

Syssa Aircraft Performance

WORLD CLASS GASOLINE AIRCRAFT ENGINES

www.syssaaircraft.com (860) 538 2937

360 Captain Lewis Drive Southington, CT, USA 06489

SAP-180HP™

***High Performance Gasoline
RC Aircraft Engine***

Owners Manual (Version 1.2)

Thank you for purchasing the SAP-180HP™.

With reasonable care your SAP-180HP™ high performance engine will give you years of reliable, big-horsepower enjoyment. Whether it's a sky-ripping warbird, 3D monster, or scale Cub, we constantly strive to provide, you, our customer with the most complete, reliable and highest performing gasoline engine package available in the world.

Even though your SAP-180HP™ has been designed for the rigors and reliability required for 3D and aerobatic flying, it will work extremely well in your 1.00 – 1.80 or (larger) sized sport aircraft, warbird, or scale model. Not just another “converted” gas engine, your SAP-180HP™ has been designed from the ground up as a serious RC aircraft engine without the typical compromises that have to be made using off-the-shelf “weedwacker” engine parts. Using the latest in CAD, CAM, CAE and CNC machine tools, your SAP-180HP™ has been painstakingly engineered, manufactured and optimized in all areas possible by fellow enthusiasts.

Your SAP-180HP™ comes complete with and installation template, lightweight and high strength SAP standoffs (3), a high performance pumped and regulated Walbro carburetor (with an accelerator pump and high speed check valve), a specially designed rear mount, Vari-Tune™ Pitts Style Muffler that is smoke ready with optional smoke fittings, and a state of the art, auto advancing SAP electronic ignition that includes a switch and charge jack. All engines are serialized for QC and identification purposes in the event of theft.

The entire engine is covered by an SAP 2 Year Warranty against defects. Obviously, crash damage, modifications and improper use cannot be covered. If, for some reason, there is a defect with your engine, or you have a problem, please call us right away. The SAP-180 is designed for minimal maintenance, but there are still a few things for the user to do annually.

If your engine has crash damage and you would like us to repair it, please send it to our factory. We will evaluate the engine and call you before any work is performed. Although we very strongly suggest that you send your SAP engine to us at our factory (which is in the USA) to perform repairs to your engine, customers can order parts from us to perform their own repairs as well. We can quickly and accurately restore your engine to like new, factory performance with our own dedicated fixtures, balancing and gauging equipment, and get it back to you usually within a few days.

Building, flying, operating, maintaining, and spectating RC aircraft, especially giant scale aircraft can be dangerous. By using your SAP-180HP you agree to hold harmless Syssa Aircraft Performance and its employees from any injury, damage or loss.

If you do not agree to hold harmless Syssa Aircraft Performance and its employees from any injury, damage or loss, send your SAP-180HP engine back, postage free to:

***Syssa Aircraft Performance
360 Captain Lewis Drive
Southington, CT, USA 06489***

Drugs, Alcohol and Aircraft do not mix!

Any of Syssa Aircraft Performance components, including the engine itself, are not to be used with any “human-carrying” vehicle or aircraft. We are not liable for damage or loss, should this engine or any part of it be used to power any human-carrying aircraft or vehicle.

Safety First!

Large Scale Model Aircraft are not toys!

(and small)

They have propellers spinning at thousands of rpm. You can be seriously injured by a model aircraft in many ways. Do not let the size of the aircraft fool you into thinking you cannot be hurt. Even a small electric model can inflict surprising physical injury and property damage.

Operating model aircraft can create a hazard for the user and spectators alike. You should treat engines and model aircraft with similar respect given to machinery, motor-vehicles and firearms.

