

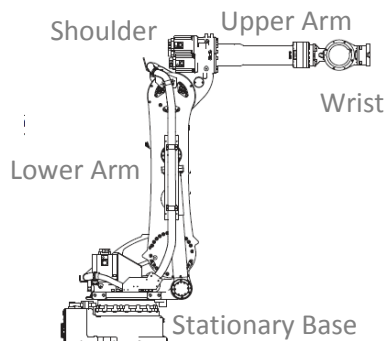


ROBOSUIT® INSTALLATION INSTRUCTIONS FOR THE MOTOMAN MH180

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.

1. Move the robot to its home position.



Motoman MH180 “Home Position”

PREPARATIONS FOR SUITING ROBOT:

2. Remove shipping lugs (eye-bolts) and fork-lift pockets. Confirm you have removed all custom bracketry, valve-packs, etc.
3. You **MUST** remove synch markers (at axes J1 through J5) and the hard-stop pin at J1 prior to installing the suit. **Failure to do so will result in (non-warranted) damage** to the Robosuit®. See accompanying photos 1 through 5.
4. Apply ¾” Velcro HOOK tape along the bottom perimeter of the J2 synch marker casting (photo-6).
5. Set the Teflon® cover atop the J2 casting, and mate Velcro sections to one-another (photo-7).
6. Apply 2”x3” Velcro HOOK pad to outward facing side of the J2 motor cover (photo-8).
7. Apply 2”x6” Velcro HOOK pad to mid-section of lower-arm as shown in photo-9. (Consider pre-positioning the lower-arm cover to determine exact location.)
8. Apply 2” Velcro HOOK tape to the front side of the J1 motor shield (photo-10).

9. Apply 2"x4" and 2"x2-1/2" Velcro HOOK pads to top of stationary base straddling the J1 deflection stop (photo-11). (Consider pre-positioning the stationary base cover to determine exact location.)
10. Transition to the cable tray on the back of the upper-arm, above J3 (photo-12). This tray must be elevated in order to fit the Robosuit® J3 ring (later steps).
11. Remove Qty-4, M6-1.0x20mm cap bolts from tray (photo-13), and lift the tray enough to insert the milled-aluminum riser (supplied). See photos 14 and 15.
12. Re-attach the cable tray using the supplied (Qty-4) M6-1.0x50mm cap bolts.
13. Apply a 2"x4" section of Velcro HOOK tape to the underside of the cable tray as shown in photo-15. (Consider pre-positioning the upper-arm cover to determine exact location.)

INSTALLING THE ROBOSUIT®:

14. Begin by locating the J1 servo motor suit cover. This is manufactured from grey Teflon® and features mesh vents along both sides of the cover (photo-16).
15. Orient the servo motor cover so that the Velcro tape on the inner/front edge aligns with the Velcro HOOK tape applied in step 8 (reference photo-10).
16. Pull the cover over the shield and motor, and drape the strap along the back of the robot. Secure the strap underneath the control cables at the rear of the robot (photo-17), and underneath the bracket (photo-18). Cinch the strap.
17. Locate the stationary base cover (if this option was selected). Not all Robosuits® ship with this option. The stationary base cover features a Velcro and Nickle-plated steel snap seam on the right-side of the cover (photo-19).
18. Before installing, locate the gum rubber panel sewn into the cover. This must be cut (using a sharp utility knife/blade) so that the J1 limit-switch can pass through the gum rubber (photo-20).
19. Once the gum rubber has been cut, open stationary base cover's Velcro seam, and drape the stationary base around the casting of the robot.
20. When properly oriented, note that the J1-limit switch/stop aligns with a gum-rubber panel sewn to the stationary base cover. The two pads of Velcro HOOK (applied in step 9, photo-11) will align with the mating LOOP pads on the inside of the stationary base cover (photo-20).
21. Locate the Robosuit® shoulder/upper-arm (UA) cover. This is most easily identified by the torque-tube sleeve (photo-21) and large PVC ring (photo-22). Open all Velcro seams/zippers.
22. Stand on the left side of the robot facing the J3 motor (photo 23). Hold the J3 PVC (large diameter) ring in hand. Orient the cover so that the ring is facing the robot (at J3), and the torque tube sleeve faces J6 (to your left). Separate the large PVC ring (at the Velcro joint) and install around the J3 gap.
23. Position the ring so that it sits atop the hard stop, and between the J3 synch marker castings of the upper-arm and lower-arm (photos-23 and 24). The ring is designed to operate approximately 10-degrees FROM VERTICAL (see photo-25).

