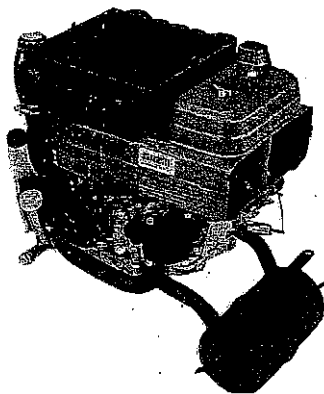




20hp Liquid
FD440/FD590/FD620

22hp Liquid
FD501/FD611/FD661

4-Stroke liquid-cooled V-twin gasoline engine



OWNER'S MANUAL

Part No. 99920-2122-03

READ THIS FIRST

For your safety, read this Owner's Manual and understand it thoroughly before operating this ENGINE.

▲WARNING

- Never allow children to operate the engine or equipment.
- Keep people and pets out of area where you are using the engine or equipment.
- Never wear loose, torn, or bulky clothing. It may catch on moving parts or controls, leading to the risk of accident.
- Never consume alcohol or drug before or while operating this engine.
- Do not run the engine in a closed area. Exhaust gas contains carbon monoxide, an odorless and deadly poison.
- Gasoline is extremely flammable and can be explosive under certain condition.
 - Stop engine and allow the engine to cool before refueling.
 - Do not smoke. Make sure area is well ventilated and free from any source of flame or sparks including the pilot light of any appliance while refueling, servicing fuel system, draining gasoline and/or adjusting carburetor.
 - Do not fill the tank so the fuel level rises into the filler neck or level surface of level gauge. If the tank is overfilled, heat may cause the fuel to expand and overflow through the vents in the tank cap.
 - Wipe off any spilled gasoline immediately.
- To prevent fire hazard:
 - Keep the engine at least 1 m (3.3 ft) away from buildings, obstructions and other burnable objects.
 - Do not place flammable objects close to the engine.
 - Do not expose combustible materials to the engine exhaust.
 - Do not use the engine on any forest covered, bush covered or grass covered unimproved land unless spark arrester is installed on the muffler.
- To avoid getting an electric shock, do not touch spark plug, plug cap or spark plug lead during engine running.
- To avoid a serious burn, do not touch a hot engine or muffler. The engine becomes hot during operation. Before you service or remove parts, stop engine and allow the engine to cool.
- Do not place hands or feet near moving or rotating parts.
- Do not run engine at excessive speeds. This may result in injury.
- Always remove the spark plug lead from spark plug when servicing the engine to prevent accidental starting.

SAFETY AWARENESS

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

WARNING

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

CAUTION

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

NOTE

○ Indicates points of particular interest for more efficient and convenient operation.

FOREWORD

We wish to thank you for choosing this Kawasaki Engine. Please read this Owner's Manual and understand thoroughly before operating, as it contains information which will be of value in obtaining maximum service from your Kawasaki Engine. To ensure a long, trouble-free life for your engine, give it the proper care and maintenance described in this manual.

○ Due to improvements in design and performance during production, in some cases there may be minor discrepancies between the actual engine and the illustrations or text in this manual.

The right is reserved to make changes at anytime without notice.

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READ THE OPERATING INSTRUCTIONS OF THE EQUIPMENT THIS ENGINE POWERS.

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First Edition (1): Apr. 1997 (M)

EMISSION CONTROL INFORMATION

Fuel Information

THIS ENGINE IS CERTIFIED TO OPERATE ON UNLEADED REGULAR GRADE GASOLINE ONLY. A minimum of 87 octane of the antiknock index is recommended. The antiknock index is posted on service station pumps in the U.S.A..

Emission Control Information

To protect the environment in which we all live, Kawasaki has incorporated crankcase emission (1) and exhaust emission (2) control system (EM) in compliance with applicable regulations of the United States Environment Protection Agency and California Air Resources Board.

1. Crankcase Emission Control System

A sealed-type crankcase emission control system is used to eliminate blow-by gases. The blow-by gases are led to the breather chamber through the crankcase. Then, it is led to the air cleaner.

Oil is separated from the gases while passing through the inside of the breather chamber from the crankcase, and then returned back to the bottom of crankcase.

2. Exhaust Emission Control System

The exhaust emission control system applied to this engine consists of a carburetor and an ignition system having optimum ignition timing characteristics.

