

LTI Locking Shoulder Joint (SJ90)

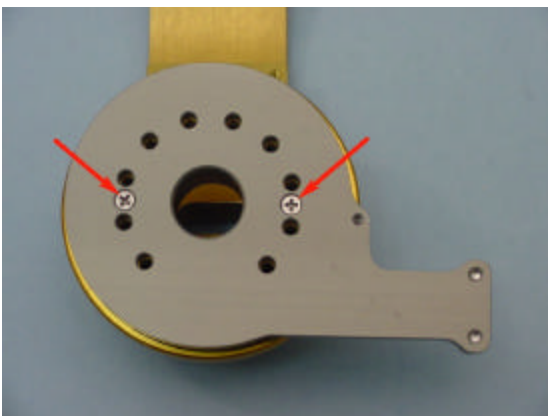
The LTI Locking Shoulder Joint (SJ90) is a new design that replaces the previous LTI-Collier Locking Shoulder Joint (SJ50). This new joint has many features to improve performance and longevity. Steel locking components have replaced aluminum, ball bearings have replaced bushings and a bronze bushing is used for the friction abduction adjustment. Additionally, the lock/unlock is an “alternating” mechanism, so each time the slider is pulled, the lock state changes from locked to unlocked or visa versa. The release can be actuated manually by any of three devices: 1) a knob on the slider, 2) a remote release lever mounted on the socket, or 3) a chin nudge control. This joint is supplied as an exoskeletal set-up with a humeral plate, however an optional endoskeletal adapter kit is available to convert the joint. A 3-spoke mounting plate is also available for additional “structure” when used with test sockets or small X-frame sockets.



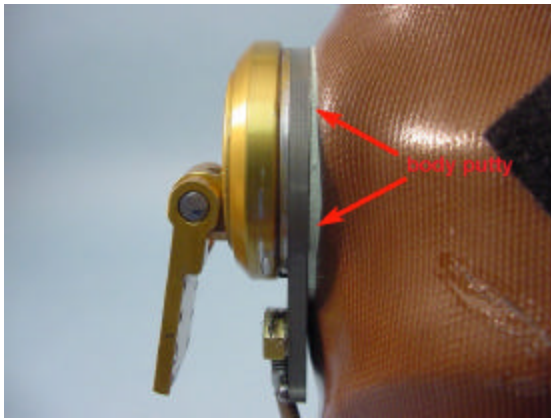
The LTI Locking Shoulder Joint (SJ90) shown here has 36 locking positions in flexion and adjustable friction in abduction. The size is $2\frac{3}{8}$ ” in diameter and it weighs 172 grams. The most notable difference between this shoulder joint and the previous model (SJ50) is this joint’s ability to rest in either the locked or free-swing position. Since the mounting and humeral plates are identical to the old joint, it is relatively easy to replace the old joint with this one.



The SJ90 Shoulder Joint kit consists of the shoulder joint, humeral plate, mounting plate and associated hardware and 3 hex wrenches. Additionally, an optional remote release lever can be added to make it convenient for the user to activate the lock. Alternatively, a modified Sierra Nudge Control is available for chin operation.



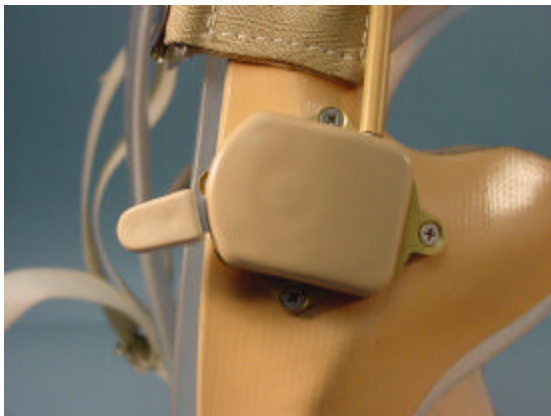
The shoulder joint is shipped assembled with two flat-head screws holding the backing plate in place. There is no need to remove these screws. Keep this assembly together to avoid problems! Removing this plate frees the locking ring and reassembling this ring and the associated plunger pins can be difficult. Additionally, the locking ring could be installed backwards causing the joint not to operate.