See the AMA code of conduct for additional safety precautions when operating model aircraft. When operating this or any engine of any size, you should observe the following rules:

DO NOT:

- stand in front of, to the side of, or in line with, the radial path of any propeller
- smoke around fuel or fuel vapors of any type
- wear dangling-type jewelry
- wear loose clothing that can be caught up in propellers
- place fingers near the propeller while the engine is running
- touch any part of ignition system (including the CDI Box) unless you are sure it is off and discharged (done by flipping prop 3 revolutions)
- touch any part of the engine until you are sure it is cool
- run the engine near sand and gravel for safety and engine lifespan
- casually turn or flip the prop over as it could start if the ignition is on
- work on aircraft or engines when fatigued, stressed or hurried

DO:

- tie back (restrain in some way) long hair
- wear some type of eye protection
- use hearing protection
- have a helper/spotter during flight and ground testing
- assume the engine ignition is “on” / “hot” regardless of ignition switch position (casually flipping prop could start an engine)
- prevent children from ever touching an engine or aircraft, even when it is not running!
- make sure your prop is balanced and is in good condition
- range check your model with and without engine operation

Your SAP-180HP™ Gasoline Engine **Comes Complete With:**

- ✓ **SAP Standoff Mounts (3)**
- ✓ **Complete Mounting Hardware Package Including Firewall Screws and washers (8-32 class 12.9)**
- ✓ **Pumped and Metered Walbro Carburetor w/Accelerator Pump**
- ✓ **SAP “Vari-Tune™” Muffler - Rear Mount/Dual Outlet**
- ✓ **2 Smoke Port Plugs (for non-smoke operation)**
- ✓ **CDI Auto Advancing Electronic Ignition with Complete Wire Harness**
- ✓ **Heavy Duty On/Off Ignition Switch with Flush Mount Charge Jack**
- ✓ **SAP EZ-Drill Firewall Mount Template (Clear, Laser Marked, Plastic that you can tape to your firewall and drill through)**
- ✓ **Throttle Linkage 2-56 Ball Link with 2-56 Stud**
- ✓ **Complete Installation Instruction Set**
- ✓ **Choke 2-56 Ball Link with 2-56 Stud**
- ✓ **Peace of Mind – Complete engine is pre-assembled, torqued to proper values with proper thread locking compounds, and tested**
- ✓ **SAP - 2 Year Parts and Labor Warranty against defects**

SAP-180HP™ Engine Specifications

Engine Weight (less ignition, but including muffler): 33.28 ounces

Engine Weight (w/ignition and mounts and muffler): 42 ounces

Static Thrust: 17.7 lbs (w/18x6 Vess Prop and as installed in a Funtana 100X™ on the ground at 78 F degrees at 500 ft ASL turning at 8750 rpm with stock, Vari-Tune exhaust)

Recommended Gasoline: 87-89 Octane Unleaded USA (R+M)/2 Method

Note: RON/MON/AKI vary by country – please check locally

Recommended Gas/Oil Mix: Any High Quality Fully Synthetic Oil such as Klotz or Amsoil 100:1 Saber Professional 1.5 oz packet and mixed with 1 gallon of gas yields 85:1 gas/oil ratio

Recommended Idle: 2300 rpm

Propeller selection: 16x10 – 20x6 depending on your aircraft's speed and thrust requirements

Spark Plug: NGK CM-6, 10mm x 1.00, metal gasket seat, non-resistor, .017" - .021" (.43mm to .53mm) gap

Ignition Timing: Factory set at 30 degrees before top dead center

Carburetor Adjustments: High Needle is marked "H" and the Low Needle is marked "L"

Firewall to Prop Hub dimension range: 5.200" – 6.600"

Please Note: The needle settings are the only user adjustable settings. All internal adjustments are only to be made by Syssa Aircraft Performance.

Torque Specs on SAP-180HP Fasteners

<u>Description</u>	<u>Qty</u>	<u>Thread</u>	<u>Tool</u>	<u>Torque</u>	<u>Torque</u>
Reed Fixing Screws	4	M3	2mm Hex	15 inch pounds	170 N cm
Reed Cage Fixing Screws	4	M3	4mm Hex	17 inch pounds	192 N cm
Carb Fixing Screws	2	M5	4mm Hex	65 inch pounds	7.34 N m
Carb Diaphragm Cover	4	4-40	#1 Phillips	15 inch pounds	170 N cm
Backplate Fixing Screws	8	M3	2.5mm Hex	22 inch pounds	248 N cm
Muffler Fixing Screws	2	M5	4mm Hex	85 inch pounds	960 N cm
Cylinder Fixing Screws	4	M5	4mm Hex	85 inch pounds	960 N cm
Sensor Fixing Screws	2	M3	2mm Hex	7.5 inch pounds	85 N cm
Standoff to Backplate Screws	3	8-32	9/64 Hex	30 inch pounds	339 N cm
Standoff to Firewall Screws	3	8-32	9/64 Hex	25 inch pounds	283 N cm
Carb Throttle Arm Screw	1	4-40	#1 Phillips	8 inch pounds	90 N cm
NGK CM-6 Spark Plug	1	M10x1	14mm Socket	96 inch pounds	1085 N cm
Prop Nut	1	M8x1.25	12mm Socket	106 inch pounds	1200 N cm