The carburetors have been calibrated to provide lean air/fuel mixture characteristics and optimum fuel economy with a suitable air cleaner and exhaust system.

Maintenance and Warranty

Proper maintenance is necessary to ensure that your engine will continue to have low emission levels. This Owner's Manual contains those maintenance recommendations for your engine. Those items identified by the Periodic Maintenance Chart are necessary to ensure compliance with the applicable standards.

The Kawasaki Limited Emission Control System Warranty requires that you return your engine to an authorized Kawasaki engine Dealer for remedy under warranty. Please read the warranty carefully, and keep it valid by complying with the owner's obligations it contains.

Tampering with Emission Control System Prohibited

Federal law and California State 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.

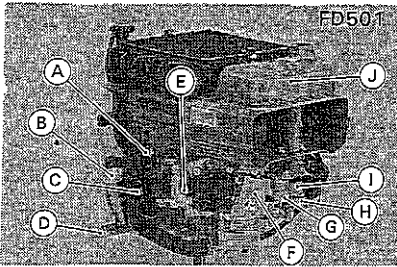
Among those acts presumed to constitute tampering are the acts listed below:

Do not tamper with the original emission related parts:

- Carburetor and internal parts
- Spark Plugs
- Magneto or electronic ignition system
- Fuel Filter element
- Air cleaner element
- Crankcase
- Cylinderhead
- Breather chamber and internal parts
- Intakepipe and tube

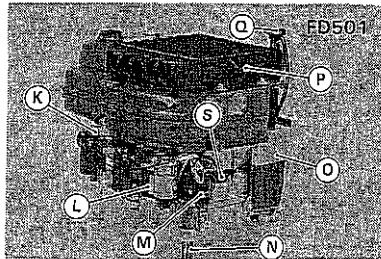
GENERAL INFORMATION

FD501



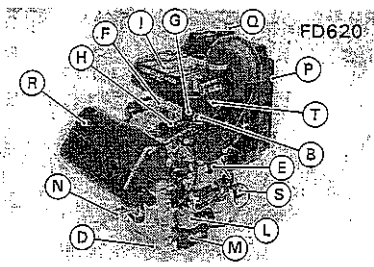
- A. Oil Pressure Switch E. Spark Plug
 B. Oil Gauge F. Control Plate
 C. Oil Filter G. Carburetor
 D. Oil Drain Plug

FD501



- H. Fuel Shut-off Valve L. Electric Starter
 I. Fuel Pump M. Igniter
 J. Air Cleaner
 K. Coolant Temperature Switch

FD620



- N. P.T.O Shaft S. Packard Connector
 O. Overflow Reservoir T. Oil Filler Cap
 P. Radiator Screen
 Q. Radiator Cap
 R. Muffler

Engine Oil Capacity
 See Page 6. Engine Oil

Coolant

Type : Permanent Type of Antifreeze.
 Green Colored.
 Mixed Ratio : 50 % mixed
 Freezing Point : -35°C (-31°F)

Coolant Capacity

FD440/501	2.1 L (2.2 U.S. qt)
FD590/611	3.4 L (3.6 U.S. qt)
FD620/661	2.7 L (2.8 U.S. qt)

Engine Serial Number

The engine number is only means of identifying your particular engine from others of the same model type. This serial number is needed by your dealer when ordering parts.

Tune-up Specifications

ITEM	Specification
Valve Clearance (Inlet, Exhaust) FD440, FD501 -	0.15 mm (0.006 in.)
FD590, FD620 - FD611, FD661	0.25 mm (0.009 in.)
Ignition Timing	Unadjustable
High Idle Speed	3600 rpm
Low Idle Speed	1450~1650 rpm
Spark Plug Gap	0.6~0.7 mm (0.024~0.028 in.)
Other Specifications	NO OTHER ADJUSTMENT NEEDED

NOTE

○ High and low idle speeds may vary depending on each equipment on which the engine is used. Refer to the equipment specification.

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FUEL AND OIL RECOMMENDATIONS

Fuel

Use only clean, fresh, unleaded regular grade gasoline.

Octane Rating

The octane rating of a gasoline is a measure of its resistance to "knocking". Use a minimum of 87 octane of the antiknock index is recommended. The antiknock index is posted on service station pumps in the U.S.A..

NOTE

○ If "knocking or pinging" occurs, use a different brand of gasoline or higher octane rating.

CAUTION

Do not mix oil with gasoline.

