



3.5 SX Outboard Owners Guide Item #8950

Thank You for selecting the finest American Made engine available. With simple care and common sense your engine will provide you years of trouble free service. This product does require mechanical ability and know-how to operate. You must be the judge of your own ability. YOU are the person who will control your model and engine in a safe manner and must assume all responsibility for your activity.

NOTICE! READ THIS!

IT IS NORMAL FOR THERE TO BE A TIGHT SPOT WHILE TURNING OVER THE ENGINE. THIS IS EXPLAINED FURTHER IN THIS MANUAL.

THE FOLLOWING WILL RESULT IN DAMAGE TO THE ENGINE WHICH WILL NOT BE COVERED UNDER WARRANTY.

RUNNING THE ENGINE OUT OF THE WATER AT HIGH RPM'S OR FOR EXTENDED PERIODS OF TIME. When the engine is not in the water there is no load on the prop so the engine can over rev. This will cause the connecting rod to break or stretch and break at a later date. Since there is no load on the engine it will run at a higher RPM's with less fuel and in turn less oil, this will not supply the rod bearing enough oil and will result in breakage. Be careful. Only run your engine at low rpm's while it is out of the water. Perform carburetor adjustments after running your engine in the water. The only way to obtain the correct carburetor settings is to have the correct load on the prop.

IF YOU FLIP YOUR BOAT OR CAUSE THE ENGINE TO INGEST WATER WHILE IT IS RUNNING. This will cause the connecting rod to break or stretch and break at a later date. This is caused by the piston trying to compress the ingested water which will not compress in turn placing extreme loads on the connecting rod. This condition can also be caused by fuel flooding the engine and trying to spin it with an electric starter.

DO NOT RUN YOUR ENGINE AT AN EXTREMELY RICH SETTING. An ABC engine needs to come up to temperature and running it at an extremely rich setting for a period of time will cause premature wear on the piston as well as the rod to stretch and break. This is because the cylinder is too cold and the piston is forced into the taper and sticks and is then pulled back down with the connecting rod. The normal warm up period will not hurt the engine but trying to run it very rich will because of the accumulative effect of 15,000 rpm's or 15,000 sticks and pulls of the rod per minute. The damage may not be apparent initially but the rod may break in the future seemingly for no apparent reason.

DO NOT TRY TO BREAK YOUR ENGINE IN BY SPINNING IT WITH AN ELECTRIC STARTER OR DRILL MOTOR. This is the worst thing to do. You cause the same problems as running it too rich but even worse. By doing this the cylinder isn't even close to the correct temperature and there is no combustion to help the piston back down the stroke. So by doing this you are forcing the piston into the taper and then pulling it back down with the connecting rod. Connecting rods are designed to take force in one direction only and doing this will cause the rod to stretch and break as well as premature wear on the piston. The damage may not be apparent initially but the rod may break in the future seemingly for no apparent reason.

THE ABOVE IS TRUE WITH ALL ENGINES, NOT JUST K&B, SO BE AWARE OF WHAT YOU ARE DOING AND THE POSSIBLE CONSEQUENCES OF NOT FOLLOWING THESE INSTRUCTIONS.

PLEASE READ ALL SAFETY INSTRUCTIONS!

Failure to read, understand and follow these instructions could result in personal injury and/or property damage to yourself or others.

Do not attempt to run your model before completely checking out your installation.

Engines produce heat when running. Be careful as parts of the engine may cause burns even after the engine is stopped prior to cooling off.

Never run your engine in an enclosed area. Engines produce dangerous exhaust gases and must be run outdoors only.

In case of difficulty, the safest and easiest way to stop the engine is to pinch off the fuel line or remove it from the carburetor. Never throw anything into the propeller (rags, etc.) to stop the engine.

Never clamp your engine in a vice to test run. Mount your engine securely on your boat. Never use wood screws to mount your engine. Use good quality machine screws and nuts.

Store your fuel in a tightly sealed container (metal or suitable plastic, NOT GLASS). Model fuel is poisonous and flammable. Keep it away from heat, flames, and the reach of children.

Never use propellers with nicks, scratches or cracks. Always use the correct size propeller for your engine.

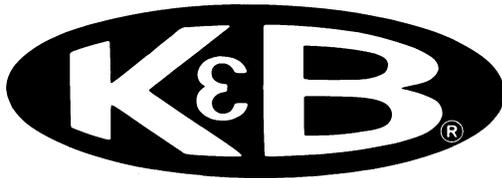
Keep your hands a safe distance from the propeller at all times.

