ROBOSUIT® INSTALLATION INSTRUCTIONS FOR THE KUKA KR210 QUANTEC SERIES

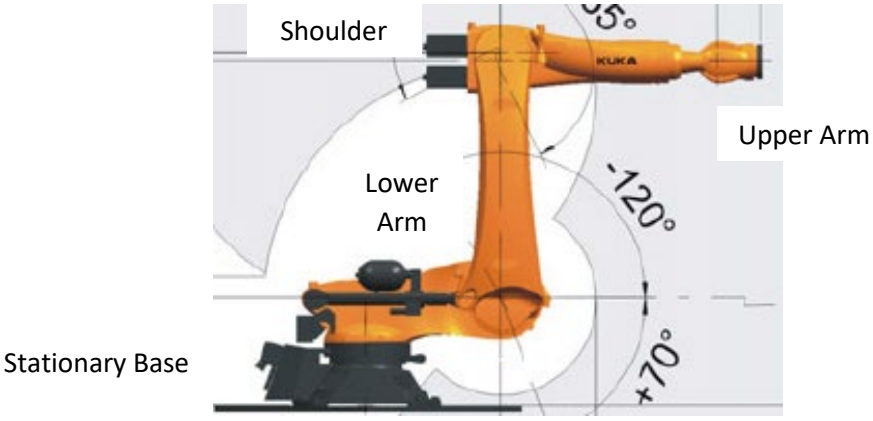
ROBOT PREPARATIONS:

1. Read through this entire set of instructions and familiarize yourself with these procedures. If you have questions, contact Roboworld at (513) 633-2585.

2. This suit is designed to fit over the OE castings/cables only. Disconnect any shipping lugs, fork-lift pick-pockets, custom brackets, valve-packs, weld spools, (etc.) that will interfere with installation—these may be reattached after installing the suit.

3. Estimated time to complete:
   Instruction/Familiarization Review: 30-min
   Installation Time: (1-man): 2+00hrs, plus time to clean and/or reattach any accessories.
   (2-man): 1+15hrs, plus time to clean and/or reattach any accessories.

4. SAFETY PROTOCOL: Move the robot to its home position. Make the area around the robot safe for installation. Observe all Kuka and local safety instructions. Electrically isolate (lock out) the cell.



KUKA QUANTEC KR210 R3300 “Home Position”

5. Clean the robot surface, particularly if the robot has been in operation without any effective protection.

SUIT PREPARATIONS:

1. Unpack and identify the four (4) major components of the Robosuit® (photo-1). Each component is labelled on the production tag (located inside each cover):

- UA Upper-Arm (J4-J6),
- SH Shoulder (J3-J4),
- LA Lower-Arm (J1-J3), and
- SB Stationary Base (floor-J1)
- Some versions also have assorted Velcro tape sections, hard stop covers, etc.

2. OPTIONAL: If you specified a pressurized Robosuit®, locate the barb-installation kit (packaged separately). The barb is oriented as shown in photos 3-6. Individual barb installation instructions are provided with each kit.

INSTALLING THE ROBOSUIT®:

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

1. Install the stationary base cover. Open the Velcro seam and wrap the cover around the stationary base so that the cabling canopy faces aft. Note the accommodation in this cover for the Kuka I/O housing (photo 2). Fit the concave section of the cover into the J1 limit stop tunnel on the black portion of Kuka's base casting. Close all seams/snaps. See photos 2, 7, 8. **Note**: Some customers have opted to cut away material from the tunnel, especially if your programming routine requires +/- 180-degrees rotation through the axis 1 limit switch.

2. Locate the shoulder cover. This is most easily identified by two Kydex 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 Kydex slip rings. Locate the J3 motor pocket. Reference photos 9-13.

3. Drape the cover over the shoulder. The large (Kuka) OE cabling bundles are designed to be covered independently by sleeves fitted to the suit components. Open the Velcro tab on the J4 slip-ring. Locate ring in the J4 joint gap. The KYDEX ring is flexible-enough to be twisted and opened into the joint. Reattach the Velcro tab on the ring.