Oxygenated Fuel

Oxygenates (either ethanol or MTBE) are added to the gasoline. If you use the oxygenated fuel be sure it is unleaded and meets the minimum octane rating requirement.

The following are the EPA approved percentages of fuel oxygenates.

ETHANOL : (Ethyl or Grain Alcohol)
 You may use gasoline containing up to 10% ethanol by volume.

MTBE : (Methyl Tertiary Butyl Ether)
 You may use gasoline containing up to 15% MTBE by volume.

METHANOL : (Methyl or Wood Alcohol)

You may use gasoline containing up to 5% methanol by volume, as long as it also contains cosolvents and corrosion inhibitors to protect the fuel system.

Gasoline containing more than 5% methanol by volume may cause starting and/or performance problems. It may also damage metal, rubber, and plastic parts of your fuel system.

WARNING

After refueling, make sure the tank cap is closed securely. If gasoline is spilled on the fuel tank wipe it off immediately.

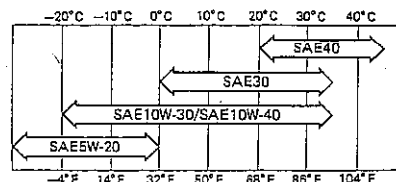
Engine Oil

The following engine oils are recommended.

API Service Classification : SC, SD, SE, SF, SG, or SH.

Oil Viscosity

Choose the viscosity according to the temperature as follows:



NOTE

○ Using multi grade oils (5W-20, 10W-30, and 10W-40) will increase oil consumption. Check oil level more frequently when using them.

5

PREPARATION

Fuel

- Level the engine before fueling.
- Remove the fuel tank cap.
- Slowly pour fuel into the tank through the fuel strainer.

⚠WARNING

Do not fill the fuel more than level gauge surface of fuel strainer to prevent spill out of the fuel from tank cap.

- Close the tank cap securely by turning it clockwise as far as it will go.

Engine Oil

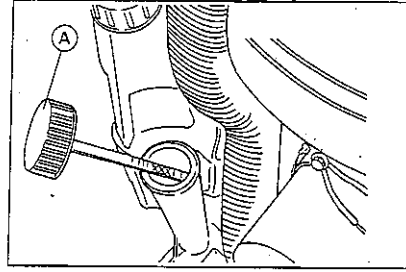
Check the engine oil daily before starting the engine otherwise shortage of the engine oil may cause serious damage to the engine such as seizure.

- Place the engine on level surface. Clean area around the oil gauge before removing it.
- Remove the oil gauge (A) and wipe it with clean cloth.
- Pour the oil slowly to "FULL" mark on the oil gauge.
- Insert the oil gauge into tube (B) WITHOUT SCREWING IT IN.
- Remove the oil gauge (A) to check the oil level. Level should be between "ADD" and "FULL" marks. Do not overfill.
- Install and tighten the oil gauge (A).

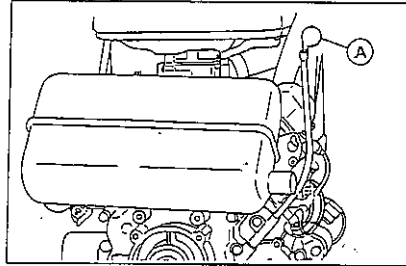
Engine Oil Capacity

	FD440/501/620/661	FD590/611
When changing oil filter	1.8 L (1.9 US qt)	2.1 L (2.2 US qt)
New engine and without changing oil filter	1.5 L (1.6 US qt)	1.7 L (1.8 US qt)

FD440/501/590/611



FD620/661/501D



CAUTION

The engine is shipped without engine oil.

6

STARTING

Start Engine

NOTE

○ Be aware of followings in order to start the engine easily in cold weather.

- Use proper oil for temperature expected (See FUEL AND OIL RECOMMENDATIONS).
- Use fresh gasoline.
- Protect the engine or equipment from direct exposure to weather when not in operation.
- Before starting the engine insure all possible external loads are disconnected.
- Open the fuel valve on the equipment.

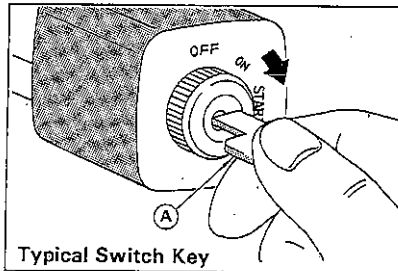
Starting by Electric Starter

—except FD620, FD661 and FD501D

- Put the switch key into the engine switch.
- Turn the switch key to the START position on the equipment. Usually engine will start within 3 seconds.

