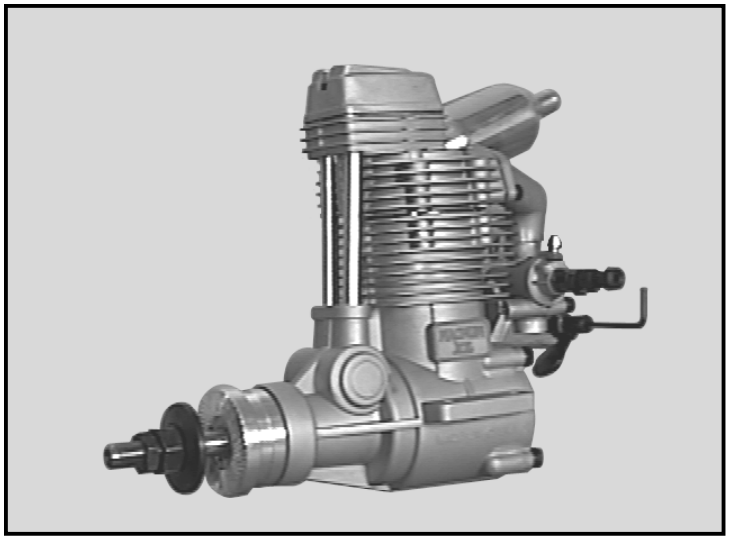
MAGNUM XL 1.20RFS

Single Cylinder Ringed Four Cycle Engine

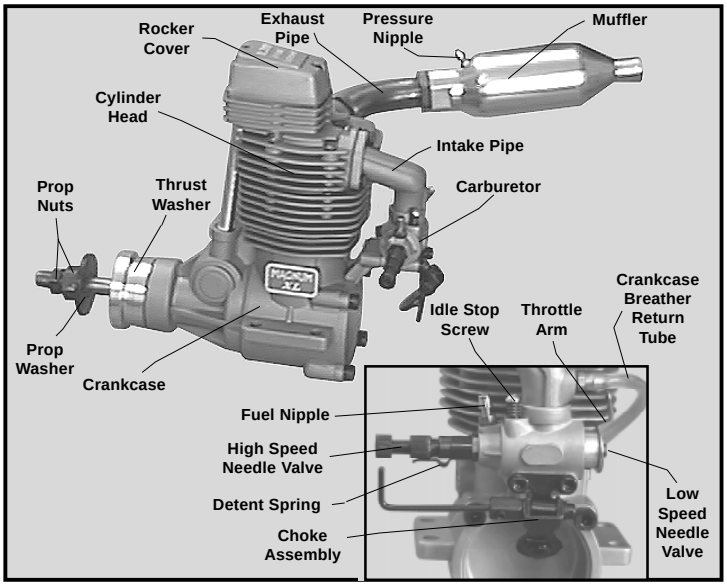


INTRODUCTION

The Magnum XL 1.20RFS is a single cylinder, overhead valve four stroke engine incorporating ringed piston technology for long life and a dual needle carburetor for precise adjustments. A polished aluminum muffler is included to keep the noise to a minimum without sacrificing power. The 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 THE MAGNUM XL 1.20RFS

Before attempting to operate your new engine, please read through this instruction sheet in it's entirety. This will help you familiarize yourself with the features and operation of your new engine. Use the photos below to identify the major component parts of your new engine.



SPECIFICATIONS

Displacement.....19.6cc (1.22cu.in.)
Bore.....30.4mm
Stroke.....27.5mm
Practical R.P.M.....2,000 - 11,000
Weight (w/Muffler).....31.08oz.
Crankshaft Thread Size.....5/16-24

WARNING!

Magnum model 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. Do not let pleasure turn into injury and/or tragedy! You alone are responsible for the safe operation of your engine, so act sensibly and with care at all times. This Magnum model 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, 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 kits 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 nuts. Do not use pliers.

☠ Inspect the spinner, propeller and propeller 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 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.

☠ Stand behind the engine when it is running to make any adjustments to the mixture controls. Do not reach over or around the propeller. Do not lean towards the engine. Do not wear loose clothing or allow anything to be drawn into the spinning propeller when 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.

☠ Do not use tight fitting cowls or oversized spinners as these can impede airflow over the engine and result in overheating and damage to the engine.

