

TRIPLE ACTION<sup>®</sup>

Pediatric Ankle Joint

PRODUCT  
**MANUAL**

2<sup>nd</sup> EDITION

 **BECKER**

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# TRIPLE ACTION<sup>®</sup>

## Pediatric Ankle Joint

### TRIPLE ACTION<sup>®</sup> **DIFFERENCE**

**The Pediatric Triple Action** ankle joint offers unique features and exceptional performance for the orthotic treatment of complex and combined

biomechanical deficits in Cerebral Palsy, Spina Bifida and other pathologic neuromuscular conditions. Triple Action<sup>®</sup> has been shown to systematically influence the gait cycle in biomechanical studies.

The defining feature of Triple Action orthotics is the **independent** action of plantarflexion resistance, dorsiflexion resistance and alignment. The component's high stiffness, long-life springs and alignment feature can be tuned to optimize the phases of the gait cycle. This **adjustability** gives the clinician an effective tool to help balance support for the ankle and knee.

The Triple Action<sup>®</sup> ankle joint delivers features for all stages of pediatric orthotic management; as a static progressive orthotic adjunct to Botox<sup>®</sup> treatment, post-surgical immobilization following heel cord release or mobilization of the spastic ankle for active ambulation.

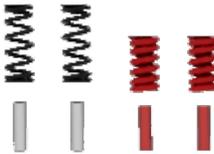


# What's *included*?

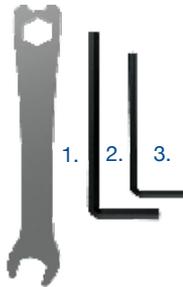


- A. 1-Pediatric Triple Action® ankle joint (assembled)
- B. 2-Standard and 2-High Resist Springs with motion limiter pins
- C. Adjustment Wrenches
- D. Attachment Screws
- E. Grease and Thread Locker

**A.** Pediatric Triple Action® ankle joint with Lateral Stirrup option  
(Model 3C76-LAT shown)



**B.**



- C.**
1. Combination Wrench
  2. Adjustment Wrench (4mm)
  3. Attachment Screw Wrench (2.5mm)



**D.** Attachment Screws  
(M4X6 and M4X8)



**E.**

# Options & Accessories

## Stirrup Options



**Lateral Stirrup**  
(Universal)  
*Model 3C76-LAT*



**Right Medial Stirrup**  
*Model 3C76-MEDR*



**Left Medial Stirrup**  
*Model 3C76-MEDL*

## Accessories



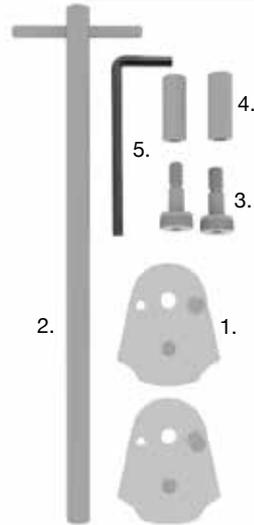
**Booster Spring  
Staged Resist  
Adapter (SRA)**  
*Model 3C00-SRA*

**The Booster Spring (SRA)** may be installed in the dorsiflexion or plantarflexion resist channel to increase the spring force. The SRA increases the active resistance of the component and facilitates 'staged resist'. The SRA includes Standard and High Resist Springs, and motion limiter pins and a blue spacer (not shown) for spring configuration number 5.



**Adjustment Tools**  
*Model 3C00-ATK#1*

A 4mm T-Handle adjustment wrench is available to simplify adjustment.



**Fabrication Tool Kit**  
*Model 3C00-FTK*

The Fabrication Tool Kit Includes:

1. Fabrication Dummy
2. Alignment Axis
3. Shoulder Screw (M6)
4. Alignment Bushing
5. Fabrication Wrench (4mm)

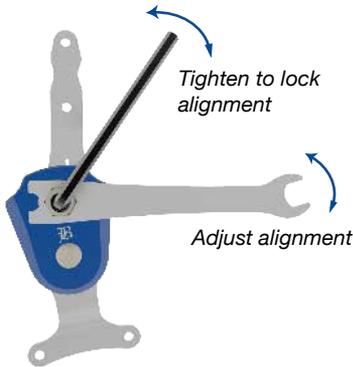
# Adjustment

Alignment, range of motion, and resist are independently adjustable. The alignment adjustment determines the null angle of the stirrup and rotates the upper bar around the pivot bushing. Alignment is adjusted by turning the hex on the front of the component body. The screw inside the hex locks the alignment adjustment.

Range of motion settings are adjusted by turning the adjustment screws on top of the component body. There are motion limiter pins inside the springs to establish the 0° ROM position as a reference for this adjustment. Resist is adjusted by changing spring configurations. Five unique spring configurations are possible with the optional Booster Spring SRA.