CAUTION

Do not run the starter continuously more than 5 seconds, otherwise the battery may discharge quickly. If the engine does not start right away, wait 15 seconds and try again.



For A Cold Engine — Place the throttle lever into "CHOCK" position.

For A Warm Engine (normal operating temperatures) — Place the throttle lever midway between "SLOW" and "FAST" positions.

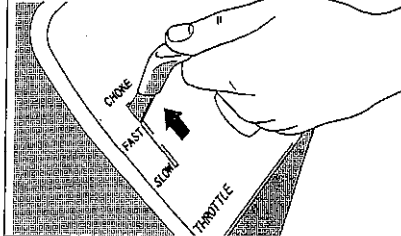
CAUTION

Whenever you start engine, make sure warning light is not on in started engine. If warning light comes on, stop engine immediately and check oil level (if equipped).

Warming Up

After the engine starts, move the throttle lever (A) on the equipment to between "FAST" and "SLOW". To warm up the engine, run it for 3 to 5 minutes with the throttle lever in the same (halfway) position before putting the equipment under load. Then, move the throttle lever (A) on the equipment to its "FAST" position.

Typical Throttle Control



CAUTION

Keep warming up before loading. This will allow oil to reach all the engine parts, and the piston clearance to reach design specification, before the engine is ready for loading.

7

OPERATING

Starting by Electric Starter

—FD620, FD661 and FD501D

- Move throttle lever on dash to half throttle position.
- Use full choke when the engine is cold, but in hot weather or when the engine is already warm, use half-choke or leave the choke fully open.
- After starting the engine, gradually return the choke lever to the full open position.

NOTE

○ When the engine is very warm, or when the engine does not start immediately, DO NOT keep trying to start it with the choke closed as this will cause flooding and make starting more difficult. Instead, fully open the choke and start the engine.

Unti-engine inclination

This engine will operate continuously at angles up to 25° in any direction.

Refer to the operating instructions of the equipment this engine powers. Because of equipment design or application, there may be more stringent restrictions regarding the angle of operation.

CAUTION

Do not operate this engine continuously at angles exceeding 25° in any direction. Engine damage could result from insufficient lubrication.

STOPPING

Ordinary Stop

- Lower the engine speed to an idle. Keep on running at idle for about one minute.

CAUTION

Do not stop the engine from high speed loaded operation. It may cause run-on or after burning.

- Turn the key switch to "OFF" position.

Emergency Stop

- Immediately turn the engine switch or the key switch to "OFF" position.
- Close the fuel valve on the equipment.
- Turn the key switch to "OFF" position.

WARNING

Always remove Engine Key from switch when leaving equipment unattended or when equipment is not in use.

ADJUSTMENT

Throttle Cable Installation,

Adjustment—except FD620, FD661

Make sure that the throttle lever on the equipment has been linked to the engine with the throttle cable.

- Leave the cable clamp bolt(A) loose.
- Align the hole(B) of speed control lever(C) with the hole(D) of base plate(E) moving the lever(C); insert 6 mm dia. pin (or 6 mm bolt) through two holes.
- Pull up the outer housing(F) of throttle cable until the inner wire(G) has almost no slack, and tighten the cable clamp bolt(A). Remove the 6 mm dia. pin.

Make sure that the carburetor choke valve(H) is closed completely when the throttle lever on equipment is moved to "CHOKE" position. If not, perform "CHOKE ADJUSTMENT".

NOTE

○ There are differences in orientation and appearance between the control panel illustrated and those of FD440, FD501, FD590, FD611 and FD620, FD661, FD501D; but it is good to get the knack of adjusting as described.

