MAGNUM

OPERATING INSTRUCTIONS

For XL .80RFS and XL .91RFS Series Four-Stroke Engines

XL .80RFS/.91RFS ENGINE SPECIFICATIONS	
Displacement:	**.80ci (12.8cc) / .91ci (14.95cc)**
Bore:	**26.5mm / 27.7mm**
Stroke:	**24.8mm / 24.8mm**
Practical RPM:	**2,000 - 12,000 / 2,000 - 12,000**
Weight:	**20.0oz / 20.7oz (w/o Muffler)**
	21.7oz / 22.4oz (w/ Muffler)

Both Engines Feature:

- Ringed-Piston Design for Long Life and High Power
- Rear-Updraft, Dual-Needle Carburetor w/Choke
- High-Flow Quiet Muffler
- Dual Ball Bearing-Supported Crankshaft & Camshaft
- Dual Bushing-Supported Connecting Rod

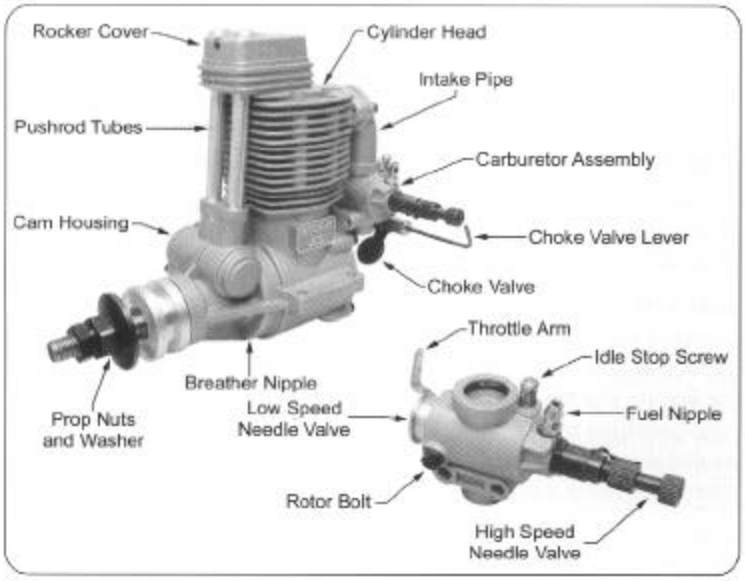
INTRODUCTION

Thank you for choosing a Magnum XL RFS series aircraft engine. The XL .80RFS and .91RFS engines are single cylinder, four-stroke engines incorporating an aluminum piston, iron ring and steel sleeve for long life and high power output. A dual needle valve carburetor for precise fuel/airflow metering is standard. Both engines feature a ball bearing-supported crankshaft and camshaft, dual bushing-supported connecting rod, and a high-flow muffler for more power and reduced noise. Your Magnum XL RFS series engine was designed by expert engineers and built by master craftsmen using only the highest quality materials and CNC machinery. These qualities provide the long life and dependability you have come to expect from an engine of this caliber.

BECOMING FAMILIAR WITH YOUR ENGINE

If you are familiar with the operation of model engines or just can't wait to run your new engine, please read through the Quick-Start Guide included. This guide will help you get started right away and also includes some good recommendations. We do recommend reading through these Operating Instructions in their entirety to familiarize yourself with the features and operation of your new engine. We have also included a Troubleshooting Guide should you encounter any problems.

Please use the photos below to familiarize yourself with the components of your new Magnum XL RFS series engine.



CAUTION - PLEASE READ!!

Magnum XL RFS series model airplane engines will consistently give you dependable performance and reliability and will be a source of satisfaction and pleasure if you follow these instructions as to the engine's proper and safe use. You alone are responsible for the safe operation of your engine, so act sensibly and with care at all times. This Magnum XL RFS series model airplane engine is not a toy. It is a precision-built machine whose power is capable of causing serious injury to yourself and others if abused or misused, or if you fail to observe proper safety precautions while using it.

