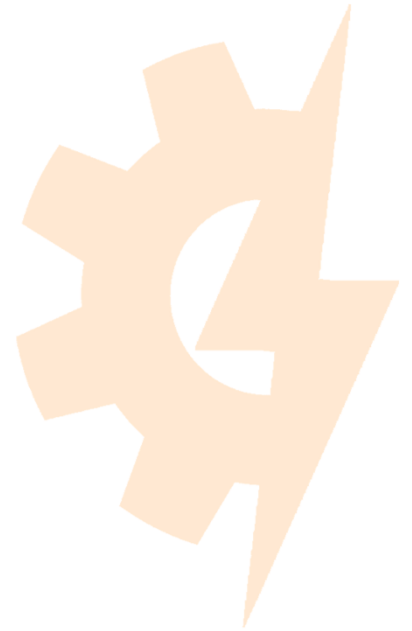


Bumper Covers

5892 Energy Heros

Taming that pesky soft, squishy
stuff that doesn't like rivets...



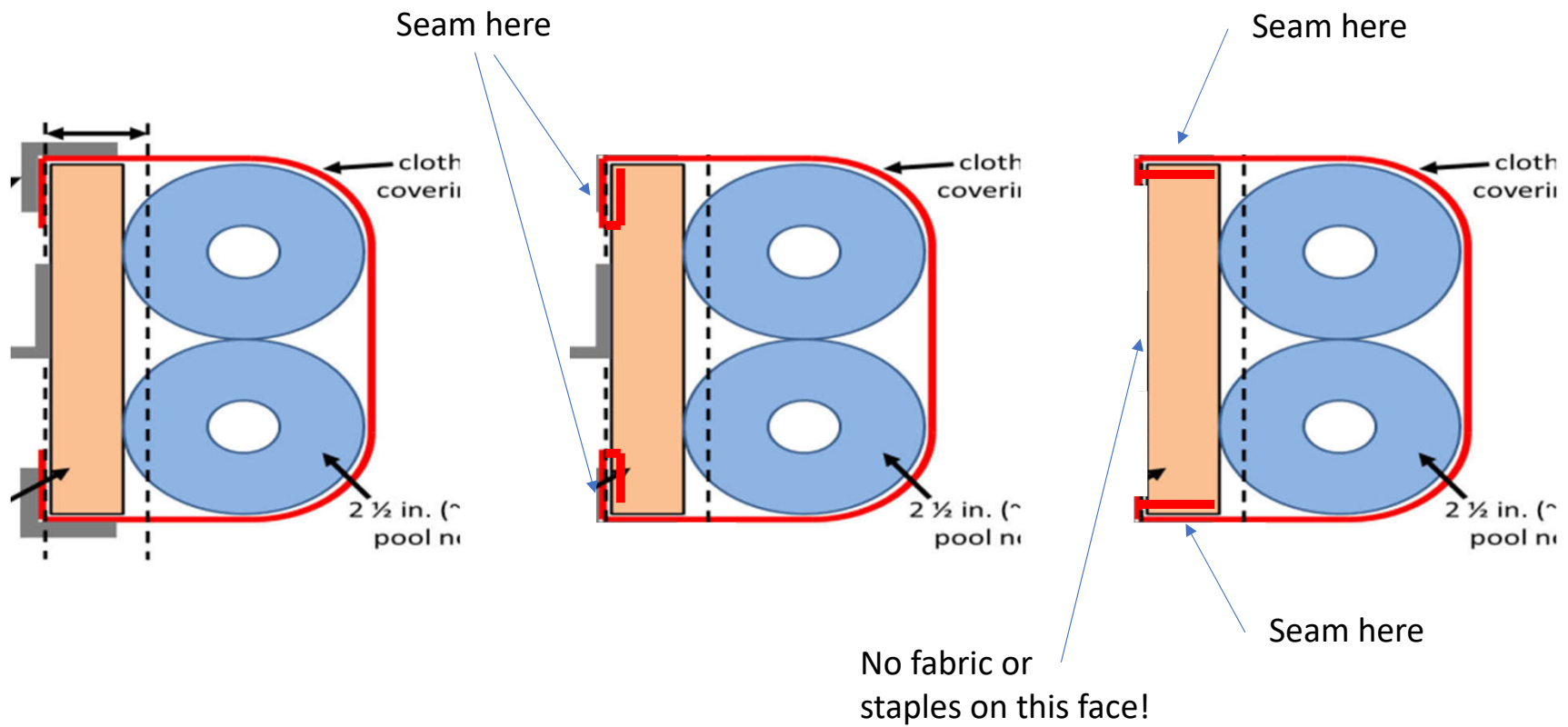
First Decision: Attachment to the Wood

- Standard: Go around the corner and staple with a raw edge
 - Old school
- Wrap: Go around the corner and staple with a hemmed edge
 - More robust than Top/Bottom, but fabric on the inside
- Top/Bottom: Staple on the top and bottom with a hemmed edge
 - No staples or fabric on the inside of your bumper wood!
 - Hardest to get it the right length AND tight!
- Combo: combine any of the above.
 - You might want the third option on the bottom and a wrap on top, if you lower your bumpers down onto the robot.
- Sorry to get confusing fast; picture on the next page!

