**Loki Research**

**Instructions for gluing 38/1200 grains into the liner**

**Items Needed**

1 – A large enough covered work area to epoxy grains that is very flat, level and stable.

2 – Rubber Gloves

3 – Saran Wrap, double a piece over so that it is two layers thick and at least 4” x 4” square. (found in these instructions)

4 – Paper towels

5 – 1” wide clear Scotch tape. (Some can be found on the back of the plastic bag containing the propellant)

6 – Epoxy and mixing cup. (At least 30 minute epoxy is preferred and 20 grams should be plenty)

**Before Beginning**

Great care has been taken to eliminate any wasted space in order to maximize propellant loading. It is extremely important that you install all of the grains in the correct numbered order and in the direction in which all alignment marks line up together to ensure everything fits properly. Dry assemble the complete motor (except for the smoke grain and Nozzle O-ring) to ensure that all of the reload components fit together in the motor case with about 1/64” to 1/16” of room to spare. Grease the bulkhead o-ring and lightly grease the forward end of the case. If the grains or liner are too long to install both retaining rings, lightly sand the parts down until the snap rings are able to be easily installed in the grooves.

Because of variance in manufacturing tolerances of the liner and propellant grain tubes, some grains will fit tight while others will not. **When inserting the grains, if many pounds of force is required to push all of the grains into the liner, they do not need to be bonded in with epoxy and you may go ahead with the complete motor assembly. However, if you are able to, glue in the very bottom two grains.** If the bottom grains are the least bit loose, the paper tube may spit out of the nozzle in whole, possibly cracking the nozzle. Otherwise, if the grains are loose enough, push the grains back out of the liner using a large wooden dowel and follow the instructions below.

**Completely read each step before beginning.**

**Only the bottom half of the propellant grains need to be glued in place.**

1 – Set the 1st grain marked nozzle on the table with the arrow pointing down. Place the next matching grain on top so that the marks are aligned together. Be sure to vertically align the grains so they sit together flush and strait, so that the sides are even at the joint all the way around.

2 – Using plastic Scotch brand tape, carefully and straightly place one complete wrap of tape over the grain joint. Go slow so you do not wrinkle the tape making sure the tape is placed on fairly strait and centered over the grain joint. If the tape gets wrinkled, try to straighten it out, or carefully remove it and start with another clean piece of tape. Use a razor blade to trim off any overlapped tape. Be sure that the tape and tape edges are firmly adhered to the grain.

3 - Test the fit these first two grains into the liner tube. If a single wrap of tape makes it too tight to push them in, push them back out with a large wooden dowel and carefully remove the tape. In this instance, glue only the bottom two grains into the liner. See the appendix at the end. If they fit snugly in the liner with the tape, push them back out and continue with step 4.

4 - Place the next matching grain on top, aligning the marks and repeat step 2 until all grains are taped together. Lay down the entire grain stack when this is completed.

5 – Prepare and clean off your work place for gluing the remaining grains in. Weigh out a cup of 15-30 minute epoxy. About 15 to 20 grams should do fine.

6 – When you are gloved up and ready, thoroughly mix the epoxy. Next, stand the taped stack of grains in the vertical position, nozzle grain on the table, holding it near the top. Do not “man handle” them as the tape is the only thing holding it all together.

7 – Tilt the stack at a very slight angle and pour the epoxy down the side. Quickly begin to coat the grains with one hand only, using your other hand to hold the very top of the stack. Be careful not to let the epoxy drip down to the bottom or drip off onto your tables work space. Once you have completely covered the taped grains with epoxy, stand the stack back up strait.

8 – With your clean hand, pick up the liner and place it on the top of the epoxied stack being sure to align the markings. Slowly push the liner strait down over the epoxied grains. Do not twist the grains. Work any excess epoxy down the grains as the liner is pushed further down. You should have enough epoxy on the grain stack so that there is always excess epoxy being pushed off.

9 – Push the liner all the way down flush to the table, then quickly pick it back up. Using a clean paper towel, wipe off any epoxy that is on the liner or on the bottom of the propellant grain.

10 – After cleaning off any remaining epoxy, lay the liner down on its side on a clean surface.

11 – Set the nozzle on the table (entrance cone up) and place the doubled up layer of Saran Wrap (found in these instructions) over the top of the nozzle. Stand the liner (nozzle end down) over the shoulder of the nozzle and firmly push down on the liner until the nozzle shoulder and the liner are flush with each other at the base of the nozzle shoulder.

12 – Place the forward closure on the top end of the liner and firmly push down to ensure that the grains are pushed tightly against the nozzle.

13 – Remove the closure and carefully place the assembly upright in a corner until the epoxy has cured enough so that the grains are held firmly in place. It is important to allow plenty of time for the epoxy to set with the nozzle and saran wrap in place. If not left to dry and the nozzle is removed, the epoxy may puddle on one side behind the nozzle grain which may prevent you from seating the nozzle back in place. If this happens, you must carefully remove the epoxy obstruction. Do not fly the motor until the epoxy is fully cured.

14 – Only after the epoxy has reached the gel stage (as verified by the epoxy on the side of your mixing cup) and the grains a guaranteed not to move, remove the nozzle and Saran Wrap. Using a knife, remove any remaining epoxy that has pooled at the bottom of the liner around the liner shoulder to ensure that the nozzle will be unobstructed and can be reinstalled flush with the shoulder once it is put back in place.

15 – Lay the liner back down on its side and allow the epoxy to harden some more. Afterwards you may complete the rest of the normal motor assembly.

Using this method may seem a bit lengthy at first, but it has several advantages.

– It is the best way to ensure that you don’t get epoxy on the grain faces, inhibiting the propellant surface.

– It ensures that the epoxy doesn’t set up by the time you get all the grains into the liner. Gluing one grain at a time can be time consuming for some. Sliding the liner down over the entire epoxied stack of grains should take no more than 60 seconds.

– As you slide the liner down over the stack, each wrap of tape acts like a small wiper, pushing the epoxy above it up and into the liner. This ensures that there is plenty of epoxy inside the liner where it needs to be.

**Appendix** –

1) Insert the #6 grain into the liner with the direction of the arrow. Push in each subsequent grain into the liner while carefully lining them up to the next grain. Do not rotate the grains but push them strait in. Continue until about ½” of grain #4 is sticking out from the end of the liner so you can still see the alignment marks.

2) Carefully coat the #5 & #6 grain with epoxy, using care not to get epoxy on the grain faces or bore. Stand the grains up on the table with the numbered end up.

3) Aline the markings at the top of #5 grain with the markings from grain #4 that is sticking out from the end of the liner. Push the liner down over the #5 grain until ½” is exposed. Repeat this step with the last grain #6. When finished, pick back up with instruction Step #10.

If you have any questions, please email me or call and ask.

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