- Keep spectators, especially small children, at least 20 feet away from the engine while it is running.
- Mount the engine securely in the airplane or on a suitable engine test stand to run the engine. Follow the mounting instructions in your kit's instruction manual or on the plans for individual mounting recommendations. Do not clamp the engine in a vise to test-run it.
- Use the recommended size propeller and follow the proper procedure for mounting the propeller. Use the correct size wrench to tighten the propeller nut and the safety nut. Do not use pliers.
- Inspect the spinner, propeller, and propeller and safety nuts on a regular basis, looking for any signs of nicks, cracks or loosening.
- To stop the engine, adjust the throttle linkage to completely close the throttle barrel and therefore cut off the fuel/air supply. You can also pinch the fuel line to stop the engine, but only if it is accessible. Do not throw anything into the spinning propeller or attempt to use your hands to stop the engine.
- While the engine is running, stand behind the engine to make any adjustments to the needle valves. Do not reach over or around the propeller. Do not lean toward the engine. Do not wear loose clothing or allow anything to be drawn into the spinning propeller while the engine is running.
- If you need to carry your model while the engine is running, be conscious of the spinning propeller. Keep the airplane pointed away from you and others at all times.
- Do not use tight-fitting cowls over the engine. They can restrict air from flowing over the engine, which could result in engine damage from overheating.

ENGINE INSTALLATION

Engine Orientation

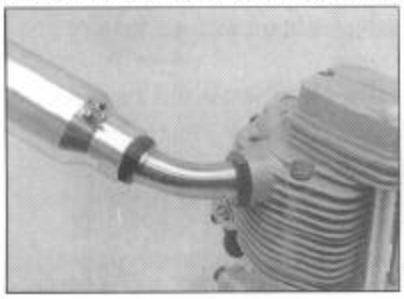
Your XL RFS series engine can be orientated in any position on the firewall. Keep in mind that when the engine is mounted inverted, carburetor adjustments will need to be made differently and the fuel tank may need to be lowered. (See fuel tank size and orientation to carburetor on the next page.)

Engine Bolts & Firewall Requirements

The engine should be mounted to either a heavy-duty, glass-filled nylon engine mount, a machined aluminum engine mount or an integrated hardwood beam mount. Use only high-quality steel cap screws and related hardware to mount the engine to the engine mount. The firewall in the airplane should be aircraft grade 5-ply plywood no less than 5/16" thick and the firewall should be reinforced to meet the torque and weight of the engine.

Muffler Installation

The muffler threads onto the exhaust pipe, which then threads into the engine's cylinder head. First thread one cinch nut onto each end of the exhaust pipe, then thread the muffler onto one end. The muffler should be threaded on at least 1/4" to prevent vibration from damaging the threads. Once you have threaded the muffler onto the exhaust pipe use an open end wrench to firmly tighten the cinch nut up against the muffler. The exhaust pipe is adjustable to better suit the installation of your particular application. Thread the exhaust pipe into the engine's cylinder head. The exhaust pipe should be threaded in no less than 1/4" to prevent vibration from damaging the threads. Once you have threaded the exhaust pipe into place and into the proper position for your application, use an open end wrench to firmly tighten the cinch nut against the cylinder head.



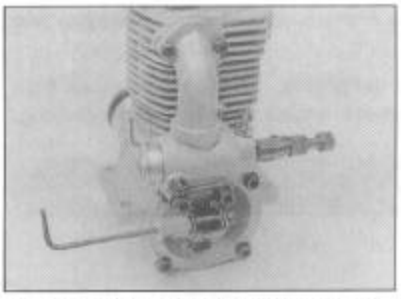
Fuel Tank Size & Orientation to Carburetor

Ideally, the stopper in the fuel tank should be even with the high speed needle valve or just slightly below it. Some models will only allow the fuel tank to be mounted higher than the ideal location. A fuel tank that is positioned higher than the ideal location usually doesn't pose any problem except when it is mounted excessively higher and/or is used in conjunction with an inverted mounted engine or during extreme aerobatic flight. If you mount the engine inverted, we strongly suggest lowering the fuel tank so the stopper assembly is slightly below the high speed needle valve. Doing this will prevent fuel from siphoning into the engine and flooding it when the fuel tank is full. If you cannot lower the fuel tank far enough, we suggest lowering it as far as can be allowed in your particular application.

The size of the fuel tank used should be 12oz. - 14oz., depending on the model and the length of flights desired. Use of a 14oz. tank will provide between 10 - 15 minutes of run time at full throttle. Use of a fuel tank any larger than 14oz. can lead to excessive leaning of the engine during flight and is not recommended.

Carburetor Orientation

In some cases you may want the throttle arm on the opposite side of the engine from how it comes preinstalled. You can remove the carburetor and reinstall it in the opposite direction with no effect on performance. To remove the carburetor, loosen the two screws holding the intake manifold in place. Next, remove the two screws holding the choke assembly/carburetor to the engine. Remove the carburetor by gently pulling it down off the intake pipe. To reinstall the carburetor, apply machine oil to the o-ring inside the carburetor mounting base and reverse the process, making sure to tighten all the bolts securely.