Interlocking Choke Adjustment

—except FD620, FD661 and FD501D

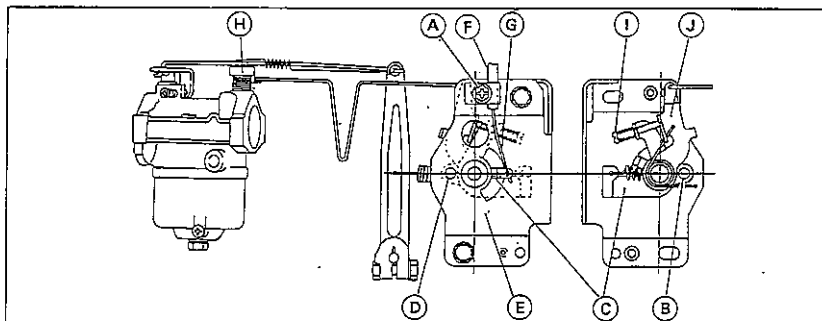
- Stop the engine.
- Align the hole (B) of speed control lever (C) with the hole (D) of base plate (E) by moving the lever (C); insert 6 mm dia. pin (or 6 mm bolt) through two holes.
- Turn in the choke setting screw (I) until its end just begins to touch tongue of the lever (J). Remove the 6 mm dia. pin or bolt.

Engine Speed Adjustment

NOTE

○ Do not tamper with the governor setting or the carburetor setting to increase the engine speed. Every carburetor is adjusted at the factory and a cap or a stop plates were installed on each mixture screw.

○ If adjustment is needed, have it performed by your authorized Kawasaki Engine dealer.



MAINTENANCE

Periodic Maintenance Chart

⚠ WARNING

Always remove the spark plug cap from spark plug when servicing the engine to prevent accidental starting.

MAINTENANCE	INTERVAL							
	Daily	First 8 hr.	Every 25 hr.	Every 50 hr.	Every 100 hr.	Every 200 hr.	Every 300 hr.	Every 400 hr.
Check and add engine oil. Check for loose or lost nuts and screws. Check for fuel and oil leakage. Check battery electrolyte level. Check or clean air intake screen. Tighten nuts and screws	● ● ● ●							
★ Clean air cleaner foam element			●					
★ Clean air cleaner paper element					●			
Clean fuel filter element				●				
Change engine oil (without oil filter) Change engine oil (with oil filter)		● ●		●				
Clean and regap spark plug Change oil filter					●		●	
★ Replace air cleaner paper element ★ Clean dust and dirt from cylinder and cylinder head fins							● ●	
K Clean combustion chamber K Check and adjust valve clearance K Clean and lap valve seating surface							● ● ●	
K Inspect radiator and hoses K Check fan belt conditions and tension-FD620/FD661						● ●		
K Change coolant								●

Note: The service intervals indicated are to be used as a guide. Service should be performed more frequently as necessary by operating condition.

★ Service more frequently under dusty conditions.

K: Have an authorized Kawasaki engine dealer perform these services.

Oil Level Check

Check oil level daily and before each time of operation. Be sure oil level is maintained. See PREPARATION.

Oil Change

Change oil after first 8 hours of operation. Thereafter change oil every 50 hours. (without oil filter type) and 100 hours (with oil filter type).

- Run the engine to warm oil.
- Be sure the engine (equipment) is level.
- Stop the engine.
- Remove the oil drain screw and drain the oil to suitable container while engine is warm.

⚠ WARNING

Be careful with hot oil being drained. It may be hot enough to burn you severely.

- Install the oil drain screw.
- Remove oil gauge and refill with new oil (See FUEL AND OIL RECOMMENDATIONS).
- Check the oil level (see Oil Level Check).

Oil Filter Change

- Change the oil filter at first 200 hours of operation.

⚠ WARNING

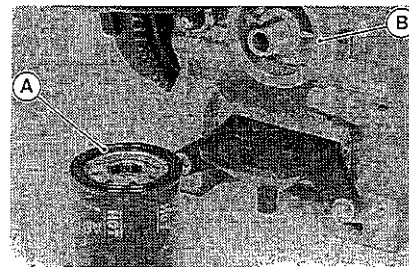
Stop the engine and be careful with hot oil drained.

- Drain engine oil to suitable containers.

CAUTION

Before removing the oil filter, place suitable pan under filter connection.

- Rotate the filter (A) counterclockwise to remove it.
- Coat a film of clean engine oil on seal of new filter.
- Install new filter rotating it clockwise until seal contacts mounting surface (B). Then rotate filter 3/4 turn more by hand.
- Supply engine oil as specified.
- Run the engine for about 3 minutes, stop engine, and check oil leakage around the filter.
- Add oil to compensate oil level down due to oil filter capacity (see PREPARATION for oil level check).



Air Cleaner Service

CAUTION

To prevent excessive engine wear, do not run the engine with the air cleaner removed.

