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.40NX Evolution® Engine

USER GUIDE



E[®]
EVOLUTION

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Content Included

Engine

Muffler (EVO040601A)
Muffler Screws & Gasket (EVO036E36A)
Glow Plug (EVOGP1)
Instruction manual
Decal sheet

Optional Items

Startup Field Pack (HANSTART)
Tachometer (HAN156)
Propeller 9 x 6 (EVO09060) 10 x 6 (EVO10060)
Blue Block After Run Engine Oil Applicator (EVOX1001)
Blue Block After Run Engine Oil Refill (EVOX1002)
HAN3015 # 9 Performance Glow Plug

Introduction

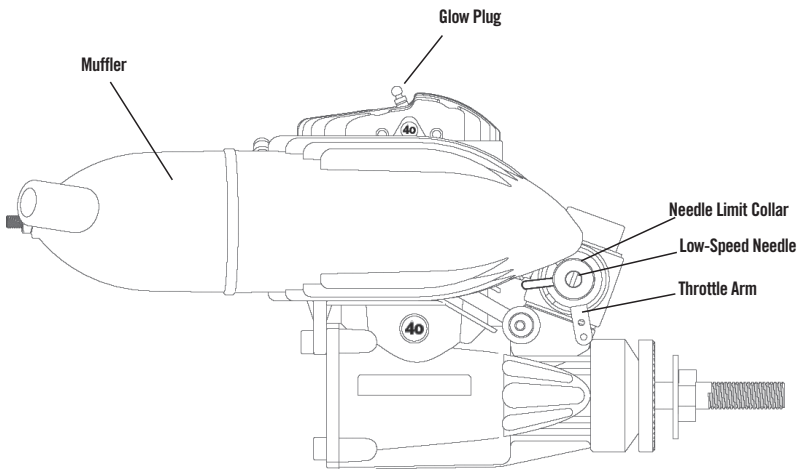
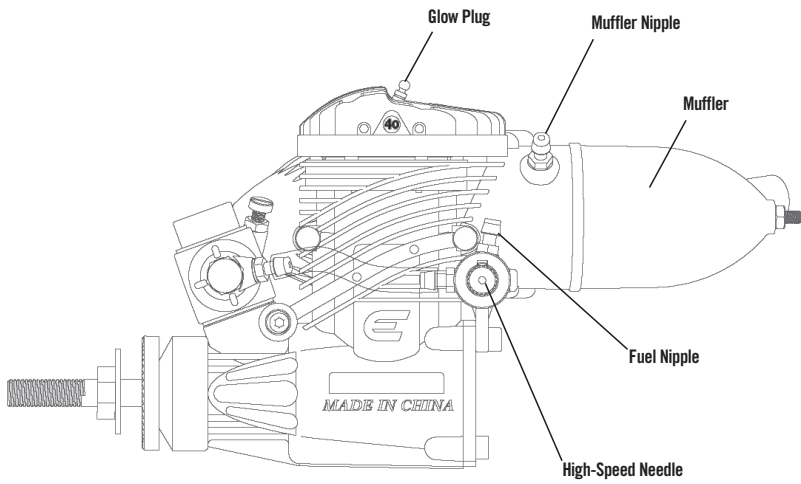
Congratulations on your purchase of the newest and one of the most technically advanced 2-stroke model airplane engines in the world. Whether you are new to the sport of model aviation or are an experienced flier, you will enjoy the features of the new Evolution® Engines .40NX Engine.

The Evolution .40NX Engine is designed to be the most powerful in its class, extremely easy to start and operate, and provide years of enjoyable service. It incorporates many unique design features, such as our Set Right™ needle valve assemblies. Every feature is designed to ensure success with your new engine.

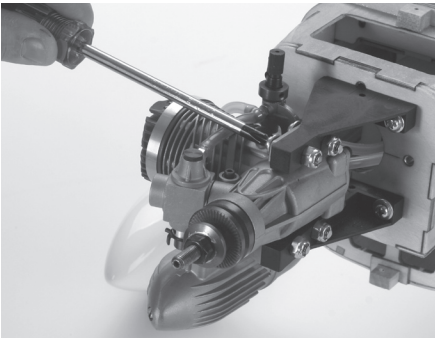
This user guide is intended to provide the basic information needed to operate and maintain your Evolution .40NX Engine.

