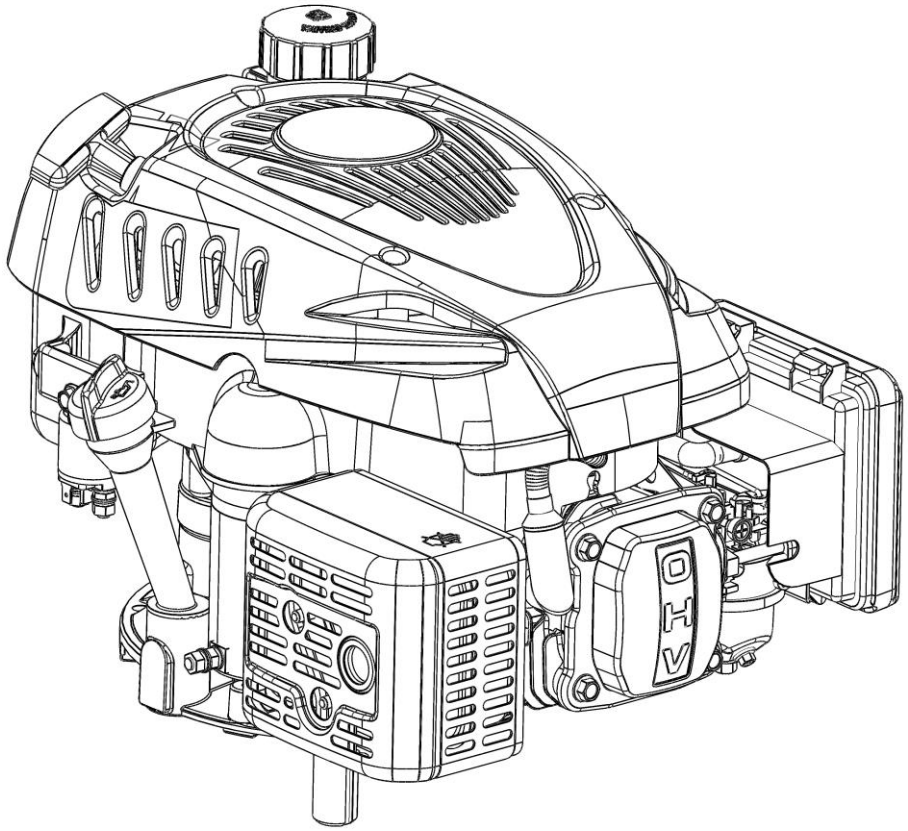
DR® VERTICAL SHAFT ENGINE
SAFETY & OPERATING INSTRUCTIONS



Models:
RV170

DR Power Equipment
Toll-free phone: 1-800-DR-OWNER (376-9637)
Website: www.DRpower.com

⚠ WARNING

Read and understand this manual and all instructions before operating the DR VERTICAL SHAFT ENGINE.

Table of Contents

Conventions used in this manual

⚠ DANGER

This indicates a hazardous situation, which, if not followed, ***will*** result in death or serious injury.

⚠ WARNING

This indicates a hazardous situation, which, if not followed, ***could*** result in death or serious injury.

⚠ CAUTION

This indicates a hazardous situation, which, if not avoided, ***could*** result in minor or moderate injury.

NOTICE

This information is important in the proper use of your machine. Failure to follow this instruction could result in damage to your machine or property.

Additional Information and Potential Changes

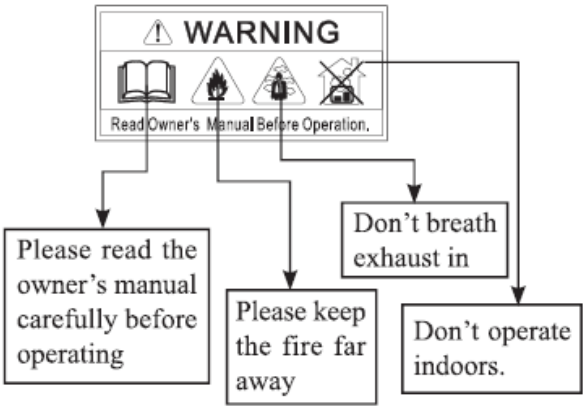
DR Power Equipment reserves the right to discontinue, change, and improve its products at any time without notice or obligation to the purchaser. The descriptions and specifications contained in this manual were in effect at printing. Equipment described within this manual may be optional. Some illustrations may not be applicable to your Engine.

⚠ WARNING

Read this safety & operating Instructions manual before you use the DR VERTICAL SHAFT ENGINE. Become familiar with the operation and service recommendations to ensure the best performance from your Engine. If you have any questions or need assistance, please contact us at www.DRpower.com or call toll-free 1-800-DR-OWNER (376-9637) and one of our Technical Support Representatives will be happy to help you.

Labels

Your DR VERTICAL SHAFT ENGINE carries prominent labels as reminders for its proper and safe use. Shown below are copies of all the Safety and Information labels that appear on the equipment. Take a moment to study them and make a note of their location on your VERTICAL SHAFT ENGINE as you set up and before you operate the unit. Replace damaged or missing safety and information labels immediately.



Safety with Gasoline-Powered Engines

⚠ WARNING

Gasoline is a highly flammable liquid. Gasoline also gives off flammable vapor that can be easily ignited and cause a fire or explosion. Never overlook the hazards of gasoline. Always follow these precautions:

