**Loki Research**

**Instructions for gluing multiple 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 – 2 layers thick and large enough to extend at least 1 inch past the diameter of the nozzle in all directions.

4 – Paper towels

5 – 1” wide clear Scotch tape.

6 – Epoxy and mixing cup. (≥30 minute epoxy is preferred) West Sytems 105/205 resin/hardener or equivalent is recommended.

**Before Beginning**

1 – Dry assemble the complete motor (except for the smoke grain and O-rings) to ensure that all of the reload components fit together in the motor case with about 1/32” to 1/16” of extra room to spare. If the grains or liner are too long, lightly sand the parts down until they fit with the required extra room. If necessary, use a large wooden dowel to push the grains back out of the liner when you are done.

2- If for some reason the grains are an extremely tight fit and they will not allow room for one single wrap of scotch tape, try removing the grain labels if any. They should be tight enough to require some amount of force, but not excess force. If they are still too tight for tape, then do not tape the grains together. Glue the grains in one at a time the old fashion way, one at a time, gluing in only the bottom 3 to 4 grains. Move quickly and use an epoxy with a ½ to 1 hour pot life and pick up at step #12. Be very careful not to get any epoxy on the grain faces. When finished, install the upper grains without glue.

3 – For every grain, cut off a piece of clear 1” wide Scotch tape which is long enough to wrap completely around each grain.

4 – Prepare your work space for using epoxy.

**Completely read each step before beginning, then read it again**

1 – If the grains are labeled, numbered, and/or have alignment marks, begin with the nozzle end grain (#1) with the arrow pointing down, followed by each succeeding grain. Set the #2 grain on top of #1. If there are pre-made lines drawn on the grains to align them with each other, please use them. Otherwise, just start with the grains marked for the nozzle end and work your way up to the top grain. *The M-3000 Loki White grains will not be marked.*

2 – Using clear, 1” wide Scotch 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 piece. Have a second person apply light pressure to the upper grain to hold it in place. Use a razor blade to trim off any overlapped tape. Be sure that the tape and tape edges are firmly adhered to the grain. **Before continuing, test fit these two grains in the liner and refer to Step #2 above in the “Before Beginning” section.** After the test fit, pull or push the grains out of the liner from the opposite end.

3 – Put a third grain on top of the bottom two and repeat the process, again having someone hold the stack of grains in place. Be sure to align and center each grain before applying the tape.

4 – Continue straightly stacking the grains in proper order on top of each other, being careful not to let the stack fall over. This is the second person’s job.

5 – After taping the complete stack of grains together, carefully stand them up in a corner so that they do not fall over. If this is a smaller 54mm or 38mm reload you may carefully lay the stack flat on the table.

6 – Prepare and clean off your work place for gluing the grains in. Weigh out and mix up a cup of 30 minute to 1 hour epoxy.

7 – When you are gloved up and ready, and the epoxy is mixed, carefully bring back the stack of grains in the vertical position with both hands. Do not lift it with one hand as the tape is the only thing holding it all together.

8 – Set the stack on the table, nozzle end down. Holding the stack at the top, tilt the stack at a very slight angle and slowly pour the epoxy down the side. Be careful not to let the epoxy drip down to the bottom or drip off onto your tables work space.

9 – Stand the stack back up strait and work the epoxy down the sides of the grain stack. USE ONE HAND ONLY ON THE EPOXY. Keep your second hand clean and free of epoxy by holding the stack at the top. Keep the stack vertical and DO NOT lean it over except to apply more epoxy. Completely cover the entire stack within 4-6 inches of the bottom grain, being careful not to make a mess and drip epoxy all over your work surface.

10 – Holding on to the middle of the stack with your epoxy covered hand. Grab the liner with your clean hand.

11 – Starting with the “nozzle end” of the liner, arrow pointing down, slowly push the liner down over the bulkhead end of the grain stack. Work the 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.

12 – When you get close to the last grain, carefully work the epoxy over the last grain and slide the liner all the way down flush to the table. Quickly pick it back up, bringing the liner parallel to the ground so the grains don’t slide back out. With a clean paper towel, wipe off the epoxy from the end of the liner, the bottom of the propellant grain, and anywhere else you see epoxy on the liner. Set the liner down on the table and remove your epoxy covered glove so you do not transfer epoxy anywhere.

13 – Holding on to the liner, push the grains in from the nozzle end .100” (38-54mm) to .500” (76mm) into the liner. Wipe off and clean the epoxy from the inside of the liner or the bottom of the nozzle end grain. There will be a small amount of epoxy left around the edges.

14 – Place the doubled up layer of Saran wrap over the top of the nozzle and insert the nozzle shoulder into the liner until it is all the way in and seated at the base of the shoulder. The nozzle MUST NOT be glued to the liner shoulder.

15 – Stand the assembly back up on the nozzle and push the grains back down from the top.

16 – Place the forward closure on the top end of the liner to ensure that it sits flush. Once this is verified you may remove the closure.

17 – Carefully place the assembly upright in a corner until the epoxy has cured enough so that the grains are held firmly in place. Be sure to set a piece of cardboard under the nozzle so as not to damage it on any hard surfaces. Do not fly the motor until the epoxy is fully cured. Keep you left over epoxy to check the epoxy’s cure state.

18 – Once the epoxy has hardened, remove the nozzle and Saran wrap and complete the rest of the normal motor assembly steps.

For a detailed video on steps 7 through 18, go to YouTube and search “Gluing Loki Research propellant grains”.

Using this method may seem more time consuming but it has several advantages.

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

2 – It ensures that the epoxy doesn’t set up by the time you get all the grains into the liner. Sliding the liner down over the epoxied stack of grains should take less than 60 seconds.

3 – An unseen benefit is the tape at the grain joints. 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.

If you have any questions, don’t hesitate to call me. 573-216-8997.

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