Every Evolution engine has been baseline adjusted at the factory and is ready to fly. We recommend a 20-minute break-in period to become familiar with the engine.

Important: While the Evolution engine is extremely easy to operate, if this is your first experience flying a model airplane, it is highly recommended that you have the help of an experienced modeler during the first few flights. Your local hobby store or flying club can put you in touch with an experienced pilot in your area.



Mounting the Engine

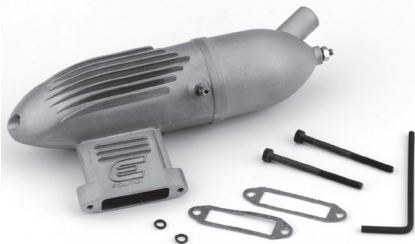


Securely tighten all engine mounting screws and recheck tightness before each flying session.

Most model airplanes include an engine mount. It is extremely important that the engine mount be securely mounted to the airplane's firewall and that the engine is securely mounted to the engine mount. Follow the instructions included with the airplane for mounting the engine.

Important: Before each flying session, check that all engine mounting screws are securely tightened.

Installing the Muffler

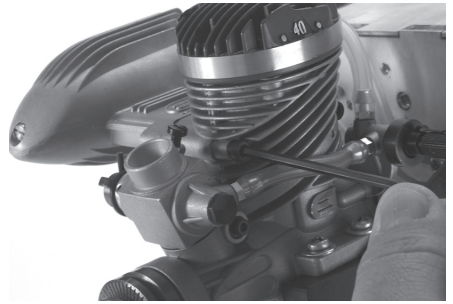


The muffler mounting accessory package includes mounting screws (2), lock washers (2), muffler gaskets (2) and an L-wrench.

WARNING: Read and follow all instructions and precautions before use. Failure to do so could result in product malfunction, damage and injury.

WARNING: This product can become extremely hot when in use, which could lead to burns.

NOTICE: Only use this product with parts specified in the product literature.



Using the included muffler mounting screws and lock washers, attach the muffler with the included hex wrench. Be sure the lock washers are placed over the screws and that you securely tighten both screws with good torque.

EVO Team Tip: Because of the small size of this engine you will need to loosen the two engine backplate screws that hold the remote needle valve mount to the engine in order to insert the rear muffler mounting screw. Once you have inserted the muffler mounting screw into the engine don't forget to tighten the remote needle valve mount to the backplate.

EVO Team Tip: A quick note about muffler gaskets. One of the many causes of a muffler coming loose is that the paper gasket material becomes crushed by the muffler mounting to the engine, and this leads to the screws actually loosening on their own. As the two surfaces (engine crankcase mount and muffler mounting face) are both machined surfaces there should be little, if any leaks between these two surfaces and you may choose to mount the muffler without the included gasket.

Important: After five runs, retighten the muffler mounting screws. Also, tighten the muffler thru-bolt at this time as well—loosen the lock nut on the back of the muffler, tighten the thru-bolt via the screwhead at the front of the muffler then retighten the lock nut at the rear.



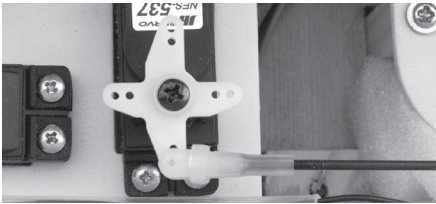
Attach the linkage to the throttle arm.

Throttle Linkage

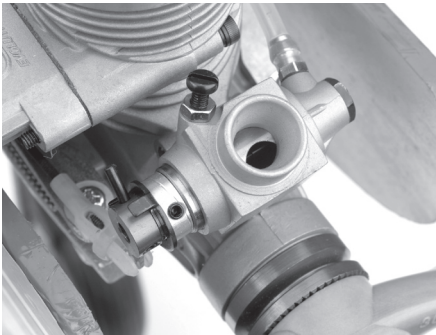
A clevis is recommended for attaching the throttle linkage to the throttle. Attach the throttle linkage to the hole in the throttle arm (see photo above).

Turn on the radio. With the throttle stick at 1/2 throttle, install the arm on the servo so that the arm is 90° to the throttle pushrod.

