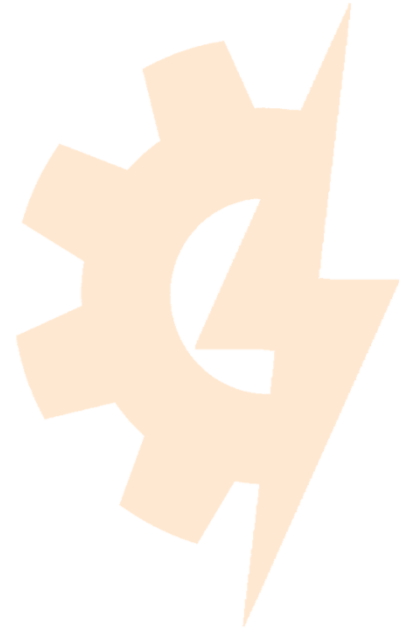


# Bumper Covers

## 5892 Energy Heros

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



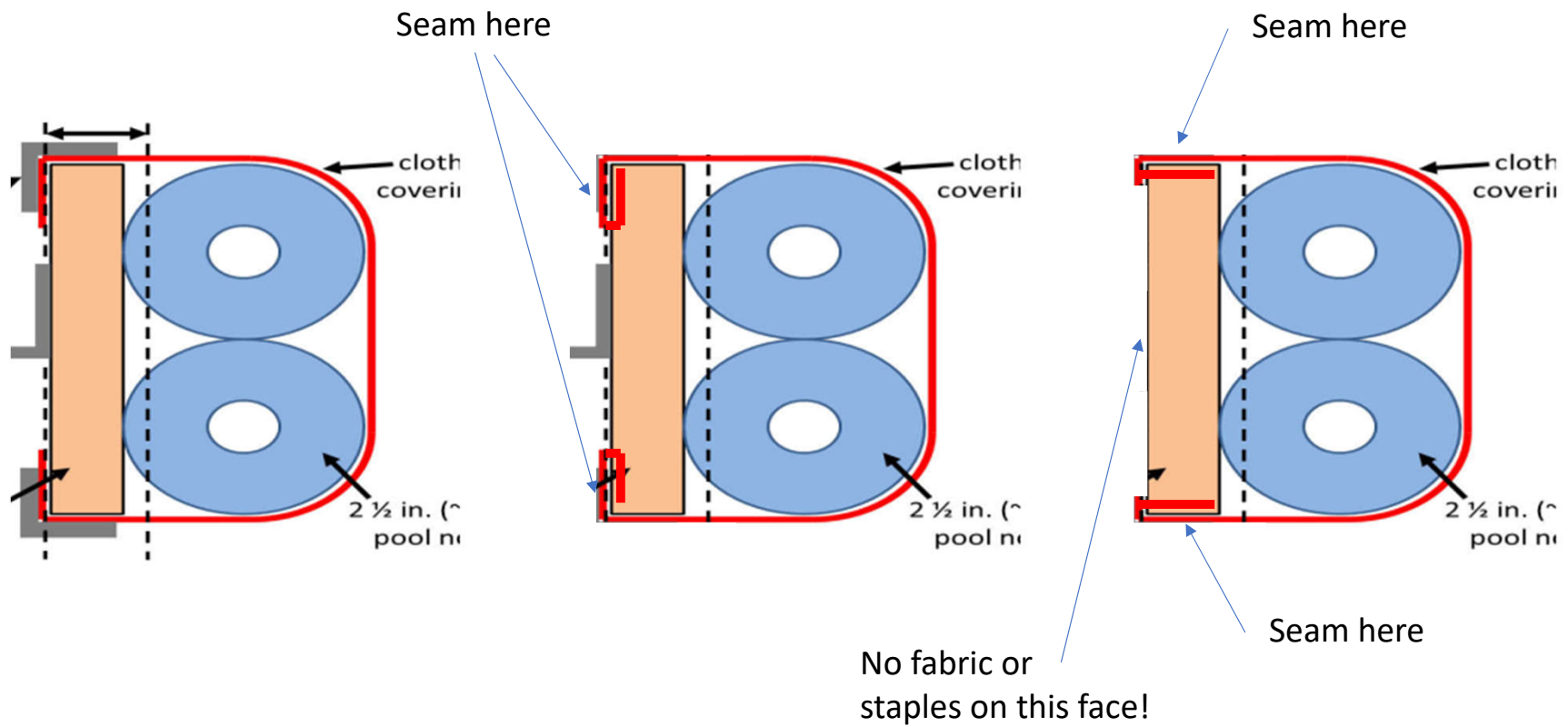
# First Decision: Attachment to the Wood