- Never run the Engine in an enclosed area or without proper ventilation as the exhaust from the Engine contains carbon monoxide, which is an odorless, tasteless, and deadly poisonous gas.
- Store all fuel and Oil in containers specifically designed and approved for this purpose and keep away from heat and open flame, and out of the reach of children.
- Fill the gasoline tank outdoors with the Engine off and allow the Engine to cool completely. Do not handle gasoline if you or anyone nearby is smoking or if you are near anything that could cause it to ignite or explode. Replace the fuel tank and fuel container caps securely.
- If you spill gasoline, do not attempt to start the Engine. Move the machine away from the area of the spill and avoid creating any source of ignition until the gas vapors have dissipated. Wipe up any spilled fuel to prevent a fire hazard and properly dispose of the waste.
- Allow the Engine to cool completely before storing the DR VERTICAL SHAFT ENGINE in any enclosure. Never store the machine with gas in the tank or a fuel container near an open flame or spark, such as a water heater.
- Never make adjustments or repairs with the Engine running. Disconnect the Spark Plug wire and keep the wire away from the Spark Plug to prevent accidental starting.
- Never check for an ignition spark with the Spark Plug or Spark Plug wire removed. Use an approved spark tester.
- Never tamper with safety devices. Check their proper operation regularly.
- Do not change the Engine governor settings or modify the Engine speed. Modifications will void your warranty.
- To reduce fire hazard, keep the Engine cooling fan and muffler area free of debris build-up such as leaves, grass, Oil, grease or any other combustible material.
- Never operate the Engine without the muffler. Inspect the muffler periodically and replace if necessary. If equipped with a muffler deflector, inspect the deflector periodically and replace if necessary.
- Never operate the Engine with the air cleaner or cover over the carburetor air intake removed, except for adjustment. Removal of such parts could create a fire hazard. Do not use flammable solutions to clean air filter.
- Check fuel lines and fittings frequently for cracks or leaks, replace if necessary.
- Replace rubber fuel lines and grommets when worn or damaged and after 5 years of use.
- The muffler and Engine become very hot and can cause severe burns. Do not touch a hot muffler or Engine.
- Set the Engine throttle according to the recommendation of the owner's manual. Do not overload the Engine or run it with low load and at low speed for long periods.
- Use specified grade of gasoline. The fuel should be clean with no debris. Keep the fuel opening clean and change the Oil periodically.
- Periodically check that the Engine mounting bolts are tight. Tighten as necessary.
- Periodically clean the air cleaner element and change it when necessary.
- The Engine is air-cooled. Clean the top of the Engine and cooling fins to ensure optimum air flow.
- The operator should be familiar with the working principle and structure of the gasoline Engine, knowing how to make an emergency stop and be familiar with using the controls. Anyone without training is forbidden to operate the Engine. Keep periodical maintenance. Solve problems immediately. Do not run the Engine if it not operating properly.

A Note to All Users

No list of warnings and cautions can be all-inclusive. If situations occur that are not covered by this manual, the operator must apply common sense and operate this DR® VERTICAL SHAFT ENGINE in a safe manner. Contact us at www.DRpower.com or call 1-800-DR-OWNER (376-9637) for assistance.

Additional Information and Potential Changes

DR Power Equipment reserves the right to discontinue, change, and improve its products at any time without notice or obligation to the purchaser. The descriptions and specifications contained in this manual were in effect at printing. Equipment described within this manual may be optional. Some illustrations may not be applicable to your machine.

Chapter 2: Setting Up The DR VERTICAL SHAFT ENGINE

It may be helpful to familiarize yourself with the controls and features of your DR VERTICAL SHAFT ENGINE as shown in Figure 1 before beginning these procedures. If you have any questions at all, please feel free to contact us at www.DRpower.com.