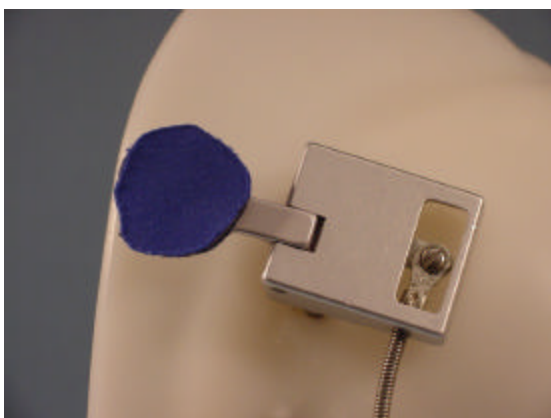
Shoulder Joint must be mounted to a flat surface with adequate structural support. If the surface is not flat, it can deform the backing plate, resulting in excess friction in the joint and unsatisfactory operation. The structure is also important because of the considerable force on the shoulder joint. Poor mounting will likely result in unwanted movement and possible failure. For proper mounting, drill (#26 bit) through the socket and use all 10 flat-head screws provided (select best length).



The Shoulder Joint shown mounted to an X-frame socket. The remote actuator lever is mounted in a convenient place for the user to reach and the path of the Bowden cable is relatively straight with no sharp bends or unnecessary turns that could increase friction and make it difficult to operate. Generally, the actuator is positioned below the joint to conceal it and to make it convenient to route the Bowden cable.



Remote Release Levers - are available for right- and left-hand mounting (Bowden cable exits right or left – right shown here). These are provided with a mounting plate to secure them to the front of the socket. This plate can be removed and the release lever mounted from the back using the threaded inserts (M3 X 0.5 metric thread) in the housing. The new Shoulder Joint requires spring-loaded release levers rather than the two-position levers used previous with the LIT-Collier Shoulder Joint.



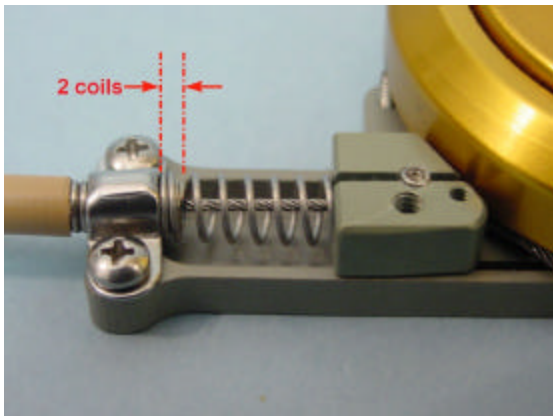
Nudge Control - An alternative to the remote release lever is the Sierra Nudge Control shown to the left. This is generally used as a chin-nudge lever rather than hand-operated release. It can be mounted from the front with the mounting plate provided or from behind by removing the mounting plate and using the two 6-32 flat-head screws provided.



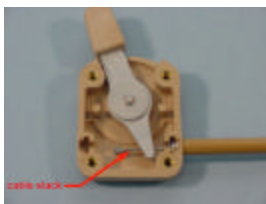
Incorrect Cable Routing - Avoid routing Bowden cable through sharp and unnecessary bends which can increase the friction in the system and make it difficult for the user to operate (as shown to the left). Also try to have the cable approach the end points straight-on.



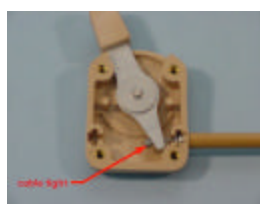
Correct Cable Routing - Relatively straight runs or broad sweeping curves are best for routing Bowden cables. Additionally, the ends of the Bowden cable (at the release lever and near the shoulder joint) should align with the two end points. Avoid any sudden or sharp changes in direction at these end points.