## Adjusting Alignment

Loosen the alignment lock (inside the hex)  
 $\frac{1}{2}$  to  $\frac{3}{4}$  turn to unlock the alignment adjustment



The alignment adjustment range is  $\pm 10^\circ$

The recommended tightening torque for the alignment lock is:  
15N-m (135 in-lb)

## Adjusting Range of Motion

The range of motion settings are referenced to the locked (0° ROM) setting. To adjust ROM, first lock the setting by fully tightening the adjustment screw.

**Do not** over tighten the adjustment screw.

The maximum ROM for the resist setting is:  
- 15° (3 full turns) for the Standard Resist Springs  
- 10° (2 full turns) for the High Resist Springs.

Adjust the setting for the desired resist/ROM by counting the number of half-turns away from the locked position.

Range of Motion changes 5° per full turn of the resist adjustment screws.



Adjusting range of motion

# High Resist Spring Installation

The Pediatric Triple Action® ankle joint comes with the Standard Resist Springs installed in both channels.

## To install the High Resist Spring

1. Remove the adjustment screw (A), Standard Resist Spring and motion limiter pin
2. **Do not** remove the ball bearing (D)
3. Grease (E) the High Resist Spring motion limiter pin (C)
4. Insert the motion limiter pin (C) into the High Resist Spring (B)
5. Wipe excess grease from the outside of the spring
6. Install the spring and motion limiter pin in the resist channel



Grease Packet

The Adjustment Screws are pre-coated with thread locker. Grease in the spring channel may cause the adjustment screws to migrate.



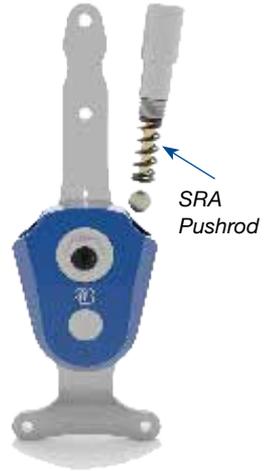
The Standard Resist and High Resist motion limiter pins are different sizes. To ensure maximum spring life, use only the silver (M3.2X11) motion limiter pin with the Standard Resist Spring (black) and the red (M3X10) motion limiter pin with the High Resist Spring (red).

# Booster Spring (SRA) Installation

The Booster Spring Staged Resist Adapter (SRA) option increases the spring options and facilitates staged-resist.

## To install the Booster Spring (SRA)

1. Remove the adjustment screw, Standard Resist Spring and motion limiter pin from the channel
2. **Do not** remove the ball bearing
3. Grease the SRA pushrod
4. Insert the SRA pushrod into the spring  
***Important:** Install Blue Spacer Bushing included with SRA prior to sliding spring over SRA Pushrod for spring configuration 5 only.*
5. Wipe excess grease from the outside of the spring
6. Install the spring and SRA in the resist channel
7. Gently tighten the SRA using the combination wrench



Refer to "Triple Action Spring Options" for information regarding how to configure the springs and SRA for the five resist and ROM options.



# Orthotic Design Considerations

For best results, Triple Action AFO designs must be rigid. AFOs that are too flexible will decrease the systematic influence of the Triple Action ankle joint on gait. Rigid thermoplastic polypropylene materials in 4mm (5/32 inches) thickness are recommended for Triple Action AFO fabrication. Ribs or stiffeners placed at the distal tibial section may also be used to stiffen the orthotic structure. It is recommended that anterior (ventral) tibial shell with full footplate AFO designs be used where dorsiflexion resist is greater than plantarflexion resist in order to manage knee flexion. Ankle foot orthoses may use one or two Triple Action components depending on patient weight and spasticity. However, if a single Triple Action is used, it is necessary to pair the Triple Action with a free motion companion joint. Becker Orthopedic recommends the medium size Tamarack flexure joint with caps (Model 740S-M-CAP or Model 740S-M-CAP-BLK) as a companion joint in single Triple Action applications.

## The decision whether to use one or two Triple Action ankle joints should consider

*Patient weight:* 25 Kg (55 lb) to 50 Kg (110 lb)

*Spasticity:* Low, Moderate, High

*Calf circumference:* 20 cm (8 in) to 40 cm (16 in)

**Important:** Two Triple Action components are recommended for Post-Op applications

## One Triple Action® or Two?



- Patient Weight  
25 Kg (55lb.)
- Low Spasticity
- Calf Circumference  
20 cm (8 in)



- Patient Weight  
39 Kg (85 lb.)
- Moderate Spasticity
- Calf Circumference  
30 cm (12 in)



- Patient Weight  
50 Kg (110 lb.)
- High Spasticity
- Calf Circumference  
40 cm (16 in)
- Post-Op Patients

