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fantom

FR12/15/18

FR12/15/18 ENGINE MANUAL

FANTOM® FR12 / FR15 / FR18

Thank you for purchasing a **Fantom® FR Series Racing Engine**. Your new engine has been developed to provide superior performance and longevity for both racing and sport applications. To attain the maximum enjoyment from your new engine, even if you have prior experience with engines, please review the following information carefully.

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TOOLS & SUPPLIES REQUIRED FOR EASY INSTALLATION

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- 2.5mm Hex Wrench
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- Throttle Return Spring
- Small Nylon Tie Straps (air filter)
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- After-Run Oil
- Manifold (FR12 and FR15)
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INTRODUCTION

This manual was written assuming that you have a general understanding of 2-stroke engines. Operating and tuning a model nitro engine does require experience to learn the skills necessary to obtain optimal performance and longevity. Even adjustments that are slightly off can make a big difference in how well your engine runs, as well as how long it will last. If at any time you do not completely understand something, make sure to contact a professional who can assist you, either through a local hobby professional or by contacting us directly. Fantom cannot be held responsible for any engine damage resulting from improper use or improper tuning.

INSTALLATION

This manual covers the installation process for the FR12, FR15 and FR18 engines. While the FR12 and FR15 installation is the same, the FR18 was developed especially for the T-Maxx™, so it requires additional installation instructions. For installing the FR12 or FR15, please proceed to the next section for instructions. If you have converted the FR18 (see page 13 for conversion options) to install in a vehicle other than the T-Maxx™ you should follow the FR12 / FR15 instructions. If you are installing the FR18 into a T-Maxx™, please skip to page 8 for installation instructions.

FR12 / FR15 INSTALLATION INSTRUCTIONS

REMOVING THE OLD ENGINE (If Applicable)

1. If your new Fantom engine is replacing an existing engine, you will need to remove your old engine from the vehicle, following your vehicle's instruction manual. If this is a new installation, please refer to this manual for installation instructions. You may also want to refer to your vehicle's instruction manual for any special instructions not covered in this manual.

2. If applicable, remove your old engine from the original engine mount and set it aside to use with your new Fantom engine.

3. If applicable, disassemble the stock clutch parts from your original engine, noting the order of their removal, as you will need to install them on your new Fantom engine in the exact reverse order that you removed them from your original engine. Clutch removal and installation is best accomplished by using a crankshaft locking tool (we recommend the Dynamite® brand part# DYN2519). This tool allows you to fully tighten or loosen the clutch nut by keeping the crankshaft locked from spinning. Never wedge anything inside your engine's exhaust or attempt to grip the shaft with pliers, as these techniques will permanently damage internal and external parts.

INSTALLING THE FANTOM® FR12 OR FR15

1. Remove the rear plate and insert the crankshaft locking tool.

2. Install your clutch parts onto your Fantom engine in the reverse order of their removal from the stock engine. If you are installing a new clutch, follow the instructions that came with the clutch. Before installing the clutch nut, apply a small drop of thread lock to the clean shaft threads; this will prevent the nut from coming loose. Because clutch shoes are important for good engine performance – and are relatively inexpensive – replace them with a new stock set (if you are installing the original clutch).

3. Remove the crankshaft locking tool and reinstall the rear plate.

4. Loosen the 5.5mm carburetor-securing nut and position (angle) the carburetor in the same position as your original carburetor was set at, or as your vehicle's instruction manual suggests. While pressing the carburetor firmly to the crankcase, retighten the securing nut.

5. Make certain that the throttle ring ball mount (slide carburetors) or throttle arm (rotary carburetors) is properly positioned like your original carburetor, or as instructed in your vehicle's instruction manual; if it isn't, loosen the small setscrew on the throttle ring (slide carburetors) or nut securing the throttle arm (rotary carburetors) and rotate the throttle ring or throttle arm to the desired location; retighten the setscrew or nut.

6. Make certain that the fuel inlet fitting is properly positioned like your original carburetor, or as instructed in your vehicle's instruction manual; if it isn't, loosen the high speed needle and swivel the fuel inlet to the desired location and then retighten the HS needle carefully.

7. A leaking fuel tank can cause severe problems with your engine's performance. Therefore, inspect the tank for leaks and replace it, if needed. Install a new fuel-line, leaving plenty of extra length; it will be cut to the proper length once the engine is installed in the chassis.

8. Install the manifold (sold separately) at this time. Make sure to install a manifold gasket between the manifold and engine. Manifold gaskets and screws are sold separately or are included with some manifolds; please see your dealer for available options. Because there are so many applications for this engine, please consult your vehicle's manual for manifold recommendations. More than likely you will be able to use your stock manifold if this is a replacement application.

9. Secure engine to the stock engine mount(s), using the original bolts … add a drop of thread lock to all the mounting bolts at this time (clean them first).

10. Position the engine within the chassis and secure it from the underside with the original mounting bolts. Add a drop of thread lock to all of the bolts at this time (clean them first). Lightly tighten the bolts prior to checking the gear mesh.

While holding the clutch bell gear in place, rock the spur gear back and forth; it should measure between 0.003 and 0.005 inch of endplay. Slide the engine back and forth in its mounted position until you achieve the proper gear mesh. DO NOT adjust the gear mesh too tight or too loose – the gears, clutch, and engine can be severely damaged. Once the proper gear mesh is obtained, fully tighten the engine mount bolts (under the chassis) and recheck the gear mesh one more time.

11. Snap the throttle servo plastic ball cup on to the carburetor ball end using needle nose pliers. Note: for rotary carburetors, you will need to install a small ball end on to the plastic throttle arm, in one of the two hole locations, as instructed in your vehicle's manual. Throttle ball ends are normally supplied with most kits, or can be purchased separately.

WARNING: At this point, you should install a throttle return spring (we recommend the Losi® brand – part# LOSA9409). This is a safety precaution, to prevent the engine from running past the idle position, in the event that you lose radio contact with the vehicle, or have any type of radio failure. This situation could cause extremely dangerous uncontrolled wide-open operation, resulting in injury to person(s) and/or property damage. Install the return spring in a manner in which the throttle returns to the idle position, when the radio is off.

12. Cut the fuel tubing to the proper length and attach it to the carburetor fuel inlet fitting. Make sure to keep the fuel line off sources of high temperature (e.g., tuned pipe, manifold, and cylinder head).

13. Should you use a stock or aftermarket tuned pipe? We recommend using a Fantom WORKS tuned pipe. Our WORKS PIPES produce much better performance than stock pipes, not to mention their unique raspy tone and awesome "factory" appearance. Your Fantom dealer has these in stock or they can order one for you, from one of our distributors. You can find complete details on our wide selection of pipes by visiting our web site www.fantomracing.com. If you decide to use the stock pipe, attach it to the manifold using the stock silicone coupler and new tie straps. If you have decided on an aftermarket pipe, follow the installation instructions included with the pipe. After completing the connection between the manifold and pipe, secure the pipe to the chassis with a standard wire mount. Finish the tuned pipe installation by connecting the fuel tank pressure line to the pipe's pressure fitting.

14. With the radio turned on, adjust the throttle and brake trim settings (refer to your radio manual for details):
    - Set the radio trims so the throttle closes and opens fully – take your time with this procedure.
    - Make sure that the transmitter throttle trigger is in the fully pulled back position at the same time the carburetor opens completely (100%); when the throttle trigger reaches its neutral position, the carb must be simultaneously closed (0%). In other words, you don't want the carburetor fully open when your throttle trigger is only partially back; likewise, you don't want the carburetor fully closed before the trigger is in the neutral position. Faulty adjustments can damage the throttle servo and/or make the engine act like it isn't running properly.

15. Install the air filter.

IMPORTANT: The stock air filter is not intended for dusty conditions. It is only a basic filter intended ONLY for non-dusty conditions. If you expect to encounter any dust, it is extremely important that you obtain an aftermarket air filter. We highly recommend Motor Saver® brand air filters. Motor Saver® manufacturers many different air filters for specific applications. Please contact your dealer or Motor Saver® direct for their latest products.

16. Make sure to oil the air filter. Use quality air filter treatment oil such as our Fantom Filter Fluid™ / Filter Wash™ kit (part # FAN20111). Use a small nylon tie strap to hold the air filter housing to the carburetor; these are available from your local dealer or hardware store.

WARNING: Never run your engine without an air filter. Rapid and permanent damage will result – which is NOT covered by warranty.

