



ROYAL RACING ENGINES

INSTRUCTION MANUAL

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Your FX Engine is a high-precision, high-performance model engine intended for use in model cars. All of the finest engineering and craftsmanship has gone into the concept, design, creation, and finishing of your very own FX Engine.

This engine and all of its parts were designed and manufactured by FX in-house in Slovakia, Europe from all the finest European materials and using the most advanced Swiss and German technologies. Even the crankcase was die cast in house using our own fully robotic die casting technology. All the products are individually measured and inspected and all of the important dimensions of every part are recorded so there is a full record of every single part being manufactured and assembled. Your engine birth certificate shows all the important serial numbers and measurements so that, at anytime, all details of the production including the batch of material, machine programs, responsible craft persons and production dates can be traced back to its roots.

Enjoy your royal FX Engine.

Before You Start

- It is extremely important - before attempting to operate your new FX engine – to read this Instruction Manual, and strictly adhere to the advice contained therein.
- This engine is not a toy but a highly efficient internal-combustion engine with power which is capable of harming you or others.
- This engine is intended for persons aged 16 years and older with previous experience building and operating RC model racing cars and with previous experience operating combustion nitro engines.
- This product is not intended for use by beginners, inexperienced customers, or by children without direct supervision of a responsible, knowledgeable adult.
- Before installing and operating your engine, YOU MUST read through all of the operating instructions and Instruction Manual and fully understand them to get the maximum enjoyment and prevent unnecessary damage.
- Keep this Instruction Manual in a safe, easily-accessible location so you can quickly & easily refer to it whenever necessary.
- Content of the box may differ from pictures shown in any promotional materials such as catalogs, leaflets, internet web site, instruction manual, etc.
- Use only genuine and original authentic FX parts for maximum performance. Using any third-party parts on this engine may negatively influence the performance and reliability of the engine and moreover using any third-party parts on this engine will void the warranty.
- Use only genuine FX glow plugs to ensure highest performance and long life time.
- In line with our policy of continuous product development, the exact specifications of the product may vary without prior notice.
- FX reserves all rights to change any specification without prior notice. All rights reserved.

■ Limitations of Liability

- FX has no control over damage resulting from shipping, improper installation, or improper usage.
- FX assumes and accepts no responsibility for personal and/or property damages resulting from the use of improper building materials, equipment and operations.
- By purchasing any item produced by FX, the buyer expressly warrants that he/she is in compliance with all applicable federal, state and local laws and regulation regarding the purchase, ownership and use of the product.
- The buyer expressly agrees to indemnify and hold harmless FX for all claims resulting directly or indirectly from the purchase, ownership or use of the product.
- By the act of assembling or operating this product, the user accepts all resulting liability. If the buyer is not prepared to accept this liability, then he/she should return this product in new, uninstalled, and unused condition to the place of purchase.
- FX makes no other warranties expressed or implied.
- FX shall not be liable for any loss, injury or damages, whether direct, indirect, special, incidental, or consequential, arising from the use, misuse, or abuse of this product and/or any product or accessory required to operate this product.
- In no case shall FX's liability exceed the monetary value of this product.

■ Safety Precautions

- When using and/or operating this engine always wear protective glasses, gloves, ear protection and protective shield.
- Take appropriate safety precautions prior to operating this product. You are responsible for this engine installation and safe operation!
- Please read the Instruction Manual before building and operating this model and follow all safety precautions.
- Improper operation may cause personal and/or property damage.



Warnings

- This product is not suitable for children under 16 years of age without the direct supervision of a responsible and knowledgeable adult.
- This model engine is designed exclusively for installation into model cars. Never use it for any other purpose as it may cause personal injury or mechanical failure.
- Mount the engine in your model securely, following the manufacturer's recommendations, using appropriate fasteners.
- Assemble and operate this product only in places away from the reach of children.
- When you operate an engine, keep children and others away from you and the engine. Anyone who is not operating the engine should remain at least 6 meters away from the engine.
- Keep small parts out of reach of small children. Children must not be allowed to put any parts in their mouth, or pull vinyl bag over their head.
- Immediately after using your model, do NOT touch equipment on the model such as the engine, muffler or manifold because they generate high temperatures. You may seriously burn yourself by touching them.
- Do not put fingers or any objects inside or near rotating and moving parts, as this may cause damage or serious injury as your finger, hair, clothes, etc. may get caught.
- Follow the operating instructions for the radio equipment at all times.
- Be sure that your operating frequency is clear before turning on or running your model, and never share the same frequency with somebody else at the same time. Ensure that others are aware of the operating frequency you are using and when you are using it.
- Use a transmitter designed for ground use with RC cars. Make sure that no one else is using the same frequency as yours in your operating area. Using the same frequency at the same time, whether it is driving, flying or sailing, can cause loss of control of the RC model, resulting in a serious accident.
- Always turn on your transmitter before you turn on the receiver in the car. Always turn off the receiver before turning your transmitter off.
- Keep the wheels of the model off the ground when checking the operation of the radio equipment and working on your engine.
- Disconnect the battery pack before storing your model.
- Exercise care when using tools and sharp instruments.
- Take care when building and operating, as some parts may have sharp edges.
- When learning to operate your model and working on your engine, go to an area that has no obstacles that can damage your model if your model suffers a collision.
- If the model behaves strangely, immediately stop the model, check and resolve the problem.
- Remove any sand, mud, dirt, grass or water before putting your model away.

- To prevent any serious personal injury and/or damage to property, be responsible when operating all remote controlled models.
- The model car is not intended for use on public places and roads or areas where its operation can conflict with or disrupt pedestrian or vehicular traffic.
- Because the model car is controlled by radio, it is subject to radio interference from many sources that are beyond your control. Since radio interference can cause momentary loss of control, always allow a safety margin in all directions around the model in order to prevent collisions.
- Never operate the engine-equipped model alone. Remember that operating any model with engine requires skills and continuous safety precautions. When you operate a model, you should ask for the assistance of an experienced person who can accompany you, recognize emergency situations nearby, and has enough experience avoiding possible dangers.
- Always test the brakes and the throttle before starting your engine to avoid losing control of the model.
- Check the throttle linkage connections before starting and running the model car. If any connections fail, it may cause personal injury.
- Before starting the engine, always check the tightness of all fasteners especially those on joints and moving parts such as the throttle arm. Failure to re-tighten loose fasteners often causes part breakages that are capable of harming you.
- Keep your face, hands, and body away from the spinning flywheel, gears and other objects on the model or engine to prevent injury. If the tires, flywheel or gears break, flying pieces may result in personal injury.
- In order to avoid ear damage, use an effective silencer (muffler) for sound reduction. Always wear ear protection.
- Keep loose objects such as shirt sleeves, neckties, and scarves away from the spinning tires, flywheel, and gears.
- Be careful not to drop any objects such as screwdrivers, pencils, utensils, etc into the spinning tires, flywheel, and gears. If these objects contact moving engine or transmission parts, it may cause mechanical breakage and personal injury.
- Do not use your model:
 - Near real cars, animals, or people that are unaware that an RC car is being driven.
 - In places where children and people gather.
 - In residential districts and parks.
 - In limited indoor spaces.
 - In wet conditions.
 - In the street.
 - In areas where loud noises can disturb others, such as hospitals and residential areas.
 - At night or anytime your line of sight to the model may be obstructed or impaired in any way.

Very Important Warnings

- Handle fuel only outdoors. Never handle nitro fuel indoors, or mix nitro fuel in a place where ventilation is not appropriate.
- Only use nitro fuel for RC models. Do not use gasoline or kerosene in RC models as it may cause a fire or explosion, and ruin your engine.
- Nitro fuel is highly inflammable, explosive, and poisonous. Never use fuel indoors or in places with open fires and sources of heat.
- Always keep the fuel container cap tightly shut.
- Always read the warning label on the fuel container for safety information.
- Nitro-powered model engines emit poisonous vapors and gasses. These vapors irritate eyes and can be highly dangerous to your health. We recommend wearing rubber or vinyl gloves to avoid direct contact with nitro fuel.
- Do not operate near open flames or smoke while running your model or while handling fuel.
- Nitro fuel for RC model cars is made of the combination of the methyl alcohol, castor or synthetic oil, nitro methane, etc. The flammability and volatility of these elements is very high, so be very careful during handling and storage of nitro fuel.
- Pour all the remaining fuel out of the fuel tank after every use. Never pour fuel back into the original fuel bottle after use; once the fuel is out of the original container and exposed to air, the quality of the fuel is affected and it deteriorates.
- Some parts will be hot after operation. Do not touch the exhaust or the engine until they have cooled. These parts may reach 135°C (275°F) during operation!
- Keep nitro fuel away from open flame, sources of heat, direct sunlight, high temperatures, or batteries.
- Store fuel in a cool, dry, dark, well-ventilated place, away from heating devices, open flames, direct sunlight, or batteries. Keep nitro fuel away from children.
- Do not leave the fuel in the carburetor or fuel tank when the model is not in use. There is danger that the fuel may leak out.
- Wipe up any spilled fuel with a cloth.
- Be aware of spilled or leaking fuel. Fuel leaks can cause fires or explosions.
- Do not dispose of fuel or empty fuel containers in a fire. There is danger of explosion.
- If someone's skin or face has been splashed with fuel, first wash it away with soap and water, then immediately consult a physician. If you swallow fuel, it is imperative to seek immediate medical treatment. Failure to undergo such treatment may endanger your life.
- Never run your engine without an air filter. Your engine can be seriously damaged if dirt and debris get inside the engine.
- Immediately after the engine has been run there exist conditions when the engine may restart if it is rotated over compression without the glow plug battery being reconnected.
- When checking the electric conduction to the glow plug, use a tool or clamp to handle. Never touch the wire plug or cable directly by hand. In this situation keep your face away from heated portion. Seething fuel may spout out and cause a skin burn.
- Make sure the air filter is clean and oiled.
- Excessively rich running and prolonged low speed running should be avoided. Prolonged low speed running and low temperature running may result in the oil in the fuel becoming gelled and the piston/liner becoming stuck together.

Warranty

- FX guarantees that all parts of a newly-purchased engine are manufactured with the highest regard to quality. However, due to the many factors inherent in model racecar competition, FX cannot guarantee any parts once you start the engine.
- FX guarantees this product to be free from defects in both material and workmanship within 30 days of purchase.
- The total monetary value under warranty will in no case exceed the cost of the original product purchased.
- FX has no control over usage of this product once it leaves the shop, therefore FX can only offer warranty against all manufacturer's defects in materials, workmanship, and assembly at point of sale and before use.
- Any and all warranty coverage will not cover replacement of any part or component damaged by neglect, abuse, or improper or unreasonable use or as a result of wear. This includes but is not limited to damage from crashing, chemical and/or water damage, excessive moisture, improper or inadequate maintenance, or user modifications which compromise the integrity of components or using non-original parts and equipment such as glow plugs, mufflers, etc.
- Any parts missing from this product must be reported within 30 days of purchase.
- No part or parts will be sent under warranty without proof of purchase.
- Should you find a defective or missing part, contact the local distributor.
- Service and customer support will be provided through the local hobby store where you have purchased the product, therefore make sure to purchase any FX products at your local hobby store.
- This product is considered to be a high-performance racing engine. As such this product will be used in an extreme range of conditions and situations, all which may cause premature wear or failure of any component at any time.
- No warranties are expressed or implied that cover damage caused by what is considered normal use, or cover or imply how long any components or parts will last before requiring replacement.
- Due to the high performance level of this product you will need to periodically maintain and replace consumable components.
- Do not modify the engine or any parts of it in any way. Any modifications will void the warranty immediately.
- FX does not pay nor refund shipping on any component sent to FX or its distributors for warranty.
- FX reserves the right to make the final determination of the warranty status of any component or part.
- Some small scratches may be visible on some of the components and is not considered a manufacturing defect.