DR VERTICAL SHAFT ENGINE Controls and Features

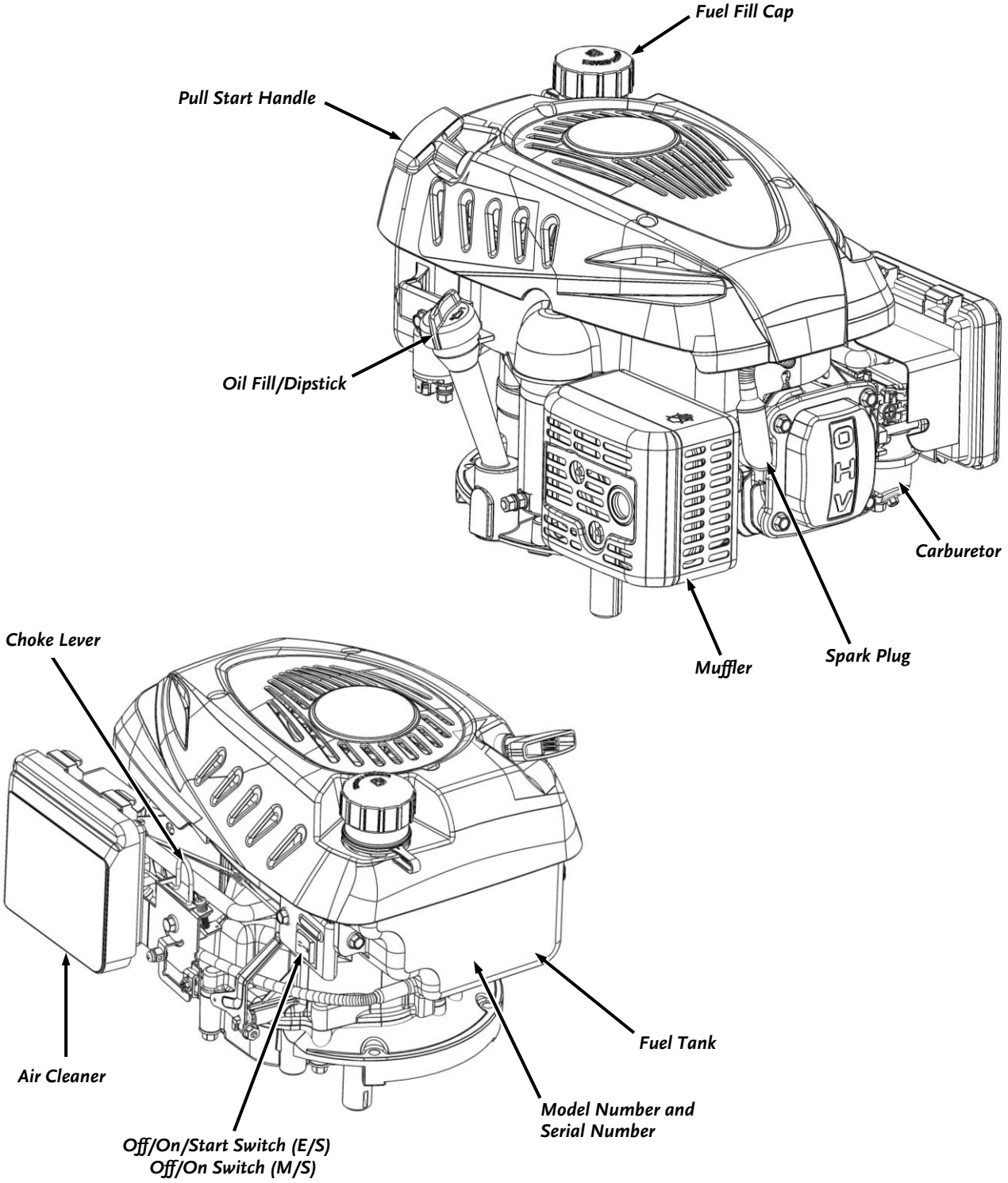


Figure 1

Engine Oil

Engine Oil is a key factor in deciding the Engine's performance. Do not use Engine Oils with additives or 2-stroke Engine Oil because they will not provide enough lubrication and may shorten the Engines service life.

⚠ WARNING

- The engine must be level before checking the oil to get an accurate reading on the dipstick

Engine Oil capacity: 0.6L / 20 oz.

Engine Oil recommended: SAE10W-30, SAE30

As viscosity varies with regions and temperatures, SJ class Oil is recommended ***(Figure 2)***.

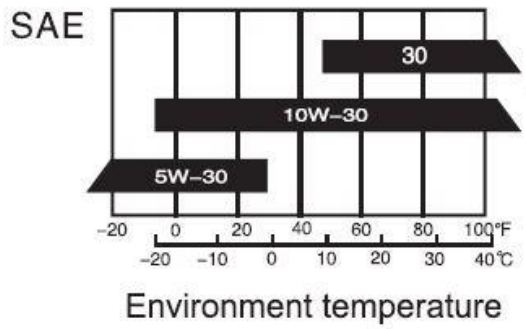


Figure 2

Checking the Oil level:

1) Remove the dipstick ***(Figure 3)*** and clean it with a rag.
2) Reinsert the dipstick into the Oil Fill hole. Remove the dipstick and check Oil level ***(Figure 3)***.
3) If the Oil level is low, add the recommended Engine Oil up to the full level on the dipstick.
4) Reinstall the dipstick when the correct Oil level is reached.

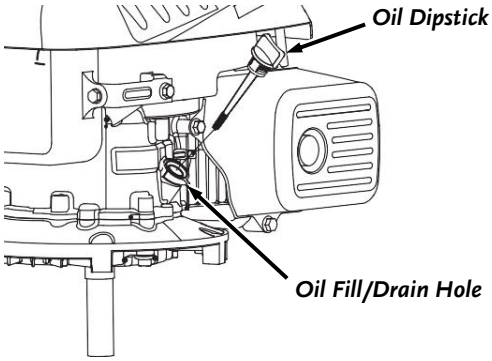


Figure 3

Engine Oil change:

⚠ WARNING

- Used engine oil may cause skin cancer if repeatedly left in contact with the skin for prolonged periods. It is advisable to thoroughly wash your hands with soap and water as soon as possible after handling used oil. Please dispose of used engine oil in a manner that is compatible with the environment.

Note: We Recommend using a small Engine Oil extractor to extract the used Engine Oil. Always drain the Engine Oil when the Engine is warm so it will flow more rapidly and completely.

1) Remove the Oil Dipstick ***(Figure 3)***
2) Extract the Oil following the Extractor Instructions.
3) Fill With the recommended Engine Oil and check Oil level with dipstick ***(Figure 4)***.
4) When finished, reinstall the Oil dipstick and tighten it securely

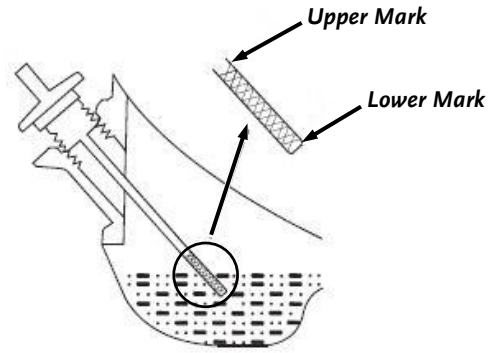


Figure 4

Air Cleaner

NOTICE

- Prevent any debris from entering the engine when the air cleaner is removed, or the engine could be damaged.
- Never run the engine without an air cleaner, or severe damage may result.

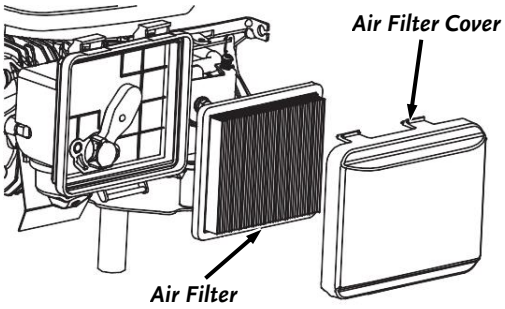


Figure 5

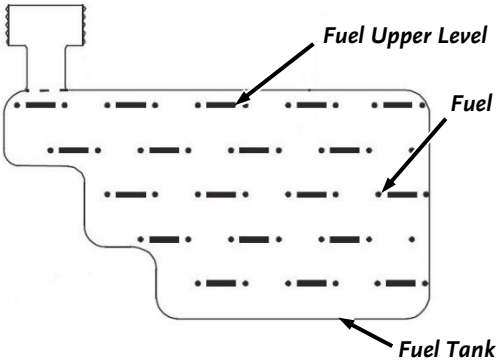


Figure 6

1) Remove the Air Cleaner Cover (***Figure 5***).
2) Remove the Air Filter (foam element or paper element).
3) Check and clean Air Cleaner parts.
4) Replace any damaged Air Cleaner parts.
5) Reinstall the Air Filter and Cover.