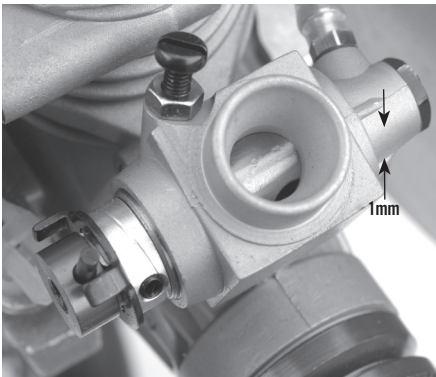
Select a servo arm that has a hole located 11mm or 7/16" out from center and attach the other end of the throttle linkage (see photos below).



Linkage 11mm out



1/2 throttle

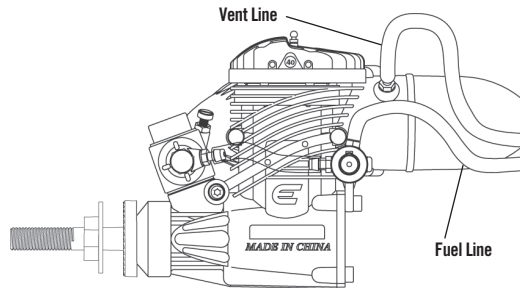
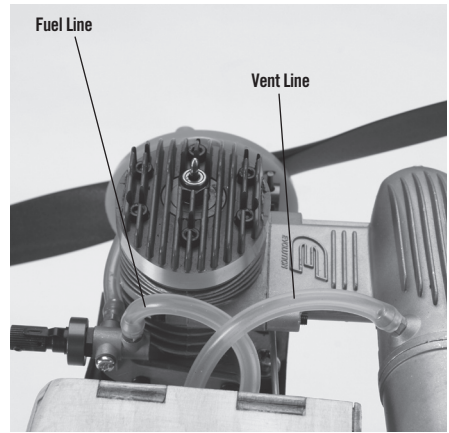


At low throttle, mid-trim, the throttle barrel should be 1mm open. With low throttle and mid-trim (idle position), the throttle barrel should be open 1mm, giving a low rpm idle (see photo above). Adjust the length of the pushrod until the

throttle barrel is exactly 1mm open. Check to be sure the servo is moving in the correct direction. Full throttle should open the throttle barrel fully, while low throttle and low-trim should completely close the throttle barrel. Reverse the servo throw if necessary.

Note: It may be necessary to slightly adjust the length of the throttle pushrod to achieve the correct mid-trim, low-stick idle position.

Attaching the Fuel Lines



Using medium silicone fuel tubing, attach the fuel tank's clunk line to the fuel nipple. This line will supply fuel to the engine. Attach the vent line to the muffer pressure nipple. This line pressurizes the fuel tank with the muffer pressure, creating consistent fuel flow, regardless of the airplane's attitude.

Recommended propellers:

Break in*

9 x 6, 10 x 6

Sport

9 x 6, 9 x 7

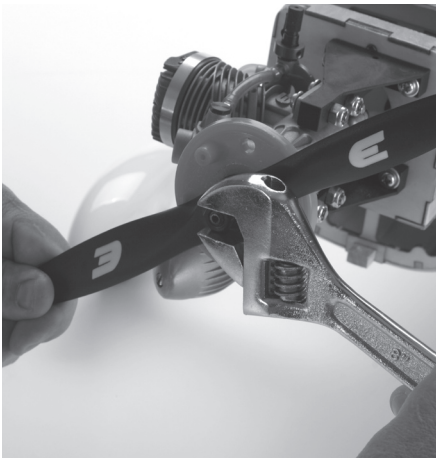
10 x 6, 11 x 5

Performance (tuned exhaust)

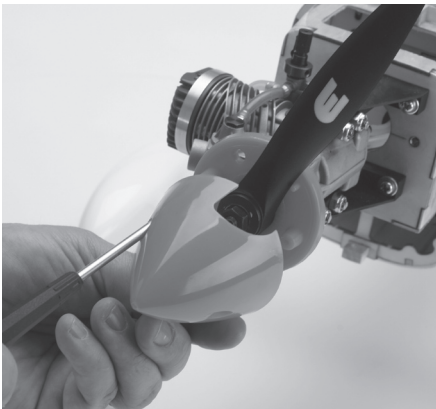
9 x 6, 9 x 7, (Prop the engine to achieve over 15,000 rpm on the ground)

* 2-blade propellers

Attaching the Propeller and Spinner



Securely tighten the prop nut using a wrench.