Included

Please refer to the exploded view sheet to see what all parts are included with your engine. Typically an FX engine includes:



Glow plug
(1 piece)



Exhaust seal ring
(1 piece)



Cylinder-head shim
(1 piece)



Carburetor venturi
(1 piece)



Dust cap $\varnothing 3$, $\varnothing 6$, $\varnothing 16$, $\varnothing 18$
(1 piece each)

Equipment Required



Silicone Fuel Tube

Special silicone fuel tube is required to connect the fuel tank to the engine.



Starter Box

To start the engine use professional starter box with a high torque motor.

#104400 HUDY Star-Box On-Road 1/10 & 1/8
#104500 HUDY Star-Box Off-Road 1/8



Glow plug Starter

A glow plug starter is required to ignite the glow plug for starting. Use a high-quality battery-operated glow plug starter.



Temperature Gauge

A temperature gauge is useful to check the engine temperature during the break-in period as well during every run on the track to verify your engine works within the standard heat limits.



Glow plug Wrench

A glow plug wrench is required for removing/installing the engine glow plug.

#107581 HUDY Glowplug Wrench # 8mm / Clutchnut #
10mm Long



Screwdriver

#154065 HUDY Slotted Screwdriver for Engine #4.0mm - Long
#111545 HUDY Allen Wrench #1.5mm
#112045 HUDY Allen Wrench #2.0mm
#112545 HUDY Allen Wrench #2.5mm
#107612 HUDY Exhaust Spring / Caster Clip Remover



Air Filter Oil

High quality air filter oil is required to prevent debris to get into the engine.

#106240 HUDY Air Filter Oil



Clutch System & Flywheel Collar

To install the engine in the car you need first to install the complete clutch system on the engine. The clutch system & flywheel collar should be included with your car kit.



Break-in Bench

To break-in the engine we recommend using an RC car engine break-in bench.

#104140 HUDY Engine Break-In Bench



Air Filter

A two-stage foam air filter must be used at all times.



Bearing Puller & Presser

Recommended for servicing and replacing the ball-bearings in the engine.

#107050 HUDY Ultimate Engine Tool Kit for .12 Engines

#107051 HUDY Ultimate Engine Tool Kit for .21 Engines



After Run Oil

We recommend using after run oil to extend the lifetime of your engine.

#106250 HUDY Engine After Run Oil



Fuel

It is suggested to use high-quality RC car fuel with 16~30% nitro methane.



Fuel Filter

A fuel filter is recommended to prevent debris from getting into the engine.



Fuel Bottle

For filling the fuel tank, a fuel bottle with a suitable spout is required.

#104200 HUDY Fuel Bottle with Aluminum Neck



Motor Spray

A motor spray is required for cleaning the engine after each run.



Flywheel Tool

Special flywheel tool will be required to install the clutch system on your engine.

#182010 HUDY Flywheel / Clutch Multi-Tool

#182015 HUDY Flywheel / Wheel Nut Multi-Tool 1/8 Off-Road



Pliers

Use pliers to install ball linkages and to check glow plug.

#189020 HUDY Micro Pliers - Combination

#189030 HUDY Micro Pliers - Long Nose

Basic Information













To get maximum performance and life time from your engine you need to work and approach the engine with very specific and detailed care and attention. Every small detail matters and has a significant influence on the performance, reliability and life time.

Terms used

To make the engine leaner	Means to tighten (close) the main (high-speed) needle CW (to the right).
To make the engine richer	Means to loosen (open) the main (high-speed) needle CCW (to the left).

Carburetor needle settings

To adjust a needle or screw on the carburetor we refer to a fraction of a turn, for example 1/12, 1/4, 1/2, etc. Sometimes the fraction of the turns are also called "hours", for example 1/12 of a turn equals to 1 hour.

 1/12 = 1/12 = 1 hour	 7/12 = 7/12 = 7 hours
 2/12 = 1/6 = 2 hours	 8/12 = 2/3 = 8 hours
 3/12 = 1/4 = 3 hours	 9/12 = 3/4 = 9 hours
 4/12 = 1/3 = 4 hours	 10/12 = 5/6 = 10 hours
 5/12 = 5/12 = 5 hours	 11/12 = 11/12 = 11 hours
 6/12 = 1/2 = 6 hours	 12/12 = 1 = 12 hours

Engine temperatures

During all the operations with your engine you need to regularly check for the temperature of the engine. To measure the temperature use a high-quality temperature infrared gauge and measure the temperature inside the engine head in the area of glow plug and from the side of the engine head.

The working temperature of the engine should be in between range 100~130°C (212~266°F). The working temperature range always depends on the weather temperature, humidity, altitude and the track conditions.

The optimum working temperature should be 100~125°C (212~257°F) when the air temperature is in the range of 5~30°C (41~86°F).

- The lower air temperature, the lower temperature of the engine will be.
- The higher air temperature, the higher temperature of the engine will be.
- The leaner the engine setting, the higher working temperature will be.
- The more rich the engine setting, the lower working temperature will be.

MINIMUM OPERATING TEMPERATURE:

The engine temperature should not fall below **80°C (176°F)** at any point while it is being operated.

WARNING:

In cases where your engine reaches temperatures higher than **140°C (284°F)**, immediately stop the engine as you risk serious damage to the engine.

Life time and performance of the engine

The performance will change during the life time of the engine. This high-performance engine is designed for high-level racing and as such its life time is limited. The life time of the engine is very individual and depends on various factors and conditions. The typical life time of the engine is in the range of 0 up to 20-30 hours.

Typical performance during life time of the engine

Life time	Performance
0-2 hours	The engine will break-in and all parts will properly seat.
2+ hours	After 2 hours of first run the performance should be very good. The temperature of the engine should not be more than 120°C (248°F).
5-15 hours	The maximum performance of the engine should usually last between the 5th-15th hours of run time.
15~30 hours	The high performance of the engine is up to 20-30 hours depending on the various factors.

Decreasing life time of your engine

The life of the engine very radically decreases when you run in:

- Extremely dusty conditions without a new filter for every run
- In rain (water and mud)

In many cases after a race in such extreme conditions the engine may be damaged regardless of the amount of prior use, therefore for these extreme conditions we suggest using an older engine if available.

How to extend the life time of your engine to the maximum

- Take the time and break-in the engine properly following the instructions in the Break-in Procedure part, this will significantly increase life time.
- Always using a clean air filter will greatly increase the life expectancy of the engine.
- Always use the proper air filter oil.
- After every race apply the after run oil.
- Always use high-quality branded fuel.
- Always use only the original FX glow plug, muffler, manifold and replacement ball-bearings.
- Always clean the engine.
- Always store the engine in dry area. Humidity will destroy parts of the engine.
- Avoid excessively dusty or wet conditions.
- Always after every run check if the wire of the glow plug is clean and has a smooth surface. If this is not the case, replace the glow plug immediately. A broken glow plug may destroy your engine.
- Always after every race check if the ball-bearings have free and smooth movement. As soon you feel some 'gritty' movement immediately exchange the ball-bearings for new ones.
- During the 20-30 hours of the life time of the engine there is no need to change crankshaft, piston, sleeve or any other part. The only parts that must be regularly changed are the ball bearings, glow plug and air filter.



Fuel consumption

The fuel consumption depends on mix of various factors such as life time of the engine, carburetor setting, venturi size used, working temperature, air temperature, humidity, track conditions, altitude, fuel, air filter, muffler, manifold, weight of the car, traction of the car, free work of drive train, driving style, etc. To find the correct and optimum fuel consumption setting of your engine is complex and requires testing and experience.

Generally the more running hours your engine has, the longer run time it should have. The run time is greatly influenced by various factors such as:

- Life of your engine
- Type of the track
- Traction
- Venturi used
- Weather
- Muffler and manifold
- Glow plug
- Shims under the head

This is an average table showing the run time depending on life of your engine under optimum circumstances:

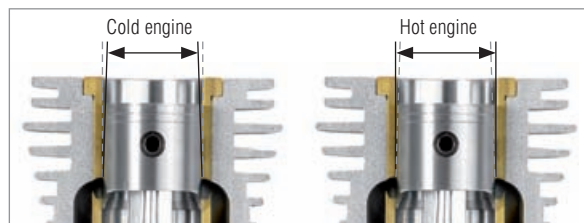
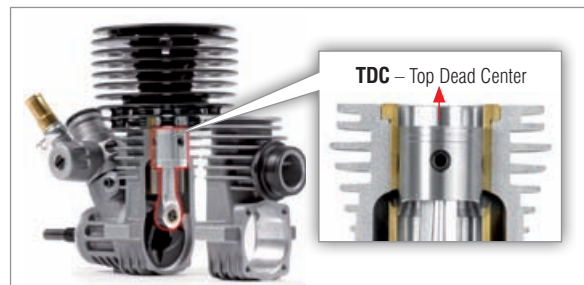
Life time	Run time
0~5 hours	6.5~8.5 min
5~10 hours	7.0~9.0 min
10~15 hours	8.0~10.0 min
15~30 hours	8.5~11.0 min

The smaller venturi you use, for example 6.0 or 6.5mm the lower fuel consumption will be. This means longer run times can be achieved, but it will be more difficult to set the carburetor.

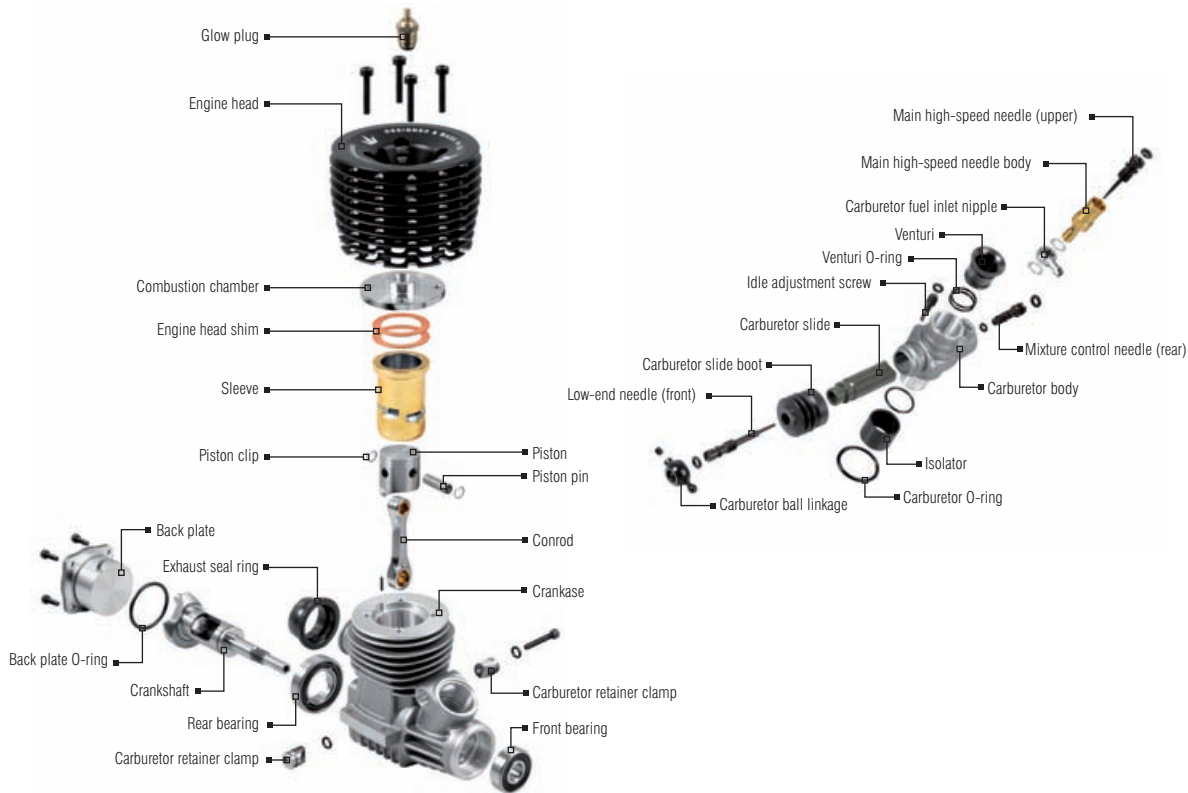
Top dead center

When the engine is cold, and especially when it is new before proper break-in, the piston will feel very tight at the top of the stroke at the top of the cylinder. This is when the piston is at a point called **TDC** – Top Dead Center. **This is normal!**

The cylinder has a slight taper to the cylinder bore; the parts are designed to achieve a perfect running clearance when the piston and cylinder reach the proper operating temperature.

