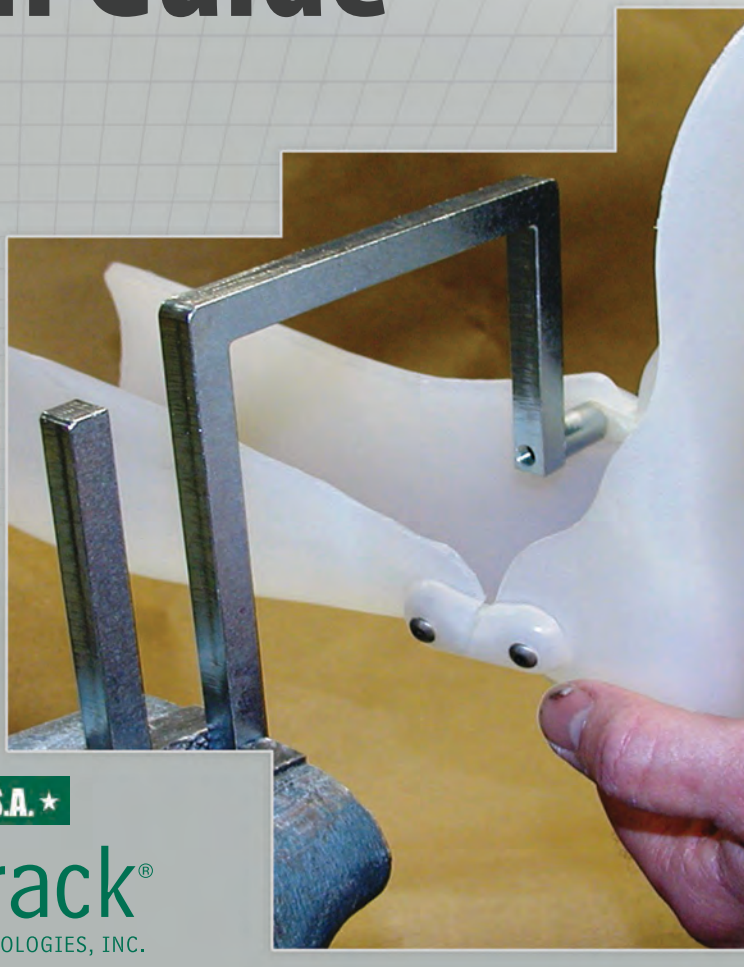
Tamarack Flexure Joint®

Fabrication Guide



MADE IN MINNESOTA ★ U.S.A. ★

Tamarack®

HABILITATION TECHNOLOGIES, INC.

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I. Tamarack Flexure Joint Product Overview

Fig. 1

740 Series **Free Motion**

- 85 durometer hardness level
- Large, Medium or Pediatric sizes
- Natural or Black joint color

Fig. 2

742 Series **Dorsiflexion Assist**

- Choose from 75, 85, and 95 durometer dorsiflexion assist levels
- Large, Medium, or Pediatric sizes
- Natural or Black joint color

Fig. 3

743 **Variable Assist**

- Unique adjustment system provides up to 3x the dorsiflexion assist moment of standard 85 durometer Dorsi Assist joints
- "Adult" size

Fig. 4

741-CAP **Flexure Joint Caps**

- Easily convert rigid AFOs to articulating using external mounting cavities
- Large, Medium or Pediatric sizes
- Natural or Black cap color
- Also available in Adjustable Assist model to generate additional dorsiflexion assist

Fig. 5

741-ML-PF **Plantarflexion Limiter Kit**

- Features a unique medial-lateral mounting system to eliminate shoe fit issues
- Provides continuous adjustment capability to achieve the perfect plantarflexion stop angle
- Large & Medium sizes
- Joints and dummies sold separately

Fig. 6

T-740 **Flexure Joint Hand Tools**

- **Tamarack Hand Punch** (T-740-2) Provides quick and accurate hole alignment in joint cavities
- **Tamarack Spanner Wrench** (T-740-3) Secure flange nut/bushing while installing or removing joints
- **Tamarack Hex Driver** (T-740-4) A large-handled driver for installing and adjusting metric hardware

Fig. 7
Tamarack Flexure Joint Family

A 741-DUMMY
Molding Dummies
available in 3 sizes
(used to form all cavities for Free Motion & Dorsi Assist joint applications)

B 740 Series
Free Motion
available exclusively in 85 durometer

C 742 Series
Dorsiflexion Assist
available in 3 durometers
- White Collar (75 durometer)
- Black Collar (85 durometer)
- Red Collar (95 durometer)

D 743
Variable Assist
available in "Adult" size

E VET-65 Series
Veterinary
available in 3 sizes
Blue collar indicates more flexible durometer for veterinary bracing applications

II. Indications for Use

Tamarack Flexure Joints are ideal for articulating joints in lower and upper extremity orthoses made using thermoformable and thermoset materials. Tamarack Flexure Joints (TFJ's) work well for several reasons:

- TFJ's are time proven since 1995 to be extremely durable for a wide spectrum of service conditions and users. Tamarack continually monitors durability and pays close attention to this product. Tamarack 100% inspects TFJ's so the customer can depend on quality.
- The Orthotist can choose to use line of progression or anatomical joint alignment. No special attention or fixturing is necessary since the joints automatically co-align to a single axis when installed in pairs.
- The joints are low profile and are available in three sizes.
- There are free motion and motion-assist options available in each size.
- Purchase price is low.
- Fabrication is very easy.

The most common application for TFJ's is at the ankle, but other applications such as at the elbow, wrist and knee are also good applications. 740 and 742 Series joints bend readily but don't elongate when under tension. They allow free dorsi and/or plantar flexion depending on how the orthosis is fabricated. The rotation and transverse stability is excellent and can be optimized by using a well formed cavity and deliberate trim lines to control and support the joint. TFJ's are not designed to withstand high
compression loads.

The most common application for the 742 Series joints is to assist ankle dorsiflexion. The 742 Series joints are available in the same three sizes as 740 Series (free motion joints), each with three levels of assistance – 75, 85, and 95 durometer. The joints are easy to distinguish – joints with white collars are 75 durometer, black collars are 85 durometer, and red collars are 95 durometer. The same molding dummy (per size) is used to form the cavity for free motion or motion assist joints. This makes it very easy to interchange the joints to get the desired amount of assist for your patient.

740 and 742 Series joints also work well at knee, elbow and wrist joint locations. The specific motion assist direction is also flexible, so the joints can be used to assist (or resist) flexion or extension of the joint being supported. A good example is when 742 Series joints are used in "reverse" for a dorsiflexion "resist" (plantarflexion assist) moment – Orthotists have reported this to work very well to encourage knee extension (most commonly for children with mild crouch gait conditions).

Another viable application for 742 Series joints is to apply a dynamic contracture resisting force in lower and upper extremity applications.

Example of traditional free motion AFO, featuring Tamarack Plantarflexion Limiter Kit.

Example of unilateral Tamarack Flexure Joint installed medially in conjunction with a lateral dorsiflexion/plantarflexion control metal ankle joint.

Photo Courtesy of Coyote Designs

Example of pediatric AFO, in laminated carbon fiber construction, featuring dorsiflexion assist Tamarack Flexure Joints.

Example of anterior stop, posterior entry AFO (used for crouch gait management).

III. Fabrication Procedures

Cavities that optimize the fit and function of the Tamarack Flexure Joints should **always** be fabricated using Tamarack Molding Dummies. The molding dummies are designed to eliminate the material gap caused when making the separation cut with a **thin** blade saw. *See Frequently Asked Questions #2*

The same molding dummy (per size) is used to form the cavity for any **Tamarack Free Motion** and any durometer **Dorsiflexion Assist Flexure Joints**. 742 Series specific fabrication procedure are discussed in Section II.

Fig. 8
Molding Dummies
741-L (Large)
741-M (Medium)
741-P (Pediatric)

NOTICE:
Using Tamarack Flexure Joints to form the joint cavities is **NOT recommended.**

Preparing Mold and Dummies for Vacuum Forming

1. The mold should be rectified as necessary for orthopedic support and provide needed clearances.

TIP! A small additional clearance allowance at the malleoli is recommended when using **742 Series Dorsi Assist Joints** because the joint body bulges slightly as the joint is compressed during loading.

Fig. 9
Pull thin stockinet over the mold.

2. Pull a thin stockinet over the mold.

3. Determine joint locations and attach the molding dummies. Position the molding dummies so the mid-point is located on or near the desired axis of joint motion. Install using shoe tacks. Either mechanical (line of progression) or anatomical joint alignment can be chosen for dummy placement.

One of the advantages gained by using the **Tamarack Flexure Joint** is that these joints automatically co-align to a single joint axis. This expedites fabrication, allows for design variations (joint axis location), enhances durability, and delivers "no bind" free movement of the articulation.

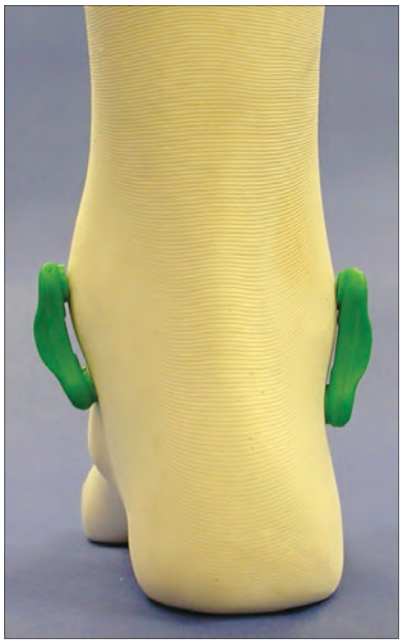
Fig. 10
Molding dummies will gradually deform with repeated use. They should be replaced after about 6 moldings to ensure consistent joint cavity formation.

Figs. 11 & 12

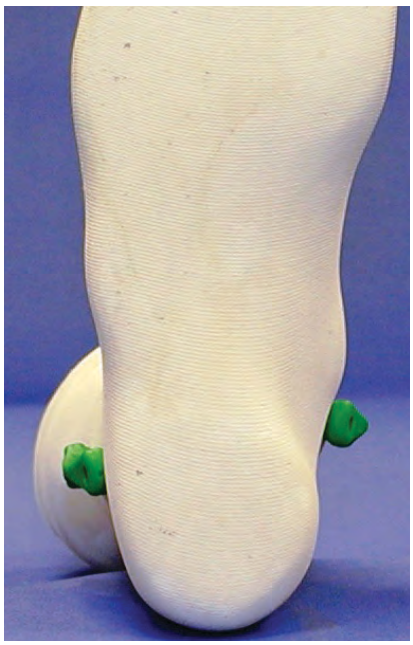
Molding dummies can be positioned wherever you prefer to locate the joint axis.

These photos demonstrate the placement for an anatomical joint axis.

These photos show the thin stockinet pulled over the mold **before** attaching the molding dummies. This method delivers the optimal cavity shape.



Posterior View



Plantar View

TIP! Adding plaster or putty around the joint head(s) will help transition between the dummy and the mold. This will prevent plastic from being pulled too far around the dummy during vacuum forming.

Fig. 13 *left image*
It is quick and easy to roll a skinny "worm" of putty and place it around the joint heads.

Fig. 14 *right image*
The center area can be left clear (for the best joint anchorage).