⚠ WARNING

- Gasoline is extremely flammable and is explosive under certain conditions.
- Refuel in a well-ventilation area with the Engine stopped. Do not smoke or allow flames or sparks in the area where gasoline is stored or where the fuel tank is refueled.
- Do not overfill the fuel tank (there should be no fuel in the filling neck). After refueling, make sure the fuel tank cap is installed securely.
- Be careful not to spill fuel when refueling. Spilled fuel or fuel vapor may ignite. If any fuel is spilled, make sure the area is dry before starting the Engine.
- Avoid repeated or prolonged contact with skin or breathing of fuel vapor. Keep out of reach of children.

NOTICE

- Only use unleaded gasoline and recommend gasoline grade 90 octane or over. Unleaded gasoline can reduce gasoline Engine carbon deposit and prolong the exhaust system service life.
- Never use contaminated gasoline or mixed gasoline with Oil. Don't allow dust, foreign matter, or water to enter fuel tank.
- Fuel may damage paint and plastic. Be careful not to spill fuel when refueling. Any damage due to spilling is not covered under warranty.
- If a "Light knocking" or "spark exploding" sound can be heard when the Engine is overloaded, it is normal, and you do not need to be concerned.
- If a " knocking" or "spark exploding" sound occurs at a steady speed under normal load, change brand of gasoline. if the sound doesn't disappear, consult your dealer for help, otherwise the Engine may be damaged.
- If you continue to operate the Engine with "Knocking" or "spark exploding" sounds it is not covered under warranty.

Fuel Check

Fuel tank capacity: 1.0L / 34oz.

1) Remove the fuel fill cap and check fuel level.
2) If the level is low, fill the gas tank with fresh, unleaded gas to approximately 1" to 1-1/2" below the top of the fill neck to allow for fuel expansion (***Figure 6***). Be careful not to overfill.
3) Reinstall the fuel fill cap before starting the Engine.

Starting the Engine

Note: For ease of operation and starting, the DR VERTICAL SHAFT ENGINE is equipped with a fixed speed Throttle Control.

RV170 M/S With Off/On Switch

1) Press the Engine Off/On switch to the "ON" position (***Figure 7***).
2) Gently push the Choke Lever Inward.
3) Pull the Starter Grip lightly until resistance is felt, then, briskly pull to start the Engine (***Figure 8***). Lightly return the Starter Grip once the Engine starts.

NOTICE

Don't allow the starter grip to snap back against the Engine. Return it gently to prevent damage to the starter.

4) Adjust the Choke until the Engine runs smoother by pulling outward on the Choke Lever.

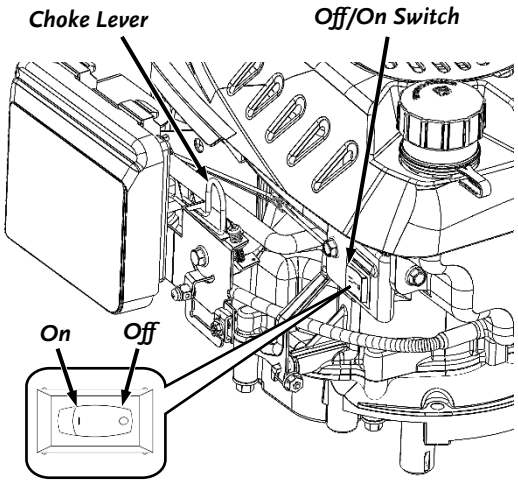


Figure 7

RV170 E/S With Off/On/Start Switch

1) Press the Engine Off/On/Start switch to the "On" position (***Figure 9***).
2) Gently Push the Choke Lever Inward.
3) Press and hold the Switch in the "Start" position until the Engine starts
4) Adjust the Choke until the Engine runs smoother by pulling outward on the Choke Lever.

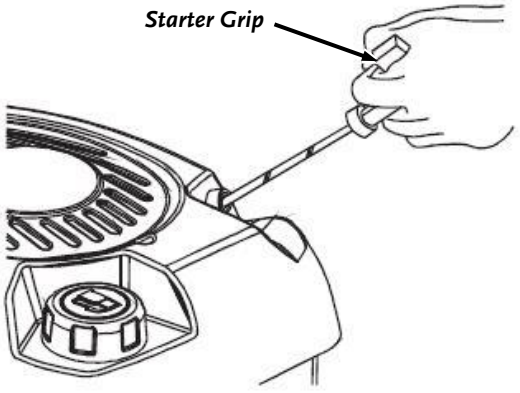


Figure 8

Stopping the Engine

RV170 M/S With Off/On Switch

1) Press the Engine Off/On switch to the "Off" position (***Figure 7***).

RV170 E/S With Off/On/Start Switch:

2) Press the Engine Off/On/Start switch to the "Off" position (***Figure 9***).

NOTICE

Suddenly stopping the Engine at high speed under heavy load could damage the Engine.

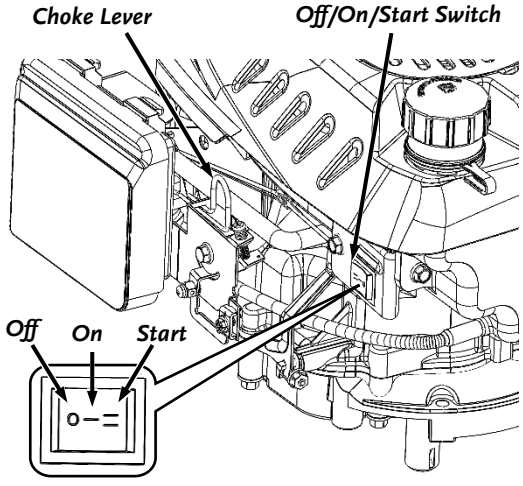


Figure 9

Chapter 4: Maintaining the Exhaust Control System

Exhaust Control System Service

With the Engine running, carbon monoxide, oxide of nitrogen and hydrocarbon will be produced. In certain conditions, oxide of nitrogen and hydrocarbon will react chemically with each other to make carbon monoxide and is toxic. Exhaust control is therefore very important. We decrease the exhaust emissions by introducing poor-fuel carburetors and other devices into the Engine to solve the problem. To keep the exhaust of your Engine within the standard exhaust emission, pay attention to the following:

Maintenance

Maintain the Engine periodically in accordance with the maintenance schedule in the manual. The maintenance schedule is made out on the base of normal use in normal conditions. If using under heavy load, dusty or wet circumstances or in high temperature, service of the Engine should be done more often.