⚠ WARNING

Clean the elements 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 low flash-point solvents to clean the element. A fire or explosion could result.

Foam Element

Clean the foam element (A) every 25 hours.

- Wash the element in detergent and water, and dry it thoroughly.
- Soak the element in a new engine oil and squeeze it to remove excess oil.

Paper Element

Clean the paper element (B) every 100 hours.

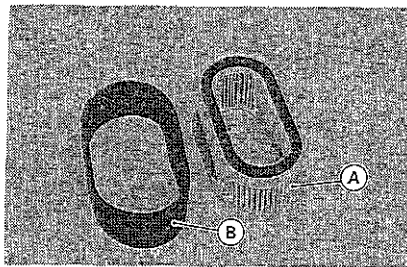
- Clean the element by tapping gently to remove dust. If very dirty, replace the element with a new one.
- Replace with a new paper-element yearly or 300 hours.

NOTE

○ Operating in a dusty condition may require more frequent maintenance than above.

CAUTION

Do not use petroleum solvent to clean paper-element.
Do not oil paper-element.
Do not use pressurized air to clean or dry paper-element.



Spark Plug Service

⚠ WARNING

Before checking spark plug, stop the engine and allow it to cool.

Clean or replace the spark plug and reset gap (B) every 100 hours of operation.

- Disconnect the spark plug wire lead and remove the spark plug.
- Clean the electrodes (A) by scraping or with a wire brush to remove carbon deposits and wetness.
- Inspect for cracked porcelain or other wear and damage. Replace the spark plug with a new one if necessary.
- Check the spark plug gap and reset it if necessary. The gap must be between 0.6 and 0.7 mm (0.024 and 0.028"). To change the gap, bend only side-electrode, using a spark plug tool.
- Install and tighten the spark plug to 17 Nm (12 ft-lb). Then connect spark plug lead.

Spark Plug Recommended

NGK BMR 6A except FD620
NGK BMR 4A for FD620

Fuel Filter Service

⚠ WARNING

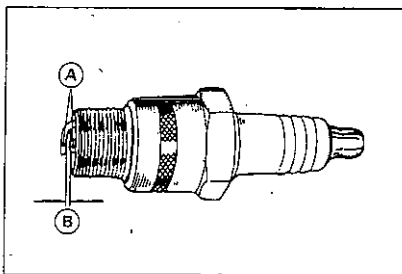
Clean the fuel filter element in a well ventilated area, and take care that there are no sparks or flame anywhere near the working area; this includes any appliance with a pilot light. Do not use gasoline or low flash-point solvents to clean the fuel filter element. A fire or explosion could result.

Clean the fuel filter element every 50 hours.

- Close the fuel valve to shut off the fuel flow.
- Loosen the sediment bowl and remove the filter element and gasket.
- Remove any sediment, wipe clean, and reinstall the assembly.

12

STORAGE



Cooling System Inspection

Inspect the radiator and the hoses every 200 hours of operation.

- Inspect the inlet and outlet tubes for cracks, kinks, dents, and fractured seams. Repair or replace the radiator if necessary.
- Check for dirt and insects that may be lodged in the radiator. Clean them out by using compressed air or a low-pressure washer.

CAUTION

Using high-pressure water, as from a car wash facility, could damage the radiator fins and impair the radiator's effectiveness.
Do not run engine before all cooling system parts reinstalled to keep cooling and carburation as intended.

Fuel System Draining

Engines to be stored over 30 days should be completely drained of fuel to prevent gum deposits forming on essential carburetor parts, fuel filter and tank.

- Clean the every part of the engine.
- Be sure that the engine key switch is positioned at "OFF".
- Close the fuel valve and remove the sediment bowl.
- Put a pan under the fuel valve to receive the drained fuel, and open the fuel valve to drain the fuel from fuel tank completely.
- Install the sediment bowl.
- Put a pan under the carburetor and loosen the drain screw of the carburetor to drain the fuel completely.
- Tighten the drain screw.
- Remove the spark plug and pour approx 1 ~ 2 mL (0.06 ~ 0.1 cu.in) of engine oil through the spark plug hole and then screw the spark plug in after turning the engine a few times. Slowly turning the engine until you feel compression and then leave it there.

○ These blocks the air to come inside the cylinder and prevent the rust inside the engine.

- Change engine oil for next use after period of storage (refer to oil change).
- Wipe the body with oily cloth.
- Wrap the engine with plastic sheeting and store it in a dry place.