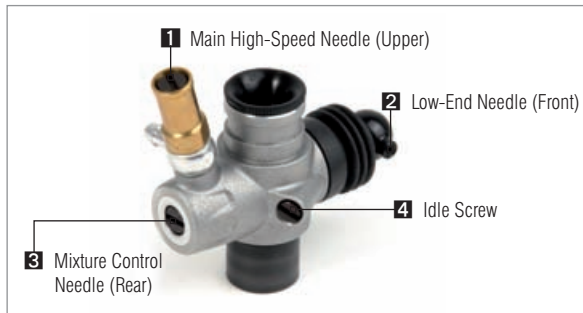


Engine Parts



Carburetor

There are four adjustable controls on the carburetor. There are 3 needles and 1 screw.



Factory Basic Carburetor Setting

The carburetor is preset at the factory and the engine should be started with these controls set as-is. Anytime you get lost we strongly suggest returning back to the factory basic setting. The factory basic carburetor setting may be different for the different types and versions of engine. For the particular basic carburetor settings please refer to the Parts List included with your engine.

Carburetor Setting After Break-in

Every type of the engine may have a different basic set-up of the carburetor after break-in. For the suggested basic set-up of your particular engine please check the Parts List included with your engine.

1 Main High-Speed Needle (Upper) Adjustment

The Main High-Speed Needle (Upper) controls the overall fuel flow to the carburetor.

When the Main High-Speed Needle is properly adjusted, the engine immediately responds to the throttle operation with clean, hard acceleration without hesitation.

The main purpose of the Main High-Speed Needle adjustment:

- Controls the overall fuel flow to the carburetor.
- Controls the maximum RPM together with power of engine when carburetor is fully open.



2 Low-End Needle (Front) Adjustment

The Low-End Needle (Front) controls the amount of fuel at idle and low-to-middle RPM. The most difficult setting is the proper low-speed adjustment.

Follow these principles:

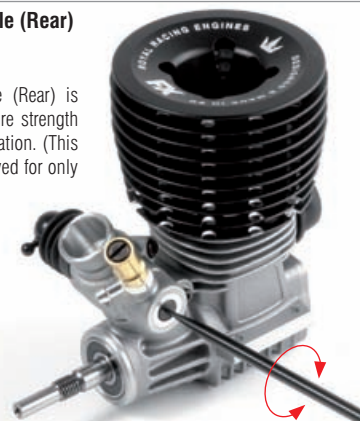
- Use the Idle Adjustment Screw to adjust the idle RPM immediately after closing the carburetor.
- Use the Low-End Needle to adjust the fuel mixture 2-5 seconds after closing the carburetor. It is recommended to make fine adjustments in 1/12 turn increments.

The Low-End Needle adjusts the performance of the engine between idle up to approximately 1/4 throttle which means middle RPM. The Low-End Needle of each individual engine is precisely adjusted at the factory.



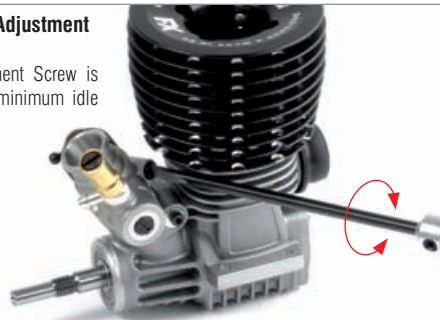
3 Mixture Control Needle (Rear) Adjustment

The Mixture Control Needle (Rear) is used for changing the mixture strength at middle speed and acceleration. (This adjustment is typically reserved for only experienced engine tuners.)



4 Idle Screw Adjustment

The Idle Adjustment Screw is used for setting minimum idle RPM.



Muffler

The muffler is sometimes also called the pipe, silencer or exhaust system. For maximum performance and reliability we recommend using only the original FX muffler. All FX mufflers are specially designed and tuned to work with FX engines. All FX mufflers are EFRA approved and as such have the EFRA number engraved. Please refer to exploded Parts List of your engine where you will find the suggested part number of the muffler to use for your particular FX engine. In case this engine was supplied as a combo with a muffler use only this muffler unless suggested by FX otherwise. FX continues the development and improvement of all the products and therefore it may happen that a new version of muffler with improved performance or reliability characteristics will be available later on as an optional part or for some particular track conditions some specific muffler should be used. All this information you will find at the FX web site www.FX-engines.com



Manifold

For maximum performance and reliability use only the original FX manifold. There are different types of the FX manifolds each designed for the particular track conditions and for the particular engine. Please refer to the exploded Parts List of your engine for the list of suggested manifolds. If your engine was supplied as a combo use the manifold supplied. Typically there are three different lengths of a manifold:

Length	Suggested
S = Short	Suggested to be used for tracks with long main straights and to achieve the highest RPM but lower performance from bottom.
M = Medium	Suggested to be used for medium or standard tracks.
L = Long	Suggested to be used for short tracks where the performance from bottom is required but the RPM will be lower.



Venturi

The venturi, sometimes called a carburetor reducer or restrictor is an insert in the carburetor which controls the amount of air that will go into the carburetor.

The smaller diameter of the venturi used, the higher run time you will achieve however the carburetor will be more difficult to tune.

The larger diameter of venturi used, the larger the amount of air flow into the engine for cooling.

The colder the air temperature, the smaller diameter of the venturi must be used.

The hotter the air temperature, the larger diameter of the venturi must be used.

Check for the Parts List included with this engine to determine which size of venturi comes with this engine and use it for break-in procedure and as a standard basic set-up. Anytime you get lost with the setting just return back to this basic venturi size setting.

#658900 Composite Carburetor Venturi (Set)

The set includes venturi of size (mm): 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5



Engine Head Shims

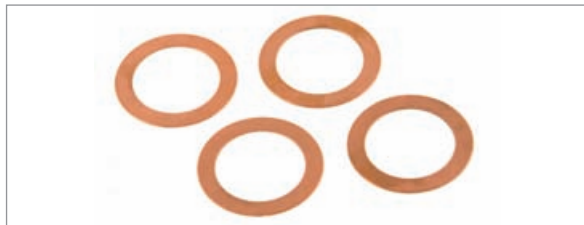
The thickness of the engine head shim installed influences the volume of the combustion chamber and compression which influences the quality of fuel combustion, performance and fuel consumption.

Check for the Parts List included with this engine to find out which size of engine head shim is installed and which size of engine shim is included in the packaging for further tuning. Anytime you get lost with the setting just return back to the basic engine head shim setting.

#655922 Heatsink Head Shim 16.4x22.8x0.2 (4)

#655923 Heatsink Head Shim 16.4x22.8x0.3 (4)

Shim thickness	When to use
0.3mm shim	Use after the engine is run-in to increase power while improving fuel consumption. Use in altitudes higher than 300 meters.
0.4mm shim (2x0.2mm)	Use for standard track conditions and for run-in.



Glow Plug

With a glow plug engine, ignition is initiated by the application of a 1.5-volt power source to pre-heat the glow-plug filament. When the battery is disconnected, the heat retained within the combustion chamber remains sufficient to keep the plug filament glowing, thereby continuing to keep the engine running. Ignition timing is automatic which means under reduced load, allowing higher RPM, the plug becomes hotter and, appropriately, fires the fuel/air charge earlier; conversely, at reduced RPM, the plug become cooler and ignition is delayed.



Your engine comes with a preinstalled glow plug and for break-in procedure and for initial run use only this glow plug. The type and quality of glow plug used has significant influence on performance and reliability of your engine. The FX glow plugs are some of the highest quality glow plugs and are strongly recommended for FX engines. Using any other glow plugs may have negative influence on performance and reliability of your engine.

There are different types of glow plugs to be used for particular track conditions:

Recommended glow plugs for off-road:

X3	Recommended for break-in procedure. Recommended to use when racing in lower temperatures. Recommended for shorter tracks.
X4	Recommended for higher temperatures. Recommended for longer tracks. Recommended for final runs.

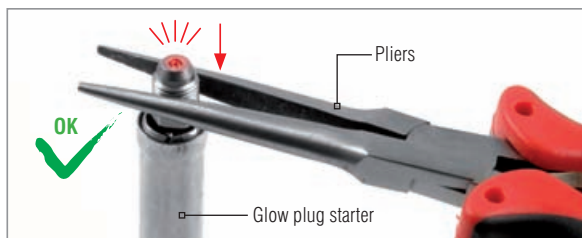
Recommended glow plugs for on-road:

X6	Recommended for break-in procedure. Recommended to use when racing in lower temperatures. Recommended for shorter tracks.
X7	Recommended for higher temperatures. Recommended for longer tracks. Recommended for final runs.
X8	Recommended for very high temperatures. Recommended for very long tracks. Recommended for long finals.

How to check the glow plug

To check if the glow plug is still working, remove it from engine and insert into the glow plug igniter to check that it glows bright red when energized. If the element does not glow or is dull replace it with a new plug. The glow plug filament coil (wire) must be shiny. It cannot be rough or deteriorated.

WARNING: Using a glow plug which has rough (deteriorated) coil (wire) may result into breaking the wire which could get into the engine and cause significant damage.



The wire is shiny and without any roughness.



The wire has rough and deteriorated surface.

Glow plug life

Particularly in the case of very high performance engines, glow plugs are considered as a consumable part. The glow plug must be regularly replaced. You can extend the life time of the glow plug and engine performance by careful use:

- Install and use only original FX glow plugs.
- Use fuel containing a moderate percentage of nitro methane unless more is essential for racing events.
- Do not run the engine too lean and do not leave the battery connected while adjusting the needle.

When to replace glow plug

Apart from when actually burned out, a plug may need to be replaced because it no longer delivers its best performance, such as when:

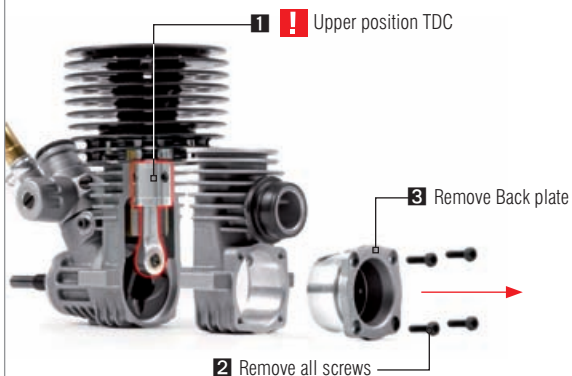
- Filament surface has roughened.
- Filament coil has become distorted.
- Foreign matter has adhered to filament; it will no longer have shiny appearance.
- When plug body has corroded.
- Engine tends to cut out when idling.
- Starting quality deteriorates.
- When you have properly set carburetor while adding throttle the car accelerates but then the engine suddenly stops.