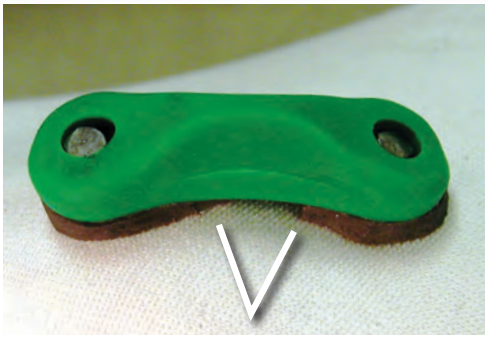
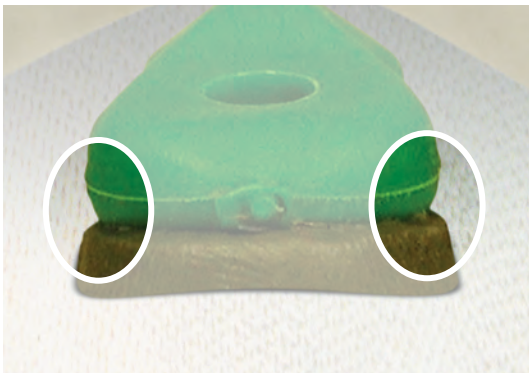


Fig. 15
Allow the inner contours of the dummy to be exposed to allow some plastic to wrap around the dummy.



TIP! Stockinet placed over the **Molding Dummy** may make too large a cavity.

If you choose to pull the stockinet over the molding dummies, use very thin or sheer stockinet. Keep the stockinet loose enough to allow it to be pulled down closely where the molding dummy meets the mold (so it does not cause a malformed cavity where the plastic "bridges" reducing anchorage of the joint).

4. Vacuum form or laminate to form the orthosis shell.

Fig. 16
Typical vacuum forming process.

Fig. 17
Good vacuum forming result (plastic is pulled tight around the mold and the molding dummy).

See Figs. 27 - 30 for more information about cavity quality.

TIP! When plantarflexion control is desired, adding extra material on the posterior of the AFO improves the contact surface.

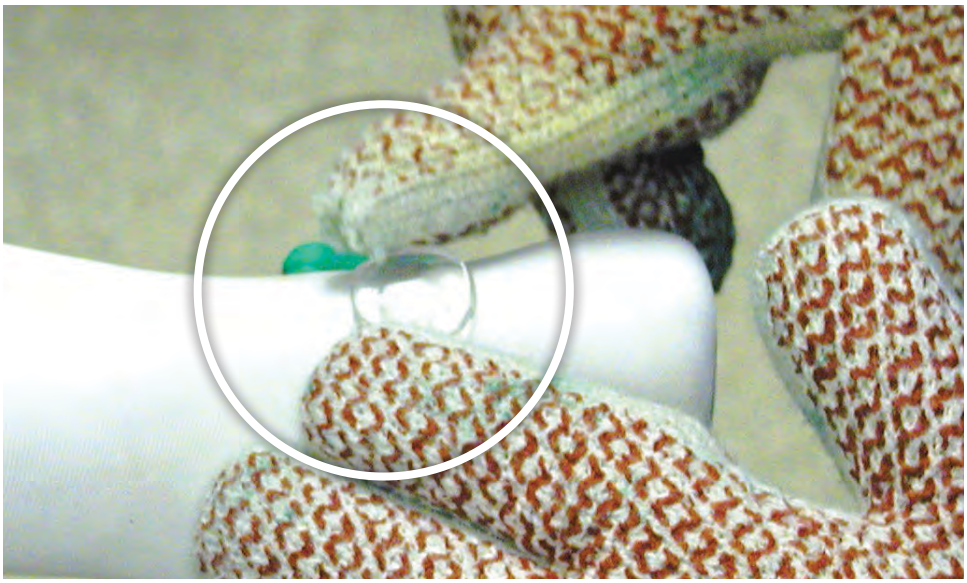


Fig. 18
Place a bar or disk of hot plastic across the area where the separation cut will be made, centered on the posterior aspect of the AFO.

5. Allow thermoplastic to cool and harden. Remove the AFO shell from the mold in one piece. An ideal, well formed cavity is formed tightly to securely anchor the flexure joint.

Fig. 19
Rough cut AFO for removal from mold.

Fig. 20
Removal of AFO shell from mold.

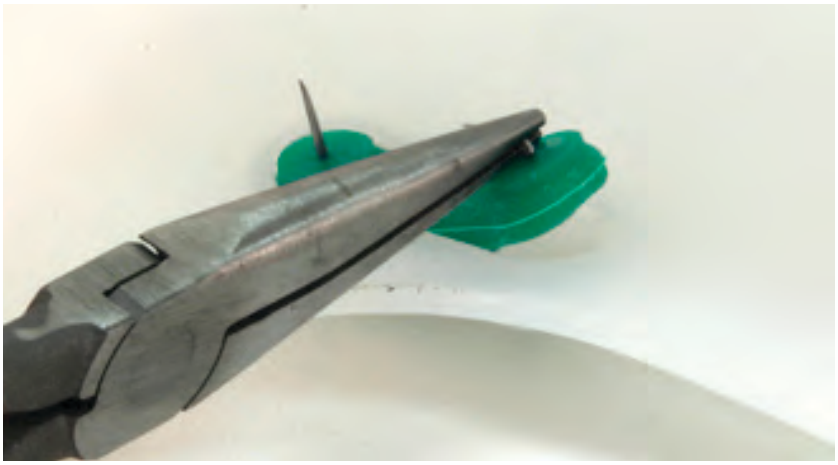


Fig. 21
It is easy to pull the dummy out of the cavity by grabbing the protruding tack with pliers.

6. Separate the foot section from the calf section using a thin bladed saw, such as a fine toothed coping saw.

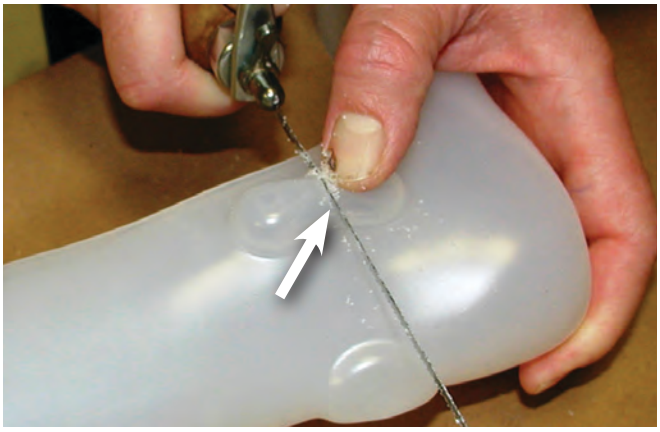


Fig. 22
For optimal results, use a fine tooth blade like a coping saw to make the separation cut.

Begin by bisecting the joint cavity.

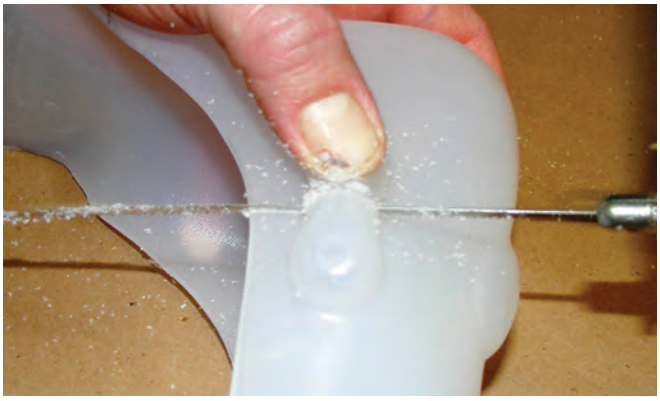


Fig. 23
Continue making the cut through the first cavity extending the cut forward through the anterior side of the AFO.

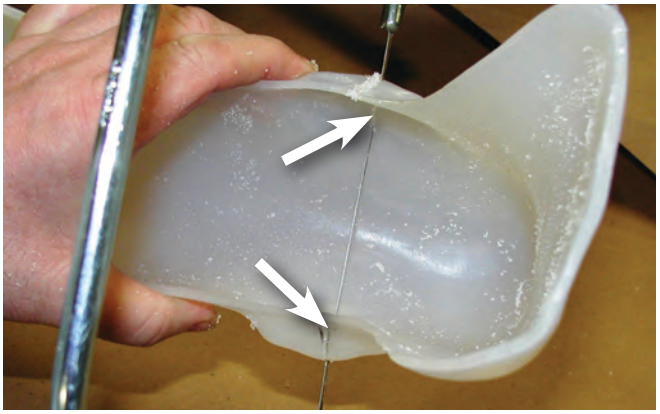


Fig. 24
Turn the AFO over and cut through the second cavity as you did the first.

Then place the blade into the cuts on both sides and continue to cut to the posterior.

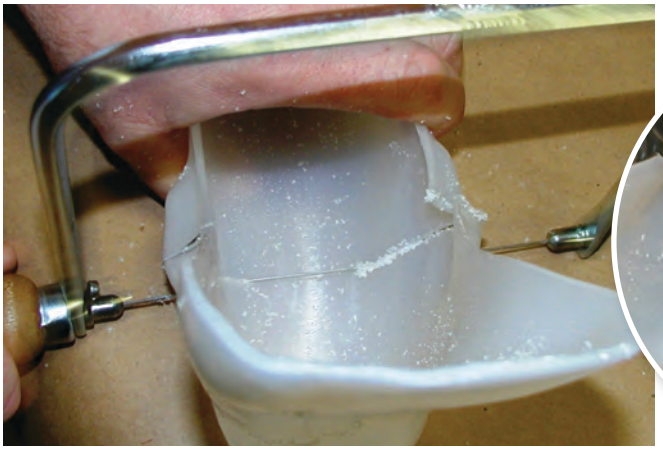


Fig. 25 *left image*
Keep cutting – the blade will continue to make one smooth line connecting the joint cavities.

As you proceed posteriorly with the cut, make sure to bisect the posterior plantarflexion stop "lump".

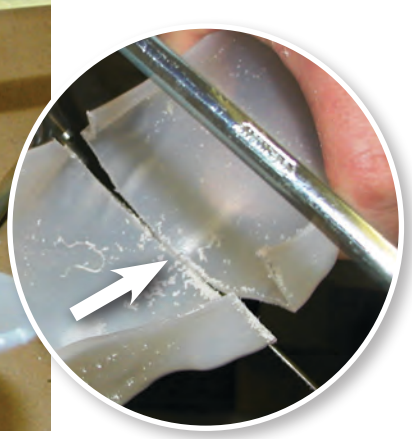


Fig. 26 *right image*
Nearly completed separation cut.

TIP! A snug, well formed and trimmed out cavity optimizes Tamarack Flexure Joint function by providing better support and anchorage of the joints in the orthosis. The benefit most noticeable is better control of rotational forces in the transverse plane.