INSTALLATION

❑ **Engine Orientation**

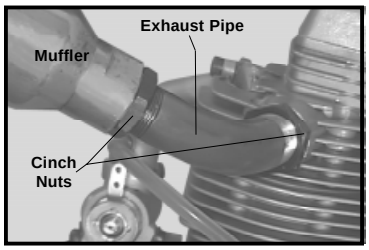
The Magnum XL 1.20RFS can be orientated in any position on the firewall. Keep in mind that when the engine is mounted inverted, carburetor adjustments will need to made differently and the fuel tank may need to be lowered. (See tank size and orientation to carburetor on next page).

❑ Engine Bolts and Firewall Requirements

The engine should be mounted to a heavy duty glass filled nylon or a metal engine mount. Use only high quality steel cap screws and related hardware to mount the engine to the motor mount. The firewall in the airplane should be aircraft grade 5-ply plywood and be no less than 1/4" thick. The firewall should also be reinforced to meet the torque and weight of the XL 1.20RFS engine.

❑ Muffler and Exhaust Pipe Installation

The muffler threads onto an exhaust pipe, which then threads into the engine head. First thread one cinch nut onto each end of the exhaust pipe.



Thread the muffler on 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 and tighten the cinch nut up against the muffler. This will prevent the muffler from loosening. The exhaust pipe is adjustable to better match the scale appearance and installation of your particular application. Thread the exhaust pipe into the engine's cylinder head. The pipe should be threaded in no less than 1/4" to prevent vibration from damaging the threads. Once you have threaded the exhaust pipe in place and into the proper position for your application, use an open end wrench and tighten the cinch nut against the cylinder head. This will prevent the exhaust pipe from loosening.

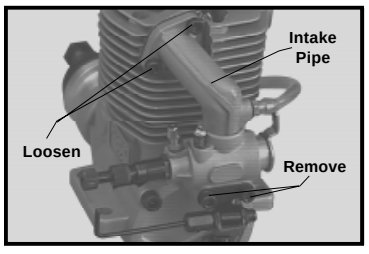
❑ Tank Size and Orientation to Carburetor

Ideally the stopper in the fuel tank should be even with the high speed needle valve or just slightly below the high speed needle valve. Most 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 used in conjunction with an inverted mounted engine or during extreme aerobatic flight. If mounting your engine inverted it is advised to lower the fuel tank so the stopper 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. - 16oz. depending on the model and the length of flights desired. Use of a 16oz. tank will provide between 15 - 20 minutes of run time at full throttle. Use of a fuel tank any larger than 16oz. can lead to excessive leaning of the engine during flight and is not recommended.

❑ Carburetor Orientation

In some cases the particular installation of the engine in your model may make it necessary to change the position of the carburetor. You may want



the throttle arm on the opposite side than 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 reverse the process. We highly recommend applying machine oil to the o-ring inside the carburetor mounting base and on the carburetor mounting flange on the intake pipe. This will prevent the o-ring from being inadvertently cut when reinstalling the carburetor.

❑ Needle Valve Extension

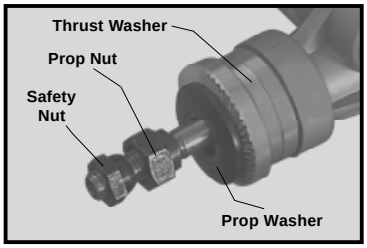
If an extension is required to adjust the high speed needle valve, use a 1.5mm diameter wire of the necessary length. Loosen the set screw in the side of the needle valve, insert the wire into the end of the needle valve and tighten the set screw firmly. If the extension is more than 3" long we recommend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

❑ 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 in place.

Note: Before installing any propeller it must be properly balanced. Running an engine, especially of this size, using an improperly balanced propeller can lead to excessive vibration causing excessive stress and wear on both the engine and the airframe. Balance the propeller using the recommended method of the propeller manufacturer. Several products are available to properly balance propellers. Ask your local retailer for more information about these items.

Using a 5/16" drill bit or a prop reamer, drill out the hole in the propeller hub to fit the crankshaft. The crankshaft is 5/16" in diameter. Slide the propeller onto the crankshaft, up against the thrust washer. Slide the propeller washer up against the propeller. Thread the prop nut onto the crankshaft. Notice that the prop nut has a flange on the back of it. This flange fits inside the washer. Completely tighten the prop nut to secure the propeller in place. Install the safety nut onto the crankshaft then tighten it against the prop nut. When tightening the prop nut and safety nut, use the proper size open end wrench. Do not use pliers.



Note: If you are installing a spinner onto your engine the cone of the spinner must not rub against the propeller. If the spinner cone rubs against the propeller this could lead to propeller damage and eventual propeller failure.

