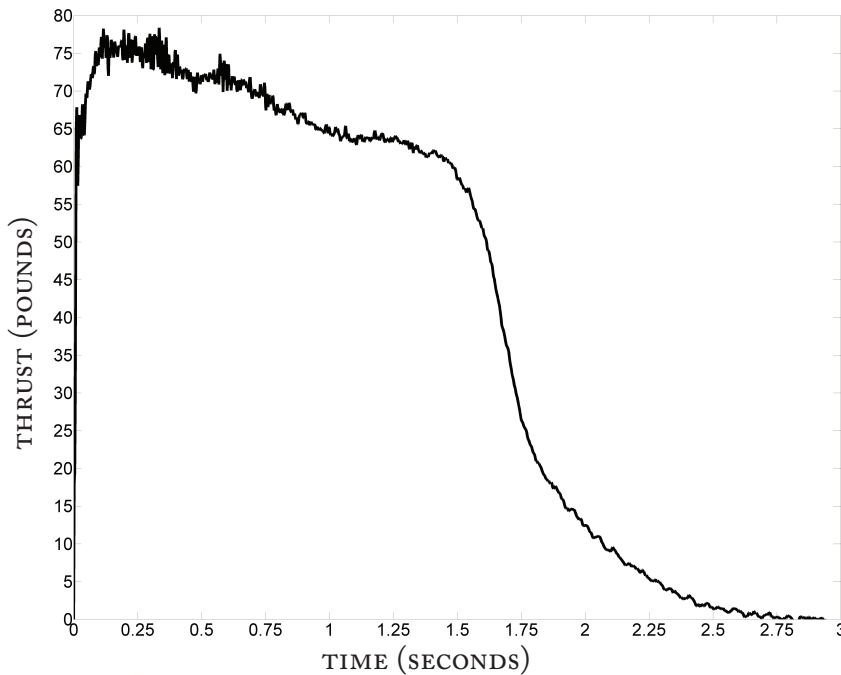




ALPHA HYBRIDS 54MM ROCKET MOTOR

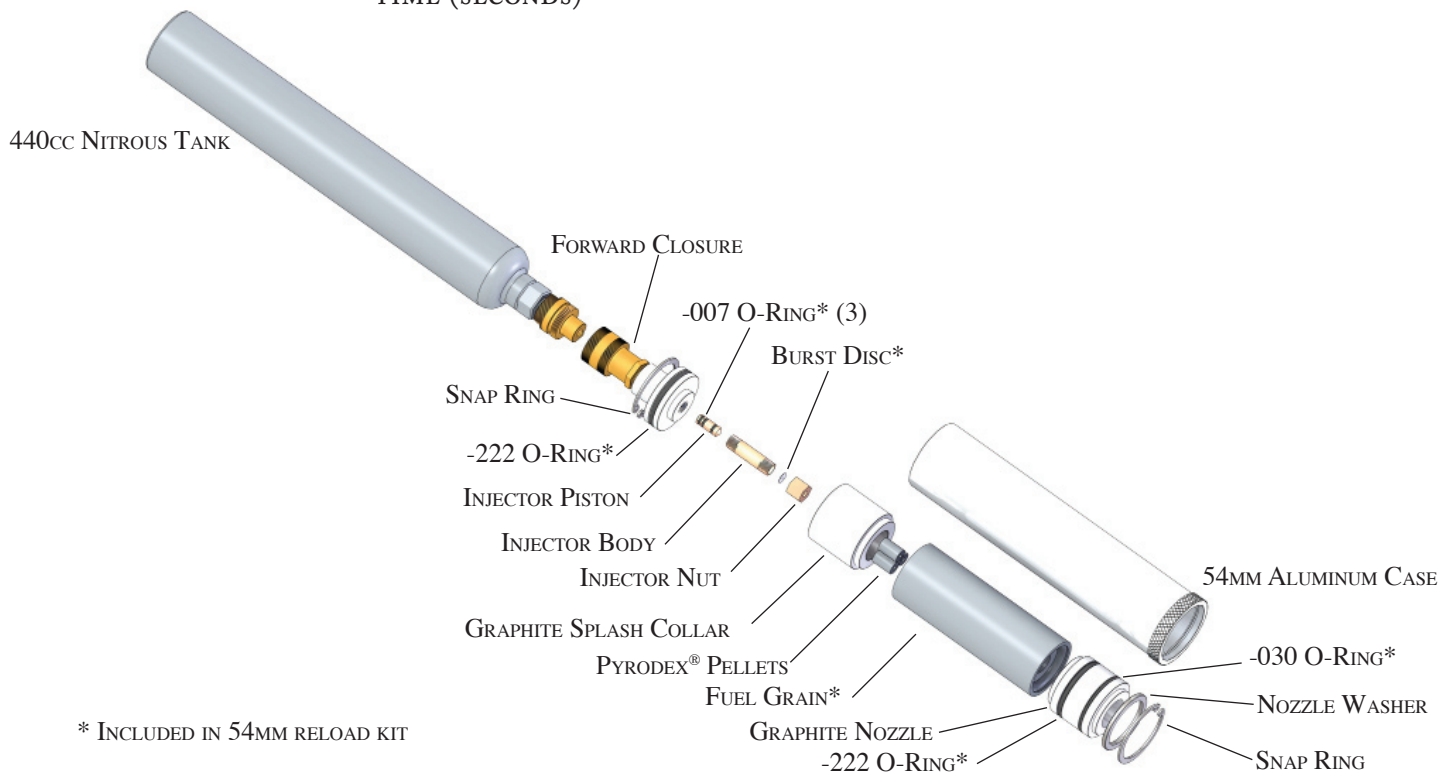
Thank you for purchasing an Alpha Hybrids 54mm hybrid rocket motor. Read these instructions thoroughly to familiarize yourself with the components, assembly procedure and operation. If you are new to hybrid propulsion, learn the component names, places, and functions in the motor.