Clamping the Bowden Cable - When setting up the Bowden cable and securing it at the shoulder joint end, leave two coils of the shroud exposed on the shoulder joint side of the clamp as shown here. This will center the spring against the clamp. Too few coils will allow the return spring to move off-center. Too many coils exposed may prevent the puller from traveling far enough to activate the alternate mechanism.

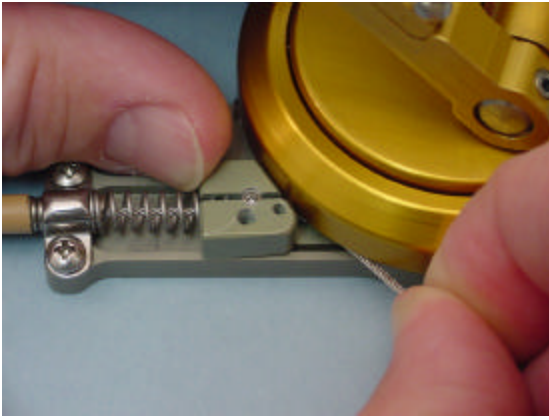


Slack present



Slack removed

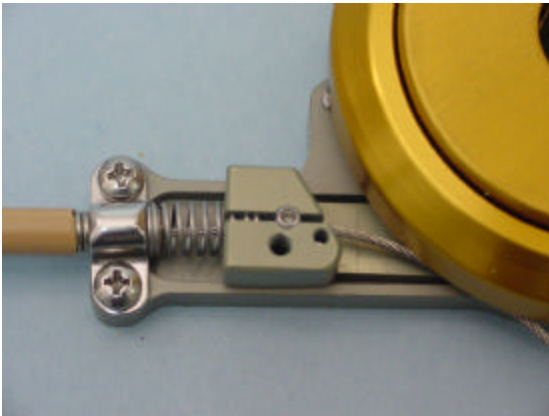
Remove slack in cable - To assure that the adjustment is correct, pull firmly on the cable at the shoulder joint end to remove any slack. If left slack the locking release mechanism may not work properly. The alternating mechanism requires almost $\frac{1}{2}$ " of travel. Since these release levers have a maximum travel of just over $\frac{1}{2}$ " (0.54") it is critical that all of their travel be used effectively. Install the 1" long coil spring over the cable and thread the cable through the block.



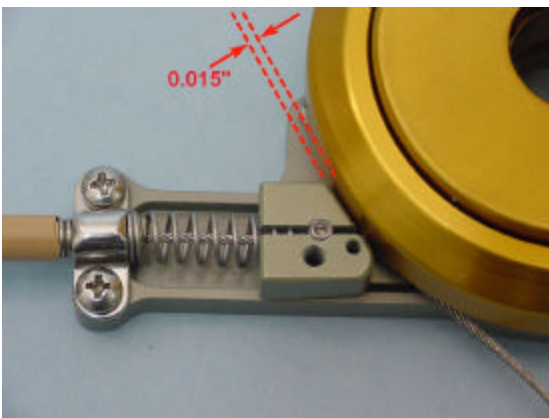
Removing Cable Slack - With the Bowden cable properly routed and ends secured, loosen the set screw, pull the cable end again to remove any slack, and push the puller block toward the shoulder joint as shown here.



Securing the Cable - With the alternating release mechanism in the “locked position” or fully extended toward the shoulder joint and continued tension on the cable end, apply pressure to the puller (as shown) and tighten the set screw with the hex wrench provided (0.05”). This will enable the shoulder joint to lock securely and not “back out” under load.



Unlocked Position - When properly set-up, the puller rests in one of two positions. The unlocked or “free swing” resting position as shown here. In this case the spring is partially compressed and the locking pins in the shoulder joint are disengaged allowing the joint to move freely.