17. Check all of your work, and read the rest of this manual (twice) to ensure that you completely understand the operational characteristics of your new FR12 or FR15 Racing Engine.

FR12 / FR15 ENGINE OPTIONS

Your FR12 / FR15 can be modified to work in optional configurations, by referring to the following information and part numbers.

1. Your FR12 or FR15 comes standard with a turbo type head button installed, which requires the use of turbo type glow plugs. If you prefer to use standard type glow plugs, we offer optional standard type head buttons, as well as a standard type glow plug. The following optional head buttons and glow plug are available:
   - FAN10600 .12/.15 Standard Long Reach Glow Plug (Alternate plug – O'Donnell® 77 / part#ODO77)
   - FAN10060 .12 Standard Head Button
   - FAN10062 .15 Standard Head Button

2. To modify the FR12 or FR15 (non-pull start models) for pull start operation, the following parts are available:
   - FAN10052 Standard Crank with Pull Start Stub
   - FAN10070 Rear Plate for Pull Start
   - FAN10071 Pull Start Assembly
   - FAN10110 Pull Start One-Way Bearing
   - FAN10111 Pull Start One-Way Bearing Shaft
   - FAN10069 Rear Plate Screws for Pull Start
   - FAN10126 Pull Start Assembly Screws

3. To modify the FR12 or FR15 (pull start models) for non-pull start operation, the following parts are available:
   - FAN10054 Rear Plate for Non-Pull Start
   - FAN10064 Gasket Set
   - FAN10068 Rear Plate Bolts for Non-Pull Start

4. To modify the FR12 or FR15 to use with SG type clutch applications (typically on-road cars), the following crankshaft is available:
   - FAN10053 .12/.15 SG Crankshaft

FR18 INSTALLATION INSTRUCTIONS (for T-Maxx™ only)

REMOVING THE OLD PARTS

1. Remove the stock engine by disconnecting the glow plug wire from the glow plug, the throttle linkage ball cup from the carburetor, and the fuel line connection from both the tuned-pipe and carburetor.

2. Remove the single machine screw securing the tuned-pipe to the wire mount; also remove the four bolts that secure the engine mount to the chassis (underside of chassis).

3. Position the engine so that you can access the three EZ-Start™ mounting bolts; remove these, followed by the EZ-Start™ gear box and motor assembly.

4. Remove the one-way starter bearing and note its orientation to the bearing shaft for future installation on the FR18 engine.

5. From the left side of the engine, remove the engine-mounting bolt that secures the yellow ground wire.

6. Remove the engine, manifold, and tuned-pipe from the vehicle.

7. Remove the remaining three engine mount bolts and remove engine from engine mount.

8. Disassemble the stock clutch parts from your original engine, noting the order of their removal, as you will need to install them on your new Fantom engine in the exact reverse order that you removed them from your original engine. Clutch removal and installation is best accomplished by using a crankshaft locking tool (we recommend the Dynamite® brand – part# DYN2519). This tool allows you to fully tighten or loosen the clutch nut by keeping the crankshaft locked from spinning. Never wedge anything inside your engine's exhaust or attempt to grip the shaft with pliers, as these techniques will permanently damage internal and/or external parts.

INSTALLING THE FANTOM® FR18

1. Remove the rear plate and insert the crankshaft locking tool.

2. Install the stock clutch parts onto the Fantom® FR18 engine in the reverse order of their removal from the stock engine. Before installing the clutch nut, apply a small drop of thread lock to the clean shaft threads; this will prevent the nut from coming loose. Because clutch shoes are important for good engine performance – and are relatively inexpensive – replace them with a new stock set.

3. Remove the crankshaft locking tool and reinstall the rear plate. We recommend using threadlock on these bolts.

4. Loosen the 5.5mm carburetor-securing nut and position (angle) the carburetor as shown in Figure 1. While pressing the carburetor firmly to the crankcase, retighten the securing nut. Make certain that the red throttle ring is properly positioned (see: Figure 2); if it isn't, loosen the small setscrew on the throttle ring and rotate the unit; retighten the setscrew.

5. A leaking fuel tank can cause severe problems with your engine's performance, therefore, inspect the tank for leaks and replace it, if needed. Install a new fuel-line, leaving plenty of extra length; it will be cut to the proper length once the engine is installed in the chassis.

6. Install the manifold seal to the exhaust port at the rear of the engine – making sure it is fully seated. Follow this by fully seating the manifold over the seal. Secure the manifold to the engine with the two springs provided. Insert the spring ends into the two small holes on one side of the manifold. Wrap the springs around the cylinder portion of the crankcase and insert their other ends into the two remaining holes of the manifold.

7. Install the stock one-way starter bearing on to the FR18 one-way bearing shaft, exactly as it was installed on the stock engine. While holding the crankshaft from spinning, and viewing the engine from the rear, you should be able to rotate the one-way bearing counter-clockwise, but NOT clockwise. Note: We recommend that a new one-way bearing be installed at this time.

8. Secure engine to the stock engine mount, using the original four bolts. Add a drop of thread lock to all four bolts at this time (clean them first). Install the yellow ground wire – as it was with the stock engine.

9. Align the one-way bearing to the EZ-Start™ system. Bolt on the EZ-Start™ system to the back plate of your FR18, using the original three bolts.

10. Position the engine within the chassis and secure it from the underside with the four original bolts. Add a drop of thread lock to all four bolts at this time (clean them first). Lightly tighten the bolts prior to checking the gear mesh. While holding the clutch bell gear in place, rock the spur gear back and forth; it should measure between 0.003 and 0.005 inch of endplay. Slide the engine back and forth in its mounted position until you achieve the proper gear mesh. DO NOT adjust the gear mesh too tight or too loose – the gears, clutch, and engine can be severely damaged. Once the proper gear mesh is obtained, fully tighten the four engine mount bolts (under the chassis) and recheck the gear mesh, one more time.

11. Attach glow plug wire to glow plug.

12. Remove the screw and washer that secures the throttle bellcrank to the post and remove bellcrank. Disconnect the throttle linkage and flip the bellcrank over. Reinstall the bellcrank linkage as shown in Figure 3 and replace the unit onto the post. Secure with the original washer and screw.

13. Snap the throttle ball cup to carburetor using needle nose pliers.

WARNING: At this point, install a throttle return spring (we recommend the Losi® brand – part# LOSA9409). This is a safety precaution, to prevent the engine from running past the idle position, in the event that you lose radio contact with the vehicle, or have any type of radio failure. This situation could cause extremely dangerous uncontrolled wide-open operation, resulting in injury to person(s) and/or property damage. Install the return spring in a manner in which the throttle returns to idle position, when the radio is off.

14. Cut the fuel tubing to the proper length and attach it to the carburetor fuel inlet fitting. Make sure to keep the fuel line off sources of high temperature (e.g., tuned pipe, manifold, and cylinder head).

15. Should you use a stock or aftermarket tuned pipe? We recommend using a Fantom WORKS tuned pipe. Our WORKS PIPES produce much better performance than stock pipes, not to mention their unique raspy tone and awesome "factory" appearance. Your Fantom dealer has these in stock or they can order one for you. They are available in natural team finish (part #F20020) or shiny nickel finish (part #F20021). If you decide to use the stock pipe, attach it to the manifold using the stock silicone coupler and new tie straps. If you use an aftermarket pipe, follow the installation instructions included with the pipe. After completing the connection between the manifold and pipe, secure the pipe to the chassis with the stock wire mount and machine screw. Finish the tuned pipe installation by connecting the tank pressure line to the pipe's pressure fitting. When using an aftermarket pipe, you may need to install a longer pressure line, depending on the location of the pipe's pressure fitting.

16. With the radio turned on, adjust the throttle and brake trim settings:
    - Set the radio trims so the throttle closes and opens fully – take your time with this procedure.

- Make sure that the transmitter throttle trigger is in the fully pulled back position at the same time the carburetor opens completely (100%); when the throttle trigger reaches its neutral position, the carb must be simultaneously closed (0%). In other words, you don't want the carburetor fully open when your throttle trigger is only partially back; likewise, you don't want the carburetor fully closed before the trigger is in the neutral position. Faulty adjustments can damage the throttle servo and/or make the engine act like it isn't running properly.

