Micro Hybrid Assembly Instructions.

This is my preferred assembly method for the Micro Hybrid.

Before any assembly the motor should be inspected for any damage, wear or dirt, special attention should be paid to the internal circlip groves, these should have a crisp edge and not be obstructed with dirt or residue build-up, this is the most common cause of motor mishap, the circlips not holding when under load of Nitrous release or firing due to worn or dirty grooves.

1) If using a paper fuel grain ensure that it fits into the motor casing, some paper fuel grains require either a wrap removing or sanding, If using a plastic fuel grain place paper disk at either end of the grain to stop it from sticking to the nozzle and injector housing.

2) Wrap the Nitrous Oxide bulb with masking tape to make it a snug fit inside the motor casing it must still slide without having to use force, ensuring a central fit within the body tube Nitrous bulb neck must be centred to align with the piercer.

3) Grease the two large O-rings and small O-ring with Nitrous safe grease such as Krytox.

4) Prepare the Piercing unit / injector and injector housing as follows:
   a) Place a pre-heater grain in the pre-heater well (the shallow but larger diameter well) My Preference is a coil of PIC coiled with a tail coming from the centre that extends out of the nozzle to an external ignitor, or this can be an Aerotech D21 fuel grain with the outer paper peeled off and inserted into the pre-heater well and then trimmed flush with the top of the well. Ensure the slot in the fuel grain extends over the hole through the centre of the housing, if it does not then drill a hole through the centre of the pre-heater; this is best done from the front of the housing.

   b) Into the piercing unit well of the injector housing insert a burst disk followed by small O-ring and the injector, the injector should be positioned with the flat side against the O-ring and the point facing out.

5) Assembly is started at the forward end of the motor by inserting the forward inner circlip. Due to the Circlip manufacturing process stamping them from sheet metal, they may have a rounded edge on one side and a flat side the opposite side, ensure the circlips are installed with the flat sides to the outside ends of the body tube so that when under load they don't try to slip out the rounded side is prone to slippage.

6) Put in the T-nut with the threaded section forwards and the flat to the rear (inside).

7) Insert the ISI nitrous bulb rounded end forward, do not push all the way in leave the neck of the bulb protruding for the moment.

8) Holding the casing vertically (forward end uppermost) at all times until instructed otherwise (or you may move the injector / piercing unit. Place the prepared injector housing/injector and preheater assembly under the nitrous bulb and gently insert it in to the rear end of the motor housing. Be very careful not to dislodge or move the injector on its O-ring. The point of the injector should be central in the indent of the front face of the nitrous bulb.

9) Insert one of the pre greased large O-rings into the rear of the motor housing so it is against the injector housing.

10) Insert the fuel grain (if using a plastic grain it is advisable to place a paper disk on each end to stop the plastic sticking when hot). Slide all of the way in, until the T-nut is securely against the forward circlip keeping it pressed in place you can now turn the whole assembly over.

11) (if using a plastic fuel grain ensure the paper disk is on the nozzle end, if not insert one now) Insert the second large O-ring into the motor housing and place it against the end of the fuel grain.

12) Insert the nozzle so that the O-ring will seat into the grove in the forward face of the nozzle. If using a PIC preheater ensure the PIC tail exits the nozzle whilst fitting the nozzle.

13) Insert the rear circlip ensuring it is the correct way round (rounded side inwards flat side outwards) and properly seated in the groove.

14) Lastly insert the outer circlip into the grove at the rear of the motor housing.

15) Insert an ignitor through the nozzle so that it touches the pre-heater grain and secure in place. Or if using a PIC preheater attach the ignitor to the pic tail outside of the nozzle.

Just before you are ready to launch your rocket arm the Nitrous by tightening the arming bolt, there may be a slight his as the bulb seals over the injector, this should stop as you finalise tightening the bolt, do not over tighten the bolt or you may damage the O-rings and injector.

If using the PIC with tail pre-heater ensure the RSO is aware that there will be second or twos delay from ignition to launch. With other preheaters they may be a little some for a second then the motor will come to life with some noticeable flame and noise.

If you have a miss fire then holding the motor at arm's length (wear suitable gloves for handling Nitrous) slowly loosen the arming screw slightly until the Nitrous start to escape from the front of the motor casing, keep clear of the front end the Nitrous is extremely cold and can cause frost bite.

After Firing the motor be careful as the motor casing and internal components may be hot.

Disassemble the motor in reverse order inspecting all components for wear, replace any worn components, carefully inspect the nozzle for wear, cracks or chips and replace if there are any suspect areas. Clean all parts of residue whilst fresh to ease clean-up, again take care cleaning the soft graphite nozzle it is easily damaged.

By arming or firing this motor you agree to do so at your own risk and release us of any liability in case anything should happen to you or your property. It is your responsibility to provide for the safety of yourself and others during arming or firing of the Micro Hybrid.

FUEL GRAINS

The Micro Hybrid was initially designed to burn paper fuel grains, however we have tested it with nylon, pvc and acrylic fuel grains with great success. We will be making these fuel grains available as spare parts. For cost effective flights the paper is best but for a more pronounced flame and more power the plastics are better.

