads.

16-34 APPENDIX

Cable, Wire and Hose Routing

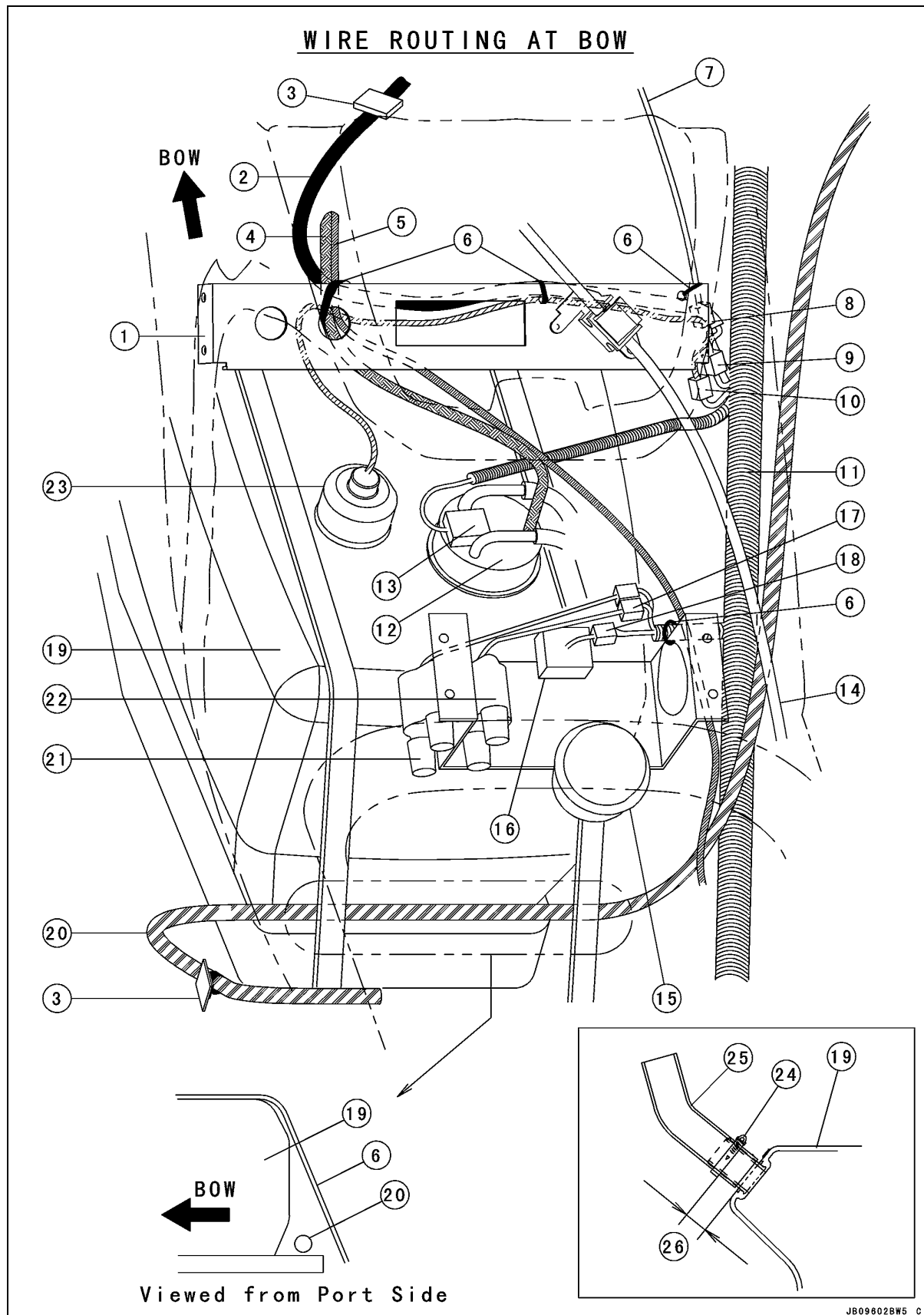


Cable, Wire and Hose Routing

1. Band
2. Main Harness
3. Rivet
4. Washer
5. See wire routing at bow.
6. See wire routing at stern.
7. Clamps
8. Speed Sensor Leads
9. Water Box Muffler Strap
10. Water Box Muffler
11. 16 Pin (Gray) and 6 Pin (White) Connectors (JT1500-A1 ~ A7 Models)
12. To Engine (JT1500A8 Model ~)
13. JT1500A9 Model ~