24. Once the ring is in position, work your way across the shoulder closing all seams, snaps and cable enclosures. See photos 26-32.
25. Close the zipper on the torque tube approximately half-way. Separate the ring at J4 (at the Velcro joint), and position the ring at the joint-4 gap. Reattach the Velcro tab on the ring. Zip the remainder of the torque tube closed. The upper-arm/shoulder is now complete (photo-33).
26. Locate the wrist section of the Robosuit®. Starting at the ring-end, separate the ring at J4 (Velcro tab), and OVERLAP the J4 ring on the torque tube (photo-34). Orient the wrist cover so that the Velcro seam faces downward (toward the floor).
27. Drape the remainder of the wrist over the robot to the tool flange (J6). Take your time, and make certain to align the folds of the Velcro-sealed bellows. Secure the tool flange cuff with a clamp or zip tie (reference photo-35).
28. (OPTIONAL): Slowly rotate J4 and note if any twisting of the torque tube or wrist occurs. If so, use a clamp (or zip tie) to secure the fabric on the torque tube immediately BEHIND J4. The clamp must be on the torque tube portion of the sleeve close to J4 (reference photo-36).
29. Locate the lower-arm of the Robosuit®. This is the last remaining component, and features large accordion-style bellows at J2 (reference photo-37).
30. Begin by locating the J1 synch marker on the robot and the corresponding gum-rubber panel on the lower-arm cover. Cut a slit in the gum rubber, and slide over the synch marker (photos 38-40).
31. Locate the J3 ring on the lower-arm piece. Lift the ring to the top of the lower-arm so that it mates with the ring at J3 on the shoulder. The lower-arm ring overlaps the shoulder ring (reference photo-41). Tip: Since clearances at J3 are tight to begin with—consider installing a short portion of the ring over the shoulder ring, and “walk” or rotate it into position around its full circumference (similar to how you would install a bicycle tire onto a rim).
32. Once the ring is installed, work your way around the top portion of the lower-arm, closing seams, and snaps (photo-42). Enclose the cable between the lower-arm and shoulder (photos 42-43).
33. Move to the front of the robot. Beginning at the top of the lower-arm, zip the vertical seam closed just to the top-most bellow of the J2 stack (photo-44), reach inside the suit and press the Velcro LOOP of the J2 motor pocket to the Velcro HOOK motor cover (applied in step-6, photo-8). Reference photo-45 for correct orientation.
34. Carefully align each section of Velcro along the J2 bellow stack. Snap the flaps closed at both ends (photo-46).
35. Using a pair of scissors, cut a cross (or “X”) through the J1-hard-stop gum-rubber panel. This will pass over the pin portion of the hard stop (shown in photos 1-2).
36. Finally, position the gum rubber panel over the J1 hard-stop pin, and close the lower-portion of the zipper. Position the lower collar OVER the underlying stationary base (photo-47). The fully-suited MH180 is shown in photo-48. Close any remaining snaps.

CONFIRM FIT/FUNCTION:

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

38. Power up the robot, and slowly jog each axis (starting at J6, and finishing at J1) to the limit of its range (both positive/negative). This will allow the suit to properly “seat” along each joint.

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

40. 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 49-52.

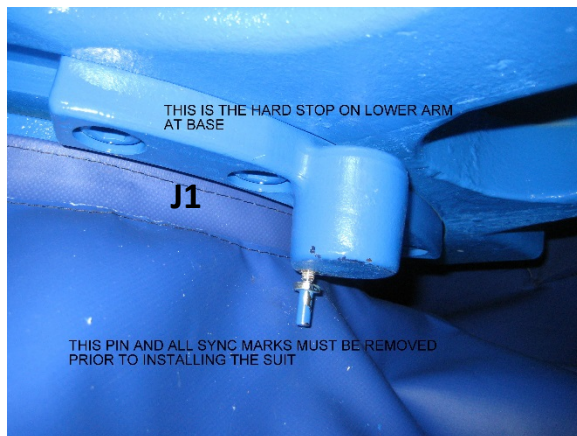


Photo-1: Location of hard-stop on lower-arm (at J1)



Photo-2: Remove pin from hard-stop on lower-arm (at J1)