PROPELLER, FUEL & GLOW PLUG

❑ Propeller Recommendation

The diameter and pitch of the propeller needed for the XL 1.20RFS 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 8,000 - 9,000 R.P.M. range, yet power the airplane sufficiently. Using a propeller that is too small will cause the engine to run at too high an R.P.M. Using a propeller that is too large will cause the engine run at too low an R.P.M. and cause it to lug down too much. In both instances this can lead to premature engine wear and eventual failure.

Propeller Size Recommendations

15 x 6 15 x 8 15 x 10
16 x 6 16 x 8

Use 15 x 6 for initial break-in procedures

❑ **Glow Plug Recommendation**

Glow plugs can also make a big difference on the performance of your engine. For the XL 1.20RFS we recommend using a glow intended specifically for four cycle engines. Do not use glow plugs intended for two cycle 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 the XL 1.20RFS. For the break-in period you must use a fuel containing no more than 10% Nitromethane and no less than 20% Castor Oil lubricant. Use of fuel containing more than the recommended percentage of Nitro Methane or any 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 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 Oil and synthetic lubricant blended fuel can be used.

Note: 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 loses it's 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. 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 6 complete turns. This is the factory setting.

STARTING PROCEDURE

The XL 1.20RFS can be started using a heavy duty 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 with an Electric Starter**

When using an electric starter it is not necessary to prime the engine. The starter turns the engine over fast enough that the engine draws fuel on it's 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 your 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. Never just use your hand or serious injury could result. To make the engine easier to start by hand it should be primed. This is done by opening the carburetor completely and choking the engine using the hand operated choke. With the carburetor choked, "pull" the propeller through the compression stroke 2 - 3 times. This will draw fuel into the engine. Release the choke and pull the propeller through the compression stroke once to check for a hydro-locked condition.

BREAK-IN PROCEDURE

Note: The XL 1.20RFS engine is a ringed engine. A ringed engine is designed differently than 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 1.20 ringed engine. Please follow the steps closely.

The break-in process allows the engine parts to perfectly fit to 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 20% Castor Oil lubricant. Synthetic lubricant fuels 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. 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 5 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 30 minutes of actual running time. After 30 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 10 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.

SETTING THE MIXTURE

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

Note: Be careful to never 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 R.P.M. After reaching peak R.P.M. richen the mixture slightly until an audible drop in R.P.M. is heard. If you are using a tachometer this should be between a 200 - 300 R.P.M. drop.

☐ 3) With the engine running at full power, carefully lift the nose of the airplane about 45º into the air. The mixture should not become too lean, but you may hear a slight increase in R.P.M. If the engine sags, or loses R.P.M. when you hold the nose up, the mixture is too lean.

Note: R.P.M. 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, and 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. It 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 will be 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 will be normal.

VALVE ADJUSTMENT

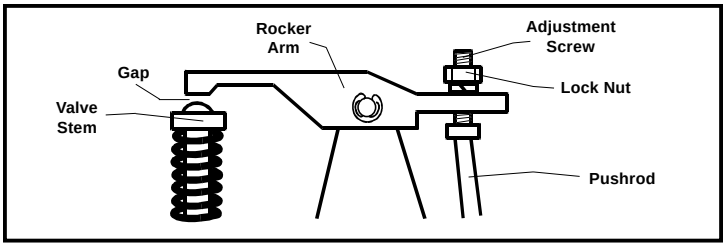
❑ **Adjusting the Valves**

The Valve clearances are preset from the factory, but will require periodic adjustment. Reset the valves after the first 1 hour of engine running. After that, the valves can be checked and adjusted about every 8 hours of running. Some signs that the valves need adjusting are loss of power, rattling sounds at low idle or if you have repaired the engine after a crash.

❑ 1) With the engine cold, remove the rocker cover on top of the cylinder head by unscrewing the two socket cap screws.

❑ 2) Rotate the crankshaft until the piston is at top dead center. Both valves are closed at this point.

❑ 3) The required valve clearance is between .04mm and .10mm measured between the valve stem and the rocker arm. Use feeler gauges to check the clearance. The .04mm gauge should pass through the gap with only slight friction. The .10mm feeler gauge should be tight.



❑ 4) Working with one valve at a time, loosen the lock nut using a small wrench. Use a screwdriver and turn the adjustment screw counterclockwise about 1/2 turn. This will open the gap slightly. Slide the .04mm feeler gauge between the rocker arm and the valve stem. Carefully turn the adjustment screw clockwise until the rocker arm contacts the feeler gauge. Using a small wrench, tighten the lock nut.

