ROBOSUIT® INSTALLATION INSTRUCTIONS FOR THE KUKA KR120, KR180 and/or KR240 R3200PA

Prior to installing the Robosuit®, clean the robot surface, particularly if the robot has been in operation without any effective protection. This suit is designed to fit over the OE castings/cables only. Disconnect any custom brackets/valve-packs (etc.) that will interfere with installation—these may be reattached after suiting the robot.

Read through this entire set of instructions, and familiarize yourself with these procedures. *If you have questions, call Roboworld at any of the phone numbers provided on pages 5-13 of this instruction set.*

Estimated time to complete:

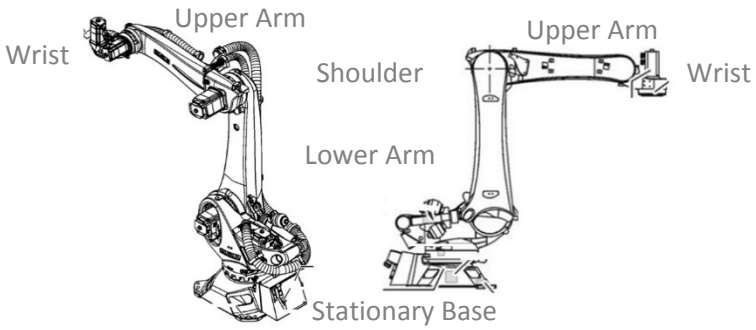
Instruction Review: 30-min

Installation Time: (1-man): 2+00hrs

(2-man): 1+15hrs

Note: All photo-references depict a 10-oz shop-grade, blue (prototyping) vinyl. Your material will differ.

1. Move the robot to its home position.



KUKA KR120, KR180 or KR240 R3200 PA "Home Position"

PREPARATIONS FOR SUITING ROBOT:

2. Remove shipping lugs (eye-bolts) and any fork-lift pockets. Confirm you have removed any custom bracketry, valve-packs, and shipping hardware, etc.

3. Unpack and identify the four (4) major components of the Robosuit® (photo-1): Wrist, Upper-Arm (UA), Lower-Arm (LA), and Stationary Base (SB). There are also covers for the synch marker at J2 (photo-2), the fin-blade casting cover (photo-3), assorted Velcro tape sections, and an OPTIONAL pressurization barb (see photo-4).

4. Begin at the robot's stationary base, forward edge of the cable connections "bump out" (photo-5). *Tip: Open the seam on the stationary base cover, and note the locations of Velcro LOOP sewn to the inside of the cover (photo-7). This will aide you in the next step.*

5. Apply ¾" Velcro HOOK tape as shown to the left and right-sides of the J1 limit switch housing, and the larger 1-1/2" section of Velcro HOOK tape along the diagonal. Also note the ¾" sections of Velcro HOOK tape applied to the top of the stationary base extending forward of the limit switch (underneath the J1 overhang), and on the rearward slope of the casting (photo-6).

6. Move to the J2 synch marker at the bottom of the lower arm. Locate the low-friction, Teflon® boot (photo-2). Test fit the boot for orientation. Mark the casting of the lower arm (pencil/sharpie), then apply four sections of ¾" Velcro HOOK tape. Install boot, and press sections firmly to one-another.

7. Move to the top of the lower-arm. Note the fin-like bump on the top of the casting. Test fit the low friction, Teflon® fin cover (photo-3). Mark the casting, and apply four sections of Velcro HOOK tape. Install cover, and press Velcro sections firmly to one-another.

8. OPTIONAL (not all Robosuits® are shipped with pressurization capability): If you specified a pressurized Robosuit®, locate the barb-installation kit (packaged separately). The barb is oriented as shown in photos 8 through 10.

INSTALLING THE ROBOSUIT®:

The installation sequence is: (1) Stationary Base, (2) Upper-Arm, (3) Wrist, and (4) Lower Arm.

9. Install the stationary base cover. Drape the cover over the stationary base so that the seam is on the right-side of the robot (when standing aft, looking forward toward J5). Note the "tunnel" for the J1 limit-stop lug (photo-11). Align the Velcro on the inside of the stationary base cover with the tape applied in step 5. Close all seams/snaps. See photos 11 through 12.

10. Locate the upper-arm cover. This is most easily identified by two PVC slip rings on either end of the cover. The smaller ring will rest in J4, the larger slip ring will rest in J3. Open all seams and PVC slip rings. Locate the J3 motor pocket. Reference photo-13 to orient the cover.