16-36 APPENDIX

Cable, Wire and Hose Routing

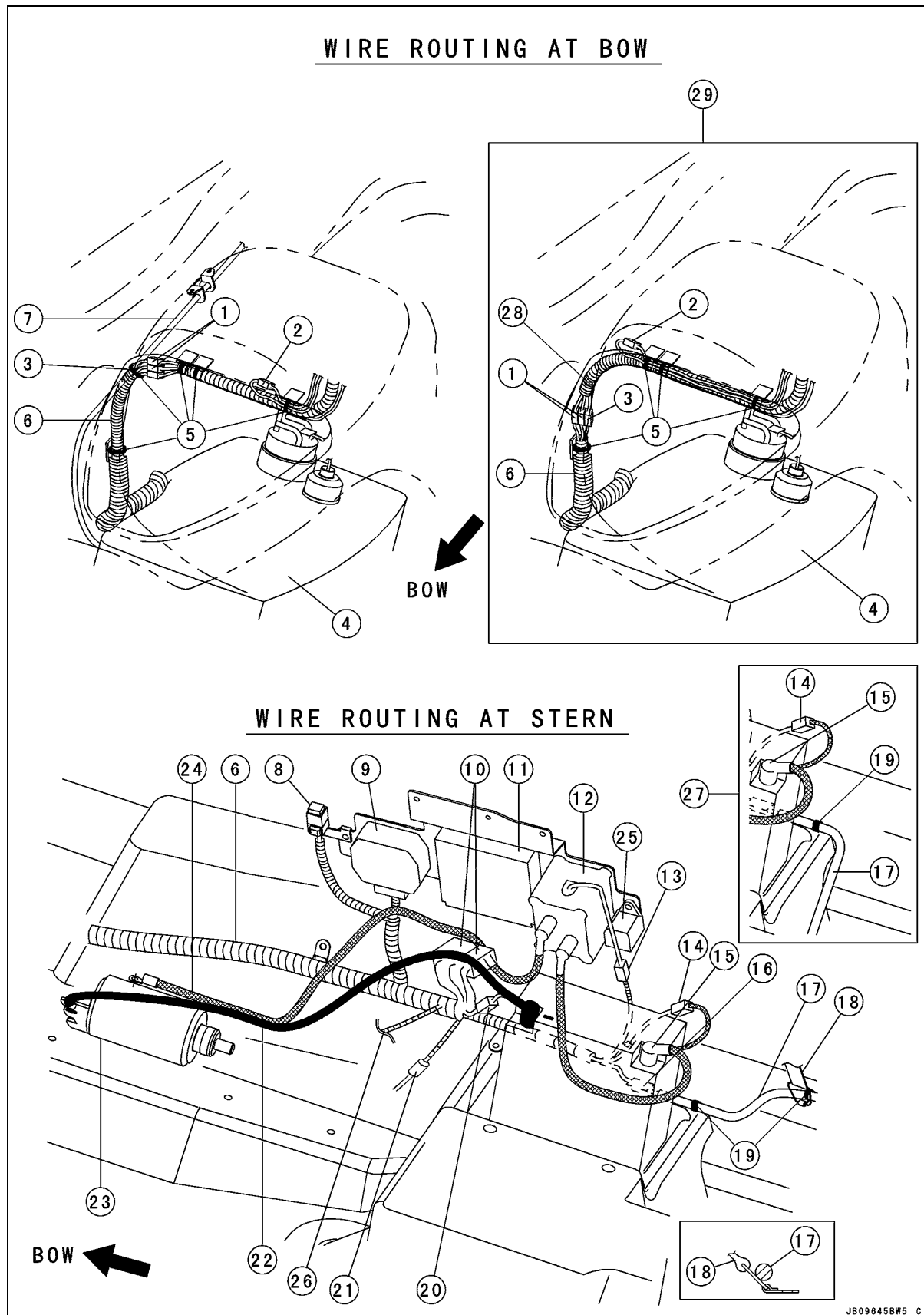


Cable, Wire and Hose Routing

1. Crossmember
2. Steering Position Sensor Leads
3. Holder and Clamp
4. Fuel Vent Hose
5. Throttle Cable
6. Band
7. Ignition Switch Lead
8. Ignition Switch Lead Connector (Black)
9. Steering Position Sensor Lead Connector (White)
10. Fuel Level Sensor Lead Connector (Black)
11. Main Harness
12. Fuel Pump
13. Fuel Pump Lead Connector (White)
14. Steering Cable
15. Fuel Filter
16. Vehicle-down Sensor
17. Ignition Coil Lead Connectors (Gray)
18. Vehicle-down Sensor Lead Connector (White)
19. Fuel Tank
20. Bypass Outlet Hose
21. #2, #3 Ignition Coils
22. #1, #4 Ignition Coils
23. Fuel Level Sensor
24. Clamp
25. Fuel Tank Filler Tube
26. 35 mm (1.38 in.)