❑ 5) Remove the feeler gauge and double check the gap. Repeat step # 4 if necessary to achieve the correct setting. Repeat for the second valve.

MAINTENANCE

❑ Avoid running the engine under dusty conditions.

❑ At the end of every flying day, purge the engine of fuel by disconnecting the fuel line and allowing the engine to run dry of fuel.

❑ Use a high quality after run oil in the engine after you have purged the engine of fuel. Inject the oil into the engine through the carburetor and through the glow plug hole.

❑ Wipe the outside of the engine dry using a soft cloth.

❑ Use a fuel filter between the fuel tank and the carburetor.

SERVICE

All Magnum engines returned for warranty service must be within the warranty terms as stated on the warranty card provided with your engine. Do not return the engine to the place of purchase. They are not authorized or equipped to perform warranty work on Magnum products. When requesting warranty service, please observe the following:

☞ Always send the complete engine including the carburetor and muffler. The engine must be removed from the model.

☞ Include a note detailing the problem or service you are requesting. Service cannot be provided without this information. Include your daytime phone number in the event we need more details pertaining to the service requested.

☞ You may request an estimate of services at the time you return your engine for service. An omission of this request implies permission for the Magnum Service Center to service your engine at our discretion.

☞ Include a method of payment for any service charges. If not specified, the unit will be returned to you C.O.D.

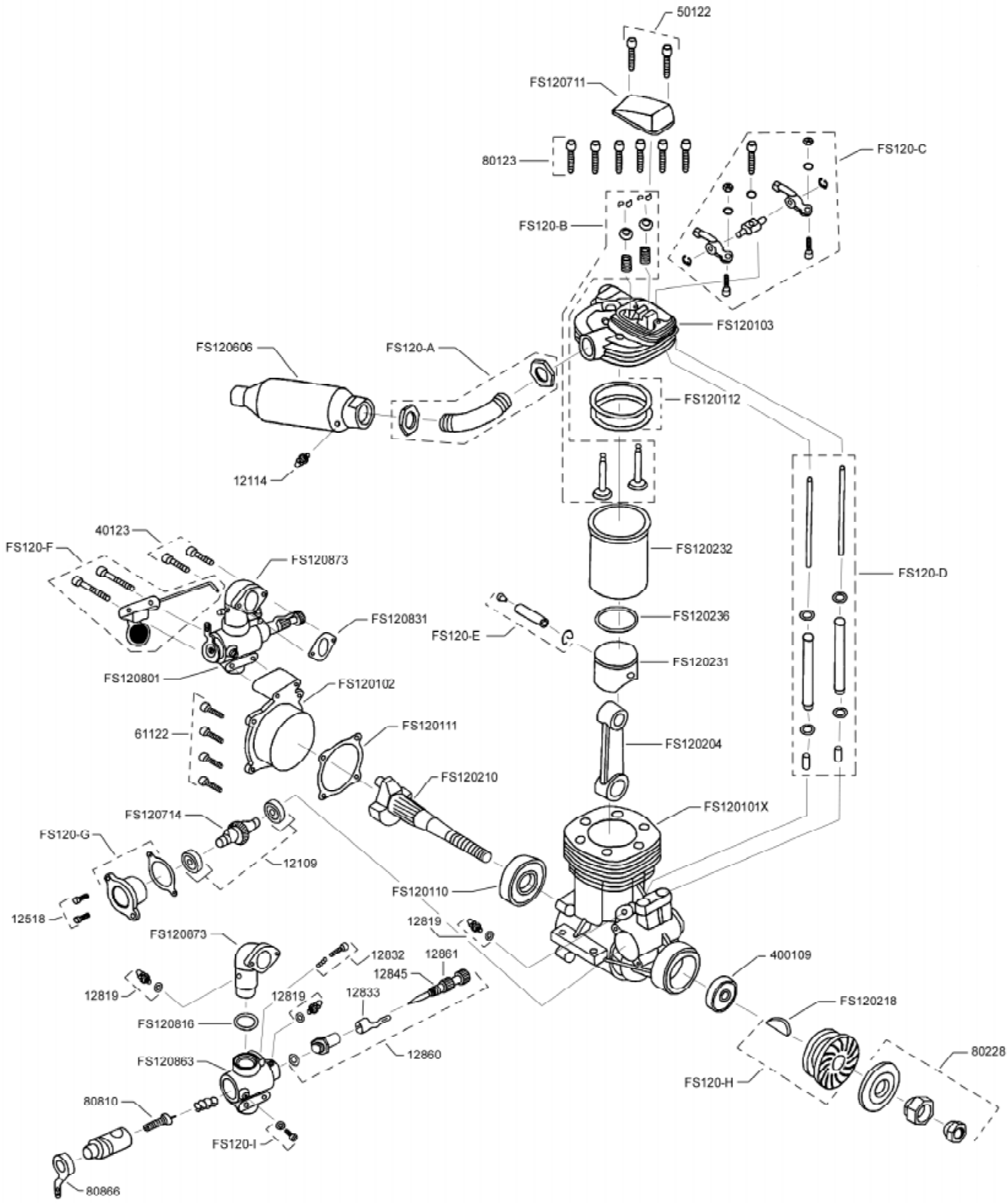
☞ Please include a check or money order in the amount of $6.50 to cover postage and handling charges for the return of your engine. Do not send cash.