11. Drape the cover over the upper arm. The large (Kuka) cabling bundles are designed to be covered by the suit. Open the Velcro tab on the J4 slip-ring. Locate ring in the J4 joint gap. The PVC ring is flexible-enough to be twisted and opened into the joint (photo-14). Reattach the Velcro tab on the ring.

12. Move to the J3 end of the upper arm. Again, un-hook the PVC slip ring and, using a twisting motion, position the ring in the J3 gap (photos 15 thru 16). Once you have properly oriented the ring at J3, begin by closing the zipper at J3. Note the 90-degree jog in the upper-arm at the J3 ring (photo-17). *Tip: If zippers are difficult to close, or hard to reach, consider adding a zip-tie loop through the zipper tang to increase leverage and/or extend reach.*

13. Continue to close zippers/Velcro seams working toward J4 (photo-18).

14. A properly installed J3 ring is shown in photo-19.

15. The Kuka cable-bundles exit the upper arm at both the J3 and J4-ends of the cover. You may wrap them loosely at this time (photos 20-23). They will be mated to either the wrist (next steps) or lower arm (later step).

16. Locate the wrist cover (photo 24). It is identified by a ring at J4 and a cuff opening at J5. Open all seams, and the ring at J4.

17. The wrist J4 ring (pocket) overlaps the upper-arm J4 ring (already installed). Pull the wrist ring (pocket) over the J4 bump stops (photo-25), and overlap the upper-arm ring (see photos-26 and 27).

18. Connect the cable bundle (cuffs) between the upper-arm and wrist cover (photo-28).

19. Carefully (and slowly) raise the tool flange and continue to secure all seams and snaps (photo-29).

20. Pull the J5 cuff as low as it will sit, and clamp or zip tie the cuff to the J5 casting (photo-30). A correctly installed wrist section is shown in photo-31.

21. Locate the remaining component (Lower-Arm cover).

BEFORE PROCEEDING: You will need to cut the 0.125" (1/8") gum-rubber panel(s) located on the lower-arm. It is recommended that this be done prior to installing the lower-arm cover. Cut on a level and stable surface using a sharp utility knife (or a pair of industrial scissors).

(a) Locate the gum-rubber panel positioned along the bottom-circumference (next to zipper). Cut as show in photo-32 to allow the J1 limit stop to pass through the suit (photo-33)
(b) If you intend to PRESSURIZE THE ROBOSUIT®, also cut the gum-rubber panel located at the pressurization barb (see photos-34 and 35). If pressurization was not specified, this panel may not be sewn to the suit.

22. Open all seams, bellows and ring connections. Lift the cover by the J3 ring to the top of the lower-arm (see photo-36). Wrap the lower-arm ring over the upper-arm ring (previously installed). See photo-37.

23. Wrap the suit around the lower arm. Drape the bellows (accordion-like folds) around J2 (photo-38). Begin zipping the lower-arm closed (see photo-39).

24. Align each Velcro seams of the J2 bellow stack (accordion style pleats). See photo 40. For the time being, leave the balance of the lower arm open. Move to the top of lower arm.

25. (Photos-41 and 42) Carefully align the seams of the cable wrap at the top of the lower-arm. Secure all remaining Velcro seams and snaps. Connect the upper-arm cable cuff to the lower-arm cable panel.

26. Transition again to the lower-most portion of the lower-arm cover. You will see a Teflon "slip" that must be pulled down around J1 (photo-43). Pull down on this slip until level with the bottom of the J1 casting (photo-44). This will allow the lower-arm to slide past the stationary base cover without binding.

27. Continue to close any remaining bellows on the J2 bellow stack (photo-45), and zip the lower zipper 75% of the way-closed. When you reach the gum rubber panel, push the J1 limit stop through the cut you made in step 21 (see photo-46).

28. Fully close the lower zipper, and secure the bottom circumference using the Velcro band (photo-47).

29. Installation is now complete (reference photo-1).

CONFIRM FIT/FUNCTION:

30. Remove all tools, ladders, and unnecessary materials from the cell.

38. Power up the robot, and slowly jog each axis (starting at J5, and finishing at J1) to the limit of its range (both positive/negative). This will allow the suit to properly "seat" along each joint.