Back Plate

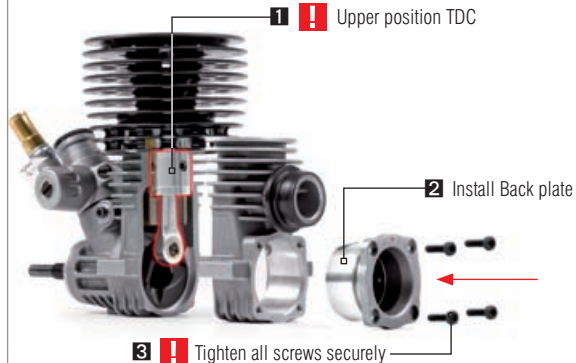
Anytime before you open or close the rear cover you need to turn the flywheel assembly (clutch) on the crankshaft so you feel that the piston is in the upper part of the sleeve, which means the piston is in upper position TDC (Top Dead Center). Failure to do so and opening or installing the engine rear cover may damage the piston.

After installation of the rear cover tighten the screws securely. When the screws are not tightened securely, the pressure inside the engine can push against the backplate, causing it to move, resulting in potential damage to the internal engine components.

Uninstall Back plate



Install Back plate



Fuel

For break-in and general running, use high-quality market-available model car fuel with a 16-30% nitro methane by volume ratio. Always use a high-quality model engine fuel that is compatible with the engine, and is acceptable for the intended use of the model car. This is important for the engine's proper operation, high performance, and long lifespan. Generally it is recommended to use a commercially-available fuel intended for model car 2-stroke engines; these fuels contain the appropriate lubricants and additives for the intended use.

When fuel brand and/or nitro content changes, it is recommended to adjust the engine carburetor settings and/or glow plug heat range as appropriate, as well. Note that with high-nitro percentage fuels, power may increase but glow plug elements typically do not last as long and engine life will be reduced.

Low quality or incorrectly stored fuel will have a significantly negative influence on the engine performance and life time. The typical symptoms of a poor quality fuel are:

- Yellow-brown thick coating on piston and sleeve causing stiff or sluggish movement of the piston. A very thin coating is not a problem.
- Black smoke residue on the bottom of the piston in combustion area.
- The sleeve may stick in the engine and cannot be removed.

Air Filter

Do not operate and run engine without an air filter and always have the air filter clean! The air filter protects the engine from the intake of dust and other contaminants. Dust which enters the engine will work like sandpaper and will destroy all the internal parts of the engine. A properly maintained air filter is essential to the life

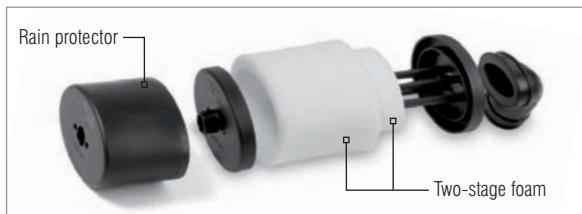
and performance of the engine. The air filter should be a two-stage foam filter and should always be clean and well lubricated with proper air filter oil. The frequency of cleaning, oiling and changing the air filter depends on track conditions.

If the track is not dusty it is recommended to clean and re-oil the air filter every 1 hour of runtime, even if the air filter looks clean, to maintain proper engine performance and avoid engine damage.

If the track is dusty it is recommended to clean and re-oil the air filter after every run.

The most effective method is to change the air filter for a new one instead of cleaning the air filter. Cleaning the air filter will decrease the efficiency of the air filter because it will "open" the pores of the filter element and dust may be able to go through the air filter. A new air filter which is properly oiled is the most effective protection.

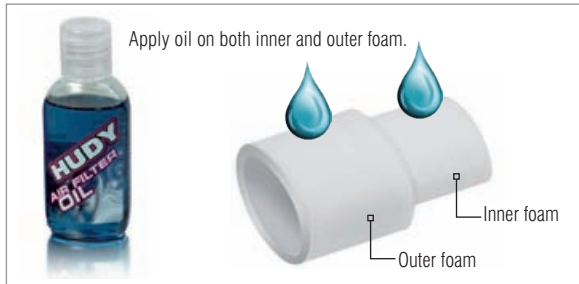
In a situation when it is not possible to change the used air filter for a new one it is suggested to clean all the air filter parts, wash the foam parts in hot soapy water and rinse thoroughly with clean water. Dry the parts with a clean towel or compressed air – remember to use safety eyewear. Oil the foam filter element with proper air filter oil.



Air Filter Oil

Proper air filter oil selection is extremely important. It is suggested to use air filter oil from professional RC companies such as the HUDY:

#106240 HUDY Air Filter Oil



Fuel Filter

A fuel filter should be installed in the fuel line between the fuel tank and carburetor to prevent dust from entering the carburetor.

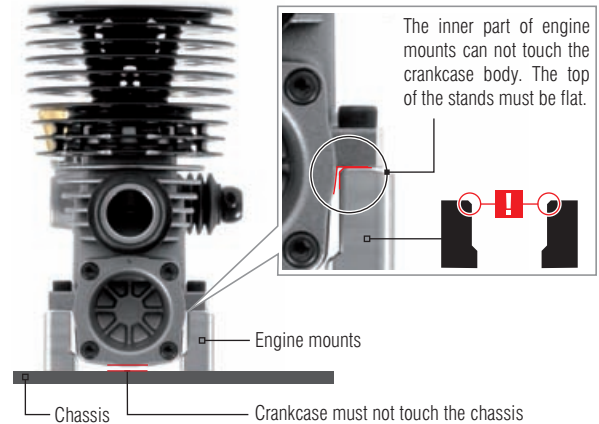


Engine Mounts

The engine mounts and mounting screws are not included with engine and are usually part of the RC car kit. Make sure that the engine mount surfaces are level and in the same plane. Poor installation may cause distortion of the crankcase, bearings and other parts resulting in erratic running and loss of performance.

The recommended screws for securing the engine are M3x10 steel socket head cap screws (SHCS).

If existing holes in the engine mount do not align perfectly with engine mounting brackets, enlarge them slightly with a needle-file so that screws are in alignment with the mounting holes.



Installation

Your new FX engine must be properly run-in using controlled conditions to ensure all parts become properly fit to each other and achieve the proper operating tolerances.

By the end of the run-in procedure, the engine should be running as close to its actual intended running conditions as possible (with respect to fuel, RPM, temperature, etc.).

Pre-installation Procedure

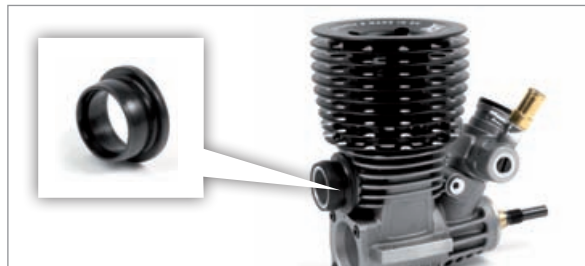
Glow plug

Your engine comes with the glow plug installed. However during the transportation the glow plug could get loose and it is suggested, before starting for the first time, to use a socket tool, slightly untighten the glow plug and then again tighten firmly. Do not overtighten. Anytime you install a glow plug please be careful not to cross-thread.



Exhaust ring

The exhaust ring is already installed on your engine.



Carburetor installation

Carburetor is pre-installed on your engine and is all preset in default position. In cases when it is needed to adjust the carburetor position:

- 1 Loosen the retainer screw by 2 turns.



Installation

- 2** Push on the retainer screw which will release the internal clamp.



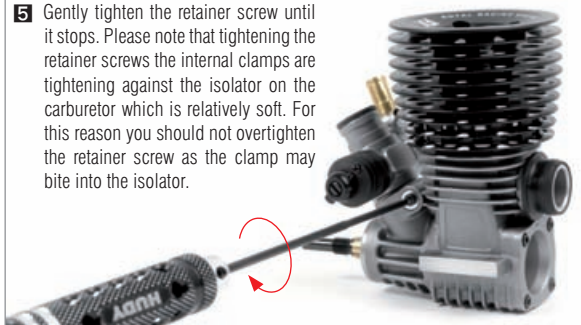
- 3** Rotate the carburetor to its correct position.



- 4** Press the carburetor down into the intake



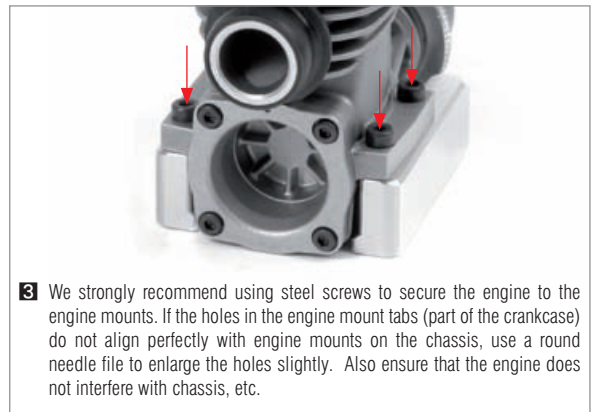
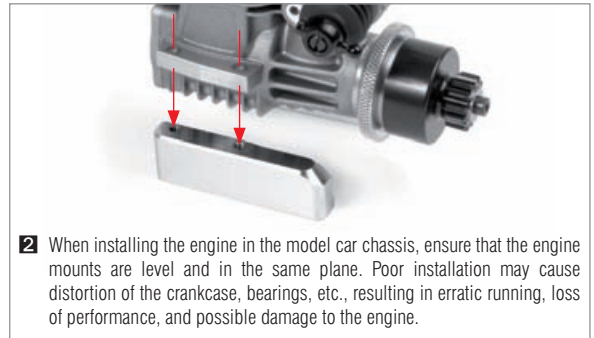
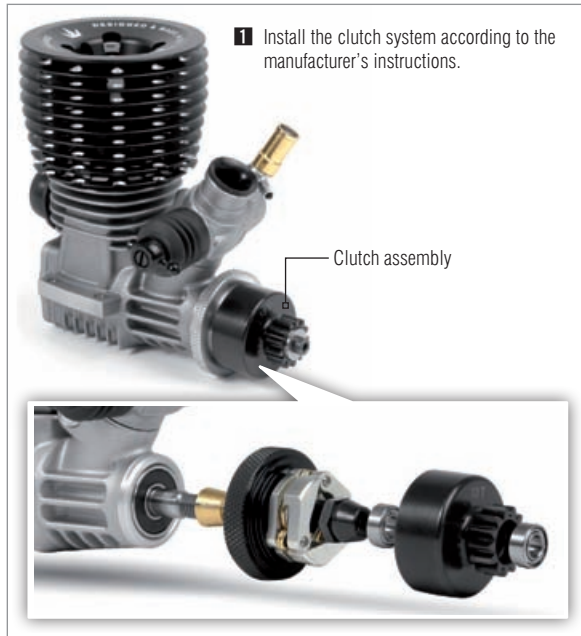
- 5** Gently tighten the retainer screw until it stops. Please note that tightening the retainer screws the internal clamps are tightening against the isolator on the carburetor which is relatively soft. For this reason you should not overtighten the retainer screw as the clamp may bite into the isolator.



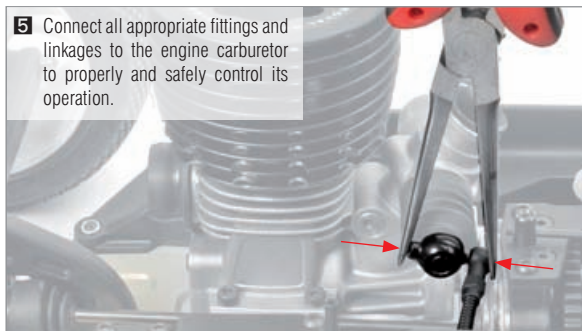
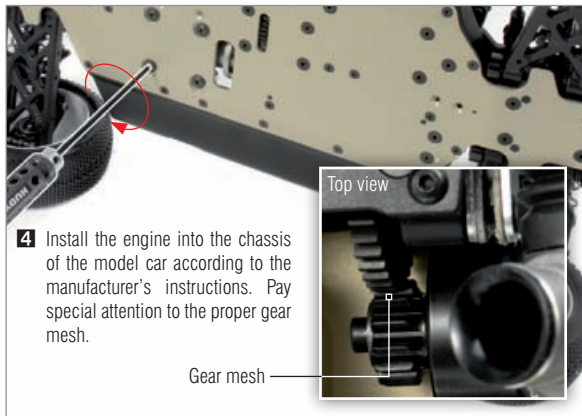
WARNING: You should not completely remove the retaining screw from the engine at any time.