# Disassembly for Fabrication

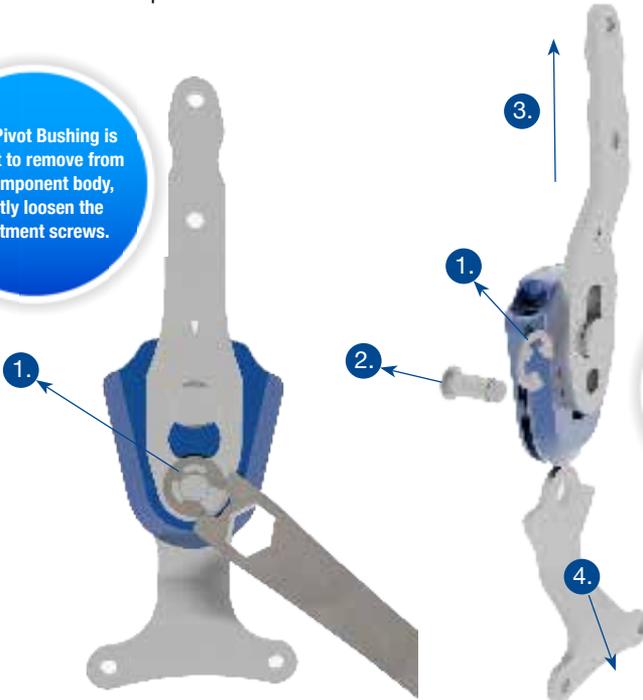
The upper bar and stirrup must be removed from the component body and attached to the Fabrication Dummy for fabrication.

## To remove the bar and stirrup from the component body

1. Remove the Pivot Bushing E-Clip using the combination wrench
2. Remove the Pivot Bushing
3. Slide the upper bar toward the top of the component body and remove
4. Remove the stirrup

Prior to re-assembly, grease the pivot bushing, upper bar slot and stirrup head.

If the Pivot Bushing is difficult to remove from the component body, slightly loosen the adjustment screws.

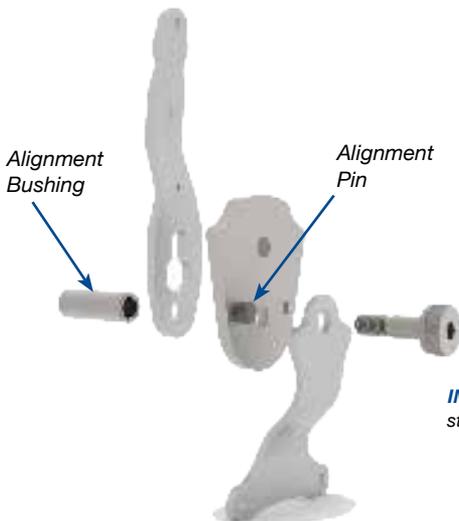


Use the combination wrench to remove the Pivot Bushing E-Clip

Disassembling the Pediatric Triple Action®

# Assembling the Fabrication Tool

The ankle angle of the negative mold should be corrected prior to filling. The Triple Action fabrication dummy holds the upper bar and stirrup in alignment. When fabricated in this way, the 0° alignment setting will correspond to the corrected ankle angle of the mold, and ensure  $\pm 10^\circ$  adjustment range with respect to the corrected ankle angle of the AFO.



The stirrup head should be firmly seated against the Alignment Pin.

**IMPORTANT:** Don't bend or mar the stirrup head or upper bar where they contact the component body during fabrication.



Set the ankle axis in the negative cast using the Alignment Axis in the Fabrication Tool Kit, and fill the mold. Strip the mold and remove the Alignment Axis from the positive mold.



The Alignment Bushing fits into the Alignment Axis hole in the positive plaster mold.

# Triple Action<sup>®</sup> Clinical Tuning Procedure

Through biomechanical research, Becker Orthopedic has developed a clinical tuning procedure to help simplify application of the Triple Action<sup>®</sup> ankle joint. This procedure is intended as a starting point to help you more quickly arrive at optimal component settings using Observational Gait Analysis.

## Tuning Procedure

1. Bench Adjustment
2. Static Alignment
3. Swing Phase Alignment
4. Stance Phase Adjustment

## Spring Selection

Before performing Bench Adjustment, the desired Triple Action springs must be installed. Refer to “High Resist Spring Installation” and “Booster Spring (SRA) Installation” for additional information on spring installation.

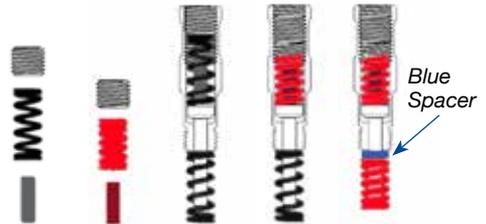
There are five spring configurations available for the Pediatric Triple Action ankle joint. Each of these options offers unique resist and range of motion capabilities for patient management.