Remove the prop nut and prop washer from the engine. Install the spinner backplate. Install the propeller, the prop washer and then the prop nut in that order (see photo). Securely tighten the prop nut using an adjustable wrench. Install the spinner cone.

Starting the Evolution Engine

Fuel

We recommend using high-quality Cool Power Omega, Hangar 9® AeroBlend™ or Power Master fuels containing 10 to 15% nitro. The Evolution Engine has been test-run using these fuels. If another brand of fuel is used, it may be necessary to slightly adjust the needle valves to compensate for the differences in fuel.

Glow Plug

The Evolution engine comes with a specially designed “Super Plug” that prevents idle and transition flameouts. The plug’s unique shape directs the incoming fuel/air mixture away from the plug element. When replacing the plug, be sure to replace it with another Evolution 2- or 4-cycle Super Plug (EVOGP1).

Starting the Engine

- Step 1.** Fill the tank with the above-mentioned 10 or 15% fuel.
- Step 2.** Reattach the fuel lines, making sure the vent and clunk line are attached to the fuel nipple and the muffler pressure nipple.
NOTICE: Do not attach the glow driver yet.
- Step 3.** The high-speed needle valve should be turned open 2-turns from closed for the initial first start.
- Step 4.** With the throttle fully open, place your thumb over the carburetor or the exhaust outlet of the muffler and flip the prop clockwise through 6 complete revolutions, thus priming the engine.
- Step 5.** Close the throttle to the idle position and have a helper hold your airplane.

If you are planning to use a tuned exhaust system then we highly recommend the use of either of the following Hangar 9® glow plugs.

HAN3015 #9 Performance Plug

HAN3020 #3 Performance Plug



The Hangar 9 START KIT (HANSTART) includes everything needed, except fuel and starter, to get the Evolution engine running.

Step 5. Attach the glow driver.

Step 6. Turn the engine over using an electric starter.

The engine should fire within seconds of applying the starter.

Step 7. Allow the engine to idle for 30 seconds. Adjust the throttle trim if necessary to achieve a constant slow idle.

Step 8. With the glow driver still attached and a helper securely holding the airplane, advance the throttle smoothly to full throttle. The engine will transition to full rpm.

Step 9. Reduce the throttle to idle and remove the glow driver.

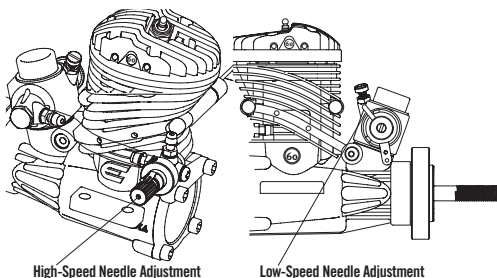
Setting the Needle Valves

The low-speed needle has a limiter that prevents over-adjustment. If your engine starts from the above procedure, but won't reliably continue to run with the glow driver removed, follow the steps below.



Step 1. High-Speed Needle Adjustment

With the engine running, advance the throttle to full throttle while a helper securely holds your airplane. Carefully pinch and release the fuel line to temporarily restrict the fuel flow.



High-Speed Needle Adjustment

Low-Speed Needle Adjustment

Note that the low-speed needle adjustment range is limited, preventing adjustment beyond the practical range.



CAUTION: Do not reach over the propeller while the engine is running.

The High-Speed Needle settings are:

Correct: If the high-speed needle adjustment is correct, the engine will increase rpm slightly (about 300 rpm) and then die.

Too Rich: If the engine increases a lot (1,000 rpm or greater), the high-speed needle is too rich and must be leaned or turned clockwise.

Too Lean: If the engine doesn't increase rpm and simply dies, the high-speed needle is lean and must be richened or turned counterclockwise.

Step 2. Low-Speed Needle Adjustment

The low-speed or idle needle valve, included with the SetRight™ assembly, is preadjusted at the factory for best performance at close to sea level conditions. It may be necessary to fine-tune the low-speed adjustment using the following procedure:

1. Start the engine and let it warm up, prior to attempting any adjustments. Make sure the high-speed adjustment process is complete before attempting to adjust the low-speed needle valve.