ALPHA HYBRIDS 540I250



MOTOR SPECIFICATIONS:

DIAMETER:	54MM
LENGTH:	28 INCHES
TANK VOLUME:	440CC
N ₂ O MASS:	300g
LOADED MASS:	1855g
RECOVERY MASS:	1575g
PEAK THRUST:	84LB
AVERAGE THRUST:	50LB
TOTAL IMPULSE:	540NS



* INCLUDED IN 54MM RELOAD KIT

READ FIRST!!!

Please read this entire sheet and become familiar with all parts and procedures before beginning. Assembling the components in the proper sequence is essential to safe and proper operation of Alpha Hybrids motors. If any parts are missing, please contact Alpha Hybrids immediately.

- DO NOT use any parts of the motor that are damaged in any way. If in doubt please contact Alpha Hybrids for assistance.
- ONLY use oxygen safe greases such as Krytox® or other fully fluorinated greases where the components will be in contact with nitrous oxide. NEVER use petroleum greases in these places.
- DO NOT remove the valve from the flight cylinder or modify the cylinder in any manner. DO NOT remove or tamper with the pressure relief valve. Doing so could cause serious injury or death.
- DO NOT modify the motor in any manner. Modifying the flight cylinder, injector, reload or casing can result in motor failure and may cause personal injury, property loss, destruction and death.
- DO NOT overfill the flight cylinder. Fill only to the rated capacity stamped on the cylinder. It is a violation of Federal Law to transport a cylinder that has been overfilled. Overfilling the cylinder can cause it to burst unexpectedly causing serious personal injury or death.
- Motor will be hot after firing. Please let the motor cool before handling it. If you need to handle the motor immediately after firing use a heat resistant mitt.
- Read and follow the safety code of the *Tripoli Rocketry Association*, *National Association of Rocketry* as well as all federal, state and local laws; ordinances and regulations concerning high power rocketry activities.

FIRST AID

In the event of a minor burn, apply burn ointment. If the burn is more serious, cool the area in ice water and get medical help immediately. In the event of frostbite from venting nitrous, see a physician immediately. Components of reload are NOT ingestible. If you ingest the reload, induce vomiting and seek immediate medical attention. The reload is made of a rubber binder and paraffin wax.

FIRE SAFETY

Alpha Hybrids reloads will burn in a fire, similar to a candle. In case of a fire, water or a Type ABC fire extinguisher can be used to put out the fire. Do not inhale the fumes of combustion from the reload. If a flight cylinder is involved in a fire call 911 or contact your local fire department. The cylinder may burst and cause serious damage to property, serious personal injury or death. Evacuate all people from the danger area. Cool cylinder with water spray from maximum distance; remove cylinder from fire area if without risk.