Keep all loose articles (pencils, eyeglasses, etc.) out of shirt pockets, as they may fall out while adjusting your engine. Long hair, neckties, loose shirt sleeves and clothing, etc. must be kept away from the prop.

YOUR ENGINE IS NOT A TOY! It is a precision piece of machinery and must be treated as such.

If you are in doubt about anything, it is best to call our factory. Asking your hobby dealer or an experienced modeler for assistance may be helpful, but may not provide the correct information.

REMEMBER: SAFE OPERATION OF YOUR MODEL AND ENGINE IS YOUR RESPONSIBILITY!

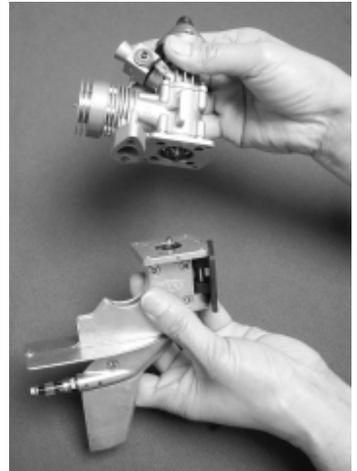


Assembling your outboard new from the box

The muffler is not attached to the engine for shipping/ packaging purposes. Note SS model shown in photos.

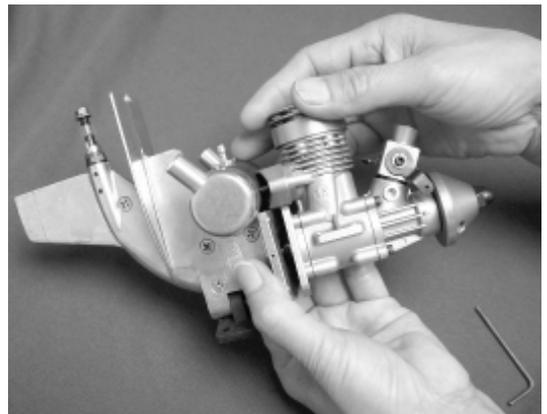
Take a few moments to familiarize yourself with the various parts of the engine as shown in the exploded parts view included with this manual. **DO NOT DISASSEMBLE YOUR ENGINE!** Doing so may void your warranty.

Displacement21 Cu. In (3.5 ccm)
Bore650"
Stroke640"
R.P.M. Range	2,200 - 25,000
Power Output	1.3 H.P. @ 25,000

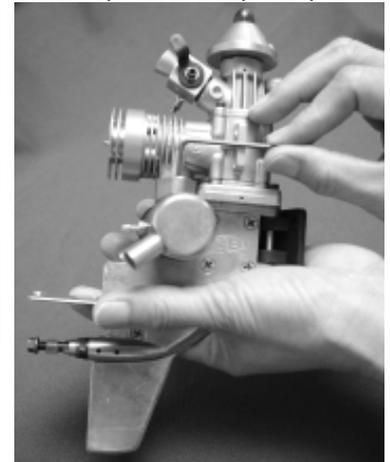
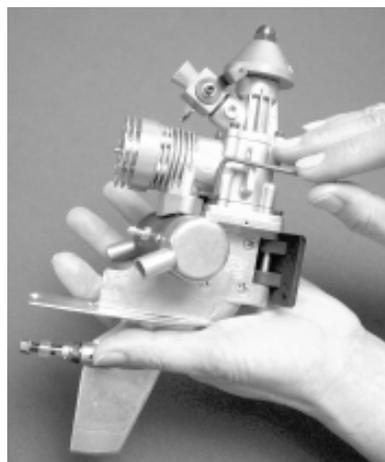
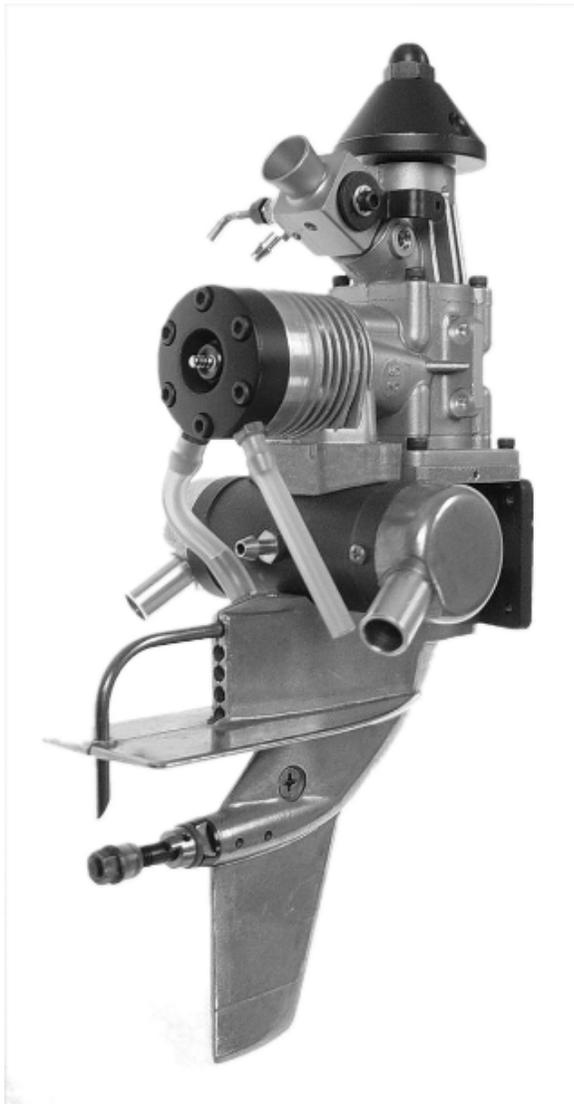