- 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,

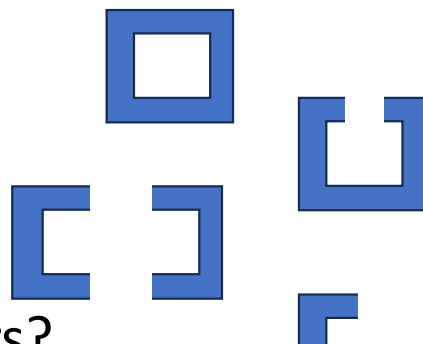
Top/Bottom



## 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?
- 
- The diagram illustrates four different bumper configurations using blue outlines:
- A full square bumper.
  - A square bumper with a gap in the top side.
  - Two C-shaped bumpers facing each other.
  - Four separate corner bumpers, one for each corner.
- 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

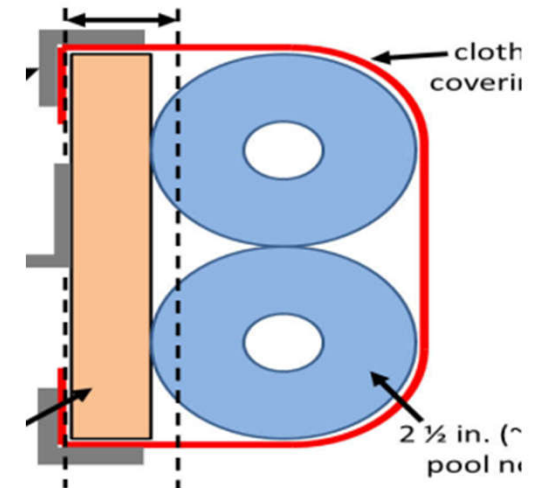
- Lay out fabric
- Iron flat as needed
- Cut strips based on attachment method and reversible/not decision
  - Cut to length for corner bumpers
- Sew strips into full length wrap
- Wrap around bumper assembly.
- Mark overlap, add seam allowance
- Sew into a loop
  - Not a Moebius loop...

# 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

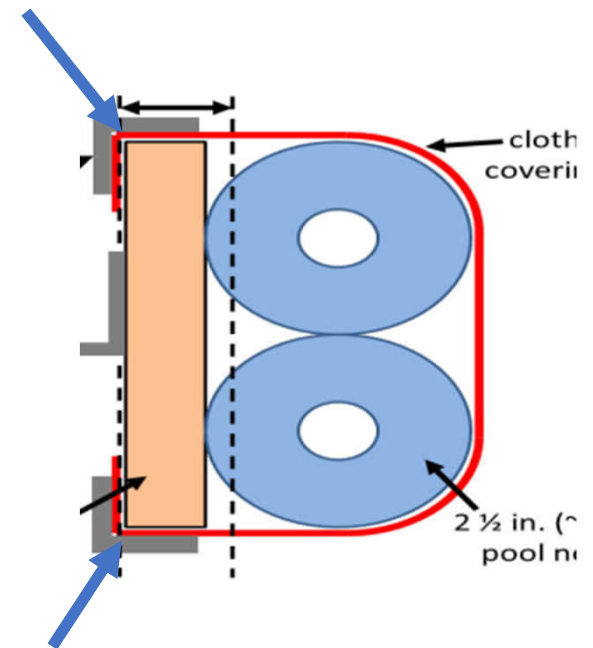
# Cover Width Measurement

- 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!

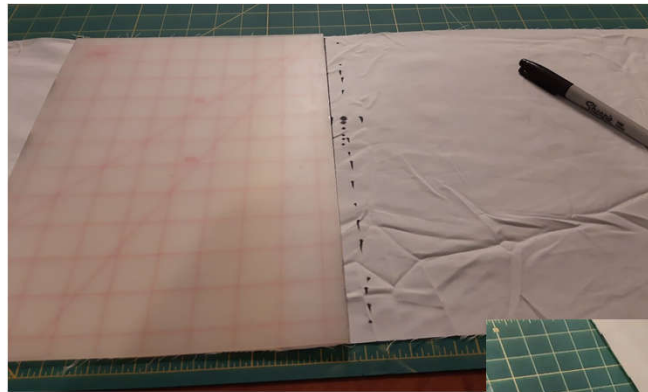
That's  $\frac{1}{2}$ " of seam  
allowance on both ends.

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  $C = \text{Frame Perimeter (80" here)} + 26"$

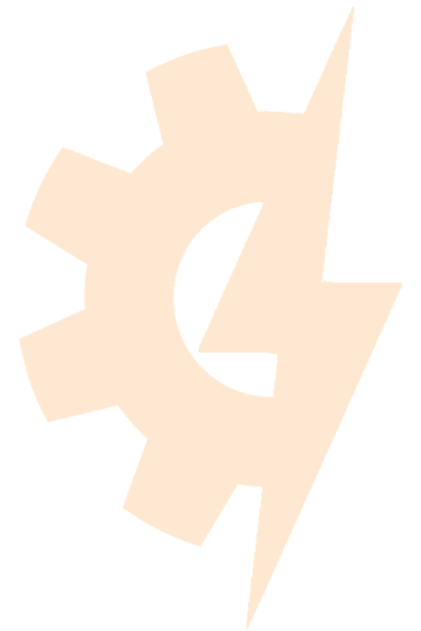
# Hem the Loop

- 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

# Notched Reversible Bumper

C shaped bumpers are EXACTLY the same, but  
only have two corners instead of 4 corners!