17. Install the air filter.

IMPORTANT: The stock air filter is not intended for dusty conditions. It is only a basic filter intended ONLY for non-dusty conditions. If you expect to encounter any dust, it is extremely important that you obtain an aftermarket air filter. We highly recommend Motor Saver® brand air filters. Motor Saver® manufacturers many different air filters for specific applications. Please contact your dealer or Motor Saver® direct for their latest products.

18. Make sure to oil the air filter. Use quality air filter treatment oil such as our Fantom Filter Fluid™ / Filter Wash™ kit (part # FAN20111). Use a small nylon tie strap to hold the air filter housing to the carburetor; these are available from your local dealer or hardware store.

WARNING: Never run your engine without an air filter. Rapid and permanent damage will result – which is NOT covered by warranty.

18. Check all of your work, and read the rest of this manual (twice) to ensure that you completely understand the operational characteristics of your new FR18 Racing Engine.

FR18 ENGINE OPTIONS

Your FR18 can be modified to work in optional configurations, by referring to the following information and part numbers.

1. Your FR18 comes standard with a turbo type head button installed, which requires the use of a turbo type glow plug. If you prefer to use standard type glow plugs, we offer an optional standard type head button, as well as a standard type glow plug. The following optional head button and glow plug are available:
   - FAN10606 .18 Standard Long Reach Glow Plug (Alternate plug – O'Donnell® 102 / part#ODO102)
   - FAN10508 .18 Standard Head Button

2. To modify the FR18 for pull start operation the following kit is available:
   - FAN10531 Pull Start Conversion Kit

3. To modify the FR18 for non-pull start and/or to eliminate the EZ-Start™ system, the following parts are available:
   - FAN10054 Rear Plate for Non-Pull Start
   - FAN10068 Rear Plate SHC Screws
   - FAN10513 Gasket Set

4. To adapt the FR18 to other vehicles, the following parts are available:
   - FAN10107 Standard Threaded Crank
   - FAN10108 Standard SG Crank
   - FAN10082 6.0mm Rotary Carburetor

ENGINE OPERATIONAL GUIDELINES

This section covers important information useful in understanding the what, how and why of your new engine. To get a full understanding of the remainder of this manual, it is important that we cover some basic principles first. Please make sure you fully understand this section of the manual before proceeding. Because the FR12 and FR15 have slightly different operating characteristics than the FR18, please make sure to pay close attention to the differences, when noted, in the balance of this manual.

NOTE FOR FR18 USERS: The FR18 will run at higher temperatures than the FR12 and FR15, with a normal operating range between 280º-320º F, due to the heavier weight and extra load placed on the engine by the 4wd system of the T-Maxx™ in which it is intended for. The FR18 is designed for this and will not suffer longevity problems because of the higher operating temperatures. DO NOT run the FR18 at lower operating temperatures, like that of the FR12 or FR15, as it will not run correctly in the 4wd T-Maxx™, however, if you convert the FR18 to run in other vehicles, such as a 1/10th scale 2wd truck, or if you convert your T-Maxx™ to 2wd, then you will notice lower operating temperatures.

The Effect of Fuel

Different fuels drastically affect the way your engine will run. One manufacturer's 30% nitro blend isn't necessarily the same as another's, as there are many possible variables: the type of oil (synthetic or castor), the amount of oil (% in the fuel blend), the oil blend (% of synthetic, % of castor), and oil quality will all affect the needle valve settings for any engine. With this in mind, here are some rules to follow when fuel-tuning your engine:

- Lower oil content and/or lower nitro content require leaner needle settings.
- Higher oil content and/or higher nitro content require richer needle settings.
- High oil content and/or low nitro content fuels are generally better for engine longevity.
- Low oil content and/or high nitro content fuels provide better engine performance, but reduce its longevity.
- By reducing the oil content in the fuel blend many properly tuned nitro engines will operate at a slightly reduced cylinder head temperature. DO NOT misinterpret reduced cylinder head temperature as protection against engine damage; to the contrary, less oil content will not protect the engine as well as higher oil content. The less-oil/cooler engine temperature subject is beyond the scope of this manual, however, the fact remains: Reduced oil content (10%, 9%, 8%, etc.) can lead to premature engine failure more easily, if the air/fuel mixture becomes lean.

Although not all are directly related to fuel, the following list includes the most common causes for lean mixtures:

1. The primary needle valve is set too lean (for atmospheric conditions).
2. Incorrect gearing - placing too much load on the engine leads to increased head temperature, producing a lean setting.
3. A leak in the fuel system can produce a lean run from an otherwise correct needle setting.
4. Incorrect glow plug.

In the final analysis, if you choose to use lower oil content fuel, you may gain performance advantages, but longevity will be sacrificed. Also, in low oil content fuel, there simply isn't enough lubricant present in the fuel-blend to defend against rapid temperature rise from an accidental or unintentional lean mixture...you have sacrificed your margin for error against massive engine damage by running less oil.

The Effect of the Weather
Weather conditions also have an effect on how well your engine performs:

• High air temperature
• High humidity
• Low barometric pressure
These conditions contribute to low oxygen density within a given volume of air; low oxygen density demands that the engine's needle valve be set leaner to ensure the correct air/fuel mixture ratio.

• Low air temperature
• Low humidity
• High barometric pressure
These conditions produce a higher oxygen density within a given volume of air; high oxygen density requires that the engine's needle valve be set richer to ensure the correct air/fuel mixture ratio.

Needle valves must always be properly adjusted for the engine to realize peak performance. Too little fuel for the amount of inducted oxygen and the engine will run lean; it will also be starved of the lubricant's protective qualities – lubrication and cooling. Too much fuel for the amount of inducted oxygen and the engine will run rich; with excess fuel and lubricant, the engine will lack power. Increased oxygen density allows more fuel to be run through the engine, producing greater horsepower. Therefore, any engine will produce more horsepower with oxygen dense air conditions; this is why you will usually notice better engine performance in the cooler spring and fall months.

IMPORTANT: In cold weather conditions (e.g., winter months and/or certain regions in the world) the outdoor temperature may make your engine run too cool. Remember, your Fantom engine is designed to run best between 190º and 230º F (280º-320º F for FR18), however, DO NOT lean the main needle to achieve these temperatures. The engine's design is such that the engine will run at these temperatures in typical weather conditions that R/C vehicles are operated in (e.g., 55º to 90º). In colder weather conditions, to keep the engine running in the recommended temperature range, without having to lean the needles to achieve this, it may be necessary to insulate the head by wrapping it with aluminum tape (found at hardware stores).

IMPORTANT: In hot weather conditions (e.g., summer months and/or certain regions in the world) the outdoor temperature may make your engine run hotter than the typical operating temperatures between 190º and 230º F (280º-320º F for FR18), however, DO NOT overly richen the main needle to reduce you engine's temperature in these conditions. The engine's design is such that the engine will run at these temperatures in typical weather conditions that R/C vehicles are operated in (e.g., 55º to 90º). In hotter weather conditions, to keep the engine running in the recommended temperature range, without having to richen the needles to achieve this, it may be necessary to increase cooling by cutting a hole in the front windshield and for extra cooling you can enlarge the cut out area of the body around the engine. Also, limiting the amount of time running the engine wide open will help maintain lower engine temperatures.

Although not related to the weather, elevation above sea level also has an effect on engine horsepower; higher altitudes produce lower barometric pressure and reduced oxygen density. The opposite is true of low elevations. The higher you are above sea level, the more you must lean the needle valve, and vice versa.

The Effect of Operating Conditions

Depending on your particular operating conditions, your engine and vehicle will need to be set up properly to maximize their potential. This mainly has to do with the surface you are running on. For example, if you are running on grass, your engine, clutch, and shift points (if applicable) will need to be tuned differently than if you were running on pavement or dirt. Different dirt conditions require specific tuning (e.g., loamy dirt puts a greater load on the engine compared to hard packed dirt). Refer to your vehicle's instruction manual for details regarding clutch set-up, gearing options & recommendations, and transmission shift points (if applicable).

IMPORTANT: No matter how you prefer to tune your vehicle (shift points, clutch set up, slipper, etc.), always make sure that the needle valves are set properly, for ideal engine operation, for the conditions that you are operating in. Don't call your buddy, who lives across the state or country, and expect to use his settings – every operating condition is unique.

STARTING YOUR ENGINE FOR THE FIRST TIME

IMPORTANT: Before starting your new engine for the first time, it is very important that you read the entire manual first. DO NOT proceed with starting your new engine until you fully understand the remainder of this manual.