Installation

If you have already run-in the engine on a break-in bench or you will break-in the engine in the car, proceed with the installation of your engine as follows:

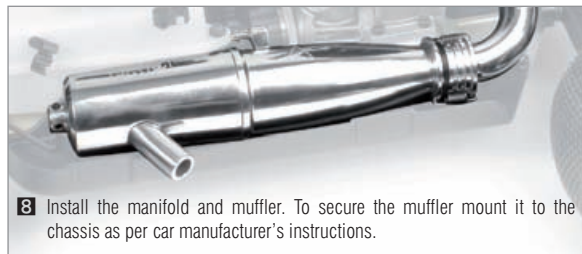


Installation

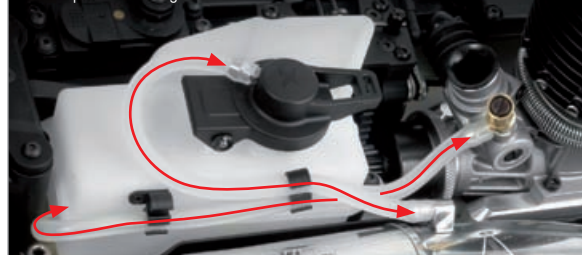


6 Use your radio transmitter to properly set the throttle servo end-points to suitably control the carburetor.

7 Check that the carburetor opens and closes smoothly without binding. If there is any restriction of movement, adjust the throttle linkage or the position of the carburetor on the engine.



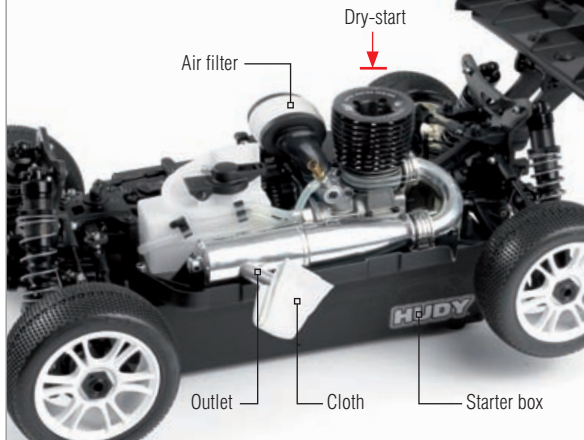
9 Connect a fuel line from the model car fuel tank to the fuel inlet of the engine carburetor. Connect a fuel line from the muffler pressure fitting to the pressure fitting of the model car fuel tank.



Starting the Engine

- 1 Fill up the fuel tank.
- 2 Turn on the radio transmitter and model car receiver.
- 3 Ensure the starter box wheel rotates in the proper direction to start the engine.

- 4 Place the car on the starter box and fill the fuel tank, cover the outlet of the muffler with a cloth and "dry-start" the engine for 2-3 seconds without applying the glow plug starter, and with the carburetor in "idle" position; this primes the fuel lines and allows the fuel to reach the engine.



- 5 Apply the glow plug starter in preparation to start the engine.
- 6 Open the carburetor slightly.

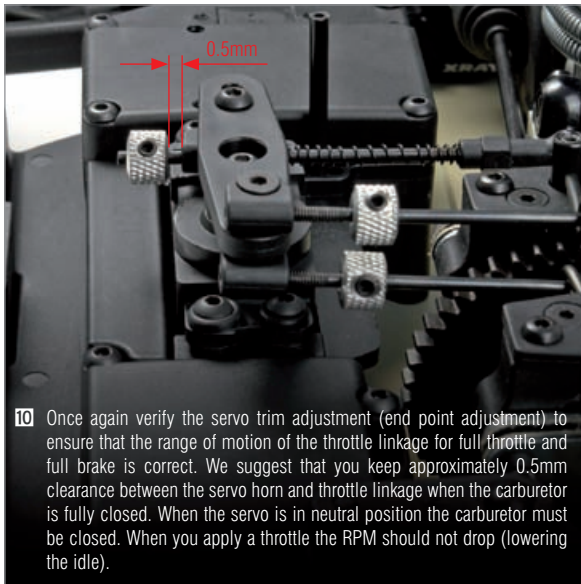
- 7 Start the starter box wheel, and press the engine flywheel against it so it rotates. The engine should fire up immediately.



If the engine does not fire up immediately, check the fuel line to see if fuel is reaching the carburetor. If fuel is not reaching the carburetor, remove the glow plug igniter, cover the exhaust outlet and "dry-start" the engine for 2 seconds. This will build up extra pressure in the pipe and in the pressure line to the fuel tank, causing the fuel to be pushed to the carburetor. Apply the glow plug starter, and start the engine.

Installation

- After the engine starts, remove the glow plug igniter, and stop pressing the model car onto the rotating starter box wheel.
- Once the engine has started, apply a little throttle and allow the engine to warm up to operating temperature. This is an important routine that you should always follow. The internal parts need to receive lubrication and reach operating temperature before the engine can have a load applied to it.



- Once again verify the servo trim adjustment (end point adjustment) to ensure that the range of motion of the throttle linkage for full throttle and full brake is correct. We suggest that you keep approximately 0.5mm clearance between the servo horn and throttle linkage when the carburetor is fully closed. When the servo is in neutral position the carburetor must be closed. When you apply a throttle the RPM should not drop (lowering the idle).

Stopping the Engine

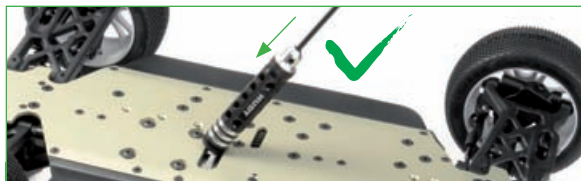
NEVER stop the engine with your hands! Severe injury may result.



WARNING: To stop the engine DO NOT cover the exhaust outlet. Oil & fuel accumulate inside the engine and make it difficult to start again.



WARNING: To stop the engine DO NOT pinch the fuel tubing from the fuel tank to force the engine to run out of fuel. The RPM of the engine will increase while the engine is lean which may result in failure of the glow plug.

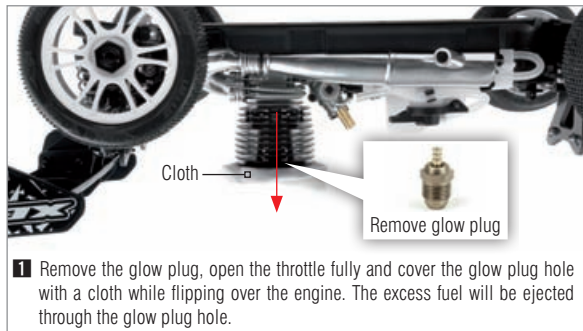


To stop the engine it is suggested to use a plastic or soft stick to stop the engine flywheel.

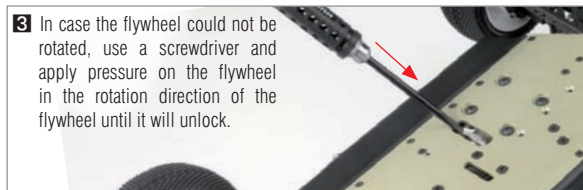
Break-in Procedure

Flooding & Hydraulic Lockup

Excess fuel in the cylinder may cause the engine to stall (by extinguishing the glow plug), or it may cause a hydraulic lockup (when excess fuel fills the cylinder above the piston, preventing the piston from moving upward). If this happens, DO NOT try to start the engine, or severe engine damage may result.



- 2** Check the operation of glow plug with the glow plug starter (see page 19) before screwing the glow plug back in again. Restart the engine.



A nitro-powered engine requires careful break-in the first time the engine is used to allow the internal parts to achieve proper operating clearances. This is especially true of the piston/cylinder, crankshaft, and conrod. Pay close attention during the initial break-in period; this process is very important to achieve the best engine performance, reliability, and lifespan.

There are two different methods to break-in the engine properly:

A. Break-in using a break-in bench

This is the most professional and highest-quality break-in procedure and is suggested to use, if possible. If you break-in the engine with the break-in bench, follow the instructions on page 30.

B. Break-in in a car

This is an alternative procedure which will allow the engine to be run-in in conditions when a break-in bench cannot be used. This procedure is not as controlled as using the break-in bench. If you break-in the engine in the car follow the instructions on page 36.

Before you proceed with break-in procedure ensure that your engine has:

- Venturi in your carburetor as per factory setting.
- Glow plug installed as per factory setting.
- Engine head shim installed as per factory setting.

IMPORTANT: During the break-in procedure, the engine should be run only **SLIGHTLY rich**; overly-rich mixtures and cold temperature during break-in will lead to premature wear and failure of the piston & sleeve and other engine components.

■ Break-in Procedure with Break-in Bench



Safety Information – Starting the Engine

Running an engine with a propeller represents great hazards. Always follow these safety precautions:

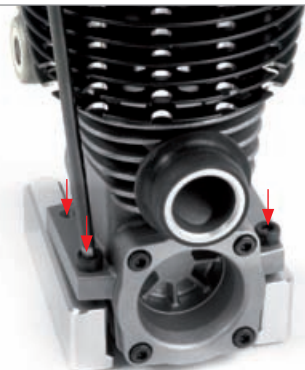
- Wear safety glasses, ear protectors, gloves & protective shields.
- Don't wear a tie, loose sleeves or other loose textile while using the bench. In case of long hair, wear your hair under a hat.
- Before starting the engine, always check the mounting of the bench to the platform.
- ONLY use the bench outside or in a well-ventilated room.
- When running the engine indoors, make sure the exhaust gases are directed to outdoors. Stay away from exhaust gases at all times.

- Start the engine only using the spinner driver and an electric starting device.
- Keep clear of the safety guard. NEVER stick your fingers or anything else through the safety guard.
- Only make engine adjustments when the engine is not running.
- Stop the engine by covering the muffler outlet with a cloth.
- Avoid touching the cylinder head or the exhaust pipe as this may cause serious burns.

Setting the Engine Mounts

1 Remove the engine mounts from the base plate.

2 Attach the engine mounts to the engine using 4x M3x12 screws.

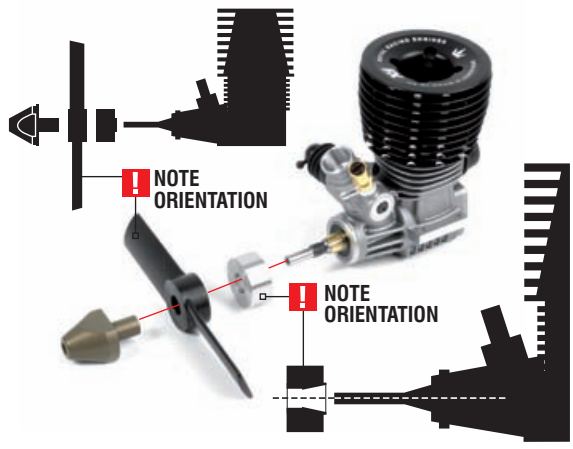


Attach the Propeller

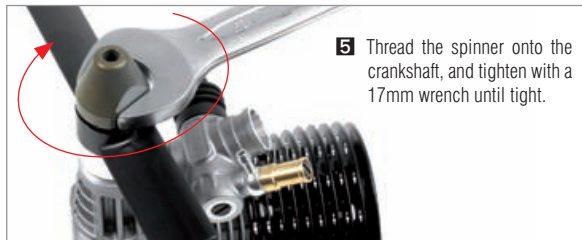
1 Use a crankshaft or piston locking tool to prevent the crankshaft from rotating. This may require the removal of the crankcase rear plate or glowplug, respectively.