4. Move to the J3 end of the shoulder. Again, un-hook the KYDEX slip ring and, using a twisting motion, position the ring in the J3 gap underneath the OEM cable bundles (photos 10, 15). Once you have properly oriented the ring at J3, begin by closing the Velcro and zipper nearest J3. **Note** the jog in the upper-arm seam near the J3 ring (photos 10, 12, 13).

5. Continue to close Velcro seams working toward J4 (photo-11).

6. A properly installed J3 ring is shown in photo-13.

7. The Kuka cable-bundles exit the shoulder near the J3 side of the cover. You may wrap them loosely around the bundles at this time (photos 15, 24, 27). They will be mated to the lower arm in a later step.

8. Locate the upper arm cover. It is identified by a ring at J4 and a cuff opening at J5 with smaller sized bellows at J5. Open all seams, and the ring at J4. Orient so that the zipper faces down. Drape over arm.

9. The upper arm J4 ring mates to the shoulder J4 ring (previously installed). Mate the rings flush with one-another and install the smaller of the two ring retainers (photos 16-18).

10. Secure all seams, zippers and snaps. Confirm zipper is facing down (toward the ground).

11. Pull the J6 cuff as low over the rotational tool flange as desired, and clamp (or zip tie) the cuff to the J6 casting (photo-18). Do not attempt to clamp to the rotating tool-flange itself as non-warranted damage to the suit may occur.

12. Locate the remaining component, Lower-Arm cover (photo 1).

13. Open all seams, bellows and ring connections. The zipper will face the tool flange once installed. You will notice that peel and stick Velcro sections are mated to select portions of the sewn velcro on the inside of the cover. **Note** their corresponding locations (roughly) on the robot for the time being. As you approach full-closure of the lower arm cover, you will separate the tape from the sewn Velcro. Wipe the casting with isopropyl alcohol to ensure clean/strong adhesion. Remove the adhesive backing and adhere the tape sections to the robot casting.

14. Lift the cover by the J3 ring to the top of the lower-arm. Mate the lower-arm J3 ring to the shoulder J3 ring (previously installed). Stay under (inside) the OEM cable bundles. Mate the rings flush with one-another and install the remaining ring retainer (see photos 15, 22).

15. Wrap the suit around the lower arm. Wrap the OEM cable bundles near J3. The balance of the cable bundles will remain inside the lower portion of the cover (inside the suit). Drape the bellows (accordion-like folds) around J2. Begin zipping the lower-arm closed (photos 15, 22) near J3.

16. Align each Velcro seam of the J2 bellow stack (accordion style pleats). See photos 23, 25. For the time being, leave the balance of the lower arm open. Move again to the top of lower arm.

17. Complete wrapping of the OEM cable bundles on both the shoulder and lower arm covers. Mate the Shoulder wraps to the lower-arm wraps (Photos 15, 24). Secure any remaining Velcro seams and snaps on the sleeves.

18. Transition again to the lower-most portion of the lower-arm cover. At the rear of the suit (opposite the zipper) remove the Velcro tape from the sewn Velcro inside the cover. **Note** the location of the velcro attachment on the robot. Wipe the casting with IPA and adhere the tape section of Velcro to the robot as it corresponds to the location of the sewn Velcro (inside the suit). Ensure good Velcro engagement.

20. Move to the front of the lower arm and continue to close any remaining bellows on the J2 bellow stack (photos 23,25) and zip the lower zipper completely closed. When you reach the rectangular cut out for the J1 limit stop, push the cover over the robot's J1 limit stop through the aperture (photo-19).

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

CONFIRM FIT/FUNCTION:

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

2. 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.

3. Once you have confirmed there is no interference, run your robot program at production servo speeds.

4. If necessary: Make the cell safe again (page 1 **Safety protocol**). Adjust any clamps/zip-ties or Velcro overlaps (as desired) and 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 photo 27.