# 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)
- If your fabric is small, you may have to sew it twice to get long enough
- You need both Red and Blue bumper fabric; start both the same way

# Marking the Overall Length

- Wrap your strip all the way around your bumpers AND into the notch (faked with white box here)
- Note that this is made of 2 sections, you can see the seam on the right



# Marking Notched Bumper

- MARK where the strip hits the inside corner of the bumper wood as shown
- Note: the pattern does NOT work with rounded corners on the outside of the notches

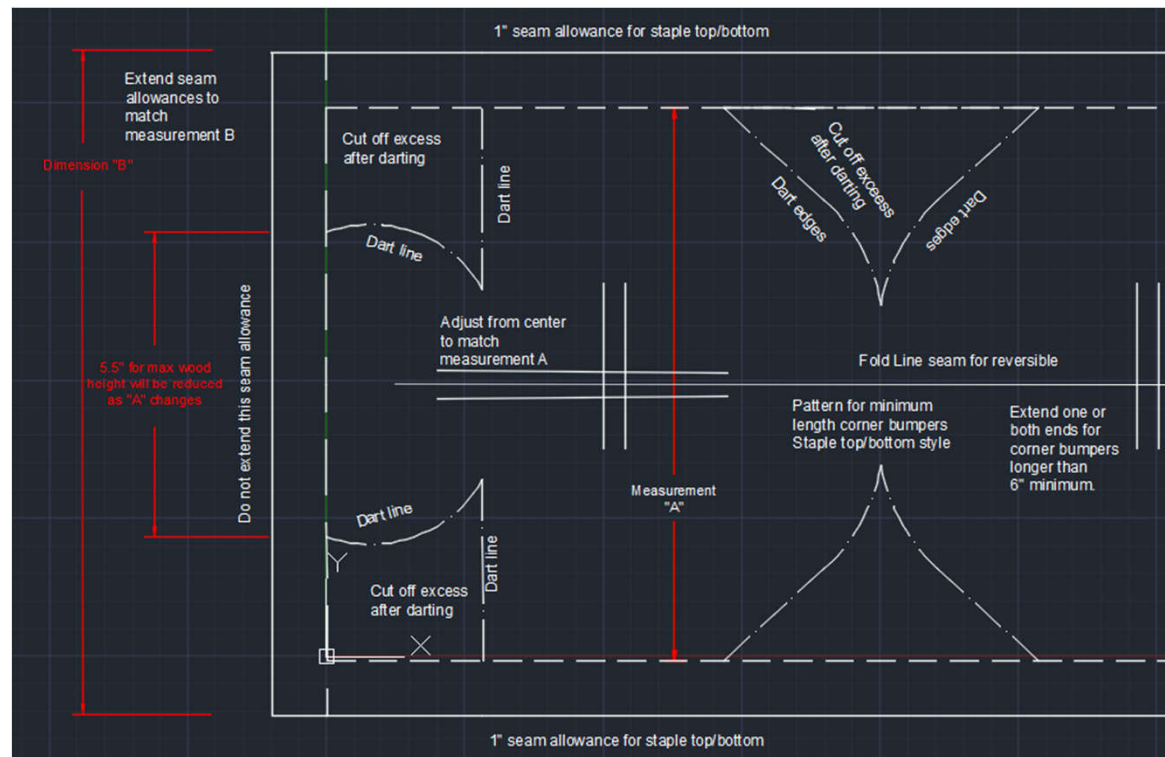


# Marking out a Notched Bumper

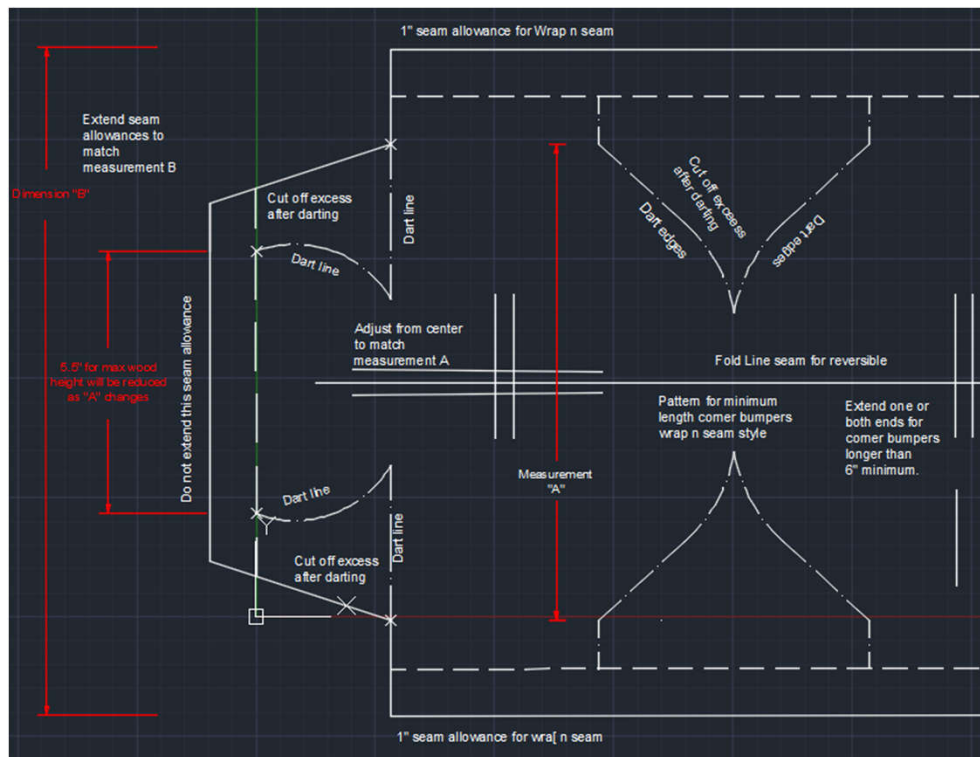
- Mark the corners as shown
- Flatten fabric and add 1" hem allowance past the notch end markings



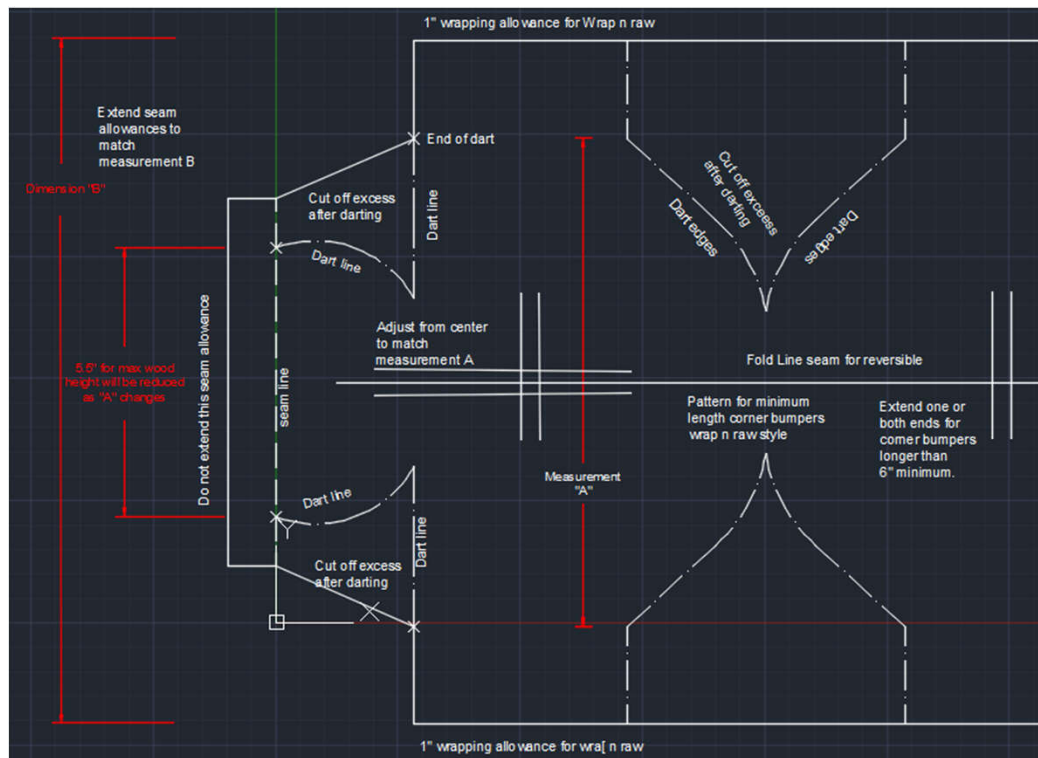
# End Pattern for 5.5" Wood, Staple Top/Bottom



# End Pattern for 5.5" Wood, Wrap n Hem



# End Pattern for 5.5" Wood, Wrap N Raw



# Hem the Strip

- 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

# Hem the Notch end

- Fold the strip end inward by your 1" hem allowance and sew the hem.
- 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

