

# PML HARDWARE FAQ

2/24/07

## Launch Lugs

- All our round/tubular launch lugs under  $\frac{3}{4}$ " are thin-wall brass tubing, like a brass soda straw.  $\frac{3}{4}$ " lugs are thin-walled copper tubing.
- The round lug sizes refer to the size rod they fit. For example, if a kit has a  $\frac{3}{8}$ " launch lug, that means it loosely fits a  $\frac{3}{8}$ " launch rod.
- Customers sometimes ask: "Is it OK to put the launch lug in the corner of a fin root and the main body? The instructions say to put it in-between two fins, but it would produce less drag near a fin root and would be stronger also." This can be done if you're careful, but by putting the lug at the fin root, you limit the size of the fillet. If you make the fillet too big, the epoxy will block the ends of the lug. Also, it just makes it harder to sand that area of the rocket while painting.
- Our Linear Rail Lugs can be screwed or glued, or both. Any epoxy will work but JB Weld is strongest. Some customers ask about screws interfering with the piston. Usually there is dead space in the booster area so we glue and screw there. If the screws might interfere with the piston travel or other functional item, we simply epoxy it in place.

## Motor Retention

### *Thrust Ring*

High-power kits don't use a thrust ring in the front of the motor mount like Estes-class rockets do, because high-power motors can vary greatly in length. Therefore, if you glued in a thrust ring you'd be stuck flying only that length of motor.

If you use a reloadable motor for high-power flights, the lower closure has an OD larger than the OD of the motor mount tube, so that provides the thrust ring by transmitting the force against the bottom of the motor mount tube. If you're using a single-use motor, as opposed to a reloadable, you'll need to wrap masking tape around and around the base of the motor, until you've built up maybe  $\frac{1}{16}$ - $\frac{3}{32}$ " thickness of tape to act as a thrust ring against the OD of the motor mount tubing. That's typically how it's done, and works just fine.

### *Motor "Ejection Clip"*

Regarding retaining the motor from ejection, you have a few options. In high power rockets, there is no "engine clip" like you may be used to with model-rocket-sized products. Many people use masking tape around the motor casing for a tight friction fit to the inside of the motor tube. You need it to be tight enough that the motor will hold against ejection charges, but not so tight you won't be able to get it out after the flight; it just takes a little practice.

A more solid retention option is to use one of our PMR or HAMR motor retainers described below. They work great and are really easy to use.

### ***HAMR Motor Retention System***

PML has developed our own line of high quality, threaded motor retainers! The HAMR (Highly Adaptable Motor Retainers) system has been designed specifically for use with our rocket kits or any scratch-built rocket using PML motor tubes. These lightweight, tool-free, threaded retainers are precision CNC turned from 6061 aluminum and anodized.

These retainers fit virtually all popular motor brands and types including Aerotech RMS™, CTI Pro XX™, Animal Motor Works™, Hypertech™, Kosdon™, Sky Ripper™, Loki™, and others.

The HAMR system can be adapted to existing rockets if the motor tube extends at least 3/8" beyond the aft centering ring. The HAMR can also be used with boattail and tailcone rockets.

PML offers both a HAMR system for standalone/single-diameter motor mounts, and a HAMR system for PML's popular Kwik-Switch 54/28/29mm motor mount system.

### **General notes for retro-fitting the HAMR system onto existing rockets and other important information**

1) The motor tube must protrude 3/8" beyond the aft ring for the sleeve to fit. If the rocket is already built and the motor tube is flush with the ring, difficult but possible surgery is required for a retro-fit. You will have to Dremel out the aft ring, Dremel back the fin tabs about 1/4", then insert a new ring to the proper depth to expose 3/8" of the motor tube. This is beyond what most people would want to do. In this case, the best solution is the original Public Missiles Ltd. PMR.

If the motor tube protrudes more than 3/8", the motor tube can be cut back to fit. Depending on how much tube needs to be removed, you can use a hack saw, X-Acto razor saw, or a coarse sanding block.

2) For years we have only sold the PMR for motor retention. Hence all of our kit instructions state that the motor tube should be flush with the aft centering ring. But as stated in note #1 above, the motor tube **MUST** protrude beyond the aft centering ring by 3/8". You can confidently ignore the kit instructions and make the required adjustment to facilitate the HAMR system. There will be no adverse effects to the rocket, it's assembly, or it's flight characteristics. However, it is always prudent to check the CP/CG relationship on any rocket before flight.

3) It is actually a very simple matter to retro-fit a rocket that uses a boattail or tailcone. Simply scribe a line around the boattail or tailcone 3/8" from the base and cut this section off with a Dremel cut-off wheel leaving the motor tube intact and exposed. Of course, you can perform the cut with a hacksaw blade or X-Acto razor saw just as easily. This

method works with kits where the motor tube is wedged into the narrow end of the boattail without the use of a centering ring (IE. Bull Puppy, Pit Bull 256). It will not work with the Bull Dog or Pit Bull 600 since these have a centering ring at the base. See note #1 above for details.