☞ Send the engine to us by United Parcel Service, Federal Express or by Insured Mail. Postage in not refundable. Send to:

Magnum Service Center
18480 Bandilier Circle
Fountain Valley, CA 92728
Phone (714) 963-0329
Fax (714) 964-6236
Email: globalhobby@earthlink.net

MAGNUM XL 1.20RFS

Exploded Parts View



REPLACEMENT PARTS LIST

FS120-A	Exhaust Pipe Set
FS120-B	Valve Set
FS120-C	Rocker Arm Set
FS120-D	Pushrod Set
FS120-E	Wrist Pin Set
FS120-F	Choke Set
FS120-G	Cam Gear Cover Set
FS120-H	Thrust Washer Set
FS120-I	Rotor Bolt Set
FS120101X	Case
FS120102	Backplate
FS120103	Cylinder Head
FS120110	Rear Bearing
FS120111	Backplate Gasket
FS120112	Head Gasket Set
FS120204	Connecting Rod
FS120210	Crankshaft
FS120218	Woodruff Key
FS120231	Piston
FS120232	Sleeve
FS120236	Ring
FS120606	Muffler Assembly
FS120711	Rocker Cover
FS120714	Cam Gear
FS120801	Carburetor Assembly
FS120816	Carburetor Intake O-Ring
FS120831	Intake Pipe Gasket
FS120863	Carburetor Body
FS120873	Intake Pipe
12109	Cam Gear Bearing Set
12114	Pressure Nipple
12518	Cam Gear Cover Bolt Set
12819	Fuel Nipple Set
12832	Idle Stop Screw
12833	Detent Spring
12845	Needle Valve O-Ring
12861	Needle Valve
12860	Needle Valve/Housing Set
40123	Intake Pipe Bolt Set
400109	Front Bearing
50122	Rocker Cover Bolt Set
61122	Backplate Bolt Set
80123	Head Bolt Set
80228	Prop Nuts/Washer Set
80810	Idle Needle Set
80866	Throttle Arm

TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	SOLUTION
1) Engine does not start	A) Failed glow plug B) Glow Starter not charged C) Engine not being turned over fast enough D) Old fuel E) Engine flooded with too much fuel	A) Replace glow plug with a new one B) Fully charge glow starter C) Use an electric starter D) Replace with new fuel E) Remove glow plug and expel fuel from cylinder
2) Engine does not draw fuel	A) Idle mixture screw set too lean B) High Speed Needle Valve fully closed C) Hole or crack in fuel lines D) Defective fuel tank	A) Reset idle mixture to factory setting B) Reset high speed needle valve to factory setting C) Replace fuel lines D) Replace fuel tank
3) Engine vibrates excessively	A) Propeller out of balance B) Spinner out of balance C) Engine or motor mount loose	A) Balance propeller B) Balance Spinner C) Check all mounting bolts and tighten securely
4) Engine does not transition	A) Failed and/or wrong type glow plug B) Old and/or wrong type fuel C) Idle mixture set too lean D) Idle mixture set too rich E) Valves out of adjustment	A) Replace with new recommended glow plug B) Replace with new recommended fuel C) Set idle mixture richer D) Set idle mixture leaner E) Readjust valves to correct gap
5) Throttle barrel does not close completely	A) Idle stop screw out of adjustment B) Idle mixture set too lean	A) Turn idle stop screw counterclockwise until barrel closes completely B) Reset idle mixture to factory setting
6) Engine Overheats	A) Engine running too lean B) Cowl too restrictive C) Improper fuel used	A) Richen high speed needle valve B) Open vents in cowling C) Use recommend fuel