31. Once you have confirmed no interference, run your robot program. Adjust any clamps/zip-ties as required.

32. Reattach any customer-specific brackets/cable connections/valve-packs (etc.). This Robosuit® is fitted with multiple Velcro-attached access panels. Panels are located at the OEM peripheral hardware mounting pads and cable connection locations. These panels may be cut to allow hardware to pass through the suit, or they may be left in-place (uncut). Reference photos 48-51.

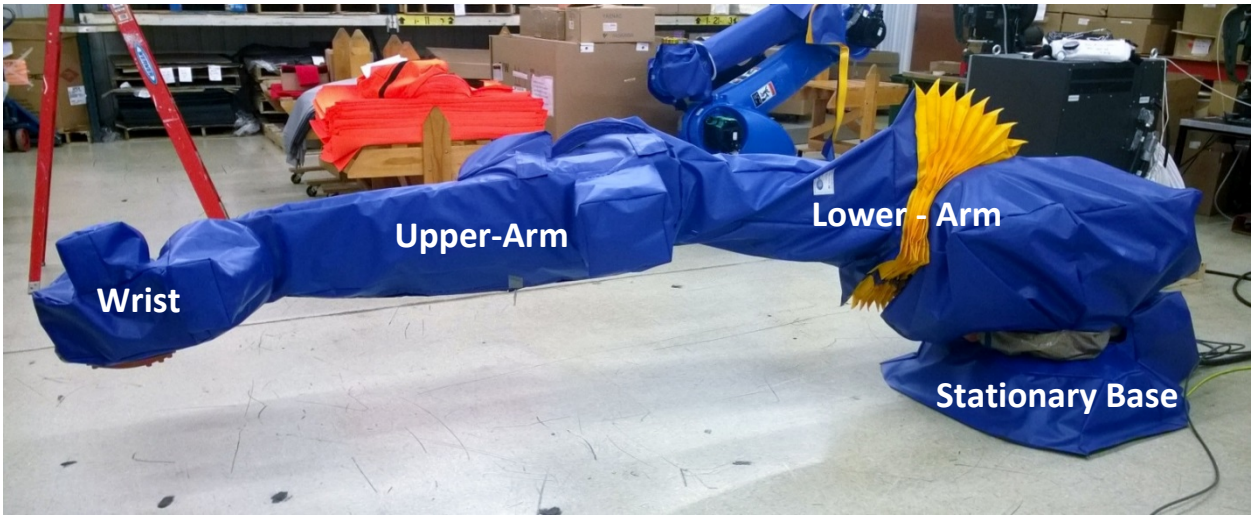


Photo-1: Major sections of Robosuit®: Wrist, Upper-Arm, Lower-Arm and Stationary Base

Photo-2: J2 synch marker cover (at base of lower-arm)

Photo-3: Casting protuberance cover (top of LA)