Standard,

Wrap,

Top/Bottom

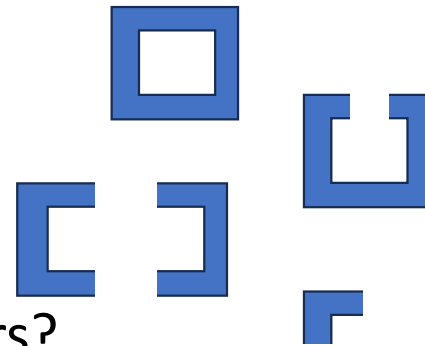


Second Decision: Type

- Two bumpers, one red, one blue
- Reversible bumpers

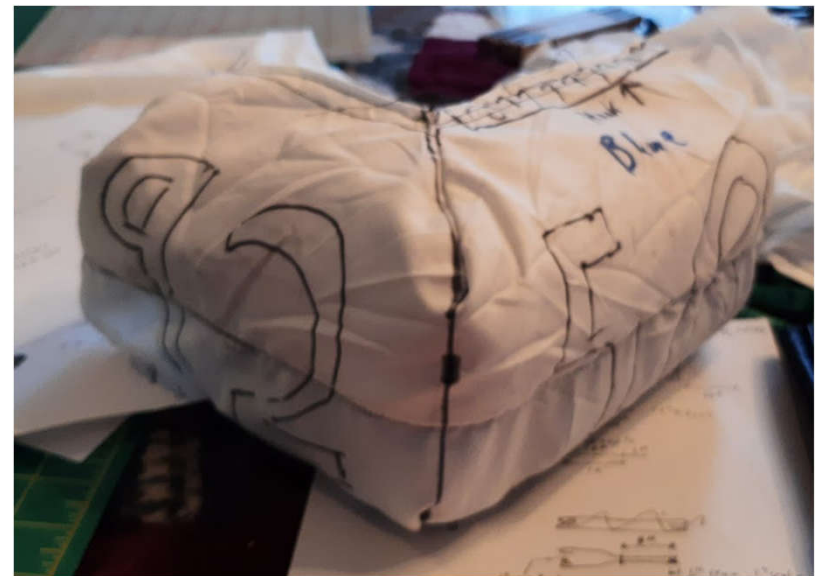
Third Decision/Question: Cuts/Openings

- Do you have a full square/rectangle?
 - Do you have a gap in your bumpers?
 - Are you using two C shapes?
 - Do you have four separate corner bumpers?
-
- Remember, the shortest piece of bumper wood is 6" from the robot corner



Just the Corners

- The minimum possible bumpers are 6" long sections on all four corners.
- These can all be identical, fit ANY chassis, and can be pre-prepped for desperate teams
- Corner bumpers are complicated to do as a reversible, as there is a LOT of sewing in a small space.