2 Slide the tapered flywheel cone onto the crankshaft.

3 Slide the propeller support plate onto the crankshaft. The small raised ridge on the support plate goes TOWARD the engine.



4 Slide the propeller onto the crankshaft. The smooth edge of the propeller goes AWAY from the engine.

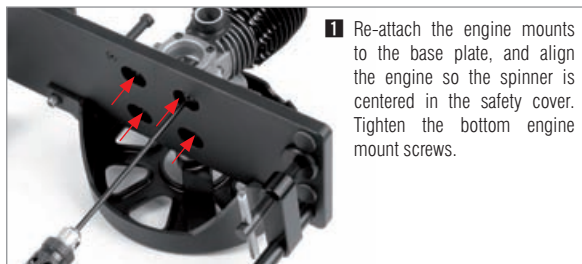


5 Thread the spinner onto the crankshaft, and tighten with a 17mm wrench until tight.

6 Remove the crankshaft or piston locking tool (if used), and install the crankcase rear cover.

7 Rotate the propeller to ensure it does not touch the carb. If it touches the carb, remove the propeller, add a shim behind the tapered cone, then re-install the propeller.

Mounting the Engine



1 Re-attach the engine mounts to the base plate, and align the engine so the spinner is centered in the safety cover. Tighten the bottom engine mount screws.

Break-in Procedure with Break-in Bench

- 2** Attach the throttle control ball-joint to the carburetor.

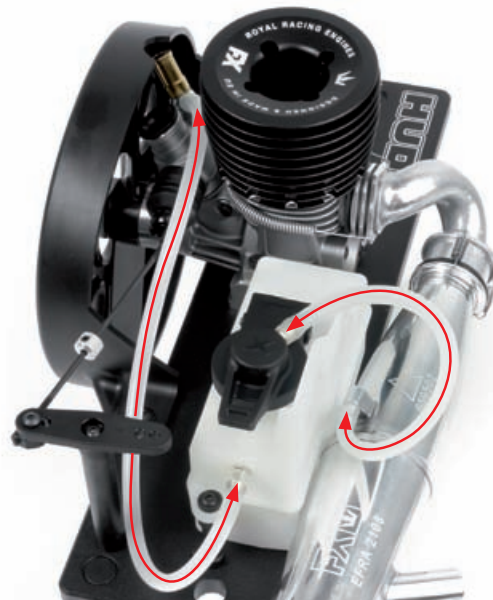


- 4** Use a length of silicone fuel tubing to connect the fuel tank to the carburetor inlet.

Use a length of silicone fuel tubing to connect the muffler pipe pressure fitting to the fuel tank cap pressure fitting.

- 3** Attach the muffler with manifold to the engine exhaust outlet; remember to use the proper gasket and springs.

For break-in procedure at break-in bench you need a manifold which allows the muffler to be mounted from the rear of the engine.



Mounting the Bench



Place the bench on a solid platform (such as a work table). Slide each clamp upward until the pad touches the underside of the table. Tighten each pad securely.

Engine Break-in Preparation

This section describes steps to take to prepare for engine break-in.

Fuel tubing free from cuts and leaks

Cuts in the fuel tubing will cause fuel leaks and make the engine run too lean.

Clear area around break-in bench

Since an air filter is not used during break-in on the bench, any swirling dirt that gets into the carb may cause internal engine damage.

All parts securely attached and tightened

There will be a lot of vibration when the engine is running. Loose parts may become undone and cause personal injury or damage to the engine. The engine should be tightly attached to the engine mounts, and the engine mounts tightly attached to the bench.

Carburetor cinch bolt is tight

Make sure the carburetor cinch bolt is tight. A loose carburetor may twist during engine operation, possibly coming into contact with the spinning propeller. This may cause personal injury or severe engine damage.

Throttle control mechanism is tight

Make sure the throttle control mechanism is not too loose; it should remain in its set position and not move freely.

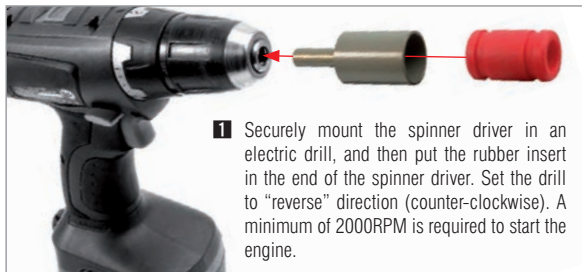
Pre-heat the engine

Before starting the engine for the first time, pre-heat the engine head with a hairdryer or heat gun. This expands the sleeve slightly, allows for easier starting, and prevents excessive wear that a cold engine is subject to.

If you use a heat gun, use the lower temperature setting; DO NOT use the higher temperature range as this may be too hot. Do not direct the hairdryer or heat gun at O-rings or other rubber or plastic parts.



Starting the Engine



5 If the engine does not fire up within 5 seconds try doing the following:

- A.** Check the fuel line to see if fuel is reaching the carburetor. If fuel is not reaching the carburetor, remove the glow plug starter, cover the muffler outlet and "dry-start" the engine for 2 seconds. This will build up extra pressure in the muffler and in the pressure line to the fuel tank, causing the fuel to be pushed to the carburetor. Apply the glow plug starter and try to start the engine again.
- B.** Unscrew the glow plug to check if the engine is getting any fuel. The glow plug should be slightly wet. If it is still dry, open the Main High-Speed Needle another 1/2 turn richer (CCW). Reinstall the glow plug and try to start the engine again.
- C.** The glow plug may also be too wet. Start the engine without the glow plug in place, for about 5 seconds with the throttle fully open. Fuel will escape through the glow plug hole in the cylinder head; place a towel over the cylinder head while doing this to avoid getting fuel over everything. Close the Main High-Speed Needle 1/4 turn leaner (CW). Reinstall the glow plug and try to start the engine again.



- 6 Once the engine has started, apply a bit of throttle and allow the engine to warm up to operating temperature (approximately 1 minute). This is an important routine that you should always follow. The internal parts need to receive lubrication and reach operating temperature.

Break-In Process

After installing the engine in the HUDY Engine Break-In Bench and performing the break-in preparation, then break-in the engine by performing the following steps:

- 1 Keep the carburetor factory settings; do not adjust.
- 2 Start the engine and allow it to reach operating temperature 100~130°C (212~266°F).
- 3 Run 1 fuel tank of fuel with engine at 25% throttle. The engine must be run very slightly rich. If not, adjust the Main High-Speed Needle and finish the remainder of the first fuel tank.
- 4 Run 3 fuel tanks of fuel with engine at 50% throttle. The engine still must be run slightly rich.
- 5 Run 3 fuel tanks of fuel with engine at 75% throttle. The engine should be running crisply now.

- 6 Run last 1 fuel tank of fuel and vary the throttle and check the crispness of the engine response.
- 7 After completing the run-in at break-in bench your engine is NOT yet ready for high-competition racing but you can already use the engine for standard practice at the track for another 14-15 fuel tanks (approx. 2 hours) with the following precautions:
 - Keep the engine setting more rich and permanently monitor the engine temperature which should be 100-120°C (212~248°F) depending on the air temperature.
 - You may start adjusting the carburetor needles to get the engine running cleaner. However, this must be done slowly and in stages.
 - After every fuel tank has been consumed turn the high-speed needle by 1/12 CW. Repeat this until the engine is running well, while ensuring that it is not too lean, and that it is operating within the appropriate temperature range.

VERY IMPORTANT: During break-in procedure never run the car at full throttle continuously.

Please remember that the top performance of the engine will be reached after approximately 10 hours of operation.

Temperature

Throughout the break-in process, regularly check the engine temperature to ensure it stays within the range of 90~120°C (194~248°F). The engine temperature and RPM should be steady and not vary significantly; any significant changes indicate that the carburetor settings require attention.

Break-in Procedure in the Car

In situations when it is not possible to break-in the engine with the break-in bench use this alternative break-in procedure. Install the engine in your car following the installation process on page 25 and follow the instructions below.

The break-in procedure in the car is made in 4 steps:

- 1.) Warm-up 2 tanks
- 2.) Static run-in 4 tanks
- 3.) Load run-in 4 tanks
- 4.) Track run-in 14 tanks

WARNING: It is extremely important to set the throttle to the correct position before starting the engine. If the engine is allowed to run with the throttle too far open under 'no load' conditions (i.e., with the driving wheels not in contact with the ground) it will rapidly overheat and may be seriously damaged.

Do not run the engine at high RPM without load which means that you should not pick the car off the ground and run the engine hard. The engine will overheat without the airflow over its cooling head, damaging the engine components.

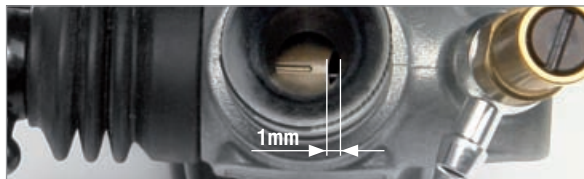
WARNING: During the break-in procedure, the engine should be run only SLIGHTLY rich; overly-rich mixtures and cold temperature during break-in will lead to premature wear and failure of the piston & sleeve and other engine components.

1.) Warm-up - 2 tanks

- 1 Start the engine for the run-in procedure as per the instructions in the section "Starting the Engine" on page 27. After the engine starts keep the car on the starter box with tires off the ground.
- 2 Warm up the engine by repeatedly increasing the RPM (adding throttle) to a medium speed and back again (brake) to a fast idle with the mixture set very rich. This rich setting will provide good lubrication and cooling, and will produce large amounts of smoke.
- 3 Keep the car on the starter box and run this warm-up procedure while using 2 tanks of fuel like this to clean out the engine.

2.) Static Run-in - 4 tanks

- 1 Keep the car on the starter box and adjust the Idle Adjustment Screw to close the throttle until the clutch just starts to be driven and the engine is running but not idling. The gap of the carburetor slide should be approximately 1mm as shown.



- 2 Keep the carburetor in default factory setting. In case the engine is still lean adjust the Main High-Speed Needle to richen as needed.

3 Keep the car on the starter box and run the engine this way for 4 tanks. Make sure that engine vibration is minimal and the muffler loudness is as low as possible, to prevent premature engine wear. In case the loudness is high making the setting more rich which will decrease the RPM at idle (turn Main High-Speed Needle CCW) or decrease the idle (turn the Idle Adjustment Screw CCW). Again these settings will produce large amounts of smoke. As such, run the engine in a wide open area.

4 Now the static run-in is finished and you can put the car on the ground.

3.) Load Run-in at the Track - 4 tanks

Run your car on the track at low-to-medium speeds for 4 tanks of fuel, continuously without excessively long breaks.

IMPORTANT: DO NOT accelerate quickly and DO NOT use full throttle at this stage. The Main High-Speed Needle should still be set rich. Monitor the engine temperature frequently, and try to main temperatures between 90–110°C (194–230°F) depending on the air temperature.

If the engine stops (dies out), restart the engine, keep the car on the starter box and hit the full throttle for a short time 2-3 seconds.

- A.** If the engine RPM increases and the engine runs continue in run-in procedure.
- B.** If the engine stops because it is too rich (too much smoke and fuel coming from the muffler), close the Main High-Speed Needle by 2/12 turns CW (clockwise - leaner) and try again.

4.) Track Run-in - 14 tanks - Driving at the Track with Richer Setting

After completing the load run-in your engine is NOT yet ready for high-competition racing but you can already use the engine for standard practice at the track for another 14-15 fuel tanks (approx. 2 hours) with the following precautions:

- Keep the engine setting more rich and permanently monitor the engine temperature which should be 100-120°C (212–248°F) depending on the air temperature.
- You may start adjusting the carburetor needles to get the engine running cleaner. However, this must be done slowly and in stages.
- After every fuel tank has been consumed turn the Main High-Speed Needle by 1/12 turn CW. Repeat this until the engine is running well, while ensuring that it is not too lean, and that it is operating within the appropriate temperature range.

