

How to Make the Playskin™ Air



How to Make the Playskin Air™ Soft Exoskeletal Garment

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Tools:

- Sewing Machine
- Fabric Scissors
- Pins
- Hair straightener or Ultrasonic Welding Machine
- Clear Ruler and/or Tape Measure
- Hot glue gun

Parts:

- Bladder
- Garment

The Playskin Air™ is a soft exoskeletal garment aiming to assist arm lifting for children with upper extremity physical disabilities. The device uses an air bladder, similar to a balloon, to aid in lifting the child's arm. Inflation and deflation of the air bladder allows for different levels of support. Due to the soft materials used in the design of the Playskin Air™, the device is lightweight and less bulky when compared to hard exoskeletons.

A DIY video tutorial is available at:

<https://www.youtube.com/watch?v=7GBDdC7IS5o>

Guide to Purchasing Materials to Make the Playskin Air™

Note that the materials listed below can be replaced by items that are similar in nature.

Item	Potential Source	Cost
<u>Garment-</u> Girls/Boys/Toddler 6 Pack Athletic Performance Long Sleeve Undershirt/Tops/Base Layer Cotton Stretch Shirts or DRI-Equip Youth Long Sleeve Moisture Wicking Athletic Shirts. Youth Sizes XS-XL	Amazon https://www.amazon.com/gp/product/B09JXYLD85/ref=ppx_yo_dt_b_asin_title_o05_s00?ie=UTF8&psc=1 or https://www.amazon.com/gp/product/B00N96UYNU/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&psc=1	\$49.99 for 6 (\$8.33/each) or \$14.99/each
<u>Cover Fabric-</u> Performance Nylon Spandex Power Mesh fabric	Joann's Fabric and Crafts https://www.joann.com/performance-nylon-spandex-power-mesh-fabric-black/16770323.html?gclid=Cj0KCQjw8uOWBhDXARIsAOxKJ2Ggr9KM_AjuvJ1o2hxK2tbivZn5lwh4blCGjkJQZ9u-b49IdqnzNrkaAmlOEALw_wcB	\$17.99/yard
<u>Shoulder Strap-</u> Powernet- 45" Wide-Heavy weight (Black)	Spandex World https://spandexworld.com/c3/catalog/product/11684 (*Product ID: 11684)	\$12.00/yard
<u>Velcro-</u> VELCRO Brand Industrial Strength Fasteners Stick-On Adhesive 15ft x 2 in Tape, White	Amazon https://www.amazon.com/gp/product/B0006HWYJM/ref=ppx_yo_dt_b_asin_title_o04_s01?ie=UTF8&th=1	\$19.89
<u>Thread-</u> Gutermann Sew All Thread 500 Meter	Joann's Fabric and Crafts https://www.joann.com/gutermann-sew-all-thread-500-m/prd13384.html	\$6.99
<u>Elastic belt-</u> White Knit Elastic Spool (2 in x 11 Yards)	Amazon https://www.amazon.com/gp/product/B074M61SJF/ref=ppx_yo_dt_b_asin_title_o05_s00?ie=UTF8&psc=1	\$9.99
<u>Elastic for cover fabric-</u> Dritz 1-½" Soft Waistband Elastic, White, 2 yd	Joann's Fabric and Crafts https://www.joann.com/dritz-1-1%2F2in-soft-waistband-elastic-white-2-yd/15377468.html?utm_source=google&utm_	\$7.29

	medium=cpc&gclid=Cj0KCQjw8uOWBhDXARIsAOxKJ2FRSr259oLhoRqOyw_-PDc9u9Q-ZvWTK9_w0XG005rYbW0NCFn_SqoaAiLQEALw_wcB	
<u>Bladder Fabric</u> - 56-58” 200 D. Heat Sealable Coated Oxford (Black)	Seattle Fabrics Inc. https://www.seattlefabrics.com/56-58-200-D-Heat-Sealable-Coated-Oxford-2295-linear-yard_p_44.html	\$22.95/ linear yard
<u>Valve</u> - Plastic Barbed Tube Fitting for Air and Water Tight-Seal, Elbow, for 1/4" Tube ID, Semi-Clear White 5463K594	McMaster- Carr https://www.mcmaster.com/tight-seal-plastic-barbed-tube-fittings-for-air-and-water/for-use-with~air/tight-seal-plastic-barbed-tube-fittings-for-air-and-water/ (*Model #: 5463K594)	\$8.42/10 (\$0.84 each)
<u>Cardboard</u> -	Any smooth piece from box	N/a
<u>Glue gun</u> - Dewalt Rapid Heat Ceramic Glue Gun	Amazon https://www.amazon.com/DeWALT-DWHTGR50-Rapid-Ceramic-Yellow/dp/B00FI6QWBM/ref=sr_1_19?crd=1FFJ3AZN8SOCZ&keywords=dewalt+glue+gun+20v+max&qid=1658425181&srefix=dewalt+glue%2Caps%2C69&sr=8-19	\$22.37
<u>Glue for glue gun</u> - Surebonder Made in the USA All Purpose Stick Glue Sticks- All Temperature-Clear 7/16” D, 10” L Glue Stick- 20 Sticks per Bag	Amazon https://www.amazon.com/Surebonder-DT-2010-Sticks-All-Temperature-Clear-Stick-20/dp/B00627G6QC/ref=sr_1_10?crd=16MX07QJG8C73&keywords=10+in+long+glue+for+hot+glue+gun&qid=1658425666&s=arts-crafts&srefix=10in+long+glue+for+hot+glue+gun%2Carts-crafts%2C43&sr=1-10	\$10.51
<u>Super Glue</u> - Gorilla Super Glue XL, 25 Gram, Clear, (Pack of 2)	Amazon https://www.amazon.com/gp/product/B09314ZGM4/ref=ppx_yo_dt_b_asin_title_o03_s00?ie=UTF8&pvc=1	\$14.91 for 2 (\$7.46/ each)
<u>Bike Pump</u> - BV Mini Bike Pump Portable Frame Pump 120PSI High Pressure, Fits Presta & Schrader- Smart Valve	Amazon https://www.amazon.com/gp/product/B07NZ8V8XP/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&pvc=1	\$12.98