Fig. 27
Cavity Formation Comparisons
A. Optimal cavity formation
B. Marginal cavity
C. Poor cavity

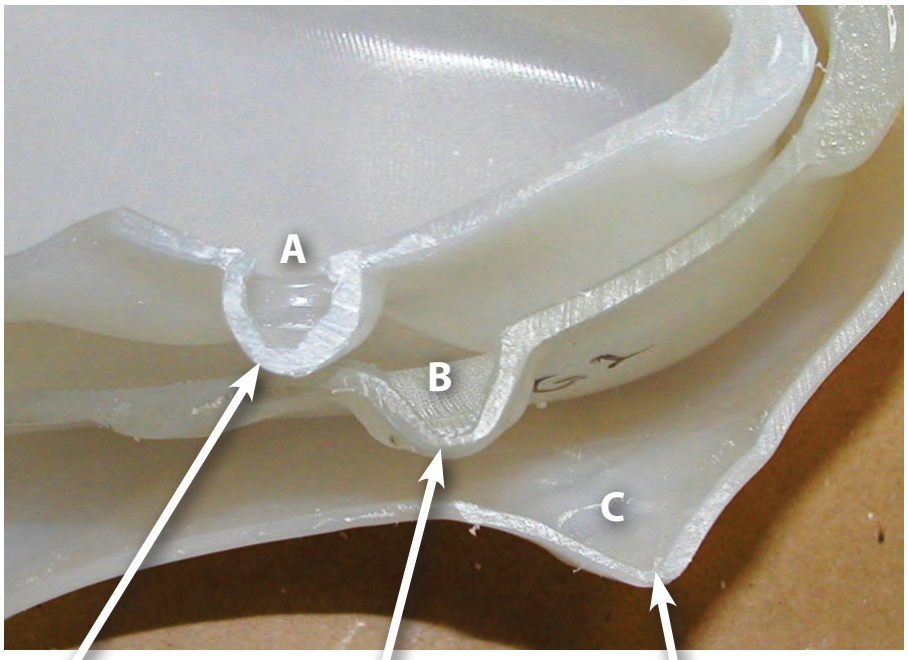


Fig. 28
Optimal Cavity Formation
There is superior coverage surrounding the joint body giving it maximum support and anchorage in the orthosis. This cavity will maximize the ability of the Tamarack Flexure Joint to provide the best rotational control.

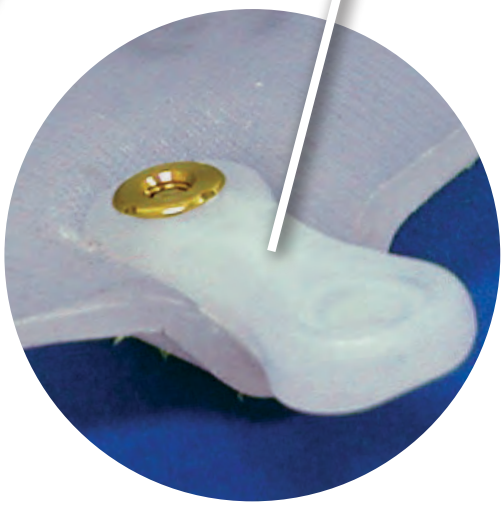


Fig. 29
Marginal Cavity Formation
Will likely work OK for most applications, but may allow more rotational motion than desired.

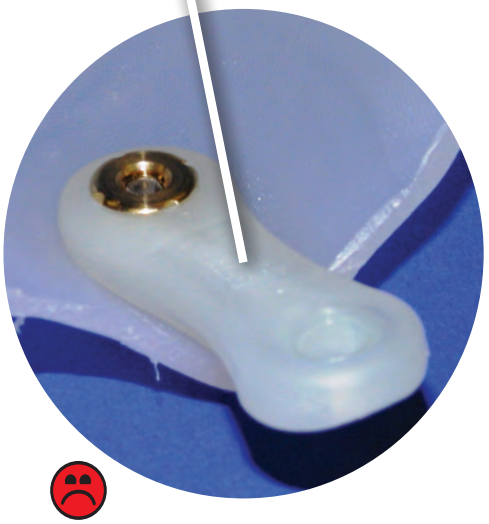


Fig. 30
Poor Cavity Formation
This cavity will not support or control the Flexure Joint and is not recommended.

7. Make holes for attachment screws.

The Tamarack Flexure Joint is best anchored when the holes are no larger than necessary for the screws – that means they must line up well. Using a **Tamarack Hand Punch** allows you to quickly punch the right size hole in the exact location for a perfect fit. Current hand punch tools have an angle guide pin installed to assist with punch orientation.

Fig. 31
We suggest using the Tamarack Hand Punch to make the screw holes sized and precisely located for mounting the flexure joint into the cavity in the AFO.

Free Motion & Dorsi Assist Screw Hole Sizes
L = 4.5mm (3/16")
M = 4.5mm (3/16")
P = 4.0mm (5/32")

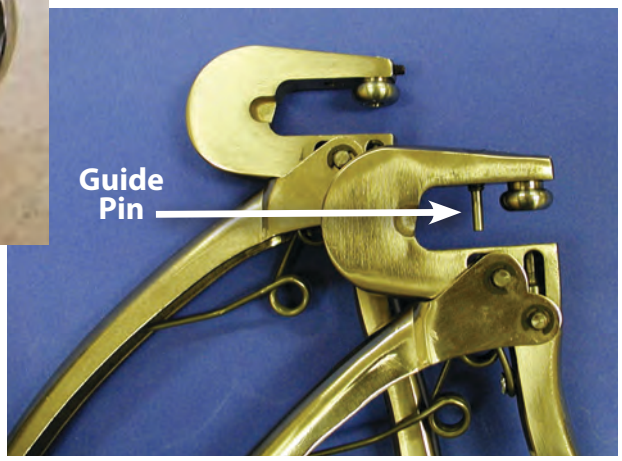
TIP! Punch holes before trimming out the cavity to assure a resting point for the guide pin.

Fig. 32
Tamarack Hand Punch
T-740-2L (Large)
T-740-2M (Medium)
T-740-2P (Pediatric)

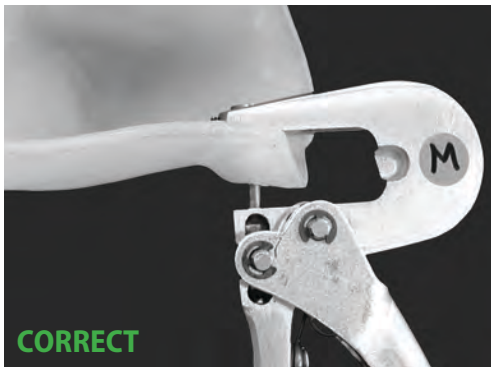
Fig. 33 *left image*
The cavity is trimmed to show the die and guide pin functions – it is recommended to punch holes **prior** to finishing the cavity.

Fig. 34 *right image*
Early and current versions of the hand punch. Both work well.

If you have an early version (does not have a guide pin) you need to hold the punch at the correct angle.



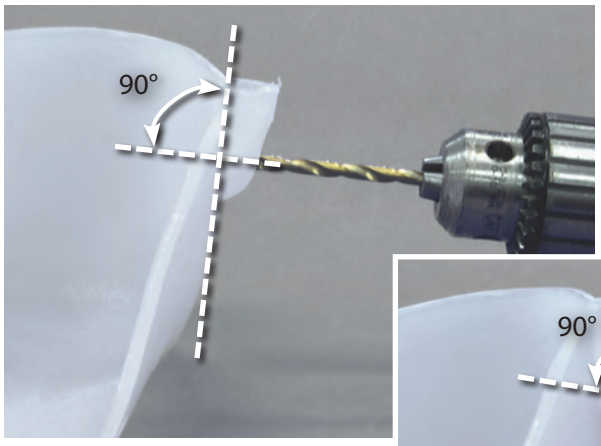
Figs. 35 & 36
The jaw of the punch is aligned parallel to the inside of the AFO when correctly positioned (the early punch versions shown here do not have an angle guide pin).



TIP! The Tamarack Hand Punch is the quickest, easiest way to make the mounting holes. Use a drill only if the punch is not available.

Fig. 37 *left image*
CORRECT
Make sure the drill bit alignment (angle/direction) is perpendicular to the INSIDE of the AFO.

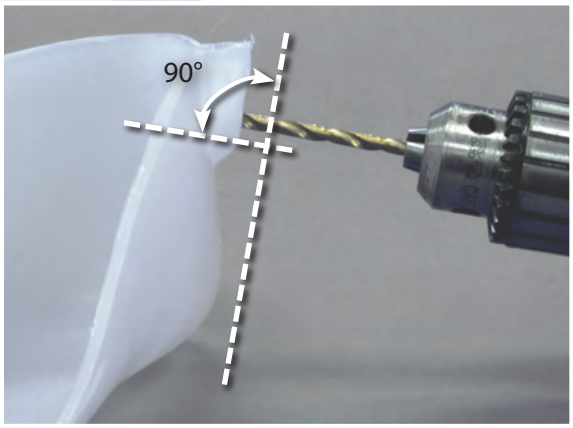
A detent is formed when molding to assist locating the correct spot.



CORRECT

Fig. 38 *right image*
INCORRECT
This shows the WRONG way – the drill is perpendicular to the OUTSIDE surface.

The screw holes will not line up well.



INCORRECT

8. Trim out the cavity based on free motion (740 Series shown in Fig. 22) or motion assist (742 Series shown in Fig. 23) joints used. For either joint, begin by bisecting the cavity vertically (screw hole to screw hole).

Fig. 39
740 Series Cavity Trim Lines

Grind or sand to round off the four anterior corners forming a small "V" anterior to the midline of the joint cavity to allow dorsiflexion motion.

Make sure the "V" does not extend behind the centerline of the joint cavity.

If plantarflexion motion is desired, the posterior aspect of the cavity can be trimmed like the anterior side, but remove as little plastic (in a wedge) as necessary to allow the calf and foot sections to move without impinging.

See Figs. 47 - 48 for final trim appearance after assembly.

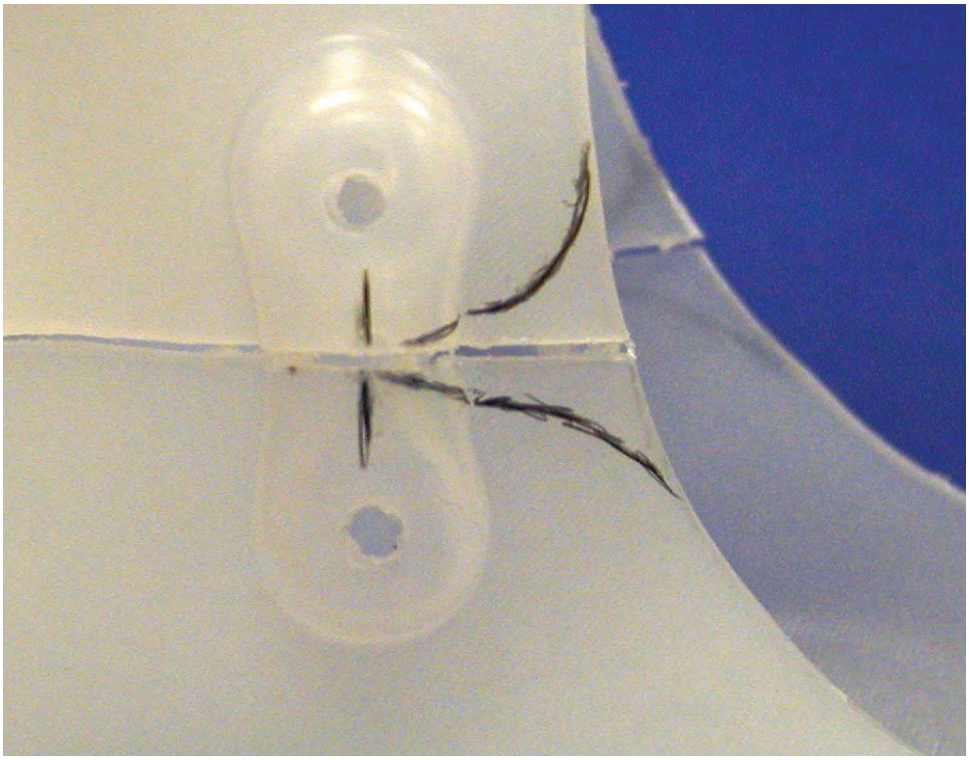
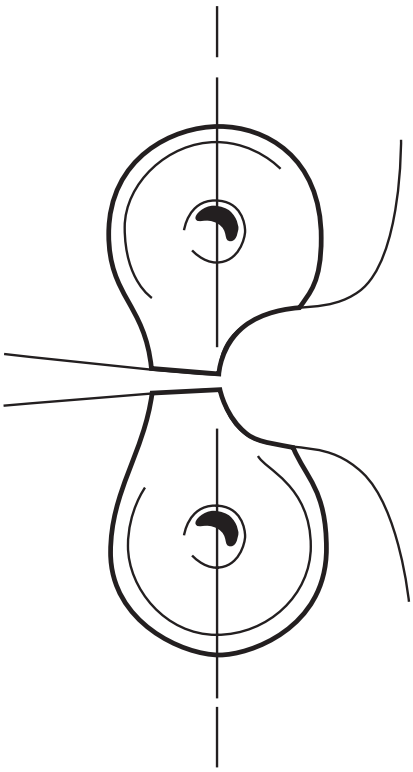


Fig. 40
742 Series Cavity Trim Lines
(typical dorsiflexion assist application)

Grind/form a "U" shaped anterior clearance. This makes room for the tension load bearing element of the dorsi assist joint. The tension element is oriented toward one side of the joint to maximize the energy storing/loading capability of the joint.