Photo-4: OPTIONAL Pressurization barb

Photo-5: Move to rear of J1/connection housing

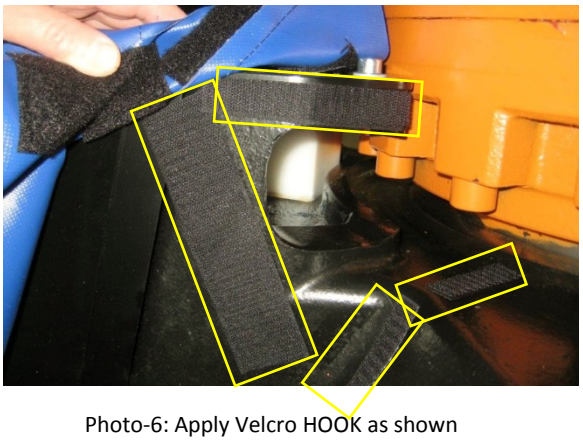


Photo-6: Apply Velcro HOOK as shown

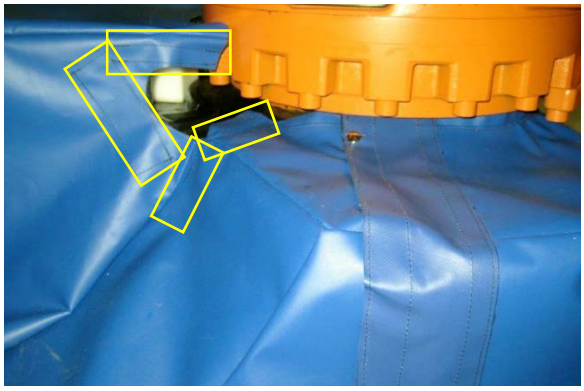


Photo-7: Note how stationary base aligns with Velcro tape

Photo-8: Open the cable clamp on left side of LA

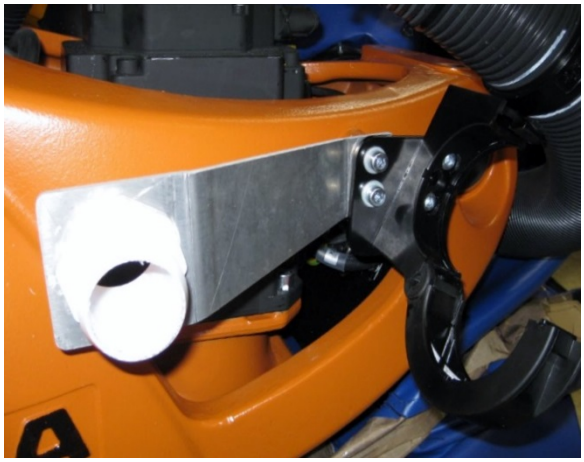


Photo-9: Remove the clamp, and slide bracket behind. Reattach

Photo-10: Note bracket position.

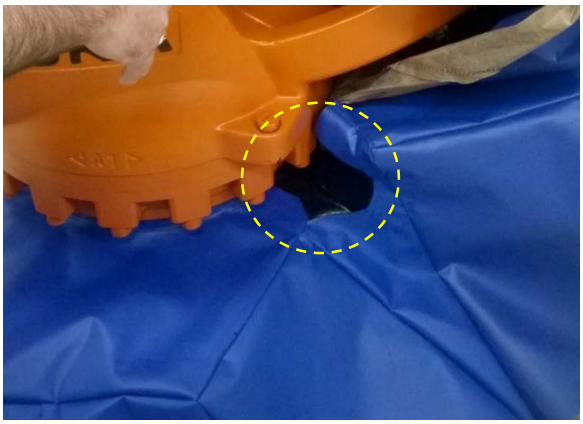


Photo-11: Installation of stationary base cover (note tunnel)

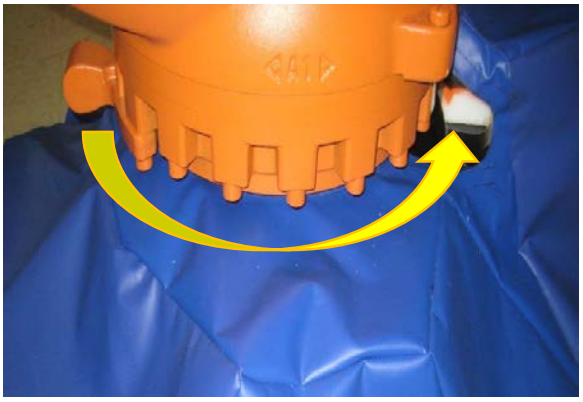


Photo-12: The J1 lug will pass through SB tunnel

Photo-13: Drape the upper-arm over robot. Note J3 pocket

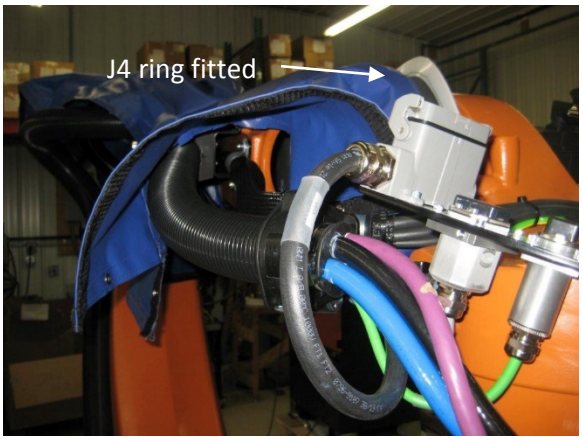


Photo-14: J4-end of upper arm. Route cables under suit.