First, fill your fuel tank with a high quality hobby fuel, such as Fantom SC20 or SC30 Performance Blend or SC20R or SC30R Racing Blend Fuel. Typically, most people use 20% nitro content fuel in .12 and .15 size engines. For .18 size engines we recommend 30% nitro content to gain extra horsepower for the heavier 4-wd T-Maxx™ truck.

IMPORTANT: Our research has shown that fuel quality plays a very important part in how long your engine will last and how well it will perform. There are many inferior fuels on the market that can cause excess wear and/or engine failure very quickly. We highly recommend that you use only Fantom Performance Blend Fuels for the best performance and longest engine life, for most applications. Fantom Race Blends can also be used, but may affect engine longevity if not used properly and are only recommended for high-level competition use. Fantom also suggests O'Donnell® R2R™ blended fuels as the only other recommended fuel. If you feel comfortable with a certain brand of fuel that you have been using, other than what we suggest, it is OK to use, but failure to use one of the types of fuel we recommend may void any warranty on your engine, if upon inspection of your engine we determine that the problem was fuel related, so use other brand fuels at your own discretion.

Before starting your engine for the first time, make sure your carburetor is set to the baseline settings outlined on page 25 of this manual. At any time, if you experience difficulty starting your engine, please refer to the "Engine Operational Guidelines" section of this manual for helpful information. Once the fuel tank is filled and the radio gear is turned-on, proceed by priming the engine by placing your finger over the exhaust outlet for a few seconds, while turning the engine over with either a starter box, pull start or EZ-Start™ depending on your engine model; this will pressurize the fuel tank, moving fuel into the carburetor and engine. NOTE: This technique is also helpful in starting your engine any time it won't start within the first couple of seconds that you turn

over the engine. By placing and removing your finger over the exhaust outlet, in one to two-second intervals, while turning over the engine, this maintains fuel pressure to the carburetor, which aids in starting the engine. Be careful not to overdo it, though, as flooding and hydralock can occur, making the engine difficult to start or turn over. With a little practice, you will learn the technique, and should find it very useful.

IMPORTANT FOR T-MAXX™ OWNERS: Make sure your EZ-Start™ controller is fully charged. Insufficient power to the glow plug and/or starter motor will result in poor starting or complete failure to start. NOTE: We have found that sometimes an external glow igniter works better than the glow plug system used on the EZ-Start™ controller. In our testing, the EZ-Start™ controller did not seem to be consistent in the way it heats up the glow plug. An external glow plug igniter will heat up the glow plug faster and more efficiently, making the engine start much easier. These can be found at any reputable dealer, and are relatively inexpensive.

NOTE TO PULL START ENGINE OWNERS – It is very important that you DO NOT pull the starter rope out to its full length, as permanent damage could result, which is not covered by warranty. Use short, quick pulls, only pulling the rope out about 10 inches.

IMPORTANT: Make sure your glow plug igniter is fully charged. Insufficient power to the glow plug will result in poor starting or complete failure to start. Just because your glow plug glows (while checking it) does not mean that the glow plug is OK and/or that the glow igniter is charged enough. A low charged igniter will make a glow plug glow, and a bad glow plug will still glow sometimes, but this does not guarantee that either is operating at 100%. We have found that one of the most common reasons for engine starting failures are due to bad glow plugs and/or igniter problems. A glow plug can go bad in less than one tank of fuel, so it is always wise to check this first if you are having difficulty starting your engine.

When starting your engine, opening up the throttle just a little (about 1/8 throttle) is recommended. Some of the more expensive radios are equipped with a push button feature that moves the throttle to a pre-set opening; this is especially helpful when trying to start an engine by your self. Once fuel reaches the carburetor, the engine should start immediately. If it doesn't, look at the fuel line to see if it contains fuel, check the needle valve settings, and glow plug and/or glow plug igniter.

Because of the high compression of your new engine, it is sometimes necessary to loosen the glow plug 1/2 to 1 turn to relieve some of the engine's compression; this will make it easier for the starter box or pull start to crank over your engine. Only perform this procedure if you experience difficulty starting your engine during the initial start up and first 2-3 tanks of fuel. After the first few tanks of fuel, the engine should be broken in sufficiently and will not require this tactic again. Once the engine starts, make sure to tighten the glow plug quickly – within the first 10 seconds of running.

NOTE TO EZ-START™ USERS: As mentioned in your T-Maxx™ manual, your EZ-Start™ controller is made with circuitry that prevents you from overloading the starter motor. Because of this feature, combined with the high compression of your new engine, it is sometimes necessary to loosen the glow plug 1/2 to 1 turn to relieve some of the engine's compression; this will make it easier for the starter motor to crank your engine. Only perform this procedure if your EZ-Start™ controller shuts down (automatically) during the initial start up. After the first tank of fuel, the engine should be broken in sufficiently and will not require this tactic again. Once the engine starts, make sure to remove the glow plug wire and tighten the glow plug quickly – within the first 10 seconds of running.

BREAK-IN PROCEDURE

You may find the following break-in steps to be different than what you are normally used to, but it is very important that you follow our instructions to obtain the best performance and longest engine life.

As your engine starts for the first time, the break-in process begins. For all ABC-type engines proper break-in is critical in obtaining the best performance and longest life. Nearly every part on your engine was produced using CNC (computer numerical control) production machinery. These programmed machines are highly accurate and produce individual engine components that fit together almost perfectly. Despite such accuracy, metal components (primarily the piston and cylinder-sleeve) require minor "seating" (e.g. mating parts perfectly that operate together) and heat-cycling to relieve internal stresses in the metal, due to their fabrication. Therefore, "break-in" can be summarized as the process of "seating-in" and heat-cycling of all engine components from ambient (outside air temperature) to normal operating temperature, by running the engine time after time, until optimal fit and stress relief are achieved.

Your new Fantom engine is built using the latest ABC technology (Aluminum piston - Brass sleeve - Chrome plated inner sleeve wall). All ABC engines are designed with a tapered sleeve, so that the piston is pinched at the top of the piston stroke, known as Top-Dead-Center. This area, at TDC, is called the “pinch-zone”. You can feel it by turning over the crank by hand and noting how the crank gets hard to turn once the piston reaches TDC. Since ABC engines don’t have piston rings, this “pinch” is necessary, in place of the rings, to create compression in the combustion chamber. The most critical aspect of a model nitro engine is compression, because without it an engine will not run properly and is nearly impossible to tune, and in some cases will not run at all. Both the fuel and glow plug require compression to work effectively. Proper break-in ensures that maximum compression and the longest usable piston and sleeve life are achieved. The piston and sleeve are made of aluminum and brass because these are two metals that work together perfectly for this application, due to their ideal expansion characteristics when heated by normal engine operation. The chrome plating serves as a very slippery and wear resistant surface for the piston to efficiently operate against. The ideal expansion rates of aluminum and brass help maintain good compression throughout the engine’s normal operating temperature range. Metal expands when it is heated and by matching the piston’s expansion (determined by the silicon content in the aluminum alloy) to the expansion of the chrome plated brass cylinder-sleeve, the best running-fit is obtained once the engine reaches normal operating temperatures of 190º-230º F (280º-320º F for FR18). Getting the engine quickly into its normal operating temperature range during break-in is critical, because if the engine is ran too cool, the sleeve will not expand enough, causing the piston to wear against the smaller diameter sleeve size. This commonly happens when someone tries to break-in an engine using the method of letting the engine idle for break-in, as instructed by some engine manufacturers. The idle break-in method does not produce enough heat to expand the sleeve to normal operating size, so the piston wears to the under-expanded sleeve size. Once the engine is run at normal temperatures, the piston is too small for the sleeve, creating loss of compression. For proper break-in and normal operation, it is critical that your engine is ALWAYS warmed up as quickly as possible to within its normal operating temperature range in order for the piston and sleeve to expand to their normal operating sizes, otherwise the piston will scrub the under-expanded sleeve too much causing premature wear and loss of compression quickly.

WARNING: Pinch-zone wear, resulting in loss of compression, is NOT covered by warranty. We have no control over what brand of fuel you use, and/or the way you tune and operate your engine. Your Fantom engine is built using the latest ABC technology, and will last just as long as any other brand of ABC type engine, as long as it is used in accordance with this instruction manual, therefore it is your responsibility to operate your engine properly, to obtain the longest usable life possible.