16-38 APPENDIX

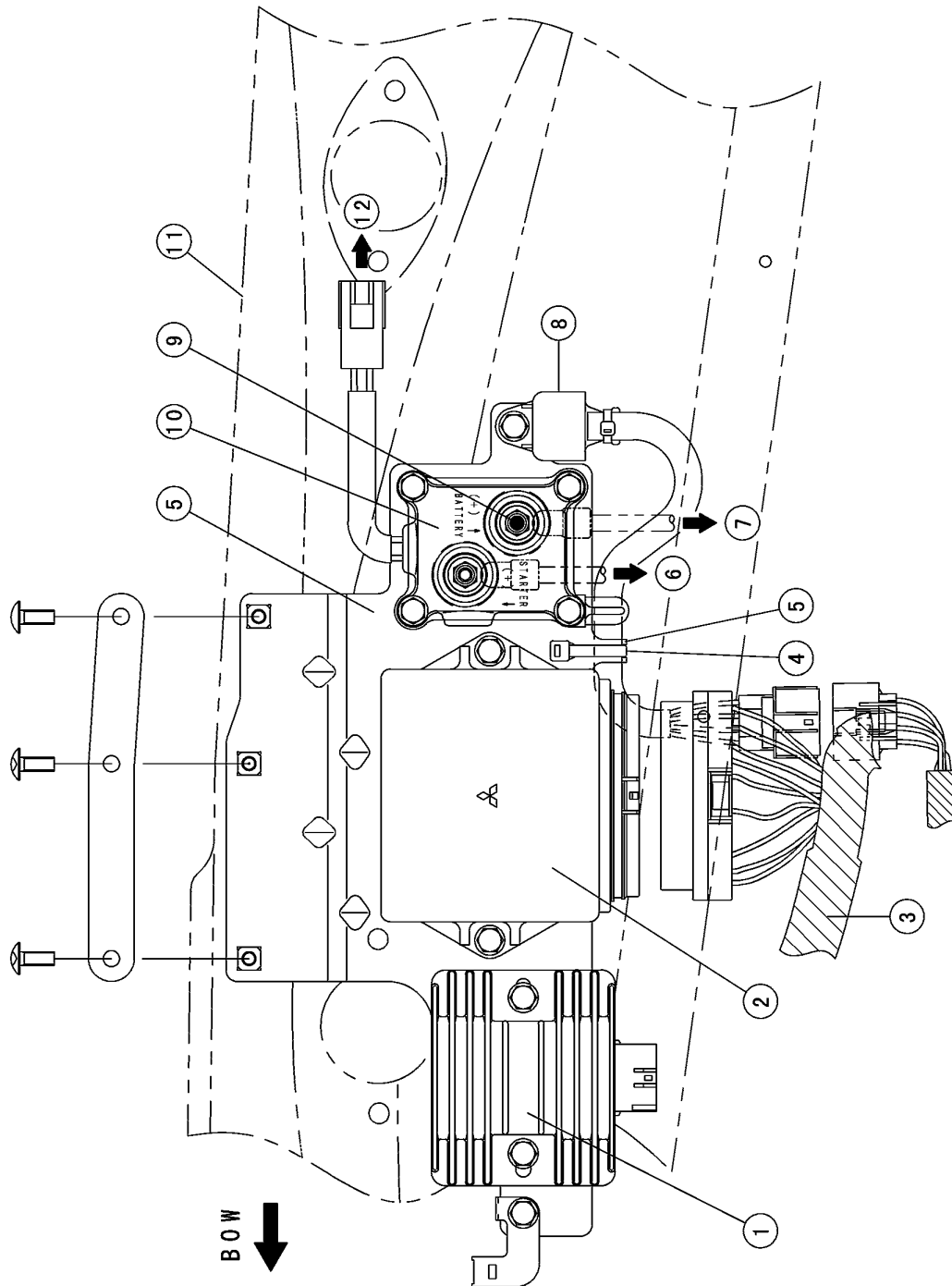
Cable, Wire and Hose Routing



Cable, Wire and Hose Routing

1. Multifunction Meter Lead Connector (Blue and Yellow: JT1500-A1 Model), (Blue and White: JT1500-A2 Model ~)
2. Buzzer Lead Connector (Blue)
3. Start/Stop Switch Lead Connector (White)
4. Fuel Tank
5. Holders and Bands
6. Main Harness
7. Shift Cable
8. Fuse Case
9. Regulator/Rectifier
10. 16 Pin (Gray) and 6 Pin (White) Connectors (JT1500-A1 ~ A7 Models)
11. ECU (Electronic Control Unit)
12. Starter Relay Case
13. Starter Relay Lead Connector (Black)
14. Battery (+) Cable Connector (Gray: JT1500-A1 Model), (White: JT1500-A2 Model ~)
15. Battery (+) Cable
16. Speed Sensor Lead Connector (Black)
17. Speed Sensor Lead
18. Right Water Box Muffler Strap
19. Clamp
20. Battery (–) Cable Connector (Black)
21. Magneto Lead Connector (Black)
22. Battery (–) Cable
23. Starter Motor
24. Starter Motor Cable
25. Relay Assembly
26. To Engine (JT1500A8 Model ~)
27. JT1500A9 Model ~
28. White Tape
29. JT1500A9 Late Model ~