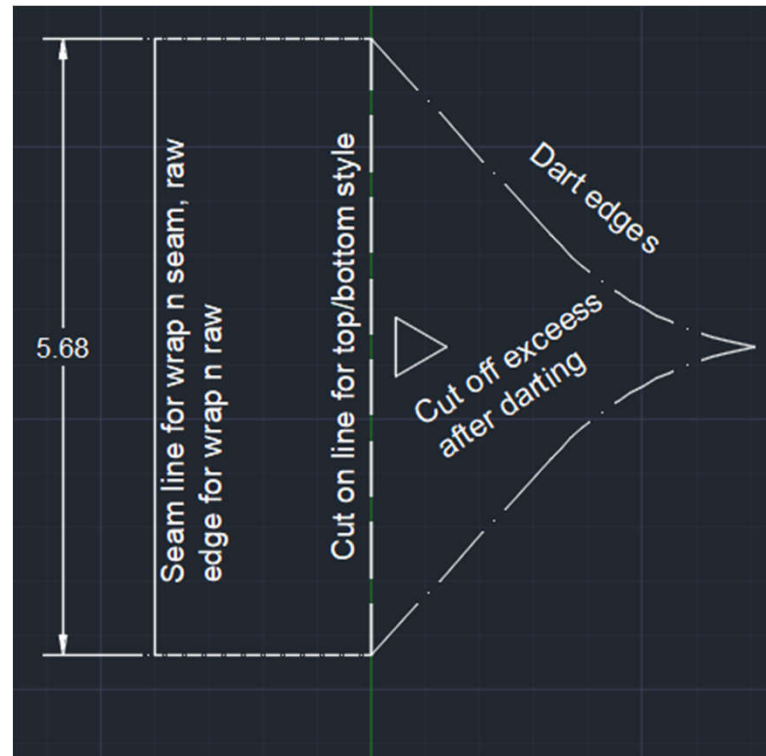


# Marking Dart Lines

- 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!

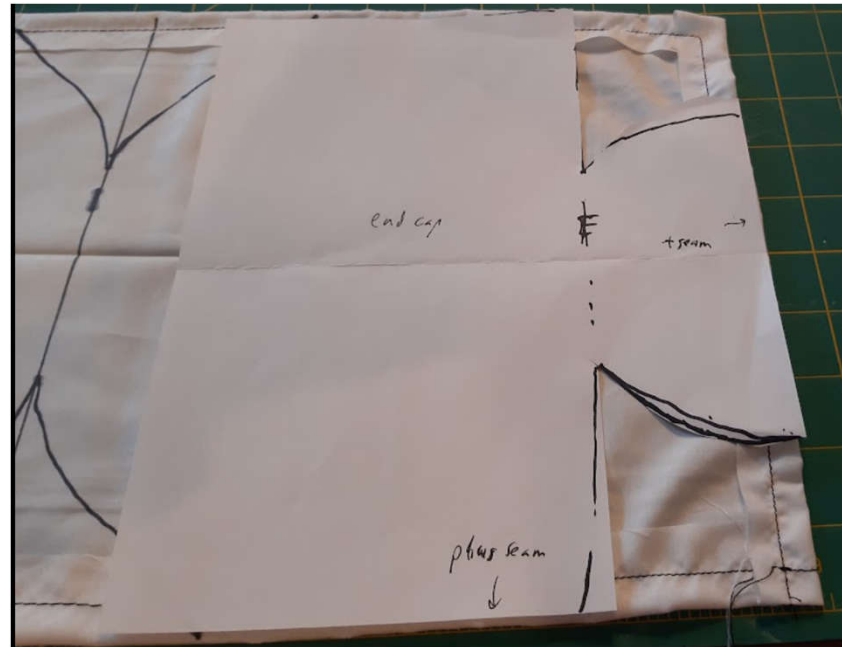


# Pattern for Corner Dart



# Marking Notch End Lines

- Line pattern up with marked inside corner of bumper wood.
- Mark the straight lines and curves



# Numbering Bumpers

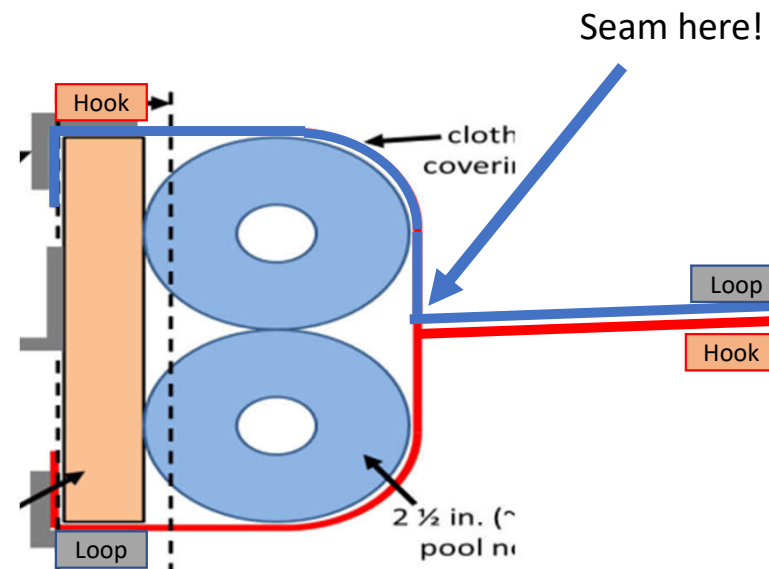
- This is a good time to iron on bumper numbers!
- Remember that the number is split across the notch
- Don't try to iron on against the noodles...
- Painting works fine after assembly