WARNING: Do not let the engine sit and idle for its break-in. Proper operating temperatures will not be obtained to achieve the correct “seating” of the piston and sleeve in the pinch-zone area.

WARNING: Never run your engine at wide-open throttle for extended periods of time. No engine, no mater what brand, is designed for this type of operation. Running your engine wide-open for extended periods of time will cause premature engine failure, which is not covered under warranty. We recommend limiting your wide-open passes to 150 feet or less at a time, and not repeatedly time after time, right in a row. Engines are generally designed for racing type conditions, so think of how you would run your engine on a racetrack. Typically, a racetrack consists of one or two long straightaways and a series of short straights and turns. In a racing situation you are never running your engine wide-open for extended periods of time, so neither should you run your engine this way when using it for fun in the back-yard or street. Use common sense and your engine will last much longer and your experience will be much more enjoyable.

Here’s how to perform the break-in procedure correctly:

1. Decide on a fuel brand and type of blend (nitro and oil content) that you want to use.

WARNING: Whichever type of fuel that you choose, use the same fuel for break-in and everyday operation, for the life of the engine, especially the nitro content. Here’s why: By changing fuels, chances are that either the nitro and/or oil content will change. Different ratios of nitro and/or oil in the fuel will cause combustion chamber temperatures to change. As combustion chamber temperatures change, the expansion rate of the piston and cylinder-sleeve will also change slightly. During the break-in process, primarily effected is the piston and sleeve size, which “seat” (fit) together at a certain expansion rate, determined by the normal operating temperature. Nitro and oil content in different fuels have an effect on normal operating temperature. By changing fuels after break-in, chances are the normal operating temperatures will change. These temperature changes will change the perfect fit (established during break-in) between the piston and sleeve, usually causing improper and/or greater piston and sleeve clearance, causing combustion “blow-by” (loss of compression). Also, by changing nitro and/or oil contents, all needle settings will require readjustment.

2. Start your engine following the starting procedures previously covered. During the break-in period it is much easier if you have someone to help you, so that you can concentrate on keeping the engine running while your helper adjusts the needles and keeps track of the temperature of the engine. A temperature gun is especially important during the break-in period.

TUNING TIP: At any time (during and after break-in), when you first start your engine, rev the engine in quick intervals a few times, before placing it on the ground. This helps clear out any excess fuel in the pipe, crankcase and combustion chamber and helps get the engine warmed up quickly. It is very important to keep in mind that you should NOT fine-tune your needles this way; this is only a quick warm-up procedure to clear the engine out and to get some quick heat into the engine. Optimal carburetor settings will be set once the vehicle is placed on the ground and warmed up completely, following the "SETTING THE NEEDLE VALVES FOR OPTIMUM PERFORMANCE" section further in this manual.

3. Once you have cleaned out your engine, following the "tuning tip" above, place the vehicle on the ground and begin driving it around while cycling the throttle between 1/4 and wide open, while you or your helper periodically check the engine's temperature and make adjustments to the Main needle (if necessary) during quick pit stops. We strongly recommend doing this by running your vehicle in figure 8's, in an area approximately 30' x 50'. Figure 8's, in this size area, work good because they allow you to cycle the engine between 1/4 and full throttle without over-reving the engine, while at the same time maintaining normal operating temperatures. Immediately, evaluate how the engine is running. It should be running rich, meaning the engine should feel low on power and quite a bit of smoke should be coming from the exhaust at full throttle. Break-in is a 4-tank procedure, and the goal during the first 4 tanks is to start the Main needle (also known as the high-speed needle) at a rich setting. NOTE: a good starting point is approximately 5/8 turn richer than the baseline Main needle setting found on page 25. With each consecutive tank, the Main needle should be leaned about an1/8 turn. As you lean the needle each tank, you should notice that the engine's temperature and performance will also increase. Once you are ready for the 5th tank of fuel, ideally your Main needle should still be slightly on the rich side and within 1/8 to 1/4 turn from optimum setting. Following these procedures, run the engine for a complete tank of fuel – then shut it down. Allow the engine to cool down COMPLETELY before re-starting.

WARNING: During the break-in procedure NEVER allow the engine to over-rev to maximum RPM, as this will cause excess stress on the piston, which can lead to the piston shattering. During break-in, when running at full throttle, always let off the throttle before the engine reaches approximately 50% of its RPM potential.

NOTE: the low-speed needle will be fine-tuned later; however, during the break-in procedure it is a good idea to make sure it is set about 1/4 turn richer than the baseline setting found on page 25.

4. Continue this process for 4 tanks of fuel, making sure to allow the engine to cool down completely to ambient temperature before running the next tank of fuel. Also, make sure to lean the Main needle 1/8 turn prior to starting the engine each tank. On the 5th tank of fuel, you should be ready for fine-tuning the carburetor to optimal settings and cool-down between tanks of fuel are no longer necessary.

TUNING TIP: Over the years it has become customary to set the Main needle valve by engine cylinder head temperature (usually called temperature tuning); however, we have found that many people tend to rely too much on tuning their engine by temperature alone. Temperature tuning can lead to overly rich or overly lean needle settings. While overly rich settings normally are not too much concern and usually just result in poor engine performance, overly lean settings can cause severe and permanent damage to internal engine components in less than one tank of fuel. We recommend using a temperature gun whenever you run your engine, but use it to reference your operating temperatures, not to tune to them. It is most important that you get a "feel" for how your engine runs best by listening to its tone, watching for the proper smoke coming from the pipe, and noting its power and acceleration characteristics while driving. Once you learn your engine's operating characteristics, a temperature gun can be very useful in referencing operating temperatures for different conditions. Depending on your operating conditions (e.g., weather conditions, altitude, surface you are running on, fuel type, etc.), you should find that the FR12, FR15, and FR18 cylinder head temperatures (taken with a temperature gun; aiming down inside at the glow plug area of the cylinder head) will generally range between 190º and 230º F (280º-320º F for FR18).

NOTE: The FR18 will run at higher operating temperatures, compared to the FR12 and FR15, when installed in a T-Maxx, because of the extra weight and load that the 4wd system puts on the engine. The FR18 is designed for these temperatures and engine life will not be affected. If you are concerned about these higher operating temperatures, keep in mind that the flash point (burn point) of protective lubricants, found in high quality fuel, is generally a minimum of 700º F; meaning as long as you are using high quality fuel, your engine is protected even at higher operating temperatures, IF THE AIR-FUEL MIXTURE IS NOT SET LEAN.

WARNING: Just because the engine is designed to run up to 230º F (320º F for FR18), do not lean the primary (main) needle valve to achieve this head temperature, unless your operating conditions dictate it! It's OK to run the engine this temperature ONLY if the air-fuel mixture is properly set for the operating conditions that YOU are running in. If you are ever in doubt whether your engine is running too lean, it is always the best practice to run your engine more on the rich side.

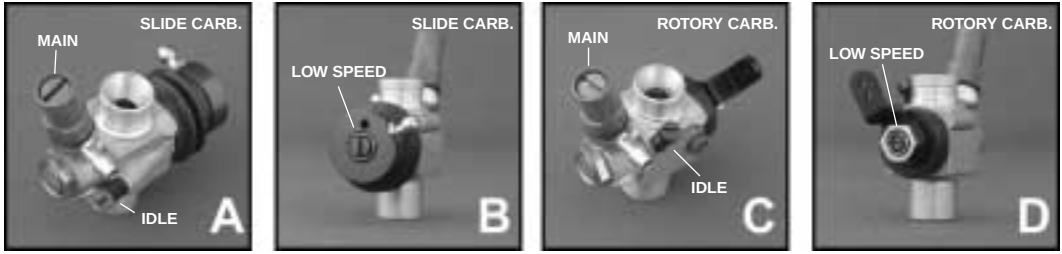
SETTING THE NEEDLE VALVES FOR OPTIMUM PERFORMANCE

Carburetor settings should always be made after the engine has been brought up to normal operating temperature; this is accomplished by running the vehicle for a minute or so.

IMPORTANT: The needle valve settings may vary from day to day depending on outside weather conditions, however, typically we have found that once the needle valves have been set to optimum settings, only very small changes may be necessary. In most cases this will only be about an 1/8th of a turn or less, rich or lean.

There are 3 settings that can be adjusted:

1. The high-speed (main) needle valve (see: Figures A and C).
2. The low-speed needle valve (see: Figures B and D).
3. The idle adjustment screw (see: Figures A and C).