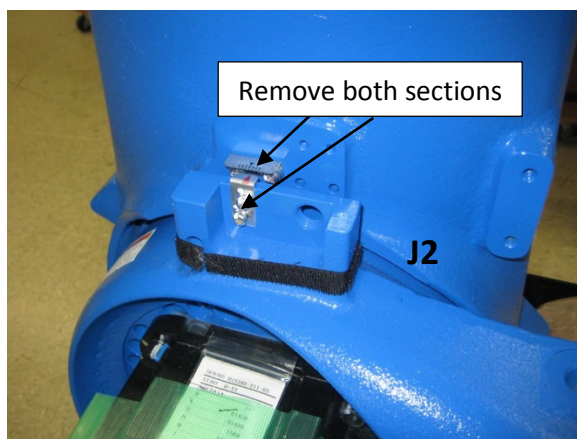


Photo-3: Remove both sections of synch markers at J2

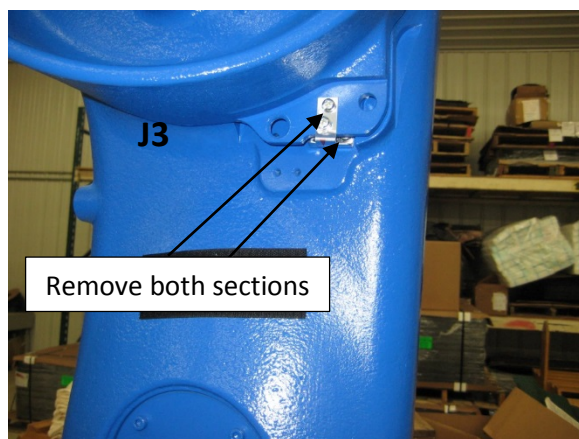


Photo-4: Remove both sections of synch markers at J3

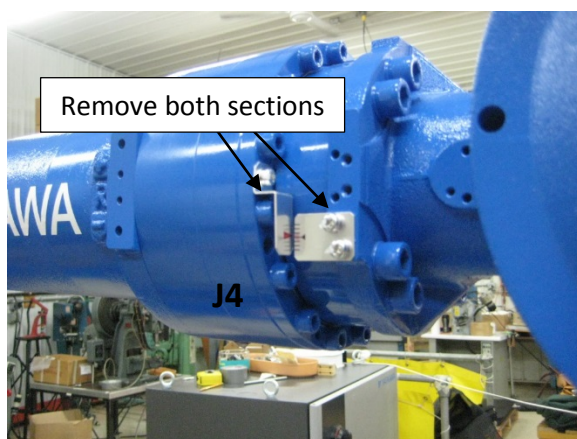


Photo-5: Remove both sections of synch markers at J4



Photo-6: Apply 3/4" Velcro HOOK tape to J2 synch casting

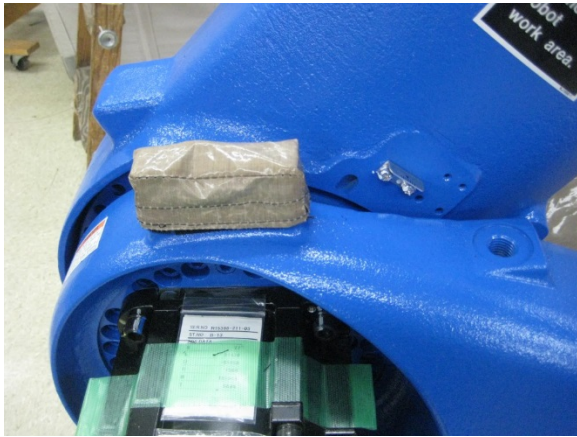


Photo-7: Affix Teflon® cap atop J2 synch casting

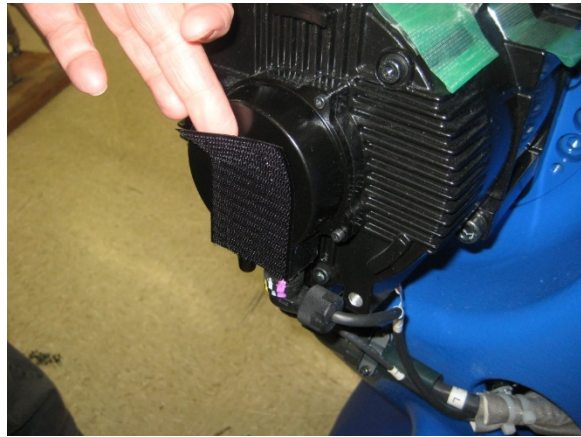


Photo-8: Apply 2"x3" Velcro HOOK tape to J2 servo motor



Photo-9: Apply 2"x4" Velcro HOOK tape to Lower Arm

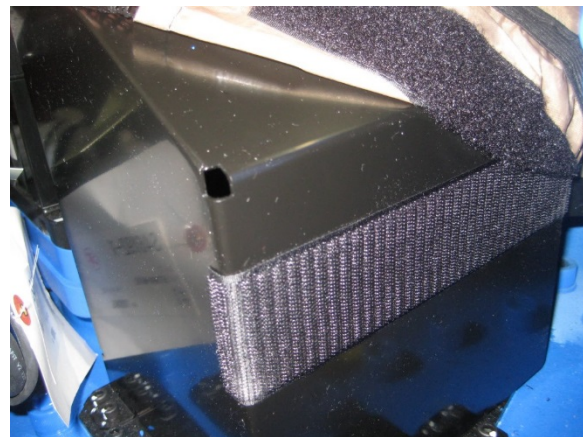


Photo-10: Apply 2" Velcro HOOK tape along J1 motor cover