See Figs. 49 - 50 for final trim appearance after assembly.



9. Install the Tamarack Flexure Joints into the cavities with the hardware supplied with the package. Use a thread locker to prevent the hardware from loosening. Loctite® 242 removable is recommended.

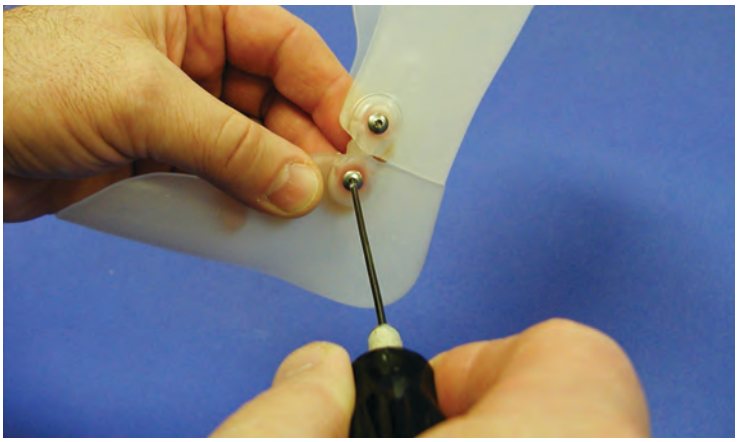
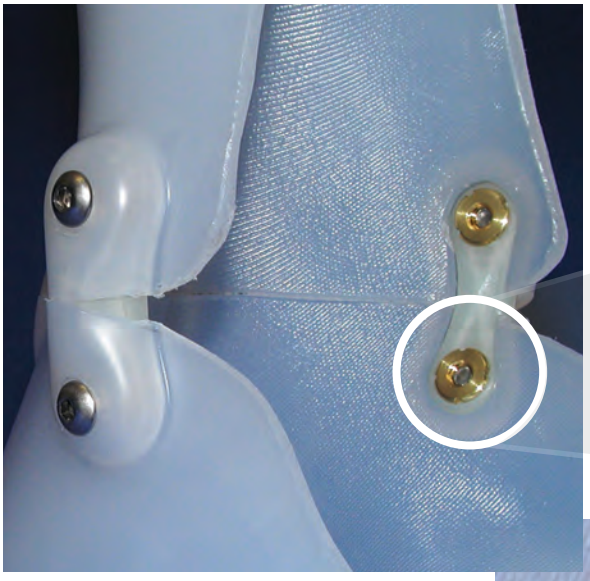


Fig. 41
Large handled **Tamarack Hex Drivers** are available to assist assembly (shown here).

Tamarack Hex Drivers
T-740-4LM (Large & Medium)
T-740-4P (Pediatric)

TIP! **Hardware Cautions:** In order to avoid contact with the skin, screws must not protrude into the AFO. Optional screw hardware is available. ***See Fig. 63***

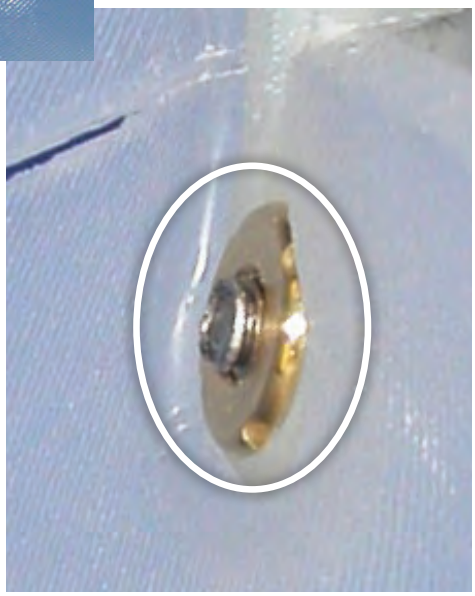
Fig. 42 *exploded view*
Make sure that the screw does not protrude into the orthosis, but is at least half way through the flange nut.



CORRECT
Screw properly installed.

Fig. 43
This screw is **too long** and could cause injury to the skin (a longer screw would be even more hazardous!).

740 Series application shown



INCORRECT
Screw protruding too far!

TIP! The **Tamarack Spanner Tool** is a wrench developed specifically to match up with the Flexure Joint flange nut (740 & 742 Series Joints).

Fig. 44
Spanner tool prongs match with the flange nut functioning as a wrench against the flange nut to easily loosen the screw.

The spanner tool is not usually needed during installation. Check to make sure the threads have not crossed if the screw is hard to turn.

Tamarack Spanner Tools
T-740-3LM (Large & Medium)
T-740-3P (Pediatric)

See Figs. 59 - 62 for alternative application examples.

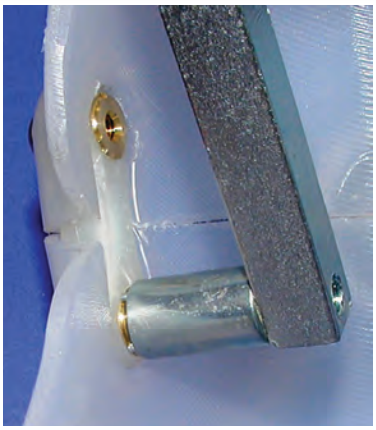
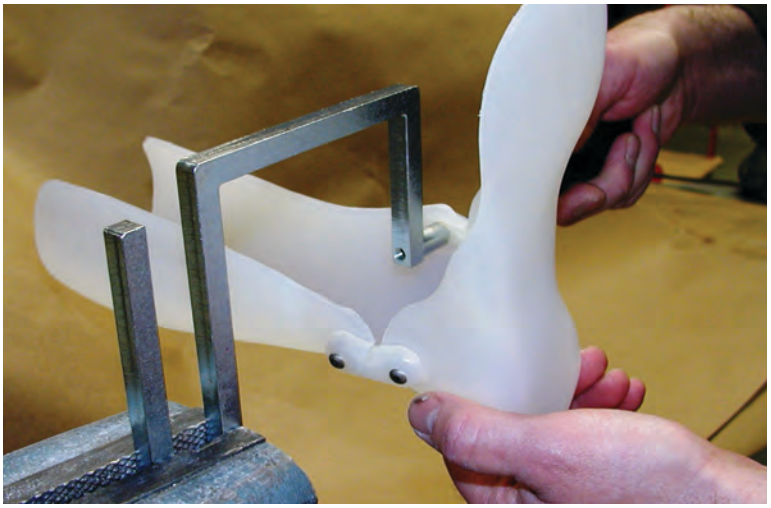


Fig. 45
The spanner tool can be hand held, but it is most useful when mounting it in a vice as shown, providing good visibility and leverage.

The hex driver being used is hidden by the foot section of the AFO.



TIP! The Tamarack Spanner Tool is especially helpful when installing dorsi assist joints into an AFO design that limits motion. *See Figs. 46, 59-62*

Fig. 46
Install the joints in either the foot section or the calf section. When installing the remaining side, it is very difficult to get the screw started by hand because the joint needs to be "preloaded".

With the spanner tool held in a vice, it will back up and hold the flange nut as you firmly push the AFO and screw against it as shown.

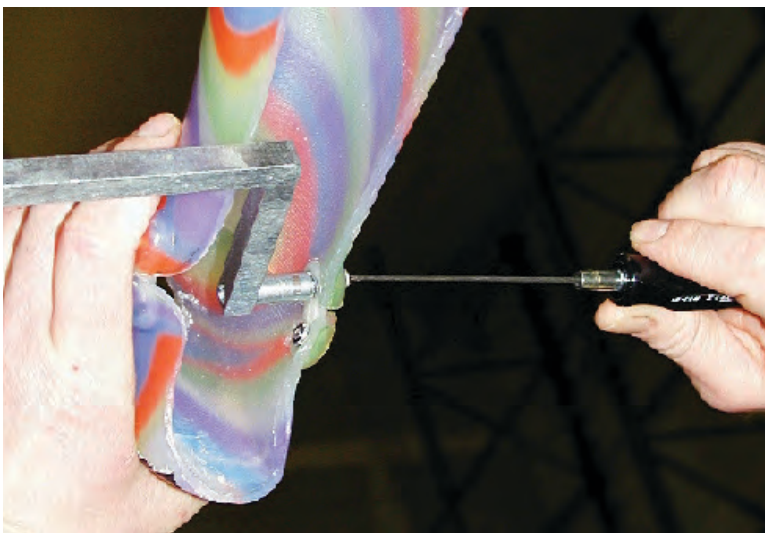


Fig. 47 & 48
Completed
Free Motion (740 Series)
Joint Installation

Properly installed 740 Series joints will show no gapping along the separation cut except for the "V" shaped anterior clearance area.

GOOD Anchoring Conditions

Fig. 49
Completed
Dorsiflexion Assist (742 Series)
Joint Installation

Anterior portion of cavity trimmed properly to allow for the tension load bearing element in the joint.

Fig. 50

Posterior portion of cavity fully covers the dorsiflexion assist joint when it is fully loaded.

Joint is Resting

View when ankle is dorsiflexed

Joint is Loading

View when ankle is plantarflexed

TIP! We recommend installing a **strap to limit dorsiflexion**. This avoids excessive dorsiflexion power acting at the end of anatomical dorsiflexion range, especially when joints with high moments of assist are used.

