The Lamination Collar and Clamp Ring

1. Orientation of the Lamination Collar

There are two pins inside the groove on the distal edge of the Lamination Collar. These pins prevent excess rotation which could damage the three gray cables connecting the Forearm to the Input Board that rotates with the upper arm. You must read and understand the sections that follow so that you orient the Lamination Collar correctly during fabrication.

2. Internal Rotation

The anti-rotation pins provide a "keep out" zone of 90º, leaving 270º for internal and external rotation. Half of 270º is 135º, so centering the range of motion would allow 135º in each direction. The normal range of human motion is 30º externally and 135º internally. To get the full 135º of internal rotation, you must set the orientation of the Lamination Collar just right following the instructions below. Alternatively, set the lamination collar to provide more than 135º of internal rotation (i.e. 150º), still leaving more than enough for normal external rotation.

3. Attaching the Collar to the Drive Assembly

Study Figure1 showing the Drive Unit with the Lamination Collar and Clamp Ring installed. Regardless of whether an elbow will be a left or right, the wires are always routed up the left side of the Drive Unit where they pass through a slot in the flange that holds the Clamp Ring to the Drive.

The Collar has two pins 280º apart to prevent excess rotation. They stop rotation when they hit a small limit-stop flange on the Clamp Ring as shown in Figure 2.

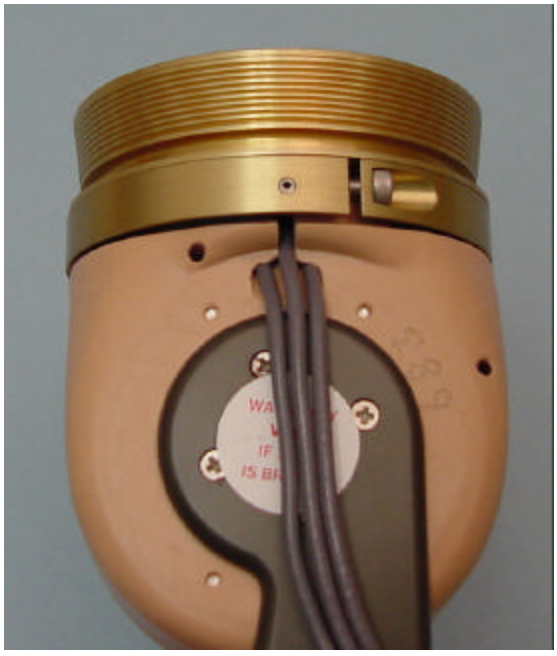

Figure 1. The Clamp Ring has been installed with a clamping screw. Note the pin just above the three cables. It goes into the same slot that passes the cables and prevents the ring from rotating with respect to the Drive Assembly. A small flange on the ring goes into a slot on the Lamination Collar where it will bump against two pins during rotation. These pins define a "keep out zone" of 90º to keep the Collar from rotating far enough that the cables wind around one another causing damage. The second function of the Clamp Ring is to adjust the friction of humeral rotation. Keep this screw relatively loose until it can be adjusted with the final user. Adequate friction can be achieved without tightening the screw very much. Do not attempt to tighten it until the gap disappears. This will completely lock humeral rotation and may damage the screw threads.