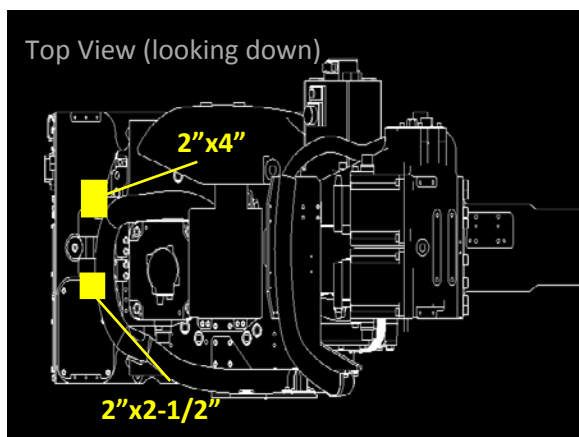


Photo-11: Qty-2 Velcro HOOK pads mounted to base

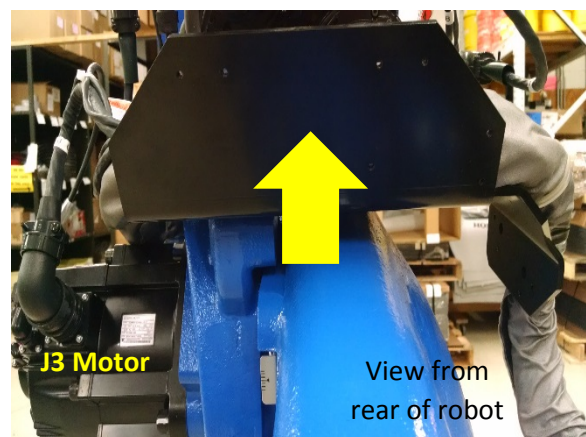


Photo-12: Cable tray atop J3 must be elevated before proceeding



Photo-13: Remove the (Qty-4) M6x20 cap-head bolts



Photo-14: Insert aluminum block and M6x50 bolts (supplied)

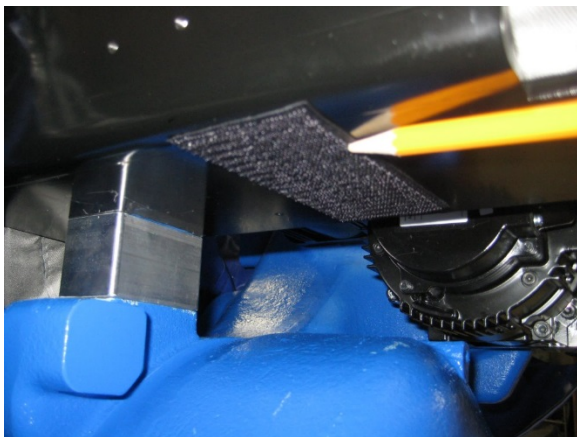


Photo-15: Apply 2"x5" Velcro HOOK tape to bottom of tray



Photo-16: J1 servo motor cover



Photo-17: Strap routed underneath control cable bundle

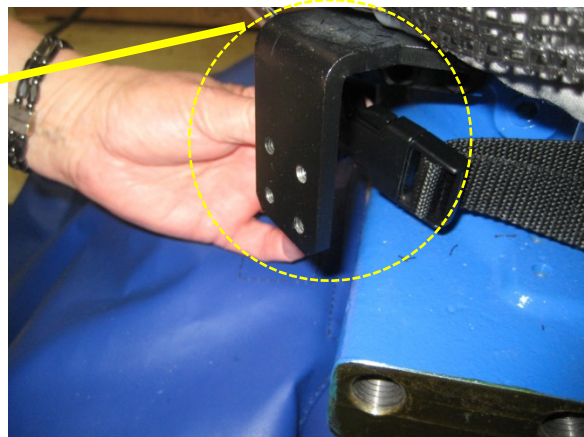


Photo-18: Route the strap under the mounting bracket



Photo-19: Stationary base cover (shown installed)