WIRE ROUTING AT STERN

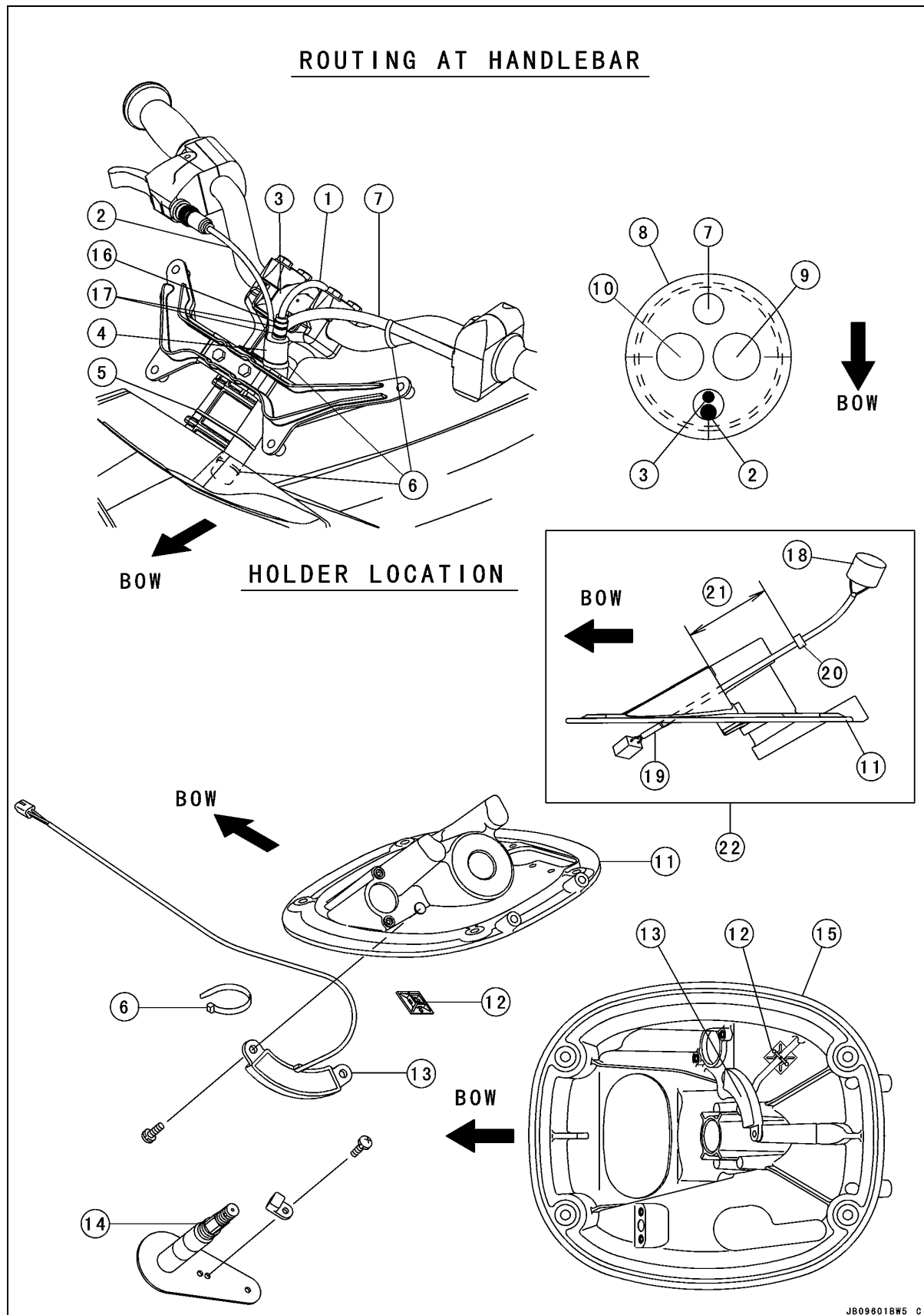


Cable, Wire and Hose Routing

1. Regulator/rectifier
2. ECU (Electronic Control Unit)
3. Main Harness
4. Clamp
5. Electrical Parts Bracket
6. To Starter Motor
7. To Battery
8. Relay Assembly
9. Red Mark
10. Starter Relay
11. Right Side Deck
12. Main Harness