# The Fiddly Bits

- Reversible bumpers work by having Velcro on the top and bottom edges of the bumper.
- A double sided flap is sewn so it hinges up and down from the horizontal center line of the bumper.
- The flap has Velcro on its long edges, on BOTH sides.
- DO NOT use sticky back Velcro. Ick. Will goo up the machine!
- KEY: NEVER have hook Velcro looking down. You WILL grab the carpet with it. Doom. Cursing.

# Velcro Locations

- This is SUPER IMPORTANT!!!!!!
- Really!
- OMG, if you mess this up your robot will **STICK TO THE CARPET!!!!**

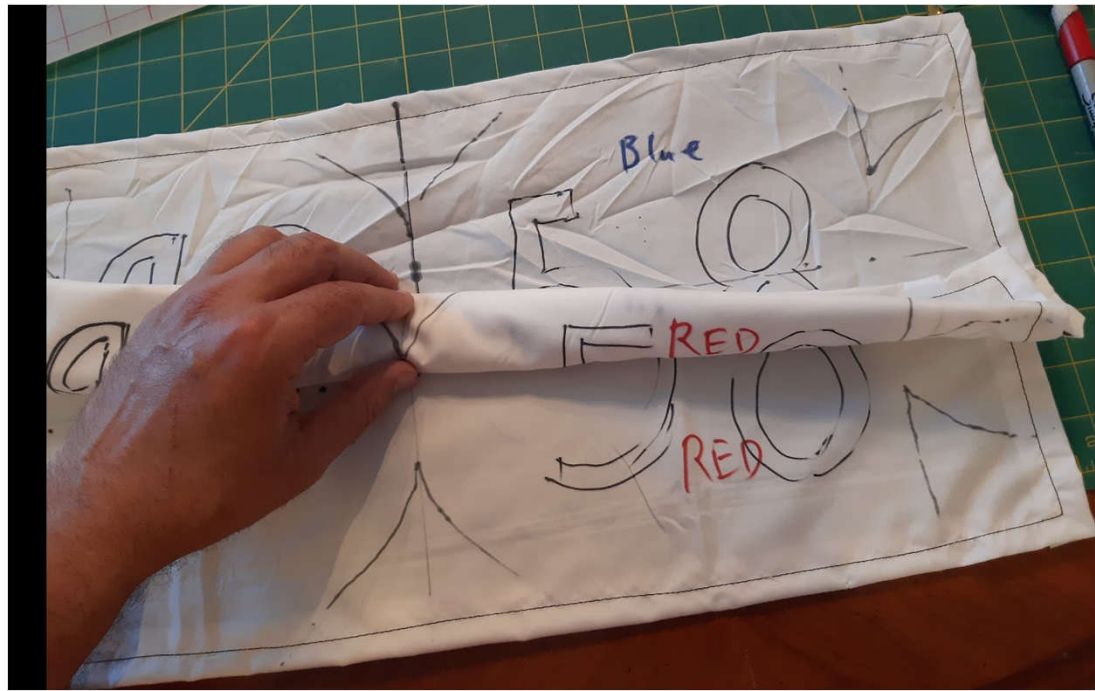


# Progress so Far

- You should have 2 long panels (red and blue) with hems on all the edges that you planned to do them on.
  - For a C-shaped bumper pair, you will have 4 not so long panels
- You should have the markings laid out on the INSIDE of every one of them
  - Its OK to mark the darts on both sides if you want to...
- You should have numbers on them.

# Center Seam

- Stack a red and a blue.
- Note that this is the OUTSIDE shown.
- The bottom panel must be upside down.
- IE: back side to back side
- NO exposed dart markings
- Pin it!



# Sewn View

- With the center seam sewn you can open one red/blue pair as shown.
- The numbers should read right with the center flap rolled up
- The numbers **MUST** read right with the flap up and down



# Sewing the Center Seam

- ONLY sew down the center line!!!
- Once you get maybe 6 inches in, VERIFY that it operates right! See the last page!