Suggested process

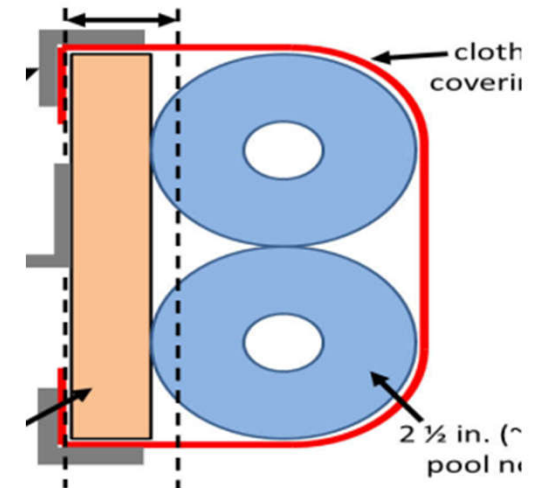
- Lay out fabric
- Iron flat as needed
- Cut strips based on attachment method and reversible/not decision
 - Cut to length for corner bumpers
- Sew strips into full length wrap
- Wrap around bumper assembly.
- Mark overlap, add seam allowance
- Sew into a loop
 - Not a Moebius loop...

Continued

- If hemming, fold over, iron, and sew seams
- Mark location of corners on loop
- Mark locations of gap edges on loop
- MARK “inside”
- Using template, mark out corner darts
- Using template, mark out gap darts (if used)
- Sew darts and trim excess
 - Reversible bumpers have extra steps here...
- Stretch on and staple

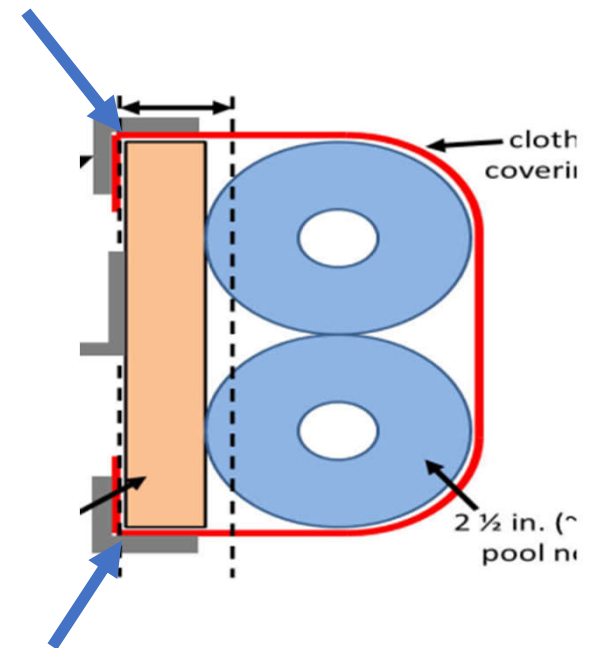
Cover Width Measurement

- Need to know the bumper wood measurement: 5" \pm 1/2"
 - What is the ACTUAL dimension??? 4.5" to 5.5" range.
- What pool noodles did you FIND? 2.5" nominal...
- Wrap a soft tape measure around your wood plus noodle sandwich
- Go from inside robot corner to inside robot corner



Expected Cover Widths

- Wrap a soft tape measure around your wood plus noodle sandwich
- Go from inside robot corner to inside robot corner as indicated
- DO NOT measure on the inside face.
- **Expected measurements:**
 - 5.5" wood **A=10"**
 - 5" wood **A=9.5"**
 - 4.5" wood **A=9"**
- **Call this measurement "A"**