16-42 APPENDIX

Cable, Wire and Hose Routing



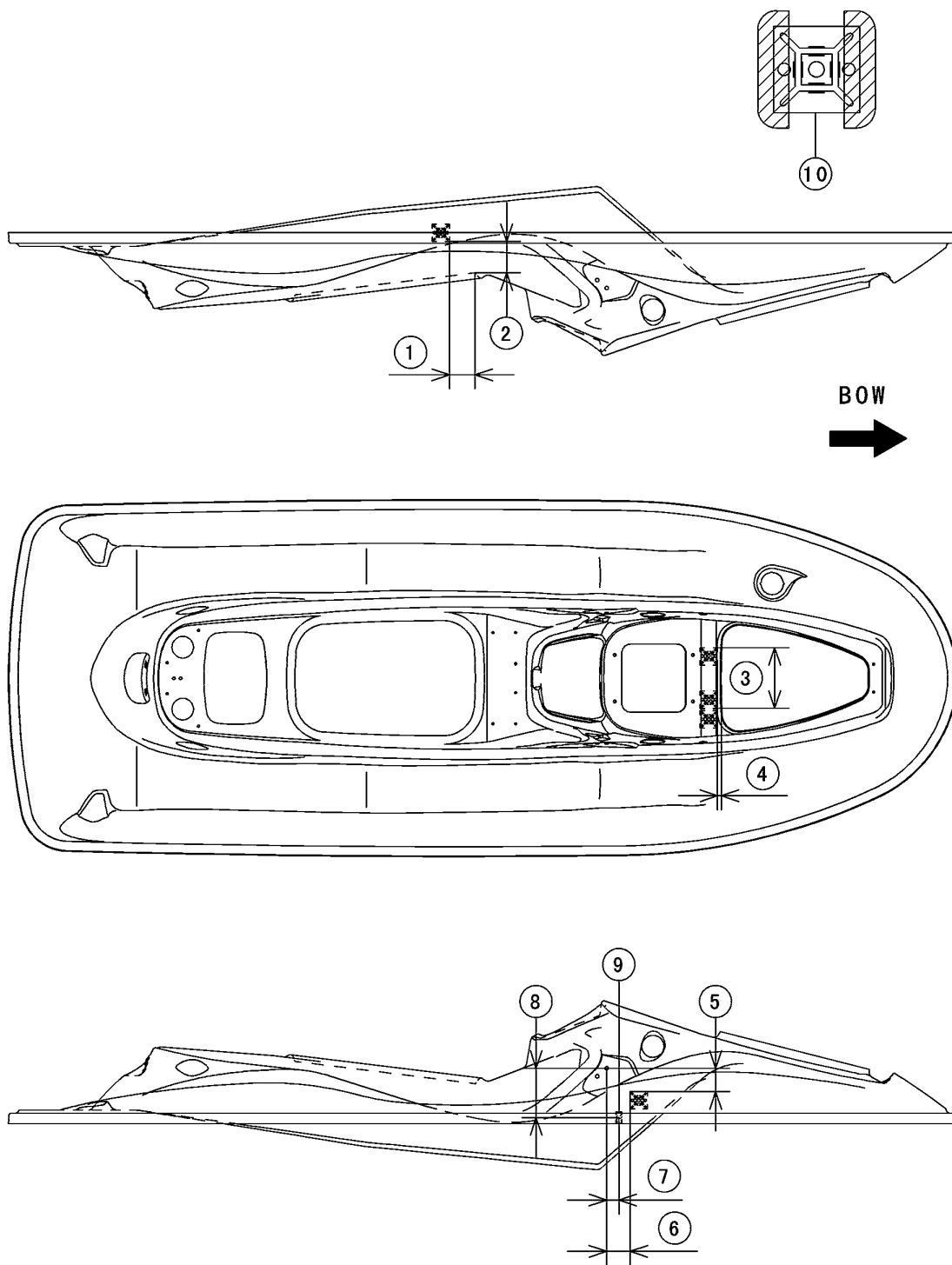
Cable, Wire and Hose Routing

1. Fuel Vent Pipe: Hook the pipe at the handlebar.
2. Throttle Cable
3. Buzzer Leads (Run the leads through the protective tube.)
4. Protective Tube
5. Band
6. Clamp
7. Start/Stop Switch Leads
8. Grommet on Steering Holder
9. Multifunction Meter Leads
10. Fuel Vent Hose
11. Steering Holder
12. Holder
13. Steering Position Sensor
14. Steering Shaft
15. Reverse Side of Steering Holder
16. Protective Tube (small diameter)
17. Clamps
18. Buzzer
19. Buzzer Leads
20. White Tape
21. 50 mm (1.97 in.)
22. JT1500A9 Model ~

16-44 APPENDIX

Cable, Wire and Hose Routing

HOLDER LOCATION



Starboard Side

JB09140BWS C

Cable, Wire and Hose Routing

1. 80 mm (3.15 in.)
2. 100 mm (1.18 in.)
3. 180 mm (7.09 in.)
4. 40 mm (1.57 in.)
5. 105 mm (4.13 in.)
6. 90 mm (3.54 in.)
7. 50 mm (1.97 in.)
8. 130 mm (5.12 in.)
9. Detent
10. Holder

NOTE

○ *This is not an exhaustive list, giving every possible cause for each problem listed. It is meant simply as a rough guide to assist the troubleshooting for some of the more common difficulties.*

Engine Doesn't Start, Starting Difficulty

Starter motor not rotating

- Starter motor trouble (brushes worn)
- Battery voltage low
- Starter relay not contacting or operating
- Start button not contacting
- Wiring open or shorted
- Ignition switch trouble
- Engine stop switch trouble
- Fuse blown

Starter motor rotating but engine doesn't turn over

- Reduction gear trouble
- Vehicle-down sensor (DFI) coming off

Engine won't turn over

- Valve seizure
- Valve lifter seizure
- Cylinder, piston seizure
- Crankshaft seizure
- Connecting rod small end seizure
- Connecting rod big end seizure