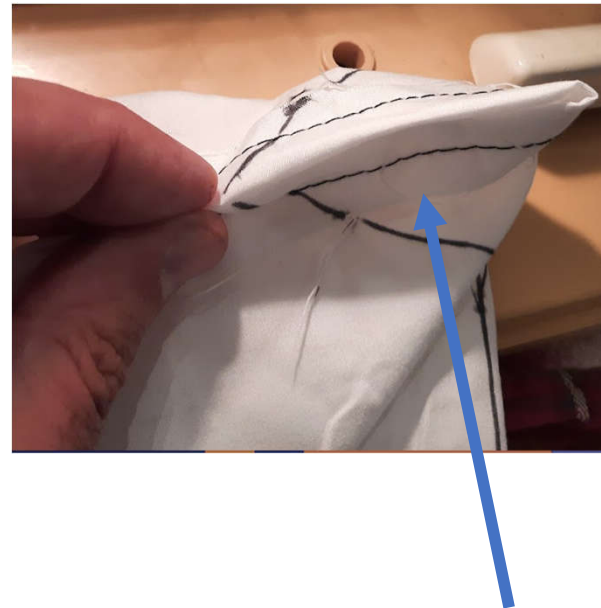
# Flap Sewing

- Carefully working on the inside/backside of the two flap parts:
- Sew notch darts (4 places)
- Sew corner darts (2 places)



# 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.



# Sewing Notch End Darts

- These are tricky; only one side is straight, and they don't match!
- Fold the outside of the darts together, lining up neatly
- Pinning the seam will help...
- Sew on the line, then do a second stitch about  $\frac{1}{4}$ " to  $\frac{3}{8}$ " toward the corner.



# Trimming Excess Bulk

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



# Closing the Flap

- Work things around to get the two insides of the flaps against each other and neat.
- Consider pinning them...
- Sew along the outside edge of the flap from center seam to center seam
- Make sure you don't close the two noodle side flaps accidentally