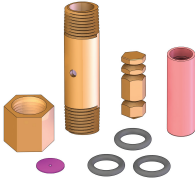
FILLING THE FLIGHT TANK

You will need the following items to fill the flight cylinder:

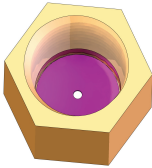
Alpha Hybrids GSE	7/8" open end wrench
8" or greater pipe wrench	Open end adjustable wrench
Safety glasses	Leather Gloves
Nitrous supply tank (10-75 pounds)	Scale capable of 1500 grams, 1 gram accuracy
Cooler with ice water	

1. Put the flight cylinder in the cooler with ice water until the the temperature equalizes. **DO NOT** submerge the valve. This is done so that nitrous flows easily into the cylinder. Do not fill flight cylinder more than 24 hours prior to planned use.
2. Attach the GSE to your tank using the adjustable wrench. Close both the fill and dump valves.
3. Place the scale on a flat, level surface within reach of the fill hose on the GSE and turn on.
4. Once the flight cylinder has cooled, take it out of the ice water and screw it onto the coupler on the GSE until it seats. Always use a wrench to connect and disconnect the flight cylinder. Never grab the cylinder to thread together. Make sure you place your wrench on the quick coupler fitting, never the tank fitting.
5. Place the flight cylinder onto the scale. Once the scale equalizes tare the scale so that it reads zero.
6. The flight tank will be filled with 300 grams nitrous oxide. Ensure that the fill and dump valves are closed and slowly open the supply tank valve fully. Open the fill valve and watch the scale closely. When the scale is approaching 250 grams start to close the valve. When the scale gets to 275 grams close the valve completely. Let the scale equalize. If the tank is short of 300 grams, gently open the valve a bit and then close when you get to 300 grams. If the tank is over 300 grams do the following to bleed off until you reach 300 grams. Close the supply tank valve. Next open the fill valve completely. Now gently open the dump valve making sure to be clear of the venting nitrous. Watch the scale and close the dump valve when it reaches 300 grams.
7. Close the supply tank valve. Close both fill and dump valves. Put your 7/8" open end wrench on the flight cylinders quick coupler and the pipe wrench on the collar of the fill coupler. Make sure that the pipe wrench and open end wrench are lined up with each other, like the hands of a clock at noon. Unscrew the tank using the open end wrench **EXACTLY 2 AND ¼ TURNS**. This will let the poppet valves inside of the coupler close. Open the dump valve slowly to let the nitrous vent. Open the fill valve slowly and let it vent the nitrous in the fill line. Do not open it all the way. The pressure on the gauge should go down indicating that the fill line is emptying. Once it is done venting you may then completely unscrew the flight tank using the pipe wrench and open end wrench.
8. Zero the scale and place the flight cylinder on it. It should weigh no more than 950 grams. If the flight cylinder weighs more you will need to bleed some nitrous off. You can do this by slowly screwing the flight cylinder back onto the fill coupler on the GSE with both the fill and dump valves open. Vent for 2-5 seconds and then disconnect the tank and re-weigh. Repeat the procedure until the tank weighs 950 grams.
9. Store filled flight cylinder in a clean environment at 75°F ±5°F until ready to assemble complete motor. Do not store cylinders in motor vehicles or in living spaces.

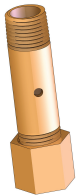
INJECTOR ASSEMBLY



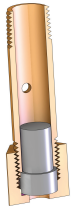
1. Gather all parts shown. You will also need 4FFFF black powder, Krytox[®] grease and a 3/16" wooden dowel or similar.



2. Push the burst disc all the way to the bottom of the injector nut. Only use one; two are included in case you lose one.



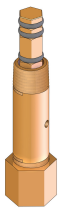
3. Screw the injector nut with burst disc onto the injector body hand tight.



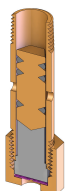
4. Fill the red cap to the top with 4FFFF black powder. Shake to settle and re-fill to the top. Pour the black powder in the red cap into the injector.



5. Put the three -007 o-rings onto the injector piston. Grease all of the o-rings with Krytox[®] grease liberally. Run a thin bead of Krytox[®] around the top opening of the injector.



6. Insert the injector piston pointed end down into the injector body. Seat firmly at the bottom with the 3/16" dowel.

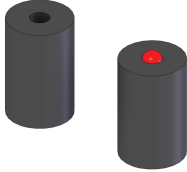


7. Assembly complete. Set the injector assembly with injector nut pointing up on a clean surface while assembling the rest of the motor. This will assure that no black powder will leak out of the injector assembly.