- Camshaft seizure

No fuel flow

- No fuel in tank
- Fuel tank air vent obstructed
- Fuel pump screen and/or fuel filter clogged
- Fuel injector trouble
- Fuel line clogged

Engine flooded

- Clean spark plug and adjust plug gap
- Starting technique faulty (When flooded, do not crank the engine with the throttle fully opened. This promotes engine flood because more fuel is supplied automatically by DFI.)

No spark; spark weak

- Ignition coil faulty
- Vehicle-down sensor (DFI) coming off
- Vehicle-down sensor trouble
- Ignition switch turned OFF and/or lanyard key not pushed under stop button
- Battery voltage low
- Spark plug dirty, broken, or gap maladjusted
- Ignition coil shorted or not in good contact
- Ignition coil trouble
- Spark plug incorrect
- Spark plug cap trouble

- Spark plug cap shorted or not in good contact

- IC igniter in ECU trouble
- Camshaft position sensor trouble
- Crankshaft sensor trouble
- Wiring shorted or open
- Fuse blown

Fuel/air mixture incorrect

- Air passage clogged
- Air filter poorly sealed
- Fuel injector trouble
- Water or foreign matter in fuel
- Throttle sensor trouble
- Fuel pressure may be low
- Fuel pump trouble
- Inlet air pressure sensor trouble
- Inlet air temperature sensor trouble
- Water temperature sensor trouble
- Crankshaft sensor trouble

Compression Low

- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Poor Running at Low Speed

Spark weak

- Battery voltage low
- Spark plug dirty, broken, or maladjusted
- Ignition coil shorted or not in good contact
- Ignition coil trouble
- Spark plug incorrect
- Spark plug cap trouble
- Spark plug cap shorted or not in good contact
- IC igniter in ECU trouble
- Camshaft position sensor trouble
- Crankshaft sensor trouble