4) JB Weld, Loctite Weld, or similar must be used to secure the sleeve to the motor tube. These epoxies have a high temp rating, are not brittle, and bond very well with phenolic and aluminum. Common hobby epoxy may soften from the heat of the motor and fail. Do NOT use standard hobby epoxy or even the epoxy PML sells for general kit construction. The high temperatures generated by the motor can cause these epoxies to fail. The motor retainer sleeve should be inspected after every flight to make sure the impact from landing did not loosen the retainer sleeve.

5) For the KS washers to work with older KS kits already in the field, both adapter tubes must be cut 1/8" to 3/16" by the user. In the past, we made the adapter tubes a bit long to aid in insertion and removal of the adapters within the mother tube. This is not really necessary and now the adapter tubes are too long to work with the HAMR-KS adapters. The tubes can be easily cut by the user with a hack saw, Dremel, miter saw, X-Acto saw, etc. whether they are assembled or not. Beginning in mid-February 2007, we have changed the length of the KS adapter tubes to accommodate the use of these retainers. This includes all KS kits that were in stock at that time. Keep in mind that dealers may have older kits on their shelves for an extended period of time. If all of the tubes in the Kwik-Switch set (Mother tube and both adapter tubes) are the same length, then you have the new version. This change will not affect the use of the original PMR KS version.

6) The bonding surface of the sleeve must be sanded with 80 grit sandpaper to thoroughly scuff the anodized surface. The anodizing does NOT have to be removed (that's almost impossible anyway), just scuffed.

7) The motor tube must be sanded with 80 grit as well. The retainer sleeve should fit loosely on the motor tube. IE. It should just fall off when tipped. This will assure that the JB Weld (or similar) is not just pushed out of the way when mounting the sleeve on the tube. The sleeve's bonding surface and the tube should be coated with the epoxy and then the sleeve should be pushed onto the tube with a slow twisting motion. Any epoxy squeeze-out can be removed when the epoxy gels but before it cures.

8) After....and only after....the adapter sleeve is epoxied to the rocket, the threads can be lubed with a tiny bit of grease for smoother threading of the 2 pieces and to prevent future galling (however unlikely). The grease should not be applied before assembly since even the slightest bit accidentally smeared on the bonding surface will weaken the epoxy bond.

### ***PMR Motor Retention System***

- Regular (non-KS) motor retainers use the lower centering ring as the anchoring point for the threaded inserts. For Kwik-Switch motor retainers, they do not mount to the KwikSwitch adapters, but actually span across to the CR that holds the KS Mother

tube to the airframe. Both KS retainers (one for 29/38mm and one for 54mm) have the same bolt hole pattern, just the ID is different. The reason we had to do this is that the Medusa nozzle on the 54mm motors is larger in OD than a 29mm motor casing; two different retainers with different ID's were required.

- The PMR-29/38-KS and the PMR-54 stainless steel retainers have the same “hole pattern” dimensions. This means they can be interchanged on the same rocket. However, they will NOT interchange with the hole pattern for a PMR-29/38. Said another way, if you have a rocket that can use a 54mm and a 38 or 29mm, EVEN IF IT DOES NOT USE A KWIK-SWITCH SYSTEM, you must buy the PMR-54 and PMR-29/38-KS. The “non-KS” PMR-29/38 and the PMR-54 do not have the same hole pattern; the PMR-29/38-KS and PMR-54 do.
- PMR-29/38 should not be used on CR-2.1-1.5 (1.5=38mm) and CR-2.5-2.1 (2.1=54mm) as there is not enough wood for ample insert anchoring. PMR-29/38KS and PMR-54 should not be used in a Quasar kit or with any CR-2.5-2.1 application.
  - CR-2.1-1.5 kit examples: Callisto 38mm, Io 38mm, Phantom/X-Calibur, Phobos 38mm, Explorer 38mm, Black Brant VB 38mm
  - CR-2.5-2.1 kit examples: Quasar, Small Endeavour, Tempest, Thunder ‘n’ Lightning
- Since the threaded inserts for the KS-compatible retainers require a 3/16” hole drilled in the aft centering ring, no retainer is available for a 2.5" diameter rocket using a 54mm motor mount. The PMR retainers cannot be used with boattailed or minimum diameter rockets (with the exception of our Bulldog kit, which has enough exposed centering ring area at the boattail). For ideas on other motor retention options for kits which cannot use a PMR system go to Rocketry Online at [www.rocketryonline.com](http://www.rocketryonline.com), click on InfoCentral, then on Construction, then on Motor Retention.
- PMR motor retainers **should NOT** be used on Loki motors. The retainer will very slightly block the exit of the motor causing overheating of the retainer and/or motor casing and potential failure of the retainer, motor casing, or both. For retainers to use with Loki motors goto <http://www.lokiresearch.com/retainer.asp>.
- Extra PMR inserts are available separately so you can equip all your rockets for the motor retention system without having to buy a complete retainer system for every rocket.
- We recommend installing the PMR after the rocket is built. This gives the best support for the ID of the centering ring when drilling for the inserts.
- The PMR-54 will work with many hybrid motors; it does not work with a Hypertek J grain, the hole ID on the PMR is about 1/8” too small.
- The PMR system will work with Cesaroni Pro38 motors.
- The PMR-29/38KS and PMR-54 use 8-32 screws. The PMR-29/38 uses 4-40.

### ***Other Motor Retention Solutions***

See the Motor Mounts FAQ for details on other potential positive motor retention solutions for PML kits.