Fig. 51

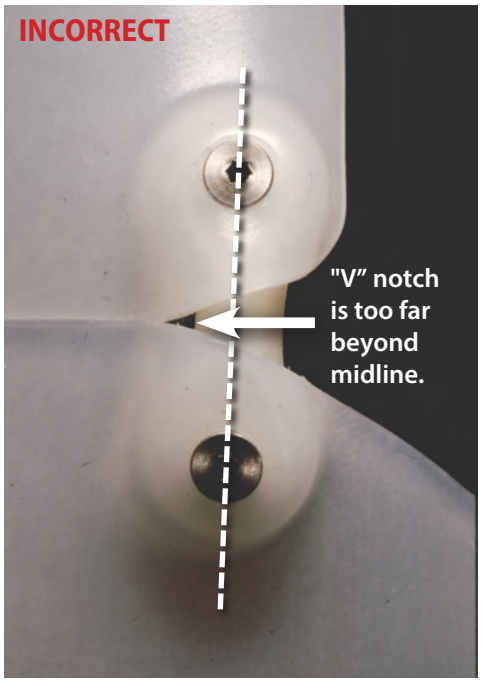
If you use a limiting strap, set the length of the strap to just less than the patient's ROM. A Dacron strap is supplied in all sizes of 95 durometer motion assist packages for this optional purpose.

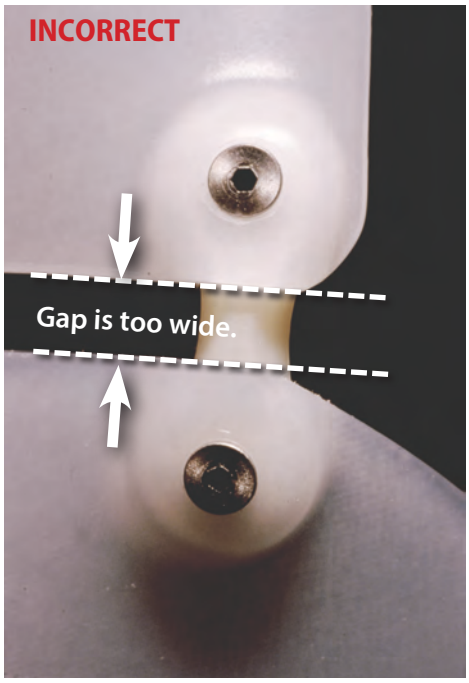
Poor Anchoring Conditions

Too much material has been removed reducing joint anchorage in these examples.

Fig. 52 *left photo*
"V" notch goes posterior to the cavity midline.

Fig. 53 *right photo*
Too wide a gap between foot and calf sections.



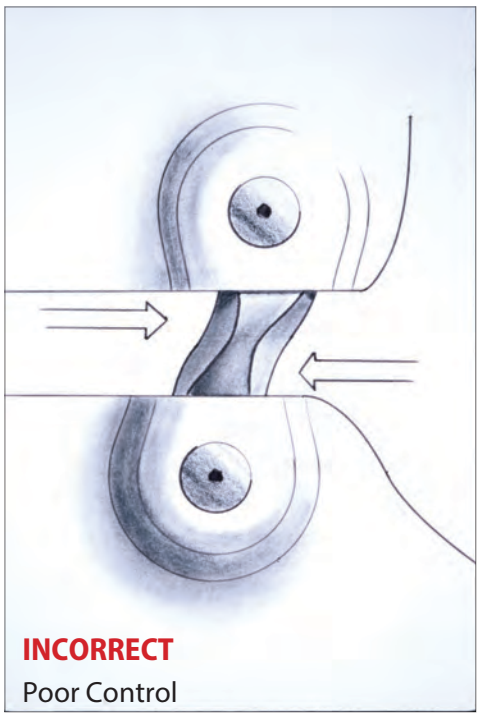


TIP! Fabrication of the joint cavity area is simple, but optimal results are possible if only a minimal amount of material is removed during fabrication.

Fig. 54 *left illustration*
Illustrates rotational forces being placed on the joint.

Fig. 55 *right photo*
Demonstrates this effect in an AFO (the joint is not elongating).

Poor Anchoring: Concept



Poor Anchoring: Application

10. Install cosmetic patches.

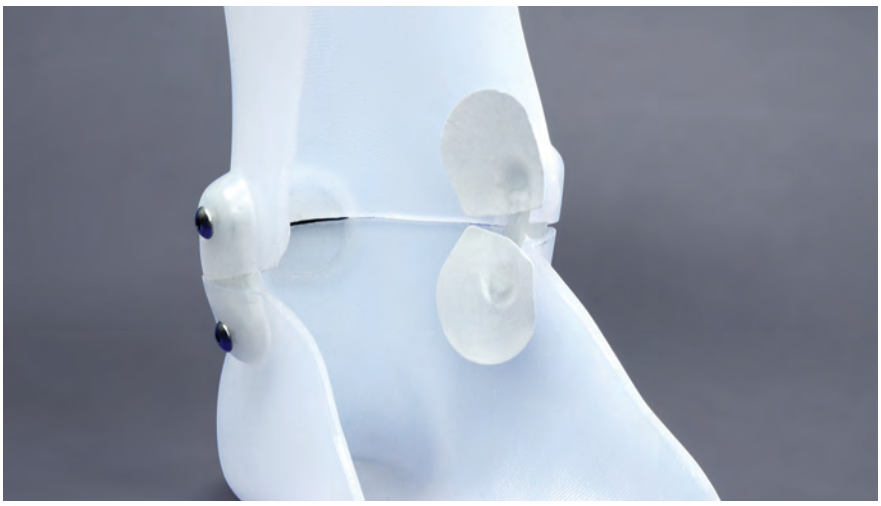


Fig. 56
Cosmetic patches made with ShearBan® make excellent covers to keep the orthosis and joint area clean.

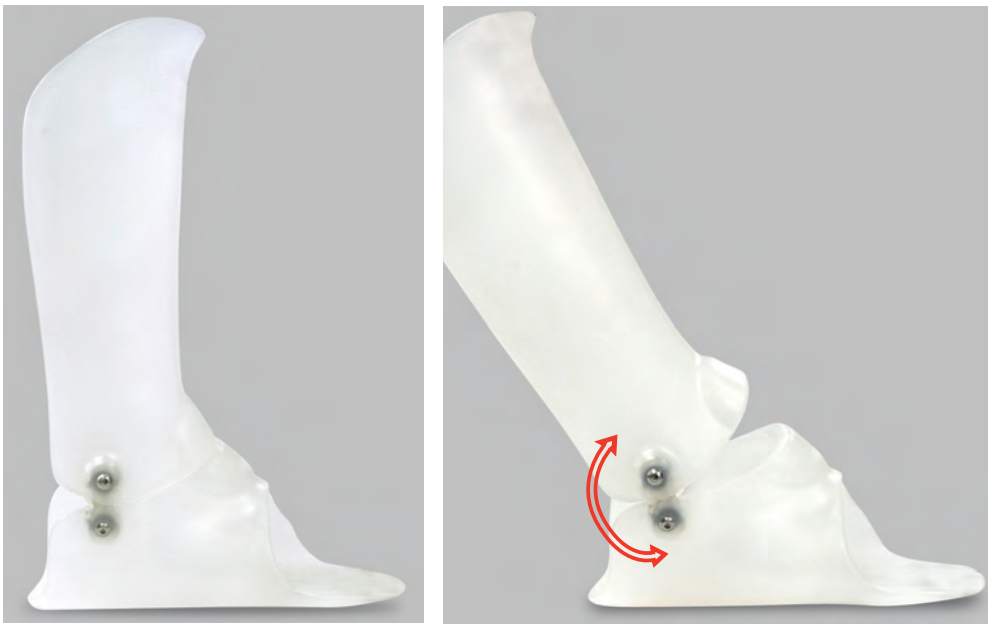
Available in black or beige.

11. If the AFO limits plantarflexion, apply the Tamarack silencer pad to reduce clicking noise during gait when the planter stop surfaces contact each other.

Fig. 57
Simple silencer pads can be adhered to either the calf or foot section.

Fig. 58
Replacement silencer pads are included.

Alternative Application Example #1



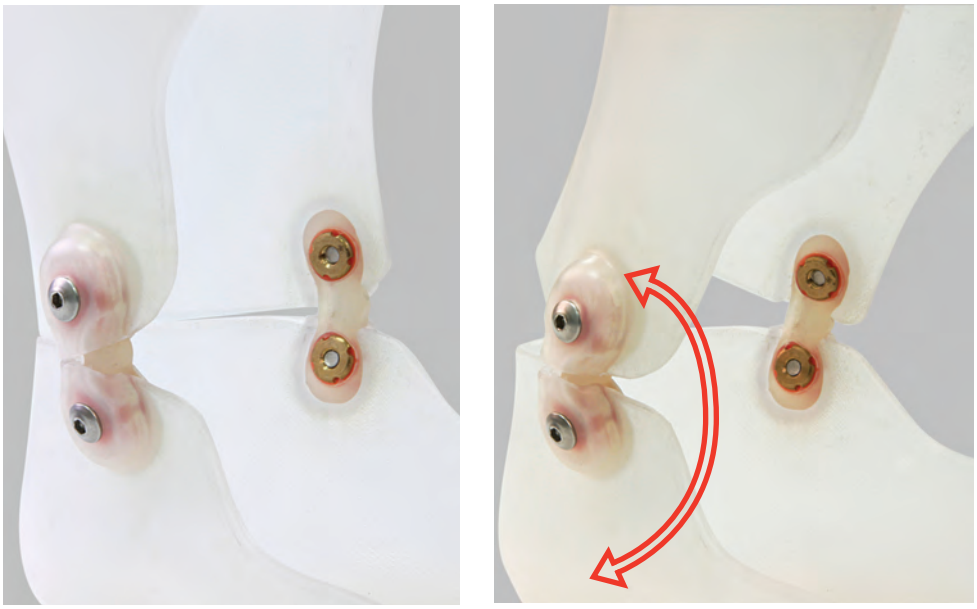
Dorsiflexion Assist (rigid anterior stop)

Fig. 59 *left photo*
The rigid anterior stop delivers a firm knee extension moment (floor reaction force). Dorsiflexion assist (*shown in Fig. 59*) or free motion joints can be used as needed, and are capable of withstanding the tension forces present during 2nd and 3rd rocker.

Fig. 60 *right photo*
Dorsiflexion assist joints load during plantarflexion. As the gait cycle progresses into swing phase the energy is released assisting ankle dorsiflexion.

Use the installation technique shown in Fig. 46 when dorsiflexion range is limited (if using 742 Series joints, they will be loading slightly during installation).

Alternative Application Example #2



Dorsiflexion Resist

Fig. 61 *left photo*
742 Series joints installed in "reverse" of typical dorsiflexion assist application.

Fig. 62 *right photo*
The joints provide a gentle knee extension moment. This design is reported to be very useful when working with children that have mild CP "crouch gait" conditions.

Use the installation technique shown in Fig. 46 if plantar flexion motio is limited (the joints will be loading slightly during installation).

IV. Retrofit Articulating AFO Fabrication using Tamarack Flexure Joint Caps

Tamarack Flexure Joint Caps (Part No. 741-CAP) provide the ability to convert an existing solid AFO to articulating by securing externally mounted joint cavities to the brace, eliminating time and expense associated with fabricating an entirely new articulating AFO.

TFJ Caps are an excellent choice for both printed and laminated orthoses, and can be used with both free motion and dorsi-assist Tamarack Flexure Joints. Available in two models, Standard or Adjustable, each package contains a drill guide and mounting hardware to make fabrication and joint installation easy.

For applications with large torsion or generally higher loads on the orthosis, using the Caps will provide additional stability. The encapsulated Flexure Joints provide better resistance to twisting and bending than a standard vacuum formed fixation.