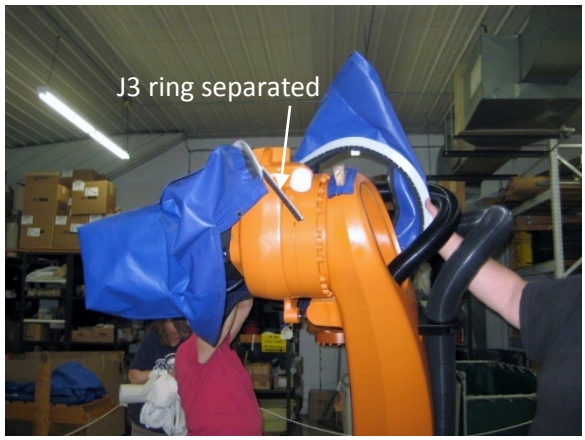


Photo-15: Maneuver the J3 ring into the joint

Photo-16: Route the J3 ring along the castings (under cables)

Photo-17: Reconnect J3 ring, and begin closing zippers

Photo-18: Work toward J4 closing zippers

Photo-19: Properly installed upper arm (Ring J3)

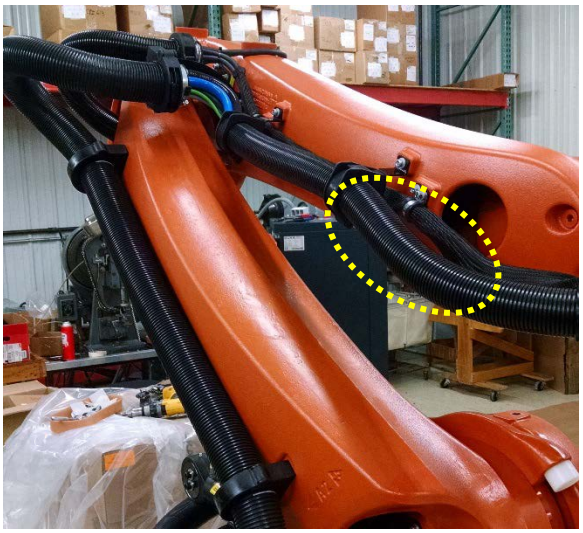


Photo-20: Cables exit upper arm here (via cuff)

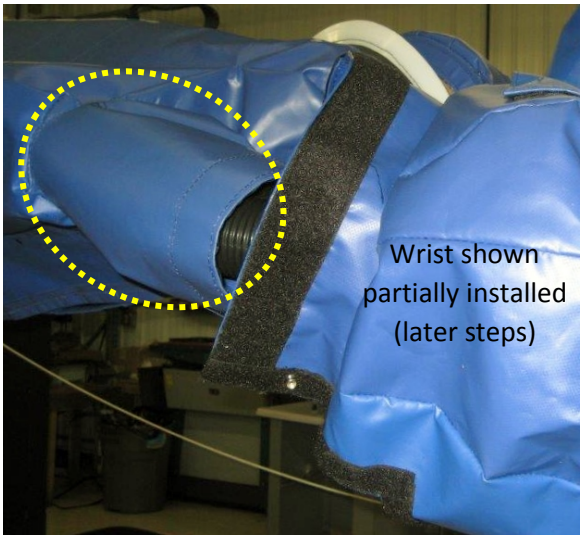


Photo-21: Note upper arm cable wrap near J4

Photo-22: (Rotated 90-degrees) Note cable exit near J3

Photo-23: Note cable wrap at J3 (Lower-Arm shown installed)

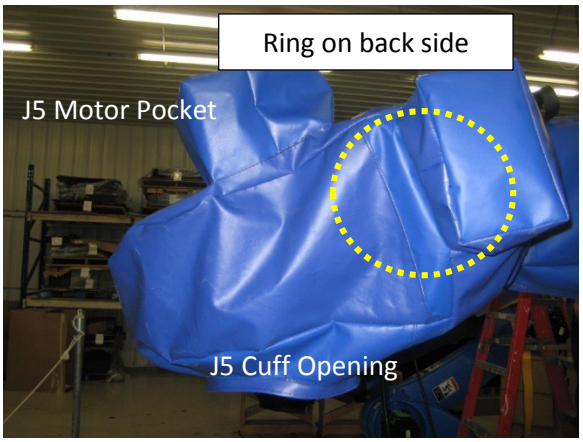


Photo-24: Open the J4 ring (back side) and place in joint-4

Photo-25: Pull the wrist (ring) over the bumper and mate

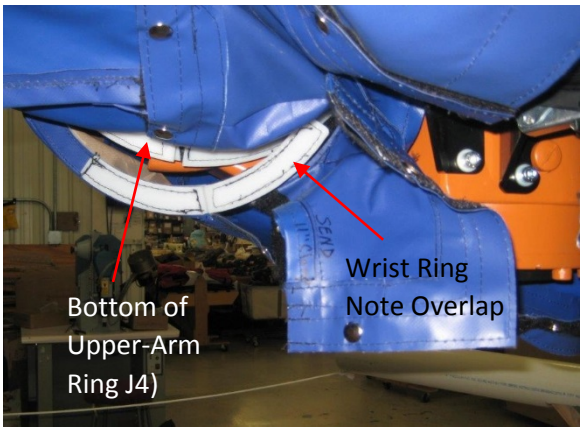


Photo-26: The wrist (ring) overlaps the upper-arm (ring)