Replacing Parts

To ensure the best quality and reliability, use only new genuine DR Power Equipment parts or their equivalents for repair and replacement.

Tampering and Altering

Tampering with or altering the emission control system may increase emissions beyond the legal limit. Among those acts that constitute tampering are:

- Removal or alteration of any part of the intake, fuel, or exhaust systems.
- Altering or defeating the governor linkage or speed-adjusting mechanism to cause the Engine to operate outside its design parameters.

Problems Affecting Exhaust Emissions

- Difficult starting or difficult stopping.
- Unstable idle speed.
- Give off black smoke or consume too much fuel.
- Poor ignition spark or spark knock.
- Too early ignition.

Chapter 5: General Maintenance

Maintenance Schedule for Vertical Engine

Proper maintenance is essential for safe, economical, and trouble-free operation. It also helps reduce air pollution. In order to keep your gasoline Engine in good working condition, it must be periodically serviced. The following maintenance schedule and routine inspection procedures must be carefully followed.

Procedure	Before Each Use	First Month or 10 hrs of operation	Thereafter, every 3 months or 30hrs of operation	Every 6 months or 50 hrs of operation	Every year or 100 hrs of operation
Check/Refill Engine Oil Level	▲				
Change Engine Oil		▲	▲		
Check Air Filter	▲				
Clean Air Filter			▲		
Change Air Filter				▲	
Clean/Adjust Spark Plug *				▲	
Clean Spark Arrestor				▲	
Check/Adjust Valve Clearance **					▲
Check Fuel Line	Every 2 years (change if necessary)				
Remove Carbon Deposits on Cylinder Head and piston **	Every 125 hours				

* These items should be replaced by new ones if necessary.

** These items should be serviced by a mechanically proficient person or by our authorized servicing dealer.

⚠ WARNING

Stop the Engine before servicing. Put the Engine on a level surface and remove the Spark Plug cap to avoid starting.
Never run your Engine in a poorly ventilated area. Be sure to keep good ventilation in working area. The exhaust from the Engine may contain poisonous carbon monoxide, breathing it would cause shock, unconsciousness and even death.

NOTICE

- If you frequently operate your gasoline Engine under high-load or high-temperature conditions, change the Engine Oil every 10 hours of operation.
- If your gasoline Engine frequently works under dusty or severe conditions, clean the air filter element every 10 hours of operation. If necessary, change the element every 25 hours of operation.

Replacing Engine Oil

Note: *We Recommend using a small Engine Oil extractor to extract the used Engine Oil. Always drain the Engine Oil when the Engine is warm so it will flow more rapidly and completely.*

1) Remove the Oil Dipstick ***(Figure 3)***
2) Extract the Oil following the Extractor manufactures Instructions.
3) Fill With the recommended Engine Oil and check Oil level with Dipstick ***(Figure 4)***.
4) When finished, reinstall the Oil Dipstick and tighten it securely.

⚠ WARNING

Please dispose of used Engine Oil and the Oil containers in a manner that is compatible with the environment. We suggest you take used Oil in a sealed container to your local recycling center or service station for reclamation. Do not throw it in the trash or pour it on the ground or down a drain.

Maintenance of Air Cleaner

A dirty or damaged air cleaner will allow dust to enter into the Engine causing rapid Engine wear. Service the air cleaner as recommended by the manufacturer.

⚠ WARNING

Never clean the air cleaner element with gasoline or low flash-point detergents, or explosion may happen.

⚠ CAUTION

If you use compressed air to clean the paper element, wear ear and eye protection to prevent injury.

1) Remove the Air Filter Cover (***Figure 10***).
2) Remove the air filter (foam element or paper element).
3) Check and clean air cleaner parts.
4) Replace any damaged air cleaner parts.
5) Reinstall the air filter and cover

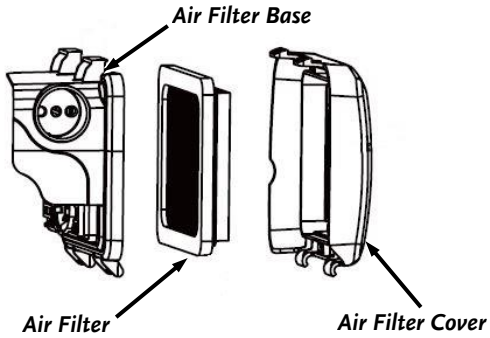


Figure 10

Maintenance of Spark Plug

⚠ CAUTION

Allow the muffler to cool for at least 15 minutes before removing the Spark Plug to prevent burn injuries.

In order to ensure the Engine will run normally, setting the gap of the Spark Plug must be correct and no deposit around the Spark Plug.

Recommended Spark Plugs:

NGK:	BP6ES/BPR6ES
DENSO:	W20EPR-U
CHAMPION:	RN11YC4
TORCH:	F6TC/F6RTC

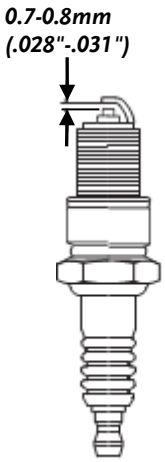


Figure 11

1) Remove the Spark Plug cap.
2) Clear away any dirt or debris around the Spark Plug base.
3) Remove the Spark Plug with a Spark Plug wrench.
4) Visually check the Spark Plug (***Figure 11***). Clean with a steel brush. If the insulator is damaged, replace the Spark Plug.
5) Measure the Spark Plug clearance with a feeler gauge. The clearance should be 0.7~0.8mm (.028"-.031"). If adjustment is necessary, bend the side electrode carefully.
6) To avoid cross-threading, first, screw in Spark Plug by hand, then tighten with a Spark Plug wrench to compress the gasket.