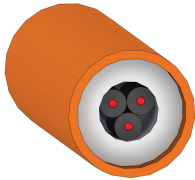
RELOAD & CASE ASSEMBLY



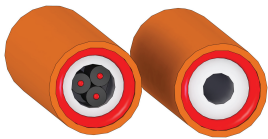
1. Gather all parts shown in the picture. You will need the following things in addition to what is shown in the illustration: Permatex® Black RTV Silicone, Slick 50® Hi-Temp Grease, ¼" Teflon® Seal Tape and 3 44/45 30 Grain Pyrodex® Pellets.



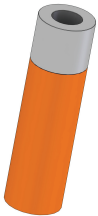
2. Fill the cores of the three Pyrodex® Pellets with Permatex® Black RTV Silicone. (Shown in red for contrast) Set aside to cure. This step can be done ahead of time so that the RTV Silicone cures.



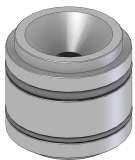
3. Insert three Pyrodex® Pellets into the preheater well on the top end of the grain. The last pellet may require gentle pushing to get in. Make sure that none of the pellets crack.



4. Put a 3/16" bead of Permatex® Black RTV silicone on each end of the grain as shown in red in the picture. The motor should be fired before the RTV has cured for best protection and ease of cleanup.



5. Put the graphite splash collar on the reload and seat firmly. The splash collar goes on the end where the Pyrodex® Pellets fit into the preheater well.



6. In a clean area inspect all the o-rings and make sure they are clean. Then place one -222 (thicker) o-ring onto the nozzle as well as one -030 (thinner) o-ring onto the nozzle.



7. Insert the nozzle onto the other end of the reload and seat firmly. Put three BB sized dots of Slick 50® Grease evenly spaced on each o-ring. Then smear to coat the o-rings fully. Put 3 BB sized dots of grease inside of the case on the knurled end. Smear to coat the inside 1" of the case evenly.



8. Install the assembly splash collar first from the knurled end into the case. Push the o-rings past the snap ring groove by 1/8" to 3/16".



9. Seat the nozzle washer on the lip of the nozzle.



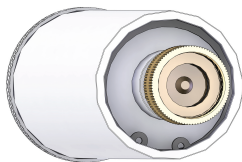
10. Insert one snap ring into the snap ring groove. Make sure that the flat face of the snap ring, not the slightly rounded face, is facing outward.



11. Holding the injector assembly thread side up, put three to four wraps of Teflon[®] tape on the threads in a clockwise direction. Next thread the injector hand tight into the forward closure and then tighten with a 6" pipe wrench. Make sure not to mar the injection ports with the wrench.



12. Install the remaining -222 (thicker) o-ring into the groove on the forward closure. Rub the o-ring between your fingers to transfer the grease from previous steps to the o-ring. DO NOT add additional grease.



13. Insert the forward closure into the forward end of the case and install the snap ring with the flat, not slightly rounded face, facing outward.

14. Push to snap on both snap rings to insure they are seated in the grooves.

FINAL ASSEMBLY AND FLIGHT PREPARATION

The following items are necessary for final assembly and flight:

Assembled casing	Filled flight cylinder (300 grams N_2O)
7/8" open end wrench	10" or larger pipe wrench
E-match, igniter or similar	Safety glasses
Gloves	

The final assembly of the motor should be done after the rocket has been fully prepared for launch. All electronics should be installed and ready to be armed and parachutes packed. The last step before flight is mating the filled flight cylinder with assembled casing. Make sure that the tank is within $75^{\circ}F \pm 5^{\circ}F$ for flight. Use water to cool or heat the flight tank to the proper temperature range. If necessary assemble with the flight tank cooler or warmer depending on local environmental conditions to insure that it will be within the range when the motor is fired.