Choke Valve

Your XL RFS series engine is equipped with a choke valve to aid in priming the engine for hand-starting. The engine is choked by opening the carburetor barrel completely and turning the choke lever to close off the carburetor opening. Fuel can then be drawn into the engine by turning the propeller. If the choke lever is too short for your particular application, fabricate a longer choke lever out of 2mm diameter piano wire and secure it into the choke assembly using the 1.5mm grub screw. If the choke lever is more than 3" long we recommend supporting the outer end of it to prevent excessive vibration.

Idle Stop Screw & Rotor Bolt

The idle stop screw adjusts the closure of the throttle barrel. Turning the idle stop screw clockwise will make the throttle barrel stay open more. Turning it counter-clockwise will allow the throttle barrel to be closed more. Adjust the idle stop screw so that you can close the throttle barrel completely to shut off the engine. The rotor bolt holds the throttle barrel in the carburetor body and prevents the throttle barrel from being over-rotated in either direction. It does not require adjustment. Periodically check the rotor bolt to ensure that it is tight.

Optional Needle Valve Extension

If an extension is required to adjust the high speed needle valve, use a 1.5mm diameter wire of the necessary length. Loosen the grub screw in the side of the needle valve, insert the wire into the end of the needle valve and tighten the set screw firmly. If the extension is more than 3" long we recommend supporting the outer end of the extension to prevent excessive vibration.

Crankcase Breather Nipple

A nipple is located on the bottom of the crankcase. This is a breather nipple and should not be plugged or have any part of the fuel system hooked to it. Ideally, the nipple should be left as-is; however, a short piece of fuel tubing can be attached to it and run outside of the cowling or fuselage.

WARNING Do not plug the breather nipple or the engine will not run properly. If you place an extension on the breather nipple it should not be more than 3" long.

Propeller Installation

Your engine comes equipped with a main propeller nut and one safety nut. For your safety, we recommend using both the propeller nut and the safety nut to secure the propeller into place.

WARNING Before installing the propeller it must be properly balanced. Running your engine using an out-of-balance propeller can lead to excessive vibration, which will result in excessive stress and wear on both the engine and the airframe. Balance the propeller using the method recommended by the propeller manufacturer. Several products are available to properly balance propellers. Ask your local retailer for more information about these items.

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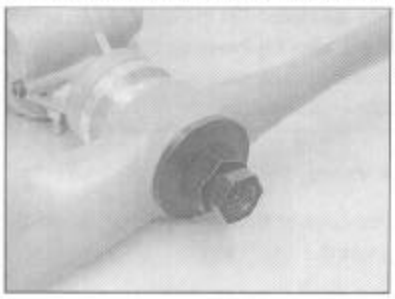
The diameter of the crankshaft is 5/16". Using a 5/16" drill bit or a prop reamer, enlarge the hole in the propeller hub to fit the crankshaft. Slide the propeller onto the crankshaft, up against the thrust washer. Slide the propeller washer up against the propeller and thread the prop nut into place. Tighten the prop nut firmly to secure the propeller in place, then install and tighten the safety nut against the propeller nut. When tightening the nuts, use an adjustable wrench. Do not use pliers.



WARNING If you are installing a spinner onto your engine, the cone of the spinner must not rub against the propeller. Allowing the spinner cone to rub against the propeller could lead to propeller damage and eventual propeller failure.

PROPELLER, GLOW PLUG & FUEL

Propeller Recommendation

The diameter and pitch of the propeller needed for your XL RFS series engine will vary greatly depending on the application the engine is used in. The weight, drag and the type of model and how you intend to fly it are all factors in determining the correct size propeller to use. Experimentation will be necessary to find the optimal size propeller for your particular application. Ideally you want a propeller that the engine will turn in the 10,000 - 12,000 rpm range on the ground, yet power the airplane sufficiently. Using a propeller that is too small will cause the engine to run at too high an rpm. Using a propeller that is too large will cause the engine to run at too low an rpm and cause it to lug down too much. In both instances this can lead to premature engine wear and eventual failure.

PROPELLER SIZE RECOMMENDATIONS FOR XL .80RFS

Use for Break-In	12 x 6	13 x 6	13 x 7
	12 x 8-10		13 x 8

PROPELLER SIZE RECOMMENDATIONS FOR XL .91RFS

Use for Break-In	13 x 6	14 x 6	14 x 8
	13 x 8		

Glow Plug Recommendation

Glow plugs can make a big difference in the performance of your engine. We recommend using a hot heat-range glow plug intended specifically for four-stroke engines. Do not use a cold heat-range plug or a plug designed for two-stroke engines. This can lead to erratic engine runs and eventual engine wear and failure.