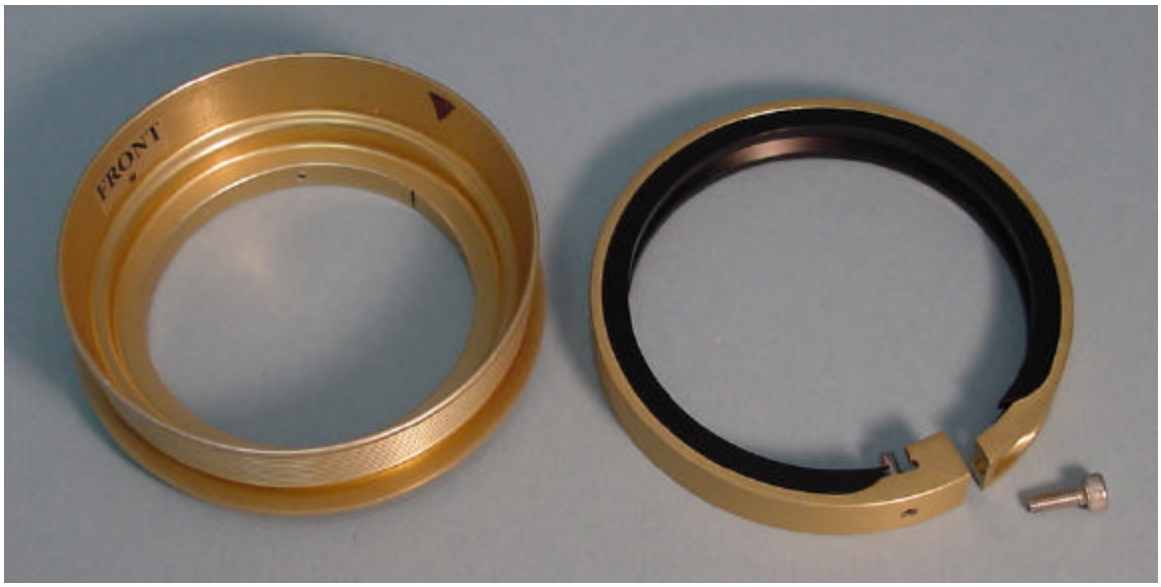

Figure 2. The Lamination Collar and Clamp Ring. A groove in the black insert in the Ring creates two flanges. The upper flange engages a slot in the Collar, the lower slips over a flange on the Drive Assembly. The inside of the Lamination Collar has a label identifying the front side. When the collar is correctly installed, this side is on the same side as the forearm. Note the other mark on the right side for aligning the Input Connector Board when installed in the Collar. The socket head cap screw is an M3x0.5 by 10mm.

4. Orienting the Lamination Collar

Figure 2 above shows the Lamination Collar and the Clamp Ring. If the Collar is not oriented correctly, the user may not have a full range of either external or internal rotation before a pin prevents further rotation. The best way to get the orientation correct is to use a temporary attachment to the socket during the trial fitting. Follow this procedure.

1. **Attach just the Collar.** Referring to Figure 3 install the Input Connector Board into the Lamination Collar and then add the Cover Board. (You may save time if you install the input cables to the Input Connector Board first.) Figure 4 shows the addition of the Clamp Ring. When the Clamp is screwed loosely in place, it should look like Figure 1.
2. **Test the Collar orientation.** Place the Collar under the user's check socket with the word "FRONT" facing forward. Next rotate the forearm and drive in and out. Is there enough internal rotation before the pin hits? If not just rotate the collar slightly to give more internal rotation and less external
3. **Attach the Lamination Collar to the check socket.** In the usual way fill the space between the Collar and the check socket with a paper cup or other suitable spacer and apply a wrap of fiberglass to secure the whole assembly. Do a final test of the rotation before the fiberglass sets.
4. **Copy the orientation in the definitive socket.** Use the same orientation when making the definitive socket.

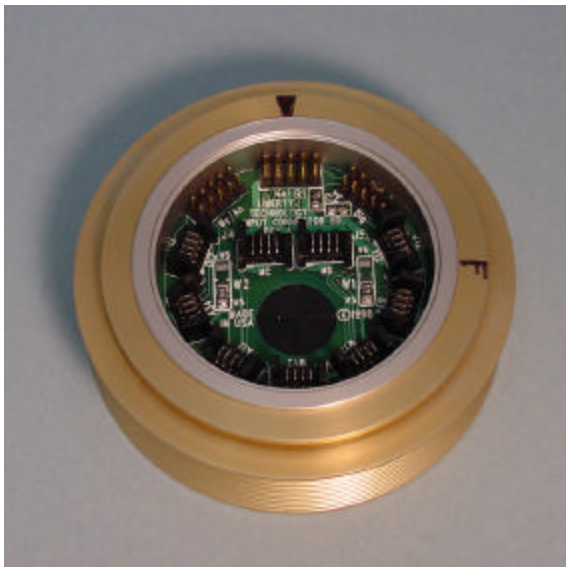

Figure 3. There are three sets of pins on the Input Connector Board. Center the middle set on the mark on the Lamination Collar.

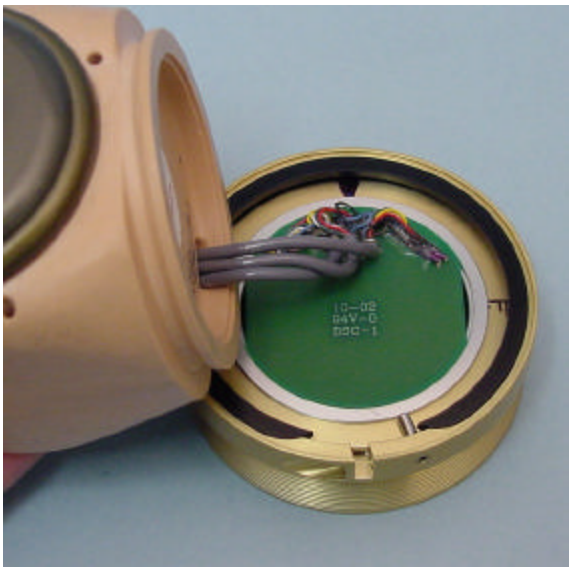

Figure 4. The three plugs on the Cover Board have been placed over the pins on the Input Connector Board.