1. Working on a clean surface with safety glasses and gloves mate the fill nipple of the flight cylinder into coupler on the casing forward closure. Thread the collar onto the fill nipple until resistance is felt.
2. Pointing the cylinder away from you and bystanders fit the pipe wrench on the collar of the coupler and the 7/8" open end wrench on the fill nipple. Tighten the flight cylinder slowly until fully seated.
3. If the injector leaks or hissing is heard immediately disconnect the tank from the cylinder using the pipe wrench and 7/8" open end wrench. A slight pop may be heard as it disconnects. Disassemble, clean and reassemble the injector followed by reassembly of the casing.
4. After seating the fill nipple into the coupler the motor is ready to fire. Install with positive motor retention and proceed to the launch pad with an igniter.
5. Load the rocket onto the pad and arm the electronics. Check to ensure that the pad leads are dead and connect your igniter to the leads. Install the igniter through the nozzle until it contacts the Pyrodex pellets at the top of the core. Create a loop with the extra wire and push into the nozzle to hold the igniter in place.
6. Clear area and relocate to proper safety distances as prescribed by *Tripoli Rocketry Association* or the *National Association of Rocketry*.
7. Launch rocket.

POST FIRING & MOTOR CLEANUP

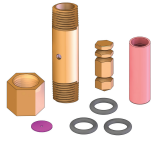
WARNING: Motor will be hot after firing. Use gloves to protect your hands when removing motor from rocket.

Clean the motor as soon as possible after firing. Cleaning after 24 hours becomes much more difficult. Warm soapy water should be used to clean the motor. A mild abrasive such as baking soda may be used. Stubborn spots generally respond to CRC® Brakleen.

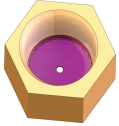
1. Unscrew the flight cylinder from the casing using a pipe wrench and 7/8" open end wrench. Replace the plastic sleeve on the flight cylinder to keep it clean. Store in a clean place.
2. Remove the forward closure snap ring with care. Clean and set aside.
3. Remove the forward closure and injector. Take off the forward closure o-ring and discard. Remove the injector with the 6" pipe wrench and set aside.
4. Pull the graphite splash collar out and set aside.
5. Remove the nozzle snap ring and nozzle washer. Using a 1" dowel wrapped in a towel carefully push the graphite nozzle out by inserting the dowel from the forward closure end. Make sure to have an extra set of gloved hands ready to catch the nozzle when it comes out. The nozzle may be hot.
6. Remove the o-rings off the nozzle and discard. Set nozzle aside.
7. If the reload was not pushed out in the previous step use the 1" dowel to push all of the reload out. Discard the reload. It cannot be re-used.
8. Using a rag and warm soapy water clean the forward closure, nozzle, graphite splash collar and casing. If stubborn parts still remain a cleaner such as CRC® Brakleen will be very helpful. After cleaning, dry off parts and store in a clean place.
9. To clean the injector, unscrew the injector nut and use a 3/16" dowel or similar to push the injector piston out. Remove all o-rings and discard. Clean thoroughly. Leave no residue on the injector. If needed, use a mild abrasive such as baking soda or use CRC® Brakleen. After the injector parts have been cleaned, rinse with hot soapy water and let dry.
10. After all parts have been cleaned dry them and store in a clean place.

QUICK REFERENCE GUIDE

INJECTOR ASSEMBLY



1. Gather all parts shown



2. Place burst disc into injector nut



3. Screw injector nut to injector body



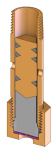
4. Fill red cap with black powder and pour in injector body



5. Install three -007 o-rings onto injector piston and grease with Krytox®



6. Push injector piston pointy end down into injector body and seat firmly



7. Store injector with injector nut pointing up to prevent black powder from leaking

RELOAD & CASE ASSEMBLY



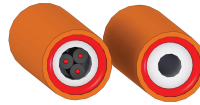
1. Gather all parts shown



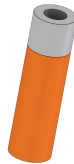
2. Fill Pyrodex® Pellet cores with RTV and let cure



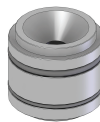
3. Place three pellets in preheater well



4. Place a bead of RTV inside each end of fuel grain



5. Place splash collar on end with Pyrodex® Pellets



6. Put one -222 o-ring and one -030 o-ring on the graphite nozzle



7. Place nozzle on opposite end of fuel grain and grease o-rings



8. Push reload into the case from the knurled end



9. Place nozzle washer onto nozzle step



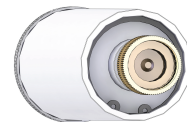
10. Insert snap ring into groove



11. Apply Teflon® tape to injector and tighten with 6" pipe wrench



12. Put one -222 o-ring onto the forward closure - DO NOT GREASE



13. Insert forward closure into the case and insert snap ring. Push on both snap rings to insure they are seated