To install muffler, separate the lower unit from the power head by removing the water line and four mounting screws from the power take off mounting plate.

Place the muffler into the cutout on the lower unit and install the engine back onto the lower unit. Make certain that the exhaust outlets are pointing the



correct direction. Be sure to align the square drive on the flex shaft with the output shaft. Install the four screws loosely but completely into the lower unit thru the PTO (Power Take Off) plate then tighten them. Tighten them in a diagonal fashion. Install the muffler screws and hook up the water pick up line.



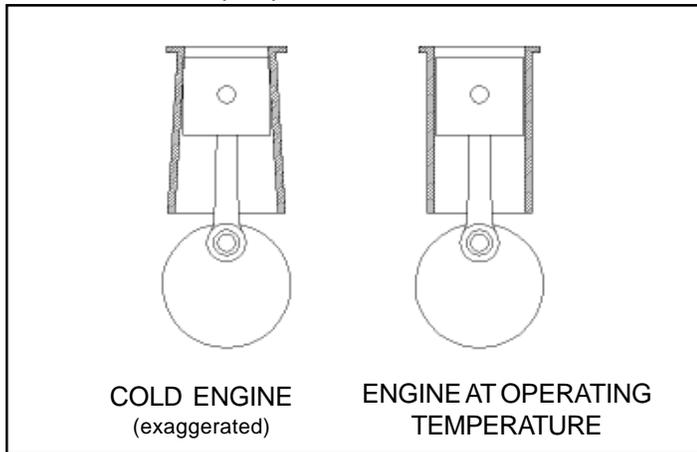
Important Information...

PLEASE NOTE: This engine is of "ABC" construction. That means that it has an Aluminum piston fitted into a Brass, Chrome plated cylinder.

ABC type engines are intentionally manufactured with a "taper" in the cylinder so you will feel a "binding" when the piston is moving through the top of its stroke. You may also detect what seems like a dead spot or disconnected feeling of the crankshaft and you may even hear a clicking sound when the piston is at this point.

These feelings and sounds are the result of the taper (binding) in the cylinder affecting the required clearances in the connecting rod ends. All of these conditions are normal.

As the ABC type engine obtains operating temperature the cylinder becomes straight and the clearances between the piston and cylinder become correct. The straightening is due to the top of the cylinder running at a higher temperature than the bottom, thus the top expands more.



It is also normal for compression to sometimes feel poor when the engine is stopped and turned over while still hot. This is due to the piston cooling faster than the cylinder. If the engine temperature is allowed to stabilize the compression will return to normal.

RUNNING THE ENGINE TOO RICH WILL RUIN THE FIT

If the operating temperature is not reached, the piston is prematurely worn from lack of clearance. You do not want to "break-in" an ABC engine at a very rich setting. Just a slightly rich setting for the first 30 to 45 minutes of running is adequate.