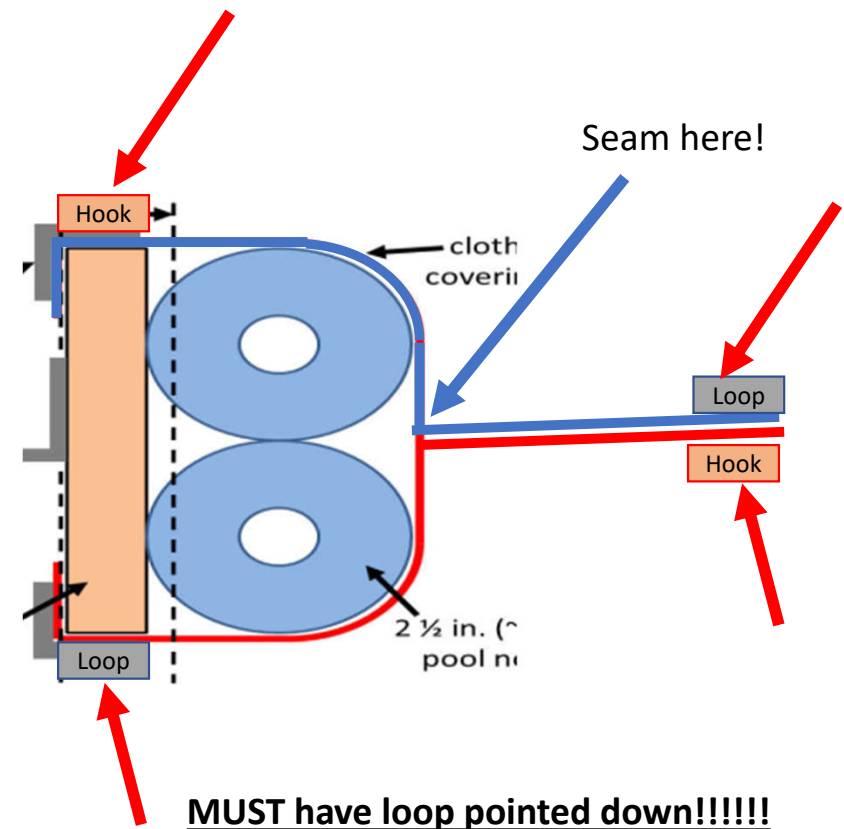


## Repeat Corner and Notch Darts

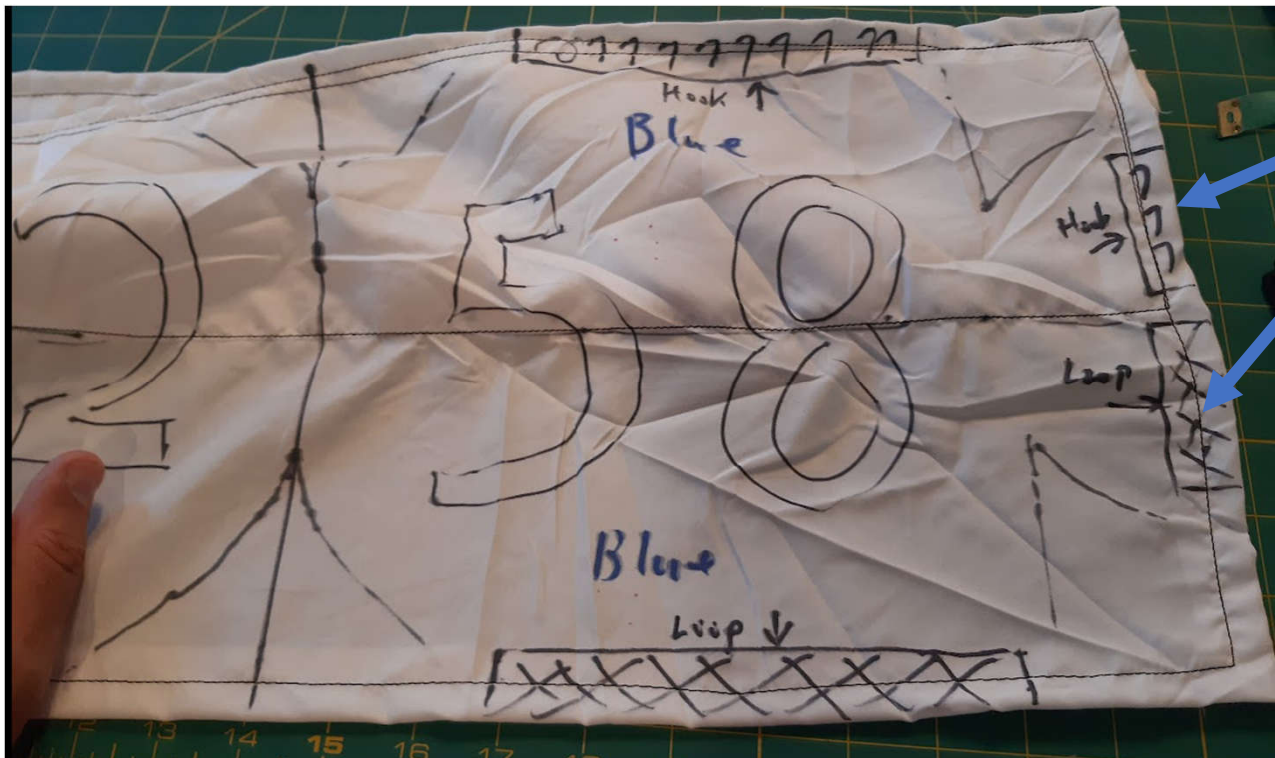
- But this time on the noodle side parts
- I'll wait.

# Sew on the Velcro strips

- If you only sew the Velcro on its center line it makes the grip stronger because the flap can fold and convert a straight pull off to shear.
- You may want to double stitch the wood sides and single stitch the flap sides. Double on both works too...
- Don't run the Velcro all the way to the ends of the bumper cover.
- **WATCH the HOOK SIDE!!!**



# Velcro Suggestions



Probably not needed!

# Velcro strips on Notch Sides

- You may find that you don't NEED Velcro on these area. Your call.
- As long as you have a hook/loop pair across the flap it will work.
- Double stitch all of this velcro.
- Don't run the Velcro all the way to the ends of stuff.



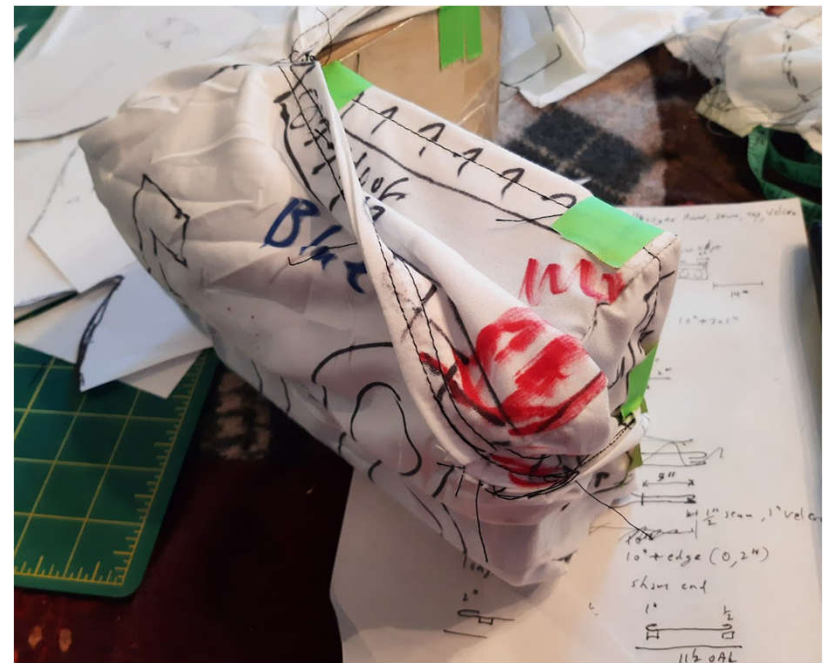
# Installation

- Turn it right side out
- Adjust positions and staple to the wood
- You may want to trim excess fabric on the inside
- Repeat for the other color



# Rolling it Over

- Sorry about drawing all over it!



# Notch End Attachment

- Notch end gets stapled to the cut end of the bumper wood
- DON'T staple the flap!!!
- Apply celebration method of choice!