IMPORTANT: Carburetors are very sensitive to minor adjustments. Any adjustments should be made in increments of 1/16th to 1/8th of-a-turn, at a time. New carburetors should be set to the following guidelines and are <u>not</u> considered pre-set from the factory.

The following settings are good baseline settings, but are not necessarily optimal. Use these settings as a starting point, as optimum settings will depend on your conditions:

ROTARY CARBURETOR

- High-speed needle: 2-1/2 turns counter clockwise (CCW) out from closed.
- Low-speed needle: 1-1/2 turns counter clockwise (CCW) out from closed. IMPORTANT: The low speed needle must be set with the throttle in the closed (idle) position. We recommend that you first back the low speed needle out a few turns and set the idle screw to its approximate position. Once the idle position is set, then turn the low-speed needle back in until it gently bottoms out and then back it out CCW to the 1-1/2 turn setting. The reason for this is because the LS needle screw will effect the idle position of the throttle barrel if screwed in too far.
- Idle adjustment (throttle stop): should be set so that the throttle is open approximately .5mm from the "just-closed" position (see illustration 6).

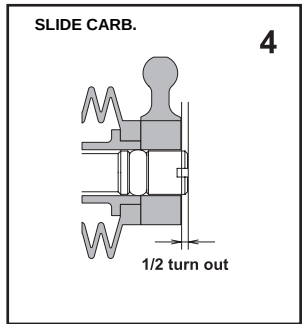
SLIDE CARBURETOR

- High-speed needle: (FR12 / FR15) 2-1/2 turns counter clockwise (CCW) out from closed.
- High-speed needle: (FR18) 3-1/4 turns counter clockwise (CCW) out from closed.
- Low-speed needle: 1/2 turn out from flush (see illustration 4).
- Idle adjustment (throttle stop): should be set so that the throttle is open approximately .5mm from the "just-closed" position (see illustration 5).

Baseline settings were obtained in the following operating conditions:

- Hard packed dirt.
- 80º F (air temperature).
- Low humidity (60%)
- Using Fantom SC20 Fuel (FR12 / FR15) and SC30 Fuel (FR18)

NOTE: Your baseline settings may differ slightly from ours.



High-Speed Needle Valve

1. Start with the high-speed (main) needle valve. This needle controls the amount of fuel allowed to pass through the carburetor at all times. Turning the screw clockwise (CW) makes the engine run leaner; CCW makes it run richer. Continue making small adjustments to this screw until maximum RPM and power is obtained.

WARNING: Leaning the main needle too much may result in higher obtained RPM and power, but may starve the engine of lubrication. Be careful not to over-lean the engine, once you get close to optimal performance. A step too lean can result in permanent piston and cylinder-sleeve damage very quickly, which is NOT COVERED UNDER WARRANTY.

2. For maximum life, it is always best to run your engine slightly on the rich side, rather than too lean. When the engine is tuned for maximum performance, you should still be able to see light smoke coming from the pipe at full throttle.

3. Signs of overly rich mixture:
   - Sputtering and/or bogging at mid to full-throttle.
   - Sluggish acceleration with excessive blue smoke coming from the exhaust.
   - Excessive unburned fuel exiting exhaust.

4. Signs of overly lean mixture:
   - Sagging and/or erratic engine response.
   - Sudden loss of power and/or engine cuts out during mid to full-throttle.
   - Over-heating (not due to engine design, but rather by over-lean needle settings).
   - No smoke coming from exhaust.
   - Distorted, broken and/or white glow plug coil.

Both needle valve settings (too lean and too rich) can produce similar symptoms; be observant and careful when trying to determine what the engine is actually doing. If you get lost, refer to the factory needle settings.

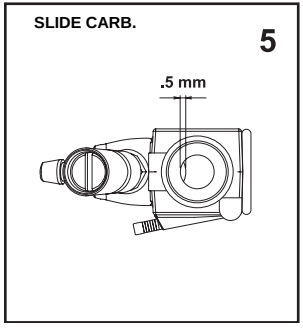
WARNING: Prolonged too-lean operation of the engine produces a hot, lubrication-starved condition resulting in permanent damage, which is not covered by warranty.

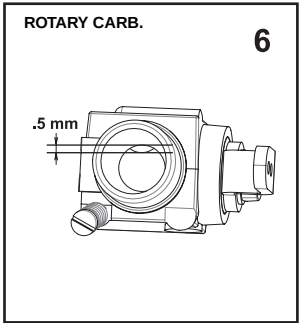
Low-Speed Needle Valve

1. Next, adjust the low speed needle. This adjustment should always be made after the high-speed needle is set. This needle controls the low RPM throttle response, from approximately 0 to 1/4 throttle. Like the high-speed needle, turning the screw CW leans the mixture, while turning the screw CCW richens the mixture.

2. When properly set, the engine should not hesitate when throttle is applied; throttle response should be crisp.

3. The pinch test: by pinching the fuel line closed (at a point just before the fuel inlet of the carburetor), the engine should momentarily speed up and then quit; if it quits immediately – the needle is set too lean.





Setting the Idle-Speed
(see illustrations 5 & 6 for initial setting)

1. Turning the idle-speed screw CW increases engine rpm.

2. Turning the idle-screw CCW reduces engine rpm.

This setting is a personal preference adjustment; we like to set ours so that the engine idles just below clutch engagement.

ENGINE MAINTENANCE

Proper care is necessary for maintaining engine longevity, reliability, and maximum performance. We have no control over how you operate your engine, so it is your responsibility to maintain the proper care for your engine. Fantom is not responsible for engine problems related to improper use or care of your engine. Most engine problems are due to user error, so it is very important that you maintain your engine on a daily use basis to avoid preventable problems.

Engine Bolts

Because of the extreme conditions that model engines are exposed to (e.g. heat, vibration, etc.), all the screws and bolts on your engine must be regularly checked to avoid having them come loose, as air leaks from loose parts will cause damage to your engine that is NOT covered under warranty. For preventative maintenance, we recommend using a mild thread lock compound on all of the screws and bolts on your engine.

Air Filter

Never run your engine without an air filter. An air filter prevents dirt, dust, and debris from entering the engine, which can cause quick and permanent damage that is not covered by warranty. It is extremely important to keep the air filter clean; a clean air filter allows the engine to “breathe” properly for maximum performance. As described earlier, increased airflow (oxygen) allows more fuel flow; in the proper proportion with air, increased fuel flow equals more horsepower. We recommend using high quality air filter oil, such as our Fantom Filter Fluid™ / Filter Wash™ maintenance kit (part # F20111) for the ultimate air filter care. Whichever air filter oil you select, make sure to follow the manufacturer’s instructions carefully.

Glow Plug

In the process of break-in and normal operation, you will periodically need to replace the glow plug. The frequency of plug changes will vary depending on products and operating conditions. Some of these include:

- Glow plug brand and quality
- Needle valve settings
- Weather conditions

Checking the Glow Plug's Condition

Under racing conditions, we generally replace the glow plug before the Main, as preventative maintenance. In general use conditions – change as needed. A simple way of checking the glow plug's condition:

1. Start the engine.
2. For a few moments, while the engine is idling, leave the glow plug igniter on the glow plug and note the sound and/or rpm of the engine.
3. Next, remove the glow plug igniter and note the sound and/or rpm again. After removing the igniter, if you notice a drop in RPM, or the engine sounds as if it is loading up with fuel, the glow plug should be replaced. If the engine won't start at all, this is also a good sign that the glow plug needs replacing, especially if the engine was running fine the last time you used it.

NOTE: Alternative glow plugs to the stock Fantom turbo glow plug (part #FAN10601) for the FR12 / FR15 include any brand turbo plug in the medium heat range and/or 1/10 off-road configuration, depending on how the company labels their plugs; the most common aftermarket plug being the O'Donnell® 77T (part #ODO77T). Alternative glow plugs to the stock Fantom turbo glow plug (part #FAN10602) for the FR18 include any brand turbo plug in the medium heat range and/or monster truck configuration, depending on how the company labels their plugs; the most common aftermarket plug being the O'Donnell® 97T (part #ODO97T).