Note: *If a new Spark Plug is used, please replace it with same Spark Plug model.*

7) Turn a new Spark Plug 1/2 turn after the gasket is touching to compress the gasket.
8) Turn a used Spark Plug 1/8-1/4 turns after the gasket is touching to compress the gasket.

NOTICE

- The Spark Plug must be tightened securely or it may become very hot and damage the Engine.
- Only use recommended Spark Plug or the equivalent. Incorrect heat range of the Spark Plug may damage the Engine.

Idle speed adjustment of the carburetor

1) Start the Engine and preheat it to normal operating temperature.
2) Adjust the throttle stopping screw to obtain minimum idle speed. Minimum idle speed:(1,900±300) r/min.

High Altitude Kit for EPAIII Engines

3000ft to 6000ft or 6000ft to 8000ft of elevation

At high altitude, the standard carburetor air-fuel mixture will be too rich. Performance will decrease and fuel consumption will increase. A very rich mixture will also foul the Spark Plug and cause hard starting. Operation at an altitude that differs from that at which this Engine was certified, for extended periods of time, may increase emissions.

The fuel system on this Engine or Equipment may be influenced by operation at higher altitudes. Proper operation can be ensured by installing an altitude kit when required. See the table below to determine when an altitude kit is required. Operating this Engine without the proper altitude kit installed may increase the Engine's emissions and decrease fuel economy and performance. Kits may be obtained from DR Power Equipment and should be installed by a qualified individual.

Fuel	Altitude Range*	Kit Part Number
Gasoline	0 – 3000 ft	Not Required
	3000 – 6000 ft	Kit # A0002862422
	6000 – 8000 ft	Kit # A0002862423
Engine, Generator Set, Pressure Washer, Walk-Behind Lawnmower, Compressor, Pump, Tiller etc. *Elevation above sea level.		

- This high altitude jet is to be used at elevations above 3000 feet.
- At elevations above 8000 feet, the Engine may experience decreased performance, even with the high-altitude kit.

⚠ WARNING

To prevent serious injury from fire, follow the kit procedures in a well-ventilated area away from ignition sources. If the Engine is hot from use, shut the Engine off and wait for it to cool before proceeding.

NOTICE

The warranty may be void if necessary adjustments are not made for high altitude use by installing a high altitude kit.

If a carburetor is replaced, the proper high altitude kit jet will need to be installed into the replacement carburetor.

Chapter 6: Transport And Storage

Transport

⚠ WARNING

To avoid fuel spills during transporting, keep the Engine level. Spilled fuel or fuel vapor may ignite to cause fire.

Storage

If the Engine will not be used for a long time, storage should be as follows:

1) The storage area should be dry and free of dust.
2) Completely drain fuel out of the fuel tank and carburetor.
3) Replace Engine Oil.
4) Remove the Spark Plug. Fill about a spoon of fresh Engine Oil onto the cylinder. Pull the recoil starter rope slowly to distribute Engine Oil evenly. Reinstall the Spark Plug.
5) Close the choke to protect dust from entering Engine.
6) Cover the Engine to protect against moisture and dust.

Engine is difficult to start

TROUBLE			CAUSE		REMEDY
Normal cylinder compression	Normal Spark Plug spark	Something wrong with the fuel system	Fuel supply is not smooth or no fuel supply	There is not enough fuel in fuel tank and fuel cock is closed.	Fill fuel, open fuel cock.
				Air vent in the fuel filler cap is clogged	Dredge air vent.
				Fuel cock is clogged	Clean first and then dredge
				Improper or clogged main Oil flow hole.	Readjust or clean, blow to get through.
				Needle valve is not closed properly or start hole is clogged.	Dismantle needle valve and re-pair, clean, blow to get through.
				Float is damaged or sticking.	Repair float
			Fuel Supply is normal	Fuel is too filthy or deteriorated	Replace
				There is water in fuel.	Replace
				Too much fuel in Engine	Drain extra fuel, dry up Spark Plug electrodes.
				Wrong fuel brand	Select proper fuel brand corresponding with the requirements.
	Normal fuel supply system	Normal high – tension line	Spark Plug is in bad conditions	Too much carbon deposit and dirt around electrodes.	Clear away.
				Electrodes are burn damaged seriously or insulators damaged.	Replace Spark Plug.
				Improper electrodes gap.	Adjust to proper value.
		High-tension line no spark	Normal Spark Plug	High –tension line is damaged.	Replace
				Ignition coil is damaged.	Replace
				Magneto loses magnetism.	Replace
				Wrong gap between ignition coil and flywheel	Adjust gap between ignition and flywheel
Abnormal cylinder compression	Normal fuel supply system	High-tension coil run out Normal ignition system		Piston ring is worn to or even over its wear limit	Replace
				Piston ring is broken.	Replace
				Piston ring is sticking.	Clear up carbon fouling.
				Spark Plug is not installed tight or is without a gasket.	Tighten with a gasket in.
				Air leakage between cylinder block and cylinder head.	Check cylinder gasket, and the flatness of the surface by which cylinder block contacting with cylinder head
					Tighten cylinder head bolts in stipulated order to stipulated torque.
				Air leakage in the valves	Check valve clearance and tightness, repair if necessary.