⚠ WARNING

Drain the fuel in a well ventilated area. Keep the drained fuel in a safe area.

13

TROUBLESHOOTING GUIDE

If the engine malfunctions, carefully examine the symptoms and the operating conditions, and use the table below as a guide to troubleshooting.

Symptom		Probable Cause	Remedy
Engine will not start or output is Low	Insufficient compression	● Loose spark plug	Tighten properly
		● Loosen cylinder head bolts	
	No fuel to combustion chamber	No fuel in fuel tank	Fill fuel tank
		● Blocked fuel tube	Clean
		● Blocked air vent in tank cap	
	Spark plug fouled by fuel	Over-rich fuel/air mixture	Rotate engine with plug removed to discharge excess fuel
		Clogged air cleaner	Clean
		● Incorrect grade/type of fuel	Change gasoline
		● Water in fuel	
	No spark or weak spark	Faulty spark plug	Change spark plug
Faulty ignition coil		*	
Faulty igniter		*	
Cranking system	Weak or faulty battery	Charge or change battery	
	Faulty starter motor	*	
Low output	Engine overheats	Clogged air cleaner	Clean
		Clogged Cooling system	*
		Loose or slipping fan belt	*
		insufficient engine oil	Replenish or change oil
	Poor ventilation around engine	Select a better location	
	Lack of coolant	Add coolant to correct level	
	Too much oil in crankcase	Correct oil level	

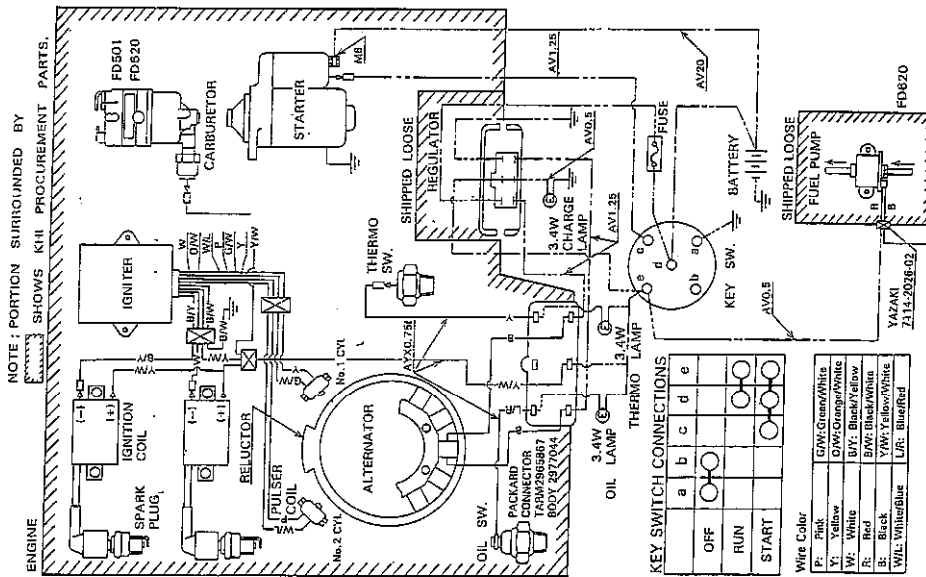
*: Have an authorized Kawasaki engine dealer perform these service.

SPECIFICATIONS

	FD440	FD501	FD590/FD611	FD620/FD661
Type of engine	Liquid-cooled, 4-stroke OHV, V twin gasoline engine			
Bore x Stroke	67 x 62 mm (2.63 x 2.44 in.)		74 x 68 mm (2.91 x 2.68 in.)	76 x 68 mm (2.99 x 2.68 in.)
Displacement	437 mL (26.7 cu.in)		585 mL (35.7 cu.in)	617 mL (37.6 cu.in)
Ignition system	Solid-state ignition			
Direction of rotation	Counterclockwise facing the P.T.O Shaft			
Starting system	Electric starter			
Dry weight	35.2 kg (77.6 lbs)		43.1 kg (95.0 lbs)	41.5 kg (91.5 lbs)

Specifications subject to change without notice.

WIRING DIAGRAM



⚠ WARNING

For electrical safety, always remove cable from negative (-) side of battery before attempting any repair or maintenance.

⚠ WARNING: ⚠

The engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.



KAWASAKI HEAVY INDUSTRIES, LTD.
Consumer Products Group