Picking Strip Width

- If you have the SAME edge on top and bottom:
- Wrap around and staple raw edge (2" of fabric on the inside)
 - Add 4"
- Wrap around with hemmed edge (2" of fabric on the inside)
 - Add 8"
- Staple top and bottom with hemmed edge (no fabric on the inside)
 - Add 2"
- Call this "B"

Picking Strip Width

- IF your top and bottom will be DIFFERENT:
- Based on EACH edge: top and bottom
- Wrap around and staple raw edge (2" of fabric on the inside)
 - Add 2" PER EDGE
- Wrap around with hemmed edge (2" of fabric on the inside)
 - Add 4" PER EDGE
- Staple top and bottom with hemmed edge (no fabric on the inside)
 - Add 1" PER EDGE
- Call this "B"

Predicted Strip Width

| Same top/bottom | 4.5" Wood | 5" Wood | 5.5" Wood |
|-------------------|-----------|---------|-----------|
| Wrap and raw | 13" | 13.5" | 14" |
| Wrap and hemmed | 17" | 17.5" | 18" |
| Top/bottom hemmed | 11" | 11.5" | 12" |

Use this "B" dimension as the cut width of your fabric strips

I did my test with top/bottom and 5.5" wood.
Really, the hardest case to get right. Wrap is MUCH
easier, as you can just pull it tight.

Cutting Strips

- Ironing your fabric before cutting makes it MUCH easier. Trust me, even if I didn't do it...
- A T-square is nice for making strips.
- The rolling cutters are CRAZY sharp.
 - They DO NOT like metal!
 - Don't drive over pin or run it into the ruler
 - Use a cutting mat
- You can also mark it out and cut with scissors
- Don't let people use sewing scissors on ANYTHING ELSE!



Overall Strip Length for Simple Bumper

- Take the RI measurement: FLEXIBLE tape measure wrapped around the bot's metal structure.
- FYI: the absolute maximum frame perimeter is 120 inches
- Add a factor for the four rounded corners and closing seam: 26"
- The longest possible strip for the largest possible robot is 146"

- Alternatively: measure around your noodle+frame and don't calculate it! Bonus points if you use the actual strip to mark it out.
- **Call this measurement "C"**

Real Life!

If you measure this way,
add 1" past the overlap
to allow for the seam!

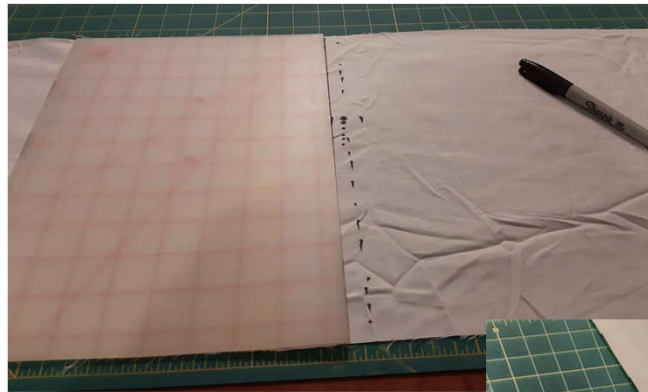
That's $\frac{1}{2}$ " of seam
allowance on both ends.

Note that this is made
of 2 sections, you can
see the first seam on
the right



Making the Loop

- Mark the $\frac{1}{2}$ " seam allowance on both ends and trim to length.
- Stack marked lines (pinning helps) and sew.
- Put the seam on the inside
- DON'T make a Moebius strip...