Locked Position - The correct “locked position” is shown here. The puller must travel fully toward the shoulder joint to lock properly. The gap between the shoulder joint and the release mechanism should be about 0.015”. To test this, if more than 3 thicknesses of paper can be inserted here, then the release mechanism should be readjusted. Back out the set screw, and push the puller block toward the shoulder joint again, then re-tighten the set screw.



When possible, it is best to pass the prosthetic wiring through the center hole provided in the shoulder joint. These wires can pass through the yoke of the humeral joint as shown to the left or can simply run down the medial side of the humeral joint and into the humeral section. It is also wise to protect the wiring with a chafing sheath as shown here. The humeral plate can be hinged either at the top or bottom of the joint, whichever is more convenient and is more anatomically correct.



Reversible Humeral Plate (SJ61) – this plate is supplied with mounting screw holes on both ends, allowing the clinician to determine the best way to orient this plate during fabrication of the prosthesis. Once the desired orientation is determined, cut off the unwanted end. Additional holes can be drilled into this piece to “key in” the laminate. Use all six Phillips head screws provided when installing this plate as the loads here are quite high.



Preferred orientation - of the Humeral Plate is shown to the left. The bend at the top creates a natural shoulder line and moves the humeral section of the prosthesis away from the trunk, thus making it easier to clear the socket. Additionally, with the bent plate, the user can internally rotate 15° toward the body mid-line when the upper arm is straight ahead. If you prefer a straight line, reverse the Humeral Plate, cut off the bent end and attach it to the humeral section of the prosthesis.



Endoskeletal Conversion Kit (SJ62) - The LTI Locking Shoulder Joint can be converted to an endoskeletal system with a humeral clamp conversion kit (SJ62). The exoskeletal Humeral Plate (SJ61) is removed and the exoskeletal clamp installed in its place. This kit provides a clamp and 20mm tube which easily couples with the distal endoskeletal components.

Mounting the Shoulder Joint

Create room for the Mounting Plate. Use a little plaster to position the Mounting Plate on the patient's plaster model. Check the plate orientation by placing the joint over the Mounting Plate. Then double check the vertical lines transferred from the cast to the model. Usually it is best to position the Mounting Plate in a vertical plane. Pull the check socket over the mounted plate. Afterward clean off the plate for use in mounting the joint.

Create a flat mounting surface on the socket. If you thermoform the check socket, place a flat plate over the area outside the mounting plate and press firmly to create a flat mounting surface 2 1/2 inches (60mm) in diameter. If you have overlooked this step, you can shim the surface with 5-minute epoxy. Coat the flat plate you place over the surface with wax to release the epoxy. When doing a laminated socket, use the flat plate technique over the PVA bag.

Drill two mounting holes. Place the Mounting Plate in the pocket created inside the check socket. You need to drill two holes 180° apart using the holes in the plate as a template. Before drilling place the joint assembly where it will go and select an angle for the first two holes that best suits both cosmesis and the later routing of the release cable. Use a 3mm metric drill bit or a No. 31 (inch) bit. Use of a larger drill is not recommended, because the joint will be unstable.

Test the mounting of the joint on the socket. Flat head screws have been provided in two lengths. Usually you will need the long M3x0.5 30mm screws for attaching to a thick check socket and the short 20mm screws for the thinner definitive socket. Mount the joint initially with just 2 screws. This permits you to study the orientation of the unlock mechanism and to consider how you will want to route the Bowden cable. It is not too late to change the angle.

Add the remaining screws. Place 3mm screws in the two holes and then drill the other eight holes. We suggest rotating the plate and drilling two more holes for a total of 12. You will only use 10, but with 12 you can change the mounting angle by 30° if necessary for better cable alignment. To route the wires through the center of the joint, drill a 9/16 inch (14mm) hole in the center of the mounting area.

Caution!

Do not attempt to disassemble the shoulder joint – this may void the warranty!

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