Fuel Recommendation

Fuel can make a big difference in the way your engine performs. We recommend using two types of fuel with your XL RFS series engine. For the break-in period you must use a fuel containing no more than 10% nitro methane and no less than 18% Castor/synthetic blend lubricant. Use of fuel containing more than the recommended percentage of nitro methane or only synthetic lubricants will cause the engine to run too hot and result in excessive wear and engine failure in a very short period of time. Once the engine has been adequately broken in (about 1/2 gallon of the recommended break-in fuel), a fuel containing up to, but no more than, 15% nitro methane and no less than 16% Castor/synthetic blend lubricant fuel can be used.

WARNING We do not recommend using fuels that contain only synthetic lubricants. Synthetic lubricants have a much lower flash point than Castor Oil lubricants. Flash point is the point at which the lubricant begins to actually burn and lose its lubricating qualities. Using fuels containing a blend of Castor Oil and synthetic lubricants results in an engine that runs cooler and lasts longer. One lean run using a fuel containing only synthetic lubricants can cause engine failure. Using fuels with a Castor Oil and synthetic blend of lubricants greatly reduces this chance.

HIGH & LOW SPEED NEEDLE VALVES

High Speed Needle Valve

The high speed needle valve is used to meter the air/fuel mixture at full throttle. Turn the needle clockwise to lean the mixture or turn the needle counterclockwise to richen the mixture. When you start the engine for the very first time the needle valve should be turned in completely, then backed out 2-1/2 turns. When you start the engine after that, leave the needle valve in the same position it was in when you shut down the engine.

Low Speed Needle Valve

The low speed needle valve regulates the air/fuel mixture at idle and during transition from idle to full throttle. Turn the idle mixture screw clockwise to lean the mixture. Turn it counterclockwise to richen the mixture. The idle mixture screw is preset from the factory, but minor adjustments may need to be made after the engine is broken in. **To reset the mixture screw to the factory setting, open the carburetor barrel completely. While holding the barrel open, turn the mixture screw OUT until it stops. From this point, turn the mixture screw IN 4-1/4 turns. This is the factory setting.**

STARTING PROCEDURE

Your XL RFS series engine can be started using an electric starter or it can be started by hand. For safety and ease of starting, especially when the engine is new, we recommend using an electric starter. The following two procedures should be done with the power to the glow plug off.

Starting Using an Electric Starter

When using an electric starter it is not necessary to choke and prime the engine. The starter turns the engine over fast enough that the engine draws fuel on its own. Priming the engine prior to using an electric starter can cause the engine to "hydro-lock" or flood. This is a result of too much fuel in the engine before it actually fires. **Turning the engine over with an electric starter while the engine is flooded can cause extreme damage to the engine and/or cause the propeller assembly to come loose. Turn the propeller through the compression stroke one time by hand to check for a hydro-locked state before applying the starter.**

Starting by Hand

When starting the engine by hand always use a chicken stick or a heavy leather glove. Never just use your bare hand or serious injury could result. To make the engine easier to start by hand it should first be primed. This is done by opening the carburetor barrel completely and turning the choke lever to close off the carburetor opening. Fuel can then be drawn into the engine by "pulling" the propeller through the compression stroke 2 - 3 times. This will draw fuel into the engine. Release the choke lever and pull the propeller through the compression stroke once to check for a hydro-locked condition.

BREAK-IN PROCEDURE

IMPORTANT Your XL RFS series engine is a ringed engine. A ringed engine is designed differently from a typical ABC designed engine that you might be more familiar with; therefore you will not feel much hesitation as the piston moves through the top of the stroke. A ringed engine does not have any taper in the sleeve. Ring tension is what seals the combustion chamber. When the engine is brand new, it will not feel like it has much compression. This is because the ring has not yet been seated with the sleeve. After the engine has been broken-in, compression will increase. The break-in procedure will guide you through the steps necessary to properly break in your new XL RFS series ringed engine. Please follow the steps closely.

The break-in process allows the engine parts to perfectly fit each other and properly protect each part from premature wear. The engine should be broken in using a fuel that contains no more than 10% nitro methane and no less than 18% Castor/synthetic blend ubricant. Fuel containing only synthetic lubricants should not be used during the break-in procedure. For the break-in procedure we recommend mounting the engine into the airplane it will be used in. This way the muffler, fuel tank and throttle linkage can all be tested in combination with the engine. If your airplane uses a cowling, it should be removed during the break-in procedure.

❑ 1) Turn the high speed needle valve out 2-1/2 turns from the fully closed position.