Fig. 63 Standard Model

Fig. 64 Drill Guide Template

Adjustable TFJ Caps

Adjustable Assist Tamarack Flexure Joint Caps provide orthotists the opportunity to further increase dorsiflexion forces (by up to 20%), either during initial patient fitting or at a future time; enhancing the dorsiflexion forces delivered by Dorsiflexion Assist Tamarack Flexure Joints.

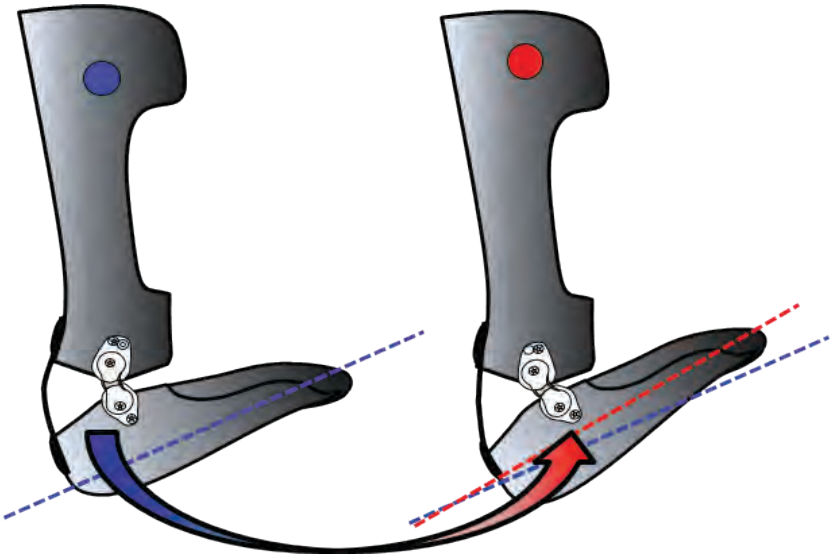


Fig. 65 Adjustable Assist Model

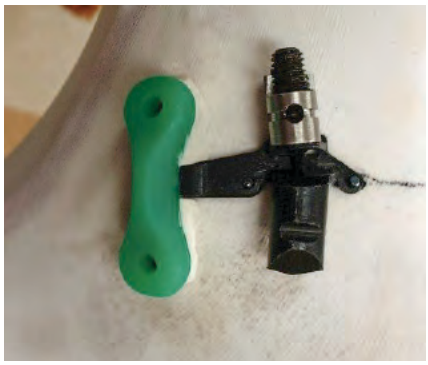
V. Tamarack Plantarflexion Motion Limiter Kit

The Tamarack Plantarflexion Motion Limiter Kit features a unique, dual side-mount design which eliminates shoe fit concerns associated with posterior-mounted motion limiters. Continuous adjustability is provided through a pair of stainless steel set screws formed medially and laterally, adjacent to the joint cavities.

The Tamarack Plantarflexion Limiter Kit has been tested to exceed 2 million steps; ensuring the same long-lasting durability you've come to expect from Tamarack Flexure Joints. It can be used with either thermoplastic or laminated materials.

Fig. 66
Each kit includes a pair of motion limiters.
Joints and dummies sold separately.

Fig. 67
The assembly's built-in arm establishes molding dummy placement.



Included in each kit, the plantarflexion limiter assembly mounts immediately posterior to the joint dummy on the plaster cast prior to thermoforming or lamination. The plantarflexion limiter assembly is designed to establish the necessary distance away from the molding dummy to ensure proper placement.

Once the orthosis is removed from the cast, remove the molding dummies as usual; leaving the plantarflexion limiter assembly in place. Separate the calf and footplate segments of the orthosis as usual, keeping the plantarflexion stop assembly in place. Utilize the threaded screw to adjust the plantarflexion stop angle to the desired position.

*Refer to the **Tamarack Plantarflexion Limiter Kit Instructions for Use** for comprehensive step-by-step instructions and photos.*

VI. Digital Work Flow with Tamarack Flexure Joints

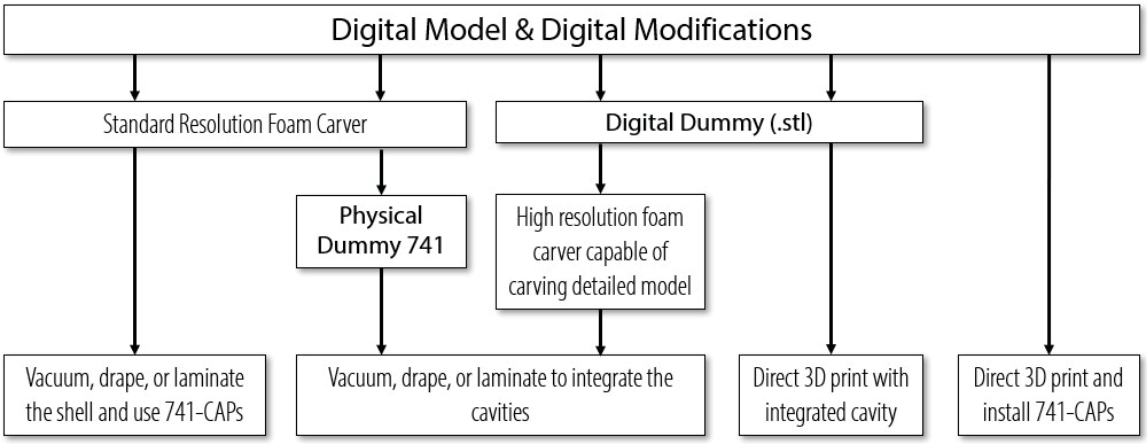
Using the flexure joints with your digital work flow is easy. There are two main ways to approach this, either using the digital dummies within your CAD software and digital modifications, or using the Tamarack CAPs after the AFO shell has been manufactured. These two methods are described below, along with differences between the "Actual Length" dummy and "Standard Length" dummy, and when to use each.

*Contact us at **info@tamarackhti.com** for access to our digital dummy library.*

Using the Digital Dummy

Cavities that optimize the fit and function of the TFJ's are critical to the performance and longevity of an orthosis. Methods and reasons for choosing the correct molding dummy and process are based on the orthosis material and how the shell is created.

If you are confident in both your manufacturing process's capability to create a nice cavity and the material's performance with your AFO's characteristics and requirements, using the digital dummies can create an efficient opportunity.



"Standard Length" Dummy

Standard (normal) Length Tamarack Molding Dummies are designed to eliminate the material gap caused when making the separation cut on an orthosis with a **thin** saw blade. If the orthosis's shell is printed, laminated, or vacuum formed whole and will require a separation cut, use the Standard Length Dummy.

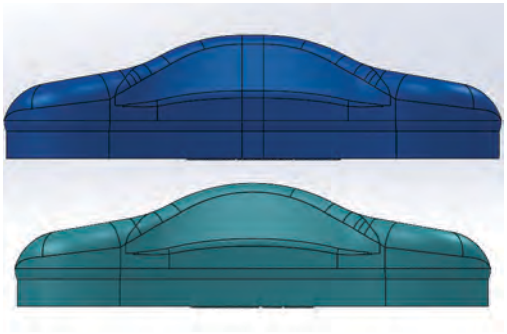


Fig. 68
Standard Length Dummy (top) compared to Actual Length Dummy (bottom)

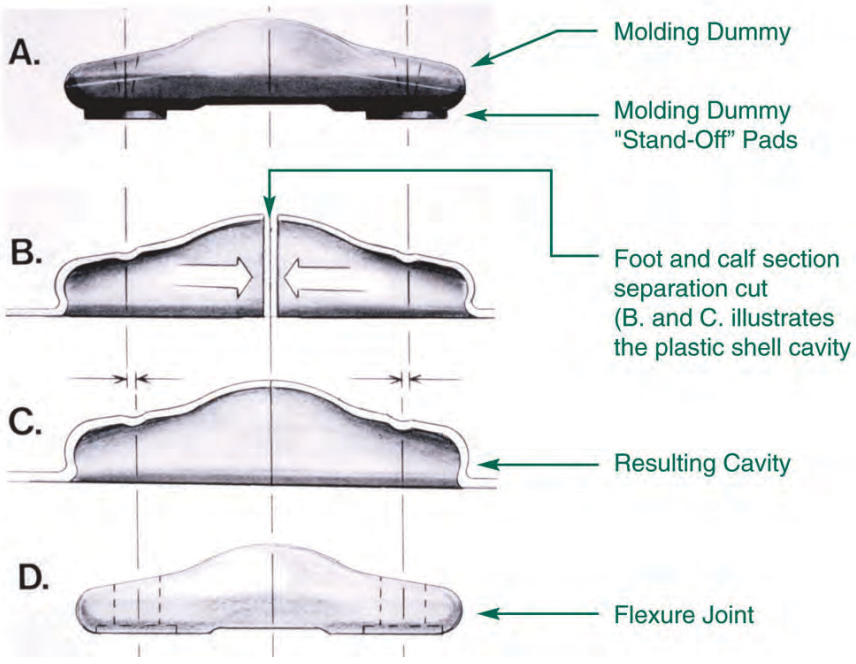


Fig. 69
The digital dummy "skirt" is the same height as the physical dummy "standoff pad" - this recesses the joint for skin clearance.

"Actual Length" Dummy

Use the Actual Length Tamarack Molding Dummy when the orthosis sections are separated digitally prior to creating the shell, assuming the software cut is made with virtually no kerf or is a very small width. We recommend this cut or gap to be **0.5mm or smaller** (0.25mm or 0.01" ideally). The resulting two sections can be printed or otherwise created separately.

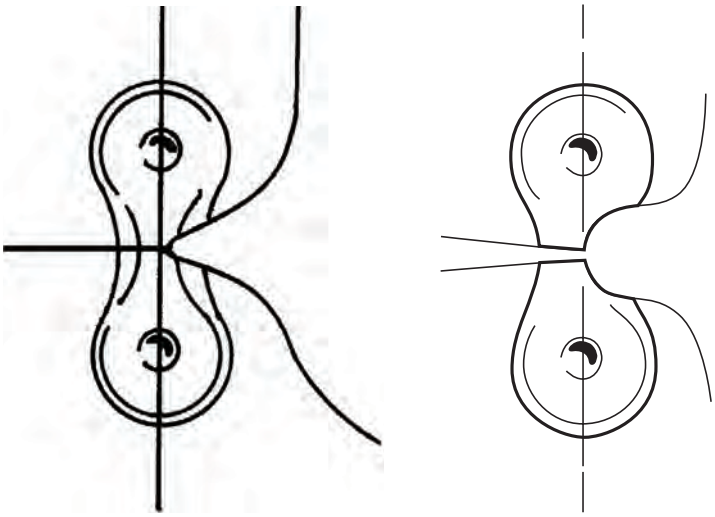
Another typical use for the Actual Length Dummy is when a Tamarack Flexure Joint will be used contra-laterally with a different style joint (such as triple action). This is required if the other joint doesn't have the same length compensation.

Digital Trim Lines

The digital trim lines can be constructed in the same manner as vacuum formed devices, as described in previous sections (pages 13, 16 and 17).

Fig. 70 *left image*
740 Series Cavity Trim Lines
See **Figs. 47-48** for final trim appearance after assembly.

Fig. 71 *right image*
742 Series Cavity Trim Lines
See **Figs. 49-50** for final trim appearance after assembly.