VERY IMPORTANT: During this stage never run the car at full throttle continuously.

Carburetor Setting after Break-in

Every type of the engine may have a different basic set-up of the carburetor after break-in. For the suggested basic set-up of your particular engine please check the Parts List included with your engine.



Maintenance

Life time of your engine is directly related how you care for the engine after each run. Every time you finish operating the engine, we strongly recommend that you follow a regular maintenance routine to ensure that the engine receives the proper care it needs for long life and good performance without problems.

1.) Remove all fuel

Power the glow plug with the glow plug igniter and try to restart the engine. The goal is to burn off any fuel that may remain inside the engine. Do this while the engine is still warm.

Having fuel remain in the engine after use may promote oxidation (rust) which can ruin the internal components of the engine (including ball-bearings, crankshaft, and conrod).

If you find oxidized parts in your engine, immediately stop using your fuel and get fresh fuel. If you continue to have the same problem with fresh fuel, change the brand of fuel. Always use high-quality fuel.

2.) Check glow plug

If you experience any problems starting an already run-in engine first check the glow plug. After every run check the glow plug even if you did not experience any problems.

How to check the glow plug

To check if the glow plug is still working, remove it from engine and insert into glow plug starter to check that it glows bright red when energized. If the element does not glow or is burned out replace it for a new plug. The glow plug filament coil (wire) must be shiny; it cannot be rough or deteriorated.



When to replace the glow plug

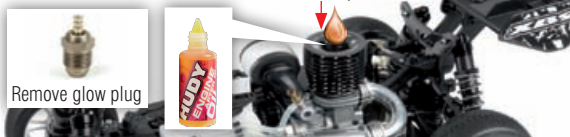
Apart from when actually burned out, a glow plug may need to be replaced because it no longer delivers its best performance, such as when:

- Filament surface has roughened.
- Filament coil has become distorted.
- Foreign matter has adhered to filament; it will no longer have shiny appearance.
- When plug body has corroded.
- Engine tends to cut out when idling.
- Starting quality deteriorates.
- When you have properly set carburetor while adding throttle the car accelerates but suddenly engine stops.

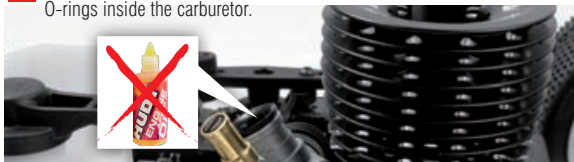
WARNING: Using a glow plug which has rough (deteriorated) coil (wire) this may result in wire breakage which will get into the engine and will destroy the engine.

3.) Use after-run oil

Remove the glow plug and add a few drops of high-quality after-run oil into the engine. The oil is best added when the engine is warm as it can reach the critical parts of the engine better.

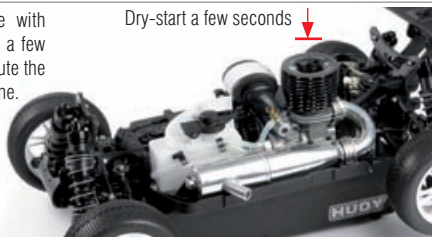


! DO NOT add after-run oil to the carburetor as this may cause damage to the O-rings inside the carburetor.



Rotate the engine with the starter box for a few seconds to distribute the oil inside the engine.

Dry-start a few seconds



4.) Remove exhaust system

After use, the exhaust system (muffler and manifold) should be dismantled from the engine and the exhaust of the engine crankcase covered with the included dust cap protectors.

Dust cap: $\varnothing 3$ / $\varnothing 6$ / $\varnothing 16$ / $\varnothing 18$



5.) Clean your engine from outside

Before cleaning the engine, make sure that all openings are covered with dust cap protectors.

✗ DO NOT use light oil, kerosene, gasoline or other petroleum-based cleaning chemicals to wash or clean the engine, as this will damage some of the silicone parts (such as in the crankshaft, O-rings and the fuel tubing).

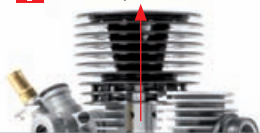
✓ Do use methyl alcohol (methanol, methyl hydrate), fuel or motor cleaner for washing. Remove exterior dirt with a small brush.

6.) Maintenance after running in water

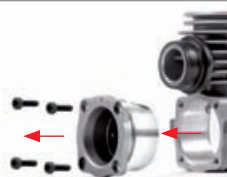
If you run your car in rainy/wet conditions you must also clean the engine from inside.

Clean the outside of the engine thoroughly before you open it. Work on a clean spot. Use proper tools. Any dust or dirt that enters the engine may destroy the engine.

! TDC – Top Dead Center



Anytime before you open the rear cover you need to turn the flywheel assembly (clutch) on the crankshaft so you feel that the piston is in the upper part of the sleeve, which means that the conrod is in the upper position. Failing to do so and opening the engine rear cover may damage your conrod.



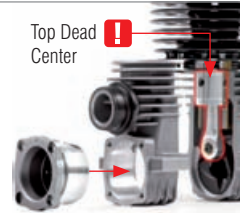
Use the same cleaner as for cleaning the outside of the engine. Motor cleaner is pressurized and is best suited for this purpose. After the motor cleaner is applied use a compressed air and blow all the motor spray liquid with the dirt out of the engine. Make sure that there is absolutely no dirt inside the engine. Any dirt may destroy the engine immediately.



Use after-run oil to lubricate all the internal parts of the engine. Apply the oil from the rear back plate area and from the exhaust opening.



Anytime before you close the rear cover you need to turn the flywheel assembly (clutch) on the crankshaft so you feel that the piston is in the upper part of the sleeve, which means conrod is in upper position. Failing to do so while closing the engine rear cover may damage your conrod.



Tighten the backplate screws securely. When the screws are not tightened securely the pressure inside the engine can push against the backplate, causing it to move, resulting in potential damage to the internal engine components.



7.) Air filter service

- Do not operate and run engine without an air filter and always have the air filter clean! The air filter protects the engine from the intake of dust and other contaminants. Dust which enters the engine will work like sand paper and will destroy all the internal parts of the engine. A properly maintained air filter is essential to the life and performance of the engine. The air filter should be two stage foam filter and should always be clean and well lubricated with proper air filter oil. The frequency of cleaning, oiling and changing the air filter depends on track conditions.
- If the track is not dusty it is recommended to clean and re-oil the air filter every 1 hour of runtime, even if the air filter looks clean, to maintain proper engine performance and avoid engine damage.
- If the track is dusty it is recommended to clean and re-oil the air filter after every run.
- The most effective method is to change the air filter for a new one instead of cleaning the air filter. Cleaning the air filter will decrease the efficiency of the air filter because it will “open” the pores of the filter element and dust may be able to go through the air filter. A new air filter which is properly oiled is the most effective protection.
- In a situation when it is not possible to change the used air filter for a new one it is suggested to clean all the air filter parts, wash the foam parts in hot soapy water and rinse thoroughly with clean water. Dry the parts with a clean towel or compressed air – remember to use safety eyewear. Oil the foam filter element with proper air filter oil.
- Cleaning and re-using air filters may decrease their effectiveness, resulting in reduced performance and engine service life. We therefore recommend, whenever possible, using a new air filter.

- When you store your engine, remove the air filter and use the included dust cap to seal the carburetor intake to ensure that no dirt will get into the carburetor and use the dust cap on the carburetor needle to protect it.

8.) Dust cap protectors

Your engine comes equipped with dust cap protectors. Anytime you dismount a part from the engine cover all the openings with the dust caps immediately to prevent dust from getting into the engine.

This applies to:

- Carburetor
- Fuel line intake
- Exhaust
- Crankshaft



IMPORTANT: Always keep the glow plug installed in your engine.

9.) Store your engine

After you have cleaned your engine, lubricated it and covered all holes with dust caps wrap your engine in a soft cloth and store it in a dry place sealed in a plastic bag. It is extremely important that the engine is stored in a dry area. Any increased humidity may damage the internal parts of the engine.

■ Replacing Parts

To extend the performance and life time of your engine automatically replace the following parts after the specified time:

Change	When
Air filter	After 1 hour of driving (1 liter of fuel) in non-dusty conditions. In dusty conditions, replace after every run.
Front bearing	If the rotation of the bearing is not smooth and you feel the operation is "gritty". When dust and corrosion get into engine.
Rear bearing	Steel bearing after 10 hours. Steel & ceramic bearing if dust & corrosion get into engine.
Conrod	After 15 hours or if damaged.
Sleeve & piston	Only when sleeve is damaged (i.e., if dust or contaminants cause scoring of the piston/sleeve).

It is normal that performance of the engine may decrease as parts wear. To extend the lifetime of your engine it is recommended to replace necessary parts when the following symptoms are detected:

- Engine sound changes and easily overheats.
- Power levels drastically reduced.
- Idling is unstable and/or engine tends to stop at idling.
- In most cases, ball-bearings, sleeve and piston assembly, connecting rod or crankcase have become worn out. Check the parts carefully and replace them if necessary.

If an engine component has broken, you must check that all other moving parts are still in good shape. If you only change one part and other parts are not in good shape, it is highly likely that your engine will suffer another failure shortly thereafter.

If you replace the conrod, be sure that crankshaft pin is still round and at a good size. If it is not, replace the crankshaft. If you do not replace the crankshaft and re-use the engine, a failure may occur such as conrod breakage.

If the crankshaft pin is not round or is not shiny, the following may occur:

- Bushing on conrod will wear very fast.
- The conrod may rub on the rear backplate, where it will remove very small pieces of aluminum from the backplate which will get into fuel mixture and will destroy piston and sleeve.

The crankshaft pin will wear in situations when:

- Engine is run lean for a long time which provides inadequate lubrication for the engine.
- Using low-quality fuel which does not have sufficient amount of lubricant.

■ Bearing Change

To change the ball-bearings we recommend using special tool and equipment designed for RC car engines, such as the ball-bearing puller and presser from HUDY.

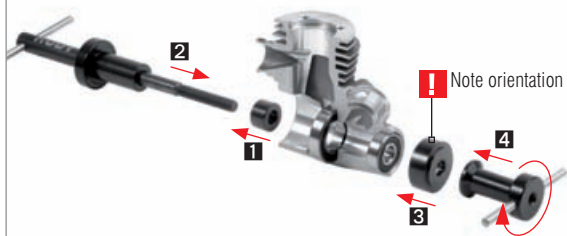
Removing the Front Bearing

Assemble the main tool body by sliding the presser adapter and collar bushing onto the presser body shaft. Make sure to use the correct collar bushing; the collar bushing should pass through the rear bushing and rest against the inner edge of the front bearing. Secure the presser adapter onto the presser body by tightening the setscrew.

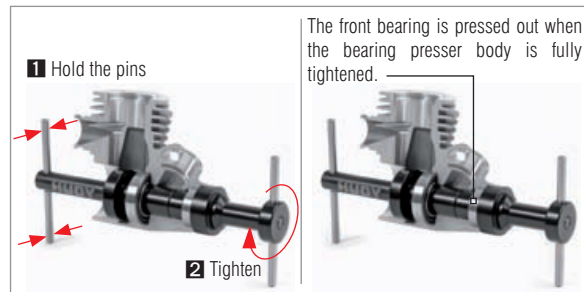
Slide the main tool body through the engine bearings from the rear as shown.

Slide the support bushing onto the front of the tool, noting the proper orientation with the cavity facing the engine housing.