After Running

After each day's use, it's important to run out any remaining fuel from the engine, fuel line and tank. Model car fuel contains methanol, which attracts moisture; if left inside your engine, this moisture will cause rust and corrosion – especially on ball bearings. After purging the engine of left over fuel, remove the glow plug and squirt a liberal amount of after run oil into the cylinder – through the glow plug hole; also squirt a liberal amount into the carburetor intake, making sure to use a needle applicator to get the after run oil down onto the crankshaft. For superior after-run protection, we recommend our Fantom Rip Saver after-run lubricant (part # FAN20110). After applying the lubricant, turn the engine over a few times with a starter box or pull start, depending on your engine model; this helps to circulate the oil.

Cleaning
Keeping the outside of the engine clean will allow it to run cooler. Never allow heavy dirt deposits to accumulate on the outside of the crankcase or in between the heat sink head fins – overheating will occur. We recommend using a high quality spray cleaner to clean the outside of the engine and heat sink head; we discourage the use of denatured alcohol for this purpose – it's a hygroscopic agent – it attracts rust producing moisture. For stubborn dirt and grime, an old toothbrush will help. Be careful not to allow any dirt or grime to be washed into the engine, through any of its orifices. If you plan on using a large quantity of cleaning agent, again – make certain there is a glow plug installed and the carburetor opening is covered. Never use water to clean your engine because of the metal parts that will rust and corrode.

Rebuilding
All engines have a life span, no matter what brand. Your Fantom engine is constructed using the latest ABC type technology, and will last just as long as any other ABC-type engine – as long as the proper care is taken. When the time comes to rebuild your engine, this manual provides exploded views of the engine and carburetor, as well as a part number list for all the available replacement parts; this will aid you in disassembling and reassembling your engine, and ordering replacement parts. For additional help, our tech support line is also available at 1-(269)-649-9583. Replacement parts are available wherever Fantom engines are sold. Fantom also offers a professional rebuild service for those customers who prefer not to service their engines themselves. This service is available at current shop rates and parts prices. Please call our tech support line for more details, or visit our web site at www.fantomracing.com

Storage
For extended periods of storage, we recommend disassembling the engine and generously coating all the internal parts of the engine with a high quality lubricant. Again, our Fantom Rip Saver lubricant (part # FAN20110) works great for this. After coating all the internal parts, reassemble the engine. A light mist of WD-40™ on the outside of the engine will also prevent any corrosion of external parts.

CAUTION STATEMENT

- Use common sense when operating your vehicle. No engine, no matter what brand, can withstand the abuses of continuous wide-open operation, severe crashes, neglect, or improper use.
- You are responsible for the maintenance of your equipment from the aspect of safety, performance, and longevity.
- Nitro powered vehicles can reach very high speeds; they can cause severe damage and injury to persons and property if not handled properly. Use caution and exercise courtesy when operating your vehicle around people and property.
- Children should ALWAYS be under adult supervision when operating nitro-powered vehicles.
- Model engines operate at high temperatures, which can cause severe burns. Always be careful when handling your vehicle to avoid touching hot components.
- Use caution when handling a vehicle with the engine running; moving parts such as the clutch and gears can cause severe injury.
- Use caution when handling model car fuel. Model car fuel can be a very hazardous material if used improperly; always follow the manufacturer's safety warnings and instructions.
- Run your vehicle in well-ventilated areas – never indoors – exhaust fumes can be very dangerous.
- Fantom has no control over the use of this product, and therefore accepts no responsibility and cannot be held responsible for any damage or injury caused by its use or misuse.
- The user accepts all responsibility for the use of this product.

WARRANTY

Because Fantom does not control the use of this engine, we offer the following limited warranty:

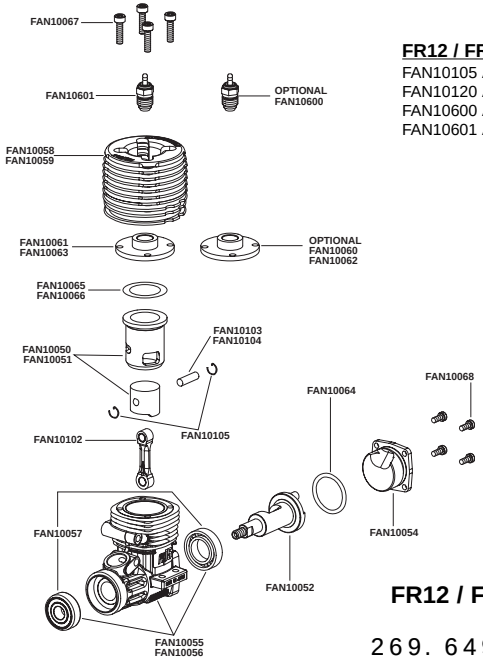
- The engine is free of manufacturing defects, and it meets all factory specifications at the time of purchase.
- Parts that are defective at the time of purchase will be repaired or replaced free of charge; all other repairs or parts will be charged to the customer.
- This warranty will not exceed 30 days from the date of purchase.
- Proof of purchase is required for any warranty service.
- Engine failure due to misuse, abuse, improper adjustment, incorrect fuel, and normal wear are not covered under warranty.
- Any warranty repairs will be at the discretion of Fantom upon inspection of the engine.
- Any modifications to the engine will void all of this warranty.
- If it is necessary to return your engine for service or warranty repair, please call: 1-(269)-649-9583 for a return authorization number and instructions for returning the engine.
- The cost of shipping the engine to Fantom, and shipping charges back to the customer from Fantom for non-warranty repairs are the responsibility of the customer. Fantom will cover only shipping charges back to the customer for warranty repair returns.

NEWS

Please check out our web site at www.fantomracing.com for the latest news, tips, and high performance parts and products.

FR12 / FR15 REPLACEMENT PARTS LIST

FAN01001 FR12 – 2005 .12 Side Exhaust, Rotary Carburetor
FAN01002 FR12 – 2005 .12 Side Exhaust, Slide Carburetor
FAN01003 FR12 – 2005 .12 Side Exhaust, Rotary Carburetor, Pull Start
FAN01004 FR12 – 2005 .12 Side Exhaust, Slide Carburetor, Pull Start
FAN01005 FR15 – 2005 .15 Side Exhaust, Rotary Carburetor
FAN01006 FR15 – 2005 .15 Side Exhaust, Slide Carburetor
FAN01007 FR15 – 2005 .15 Side Exhaust, Rotary Carburetor, Pull Start
FAN01008 FR15 – 2005 .15 Side Exhaust, Slide Carburetor, Pull Start
FAN10050 '05 .12 ABC Piston and Sleeve Set
FAN10051 '05 .15 ABC Piston and Sleeve Set
FAN10052 '05 .12 / .15 Standard Threaded Crank
FAN10053 '05 .12 / .15 SG Crank (optional – not shown)
FAN10054 '05 .12 / .15 / ('04) .18 Rear Plate for Non-Pull Start (optional for FR18)
FAN10055 '05 .12 Crankcase with Bearings
FAN10056 '05 .15 Crankcase with Bearings
FAN10057 '05 .12 / .15 Bearing Set
FAN10058 '05 .12 Head (combustion chamber head button sold separate)
FAN10059 '05 .15 Head (combustion chamber head button sold separate)
FAN10060 '05 .12 Head Button for Standard Glow Plug (optional)
FAN10061 '05 .12 Head Button for Turbo Glow Plug
FAN10062 '05 .15 Head Button for Standard Glow Plug (optional)
FAN10063 '05 .15 Head Button for Turbo Glow Plug
FAN10064 '05 .12 / .15 Gasket Set
FAN10065 '05 .12 Head Shims (pack of 3)
FAN10066 '05 .15 Head Shims (pack of 3)
FAN10067 '05 .12 / .15 / ('04) .18 Head Bolts (pack of 4)
FAN10068 '05 .12 / .15 / ('04) .18 Rear Plate Bolts for Non-Pull Start (4) (optional for FR18)
FAN10072 All .12 / .15 / .18 Cone Collet (not shown)
FAN10102 All .12 / .15 / .18 Knife-Edge Connecting Rod
FAN10103 All .12 Side Exhaust Wrist Pin
FAN10104 All .15 Side Exhaust Wrist Pin



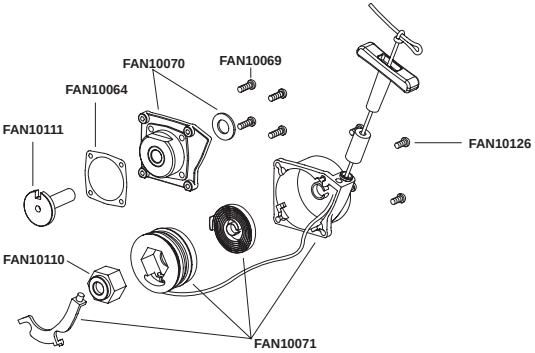
FR12 / FR15 REPLACEMENT PARTS LIST CONT.