Gasoline Engine Power Output Insufficiency

TROUBLE	CAUSE		REMEDY
When increasing throttle, speed increase slow or even decrease and stop running	Fuel supply system	Air in fuel line or fuel line clogged	Exhaust air or dredge fuel line
		Main Oil flow hole is not adjusted properly	Readjust
		In carburetor, needle valve hole and main Oil flow hole clogged.	Clean and blow to get through
		Fuel cock is clogged up.	Clean, replace damaged part
		Too much carbon deposit in combusting chamber.	Clear away
		Too much car bon fouling in muffler and exhaust pipe.	Clear away
		Air cleaner is clogged up.	Clean air cleaner filter element
		Intake pipe is leaking	Repair or replace
	Poor compression	Piston or cylinder or piston ring is worn	Replace the worn
		Air leakage from the surface by which cylinder block contacting with cylinder head.	Replace cylinder gasket
		Too big or too small valve clearance.	Readjust
		Valve tightness is poor.	Repair

Gasoline Engine Running Poorly

TROUBLE	CAUSE	REMEDY
Knocking sound	Piston, cylinder, or piston ring is worn excessively.	Replace the worn
	Piston pin and piston pin hole are worn excessively.	Replace piston or piston pin
	Tie rod small head is worn excessively.	Replace tie rod
	Roller bearing for crankshaft main shaft is worn.	Replace roller bearing
Abnormal combustion	Engine is too hot	Shoot trouble
	Too much carbon deposit in combustion chamber	Clear away
	Improper gasoline brand or low gasoline quality	Replace with qualified gasoline
Spark lacking	There is water in float chamber	Clean
	improper Spark Plug electrodes clearance	Adjust
	Something wrong with induced coil, and so on	Check and replace damaged parts

Stop Suddenly when Running

TROUBLE	CAUSE		REMEDY
Engine stops suddenly when running.	Fuel supply system	Fuel is empty	Refill fuel
		Carburetor is clogged	Check fuel line and clean
		Float chamber is leaking	Repair
		Needle valve is stuck.	Dismantle float chamber and free up valve
	Ignition system	Spark Plug is damaged, or short-circuited by carbon deposit	Replace Spark Plug
		Side electrode of Spark Plug is damaged	Replace Spark Plug
		Spark Plug wire is pulled off	Connect
		Ignition coil is damaged or short-circuited	Replace ignition coil
		Engine kill wire is touching Engine body	Find where touching and insulate
	Other causes	Cylinder is seriously scored, and valve dropped out	Repair or replace damaged parts

Gasoline Engine Is Overheat

TROUBLE	CAUSE	REMEDY
Gasoline Engine is overheating	Wrong Oil used	Refill Engine Oil
	Exhaust pipe blocked up	Clean exhaust pipe
	Shroud damaged	Repair damaged part
	Cooling fins blocked by foreign matter	Clear cooling fins
	Connection rod deformation to make piston and cylinder bushing side wear	Replace connection rod
	Cylinder, piston, or piston ring is worn to break seal between cylinder and crankcase	Replace the worn parts
	Improper adjustment of Engine governor to produce speed high.	Readjust Engine governor
	Crankshaft main bearing burnt out	Replace main bearing

⚠ CAUTION

The gasoline Engine should be kept about 80 ~ 110℃ temperature around the outlet of the shroud. If the temperature is too high, it will indicate the gasoline Engine overheating.

Abnormal Noise Exist When Engine Running

TROUBLE	CAUSE	REMEDY
Knocking sound	Piston, piston ring or cylinder is worn	Replace the worn part
	Connection rod or piston pin and piston pin hole are worn	Replace the worn part
	Crankshaft main neck is worn	Replace bearing
	Piston ring is broken	Replace piston ring
Metal knocking sound when abnormal combustion occurs	Too much carbon deposit in combusting chamber	Clear away carbon deposit
	Improper fuel brand	Replace fuel
	Engine is overheating	Find a cause and eliminate it
The other	Improper valve clearance	Readjust valve clearance properly
	Flywheel is not connected with crank-shaft tightly	Connect tightly

Specifications

Engine Model	**RV170**
L×W×H (not including crankshaft output terminal) (mm)	395 x 348 x 282
Dry Weight(kg)	12.5
Engine Type	Single cylinder horizontal,4-stroke, (OHV)
Displacement(ml)	173
Bore × Stroke(mm)	70 x 44.2
Theoretical Maximum Power	3.2kw/3600r/min
Maximum Torque	9.0N m/2500r/min
Fuel Consumption	395g/kw·h
Cooling System	Forced air
Ignition System	Capacitance discharge type
Shaft Orientation	Vertical shaft output

Adjustment Data

Items	**Technical Data**	**Service**
Spark Plug clearance (Gap)	0.7-0.8mm	See maintenance section
Carburetor idle speed	1900±300r/min	See maintenance section
Valve clearance (cold Engine)	Intake: 0.15 ± 0.02mm Exhaust: 0.20 ± 0.02mm	Serviced by DR Power Equipment or authorized dealer

Notes: Important Bolt Torque Specs

Items	Specifications	Torque Value	
		N·m	kg·m
Connection-rod bolt	M7 x 1.25	12	1.2
Cylinder head bolt	M8 × 1.5	26	2.6
Flywheel nut	M14 × 1.5	52	5.2
Crankcase cover bolt	M8 x 1.5	26	2.6
Valve clearance adjusting nut	M6 x 0.5	10	1.0
Valve Rocker Bolt	M8 x 1.25	24	2.4

California and Federal Exhaust and Evaporative Emissions Control Warranty Statement

Your Warranty Rights and Obligations

The California Air Resources Board, the United States Environmental Protection Agency and Chongqing Rato Technology Co., Ltd. (Rato), are pleased to explain the exhaust and evaporative emissions ("emissions") control system warranty on your 2022 small off-road Engine/equipment. In California, new equipment that use small off-road Engines must be designed, built, and equipped to meet the State's stringent anti-smog standards. Rato must warrant the emissions control system on your small off-road Engine/equipment for the period listed below provided there has been no abuse, neglect, or improper maintenance of your small off-road Engine/equipment leading to the failure of the emissions control system.

Your emissions control system may include parts such as the carburetor or fuel-injection system, the ignition system, catalytic converter, fuel tanks, fuel lines (for liquid fuel and fuel vapors), fuel caps, valves, canisters, filters, clamps, and other associated components. Also included may be hoses, belts, connectors, and other emission-related assemblies.

Where a warrantable condition exists, Rato will repair your small off-road Engine/equipment at no cost to you including diagnosis, parts, and labor.

Manufacturer's Warranty Coverage:

The exhaust and evaporative emissions control system on your small off-road Engine/equipment is warranted for two years. If any emissions-related part on your small off-road Engine/equipment is defective, the part will be repaired or replaced by Rato.