PHOTO SUPPLEMENT:

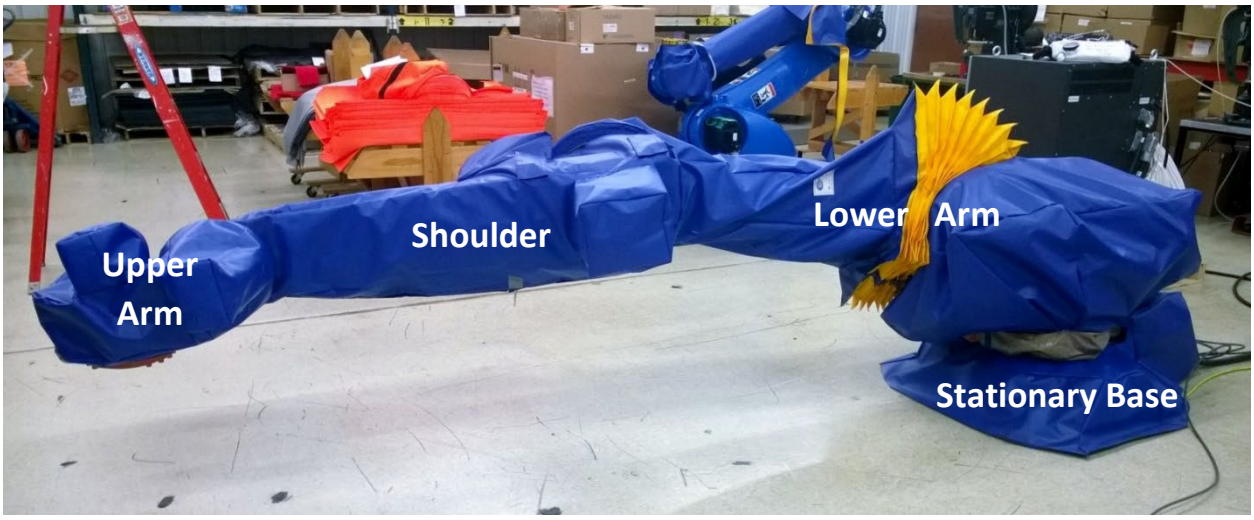


Photo-1: Major sections of Robosuit®: Upper arm, Shoulder, Lower Arm and Stationary Base

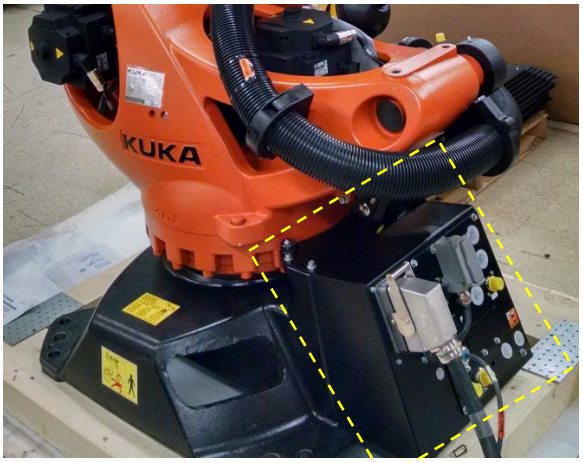


Photo-2: Kuka I/O connection housing

Photo-3: OPTIONAL Pressurization barb

Photo-4: Open the cable clamp on left side of LA

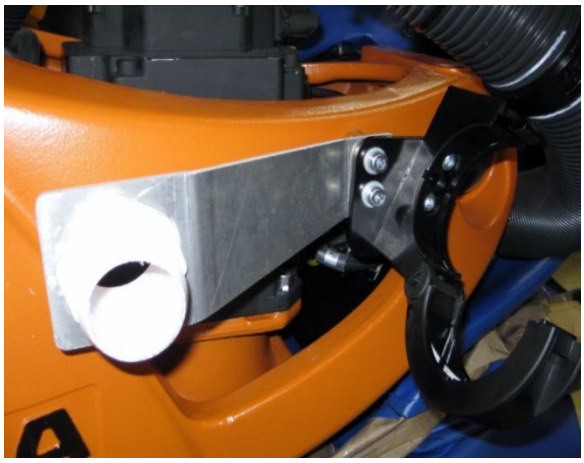


Photo-5: Remove the clamp, and slide bracket behind. Reattach

Photo-6: Note bracket position.