Fuel/air mixture incorrect

- Air passage clogged
- Air filter poorly sealed
- Fuel tank air vent obstructed
- Fuel pump trouble
- Inlet air duct loose
- Fuel pump screen and/or fuel filter clogged
- Throttle body assy loose
- Throttle body assy gasket damage

Troubleshooting Guide

Fuel line clogged
Inlet air pressure sensor trouble
Inlet air temperature sensor trouble

Engine stalls easily

Fuel pump trouble
Fuel injector trouble
Throttle sensor trouble
Camshaft position sensor trouble
Fuel pressure too low or too high
Inlet air pressure sensor trouble
Water temperature sensor trouble
Inlet air temperature sensor trouble
Fuel line clogged
Crankshaft sensor trouble
Ignition coil trouble

Compression low

Spark plug loose
Cylinder head not sufficiently tightened down
No valve clearance
Cylinder, piston worn
Piston ring bad (worn, weak, broken, or sticking)
Piston ring/groove clearance excessive
Cylinder head warped
Cylinder head gasket damaged
Valve spring broken or weak
Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface)

Hesitation

Too low fuel pressure
Clogged fuel line
Fuel pump trouble
Fuel injector trouble
Inlet air temperature sensor trouble
Throttle sensor trouble
Water temperature sensor trouble
Inlet air pressure sensor trouble
Loose injector connectors
Crankshaft sensor trouble
Ignition coil trouble
Loose terminal of battery (–) cable or engine ground cable

Poor acceleration

Too low fuel pressure
Water or foreign matter in fuel
Clogged fuel filter or pump screen
Fuel pump trouble
Fuel injector trouble
Inlet air temperature sensor trouble
Water temperature sensor trouble
Ignition coil trouble
Engine oil level too high
Spark plug dirty, broken or gap maladjusted

Stumble

Too low fuel pressure

Fuel injector trouble
Throttle sensor malfunction
Water temperature sensor trouble
Inlet air pressure sensor trouble

Surge

Unstable fuel pressure
Fuel injector trouble
Water temperature sensor trouble

Backfiring when deceleration

Spark plug dirty, broken or gap maladjusted
Too low fuel pressure
Fuel pump trouble
Throttle sensor trouble
Inlet air temperature sensor trouble
Water temperature sensor trouble
Inlet air pressure sensor trouble
Air suction valve trouble

After fire

Crankshaft sensor trouble
Spark plug burned or gap maladjusted
Inlet air temperature sensor trouble
Water temperature sensor trouble
Inlet air pressure sensor trouble
Fuel injector trouble

Run-on (dieseling)

Ignition switch trouble
Engine switch trouble
Fuel injector trouble
Loose terminal of battery (–) lead or ECU ground lead
Carbon accumulating on valve seating surface
Engine overheating

Other

IC igniter in ECU trouble
Engine oil viscosity too high
Air suction valve trouble
Engine overheating
Intermittent any DFI fault and its recovery

Poor Running or No Power at High Speed

Firing incorrect

Spark plug dirty, broken, or maladjusted
Ignition coil shorted or not in good contact
Ignition coil trouble
Spark plug incorrect
Spark plug cap trouble
Spark plug cap shorted not in good contact
Camshaft position trouble
IC igniter in ECU trouble
Crankshaft sensor trouble

Fuel/air mixture incorrect

Air filter poorly sealed
Air filter O-ring damaged
Inlet air duct loose
Water or foreign matter in fuel

Troubleshooting Guide

- Fuel to injector insufficient (DFI)
- Fuel tank air vent obstructed
- Fuel line clogged
- Fuel pump trouble (DFI)
- Injector clogged
- Throttle body assy loose
- Throttle body assy gasket damaged
- Fuel line clogged
- Fuel pump operates intermittently
- Inlet air temperature sensor trouble
- Throttle sensor trouble
- Inlet air pressure sensor trouble

Compression low

- Spark plug loose
- Cylinder head not sufficiently tightened down
- No valve clearance
- Cylinder, piston worn
- Piston ring bad (worn, weak, broken, or sticking)
- Piston ring/groove clearance excessive
- Cylinder head gasket damaged
- Cylinder head warped
- Valve spring broken or weak
- Valve not seating properly (valve bent, worn, or carbon accumulation on the seating surface.)