WATER COOLED HEAD

This K&B engine is equipped with a water cooled head. This requires the engine to be running through the water for the pick up tube located behind the propeller to feed the head. The engine can not be run outside of the water for extended periods of time since the head and lower unit require water for cooling. Also, the engine needs air moving over the cylinder fins to carry away the heat of combustion. **CAUTION:** The head, lower unit and engine becomes hot during and after running and can cause burns. Be careful.

For your information, your engine has been factory set with a head clearance between .018 to .020

THE LOWER UNIT

Tests have proven that the cable drive supplied in your K&B

engine is far more efficient and superior to a gear drive. With a cable drive, maintenance of your lower end is reduced to a minimum. Periodically check your cable drive for fraying and excess wear.

Do not turn your boat propeller or rotate your engine in a counter clockwise direction as doing so might lead to the cable fraying and unwinding. Again, regularly lube your cable by using K&B Marine Grease (P/N 8449 or equivalent). See maintenance section of this manual for information on this procedure.

FLEX SHAFT CARE

An access hole is provided in the PTO (Power Take Off) plate on the lower unit for lubrication of the flex shaft. We recommend that each time, before you run the engine, you lube the cable with a mixture of 50% STP & 50% 20-50 weight oil. In addition, we recommend that you periodically remove, inspect, and re-lube the entire flex cable with K&B P/N 8449 shaft lube or equivalent for maximum cable life.

STARTING AND BREAK-IN

All K&B engines are produced to the highest industry standards and inspected before leaving the factory, but they are not "BROKEN-IN" and will require approximately 30-45 minutes running before the full potential of the engine is realized. **BREAK-IN MUST BE DONE WHILE ON THE BOAT RUNNING IN THE WATER.**

A model engine makes sounds that will tell you how it's performing. You'll have to listen very carefully for them, recognize their message, and make adjustments to the fuel control needle valves accordingly. The mixture of fuel and air is controlled by the amount of fuel metered by the needle valve.

SLIGHTLY RICH MIXTURE running is characterized by a slower, sometimes irregular, sputtering exhaust sound. The exhaust gas will be smoky and probably contain small droplets of oil. This condition is good for Break-in since the engine receives excess lubrication and runs slightly cooler.

This is the setting you normally look for before launching the boat because the engine will run leaner when in the water.

SLOPPY RICH or FOUR CYCLING is a very rich type setting, but it is fast enough to push the boat. **THIS SETTING SHOULD BE AVOIDED WITH AN ABC TYPE ENGINE AS THE CORRECT OPERATING TEMPERATURE MAY NOT BE ACHIEVED.**

PEAKED or TWO CYCLE. As the main needle is closed (clockwise), it reduces the amount of fuel mixed with the air drawn into the engine. At a specific point, which varies with each engine, air temperature, altitude and relative humidity, the exhaust note will change quickly into a smooth, powerful note. If the needle is closed further, the note will stay smooth, but will weaken. The peak occurs just at the break point from a rich setting and further leaning will ruin the engine. A lean setting raises the engine heat above the safe point, reduces lubrication, and destroys glow plugs due to high combustion temperature.

It is important to recognize these settings as incorrect needle valve settings are very harmful to the engine and your investment. Learn to tune the engine. Remember, a slightly rich setting is always preferred for long motor life.

STARTING PREPARATIONS

GLOW PLUGS PREPARATIONS

Use a Standard long (K&B #7311 included installed in your engine) glow plug when using less than 25% nitro or High Performance (K&B #7300) glow plug when using more than 25% nitro. You also need a 1.5 volt battery to operate the glow plug.

FUEL SPECIFICATIONS

Use a good commercial grade two cycle glow fuel (K&B 500 or K&B 1000) with 15%~25% nitro-methane (more nitro helps in cold weather).

BREAK-IN FORMULA: 20% oil, 15% nitro-methane, and the balance methanol.

AFTER BREAK-IN: The nitro-methane percentage may be increased to 25% or higher desired. **LOW QUALITY FUELS CAN RUIN THE ENGINE IN A SHORT PERIOD OF TIME.** Never use fuel with less than 18% oil content by volume.

Be sure the fuel contains the right percentage of oil (18-22% by volume) and the fuel oil content is at least a 50-50 mix of castor oil. Not all synthetic oil. Use only fuel that lists percentages on the label by volume.

Keep fuel clean and filter it during fueling. Keep exposure to air to a minimum as methanol will absorb moisture rapidly.

MARINE PROPELLERS

A Prather 215 SS or 220 SS (Stainless Steel) propeller is recommended as a starting size for this engine.