2. Close the throttle slowly. You will adjust the low-speed needle setting by rotating the SetRight adjustment bar clockwise to lean the engine and counterclockwise to richen the engine.



CAUTION: Do not attempt to adjust the low-speed needle valve while the engine is running.

3. The fuel mixture should be adjusted as follows: The low-speed fuel mixture is too rich if, when opening the throttle moderately quickly, the engine emits smoke and "stutters" or "stumbles." Correct this by rotating the SetRight adjustment bar clockwise in small increments. Continue this process until the engine transitions smoothly from low rpm idle to high rpm without hesitation upon opening the throttle moderately quickly.

Step 2. Low-Speed Needle Adjustment, cont.

4. The low-speed fuel mixture may be too lean if the engine stops at the lowest idle position or it stops when the throttle is opened moderately quickly from the idle position. Correct this by rotating the SetRight adjustment bar counterclockwise in small increments until the engine transitions smoothly without hesitation upon opening the throttle rapidly from idle.

Low-Speed SetRight Needle Valves

The design of the SetRight needle valve system is such that, during normal operating conditions, the typical user will find that the range of adjustment allowed by the system is more than adequate for most situations. As a matter of fact, we intended this to be used as a tool to identify operating problems. If you find that the range of adjustment allowed by the SetRight needle is inadequate after your initial period of running, then a problem in your engine system has occurred. This might be a bad glow plug, dirty or old fuel, an air leak in the fuel system somewhere or any number of other reasons. Do not make any permanent adjustment range changes to the SetRight needle system if it was once working correctly for you and now does not. Investigate other problems first.

However, occasionally due to atmospheric, altitudinal or fuel conditions, you may find that the range of adjustment built into the SetRight needle valve system is inadequate for your needs. These conditions are rare and easy to fix.

Low-Speed SetRight Needle Valve Correction

Should the low-speed SetRight needle valve need to be adjusted outside the factory-established parameters, follow these steps:

A. Loosen the setscrew found on the ring of the SetRight assembly to which the adjustment bar is attached.

B. Rotate the needle valve itself (small slot-headed screw inside the blue ring of the SetRight assembly) clockwise to lean the mixture or counterclockwise to richen the mixture as desired.

C. Retighten the setscrew on the ring of the SetRight assembly and you have re-established a new range of motion.

Why would fuel go "bad"?

The largest portion of the fuel is methanol (alcohol). Methanol is hygroscopic; it attracts moisture. This can cause your fuel to be contaminated with water, which will cause poor engine performance. Additionally, the UV rays in sunlight will eventually break down the nitromethane if the fuel jug is stored in sunlight for long periods of time.

How can you tell when your fuel has gone "bad"?

The first indication will generally be the inability to start the engine at previously run needle-valve settings. Another clue might be that the engine has very poor idle, runs but bogs down tremendously during run up and/or will not attain the same rpms that you are used to.

How do I keep my fuel fresh?

If you have the opportunity, look for someone at a flying field on a sunny day who has a jug of fuel that is only 1/4 full. What you may notice is that there are droplets attached to the top and sides of the container. This is the moisture in the air that is condensing inside the jug because of the greenhouse effect of the semi-translucent plastic jug. This will also occur within a metal fuel can as the sun warms the contents.

You can combat the effects of the moisture in the air by squeezing all the extra air from your fuel container at the end of the day or transferring your fuel into smaller containers as the level of the fuel is reduced in your gallon jug. Many pilots will invest in 1/2 gallon or quart-size containers and only bring that amount of fuel to the field on any given day. This allows their main supply of fuel to stay at home in a controlled storage environment, virtually ensuring problem-free fuel.

How to Tell If Your Glow Plug Is Bad

The glow plugs on the market today are designed to provide good service to the user and may last a long time or a short time, all dependent upon the way you choose to operate your engine.