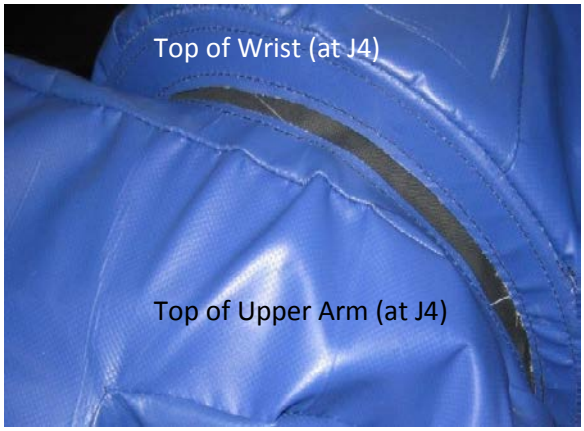


Photo-27: The wrist (ring) overlaps the upper-arm (ring)

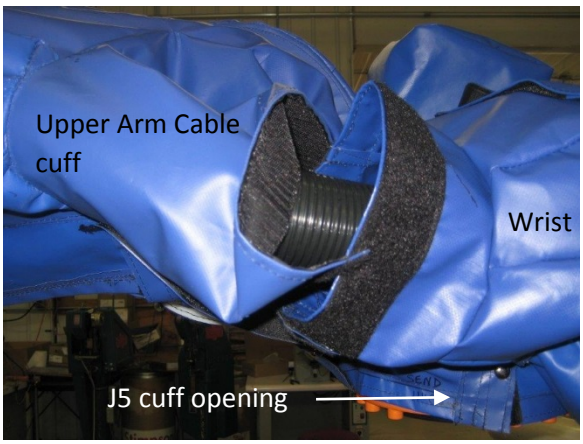


Photo-28: Attach cable section from UA to wrist

Photo-29: Raise tool flange and secure all seams/snaps

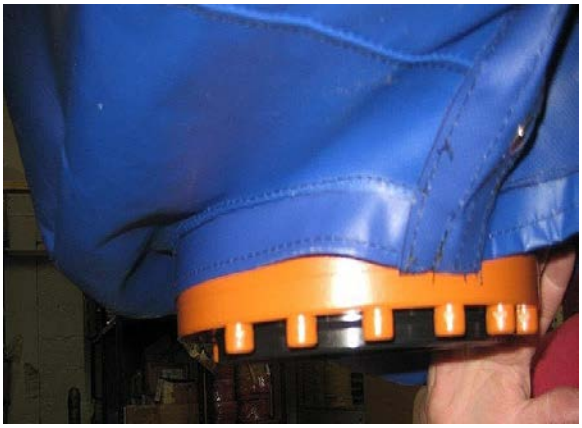


Photo-30: Clamp/Zip Tie cuff around casting

Photo-31: Top view, correctly installed wrist cover

Photo-32: Note the position of the gum rubber panel

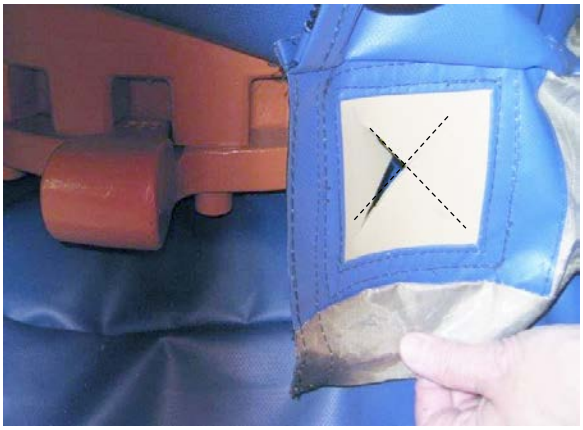


Photo-33: Cut the gum rubber to allow J1 limit stop passage

Photo-34: Gum rubber pressurization barb panel (option)