FAN10105 All .12 / .15 / .18 Wrist Pin Clips (pack of 8)
FAN10120 All .12 / .15 Side Exhaust Manifold Gasket (pack of 2) (not shown)
FAN10600 All .12 / .15 Standard Long Reach Glow Plug (optional)
FAN10601 All .12 / .15 Turbo Glow Plug (standard)

FR12 / FR15

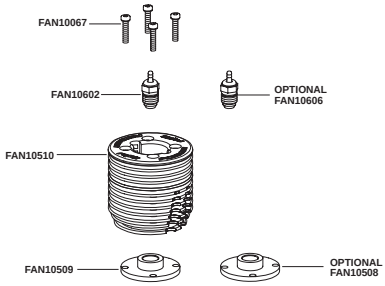
FR12 / FR15 REPLACEMENT PARTS LIST CONT.

FAN10069 '05 .12 / .15 Rear Plate Screws for Pull Start (pack of 4)
FAN10070 All .12 / .15 Side Exhaust Rear Plate for Pull Start
FAN10071 All .12 / .15 Side Exhaust Pull Start Assembly
FAN10110 All .12 / .15 Side Exhaust Pull Start One-Way Bearing
FAN10111 All .12 / .15 Side Exhaust Pull Start One-Way Bearing Shaft
FAN10126 All .12 / .15 / .18 Pull Start Assembly Screws (pack of 4)



FR18 REPLACEMENT PARTS LIST

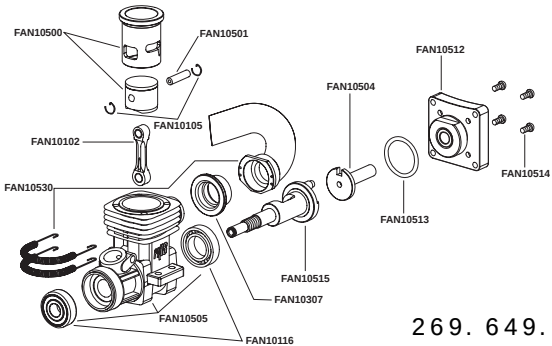
FAN01024 FR18 – 2004 .18 Rear Exhaust, Slide Carburetor, & Manifold (for T-Maxx™)
FAN10107 All .18 Standard Threaded Crank (optional – not shown)
FAN10108 All .18 Standard SG Crank (optional – not shown)
FAN10116 All .18 Crankcase Bearing Set
FAN10307 All .18 Silicone Manifold Seal (pack of 2)
FAN10500 All .18 ABC Piston and Sleeve Set
FAN10501 All .18 Wrist Pin
FAN10504 All .18 EZ-Start™ One-way Bearing Shaft
FAN10505 All .18 Crankcase with Bearings
FAN10508 '04 .18 Head Button for Standard Glow Plug (optional)
FAN10509 '04 .18 Head Button for Turbo Glow Plug
FAN10510 '04 .18 Head (combustion chamber head button sold separate)
FAN10511 '04 .18 Head Shims (pack of 4)
FAN10512 All .18 Rear Plate (for T-Maxx™)(requires FAN10513)
FAN10513 '04 .18 Gasket Set
FAN10514 All .18 Rear Plate Bolts for FAN10512
FAN10515 All .18 Standard Crank (for T-Maxx™)
FAN10530 All .18 T-Maxx™ Custom Manifold w/Springs
FAN10531 All .18 Pull Start Conversion Kit (optional - not shown)
FAN10302 All .18 Pull Start Assembly (optional – not shown)
FAN10303 All .18 Pull Start One-way Bearing (optional – not shown)
FAN10304 All .18 Pull Start One-way Bearing Shaft (optional – not shown)
FAN10305 All .18 Rear Plate for Pull Start (optional – not shown)
NOTE: Use FAN10126 Screws for FAN10302 and FAN10305



FR18 REPLACEMENT PARTS LIST CONT.

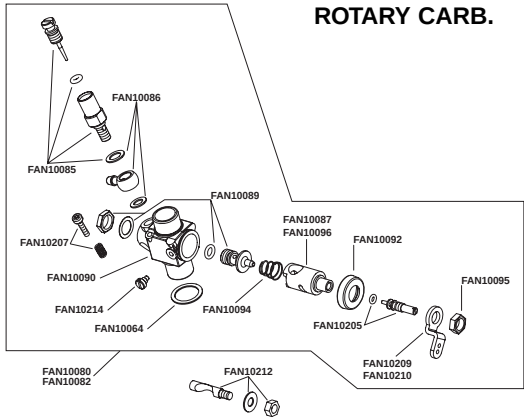
FAN10306 All .18 Rear Plate Gasket for FAN10305 (optional – not shown)
FAN10054 '05 .12 / .15 / ('04) .18 Rear Plate for Non-Pull Start (optional for FR18)
FAN10067 '05 .12 / .15 / ('04) .18 Head Bolts (pack of 4)
FAN10068 '05 .12 / .15 / ('04) .18 Rear Plate Bolts for Non-Pull Start (4) (optional for FR18)
FAN10072 All .12 / .15 / .18 Cone Collet (not shown)
FAN10102 All .12 / .15 / .18 Knife-edge Connecting Rod
FAN10105 All .12 / .15 / .18 Wrist Pin Clips (pack of 8)
FAN10606 All .18 Standard Long Reach Glow Plug (optional)
FAN10602 All .18 Turbo Glow Plug (standard)

FR18



FR12 / FR15 / FR18 REPLACEMENT PARTS LIST

FAN10080 '05 .12 5.5mm Rotary Carburetor
FAN10081 '05 .12 5.5mm Slide Carburetor
FAN10082 '05 .15 / .18 6.0mm Rotary Carburetor (optional for FR18)
FAN10083 '05 .15 6.0mm Slide Carburetor
FAN10522 '04 .18 6.0mm Slide Carburetor (for T-Maxx™)
FAN10084 '05 .12 / .15 / ('04) .18 Slide Carburetor Low-Speed Needle
FAN10085 '05 .12 / .15 / .18 Rotary / Slide Carb. High-Speed Needle
FAN10086 '05 .12 / .15 / .18 Rotary / Slide Carb. Fuel Inlet Fitting
FAN10087 All .12 5.5mm Rotary Carburetor Throttle Barrel
FAN10088 All .12 / .15 / .18 Slide Carburetor Throttle Barrel
FAN10089 All .12 / .15 / .18 Rotary Carburetor Spray Nozzle
FAN10090 All .12 / .15 / .18 Rotary Carburetor Main Body
FAN10091 All .12 5.5mm Slide Carburetor Main Body
FAN10092 All .12 / .15 / .18 Rotary Carburetor Rubber Boot
FAN10093 All .12 / .15 / .18 Slide Carburetor Rubber Boot
FAN10094 All .12 / .15 / .18 Rotary Carburetor Barrel Spring
FAN10095 All .12 / .15 / .18 Rotary Carburetor Throttle Arm Nut
FAN10096 All .15 / .18 6.0mm Rotary Carburetor Throttle Barrel
FAN10097 '05 .12 / .15 / ('04) .18 Slide Carburetor Spray Nozzle
FAN10098 All .15 / .18 6.0mm Slide Carburetor Main Body
FAN10205 All .12 / .15 / .18 Rotary Carburetor Low Speed Needle Ass.
FAN10207 All .12 / .15 / .18 Rotary Carburetor Idle Screw with Spring
FAN10208 All .12 / .15 / .18 Slide Carburetor Idle Screw with Spring
FAN10209 All .12 / .15 / .18 Rotary Carb. Aluminum Throttle Arm (optional)
FAN10210 All .12 / .15 / .18 Rotary Carb. Plastic Throttle Arm (standard)
FAN10211 All .12 / .15 Slide Carburetor Throttle Ring
FAN10521 All .18 Slide Carburetor Throttle Ring (for T-Maxx™)
FAN10212 All .12 / .15 / .18 Carburetor Securing Pin w/ Washer & Nut
FAN10214 All .12 / .15 / .18 Rotary Carburetor Barrel Guide Screw



SLIDE CARB.