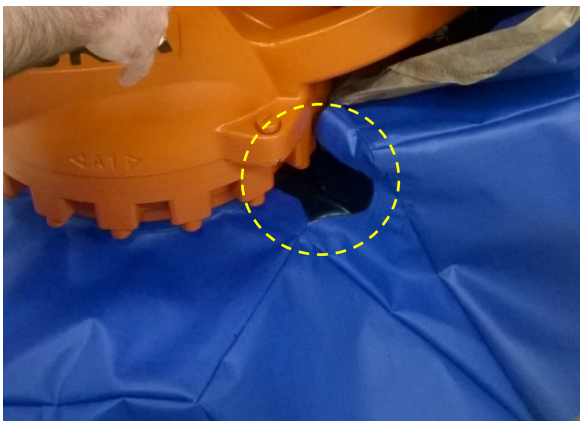


Photo-7: Stationary base cover--note tunnel. (Customer cut)

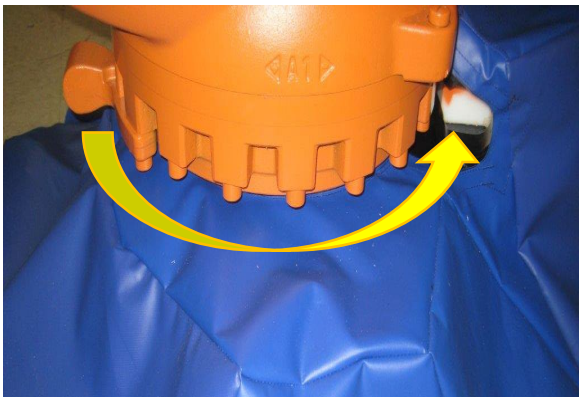


Photo-8: The J1 lug will pass through SB tunnel

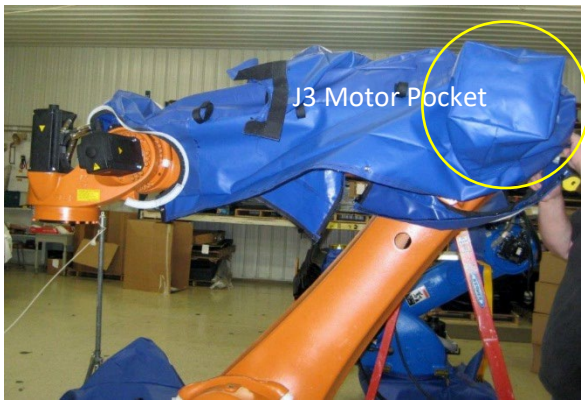


Photo-9: Drape the Shoulder over robot. Note J3 pocket

Photo-10: Maneuver the J3 ring into the joint

Photo-11: Reconnect J3 ring, and begin closing zippers

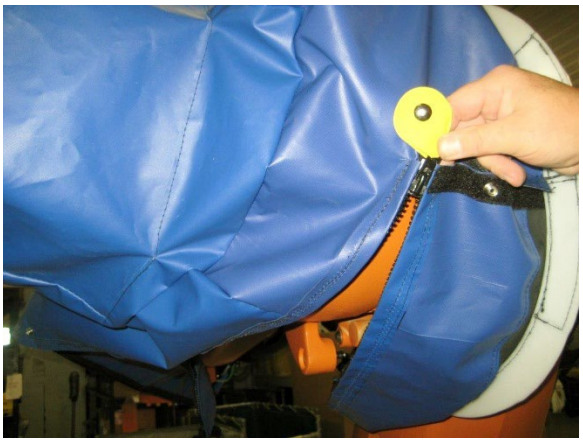


Photo-12: Work toward J4 closing zippers

Photo-13: Properly installed shoulder (Ring J3)