The ”F” on the Lamination Collar always faces the forward anterior side of the upper arm. Figures 5 and 6 show the appearance of the Collar and Input Connector board when seen from below. This is the view of the technician when laminating the Collar.

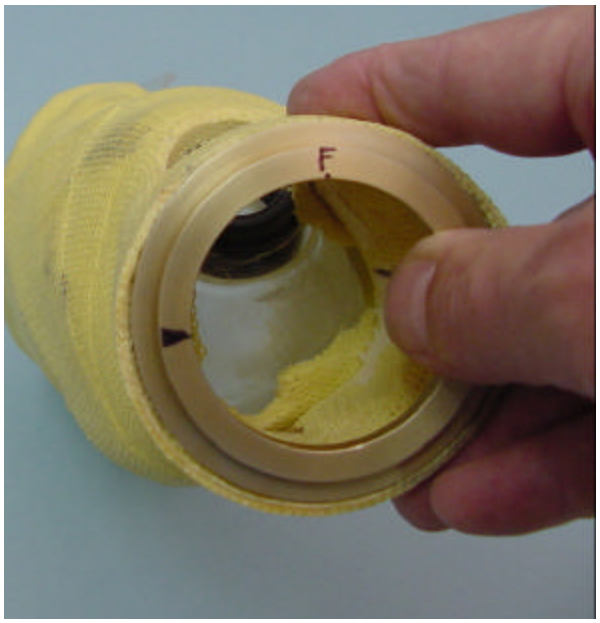

Figure 5. When the Lamination Collar is turned upside down, the letter F identifies the front. The second marker is used to align the Input Connector Board during final assembly.

Figure 6. The Input Connector Board has been added with the center set of connector pins next to the alignment mark. When the board faces down in its anatomical orientation, this mark will be on the right with the “F” facing forward toward the forearm.

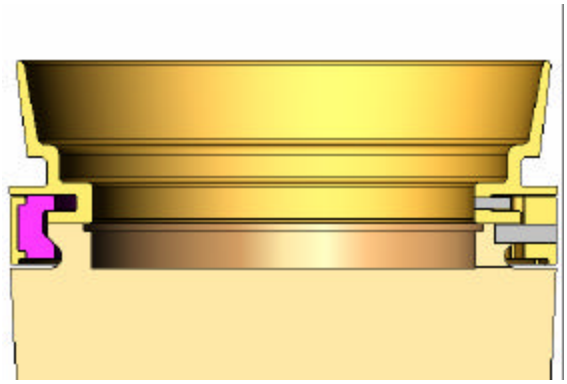

Figure 7. A cross section is shown through the Collar and Ring. On the right, one of the limit-stop pins is in its slot. The larger pin below it engages a slot in the Drive Assembly that prevents rotation of the Clamp Ring with respect to the Drive. Study the mechanism before assembling any of the parts.

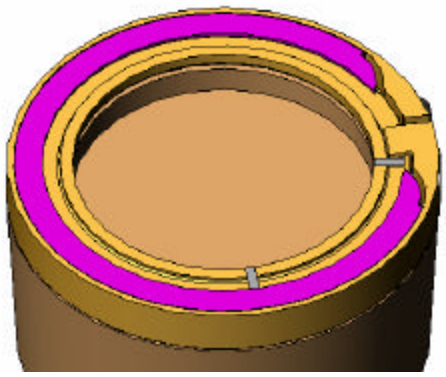

Figure 8. The assembly in 7 has been sectioned the other way to show how the two small pins prevent excessive rotation. One pin is up against the extended flange that acts as a limit stop. The other pin can rotate 270º before it hits the other side of the flange.

5. Limit Stops

Two computer generated cross sections will help to explain how the limit-stop pins work. On the left side of Figure 7, the inner plastic Clamp Ring that holds the assembly together is shown darker than the metal outer Clamp Ring or the Drive housing. As the outer Clamp Ring is tightened with the screw (not shown here, but visible in Figures 1 and 2), the slope on the plastic ring causes it to squeeze the Lamination Collar against the Housing to supply adjustable friction. On the right side of the first cross section, two pins are shown. The smaller pin on top is one of the two limit-stop pins, while the larger pin locks the Clamp Ring to the Housing.

The actual limit stop is a small flange on the Clamp Ring. Figure 8 shows that the two small pins can rotate either way until they hit the sides of this flange.

6. Final Adjustment with the User

The humeral rotation friction is adjusted with the small 2.5mm hex wrench that is supplied with the Clamp Ring. The screw itself is an M3x0.5 stainless steel socket head screw, 10 mm long. With the user wearing the prosthesis, adjust the friction until it feels right. Leave the wrench with the user. After the elbow has been used for a while the optimum friction will become apparent. Some users will even want to change the adjustment for different tasks. With this assembly making this adjustment is easy.