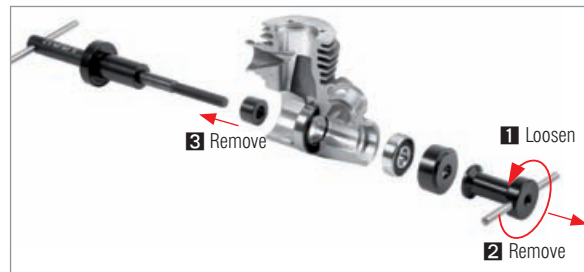
Finally, screw the clamping nut onto the threaded end of the presser body.



By tightening the clamping nut, the front bearing will be pressed out of the engine case and into the cavity of the support bushing. Sure to hold the bearing presser body while tightening the clamping nut. When the clamping nut can not be tightened anymore, the front bearing has been pressed out from the engine.

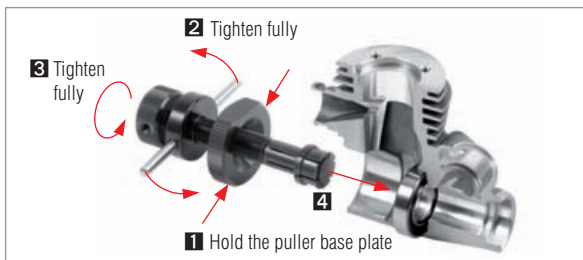


Unscrew the clamping nut from the bearing presser body and remove tool pieces from the engine. Remove the front bearing from the support bushing.

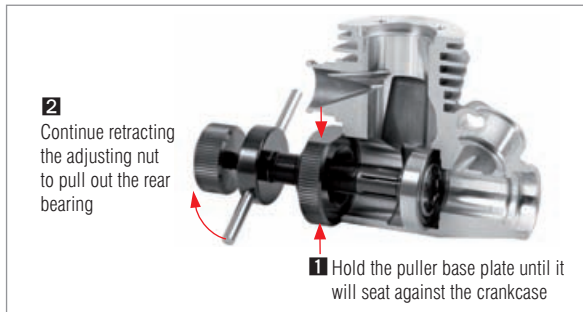
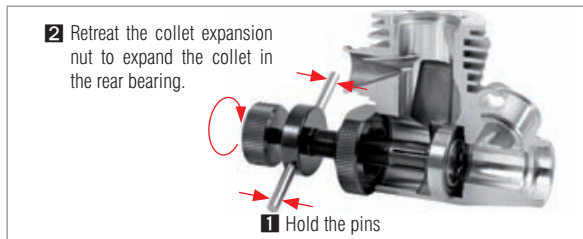


Removing the Rear Bearing

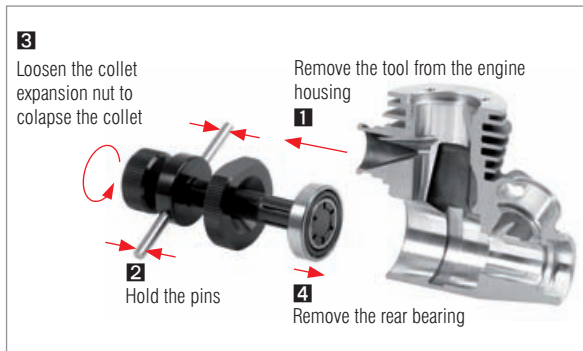
Assemble the rear bearing removal tool according to the exploded view. Note that you must tighten the setscrew onto the flat spot of the puller shaft. Be sure to use the correct collet to match the rear bearing in your engine. After you have assembled the tool, insert it into the engine as shown.



Retract the collet expansion nut to capture the rear bearing, and then tighten the adjusting nut to pull the rear bearing out of the engine housing.

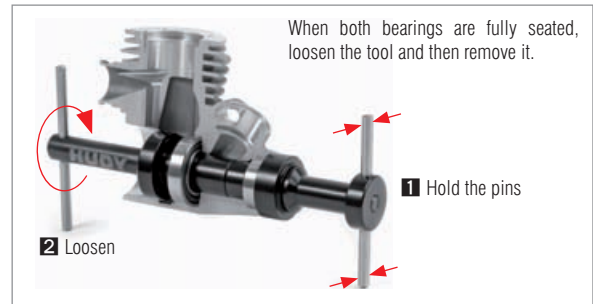
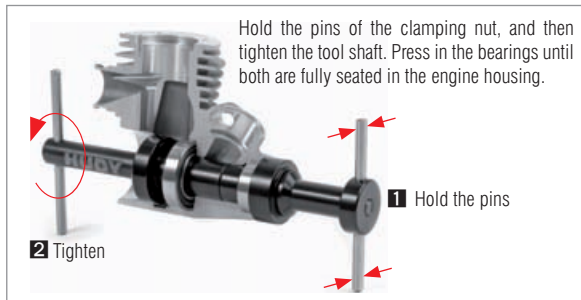
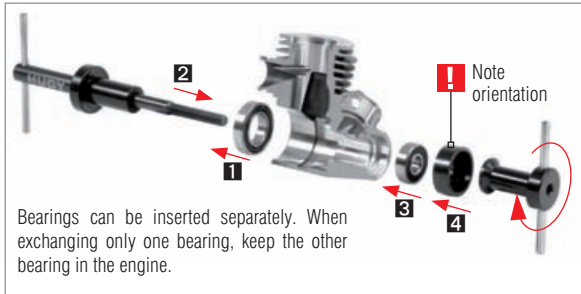


Pull out the tool; the rear bearing stays on the expanded collet and is removed when you remove the tool.



Installing Front & Rear Bearings

Use the front bearing tool to install both front and rear bearings. Note the orientation of the support bushing. When installing the bearings you **MUST** turn around the support bushing so the cavity is facing **AWAY** from the engine.



Troubleshooting

SYMPTOM	Engine spins but will not start.
CORRECTIVE ACTION	
Make sure your glow plug starter is fully charged and is properly connected to the glow plug. If the starter is fully charged, replace the glow plug.	
Verify that fuel is getting to the carburetor. Remove the fuel line from the carburetor and see if there is fuel in it.	
Check your carburetor settings. It may be necessary to adjust the carb settings if the weather has significantly changed since the last time you ran the engine.	
The engine's compression may be low due to wear. This will make the engine difficult to start when it is warm, and may tend to stall when running and when the throttle is closed suddenly.	

SYMPTOM	Engine will not spin (starter box will not turn the engine).
CORRECTIVE ACTION	
The engine may be flooded and hydraulically locked. Refer to section "Flooding & Hydraulic Lockup".	
Check for binding at the engine flywheel. If you are not able to turn the engine by hand, the engine could be flooded, there could be binding in the clutch system, the piston may be stuck at the top of the cylinder (TDC), or there could be internal engine damage. (Note: During engine break-in, it is normal for the engine to be extremely tight and hard to turn when the piston reaches the top of the cylinder.)	

SYMPTOM	Engine is very sluggish, hard to start, and will not idle during initial break-in.
CORRECTIVE ACTION	
The factory default break-in settings (on the carburetor) may be too rich for your location, weather conditions, or fuel brand. Extremes in temperature, humidity, barometric pressure, and altitude can not always be accounted for by the factory default settings. These symptoms may occur when air density is very low (such as in high mountains or extremely cold temperatures). Under these conditions, lean the Main High-Speed Needel slightly (1/8 turn CW), and check if there is any improvement in starting and idling. Only lean the Main High-Speed Needel until the engine runs and idles reliably, then continue the break-in process.	
Different fuel brands/types – in combination with extreme weather conditions – can also make the factory default break-in settings too rich and cause these symptoms. Try leaning the Mixture Control Needle slightly (1/8 turn CW), and check if there is any improvement in starting and idling.	

SYMPTOM	Engine performance is sluggish.
CORRECTIVE ACTION	
Engine performance depends on the carburetor settings and how they compensate for the weather & atmospheric conditions. Before suspecting other issues, richen the Main High-Speed Needle by at least 1/12 turn CCW, then retune the engine.	
Try installing a new glow plug.	
If carburetor settings are proper, ensure the fuel is fresh. Old fuel, or fuel that has been left uncapped for a long period, may cause sluggish performance.	
Verify that there is no drivetrain binding.	

SYMPTOM	Piston stuck at top of cylinder – Top Dead Center (TDC).
CORRECTIVE ACTION	
A brand new engine that has not had a lot of break-in will typically have a very tight fit between the piston and the top of the cylinder (known as "pinch"), since the cylinder has a tapered fit.	
The fit should not be so tight that the engine can not be started. If the piston gets stuck at TDC, use a pair of pliers to grasp the flywheel from the bottom of the engine. Rotate the flywheel CCW (viewed from the front of the engine) until the flywheel turns; you should feel the piston become unstuck from the top of the cylinder.	

SYMPTOM	Engine fails to fire.
CAUSE	CORRECTIVE ACTION
Fuel tank is empty.	Fill the tank with fuel and repeat priming procedure.
Fuel not reaching the engine.	Check fuel lines.
Glow plug element is burn out.	Replace glow plug.
Glow plug battery discharged.	Recharge or replace the battery.
Clogged fuel filter.	Clean or replace fuel filter.
Air filter is dirty.	Replace air filter for new one.
Muffler is dirty inside.	Clean muffler inside.
Over priming.	Remove glow plug and pump out excess fuel.
Fuel tubing is disconnected.	Connect fuel tubing securely.
Fuel tubing is kinked, split or has hole.	Check the tubing carefully and replace if necessary.
Incorrect servo linkage.	Connect correctly after setting servo at neutral.
Reverse rotating direction of starter box wheel.	Make sure starter box wheel rotates the engine flywheel in a counter clockwise direction when viewed from the front of the engine. If you are unsure, very slowly push the car forwards on the ground and watch the direction the clutch bell rotates, the starter wheel must also turn the engine in this direction.

SYMPTOM Not reaching expected peak RPM.	
CAUSE	CORRECTIVE ACTION
Insufficient warming up.	Set the carburetor needles only after engine has reached normal operating temperature.
Insufficient break-in time.	Complete the break-in procedure.
Muffler or manifold is not securely connected or is disconnected.	Replace seal ring. Check the connections and secure them.
Fuel tubing from tank is split or broken.	Replace fuel tubing.

SYMPTOM Poor RPM drop at idle.	
CAUSE	CORRECTIVE ACTION
Throttle position open too far.	Close Low-End Needle (front) to adequate position to lower idle RPM.
Carburetor not fully seated.	Install carburetor securely.
Metering needle closed too far.	Open Low-End Needle (front) a little.

SYMPTOM Poor response.	
CAUSE	CORRECTIVE ACTION
Deteriorated glow plug.	Replace glow plug.
Incorrect carburetor settings.	Readjust low RPM range with Low-End Needle (Front) and Mixture Control Needle (Rear).
Incorrect setting of transmitter exponential function.	Check the transmitter setting.
Incorrect linkage.	Make sure the throttle servo linkage does not bind and is connected correctly.

Troubleshooting

SYMPTOM	Unstable idle.	
CAUSE	CORRECTIVE ACTION	
Unsuitable glow plug.	Use suggested and only the original FX glow plug.	
Unsuitable fuel.	Do not use extremely high nitro or low oil content fuel.	
Extremely light flywheel.	Add heavier flywheel.	
Muffler is disconnected or has play.	Install muffler securely.	

SYMPTOM	Engine fires intermittently but does not run.	
CAUSE	CORRECTIVE ACTION	
Insufficient fuel in the tank.	Fill the tank with fuel.	
Deteriorated glow plug.	Replace glow plug.	
Clogged fuel filter.	Clean or replace fuel filter.	
Air filter is dirty.	Replace air filter for new one.	
Muffler is dirty inside.	Clean muffler inside.	
Engine overheated.	Wait until engine is cool.	
Incorrect clutch release.	Adjust the tension of clutch spring.	
Starting battery disconnected too soon.	Do not disconnect plug battery and wait until RPM becomes stable.	
Vibration causing air bubbles in fuel.	Install O-rings on the fuel tank mounting screws to prevent bubbles.	

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