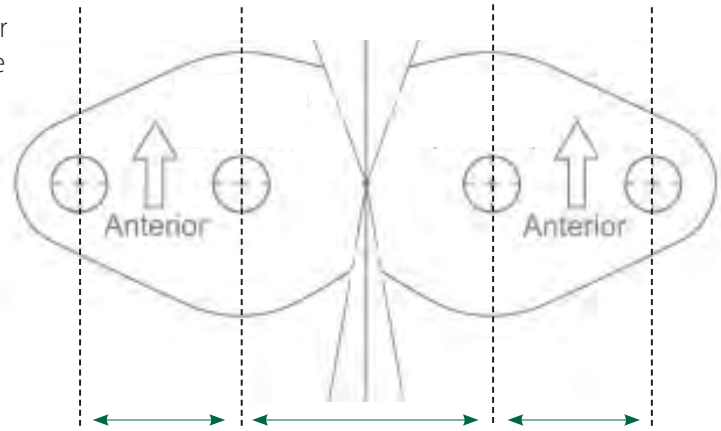


Tamarack Flexure Joint Caps in a Digital Workflow

The TFJ Caps are an excellent choice for printed or laminated orthoses, as the resulting cavity is both strong and the perfect profile. Each package containes a drill guide and mounting hardware to make fabrication and joint installation easy.

For the digital workflow, you can insert the mounting holes or a pilot/witness mark for them in your software to make fabrication easier and more precise.

Fig. 72
Hole measurement patterns for all cap sizes. Measurements are in inches (mm).



Large	**.750** (19.0)	**1.20** (30.5)	**.750** (19.0)
Medium	**.638** (16.2)	**1.00** (25.4)	**.638** (16.2)
Pediatric	**.600** (15.2)	**0.69** (17.5)	**.600** (15.2)

VII. Tamarack® Ordering Guide

TAMARACK FLEXURE JOINT / FREE MOTION

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
740-L	Tamarack Flexure Joint - Free Motion	Large	Natural or Black	White	85	Pair, 5, 10 or 100pk
740-M	Tamarack Flexure Joint - Free Motion	Medium	Natural or Black	White	85	Pair, 5, 10 or 100pk
740-P	Tamarack Flexure Joint - Free Motion	Pediatric	Natural or Black	White	85	Pair, 5, 10 or 100pk

TAMARACK FLEXURE JOINT / DORSIFLEXION ASSIST

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
742-L-75	Tamarack Flexure Joint - Dorsiflexion Assist	Large	Natural or Black	White	75	Pair, 5, 10 or 100pk
742-L-85	Tamarack Flexure Joint - Dorsiflexion Assist	Large	Natural or Black	Black	85	Pair, 5, 10 or 100pk
742-L-95	Tamarack Flexure Joint - Dorsiflexion Assist	Large	Natural or Black	Red	95	Pair, 5, 10 or 100pk
742-M-75	Tamarack Flexure Joint - Dorsiflexion Assist	Medium	Natural or Black	White	75	Pair, 5, 10 or 100pk
742-M-85	Tamarack Flexure Joint - Dorsiflexion Assist	Medium	Natural or Black	Black	85	Pair, 5, 10 or 100pk
742-M-95	Tamarack Flexure Joint - Dorsiflexion Assist	Medium	Natural or Black	Red	95	Pair, 5, 10 or 100pk
742-P-75	Tamarack Flexure Joint - Dorsiflexion Assist	Pediatric	Natural or Black	White	75	Pair, 5, 10 or 100pk
742-P-85	Tamarack Flexure Joint - Dorsiflexion Assist	Pediatric	Natural or Black	Black	85	Pair, 5, 10 or 100pk
742-P-95	Tamarack Flexure Joint - Dorsiflexion Assist	Pediatric	Natural or Black	Red	95	Pair, 5, 10 or 100pk

TAMARACK FLEXURE JOINT / MOLDING DUMMIES

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
741-L	Tamarack Flexure Joint Molding Dummies	Large	Green	n/a	n/a	Pair, 5 or 10pk
741-M	Tamarack Flexure Joint Molding Dummies	Medium	Green	n/a	n/a	Pair, 5 or 10pk
741-P	Tamarack Flexure Joint Molding Dummies	Pediatric	Green	n/a	n/a	Pair, 5 or 10pk

TAMARACK FLEXURE JOINT CAPS / STANDARD MODELS

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
741-CAP-L	Tamarack Flexure Joint Caps - Standard Model	Large	Natural or Black	n/a	n/a	Set
741-CAP-M	Tamarack Flexure Joint Caps - Standard Model	Medium	Natural or Black	n/a	n/a	Set
741-CAP-P	Tamarack Flexure Joint Caps - Standard Model	Pediatric	Natural or Black	n/a	n/a	Set

TAMARACK FLEXURE JOINT CAPS / ADJUSTABLE ASSIST MODELS

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
741-CAP-ADJ-L	Tamarack Flexure Joint Caps - Adjustable Assist Model*	Large	Natural or Black	n/a	n/a	Set
741-CAP-ADJ-M	Tamarack Flexure Joint Caps - Adjustable Assist Model*	Medium	Natural or Black	n/a	n/a	Set
741-CAP-ADJ-P	Tamarack Flexure Joint Caps - Adjustable Assist Model*	Pediatric	Natural or Black	n/a	n/a	Set

**Provides up to 20% additional assist per side, when used with dorsiflexion assist joints (sold separately)*

TAMARACK FLEXURE JOINT / VETERINARY FREE MOTION

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
VET-L-65	Veterinary - Free Motion	Large	Black	n/a	65	Pair, 5, 10 or 100pk
VET-M-65	Veterinary - Free Motion	Medium	Black	n/a	65	Pair, 5, 10 or 100pk
VET-S-65	Veterinary - Free Motion	Small	Black	n/a	65	Pair, 5, 10 or 100pk

TAMARACK PLANTARFLEXION LIMITER KITS

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
741-ML-PF	Tamarack Plantarflexion Limiter Kit	ONE	n/a	n/a	n/a	Pair

TAMARACK FLEXURE JOINT / VARIABLE ASSIST

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	COLLAR COLOR	DUROMETER	UNIT
743-L	Tamarack Flexure Joint - Variable Assist	Large	Natural	Black	85	Pair

TAMARACK FLEXURE JOINT / HARDWARE

PART NUMBER	DESCRIPTION	SIZE	METAL TYPE	LENGTH	QTY/PACK
740-1LM-6	Lg. & Med. Flexure Joint Screws (Shortest) - for part no. 741-CAP	M4 x 0.7	Stainless steel	6 mm	100
740-1LM-8	Lg. & Med. Flexure Joint Screws (Short)	M4 x 0.7	Stainless steel	8 mm	100
740-1LM-9	Lg. & Med. Flexure Joint Screws (Standard) - for part no's. 740 and 742	M4 x 0.7	Stainless steel	9 mm	100
740-1LM-10	Lg. & Med. Flexure Joint Screws (Long) - for part no. 741-CAP	M4 x 0.7	Stainless steel	10 mm	100
740-1LM-12	Lg. & Med. Flexure Joint Screws (Longer)	M4 x 0.7	Stainless steel	12 mm	100
740-1LM-14	Lg. & Med. Flexure Joint Screws (Longest)	M4 x 0.7	Stainless steel	14 mm	100
740-1P-5	Pediatric Flexure Joint Screws (Short) - for part no. 741-CAP	M3.5 x 0.6	Stainless steel	5 mm	100
740-1P-7	Pediatric Flexure Joint Screws (Standard) - for part no's. 740 and 742	M3.5 x 0.6	Stainless steel	7 mm	100
740-1P-10	Pediatric Flexure Joint Screws (Longer) - for part no. 741-CAP	M3.5 x 0.6	Stainless steel	10 mm	100
740-1P-12	Pediatric Flexure Joint Screws (Longest)	M3.5 x 0.6	Stainless steel	12 mm	100
740-1LM-9-TR	Lg. & Med. Flexure Joint Truss Head Screw	M4 x 0.7	Zinc-plated steel	9 mm	100
740-1P-7-TR	Pediatric Flexure Joint Truss Head Screw	M3.5 x 0.6	Zinc-plated steel	7 mm	100
740-2LM	Lg. & Med. Flexure Joint Flange Nut/Bushing	M4	Brass	n/a	100
740-2LM-Long	Lg. & Med. Flexure Joint Caps Flange Nut/Bushing - for part no. 741-CAP	M4	Black Brass	n/a	100
740-2P	Pediatric Flexure Joint Flange Nut/Bushing	M3.5	Brass	n/a	100
740-3LM	Lg. & Med. Flexure Joint *Flat Side* Flange Nut/Bushing	M4	Brass	n/a	100

TAMARACK FABRICATION TOOLS

PART NUMBER	DESCRIPTION	SIZE	UNIT
T-740-2L	Tamarack Hand Punch	Large	Each
T-740-2M	Tamarack Hand Punch	Medium	Each
T-740-2P	Tamarack Hand Punch	Pediatric	Each
T-740-2LRK	Tamarack Hand Punch Refurbishing Kit	Large	Kit
T-740-2MRK	Tamarack Hand Punch Refurbishing Kit	Medium	Kit
T-740-2PRK	Tamarack Hand Punch Refurbishing Kit	Pediatric	Kit
T-740-3LM	Tamarack Spanner Wrench	Large/Medium	Each
T-740-3P	Tamarack Spanner Wrench	Pediatric	Each
T-740-4LM	Tamarack Hex Driver (2.5 mm)	Large/Medium	Each
T-740-4P	Tamarack Hex Driver (2.0 mm)	Pediatric	Each
T-740-4C	Tamarack Hex Driver (3.0 mm)	Clevisphere/Motion Limiter	Each
T-740-5LM	Tamarack Hex Key - Basic (2.5 mm)	Large/Medium	Each
T-740-5P	Tamarack Hex Key - Basic (2.0 mm)	**Pediatric**	**Each**

Kit Contains:
Replacement Punch • Die • Attachment Pins

TAMARACK CLEVISPHERE™ JOINT

PART NUMBER	DESCRIPTION	SIZE	BODY COLOR	UNIT
747-L	Tamarack Clevisphere Joint - Dummies Included	Large	Stainless steel	Pair
748-L	Tamarack Clevisphere Dummy - Spare/Replacement Dummies	Large	Black	Pair

TAMARACK CLEVISPHERE™ JOINT / HARDWARE

PART NUMBER	DESCRIPTION	SIZE	HEAD	FINISH	LENGTH	UNIT
747-L-8-BTN	Tamarack Clevisphere Mounting Screw	M5	Button	Stainless Steel	8 mm	20 pk
747-L-ADJ-L	Tamarack Clevisphere Adjustment Screw L	M5	Headless	Black	14 mm	20 pk
747-L-ADJ-S	Tamarack Clevisphere Adjustment Screw S	M5	Headless	Black	10 mm	20 pk

AFO SILENCER PADS, SHEARBAN® SHEETS & PATCHES

PART NUMBER	DESCRIPTION		QUANTITY	DIMENSIONS	COLOR	UNIT
740-SIL	AFO Silencer Pad		20 pack	n/a	Black	Pack
749-740	ShearBan Cosmetic Patches		20 patches	1.25" round	Beige	Pack
749-740-BLK	ShearBan Cosmetic Patches		20 patches	1.25" round	Black	Pack
749-7	ShearBan Rivet Cover Patches	Standard	138 patches	3/4" round	Beige	Pack
749-7-BLK	ShearBan Rivet Cover Patches	Standard	138 patches	3/4" round	Black	Pack
749-7-XL	ShearBan Rivet Cover Patches	Extra Large (XL)	84 patches	15/16" round	Beige	Pack
749-7-XL-BLK	ShearBan Rivet Cover Patches	Extra Large (XL)	84 patches	15/16" round	Black	Pack
749-BEIGE	ShearBan Sheets		5 pack	8" x 12"	Beige	Box
749-BLUE	ShearBan Sheets		5 pack	8" x 12"	Blue	Box
749-BLACK	ShearBan Sheets		5 pack	8" x 12"	Black	Box
749S-BEIGE	ShearBan Single Sheet		1 pack	8"x 12"	Beige	Box
749S-BLUE	ShearBan Single Sheet		1 pack	8"x 12"	Blue	Box
749S-BLACK	ShearBan Single Sheet		1 pack	8"x 12"	Black	Box