Be sure prop is balanced. Vibrations are usually caused by props and excessive wear or breakage of the prop shaft may occur.

These propellers as well as a prop balancer may be purchased from your local hobby store or direct from K&B.

Use of smaller propellers can cause vibrations and damage to the engine. Too large a propeller can cause excessive wear as the engine is lugged below its designed operating R.P.M. range.

PRESSURE LINE HOOK UP

Muffler pressure should be connected to the tank from the nipple in the center of the muffler.

CARBURETOR SET UP

K&B engines are fitted with a variable mixture carburetor which automatically alters both fuel and air mixtures as it's closed. Best and most reliable carburetor settings are obtained after engine break-in.

The carburetor on the 3.5 has a preset idle mixture and a high speed mixture needle.

High Speed Needle Valve Adjustment: The needle, located on the carburetor assembly, controls all the fuel supply to the engine at the maximum throttle setting. It does not control the fuel at lower throttle settings.

As a starting point for the High Speed Needle adjustment, close the needle valve (clockwise) all the way closed, DO NOT force it, then open it (counterclockwise) 5 to 6 turns. This setting is an average and will require further adjustments.

3. LOW SPEED and MID-RANGE ADJUSTMENT are fixed and no adjustment can be made. carburetor.

ACTUAL STARTING

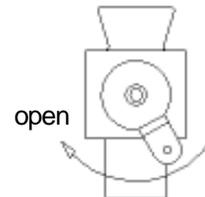
NOTE: The engine runs in a clockwise direction when looking directly down at the flywheel. This is opposite from an aircraft or car engine so the electric starter may have to be connected to your 12 volt battery in reverse.

WITHOUT battery connected, open the carburetor barrel to wide open position. Open the high speed needle valve as previously described. Choke the engine by placing your finger over the carburetor air inlet and slowly turn the flywheel over three times clockwise. You should see fuel being drawn up the fuel line. If fuel is not drawn into the carburetor, open the main needle one more turn. Fuel should be drawn into carburetor.

Close the barrel to about the 1/3 open position and connect the 1.5 volt battery to the glow plug, start the engine with your electric starter. Once the engine starts, open the carburetor to 1/2 throttle briefly and close it back to 1/4 throttle. If the engine responds well launch the boat in to the water. Running of the engine outside the water must be kept to a minimum.

If it slows, dies or only starts with a brief burst of power and

Throttle always closes to idle counter-clockwise on the 3.5 carb



stops, the needle valve setting is too lean. Unscrew the needle 1 more turn and try again. If engine starts, runs slowly and briefly the mixture is too rich. Turn the main needle in 1/2 turn and restart. **IF THE ENGINE DOES NOT FIRE AT ALL**, refer to the TROUBLE SHOOTING section in this text.

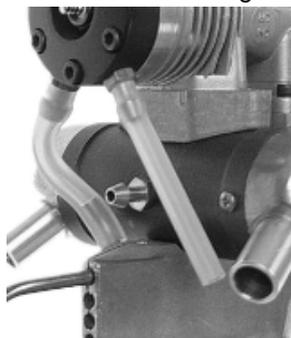
If you launch the boat and the engine dies after only 10 to 20 feet, the engine is usually running too lean.

Now adjust the main needle as described in STARTING AND BREAK IN above. **ALL ADJUSTMENTS MUST BE DONE AFTER RUNNING THE BOAT IN THE WATER.** Adjusting without running the boat in the water will not provide the correct settings. The engine must have the load of the prop in the water to obtain the correct settings.

ADJUSTING THE R/C CARBURETOR

1. Start the engine, launch the boat and open the carburetor to the full open position, then bring the boat to shore adjust the main needle and relaunch the boat. Repeat this until peak R.P.M. is reached. Then back out the main needle slightly to keep the engine on the rich side of the setting.

2. Close the carburetor barrel slowly until the lowest possible speed is reached without the engine stopping. Set your transmitter trim to this setting at full up so the engine can be killed by moving the trim level to full down position.



The engine will accelerate from idle to full throttle smoothly and instantaneously when properly adjusted. The engine may not idle well at a low setting or accelerate as quickly until it is broken in.