SAP-180HP Engine Installation

Tools you will need:

Scissors

Masking tape

9/64 (Allen) Long Hex Key Wrench or "T"

Handle Type is best

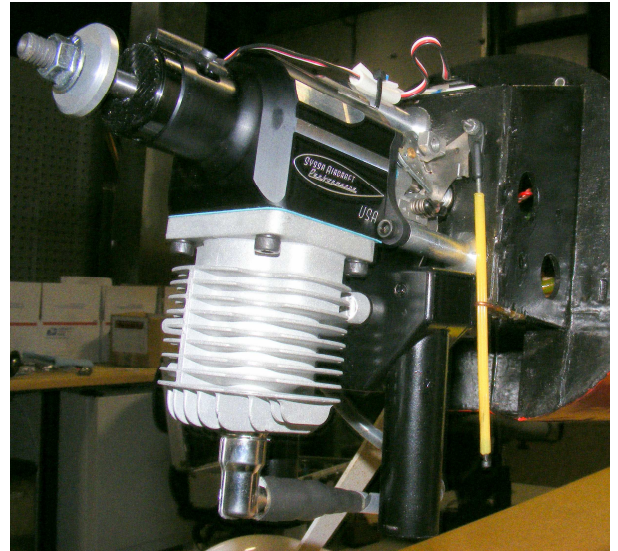
Power Drill

11/64" (.171" or 4.5mm) drill bit

Small flat blade screwdriver

12mm wrench or deep 6 point socket and drive

Blue or Semi-Permanent Threadlocker



Suggested Optional tools:

50-120 in lb (560-1355 N cm) range torque wrench

Rotary or "Dremel" type tool with sanding drum (depends on standoff length)

1. **Cut the clear EZ Drill Template to fit the firewall.**
2. **Tape the template to the firewall, taking care to line up both cross hairs. This perfectly aligns up the thrust centerline of the SAP-180HP with the thrust line of the aircraft.**
3. **Drill the mounting points, fuel line hole, and throttle arm as instructed on the template. The fuel line outlet on the carb can be carefully rotated so it aims straight back if desired.**
4. **Cut out the firewall as instructed for the carb choke screws to fit if necessary.**
5. **Mount the standoffs on the firewall using a thread locking compound (Loctite Blue or Semi-Permanent works well). Use the large stainless fender washers and the longer of the 8-32 screws. The large fender washers are for support behind the firewall and can be ground to fit if they interfere with anything. Tighten snugly.**

6. **Mount the engine to the standoffs using a thread locking compound and tighten to 30 in lbs (339 Nm)**
7. **Route the sensor wire so that it is secure and away from hot and moving parts.**
8. **Use Sullivan Golden Rod and thread into the 2-56 stud/ball link assembly to make a choke activation rod and trim so it is just protruding out of the bottom of the cowl or engine box.**
9. **Use Sullivan Golden Rod or other non-metallic rod for 2-56 hardware to connect the throttle linkage to the throttle servo.**
10. **Using wire or wood, make a retainer to keep the choke activation rod from moving around freely**
11. **The choke plate may be trimmed so that the only hole left is the one closer to the carb. It is stainless steel.**
12. **Carefully cut the cowl to fit around the muffler outlets and choke activation rod. (Be sure not to get any dust in the engine or carb.)**
13. **Be sure that the outlet area of the cowl is at least 3x the inlet area or there might not be sufficient engine cooling airflow**
14. **Mount the switch and ignition in a convenient location.**
15. **Install spinner backplate, propeller, SAP prop washer, black steel washer, spinner adapter nut (Dave Brown M8 x 1.25 short works well), and spinner. Be sure prop AND spinner assembly is balanced. Note: For thicker props and or backplate combinations, you may not need the aluminum SAP prop washer.**

SAP-180HP Installation Notes:

Use the correct EZ Drill Template for the hub to firewall distance of your aircraft. This is shown on the template.