❑ 2) If you are using an electric starter to start the engine, follow the procedure in the previous section. If you are starting the engine by hand, follow that procedure in the previous section.

❑ 3) Open the throttle barrel to approximately 1/4 throttle. Connect the power to the glow plug. Start the engine using an electric starter or by hand. If starting by hand you will need to vigorously flip the propeller through the compression stroke several times before the engine will start.

❑ 4) Once the engine starts, open the throttle barrel to about 1/2 throttle. You may need to lean the high speed needle valve in about 1/4 turn to keep the engine running at half throttle.

❑ 5) After the engine has been running about 1 minute, remove the power from the glow plug and slowly advance the throttle barrel to full throttle. Adjust the high speed needle valve so that the engine is running very rich. You should notice excessive white smoke coming from the exhaust. Let the engine run for approximately 10 minutes then stop the engine.

❑ 6) Let the engine cool for approximately 10 minutes then restart it. Set the high speed needle valve mixture to a slightly leaner setting, about 1/4 turn more in. Let the engine run for about 5 minutes at this setting, then stop the engine and let it cool for approximately 10 minutes.

❑ 7) Repeat the procedure in step # 6, while leaning the needle valve slightly more each time. In all, you should run the engine about a total of 45 minutes of actual running time. After 45 minutes of run time the engine is ready for flight. Fly the airplane with the engine set as rich as possible, but with adequate power to fly the airplane. After each flight, lean the mixture slightly. Continue to do this for about 5 flights. At this point the engine should hold a good setting on the high speed needle valve and you can begin to fine tune the needle valve settings to increase performance.

OPTIMIZING THE MIXTURE SETTINGS

Now that your engine is broken in, you can set the high and low speed needle valves for optimum performance.

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WARNING Be careful never to lean the engine out too much. Remember that the lubricants for your engine are suspended in the fuel. If you lean out the fuel mixture too much you will also be lowering the amount of lubricant entering your engine. Less lubricant means more chance of your engine overheating and possible engine failure.

Setting the High Speed Needle Valve

❑ 1) Start the engine and remove the power from the glow plug. Allow the engine to warm up for about 1 minute.

❑ 2) After the engine has warmed up, slowly lean the high speed mixture until the engine reaches peak rpm. After reaching peak rpm, richen the mixture slightly until an audible drop in rpm is heard. If you are using a tachometer this should be between a 200 - 300 rpm drop.

❑ 3) With the engine running at full power, carefully lift the nose of the airplane about 45° into the air. The mixture should not become too lean, but you may hear a slight increase in rpm. If the engine sags, or loses rpm when you hold the nose up, the mixture is too lean. If this is the case, slightly richen the mixture and follow the test once more.

IMPORTANT Rpm will increase about 10% - 30% in the air. This is due to the forward motion of the aircraft as it is flying. Because of this more air is entering the carburetor, at a higher force, which causes the mixture to lean out. Additionally, as the fuel level in the fuel tank goes down, fuel draw becomes more difficult for the engine, especially during aerobatics, thus causing the mixture to go lean. It is imperative that you set the mixture rich while on the ground to compensate for the leaning tendencies that will happen in the air. Always watch the exhaust during your flight. The engine should leave a noticeable white smoke trail at all times. If there is no smoke trail, the engine is running too lean. You should land immediately and reset the mixture.

Setting the Low Speed Needle Valve

❑ 1) Start the engine and lean out the high speed needle valve as per the previous steps. Close the throttle until the slowest **reliable** idle is reached. Allow the engine to idle for about 30 seconds.

❑ 2) Quickly advance the throttle to full. If the engine just stops running as soon as the throttle is advanced, the idle mixture is too lean. With the engine stopped, richen the idle mixture about 1/8 of a turn.

❑ 3) Repeat steps # 1 and # 2 until the engine will transition from idle to full throttle smoothly. Minor hesitation in the transition is normal.

❑ 4) If you quickly advance the throttle from idle to full and the engine seems to be very rich during transition (i.e., lots of smoke coming from the exhaust), the mixture is too rich. With the engine stopped, lean the idle mixture about 1/8 of a turn.

❑ 5) Repeat steps # 1 and # 4 until the engine will transition from idle to full throttle smoothly. Minor hesitation in the transition is normal.

Information about engine maintenance, including adjusting the valves and returning your engine for warranty service can be found on the separate sheets packaged with these Operating Instructions.

Magnum XL RFS series engines are distributed exclusively by Global Hobby Distributors 18480 Bandilier Circle, Fountain Valley, CA 92708