Example Strip Length

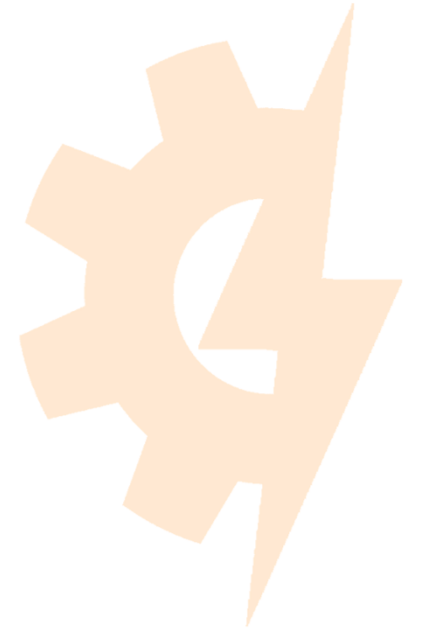
- Robot is a 19" by 21" rectangle
 - 80" frame perimeter; a small robot
- Bumper wood increases this to 20.5" by 22.5".
- 2.5" noodles on both sides increase this to 25.5" by 27.5"
- Straight edge length is $(25.5 + 27.5) * 2 = 106"$
- ACTUAL circumference measurement was 105"
 - Remember there is an extra inch for the seam!
 - And rounded corners are shorter...
- Formula $C = \text{Frame Perimeter (80" here)} + 26"$

Hem the Loop

- If you are using a raw edge, skip this step
- If you are using a hemmed edge, fold inward by your hem allowance and sew the hem.
 - 1" for wrap around
 - 1" for top/bottom
- Stitch location is not critical; roughly in the middle of the hem
- Remember, BOTH edges go in, and are folded toward the INSIDE surface
- When you wrap your bumper, all the raw edges will be hidden.

Sorry, no picture

Single Color Bumper



Starting

- Figure out your strip width “B” above
- Cut out more strip length than dimension “C”
- Stack two strips with the ends lined up neatly.
- Sew through both strips $\frac{1}{2}$ ” in from the edge (the SHORT dimension) to make a longer strip
- If your fabric is small, you may have to sew it twice to get long enough

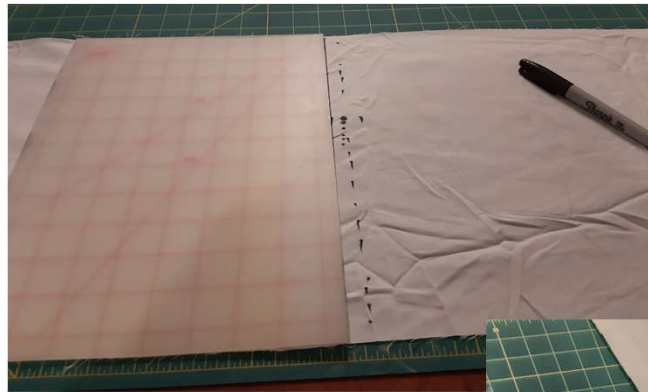
Marking the Overall Length

- Wrap your strip all the way around your bumpers
- If you measure this way, add 1" past the overlap to allow for the seam!
- Note that this is made of 2 sections, you can see the seam on the right



Making the Loop

- Mark the $\frac{1}{2}$ " seam allowance on both ends and trim to length.
- Stack marked lines (pinning helps) and sew.
- Put the seam on the inside
- DON'T make a Moebius strip...



Hem the Loop

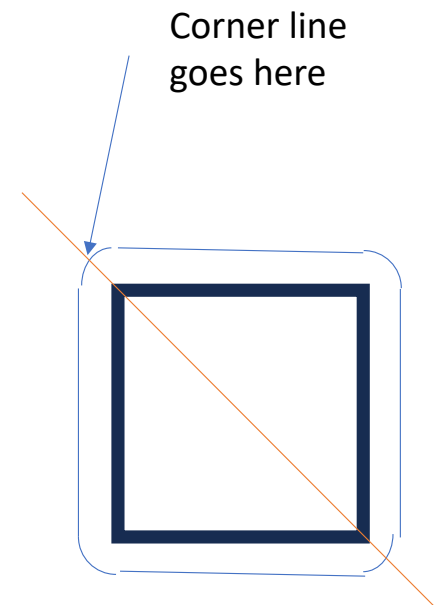
- If you are using a raw edge, skip this step
- If you are using a hemmed edge, fold inward by your hem allowance and sew the hem.
 - 1" for wrap around with hem
 - 1" for top/bottom
- Ironing the folds and pinning will make this step easier!
- Stitch location is not critical; roughly in the middle of the hem
- Two lines of stitching on the hems can result in a neater job.
- Remember, BOTH edges go in, and are folded toward the INSIDE surface
- When you wrap your bumper, all the raw edges will be hidden.