SPARE PARTS

If you require any spare parts for your Micro Hybrid then please feel free to contact us with your requirements. We will then give you the current price on the item you require. Parts available as spares are:

1. Blank Carbon for making your own Nozzles sold by the inch.

2. Brass for making your own Injector.

3. Aluminium tube for motor casing.

4. Aluminium Bar for Injector Body.

5. Pre machined Nozzles, Standard or to your specifications.

6. O-Rings.

7. Burst Disks.

8. Circlips (internal and external).

9. Injector, standard or to your specification.

10. Injector body.

11. Motor casing.

12. Alan Key.

13. Screw and T-Nut.

14. Paper Fuel Grains.

15. Nylon Fuel Grains.

16. ISI Nitrous bulbs.

WHAT ELSE SHOULD I KNOW?

The aluminium tube used for the Micro Hybrid motor casings is not the same size as specified by Rene and hence measurements will not match up exactly with his as the tube available in the UK is slightly smaller. It has hence been necessary to redesign the motor slightly, both plans are now included. Also the injector and nozzle has been redesigned to give a better performance.

COMPLETED MOTOR KIT CONTENTS

Your completed Micro Hybrid should contain:

One aluminium motor casing.
One Injector body.
One Graphite Nozzle.
One brass injector.
Three large O-Rings and two small O-Rings.
Two paper fuel grains and NOX bulbs*.
Ten Burst Disks.
One Alan Key, screw and T-Nut.
Modified Plans as Per this Hybrid.
One outer circlip and two internal circlips.

* NOX replaced with paper fuel for international orders

The Micro Hybrid

Eclipse Rocketry

24 Wolston Meadow,
Middleton,
Milton Keynes,
MK10 9AY
Mobile: 07515 253193
Email: Roy@EclipseRocketry.com

IMPORTANT INFORMATION

Congratulations on the purchase of your Micro Hybrid, please read all documentation supplied with your motor before firing it.

Disclaimer

The Micro Hybrid uses circlips to hold everything inside and should be inserted carefully and the correct way around to avoid the possibility of parts of the motor being ejected when arming or firing.

By arming or firing this motor you agree to do so at your own risk and release us of any liability in case anything should happen to you or your property. It is your responsibility to provide for the safety of yourself and others during arming or firing of the Micro Hybrid.

Safety

1. Follow the instructions carefully for preparing the hybrid.

2. When arming the hybrid ensure the ends are not pointing at anyone or yourself.

3. It is advised to wear protective gloves when arming or handling an armed hybrid. If the injector / O-ring is not seated properly, liquid NOX will vent out of the engine. Liquid NOX is cryogenic (it freezes anything it touches).

4. If you have a failed launch due to burst disks not bursting care should be taken when venting the NOX, see previous point.

5. Follow the UKRA or governing body's safety code for the launch of model rockets.

6. After firing the motor casing can be hot.

7. Ensure the circlip grooves are free of any debris.

8. Insert the circlip flat side outward. Circlips are made by stamping them out of sheet metal and hence have one side that is slightly rounded.

9. If the circlip grooves show sign of wear get a new casing it could be dangerous.

IGNITERS

The instructions supplied detail how to modify an Estes igniter to initiate the Micro Hybrid however I have also used First Fire Junior, and Igniter Man igniters made from thin wire.

PRE-HEATER GRAIN

We have had good success with the following methods.

1. Using spare (29mm RMS) delay grains from Aerotech reloads or D24 reload grains. You can make 5 or 6 pre-heater grains from one delay grain. To use a delay grain simply trim the diameter to slightly oversize for the pre-heater recess then force it into the pre-heater recess. The recess will cut the grain to size (it is very soft). If using D24 reloads just peel off the paper outer layer and insert in the pre-heater recess. Next using a sharp knife cut off flush with the surface of the pre-heater well. (Dispose carefully of any trimmed material).

2. Using a compressed black powder pellet or black powder mixed with a binder has worked successfully. However you should not make your own black powder pellets in the UK either by compression or by additive of a binder as this contravenes the 1875 Explosives act, and requires proper paperwork to do so. Also extreme care should be taken as BP burns generating a lot more pressure and if too much is used can overpressure the motor and cause a circlip to blow out followed by the motor contents.

3. Make a coil out of Plastic Ignitor Cord (PIC) that will fit in the pre-heater well, leave a tail of PIC from the centre of the coil that is long enough to pass through the fuel grain and out of the nozzle, this can then be lit by a standard ignitor outside the motor.

The delay grain pre-heater will take slightly longer to initiate the flow of nitrous a compressed BP grain but a D24 is the fastest method of igniting the Micro Hybrid. PIC has a slight delay due to the time it takes to burn along the inside of the fuel grain to the preheater well.

We have even managed to start the Micro Hybrid with just an Igniter Man igniter with a larger than normal amount of pyrogen. Check local legislations for legality of each method detailed.