Physical indications that you might need to change the glow plug are:

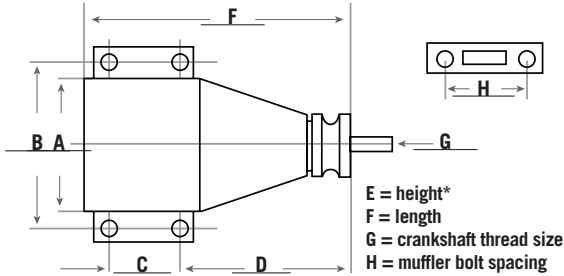
1. Twisted or mangled glow plug elements (usually caused by too high a compression ratio).
2. Small “bumps” are attached to the glow plug element. This will generally be most noticeable during the break-in process. These are actually tiny pieces of aluminum that have attached to the element and will severely hinder the operation of the glow plug.
3. The glow plug element is no longer shiny but is dull, almost a white powder color. (This just comes with age and is a by-product of the catalytic reaction). The shinier the wire, the better the catalytic reaction can be.

Operating indications that you need to change your glow plug are:

1. The glow element will not light with a charged glow igniter. This indicates that there is a physical short or breakage in the element wire itself.
2. Glow plug lights but the engine will not continue running once the battery is disconnected. (This is usually an indication of the microscopic particles discussed earlier.)
3. Glow plug lights, engine runs but there is a perceptible loss of rpm at full throttle when the battery is disconnected. This is a typical indication that the white powder residue is building to the point that the catalytic reaction of the glow plug is no longer anywhere close to being optimum.

.40NX Evolution Engines Specifications

Items	Disp (c.i.)	Bore (mm)	Stroke (mm)	Weight (oz)	Crank K (ISO)	Cylinder	Propeller
EVOE0401	.41	21.7	18.2	10.0	1/4 x 28	ABC	10 x 6 APC @ 14,100 RPM



Dimensions (mm)	A	B	C	D	E*	F	G	H
EVOE0600	30	38	15	47	78	78	1/4 x 28	35

* Height is from engine C/L to top of cylinder head

Troubleshooting Guide

Engine Won't Fire

- Glow starter not charged
 - Charge glow starter
- Glow plug burnt out
 - Replace glow plug
- No fuel is getting to the carburetor
 - Check tank, fuel lines reversed
- The starter is reversed
 - Reverse the polarity on the starter cables

Engine Quits Repeatedly

- Needles need adjusting
 - See adjustment procedure
- Bad or old fuel
 - Replace with fresh fuel
- Worn out glow plug
 - Replace with new EVOGP1 glow plug

Engine Runs Inconsistently

- Hole in fuel line
 - Replace fuel line
- Bad or old fuel
 - Replace with fresh fuel

Maintenance

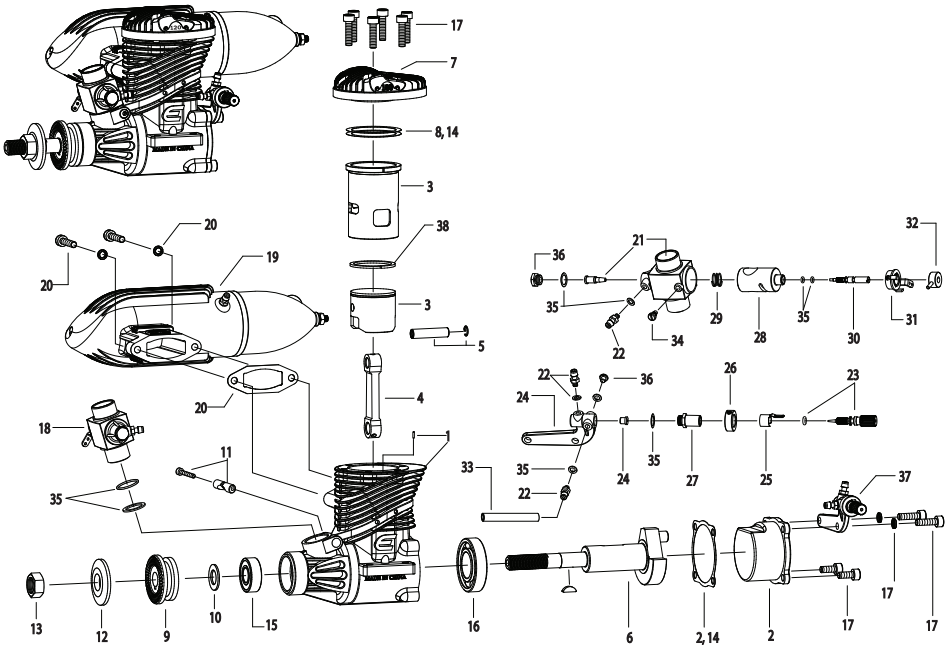
After each flying session:

1. Fully drain the fuel from the tank.
2. Start the engine and run it until the fuel is completely run out of the engine.
3. Try starting the engine three more times or until it will no longer fire. This gets all the fuel out of the engine.