BREAK-IN

1. BREAK-IN running should be done at a slightly rich setting. The needle valve should be set at a point just into this range from a four cycle setting. Run the boat in the water at maximum throttle for 2 minutes, then throttle back for approximately 30 seconds. Repeat this sequence until approximately 30 minutes of accumulated running time has been obtained. **AVOID MAXIMUM THROTTLE FOR LONG PERIODS OF TIME DURING BREAK IN and AVOID RUNNING FOR LESS THAN 5 MINUTE RUNS.**

2. After the first 30~45 minutes, run the engine at a normal peak needle valve setting. This should be a little on the rich side to ensure engine received proper lubrication.

BOAT INSTALLATION

The engine must be mounted firmly to the transom of the boat using the machine screws and plate supplied with the engine. Never use wood screws to mount the engine.

Care should be taken to the mounting position as recommended by the boat manufacturer.

TROUBLE SHOOTING

Generally most engine starting problems can be traced to bad glow plugs, weak starting batteries, or inadequate fuel systems.

GLOW PLUGS

The glow plug when connected to a 1.5 volt battery should glow a bright orange. If the plug slightly glows the battery or plug should be replaced.

If the seal leaks around the center plug post, replace it.

The glow plug element should be examined after several flights. If the element is deformed or touching the side of the plug body, replace it. If the glow plug element is pitted or has a frosty look, the engine is running too lean and continued running will seriously harm the engine.

FUEL SYSTEMS

The most frequent problems encountered with fuel systems are:

1. Improper fuel tank location. The fuel tank should be located as close to the engine as possible.

2. Fuel pick up in tank is not free or in the wrong location. If the boat runs rich, then lean, then rich, the pick up may be picking up air, then fuel, then air, as the thrust of the engine causes the fuel to be forced from the front of the tank to the back.

3. Dirt or contaminants in the fuel, tank, lines, filter or carburetor. Many times a sliver of fuel line or other debris will cause the needle orifices to become plugged intermittently so a consistent mixture setting can not be obtained. Careful inspection and cleaning of these passages will usually solve the problem. Don't use silicone sealant on areas of the carburetor that involve fuel passages.

4. Holes in the fuel line. The tear resistance of silicon tubing is very low and it's not uncommon to develop a hole where the fuel line is assembled over the edges of brass tubing. If the engine runs well on the first half of tank and then quits, it's almost always caused by a hole in the pick up line inside the tank. Look for bubbles in the fuel line while the engine is running, this is a sign of holes somewhere in line.

5. Pressure tap in muffler plugged or restricted. Some fuels contain oil that can collect on the interior of the muffler and plug off the pressure tap causing the fuel tank to loose pressure and starve the engine for fuel. This will cause the engine to run lean then rich then lean. Try running the engine with the pressure line removed from the muffler to see if the problem still exists.

MAINTENANCE

When you are finished running for the day, run your engine dry by removing the fuel line at a moderate speed or allow the fuel tank to run dry. It is best to squirt some K&B AFTER RUN OIL in the carburetor, then flip the propeller about 10 to 20 times. This oil will keep castor based fuels from gumming and protect internal engine parts from rust and corrosion. When storing your model between running sessions, it is best to wrap your engine in a rag or plastic to prevent dust, dirt and moisture from entering the engine. The engine should also be wrapped in a rag between running sessions at the pond.

CHECK TIGHTNESS OF ALL SCREWS

On a regular basis you should check all screws associated with the engine. Mounting, head, back cover, muffler, prop, lower unit, etc. These screws must be properly torqued and not over-tightened. Always use a cross torquing technique as mentioned below.

BEARING CARE

Your engine operates in an aquatic environment and uses fuels which attract moisture which will shorten the life of the bearings if not cared for properly.

A cleaning hole is provided in the front housing to aid in cleaning the front (or top) bearing. Simply place the spout tube of WD40 (or similar product) up to the hole in the housing and "back-flush" the bearing until you see fresh lube coming out from under the flywheel. The bearing may also be oiled with K&B After Run Oil using this same procedure. Do not use WD40 (or similar product) on the lower unit.

FLEX SHAFT CARE

An access hole is provided in the lower unit for pre operation lubrication of the flex shaft. We recommend that each time, before you run the engine, you lube the cable with a mixture of 50% STP & 50% 20-50 weight oil. In addition, we recommend that you periodically remove, inspect, and re-lube the entire flex cable with K&B # 8449 shaft lube or equivalent for maximum cable life.

FUEL & CLEANLINESS

Always use fresh, clean fuel to prevent starting problems and poor engine performance. We recommend that you use a fuel filter in the line between the tank and the needle valve assembly. A filter will prevent foreign material from reaching the carburetor and causing a clog.