*Pediatric Triple Action ankle joint shown with Booster Spring SRA Installed.*

## Triple Action Spring Options

-  Standard Resist Spring (black) and motion limiter pin (silver)
-  High Resist Spring (red) and motion limiter pin (red)



Config. No.	1	2	3	4*	5
Resist	Low	Mod	Mod	High	Very High
ROM	15°	10°	15°	15°	10°

\*Staged Resist

## Spring Selection (Continued)

The Standard and High Resist Springs are suitable for the management of mild biomechanical deficits in larger patients or smaller patients with more severe deficits. To expand applications to heavier patients with higher spasticity, the Booster Spring SRA option may be installed or two components may be used. The SRA can be installed in either or both the plantarflexion and dorsiflexion resist channel(s).

Gait Type*	Pattern	Orthotic Design	Mild to Moderate	Moderate to Severe
<b>Gait Type 1:</b> Hemiparesis with drop foot in swing phase secondary to dorsiflexion insufficiency. No significant triceps surae contracture.		Posterior (dorsal) tibial shell. Sulcus length footplate.		
<b>Gait Type 2:</b> Hemiparesis with dropfoot and true equinus secondary to triceps surae contracture, with or without genu recurvatum.		Posterior (dorsal) tibial shell. Sulcus length footplate.		
<b>Gait Type 3:</b> Hemiparesis with true equinus. Jump gait with contracture or spasticity of gastrosoleus. Spastic co-contraction of quadriceps and hamstrings.		Anterior (ventral) tibial shell. Full length footplate.		
<b>Gait Type 4:</b> Hemiparesis gait type 3 plus hip flexor/adductor spasticity.		Anterior (ventral) tibial shell. Full length footplate.		
<b>Crouch Gait:</b> Diplegia with excessive dorsiflexion, knee and hip flexion.		Anterior (ventral) tibial shell. Full length footplate.		

\*Gait Type from "Classification of gait patterns in spastic hemiplegia and spastic diplegia: a basis for a management algorithm". Rodda et al. 2001.

# Triple Action<sup>®</sup> Clinical Tuning Procedure

## Bench Adjustment

Prior to fitting the orthosis, bench adjust the components as follows:

1. Lock plantarflexion (PF) ROM at 0°
2. Lock dorsiflexion (DF) ROM at 0°
3. Set the alignment to 0°



*Lock both ROM settings by turning the adjustment screws fully clockwise. Refer to “Adjusting Range of Motion” for additional information.*



*Adjust the alignment setting to 0°. Refer to “Adjusting Alignment” for additional information.*

## Static Alignment (PF and DF ROM at 0°)

Don the orthosis and shoes to the patient and perform static alignment with the patient standing. Adjust the ankle angle with the ROM settings locked at 0° to tune the shank to vertical angle, and move the weight line over the midfoot. The knee should be slightly flexed. A typical starting point for the shank to vertical angle is 11°. This is measured at the tibial crest with the orthosis and shoe donned. Optimize the patient's sense of standing balance and stability. If there is insufficient dorsiflexion ROM to make the adjustment due to a gastrosoleus contracture, a lift may be required under the heel of the AFO to incline the shank.



## Swing Phase Alignment (PF and DF ROM at 0°)

With the ROM settings still locked at 0°, use the alignment setting to adjust toe clearance in mid swing and foot position at initial contact. Observe the foot to floor angle while making this adjustment. Note that increasing dorsiflexion alignment may reduce knee extension at terminal swing if there is gastrocnemius tone or contracture. Also observe step length symmetry while making this adjustment.



*Toe Clearance (left) and Foot to Floor Angle (right)*

## Early Stance Phase Adjustment (DF ROM at 0°)

Adjust plantarflexion ROM to activate the ankle in 1<sup>st</sup> rocker and early stance to stabilize the knee. Begin by increasing the plantarflexion (PF) ROM setting by 1 to 2-turns (5 to 10°) of the adjustment screw.

- If toe clearance or foot to floor angle decreases → Decrease the PF ROM.
- If knee hyperextension in early stance increases → Decrease the PF ROM.
- If the knee flexes excessively in 1<sup>st</sup> rocker → Increase the PF ROM.



## Late Stance Phase Adjustment

Adjust dorsiflexion ROM to activate the ankle in 2<sup>nd</sup> rocker and late stance to stabilize the knee. Begin by increasing the dorsiflexion (DF) ROM by 1 to 2-turns (5 to 10°) of the adjustment screw.

- If the knee flexes excessively after midstance → Decrease the DF ROM.
- If the knee hyperextends at the end of stance phase → Increase the DF ROM.





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