Now add several drops (about 10) of after-run oil (EVOX1001 Evolution Engine's Blue Block Rust Inhibitor) should be applied into the carburetor and the engine should be turned over for a few seconds with the starter. This will prevent rust and corrosion.

If you need additional help or have any questions, please call the appropriate Horizon Product Support department. Horizon has trained technicians who are qualified to answer your engine questions.

Exploded View



Cross Reference of Evolution .40NX Part Numbers

No. Description

1 Crankcase	EV0040101A	20 Muffler Mounting Screw Set with Gasket	EV0036E36A
2 Back Cover with Gasket	EV0032102	21 Carburetor Body and Spray Bar	EV0036863
3 Cylinder Liner and Piston Set (ABC)	EV0040203A	22 Fuel Nipple and Gasket	EV0100114
4 Connecting Rod	EV0032204	23 High Speed Needle Valve	EV0040829F
5 Wrist Pin with Clips (Teflon)	EV0040209	24 Spray Bar Bracket (Remote)	EV0036873
6 Crankshaft	EV0032210	25 High-Speed Needle Valve Ratchet	EV0100833
7 Cylinder Head	EV0040103A	26 Collar with Setscrew	EV0100834A
8 Cylinder Head Gasket 40NX (2 pcs)	EV0040112A	27 Needle Valve Assembly: 36NT	EV0036874
9 Prop Driver	EV0036219	28 Throttle Barrel	EV0036813
10 Spacer Washer	EV0032225	29 Spring (Throttle Barrel)	EV0100814A
11 Carburetor Retainer	EV0036129	30 Idle Needle	EV0100844A
12 Prop Washer	EV0100220	31 Throttle Arm	EV0100864A
13 Prop Nut (1/4 x 28)	EV0100221	32 Idle Needle Limit Collar	EV0100850A
14 Gasket Set (Engine)	EV0040416A	33 45mm Fuel Tube	EV0032872
15 Front Ball Bearing	EV0032109	34 Idle Stop Screw with Nut	EV0100825F
16 Rear Ball Bearing	EV0028110	35 Carburetor Gasket/O-Ring Set	EV0036E36B
17 Screw Set (Engine)	EV0040901	36 Small Parts Set (Carburetor)	EV0036E36C
18 Complete Carburetor	EV0036801	37 Needle Valve Assembly	EV0036874
19 Muffler	EV0040601A	38 Prop Washer and Nut Set	EV0040228

Warranty and Repair Policy

Warranty Period

Exclusive Warranty- Horizon Hobby, Inc., (Horizon) warrants that the Products purchased (the "Product") will be free from defects in materials and workmanship for a period of 2 years from the date of purchase by the Purchaser.

2 Year Limited Warranty

Horizon reserves the right to change or modify this warranty without notice and disclaims all other warranties, express or implied.

(a) This warranty is limited to the original Purchaser ("Purchaser") and is not transferable. REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. This warranty covers only those Products purchased from an authorized Horizon dealer. Third party transactions are not covered by this warranty. Proof of purchase is required for all warranty claims.

(b) Limitations- HORIZON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCT. THE PURCHASER ACKNOWLEDGES THAT THEY ALONE HAVE DETERMINED THAT THE PRODUCT WILL SUITABLY MEET THE REQUIREMENTS OF THE PURCHASER'S INTENDED USE.

(c) Purchaser Remedy- Horizon's sole obligation hereunder shall be that Horizon will, at its option, (i) repair or (ii) replace, any Product determined by Horizon to be defective. In the event of a defect, these are the Purchaser's exclusive remedies. Horizon reserves the right to inspect any and all equipment involved in a warranty claim. Repair or replacement decisions are at the sole discretion of Horizon. This warranty does not cover cosmetic damage or damage due to acts of God, accident, misuse, abuse, negligence, commercial use, or modification of or to any part of the Product. This warranty does not cover damage due to improper installation, operation, maintenance, or attempted repair by anyone other than Horizon. Return of any Product by Purchaser must be approved in writing by Horizon before shipment.