In time, the fuel filter can itself clog so we recommend you remove the filter from the line from time to time and to clean it.

AFTER RUN OIL

We recommend the use of RJL or K&B after run oil (or equivalent) after each days operation. After the engine is run dry of fuel squirt several drops in the glow plug hole and several drops into the carb intake of the still warm engine is sufficient. Briefly hit the flywheel with your starter to distribute the oil evenly throughout the engine.

ENGINE CLEAN OUT

If dirt or water does enter the engine do not turn it over until it has been flushed out completely. Alcohol is recommended for this. **DO NOT USE** carburetor cleaner or chlorinated industrial solvents as they may attack the plastic parts of the engine. The following steps may be used as a disassembly/assemble guide: (See warranty on reverse side.)

1. Remove carburetor and glow plug.
2. Remove the engine from lower unit.
3. Remove the PTO cover, muffler, and cylinder head.
3. Flush engine out completely using alcohol or mild solvent.
4. Install PTO cover, muffler, and head. Insert screws into head and tighten until they just touch the head. Then tighten them in a cross pattern sequence. Tighten the screws only slightly, repeating the sequence a number of times until the screws are tight.
5. Remove the flex shaft and grease with K&B flex shaft lube.
6. Attach the engine to the lower unit
7. Install the glow plug and carburetor.

LIMITED WARRANTY

Your K&B Model Engine has passed rigid factory inspections and is warranted to be free from defects in materials and workmanship for a period of 90 DAYS from date of original purchase.

PLEASE NOTE WE ONLY COVER DEFECTS, NOT OTHER FAILURES AS MENTIONED ON THE FIRST PAGE OF THIS MANUAL. DEFECTS WILL BE DETERMINED AT OUR FACTORY BY OUR PERSONNEL, NOT BY THE CUSTOMER.

Retain your bill of sale or sales receipt as proof of purchase date is required.

This warranty does not apply to damage or loss caused by:

- 1 ... Shipping and handling.
- 2 ... Improper break-in.
- 3 ... Use of fuel other than specified.
- 4 ... Crash, misuse or abnormal service.
- 5 ... Use of muffler or tuned pipe not provided by K&B.
- 6 ... Any modification, alteration, or abuse of the engine.
- 7 ... Use for purposes other than engine was designed.
- 8 ... Running engine without adequate cooling.
- 9 ... Use of incorrect size propeller.
- 10 . Rusted internal parts.
- 11 . Customer disassembly.
- 12 . Striped threads caused by overtightening.
- 13 . Items that become loose and fall off engine or muffler.

Other exclusions from warranty are marring or scratching of the finish, any incidental or consequential damages caused by, or resulting from, a defect in material or workmanship, and normal wear.

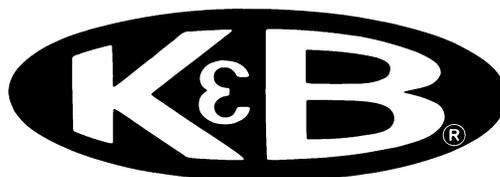
DO NOT DISASSEMBLE YOUR ENGINE! Doing so may void your warranty. No exceptions! Call or write us first and explain your problem.

Our liability under this warranty is limited to the repair or replacement of the defect or defective part at our factory and does not include inbound or outbound shipping expenses. Specifically, no responsibility is assumed for any damage to any model, accessory, radio control equipment, person or property resulting from use of or a crash or mishap in which a K&B model engine is used.

WARRANTY CARD MUST BE MAILED WITHIN 10 DAYS OF PURCHASE TO BE VALID. If purchased directly from our factory or affiliate company, your warranty is automatically activated.

IF YOU DO NOT AGREE TO THE TERMS OF OUR WARRANTY, PLEASE RETURN THE UNUSED ENGINE TO PLACE OF PURCHASE IN ACCORDANCE WITH TIME PERIOD ALLOWED FOR RETURN.

BY USING ENGINE, OR RETURNING WARRANTY CARD TO FACTORY, THE CUSTOMER AGREES TO ALL TERMS & CONDITIONS OF WARRANTY AND THE CUSTOMER ASSUMES ALL RESPONSIBILITY FOR ANY PROPERTY DAMAGE OR INJURY WHICH MAY RESULT FROM THE USE THIS PRODUCT.



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