<u>Tubing</u> - Super-Soft Latex Rubber Tubing for Air&Water 1/4" ID 3/8" OD, Opaque Amber, 25 ft. Length 5234K44	McMaster- Carr https://www.mcmaster.com/tubing/super-soft-rubber-tubing-for-air-and-water/ (Model #: 5234K4)	\$32.00 (\$1.28/ft)
<u>Hair Straightener</u> - Conair 1” Double Ceramic Flat Iron Hair Straightener	Walmart https://www.walmart.com/ip/Conair-1-Double-Ceramic-Flat-Iron-Hair-Straightener-Anti-Static-Technology-White/55243101?athbdg=L1200	\$19.58
<u>Switch</u> - Quicken ¼” Drip Irrigation Barbed Ball Valve Shut Off Switch Hose Barb Vave for Garden Drip Irrigation Aquarium Hose Tube, 5Pcs	Amazon https://www.amazon.com/gp/product/B08LB9WHYP/ref=ppx_yo_dt_b_asin_title_o03_s00?ie=UTF8&psc=1	\$7.89 for 5 (\$1.58/each)
Total Cost of Purchasing All Materials		\$256.17 Or \$221.17

*If you can't buy this exact shirt any form-fitting shirt that the child feels comfortable in will do

Size Suggestion Chart

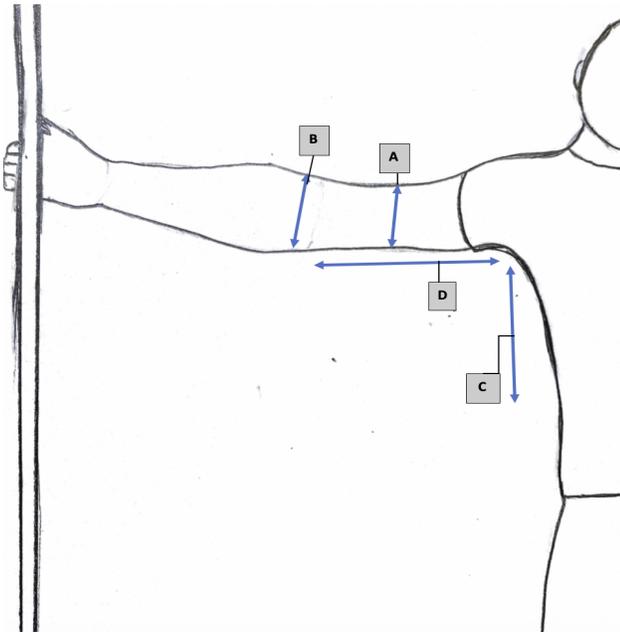
Size	Bicep Circumference (A)	Elbow Circumference (B)	Armpit to Waist Length (C)	Armpit to Elbow Crease Length (D)
<u>4-5</u>	6in	5.5in	5.5in	6in
<u>5-6</u>	8.5in	6.5in	9.5in	4.5in
<u>10</u>	11in	7in	6in	6in

*In reference to the shirts mentioned in the materials table

Patterning the Air Bladder

Step 1- Take Measurement

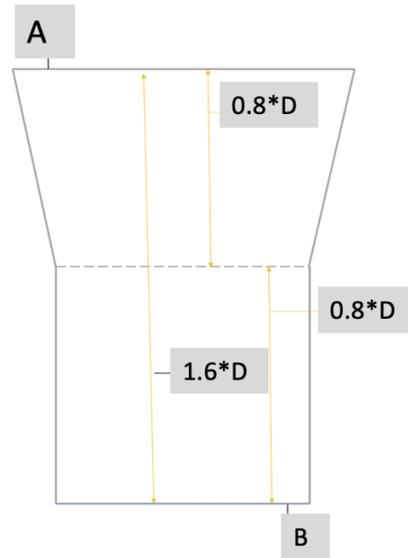
- Referencing the diagrams below, use a measuring tape to take the following measurements:
 - Bicep Circumference
 - Elbow Circumference
 - Length between Armpit and Waist
 - Length between Armpit and Elbow Crease