The length of the propeller should run the same direction as the lines in the hub. This has the propeller in the correct clocking position for easy hand starting.

It's a good idea to mount the engine and then install the CDI module and ignition battery to help obtain correct lateral and longitudinal CG.

Ignition System and Components

When your battery is low, the SAP-180HP ignition system will start to skip at higher rpms. It will not shut down completely. If you notice your engine starting to skip at higher rpms, this is a warning that you should land and recharge your ignition battery.

The ignition needs to have its own battery and the receiver needs to have its own battery. You may not run or "T" the ignition off the receiver or receiver battery unless you are using a special filtering system designed and built for this purpose. Please contact Syssa Aircraft Performance concerning an ignition battery eliminator (IBE) with built in voltage regulator and cutoff.

Use a 4.8 volt battery pack for the ignition. A 4.8V 1100 mah battery is sufficient for 5 flights of 15 minutes each.

Using a 6.0 volt battery does not boost performance. Actually, you will get less flight time with a 6.0 volt battery pack of the equivalent capacity (mah).

The timing is set at the factory to 28 degrees before top dead center. The timing should never need adjustment.

A special sealant is used on the threads of the sensor. Only a special gasoline proof sealant should be used on these threads.

Beware - there are very few 100% gasoline proof sealants.

We strongly suggest the use of clips to lock all Futuba-type connectors together on the ignition system. This includes the sensor wires and battery/switch connection. It is an excellent idea to use some type of positive connection retaining system on all your receiver and flight control servo connections in your airplane.

Remember, it only takes one failed connection to bring down any plane.

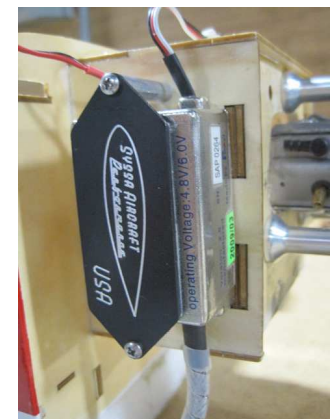
It is strongly suggested to wrap the sensor wires as well as the spark plug wire with the included white plastic spiral wrap. It will help protect the wiring and shielding cover in case there in chaffing.

Always take care to avoid routing wires near hot components (such as the muffler or the top of the cylinder) or sharp edges. It is best to route the spark plug wire straight back between the muffler outlet tubes and then secure it with zip ties cushioned with double sided tape (or another similar method)

It is suggested to keep the CDI Module and spark plug wire at least 8 inches from the receiver, receiver battery or wiring, servos or servo wiring.

SAP CDI Mount Installation (Optional)

- 1) ***Plan on where you will install the CDI Module – be sure the spark plug wire does not bend sharply - less than a .750” (19mm) centerline radius***
- 2) ***Be sure the holes will have enough room behind them for the blind nuts***
- 3) ***Using the CDI mount plate, mark the center of the 2 holes with a fine point ink pen or pencil***
- 4) ***Use an 11/64 or .172” (4.5mm) drill bit and drill the two through holes***
- 5) ***Install the 2 blind nuts***
- 6) ***Stick the double sided tape on the back of the mount plate***
- 7) ***Stick the double sided tape on the back of the CDI Module***
- 8) ***Peel off the wax paper from all double sided tape***
- 9) ***Press CDI module up against surface of mounting plate (it will stay in place)***
- 10) ***Put a small amount of blue Loctite on blind nuts***
- 11) ***Put screws through the mounting plate and aluminum spacers and through holes and thread into blind nuts while lining up mounting plate***
- 12) ***Tighten screws up snug using a #1 Phillips Screwdriver and tighten to 7 in lbs (80 N cm)***
- 13) ***Its always a good idea to restrain wiring neatly so it will not move around freely***



Vari-Tune™ Sound Insert Removal/Installation (Optional)

Your SAP-180™ is equipped with an industry exclusive exhaust/muffler system that can easily be set up for smoke with optional SAP smoke fittings. With or without the inserts, whichever sound level you choose does change the power level.