Damage Limits

HORIZON SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCT, WHETHER SUCH CLAIM IS BASED IN CONTRACT,

WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

Further, in no event shall the liability of Horizon exceed the individual price of the Product on which liability is asserted. As Horizon has no control over use, setup, final assembly, modification or misuse, no liability shall be assumed nor accepted for any resulting damage or injury. By the act of use, setup or assembly, the user accepts all resulting liability.

If you as the Purchaser or user are not prepared to accept the liability associated with the use of this Product, you are advised to return this Product immediately in new and unused condition to the place of purchase.

Law: These Terms are governed by Illinois law (without regard to conflict of law principals).

WARRANTY SERVICES

Questions, Assistance and Repairs

Your local hobby store and/or place of purchase cannot provide warranty support or repair. Once assembly, setup or use of the Product has been started, you must contact Horizon directly. This will enable Horizon to better answer your questions and service you in the event that you may need any assistance. For questions or assistance, please direct your email to productsupport@horizonhobby.com, or call 877.504.0233 toll free to speak to the Product Support Department.

Inspection or Repairs

If this Product needs to be inspected or repaired, please use the Horizon Online Repair Request submission process found on our website or call Horizon to obtain a Return Merchandise Authorization (RMA) number. Pack the Product securely using a shipping carton. Please note that original boxes may be included, but are not designed to withstand the rigors of shipping without additional protection. Ship via a carrier that provides tracking and insurance for lost or damaged parcels, as Horizon is not responsible for merchandise until it arrives and is accepted at our facility. An Online Repair Request is available at www.horizonhobby.com <http://www.horizonhobby.com> under the Repairs tab. If you do not have internet access, please contact Horizon Product Support to obtain a RMA number along with instructions for submitting your product for repair. When calling Horizon, you will be asked to provide your complete name, street address, email address and phone number where you can be reached during business hours. When sending product into Horizon, please include your RMA number, a list of the included items, and a brief summary of the problem. A copy of your original sales receipt must be included for warranty consideration.

Be sure your name, address, and RMA number are clearly written on the outside of the shipping carton.

Notice: Do not ship batteries to Horizon. If you have any issue with a battery, please contact the appropriate Horizon Product Support Department.

Warranty Inspections and Repairs

To receive warranty service, you must include your original sales receipt verifying the proof-of-purchase date. Provided warranty conditions have been met, your Product will be repaired or replaced free of charge. Repair or replacement decisions are at the sole discretion of Horizon.

Non-Warranty Repairs

Should your repair not be covered by warranty the repair will be completed and payment will be required without notification or estimate of the expense unless the expense exceeds 50% of the retail purchase cost. By submitting the item for repair you are agreeing to payment of the repair without notification. Repair estimates are available upon request. You must include this request with your repair. Non-warranty repair estimates will be billed a minimum of ½ hour of labor. In addition you will be billed for return freight. Horizon accepts money orders and cashiers checks, as well as Visa, MasterCard, American Express, and Discover cards. By submitting any item to Horizon for inspection or repair, you are agreeing to Horizon's Terms and Conditions found on our website under the Repairs tab.

Country of Purchase	Horizon Hobby	Address	Phone Number/ Email
United States	Horizon Service Center (Electronics and engines)	4105 Fieldstone Rd Champaign, Illinois 61822 USA	877-504-0233 Online Repair Request visit: www.horizonhobby.com/repairs
	Horizon Product Support (All other products)	4105 Fieldstone Rd Champaign, Illinois 61822 USA	877-504-0233 productsupport@horizonhobby.com
United Kingdom	Horizon Hobby Limited	Units 1-4 Ployters Rd Staple Tye Harlow, Essex CM18 7NS United Kingdom	+44 (0) 1279 641 097 sales@horizonhobby.co.uk
Germany	Horizon Technischer Service	Hamburger Str. 10 25335 Elmshorn Germany	+49 4121 46199 66 service@horizonhobby.de
France	Horizon Hobby SAS	14 Rue Gustave Eiffel Zone d'Activité du Réveil Matin 91230 Montgeron	+33 (0) 1 60 47 44 70 infofrance@horizonhobby.com