Hemmed Loop



Marking out a Single Color Bumper

- Put the loop on inside-out
- Mark the four corners as shown
- Imagine taking a long ruler and laying the edge on the two wood corners. The line should also be on the ruler edge.

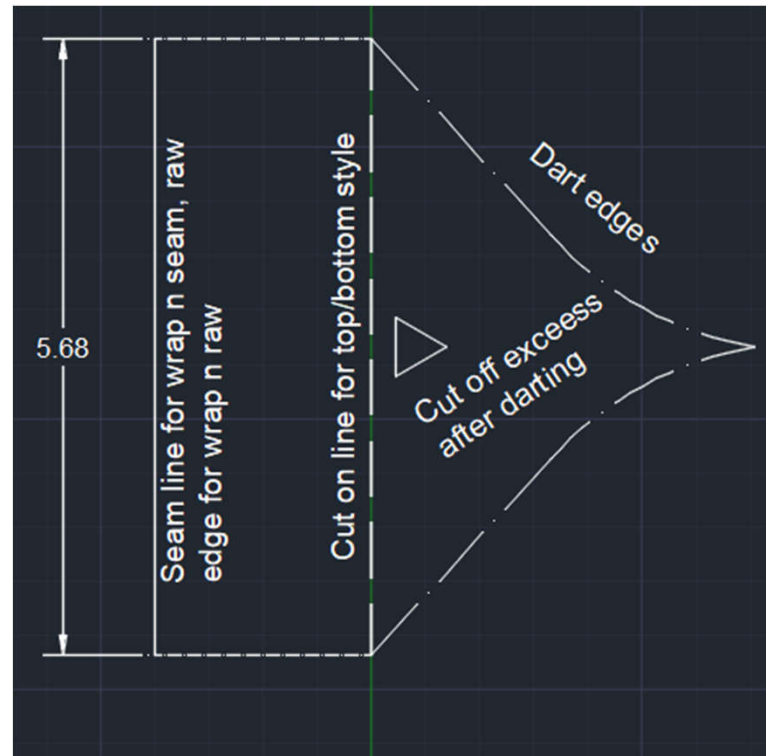


Marking Dart Lines

- **Use the right pattern: wrap or top/bottom!!!!**
- Line up the notch with the marked corners and the outside edge of the cover
- Sharpie that sucker!
- The funny curve is important to get the shape to follow the noodles!