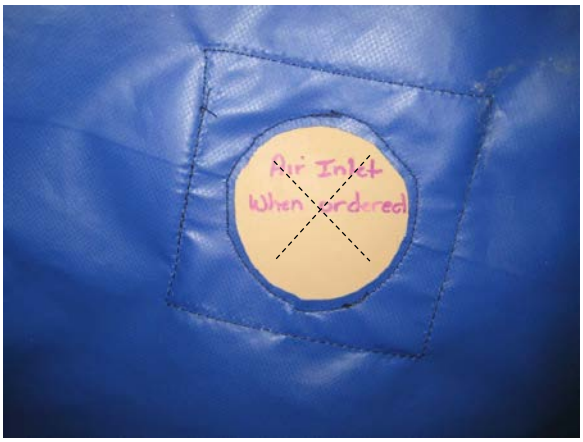


Photo-35: (Option) Cut the gum rubber pressurization port

Photo-36: Clamp at J6 tool flange

Photo-37: Note: Lower-Arm overlaps upper-arm (ring)

Photo-38: Wrap suit around arm, and position bellows

Photo-39: Begin closing zippers from top of lower arm (@J3)

Photo-40: Close the bellows and leave bottom un-zipped

Photo-41: Connect Cabling cuffs between UA and LA

Photo-42: Cable wrap between LA and UA (complete)

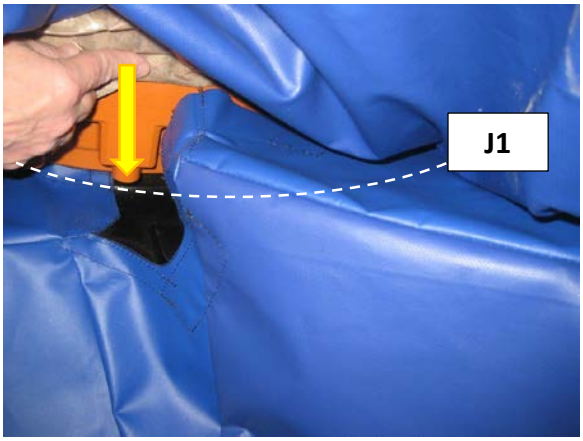


Photo-43: Pull Teflon “slip” between casting and SB

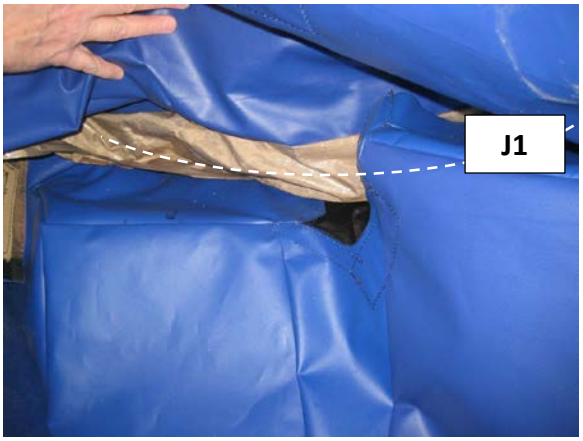


Photo-44: Teflon “slip” shown in position

Photo-45: Close Velcro seams on bellows. Close remaining zipper

Photo-46: Mate the Velcro inside motor pocket to motor

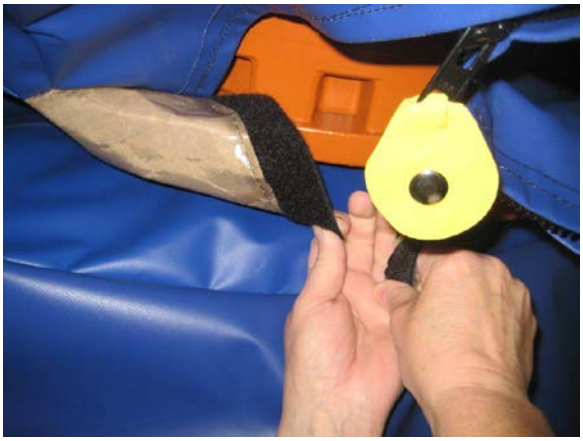


Photo-47: Complete LA installation by fastening Velcro

Photo-48: Velcro access panels on wrist

Photo-49: Velcro access panels on wrist (open)

Photo-50: Pressurization Vent (Choke with adjustable strap)

Photo-51: Hardware mounting access panels