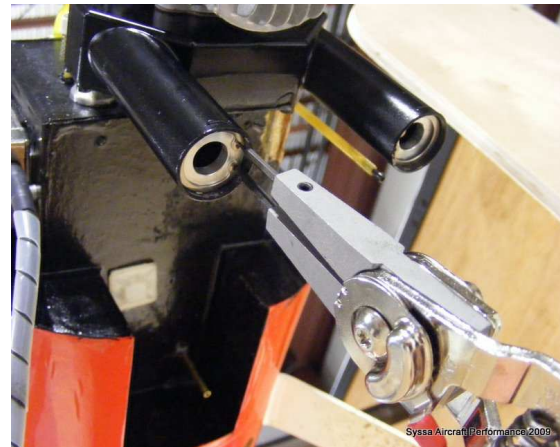
Removal of muffler inserts:

- 1) Using needle nose pliers or retaining ring pliers, squeeze the insert retaining rings carefully and then slowly pull the retaining ring out.
- 2) Using a piece of hooked steel wire, insert through the hole in the tone insert and pull the tone insert out.



Insertion of muffler inserts:

- 1) Put a small amount of oil on both O-rings of each tone insert.
- 2) Push each tone insert into bottom of muffler tube as shown. Make sure it is in just far enough to allow retaining ring to lock into rectangular holes.
- 3) Using needle nose pliers or retaining ring pliers, squeeze gently to constrict retaining ring and carefully insert into bottom of muffler so that the ears of each retaining ring lock into the corresponding rectangular slots in the bottom of each outlet tube.



SAP-180HP Carburetor

Adjustments

Richen = turn needle counter clockwise

Lean = turn needle clockwise

No carburetor can be “set” from the factory to match your air density. The modeler must tune the engine for his/her air density. Air density is affected by altitude, temperature and humidity. After flying or running your engine, do not run the carb dry. This will make it easier to start next time.

1. To Set the low needle:

A. Start at 1.5 turns out

B. Run engine at idle

C. Lean needle until engine stumbles on acceleration

D. Richen needle 1/8 turn.

2. To Set the high needle:

A. Start at 2 turns out.

B. Run engine to full throttle

C. Lean high needle until engine reaches peak rpm

D. Richen needle max of 1/8 turn (when ambient temperature is warmer than 85F (29.5 C) degrees richen up to 1/4 turn past peak if necessary

3. To Test adjustments:

A. Run engine at idle for 10 seconds

B. Check throttle response – if engine sags or stalls upon acceleration, richen low needle

C. Run engine at full throttle for 5 seconds – if engine “sags” (rpm decreases), richen high needle

SAP-180HP Break-In Procedure

The first 15 minutes of your engine's life are the most critical and can greatly influence the power level, idle quality, reliability, and lifespan of your new engine. The next 1.5 gallons are important as well. No special break-in prop is required.

During the first 15 minutes you should:

- ✓ Vary throttle settings and engine loading frequently (no sustained hovering)
- ✓ Use a high quality, non-synthetic oil mix of 40:1
- ✓ Run both carburetor needles only slightly richer (1/8 turn richer than peak)
- ✓ Break-In your new SAP-180HP in the air

During the first 15 minutes you should not:

- ✓ "Punch" the throttle
- ✓ Use a synthetic oil
- ✓ Use full throttle
- ✓ Run the engine lean

After this 15 minute period you will see slight power gains and a smoother idle for the next 1.5 - 2.0 gallons. Excessively rich needles and/or higher oil mixtures beyond what is described in the manual during break in and normal running will only accomplish carbon build-up and plug fouling.