Key	
A	Bicep Circumference
B	Elbow Circumference
C	Armpit to Waist Length
D	Armpit to Elbow Crease Length

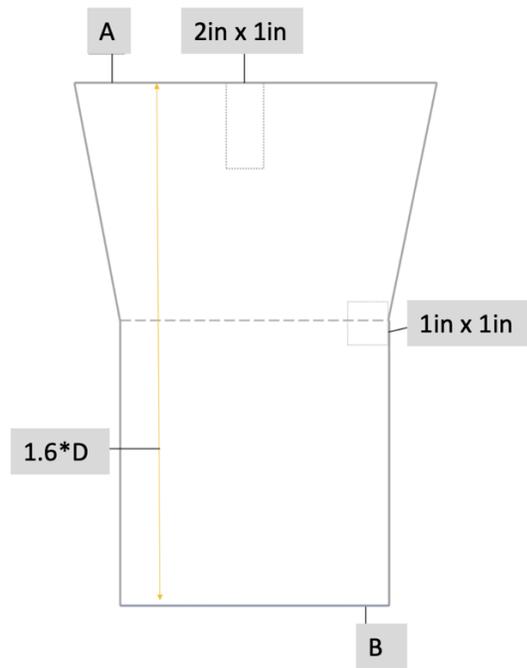
Step 2- Creating the Bladder Pattern

- On a large piece of paper, use the measurements taken to create the pattern on the right
- Refer to A, B, C, D measurements above
- Multiply measurements taken by number's indicated on pattern



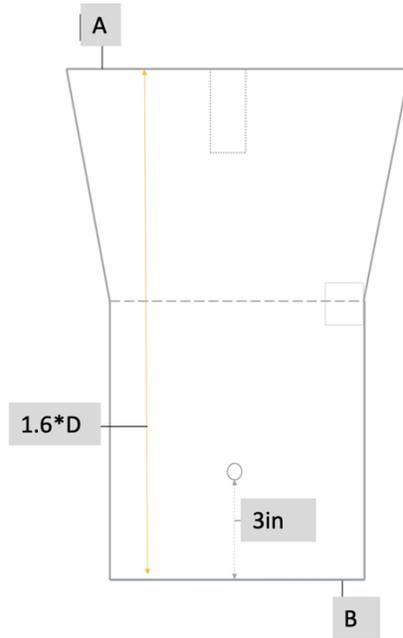
Step 3- Mark where kinks will go

- Add a 1 inch long by 1 inch wide square centered at left or right depending on dominant arm
- Add a 2 inch long by 1 inch wide rectangle centered at the top of the pattern



Step 4- Mark Where Nozzle will go

- Measure 3 inches from bottom at center
- Transfer nozzle opening markings from pattern to fabric



Bladder Construction

Step 1- Cutting Fabric

- Trace the pattern created above onto the heat sealable fabric twice
- Trace on only one piece for valve:
 - 2 inch long by 1inch wide rectangle at center top
 - 1 inch long by 1 inch wide square on the right side in chalk (refer to above pattern for placement)
 - Nozzle hole marking



- Cut the 2 pieces of heat-sealable fabric
*Do NOT pin pattern to polyurethane fabric as it will compromise its ability to retain air



Step 2- Attaching Knob for Inflation

- Trace width of knob with chalk
*1.5in, 2in, or 3in from
bottom depending on size of bladder



- Fold fabric then cut a small hole in the middle of one of the polyurethane pieces with fabric scissors
- Insert the knob with nozzle pointing down then place cardboard around knob



- Carefully, hot glue polyurethane fabric around knob
- Allow hot glue to dry for 12 hours
- Once dry, remove cardboard and make sure opening is air tight adding more hot glue, if needed



Step 3- Seal Bladder

Do NOT use any pins with heat sealable fabric as this will eliminate its ability to retain air

<p><u>OPTION 1:</u> with a hair straightener</p> <ul style="list-style-type: none">- Leaving a 1inch seam allowance, carefully press the 2 pieces of heat sealable fabric together- Press fabric together for 10 secs at 180°<ul style="list-style-type: none">- Fold while pressing to get hard to reach areas- Press until you have sealed the full length of the seam- Carefully, trim away seam allowance using caution not to cut into the sealed edges- Press 1 inch from top corners to make angles larger than 90° then trim excess to avoid breaking	 A photograph showing a person's hand holding a blue heat-sealable fabric bladder. The bladder is laid flat on a green cutting mat with a white grid. A hair straightener is being used to press the two layers of fabric together, creating a seal. The straightener is held horizontally across the width of the bladder. The person's hand is visible on the left side, holding the fabric steady.
<p><u>OPTION 2:</u> with Ultrasonic Welding Machine</p> <ul style="list-style-type: none">-turn on machine and adjust the setting (more detail please check with the company)-stack the 2 cut pieces of polyurethane fabric together with finished sides together-carefully roll over edges leaving a 1 inch seam allowance	