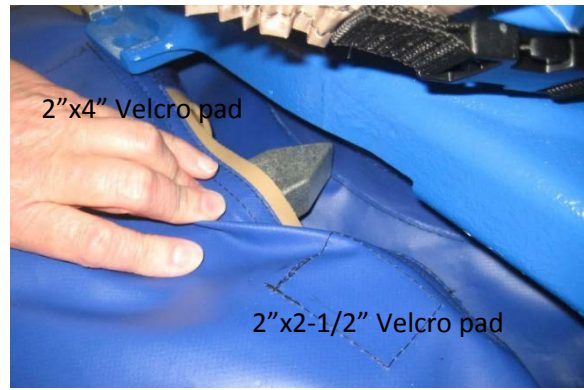


Photo-20: Gum rubber panel positioned over J1-limit switch

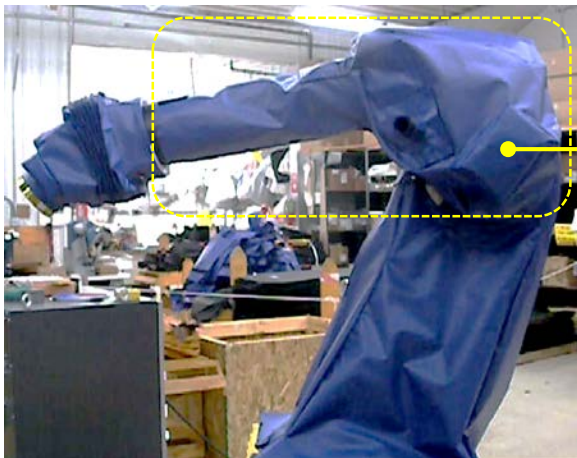


Photo-21: Upper-Arm/Shoulder piece (note motor pocket)