Owner's Warranty Responsibilities:

As the small off-road Engine/equipment owner, you are responsible for performance of the required maintenance listed in your owner's manual. Rato recommends that you retain all receipts covering maintenance on your small off-road Engine/equipment, but Rato cannot deny warranty coverage solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

As the small off-road Engine/equipment owner, you should however be aware that Rato may deny you warranty coverage if your small off-road Engine/equipment or a part has failed due to abuse, neglect, or improper maintenance or unapproved modifications.

You are responsible for presenting your small off-road Engine/equipment to a Rato distribution center or service center as soon as the problem exists. The warranty repairs shall be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities, you should contact Great Lakes Technologies, LLC. at 800-232-1195 or techsupport@wenproducts.com.

Defects Warranty Requirements:

(a) The warranty period begins on the date the small off-road Engine/equipment is delivered to an ultimate purchaser.

(b) General Emissions Warranty Coverage. Rato warrants to the ultimate purchaser and each subsequent owner that the Engine or equipment is:

(1) Designed, built, and equipped so as to conform with all applicable regulations adopted by the Air Resources Board; and

(2) Free from defects in materials and workmanship that causes the failure of a warranted part for a period of two years.

(c) The warranty on emission-related parts will be interpreted as follows:

(1) Any warranted part that is not scheduled for replacement as required maintenance in the written instructions must be warranted for the warranty period defined in Subsection (b)(2). If any such part fails during the period of warranty coverage, it must be repaired or replaced by Rato according to Subsection (4) below. Any such part repaired or replaced under the warranty must be warranted for the remaining warranty period.

(2) Any warranted part that is scheduled only for regular inspection in the written instructions must be warranted for the warranty period defined in Subsection (b)(2). A statement in such written instructions to the effect of "repair or replace as necessary" shall advise owners of the warranty coverage for emissions related parts. Replacement within the warranty period is covered by the warranty and will not reduce the period of warranty coverage. Any such part repaired or replaced under warranty must be warranted for the remaining warranty

period.

(3) Any warranted part that is scheduled for replacement as required maintenance in the written instructions must be warranted for the period of time prior to the first scheduled replacement point for that part. If the part fails prior to the first scheduled replacement, the part must be repaired or replaced by Rato according to Subsection (4) below. Any such part repaired or replaced under warranty must be warranted for the remainder of the period prior to the first scheduled replacement point for the part.

(4) Repair or replacement of any warranted part under the warranty provisions must be performed at no charge to the owner at a warranty station.

(5) Notwithstanding the provisions of Subsection (4) above, warranty services or repairs must be provided at distribution centers that are franchised to service the subject Engine/equipment.

(6) The owner must not be charged for diagnostic labor that leads to the determination that a warranted part is in fact defective, provided that such diagnostic work is performed at a warranty station.

(7) Rato is liable for damages to other Engine/equipment components proximately caused by a failure under warranty of any warranted part.

(8) Throughout the emissions control system's warranty period set out in subsection (b)(2), Rato must maintain a supply of warranted parts sufficient to meet the expected demand for such parts and must obtain additional parts if that supply is exhausted.

(9) Manufacturer-approved replacement parts that do not increase the exhaust or evaporative emissions of the Engine or emissions control system must be used in the performance of any warranty maintenance or repairs and must be provided without charge to the owner. Such use will not reduce the warranty obligations of Rato.

(10) Add-on or modified parts that are not exempted by the Air Resources Board may not be used. The use of any non-exempted add-on or modified parts will be grounds for disallowing a warranty claim. Rato will not be liable to warrant failures of warranted parts caused by the use of a non-exempted add-on or modified part.

(11) Rato issuing the warranty shall provide any documents that describe that warranty procedures or policies within five working days of request by the Executive Officer.

(d) Emission Warranty Parts List for Exhaust

(1) Fuel Metering System
- (i) Carburetor and internal parts (and/or pressure regulator or fuel injection system).
- (ii) Air/fuel ratio feedback and control system.
- (iii) Cold start enrichment system.

(2) Air Induction System
- (i) Controlled hot air intake system.
- (ii) Intake manifold.
- (iii) Air filter.

(3) Ignition System
- (i) Spark Plugs.
- (ii) Magneto or electronic ignition system.
- (iii) Spark advance/retard system.

(4) Exhaust Gas Recirculation (EGR) System
- (i) EGR valve body, and carburetor spacer if applicable.
- (ii) EGR rate feedback and control system.

(5) Air Injection System
- (i) Air pump or pulse valve.
- (ii) Valves affecting distribution of flow.
- (iii) Distribution manifold.

(6) Catalyst or Thermal Reactor System
- (i) Catalytic converter.
- (ii) Thermal reactor.
- (iii) Exhaust manifold.

(7) Particulate Controls
- (i) Traps, filters, precipitators, and any other device used to capture particulate emissions.

(8) Miscellaneous Items Used in Above Systems
(i) Electronic controls.
(ii) Vacuum, temperature, and time sensitive valves and switches.
(iii) Hoses, belts, connectors, and assemblies.

(e) Emission Warranty Parts List for Evap
(1) Fuel Tank
(2) Fuel Cap
(3) Fuel Lines (for liquid fuel and fuel vapors)
(4) Fuel Line Fittings
(5) Clamps*
(6) Pressure Relief Valves*
(7) Control Valves*
(8) Control Solenoids*
(9) Electronic Controls*
(10) Vacuum Control Diaphragms*
(11) Control Cables*
(12) Control Linkages*
(13) Purge Valves*
(14) Gaskets*
(15) LiquidNapor Separator
(16) Carbon Canister
(17) Canister Mounting Brackets
(18) Carburetor Purge Port Connector

*Note: As they relate to the evaporative emission control system.

Rato will furnish with each new small off-road Engine/equipment written instructions for the maintenance and use of the Engine/equipment by the owner.

800 HINESBURG ROAD, SOUTH BURLINGTON, VERMONT 05403