You may run the engine with fully synthetic or conventional two stroke oil after the first 15 minutes to 1 hour of running, but the mixture should be 50:1 for full synthetic or 40:1 for conventional oil. After the first 2 gallons, run fully synthetic oil at 50:1 to 80:1 ratios.

When starting and running your SAP-180HP, always start the engine and let it warm up for about 30 seconds running time before you rev to high rpm's (above 3500 rpm). This rule should be followed for any engine whether it is gasoline or nitro/methanol.

SAP-180HP Propeller Selection

Although final propeller selection comes down to personal preference, using the correct propeller with your new engine is critical to achieving correct performance for your application. We have a guide for general applications with examples. Please note the SAP-180HP is engineered and manufactured with very tight tolerances and is built using extremely high quality materials; this allows for a very long lifespan at higher rpm's compared with most other engines.

On the ground with the engine warm, your propeller selection should allow your SAP-180HP to rev between 8,000 rpm and 9,600 rpm (with the exception of some higher pitch props)

Generally, with lower pitched props you will have:

- Less top speed
- More thrust
- Greater braking ability/control
- Lower landing speed

Generally, with higher pitched props you will have:

- More top speed
- Lower thrust
- Less braking ability/control
- Higher landing speed

A few correct examples:

Scale: 15 pound J-3 Cub with 100" wingspan - 18x6

Warbird: 15 pound Mustang with 80" wingspan - 18x8 or 17x10

Aerobatic: 9-13 pound Extra or Yak with 68-78" wingspan - 18x6

An example of poor prop selection would be using a 17x10 on a 12 pound "Extra" type plane or 15 pound Cub. Resulting thrust would be low and the airspeed would be too high. You would have poor braking and a higher than desired landing speed.

Using higher pitched props than necessary only results in loading the engine incorrectly for the application.

SAP-180HP Starting Procedure

- ✓ The use of a starter stick is very strongly suggested! Never use your hand to flip over any propeller!
- ✓ While starting any engine, the airplane should be restrained, preferably by a strap and all strap components having a minimum 60 pound working load rating.
- ✓ Be careful of any long hair or loose clothing or wiring!
- ✓ Always take tach readings from behind the propeller, preferably staying as far away from the prop as the tach will allow.
- ✓ Rocking the prop between near BDC and near TDC is safer, easier, faster and more effective than turning it over during engine chocking.

Electric Starting with engine hot or cold:

1. With IGNITION ON and throttle just slightly above idle, spin the engine up with the electric starter.

Hand Starting with engine cold:

1. With Ignition OFF, the choke closed, the throttle at least 3/4 open, rock the engine back and forth 6 times to bring fuel into the engine.

Note: Rocking 6 times = piston up/piston down 6 times

2. With Ignition ON, the choke open, and the throttle just slightly above idle, flip the prop over slowly with a chicken stick. It should "bump" as you go just past top dead center. If it does "bump", it's ready to start on the next flip. Flip it quickly and positively through the compression stroke to start it. If it does not "bump" it needs to be choked and rocked 1-3 times.

Hand Starting with engine hot, warm or recently run:

With Ignition ON, the choke open, and the throttle just slightly above idle, flip the prop over quickly and positively with a chicken stick. If it does fire after the 2nd or 3rd flip, the engine needs to be choked and rocked 1-3 times.

SAP-180HP General Notes:

- *Loose sand or dusty conditions can shorten the life of any engine*
- *Do not use any sealant anywhere on the intake side of the engine*
- *For easiest priming (choking), insure that that choke plate is seated flat against the face of the carb when activated and it is not damaged or lifting away from the carb face due to a choke rod that is pulling at an angle*
- *Do not unhook the spring on the carburetor – it is needed to keep a small amount of tension on butterfly assembly so it does not wear out prematurely*
- *During priming listen for fuel “squishing” and look/smell for fuel*
- *2.4 GHz Radio Systems have many advantages over 72 MHz, much more than just the ability to forget about frequency pins*
- *The CDI module can be located inside the airplane and does not need to be cooled in the outside air*
- *The CDI module, if mounted inside the airplane, should be wrapped and secured as a receiver should be*

Syssa Aircraft Performance Glossary

As related to aircraft - some terms relate to other disciplines as well

ATDC - After Top Dead Center (of the piston relationship to its travel)