Photo-22: Begin Upper-Arm installation on this side of robot

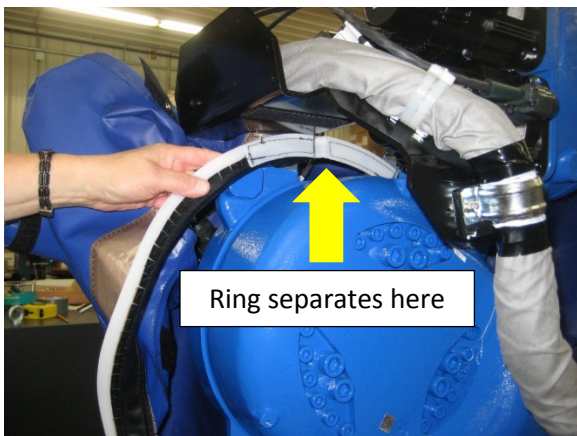


Photo-23: Separate the PVC ring and install as shown

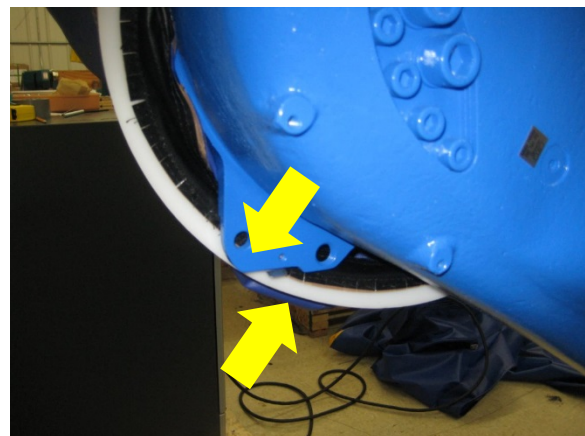


Photo-24: Locate between synch castings of LA and UA



Photo-25: Upper Arm at J3. Note 10-degree deflection



Photo-26: Correctly installed J3 orientation



Photo-27: Work across shoulder closing seams/cable cuffs

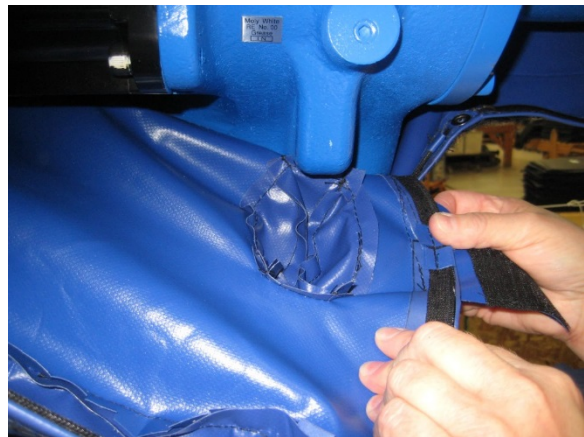


Photo-28: Note pocket in shoulder for bump stop



Photo-29: Bump Stop pocket (fit)



Photo-30: Velcro access panels on shoulder



Photo-31: Velcro access panels on shoulder



Photo-32: J3 area (installed)



Photo-33: Zipper torque tube sleeve closed and install wrist



Photo-34: Wrist ring overlaps torque tube ring



Photo-35: Clamp at J6 tool flange



Photo-36: OPTIONAL Clamp location on torque tube



Photo-37: Lower-Arm segment

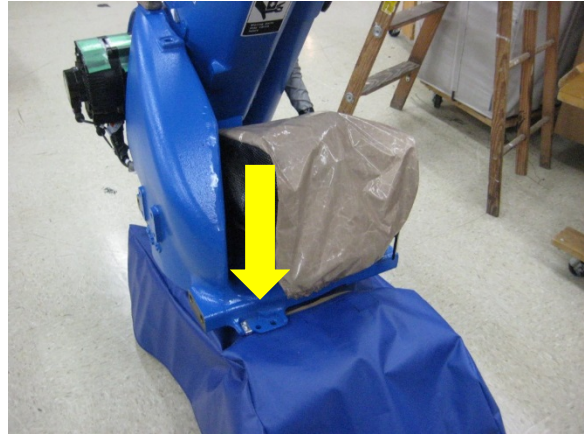


Photo-38: Note position of J1 synch marker



Photo-39: Mark the gum-rubber panel and cut

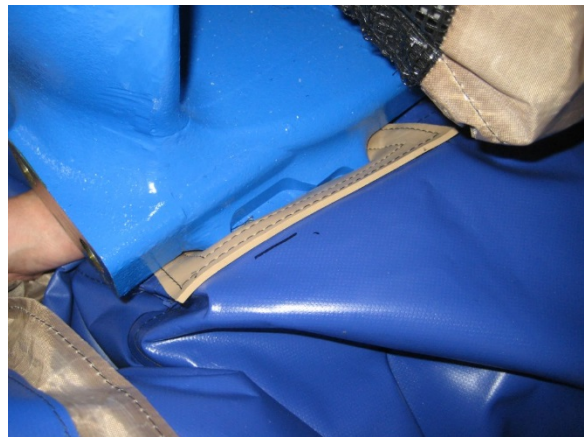


Photo-40: Slide gum rubber over synch marker



Photo-41: OVERLAP the J3 ring at the shoulder



Photo-42: Close seams along top of arm



Photo-43: Wrap the cable and attach to shoulder



Photo-44: Close zipper along front of lower arm



Photo-45: Mate the Velcro inside motor pocket to motor



Photo-46: Align/Close Velcro seams along each bellow-fold



Photo-47: Cut gum rubber. Velcro band over base collar



Photo-48: Installed MH180 Robosuit®

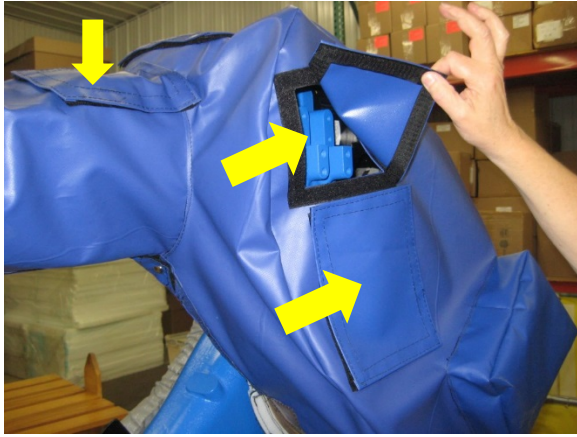


Photo-49: Velcro access panel locations



Photo-50: Velcro access panel locations



Photo-51: Cabling/Hose access panel locations



Photo-52: Cabling/Hose gooseneck access panel