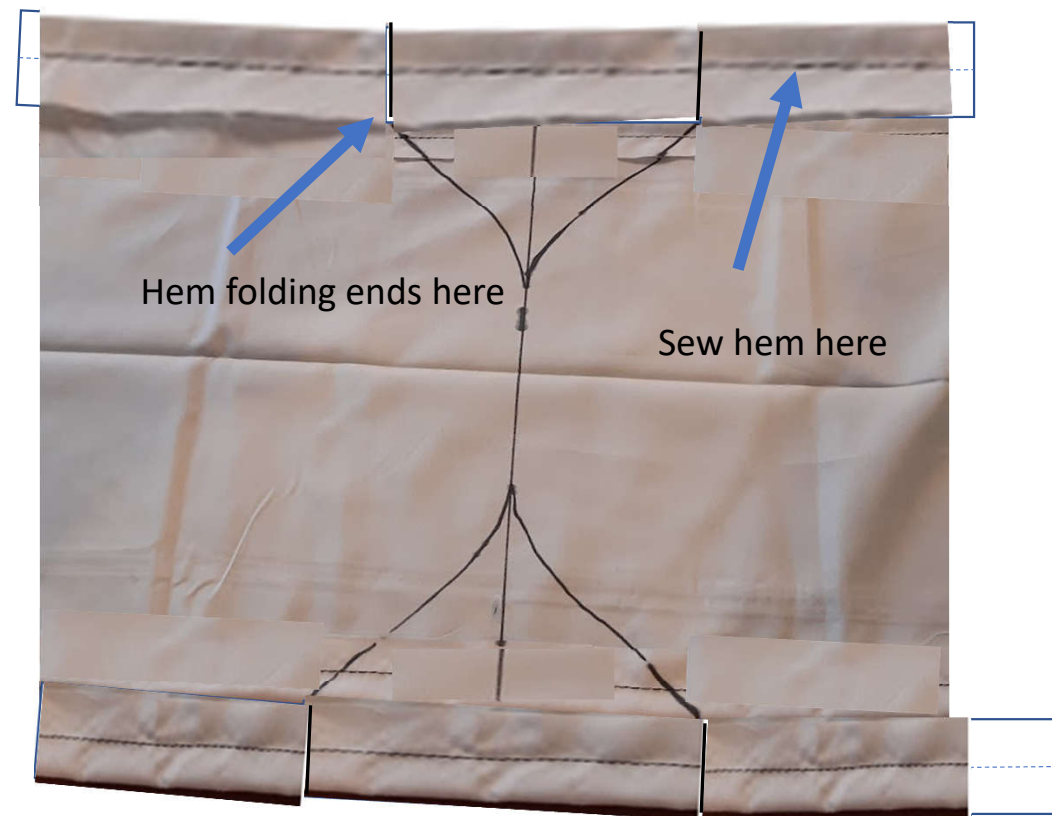
Pattern for Corner Dart



Marking for Top/Bottom Stapling



Marking for Standard and Wrap Around Edges

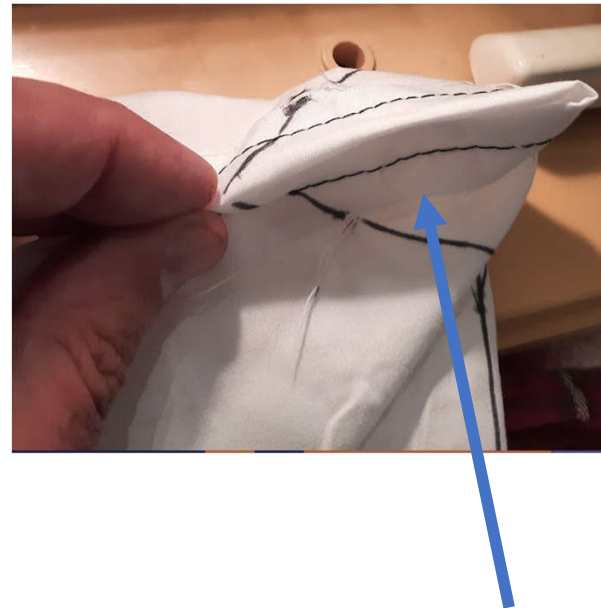


Numbering Bumpers

- This is a good time to iron on bumper numbers!
- Don't try to iron on against the noodles...
- Painting works fine after assembly

Sewing Darts

- Fold the outside of the darts together, lining up neatly
 - Pinning the seam will help...
 - Remember, the side with numbers is INSIDE right now.
 - Note the marked raw edge and the visible sharpie marks
-
- Sew on the line, then do a second stitch about $\frac{1}{4}$ " to $\frac{3}{8}$ " toward the corner.



Trimming Excess Bulk; Optional Step

- Note the second line of stitching. It can be really rough; nobody will ever see it...
- Trim off the corners



Installation

- Turn it right side out
- Work it over the bumpers
- Yes, you will have to squish the noodles to finish.
- Adjust positions and staple to the wood.
- Trim excess fabric as desired
- Repeat for the other color
- Apply celebration method of choice!