BTDC - Before Top Dead Center (of the piston relationship to its travel)

TDC - Top Dead Center (of the piston relationship to its travel)

Braking - using the propeller to slow the airspeed of an aircraft

CDI - Capacitive Discharge Ignition

Chicken stick – a hand held stick that is used to flip props over to start an engine instead of a hand or glove: *People who like to keep all their fingers use chicken sticks*

Choke - to block or partially block the opening of a carburetor in order to draw fuel through the fuel system into the engine

CG - Center of gravity

Lean - condition where the fuel air mixture ratio has too much air (can be dangerous, seize and ruin an engine)

Peak - adjusting carb mixture which results in the highest engine rpm

Pitch - (relating to propeller) Number which designates the distance a propeller will travel through a theoretical solid in one revolution

Rich - condition where the fuel air mixture ratio has too much fuel (will eventually cause carbon build up and foul spark plugs)

“Rocking the Prop” - moving the propeller quickly between compression areas or moving the piston up and down quickly to pull fuel in during choking

RON / MON / AKI – (Research Octane Number / Motor Octane Number / Anti-Knock Index) these numbers show how resistant a fuel is to detonation (engine knocking) and vary in significance by country

Flying can be dangerous and costly! Think safety and minimize both!

RC Fixed Wing Aircraft Pre-Flight Checklist

Structural/Weight and Balance –

- ❑ Longitudinal CG at proper location
- ❑ Lateral CG at center
- ❑ Rear Stabilizer assembly secure
- ❑ Rudder assembly secure
- ❑ Wings secure to fuselage
- ❑ Landing gear wheel stops/collars are tight
- ❑ Landing gear secure to fuselage
- ❑ All other hardware (hatch screws/etc.) secure

Engine –

- ❑ Engine mounting hardware is secure
- ❑ Throttle linkage hardware is secure
- ❑ Throttle linkage is not binding during complete travel
- ❑ Throttle linkage has no metal to metal contact
- ❑ Muffler/Exhaust fittings are tight and no leaks
- ❑ Spark plug is correct for application
- ❑ Spark plug is working correctly
- ❑ Spark plug is tight
- ❑ Spark plug is grounded sufficiently (*Gas Engine Only*)
- ❑ Transmitter engine shutdown working correctly

Propeller –

- ❑ Propeller nut/bolt is tightened correctly
- ❑ No cracks or notches in propeller
- ❑ Prop is centered on hub
- ❑ Spinner and related hardware are tight and secure
- ❑ Adequate tip to ground clearance of propeller
- ❑ Propeller is balanced

Fuel –

- ❑ Fuel tank stopper is secured properly
- ❑ Fuel tank mounting is secured properly
- ❑ Fuel lines are properly secured and not leaking
- ❑ Fuel lines are away from sharp edges and hot surfaces
- ❑ Fuel lines have no kinks or cracks
- ❑ Fuel line is correct type and size for application
- ❑ Fuel line clunk is free to move to all sides in tank and does not contact back of tank when airframe is pointed vertical
- ❑ Timer is ready to avoid running out of fuel

Electronics/Servos/Flight Controls –

- ❑ Servo horns/linkage/joints/hardware tight and secure
- ❑ Servo wire connectors secure
- ❑ Tail Servo wires routed as far from RX antennae as possible (N/A with 2.4 Ghz)
- ❑ Servo wires are bundled securely/not allowed to move freely and are not near sharp edges or hot surfaces
- ❑ Receiver battery is secured properly
- ❑ Receiver crystal is inserted fully and secured properly(N/A with 2.4 Ghz)
- ❑ Receiver Battery charged and proper voltage is observed
- ❑ Transmitter Battery charged and proper voltage is observed
- ❑ Engine ignition battery charged/proper voltage is observed
- ❑ Range check and controls check out with transmitter antenna down and engine off
- ❑ Range check and controls check out with transmitter antenna down and engine running
- ❑ Control surface throws and movement are at recommended settings and are **not** reversed
- ❑ ALL electronic engine ignition components are a safe distance away from ALL receiver and servo components