FLEXURE JOINT PACKAGE COMPONENTS

740 FREE MOTION	1 PK	5 PK	10 PK	100 PK
Joints	X	X	X	X
Screws & Nuts	X	X	X	X
Patches	X	X	X	
Silencers	X	X	X	
Dummies		1 PK	2 PK	

742 DORSI ASSIST	1 PK	5 PK	10 PK	100 PK
Joints	X	X	X	X
Screws & Nuts	X	X	X	X
Patches	X	X	X	
Silencers				
Dummies		1 PK	2 PK	

VET - 65 FREE MOTION	1 PK	5 PK	10 PK	100 PK
Joints	X	X	X	X
Screws & Nuts	X	X	X	X
Patches				
Silencers				
Dummies		1 PK	2 PK	10 PK

741 - DUMMIES	1 PK	5 PK	10 PK
Dummies	X	X	X
Tacks or Brads	X	X	X

BECKER

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Becker Orthopedic
Toll Free: (800) 521-2192
Phone: (248) 588-7480

beckerorthopedic.com

Tamarack® HABILITATION TECHNOLOGIES, INC.

For technical questions, please contact:

Tamarack Habilitation Technologies, Inc.
Toll Free: (866) 795-0057
Phone: (763) 795-0057

info@tamarackhti.com

VIII. Frequently Asked Questions

Q: What L-codes should I use for billing?

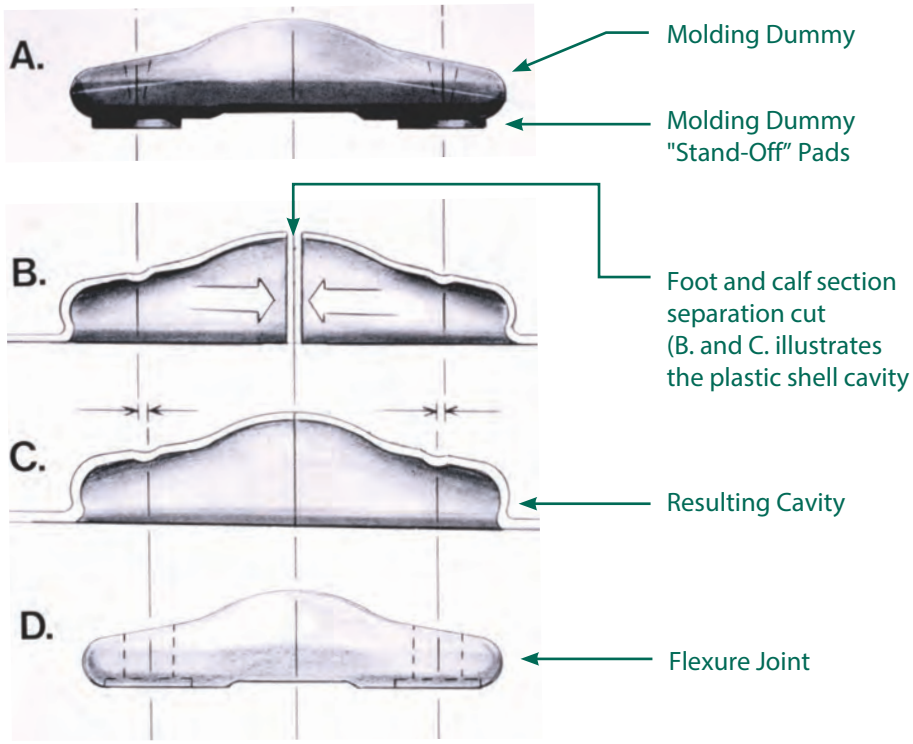
A: L - code suggestions for providers in the US can be found at **www.tamarackhti.com**.

Q: Why should I use molding dummies?

A: It does not damage the Tamarack Flexure Joint to use it in the vacuum forming process. However, plastic forming (either vacuum forming or lamination) with the actual joint creates risks and sacrifices you may not be willing to make – the net result is reduced product performance, especially in the transverse plane (rotational forces);

- The molding dummy stand-off pads allow the hot plastic to pull in around the flexure for best support.
- The stand-off pads also ensure that the joint and its mounting hardware will be recessed for better skin clearance.
- The molding dummies accommodate the material that is removed when cutting the foot and calf sections apart during AFO fabrication (see diagram below). Using a thick or jagged blade (like a cast saw) removes more material than what the dummies are designed to accommodate.
- There is some chance that you could damage the joint when prying it out of the cavity, or knick it when doing trimming processes.

Fig. 71



Q: How do I select the joint size for my client? Is weight the determining factor?

A: There are no weight guidelines because Tamarack Flexure Joints are not weight bearing joints (such as some prosthetics components) and there are multiple variables (activity level and functional requirements) that have little to do with body weight. When the AFO is controlling motion (e.g.; limiting plantar flexion) tension loading is the highest force that will be placed on the ankle joints. While body weight is a factor, functional activities and activity level will influence tension loading more than body weight alone. The tension load bearing element within the joint is designed to be so strong that the plastic shell will fracture before the Tamarack Flexure Joint will pull apart. A good rule of thumb is to select the joint size and AFO plastic thickness based on the activity level while considering the physical size of the client.

Q: How do I select the durometer of dorsi assist?

A. This is something that takes some practice since there is no standard answer. Gait analysis (clinical observation) and muscle strength are two primary factors to help guide durometer selection. Within each size range, all durometers and free motion joints can be combined for a wide range of assist. Other factors that will guide you include patient size and flexibility /range of the ankle joint.

Q: My patient complains of Achilles tendon soreness when using dorsi assist joints - Why?

A. If dorsiflexion range is not limited the dorsi assist function may place an excessive stretch on the Achilles tendon. Try installing a limiter strap on the orthosis at, or just short of, the limit of the patient's range of motion. Doing this will not affect gait and will prevent the stretch from becoming painful. See **Fig. 51** for an example.

Q: Can I use 742 Series joints installed "backwards"?

A. Sure. They can assist motion in either flexion or extension as you need or want - these joints allow you to be creative. **Fig's. 61-62** show an example.

Fig's. 44-46 provide tips on installing joints when they must be "pre-loaded" in these types of applications while being installed.

Q: I notice that my dorsi assist joints seem to lose power after a while – Why?

A. There is a property called "cold flow" that occurs in all materials, and is very evident in polyurethanes, which Tamarack Flexure Joints are made of. As the joint is compressed the material gradually moves away from the compression resulting in what you notice as a loss of power over time. The initial loss occurs very rapidly (within 1 or 2 dozen gait cycles) – we consider this a normal "break-in" of the dorsi assist joints. After break in, the joints stabilize with assistance reduction continuing very slowly. It may make sense to use a slightly stronger moment of assistance.

One way to plan and compensate for this gradual reduction is to use the Tamarack Variable Assist (TVA 743-L) or the adjustable TFJ Caps (741-CAP). These flexure joint methods have adjustable assist features for fine tuning or occassional adjustments.

Q: I cannot get the 742 Series (dorsiflexion assist) joint to fit into the cavity; is there something wrong with the molding dummy or with the joint?

A1. If you are using the "typical" dorsiflexion assist application, it may help to remove more material from the "U" shaped anterior cavity opening. See the "U" section trim line referred to in **Fig. 40** and **Fig's. 49 & 50**.

A2. It is very difficult to install 742 Series joints if you are incorporating them into an "alternative application" (see examples shown in **Fig's. 59-62**) because the joints must be "loaded" during installation. **Fig's. 44-46** describe a technique using the Spanner Tool that makes this much easier.

Q: How do I modify the AFO to make it wider in the ankle area? (e.g.; widen the area to relieve for malleolus contact or to make a growth adjustment)

A1. If the medial malleolus is contacting the medial aspect of the Tamarack Flexure Joint or other parts of the AFO shell, here is a simple solution to try before heating and bulging; place a medial wedge under the calcaneous (inside the AFO) – this will often relieve the medial malleolus. If this does not work, or you need to make the AFO shell wider for other reasons, try option A2.

A2. Leave the Tamarack Flexure Joints mounted in the AFO. Heat the surrounding area (except for directly on the cavity area) and push outwards as though it is a solid ankle AFO.

Q: Is there a Tamarack joint option to provide adjustable dorsi assistance?

A: Yes, with a product called the "Tamarack Variable Assist™" (TVA 743-L). The Tamarack Variable Assist(TVA)allows a practitioner or therapist to easily adjust the assist moment while the individual is wearing the orthosis. The joint can be set to decrease the assist moment to almost zero (nearly free motion) or to increase the assist moment up to nearly double the assist moment power provided by the 85 durometer dorsi assist joint alone.

The adjustability and variety of assist moments available makes the TVA joint a good candidate to consider for contracture applications, as well as for dynamic, changing conditions requiring fine tuning to optimize gait. More information about the Tamarack Variable Assist joint can be found at **www.tamarackhti.com**.

Additionally, the adjustable TFJ Caps (741-CAP) offer two incremental adjustments of 20% each; by rotating the medial cap and, additionally, by rotating the lateral cap. See **page 20** for more information.

Q: I've found it difficult to form a good cavity when using molding dummies to fabricate a carbon fiber orthosis – are there other options?

A: Our new Tamarack Flexure Joint Caps™ make it very easy to articulate an orthosis when using carbon or other layup processes to form the shell. The caps are "perfect cavities" that anchor the Tamarack Flexure Joints (free motion or dorsi assist models) to the side of the orthosis shell. More information about the Tamarack Flexure Joint Caps can be found at **www.tamarackhti.com**.

Q: Is it possible to articulate an existing solid ankle orthosis?

A. Yes, the Tamarack Flexure Joint Caps™ also make it easy to articulate an existing AFO (see previous question).

Q: Can Tamarack joints be used for pet orthotics and prosthetics?

A: Yes! The regular line of Tamarack Flexure Joints is well known as being excellent choices for use in animal orthotic and prosthetic devices. Because of the need for increased flexibility for some animal applications, Tamarack has developed a line of veterinary Tamarack Flexure Joints, designed specifically for animal orthotics and prosthetics.

See **www.animaloandp.com** for more information about veterinary orthotic and prosthetic applications.

Veterinary Tamarack Flexure Joints are not recommended for a human lower extremity orthosis because of the enhanced torsional flexibility. However, there may be unusual human situations or requirements where additional flexibility is desired. In such cases, there is nothing about the design or materials which would contraindicate use of Veterinary Tamarack Flexure Joints for human use. Veterinary Tamarack Flexure Joints are available from Becker Orthopedic and other O&P distributors.

IX. Additional Resources

Website: www.tamarackhti.com

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Publications/Journals Authored by Marty Carlson, CPO, FAAOP: www.martycarlson.com

Additional Tamarack Product Guides: ShearBan Product Guide, Clevisphere Product Guide

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