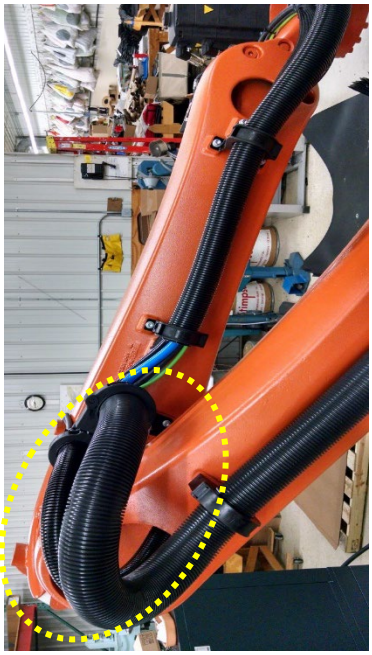


Photo-14: (Rotated 90-degrees) Note cable exit near J3

Photo-15: Your cable bundles are wrapped individually.

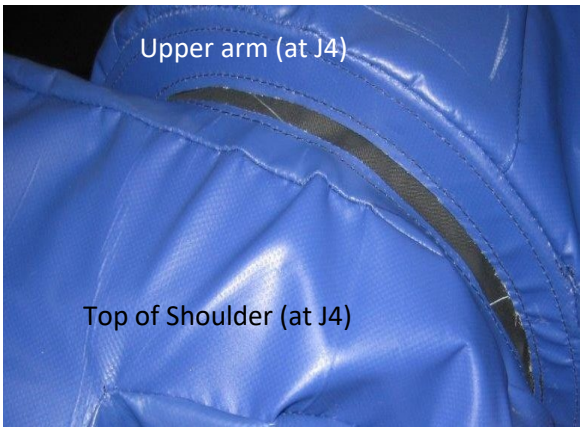


Photo-16: The upper arm (ring) overlaps the upper-arm (ring)

Photo-17: Wrap tool flange and secure all seams/snaps

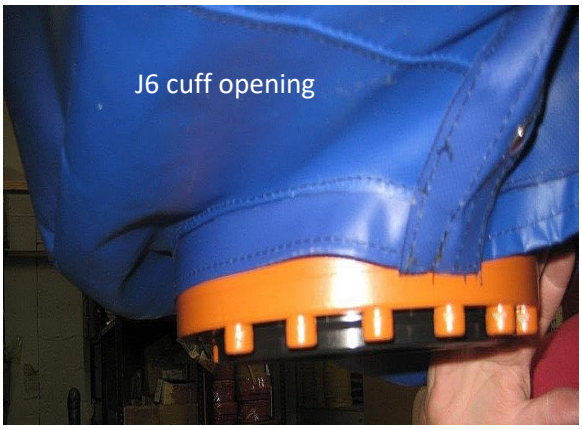


Photo-18: Clamp/Zip Tie cuff around casting

Photo-19: J1 limit stop passage

Photo-20: Gum rubber pressurization barb panel (option)

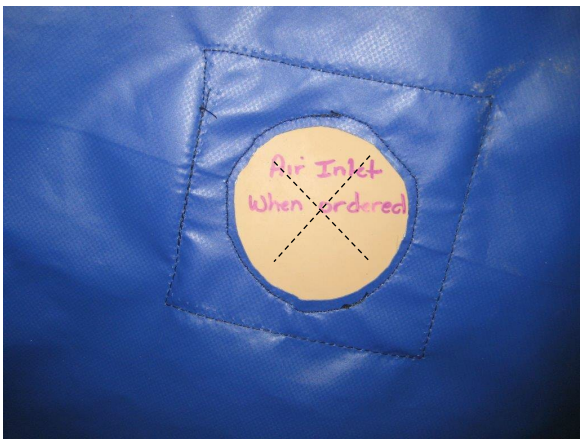


Photo-21: (Option) Cut the gum rubber pressurization port

Photo-22: Begin closing zippers from top of lower arm (@J3)

Photo-23: Close the bellows and leave bottom un-zipped

Photo-24: Connect Cabling cuffs between UA and LA

Photo-25: Close Velcro seams on bellows. Close remaining zipper

Photo-26: Pressurization Vent (Option)

Photo-27: Hardware mounting access panel