Knocking

- Carbon built up in combustion chamber
- Fuel poor quality or incorrect
- Spark plug incorrect
- IC igniter in ECU trouble
- Camshaft position sensor trouble
- Crankshaft sensor trouble
- Ignition coil trouble
- Inlet air temperature sensor trouble

Miscellaneous

- Throttle valve won't fully open
- Engine overheating
- Engine oil level too high
- Engine oil viscosity too high
- Air suction valve trouble
- Camshaft cam worn

Overheating

Firing incorrect

- Spark plug dirty, broken, or maladjusted
- Spark plug incorrect
- IC igniter in ECU trouble

Fuel/air mixture incorrect

- Inlet air duct loose
- Air filter poorly sealed
- Air filter O-ring damaged

Compression high

- Carbon built up in combustion chamber

Engine load faulty

- Engine oil level too high

- Engine oil viscosity too high

Lubrication inadequate

- Engine oil level too low
- Engine oil poor quality or incorrect

Oil cooler incorrect

- Oil cooler clogged

Sensor incorrect

- Water temperature sensor broken

Over Cooling

Sensor incorrect

- Water temperature sensor broken

Abnormal Engine Noise

Knocking

- IC igniter in ECU trouble
- Carbon built up in combustion chamber
- Fuel poor quality or incorrect
- Spark plug incorrect
- Overheating

Piston slap

- Cylinder/piston clearance excessive
- Cylinder, piston worn
- Connecting rod bent
- Piston pin, piston pin hole worn

Valve noise

- Valve clearance incorrect
- Valve spring broken or weak
- Camshaft bearing worn
- Valve lifter worn

Other noise

- Connecting rod small end clearance excessive
- Connecting rod big end clearance excessive
- Piston ring/groove clearance excessive
- Piston ring worn, broken, or stuck
- Piston ring groove worn
- Piston seizure, damage
- Cylinder head gasket leaking
- Crankshaft runout excessive
- Engine mount loose
- Crankshaft bearing worn
- Camshaft chain tensioner trouble
- Camshaft chain, sprocket, guide worn
- Air suction valve damaged
- Magneto flywheel loose

Oil Pressure Warning Light Goes On

- Oil pump damaged
- Oil screen clogged
- Oil filter clogged
- Engine oil level too low
- Engine oil viscosity too low
- Camshaft bearing worn
- Crankshaft bearing worn

Troubleshooting Guide

Oil pressure switch damaged
 Wiring faulty
 O-ring at the oil passage in the crankcase damaged

Battery Trouble

Battery discharged

Charge insufficient
 Battery faulty (too low terminal voltage)
 Battery lead making poor contact
 Magneto trouble
 Wiring faulty
 Regulator/rectifier trouble

Battery overcharged

Magneto trouble
 Regulator/rectifier trouble
 Battery faulty

Poor Performance through Engine Runs Properly

Jet pump

Intake area obstructed
 Impeller or pump case damaged
 Excessive clearance between impeller and pump case

Poor Steering Control (Since faulty steering is dangerous, this problem should be examined by an authorized Jet Ski dealer)

Handlebar hard to turn

Steering maladjusted
 Bushing damaged or cracked
 Steering shaft bent
 No lubricant on steering pivot
 Steering cable damaged or improperly routed

Engine Activates Slow Down Mode

Cooling water temperature gets high

Weeds or debris in jet pump
 Cooling water line clogged

Low oil pressure

Low oil level
 Improper engine oil quality

Water temperature sensors malfunction, wiring open or short

Vehicle-down sensor malfunction, wiring open or short

Oil temperature sensor gets high

Low oil level
 Oil pump malfunction
 Relief valve malfunction
 Weeds or debris in jet pump
 Cooling water line clogged

Oil temperature sensor malfunction, wiring open or short

MODEL APPLICATION

Year	Model	Beginning Hull No.
2004	JT1500-A1	KAW60001□304
2005	JT1500-A2	US-KAW50001□405
2006	JT1500A6	US-KAW40001□506
2007	JT1500A7	US-KAW20001□607
2008	JT1500A8	US-KAW30001□708
2009	JT1500A9	US-KAW50001□809 US-KAW59001□809
2010	JT1500AA	US-KAW20001□910 US-KAW29001□910
2011	JT1500AB	US-KAW10001□011 US-KAW19001□011
2012	JT1500AC	US-KAW10001□112 US-KAW19001□112

□: This digit in the hull number changes from one machine to another.



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